SKYNAV DME BY INTELCAN

Distance Measuring Equipment

Maintenance Manual

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Revisions

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SAFETY SUMMARY

The following are safety precautions that personnel must understand and apply during the phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

To avoid electrical shock, operating personnel must observe all safety regulations at all times. Do not replace components or make adjustments to the equipment with the high voltage supply turned on. Under certain conditions, the potential of danger is present due to charges retained by capacitors that may exist in circuits, even though the power control switch is in the OFF position. To avoid casualties, always remove power, discharge and ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE

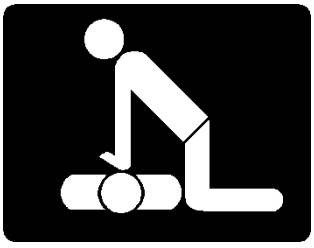
Under no circumstances should any person reach into or enter an enclosure which contains a high voltage component which requires service or adjustment without the presence of another person who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

FIRST AID IN CASE OF ELECTRICAL SHOCK

First aid is the initial care given to an injured person. It is usually performed by a non-expert, but trained personnel to an injured person until definitive medical treatment can be accessed. Certain minor injuries may not require further medical care beyond the first aid intervention. It generally consists of a series of simple and in some cases, potentially life-saving techniques that an individual can be trained to perform with minimal equipment.



Mostly, this timely care prior to the arrival of the medical help can mean the difference between life and death. It must start immediately when the injury or illness occurs and continue until medical help arrives or the casualty recovers. The first hour after the trauma is called the ‘golden hour’. If proper first aid is given, the victim has a greater chance of survival and a reduction in the severity of their injuries.

The basic aims of first aid are:

- To save life
- To prevent further harm: also sometimes called preventing the condition from worsening, or danger of further injuries
- To reduce pain
- To promote recovery

PROTECTION OF ELECTRO STATIC DISCHARGE (ESD)

To reduce the risk of equipment damage, the system should be kept in an electrostatic discharge (ESD) protected environment. The equipment should be properly grounded at all times. When performing routine maintenance on the unit, a wrist strap should be plugged into the ESD jack located on front panel of the cabinet.

To prevent ESD damage the following precautions must be taken:

- Wear an ESD grounding strap connected to a proper ground when handling modules.
- Keep boards in their antistatic protection bags until you are ready to install them.
- Do not touch pins, leads, or solder connections on the boards.
- Handle modules only by their edges, ejector handles, or stiffener rails.
- Store and ship modules in antistatic protection packaging.

ESD GROUND CONNECTION

The rack provides an ESD ground connection in the form of grounding plugs for installation and removal of user-serviceable components. Use an ESD wrist strap attached to the grounding plugs; one is located on the front and one on the rear of the rack.

1. INTRODUCTION

This document provides the technical maintenance theory and procedures for the SKYNAV N9000 Distance Measuring Equipment system (DME).

1.1 Intended Audience

This document is intended for technical personnel involved in the maintenance of the DME system.

2. LIST OF ABBREVIATIONS

Abbreviation	Meaning
AC/DC	Alternative Current to Direct Current converter
ADC	Analog to Digital Converter
BITE	Built-In Test Equipment
DAC	Digital to Analog Converter
dBi	Decibels With Respect to An Isotropic Radiator
DME	Distance Measuring Equipment
EEPROM	Electrically Erasable Programmable Read Only Memory
FDU	Front Display Unit
FPGA	Field Programmable Gate Array
IC	Integrated Circuit
ICAO	International Civil Aviation Organization
IDENT	Identification
ILS	Instrument Landing System
IF	Intermediate Frequency
IO	Input Output
LED	Light Emitting Diode
LLZ	Localizer
LRU	Line Replaceable Unit
LPU	Low Power amplificatier Unit
MOD	Modulation Module (CCA) inside the LPU
MOU	Monitor Unit
MPU	Main Processing Unit
MTBF	Mean Time Before Failure
PRF	Pulse Repetition Frequency
PPPS	Pulse-Pairs per Second
PSU	Power Supply Unit
RAM	Random Access Memory
RCU	Remote Control Unit
RF	Radio Frequency
RMM	Remote Maintenance Monitoring
RSU	Remote Status Unit
RTC	Real Time Clock

Abbreviation	Meaning
TCM	Transceiver Control Module
TTL	Transistor-Transistor Logic
TRX	Transmit and Receive Module
TXD	Transmitted Data
TRU	Transponder Unit
USB	Universal Serial Bus

3. PREVENTIVE MAINTENANCE

Intelcan recommends that regular scheduled maintenance be performed on the DME systems to ensure its proper operation and extend its life. There are three recommended maintenance periods:

- Weekly
- Every six months
- Every twelve months

The three maintenance periods are recommendations for DME systems operating in a normal environment. It is assumed that technical maintenance personnel are trained in the operation and maintenance of DME equipment.

Technical maintenance authorities may wish to adjust intervals or add additional maintenance checks in accordance with their policies and available test equipment.

Note: During the maintenance checks, no adjustments or alignments of any configurable parameter are to be done. All measured parameters shall be recorded and compared with the nominal operational values that were recorded as baseline references after the flight check.

During the expected life span of the equipment, some parameters may change, caused by the environment. Changes of less than 50% of the configured alarm limit threshold are acceptable. For example, if the nominal parameter is 100 and the alarm limit is 110, a change of 50% will be 105.

If a parameter varies by more than 50% of its configured alarm limit, corrective action shall be taken to investigate and correct the issue. If corrective measures do not resolve the problem, the defective unit should be replaced with a spare unit. Depending on the severity of the equipment fault issue, a flight check may be advisable to check that all parameters are within the standard required operating tolerances.

The defective unit should be returned to the factory for service.

3.1 Maintenance Schedule

The schedule for recommended DME preventive maintenance procedures is described in Table 1

Table 1 - Schedule of Maintenance Procedures

No.	Parameter	Expected	Test Equipment	Periodicity	Note
1	Visual check antenna and shelter around	Normal and In good shape	N/A	Weekly	
2	Monitors Status Readings	No Alarms or Warnings	FDU / RMM	Weekly	
3	BITE Status Readings	No Warnings	FDU / RMM	Weekly	

No.	Parameter	Expected	Test Equipment	Periodicity	Note
4	Print Status Report		RMM	Weekly	
5	TX pulse spacing	12 ± 0.5 µs (X Mode)	Oscilloscope	6 months	
6	TX peak power	≥100 W /1000W	Power Meter	6 months	
7	TX PRF	Minimum 700 pps	Freq. Counter	6 months	
8	Reply delay	50 µs ± 0.5 µs (X Mode)	Oscilloscope	6 months	
9	TX frequency	± 20KHz	Freq. Counter	Annually	
10	INT frequency	± 20KHz	Freq. Counter	Annually	
11	Identification	1350 pps + Morse timing	Oscilloscope	Annually	Note 1
12	Shutdown/Changeover	Delay > 0.5 µs for 10 s	RMM	Annually	Note 1
Note 1	Transmitter will be on/off. The DME operation will be interrupted (around 20 minutes for each DME)				

3.1.1 Weekly Maintenance Checks

The following actions are performed during the weekly maintenance checks:

- Visually check site condition and status
- Check all noted parameters
- Record all parameters and compare with nominal operating values
- Generate a status report using RMM

3.1.1.1 Site Visual Check

- Visually check the DME antenna
- Visually check shelter and equipment
- Make a “Visual Check Normal or Abnormal” note on maintenance log book. If abnormal, describe the details on the maintenance log book.

3.1.1.2 Monitors Status Readings

- Check all monitor parameter status readings using RMM or FDU
- Confirm that there are no alarms or warnings
- Compare with nominal operating values

3.1.1.3 BITE Status Readings

- Confirm all maintenance values are within specifications using RMM or FDU
- Compare with nominal operating values

3.1.1.4 Print Status Report

- Print status report using RMM

- Archive the report in binder.

3.1.2 Six-Month Maintenance Checks

The following actions are performed during the six-monthly maintenance checks:

- Check transponder pulse pair spacing
- Check transponder peak power
- Check transponder PRF (Pulse repetition frequency)
- Check Transponder Reply Delay

3.1.2.1 Pulse Pair Spacing

- Connect the oscilloscope MOU's test port TX1 ENV.
- Connect the oscilloscope to trigger input on INT ENV.
- Measure the time interval between the 1st pulse and 2nd pulse at 50% amplitude point of rising edge.
- Repeat for TX2 ENV.

3.1.2.2 Transponder Peak Power

- Connect the power meter to the DPU's test port TX1 CPL.
- Set the power meter to the carrier frequency in use.
- Set the power meter offset to value from the sticker on the DPU, which is the coupling factor on the DPU's test port.
- Read the power should be 100W or above. If it is lower than 100 W, adjust it from RMM > Config > Transponder.
- Record the tested values.

3.1.2.3 Transponder Pulse Repetition Frequency (PRF)

- Connect the low frequency channel of the frequency counter to the TRU's test port TX GAU.
- Set the frequency counter averaging to approximately 8 counts.
- The counter will display the number of single pulses, divided by two; this provides the number of transmitted pps.
- The transmit rate can also be viewed on the FDU's Monitor Readings screen, or the RMM/LMM > Status > Monitors.
- The squitter rate may be adjusted to a live display of the transmit rate change; to do so, go to LMM > Configuration > Transponder.

3.1.2.4 Reply Delay

- Connect the oscilloscope first channel to the MOU's test port INT ENV.
- Connect the oscilloscope second channel to the MOU's test port TX1 ENV.
- Adjust the oscilloscope to trigger on INT ENV, which is the interrogation.
- Measure the time between the peak of INT ENV and the peak of TX1 ENV.

- Repeat for TX2 ENV
- Record the tested values

3.1.3 Annually Maintenance Checks

The following actions are performed during the annually maintenance checks:

- Check Transponder and Interrogator frequencies
- Check Identification
- Changeover and Shutdown

3.1.3.1 Transponder and Interrogator Frequencies

- Connect the frequency counter to the TRU's test port TX FREQ.
- The measured value should be at the assigned transmit frequency and should not drift or fluctuate by more than 20 kHz
- Repeat by measuring the MOU's test port INT FREQ.
- The measured value should be at the assigned receive frequency and should not drift or fluctuate by more than 20 kHz
- Record the tested values

3.1.3.2 Identification

This test puts the system out of operation; ensure that it is conducted at the proper time and that the concerned parties are informed (NOTAM may be required).

- Connect the oscilloscope's first channel to the TRU's test port TX GAU.
- Reduce the time span by 500 msec/DIV until the ident appears every 34 s.
- Check the transmitted code and the period at which is sent
- Go to LMM > Configuration > Identification and set the mode to be continuous.
- The oscilloscope should display 1350 pps
- As an alternative, you may use the frequency counter to counts the pps
- Set the identification mode back to Normal.

3.1.3.3 Changeover and Shutdown

This test puts the system out of operation; ensure that it is conducted at the proper time and that the concerned parties are informed (NOTAM may be required).

- From RMM > Configuration > System, change the active TRU delay setting to 50.7 µs.
  - After 10s, the MOUs will declare an alarm, and cause a changeover.
- From RMM > Configuration > System, change the active TRU delay setting to 50.7 µs.
  - After 10s, the MOUs will declare an alarm, and cause a shutdown.

3.2 Other Recommended Checks Weekly or Monthly

- Check that the shelter interior and exterior are clean and regularly maintained
- Check that all antennas and support structure assemblies are clean and well maintained
- Check that antenna beam forming areas are regularly maintained, that is, keep the grass short and remove snow or any objects or debris that may affect the radiation beam structure
- Check that the equipment is clean
- Check that the connectors (RF, communication and electrical) are tightly fastened
- Check that the cables (RF, communication and electrical) show no cracks or damage
- Check that the batteries are not corroded or leaking
- Check that all environmental monitoring sensors are working as per design
- Check critical area. Make sure is in normal condition and clear of any foreign objects.

4. CORRECTIVE MAINTENANCE

The architecture and build of the system allows restoration to service by simple exchange of modules, module trays or whole equipment. Faulty LRUs are quickly identified through the RMM or visually on the equipment indicators.

The faulty LRUs are sent to Intelcan or another authorized depot for repair. This strategy keeps the equipment in service, limits the time, skill, and equipment needs of onsite personnel, and limits assembly level diagnosis, repair, and testing to those facilities with the highly specialized equipment and technicians required to do it efficiently.

Wear an electrostatic discharge (ESD) wrist strap that is connected to a ground point. The LRUs are electrostatic-sensitive devices. Touching the units without ESD protection will cause irreparable damage to them.

If system shutdown due to equipment failure, maintenance personnel should communicate with control tower immediately and carry out the corrective maintenance accordingly.

For the procedure of corrective maintenance, refer to the procedure described in the equipment manuals.

4.1 Maintenance Test Procedures

This section describes the following recommended maintenance procedures:

- Carrier Frequency
- Transmitter Peak Power Output
- Transmitter Peak Power Variation
- Transmitter Output Spectrum
- Monitor Interrogator Status
- Reply Delay
- Transmitter Pulse Shape
- Pulse Repetition Frequency
- Identification
- Changeover and Shutdown
- User Defined IOs
- Software Upgrade
- Frequency Change

4.1.1 Carrier Frequency

Objective The transmit and receive frequencies shall be as per the assigned channel, and stable at ±0.002% (approximately 20 KHz)

Required Tools Frequency Counter, DC to 2000 MHz, 1 Hz resolution

1. Connect the frequency counter to the TRU's test port TX FREQ.
   - The measured value should be at the assigned transmit frequency and should not drift or fluctuate by more than 20 kHz
2. Repeat by measuring the MOU's test port INT FREQ.
   - The measured value should be at the assigned receive frequency and should not drift or fluctuate by more than 20 kHz
3. If the frequency is off by more than 20 kHz, check RMM > Config > System > Channel, to ensure that the system is set for the right channel. It is also displayed on the RMM's Main Info.
4. If it remains within the limits, but fluctuates repeatedly, check the standby TRU and change over to it.

4.1.2 Transmitter Peak Power Output

Objective The transmitted signal shall be at least 100 W, with 1 dB uncertainty (20 W)

Required Tools Digital Peak Power Meter

1. Connect the power meter to the DPU's test port TX1 CPL.
2. Set the power meter to the carrier frequency in use.
3. Set the power meter offset to value from the sticker on the DPU, which is the coupling factor on the DPU's test port.
4. If the power is lower than 100 W, adjust it from RMM > Config > Transponder.

4.1.3 Transmitter Peak Power Variation

Objective The difference in peak power between the two pulses of a pair shall be within 1 dB

Required Tools Digital Peak Power Meter

This test setup is similar to the "Transmitter Peak Power Output".

1. Connect the power meter to the DPU's test port TX1 CPL.
2. Set the power meter to the carrier frequency in use.
3. Set the power meter offset to value from the sticker on the DPU, which is the coupling factor on the DPU's test port.
4. Check the delta power between the first and second pulse.
5. If it is higher than 1 dB, then the TRU under test needs to be replaced.

4.1.4 Transmitter Output Spectrum

Objective ≤ 200 mW in 0.5 MHz band at fc±0.8 MHz (27dBc) ≤ 2 mW in 0.5 MHz band at fc±2.0 MHz (47dBc)

Required Tools Spectrum Analyzer

1. Connect the spectrum analyzer to the LPU's test port TX CPL.

2. On the analyzer, select the frequency as your channel.
3. Set maximum hold to observe the distribution (see Figure 1).
   - Same test applies to the DPU output test port TX1 CPL and TX2 CPL
4. Objective is not to interfere with a neighboring channel.
5. Check and adjust the modulation levels (Gaussian and Pedestal) from RMM.
   - There are no alarm limits for these parameters
6. Perform a changeover if outside ICAO's recommendation.

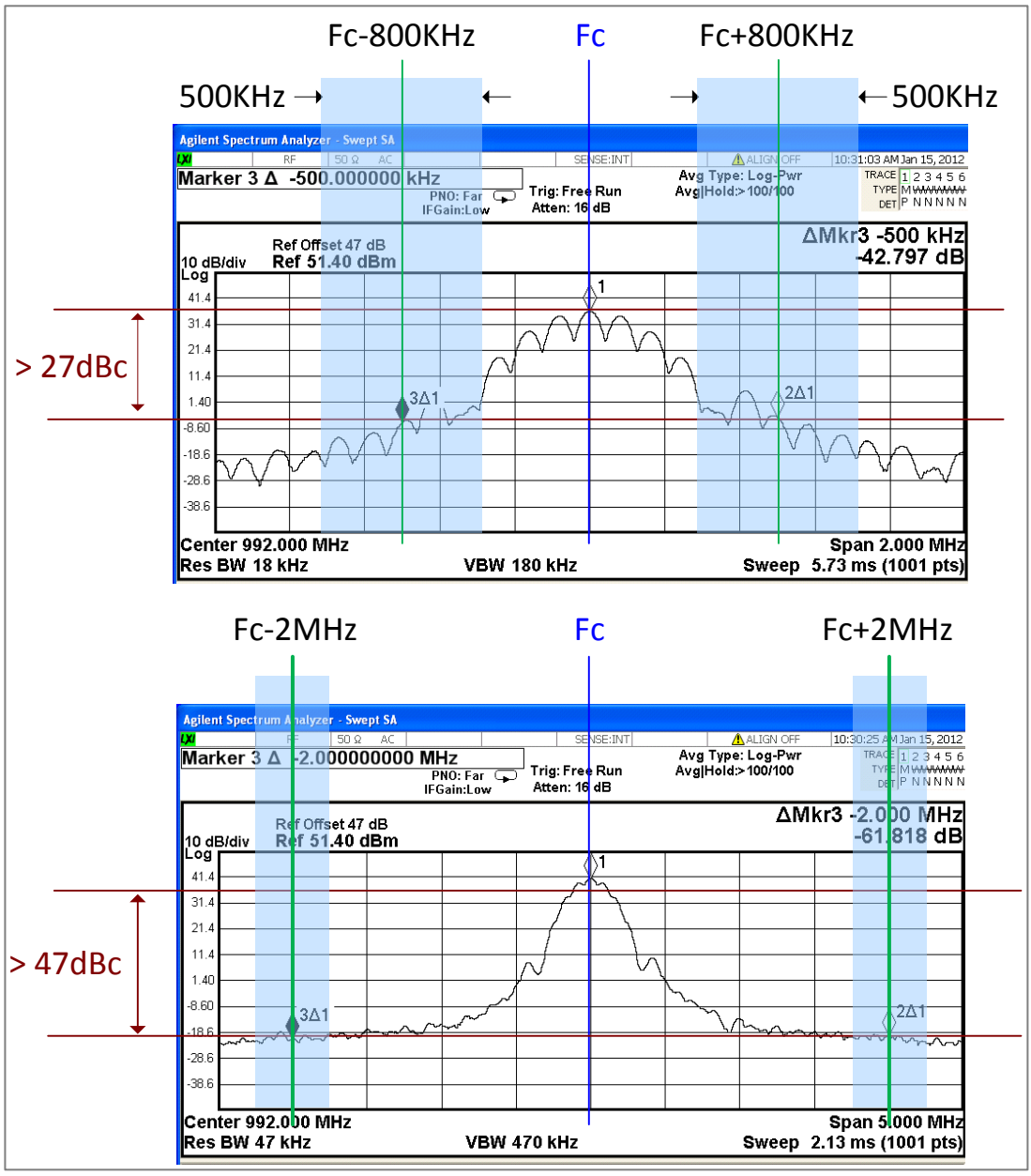


Figure 1 - Spectrum Analyzer

4.1.5 Monitor Interrogator Status

Objective The test interrogations generated by the MOU shall be valid

Required Tools Frequency Counter, DC to 2000 MHz, 1 Hz resolution
Digital Oscilloscope

1. Connect using the LMM, as a Level 3 user.
2. Go to LMM > Status > Interrogator, and confirm there are no warnings.
3. Connect the oscilloscope to the MOU's test port INT GAU, and confirm the appearance of a typical Gaussian shape.
4. Connect the frequency counter to the MOU's test port INT FREQ, and confirm it measures the operating receive frequency of the system.

4.1.6 Reply Delay

Objective The system's reply delay shall be nominally 50 µs in X Mode, and 56 µs in Y Mode. The system is in alarm if the delay is 0.6 µs higher or lower than the nominal.

Required Tools Digital Oscilloscope

1. Connect the oscilloscope's first channel to the MOU's test port INT ENV.
2. Connect the oscilloscope's second channel to the MOU's test port TX1 ENV.
3. Adjust the oscilloscope to trigger on INT ENV, which is the interrogation.
4. Measure the time between the peak of INT ENV and the peak of TX1 ENV.
5. Repeat for TX2 ENV.
6. Check the corresponding delay readings from LMM > Status > Monitors.

4.1.7 Transmitter Pulse Shape

Objective Rise: ≤ 3.0 µs
Duration: 3.5 ± 0.5 µs
Fall: 0.8 µs to 3.5 µs
Spacing: 12 ± 0.5 µs (X Mode), 30 ± 0.5 µs (Y Mode)

Required Tools Digital Peak Power Meter

This test setup is similar to the "Transmitter Peak Power Output".

1. Connect the power meter to the DPU's test port TX1 CPL.
2. Set the power meter to the carrier frequency in use.
3. Set the power meter offset to value from the sticker on the DPU, which is the coupling factor on the DPU's test port.
4. Set the power meter's markers to see the pulses' different amplitude points (see Figure 2).

   The pulse shape is not configurable. If its measurements are outside the limit, then the TRU under test needs to be replaced.

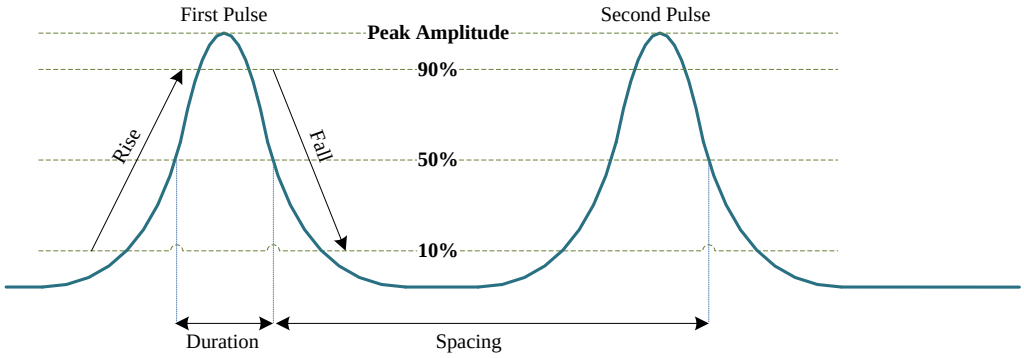


Figure 2 - Transmitter Pulse Shape

4.1.8 Receiver Sensitivity

Objective The equipment shall have at least a sensitivity of -90 dBm measured at its antenna connector

Required Tools Laptop or PC running LMM/RMM

Note: Receiver sensitivity test can only be run on Standby Transmitter

1. Connect using the LMM, as a Level 3 user.
2. Go to BIST > Decoder Test.
3. Select Sensitivity -90 dBm tests.
4. Click on Run Tests.
5. Wait until test completion and verify results
6. Changeover to the other transmitter and repeat test

4.1.9 Pulse Repetition Frequency

Objective The system shall have a transmit rate of at least 700 pps

Required Tools Frequency Counter, DC to 2000 MHz, 1 Hz resolution

1. Connect the low frequency channel of the frequency counter to the TRU's test port TX GAU.
2. Set the frequency counter averaging to approximately 8 counts.
   - The counter will display the number of single pulses, divided by two; this provides the number of transmitted pps.
3. The transmit rate can also be viewed on the FDU's Monitor Readings screen, or the RMM/LMM > Status > Monitors.
4. The squitter rate may be adjusted to a live display of the transmit rate change; to do so, go to LMM > Configuration > Transponder.

4.1.10 Identification

Objective The correct identification code shall be transmitted, every 34 sec, at 1350 pps

Required Tools Digital Oscilloscope

1. Connect the oscilloscope's first channel to the TRU's test port TX GAU.
2. Reduce the time span by 500 msec/DIV until the ident appears every 34 s.
   - Check the transmitted code and the period at which is sent
3. Go to LMM > Configuration > Identification and set the mode to be continuous.
   - The oscilloscope should display 1350 pps
   - As an alternative, you may use the frequency counter to counts the pps
4. Set the identification mode back to Normal.

4.1.11 Decoder Tests

Objective The transceiver shall only decode and reply to interrogations with valid frequency and pulse spacing

Required Tools Laptop or PC running LMM/RMM

Note: Decoder tests can only be run on Standby Transmitter

1. Connect using the LMM, as a Level 3 user.
2. Go to BIST > Decoder Test.
3. Select all Selectivity Freq tests.
4. Select all Pulse Spacing tests.
5. Click on Run Tests.
6. Wait until test completion and verify results
7. Changeover to the other transmitter and repeat test

4.1.12 Monitor Tests

Objective The monitor shall report alarms when transponder parameters exceed alarms limits

Required Tools Laptop or PC running LMM/RMM

Note: Monitor tests are run on standby transponder but Active transponder is automatically disabled since MOU are not operational during tests.

1. Connect using the LMM, as a Level 3 user.
2. Go to BIST > Monitor Test.
3. Select all tests.
4. Click on **Run Tests**.
5. Wait until test completion and verify results
6. Changeover to the other transmitter and repeat test

4.1.13 Changeover and Shutdown

Objective The system shall detect and declare an alarm when an out-of-tolerance condition is present for 10 sec. If the alarm is a primary one, the system shall perform a changeover and a shutdown

Required Tools Laptop or PC running LMM/RMM

This test puts the system out of operation; ensure that it is conducted at a proper time, and that concerned parties are informed.

1. Connect to the equipment using the LMM, as a Level 3 user.
2. Alarm Delay is configured by default to 10 s.
3. Reply Delay alarm high is configured to 50.6 µs or 56.6 µs.
4. From LMM > Configuration > System, change the active TRU delay setting to 50.7 µs or 56.7 µs.
5. Wait 10 s.
6. After 10 s, the MOUs will declare an alarm, and cause a changeover.
7. From LMM > Configuration > System, change the active TRU delay setting to 50.7 µs or 56.7 µs.
8. Wait 10 s.
9. After 10 s, the MOUs will declare an alarm, and cause a shutdown.

   If the system is configured to auto restart, it will turn the transmitters back on after the configured restart time. Check LMM > Configuration > System for that configuration.

4.1.14 User Defined IOs

Objective Install and configure digital and analog sensors

Required Tools Sensors to install
Laptop or PC running LMM/RMM

As described in previous sections, the DME equipment features a number of inputs and outputs to which sensors can be connected. The objective is offer remote monitoring of the equipment environment: fire detectors, temperature sensors, etc.

Note: Digital input 1 is predefined for DOOR sensor and digital input 2 for FIRE sensor.

Select sensors that meet the DME specifications:

- Digital Input: inactive when floating, active when connected to GND
- Analog Input: 0 - 15VDC, 10-bit resolution, 20kΩ impedance
- Digital Output: open collector, inactive when floating, active when connected to GND

Procedure:

1. Follow the installation procedures as per section **Error! Reference source not found.**.
2. Connect to the system using the LMM, as a Level 3 user.
3. If installing a digital input sensor, go to LMM > Configuration > Digital UDIO to enable it, and give it a meaningful name as well as its normal/warning condition (active low or active high).

4. If installing an analog input sensor, go to LMM > Configuration > Analog UDIO to enable it, give it a meaningful name, and set its scale and offset as per the sensor's specification sheet.
   - As an example, a temperature sensor manufacturer may specify the volt to Kelvin formula (offset and scale); those parameters may be changed to display the units in Celsius
   - The warning low and warning high limits for the analog sensor may also be configured
5. To view the status of a sensor, go to LMM > Status > UDIO.

4.1.15 Software Upgrade

Objective Update the MPU and FDU embedded software

Required Tools Laptop or PC running LMM/RMM

Intelcan may have an upgrade package for the MPU and/or FDU. When a client is officially notified about the update, the following steps shall be followed:

1. Copy the provided update package to the laptop or PC running LMM/RMM.
2. Connect to the equipment using the LMM/RMM, as a Level 3 user.
3. Save the system configuration with LMM > File > Save Configuration File.
4. Select LMM > File > Update Station Software.
5. Select MPU as the unit to update.
6. Browse to select the update file that was copied to the laptop or PC.
7. Click **Upload** to transfer the file to the unit.
8. Once the progress bar indicates the transfer is complete, click **Install**.
9. Reload the configuration LMM > File > Load Configuration File.
10. Select LMM > File > Update Station Software.
11. Select FDU as the unit to update.
12. Browse to select the update file that was copied to the laptop or PC.
13. Click **Upload** to transfer the file to the unit.
14. Once the progress bar indicates the transfer is complete, click **Install**.

4.1.16 Frequency Change

Objective Change the DME operating channel

Required Tools Frequency Counter, DC to 2000 MHz, 1 Hz resolution
Network Analyzer (VNA)
SMA torque wrench
Allan key #3

This procedure shall only be conducted when the ICAO channel assignment has been changed for the facility. It is rarely required.

1. Connect to the equipment using the LMM, as a Level 3 user.
2. Turn off both TX1 and TX2

3. Go to LMM > Configuration > System.
4. Change the assigned channel, then click Apply.
5. The LMM left dock will indicate the new set channel and corresponding frequencies.
6. Change the TX/RX Frequency alarm limit RMM > Configuration > Alarms
7. Change the Interrogator warning limit RMM > Configuration > Interrogator > Warnings tab
8. Using the frequency counter, connect to each unit to confirm the frequencies are set properly.
   - TX FREQ on TRU1 and TRU2
   - INT FREQ on MOU1 and MOU2
9. Go to the back of the rack to the DPU, and tune the cavity filters to the desired receiver frequency (RX).
   - Disconnect the SMA cables going into the filter
   - Connect the VNA to each SMA connector of the filter
   - Adjust the filter's two screws until the VNA measures a center at the desired frequency (see Figure 3)
   - Repeat for the second filter in the DPU
   - Reconnect the SMA cables to their original position
10. Turn TX1 and TX2 back on.

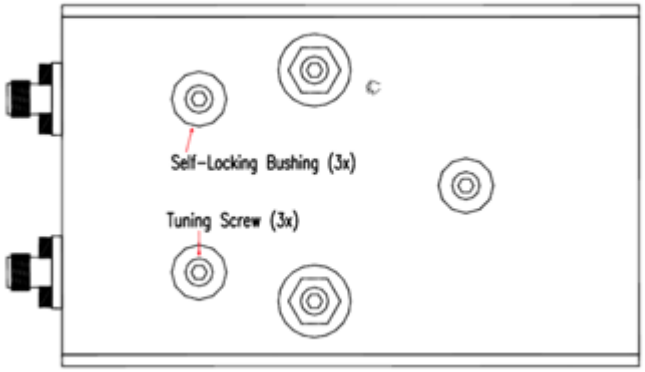


Figure 3 - DPU Tunable Filter

4.2 Card Replacement Procedures

This section describes the following card replacement procedures:

- MPU Card
- MPU Lithium Battery
- IFU Card
- FDU Card
- DPU's DPDT Switch
- MOU Card

- LPU Card
- TRU Card

4.2.1 MPU Card

Required Equipment Spare MPU

When the MPU fails, the transmitters will automatically turn off; the system cannot run without the MPU since it is responsible for executive action.

1. Save the system configuration with LMM > File > Save Station Configuration.
2. Suspend the MPU through RMM top menu > File > Suspend MPU
3. Unscrew and eject the MPU to be replaced.
4. Remove the MicroSD card from the MPU (the card contains the system configuration and logs).
5. Insert the MicroSD card into the new MPU.
6. Insert the new MPU back into the rack.
7. Make sure the date/time is adjusted to UTC using RMM > Configuration > System.
8. Load the system configuration with RMM > File > Load Station Configuration File
9. From RMM > Status > MPU, check the new MPU BITE status

4.2.2 MPU Lithium Battery

Required Equipment Spare BR2032 Lithium battery

CAUTION: Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.

The system will indicate a maintenance warning when the lithium battery is too low.

1. Suspend the MPU through RMM top menu > File > Suspend MPU
2. Unscrew and eject the MPU; the system will turn off its transmitters a few seconds later.
3. Remove the battery from the MPU.
4. Insert the new battery into the MPU.
5. Insert the new MPU back into the rack.
6. Power the system back on.

4.2.3 IFU Card

Required Equipment Spare IFU

Even though the IFU is not a redundant unit, its replacement does not interrupt the system operation. However, its failure or removal will generate maintenance warnings, as well as loss of remote control.

1. Unplug from the IFU all flat cables, Ethernet cables, IO cables, and the ground wire.
2. Unscrew the IFU from its plate and remove it.
3. Place and screw into the plate the new IFU.
4. Reconnect all cables as before.
5. From RMM > Status > IFU, check the new IFU BITE status

4.2.4 FDU Card

Required Equipment Spare FDU

Even though the FDU is not a redundant unit, its replacement does not interrupt the system operation.

1. From the front of the rack, unscrew the FDU 3U panel.
2. When the FDU is removed from the rack, the Ethernet and DB25 cables will come out with it.
3. Disconnect these cables from the back of the FDU.
4. Plug these cables into the new FDU.
5. Insert the new FDU in the rack and screw it back into place.
6. From RMM > Status > FDU, check the new FDU status

4.2.5 DPU's DPDT Switch

Required Equipment Spare DPDT switch
SMA torque wrench
SMA connector holder

The DPDT switch in the DPU is a critical component of the system. Replacing it requires approximately 20 minutes, during which the system is not operational.

The switch is located inside the DPU panel, so only its mounting screws are visible from the back of the rack.

1. Turn off the system using both front PSU breakers.
2. Using a torque wrench, disconnect the 4 RF cables (SMA) from the switch.
3. From the back of the rack, locate the DPDT switch screws and unscrew them one by one.
4. The switch will come loose and can be pulled out.
5. Disconnect the DB9 cable from the switch.
6. Plug the DB9 cable into the new switch.
7. Mount the new DPDT in its place on the DPU plate and screw it in.
8. Using a torque wrench, reconnect the 4 RF cables (SMA) from the switch.
9. Turn the system back on using both front PSU breakers.
10. From the FDU, push the "ON AIR" button to confirm that the switch is performing the changeover properly.

4.2.6 MOU Card

Required Equipment Spare MOU

1. Unscrew the front plate of the MOU to be replaced.
2. Eject the MOU by pulling the top handle up and the lower one down.
3. Insert the new MOU, and screw in its front plate.
4. From RMM > Status > MOU, check the new MOU BITE status, they should correspond to the other MOU already in the rack.
5. Check the front plate's test ports to confirm the signals are correct:
   - INT FREQ
   - INT GAU
   - INT ENV
   - TX1 ENV
   - TX2 ENV
6. From RMM > Status > Monitors Data, check the new MOU measurements, they should correspond to the other MOU already in the rack.
7. Otherwise, adjust the offsets using RMM > Configuration > Monitor Offsets.

4.2.7 TRU Card

Required Equipment Spare TRU

1. Turn off the transmitters for the unit to be replaced.
2. In order for the system to continue operating, switch the unit to be replaced to standby status, while the other TRU continues to transmit.
3. Unscrew the front plate of the unit to be replaced.
4. Eject the unit by pulling the top handle up and the lower one down.
5. Insert the new unit, and screw in its front plate.
6. Once the unit has its POWER LED on, turn its transmitter on.
7. From RMM > Status > TRU, check the new TRU BITE status
8. Check the front plate's test ports to confirm the signals are correct:
   - TX FREQ, RX ENV, TX GAU
9. From RMM > Status > Monitors Data, check the parameters; they should not be in alarm status.

   If necessary, use RMM > Configuration > Transponder Offset to adjust the forward power offset, until the monitors report nominal values.

4.2.8 LPU Card

Required Equipment Spare LPU

1. Turn off the transmitters for the unit to be replaced.
2. In order for the system to continue operating, switch the unit to be replaced to standby status, while the other TRU continues to transmit.
3. Unscrew the front plate of the unit to be replaced.

4. Eject the unit by pulling the top handle up and the lower one down.
5. Insert the new unit, and screw in its front plate.
6. Once the unit has its POWER LED on, turn its transmitter on.
7. From RMM > Status > LPU, check the new LPU BITE status
8. Check the front plate's test ports to confirm the signals are correct:
   - TX CPL, TX ENV, TX GAU
9. From RMM > Status > Monitors Data, check the parameters; they should not be in alarm status.
10. If the monitors do not indicate 100 W, use RMM > Configuration > Transponder Offset to adjust the forward power offset, until either the monitors, or the peak power meter, indicates 100 W.

4.2.9 HPU Card

Required Equipment Spare HPU

1. Turn off the transmitters for the unit to be replaced.
2. In order for the system to continue operating, switch the unit to be replaced to standby status, while the other TRU continues to transmit.
3. Unscrew the front plate of the unit to be replaced.
4. Disconnect two RF Cables, DB-25 Cable and Ground cable at the rear side of HPU.
5. Eject the unit by pulling the top handle up and the lower one down.
6. Insert the new unit, and screw in its front plate.
7. Connect two RF Cables, DB-25 Cable and Ground cable at the rear side of HPU.
8. Once the unit has its POWER LED on, turn its transmitter on.
9. From RMM > Status > HPU, check the new HPU BITE status
10. Check the front plate's test ports to confirm the signals are correct:
    - TX CPL, TX ENV, TX GAU
11. From RMM > Status > Monitors Data, check the parameters; they should not be in alarm status.
12. If the monitors do not indicate 1000 W, use RMM > Configuration > Monitor Offsets to adjust the forward power offset, until either the monitors, or the peak power meter, indicates 1000 W.

4.3 TROUBLESHOOTING

This section describes the possible causes of warnings and alarms, and assumes that the system was properly configured and working normally prior to the warning or alarm.

These troubleshooting procedures are designed to trace the warning or alarm back to a faulty line replaceable unit (LRU) or component that can be replaced or repaired.

4.4 Monitors Data

The Monitors Data window shows the measured data values for MOU1 and MOU2 of the DME station (see Figure 4).

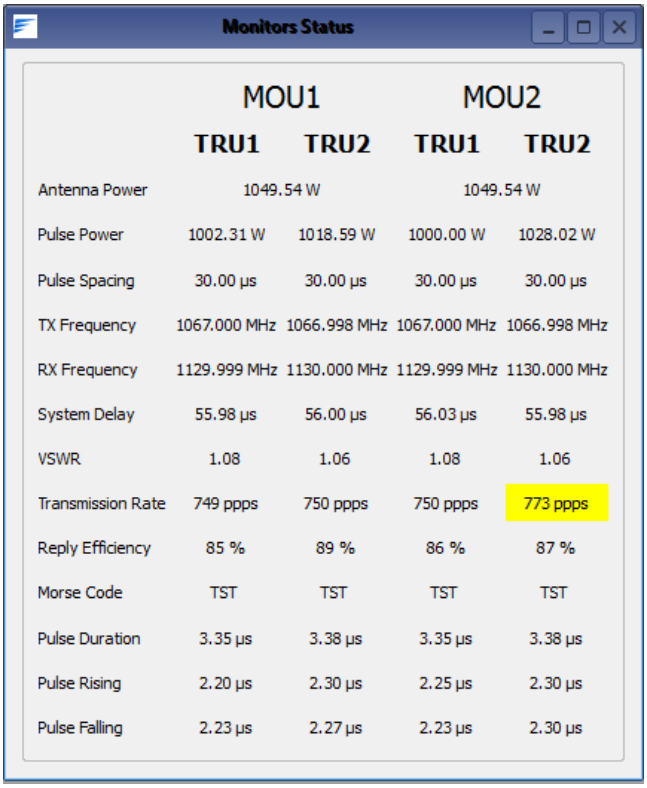


Figure 4 - Monitors Status Data Window

Table 2 describes the various data color codes in the Monitors Status Data window.

Table 2 - Monitors Status Data Window Color Description

Color	Explanation
No Color	Measured value is inside normal range.
Yellow	Measured value is between normal and warning range.
Orange	Measured value is in the secondary alarm state. Monitors will not take action on the system.
Red	Measured value is in the primary alarm state. Monitors will take action on the system.

4.4.1 Antenna Power

Antenna Power represents the transmitted peak power measured at antenna level from the antenna probe. If the antenna power differs from the pulse power on both MOUs, check the cable between the cabinet and the antenna. If the antenna power

differs from the pulse power on one monitor only, try to reboot the MOU. If the reboot does not change the warning/alarm status, the MOU shall be replaced with the spare unit.

4.4.2 Pulse Power

If the pulse power is in warning/alarm status for one TRU on both MOUs, perform the maintenance procedures described in Section 3.1.2 (Transmitter Peak Power Output) and Section 3.1.3 (Transmitter Peak Power Variation). Also, verify the path for all cables and DPU connections. If the warning/alarm status is still present, the TRU or LPU/HPU shall be replaced with the spare unit.

If the pulse power is in warning/alarm status for one or both TRUs on one MOU, the problem may be located in the DPU or in the MOU. The MOU shall be replaced with the spare unit; if the problem persists, then the problem is in the DPU path.

4.4.3 Pulse Spacing

If the pulse spacing is in warning/alarm status on both MOUs, the whole path shall be validated (TRU, LPU/HPU, cable and DPU). Refer to any other BITE information to trace the faulty LRU or component.

If the pulse spacing is in warning/alarm status on one MOU, the problem is located in the MOU. The MOU shall be replaced with the spare unit.

4.4.4 TX Frequency

If the TX frequency is in warning/alarm status on both MOUs, try to reboot the TRU. If the reboot does not change the warning/alarm status, the TRU shall be replaced with the spare unit.

If the TX frequency is in warning/alarm status on one MOU, the problem is located in the MOU. The MOU shall be replaced with the spare unit.

4.4.5 RX Frequency

If the RX frequency is in warning/alarm status on both MOUs, try to reboot the TRU. If the reboot does not change the warning/alarm status, the TRU shall be replaced with the spare unit.

If the RX frequency is in warning/alarm status on one MOU, the problem is located in the MOU. The MOU shall be replaced with the spare unit.

4.4.6 System Delay

If the system delay is in warning/alarm status on both MOUs, perform the maintenance procedure described in Section 3.1.6 (Reply Delay). If the output is still problematic, the TRU shall be replaced with the spare unit. If this is a monitoring issue, the MOU shall be replaced with the spare unit.

4.4.7 VSWR

If the VSWR is in warning/alarm status when either transmitter is active, perform a path verification of all cable and connectors from the cabinet to the antenna. If only one transmitter is problematic, perform a path verification from the TRU to the LPU/HPU. If the problem is still present, consider changing the TRU, LPU or HPU.

4.4.8 Transmission Rate

The nominal value for the transmission rate is the squitter rate configured in the transponder configuration when no aircraft interrogation is detected. In normal operation, this value takes into consideration the reply (from external or local interrogations), the squitter and identification replies. If a constant warning or alarm is displayed, maintenance action shall be performed on the TRU. If maintenance action does not solve the problem, the TRU shall be replaced with spare unit.

4.4.9 Reply Efficiency

If a warning/alarm is displayed for only one specific TRU, try to reboot the TRU and the LPU/HPU. If the reboot does not change the status or the system is not working properly, the TRU shall be replaced with the spare unit. If a warning/alarm is displayed for only one specific MOU, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.4.10 Morse Code

If a warning/alarm is displayed for both TRUs and on both MOUs, verify the "Signal from IDENT Master" status. If only one TRU is problematic, try to reboot the TRU and LPU/HPU. If the reboot does not change the status or the system is not working properly, the TRU shall be replaced with the spare unit. If only one MOU is problematic, try to reboot that MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.4.11 Pulse Duration

If the pulse duration is in warning/alarm status on both MOUs, the whole path shall be validated (TRU, LPU/HPU, cable and DPU). Please refer to any other BITE information to trace the faulty LRU or component.

If the pulse spacing is in warning/alarm status on one MOU, the problem is located in the MOU. The MOU shall be replaced with the spare unit.

4.4.12 Pulse Rising

If the pulse rising is in warning/alarm status on both MOUs, the whole path shall be validated (TRU, LPU/HPU, cable and DPU). Please refer to any other BITE information to trace the faulty LRU or component.

If the pulse spacing is in warning/alarm status on one MOU, the problem is located in the MOU. The MOU shall be replaced with the spare unit.

4.4.13 Pulse Falling

If the pulse falling is in warning/alarm status on both MOUs, the whole path shall be validated (TRU, LPU/HPU, cable and DPU). Please refer to any other BITE information to trace the faulty LRU or component.

If the pulse spacing is in warning/alarm status on one MOU, the problem is located in the MOU. The MOU shall be replaced with the spare unit.

4.5 Built-In Test Equipment (BITE)

4.5.1 Interrogator Window

The interrogator window displays the functional status of the interrogator (see Figure 5).

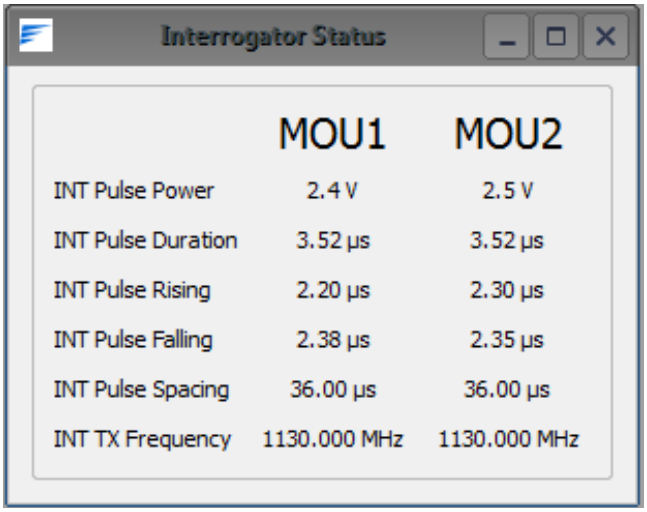


Figure 5 - Interrogator Status Window

4.5.1.1 INT Pulse Power

A BITE warning is displayed if the local interrogator pulse power is outside the configured range in the Interrogator configuration Warning tab. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.1.2 INT Pulse Duration

A BITE warning is displayed if the local interrogator pulse duration is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.1.3 INT Pulse Rising

A BITE warning is displayed if the local interrogator pulse rising is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.1.4 INT Pulse Falling

A BITE warning is displayed if the local interrogator pulse falling is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.1.5 INT Pulse Spacing

A BITE warning is displayed if the local interrogator pulse spacing is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.1.6 INT TX Frequency

A BITE warning is displayed if the local interrogator frequency is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.2 Transponder Window

The transponder status window displays the functional status of the transponders (see Figure 6).

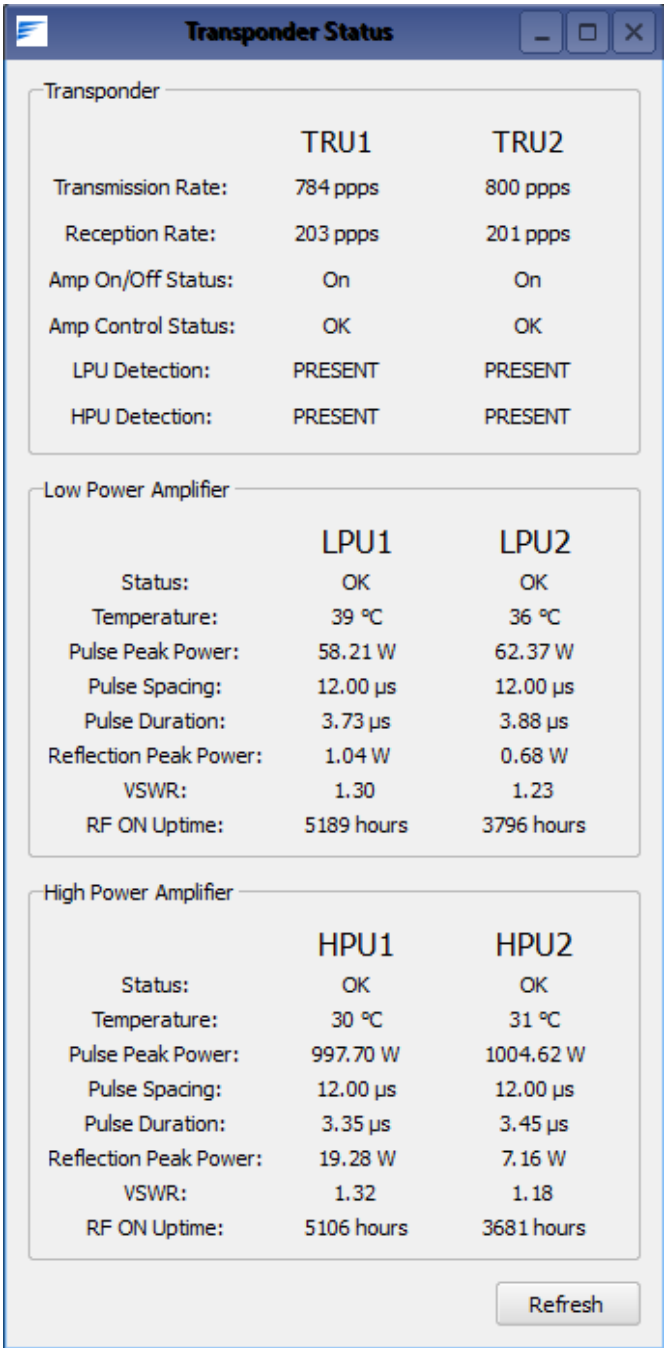


Figure 6 - Transponder Status Window

4.5.2.1 Transmission Rate

The nominal value for transmit rate is the squitter rate configured in the transponder configuration. (Nominal value refers to the transmit rate when no aircraft are present.) This value takes into consideration the reply from external or local interrogations, the squitter and identification replies. The standard squitter rate configuration is 800 ppps.

4.5.2.2 Reception Rate

The nominal value for receive rate is the local interrogation rate configured in the transponder configuration (factory setting). This value takes into consideration external or local interrogations. The standard configuration is 200 ppps.

4.5.2.3 Amp On/Off Status

Amp On/Off Status has two status levels: On and Off.

Off: The amplifier was turned off by the operator, or the TRU detected some problem on the LPU/HPU that caused an automatic shutdown of the amplifier. In this case, refer to the LPU BITE or the HPU BITE to take proper action on the equipment. If no other BITE is present, turn the transmitter off, then back on. If this does not change the status, try to reboot the TRU. If the reboot does not change the status, the TRU shall be replaced with the spare unit.

4.5.2.4 AMP Control Status

Amp Control Status has six status levels: OK. NO_MPU, LPU_FAULT, HPU_FAULT, LPU_CALIB_FAULT and HPU_CALIB_FAULT

No MPU: The TRU did not detect any MPU activity and considers the MPU as “not present”. In this case the TRU automatically shutsdown the amplifier since it is not under MPU supervision.

LPU_FAULT or HPU_FAULT: The TRU detected a fault in the LPU or HPU. This caused an automatic shutdown of the amplifier to prevent any damage. In this case, refer to the LPU BITE or the HPU BITE to take proper action on the equipment.

LPU_CALIB_FAULT or HPU_CALIB_FAULT: The TRU detected a problem with the LPU or HPU calibration data. This caused an automatic shutdown of the amplifier. In this case, refer to the LPU BITE or the HPU BITE to take proper action on the equipment.

In any of those cases, if no other BITE is present, turn the transmitter off, then back on. If this does not change the status, try to reboot the TRU. If the reboot does not change the status, the TRU shall be replaced with the spare unit.

4.5.2.5 LPU Detection

LPU Card Detection has two status levels: Present and Not Present.

Not Present: The TRU is not able to communicate with the LPU. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. If the reboot does not change the status or the system is not working properly, the TRU or the LPU shall be replaced with the spare unit.

4.5.2.6 HPU Detection

HPU Card Detection has two status levels: Present and Not Present.

Not Present: The TRU is not able to communicate with the HPU. If the system is working in normal operation without any other warning, try to reboot the TRU and HPU. If the reboot does not change the status or the system is not working properly, the TRU or the HPU shall be replaced with the spare unit.

4.5.2.7 LPU Status

This item summarizes all the BITEs of the LPU.

4.5.2.8 Temperature

A BITE warning is displayed if the card temperature is outside the range of -12 °C to +80 °C. If both LPUs report the same value, check that the system is clean and properly ventilated. If only one LPU reports a BITE warning, try to reboot the TRU and LPU. If the reboot does not change the card temperature status or the system is not working properly, the LPU shall be replaced with the spare unit.

4.5.2.9 Pulse Peak Power

A BITE warning is displayed if the pulse power is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. If the reboot does not change the status or the system is not working properly, the LPU shall be replaced with the spare unit.

4.5.2.10 Pulse Spacing

A BITE warning is displayed if the pulse spacing is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. If the reboot does not change the status or the system is not working properly, the LPU shall be replaced with the spare unit.

4.5.2.11 Pulse Duration

A BITE warning is displayed if the pulse duration is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. If the reboot does not change the status or the system is not working properly, the LPU shall be replaced with the spare unit.

4.5.2.12 Reflection Peak Power

The nominal value for reflected power is between 0.2 W and 7 W. If the system is working in normal operation without any other warning, try to reboot the TRU and

LPU. Perform a path verification from the TRU to the LPU/HPU. If the problem is still present, consider changing the TRU, LPU or HPU.

4.5.2.13 VSWR

A BITE warning is displayed when the VSWR is higher than 2:1. The nominal value shall be between 1.1:1 and 1.7:1. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. Perform a path verification from the TRU to the LPU/HPU. If the problem is still present, consider changing the TRU, LPU or HPU.

4.5.2.14 HPU Status

This item summarizes all the BITEs of the HPU. Please refer to the HPU BITE windows for more information.

4.5.2.15 Temperature

A BITE warning is displayed if the ambient temperature is outside the range of -12 °C to +80 °C. If both HPUs report the same value, check that the system is clean and properly ventilated. If only one HPU reports a BITE warning, try to reboot the TRU and HPU. If the reboot does not change the ambient temperature status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.2.16 Pulse Peak Power

A BITE warning is displayed if the pulse power is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU. If the reboot does not change the status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.2.17 Pulse Spacing

A BITE warning is displayed if the pulse spacing is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU. If the reboot does not change the status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.2.18 Pulse Duration

A BITE warning is displayed if the pulse duration is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU. If the reboot does not change the status or the system is not working properly,the HPU shall be replaced with the spare unit.

4.5.2.19 Reflection Peak Power

The nominal value for reflected power is between 2 W and 70 W. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU. Perform a path verification from the TRU to the LPU/HPU. If the problem is still present, consider changing the TRU, LPU or HPU.

4.5.2.20 VSWR

A BITE warning is displayed when the VSWR is higher than 2:1. The nominal value shall be between 1.1:1 and 1.7:1. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU. Perform a path verification from the TRU to the LPU/HPU. If the problem is still present, consider changing the TRU, LPU or HPU.

4.5.3 MPU BITE Window

The MPU BITE window displays the functional status of the MPU (see Figure 7).

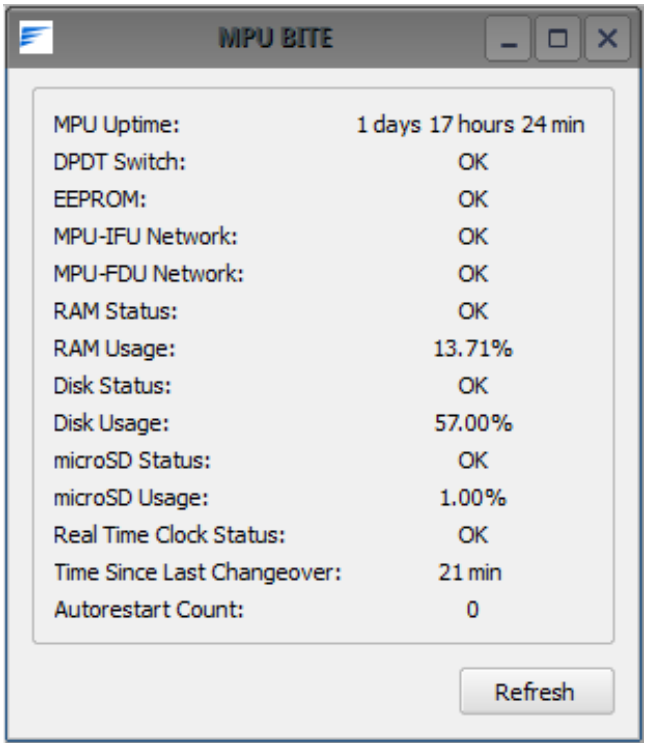


Figure 7 - MPU BITE Window

4.5.3.1 MPU Uptime

This item displays the uptime of the DME station: it does not have a BITE warning.

4.5.3.2 DPDT Switch

DPDT Switch has two status levels: OK and Warning.

Warning: A warning BITE is displayed when the DPDT switch status differs from its configuration. If the system is working in normal operation without any other warning, try to reboot the MPU and verify the DPDT cable connection. Also, confirm that the changeover is working as expected. If the warning is still present, the DPDT switch shall be changed.

4.5.3.3 EEPROM

MPU EEPROM has two status levels: OK and Fault. This status is updated at MPU initialization and shall not change during operation.

Fault: The microcontroller is not able to validate the cyclic redundancy check (CRC) from the EEPROM data. If the system is working in normal operation without any other warning, try to reboot the MPU. If the reboot does not change the EEPROM status or the system is not working properly, the MPU shall be replaced with the spare unit.

4.5.3.4 MPU-IFU Network

MPU-IFU Network has three status levels: OK, Fault and Unplugged.

Fault: The MPU detected an invalid configuration of the MPU-IFU network interface. If the system is working in normal operation without any other warning, try to reboot the MPU. If the reboot does not change the status or the system is not working properly, the MPU shall be replaced with the spare unit.

Unplugged: The MPU did not detect the communication link. Verify the connection of MPU-IFU flat cable and the “EXTERNAL ETHERNET” cable.

4.5.3.5 MPU-FDU Network

MPU-FDU Network has three status levels: OK, Fault and Unplugged.

Fault: The MPU detected an invalid configuration of the MPU-FDU network interface. If the system is working in normal operation without any other warning, try to reboot the MPU. If the reboot does not change the status or the system is not working properly, the MPU shall be replaced with the spare unit.

Unplugged: The MPU did not detect the communication link with the FDU. Verify the network cable connection between the digital backplane and the FDU, and then reboot the FDU.

4.5.3.6 RAM Status

RAM Status has two status levels: OK and Full.

Full: The MPU RAM usage is above 75%. If the system is working in normal operation without any other warning, try to reboot the MPU. If the reboot does not change the

status or the system is not working properly, the MPU shall be replaced with the spare unit.

4.5.3.7 RAM Usage

This item displays the current RAM usage, normally between 15% to 25%; any BITE warning triggered from this information is displayed in the RAM Status item.

4.5.3.8 Disk Status

Disk Status has three status levels: OK, Fault and Full.

Fault: The MPU detected a severe fault preventing from using the disk.

Full: The MPU disk usage is above 75%.

In any of these cases, if the system is working in normal operation without any other warning, try to reboot the MPU. If the reboot does not change the status or the system is not working properly, the MPU shall be replaced with the spare unit.

4.5.3.9 Disk Usage

This item displays the current disk usage, normally around 50%; any BITE warning triggered from this information is displayed in the Disk Status item.

4.5.3.10 MicroSD Status

MicroSD Status has one of the following status **:** OK, Full, Fault and Unplugged.

Full: A BITE full is displayed when the MicroSD usage is above 75%. In this case, it is recommended to download and remove old history files from the MicroSD card using the RMM menu bar > Logging > History Logs.

Fault: If BITE fault is displayed when the MicroSD usage is below 75%, then this indicates a corruption of the MicroSD card. The MPU automatically attempts to recover the MicroSD. If the BITE Fault remains for more than 15 minutes, then this means the MPU failed to recover from the corruption. There are two types of corruption:

1- Corrupted file: If a single file gets corrupted, the zipping process will fail to compress the file. In this case it is recommended to download and delete the corrupted file from the MicroSD card.

2- Corrupted file system: If the MicroSD card file system gets corrupted, then operations such as read/write from/to the card may fail. In this case, it is recommended to reformat the card using the RMM top menu > File > Reformat uSD Card. If the reformatting process fails, then the MicroSD may be damaged and it must be replaced.

Unplugged: The MPU doesn't detect an inserted MicroSD card, verify that the MicroSD card is properly inserted in the slot and restart the MPU. If the problem persists after the reinsertion, then it is recommended to replace the MicroSD card.

4.5.3.11 MicroSD Usage

This item displays the current MicroSD usage; any BITE warning triggered from this information is displayed in the MicroSD Status item.

4.5.3.12 Real Time Clock Status

Real Time Clock Status has two status levels: OK, and Fault.

Fault: The MPU detected a problem with the real time clock. Usually, this is caused by a faulty battery or by an incorrectly set date/time. If the system is working in normal operation without any other warning, the battery on the MPU shall be verified or replaced. Also make sure to set the date and time properly using the RMM.

4.5.3.13 Time Since Last Changeover

This item displays how much time has passed since the last changeover.

4.5.3.14 Auto Restart Count

This item displays the number of auto restarts that have been done.

4.5.4 FDU BITE Window

The FDU BITE window displays the functional status of the FDU (see Figure 8).

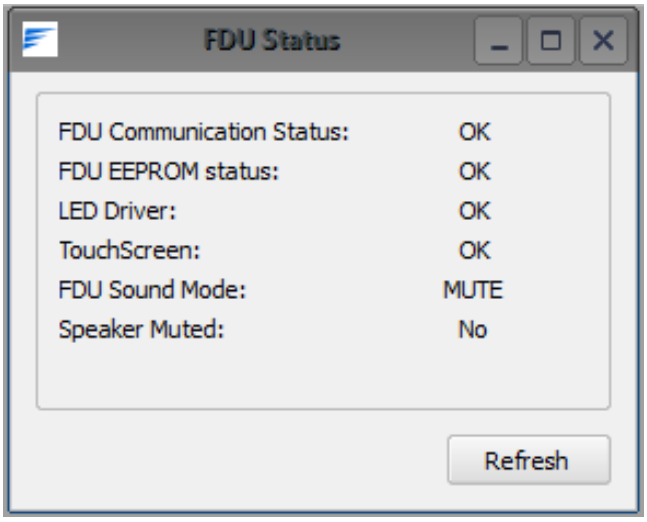


Figure 8 - FDU BITE Window

4.5.4.1 FDU Communication Status

FDU Communication Status has two status levels: OK and Fault.

Fault: The MPU is not able to communicate with the FDU. If the system is working in normal operation without any other warning, verify the cable connection between the digital backplane and the FDU, and then reboot the FDU. If the reboot does not change the status or the system is not working properly, the FDU shall be replaced with the spare unit.

A Fault status will make all other FDU BITE statuses display as “Unplugged”.

4.5.4.2 FDU EEPROM Status

FDU EEPROM Status has two status levels: OK, Fault. This status is updated at FDU initialization and shall not change during operation.

Fault: The FDU processor is not able to validate the cyclic redundancy check (CRC) from the EEPROM data. If the system is working in normal operation without any other warning, try to reboot the FDU. If the reboot does not change the EEPROM status or the system is not working properly, the FDU shall be replaced with the spare unit.

4.5.4.3 LED Driver

LED Driver has two status levels: OK and Fault.

Fault: There is a communication problem between the MPU and the LED driver. Perform a lamp test and verify that all LEDs are working properly. If the LEDs are not working, try to reboot the FDU. If the reboot does not change the LED driver status, the FDU shall be replaced with the spare unit.

4.5.4.4 Touch Screen

Touch Screen has two status levels: OK and Fault.

Fault: There is a communication problem between the MPU and the touch screen driver. If the touch screen is not working, try to reboot the FDU. If the reboot does not change the touch screen status, the FDU shall be replaced with the spare unit.

4.5.4.5 FDU Sound Mode

FDU Sound Mode has eight status levels: Alarm, MOU1_ID1, MOU1_ID2, MOU2_ID1, MOU2_ID2, Mute, TRU1_ID and TRU2_ID.

This item displays the configured value from the System Configuration > System > FDU Sound Mode menu.

4.5.4.6 Speaker Muted

Speaker Muted has two status levels: Yes and No.

This item displays the state of the mute button on the FDU panel.

4.5.5 IFU BITE Window

The IFU BITE window displays the functional status of the IFU (see Figure 9).

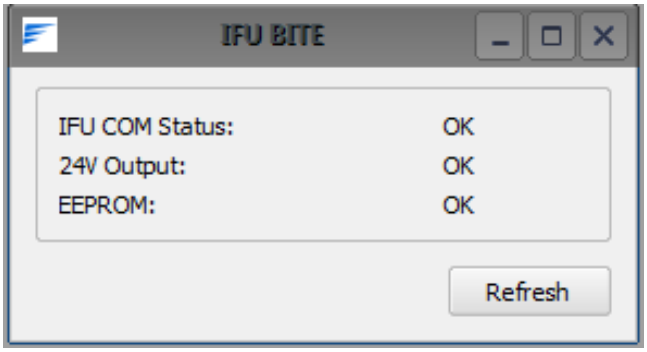


Figure 9 - IFU BITE Window

4.5.5.1 IFU COM Status

IFU COM Status two status levels: OK and Fault.

Fault: The MPU is not able to communicate with the IFU. If the system is working in normal operation without any other warning, verify the cable connection between the digital backplane and the IFU, and then reboot the IFU. If the reboot does not change the status or the system is not working properly, the IFU shall be replaced with the spare unit.

A Fault status will make all other IFU BITE statuses display as “-”.

4.5.5.2 24 V Output

24 V Output has two status levels: OK and Warning.

Warning: A BITE warning is displayed if the voltage is short-circuited. If a reboot does not change the 24 V output status or the system is not working properly, the IFU shall be replaced with the spare unit.

4.5.5.3 EEPROM

IFU EEPROM has two status levels: OK and Warning. This status is updated at IFU initialization and shall not change during operation.

Warning: The microcontroller is not able to validate the cyclic redundancy check (CRC) from the EEPROM data. If the system is working in normal operation without any other warning, try to reboot the IFU. If the reboot does not change the EEPROM status or the system is not working properly, the IFU shall be replaced with the spare unit.

4.5.6 PDU BITE Window

The PDU tab in PSS BITE window displays the functional status of the PDU (see Figure 10).

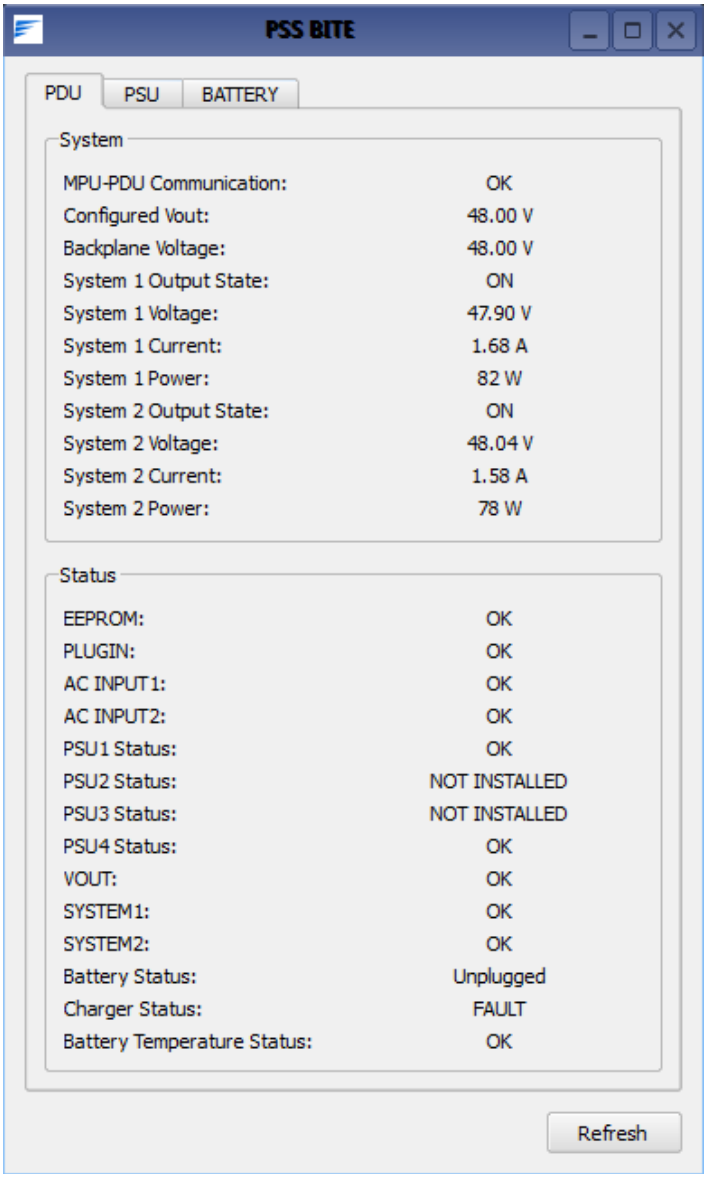


Figure 10 - PSS BITE Window (PDU Tab)

4.5.6.1 MPU-PDU Communication

MPU-PDU Communication Status has three status levels: OK, Fault and Unplugged.

Fault: The MPU is not able to communicate with the PDU. If the system is working in normal operation without any other warning, verify the cable connection between the digital backplane and the PDU, and then reboot the MPU. If the reboot does not

change the status or the system is not working properly, the PDU or MPU shall be replaced with the spare unit.

A Fault status will make all other PDU BITE statuses display as "-".

4.5.6.2 Configured Vout

Configured Vout is the output voltage setting when operating without battery in-circuit. When the PDU puts a battery in-circuit, it adjusts the PSU output voltage based on the battery voltage, so configured Vout isn't effective anymore.

4.5.6.3 Backplane Voltage

Backplane voltage is measured by the PDU; the nominal value is 54 V but it varies depending on the battery charge level. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.6.4 System 1 Output State

System 1 Output State has two status levels: On and Off.

This item displays the state of the System 1 DC switch. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.6.5 System 1 Voltage

System 1 voltage is measured by the PDU; the nominal value is 54 V but it varies depending on the battery charge level. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.6.6 System 1 Current

System 1 current is measured by the PDU; the nominal value is dependent on system configuration. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.6.7 System 1 Power

System 1 power is measured by the PDU; the nominal value is dependent on system configuration. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.6.8 System 2 Output State

System 2 Output State has two status levels: On and Off.

This item displays the state of the System 2 DC switch. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.6.9 System 2 Voltage

System 2 voltage is measured by the PDU; the nominal value is 54 V but it varies depending on the battery charge level. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.6.10 System 2 Current

System 2 current is measured by the PDU; the nominal value is dependent on system configuration. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.6.11 System 2 Power

System 2 power is measured by the PDU; the nominal value is dependent on system configuration. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.6.12 PDU EEPROM

PDU EEPROM has two status levels: OK and Fault. This status is updated at PDU initialization and shall not change during operation.

Fault: The microcontroller is not able to validate the cyclic redundancy check (CRC) from the EEPROM data. If the system is working in normal operation without any other warning, try to power cycle (turn off, then turn on) the PDU. If the power cycle does not change the EEPROM status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.6.13 Plug-In

Plug-In has two status levels: OK and Fault.

Fault: The PDU may not be inserted properly. If the system is working in normal operation without any other warning, try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.6.14 AC Input 1

AC Input 1 has two status levels: OK and Fault.

Fault: The AC 1 cable may not be inserted properly. If the system is working in normal operation without any other warning, try to reinsert the AC cable for PSU1/PSU2. If the reinsertion does not change the status or the system is not working properly, the PSU1 or PSU2 shall be replaced with the spare unit.

4.5.6.15 AC Input 2

AC Input 2 has two status levels: OK and Fault.

Fault: The AC 2 cable may not be inserted properly. If the system is working in normal operation without any other warning, try to reinsert the AC cable for PSU3/PSU4. If the reinsertion does not change the status or the system is not working properly, the PSU3 or PSU4 shall be replaced with the spare unit.

4.5.6.16 PSU1

PSU1 has four status levels: OK, Fault, Unplugged and Not Installed.

Fault: This is the global status of the PSU.

Unplugged: The PDU did not detect the PSU. If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

Not Installed: The PSU has been configured as “Disabled”.

4.5.6.17 PSU2

PSU2 has four status levels: OK, Fault, Unplugged and Not Installed.

Fault: This is the global status of the PSU.

Unplugged: The PDU did not detect the PSU. If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

Not Installed: The PSU has been configured as “Disabled”.

4.5.6.18 PSU3

PSU3 has four status levels: OK, Fault, Unplugged and Not Installed.

Fault: This is the global status of the PSU.

Unplugged: The PDU did not detect the PSU. If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

Not Installed: The PSU has been configured as “Disabled”.

4.5.6.19 PSU4

PSU4 has four status levels: OK, Fault, Unplugged and Not Installed.

Fault: This is the global status of the PSU.

Unplugged: The PDU did not detect the PSU. If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

Not Installed: The PSU has been configured as “Disabled”.

4.5.6.20 VOUT

VOUT has two status levels: OK and Fault.

Fault: The backplane voltage is too far from the configured voltage. If the system is working in normal operation without any other warning, try to reinsert the PDU. If the reinsertion does not change the status, the defective PSU must be replaced.

4.5.6.21 System 1

System 1 has two status levels: OK and Fault.

Fault: The PDU has detected a fault condition on the System 1 bus. If the system is working in normal operation without any other warning, try to reinsert the PDU. If the reinsertion does not change the status, the defective PSU must be replaced.

4.5.6.22 System 2

System 2 has two status levels: OK and Fault.

Fault: The PDU has detected a fault condition on the System 2 bus. If the system is working in normal operation without any other warning, try to reinsert the PDU. If the reinsertion does not change the status, the defective PSU must be replaced.

4.5.6.23 Battery Status

Battery has three status levels: OK, Fault and Not Installed.

Fault: This is the global status of the battery.

Not Installed: The battery has been configured as “Disabled”.

4.5.6.24 Charger Status

Charger has three status levels: OK, Fault and Not Installed.

Fault: This is the global status of the charger.

Not Installed: The battery has been configured as “Disabled”.

4.5.6.25 Battery Temperature Status

Battery Temperature has three status levels: OK, Fault and Not Installed.

Fault: This is the global status of the battery temperature.

Not Installed: The battery has been configured as “Disabled”.

4.5.7 PSU BITE Window

The PSU tab in PSS BITE window displays the functional status of the PSU (see Figure 11).

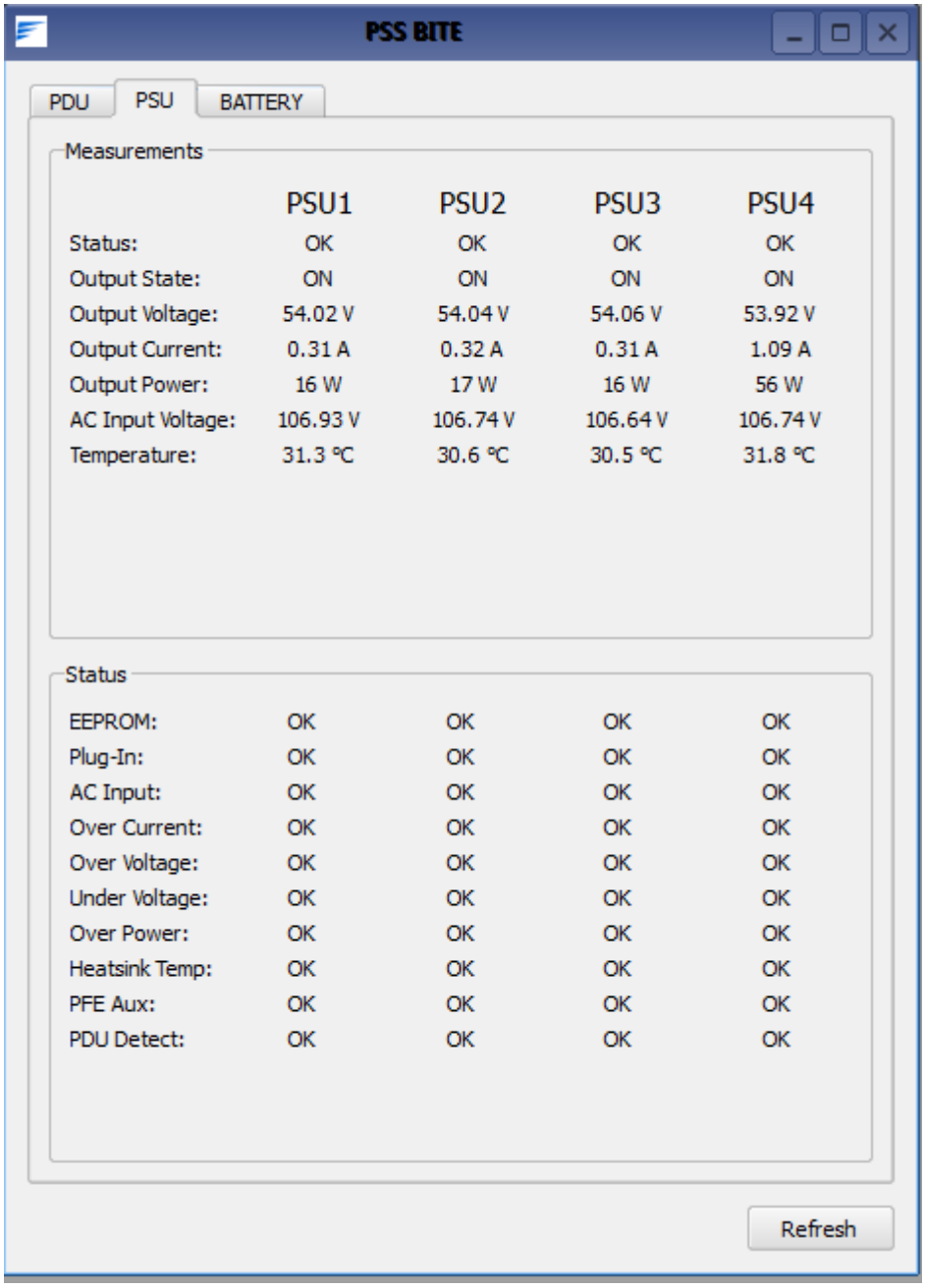


Figure 11 - PSS BITE Window (PSU Tab)

4.5.7.1 Status

Status has four status levels: OK, Fault, Unplugged and Not Installed.

Fault: This is the global BITE status of the PSU. Refer to the BITE status.

An “Unplugged” or “Not Installed” status will make all other PSU BITE statuses display as “-”.

4.5.7.2 Output State

Output State has two status levels: On and Off.

OFF: If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

4.5.7.3 Output Voltage

Output voltage is measured by the PSU; the nominal value is 54 V but it varies depending on the battery charge level. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.7.4 Output Current

Output current is measured by the PSU; the nominal value is dependent on system configuration. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.7.5 Output Power

Output power is measured by the PSU; the nominal value is dependent on system configuration. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.7.6 AC Input Voltage

AC input is measured by the PSU; the nominal value is dependent on installation. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.7.7 Temperature

The PSU temperature is measured by the PSU.This measurement is for information purposes only; a BITE warning will not be triggered. The PSU will automatically shut down if the temperature is higher than 95 °C.

4.5.7.8 EEPROM

PSU EEPROM has two status levels: OK and Fault. This status is updated at PSU initialization and shall not change during operation.

Fault: The microcontroller is not able to validate the cyclic redundancy check (CRC) from the EEPROM data. If the system is working in normal operation without any other warning, try to reboot the PSU. If the reboot does not change the EEPROM status or the system is not working properly, the PSU shall be replaced with the spare unit.

4.5.7.9 Plug-In

Plug-In has two status levels: OK and Fault.

Fault: The PSU may not be inserted properly. If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

4.5.7.10 AC Input

AC Input has two status levels: OK and Fault.

Fault: The AC voltage is outside the range of 80 VAC to 270 VAC, or the AC frequency is outside the range of 45 Hz to 65 Hz. The cable may not be inserted properly. If the system is working in normal operation without any other warning, try to reinsert the AC cable (AC1 for PSU1/2 and AC2 for PSU3/4). If the reinsertion does not change the status or the system is not working properly, the PSU shall be replaced with the spare unit.

4.5.7.11 Over Current

Over Current has two status levels: OK and Fault.

Fault: The current is higher than 10.5 Amp. If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

4.5.7.12 Over Voltage

Over Voltage has two status levels: OK and Fault.

Fault: The voltage is greater than 59V. If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

4.5.7.13 Under Voltage

Under Voltage has two status levels: OK and Fault.

Fault: The voltage is lower than 36V. If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

4.5.7.14 Heatsink Temperature

Heat Sink Temperature has two status levels: OK and Fault.

Fault: The heat sink temperature is higher than 95 °C. If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

4.5.7.15 PFE Aux

PFE Aux has two status levels: OK and Fault.

Fault: If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

4.5.7.16 PDU Detect

PDU Detect has two status levels: OK and Fault.

Fault: If the system is working in normal operation without any other warning, try to reinsert the PSU. If the reinsertion does not change the status, the PSU shall be replaced with the spare unit.

4.5.8 Battery BITE Window

The Battery Tab in PSS BITE window displays the functional status of the battery (see Figure 12).

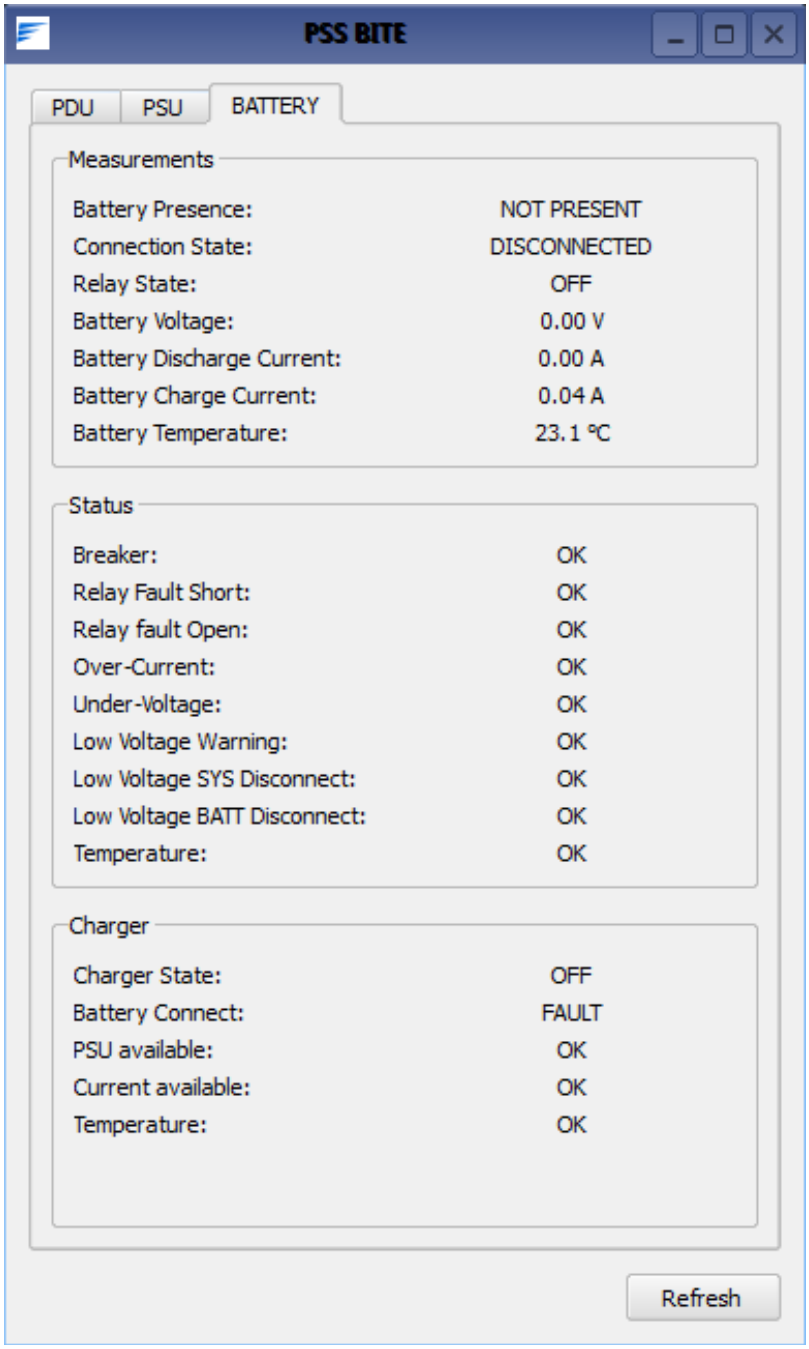


Figure 12 - PSS BITE Window (Battery Tab)

4.5.8.1 Battery Presence

Battery Presence has two status levels: OK and Not Present.

Not Present: Cannot detect the battery because the voltage is too low.Verify that the cables are properly connected to the battery and to to PSS backplane.

4.5.8.2 Connection State

Connection State has four status levels: Connected, Disconnected, Connecting and Disconnecting.

Disconnected: Verify the battery BITE status.

4.5.8.3 Relay State

Relay State has two status levels: On and Off.

OFF: If the system is working in normal operation without any other warning, switch the breaker off/on and try to reinsert the PDU. If the reinsertion does not change the status, the PDU shall be replaced with the spare unit.

4.5.8.4 Battery Voltage

Battery voltage is measured by the PDU. The nominal value is 44.4 V to 57 V. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.8.5 Battery Discharge Current

Battery discharge current is measured by the PDU; the nominal value is dependent on system configuration. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.8.6 Battery Charge Current

Battery charge current is measured by the PDU; the nominal value is dependent on system configuration. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.8.7 Battery Temperature

Battery temperature is measured by a temperature sensor installed on the battery.

4.5.8.8 Breaker

Breaker has two status levels: OK and Fault.

Fault: The PDU has detected that the breaker is open. If the system is working in normal operation without any other warning, switch the breaker off/on. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.9 Relay Fault Short

Relay Fault Short has two status levels: OK and Fault.

Fault: The PDU has detected that the battery relay is short. If the system is working in normal operation without any other warning, switch the breaker off/on and try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.10 Relay Fault Open

Relay Fault Open has two status levels: OK and Fault.

Fault: The PDU has detected that the battery relay is open. If the system is working in normal operation without any other warning, switch the breaker off/on and try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.11 Over Current

Over Current has two status levels: OK and Fault.

Fault: The PDU has detected an overcurrent condition. If the system is working in normal operation without any other warning, try to reinsert the PDU. Also, check for a short circuit or a defective battery. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.12 Under Voltage

Under Voltage has two status levels: OK and Fault.

Fault: The PDU has detected an under voltage on the bus. If the system is working in normal operation without any other warning, try to reinsert the PDU. Also, the battery may be defective. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.13 Low Voltage Warning

Low Voltage Warning has two status levels: OK and Fault.

Fault: The battery voltage is below 44 V. The PDU has identified a low voltage condition. If the system is working in normal operation without any other warning, try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.14 Low Voltage System Disconnect

Low Voltage System Disconnect has two status levels: OK and Fault.

Fault: The battery voltage is below 43 V. The PDU has identified a low voltage system disconnect condition. If the system is working in normal operation without any other

warning, try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.15 Low Voltage Battery Disconnect

Low Voltage Battery Disconnect has two status levels: OK and Fault.

Fault: The battery voltage is below 42 V. The PDU has identified a low voltage battery disconnect condition. If the system is working in normal operation without any other warning, try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.16 Battery Temperature

Battery Temperature has two status levels: OK and Fault.

Fault: The PDU has detected a battery temperature that is outside the range of -25 °C to 65 °C. If the batteries are not in a high temperature condition, try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.17 Charger State

Charger State has five status levels: Fast Charge, Slow Charge, Float Charge, Standby and Off.

This status is provided for information purposes only; a BITE warning will not be triggered.

4.5.8.18 Battery Connect

Battery Connect has two status levels: OK and Fault.

Fault: The PDU charger has detected that the battery is not connected. If the system is working in normal operation without any other warning, try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.19 PSU Available

PSU Available has two status levels: OK and Fault.

Fault: The PDU charger has detected that no PSU is available. If the system is working in normal operation without any other warning, try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.20 Current Available

Current Available has two status levels: OK and Fault.

Fault: The PDU charger has detected that not enough current is available to charge the battery. If the system is working in normal operation without any other warning, try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.8.21 Charger Temperature

Charger Temperature has two status levels: OK and Fault.

Fault: The PDU charger has detected a charger temperature that is outside the range of -20 °C to 50 °C. If the system is working is in normal operation, try to reinsert the PDU. If the reinsertion does not change the status or the system is not working properly, the PDU shall be replaced with the spare unit.

4.5.9 MOU BITE Window

The MOU BITE window displays the functional status of MOU1 and MOU2 (see Figure 13).

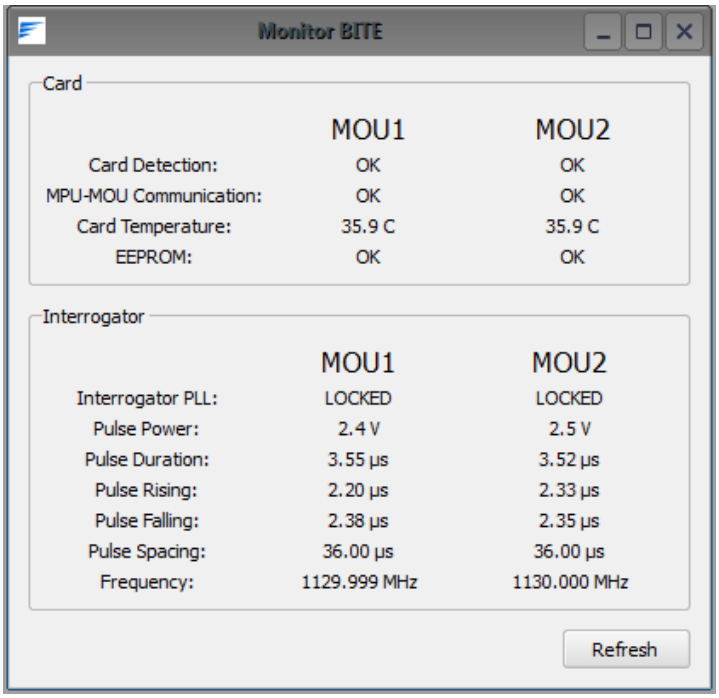


Figure 13 - MOU BITE Window

4.5.9.1 Card Detection

MOU Card Detection has three status levels: OK, Fault and Unplugged.

Fault: The test register is not writing/reading properly from the MPU. If the system is working in normal operation without any other warning, try to reboot the MOU and

MPU. If the reboot does not change the card detection status or the system is not working properly, the MOU shall be replaced with the spare unit.

Unplugged: The hardware plug-in is not detected by the MPU. If the system is working in normal operation without any other warning, try to reboot the MOU and MPU. If the reboot does not change the card detection status or the system is not working properly, the MOU shall be replaced with the spare unit.

An “Unplugged” status will make all other MOU BITE statuses display as “-”.

4.5.9.2 MPU-MOU Communication

MPU-MOU Communication has two status levels: OK and Fault.

Fault: The MPU is not able to communicate with the MOU. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.9.3 Card Temperature

A BITE warning is displayed if the card temperature is outside the range of -12 °C to +80 °C. If both MOUs report the same value, check that the system is clean and properly ventilated. If only one MOU reports a BITE warning, try to reboot the MOU. If the reboot does not change the card temperature status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.9.4 EEPROM

MOU EEPROM has two status levels: OK and Fault. This status is updated at MOU initialization and shall not change during operation.

Fault: The microcontroller is not able to validate the cyclic redundancy check (CRC) from the EEPROM data. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the EEPROM status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.9.5 Interrogator PLL

Interrogator PLL has two status levels: Locked and Unlocked.

Unlocked: The PLL is not able to lock to the configured interrogator frequency. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.9.6 Pulse Power

A BITE warning is displayed if the local interrogator pulse power is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not

change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.9.7 Pulse Duration

A BITE warning is displayed if the local interrogator pulse duration is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.9.8 Pulse Rising

A BITE warning is displayed if the local interrogator pulse rising is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.9.9 Pulse Falling

A BITE warning is displayed if the local interrogator pulse falling is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.9.10 Pulse Spacing

A BITE warning is displayed if the local interrogator pulse spacing is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.9.11 Frequency

A BITE warning is displayed if the local interrogator frequency is outside the configured range in the interrogator configuration warnings tab. If the system is working in normal operation without any other warning, try to reboot the MOU. If the reboot does not change the status or the system is not working properly, the MOU shall be replaced with the spare unit.

4.5.10 TRU BITE Window

The TRU BITE window displays the functional status of TRU1 and TRU2 (see Figure 14).

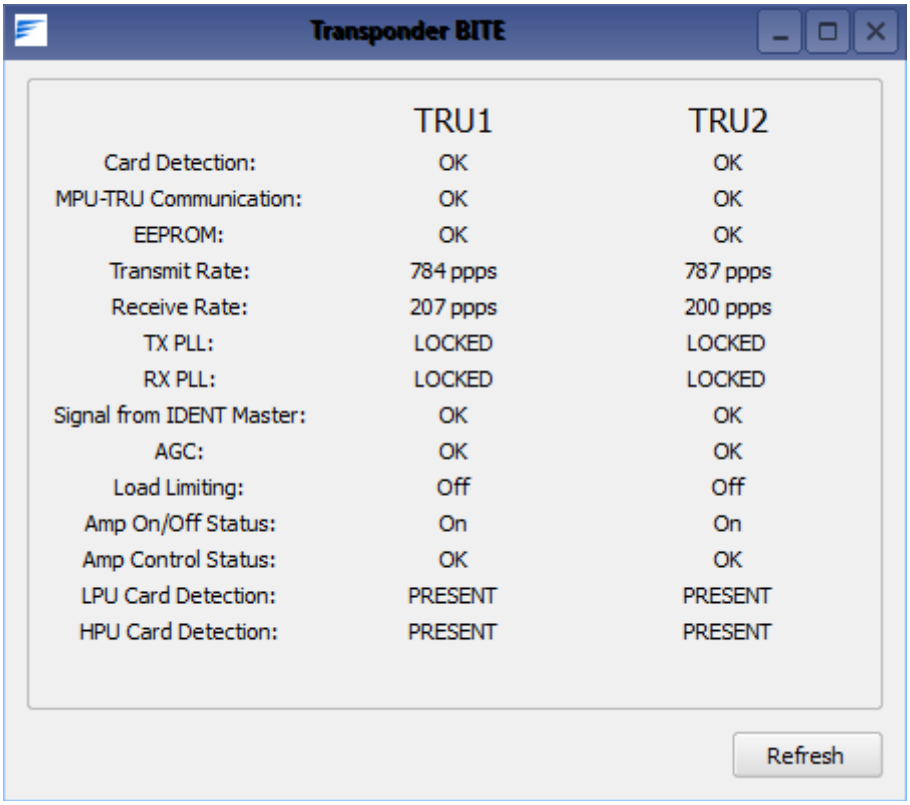


Figure 14 - TRU BITE Window

4.5.10.1 Card Detection

TRU Card Detection has three status levels: OK, Fault and Unplugged.

Fault: The test register is not writing/reading properly from the MPU. If the system is working in normal operation without any other warning, try to reboot the TRU and MPU. If the reboot does not change the card detection status or the system is not working properly, the TRU shall be replaced with the spare unit.

Unplugged: The hardware plug-in is not detected by the MPU. If the system is working in normal operation without any other warning, try to reboot the TRU and MPU. If the reboot does not change the card detection status or the system is not working properly, the TRU shall be replaced with the spare unit.

An “Unplugged” status will make all other TRU BITE statuses display as “-”.

4.5.10.2 MPU-TRU Communication

MPU-TRU Communication has two status levels: OK and Fault.

Fault: The MPU is not able to communicate with the TRU. If the system is working in normal operation without any other warning, try to reboot the TRU. If the reboot does not change the status or the system is not working properly, the TRU shall be replaced with the spare unit.

4.5.10.3 EEPROM

TRU EEPROM has two status levels: OK and Fault. This status is updated at TRU initialization and shall not change during operation.

Fault: The microcontroller is not able to validate the cyclic redundancy check (CRC) from the EEPROM data. If the system is working in normal operation without any other warning, try to reboot the TRU. If the reboot does not change the EEPROM status or the system is not working properly, the TRU shall be replaced with the spare unit.

4.5.10.4 Transmit Rate

The nominal value for transmit rate is the squitter rate configured in the transponder configuration. (Nominal value refers to the transmit rate when no aircraft are present.) This value takes into consideration the reply from external or local interrogations, the squitter and identification replies. The standard squitter rate configuration is 800 ppps.

4.5.10.5 Receive Rate

The nominal value for receive rate is the local interrogation rate configured in the transponder configuration (factory setting). This value takes into consideration external or local interrogations. The standard configuration is 200 ppps.

4.5.10.6 TX PLL

TX PLL has two status levels: Locked and Unlocked.

Unlocked: The PLL is not able to lock to the configured TX frequency. If the system is working in normal operation without any other warning, try to reboot the TRU. If the reboot does not change the status or the system is not working properly, the TRU shall be replaced with the spare unit.

4.5.10.7 RX PLL

RX PLL has two status levels: Locked and Unlocked.

Unlocked: The PLL is not able to lock to the configured RX frequency. If the system is working in normal operation without any other warning, try to reboot the TRU. If the reboot does not change the status or the system is not working properly, then the TRU shall be replaced with the spare unit.

4.5.10.8 Signal From IDENT Master

Signal from IDENT Master has two status levels: OK and Warning.

Warning: The TRU has not received an external identification synchronization signal from the master equipment for 45 seconds. Possible reasons for this include: a master equipment problem, a synchronization link problem, a DME IFU problem or a TRU problem. If only one TRU displays the warning, then switch the TRU with the spare unit. If both TRUs display the warning and the master equipment and communication link are working properly, the IFU shall be replaced with the spare unit.

4.5.10.9 AGC

AGC has two status levels: OK and Warning.

Warning: The Automatic Gain Controller (AGC) is not able to reach the configured power. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU (if this is a High Power model). If the reboot does not change the status or the system is not working properly, the TRU, LPU or HPU shall be replaced with the spare unit.

4.5.10.10 Load Limiting

Load Limiting has two status levels: On and Off

On: The Load Limiting mechanism is reducing sensitivity in order to avoid transponder overload. This is due to a high reception rate. Investigate the cause of this high reception rate. Perform a changeover to see if other transponder has the same behavior. If only one transponder shows this issue, and no other BITE is present, try to reboot the TRU. If the reboot does not change the status, the TRU shall be replaced with the spare unit.

4.5.10.11 Amp On/Off Status

Amp On/Off Status has two status levels: On and Off.

Off: The amplifier was turned off by the operator, or the TRU detected some problem on the LPU/HPU that caused an automatic shutdown of the amplifier. In this case, refer to the LPU BITE or the HPU BITE to take proper action on the equipment. If no other BITE is present, turn the transmitter off, then back on. If this does not change the status, try to reboot the TRU. If the reboot does not change the status, the TRU shall be replaced with the spare unit.

4.5.10.12 Amp Control Status

Amp Control Status has six status levels: OK. NO_MPU, LPU_FAULT, HPU_FAULT, LPU_CALIB_FAULT and HPU_CALIB_FAULT

No MPU: The TRU did not detect any MPU activity and considers the MPU as “not present”. In this case the TRU automatically shutsdown the amplifier since it is not under MPU supervision.

LPU_FAULT or HPU_FAULT: The TRU detected a fault in the LPU or HPU. This caused an automatic shutdown of the amplifier to prevent any damage. In this case, refer to the LPU BITE or the HPU BITE to take proper action on the equipment.

LPU_CALIB_FAULT or HPU_CALIB_FAULT: The TRU detected a problem with the LPU or HPU calibration data. This caused an automatic shutdown of the amplifier. In this case, refer to the LPU BITE or the HPU BITE to take proper action on the equipment.

In any of those cases, if no other BITE is present, turn the transmitter off, then back on. If this does not change the status, try to reboot the TRU. If the reboot does not change the status, the TRU shall be replaced with the spare unit.

4.5.10.13 LPU Card Detection

LPU Card Detection has two status levels: Present and Not Present.

Not Present: The TRU is not able to communicate with the LPU. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. If the reboot does not change the status or the system is not working properly, the TRU or the LPU shall be replaced with the spare unit.

A “Not Present” status will make all other LPU BITE statuses display as “-”.

4.5.10.14 HPU Card Detection

HPU Card Detection has two status levels: Present and Not Present.

Not Present: The TRU is not able to communicate with the HPU. If the system is working in normal operation without any other warning, try to reboot the TRU and HPU. If the reboot does not change the status or the system is not working properly, the TRU or the HPU shall be replaced with the spare unit.

A “Not Present” status will make all other HPU BITE statuses display as “-”.

4.5.11 LPU BITE Window

The LPU BITE window displays the functional status of LPU1 and LPU2 (see Figure 15).

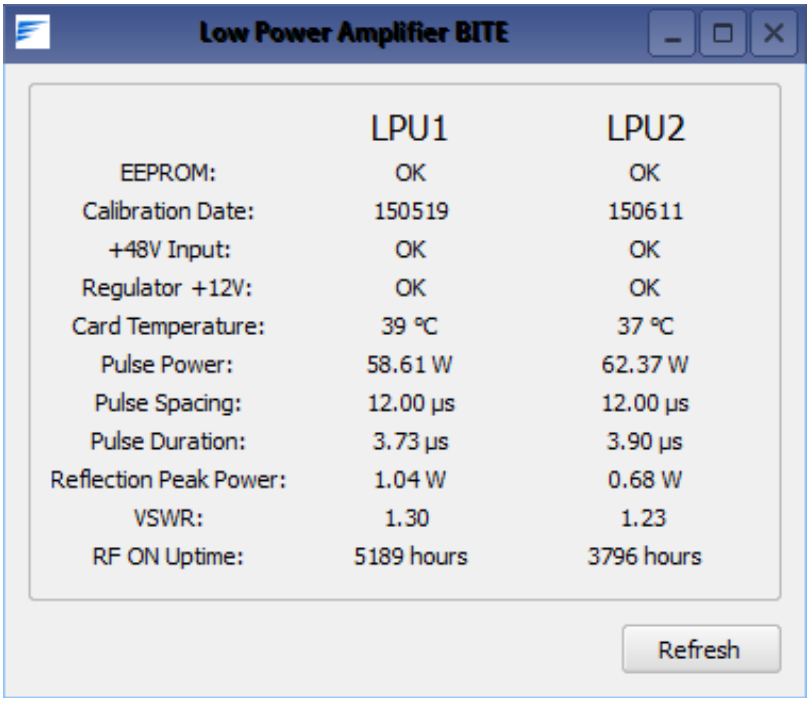


Figure 15 - LPU BITE Window

4.5.11.1 EEPROM

LPU EEPROM has three status levels: OK, Fault and Unplugged. This status is updated during LPU and TRU initialization and shall not change during operation.

Fault: The microcontroller is not able to validate the cyclic redundancy check (CRC) from the EEPROM data. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. If the reboot does not change the EEPROM status or the system is not working properly, then the LPU shall be replaced with the spare unit.

4.5.11.2 Calibration Date

The calibration date is updated at the factory and stored in the EEPROM. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. If the reboot does not change the calibration date status or the system is not working properly, the LPU shall be replaced with the spare unit.

4.5.11.3 48 V Input

A BITE warning is displayed if the 48 V input is outside the range of 41500 mV to 60000 mV. If the system is running on main power and the PDU BITE window is

reporting normal voltage, check that the digital cable between the LPU and the digital backplane is properly connected. If the system is running on standby power, check the PDU BITE window and verify that the battery status is “OK”. If none of these items caused the BITE warning, the LPU shall be replaced with the spare unit.

4.5.11.4 12 V Regulator

A BITE warning is displayed if the 12 V input is outside the expected range. If the system is running on main power and the PDU BITE window is reporting normal voltage, check that the digital cable between the LPU and the digital backplane is properly connected. If the system is running on standby power, check the PDU BITE window and verify that the battery status is “OK”. If none of these items caused the BITE warning, the LPU shall be replaced with the spare unit.

4.5.11.5 Card Temperature

A BITE warning is displayed if the card temperature is outside the range of -12 °C to +80 °C. If both LPUs report the same value, check that the system is clean and properly ventilated. If only one LPU reports a BITE warning, try to reboot the TRU and LPU. If the reboot does not change the card temperature status or the system is not working properly, the LPU shall be replaced with the spare unit.

4.5.11.6 Pulse Power

A BITE warning is displayed if the pulse power is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. If the reboot does not change the status or the system is not working properly, the LPU shall be replaced with the spare unit.

4.5.11.7 Pulse Spacing

A BITE warning is displayed if the pulse spacing is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. If the reboot does not change the status or the system is not working properly, the LPU shall be replaced with the spare unit.

4.5.11.8 Pulse Duration

A BITE warning is displayed if the pulse duration is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. If the reboot does not change the status or the system is not working properly, the LPU shall be replaced with the spare unit.

4.5.11.9 Reflection Peak Power

The nominal value for reflected power is between 0.2 W and 7 W. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. Perform a path verification from the TRU to the LPU/HPU. If the problem is still present, consider changing the TRU, LPU or HPU.

4.5.11.10 VSWR

A BITE warning is displayed when the VSWR is higher than 2:1. The nominal value shall be between 1.1:1 and 1.7:1. If the system is working in normal operation without any other warning, try to reboot the TRU and LPU. Perform a path verification from the TRU to the LPU/HPU. If the problem is still present, consider changing the TRU, LPU or HPU.

4.5.11.11 RF ON Uptime

The RF ON Uptime indicates the time during which the LPU RF output has been ON. This measurement is for information purposes only; a BITE warning will not be triggered.

4.5.12 HPU BITE Window

The HPU BITE window displays the functional status of HPU1 and HPU2 (see Figure 16).

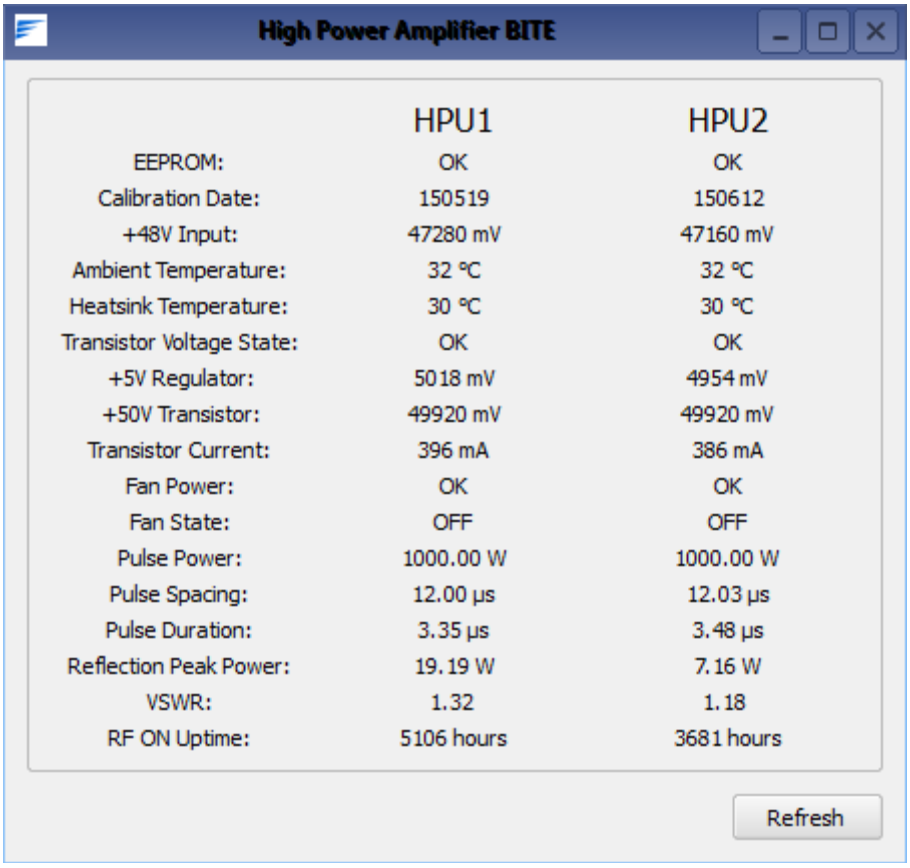


Figure 16 - HPU BITE Window

4.5.12.1 EEPROM

HPU EEPROM has three status levels: OK, Fault and Unplugged. This status is updated after the HPU/TRU initialization and shall not change during operation.

Fault: The microcontroller is not able to validate the cyclic redundancy check (CRC) from the EEPROM data. If the system is working in normal operation without any other warning, try to reboot the TRU and HPU. If the reboot does not change the EEPROM status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.2 Calibration Date

The calibration date is updated at the factory and stored in the EEPROM. If the system is working in normal operation without any other warning, try to reboot the TRU and HPU. If the reboot does not change the calibration date status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.3 48 V Input

A BITE warning is displayed if the 48 V input is outside the range of 41500 mV to 60000 mV. If the system is running on main power and the PDU BITE window is reporting normal voltage, check that the digital cable between the HPU and the digital backplane is properly connected. If the system is running on standby power, check the PDU BITE window and verify that the battery status is “OK”. If none of these is the cause of the BITE warning, the HPU shall be replaced with the spare unit.

4.5.12.4 Ambient Temperature

A BITE warning is displayed if the ambient temperature is outside the range of -12 °C and +80 °C. If both HPUs report the same value, check that the system is clean and properly ventilated. If only one HPU reports a BITE warning, try to reboot the TRU and HPU. If the reboot does not change the ambient temperature status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.5 Heat Sink Temperature

A BITE warning is displayed if the heat sink temperature is outside the range of -15 °C to +100 °C. If both HPUs report the same value, check that the system is clean and properly ventilated. If only one HPU reports a BITE warning, try to reboot the TRU and HPU. If the reboot does not change the heat sink temperature status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.6 Transistor Voltage State

Transistor Voltage State has two status levels: OK and Warning.

Warning: A BITE warning is displayed if the +50 V transistor is outside the range of 48500 mV to 51500 mV. If the system is running on standby power, check the PDU BITE window and verify that the battery status is “OK”. Also, try to reboot the TRU and HPU. If the reboot does not change the status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.7 5 V Regulator

A BITE warning is displayed if the regulator voltage is outside the range of 4800 mV to 5200 mV. If the system is running on standby power, check the PDU BITE window and verify that the battery status is “OK”. Also, try to reboot the TRU and HPU. If the reboot does not change the status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.8 50 V Transistor

A BITE warning is displayed if the transistor voltage is outside the range of 48500 mV to 51500 mV. If the system is running on standby power, check the PDU BITE window and verify that the battery status is “OK”. Also, try to reboot the TRU and HPU. If the reboot does not change the status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.9 Transistor Current

A BITE warning is displayed if the transistor current is outside the range of 700 mA to 900 mA. If the system is running on standby power, check the PDU BITE window and verify that the battery status is “OK”. Also, try to reboot the TRU and HPU. If the reboot does not change the status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.10 Fan Power

Fan Power has two status levels: OK and Warning.

Warning: A BITE warning is displayed if the input voltage or current is outside the expected limits. The fan is not mandatory for normal operation, but an operating fan increases the system MTBF. Try to reboot the TRU and HPU. If the reboot does not change the status or the system is not working properly, the HPU may be replaced with the spare unit.

4.5.12.11 Fan State

Fan State has two status levels: Running and Off.

Off: The state of the fan is reported directly by the fan controller. The fan is not mandatory for normal operation, but an operating fan increases the system MTBF. Try to reboot the TRU and HPU. If the reboot does not change the status or the system is not working properly, the HPU may be replaced with the spare unit.

4.5.12.12 Pulse Power

A BITE warning is displayed if the pulse power is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU. If the reboot does not change the status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.13 Pulse Spacing

A BITE warning is displayed if the pulse spacing is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU. If the reboot does not change the status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.14 Pulse Duration

A BITE warning is displayed if the pulse duration is outside the configured range in the alarm setting window. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU. If the reboot does not change the status or the system is not working properly, the HPU shall be replaced with the spare unit.

4.5.12.15 Reflection Peak Power

Nominal value for reflected power is between 2 W and 70 W. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU. Perform a path verification from the TRU to the LPU/HPU. If the problem is still present, consider changing the TRU, LPU or HPU.

4.5.12.16 VSWR

A BITE warning is displayed when the VSWR is higher than 2:1. Nominal value shall be between 1.1:1 and 1.7:1. If the system is working in normal operation without any other warning, try to reboot the TRU, LPU and HPU. Perform a path verification from the TRU to the LPU/HPU. If the problem is still present, consider changing the TRU, LPU or HP.

4.5.12.17 RF ON Uptime

The RF ON Uptime indicates the time during which the LPU RF output has been ON. This measurement is for information purposes only; a BITE warning will not be triggered.

5. MAINTENANCE LOG AND REPORT

5.1 Maintenance Log Book

In order to track the maintenance history of the equipment, a maintenance log book is required in each shelter.

The maintenance engineer will make notes or records on the log book when each maintenance work is done.

5.2 Storing and archiving system data

Intelcan DME equipment has a SD card inside the equipment to save the daily system data as history file. It can keep saving the data over 10 years without cleaning the SD card.

However the maintenance engineer will archive the system data into the maintenance computer during the monthly maintenance.

5.3 Maintenance Report

A maintenance report will be filled out by the maintenance engineer during the maintenance on site.

END OF DOCUMENT