THALES 'TOP FLIGHT' SATELLITE DATA UNIT (SDU)

KV6-TFS-SDU82155D

EXHIBIT 12 – OPERATING DESCRIPTION

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1 SDU Operating Description

1.1 Top Level System Description and Architecture

1.1.1 This document describes the Thales KV6-TFS-SDU82155D Aeronautical Inmarsat Satcom terminal that is designed to support Inmarsat Class 6 and 7 Swift BroadBand (SBB), Swift64 (S64) and Classic Aero services.

1.1.2 System Architecture

1.1.2.1 Figure 1 illustrates the system architecture. The Thales KV6-TFS-SDU82155D Satcom Data Unit (SDU) contains two Channel Card Modules and will interface with an electronically steered Intermediate Gain Antenna (IGA) or High Gain Antenna (HGA) and a Type-F DLNA as defined by ARINC 781. The SDU integrates the functions of the SDU, RFU and HPA as previously defined in a typical ARINC 741 configuration.

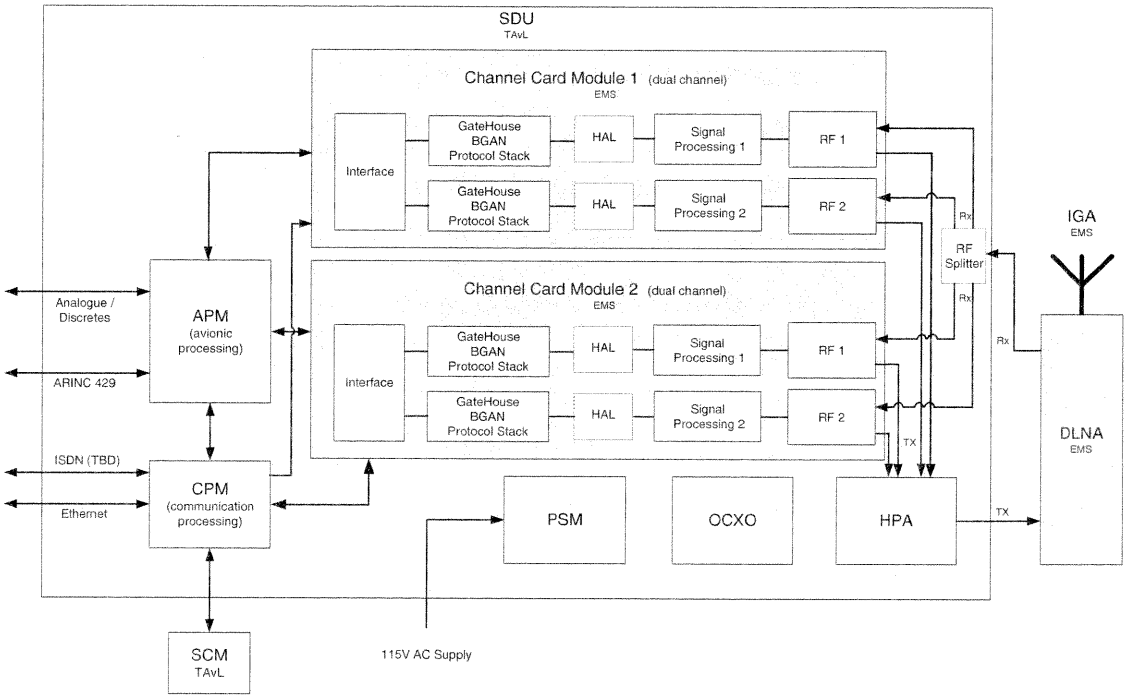

Figure 1 – Generic System Architecture

1.2 System Description and Operational Characteristics

1.2.1 System Hardware

1.2.1.1 The Thales SDU includes a Chassis containing the following major subsystem modules as illustrated in Figure 2:

- High Power Amplifier (HPA)
- 2 x Channel Card Module (CCM)
- Communication Processor Module (CPM)
- Power Supply Module (PSM)
- Oscillator (OCXO) – Provides a stable 10 MHz system operating frequency over a temperature range.
- Avionics Processor Module (APM)
- Backplane
- Front Panel

1.2.1.2 The associated SDU Configuration Module (SCM):

- Holds up to 4 USIM cards
- Holds memory for ORT storage

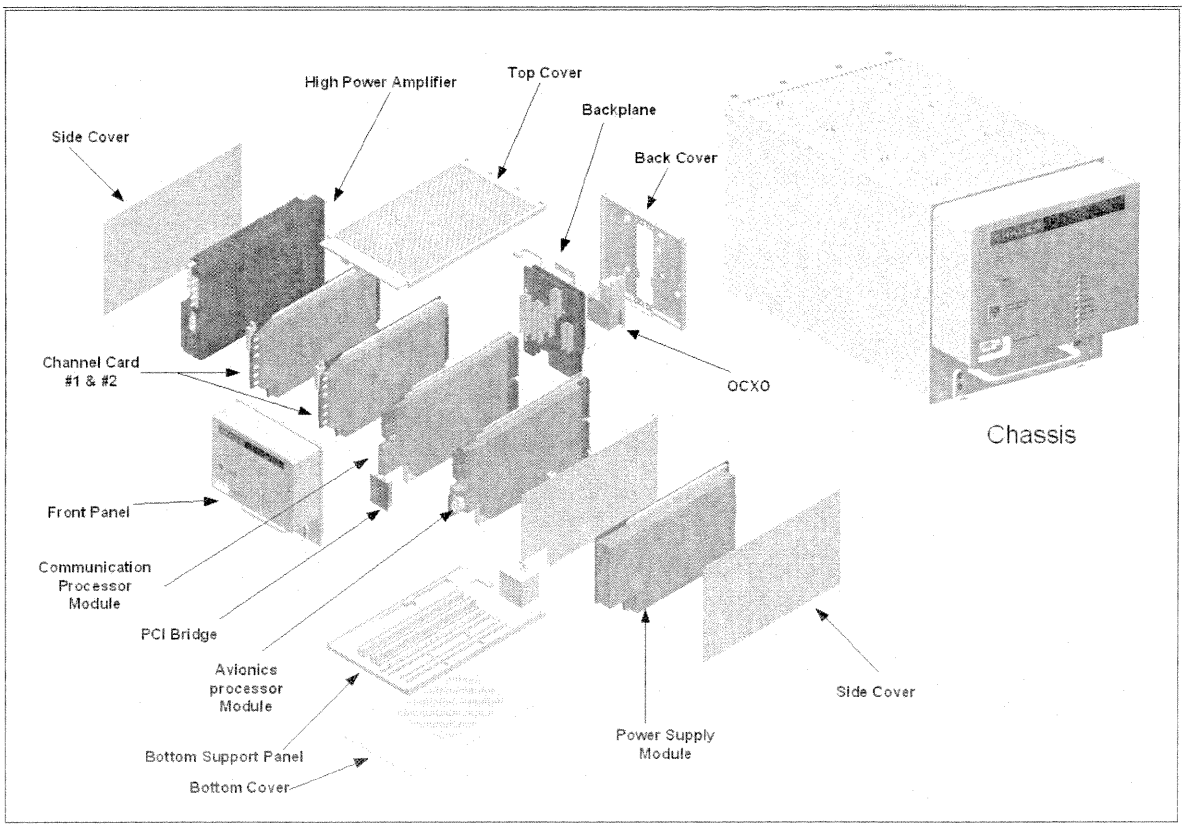

Figure 2 - SDU Subsystem Modules

1.2.2 System Software

1.2.2.1 The software in the TFS SDU can be considered as being supplied in two elements, one contained within the CCM the other operating on the SDU processors (CPM & APM).

1.2.2.2 The SDU's application software primarily functions as the system controller providing system level tasks such as CCM control, BITE reporting, Avionics interfacing via ARINC-429 (including IRS) and providing external interfaces (such as Ethernet) as well as routing functions between the external interfaces and the CCMs as necessary. Table 1 details the functionality provided by the SDU CCM, APM and CPM modules.

SDU HW Module	Functionality
EMS CCM	• One or two Class 6 and 7 SBB channels, • One to four S64 channels • One or two Inmarsat Classic voice channels, • Classic data functionality • L-band transceiver (excluding HPA and DLNA) • Modulation/demodulation and FEC encoding/decoding • Full BGAN protocol handling {note: including beam selection, transmit burst timing, etc.} • Interface to the APM and CPM processors within the SDU
Thales CPM	• Interface to external DTE via Ethernet • Handling and routing of ISDN and voice connections which are between the SDU and external entities • Handling of external DTE signalling in AT commands and user data via Telnet and PPPoE over the Ethernet interface {note: the AT commands are used to define, activate and deactivate PDP Contexts} • Interface to APM and CCMs within the SDU • Interface to external SCM
Thales APM	• Interface to external avionics • Reception of aircraft position, speed and heading information from external avionics via ARINC 429 – also updates CCM with position information every second • Satellite Selection based on aircraft position • Maintain antenna pointing to the wanted satellite – beam steering via ARINC 429 • Management of RF resources • Set CCM transmit power level – taking into account antenna gain and cable losses stored in the ORT • Set HPA back-off • Compensation of Aircraft Doppler – update CCM with frequency drift rate • Determine satellite and/or beam transition when carrying user traffic • Interface to CCMs via CPM within the SDU

Table 1 - SDU SW Functionality

1.2.3 System Data Ports

1.2.3.1 The terminal supports only a single 10/100 Base T Ethernet port.

1.2.3.2 The Ethernet port is capable of supporting static and dynamic IP addressing and will support the following protocols:

- PPPoE
- DHCP
- Telnet
- SNMP
- TCP/IP
- UDP/IP

1.2.3.3 The physical interface for these ports will is ARINC 600 connector on the rear of the SDU chassis.

1.2.4 Tx and Rx Band Frequencies

- Tx 1626.5 MHz to 1660.5 MHz
- Rx 1525.0 MHz to 1559.0 MHz

1.2.5 System Dimensions and Weight

1.2.5.1 **SDU Size:**

- ARINC 600 6 MCU chassis
- Dimensions 195mm x 191 mm x 321 mm

1.2.5.2 **SCM Size:**

- The SCM is housed in an enclosure that is consistent with the maximum dimensions identified in ARINC781 Attachment 1-6.
- Dimensions 110mm x 101mm x 22.5mm

1.2.5.3 **SDU Weight:**

- 11 Kg maximum

1.2.5.4 **SCM Weight:**

- 0.3 Kg maximum

1.2.6 System UT Operational Parameters

1.2.6.1 **Power:**

- Voltage Range 100 to 122 Vrms, AC
- Frequency Range 360 to 800 Hz, sinusoidal.

1.2.6.2 **Cooling:**

- Forced air, maximum inlet temperature 40 °C, mass flow 50 Kg/hr

1.2.7 System UT Operational Environmental Conditions

1.2.7.1 The expected Environmental Conditions for the terminal are listed in Table 2.

SDU Environmental Conditions (RTCA DO160E)	**RTCA DO-160E Category**
Section 4 -Temperature and Altitude	Category A1/A2/Z Z – 30mins @ 40°C,
Section 5 - Temperature Variation	Category B
Section 6 - Humidity	Category A
Section 7 - Shock	Category B, E
Section 8 - Vibration	Category S, Curve B, C
Section 9 - Explosion	Category E
Section 10 - Waterproofness	Category X
Section 11 - Fluids Susceptibility	Category X
Section 12 - Sand and Dust	Category X
Section 13 - Fungus Resistance	Category F
Section 14 - Salt Spray	Category X
Section 15 - Magnetic Effect	Category A
Section 16 - Power Input	Category A(WF)H (115V AC)
Section 17 - Voltage Spike	Category A
Section 18 - Audio Frequency Susceptibility	Category R(WF) (115V AC) Category B (28V DC)
Section 19 - Induced Signal Susceptibility	Category ZW
Section 20 - Radio Frequency Susceptibility	Category R,R
Section 21 - Radio Frequency Emissions	Category H,M
Section 22 - Lightning Induced	Category A3G33
Section 23 - Lightning Direct	Category X
Section 24 - Icing	Category X
Section 25 – Electrostatic Discharge	Category A
Section 26-Fire/Flammability	Category C

Table 2 - Environmental Conditions for UT