

USER MANUAL

VHF GBAS TRANSMITTER

EM9009 - EM9009A

Code : 40100232 V1.00

Ref. : NEXGB EM9009-A



telerad

2 avenue de la Butte aux Cailles - BP 302 - 64603 ANGLET cedex - FRANCE - Tél: 05 59 58 55 00 - Fax: 05 59 58 55 01
Tél international: +33 5 59 58 55 00 - Fax international: +33 5 59 58 55 01



LIST OF MODIFICATIONS

N°	PAGE(S) MODIFIED	DATE	VISA
V1.00	Pages A to 34.	07/12/2007 12:23	BP

This page is left blank intentionally.

CONTENTS

CHAPTER 1	GENERAL.....	1
CHAPTER 2	PRESENTATION.....	3
2.1	OPERATIONAL COMPOSITION.....	3
2.2	CONSTITUENT SUB-ASSEMBLIES.....	3
2.3	COMPATIBLE UNITS.....	4
CHAPTER 3	GENERAL CHARACTERISTICS.....	5
3.1	ELECTRICAL CHARACTERISTICS.....	5
3.2	MECHANICAL CHARACTERISTICS.....	6
3.3	CLIMATIC CHARACTERISTICS.....	6
CHAPTER 4	INTERFACE CONTROL DOCUMENTS.....	7
4.1	MAINTENANCE CONNECTOR.....	7
4.2	TELEMONITORING (JBUS) CONNECTOR (J2).....	7
4.3	DATA CONNECTOR (J5).....	7
CHAPTER 5	CONNECTIONS - CONFIGURATION	9
5.1	EM 9009 TRANSMITTER.....	9
5.1.1	Rear panel description.....	9
5.1.2	Front panel description.....	10
5.2	EM 9009 A TRANSMITTER.....	11
5.2.1	Rear Panel Description.....	11
5.2.2	Front panel description.....	12
5.3	CONNECTORS.....	13
5.3.1	Rear panel connector.....	13
5.3.2	Front panel connector.....	16
5.3.3	Electrical interfaces used.....	17
5.4	DESCRIPTION OF INTERNAL CONNECTORS - CONFIGURATION OF JUMPERS.....	20
5.4.1	Physical view of the CTRL 11170 PCB.....	20
5.4.2	Description of internal connectors of CTRL 11170 PCB.....	21
5.4.3	Description of CTRL 11170 PCB jumpers.....	25
5.4.4	Description of CTRL 11170 PCB potentiometers.....	26
5.4.5	Description of CTRL 11170 PCB indicators.....	26
CHAPTER 6	SETTING INTO SERVICE - OPERATION	27
6.1	FRONT PANEL OPERATING ELEMENTS.....	27
6.1.1	Definitions.....	27
6.1.2	Front panel of EM 9009.....	28
6.1.3	Front panel of EM 9009 A.....	28
6.1.4	Description of light indicators and switches.....	29
6.2	SETTING THE TRANSMITTER INTO SERVICE.....	31
6.3	OPERATING SETTINGS	32
6.3.1	Introduction.....	32
6.3.2	Operation verification.....	32
6.3.3	Frequency verification.....	32
6.3.4	Frequency adjustment.....	32
CHAPTER 7	DIAGRAMS.....	33

LIST OF FIGURES

FIGURE 1 - EM 9009 REAR PANEL	9
FIGURE 2 - EM 9009 FRONT PANEL	10
FIGURE 3 - EM 9009 A REAR PANEL	11
FIGURE 4 - EM 9009 A FRONT PANEL.....	12
FIGURE 5 - INTERFACES USED (10 to 116).....	17
FIGURE 6 - INTERFACES USED (117 to 122).....	18
FIGURE 7 - INTERFACES USED (123 to 128).....	19
FIGURE 8 - CTRL 11170 PCB PHYSICAL VIEW	20
FIGURE 9 - EM 9009 FRONT PANEL	28
FIGURE 10 - EM 9009 A FRONT PANEL.....	28

This page is left blank intentionally.

LIST OF PLATES

PLATE 0	MECHANICAL VIEWS
PLATE 1	GENERAL BLOCK DIAGRAM
PLATE 2	FRONT AND BACK VIEW (EM9009A)

This page is left blank intentionally.

CHAPTER 1 GENERAL

The GBAS VHF **EM 9009 / EM 9009 A** transmitter has been designed and developed to comply with the new requirements of data transmission in the 108.025-117.950 MHz range for civil aeronautical telecommunications.

Designed for *Ground Based Augmentation Systems (GBAS)*, the transmitter is a multi-frequency unit equipped with a number of functions enabling it to fit into various configurations.

From the EMC point of view the unit is compliant with the European Directives 199/05/CE. The standard references are: EN 55022 edition 1998, ETS 301 489-1 edition 2000, ETS 301 489-22 edition 2000, EN 61000-3-2 edition 2000 and EN 6100-3-3 edition 1995.

With regards to low voltage, the unit complies with the modified European Directives 73/23/CEE. The reference norm is: NF EN 60950.

Due to its modular conception, the maintenance of the unit is easy and fast through simple replacement of defective sub-assembly.

The unit comes with or without mains and is characterized by the following:

- **Frequency range:**
 - 108.025 - 117.950 MHz.
- **Operating modes:**
 - VDB for GBAS CAT 1 data transmission,
- **Rated power:**
 - Adjustable to 10W up 80W by the user.
- **Other functions:**
 - Operation under local or remote control,
 - Integrated remote control and remote processing (RS485, J-BUS protocol),
 - Digital processing of signal,
 - Can be configured under local mode with an ASCII/PC terminal or TELERAD PGM 9000 programmer (see specific Guide), or remote using a PC,
 - Integrated test,
 - Internal protection against over voltage, overheating, SWR...
 - Power supply with 24V dc battery voltage (21V-31V). The version A has at its disposal an additional power through the mains voltage, with an automatic mains/ battery switching in case of mains voltage failure.

This page is left blank intentionally.

CHAPTER 2 PRESENTATION

2.1 OPERATIONAL COMPOSITION

The VHF GBAS transmitter EM 9009/EM 9009 A can fit into a standard 19" rack with a height of 3U.

This modular unit is made of a chassis containing the following:

- For the EM 9009 version, the dc voltage monitoring PCB, mounted on the right side of the unit.
- For the EM 9009 A version, the mains power supply module with the switching power supply PCB, being the right side of the unit.
- The VHF amplifier module whose radiator forms the left side of the unit.
- The AF control PCB fixed to the bottom of the chassis. It occupies the space between the two preceding sub-assemblies.
- The front panel which regroups the local operating controls and signals is directly linked to the AF control PCB.
- A removable cover which protects the sub-assemblies mounted inside the chassis.

2.2 CONSTITUENT SUB-ASSEMBLIES

The sub-assemblies of the transmitter are here below (each module or PCB is marked by its *reference*, followed by the Telerad code).

- **VHF GBAS transmitter EM 9009(800 00080):**
 - Front Panel PAVE 42083(500 01215),
 - Transmitter chassis..... CHEM 42084(500 01216),
 - AF control PCB CTRL 11170.....(510 01024),
 - Power supply monitoring PCB REAL 16069(510 00988),
 - VHF amplifier module AMPV 26225(520 00542).
- **VHF GBAS transmitter EM 9009 A.....(800 00079):**
 - Front Panel PAVE 42072(500 01131),
 - Transmitter chassis..... CHEM 42073(500 01132),
 - AF control PCB CTRL 11170.....(510 01024),
 - Mains power supply Module ALIM 26223(520 00540),
 - VHF amplifier module AMPV 26225(520 00542).
- Set of mobile plugs option JFMEM9009.....(570 00714),
- Set of mobile plugs option JFMEM9009A.....(570 00689),

2.3 **COMPATIBLE UNITS**

- VHF GBAS receiver RE 9009 (801 00054),
- VHF GBAS receiver RE 9009 A (801 00053),
- GBAS commuting unit UCEG 9009 (807 00096),
- Static coaxial relay REST26154 (520 00409).

CHAPTER 3 GENERAL CHARACTERISTICS

3.1 ELECTRICAL CHARACTERISTICS

- Modes GBAS VHF Data Broadcast (VDB).....: D8PSK 31.5kbits/s - TDMA
- Frequency range.....: 118.025 - 117.950 MHz
- Frequency stability.....: ≤ 1 p.p.m. (0°C to 50°C)
- Channel spacing.....: 25 kHz
- Power supply.....: 24 V dc (21-31 V),
120/240 V ac $\pm 10\%$ (version A only)
- Teleprocessing - Remote control - Maintenance.: Serial ports for local control (front panel socket RS232) or remote control (rear side socket RS485),
 - Maintenance.....: Built-in test and report,
Software maintenance,
 - Parameterization: • frequencies,
• operating parameters,
 - Measurements: • Forward output power,
• SWR,
• DC power supply voltage,
• VHF module temperature,
• Power supply module temperature (version A only),
- Data transmission port: Electrical interface RS485,
- Consumption (80%):
 - 230 V ac.....: 2.2 A (typical),
 - 24 V dc.....: 10 A (typical),
- Output power: 80 to 10 W carrier (for V dc ≥ 24 V dc)
adjustable by steps of 0.5 dB on 50 ohms,
- Cyclic ratio.....: 100%,
- SWR.....: Operation up to SWR of 2/1 without power reduction,
- Protection.....: Progressive reduction of power depending on temperature and voltage. Step by step reduction from SWR > 2. Shutdown on infinite SWR,
- AF band-pass data transmission:
 - Channel spacing of 25kHz.....: > -3dB at 0-8 kHz,
- Spectrum purity:
 - Harmonic.....: < -53dBm
 - Parasites: < -53dBm
 - Noise at 1% of F_0: < -115dBc
- Power in adjacent channels:
 - D8PSK (1st channel).....: < -40dBm (25kHz)
 - D8PSK (2nd channel).....: < -65dBm (25kHz)
 - D8PSK (4th channel).....: < -75dBm (25kHz)

3.2 **MECHANICAL CHARACTERISTICS**

See PLATE 0 for general dimensions and weight.

- Dimensions standard 19" : 3U

3.3 **CLIMATIC CHARACTERISTICS**

- Operation assured : between -20°C and +55°C
- Relative humidity : 95% at 40°C (no condensing)
- Storage..... : from -40°C to +80°C

CHAPTER 4 INTERFACE CONTROL DOCUMENTS

Interface control documents (ICDs).

4.1 MAINTENANCE CONNECTOR

The description of maintenance terminal commands is given in Annex A (Telerad code 40600006).
See note 1.

4.2 TELEMONITORING (JBUS) CONNECTOR (J2)

The ICD related to the TELEMONITORING (JBUS) port is given in Annex B (Telerad code 40600004). *See note 1.*

4.3 DATA CONNECTOR (J5)

The ICD related to the DATA port is given in Annex C (Telerad code 40600005). *See note 1.*

Note 1 : *The document is common to both the transmitter EM 9009-9009 A and the receiver RE 9009-9009 A. Please refer to the relevant sections.*

This page is left blank intentionally.

CHAPTER 5 CONNECTIONS - CONFIGURATION

Most of the transmitter connections are made on the rear panel sockets of the unit except for the front panel maintenance connector.

5.1 EM 9009 TRANSMITTER

5.1.1 Rear panel description

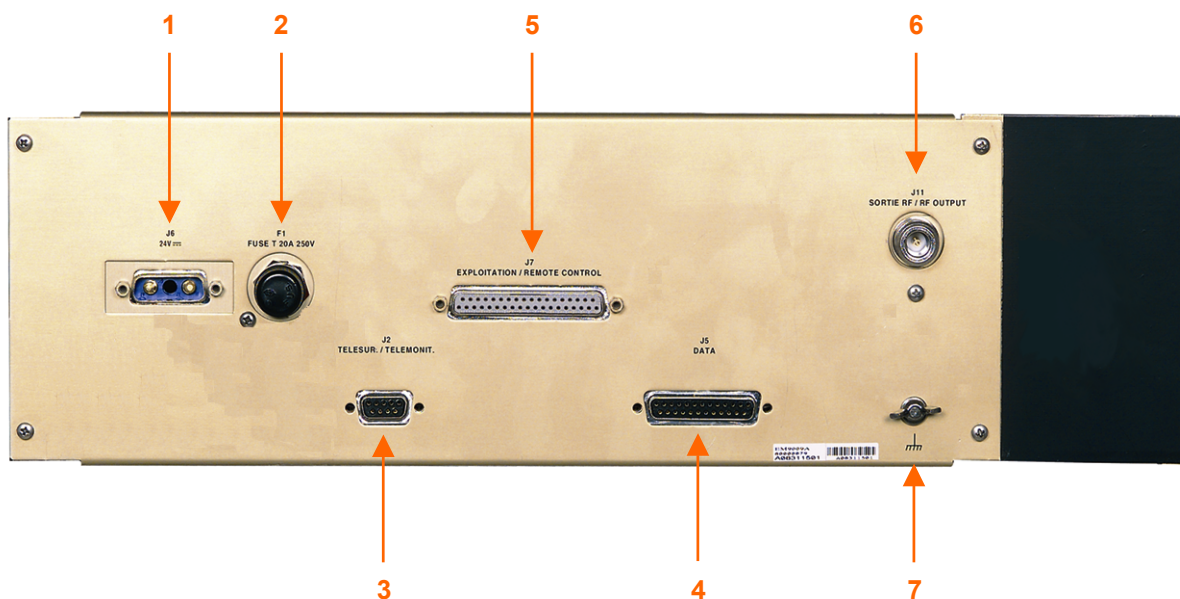


FIGURE 1 - EM 9009 REAR PANEL

- ① **24 V DC POWER SUPPLY Socket - J6 :**
It receives 24 V dc voltage, required for the transmitter operation
- ② **"Time-Delay" fuse 20 A/250V - F1 :**
It protects the DC power supply of the transmitter
Reference D8TD 20A (210 00054).
- ③ **TELEMONITORING Socket (link RS485) - J2:**
9 pins socket connected to a telemonitoring unit (external supervisor using the JBUS protocol.)

- ④ **DATA Socket - J5:**
The digital data to be transmitted pass through this socket. It can be used as a second JBUS link in the A3E mode.
- ⑤ **OPERATING SOCKET - J7:**
It receives commands for a remote operation of the unit and provides the information necessary for the operation control.
- ⑥ **RF OUTPUT Socket - J11:**
RF power output of the transmitter for connection with the antenna. Coaxial socket type N.
- ⑦ **Ground terminal:**
Screw rod terminal, diameter 4 mm with butterfly nut for ground connection.

5.1.2 Front panel description



FIGURE 2 - EM 9009 FRONT PANEL

- ⑤ **MAINTENANCE socket (connection RS232):**
Socket SUB-D 9 contacts designed for connection with the Telerad programmer, type PGM 9000 (see specific manual) or with terminal corresponding to this communication protocol.

5.2 EM 9009 A TRANSMITTER

5.2.1 Rear Panel Description

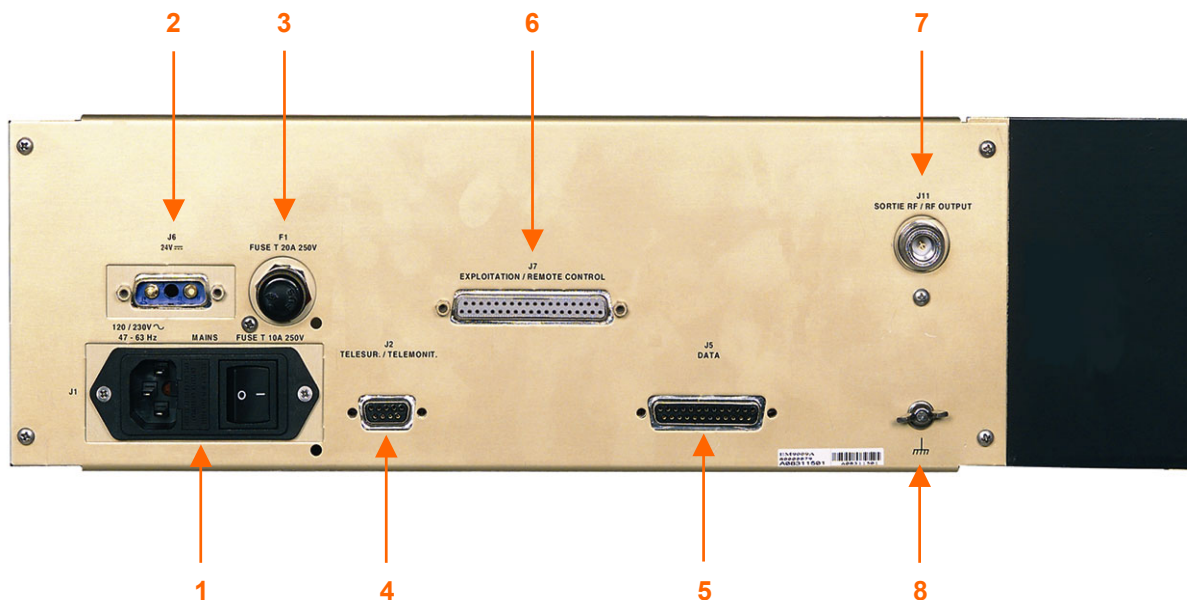


FIGURE 3 - EM 9009 A REAR PANEL

- ① **MAINS socket - J1:**
It receives 110A/220V AC voltage required for the mains module operation. This socket includes a mains filter; a switch for cutting off the voltage and a set of two time-delay fuses 10A/250V.
Reference D1TD 10A (210 00012).
- ② **POWER SUPPLY Socket 24V DC - J6:**
It receives the 24V DC voltage required for the transmitter operation. In case of mains voltage failure, an automatic switching to DC voltage will take place without restarting the transmitter.
- ③ **Time-delay fuse 20 A/250V - F1:**
It protects the dc mains of the transmitter.
Reference D8TD 20A (210 00054).
- ④ **TELEMONITORING Socket (link RS485) - J2:**
9 pins socket for connection to a telemonitoring unit (external supervisor using the JBUS protocol).
- ⑤ **DATA Socket - J5:**
The digital data to be transmitted flows through this socket. It can be used as a second JBUS link in A3E mode.

- ⑥ **OPERATING Socket - J7:**
It receives commands for the remote operation of the unit and provides the information necessary for the operation control.
- ⑦ **RF OUTPUT socket - J11:**
RF power output of the transmitter for connection with the antenna. Coaxial socket type N.
- ⑧ **Ground terminal:**
Screw rod terminal, diameter 4 mm with butterfly nut for ground connection

5.2.2 Front panel description

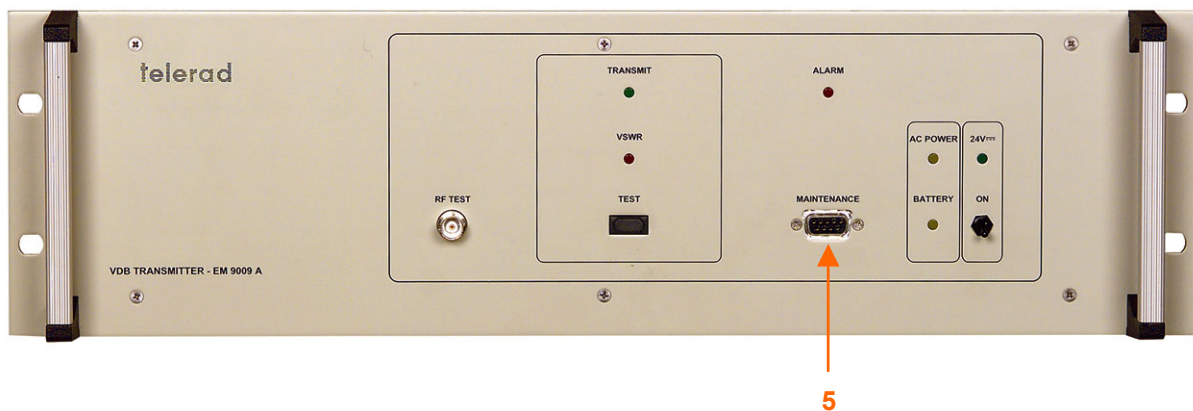


FIGURE 4 - EM 9009 A FRONT PANEL

- ⑤ **MAINTENANCE Socket (link RS232):**
SUB-D 9 pins socket for connection to Telerad programmer PGM 9000 (see user's guide) or with an ASCII terminal or with a PC in a terminal emulation.

5.3 CONNECTORS

5.3.1 Rear panel connector

J1 MAINS POWER SUPPLY connector (only version A)

Mains filter socket FN 282-6-06..... TELERAD code (370 00207)
Mobile plug: see standard mains wire 3020-4360B..... TELERAD code (275 00011)
(length 2.5m, equipped with female plug IEC)

PIN N°	INPUT/ OUTPUT	SIGNAL
1	I	Neutral
2	I	Phase
3	I	Earth and electrical ground

J6 24VDC POWER SUPPLY connector

SUB-D 15-3 pins socket CBD3W3M..... TELERAD code (150 01033)
Mobile plug CBD3W3F..... TELERAD code (150 01034)
Cover 09670150343..... TELERAD code (150 01147)

PIN N°	INPUT/ OUTPUT	SIGNAL	MARK SIGNAL
A1	I	+V= battery	PWR3
A2		Not used	
A3	I	Electrical ground	GND

J2 TELEMONITORING connector

SUB-D 9 pins socket.....DEP09S500..... TELERAD code (150 00503)
Mobile SUB-D 9 pins plugDEP09P..... TELERAD code (150 00023)
Cover8630-3637A TELERAD code (150 00152)

PIN N°	INPUT/ OUTPUT	SIGNAL	MARK SIGNAL	CHARACTERISTICS	N° INT#
1 - 2		Not used			
3		Digital ground	GND1		
4	O	TxD2 A	BX	JBUS connection: data transmission. RS485 non-inverting output. Level 0/5V	114
5	O	TxD2 B	BY	JBUS connection: data transmission. RS485 inverting output. Level 0/5V	114
6 - 7		Not used			
8	I	RxD2 A	BZ	JBUS connection : data reception RS485 non-inverting input. Level 0/5V.	115
9	I	RxD2 B	CA	JBUS connection : data reception RS485 inverting input. Level 0/5V.	115

J5 DATA connector

SUB-D 25 pins socket..... DBP-25S-500 TELERAD code (150 00229)
Mobile SUB-D 25 pins plug DBP-25P..... TELERAD code (150 00149)
Cover 8630-3639A..... TELERAD code (150 00153)

PIN N°	INPUT/OUTPUT	SIGNAL	SIGNAL MARK	CHARACTERISTICS	N° INT#
1		Not used			
2	O	TXD1 A	BJ	Data transmission: RS485 non-inverting output. Level 0/5V.	114
3	I	RXD1 A	BI	Data reception: RS485 non-inverting input. Level 0/5V.	115
4	O	RTS1 A	BT	Data connection: Request to send. RS485 non-inverting output. Level 0/5V.	114
5	I	CTS1 A	BK	Data link: Clear to send. RS485 non-inverting input. Level 0/5V.	115
6	I	1 PPS A	BE	Signal 1 Pulse Per Second RS485 non-inverting input	115
7		Digital ground	GND1	Digital ground of the CTRL PCB linked to general ground.	
8	O	5V digital		+5V digital power supply.	
9		Not used			
10	O	TXD CLK1 A	BL	Data connection: transmission clock. RS485 non-inverting output. Level 0/5V.	114
11	I	RXD CLK1 A	BM	Data connection: reception clock. RS485 non-inverting input. Level 0/5V.	115
12	O	RxD1Test	BV	Reception channel test output of serial link 1	121
13	O	RxD2 Test	CW	Reception channel test output of serial link 2	121
14	O	TXD1 B	BN	Data transmission RS485 inverting output. Level 0/5V.	114
15	I	RXD1 B	BO	Data reception RS485 inverting input. Level 0/5V.	115
16	O	RTS1 B	BP	Data connection: Request to send. RS485 inverting output. Level 0/5V.	114
17	I	CTS1 B	BQ	Data connection: Clear to send RS485 inverting input. Level 0/5V.	115
18	I	1 PPS B	BF	Signal 1 Pulse Per Second RS485 non-inverting input	115
21		Not used			
22	O	TXD CLK1 B	BR	Data connection: transmission clock. RS485 inverting output. Level 0/5V.	114
23	I	RXD CLK1 B	BS	Data connection: reception clock. RS485 inverting input; Level 0/5V.	115
24	O	TxD1 Test	BU	Transmis. channel test output of serial link 1	121
25	O	TxD2 Test	CV	Transmis. channel test output of serial link 2	121

See INTERFACES USED, following pages.

J7 OPERATING connector

SUB-D 37 pins socket.....609-37S TELERAD code (150 00737)
Mobile SUB-D 37 pins plugDCP-37P TELERAD code (150 00056)
Cover.....8630-3640A TELERAD code (150 00386)

PIN N°	INPUT/OUTPUT	SIGNAL	SIGNAL MARK	CHARACTERISTICS	N° INT#
1		Digital ground	GND1	Digital ground linked to the general ground.	
2		Reserved			
3		Reserved			
4		Reserved			
5		Reserved			
6	O	Alarm Tx	BD	Indicates a transmitter operation failure. Signal sent as open collector such as "0" = alarm.	121
7	O	Protected supply 1A	PWR2	Available DC voltage + V=.	122
8	I	Signal 1 PPS A	BE	Synchronization signal (+). RS485 non-inverting input giving a 0/5V level.	115
9-10		Not used			
11		Not used			
12		Not used			
13	O	SWR info	U	SWR information signal. Active for SWR ≥ 2 . Open collector such as "0" = active SWR	51
14	O	Fan Control	BC	External fan control. Powered open collector such as "0" = active control.	124
15	O	Carrier info (RF presence)	AZ	Indication of RF presence in transmission. Info valid as soon as the power attains or exceeds rated power less 3dB, in form of open collector such as "0" = RF presence.	119
16		Reserved			
17		Analog ground	GND2	Analog ground linked to the general ground.	
18		Reserved			
19		Not used			
20		Not used			
21		Reserved			
22	O	Tx good operation information	AX	Good operation information of transmitter. The information is valid if no alarm on the transmitter. Info provided as open collector such as "0" = good operation.	51
23		Reserved			
24	O	PTT feedback	AQ	Indicating transmission or stand-by status. In phase with PTT on falling edge, delayed by 700 μ s on rising edge. Open collector such as "0" = transmission.	10
25	I	Remote test command	AW	Command for enabling remote test. Contact to ground as "0" = test enabled.	
26	I	Signal 1 PPS B	BF	Synchronization signal (-). Inverting input RS485 giving a level of 0/5V.	115
27-28		Not used			
29		Digital ground	GND1	Digital ground linked to general ground.	
30 - 31		Not used			
32		Reserved			
33	I	Transmission inhibition	AS	Forces Transmitter in stand-by. Should be an open collector such as "0" = inhibition.	11
34		Not used			

See INTERFACES USED, following pages.