HIRDLS

TP-OXF-225

HIGH RESOLUTION DYNAMICS LIMB SOUNDER

Originator: C Hepplewhite

Date: 21 June 2000

Subject/Title: **IFC Comprehensive & Limited Performance Test Procedures**

Description/Summary/Contents:

Two procedures are covered by this document - the IFC comprehensive performance tests (CPT) and the IFC limited performance tests (LPT).

This document covers those items identified in the IFC subsystem specification document which must be verified by test.

Keywords:

Reviewed/Approved by: Date (yy-mm-dd):			

Oxford University
Atmospheric, Oceanic & Planetary Physics
Parks Road
OXFORD OXI 3PU
United Kingdom

EOS

Signature List

IFC Responsible Engineer
C. Hepplewhite (Oxford University)

UK Programme manager
N. Morris (RAL)

HIRDLS System Engineer
J Whitney (Oxford University)

Technical Manager
E. Johnson (Lockheed)

Contents

1. General

1.1 Purpose & Scope

This document provides the combined procedures for limited & comprehensive performance testing of the IFC. This is possible because of the simplicity of the interfaces to the IFC and its single operating mode. The sections required for only the LPT are listed below.

Limited performance tests are required to demonstrate what if any changes have occurred in the performance of the IFC with exposure to thermal vacuum cycling or vibration. In this case they are also used for release and bench acceptance tests before and after shipment.

Limited performance testing of the BEU is achieved using the dummy BB which provides a known reference calibration point for the thermometry bridge in the BEU.

Comprehensive performance testing of the IFC ensures that all sub-modes for the IFC are demonstrated and that the IFC provides the performance required over the range of specified electrical supply conditions. Because it is not possible to isolate the effect of temperature changes in the IFCBB from changes of BEU bridge performance, part of the CPT includes use of the IFCBB-simulator as this provides standard resistance values.

Note that the IFC has only one operating mode – however there are five sub-states that can be considered: Off, Quiescent/active, Valid control & data, IFCBB warming, IFCBB at thermal equilibrium. These are explained elsewhere (RD4).

Electrical interface items are covered in RD1.

All the elements of the procedure are identical for side-A and side-B of the IFC.

1.2 References & Related documents:

RD1 sp-oxf-212 IFC Functional & Interface test procedures.
RD2 sp-oxf-240 IFC Thermometric test procedures.
RD3 sp-oxf-044 IFC Subsystem Specification Document.
RD4 sp-oxf-stm IFC safe to mate procedure
RD5 sp-oxf-nnn IFC IPU Simulator set-up & operating procedures.
RD6 sp-hir-267 IFC to IPS Interface Control Document.
RD7 sp-hir-223 IFC Thermal Vacuum Test Procedure.

1.3 Acronyms & Abbreviations

IFC Science Telemetry/Data: Data obtained from the IFC bridge circuit, giving a 24-bit number corresponding to the temperature sensors in the black body (or is simulator).
IFCBB Dummy/Simulator: The electrical simulator for the IFC BB giving a single point calibration for the bridge circuit.

2 Equipment & Facilities

2.1 Facility Environments and Precautions

Standard precautions shall be adopted when handling flight hardware, this includes ESD and contamination control. Unless operated on a class 100 flow-bench, the U25 cable will remain sleeved in a protective bag.

The procedures outlined below shall be carried out on the bench, in the instrument or in the vacuum chamber.

2.2 Equipment

The following items of equipment are required:
PFM IFC Black Body (IFCBB)
PFM IFC Electronics Unit (BEU) with connector savers
PFM BEU to IFCBB cable (U25).
IFCBB Simualtor (dummy BB).
IFC IPU Simualtor, consisting of:
- DC Bench power supplies,
- PC node
- 500 Hz sync generator.
- Switch Box.
- U15 test harness.

Digital voltmeter.

2.3 Configuration & Flow

The following methodology shall be adopted when first preparing to carry out live tests on the IFC subsystem:
1. Visual inspection of the units.
2. Prepare the test area.
3. Lay out the units with including box ground connections.
4. Prepare the IPU simulator.
5. Safe to mate if configuration changed.
6. Mate up the units.
7. Aliveness test.
8. These procedures.

2.4. LPT & CPT lists

2.4.1 LPT Items

1. Nominal Science & Housekeeping telemetry.
2. Heater function.

2.4.2 CPT items:

1. Science temperature measurement accuracy & resolution. (refer to RD2)
2. Power consumption at supply rails (quiescent & peak power).
3. Performance sensitivity to supply rail voltages (min, nom, max).
4. Housekeeping telemetry verification.
5. Heater & thermal response.

3. Detailed Procedures:

3.1 Science temperature measurement accuracy & resolution

See procedure RD2.

3.2 Power consumption

Determine power at each supply rail when operating in nominal mode & full power mode.

Configuration 1. (BEU, U25 Dummy BB + IPU Simulator, on the bench)

STEP	DETAILS	RESULTS	INITs
	Configure equipment & IFC per fig. 1a		
	Select Side-A, Safe-to-mate & connect up		
	Apply nominal power & Verify HCW=00 record voltages across each line impedance. +15V: @ 75mA -15V:@ 50mA +5 V:@ 95mA		
	Send command HCW=FF record voltage across each line impedance +15V: @140mA -15V: @55mA +5V: @95mA		
	Power-down.		
	Select Side-B, Safe-to-mate & connect up		
	Apply nominal power & Verify HCW=00 record voltages across each line impedance. +15V: @ 75mA -15V:@ 50mA +5 V:@ 95mA		
	Send command HCW = FF record voltage across each line impedance +15V: @140mA -15V: @55mA +5V: @95mA		
	Power down and make safe		
	Are the results for these steps satisfactory?	(Yes/No)	

3.3 Sensitivity to supply rail voltages.

Configuration 1.
Determine change in telemetry and heater power level for minimum and maximum specified supply rail voltages.

STEP	DETAILS	RESULTS	INITs
	Configure equipment & IFC per fig. 1b		

STEP	DETAILS	RESULTS	INITs
	Select Side-A, Safe-to-mate & connect up		
	Apply minimum specified supply voltages & Verify HCW=00 record voltages across each line impedance.	+15V: @15.00 -15V: @-15.00 +5V: @+5.00	
	Log all telemetry values - ensure readings are stable. (<2 LSB pk.). Record Log file & time reference.		
	Send command HCW=FF record voltage across each line impedance	+15V: -15V: +5V:	
	Measure voltage across "heater" terminal of the dummy BB.		
	Power-down.		
	Select Side-B, Safe-to-mate & connect up		
	Apply maximum specified supply voltages & Verify HCW=00 record voltages across each line impedance.	+15V: @ 15.30 -15V: @-15.30 +5V: @5.10	
	Log all telemetry values - ensure readings are stable. (<2 LSB pk.)		
	Send command HCW=FF record voltage across each line impedance	+15V: -15V: +5V:	
	Power down and make safe.		
	Are the results for these steps satisfactory?	(Yes/No)	

3.4 Nominal Housekeeping & Science Telemetry Test

Configuration 1 - IFCBB-simulator.
Scope: verify that data fields are filled with valid data.
Note: Oven _temperature reading depends upon BEU environment temperature.

STEP	DETAILS	RESULTS	INITs
	Configure equipment & IFC per fig. 1b		
	Select Side-A, Safe-to-mate & connect & power up		
	Log telemetry values (ensure the readings are steady to <2LSB)		
	+15V_mon: 0x00EA -15V_mon: 0x00EA +5V_mon: 0x00DD Oven_temp: 0x007B PRT-1: 0xAFB7 PRT-2: 0xABC4 PRT-3: 0xA7D4		

STEP	DETAILS	RESULTS	INITs
	Select Side-B, Safe-to-mate & connect & power up		
	Log telemetry values (ensure the readings are steady to <2LSB)		
	+15V_mon: 0x00EA -15V_mon: 0x00EA +5V_mon: 0x00DD Oven_temp: 0x007B PRT-1: 0xAFC8 PRT-2: 0xABCF PRT-3: 0xA7DC		
	power-down and make safe.		
	Are the results for these steps satisfactory?	(Yes/No)	

3.5 Telemetry Conversions

The supply rail voltage telemetry conversions are verified by test in the procedure 3.3. The Oven temperature telemetry is verified during the T/V test

3.6 AD590 sensor function

Determine that the AD590 temperature sensors on the IFCBB front aperture plate are connected with the correct polarity, and are alive. Note that the IFC does not sample or condition the AD590 sensors. The IFC only provides straight through wire connections to the IPU.

STEP	DETAILS	RESULTS	INITs
	Configure equipment & IFC per fig 1 with bias source for the AD590s.		
	Select side A, Safe-to-mate & connect up		
	Apply bias power & measure the voltage across the bias resistor. nom value:		
	Power down and select side B.		
	Apply bias power & measure the voltage across the bias resistor. nom value:		
	Power down.		
	Are the results for these steps satisfactory?	(Yes/No)	

3.7 Heater Function (LPT)

Configuration 1 (IFCBB simulator)
Verify function of heater power controller.

STEP	DETAILS	RESULTS	INITs
	Configure equipment & IFC per fig 1.		
	Select side A, Safe-to-mate & connect up		
	Apply power		
	Verify heater supply to IFCBB-A simulator is off (measure voltage across test terminals).	<0.25V	
	Send HCW_word1 (40AB) & measure heater supply voltage.	10.2V	
	Power down.		
	Select side A, Safe-to-mate & connect up		
	Apply power		
	Verify heater supply to IFCBB-B simulator is off (measure voltage across test terminals).	<0.25V	
	Send HCW_word1 (40AB) & measure heater supply voltage.	10.2V	
	Power down & make safe.		
	Are the results for these steps satisfactory?	(Yes/No)	

3.8 Heater command response (CPT)

Configuration 1 (IFCBB simulator)
Verify that all heater decode bits function correctly and supply the expected power to the IFCBB heater element.

STEP	DETAILS	RESULTS	INITs
	Configure equipment & IFC per fig 1b.		
	Select side A, Safe-to-mate & connect up		
	Apply power & Verify HCW=00.		
	Record voltage across "heater" terminals	<0.25V	
	Send HCW=01		
	Record voltage across "heater" terminals		
	Send HCW=02		
	Record voltage across "heater" terminals		
	Send HCW=04		
	Record voltage across "heater" terminals		
	Send HCW=08		
	Record voltage across "heater" terminals		
	Send HCW=0F		

STEP	DETAILS	RESULTS	INITs
	Record voltage across "heater" terminals		
	Send HCW=20		
	Record voltage across "heater" terminals		
	Send HCW=40		
	Record voltage across "heater" terminals		
	Send HCW=80		
	Record voltage across "heater" terminals		
	Send HCW=80		
	Record voltage across "heater" terminals		
	Send HCW=FF		
	Record voltage across "heater" terminals		
	Power down.		
	Select side B, Safe-to-mate & connect up		
	Apply power & Verify HCW=00.		
	Send HCW=01		
	Record voltage across "heater" terminals		
	Send HCW=02		
	Record voltage across "heater" terminals		
	Send HCW=04		
	Record voltage across "heater" terminals		
	Send HCW=08		
	Record voltage across "heater" terminals		
	Send HCW=0F		
	Record voltage across "heater" terminals		
	Send HCW=20		
	Record voltage across "heater" terminals		
	Send HCW=40		
	Record voltage across "heater" terminals		
	Send HCW=80		
	Record voltage across "heater" terminals		
	Send HCW=80		
	Record voltage across "heater" terminals		
	Send HCW=FF		
	Record voltage across "heater" terminals		
	Power down and make safe.		
	Are the results for these steps satisfactory?	(Yes/No)	

3.9 Heater thermal response

Configuration 2 (IFCBB on the bench, in vacuum or in the instrument)
Verify that the heater in the IFCBB supplies heat to the unit and the science temperature sensors respond.
Note: the thermal rise time and expected maximum temperature for the cavity will be tested during the T/V test (RD7).

STEP	DETAILS	RESULTS	INITs
	Configure equipment & IFC per fig 2.		
	Select side A, Safe-to-mate & connect up		
	Apply power & Verify HCW=00.		
	Poll the IPU for 5 minutes and log all telemetry. Note the log file and time reference:		
	Send HCW word 1 (40AB)		
	Continue IPU poll for a further 30 minutes and log all telemetry. Note the log file and time reference.		
	Terminate IPU poll, send HCW=00 an wait for 30 minutes.		
	Select side B, Safe-to-mate & connect up		
	Apply power & Verify HCW=00.		
	Poll the IPU for 5 minutes and log all telemetry. Note the log file and time reference:		
	Send HCW word 1 (40AB)		
	Continue IPU poll for a further 30 minutes and log all telemetry. Note the log file and time reference.		
	Terminate IPU poll, power down and make safe.		
	Are the results for these steps satisfactory?	(Yes/No)	

4. Reporting

This procedure will be completed and form the body of the report. Log files are automatically created when polling from the IPU GSE.

These activities will be referenced and where appropriate further details are recorded in the IFC logbook.

[END]