



REFERENCE : H-P-1-ASPI-PL-0201

DATE : 03/05/2002

ISSUE : 1 Rev. Page : 1/20

TOTAL PAGES : 20

HERSCHEL / PLANCK

Herschel/Planck Frequency Plans

Product Code : 000000

<i>Written by</i>	<i>Responsibility-Office -Company</i>	<i>Date</i>	<i>Signature</i>
L. TROUGNOU	EMC engineer	03/05/02	
<i>Verified by</i>			
K. HIBBERD	Electrical Interfaces manager	3/5/02	
P. COUZIN	Electrical Architecture manager	3/5/02	
<i>Approved by</i>			
P. RIDEAU	Engineering manager	16/5/02	
C. MASSE	PA manager	17/05/02	
J.J. JUILLET	Project manager	24/05/02	

DATA MANAGEMENT:

Entité Emettrice : Alcatel Space - Cannes
(détentrice de l'original) :

HERSCHEL/PLANCK		DISTRIBUTION RECORD	
DOCUMENT NUMBER :		Issue 1 / Rev. : Date: 03/05/2002	
EXTERNAL DISTRIBUTION		INTERNAL DISTRIBUTION	
ESA	X	HP team	X
ASTRIUM	X		
ALENIA	X		
CONTRAVES			
TICRA			
TECNOLOGICA			
		Clf Documentation	Orig.

ENREGISTREMENT DES EVOLUTIONS / *CHANGE RECORDS*

ISSUE	DATE	§ : DESCRIPTION DES EVOLUTIONS § : <i>CHANGE RECORD</i>	REDACTEUR <i>AUTHOR</i>
1	03/05/2002	Initial issue	

TABLE OF CONTENTS

1. SCOPE	5
2. DOCUMENTS	6
2.1 Applicable documents	6
2.2 Reference documents	6
3. ACRONYMS	7
3.1 SVM acronyms	7
3.2 HPLM acronyms	7
3.3 SPIRE acronyms	7
3.4 PACS acronyms	7
3.5 HIFI acronyms	8
3.6 LFI acronyms	8
3.7 HFI acronyms	8
4. SVM FREQUENCY PLAN	9
5. HERSCHEL PLM FREQUENCY PLAN	12
5.1 CCU	12
5.2 SPIRE	13
5.3 PACS	14
5.4 HIFI	16
6. PLANCK PLM FREQUENCY PLAN	19
6.1 LFI	19
6.2 Sorption Cooler	20
6.3 HFI	20

1. SCOPE

The present document is a summary of the various SVM and Instruments frequency plans.

It is meant to be used as a reference document for engineering purpose.

2. DOCUMENTS

2.1 Applicable documents

[AD-01] First/Planck System Requirements Specification (SRS), SCI-PT-RS-05991

[AD-02] IID Part A, SCI-PT-IIDA-04624

[AD-03] IID Part B, Bolometer Instrument, SCI-PT-IIDB/SPIRE-02124

[AD-04] IID Part B, Heterodyne Instrument, SCI-PT-IIDB/HIFI-02125

[AD-05] IID Part B, Photoconductor Instrument, SCI-PT-IIDB/PACS-02126

[AD-06] IID Part B, HFI, SCI-PT-IIDB/HFI-04141

[AD-07] IID Part B, LFI, SCI-PT-IIDB/HFI-04142

[AD-08] Ariane 5 user manual, Issue 3/Rev. 00 - March 2000

[AD-09] General Design and Interface Requirements, H-P-1-ASPI-SP-0027

[AD-10] EMC Specification, H-P-1-ASPI-SP-0037

[AD-11] EMC/ESD Control Plan, H-P-1-ASPI-PL-0038

2.2 Reference documents

- PACS EMC Control Plan & Frequency Plan, PACS-ME-PL-015, Draft 0.2, 14-01-02
- Draft Planck HFI EMC Control Plan, PL-PH251-200168-IAS, Issue 0, Rev 0, 19/04/2002
- Alenia Fax "Herschel-Planck : SVM Frequency Plan", SIEL/EC/02-0034

3. ACRONYMS

ADC : Analogue to Digital Converter
CV : Converter
DPU : Digital Processing Unit
DSP : Digital Signal Processor
FPU : Focal Plane Unit
HK : Housekeeping

3.1 SVM acronyms

ACC : Attitude Control Computer
CDMS : Central Data Management Subsystem
CDMU : Central Data Management Unit
GYR : Gyro Blocks
PCDU : Power Control and Distribution Unit
QRS : Quartz Rate Sensor
RCS : Reaction Control System
RWE : Reaction Wheels Equipment
SAS : Sun Acquisition Sensor
SREM : Standard Radiation Environment Monitor
STR : Star Trackers
XPND: Transponder
TWTA: Traveling Wave Tube Amplifier

3.2 HPLM acronyms

CCU : Cryostat Control Unit

3.3 SPIRE acronyms

MCU :
DCU : Detection Control Unit
SCU :

3.4 PACS acronyms

BOLA : BOLOmeter buffer Amplifier unit
BOLC : BOLOmeter and cooler Control unit
DEC : DEtector Control unit
MEC : MEchanism Control unit
SPU : Signal Processing Unit

3.5 HIFI acronyms

FCU : Focal plane Control Unit
HRH : High Resolution spectrometer, Horizontal polarisation
HRS : High Resolution Spectrometer
HRV : High Resolution spectrometer, Vertical polarisation
ICU : Instrument Control Unit
IF : Intermediate Frequency
LCU : Local oscillator Control Unit
LOU : Local Oscillator Unit
LSU : Local oscillator Source Unit
WEH : Wide band spectrometer Electronics, Horizontal polarisation
WEV : Wide band spectrometer Electronics, Vertical polarisation
WOH : Wide band spectrometer Optics, Horizontal polarisation
WOV : Wide band spectrometer Optics, Vertical polarisation

3.6 LFI acronyms

DAE : Data Acquisition Electronics
REBA : Radiometer Electronics Box Assembly

3.7 HFI acronyms

REU : Readout Electronics Unit

4. SVM FREQUENCY PLAN

Source : Fax "Herschel-Planck : SVM Frequency Plan", SIEL/EC/02-0034, from Alenia

XPND receiver F0	9.62330796	MHz	Herschel	XPND
XPND receiver 4F0	38.49323182	MHz	Herschel	XPND
XPND receiver 19F0	182.8428512	MHz	Herschel	XPND
XPND receiver 24 F0	230.959391	MHz	Herschel	XPND
X-Band Uplink (749F0)	7207.857662	MHz	Herschel	XPND
XPND receiver 768F0	7390.700513	MHz	Herschel	XPND
XPND transmitter 4F0	38.49323182	MHz	Herschel	XPND
XPND transmitter 40F0	384.9323182	MHz	Herschel	XPND
XPND transmitter 80F0	769.8646368	MHz	Herschel	XPND
XPND transmitter 240F0	2309.593910	MHz	Herschel	XPND
XPND transmitter 640F0	6158.917094	MHz	Herschel	XPND
X-Band Downlink (880F0)	8468.511005	MHz	Herschel	XPND

XPND receiver F0	9.607955	MHz	Planck	XPND
XPND receiver 4F0	38.431818	MHz	Planck	XPND
XPND receiver 19F0	182.551145	MHz	Planck	XPND
XPND receiver 24 F0	230.590920	MHz	Planck	XPND
X-Band Uplink (749F0)	7196.358295	MHz	Planck	XPND
XPND receiver 768F0	7378.909440	MHz	Planck	XPND
XPND transmitter 4F0	38.431818	MHz	Planck	XPND
XPND transmitter 40F0	384.318200	MHz	Planck	XPND
XPND transmitter 80F0	768.636400	MHz	Planck	XPND
XPND transmitter 240F0	2305.909200	MHz	Planck	XPND
XPND transmitter 640F0	6149.091200	MHz	Planck	XPND
X-Band Downlink (880F0)	8455.000400	MHz	Planck	XPND

XPND TM data clock	500	Hz	Low rate	XPND
XPND TM data clock	5	kHz	Low rate	XPND
XPND TM data clock	107	kHz	Medium rate	XPND
XPND TM data clock	1.5	MHz	High rate	XPND
XPND TM Subcarrier	45.844	kHz		XPND
XPND TC data clock	125	Hz		XPND
XPND TC data clock	4	kHz		XPND
XPND clock	20.647800	MHz		XPND
XPND Rx/Tx DC/DC converter	TBD			XPND
TWTA X-Band Downlink	8468.5	MHz		TWTA

ACC DC/DC converter	TBD			ACC
ACC 131 kHz clock signal	131.072	kHz		ACC
ACC CPU clock	40	MHz		ACC
ACC RM OBT oscillator	16	MHz		ACC
ACC OBT clock	8.3886	MHz		ACC
ACC 1553 I/F oscillator	16	MHz		ACC
ACC OBDH nominal bus frequency	524.288	kHz		ACC
ACC main bus clock 1553	1	MHz		ACC

RCS PWM	TBD			RCS
---------	-----	--	--	-----

GYR DC/DC converter	TBD			GYR
GYR TM/TC Module DC/DC converter	TBD			GYR
GYR Oscillators/Clocks	TBD			GYR
GYR Command & Monitoring clock	TBD			GYR
GYR main bus clock 1553	1	MHz		GYR
STR DC/DC converter	TBD			STR
STR TM/TC Module DC/DC converter	TBD			STR
STR Oscillators/Clocks	TBD			STR
STR Command & Monitoring clock	TBD			STR
STR main bus clock 1553	1	MHz		STR
RWE DC/DC converter	TBD			RWE
SAS DC/DC converter	TBD			SAS
QRS DC/DC converter	550	kHz	(TBC)	QRS

CDMU DC/DC converters	TBD			CDMU
CDMU 131 kHz clock signal	131.072	kHz		CDMU
CDMU CPU clock	40	MHz		CDMU
CDMU TTR OBT oscillator	16	MHz		CDMU
CDMU TM oscillator	6.8826	MHz		CDMU
CDMU TM clock	13.765022	MHz		CDMU
CDMU OBT clock	8.3886	MHz		CDMU
CDMU TM Low 1 rate	1.1471	kHz		CDMU
CDMU TM Low 2 rate	11.471	kHz		CDMU
CDMU TM Medium rate	246.626	kHz	(TBC)	CDMU
CDMU TM High rate	3.441300	MHz		CDMU
CDMU bus 1553 interface oscillator	16	MHz		CDMU
CDMU OBDH nominal bus frequency	524.288	kHz		CDMU
CDMU main bus clock 1553	1	MHz		CDMU

PCDU BDR	100	kHz		PCDU
PCDU TM/TC module DC/DC converter	TBD			PCDU
PCDU Quartz oscillator	12	MHz	(TBC)	PCDU
PCDU Oscillators/Clocks	TBD			PCDU
PCDU Command & Monitoring clock	TBD			PCDU
PCDU main bus clock 1553	1	MHz		PCDU
S3R frequency	3 to 5	kHz	(TBC)	PCDU
SREM DC/DC converter	TBD			SREM
SREM Oscillators/Clocks	TBD			SREM

5. HERSCHEL PLM FREQUENCY PLAN

5.1 CCU

Source : Fax HP-2-ASED-0090/01, 12.09.2001

CCU DC/DC CV	125	kHz		Cryostat
CCU HK	4	kHz		Cryostat

5.2 SPIRE

Source : email from Doug Griffin

DPU 1553 Quartz	16	MHz		SPIRE
DPU 1553 Data exchange with S/C clock	1	MHz		SPIRE
DPU clock	20	MHz		SPIRE
DPU Io serial link bus clock from DPU to S/S	312.5	kHz		SPIRE
DCU-SCU-MCU fast serial link clock from Subsystems to DPU	2	MHz		SPIRE
DPU HK data	4	kHz	4 kbps average rate	SPIRE
DPU Science Data	120	kHz	120 kbps subframes average rate	SPIRE
DPU DC/DC CV	131.072	kHz		SPIRE
DCU Cmd IF Clock	312	kHz	RS422	SPIRE
DCU Data IF	1 to 2.5	MHz	RS422	SPIRE
DCU Master Clock	10	MHz	Crystal Oscillator internal to unit	SPIRE
DCU Bolometer Bias	50 to 300	Hz	Sine, Signal level 100mV, differential, sensitive	SPIRE
DCU T/C Bias	50 to 300	Hz	Sine, Signal level 500mV, differential, sensitive	SPIRE
MCU Cmd IF Clock	312	kHz	RS422	SPIRE
MCU Data IF	1 to 2.5	MHz	RS422	SPIRE
MCU Master Clock	10	MHz	Crystal Oscillator internal to unit	SPIRE
MCU LVDT Excitation			Differential	SPIRE
SCU Cmd IF Clock	312	kHz	RS422	SPIRE
SCU Data IF	1 to 2.5	MHz	RS422	SPIRE
SCU Master Clock	10	MHz	Crystal Oscillator internal to unit	SPIRE
SCU 300mK TS bias	20	Hz	Rect., Signal level 6mV, tr/ta = 1ms, sensitive	SPIRE
SCU Photo Stimulus	0 to 5	Hz	Rect.	
PSU DC/DC CV	131	kHz	Free running +- 10%, internal to unit	SPIRE

5.3 PACS

Source : EMC Control Plan & Frequency Plan, PACS-ME-PL-015, Draft 0.2, 14-01-02

DPU 1553 Quartz	16	MHz	5V rect.	PACS
DPU clock	20	MHz	5V rect.	PACS
DPU DC/DC CV	131.072	kHz	56Vpp	PACS
DPU HK	4	kHz	5V rect.	PACS
DPU science data	120	kHz	subframes	PACS
DPU science data	50	kHz	subframes	PACS
DPU science data	300	kHz	subframes	PACS
DPU-MEC IEEE 1355 over RS422	10	MHz	3V rect. (LVDS)	PACS
DPU-SPU IEEE 1355 over RS422	10	MHz	3V rect. (LVDS)	PACS
SPU Main oscillator	36	MHz	5V (TBC) rect.	PACS
SPU processor (DSP)	18	MHz	5V (TBC) rect.	PACS
DEC CRE clock	8192	Hz	5V square (cryoharness)	PACS
DEC CRE sync	256	Hz	5V pulse (cryoharness)	PACS
DEC internal logic	max. 18	MHz	3.3 V square (with FPGA)	PACS
DEC/MEC commun.	10	MHz	1V pulse/square (LVDS)	PACS
DEC power supply	64 TBC	kHz	square or sine 12 V TBC (on backplane)	PACS
DEC-MEC clock	8192	Hz	1V square (LVDS)	PACS
DEC-MEC sync	256	Hz	1V pulse (LVDS)	PACS
DEC-SPU Detector readout	4	MHz	5V rect.	PACS
DEC-SPU IEEE 1355	10	MHz	3V rect. (LVDS)	PACS
DEC DC/DC CV	128 TBC	kHz	28V TBC pulse (PWM) internal to CV	PACS

MEC DSP clock	36	MHz	5V TBC square (DSP module internal)	PACS
MEC DSP clock	18	MHz	5V TBC square (DSP and backplane)	PACS
MEC IEEE 1355 clock	10	MHz	5V TBC square (DSP and backplane)	PACS
MEC Inductosyn	16384	Hz	30V square and sine TBC (sine to cryoharness)	PACS
MEC HK	8192	Hz	5V TBC square (FPGA and backplane)	PACS
MEC Chopper	f0 = DC to 5	Hz	Photometer (f0 = trapez. + harmonics up to 2 kHz), 30Vp, cryoharness	PACS
MEC Chopper	f0 = DC to 8	Hz	Spectrometer, waveform TBC, cryoharness	PACS
MEC grating	4	Hz	30Vpp TBC pulse, cryoharness	PACS
MEC calibration sources	0 TBC	Hz	slowly varying, 1V TBC	PACS
MEC temp. Sensors	1 TBC	Hz	slowly varying, 1V TBC	PACS
MEC filter wheels	TBD	Hz	30Vpp TBC pulse, cryoharness	PACS
BOLC main oscillator	20	MHz	5V rect.	PACS
BOLC DC/DC CV(s)	131 TBC	kHz	56Vpp TBC	
BOLC ADC readout/ LVDS	5	MHz	0.3V	
BOLC-MEC IEEE 1355/ LVDS	10	MHz	3V rect.	PACS
BOLC-MEC Sync./ LVDS	40	Hz	0.3V rect.	PACS
BOLC-FPU 0.3K temp. probe	20	Hz	0.012Vpp rect.	PACS
BOLC-BOLA Bolometer O/P chop	1280	Hz	1Vmax rect.	PACS
BOLC-BOLA Bolometer Add.	100	kHz	3Vmax rect., 1 burst @ 640 Hz	PACS
BOLC-BOLA Other bolo. clocks	100	kHz	1Vmax rect.	PACS
BOLA n.a.				PACS

5.4 HIFI

Source : Change Request HP-HIFI-CR-0014 to IID-B, 22/03/2002

LSU output to LOU	23.7 to 35.7	GHz	26 dBm	HIFI
LSU YIG tuned oscillator	7.9 to 11.9	GHz	24 dBm	HIFI
LSU YIG tuned oscillator	8.5 to 10.5	GHz	13 dBm	HIFI
LSU PLO	8	GHz	13 dBm	HIFI
LSU PLO	4	GHz	13 dBm	HIFI
LSU mixer output	0.5 to 2.5	GHz	4 dBm	HIFI
LSU master oscillator	10	MHz	12 dBm	HIFI
LSU command from LCU	2.5	kHz	5 V	HIFI
LCU micro-controller clock	10	MHz	5 V	HIFI
LCU command and HK from/to ICU	312.5	kHz	5 V	HIFI
LCU DC/DC CV	131	kHz	+/- 10 %	HIFI
LCU command to LSU	2.5	kHz	5 V	HIFI
FPU IF output to FCU (HRS operational)	3.5 to 9	GHz	interference limit : -155 dBm	HIFI
FCU IF signal from FPU and to HRI, WEH/WEV (HRS operationnal)	3.5 to 9	GHz	interference limit : -125 dBm	HIFI
FCU command and HK from/to ICU	312.5	kHz	5 V	HIFI
FCU command and HK	200	kHz	5 V	HIFI
FCU position sensors	5	kHz	5 V / 1 mA	HIFI
FCU ADC sample rate	2	kHz	5 V	HIFI
FCU mechanism control loop	1	kHz	5 V	HIFI
FCU temperature control loop	10	Hz	5 V	HIFI
FCU chopper actuator	5	Hz	30 mAp / 12 Vp	HIFI

HRH/V(IF) local oscillators	13 to 17	GHz	20 dBm	HIFI
HRH/V(IF) local oscillators	10.5	GHz	15 dBm	HIFI
HRH/V(IF) astronomical signal	9 to 10	GHz		HIFI
HRH/V(IF) IF signal from FCU	3.5 to 9	GHz	interference limit : -127 dBm	HIFI
HRH/V(IF) astronomical signal	1 to 1.5	GHz	interference limit : -110 dBm	HIFI
HRH/V(IF) local oscillators	1.25	GHz	15 dBm	HIFI
HRH/V(IF) ref. from LSU	10	MHz	0 dBm	HIFI
HRH/V(IF) ref. to ACS	10	MHz	0 dBm	HIFI
HRH/V(IF) signal to HRH/V(ACS)	0 - 250	MHz	interference limit : -110 dBm	HIFI
HRH/V(IF) command from HRH/V(ACS)	312.5	kHz	5 V	HIFI
HRH/V(ACS) ACS clock	550	MHz	12 dBm	HIFI
HRH/V(ACS) ref. from HRI	10	MHz	0 dBm	HIFI
FPGA clock (synchronous with the ref. from HRI)	11	MHz	3.3 V	HIFI
HRH/V(ACS) signal from HRI	0 - 250	MHz	interference limit : -110 dBm	HIFI
HRH/V(ACS) HK/science data to ICU	2.5	MHz	5 V	HIFI
HRH/V(ACS) command from ICU	312.5	kHz	5 V	HIFI
HRH/V(ACS) DC/DC CV	131	kHz	+/- 10%	HIFI
WEH/WEV IF signal from FCU	3.5 to 9	GHz	interference limit : -120 dBm	HIFI
WEH/WEV DRO	6.6	GHz	13 dBm	HIFI
WEH/WEV DRO	7.6	GHz	13 dBm	HIFI
WEH/WEV DRO	8.6	GHz	13 dBm	HIFI
WEH/WEV DRO	9.6	GHz	13 dBm	HIFI
WEH/WEV signal to WOH/WOV	1.55 to 2.65	GHz		HIFI
WEH/WEV comb generator	100	MHz	23 dBm	HIFI
WEH/WEV ref. from LSU	10	MHz	0 dBm	HIFI
WEH/WEV basic timing clock	10	MHz	5 V	HIFI
WEH/WEV command from ICU	312.5	kHz	5 V	HIFI
WEH/WEV video signal from WOH/WOV	250 kHz 100 Hz		Pixel clock Transfer clock	HIFI
WEH/WEV pixel clock and HK/science data to ICU	250	kHz	5 V	HIFI
WEH/WEV DC/DC CV	TBD	kHz		HIFI
WEH/WEV transfer clock	100	Hz	5 V	HIFI

WOH/WOV signal from WEH/WEV	1.55 to 2.65	GHz		HIFI
WOH/WOV video signal to WEH/WEV	250	kHz	Pixel clock	HIFI
WOH/WOV pixel clock	100	Hz	Transfer clock	HIFI
WOH/WOV transfer clock	250	kHz	5 V	HIFI
	100	Hz	5 V	HIFI
ICU DSP clock	20	MHz	5 V	HIFI
ICU 1553 chip clock	16	MHz	5 V	HIFI
ICU HK/science data from HRS	2.5	MHz	5 V	HIFI
ICU CDMS bus clock	1	MHz	5 V	HIFI
ICU command and HK	312.5	kHz	5 V	HIFI
ICU HK/science data from WBS	250	kHz	5 V	HIFI
ICU DC/DC CV	131	kHz	+/- 10% ; 540 mA	HIFI
ICU TM packet equivalent (nom.)	100	kHz	5 V	HIFI
ICU TC packet equivalent	4	kHz	5 V	HIFI

6. PLANCK PLM FREQUENCY PLAN

6.1 LFI

Source : email from Maurizio Miccolis

DAE Power Box DC/DC converters PWM	131.072	kHz		LFI
DAE Power Box Command link from BEU box	1	MHz		LFI
DAE BEU Box On Board Clock signal	131.072	kHz		LFI
DAE BEU Box Sync signal from the REBA	1	Hz		LFI
DAE BEU Box Phase Switch	4096	Hz		LFI
DAE BEU Box Science data sampling	8192	Hz		LFI
DAE BEU Box Sequencer internal clock	20	MHz		LFI
DAE BEU Box HK acquisition frequency	1	Hz		LFI
DAE BEU Box 1355 serial data digital interface	10/80	MHz		LFI
DAE BEU Box Internal transfer of digital data	1	MHz		LFI
REBA DC/DC converters PWM	131.072	kHz	(TBC)	LFI
REBA On Board Clock signal	131.072	kHz		LFI
REBA Sync signal to the DAE	1	Hz		LFI
REBA 1553B bus	1	MHz		LFI
REBA 1355 serial data digital interface	10/80	MHz		LFI
REBA DSP clock	17.46	MHz		LFI

6.2 Sorption Cooler

Source : "Draft Planck HFI EMC Control Plan", PL-PH251-200168-IAS, Issue 0, 19/04/2002

SC DSP processor clock	16	MHz	quartz	SC
SC 1553 bus	1	MHz	from 16 MHz quartz	SC
SC 12V DC/DC CV (2 units)	200	kHz	(free running)	SC
SC 5 & 15V DC/DC CV	100	kHz	(free running)	SC
SC internal timer	10	Hz	from 16 MHz quartz	SC
SC ADC clock	8	MHz	from 16 MHz quartz	SC
SC Lockin clocks (3 units)	1	kHz	from 16 MHz quartz	SC

6.3 HFI

Source : "Draft Planck HFI EMC Control Plan", PL-PH251-200168-IAS, Issue 0, 19/04/2002

DPU processor clock	20	MHz		HFI
DPU High Speed Link clock	2	MHz	from DPU 20 MHz	HFI
DPU 1553 clock	1	MHz	from 16 MHz quartz	HFI
DPU low speed link I/F	100	kHz	from 20 MHz	HFI
DPU DC/DC CV (5V & 15V)	100	kHz	(free running)	HFI
REU processor clock	20	MHz	from 40 MHz quartz	HFI
REU modulation	80	Hz	typical (twice 4K compressors) from 40 MHz	HFI
REU bolometers sampling	160	Hz	(twice modulation) from 40 MHz quartz	HFI
REU ADC sampling	7.2	kHz	per channel from 40 MHz quartz	HFI
REU Pre-Processing FPGAs clock	158.7	kHz	from 40 MHz	HFI
REU DC/DC CV	100	kHz	free running	HFI
or	131	kHz	from 40 MHz quartz	
REU High Speed Link clock	2	MHz	from DPU	HFI
4K Cooler compressors	40	Hz	from REU modulation	HFI
4K Cooler sinus samples	7.2	kHz	from REU modulation	HFI
4K Cooler low speed link I/F	100	kHz		HFI
4K Cooler DC/DC CV	100	kHz	(free running)	HFI
0.1K Cooler DC/DC CV (5V & 15V)	100	kHz	(free running)	HFI
0.1K Cooler low speed link I/F	100	kHz	from DPU	HFI

END OF DOCUMENT