PROGRAM: **MARSIS**

MANUAL

MARSIS

FLIGHT USER MANUAL

Signature and Approvals on Original

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DOCUMENT CHANGE LOG

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3	18/12/2003	§1: Modified "Reference Document" table §1.4.4: Modified content. Updated monopole accuracy §2.3: Updated Figure 2.3-3 §2.4: Updated Content §2.5.1 Modified Table 2.5-1: MARSIS Power and Energy Budget, modified Table 2.5-2, deleted table 2.5-3 §2.5.2: Deleted §2.5.3: Revised §2.5.4-2: Deleted §3.3.1: Updated figures 3.3.1-1, 3.3.1-2, 3.3.1-4, 3.3.1-4 §3.5: Modified content §3.6: Modified content §3.7: Modified content. Added alternative Heaters control concept. §3.9: Modified content, reference to ANNEX 6 introduced §4.1: Modified content §4.2: Modified content §4.2.1: Modified content §4.2.2: Modified content	Issue updated before MOI

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Short Table of Contents

Detailed Table of Contents

1. General Description

This document presents the Flight User Manual (FUM) for the Mars Express payload instrument MARSIS. It defines the mission objectives, physical and functional configuration and operations modes of the instrument and also describes how the instrument can be controlled, utilized and monitored by ground operations.

The following documents are referenced in this Flight User Manual, and may be referred to if more information is required.

In particular RD-10, RD-11, RD-15 and RD-16 have to be considered as part of this Manual and they are inserted, respectively, in the following ANNEXES:

RD-10: ANNEX 6
RD-11: ANNEX 5
RD-15: ANNEX 8
RD-16: ANNEX 7

RD-1	PID MEX-MMT-SP-007, Issue 02 Rev. 00, dtd. 06-July-99,
RD-2	Annex A (E-IDS) to AD-1
RD-3	Annex B (E-EMC) to AD-1
RD-4	Annex C (DRD) to AD-1
RD-5	Annex D (E-TPL) to AD-1
RD-6	MARSIS Payload Interface Document-B (PID-B), ID-MAR-0002-INF, issue3, dtd 15/02/2001
RD-7	MARSIS Electrical Interface Control Document; ID-MAR-0015-INF; Issue 5, dtd. 15/02/2001
RD-8	MARS EXPRESS Space / Ground Interface Control document ME-ESC-IF-5001 Issue 2.0, dtd. December 99
RD-9	MARSIS FM EGSE User Manual; MAN-MAR-0002-INF; Issue draft, dtd. 12/02/2001
RD-10	MARSIS Packet Structure Definition, TL 16927 issue 6, dtd. January 2003
RD-11	MARSIS DES Parameter Table, TL 18546, dtd. December 2002
RD-12	MARS ADVANCED RADAR FOR SUBSURFACE AND IONOSPHERE SOUNDING (MARSIS): MODELS AND SYSTEM ANALYSIS; Info-Com Technical Report MRS-001/005/99
RD-13	Mars Express: Subsurface Sounding Radar/Altimeter Proposal INFOCOM doc. N. 188-23/2/1988
RD-14	MARSIS System Functional Requirements Document JPL D-18478, Version 1.0, 23/10/2000
RD-15	MARSIS UGS: Operation Sequence Table Generation Logic, TNO-MGS-0003-ALS
RD-16	MARSIS Flight Operations - FCP/CRP

This FUM consists of 9 major Sections and the contents of these are summarized here and details are presented in the different individual sections.

Section 1 'General Description' presents the scope of this document, gives a list of reference documents and also provide an overview of the Experiment/Instrument such that the detailed design information presented in the subsequent sections can be understood in the overall context.

Section 2 'Instrument Configuration' presents the configuration of the instrument from HW and SW point of view and in addition the following MARSIS budgets:

- Power in each mode
- Mass
- Antenna Alignment
- Timing
- Data

Section 3 'Instrument Detailed Description' presents a detailed description of MARSIS and its functionalities

Section 4 'Instrument Operation' presents the MARSIS Nominal Operational Plans and in particular:

- Ground Operational Plan
- In-orbit Commissioning Plan
- Flight Operations Plans by Mission Phase

In addition is reported the Failure Detection and Recovery Strategy

Section 5 'Modes Description' presents the detailed description of MARSIS Operative Mode and the Modes Transition Diagram.

Section 6 'Interfaces' presents the description of the external interface of the instrument relative to the in-orbit conditions and in particular:

Note: Section 6 has been embedded into Section 3, effective since issue 3

- Power
- Mechanical
- Thermal
- Data
- Control

- TTC interface to ground.

Section 7 'Nominal and Contingency Operations Procedures' presents the Nominal and Contingency MARSIS Operation Procedures and in particular:

- Ground Test Sequences
- On-Board Control Procedures
- Flight Control Procedures
- Operational Constraints
- Contingency Recovery Procedures

Section 8 'Summary of Telemetry and Telecommand Data' presents a summary definition of MARSIS Telemetries and Telecommands packets with particular attention devoted to the Critical TC.

Section 9 'Data Operations Handbook' presents the definition of MARSIS Telecommands and Telemetries instances and their related parameters.

1.1. Scientific Objectives

The set of scientific objectives for the MARSIS investigation was defined in the context of the objectives of the Mars Express mission and in the more general frame of the current open issues in the study of Mars. This set will be the main reference in driving the instrument requirements and in deciding design tradeoffs.

The MARSIS primary objective is to map the distribution of water, both liquid and solid, in the upper portions of the crust of Mars. Detection of such reservoirs of water will address key issues in the hydrologic, geologic, climatic and possible biologic evolution of Mars, including:

- the current and past global inventory of water,
- mechanisms of transport and storage of water,
- the role of liquid water and ice in shaping the landscape of Mars,
- the stability of liquid water and ice at the surface as an indication of climatic conditions,
- the implications of the hydrologic history for the evolution of possible Martian ecosystems.

Three secondary objectives are defined for the MARSIS experiment: subsurface geologic probing, surface characterization, and ionosphere sounding.

1. The first is to probe the subsurface of Mars, to characterize and map geologic units and structures in the third dimension. Detection of subsurface geologic boundaries will allow:

    - determination of the thickness and properties of sedimentary units, such as outflow channel deposits and possible lacustrine materials,
    - mapping of the thickness of polar layered deposits, and measurements of their physical properties that are likely to record climate variations,
    - an inventory of mobile materials such as dust and sand deposits,
    - study of volcanic stratigraphy to understand eruptive processes and crust evolution,
    - mapping of subsurface geologic structures (e.g., folds and faults) to understand tectonics of the Martian crust and address such issues as the nature of the global dichotomy and the history of the Tharsis plateau.

2. The additional secondary objective is to acquire information about the surface of Mars. The specific goals of this part of the experiment are to characterize the roughness of the surface at scales of tens of meters to kilometers, to measure the radar reflection coefficient of the surface and to generate a topographic map of the surface at approximately 15-30 kilometers lateral resolution. These data sets can be used to address a wide range of scientific questions, including:

    - the large-scale surface roughness of various geologic units, and implications for the processes of emplacement and modification,

- determination of the bulk density (providing constraints on the composition) of upper crust materials,
- a global topographic data set to complement those derived by other techniques.

3. A final secondary objective is to use MARSIS as an ionosphere sounder to characterize the interactions of the solar wind with the ionosphere and upper atmosphere of Mars. Radar studies of the ionosphere will allow:

- global measurements of the ionosphere electron density,
- investigation of the influence of the Sun and the solar wind on the electron density.

1.2. Functional Objectives

Due to the Mission characteristics, to the limited Data Rate provided by the S/C and the limited available Data Volume, most of the data processing will be done on-board. In particular the digital processing is in charge of the following major task: range compression, Surface echo Acquisition/Tracking, Coherent echo processing (Synthetic Aperture) and multi looking.
In addition the instrument has the capability to predict some Orbit parameters as the orbit Height, the tangential velocity and the radial velocity that are needed in real time for timing and processing tasks.
This means that a lot of HW and SW resources are used for the above mentioned functionalities.
Starting from the above considerations one of the main functional objective of MARSIS is to reduce and simplified as much as possible the Interfaces with S/C in terms of TC and TM exchange.
To follow this approach the number of TCs that MARSIS needs to operate is limited to a small number and it can receive TC PACKETS only in a well defined mode (STANDBY).
In addition, with the exception of the "SILENT MODES" (see §5), all the Instrument Mode Transitions are or autonomous or commanded by the DES following the instruction contained in the Operation Sequence Table (OST) that is detailed in §3.
In particular the OST is a sort of table in which all the Operational Modes, their duration and the main instrument parameters are reported for the entire Orbit in order to avoid any request to the S/C (a part the OST loading).

1.3. Basic Design Description

MARSIS consists of two electronics assemblies and two antennas mounted on the Mars Express Orbiter. A simple block diagram of the sounder is shown in Figure 1.3-1.
Functionally and also from the responsibility point of view of each organization involved in MARSIS, the instrument can be split into three subsystems:

- Antenna (ANT) including both the primary Dipole antenna for transmission and reception of the sounder pulses and the secondary monopole antenna for surface clutter echoes reception only,
- Radio Frequency Subsystem (RFS) including both the TX channel and the two RX channels for the dipole and monopole antenna respectively,
- Digital Electronics Subsystem (DES) including the signal generator, timing and control unit and the processing unit.

Anyway it is worth considering that from the mechanical point of view DES and RX Section of RFS subsystem are allocated in the same box inside the S/C (SISD)
Inside the S/C is also allocated the mechanical box for the TX electronics housing (SIST).
The Dipole Antenna, element 1 and 2, and Monopole antenna are allocated outside the S/C.

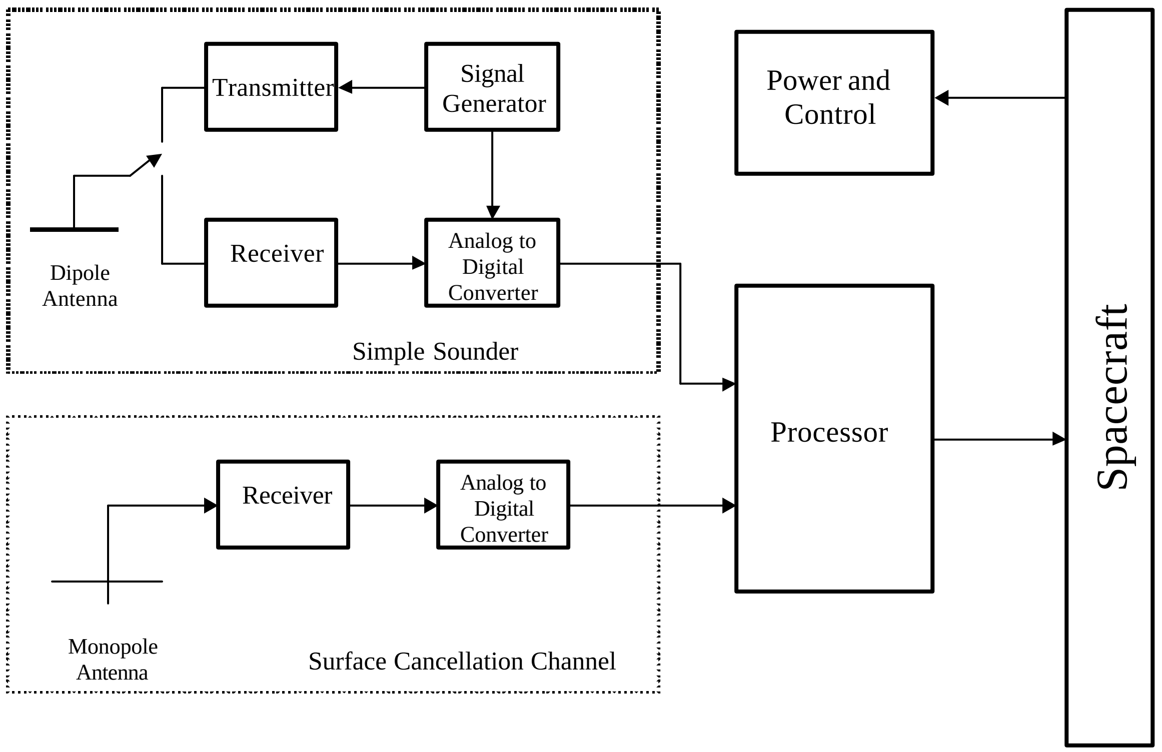


Fig. 1.3-1: MARSIS Block Diagram

INTERFACES

In figure 1.3-2 are shown both the signals exchanged between MARSIS and the S/C and the signal lines internal to the instrument.

REDUNDANCY PHILOSOPHY

MARSIS is not a redundant instrument; therefore only the interfaces with the S/C are redundant.
In particular only the Nominal Interface lines between MARSIS and S/C are shown in figure 1.3-2.

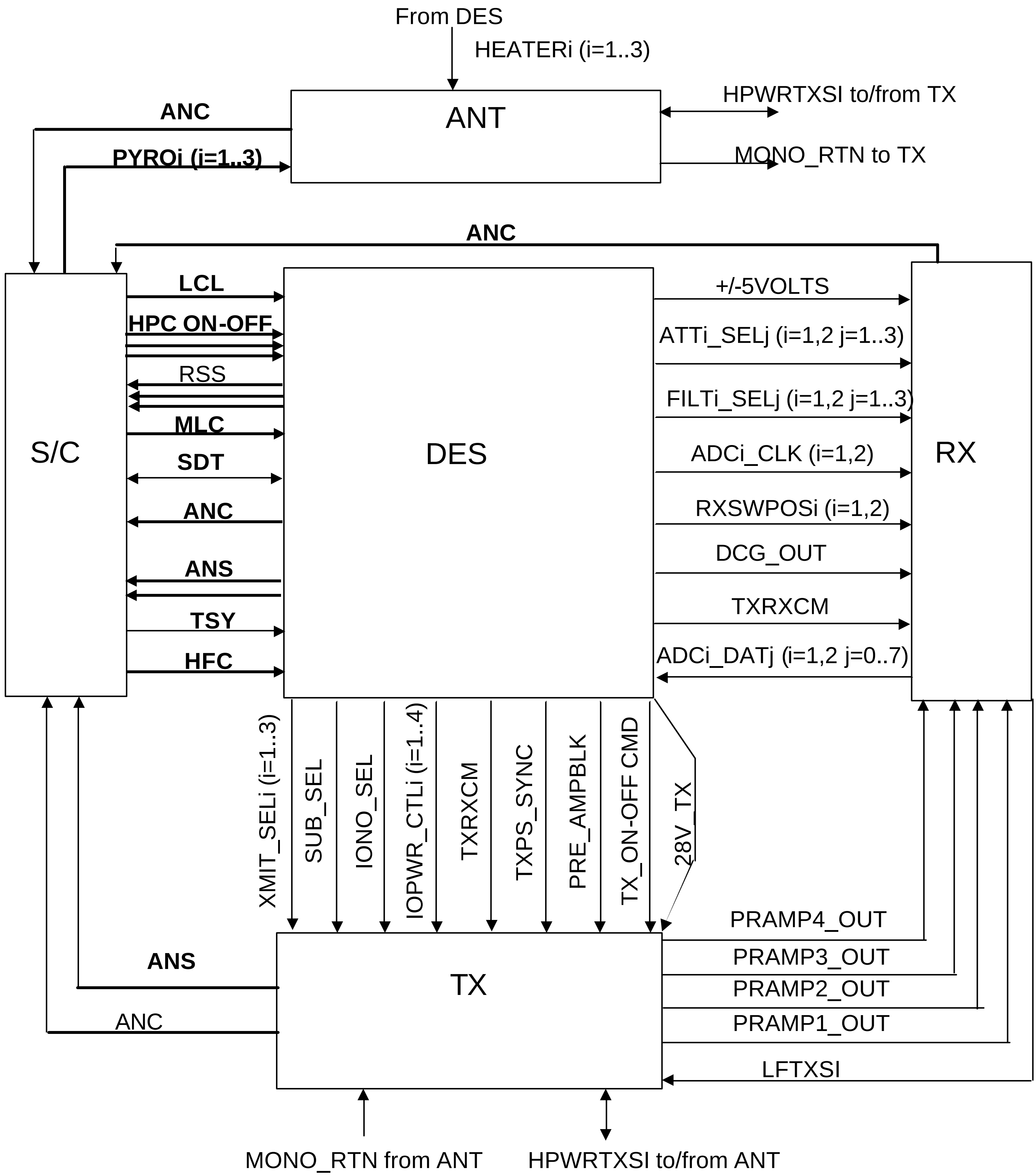
INSTRUMENT SOFTWARE

The instrument SW is stored and runs in the Digital Electronics Subsystem (DES).
As the task of the DES is to carry out the correct operation and the interfacing with the S/C of the MARSIS instrument during the mission, the DES software purpose is:

- to assure on-board acquisition, processing, collection, and transmission of Scientific Data coming from the RF channels;
- to handle the DES interfacing with the S/C;
- to command and control all the MARSIS instruments.

In particular the software has to implement the following functions:

- receive Telecommands (TC) by means of Memory Load Commands (MLC) from the S/C and handle their validation and execution;
- synchronize the MARSIS time with the S/C Elapsed Time (SCET) and command MARSIS instruments during the switch ON/OFF sequence;
- support S/C commanded Patch and Dump Operations when requested;
- drive MARSIS instruments during the operation sequence, following the instructions contained in the Operations Sequence Tables (OST);
- distribute to the MARSIS instruments all the needed parameters. These parameters are stored in the Parameters Table (PT);
- perform runtime self check;
- collect and packetize Housekeeping (HK), Event Report and Scientific Data into the relevant TM Source Packets;
- handle the TM-Block protocol to allow S/C TM Packets acquisition by the DMS-computer via the OBDH-Bus and the RTU.


From DES
HEATERi (i=1..3)
ANT
HPWRTXSI to/from TX
MONO_RTN to TX
ANC
PYROi (i=1..3)
ANC
S/C
DES
RX
LCL
HPC ON-OFF
RSS
MLC
SDT
ANC
ANS
TSY
HFC
+/-5VOLTS
ATTi_SELj (i=1,2 j=1..3)
FILTi_SELj (i=1,2 j=1..3)
ADCi_CLK (i=1,2)
RXSWPOSi (i=1,2)
DCG_OUT
TXRXCM
ADCi_DATj (i=1,2 j=0..7)
XMIT_SELi (i=1..3)
SUB_SEL
IONO_SEL
IOPWR_CTLi (i=1..4)
TXRXCM
TXPS_SYNC
PRE_AMPBLK
TX_ON-OFF CMD
28V_TX
TX
ANS
ANC
PRAMP4_OUT
PRAMP3_OUT
PRAMP2_OUT
PRAMP1_OUT
LFTXSI
MONO_RTN from ANT
HPWRTXSI to/from ANT

1.4. Synthesis of Operating Principles

The MARSIS instrument is a low-frequency nadir-looking pulse limited radar sounder and altimeter with ground penetration capabilities, which uses synthetic aperture techniques and a secondary-receiving antenna to isolate subsurface reflections.

The operational altitudes of MARSIS are up to 800 km for subsurface sounding and up to 1200 kilometers for ionospheric sounding above the surface of Mars. In standard operative mode the instrument will be able to operate in any of the following bands: 1.3-2.3 MHz (centered at 1.8 MHz), 2.5-3.5 MHz (centered at 3.0 MHz), 3.5-4.5 MHz (centered at 4.0 MHz) and 4.5-5.5 MHz (centered at 5.0 MHz).

Operation of the sounder is as follows.

After receipt of a turn on command from the spacecraft and the instrument has cycled through its turn on process, the Control Electronics (part of DES) generates a linear frequency modulated chirp, which is amplified by the transmitter, and the energy radiated by a nadir looking dipole antenna. At this point, both receivers are protected from the transmit event. After the transmit pulse is completed, the return signal from the Martian surface is received by both antennas and the receiver protectors are disabled. The dipole antenna is then connected to the receiver, which amplifies the return signal, that is downconverted to range offset video prior to conversion to digital form by the Analog to Digital Converter. A secondary monopole antenna, oriented along the nadir axis will receive mostly the off-nadir surface returns, that could be thus subtracted in the ground re-processing, further reducing the surface clutter level (about ~15-20 dB). This channel receives signals from the surface, which are not in the local nadir direction as this antenna exhibits a null in its antenna directivity in this direction. These surface clutter returns are then amplified by a receiver with a dynamic gain response, downconverted to range offset video in identical form to that of the Simple Sounder channel and converted to digital format by the Analog to Digital Converter. The digital signals from both channels are then sent to the on-board digital processor for processing the data to a sounder format. These signals are then sent to the spacecraft for relaying to the earth.

During normal operations, MARSIS may operate in one of the following four operation modes:

- Calibration
- Subsurface Sounding
- Active Ionosphere Sounding
- Receive Only.

Subsurface Sounding Mode is intended to obtain sounder data about the subsurface of Mars and the Ionosphere Sounding Mode is intended to obtain information about the ionosphere of Mars. Subsurface Sounding Mode is further subdivided into five separate sub-modes (SS1-SS5). Calibration Mode is intended to obtain calibration information about the system. Receive Only Mode is intended mainly to measure and characterize, from the EM point of view, the environment in which MARSIS will work.

MARSIS has been designed to perform Subsurface Sounding at each orbit when the altitude is lower than about 800 Km. A highly eccentric orbit such as the baseline orbit places the spacecraft within 800 km from the surface for a period of about 26 minutes. This would allow mapping of about 100 degrees of arc on the surface of Mars each orbit, allowing extensive coverage at all latitudes within the nominal mission duration. To achieve this global coverage MARSIS has been designed to support both dayside and nightside operations, although performances are maximized during night time (solar zenith angle >80°), when the ionosphere plasma frequency drops off significantly and the lower frequency bands, which have greater penetration capability, can be used.

Active Ionospheric Sounding will be also carried out by MARSIS at certain passes when the orbiter is at an altitude up to 1200 Km both during day and night time.

MARSIS will be in Calibration Mode periodically during the operation phase of the mission. The purpose of this mode is to acquire a limited amount of data in an unprocessed format. This data can be acquired separately in the calibration mode or include even more limited quantities of data along with the processed data set for transmission to the ground. This operation is basically an adaptive matched filter computation which will then be used by the processor to compress the dispersed echo from the surface and subsurface. Calibration Mode will be done after ground processing of the raw data collected during the calibration mode and the computed matched filter parameters uploaded to MARSIS.

1.4.1. Subsurface Sounding Detailed Description

The basic observation geometry and the principle of operation during Subsurface Sounding are depicted in Fig. 1.4-1.
The electromagnetic wave transmitted by the antenna impinges on the top of the Mars surface producing a first reflection echo which propagates backward to the radar, generating a strong return signal received at time t0=2H/c, being H the spacecraft height and c the speed of light in vacuum. However, thanks to the long wavelengths employed, a significant fraction of the EM. energy impinging on the surface is transmitted into the crust and propagates downward with a decreased velocity v=c/n (being n the crust refraction index related to the real dielectric constant e_r by *n*=Öe_r) and an attenuation proportional to the penetration depth (z), to the wavelength (λ)and to the material loss tangent (*tan d*, efined as the ratio of the imaginary part to the real part of the complex dielectric constant *tan d* = e_i/e_r). Should subsurface dielectric discontinuities be present at depth z_0 below the surface, additional reflections would occur and the relevant echoes would propagate backward through the first layer medium and then to the radar generating further echo signals, much weaker than the front surface signal, with time delay $t_0+2\ z_0/v$. As consequence time domain analysis of the strong surface return, eventually after multi-look non-coherent integration, will allow estimation of surface roughness, reflectivity and mean distance, just like in classical pulse limited surface radar altimeters. Moreover the presence of weaker signals after the first strong surface return will enable the detection of

subsurface interfaces, while the estimation of their time delay from the first surface signal will allow the measurement of the depth of the detected interfaces.

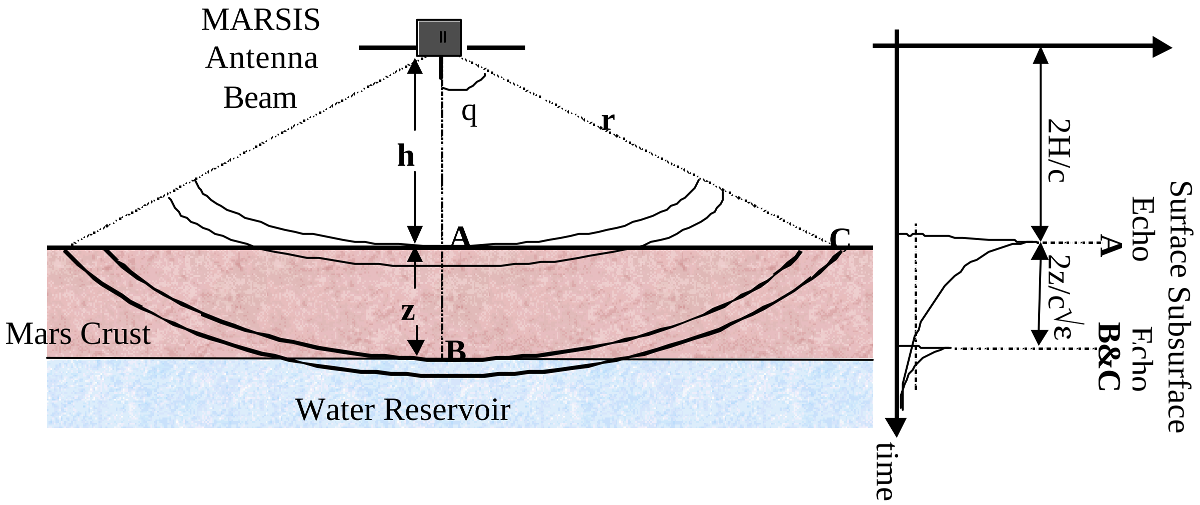


Figure 1.4.1-1

The detection performance will be limited by two main factors, namely the surface clutter echoes and the noise floor entering the receiver. The surface clutter echoes are originated by reflections from those surface areas (marked C in Figure 1.4.1-1) which have two-way propagation path delay identical to the one of useful subsurface signal (point marked B in Figure 1.4.1-1). While this is not a problem for perfectly flat surfaces - since the angular backscattering law would impose a very high attenuation on such lateral reflections - most natural surfaces are not at all flat and surface clutter echoes can be very strong in practical situations; as a direct consequence, when the competing subsurface echoes are highly attenuated by the propagation into the crust, the surface clutter echoes may happen to mask the useful signal and limit the detection performance. Furthermore, even when the surface clutter power is lower than the competing subsurface echo, the detection performance can be limited by the noise floor of the receiver. Such noise can be very high at the low frequencies commonly used for radar sounding due to the contribution of the cosmic noise temperature entering the receiver which is many order of magnitudes higher than receiver internal noise, for typical noise figures of 3-4 dB, and frequencies in the range 1-10.

In standard sub-surface sounding operative mode MARSIS will be able to transmit and receive any of the following bands: 1.3-2.3 MHz (centered at 1.8 MHz), 2.5-3.5 MHz (centered at 3 MHz), 3.5-4.5 MHz (centered at 4 MHz), 4.5-5.5 MHz (centered at 5 MHz). The instantaneous bandwidth will be 1 MHz for all the frequency bands, and the transmitted waveform will be a pseudo-linear frequency modulated pulse (chirp). Since on the dayside of Mars the ionosphere will not allow the use of frequencies < ~3 MHz, only the two higher frequency bands (4 MHz and 5 MHz) will be used for surface/subsurface sounding during day time. However the best penetration capabilities will be obtained during night time observation, when also the longest wavelengths can be used.

Transmitted pulses will be radiated through a 40 m thin dipole mounted parallel to the surface and normal to the direction of motion, fed by a matching network which has the purpose of flattening the antenna frequency response over the full 1.3-5.5 MHz range. The reflected echoes will be received both from the primary dipole antenna and from a secondary receiving antenna, namely a short monopole mounted vertically aligned with the nadir axis which features a null in the nadir direction and thus records off-nadir surface echoes alone. Received echoes on both channels are converted to a small offset frequency and digitized for on-board processing and later downlink. Since the data rate of digitized samples would in the order of few Mbit/s strong data reduction has to be performed on-board to comply with the limits of data rate and volume of the Mars Express orbiter.

The on-board processor, which features adaptive range compression, azimuth compression and multi-look non-coherent integration, depending on the operative modes, performs data reduction. The obtained modes dependent Data Rate will be in the range 16 and 80 kbps.

The range compression will allow a range resolution equivalent to 150 m in vacuum and waveform sidelobes controlled to fulfil a system dynamic range in excess of 50 dB. Azimuth compression will be performed by coherent unfocused Doppler processing, to reduce along track surface clutter and noise power; the along track resolution after azimuth compression will be sharpened to values between 5-9 Km, depending on the altitude. Cross track surface clutter reduction by dipole/monopole signals combination will be performed during ground processing, provided that complex data are downlinked to Earth. Non coherent average with multiple Doppler filters (looks) can be also performed before downlink, to reduce statistical fluctuations of the final profiles. Finally, echo profiles collected at different frequencies can be processed to enhance the discrimination of subsurface reflections, which are strongly dependent on the frequency, from the surface reflections, which are mostly frequency independent.

1.4.2. Ionosphere Sounding Detailed Description

Ionospheric measurements will be carried out with MARSIS either with passive technique (to measure the plasma electron density close to the antenna in very accurate way) or with active technique (to obtain full electron density profiles of the topside ionospheric layer).
In the Active Ionosphere Sounding Mode MARSIS will transmit a stepped sequence of sinusoidal tones (91.43us of pulse length) at frequency between 0.1 and 5.588 MHz and a step size (in frequency) of 10.937 kHz or its multipliers.
A total of 160 pulses will be transmitted for each sweep and the total duration of the sweep will be 1.23 seconds. The repetition interval of the sweep will be 7.38 seconds. As a consequence the plasma frequency distribution will be mapped with a vertical resolution of 15 Km, a spatial sampling step of about 30 km and a frequency granularity of 10.937 kHz.
At least two modes of operation are planned; continuous and interleaved. The continuous mode of operation would provide a contiguous series of ionospheric sounding sweeps, thereby providing the highest possible horizontal resolution. Since such a contiguous series of sweeps would not leave any time for subsurface soundings, this mode of

operation would be used relatively infrequently, perhaps once ever ten orbits. The more frequently used mode of operation will be to interleave the subsurface soundings with the ionospheric soundings in some regular pattern. Interleaved subsurface/ionospheric soundings will be particularly useful if ionospheric electron density information is needed to interpret or optimize the subsurface soundings.

1.4.3. Instrument Observation Coverage During Mission Period

The goal of MARSIS subsurface sounding data coverage is contiguous and global. It is estimated that this requires ~3100 non-overlapping data passes (orbits). During two Mars years, 4747 orbits are planned. Therefore, global coverage would be obtained in two Mars years by operating MARSIS during ~65% of the orbits. If full global coverage is not possible, MARSIS desires, at a minimum, to collect samples of subsurface sounding data for all regions of Mars, with a substantial fraction of observations during night-side pericentre passes.

During Mars operations, the nature of MARSIS science data collection will depend primarily on the ionospheric conditions, which are governed by the solar illumination conditions during the data pass.

Other considerations include the latitude of the ground track, whether the observation is a first-time or revisit, martian season, and downlink data volume availability.

1.4.4. Observation Specific Requirements

- MARSIS subsurface sounding requires a spacecraft altitude < 800 km. MARSIS ionospheric sounding requires a spacecraft altitude < 1200 km.
- MARSIS has no requirement for simultaneous observations with other instruments.
- The basic nadir pointing attitude of the S/C during observation phase is fully compatible with MARSIS requirements.
- When the monopole is not needed it is also possible, for Marsis, to live with other instruments off-nadir of-track requirements (till TBD degree)
- When the second antenna is needed Monopole Nadir pointing requirements are stricter, the accuracy needed is :
  - ± 1 deg. roll angle (wrt nadir) (cross track)
  - ±2 deg. pitch angle (wrt nadir) (along tack)
- **A very important requirement** is the accuracy of Orbit Prediction and in particular the accuracy of the prediction of the time (in SCET) of the pericenter passage that as to be better than 1 second. **This is a critical point for all MARSIS operations.**

2. Instrument Configuration

2.1. Hierarchical configuration

In figure 2.1-1 is shown the breakdown in general terms of Instrument functions.

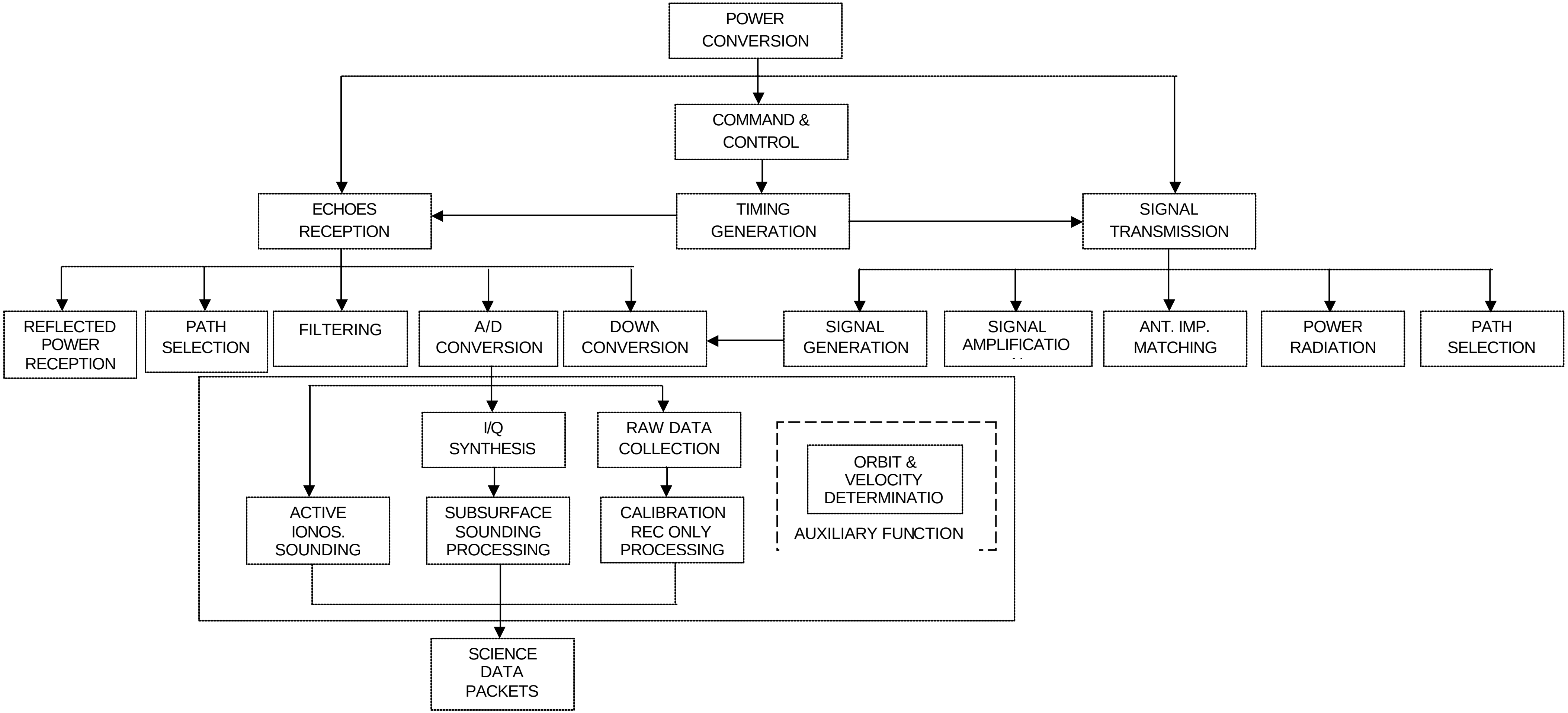


Figure 2.1-1 MARSIS Hierarchical Configuration (in function)

2.2. Physical configuration

In this paragraph is shown the distribution of the functions outlined in the hierarchical configuration (see §2.1) between the different parts making up the instrument.
Functionally and also from the responsibility point of view of each organization involved in MARSIS, the instrument can be split into three subsystems:

- Antenna: ANT
- Radio Frequency Subsystem: RFS (TX+RX)
- Digital Electronics Subsystem: DES

Anyway it is worth considering that from the mechanical (physical) point of view DES and RX Section of RFS subsystem are allocated in the same box inside the S/C.
The acronym for this box is SISD. Inside the S/C is also allocated the mechanical box for the TX electronics housing. The acronym for this box is SIST
The Dipole Antenna, element 1 and 2, and Monopole antenna are allocated outside the S/C.

The physical hierarchical configuration is shown in figure 2.2-1.

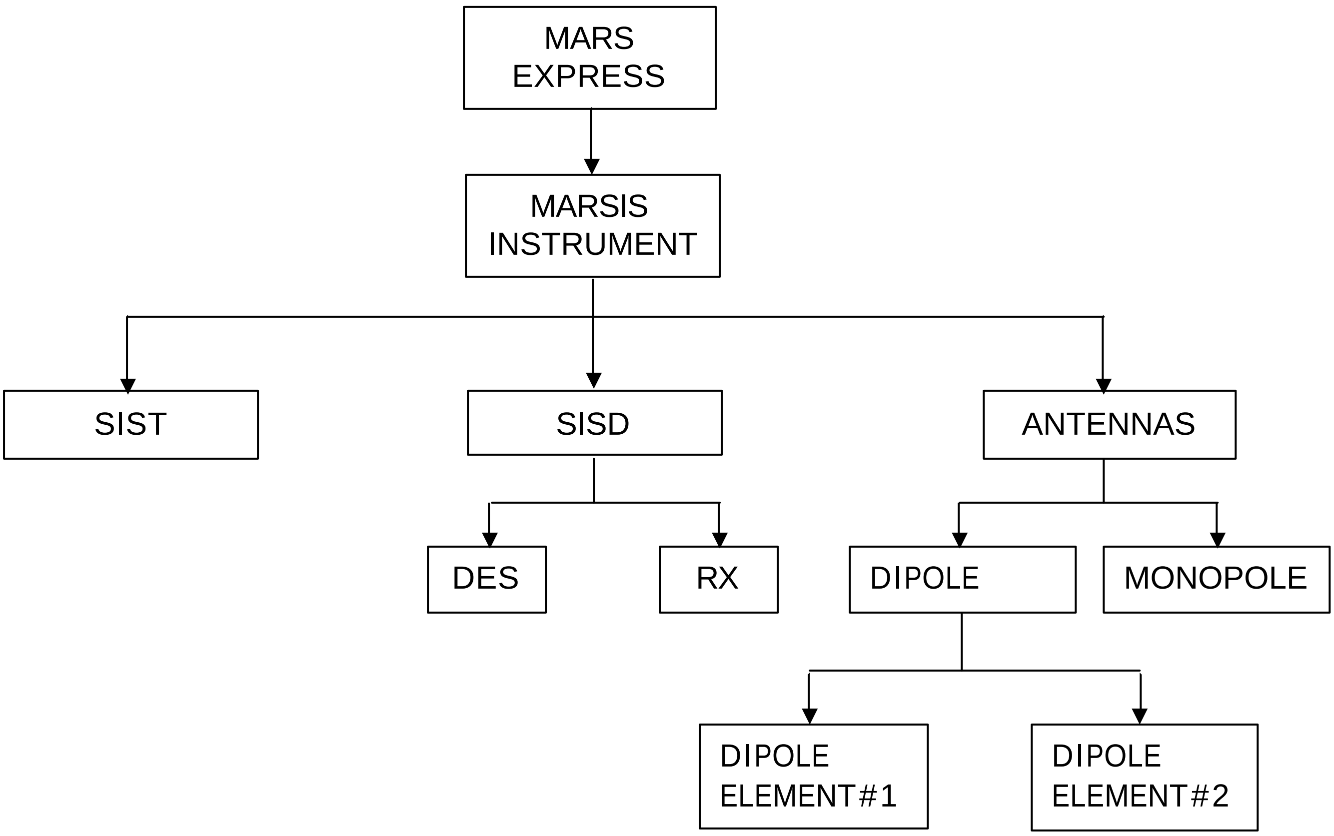


Figure 2.2-1

The distribution of the function shown in the figure 3.1-1 between the different parts constituting MARSIS (see figure 2.1-1) is the following:

DES

- Power Conversion
- Command & Control
- Timing Generation
- Signal Processing
- I&Q Synthesis
- Raw Data Collection
- Active Ionospheric Sounding
- Subsurface Sounding
- Calibration and Receive Only Processing
- Orbit & Velocity Determination
- Science Data Packets Generation

RX

- Path selection
- Filtering
- A/D Conversion
- Down Conversion

SIST

- Signal Amplification
- Antenna Impedance Matching
- Path Selection

DIPOLE

- Power Radiation
- Reflected Power Reception

MONOPOLE

- Reflected Power Reception

2.3. Electrical Configuration

Due to the complexity of the instrument the Functional Electrical Block Diagram has been divided in two parts:

1) Digital Section of the Instrument (figure 2.3-1)

2) Radio Frequency section of the instrument (figure 2.3-2)

The Digital Section is composed by the subsystem DES that is part of the unit SISD (together with RX unit).

The Radio Frequency Section is composed by the subsystem RX that is part of the unit SISD (together with DES unit), the unit SIST and the unit Antenna.
The Instrument Interconnection Diagram is shown in figure 2.3-3

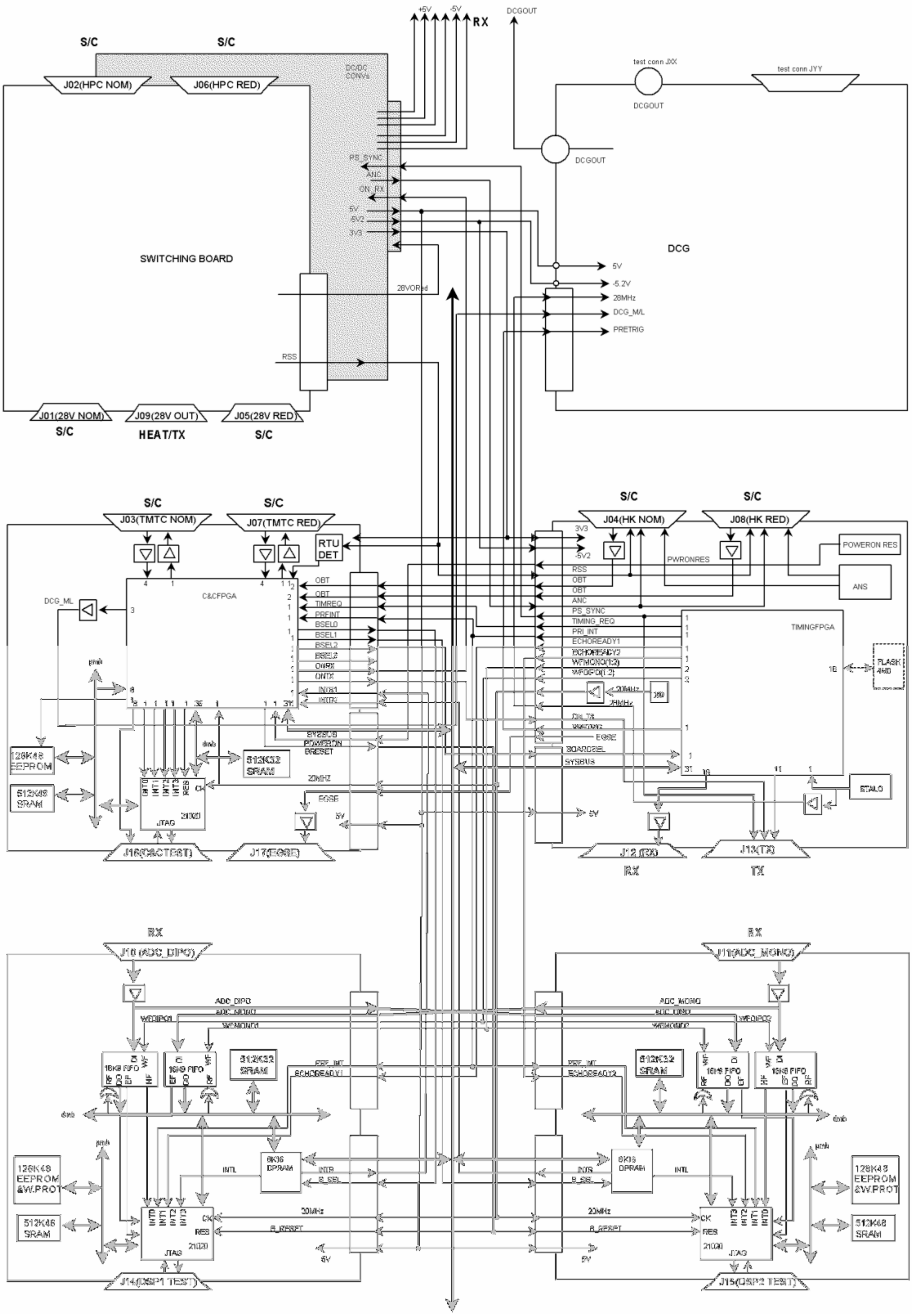

RX
DCGOUT
S/C
S/C
J02(HPC NOM)
J06(HPC RED)
DC/DC CONVs
PS_SYNC
ANC
ON_RX
5V
-5V2
3V3
SWITCHING BOARD
28VORed
RSS
test conn JXX
test conn JYY
DCGOUT
DCGOUT
DCG
5V
-5.2V
28MHz
DCG_M/L
PRETRIG
J01(28V NOM)
J09(28V OUT)
J05(28V RED)
S/C
HEAT/TX
S/C
S/C
S/C
J03(TMTC NOM)
J07(TMTC RED)
RTU DET
S/C
S/C
J04(HK NOM)
J08(HK RED)
POWERON RES
PWRONRES
ANS
C&CFPGA
DCG_ML
TIMINGFPGA
128K48 EEPROM
512K48 SRAM
512K32 SRAM
EGSE
J16(C&CTEST)
J17(EGSE)
J12 (RX)
J13(TX)
RX
TX
RX
RX
J10 (ADC_DIPO)
J11(ADC_MONO)
ADC_DIPO
ADC_MONO
16K9 FIFO
16K9 FIFO
512K32 SRAM
8K16 DPRAM
128K48 EEPROM &W.PROT
512K48 SRAM
20MHz
B_RESET
J14(DSP1 TEST)
J15(DSP2 TEST)

Figure 2.3-1

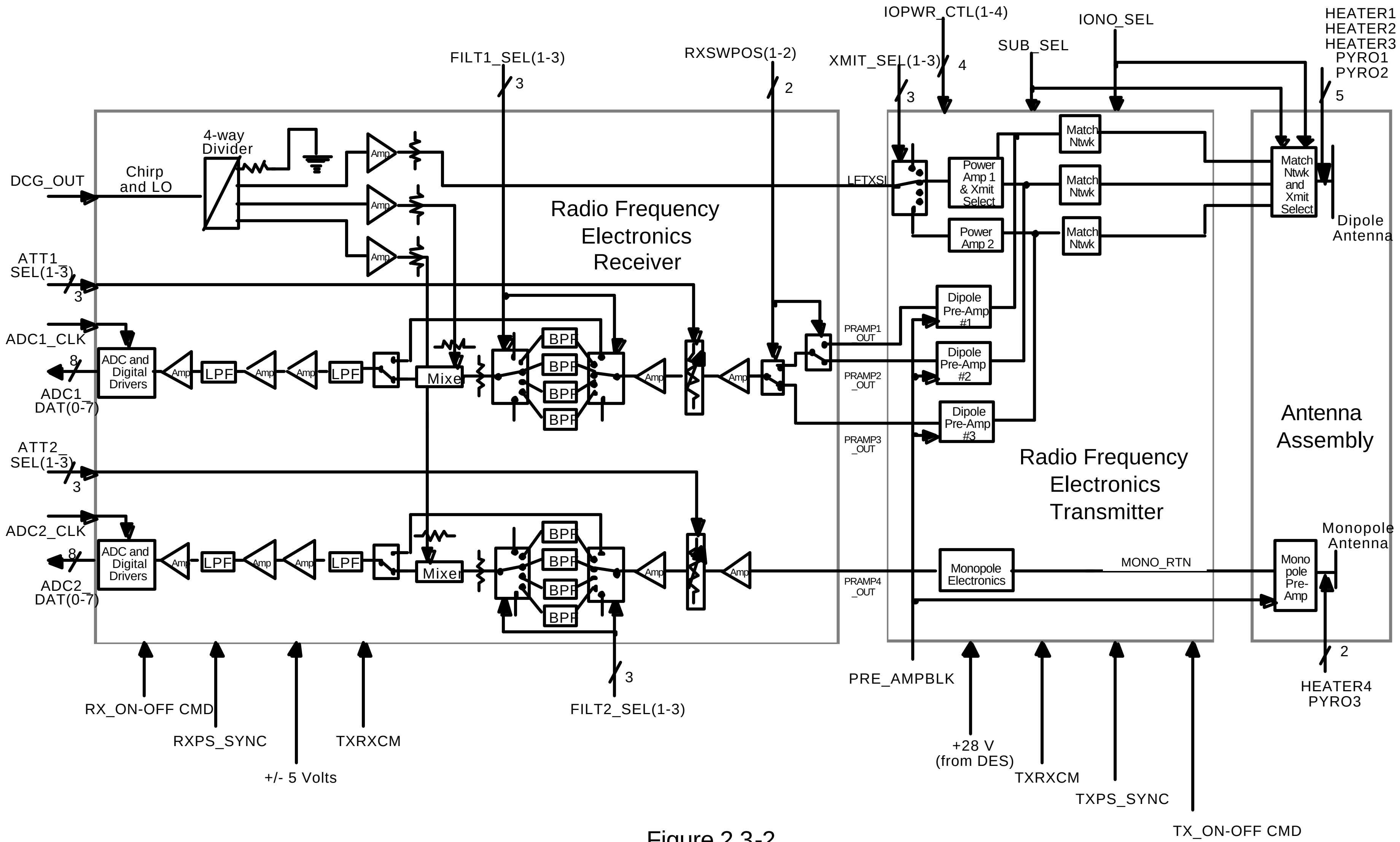

IOPWR_CTL(1-4)
IONO_SEL
HEATER1
HEATER2
HEATER3
PYRO1
PYRO2
SUB_SEL
FILT1_SEL(1-3)
RXSWPOS(1-2)
XMIT_SEL(1-3)
4-way Divider
Chirp and LO
DCG_OUT
ATT1_SEL(1-3)
ADC1_CLK
ADC1_DAT(0-7)
ATT2_SEL(1-3)
ADC2_CLK
ADC2_DAT(0-7)
ADC and Digital Drivers
LPF
Amp
Mixer
BPF
Radio Frequency Electronics Receiver
LFTXSI
Power Amp 1 & Xmit Select
Power Amp 2
Match Ntwk
Match Ntwk and Xmit Select
Dipole Antenna
Dipole Pre-Amp #1
Dipole Pre-Amp #2
Dipole Pre-Amp #3
PRAMP1_OUT
PRAMP2_OUT
PRAMP3_OUT
PRAMP4_OUT
Radio Frequency Electronics Transmitter
Antenna Assembly
Monopole Antenna
Monopole Electronics
MONO_RTN
Mono pole Pre-Amp
RX_ON-OFF CMD
RXPS_SYNC
+/- 5 Volts
TXRXCM
FILT2_SEL(1-3)
PRE_AMPBLK
+28 V (from DES)
TXPS_SYNC
TX_ON-OFF CMD
HEATER4
PYRO3

Figure 2.3-2

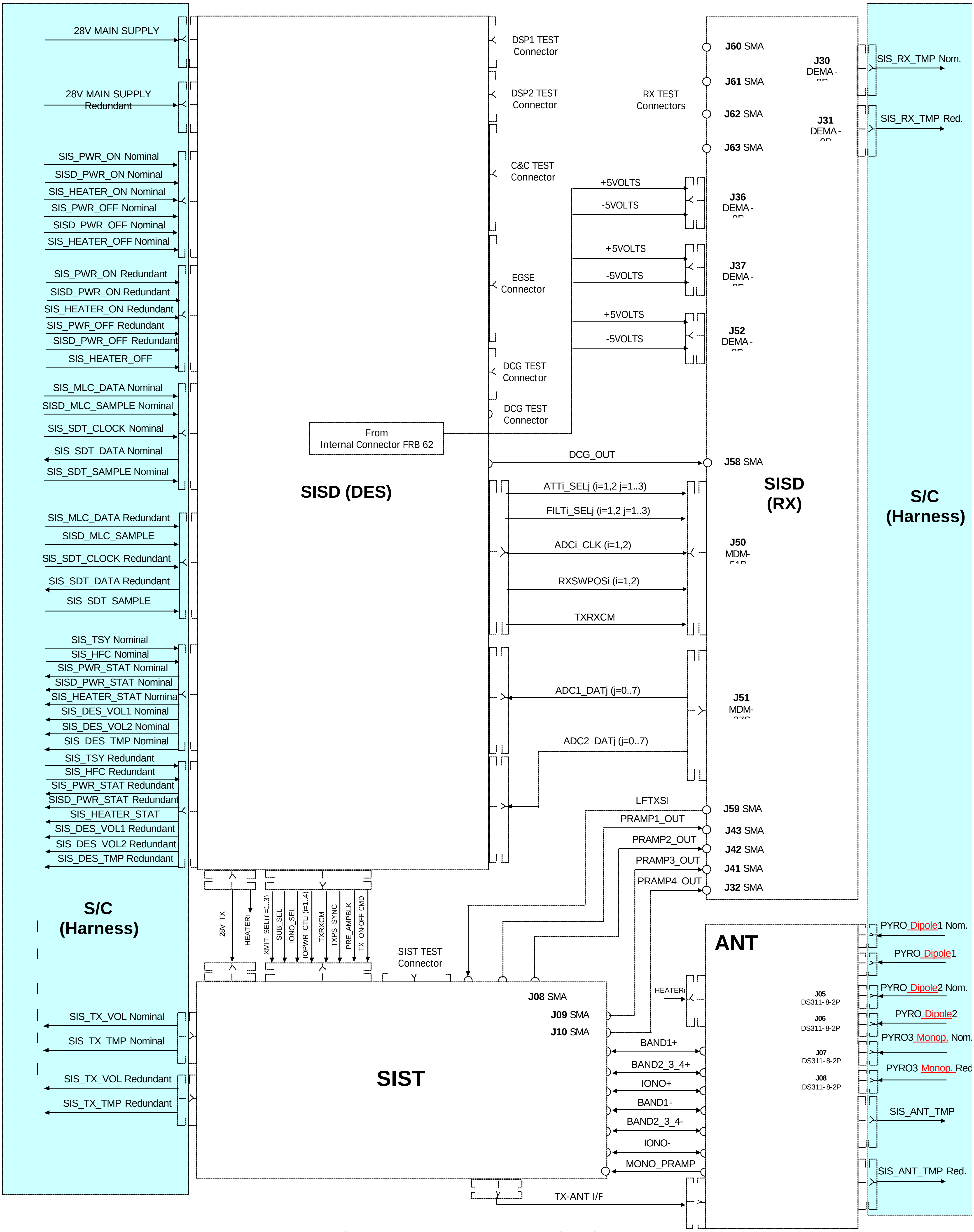


Figure 2.3-3: MARSIS Interconnection Diagram

2.4. Software

2.4.1. Functional Description

The DES software runs on the hardware platform described in §3.3, which consists of the following boards:

- DC/DC Converters Module, which provides secondary power, from S/C primary power sources, to all MARSIS units;
- Switching Board, which houses power relays;
- Timing Board, which manages the clock and timing signal sources for the instrument and for the radar operations;
- Digital Chirp Generator Board, which, under programming of the C&C Board and under triggering of the Timing Board, outputs the radio-frequency signal to the RX and TX;
- C&C Board;
- two identical boards: DSP1 and DSP2.

Software is present in three of these boards: the C&C Board and the DSP1 and DSP2 Boards.

The C&C Board is the Master Processor of the DES and it is based on an ADSP-21020 DSP (referred in the following as the Master CPU). The Board purposes are:

- to handle the DES interfacing with the S/C;
- to Command and Control the overall instrument.
- to create HK and Event Report TM Packets with data coming from the Master CPU itself and from the DSP Boards;
- to collect Scientific Data from the DSP Boards and to packetize them into the relevant TM Packets types;
- to create TM-Blocks starting from TM Packets;

The two identical Boards called DSP1 and DSP2, are each one based on an ADSP-21020 DSP (referred in the following as Slave DSPs). The Slave DSPs implement functions devoted to processing scientific data coming from the two A/D Converters of the RF section of MARSIS.

As a result of this hardware partitioning, DES SW is structured as follows:

- a Data Handling section implemented by the Master CPU;
- a Command and Control section still implemented by the Master CPU;
- a Computing Intensive section, implemented by the two Slave DSPs.

The SW for the Master CPU is written in “ANSI C” and ADSP-21020 Assembly.
The Computing Intensive SW for the two Slave DSPs is written in ADSP-21020 Assembly.

The SW architecture uses a real-time operating system (RTOS) for run-time support, inclusive of standard libraries and run-time features of a typical kernel, known as EONIC Virtuoso.

2.4.2. Software Structure

The following diagram illustrates the layered structure of the DES software running on the Master and Slave DSPs.

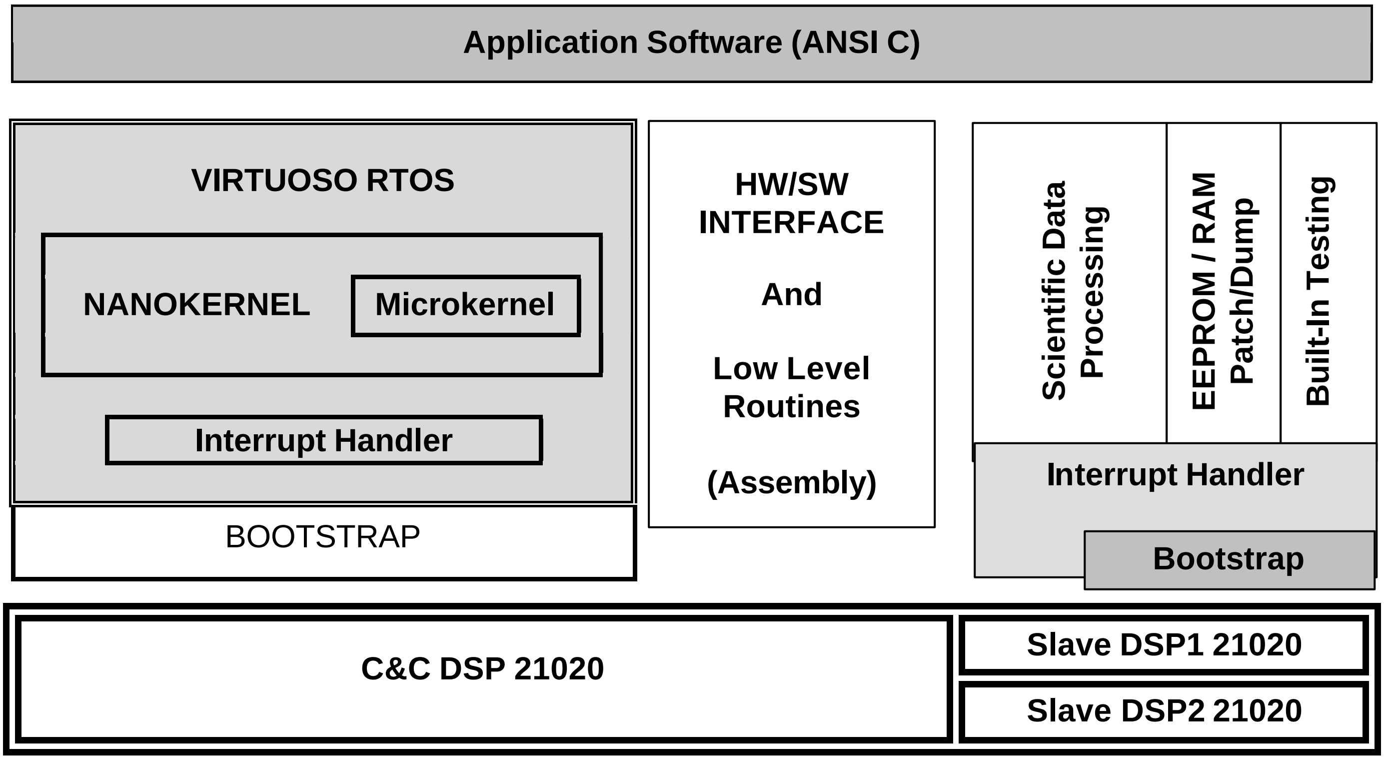


Fig. 2.4.1.1-1: Layered structure of the DES software model

For the Master CPU at the bottom layer is present the bootstrap section. At the same level a collection of assembly routines to handle interfacing with low-level resources is foreseen. At higher level it is present the application software, coded in ANSI C. The intermediate layer is constituted by the RTOS Virtuoso, which manages interrupt handling and tasks/processes scheduling.

For the Slave DSPs, which share a common architecture, at the bottom layer is present the bootstrap section. At the same level a collection of interrupt-driven assembly routines implement the Scientific Data Processing and the Support Functions (i.e. Memory Dump/Patch, background BIT, inter processors communication). No intermediate layer (no OS layer) is foreseen for the DES software running on the Slave DSPs.

2.4.2.1 Memory Allocation

The memory devices and sizes available in the Digital Electronics Subsystem (DES) are shown in the following table 2.4.2.1-1.

In the table are shown:

- Type of memory
- Memory Integrated Circuit device name
- Size of the single memory Integrated Circuit device
- Location of the memory Integrated Circuits devices (in which board they are located and the number of IC in the board)
- The total number of Integrated Circuits inside the DES for each type of memory
- The total available size of each type of memory

TYPE	DEVICE	SIZE	POSITION				TOTAL IC	TOTAL SIZE
			DSP MODULES			Other		
			C&C	DSP1	DSP2	TIMING		
SRAM	UT9Q512/Q	512kB	10	10	10	0	30	15360kB
EEPROM	MEM8129/883B	128kB	6	6	6	0	18	2304kB
FLASH	ACT-F2M32A-090-F18Q 2Mx32	8MB	0	0	0	2	2	16MB
DPRAM	SMK2-67025EV-35/883B	16kB	0	1	1	0	2	32kB
FIFO	SMK2-67025EV-35/883B	16kB	0	2	2	0	4	64kB

Table 2.4.2.1-1

Additional details about the memory areas (with each memory area identified by its ID) is provided in §3.6.

The memory associated to each CPU is organized as follows:

Function	Device Type	Word Size	Overall Size
Program and data storage	EEPROM	48 bit	128Kwords
Program execution	SRAM	48 bit	512Kwords
Data memory	SRAM	32 bit	512Kwords

The partitioning of CPU-associated memories is as follows (next page).

Master CPU

EEPROM	**Partition**
BOOT CODE	Write Disabled Section Of EEPROM (HW Disabled, no Patch Operation possible)
BASIC PROGRAM CODE STORAGE	
DEFAULT DATA STORAGE	Write Enabled Section Of EEPROM (Patch Operations possible with SIS_PATCH_TC)

Program SRAM	**Partition**
PROGRAM CODE	Write Enabled Section (Patch Operations possible with SIS_PATCH_TC)
CONSTANTS STORAGE (i.e. Parameters Table or Operational Sequence Table)	Write Enabled Section (Patch Operations possible with SIS_PATCH_TC and SIS_PT_TC or SIS_OST_TC)

Slave DSPs

EEPROM	**Partition**
BOOT CODE	Write Disabled Section Of EEPROM (HW Disabled, no Patch Operation possible)
BASIC PROGRAM CODE STORAGE	Write Enabled Section Of EEPROM (Patch Operations possible with SIS_PATCH_TC)
DEFAULT DATA STORAGE	

Program SRAM	**Partition**
PROGRAM CODE	Write Enabled Section (Patch Operations possible with SIS_PATCH_TC and SIS_PT_TC)
CONSTANTS STORAGE (TBC)	

The following partition sizes are reported:

	Program Memory Partition (Sw Rel 4.2)		
MASTER DSP	Boot Code	8192 words	49152 bytes
	Program Code	40960 words	245760 bytes
	Parameter Table	4096 words	24576 bytes
Slave DSPs	Program Code	12288 words	73728 bytes
	Parameter Table	32769 words	196614 bytes

2.4.3. Software Operations

MARSIS Operations are defined on a single orbit basis. For each active orbit measurements and data processing sections are performed, as well as the required command and control tasks to support science activities.

An active orbital “session” (from the software point of view) consists of successive **POWER-ON**, **OPERATION** (Operative part of the Orbit during which the measurement and data processing shall be made) and **POWER-OFF** phases.

The OPERATION phase consist of a sequence of several **Operative Modes**, interleaved in any possible way, and programmed in the Operational Sequence Table. Basic characteristic of MARSIS is that each Operative Mode is composed of different sets of Pulse Repetition Intervals (**PRI**s) called **Frames**. A Frame can belong to only one Operative Mode.
For Calibration, Receive Only and Active Ionospheric Sounding Operative Modes, the size of every frame is fixed. On the contrary, for the Subsurface Sounding Operative Modes the relevant Frame sizes is variable with respect to the orbit characteristics, the satellite position on the orbit and the used TX frequency.
As Frames can belong to only one Operative Mode the **minimum duration** of a single Operative Mode coincides with that required by the execution of a single “processing” Frame. Note that for Calibration, Receive Only and Active Ionospheric Sounding a fixed number of “idling” frames is foreseen in order to execute a single “processing” Frame (see detailed description of each Operative Mode)

In the following a detailed explanation of the DES software activities will be given on **Orbit**, **Frame** and **PRI** basis.

2.4.3.1 Orbit Basis Operations

MARSIS operations on an orbit basis consist of a succession of three phases: POWER-ON, OPERATION and POWER-OFF.

The Master CPU manages and drives MARSIS operations during all these phases as shown in the Mode Transition Diagram (see §5.2) and as explained in the following.

2.4.3.1.1 POWER-ON Sequence

The POWER-ON sequence (for what concern the SW) starts on the reception of the SISD_PWR_ON HPC on from S/C to MARSIS which closes the SISD relay of the Switching Board, thus providing power to the DES power supply.

The POWER-ON sequence is defined around MARSIS Support Modes: **CHECK/INIT**, **STANDBY(Basic code), STANDBY(patchable code)**, **WARM-UP1** and **WARM-UP2**.

In general, during all these Modes the **Master CPU** will:

- perform the generation of the relevant internal power on commands to the on-board equipment (detailed below);
- perform the self-monitoring, and the transition to IDLE Mode in case of any failure or any malfunction occurrence, together with the generation of the corresponding Error/Anomaly Report TM;
- perform the transition to the successive Support Mode, generating Normal/Progress Report TM to let the transition between Modes observable by the S/C or Ground, in case of no failure detection;
- perform the generation, collection and packetization of Housekeeping Data in TM Packet.

At the same time each of the **Slave DSPs** will:

- perform its bootstrapping operations (power-up, initializing, Built-In Tests), in order to prepare to operate in the proper way during the Operative Modes.

In particular, the following activities will be performed during each Support Mode.

In **CHECK/INIT Mode** the DES will prepare the instrument to operate in the proper way during the Operative Modes, performing the following bootstrapping operations:

- HW initialization;
- Built-In Tests (BIT), consisting of an initial EEPROM code checksum and memory check;
- SW code and Default Tables transfer from EEPROM to RAM;
- RAM code checksum.

Then the DES will:

- enter STANDBY Mode autonomously (after 6 seconds from SISD_PWR_ON reception) in any case (STANDBY Mode will always be entered, also in case of initialization BIT failure, to allow the execution of memory patches).

The **STANDBY Mode** consists of two separated phases. During the first phase the Basic Code is executed and the DES will:

- receive any TC (both discrete or MLC) defined in MARSIS TC/TM Database and will send to the S/C all TM packets defined in MARSIS TC/TM Database, with the exception of Science TM.

In particular, when entering STANDBY Mode the DES will:

- generate the Normal/Progress Report TM Packet;

- report initialization BIT results with the first HK TM Packet;
- receive the TC Time Packet containing the initial SCET Time;
- write the received SCET Time into the OBT register within 0.5 seconds;
- receive, validate, acknowledge (by the relevant TM) and execute any TC applicable to MARSIS;
- perform Memory Management (Patch/Dump) operations if required, with the exception of FLASH memories related operation;
- generate HK TM Packets (every 8 seconds, starting from STANDBY transition, until S/C power off command) if the special Disable HK Report Packet Generation TC was not received;
- build TM-Block putting together single TM Source Packets.
- stay in STANDBY Mode forever until the reception of a special TC(206,2), called **Restart_With_Code2** (see RD-11), which triggers the execution of the second phase.

OPS CONSTRAINT
After Power On MARSIS transitions to Stand By state where it can be programmed. To perform science operations MARSIS shall be restarted with the dedicated TC to load the most recently updated SW.

During the second phase the Patchable Code is loaded and executed and the DES will:

- receive, validate, acknowledge (by the relevant TM) and execute any TC applicable to MARSIS;
- perform Memory Management (Patch/Dump) operations if required, including FLASH memories related operation;
- generate HK TM Packets (every 8 seconds, starting from STANDBY transition, until S/C power off command) if the special Disable HK Report Packet Generation TC was not received;
- build TM-Block putting together single TM Source Packets;
- after about 80 seconds from the reception of the special **Restart_With_Code2** TC(206,2) the DES will:
  - IF the initialization BIT performed during bootstrapping operations in CHECK/INIT Mode was not successful:
    - THEN go in IDLE Mode immediately.
    - ELSE IF the initialization BIT performed during bootstrapping operations in CHECK/INIT Mode was successful:
      - THEN the DES will execute a run-time BIT consisting of code checksum and then IF run-time BIT results are successful and the special Automatic Mode Transition Disable TC was not received:
        - THEN enter WARM-UP1 Mode autonomously;
        - ELSE enter WARM-UP1 Mode autonomously after n seconds (where n is the STANDBY duration indicated within the automatic Mode Transition Disable TC) from Automatic Mode Transition Disable TC reception (IF BIT results are successful and the special Automatic Mode Transition Disable TC was received)
      - ELSE go in IDLE mode.

OPS CONSTRAINT
Once the updated SW is loaded with the dedicated TC, MARSIS commandability is time constrained to a pre-programmed interval (60 sec) which can be altered only by prior issuing another dedicated command.

In **WARM-UP2 Mode** the DES cannot accept any TC (except a HPC_OFF) and will:

- generate the Normal/Progress Report TM Packet;
- generate residual DUMP TM Packets (if any) in case a dump request TC has been received during STANDBY Mode;
- switch on the TX power supply;
- execute run-time BIT consisting of code checksum;

Then the DES will:

- if BIT results are successful:
  - THEN enter the first Operative Mode autonomously at the beginning of the first PRI after the time SCET*, whose value is loaded by the proper TC and stored in the PT.
  - ELSE go in IDLE Mode immediately.

OPS CONSTRAINT
Permanence in Warm Up 2 state depends from the programmed time tag called **SCET ***. When SCET * expires, then the loaded operational sequence will start.

2.4.3.1.2 OPERATIVE Phase

In the OPERATIVE phase the **Master CPU** will completely and autonomously (without external intervention) control the MARSIS Instrument functionality, following the "instructions" listed in the OST and using the parameters stored into the PT (see the "on Frame" aspects listed below), while the **Slave DSPs** will execute the intensive onboard scientific data processing, together with self-checks.

The OPERATIVE phase is defined around the following Operational Modes: **RECEIVE ONLY**, **ACTIVE IONOSPHERE SOUNDING**, **SUB SURFACE SOUND 1 to 5**, and **CALIBRATION**.

In this phase the **Master CPU** will handle:

- the transitions between several Operative Modes (following the timelines listed in OST);
- the generation of Normal/Progress Report TM Packets to let the transitions between Modes observable by the S/C or Ground, storing them in the corresponding memory buffer;

- self-monitoring, and the transition to IDLE Mode, in case of any failure or any malfunction occurrence, together with the generation of the corresponding Error/Anomaly Report TM;
- once every 8 sec., the generation, collection and packetization of Housekeeping Data in TM Packets, storing them in the corresponding memory buffer;
- once every second, the generation of TM-Block from single TM Packets, storing them in the proper buffer, ready to be acquired by the DMS;
- the control of MARSIS Instrument functionality putting the instruction listed in OST into effect during each Operative Mode;
- the detailed and listed below "on Frame basis" operations (see §2.4.2.2);
- the transition to WARM-UP2 as indicated by the last line of the OST, generating the relevant TM Report.

Operative Modes are managed in terms of PRIs and Frames.

OPS CONSTRAINT
A sequence of Operational Modes proceeds without interruptions unless an error or anomalous event verifies within the instrument. It is not possible to send any command to the instrument during the execution of the sequence but an HPC_OFF.

2.4.3.1.3 POWER-OFF Sequence

The POWER-OFF sequence starts on the conclusion of the last selected Operative Mode and therefore with the transition back to WARM-UP2.

The POWER OFF sequence is defined around the MARSIS Support Modes **WARM-UP2**, **WARM-UP1** and **STANDBY**.

During all these Modes the **Master CPU** will:

- perform the generation of the related internal power off commands to the on-board equipment (detailed below);
- execute the self-monitoring, and the transition to IDLE Mode, in case of any failure or any malfunction occurrence, together with the generation of the corresponding Error/Anomaly Report TM Packet;
- perform the transitions to the successive Support Mode, generating Normal/Progress Report TM Packet to let the transition between Modes observable by the S/C or Ground, in case of no one malfunction occurrence is detected;
- once every 8 sec., the generation, collection and packetization of Housekeeping Data in TM Packets, storing them in the corresponding memory buffer;
- generate residual Packets (if any);
- once every second, the generation of TM-Block from single TM Packets, storing them in the proper buffer, ready to be acquired by the DMS;

In particular, the following activities will be performed during each Support Mode.

In **WARM-UP2 Mode** the DES cannot accept any TC (except a HPC_OFF) and will:

- generate the Normal/Progress Report TM Packet;
- generate residual DUMP TM Packets (if any) in case a dump request TC has been received during POWER-ON STANDBY Mode;
- generate residual science TM Packets (if any);
- execute run-time BIT consisting of code checksum;

Then the DES will:

- IF BIT results are successful:
  - THEN enter WARM-UP1 Mode autonomously (after 2 seconds from WARM-UP2 mode beginning), sending an OFF command to the TX;
  - OR go in IDLE Mode immediately.

In **WARM-UP1 Mode** the DES cannot accept any TC (except a HPC_OFF) and will:

- generate the Normal/Progress Report TM Packet;
- generate residual DUMP TM Packets (if any) in case a dump request TC has been received during POWER-ON STANDBY Mode;
- generate residual science TM Packets (if any);
- carry out run-time BIT consisting of code checksum;

Then the DES will:

- IF BIT results are successful:
  - THEN enter STANDBY Mode autonomously (after 4 seconds from WARM-UP1 transition), sending an OFF command to the RX;
  - OR go in IDLE Mode immediately.

When back in **STANDBY Mode** the Master CPU **cannot accept TC anymore** (except a HPC_OFF) and will:

- generate the Normal/Progress Report TM Packet;
- generate residual DUMP TM Packets (if any) in case a dump request TC has been received during POWER-ON STANDBY Mode;
- generate residual science TM Packets (if any);
- **wait for the S/C power off command**.

OPS CONSTRAINT
There is no possibility to command the instrument after an operational sequence has been performed. without first cycling off and then on its power.

2.4.3.2 Frame Basis Operations

Frame basis operations are characteristic of the OPERATIVE phase of MARSIS.

The actions needed to command the Operative Modes transitions and the Frame transitions are performed in the last PRIs before the transition itself, which will always coincide with the starting time of a single PRI. The only exception regards the Mode transitions in which the Active Ionospheric Sounding Mode is involved.

Based on the above considerations, in the following are highlighted the actions to be performed within each Frame (to allow intra-Mode Frame transitions) and during the last Frame of an Operative Mode (to allow the Operative Modes transitions).

During each Frame the **Master CPU** will:

- perform background parallel calculation in order to update the frame size (cf. formulas related to the determination of the Frame size 'NB' in § 10.1.1);
- carry out periodic background BIT consisting of code checksum and other HW status checks, and collect BIT results from the Slave DSPs;
- go in IDLE Mode immediately if BIT results are not successful;
- collect and packetize the processed Science Data in TM Source Packets, storing them in the proper memory buffer.
- collect individual echoes data (if any) and packetize them in TM Source Packets, storing them in the proper memory buffer;
- collect FLASH memories data (if any) and handle their storing in FLASH memory chips;

During the last Frame of an Operative Mode the **Master CPU** will:

- perform all of the above operations;
- acquire the next Operative Mode and its duration from OST;
- acquire the next Operative Mode parameters set from PT;
- notify the next Operative Mode and the relevant parameters to the other components of the MARSIS Instrument;
- go in the next Operative Mode autonomously when scheduled in OST, if BIT results are successful.

During each Frame each of the **Slave DSPs** will:

- carry out periodic background BIT, consisting of code checksum, store the results in a predefined memory area and notify them to the Master CPU;
- acquire the next Operative Mode from the Master CPU, by means of an Inter Processor Communication (via a dual port memory and the system bus);
- acquire the next Operative Mode parameters from the Master CPU, by means of an Inter Processor Communication;
- acquire background calculation results, from the Master CPU by means of an Inter Processor Communication;
- carry out the Scientific Data processing, storing the results for the actual Frame;

- collect individual echoes data (if any), storing them in the proper memory buffer;
- collect FLASH memories data (if any) , storing them in the proper memory buffer;
- signal the Master CPU when results for the actual Frame are ready.

2.4.3.3 PRI Basis Operations

PRI basis operations are also characteristic of the OPERATIVE phase of MARSIS. Each PRI, or Pulse repetition Interval, is the basic radar operation timing source. A PRI starts with the beginning of the generation of the radar pulse and ends at the beginning of the next radar pulse. Within a PRI the echoes are acquired. Echoes acquisition is performed within a Receiving Window measured from the beginning of the PRI and whose delay and width is computed according to different parameters.

The **Master CPU** will:

- handle the PRI pulse occurrences to keep the whole instrument synchronization;
- drive the DCG and Timing boards writing on them, on Timing Unit request, the correct values to be used;

Each of the **Slave DSPs** will:

- acquire and process the Scientific Data, coming from the currently sampled RF echoes;
- collect individual echoes or FLASH memories data if requested;
- collect partial results related to this processing.

Operations on PRI basis are strictly hardware managed by means of interrupts generated by the Timing Board which takes care that all the activities are performed within the tight constraints of radar operations. In particular the Master CPU will:

- handle the Inter Processor Communication requests coming from the couple of Slave DSPs;
- handle the request coming from the Timing board, which may interrupt the MASTER CPU in two ways:
  - sending a transition synchronous with the PRF;
  - sending a transition that requires a change in DCG and TIMING parameters.

These two transitions will never occur contemporarily (the minimum delay is of 400 us). The Interrupt Service Routine which manages these requests must branch differently for the two cases:

- on PRF arrival, the MASTER CPU shall perform all operations required to manage the current PRI; among them there is the programming of the DCG, in particular of the first output frequency. Moreover on PRF arrival a PRI counter shall be incremented via HW so that the Master CPU shall know the time position in number of PRI within each frame.

- on Frequency Load request, the Master CPU will simply load the frequency register in the DCG with the programmed frequency value. Note that for some operating modes, this request occurs 3 times every PRI.

2.4.4. Special Software Services

2.4.4.1 S/C Service Requests Management

In order to manage the RTU MLC/SDT interface, the **Master CPU** will:

- handle the request coming from SDT to acquire a 16-bit word from the DES TM-Blocks buffer. The Standard Telemetry's and Science Data from MARSIS are acquired on board MARS EXPRESS by the DMS-computer via the OBDH-Bus and the RTU as TM-Blocks containing TM Source Packets. The S/C SDT channel rate shall have a maximum rate of about 80 Kbps;

- handle the request coming from MLC to transfer a 16-bit word from the DMS subsystem via the RTU to the DES TC packets buffer containing the TC packets distributed from the RTU to the DES. The TC throughput rate shall not exceed 32.8 Kbps.

2.4.4.2 On-Board Time Distribution and Synchronisation

In order to synchronize MARSIS the DMS will send to the DES the TC time packet with the new calculated time. The **Master CPU** will process the TC time packet and will write the SCET value in the specific OBT register within 0.5 sec.

A 48-bit counter, clocked by the HFC provided by the S/C, will keep the instrument on-board time.

On arrival of the TSYNC pulse, the On Board Time, OBT, counter will be loaded (via HW) with the value stored in the OBT register (48 bit as well).
The Master CPU reads the OBT not from the counter directly, but rather from a register (Freeze Register) whose content is always stable when accessed.

2.4.4.3 Malfunction Or Failure Occurrences

As outlined above, on any unrecoverable malfunction or failure occurrence, the DES will go in **IDLE Mode**, during which the following actions will be performed:

- switch OFF both RX and TX;
- generate the proper Error/Anomaly Report TM Packet

- not accept any TC from S/C (except a HPC_OFF and the Memory DUMP request TC);
- collect and packetize residual Scientific Data (if any) and Housekeeping Data in TM Packets, storing them in the corresponding memory buffers;
- generate DUMP TM Packets if requested;
- build TM-Blocks with single TM Packets, storing them in the proper buffer ready to be acquired by DMS.

As indicated above, during the IDLE Mode:

- the Data Handling section will be able to send Packetized Telemetry to the S/C;
- the Computing Intensive section will not perform any particular action.
- Therefore it has been chosen that, after the Master CPU has retrieved the SW Status Word of each of the Slave DSPs, the whole Computing Intensive section will be maintained at a persistent active reset level by the Master CPU during all the IDLE Mode duration.
- Data Handling and Computing Intensive sections may be interrupted by a watchdog reset.

A watchdog reset in both Data Handling and Computing Intensive section is considered an **unrecoverable malfunction**; therefore on a watchdog reset the DES will go in IDLE Mode in the way described below.

2.4.4.3.1 Watchdog time-out detected on the Master CPU

At the Data Handling section level the watchdog reset is HW driven.

The Master CPU will periodically re-arm a HW counter to avoid the HW watchdog reset to be triggered. In case of SW failure the HW watchdog reset is triggered as follows.

The **first watchdog expiration** will cause the HW:

- to generate a low-level reset pulse on the whole DES HW (the watchdog reset Guard is not cleared, because the RAM is kept alive and the software restart does not clean the memory up);
- to set the watchdog reset counter internal to the FPGA.

Therefore the **Master CPU** bootstraps again but taking into account the current condition (different from the power-on condition), and with reference to **CHECK/INIT Mode** Actions, will try to perform the following actions:

- no initialization of the whole HW (especially Program RAM clean up and initialization),
  - check which code version (Base Code or Patchable Code) was running in Program RAM when the watchdog reset occurred, and initialize the Data RAM consequently
- perform generation of the Error/Anomaly Report TM Packet;
- perform generation, collection and packetization of the Housekeeping Data, storing them in the proper buffer;

- collect and packetize residual Scientific Data (if any), storing them in the proper buffer;
- build TM-Blocks with single TM Packets, storing them in the proper buffer ready to be acquired by DMS;
- wait for the DSPs BIT results for a maximum time interval and report them in the relevant TM Packet;
- stay in STANDBY forever, or until the special TC(206,2) **Restart_With_Code2** is received
- go in IDLE Mode at the end of STANDBY Mode second phase in case the special TC(206,2) is received.

Because of the HW reset generation on the whole DES, each of the Slave DSPs bootstraps again, acting in the same way expected at power-on (the watchdog reset counter is mapped on the Master CPU memory) and performing the same operation executed during a cold restart.

At the **second watchdog expiration** the exceeding of the value of the HW watchdog reset counter described above shall cause the HW:

- to generate a low-level persistent reset on the whole DES, keeping all the DES in a persistent reset state.

The DES will therefore stop operating altogether and will only be able to be switched off.

2.4.4.3.2 Watchdog time-out Detected on one of the Slave DSPs

At the Computing Intensive section level the watchdog reset is SW driven.

The watchdog policy during each of the Support Modes shall consist of limiting the time interval that the Master CPU waits for each of the Slave DSPs to report BIT results.

The watchdog policy during each of the Operative Modes consists of limiting the time interval that the Master CPU waits for:

- Slave DSPs BIT results;
- Patch/Dump operation;
- Individual Echoes or FLASH Memories data;
- Processed Scientific Data.

The Master CPU will command a SW watchdog reset on both the Slave DSPs when the any of the SW watchdog timer reach its time-out value. Hence, when such a time-out occurs the **Master CPU** will:

- generate an HW reset signal on the reset pins of both Slave DSPs;
- perform generation of the Error/Anomaly Report TM Packet;
- perform generation, collection and packetization of the Housekeeping Data storing them in the corresponding buffer;

- collect and packetize residual Scientific Data (if any), storing them in the corresponding buffer;
- build TM-Blocks with single TM Packets, storing them in the proper buffer ready to be acquired by DMS;
- wait for the DSPs BIT results for a maximum time interval and report them in the relevant TM Packet.

Because of the Master CPU HW reset generation on the reset pins of the Slave DSPs pair, each of the Slave DSPs bootstraps again, acting in the same way expected at power-on.

If during the transition to IDLE Mode described above, a successive time-out occurs on one of the Slave DSPs, no further acknowledge will be expected from the Computing Intensive section. This is to avoid a multiplicity of SW watchdog resets.

2.4.5. Software Maintenance

2.4.5.1 In Flight Maintenance

It is possible to reconfigure all the software and data in SRAM by means of standard Patch Telecommands, SIS_PATCH_TC.
In order to activate any patched SRAM code a special TC (206,2), called **Execute_Master_PM_Patch** (see RD-11), shall be sent to the DES (to perform a soft reboot without altering SRAM content).

It is possible to load a new software revision, including default data, into the patchable partition of the EEPROM by means of standard Patch Telecommands.

The SIS_PT_TC and SIS_OST_TC telecommands are special patch commands used to update the Parameter Table and the Operational Sequence Table in order to program the instrument for an observation. These commands act only on the SRAM copy (the working copy) of the PT and the OST. Patched values are reset to default at the next power on.

OPS CONSTRAINT
Warning Locations addresses and values alignment in the SIS_PT_TC and SIS_OST_TC telecommands do not represent necessarily the real allocation scheme. (see RD-10)

2.4.5.2 On-ground Maintenance

It is possible to load a new software revision into SRAM by means of a dedicated JTAG interface and its test cable connected to a PC running the developent environment.

It is possible to load a new software revision, including default data, into the patchable partition of the EEPROM by means of standard Patch Telecommands.
Access to the not Patchable partition of the EEPROM is granted by removal of the hardware write-disabling feature.

2.5. Budgets

2.5.1. Power

The power and energy budgets (<u>using values measured during FM test campaign</u>) for operation of the MARSIS Instrument are shown in Table 2.5-1.

		SILENT				SUPPORT				OPERATIVE			
	Operative MODES	OFF	SIS-ON	CRUISE	NON-OP	CHECK INIT	STANDBY	WA-UP1	WA-UP2	REC. ONLY	CALIB.	SS Modes	AIS
	DC Power [W]	**0,00**	**0,96**	**13,21**	**11,67**	**24,50**	**24,50**	**25,80**	**29,70**	**30,00**	**62,00**	**64,40**	**53,00**
IT#1	Time [s]		15,00	86400[2]	80044,50[3]	5,9[1]	240[1]	5[1]	300[1]	1580[1]			
	Energy [kJ]	0,00	0,01	1141,34[2]	934,12[3]	0,14[1]	5,88[1]	0,13[1]	8,91[1]	101,75[5]			
IT#2	Time [s]		15,00	86400[2]	76444,50[4]	5,9[1]	240[1]	5[1]	300[1]	2180[1]			
	Energy [kJ]	0,00	0,01	1141,34[2]	892,11[4]	0,14[1]	5,88[1]	0,13[1]	8,91[1]	133,55[5]			

(1) Per Orbit
(2) Per Day (24hrs)
(3) Per Day considering three orbits with Timeline IT#1
(4) Per Day considering three orbits with Timeline IT#2
(5) Per Orbit (worst case condition considering always 64.4 Watts for SS Modes when AIS is not used)

Table 2.5-1 MARSIS Power and Energy Budget

<u>Instrument Timeline #1 (Baseline)</u>
The used energy per orbit (2130.9 seconds of operation) is 116.82 kJ.

<u>Instrument Timeline #2</u>
The used energy per orbit (2730.9 seconds of operation) is 148.62 kJ.

During the 26 minutes (1580 seconds) operate time (Operation Modes in IT#1) the Calibration, Subsurface, Receive Only and Active Ionospheric Sounding Mode can be interleaved in a pre-defined way, following the sequence listed in the OST.
In IT#2 the first 300 seconds and the last 300 seconds of Operation Modes are completely dedicated to the Active Ionospheric Sounding Mode.

In Tables 2.5-2 are shown, mode by mode, the MARSIS Power and Current demand, respectively.

Mode		Power Demand [W]	Current Demand [A]		
			Supply Voltage: 26 V	Supply Voltage: 28 V	Supply Voltage: 29 V
Silent Modes	**OFF**	0,00	**0,00**	**0,00**	**0,00**
	SIS-ON	0,96	**0,04**	**0,03**	**0,03**
	CRUISE	13,21	**0,51**	**0,47**	**0,46**
	NON-OP.	11,67	**0,45**	**0,42**	**0,40**
Support Modes	**CHECK/INIT**	24,50	**0,94**	**0,88**	**0,84**
	STANDBY	24,50	**0,94**	**0,88**	**0,84**
	WARM-UP1	25,80	**0,99**	**0,92**	**0,89**
	WARM-UP2	29,70	**1,14**	**1,06**	**1,02**
	IDLE	24,50	**0,94**	**0,88**	**0,84**
Ops Modes	**RX ONLY**	30,00	**1,15**	**1,07**	**1,03**
	CALIBRATION	62,00	**2,38**	**2,21**	**2,14**
	IONOSPHERE	53,00	**2,04**	**1,89**	**1,83**
	SUBSURFACE	64,40	**2,48**	**2,30**	**2,22**

Table 2.5-2: Mode by Mode (for different Supply Voltages) Current Absorbtion

2.5.2. Antenna Alignment

The antenna pre-flight alignment requirements are as follows:

- The dipole antenna elements are to be aligned perpendicular to the nadir direction and perpendicular to the spacecraft velocity vector to an accuracy of + 0.5 degrees in roll and + 1 degree in pitch.
- The monopole antenna element is to be mounted in a direction parallel to the local nadir direction away from the direction of the Mars surface to an accuracy of of + 0.5 degrees in roll and + 1 degree in pitch.

Due to the mechanical mounting of the antennas and the subsequent interaction with the S/C body, it is requested that an alignment maneuver to measure the electrical null direction of the monopole antenna during the commissioning phase of the mission and also at a time when the periapsis solar zenith angle is greater than 90 degrees be scheduled. This maneuver will require the spacecraft to change its attitude (mainly roll and pitch) of up to 10 deg. in order to make the antenna axes nadir pointing with the accuracy mentioned above. During this maneuver, MARSIS will acquire sounding data for calibration of the monopole antenna pointing.

2.5.3. Critical Timings

OPS CONSTRAINT
This paragraph contains important operational quantities and timings

2.5.3.1 Commands timing

MARSIS can accept telecommands much faster than the S/C is able to send them. For nominal operations a delay of **5 seconds** between each telecommand is considered a good operating practice.

In case of need telecommands the maximum recommended rate shall be **1 TC per second** (still lower than instrument capability).

2.5.3.2 Operations timing

Details for operations crtical timings are reported in the different timelines described in this document. For convenience some crtical timings are reported in the following table.

Timing	**Real value**	**Safe value**	**Nominal value**
Power On to Stand By State	6 sec	10 sec	20 sec (TBC)
Patchable Code reboot (#)	60 sec	60 sec	60 sec
Warm Up 1 to Warm Up 2	5 sec	5 sec	5 sec
Warm Up 2 to OST Start (*)	minimum 15 sec	15 sec	25 sec
Warm Up 2 to Stand By (§)	5 sec	60 sec	60 sec

(#) The default value of 60 sec can be altered using the dedicated SIS_MOD_TR_DIS_TC telecommand.

(*) After this time the OST start will be controlled by the expiration of the programmed OST Time Tag.

(§) Permanence in Stand By after OST execution may be required to flush all the internal science data buffers.

2.5.3.3 Memory Patch/Dump Operations Estimates

Assumptions for EEPROM Patch estimate:

- each Patch TC packet contains up to 228 data bytes
- Patch TC rate: 1 TC per second (*)

(*) SRAM and DPRAM patches have been successfully tested at 64 TC per second while EEPROM patches have been successfully tested at 2 TC per second.

MASTER DSP EEPROM Patch			
Code/Data Size (current SW Rel 4.2):	53248 words	319488 bytes	1402 TC
Full EEPROM (patchable partition):	86015 words	516090 bytes	2264 TC

SLAVE DSPs EEPROM Patch			
Code/Data Size (current SW Rel 4.2):	45057 words	270342 bytes	1186 TC
Full EEPROM (patchable partition):	122879 words	737274 bytes	3234 TC

Assumptions for Dump Estimates:

- each Dump TM packet contains up to 4096 bytes of data
- each TM-block contains up to 2 maximum size Dump TM packets
- the generation rate of TM-block is programmable from 1 to 8 TM-block per second by means of a dedicated TC(206,2) (default value 1 TM-block per sec)
- Dump duration depends also from the DMS polling rate
- if the polling rate is not sufficient, there will be no bad effects (not the same in the case of Science Data)

The following data apply to all the three CPUs:

Full Memory Dump			
Program EEPROM	131072 words	786432 bytes	192 TM
Program RAM	524288 words	3145728 bytes	768 TM
Data RAM	524288 words	2097152 bytes	512 TM

The following data apply to special memories:

Special memories Dump			
Dual Port RAM	8192 words	16384 bytes	4 TM
Full Flash EPROM (4 chips)	8388608 words	16777216 bytes	4096 TM

2.5.4. Data

MARSIS is a multimode flexible instrument and the produced data rate can vary between 10 kbps and 80kbps depending from the used Operation Mode, the Transmitted frequency and the S/C position during the Orbit

The produced Data Rate has the following charactheristics detailed for each mode in table 2.5.5-1.

		DATA RATE CHARACTERISTICS	
Operative Mode		Amount of Data	Produced Data Rate
SILENT MODES	OFF	NONE	-
	SIS-ON	NONE	-
	CRUISE	NONE	-
	NON-OPERATIVE	NONE	-
SUPPORT MODES		VERY LOW[1]	FIXED
OPERATION MODES	SS1	MEDIUM	VARIABLE
	SS2	LOW	VARIABLE
	SS3	MEDIUM HIGH	VARIABLE
	SS4	HIGH	VARIABLE
	SS5	MEDIUM HIGH	VARIABLE
	AIS	MEDIUM	FIXED
	CALIB	MEDIUM LOW	FIXED
	REC. ONLY	MEDIUM LOW	FIXED

[1]With the exception of Memory Dump Operation in STANDBY Mode

Table 2.5.5-1

During the all SUBSURFACE SOUNDING Submodes the Data rate will vary depending from:

- Orbit Heght
- S/C tangential Velocity
- Transmitted frequency

In table 2.5.5-2 is reported (mode by mode) the maximum and minimum amount of scientific data produced by the two slave DSPs and also the overhead due to packet headers and Auxiliary data.

In table 2.5.5-3 is reported (mode by mode) the worst case condition (maximum data rate) considering all the contributions.

The numbers reported in the above mentioned tables are obtained considering the following instrument and Orbit parameters:

- **PRF = 127.271Hz => PRI = 7.86 ms**
- **Orbit Height at the beginning of Operation Modes = 802.038 Km (based on the actual knowledge of G3u Orbit)**
- **Time to pericenter passage at the beginning of Operation Modes= 790 sec (based on the actual knowledge of G3u Orbit)**

The strategy used to create Scientific TM Packets is detailed in RD-10.
The Data Rate Profile is shown in §5.6

Function	Op. Mode	Number of Samples	Signal Components (I/Q or Real)	Bit	Total Channels (Echoes)	Frame Duration / Time needed for the Data Transfer (sec)		DR (kbit/sec)		Comments
						Min	MAX	Min	MAX	
2 Frequencies, 2 Antennas	SS1	512	2	8	4	1.26	2.44	13.4	26.1	This Funct. allows coherent dual clutter cancellation on two frequencies.
2 frequencies, 1 antenna (Dip.) Multilook (on board)	SS2	512	1	16	2	1.26	2.44	6.7	13	This mode allows non-coherent dual freq. cancellation or subsurface reflectivity estimation and estimation of surface parameters
2 frequency, 1 antenna (Dip) Multilook (possible on ground)	SS3	512	2	8	2×3 filters	1.26	2.44	20.1	39.1	This mode allows coherent dual freq. cancellation or subsurface reflectivity estimation and estimation of surface parameters (3 Doppler Filters)
1 frequency, 2 antennas Multilook (possible on ground)	SS4	512	2	8	2×5 filters	1.26	2.44	33.5	65.2	Dual channel coherent cancellation on ground (5 Doppler Filters)
1 frequency, 2 antennas 4 Pre-summed Short Pulses (30µs)	SS5	512	2	8	2×3 filters	1.26	2.44	20.1	39.1	To avoid sidelobes problems (3 Doppler Filters)
Passive Ionosphere	embedded in SS1÷SS5	128	1	16	2	1.26	2.44	1.68	3.25	
Individual Echoes (Raw Data) SS1 SS2 SS3 SS4 SS5	embedded (optional) in SS1÷SS5	980*128 980*256 980*256 980*256 980*64	1	8	4 2 2 2 8	1.006 2.011 2.011 2.011 0.503		4 (Baseline, pending data rate allocation for this function)		To check on ground the performance of the on board processor, referred to a cell defined from the spatial resolution after doppler processing
Active Ionosphere	AIS	80*160	1	16	1	6.288		32.57		
Raw Data	CAL	1960*80	1	8	2	100.6		24.93		raw data corresponding to about 110 km of observed surface will be transferred to S/C mass memory during 26 min
Raw Data	Rec. Only	1960*80	1	8	2	100.6		24.93		
SS1-SS5 Auxiliary Data (i.e. Packet Header, Data Field Header, SCET, S/C velocity etc.)	embedded in all SS Modes							2.3 (Worst case)		Common contribution to all Sub-modes and processing options. The worst case is related to the minimum frame duration.
AIS Auxiliary Data (i.e. Packet Header, Data Field Header, SCET, S/C velocity etc.)	embedded in AI Mode							0.7		
CAL-Rec. Oly Auxiliary Data (i.e. Packet Header, Data Field Header, SCET, S/C velocity etc.)	embedded in CAL and Rec. Only Mode							0.3		

Table 2.5.5-2

Operat. Mode	FUNCTIONS	Worst case Data rate (kbit/sec)	COMMENTS
SS1	2 freq., 2ant. + Passive Ionosph. (3.25 kbps) + Auxiliary data (2.3 kbps) + Ind. Echoes (opt)	31.65 (35.65)	This mode allows coherent (J+Q on ground) dual clutter cancellation on two frequencies
SS2	2 freq., 1 ant.(Dip.) Multilook (on board) + Passive Ionosph. (3.25 kbps) + Auxiliary data (2.3 kbps) + Ind. Echoes (opt)	18.55 (22.55)	This mode allows non-coherent (amplitude on ground) dual freq. cancellation or subsurface reflectivity estimation and estimation of surface parameters
SS3	1 freq., 2 ant. Multilook (possible on ground) + Passive Ionosph. (3.25 kbps) + Auxiliary data (2.3 kbps) + Ind. Echoes (opt)	44.65 (48.65)	This mode allows coherent dual freq. cancellation or subsurface reflectivity estimation and estimation of surface parameters (3 Doppler Filters)
SS4	1 freq., 1 ant.(Dip.) Multilook (possible on ground) + Passive Ionosph. (3.25 kbps) + Auxiliary data (2.3 kbps) + Ind. Echoes (opt)	70.75 (74.75)	This mode allows coherent (J+Q on ground) dual channel cancellation on one freq. and estimation of surface parameters
SS5	1 freq., 2 ant. 4 Pre-summed Short Pulses(30μs) + Passive Ionosph. (3.25 kbps) + Auxiliary data (2.3 kbps) + Ind. Echoes (opt)	44.65 (48.65)	This mode allows coherent dual channel cancellation on one freq., avoiding sidelobes problems. Surface parameters can be estimated. (3 Doppler Filters).
AIS	Active Ionosphere sounding + Auxiliary data (0.7 kbps)	33.27	This mode can be operating interleaved with the other Modes or in a dedicated orbit.
CAL	HW Calibration + Auxiliary data (0.3 kbps)	25.23	
REC. ONLY	Receive Only + Auxiliary data (0.3 kbps)	25.23	

Table 2.5.5-3

3. MARSIS Detailed Description

3.1. Instrument detailed Description

Functionally and also from the responsibility point of view of each organization involved in MARSIS, the instrument can be split into three subsystems:

- Antenna: ANT
- Radio Frequency Subsystem: RFS (TX+RX)
- Digital Electronics Subsystem: DES

Anyway it is worth considering that from the mechanical point of view DES and RX Section of RFS subsystem are allocated in the same box inside the S/C.
The acronym for this box is SISD
Inside the S/C is also allocated the mechanical box for the TX electronics housing.
The acronym for this box is SIST
The Dipole Antenna, element 1 and 2, and Monopole antenna are allocated outside the S/C.

3.1.1. Antenna Subsystem Description

The Antenna consists of two main components: 1) A deployable dipole antenna or primary antenna, 2) A deployable clutter cancellation antenna with preamplifier.
The primary antenna is a high efficiency dipole antenna used for the transmission and reception of the basic sounder signals. The clutter cancellation antenna is a low efficiency antenna with a null in the nadir direction which is used in a receive only mode for clutter cancellation.
The primary antenna consists of a deployable structure configured as a dipole with a radiation gain peak in the local nadir direction. The design of the antenna allows for operation over the 1.3 to 5.5 MHz range. The antenna is also capable of operating to a frequency of 0.1 MHz at reduced efficiency for ionospheric sounding. The antenna interfaces with the transmitter/matching network and radiates a maximum of 15 watts peak in a vacuum environment. To operate correctly within the required MARSIS frequency range, each dipole element is 20 meters in length.
The clutter cancellation antenna consists of a deployable structure whose radiation null direction is in the local nadir direction. This is a receive-only antenna with efficiency not considered a design factor. A high impedance low noise preamp is included with this antenna. In order to have sufficient sensitivity, the monopole element is of 7 meters in length.
Due to severe limitations in available mass, a new self-deploying type of antenna is used for the MARSIS dipole and monopole elements. This new type of antenna is a folding composite tube which supports a pair of wires that form the conductive element of the antenna. The combined mass of dipole and monopole elements plus deployment containers is less than 7.5 kg.

The antenna assembly is mounted on the outside of the spacecraft near the bottom (engine end) of the +Y Lateral Wall as defined in the Mars Express PID A.

3.1.1.1 Antenna Deployment Control

The antenna deployment control consists of three pyrotechnic release mechanisms. For deployment, the associated pyro circuit will be enabled by the spacecraft as part of a special antenna deployment operation.

3.1.2. Radio Frequency Subsystem Description

The RFS consists of two main components:

1) A transmitter with matching network, and
2) A receiver Transmitter and Matching Network (TX Electronics)

The transmitter is connected to the primary antenna via a suitable impedance matching network for the transmission of the sounding pulses.
The transmitter, with its associated matching network, provides the amplification and high RF power necessary for radiation from the primary antenna. A gating function turns off the amplifier electronics after transmission during the reception of the surface, subsurface or ionosphere echoes.
The TX unit is mounted inside of the spacecraft, with one end of the unit near to the center of the antenna subassembly for electrical connection.
The TX electronics (including PCBs located within the antenna assembly) does not exceed 4.3 kg in total mass.
The nominal operating frequency of the Antenna/TX subsystem in the subsurface sounder modes is 1.3 MHz to 5.5 MHz. The instantaneous bandwidth required is 1 MHz or greater.
In the ionospheric sounding mode, the operating frequency range is 0.1 MHz to 5.4 MHz
The TX subassembly receives 28 volt DC power from the DES. For the TX electronics to operate, a relay is contained in the TX assembly, which is enabled by the DES.

3.1.2.1 Receiver (RX Electronics)

The Receiver (RX) is an assembly mounted inside the spacecraft instrument bay on two mechanical slices and in physical contact with the Digital Electronics Assembly.
(DES and RX together have to be considered as a unique box, that from the S/C point of view is called SISD.)
The RF Electronics receiver consists of the CHIRP/LO distribution and the dual channel receiver, which down converts the returned echo from the dipole and monopole antennas.
The RFS-RX consists of a power divider, switches, two selectable bandpass filter banks, two amplifier chains, two mixers, four lowpass filters, two Analog to Digital Converters, which all together provides for two receiver channels and CHIRP/LO power division. The bandpass filter is selectable for each receiver channel. The filter for Band 1 has a larger

bandwidth so as to include the frequency range 2.3 MHz to 2.5 MHz in the passband during the ionosphere-sounding mode.
The receiver design has stringent sidelobe requirements with high order amplitude and phase error requirements, which are consistent with the overall system sidelobe requirements. The receiver also has stringent linearity requirements in order to not generate unwanted harmonics.
The ADC provides an 8-bit logic output. The ADC maximum input is set to an input power of +6 dBm with a sampling frequency of 2.8 MHz.
The power for the receiver subsystem is provided by the converters located in the DES housing(s). The total DC power used by the RFS is limited to 3.3 watts. The RFS receives chirp waveforms and local oscillator frequency signals from the DES at a nominal power of 0 dBm. The chirp waveforms are then routed to the transmitter for amplification and the local oscillator frequency signals are routed to the receiver channel 1 and 2 mixers local oscillator inputs. All RFS control signals originate from the DES. The RFS receives the ADC clock signals from the DES with a separate ADC clock input provided for each of the two receiver channels. The frequency of the ADC clock is a 2.8 MHz logical signal with a duty cycle of 50 percent. The RFS provides 8-bit digital sample data to the DES for each of the 2 receiver channels. The RFS provides a transmit pulse of the appropriate amplitude and frequency to the dipole antenna at the correct time under control of the DES. Channel one of the RFS receives echoes from the dipole antenna for eventual down-conversion and sampling. Channel 2 receives signals from the monopole antenna. Frequency band selection is under control of the DES.

3.1.3. Digital Electronics Subsystem Description

The DES implements all the logics of the instrument and most of the interfaces with the Spacecraft. A reference oscillator provides the coherence required by the instrument. A sounder signal generator generates the transmission waveforms as well as the reference local oscillator frequencies for the radio frequency part of the instrument (RFS).
The DES processor has the task of operating the on-board processing of the echoes in two separate channels corresponding to each of the antennas. The control of the instrument and the interface with the spacecraft is supervised by the Command and Control section. The task of generating the timing for the entire instrument is in charge to the Timing Generator.
Dedicated power converters provide the regulated voltages for the DES electronics and for the RX section of RFS.
To carry out the tasks above mentioned the HW has been divided in a certain number of modules taking into account the necessity to accommodate homogeneous and autonomous hardware functions under mechanical constraint. The set of the modules form a unique mechanical structure and its layout is reported in the chapter dedicated to the mechanical design.

The modules making up the unit, so identified, are the following:

Double Width Module 1	Digital Signal Processor_1 board
	Command & Control board

Double Width Module 2	Digital Signal Processor _2 board
	Timing board
Single Width Module	Digital Chirp Generator board
Double Width Module 3	Switching board
	DC/DC Converter board

The mechanical box is composed of four slices: three double width modules plus one single width module.
Hereafter are reported the functional description and the main requirement of the above mentioned boards.

3.1.3.1 Command & Control board

The C&C Board is devoted to the Command & Control of the whole Instrument and it is based on a ATMEL TSC21020F DSP. The major tasks of this module are:

- Command MARSIS instrument during the switch ON/OFF sequence.
- Drive MARSIS instrument during its Operative Mode Transitions, following the instructions contained in the Operations Sequence Tables (OST) (loaded, in a dedicated memory area, by MLC, or using the default ones in EEPROM).
- Distribute to MARSIS all the parameters that the instrument needs, these parameters are stored in the Parameters Table (PT) (loaded, in a dedicated memory area, by MLC or using the default ones).
- Support S/C commanded Patch and Dump Operations when requested.
- Perform runtime self check.
- Perform minimal recovery actions.
- Synchronization with the S/C On Board Time.
- Receive Telecommands (TC) by means of Memory Load Commands (MLC) from the S/C.
- Perform Telemetry acquisition and Commands propagation
- Collect information from C&C and packetise them both in Housekeeping and Event Report TM.
- Collect data from DSP1 and DSP2 and packetize them into the Science data Packet together with the auxiliary informations.
- Interface the S/C through the defined physical and protocol layers and for the TM and Science Data

In addition one background parallel task shall be considered to allow Orbit and Velocity Determination during the flyby phase for any of the Operational Modes identified.

3.1.3.2 Timing board

The Timing board undertakes the task of generating all the timing signals both internal and external to the DES needed to manage a given operational mode.
This module contains two main functional blocks:

- Frequency Generator (FG)
- Timing Generator (TG)

The Frequency Generator is a hardware block built around a Stable Local Oscillator (STALO) which generates a reference frequency of 28MHz.
All the frequencies that runs inside the MARSIS instrument (with the exception of the processor clocks) are derived from the STALO in order to achieve totally coherent radar instrument.
The main frequencies that the FG has to generate are:

- 28MHz_CLK for the DCG Module: 28 MHz
- ADCi_CLK (i=1,2) for the two AD Converters of the RFS section of MARSIS:2.8 MHz
- DESPS_SYNC and TXPS_SYNC for all MARSIS DC/DC converters synchronization: 127.272kHz+/-2%

The Timing Generator function is devoted to the generation of the proper timings to operate the MARSIS instrument in the different Operative Modes. The TG derives from the STALO reference clock, the basic signals of the radar such as PRF and all the other related signal.
The PRI sequence as well the other timing signals is clocked out with a basic quantum rate of 2.8 MHz. Such signals allow proper setting of RX/TX filters and attenuators, accurate triggering of chirp generation and local oscillation generation, RX ADC data storage into DSP1/2 boards FIFO memories.

A bank of two 4Mx32bit FLASH memories is also mounted on this board, with the aim of providing non-volatile storage for raw data acquisition.

3.1.3.3 Digital Chirp Generator board

It is devoted to the synthesis of both the transmitted signal and the local oscillator, for the different operations, on the basis of the parameters provided by the C&C.
The Digital Chirp Generator board generates both linearly frequency-modulated signals and CW pulsed signals.
The C&C board can set, by commands, the initial frequency of the signal (SF=CF-BW/2) its bandwidth (BW) and its pulsewidth (PW).
The Digital Chirp Generator is a portion of hardware built around a Numerically Controlled Oscillator (NCO) which is clocked at 28 MHz.
The DCG has been conceived using the Direct Digital Synthesis technique which consists in the generation of discrete samples of a sinewave and in the successive reconstruction at analog level. A Numerical Controlled Oscillator, in ASIC version, has been employed to implement this technique, allowing to obtain both surface area occupation and power consumption savings. The DCG is a programmable signal synthesizer. This characteristic permits to achieve a high flexibility and adaptability of use during the radar operative modes.
The main functional blocks of this architecture are:

- CONTROL INTERFACE
- CHIRP MODULATOR

- NCO
- TIMING & CONTROL GENERATOR
- DIGITAL TO ANALOG CONVERTER
- LOW PASS FILTER

The NCO allows to compute, with its internal accumulator, incrementing phase angles which are used to address a sin look-up table and then to generate an output signal. The DAC placed at the output of the NCO converts these signals in analog levels at a conversion rate of 28 Msps. Such sampled data generates spectral components at frequency n*fck+/-fout. In order to attenuate all the undesired spectral components and the alias bands a low pass filter is provided after the DAC. DCG board receives regulated secondary lines (positive and negative) from the DES power supply (DC/DC1) that converts energy from S/C main bus.

3.1.3.4 Digital Signal Processor boards (2)

The two identical Slave DSP Boards are based on one DSP (21020 type) each, running at 20MHz.
Each DSP may receive the 8-bits data in two separate FIFO memories from the monopole or from the dipole channel of the Receiver.
The DES provides a suite of processing functionalities suitable to meet the science needs of the MARSIS experiment.
Specific processing functions are available and selected according to the chosen operational mode. This is to say that different processing schemes are applied for Subsurface Sounding Modes, Active Ionospheric Sounding Mode or Calibration Modes, following a general data preprocessing for the I/Q data synthesis and raw data collection. Final results are made available to the C&C DSP in a dedicated dual-ported memory. Such memory will used also for data exchange from the C&C DSP to the DSP1 and DSP2 boards.

3.1.3.5 Switching board

This Board comprises the contact relays that receive from the S/C the High Power Commands ON/OFF that initiates/concludes all the MARSIS Operative Modes and provide, to the S/C itself, its status (by RSS signal).
The relays do the primary buses OR-ing (nominal and redundant 28V), can switch on-off the antenna heaters and can switch on-off the SISD.

DC/DC Converter board
DC/DC functional module includes two separate DC/DC converters; one for the DES (DC/DC1) and one for the RX Section of RFS (DC/DC2). It has the task to generate the secondary lines voltage needed from DES and RX starting from the primary bus power supply (28 V).

3.2. Instrument Performance

The following table 3.2-1 lists the principal parameters for the Subsurface Sounding Operative mode of MARSIS.

Subsurface Sounding Mode

Parameter	Value	Units
Center Frequencies	1.8 3.0 4.0 5.0	MHz MHz MHz MHz
Bandwidth	1.0	MHz
Irradiated Power	1.5 Band 1 5.0 Band 2 5.0 Band 3 5.0 Band 4	Watt
Transmit Pulse Width	250 (30 in mode SS5)	microsecond
PRF	130	Pulses Per Second
Minimum Altitude	250	kilometer
Maximum Altitude for subsurface sounding	800	kilometer
Maximum Altitude for ionosphere sounding	1200	kilometer
Receive Window Size per channel (baseline)	350	microsecond
Analog to Digital Conversion Rate	2.8	MHz
Analog to Digital Conversion	8	Bit
Number of Processed Channels	4 (max)	
Maximum Number of Simultaneous Frequencies	2	
Radiation Gain	2.1	dB
Dipole Antenna Element Length	20	meter
Monopole Antenna Length	7	meter
Data Rate Output	18 (min) 75 (max)	kbps
Data Volume	285(max)	Mbit/day
Mass (CBE)	17	kg
Power (max including margins)	64.5	Watt

Table 3.2-1

The choice of the operating pulse repetition frequencies (PRF's) has been made by selecting the lower frequency of operation still consistent with adequately sampling the Doppler spectrum, and consistent with the maximum relevant Doppler frequency expected from the surface clutter. Minimizing the PRF also ensures that a maximum time is available for transmission of the two frequencies in order to maximize the transmitted energy per pulse. According to the evaluations discussed in the document RD-1, it has been decided to use a nominal PRF equal to 130 Hz, taking into account that the risk related to the undersampling of doppler spectrum appears very small and that the implementation constraints appear relevant.

The main parameters of the MARSIS instrument, for the Active Ionospheric Sounding Operative mode, are summarized in the following table 3.2-2.

Ionosphere Sounding Mode

Start Frequency	100	kHz
End Frequency	5.4	MHz
Number of Frequencies	160	
Transmit Pulse Length	91.43	microsecond
Frequency Step	10.937	kHz
PRF	130	Pulses Per Second
Frequency Sweep Duration	7.38	Second

Table 3.2-2

3.3. Instrument Timing

Basic characteristic of MARSIS is that each Operation Mode is composed of different Sets of PRIs called Frames. The size of the frames can be fixed (as for Calibration, Receive Only and Active Ionospheric Sounding) or variable w.r.t. the orbit characteristics and the used frequency (Subsurface Sounding Mode).
The time slot of each orbit dedicated to the MARSIS Operation Modes (1580 seconds for IT#1 and 2160 seconds for IT#2) shall be divided in an integer number of frames.
Frames can belong to only one Operation Mode or to different Operation Modes interleaved in any possible way (but pre-defined in OST).
MARSIS is be able to implement a sequence of Operation Modes, in the dedicated time slot during the orbit, equivalent to the one shown in figure 3.3-1 following the instructions (mode, sub-mode, duration, etc.) that are contained in the relevant OST.
In addition MARSIS has the capability to perform the correct relationship between the above mentioned instructions and the parameters setting imposed by the relevant PT.
In particular from OST shall be possible to compute the number of frames for each Operation Mode.
Indicative ranges in which the number of frames can vary for each Operation Mode are listed here below (see figure 3.3-1):

$0 \leq N_{IONO} \leq 292$	(TBC)	(IT#2)
$0 \leq N_{SS1} \leq 1267$	(TBC)	(IT#1 and IT#2)
$0 \leq N_{SS2} \leq 1267$	(TBC)	(IT#1 and IT#2)
$0 \leq N_{SS3} \leq 1267$	(TBC)	(IT#1 and IT#2)
$0 \leq N_{SS4} \leq 1267$	(TBC)	(IT#1 and IT#2)
$0 \leq N_{SS5} \leq 1267$	(TBC)	(IT#1 and IT#2)
$0 \leq N_{CAL} \leq 16$	(TBC)	(IT#1 and IT#2)
$0 \leq N_{REC} \leq 22$	(TBC)	(IT#2)

In particular During the Subsurface Operation Modes the computed frames number (N_{SS1} ... N_{SS5}) shall be shared between the Acquisition and Tracking/Doppler Frames number N_{SS1_A} ... N_{SS5_A} and N_{SS1_T} ... N_{SS5_T} (see figure 3.3-1) following the indications coming from the processing algorithms.
The Acquisition and Tracking/Doppler Frames number will vary in the ranges listed here below:

$0 \leq N_{SS1\_A} \leq 1267$ (TBC)	if $N_{SS1} \neq 0$	(IT#1 and IT#2)
.		
.		
$0 \leq N_{SS5\_A} \leq 1267$ (TBC)	if $N_{SS5} \neq 0$	(IT#1 and IT#2)
$0 \leq N_{SS1\_T} \leq 1267$ (TBC)	if $N_{SS1} \neq 0$	(IT#1 and IT#2)
.		

.

$0 \le N_{SS5\_T} \le 1267$ (TBC) if $N_{SS5} \neq 0$ (IT#1 and IT#2)

MARSIS will be able to command the Operation Modes transitions and the Frame transitions (from an operation mode to another and to one frame to another) in the time frame between a PRI and the following one.
The only exception shall be applicable to all Mode Transitions in which the Active Ionosphere Sounding Mode is involved.
In these cases (from or to Active Ionosphere Sounding Mode), to allow the correct positioning of the Transmitter relay, the new Operation Mode shall wait the first PRI available 200 ms after the transition of IONO_SEL and SUB_SEL commands.

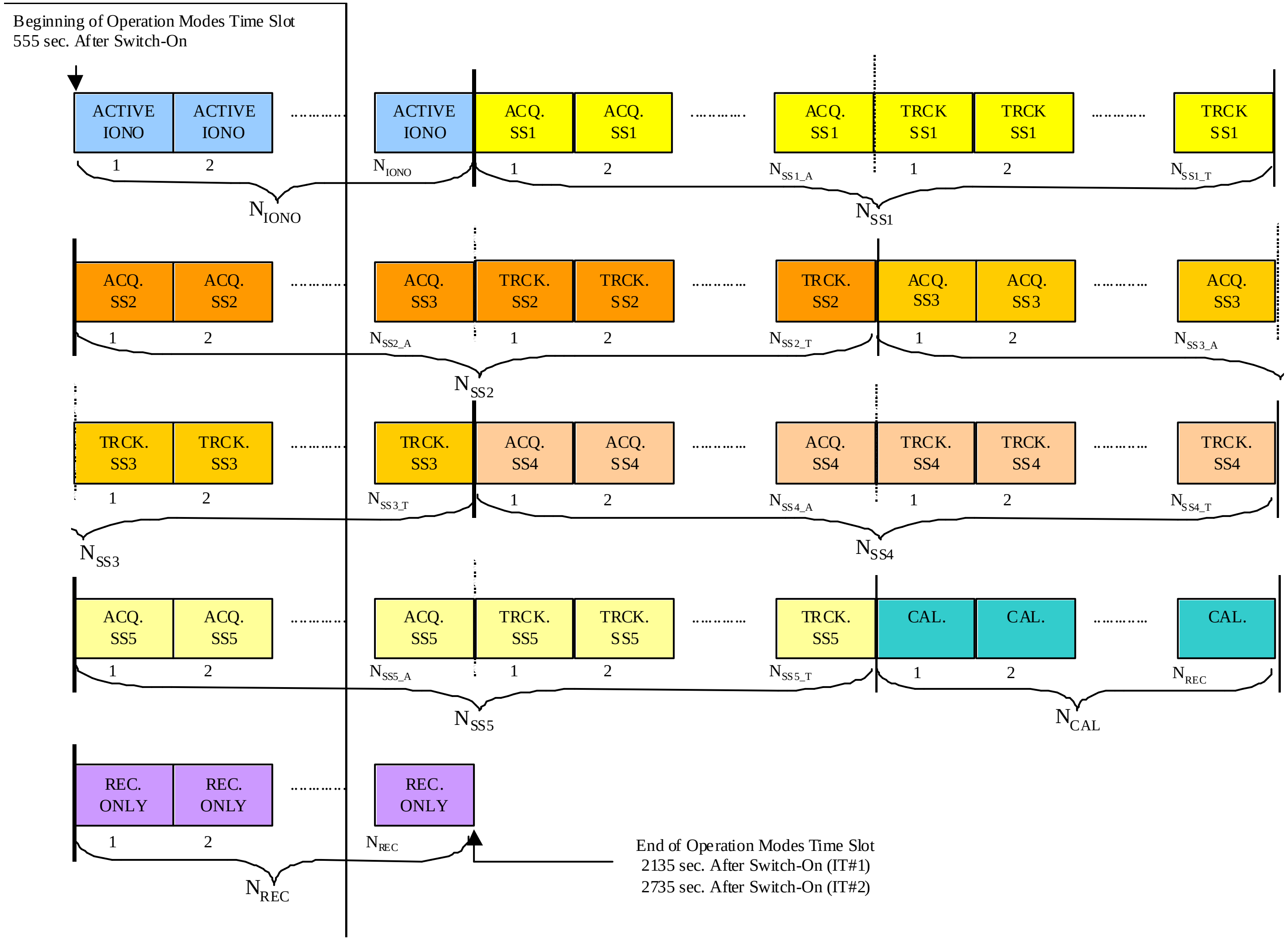

Beginning of Operation Modes Time Slot
555 sec. After Switch-On
ACTIVE IONO
ACQ. SS1
TRCK SS1
N_{IONO}
N_{SS1_A}
N_{SS1_T}
N_{SS1}
ACQ. SS2
TRCK. SS2
ACQ. SS3
N_{SS2_A}
N_{SS2_T}
N_{SS3_A}
N_{SS2}
TRCK. SS3
ACQ. SS4
TRCK. SS4
N_{SS3_T}
N_{SS4_A}
N_{SS4_T}
N_{SS3}
N_{SS4}
ACQ. SS5
TRCK. SS5
CAL.
N_{SS5_A}
N_{SS5_T}
N_{REC}
N_{SS5}
N_{CAL}
REC. ONLY
End of Operation Modes Time Slot
2135 sec. After Switch-On (IT#1)
2735 sec. After Switch-On (IT#2)

Figure 3.3-1

3.3.1. Frame Structure

Inside the Frames the PRIs are structured as shown in figures 3.3.1-1/4
In this figure are also listed the following information for each PRIs Subset:

- Number of PRIs
- Descriptions of the Basic tasks
- Timing Category
- Size
- Timing Characteristics.

In particular the PRIs have been groupped in the following categories:

Processing Only

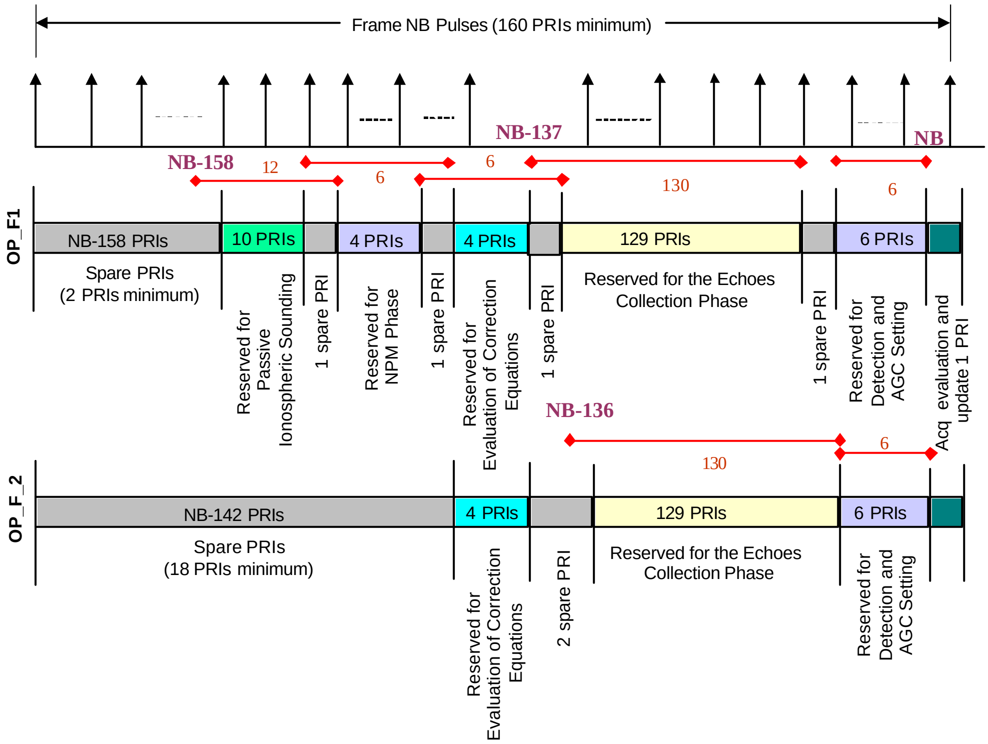
In this category are grouped all the PRIs Subsets in which the performed tasks are Digital Signal Processing or/and Data Handling only and so no particular signal timing is foreseen.

TX/RX

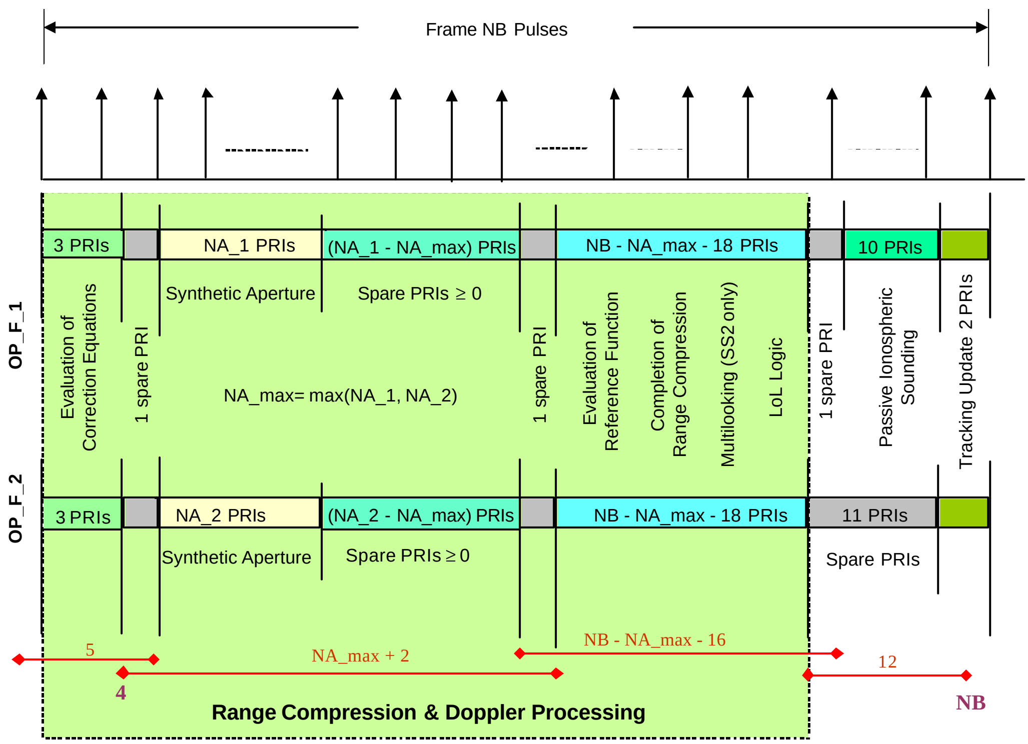
In this category are grouped all the PRIs Subsets in which, in addition to the digital signal processing and data handling, the Digital Chirp Generator module of DES is generating TX and LO signals.
This is the category in which the most intensive timing signals transitions take place (TX/RX selection, Path selection, Attenuation selection, Automatic RX Gate Positioning, etc.).

RX Only

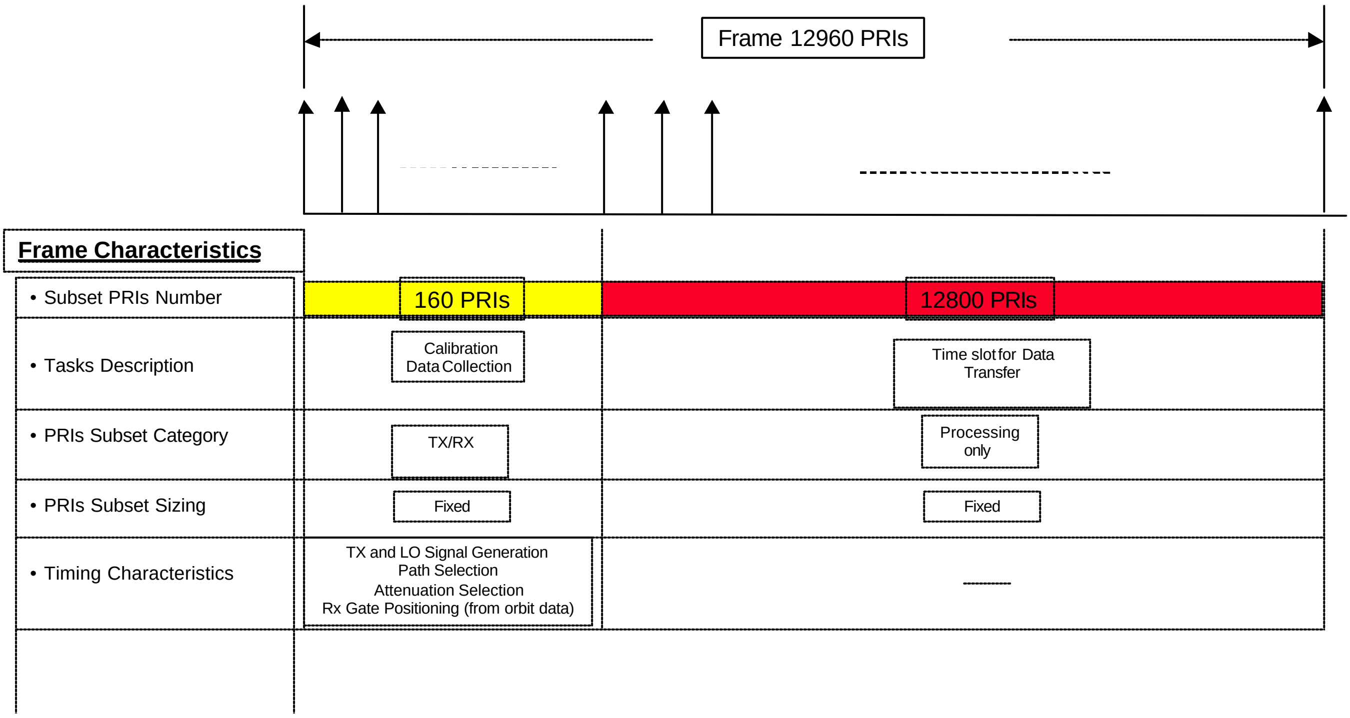
In this category are grouped all the PRIs Subsets in which, in addition to the digital signal processing and data handling, the Digital Chirp Generator module of DES is generating LO signals only.
This is the category in which the TX/RX selection is not performed in each PRI.
Anyway the Path Selection, Attenuation selection, and Pre-defined RX gate positioning take place at PRI rate.



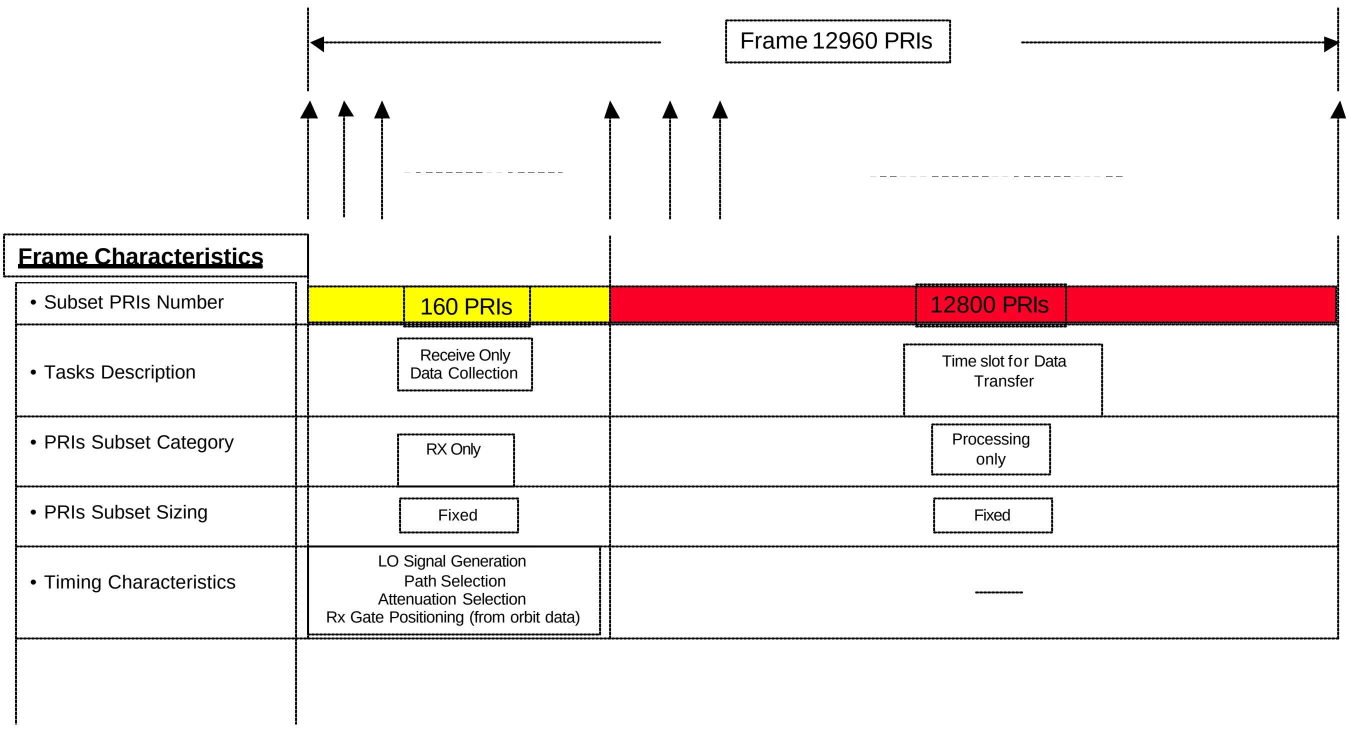
Figures 3.3.1-1: SUBSURFACE MODE-Acquisition Phase



Figures 3.3.1-2: SUBSURFACE MODE-Tracking/Doppler Phase
(single or double Frequency)



Figures 3.3.1-3: CALIBRATION MODE



Figures 3.3.1-4: RECEIVE ONLY MODE

3.3.2. Timing Diagram

Dedicated Timing diagrams for each Operation Modes, Sub-Mode and Phase, are shown in the following pages.

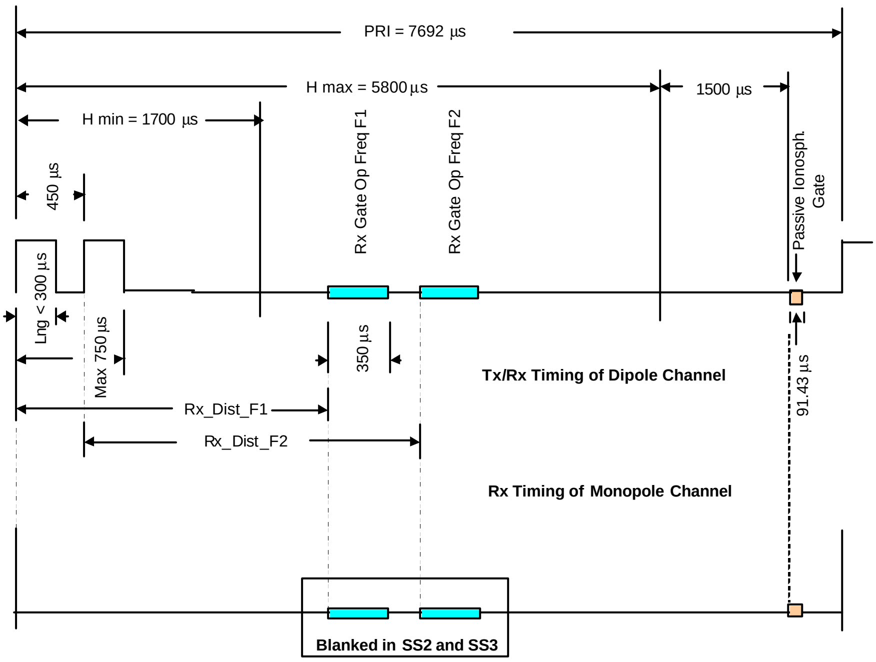


Figure 3.3.2-1 Sub-Modes SS1, SS2 and SS3 Timing

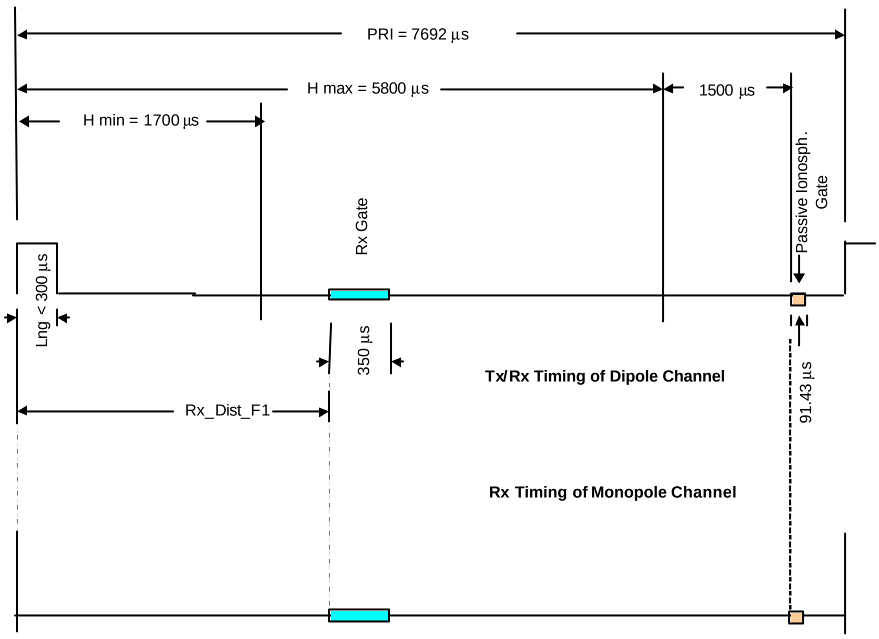


Figure 3.3.2-2 Sub Mode SS4 Timing

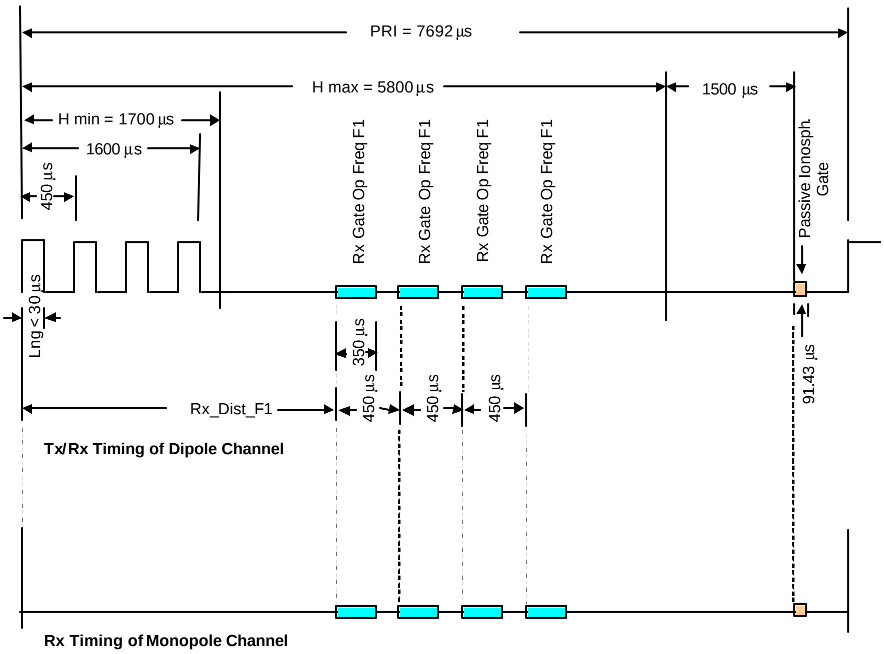


Figure 3.3.2-3 Sub Mode SS5 Timing

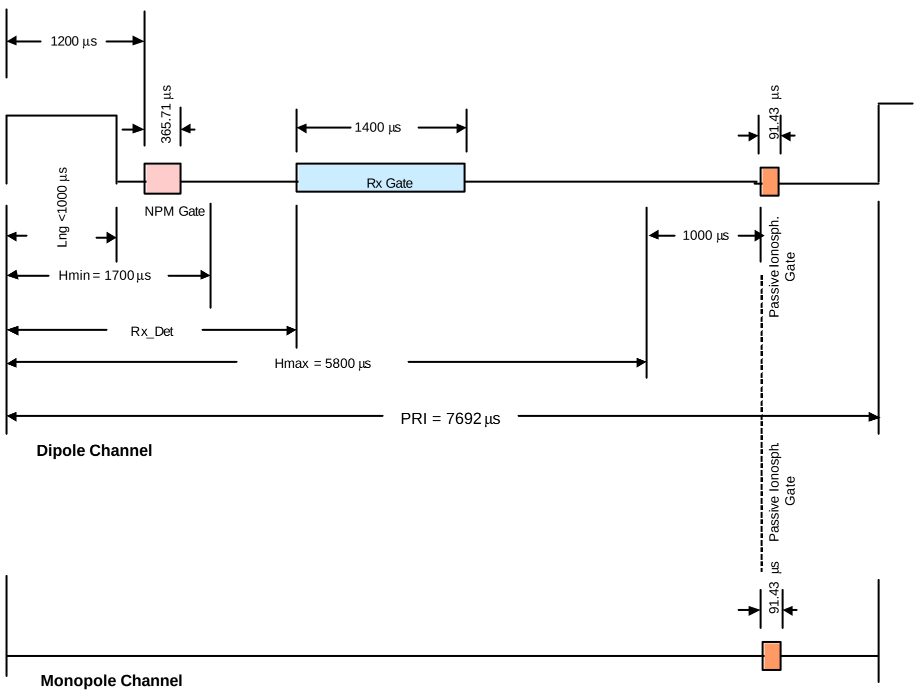


Figure 3.3.2-4 Acquisition Phase Timing

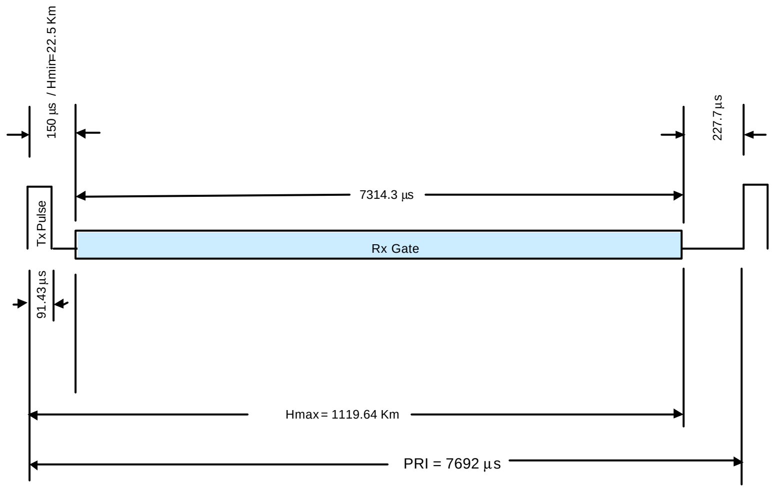


Figure 3.3.2-5 Active Ionospheric Sounding Timing

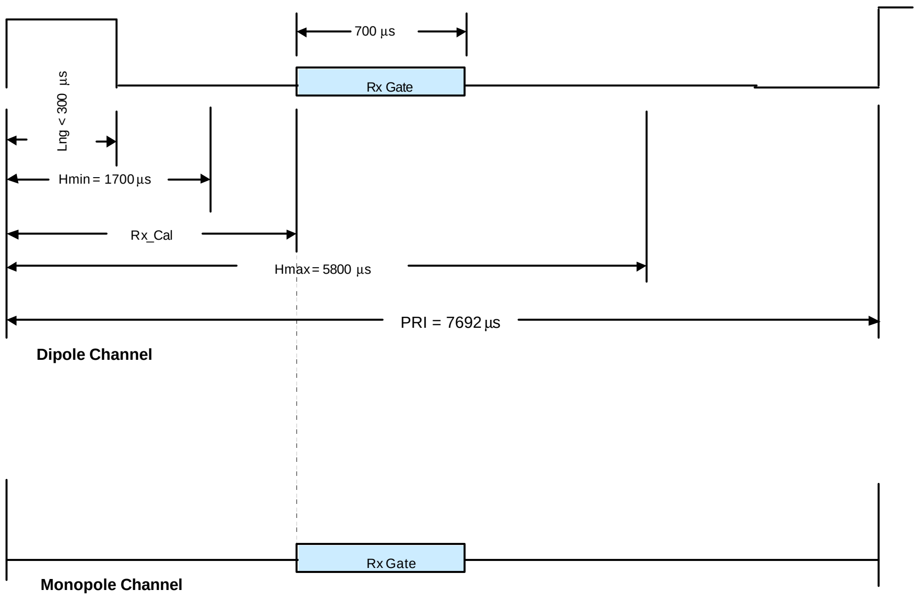


Figure 3.3.2-6 Calibration/Receive Only(1) Timing

(1) In Receive Only mode the TX Pulse is not present.

3.4. Interface with the S/C

MARSIS has one Nominal and one Redundant **CLASS "E" LCL.**

Electrical interfaces are shown in paragraphs 1.3-2, 2.3-1, 2.3-2 and 2.3-3.

In the following table 3.4-1 are listed all the interface signal lines between MARSIS and S/C. Details about MARSIS-S/C interfaces are reported in [RD-7].

TM/TC		**Nominal**	**Redundant**	**Comment**
HPC	High Power Command	6	6	6 Nom. to SISD (DES) (3 ON, 3OFF) 6 Red. to SISD (DES) (3 ON, 3OFF)
MLC	Memory Load Command	1	1	To SISD
TSY	Time Synchronisation	1	1	To SISD
ANC	Analogue Conditioned	4	4	2 Nom. from SISD (1 from DES, 1 from RX) 2 Red. from SISD (1 from DES, 1 from RX) 1 Nom. from SIST 1 Red. from SIST 1 Nom. from ANTENNA 1 Red. from ANTENNA
ANS	Analogue Standard	3	3	2 Nom. from SISD (2 from DES) 2 Red. from SISD (2 from DES) 1 Nom. from SIST 1 Red. from SIST
SDT	Serial Digital Channel	1	1	From SISD (DES) (the clock is shared with MLC)
RSS	Relay Switch Status	3	3	3 Nom. from SISD (DES) 3 Red. from SISD (DES)
HFC	High frequency Clock	1	1	To SISD (DES)
PYR	Pyro Firing	3	3	To ANTENNA

Table 3.4-1 MARSIS External Interfaces

3.4.1. Command and Control interfaces

3.4.1.1 Data Interfaces

MARSIS will send both HK Packets and Science data to the S/C using the 16 bits Serial Digital line.

In addition it has seven analogue TM (4 +4 temperatures and 3+3 Voltage monitor) and three Relay swith Status TM (3+3).

In particular, concerning the four analogue conditioned TM, the used Thermistors are of the following type:

- "A" for SISD and SIST Units (3 Nominal+3 Redundant)
- "B" for Antenna Unit (1 Nominal+1Redundant)

3.4.1.2 Control Interfaces

MARSIS can receive from the S/C both High Power Commands (3+3) using dedicated lines and Packet TC using the 16 bits Memory Load Command lines.

3.4.2. Power Interfaces

The DES is connected to the main and redundant 28V power bus.
DES distributes the 28V to TX and Antenna Heaters and provides the secondary voltage lines to the RX.

In figure 6.1-1 is shown the Power Distribution Diagram (DES-Switching Board).

The Status of the relays, shown in the Power Distribution Diagram (see figure 6.1-1), for each mode is reported in table 6.1-1.

		DES Switching board Relays		
		SIS_PWR (Nom or Red)	**SIS_HEATER**	**SISD_PWR**
Operative Mode				
SILENT	OFF	OPEN	OPEN	OPEN
	SIS-ON	CLOSED	OPEN	OPEN
	CRUISE	CLOSED	CLOSED	OPEN
	NON-OPERATIVE	CLOSED	CLOSED	OPEN
SUPPORT		CLOSED	OPEN	CLOSED
OPERATIVE		CLOSED	OPEN	CLOSED

Table 3.4.1-1.

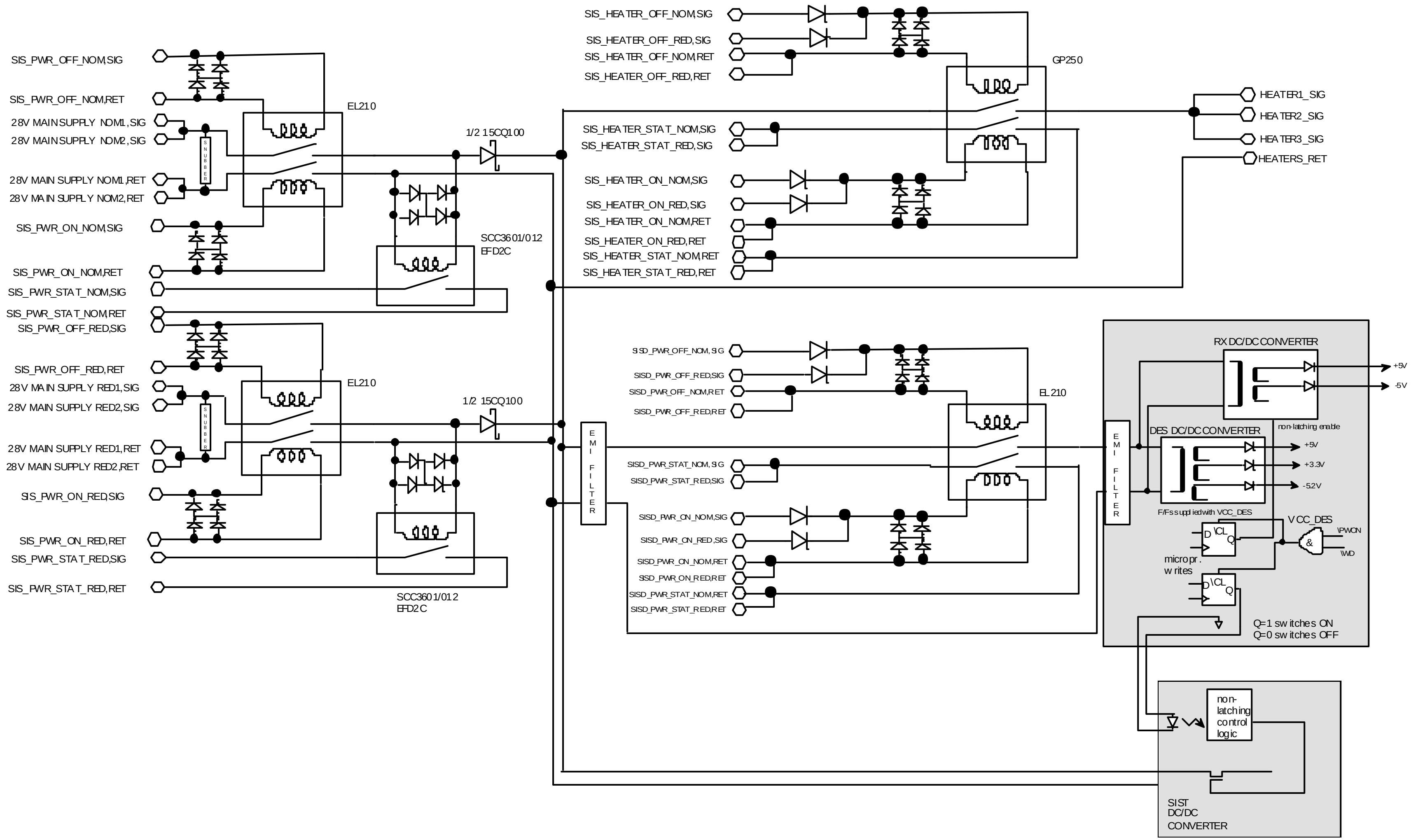


Figure 3.4.1-1 Power Distribution Diagram

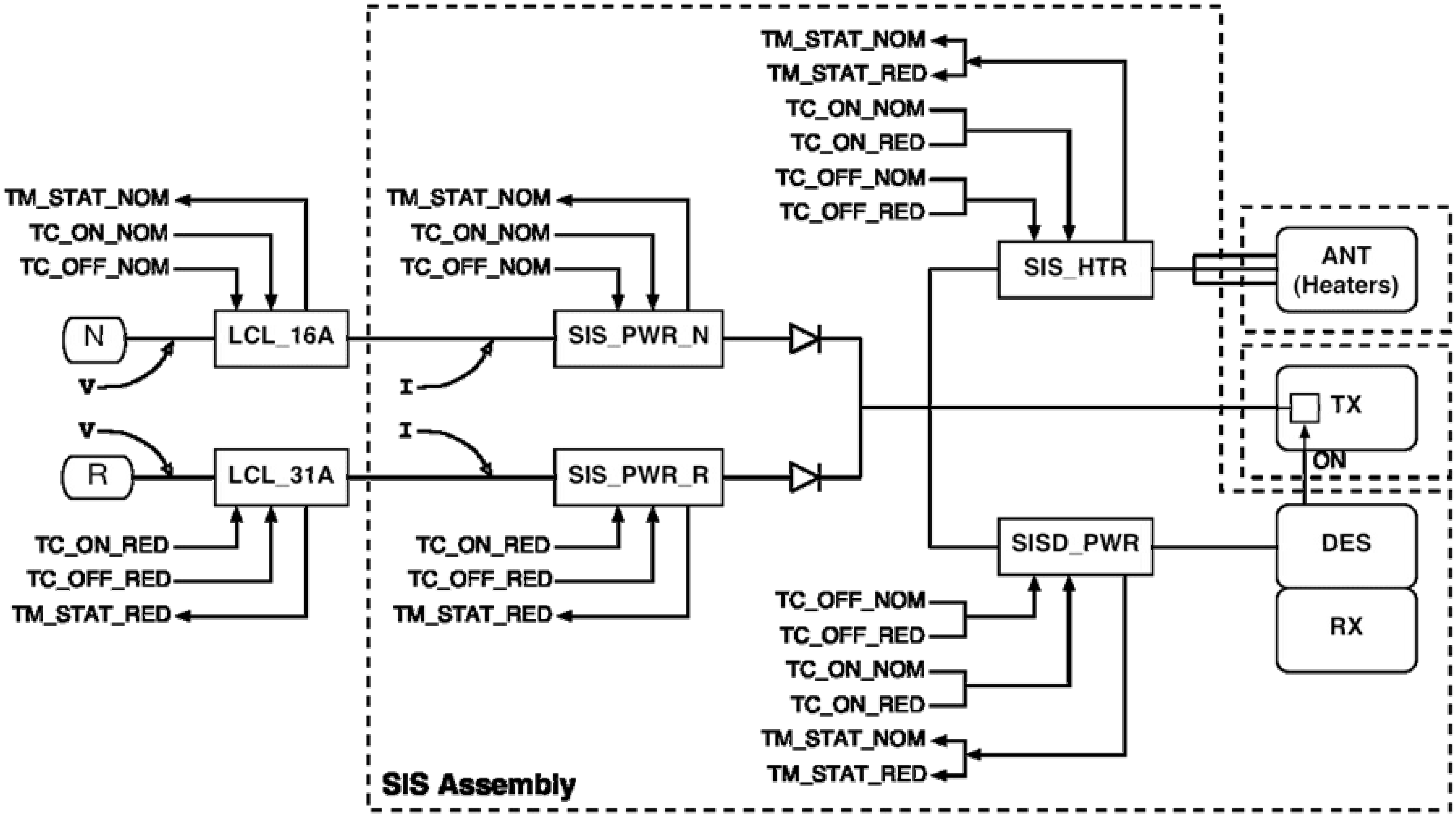


Figure 3.4.1-2 Power Distribution Control Diagram

3.4.2.1 Full Switch On Sequence

The activation of LCL and Relays to fully power on MARSIS shall be as follows:

1. LCL (Nominal or Redundant)
2. SIS_PWR Relay (Nominal or Redundant, according to LCL selection)
3. SIS_HEATER Relay (according to thermal control needs)
4. SISD_PWR Relay

OPS CONSTRAINT
At any single moment **only one** MARSIS LCL shall be Closed (On)

3.4.2.2 Full Switch Off Sequence

The deactivation of LCL and Relays to fully power down MARSIS shall be as follows:

1. SISD_PWR Relay
2. SIS_HEATER Relay
3. SIS_PWR Relay (Nominal or Redundant, according to LCL selection)
4. LCL (Nominal or Redundant)

OPS CONSTRAINT
In case of need, MARSIS can be immediately powered down by acting only on the active LCL.

3.4.2.3 Partial Switch On Sequence

The activation of LCL and Relays to permit MARSIS thermal control shall be as follows:

5. LCL (Nominal or Redundant)
6. SIS_PWR Relay (Nominal or Redundant, according to LCL selection)
7. SIS_HEATER Relay (according to thermal control needs)

OPS CONSTRAINT
At any single moment **only one** MARSIS LCL shall be Closed (On)

OPS CONSTRAINT
An alternative procedure to perform MARSIS thermal control is described in Section 7

3.5. Instrument Control Concept

Due to the Mission characteristics, to the limited Data Rate provided by the S/C and the limited available Data Volume, most of the data processing will be done on-board. In addition the instrument has the capability to predict some Orbit parameters as the orbit Height, the tangential velocity and the radial velocity that are needed in real time for timing and processing tasks.
This means that a lot of HW and SW resources are used for the above-mentioned functionalities.

- **Starting from the above considerations one of the main functional objective of MARSIS is to reduce and simplify as much as possible the Interfaces with S/C in terms of TC and TM exchange.**

To follow this approach the number of TCs that MARSIS needs to operate is limited to a small set. In addition the instrument can receive TC PACKETS only in a well defined mode (STANDBY).

- **On the other hand, due to the experimental nature of MARSIS, the instrument has been designed following a philosophy of maximum flexibility to make the experiment "robust", as much as possible, with regards to unpredictable scenarios** (in terms of Ionosphere characteristics, Surface and Subsurface physical and chemical characteristics, etc).

To achieve this goal, **8 different Operation Modes** have been implemented (detailed in §5) and **4 different frequency Bands** will be used in Subsurface Sounding.

- **In order to meet the apparently contrasting requirements, MARSIS instrument control concept has been based on tables of instructions and parameters to be loaded by TC just before the beginning of operations.**

The tables are called:

- **OPERATIONS SEQUENCE TABLE: OST**
- **PARAMETERS TABLE: PT**

Details about how to operate the instrument using this table-based approach are provided in §4.1.

3.5.1. Operation Sequence Table

The OST is the Table used to specify the sequence of Operational Modes to be performed while executing the measuring portion of a given orbit. Depending on the known characteristics of the local terrain and the those assumed about the geological (surface and subsurface) structure, the sequence of modes is built, for each active orbit, according to science objectives.

For each specified Operational Mode it is possible to define the Duration (in term of number of radar pulses, or PRIs), the selected Mode characteristics and other engineering or scientific parameters to be used during the given Mode.

The required Operational Modes for a given flyby are pre-programmed in advance of the active portion of the orbit. Once programmed, no further interaction with the S/C is required. The OST processing will start at a given time tag, defined as SCET * (or SCET Star), and will proceed autonomously throughout the entire succession of Modes strictly governed by the Duration of each Mode specified in the OST lines.

At boot, a default copy of the OST is copied from EEPROM into RAM. Its content is neutral in terms of operations (that is, trying to execute a default OST will produce null results as if the OST were empty).

The OST structure is detailed in the following §3.5.1.1.

3.5.1.1 OST Structure

The OST structure is that of a Table loaded line by line using the dedicated TC (SIS_OST_TC). A single TC can be used to load **up to 19 OST lines**.
OST lines are relatively addressed from the beginning of the OST starting from 0 (only even line numbers apply due to the mapping to 48 bit wide memory locations).

The structure of the OST and the meaning of each field are reported in figure 3.5.1-1 and in table 3.5.1-1.

More details can be found in ANNEX 8

96 bits	2 words		1 word					1 word							1 word		1 word
Bit #	0 8	9 31	32 33	34 37	38 41	42 44	45 47	48	49 50	51 52	53	54 55	56 59	60 63	64 75	76 79	80 95
Number of bit	8	24	2	4	4	3	3	1	2	2	1	2	4	4	12	4	16
	Pad	Mode Duration in PRI	Pad	Mode Sel	DCG Configuration	PI-1 Band Sel	PI-2 Band Sel	PIM_RX	Ref_Alg_Sel	LOL logic MF	Preset Tracking	f_{new} Address	Slope Address	TX Power	A2_0 OST abscissa	Individual Echoes / Flash Memory	consecutive frames in Flash Memories

0_4	0_8	9_31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80_95
Pad		Duration	Pad		Mode				DCG				PI-B1			PI-B2			PX	RFS		LOL		Pr	fNPM		Slope adr				TX Power				A2_0_OST_abscissa												raw data				Cons. Frames in Flash Mem.
0	0	12079	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	13				1	1	1	1	0												0	0	0	1	0
0	0	002F2F	2				3				0				0				1				C				D				F				000												1				0000

0_4	0_8	9_31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80_95
Pad		Duration	Pad		Mode				DCG				PI-B1			PI-B2			PX	RFS		LOL		Pr	fNPM		Slope adr				TX Power				A2_0_OST_abscissa												raw data				Cons. Frames in Flash Mem.
0	0	11310	0	0	1	0	1	0	1	0	0	1	0	1	0	0	0	1	1	0	1	1	1	1	0	0	7				1	1	1	1	9												0	0	0	0	0
0	0	002C2E	2				A				5				1				B				C				7				F				009												0				0000

0_4	0_8	9_31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80_95
Pad		Duration	Pad		Mode				DCG				PI-B1			PI-B2			PX	RFS		LOL		Pr	fNPM		Slope adr				TX Power				A2_0_OST_abscissa												raw data				Cons. Frames in Flash Mem.
0	0	11415	0	0	1	1	0	0	1	0	1	1	0	1	1	1	0	0	1	1	0	0	0	1	0	0	3				1	1	1	1	0												0	0	0	1	0
0	0	002C97	3				2				D				C				C				4				3				F				000												1				0000

0_4	0_8	9_31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80_95
Pad		Duration	Pad		Mode				DCG				PI-B1			PI-B2			PX	RFS		LOL		Pr	fNPM		Slope adr				TX Power				A2_0_OST_abscissa												raw data				Cons. Frames in Flash Mem.
0	0	16260	0	0	1	0	1	1	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	8				1	1	1	1	0												0	0	0	0	0
0	0	003F84	2				F				C				2				8				0				8				F				000												0				0000

Figure 3.5.1.1-1.

In the following table the field of the Operation Sequence Table (OST) are listed and summarised. Note that some fields are significant only in some operative mode and insignificant in other. In this case it is suggested to set them to zero, even if they are labelled as "DON'T CARE".

OST field	Number of bits	Bit Position	codes
Pad	8	1-8	DON'T CARE
Mode duration	24	9-32	Duration of the mode expressed in PRI
Pad	2	33-34	DON'T CARE
Mode Selection	4	35-38	See para "Operation mode identifier"
DCG Configuration	4	39-42	xxyy: xx refer to the first band transmitted, yy to the second xx (or yy) = 00 -> B1 xx (or yy) = 01 -> B2 xx (or yy) = 10 -> B3 xx (or yy) = 11 -> B4 In AIS these bits are used as an address to select the requested row in the AIS frequencies table
PI-1 Band Sel	3	43-45	band selection for Passive Ionospheric Sound (PIS) acquisition in the first 5 PRIs of the PIS slot PI-1 = 000 -> B0 PI-1 = 001 -> B1 PI-1 = 010 -> B2 PI-1 = 011 -> B3 PI-1 = 100 -> B4
PI-2 Band Sel	3	46-48	band selection for PIS acquisition in the second 5 PRIs of the PIS slot (see PI-1 Band Sel)
PIM_RX	1	49	PIM_RX = 0 -> PIS data from the dipole antenna PIM_RX = 1 -> PIS data from the monopole antenna

Ref_Alg_Sel	2	50-51	Ref_Alg_Sel = 0 -> in TRK use the default reference functions Ref_Alg_Sel = 01 -> in TRK use contrast method to evaluate the reference functions Ref_Alg_Sel = 10 -> in TRK use FSR method to evaluate the reference functions
LOL Logic MF	2	52-53	Xy: x refer to the first band transmitted, y to the second one.
Preset Tracking	1	54	PT = 0 -> acquisition/tracking operation PT = 1 -> preset tracking operation
f_NPM Address	2	55-56	Band of the Noise Power Measurement during ACQ f_NPM = 00 -> B1 f_NPM = 01 -> B2 f_NPM = 10 -> B3 f_NPM = 11 -> B4
Slope Address	4	57-60	binary 4 bit integer addressing among 16 available in PT the value to be assumed by the variable Slope Address
TX Power	4	61-64	The power level of the transmitted signal in count
A2_0 OST Abscissa	12	65-76	12 bit integer,. Values used to initialise the Contrast Method
Ind. Echoes or Flash Mem.	4	77-80	
Consecutive frames in Flash Memories.	16	81-96	

TABLE 3.5.1.1-1

3.5.1.2 Operations Sequence Table Definition

The logic of generation of the MARSIS OST is detailed in ANNEX 8

3.5.2. Parameters Table

While the OST is used to define a succession of different Operational Modes and specify details for each Mode, the Parameters Table specify values that apply to all Operational Modes and to the general behaviour of the instrument.

The Parameters Table specifies a wide memory area in which all the parameters needed by the instrument are stored and its full content is detailed in **ANNEX 5**.

A default copy of the PT is maintained in EEPROM and it is loaded into SRAM upon instrument boot. During flight it is possible, by means of dedicated TC Packets (SIS_PT_TC) to change/update the value of one, or more, Parameters stored in the SRAM copy of the PT in support of nominal operations.
It is also possible to update/change the value of Parameters stored in the default copy of the PT, in EEPROM, by means of the standard Memory Patch services.

Using the PT Load TC it is possible to load **38 contiguous**, or **19 not contiguous**, Parameters values per single TC.

3.5.2.1 PT Structure

The Parameter Table is defined as a single table but, in practical terms, it is partitioned into three separte memory areas:

- Master DSP PT: from Par. #0 to Par. #3838 (not all locations used)
- Slave 1 DSP PT: from Par. #0 to Par. #32767 (not all locations used)
- Slave 2 DSP PT: from Par. #0 to Par. #32767 (not all locations used)

Slave 1 DSP and Slave 2 Dsp portions od the PT have the same structure.

All the necessary details about the PT are found in **ANNEX-5**

Basically a set of PT values is programmed before each observation and they include coefficients for the estimation of orbital and topographical parameters, as well as other processing related values. Most of the PT is anyhow used to collect a great number of instrument look-up-tables (LUTs) and other calibration/engineering values set on ground or to be set (updated) after on-orbit commissioning of the instrument.

Parameters can be arranged in four different categories:
- Internal radar parameters that shall not modified for any reason.
- Calibrated parameters that are seldom changed once set at the beginning of MARSIS operations.
- Parameter that shall be programmed at each observation, but could become Calibrated parameters in the future.
- Parameter that shall programmed at each observation.

Parameters have all 32-bit wide values stored (left-aligned) into 48-bit wide memory locations. There are two important exceptions to this, noted as follows.

The two most important PT values that require mandatory update whenever the instrument is commanded for measurement activities are those known as **SCET *** (or **SCET Star**) and **SCET Pc**. The two values are time references specified as full 48-bit values to (respectively) the beginning of the OST (or OST time tag) and the Pericenter passage (for processing purposes).

Special PT Parameters are those used to activate software functions (kind of embedded commandability). The following are currently available (SW Rel 4.1):

- **#38** Restart_With_Code2
- **#57** Execute_Master_PM_Patch
- **#140** FLASH_Erase
- **#150** FLASH_Test

3.6. Instrument Memory Management

The service 6 supports scatter load and dump, as well as block load and dump, of any of the available on-board memories.

Only Absolute address method of addressing the memory is supported: this allows the user to specify a real address start loading or dumping from.

With regard to the DES Dump and Patch functionality:

- Memory Patch and Dump Telecommands are accepted by MARSIS only in STANDBY Mode.
- All DES memory areas (volatile and non volatile) are accessible for Dump operations.
- All DES writable memory areas are accessible for Patch operations.
- It is possible to load/modify the Default Operations Sequence Table (DOST) and Default Parameters Table (DPT) performing a patch operation on the relevant EEPROM memories.
- The length of the area to be dumped is not limited to the size of the maximum TM packet size.
- The DES SW generates, as result of a Dump request area that requires more than one Dump TM Packet, as many TM Dump packets as required to manage the entire Dump area.
- There are no constraints imposed on how to break down the dump area into TM(6,6) dump packets.

Memory management TC packets are SIS_PATCH_TC and SIS_DUMP_TC.

The destination memory to be patched/dumped shall be uniquely identified by a Memory ID, as detailed in the following table:

Proc. ID	Destin.	Mem. ID	Memory Type	Bank #	Mem. size x width	Abs. Start-End Address	Dump Range	Patch Range
76	C&C	176	EEPROM	1	128K x 48bit	0x0 – 0x1FFFF	0x0 – 0x1FFFF	0xB000 – 0x1FFFF
	C&C	177	Program SRAM	1	512K x 48bit	0x20000 – 0x9FFFF	0x20000 – 0x9FFFF	0x20000 – 0x9FFFF
	C&C	178	Data SRAM	0	512K x 32bit	0x0 – 0x7FFFF	0x0 – 0x7FFFF	0x0 – 0x7FFFF
	C&C	191	FPGA Registers (memory mapped)	0	Variable (see annex 1)	0x80000 - 0xABFFF	See Annex1	See Annex1
77	DSP1	179	EEPROM	1	128K x 48bit	0x0 – 0x1FFFF	0x0 – 0x1FFFF	0x2000 – 0x1FFFF
	DSP1	180	Program SRAM	1	512K x 48bit	0x20000 – 0x9FFFF	0x20000 – 0x9FFFF	0x20000 – 0x9FFFF
	DSP1	181	Data SRAM	0	512K x 32bit	0x0 – 0x7FFFF	0x0 – 0x7FFFF	0x0 – 0x7FFFF
	DSP1	182	Dual-port SRAM	0	8K x 16bit	0x80000- 0x81FFFF	0x80000- 0x81FFFF	0x80000- 0x81FFFF
78	DSP2	183	EEPROM	1	128K x 48bit	0x0 – 0x1FFFF	0x0 – 0x1FFFF	0x2000 – 0x1FFFF
	DSP2	184	Program SRAM	1	512K x 48bit	0x20000 – 0x9FFFF	0x20000 – 0x9FFFF	0x20000 – 0x9FFFF
	DSP2	185	Data SRAM	0	512K x 32bit	0x0 – 0x7FFFF	0x0 – 0x7FFFF	0x0 – 0x7FFFF
	DSP2	186	Dual-port SRAM	0	8K x 16bit	0x80000- 0x81FFFF	0x80000- 0x81FFFF	0x80000- 0x81FFFF
79	TIMING	187	FLASH (chip 0)	0	2M x 16 bit	0x0 – 0x1FFFFF	0x0 – 0x1FFFFF	N/A
	TIMING	188	FLASH (chip 1)	0	2M x 16 bit	0x0 – 0x1FFFFF	0x0 – 0x1FFFFF	N/A
	TIMING	189	FLASH (chip 2)	1	2M x 16 bit	0x0 – 0x1FFFFF	0x0 – 0x1FFFFF	N/A
	TIMING	190	FLASH (chip 3)	1	2M x 16 bit	0x0 – 0x1FFFFF	0x0 – 0x1FFFFF	N/A

Table 3.6-1 Memory Management, MARSIS Payload Memory ID definition

Depending on the memory width, the memory structure is defined as follows:

For 16 bits memory width				Data word
				2 octets
For 32 bits memory width			Most Significant Word	Least Significant Word
			2 octets	2 octets
For 40 bits memory width	Not Used	Most Sign. Byte	Middle Data Word	Least Significant Word
	1 octet	1 octet	2 octets	2 octets
For 48 bits memory width	Most Significant Word		Middle Data Word	Least Significant Word
	2 octets		2 octets	2 octets

Table 3.6-2 Memory Management, Memory Structure

3.7. Instrument Thermal Control

MARSIS Thermal Control is entirely managed by the S/C.

All units Thermal Control is mainly passive.
Heaters are used to keep under active control the Antenna PCBs and Pyro Devices (the latter used for the deployment of the Antenna).

Therefore the use of the Antenna Heaters is needed to ensure that the thermal environment of portions of the Antenna Assembly is maintained within required limits during the cruise and science phases, as well as during the MARSIS Antenna Deployment Sequence.

Heater devices included in the Antenna Assembly design are as follows.

Function	Location	# Heaters	# Lines	Type	Power (W)
Dipole 1 PCB Heater	Ant. Assembly PCBs Thermal Enclosure	1	3	TSP	3.75
Dipole 2 PCB Heater	Ant. Assembly PCBs Thermal Enclosure	1	3	TSP	3.75
Monopole PCB Heater	Ant. Assembly PCBs Thermal Enclosure	1	3	TSP	3.0
Dipole 1 Pyro Heater	Dipole 1 Compartment	1	3	TSP	0.5
Dipole 2 Pyro Heater	Dipole 2 Compartment	1	3	TSP	0.5
Monopole Pyro Heater	Monopole Compartment	1	3	TSP	0.5

Sizing of the heaters (in terms of power dissipated) has been determined by thermal analysis carried out during the Antenna Assembly design process.

3.7.1. Heaters Management

As already mentioned the heaters in the MARSIS antenna assembly are used for maintaining acceptable temperatures for the PCBs and the deployment Pyros.
Temperature telemetry is provided to the spacecraft for the purpose of monitoring the temperature of the antenna assembly, and thus the PCBs and the Pyros, as well as of the other MARSIS units, the SISD and the SIST.

The temperature range for the Pyros is quite broad (as low as -115° C), but the PCBs will not survive such a low temperature (**minimum acceptable -20°C**).

3.7.1.1 Baseline concept

It is expected that **the heaters shall to be turned on by the spacecraft** (using SIS_HEATER_ON HPC command) shortly after launch.

From the Antenna Thermal Analysis, it is expected that the heaters will remain on for the duration of the mission. The antenna temperature telemetry will be used to confirm this need.

The Pyro heaters will be turned off by way of microswitches in the antenna assembly after the Pyros are blown. From that point in time until the end of the mission, only the PCB heaters will be operating.

The S/C shall therefore implement a controlling process to keep Antenna temperature **between 0°C and 60°C**. Since the controlling element is a Relay within the SISD unit, the control shall be performed by means of S/C Monitoring Tables. This because the Thermal Control process can only manage S/C LCL to activate/deactivate heaters.

3.7.1.2 Alternative concept

In order to perform a more power-otpimised control of the Heaters it is possible to transfer control of the Antenna PCB and Pyro Heaters to the Thermal Control process of the S/C.

In order to do so the SISD SIS_HEATER Relay shall be set permanently closed while the controlling process, via Temperature Control Tables, acts on MARSIS nominal/redundant primary power LCLs.

The temperature limits to be applied in this concept are **between 0°C and 20°C.**
This concept produces a power consumption reduction of 75% with respect to the baseline concept described above.

Procedural details for this concept are given in §7.

3.8. Data compression

MARSIS has two product type:

- raw data, where NO on-board processing is carried out,
- the processed data.

It is clear that the desire is to have as little processing as possible on board since the science data quality is highest at the unprocessed stage.
However, the requirement for global coverage and the fact that MARSIS has limited data rate, forces the instrument to carry out the processing onboard to reduce the data volume.
The reduction in data volume is achieved maily implementing the the along track processing (doppler processing)

The actual data reduction factor due to the along track processing is in the range of 160-300 and it depends from S/C heigth and tangential velocity and from the transmitted frequency.
In fact it is exactly equal to the frame size NB (in number of PRI) during the SUB-SURFACE Sounding Submodes.

3.9. Data Formatting

In this section is reported the structure of the Telemetry Packets, and the packetization stategy followed by the Digital Electronics Subsystem.

All the details are now available in RD-10.

4. Instrument Operations

4.1. Overview of Operating Principles

MARSIS Operating Principles include the following phases:

- CRUISE Phase
- IN-ORBIT PRE-COMMISSIONING Phase
- ANTENNA DEPLOYMENT Phase
- IN-ORBIT COMMISSIONING Phase
- IN-ORBIT SCIENCE Phase

4.1.1. CRUISE Phase

It is requested that the Antenna Heaters will be turned on, by the S/C, shortly after the launch and managed according to the baseline Concept described in §3.7. (The Alternative Concept will be considered only upon formal request).

It is expected that the heaters will remain on for the duration of the Cruise. Relevant procedures are in §7.

MARSIS in this phase will remain always in CRUISE MODE (with the exception of the instruments Check-out operations during S/C Near Earth Verification, Interplanetary Cruise and Post-MOI phases).

4.1.2. IN-ORBIT PRE-COMMISSIONING Phase

MARSIS will be managed like in the CRUISE Phase.

4.1.3. ANTENNA DEPLOYMENT Phase

This is one of the most critical phases of MARSIS Operations.

The Sequence of Operation will be driven by the S/C and the relative procedure is detailed in §7.

The Antenna Elements will be deployed one at time following this sequence:

1. Dipole#1

2. Dipole#2
3. Monopole

In this phase the S/C is requested:

- to send the proper Pyro Firing Commands;
- to check its attitude dinamics;
- to monitor the Antenna Temperature.

The Pyro heaters will be automatically turned off by way of microswitches embedded in the Antenna Assembly, after the Pyros are fired.

After the Antenna Deployment MARSIS will go in NON-OPERATIVE MODE.

4.1.4. IN-ORBIT COMMISSIONING Phase

MARSIS will be managed like in the IN-ORBIT SCIENCE Phase.

4.1.5. IN-ORBIT SCIENCE Phase

After the deployment of its antenna, MARSIS will be ready to start its IN-ORBIT phase.

Thermal Control of the Antenna (limited to the PCBs) shall be performed independently of instrument operations.

MARSIS will be turned ON and OFF every active Orbit in correspondence of the Pericenter passage interval (about 36 minutes before and after the pericenter passage time). In this respect, the operative, or active, phase of the instrument will happen at most one time per Orbit.

In correspondence of the active phase of a given orbit the instrument will be powered and will go in SIS-ON MODE.

From that moment on, the instrument will be managed as per the Nominal Operations Timeline, which is described in §5 and §7 and here summarized:

1. After Power On, the instrument goes first in CHECK/INIT Mode and then in STAND BY Mode.
    a. In case of problems during the boot sequence the instrument will go in SAFE/IDLE Mode.
    b. The instrument starts generating HK, Mode transitions and Event TM Packets.

2. The instrument On Board Time is synchronized with the S/C's one.
3. The instrument is loaded with a new Operational Sequence Table (OST) and a number (variable) of Parameter Table (PT) values is updated.
4. The instrument is programmed with the initial OST time tag (SCET * value) and the Pericenter passage time for the given orbit (SCET Pc).
5. The instrument is commanded to load the upgraded software and thus start the automatic OST processing.
    a. The RX unit and the TX unit are switched On.
    b. Instrument commands used so far (since switch on, no other commands will be required):
        - SIS_TIME_UP (On Nominal or Redundant Branch): Mandatory
        - SIS_HK_EN (On Nominal or Redundant Branch): Optional
        - SIS_HK_DIS (On Nominal or Redundant Branch): Optional
        - SIS_OST_TC (On Nominal or Redundant Branch): Mandatory (1 or more)
        - SIS_PT_TC (On Nominal or Redundant Branch): Mandatory (1 or more)
6. As the OST time tag elapses the OST programmed Operational Modes are executed. Their duration is specified in the OST lines that define each Mode in the sequence.
    a. Science Data are produced.
    b. In case of problems during the operational sequence the instrument will go in SAFE/IDLE Mode.
7. At the end of the OST processing the instrument transitions back to STAND BY Mode.
    a. The RX unit and the TX unit are switched Off.
8. The Instrument remains in STAND BY Mode and cannot be programmed further (it can only be powered off).

As per the current SW version (4.2), in order to transfer Flash Memories data (optional storage of Science Data within the instrument) to the SSMM, it is necessary to perform the following, additional, timeline (other possibile options are discussed in §7):

1. After Power On, the instrument goes first in CHECK/INIT Mode and then in STAND BY Mode.
    a. In case of problems during the boot sequence the instrument will go in SAFE/IDLE Mode.
    b. The instrument starts generating HK, Mode transitions and Event TM Packets.

2. The instrument On Board Time is synchronized with the S/C's one.
3. Data from the Flash Memories are retrieved (using SIS_PATCH_TC) while in STAND BY Mode.
4. The instrument is powered off.

4.2. Nominal operations Plans

4.2.1. Ground Operations Plan

Mission planning for MARSIS experiment is driven by the goal of obtaining maximum coverage over the surface of Mars. All periods during operations when the spacecraft is below 800 (1200) km altitude will be considered data acquisition opportunities for MARSIS subsurface (ionosphere) sounding mode. MARSIS team will co-ordinate with the Mars Express Science Operations Center (MESOC) to develop and update data taking plans as needed. MARSIS team recognizes that it will be necessary during the mission planning phase to accommodate the data observation strategies of all of the instruments on the payload. In nominal operations, a long-term plan and associated command sequences will be established for data take timing and mode selection. As needed, updates to this plan will be instituted based on near real-time analysis of downlinked data and instrument performance assessments.
Under most orbit evolution scenarios for Mars Express, high latitude observations are likely to produce some repeated coverage for MARSIS. These opportunities may be used to optimize the mode of operation for special studies, such as capturing a segment of raw data for analysis of an area especially promising for water detection.

4.2.2. In-Orbit Commissioning Plan

One of the scope of the commissioning phase is to assess the correct way of working of the MARSIS instrument.
Therefore the first part of the commissioning phase shall be dedicated to operate the radar in several different operative modes in order to exploit the major functionalities of the instrument.

In particular the following functionalities and performances shall be tested:

- Telecommand Reception and execution
- Telemetry Packets Generation (Event, Housekeeping)
- Correct Analogue Telemetry (Temperature, Voltages) Generation
- Operative Modes Transition
- Correct Operation Sequence Table reception and execution
- Galactic Noise and External & Internal Electromagnetic Interference characterization for each band
- Capability to transmit RF signals for each band
- Capability to receive RF signals for each band
- Capability to receive RF signals with different Gain
- Correct positioning of the receive window as results of on-board orbit prediction
- Basic functions of the on-board processing algorithms
- Azimuth and range processing
- Adaptive reference function selection (Contrast Method and Front Surface Reflection)

- Tracking Algorithms functionality
- Active Ionosphere Sounding algorithms functionality
- Raw evaluation of the S/N ratio (if possible)
- Comparison with the results obtained during the on-ground calibration
- First tune of the Parameters Table
- Insure that the MARSIS is turned on in orbit in expedition manner with a proper safeguards consistent with an early commissioning
- Provide the plan to evaluate instrument performance and to establish the nominal configuration parameters for use during the mission
- Analyze the performance of MARSIS to optimize the science data acquisition of subsequent operations

The baseline commissioning procedure after deployment is as follows:

1. Start with Receive Only mode after antenna deployment (possibly first orbit after deployment).
2. Then proceed with 1 orbit of CAL mode at low power
3. At least two working days after step 2 data reception: two orbits of CAL mode (for the highest and lowest bandwidth).
4. After 2 working days from the reception of the step 3 data: 7 orbits dedicated to the subsurface operative mode. This to check of operative modes transition, validation on board processor and tracking using individual echoes capability:
   - 3 orbits with the following sequence: AIS - 5min, SS1 - 5 min, SS2 - 5min, SS3 - 5 min, SS4 - 5 min, SS5 - 5 min, AIS - 5 min.
   - 2 orbit with SS3 - 26 min
   - 1 Orbit with the following procedure (Repetition of the test ST01_1 performed on ground during instrument test, ISST and IST): SS4 - 2 min, CAL - 24 min, SS3 - 1 min, SS3 - 1 min
   - 1 orbit with SS4 - 26 min
5. 1 orbit dedicated to Ionosphere measurement : AIS - 36 min

4.2.2.1 Antenna Calibration

In order to get the predicted performances in the dual antenna clutter cancellation procedure, and consequently to reach the expected penetration depth, the null of the monopole antenna has to be controlled .

In order to meet the spacecraft maneuver constraints two procedure are proposed, the 1st is optimized while the second is a backup procedure

<u>First procedure</u>

A first estimation of the direction of the null in the monopole channel can be obtained by acquiring calibration data over a rough (related to the wavelength) area (range - azimuth transform to detect the null direction). This would require MARSIS to operate at full power with the pitch set at zero degree and over a rough terrain to get a strong surface clutter and with proper illumination condition in order to use all the frequencies.

After data analysis, the pitch (along track) null region direction would be identified with a coarse accuracy; around this point we require S/C manouvre to get the 1 deg accuracy required. The following procedure should be applied over a smooth area:

- Every orbit should have a different roll (cross track) pointing: from -2 to 2 deg (TBC) with steps of 1 deg
- In each orbit the pitch pointing shall be varied continuously (with steps of 1 deg) during the pericenter passage from -4 to 1 deg (TBC)

Second procedure (backup)

Every orbit should have a different roll (cross track) pointing: from -5° to 5 deg (TBC) with steps of 1 deg

During each orbit pitch (along track) pointing shall be varied continuously during the pericenter passage from -5° to 5 deg, measurement shall be done continuously alternating all the frequencies

The above mentioned plan is implemented by referring to the MEX Commissioning Request Forms reported in ANNEX 4

This plan describes the activities during the commissioning phase of the MARSIS instrument on the Mars Express Spacecraft. The activities to checkout MARSIS start with the deployment of the MARSIS antenna elements and end with the final adjustment of the parameters for data acquisition.

4.2.2.2 Commissionig Plan Objectives

The objectives of this plan are:

1) To insure that the MARSIS instrument is turned on in orbit in an expeditious manner with the proper safeguards consistent with an early commissioning.

2) Provide the plan to evaluate instrument performance and to establish the nominal configuration parameters for use during the mission.

3) Analyze the performance of MARSIS to optimize the science data acquisition of subsequent operations.

4.2.2.3 Commissioning Plan Implementation

For the purpose of this plan, the MARSIS instrument is configured with the Antenna fully deployed.

The Commissioning Plan is implemented according to flight control requirements stated for the mission phase interested by the execution of the plan.

MARSIS also includes elements at the European Space Operations Center (ESOC). Apart from ESOC provided workstations to monitor the status of the S/C and of the instrument, in the PI Support Area workstations will be set to:

- manage commanding operations
- manage instrument monitoring
- manage initial science data analysis

Additional workstations are available in Rome, at the MARSIS Control Center facilities.

The operational stations at the Mission Support area of JPL are:

- MARSIS Data Analysis Workstation

Communication between the ESOC-installed workstations and the JPL Mission Support Area is via Internet.

4.2.3. Flight Operations Plans by Mission Phase

From the MARSIS standpoint the Mars Express science mission will consist of a sequence of phases, each lasting 100 to 200 days, which are characterized by the illumination conditions and the latitude of the ground track.

4.2.3.1 Nominal mission (1st Mars year)

The project baseline is to deploy MARSIS antennas on the 20 April 04

1. Day 100-115 (TBC) MARSIS commissioning

2. Day 100-300. Nightside south pole and Southern Hemisphere.

This is the first critical mapping phase for MARSIS. Conditions should be optimal for subsurface penetration (lowest frequency bands). This region of Mars will not be accessible on the nightside again until the extended mission. Downlink rates is low for MEX MARSIS could require the 60% of the MEX data Volume during this phase.

3. Day 300-450. Dayside Northern Hemisphere.

During dayside phases, MARSIS will operate primarily in the higher frequency bands, although the other bands may be used away from periapsis. Downlink data rates are low during this particular phase, and there may be competition for bandwidth and for the OBDH usage among the payloads.

4. Day 450-600. Nightside Northern Hemisphere.

This is the second critical mission phase for MARSIS. It is the only opportunity to observe the northern hemisphere on the nightside during the nominal mission. Downlink data rates are favorable.

5. Day 600-720. Dayside Southern Hemisphere.

This phase carries into the extended mission.

4.2.3.2 Extended mission (2nd Mars year)

6. Day 720-880. Nightside Southern Hemisphere.

Although not as optimal for subsurface sounding as the earlier phase, this is the first opportunity to revisit areas observed earlier under the same conditions. Areas identified as high scientific priority from earlier data will be targeted for special study, including collection of raw data and for change detection.

7. Day 880-1050. Dayside Northern Hemisphere.

8. Day 1050-1180. Nightside Northern Hemisphere.

This phase includes opportunities to revisit northern hemisphere targets and is also the only opportunity to acquire substantial coverage of low latitude (equatorial) areas on the night side.

9. Day 1180-1250. Dayside Southern Hemisphere.

10. Day 1250-1363 (end of mission). Nightside Southern Hemisphere.

4.3. Failure Detection and Recovery Strategy

Three classes of failures are identified:
1. Instrument failures due S/C anomalies
2. Instrument failures due to internal causes
3. Instrument failure to operate properly due to programming errors

4.3.1. Instrument failures due S/C anomalies

Instrument failures, or impossibility to operate properly, due to S/C-related anomalies can be broadly considered related to:

- the power subsystem
- the TC/TM links
- the RTU subsystem
- the SSMM subsystem

Power subsystem and TC/TM anomalies handling is mamaged by ESOC using redundant capabilites (like reverting to redundant power command paths, redundant power bus or redundant TC/TM link).

RTU subsystem anomalies are handled by ESOC after monitoring activities performed after downlinking S/C and instrument HK telemetry at the end of the active portion of an orbit.
Definition of ESOC and MCC roles in verification of downlinked telemetry is TBD. In particular it shall be defined if ESOC as a role, if at all, in this.

SSMM subsystem anomalies include also the downlink process and the retrieval of data from the Data Distribution Server (DDS). SSMM failures are handled by ESOC. SSMM data storage anomalies, as well as downlink and data retrieval errors can be detected by the MARSIS Team and in case of problems notification will be given to ESOC FCT for discussion and resolution.

4.3.2. Instrument failures due to internal causes

From instrument Switch On to instrument Switch Off it is possibile to monitor, not in real time, instrument status and behaviour from instrument TM packets and S/C HK TM Packets.

Any out of limits condition shall be identified by ESOC and corrective action applied. The corrective action is:

- for temperature management – verify the failure of the automatic thermal monitoring/control process and act accordingly to re-establish safe conditions

- for all other causes – switch off the instrument and notify MARSIS Team.

During instrument operational phases, i.e. while performing measurements, there is no way to verify the status since, during the nominal science phase, there will be no direct contact with Ground (even delayed).
If at the end of an operational orbital flyby errors are found in the HK TM downlink ESOC FCT shall ensure that the instrument is safed (switched off and thermal control active) and then notify the MARSIS Team.
In particular, if the instrument was found in IDLE State before switch off, this event shall be notified promptly to the MARSIS Team for proper action.

4.3.3. Instrument failure to operate properly due to programming errors

It is possibile to program the instrument wrongly. There are two possible outcomes of these situations:

- the instrument perform the entire observation sequence per schedule but produce useless, or wrong, science data;
- the instrument performs the observation sequence in the wrong way.

In the first case the error will be catched by the MARSIS Team upon HK and Science Data retrieval from DDS and subsequent validation.

In the second case ESOC may verify the basic correct implementation of the intended sequence in terms of:

- OST start of processing
- OST Modes succession
- OST Modes duration

Errors in programming may produce too much data on the OBDH bus or can see the instrument behaving differently than expected in terms of power usage.

Since there is no way to stop the instrument from operating once programmed to do so, the only possibile action is to notify immediately the MARSIS Team of any abnormal situation to avoid that the same kind of programming error is propagated to subsequent orbits.
In particular it shall be noted that programming errors may be found in OST/PT load packets already sent to the S/C. In these cases MARSIS Team shall be contacted imemdiately to ascertain the cause of the error and clear the following observations (or request to cancel the following loaded timelines of commands).
Also, if the instrument was found in IDLE State before switch off, this event shall be notified promptly to the MARSIS Team for proper action.

5. Modes Description

This section presents the detailed description of MARSIS Operative Mode and the Modes Transition Diagram.

5.1. Operative Modes: Summary

The instrument operation modes are described in the following table:

	Mode		Characteristics									
	No.	**Name**	**Description**	**Powered units**	**Approx power consumption [W]**	**Time duration (nominal) [s]**	**HPC allowed**	**TC packets allowed**	**Analogue and RSS valid**	**HK/Event TM packets generated**	**Science TM generation**	**RF transmission from antennas**
SILENT MODES	1	**OFF**	MARSIS is powered-off, power busses can be powered or not (i.e. it is don't care).	NONE	0	-	Y	N	Y[13]	N	N	N
	2	**SIS-ON**	MARSIS is powered and ready to operate, the main input switch is closed	SISD[1] SIST[2]	1	-	Y	N	Y	Y	N	N
	3	**CRUISE**	Antenna heaters are ON, Antenna is in the launch configuration (i.e. stowed).	SISD[1] SIST[2] HTRS	13	-	Y	N	Y	Y	N	N
	4	**NON-OP**	Antenna heaters are ON, Antenna is deployed.	SISD[1] SIST[2] HTRS	12	-	Y	N	Y	Y	N	N
SUPPORT MODES	5	**CHECK/INIT**	MARSIS enter in this mode after the SISD_PWR_ON HPC CMD from S/C, DES performs its own initialization and internal tests. In case of failure DES provides the S/C an event TM and goes in IDLE MODE.	SISD[3] SIST[2]	27	5	Y	N	Y	Y	N	N
	6	**IDLE**	MARSIS will autonomously enter this mode after recovery actions if a dangerous HW or SW failure occurs. Only SILENT modes are reachable from this mode	SISD[3] SIST[2]	27	-	Y	N	Y	Y	N	N
	7	**STANDBY**	MARSIS enters autonomously into this mode if the Check/Init mode is completed correctly). Mode transition is reported by an Event TM packet. Using Packet TC the S/C shall load into DES: i) SCET (mandatory), ii) Operation Sequence Table (optional), iii) Parameter Table (mandatory). Software patch and memory dump operations are permitted in this mode.	SISD[3] SIST[2]	27	240	Y	Y	Y	Y	N	N
	8	**WARM-UP1**	DES commands MARSIS into this mode sending an ON Command to RX Power Supply. Mode transition is reported by an Event TM packet.	SISD[4] SIST[2]	32	5[7] 4[8]	Y	N	Y	Y	N	N
	9	**WARM-UP2**	DES commands MARSIS into this mode sending an ON Command to SIST Power Supply. Mode transition is reported by an Event TM packet. In WARM-UP2 the Stable Oscillator and RX and TX Stabilization is completed	SISD[4] SIST[5]	35	300[9] 2[10]	Y	N	Y	Y	N	N

	Mode		Characteristics									
	No.	Name	Description	Powered units	Approx power consumption [W]	Time duration (nominal) [s]	HPC allowed	TC packets allowed	Analogue and RSS valid	HK/Event TM packets generated	Science TM generation	RF transmission from antennas
OPERATION MODES	10	**RX ONLY**	This mode is entered according to the loaded OST; Mode transition is reported by an Event TM packet; MARSIS performs the following tasks: Collection of environmental noise. Science Data Generation.	SISD[4] SIST[5]	49	var[11]	Y	N	Y	Y	Y	N
	11	**CALIBRATION**	This mode is entered according to the loaded OST; Mode transition is reported by an Event TM packet; MARSIS performs the following tasks: Pulses transmission and reception of linearly frequency modulated (chirp) pulsed signals. Science Data Generation.	SISD[4] SIST[6]	63	var[11]	Y	N	Y	Y	Y	☠ Y
	12	**IONOSPHERE**	This mode is entered according to the loaded OST; Mode transition is reported by an Event TM packet; MARSIS performs the following tasks: Pulses transmission and reception of CW pulsed signals; Processing of received echoes; Science Data Generation.	SISD[4] SIST[6]	63	var[12]	Y	N	Y	Y	Y	☠ Y
	13	**SUBSURFACE**	This mode is composed by 5 different sub-modes, selected according to the loaded OST; Mode transitions are reported by Event TM packets; MARSIS performs the following tasks: Pulses transmission and reception of linearly frequency modulated (chirp) pulsed signals. • Processing of received echoes • Science Data Generation.	SISD[4] SIST[6]	63	var[11]	Y	N	Y	Y	Y	☠ Y

Notes are found in next page.

Notes:

(1) Only the main switch is closed, DES and RX are OFF
(2) Only the DC/DC input section is powered, TX is OFF
(3) Only the DES is powered, the RX is OFF
(4) Both DES and RX are powered
(5) The TX is ON but no RF power is radiated
(6) The TX is ON and RF energy is radiated
(7) from ST-BY to WUP2
(8) from WUP2 to STBY
(9) from WUP1 to operation modes
(10) from operation mode to WUP1
(11) variable 0Φ1560, depending on loaded OST
(12) variable 0Φ1560 (or 0Φ2160), depending on loaded OST
(13) RSS are valid only if the power bus is ON

5.2. Mode Transition Diagram

MARSIS Mode Transition Diagram is shown per figure 2.1.3.2-1

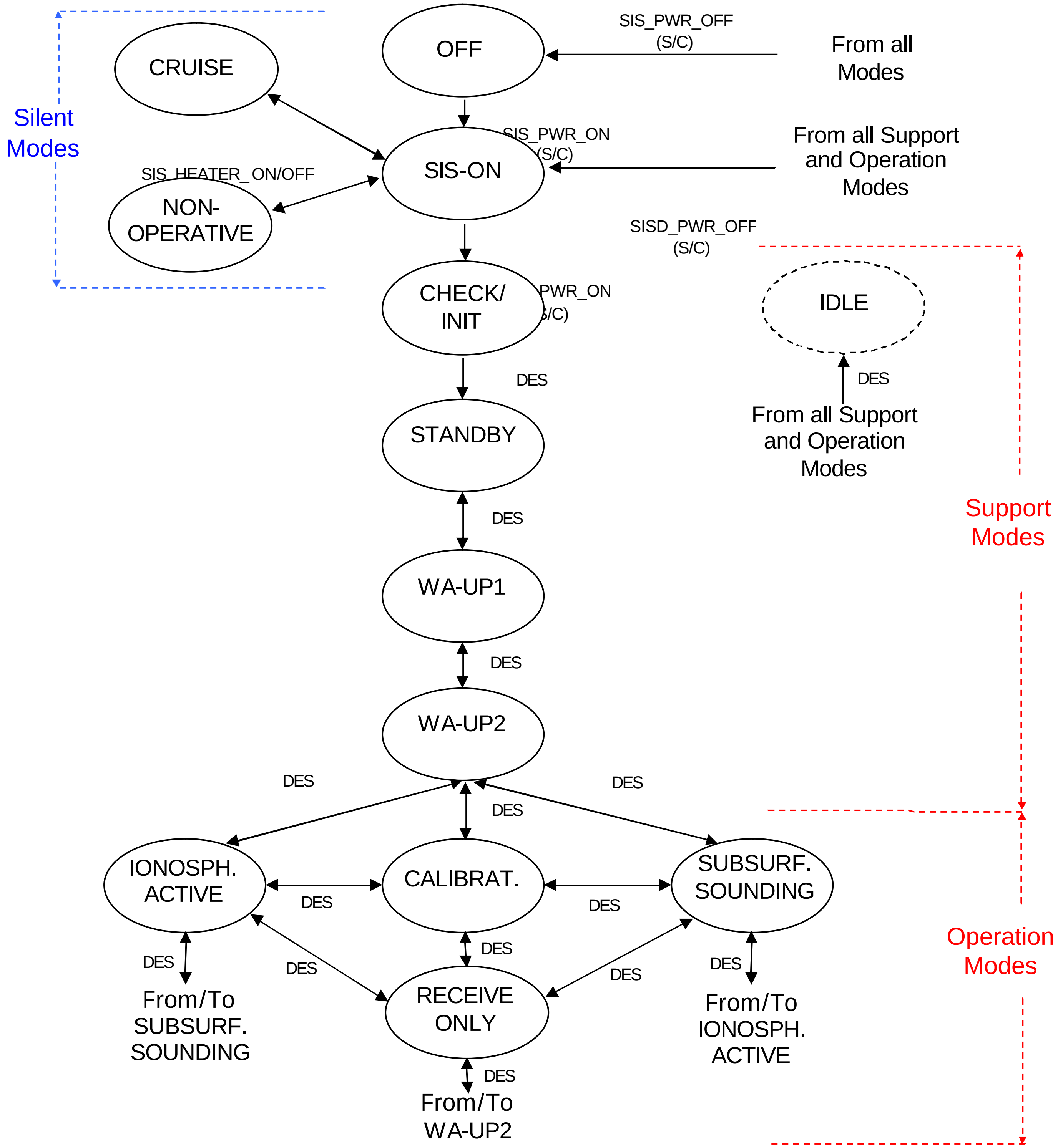


Figure 5.2-1 MARSIS Operative Modes Transition Diagram

The allowed Mode Transitions between MARSIS SUPPORT and OPERATION Modes are shown in table 5.2-1

TO / FROM	CHECK/ INIT	STANDBY	WA-UP1	WA-UP2	IDLE	REC. ONLY	CALIB.	SUBSURF. SOUNDING	ACTIVE IONOSP. SOUNDING
CHECK/INIT	Y	Y	N	N	Y	N	N	N	N
STANDBY	Y		Y	N	Y	N	N	N	N
WA-UP1	Y	Y		Y	Y	N	N	N	N
WA-UP2	Y	N	Y		Y	Y	Y	Y	Y
IDLE	N	N	N	N		N	N	N	N
REC. ONLY	Y	N	N	Y	Y		Y	Y	Y
CALIB.	Y	N	N	Y	Y	Y		Y	Y
SUBSURF. SOUNDING	Y	N	N	Y	Y	Y	Y		Y
ACT. IONO. SOUNDING	Y	N	N	Y	Y	Y	Y	Y	

Table 5.2-1 Allowed Transitions between Operative Modes

MARSIS Mode Transitions are classified in two categories:

- S/C commanded Mode Transitions
    - MARSIS instrument is commanded by the S/C only to perform Mode Transitions from/to OFF Mode.
- DES commanded Mode Transitions
    - DES is able to perform MARSIS instrument transitions between Support Modes as per Table 1.5-1 at a pre-defined scheduled time.
    - DES is able to implement the proper MARSIS instrument transitions to the selected Operation Mode at the time scheduled inside the OST.
    - DES is able to implement the transition between any Operation Modes and WARM-UP2 Mode when scheduled in the OST. It occurs always at the end of Operation Mode Sequence.
    - DES is able to implement the transition to IDLE Mode if some failure or malfunction is detected during its self-test or initialization.

MARSIS Mode Transitions are caused by the events shown in table 5.2-2

TO / FROM	CHECK/ INIT	STANDBY	W A-UP1	W A-UP2	IDLE	REC. ONLY.	CALIB.	SUBSURF. SOUNDING	IONOSP. SOUNDING
CHECK/INIT	WATCHDOG RESET	END of CHECK/INIT			FAILURE/ MALFUNC.				
STANDBY	WATCHDOG RESET		RX ON CMD		FAILURE/ MALFUNC.				
W A-UP1	WATCHDOG RESET	RX OFF CMD		TX ON CMD	FAILURE/ MALFUNC.				
W A-UP2	WATCHDOG RESET		TX OFF CMD		FAILURE/ MALFUNC.	END of WA_UP2 & REC. ONLY SELECTION	END of WA_UP2 & CALIB SELECTION	END of WA_UP2 & SUBSURF. SELECTION	END of WA_UP2 & IONOSP. SELECTION
IDLE	WATCHDOG RESET								
REC. ONLY.	WATCHDOG RESET			END of OPERATIVE MODES SEQUENCE	FAILURE/ MALFUNC.		END of REC. ONLY & CALIB SELECTION	END of CALIB & SUBSURF. SELECTION	END of CALIB & IONOSPH. SELECTION
CALIB.	WATCHDOG RESET			END of OPERATIVE MODES SEQUENCE	FAILURE/ MALFUNC.	END of CALIBR. & REC. ONLY SELECTION		END of REC. ONLY & SUBSURF. SELECTION	END of REC. ONLY & IONOSPH. SELECTION
SUBSURF. SOUNDING	WATCHDOG RESET			END of OPERATIVE MODES SEQUENCE	FAILURE/ MALFUNC.	END of SUBSURF & REC. ONLY SELECTION	END of SUBSURF & CALIB SELECTION		END of SUBSURF & IONOSPH. SELECTION
IONOSP. SOUNDING	WATCHDOG RESET			END of OPERATIVE MODES SEQUENCE	FAILURE/ MALFUNC.	END of IONOSPH & REC. ONLY SELECTION	END of IONOSPH & CALIB SELECTION	END of IONOSPH & SUBSURF. SELECTION	

Table 5.2-2 Mode Transitions Events

5.3. Operative Modes: Detailed Description

MARSIS Operative Modes are classified as "SILENT" modes, "SUPPORT" modes and "OPERATION" modes. In the Operation Modes the radar performs its main tasks i.e. acquisition, tracking, calibration, subsurface and ionosphere sounding etc..
In the Support Modes the instrument performs all the other tasks, i.e. initializing, testing, recovery from failure, telecommand reception etc.
The silent mode mode are mostly used during the cruise phase or in the non-operative part of the orbit
The powered configuration for each Operative Mode is as shown in table 5.3-1

	Operative Modes												
	Silent Modes				Support Modes					Operation Modes			
Subsystem	OFF	SIS-ON(1)	CRUISE(3)	NON OPER.(4)	CHECK/ INIT	STAND-BY	W A-UP1	W A-UP2	IDLE	CALIB.	REC ONLY	SUBSURF SOUND-ING	IONOSP SOUND-ING
SISD (DES)	-	ON(2)	ON(2)	ON(2)	ON	ON	ON	ON	ON	ON	ON	ON	ON
SISD (RX)	-	-	-	- - -	-	-	ON	ON	-	ON	ON	ON	ON
SIST (TX)	-	ON(2)	ON(2)	ON(2)	ON(2)	ON(2)	ON(2)	ON	ON(2)	ON	ON	ON	ON
ANTENNA (HEATERS)	-	-	ON	ON	-	-	-	-	-	-	-	-	-

(1) SIS-ON: Only the MARSIS Main relay is closed after the reception of the HPC: SIS_PWR_ON
(2) Only the Power interface circuits with the S/C are powered (the 28V main Bus is distributed to SIST by DES)
(3) CRUISE: During cruise phase before Antenna Deployment
(4) NON-OPERATIVE: After the Antenna Deployment during the non-operative part of the Orbit

Table 5.3-1

The configuration of the relays (contained in the switching board of DES) for each mode is reported in table 5.3-2

		DES Switching board Relays		
		SIS_PWR (Nom or Red)	SIS_HEATER	SISD_PWR
Operative Mode				
SILENT	OFF	OPEN	OPEN	OPEN
	SIS-ON	CLOSED	OPEN	OPEN
	CRUISE	CLOSED	CLOSED	OPEN
	NON-OPERATIVE	CLOSED	CLOSED	OPEN
SUPPORT		CLOSED	OPEN	CLOSED
OPERATION		CLOSED	OPEN	CLOSED

Table 5.3-2

5.3.1. Silent Modes

In the "Silent Modes" category are considered the following modes:

OFF MODE: SISD, SIST and Antenna Heaters are OFF.
SIS_ON MODE: Power interface of SISD and SIST are ON, all the Antenna Heaters are OFF.
CRUISE MODE: Power interface of SISD and SIST are ON, all the Antenna Heaters are ON (12Watts). MARSIS will be in this mode during cruise before the Antenna Deployment.
NON-OPERATIVE MODE: Power interface of SISD and SIST are ON, the Antenna PCBs Heaters are ON (10.5 Watts). MARSIS will be in this mode after Antenna Deployment during the non-operative part of the Orbit. The Deployment of Antenna will deactivate the Pyros Heaters.

The use of the heaters is needed to ensure that the thermal environment within the Antenna Assembly is maintained within required limits during the cruise phase, and within required limits during the MARSIS Antenna Deployment Sequence.

Only a subset of MARSIS discrete TM (Temperatures and RSS) can be acquired by the S/C in these modes.

5.3.2. Support Modes

The Support Modes are listed here below:

- CHECK/INIT
- STANDBY
- WARM-UP1
- WARM-UP2
- IDLE

CHECK/INIT Mode
MARSIS enter in this mode after the SISD_PWR_ON command from S/C to DES Power Supply.
In this modes the digital section performs Bootstrap, Hardware and Software initialization and its own initial self-tests.
In case of unrecoverable failure (during initialization or self-tests) all the operations are suspended and MARSIS goes autonomously in IDLE Mode sending Error/Anomaly Report Telemetry packet (SIS_ERR_REP) to the S/C DMS.
If no failure will be detected, initialization OK, self-tests OK, MARSIS (DES) are ready to run and goes autonomously in Standby Mode sending a Normal/Progress Report

Telemetry (SIS_PROG_REP) to let the transition to STANDBY Mode observable by the S/C and Ground.
No TC Packets can be accepted from MARSIS during this mode.

- The time duration of this mode is fixed to 3.5 seconds
- Only DES is ON and other subsystems are OFF.

STANDBY Mode
DES commands MARSIS into this mode:
1. during the power-up phase (if the previous mode is completed correctly), 5 seconds after the SIS_PWR_ON command
2. during the power-down phase, after the conclusion of the WARM-UP1 mode

Mode transition is reported by an Event TM packet (SIS_PROG_REP).
Only during this mode TC Packets can be accepted from MARSIS.
In particular in STANDBY Mode MARSIS can accept the following Packet TC:

SIS_TIME_UP:	to load the current SCET
SIS_OST_TC:	to load the Operations Sequence Table
SIS_PT_TC:	to load the Parameters Table
SIS_HK_DIS:	to disable the HK TM packets transmission
SIS_HK_EN:	to enable the HK TM packets transmission
SIS_PATCH:	to perform patch operations on any writable memory area
SIS_DUMP:	to perform dump operation on any memory area
SIS_MOD_TR_DIS:	to disable the automatic mode transition from STANDBY to WARM-UP1 and mantain MARSIS in Standby mode for a time duration defined in the packet TC itself.

Dedicated HK TM Packets are generated in this mode (SIS_HK_TM).
It is recommended to go in this state before the instrument switch-off.

- STANDBY Mode time duration is fixed to 240seconds (power-up) and to 4seconds (power-down)
- Only DES is ON and other subsystems are OFF (with the exception of the SIST power interface).

WARM-UP1 Mode
DES commands MARSIS into this mode:
1. during the power-up phase sending an ON command to the RX section, after the conclusion of the STANDBY mode
2. during the power-down phase sending an OFF command to the TX section, after the conclusion of the WARM-UP2 mode

Mode transition is reported by an Event TM packet (SIS_PROG_REP).
Dedicated HK TM Packets are generated in this mode (SIS_HK_TM).
No TC Packets can be accepted from MARSIS during this mode.

- WARM_UP1 Mode time duration is fixed to 5 seconds (power-up) and to 4 seconds (power-down)
- SISD (DES and RX) is ON SIST and Heaters are OFF (with the exception of the SIST power interface).

WARM-UP2 Mode

DES commands MARSIS into this mode:

1. during the power-up phase sending an ON command to the TX section, after the conclusion of the WARM-UP1 mode
2. during the power-down phase after the conclusion of the last Operation Mode.

Mode transition is reported by an Event TM packet (SIS_PROG_REP).
Dedicated HK TM Packets are generated in this mode (SIS_HK_TM).
No TC Packets can be accepted from MARSIS during this mode.
This mode is used to allow the warm-up and the complete stabilization of both RFS subsystem and the Stable oscillator of the Digital Electronics Subsystem.

- WARM_UP2 Mode time duration is fixed to 300 seconds (power-up) and to 2 seconds (power-down)
- SISD and SIST are ON, Antenna Heaters are OFF (with the exception of the SIST power interface).

IDLE Mode

This is a "virtual" mode in which the instrument goes autonomously after recovery actions "not controllable". If a dangerous HW or SW failure occurs the instruments goes in this mode.
It is possible to go out from this mode only by switching–off and then switching-on DES.

- IDLE Mode time duration is not fixed and depends by the moment in which the malfunction is detected
- Only SISD (DES only) is ON and other subsystems are OFF (with the exception of the SIST power interface).

5.3.3. Operation Modes

MARSIS Operation Modes are listed here below:

- CALIBRATION
- SUBSURFACE SOUNDING
- ACTIVE IONOSPHERE SOUNDING
- RECEIVE ONLY

Mode transitions are reported by an Event TM packet (SIS_PROG_REP).
HK TM Packets are generated in these modes

No TC Packets can be accepted from MARSIS during these modes.

- Operation Modes time duration is fixed (based on the current knowledge of the G3u orbit) to 1560 seconds (Instrument Timeline#1) and to 2160 seconds (Instrument Timeline#2)
- SISD and SIST are ON, Antenna Heaters are OFF.

During operations, MARSIS may operate in anyone of the four operation modes that can be interleaved in any possible combination.

The Calibration mode is intended to obtain HW calibration information about the overall system.
The Subsurface Sounding Mode is intended to obtain data about the subsurface of Mars, the Active Ionosphere Sounding Mode is intended to obtain information about the ionosphere of Mars and the Receive Only mode is intended to collect samples of the signal recorded by MARSIS in purely passive mode. The main use of these data is to characterise the noise environment (either galactic noise and/or EMC noise) in which MARSIS is operating.
The Subsurface Sounding Mode is further subdivided into five separate submodes.

5.3.3.1 Subsurface Sounding Modes

During Subsurface Sounding Mode MARSIS can operate at four independent frequency bands.

The lowest frequency band is between 1.3 and 2.3 MHz and its operation is limited to night-time since the Mars ionosphere prevents these radio signals from reaching the surface during day-time. This frequency also will penetrate the deepest.
The second frequency band is between 2.5 and 3.5 MHz and again, its operation will be limited to night-time operations due to the ionosphere.
The third frequency band is between 3.5 and 4.5 MHz.
The fourth frequency band is between 4.5 and 5.5 MHz.
Operation of the sounder is limited to a maximum of two simultaneous frequencies at any one time with a total of four processing channels.

Five different sub-modes, SS1 to SS5, have been identified to optimize the science return in different possible operating scenarios.

During these modes the following processing can be performed (see details in the following):
- calibration of distortions due to ionosphere,
- acquisition and tracking of the surface echo time delay.,
- passive ionospheric measurement (embedded in the Subsurface Sounding)
- range and doppler processing

In any case also limited un-processed data can be appended to any sub-mode for ground processing monitoring.

SS1: 2 Frequency Bands – 2 Antennas – 1 Doppler Filter
This mode allows coherent clutter cancellation on two frequency bands by means of dual antenna clutter cancellation ground processing.
The I and Q (i.e., complex) Doppler processed samples of the zero Doppler filter will be downloaded at each frame. Range processing will be performed on the ground.
Through a suitable ground processing of the dual-frequency, clutter-corrected echo profiles the following information can be extracted for each frame:
surface roughness

- reflectivity of the first layer
- attenuation of the first layer
- reflectivity of the second layer

This mode can be used in rough areas (requiring clutter cancellation), where dual-frequency information is also desired. However, the use of only one Doppler filter can incur some loss in SNR, compared with multiple-filter modes.

SS2: 2 Frequency Bands - 1 Antenna (dipole) – Onboard Multi-look
This mode carries out onboard non-coherent integration of 5 looks (radiometric resolution on the order of 1 dB) and downloads a single amplitude detected averaged echo profile per each synthetic aperture (frame), at two frequency channels.
Through a suitable ground processing of the dual-frequency echo profiles the following information can be extracted for each frame:

- surface roughness
- reflectivity of the first layer
- attenuation of the first layer
- reflectivity of the second layer

This mode can be used in areas where clutter cancellation is not required, and data rate constraints do not allow downlink of complex and/or multiple filter data.

SS3: 2 Frequency Bands - 1 Antenna – 3 Doppler Filters
This mode allows downlink, for each frame, of the I and Q data of three Doppler filters (around the zero Doppler filter) collected on the dipole antenna channel at two frequencies. Range processing will be performed on the ground. This operation will allow the coherent dual-frequency analysis over a 3 look non-coherent integration at the frame rate.
Through a suitable ground processing of the dual-frequency echo profiles the following information can be extracted for each frame:

- surface roughness
- reflectivity of the first layer
- attenuation of the first layer
- reflectivity of the second layer

This mode can be used in areas where clutter cancellation is not required, and the data rate permits downlink of complex, multiple filter data.

SS4: 1 Frequency Band - 2 Antennas – 5 Doppler Filters

This mode allows downlink, for each frame, of the I and Q data of five Doppler filters (around the zero Doppler filter) for both the dipole and the monopole channels at one frequency. Range processing will be performed on the ground. In this mode it will be possible to perform, on the ground, the dual antenna cross track clutter cancellation, and a 5 look non-coherent integration on each frame.
Through a suitable ground processing of the echo profiles the following information can be extracted for each frame:

- surface roughness
- reflectivity of the first layer
- detection of subsurface layers (if any)

Since only one frequency channel is used the estimate of only the surface parameters can be obtained
This mode can be used in areas where clutter cancellation is required, and the data rate permits downlink of complex, multiple filter data.

SS5: 1 Frequency Band - 2 Antennas - Short Pulse (30 uS) – 3 Doppler Filters

This mode uses a short pulse waveform to reduce the impact of uncontrolled sidelobes on deep subsurface reflections.
The echoes returning after the transmission of four short pulses with the same carrier frequency are pre-summed upon reception and the I and Q processed data at two antennas and three Doppler filters are downlinked to Earth for each frame. Range compression and clutter cancellation are performed on the ground.
Through a suitable ground processing of the echo profiles the following information can be extracted for each frame:

- surface roughness
- reflectivity of the first layer
- detection of subsurface layers (if any)

Since only one frequency channel is used the estimate of only the surface parameters can be obtained
This mode can be used in areas where clutter cancellation is required, the data rate permits downlink of complex, multiple filter data, and a shorter pulse is preferred in order to reduce sidelobe impacts.

<u>Acquisition Phase</u>

The distance as predictable from the orbit and the topographic DEM does not account for the ionosphere effect, which introduces a delay that can be in the order of 50 up to 150 ?sec. Since this figure is in the same order of the RX window (350 usec., needed to limit the FFT size) a continuous tracking of the received echo is needed in order to optimize the time delay of the Rx window. The acquisition phase has the task of initializing the tracking providing a first estimate of the echo time delay. It is worth noting that we know, for each orbit, the sun elevation angle, which gives, in turn, a rough indication of the ionosphere plasma frequency: therefore by applying the available ionosphere models, like the "Gamma Model" or the "Single Parameter Equivalent Model" we can obtain a first rough information concerning the time delay and the phase distortion.

The acquisition can be in principle performed at single pulse level, after only range compression by considering a classic threshold technique (by selecting appropriately either the false alarm probability Pfa and the detection probability PD). The noise level can be evaluated in the first TBD PRI's of the frame (TX off) and it can be used to set-up the Rx gain control level (the 4 dB steps can be compensated by adjusting the threshold level). The EMI problem must be investigated in order to have a sufficiently accurate galactic noise measurements. Moreover the tests made at Terma on the Rosetta PCU have shown a spectral window without interference lines.

Ionosphere Calibration Phase

The ionospheric calibration is required to correct for the ionospheric phase dispersion. The on-board ionospheric calibration is only used for mode SS-2 where on-board multilooking is required and for the acquisition and tracking modes.

Two techniques will be implemented.

- The first technique is based on the fact that we have a large spectrum for each transmitted frequency and that we can apply the amplitude maximum contrast to the range compressed signal, that is we can select, with a relatively simple algorithm, the echo with minimum mean value. This can be done open loop by using, to range compress the data possibly averaged over several PRI's, at least 10 different reference functions with slightly different chirp slope (as a matter of fact the main effect of the propagation through the ionosphere will be a change of the chirp slope wrt the slope of the transmitted chirp) in order to span the expected ionosphere effects. A smoothing of the estimated plasma frequency (the chirp slope variation is directly related to this parameter) can be performed by considering an average over several (TBD) successive frames.

- The second technique is based on the simple principle that the reflection from a specular or near-specular surface can be used as the impulse response of the ionospheric phase dispersion. This technique makes two assumptions: 1) the returned radar echo is dominated by the first (front) surface return, and 2) the first surface return is composed of a single coherent component due to surface smoothness at MARSIS frequencies. In this technique, the first step is the determination of the adaptive reference function (i.e. the first surface return) after the presumming (i.e. doppler formation) is complete. This is done by a peak-detection operation, similar to the one used in the acquisition/tracking stage, and an appropriate windowing which will isolate the reference function. The extracted reference function is manipulated to remove any time-jitter and then is Fourier transformed and is used for pulse compression in the current frame.

Passive ionosphere sounding

Two Passive Noise Measurement data sets shall be acquired on each PRI either from the Dipole or from the Monopole channel according to the Operation Sequence Table.
It is excluded the possibility to carry out one measurement on Dipole and one measurement on Monopole. Both measurements shall make use of the same channel (but selecting different receiver bandwidths if desired). Allowed values for these bandwidths are:

10 Khz - 1.3 Mhz band
1.3 Mhz - 2.3 Mhz band
2.5 MHz - 3.5 Mhz band
3.5 MHz - 4.5 Mhz band
4.5 MHz - 5.5 Mhz band

Passive Noise Measurement shall be performed during any of the Subsurface Sounding Mode options always using the allocated slot of 10 PRIs of a frame (either Acquisition Frames of Tracking/Doppler Processing Frames). The 10 PRIs are divided into two sets of 5 PRIs, the first group to allow Passive Noise Measurements at the first receiver bandwidth, the second group to allow Passive Noise Measurements at the second receiver bandwidth. A couple of Passive Noise Measurement spectra is then made available every frame.
The Passive Noise Measurements processing for each selected bandwidth shall be as follows: 128 I/Q samples are available after the I/Q Synthesis in each 91.4 ?s Rx gate. Process can include averaging over 5 spectra for each band or no averaging at all. In this case only one PRI is used to accomplish the measurement out of the 5 available in each of the two sets. The averaging option is controlled by a Parameters Table parameter which cannot exceed the value of 5.
Once a Passive Measurement is completed, the 128 samples shall be transferred into the instrument source packet layout. Two average spectra are then transferred as outcome of the processing every frame.

5.3.3.2 Active Ionospheric Sounding Mode

In this mode, MARSIS sweeps the range of frequencies from 0.1 MHz to 5.4 MHz in 160 frequency steps of Δt_0=91.43Us over a 7.38 seconds interval in order to generate ionospheric plasma frequency profiles. MARSIS can be in the Active Ionospheric Sounding Mode for certain data takes during each orbit when the altitude is less than 1200 km. Transmit pulses and echoes are received over the dipole channels, spectral analysis made and transferred to the science source packet data.

5.3.3.3 Calibration Mode

MARSIS will be in the Calibration Mode periodically on portions of selected orbits during the mission. The instrument is able to enter to this mode in every orbit and will execute the instructions contained in the Operations Sequence Table.
The purpose of this mode is to acquire a limited amount of data in an unprocessed format. This data can be acquired separately in the calibration mode or include even more limited quantities of data along with the processed data set for transmission to the ground.
This operation is basically an adaptive matched filter computation which will then be used by the processor to compress the dispersed echo from the surface and subsurface.
The calibration will be done after ground processing of the raw data collected during the calibration mode and the computed matched filter parameters uploaded to MARSIS.

5.3.3.4 Receive Only Mode

DES commands the instrument into this mode following the instructions contained in the OST.
Mode transition is reported by an Event TM packet.
MARSIS, in this mode, performs the following tasks:
- Collection of environmental noise.
- Science Data Generation

The purpose of this mode is to acquire a limited amount of “noise” data in an unprocessed format to characterize the noise level of the system and to “listen” the interference from the S/C subsystems and from the other payloads.

5.4. Instrument Flyby Timeline

In this section are shown two typical Timelines for the Operative Part of the orbit (flyby).
In the time between two different flybies the instrument will remain in **NON-OPERATIVE Mode**.

During the Cruise and before Antenna deployment the the instrument will remain in **CRUISE Mode**, with the exception of the Instrument Check-out phases.

Two different Instrument FlybyTimelines are foreseen for MARSIS:
In figures 5.4-1 and 5.4-2 the IT#1 and IT#2 are pictorially described.

Instrument Flyby Timeline#1 (IT#1): Operation Modes start below 800 km (Baseline).
Instrument Flyby Timeline#2 (IT#2): Operation Modes start below 1200 km

Both Timelines are presented in this section and it is worth considering that the only differences are in Operation Modes duration and in the Sequence of operations.
The time from switch-on (SISD_PWR_ON) is based on the actual knowledge of G3U Orbit.

In figures 5.4-1 and 5.4-2 the IT#1 and IT#2 are pictorially described.
In table 5.4-1 and 5.4-2 the two timeline are explained in detail.

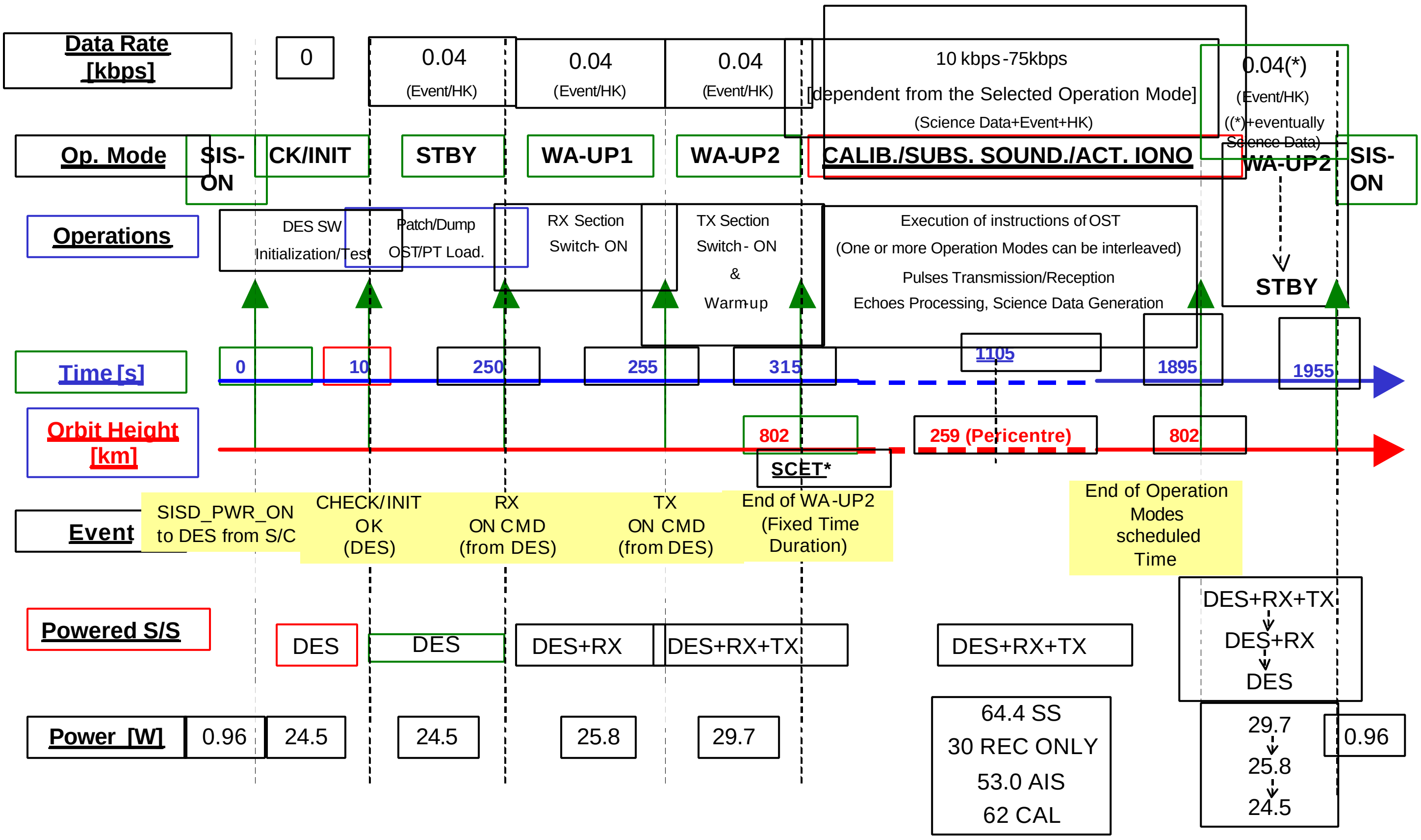


Figure 5.4-1 IT#1

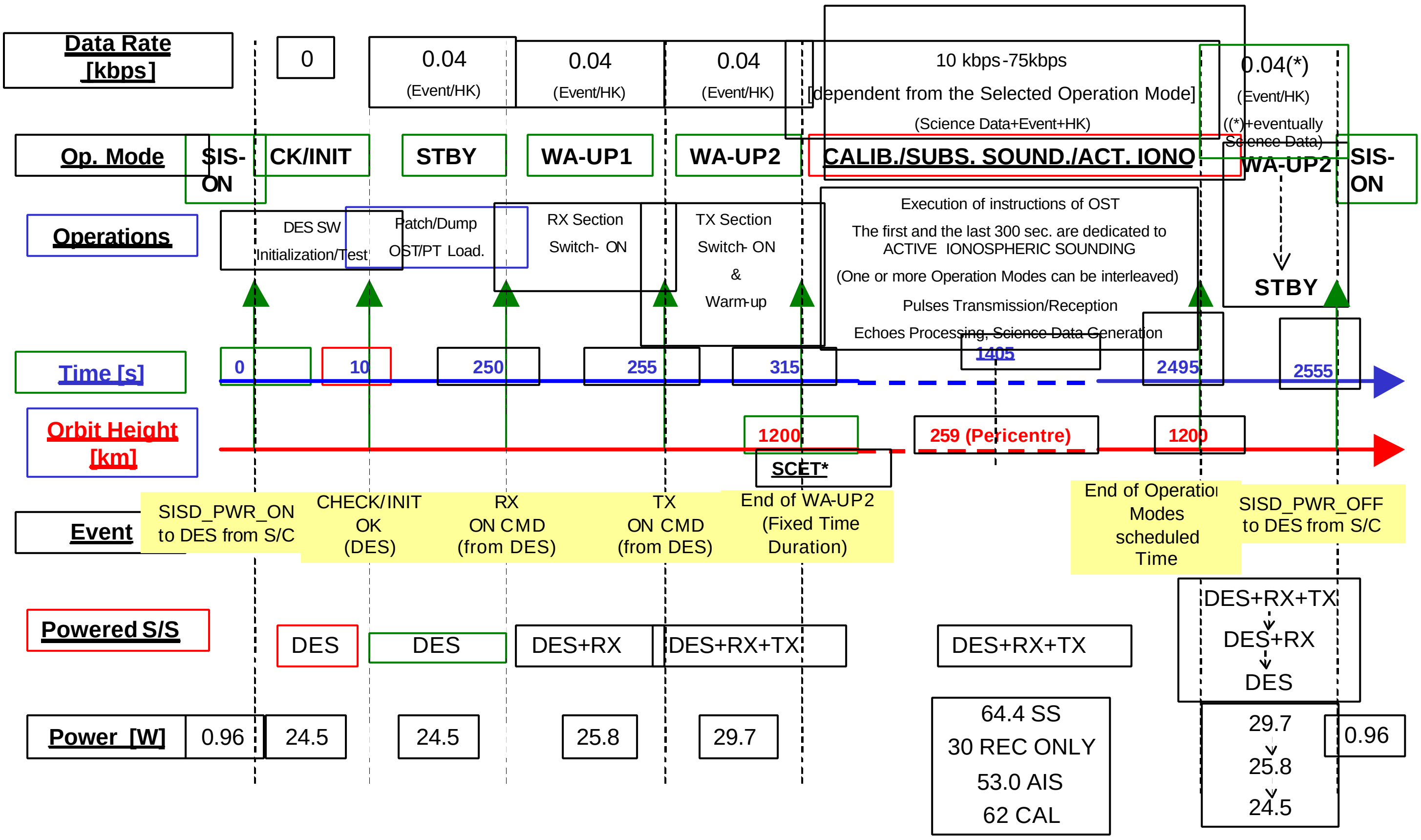


Figure 5.4-2 IT#2

INSTRUMENT FLYBY TIMELINE #1 (Baseline)	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
	Initlal Conditions	Instrument is **SIS-ON MODE** MARSIS LCL (Nom or Red) is ON. MARSIS SIS Relat (Nom or Red) is ON MARSIS SIS_HEATER Relay is ON or OFF depending from thermal control.
From 0s to 10s	**SISD_PWR_ON**	**CHECK/INIT MODE** MARSIS enter in this mode after an HPC ON CMD (Nominal or Redundant) from S/C to DES Power Supply (SISD_PWR_ON). DES is ON, RFS is OFF DES performs its own initialization and internal tests. In case of failure DES provide the S/C an event TM and goes in STANDBY before to go in IDLE MODE.

INSTRUMENT FLYBY TIMELINE #1 (Baseline)	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
From 10s to 250s	**Successful Conclusion of CHECK/INIT MODE** SIS_TIME_UP (On Nominal or Redundant Branch): Mandatory SIS_HK_EN (On Nominal or Redundant Branch): Optional SIS_HK_DIS (On Nominal or Redundant Branch): Optional SIS_OST_TC (On Nominal or Redundant Branch): Mandatory SIS_PT_TC (On Nominal or Redundant Branch): Mandatory SIS_PATCH_TC (On Nominal or Redundant Branch): Optional SIS_DUMP_TC (On Nominal or Redundant Branch): Optional SIS_PT_TC (Enable-Code-2): Mandatory	**STANDBY MODE** DES commands MARSIS into this mode (if the previous mode is completed correctly) 10 seconds after the HPC ON Command. Mode transition is reported by an Event TM packet. DES is ON, RFS is OFF S/C loads the Operation Sequence Table and Parameter Table into DES. Software patch and memory dump operation are permitted in this mode. HK TM are generated in this mode A pratical time duration value for the permanence in STANDBY Mode is to 240seconds. The final SIS_PT_TC is used to activate the automatic process wich brings to the execution of the OST.
From 250s to 255s	**ON CMD from DES to RX Power supply**	**WARM-UP1 MODE** DES commands the instrument into this mode. Mode transition is reported by an Event TM packet. DES is ON, RX Section of RFS is ON. HK TM are generated in this mode. WARM-UP1 Mode time duration is fixed to 5 seconds.

INSTRUMENT FLYBY TIMELINE #1 (Baseline)	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
From 255s to 315s	**ON CMD from SISD (DES) to TX Power supply**	**WARM-UP2 MODE** DES commands the instrument into this mode. Mode transition is reported by an Event TM packet. DES is ON, RFS is ON (both TX and RX). In WARM-UP2 the Stable Oscillator and RFS Stabilisation is completed. HK TM are generated in this mode. WARM-UP2 Mode minimum time duration is fixed to 15 seconds. After 15 seconds the instrument remains in Warm Up 2 until the OST start time tag expires.

INSTRUMENT FLYBY TIMELINE #1 (Baseline)	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
From 315s to 1895s	**END of WARM-UP2 (SCET = SCET*)**	**OPERATION MODES (CALIBRATION, SUBSURFACE and ACTIVE IONOSPHERIC SOUNDING)** DES commands the instrument into these modes. Mode transition is reported by an Event TM packet. All the OPERATION MODES can be executed in an interleaved way following the instruction listed in the OST. The sequence of Operation Modes and so the data collection strategy depends from several considerations: -dayside or nightside operation, -backscattering condition -first data evaluation MARSIS, in this phase, performs the following tasks: Pulses transmission and reception Processing of received echoes Science Data Generation. HK and Event packets (including Mode Transitions report) are generated during Operation Modes.

INSTRUMENT FLYBY TIMELINE #1 (Baseline)	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
From 1895s to 1897s	**END of OPERATION MODES**	**<u>WARM-UP2 MODE</u>** Mode transition is reported by an Event TM packet. WARM-UP2 Mode time duration (during power down phase) is fixed to 2 seconds.
From 1897s to 1900s	**OFF CMD from SISD (DES) to TX Power supply**	**<u>WARM-UP1 MODE</u>** Mode transition is reported by an Event TM packet. WARM-UP1 Mode time duration (during power down phase) is fixed to 3 seconds
From 1900s to 1955s	**OFF CMD from DES to RX Power supply**	**<u>STANDBY MODE</u>** Mode transition is reported by an Event TM packet. STANDBY Mode time duration (during power down phase) depends on the amount of TM Packets to be flushed (if any) in the SSMM.
1955s to 1960s	**SISD_PWR_OFF**	**<u>SIS-ON MODE</u>** MARSIS enter in this mode after an HPC OFF CMD (Nominal or Redundant) from S/C to DES Power Supply (SISD_PWR_OFF). DES is OFF, RFS is OFF (only the SISD and SIST Power interface circuits are powered).

INSTRUMENT FLYBY TIMELINE #1 (Baseline)	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
From 1960s to next Flyby	**SIS_HEATER_ON**	**<u>NON-OPERATIVE MODE</u>** HPC ON CMD (Nominal or Redundant) from S/C to MARSIS SIS_HEATER relay (about 5 seconds after the end of the flyby operations). The Antenna PCB's Heaters will be turned ON to maintain the Antenna Thermal enviroment whitin required limits.

Table 5.4-1

INSTRUMENT FLYBY TIMELINE #2	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
	Initial Conditions	Instrument is **<u>SIS-ON MODE</u>** MARSIS LCL (Nom or Red) is ON. MARSIS SIS Relat (Nom or Red) is ON MARSIS SIS_HEATER Relay is ON or OFF depending from thermal control.
From 0s to 10s	**SISD_PWR_ON**	**<u>CHECK/INIT MODE</u>** MARSIS enter in this mode after an HPC ON CMD (Nominal or Redundant) from S/C to DES Power Supply (SISD_PWR_ON). DES is ON, RFS is OFF DES performs its own initialization and internal tests. In case of failure DES provide the S/C an event TM and goes in STANDBY before to go in IDLE MODE.

INSTRUMENT FLYBY TIMELINE #2	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
From 10s to 250s	**Successful Conclusion of CHECK/INIT MODE** SIS_TIME_UP (On Nominal or Redundant Branch): Mandatory SIS_HK_EN (On Nominal or Redundant Branch): Optional SIS_HK_DIS (On Nominal or Redundant Branch): Optional SIS_OST_TC (On Nominal or Redundant Branch): Mandatory SIS_PT_TC (On Nominal or Redundant Branch): Mandatory SIS_PATCH (On Nominal or Redundant Branch): Optional SIS_DUMP_TC (On Nominal or Redundant Branch): Optional SIS_PT_TC (Enable-Code-2): Mandatory	**STANDBY MODE** DES commands MARSIS into this mode (if the previous mode is completed correctly) 3.5 seconds after the HPC ON Command. Mode transition is reported by an Event TM packet. DES is ON, RFS is OFF S/C loads the Operation Sequence Table and Parameter Table into DES. Software patch and memory dump operation are permitted in this mode. HK TM are generated in this mode A pratical time duration value for the permanence in STANDBY Mode is to 240seconds. The final SIS_PT_TC is used to activate the automatic process wich brings to the execution of the OST.
From 250s to 255s	**ON CMD from DES to RX Power supply**	**WARM-UP1 MODE** DES commands the instrument into this mode. Mode transition is reported by an Event TM packet. DES is ON, RX Section of RFS is ON. HK TM are generated in this mode. WARM-UP1 Mode time duration is fixed to 5 seconds.

INSTRUMENT FLYBY TIMELINE #2	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
From 255s to 315s	**ON CMD from SISD (DES) to TX Power supply**	**WARM-UP2 MODE** DES commands the instrument into this mode. Mode transition is reported by an Event TM packet. DES is ON, RFS is ON (both TX and RX). In WARM-UP2 the Stable Oscillator and RFS Stabilisation is completed. HK TM are generated in this mode. WARM-UP2 Mode minimum time duration is fixed to 15 seconds. After 15 seconds the instrument remains in Warm Up 2 until the OST start time tag expires.
From 315s to 615s	**END of WARM-UP2 (SCET = SCET*)**	**ACTIVE IONOSPHERIC SOUNDING MODE** DES commands the instrument into these modes. Only Active Ionospheric Sounding Mode is performed in this time frame Hk and Event packets (including Mode Transitions report) are generated during Operation Modes.

INSTRUMENT FLYBY TIMELINE #2	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
From 615s to 2195s	**END of ACTIVE IONOSOHERIC SOUNDING MODE**	**<u>OPERATION MODES (CALIBRATION, SUBSURFACE and ACTIVE IONOSPHERIC SOUNDING)</u>** DES commands the instrument into these modes. Mode transition is reported by an Event TM packet. All the OPERATION MODES can be executed in an interleaved way following the instruction listed in the OST. The sequence of Operation Modes and so the data collection strategy depends from several considerations: -dayside or nightside operation, -backscattering condition -first data evaluation MARSIS, in this phase, performs the following tasks: Pulses transmission and reception Processing of received echoes Science Data Generation. HK and Event packets (including Mode Transitions report) are generated during Operation Modes.

INSTRUMENT FLYBY TIMELINE #2	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
From 2195s to 2495s	**END of OPERATION MODES** **[between –T (800km) and +T(800km)]**	**ACTIVE IONOSPHERIC SOUNDING MODE** DES commands the instrument into these modes. Only Active Ionospheric Sounding Mode is performed in this time frame Hk and Event packets (including Mode Transitions report) are generated during Operation Modes.
From 2495s to 2497s	**END of OPERATION MODES**	**WARM-UP2 MODE** Mode transition is reported by an Event TM packet. WARM-UP2 Mode time duration (during power down phase) is fixed to 2 seconds.
From 2497s to 2500s	**OFF CMD from SISD (DES) to TX Power supply**	**WARM-UP1 MODE** Mode transition is reported by an Event TM packet. WARM-UP1 Mode time duration (during power down phase) is fixed to 3 seconds

INSTRUMENT FLYBY TIMELINE #2	**INSTRUMENT:SIS**	**MODEL: FM**
TIME	**EVENTS**	**REMARKS**
From 2500s to 2555s	**OFF CMD from DES to RX Power supply**	**<u>STANDBY MODE</u>** Mode transition is reported by an Event TM packet. STANDBY Mode time duration (during power down phase) depends on the amount of TM Packets to be flushed (if any) in the SSMM.
2555s to 2560s	**SISD_PWR_OFF**	**<u>SIS-ON MODE</u>** MARSIS enter in this mode after an HPC OFF CMD (Nominal or Redundant) from S/C to DES Power Supply (SISD_PWR_OFF). DES is OFF, RFS is OFF (only the SISD and SIST Power interface circuits are powered).
From 2560s to next Flyby	**SIS_HEATER_ON**	**<u>NON-OPERATIVE MODE</u>** HPC ON CMD (Nominal or Redundant) from S/C to MARSIS SIS_HEATER relay (about 5 seconds after the end of the flyby operations). The Antenna PCB's Heaters will be turned ON to maintain the Antenna Thermal enviroment whitin required limits.

Table 5.4-2

5.5. Flyby Power Profile

As detailed in §5.4 two different Instrument Timelines are foreseen for MARSIS:

Instrument Timeline#1 (IT#1): Operation Modes start below 800 km (Baseline).
Instrument Timeline#2 (IT#2): Operation Modes start below 1200 km

In this section is shown (figure 5.5-1) a typical Power profile for the Operative Part of the orbit (flyby) considering both IT1 and IT#2.

In the time between two different flybies the Power demand will be constant and equal to 11.67 W **(NON-OPERATIVE Mode**).

During the Cruise and before Antenna deployment the Power demand will be constant and equal to 13.21 W (**CRUISE Mode**).

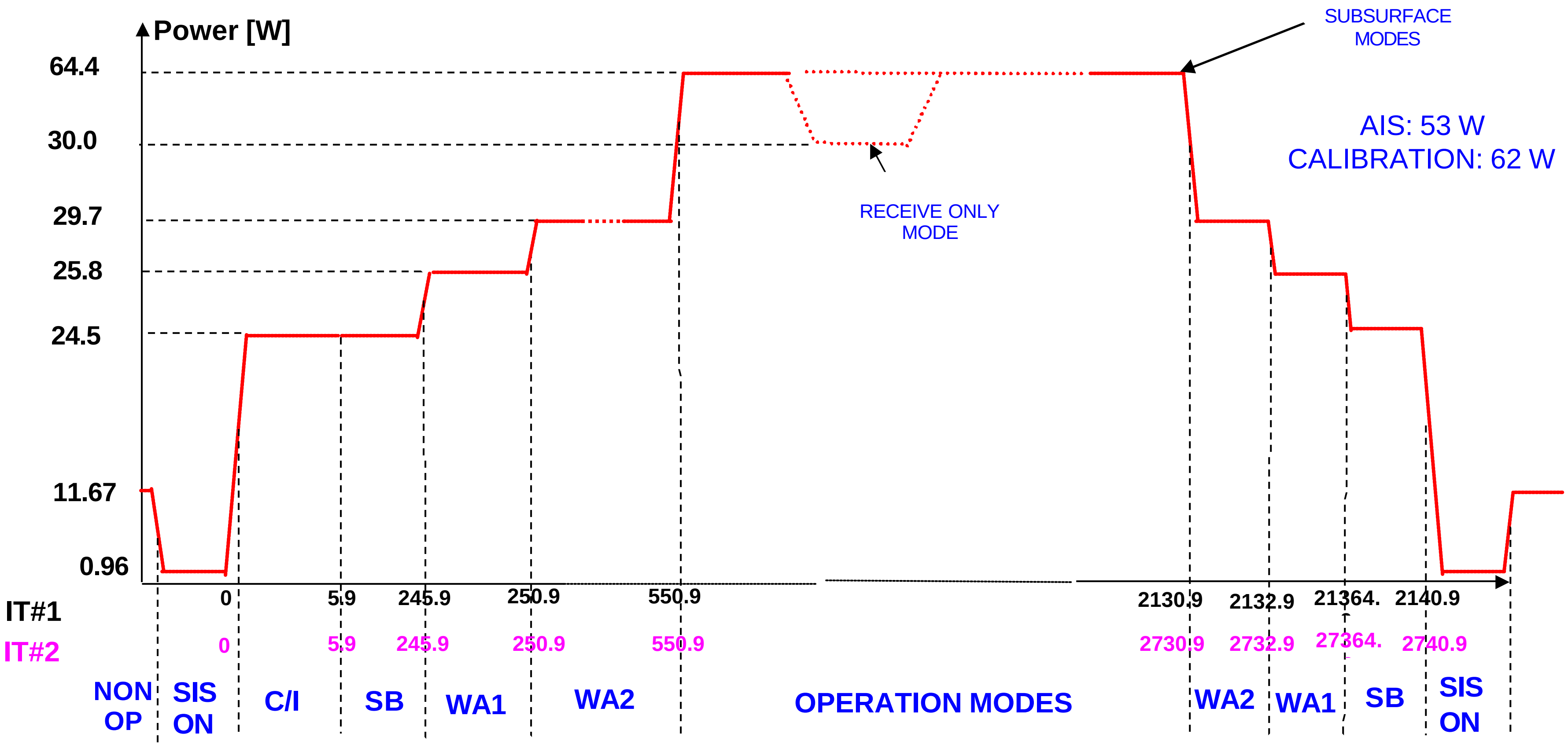


Figure 5.5-1 Power Profile

5.6. Flyby Data Rate Profile

As already stated in §2.5.5 MARSIS is a multimode flexible instrument and the produced data rate can vary between 10 kbps and 80kbps depending from the used Operation Mode, the Transmitted frequency and the S/C position during the Orbit.
In addition the modes: CALIBRATION, ACTIVE IONOSPHERE SOUNDING and RECEIVE ONLY has a fixed data rate, while all the SUBSURFACE SOUNDING Submodes produce a data rate variable(see table 2.5.5-1).

During the all SUBSURFACE SOUNDING Submodes the Data rate will vary depending from:

- Orbit Height
- S/C tangential Velocity
- Transmitted frequency

In Figure 5.6-1 is reported the data rate versus the time from pericenter passage considering all possible configurations of submodes and transmitted frequency.

It is worth to notice that only the amount of Subsurface Scientific data is considered in this figure (no passive Ionosphere Sounding, no header and auxiliary data).

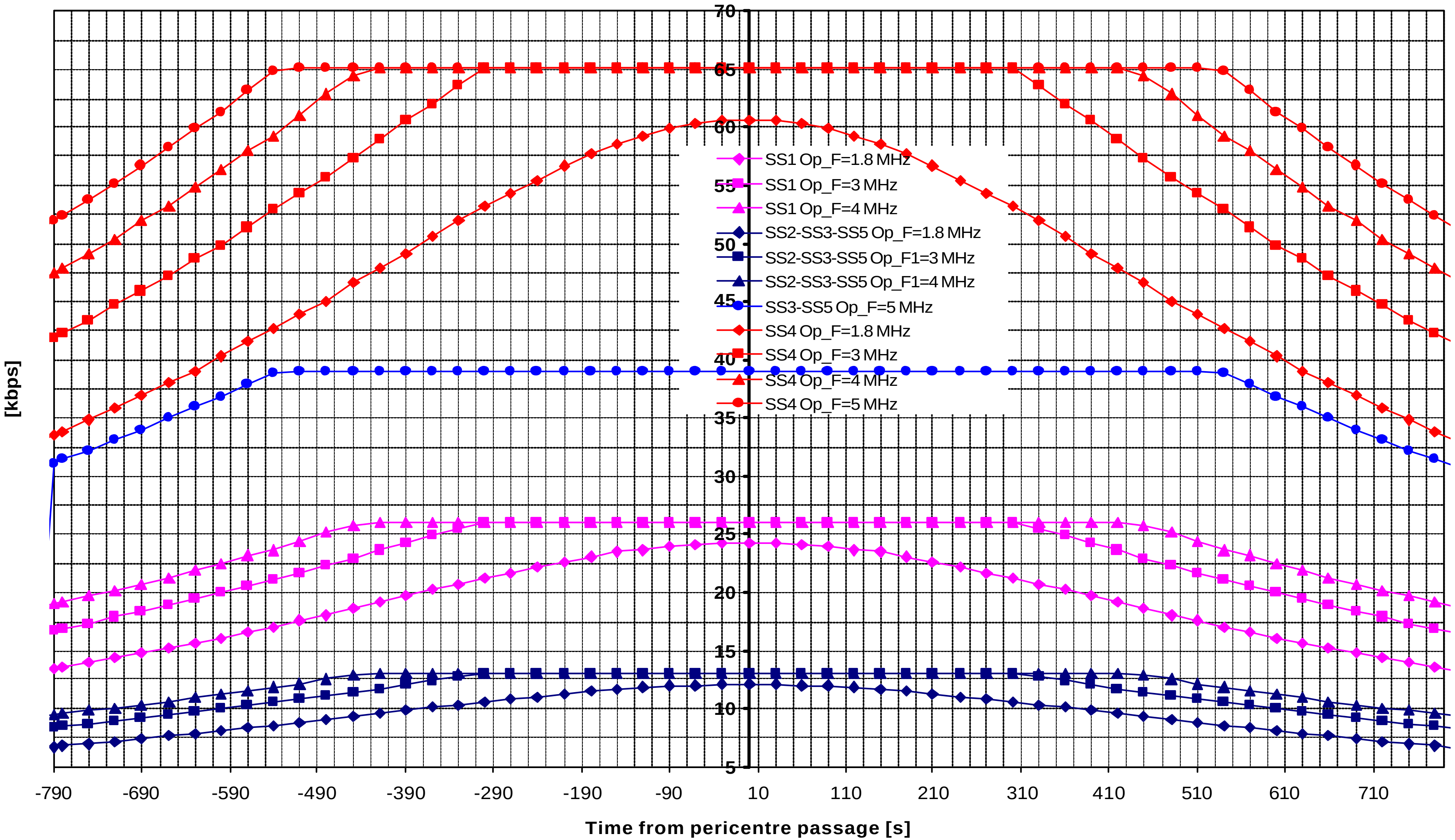


Figure 5.6-1 SUBSURFACE SOUNDING Data Rate

Due to the variability of the data rate in subsurface it is difficult to find out a typical Data Rate Profile.

In table 5.6-1 is reported a very generic mode Sequence (part of OST) that can be used only as reference (a sequence will not be never used) to show a Data rate Profile.

The relative Data Rate Profile is shown in figure 5-6-2.

MODE	BAND	DURATION [PRI]	Duration in time [sec]	Time from pericenter passage at beginning of mode	Time from pericenter passage at the end of mode
CAL	-	12960	99.846	-790.00000	-690.15408
REC	-	12960	99.846	-690.15408	-590.30817
AIS	-	3840	29.584	-590.30817	-560.72419
SS1	1	3751	28.898	-560.72419	-531.82589
SS1	2	3731	28.744	-531.82589	-503.08166
SS1	3	3746	28.860	-503.08166	-474.22188
SS2	1	3683	28.374	-474.22188	-445.84746
SS2	2	3811	29.361	-445.84746	-416.48690
SS2	3	3840	29.584	-416.48690	-386.90293
SS3	1	3822	29.445	-386.90293	-357.45763
SS3	2	3869	29.807	-357.45763	-327.65023
SS3	3	3840	29.584	-327.65023	-298.06626
SS3	4	3840	29.584	-298.06626	-268.48228
SS4	1	3856	29.707	-268.48228	-238.77504
SS4	2	3840	29.584	-238.77504	-209.19106
SS4	3	3840	29.584	-209.19106	-179.60709
SS4	4	3840	29.584	-179.60709	-150.02311
SS5	1	3778	29.106	-150.02311	-120.91680
SS5	2	3840	29.584	-120.91680	-91.33282
SS5	3	3840	29.584	-91.33282	-61.74884
SS5	4	3840	29.584	-61.74884	-32.16487
SS1	1	3838	29.569	-32.16487	-2.59630
SS1	2	3840	29.584	-2.59630	26.98767
SS1	3	3840	29.584	26.98767	56.57165
SS2	1	3869	29.807	56.57165	86.37904
SS2	2	3840	29.584	86.37904	115.96302
SS2	3	3840	29.584	115.96302	145.54700
SS3	1	3819	29.422	145.54700	174.96918
SS3	2	3840	29.584	174.96918	204.55316
SS3	3	3840	29.584	204.55316	234.13713
SS3	4	3840	29.584	234.13713	263.72111
SS4	1	3726	28.706	263.72111	292.42681
SS4	2	3759	28.960	292.42681	321.38675
SS4	3	3840	29.584	321.38675	350.97072
SS4	4	3840	29.584	350.97072	380.55470
SS5	1	3678	28.336	380.55470	408.89060
SS5	2	3780	29.122	408.89060	438.01233
SS5	3	3791	29.206	438.01233	467.21880
SS5	4	3840	29.584	467.21880	496.80277
SS4	4	38022	292.928	496.80277	789.73035
WAUP2	-	-	-	789.73035	-

Table 5.6-1

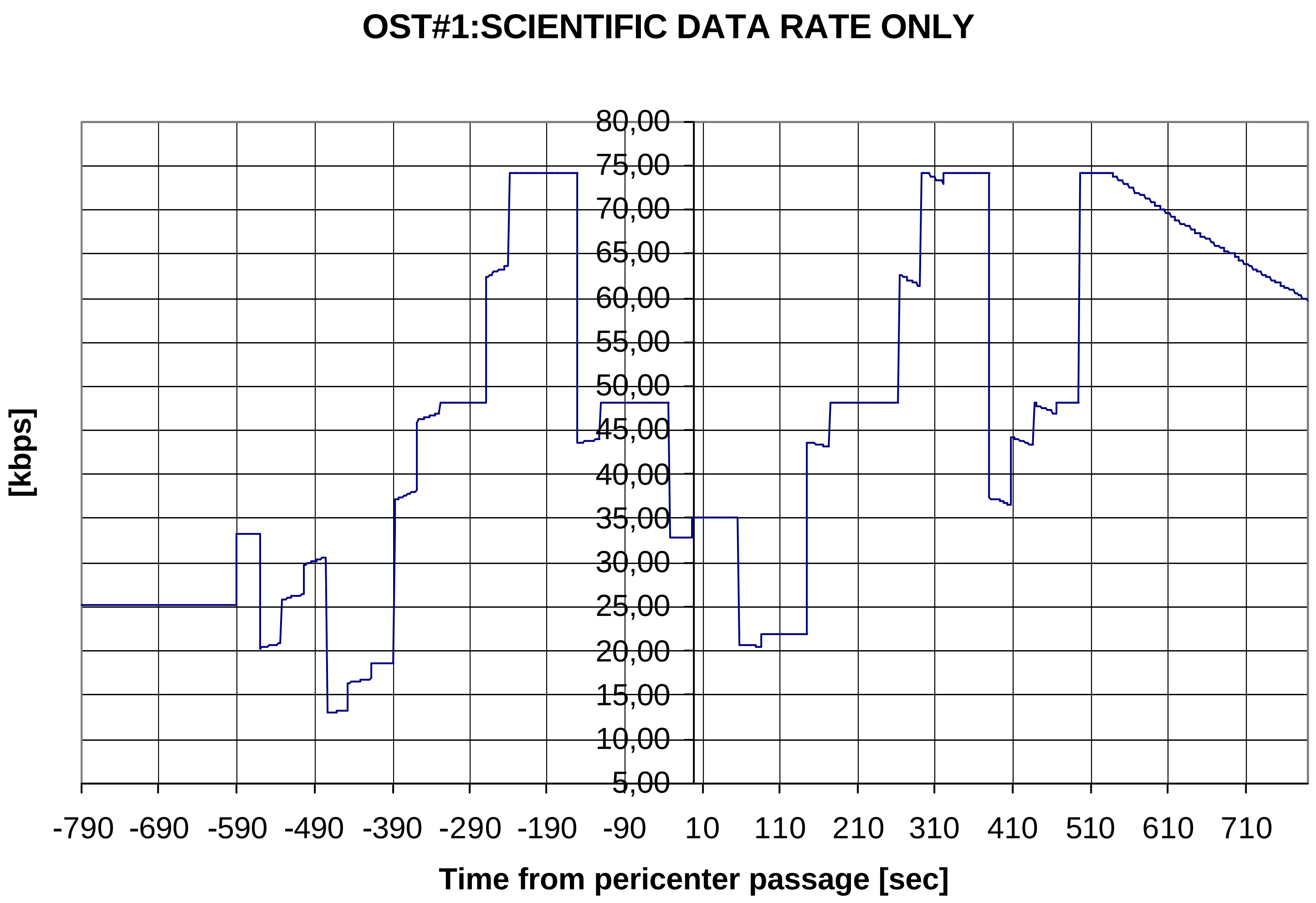


Figure 5-6-2 Data Rate Profile

5.7. Data Volume

During the course of an instrument switch on / switch off cycle the amount of telemetry data produced by the instrument can be estimated referring exclusively to the amount of Science Data TM packets generated by the different Operational Modes programmed in the OST. This because the amount of HK TM Packets is comparatively negligible.

In case of Memory Dump operations the amount of Dump TM Packets depends from the size of the dumped memory and is directly related to it (CCSDS packet overhead might be included for more accuracy).
During the execution of a Memory Dump request the instrument will maximize the size of each packet but the last in the dump sequence.
Note that the number of bytes corresponding to each dumped memory location depends from the target memory (4 or 6 bytes).

Science Data packets size and rate are described in RD-10.

6. Interfaces

This section has been incorporated and expanded in Section 3.

7. Nominal and contingency Operations procedures

7.1. Ground Test Sequences

MARSIS EGSE has the capability to run Test Sequences (both at instrument and at System level) that simulate the entire Flyby Timeline both in terms of TM and TC exchange and in terms of the RF stimuli simulating the Mars environment.
This means that MARSIS can be tested while transmitting RF signals and, at the same time, receiving in real time simulated Echoes from Mars Surface and Subsurface models.

In particular the following test have been defined:

FPT: Full Performance Test, in which the complete system is verified both in terms of scientific performance and in terms of operability/observability;

LPT: Limited Performance Test, in which the instrument is verified, without external stimuli. It is a sub-set of the FPT;

GNT: GoNogo Test, in which a short check of the instrument health is performed. Actually it is equivalent to LPT but with limited duration.

Other specific tests related to specific features are managed by specific test sequences (in particular the Antenna Continuity Tests, the Receive Only Test, the Patch/Dump Test and the Pyro Test)

Full Performance Test (FTP) are composed by the following test sequences:

I. ST01/1: Nominal OST #1
II. ST01/2: Nominal OST #2
III. ST02/1: Receive only (long), i.e. LPT
IV. ST03/1: Receive only (short), i.e Go/Nogo

During the Full Performance Test MARSIS will transmit RF Signals and so the RF-FEE must be connected to the SIST Unit.

The Limited Performance Test (LPT) is a subset of the Full Performance Test (FPT) selected such that it will allow verifying the main functions of the instrument and the function of its nominal or redundant interfaces to the spacecraft.
The selected test sequence is:

ST02/1: Receive only (long).

The LPT Test will not require stimuli for the instrument and so no RF signals will be transmitted during this Test.
This means that this kind of test can be performed either using the Antenna RF-FEE or the real Antennas connected to the SIST unit (Launch Configuration).

The GO-NOGO Test is a very short test aimed to check that the instrument in its default configuration operates correctly. Its major topic is to verify the electrical integrity after transportation.
The selected test sequence is:

ST03/1: Receive only (short).

The GO-NO GO Test will not require stimuli for the instrument and so no RF signals will be transmitted during this Test.
This means that this kind of test can be performed either using the Antenna RF-FEE or the real Antennas connected to the SIST unit (Launch Configuration).

7.2. On-Board Control Procedures

The following On-Board Control Procedures have been defined so far:

- MARSIS Basic Power On – Nominal
- MARSIS Basic Power On – Redundant
- MARSIS Basic Power Off – Nominal
- MARSIS Basic Power Off - Redundant
- MARSIS Nominal Operations
- MARSIS Nominal Operations with Initial FM Dump
- MARSIS Flash Memories Dump
- MARSIS Checkout
- MARSIS Patch/Dump Operations
- MARSIS Antenna Deployment
- MARSIS Antenna Thermal Control

7.2.1. MARSIS Basic Power On – Nominal

This procedure configure MARSIS nominal primary power supply for subsequent operations and also provide power to the SIS_Heater relay for antenna thermal control.

Assumptions	
1	All SIS Relays are OPEN (Off). All S/C MARSIS LCL Switches are OPEN (Off).

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
1		Switch On LCL 16 A	
2		Switch On SIS_Power_Nominal Relay	

7.2.2. MARSIS Basic Power On – Redundant

This procedure configure MARSIS redundant primary power supply for subsequent operations and also provide power to the SIS_Heater relay for antenna thermal control.

Assumptions	
1	All SIS Relays are OPEN (Off). All S/C MARSIS LCL Switches are OPEN (Off).

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
1		Switch On LCL 31 A	
2		Switch On SIS_Power_Redundant Relay	

7.2.3. MARSIS Basic Power Off – Nominal

This procedure restore MARSIS nominal primary power supply to the off state.

Assumptions	
1	SIS_Power_Nominal CLOSED (On). LCL 16A CLOSED (On).

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
1		Switch Off SIS_Power_Nominal Relay	
2		Switch Off LCL 16 A	

This procedure can also be used to quickly safe the instrument regardless of the status of other instrument's relays.

Warning: Thermal Control will result disabled

7.2.4. MARSIS Basic Power Off – Redundant

This procedure restore MARSIS redundant primary power supply to the off state.

Assumptions	
1	SIS_Power_Redundant CLOSED (On). LCL 31A CLOSED (On).

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
1		Switch Off SIS_Power_Redundant Relay	
2		Switch Off LCL 31 A	

This procedure can also be used to quickly safe the instrument regardless of the status of other instrument's relays.

Warning: Thermal Control will result disabled

7.2.5. MARSIS Nominal Operations

This procedure exemplify the typical timeline executed every time that MARSIS is activated in order to perform observations. The only dynamic portions are the loading operations (which depends on the peculiar programming for a given orbit) and the duration of the observations.

Assumptions	
1	Instrument already powered on (nominal or redundant source) via LCL and SIS_Power relay.

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
00:00		Switch On SISD_Power Relay (using Nominal or Redundant HPC).	
00:10		Enable TC/TM link and Send Time Update	
01:00		Load operational modes programming	
	A	Load OST by means of one or multiple OST_LOAD_TC	
	B	Load PT by means of one or multiple PT_LOAD_TC	
	C	Load SCET Pc and SCET * values	
04:00		Send Restart_with_Code_2 Special TC	
05:05		Begin observations	Real observations starts at SCET * time value
…			
XX:YY		End of observations	
XX+1:YY		Switch Off SISD_Power Relay (using Nominal or Redundant HPC)	

7.2.6. MARSIS Nominal Operations with Initial FM Dump

This procedure exemplify the typical timeline executed every time that MARSIS as in the previous paragraphs taking advantage of the possibility to perform Flash Memory Dump operations before executing an observation. This may be required to dump data obtained in a previous pass.

Assumptions	
1	Instrument already powered on (nominal or redundant source) via LCL and SIS_Power relay.
2	Flash Memories contain data froma previous observation.

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
00:00		Switch On SISD_Power Relay (using Nominal or Redundant HPC).	
00:10		Enable TC/TM link and Send Time Update	
01:00		Send Restart_with_Code_2 Special TC	The actual time can be delayed to take into account the duration of the FM Dump.
01:20		Update Automatic transition delay	Set to N minutes over the 60 sec default to take into account the duration of the FM dump.
01:25		Program FM Dump activity	
01:30		Load operational modes programming	
	B	Load OST by means of one or multiple OST_LOAD_TC	
	C	Load PT by means of one or multiple PT_LOAD_TC	
	C	Load SCET Pc and SCET * values	
01+N:05		Begin observations	Real observations starts at SCET * time value
…			
XX:YY		End of observations	
XX+1:YY		Switch Off SISD_Power Relay (using Nominal or Redundant HPC)	

7.2.7. MARSIS Flash Memories Dump

This procedure is to perform a Flash Memory Dump.

Assumptions	
1	Instrument already powered on (nominal or redundant source) via LCL and SIS_Power relay.
2	Flash Memories contain data froma previous observation.

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
00:00		Switch On SISD_Power Relay (using Nominal or Redundant HPC).	
00:10		Enable TC/TM link and Send Time Update	
01:00		Send Restart_with_Code_2 Special TC	The actual time can be delayed to take into account the duration of the FM Dump.
01:20		Update Automatic transition delay	Set to N minutes over the 60 sec default to take into account the duration of the FM dump.
01:25		Program FM Dump activity	
XX:YY		End of dump data collection	
XX+1:YY		Switch Off SISD_Power Relay (using Nominal or Redundant HPC)	

7.2.8. MARSIS Checkout

This procedure apply the MARSIS Nominal Operations procedure with a peculiar programming based on the sequence:

- Receive Only
- AIS
- SS3
- Receive Only

7.2.9. MARSIS Patch/Dump Operations

Three different patch/dump operations scenarios have been identified.

Assumptions	
1	Instrument already powered on (nominal or redundant source) via LCL and SIS_Power relay.

7.2.9.1 Dump only Operations

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
00:00		Switch On SISD_Power Relay (using Nominal or Redundant HPC).	
00:10		Enable TC/TM link and Send Time Update	
01:00		Send Dump TC(s)	

XX:YY		End of dump data collection	
XX+1:YY		Switch Off SISD_Power Relay (using Nominal or Redundant HPC)	

7.2.9.2 Patch and Dump Operations

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
00:00		Switch On SISD_Power Relay (using Nominal or Redundant HPC).	
00:10		Enable TC/TM link and Send Time Update	
01:00		Send Patch TC(s)	
02:00		Send Dump TC(s)	
XX:YY		End of dump data collection	
XX+1:YY		Switch Off SISD_Power Relay (using Nominal or Redundant HPC)	

Warning: Dump data shall be verified against the Patch request to ensure a successful achievement of the Patch operations

7.2.9.3 RAM Patch Operations

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
00:00		Switch On SISD_Power Relay (using Nominal or Redundant HPC).	
00:10		Enable TC/TM link and Send Time Update	
01:00		Send Patch TC(s)	
02:00		Send Dump TC(s)	If applicable due to round trip delays
XX:YY		End of dump data collection	
XX:YY+5		Send Master_Boot special TC	To restart with new SW in RAM
		Additional operations	
WW:ZZ		Switch Off SISD_Power Relay (using Nominal or Redundant HPC)	

Warning: RAM Patches are complex operations that require careful planning.

7.2.10. MARSIS Antenna Deployment

Details of the MARSIS Antenna Deployment sequence are as follows:

Assumptions	
1	Based on results from thermal and materials analyses, TRW Astro states that a preferred thermal environment (by rotating the s/c to an optimal sun orientation, for example) does not need to be established prior to deployment.
2	The dynamical state of the s/c shall be the primary indicator for confirming proper deployment. It is assumed that such confirmation will be obtained for each element deployment, and that the s/c will be stabilized after each element deployment.

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
1		Begin Deployment Sequence	
2		Enable pyro firing circuit(s)	
3		Verify S/C dynamics (for baseline)	
4		Perform MARSIS Antenna Signature Operations	See Note 1
5		Deploy Dipole Element #1	
5	A	Fire Dipole #1 Primary Pyro	
5	B	Stabilize S/C	
5	C	Verify via S/C dynamics that Dipole #1 was deployed properly	
6		If deployment of Dipole #1 affirmative, CONTINUE, ELSE repeat Step 5 with Redundant Pyro. If deployment still negative STOP SEQUENCE, ELSE CONTINUE	
7		Perform MARSIS Antenna Signature Operations	See Note 1
8		Deploy Dipole Element #2	
8	A	Fire Dipole #2 Primary Pyro	
8	B	Stabilize S/C	
8	C	Verify via S/C dynamics that Dipole #2 was deployed properly	
9		If deployment of Dipole #2 affirmative, CONTINUE, ELSE repeat Step 8 with Redundant Pyro. If deployment still negative STOP SEQUENCE, ELSE CONTINUE	
10		Perform MARSIS Antenna Signature Operations	See Note 1
11		Deploy Monopole Element	
11	A	Fire Monopole Primary Pyro	
11	B	Stabilize S/C	
11	C	Verify via S/C dynamics that Monopole was deployed properly	
12		If deployment of Monopole affirmative,	

		CONTINUE, ELSE repeat Step 11 with Redundant Pyro. If deployment still negative STOP SEQUENCE, ELSE CONTINUE	
13		Perform MARSIS Antenna Signature Operations	See Note 1
14		End of Deployment Sequence	

Note 1. MARSIS Antenna Signature Operations is a brief operational sequence performed with the instrument to acquire noise figure of the antenna and provide additional cues about the deployment.

7.2.11. MARSIS Antenna Thermal Control

Warning: Thermal Control shall be activated as soon as possible after launch.

Warning: Before using the instrument for any operation, the Improved Thermal Control (if implemented) shall be disabled and the thermal control shall revert to the Baseline one.

7.2.11.1 Baseline Thermal Control

Thermal Control of Antenna PCB is managed by using the S/C Monitoring Table which ensure that thermal limits are not exceeded. Heater control is performed via the SIS_Heater Relay internal to the instrument.

Assumptions	
1	Instrument already powered on (nominal or redundant source) via LCL and SIS_Power relay.

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
1		Switch On SIS_Heater Relay (using Nominal or Redundant HPC).	
2		If Antenna Temp > Upper Limit THEN Switch Off SIS_Heater Relay (using Nominal or Redundant HPC).	
3		If Antenna Temp < Lower Limit THEN Switch On SIS_Heater Relay (using Nominal or Redundant HPC). Goto Step 1	

7.2.11.2 Improved Thermal Control

Thermal Control of Antenna PCB is managed by using the S/C Thermal Control Table which ensure that thermal limits are kept within tighter limit and without generation of OOL alarms. Heater control is performed via the primary power S/C LCL while the SIS_Power and SIS_Heater Relays internal to the instrument are kept Closed (On).

Assumptions	
1	All SIS Relays are OPEN (Off). All S/C MARSIS LCL Switches are OPEN (Off).

Sequence			**Issue 1**
Step / Timing	***Sub-step***	***Operation***	***Notes***
1		Switch On SIS_Power_Nominal (or _Redundant) Relay	

2		Switch On SIS_Heater Relay (using Nominal or Redundant HPC).	
3		If Antenna Temp < Lower Limit THEN Switch On LCL_16 A (or LCL_31 A) Relay.	
2		If Antenna Temp > Upper Limit THEN Switch Off LCL_16 A (or LCL_31 A) Relay.	
1		Goto Step 3	

Assumptions	
1	Instrument completely powered on (nominal or redundant source) via LCL and SIS_Power relay.

7.2.12. Nominal IN-ORBIT Phase Control Procedure

To be provided in accordance with new orbit definition and other constraints.

7.3. Flight Control Procedures

Detailed Flight Control Pprocedures are defined in the FCP/CRP Annex to this document (see RD-16).

7.4. Operational Constraints

Generic definitions of operational constraints are provided throughout this document.

Additional constraints may be added here in view of the Commissioning and subsequent Science Operations.

7.5. Contingency Recovery Procedures

Generic discussion about Contigency/Recovery Procedures is provided in § 4.3.

Detailed Contingency/Recovery Procedures are defined in the FCP/CRP Annex to this document (see RD-16).

8. Summary of Telecommand and Telemetry Data

8.1. MEX Packet Category Definitions

The following Packet Categories are defined for Mars Express and are related to MARSIS TC/TM Service/Type definitions:

Pkt Cat	Category	MARSIS TC	MARSIS TM
0	Time		
1	Acknowledge		1
2	*Spare*		
3	Table		
4	HK		3
5	Functional Cyclic		
6	Functional Non Cyclic		
7	Event		5
8	*Spare*		
9	Dump		6
10	File Transfer		
11	Context		
12	Private (science)	3, 6, 9, 206, 207	20, 206
13	*Spare*		
14	*OCG/EGSE Reserved*		
15	Idle		

8.2. MARSIS APIDs Definitions

The following APIDs are defined for MARSIS.

APID	PID	PCAT	TC	TM	Source	Dest	Avlb Services/Types
1228	76	12	X			Master CPU	3, 6, 9, 206, 207
1244	77	12	X			DSP1 CPU	6
1260	78	12	X			DSP2 CPU	6
1276	79	12	X			Timing Board	6
1217	76	1		X	Master CPU		1
1220	76	4		X	Master CPU		3
1223	76	7		X	Master CPU		5
1225	76	9		X	Master CPU		6
1228	76	12		X	Master CPU		20, 206
1241	77	9		X	DSP1 CPU		6
1244	77	12		X	Science Data		20 (SSn), 206
1257	78	9		X	DSP2 CPU		6
1260	78	12		X	Science Data		20 (AIS), 206
1273	79	9		X	Timing Board		6
1276	79	12		X	Science Data		20 (CAL), 206
1292	80	12		X	Science Data		20 (RCV), 206

Note. Service 206 for TM is a Spare definition.

8.3. MARSIS TC Listing

MARSIS is controlled by means of the following Packet Telecommands:

Service (dec)	Telecommand Type/Subtype (dec)
3	(3,5): Enable Housekeeping Report (3,6): Disable Housekeeping Report
6	(6,2): Load Memory Using Absolute Addresses (6,5): Dump Memory Using Absolute Addresses
9	(9,1): Accept Time Update
206	(206,1): MARSIS Private Telecommand: OST Patch (206,2): MARSIS Private Telecommand: PT Patch
207	(207,1): MARSIS Automatic Mode Transition Disable

The acronyms associated to each Packet TC are listed in the following table:

Acronym	Description	Crit.
SIS_HK_EN	Enable Housekeeping Report Packet Generation - TC (3,5)	NO
SIS_HK_DIS	Disable Housekeeping Report Packet Generation - TC (3,6)	NO
SIS_PATCH_C (*)	Load C&C Memory using Absolute Addresses - TC (6,2)	YES
SIS_PATCH_1 (*)	Load DSP1 Memory using Absolute Addresses - TC (6,2)	YES
SIS_PATCH_2 (*)	Load DSP2 Memory using Absolute Addresses - TC (6,2)	YES
SIS_DUMP_TC_C (**)	Dump C&C Memory using Absolute Addresses - TC (6,5)	NO
SIS_DUMP_TC_1 (**)	Dump DSP1 Memory using Absolute Addresses - TC (6,5)	NO
SIS_DUMP_TC_2 (**)	Dump DSP2 Memory using Absolute Addresses - TC (6,5)	NO
SIS_TIME_UP	Accept Time Update - TC (9,1)	NO
SIS_OST_TC	Load Operation Sequence Table - TC (206,1)	NO
SIS_PT_TC	Load Parameter Table - TC (206,2)	NO
SIS_MOD_TR_DIS_TC	Automatic Mode Transition Disable - TC (207,1)	YES

(*) Instances of the same TC, SIS_PATCH
(**) Instances of the same TC, SIS_DUMP_TC

Note. All Packet TCs are not identified as "Nominal & Redundant" because only the physical lines (CLK+DATA+SAMPLE) are redounded; for MARSIS there is no way to distinguish between a TC received by the nominal lines and a TC received by the redundant lines.

Additional discrete telecommands are managed by S/C (see § 8.5).

8.4. MARSIS TM Listing

MARSIS provides the following Packet Telemetries:

Service (dec)	Telemetry Type/Subtype (dec)
1	(1,1): Acceptance Report - Success (1,2): Acceptance Report - Failure
3	(3,25): Housekeeping Report
5	(5,1): Event Reporting: Normal/Progress Report (5,2): Event Reporting: Error/Anomaly Report
6	(6,6): Memory Dump
20	(20,3): MARSIS Science Data Transfer
206	(206,3): MARSIS Private Services (spare)

The acronyms associated to each Packet TM are listed in the following table:

Acronym	Description
SIS_ACC_REP_S	Telecommand Acceptance Report: Success - TM(1,1)
SIS_ACC_REP_F	Telecommand Acceptance Report: Failure - TM(1,2)
SIS_HK_TM	Housekeeping Report Packet - TM(3,25)
SIS_PROG_REP	Event Reporting: Normal/Progress Report - TM(5,1)
SIS_ERR_REP	Event reporting: Error/Anomaly Report - TM(5,2)
SIS_DUMP_TM_C (*)	Dump Report from C&C memory - TM(6,6)
SIS_DUMP_TM_1 (*)	Dump Report from DSP1 memory - TM(6,6)
SIS_DUMP_TM_2 (*)	Dump Report from DSP2 memory - TM(6,6)
SIS_SCIENCE_SS (**)	Science Data in Sub-Surface Sounding mode - TM(20,3)
SIS_SCIENCE_AIS (**)	Science Data in Active Ionosphere Sounding mode - TM(20,3)
SIS_SCIENCE_CAL (**)	Science Data in Calibration mode - TM(20,3)
SIS_SCIENCE_REC (**)	Science Data in Receive Only mode - TM(20,3)
SIS_PRIVATE_TM	Spare - TM(206,3)

(*) Instances of the same TM, SIS_DUMP_TM
(**) Instances of the same TM, SIS_SCIENCE_TM

Note. All Packet TMs are not identified as "Nominal" & "Redundant" because only the physical lines (CLK+DATA+SAMPLE) are redounded; MARSIS sends the same data on both lines at the same time (hot redundancy).

Additional housekeeping/status telemetries are available through the S/C HK Report (see § 8.5).

8.5. MARSIS-related S/C Commands and Telemetries

8.5.1. MARSIS CMDs

The following table lists the discrete telecommands, and the related acronym, accepted by MARSIS and driven by the S/C.

Acronym	Description	Crit.
SIS_PWR_ON_N	Nominal MARSIS HPC ON CMD	NO
SIS_PWR_ON_R	Redundant MARSIS HPC ON CMD	NO
SIS_PWR_OFF_N	Nominal MARSIS HPC OFF CMD	NO
SIS_PWR_OFF_R	Redundant MARSIS HPC OFF CMD	NO
SISD_PWR_ON_N	Nominal HPC ON CMD to DES PWR Supply	NO
SISD_PWR_ON_R	Redundant HPC ON CMD to DES PWR Supply	NO
SISD_PWR_OFF_N	Nominal HPC OFF CMD to DES PWR Supply	NO
SISD_PWR_OFF_R	Redundant HPC OFF CMD to DES PWR Supply	NO
SIS_HEATER_ON_N	Nominal HPC ON CMD to DES Heater PWR Control	NO
SIS_HEATER_ON_R	Redundant HPC ON CMD to DES Heater PWR Control	NO
SIS_HEATER_OFF_N	Nominal HPC OFF CMD to DES Heater PWR Control	NO
SIS_HEATER_OFF_R	Redundant HPC OFF CMD to DES Heater PWR Control	NO
SIS_PYR_DIP1_N	Nominal Pyro firing CMD for Dipole 1 Antenna deployment	YES
SIS_PYR_DIP1_R	Redundant Pyro firing CMD for Dipole 1 Antenna deployment	YES
SIS_PYR_DIP2_N	Nominal Pyro firing CMD for Dipole 2 Antenna deployment	YES
SIS_PYR_DIP2_R	Redundant Pyro firing CMD for Dipole 2 Antenna deployment	YES
SIS_PYR_MON_N	Nominal Pyro firing CMD for Monopole Antenna deployment	YES
SIS_PYR_MON_R	Redundant Pyro firing CMD for Monopole Antenna deployment	YES

8.5.2. MARSIS TLMs

The following table lists the analogue, state and discrete MARSIS telemetries, and the related acronym, available through S/C'c APID 20 (S/C HK TM Packet).

Acronym	Description
SIS_PWR_STAT_N	Nominal MARSIS LCL Status (RSS)
SIS_PWR_STAT_R	Redundant MARSIS LCL Status (RSS)
SISD_PWR_STAT_N	Nominal SISD (DES) Status (RSS)
SISD_PWR_STAT_R	Redundant SISD (DES) Status (RSS)
SIS_HEATER_STAT_N	Nominal Antenna Heaters Status (RSS)
SIS_HEATER_STAT_R	Redundant Antenna Heaters Status (RSS)
SIS_ANT_TMP_N	Nominal Antenna Temperature (ANC)
SIS_ANT_TMP_R	Redundant Antenna Temperature (ANC)
SIS_TX_TMP_N	Nominal TX Temperature (ANC)
SIS_TX_TMP_R	Redundant TX Temperature (ANC)
SIS_RX_TMP_N	Nominal RX Temperature (ANC)
SIS_RX_TMP_R	Redundant RX Temperature (ANC)
SIS_DES_TMP_N	Nominal DES Temperature (ANC)
SIS_DES_TMP_R	Redundant DES Temperature (ANC)
SIS_DES_VOL1_N	Nominal DES Voltage 1 (ANS)
SIS_DES_VOL1_R	Redundant DES Voltage 1 (ANS)
SIS_DES_VOL2_N	Nominal DES Voltage 2 (ANS)
SIS_DES_VOL2_R	Redundant DES Voltage 2 (ANS)
SIS_TX_VOL_N	Nominal TX Voltage (ANS)
SIS_TX_VOL_R	Redundant TX Voltage (ANS)

8.6. MARSIS TC Verification

The following table provide the acknowledge relationship between MARSIS Telecommands and Telemetries and the some verification criteria.

TC	ACK By TM	Verified By
SIS_HK_EN	SIS_ACC_REP_S SIS_ACC_REP_F	checking generation of SIS_HK_TM packets
SIS_HK_DIS	SIS_ACC_REP_S SIS_ACC_REP_F	checking absence of SIS_HK_TM packets
SIS_PATCH	SIS_ACC_REP_S SIS_ACC_REP_F	TBD
SIS_DUMP_TC	SIS_ACC_REP_S SIS_ACC_REP_F	checking generation of the expected number of SIS_DUMP_TM packets
SIS_TIME_UP	SIS_ACC_REP_S SIS_ACC_REP_F	checking the updated SCET in SIS_HK_TM packets
SIS_OST_TC	SIS_ACC_REP_S SIS_ACC_REP_F	TBD
SIS_PT_TC	SIS_ACC_REP_S SIS_ACC_REP_F	TBD
SIS_MOD_TR_DIS_TC	SIS_ACC_REP_S SIS_ACC_REP_F	TBD

8.7. List of dangerous commands

By reference to the TCs identified as Crtical in the previous paragraphs, here follows the list of MARSIS Dangerous Commands, that shall be sent only on specific, controlled, conditions.

Acronym	Description	Crit.
SIS_PATCH_C	Load C&C Memory using Absolute Addresses - TC (6,2)	YES
SIS_PATCH_1	Load DSP1 Memory using Absolute Addresses - TC (6,2)	YES
SIS_PATCH_2	Load DSP2 Memory using Absolute Addresses - TC (6,2)	YES
SIS_MOD_TR_DIS_TC	Automatic Mode Transition Disable - TC (207,1)	YES
SIS_PYR_DIP1_N	Nominal Pyro firing CMD for Dipole 1 Antenna deployment	YES
SIS_PYR_DIP1_R	Redundant Pyro firing CMD for Dipole 1 Antenna deployment	YES
SIS_PYR_DIP2_N	Nominal Pyro firing CMD for Dipole 2 Antenna deployment	YES
SIS_PYR_DIP2_R	Redundant Pyro firing CMD for Dipole 2 Antenna deployment	YES
SIS_PYR_MON_N	Nominal Pyro firing CMD for Monopole Antenna deployment	YES
SIS_PYR_MON_R	Redundant Pyro firing CMD for Monopole Antenna deployment	YES

8.8. Summary of Telemetry and Telecommand Packets

8.8.1. Telecommands

Basic TC Format

The unit of measure is the byte (octet) unless otherwise noted.

Packet Header			Data Field Header				DATA FIELD	Trailer
Pkt ID	Seq Ctrl	Length		Typ	Sty		….	
2	2	2	1	1	1	1	1 … 236	2

Pkt ID contains Process ID (7 bits) and Packet Category (4 bits).
Together they form the Packet APID.

Details of each TC Format, and of its Data Field, are provided in the following pages.

TC(3,5)	SIS_HK_EN	Enable Housekeeping Report Packet Generation

Purpose	Enable the generation of the housekeeping packets TM(3,25) SIS_HK_TM. By default, at the power on, the generation is enabled. This TC shall be used (if necessary) to re-start the generation of the HK telemetry in case it has been disabled with the TC(3,6) SIS_HK_DIS.
APID	**1228** (Process ID – PID : 76, Packet category – PCAT : 12)
Type	3
Subtype	5
Length	Fixed length = 7 (i.e. total length = 14 octets)
Summary content	The Data Field contains: ▪ PAD = 0 (fixed field) ▪ SID = 0 (fixed field, only one SID is foreseen for MARSIS)

DATA FLD	
00h	00h
1	1

TC(3,6)	SIS_HK_DIS	Disable Housekeeping Report Packet Generation

Purpose	Disable the generation of the housekeeping packets TM(3,25) SIS_HK_TM. By default, at the power on, the generation is enabled. This TC shall be used (if necessary) to stop the generation of the HK telemetry. In such case the generation of the HK Telemetry can be re-started with the TC(3,6) SIS_HK_DIS.
APID	**1228** (Process ID – PID : 76, Packet category – PCAT : 12)
Type	3
Subtype	6
Length	Fixed length = 7 (i.e. total length = 14 octets)
Summary content	The Data Field contains: ▪ PAD = 0 (fixed field) ▪ SID = 0 (fixed field, only one SID is foreseen for MARSIS)

DATA FLD	
00h	00h
1	1

TC(6,2)	SIS_PATCH_C	Load C&C Memory using Absolute Addresses

This Telecommand is CRITICAL

Purpose	Load the C&C memory with the provided data. Three different versions of this TC are considered for the three different memory type present on the C&C board. They are: ▪ the EEPROM (the patchable partition) ▪ the Program SRAM ▪ the Data SRAM
APID	**1228** (Process ID – PID : 76, Packet category – PCAT : 12)
Type	6
Subtype	2
Length	Variable length = 15 ÷ 241 (i.e. total variable length = 22 ÷ 248 octets)
Summary content	The Data Field contains: ▪ The Memory ID (MID)=176 for EEPROM 177 for Program SRAM 178 for Data SRAM ▪ The number of the following blocks (in the range 1 ÷ 29) ▪ Each of the contained block contains: o The Start Address o The Number of Word composing the Data o The Data themselves

DATA FIELD					
MID	NBK	BLOCK 1	BLOCK 2	…	BLOCK N
1	1				

BLOCK		
Address	Length	Data
4	2	

TC(6,2)	SIS_PATCH_1	Load DSP1 Memory using Absolute Addresses

This Telecommand is CRITICAL

Purpose	Load the DSP#1 memory with the provided data. Three different versions of this TC are considered for the three different memory type present on the DSP#1 board. They are: ▪ the EEPROM ▪ the Program SRAM ▪ the Data SRAM ▪ the Dual Port RAM
APID	**1244** (Process ID – PID : 77, Packet category – PCAT : 12)
Type	6
Subtype	2
Length	Variable length = 15 ÷ 241 (i.e. total variable length = 22 ÷ 248 octets)
Summary content	The Data Field contains: ▪ The Memory ID (MID)=179 for EEPROM 180 for Program SRAM 181 for Data SRAM 182 for Dual Port RAM ▪ The number of the following blocks (in the range 1 ÷ 29) ▪ Each of the contained block contains: o The Start Address o The Number of Word composing the Data o The Data themselves

DATA FIELD					
MID	NBK	BLOCK 1	BLOCK 2	…	BLOCK N
1	1				

BLOCK		
Address	Length	Data
4	2	

TC(6,2)	SIS_PATCH_2	Load DSP2 Memory using Absolute Addresses

This Telecommand is CRITICAL

Purpose	Load the DSP#2 memory with the provided data. Three different versions of this TC are considered for the three different memory type present on the DSP#2 board. They are: ▪ the EEPROM ▪ the Program SRAM ▪ the Data SRAM ▪ the Dual Port RAM
APID	**1260** (Process ID – PID : 78, Packet category – PCAT : 12)
Type	6
Subtype	2
Length	Variable length = 15 ÷ 241 (i.e. total variable length = 22 ÷ 248 octets)
Summary content	The Data Field contains: ▪ The Memory ID (MID)=183 for EEPROM 184 for Program SRAM 185 for Data SRAM 186 for Dual Port RAM ▪ The number of the following blocks (in the range 1 ÷ 29) ▪ Each of the contained block contains: o The Start Address o The Number of Word composing the Data o The Data themselves

DATA FIELD					
MID	NBK	BLOCK 1	BLOCK 2	…	BLOCK N
1	1				

BLOCK		
Address	Length	Data
4	2	

TC(6,3)	SIS_DUMP_TC_C	Dump C&C Memory using Absolute Addresses

Purpose	Dump the C&C memory. Three different versions of this TC are defined for the three different memory type present on the C&C board. They are: ▪ the EEPROM (the patchable partition) ▪ the Program SRAM ▪ the Data SRAM
APID	**1228** (Process ID – PID : 76, Packet category – PCAT : 12)
Type	6
Subtype	3
Length	Variable length = 13 ÷ 241 (i.e. total variable length = 20 ÷ 248 octets)
Summary content	The Data Field contains: ▪ The Memory ID (MID)=176 for EEPROM 177 for Program SRAM 178 for Data SRAM ▪ The number of the following blocks (in the range 1 ÷ 29) ▪ Each of the contained block contains: o The Start Address o The Number of Word to be dumped

DATA FIELD					
MID	NBK	BLOCK 1	BLOCK 2	…	BLOCK N
1	1				

BLOCK	
Address	Length
4	2

TC(6,3)	SIS_DUMP_TC_1	Dump DSP1 Memory using Absolute Addresses

Purpose	Dump the DSP#1 memory. Three different versions of this TC are defined for the three different memory type present on the DSP#1 board. They are: ▪ the EEPROM (the patchable partition) ▪ the Program SRAM ▪ the Data SRAM ▪ the Dual Port RAM
APID	**1244** (Process ID – PID : 77, Packet category – PCAT : 12)
Type	6
Subtype	3
Length	Variable length = 13 ÷ 241 (i.e. total variable length = 20 ÷ 248 octets)
Summary content	The Data Field contains: ▪ The Memory ID (MID)=179 for EEPROM 180 for Program SRAM 181 for Data SRAM 182 for Dual Port RAM ▪ The number of the following blocks (in the range 1 ÷ 29) ▪ Each of the contained block contains: o The Start Address o The Number of Word to be dumped

DATA FIELD					
MID	NBK	BLOCK 1	BLOCK 2	…	BLOCK N
1	1				

BLOCK	
Address	Length
4	2

TC(6,3)	SIS_DUMP_TC_2	Dump DSP2 Memory using Absolute Addresses

Purpose	Dump the DSP#1 memory. Three different versions of this TC are defined for the three different memory type present on the DSP#1 board. They are: ▪ the EEPROM (the patchable partition) ▪ the Program SRAM ▪ the Data SRAM ▪ the Dual Port RAM
APID	**1260** (Process ID – PID : 77, Packet category – PCAT : 12)
Type	6
Subtype	3
Length	Variable length = 13 ÷ 241 (i.e. total variable length = 20 ÷ 248 octets)
Summary content	The Data Field contains: ▪ The Memory ID (MID)=183 for EEPROM 184 for Program SRAM 185 for Data SRAM 186 for Dual Port RAM ▪ The number of the following blocks (in the range 1 ÷ 29) ▪ Each of the contained block contains: o The Start Address o The Number of Word to be dumped

DATA FIELD					
MID	NBK	BLOCK 1	BLOCK 2	…	BLOCK N
1	1				

BLOCK	
Address	Length
4	2

TC(9,1)	SIS_TIME_UP	Accept Time Update

Purpose	Load the SCET into MARSIS. It MUST be the first TC sent to MARSIS after the power on. The generation of the HK TM packet is not enabled until this TC is correctly received, any other TC will be discarded if this TC is not yet received.
APID	**1228** (Process ID – PID : 76, Packet category – PCAT : 12)
Type	9
Subtype	1
Length	Fixed length = 11 (i.e. total length = 18 octets)
Summary content	The Data Field contains: ▪ The SCET (on board time) at the next Time Broadcast Pulse.

DATA FIELD
SCET
6

TC(206,1)	SIS_OST_TC	Load Operation Sequence Table (MARSIS Private)

Purpose	Load the Operation Sequence table into MARSIS memory. The OST represents the "flight plan" for the current orbit. It contains all the information on when a certain mode shall be executed by MARSIS. A default OST is loaded into the MARSIS memory, so this TC is not mandatory.
APID	**1228** (Process ID – PID : 76, Packet category – PCAT : 12)
Type	Variable length = 15 ÷ 241 (i.e. total variable length = 22 ÷ 248 octets)
Subtype	206
Length	1
Summary content	The Data Field contains: ▪ The Memory ID (MID)=177 for Program SRAM ▪ The Number of Blocks (in the range 1 ÷ 13, typically always set to 1) ▪ Each of the contained block contains: o The Line Number x 2 of the first OST line in the block o The Number of OST lines x 2 contained in the Data portion o The Data themselves.

Note. The following layout represent the typical case of a single block TC used to program N contiguous OST lines.

DATA FIELD				
177	1	Address	Length	OST Lines
1	1	1st Line No x 2	2 x N Lines	6 x N Lines

TC(206,2)	SIS_PT_TC	Load Parameter Table (MARSIS Private)

Purpose	Load the Parameter table into MARSIS memory. The PT contains all the parameters needed by the on-board software to perform it operation correctly. The first two parameter represent the *SCET** and the *SCET at pericenter* that will change at each orbit so this TC is mandatory.
APID	**1228** (Process ID – PID : 76, Packet category – PCAT : 12)
Type	Variable length = 15 ÷ 241 (i.e. total variable length = 22 ÷ 248 octets)
Subtype	206
Length	2
Summary content	The Data Field contains: ▪ The Memory ID (MID)=177 for Program SRAM ▪ The number of the following blocks (in the range 1 ÷ 19) ▪ Each of the contained block contains: o The Start Address o The Number of consecutive parameters' values composing the Data portion o The Data themselves.

Note. The following layout represent the typical case of a single block TC used to set the value of N contiguous parameters.

DATA FIELD				
177	1	Address	Length	OST Lines
1	1	1st Parameter	N Values	3 x N Values

TC(207,1)	SIS_MOD_TR_DIS_TC	Automatic Mode Transition Disable (MARSIS Priv.)

This Telecommand is CRITICAL

Purpose	Modify the default permanence in STANDBY mode after the Restart_With_Code_2 special TC has been issued (default is 60 seconds). This can be used in case it is necessary to modify the normal timeline to perform specific operations that require longer STANDBY duration (like a FM dump).
APID	**1228** (Process ID – PID : 76, Packet category – PCAT : 12)
Type	207
Subtype	1
Length	Fixed length = 9 (i.e. total length = 16 octets)
Summary content	The Data Field contains: ▪ The new STANDBY mode duration in seconds (> 60)

DATA FIELD
Mode Duration
4

8.8.2. Telemetries

Basic TM Format

The unit of measure is the byte (octet) unless otherwise noted.

Packet Header		
Pkt ID	Seq Ctrl	Length
2	2	2

Data Field Header					DATA FIELD
Packet SCET		Typ	Sty		….
6	1	1	1	1	1 … 4096

Pkt ID contains Process ID (7 bits) and Packet Category (4 bits).
Together they form the Packet APID.

The following codes apply for Mode/State identification:

Code	Mode
0	Check/Init
1	StandBy
2	Warm Up 1
3	Warm Up 2
4	Idle
5	Calibration
6	Receive Only
7	Active Ionospheric Sounding
8	Subsurface Sounding 1
9	Subsurface Sounding 2
10	Subsurface Sounding 3
11	Subsurface Sounding 4
12	Subsurface Sounding 5
13	Data Move from RAM buffer to FM
14	*Spare*
15	*Not usable (empty OST fill value)*

Details of each TM Format, and of its Data Field, are provided in the following pages.

TM(1,1)	SIS_ACC_REP_S	Telecommand Acceptance Report – Success

Purpose	Indicates that MARSIS has received and correctly accepted one packet.
APID	**1217** (Process ID – PID : 76, Packet category – PCAT : 1)
Type	1
Subtype	1
Length	Fixed length = 13 (i.e. total length = 20 octets)
Summary content	The Data Field contains: ▪ A replica of the acknowledged *TC Packet ID field* ▪ A replica of the acknowledged *TC Sequence Control field*
Generation and Rate	This TM is generated each time a correctly received TC, that requires the acknowledge, is accepted, i.e. it is formally correct and can be executed.

DATA FIELD	
TC Pkt ID	TC Seq Ctr
2	2

TM(1,2)	SIS_ACC_REP_F	Telecommand Acceptance Report – Failure

Purpose	Indicates that MARSIS has received and not correctly accepted one packet.
APID	**1217** (Process ID – PID : 76, Packet category – PCAT : 1)
Type	Variable length = 17 ÷ 21 (i.e. total variable length = 24 ÷ 28 octets)
Subtype	1
Length	2
Summary content	The Data Field contains: ▪ A replica of the acknowledged TC packet ID ▪ A replica of the acknowledged TC sequence control ▪ The Failure Code – FID. (See table). ▪ Additional parameters, TC Type/Stype plus other optional, used to better identify the failure
Generation and Rate	This TM is generated each time a received TC does not can be accepted either because it has wrong format or cannon be accepted.

DATA FIELD						
TC Pkt ID	TC Seq Ctr	FID	Typ	Styp	Param 3	Param 4
2	2	2	1	1	0 or 2	0 or 2

FID		**Param 3**	**Param 4**
1		TC Length	Rcvd Octets
2		Rcvd Chksum	Calc Chksum
3		N/A	N/A
4		N/A	N/A
5		Mode ID	**Reason** (blw)
6		Position	Error value

FID	Meaning
1	Incomplete Packet with Timeout
2	Incorrect Packet CRC
3	Incorrect Packet APID
4	Incorrect Packet Type/Subtype
5	Incorrect Packet Mode Eligibility
6	Inconsistent Application Data (see table)

Reason	Meaning
1	SCET not yet updated
2	Invalid Op Mode
3	Master PM Patch TC Buffer Full
4	Execute Master PM Patch without Patch
5	TC Buffer Full
6	Flash Memorie Busy

TM(3,25)	SIS_HK_TM	Housekeeping Report Packet

Purpose	Contains the housekeeping parameters of MARSIS.
APID	**1220** (Process ID – PID : 76, Packet category – PCAT : 4)
Type	3
Subtype	25
Length	Fixed length = 211 (i.e. total length = 218 octets)
Summary content	The Data Field contains: ▪ PAD = 0 (fixed field) ▪ SID = 0 (fixed field, only one SID is foreseen for MARSIS) ▪ The HK data (200 16bits-words)
Generation and Rate	When enabled (default condition) this TM is generated every 8 seconds.

DATA FIELD						
00h	00h	Mode	PRI	TM Generation SCET	AccTC	RefTC
2	2	2	4	6	2	2

DATA FIELD				
BIT Results	Other	FM State	RAM Buf State	Spare
70	80	4 x 4	2 x 4	10

TM(5,1)	SIS_PROG_REP	Event Reporting: Normal/Progress Report

Purpose	Reports any nominal mode change occurred on-board.
APID	**1223** (Process ID – PID : 76, Packet category – PCAT : 7)
Type	5
Subtype	1
Length	Fixed length = 25 (i.e. total length = 32 octets)
Summary content	The Data Field contains: ▪ Event ID (EID)= Error Code (see table) ▪ Transaction Identification ▪ Pulse Repetition Interval count at which the transition has occurred ▪ SCET value at which the transition is occurred ▪ OST line number at which the transition is occurred for EID=41802 or 0xFFFF for EID=41801
Generation and Rate	TM(5,1) is generated for each occurred mode transition.

DATA FIELD				
EID	Tr ID	PRI	Transition SCET	Param
2	2	4	6	2

EID	TrID
A349	(1)
A34A	(2)

Param
FFFF
OST #

(1) From 41517 (A22D) to 41561 (A259)
(2) From 41584 (A270) to 41705 (A2E9)
Additional details about Tr ID values are found in RD-10.

EID	EIDh	Meaning
41801	A349	Transition to any Support mode
41802	A34A	Transition to any Operation mode

TM(5,2)	SIS_ERR_REP	Event reporting: Error/Anomaly Report (Warning)

Purpose	Reports any mode change occurred on-board due to non-nominal event and/or wrong TC received but no acknowledge is requested.
APID	**1223** (Process ID – PID : 76, Packet category – PCAT : 7)
Type	5
Subtype	2
Length	Variable length = 19 ÷ 95 (i.e. total variable length = 26 ÷ 102 octets)
Summary content	The Data Field contains: ▪ Event ID (EID)=Error Code (see table) ▪ Several information related to the detected event/error.
Generation and Rate	TM(5,2) is generated for each occurred mode transition or when a wrong TC, that does not require acknowledge, is received.

DATA FIELD					
A3AD	TrID	FFFF	Transition PRI	Transition SCET	Last BIT Results
2	2	2	4	6	70

DATA FIELD					
A3AE	TrID	FFFF	Transition PRI	Trans. PRI (SCET N/A)	Last BIT Results
2	2	2	4	6	70

DATA FIELD				
A3AF	TrID	FFFF	Transition PRI	Transition SCET
2	2	2	4	6

DATA FIELD			
A3B0	A25E	FFFF	Transition PRI
2	2	2	4

DATA FIELD					
A3B1	TrID	FFFF	Transition PRI	Transition SCET	Last BIT Results
2	2	2	4	6	70

DATA FIELD					
A3B2	TrID	TmrID	Transition PRI	Transition SCET	Last BIT Results
2	2	2	4	6	70

DATA FIELD					
A3B3	TrID	FID	Transition PRI	Transition SCET	Other
2	2	2	4	6	14

FID	Anomaly
50	SCET Inconsistency
51	OST Inconsistency

DATA FIELD							
A3B4	PID	SEQ	FID	Typ	Sty	Par. 1	Par. 2
2	2	2	2	1	1	2	2

FID (*)
1
2
3
4
5
6

Par. 1	Par. 2
Length	Rcvd oct
Rcv Chks	Cal Chks
FFFF	FFFF
FFFF	FFFF
Mode ID	Reason
Position	Err Value

(*) See definition for TM(1,2)

EID	EIDh	Meaning
41901	A3AD	BIT failed – not in CHECK/INIT
41902	A3AE	BIT failed – in CHECK/INIT
41903	A3AF	TM packet buffer overflow
41904	A3B0	SCET not received within timeout
41905	A3B1	Watchdog reset
41906	A3B2	Watchdog reset in CHECK/INIT
41907	A3B3	SCET* < current SCET in WARM-UP2
41908	A3B4	Wrong TC received but no ACK requested

TM(6,6)	SIS_DUMP_TM_C	Dump Report from C&C memory

Purpose	Reports the requested dump data after a SIS_DUMP_TC_C TC(6,5).
APID	**1225** (Process ID – PID : 76, Packet category – PCAT : 9)
Type	6
Subtype	6
Length	Variable length = 19 ÷ 4099 (i.e. total variable length = 26 ÷ 4106 octets)
Summary content	The Data Field contains: ▪ The Memory ID (MID)=176 for EEPROM 177 for Program SRAM 178 for Data SRAM ▪ The number of the following blocks (in the range 1 ÷ 29) ▪ Each of the contained block contains: o The Start Address o The Number of dumped words o The dumped Data
Generation and Rate	TM(6,6) is generated once after reception of a SIS_DUMP_TC_C TC(6,5).

DATA FIELD					
MID	NBK	BLOCK 1	BLOCK 2	…	BLOCK N
1	1				

BLOCK		
Address	N Loc	Data
4	2	N Loc x Word size

TM(6,6)	SIS_DUMP_TM_1	Dump Report from DSP1 memory

Purpose	Reports the requested dump data after a SIS_DUMP_TC_1 TC(6,5).
APID	**1241** (Process ID – PID : 77, Packet category – PCAT : 9)
Type	6
Subtype	6
Length	Variable length = 19 ÷ 4099 (i.e. total variable length = 26 ÷ 4106 octets)
Summary content	The Data Field contains: ▪ The Memory ID (MID)=180 for EEPROM 181 for Program SRAM 182 for Data SRAM ▪ The number of the following blocks (in the range 1 ÷ 29) ▪ Each of the contained block contains: o The Start Address o The Number of dumped words o The dumped Data
Generation and Rate	TM(6,6) is generated once after reception of a SIS_DUMP_TC_1 TC(6,5).

DATA FIELD					
MID	NBK	BLOCK 1	BLOCK 2	…	BLOCK N
1	1				

BLOCK		
Address	N Loc	Data
4	2	N Loc x Word size

TM(6,6)	SIS_DUMP_TM_2	Dump Report from DSP2 memory

Purpose	Reports the requested dump data with a SIS_DUMP_TC_2 TC(6,5).
APID	**1257** (Process ID – PID : 78, Packet category – PCAT : 9)
Type	6
Subtype	6
Length	Variable length = 19 ÷ 4099 (i.e. total variable length = 26 ÷ 4106 octets)
Summary content	The Data Field contains: ▪ The Memory ID (MID)=184 for EEPROM 185 for Program SRAM 186 for Data SRAM ▪ The number of the following blocks (in the range 1 ÷ 29) ▪ Each of the contained block contains: o The Start Address o The Number of dumped words o The dumped Data
Generation and Rate	TM(6,6) is generated once after reception of a SIS_DUMP_TC_2 TC(6,5).

DATA FIELD					
MID	NBK	BLOCK 1	BLOCK 2	...	BLOCK N
1	1				

BLOCK		
Address	N Loc	Data
4	2	N Loc x Word size

TM(20,3)	SIS_SCIENCE_SS	Science Data in Sub-Surface Sounding mode

Purpose	Contains the scientific data generated on-board in Sub-surface modes (SS1, SS2, SS3, SS4, SS5).
APID	**1244** (Process ID – PID : 77, Packet category – PCAT : 12)
Type	20
Subtype	3
Length	Variable length = 19 ÷ 4105 (i.e. total variable length = 26 ÷ 4112 octets)
Summary content	The Data Field contains: ▪ Ancillary data with dedicated header when necessary ▪ Scientific data
Generation and Rate	TM(20,3) is generated in any Subsurface Sounding mode at variable rate.

DATA FIELD	
ANCILLARY DATA	SCIENCE DATA
28 or 256	3840 or 4068

ANCILLARY DATA	
ANC. DATA HDR	Auxiliary Data
28	0 or 228

ANCILLARY DATA HEADER				
SCET	OST#	OST Line	Frame	SD Sequence Control
6	2	12	2	6

TM(20,3)	SIS_SCIENCE_AIS	Science Data in Active Ionosphere Sounding mode

Purpose	Contains the scientific data generated on-board in Active Ionosphere Sounding mode.
APID	**1260** (Process ID – PID : 78, Packet category – PCAT : 12)
Type	20
Subtype	3
Length	Variable length = 19 ÷ 4105 (i.e. total variable length = 26 ÷ 4112 octets)
Summary content	The Data Field contains: ▪ Ancillary data with dedicated header when necessary ▪ Scientific data
Generation and Rate	TM(20,3) is generated in Active Ionosphere Sounding mode at variable rate.

DATA FIELD	
ANCILLARY DATA	SCIENCE DATA
28 or 256	3840 or 4068

ANCILLARY DATA	
ANC. DATA HDR	Auxiliary Data
28	0 or 228

ANCILLARY DATA HEADER				
SCET	OST#	OST Line	Frame	SD Sequence Control
6	2	12	2	6

TM(20,3)	SIS_SCIENCE_CAL	Science Data in Calibration mode

Purpose	Contains the scientific data generated on-board in Calibration mode.
APID	**1276** (Process ID – PID : 79, Packet category – PCAT : 12)
Type	20
Subtype	3
Length	Variable length = 19 ÷ 4105 (i.e. total variable length = 26 ÷ 4112 octets)
Summary content	The Data Field contains: ▪ Ancillary data with dedicated header when necessary ▪ Scientific data
Generation and Rate	TM(20,3) is generated in Calibration mode at variable rate.

DATA FIELD	
ANCILLARY DATA	SCIENCE DATA
28 or 256	3840 or 4068

ANCILLARY DATA	
ANC. DATA HDR	Auxiliary Data
28	0 or 228

ANCILLARY DATA HEADER				
SCET	OST#	OST Line	Frame	SD Sequence Control
6	2	12	2	6

TM(20,3)	SIS_SCIENCE_REC	Science Data in Receive Only mode

Purpose	Contains the scientific data generated on-board in Receive Only mode.
APID	**1292** (Process ID – PID : 80, Packet category – PCAT : 12)
Type	20
Subtype	3
Length	Variable length = 19 ÷ 4105 (i.e. total variable length = 26 ÷ 4112 octets)
Summary content	The Data Field contains: ▪ Ancillary data with dedicated header when necessary ▪ Scientific data
Generation and Rate	TM(20,3) is generated in Receive Only mode at variable rate.

DATA FIELD	
ANCILLARY DATA	SCIENCE DATA
28 or 256	3840 or 4068

ANCILLARY DATA	
ANC. DATA HDR	Auxiliary Data
28	0 or 228

ANCILLARY DATA HEADER				
SCET	OST#	OST Line	Frame	SD Sequence Control
6	2	12	2	6

TM(206,3)	SIS_PRIVATE_TM	Spare

Purpose	Spare TM
APID	N/A
Type	206
Subtype	3
Length	N/A
Summary content	N/A
Generation and Rate	N/A

No Format

8.9. Summary of Telemetry and Telecommand parameters

The following table lists the Packet Telecommands' parameters identified in the previous paragraphs.

Parameter	Telecommand
SCET TIME	TC(9,1)
SCET IN SEC	TC(9,1)
SCET FRACTIONARY	TC(9,1)
START ADDRESS	TC(6,2), TC(6,5), TC(206,1), TC(206,2)
MSW	TC(6,2), TC(6,5), TC(206,1), TC(206,2)
MIDDLE	TC(6,2), TC(6,5), TC(206,1), TC(206,2)
LSW	TC(6,2), TC(6,5), TC(206,1), TC(206,2)
DUMP LENGTH	TC(6,5)
STBY DURATION	TC(207,1)
STBY DURATION IN SEC	TC(207,1)
STBY DURATION FRACTIONARY	TC(207,1)
FORCED MODE TRANSITION	TC(207,2)

The following table lists the Packet Telemetries' parameters identified in the previous paragraphs.

Parameter	Telemetry
TC PCK ID	TM(1,1)
TC SEQ CTRL	TM(1,1)
TC PCK ID	TM(1,2)
TC SEQ CTRL	TM(1,2)
FAILURE CODE	TM(1,2)
FAILED PACKET TYPE	TM(1,2)
FAILED PACKET SUBTYPE	TM(1,2)
PAR3 (LEN IN HEADER)	TM(1,2) FID=1
PAR4 (ACTUAL LEN)	TM(1,2) FID=1
PAR3 (RCVD CKSUM)	TM(1,2) FID=2
PAR4 (COMPUTED CKSUM)	TM(1,2) FID=2
PAR3 (MODE ID)	TM(1,2) FID=5
PAR4 (REASON)	TM(1,2) FID=5
PAR3 (POSITION)	TM(1,2) FID=6
PAR4 (VALUE)	TM(1,2) FID=6
CURRENT OPERATIVE MODE	TM(3,25)
CURRENT PRI	TM(3,25)
CURRENT SCET	TM(3,25)
NO OF ACCEPTED TC	TM(3,25)
NO OF REFUSED TC	TM(3,25)
NO OF ACCEPT.REP TM(1,2) QUEUED	TM(3,25)
NO OF EV.REP TM(5,1) AND (5,2) QUEUED	TM(3,25)
NO OF HK.REP TM(3,25) QUEUED	TM(3,25)
NO OF SCIENCE.REP TM(20,3) QUEUED	TM(3,25)
CKSUM OF MASTER DSP EEPROM-BOOT	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
CKSUM OF MASTER DSP EEPROM-PROGRAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
CKSUM OF SLAVE DSP1 EEPROM-BOOT	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
CKSUM OF SLAVE DSP1 EEPROM-PROGRAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
CKSUM OF SLAVE DSP2 EEPROM-BOOT	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
CKSUM OF SLAVE DSP2 EEPROM-PROGRAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
CKSUM OF MASTER DSP RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
CKSUM OF SLAVE DSP1 RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
CKSUM OF SLAVE DSP2 RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
RAM CHECK RESULTS (1=FAILED)	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906

FIRST WRONG CELL MASTER PROGRAM RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
FIRST WRONG CELL MASTER DATA RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
FIRST WRONG CELL SLAVE DSP1 PROGRAM RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
FIRST WRONG CELL SLAVE DSP1 DATA RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
FIRST WRONG CELL SLAVE DSP1 DUALPORT RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
FIRST WRONG CELL SLAVE DSP2 PROGRAM RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
FIRST WRONG CELL SLAVE DSP2 DATA RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
FIRST WRONG CELL SLAVE DSP2 DUALPORT RAM	TM(3,25) + TM(5,2) EIDs=41901, 41902, 41906
EVENT ID	TM(5,1)
TRANSITION ID	TM(5,1)
TRANSITION PRI#	TM(5,1)
TRANSITION SCET	TM(5,1)
OST ENTRY ID	TM(5,1)
EVENT ID	TM(5,2) all EIDs
TRANSITION ID	TM(5,2) EIDs=41901÷41907
FAILURE CODE	TM(5,2) EIDs=41905, 41906, 41908
TRANSITION PRI#	TM(5,2) EIDs=41901÷41907
TRANSITION SCET	TM(5,2) EIDs=41901, 41903, 41905, 41906, 41907
TC PCK ID	TM(5,2) EID=41908
TC SEQ CTRL	TM(5,2) EID=41908
FAILED PACKET TYPE	TM(5,2) EID=41908
FAILED PACKET SUBTYPE	TM(5,2) EID=41908
PAR6	TM(5,2) EID=41908
PAR7	TM(5,2) EID=41908

9. Data Operations Handbook

Warning
Data contained in this section are extracted from MEDOC's MIB export database **version 5.1** released the **25th of November 2003**.

9.1. Flight Control / Contingency Recovery Procedures

Please refer to RD-16.

9.2. MEDOC Sequences Definitions

Please refer to RD-16.

9.3. MEDOC Telecommand Instances

9.3.1. MEDOC Cross-references

TC Instances vs MARSIS Packet Telecommands

TO BE ADDED TO BE VERIFIED TO BE DELETED

Name	Description	Cr	APID	T	S	Instance Of
ZMI00100	MARSIS-Enable HK Packet Generation	N	**1228**	3	5	SYS_HK_EN
ZMI00110	MARSIS-Disable HK Report Pckt Generation	N	**1228**	3	6	SYS_HK_DIS
ZMI00200	MARSIS-Load Mem: EEPROM C-C	Y	**1228**	6	2	SIS_PATCH_C
ZMI00201	MARSIS-Load Mem: EEPROM DSP1	Y	**1244**	6	2	SIS_PATCH_1
ZMI00202	MARSIS-Load Mem: EEPROM DSP2	Y	**1260**	6	2	SIS_PATCH_2
ZMI00210	MARSIS-Load Mem: Prog. RAM C-C	Y	**1228**	6	2	SIS_PATCH_C
ZMI00211	MARSIS-Load Mem: Prog. RAM DSP1	Y	**1244**	6	2	SIS_PATCH_1
ZMI00212	MARSIS-Load Mem: Prog. RAM DSP2	Y	**1260**	6	2	SIS_PATCH_2
ZMI00220	MARSIS-Load Mem: Data RAM C-C	Y	**1228**	6	2	SIS_PATCH_C
ZMI00221	MARSIS-Load Mem: Data RAM DSP1	Y	**1244**	6	2	SIS_PATCH_1
ZMI00222	MARSIS-Load Mem: Data RAM DSP2	Y	**1260**	6	2	SIS_PATCH_2
ZMI00231	MARSIS-Load Mem: dual-port SRAM DSP1	Y	**1244**	6	2	SIS_PATCH_1
ZMI00232	MARSIS-Load Mem: dual-port SRAM DSP2	Y	**1260**	6	2	SIS_PATCH_2
ZMI00300	MARSIS-Dump Mem: EEPROM C-C	N	**1228**	6	5	SIS_DUMP_TC_C
ZMI00301	MARSIS-Dump Mem: EEPROM DSP1	N	**1244**	6	5	SIS_DUMP_TC_1
ZMI00302	MARSIS-Dump Mem: EEPROM DSP2	N	**1260**	6	5	SIS_DUMP_TC_2
ZMI00310	MARSIS-Dump Mem: Prog. RAM C-C	N	**1228**	6	5	SIS_DUMP_TC_C
ZMI00311	MARSIS-Dump Mem: Prog. RAM DSP1	N	**1244**	6	5	SIS_DUMP_TC_1
ZMI00312	MARSIS-Dump Mem: Prog. RAM DSP2	N	**1260**	6	5	SIS_DUMP_TC_2
ZMI00320	MARSIS-Dump Mem: Data RAM C-C	N	**1228**	6	5	SIS_DUMP_TC_C
ZMI00321	MARSIS-Dump Mem: Data RAM DSP1	N	**1244**	6	5	SIS_DUMP_TC_1
ZMI00322	MARSIS-Dump Mem: Data RAM DSP2	N	**1260**	6	5	SIS_DUMP_TC_2

ZMI00331	MARSIS-Dump Mem: dual-port SRAM DSP1	N	**1244**	6	5	SIS_DUMP_TC_1
ZMI00332	MARSIS-Dump Mem: dual-port SRAM DSP2	N	**1260**	6	5	SIS_DUMP_TC_2
ZMI00333	MARSIS-Dump Mem: Flash Chip0 Timing	N	**1276**	6	5	SIS_DUMP_TC
ZMI00334	MARSIS-Dump Mem: Flash Chip1 Timing	N	**1276**	6	5	SIS_DUMP_TC
ZMI00335	MARSIS-Dump Mem: Flash Chip2 Timing	N	**1276**	6	5	SIS_DUMP_TC
ZMI00336	MARSIS-Dump Mem: Flash Chip3 Timing	N	**1276**	6	5	SIS_DUMP_TC
ZMI00350	MARSIS-Accept Time Update	N	**1228**	9	1	SIS_TIME_UP
ZMI00400	MARSIS-Load OST	Y	**1228**	206	1	SIS_OST_TC
ZMI00410	MARSIS-Load PT	Y	**1228**	206	2	SIS_PT_TC
ZMI00411	MARSIS-Load PT on DSP1	Y	**1244**	206	2	SIS_PT_TC
ZMI00412	MARSIS-Load PT on DSP2	Y	**1260**	206	2	SIS_PT_TC
ZMI00500	MARSIS-Disable Mode Transition	N	**1228**	207	1	SIS_MOD_TR_DIS_TC
ZMI00510	MARSIS-Force Mode Transition	N	**1228**	207	2	STDACC
ZMIX0200	MARSIS-Load Mem: EEPROM C-C OBSM	Y	**1228**	6	2	SIS_PATCH_C
ZMIX0201	MARSIS-Load Mem: EEPROM DSP1 OBSM	Y	**1244**	6	2	SIS_PATCH_1
ZMIX0202	MARSIS-Load Mem: EEPROM DSP2 OBSM	Y	**1260**	6	2	SIS_PATCH_2
ZMIX0210	MARSIS-Load Mem: Prog. RAM C-C OBSM	Y	**1228**	6	2	SIS_PATCH_C
ZMIX0211	MARSIS-Load Mem: Prog. RAM DSP1 OBSM	Y	**1244**	6	2	SIS_PATCH_1
ZMIX0212	MARSIS-Load Mem: Prog. RAM DSP2 OBSM	Y	**1260**	6	2	SIS_PATCH_2
ZMIX0220	MARSIS-Load Mem: Data RAM C-C OBSM	Y	**1228**	6	2	SIS_PATCH_C
ZMIX0221	MARSIS-Load Mem: Data RAM DSP1 OBSM	Y	**1244**	6	2	SIS_PATCH_1
ZMIX0222	MARSIS-Load Mem: Data RAM DSP2 OBSM	Y	**1260**	6	2	SIS_PATCH_2
ZMIX0231	MARSIS-Load Mem:dual-port SRAM DSP1 OBSM	Y	**1244**	6	2	SIS_PATCH_1
ZMIX0232	MARSIS-Load Mem:dual-port SRAM DSP2 OBSM	Y	**1260**	6	2	SIS_PATCH_2
ZMIX0233	MARSIS-Load Mem: Flash Bk0 Timing OBSM	Y	**1276**	6	2	STDACC
ZMIX0234	MARSIS-Load Mem: Flash Bk1 Timing OBSM	Y	**1276**	6	2	STDACC
ZMIX0401	MARSIS OST - Load 1 Row	N	**1228**	206	1	SIS_OST_TC
ZMIX0402	MARSIS OST - Load 2 Row	N	**1228**	206	1	SIS_OST_TC
ZMIX0403	MARSIS OST - Load 4 Row	N	**1228**	206	1	SIS_OST_TC
ZMIX0404	MARSIS OST - Load 8 Row	N	**1228**	206	1	SIS_OST_TC
ZMIX0405	MARSIS OST - Load 16 Row	N	**1228**	206	1	SIS_OST_TC
ZMIX0411	MI PT SCET Start Ops	Y	**1228**	206	2	SIS_PT_TC
ZMIX0412	MI PT Boot Patchable Mem	Y	**1228**	206	2	SIS_PT_TC
ZMIX0413	MI PT - Load 1 Value	Y	**1228**	206	2	SIS_PT_TC
ZMIX0414	MI PT - Load 2 Value	Y	**1228**	206	2	SIS_PT_TC
ZMIX0415	MI PT - Load 4 Value	Y	**1228**	206	2	SIS_PT_TC
ZMIX0416	MI PT - Load 8 Value	Y	**1228**	206	2	SIS_PT_TC

ZMIX0417	MI PT - Load 16 Value	Y	**1228**	206	2	SIS_PT_TC
ZMIX0418	MI PT - Load 48bit	Y	**1228**	206	2	SIS_PT_TC
ZMIX0419	MI PT DSP1-Load 1 Value	Y	**1244**	206	2	SIS_PT_TC
ZMIX0420	MI PT DSP1-Load 2 Value	Y	**1244**	206	2	SIS_PT_TC
ZMIX0421	MI PT DSP1-Load 4 Value	Y	**1244**	206	2	SIS_PT_TC
ZMIX0422	MI PT DSP1-Load 8 Value	Y	**1244**	206	2	SIS_PT_TC
ZMIX0423	MI PT DSP1-Load 16 Value	Y	**1244**	206	2	SIS_PT_TC
ZMIX0424	MI PT DSP1-Load 48bit	Y	**1244**	206	2	SIS_PT_TC
ZMIX0425	MI PT DSP2-Load 1 Value	Y	**1260**	206	2	SIS_PT_TC
ZMIX0426	MI PT DSP2-Load 2 Value	Y	**1260**	206	2	SIS_PT_TC
ZMIX0427	MI PT DSP2-Load 4 Value	Y	**1260**	206	2	SIS_PT_TC
ZMIX0428	MI PT DSP2-Load 8 Value	Y	**1260**	206	2	SIS_PT_TC
ZMIX0429	MI PT DSP2-Load 16 Value	Y	**1260**	206	2	SIS_PT_TC
ZMIX0430	MI PT DSP2-Load 48 bit	Y	**1260**	206	2	SIS_PT_TC
ZMIX04xx	MI PT Master PM Reboot	Y	**1228**	206	2	SIS_PT_TC
ZMIX04xx	MI PT Flash Mem Test	Y	**1228**	206	2	SIS_PT_TC
ZMIX04xx	MI PT Flash Mem Erase	Y	**1228**	206	2	SIS_PT_TC

MARSIS Packet Telecommands vs TC Instances

TO BE ADDED   TO BE VERIFIED   TO BE DELETED

Instances Of	APID	T	S	Name	Description	Cr
N/A	1228	207	2	ZMI00510	MARSIS-Force Mode Transition	N
SIS_DUMP_TC	1276	6	5	ZMI00333	MARSIS-Dump Mem: Flash Chip0 Timing	N
	1276	6	5	ZMI00334	MARSIS-Dump Mem: Flash Chip1 Timing	N
	1276	6	5	ZMI00335	MARSIS-Dump Mem: Flash Chip2 Timing	N
	1276	6	5	ZMI00336	MARSIS-Dump Mem: Flash Chip3 Timing	N
SIS_DUMP_TC_1	1244	6	5	ZMI00301	MARSIS-Dump Mem: EEPROM DSP1	N
	1244	6	5	ZMI00311	MARSIS-Dump Mem: Prog. RAM DSP1	N
	1244	6	5	ZMI00321	MARSIS-Dump Mem: Data RAM DSP1	N
	1244	6	5	ZMI00331	MARSIS-Dump Mem: dual-port SRAM DSP1	N
SIS_DUMP_TC_2	1260	6	5	ZMI00302	MARSIS-Dump Mem: EEPROM DSP2	N
	1260	6	5	ZMI00312	MARSIS-Dump Mem: Prog. RAM DSP2	N
	1260	6	5	ZMI00322	MARSIS-Dump Mem: Data RAM DSP2	N
	1260	6	5	ZMI00332	MARSIS-Dump Mem: dual-port SRAM DSP2	N
SIS_DUMP_TC_C	1228	6	5	ZMI00300	MARSIS-Dump Mem: EEPROM C-C	N
	1228	6	5	ZMI00310	MARSIS-Dump Mem: Prog. RAM C-C	N
	1228	6	5	ZMI00320	MARSIS-Dump Mem: Data RAM C-C	N
SIS_MOD_TR_DIS_TC	1228	207	1	ZMI00500	MARSIS-Disable Mode Transition	N
SIS_OST_TC	1228	206	1	ZMI00400	MARSIS-Load OST	Y
	1228	206	1	ZMIX0401	MARSIS OST - Load 1 Row	N
	1228	206	1	ZMIX0402	MARSIS OST - Load 2 Row	N
	1228	206	1	ZMIX0403	MARSIS OST - Load 4 Row	N
	1228	206	1	ZMIX0404	MARSIS OST - Load 8 Row	N
	1228	206	1	ZMIX0405	MARSIS OST - Load 16 Row	N
SIS_PATCH	1276	6	2	ZMIX0233	MARSIS-Load Mem: Flash Bk0 Timing OBSM	Y
	1276	6	2	ZMIX0234	MARSIS-Load Mem: Flash Bk1 Timing OBSM	Y
SIS_PATCH_1	1244	6	2	ZMI00201	MARSIS-Load Mem: EEPROM DSP1	Y
	1244	6	2	ZMI00211	MARSIS-Load Mem: Prog. RAM DSP1	Y
	1244	6	2	ZMI00221	MARSIS-Load Mem: Data RAM DSP1	Y
	1244	6	2	ZMI00231	MARSIS-Load Mem: dual-port SRAM DSP1	Y

	1244	6	2	ZMIX0201	MARSIS-Load Mem: EEPROM DSP1 OBSM	Y
	1244	6	2	ZMIX0211	MARSIS-Load Mem: Prog. RAM DSP1 OBSM	Y
	1244	6	2	ZMIX0221	MARSIS-Load Mem: Data RAM DSP1 OBSM	Y
	1244	6	2	ZMIX0231	MARSIS-Load Mem:dual-port SRAM DSP1 OBSM	Y
SIS_PATCH_2	**1260**	6	2	ZMI00202	MARSIS-Load Mem: EEPROM DSP2	Y
	1260	6	2	ZMI00212	MARSIS-Load Mem: Prog. RAM DSP2	Y
	1260	6	2	ZMI00222	MARSIS-Load Mem: Data RAM DSP2	Y
	1260	6	2	ZMI00232	MARSIS-Load Mem: dual-port SRAM DSP2	Y
	1260	6	2	ZMIX0202	MARSIS-Load Mem: EEPROM DSP2 OBSM	Y
	1260	6	2	ZMIX0212	MARSIS-Load Mem: Prog. RAM DSP2 OBSM	Y
	1260	6	2	ZMIX0222	MARSIS-Load Mem: Data RAM DSP2 OBSM	Y
	1260	6	2	ZMIX0232	MARSIS-Load Mem:dual-port SRAM DSP2 OBSM	Y
SIS_PATCH_C	**1228**	6	2	ZMI00200	MARSIS-Load Mem: EEPROM C-C	Y
	1228	6	2	ZMI00210	MARSIS-Load Mem: Prog. RAM C-C	Y
	1228	6	2	ZMI00220	MARSIS-Load Mem: Data RAM C-C	Y
	1228	6	2	ZMIX0200	MARSIS-Load Mem: EEPROM C-C OBSM	Y
	1228	6	2	ZMIX0210	MARSIS-Load Mem: Prog. RAM C-C OBSM	Y
	1228	6	2	ZMIX0220	MARSIS-Load Mem: Data RAM C-C OBSM	Y
SIS_PT_TC	**1228**	206	2	ZMI00410	MARSIS-Load PT	Y
	1228	206	2	ZMIX0411	MI PT SCET Start Ops	Y
	1228	206	2	ZMIX0412	MI PT Boot Patchable Mem	Y
	1228	206	2	ZMIX0413	MI PT - Load 1 Value	Y
	1228	206	2	ZMIX0414	MI PT - Load 2 Value	Y
	1228	206	2	ZMIX0415	MI PT - Load 4 Value	Y
	1228	206	2	ZMIX0416	MI PT - Load 8 Value	Y
	1228	206	2	ZMIX0417	MI PT - Load 16 Value	Y
	1228	206	2	ZMIX0418	MI PT - Load 48bit	Y
	1228	206	2	ZMIX04xx	MI PT Master PM Reboot	Y
	1228	206	2	ZMIX04xx	MI PT Flash Mem Test	Y
	1228	206	2	ZMIX04xx	MI PT Flash Mem Erase	Y
	1244	206	2	ZMI00411	MARSIS-Load PT on DSP1	Y
	1244	206	2	ZMIX0419	MI PT DSP1-Load 1 Value	Y
	1244	206	2	ZMIX0420	MI PT DSP1-Load 2 Value	Y
	1244	206	2	ZMIX0421	MI PT DSP1-Load 4 Value	Y
	1244	206	2	ZMIX0422	MI PT DSP1-Load 8 Value	Y
	1244	206	2	ZMIX0423	MI PT DSP1-Load 16 Value	Y
	1244	206	2	ZMIX0424	MI PT DSP1-Load 48bit	Y
	1260	206	2	ZMI00412	MARSIS-Load PT on DSP2	Y
	1260	206	2	ZMIX0425	MI PT DSP2-Load 1 Value	Y

	1260	206	2	ZMIX0426	MI PT DSP2-Load 2 Value	Y
	1260	206	2	ZMIX0427	MI PT DSP2-Load 4 Value	Y
	1260	206	2	ZMIX0428	MI PT DSP2-Load 8 Value	Y
	1260	206	2	ZMIX0429	MI PT DSP2-Load 16 Value	Y
	1260	206	2	ZMIX0430	MI PT DSP2-Load 48 bit	Y
SIS_TIME_UP	**1228**	9	1	ZMI00350	MARSIS-Accept Time Update	N
SYS_HK_DIS	**1228**	3	6	ZMI00110	MARSIS-Disable HK Report Pckt Generation	N
SYS_HK_EN	**1228**	3	5	ZMI00100	MARSIS-Enable HK Packet Generation	N

MARSIS-related S/C Packet Telecommands

Name	Description	Cr	APID	T	S
ZAC02047	AOCMS-Set MARSIS Antenna Deployement	Y	188	172	10
ZDM01268	DMS-Req MARSIS-1 Connection Test	N	28	17	3
ZDM01269	DMS-Req MARSIS-2 Connection Test	N	28	17	3
ZDM01270	DMS-Req MARSIS-3 Connection Test	N	28	17	3
ZDM02606	DMS-Set MARSIS antenna deploymt status f	Y	28	139	170
ZDMX1204	MI Enable TC link	Y	28	16	3
ZDMX1214	MI Disable TC link	Y	28	16	3
ZDMX1224	MI Nom Branch data Tr	Y	28	16	1
ZDMX1234	MI Red Branch data Tr	Y	28	16	1
ZDMX1244	MI Enable TM Polling	Y	28	16	2
ZDMX1254	MI Disable TM Polling	Y	28	16	2
ZDMX1264	MI Connection Test	N	28	17	3
ZDMX1404	MI Start time update	Y	28	9	2
ZDMX1414	MI Stop Time Update	Y	28	9	3
ZMI02600	MARSIS HTR OFF (Nom.)	N	28	2	1
ZMI02601	MARSIS DES ON (Nom.)	Y	28	2	1
ZMI02602	MARSIS DES OFF (Nom.)	N	28	2	1
ZMI02603	MARSIS PWR ON (Nom.)	N	28	2	1
ZMI02604	MARSIS PWR OFF (Nom.)	N	28	2	1
ZMI02605	MARSIS HTR ON (Nom.)	N	28	2	1
ZMIR2600	MARSIS HTR OFF (Red)	N	28	2	1
ZMIR2601	MARSIS DES ON (Red)	Y	28	2	1
ZMIR2602	MARSIS DES OFF (Red)	N	28	2	1
ZMIR2603	MARSIS PWR ON (Red)	N	28	2	1
ZMIR2604	MARSIS PWR OFF (Red)	N	28	2	1
ZMIR2605	MARSIS HTR ON (Red)	N	28	2	1
ZPWM2020	MARSIS + X Dipole (Parm 4 PYRO_1B OFF_N)	N	28	2	2
ZPWM2021	MARSIS - X Dipole (Parm 4 PYRO_2B OFF_N)	N	28	2	2
ZPWM2052	MARSIS A (LCL_16A OFF_N)	N	28	2	2
ZPWM2053	MARSIS + X Dipole (Parm 4 PYRO_1A OFF_N)	N	28	2	2
ZPWM2056	MARSIS - X Dipole (Parm 4 PYRO_2A OFF_N)	N	28	2	2
ZPWM2084	MARSIS + X Dipole (Parm 4 PYRO_1A ON_N)	N	28	2	2
ZPWM2085	MARSIS - X Dipole (Parm 4 PYRO_2A ON_N)	N	28	2	2
ZPWM2116	MARSIS + X Dipole (Parm 4 PYRO_1B ON_N)	N	28	2	2
ZPWM2117	MARSIS - X Dipole (Parm 4 PYRO_2B ON_N)	N	28	2	2
ZPWM2174	MARSIS Z Monopole (Parm 4 PYRO_3B OFF_N)	N	28	2	2
ZPWM2180	MARSIS A (LCL_16A Sel Profile_N)	N	28	2	2
ZPWM2219	MARSIS B (LCL_31A Sel Profile_N)	N	28	2	2
ZPWM2252	MARSIS Z Monopole (Parm 4 PYRO_3A ON_N)	N	28	2	2
ZPWM2258	MARSIS A (LCL_16A ON_N)	N	28	2	2
ZPWM2297	MARSIS B (LCL_31A ON_N)	N	28	2	2
ZPWM2332	MARSIS Z Monopole (Parm 4 PYRO_3B ON_N)	N	28	2	2
ZPWM2339	MARSIS B (LCL_31A OFF_N)	N	28	2	2
ZPWM2381	MARSIS Z Monopole (Parm 4 PYRO_3A OFF_N)	N	28	2	2
ZPWM2520	MARSIS + X Dipole (Parm 4 PYRO_1B OFF_R)	N	28	2	2
ZPWM2521	MARSIS - X Dipole (Parm 4 PYRO_2B OFF_R)	N	28	2	2
ZPWM2552	MARSIS A (LCL_16A OFF_R)	N	28	2	2
ZPWM2553	MARSIS + X Dipole (Parm 4 PYRO_1A OFF_R)	N	28	2	2
ZPWM2556	MARSIS - X Dipole (Parm 4 PYRO_2A OFF_R)	N	28	2	2
ZPWM2584	MARSIS + X Dipole (Parm 4 PYRO_1A ON_R)	N	28	2	2
ZPWM2585	MARSIS - X Dipole (Parm 4 PYRO_2A ON_R)	N	28	2	2

ZPWM2616	MARSIS + X Dipole (Parm 4 PYRO_1B ON_R)	N	**28**	2	2
ZPWM2617	MARSIS - X Dipole (Parm 4 PYRO_2B ON_R)	N	**28**	2	2
ZPWM2674	MARSIS Z Monopole (Parm 4 PYRO_3B OFF_R)	N	**28**	2	2
ZPWM2680	MARSIS A (LCL_16A Sel Profile_R)	N	**28**	2	2
ZPWM2719	MARSIS B (LCL_31A Sel Profile_R)	N	**28**	2	2
ZPWM2752	MARSIS Z Monopole (Parm 4 PYRO_3A ON_R)	N	**28**	2	2
ZPWM2758	MARSIS A (LCL_16A ON_R)	N	**28**	2	2
ZPWM2797	MARSIS B (LCL_31A ON_R)	N	**28**	2	2
ZPWM2832	MARSIS Z Monopole (Parm 4 PYRO_3B ON_R)	N	**28**	2	2
ZPWM2839	MARSIS B (LCL_31A OFF_R)	N	**28**	2	2
ZPWM2881	MARSIS Z Monopole (Parm 4 PYRO_3A OFF_R)	N	**28**	2	2

9.3.2. MARSIS Packet TC Parameters

9.3.2.1 Parameters definition

TC Name	APID	T	S	Parameter	Par Name	Off_bit	Grp
ZMI00100	1228	3	5	SID	FMI00001	0008	0
ZMI00110	1228	3	6	SID	FMI00001	0008	0
ZMI00200	1228	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	5
ZMI00200	1228	6	2	Start Address: EEPROM	FMI00004	0016	0
ZMI00200	1228	6	2	Length of Block	FMI00010	0048	3
ZMI00200	1228	6	2	Data, MSW	FMI00013	0064	0
ZMI00200	1228	6	2	Data, Middle W	FMI00012	0080	0
ZMI00200	1228	6	2	Data, LSW	FMI00011	0096	0
ZMI00201	1244	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	5
ZMI00201	1244	6	2	Start Address: EEPROM	FMI00004	0016	0
ZMI00201	1244	6	2	Length of Block	FMI00010	0048	3
ZMI00201	1244	6	2	Data, MSW	FMI00013	0064	0
ZMI00201	1244	6	2	Data, Middle W	FMI00012	0080	0
ZMI00201	1244	6	2	Data, LSW	FMI00011	0096	0
ZMI00202	1260	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	5
ZMI00202	1260	6	2	Start Address: EEPROM	FMI00004	0016	0
ZMI00202	1260	6	2	Length of Block	FMI00010	0048	3
ZMI00202	1260	6	2	Data, MSW	FMI00013	0064	0
ZMI00202	1260	6	2	Data, Middle W	FMI00012	0080	0
ZMI00202	1260	6	2	Data, LSW	FMI00011	0096	0
ZMI00210	1228	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	5
ZMI00210	1228	6	2	Start Address: Prog. RAM	FMI00005	0016	0
ZMI00210	1228	6	2	Length of Block	FMI00010	0048	3
ZMI00210	1228	6	2	Data, MSW	FMI00013	0064	0
ZMI00210	1228	6	2	Data, Middle W	FMI00012	0080	0
ZMI00210	1228	6	2	Data, LSW	FMI00011	0096	0
ZMI00211	1244	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	5
ZMI00211	1244	6	2	Start Address: Prog. RAM	FMI00005	0016	0
ZMI00211	1244	6	2	Length of Block	FMI00010	0048	3
ZMI00211	1244	6	2	Data, MSW	FMI00013	0064	0
ZMI00211	1244	6	2	Data, Middle W	FMI00012	0080	0
ZMI00211	1244	6	2	Data, LSW	FMI00011	0096	0
ZMI00212	1260	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	5
ZMI00212	1260	6	2	Start Address: Prog. RAM	FMI00005	0016	0
ZMI00212	1260	6	2	Length of Block	FMI00010	0048	3
ZMI00212	1260	6	2	Data, MSW	FMI00013	0064	0
ZMI00212	1260	6	2	Data, Middle W	FMI00012	0080	0
ZMI00212	1260	6	2	Data, LSW	FMI00011	0096	0

ZMI00220	1228	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	4
ZMI00220	1228	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMI00220	1228	6	2	Length of Block	FMI00010	0048	2
ZMI00220	1228	6	2	Data, MSW	FMI00013	0064	0
ZMI00220	1228	6	2	Data, LSW	FMI00011	0080	0

ZMI00221	1244	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	4
ZMI00221	1244	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMI00221	1244	6	2	Length of Block	FMI00010	0048	2
ZMI00221	1244	6	2	Data, MSW	FMI00013	0064	0
ZMI00221	1244	6	2	Data, LSW	FMI00011	0080	0

ZMI00222	1260	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	4
ZMI00222	1260	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMI00222	1260	6	2	Length of Block	FMI00010	0048	2
ZMI00222	1260	6	2	Data, MSW	FMI00013	0064	0
ZMI00222	1260	6	2	Data, LSW	FMI00011	0080	0

ZMI00231	1244	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	3
ZMI00231	1244	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMI00231	1244	6	2	Length of Block	FMI00010	0048	1
ZMI00231	1244	6	2	Data, LSW	FMI00011	0064	0

ZMI00232	1260	6	2	N: Repeat Counter, 1 byt	FMI00003	0008	3
ZMI00232	1260	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMI00232	1260	6	2	Length of Block	FMI00010	0048	1
ZMI00232	1260	6	2	Data, LSW	FMI00011	0064	0

ZMI00300	1228	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00300	1228	6	5	Start Address: EEPROM	FMI00004	0016	0
ZMI00300	1228	6	5	Length of Block	FMI00010	0048	0

ZMI00301	1244	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00301	1244	6	5	Start Address: EEPROM	FMI00004	0016	0
ZMI00301	1244	6	5	Length of Block	FMI00010	0048	0

ZMI00302	1260	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00302	1260	6	5	Start Address: EEPROM	FMI00004	0016	0
ZMI00302	1260	6	5	Length of Block	FMI00010	0048	0

ZMI00310	1228	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00310	1228	6	5	Start Address: Prog. RAM	FMI00005	0016	0
ZMI00310	1228	6	5	Length of Block	FMI00010	0048	0

ZMI00311	1244	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00311	1244	6	5	Start Address: Prog. RAM	FMI00005	0016	0
ZMI00311	1244	6	5	Length of Block	FMI00010	0048	0

ZMI00312	1260	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00312	1260	6	5	Start Address: Prog. RAM	FMI00005	0016	0
ZMI00312	1260	6	5	Length of Block	FMI00010	0048	0

ZMI00320	1228	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00320	1228	6	5	Start Address: Data RAM	FMI00006	0016	0

ZMI00320	1228	6	5	Length of Block	FMI00010	0048	0
ZMI00321	1244	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00321	1244	6	5	Start Address: Data RAM	FMI00006	0016	0
ZMI00321	1244	6	5	Length of Block	FMI00010	0048	0
ZMI00322	1260	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00322	1260	6	5	Start Address: Data RAM	FMI00006	0016	0
ZMI00322	1260	6	5	Length of Block	FMI00010	0048	0
ZMI00331	1244	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00331	1244	6	5	Start Address: Flash or	FMI00007	0016	0
ZMI00331	1244	6	5	Length of Block	FMI00010	0048	0
ZMI00332	1260	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00332	1260	6	5	Start Address: Flash or	FMI00007	0016	0
ZMI00332	1260	6	5	Length of Block	FMI00010	0048	0
ZMI00333	1276	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00333	1276	6	5	Start Address: Flash or	FMI00007	0016	0
ZMI00333	1276	6	5	Length of Block	FMI00010	0048	0
ZMI00334	1276	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00334	1276	6	5	Start Address: Flash or	FMI00007	0016	0
ZMI00334	1276	6	5	Length of Block	FMI00010	0048	0
ZMI00335	1276	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00335	1276	6	5	Start Address: Flash or	FMI00007	0016	0
ZMI00335	1276	6	5	Length of Block	FMI00010	0048	0
ZMI00336	1276	6	5	N: Repeat Counter, 1 byt	FMI00003	0008	2
ZMI00336	1276	6	5	Start Address: Flash or	FMI00007	0016	0
ZMI00336	1276	6	5	Length of Block	FMI00010	0048	0
ZMI00350	1228	9	1	Onboard Time at Next TBP	FMI00015	0000	0
ZMI00400	1228	206	1	N: Repeat Counter, 1 byt	FMI00003	0008	5
ZMI00400	1228	206	1	Start Address: Prog. RAM	FMI00005	0016	0
ZMI00400	1228	206	1	Length of Block	FMI00010	0048	3
ZMI00400	1228	206	1	Data, MSW	FMI00013	0064	0
ZMI00400	1228	206	1	Data, Middle W	FMI00012	0080	0
ZMI00400	1228	206	1	Data, LSW	FMI00011	0096	0
ZMI00410	1228	206	2	N: Repeat Counter, 1 byt	FMI00003	0008	5
ZMI00410	1228	206	2	Start Address: Prog. RAM	FMI00005	0016	0
ZMI00410	1228	206	2	Length of Block	FMI00010	0048	3
ZMI00410	1228	206	2	Data, MSW	FMI00013	0064	0
ZMI00410	1228	206	2	Data, Middle W	FMI00012	0080	0
ZMI00410	1228	206	2	Data, LSW	FMI00011	0096	0
ZMI00411	1244	206	2	N: Repeat Counter, 1 byt	FMI00003	0008	5
ZMI00411	1244	206	2	Start Address: Prog. RAM	FMI00005	0016	0
ZMI00411	1244	206	2	Length of Block	FMI00010	0048	3
ZMI00411	1244	206	2	Data, MSW	FMI00013	0064	0
ZMI00411	1244	206	2	Data, Middle W	FMI00012	0080	0

ZMI00411	1244	206	2	Data, LSW	FMI00011	0096	0

ZMI00412	1260	206	2	N: Repeat Counter, 1 byt	FMI00003	0008	5
ZMI00412	1260	206	2	Start Address: Prog. RAM	FMI00005	0016	0
ZMI00412	1260	206	2	Length of Block	FMI00010	0048	3
ZMI00412	1260	206	2	Data, MSW	FMI00013	0064	0
ZMI00412	1260	206	2	Data, Middle W	FMI00012	0080	0
ZMI00412	1260	206	2	Data, LSW	FMI00011	0096	0

ZMI00500	1228	207	1	Standby Duration in Sec	FMID0001	0000	0
ZMI00500	1228	207	1	Standby Duration Fractio	FMID0002	0032	0

ZMI00510	1228	207	2	Forced Mode Transition	FMI00021	0000	0

ZMIX0200	1228	6	2	Start Address: EEPROM	FMI00004	0016	0
ZMIX0200	1228	6	2	Length of Block	FMI00010	0048	0
ZMIX0200	1228	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0201	1244	6	2	Start Address: EEPROM	FMI00004	0016	0
ZMIX0201	1244	6	2	Length of Block	FMI00010	0048	0
ZMIX0201	1244	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0202	1260	6	2	Start Address: EEPROM	FMI00004	0016	0
ZMIX0202	1260	6	2	Length of Block	FMI00010	0048	0
ZMIX0202	1260	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0210	1228	6	2	Start Address: Prog. RAM	FMI00005	0016	0
ZMIX0210	1228	6	2	Length of Block	FMI00010	0048	0
ZMIX0210	1228	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0211	1244	6	2	Start Address: Prog. RAM	FMI00005	0016	0
ZMIX0211	1244	6	2	Length of Block	FMI00010	0048	0
ZMIX0211	1244	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0212	1260	6	2	Start Address: Prog. RAM	FMI00005	0016	0
ZMIX0212	1260	6	2	Length of Block	FMI00010	0048	0
ZMIX0212	1260	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0220	1228	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMIX0220	1228	6	2	Length of Block	FMI00010	0048	0
ZMIX0220	1228	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0221	1244	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMIX0221	1244	6	2	Length of Block	FMI00010	0048	0
ZMIX0221	1244	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0222	1260	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMIX0222	1260	6	2	Length of Block	FMI00010	0048	0
ZMIX0222	1260	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0231	1244	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMIX0231	1244	6	2	Length of Block	FMI00010	0048	0
ZMIX0231	1244	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0232	1260	6	2	Start Address: Data RAM	FMI00006	0016	0

ZMIX0232	1260	6	2	Length of Block	FMI00010	0048	0
ZMIX0232	1260	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0233	1276	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMIX0233	1276	6	2	Length of Block	FMI00010	0048	0
ZMIX0233	1276	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0234	1276	6	2	Start Address: Data RAM	FMI00006	0016	0
ZMIX0234	1276	6	2	Length of Block	FMI00010	0048	0
ZMIX0234	1276	6	2	DataWORD 48 bits for OBS	FMIX0048	0064	0

ZMIX0401	1228	206	1	OST Rel. Start Addr.	FMIX1003	0016	0
ZMIX0401	1228	206	1	R1[8-31] Mode Duration	FMIX1100	0072	0
ZMIX0401	1228	206	1	R1[34-41] Mode&DCG Sel.	FMIX1101	0098	0
ZMIX0401	1228	206	1	R1[42-47] PIS Band Sel.	FMIX1102	0106	0
ZMIX0401	1228	206	1	R1[48-59] Radar Param.	FMIX1103	0112	0
ZMIX0401	1228	206	1	R1[60-63] TX Power	FMIX1104	0124	0
ZMIX0401	1228	206	1	R1[64-75] A2_0 Abscissa	FMIX1105	0128	0
ZMIX0401	1228	206	1	R1[76-79] Ind.Ech/F.Mem	FMIX1106	0140	0
ZMIX0401	1228	206	1	R1[80-95] F.Mem Frames	FMIX1107	0144	0

ZMIX0402	1228	206	1	OST Rel. Start Addr.	FMIX2003	0016	0
ZMIX0402	1228	206	1	R1[8-31] Mode Duration	FMIX2100	0072	0
ZMIX0402	1228	206	1	R1[34-41] Mode&DCG Sel.	FMIX2101	0098	0
ZMIX0402	1228	206	1	R1[42-47] PIS Band Sel.	FMIX2102	0106	0
ZMIX0402	1228	206	1	R1[48-59] Radar Param.	FMIX2103	0112	0
ZMIX0402	1228	206	1	R1[60-63] TX Power	FMIX2104	0124	0
ZMIX0402	1228	206	1	R1[64-75] A2_0 Abscissa	FMIX2105	0128	0
ZMIX0402	1228	206	1	R1[76-79] Ind.Ech/F.Mem	FMIX2106	0140	0
ZMIX0402	1228	206	1	R1[80-95] F.Mem Frames	FMIX2107	0144	0
ZMIX0402	1228	206	1	R2[8-31] Mode Duration	FMIX2200	0168	0
ZMIX0402	1228	206	1	R2[34-41] Mode&DCG Sel.	FMIX2201	0194	0
ZMIX0402	1228	206	1	R2[42-47] PIS Band Sel.	FMIX2202	0202	0
ZMIX0402	1228	206	1	R2[48-59] Radar Param.	FMIX2203	0208	0
ZMIX0402	1228	206	1	R2[60-63] TX Power	FMIX2204	0220	0
ZMIX0402	1228	206	1	R2[64-75] A2_0 Abscissa	FMIX2205	0224	0
ZMIX0402	1228	206	1	R2[76-79] Ind.Ech/F.Mem	FMIX2206	0236	0
ZMIX0402	1228	206	1	R2[80-95] F.Mem Frames	FMIX2207	0240	0
ZMIX0403	1228	206	1	OST Rel. Start Addr.	FMIX4003	0016	0

ZMIX0403	1228	206	1	R1[8-31] Mode Duration	FMIX4100	0072	0
ZMIX0403	1228	206	1	R1[34-41] Mode&DCG Sel.	FMIX4101	0098	0
ZMIX0403	1228	206	1	R1[42-47] PIS Band Sel.	FMIX4102	0106	0
ZMIX0403	1228	206	1	R1[48-59] Radar Param.	FMIX4103	0112	0
ZMIX0403	1228	206	1	R1[60-63] TX Power	FMIX4104	0124	0
ZMIX0403	1228	206	1	R1[64-75] A2_0 Abscissa	FMIX4105	0128	0
ZMIX0403	1228	206	1	R1[76-79] Ind.Ech/F.Mem	FMIX4106	0140	0
ZMIX0403	1228	206	1	R1[80-95] F.Mem Frames	FMIX4107	0144	0
ZMIX0403	1228	206	1	R2[8-31] Mode Duration	FMIX4200	0168	0
ZMIX0403	1228	206	1	R2[34-41] Mode&DCG Sel.	FMIX4201	0194	0
ZMIX0403	1228	206	1	R2[42-47] PIS Band Sel.	FMIX4202	0202	0
ZMIX0403	1228	206	1	R2[48-59] Radar Param.	FMIX4203	0208	0
ZMIX0403	1228	206	1	R2[60-63] TX Power	FMIX4204	0220	0
ZMIX0403	1228	206	1	R2[64-75] A2_0 Abscissa	FMIX4205	0224	0
ZMIX0403	1228	206	1	R2[76-79] Ind.Ech/F.Mem	FMIX4206	0236	0

ZMIX0403	1228	206	1	R2[80-95] F.Mem Frames	FMIX4207	0240	0
ZMIX0403	1228	206	1	R3[8-31] Mode Duration	FMIX4300	0264	0
ZMIX0403	1228	206	1	R3[34-41] Mode&DCG Sel.	FMIX4301	0290	0
ZMIX0403	1228	206	1	R3[42-47] PIS Band Sel.	FMIX4302	0298	0
ZMIX0403	1228	206	1	R3[48-59] Radar Param.	FMIX4303	0304	0
ZMIX0403	1228	206	1	R3[60-63] TX Power	FMIX4304	0316	0
ZMIX0403	1228	206	1	R3[64-75] A2_0 Abscissa	FMIX4305	0320	0
ZMIX0403	1228	206	1	R3[76-79] Ind.Ech/F.Mem	FMIX4306	0332	0
ZMIX0403	1228	206	1	R3[80-95] F.Mem Frames	FMIX4307	0336	0
ZMIX0403	1228	206	1	R4[8-31] Mode Duration	FMIX4400	0360	0
ZMIX0403	1228	206	1	R4[34-41] Mode&DCG Sel.	FMIX4401	0386	0
ZMIX0403	1228	206	1	R4[42-47] PIS Band Sel.	FMIX4402	0394	0
ZMIX0403	1228	206	1	R4[48-59] Radar Param.	FMIX4403	0400	0
ZMIX0403	1228	206	1	R4[60-63] TX Power	FMIX4404	0412	0
ZMIX0403	1228	206	1	R4[64-75] A2_0 Abscissa	FMIX4405	0416	0
ZMIX0403	1228	206	1	R4[76-79] Ind.Ech/F.Mem	FMIX4406	0428	0
ZMIX0403	1228	206	1	R4[80-95] F.Mem Frames	FMIX4407	0432	0

ZMIX0404	1228	206	1	OST Rel. Start Addr.	FMIX8003	0016	0
ZMIX0404	1228	206	1	R1[8-31] Mode Duration	FMIX8100	0072	0
ZMIX0404	1228	206	1	R1[34-41] Mode&DCG Sel.	FMIX8101	0098	0
ZMIX0404	1228	206	1	R1[42-47] PIS Band Sel.	FMIX8102	0106	0
ZMIX0404	1228	206	1	R1[48-59] Radar Param.	FMIX8103	0112	0
ZMIX0404	1228	206	1	R1[60-63] TX Power	FMIX8104	0124	0
ZMIX0404	1228	206	1	R1[64-75] A2_0 Abscissa	FMIX8105	0128	0
ZMIX0404	1228	206	1	R1[76-79] Ind.Ech/F.Mem	FMIX8106	0140	0
ZMIX0404	1228	206	1	R1[80-95] F.Mem Frames	FMIX8107	0144	0
ZMIX0404	1228	206	1	R2[8-31] Mode Duration	FMIX8200	0168	0
ZMIX0404	1228	206	1	R2[34-41] Mode&DCG Sel.	FMIX8201	0194	0
ZMIX0404	1228	206	1	R2[42-47] PIS Band Sel.	FMIX8202	0202	0
ZMIX0404	1228	206	1	R2[48-59] Radar Param.	FMIX8203	0208	0
ZMIX0404	1228	206	1	R2[60-63] TX Power	FMIX8204	0220	0
ZMIX0404	1228	206	1	R2[64-75] A2_0 Abscissa	FMIX8205	0224	0
ZMIX0404	1228	206	1	R2[76-79] Ind.Ech/F.Mem	FMIX8206	0236	0
ZMIX0404	1228	206	1	R2[80-95] F.Mem Frames	FMIX8207	0240	0
ZMIX0404	1228	206	1	R3[8-31] Mode Duration	FMIX8300	0264	0
ZMIX0404	1228	206	1	R3[34-41] Mode&DCG Sel.	FMIX8301	0290	0
ZMIX0404	1228	206	1	R3[42-47] PIS Band Sel.	FMIX8302	0298	0
ZMIX0404	1228	206	1	R3[48-59] Radar Param.	FMIX8303	0304	0
ZMIX0404	1228	206	1	R3[60-63] TX Power	FMIX8304	0316	0
ZMIX0404	1228	206	1	R3[64-75] A2_0 Abscissa	FMIX8305	0320	0
ZMIX0404	1228	206	1	R3[76-79] Ind.Ech/F.Mem	FMIX8306	0332	0
ZMIX0404	1228	206	1	R3[80-95] F.Mem Frames	FMIX8307	0336	0
ZMIX0404	1228	206	1	R4[8-31] Mode Duration	FMIX8400	0360	0
ZMIX0404	1228	206	1	R4[34-41] Mode&DCG Sel.	FMIX8401	0386	0
ZMIX0404	1228	206	1	R4[42-47] PIS Band Sel.	FMIX8402	0394	0
ZMIX0404	1228	206	1	R4[48-59] Radar Param.	FMIX8403	0400	0
ZMIX0404	1228	206	1	R4[60-63] TX Power	FMIX8404	0412	0
ZMIX0404	1228	206	1	R4[64-75] A2_0 Abscissa	FMIX8405	0416	0
ZMIX0404	1228	206	1	R4[76-79] Ind.Ech/F.Mem	FMIX8406	0428	0
ZMIX0404	1228	206	1	R4[80-95] F.Mem Frames	FMIX8407	0432	0
ZMIX0404	1228	206	1	R5[8-31] Mode Duration	FMIX8500	0456	0
ZMIX0404	1228	206	1	R5[34-41] Mode&DCG Sel.	FMIX8501	0482	0
ZMIX0404	1228	206	1	R5[42-47] PIS Band Sel.	FMIX8502	0490	0
ZMIX0404	1228	206	1	R5[48-59] Radar Param.	FMIX8503	0496	0

ZMIX0404	1228	206	1	R5[60-63] TX Power	FMIX8504	0508	0
ZMIX0404	1228	206	1	R5[64-75] A2_0 Abscissa	FMIX8505	0512	0
ZMIX0404	1228	206	1	R5[76-79] Ind.Ech/F.Mem	FMIX8506	0524	0
ZMIX0404	1228	206	1	R5[80-95] F.Mem Frames	FMIX8507	0528	0
ZMIX0404	1228	206	1	R6[8-31] Mode Duration	FMIX8600	0552	0
ZMIX0404	1228	206	1	R6[34-41] Mode&DCG Sel.	FMIX8601	0578	0
ZMIX0404	1228	206	1	R6[42-47] PIS Band Sel.	FMIX8602	0586	0
ZMIX0404	1228	206	1	R6[48-59] Radar Param.	FMIX8603	0592	0
ZMIX0404	1228	206	1	R6[60-63] TX Power	FMIX8604	0604	0
ZMIX0404	1228	206	1	R6[64-75] A2_0 Abscissa	FMIX8605	0608	0
ZMIX0404	1228	206	1	R6[76-79] Ind.Ech/F.Mem	FMIX8606	0620	0
ZMIX0404	1228	206	1	R6[80-95] F.Mem Frames	FMIX8607	0624	0
ZMIX0404	1228	206	1	R7[8-31] Mode Duration	FMIX8700	0648	0
ZMIX0404	1228	206	1	R7[34-41] Mode&DCG Sel.	FMIX8701	0674	0
ZMIX0404	1228	206	1	R7[42-47] PIS Band Sel.	FMIX8702	0682	0
ZMIX0404	1228	206	1	R7[48-59] Radar Param.	FMIX8703	0688	0
ZMIX0404	1228	206	1	R7[60-63] TX Power	FMIX8704	0700	0
ZMIX0404	1228	206	1	R7[64-75] A2_0 Abscissa	FMIX8705	0704	0
ZMIX0404	1228	206	1	R7[76-79] Ind.Ech/F.Mem	FMIX8706	0716	0
ZMIX0404	1228	206	1	R7[80-95] F.Mem Frames	FMIX8707	0720	0
ZMIX0404	1228	206	1	R8[8-31] Mode Duration	FMIX8800	0744	0
ZMIX0404	1228	206	1	R8[34-41] Mode&DCG Sel.	FMIX8801	0770	0
ZMIX0404	1228	206	1	R8[42-47] PIS Band Sel.	FMIX8802	0778	0
ZMIX0404	1228	206	1	R8[48-59] Radar Param.	FMIX8803	0784	0
ZMIX0404	1228	206	1	R8[60-63] TX Power	FMIX8804	0796	0
ZMIX0404	1228	206	1	R8[64-75] A2_0 Abscissa	FMIX8805	0800	0
ZMIX0404	1228	206	1	R8[76-79] Ind.Ech/F.Mem	FMIX8806	0812	0
ZMIX0404	1228	206	1	R8[80-95] F.Mem Frames	FMIX8807	0816	0

ZMIX0405	1228	206	1	OST Rel. Start Addr.	FMIX0003	0016	0
ZMIX0405	1228	206	1	R1[8-31] Mode Duration	FMIX0100	0072	0
ZMIX0405	1228	206	1	R1[34-41] Mode&DCG Sel.	FMIX0101	0098	0
ZMIX0405	1228	206	1	R1[42-47] PIS Band Sel.	FMIX0102	0106	0
ZMIX0405	1228	206	1	R1[48-59] Radar Param.	FMIX0103	0112	0
ZMIX0405	1228	206	1	R1[60-63] TX Power	FMIX0104	0124	0
ZMIX0405	1228	206	1	R1[64-75] A2_0 Abscissa	FMIX0105	0128	0
ZMIX0405	1228	206	1	R1[76-79] Ind.Ech/F.Mem	FMIX0106	0140	0
ZMIX0405	1228	206	1	R1[80-95] F.Mem Frames	FMIX0107	0144	0
ZMIX0405	1228	206	1	R2[8-31] Mode Duration	FMIX0200	0168	0
ZMIX0405	1228	206	1	R2[34-41] Mode&DCG Sel.	FMIX0201	0194	0
ZMIX0405	1228	206	1	R2[42-47] PIS Band Sel.	FMIX0202	0202	0
ZMIX0405	1228	206	1	R2[48-59] Radar Param.	FMIX0203	0208	0
ZMIX0405	1228	206	1	R2[60-63] TX Power	FMIX0204	0220	0
ZMIX0405	1228	206	1	R2[64-75] A2_0 Abscissa	FMIX0205	0224	0
ZMIX0405	1228	206	1	R2[76-79] Ind.Ech/F.Mem	FMIX0206	0236	0
ZMIX0405	1228	206	1	R2[80-95] F.Mem Frames	FMIX0207	0240	0
ZMIX0405	1228	206	1	R3[8-31] Mode Duration	FMIX0300	0264	0
ZMIX0405	1228	206	1	R3[34-41] Mode&DCG Sel.	FMIX0301	0290	0
ZMIX0405	1228	206	1	R3[42-47] PIS Band Sel.	FMIX0302	0298	0
ZMIX0405	1228	206	1	R3[48-59] Radar Param.	FMIX0303	0304	0
ZMIX0405	1228	206	1	R3[60-63] TX Power	FMIX0304	0316	0
ZMIX0405	1228	206	1	R3[64-75] A2_0 Abscissa	FMIX0305	0320	0
ZMIX0405	1228	206	1	R3[76-79] Ind.Ech/F.Mem	FMIX0306	0332	0
ZMIX0405	1228	206	1	R3[80-95] F.Mem Frames	FMIX0307	0336	0
ZMIX0405	1228	206	1	R4[8-31] Mode Duration	FMIX0400	0360	0

ZMIX0405	1228	206	1	R4[34-41] Mode&DCG Sel.	FMIX0401	0386	0
ZMIX0405	1228	206	1	R4[42-47] PIS Band Sel.	FMIX0402	0394	0
ZMIX0405	1228	206	1	R4[48-59] Radar Param.	FMIX0403	0400	0
ZMIX0405	1228	206	1	R4[60-63] TX Power	FMIX0404	0412	0
ZMIX0405	1228	206	1	R4[64-75] A2_0 Abscissa	FMIX0405	0416	0
ZMIX0405	1228	206	1	R4[76-79] Ind.Ech/F.Mem	FMIX0406	0428	0
ZMIX0405	1228	206	1	R4[80-95] F.Mem Frames	FMIX0407	0432	0
ZMIX0405	1228	206	1	R5[8-31] Mode Duration	FMIX0500	0456	0
ZMIX0405	1228	206	1	R5[34-41] Mode&DCG Sel.	FMIX0501	0482	0
ZMIX0405	1228	206	1	R5[42-47] PIS Band Sel.	FMIX0502	0490	0
ZMIX0405	1228	206	1	R5[48-59] Radar Param.	FMIX0503	0496	0
ZMIX0405	1228	206	1	R5[60-63] TX Power	FMIX0504	0508	0
ZMIX0405	1228	206	1	R5[64-75] A2_0 Abscissa	FMIX0505	0512	0
ZMIX0405	1228	206	1	R5[76-79] Ind.Ech/F.Mem	FMIX0506	0524	0
ZMIX0405	1228	206	1	R5[80-95] F.Mem Frames	FMIX0507	0528	0
ZMIX0405	1228	206	1	R6[8-31] Mode Duration	FMIX0600	0552	0
ZMIX0405	1228	206	1	R6[34-41] Mode&DCG Sel.	FMIX0601	0578	0
ZMIX0405	1228	206	1	R6[42-47] PIS Band Sel.	FMIX0602	0586	0
ZMIX0405	1228	206	1	R6[48-59] Radar Param.	FMIX0603	0592	0
ZMIX0405	1228	206	1	R6[60-63] TX Power	FMIX0604	0604	0
ZMIX0405	1228	206	1	R6[64-75] A2_0 Abscissa	FMIX0605	0608	0
ZMIX0405	1228	206	1	R6[76-79] Ind.Ech/F.Mem	FMIX0606	0620	0
ZMIX0405	1228	206	1	R6[80-95] F.Mem Frames	FMIX0607	0624	0
ZMIX0405	1228	206	1	R7[8-31] Mode Duration	FMIX0700	0648	0
ZMIX0405	1228	206	1	R7[34-41] Mode&DCG Sel.	FMIX0701	0674	0
ZMIX0405	1228	206	1	R7[42-47] PIS Band Sel.	FMIX0702	0682	0
ZMIX0405	1228	206	1	R7[48-59] Radar Param.	FMIX0703	0688	0
ZMIX0405	1228	206	1	R7[60-63] TX Power	FMIX0704	0700	0
ZMIX0405	1228	206	1	R7[64-75] A2_0 Abscissa	FMIX0705	0704	0
ZMIX0405	1228	206	1	R7[76-79] Ind.Ech/F.Mem	FMIX0706	0716	0
ZMIX0405	1228	206	1	R7[80-95] F.Mem Frames	FMIX0707	0720	0
ZMIX0405	1228	206	1	R8[8-31] Mode Duration	FMIX0800	0744	0
ZMIX0405	1228	206	1	R8[34-41] Mode&DCG Sel.	FMIX0801	0770	0
ZMIX0405	1228	206	1	R8[42-47] PIS Band Sel.	FMIX0802	0778	0
ZMIX0405	1228	206	1	R8[48-59] Radar Param.	FMIX0803	0784	0
ZMIX0405	1228	206	1	R8[60-63] TX Power	FMIX0804	0796	0
ZMIX0405	1228	206	1	R8[64-75] A2_0 Abscissa	FMIX0805	0800	0
ZMIX0405	1228	206	1	R8[76-79] Ind.Ech/F.Mem	FMIX0806	0812	0
ZMIX0405	1228	206	1	R8[80-95] F.Mem Frames	FMIX0807	0816	0
ZMIX0405	1228	206	1	R9[8-31] Mode Duration	FMIX0900	0840	0
ZMIX0405	1228	206	1	R9[34-41] Mode&DCG Sel.	FMIX0901	0866	0
ZMIX0405	1228	206	1	R9[42-47] PIS Band Sel.	FMIX0902	0874	0
ZMIX0405	1228	206	1	R9[48-59] Radar Param.	FMIX0903	0880	0
ZMIX0405	1228	206	1	R9[60-63] TX Power	FMIX0904	0892	0
ZMIX0405	1228	206	1	R9[64-75] A2_0 Abscissa	FMIX0905	0896	0
ZMIX0405	1228	206	1	R9[76-79] Ind.Ech/F.Mem	FMIX0906	0908	0
ZMIX0405	1228	206	1	R9[80-95] F.Mem Frames	FMIX0907	0912	0
ZMIX0405	1228	206	1	R10[8-31] Mode Duration	FMIX0110	0936	0
ZMIX0405	1228	206	1	R10[34-41] Mode&DCG Sel.	FMIX0111	0962	0
ZMIX0405	1228	206	1	R10[42-47] PIS Band Sel.	FMIX0112	0970	0
ZMIX0405	1228	206	1	R10[48-59] Radar Param.	FMIX0113	0976	0
ZMIX0405	1228	206	1	R10[60-63] TX Power	FMIX0114	0988	0
ZMIX0405	1228	206	1	R10[64-75] A2_0 Abscissa	FMIX0115	0992	0
ZMIX0405	1228	206	1	R10[76-79] Ind.Ech/F.Mem	FMIX0116	1004	0
ZMIX0405	1228	206	1	R10[80-95] F.Mem Frames	FMIX0117	1008	0

ZMIX0405	1228	206	1	R11[8-31] Mode Duration	FMIX0120	1032	0
ZMIX0405	1228	206	1	R11[34-41] Mode&DCG Sel.	FMIX0121	1058	0
ZMIX0405	1228	206	1	R11[42-47] PIS Band Sel.	FMIX0122	1066	0
ZMIX0405	1228	206	1	R11[48-59] Radar Param.	FMIX0123	1072	0
ZMIX0405	1228	206	1	R11[60-63] TX Power	FMIX0124	1084	0
ZMIX0405	1228	206	1	R11[64-75] A2_0 Abscissa	FMIX0125	1088	0
ZMIX0405	1228	206	1	R11[76-79] Ind.Ech/F.Mem	FMIX0126	1100	0
ZMIX0405	1228	206	1	R11[80-95] F.Mem Frames	FMIX0127	1104	0
ZMIX0405	1228	206	1	R12[8-31] Mode Duration	FMIX0130	1128	0
ZMIX0405	1228	206	1	R12[34-41] Mode&DCG Sel.	FMIX0131	1154	0
ZMIX0405	1228	206	1	R12[42-47] PIS Band Sel.	FMIX0132	1162	0
ZMIX0405	1228	206	1	R12[48-59] Radar Param.	FMIX0133	1168	0
ZMIX0405	1228	206	1	R12[60-63] TX Power	FMIX0134	1180	0
ZMIX0405	1228	206	1	R12[64-75] A2_0 Abscissa	FMIX0135	1184	0
ZMIX0405	1228	206	1	R12[76-79] Ind.Ech/F.Mem	FMIX0136	1196	0
ZMIX0405	1228	206	1	R12[80-95] F.Mem Frames	FMIX0137	1200	0
ZMIX0405	1228	206	1	R13[8-31] Mode Duration	FMIX0140	1224	0
ZMIX0405	1228	206	1	R13[34-41] Mode&DCG Sel.	FMIX0141	1250	0
ZMIX0405	1228	206	1	R13[42-47] PIS Band Sel.	FMIX0142	1258	0
ZMIX0405	1228	206	1	R13[48-59] Radar Param.	FMIX0143	1264	0
ZMIX0405	1228	206	1	R13[60-63] TX Power	FMIX0144	1276	0
ZMIX0405	1228	206	1	R13[64-75] A2_0 Abscissa	FMIX0145	1280	0
ZMIX0405	1228	206	1	R13[76-79] Ind.Ech/F.Mem	FMIX0146	1292	0
ZMIX0405	1228	206	1	R13[80-95] F.Mem Frames	FMIX0147	1296	0
ZMIX0405	1228	206	1	R14[8-31] Mode Duration	FMIX0150	1320	0
ZMIX0405	1228	206	1	R14[34-41] Mode&DCG Sel.	FMIX0151	1346	0
ZMIX0405	1228	206	1	R14[42-47] PIS Band Sel.	FMIX0152	1354	0
ZMIX0405	1228	206	1	R14[48-59] Radar Param.	FMIX0153	1360	0
ZMIX0405	1228	206	1	R14[60-63] TX Power	FMIX0154	1372	0
ZMIX0405	1228	206	1	R14[64-75] A2_0 Abscissa	FMIX0155	1376	0
ZMIX0405	1228	206	1	R14[76-79] Ind.Ech/F.Mem	FMIX0156	1388	0
ZMIX0405	1228	206	1	R14[80-95] F.Mem Frames	FMIX0157	1392	0
ZMIX0405	1228	206	1	R15[8-31] Mode Duration	FMIX0160	1416	0
ZMIX0405	1228	206	1	R15[34-41] Mode&DCG Sel.	FMIX0161	1442	0
ZMIX0405	1228	206	1	R15[42-47] PIS Band Sel.	FMIX0162	1450	0
ZMIX0405	1228	206	1	R15[48-59] Radar Param.	FMIX0163	1456	0
ZMIX0405	1228	206	1	R15[60-63] TX Power	FMIX0164	1468	0
ZMIX0405	1228	206	1	R15[64-75] A2_0 Abscissa	FMIX0165	1472	0
ZMIX0405	1228	206	1	R15[76-79] Ind.Ech/F.Mem	FMIX0166	1484	0
ZMIX0405	1228	206	1	R15[80-95] F.Mem Frames	FMIX0167	1488	0
ZMIX0405	1228	206	1	R16[8-31] Mode Duration	FMIX0170	1512	0
ZMIX0405	1228	206	1	R16[34-41] Mode&DCG Sel.	FMIX0171	1538	0
ZMIX0405	1228	206	1	R16[42-47] PIS Band Sel.	FMIX0172	1546	0
ZMIX0405	1228	206	1	R16[48-59] Radar Param.	FMIX0173	1552	0
ZMIX0405	1228	206	1	R16[60-63] TX Power	FMIX0174	1564	0
ZMIX0405	1228	206	1	R16[64-75] A2_0 Abscissa	FMIX0175	1568	0
ZMIX0405	1228	206	1	R16[76-79] Ind.Ech/F.Mem	FMIX0176	1580	0
ZMIX0405	1228	206	1	R16[80-95] F.Mem Frames	FMIX0177	1584	0

ZMIX0411	1228	206	2	PT Rel. Start Addr.	FMIXP000	0016	0
ZMIX0411	1228	206	2	PT SCET-Star Value	FMIXP001	0064	0
ZMIX0411	1228	206	2	PT SCET-Pericenter Value	FMIXP002	0112	0

ZMIX0412	1228	206	2	PT Rel. Start Addr.	FMIXP003	0016	0

ZMIX0413	1228	206	2	PT1 Rel. Start Addr.	FMIXP100	0016	0
ZMIX0413	1228	206	2	PT1 Val1[31-16] - UppW	FMIXP101	0064	0
ZMIX0413	1228	206	2	PT1 Val1[15-0] - LowW	FMIXP102	0080	0

ZMIX0414	1228	206	2	PT2 Rel. Start Addr.	FMIXP200	0016	0
ZMIX0414	1228	206	2	PT2 Val1[31-16] - UppW	FMIXP201	0064	0
ZMIX0414	1228	206	2	PT2 Val1[15-0] - LowW	FMIXP202	0080	0
ZMIX0414	1228	206	2	PT2 Val2[31-16] - UppW	FMIXP203	0112	0
ZMIX0414	1228	206	2	PT2 Val2[15-0] - LowW	FMIXP204	0128	0

ZMIX0415	1228	206	2	PT4 Rel. Start Addr.	FMIXP400	0016	0
ZMIX0415	1228	206	2	PT4 Val1[31-16] - UppW	FMIXP401	0064	0
ZMIX0415	1228	206	2	PT4 Val1[15-0] - LowW	FMIXP402	0080	0
ZMIX0415	1228	206	2	PT4 Val2[31-16] - UppW	FMIXP403	0112	0
ZMIX0415	1228	206	2	PT4 Val2[15-0] - LowW	FMIXP404	0128	0
ZMIX0415	1228	206	2	PT4 Val3[31-16] - UppW	FMIXP405	0160	0
ZMIX0415	1228	206	2	PT4 Val3[15-0] - LowW	FMIXP406	0176	0
ZMIX0415	1228	206	2	PT4 Val4[31-16] - UppW	FMIXP407	0208	0
ZMIX0415	1228	206	2	PT4 Val4[15-0] - LowW	FMIXP408	0224	0

ZMIX0416	1228	206	2	PT8 Rel. Start Addr.	FMIXP800	0016	0
ZMIX0416	1228	206	2	PT8 Val1[31-16] - UppW	FMIXP801	0064	0
ZMIX0416	1228	206	2	PT8 Val1[15-0] - LowW	FMIXP802	0080	0
ZMIX0416	1228	206	2	PT8 Val2[31-16] - UppW	FMIXP803	0112	0
ZMIX0416	1228	206	2	PT8 Val2[15-0] - LowW	FMIXP804	0128	0
ZMIX0416	1228	206	2	PT8 Val3[31-16] - UppW	FMIXP805	0160	0
ZMIX0416	1228	206	2	PT8 Val3[15-0] - LowW	FMIXP806	0176	0
ZMIX0416	1228	206	2	PT8 Val4[31-16] - UppW	FMIXP807	0208	0
ZMIX0416	1228	206	2	PT8 Val4[15-0] - LowW	FMIXP808	0224	0
ZMIX0416	1228	206	2	PT8 Val5[31-16] - UppW	FMIXP809	0256	0
ZMIX0416	1228	206	2	PT8 Val5[15-0] - LowW	FMIXP810	0272	0
ZMIX0416	1228	206	2	PT8 Val6[31-16] - UppW	FMIXP811	0304	0
ZMIX0416	1228	206	2	PT8 Val6[15-0] - LowW	FMIXP812	0320	0
ZMIX0416	1228	206	2	PT8 Val7[31-16] - UppW	FMIXP813	0352	0
ZMIX0416	1228	206	2	PT8 Val7[15-0] - LowW	FMIXP814	0368	0
ZMIX0416	1228	206	2	PT8 Val8[31-16] - UppW	FMIXP815	0400	0
ZMIX0416	1228	206	2	PT8 Val8[15-0] - LowW	FMIXP816	0416	0

ZMIX0417	1228	206	2	PT16 Rel. Start Addr.	FMIXP900	0016	0
ZMIX0417	1228	206	2	PT16 Val1[31-16] - UppW	FMIXP901	0064	0
ZMIX0417	1228	206	2	PT16 Val1[15-0] - LowW	FMIXP902	0080	0
ZMIX0417	1228	206	2	PT16 Val2[31-16] - UppW	FMIXP903	0112	0
ZMIX0417	1228	206	2	PT16 Val2[15-0] - LowW	FMIXP904	0128	0
ZMIX0417	1228	206	2	PT16 Val3[31-16] - UppW	FMIXP905	0160	0
ZMIX0417	1228	206	2	PT16 Val3[15-0] - LowW	FMIXP906	0176	0
ZMIX0417	1228	206	2	PT16 Val4[31-16] - UppW	FMIXP907	0208	0
ZMIX0417	1228	206	2	PT16 Val4[15-0] - LowW	FMIXP908	0224	0
ZMIX0417	1228	206	2	PT16 Val5[31-16] - UppW	FMIXP909	0256	0
ZMIX0417	1228	206	2	PT16 Val5[15-0] - LowW	FMIXP910	0272	0
ZMIX0417	1228	206	2	PT16 Val6[31-16] - UppW	FMIXP911	0304	0
ZMIX0417	1228	206	2	PT16 Val6[15-0] - LowW	FMIXP912	0320	0
ZMIX0417	1228	206	2	PT16 Val7[31-16] - UppW	FMIXP913	0352	0
ZMIX0417	1228	206	2	PT16 Val7[15-0] - LowW	FMIXP914	0368	0
ZMIX0417	1228	206	2	PT16 Val8[31-16] - UppW	FMIXP915	0400	0
ZMIX0417	1228	206	2	PT16 Val8[15-0] - LowW	FMIXP916	0416	0

ZMIX0417	1228	206	2	PT16 Val9[31-16] - UppW	FMIXP917	0448	0
ZMIX0417	1228	206	2	PT16 Val9[15-0] - LowW	FMIXP918	0464	0
ZMIX0417	1228	206	2	PT16 Val10[31-16] - UppW	FMIXP919	0496	0
ZMIX0417	1228	206	2	PT16 Val10[15-0] - LowW	FMIXP920	0512	0
ZMIX0417	1228	206	2	PT16 Val11[31-16] - UppW	FMIXP921	0544	0
ZMIX0417	1228	206	2	PT16 Val11[15-0] - LowW	FMIXP922	0560	0
ZMIX0417	1228	206	2	PT16 Val12[31-16] - UppW	FMIXP923	0592	0
ZMIX0417	1228	206	2	PT16 Val12[15-0] - LowW	FMIXP924	0608	0
ZMIX0417	1228	206	2	PT16 Val13[31-16] - UppW	FMIXP925	0640	0
ZMIX0417	1228	206	2	PT16 Val13[15-0] - LowW	FMIXP926	0656	0
ZMIX0417	1228	206	2	PT16 Val14[31-16] - UppW	FMIXP927	0688	0
ZMIX0417	1228	206	2	PT16 Val14[15-0] - LowW	FMIXP928	0704	0
ZMIX0417	1228	206	2	PT16 Val15[31-16] - UppW	FMIXP929	0736	0
ZMIX0417	1228	206	2	PT16 Val15[15-0] - LowW	FMIXP930	0752	0
ZMIX0417	1228	206	2	PT16 Val16[31-16] - UppW	FMIXP931	0784	0
ZMIX0417	1228	206	2	PT16 Val16[15-0] - LowW	FMIXP932	0800	0

ZMIX0418	1228	206	2	PT48 Rel. Start Addr.	FMIXP481	0016	0
ZMIX0418	1228	206	2	PT48 Val[47-32] - UppW	FMIXP482	0064	0
ZMIX0418	1228	206	2	PT48 Val[31-16] - MidW	FMIXP483	0080	0
ZMIX0418	1228	206	2	PT48 Val[15-0] - LowW	FMIXP484	0096	0

ZMIX0419	1244	206	2	PT1 Rel. Start Addr.	FMIXM100	0016	0
ZMIX0419	1244	206	2	PT1 Val1[31-16] - UppW	FMIXM101	0064	0
ZMIX0419	1244	206	2	PT1 Val1[15-0] - LowW	FMIXM102	0080	0

ZMIX0420	1244	206	2	PT2 Rel. Start Addr.	FMIXM200	0016	0
ZMIX0420	1244	206	2	PT2 Val1[31-16] - UppW	FMIXM201	0064	0
ZMIX0420	1244	206	2	PT2 Val1[15-0] - LowW	FMIXM202	0080	0
ZMIX0420	1244	206	2	PT2 Val2[31-16] - UppW	FMIXM203	0112	0
ZMIX0420	1244	206	2	PT2 Val2[15-0] - LowW	FMIXM204	0128	0

ZMIX0421	1244	206	2	PT4 Rel. Start Addr.	FMIXM400	0016	0
ZMIX0421	1244	206	2	PT4 Val1[31-16] - UppW	FMIXM401	0064	0
ZMIX0421	1244	206	2	PT4 Val1[15-0] - LowW	FMIXM402	0080	0
ZMIX0421	1244	206	2	PT4 Val2[31-16] - UppW	FMIXM403	0112	0
ZMIX0421	1244	206	2	PT4 Val2[15-0] - LowW	FMIXM404	0128	0
ZMIX0421	1244	206	2	PT4 Val3[31-16] - UppW	FMIXM405	0160	0
ZMIX0421	1244	206	2	PT4 Val3[15-0] - LowW	FMIXM406	0176	0
ZMIX0421	1244	206	2	PT4 Val4[31-16] - UppW	FMIXM407	0208	0
ZMIX0421	1244	206	2	PT4 Val4[15-0] - LowW	FMIXM408	0224	0

ZMIX0422	1244	206	2	PT8 Rel. Start Addr.	FMIXM800	0016	0
ZMIX0422	1244	206	2	PT8 Val1[31-16] - UppW	FMIXM801	0064	0
ZMIX0422	1244	206	2	PT8 Val1[15-0] - LowW	FMIXM802	0080	0
ZMIX0422	1244	206	2	PT8 Val2[31-16] - UppW	FMIXM803	0112	0
ZMIX0422	1244	206	2	PT8 Val2[15-0] - LowW	FMIXM804	0128	0
ZMIX0422	1244	206	2	PT8 Val3[31-16] - UppW	FMIXM805	0160	0
ZMIX0422	1244	206	2	PT8 Val3[15-0] - LowW	FMIXM806	0176	0
ZMIX0422	1244	206	2	PT8 Val4[31-16] - UppW	FMIXM807	0208	0
ZMIX0422	1244	206	2	PT8 Val4[15-0] - LowW	FMIXM808	0224	0
ZMIX0422	1244	206	2	PT8 Val5[31-16] - UppW	FMIXM809	0256	0
ZMIX0422	1244	206	2	PT8 Val5[15-0] - LowW	FMIXM810	0272	0
ZMIX0422	1244	206	2	PT8 Val6[31-16] - UppW	FMIXM811	0304	0
ZMIX0422	1244	206	2	PT8 Val6[15-0] - LowW	FMIXM812	0320	0

ZMIX0422	1244	206	2	PT8 Val7[31-16] - UppW	FMIXM813	0352	0
ZMIX0422	1244	206	2	PT8 Val7[15-0] - LowW	FMIXM814	0368	0
ZMIX0422	1244	206	2	PT8 Val8[31-16] - UppW	FMIXM815	0400	0
ZMIX0422	1244	206	2	PT8 Val8[15-0] - LowW	FMIXM816	0416	0

ZMIX0423	1244	206	2	PT16 Rel. Start Addr.	FMIXM900	0016	0
ZMIX0423	1244	206	2	PT16 Val1[31-16] - UppW	FMIXM901	0064	0
ZMIX0423	1244	206	2	PT16 Val1[15-0] - LowW	FMIXM902	0080	0
ZMIX0423	1244	206	2	PT16 Val2[31-16] - UppW	FMIXM903	0112	0
ZMIX0423	1244	206	2	PT16 Val2[15-0] - LowW	FMIXM904	0128	0
ZMIX0423	1244	206	2	PT16 Val3[31-16] - UppW	FMIXM905	0160	0
ZMIX0423	1244	206	2	PT16 Val3[15-0] - LowW	FMIXM906	0176	0
ZMIX0423	1244	206	2	PT16 Val4[31-16] - UppW	FMIXM907	0208	0
ZMIX0423	1244	206	2	PT16 Val4[15-0] - LowW	FMIXM908	0224	0
ZMIX0423	1244	206	2	PT16 Val5[31-16] - UppW	FMIXM909	0256	0
ZMIX0423	1244	206	2	PT16 Val5[15-0] - LowW	FMIXM910	0272	0
ZMIX0423	1244	206	2	PT16 Val6[31-16] - UppW	FMIXM911	0304	0
ZMIX0423	1244	206	2	PT16 Val6[15-0] - LowW	FMIXM912	0320	0
ZMIX0423	1244	206	2	PT16 Val7[31-16] - UppW	FMIXM913	0352	0
ZMIX0423	1244	206	2	PT16 Val7[15-0] - LowW	FMIXM914	0368	0
ZMIX0423	1244	206	2	PT16 Val8[31-16] - UppW	FMIXM915	0400	0
ZMIX0423	1244	206	2	PT16 Val8[15-0] - LowW	FMIXM916	0416	0
ZMIX0423	1244	206	2	PT16 Val9[31-16] - UppW	FMIXM917	0448	0
ZMIX0423	1244	206	2	PT16 Val9[15-0] - LowW	FMIXM918	0464	0
ZMIX0423	1244	206	2	PT16 Val10[31-16] - UppW	FMIXM919	0496	0
ZMIX0423	1244	206	2	PT16 Val10[15-0] - LowW	FMIXM920	0512	0
ZMIX0423	1244	206	2	PT16 Val11[31-16] - UppW	FMIXM921	0544	0
ZMIX0423	1244	206	2	PT16 Val11[15-0] - LowW	FMIXM922	0560	0
ZMIX0423	1244	206	2	PT16 Val12[31-16] - UppW	FMIXM923	0592	0
ZMIX0423	1244	206	2	PT16 Val12[15-0] - LowW	FMIXM924	0608	0
ZMIX0423	1244	206	2	PT16 Val13[31-16] - UppW	FMIXM925	0640	0
ZMIX0423	1244	206	2	PT16 Val13[15-0] - LowW	FMIXM926	0656	0
ZMIX0423	1244	206	2	PT16 Val14[31-16] - UppW	FMIXM927	0688	0
ZMIX0423	1244	206	2	PT16 Val14[15-0] - LowW	FMIXM928	0704	0
ZMIX0423	1244	206	2	PT16 Val15[31-16] - UppW	FMIXM929	0736	0
ZMIX0423	1244	206	2	PT16 Val15[15-0] - LowW	FMIXM930	0752	0
ZMIX0423	1244	206	2	PT16 Val16[31-16] - UppW	FMIXM931	0784	0
ZMIX0423	1244	206	2	PT16 Val16[15-0] - LowW	FMIXM932	0800	0

ZMIX0424	1244	206	2	PT48 Rel. Start Addr.	FMIXM481	0016	0
ZMIX0424	1244	206	2	PT48 Val[47-32] - UppW	FMIXM482	0064	0
ZMIX0424	1244	206	2	PT48 Val[31-16] - MidW	FMIXM483	0080	0
ZMIX0424	1244	206	2	PT48 Val[15-0] - LowW	FMIXM484	0096	0

ZMIX0425	1260	206	2	PT1 Rel. Start Addr.	FMIXR100	0016	0
ZMIX0425	1260	206	2	PT1 Val1[31-16] - UppW	FMIXR101	0064	0
ZMIX0425	1260	206	2	PT1 Val1[15-0] - LowW	FMIXR102	0080	0

ZMIX0426	1260	206	2	PT2 Rel. Start Addr.	FMIXR200	0016	0
ZMIX0426	1260	206	2	PT2 Val1[31-16] - UppW	FMIXR201	0064	0
ZMIX0426	1260	206	2	PT2 Val1[15-0] - LowW	FMIXR202	0080	0
ZMIX0426	1260	206	2	PT2 Val2[31-16] - UppW	FMIXR203	0112	0
ZMIX0426	1260	206	2	PT2 Val2[15-0] - LowW	FMIXR204	0128	0

ZMIX0427	1260	206	2	PT4 Rel. Start Addr.	FMIXR400	0016	0

ZMIX0427	1260	206	2	PT4 Val1[31-16] - UppW	FMIXR401	0064	0
ZMIX0427	1260	206	2	PT4 Val1[15-0] - LowW	FMIXR402	0080	0
ZMIX0427	1260	206	2	PT4 Val2[31-16] - UppW	FMIXR403	0112	0
ZMIX0427	1260	206	2	PT4 Val2[15-0] - LowW	FMIXR404	0128	0
ZMIX0427	1260	206	2	PT4 Val3[31-16] - UppW	FMIXR405	0160	0
ZMIX0427	1260	206	2	PT4 Val3[15-0] - LowW	FMIXR406	0176	0
ZMIX0427	1260	206	2	PT4 Val4[31-16] - UppW	FMIXR407	0208	0
ZMIX0427	1260	206	2	PT4 Val4[15-0] - LowW	FMIXR408	0224	0

ZMIX0428	1260	206	2	PT8 Rel. Start Addr.	FMIXR800	0016	0
ZMIX0428	1260	206	2	PT8 Val1[31-16] - UppW	FMIXR801	0064	0
ZMIX0428	1260	206	2	PT8 Val1[15-0] - LowW	FMIXR802	0080	0
ZMIX0428	1260	206	2	PT8 Val2[31-16] - UppW	FMIXR803	0112	0
ZMIX0428	1260	206	2	PT8 Val2[15-0] - LowW	FMIXR804	0128	0
ZMIX0428	1260	206	2	PT8 Val3[31-16] - UppW	FMIXR805	0160	0
ZMIX0428	1260	206	2	PT8 Val3[15-0] - LowW	FMIXR806	0176	0
ZMIX0428	1260	206	2	PT8 Val4[31-16] - UppW	FMIXR807	0208	0
ZMIX0428	1260	206	2	PT8 Val4[15-0] - LowW	FMIXR808	0224	0
ZMIX0428	1260	206	2	PT8 Val5[31-16] - UppW	FMIXR809	0256	0
ZMIX0428	1260	206	2	PT8 Val5[15-0] - LowW	FMIXR810	0272	0
ZMIX0428	1260	206	2	PT8 Val6[31-16] - UppW	FMIXR811	0304	0
ZMIX0428	1260	206	2	PT8 Val6[15-0] - LowW	FMIXR812	0320	0
ZMIX0428	1260	206	2	PT8 Val7[31-16] - UppW	FMIXR813	0352	0
ZMIX0428	1260	206	2	PT8 Val7[15-0] - LowW	FMIXR814	0368	0
ZMIX0428	1260	206	2	PT8 Val8[31-16] - UppW	FMIXR815	0400	0
ZMIX0428	1260	206	2	PT8 Val8[15-0] - LowW	FMIXR816	0416	0

ZMIX0429	1260	206	2	PT16 Rel. Start Addr.	FMIXR900	0016	0
ZMIX0429	1260	206	2	PT16 Val1[31-16] - UppW	FMIXR901	0064	0
ZMIX0429	1260	206	2	PT16 Val1[15-0] - LowW	FMIXR902	0080	0
ZMIX0429	1260	206	2	PT16 Val2[31-16] - UppW	FMIXR903	0112	0
ZMIX0429	1260	206	2	PT16 Val2[15-0] - LowW	FMIXR904	0128	0
ZMIX0429	1260	206	2	PT16 Val3[31-16] - UppW	FMIXR905	0160	0
ZMIX0429	1260	206	2	PT16 Val3[15-0] - LowW	FMIXR906	0176	0
ZMIX0429	1260	206	2	PT16 Val4[31-16] - UppW	FMIXR907	0208	0
ZMIX0429	1260	206	2	PT16 Val4[15-0] - LowW	FMIXR908	0224	0
ZMIX0429	1260	206	2	PT16 Val5[31-16] - UppW	FMIXR909	0256	0
ZMIX0429	1260	206	2	PT16 Val5[15-0] - LowW	FMIXR910	0272	0
ZMIX0429	1260	206	2	PT16 Val6[31-16] - UppW	FMIXR911	0304	0
ZMIX0429	1260	206	2	PT16 Val6[15-0] - LowW	FMIXR912	0320	0
ZMIX0429	1260	206	2	PT16 Val7[31-16] - UppW	FMIXR913	0352	0
ZMIX0429	1260	206	2	PT16 Val7[15-0] - LowW	FMIXR914	0368	0
ZMIX0429	1260	206	2	PT16 Val8[31-16] - UppW	FMIXR915	0400	0
ZMIX0429	1260	206	2	PT16 Val8[15-0] - LowW	FMIXR916	0416	0
ZMIX0429	1260	206	2	PT16 Val9[31-16] - UppW	FMIXR917	0448	0
ZMIX0429	1260	206	2	PT16 Val9[15-0] - LowW	FMIXR918	0464	0
ZMIX0429	1260	206	2	PT16 Val10[31-16] - UppW	FMIXR919	0496	0
ZMIX0429	1260	206	2	PT16 Val10[15-0] - LowW	FMIXR920	0512	0
ZMIX0429	1260	206	2	PT16 Val11[31-16] - UppW	FMIXR921	0544	0
ZMIX0429	1260	206	2	PT16 Val11[15-0] - LowW	FMIXR922	0560	0
ZMIX0429	1260	206	2	PT16 Val12[31-16] - UppW	FMIXR923	0592	0
ZMIX0429	1260	206	2	PT16 Val12[15-0] - LowW	FMIXR924	0608	0
ZMIX0429	1260	206	2	PT16 Val13[31-16] - UppW	FMIXR925	0640	0
ZMIX0429	1260	206	2	PT16 Val13[15-0] - LowW	FMIXR926	0656	0
ZMIX0429	1260	206	2	PT16 Val14[31-16] - UppW	FMIXR927	0688	0

ZMIX0429	1260	206	2	PT16 Val14[15-0] - LowW	FMIXR928	0704	0
ZMIX0429	1260	206	2	PT16 Val15[31-16] - UppW	FMIXR929	0736	0
ZMIX0429	1260	206	2	PT16 Val15[15-0] - LowW	FMIXR930	0752	0
ZMIX0429	1260	206	2	PT16 Val16[31-16] - UppW	FMIXR931	0784	0
ZMIX0429	1260	206	2	PT16 Val16[15-0] - LowW	FMIXR932	0800	0

ZMIX0430	1260	206	2	PT48 Rel. Start Addr.	FMIXR481	0016	0
ZMIX0430	1260	206	2	PT48 Val[47-32] - UppW	FMIXR482	0064	0
ZMIX0430	1260	206	2	PT48 Val[31-16] - MidW	FMIXR483	0080	0
ZMIX0430	1260	206	2	PT48 Val[15-0] - LowW	FMIXR484	0096	0

9.3.2.2 TC Calibrated Parameters

MARSIS Packet Telecommands Calibrated Parameters (Numeric)

No parameters with Numerical values

MARSIS Packet Telecommands Calibrated Parameters (Range)

No parameters with Range values

MARSIS Packet Telecommands Calibrated Parameters (Text)

TC_Name	Par_Name	Calib	Cal Description
ZMIX0401	FMIX1101	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0401	FMIX1102	**1142**	MI OST PIS Band Select
ZMIX0401	FMIX1104	**1143**	MI OST TX Power Level
ZMIX0401	FMIX1106	**1144**	MI OST Indiv Echoes - FM
ZMIX0402	FMIX2101	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0402	FMIX2102	**1142**	MI OST PIS Band Select
ZMIX0402	FMIX2104	**1143**	MI OST TX Power Level
ZMIX0402	FMIX2106	**1144**	MI OST Indiv Echoes - FM
ZMIX0402	FMIX2201	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0402	FMIX2202	**1142**	MI OST PIS Band Select
ZMIX0402	FMIX2204	**1143**	MI OST TX Power Level
ZMIX0402	FMIX2206	**1144**	MI OST Indiv Echoes - FM
ZMIX0403	FMIX4101	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0403	FMIX4102	**1142**	MI OST PIS Band Select
ZMIX0403	FMIX4104	**1143**	MI OST TX Power Level
ZMIX0403	FMIX4106	**1144**	MI OST Indiv Echoes - FM
ZMIX0403	FMIX4201	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0403	FMIX4202	**1142**	MI OST PIS Band Select
ZMIX0403	FMIX4204	**1143**	MI OST TX Power Level
ZMIX0403	FMIX4206	**1144**	MI OST Indiv Echoes - FM
ZMIX0403	FMIX4301	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0403	FMIX4302	**1142**	MI OST PIS Band Select
ZMIX0403	FMIX4304	**1143**	MI OST TX Power Level
ZMIX0403	FMIX4306	**1144**	MI OST Indiv Echoes - FM
ZMIX0403	FMIX4401	**1141**	MI OST Mode Sel-DCG Conf

ZMIX0403	FMIX4402	**1142**	MI OST PIS Band Select
ZMIX0403	FMIX4404	**1143**	MI OST TX Power Level
ZMIX0403	FMIX4406	**1144**	MI OST Indiv Echoes - FM
ZMIX0404	FMIX8101	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0404	FMIX8102	**1142**	MI OST PIS Band Select
ZMIX0404	FMIX8104	**1143**	MI OST TX Power Level
ZMIX0404	FMIX8106	**1144**	MI OST Indiv Echoes - FM
ZMIX0404	FMIX8201	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0404	FMIX8202	**1142**	MI OST PIS Band Select
ZMIX0404	FMIX8204	**1143**	MI OST TX Power Level
ZMIX0404	FMIX8206	**1144**	MI OST Indiv Echoes - FM
ZMIX0404	FMIX8301	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0404	FMIX8302	**1142**	MI OST PIS Band Select
ZMIX0404	FMIX8304	**1143**	MI OST TX Power Level
ZMIX0404	FMIX8306	**1144**	MI OST Indiv Echoes - FM
ZMIX0404	FMIX8401	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0404	FMIX8402	**1142**	MI OST PIS Band Select
ZMIX0404	FMIX8404	**1143**	MI OST TX Power Level
ZMIX0404	FMIX8406	**1144**	MI OST Indiv Echoes - FM
ZMIX0404	FMIX8501	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0404	FMIX8502	**1142**	MI OST PIS Band Select
ZMIX0404	FMIX8504	**1143**	MI OST TX Power Level
ZMIX0404	FMIX8506	**1144**	MI OST Indiv Echoes - FM
ZMIX0404	FMIX8601	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0404	FMIX8602	**1142**	MI OST PIS Band Select
ZMIX0404	FMIX8604	**1143**	MI OST TX Power Level
ZMIX0404	FMIX8606	**1144**	MI OST Indiv Echoes - FM
ZMIX0404	FMIX8701	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0404	FMIX8702	**1142**	MI OST PIS Band Select
ZMIX0404	FMIX8704	**1143**	MI OST TX Power Level
ZMIX0404	FMIX8706	**1144**	MI OST Indiv Echoes - FM
ZMIX0404	FMIX8801	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0404	FMIX8802	**1142**	MI OST PIS Band Select
ZMIX0404	FMIX8804	**1143**	MI OST TX Power Level
ZMIX0404	FMIX8806	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0101	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0102	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0104	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0106	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0111	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0112	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0114	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0116	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0121	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0122	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0124	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0126	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0131	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0132	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0134	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0136	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0141	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0142	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0144	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0146	**1144**	MI OST Indiv Echoes - FM

ZMIX0405	FMIX0151	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0152	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0154	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0156	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0161	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0162	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0164	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0166	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0171	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0172	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0174	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0176	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0201	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0202	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0204	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0206	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0301	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0302	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0304	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0306	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0401	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0402	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0404	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0406	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0501	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0502	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0504	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0506	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0601	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0602	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0604	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0606	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0701	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0702	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0704	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0706	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0801	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0802	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0804	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0806	**1144**	MI OST Indiv Echoes - FM
ZMIX0405	FMIX0901	**1141**	MI OST Mode Sel-DCG Conf
ZMIX0405	FMIX0902	**1142**	MI OST PIS Band Select
ZMIX0405	FMIX0904	**1143**	MI OST TX Power Level
ZMIX0405	FMIX0906	**1144**	MI OST Indiv Echoes - FM

9.3.2.3 TC Parameters Calibration Values

<u>MARSIS Packet Telecommands Calibrated Parameter Values (Text)</u>

Calib	Cal Description	Text Value	Num Value
1141	MI OST Mode Sel-DCG Conf	RXOnly Band2	100

1141	MI OST Mode Sel-DCG Conf	RXOnly Band3	104
1141	MI OST Mode Sel-DCG Conf	RXOnly Band4	108
1141	MI OST Mode Sel-DCG Conf	A IS-Table1	112
1141	MI OST Mode Sel-DCG Conf	AIS-Table2	113
1141	MI OST Mode Sel-DCG Conf	AIS-Table3	114
1141	MI OST Mode Sel-DCG Conf	AIS-Table4	115
1141	MI OST Mode Sel-DCG Conf	AIS-Table5	116
1141	MI OST Mode Sel-DCG Conf	AIS-Table6	117
1141	MI OST Mode Sel-DCG Conf	AIS-Table7	118
1141	MI OST Mode Sel-DCG Conf	AIS-Table8	119
1141	MI OST Mode Sel-DCG Conf	AIS-Table9	120
1141	MI OST Mode Sel-DCG Conf	AIS-Table10	121
1141	MI OST Mode Sel-DCG Conf	AIS-Table11	122
1141	MI OST Mode Sel-DCG Conf	AIS-Table12	123
1141	MI OST Mode Sel-DCG Conf	AIS-Table13	124
1141	MI OST Mode Sel-DCG Conf	AIS-Table14	125
1141	MI OST Mode Sel-DCG Conf	AIS-Table15	126
1141	MI OST Mode Sel-DCG Conf	AIS-Table16	127
1141	MI OST Mode Sel-DCG Conf	SS1 P1B1P2B1	128
1141	MI OST Mode Sel-DCG Conf	SS1 P1B2P2B1	129
1141	MI OST Mode Sel-DCG Conf	SS1 P1B3P2B1	130
1141	MI OST Mode Sel-DCG Conf	SS1 P1B4P2B1	131
1141	MI OST Mode Sel-DCG Conf	SS1 P1B1P2B2	132
1141	MI OST Mode Sel-DCG Conf	SS1 P1B2P2B2	133
1141	MI OST Mode Sel-DCG Conf	SS1 P1B3P2B2	134
1141	MI OST Mode Sel-DCG Conf	SS1 P1B4P2B2	135
1141	MI OST Mode Sel-DCG Conf	SS1 P1B1P2B3	136
1141	MI OST Mode Sel-DCG Conf	SS1 P1B2P2B3	137
1141	MI OST Mode Sel-DCG Conf	SS1 P1B3P2B3	138
1141	MI OST Mode Sel-DCG Conf	SS1 P1B4P2B3	139
1141	MI OST Mode Sel-DCG Conf	SS1 P1B1P2B4	140
1141	MI OST Mode Sel-DCG Conf	SS1 P1B2P2B4	141
1141	MI OST Mode Sel-DCG Conf	SS1 P1B3P2B4	142
1141	MI OST Mode Sel-DCG Conf	SS1 P1B4P2B4	143
1141	MI OST Mode Sel-DCG Conf	SS2 P1B1P2B1	144
1141	MI OST Mode Sel-DCG Conf	SS2 P1B2P2B1	145
1141	MI OST Mode Sel-DCG Conf	SS2 P1B3P2B1	146
1141	MI OST Mode Sel-DCG Conf	SS2 P1B4P2B1	147
1141	MI OST Mode Sel-DCG Conf	SS2 P1B1P2B2	148
1141	MI OST Mode Sel-DCG Conf	SS2 P1B2P2B2	149
1141	MI OST Mode Sel-DCG Conf	SS2 P1B3P2B2	150
1141	MI OST Mode Sel-DCG Conf	SS2 P1B4P2B2	151
1141	MI OST Mode Sel-DCG Conf	SS2 P1B1P2B3	152
1141	MI OST Mode Sel-DCG Conf	SS2 P1B2P2B3	153
1141	MI OST Mode Sel-DCG Conf	SS2 P1B3P2B3	154
1141	MI OST Mode Sel-DCG Conf	SS2 P1B4P2B3	155
1141	MI OST Mode Sel-DCG Conf	SS2 P1B1P2B4	156
1141	MI OST Mode Sel-DCG Conf	SS2 P1B2P2B4	157
1141	MI OST Mode Sel-DCG Conf	SS2 P1B3P2B4	158
1141	MI OST Mode Sel-DCG Conf	SS2 P1B4P2B4	159
1141	MI OST Mode Sel-DCG Conf	SS3 P1B1P2B1	160
1141	MI OST Mode Sel-DCG Conf	SS3 P1B2P2B1	161
1141	MI OST Mode Sel-DCG Conf	SS3 P1B3P2B1	162
1141	MI OST Mode Sel-DCG Conf	SS3 P1B4P2B1	163
1141	MI OST Mode Sel-DCG Conf	SS3 P1B1P2B2	164

1141	MI OST Mode Sel-DCG Conf	SS3 P1B2P2B2	165
1141	MI OST Mode Sel-DCG Conf	SS3 P1B3P2B2	166
1141	MI OST Mode Sel-DCG Conf	SS3 P1B4P2B2	167
1141	MI OST Mode Sel-DCG Conf	SS3 P1B1P2B3	168
1141	MI OST Mode Sel-DCG Conf	SS3 P1B2P2B3	169
1141	MI OST Mode Sel-DCG Conf	SS3 P1B3P2B3	170
1141	MI OST Mode Sel-DCG Conf	SS3 P1B4P2B3	171
1141	MI OST Mode Sel-DCG Conf	SS3 P1B1P2B4	172
1141	MI OST Mode Sel-DCG Conf	SS3 P1B2P2B4	173
1141	MI OST Mode Sel-DCG Conf	SS3 P1B3P2B4	174
1141	MI OST Mode Sel-DCG Conf	SS3 P1B4P2B4	175
1141	MI OST Mode Sel-DCG Conf	SS4 - Band 1	176
1141	MI OST Mode Sel-DCG Conf	SS4 - Band 2	180
1141	MI OST Mode Sel-DCG Conf	SS4 - Band 3	184
1141	MI OST Mode Sel-DCG Conf	SS4 - Band 4	188
1141	MI OST Mode Sel-DCG Conf	SS5 - Band 1	192
1141	MI OST Mode Sel-DCG Conf	SS5 - Band 2	196
1141	MI OST Mode Sel-DCG Conf	SS5 - Band 3	200
1141	MI OST Mode Sel-DCG Conf	SS5 - Band 4	204
1141	MI OST Mode Sel-DCG Conf	RAM to FMem	208
1141	MI OST Mode Sel-DCG Conf	OST End-WA2	48
1141	MI OST Mode Sel-DCG Conf	Cal - Band 1	80
1141	MI OST Mode Sel-DCG Conf	Cal - Band 2	84
1141	MI OST Mode Sel-DCG Conf	Cal - Band 3	88
1141	MI OST Mode Sel-DCG Conf	Cal - Band 4	92
1141	MI OST Mode Sel-DCG Conf	RXOnly Band1	96

1142	MI OST PIS Band Select	PIS1B0PIS2B0	0
1142	MI OST PIS Band Select	PIS1B0PIS2B1	1
1142	MI OST PIS Band Select	PIS1B1PIS2B2	10
1142	MI OST PIS Band Select	PIS1B1PIS2B3	11
1142	MI OST PIS Band Select	PIS1B1PIS2B4	12
1142	MI OST PIS Band Select	PIS1B2PIS2B0	16
1142	MI OST PIS Band Select	PIS1B2PIS2B1	17
1142	MI OST PIS Band Select	PIS1B2PIS2B2	18
1142	MI OST PIS Band Select	PIS1B2PIS2B3	19
1142	MI OST PIS Band Select	PIS1B0PIS2B2	2
1142	MI OST PIS Band Select	PIS1B2PIS2B4	20
1142	MI OST PIS Band Select	PIS1B3PIS2B0	24
1142	MI OST PIS Band Select	PIS1B3PIS2B1	25
1142	MI OST PIS Band Select	PIS1B3PIS2B2	26
1142	MI OST PIS Band Select	PIS1B3PIS2B3	27
1142	MI OST PIS Band Select	PIS1B3PIS2B4	28
1142	MI OST PIS Band Select	PIS1B0PIS2B3	3
1142	MI OST PIS Band Select	PIS1B4PIS2B0	32
1142	MI OST PIS Band Select	PIS1B4PIS2B1	33
1142	MI OST PIS Band Select	PIS1B4PIS2B2	34
1142	MI OST PIS Band Select	PIS1B4PIS2B3	35
1142	MI OST PIS Band Select	PIS1B4PIS2B4	36
1142	MI OST PIS Band Select	PIS1B0PIS2B4	4
1142	MI OST PIS Band Select	PIS1B1PIS2B0	8
1142	MI OST PIS Band Select	PIS1B1PIS2B1	9

1143	MI OST TX Power Level	TX PWR NULL	0
1143	MI OST TX Power Level	TX PWR LVL1	1

1143	MI OST TX Power Level	TX PWR LVL10	10
1143	MI OST TX Power Level	TX PWR LVL11	11
1143	MI OST TX Power Level	TX PWR LVL12	12
1143	MI OST TX Power Level	TX PWR LVL13	13
1143	MI OST TX Power Level	TX PWR LVL14	14
1143	MI OST TX Power Level	TX PWR MAX	15
1143	MI OST TX Power Level	TX PWR LVL2	2
1143	MI OST TX Power Level	TX PWR LVL3	3
1143	MI OST TX Power Level	TX PWR LVL4	4
1143	MI OST TX Power Level	TX PWR LVL5	5
1143	MI OST TX Power Level	TX PWR LVL6	6
1143	MI OST TX Power Level	TX PWR LVL7	7
1143	MI OST TX Power Level	TX PWR LVL8	8
1143	MI OST TX Power Level	TX PWR LVL9	9

1144	MI OST Indiv Echoes - FM	NoFMStore	0
1144	MI OST Indiv Echoes - FM	NoFMSTmTrkE	1
1144	MI OST Indiv Echoes - FM	NoFMSTmAcqE	2
1144	MI OST Indiv Echoes - FM	FMSTrkE	3
1144	MI OST Indiv Echoes - FM	FMSTrkAcqE	4
1144	MI OST Indiv Echoes - FM	FMSTrkUncE	5
1144	MI OST Indiv Echoes - FM	FMSTrkAcqUE	6
1144	MI OST Indiv Echoes - FM	NoFMStore	7

9.3.3. MARSIS-related S/C Packet Telecommands

The format and the parameters of these TC Packets is managed by ESOC.

9.4. MEDOC Telemetry Instances

Details of each Telemetry Instance are found in RD-17.

9.4.1. MEDOC Cross-references

TM Instances vs MARSIS Packet Telemetries

Name	Description	APID	T	S	PI 1	PI 2	Instance Of
YMI00000	MARSIS-TC Accept. Report: Success	**1217**	1	1	0	0	SIS_ACC_REP_S
YMI00001	MARSIS-Incomplete Packet	**1217**	1	2	1	0	SIS_ACC_REP_F
YMI00002	MARSIS-Incorrect Checksum (CRC)	**1217**	1	2	2	0	SIS_ACC_REP_F
YMI00003	MARSIS-Incorrect APID in TC Haeder	**1217**	1	2	3	0	SIS_ACC_REP_F
YMI00004	MARSIS-Invalid Command Code	**1217**	1	2	4	0	SIS_ACC_REP_F
YMI00005	MARSIS-Cannot Execute Command	**1217**	1	2	5	0	SIS_ACC_REP_F
YMI00006	MARSIS-Pckt Data Field Inconsistent	**1217**	1	2	6	0	SIS_ACC_REP_F
YMI00007	MARSIS-HK Report Packet	**1220**	3	25	0	0	SIS_HK_TM
YMI00008	MARSIS-Transition to Support Mode	**1223**	5	1	41801	0	SIS_PROG_REP
YMI00009	MARSIS-Transition to Operative Mode	**1223**	5	1	41802	0	SIS_PROG_REP
YMI00010	No Nom Trans-BIT failed out of Ck_Init	**1223**	5	2	41901	0	SIS_ERR_REP
YMI00011	No Nom Trans-BIT failed while in Ck_Init	**1223**	5	2	41902	0	SIS_ERR_REP
YMI00012	No Nom Trans-TM pck Buffer Oveflow	**1223**	5	2	41903	0	SIS_ERR_REP
YMI00013	No Nom Trans-No SCET Available	**1223**	5	2	41904	0	SIS_ERR_REP
YMI00014	No Nom Trans-HW Watchdog	**1223**	5	2	41905	0	SIS_ERR_REP
YMI00015	No Nom Trans-to IDLE due to SW Watchdog	**1223**	5	2	41906	0	SIS_ERR_REP
YMI00016	No Nom Trans-SCET start/OST inconsistenc	**1223**	5	2	41907	0	SIS_ERR_REP
YMI00017	Erroneus TC	**1223**	5	2	41908	0	SIS_ERR_REP
YMI00021	MARSIS-Science Report 1 via RTU Link	**1244**	20	3	0	0	SIS_SCIENCE_SS
YMI00022	MARSIS-Science Report 2 via RTU Link	**1260**	20	3	0	0	SIS_SCIENCE_AIS
YMI00023	MARSIS-Science Report 3 via RTU Link	**1276**	20	3	0	0	SIS_SCIENCE_CAL
YMI00024	MARSIS-Science Report 4 via RTU Link	**1292**	20	3	0	0	SIS_SCIENCE_RCV
YMI00300	MARSIS-Dump Rep:	**1225**	6	6	176	0	SIS_DUMP_TM_C

	EEPROM C-C						
YMI00301	MARSIS-Dump Rep: EEPROM DSP1	**1241**	6	6	179	0	SIS_DUMP_TM_1
YMI00302	MARSIS-Dump Rep: EEPROM DSP2	**1257**	6	6	183	0	SIS_DUMP_TM_2
YMI00310	MARSIS-Dump Rep: Prog. RAM C-C	**1225**	6	6	177	0	SIS_DUMP_TM_C
YMI00311	MARSIS-Dump Rep: Prog. RAM DSP1	**1241**	6	6	180	0	SIS_DUMP_TM_1
YMI00312	MARSIS-Dump Rep: Prog. RAM DSP2	**1257**	6	6	184	0	SIS_DUMP_TM_2
YMI00320	MARSIS-Dump Rep: Data RAM C-C	**1225**	6	6	178	0	SIS_DUMP_TM_C
YMI00321	MARSIS-Dump Rep: Data RAM DSP1	**1241**	6	6	181	0	SIS_DUMP_TM_1
YMI00322	MARSIS-Dump Rep: Data RAM DSP2	**1257**	6	6	185	0	SIS_DUMP_TM_2
YMI00331	MARSIS-Dump Rep: dual-port SRAM DSP1	**1241**	6	6	182	0	SIS_DUMP_TM_1
YMI00332	MARSIS-Dump Rep: dual-port SRAM DSP2	**1257**	6	6	186	0	SIS_DUMP_TM_2
YMI00333	MARSIS-Dump Rep: Flash Chip0 Timing	**1273**	6	6	187	0	SIS_DUMP_TM
YMI00334	MARSIS-Dump Rep: Flash Chip1 Timing	**1273**	6	6	188	0	SIS_DUMP_TM
YMI00335	MARSIS-Dump Rep: Flash Chip2 Timing	**1273**	6	6	189	0	SIS_DUMP_TM
YMI00336	MARSIS-Dump Rep: Flash Chip3 Timing	**1273**	6	6	190	0	SIS_DUMP_TM

MARSIS Packet Telemetries vs TM Instances

Instance Of	APID	T	S	PI 1	PI 2	Name	Description
SIS_ACC_REP_F	**1217**	1	2	1	0	YMI00001	MARSIS-Incomplete Packet
	1217	1	2	2	0	YMI00002	MARSIS-Incorrect Checksum (CRC)
	1217	1	2	3	0	YMI00003	MARSIS-Incorrect APID in TC Haeder
	1217	1	2	4	0	YMI00004	MARSIS-Invalid Command Code
	1217	1	2	5	0	YMI00005	MARSIS-Cannot Execute Command
	1217	1	2	6	0	YMI00006	MARSIS-Pckt Data Field Inconsistent
SIS_ACC_REP_S	**1217**	1	1	0	0	YMI00000	MARSIS-TC Accept. Report: Success
SIS_DUMP_TM	**1273**	6	6	187	0	YMI00333	MARSIS-Dump Rep: Flash Chip0 Timing
	1273	6	6	188	0	YMI00334	MARSIS-Dump Rep: Flash Chip1 Timing
	1273	6	6	189	0	YMI00335	MARSIS-Dump Rep: Flash Chip2 Timing
	1273	6	6	190	0	YMI00336	MARSIS-Dump Rep: Flash Chip3 Timing
SIS_DUMP_TM_1	**1241**	6	6	179	0	YMI00301	MARSIS-Dump Rep: EEPROM DSP1
	1241	6	6	180	0	YMI00311	MARSIS-Dump Rep: Prog. RAM DSP1
	1241	6	6	181	0	YMI00321	MARSIS-Dump Rep: Data RAM DSP1
	1241	6	6	182	0	YMI00331	MARSIS-Dump Rep: dual-port SRAM DSP1
SIS_DUMP_TM_2	**1257**	6	6	183	0	YMI00302	MARSIS-Dump Rep: EEPROM DSP2
	1257	6	6	184	0	YMI00312	MARSIS-Dump Rep: Prog. RAM DSP2
	1257	6	6	185	0	YMI00322	MARSIS-Dump Rep: Data RAM DSP2
	1257	6	6	186	0	YMI00332	MARSIS-Dump Rep: dual-port SRAM DSP2
SIS_DUMP_TM_C	**1225**	6	6	176	0	YMI00300	MARSIS-Dump Rep: EEPROM C-C
	1225	6	6	177	0	YMI00310	MARSIS-Dump Rep: Prog. RAM C-C
	1225	6	6	178	0	YMI00320	MARSIS-Dump Rep: Data RAM C-C
SIS_ERR_REP	**1223**	5	2	41901	0	YMI00010	No Nom Trans-BIT failed out of Ck_Init
	1223	5	2	41902	0	YMI00011	No Nom Trans-BIT failed while in Ck_Init
	1223	5	2	41903	0	YMI00012	No Nom Trans-TM pck Buffer Oveflow
	1223	5	2	41904	0	YMI00013	No Nom Trans-No SCET Available

	1223	5	2	41905	0	YMI00014	No Nom Trans-HW Watchdog
	1223	5	2	41906	0	YMI00015	No Nom Trans-to IDLE due to SW Watchdog
	1223	5	2	41907	0	YMI00016	No Nom Trans-SCET start/OST inconsistenc
	1223	5	2	41908	0	YMI00017	Erroneus TC
SIS_HK_TM	**1220**	3	25	0	0	YMI00007	MARSIS-HK Report Packet
SIS_PROG_REP	**1223**	5	1	41801	0	YMI00008	MARSIS-Transition to Support Mode
	1223	5	1	41802	0	YMI00009	MARSIS-Transition to Operative Mode
SIS_SCIENCE_SS	**1244**	20	3	0	0	YMI00021	MARSIS-Science Report 1 via RTU Link
SIS_SCIENCE_AIS	**1260**	20	3	0	0	YMI00022	MARSIS-Science Report 2 via RTU Link
SIS_SCIENCE_CAL	**1276**	20	3	0	0	YMI00023	MARSIS-Science Report 3 via RTU Link
SIS_SCIENCE_RCV	**1292**	20	3	0	0	YMI00024	MARSIS-Science Report 4 via RTU Link

MARSIS-related S/C Packet Telemetries

Name	Description	APID	T	S	PI 1	PI 2
YAC00049	AOCS SW 1	**196**	3	25	49	0
YDM00002	Thermal control temperature	**20**	3	25	2	0
YDM00003	P/L analogue TM	**20**	3	25	3	0
YDM00006	PDU normal acquisitions	**20**	3	25	6	0
YDM00011	Subsystems Manager	**20**	3	25	11	0
YDM00098	DMS Safe Mode 1	**68**	3	25	98	0
YDM02428	DMS-Set MARSIS fail-no SGM	**17**	1	2	19740	0
YDM02429	DMS-Set MARSIS flag failure	**17**	1	8	19741	0

Relevant parameters of interest for MARSIS operations are:

Parameter	Par Name
Arm_Group_4A MAR	NPWD2034
Arm_Group_4B MAR	NPWD2154
Arm4Pyro_1B MARS	NPWD2147
Arm4Pyro_2B MARS	NPWD2146
Arm4Pyro_3B MARS	NPWD2145
Dis/En for TC fo	NDWD0A1B
Dis/En for TM fo	NDWD0A1A
flag- MARSIS ant	NAWD0Z50
LCL16A curr MARS	NPWD2442
LCL16A stat MARS	NPWD2106
LCL16A stat MARS	NPWD2106
LCL31A curr MARS	NPWD2371
LCL31A stat MARS	NPWD2095
LCL31A stat MARS	NPWD2095
MARSIS ant deplo	NDWD5100
MARSIS-DES Volta	NMIA0105
MARSIS-DES Volta	NMIA0106
MARSIS-DES Volta	NMIA0205
MARSIS-DES Volta	NMIA0206
MARSIS-Temp ANT	NMIA0109
MARSIS-Temp ANT	NMIA0209
MARSIS-Temp DES	NMIA0101
MARSIS-Temp DES	NMIA0201
MARSIS-Temp RX N	NMIA0102
MARSIS-Temp RX R	NMIA0202
MARSIS-Temp TX N	NMIA0103
MARSIS-Temp TX R	NMIA0203
MARSIS-TX Voltag	NMIA0108
MARSIS-TX Voltag	NMIA0208
PT2343-MARSIS An	NTSA3503
PT2344-MARSIS An	NTSA3504
Red/Nom path for	NDWD0A19
YSI341-MARSIS DE	NTSA3501
YSI342-MARSIS TX	NTSA3502

9.4.2. MARSIS Packet TM Parameters

9.4.2.1 Parameters definition

TM Name	APID	T	S	SPID	Parameter	Par Name	Offset		occ
							Byte	Bit	
YMI00000	1217	1	1	2077	TC Packet ID	NMI00001	00016	0	1
YMI00000	1217	1	1	2077	TC Sequence Cont	NMI00002	00018	0	1
YMI00001	1217	1	2	2078	TC Packet ID	NMI00001	00016	0	1
YMI00001	1217	1	2	2078	TC Sequence Cont	NMI00002	00018	0	1
YMI00001	1217	1	2	2078	VPD PAD 16 BITS	NGSFIX16	00020	0	1
YMI00001	1217	1	2	2078	Packet Type	NMI00003	00022	0	1
YMI00001	1217	1	2	2078	Packet Sub-Type	NMI00004	00023	0	1
YMI00001	1217	1	2	2078	Length of Receiv	NMI00005	00024	0	1
YMI00001	1217	1	2	2078	Number of Receiv	NMI00006	00026	0	1
YMI00002	1217	1	2	2079	TC Packet ID	NMI00001	00016	0	1
YMI00002	1217	1	2	2079	TC Sequence Cont	NMI00002	00018	0	1
YMI00002	1217	1	2	2079	VPD PAD 16 BITS	NGSFIX16	00020	0	1
YMI00002	1217	1	2	2079	Packet Type	NMI00003	00022	0	1
YMI00002	1217	1	2	2079	Packet Sub-Type	NMI00004	00023	0	1
YMI00002	1217	1	2	2079	Received Checksu	NMI00007	00024	0	1
YMI00002	1217	1	2	2079	Computed Checksu	NMI00008	00026	0	1
YMI00003	1217	1	2	2080	TC Packet ID	NMI00001	00016	0	1
YMI00003	1217	1	2	2080	TC Sequence Cont	NMI00002	00018	0	1
YMI00003	1217	1	2	2080	VPD PAD 16 BITS	NGSFIX16	00020	0	1
YMI00003	1217	1	2	2080	Packet Type	NMI00003	00022	0	1
YMI00003	1217	1	2	2080	Packet Sub-Type	NMI00004	00023	0	1
YMI00004	1217	1	2	2081	TC Packet ID	NMI00001	00016	0	1
YMI00004	1217	1	2	2081	TC Sequence Cont	NMI00002	00018	0	1
YMI00004	1217	1	2	2081	VPD PAD 16 BITS	NGSFIX16	00020	0	1
YMI00004	1217	1	2	2081	Packet Type	NMI00003	00022	0	1
YMI00004	1217	1	2	2081	Packet Sub-Type	NMI00004	00023	0	1
YMI00005	1217	1	2	2082	TC Packet ID	NMI00001	00016	0	1
YMI00005	1217	1	2	2082	TC Sequence Cont	NMI00002	00018	0	1
YMI00005	1217	1	2	2082	VPD PAD 16 BITS	NGSFIX16	00020	0	1
YMI00005	1217	1	2	2082	Packet Type	NMI00003	00022	0	1
YMI00005	1217	1	2	2082	Packet Sub-Type	NMI00004	00023	0	1
YMI00005	1217	1	2	2082	Id Operative Mod	NMI00043	00024	0	1
YMI00005	1217	1	2	2082	Reason	NMI00044	00026	0	1
YMI00006	1217	1	2	2083	TC Packet ID	NMI00001	00016	0	1
YMI00006	1217	1	2	2083	TC Sequence Cont	NMI00002	00018	0	1
YMI00006	1217	1	2	2083	VPD PAD 16 BITS	NGSFIX16	00020	0	1
YMI00006	1217	1	2	2083	Packet Type	NMI00003	00022	0	1
YMI00006	1217	1	2	2083	Packet Sub-Type	NMI00004	00023	0	1

YMI00006	1217	1	2	2083	Position of 1st	NMI00009	00024	0	1
YMI00006	1217	1	2	2083	Recived Value of	NMI00010	00026	0	1

YMI00007	1220	3	25	2084	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00007	1220	3	25	2084	Current Operativ	NMI00011	00018	0	1
YMI00007	1220	3	25	2084	Current PRI	NMI00012	00020	0	1
YMI00007	1220	3	25	2084	Current SCET	NMI00013	00024	0	1
YMI00007	1220	3	25	2084	Nb of Accepted T	NMI00014	00030	0	1
YMI00007	1220	3	25	2084	Nb of Refused TC	NMI00015	00032	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00201	00034	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00202	00036	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00203	00038	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00204	00040	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00205	00042	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00206	00044	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00207	00046	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00208	00048	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00209	00050	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00210	00052	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00211	00054	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00212	00056	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00213	00058	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00214	00060	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00215	00062	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00216	00064	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00217	00066	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00218	00068	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00219	00070	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00220	00072	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00221	00074	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00222	00076	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00223	00078	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00224	00080	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00225	00082	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00226	00084	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00227	00086	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00228	00088	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00229	00090	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00230	00092	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00231	00094	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00232	00096	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00233	00098	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00234	00100	0	1
YMI00007	1220	3	25	2084	Last BIT result	NMI00235	00102	0	1
YMI00007	1220	3	25	2084	Nb of Acceptance	NMI00016	00104	0	1
YMI00007	1220	3	25	2084	Nb of Event Rep	NMI00017	00106	0	1
YMI00007	1220	3	25	2084	Nb of HK Rep Que	NMI00018	00108	0	1
YMI00007	1220	3	25	2084	Nb of Dump Rep Q	NMI00054	00110	0	1
YMI00007	1220	3	25	2084	Nb of Science Re	NMI00019	00112	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00401	00114	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00402	00116	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00403	00118	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00404	00120	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00405	00122	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00406	00124	0	1

YMI00007	1220	3	25	2084	HK Minor error s	NMI00407	00126	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00408	00128	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00409	00130	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00410	00132	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00411	00134	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00412	00136	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00413	00138	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00414	00140	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00415	00142	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00416	00144	0	1
YMI00007	1220	3	25	2084	HK Minor error s	NMI00417	00146	0	1
YMI00007	1220	3	25	2084	Nb of individual	NMI00055	00148	0	1
YMI00007	1220	3	25	2084	FLASH Memories s	NMI00059	00152	0	1
YMI00007	1220	3	25	2084	TM-Block queued	NMI00060	00156	0	1
YMI00007	1220	3	25	2084	SW Version	NMI00061	00158	0	1
YMI00007	1220	3	25	2084	ON-Board Compute	NMI00062	00160	0	1
YMI00007	1220	3	25	2084	PT PRF	NMI00063	00164	0	1
YMI00007	1220	3	25	2084	FM TEST/ERASE St	NMI00064	00168	0	1
YMI00007	1220	3	25	2084	FM TEST/ERASE Cu	NMI00065	00172	0	1
YMI00007	1220	3	25	2084	FM TEST/ERASE In	NMI00066	00176	0	1
YMI00007	1220	3	25	2084	FM TEST/ERASE En	NMI00067	00180	0	1
YMI00007	1220	3	25	2084	Words stored in	NMI00068	00184	0	1
YMI00007	1220	3	25	2084	Words stored in	NMI00069	00188	0	1
YMI00007	1220	3	25	2084	Words stored in	NMI00070	00192	0	1
YMI00007	1220	3	25	2084	Words stored in	NMI00071	00196	0	1
YMI00007	1220	3	25	2084	Words stored in	NMI00072	00200	0	1
YMI00007	1220	3	25	2084	Words stored in	NMI00073	00204	0	1
YMI00007	1220	3	25	2084	DUMP 16 bit PAD	NACX9999	00208	0	5

YMI00008	1223	5	1	2085	VPD PAD 16 BITS	NGSFIX16	00016	0	1
YMI00008	1223	5	1	2085	Transition ID ev	NMI00045	00018	0	1
YMI00008	1223	5	1	2085	Transition PRI#	NMI00038	00020	0	1
YMI00008	1223	5	1	2085	Transition SCET	NMI00039	00024	0	1

YMI00009	1223	5	1	2086	VPD PAD 16 BITS	NGSFIX16	00016	0	1
YMI00009	1223	5	1	2086	Transition ID ev	NMI00046	00018	0	1
YMI00009	1223	5	1	2086	Transition PRI#	NMI00038	00020	0	1
YMI00009	1223	5	1	2086	Transition SCET	NMI00039	00024	0	1
YMI00009	1223	5	1	2086	OST Entry ID	NMI00040	00030	0	1

YMI00010	1223	5	2	2087	VPD PAD 16 BITS	NGSFIX16	00016	0	1
YMI00010	1223	5	2	2087	Transition ID ev	NMI00047	00018	0	1
YMI00010	1223	5	2	2087	Transition PRI#	NMI00038	00022	0	1
YMI00010	1223	5	2	2087	Transition SCET	NMI00039	00026	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00201	00032	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00202	00034	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00203	00036	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00204	00038	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00205	00040	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00206	00042	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00207	00044	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00208	00046	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00209	00048	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00210	00050	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00211	00052	0	1

YMI00010	1223	5	2	2087	Last BIT result	NMI00212	00054	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00213	00056	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00214	00058	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00215	00060	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00216	00062	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00217	00064	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00218	00066	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00219	00068	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00220	00070	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00221	00072	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00222	00074	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00223	00076	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00224	00078	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00225	00080	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00226	00082	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00227	00084	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00228	00086	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00229	00088	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00230	00090	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00231	00092	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00232	00094	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00233	00096	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00234	00098	0	1
YMI00010	1223	5	2	2087	Last BIT result	NMI00235	00100	0	1

YMI00011	1223	5	2	2088	VPD PAD 16 BITS	NGSFIX16	00016	0	1
YMI00011	1223	5	2	2088	Transition ID ev	NMI00048	00018	0	1
YMI00011	1223	5	2	2088	Transition PRI#	NMI00038	00022	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00201	00032	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00202	00034	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00203	00036	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00204	00038	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00205	00040	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00206	00042	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00207	00044	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00208	00046	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00209	00048	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00210	00050	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00211	00052	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00212	00054	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00213	00056	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00214	00058	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00215	00060	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00216	00062	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00217	00064	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00218	00066	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00219	00068	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00220	00070	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00221	00072	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00222	00074	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00223	00076	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00224	00078	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00225	00080	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00226	00082	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00227	00084	0	1

YMI00011	1223	5	2	2088	Last BIT result	NMI00228	00086	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00229	00088	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00230	00090	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00231	00092	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00232	00094	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00233	00096	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00234	00098	0	1
YMI00011	1223	5	2	2088	Last BIT result	NMI00235	00100	0	1

YMI00012	1223	5	2	2089	VPD PAD 16 BITS	NGSFIX16	00016	0	1
YMI00012	1223	5	2	2089	Transition ID ev	NMI00049	00018	0	1
YMI00012	1223	5	2	2089	Transition PRI#	NMI00038	00022	0	1
YMI00012	1223	5	2	2089	Transition SCET	NMI00039	00026	0	1

YMI00013	1223	5	2	2090	VPD PAD 16 BITS	NGSFIX16	00016	0	1
YMI00013	1223	5	2	2090	Transition ID ev	NMI00050	00018	0	1
YMI00013	1223	5	2	2090	Transition PRI#	NMI00038	00022	0	1

YMI00014	1223	5	2	2091	VPD PAD 16 BITS	NGSFIX16	00016	0	1
YMI00014	1223	5	2	2091	Transition ID ev	NMI00051	00018	0	1
YMI00014	1223	5	2	2091	Failure Code	NMI00042	00020	0	1
YMI00014	1223	5	2	2091	Transition PRI#	NMI00038	00022	0	1
YMI00014	1223	5	2	2091	Transition SCET	NMI00039	00026	0	1

YMI00015	1223	5	2	2092	VPD PAD 16 BITS	NGSFIX16	00016	0	1
YMI00015	1223	5	2	2092	Transition ID ev	NMI00052	00018	0	1
YMI00015	1223	5	2	2092	Failure Code	NMI00042	00020	0	1
YMI00015	1223	5	2	2092	Transition PRI#	NMI00038	00022	0	1
YMI00015	1223	5	2	2092	Transition SCET	NMI00039	00026	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00201	00032	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00202	00034	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00203	00036	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00204	00038	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00205	00040	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00206	00042	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00207	00044	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00208	00046	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00209	00048	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00210	00050	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00211	00052	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00212	00054	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00213	00056	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00214	00058	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00215	00060	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00216	00062	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00217	00064	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00218	00066	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00219	00068	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00220	00070	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00221	00072	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00222	00074	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00223	00076	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00224	00078	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00225	00080	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00226	00082	0	1

YMI00015	1223	5	2	2092	Last BIT result	NMI00227	00084	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00228	00086	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00229	00088	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00230	00090	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00231	00092	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00232	00094	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00233	00096	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00234	00098	0	1
YMI00015	1223	5	2	2092	Last BIT result	NMI00235	00100	0	1

YMI00016	1223	5	2	2093	VPD PAD 16 BITS	NGSFIX16	00016	0	1
YMI00016	1223	5	2	2093	Transition ID ev	NMI00053	00018	0	1
YMI00016	1223	5	2	2093	Failure Code	NMI00042	00020	0	1
YMI00016	1223	5	2	2093	Transition PRI#	NMI00038	00022	0	1
YMI00016	1223	5	2	2093	Transition SCET	NMI00039	00026	0	1
YMI00016	1223	5	2	2093	SCET/OST inconsi	NMI00251	00032	0	1
YMI00016	1223	5	2	2093	SCET/OST inconsi	NMI00252	00034	0	1
YMI00016	1223	5	2	2093	SCET/OST inconsi	NMI00253	00036	0	1
YMI00016	1223	5	2	2093	SCET/OST inconsi	NMI00254	00038	0	1
YMI00016	1223	5	2	2093	SCET/OST inconsi	NMI00255	00040	0	1
YMI00016	1223	5	2	2093	SCET/OST inconsi	NMI00256	00042	0	1
YMI00016	1223	5	2	2093	SCET/OST inconsi	NMI00257	00044	0	1

YMI00017	1223	5	2	2094	VPD PAD 16 BITS	NGSFIX16	00016	0	1
YMI00017	1223	5	2	2094	TC Packet ID	NMI00001	00018	0	1
YMI00017	1223	5	2	2094	TC Sequence Cont	NMI00002	00020	0	1
YMI00017	1223	5	2	2094	Failure Code	NMI00042	00022	0	1
YMI00017	1223	5	2	2094	Packet Type	NMI00003	00024	0	1
YMI00017	1223	5	2	2094	Packet Sub-Type	NMI00004	00025	0	1
YMI00017	1223	5	2	2094	Received Checksu	NMI00007	00026	0	1
YMI00017	1223	5	2	2094	Computed Checksu	NMI00008	00028	0	1

YMI00021	1244	20	3	2095	Raw Science Data	NMI00100	00016	0	1

YMI00022	1260	20	3	2096	Raw Science Data	NMI00100	00016	0	1

YMI00023	1276	20	3	2097	Raw Science Data	NMI00100	00016	0	1

YMI00024	1292	20	3	2098	Raw Science Data	NMI00100	00016	0	1

YMI00300	1225	6	6	2561	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00300	1225	6	6	2561	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00300	1225	6	6	2561	Start address	NMI00301	00018	0	1
YMI00300	1225	6	6	2561	Length of dump b	NMI00302	00022	0	1

YMI00301	1241	6	6	2562	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00301	1241	6	6	2562	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00301	1241	6	6	2562	Start address	NMI00301	00018	0	1
YMI00301	1241	6	6	2562	Length of dump b	NMI00302	00022	0	1

YMI00302	1257	6	6	2563	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00302	1257	6	6	2563	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00302	1257	6	6	2563	Start address	NMI00301	00018	0	1
YMI00302	1257	6	6	2563	Length of dump b	NMI00302	00022	0	1

YMI00310	1225	6	6	2564	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00310	1225	6	6	2564	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00310	1225	6	6	2564	Start address	NMI00301	00018	0	1
YMI00310	1225	6	6	2564	Length of dump b	NMI00302	00022	0	1

YMI00311	1241	6	6	2565	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00311	1241	6	6	2565	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00311	1241	6	6	2565	Start address	NMI00301	00018	0	1
YMI00311	1241	6	6	2565	Length of dump b	NMI00302	00022	0	1

YMI00312	1257	6	6	2566	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00312	1257	6	6	2566	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00312	1257	6	6	2566	Start address	NMI00301	00018	0	1
YMI00312	1257	6	6	2566	Length of dump b	NMI00302	00022	0	1

YMI00320	1225	6	6	2567	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00320	1225	6	6	2567	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00320	1225	6	6	2567	Start address	NMI00301	00018	0	1
YMI00320	1225	6	6	2567	Length of dump b	NMI00302	00022	0	1

YMI00321	1241	6	6	2568	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00321	1241	6	6	2568	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00321	1241	6	6	2568	Start address	NMI00301	00018	0	1
YMI00321	1241	6	6	2568	Length of dump b	NMI00302	00022	0	1

YMI00322	1257	6	6	2569	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00322	1257	6	6	2569	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00322	1257	6	6	2569	Start address	NMI00301	00018	0	1
YMI00322	1257	6	6	2569	Length of dump b	NMI00302	00022	0	1

YMI00331	1241	6	6	2570	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00331	1241	6	6	2570	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00331	1241	6	6	2570	Start address	NMI00301	00018	0	1
YMI00331	1241	6	6	2570	Length of dump b	NMI00302	00022	0	1
YMI00331	1241	6	6	2570	Data (fixed size	NMI00303	00024	0	1

YMI00332	1257	6	6	2571	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00332	1257	6	6	2571	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00332	1257	6	6	2571	Start address	NMI00301	00018	0	1
YMI00332	1257	6	6	2571	Length of dump b	NMI00302	00022	0	1
YMI00332	1257	6	6	2571	Data (fixed size	NMI00303	00024	0	1

YMI00333	1273	6	6	2572	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00333	1273	6	6	2572	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00333	1273	6	6	2572	Start address	NMI00301	00018	0	1
YMI00333	1273	6	6	2572	Length of dump b	NMI00302	00022	0	1
YMI00333	1273	6	6	2572	Data (fixed size	NMI00303	00024	0	1

YMI00334	1273	6	6	2573	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00334	1273	6	6	2573	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00334	1273	6	6	2573	Start address	NMI00301	00018	0	1
YMI00334	1273	6	6	2573	Length of dump b	NMI00302	00022	0	1
YMI00334	1273	6	6	2573	Data (fixed size	NMI00303	00024	0	1

YMI00335	1273	6	6	2780	VPD PAD 08 BITS	NGSFIX08	00016	0	1

YMI00335	1273	6	6	2780	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00335	1273	6	6	2780	Start address	NMI00301	00018	0	1
YMI00335	1273	6	6	2780	Length of dump b	NMI00302	00022	0	1
YMI00335	1273	6	6	2780	Data (fixed size	NMI00303	00024	0	1

YMI00336	1273	6	6	2781	VPD PAD 08 BITS	NGSFIX08	00016	0	1
YMI00336	1273	6	6	2781	Repeat Cntr (8bi	NMI00300	00017	0	1
YMI00336	1273	6	6	2781	Start address	NMI00301	00018	0	1
YMI00336	1273	6	6	2781	Length of dump b	NMI00302	00022	0	1
YMI00336	1273	6	6	2781	Data (fixed size	NMI00303	00024	0	1

9.4.2.2 TM Calibrated Parameters

MARSIS Packet Telemetries Calibrated Parameter (Numeric)

No parameters with Numerical values

MARSIS Packet Telemetries Calibrated Parameter (Polynomial)

No parameters with Polynomial values

MARSIS Packet Telemetries Calibrated Parameter (Text)

TC_Name	Par_Name	Calib	Validity	V_Value	Cal Description
YMI00007	NMI00011	**1175**		1	Operative Mode
YMI00008	NMI00045	**1198**		1	Mode Transition
YMI00009	NMI00046	**1198**		1	Mode Transition
YMI00010	NMI00047	**1198**		1	Mode Transition
YMI00011	NMI00048	**1198**		1	Mode Transition
YMI00012	NMI00049	**1198**		1	Mode Transition
YMI00013	NMI00050	**1198**		1	Mode Transition
YMI00014	NMI00051	**1198**		1	Mode Transition
YMI00015	NMI00052	**1198**		1	Mode Transition
YMI00016	NMI00053	**1198**		1	Mode Transition

9.4.2.3 TM Parameters Calibration Values

MARSIS Packet Telemetries Calibrated Parameter Values (Text)

Calib	Cal Description	From	To	Text Value
1175	Operative Mode	0	0	CHECK/INIT
1175	Operative Mode	1	1	STANDBY
1175	Operative Mode	10	10	SS3
1175	Operative Mode	11	11	SS4

1175	Operative Mode	12	12	SS5
1175	Operative Mode	13	13	DATAtoFLASH
1175	Operative Mode	2	2	WARM-UP1
1175	Operative Mode	3	3	WARM-UP2
1175	Operative Mode	4	4	IDLE
1175	Operative Mode	5	5	CALIBRATION
1175	Operative Mode	6	6	RECEIVE ONLY
1175	Operative Mode	7	7	ACTIVE IONO
1175	Operative Mode	8	8	SS1
1175	Operative Mode	9	9	SS2

1198	Mode Transition	41501	41501	CK_IN/CK_IN
1198	Mode Transition	41502	41502	STBY/CK_IN
1198	Mode Transition	41503	41503	WUP1/CK_IN
1198	Mode Transition	41504	41504	WUP2/CK_IN
1198	Mode Transition	41506	41506	CALIBR/CK_IN
1198	Mode Transition	41507	41507	REC.ON/CK_IN
1198	Mode Transition	41508	41508	ACT.IO/CK_IN
1198	Mode Transition	41509	41509	SS1/CK_IN
1198	Mode Transition	41510	41510	SS2/CK_IN
1198	Mode Transition	41511	41511	SS3/CK_IN
1198	Mode Transition	41512	41512	SS4/CK_IN
1198	Mode Transition	41513	41513	SS5/CK_IN
1198	Mode Transition	41514	41514	FLASHT/CK_IN
1198	Mode Transition	41517	41517	CK_IN/STBY
1198	Mode Transition	41519	41519	WUP1/STBY
1198	Mode Transition	41520	41520	WUP2/STBY
1198	Mode Transition	41534	41534	STBY/WUP1
1198	Mode Transition	41536	41536	WUP2/WUP1
1198	Mode Transition	41551	41551	WUP1/WUP2
1198	Mode Transition	41552	41552	WUP2/WUP2
1198	Mode Transition	41554	41554	CALIBR/WUP2
1198	Mode Transition	41555	41555	REC.ON/WUP2
1198	Mode Transition	41556	41556	ACT.ION/WUP2
1198	Mode Transition	41557	41557	SS1/WUP2
1198	Mode Transition	41558	41558	SS1/WUP2
1198	Mode Transition	41559	41559	SS1/WUP2
1198	Mode Transition	41560	41560	SS1/WUP2
1198	Mode Transition	41561	41561	SS1/WUP2
1198	Mode Transition	41562	41562	FLASHT/WUP2
1198	Mode Transition	41565	41565	CK_IN/IDLE
1198	Mode Transition	41566	41566	STBY/IDLE
1198	Mode Transition	41567	41567	WUP1/IDLE
1198	Mode Transition	41568	41568	WUP2/IDLE
1198	Mode Transition	41570	41570	CALIBR/IDLE
1198	Mode Transition	41571	41571	REC.ONL/IDLE
1198	Mode Transition	41572	41572	ACT.ION/IDLE
1198	Mode Transition	41573	41573	SS1/IDLE
1198	Mode Transition	41574	41574	SS2/IDLE
1198	Mode Transition	41575	41575	SS3/IDLE
1198	Mode Transition	41576	41576	SS4/IDLE
1198	Mode Transition	41577	41577	SS5/IDLE
1198	Mode Transition	41578	41578	FLASHT/IDLE
1198	Mode Transition	41584	41584	WUP2/CALIBR
1198	Mode Transition	41586	41586	CALIB/CALIB

1198	Mode Transition	41587	41587	REC.ON/CALIB
1198	Mode Transition	41588	41588	ACT.IO/CALIB
1198	Mode Transition	41589	41589	SS1/CALIBR
1198	Mode Transition	41590	41590	SS2/CALIBR
1198	Mode Transition	41591	41591	SS3/CALIBR
1198	Mode Transition	41592	41592	SS4/CALIBR
1198	Mode Transition	41593	41593	SS5/CALIBR
1198	Mode Transition	41594	41594	FLASHT/CALIB
1198	Mode Transition	41600	41600	WUP2/REC.ONL
1198	Mode Transition	41602	41602	CALIB/REC.ON
1198	Mode Transition	41603	41603	REC.O/REC.O
1198	Mode Transition	41604	41604	ACT.IO/REC.O
1198	Mode Transition	41605	41605	SS1/REC.ONLY
1198	Mode Transition	41606	41606	SS2/REC.ONLY
1198	Mode Transition	41607	41607	SS3/REC.ONLY
1198	Mode Transition	41608	41608	SS4/REC.ONLY
1198	Mode Transition	41609	41609	SS5/REC.ONLY
1198	Mode Transition	41610	41610	FLASHT/REC.O
1198	Mode Transition	41616	41616	WUP2/ACT.ION
1198	Mode Transition	41618	41618	CALIB/ACT.IO
1198	Mode Transition	41619	41619	REC.ON/ACT.I
1198	Mode Transition	41620	41620	ACT.IO/ACT.I
1198	Mode Transition	41621	41621	SS1/ACT.IONO
1198	Mode Transition	41622	41622	SS2/ACT.IONO
1198	Mode Transition	41623	41623	SS3/ACT.IONO
1198	Mode Transition	41624	41624	SS4/ACT.IONO
1198	Mode Transition	41625	41625	SS5/ACT.IONO
1198	Mode Transition	41626	41626	FLASHT/ACT.I
1198	Mode Transition	41632	41632	WUP2/SS1
1198	Mode Transition	41634	41634	CALIBR/SS1
1198	Mode Transition	41635	41635	REC.ONLY/SS1
1198	Mode Transition	41636	41636	ACT.IONO/SS1
1198	Mode Transition	41637	41637	SS1/SS1
1198	Mode Transition	41638	41638	SS2/SS1
1198	Mode Transition	41639	41639	SS3/SS1
1198	Mode Transition	41640	41640	SS4/SS1
1198	Mode Transition	41641	41641	SS5/SS1
1198	Mode Transition	41642	41642	FLASHT/SS1
1198	Mode Transition	41648	41648	WUP2/SS2
1198	Mode Transition	41650	41650	CALIBR/SS2
1198	Mode Transition	41651	41651	REC.ONLY/SS2
1198	Mode Transition	41652	41652	ACT.IONO/SS2
1198	Mode Transition	41653	41653	SS1/SS2
1198	Mode Transition	41654	41654	SS2/SS2
1198	Mode Transition	41655	41655	SS3/SS2
1198	Mode Transition	41656	41656	SS4/SS2
1198	Mode Transition	41657	41657	SS5/SS2
1198	Mode Transition	41658	41658	FLASHT/SS2
1198	Mode Transition	41664	41664	WUP2/SS3
1198	Mode Transition	41666	41666	CALIBR/SS3
1198	Mode Transition	41667	41667	REC.ONLY/SS3
1198	Mode Transition	41668	41668	ACT.IONO/SS3
1198	Mode Transition	41669	41669	SS1/SS3
1198	Mode Transition	41670	41670	SS2/SS3
1198	Mode Transition	41671	41671	SS3/SS3

1198	Mode Transition	41672	41672	SS4/SS3
1198	Mode Transition	41673	41673	SS5/SS3
1198	Mode Transition	41674	41674	FLASHT/SS3
1198	Mode Transition	41680	41680	WUP2/SS4
1198	Mode Transition	41682	41682	CALIBR/SS4
1198	Mode Transition	41683	41683	REC.ONLY/SS4
1198	Mode Transition	41684	41684	ACT.IONO/SS4
1198	Mode Transition	41685	41685	SS1/SS4
1198	Mode Transition	41686	41686	SS2/SS4
1198	Mode Transition	41687	41687	SS3/SS4
1198	Mode Transition	41688	41688	SS4/SS4
1198	Mode Transition	41689	41689	SS5/SS4
1198	Mode Transition	41690	41690	FLASHT/SS4
1198	Mode Transition	41696	41696	WUP2/SS5
1198	Mode Transition	41698	41698	CALIBR/SS5
1198	Mode Transition	41699	41699	REC.ONLY/SS5
1198	Mode Transition	41700	41700	ACT.IONO/SS5
1198	Mode Transition	41701	41701	SS1/SS5
1198	Mode Transition	41702	41702	SS2/SS5
1198	Mode Transition	41703	41703	SS3/SS5
1198	Mode Transition	41704	41704	SS4/SS5
1198	Mode Transition	41705	41705	SS5/SS5
1198	Mode Transition	41706	41706	FLASHT/SS5
1198	Mode Transition	41712	41712	WUP2/FLASHT
1198	Mode Transition	41714	41714	CALIB/FLASHT
1198	Mode Transition	41715	41715	REC.ON/FLASH
1198	Mode Transition	41716	41716	ACT.IO/FLASH
1198	Mode Transition	41717	41717	SS1/FLASHT
1198	Mode Transition	41718	41718	SS2/FLASHT
1198	Mode Transition	41719	41719	SS3/FLASHT
1198	Mode Transition	41720	41720	SS4/FLASHT
1198	Mode Transition	41721	41721	SS5/FLASHT
1198	Mode Transition	41722	41722	FLASH/FLASH

9.4.3. MARSIS-related S/C Packet TM

9.4.3.1 Parameters definition

TM Name	APID	T	S	SPID	Parameter	Par Name	Offset		occ
							Byte	Bit	
YAC00049	196	3	25	2282	SDF Place Holder	NACHKSDF	00016	0	1
YAC00049	196	3	25	2282	Curent Timer val	NACW0300	00018	0	1
YAC00049	196	3	25	2282	TC Receipt Timeo	NACW0301	00022	0	1
YAC00049	196	3	25	2282	Start of ground	NAWD0300	00026	0	1
YAC00049	196	3	25	2282	Start of ground	NAWD0301	00028	0	1
YAC00049	196	3	25	2282	End of ground ac	NAWD0302	00030	0	1
YAC00049	196	3	25	2282	End of ground ac	NAWD0303	00032	0	1
YAC00049	196	3	25	2282	Nb of Grnd TC re	NACW0304	00034	0	1
YAC00049	196	3	25	2282	Curr Seq cntr	NACW0305	00036	0	1
YAC00049	196	3	25	2282	Flag - suspensio	NAWD0304	00039	7	1
YAC00049	196	3	25	2282	Free wds Nb in M	NACW0700	00040	0	1
YAC00049	196	3	25	2282	Start of ASYNC_M	NAWD0904	00042	0	1
YAC00049	196	3	25	2282	Start of ASYNC_M	NAWD0905	00044	0	1
YAC00049	196	3	25	2282	End of ASYNC_MGR	NAWD0906	00046	0	1
YAC00049	196	3	25	2282	End of ASYNC_MGR	NAWD0907	00048	0	1
YAC00049	196	3	25	2282	Start of MEMORY_	NAWD0912	00050	0	1
YAC00049	196	3	25	2282	Start of MEMORY_	NAWD0913	00052	0	1
YAC00049	196	3	25	2282	End of MEMORY_MG	NAWD0914	00054	0	1
YAC00049	196	3	25	2282	End of MEMORY_MG	NAWD0915	00056	0	1
YAC00049	196	3	25	2282	Time of receivin	NAWD0916	00058	0	1
YAC00049	196	3	25	2282	Time of receivin	NAWD0917	00060	0	1
YAC00049	196	3	25	2282	Time of ending c	NAWD0918	00062	0	1
YAC00049	196	3	25	2282	Time of ending c	NAWD0919	00064	0	1
YAC00049	196	3	25	2282	Type of msg: dmp	NACW090C	00066	0	1
YAC00049	196	3	25	2282	Status Reg val	NACW0D00	00068	0	1
YAC00049	196	3	25	2282	Firmware Reg val	NACW0D01	00070	0	1
YAC00049	196	3	25	2282	Config Reg val	NACW0D02	00072	0	1
YAC00049	196	3	25	2282	Overall AVI reco	NACW0D09	00074	0	1
YAC00049	196	3	25	2282	AOCMS Reconf cnt	NACW0D0C	00076	0	1
YAC00049	196	3	25	2282	Unused IT cntr	NACW0D0D	00078	0	1
YAC00049	196	3	25	2282	Minor machine Er	NACW0D0E	00080	0	1
YAC00049	196	3	25	2282	EDAC cntr	NACW0D0A	00082	0	1
YAC00049	196	3	25	2282	EDAC+No IT+Minor	NACW0D0G	00084	0	1
YAC00049	196	3	25	2282	EDAC last addres	NAWD0D06	00087	4	1
YAC00049	196	3	25	2282	EDAC last addres	NAWD0D07	00088	4	1
YAC00049	196	3	25	2282	RAM scrubbing te	NAWD0D08	00090	0	1
YAC00049	196	3	25	2282	AOCMS reboot Nb	NACW0V06	00092	0	1
YAC00049	196	3	25	2282	SAM-SHM transit	NACW0V50	00094	0	1
YAC00049	196	3	25	2282	Out of GSEP Time	NACW0V51	00096	0	1
YAC00049	196	3	25	2282	flag-Init Phase	NAWD0V03	00101	6	1
YAC00049	196	3	25	2282	flag-AOCMS MSO e	NAWD0V04	00101	7	1
YAC00049	196	3	25	2282	Curr AOCMS Mode	NAWD0V05	00103	0	1
YAC00049	196	3	25	2282	Timeout Stat	NAWD0V50	00105	6	1
YAC00049	196	3	25	2282	Spare	NACW0V53	00106	0	1

YAC00049	**196**	**3**	**25**	**2282**	**flag- MARSIS ant**	**NAWD0Z50**	**00109**	**7**	**1**
YAC00049	196	3	25	2282	flag-Last HF cyc	NAWD0Z01	00111	7	1

YDM00002	20	3	25	1565	SDF Place Holder	NDMHKSDF	00016	0	1
YDM00002	20	3	25	1565	YSI001-LVA 1	NTSA1101	00018	0	1
YDM00002	20	3	25	1565	YSI002-Not_Conne	NTSA1102	00020	0	1
YDM00002	20	3	25	1565	YSI003-LVA 3	NTSA1103	00022	0	1
YDM00002	20	3	25	1565	YSI004-IMU 1	NTSA2202	00024	0	1
YDM00002	20	3	25	1565	YSI005-IMU 2	NTSA2203	00026	0	1
YDM00002	20	3	25	1565	YSI006-IMU Brack	NTSA2802	00028	0	1
YDM00002	20	3	25	1565	YSI010-AIU	NTSA2201	00030	0	1
YDM00002	20	3	25	1565	YSI011-RW 1	NTSA2204	00032	0	1
YDM00002	20	3	25	1565	YSI012-RW 2	NTSA2205	00034	0	1
YDM00002	20	3	25	1565	YSI013-RW 3	NTSA2206	00036	0	1
YDM00002	20	3	25	1565	YSI014-RW 4	NTSA2207	00038	0	1
YDM00002	20	3	25	1565	YSI021-SAS 1	NTSA2208	00040	0	1
YDM00002	20	3	25	1565	YSI022-Not_Conne	NTSA2209	00042	0	1
YDM00002	20	3	25	1565	YSI031-STR 1	NTSA2210	00044	0	1
YDM00002	20	3	25	1565	YSI032-STR 2	NTSA2211	00046	0	1
YDM00002	20	3	25	1565	YSI033-SSE 1	NTSA2212	00048	0	1
YDM00002	20	3	25	1565	YSI034-SSE 2	NTSA2213	00050	0	1
YDM00002	20	3	25	1565	YSI035-STR Panel	NTSA2801	00052	0	1
YDM00002	20	3	25	1565	YSI061-TWT 2	NTSA2303	00054	0	1
YDM00002	20	3	25	1565	YSI062-TWT 1	NTSA2304	00056	0	1
YDM00002	20	3	25	1565	YSI063-EPC 2	NTSA2305	00058	0	1
YDM00002	20	3	25	1565	YSI064-EPC 1	NTSA2306	00060	0	1
YDM00002	20	3	25	1565	PT5065-HGA 1	NTSA2401	00062	0	1
YDM00002	20	3	25	1565	YSI066-HGA 2	NTSA2402	00064	0	1
YDM00002	20	3	25	1565	YSI070-PCU	NTSA2501	00066	0	1
YDM00002	20	3	25	1565	YSI071-SADM 1	NTSA2601	00068	0	1
YDM00002	20	3	25	1565	YSI072-SADM 2	NTSA2602	00070	0	1
YDM00002	20	3	25	1565	YSI073-SADE	NTSA2603	00072	0	1
YDM00002	20	3	25	1565	YSI081-Battery 1	NTSA2701	00074	0	1
YDM00002	20	3	25	1565	YSI082-Battery 2	NTSA2702	00076	0	1
YDM00002	20	3	25	1565	YSI083-Battery 3	NTSA2703	00078	0	1
YDM00002	20	3	25	1565	YSI201-He Tank	NTSA1605	00080	0	1
YDM00002	20	3	25	1565	YSI202-He Tank	NTSA1606	00082	0	1
YDM00002	20	3	25	1565	YSI205-NTO Tank	NTSA1204	00084	0	1
YDM00002	20	3	25	1565	YSI207-MMH Tank	NTSA1201	00086	0	1
YDM00002	20	3	25	1565	YSI209-NTO Tank	NTSA1205	00088	0	1
YDM00002	20	3	25	1565	YSI211-MMH Tank	NTSA1202	00090	0	1
YDM00002	20	3	25	1565	YSI213-NTO Tank	NTSA1206	00092	0	1
YDM00002	20	3	25	1565	YSI215-MMH Tank	NTSA1203	00094	0	1
YDM00002	20	3	25	1565	YSI221-CPS Lin A	NTSA1301	00096	0	1
YDM00002	20	3	25	1565	YSI222-CPS Lin A	NTSA1302	00098	0	1
YDM00002	20	3	25	1565	YSI223-CPS Lin A	NTSA1303	00100	0	1
YDM00002	20	3	25	1565	YSI224-CPS Lin A	NTSA1304	00102	0	1
YDM00002	20	3	25	1565	YSI225-CPS Lin B	NTSA1321	00104	0	1
YDM00002	20	3	25	1565	YSI226-CPS Lin B	NTSA1322	00106	0	1
YDM00002	20	3	25	1565	YSI227-CPS Lin B	NTSA1323	00108	0	1
YDM00002	20	3	25	1565	YSI228-CPS Lin B	NTSA1324	00110	0	1
YDM00002	20	3	25	1565	YSI229-CPS Lin B	NTSA1325	00112	0	1
YDM00002	20	3	25	1565	YSI230-CPS Lin B	NTSA1326	00114	0	1
YDM00002	20	3	25	1565	YSI231-CPS Lin B	NTSA1327	00116	0	1
YDM00002	20	3	25	1565	YSI232-CPS Lin C	NTSA1343	00118	0	1

YDM00002	20	3	25	1565	YSI233-CPS Lin C	NTSA1344	00120	0	1
YDM00002	20	3	25	1565	YSI234-CPS Lin C	NTSA1345	00122	0	1
YDM00002	20	3	25	1565	YSI235-CPS Lin C	NTSA1346	00124	0	1
YDM00002	20	3	25	1565	YSI236-CPS Lin C	NTSA1347	00126	0	1
YDM00002	20	3	25	1565	YSI237-CPS Lin C	NTSA1348	00128	0	1
YDM00002	20	3	25	1565	YSI238-CPS Lin D	NTSA1361	00130	0	1
YDM00002	20	3	25	1565	YSI239-CPS Lin D	NTSA1362	00132	0	1
YDM00002	20	3	25	1565	YSI240-CPS Lin D	NTSA1363	00134	0	1
YDM00002	20	3	25	1565	YSI241-CPS Lin D	NTSA1364	00136	0	1
YDM00002	20	3	25	1565	YSI242-CPS Lin D	NTSA1365	00138	0	1
YDM00002	20	3	25	1565	YSI243-CPS Lin D	NTSA1366	00140	0	1
YDM00002	20	3	25	1565	YSI244-CPS Lin D	NTSA1367	00142	0	1
YDM00002	20	3	25	1565	YSI245-CPS Lin D	NTSA1368	00144	0	1
YDM00002	20	3	25	1565	YSI246-Press Tra	NTSA1401	00146	0	1
YDM00002	20	3	25	1565	YSI247-Press Tra	NTSA1402	00148	0	1
YDM00002	20	3	25	1565	YSI248-Press Tra	NTSA1403	00150	0	1
YDM00002	20	3	25	1565	YSI249-Press Tra	NTSA1404	00152	0	1
YDM00002	20	3	25	1565	YSI250-Latch Val	NTSA1601	00154	0	1
YDM00002	20	3	25	1565	YSI251-Latch Val	NTSA1602	00156	0	1
YDM00002	20	3	25	1565	YSI252-Not_Conne	NTSA1603	00158	0	1
YDM00002	20	3	25	1565	YSI253-FIL 2	NTSA1604	00160	0	1
YDM00002	20	3	25	1565	YSI255-CPS Lin A	NTSA1305	00162	0	1
YDM00002	20	3	25	1565	YSI256-CPS Lin A	NTSA1306	00164	0	1
YDM00002	20	3	25	1565	YSI257-CPS Lin C	NTSA1341	00166	0	1
YDM00002	20	3	25	1565	YSI258-CPS Lin C	NTSA1342	00168	0	1
YDM00002	20	3	25	1565	YSI259-CPS Lin A	NTSA1307	00170	0	1
YDM00002	20	3	25	1565	YSI260-ME Valve	NTSA1701	00172	0	1
YDM00002	20	3	25	1565	YSI261-ME Valve	NTSA1702	00174	0	1
YDM00002	20	3	25	1565	YSI262-ME Flange	NTSA1703	00176	0	1
YDM00002	20	3	25	1565	PT5271-ME Flange	NTSA1704	00178	0	1
YDM00002	20	3	25	1565	PT5272-ME Flange	NTSA1705	00180	0	1
YDM00002	20	3	25	1565	YSI275-Press Reg	NTSA1801	00182	0	1
YDM00002	20	3	25	1565	YSI281-FCV 1A	NTSA1501	00184	0	1
YDM00002	20	3	25	1565	YSI282-FCV 1B	NTSA1502	00186	0	1
YDM00002	20	3	25	1565	YSI283-FCV 2A	NTSA1503	00188	0	1
YDM00002	20	3	25	1565	YSI284-FCV 2B	NTSA1504	00190	0	1
YDM00002	20	3	25	1565	YSI285-FCV 3A	NTSA1505	00192	0	1
YDM00002	20	3	25	1565	YSI286-FCV 3B	NTSA1506	00194	0	1
YDM00002	20	3	25	1565	YSI287-FCV 4A	NTSA1507	00196	0	1
YDM00002	20	3	25	1565	YSI288-FCV 4B	NTSA1508	00198	0	1
YDM00002	20	3	25	1565	YSI301-ASPERA MU	NTSA3101	00200	0	1
YDM00002	20	3	25	1565	YSI302-ASPERA IM	NTSA3102	00202	0	1
YDM00002	20	3	25	1565	YSI311-BEAGLE2 L	NTSA3201	00204	0	1
YDM00002	20	3	25	1565	YSI312-BEAGLE2 L	NTSA3202	00206	0	1
YDM00002	20	3	25	1565	YSI313-BEAGLE2 P	NTSA3203	00208	0	1
YDM00002	20	3	25	1565	YSI321-HRSC Cam	NTSA3301	00210	0	1
YDM00002	20	3	25	1565	YSI322-HRSC Cam	NTSA3302	00212	0	1
YDM00002	20	3	25	1565	YSI323-HRSC Cam	NTSA3303	00214	0	1
YDM00002	20	3	25	1565	YSI324-HRSC Cam	NTSA3304	00216	0	1
YDM00002	20	3	25	1565	YSI325-HRSC Cam	NTSA3305	00218	0	1
YDM00002	20	3	25	1565	YSI326-HRSC DU	NTSA3306	00220	0	1
YDM00002	20	3	25	1565	YSI331-MELACOM E	NTSA3401	00222	0	1
YDM00002	20	3	25	1565	YSI332-MELACOM A	NTSA3402	00224	0	1
YDM00002	20	3	25	1565	YSI333-MELACOM A	NTSA3403	00226	0	1
YDM00002	**20**	**3**	**25**	**1565**	**YSI341-MARSIS DE**	**NTSA3501**	**00228**	**0**	**1**

YDM00002	**20**	**3**	**25**	**1565**	**YSI342-MARSIS TX**	**NTSA3502**	**00230**	**0**	**1**
YDM00002	**20**	**3**	**25**	**1565**	**PT2343-MARSIS An**	**NTSA3503**	**00232**	**0**	**1**
YDM00002	**20**	**3**	**25**	**1565**	**PT2344-MARSIS An**	**NTSA3504**	**00234**	**0**	**1**
YDM00002	20	3	25	1565	PT2351-OMEG Cam	NTSA3601	00236	0	1
YDM00002	20	3	25	1565	PT2352-OMEG Cam	NTSA3602	00238	0	1
YDM00002	20	3	25	1565	PT2353-OMEG CamS	NTSA3604	00240	0	1
YDM00002	20	3	25	1565	PT2354-OMEG CamR	NTSA3606	00242	0	1
YDM00002	20	3	25	1565	PT2355-PFS ModO	NTSA3607	00244	0	1
YDM00002	20	3	25	1565	YSI356-OMEG Cam	NTSA3603	00246	0	1
YDM00002	20	3	25	1565	YSI357-OMEG CamS	NTSA3605	00248	0	1
YDM00002	20	3	25	1565	YSI358-OMEG CamR	NTSA3608	00250	0	1
YDM00002	20	3	25	1565	YSI359-OMEGA ME	NTSA3609	00252	0	1
YDM00002	20	3	25	1565	PT5361-PFS Mod_O	NTSA3701	00254	0	1
YDM00002	20	3	25	1565	PT5362-PFS Mod_O	NTSA3702	00256	0	1
YDM00002	20	3	25	1565	PT5363-PFS Mod_O	NTSA3704	00258	0	1
YDM00002	20	3	25	1565	PT5364-PFS Modul	NTSA3705	00260	0	1
YDM00002	20	3	25	1565	PT5365-PFS Modul	NTSA3706	00262	0	1
YDM00002	20	3	25	1565	YSI366-PFS Mod_O	NTSA3703	00264	0	1
YDM00002	20	3	25	1565	YSI367-PFS Modul	NTSA3707	00266	0	1
YDM00002	20	3	25	1565	YSI368-PFS Modul	NTSA3708	00268	0	1
YDM00002	20	3	25	1565	YSI369-PFS Modul	NTSA3709	00270	0	1
YDM00002	20	3	25	1565	YSI371-SPICAM SU	NTSA3801	00272	0	1
YDM00002	20	3	25	1565	YSI372-SPICAM DU	NTSA3802	00274	0	1
YDM00002	20	3	25	1565	YSI401-Wall Z- 1	NTSA2901	00276	0	1
YDM00002	20	3	25	1565	YSI402-Wall Z- 2	NTSA2902	00278	0	1
YDM00002	20	3	25	1565	YSI403-Wall Z- 3	NTSA2903	00280	0	1
YDM00002	20	3	25	1565	YSI411-Wall Y- 1	NTSA2904	00282	0	1
YDM00002	20	3	25	1565	YSI412-Wall Y- 2	NTSA2905	00284	0	1
YDM00002	20	3	25	1565	YSI413-Wall Y- 3	NTSA2906	00286	0	1
YDM00002	20	3	25	1565	YSI421-Wall Y+ 1	NTSA2907	00288	0	1
YDM00002	20	3	25	1565	YSI422-Wall Y+ 2	NTSA2908	00290	0	1
YDM00002	20	3	25	1565	YSI423-Wall Y+ 3	NTSA2909	00292	0	1
YDM00002	20	3	25	1565	YSI431-Wall Z+ 1	NTSA2910	00294	0	1
YDM00002	20	3	25	1565	YSI432-Wall Z+ 2	NTSA2911	00296	0	1
YDM00002	20	3	25	1565	YSI433-Wall Z+ 3	NTSA2912	00298	0	1
YDM00002	20	3	25	1565	YSI441-X Shear W	NTSA4101	00300	0	1
YDM00002	20	3	25	1565	YSI442-X Shear W	NTSA4102	00302	0	1
YDM00002	20	3	25	1565	YSI443-X Shear W	NTSA4103	00304	0	1
YDM00002	20	3	25	1565	YSI451-X Shear W	NTSA4104	00306	0	1
YDM00002	20	3	25	1565	YSI452-X Shear W	NTSA4105	00308	0	1
YDM00002	20	3	25	1565	YSI453-X Shear W	NTSA4106	00310	0	1
YDM00002	20	3	25	1565	PT2501-HRSC/OM_-	NTSA4201	00312	0	1
YDM00002	20	3	25	1565	PT2502-HRSC/OM_-	NTSA4202	00314	0	1
YDM00002	20	3	25	1565	YSI022-Line503-S	NTSA4203	00316	0	1
YDM00002	20	3	25	1565	YSI504-SPI/PFS_-	NTSA4204	00318	0	1
YDM00002	20	3	25	1565	YSI002-Line505-L	NTSA4205	00320	0	1
YDM00002	20	3	25	1565	YSI252-Line506-F	NTSA4206	00322	0	1
YDM00002	20	3	25	1565	YSI507-HRSC/CAM_	NTSA4207	00324	0	1
YDM00002	20	3	25	1565	YSI508-HRSC/CAM_	NTSA4208	00326	0	1
YDM00002	20	3	25	1565	YSI509-HRSC/CAM_	NTSA4209	00328	0	1
YDM00002	20	3	25	1565	YSI510-HRSC/OM_-	NTSA4210	00330	0	1
YDM00002	20	3	25	1565	YSI511-Spicam1_2	NTSA4211	00332	0	1
YDM00002	20	3	25	1565	YSI512-Spicam2_1	NTSA4212	00334	0	1

YDM00003	20	3	25	1566	SDF Place Holder	NDMHKSDF	00016	0	1

YDM00003	20	3	25	1566	ASPERA-Scanner	NASA0101	00018	0	1
YDM00003	20	3	25	1566	ASPERA-IMA	NASA0103	00020	0	1
YDM00003	20	3	25	1566	ASPERA-DPU	NASA0102	00022	0	1
YDM00003	20	3	25	1566	HRSC-Temp DU Hot	NHRA0103	00024	0	1
YDM00003	20	3	25	1566	HRSC-Temp CH The	NHRA0104	00026	0	1
YDM00003	20	3	25	1566	HRSC-Temp SRC TR	NHRA0101	00028	0	1
YDM00003	20	3	25	1566	HRSC-Temp DU TRP	NHRA0102	00030	0	1
YDM00003	20	3	25	1566	HRSC-TM +5,1 V S	NHRA0110	00032	0	1
YDM00003	20	3	25	1566	HRSC-TM +10 V Su	NHRA0111	00034	0	1
YDM00003	20	3	25	1566	HRSC-TM +5,1 V S	NHRA0210	00036	0	1
YDM00003	20	3	25	1566	HRSC-TM +10 V Su	NHRA0211	00038	0	1
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-Temp DES**	**NMIA0101**	**00040**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-Temp RX N**	**NMIA0102**	**00042**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-Temp TX N**	**NMIA0103**	**00044**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-Temp ANT**	**NMIA0109**	**00046**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-Temp DES**	**NMIA0201**	**00048**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-Temp RX R**	**NMIA0202**	**00050**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-Temp TX R**	**NMIA0203**	**00052**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-Temp ANT**	**NMIA0209**	**00054**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-DES Volta**	**NMIA0105**	**00056**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-DES Volta**	**NMIA0106**	**00058**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-TX Voltag**	**NMIA0108**	**00060**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-DES Volta**	**NMIA0205**	**00062**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-DES Volta**	**NMIA0206**	**00064**	**0**	**1**
YDM00003	**20**	**3**	**25**	**1566**	**MARSIS-TX Voltag**	**NMIA0208**	**00066**	**0**	**1**
YDM00003	20	3	25	1566	MELACOM-Temp DC	NMSA0101	00068	0	1
YDM00003	20	3	25	1566	MELACOM-Temp TX	NMSA0102	00070	0	1
YDM00003	20	3	25	1566	MELACOM-Temp DC	NMSA0201	00072	0	1
YDM00003	20	3	25	1566	MELACOM-Temp TX	NMSA0202	00074	0	1
YDM00003	20	3	25	1566	OMEGA- ANC_SA_N	NOMA0101	00076	0	1
YDM00003	20	3	25	1566	OMEGA- ANC_SA_R	NOMA0201	00078	0	1
YDM00003	20	3	25	1566	OMEGA- ANP_SOA	NOMA0102	00080	0	1
YDM00003	20	3	25	1566	OMEGA- ANP_ME	NOMA0103	00082	0	1
YDM00003	20	3	25	1566	OMEGA- ANP_VOA	NOMA0104	00084	0	1
YDM00003	20	3	25	1566	OMEGA- ANP_SKA	NOMA0105	00086	0	1
YDM00003	20	3	25	1566	OMEGA- ANP_FOA	NOMA0106	00088	0	1
YDM00003	20	3	25	1566	PFS-Temp module	NPSA0101	00090	0	1
YDM00003	20	3	25	1566	PFS-Temp module	NPSA0102	00092	0	1
YDM00003	20	3	25	1566	PFS-Temp module	NPSA0103	00094	0	1
YDM00003	20	3	25	1566	PFS-Temp module	NPSA0104	00096	0	1
YDM00003	20	3	25	1566	PFS-Temp module	NPSA0105	00098	0	1
YDM00003	20	3	25	1566	PFS-Temp module	NPSA0202	00100	0	1
YDM00003	20	3	25	1566	PFS-Temp module	NPSA0204	00102	0	1
YDM00003	20	3	25	1566	VMC-Internal Tem	NVMA0101	00104	0	1
YDM00003	20	3	25	1566	MELACOM-CACG Nom	NMSA0103	00106	0	1
YDM00003	20	3	25	1566	MELACOM-CLS Nom.	NMSA0104	00108	0	1
YDM00003	20	3	25	1566	MELACOM-CACG Red	NMSA0203	00110	0	1
YDM00003	20	3	25	1566	MELACOM-CLS Red.	NMSA0204	00112	0	1

YDM00006	20	3	25	1568	SDF Place Holder	NDMHKSDF	00016	0	1
YDM00006	20	3	25	1568	COARSE of SS PDU	NDWDBT52	00018	0	1
YDM00006	20	3	25	1568	PRECISION of SS	NDWDBT53	00022	0	1
YDM00006	20	3	25	1568	PDU-N00 Last Cmd	NPWA2000	00024	0	1
YDM00006	20	3	25	1568	PDU-Norm-Fault b	NPWD2011	00026	0	1
YDM00006	20	3	25	1568	PDU-Norm-Parity	NPWD2012	00026	1	1

YDM00006	20	3	25	1568	PDU-Norm-Delay b	NPWD2013	00026	2	1
YDM00006	20	3	25	1568	PDU-Norm-LastCmd	NPWD2014	00026	6	1
YDM00006	20	3	25	1568	PDU-Norm-LastCmd	NPWD2015	00026	7	1
YDM00006	20	3	25	1568	PDU-Norm-UpdatIn	NPWD2016	00027	0	1
YDM00006	20	3	25	1568	PDU-Norm-ReadInt	NPWD2017	00027	1	1
YDM00006	20	3	25	1568	PDU-Norm-Updatio	NPWD2018	00027	2	1
YDM00006	20	3	25	1568	PDU-Norm-TMmode	NPWD2019	00027	3	1
YDM00006	20	3	25	1568	PDU-Norm-PwrS bi	NPWD201A	00027	6	1
YDM00006	20	3	25	1568	PDU-Norm-PwrT bi	NPWD201B	00027	7	1
YDM00006	20	3	25	1568	Arm5Pyro_4A BEAG	NPWD2021	00028	1	1
YDM00006	20	3	25	1568	Arm5Pyro_3A (Spa	NPWD2022	00028	2	1
YDM00006	20	3	25	1568	Arm5Pyro_2A (Spa	NPWD2023	00028	3	1
YDM00006	20	3	25	1568	Arm5Pyro_1A (Spa	NPWD2024	00028	4	1
YDM00006	20	3	25	1568	Arm4Pyro_3A MARS	NPWD2025	00028	5	1
YDM00006	20	3	25	1568	Arm4Pyro_2A MARS	NPWD2026	00028	6	1
YDM00006	20	3	25	1568	Arm4Pyro_1A MARS	NPWD2027	00028	7	1
YDM00006	20	3	25	1568	Pyro_Pwr_A Bat3	NPWD2028	00029	1	1
YDM00006	20	3	25	1568	Pyro_Pwr_A Bat1	NPWD2029	00029	2	1
YDM00006	20	3	25	1568	PDU-A-Pfire bit	NPWD2031	00030	0	1
YDM00006	20	3	25	1568	PDU-A-Fired bit	NPWD2032	00030	1	1
YDM00006	20	3	25	1568	Arm_Group_5A BEA	NPWD2033	00030	3	1
YDM00006	**20**	**3**	**25**	**1568**	**Arm_Group_4A MAR**	**NPWD2034**	**00030**	**4**	**1**
YDM00006	20	3	25	1568	Arm_Group_3A ME	NPWD2035	00030	5	1
YDM00006	20	3	25	1568	Arm_Group_2A RCS	NPWD2036	00030	6	1
YDM00006	20	3	25	1568	Arm_Group_1A SA	NPWD2037	00030	7	1
YDM00006	20	3	25	1568	Arm1Pyro_8A SA -	NPWD2038	00031	0	1
YDM00006	20	3	25	1568	Arm1Pyro_7A SA -	NPWD2039	00031	1	1
YDM00006	20	3	25	1568	Arm1Pyro_6A SA -	NPWD203A	00031	2	1
YDM00006	20	3	25	1568	Arm1Pyro_5A SA -	NPWD203B	00031	3	1
YDM00006	20	3	25	1568	Arm1Pyro_4A SA +	NPWD203C	00031	4	1
YDM00006	20	3	25	1568	Arm1Pyro_3A SA +	NPWD203D	00031	5	1
YDM00006	20	3	25	1568	Arm1Pyro_2A SA +	NPWD203E	00031	6	1
YDM00006	20	3	25	1568	Arm1Pyro_1A SA +	NPWD203F	00031	7	1
YDM00006	20	3	25	1568	Arm2Pyro_8A PVNC	NPWD2041	00032	0	1
YDM00006	20	3	25	1568	Arm2Pyro_7A PVNC	NPWD2042	00032	1	1
YDM00006	20	3	25	1568	Arm2Pyro_6A PVNC	NPWD2043	00032	2	1
YDM00006	20	3	25	1568	Arm2Pyro_5A PVNC	NPWD2044	00032	3	1
YDM00006	20	3	25	1568	Arm2Pyro_4A PVNC	NPWD2045	00032	4	1
YDM00006	20	3	25	1568	Arm2Pyro_3A PVNC	NPWD2046	00032	5	1
YDM00006	20	3	25	1568	Arm2Pyro_2A PVNC	NPWD2047	00032	6	1
YDM00006	20	3	25	1568	Arm2Pyro_1A PVNC	NPWD2048	00032	7	1
YDM00006	20	3	25	1568	Arm3Pyro_8A PVNC	NPWD2049	00033	0	1
YDM00006	20	3	25	1568	Arm3Pyro_7A PVNC	NPWD204A	00033	1	1
YDM00006	20	3	25	1568	Arm3Pyro_6A PVNO	NPWD204B	00033	2	1
YDM00006	20	3	25	1568	Arm3Pyro_5A PVNO	NPWD204C	00033	3	1
YDM00006	20	3	25	1568	Arm3Pyro_4A PVNC	NPWD204D	00033	4	1
YDM00006	20	3	25	1568	Arm3Pyro_3A PVNC	NPWD204E	00033	5	1
YDM00006	20	3	25	1568	Arm3Pyro_2A PVNC	NPWD204F	00033	6	1
YDM00006	20	3	25	1568	Arm3Pyro_1A PVNC	NPWD204G	00033	7	1
YDM00006	20	3	25	1568	Arm3Pyro_9A PVNO	NPWD2051	00034	7	1
YDM00006	20	3	25	1568	PDU-N06 NULL dat	NPWA2060	00036	0	1
YDM00006	20	3	25	1568	PDU-N07 NULL dat	NPWA2070	00038	0	1
YDM00006	20	3	25	1568	PDU-N08 NULL dat	NPWA2080	00040	0	1
YDM00006	20	3	25	1568	LCL36A stat RTU	NPWD2091	00042	0	1
YDM00006	20	3	25	1568	LCL35A stat PFS	NPWD2092	00042	1	1

YDM00006	20	3	25	1568	LCL33A stat HRSC	NPWD2093	00042	3	1
YDM00006	20	3	25	1568	LCL32A stat Htr	NPWD2094	00042	4	1
YDM00006	**20**	**3**	**25**	**1568**	**LCL31A stat MARS**	**NPWD2095**	**00042**	**5**	**1**
YDM00006	20	3	25	1568	LCL30A stat Prop	NPWD2096	00042	6	1
YDM00006	20	3	25	1568	LCL29A stat RW 1	NPWD2097	00042	7	1
YDM00006	20	3	25	1568	LCL42A stat AIU_	NPWD2098	00043	2	1
YDM00006	20	3	25	1568	LCL41A stat ASPE	NPWD2099	00043	3	1
YDM00006	20	3	25	1568	LCL40A stat SSMM	NPWD209A	00043	4	1
YDM00006	20	3	25	1568	LCL39A stat TRSP	NPWD209B	00043	5	1
YDM00006	20	3	25	1568	LCL38A stat Htr	NPWD209C	00043	6	1
YDM00006	20	3	25	1568	LCL37A stat Htr	NPWD209D	00043	7	1
YDM00006	20	3	25	1568	LCL22A stat Htr	NPWD2101	00044	0	1
YDM00006	20	3	25	1568	LCL21A stat Htr	NPWD2102	00044	1	1
YDM00006	20	3	25	1568	LCL19A stat Gyro	NPWD2103	00044	3	1
YDM00006	20	3	25	1568	LCL18A stat MELA	NPWD2104	00044	4	1
YDM00006	20	3	25	1568	LCL17A stat Htr	NPWD2105	00044	5	1
YDM00006	**20**	**3**	**25**	**1568**	**LCL16A stat MARS**	**NPWD2106**	**00044**	**6**	**1**
YDM00006	20	3	25	1568	LCL15A stat RW 3	NPWD2107	00044	7	1
YDM00006	20	3	25	1568	LCL28A stat STR1	NPWD2108	00045	2	1
YDM00006	20	3	25	1568	LCL27A stat Htr	NPWD2109	00045	3	1
YDM00006	20	3	25	1568	LCL26A stat OMEG	NPWD210A	00045	4	1
YDM00006	20	3	25	1568	LCL25A stat Htr	NPWD210B	00045	5	1
YDM00006	20	3	25	1568	LCL24A stat Htr	NPWD210C	00045	6	1
YDM00006	20	3	25	1568	LCL23A stat Htr	NPWD210D	00045	7	1
YDM00006	20	3	25	1568	LCL8A stat Htr C	NPWD2111	00046	0	1
YDM00006	20	3	25	1568	LCL7A stat Htr D	NPWD2112	00046	1	1
YDM00006	20	3	25	1568	LCL5A stat BEAGL	NPWD2113	00046	3	1
YDM00006	20	3	25	1568	LCL4A stat Htr D	NPWD2114	00046	4	1
YDM00006	20	3	25	1568	LCL3A stat Htr D	NPWD2115	00046	5	1
YDM00006	20	3	25	1568	LCL2A stat BEAGL	NPWD2116	00046	6	1
YDM00006	20	3	25	1568	LCL1A stat EPC A	NPWD2117	00046	7	1
YDM00006	20	3	25	1568	LCL14A stat VMC	NPWD2118	00047	2	1
YDM00006	20	3	25	1568	LCL13A stat SADE	NPWD2119	00047	3	1
YDM00006	20	3	25	1568	LCL12A stat AIU	NPWD211A	00047	4	1
YDM00006	20	3	25	1568	LCL11A stat SPIC	NPWD211B	00047	5	1
YDM00006	20	3	25	1568	LCL10A stat Htr	NPWD211C	00047	6	1
YDM00006	20	3	25	1568	LCL9A stat Htr C	NPWD211D	00047	7	1
YDM00006	20	3	25	1568	PDU-N12 NULL dat	NPWA2120	00048	0	1
YDM00006	20	3	25	1568	PDU-N13 NULL dat	NPWA2130	00050	0	1
YDM00006	20	3	25	1568	Arm5Pyro_4B BEAG	NPWD2141	00052	1	1
YDM00006	20	3	25	1568	Arm5Pyro_3B (Spa	NPWD2142	00052	2	1
YDM00006	20	3	25	1568	Arm5Pyro_2B (Spa	NPWD2143	00052	3	1
YDM00006	20	3	25	1568	Arm5Pyro_1B (Spa	NPWD2144	00052	4	1
YDM00006	**20**	**3**	**25**	**1568**	**Arm4Pyro_3B MARS**	**NPWD2145**	**00052**	**5**	**1**
YDM00006	**20**	**3**	**25**	**1568**	**Arm4Pyro_2B MARS**	**NPWD2146**	**00052**	**6**	**1**
YDM00006	**20**	**3**	**25**	**1568**	**Arm4Pyro_1B MARS**	**NPWD2147**	**00052**	**7**	**1**
YDM00006	20	3	25	1568	Pyro_Pwr_B Bat3	NPWD2148	00053	1	1
YDM00006	20	3	25	1568	Pyro_Pwr_B Bat2	NPWD2149	00053	2	1
YDM00006	20	3	25	1568	PDU-B-Pfire bit	NPWD2151	00054	0	1
YDM00006	20	3	25	1568	PDU-B-Fired bit	NPWD2152	00054	1	1
YDM00006	20	3	25	1568	Arm_Group_5B BEA	NPWD2153	00054	3	1
YDM00006	**20**	**3**	**25**	**1568**	**Arm_Group_4B MAR**	**NPWD2154**	**00054**	**4**	**1**
YDM00006	20	3	25	1568	Arm_Group_3B ME	NPWD2155	00054	5	1
YDM00006	20	3	25	1568	Arm_Group_2B RCS	NPWD2156	00054	6	1
YDM00006	20	3	25	1568	Arm_Group_1B SA	NPWD2157	00054	7	1

YDM00006	20	3	25	1568	Arm1Pyro_8B SA -	NPWD2158	00055	0	1
YDM00006	20	3	25	1568	Arm1Pyro_7B SA -	NPWD2159	00055	1	1
YDM00006	20	3	25	1568	Arm1Pyro_6B SA -	NPWD215A	00055	2	1
YDM00006	20	3	25	1568	Arm1Pyro_5B SA -	NPWD215B	00055	3	1
YDM00006	20	3	25	1568	Arm1Pyro_4B SA +	NPWD215C	00055	4	1
YDM00006	20	3	25	1568	Arm1Pyro_3B SA +	NPWD215D	00055	5	1
YDM00006	20	3	25	1568	Arm1Pyro_2B SA +	NPWD215E	00055	6	1
YDM00006	20	3	25	1568	Arm1Pyro_1B SA +	NPWD215F	00055	7	1
YDM00006	20	3	25	1568	Arm2Pyro_8B PVNC	NPWD2161	00056	0	1
YDM00006	20	3	25	1568	Arm2Pyro_7B PVNC	NPWD2162	00056	1	1
YDM00006	20	3	25	1568	Arm2Pyro_6B PVNC	NPWD2163	00056	2	1
YDM00006	20	3	25	1568	Arm2Pyro_5B PVNC	NPWD2164	00056	3	1
YDM00006	20	3	25	1568	Arm2Pyro_4B PVNC	NPWD2165	00056	4	1
YDM00006	20	3	25	1568	Arm2Pyro_3B PVNC	NPWD2166	00056	5	1
YDM00006	20	3	25	1568	Arm2Pyro_2B PVNC	NPWD2167	00056	6	1
YDM00006	20	3	25	1568	Arm2Pyro_1B PVNC	NPWD2168	00056	7	1
YDM00006	20	3	25	1568	Arm3Pyro_8B PVNC	NPWD2169	00057	0	1
YDM00006	20	3	25	1568	Arm3Pyro_7B PVNC	NPWD216A	00057	1	1
YDM00006	20	3	25	1568	Arm3Pyro_6B PVNO	NPWD216B	00057	2	1
YDM00006	20	3	25	1568	Arm3Pyro_5B PVNO	NPWD216C	00057	3	1
YDM00006	20	3	25	1568	Arm3Pyro_4B PVNC	NPWD216D	00057	4	1
YDM00006	20	3	25	1568	Arm3Pyro_3B PVNC	NPWD216E	00057	5	1
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YDM00006	20	3	25	1568	Arm3Pyro_1B PVNC	NPWD216G	00057	7	1
YDM00006	20	3	25	1568	Arm3Pyro_9B PVNO	NPWD2171	00058	7	1
YDM00006	20	3	25	1568	PDU-N18 NULL dat	NPWA2180	00060	0	1
YDM00006	20	3	25	1568	PDU-N19 NULL dat	NPWA2190	00062	0	1
YDM00006	20	3	25	1568	PDU-N20 NULL dat	NPWA2200	00064	0	1
YDM00006	20	3	25	1568	LCL36B stat RTU	NPWD2211	00066	0	1
YDM00006	20	3	25	1568	LCL35B stat PFS	NPWD2212	00066	1	1
YDM00006	20	3	25	1568	LCL33B stat AIU_	NPWD2213	00066	3	1
YDM00006	20	3	25	1568	LCL32B stat Htr	NPWD2214	00066	4	1
YDM00006	20	3	25	1568	LCL31B stat Htr	NPWD2215	00066	5	1
YDM00006	20	3	25	1568	LCL30B stat Prop	NPWD2216	00066	6	1
YDM00006	20	3	25	1568	LCL29B stat RW 2	NPWD2217	00066	7	1
YDM00006	20	3	25	1568	LCL42B stat Htr	NPWD2218	00067	2	1
YDM00006	20	3	25	1568	LCL41B stat ASPE	NPWD2219	00067	3	1
YDM00006	20	3	25	1568	LCL40B stat SSMM	NPWD221A	00067	4	1
YDM00006	20	3	25	1568	LCL39B stat TRSP	NPWD221B	00067	5	1
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YDM00006	20	3	25	1568	LCL37B stat Htr	NPWD221D	00067	7	1
YDM00006	20	3	25	1568	LCL22B stat Htr	NPWD2221	00068	0	1
YDM00006	20	3	25	1568	LCL21B stat Htr	NPWD2222	00068	1	1
YDM00006	20	3	25	1568	LCL19B stat Gyro	NPWD2223	00068	3	1
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YDM00006	20	3	25	1568	LCL17B stat Htr	NPWD2225	00068	5	1
YDM00006	20	3	25	1568	LCL16B stat HRSC	NPWD2226	00068	6	1
YDM00006	20	3	25	1568	LCL15B stat RW 4	NPWD2227	00068	7	1
YDM00006	20	3	25	1568	LCL28B stat STR2	NPWD2228	00069	2	1
YDM00006	20	3	25	1568	LCL27B stat Htr	NPWD2229	00069	3	1
YDM00006	20	3	25	1568	LCL26B stat OMEG	NPWD222A	00069	4	1
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YDM00006	20	3	25	1568	LCL24B stat Htr	NPWD222C	00069	6	1
YDM00006	20	3	25	1568	LCL23B stat Htr	NPWD222D	00069	7	1
YDM00006	20	3	25	1568	LCL8B stat Htr C	NPWD2231	00070	0	1

YDM00006	20	3	25	1568	LCL7B stat Htr D	NPWD2232	00070	1	1
YDM00006	20	3	25	1568	LCL5B stat BEAGL	NPWD2233	00070	3	1
YDM00006	20	3	25	1568	LCL4B stat Htr D	NPWD2234	00070	4	1
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YDM00006	20	3	25	1568	LCL1B stat EPC B	NPWD2237	00070	7	1
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YDM00006	20	3	25	1568	LCL13B stat SADE	NPWD2239	00071	3	1
YDM00006	20	3	25	1568	LCL12B stat AIU	NPWD223A	00071	4	1
YDM00006	20	3	25	1568	LCL11B stat SPIC	NPWD223B	00071	5	1
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YDM00006	20	3	25	1568	PDU-N24 NULL dat	NPWA2240	00072	0	1
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YDM00006	20	3	25	1568	PDU-A-Primary Cu	NPWD2261	00076	0	1
YDM00006	20	3	25	1568	PDU-A-Secondary	NPWD2262	00077	0	1
YDM00006	20	3	25	1568	PDU-N27 NULL dat	NPWA2270	00078	0	1
YDM00006	20	3	25	1568	Measurement of 0	NPWD2281	00080	0	1
YDM00006	20	3	25	1568	Measurement of 0	NPWD2282	00081	0	1
YDM00006	20	3	25	1568	Measurement of 0	NPWD2291	00082	0	1
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YDM00006	20	3	25	1568	Measurement of 0	NPWD2301	00084	0	1
YDM00006	20	3	25	1568	Measurement of 0	NPWD2302	00085	0	1
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YDM00006	20	3	25	1568	Measurement of 0	NPWD2341	00092	0	1
YDM00006	20	3	25	1568	Measurement of 0	NPWD2342	00093	0	1
YDM00006	20	3	25	1568	Measurement of 0	NPWD2351	00094	0	1
YDM00006	20	3	25	1568	Measurement of 0	NPWD2352	00095	0	1
YDM00006	20	3	25	1568	LCL29A curr RW 1	NPWD2361	00096	0	1
YDM00006	20	3	25	1568	LCL30A curr Prop	NPWD2362	00097	0	1
YDM00006	**20**	**3**	**25**	**1568**	**LCL31A curr MARS**	**NPWD2371**	**00098**	**0**	**1**
YDM00006	20	3	25	1568	LCL32A curr Htr	NPWD2372	00099	0	1
YDM00006	20	3	25	1568	LCL33A curr HRSC	NPWD2381	00100	0	1
YDM00006	20	3	25	1568	FCL34A curr TRSP	NPWD2382	00101	0	1
YDM00006	20	3	25	1568	LCL35A curr PFS	NPWD2391	00102	0	1
YDM00006	20	3	25	1568	LCL36A curr RTU	NPWD2392	00103	0	1
YDM00006	20	3	25	1568	LCL37A curr Htr	NPWD2401	00104	0	1
YDM00006	20	3	25	1568	LCL38A curr Htr	NPWD2402	00105	0	1
YDM00006	20	3	25	1568	LCL39A curr TRSP	NPWD2411	00106	0	1
YDM00006	20	3	25	1568	LCL40A curr SSMM	NPWD2412	00107	0	1
YDM00006	20	3	25	1568	LCL41A curr ASPE	NPWD2421	00108	0	1
YDM00006	20	3	25	1568	LCL42A curr AIU_	NPWD2422	00109	0	1
YDM00006	20	3	25	1568	PDU-N43 NULL dat	NPWA2430	00110	0	1
YDM00006	20	3	25	1568	LCL15A curr RW 3	NPWD2441	00112	0	1
YDM00006	**20**	**3**	**25**	**1568**	**LCL16A curr MARS**	**NPWD2442**	**00113**	**0**	**1**
YDM00006	20	3	25	1568	LCL17A curr Htr	NPWD2451	00114	0	1
YDM00006	20	3	25	1568	LCL18A curr MELA	NPWD2452	00115	0	1
YDM00006	20	3	25	1568	LCL19A curr Gyro	NPWD2461	00116	0	1
YDM00006	20	3	25	1568	FCL20A curr CDMU	NPWD2462	00117	0	1
YDM00006	20	3	25	1568	LCL21A curr Htr	NPWD2471	00118	0	1
YDM00006	20	3	25	1568	LCL22A curr Htr	NPWD2472	00119	0	1

YDM00006	20	3	25	1568	LCL23A curr Htr	NPWD2481	00120	0	1
YDM00006	20	3	25	1568	LCL24A curr Htr	NPWD2482	00121	0	1
YDM00006	20	3	25	1568	LCL25A curr Htr	NPWD2491	00122	0	1
YDM00006	20	3	25	1568	LCL26A curr OMEG	NPWD2492	00123	0	1
YDM00006	20	3	25	1568	LCL27A curr Htr	NPWD2501	00124	0	1
YDM00006	20	3	25	1568	LCL28A curr STR1	NPWD2502	00125	0	1
YDM00006	20	3	25	1568	PDU-N51 NULL dat	NPWA2510	00126	0	1
YDM00006	20	3	25	1568	LCL1A curr EPC A	NPWD2521	00128	0	1
YDM00006	20	3	25	1568	LCL2A curr BEAGL	NPWD2522	00129	0	1
YDM00006	20	3	25	1568	LCL3A curr Htr D	NPWD2531	00130	0	1
YDM00006	20	3	25	1568	LCL4A curr Htr D	NPWD2532	00131	0	1
YDM00006	20	3	25	1568	LCL5A curr BEAGL	NPWD2541	00132	0	1
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YDM00006	20	3	25	1568	LCL7A curr Htr D	NPWD2551	00134	0	1
YDM00006	20	3	25	1568	LCL8A curr Htr C	NPWD2552	00135	0	1
YDM00006	20	3	25	1568	LCL9A curr Htr C	NPWD2561	00136	0	1
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YDM00006	20	3	25	1568	LCL11A curr SPIC	NPWD2571	00138	0	1
YDM00006	20	3	25	1568	LCL12A curr AIU	NPWD2572	00139	0	1
YDM00006	20	3	25	1568	LCL13A curr SADE	NPWD2581	00140	0	1
YDM00006	20	3	25	1568	LCL14A curr VMC	NPWD2582	00141	0	1
YDM00006	20	3	25	1568	PDU-N59 NULL dat	NPWA2590	00142	0	1
YDM00006	20	3	25	1568	Measurement of 0	NPWD2601	00144	0	1
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YDM00006	20	3	25	1568	Measurement of 0	NPWD2632	00151	0	1
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YDM00006	20	3	25	1568	Measurement of 0	NPWD2671	00158	0	1
YDM00006	20	3	25	1568	Measurement of 0	NPWD2672	00159	0	1
YDM00006	20	3	25	1568	LCL29B curr RW 2	NPWD2681	00160	0	1
YDM00006	20	3	25	1568	LCL30B curr Prop	NPWD2682	00161	0	1
YDM00006	20	3	25	1568	LCL31B curr Htr	NPWD2691	00162	0	1
YDM00006	20	3	25	1568	LCL32B curr Htr	NPWD2692	00163	0	1
YDM00006	20	3	25	1568	LCL33B curr AIU_	NPWD2701	00164	0	1
YDM00006	20	3	25	1568	FCL34B curr TRSP	NPWD2702	00165	0	1
YDM00006	20	3	25	1568	LCL35B curr PFS	NPWD2711	00166	0	1
YDM00006	20	3	25	1568	LCL36B curr RTU	NPWD2712	00167	0	1
YDM00006	20	3	25	1568	LCL37B curr Htr	NPWD2721	00168	0	1
YDM00006	20	3	25	1568	LCL38B curr Htr	NPWD2722	00169	0	1
YDM00006	20	3	25	1568	LCL39B curr TRSP	NPWD2731	00170	0	1
YDM00006	20	3	25	1568	LCL40B curr SSMM	NPWD2732	00171	0	1
YDM00006	20	3	25	1568	LCL41B curr ASPE	NPWD2741	00172	0	1
YDM00006	20	3	25	1568	LCL42B curr Htr	NPWD2742	00173	0	1
YDM00006	20	3	25	1568	PDU-N75 NULL dat	NPWA2750	00174	0	1
YDM00006	20	3	25	1568	LCL15B curr RW 4	NPWD2761	00176	0	1
YDM00006	20	3	25	1568	LCL16B curr HRSC	NPWD2762	00177	0	1
YDM00006	20	3	25	1568	LCL17B curr Htr	NPWD2771	00178	0	1

YDM00006	20	3	25	1568	LCL18B curr MELA	NPWD2772	00179	0	1
YDM00006	20	3	25	1568	LCL19B curr Gyro	NPWD2781	00180	0	1
YDM00006	20	3	25	1568	FCL20B curr CDMU	NPWD2782	00181	0	1
YDM00006	20	3	25	1568	LCL21B curr Htr	NPWD2791	00182	0	1
YDM00006	20	3	25	1568	LCL22B curr Htr	NPWD2792	00183	0	1
YDM00006	20	3	25	1568	LCL23B curr Htr	NPWD2801	00184	0	1
YDM00006	20	3	25	1568	LCL24B curr Htr	NPWD2802	00185	0	1
YDM00006	20	3	25	1568	LCL25B curr AIU_	NPWD2811	00186	0	1
YDM00006	20	3	25	1568	LCL26B curr OMEG	NPWD2812	00187	0	1
YDM00006	20	3	25	1568	LCL27B curr Htr	NPWD2821	00188	0	1
YDM00006	20	3	25	1568	LCL28B curr STR2	NPWD2822	00189	0	1
YDM00006	20	3	25	1568	PDU-N83 NULL dat	NPWA2830	00190	0	1
YDM00006	20	3	25	1568	LCL1B curr EPC B	NPWD2841	00192	0	1
YDM00006	20	3	25	1568	LCL2B curr BEAGL	NPWD2842	00193	0	1
YDM00006	20	3	25	1568	LCL3B curr Htr D	NPWD2851	00194	0	1
YDM00006	20	3	25	1568	LCL4B curr Htr D	NPWD2852	00195	0	1
YDM00006	20	3	25	1568	LCL5B curr BEAGL	NPWD2861	00196	0	1
YDM00006	20	3	25	1568	FCL6B curr CDMU	NPWD2862	00197	0	1
YDM00006	20	3	25	1568	LCL7B curr Htr D	NPWD2871	00198	0	1
YDM00006	20	3	25	1568	LCL8B curr Htr C	NPWD2872	00199	0	1
YDM00006	20	3	25	1568	LCL9B curr Htr C	NPWD2881	00200	0	1
YDM00006	20	3	25	1568	LCL10B curr Htr	NPWD2882	00201	0	1
YDM00006	20	3	25	1568	LCL11B curr SPIC	NPWD2891	00202	0	1
YDM00006	20	3	25	1568	LCL12B curr AIU	NPWD2892	00203	0	1
YDM00006	20	3	25	1568	LCL13B curr SADE	NPWD2901	00204	0	1
YDM00006	20	3	25	1568	LCL14B curr AIU_	NPWD2902	00205	0	1
YDM00006	20	3	25	1568	PDU-N91 NULL dat	NPWA2910	00206	0	1
YDM00006	20	3	25	1568	PDU-B-Primary Cu	NPWD2921	00208	0	1
YDM00006	20	3	25	1568	PDU-B-Secondary	NPWD2922	00209	0	1
YDM00006	20	3	25	1568	PDU-N93 TM pckt	NPWA2930	00210	0	1

YDM00011	20	3	25	2303	SDF Place Holder	NDMHKSDF	00016	0	1
YDM00011	20	3	25	2303	Start OBT in cyc	NDMW0A00	00018	0	1
YDM00011	20	3	25	2303	Start OBT in cyc	NDWD0A00	00018	0	1
YDM00011	20	3	25	2303	Start OBT in cyc	NDWD0A01	00020	0	1
YDM00011	20	3	25	2303	End OBT in cycle	NDMW0A01	00022	0	1
YDM00011	20	3	25	2303	End OBT in cycle	NDWD0A02	00022	0	1
YDM00011	20	3	25	2303	End OBT in cycle	NDWD0A03	00024	0	1
YDM00011	20	3	25	2303	Start of SSMM_MG	NDMW0A02	00026	0	1
YDM00011	20	3	25	2303	Start SSMM_MGR w	NDWD0A04	00026	0	1
YDM00011	20	3	25	2303	Start SSMM_MGR w	NDWD0A05	00028	0	1
YDM00011	20	3	25	2303	End of SSMM_MGR	NDMW0A03	00030	0	1
YDM00011	20	3	25	2303	End SSMM_MGR wrk	NDWD0A06	00030	0	1
YDM00011	20	3	25	2303	End SSMM_MGR wrk	NDWD0A07	00032	0	1
YDM00011	20	3	25	2303	Start of AOCMS_M	NDMW0A04	00034	0	1
YDM00011	20	3	25	2303	Start AOCMS_MGR	NDWD0A08	00034	0	1
YDM00011	20	3	25	2303	Start AOCMS_MGR	NDWD0A09	00036	0	1
YDM00011	20	3	25	2303	End of AOCMS_MGR	NDMW0A05	00038	0	1
YDM00011	20	3	25	2303	End AOCMS_MGR wr	NDWD0A0A	00038	0	1
YDM00011	20	3	25	2303	End AOCMS_MGR wr	NDWD0A0B	00040	0	1
YDM00011	20	3	25	2303	Start of OBDH pa	NDMW0A08	00042	0	1
YDM00011	20	3	25	2303	Start OBDH pckt	NDWD0A0G	00042	0	1
YDM00011	20	3	25	2303	Start OBDH pckt	NDWD0A0H	00044	0	1
YDM00011	20	3	25	2303	Start of OBDH pa	NDMW0A09	00046	0	1
YDM00011	20	3	25	2303	Start OBDH pckt	NDWD0A0I	00046	0	1

YDM00011	20	3	25	2303	Start OBDH pckt	NDWD0A0J	00048	0	1
YDM00011	20	3	25	2303	End of OBDH pack	NDMW0A0A	00050	0	1
YDM00011	20	3	25	2303	End OBDH pckt ac	NDWD0A0K	00050	0	1
YDM00011	20	3	25	2303	End OBDH pckt ac	NDWD0A0L	00052	0	1
YDM00011	20	3	25	2303	Start of OBDH no	NDMW0A06	00054	0	1
YDM00011	20	3	25	2303	Start OBDH non p	NDWD0A0C	00054	0	1
YDM00011	20	3	25	2303	Start OBDH non p	NDWD0A0D	00056	0	1
YDM00011	20	3	25	2303	End of PF acq/c	NDMW0A0U	00058	0	1
YDM00011	20	3	25	2303	End PF acq/cmd+P	NDWD0A2A	00058	0	1
YDM00011	20	3	25	2303	End PF acq/cmd+P	NDWD0A2B	00060	0	1
YDM00011	20	3	25	2303	Start of prep of	NDMW0A0V	00062	0	1
YDM00011	20	3	25	2303	Start prep of fl	NDWD0A2C	00062	0	1
YDM00011	20	3	25	2303	Start prep of fl	NDWD0A2D	00064	0	1
YDM00011	20	3	25	2303	End of prep of	NDMW0A0W	00066	0	1
YDM00011	20	3	25	2303	End prep of flip	NDWD0A2E	00066	0	1
YDM00011	20	3	25	2303	End prep of flip	NDWD0A2F	00068	0	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0B	00070	0	1
YDM00011	20	3	25	2303	Red/Nom path for	NDWD0A10	00071	5	1
YDM00011	20	3	25	2303	Dis/En for TM fo	NDWD0A11	00071	6	1
YDM00011	20	3	25	2303	Dis/En for TC fo	NDWD0A12	00071	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0C	00072	0	1
YDM00011	20	3	25	2303	Red/Nom path for	NDWD0A13	00073	5	1
YDM00011	20	3	25	2303	Dis/En for TM fo	NDWD0A14	00073	6	1
YDM00011	20	3	25	2303	Dis/En for TC fo	NDWD0A15	00073	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0D	00074	0	1
YDM00011	20	3	25	2303	Red/Nom path for	NDWD0A16	00075	5	1
YDM00011	20	3	25	2303	Dis/En for TM fo	NDWD0A17	00075	6	1
YDM00011	20	3	25	2303	Dis/En for TC fo	NDWD0A18	00075	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0E	00076	0	1
YDM00011	**20**	**3**	**25**	**2303**	**Red/Nom path for**	**NDWD0A19**	**00077**	**5**	**1**
YDM00011	**20**	**3**	**25**	**2303**	**Dis/En for TM fo**	**NDWD0A1A**	**00077**	**6**	**1**
YDM00011	**20**	**3**	**25**	**2303**	**Dis/En for TC fo**	**NDWD0A1B**	**00077**	**7**	**1**
YDM00011	20	3	25	2303	routing table fo	NDMW0A0F	00078	0	1
YDM00011	20	3	25	2303	Red/Nom path for	NDWD0A1C	00079	5	1
YDM00011	20	3	25	2303	Dis/En for TM fo	NDWD0A1D	00079	6	1
YDM00011	20	3	25	2303	Dis/En for TC fo	NDWD0A1E	00079	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0G	00080	0	1
YDM00011	20	3	25	2303	Red/Nom path for	NDWD0A1F	00081	5	1
YDM00011	20	3	25	2303	Dis/En for TM fo	NDWD0A1G	00081	6	1
YDM00011	20	3	25	2303	Dis/En for TC fo	NDWD0A1H	00081	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0H	00082	0	1
YDM00011	20	3	25	2303	Red/Nom path for	NDWD0A1I	00083	5	1
YDM00011	20	3	25	2303	Dis/En for TM fo	NDWD0A1J	00083	6	1
YDM00011	20	3	25	2303	Dis/En for TC fo	NDWD0A1K	00083	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0I	00084	0	1
YDM00011	20	3	25	2303	Red/Nom path for	NDWD0A1L	00085	5	1
YDM00011	20	3	25	2303	Dis/En for TM fo	NDWD0A1M	00085	6	1
YDM00011	20	3	25	2303	Dis/En for TC fo	NDWD0A1N	00085	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0J	00086	0	1
YDM00011	20	3	25	2303	Red/Nom path for	NDWD0A1O	00087	5	1
YDM00011	20	3	25	2303	Dis/En for TM fo	NDWD0A1P	00087	6	1
YDM00011	20	3	25	2303	Dis/En for TC fo	NDWD0A1Q	00087	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0P	00088	0	1
YDM00011	20	3	25	2303	PF active branch	NDWD0A20	00089	6	1
YDM00011	20	3	25	2303	PF validity chec	NDWD0A21	00089	7	1

YDM00011	20	3	25	2303	routing table fo	NDMW0A0Q	00090	0	1
YDM00011	20	3	25	2303	PF active branch	NDWD0A22	00091	6	1
YDM00011	20	3	25	2303	PF validity chec	NDWD0A23	00091	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0R	00092	0	1
YDM00011	20	3	25	2303	PF active branch	NDWD0A24	00093	6	1
YDM00011	20	3	25	2303	PF validity chec	NDWD0A25	00093	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0S	00094	0	1
YDM00011	20	3	25	2303	PF active branch	NDWD0A26	00095	6	1
YDM00011	20	3	25	2303	PF validity chec	NDWD0A27	00095	7	1
YDM00011	20	3	25	2303	routing table fo	NDMW0A0T	00096	0	1
YDM00011	20	3	25	2303	PF active branch	NDWD0A28	00097	6	1
YDM00011	20	3	25	2303	PF validity chec	NDWD0A29	00097	7	1
YDM00011	20	3	25	2303	Start of CDMU ac	NDMW0A0N	00098	0	1
YDM00011	20	3	25	2303	Start CDMU acq w	NDWD0A0M	00098	0	1
YDM00011	20	3	25	2303	Start CDMU acq w	NDWD0A0N	00100	0	1
YDM00011	20	3	25	2303	End of CDMU acq	NDMW0A0O	00102	0	1
YDM00011	20	3	25	2303	End CDMU acq wrk	NDWD0A0O	00102	0	1
YDM00011	20	3	25	2303	End CDMU acq wrk	NDWD0A0P	00104	0	1
YDM00011	**20**	**3**	**25**	**2303**	**MARSIS ant deplo**	**NDWD5100**	**00107**	**7**	**1**
YDM00011	20	3	25	2303	SafeMode author.	NDWD5101	00109	7	1
YDM00011	20	3	25	2303	spare bit (inval	NDWD5102	00110	0	1
YDM00011	20	3	25	2303	SSAP status	NDWD5103	00110	1	1
YDM00011	20	3	25	2303	RPAP status	NDWD5104	00110	2	1
YDM00011	20	3	25	2303	SADAP status	NDWD5105	00110	3	1
YDM00011	20	3	25	2303	TCS Heater Contr	NDWD5106	00110	4	1
YDM00011	20	3	25	2303	TCS PF Monitorin	NDWD5107	00110	5	1
YDM00011	20	3	25	2303	TCS PL Monitorin	NDWD5108	00110	6	1
YDM00011	20	3	25	2303	TLMAP status	NDWD5109	00110	7	1
YDM00011	20	3	25	2303	TLRAP status	NDWD510A	00111	0	1
YDM00011	20	3	25	2303	SAFCAP status	NDWD510B	00111	1	1

YDM00098	68	3	25	2318	SDF Place Holder	NDMHKSDF	00016	0	1
YDM00098	68	3	25	2318	PDU-Norm-Fault b	NPWD2011	00018	0	1
YDM00098	68	3	25	2318	PDU-Norm-Parity	NPWD2012	00018	1	1
YDM00098	68	3	25	2318	PDU-Norm-Delay b	NPWD2013	00018	2	1
YDM00098	68	3	25	2318	PDU-Norm-LastCmd	NPWD2014	00018	6	1
YDM00098	68	3	25	2318	PDU-Norm-LastCmd	NPWD2015	00018	7	1
YDM00098	68	3	25	2318	PDU-Norm-UpdatIn	NPWD2016	00019	0	1
YDM00098	68	3	25	2318	PDU-Norm-ReadInt	NPWD2017	00019	1	1
YDM00098	68	3	25	2318	PDU-Norm-Updatio	NPWD2018	00019	2	1
YDM00098	68	3	25	2318	PDU-Norm-TMmode	NPWD2019	00019	3	1
YDM00098	68	3	25	2318	PDU-Norm-PwrS bi	NPWD201A	00019	6	1
YDM00098	68	3	25	2318	PDU-Norm-PwrT bi	NPWD201B	00019	7	1
YDM00098	68	3	25	2318	LCL36A stat RTU	NPWD2091	00020	0	1
YDM00098	68	3	25	2318	LCL35A stat PFS	NPWD2092	00020	1	1
YDM00098	68	3	25	2318	LCL33A stat HRSC	NPWD2093	00020	3	1
YDM00098	68	3	25	2318	LCL32A stat Htr	NPWD2094	00020	4	1
YDM00098	**68**	**3**	**25**	**2318**	**LCL31A stat MARS**	**NPWD2095**	**00020**	**5**	**1**
YDM00098	68	3	25	2318	LCL30A stat Prop	NPWD2096	00020	6	1
YDM00098	68	3	25	2318	LCL29A stat RW 1	NPWD2097	00020	7	1
YDM00098	68	3	25	2318	LCL42A stat AIU_	NPWD2098	00021	2	1
YDM00098	68	3	25	2318	LCL41A stat ASPE	NPWD2099	00021	3	1
YDM00098	68	3	25	2318	LCL40A stat SSMM	NPWD209A	00021	4	1
YDM00098	68	3	25	2318	LCL39A stat TRSP	NPWD209B	00021	5	1
YDM00098	68	3	25	2318	LCL38A stat Htr	NPWD209C	00021	6	1

YDM00098	68	3	25	2318	LCL37A stat Htr	NPWD209D	00021	7	1
YDM00098	68	3	25	2318	LCL22A stat Htr	NPWD2101	00022	0	1
YDM00098	68	3	25	2318	LCL21A stat Htr	NPWD2102	00022	1	1
YDM00098	68	3	25	2318	LCL19A stat Gyro	NPWD2103	00022	3	1
YDM00098	68	3	25	2318	LCL18A stat MELA	NPWD2104	00022	4	1
YDM00098	68	3	25	2318	LCL17A stat Htr	NPWD2105	00022	5	1
YDM00098	**68**	**3**	**25**	**2318**	**LCL16A stat MARS**	**NPWD2106**	**00022**	**6**	**1**
YDM00098	68	3	25	2318	LCL15A stat RW 3	NPWD2107	00022	7	1
YDM00098	68	3	25	2318	LCL28A stat STR1	NPWD2108	00023	2	1
YDM00098	68	3	25	2318	LCL27A stat Htr	NPWD2109	00023	3	1
YDM00098	68	3	25	2318	LCL26A stat OMEG	NPWD210A	00023	4	1
YDM00098	68	3	25	2318	LCL25A stat Htr	NPWD210B	00023	5	1
YDM00098	68	3	25	2318	LCL24A stat Htr	NPWD210C	00023	6	1
YDM00098	68	3	25	2318	LCL23A stat Htr	NPWD210D	00023	7	1
YDM00098	68	3	25	2318	LCL8A stat Htr C	NPWD2111	00024	0	1
YDM00098	68	3	25	2318	LCL7A stat Htr D	NPWD2112	00024	1	1
YDM00098	68	3	25	2318	LCL5A stat BEAGL	NPWD2113	00024	3	1
YDM00098	68	3	25	2318	LCL4A stat Htr D	NPWD2114	00024	4	1
YDM00098	68	3	25	2318	LCL3A stat Htr D	NPWD2115	00024	5	1
YDM00098	68	3	25	2318	LCL2A stat BEAGL	NPWD2116	00024	6	1
YDM00098	68	3	25	2318	LCL1A stat EPC A	NPWD2117	00024	7	1
YDM00098	68	3	25	2318	LCL14A stat VMC	NPWD2118	00025	2	1
YDM00098	68	3	25	2318	LCL13A stat SADE	NPWD2119	00025	3	1
YDM00098	68	3	25	2318	LCL12A stat AIU	NPWD211A	00025	4	1
YDM00098	68	3	25	2318	LCL11A stat SPIC	NPWD211B	00025	5	1
YDM00098	68	3	25	2318	LCL10A stat Htr	NPWD211C	00025	6	1
YDM00098	68	3	25	2318	LCL9A stat Htr C	NPWD211D	00025	7	1
YDM00098	68	3	25	2318	LCL36B stat RTU	NPWD2211	00026	0	1
YDM00098	68	3	25	2318	LCL35B stat PFS	NPWD2212	00026	1	1
YDM00098	68	3	25	2318	LCL33B stat AIU_	NPWD2213	00026	3	1
YDM00098	68	3	25	2318	LCL32B stat Htr	NPWD2214	00026	4	1
YDM00098	68	3	25	2318	LCL31B stat Htr	NPWD2215	00026	5	1
YDM00098	68	3	25	2318	LCL30B stat Prop	NPWD2216	00026	6	1
YDM00098	68	3	25	2318	LCL29B stat RW 2	NPWD2217	00026	7	1
YDM00098	68	3	25	2318	LCL42B stat Htr	NPWD2218	00027	2	1
YDM00098	68	3	25	2318	LCL41B stat ASPE	NPWD2219	00027	3	1
YDM00098	68	3	25	2318	LCL40B stat SSMM	NPWD221A	00027	4	1
YDM00098	68	3	25	2318	LCL39B stat TRSP	NPWD221B	00027	5	1
YDM00098	68	3	25	2318	LCL38B stat Htr	NPWD221C	00027	6	1
YDM00098	68	3	25	2318	LCL37B stat Htr	NPWD221D	00027	7	1
YDM00098	68	3	25	2318	LCL22B stat Htr	NPWD2221	00028	0	1
YDM00098	68	3	25	2318	LCL21B stat Htr	NPWD2222	00028	1	1
YDM00098	68	3	25	2318	LCL19B stat Gyro	NPWD2223	00028	3	1
YDM00098	68	3	25	2318	LCL18B stat MELA	NPWD2224	00028	4	1
YDM00098	68	3	25	2318	LCL17B stat Htr	NPWD2225	00028	5	1
YDM00098	68	3	25	2318	LCL16B stat HRSC	NPWD2226	00028	6	1
YDM00098	68	3	25	2318	LCL15B stat RW 4	NPWD2227	00028	7	1
YDM00098	68	3	25	2318	LCL28B stat STR2	NPWD2228	00029	2	1
YDM00098	68	3	25	2318	LCL27B stat Htr	NPWD2229	00029	3	1
YDM00098	68	3	25	2318	LCL26B stat OMEG	NPWD222A	00029	4	1
YDM00098	68	3	25	2318	LCL25B stat AIU_	NPWD222B	00029	5	1
YDM00098	68	3	25	2318	LCL24B stat Htr	NPWD222C	00029	6	1
YDM00098	68	3	25	2318	LCL23B stat Htr	NPWD222D	00029	7	1
YDM00098	68	3	25	2318	LCL8B stat Htr C	NPWD2231	00030	0	1
YDM00098	68	3	25	2318	LCL7B stat Htr D	NPWD2232	00030	1	1

YDM00098	68	3	25	2318	LCL5B stat BEAGL	NPWD2233	00030	3	1
YDM00098	68	3	25	2318	LCL4B stat Htr D	NPWD2234	00030	4	1
YDM00098	68	3	25	2318	LCL3B stat Htr D	NPWD2235	00030	5	1
YDM00098	68	3	25	2318	LCL2B stat BEAGL	NPWD2236	00030	6	1
YDM00098	68	3	25	2318	LCL1B stat EPC B	NPWD2237	00030	7	1
YDM00098	68	3	25	2318	LCL14B stat AIU_	NPWD2238	00031	2	1
YDM00098	68	3	25	2318	LCL13B stat SADE	NPWD2239	00031	3	1
YDM00098	68	3	25	2318	LCL12B stat AIU	NPWD223A	00031	4	1
YDM00098	68	3	25	2318	LCL11B stat SPIC	NPWD223B	00031	5	1
YDM00098	68	3	25	2318	LCL10B stat Htr	NPWD223C	00031	6	1
YDM00098	68	3	25	2318	LCL9B stat Htr C	NPWD223D	00031	7	1
YDM00098	68	3	25	2318	PDU-A-Primary Cu	NPWD2261	00032	0	1
YDM00098	68	3	25	2318	PDU-A-Secondary	NPWD2262	00033	0	1
YDM00098	68	3	25	2318	PDU-B-Primary Cu	NPWD2921	00034	0	1
YDM00098	68	3	25	2318	PDU-B-Secondary	NPWD2922	00035	0	1
YDM00098	68	3	25	2318	Overall AVI reco	NDMW0D09	00036	0	1
YDM00098	68	3	25	2318	Reconf due to AO	NDMW0D0C	00038	0	1
YDM00098	68	3	25	2318	BARS En/Dis flag	NDWD5300	00040	0	1
YDM00098	68	3	25	2318	BARS BCDR1 failu	NDWD5301	00040	5	1
YDM00098	68	3	25	2318	BARS BCDR2 failu	NDWD5302	00040	6	1
YDM00098	68	3	25	2318	BARS BCDR3 failu	NDWD5303	00040	7	1
YDM00098	68	3	25	2318	BDCS En/Dis flag	NDWD5304	00041	0	1
YDM00098	68	3	25	2318	BDCS IBDR1 Monit	NDWD5305	00041	5	1
YDM00098	68	3	25	2318	BDCS IBDR2 Monit	NDWD5306	00041	6	1
YDM00098	68	3	25	2318	BDCS IBDR3 Monit	NDWD5307	00041	7	1

YDM02428	17	1	2	2387	TC Packet ID	NDMP2073	00016	0	1
YDM02428	17	1	2	2387	TC Sequence Cont	NDMP2075	00018	0	1
YDM02428	17	1	2	2387	VPD PAD 16 BITS	NGSFIX16	00020	0	1
YDM02428	17	1	2	2387	TC type	NDMP2078	00022	0	1
YDM02428	17	1	2	2387	TC subtype	NDMP2076	00023	0	1

YDM02429	17	1	8	2388	TC Packet ID	NDMP2073	00016	0	1
YDM02429	17	1	8	2388	TC Sequence Cont	NDMP2075	00018	0	1
YDM02429	17	1	8	2388	VPD PAD 16 BITS	NGSFIX16	00020	0	1
YDM02429	17	1	8	2388	TC type	NDMP2078	00022	0	1
YDM02429	17	1	8	2388	TC subtype	NDMP2076	00023	0	1

9.4.3.2 MARSIS-related S/C TM Calibrated Parameters

MARSIS-related S/C Packet Telemetries Calibrated Parameters (Numeric)

TC_Name	Par_Name	Calib	Validity	V_Value	Cal_Description
YDM00002	NTSA3501	**457**		1	TCS-Generic acq with YSI-44907
YDM00002	NTSA3502	**457**		1	TCS-Generic acq with YSI-44907
YDM00002	NTSA3503	**455**		1	TCS-Generic acq with PT2 thermis
YDM00002	NTSA3504	**455**		1	TCS-Generic acq with PT2 thermis
YDM00003	NMIA0101	**449**		1	MARSIS-First cal for YSI-44907 t
YDM00003	NMIA0102	**449**		1	MARSIS-First cal for YSI-44907 t
YDM00003	NMIA0103	**449**		1	MARSIS-First cal for YSI-44907 t
YDM00003	NMIA0109	**450**		1	MARSIS-Generic acq with PT2 ther
YDM00003	NMIA0201	**449**		1	MARSIS-First cal for YSI-44907 t

YDM00003	NMIA0202	**449**		1	MARSIS-First cal for YSI-44907 t
YDM00003	NMIA0203	**449**		1	MARSIS-First cal for YSI-44907 t
YDM00003	NMIA0209	**450**		1	MARSIS-Generic acq with PT2 ther
YDM00006	NPWD2371	**808**		1	PDU-LCL31A current calibration
YDM00006	NPWD2442	**821**		1	PDU-LCL16A current calibration

MARSIS-related S/C TM Calibrated Parameter (Text)

TC_Name	Par_Name	Calib	Validity	V_Value	Cal Description
YAC00049	NAWD0Z50	**329**		1	DMS SW-Internal Variable (SW tea
YDM00006	NPWD2034	**351**		1	PDU-Parm bit status calibration
YDM00006	NPWD2095	**357**		1	PDU-LCL bit status calibration
YDM00006	NPWD2106	**357**		1	PDU-LCL bit status calibration
YDM00006	NPWD2145	**350**		1	PDU-ParmPyro Status Calibration
YDM00006	NPWD2146	**350**		1	PDU-ParmPyro Status Calibration
YDM00006	NPWD2147	**350**		1	PDU-ParmPyro Status Calibration
YDM00006	NPWD2154	**351**		1	PDU-Parm bit status calibration
YDM00011	NDWD0A19	**330**		1	DMS SW-Internal Variable (SW tea
YDM00011	NDWD0A1A	**334**		1	DMS SW-Internal Variable (SW tea
YDM00011	NDWD0A1B	**334**		1	DMS SW-Internal Variable (SW tea
YDM00011	NDWD5100	**551**		1	MARSIS antenna deployment status
YDM00098	NPWD2095	**357**		1	PDU-LCL bit status calibration
YDM00098	NPWD2106	**357**		1	PDU-LCL bit status calibration

MARSIS-related S/C TM Calibrated Parameter (Polynomial)

TC_Name	Par_Name	Calib	Validity	V_Value	Cal Description
YDM00003	NMIA0105	**673**	NDAD0553	0	MARSIS-First cal for voltage acq
YDM00003	NMIA0106	**673**	NDAD0553	0	MARSIS-First cal for voltage acq
YDM00003	NMIA0108	**673**	NDAD0553	0	MARSIS-First cal for voltage acq
YDM00003	NMIA0205	**673**	NDAD0653	0	MARSIS-First cal for voltage acq
YDM00003	NMIA0206	**673**	NDAD0653	0	MARSIS-First cal for voltage acq
YDM00003	NMIA0208	**673**	NDAD0653	0	MARSIS-First cal for voltage acq

9.4.3.3 MARSIS-related S/C TM Parameters Calibration Values

MARSIS-related S/C Packet Telemetries Calibrated Parameters (Numeric)

Calib	Cal Description	X Value	Y Value
449	MARSIS-First cal for YSI-44907 t	5	90
449	MARSIS-First cal for YSI-44907 t	6	85
449	MARSIS-First cal for YSI-44907 t	7	80
449	MARSIS-First cal for YSI-44907 t	8	75
449	MARSIS-First cal for YSI-44907 t	10	70
449	MARSIS-First cal for YSI-44907 t	11	65
449	MARSIS-First cal for YSI-44907 t	13	60
449	MARSIS-First cal for YSI-44907 t	15	55
449	MARSIS-First cal for YSI-44907 t	18	50

449	MARSIS-First cal for YSI-44907 t	21	45
449	MARSIS-First cal for YSI-44907 t	25	40
449	MARSIS-First cal for YSI-44907 t	30	35
449	MARSIS-First cal for YSI-44907 t	35	30
449	MARSIS-First cal for YSI-44907 t	42	25
449	MARSIS-First cal for YSI-44907 t	49	20
449	MARSIS-First cal for YSI-44907 t	58	15
449	MARSIS-First cal for YSI-44907 t	68	10
449	MARSIS-First cal for YSI-44907 t	80	5
449	MARSIS-First cal for YSI-44907 t	93	0
449	MARSIS-First cal for YSI-44907 t	107	-5
449	MARSIS-First cal for YSI-44907 t	122	-10
449	MARSIS-First cal for YSI-44907 t	137	-15
449	MARSIS-First cal for YSI-44907 t	153	-20
449	MARSIS-First cal for YSI-44907 t	168	-25
449	MARSIS-First cal for YSI-44907 t	183	-30
449	MARSIS-First cal for YSI-44907 t	195	-35
449	MARSIS-First cal for YSI-44907 t	207	-40
449	MARSIS-First cal for YSI-44907 t	217	-45
449	MARSIS-First cal for YSI-44907 t	225	-50

450	MARSIS-Generic acq with PT2 ther	31	-200
450	MARSIS-Generic acq with PT2 ther	45	-180
450	MARSIS-Generic acq with PT2 ther	58	-160
450	MARSIS-Generic acq with PT2 ther	70	-140
450	MARSIS-Generic acq with PT2 ther	82	-120
450	MARSIS-Generic acq with PT2 ther	93	-100
450	MARSIS-Generic acq with PT2 ther	103	-80
450	MARSIS-Generic acq with PT2 ther	112	-60
450	MARSIS-Generic acq with PT2 ther	121	-40
450	MARSIS-Generic acq with PT2 ther	130	-20
450	MARSIS-Generic acq with PT2 ther	138	0
450	MARSIS-Generic acq with PT2 ther	145	20
450	MARSIS-Generic acq with PT2 ther	153	40
450	MARSIS-Generic acq with PT2 ther	160	60
450	MARSIS-Generic acq with PT2 ther	167	80
450	MARSIS-Generic acq with PT2 ther	174	100
450	MARSIS-Generic acq with PT2 ther	180	120
450	MARSIS-Generic acq with PT2 ther	186	140
450	MARSIS-Generic acq with PT2 ther	189	150

455	TCS-Generic acq with PT2 thermis	31	-200
455	TCS-Generic acq with PT2 thermis	45	-180
455	TCS-Generic acq with PT2 thermis	58	-160
455	TCS-Generic acq with PT2 thermis	70	-140
455	TCS-Generic acq with PT2 thermis	82	-120
455	TCS-Generic acq with PT2 thermis	93	-100
455	TCS-Generic acq with PT2 thermis	103	-80
455	TCS-Generic acq with PT2 thermis	112	-60
455	TCS-Generic acq with PT2 thermis	121	-40
455	TCS-Generic acq with PT2 thermis	130	-20
455	TCS-Generic acq with PT2 thermis	138	0
455	TCS-Generic acq with PT2 thermis	145	20
455	TCS-Generic acq with PT2 thermis	153	40
455	TCS-Generic acq with PT2 thermis	160	60

455	TCS-Generic acq with PT2 thermis	167	80
455	TCS-Generic acq with PT2 thermis	174	100
455	TCS-Generic acq with PT2 thermis	180	120
455	TCS-Generic acq with PT2 thermis	186	140
455	TCS-Generic acq with PT2 thermis	189	150

457	TCS-Generic acq with YSI-44907	1	150
457	TCS-Generic acq with YSI-44907	5	90
457	TCS-Generic acq with YSI-44907	6	85
457	TCS-Generic acq with YSI-44907	7	80
457	TCS-Generic acq with YSI-44907	8	75
457	TCS-Generic acq with YSI-44907	10	70
457	TCS-Generic acq with YSI-44907	11	65
457	TCS-Generic acq with YSI-44907	13	60
457	TCS-Generic acq with YSI-44907	15	55
457	TCS-Generic acq with YSI-44907	18	50
457	TCS-Generic acq with YSI-44907	21	45
457	TCS-Generic acq with YSI-44907	25	40
457	TCS-Generic acq with YSI-44907	30	35
457	TCS-Generic acq with YSI-44907	35	30
457	TCS-Generic acq with YSI-44907	42	25
457	TCS-Generic acq with YSI-44907	49	20
457	TCS-Generic acq with YSI-44907	58	15
457	TCS-Generic acq with YSI-44907	68	10
457	TCS-Generic acq with YSI-44907	80	5
457	TCS-Generic acq with YSI-44907	93	0
457	TCS-Generic acq with YSI-44907	107	-5
457	TCS-Generic acq with YSI-44907	122	-10
457	TCS-Generic acq with YSI-44907	153	-20
457	TCS-Generic acq with YSI-44907	168	-25
457	TCS-Generic acq with YSI-44907	183	-30
457	TCS-Generic acq with YSI-44907	195	-35
457	TCS-Generic acq with YSI-44907	207	-40
457	TCS-Generic acq with YSI-44907	225	-50
457	TCS-Generic acq with YSI-44907	231	-55
457	TCS-Generic acq with YSI-44907	236	-60
457	TCS-Generic acq with YSI-44907	247	-80
457	TCS-Generic acq with YSI-44907	255	-120

808	PDU-LCL31A current calibration	0	0
808	PDU-LCL31A current calibration	10	.014449
808	PDU-LCL31A current calibration	255	6.603234

821	PDU-LCL16A current calibration	0	0
821	PDU-LCL16A current calibration	255	6.602746
821	PDU-LCL16A current calibration	9	.01339

MARSIS-related S/C Packet Telemetries Calibrated Parameters (Text)

Calib	Cal Description	From	To	Text Value
329	DMS SW-Internal Variable (SW tea	0	0	FALSE
329	DMS SW-Internal Variable (SW tea	1	1	TRUE

330	DMS SW-Internal Variable (SW tea	0	0	REDUNDANT
330	DMS SW-Internal Variable (SW tea	1	1	NOMINAL

334	DMS SW-Internal Variable (SW tea	0	0	DISABLED
334	DMS SW-Internal Variable (SW tea	1	1	ENABLED

350	PDU-ParmPyro Status Calibration	0	0	OFF state
350	PDU-ParmPyro Status Calibration	1	1	ON state

351	PDU-Parm bit status calibration	0	0	OFF state
351	PDU-Parm bit status calibration	1	1	ON state

357	PDU-LCL bit status calibration	0	0	OFF state
357	PDU-LCL bit status calibration	1	1	ON state

551	MARSIS antenna deployment status	0	0	INHIBITED
551	MARSIS antenna deployment status	1	1	RUNNING

MARSIS-related S/C Packet Telemetries Calibrated Parameters (Polynomials)

Calib	Cal Description	Pol_A0	Pol_A1	Pol_A2	Pol_A3	Pol_A4
673	MARSIS-First cal for voltage acq	0	0.02114	0	0	0

9.5. Summary of Software parameters

MARSIS On Board Software parameters are organized and maintained in the instrument Parameter Table. The scope of the Parameter Table is not limited to the management of operational values but is broadened to include all possible software values (including system constants).

The complete list of Software parameters defined for the MARSIS instrument is therefore reported in RD-11.

10. ANNEXES

10.1. ANNEX 1: Mathematical Models

10.1.1. On-board Orbit Parameters Calculation

In addition of the Science Data processing carried on by the Slave DSPs, the Master CPU shall perform a background parallel task.

This task shall provide the Orbit and Velocity determination and in particular:

- satellite altitude information (**H**);
- satellite tangential velocity component (**V_T**);
- satellite radial velocity component (**V_R**);

$$H = a_{h0} + a_{h2}t^2 + a_{h4}t^4 + a_{h6}t^6 \qquad (1)$$
$$V_R = t\left(a_{R1} + a_{R3}t^2 + a_{R5}t^4 + a_{R7}t^6\right) \qquad (2)$$
$$V_T = a_{T0} + a_{T2}t^2 + a_{T4}t^4 + a_{T6}t^6 \qquad (3)$$

Being:
a_{h0}, a_{h2},a_{h4}, a_{h6} the Parameters Table coefficients for the H evaluation;
a_{T0}, a_{T2}, a_{T4}, a_{T6} the Parameters Table polynomial coefficients for the VT evaluation;
a_{R1}, a_{R3}, a_{R5}, a_{R7} the Parameters Table polynomial coefficients for the VR evaluation;

t is the time instant for which the information need to be evaluated, referred to a time scale whose zero coincides with the pericenter passage.

REMARK: polynomial coefficients can be specific for each flyby.

The time instant of calculation tk shall be the time_to_pericenter corresponding to the beginning of the k-th Frame. The following formula holds:

$$t_k = SCET\_k - SCET\_PERICENTER$$

being SCET_k the SCET (absolute onboard time) at the beginning of the k-th frame. The value of the time t_k is shall be in the ranges:

$-790s < t_k < +790s$
$-1200s < t_k < +1200s$

and it shall be equal to zero at the pericenter passage.

At the beginning of Operative Modes (end of WARM-UP2) t_0 = - SCET* seconds from pericenter passage.

The parameter SCET_PERICENTER as SCET* shall be loaded ad stored in the PT by the proper TC.

The above calculations are performed every frame to allow Orbit and Velocity determination during the flyby phase for any of the MARSIS instrument Operative Mode.

V_R is used in the Doppler processing during phase compensation process.

H,and V_T are then used for the evaluation, every frame, of the frame size NB (number of PRI). The following algorithm is used.

1. The space to be covered by the spacecraft during NB pulses shall be computed first as:

$$\Delta S = \sqrt{\frac{l_1 \cdot H}{2}} + N_o \cdot \frac{V_{Tan}}{PRF} \qquad (4)$$

being:

- PRF is equal to 130 Hz (nominally)
- No is an offset equal to 36 PRIs (TBC)
- λ1 is the wavelength of the lowest Operative Frequency in use Op_F1.
- H and V_T are the Spacecraft Height and the tangential velocity made available from the Orbit and Velocity Determination Function.

2. The computed DS shall be checked as below:

If ΔS < ΔS_min then ΔS = ΔS_min (ΔS_min = 5500 m TBC)

3. The Frame size NB shall be evaluated as below:

$$NB = Int\left[\frac{\Delta S}{V_{Tan}} \cdot PRF\right] \qquad (5)$$

The consistency check on NB shall be performed as:

if NB < NB_min then set NB = NB_min (NB_min = 160 TBC)

10.2. ANNEX 2: Pointing and special requirements for instrument science observation.

10.2.1. Orbit Prediction Accuracy

One of the most critical points for the overall MARSIS Opeartions is the accuracy of the predicted orbit that will be provided by ESOC to MARSIS Team (see §10.3).

In fact MARSIS needs to know for each Orbit and with great accuracy (less than 1 seconds) the SCET at pericenter passage (SCET_PERICENTER) and the SCET when it will start its Operation Modes (SCET*) at 800 km (for IT#1) from MARS.

These SCET values will be part of the Parameters Table TC (Type 206, Subtype 2) that is mandatory for each Flyby (see §4.1.3)

Due to the fact that the S/C will not provide information about orbit parameters such as altitude and velocity components, MARSIS shall use the following Polynomial laws:

$$H = a_{h0} + a_{h2}t^2 + a_{h4}t^4 + a_{h6}t^6 \qquad (1)$$
$$V_R = t\left(a_{R1} + a_{R3}t^2 + a_{R5}t^4 + a_{R7}t^6\right) \qquad (2)$$
$$V_T = a_{T0} + a_{T2}t^2 + a_{T4}t^4 + a_{T6}t^6 \qquad (3)$$

to estimate (see §10.1.1):

- satellite altitude information (**H**);
- satellite tangential velocity component (**V_T**);
- satellite radial velocity component (**V_R**);

The above mentioned polinomial laws are based on Orbit Prediction Data that ESOC will provide to MARSIS team.

In fact starting from H, V_T and V_R data provided by ESOC the coefficients of the best fitting polynomial laws will be computed and loaded in the Parameters Table always using the TC(206,2).

MARSIS processor will start to evaluate the polynomial formulas when the internal SCET counter will reach the value SCET* (loaded in STANDBY by TC(206,2)).

If the knowledge of SCET* will not be accurate all MARSIS operations and processing will fail.

In fact on V_R , H,and V_T are based the following MARSIS functionalities:

- Frame size Evaluation

- Operations Sequence Table Creation
- Doppler Processing of Scientific Data
- RX window openind in Acquisition Phase and Calibration Mode

The requirement of 1 second in the Orbit Prediction accuracy is mapped in:

- about 1km of accuracy in altitude prediction
- about 4m/s on radial velocity
- about 15m/s on tangential velocity.

That are the maximum errors that MARSIS experiment can support.

10.3. ANNEX 3: Auxiliary Data Requirements.

In the following table are summarized the MARSIS orbit and attitude data requirements that represent the data requested to ESOC to be available to MARSIS for either the on board real time processing and the ground processing of the scientific data. This request has been submitted to ESOC on May 2000.

MARSIS Experiment: ORBIT AND ATTITUDE DATA CONSOLIDATED REQUIREMENTS

Data required	Timing	Data source	Resp.	Delivery Method	Freq.	Sampling	Accuracy (Required)
Major S/C events (Orbit Manoeuvres, Eclipse etc)	Planned and Predicted	Ground	ESOC	DDS (Aux Data)	*Monthly*	*Every day*	
Long range Orbit Prediction	Predict	Ground	ESOC	DDS (Aux Data)	*Monthly*	*NA*	*NA*
Near Term Orbit Prediction	Prediction	Ground	ESOC	DDS (Aux Data)	*Weekly*	*Every orbit*	*Knowledge in time 1sec, in range 1 Km*
Quick look Orbit Estimation	Post-obs	Tracking Data	ESOC	DDS (Aux Data)	*Once in 2 days*	*Every orbit*	
Precision Orbit Estimation	Post-obs	Tracking Data	ESOC	DDS (Aux Data)	*Once in 2 weeks*	*Every orbit*	*300 m*
Predicted Attitude	Prediction	Ground	ESOC	DDS (Aux Data)	*Weekly*	*Every orbit*	*1 degree for each angle*
Reconstituted Attitude (Attitude and Rates)	Post-obs.	S/C Data+ Ground	ESOC	DDS (Aux Data)	*Weekly*	*Every orbit*	*1 degree*
Rotation Angle of SA (with respect to S/C frame of reference**)**	Post–obs.	S/C Data	ESOC	DDS (Aux Data)	*Weekly*	*NA*	*NA*
Pericentre 'TICK'	Prediction	Ground	ESOC	DDS (Aux Data)	*Weekly*	*Every Orbit*	*1 sec*
Orbit Time Period	Prediction	Ground	ESOC	DDS (Aux Data)	*Weekly*	*Every Orbit*	*NA*

Thruster Firing Times (Start Time & Duration)	Prediction & Post-obs.	Groun d	ESO C	DDS (Aux Data)	*Event related*	*Every Manoeuvr e*	*NA*
Sun Zenith Angle (Over Pericentre)	Prediction	Groun d	ESO C	DDS (Aux Data)	*Weekl y*	*Every orbit*	*2 degree*
Times of Occultation (Star/Sun) (Refer to SPICAM Star Catalogue)	Prediction	Groun d	ESO C	DDS (Aux Data)	*Weekl y*	*NA*	*NA*
Spacecraft Position (PSO)	Prediction	Groun d	ESO C	DDS (Aux Data)	*Weekl y*	*Every orbit*	*1 km*
Longitude & Latitude of occulted Mars point	Prediction	Groun d	ESO C	DDS (Aux Data)	*Weekl y*	*NA*	*NA*
Solar Zenith Angle (of occulted Mars Point)	Prediction	Groun d	ESO C	DDS (Aux Data)	*Weekl y*	*NA*	*NA*
Duration of Occultation (between 200 Km and 0 Km)	Prediction	Groun d	ESO C	DDS (Aux Data)	*Weekl y*	*NA*	*NA*
Spacecraft tangential radial velocity	*Prediction*	*Groun d*	*ESO C*	*DDS*	*Weekl y*	*Every Orbit*	*4 m/s (radial) 15 m/s (tangential)*

In the following table are summarized the MARSIS instrument requirements provided to the project scientist on Nov. 2000.

MARSIS SPECIFICATIONS	
Time of Operations	Daylight or night-time Optimized for night (subsurface sounding)
Duration of Observations	+/- 13 min. around PP nominal science ops. +/- 18 min around PP enhanced science ops. Standby: 4 min. Pre-obs: 5 min. Post-obs: 10 sec. After science ops.
Sun Elevation	All elevations < 0° optimal for subsurface sounding
Operating Altitude	Enhanced ops. Below 1200 km (+/- 18 min.) Nominal ops. Below 800 km (+/- 13 min.)
Pointing	Nadir
True Anomaly	+/- 50° around PP
Data Volume Share (critical phases)	12%
Data Volume Spec.	285 Mbits/day typical 57.9 Mbits/orbit typical in nominal mode 75.9 Mbits/orbit typical in enhanced mode
Data Volume for 2500 Mbits/day	372.5 Mbits/day max in nominal mode 116.4 Mbits/orbit max in nominal mode 161.1 Mbits/orbit max in enhanced mode
Data Volume for 1250 Mbits/day	150 Mbits/day typical 30.5 Mbits/orbit max in nominal mode 40 Mbits/orbit max in enhanced mode
Data Rate	Standby: 0.1 kbps Pre-obs (warm up 1 and 2): 0.1 kbps Mini (SS2, AIS, Calib., Rx only): 24.7 kbps Lowi (SS1): 35.5 kbps Medi (SS3, SS5): 48.4 kbps Maxi (SS4): 74.6 kbps Post-obs: 0.1 kbps
Power	Standby: 30 W Pre-obs: 37 W Mini: 62 W Lowi: 62 W Medi: 62 W Maxi: 62 W Post-obs: 33 W
Compression	NA
Calibration	TBD
Self-Checks	TBD
Switch-On	MARSIS will be switched on and off by the S/C each orbit
Commissioning Phase	TBD
Cruise Phase	No cruise activities (TBC)
Specific Requirements	3133 total orbits for global coverage
Ancillary Data Format	SPICE OK
Instrument Modes	5 subsurface sounding modes (passive ionosphere sounding embedded) with dual frequency and/or dual antenna capability. Spatial sampling rate of ~5 to 10 km (depending on the altitude) Active ionosphere sounding mode. Vertical resolution of 15 km, spatial sampling step of ~30 km
SRC Operating Modes	NA
Preferred Mode	NA
Modes not prioritary	NA
Heating Phase	311 sec, each orbit, after switch on and standby

10.4. ANNEX 4: MEX Commissioning Request Forms

10.4.1. MC COMMISSIONING FORMS

<table>
<tr><td colspan="4">MEX EV-IC-MC REQUEST FORM (MECC)</td></tr>
<tr><td colspan="2">INSTRUMENT
MARSIS</td><td>ORIGINATOR NAME</td><td>DATE</td></tr>
<tr><td>MISSION PHASE
MC</td><td>ACTIVITY ID
MC-MARSIS-001</td><td colspan="2">ACTIVITY NAME
RECEIVE_ONLY_AFTER_DEPLOY</td></tr>
<tr><td colspan="4">DESCRIPTION OF ACTIVITY:
MEASURE OF THE INTERNAL NOISE AND INTERACTION OF OTHER INSTRUMENTS.
IN THIS PHASE THE INSTRUMENT IS PASSIVE (NO TRASMISSION) .

ACTIVITY DURATION:1 ORBIT 26 MIN
TIME CONSTRAINS: PERICENTER PASSAGE, 26 MIN AROUND TIME OF PERICENTER
TIME CRITICALITY (IF ANY, CAN THIS ACTIVITY BE DONE IN ANY OTHER PORTION OF THE MISSION): POSSIBLY 1ST ORBIT AFTER ANTENNA DEPLOYMENT PHASE

INSTRUMENT MODE: RO (RECEIVE ONLY)
TELEMETRY RATE: 25.23 KBPS (*)
POWER PROFILE (APPROXIMATE): 30 (*)
MONITORING REQUIRED (1): NONE
INTERACTION REQUIRED (2): NONE
INSTRUMENT THERMAL REQUIREMENT: NONE

GEOMETRY REQUIREMENTS: NONE
S/C POINTING REQUIREMENTS: NADIR</td></tr>
<tr><td colspan="4">COMMENTS/OTHER CONSTRAINS:
(*)MARSIS PRE OPERATION SEQUENCE (9MIN)AND POST OPERATION SEQUENCE (LESS THAN 1 MIN) ARE NOT EXPLICITLY INDICATED, THE MAXIMUM POWER IS 30 W, TELEMETRY RATE 0.1 KBPS (FOR DETAILS REFER TO MARSIS FUM)
CYCLED TROUGH ALL BAND</td></tr>
<tr><td>ACCEPTED:</td><td>PI</td><td>MEX PROJECT</td><td>ESOC</td></tr>
</table>

MEX EV-IC-MC REQUEST FORM (MECC)			
INSTRUMENT MARSIS		ORIGINATOR NAME	DATE
MISSION PHASE MC	ACTIVITY ID MC-MARSIS-002	ACTIVITY NAME RAW_DATA_LOW_POWER_AFTER_DEPLOY	

DESCRIPTION OF ACTIVITY:
TO ACQUIRE A LIMITED AMOUNT OF DATA IN AN UNPROCESSED FORMAT STARTING WITH LOW TRASMITTED POWER
ACTIVITY DURATION:1 ORBIT 26 MIN
TIME CONSTRAINS: PERICENTER PASSAGE, 26 MIN AROUND TIME OF PERICENTER
TIME CRITICALITY (IF ANY, CAN THIS ACTIVITY BE DONE IN ANY OTHER PORTION OF THE MISSION): POSSIBLY 2ND ORBIT AFTER ANTENNA DEPLOIMENT PHASE

INSTRUMENT MODE: CAL (CALIBRATION MODE)
TELEMETRY RATE: 25.23 KBPS (*)
POWER PROFILE (APPROXIMATE): 62 W (*)
MONITORING REQUIRED (1): NONE
INTERACTION REQUIRED (2): NONE
INSTRUMENT THERMAL REQUIREMENT: NONE

GEOMETRY REQUIREMENTS: NONE
S/C POINTING REQUIREMENTS: NADIR

COMMENTS/OTHER CONSTRAINS:
(*)MARSIS PRE OPERATION SEQUENCE (9MIN)AND POST OPERATION SEQUENCE (LESS THAN 1 MIN) ARE NOT EXPLICITLY INDICATED, THE MAXIMUM POWER IS 30W, TELEMETRY RATE 0.1 KBPS (FOR DETAILS REFER TO MARSIS FUM)
CYCLED TROUGH ALL BAND

ACCEPTED:	PI	MEX PROJECT	ESOC

<table>
<tr><td colspan="4">MEX EV-IC-MC REQUEST FORM (MECC)</td></tr>
<tr><td colspan="2">INSTRUMENT
MARSIS</td><td>ORIGINATOR NAME</td><td>DATE</td></tr>
<tr><td>MISSION PHASE
MC</td><td>ACTIVITY ID
MC-MARSIS-003</td><td colspan="2">ACTIVITY NAME
RAW_DATA_AFTER_DEPLOY</td></tr>
<tr><td colspan="4">DESCRIPTION OF ACTIVITY:
TO ACQUIRE A LIMITED AMOUNT OF DATA IN AN UNPROCESSED FORMAT
ACTIVITY DURATION:2 ORBITS 26 MIN EACH
TIME CONSTRAINS: PERICENTER PASSAGE, 26 MIN AROUND TIME OF PERICENTER
TIME CRITICALITY (IF ANY, CAN THIS ACTIVITY BE DONE IN ANY OTHER PORTION OF THE MISSION): TO START AT LEAST 2 WORKING DAYS AFTER MC-MARSIS-001 MC-MARSIS-002 DATA ARE AVAILABLE
INSTRUMENT MODE: CAL (CALIBRATION MODE)
TELEMETRY RATE: 25.23 KBPS (*)
POWER PROFILE (APPROXIMATE): 62 W
MONITORING REQUIRED (1): NONE
INTERACTION REQUIRED (2): NONE
INSTRUMENT THERMAL REQUIREMENT: NONE

GEOMETRY REQUIREMENTS: NONE
S/C POINTING REQUIREMENTS: NADIR</td></tr>
<tr><td colspan="4">COMMENTS/OTHER CONSTRAINS:
(*)MARSIS PRE OPERATION SEQUENCE (9MIN)AND POST OPERATION SEQUENCE (LESS THAN 1 MIN) ARE NOT EXPLICITLY INDICATED, THE MAXIMUM POWER IS 30 W, TELEMETRY RATE 0.1 KBPS (FOR DETAILS REFER TO MARSIS FUM)
CYCLED TROUGH ALL BAND</td></tr>
<tr><td>ACCEPTED:</td><td>PI</td><td>MEX PROJECT</td><td>ESOC</td></tr>
</table>

MEX EV-IC-MC REQUEST FORM (MECC)			
INSTRUMENT MARSIS		ORIGINATOR NAME	DATE
MISSION PHASE MC	ACTIVITY ID MC-MARSIS-004	ACTIVITY NAME MODE_TRANSITION_1	

DESCRIPTION OF ACTIVITY:
TO MONITOR OPERATIVE MODES TRANSITION
VALIDATION OF ON BOARD PROCESSOR USING INDIVIDUAL ECHOES CAPABILITY
ACTIVITY DURATION:3 ORBIT 35 MIN EACH
TIME CONSTRAINS: PERICENTER PASSAGE: 35 MIN AROUND TIME OF PERICENTER
TIME CRITICALITY (IF ANY, CAN THIS ACTIVITY BE DONE IN ANY OTHER PORTION OF THE MISSION): TO START AT LEAST 2 WORKING DAYS AFTER MC-MARSIS-003 DATA ARE AVAILABLE
INSTRUMENT MODE: ACTIVE IONOSPHERE+ SUBSURFACE MODES SEQUENCE :
TELEMETRY RATE: (*)

STEP1 : AIS 5MIN	MAX TELEMETRY RATE	33.27 KBPS
STEP2 : SS1 5MIN	MAX TELEMETRY RATE	34 KBPS
STEP3 : SS2 5MIN	MAX TELEMETRY RATE	23 KBPS
STEP4 : SS3 5MIN	MAX TELEMETRY RATE	48 KBPS
STEP5 : SS4 5MIN	MAX TELEMETRY RATE	75 KBPS
STEP6 : SS5 5MIN	MAX TELEMETRY RATE	48 KBPS
STEP7 : AIS 5MIN	MAX TELEMETRY RATE	33.27 KBPS

POWER PROFILE (APPROXIMATE): (*) 64W
MONITORING REQUIRED (1): NONE
INTERACTION REQUIRED (2): NONE
INSTRUMENT THERMAL REQUIREMENT: NONE

COMMENTS/OTHER CONSTRAINS:
(*)MARSIS PRE OPERATION SEQUENCE (9MIN)AND POST OPERATION SEQUENCE (LESS THAN 1 MIN) ARE NOT EXPLICITLY INDICATED, THE MAXIMUM POWER IS 30 W, TELEMETRY RATE 0.1 KBPS (FOR DETAILS REFER TO MARSIS FUM)

PLEASE NOTE THAT THE SCIENTIFIC CAPABILITY OF THE INSTRUMENT CANNOT BE EVALUATED COMPLETELY IN THIS PHASE CAUSE OF THE HIGH SUN ELEVATION.

ACCEPTED:	PI	MEX PROJECT	ESOC

<table>
<tr><td colspan="4">MEX EV-IC-MC REQUEST FORM (MECC)</td></tr>
<tr><td colspan="2">INSTRUMENT
MARSIS</td><td>ORIGINATOR NAME</td><td>DATE</td></tr>
<tr><td>MISSION PHASE
MC</td><td>ACTIVITY ID
MC-MARSIS-005</td><td colspan="2">ACTIVITY NAME
MODE_TRANSITION_2</td></tr>
<tr><td colspan="4">DESCRIPTION OF ACTIVITY:
TO MONITOR DIFFERENT OST SETTINGS AND ON BOARD TRACKING
VALIDATION OF ON BOARD PROCESSOR USING INDIVIDUAL ECHOES CAPABILITY
ACTIVITY DURATION:2 ORBIT 26 MIN EACH
TIME CONSTRAINS: PERICENTER PASSAGE, 26 MIN AROUND TIME OF PERICENTER
TIME CRITICALITY (IF ANY, CAN THIS ACTIVITY BE DONE IN ANY OTHER PORTION OF THE MISSION): TO START AT LEAST 2 WORKING DAYS AFTER MC-MARSIS-003 DATA ARE AVAILABLE
INSTRUMENT MODE: SS3 :
TELEMETRY RATE: (*) MAX TELEMETRY RATE 48 KBPS
POWER PROFILE (APPROXIMATE): (*) 64W
MONITORING REQUIRED (1): NONE
INTERACTION REQUIRED (2): NONE
INSTRUMENT THERMAL REQUIREMENT: NONE

GEOMETRY REQUIREMENTS: NONE
S/C POINTING REQUIREMENTS: NADIR</td></tr>
<tr><td colspan="4">COMMENTS/OTHER CONSTRAINS:
(*)MARSIS PRE OPERATION SEQUENCE (9MIN)AND POST OPERATION SEQUENCE (LESS THAN 1 MIN) ARE NOT EXPLICITLY INDICATED, THE MAXIMUM POWER IS 30 W, TELEMETRY RATE 0.1 KBPS (FOR DETAILS REFER TO MARSIS FUM)

PLEASE NOTE THAT THE SCIENTIFIC CAPABILITY OF THE INSTRUMENT CANNOT BE EVALUATED COMPLETELY IN THIS PHASE CAUSE OF THE HIGH SUN ELEVATION.</td></tr>
<tr><td>ACCEPTED:</td><td>PI</td><td>MEX PROJECT</td><td>ESOC</td></tr>
</table>

<table>
<tr><td colspan="4">MEX EV-IC-MC REQUEST FORM (MECC)</td></tr>
<tr><td colspan="2">INSTRUMENT
MARSIS</td><td>ORIGINATOR NAME</td><td>DATE</td></tr>
<tr><td>MISSION PHASE
MC</td><td>ACTIVITY ID
MC-MARSIS-006</td><td colspan="2">ACTIVITY NAME
MODE_TRANSITION_3</td></tr>
<tr><td colspan="4">DESCRIPTION OF ACTIVITY:
TO MONITOR DIFFERENT OST SETTINGS AND ON BOARD TRACKING
VALIDATION OF ON BOARD PROCESSOR USING INDIVIDUAL ECHOES CAPABILITY
ACTIVITY DURATION:1 ORBIT 26 MIN
TIME CONSTRAINS: PERICENTER PASSAGE, 26 MIN AROUND TIME OF PERICENTER
TIME CRITICALITY (IF ANY, CAN THIS ACTIVITY BE DONE IN ANY OTHER PORTION OF THE MISSION): TO START AT LEAST 2 WORKING DAYS AFTER MC-MARSIS-003 DATA ARE AVAILABLE
INSTRUMENT MODE: SS4 :
TELEMETRY RATE: (*) MAX TELEMETRY RATE 75 KBPS
POWER PROFILE (APPROXIMATE): (*) 64W
MONITORING REQUIRED (1): NONE
INTERACTION REQUIRED (2): NONE
INSTRUMENT THERMAL REQUIREMENT: NONE

GEOMETRY REQUIREMENTS: NONE
S/C POINTING REQUIREMENTS: NADIR</td></tr>
<tr><td colspan="4">COMMENTS/OTHER CONSTRAINS:
(*)MARSIS PRE OPERATION SEQUENCE (9MIN)AND POST OPERATION SEQUENCE (LESS THAN 1 MIN) ARE NOT EXPLICITLY INDICATED, THE MAXIMUM POWER IS 37.5 W, TELEMETRY RATE 0.1 KBPS (FOR DETAILS REFER TO MARSIS FUM)

PLEASE NOTE THAT THE SCIENTIFIC CAPABILITY OF THE INSTRUMENT CANNOT BE EVALUATED COMPLETELY IN THIS PHASE CAUSE OF THE HIGH SUN ELEVATION.</td></tr>
<tr><td>ACCEPTED:</td><td>PI</td><td>MEX PROJECT</td><td>ESOC</td></tr>
</table>

<table>
<tr><td colspan="4">MEX EV-IC-MC REQUEST FORM (MECC)</td></tr>
<tr><td colspan="2">INSTRUMENT
MARSIS</td><td>ORIGINATOR NAME</td><td>DATE</td></tr>
<tr><td>MISSION PHASE
MC</td><td>ACTIVITY ID
MC-MARSIS-007</td><td colspan="2">ACTIVITY NAME
MODE_TRANSITION_4</td></tr>
<tr><td colspan="4">DESCRIPTION OF ACTIVITY:
TO MONITOR OPERATIVE MODES TRANSITION
VALIDATION OF ON BOARD PROCESSOR USING INDIVIDUAL ECHOES CAPABILITY
ACTIVITY DURATION:1 ORBIT 26 MIN EACH
TIME CONSTRAINS: PERICENTER PASSAGE: 26 MIN AROUND TIME OF PERICENTER
TIME CRITICALITY (IF ANY, CAN THIS ACTIVITY BE DONE IN ANY OTHER PORTION OF THE MISSION): TO START AT LEAST 2 WORKING DAYS AFTER MC-MARSIS-003 DATA ARE AVAILABLE
INSTRUMENT MODE: SUBSURFACE MODES SEQUENCE :
TELEMETRY RATE: (*)
STEP1 : SS4 2 MIN MAX TELEMETRY RATE 65 KBPS
STEP2 : CAL 24MIN TELEMETRY RATE 25.23 KBPS
STEP3 : SS3 2MIN MAX TELEMETRY RATE 40 KBPS
POWER PROFILE (APPROXIMATE): (*) 64W
MONITORING REQUIRED (1): NONE
INTERACTION REQUIRED (2): NONE
INSTRUMENT THERMAL REQUIREMENT: NONE

GEOMETRY REQUIREMENTS: NONE
S/C POINTING REQUIREMENTS: NADIR</td></tr>
<tr><td colspan="4">COMMENTS/OTHER CONSTRAINS:
(*)MARSIS PRE OPERATION SEQUENCE (9MIN)AND POST OPERATION SEQUENCE (LESS THAN 1 MIN) ARE NOT EXPLICITLY INDICATED, THE MAXIMUM POWER IS 30 W, TELEMETRY RATE 0.1 KBPS (FOR DETAILS REFER TO MARSIS FUM)

PLEASE NOTE THAT THE SCIENTIFIC CAPABILITY OF THE INSTRUMENT CANNOT BE EVALUATED COMPLETELY IN THIS PHASE CAUSE OF THE HIGH SUN ELEVATION.</td></tr>
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</table>

MEX EV-IC-MC REQUEST FORM (MECC)

Instrument MARSIS		Originator Name	Date
Mission Phase MC	Activity ID MC-MARSIS-008	Activity Name First Ionoshere measurement	

Description of Activity:
Start Ionosphere measurement
Activity Duration:1 orbit 36 min
Time constrains: pericenter passage: 36 min around time of pericenter
Time Criticality (if any, can this activity be done in any other portion of the mission): after MC-MARSIS-007
Instrument Mode: AIS
Telemetry rate: (*) 33.27 kbps
Power Profile (approximate): (*) 53W
Monitoring Required (1): none
Interaction Required (2): none
Instrument Thermal requirement: none

Geometry Requirements: none
s/c Pointing Requirements: nadir

Comments/other constrains:
(*)MARSIS Pre operation sequence (9min)and post operation sequence (less than 1 min) are not explicitly indicated, the maximum power is 30 W, telemetry rate 0.1 kbps (for details refer to MARSIS Fum)

Accepted:	PI	MEX Project	ESOC

10.4.2. EV COMMISSIONING FORM

<table>
<tr><td colspan="4">MEX EV-IC-MC REQUEST FORM (MECC)</td></tr>
<tr><td colspan="2">INSTRUMENT
MARSIS</td><td>ORIGINATOR NAME</td><td>DATE</td></tr>
<tr><td>MISSION PHASE
MC?</td><td>ACTIVITY ID
MARSIS-MON_CAL_001</td><td colspan="2">ACTIVITY NAME
MARSIS_MONOPOLE_CALIBRATION_1</td></tr>
<tr><td colspan="4">DESCRIPTION OF ACTIVITY:
MONOPOLE CALIBRATION.

ACTIVITY DURATION: 1 ORBIT 26 MIN (AROUND PERICENTER)
TIME CONSTRAINS: NEGATIVE SUN ELEVATION AND ROUGH SURFACE (ORBIT TBD)
TIME CRITICALITY (IF ANY, CAN THIS ACTIVITY BE DONE IN ANY OTHER PORTION OF THE MISSION):
AS SOON AS THE CONDITION " NEGATIVE SUN ELEVATION AND ROUGH SURFACE" IS VERIFIED

INSTRUMENT MODE: CAL (CALIBRATION MODE)
TELEMETRY RATE: 25.23 KBPS (*)
POWER PROFILE (APPROXIMATE): 62 (*)
MONITORING REQUIRED (1): NONE
INTERACTION REQUIRED (2): NONE
INSTRUMENT THERMAL REQUIREMENT: NONE

GEOMETRY REQUIREMENTS: NADIR
S/C POINTING REQUIREMENTS: NONE</td></tr>
<tr><td colspan="4">COMMENTS/OTHER CONSTRAINS:
FIRST ROUGH IDENTIFICATION OF THE NULL OF THE MONOPOLE
(*)MARSIS PRE OPERATION SEQUENCE (9MIN)AND POST OPERATION SEQUENCE (LESS THAN 1 MIN) ARE NOT EXPLICITLY INDICATED, THE MAXIMUM POWER IS 30 W, TELEMETRY RATE 0.1 KBPS (FOR DETAILS REFER TO MARSIS FUM)</td></tr>
<tr><td>ACCEPTED:</td><td>PI</td><td>MEX PROJECT</td><td>ESOC</td></tr>
</table>

<table>
<tr><td colspan="4">MEX EV-IC-MC REQUEST FORM (MECC)</td></tr>
<tr><td colspan="2">INSTRUMENT
MARSIS</td><td>ORIGINATOR NAME</td><td>DATE</td></tr>
<tr><td>MISSION PHASE
EV</td><td>ACTIVITY ID
EV-MARSIS-002</td><td colspan="2">ACTIVITY NAME
RECEIVE_ONLY_EV_ INTERFERENCE TEST</td></tr>
<tr><td colspan="4">DESCRIPTION OF ACTIVITY:
MEASURE OF THE INTERNAL NOISE AND INTERACTION OF OTHER INSTRUMENTS, PASSIVE MEASURE OVERLAPPED WITH OTHER INSTRUMENTS TURNED ON ONE AT TIME

ACTIVITY DURATION: 2MIN FOR EACH INTRUMENT ACTIVATED
TIME CONSTRAINS: NONE
TIME CRITICALITY (IF ANY, CAN THIS ACTIVITY BE DONE IN ANY OTHER PORTION OF THE MISSION): NONE

INSTRUMENT MODE: RO (RECEIVE ONLY)
TELEMETRY RATE: 25.23 KBPS (*)
POWER PROFILE (APPROXIMATE): 30 (*)
MONITORING REQUIRED (1): NONE
INTERACTION REQUIRED (2): NONE
INSTRUMENT THERMAL REQUIREMENT: NONE

GEOMETRY REQUIREMENTS: NONE
S/C POINTING REQUIREMENTS: NONE</td></tr>
<tr><td colspan="4">COMMENTS/OTHER CONSTRAINS:
IN THIS PHASE AS THE ANTENNA IS NOT YET DEPLOYED, IT IS POSSIBLE TO OPERATE IN PASSIVE WAY, AND ONLY A PART OF THE INSTRUMENT CAN BE CHECKED OUT.
(*)MARSIS PRE OPERATION SEQUENCE (9MIN)AND POST OPERATION SEQUENCE (LESS THAN 1 MIN) ARE NOT EXPLICITLY INDICATED, THE MAXIMUM POWER IS 30 W, TELEMETRY RATE 0.1 KBPS (FOR DETAILS REFER TO MARSIS FUM)</td></tr>
<tr><td>ACCEPTED:</td><td>PI</td><td>MEX PROJECT</td><td>ESOC</td></tr>
</table>

10.5. ANNEX 5: Parameters Table

The annexed document details the content of MARSIS Parameter Table.

10.6. ANNEX 6: TM and TC Packets Structure Definition

The annexed document details the structure of MARSIS Telemetry and Telecommand Packets, and the packetization strategy followed by the instrument's Digital Electronics Subsystem (DES).

10.7. ANNEX 7: Flight Control Procedures / Contingency Recovery Procedures

The annexed document describes all the FCP and the CRP defined currently with this edition of the FUM.

10.8. ANNEX 8: Operation Sequence Table Generation Logic.

The annexed document details the characteristics of the OST entries and the rules for the management of the OST fields.

10.9. ANNEX 9: List of Abbreviations.

ADC	Analogue To Digital Converter
AGC	Automatic Gain Control
AGMP	Altimetric Global Map Product
ALS	Alenia Aerospazio
ANC	Conditioned Analog T/M
ANS	Analogue Telemetry
AS	Antenna Subsystem
BP	Bandpass Filter Section
BW	Bandwidth
CF	Center Frequency
CRP	Contingency and Recovery Procedure
CU	Control Unit
CW	Continuous Wave
DC	Direct Current
DC1	Digital Subsystem DC/DC Converter
DC2	RF Subsystem DC/DC Converter
DCG	Digital Chirp Generator
DEM	Digital Elevation Model
DES	Digital Electronic Subsystem
DPLR	Deployer
DR	Data Rate
DSP	Digital Signal Processing
DV	Data Volume
DWC	Downconversion Section
EMC	Electromagnetic Compatibility
EQM	Engineering Qualification Model
ESA	European Space Agency
ESOC	European Space Operations Centre
ESTEC	European Space Technology Centre
FCP	Flight Control Procedure
FFT	Fast Fourier Transform
FM	Flight Model
GSE	Groun Support Equipment
H/K	Housekeeping
HFC	High Frequency Clock
HPC	High Power Command
HW	Hardware
I/F	Interface
IF	Improvement Factor
IFFT	Inverse Fast Fourier Transform
IFU	Interface Unit
INFO-COM	Information and Communication Department of the University of Rome "La Sapienza"
IT	Instrument Timeline

IT#1	Instrument Timeline#1
IT#2	Instrument Timeline#2
JPL	Jet Propulsion Laboratory
kbit	Kilobit
kbps	Kilobit per second
MARSIS	Mars Advanced Radar for Subsurface and Ionosphere Sounding
Mbit	Megabit
MDE	Motor Drive Electronics
MESDA	Mars Express Science Data Archive
MEDOC	
MESOC	Mars Express Science Operation Center
MIF	Monopole Antenna Interface Section
MLC	Menory Load Command
MMS	Matra Marconi Space
NA	Not Applicable
NASA	National Aeronautics and Space Administration
OBDH	On-Board Data Handling
ODOST	Orbit Dedicated Operations Sequence Table
ODPT	Orbit Dedicated Parameters Table
OST	Operations Sequence Table
PI	Principal Investigator
PID-B	Payload Interface Document part B
PRF	Pulse Repetition Frequency
PSDP	Primary Science Data Product
PT	Parameters Table
PW	Pulsewidth
RAM	Random Access Memory
RF	Radio Frequency
RFS	Radio Frequency Subsystem
RMS	Root Mean Square
ROM	Read-Only Memory
RSS	Relay/Switch Status T/M
RTU	Remote Terminal Unit
RX	Receiver
S/C	Spacecraft
SDI	Science Data Interface
SDT	Serial 16 Bit Digital Telemetry
SF	Start Frequency
SGMP	Subsurface Global Map Product
SISD	Acronym for DES + RX Box
SIST	Acronym for Transmitter box
SNR	Signal to Noise Ratio
TBC	To Be Confirmed
TBD	To Be Determined/Defined
TC	Telecommand
TM	Telemetry

TSY	Timer and Synchronisation Pulse
TU	Timing Unit
TX	Transmitter Section
V	Volt
Vs	Versus
W	Watt
wrt	with respect to

10.10. ANNEX 10: Instrument Contact Points for Contingency

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