SUBJECT: **SPIRE DRCU Integration Test Specification**

PREPARED BY: **Ken King**

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Distribution

RAL	Dave Smith
	Ken King
	Bruce Swinyard
	Tanya Lim
	Sunil Sidher
	Asier Aramburu
CEA	Jean-Louis Augueres
	Christophe Cara

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1.0 Draft 1	8th September 2003	1st Draft for comment
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FIGURES

TBW

TABLES

TBW

Glossary

AD	Applicable Document
AIV	Assembly Integration and Verification
AVM	Avionics Model
BSM	Beam Steering Mechanism
CQM	Cryogenic Qualification Model
DCU	Detector Control Unit
DPU	Digital Processing Unit
DRCU	Detector Readout and Control Unit
EGSE	Electrical Ground Support Equipment
FLT	Flight Level Test
FTS	Fourier Transform Spectrometer
HOB	Herschel Optical Bench
ILT	Instrument Level Test
IST	Integrated System Test
MCU	Mechanism Control Unit
MGSE	Mechanical Ground Support Equipment
N/A	Not Applicable
PCAL	Photometer Calibrator source
PFM	Proto-Flight Model
PLT	Payload Level Test
RAL	Rutherford Appleton Laboratory
RD	Reference Document
SCAL	Spectrometer Calibrator source
SCU	Subsystem Control Unit
SMEC	Spectrometer Mechanism
SPIRE	Spectral and Photometric Imaging Receiver
STM	Structural Test Model
TBC	To Be Confirmed
TBD	To Be Defined
TFCS	Test Facility Control System
AD	Applicable Document
AIV	Assembly Integration and Verification
AVM	Avionics Model

1. INTRODUCTION

1.1 Scope

This document contains the specification of the Integration tests to be performed on the SPIRE Warm Electronics. These tests exercise the interface between the DPU and DRCU and check that data is transferred in both directions according to the interface specification.

1.2 Structure of Document

Section 2 gives a short summary of each test. Section 3 indicates the expected test sequence and section 4 gives the specification of each test. Section 5 lists the test procedures and scripts used in the specifications but defined elsewhere.

1.2.1 Applicable Documents

	Title	Author	Reference	Date

1.2.2 Reference Documents

	Title	Author	Reference	Date
RD01	SCU Qm1 Functional Test Plan in LTU/SCU/FPU Simulator Confriguration	H Triou	SAp-SPIRE-HT-0122-03, Issue 1.0 Draft	05/08/2003
RD02	MCU QM0 Functional Test Plan and Test procedures	Didier Ferrand	LAM/ELE/SPI/080703, Issue 1.0	29/072003
RD03	SPIRE Data ICD	K.J. King	SPIRE-RAL-PRJ-001078, Issue 1.1 Draft 3	13/08/2003
RD04	DRCU/DPU ICD	Pinsard, Ferrand, Mur	Sap-SPIRE-CCa-076-02, Issue 1.0	14/02/2003
RD05	Subsystem reaction for specification for the instrument simulator	Bruce Swinyard	SPIRE-RAL-NOT-001715, Issue 1.0	11/06/2003
RD06	Operating modes for the SPIRE instrument	Bruce Swinyard, Matt Griffin	SPIRE-RAL-DOC-000320, Issue 3.0	04/01/2002

2. TEST SUMMARIES

2.1 SCU tests

2.1.1 INT-SCU-01, DRCU Switch on

This procedure allows the DRCU to be powered on and checks the basic housekeeping telemetry contents.

2.1.2 INT-SCU-02, SCU High-Speed Interface Nominal Data Test

Request different amounts of SCU science frames at the nominal operational rate and check correct receipt

2.1.3 INT-SCU-03, SCU High-Speed Interface Data Performance Test

Checking the performance and timing of SCU science frame generation:

The following tests are made
Generation of DCU packets at 80, 40, 20 and 10Hz
Generation of Test Packets at 80Hz
For each frame type the reset of the Time Stamp word in data frames is checked and the frame rate accuracy

2.1.4 INT-SCU-04, SCU Low-Speed Interface Test

Checking the operation of the interface registers and their commands:

The test sends commands to the subsystem interface, which passes them on to the subsystem.
The time between the command being passed to the subsystem and the response from the subsystem being returned to the interface is termed the Subsystem Delay
When reading a register in the subsystem the delay should be ~ 3 steps
When reading from a component (e.g. an ADC) the delay is ~ 16-23 steps
If a time out occurs a delay of 255 steps is returned
This test sets the interface into various states and checks the response

2.2 MCU tests

2.2.1 INT-MCU-01, MCU power on

To power on the MCU into a state ready to execute SMEC or BSM commands:

This procedure also tests the low speed interface to the MCU, used for command and housekeeping data transfer
Apply power to MCU from SCU and boot the MCU DSP ROM software, checking voltages and status

2.2.2 INT-MCU-02, MCU High-Speed Interface Nominal DataTest

Checking transfer of MCU Nominal Science data frames:

Request science frames at frequencies associated with nominal operations and in various quantities and check correct receipt.
Number of frames and frequencies are:
SMEC: ~1000 and continuous frames at 253Hz
BSM: ~250 and continuous at 63Hz
SMEC+BSM (Scanning mode): continuous at 253+16Hz)

2.2.3 INT-MCU-03, High-Speed Interface Data PerformanceTest

Checking the performance and timing of MCU science frame generation.
The following tests are made
Generation of SMEC packets at 320Hz
Generation of BSM packets at 80Hz
Generation of Test Packets at 400Hz
Generation of Engineering packets at 400Hz
For each frame type the reset of the Time Stamp word in data frames is checked and the frame rate accuracy

2.2.4 INT-MCU-04, MCU Low-Speed Interface Test

Checking the operation of the interface registers and their commands

2.3 DCU tests

2.3.1 INT-DCU-01, DCU High-Speed Interface Nominal Data Test

Checking transfer of DCU Science data frames:

Request science frames at various frequencies and in various quantities and check correct receipt

2.3.2 INT-DCU-02, DCU High-Speed Interface Data Performance Test

Checking the performance and timing of DCU science frame generation

2.3.3 INT-DCU-03, DCU Low-Speed Interface Test

Checking the operation of the interface registers and their commands:

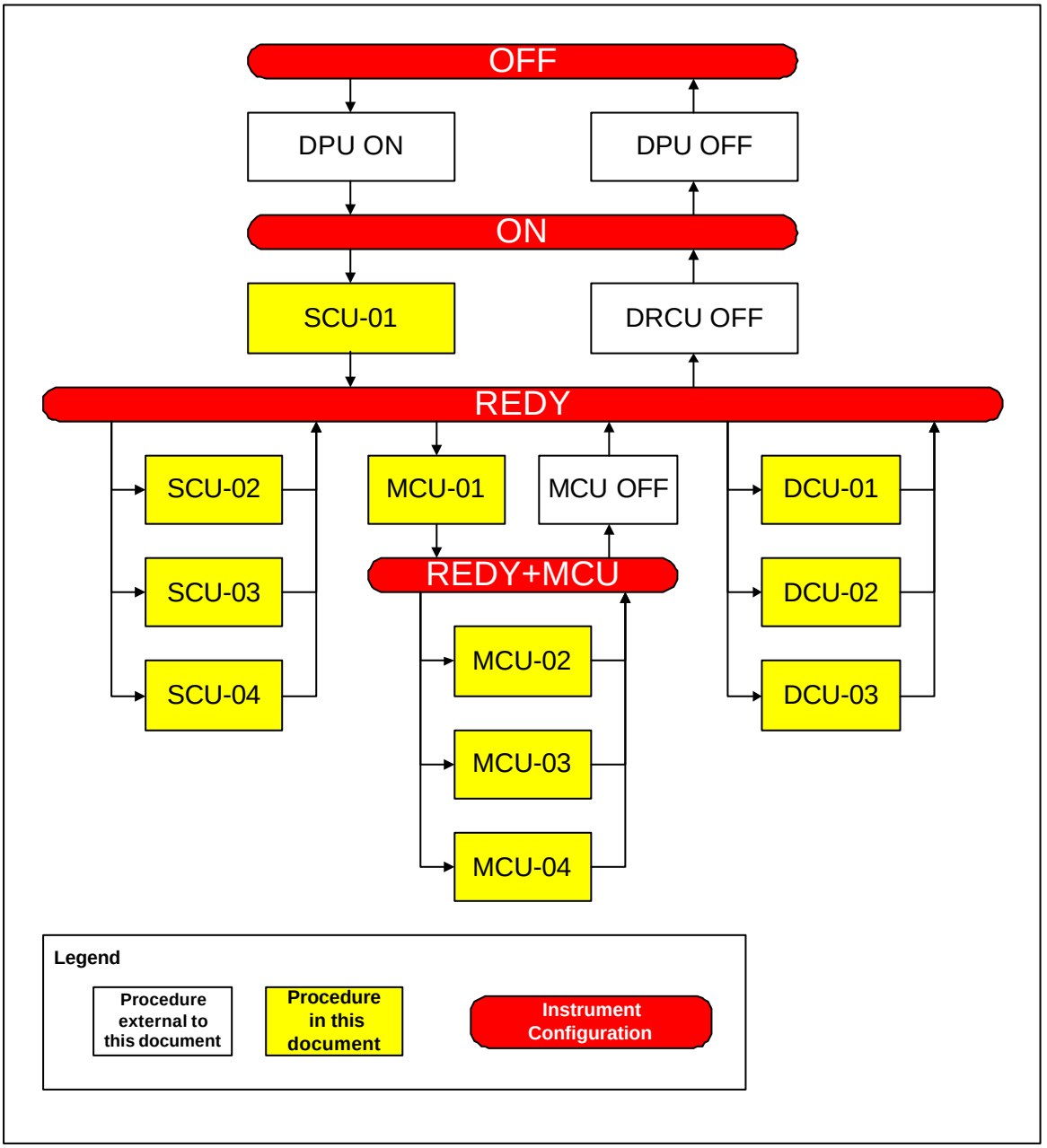
The test sends commands to the subsystem interface, which passes them on to the subsystem.
The time between the command being passed to the subsystem and the response from the subsystem being returned to the interface is termed the Subsystem Delay
When reading a register in the subsystem the delay should be ~ 3 steps
When reading from a component (e.g. an ADC) the delay is ~ 16-23 steps
If a time out occurs a delay of 255 steps is returned
This test sets the interface into various states and checks the response

3. TEST SEQUENCE

In this section the sequence of tests is provided based on the given starting conditions for each test

3.1 Test Flow

The following diagram shows the instrument configurations used during the integration testing and the tests which may be run from each configuration



3.2 Test Sequence

It is planned that the procedures will be carried out in the following order:

Procedure	Estimated Duration	Comments
DPU ON		
SCU-01		
SCU-02		
SCU-03		
SCU-04		
DCU-01		
DCU-02		
DCU-03		
MCU-01		
MCU-02		
MCU-03		
MCU-04		
MCU OFF		
DRCU OFF		
DPU OFF		

4. TEST SPECIFICATION

4.1 SCU-01, DRCU Switch-On

ID:	SCU-01		
Test name:	DRCU Switch On		
Purpose	Power on the DRCU		
Description of test:	This procedure allows the DRCU to be powered on and checks the basic housekeeping telemetry contents. This test implicitly tests the low-speed interface to the SCU		
Test Type:	Interface Check		
Instrument Models:	AVM/CQM/PFM/FS		
Redundancy:	This test can be applied to both Prime and Redundant systems		
Instrument Configuration:	SPIRE in 'On' Mode: DPU powered on and generating housekeeping telemetry		
EGSE Configuration:	SCOS-2000 required		
Level	ILT/PLT/IST/FLT		
Test Conditions:	FPU Warm or Cold, or FPU Simulator		
Constraints:			
Outline procedure and analysis:	1.	**Setup EGSE**	Select SCOS display *(DPU and OBS_PARAMETERS)* Send SET_BBID(TBD)
	2.	**Stop Housekeeping requests to DRCU** a) Stop Critical Housekeeping b) Stop Nominal Housekeeping c) Check both housekeeping reports have stopped	Send **CLEAR_HK_REPORT** (0) Send **CLEAR_HSK_REPORT** (1)
	3.	**Power on DRCU** a) Apply 28v bus **b)** Check input currents to DRCU	For QM1: switch on power supplies (see procedure). For other models, TBD For QM1 record and check power supply currents. For other models, TBD

	4.	**Restart Housekeeping requests to DRCU** a) Start Critical Housekeeping b) Start Nominal Housekeeping c) Check both housekeeping reports have started	Send **DEFINE_NEW_HK_REPORT** (0,0x300,2000,1,0,0) Send **DEFINE_NEW_HK_REPORT** (1,0x301,1000,1,1,1)
	5.	**Check SCU status**	SCUSTAT = 0x0000 SCUTEMPSTAT = 0x0000 SCUDCDCSTAT = 0x0000 SUBKSTAT = 0x0000 SCU+5V = 0xB554 SCU+9V = 0xE00D SCU-9V = 0x1FF0 SCU25V = 0x9AAD SCUREF = TBD SCUGND = 0x7FFF, TBC SPHSV = 0x7FFF, TBC EVHSV = 0x7FFF, TBC TCHTRV = 0x7FFF, TBC SPHTRV = 0x7FFF, TBC PCALV = 0x7FFF, TBC SCAL2V = 0x7FFF, TBC SCAL4V = 0x7FFF, TBC BIASP5V = 0xB554 BIASP9V = 0xE00D BIASN9V = 0x1FF0 LIASTAT = 0x0000 PSWJFETSTAT = 0x0000 PMLWJFETSTAT = 0x0000 SPECJFETSTAT = 0x0000
Success/Failure Criteria:	Procedure completed with no errors		

Comments/Open issues:

4.2 SCU-02, SCU High-Speed Interface Nominal Data Test

ID:	SCU-02		
Test name:	SCU High-Speed Interface Data Test		
Purpose	Checking transfer of SCU Science data frames		
Description of test:	Request different amounts of SCU science frames at the nominal operational rate and check correct receipt		
Test Type:	Interface Check		
Instrument Models:	AVM/CQM/PFM/FS		
Redundancy:	This test can be applied to both Prime and Redundant systems		
Instrument Configuration:	SPIRE in 'REDY' mode: DPU and DRCU Powered on		
EGSE Configuration:	SCOS 2000 required QLA required		
Level	ILT/PLT/IST/FLT		
Test Conditions:	FPU Warm or Cold, or FPU Simulator		
Constraints:			
Outline procedure and analysis:	1.	**Setup EGSE**	• Set SCOS Display (SCU_PARAMETERS) • Set QLA Scrolling display of SCU Science packet header parameters (SCUOBSID, SCUBBID, SCUBLKLEN, SCUFRAMEID, SCUFRAMETIME, SCUADCFLAGS) • Use GUI to change display to HEX • Set QLA Clock display of SCUFRAMECNT and note the value • Note OBSID value • Send SET_BBID(TBD)
	2.	**Setup Data contents** a) For QM1: Load SCU parameter file 1 b) Switch on temperature channels **c)** Switch on SubK temp **d)** Check Housekeeping values on SCOS Display	TBD Send **SEND_DRCU_COMMAND** (A085FFFF) Send **SEND_DRCU_COMMAND** (A0860001)
	3.	**Request Nominal data Rate (80Hz)**	Send **SEND_DRCU_COMMAND** (A0830000)

	4.	**Request 1 frame** b) Stop data generation c) Set sequence length to 1 d) Start data generation e) Wait 1 sec **f)** Flush SCU FIFO	 Send **SEND_DRCU_COMMAND** (A0820000) Send **SEND_DRCU_COMMAND** (A0840001) Send **SEND_DRCU_COMMAND** (A0820001) Send **FLUSH_FIFO** (0x4000)
	5.	Check 1 frame received, with correct contents	SCUFRAMECNT has incremented by 1 SCUOBSID = OBSID value SCUBBID = BBID SCUBLKLEN = 30 SCUFRAMEID = 0x20 SCUADCFLGS = 0
	6.	**Request 10 frames** b) Stop data generation c) Set sequence length to 10 d) Start data generation e) Wait 1 sec **f)** Flush SCU FIFO	 Send **SEND_DRCU_COMMAND** (A0820000) Send **SEND_DRCU_COMMAND** (A084000A) Send **SEND_DRCU_COMMAND** (A0820001) Send **FLUSH_FIFO** (0x4000)
	7.	Check 10 frames received, with correct contents	SCUFRAMECNT has incremented by 10 For each frame check SCUOBSID = OBSID value SCUBBID = BBID SCUBLKLEN = 30 SCUFRAMEID = 0x20 SCUADCFLGS = 0 Check SCUFRAMETIME increases (unless it wraps around)
	8.	**Request 31 frames** a) Stop data generation b) Set sequence length to 31 c) Start data generation d) Wait 1 sec e) Flush SCU FIFO **f)** Check 31 frames received, with correct contents	 Send **SEND_DRCU_COMMAND** (A0820000) Send **SEND_DRCU_COMMAND** (A084001F) Send **SEND_DRCU_COMMAND** (A0820001) Send **FLUSH_FIFO** (0x4000) TBD

	9.	Check 31 frames received, with correct contents	SCUFRAMECNT has incremented by 31 For each frame check SCUOBSID = OBSID value SCUBBID = BBID SCUBLKLEN = 30 SCUFRAMEID = 0x20 SCUADCFLGS = 0 Check SCUFRAMETIME increases (unless it wraps around)
	10.	**Request continuous frames** a) Stop data generation b) Set sequence length to 0 c) Start data generation d) Wait 60 sec e) Stop data generation **f)** Flush SCU FIFO	 Send **SEND_DRCU_COMMAND** (A0820000) Send **SEND_DRCU_COMMAND** (A0840000) Send **SEND_DRCU_COMMAND** (A0820001) Send **SEND_DRCU_COMMAND** (A0820000) Send **FLUSH_FIFO** (0x4000)
	11.	Check frames received OK	Check no errors in transmission (no event packets received) Check SCUFRAMECNT has incremented by approximately 4800
Success/Failure Criteria:	Procedure completed with no errors		

Comments/Open issues:

4.3 SCU-03, SCU High-Speed Interface Data Performance Test

ID:	SCU-03		
Test name:	SCU High-Speed Interface Timing Test		
Purpose	Checking the performance and timing of SCU science frame generation.		
Description of test:	The following tests are made Generation of DCU packets at 80, 40, 20 and 10Hz Generation of Test Packets at 80Hz For each frame type the reset of the Time Stamp word in data frames is checked and the frame rate accuracy		
Test Type:	Interface Test		
Instrument Models:	AVM/CQM/PFM/FS		
Redundancy:	This test can be applied to both Prime and Redundant systems		
Instrument Configuration:	SPIRE in 'READY' mode: DPU and DRCU Powered on		
EGSE Configuration:	SCOS 2000 required QLA required		
Level	ILT/PLT/IST/FLT		
Test Conditions:	FPU Warm or Cold, or FPU Simulator		
Constraints:			
Outline procedure and analysis:	1.	**Setup EGSE**	Set SCOS Display (DPU and OBS_PARAMETERS) Set QLA Scrolling display of SCU Science packet header
	2.	**Setup Data contents** a) For QM1: Load SCU parameter file 1 b) Switch on temp erature channels **c)** Switch on SubK temp	 TBD Send **SEND_DRCU_COMMAND** (A085FFFF) Send **SEND_DRCU_COMMAND** (A0860001)
	3.	**Setup Data generation** a) Request sequence of 10 Frames b) Reset Time Stamp c) Wait 30 seconds	 Send **SEND_DRCU_COMMAND** (A084000A) Send **SYNC_DRCU_COUNTERS** ()

	4.	**Test 80Hz generation**	
		a) Stop data generation	Send **SEND_DRCU_COMMAND** (A0820000)
		b) Set frame rate to 80Hz	Send **SEND_DRCU_COMMAND** (A0830000)
		c) Reset Time Stamp	Send **SYNC_DRCU_COUNTERS** ()
		d) Start data generation	Send **SEND_DRCU_COMMAND** (A0820001)
		e) Wait 1 sec	
		f) Flush SCU FIFO	Send FLUSH(0x4000)
		g) Check time between frames corresponds to ~12.5ms	TBD
		h) Check Time Stamp in frames is less than 30 seconds	TBD
	5.	**Test 40Hz generation**	
		a) Stop data generation	Send **SEND_DRCU_COMMAND** (A0820000)
		b) Set frame rate to 40Hz	Send **SEND_DRCU_COMMAND** (A0830001)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send **SEND_DRCU_COMMAND** (A0820001)
		e) Wait 1 sec	
		f) Flush SCU FIFO	Send FLUSH(0x4000)
		g) Check time between frames corresponds to ~25ms	TBD
	6.	**Test 20Hz generation**	
		a) Stop data generation	Send DRCU_CMD(A0820000)
		b) Set frame rate to 20Hz	Send DRCU_CMD(A0830003)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(A0820001)
		e) Wait 1 sec	
		f) Flush SCU FIFO	Send FLUSH(0x4000)
		g) Check time between frames corresponds to ~50ms	TBD
	7.	**Test 10Hz generation**	
		a) Stop data generation	Send DRCU_CMD(A0820000)
		b) Set frame rate to 10Hz	Send DRCU_CMD(A0830007)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(A0820001)
		e) Wait 1 sec	
		f) Flush SCU FIFO	Send FLUSH(0x4000)
		g) Check time between frames corresponds to ~50ms	TBD

	8.	**Test Test Pattern generation**	
		i) Stop data generation	Send DRCU_CMD(A0820000)
		j) Set frame rate to 80Hz with Test Pattern Data	Send DRCU_CMD(A0838003)
		k) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		l) Start data generation	Send DRCU_CMD(A0820001)
		m) Wait 1 sec	
		n) Flush SCU FIFO	Send FLUSH(0x4000)
		o) Check time between frames corresponds to ~12.5ms	TBD
		p) Check Test Pattern is correct	TBD
		q) Stop data generation	Send DRCU_CMD(A0820000)
		r) Set nominal data mode	Send DRCU_CMD(A0830000)
Success/Failure Criteria:	Procedure completed with no errors		

Comments/Open issues:

4.4 SCU-04, SCU Low-Speed Interface Test

ID:	SCU-04		
Test name:	SCU Low-Speed Interface Test		
Purpose	Checking the operation of the interface registers and their commands		
Description of test:	The test sends commands to the subsystem interface, which passes them on to the subsystem. The time between the command being passed to the subsystem and the response from the subsystem being returned to the interface is termed the Subsystem Delay When reading a register in the subsystem the delay should be ~ 3 steps When reading from a component (e.g. an ADC) the delay is ~ 16-23 steps If a time out occurs a delay of 255 steps is returned This test sets the interface into various states and checks the response		
Test Type:	AVM/CQM/PFM/FS		
Instrument Models:	This test can be applied to both Prime and Redundant systems		
Redundancy:	SPIRE in 'READY' mode: DPU and DRCU Powered on		
Instrument Configuration:	SCOS 2000 required QLA required		
EGSE Configuration:	ILT/PLT/IST/FLT		
Level	FPU Warm or Cold, or FPU Simulator		
Test Conditions:	AVM/CQM/PFM/FS		
Constraints:			
Outline procedure and analysis:	1.	**Setup EGSE**	Set SCOS Display (SCU PARAMETERS)
	2.	**Stop Housekeeping requests to DRCU** a) Stop Critical Housekeeping b) Stop Nominal Housekeeping c) Check Housekeeping has stopped	 Send **CLEAR_HK_REPORT**(0) Send **CLEAR_HK_REPORT**(1)

	3.	**Check Timeout**	
		a) Reset Subsystem	Send **RUN_VM**(101, SCU_CMD, 1, 0xA0010005)
		b) Check command status in DPU Science Frame	SCUIFSTAT = 0x0000
		c) Send a command to the subsystem	Send **RUN_VM**(101, SCU_CMD, 1, 0xA8840000)
		d) Check command status in DPU Science Frame	SCUIFSTAT = 0x0038 SCUSSDEL = 0x0100
		e) Remove Subsystem Reset	Send **SEND_DRCU_COMMAND** (A0010007)
		f) Send a command to the subsystem	Send **RUN_VM**(101, SCU_CMD, 1, 0xA8840000)
		g) Check returned value in DPU Science Frame	RESPONSE = 0x0000
	4.	**Check Data Interface**	
		a) Reset Data Interface	Send **RUN_VM**(101, SCU_CMD, 1, 0xA0010003)
		b) Check interface status in DPU Science Frame	SCUIFSTAT = 0x0000 SCUIFCTRL = 0x0003
		c) Remove Data Interface Reset	Send **RUN_VM**(101, SCU_CMD, 1, 0xA0010007)
		d) Check interface status in DPU Science Frame	SCUIFSTAT = 0x0000 SCIIFCTRL = 0x0007
	5.	**Check Subsystem Delay**	
		a) Read a register	Send **RUN_VM**(101, SCU_CMD, 1, 0xA8840000)
		b) Check Subsystem Delay in DPU Science Frame	SCUSSDEL = 2 or 3
		c) Read an ADC	Send **RUN_VM**(101, SCU_CMD, 1, 0xA8C90000)
		d) Check Subsystem Delay in DPU Science Frame	SCUSSDEL = 16 to 23
	6.	**Check Latch up Reset**	
		a) Read a Latchup status	Send **RUN_VM**(101, SCU_CMD, 1, 0xA8800000)
		b) Check Latchup Status in DPU Science Frame	RESPONSE = 0, 1or 2
		c) Reset Latchup status	Send **SEND_DRCU_COMMAND**(A0810000)
		d) Read a Latchup status	Send **RUN_VM**(101, SCU_CMD, 1, 0xA8800000) RESPONSE = 0
		e) Check Latchup Status in DPU Science Frame	Send **SEND_DRCU_COMMAND**(A0810001)
		f) Remove Latchup Reset	

	7.	**Restart Housekeeping requests to DRCU** a) Start Critical Housekeeping b) Start Nominal Housekeeping c) Check Hsk has started	 Send **DEFINE_NEW_HK_REPORT** (0,0x300,2000,1,0,0) Send **DEFINE_NEW_HK_REPORT** (1,0x301,1000,1,1,1)
Success/Failure Criteria:	Procedure completed with no errors		

Comments/Open issues:

4.5 DCU-01, DCU High-Speed Interface Nominal Data Test

ID:	DCU-01		
Test name:	DCU High-Speed Interface Nominal Data Test		
Purpose	Checking transfer of DCU Science data frames		
Description of test:	Request science frames at various frequencies and in various quantities and check correct receipt		
Test Type:	Interface Check		
Instrument Models:	AVM/CQM/PFM/FS		
Redundancy:	This test can be applied to both Prime and Redundant systems		
Instrument Configuration:	SPIRE in 'READY' mode: DPU and DRCU Powered on		
EGSE Configuration:	SCOS 2000 required QLA required		
Level	ILT/PLT/IST/FLT		
Test Conditions:	FPU Warm or Cold, or FPU Simulator		
Constraints:			
Outline procedure and analysis:	1. b	**Setup EGSE**	b) Set SCOS Display (DPU and OBS_PARAMETERS) c) Set QLA Scrolling display of DCU Science packet header
	2.	**Setup Data contents** Set Data Mode (Full Photometer)	Send DRCU_CMD(843C0000)
	3.	**Set Nominal data Rate (15Hz)** a) Set Bias Frequency (200Hz) b) Set Sample frequency (15.3Hz)	Send DRCU_CMD(84190062) Send DRCU_CMD(8418000C)
	4.	**Request 1 frame** a) Stop data generation b) Set sequence length to 1 c) Start data generation d) Wait 1 sec e) Flush DCU FIFO **f)** Check 1 frame received, with correct contents	 Send DRCU_CMD(843E0000) Send DRCU_CMD(843D0001) Send DRCU_CMD(843E0001) Send FLUSH(0x1000) TBD

	5.	**Request 10 frames** a) Stop data generation b) Set sequence length to 10 c) Start data generation d) Wait 1 sec e) Flush DCU FIFO **f)** Check 10 frames received, with correct contents	 Send DRCU_CMD(843E0000) Send DRCU_CMD(843D000A) Send DRCU_CMD(843E0001) Send FLUSH(0x1000) TBD
	6.	**Request 100 frames** a) Stop data generation b) Set sequence length to 100 c) Start data generation d) Wait 10 sec e) Flush DCU FIFO **f)** Check 100 frames received, with correct contents	 Send DRCU_CMD(843E0000) Send DRCU_CMD(843D0064) Send DRCU_CMD(843E0001) Send FLUSH(0x1000) TBD
	7.	**Request continuous frames** a) Stop data generation b) Set sequence length to 0 c) Start data generation d) Wait 600 sec e) Stop data generation f) Flush DCU FIFO **g)** Check frames received OK	 Send DRCU_CMD(843E0000) Send DRCU_CMD(843D0000) Send DRCU_CMD(843E0001) Send DRCU_CMD(843E0000) Send FLUSH(0x1000) TBD
Success/Failure Criteria:	Procedure completed with no errors		

Comments/Open issues:

4.6 DCU-02, DCU High-Speed Interface Data Performance Test

ID:	DCU-03		
Test name:	DCU High-Speed Interface Data Performance Test		
Purpose	Checking the performance and timing of DCU science frame generation.		
Description of test:			
Test Type:	Interface Test		
Instrument Models:	AVM/CQM/PFM/FS		
Redundancy:	This test can be applied to both Prime and Redundant systems		
Instrument Configuration:	SPIRE in 'READY' mode: DPU and DRCU Powered on		
EGSE Configuration:	SCOS 2000 required QLA required		
Level	ILT/PLT/IST/FLT		
Test Conditions:	FPU Warm or Cold, or FPU Simulator		
Constraints:			
Outline procedure and analysis:	1.	**Setup EGSE**	Set SCOS Display (DPU and OBS_PARAMETERS) Set QLA Scrolling display of DCU Science packet header
	2.	**Setup Photometer Data generation** a) Set Bias Frequency (200Hz) b) Request sequence of 10 Frames	 Send DRCU_CMD(84190062) Send DRCU_CMD(843D000A)
	3.	**Setup to Test Nominal Photometer Mode** a) Set Data Mode (Full Photometer) b) Reset Time Stamp c) Wait 30 seconds	 Send DRCU_CMD(843C0000) Send SYNCHRONIZE_DRCU()

	4.	**Test 15Hz generation**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set frame rate to 15Hz	Send DRCU_CMD(8418000C)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~60ms	TBD
		h) Check Time Stamp in frames is less than 30 seconds	TBD
	5.	**Test 25Hz generation**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set frame rate to 25Hz	Send DRCU_CMD(84180007)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~40ms	TBD
	6.	**Setup toTest Non-nominal Photometer modes**	
		Set frame rate to 15Hz	Send DRCU_CMD(8418000C)
	7.	**Test Offset Mode**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set Data Mode to Offsets	Send DRCU_CMD(843C0010)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~60ms	TBD
		h) Check Data Contents	TBD

	8.	**Test Test Pattern Mode**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set Data Mode to Test Pattern	Send DRCU_CMD(843C0008)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~60ms	TBD
		h) Check Data Contents	TBD
	9.	**Test PSW Mode**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set Data Mode to PSW	Send DRCU_CMD(843C0001)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~60ms	TBD
		h) Check Data Contents	TBD
	10.	**Test PMW Mode**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set Data Mode to PMW	Send DRCU_CMD(843C0002)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~60ms	TBD
		h) Check Data Contents	TBD

	11.	**Test PLW Mode**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set Data Mode to PLW	Send DRCU_CMD(843C0003)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~60ms	TBD
		h) Check Data Contents	TBD
	12.	**Setup Spectrometer Data generation**	
		a) Set Bias Frequency (160Hz)	Send DRCU_CMD(8439007A)
		b) Request sequence of 10 Frames	Send DRCU_CMD(843D000A)
	13.	**Setup to Test Nominal Spectrometer Mode**	
		a) Set Data Mode (Full Spectrometer)	Send DRCU_CMD(843C0004)
		b) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		c) Wait 30 seconds	
	14.	**Test 80Hz generation**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set frame rate to 80Hz	Send DRCU_CMD(84380001)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~12.5ms	TBD
		h) Check Time Stamp in frames is less than 30 seconds	TBD
	15.	**Setup toTest Non-nominal Spectrometer modes**	
		None, TBC	

	16.	**Test Offset Mode**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set Data Mode to Offsets	Send DRCU_CMD(843C0014)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~12.5ms	TBD
		h) Check Data Contents	TBD
	17.	**Test Test Pattern Mode**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set Data Mode to Offsets	Send DRCU_CMD(843C000C)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~12.5ms	TBD
		h) Check Data Contents	TBD
	18.	**Test SSW Mode**	
		a) Stop data generation	Send DRCU_CMD(843E0000)
		b) Set Data Mode to SSW	Send DRCU_CMD(843C0006)
		c) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		d) Start data generation	Send DRCU_CMD(843E0001)
		e) Wait 1 sec	
		f) Flush DCU FIFO	Send FLUSH(0x1000)
		g) Check time between frames corresponds to ~12.5ms	TBD
		h) Check Data Contents	TBD

	19.	**Test SLW Mode** a) Stop data generation b) Set Data Mode to SLW c) Reset Time Stamp d) Start data generation e) Wait 1 sec f) Flush DCU FIFO g) Check time between frames corresponds to ~12.5ms **h)** Check Data Contents	 Send DRCU_CMD(843E0000) Send DRCU_CMD(843C0005) Send SYNCHRONIZE_DRCU() Send DRCU_CMD(843E0001) Send FLU SH(0x1000) TBD TBD
	20.	**Reset to Nominal Modes** a) Stop data generation **b)** Set Data Mode to Full Photometer	 Send DRCU_CMD(843E0000) Send DRCU_CMD(843C0000)
Success/Failure Criteria:	Procedure completed with no errors		

Comments/Open issues:

4.7 DCU-03, DCU Low-Speed Interface Test

ID:	DCU-03		
Test name:	DCU Low-Speed Interface Test		
Purpose	Checking the operation of the interface registers and their commands		
Description of test:	The test sends commands to the subsystem interface, which passes them on to the subsystem. The time between the command being passed to the subsystem and the response from the subsystem being returned to the interface is termed the Subsystem Delay When reading a register in the subsystem the delay should be ~ 3 steps When reading from a component (e.g. an ADC) the delay is ~ 16-23 steps If a time out occurs a delay of 255 steps is returned This test sets the interface into various states and checks the response		
Test Type:	AVM/CQM/PFM/FS		
Instrument Models:	This test can be applied to both Prime and Redundant systems		
Redundancy:	SPIRE in 'READY' mode: DPU and DRCU Powered on		
Instrument Configuration:	SCOS 2000 required QLA required		
EGSE	ILT/PLT/IST/FLT		
Level	FPU Warm or Cold, or FPU Simulator		
Test Conditions:	AVM/CQM/PFM/FS		
Constraints:			
Outline procedure and analysis:	1.	**Setup EGSE**	Set SCOS Display (DCU PARAMETERS)
	2.	**Stop Housekeeping requests to DRCU** a) Stop Critical Housekeeping b) Stop Nominal Housekeeping c) Check Hsk has stopped	 Send CLEAR_HSK_DEFN(0) Send CLEAR_HSK_DEFN(1)

	3.	**Check Timeout**	
		a) Reset Subsystem	Send RUN_VM(101, DCU_CMD, 1, 0x80010005)
		b) Check command status in DPU Science Frame	DCUIFSTAT = 0x0000
		c) Send a command to the subsystem	Send RUN_VM(101, DCU_CMD, 1, 0x8C000000)
		d) Check command status in DPU Science Frame	DCUIFSTAT = 0x0038 DCUSSDEL = 0x0100
		e) Remove Subsystem Reset	Send DRCU_CMD(80010007)
		f) Send a command to the subsystem	Send RUN_VM(101, DCU_CMD, 1, 0x8C000000)
		g) Check returned value in DPU Science Frame	RESPONSE = 0x0000
	4.	**Check Data Interface**	
		e) Reset Data Interface	Send RUN_VM(101, DCU_CMD, 1, 0x80010003)
		f) Check interface status in DPU Science Frame	DCUIFSTAT = 0x0000 DCUIFCTRL = 0x0003
		g) Remove Data Interface Reset	Send RUN_VM(101, DCU_CMD, 1, 0x80010007)
		h) Check interface status in DPU Science Frame	DCUIFSTAT = 0x0000 DCIIFCTRL = 0x0007
	5.	**Check Subsystem Delay**	
		e) Read a register	Send RUN_VM(101, DCU_CMD, 1, 0xC0000000)
		f) Check Subsystem Delay in DPU Science Frame	DCUSSDEL = 2 or 3
		g) Read an ADC	Send RUN_VM(101, DCU_CMD, 1, 0x8C330000)
		h) Check Subsystem Delay in DPU Science Frame	DCUSSDEL = 16 to 23

	6.	**Restart Housekeeping requests to DRCU** d) Start Critical Housekeeping e) Start Nominal Housekeeping f) Check Hsk has started	 Send DEFINE_HSK_REPORT(0,0x300,2000,1,0,0) Send DEFINE_HSK_REPORT(1,0x301,1000,1,1,1)
Success/Failure Criteria:	Procedure completed with no errors		

Comments/Open issues:
This test requires a Command List which send a given DRCU command and returns the response, and the I/F status words

4.8 MCU-01, MCU power on

ID:	MCU-01		
Test name:	MCU Power On		
Purpose	To power on the MCU into a state ready to execute SMEC or BSM commands. This procedure also tests the low speed interface to the MCU, used for command and housekeeping data transfer		
Description of test:	Apply power to MCU from SCU and boot the MCU DSP ROM software, checking voltages and status		
Test Type:	Configuration		
Instrument Models:	AVM/CQM/PFM/FS		
Redundancy:	prime and redundant		
Instrument Initial Configuration:	SPIRE in READY mode		
EGSE Configuration:	SCOS-2000 required		
Level	ILT/PLT/IST/FLT		
Test Conditions:	Warm and cold		
Constraints:	None		
Outline procedure and analysis:	1.	**Setup EGSE**	**Select SCOS display** (MCU_PARAMETERS)
	2.	**Power on MCU**	Send DRCU_CMD(A0870004)
	3.	**Check MCU power status**	SCUDCDCSTAT = 4 MCU+5V = 0xA804 MCU+15V = 0xF810 MCU-15V = 0x07ED MCU+13V = 0cE80E MCU-13V = 0x17EF MCUMACTEMP = 0x1000 MCUSMECTEMP = 0x1000 MCUBSMTEMP = 0x1000
	4.	**Reset MCU Subsystem** a) Reset on b) Wait 5 seconds c) Reset off d) Wait 5 seconds e) Check Status	 Send DRCU_CMD(90010005) Send DRCU_CMD(90010007) MCUBOOTSTAT = 0x0001 MCUIFSTAT = 0x0000

	5.	**Boot MCU** a) Download Code to RAM b) Wait 5 seconds c) Check Boot Status d) Start Code in RAM	 Send DRCU_CMD(9021C000) MCUBOOTSTAT = 0x0001 Send DRCU_CMD(90240001)
	6.	**Check MCU status**	MCUBOOTSTAT = 0x0001 MCUIFSTAT = 0x0000 MCUERR = 0x0000 MCUSCHEDCNTLSW = TBD MCUSCHEDCNTMSW = TBD
Success/Failure Criteria:	Procedure completed with no errors		

Comment/Open Issue:

4.9 MCU-02, MCU High-Speed Interface Nominal Data Test

ID:	MCU-02		
Test name:	MCU High-Speed Interface Nominal DataTest		
Purpose	Checking transfer of MCU Nominal Science data frames		
Description of test:	Request science frames at frequencies associated with nominal operations and in various quantities and check correct receipt. Number of frames and frequencies are: SMEC: ~1000 and continuous frames at 253Hz BSM: ~250 and continuous at 63Hz SMEC+BSM (Scanning mode): continuous at 253+16Hz		
Test Type:	Interface Check		
Instrument Models:	AVM/CQM/PFM/FS		
Redundancy:	This test can be applied to both Prime and Redundant systems		
Instrument Configuration:	SPIRE in 'REDY' mode: DPU and DRCU Powered on		
EGSE Configuration:	SCOS 2000 required QLA required		
Level	ILT/PLT/IST/FLT		
Test Conditions:	FPU Warm or Cold, or FPU Simulator		
Constraints:			
Outline procedure and analysis:	1.	**Setup EGSE**	Set SCOS Display (DPU and OBS_PARAMETERS) Set QLA Scrolling display of SMEC and BSM Science packet headers
	2.	**Setup Data contents**	TBD
	3.	**Setup SMEC Nominal data** a) Uplink SMEC Selection Table b) Set Selection c) Stop Data generation d) Reset Time Stamp	 Execute Load_SMEC_Selection _Table Send ENABLE_SELECTION(1, 0x1001, 0x0A, 0x0A) Send DRCU_CMD(91C00000) Send SYNCHRONIZE_DRCU()

	4.	**Request ~1000 frames** a) Start data generation at 253Hz b) Wait 4 sec c) Stop data generation d) Flush MCU FIFO **e)** Check ~1000 frames received, with correct contents, and time interval	 Send DRCU_CMD(91C0000B) Send DRCU_CMD(91C00000) Send FLUSH(0x2000) TBD
	5.	**Request continuous frames** a) Start data generation at 253Hz b) Wait 15 mins, TBC c) Stop data generation d) Flush MCU FIFO **e)** Check frames received OK	 Send DRCU_CMD(91C0000B) Send DRCU_CMD(91C00000) Send FLUSH(0x2000) TBD
	6.	**Setup BSM Nominal data** a) Stop Data generation b) Reset Time Stamp	 Send DRCU_CMD(91C20000) Send SYNCHRONIZE_DRCU()
	7.	**Request ~250 frames** a) Start data generation at 63Hz b) Wait 4 sec c) Stop data generation d) Flush MCU FIFO **e)** Check ~250 frames received, with correct contents, and time interval	 Send DRCU_ CMD(91C2002C) Send DRCU_CMD(91C20000) Send FLUSH(0x2000) TBD
	8.	**Request continuous frames** a) Start data generation at 63Hz b) Wait 15 mins, TBC c) Stop data generation d) Flush MCU FIFO **e)** Check frames received OK	 Send DRCU_CMD(91C2002C) Send DRCU_CMD(91C20000) Send FLUSH(0x2000) TBD

	9.	**Request Scanning nominal data** a) Stop data generation b) Reset Time Stamp c) Start SMEC frames at 253Hz d) Start BSM frames at 16Hz e) Wait 15 mins f) Stop data generation g) Check both types of frames received with correct contents, and time interval	 Send DRCU_CMD(91C00000) Send DRCU_CMD(91C20000) Send SYNCHRONIZE_DRCU() Send DRCU_CMD(91C0000B) Send DRCU_CMD(91C200AD) Send DRCU_CMD(91C00000) Send DRCU_CMD(91C20000) TBD
Success/Failure Criteria:	Procedure completed with no errors		

Comments/Open issues :

4.10 MCU-03, MCU High-Speed Interface Data Performance Test

ID:	MCU-03		
Test name:	MCU High-Speed Interface Data PerformanceTest		
Purpose	Checking the performance and timing of MCU science frame generation.		
Description of test:	The following tests are made Generation of SMEC packets at 320Hz Generation of BSM packets at 80Hz Generation of Test Packets at 400Hz Generation of Engineering packets at 400Hz For each frame type the reset of the Time Stamp word in data frames is checked and the frame rate accuracy		
Test Type:	Interface Test		
Instrument Models:	AVM/CQM/PFM/FS		
Redundancy:	This test can be applied to both Prime and Redundant systems		
Instrument Configuration:	SPIRE in 'READY' mode: DPU and DRCU Powered on		
EGSE Configuration:	SCOS 2000 required QLA required		
Level	ILT/PLT/IST/FLT		
Test Conditions:	FPU Warm or Cold, or FPU Simulator		
Constraints:			
Outline procedure and analysis:	1.	**Setup EGSE**	Set SCOS Display (DPU and OBS_PARAMETERS) Set QLA Scrolling display of MCU Science packet headers
	2.	**Setup Data contents**	TBD
	3.	**Setup SMEC data** a) Uplink SMEC Selection Table b) Set Selection c) Stop Data generation d) Reset Time Stamp e) Wait 30 secs	 Execute Load_SMEC_Selection _Table Send ENABLE_SELECTION(1, 0x1001, 0x0A, 0x0A) Send DRCU_CMD(91C00000) c

	4.	**Request SMEC frames**	
		a) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		b) Start data generation at 400Hz	Send DRCU_CMD(91C00004)
		c) Wait 4 sec	
		d) Stop data generation	Send DRCU_CMD(91C00000)
		e) Flush MCU FIFO	Send FLUSH(0x2000)
		f) Check frames received, with correct contents, time interval, and time stamp has been reset	TBD
	5.	**Request BSM frames**	
		a) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		b) Start data generation at 80Hz	Send DRCU_CMD(91C20023)
		c) Wait 4 sec	
		d) Stop data generation	Send DRCU_CMD(91C20000)
		e) Flush MCU FIFO	Send FLUSH(0x2000)
		f) Check frames received, with correct contents, time interval, and time stamp has been reset	TBD
	6.	**Request Test frames**	
		a) Reset Time Stamp	Send SYNCHRONIZE_DRCU()
		b) Start data generation at 400Hz	Send DRCU_CMD(91C40004)
		c) Wait 4 sec	
		d) Stop data generation	Send DRCU_CMD(91C40000)
		e) Flush MCU FIFO	Send FLUSH(0x2000)
		f) Check frames received, with correct contents, time interval, and time stamp has been reset	TBD

	7.	**Request Engineering frames** a) Reset Time Stamp b) Start data generation at 400Hz c) Wait 4 sec d) Stop data generation e) Flush MCU FIFO **f)** Check frames received, with correct contents, time interval, and time stamp has been reset	 Send SYNCHRONIZE_DRCU() Send DRCU_CMD(91C50004) Send DRCU_CMD(91C50000) Send FLUSH(0x2000) TBD
Success/Failure Criteria:	Procedure completed with no errors		

Comments/Open issues:

4.11 MCU-04, MCU Low-Speed Interface Test

ID:	MCU-04		
Test name:	MCU Low-Speed Interface Test		
Purpose	Checking the operation of the interface registers and their commands		
Description of test:	The test sends commands to the subsystem interface, which passes them on to the subsystem. The time between the command being passed to the subsystem and the response from the subsystem being returned to the interface is termed the Subsystem Delay When reading a register in the subsystem the delay should be ~ 3 steps When reading from a component (e.g. an ADC) the delay is ~ 16-23 steps If a time out occurs a delay of 255 steps is returned This test sets the interface into various states and checks the response		
Test Type:	AVM/CQM/PFM/FS		
Instrument Models:	This test can be applied to both Prime and Redundant systems		
Redundancy:	SPIRE in 'READY' mode: DPU and DRCU Powered on		
Instrument Configuration:	SCOS 2000 required QLA required		
EGSE Configuration	ILT/PLT/IST/FLT		
Level	FPU Warm or Cold, or FPU Simulator		
Test Conditions:	AVM/CQM/PFM/FS		
Constraints:			
Outline procedure and analysis:	8.	**Setup EGSE**	Set SCOS Display (SCU PARAMETERS)
	9.	**TBD**	
Success/Failure Criteria:	Procedure completed with no errors		

Comments/Open issues:
This test requires a Command List which send a given DRCU command and returns the response, and the I/F status words