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 **THOMSON-CSF**
COMMUNICATIONS

OPERATION AND INSTALLATION MANUAL

Enhanced VHF Radio

VHF Communications Transceiver

PN : EVR716-11-0300A
EVR716-11-0350A

SERVICE INFORMATION LETTER LIST

SERVICE INFORMATION LETTER No	INCLUDED IN REVISION	DATE OF INCORPORATION	TITLE
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2	First Issue	2000/02/15	To upgrade the current Transmitter (TX), Receiver (RX), and HIRF boards to industrial level a re-layout of the printed circuit.

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RECORD OF REVISIONS

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INTRODUCTION

1. General

This Operation and Installation Manual includes information related to the operation and installation of the THOMSON-CSF COMMUNICATIONS EVR716 Enhanced VHF Radio Communications Transceiver.

The Operation and Installation instructions are presented in the following sections:

- Introduction.
- 10 - System Description.
- 20 - External Interfaces.
- 30 - Installation.
- 40 - Operating Instruction.

CAUTION: THE EQUIPMENT IN THIS MANUAL IS SUBJECT TO CHANGE. BEFORE ATTEMPTING ANY OPERATION ON THE EQUIPMENT COVERED IN THIS MANUAL, VERIFY THAT YOU HAVE COMPLETE AND UP-TO-DATE PUBLICATIONS BY REFERRING TO THE APPLICABLE PUBLICATIONS, SERVICE BULLETIN, SERVICE BULLETIN LIST, SERVICE INFORMATION LETTER INDEXES.

Refer to the Table of Contents for the page location of applicable sections.

An asterisk flagnote *[] in place of the page number indicates that no special instructions are provided since the function can be performed using standard industry practices.

A list of uncommon/acronyms abbreviations used in this manual is described in paragraph 2 of the INTRODUCTION SECTION. This manual will be revised as necessary to reflect current information.

We welcome your comments concerning this manual. Although every effort has been made to keep it free of errors, some may occurs. When reporting a specific problem, please describe it briefly and include the manual part number, the paragraph or figure number, and the page number.

Send your comments to:

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2. Uncommon Abbreviations /Acronyms

ABBREVIATIONS/ ACRONYMS	IDENTIFICATION
ACARS	Aircraft Communication Addressing and Reporting System
AMU	Audio Management Unit
ATC	Air Traffic Control
BIT	Built In Test
CFDS	Centralized Fault Display System
CMU	Communications Management Unit
CSMA	Carrier Sense Multiple Access
DFS	Data Frequency System
FM	Frequency Modulation
Hz	Hertz
LED	Light Emitting Diode
LF	Low Frequency
LO	Local Oscillator
LRU	Line Replaceable Unit
MHz	Megahertz
MU	Management Unit
OMS	On-board Maintenance System
P/N	Part Number
Rx	Receiver
SDI	Source Destination Identifier
SELCAL	SElective CALling
SRU	Shop Replaceable Unit
T/R	Transmitter/Receiver
Tx	Transmitter

(Continued)

ABBREVIATIONS/ ACRONYMS	IDENTIFICATION
UHF	Ultra High Frequency
VAC	Voltage Alternative Current
VDC	Voltage Direct Current
VHF	Very High Frequency
VHFCP	VHF Control Panel
EVR	Enhanced VHF Radio

SYSTEM DESCRIPTION

1. Function and Composition

The Radio communication airborne system (see figure 10-1), known as the EVR716, is a VHF transceiver operating in the aeronautical band (118 MHz to 137 MHz), used by Air Transport Aircraft as a primary equipment for communications with the ground ATC infrastructure (in continental areas) or for communications between aircrafts (relay, emergency).

The EVR716 transceiver includes:

- On the rear panel:
 - an ARINC 600 connector, size 1.
- On the front panel:
 - two attaching lugs,
 - a handle,
 - a test pushbutton,
 - six display LEDs.

The EVR716 transceiver is identified by labels stuck on its front panel.

The first label mentions:

- the equipment name,
- the TSO,
- the Quality Control,
- the serial number (S/N),
- the factory clearance date.

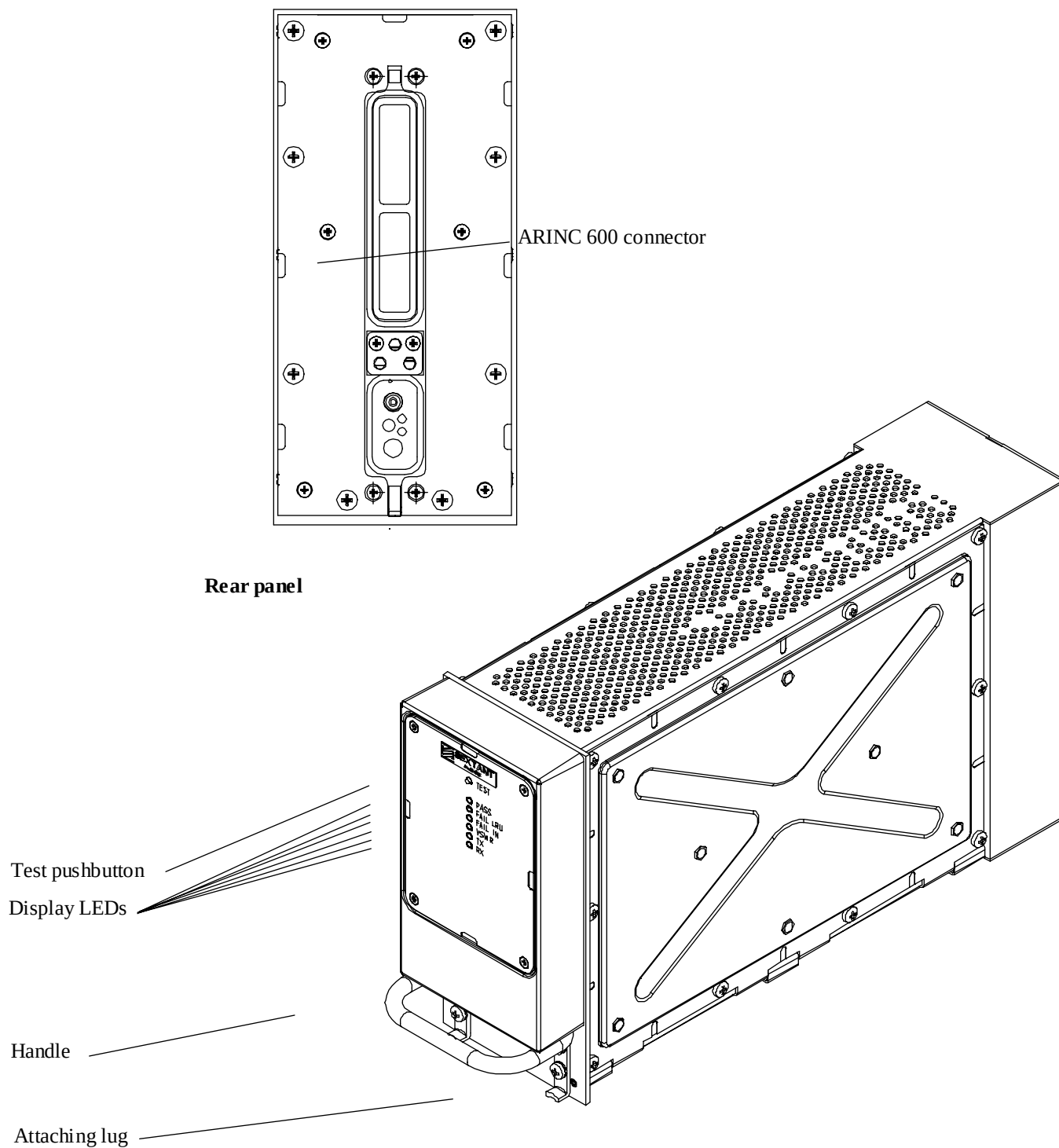
The second label mentions the service bulletin numbers applied.

The third label mentions the commercial reference.

The fourth label mentions the QAC.

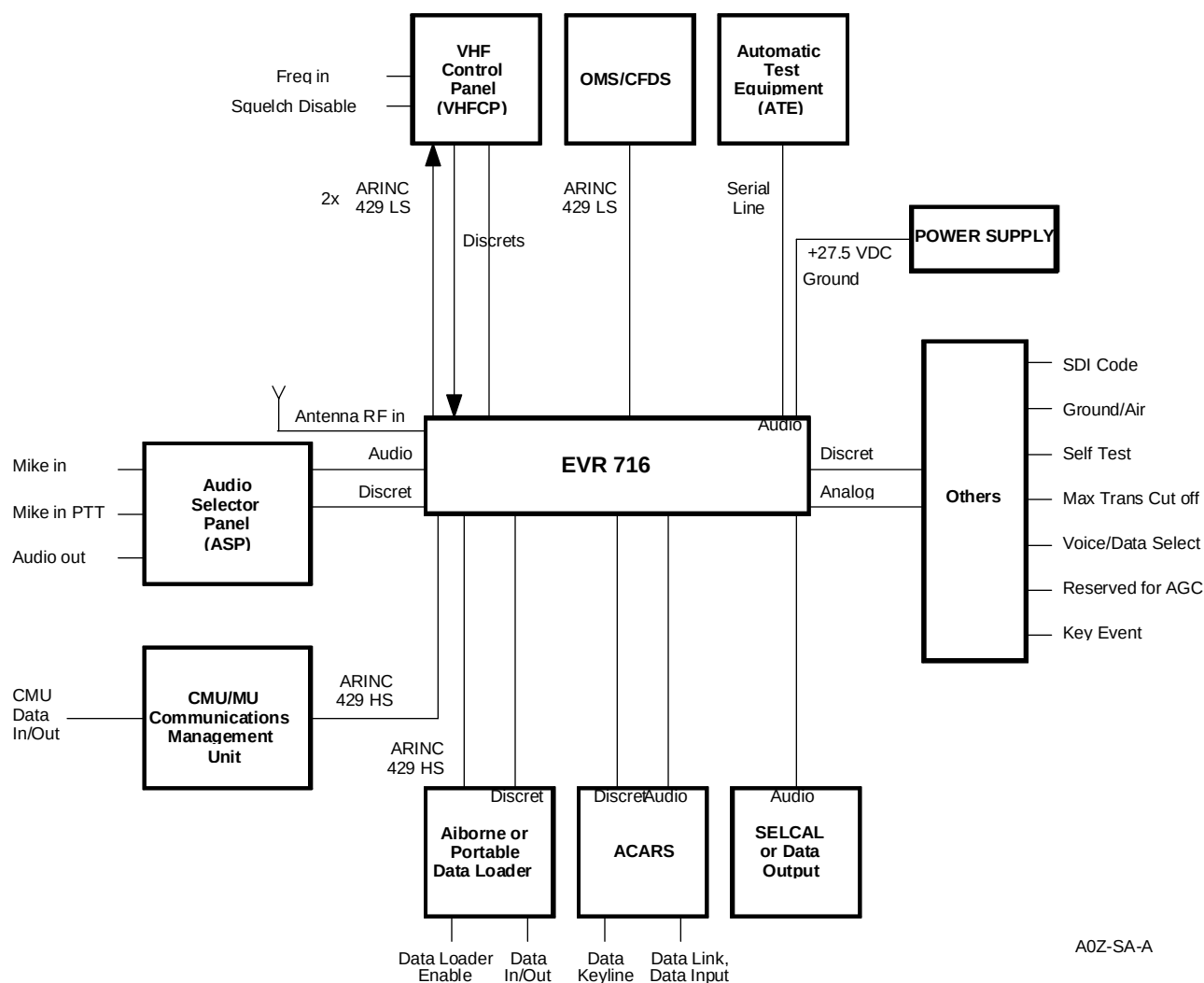
Aboard the aircraft (see figure 10-2), the EVR716 transceiver operates with the items of equipment below:

- a Data Frequency System (DFS) which can be an RCU (Radio Control Unit or control unit) or an RMP (Radio Management Panel) to agree with the aircraft configuration,



Interface block diagram
Figure 10-2

A0Z-MAA1



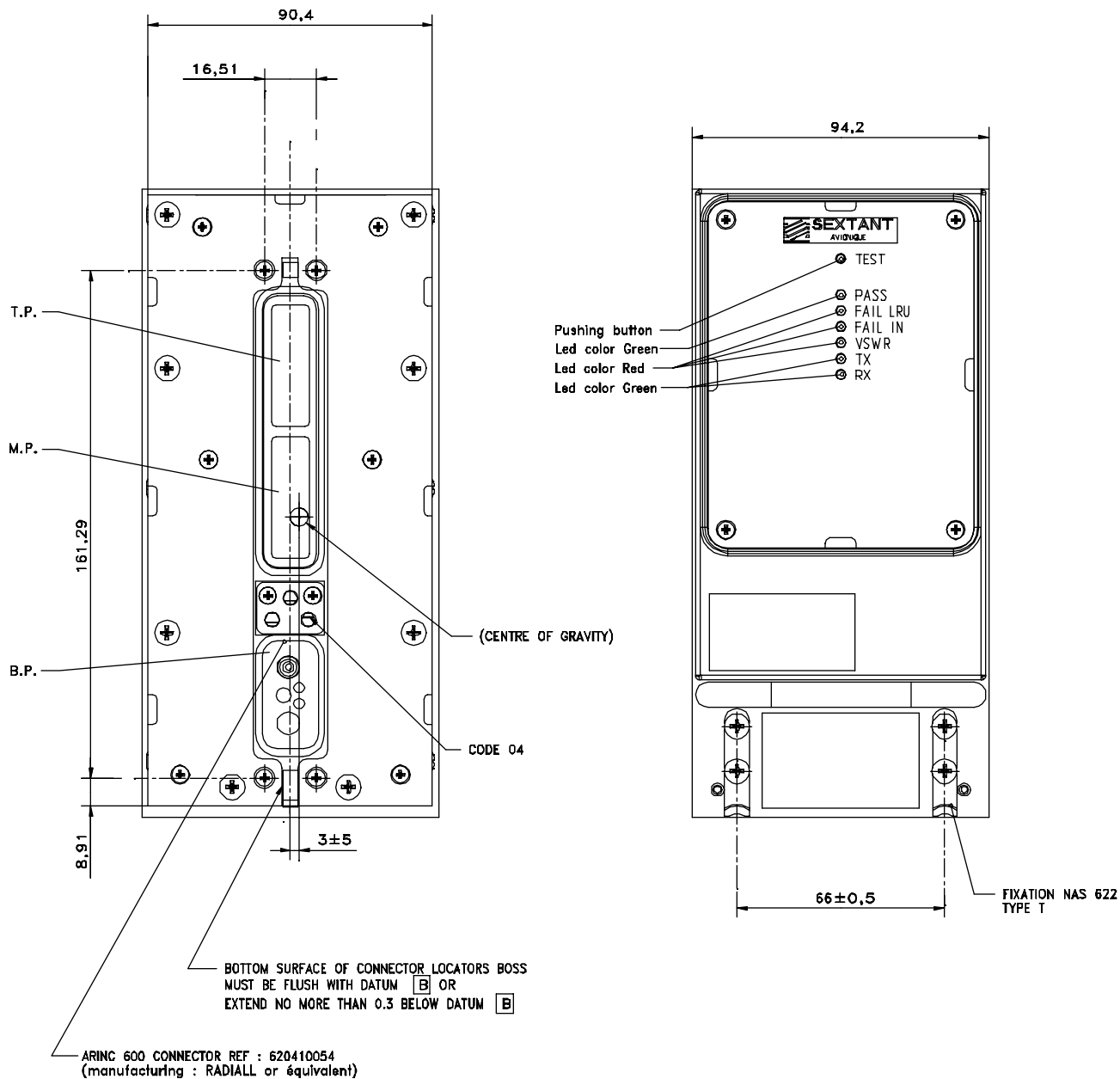
- an ACARS MU (Management Unit, ARINC 724 or 724A) or a CMU (Communications Management Unit, ARINC 758),
- an Audio Management Unit (AMU), audio control panel (microphone, loudspeakers),
- a maintenance computer : OMS (ARINC 624) or CFDS (ARINC 604),
- a VHF antenna.

2. Mechanical Characteristics (see figures 10-3 and 10-4)

DESIGNATION	DIMENSIONS (mm)	WEIGHT (kg)
T/R Unit EVR716	3 MCU to ARINC 600 ie 200 x 94 x 387.5	4.450 ± 0.050

3. Electrical Characteristics

- Frequency range : 117.975 MHz to 137 MHz
- Transmitted power : 16 W
- Power Supply : 28 VDC
- Modes of operation:
 - Mode OA : Analogue voice transmission, 25 kHz channel spacing
 - Mode OB : Analogue voice transmission, 8.33 kHz channel spacing
 - Mode 1A : Data, 25 kHz channel spacing,
AM-MSK modulation (2.4 kb/s),
external modem, CSMA access,
ACARS protocol.

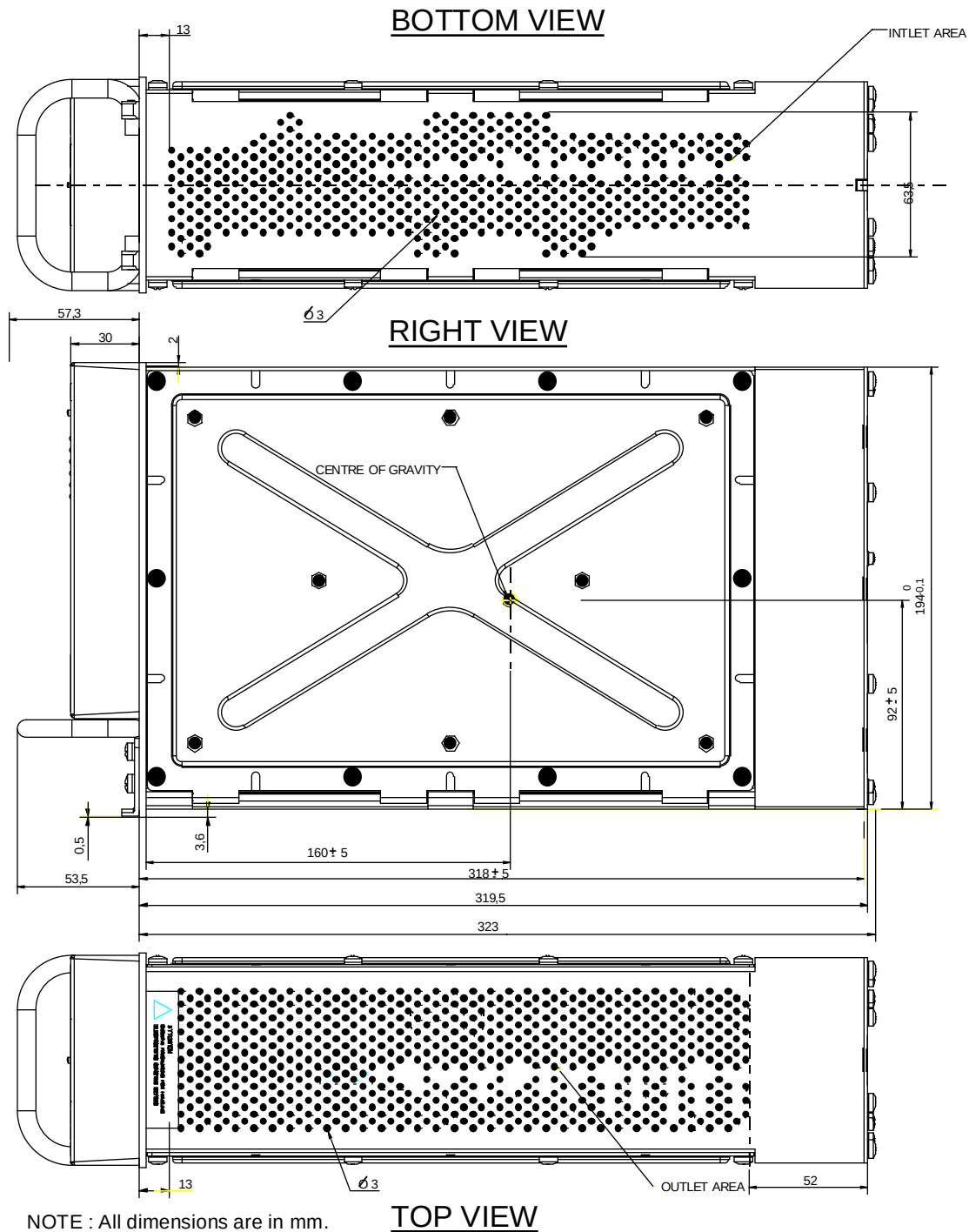


NOTE: All dimensions are in mm.

Mechanical characteristics
Figure 10-3

A0Z-MAA2

23-11-02



NOTE: All dimensions are in mm.

A0Z-MAA2

Mechanical characteristics
Figure 10-4

23-11-02

EXTERNAL INTERFACES

1. Interwiring

The inputs/outputs go through the ARINC 600 rear connector and the front panel.

The ARINC 600 rear connector has the three parts below:

- the 60-way Top Part (TP) with the contacts used for the ATE (TP5A to TP7D),
- the 60-way Middle Part (MP) with all the transceiver inputs (discrete, ARINC bus),
- the Bottom Part (BP) with the power supply contacts and the antenna coaxial connector (five contacts).

The detailed characteristics of inputs/outputs are given in the followings tables.

TOP PART OF THE CONNECTOR				
Pin number	Signal name	Type	I/O	To/From
TP1A	Manufacturer Identifier			
TP1B	Manufacturer Identifier			
TP1C	Part number or type number			
TP1D	Part number or type number			
TP2A				
TP2B				
TP2C	COMMON			
TP2D TP3A - TP3B - TP3C - TP3D TP4A - TP4B - TP4C - TP4D	Not used			
TP5A	SELECT Mode ATE	Pin programming	I	

(Continued)

TOP PART OF THE CONNECTOR (continued)				
Pin number	Signal name	Type	I/O	To/From
TP5B	RS232 Transmission	Serial bus	O	Management Module
TP5C	DC Ground			
TP5D	RS232 Reception	Serial bus	I	
TP6A	LED 1	Discrete	O	Management Module
TP6B	LED 2	Discrete	O	Management Module
TP6C	LED 3	Discrete	O	Management Module
TP6D	LED 4	Discrete	O	Management Module
TP7A	LED 5	Discrete	O	Management Module
TP7B	Reserved for AGC		O	
TP7C	Future Spare			
TP7D	Flash Write enable	Pin programming	I	
TP8C - TP8D - TP9C - TP9D TP10D - TP11A - TP11B - TP11C TP11D - TP12A - TP12B - TP12C TP12D - TP13A - TP13B - TP13C TP13D - TP14A - TP14B - TP14C TP14D - TP15A - TP15B - TP15C TP15D	Future Spare			
TP8A	P5VT			
TP8B	P15VT			
TP9A	Reserved			

TOP PART OF THE CONNECTOR (continued)				
Pin number	Signal name	Type	I/O	To/From
TP9B	Reserved			
TP10A	BLOSQLT	Discrete	O	
TP10B	CANOCT	Discrete	O	
TP10C	COMP			

MIDDLE PART OF THE CONNECTOR				
Pin number	Signal name	Type	I/O	To/From
MP1A	Hi Mike Input		I	
MP1B	Lo Mike Input		I	
MP1C	PTT Mike Input	Discrete	I	
MP1D	Key Event	Discrete	O	Management Module
MP2A	Max TRANS Cut-off	Discrete	I	
MP2B	Mike Input			
MP2C MP2D	Data loader Input	ARINC 429 High Speed	I	
MP3A MP3B MP3C	Optional (Remote Squelch)		I	
MP3D	DC Ground			
MP4A	Self Test	Discrete	I	
MP4B	Audio Ground			

(Continued)

MIDDLE PART OF THE CONNECTOR (continued)				
Pin number	Signal name	Type	I/O	To/From
MP4C MP4D	Data Loader Output	ARINC 429 High Speed	O	Management Module
MP5A MP5B	Data Link Input HI Data Link Input LO		I	
MP5C	Reserved for 716 compatibility			
MP5D	8.33 kHz program for 716 compatibility	Discrete Grounded for T/R with 8.33 KHz	O	
MP6A MP6B	Data from OMS/CFDS #1 Input Port A	ARINC 429 Low Speed	I	
MP6C MP6D	Data from OMS/CFDS #2 Input Port B	ARINC 429 Low Speed	I	
MP7A MP7B	Data from ARDU Port B	ARINC 429 Low Speed	I	
MP7C	Voice/Data Select	Discrete	I	
MP7D	Data Key Line	Discrete	I	
MP8A	Reserved	Discrete		
MP8B	Data Loader Enable	Discrete	I	
MP8C	Reserved			
MP8D	Data Key Line Return	Ground		
MP9A	SDI Code Input	Discrete	I	

MIDDLE PART OF THE CONNECTOR (continued)				
Pin number	Signal name	Type	I/O	To/From
MP9B	SDI Code Input	Discrete	I	
MP9C	Ground			
MP9D	Reserved for AGC		O	
MP10A	Reserved			
MP10B	Interlocking Control input			
MP10C MP10D	Data to both CMUs Output Port	ARINC 429 High Speed	O	Management Module
MP11A MP11B	Data from ARCDU Port A	ARINC 429 Low Speed	I	
MP11C	Reserved		I	
MP11D	Data Select Discrete	Discrete	I	
MP12A MP12B	Data from CMU #1 Input Port A	ARINC 429 High Speed	I	
MP12C MP12D	Data from CMU #2 Input Port B	ARINC 429 High Speed	I	
MP13A MP13B	SELCAL Audio and Data Output		O	Receiver Module
MP13C	Squelch Disable	Discrete	I	
MP13D	Squelch Disable return			
MP14A	Reserved		I	
MP14B	Ground/Air	Discrete	I	

(Continued)

MIDDLE PART OF THE CONNECTOR (continued)				
Pin number	Signal name	Type	I/O	To/From
MP14C MP14D	CDS/ARCDU /SCP	ARINC 429 Low Speed	O	Management Module
MP15A MP15B	Audio/Sidetone output		O	Receiver Module
MP15C	Muting	Discrete	O	Management Module
MP15D	Muting Return (Ground)	Ground		

BOTTOM PART OF THE CONNECTOR				
Pin number	Signal name	Type	I/O	To/From
BP1	Antenna RF		I/O	Antenna / Receiver Module
BP2	Power input + 27.5 VDC		I	
BP3	Spare			
BP4	Power Input Ground		I	
BP5	Not used			

The links with the aircraft environment are distributed as follows:

- Antenna Input/Output via a coaxial insert located in the lower part of the rear connector.
- Power supply inputs.
- Discrete Inputs/Outputs.
- Serial ARINC 429 link (four low speed inputs and one output, three high speed inputs and two outputs).

2. Electrical Power Supply

The EVR716 transceiver is directly connected to the aircraft 28 VDC primary power supply via the aircraft switchboard.

3. ARINC 429 Links

The EVR716 transceiver has four links by ARINC 429 bus:

- a link with the frequency selection equipment, two low speed inputs (MP7A/B, MP11A/B),
- a link with ARINC 615-1 software downloading system, one high speed input and one high speed output (MP2C/D, MP4C/D),
- a link with the OMS/CFDS on-board maintenance systems, two low speed inputs and one low speed output (MP6A/B, MP6C/D, MP14C/D),
- a link with the (C)MUs, two high speed inputs and one high speed output (MP12A/B, MP12C/D, MP10C/D).

INSTALLATION

1. Environment

The EVR716 transceiver is provided for the following environmental conditions:

- Operating temperature : - 40°C to + 70°C (- 40°F to + 158°F)
- Storage temperature : - 55°C to + 85°C (- 67°F to + 185°F)
- Ventilation : The EVR716 transceiver has an inlet air area on its bottom face and an outlet air area on its top face (see figure 10-4).

2. First Installation Check Out

Prior to install the EVR716 transceiver, check all interwiring for continuity and isolation.

Install and connect the EVR716 transceiver (see paragraph 3).

Energize the equipment and check that the green LED (PASS) lights on.

3. Mechanical Installation

The EVR716 transceiver is provided to be mounted in a rack in the aircraft. The EVR716 transceiver is equipped with two ARINC 600 attaching lugs (see figure 10-1). The mechanical installation complies with requirements as defined by the ARINC 600 specifications.

The figures 10-2 and 10-3 show the mechanical characteristics of the EVR716 transceiver.

After installation, energize the equipment and check that the green LED (PASS) lights on.

4. Interwiring

The interwiring complies with requirements as defined by the ARINC 600 specifications.

OPERATING INSTRUCTION

1. Energization of the Equipment

The EVR716 transceiver is not provided with an "ON-OFF" switch. The EVR716 transceiver starts operating as soon as 28 VDC is applied to the connector of the EVR716 unit.

2. Normal Operating Modes

The EVR716 transceiver is not provided with operating buttons. It operate via the aircraft controls.

A. Operational State

This is the EVR716 transceiver normal operating. A BITE device initializing the cyclic tests allows checking operation of the EVR716 transceiver and indicating failures.

B. Modes

(1) Operating Modes

The operating modes are the following:

(a) **Mode 0A**

- 25 kHz analog voice transmission (ED-23B, DO-186A : receiver class C, transmitter class 3; ARINC 716).
- RF modulation : Amplitude modulation with double side bands.
- 25 kHz channelling.
- Link with the microphone : normal audio input/output.

(b) **Mode 0B**

- 8.33 kHz analog voice transmission (ED-23B, DO-186A : receiver class E, transmitter class 5; ARINC 716).
- RF modulation : Amplitude modulation with double side bands.
- 8.33 kHz channelling.
- Link with the microphone : normal audio input/output.

(c) **Mode 1A**

- Data transmission with modem outside the transceiver. ACARS protocol (ARINC 716, ARINC 618).
- RF modulation : Minimum Shift Keying Amplitude Modulation (MSK-AM).
- Channelling : 25 kHz.
- Rate : 2.4 kb/s.
- Access to the CSMA : non-persistent.

NOTE : This modem function is performed by the (C)MU)

- Link with the (C)MU : twisted pair analog signal.

(2) Default Mode

At power up, the default mode is mode 0A, tuned to the fast tuned frequency (before switching off).

NOTE: In less than one second, the aircraft control provides the ARINC 429 word indicating the active frequency use.

(3) Change of Mode

Possible modes are ARINC 716 VOICE (0A or 0B modes) and ARINC 716 data (mode 1A).

The selection is determined by:

- the Voice/Data discrete ("V" : open state; "D" : grounded state),
- the content of the ARINC 429 DFS bus label word,
- the activity of the ARINC 429 bus (C)MU ("active" if the EVR716 transceiver receives the 270 label every second),
- the content of the label 270 word which determines if one (C)MU can be declared primary.

C. Maintenance States

Two maintenance states are to be considered:

(1) On-Line Maintenance (Aircraft Grounded)

In this state, the EVR716 transceiver is in the same environment as in its operational state. This state is activated either by power up or by tests initiated by a pushbutton (TEST) on the front panel (see figure 10-1).

During the tests, the equipment is not operational. Initiated tests are also allowed by maintenance software control.

The result of the test is displayed on six LEDs on the front panel (see figure 10-3), saved on the NVM (Non Volatile Memory).

(2) Off-Line Maintenance

In this state, the EVR716 transceiver is not in its operational system environment but in a technical environment (test bench, maintenance workshop, etc.). The activation of this state is possible only when pins TP5A and MP14B are grounded. This state allows the downloading of the functional and maintenance software. The tests provided in this state allow an investigation at the SRU level.

The result of the tests is displayed on six LEDs on the front panel and five LEDs located on the DPU (Digital Processing Unit) module indicating a failure code (SRU level).

3. Default Operating Instructions

The result of the tests activated either by power up or by the "TEST" pushbutton on the front panel, is displayed on six LEDs on the front panel (see figure 10-3).

The following table presents the different cases :

LED	LIGHTING	CAUSE	CORRECTIVE ACTIONS
"FAIL LRU"	Red	comes on when the operator initiated tests (init or pushbutton) detect an internal fault on the EVR716 transceiver (except on ARINC 429 bus or discrete inputs).	Replace the EVR716 transceiver.
"FAIL IN"	Red	comes on when the operator initiated tests (init or pushbutton) detect an input fault on ARINC 429 bus or discrete inputs.	– Check the interwiring. – Replace the EVR716 transceiver
"PASS"	Green	comes on when the operator initiated tests (init or pushbutton) do not detect any fault.	Not applicable
"VSWR"	Red	comes on when VSWR measured by the EVR716 transceiver is higher than 2:1.	Not applicable
"TX"	Green	comes on when the EVR716 transceiver is in transmit mode.	Not applicable
"RX"	Green	comes on when the EVR716 transceiver is in receive mode.	Not applicable