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O-LEVEL MAINTENANCE MANUAL

Gabbiano TS-20 Belly

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List of Effective Pages

This manual shall include the following pages in initial edition:

Object	Page	Date
Front	1	05/07/2018
	2	blank
List of Effective Pages	1	05/07/2018
	2	blank
Change Record	1	05/07/2018
	2	blank
List of Abbreviations	1 and 2	05/07/2018
Table of Contents	1	05/07/2018
	2	blank
Introduction	1 and 2	05/07/2018
Warnings and Cautions	1 to 4	05/07/2018
Chapter 1	1 to 18	05/07/2018
Chapter 2	1 to 19	05/07/2018
	20	blank
Chapter 3	1 to 4	05/07/2018

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Change Record - Original Issue

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Amdt No	Incorporated date	by (signature)	Amdt No	Incorporated date	by (signature)
1			26		
2			27		
3			28		
4			29		
5			30		
6			31		
7			32		
8			33		
9			34		
10			35		
11			36		
12			37		
13			38		
14			39		
15			40		
16			41		
17			42		
18			43		
19			44		
20			45		
21			46		
22			47		
23			48		
24			49		
25			50		

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List of Abbreviations

Acronym/Abbreviation	Definition
°	Degrees (angular)
A	Ampere
AG	Antenna Group
A/A-TWS	Air to Air Track While Scan
°C	Celsius degrees
CBIT	Continuous BIT
DBS	Doppler Beam Sharpening
GM	Ground Map
GMTI	Ground Moving Target Indicator
GMTT	Ground Moving Target Track
Hz	Hertz
IBC	Identification Basic Code
IBIT	Interruptive Test
INS	Inertial Navigation System
IPL	Illustrated Parts List
mA	Milliamperes
mm	Millimetres
MRP	Modular Radar Processor
MSDS	Material Safety Data Sheets
mΩ	Milliohms
MΩ	Megaohms
NAS	Narrow Area Scan
PBIT	Power-Up Bit
REP	Receiver Exciter Processor
RF	Radio Frequency
REF	Reference
SES	Leonardo SPA S.p.a
SB	Service bulletin
Spot-SAR	Spot Synthetic Aperture Radar
Strip -SAR	Strip Synthetic Aperture Radar
TA	Terrain Avoidance
TBC	To Be Confirm
TX-FE	Transmitter Front End
V	Volts
VAC/Vac	Volts alternating current
VDC/Vdc	Volts direct current
W	Watt
WA	Weather Mode

Acronym/Abbreviation	Definition
WAS	Wide Area Scan
WI	Work Item
WX	Turbulence Mode
WOW	Weight on Wheels

Table of Contents

Chapter 1
Description and Technical Data
Chapter 2
Maintenance
Chapter 3
Illustrated Parts List

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Introduction

This Maintenance Manual gives the “O Level” maintenance instructions for the GABBIANO TS-20 BELLY IBC 2041885V01.

The GABBIANO TS-20 BELLY is manufactured by:

Leonardo Spa – LASSD Division --
Viale Europa
20014 Nerviano (MI) - Italy

Quality Improvement Note:
Non-conformances of contents related to the operability of the GABBIANO TS-20 BELLY, have to be written highlighted to Leonardo SPA Quality Department.

This manual is organized into three chapters.

CHAPTER 1 – Description and Technical Data

This chapter contains the introduction of this manual, the list of the related publications applicable to the System and a brief description of the GABBIANO TS-20 BELLY.

CHAPTER 2 – Maintenance

This chapter describes the scheduled maintenance operations that must be performed on the system. It also includes the table of the maintenance task of the GABBIANO TS-20 BELLY.

CHAPTER 3 – Illustrated Parts List

This chapter contains the list of the replaceable items of the GABBIANO TS-20 BELLY.

This manual contains all the information available at the date of issue. Revisions are issued as required. The updating will be issued under the form of amendments. They are accompanied by Highlight pages which identify the reason for each change. The holder is responsible for ensuring that the manual is complete and updated to the last edition. Refer to sheet Change Record where all the changes will recorded by holder, each time they are issued.

The list of Effective Pages, which accompanies each revision, should be consulted to determine if the manual is complete and update.

The manual is arranged by chapters. The Pages, Figures and Tables are numbered within Chapter (E.g.: Page 1, Page 2, etc.; Figure 1, Figure 2, Table 1, Table 2, etc.).The date on each page shows when the page was issued or last changed. The portion of the text affected by changes is indicated by a vertical line in the outer margin of the page. **WARNING**, **CAUTION** and **Note** are used to emphasize information throughout this publication.

WARNINGS

MUST BE FOLLOWED TO AVOID INJURY OR DEATH TO PERSONS.

CAUTIONS

Must be followed to avoid damage to components.

Notes

Call attention to work simplification or give additional information.

Warnings and Cautions

1. Scope

This publication describes processes that may require the use of chemicals, solvents, paints, or other materials that can affect a person's health or safety. Warnings are placed just ahead of these procedures to bring attention to the existence of a procedure or material that can be dangerous.

2. Significance of Material Safety Data Sheets (MSDS) and How to Obtain MSDS

WARNING

BEFORE USING ANY OF THE MATERIALS SPECIFIED IN THIS MANUAL, BE AWARE OF ALL HANDLING, STORAGE, AND DISPOSAL PRECAUTIONS RECOMMENDED BY THE MANUFACTURER OR SUPPLIER. FAILURE TO COMPLY WITH MANUFACTURER'S OR SUPPLIER'S RECOMMENDATIONS MAY RESULT IN PERSONAL INJURY OR DISEASE.

THE USER OF THIS PUBLICATION SHOULD OBTAIN THE MATERIAL SAFETY DATA SHEETS (OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) FORM 20 OR EQUIVALENT) FROM THE MANUFACTURERS OR SUPPLIERS OF MATERIALS TO BE USED. THE USER MUST BECOME COMPLETELY FAMILIAR WITH THE MANUFACTURER OR SUPPLIER INFORMATION AND ADHERE TO THE PROCEDURES, RECOMMENDATIONS, WARNINGS, AND CAUTIONS OF THE MANUFACTURER OR SUPPLIER FOR THE SAFE USE, HANDLING, STORAGE, AND DISPOSAL OF THESE MATERIALS.

Refer to the materials list at the beginning of each section of this manual for materials used for the maintenance of the GABBIANO TS-20 BELLY equipment.

If you do not have a copy of the manufacturer's MSDS for the materials covered in the materials list, contact the manufacturer and request that a MSDS be supplied before you use the material.

3. Purpose

The warnings brings your attention to the existence of a procedure that can affect a person's health or safety.

Short warnings are provided in this maintenance publication to alert operating and maintenance personnel of potential hazards that could result in personal injury or health hazards. The warnings do not replace the manufacturer's recommendations. When there is a reference to the Warnings Registry 341-006, that publication will provide more information about the dangers of the material. The information contained in the Warnings Registry is a summary of the manufacturer's MSDS. The full-length warnings provide three principle parts of safety: (1) a

listing of the known dangers, (2) what is needed to do to protect you from the dangers, and (3) what to do if the dangers occur.

The detailed warnings in Warnings Registry 341-006 are a summary of the manufacturer's MSDS and are not intended to replace the material on the sheet, but are intended to supplement them.

Cautions are provided in the maintenance publication or service bulletin to alert operating and maintenance personnel to conditions that could result in equipment damage.

4. Definitions Applying to Warnings

1 Flammable: A material that can catch fire easily and can be explosive. These materials are labeled according to the flash point of the material.

2 Flash Point: The lowest temperature at which a flammable liquid gives off fumes that can burn.

3 Ignition Source: Includes flames, sparks, or heat.

- Flames: Materials that are burning such as lit matches, propane torches, or pilot lights.
- Sparks: Materials such as lighted cigarettes, electrical motors, or static electricity.
- Heat: Any source of energy that will raise the temperature of a flammable material to its flash point and could include hot parts, heated tools, or direct sunlight.

4 Corrosive: Acidic or alkaline material that will remove human tissue or create chemical reactions with other materials.

5 Toxic: Material that is poisonous.

6 Reactive: Material that will make fumes, burn, or can be explosive when mixed with certain other materials.

7 Shock (Electrical): The result of any source of electricity more than 50 volts that causes current to flow through a person and can result in dangerous burns to human tissues or death.

8 Exposure: Contact with the material or physical process without protection. Contact may be by the eyes, breathing, touch, skin absorption, or swallowing.

9 Irritation: Any sense of pain, soreness, rash, or general discomfort.

5. Warnings Included in this Manual

- **Radiation hazard**

WARNING

PRIOR TO OPERATING THE GABBIANO TS-20 BELLY ON THE GROUND, THE AIRCRAFT MUST BE POSITIONED IN A SAFE AREA CLEAR OF BUILDINGS, AND ALL PERSONNEL AND EQUIPMENT MUST BE CLEAR OF THE RADIATION AREA.

IF THE WEIGHT-ON-WHEELS (WOW) SAFETY INTERLOCK IS OVERRIDDEN ON THE GROUND, THE GABBIANO TS-20 BELLY CAN TRANSMIT RADIO FREQUENCY (RF) ENERGY IF THE TRANSMIT FUNCTION IS SELECTED. ANY SWITCH USED TO OVERRIDE THE WOW SAFETY INTERLOCK MUST BE OF THE MOMENTARY TYPE, SUCH THAT IT CANNOT BE ACCIDENTALLY LEFT IN THE OVERRIDE POSITION.

- **Antenna group movement**

WARNING

THE ANTENNA OF ANTENNA GROUP IS A MOVING PART; KEEP CLEAR WHENEVER POWER IS APPLIED. EXTRA CARE SHOULD BE TAKEN TO KEEP CLEAR OF THE ANTENNA WHENEVER THE RADOME INTERLOCK HAS BEEN OVERRIDDEN AS THE RADOME INTERLOCK NORMALLY PREVENTS ANTENNA MOVEMENT WHEN THE RADOME IS OPEN.

- **Heavy items**

N/A

- **Navigation**

WARNING

THE GABBIANO TS-20 BELLY IS NOT SUITABLE FOR USE AS A SOLE MEANS OF NAVIGATION. THE OPERATOR SHOULD ALWAYS TAKE APPROPRIATE PRECAUTIONS WHEN INTERPRETING IMAGES/PLOT DATA OR USING DATA DERIVED FROM THE GABBIANO TS-20 BELLY.

- **Moving parts**

WARNING

THE LRU'S PACKAGINGS CONTAIN MOVEABLE HANDLES. CARE SHOULD BE TAKEN TO AVOID TRAPPING FINGERS.

- **Do not extinguish with water**

WARNING

IN CASE OF FIRE OR SMOKE PRODUCED BY THE EQUIPMENT OR IN THEIR VICINITY ADOPT FIRE EXTINGUISHING MATERIALS QUALIFIED FOR USE ON ELECTRIC APPLIANCES.
DO NOT USE WATER TO AVOID SHORT-CIRCUITS AND FURTHER PERSONNEL DANGEROUS CONDITIONS.

- **Solvents**

CAUTION

Solvent cleaners must not be used on plastic materials which are part of the GABBIANO TS-20 BELLY.

- **Static sensitive devices**

CAUTION

Static sensitive devices are fitted within the Gabbiano LRU. Care must be taken during the handling of these LRUs as static electricity, on the fingertips, can seriously damage these devices. Approved procedures for handling and maintenance must be observed. Interface connectors must be fitted with conductive blanks/covers at all times when the LRU is not installed.

Chapter 1

Description and Technical Data

Table of Contents

page

1 Introduction 2
1.1 Overview 2
1.2 Configuration 5
1.3 Technical Data 5
2 System components 7
2.1 Receiver Exciter Processor (REP) 7
2.2 Transmitter Front-End (TX-FE) 12
2.3 Antenna Group (AG) 14
2.3.1 Description 14
2.4 Mounting Trays 16
2.4.1 REP Mounting Tray 16
2.4.2 TX-FE Mounting Tray 17
3 System Operational Modes 18

List of Figures

Figure 1 Radar/Avionics Connections 4
Figure 2 Receiver Exciter Processor Main Task 8
Figure 3 REP Functional Block Diagram 9
Figure 4 Receiver Exciter Processor (REP) 10
Figure 5 Receiver Exciter Processor (REP) - Front View 11
Figure 6 Receiver Exciter Processor (REP) - Rear View 11
Figure 7 TX-FE Functional Block Diagram 13
Figure 8 Transmitter Front-End (TX-FE) 13
Figure 9 Antenna Group Functional Block Diagram 14
Figure 10 Antenna Group (AG) 15
Figure 11 REP Mounting Tray 16
Figure 12 TX-FE Mounting Tray 17

List of Tables

Table 1 Gabbiano TS-20 Belly LRU 5
Table 2 Gabbiano TS-20 Mounting Trays 5
Table 3 Gabbiano TS-20 Belly Technical Data 5

1 Introduction

1.1 Overview

The Gabbiano TS-20 Belly is a Tactical Radar System that incorporates a set of Air-to-Ground and Navigation Aid modes, including high resolution mapping modes (SPOT-SAR and STRIP-SAR).

The Gabbiano TS-20 Belly is a Pulse Doppler Radar designed with the state-of-the-art technology.

The Gabbiano TS-20 Belly is able to operate in the frequency range 9.1 GHz to 9.5 GHz.

The Gabbiano TS-20 Belly receives from external equipment the input power and the information necessary to guarantee the proper operation.

The Radar is supplied by a Power Supply equipment through 28 VDC lines, delivering the input power to each LRU.

The operator can command the Radar by using the Mission Computer, interfaced to the Radar by means of Ethernet links. Through these Ethernet lines, high speed data as well as command and controls are transferred to the REP LRU which works as the main controlled of the Radar.

Additionally, from the Inertial Navigation System (INS), the Radar receives the inertial navigation data necessary to perform yaw, pitch and roll stabilization.

The REP LRU receives and processes the data coming from the external interfaces, it has to properly output the commands and data to the other LRUs it is connected with.

The TX-FE, the transmitter channel receives from the REP the driver signal and amplifies it before output it to the AG. In the receiver chain, the targets' echoes from the AG are sent back to the Front End of the TX-FE, amplified, and then transferred back to the Processor of the REP.

Serial links between LRUs, RF signals and discrete signals compose the Radar Internal Interfaces.

The Gabbiano TS-20 Belly is able to perform different modes while in the Operate or Test states. The Gabbiano TS-20 Belly modes are chosen by the operator through the Mission Computer.

The Gabbiano TS-20 Belly includes the following Operating Modes:

1 Air to Surface Modes:

- Ground Map (GM)
- Ground Moving Target Indicator (GMTI)
- Spot Synthetic Aperture Radar (Spot-SAR)
- Strip Synthetic Aperture Radar (Strip-SAR)
- Air-to-Surface Track While Scan (TWS)
- Inverse SAR (ISAR)
- Sea Moving Target Indicator

2 Navigation Modes:

- Weather Mode (WA)
- Beacon Mode (BCM)
- Search and Rescue Track While Scan (SR- TWS)

3 Maintainability Modes:

- Power-Up BIT (PBIT)
- Interruptive BIT (IBIT)
- Continuous BIT (CBIT)

Note:

The Power-Up and Interruptive BIT are capable to detect failures on the Radar LRU as well as down to SRU modules.

The Gabbiano TS-20 Belly includes the following Interfaces with the Avionic Equipment as shown in 1.1Figure 1:

- MISSION COMPUTER Ethernet Line
- INERTIAL NAVIGATION UNIT Ethernet Line
- ANTENNA ROTATION ON/OFF Discrete Signal
- WEIGHT ON WHEELS (WOW) Discrete Signal
- BLANKING OUT → RS-422 Signal

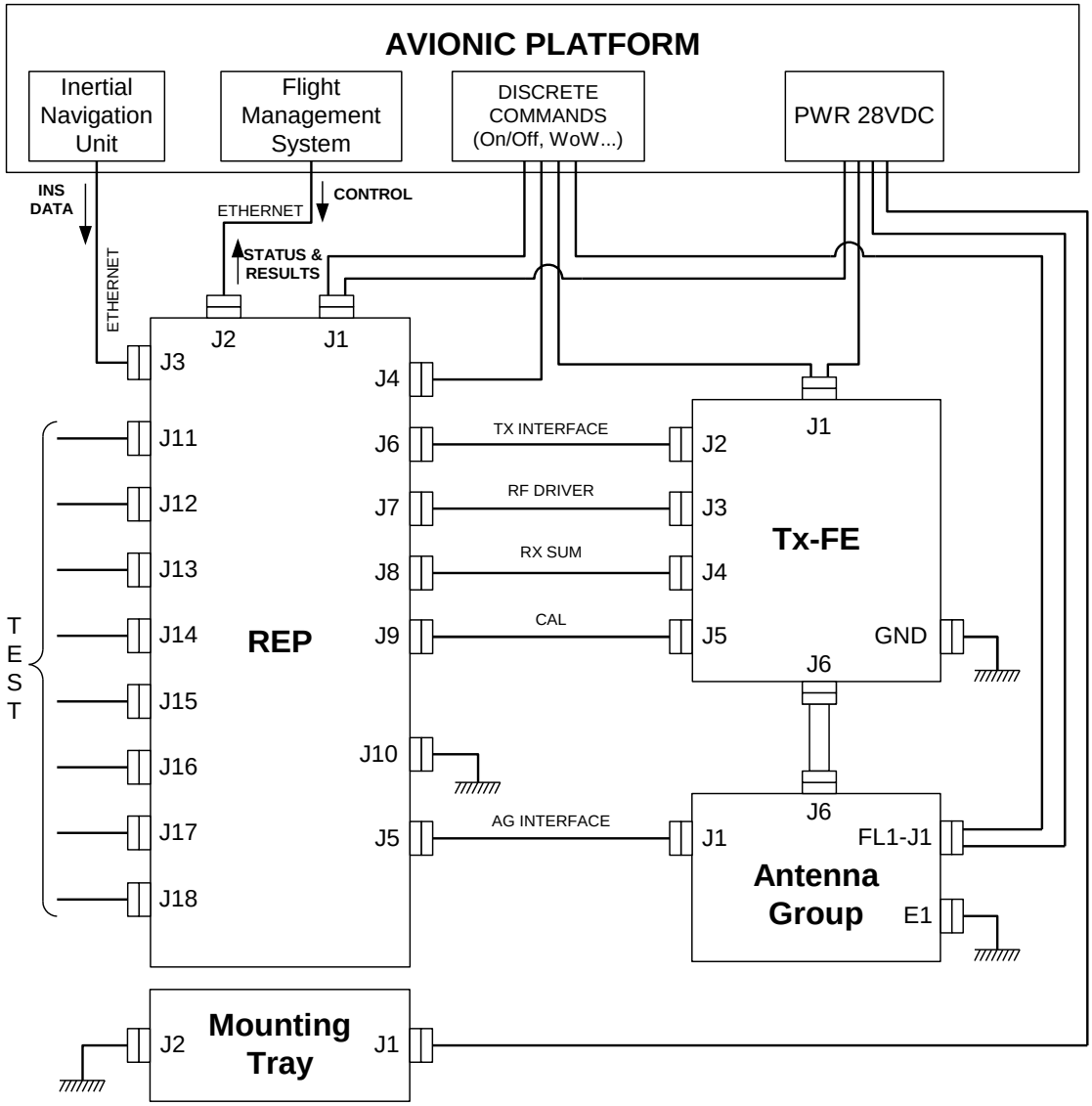

Figure 1 Radar/Avionics Connections

1.2 Configuration

The Gabbiano TS-20 Belly is composed by the following LRUs:

Table 1 Gabbiano TS-20 Belly LRU

LRU Name	LRU IBC
Receiver Exciter Processor (REP)	372787-001
Transmitter Front End (TX-FE)	T0086906
Antenna Group (AG)	T0076655

Table 2 Gabbiano TS-20 Mounting Trays

LRU Name	LRU IBC
Mounting Tray REP	365126-050
Mounting Tray TX	T0079158

1.3 Technical Data

Table 3 gives the main characteristics of Gabbiano TS-20 Belly

Table 3 Gabbiano TS-20 Belly Technical Data

		Technical Data
1	ANTENNA Group	
	Mass Dimension (reported width include the over all of envelope required for the antenna rotation)	16 Kg max. 785 X 533 X 548 mm
	Antenna Scan Limits: Electrical - Azimuth - Elevation Mechanical - Azimuth - Elevation	 360° +10° / -25° 360° +7.5° / -15°
	Antenna Stow Position Azimuth Elevation	 N/A +21°
	Elevation Scanning Speed	360°/s
	Operative Temperature	-40 / +55°C
	Storage Temperature	-45°C / +85°C

		Technical Data
	Polarization	Horizontal
	Nominal Voltage	28 Vdc (from 22.0Vdc to 32.0Vdc)
	Power Drain	Stand-by 20 W Operate 60 W
	Dissipation Data	Stand-by 20 W Operate 60 W
	Frequency Range	9.200 GHZ ÷ 9.600 GHz
	VSWR	≤ 2:1
	Insertion Loss	≤ 0.5 dB
	Gain	≥28.5 dBi
2	TX-FE	
	Mass	8 Kg max.
	Dimension	342 X 260 X 133 mm
	Operative Temperature	-40°C / +55°C
	Storage Temperature	-45°C / +85°C
	Nominal Voltage	28 Vdc (from 22.0Vdc to 32.0Vdc)
	Transmitter Peak Power	112 W
	Power Drain	Stand-by 35W Operate 180 W
	Dissipation Data	Stand-by 35W Operate 140 W
3	REP	
	Mass	21 Kg
	Dimension (this value include the plenum, the connectors and the handle)	455 X 322 X 220 mm
	Operative Temperature	-40°C / +55°C
	Storage Temperature	-45°C / +85°C
	Nominal Voltage	28 Vdc (from 22Vdc to 32Vdc)
	Power Drain	270W
	Dissipation Data	Operate 270W

2 System components

2.1 Receiver Exciter Processor (REP)

The master controller of the Gabbiano TS-20 Belly is the REP. The AG and the TX-FE are directly controlled by the REP.

The Receiver Exciter Processor consists:

1 Wide band-compact single channel receiver.

2 Flexible digital waveform generator.

3 High efficiency Modular Radar Processor (MRP) digital processing boards.

The REP is designed in conformance with the MRP architecture system and performs the following main tasks:

1 Pulse generation: According to the selected operational mode, the REP generates the pulses with a predetermined length and bandwidth. The REP is able to generate both linear chirps and non-linear chirps.

2 Timing: The REP generates all the timing signals needed to perform synchronization of the transmitter, receiver and processor.

3 Frequency Up-conversion: The generated pulses are up-converted to the radio frequency band. This signal is output to the TX-FE LRU.

4 Frequency Down-conversion: The REP is able to perform both frequency shift, from RF band to IF, and de-ramp-on receive conversion.

5 Digitalization: The REP must sample and digitally convert the IF signal.

6 Fast signal processing: The REP performs I/Q Splitter, decimation and pulse compression of the digital signal converted by the A/D converter.

7 Digital signal processing: The REP is able to digitally process the received signal in order to extract information and produce the required radar modes output.

8 Main Radar Controller: The REP directly controls all the functionalities and interacts with Mission Computer by the external interfaces.

9 External interface management: The REP manages the connection with the external equipment. It receives the commanded operational mode with specific settings from the Mission Computer and send the results back to either the MC or the RCI system, depending on the Ethernet availability. To guarantee the mode performances the Radar needs INS data.

10 Internal interface management: The REP manages all the interfaces between LRU (data-link and discrete) to configure the LRUs in order to perform the commanded mode.

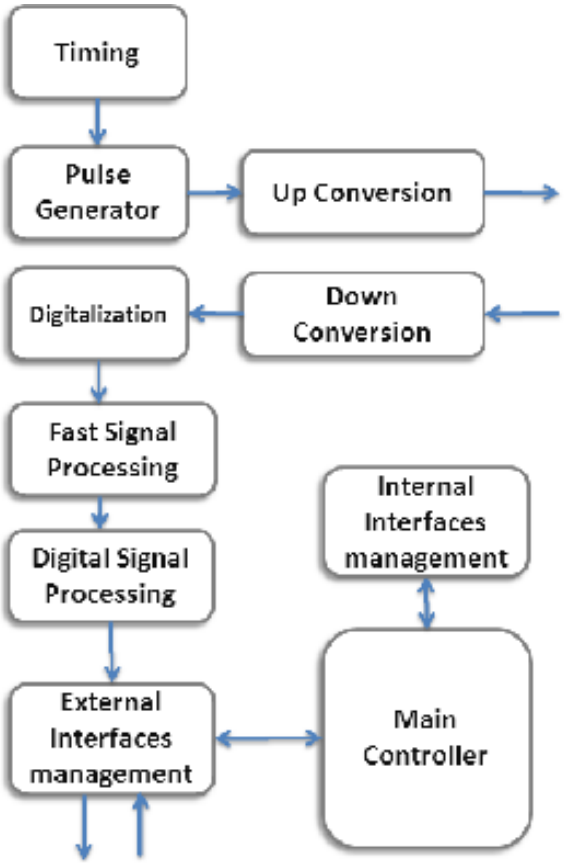

Figure 2 Receiver Exciter Processor Main Task

The REP is composed of a single box.

The REP LRU includes the following SRU:

SRU Number	SRU name	Hosted Boards / Function
1	PX-CTRL / EIF	Px-Controller and External Interface boards
2	DSP	Digital signal processor board
3	DSP4	Digital signal processor boards
4	DSP4	Digital signal processor boards
5	DSP4	Digital signal processor boards

SRU Number	SRU name	Hosted Boards / Function
6	ADWB	AD Converter and baseband demodulation
7	TIM / EXP	Timer and Expander boards
8	PSM	Power Supply Module
9	RX_RXC_LF	UHF Up/Down Converter
10	RX_RXC_HF	S/X band Up/Down Converter
11	Chassis	LRU box, wirings and Signal Processor motherboard

A Functional Block Diagram of the REP is shown in Figure 3.

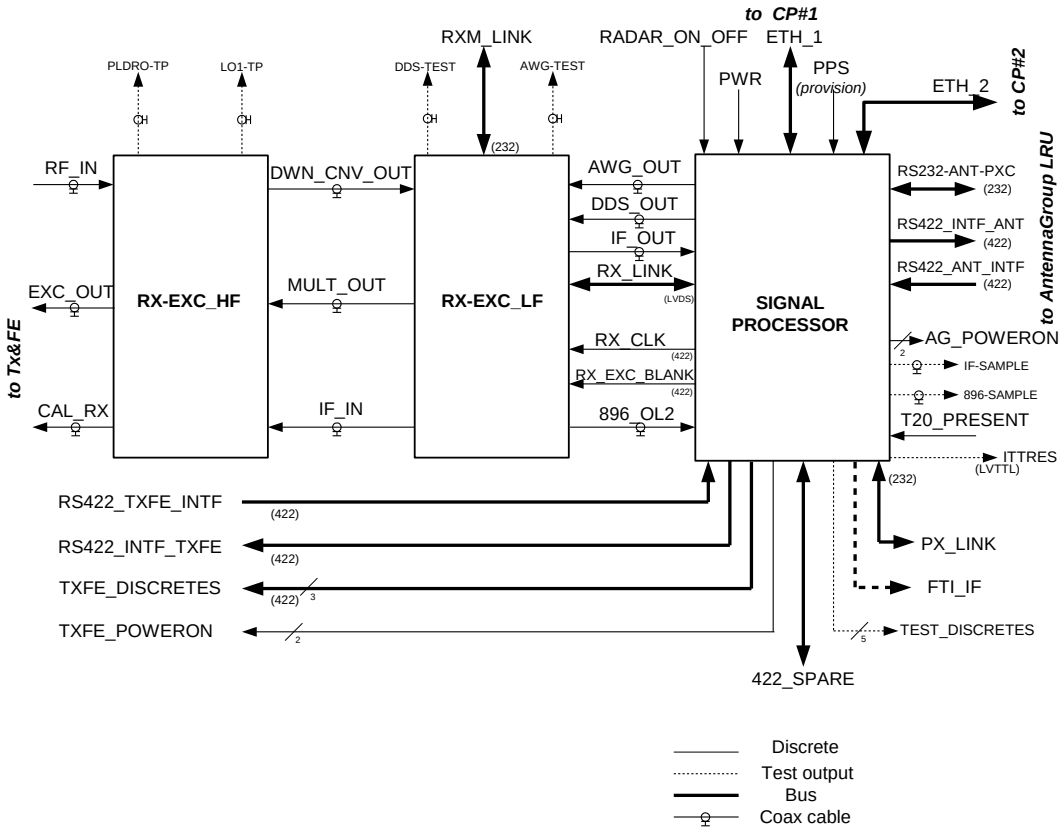

Figure 3 REP Functional Block Diagram

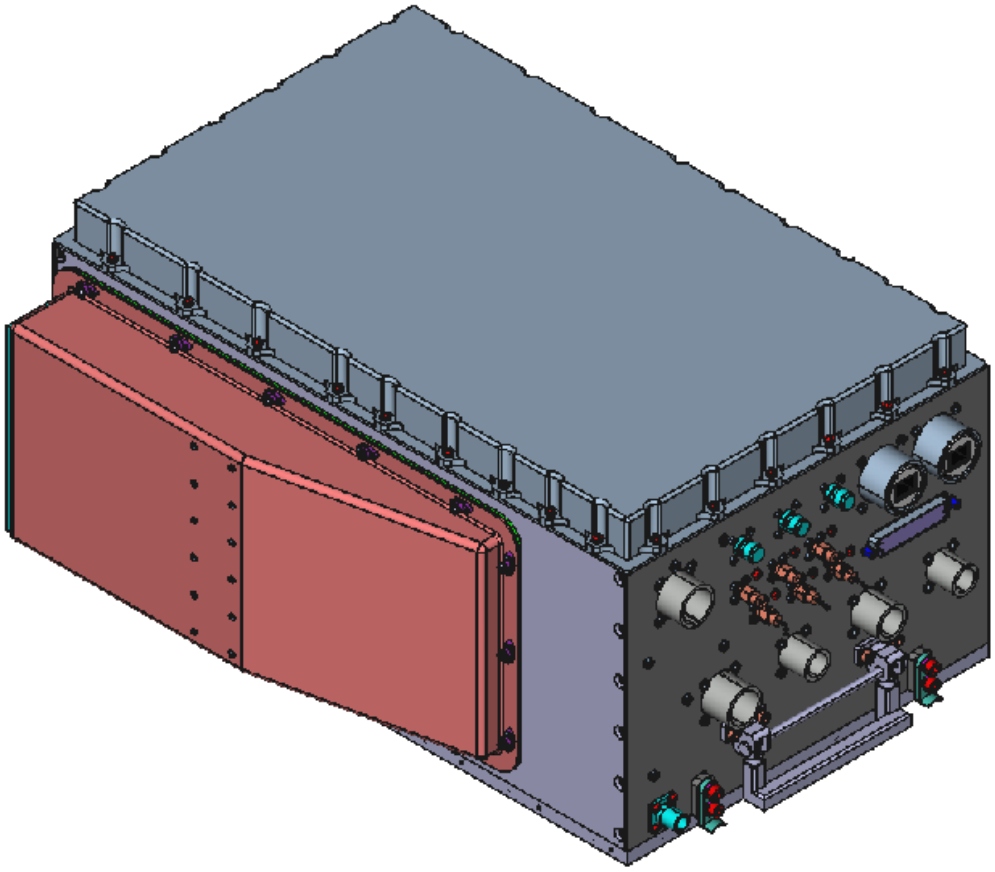

Figure 4 Receiver Exciter Processor (REP)

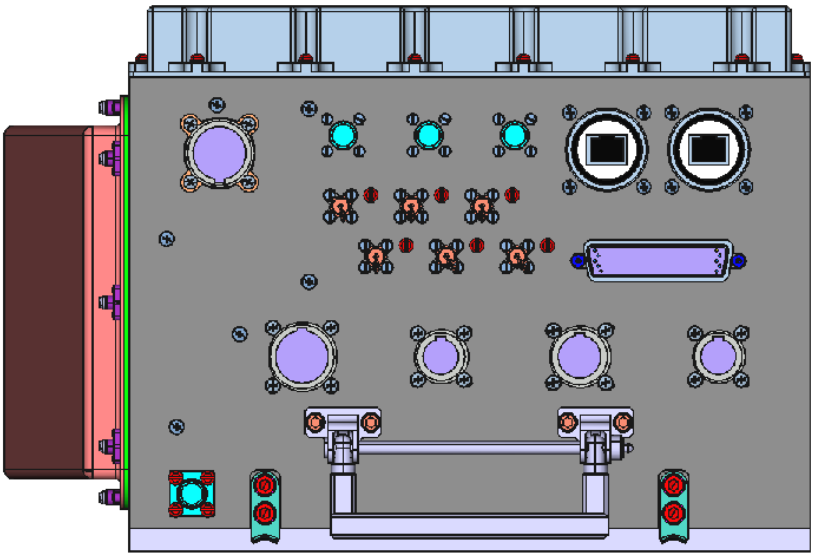

Figure 5 Receiver Exciter Processor (REP) - Front View

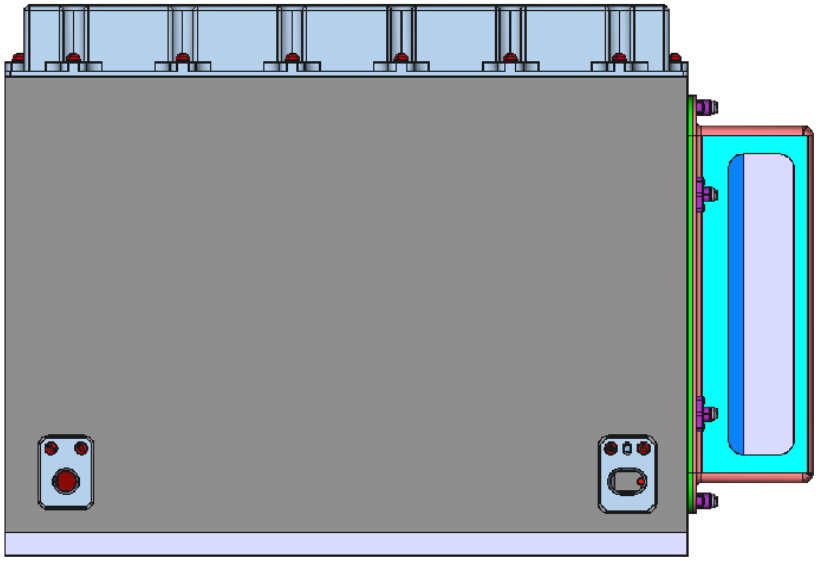

Figure 6 Receiver Exciter Processor (REP) - Rear View

2.2 Transmitter Front-End (TX-FE)

This unit incorporates in a compact box a 20 W average power Solid State Amplifier and the Receiver Front-End (Low Noise Amplifier, Limiter, X-Band filters and circulators). The use of Solid State Amplifier technology increases system compactness and reliability.

The bottom part of the chassis is equipped of an adapted fins in order to guarantee the cooling of the unit and in particular of SSPA module.

The cooling is provided by natural convection with through forced air aid, coming from the platform system cooling. In correspondence of the base plate of the SSPA there are two thermal sensors monitoring the unit temperature. The RF functional items are contained in a completely shielded metallic box. RF Modules are interconnected by means of coaxial cables. The wiring is of "spun" type and comprises a series of connectors.

The TX-FE performs the following main tasks:

1 Manages the commands and the BIT information of the unit towards REP

2 Amplifies the RF pulsed signal received from the REP

3 Detect the RF signal in order to pre-amplify the signal received from the antenna

This LRU includes:

1 CHASSIS (unit structure; the EMI Filter, the wiring, the interface connectors are assembled on part of it)

2 DC POWER (which supplies all the necessary voltages for to the unit)

3 INTERFACE BOARD (interface & BIT)

4 SSPA ASSY (which amplifies the RF pulsed signal)

5 TRL & HL-LNA (include a TR-Limiter, a low noise amplifier with a controller out-of-band response, a temperature compensated power amplifier chain and a switch able to inhibit the output)

6 WAVEGUIDE RF ASSY

A Functional Block Diagram of the LRU is shown in Figure 7.

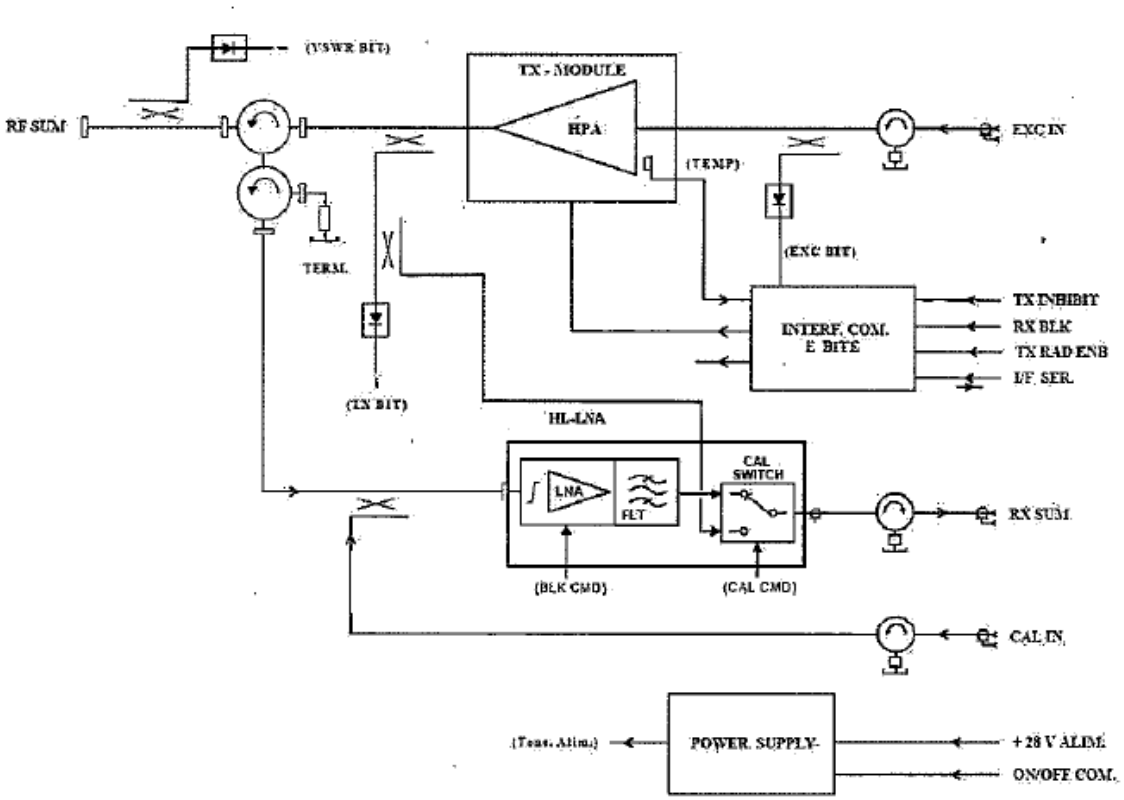

Figure 7 TX-FE Functional Block Diagram

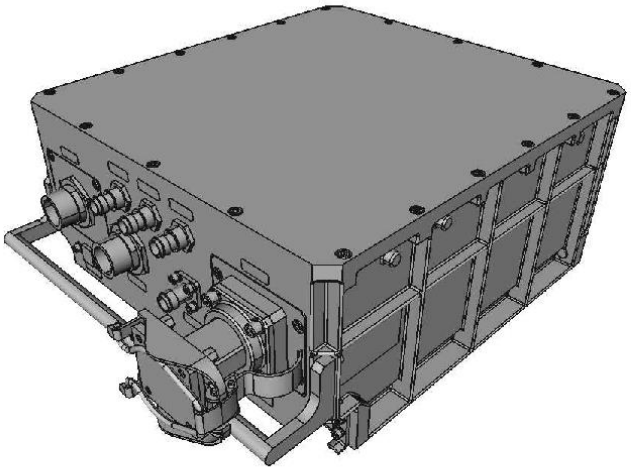

Figure 8 Transmitter Front-End (TX-FE)

2.3 Antenna Group (AG)

2.3.1 Description

This unit consists of the following parts (SRUs):

- Antenna Elevation Assy
- Azimuth Pedestal
- Servo Unit;

Main Antenna characteristics are:

- 3 degrees azimuth beam width, 10 degrees elevation beam width (a specific processing is applied during the Ground Map and Beacon modes to reduce the azimuth beam width by 25%)
- 360 degrees azimuth coverage, variable scan rate up to 60 rpm.
- sector-based scan, with centre and width operator selectable, the latter among the following. values: ±15°, ±30°, ±60°, ±90°.
- elevation coverage better than 10° up ÷ 25° down.
- pointing capability.

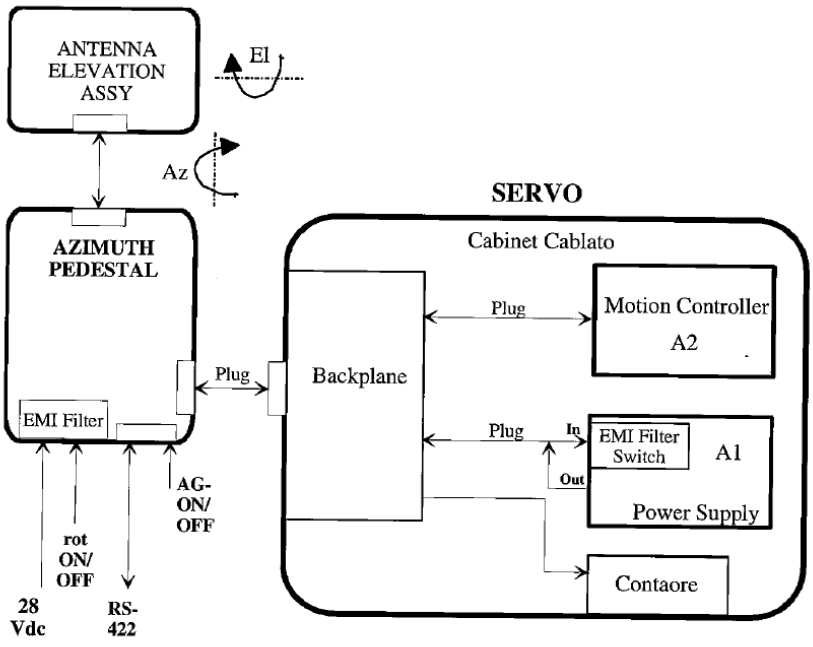

Figure 9 Antenna Group Functional Block Diagram

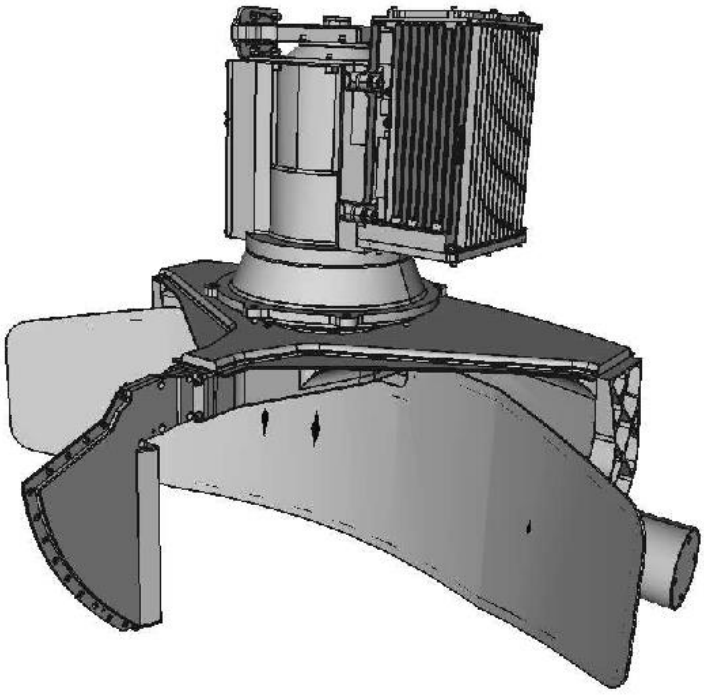

Figure 10 Antenna Group (AG)

The AG unit performs the following functions:

1 Movement of the antenna in accordance with the commands received by the REP unit

2 Inertial stabilization of the antenna movement against roll, pitch and heading variation

3 Emits the RF power received from the TX-FE unit

4 Receives the SUM signal and send it to the TX-FE unit.

5 Interface Management with the REP Unit

6 AG Bite data Collection

2.4 Mounting Trays

2.4.1 REP Mounting Tray

The REP on the aircraft is installed on a dedicated mounting tray that provides the mechanical interface between the LRU and the airframe.

The REP Mounting Tray is a mechanical structure designed to:

1 permits to install/remove the REP unit in line of flight

2 permits to implement vibration isolators.

3 provides the cooling of the REP.

The REP Mounting Tray is shown in Figure 11.

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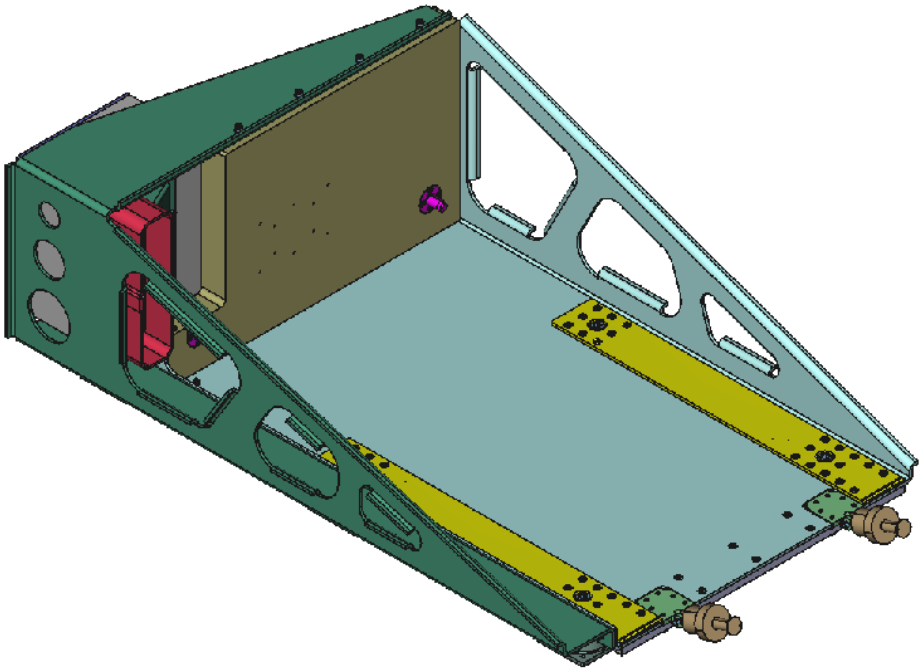


Figure 11 REP Mounting Tray

2.4.2 TX-FE Mounting Tray

The TX-FE on the aircraft is installed on a dedicated mounting tray that provides the mechanical interface between the LRU and the airframe.

The TXFE Mounting Tray is a mechanical structure designed to:

1 permits to install/remove the TXFE unit in line of flight

2 permits to implement vibration isolators

3 permit the cooling for the TX-FE by a dedicated plenum

The TX-FE Mounting Tray is shown in Figure 12.

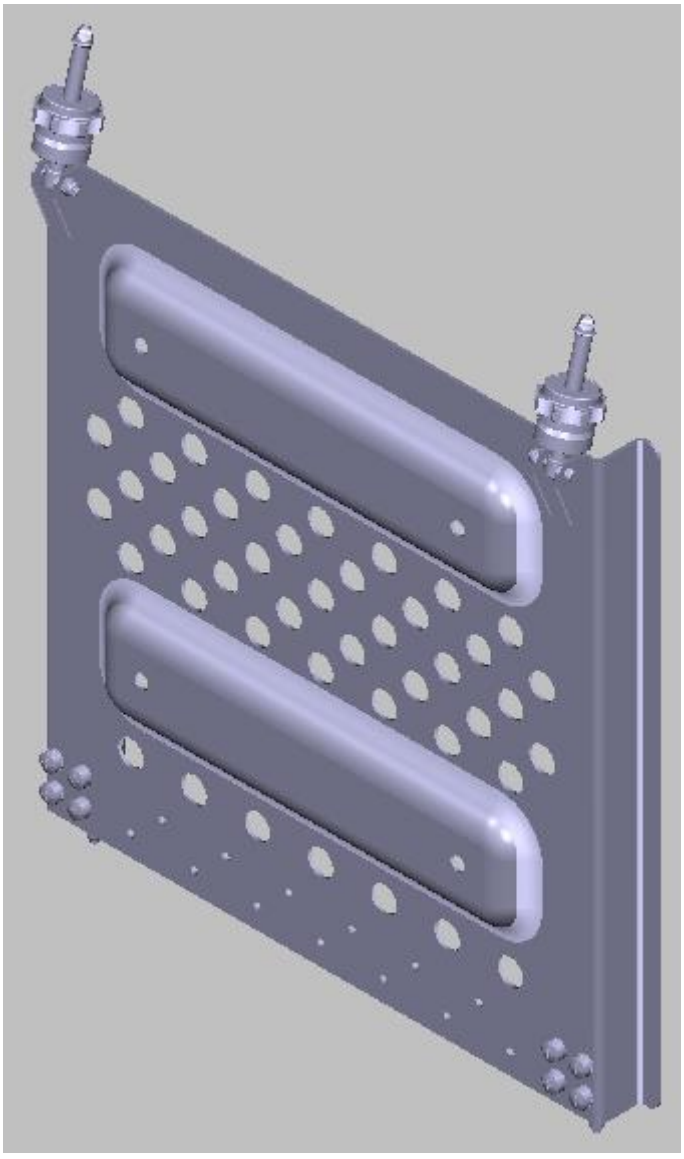


Figure 12 TX-FE Mounting Tray

3 System Operational Modes

The Radar supports the following modes:

- Air to Sea Surveillance and TWS
- Sea Search & Rescue and TWS
- Sea Moving Target Indicator and TWS
- ISAR
- Ground Moving Target Indicator
- Spot-SAR
- Strip-SAR
- Real Beam Ground Map
- Weather Avoidance
- Beacon

The different modes are tailored to meet specific requirements:

- Air to Sea Surveillance for detection of large surface vessels at long distance.
- Sea Search & Rescue for detection of small targets in high sea state at short distances.
- Sea Moving Target Indicator for detection of moving targets in sea clutter conditions from short to medium distances.
- Track-While-Scan (TWS) function for sea surface targets is available for scenario assessment and targets control; multiple targets can be tracked simultaneously with position and speed data sent to the avionics through the data link.
- ISAR and High Range Resolution Profile modes provide images of seaborne targets to be presented to the operator for recognition.
- Ground Moving Target Indicator for detection of ground movers from short to medium distances.
- Strip SAR provides detailed maps of designated coastline areas and harbours to support surveillance missions.
- Spot SAR provides high resolution radar image of limited areas.
- Real Beam Ground Map provide a low resolution of ground map for navigation aid.
- Weather Avoidance for navigation aid, useful for detection of atmospheric phenomena.
- Beacon modes are useful for discovering range and azimuth coordinates of airborne and ground beacons.

Chapter 2

Maintenance

Table of Contents

page

1 Testing and Fault Isolation 2
2 Routine maintenance 3
2.1 Checks 3
2.2 Cleaning 4
2.2.1 Materials and tools 4
2.2.2 Cleaning procedures 5
3 Removal 5
3.1 Receiver Exciter Processor (REP) Removal Procedure 5
3.2 Transmitter Front End (TX-FE) Removal Procedure 6
3.3 Antenna Group (AG) Removal Procedure 6
4 Installation 8
4.1 Receiver Exciter Processor (REP) Installation Procedure 8
4.2 Transmitter Front End (TX-FE) Installation Procedure 8
4.3 Antenna Group (AG) Installation Procedure 10
5 General Information for Storage 15
5.1 Materials and Tools 15
5.2 Storage Instructions 16
5.2.1 Storage Instructions for the Gabbiano TS-20 Belly Equipment 16
5.2.2 Storage Instructions for Mounting Tray 17
5.2.3 Transportation 17
5.2.4 Unpacking Procedure 17
5.2.5 Standard ESD Handling Procedures 19

List of Figures

Figure 1 Mechanical stop inserted 7
Figure 2 Antenna El. Assy and Az. Pedestal Assy linked together 7
Figure 3 REP Interconnection 8
Figure 4 TX-FE Interconnection 9
Figure 5 Az Pedestal Section 11
Figure 6 Antenna El. Assy and Az. Pedestal Assy linked together 11
Figure 7 Mechanical stop inserted 12
Figure 8 Mechanical stop releasing 12
Figure 9 Mechanical stop free 12
Figure 10 Antenna Group parts 13
Figure 11 Antenna group Connections 14
Figure 12 REP Container 18
Figure 13 TX-FE Container 18
Figure 14 AG Container 18

List of Tables

Table 1 Consumable Materials 4
Table 2 Consumable Materials 15
Table 3 Packaging Support equipment 16

1 Testing and Fault Isolation

The GABBIANO TS-20 Belly is equipped with a comprehensive built-in test (BIT) which is used to verify and monitor the performance of the radar system. In all modes of operation, the status of the radar system is transmitted to the Avionic System via the Ethernet.

WARNING

PRIOR TO OPERATING THE GABBIANO TS-20 BELLY ON THE GROUND, THE AIRCRAFT MUST BE POSITIONED IN A SAFE AREA CLEAR OF BUILDINGS, AND ALL PERSONNEL AND EQUIPMENT MUST BE CLEAR OF THE RADIATION AREA.

IF THE WEIGHT-ON-WHEELS (WOW) SAFETY INTERLOCK IS OVERRIDDEN ON THE GROUND, GABBIANO TS-20 BELLY CAN TRANSMIT RADIO FREQUENCY (RF) ENERGY IF THE TRANSMIT FUNCTION IS SELECTED. ANY SWITCH USED TO OVERRIDE THE WOW SAFETY INTERLOCK MUST BE OF THE MOMENTARY TYPE, SUCH THAT IT CANNOT BE ACCIDENTALLY LEFT IN THE OVERRIDE POSITION RADIATION HAZARD.

This section describes the three types of radar built-in test (PBIT, CBIT and IBIT) and faults detected by the radar.

Faults detected by the system BIT are also logged in Non Volatile Memory of the REP as a diagnostic aid for LRU maintenance

The GABBIANO TS-20 Belly have three different types of built-in test:

1 The power-up built-in tests (PBIT) check certain processor functions and are automatically performed during radar initialization after switch-on. Any failure detected is reported as for continuous tests.

- Activated by a RADAR_ON event
- Non interruptible
- Maximum detection & localization coverage

2 The GABBIANO TS-20 Belly has comprehensive continuous built-in test (CBIT) functions which continuously check various functions of the LRUs.
Protected faults shutdown all or part of the radar to prevent damage to the radar, or the loss of stored information or a reduction in reliability (by preventing overstressing of components which could lead to premature failure).
Unprotected faults are unlikely to damage the radar although there may be some loss of performance.

- Active while in STBY or OPERATE states
- Real-time detection of Radar malfunctions
- No localization coverage

3 The system has several interruptive built-in tests (IBIT) that can be initiated by the operator

- Activate by a Test command

- Interruptible
- Same tests performed by the P-BIT

The GABBIANO TS-20 Belly system has a built-in test capability in order to detect, isolate and report internal and interface faults at LRU/SRU level.

The GABBIANO TS-20 Belly Built-in test results are sent to the Mission Computer through Ethernet line and displayed to the operators by mean of messages.

2 Routine maintenance

2.1 Checks

This section has the procedures necessary to do the checks to the parts of the GABBIANO TS-20 Belly.

The following tasks should be carried out on the LRUs and Mounting Trays at least once a year:

1 Check that each component is secure.

2 Dust off/wipe down all external surfaces.

3 Inspect each component for cleanliness, cracks, corrosion, security and deterioration.

4 Inspect mounts for cleanliness, cracks, corrosion and security.

5 Check each component for loose captive fasteners and missing screws, bolts, washers or nuts.

6 Check that all cables are securely fastened.

7 Verify that dust covers are in place on all unused connectors.

8 Inspect connectors for cracks, corrosion, security, and deterioration.

9 Check that the earth bonding leads are secure.

The following tasks should be carried out on the LRU's Container at each usage:

1 Check that the container is not damaged.

2 Check the latches of the container are not damaged.

2.2 Cleaning

This section has the procedures necessary to clean the Gabbiano TS-20 Belly and its detail components.

WARNING

REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR ISOPROPYL ALCOHL INFORMATION SUCH AS:
HAZARDOUS INGREDIENTS PHYSICAL/CHEMICAL CHARACTERISTICS
FIRE, EXPLOSION, REACTIVITY, AND HEALTH HAZARD DATA, PRECAUTION FOR SAFE HANDLING USE AND CONTROL MEASURES.

WARNING

WHEN YOU USE COMPRESSED AIR TO CLEAN OR DRY PARTS, MAKE SURE THAT THE PRESSURE IS NOT MORE THAN 50 POUNDS PER SQUARE INCH (PSI). DO NOT DIRECT THE AIRSTREAM AT PERSONNEL OR LIGHT OBJECTS. PUT ON GOGGLES OR A FACE MASK TO PROTECT YOUR EYES. THIS WILL HELP TO PREVENT INJURIES TO PERSONNEL, OR DAMAGE TO THE EQUIPMENT. IF YOU HAVE AN EYE INJURY, GET MEDICAL ATTENTION.

CAUTION

Allow parts to come up to room temperature after drying with compressed air to permit surface condensate to evaporate.

Use extreme care to prevent the entrance of foreign material in the connectors and in the waveguide window of the TX-FE and AG. If a LRU is not installed on the aircraft immediately, put the cleaned LRU on its container.

2.2.1 Materials and tools

Use the materials shown in Table 1 to clean the component parts of the GABBIANO TS-20 Belly.

Table 1 Consumable Materials

Material Number and Name	Source	Use
Isopropyl Alcohol	Commercially Available	To clean the LRU
Lint-free cloth	Commercially Available	

Note:
You can use equivalent alternatives for the items specified.

2.2.2 Cleaning procedures

1 Use a soft lint-free cloth moistened with de-ionised water to clean the Receiver Exciter Processor (REP).

2 Use a soft lint-free cloth moistened with de-ionised water to clean the Transmitter Front-End (TX-FE).

3 Use a soft lint-free cloth moistened with de-ionised water to clean the Antenna Group.

4 Clean the window in the Waveguide/Window using a soft lint-free cloth moistened with de-ionised water.

5 Remove remaining grease using a lint-free cloth moist with Isopropyl Alcohol.

3 Removal

WARNING

Perform these tasks with the GABBIANO TS-20 Belly disconnected to the power.

Note:
Refer the Aircraft Manual for the detailed procedures of the removal of the equipment from the Aircraft.

3.1 Receiver Exciter Processor (REP) Removal Procedure

1 Open the aircraft cover bay.

Note: Record the position of all connectors before you disconnect them.

2 Disconnect all connectors from the relevant front connectors of the unit.

3 Disengage the 2 hold-down fasteners that fix the REP to its mounting tray.

4 Remove the REP from the mounting tray.

5 Install the protective caps on all external connectors of the REP.

3.2 Transmitter Front End (TX-FE) Removal Procedure

1 Open the aircraft cover bay.

Note: Record the position of all connectors before you disconnect them.

2 Disconnect all connectors from the relevant front connectors of the unit.

3 Unlock the clamp of the waveguide connector J6.

4 Disconnect the aircraft waveguide from the TX-FE.

5 Install the cover on the connector J6 and lock it with the clamp.

6 Disengage the 2 hold-down fasteners that fix the TX-FE to its mounting tray.

7 Remove the TX-FE from the mounting tray.

8 Install the protective caps on all external connectors of the TX-FE.

3.3 Antenna Group (AG) Removal Procedure

WARNING

BEFORE REMOVE THE OF ANTENNA EI. ASSY FROM THE AZ.PEDESTAL ASSY, INSERT THE MECHANICAL STOP.

WARNING

NONE OBJECT MUST FALL OR TO BE INSERTED IN THE GAPS AROUND THE WAVEGUIDE FLANGE AND IN THE WAVEGUIDE WINDOW.

Note: Refer the Aircraft Manual for the detailed procedures of the removal of the Az. Pedestal Assy from the Aircraft.

Required Tools:

a. screwdriver 4mm

b. 4 mm male hex wrench

c. 3mm male hex wrench

d. 17mm wrench

- Remove the round lid of the Antenna El. Assy.
- Insert the mechanical stop by means 17mm wrench (d) and block it in stop position as Figure 1.

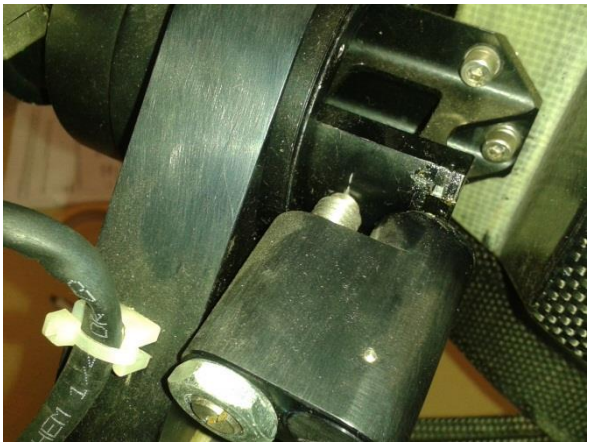


Figure 1 Mechanical stop inserted

- unscrew the 4 waveguide screws by means 3mm male hex wrench (c) and the 2 screws of the plug connector of the Antenna El Assy by means screwdriver (a).
- unscrew the 6 captive screws of the Antenna El. by means 4 mm male hex wrench (b) See Figure 2.

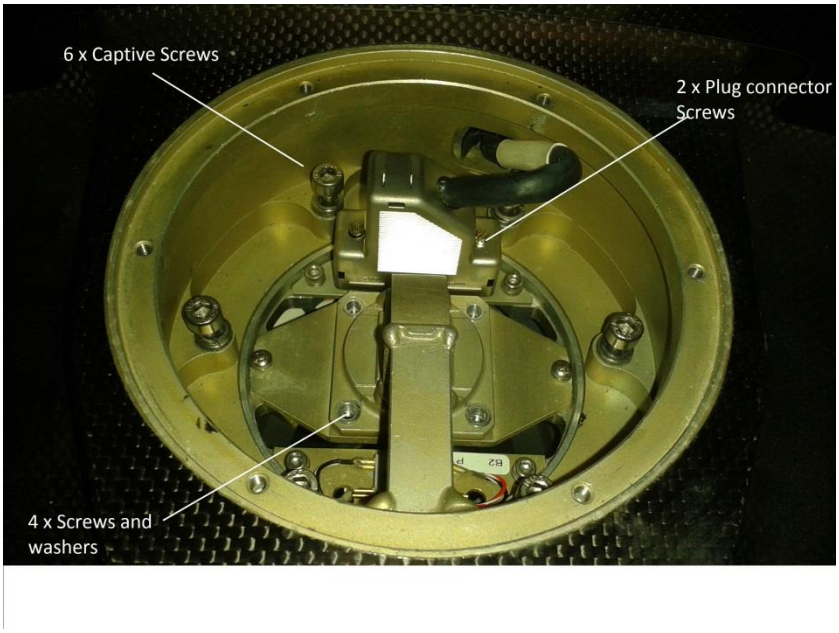


Figure 2 Antenna El. Assy and Az. Pedestal Assy linked together

- Remove the Antenna El. Assy from the Az. Pedestal Assy
- Insert the waveguide plastic caps to the Antenna El. Assy and the Az. Pedestal Assy
- Install the protective caps on all external connectors of the Az. Pedestal Assy.

4 Installation

WARNING

PERFORM THESE TASKS WITH THE GABBIANO TS-20 BELLY DISCONNECTED TO THE POWER.

Note: Refer to the Aircraft Manual for the detailed procedures of the installation of the equipment in the Aircraft.

4.1 Receiver Exciter Processor (REP) Installation Procedure

1 Remove the protective caps from the connectors of the REP.

2 Slide the REP into its mounting tray and push firmly home until the locating spigots on the bottom of the mounting are engaged.

3 Connect the cooling tube of the REP to the air tube of the Aircraft.

4 Engage the 2 hold-down fasteners, then tighten them by hand.

5 Connect the cables to the relevant front connectors of the units as per recorded position or as shown in Figure 3.

6 Close the aircraft cover bay.

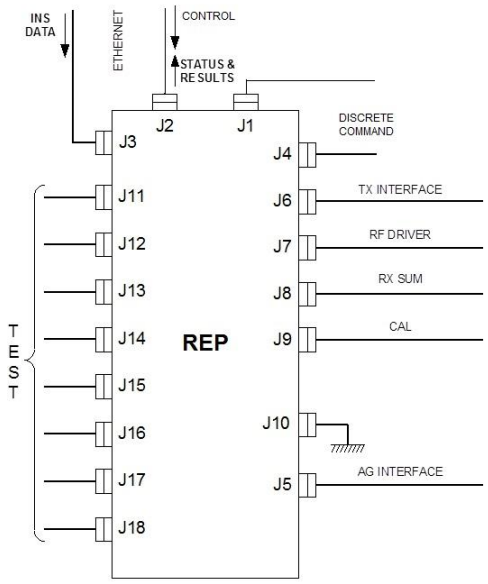


Figure 3 REP Interconnection

4.2 Transmitter Front End (TX-FE) Installation Procedure

1 Remove the protective caps from the connectors of the TX-FE.

2 Slide the TX-FE into its mounting tray and push firmly home until the locating spigots on the bottom of the mounting are engaged.

3 Engage the 2 hold-down fasteners, then tighten them by hand.

4 Connect the cables to the relevant front connectors of the units as per recorded position or as shown in Figure 4.

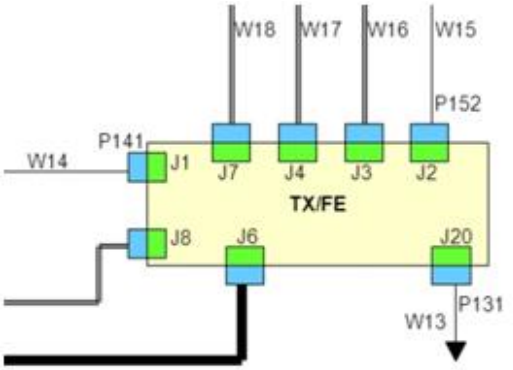


Figure 4 TX-FE Interconnection

CAUTION

BEFORE YOU INSTALL THE WAVEGUIDE ON THE EQUIPMENT BE SURE THAT THE GASKET, INSTALLED ON THE END OF THE WAVEGUIDE, IS NOT MISSING OR DAMAGED. IF DAMAGED, DISCARD AND REPLACE THE GASKET.

5 Unlock the clamp of the connector J6.

6 Remove the cover of the connector J6.

7 Put in position and align the waveguide of the aircraft on the connector J6 of the TX-FE.

8 Lock the clamp of the connector J6 in order to lock the waveguide of the aircraft to the TX-FE.

9 Close the aircraft cover bay.

4.3 Antenna Group (AG) Installation Procedure

CAUTION

BEFORE YOU INSTALL THE WAVEGUIDE ON THE AG BE SURE THAT THE GASKET, INSTALLED ON THE END OF THE WAVEGUIDE, IS NOT MISSING OR DAMAGED. IF DAMAGED, DISCARD AND REPLACE THE GASKET.

WARNING

AFTER THE INSTALLATION OF ANTENNA EI. ASSY AND THE AZ.PEDESTAL ASSY TOGETHER, RELEASE THE MECHANICAL STOP.

WARNING

NONE OBJECT MUST FALL OR TO BE INSERTED IN THE GAPS AROUND THE WAVEGUIDE FLANGE AND IN THE WAVEGUIDE WINDOW.

Note: Refer the Aircraft Manual for the detailed procedures of the Installation of the Az. Pedestal Assy on the Aircraft.

Required Tools:

a. screwdriver 4mm
b. 4 mm male hex torque wrench
c. 3mm male hex torque wrench
d. 17mm wrench

- Fit The two O-RINGs supplied with the Antenna Group on the Azimuth Pedestal Assy grooves as shown in Figure 5.

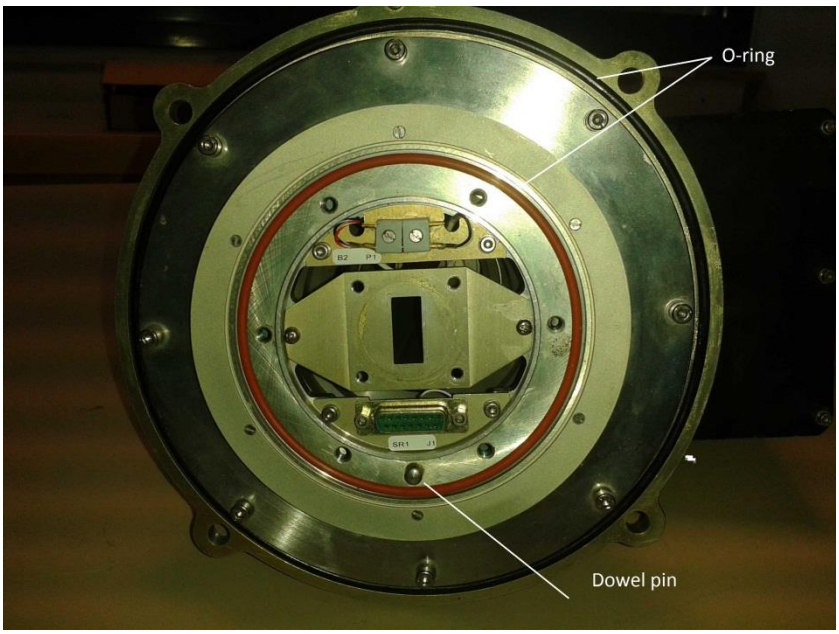


Figure 5 Az Pedestal Section

- Remove the waveguide plastic caps from the Antenna El. Assy and the Az. Pedestal Assy and insert the gasket waveguide in the Antenna El. Assy wave guide groove.
- Couple the Antenna El. Assy to the Az. Pedestal Assy , making sure to plug the dowel pin of the Az. Pedestal Assy into the relevant hole of Antenna El. Assy, and match the six captive screws of the Antenna El. Assy on the relevant holes of the Az. Pedestal Assy.

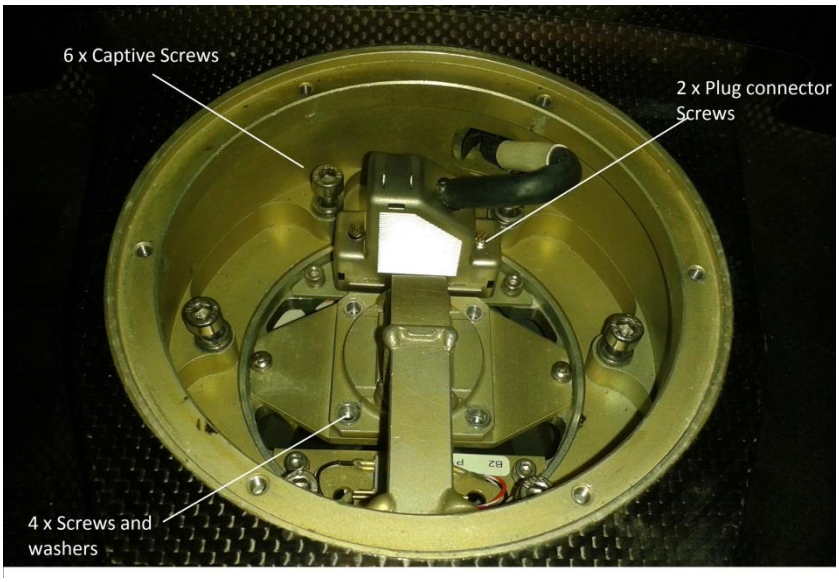


Figure 6 Antenna El. Assy and Az. Pedestal Assy linked together

- Tighten the six captive screws of the Antenna El. Assy by means a torque wrench (b) with a torque of 4Nm

- Fix the waveguide by means a torque wrench (c) with a torque of 2Nm and the plug connector of the Antenna El. Assy on the underlying fixed parts of the Az. Pedestal Assy by means a screwdriver (a).
  For the waveguide using the screws and washers supplied with the Antenna Group.
- Release the mechanical stop by means 17mm wrench (d) Figure 8 and block it in free position as Figure 9.

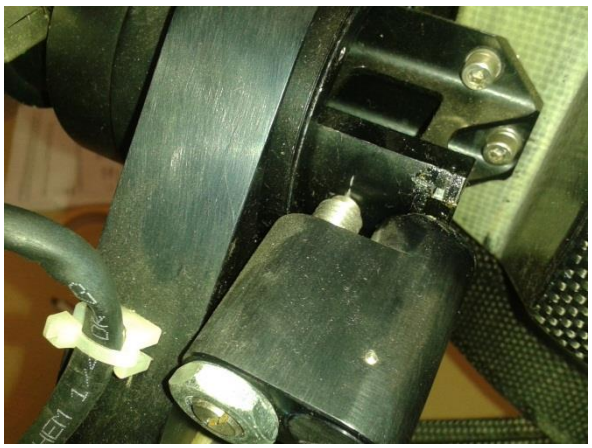


Figure 7 Mechanical stop inserted

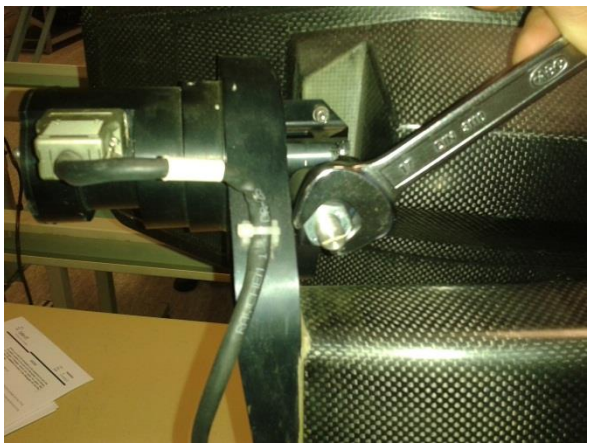


Figure 8 Mechanical stop releasing

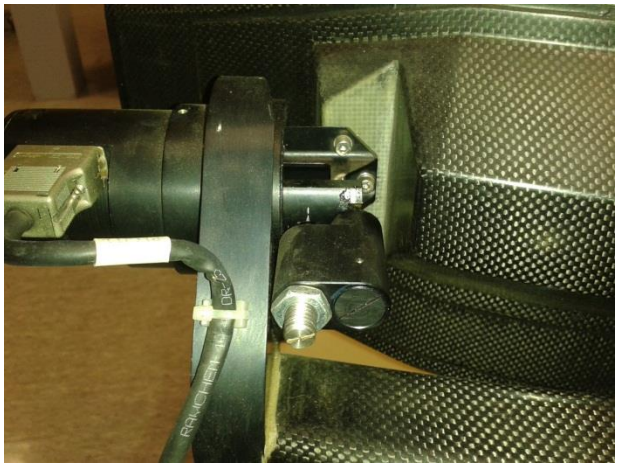
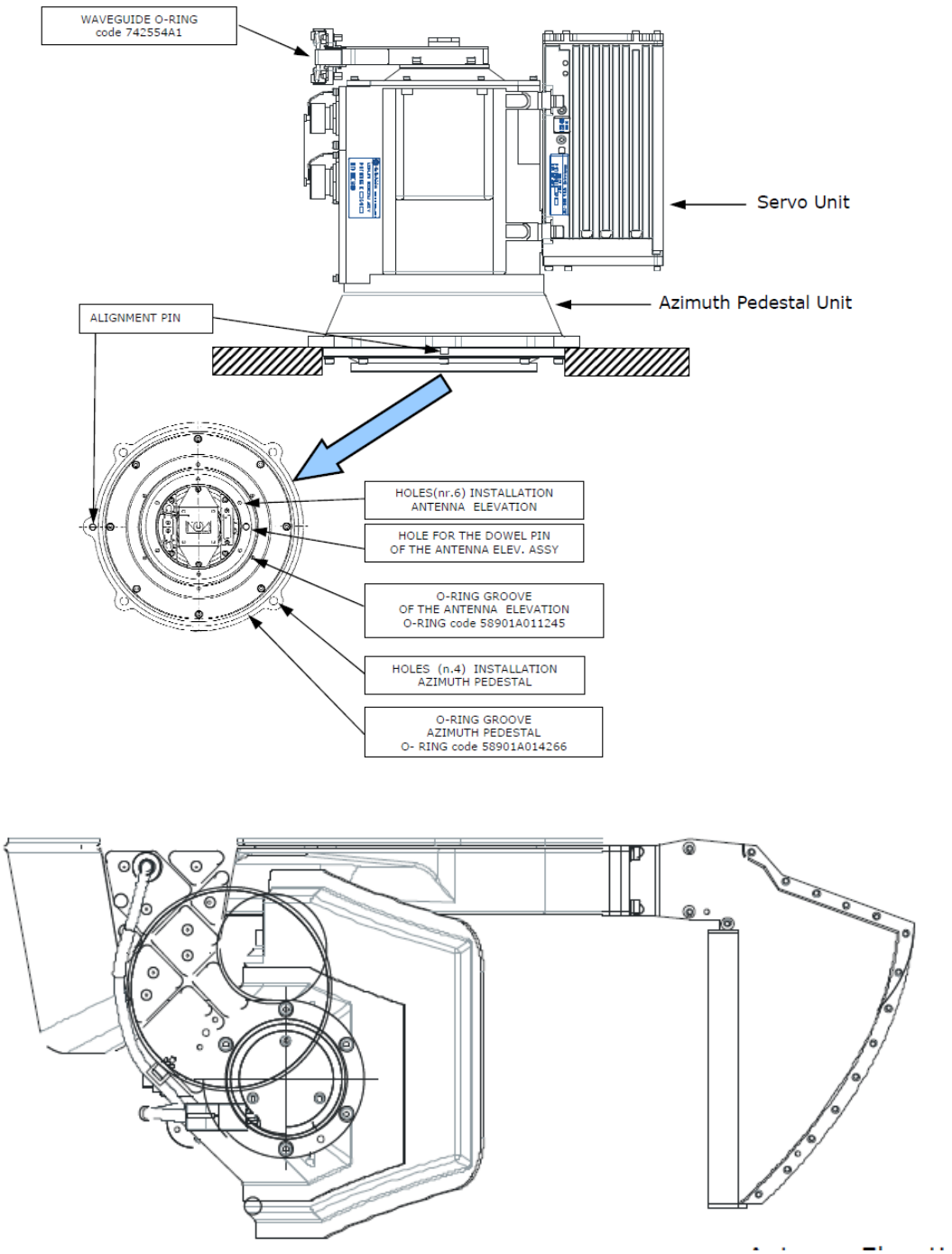


Figure 9 Mechanical stop free

- Insert and fix the round lid of the Antenna El. Assy with the 6 screws supplied with the Antenna Group



Antenna Elevation Assy

Figure 10 Antenna Group parts

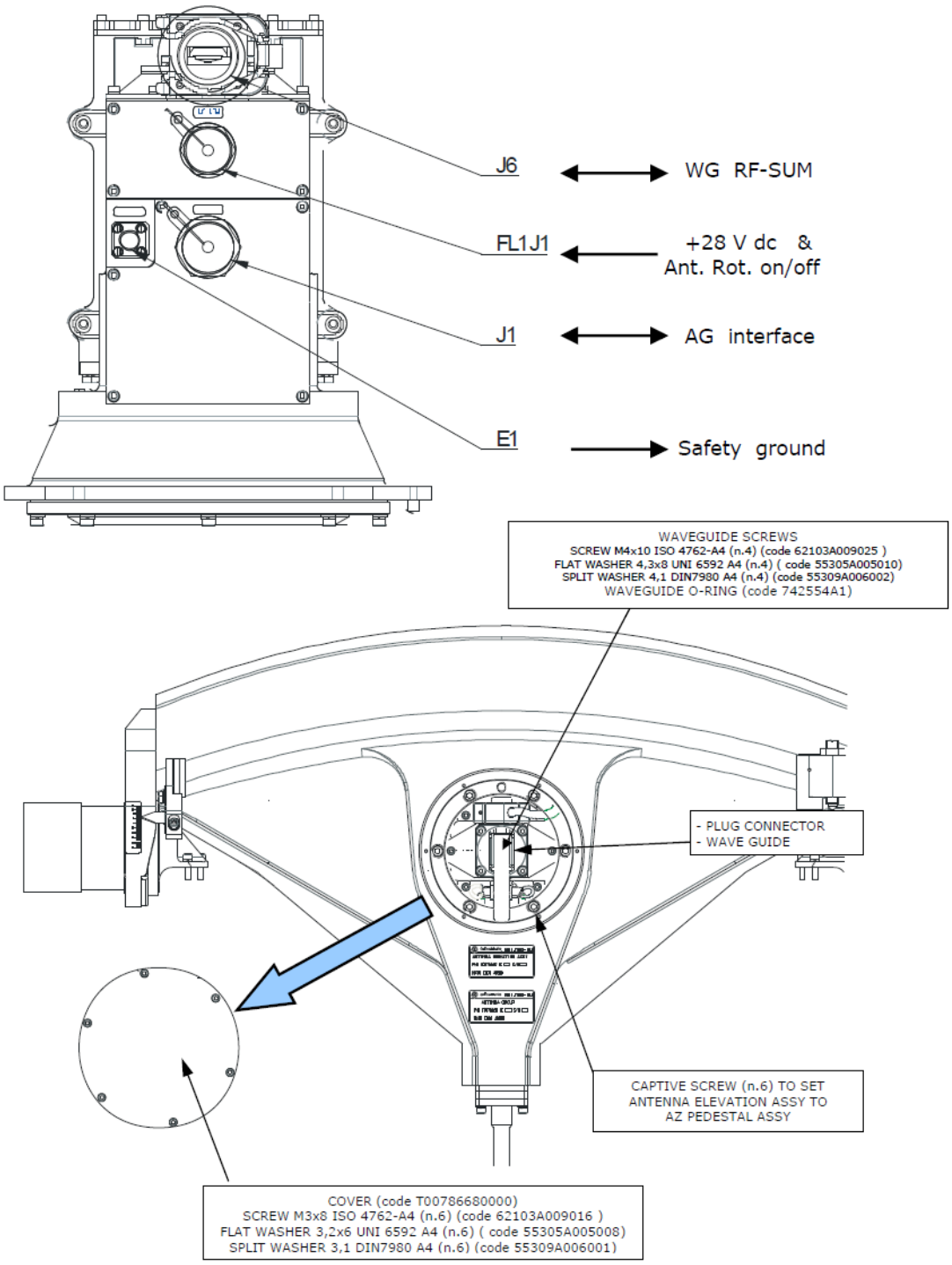


Figure 11 Antenna group Connections

5 General Information for Storage

CAUTION

THE INTERNAL COMPONENTS OF THE GABBIANO TS-20 BELLY LRU'S ARE ELECTRO-STATIC DISCHARGE (ESD) SENSITIVE DEVICES. DO NOT TOUCH THE PINS OF THE ELECTRICAL CONNECTOR. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THESE COMPONENTS. INSTALL PROTECTIVE CAPS ON ALL ELECTRICAL CONNECTORS IMMEDIATELY AFTER YOU DISCONNECT THEM TO PREVENT THE INGRESS OF DIRT. OBEY THE HANDLING RULES AND THE PRECAUTIONS FOR THE ESD DEVICES.

Packaging includes all the activities necessary to prepare the units for transportation or storage. The packaging procedures are mandatory to avoid any damage to the units during transport and storage. Each unit is packed separately in its own container.

The conditions listed in this document are relative to storage in a closed depot/warehouse and do not take into consideration water exposure, salt spray etc. The equipment must remain in the original shipment containers during storage.

The storage environmental conditions for the Gabbiano TS-20 Belly LRU are the following:

- Temperature: -45 °C / + 85°C.
- Humidity: 30% to 95%

5.1 Materials and Tools

Table 2 Consumable Materials

Material Number and Name	Source	Q.ty	Use
Polyethylene bag	Commercially Available	2	To pack the Mounting Tray
Adhesive tape	Commercially Available	As Necessary	To pack the Mounting Tray
Bubble wrap (Pluriball)	Commercially Available	As Necessary	To pack the Mounting Tray
Cardboard box	Commercially Available	1	To pack the Mounting Tray
Shock absorber or Ethafoam	Commercially Available	As Necessary	To pack the Mounting Tray
Self-adhesive identification label	Commercially Available	As Necessary	To pack the Mounting Tray

Note:
You can use equivalent alternatives for the items specified.

Table 3 Packaging Support equipment

Material Number and Name	Source	Q.ty	Use
REP CONTAINER (Figure 12)	Leonardo SPA	1	To pack the REP
TX FE CONTAINER (Figure 13)	Leonardo SPA	1	To pack the TX-FE
AG CONTAINER (Figure 14)	Leonardo SPA	1	To pack the AG

5.2 Storage Instructions

5.2.1 Storage Instructions for the Gabbiano TS-20 Belly Equipment

Note: This instruction is applicable to the REP, the TX-FE and to AG.

Note: The equipment shall always be secured and transported in its Container.

1 Put the protective caps on the connectors of the LRU.

2 Open the container.

3 Place the equipment into its container.

4 Ensure that all applicable documentation (If applicable) is completed and is included into the container.

5 Close the container and its latch.

6 The container must at all times be handled by two persons, one on each side of the container.

5.2.2 Storage Instructions for Mounting Tray

1 Put the Mounting Tray inside a suitable Polyethylene bag.

2 Remove the air in excess by means of a manual little pressure.

3 Close the Polyethylene bag with the adhesive tape or thermo-solder the polyethylene bag. The bag must be able to permit any inspection and further thermo-solders.

4 Wrap the unit with the Polyethylene bag in protective "bubble wrap" (Pluriball), hold together with adhesive tape.

5 Put the unit in a suitable cardboard box.

6 Add approved shock absorber separator made of sponge rubber or Ethafoam foam to reduce the movements and the impacts of the item inside the cardboard box.

7 Seal the container with adhesive tape.

8 Put the identification label and the information about the shipment into the adhesive polyvinyl bag.

5.2.3 Transportation

Each equipment must remain within its package during transport.

5.2.4 Unpacking Procedure

Note:
This instruction is applicable to the REP, the TX-FE and to AG.

The unpacking procedures consist of the following operations:

1 Ensure that the container is sealed on arrival.

2 Place the container on a firm flat surface, ensuring that the lid is on top.

3 Open the lid loosening the four or six latches that hold it in container.

4 Ensure that the item is properly secured and supported by the foam insert in the container.

5 Check that there is no visual evidence of physical damage of the LRU.

6 Ensure that the documentation, relevant to the LRU, is present in the container.

7 Lift the LRU out of the Container. Place it on flat surface.

8 Remove any documentation from the container.

9 Keep the container for re-use.

Figure 12 REP Container

Figure 13 TX-FE Container

Figure 14 AG Container

5.2.5 Standard ESD Handling Procedures

The component of the Gabbiano TS-20 Belly contains static devices. Be careful when you work on electrostatic discharge sensitive devices:

1 Use an approved wrist strap that is connected to a ground point only when no electrical power is supplied to the system.

2 Do not touch the electric pins.

3 Use an antistatic transport tray to move the equipment.

4 Do not open the equipment.

5 Electrostatic discharge can cause damage to equipment or injury personnel.

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Chapter 3

Illustrated Parts List

Table of Contents

page

1 Introduction 2
1.1 General Information 2
1.2 Organization and Use 2
1.3 General System of Assembly Order 3
1.4 Manufacturer column 3
2 Detailed Parts List 3

List of Figures

Figure 1 Gabbiano TS-20 Belly 4

1 Introduction

1.1 General Information

The Illustrated Parts List is intended to assist customer personnel in requisitioning, storing and issuing the replaceable components and in identifying new and reclaimed parts. It is not approved for any other purpose.

The illustrated parts list does not list or illustrate parts which loose their identity by being permanently welded or riveted to other pieces.

1.2 Organization and Use

The figure number on the parts list refers to the corresponding illustration.

The number in the FIG. ITEM column corresponds to the item number pointing to the part on the corresponding illustration.

A hyphen in front of the item number indicates that the item is not shown on the illustration.

Quantities specified in the UNITS PER ASSY column are the total number of each part required per assembly or subassembly and are not necessarily the total used per complete end item assembly.

REF in the UNITS PER ASSY column indicates that the item is listed for reference purposes.

AR in the UNITS PER ASSY column indicates that the part is used as required.

1.3 General System of Assembly Order

The indention system used in this illustrated parts list shows the relationship of one part to another. Each unit listed is followed immediately by a listing of its component parts. For a given item the indention code shows a system, installation or general heading starting in the extreme left position continuing on down into succeeding columns until the end detail is reached, as follows:

1 1234567
Installation Assembly (REF) Number
Detail Parts for Installation
Assembly

2 Attaching Parts for Assembly
***

3 .Detail Parts for Assembly
.Subassembly
Attaching Parts for Subassembly
***

4 ..Detail Parts for Subassembly
..Sub-subassembly
Attaching Parts for Sub-subassembly
***

5 ...Detail Parts for Sub-subassembly

Parts are listed in general order of disassembly, with the exception of attaching parts. ATTACHING PARTS are captioned as such and follow immediately after the part they attach and are separated from other detail parts by the symbol ***.

1.4 Manufacturer column

In this column the following manufacturer is listed:

- Leonardo SPA S.p.a. - Nerviano
Viale Europa
20014 Nerviano (MI) - Italy

2 Detailed Parts List

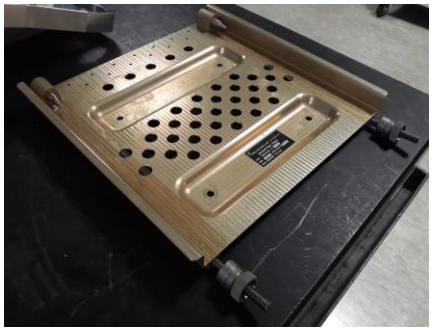
Figure Item	Nomenclature 1 2 3 4 5	Units per Assy	Manufacturer
	Gabbiano TS-20 Belly	REF	Leonardo SPA
1	. Antenna group	1	Leonardo SPA
2	. Receiver exciter processor	1	Leonardo SPA
3	. REP Mounting Tray	1	Leonardo SPA
4	. Transmitter Front End	1	Leonardo SPA
5	. TX- FE Mounting Tray	1	Leonardo SPA

1 Antenna Group

2 Receiver Exciter Processor

3 REP Mountig Tray

4 Transmitter Front End



5 TX-FE Mounting Tray

Figure 1 Gabbiano TS-20 Belly