Run 25/9/02.

Prepared by	:	Jeff Payne & Dave Parker	Date	:	25/9/01
Checked by	:		Date	:	
Agreed by	:		Date	:	
Authorised by	:		Date	:	

V.1.2

CDMS_SIM.VI 24/9/02

Distribution:
O.Bauer
L.Dubbeldam
K.King
P. Gomez
J-L.Beney
S.Thuerey
F.Wechsler

27/9/02 THREQ_TIME =14400

DDC.CPP 10/9/02

DDC.H 10/9/02

Remsbe Terminal Simulator V.1.1 28/5/02

Document Change Record

Issue	Date Changed	Section Description of Change

CONTENTS

1. INTRODUCTION

The CDMS data interface Simulator forms a connection between the MIL-STD-1553B data bus (which is the data interface for instruments on Herschel/Planck) and a computer network.
The 1553 bus interface hardware used in the CDMS-Sim is a BU65549M2-300 PCI card, which is a standard off-the-shelf product from Data Device Corporation (DDC). The CDMS Simulator software has been developed at RAL using the DDC C code library.

This document describes the tests that shall be carried out before the unit is delivered to and accepted by the Herschel instruments. The purpose of the tests is to ensure compliance of the CDMS Simulator with all aspects of the design and users requirements. The procedure section, filled out with test results together with any associated test logs, will form the acceptance test report.

The test procedure incorporates the test requirements specifications SRON-U/HIFI-SP-5 draft 0.2, and also an Email dated 1 May 2001 from L.Dubbeldam to Wechsler, Bauer, King and Thuerey.

1.1 Purpose

The purpose of this document is to define the activities and responsibilities required for the acceptance testing of the CDMS for the three Herschel instruments.

1.2 Scope

The CDMS Simulator test specifications in the SRON document are derived from a suggested test plan in MIL-HDBK-1553A. However the MIL-HDBK test plan is written to test a 1553 RT device using a 1553 Tester. In our case the CDMS Simulator is a 1553 BC - the *instrument* is the RT, so the plan has to be adapted for our use.

DDC, the manufacturer of the CDMS Simulator bus interface card, has demonstrated that their equipment is compatible with that same 1553 test plan. These measurements have been made with the ACE device (bus interface component) acting as an RT. The DDC report may be found in Appendix A.

This CDMS Simulator test acceptance test comprises:

- Interface hardware measurements
  These are performed to confirm the build standard of the DDC card. Measurements of the Simulator output voltages, which my be important for the safety of flight equipment, are made in several different bus configurations. These were not in the requirements, but may be useful for future reference.

- Low-level 1553 bus protocol measurements
  These demonstrate the use of the DDC ACE windows menu to generate single messages and short sequences of messages.

- Satellite bus protocol measurements
  These demonstrate compliance with the PS-ICD and the Simulator requirements specification.

- Verification of user interface and Router interface
  Demonstrating the user interface requirements which were specified in the Simulator requirements specification.

The test procedure verifies the CDMS Simulator only. It does not include any instrument-specific or EGSE tesing.

2. DOCUMENT REFERENCES

2.1 Applicable documents

AD.1. FIRST-PLANCK CDMS interface test-requirements specifications, SRON-U-HIFI-SP-2000-5.
AD.2 Packet Structure ICD, SCI-PT-ICD-07527 issue 1
AD.3 Mil-Std-1553B
AD.4 FIRST/Planck CDMS Simulator Requirements, SRON-U/HIFI/SP/2000-004 issue ~~1~~ 1.1 3/5/01
CDMS-Simulator Data ICD SPIRE-RAL-DOC-001196 draft 4 22/7/02

2.2 Reference Documents

RD.1 Hardware Manual MIL-STD 1553 BC/RT/MT PCI Interface Card, MN-65549-001.
RD.2. EGSE-ILT Users Requirements Document, FIRST-SPI-DOC-000127.
RD.3. CDMS Simulator Users Guide, SPIRE-RAL-PRJ-000807. v 1.3 for s/w version 1.2

3. DELIVERABLES

3.1 Hardware

DDC 1553 BUS Card Part No BU-65549M2-300
Personal Computer Pentium III 900Mhz or better, 256Mb Memory.

3.2 Software

This software is provided on a CD which includes an installation procedure:

CDMS_SIM.EXE	(RAL CDMS Simulator LabView VI's in compiled form)
DDC.DLL	(RAL CDMS Simulator C Code)
Remote Terminal.EXE	(Simple instrument simulator)
Example telecommands	
Example buslists	

With hardware deliveries only:
DDC ACE Runtime library
DDC 'ACE Windows menu' program

3.3 Documentation

CDMS Simulator Users Guide

Certificates of Conformance

4. ENVIRONMENT

The CDMS-Sim acceptance tests will be performed at RAL.
Three PCs are used during the tests:

- CDMS-SIM
- Remote Terminal (simple instrument simulator)
- Router

The Router PC can optionally run the Systran 1553 bus monitor software to assist in understanding any problems encountered.

The computers will be isolated from any local computer Network during the testing.

4.1 Remote Terminal (simple instrument simulator)

The simple instrument simulator program used in simulator testing has two modes:

- Echo TC

The program receives a TC packet via the 1553 transfer protocol, changes the packet header into a valid TM header, and re-sends it back to the bus controller.

- Transmit TM "Continuous"

The program creates TM packet data of maximum packet length. It has a valid header containing a packet counter. The data area consists of a counting data pattern. The program generates TM requests and then transfers packet data over the bus at the maximum possible rate.

The instrument simulator can emulate any instrument; a control on the front panel sets the remote terminal (RT) number.

The RT is only intended to support the packet transfer protocol for simulator self-test and EGSE integration purposes. It has not been exhaustively tested in all 1553 configurations.

4.2 Router and Test Client

The Router with software version 0.92 is installed on a separate PC from the CDMS-Sim.
This PC also has a simple test client written in Java to send telecommands to and receive telemetry packets from the router.

5. CDMS-SIM TEST REQUIREMENTS MATRIX

5.1 Spacecraft Data Interface Requirements

Note: The CDMS Simulator is not required to perform all of the 'instrument' tests listed in the test matrix of the Test Requirements document, AD1. A bus tester may be required for those instrument-specific tests.

Test Requirement section		Test plan Section	Comments
4.2	Output Characteristics	6.1	
4.2.1	Amplitude	6.1.1	
4.2.2	Risetime / falltime	6.1.2	
4.2.3	Zero crossing stability	6.1.3	
4.2.4	Distortion, overshoot and ringing	6.1.4	
4.2.5	Output symmetry	6.1.5	
4.2.6	Output noise	6.1.6	
4.2.7	Output isolation	6.1.7	
4.2.8	Power on/off noise	6.1.8	
4.2.9	n/a		
4.2.10	n/a		
4.2.11	Frequency stability	6.1.9	
4.3.5	Input impedance	6.1.10	
4.5.9	Required mode commands	6.2.1	
	Transmit status		
	Transmitter shutdown and override		
	Reset remote terminal		
4.7	CDMS_Sim data link support	6.2	
4.7.1	Mode commands	6.2.1	
4.7.2	No response timeout	6.2.2	
4.7.3	Receive message	6.2.3	
4.7.4	Broadcast message	6.2.4	
4.7.5	Transmit message	6.2.5	
4.7.6	Receive low-level command	6.2.6	
4.8	Satellite data-bus protocol	6.3	
4.8.1	EGSE connection		
4.8.2	Basic protocol without TM or TC transfer	6.3.1	
4.8.3	Transfer of TC packet	6.3.2	
4.8.4	RT error conditions during data transfer	6.3.3	
4.8.5	TM packet transfer	6.3.4	
4.8.6	CDMS Sim error conditions during data transfer	6.3.5	
4.8.7	Nominal mode	6.3.6	
4.8.8	Burst mode	6.3.7	

5.2 Users Requirements

User Requirement section		Test plan Section	Comments
4.1.1	Implement bus controller functions according to MIL-STD-1553B	6	
4.1.1	Transfer TC packets received from the Router as messages on the 1553 bus.	6.5.2	
4.1.1	Transfer TM packets received as messages over the 1553 bus to the Router.	6.5.3	
4.1.1	Retrieve and send TM packets from file to the Router.	6.6	
4.1.1	Support creation, modification and storage of several bus profiles.	6.3.6 - 6.3.8	Buslists created with EXCEL.
4.1.1	Start up automatically in a reproducible configuration.		
4.1.1	Nominal bus profile: 25 TM packets/sec 2 Async. short TM packets/sec 2 TC packets/sec 2 Async. short TC packets/sec 1 Time / sec	6.3.6	Async messages/packets not yet fully defined, therefore not yet implemented. Time is a message not a packet.
4.1.1	Burst mode bus profile: 50 TM packets/sec 2 Async. short TM packets/sec 2* TC packets/sec 2 Async. short TC packets/sec 1 Time / sec	6.3.7	Async messages/packets not yet fully defined, therefore not yet implemented. TM packets cannot be redefined as TC packets at run-time. Time is a message not a packet.
4.1.1	Memory load mode bus profile: 0 TM packets/sec 2 Async. short TM packets/sec 20 TC packets/sec 2 Async. short TC packets/sec 1 Time / sec	6.3.8	Async messages/packets not yet fully defined, therefore not yet implemented. Time is a message not a packet.
4.1.2	The CDMS Simulator shall be able to operate stand-alone:	6.4	
4.1.2	Implement 1553 Bus Controller functions.	6	
4.1.2	Store TC packets as files.	6.4.1.2	
4.1.2	Edit TC files		Use any text editor eg Notepad
4.1.2	Generate TC packets from application data by adding header and checksum.	-	This requirement was deleted in a working group meeting; see CDMS requirements annex A, 18.
4.1.2	Display TM packets (hex)	6.4.1.3	
4.1.2	Transfer malformed TC packets (Length, APID, checksum)	6.4.1.2	The CDMS-Sim makes no checks on packet contents.
4.1.3	Perform bus monitor functions in addition to Stand-alone or connected functions:	6.4	

4.1.3	Archive TC and TM packets for 30 minutes at maximum rate.	6.3.7, 6.4.2	
4.1.3	Archive 1553 bus messages for 30 minutes at maximum rate.	6.4.2.3	
4.1.3	Display a list of transferred TM/TC packets.	6.4.1.2, 6.4.1.3	
4.1.3	Display individual TM/TC packets.	6.4.1.2, 6.4.1.3	
4.1.3	Display a list of transferred 1553 messages.	6.3.6 - 6.3.8	
4.1.3	Display individual 1553 messages	6.3.6 - 6.3.8	
4.1.3	Display traffic status information in real time.	6.4.1.2, 6.4.1.3	
4.1.3	Archived and displayed packets and messages shall be time-stamped.	6.4	
4.1.4	The CDMS-Sim shall synchronise its time and synchronise instruments according to the PS-ICD procedures:	6.3.1, 6.4.1.1	Full time synchronisation not yet implemented; but 1553 frame is synchronised to PC seconds.
4.1.4	The CDMS-Sim shall provide: 131.072 kHz		not implemented yet
4.1.4	The CDMS-Sim shall provide: 1 Hz synchronised to master time.		not implemented yet
4.1.5	Fault Detection, Isolation and Recovery:	6.4.1.4	
4.1.5	Display BC and RT error messages in real time.	6.4.1.4	
4.1.5	Display detected bus error conditions in real time.	6.4.1.4	
4.1.5	Display protocol errors in real time.	6.4.1.4	
4.1.5	Display CDMS-Sim error conditions.	6.4.1.4	
4.1.5	Switch between bus A and B as part of set-up.	6.4.1.1	
4.3.1	The CDMS-Sim shall interface with up to 4 RTs.	6.3.6	Buslist controls message destinations; can use all RTs.
4.3.3	The CDMS-Sim shall have controls/displays for:	6.4.1.1	
4.3.3	Simulator Configuration	6.4.1.1	
4.3.3	1553 traffic start/stop	6.4.1.1	
4.3.3	TM/TC packets in hex format	6.4.1.2, 6.4.1.3	
4.3.3	1553B messages	6.3	
4.3.3	Simulator status	6.4.1.1	
4.3.3	1553 bus traffic status	6.4.1.1	
4.3.4	The CDMS-Sim shall be capable of commanding, configuration and monitoring from an instrument EGSE.		Not yet implemented

6. TEST PROCEDURE

6.1 1553 Bus Electrical Interfaces

The BU-65549 card has a jumper selection for 'Direct Coupled' or 'Transformer Coupled' configuration. This refers to the external connection of the bus between units; signals are always isolated on the card by transformers. 'Transformer Coupled' is the default configuration for spacecraft connection using bus couplers, but measurements with 'Direct Coupled' connection are included here, since this method can be useful during bench tests.

6.1.1 Output Signal Amplitude

6.1.1.1 Open Circuit

Make peak-peak voltage measurements of the BC output signal at points A and B shown in the figure:

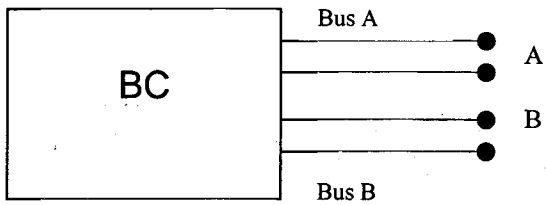


Figure 6.1.1.1 – Open Circuit measurement

Jumper setting	Bus A – open circuit pk-pk voltage	Bus B – open circuit pk-pk voltage
Direct Coupled		
Transformer Coupled		

6.1.1.2 Direct Coupled – with 39 ohm Load

This is the recommended load for direct coupled bench test connections (see RD.1 page 8). It should only be used with direct connections both ends. Connect the DDC BC and RT as shown below:

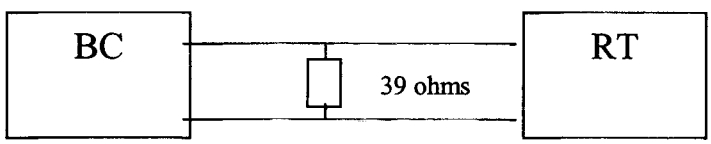


Figure 6.1.1.2

Make peak-peak voltage measurements of the BC output signal by connecting the oscilloscope across the 39 ohm resistor.

Jumper setting	Bus A pk-pk voltage	Bus B pk-pk voltage
Direct Coupled		

6.1.1.3 Transformer Coupled – Unterminated Bus

Change the DDC card jumpers to transformer-coupled for the remainder of the tests. Connect a North Hills bus coupler type DB40010 or equivalent as shown below. For this test the bus terminations are not fitted to the ends of the coupler (bus unterminated). Connect a link with breakout provision between BC and coupler and a test cable on the RT side, as shown:

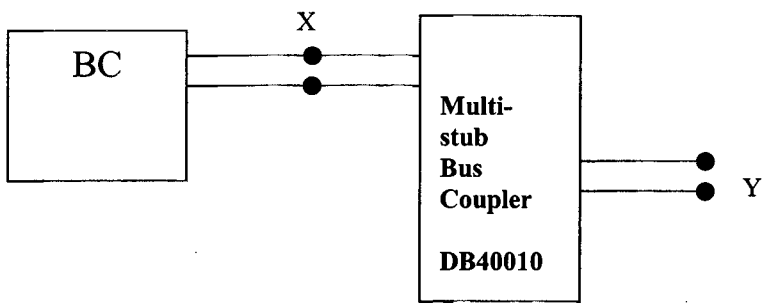


Figure 6.1.1.3

Jumper setting : Transformer coupled	Bus A voltage (peak-peak)	Bus B voltage (peak-peak)
BC Output at measurement point X		
Coupler Output at measurement point Y		

6.1.1.4 Transformer Coupled – Normal Bus Loads

This is a measurement of the Simulator (BC) connected to an Instrument (RT) via a bus coupler with 75 ohm bus terminations on each end of the bus. In this case the 'bus' is merely the short length inside the multi-stub coupler unit.

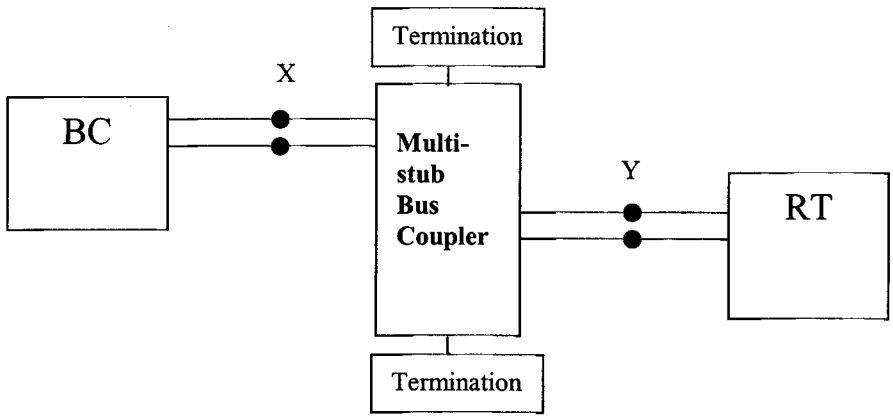


Figure 6.1.1.4

Jumper setting : Transformer coupled	Bus A voltage (peak-peak)	Bus B voltage (peak-peak)
BC Output at measurement point X		
Coupler Output at measurement point Y		

spec for voltages measured as above in transformer coupled configuration is 18-27v p-p.

6.1.2 Output Risetime

Continuing in the configuration of Figure 6.1.1.4 a valid sync command shall be sent from the CDMS Simulator. The risetime and falltime shall be measured between 10% and 90% points, see Figure 6.1.2. The pass criteria are

100nS < Tr < 300nS
100nS < Tf < 300nS

Rise time, Tr	
Fall time, Tf	

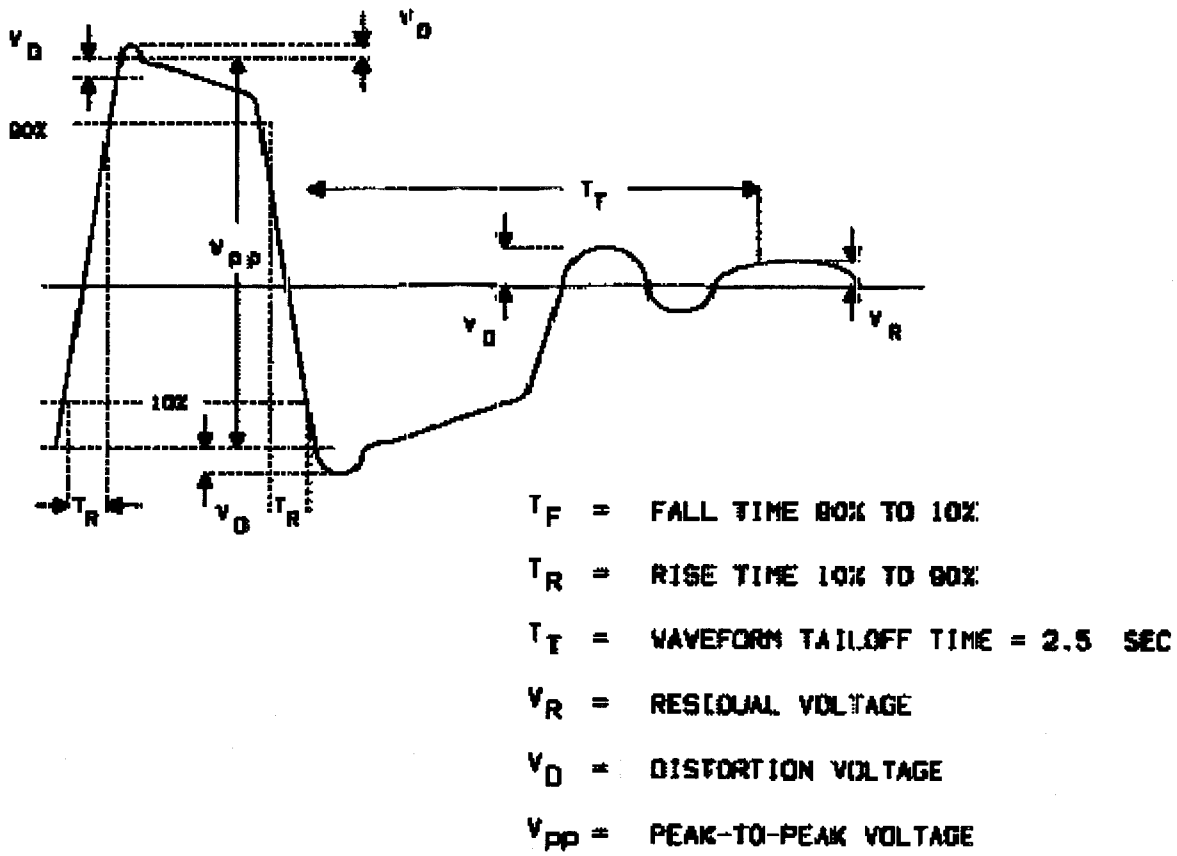


Figure 6.1.2 – Output Signal measurements

6.1.3 Output Zero Crossing

Messages shall be sent from the CDMS Simulator with data transitions at time intervals of 500nS, 1000nS, 1500nS and 2000nS (1,2,3,4 bit periods). The zero crossing time shall be measured for positive and negative transitions, see Figure 6.1.3. Specification is +/-25nS for each case.

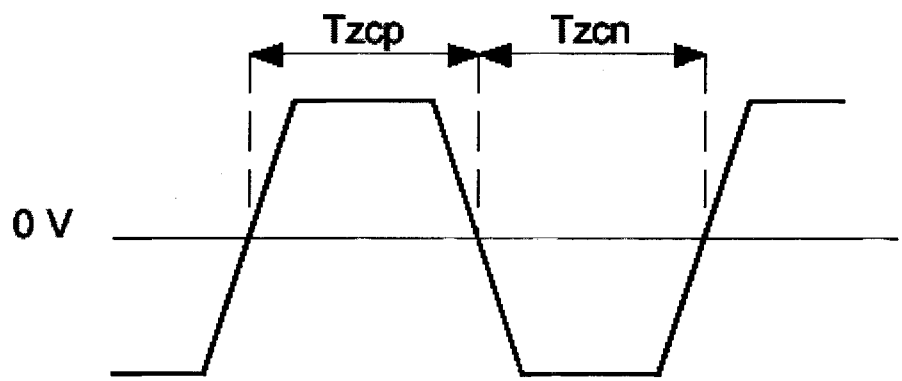


Figure 6.1.3– Zero Crossing Interval measurement

Zero Crossing Intervals, nominal	Measurement
500nS +/- 25	Tzcp =
500nS +/- 25	Tzcn =
1000nS +/- 25	Tzcp =
1000nS +/- 25	Tzcn =
1500nS +/- 25	Tzcp =
1500nS +/- 25	Tzcn =
2000nS +/- 25	Tzcp =
2000nS +/- 25	Tzcn =

6.1.4 Output Distortion

Measure the distortion voltage Vd on the CDMS Simulator signal as defined in Figure 6.1.2.
Specification is < 900mV peak, line-line for transformer-coupled configuration.

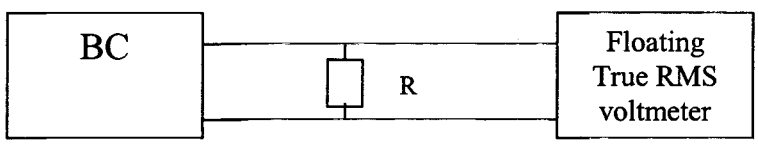
Distortion Voltage, Vd	

6.1.5 Output Symmetry

32 word messages shall be sent from the CDMS Simulator containing various repeating data values as listed in the table. The output symmetry is determined by measuring the waveform tail-off at the end of each message. The residual voltage (Vr) as shown in Figure 6.1.2 is measured at Tt (2.5uS after last transition). The pass criterion is Vr < 250mV.

Data Pattern	Residual Voltage, Vr
0x8000	
0x7FFF	
0x0000	
0xFFFF	
0x5555	
0xAAAA	

6.1.6 Output Noise



R = 70 ohms, transformer coupled

Figure 6.1.6 – Configuration for Noise measurement

The RMS voltmeter should have a bandwidth of DC to 10 MHz.
Measure the output noise voltage Vrms across the resistor R, with the power off and with the BC disabled.
Specification is Vrms < 14mV, for transformer-coupled.

Power	Noise voltage, RMS
Off	
On, BC disabled	

6.1.7 Output Isolation

Start the CDMS Simulator software running in Normal mode, generating a continuous sequence of messages, using the reference Astrium buslist. Measure the signal voltage on the active and inactive busses at the points shown in Figure 6.1.7. Change active bus and repeat the measurement. The specification for isolation is >45dB.

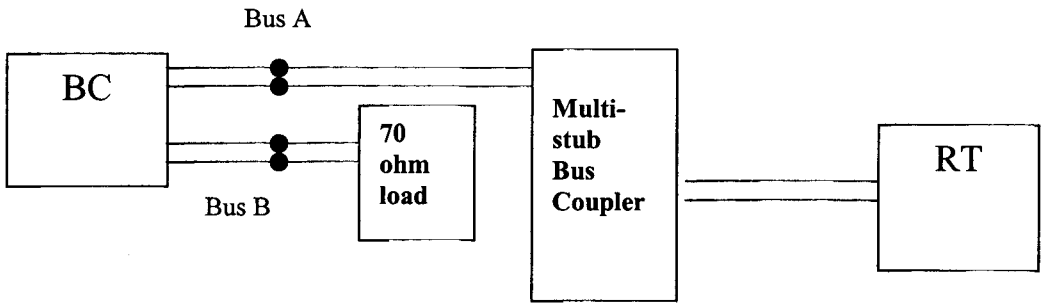


Figure 6.1.7 – Output Isolation measurement

Active Bus	Active Bus Voltage (peak-peak)	Inactive Bus Voltage (peak-peak)	dB (20Log10 Active/Inactive)
A			
B			

6.1.8 Output – Power On/Off noise

Using the configuration of Figure 6.1.7 monitor the voltage on both busses. Shut down the simulator software, then the PC power and record the maximum noise voltage. Repeat the measurement when switching on and starting the Simulator software. Do this test 10 times and record the worst case. Make a copy of oscilloscope traces and attach to the report.

The specification for noise spikes is < +/- 250 mV p-p.

Bus	Max noise transient at Switch Off (peak-peak)		Max noise transient at Switch On (peak-peak)	
	Voltage	Duration	Voltage	Duration
A				
B				

6.1.9 Output Frequency Stability

While running the reference Astrium buslist as in section 6.1.7, monitor the bus signal on an oscilloscope and measure the bit frequency (Fi). Record the minimum (Fsmin) and maximum (Fsmax) over >10,000 measurements. Also measure the average (Fav) over >1000 measurements.
Calculate:

SS1 = 100 * (Fsmax – Fav) / Fav [spec < 0.01]
SS2 = 100 * (Fav – Fsmin) / Fav [spec < 0.01]
S1 = 100 * (Fav – Fi) / Fi [spec < 0.1]

Bit Frequency, Fi	
Minimum, Fmin	
Maximum, Fmax	
Average, Fav	
SS1	
SS2	
S1	

6.1.10 Input Impedance

The input impedance of the BC is measured in the same way as that specified for a RT in section 4.3.5 of the test specifications, RD1. Disable the BC output. Connect a sinewave generator and resistance box to the bus output of the DDC card as shown in the figure. The generator amplitude shall be set to 1 to 2 volts RMS. At each test frequency increase the series resistance from zero until the peak-to-peak voltage measured at point X is halved. (Showing that the input impedance is equal to the resistance box reading).

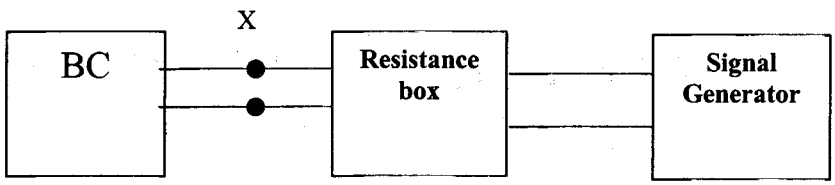


Figure 6.1.10

Frequency	Impedance, Bus A (ohms)	Impedance, Bus B (ohms)
75 kHz		
100 kHz		
250 kHz		
500 kHz		
1.0 MHz		

Specification: the impedance should be >1k ohms at all frequencies. (In transformer coupled configuration).

6.2 1553 Bus Data-link Layer Support

In this section we demonstrate that the Simulator can generate simple messages for later use in testing the instrument RTs. The DDC program "ACE Windows menu" is used. Figure 5.3 shows the setup. A jumper connection is made between channels A and C on the card, to connect BC and BM for bus A.

The RT provided with the simulator is not under test in this section; the aim is to test the Bus Controller which forms part of the CDMS Simulator. The RT is not guaranteed to support all data-link message responses.

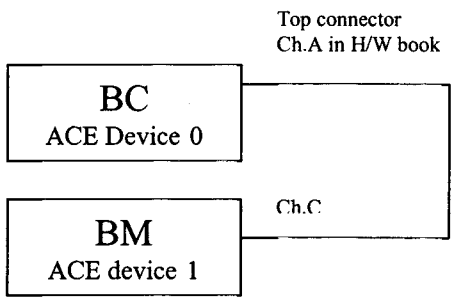


Figure 6.2 : Bus Loop-back for data-link tests on Simulator

The RAL CDMS Simulator software is not used in this section, since it is designed to run in a continuous manner controlled by a buslist file. Here only single messages are required.

6.2.1 Mode Commands

Using the DDC program 'ACE Windows menu' in Bus Controller mode create a command message for each of Mode Codes in Table 6-1. Store these commands in configuration file MODECMDS.ACE

Send each mode code command in turn and check that they appear correctly in the bus monitor log file.

Mode command	Pattern	SA	ref to AD-#3	BC	RT
Dynamic Bus Control	00000	00000	4.3.3.5.1.7.1	NO	NO
Synchronize (without data word) *)	00001	00000	4.3.3.5.1.7.2	YES	YES
Transmit Status Word	00010	00000	4.3.3.5.1.7.3	YES	YES
Initiate Self-test **)	00011	00000	4.3.3.5.1.7.4	YES	YES
Transmitter (TX) Shut-Down	00100	00000	4.3.3.5.1.7.5	YES	YES
Override TX Shut-Down	00101	00000	4.3.3.5.1.7.6	YES	YES
Inhibit Terminal Flag	00110	00000	4.3.3.5.1.7.7	YES	YES
Override Inhibit Terminal Flag Bit	00111	00000	4.3.3.5.1.7.8	YES	YES
Reset Remote Terminal **)	01000	00000	4.3.3.5.1.7.9	YES	YES
Transmit Vector Word	10000	00000	4.3.3.5.1.7.11	YES	YES
Synchronize (with data word) *)	10001	00000	4.3.3.5.1.7.12	YES	YES
Transmit Last Command	10010	00000	4.3.3.5.1.7.13	YES	YES
Transmit BIT (built-in Test data) Word **)	10011	00000	4.3.3.5.1.7.14	YES	YES
Selected TX Shut Down (SD)	10100	00000	4.3.3.5.1.7.15	NO	NO
Override Selected TX SD	10101	00000	4.3.3.5.1.7.16	NO	NO
Remaining Possible Command pattern (reserved for future use)	all other	00000	4.3.3.5.1.7.10	N/A	N/A

Table 6-1

Mode Code sent	Details	Log Entry
Dynamic bus control: MC0	31-T-00-00	
Sync without data word: MC1	31-T-00-01	
Transmit status word: MC2	02-T-00-02	
Initiate self-test: MC3	31-T-00-03	
Transmitter shut-down: MC4	31-T-00-04	
Override Tx shut-down: MC5	31-T-00-05	
Inhibit terminal flag: MC6	31-T-00-06	
Override terminal flag inhibit: MC7	31-T-00-07	
Reset Remote Terminal: MC8	31-T-00-08	
Transmit Vector word: MC16	02-T-00-16	
Sync with data: MC17	31-R-00-17, 5555	
Transmit last command: MC18	02-T-00-18	
Transmit built-in-test word: MC19	02-T-00-19	
Tx shutdown	31-R-00-20, 000A	
Override Tx shutdown	31-R-00-21,000A	

6.2.1.1 Required Mode Commands for RT Transmitter Control

This section shows that the simulator can be used to generate messages required by requirements (AD1) section 4.5.9.
Start the Bus Monitor (ACE device 1) logging to a file.
Start the Bus Controller (ACE device 0).
Run the test frame.

Examine the MON.ASF file and record the messages transmitted when each command was sent.

Command	Expected message(s) sent by BC	Bus monitor messages logged.
Valid message PACSCMD1	02-R-11-07 1C80,C000,0007,0102,0008, 0000,0A72	
Expected status	1000	
Mode code: Transmit status, SA0 MC2	02-T-00-02	
Expected status	1000	
Mode code: Transmitter shutdown MC4	31-T-00-04	
Expected block status word	8100	
Mode code: Override Transmitter shutdown MC5	31-T-00-05	
Expected block status word	8100	
Mode command: Reset remote terminal MC8	31-T-00-08	
Expected block status word	8100	

6.2.2 No Response Timeout

Not applicable to the CDMS Simulator BC.

6.2.3 Receive Message

Send the messages listed in Table 6-2 and note the bit pattern recorded in the monitor log file.

Test receive message	Log Entry
BC send TMConf message to RT2	
02-R-10-02, 1000, 0023	

Table 6-2

6.2.4 Broadcast Message

By design, the CDMS Simulator card will transmit any required bit pattern.

Note: The only apparent anomaly in the specification RD.4 is figure 4.2-1 showing mode code 1 where T/R =1. However the DDC monitor recognises this as a valid command (and T/R = 0 as invalid).

As a broadcast message test, send a typical spacecraft time broadcast message and note the bit pattern recorded in the monitor log file.

Test broadcast message	Log Entry
Timecode : 31-R-08-04, 002E, 0102, 0304, 0000	
Sync without data : 31-T-00-01	
sync with data : 31-R-00-17, 000C	

Table 6-3

6.2.5 Transmit Message

Send the messages listed in Table 5-2 and note the bit pattern recorded in the monitor log file.

Test transmit message	Log Entry
BC collects TMReq from RT2	
02-T-10-02	

Table 6-4

6.2.6 Receive Low-Level Command

Not applicable to CDMS Simulator.

6.2.7 Data-link Error Messages

Tests to verify the CDMS-Sim response to data-link errors are included in section 6.4.1.4 covering the following errors:

6.2.7.1 RT Status Errors

RT message error
RT busy error
RT subsystem flag
RT terminal flag

6.2.7.2 BC Status Errors

RT transmission error
RT no response timeout
BC loop back error

6.3 Satellite 1553 Bus Transfer-Layer Protocol

6.3.1 Basic Protocol without TM or TC transfer

For this test continue to use the test setup of Figure 6.2 (BC plus bus monitor).
~~Start the ACE menu in Bus monitor mode, ACE device~~ 1. System Gold Express
Run the simulator with buslist file **RT2 buslist** for at least one major frame. (1 second) OLD BUSLIST
Check the bus monitor log file against the list of messages in the table below. Record the start time of each subframe and the offset of each message within a subframe. TIMING FOR TMReq, TMCmd

Note that this list includes only Broadcast messages (sync, timecode) and TMReq messages. When there is no RT and there are no TCs sent they are the only messages sent on the bus. For an explanation of the buslist format see RD3, CDMS-Sim Users Guide.

Subframe	Message slot (0 - 23)	Start time (uS)	Message type	RT (0 if TC)	SA	Data type		Log file time (uS)	Message MS	Message NMS
								8.23600		
0	0	0	MCSync	31	0	None		8.236007	FC01	
						TMReq			D402	← Dummy
1	0	0	MCData	31	0	SyncFC	✓		F811	0001
									D402	
2	0	0	MCData	31	0	SyncFC	✓		F811	1002
									D402	
3	0	0	MCData	31	0	SyncFC	✓		F811	0003
3	21	14550	RTtoBC	2	10	TMReq	✓		1542	
4	0	0	MCData	31	0	SyncFC	✓			4
							✓			
5	0	0	MCData	31	0	SyncFC	✓			5
							✓			
6	0	0	MCData	31	0	SyncFC	✓			6
6	21	14550	RTtoBC	2	10	TMReq	✓			
7	0	0	MCData	31	0	SyncFC	✓			7
							D			
8	0	0	MCData	31	0	SyncFC	✓			
							D			
9	0	0	MCData	31	0	SyncFC	✓			
9	21	14550	RTtoBC	2	10	TMReq	✓			
10	0	0	MCData	31	0	SyncFC	✓			
							D			
11	0	0	MCData	31	0	SyncFC	✓			
							D			
12	0	0	MCData	31	0	SyncFC	✓			
12	21	14550	RTtoBC	2	10	TMReq	✓			
13	0	0	MCData	31	0	SyncFC	✓			
							D			
14	0	0	MCData	31	0	SyncFC	✓			
							D			

old error → corrected on Q disk. Re-Run test

15	0	0	MCData	31	0	SyncFC	✓		
							A		
16	0	0	MCSync	31	0	SyncFC	✓		
							A		
17	0	0	MCData	31	0	SyncFC	✓		
							A		
18	0	0	MCData	31	0	SyncFC	✓		
							A		
19	0	0	MCData	31	0	SyncFC	✓		
19	21	14550	RTtoBC	2	10	TMReq	✓		
20	0	0	MCData	31	0	SyncFC	✓		
							A		
21	0	0	MCData	31	0	SyncFC	✓		
							A		
22	0	0	MCData	31	0	SyncFC	✓		
							A		
23	0	0	MCData	31	0	SyncFC	✓		
							A		
24	0	0	MCData	31	0	SyncFC	✓		
							A		
25	0	0	MCData	31	0	SyncFC	✓		
25	21	14550	RTtoBC	2	10	TMReq	✓		
26	0	0	MCData	31	0	SyncFC	✓		
							A		
27	0	0	MCData	31	0	SyncFC	✓		
							A		
28	0	0	MCData	31	0	SyncFC	✓		
28	21	14550	RTtoBC	2	10	TMReq	✓		
29	0	0	MCData	31	0	SyncFC	✓		
							A		
30	0	0	MCData	31	0	SyncFC	✓		
							A		
31	0	0	MCData	31	0	SyncFC	✓		
31	21	14550	RTtoBC	2	10	TMReq	✓		
32	0	0	MCData	31	0	SyncFC	✓		
32	2	900	MCData	31	8	Timecode	✓	002E 3D90 8135	0000
							A		
33	0	0	MCData	31	0	SyncFC	✓		
							A		
34	0	0	MCData	31	0	SyncFC	✓		
							A		
35	0	0	MCData	31	0	SyncFC	✓		
							A		
36	0	0	MCData	31	0	SyncFC	✓		
							A		
37	0	0	MCData	31	0	SyncFC	✓		
							A		
38	0	0	MCData	31	0	SyncFC	✓		
38	21	14550	RTtoBC	2	10	TMReq	✓		

39	0	0	MCData	31	0	SyncFC			
40	0	0	MCData	31	0	SyncFC			
41	0	0	MCData	31	0	SyncFC			
41	21	14550	RTtoBC	2	10	TMReq			
42	0	0	MCData	31	0	SyncFC			
43	0	0	MCData	31	0	SyncFC			
44	0	0	MCData	31	0	SyncFC			
44	21	14550	RTtoBC	2	10	TMReq			
45	0	0	MCData	31	0	SyncFC			
46	0	0	MCData	31	0	SyncFC			
47	0	0	MCData	31	0	SyncFC			
47	21	14550	RTtoBC	2	10	TMReq			
48	0	0	MCData	31	0	SyncFC			
49	0	0	MCData	31	0	SyncFC			
50	0	0	MCData	31	0	SyncFC			
51	0	0	MCData	31	0	SyncFC			
51	21	14550	RTtoBC	2	10	TMReq			
52	0	0	MCData	31	0	SyncFC			
53	0	0	MCData	31	0	SyncFC			
54	0	0	MCData	31	0	SyncFC			
54	21	14550	RTtoBC	2	10	TMReq			
55	0	0	MCData	31	0	SyncFC			
56	0	0	MCData	31	0	SyncFC			
57	0	0	MCData	31	0	SyncFC			
57	21	14550	RTtoBC	2	10	TMReq			
58	0	0	MCData	31	0	SyncFC			
59	0	0	MCData	31	0	SyncFC			
60	0	0	MCData	31	0	SyncFC			
60	21	14550	RTtoBC	2	10	TMReq			
61	0	0	MCData	31	0	SyncFC			
62	0	0	MCData	31	0	SyncFC			

63	0	0	MCData	31	0	SyncFC	✓		
63	21	14550	RTtoBC	2	10	TMReq	✓		

	Specification	
Major Frame duration	1.000 seconds	1.000,078 uS +/- uS
Subframe duration	15,625 mS	15.6 uS +/- uS
Broadcast time increments OK ?		
Subframe counter increments ?	✓	

6.3.2 TC Packet transfer

Connect the Simulator (BC), monitor (BM), and the Remote Terminal (RT) together via a bus coupler unit as shown in Figure 6.3.2.

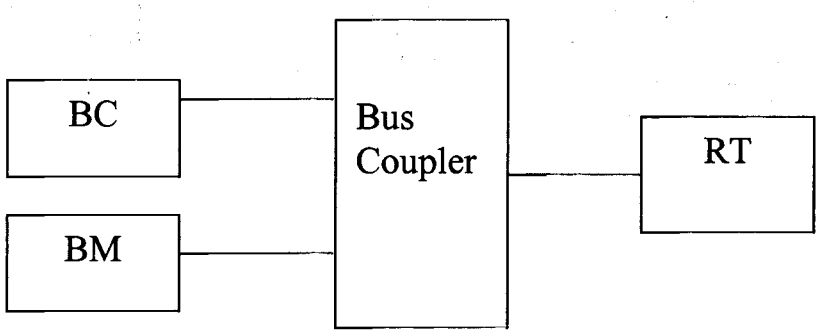


Figure 6.3.2 – Bus Configuration for TC Packet Trnsfer

Start the ACE menu as Bus monitor – logging on.
Select buslist file **RT2 buslist.**
Select bus A
Start the Bus Controller
Set the RT mode to Echo.
Start the RT running.
Set TC mode to local.
Select the TC to **MaxlenTC.txt**; this TC has length = 124 words with the data in a counting pattern.
Send the TC
Check the bus monitor log file and record the messages and RT responses in the table below.

	Messages	Expected values	Recorded values from Log file
1	RT2, SA11R, TC transfer	02-R-11-00	✓
2	RT status	1000	✓
3	RT2, SA12R, TC transfer	02-R-12-00	✓
4	RT status	1000	✓
5	RT2, SA13R, TC transfer	02-R-13-00	✓
6	RT status	1000	✓
7	RT2, SA14R, TC transfer	02-R-14-28	✓
8	RT status	1000	✓
9	RT2, SA27R, TC descriptor	02-R-27-02, 041C, 0101	✓
10	RT status	1000	✓
11	wait 2 subframes		
12	RT2, SA27T, TC confirmation	02-T-27-02, 041C, 0101	✓
13	RT status	1000	✓
14	Simulator TC list indicates confirmation received ?		✓

Are 1-10 in same subframe ? ☐

Message 1 contains data words 1C80 – 001C ? ☑

Message 2 contains data words 001D – 003C ? ☑

Message 3 contains data words 003D – 005C ? ☑

Message 4 contains data words 005D – 0078 ? ☑

6.3.3 RT Error Conditions

6.3.3.1 No TC Confirmation Message

Disable the TC confirmation in the RT software.
Re-send the maximum length TC.
Wait 2 major frames.

DDC Log.

Confirm that the Simulator indicates no confirmation on the transmitted TCs list. ☐

TC Conf display OK sometimes.

6.3.3.2 No Increment of TC Sequence Counter

This condition cannot be simulated by the CDMS Sim software.
There would be no RT error, since an RT cannot detect a new TC without it?

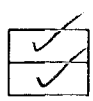
6.3.4 TM Packet transfer

Continue with same hardware configuration as Figure 6.3.2
Start the Bus monitor software.
Run the simulator with buslist file **RT2 buslist** for at least two major frames.
Run RT with mode = ~~burst~~ (TM packet length is maximum at 512 words, with counting data.) continuous
Check the bus monitor log file for the messages in the table below.

SYNC 17.927197

	Messages	Expected message	Messages from Log file	
1	RT2, SA10T, TM Request	02-T-10-02,1000,0001	1000, 0801	0801 includes flow control
2	RT status	1000	✓	
3	wait 2 subframes		✓	
4	RT2, SA11T, TM transfer	data = 0C80 – 0018	✓ +2401 µs	17.929598
5	RT status	1000		
5	RT2, SA12T, TM transfer	data = 0019 – 0038	✓	.930349
6	RT status	1000		
7	RT2, SA13T, TM transfer	data = 0039 – 0058	✓	931099
8	RT status	1000		
9	RT2, SA14T, TM transfer	data = 0059 – 0078	✓	931850
10	RT status	1000		
11	RT2, SA15T, TM transfer	data = 0079 – 0098	✓	932601
12	RT status	1000		
13	RT2, SA16T, TM transfer	data = 0099 – 00B8	✓	933352
14	RT status	1000		
15	RT2, SA17T, TM transfer	data = 00B9 – 00D8	✓	934102
16	RT status	1000		
17	RT2, SA18T, TM transfer	data = 00D9 – 00F8		934853
18	RT status	1000		
19	RT2, SA19T, TM transfer	data = 00F9 – 0118	✓	935604
20	RT status	1000		
21	RT2, SA20T, TM transfer	data = 0119 – 0138	✓	936355
22	RT status	1000		
23	RT2, SA21T, TM transfer	data = 0139 – 0158	✓	937106
24	RT status	1000		
25	RT2, SA22T, TM transfer	data = 0159 – 0178	✓	937856
26	RT status	1000		
27	RT2, SA23T, TM transfer	data = 0179 – 0198	✓	938607
28	RT status	1000		
29	RT2, SA24T, TM transfer	data = 0199 – 01B8	✓	939358
30	RT status	1000		
31	RT2, SA25T, TM transfer	data = 01B9 – 01D8	✓	940109
32	RT status	1000 7DEE = Checksum		
33	RT2, SA26T, TM transfer	data = 01D9 – ~~01F8~~	✓ + 13663 µs	940860
34	RT status	1000	7366	
35	RT2, SA10R, TM confirmation	02-R-10-02	✓ +−	941611
36	RT status	1000		

Record number of messages requested = 0x10
Record number of words in last message



All TM transfer messages in same subframe ? ✓
Time of transfers correct ? ✓

Correct number of data words in each message (32) ? ✓

Packet displayed correctly on Simulator display ? ✓

6.3.5 CDMS-Sim (BC) Error Conditions

Cannot be tested; won't work without handshake.

6.3.6 Bus Polling Sequence: Nominal Mode

Continue the same hardware configuration as Figure 6.3.2

Start the Bus monitor software.
Run the simulator with the **Astrium buslist** . This is the suggested bus polling sequence for CDMS Nominal mode. modified
RT mode = burst TM
RT emulated = RT1
Start the RT.
The RT should be capable of generating 16 packets/major frame.
Let the BC run for at least two major frames.

NB: Old position of TMReq

Check the bus monitor log file and find the point where the RT started. Record the messages in the table below.
Note that only the bold messages are sent unless there is a TC, or a different RT is present.

Subframe	Message slot (0 - 23)	Start time (uS)	Message type	RT (0 if TC)	SA	Data type		Logfile time (uS)	Message MS	Message NMS	
0	**0**	**0**	**MCSync**	**31**	**0**	**None**	✓	49.507904	FC01		
0	4	2400	BCtoRT	0	11	PacketTC					
0	20	14400	BCtoRT	0	27	TCDesc					
							D				
1	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓	523504			
1	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**					
1	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**					
1	**21**	**14550**	**RTtoBC**	**3**	**10**	**TMReq**	✓	538055			
2	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓	539104			+31.2mS
2	4	2400	RTtoBC	2	11	PacketTM					
2	20	14400	BCtoRT	2	10	TMConf					
2	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓	553655	+14,551		
2	22	14700	RTtoBC	0	27	TCConf					
3	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓				
3	4	2400	RTtoBC	3	11	PacketTM					
3	20	14400	BCtoRT	3	10	TMConf					
						D...	D				
4	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓	570304			
4	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**	✓	572705	+2,401 µS		
4	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**	✓	584718	+14,414 µS		
5	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓				
5	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓				

6	0	0	MCData	31	0	SyncFC	✓		
							D		
7	0	0	MCData	31	0	SyncFC	✓		
7	4	2400	RTtoBC	1	11	PacketTM	✓		
7	20	14400	BCtoRT	1	10	TMConf	✓		
							D		
8	0	0	MCData	31	0	SyncFC	✓		
8	21	14550	RTtoBC	1	10	TMReq	✓		
9	0	0	MCData	31	0	SyncFC	✓		
							D		
10	0	0	MCData	31	0	SyncFC	✓		
10	4	2400	RTtoBC	1	11	PacketTM	✓		
10	20	14400	BCtoRT	1	10	TMConf	✓		
							D		
11	0	0	MCData	31	0	SyncFC	✓		
11	21	14550	RTtoBC	1	10	TMReq	✓		
12	0	0	MCData	31	0	SyncFC	✓		
12	21	14550	RTtoBC	2	10	TMReq	✓		
13	0	0	MCData	31	0	SyncFC	✓		
13	4	2400	RTtoBC	1	11	PacketTM	✓		
13	20	14400	BCtoRT	1	10	TMConf	✓		
13	21	14550	RTtoBC	3	10	TMReq	✓		
14	0	0	MCData	31	0	SyncFC	✓		
14	4	2400	RTtoBC	2	11	PacketTM			
14	20	14400	BCtoRT	2	10	TMConf			
14	21	14550	RTtoBC	1	10	TMReq	✓		
15	0	0	MCData	31	0	SyncFC	✓		
15	4	2400	RTtoBC	3	11	PacketTM			
15	20	14400	BCtoRT	3	10	TMConf			
							D		
16	0	0	MCSync	31	0	SyncFC	✓		
16	4	2400	BCtoRT	0	11	PacketTC			
16	20	14400	BCtoRT	0	27	TCDesc			
16	21	14550	RTtoBC	10	10	TMReq	✓		
17	0	0	MCData	31	0	SyncFC	✓		
17	4	2400	RTtoBC	1	11	PacketTM	✓		
17	20	14400	BCtoRT	1	10	TMConf	✓		
							D		
18	0	0	MCData	31	0	SyncFC	✓		
18	4	2400	RTtoBC	10	11	PacketTM			
18	20	14400	BCtoRT	10	10	TMConf			
18	21	14550	RTtoBC	1	10	TMReq	✓		
18	22	14700	RTtoBC	0	27	TCConf			
19	0	0	MCData	31	0	SyncFC	✓		
							D		
20	0	0	MCData	31	0	SyncFC	✓		
20	4	2400	RTtoBC	1	11	PacketTM	✓		
20	20	14400	BCtoRT	1	10	TMConf	✓		
20	21	14550	RTtoBC	11	10	TMReq	✓		
21	0	0	MCData	31	0	SyncFC	✓		
21	21	14550	RTtoBC	1	10	TMReq	✓		
22	0	0	MCData	31	0	SyncFC	✓		
22	4	2400	RTtoBC	11	11	PacketTM			
22	20	14400	BCtoRT	11	10	TMConf			
22	21	14550	RTtoBC	12	10	TMReq	✓		

23	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
23	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**	✓		
23	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**	✓		
							D		
24	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
24	4	2400	RTtoBC	12	11	PacketTM			
24	20	14400	BCtoRT	12	10	TMConf			
24	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓		
25	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
							D		
26	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
26	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**	✓		
26	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**	✓		
							D		
27	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
27	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓		
28	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
							D		
29	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
29	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**	✓		
29	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**	✓		
							D		
30	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
30	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓		
31	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
							D		
32	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
32	**2**	**900**	**MCData**	**31**	**8**	**Timecode**	✓	+901μS	
32	4	2400	BCtoRT	0	11	PacketTC			
32	20	14400	BCtoRT	0	27	TCDesc			
32	**21**	**14550**	**RTtoBC**	**13**	**10**	**TMReq**	✓		
33	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
33	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**	✓		
33	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**	✓		
							D		
34	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
34	4	2400	RTtoBC	13	11	PacketTM			
34	20	14400	BCtoRT	13	10	TMConf			
34	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓		
34	22	14700	RTtoBC	0	27	TCConf			
35	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
35	**21**	**14550**	**RTtoBC**	**14**	**10**	**TMReq**	✓		
36	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
36	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**	✓		
36	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**	✓		
							D		
37	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
37	4	2400	RTtoBC	14	11	PacketTM			
37	20	14400	BCtoRT	14	10	TMConf			
37	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓		
38	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
38	**21**	**14550**	**RTtoBC**	**2**	**10**	**TMReq**	✓		
39	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
39	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**	✓		
39	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**	✓		
							D		

40	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
40	4	2400	RTtoBC	2	11	PacketTM			
40	20	14400	BCtoRT	2	10	TMConf			
40	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓		
41	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
							A		
42	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
42	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**	✓		
42	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**	✓		
							A		
43	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	A ✓		
							A		
44	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	A ✓		
							A		
45	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	A ✓		
							A		
46	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	A ✓		
							A		
47	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	A ✓		
							A		
48	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
48	4	2400	BCtoRT	0	11	PacketTC			
48	20	14400	BCtoRT	0	27	TCDesc			
							A		
49	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	A ✓		
							A		
50	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	A ✓		
50	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓		
50	22	14700	RTtoBC	0	27	TCConf			
51	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
							A		
52	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
52	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**	✓		
52	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**	✓		
52	**21**	**14550**	**RTtoBC**	**3**	**10**	**TMReq**	✓		
53	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
53	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓		
54	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
54	4	2400	RTtoBC	3	11	PacketTM			
54	20	14400	BCtoRT	3	10	TMConf			
							A		
55	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
55	**4**	**2400**	**RTtoBC**	**1**	**11**	**PacketTM**	✓		
55	**20**	**14400**	**BCtoRT**	**1**	**10**	**TMConf**	✓		
							A		
56	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
							A		
57	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
							A		
58	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
							A		
59	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
							A		
60	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
							A		
61	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	X		
62	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		
62	**21**	**14550**	**RTtoBC**	**1**	**10**	**TMReq**	✓		
63	**0**	**0**	**MCData**	**31**	**0**	**SyncFC**	✓		

Frame 60 = 0x3C repeated, no 61

63	21	14550	RTtoBC	2	10	TMReq	✓		

Check the following:

All TM packet transfer subframes are filled? (bitrate = 131k bits/sec) — Yes

37.896263
36.896146

Major Frame duration — 1,000,117 uS

Major Frame Sync message — FC01

Subframe Sync message — F811 ----

Subframe counter increments correctly ? — Frame 61 missed.

Make a printout of the TM packet logfile. Check that the datalink layer TM packet counter increments from 1 to 255 then resets to 1 at rollover. — OK

Make a printout of the 1553 message logfile.

6.3.7 Burst Mode

Use the same hardware configuration as Figure 6.4.2
Start the Bus monitor software.
RT mode = burst TM
RT emulated = RT2
The RT should be capable of generating 60 packets/major frame.
Start the RT.

Run the simulator with buslist file **RT2 BurstMode buslist**. for at least two major frames.
Check the bus monitor log file for the messages in the table below.

Subframe	Message slot (0 - 23)	Start time (uS)	Message type	RT (0 if TC)	SA	Data type		Log file time (uS)	Message MS	Message NMS
0	0	0	MCSync	31	0	None	✓			
0	4	2400	BCtoRT	0	11	PacketTC				
0	20	14400	BCtoRT	0	27	TCDesc				
							✓			
1	0	0	MCData	31	0	SyncFC	✓			
1	4	2400	RTtoBC	2	11	PacketTM		First — no TM Req yet		
1	20	14400	BCtoRT	2	10	TMConf				
1	21	14550	RTtoBC	2	10	TMReq	✓			
2	0	0	MCData	31	0	SyncFC	✓			
2	4	2400	RTtoBC	2	11	PacketTM	✓			
2	20	14400	BCtoRT	2	10	TMConf	✓			
2	21	14550	RTtoBC	2	10	TMReq	✓			
2	22	14700	RTtoBC	0	27	TCConf				
3	0	0	MCData	31	0	SyncFC	✓			
3	4	2400	RTtoBC	2	11	PacketTM	✓			
3	20	14400	BCtoRT	2	10	TMConf	✓			
3	21	14550	RTtoBC	2	10	TMReq	✓			

4	0	0	MCData	31	0	SyncFC	✓			
4	4	2400	RTtoBC	2	11	PacketTM	✓			
4	20	14400	BCtoRT	2	10	TMConf	✓			
4	21	14550	RTtoBC	2	10	TMReq	✓			
5	0	0	MCData	31	0	SyncFC	✓			
5	4	2400	RTtoBC	2	11	PacketTM	✓			
5	20	14400	BCtoRT	2	10	TMConf	✓			
5	21	14550	RTtoBC	2	10	TMReq	✓			
6	0	0	MCData	31	0	SyncFC	✓			
6	4	2400	RTtoBC	2	11	PacketTM	✓			
6	20	14400	BCtoRT	2	10	TMConf	✓			
6	21	14550	RTtoBC	2	10	TMReq	✓			
7	0	0	MCData	31	0	SyncFC	✓			
7	4	2400	RTtoBC	2	11	PacketTM	✓			
7	20	14400	BCtoRT	2	10	TMConf	✓			
7	21	14550	RTtoBC	2	10	TMReq	✓			
8	0	0	MCData	31	0	SyncFC	✓			
8	4	2400	RTtoBC	2	11	PacketTM	✓			
8	20	14400	BCtoRT	2	10	TMConf	✓			
8	21	14550	RTtoBC	2	10	TMReq	✓			
9	0	0	MCData	31	0	SyncFC	✓			
9	4	2400	RTtoBC	2	11	PacketTM	✓			
9	20	14400	BCtoRT	2	10	TMConf	✓			
9	21	14550	RTtoBC	2	10	TMReq	✓			
10	0	0	MCData	31	0	SyncFC	✓			
10	4	2400	RTtoBC	2	11	PacketTM	✓			
10	20	14400	BCtoRT	2	10	TMConf	✓			
10	21	14550	RTtoBC	2	10	TMReq	✓			
11	0	0	MCData	31	0	SyncFC	✓			
11	4	2400	RTtoBC	2	11	PacketTM	✓			
11	20	14400	BCtoRT	2	10	TMConf	✓			
11	21	14550	RTtoBC	2	10	TMReq	✓			
12	0	0	MCData	31	0	SyncFC	✓			
12	4	2400	RTtoBC	2	11	PacketTM	✓			
12	20	14400	BCtoRT	2	10	TMConf	✓			
12	21	14550	RTtoBC	2	10	TMReq	✓			
13	0	0	MCData	31	0	SyncFC	✓			
13	4	2400	RTtoBC	2	11	PacketTM	✓			
13	20	14400	BCtoRT	2	10	TMConf	✓			
13	21	14550	RTtoBC	2	10	TMReq	✓			
14	0	0	MCData	31	0	SyncFC	✓			
14	4	2400	RTtoBC	2	11	PacketTM	✓			
14	20	14400	BCtoRT	2	10	TMConf	✓			
14	21	14550	RTtoBC	2	10	TMReq	✓			
15	0	0	MCData	31	0	SyncFC	✓			
15	4	2400	RTtoBC	2	11	PacketTM	✓			
15	20	14400	BCtoRT	2	10	TMConf	✓			
15	21	14550	RTtoBC	2	10	TMReq	✓			

MCData

16	0	0	~~MCSync~~	31	0	SyncFC	✓		
16	4	2400	BCtoRT	0	11	PacketTC			
16	20	14400	BCtoRT	0	27	TCDesc			
							D		
17	0	0	MCData	31	0	SyncFC	✓		
17	4	2400	RTtoBC	2	11	PacketTM	✓		
17	20	14400	BCtoRT	2	10	TMConf	✓		
17	21	14550	RTtoBC	2	10	TMReq	✓		
18	0	0	MCData	31	0	SyncFC	✓		
18	4	2400	RTtoBC	10	11	PacketTM		No packet transfer expected from RT 10	
18	20	14400	BCtoRT	10	10	TMConf			
18	21	14550	RTtoBC	2	10	TMReq	✓		
18	22	14700	RTtoBC	0	27	TCConf			
19	0	0	MCData	31	0	SyncFC	✓		
19	4	2400	RTtoBC	2	11	PacketTM	✓		
19	20	14400	BCtoRT	2	10	TMConf	✓		
19	21	14550	RTtoBC	2	10	TMReq	✓		
20	0	0	MCData	31	0	SyncFC	✓		
20	4	2400	RTtoBC	2	11	PacketTM	✓		
20	20	14400	BCtoRT	2	10	TMConf	✓		
20	21	14550	RTtoBC	2	10	TMReq	✓		
21	0	0	MCData	31	0	SyncFC	✓		
21	4	2400	RTtoBC	2	11	PacketTM	✓		
21	20	14400	BCtoRT	2	10	TMConf	✓		
21	21	14550	RTtoBC	2	10	TMReq	✓		
22	0	0	MCData	31	0	SyncFC	✓		
22	4	2400	RTtoBC	2	11	PacketTM	✓		
22	20	14400	BCtoRT	2	10	TMConf	✓		
22	21	14550	RTtoBC	2	10	TMReq	✓		
23	0	0	MCData	31	0	SyncFC	✓		
23	4	2400	RTtoBC	2	11	PacketTM	✓		
23	20	14400	BCtoRT	2	10	TMConf	✓		
23	21	14550	RTtoBC	2	10	TMReq	✓		
24	0	0	MCData	31	0	SyncFC	✓		
24	4	2400	RTtoBC	12	11	PacketTM		No packet	
24	20	14400	BCtoRT	12	10	TMConf			
24	21	14550	RTtoBC	2	10	TMReq	✓		
25	0	0	MCData	31	0	SyncFC	✓		
25	4	2400	RTtoBC	12	11	PacketTM		No packet	
25	20	14400	BCtoRT	12	10	TMConf			
25	21	14550	RTtoBC	2	10	TMReq	✓		
26	0	0	MCData	31	0	SyncFC	✓		
26	4	2400	RTtoBC	2	11	PacketTM	✓		
26	20	14400	BCtoRT	2	10	TMConf	✓		
26	21	14550	RTtoBC	2	10	TMReq	✓		
27	0	0	MCData	31	0	SyncFC	✓		
27	4	2400	RTtoBC	12	11	PacketTM		No packet	
27	20	14400	BCtoRT	12	10	TMConf			
27	21	14550	RTtoBC	2	10	TMReq	✓		
28	0	0	MCData	31	0	SyncFC	✓		

28	4	2400	RTtoBC	12	11	PacketTM	✓	No	Packet
28	20	14400	BCtoRT	12	10	TMConf	✓		
28	21	14550	RTtoBC	2	10	TMReq	✓		
29	0	0	MCData	31	0	SyncFC	✓		
29	4	2400	RTtoBC	2	11	PacketTM	✓		
29	20	14400	BCtoRT	2	10	TMConf	✓		
29	21	14550	RTtoBC	2	10	TMReq	✓		
30	0	0	MCData	31	0	SyncFC	✓		
30	4	2400	RTtoBC	2	11	PacketTM	✓		
30	20	14400	BCtoRT	2	10	TMConf	✓		
30	21	14550	RTtoBC	2	10	TMReq	✓		
31	0	0	MCData	31	0	SyncFC	✓		
31	4	2400	RTtoBC	2	11	PacketTM	✓		
31	20	14400	BCtoRT	2	10	TMConf	✓		
31	21	14550	RTtoBC	2	10	TMReq	✓		
32	0	0	MCData	31	0	SyncFC	✓		
32	2	900	MCData	31	8	Timecode	✓		
32	4	2400	BCtoRT	0	11	PacketTC			
32	20	14400	BCtoRT	0	27	TCDesc			
							D		
33	0	0	MCData	31	0	SyncFC	✓		
33	4	2400	RTtoBC	2	11	PacketTM	✓		
33	20	14400	BCtoRT	2	10	TMConf	✓		
33	21	14550	RTtoBC	2	10	TMReq	✓		
34	0	0	MCData	31	0	SyncFC			
34	4	2400	RTtoBC	13	11	PacketTM		No	
34	20	14400	BCtoRT	13	10	TMConf			
34	21	14550	RTtoBC	2	10	TMReq	✓		
34	22	14700	RTtoBC	0	27	TCConf			
35	0	0	MCData	31	0	SyncFC	✓		
35	4	2400	RTtoBC	2	11	PacketTM	✓		
35	20	14400	BCtoRT	2	10	TMConf	✓		
35	21	14550	RTtoBC	2	10	TMReq	✓		
36	0	0	MCData	31	0	SyncFC	✓		
36	4	2400	RTtoBC	2	11	PacketTM	✓		
36	20	14400	BCtoRT	2	10	TMConf	✓		
36	21	14550	RTtoBC	2	10	TMReq	✓		
37	0	0	MCData	31	0	SyncFC	✓		
37	4	2400	RTtoBC	14	11	PacketTM		No	RT 14
37	20	14400	BCtoRT	14	10	TMConf			
37	21	14550	RTtoBC	2	10	TMReq	✓		
38	0	0	MCData	31	0	SyncFC	✓		
38	4	2400	RTtoBC	2	11	PacketTM	✓		
38	20	14400	BCtoRT	2	10	TMConf	✓		
38	21	14550	RTtoBC	2	10	TMReq	✓		
39	0	0	MCData	31	0	SyncFC	✓		
39	4	2400	RTtoBC	2	11	PacketTM	✓		
39	20	14400	BCtoRT	2	10	TMConf	✓		
39	21	14550	RTtoBC	2	10	TMReq	✓		
40	0	0	MCData	31	0	SyncFC	✓		

40	4	2400	RTtoBC	2	11	PacketTM	✓		
40	20	14400	BCtoRT	2	10	TMConf	✓		
40	21	14550	RTtoBC	2	10	TMReq	✓		
41	0	0	MCData	31	0	SyncFC	✓		
41	4	2400	RTtoBC	2	11	PacketTM	✓		
41	20	14400	BCtoRT	2	10	TMConf	✓		
41	21	14550	RTtoBC	2	10	TMReq	✓		
42	0	0	MCData	31	0	SyncFC	✓		
42	4	2400	RTtoBC	2	11	PacketTM	✓		
42	20	14400	BCtoRT	2	10	TMConf	✓		
42	21	14550	RTtoBC	2	10	TMReq	✓		
43	0	0	MCData	31	0	SyncFC	✓		
43	4	2400	RTtoBC	2	11	PacketTM	✓		
43	20	14400	BCtoRT	2	10	TMConf	✓		
43	21	14550	RTtoBC	2	10	TMReq	✓		
44	0	0	MCData	31	0	SyncFC	✓		
44	4	2400	RTtoBC	2	11	PacketTM	✓		
44	20	14400	BCtoRT	2	10	TMConf	✓		
44	21	14550	RTtoBC	2	10	TMReq	✓		
45	0	0	MCData	31	0	SyncFC	✓		
45	4	2400	RTtoBC	2	11	PacketTM	✓		
45	20	14400	BCtoRT	2	10	TMConf	✓		
45	21	14550	RTtoBC	2	10	TMReq	✓		
46	0	0	MCData	31	0	SyncFC	✓		
46	4	2400	RTtoBC	2	11	PacketTM	✓		
46	20	14400	BCtoRT	2	10	TMConf	✓		
46	21	14550	RTtoBC	2	10	TMReq	✓		
47	0	0	MCData	31	0	SyncFC	✓		
47	4	2400	RTtoBC	2	11	PacketTM	✓		
47	20	14400	BCtoRT	2	10	TMConf	✓		
47	21	14550	RTtoBC	2	10	TMReq	✓		
48	0	0	MCData	31	0	SyncFC	✓		
48	4	2400	BCtoRT	0	11	PacketTC			
48	20	14400	BCtoRT	0	27	TCDesc			
							D		
49	0	0	MCData	31	0	SyncFC	✓		
49	4	2400	RTtoBC	2	11	PacketTM	✓		
49	20	14400	BCtoRT	2	10	TMConf	✓		
49	21	14550	RTtoBC	2	10	TMReq	✓		
50	0	0	MCData	31	0	SyncFC	✓		
50	4	2400	RTtoBC	2	11	PacketTM	✓		
50	20	14400	BCtoRT	2	10	TMConf	✓		
50	21	14550	RTtoBC	2	10	TMReq	✓		
50	22	14700	RTtoBC	0	27	TCConf			
51	0	0	MCData	31	0	SyncFC	✓		
51	4	2400	RTtoBC	2	11	PacketTM	✓		
51	20	14400	BCtoRT	2	10	TMConf	✓		
51	21	14550	RTtoBC	2	10	TMReq	✓		
52	0	0	MCData	31	0	SyncFC	✓		
52	4	2400	RTtoBC	2	11	PacketTM	✓		

52	20	14400	BCtoRT	2	10	TMConf	✓		
52	21	14550	RTtoBC	2	10	TMReq	✓		
53	0	0	MCData	31	0	SyncFC	✓		
53	4	2400	RTtoBC	2	11	PacketTM	✓		
53	20	14400	BCtoRT	2	10	TMConf	✓		
53	21	14550	RTtoBC	2	10	TMReq	✓		
54	0	0	MCData	31	0	SyncFC	✓		
54	4	2400	RTtoBC	2	11	PacketTM	✓		
54	20	14400	BCtoRT	2	10	TMConf	✓		
54	21	14550	RTtoBC	2	10	TMReq	✓		
55	0	0	MCData	31	0	SyncFC	✓		
55	4	2400	RTtoBC	2	11	PacketTM	✓		
55	20	14400	BCtoRT	2	10	TMConf	✓		
55	21	14550	RTtoBC	2	10	TMReq	✓		
56	0	0	MCData	31	0	SyncFC	✓		
56	4	2400	RTtoBC	2	11	PacketTM	✓		
56	20	14400	BCtoRT	2	10	TMConf	✓		
56	21	14550	RTtoBC	2	10	TMReq	✓		
57	0	0	MCData	31	0	SyncFC	✓		
57	4	2400	RTtoBC	2	11	PacketTM	✓		
57	20	14400	BCtoRT	2	10	TMConf	✓		
57	21	14550	RTtoBC	2	10	TMReq	✓		
58	0	0	MCData	31	0	SyncFC	✓		
58	4	2400	RTtoBC	2	11	PacketTM	✓		
58	20	14400	BCtoRT	2	10	TMConf	✓		
58	21	14550	RTtoBC	2	10	TMReq	✓		
59	0	0	MCData	31	0	SyncFC	✓		
59	4	2400	RTtoBC	2	11	PacketTM	✓		
59	20	14400	BCtoRT	2	10	TMConf	✓		
59	21	14550	RTtoBC	2	10	TMReq	✓		
60	0	0	MCData	31	0	SyncFC	✓		
60	4	2400	RTtoBC	2	11	PacketTM	✓		
60	20	14400	BCtoRT	2	10	TMConf	✓		
60	21	14550	RTtoBC	2	10	TMReq	✓		
61	0	0	MCData	31	0	SyncFC	✓		
61	4	2400	RTtoBC	2	11	PacketTM	✓		
61	20	14400	BCtoRT	2	10	TMConf	✓		
61	21	14550	RTtoBC	2	10	TMReq	✓		
62	0	0	MCData	31	0	SyncFC	✓		
62	4	2400	RTtoBC	2	11	PacketTM	✓		
62	20	14400	BCtoRT	2	10	TMConf	✓		
62	21	14550	RTtoBC	2	10	TMReq	✓		
63	0	0	MCData	31	0	SyncFC	✓		
63	4	2400	RTtoBC	2	11	PacketTM	✓		
63	20	14400	BCtoRT	2	10	TMConf	✓		
63	21	14550	RTtoBC	2	10	TMReq	✓		

Check the following:

All TM packet transfer subframes are filled?
(bitrate = 491k bits/sec)

Make a printout of the TM packet logfile.

Make a printout of the 1553 message logfile.

6725251
6.709631
5.709435
1.000196 secs / frame

No packets missed from RT 2.

6.3.8 Memory load Mode

Use the same hardware configuration as Figure 6.3.2

Start the Router
Start Test client module, Commander.
Run RT software to echo received TC packets as TM packets. RT3
Start the Bus monitor software.

Start the simulator.
Logon to Router, and specify APIDs of required packets.
Select buslist file **RT3 MemoryLoad buslist**.
Run the BC.
Pause the TC display.
In Commander load and run script to send commands.
Check the bus monitor log file for the messages in the table below.

Subframe	Message slot	Start time	Message type	RT	SA	Data type	Log file time (uS)	Message MS	Message NMS
	(0 - 23)	(uS)							Second Run
0	0	0	MCSync	31	0	None	✓ 6.274306		53.193253
0	4	2400	BCtoRT	0	11	PacketTC	✓ 7.288708	1D50	COAA
0	20	14400	BCtoRT	0	27	TCDesc	✓ 7.276707	0108	0115 2401µS
0	21	14550	RTtoBC	2	10	TMReq	✓		
1	0	0	MCData	31	0	SyncFC	✓		
1	4	2400	RTtoBC	1	11	PacketTM	✓ First		
1	20	14400	BCtoRT	1	10	TMConf	✓		
							D		
2	0	0	MCData	31	0	SyncFC	✓		
2	4	2400	RTtoBC	2	11	PacketTM			
2	20	14400	BCtoRT	2	10	TMConf			
2	21	14550	RTtoBC	3	10	TMReq	✓		
2	22	14700	RTtoBC	0	27	TCConf	✓	0108	0111
3	0	0	MCData	31	0	SyncFC	✓		
3	4	2400	BCtoRT	0	11	PacketTC	✓		
3	20	14400	BCtoRT	0	27	TCDesc	✓		
3	21	14550	RTtoBC	1	10	TMReq	✓		
4	0	0	MCData	31	0	SyncFC	✓		
4	4	2400	RTtoBC	3	11	PacketTM	✓		
4	20	14400	BCtoRT	3	10	TMConf	✓		
							D		
5	0	0	MCData	31	0	SyncFC	✓		
5	4	2400	RTtoBC	1	11	PacketTM			
5	20	14400	BCtoRT	1	10	TMConf			

5	21	14550	RTtoBC	2	10	TMReq	✓		
5	22	14700	RTtoBC	0	27	TCConf	✓		
6	0	0	MCData	31	0	SyncFC	✓		
6	4	2400	BCtoRT	0	11	PacketTC	✓		
6	20	14400	BCtoRT	0	27	TCDesc	✓		
6	21	14550	RTtoBC	3	10	TMReq	✓		
7	0	0	MCData	31	0	SyncFC	✓		
7	4	2400	RTtoBC	2	11	PacketTM	✓		
7	20	14400	BCtoRT	2	10	TMConf			
							D		
8	0	0	MCData	31	0	SyncFC	✓		
8	4	2400	RTtoBC	3	11	PacketTM	✓		
8	20	14400	BCtoRT	3	10	TMConf	✓		
8	21	14550	RTtoBC	1	10	TMReq	✓		
8	22	14700	RTtoBC	0	27	TCConf	✓		
9	0	0	MCData	31	0	SyncFC	✓		
9	4	2400	BCtoRT	0	11	PacketTC	✓		
9	20	14400	BCtoRT	0	27	TCDesc	✓		
9	21	14550	RTtoBC	2	10	TMReq	✓		
10	0	0	MCData	31	0	SyncFC	✓		
10	4	2400	RTtoBC	1	11	PacketTM			
10	20	14400	BCtoRT	1	10	TMConf			
							D		
11	0	0	MCData	31	0	SyncFC	✓		
11	4	2400	RTtoBC	2	11	PacketTM			
11	20	14400	BCtoRT	2	10	TMConf			
11	21	14550	RTtoBC	3	10	TMReq	✓		
11	22	14700	RTtoBC	0	27	TCConf	✓		
12	0	0	MCData	31	0	SyncFC	✓		
12	4	2400	BCtoRT	0	11	PacketTC	✓		
12	20	14400	BCtoRT	0	27	TCDesc	✓		
12	21	14550	RTtoBC	1	10	TMReq	✓		
13	0	0	MCData	31	0	SyncFC	✓		
13	4	2400	RTtoBC	3	11	PacketTM	✓		
13	20	14400	BCtoRT	3	10	TMConf	✓		
							D		
14	0	0	MCData	31	0	SyncFC	✓		
14	4	2400	RTtoBC	1	11	PacketTM			
14	20	14400	BCtoRT	1	10	TMConf			
14	21	14550	RTtoBC	2	10	TMReq	✓		
14	22	14700	RTtoBC	0	27	TCConf	✓		
15	0	0	MCData	31	0	SyncFC			
15	4	2400	BCtoRT	0	11	PacketTC	✓		
15	20	14400	BCtoRT	0	27	TCDesc	✓		
15	21	14550	RTtoBC	3	10	TMReq	✓		
16	0	0	MCData	31	0	SyncFC	✓		
16	4	2400	RTtoBC	2	11	PacketTM			
16	20	14400	BCtoRT	2	10	TMConf			
							b		
17	0	0	MCData	31	0	SyncFC	✓		
17	4	2400	RTtoBC	3	11	PacketTM	✓		

17	20	14400	BCtoRT	3	10	TMConf	✓		
17	21	14550	RTtoBC	1	10	TMReq	✓		
17	22	14700	RTtoBC	0	27	TCConf	✓		
18	0	0	MCData	31	0	SyncFC	✓		
18	4	2400	BCtoRT	0	11	PacketTC	✓		
18	20	14400	BCtoRT	0	27	TCDesc	✓		
18	21	14550	RTtoBC	2	10	TMReq	✓		
19	0	0	MCData	31	0	SyncFC	✓		
19	4	2400	RTtoBC	1	11	PacketTM			
19	20	14400	BCtoRT	1	10	TMConf			
							D		
20	0	0	MCData	31	0	SyncFC	✓		
20	4	2400	RTtoBC	2	11	PacketTM			
20	20	14400	BCtoRT	2	10	TMConf			
20	21	14550	RTtoBC	3	10	TMReq	✓		
20	22	14700	RTtoBC	0	27	TCConf	✓		
21	0	0	MCData	31	0	SyncFC	✓		
21	4	2400	BCtoRT	0	11	PacketTC	✓		
21	20	14400	BCtoRT	0	27	TCDesc	✓		
21	21	14550	RTtoBC	1	10	TMReq	✓		
22	0	0	MCData	31	0	SyncFC	✓		
22	4	2400	RTtoBC	3	11	PacketTM	✓		
22	20	14400	BCtoRT	3	10	TMConf	✓		
							D		
23	0	0	MCData	31	0	SyncFC	✓		
23	4	2400	RTtoBC	1	11	PacketTM			
23	20	14400	BCtoRT	1	10	TMConf			
23	21	14550	RTtoBC	2	10	TMReq	✓		
23	22	14700	RTtoBC	0	27	TCConf	✓		
24	0	0	MCData	31	0	SyncFC	✓		
24	4	2400	BCtoRT	0	11	PacketTC	✓		
24	20	14400	BCtoRT	0	27	TCDesc	✓		
24	21	14550	RTtoBC	3	10	TMReq	✓		
25	0	0	MCData	31	0	SyncFC	✓		
25	4	2400	RTtoBC	2	11	PacketTM	X		
25	20	14400	BCtoRT	2	10	TMConf	X		
							D		
26	0	0	MCData	31	0	SyncFC	✓		
26	4	2400	RTtoBC	3	11	PacketTM	✓		
26	20	14400	BCtoRT	3	10	TMConf	✓		
26	21	14550	RTtoBC	1	10	TMReq	✓		
26	22	14700	RTtoBC	0	27	TCConf	✓		
27	0	0	MCData	31	0	SyncFC	✓		
27	4	2400	BCtoRT	0	11	PacketTC	✓		
27	20	14400	BCtoRT	0	27	TCDesc	✓		
27	21	14550	RTtoBC	2	10	TMReq	✓		
28	0	0	MCData	31	0	SyncFC	✓		
28	4	2400	RTtoBC	1	11	PacketTM			
28	20	14400	BCtoRT	1	10	TMConf			
							D		
29	0	0	MCData	31	0	SyncFC	✓		

29	4	2400	RTtoBC	2	11	PacketTM			
29	20	14400	BCtoRT	2	10	TMConf			
29	21	14550	RTtoBC	3	10	TMReq	✓		
29	22	14700	RTtoBC	0	27	TCConf	✓		
30	0	0	MCData	31	0	SyncFC	✓		
30	4	2400	BCtoRT	0	11	PacketTC	✓		
30	20	14400	BCtoRT	0	27	TCDesc	✓		
30	21	14550	RTtoBC	1	10	TMReq	✓		
31	0	0	MCData	31	0	SyncFC	✓		
31	4	2400	RTtoBC	3	11	PacketTM	✓		
31	20	14400	BCtoRT	3	10	TMConf	✓		
32	0	0	MCData	31	0	SyncFC	✓		
32	2	900	MCData	31	8	Timecode	✓		
32	4	2400	RTtoBC	1	11	PacketTM			
32	20	14400	BCtoRT	1	10	TMConf			
32	21	14550	RTtoBC	2	10	TMReq	✓		
32	22	14700	RTtoBC	0	27	TCConf	✓		
33	0	0	MCData	31	0	SyncFC	✓		
33	4	2400	BCtoRT	0	11	PacketTC	✓		
33	20	14400	BCtoRT	0	27	TCDesc	✓		
33	21	14550	RTtoBC	3	10	TMReq	✓		
34	0	0	MCData	31	0	SyncFC	✓		
34	4	2400	RTtoBC	2	11	PacketTM			
34	20	14400	BCtoRT	2	10	TMConf			
35	0	0	MCData	31	0	SyncFC	✓		
35	4	2400	RTtoBC	3	11	PacketTM	✓		
35	20	14400	BCtoRT	3	10	TMConf	✓		
35	21	14550	RTtoBC	1	10	TMReq	✓		
35	22	14700	RTtoBC	0	27	TCConf	✓		
36	0	0	MCData	31	0	SyncFC	✓		
36	4	2400	BCtoRT	0	11	PacketTC	✓		
36	20	14400	BCtoRT	0	27	TCDesc	✓		
36	21	14550	RTtoBC	2	10	TMReq	✓		
37	0	0	MCData	31	0	SyncFC	✓		
37	4	2400	RTtoBC	1	11	PacketTM			
37	20	14400	BCtoRT	1	10	TMConf			
38	0	0	MCData	31	0	SyncFC	✓		
38	4	2400	RTtoBC	2	11	PacketTM			
38	20	14400	BCtoRT	2	10	TMConf			
38	21	14550	RTtoBC	3	10	TMReq	✓		
38	22	14700	RTtoBC	0	27	TCConf	✓		
39	0	0	MCData	31	0	SyncFC	✓		
39	4	2400	BCtoRT	0	11	PacketTC	✓		
39	20	14400	BCtoRT	0	27	TCDesc	✓		
39	21	14550	RTtoBC	1	10	TMReq	✓		
40	0	0	MCData	31	0	SyncFC	✓		
40	4	2400	RTtoBC	3	11	PacketTM	✓		
40	20	14400	BCtoRT	3	10	TMConf	✓		

						D			
41	0	0	MCData	31	0	SyncFC	✓		
41	4	2400	RTtoBC	1	11	PacketTM			
41	20	14400	BCtoRT	1	10	TMConf			
41	21	14550	RTtoBC	2	10	TMReq	✓		
41	22	14700	RTtoBC	0	27	TCConf	✓		
42	0	0	MCData	31	0	SyncFC	✓		
42	4	2400	BCtoRT	0	11	PacketTC	✓		
42	20	14400	BCtoRT	0	27	TCDesc	✓		
42	21	14550	RTtoBC	3	10	TMReq	✓		
43	0	0	MCData	31	0	SyncFC	✓		
43	4	2400	RTtoBC	2	11	PacketTM			
43	20	14400	BCtoRT	2	10	TMConf			
							D		
44	0	0	MCData	31	0	SyncFC	✓		
44	4	2400	RTtoBC	3	11	PacketTM	✓		
44	20	14400	BCtoRT	3	10	TMConf	✓		
44	21	14550	RTtoBC	1	10	TMReq	✓		
44	22	14700	RTtoBC	0	27	TCConf	✓		
45	0	0	MCData	31	0	SyncFC	✓		
45	4	2400	BCtoRT	0	11	PacketTC	✓		
45	20	14400	BCtoRT	0	27	TCDesc	✓		
45	21	14550	RTtoBC	2	10	TMReq	✓		
46	0	0	MCData	31	0	SyncFC	✓		
46	4	2400	RTtoBC	1	11	PacketTM			
46	20	14400	BCtoRT	1	10	TMConf			
							D		
47	0	0	MCData	31	0	SyncFC	✓		
47	4	2400	RTtoBC	2	11	PacketTM	✓		
47	20	14400	BCtoRT	2	10	TMConf			
47	21	14550	RTtoBC	3	10	TMReq	✓		
47	22	14700	RTtoBC	0	27	TCConf	✓		
48	0	0	MCData	31	0	SyncFC	✓		
48	4	2400	BCtoRT	0	11	PacketTC	✓		
48	20	14400	BCtoRT	0	27	TCDesc	✓		
48	21	14550	RTtoBC	1	10	TMReq	✓		
49	0	0	MCData	31	0	SyncFC	✓		
49	4	2400	RTtoBC	3	11	PacketTM	✓		
49	20	14400	BCtoRT	3	10	TMConf	✓		
							D		
50	0	0	MCData	31	0	SyncFC	✓		
50	4	2400	RTtoBC	1	11	PacketTM			
50	20	14400	BCtoRT	1	10	TMConf			
50	21	14550	RTtoBC	2	10	TMReq	✓		
50	22	14700	RTtoBC	0	27	TCConf	✓		
51	0	0	MCData	31	0	SyncFC	✓		
51	4	2400	BCtoRT	0	11	PacketTC	✓		
51	20	14400	BCtoRT	0	27	TCDesc	✓		
51	21	14550	RTtoBC	3	10	TMReq	✓		
52	0	0	MCData	31	0	SyncFC	✓		
52	4	2400	RTtoBC	2	11	PacketTM			

52	20	14400	BCtoRT	2	10	TMConf			
							D		
53	0	0	MCData	31	0	SyncFC	✓		
53	4	2400	RTtoBC	3	11	PacketTM	✓		
53	20	14400	BCtoRT	3	10	TMConf	✓		
53	21	14550	RTtoBC	1	10	TMReq	✓		
53	22	14700	RTtoBC	0	27	TCConf	✓		
54	0	0	MCData	31	0	SyncFC	✓		
54	4	2400	BCtoRT	0	11	PacketTC	✓		
54	20	14400	BCtoRT	0	27	TCDesc	✓		
54	21	14550	RTtoBC	2	10	TMReq	✓		
55	0	0	MCData	31	0	SyncFC	✓		
55	4	2400	RTtoBC	1	11	PacketTM			
55	20	14400	BCtoRT	1	10	TMConf			
							D		
56	0	0	MCData	31	0	SyncFC	✓		
56	4	2400	RTtoBC	2	11	PacketTM			
56	20	14400	BCtoRT	2	10	TMConf			
56	21	14550	RTtoBC	3	10	TMReq	✓		
56	22	14700	RTtoBC	0	27	TCConf	✓		
57	0	0	MCData	31	0	SyncFC	✓		
57	4	2400	BCtoRT	0	11	PacketTC	✓		
57	20	14400	BCtoRT	0	27	TCDesc	✓		
57	21	14550	RTtoBC	1	10	TMReq	✓		
58	0	0	MCData	31	0	SyncFC	✓		
58	4	2400	RTtoBC	3	11	PacketTM	✓		
58	20	14400	BCtoRT	3	10	TMConf	✓		
							D		
59	0	0	MCData	31	0	SyncFC	✓		
59	4	2400	RTtoBC	1	11	PacketTM			
59	20	14400	BCtoRT	1	10	TMConf			
59	21	14550	RTtoBC	2	10	TMReq	✓		
59	22	14700	RTtoBC	0	27	TCConf	✓		
60	0	0	MCData	31	0	SyncFC	✓		
60	4	2400	BCtoRT	0	11	PacketTC	✓		
60	20	14400	BCtoRT	0	27	TCDesc	✓		
60	21	14550	RTtoBC	3	10	TMReq	✓		
61	0	0	MCData	31	0	SyncFC	✓		
61	4	2400	RTtoBC	2	11	PacketTM			
61	20	14400	BCtoRT	2	10	TMConf			
							D		
62	0	0	MCData	31	0	SyncFC	✓		
62	4	2400	RTtoBC	3	11	PacketTM	✓		
62	20	14400	BCtoRT	3	10	TMConf	✓		
62	21	14550	RTtoBC	1	10	TMReq	✓		
62	22	14700	RTtoBC	0	27	TCConf	✓		
63	0	0	MCData	31	0	SyncFC	✓		

D

All TC packet transfer subframes are filled? Yes

Make a printout of the TC packet logfile. ☐

Make a printout of the 1553 message logfile. ☐

6.4 Simulator Stand-Alone Operation

6.4.1 Front Panel

6.4.1.1 Simulator Control and Monitoring

6.4.1.1.1 Spacecraft Clock (master time)

Type an initial clock value in the control box, decimal value = ☐

Start the bus monitor
Start the Simulator bus polling

Check master time increments in display box ☐

Check in the bus log that master time starts at the selected offset and increments as displayed on screen. ☐

6.4.1.1.2 Buslist

Different buslists have been already used in section 6.3.
Confirm that buslists can be selected from the pull-down menu, and that the selection is displayed in the box. ☐

6.4.1.1.3 1553 Bus Status

Start and stop the bus polling by using the Run and Master Stop buttons
Confirm that the Bus Alive indicator is flashing when the polling is active. ☐

Select Bus B
Confirm that Bus B is indicated and the bus polling runs when started as above. ☐
Stop the polling.

Select Bus A
Confirm that Bus A is indicated and the bus polling runs when started as above. ☐

6.4.1.1.4 Router Status

Confirm that the Router Alive indicator flashes when a router connection is active, see section 6.5. ☐

6.4.1.2 TC displays

Ensure that the Simulator is running.
Select a TC stored on the Simulator from the pull-down menu.
Confirm that the command file name is displayed.
Reselect a different TC if required.

Press the Send button
Confirm that the command header is displayed on the TC list, with the time of transmission.

Click on the TC display line.
Confirm that the complete command packet is displayed in hex format in a pop-up window.

Repeat as required.

6.4.1.3 TM displays

Start the Instrument Simulator RT.
Start the CDMS Simulator.

Confirm that TM packets are being received by monitoring the TM packet list.

Pause the displayed packet list (logging to file does not stop).
Click on the list.
Confirm that the complete telemetry packet is displayed in hex format in a pop-up window.

6.4.1.4 Error displays

For this section, use the DDC 'ACE Windows Menu' program in RT mode to generate simple RT messages containing errors.

Start the Simulator, running buslist file **RT2 Only bustlist.**
Monitor the Error display panel.
Confirm that No Response errors are being displayed from RT2, since the Simulator is polling for TMReq messages and there is no RT connected yet.

Record the Error string.

Start the 'ACE Windows menu' as RT2
Confirm that the error messages stop.

Configure the RT to respond to SA11R, generating RT status errors:
Send TCs to RT2 setting one error at a time, as shown in the table below.
Record the displayed error strings.

Status Bit set	Displayed error string
Sub System	
Terminal	

Service	
Busy	

6.4.2 Log Files

6.4.2.1 1553 Message File

The 1553 bus message file has been used extensively during section 6.3 of this document. No other tests are planned at this time.

6.4.2.2 TC Log File

A single TC log file in text format is created per Simulator session.
Open one of the previously generated TC log files with a text editor and check:

Time is written correctly? ☐

Full length (128 word) packets written correctly? ☐

6.4.2.3 TM Log File

Start the Simulator software again running a Burst Mode buslist and leave it running for >60 minutes.

TM packet files are changed after 30 minutes? ☐

Logging continues after one hour by overwriting first TM file? ☐

Check the file contents:

Time is written correctly? ☐

Full length (512 word) packets written correctly? ☐

6.5 Router Interface

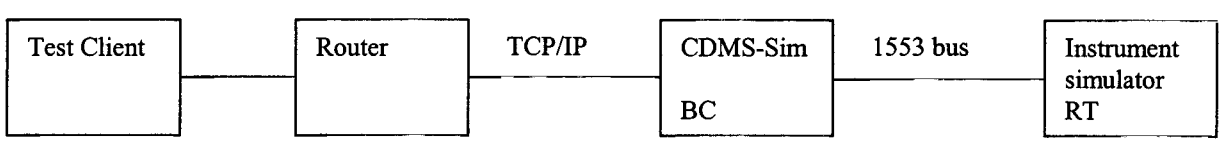


Figure 6.5 – Setup for Router Interface Testing

6.5.1 Log on

Use the Log On dialog box to make a connection to the Router.

Check that Router Alive indicator on front panel is flashing ☐

6.5.2 TC Packet flow

Send a TC from Test Client.

Check that the TC appears on the transmitted TCs list ☐

6.5.3 TM Packet flow

Start the Instrument Simulator RT with Command echo facility.
Send a short TC from the Test Client

Check that the TC appears on the CDMS-Sim transmitted TCs list ☐

Check that a TM packet appears on the CDMS-Sim received TM list ☐

6.6 TM Playback

Playback of TM files recorded during a Simulator session is an offline activity.
Copy the TM files which may be needed later or they will be over-written.

Start the Router
Connect a test client with TC and TM facilities

Open **Playback.vi**
Connect to the Router
Select the required file from the pulldown menu.
Select the required start time.
Press Play.
TM packets received OK by Router and Test Client ? ☐

Stop, fast forward and rewind buttons can be used to navigate through the TM file.

6.7 Remote Operation of Simulator

Define remote command functions
test them

7. ACCEPTANCE TEST REVIEW

Inspect documentation and data package.

8. APPENDIX A – DDC TEST REPORT

1	0	0	0	MCSync	31	0	None
2	0	4	2400	BCtoRT	0	11	PacketTC
3	0	20	14400	BCtoRT	0	27	TCDesc
4	0	21	14550	RTtoBC	7	10	TMReq
5							
6	1	0	0	MCData	31	0	SyncFC
7	1	4	2400	RTtoBC	7	11	PacketTM
8	1	20	14400	BCtoRT	7	10	TMConf
9	1	22	14700	RTtoBC	0	27	TCConf
10							
11	2	0	0	MCData	31	0	SyncFC
12	2	21	14550	RTtoBC	7	10	TMReq
13							
14	3	0	0	MCData	31	0	SyncFC
15	3	4	2400	RTtoBC	7	11	PacketTM
16	3	20	14400	BCtoRT	7	10	TMConf
17							
18	4	0	0	MCData	31	0	SyncFC
19	4	21	14550	RTtoBC	7	10	TMReq
20							
21	5	0	0	MCData	31	0	SyncFC
22	5	4	2400	RTtoBC	7	11	PacketTM
23	5	20	14400	BCtoRT	7	10	TMConf
24							
25	6	0	0	MCData	31	0	SyncFC
26	6	21	14550	RTtoBC	7	10	TMReq
27							
28	7	0	0	MCData	31	0	SyncFC
29	7	4	2400	RTtoBC	7	11	PacketTM
30	7	20	14400	BCtoRT	7	10	TMConf
31							
32	8	0	0	MCData	31	0	SyncFC
33	8	21	14550	RTtoBC	7	10	TMReq
34							
35	9	0	0	MCData	31	0	SyncFC
36	9	4	2400	RTtoBC	7	11	PacketTM
37	9	20	14400	BCtoRT	7	10	TMConf
38							
39	10	0	0	MCData	31	0	SyncFC
40	10	21	14550	RTtoBC	7	10	TMReq
41							
42	11	0	0	MCData	31	0	SyncFC
43	11	4	2400	RTtoBC	7	11	PacketTM
44	11	20	14400	BCtoRT	7	10	TMConf
45							
46	12	0	0	MCData	31	0	SyncFC
47	12	21	14550	RTtoBC	7	10	TMReq
48							
49	13	0	0	MCData	31	0	SyncFC
50	13	4	2400	RTtoBC	7	11	PacketTM
51	13	20	14400	BCtoRT	7	10	TMConf
52							
53	14	0	0	MCData	31	0	SyncFC
54	14	4	2400	BCtoRT	0	11	PacketTC
55	14	20	14400	BCtoRT	0	27	TCDesc
56	14	21	14550	RTtoBC	7	10	TMReq
57							
58	15	0	0	MCData	31	0	SyncFC
59	15	4	2400	RTtoBC	7	11	PacketTM
60	15	20	14400	BCtoRT	7	10	TMConf
61							
62	16	0	0	MCData	31	0	SyncFC
63	16	21	14550	RTtoBC	7	10	TMReq
64	16	22	14700	RTtoBC	0	27	TCConf
65							
66	17	0	0	MCData	31	0	SyncFC
67	17	4	2400	RTtoBC	7	11	PacketTM
68	17	20	14400	BCtoRT	7	10	TMConf
69							
70	18	0	0	MCData	31	0	SyncFC
71	18	21	14550	RTtoBC	7	10	TMReq
72							
73	19	0	0	MCData	31	0	SyncFC
74	19	4	2400	RTtoBC	7	11	PacketTM
75	19	20	14400	BCtoRT	7	10	TMConf
76							
77	20	0	0	MCData	31	0	SyncFC
78	20	21	14550	RTtoBC	7	10	TMReq
79							
80	21	0	0	MCData	31	0	SyncFC
81	21	4	2400	RTtoBC	7	11	PacketTM
82	21	20	14400	BCtoRT	7	10	TMConf
83							
84	22	0	0	MCData	31	0	SyncFC
85	22	21	14550	RTtoBC	7	10	TMReq
86							
87	23	0	0	MCData	31	0	SyncFC
88	23	4	2400	RTtoBC	7	11	PacketTM
89	23	20	14400	BCtoRT	7	10	TMConf
90							
91	24	0	0	MCData	31	0	SyncFC
92	24	21	14550	RTtoBC	7	10	TMReq
93							
94	25	0	0	MCData	31	0	SyncFC
95	25	4	2400	RTtoBC	7	11	PacketTM

RT7 bus list from CDMS n/c

+ Sensio's - ~~[illegible]~~?

31 TM packets.

TM Conf checked before next TM Req (by RT).

```
 96 25      20      14400   BCtoRT  7       10      TMConf
 97
 98 26      0       0       MCData  31      0       SyncFC
 99 26      21      14550   RTtoBC  7       10      TMReq
100
101 27      0       0       MCData  31      0       SyncFC
102 27      4       2400    RTtoBC  7       11      PacketTM
103 27      20      14400   BCtoRT  7       10      TMConf
104
105 28      0       0       MCData  31      0       SyncFC
106 28      21      14550   RTtoBC  7       10      TMReq
107
108 29      0       0       MCData  31      0       SyncFC
109 29      4       2400    RTtoBC  7       11      PacketTM
110 29      20      14400   BCtoRT  7       10      TMConf
111
112 30      0       0       MCData  31      0       SyncFC
113 30      21      14550   RTtoBC  7       10      TMReq
114
115 31      0       0       MCData  31      0       SyncFC
116 31      4       2400    RTtoBC  7       11      PacketTM
117 31      20      14400   BCtoRT  7       10      TMConf
118
119 32      0       0       MCData  31      0       SyncFC
120 32      2       900     MCData  31      8       Timecode
121 32      4       2400    BCtoRT  0       11      PacketTC
122 32      20      14400   BCtoRT  0       27      TCDesc
123 32      21      14550   RTtoBC  7       10      TMReq
124
125 33      0       0       MCData  31      0       SyncFC
126 33      4       2400    RTtoBC  7       11      PacketTM
127 33      20      14400   BCtoRT  7       10      TMConf
128 33      22      14700   RTtoBC  0       27      TCConf
129
130 34      0       0       MCData  31      0       SyncFC
131 34      21      14550   RTtoBC  7       10      TMReq
132
133 35      0       0       MCData  31      0       SyncFC
134 35      4       2400    RTtoBC  7       11      PacketTM
135 35      20      14400   BCtoRT  7       10      TMConf
136
137 36      0       0       MCData  31      0       SyncFC
138 36      21      14550   RTtoBC  7       10      TMReq
139
140 37      0       0       MCData  31      0       SyncFC
141 37      4       2400    RTtoBC  7       11      PacketTM
142 37      20      14400   BCtoRT  7       10      TMConf
143
144 38      0       0       MCData  31      0       SyncFC
145 38      21      14550   RTtoBC  7       10      TMReq
146
147 39      0       0       MCData  31      0       SyncFC
148 39      4       2400    RTtoBC  7       11      PacketTM
149 39      20      14400   BCtoRT  7       10      TMConf
150
151 40      0       0       MCData  31      0       SyncFC
152 40      21      14550   RTtoBC  7       10      TMReq
153
154 41      0       0       MCData  31      0       SyncFC
155 41      4       2400    RTtoBC  7       11      PacketTM
156 41      20      14400   BCtoRT  7       10      TMConf
157
158 42      0       0       MCData  31      0       SyncFC
159 42      21      14550   RTtoBC  7       10      TMReq
160
161 43      0       0       MCData  31      0       SyncFC
162 43      4       2400    RTtoBC  7       11      PacketTM
163 43      20      14400   BCtoRT  7       10      TMConf
164
165 44      0       0       MCData  31      0       SyncFC
166 44      21      14550   RTtoBC  7       10      TMReq
167
168 45      0       0       MCData  31      0       SyncFC
169 45      4       2400    RTtoBC  7       11      PacketTM
170 45      20      14400   BCtoRT  7       10      TMConf
171
172 46      0       0       MCData  31      0       SyncFC
173 46      21      14550   RTtoBC  7       10      TMReq
174
175 47      0       0       MCData  31      0       SyncFC
176 47      4       2400    RTtoBC  7       11      PacketTM
177 47      20      14400   BCtoRT  7       10      TMConf
178
179 48      0       0       MCData  31      0       SyncFC
180 48      4       2400    BCtoRT  0       11      PacketTC
181 48      20      14400   BCtoRT  0       27      TCDesc
182 48      21      14550   RTtoBC  7       10      TMReq
183
184 49      0       0       MCData  31      0       SyncFC
185 49      4       2400    RTtoBC  7       11      PacketTM
186 49      20      14400   BCtoRT  7       10      TMConf
187 49      22      14700   RTtoBC  0       27      TCConf
188
189 50      0       0       MCData  31      0       SyncFC
190 50      21      14550   RTtoBC  7       10      TMReq
```

```
191
192 51      0       0       MCData  31      0       SyncFC
193 51      4       2400    RTtoBC  7       11      PacketTM
194 51      20      14400   BCtoRT  7       10      TMConf
195
196 52      0       0       MCData  31      0       SyncFC
197 52      21      14550   RTtoBC  7       10      TMReq
198
199 53      0       0       MCData  31      0       SyncFC
200 53      4       2400    RTtoBC  7       11      PacketTM
201 53      20      14400   BCtoRT  7       10      TMConf
202
203 54      0       0       MCData  31      0       SyncFC
204 54      21      14550   RTtoBC  7       10      TMReq
205
206 55      0       0       MCData  31      0       SyncFC
207 55      4       2400    RTtoBC  7       11      PacketTM
208 55      20      14400   BCtoRT  7       10      TMConf
209
210 56      0       0       MCData  31      0       SyncFC
211 56      21      14550   RTtoBC  7       10      TMReq
212
213 57      0       0       MCData  31      0       SyncFC
214 57      4       2400    RTtoBC  7       11      PacketTM
215 57      20      14400   BCtoRT  7       10      TMConf
216
217 58      0       0       MCData  31      0       SyncFC
218 58      21      14550   RTtoBC  7       10      TMReq
219
220 59      0       0       MCData  31      0       SyncFC
221 59      4       2400    RTtoBC  7       11      PacketTM
222 59      20      14400   BCtoRT  7       10      TMConf
223
224 60      0       0       MCData  31      0       SyncFC
225 60      21      14550   RTtoBC  7       10      TMReq
226
227 61      0       0       MCData  31      0       SyncFC
228 61      4       2400    RTtoBC  7       11      PacketTM
229 61      20      14400   BCtoRT  7       10      TMConf
230
231 62      0       0       MCData  31      0       SyncFC
232
233 63      0       0       MCData  31      0       SyncFC
```

The Packet Structure ICD (SCI-PT-ICD-07527 describes the packet services, 1553 transfer protocol, and control messages available on the Herschel spacecraft for data transfer between subsystems via the 1553 bus. This note defines those elements of the protocol used by the SPIRE instrument.

1. TM Packet Transfer

Our implementation uses only a part of the protocol defined in the packet ICD. In particular the TM Confirmation message is ignored. Because of the circular buffer used in the DPU (1553 Remote Terminal) it is difficult to repeat the transmission of any packet. This circular buffer automatically updates the contents of each Sub-Address once the previous contents have been collected by the CDMU's 1553 Bus Controller.

The operation of the RT-BC protocol for TM packet transfer is as follows:
(Assume our RT is number 3)

- RT loads TM packet into SA 11T – 26T
- RT loads TM Request message into SA 10T
- BC reads TM Request message at the end of subframe N
- BC builds the message sequence for subframe (N+1) containing the following messages:-
  Subframe Sync, including the RT field set to 3.
  TM Packet transfer messages.
  TM Packet Confirmation message.
- BC runs the message sequence.

- RT detects the Subframe Sync when the message sequence is run. It checks the RT field in that message and if it is 3, immediately updates SA 10T if it has more TM Packet data ready.

2. TC Packet Transfer

Operation of the TC Packet transfer protocol:

CMDU receives a Telecommand addressed to RT 3, for example.

- BC builds a subframe containing TC Packet messages and TC Descriptor message.
- BC runs the subframe.
- RT detects the new TC Descriptor message in SA 27R.
- RT extracts the TC Packet from SA 11R – 14R.
- RT checks the TC Packet for errors and if correct writes a TC Confirmation to SA 27T. (NB the latency is not defined in PS-ICD).