EXHIBIT B

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SATCOM AERO-I

JETSAT PRODUCT

DESIGN AND PERFORMANCE

According to

FCC RULES PART 2 §2.1033

♦ **This document includes : 14 pages**

NE 935 426 AN Issue 0

Elancourt, March 20th, 2000

DOCUMENT FOLLOWUP

PROJECT :	TITRE : SATCOM AERO-I - JETSAT PRODUCT DESIGN AND PERFORMANCE FCC RULES PART 2.1033	REFERENCE : NE 935 426 AN Issue 0

ACTION	NAME	DATE	SIGNATURE
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RECORD OF REVISIONS

INDEX	DATE	REVISIONS	NAME
0	20 March 2000	Creation	G. JURQUET

CONTENT

1. APPLICANT

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2. PURPOSE

This technical report is a part of the application for certification of the THOMSON-CSF DETEXIS equipment JETSAT satellite receiver-transmitter operating under part 87 of the FCC rules.

This document provides information required for a FCC application for equipment certification and described in FCC Rules 47 CFR, Part 2, Subpart J, Section 2.1033.

3. APPLICABLE DOCUMENTS

[A1] ARINC characteristic n° 761 " Second Generation Aviation Satellite Communication System, Part 1 Aircraft Installation Provisions" published September 22, 1998.

[A2] INMARSAT AERONAUTICAL System Definition Manual Modules, version 1.46, September 1996.

[A3] RTCA paper DO160D "Environmental Conditions and Test Procedures", and its equivalent document :

[A4] EUROCAE ED14D "Environmental Conditions and Test Procedures for Airborne Equipment".

[A5] RTCA paper DO178B "Software Considerations in Airborne Systems and Equipment Certification".

4. DESCRIPTION

This section contains descriptive information covering the THOMSON-CSF DETEXIS (DEX) JETSAT SATCOM AERO-I Aircraft Earth Station (AES). In this document, the JETSAT AES may be referred to as its three subsystems (IGA, HLD, SDU) or by its full nomenclature.

The JETSAT AES is a complete communication system for satellite communication in the AERO-I INMARSAT 3 satellite network, intended to provide voice and data communication services to and from aircraft. JETSAT is a small, light, and low cost system, but offering 4 voice channels and one data channel simultaneously . The radio link between the aircraft and the satellite operates in L-band (1.5 / 1.7 GHz). Voice services and high speed data services (4800 bps) operate under spot beam satellite, while Packet Mode Data Services (600 and 1200 bps) operate under spot and global beam.

JETSAT realizes the interface with the space segment (the satellite, in L-band) for communications with the ground, and interfaces in the aircraft with ACARS/MU and other equipment, and with crew and passenger voice equipment, in accordance with the relevant technical and operational requirements.

The range of possible applications for the JETSAT services includes airline passenger communications (public correspondence), Airline Operational Communication (AOC) and Traffic Control (ATC), in conformance with FANS (Future Airspace Navigation System) requirements.

JETSAT comprises the following basic units:

- A mechanically steered Intermediate Gain Antenna (IGA),
- The High power amplifier-Low noise amplifier-Diplexer unit (HLD)
- The Satellite Data Unit (SDU)

Optional equipment is proposed:

- An integrated Mini Cabin Telecommunication Unit (MCTU)

Table 1 give a brief description of each basic units.

NOTE: In the following sections of this document, the IGA will not be characterized as it is not concerned with the FCC equipment certification.

EQUIPMENT TYPE	EQUIPMENT DESCRIPTION
IGA	The IGA is a mechanically steered antenna. It radiates and receives radio frequency signals between the aircraft and the satellite to enable communications to and from the aircraft.
HLD	The HLD is a combination of High Power Amplifier and LNA/Diplexer. The HPA section provides an adequate transmitted RF power level to the antenna in order to maintain the A/C EIRP within the specified limits. The HLD Diplexer section filters and couples the transmit signals from HLD/HPA to the antenna. The HLD Diplexer section also filters and couples the receive signals from the antenna to the HLD/LNA to prevent receiver desensitization. The HLD/LNA section amplifies the low level receive signal from the antenna after the Diplexer filtering in order to compensate for transmission line losses to the SDU.
SDU	The signal-in-space parameters are determined by the SDU in relation to modulation/demodulation, error correction, coding and data rates associated with the communication channels. The SDU integrates the circuits for RFU and avionics interfaces. It also provides basic PABX (voice, fax and PC data) and system maintenance functionality's. Option: an embedded MCTU provides a capacity of up to 32 digital handset.

Table 1 – JETSAT AES Subsystems Description

5. JETSAT IDENTIFICATION

The Part Numbers of the JETSAT subsystems are listed in table 2.

The equipment is available with two different input power supply: 115Vac/400Hz and 28Vdc.

Component	P/N (115V ac)	P/N (28V dc)	Notes
SDU	3433-500-00X	3433-500-01X	Several avionics interfaces available
SDU / MCTU	3433-500-10X	3433-500-11X	Up to 32 digital handset capacity. Several avionics interfaces available
HLD	3433-300-000	3433-300-010	

Table 2: JETSAT AES Subsystems Part-Numbers

Note: The listed Part Numbers are hardware references, final P/N includes a software related suffix (XNN)

6. INMARSAT APPROVAL

THOMSON-CSF DETEXIS JETSAT AERO-I AES is INMARSAT approved as a class 3 AES. INMARSAT Access Approval Certificate Number is DASS-102, date of issue is 25 February 2000 (see corresponding exhibit).

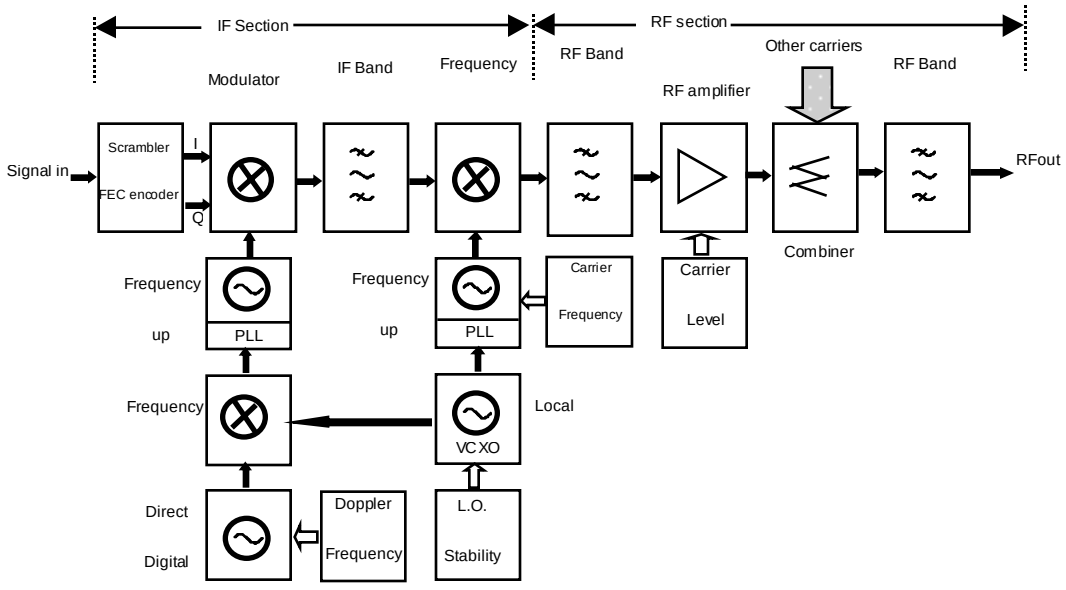
7. DESIGN

7.1 SOFTWARE COMPLIANCE

The JETSAT software was designed, test-verified following the criteria of RCTA paper DO 178 B (level D) and documented with material listed in SOFTWARE CONFIGURATION INDEX documents.

7.2 TECHNICAL CHARACTERISTICS

- **Transmit Channel Schematic Diagram**



- **Power management**

Power control capabilities is a mandatory feature in the Aircraft Earth Station (AES). The purpose of the power control is to conserve satellite L-band power in the forward direction, and to enable an AES to provide multiple channels when link conditions are favorable, while providing service with a smaller number of channels (e.g. one channel) when link conditions are unfavorable.

The initial EIRP of the Channel is set to be the value derived from the worst case link budget, and is conveyed to the AES in the Channel Assignment signal transmitted by the Ground Earth Station (GES) over the signaling channel. Before every power control signaling sequence, the GES determines the requirement for the AES to adjust its transmitting power, based on the BER value measured at the GES.

For an AES class 3 (voice and packet data) equipped with an IGA, the minimum required EIRP range for the data channel is 6.5 to 13.5 dBW. All channels must be adjustable over a range of 15 dB in steps of 1dB. The minimum required EIRP range shall be placed in the middle of the 15 dB range. Total range is therefore 2.5 dBW to 17.5 dBW.

Furthermore, the AES monitors the output power of the high power RF amplifier (HPA). An HPA output power sharing algorithm is implemented to ensure that the maximum linear operating output power is not exceeded.

- **Doppler compensation**

The frequency of all transmitted signals are corrected for Doppler frequency shifts caused by the relative motions of the aircraft and the satellite (for subsonic aircraft, the maximum adjustment due to aircraft velocity alone is approximately $\pm$ 2kHz).

Due to all causes, the total error of the transmitted frequency received at the satellite does not exceed 383 Hz (root-sum-square contribution of the various AES frequency error terms). The Doppler adjustment resolution does not exceed 10Hz and associated frequency changes is made without introducing phase discontinuity into the transmitted signal.

The maximum rate of change of the frequency of the transmitted signal received at the satellite does not exceed 15Hz/sec.

- **Modulation**

The modulation methods used are Aviation Quadrature Phase Shift Keying (A-QPSK) and Aviation Binary Phase Shift Keying (A-BPSK).

A-QPSK is aviation QPSK, a form of O-QPSK with root-raised-cosine pulse shaping, whose roll-off factor is 60%.

A-BPSK is a form of differentially encoded BPSK in which alternate modulation symbols are transmitted in notional In-Phase and Quadrature channel.

The functional blocks at the transmit end of each channel are as follows:

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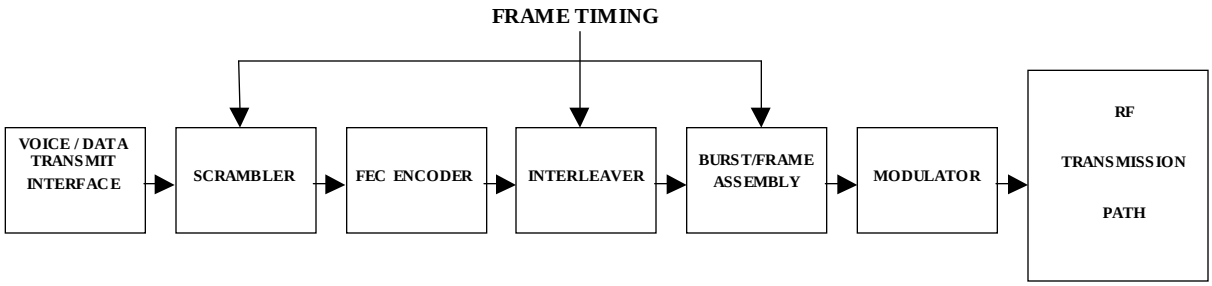

7.3 SYSTEM INTERFACES

The interfaces between the various subsystems are presented hereafter and summarized in figure 1.

Cockpit

- 2 CMU / ACARS / AFIS / ATSU
- 3 MCDU
- 1 RMP
- 1 Cockpit Audio System

Cabin Functionalities

- 1 CPDF
- Up to 4 Analog Handsets
- Up to 32 Digital Handsets (MCTU option)
- Up to 2 DTMF Fax/PC with modem devices
- 1 External CTU (via CEPT E1 serial bus)

E BAY Functionalities

- 2 IRS
- 1 CFDS (ARINC 604 and ABD048 compliant)
- 1 ADL
- 1 Other SDU (dual SATCOM)
- 2 FMC
- 64 Discrete (ICAO Address, WOW, MS,…)
- APM Device
- 2 ARINC 429 links HLD/SDU
- 2 RF Coaxial Cables HLD/SDU
- 1 RF Coaxial Cables HLD/IGA

Other Functionalities

- 7 JETSAT Status Indicators
- 1 Maintenance RS232 Port
- 115V/400Hz Power Supply
- 28 Vdc Power Supply

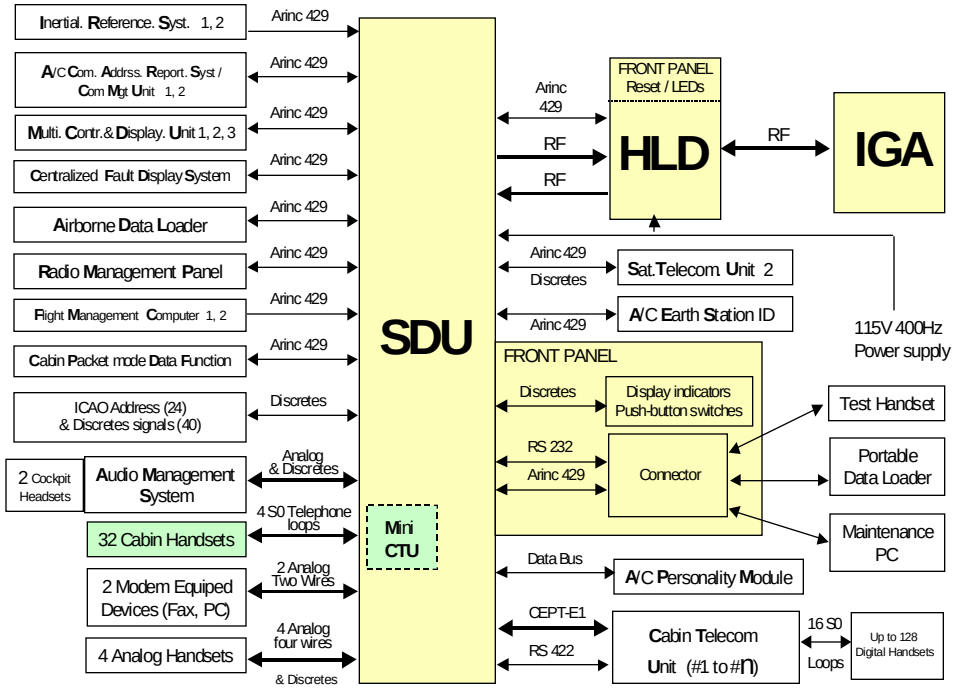

Figure 1: System Interfaces

8. SYSTEM PERFORMANCE

The JETSAT AERO-I AES fully complies with ARINC characteristic 761and Inmarsat Aero-I System Definition Manual. The receiver-transmitter is separated into two main components:

- The High power amplifier-Low noise amplifier-Diplexer unit (HLD)
- The Satellite Data Unit (SDU)

8.1 HLD SUBSYSTEM PERFORMANCE

Transmit band	:	1.6265 to 1.6605 GHz
Receive band	:	1.530 to 1.559 GHz
Input Power	:	-25 dBm $\leq$ Pin $\leq$ -19 dBm
Input VSWR	:	$\leq$ 2.0 : 1 (50 Ω)
Output Power	:	< 41dBm Linear
Output VSWR	:	$\leq$ 1.5 : 1 (50 Ω)
Tx Gain	:	> 61 dB
Rx Noise Figure	:	$\leq$ 1.8 dB
Rx Gain	:	> 49 dB
Electrical	:	115v/400Hz or 28Vdc
Power Consumption	:	170 W max.
Mechanical	:	ARINC 600 packaging, 4 MCU size
Weight	:	10 kg (22 lbs.)
Altitude	:	15000 feet
Storage Temperature	:	-55°C to +85°C
Operating Temperature	:	-15°C to +70°C

8.2 SDU SUBSYSTEM PERFORMANCE

Transmit band	:	1.6265 to 1.6605 GHz
Receive band	:	1.530 to 1.559 GHz
Type of Emission	:	21K0G1W
Output Power	:	< +6 dBm
AES Class	:	3 (spot and global beam)
Number of Channels	:	4 voice / 1 data
Telephony Rate	:	8400 bps
Fax Rate	:	2400 bps
Modem Rate	:	2400 bps
Packet Mode Data	:	600, 1200 bps

Transmission Characteristics:

Channel Rate (bit/s)	Channel Spacing (kHz)	Modulation	Filter Roll-Off
8400	5.0	A-QPSK	60%
2400	5.0	A-BPSK	40%
1200	2.5	A-BPSK	40%
600	2.5	A-BPSK	40%

I-Q Channel Balance	:	Amplitude	$\pm$0.2dB
	:	Phase	$\pm$3°
Frequency Error	:	< $\pm$ 320 Hz	
Doppler Compensation	:	$\pm$2kHz (~$\pm$360m/s or 700 knots)	
Doppler Freq Rate Chge	:	Max. $\pm$15 Hz/s	
Aircraft Interfaces	:	See figure 1	
Electrical	:	115v/400Hz or 28Vdc	
Power Consumption	:	70 W max.	
Mechanical	:	ARINC 600 packaging, 4 MCU size	
Weight	:	5.2 kg (11.5 lbs.)	
Altitude	:	15000 feet	
Storage Temperature	:	-55°C to +85°C	
Operating Temperature	:	-15°C to +70°C	

9. ENVIRONMENTAL CHARACTERISTICS

The JETSAT SATCOM AES meets the environmental conditions for EUROCAE (European Organisation for Civil Aviation Electronics) document number ED-14D and the RTCA (Radio Technical Commission for Aeronautics) document number DO-160D, "Environmental Conditions and Test procedure for Airborne Equipment".

Qualification documents are listed below in table 3. Environmental certification categories for each subsystem equipment are defined in table 4.

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Subsystem	Document	Reference
HLD	QUALIFICATION PLAN	NE 878 419
	QUALIFICATION TEST REPORT	NE 933 264
SDU	QUALIFICATION PLAN	NE 878 419
	QUALIFICATION TEST REPORT	NE 929 157

Table 3: Qualification Test Reports

Environmental Condition	DO160D section	SDU Category	HLD Category
Temperature/ Altitude	4.0	A1	A1
Temperature variation	5.0	B	B
Humidity	6.0	A	A
Operational shocks	7.0	B	B
Vibration	8.0	SB	SB
Explosion-proofness	9.0	x	x
Waterproofness	10.0	x	x
Fluids susceptibility	11.0	x	x
Sand and dust	12.0	x	x
Fungus resistance	13.0	x	x
Salt spray	14.0	x	x
Magnetic effect	15.0	A	A
Power input	16.0	E /Z	E/ Z
Voltage spike	17.0	A	A
Audio frequency conducted susceptibility	18.0	E	E
Induced signal susceptibility	19.0	A	A
Radio frequency susceptibility	20.0	U	RS
Emission of radio frequency energy	21.0	L	L
Lightning susceptibility	22.0	A2xx	A2xx
Lightning direct effects	23.0	x	x
Icing	24.0	x	x
Electrostatic discharge	25.0	A	A

NOTE : Category x = tests not applicable.

Table 4– JETSAT Qualification