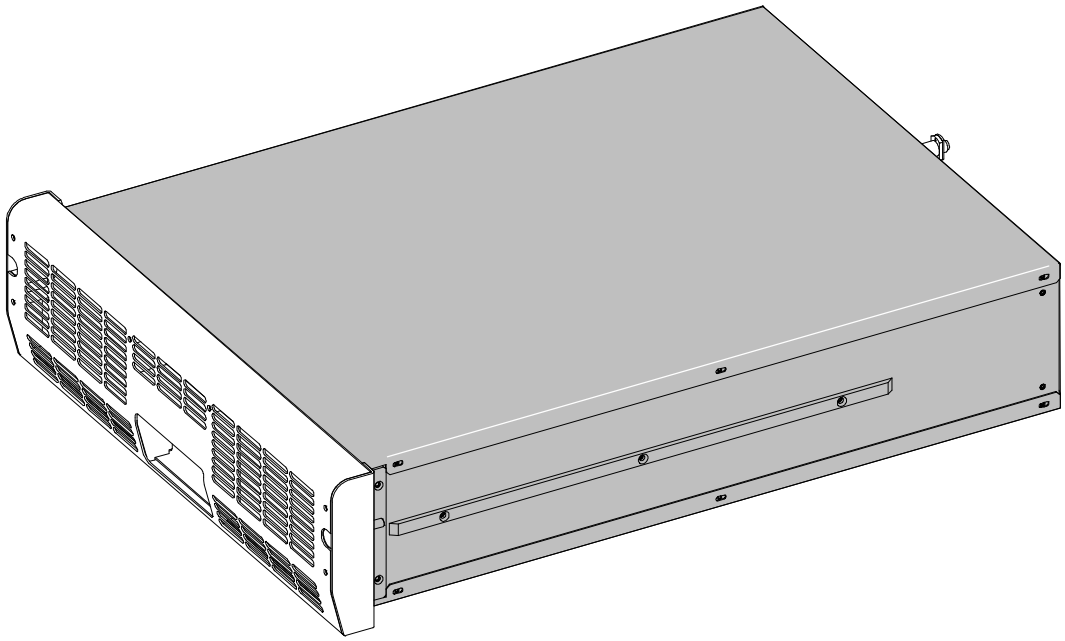
Broadcast Electronics



W3−215A VHF AMPLIFIER

Technical Manual

Document History		
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W3−215A VHF AMPLIFIER

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■

FOREWORD (how to consult the manual)

1. MANUAL ORGANIZATION

The manual is composed of the following sections:

- "*Technical Manual*" . . . dealing with units and sub−units which make up the equipment along with the associated circuit diagrams.
- *"Circuit diagrams*" . . . . including wiring diagram of the equipment and other circuit diagrams associated to units, sub−units or boards without "*Technical Manual*".

2. CIRCUIT DIAGRAMS (*how to consult them*)

2.1. Acronyms

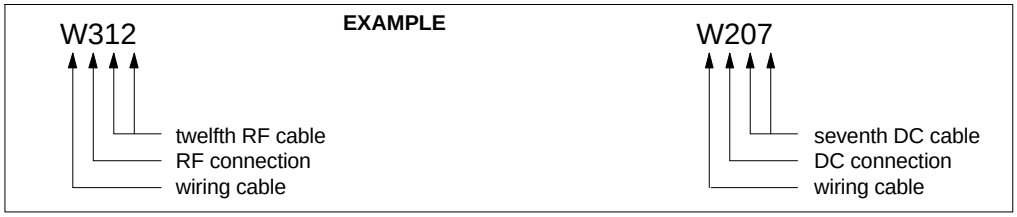
Circuit diagrams are identified by acronyms after the drawing number (i.e.: 6300621005**ID**). A list of the acronyms used is given here below:

acronym	***explanation***	***acronym***	***explanation***
SI	general wiring diagram (*for 9 digits codes)*	ST	component layout (*for 9 digits codes*)
ID	general wiring diagram (*for 10 digits codes)*	CL	component layout (*for 10 digits codes*)
SE	circuit diagram (*for 9 digits codes)*	SD	general wiring diagram for interlock chain
ED	circuit diagram (*for 10 digits codes)*		

2.2. Classification of wiring cables

Wiring cables (unipolar, multipolar, flat cables) are identified by an alphanumeric code on circuit diagrams; this code is composed of 4 digits as follows:

- 1st digit is '**W**' (for wiring)
- 2nd digit identifies the type of wiring (e.g.: AC connections, DC connections, RF connections etc.) as follows:
  - **1**... for **AC** connections;
  - **2**... for **DC** connections;
  - **3**... for **RF** connections;
  - **4**... for **LF** connections;
  - **5**... for logic signals, alarms connections.
- 3rd and 4th digits indicate the progressive numbering for each type of wiring.

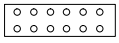


2.3. Connection of wiring cables

The wiring cables between two connectors, are always intended pin−to−pin unless otherwise specified. In the event the wiring is not pin−to−pin, it is shown on the drawing.

2.4. Symbols and identifications of connectors/terminal blocks

Connectors and terminal boards arranged inside an equipment, a unit or a board, are identified on the associated circuit diagram, by symbols as follows:

symbol	***objetc***
	male connector identified by "Jx"
	female connector identified by "Jx"
	terminal block identified by "Kx"
	coaxial cable identified by "Wx"

Both for connectors and terminal blocks, the numbering is progressive within each equipment, unit, or board; that is on a general wiring diagram two or more "J6" (or "K3") may exist because they are arranged inside different equipment, unit or board.

Male and female connectors are identified respectively by "J" and "P" in some circuit diagrams before the year 2000.

However a connector (or terminal block) will always have the same identification number both on the general wiring diagram of the unit and on the general wiring diagram of the equipment where the unit is arranged.

FOREWORD (how to consult the manual)

3. SAFETY INFORMATION

3.1 Introduction

The equipment fully complies with the requirements for the safety of personnel as specified in IEC 215 rules. The equipment, if operated per specification, is designed and manufactured to protect the operator from high voltage, heat, radiation and other dangers.

Warning labels are attached to enclosures and/or various assemblies to identify potentially dangerous conditions to the operator. These Warning labels must be adhered to.

3.2 Warning, Cautions and Notes

Throughout the manual *Warning* and *Cautions* notices are used to identify procedures, conditions and materials that could be potentially cause death, injury or damage to equipment.

WARNING!

Used to indicate a potential hazard that requires correct procedures or practises in order to prevent personal injury or damage to equipment.

CAUTION!

Used to indicate correct operation or maintenance in order to prevent damage to, or destruction of equipment or other property.

NOTE!

Used to highlight important information or procedures.

TIP

Tips on how alert the operator faster or easier to complete a task

FOREWORD (how to consult the manual)

3.3 Hazard symbols

Throughout the manual *hazard symbols* are used to alert the operator of a potential hazard related to the operation to be carried out.

Warning

Shock hazard

Danger of getting crushed when working with loads.

Danger of falling off ladders while working

Danger when lifting heavy loads.

Danger of getting hands crushed when working.

Danger of burns on contact with hot surfaces.

3.4 Beryllia devices

Some units or parts of the equipment may contain beryllia devices. Normally these components can be handled without risk, but there is a toxic hazard if beryllia dust from a damaged component is inhaled or implanted in the skin.

Units or parts containing beryllia oxide are identified by the label shown on the left.

For handling and disposal of beryllia devices, refer to "*Safety Precautions*" section, para 3. − "*SPECIFICATION ON HANDLING AND DISPOSAL OF BERYLLIA DEVICES*".

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1. *GENERAL INFORMATION*

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LIST OF ILLUSTRATIONS

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1.: GENERAL INFORMATION

1.1 INTRODUCTION

This manual provides system−oriented information, procedures and data for operation and installation of the following unit:

- W3−215A *VHF Amplifier* . . . . . p/n. 5030321500

From here on for the sake of simplicity, throughout this manual W3−215A *VHF Amplifier* will be referred to as W3−215A.

The contents of the present manual are arranged in chapters according to the following:

− 1. : General Information
− 2. : Operating Instructions
− 3. : Maintenance

1.2 GENERAL INFORMATION

1.2.1 W3−215A General description

W3−215A RF Amplifier (see general layouts on Fig. 1.1) is a hot−pluggable unit, manufactured using high reliability, solid state components. It is a wideband amplifier which is able to work in the frequency range from 170 to 250 Mhz (VHF/B III).

Due to the intrinsic high linearity offered by this RF module, it allows the application in Dual Cast emission , that means in Analog TV or digital as well DVB−T and ATSC standards.

Its nominal output power is as follows:

- 500W$_{\mathbf{avg}}$ for DVB−T/T2 signal;
- 800W$_{\mathbf{avg}}$ for ATSC signal;
- 1500W p.s. (analog signal, combined ampl.)

The cooling system is built−in air forced, performed by four DC fans: three for RF stages cooling and the fourth for the cooling of the power supply section. The unit is arranged in a 19”−3HE mechanical frame.

The RF section of W3−215A amplifier is made up by a *Pre−Driver* stage, a *Driver* stage, and 2 final stages working in AB class.

W3−215A module is self−protected from overdrive of the RF input power, from incidental reflected power, from overvoltage of the amplifier power supply voltages and from driver and final stage abnormal absorption. The protections are performed through the module control section, which consists of a *CMI Board* (***C****ontrol* ***M****odule* ***I****nterface*) and a *Module Status Interface* boards.

Refer to fig. Fig. 1.2 and fig. Fig. 1.7 for simplified block diagrams of the W3−215A RF Amplifier.

The W3−215A RF Amplifier is composed of a Full LDMOS Amplifer section, a power supply section and a control section.

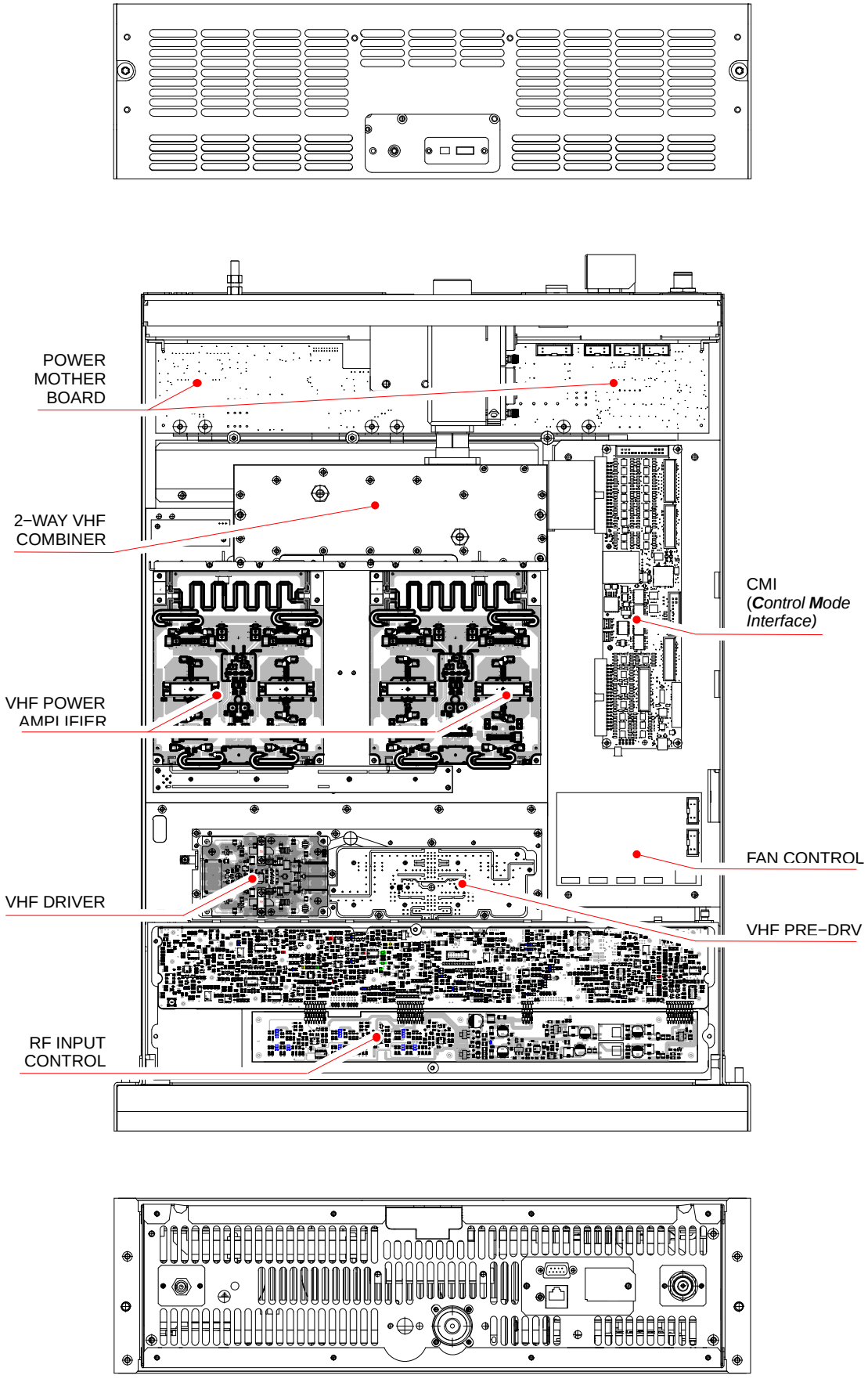

Fig. 1.1 (1/2) − W3−215A Front/rear and top view

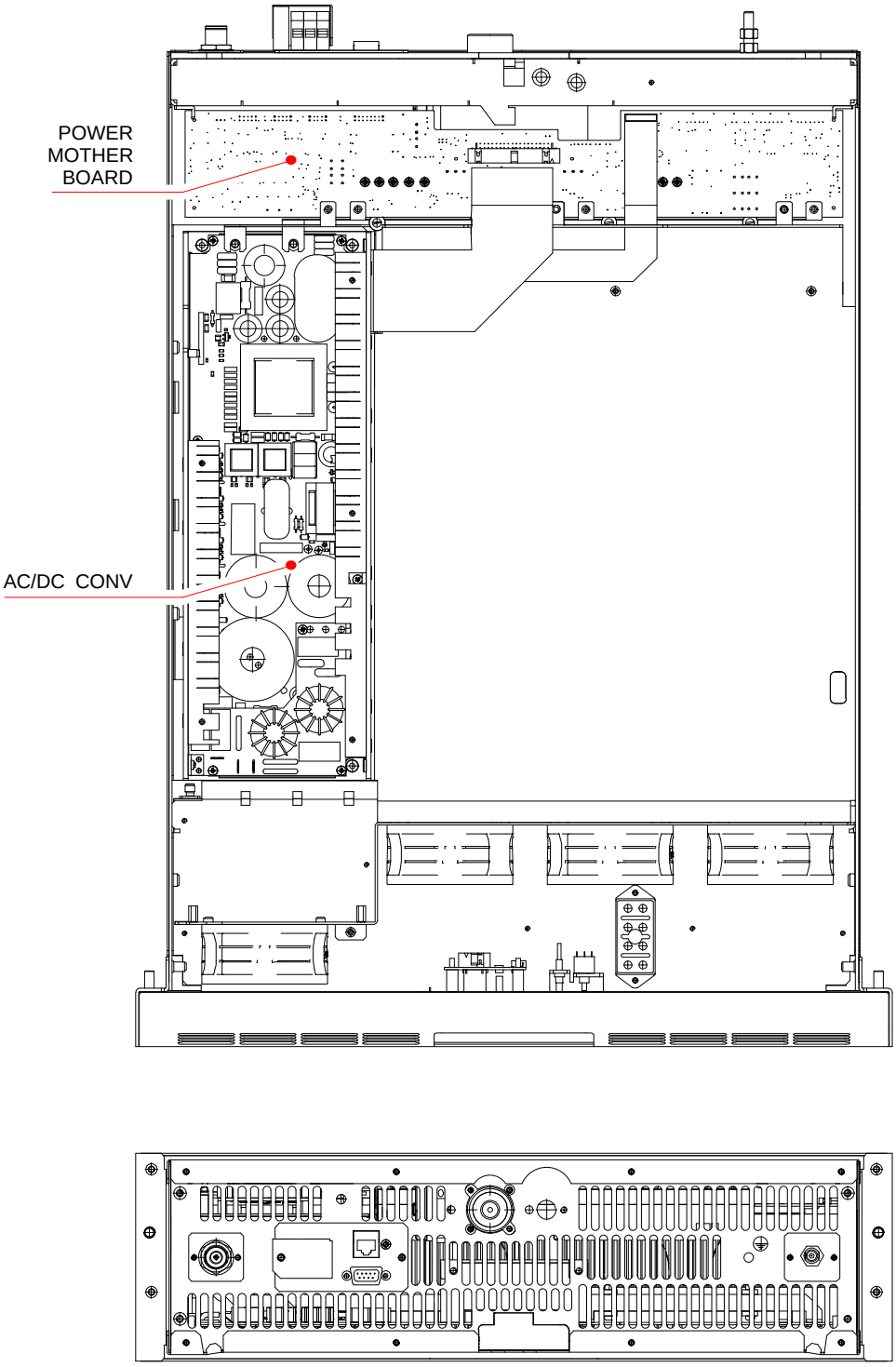

Fig. 1.1 (2/2) − W3−215A Rear and bottom view

1.3 TECHNICAL SPECIFICATIONS

RF CHARACTERISTICS	
Frequency range	170 to 250Mhz (VHF/BI)
Output Power	● 500W$_{avg}$ for DVB−T/T2 signal ● 800W$_{avg}$ for ATSC signal ● 1500W p.s. (analog signal, combined ampl.)
Power Gain	40 ± 1dB
Working class (*final stages*)	Doherty
Input/output Impedance	50Ω
Input Return Loss	≤−18dB
IMD (*DVB−T signal at f_c ±4.2MHz*) IMD (*DTV signal at f_c ±3.3MHz*) IMD (*analog signal*)	≤ −36dBc (with precorrection) ≤ −37dBc (with precorrection) ≤ −60dBc (with precorrection)
Power Consumption	● 2700W for DVB−T signal ● 3170W for ATSC signal ● 3740W (analog signal, comb ampl)
Cooling	Forced air
I/O CONNECTORS	
RF Input (*on rear panel*):	N, female
RF ouput (*on rear panel*)	$^{7}/_{16}$”
Power Supply Input (*on rear panel*)	3 pin, terminal block
I/O Signal *(on rear panel)*	25 pin ”D” female
RF Monitor	”BNC” female *(on rear panel)*
MECHANICAL	
Frame	19”−3HE
Dimensions (wxhxd) (mm):	483x178x586+50
Weight (kg):	28
ENVIRONMENTAL	
Operating Temperature	0°C to +45°C
Relative humidity	95%

1.4 FUNCTIONAL DESCRIPTION

1.4.1 Description of *RF Amplifier section*

The RF Amplifier section (simplified block diagram in Fig. 1.2) mainly consists of the RF Input/Control board, arranged at the input of the whole amplifier chain, and of the RF Amplifier Stages (PreDriver, Driver and Final section) which consists of RF amplifiers combined in order to get the necessary output power.

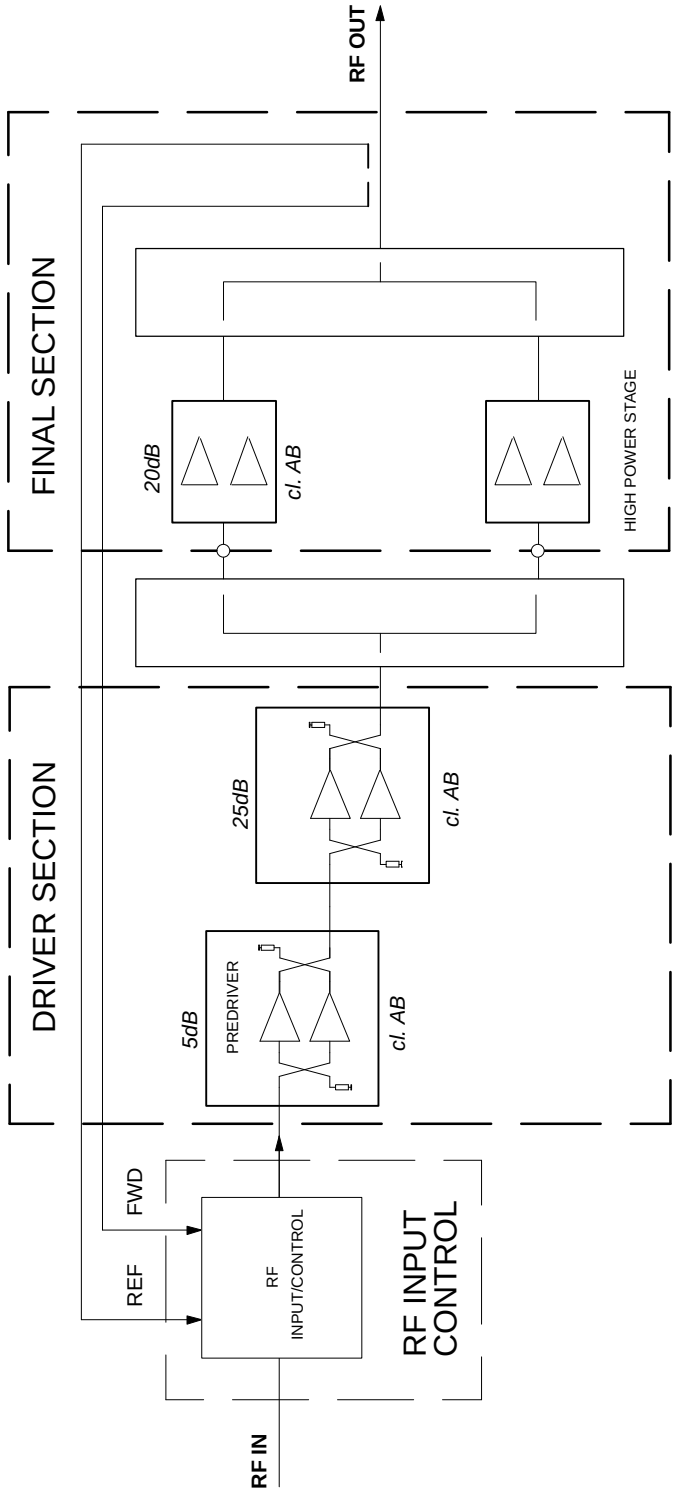

Fig. 1.2 − W3−215A RF Amplifier section/ Block Diagram

1.4.1.1 RF Input Control *(ref. dwg. no. 4040010516ED)*

The RF input signal eneters a Π attenuator and is divided by three an integrated divider:

- the first signal passes through a variable attenuator (controlled by the voltage sent from a “Temperature Compensation Circuit”), a phase shifter (controlled by *CCU*), another attenuator and, after beeing equalized, is amplified and sent to the *predriver* stage. An RF switch, at the equalizer circuit output, routes the RF signal to a dummy load if at least one of the following condition is true:
  - high reflected pwr alarm
  - overdrive alarm
  - cables of output directional couplers disconnected

  Under these conditions the variable attenuator is set at the maximum value of its attenuation.
- the second signal, attenuated and detected (*medium value* or *peak*) according to the type of the signal *digital* (DTV) or *analog* (ATV), is amplified and sent to *CCU* for displayng the relevant measurement.
- the third signal, attenuated and detected is compared with an *overdrive* thershold (factory set) from *CCU*. The signal is used to generate the relevant alarm displayed on *CCU* and which is also sent to OR logic port sending the *inhibit* signal to the RF switch.

A directional coupler at the output of HPA, picks up two RF signals proportional to *forward* (*FWD*) and *reflected* (*RFL*) power and sends them to *RF Input Control* board:

- *FWD PWR* signal (attenuated by a Π attenuator) is split in two by an integrated splitter: the first signal (again attenuated) is made available inside HPA for monitoring, the other one is attenuated and detected (*medium value* or *peak*) according to the type of the signal *digital* (DTV) or *analog* (ATV). This latter signal is sent to *CCU* for displayng the relevant measurement.
- *RFL PWR* signal (attenuated by a Π attenuator) is split in two by an integrated splitter:
  - the first signal (again attenuated) is detected (*medium value* or *peak*) according to the type of the signal *digital* (DTV) or *analog* (ATV). The signal is sent to *CCU* for displayng the relevant measurement.
  - the second signal is detected and compared with an *rfl pwr threshold* (factory set) from *CCU*. The alram signal generated is sent to *CCU* and to OR logic port sending the *inhibit* signal to the RF switch.

Temperature Compensation Circuit gets the following signals:

- *Pwr In Adj* from *CCU* is the signal driving the variable Π attenuator for putput power regulation;
- *ON/OFF (Temperature Drift Gain Corrector);* a jumper (on “Mother Board”) factory set *closed*, enables the signal from hot water temeprature detector arranged on cold plate;
- *HOT AIR TEMP. DTECTOR* outgoing from hot air temeprature detector arranged on final stages heat sink; it is a signal compesating for the thermal drift of the RF devices.

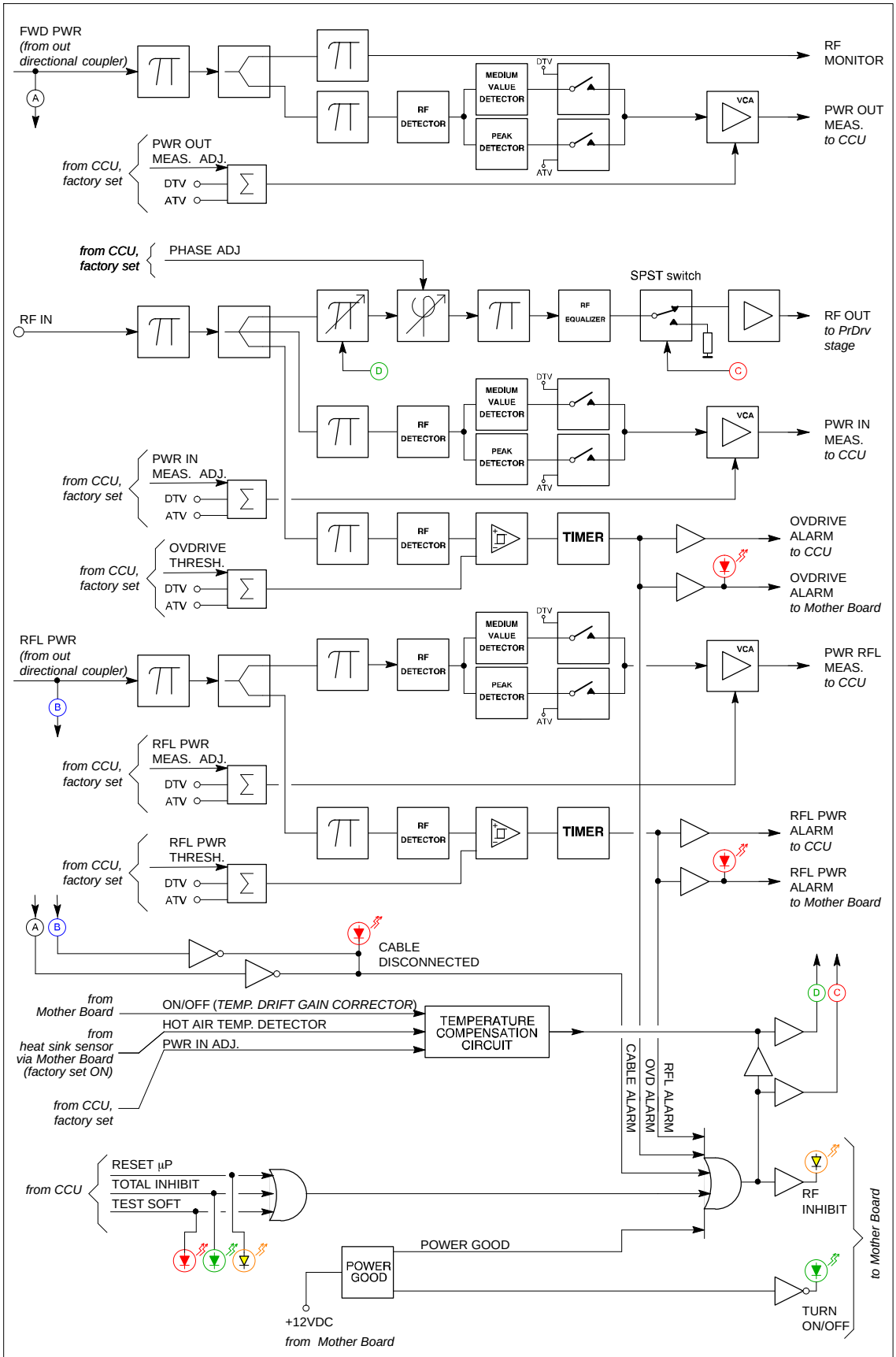

Fig. 1.3 − RF Input Control/Block diagram

1.4.1.2 RF Driver section

The RF output signal from RF Input/Control is applied to RF Driver Section (Fig. 1.4) composed of:

PREDRIVER STAGEs composed of two monolithic amplifiers working in class AB. The power supply voltage is +50V_{DC}. The gain of the stage is 5dB.

DRIVER STAGEs composed by two power LDMOS working in AB class. The power supply voltage is 50V_{DC}. The gain of the stage is 25dB.

2−way SPLITTERs splits into three signals the driver stage output and sent them to the final stages. The splitting function is achieved with 2 integrated multistep hybrid splitters.

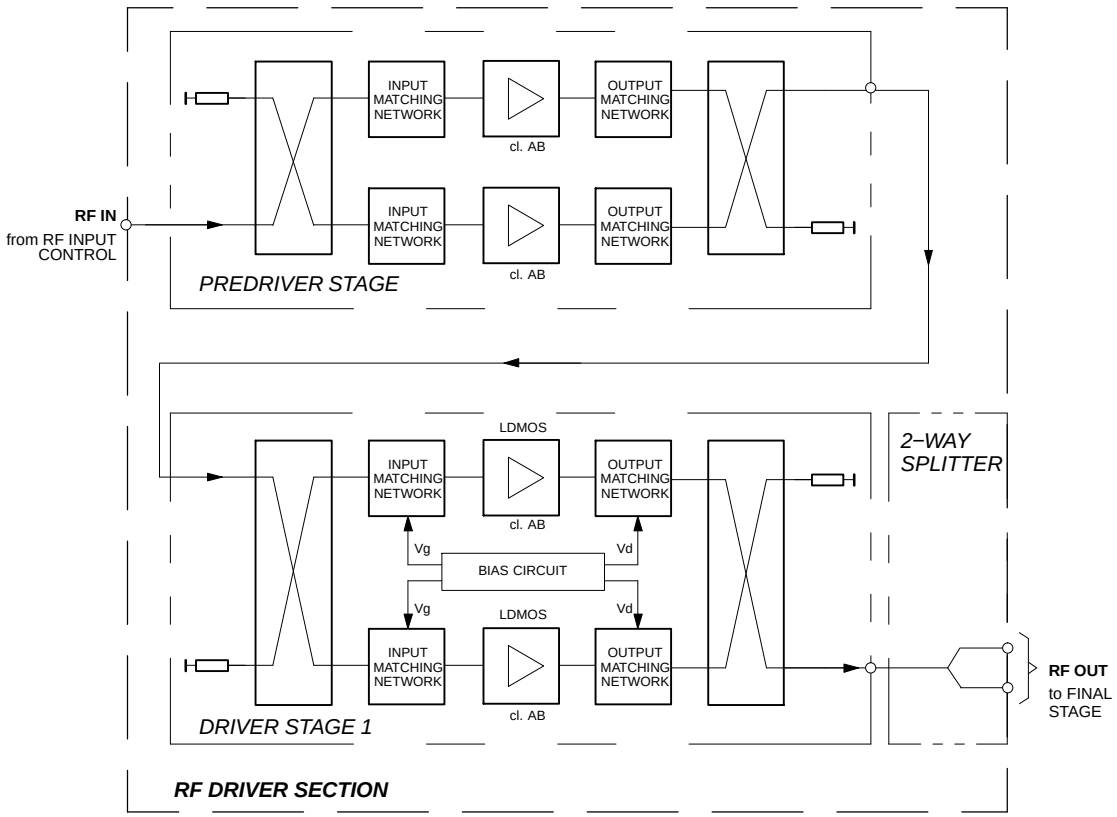

Fig. 1.4 − RF Driver section/ Block Diagram

1.4.1.3 RF Final Section

The RF output signals from the *RF Driver section* are applied to *RF Final section* (Fig. 1.5) composed of:

− Final Power Amplifiers (q.ty 2)
− 2−way Combiner

FINAL POWER AMPLIFIERS *(VHF RF Amplifier p/n. 4040059012)*
The final stage is made up of two amplifier stages, each of them is referred as ”Fnl 1 to Fnl2” on *Control Unit* display; they are made to work in class AB. The power supply voltage is $50V_{DC,}$ suitable biasing circuits deliver the gate and drain voltages. The current absorption, detected by an integrated shunt resistor mounted on *PCB*, is monitored by *Control Module Interface* via *Module Interface* board.

The gain of the stage is 20dB.

2−WAY COMBINER
A 2−way Combiner ass’y carries out the sum of the Final stage output signals. The combiner is made up by multistep hybrid couplers.

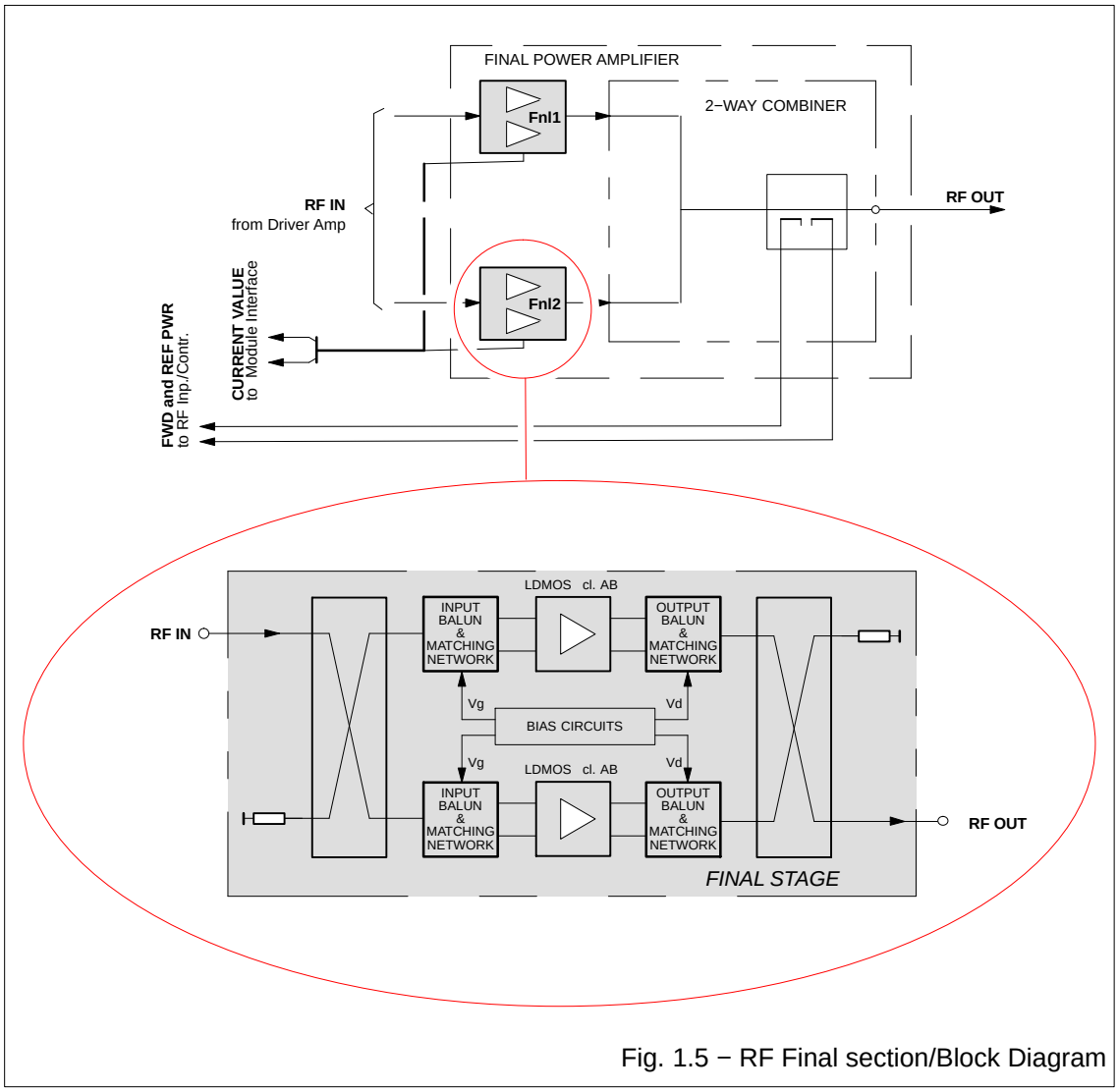

Fig. 1.5 − RF Final section/Block Diagram

1.4.2 Control section

The *Control Section* (block diagram in Fig. 1.6) receives and manages all information provided by *RF Section* and by *Power Supply Section* (AC/DC Converters). It is made up by a *CMI Board* (***C****ontrol* ***M****odule* ***I****nterface*), *Stand−alone Interface* and a *Module Status Interface* supporting the LED indicator, available to the operator on unit front panel.

Concerning the RF stages the *Control Section* detects the operating conditions (temperature and output power) and, if an anomalous condition is detected, through an RF switch (not shown on this block diagram; see block diagram of Fig. 1.3) inhibit the driving signal terminating it on dummy load. This *software protection* is carried out along with a *hardware protection* which cut−off the RF input signal when an *ovedrive* condition occurs.

The information got from *RF Section* are acquired by *CMI Board* and, through *Power Mother Board* and *Stand−alone Interface* board, are sent to the transmitter *control unit*. The information is exchanged via CAN−bus.

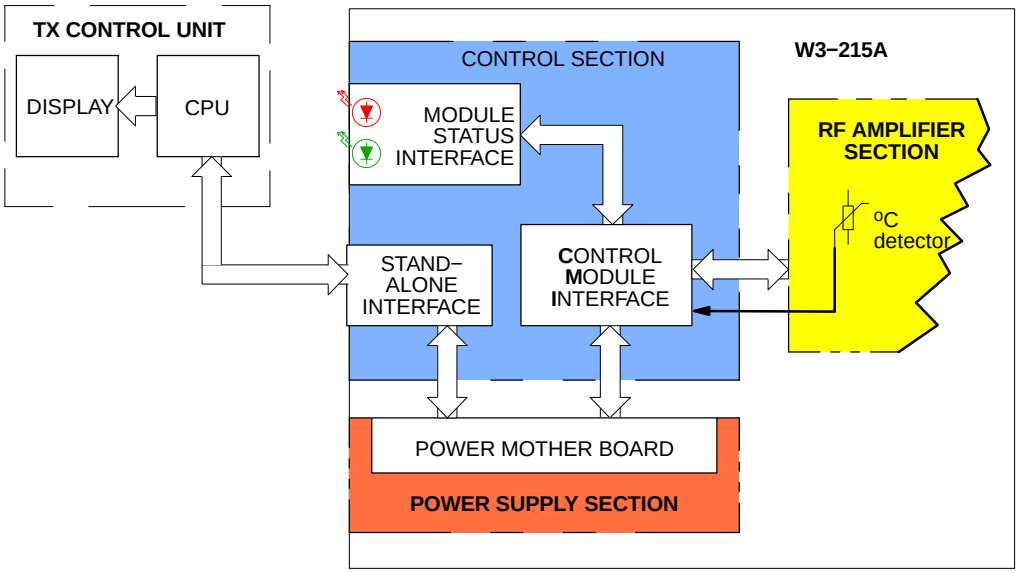

Fig. 1.6 − Control section / Block Diagram

1.4.3 Power Supply section

The power supply section (block diagram in Fig. 1.7) is made up an *AC/DC Converter* and a *DC/DC Converter* arranged on '*Power Mother Board*'. The power supply voltages are delivered through '*Power Mother Board*' as follows:

- *AC/DC Converter* (SC6) outputs $50V_{DC}$ and $12V_{DC}$ voltages, used as follows:
  - $50V_{DC}$ is delivered to the driver stage, the final stages and *DC/DC Converter*.
  - $12V_{DC}$ is delivered to *Control Module Interface* of the logic section.
- *DC/DC Converter* delivers $12V_{DC}$ to pre−driver stage and to *RF Input Control* board.

The *AC/DC Converter* delivers a stabilized voltage and is protected against overvoltage and overcurrent.

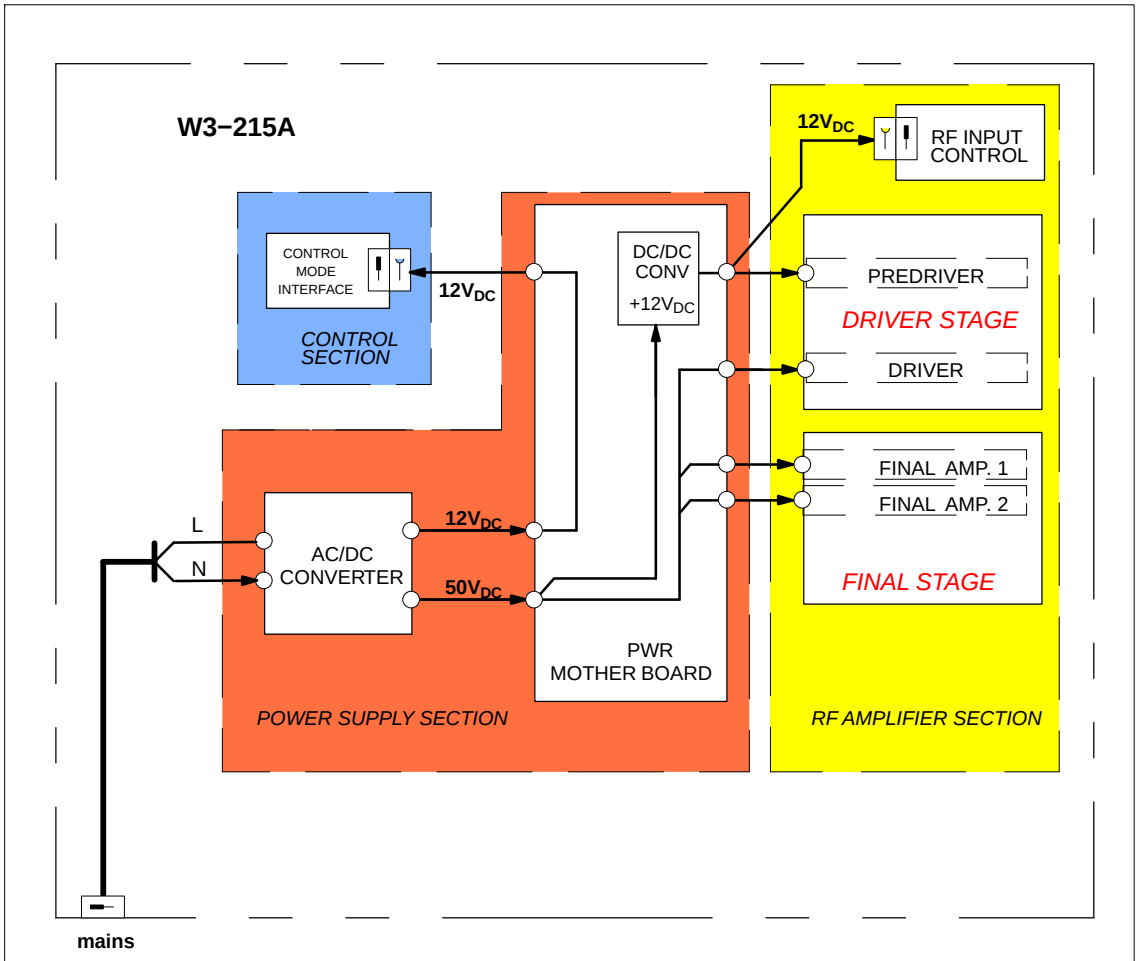

Fig. 1.7 − Module Power Supply section/ Block Diagram

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2. OPERATING INSTRUCTIONS

LIST OF TABLES

LIST OF ILLUSTRATIONS

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2.: OPERATING INSTRUCTIONS

2.1 INTRODUCTION

This chapter describes the operative functions, controls and correct ways in which to use the exciter. The contents of the present chapter are arranged in paragraphs according to the following:

- **2.2** : LEGEND
- **2.3** : CONNECTION TO THE MAINS
- **2.4** : I/O SIGNAL CONNECTOR
- **2.5** : SOFTWARE UPDATING

2.2 CALL OUT OF FRONT AND REAR PANELS

Fig. 2.1 shows the front and rear panel of W3−215A, Tab. 2.1 refers to this figure, each number of the table marks an indicator, a fuse or a connector located on the front panels of the unit.

From now on, every reference to indicators, fuses or connectors is carried out by indicating (between parentheses) the corresponding identification number with which is marked on Fig. 2.1. A simple description of the function carried out is given for each number.

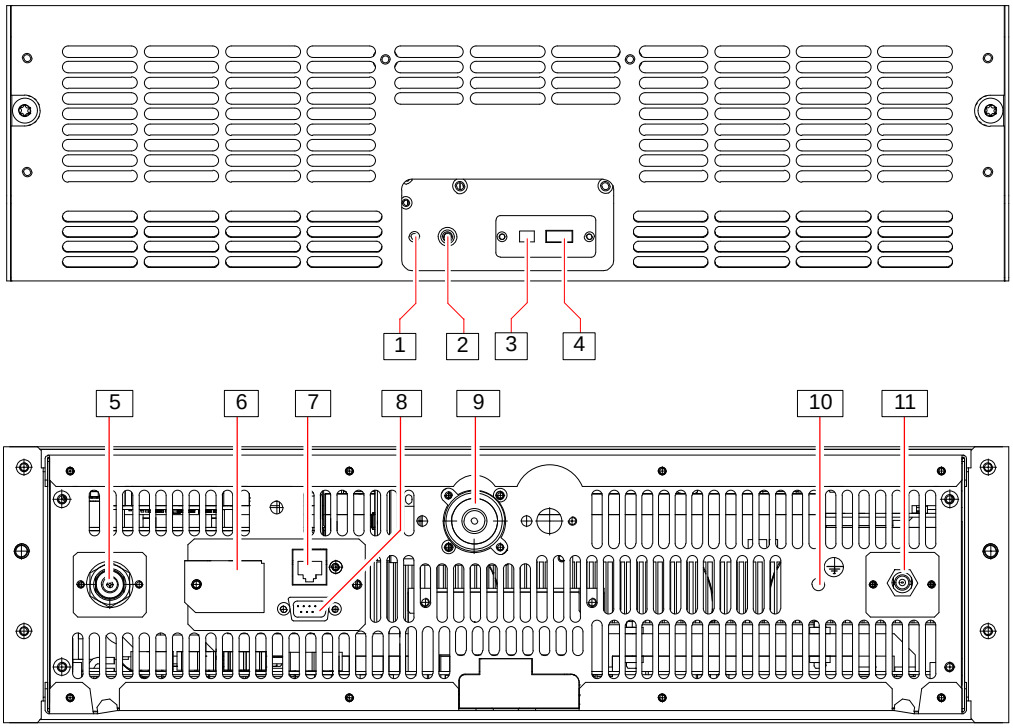


Fig. 2.1 − *W3−215A p/n. 5030321502* front and rear panels

Tab. 2.1 − *W3−215A p/n. 506062180 1/3* front and rear panels call out (ref. Fig. 2.1)

No.	LABEL	FUNCTION
1		Push−button for resetting the logic section of the unit.
2		*NOT USED*.
3		Indicator led (multicolor); depending on the unit status it is lit: *SOLID GREEN* when the unit is AC supplied, but it does not deliver RF output power; *SOLID BLUE* when the unit is AC supplied and it delivers RF output power (normal operating conditions). *BLINKING BLUE* warm up at the switching−on (approx. 12 sec); within this time interval all alarms are inhibited; *BLINKING BLUE/RED* when an alarm with *Warning level* has occurred (transmitter goes on). *SOLID RED* when an alarm with *Critical level* has occurred (transmitter stops).
4		USB connector; PC connection for monitoring the amplifier status. A dedicated software is needed.
5	RF IN	Connector (N, female), RF signal input of W3−215A.
6	PH−N−PE	Line terminal blocks.
7	CAN1	Connector (RJ45); it is the *CAN bus* connector.
8	CONTROL	Remote I/O connector (Sub D, 9 pin female); parallel port of the unit, used for exchanging I/O signals with *Control Unit*. Pin−out assignment of the connector is listed on Tab. 2.2..
9	RF OUT	Connector ($^{7}/_{16}$" female); RF signal output of W3−215A.
10		Threaded hole for ground connection of the frame.
11		Connector (BNC, female) for monitoring RF output of the amplifier.

2.3 CONNECTION TO THE MAINS

The unit is connected to the mains by means of the line socket (see #8, of Fig. 2.1) arranged on rear panel. The mains must have the following characteristics: 230 Vac ± 10 %, 50/60 Hz.

2.4 I/O SIGNAL CONNECTOR

The pin−out assignment of I/O signals connector (9 pin, male), is listed on Tab. 2.2. The interfacing between W3−215A module and *Control Unit*, is performed through *Power Mother Board (p/n. 4050008918)*. The connector is available on the rear panel of the HPA (see #6, of Fig. 2.1).

Tab. 2.2 − Pin−out assignment of I/O connector

PIN	FUNCTION	PIN	FUNCTION
1	POWER SUPPLY ENABLE	6	EXTERNAL INTERLOCK
2	EXTERNAL ADDRESS 0	7	EXTERNAL ADDRESS 1
3	EXTERNAL ADDRESS 2	8	EXTERNAL ADDRESS 3
4	CAN BUS 2 *LOW*	9	GND
5	$+24V_{DC}$		

2.5 SOFTWARE UPGRADE

2.5.1 General Information and application

Itelco **"***CMI/PIB USB Field Utility − v.1.0*" software allows a complete firmware upgrade of the CMI board (p/n. 4030002210).

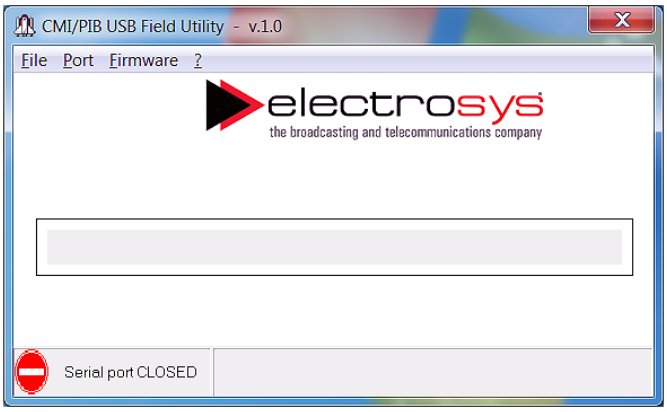
The firmware operation upgrade is controlled by a user friendly **g**raphical **u**ser **i**nterface (*GUI*) application running over Microsoft Windows operative systems 32 and 64 bit (up to Window 7).

At the end of the update operations, the board will restart automatically.

2.5.2 Connection of the unit to the PC

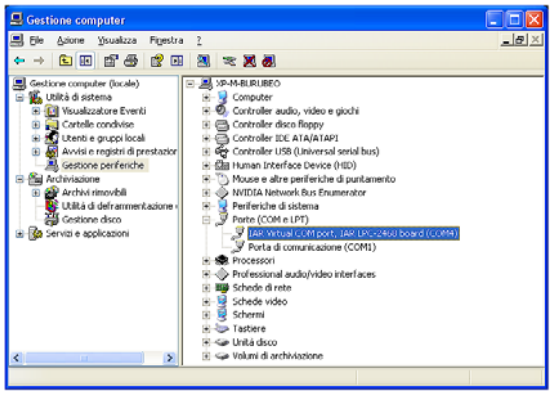
The USB port on front panel of the unit ([4] in Fig. 2.1) must be connected to any USB port of the PC where **"***CMI/PIB USB Field Utility − v.1.0*" software has been installed. Operate as follows to establish the PC connection to the unit.

Fig. 2.2 − Software start

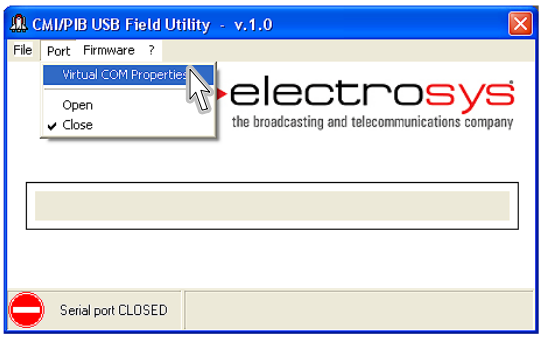


1. Double click on the software icon: the following dialog box opens.

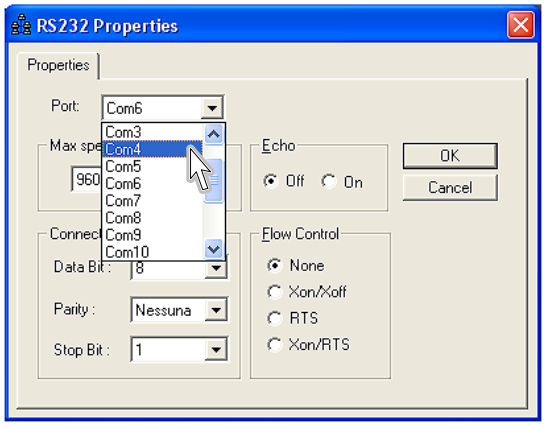
The lower left corner of the box shows the indication "Serial port CLOSED"



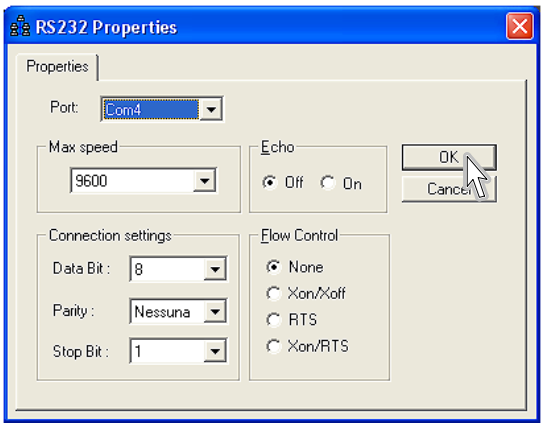
2. Open “Device Manager” to check which serial port is selected for the connection to the unit (in this example is port “COM4”).



3. On Port menu select “Virtual Port Property” to open the dialog box “RS232 Property”



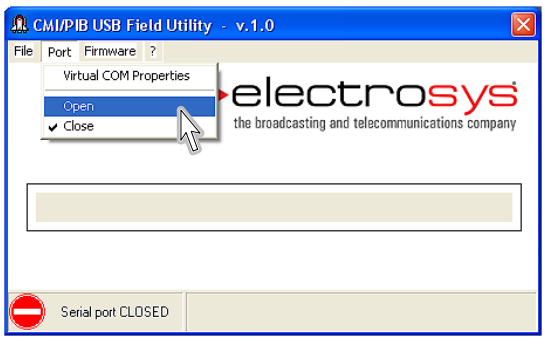
4. On “Port” field select “COM4” port.



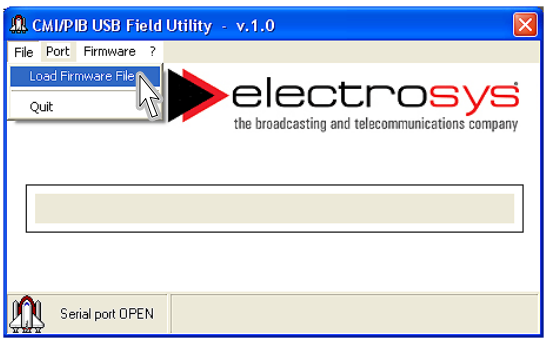
5. Now click “OK”.

2.5.3 Loading the new firmware

At this point the serial connection between the PC and the unit is fixed and you need to select the updated firmware file.

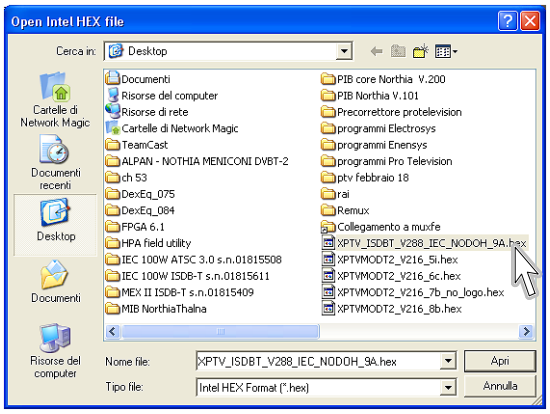


6. On “Port” field select “Open”

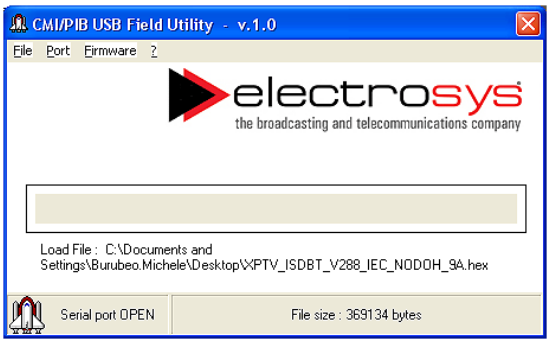


7. The lower left corner of the dialog box now shows “Serial Port OPEN”.

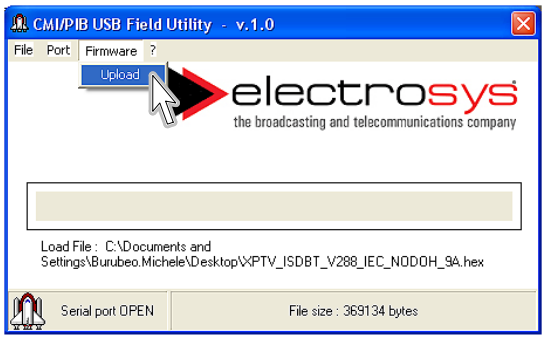
On “Port” field select “Load Firmware File”.



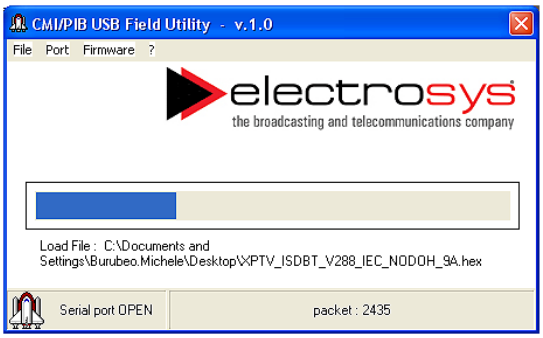
8. The dialog box opens. Now browse to the wanted file (in this example is "XPTV_ISDBT_V288_IEC_NODOH_9A.hex" on the desktop) an click "OPEN".



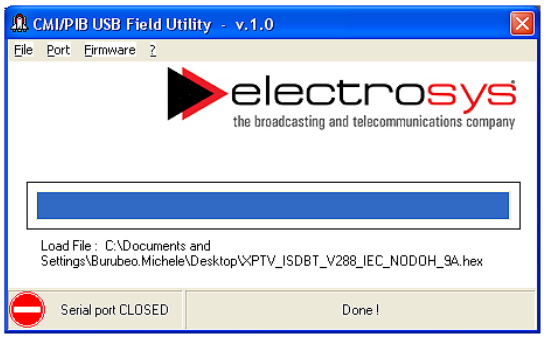
9. The dialog box shows the file name and its size.



10. On "PFirmware" field select "Upload".



11. The firmware uploading starts. A graphic bar shows the progress of the firmware loading.



12. At the end of the loading the serial port is disconnected and the logic board is restarted automatically.

3. *MAINTENANCE*

LIST OF TABLES

LIST OF ILLUSTRATIONS

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3.: MAINTENANCE

3.1 INTRODUCTION

3.1.1 Introduction to Maintenance

The purpose of this section is to assist the maintenance personnel in keeping the unit at best operational status. Maintenance can be subdivided into the following actions:

- PREVENTIVE MAINTENANCE,
- CORRECTIVE MAINTENANCE.

Preventive maintenance refers to maintenance procedures which have to be carried out periodically so as to prevent malfunctions. Corrective maintenance includes a series of tables representing a troubleshooting guide used to locate the most likely area where a malfunction has occurred or reference to the unit manuals.

3.1.2 Types and Levels of Maintenance

The type and level of maintenance to be carried out on unit depends on the adopted maintenance policy, and depends entirely on the operational requirements and level of experience of the maintenance personnel. In general, there are three maintenance levels that can be carried out:

1st Level (*On site*), including the following tasks:

- switch−on and switch−off procedures, also for emergency situations;
- activation and/or deactivation of operative and semi− operative functions, which can be performed on the relative control panel;
- replacement of fuses and monitor lamps located both on panels and switches;
- preventive maintenance on both mechanical and electrical/electronic parts. The maintenance tools and instruments will be simple to use (e.g. spanners, screwdrivers, multimeters etc.);
- corrective maintenance which includes the replacement of units or sub−assemblies. These do not require complicated procedures or adjustments and are coherent with the capabilities of the maintenance personnel.

2nd Level (*On Site*), including the following tasks:

- all first level maintenance tasks**;**
- all corrective maintenance operations which require the use of instruments which are not part of the equipment (e.g. oscilloscope, counters, function generators, ect.);
- all on−site alignments from a single module up to the whole system;
- troubleshooting procedures;
- corrective maintenance which includes the replacement of faulty modules;
- corrective maintenance of mechanical parts;
- setting of semi−operative variables (setting−up optimization) depending on the operational environment and requirements;
- evaluation of the performance of the Equipment and of the System.

3rd Level (*Laboratory*)

This is the highest maintenance level that can be performed and includes procedures which allow the personnel to isolate and replace faulty components. This level also includes adjustment procedures for the repaired modules, as well as the calibration of the instruments used by the maintenance personnel on site.

The way this maintenance is carried out depends on the available technical resources and logistic infrastructure. The technical personnel working at this level should have specific knowledge of the laboratory instruments and tools, and should be skilled in carrying out repairs to a high quality standard.

3.1.3 Maintenance Tools

Maintenance tools include Commercial, Standard and Special Tools used for the 1st and 2nd levels of Maintenance. Commercial Tools include the tools normally used for the maintenance activities (screwdrivers, pliers,soldering irons, etc.) and are normally available on the local market. Standards Tools include those materials considered as standard for maintenance activities (coax cables of standard length, coax adapters, etc.) and are available on the local market and/or from the manufacturer of the unit. Special Tools include tools prepared by the manufacturer for maintenance requirements and are available only from the manufacturer of the unit for which they are designed.

3.1.4 Test Instruments

The Test Instruments required on−site in order to carry out the maintenance activities are listed in paragraph 3.4 ”Maintenance Procedures”. Please note that all the listed Test Instruments are of commercial type and may be substituted by equivalents available on the local market.

3.2 PREVENTIVE MAINTENANCE

This paragraph deals with the suggested preventive maintenance operations to guarantee continued performance of the RF Amplifier Unit.

All unit parts shall be examined to check for dust or dirt, overheating, loose screws and foreign bodies. Dust, for example, may cause current discharges or leakages.

1) *Frames*
   Frames, through which the ventilation air flows, need to be internally cleaned from dust. Cleaning can be carried out using a vacuum cleaner for the accessible parts or a clean, dry cloth or bristle brush.

2 *Air Filters*
   Cabinet air filters shall be disassembled and cleaned to eliminate the dust accumulated during Equipment operation. The cleaning intervals depend on the number of Equipment operational hours and on the amount of dust present in the room where the Equipment operates. However, generally filters should be cleaned on monthly basis. If the dust layer is thin, it can be removed using a pressurized water spray; then dried by means of compressed air. If the dust layer is hard, dip the filter in hot water for approximately 20 minutes. Then clean the filter by means of a pressurized water spray, dry using compressed air; when perfectly dry, reassemble inside the cabinet.

3) *Connections Cables*
   Connection cables shall be periodically examined to ensure that breaks in the external insulating coating are not present to cause possible short-circuits. Cover the parts showing deterioration of the insulating coating. Coaxial cables shall be carefully examined since they can be easily damaged by crushing or sharp bends. Connectors shall be checked to ascertain that corrosion is not present on their metallic contacts. Cables showing damages must be protected and eventually replaced.

4) *Terminal Blocks*
   Terminal blocks shall be examined to ascertain that there are no traces of dirt, loose wires or excess solder on the terminals, which could cause undue contacts with the adjacent terminals. Fixing screws or mounting brackets shall be tightened. Terminal blocks shall be cleaned using a dry cloth or bristle brush.

3.2.1 Preventive maintenance Table

The preventive maintenance actions have been grouped according to periodicity; Tab. 3.1 gives the summary of periodical checks. The table is divided into four columns. The first column indicates the periodicity of the preventive maintenance. The second describes the function to be checked or the operation to be carried out. The third column contains applicable notes and/or references. The fourth column shows the time needed to carry out the maintenance procedure to allow planning of preventive maintenance for the whole equipment.

Tab. 3.1 − Summary of periodic checks

ref	PERIODICITY	TYPE OF SERVICING	REFERENCE FOR THE EXECUTION	ESTIMATED EXECUTION TIME
1	Monthly	Check direct and reflected output power.	Display of *MEX* unit: menu <HPA 1/2>. Refer to the relevant technical manual.	2 min.
2		Check regular functioning of RF module.	Display of *MEX* unit: menu <HPA 1/2>. Refer to the relevant technical manual.	2 min.
3		Cleaning of the filters (*slightly dusty environment*).	Para 3.2 − “Preventive Maintenance”, step 2, and Para 3.2.2.	15 min.
4	Six−Monthly	Check regular functioning of the fans.	Display of *MEX* unit: menu <HPA 1/2>. Refer to the relevant technical manual.	2 min.
5		Check the operating temperature of the final stages heat sink	Display of *MEX* unit: menu <HPA 1/2>. Refer to the relevant technical manual.	2 min.
6		Check power consumption	Display of *MEX* unit: menu <HPA 1/2>. Refer to the relevant technical manual.	2 min.
7		Replacement of filters (*dusty environment*).	Para 3.2 − “Preventive Maintenance”, step 2, and Para 3.2.2.	10 min.
8	Yearly	Check tightening of the RF output connector.	Refer to Fig. 2.1	2 min.

TIP

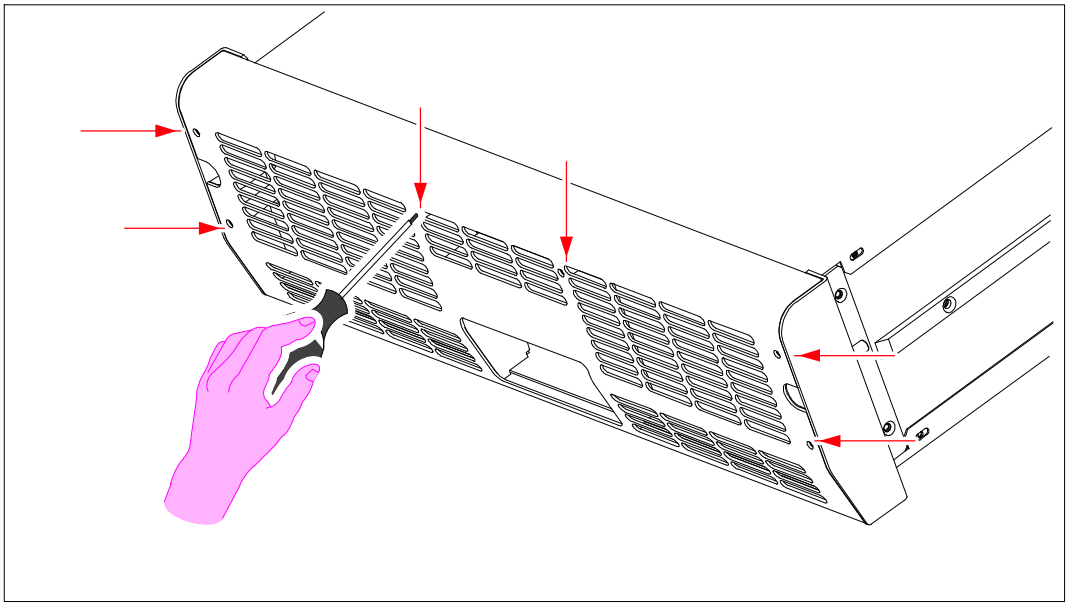
Whenever a maintenance operation or replacement of one or more devices has been carried out, a functional check process should be performed.

3.2.2 Cleaning/replacing the air filter

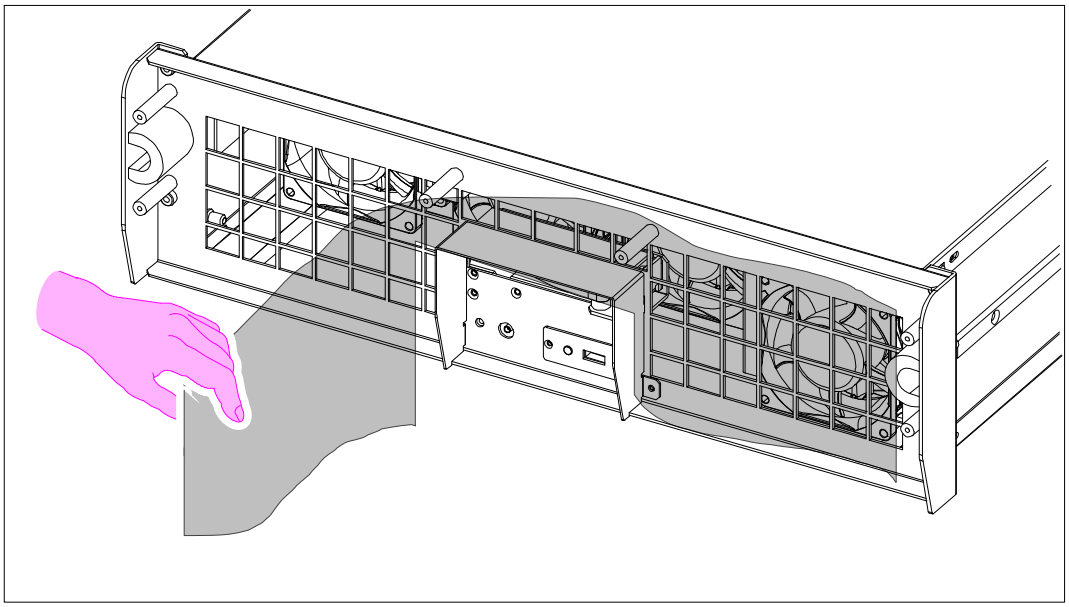
For the cleaning/replacing of the air filterit i necessary to extract the unit from the rack. Once it has been taken away, put it on a table.

No spaecial tools are necessary to carry out the operations, only a *torx screwdriver* (T10 type) is required.

Operate as indicated here below:



1. Completely unscrew the six screws (3MA, pointed out by the red arrows) of the front panel and take it away.



2. Remove and clean the air filter according the indication of Para 3.2 − “Preventive Maintenance”, step 2).

3.3 CORRECTIVE MAINTENANCE

Causes which give rise to a corrective maintenance action can derive from:

- Out of tolerance conditions of standard levels, waveforms and timings, detected during preventive maintenance;
- Failure conditions shown either by indicator lamps, displays, LEDs located on PCB (if any), TTY diagnostic print outs.
- Failure conditions detected by operative personnel.

Restoring the unit to operation in a short time also depends on the availability of spare parts and components.

3.3.1 Corrective Maintenance Concepts

1) The corrective maintenance involves the location and isolation of the failure at site level. One or more failed replaceable parts may correspond to each failed function. These parts are classified as follows:
   - repairable PCB's and assemblies;
   - single components not included in the above repairable items.
2) Once the failed part has been isolated, it shall be replaced with a serviceable one from the available spare parts. The replaceable parts of the "single components" type (i.e. fans, pushbuttons, transformers, relays, etc.) once replaced shall be discarded. The repairable items shall be sent to the third maintenance level (laboratory) where they shall be repaired by using Test Stations, repair procedures and personnel suitable for this Level of maintenance. In the same area, calibration and repair of the instruments and tools, both for site and laboratory maintenance will be accomplished.

3.4 MAINTENANCE PROCEDURES

The maintenance procedures can be utilized for periodic performances checks or after a substitution of failed component or board. These procedures can be utilized one at a time or in sequence, depending from the needs. The procedures are divided in paragraphs as follows:

3.4.1 Checking set−up of the boards
3.4.2 Fault finding on *W3−215A*
3.4.4 Functional checks on *PRE−DRIVER* stage
3.4.5 Functional checks on *DRIVER* stage
3.4.6 Functional checks on *FINAL* stage
3.4.7 Replacing the fans

Remove the top cover of the unit in order to access the RF stages and/or the logic boards; the arrangement of *driver*, *final* stages and logic boards is shown in Fig. 3.1. Remove the electric shield to access the components.

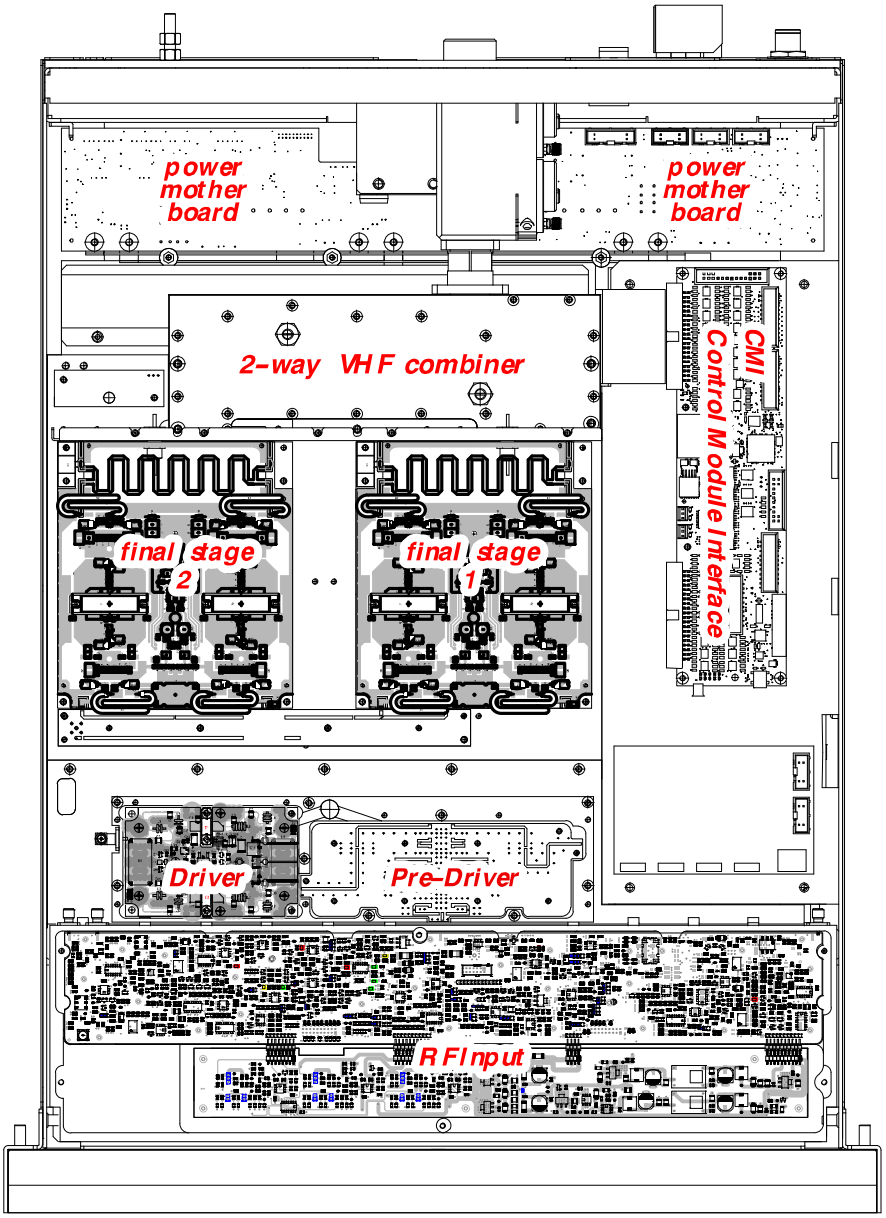
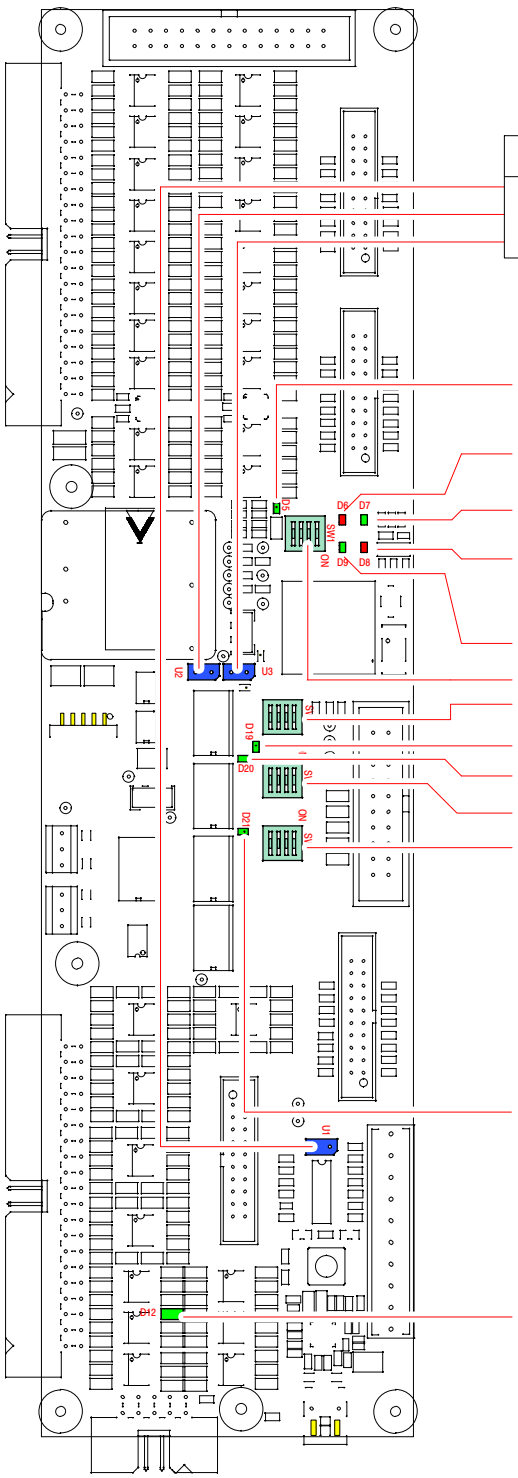


Fig. 3.1 − *W3−215A* final stage arrangement (top view)

3.4.1 Checking set−up of the boards

The boards of W3−215A involved in this checking (location on Fig. 3.1) are factory set, and do not require any other setting. If one of these boards has to be replaced it is advisable to check the correct settings of jumpers and dip−switches. The following paragraphs give information about the correct set−up.

3.4.1.1 Checking *Control Module Interface* board (p/n. 4030002210)



JUMPERS SET UP		
U1	CLOSED	*(WATCH DOG ENABLED)*
U2	CLOSED	*(+5V_{DC} ENABLED)*
U3	CLOSED	*(+3V_{DC} ENABLED)*

D5 (*green*; *blinking*) WATCH DOG REFRESHING

D6 (*green*; *blinking*) USB connection
(*red*; *solid*) USB initialization (ISP−130x) failed

D7 (*green*; *blinking*) CAN communication
(*red*; *solid*) invalid CAN address

D8 (*red*) CAN bus disconnected
(*red; blinking*) software uploading
(*off*) CAN bus connected

D9 (*green*; *blinking*) RS232 connection

SW1 MODULE ADDRESSING

SW2 MODULE ADDRESSING

D19 (*green*) +12V_{DC} FIELD PRESENT

D20 (*green*) +5V_{DC} FIELD PRESENT

SW3 *NOT USED*

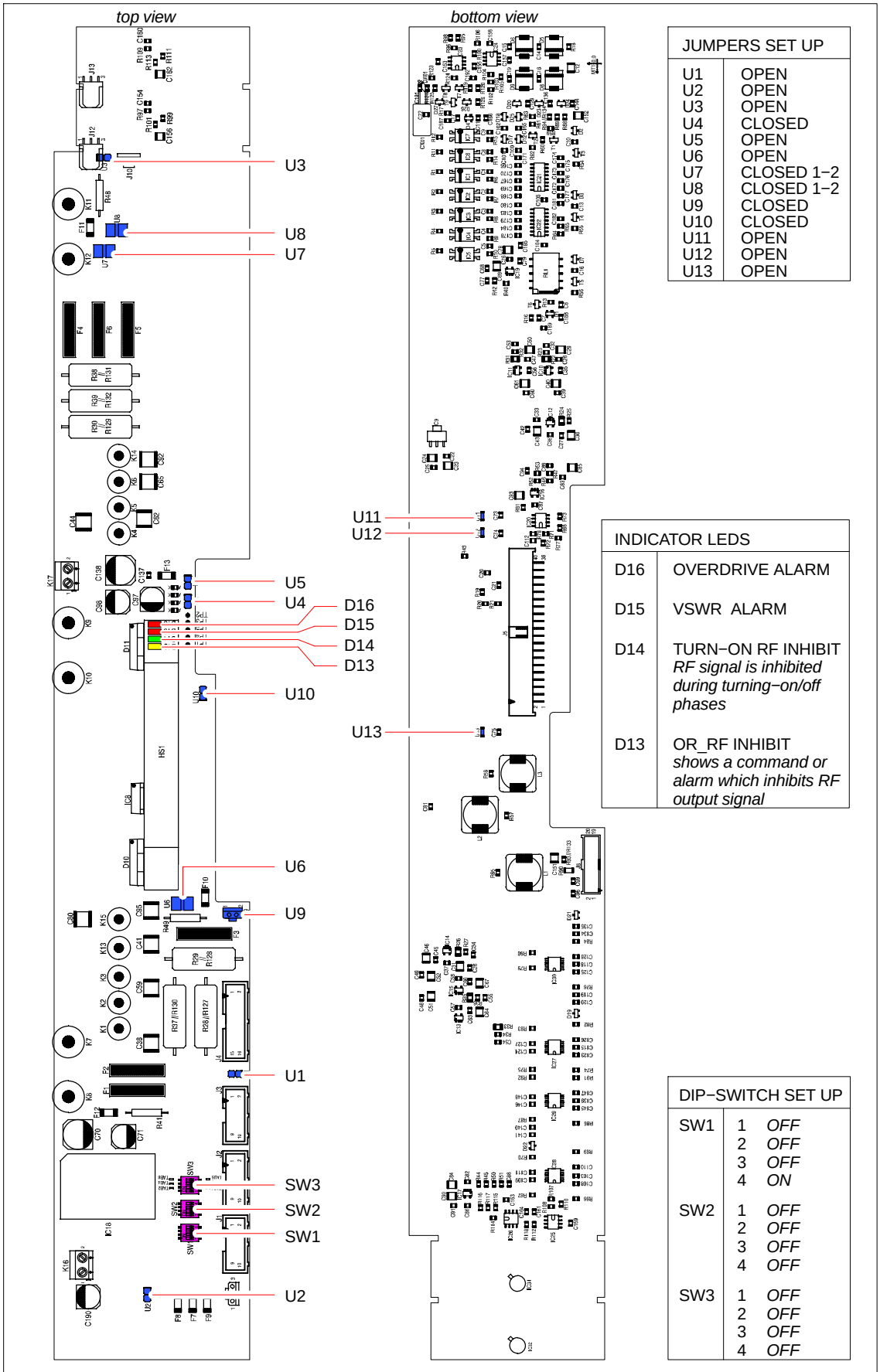
SW4 SW4_1 *ON = DIGITAL SIGNAL*
OFF = ANALOG SIGNAL
SW4_2 *ON = VHF*
OFF = VHF
SW4_3 *ON = TEST MODE*
OFF = NORMAL MODE
SW4_4 *ON = SERVICE MODE*
OFF = NORMAL MODE

D21 (*green*) +3V_{DC} FIELD PRESENT

D12 (*green*; *blinking*) SW ACTIVITY PRESENT

Fig. 3.2 − *Control Module Interface* (4030002210) layout

3.4.1.2 Checking ***Power Mother Board*** (p/n. 4050008918)



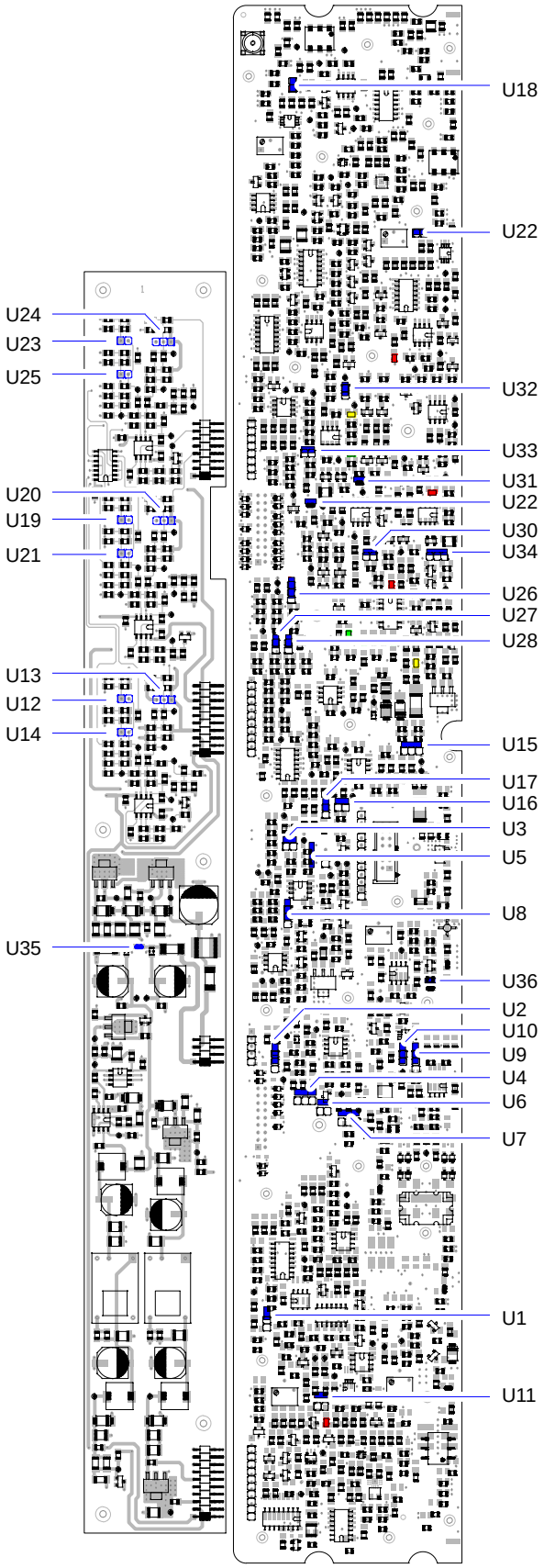
JUMPERS SET UP	
U1	OPEN
U2	OPEN
U3	OPEN
U4	CLOSED
U5	OPEN
U6	OPEN
U7	CLOSED 1−2
U8	CLOSED 1−2
U9	CLOSED
U10	CLOSED
U11	OPEN
U12	OPEN
U13	OPEN

INDICATOR LEDS	
D16	OVERDRIVE ALARM
D15	VSWR ALARM
D14	TURN−ON RF INHIBIT *RF signal is inhibited during turning−on/off phases*
D13	OR_RF INHIBIT *shows a command or alarm which inhibits RF output signal*

DIP−SWITCH SET UP		
SW1	1	*OFF*
	2	*OFF*
	3	*OFF*
	4	*ON*
SW2	1	*OFF*
	2	*OFF*
	3	*OFF*
	4	*OFF*
SW3	1	*OFF*
	2	*OFF*
	3	*OFF*
	4	*OFF*

Fig. 3.3 − *Power Mother Board* (4050008918) layout

3.4.1.3 Checking *RF Input* board (p/n. 4040010516)



JUMPERS SET UP		
	DVB−T	*ATSC*
U1	OPEN	OPEN
U2	OPEN	OPEN
U3	OPEN	OPEN
U4	OPEN	OPEN
U5	CLOSED	CLOSED
U6	OPEN	OPEN
U7	OPEN	OPEN
U8	OPEN	OPEN
U9	OPEN	OPEN
U10	OPEN	OPEN
U11	OPEN	OPEN
U12	OPEN	OPEN
U13	CLOSED	OPEN
U14	OPEN	CLOSED
U15	OPEN	OPEN
U16	CLOSED	OPEN
U17	OPEN	CLOSED
U18	OPEN	OPEN
U19	OPEN	OPEN
U20	CLOSED	OPEN
U21	OPEN	CLOSED
U22	OPEN	OPEN
U23	OPEN	OPEN
U24	CLOSED	OPEN
U25	OPEN	CLOSED
U26	OPEN	OPEN
U27	CLOSED	OPEN
U28	OPEN	CLOSED
U29	OPEN	OPEN
U30	OPEN	OPEN
U31	OPEN	OPEN
U32	OPEN	OPEN
U33	OPEN	OPEN
U34	OPEN	OPEN
U35	OOPEN	OPEN
U36	OPEN	OPEN

NOTE!

Analog operation is not affected by jumper setup

Fig. 3.4 (1/2) − *RF Input Control* board (4040010516)/Jumpers location and set−up

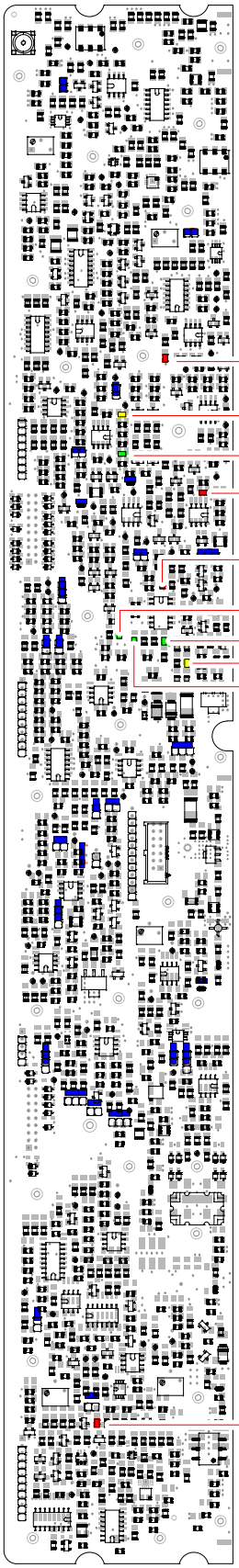


Fig. 3.4 (2/2) − *RF Input* board (4040010516)/LEDs location

3.4.2 Fault finding on W3−215A

The following procedures for the functional check of W3−215A, can be performed through *CCU* (control unit of the transmitter) and/or using a digital multimeter. In order to carry out these procedures it is necessary to extract the HPA to be tested from the rack.

FINDING THE RF STAGE IN FAILURE CONDITIONS

Access <HPA 1/2> menu on *MEX* unit and check the operating conditions of each item are the right ones. For instance an excessive current absorption of an RF stage could indicate a malfunction of it, or very differernt current absorptions of the RF stagescould indicate a malfunction of one of them.

Once a faulty condition is detected and the faulty stage is identified, carry out the checkings indicated here below:

Tab. 3.2 − Maintenance procedures summary table

faulty stage	checking
Pre−Driver	Carry out the checking of paragraph 3.4.4
Driver	Carry out the checking of paragraph 3.4.5
Final	Carry out the checking of paragraph 3.4.6

3.4.3 Necessary test equipment and preliminary operations

A digital multimeter (e.g.:*"Fluke" model 87*) is required the functional check of the unit.

NOTE!

The following checking, unless otherwise specified, has to be performed with the amplifier supplied and without RF input signal.

3.4.4 Functional checks on *PREDRIVER* stage

(*VHF PREDRIVER STAGE p/n. 4040018113*)

Remove the top cover of the HPA in order to access the *PREDRIVER* stage; location of the pallets is shown on Fig. 3.1. Remove the electric shield to access the components. The functional checks on the pallet can be carried out by following the indication given in Tab. 3.3.

Tab. 3.3 − Functional checks on *PREDRIVER* stage

checking	**measure point / component**	**measurements**	**regulation**
IC1 biasing (quiescent curr.)	control unit display	100mA	rotate R18 completely anti-clockwise (minimum of the current I_0); then adjust R18 in order to read on control unit display I_0 +100mA
	alternative procedure		
IC1 biasing (quiescent curr.)	R11	10mV (*bias current 50 mA*)	rotate R18 completely anti-clockwise; then adjust R18 (clckwise) in order to read on digital voltmeter a drop voltage of **10mV** (corresponding to *100mA*)

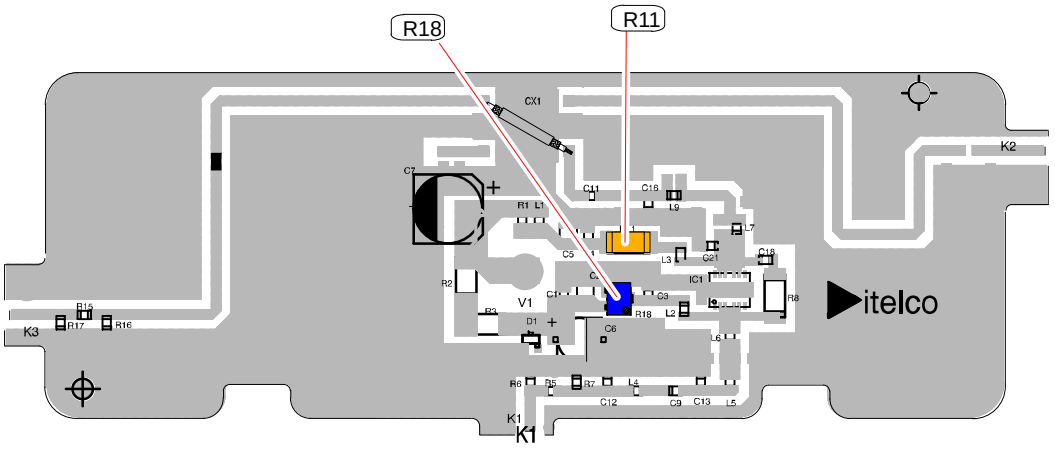


Fig. 3.5 − PREDRIVER stage (VHF PreDriver Stage p/n. 4040018113) layout

3.4.5 Functional checks on *DRIVER* stage
(*VHF DRIVER STAGE p/n. 4040012210*)

Remove the top cover of the HPA in order to access the *DRIVER* stage; location of the pallets is shown on Fig. 3.1. Remove the electric shield to access the components. The functional checks on the pallet can be carried out by following the indication given in Tab. 3.4.

Tab. 3.4 − Functional checks on *DRIVER* stage

checking	**measure point / component**	**measurements**	**regulation**
Transistors power supply	T1, T2 ”drain”	$50V_{DC} \pm 0.3V_{DC}$	
T1 biasing (quiescent curr.)	current absorption on *MEX* unit display (menu <*HPA 1/2>.* Refer to the relevant technical manual.	350mA	rotate R2 and R16 completely anticlockwise (minimum of the current $\mathbf{I_0}$); adjust R14 in order to read on control unit display $\mathbf{I_0}$ + 350mA
T2 biasing (quiescent curr.)	current absorption on *MEX* unit display (menu <*HPA 1/2>.* Refer to the relevant technical manual.	350mA	adjust R14 in order to read on control unit display $\mathbf{I_0}$ + 700mA ($\mathbf{I_0}$ + 350mA + 350mA)
	alternative procedure		
Transistors power supply	T1, T2 ”drain”	$50V_{DC} \pm 0.3V_{DC}$	
T1 biasing (quiescent curr.)	digital multimeter (series connected to power supply cable of the pallet)		rotate R2 and R16 completely anticlockwise (minimum of the current $\mathbf{I_0}$); adjust R14 in order to read on digital multimeter: $\mathbf{I_0}$ + 350mA
T2 biasing (quiescent curr.)	digital multimeter (series connected to power supply cable of the pallet)		adjust R14 in order to read on digital multimeter $\mathbf{I_0}$ + 700mA ($\mathbf{I_0}$ + 350mA + 350mA)
	alternative procedure		
Transistors power supply	T1, T2 ”drain”	$50V_{DC} \pm 0.3V_{DC}$	
T1 biasing (quiescent curr.)	R3	7mV (*bias current* 350mA)	rotate R2 and R14 completely anticlockwise; adjust R2 in order to read on digital multimeter a drop voltage of 7mV.
T2 biasing (quiescent curr.)	R15	7mV (*bias current* 350mA)	adjust R14 in order to read on digital multimeter a drop voltage of 7mV.

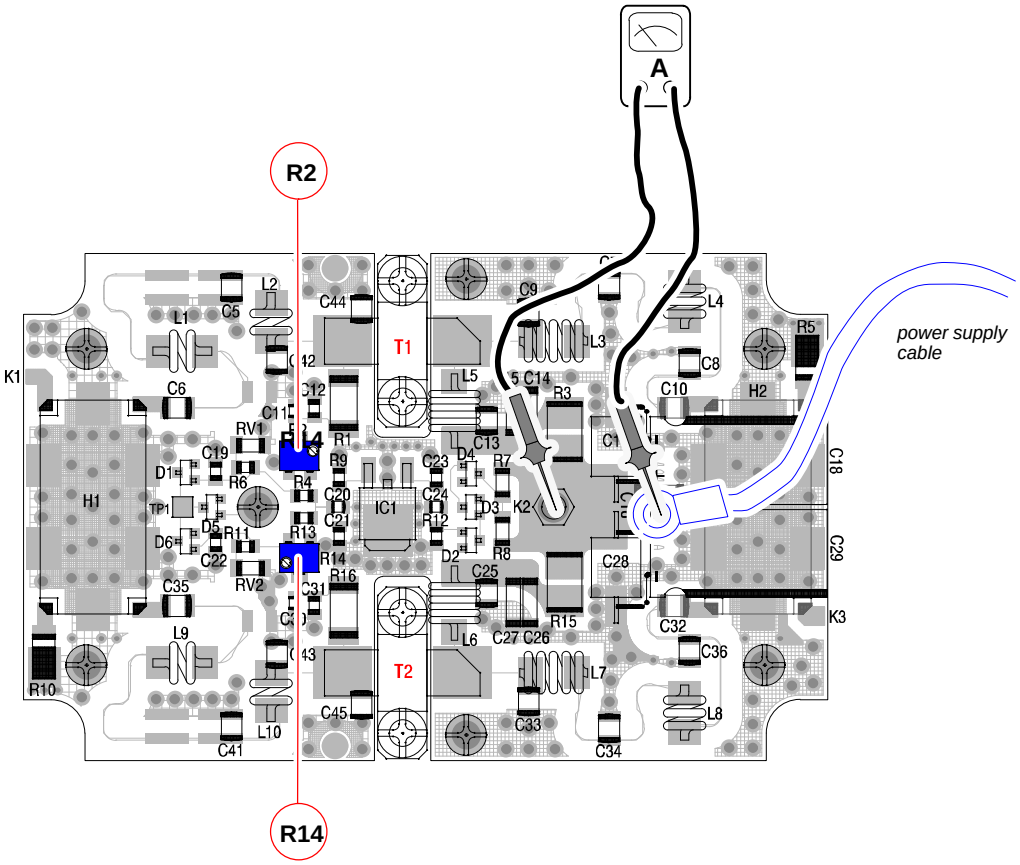


Fig. 3.6 − Driver Stage p/n. 4040012210 layout

3.4.6 Functional checks on *FINAL* stage

(*450W VHF AMPLIFIER p/n. 4040049011*)

Remove the top cover of the HPA in order to access the *FINAL* stage; location of the pallet is shown on Fig. 3.7. Remove the electric shield to access the components. The functional checks on the pallet can be carried out by following the indication given in Tab. 3.5.

Tab. 3.5 − Functional checks on *FINAL* stage

checking	**measure point / component**	**measurements**	**regulation**
Transistors power supply	T1, T2 ”drain”	$50V_{DC} \pm 0.3V_{DC}$	
T1 biasing (quiescent curr.)	current absorption on *MEX* unit display (menu <*HPA 1/2*>. Refer to the relevant technical manual.	1.4 A	rotate R13 and R26 completely anticlockwise (minimum of the current $\mathbf{I_0}$); adjust R11 in order to read on the control unit display: $\mathbf{I_0}$ + 1.4A
T2 biasing (quiescent curr.)	current absorption on *MEX* unit display (menu <*HPA 1/2*>. Refer to the relevant technical manual.	1.4 A	adjust R26 in order to read on the control unit display: $\mathbf{I_0}$ + 2.8A ($\mathbf{I_0}$ + 1.4A + 1.4A)
	alternative procedure		
Transistors power supply	T1, T2 ”drain”	$50V_{DC} \pm 0.3V_{DC}$	
T1 biasing (quiescent curr.)	digital multimeter (series connected to the relevant power supply cable)	1.4 A	rotate R13 and R26 completely anticlockwise (minimum of the current $\mathbf{I_0}$); adjust R13 in order to read on digital multimeter: $\mathbf{I_0}$ + 1.4A
T2 biasing (quiescent curr.)	digital multimeter (series connected to the relevant power supply cable)	1.4 A	adjust R26 in order to read on digital multimeter: $\mathbf{I_0}$ + 2.8A ($\mathbf{I_0}$ + 1.4A + 1.4A)
	alternative procedure		
Transistors power supply	T1, T2 ”drain”	$50V_{DC} \pm 0.3V_{DC}$	
T1 biasing (quiescent curr.)	R10 || R11	14mV (*bias current 1.4A*)	rotate R13 and R26 completely anticlockwise; adjust R13 in order to read on digital multimeter a drop voltage of 14mV.
T2 biasing (quiescent curr.)	R19 || R20	14mV (*bias current 1.4A*)	adjust R26 in order to read on digital multimeter a drop voltage of 14mV.

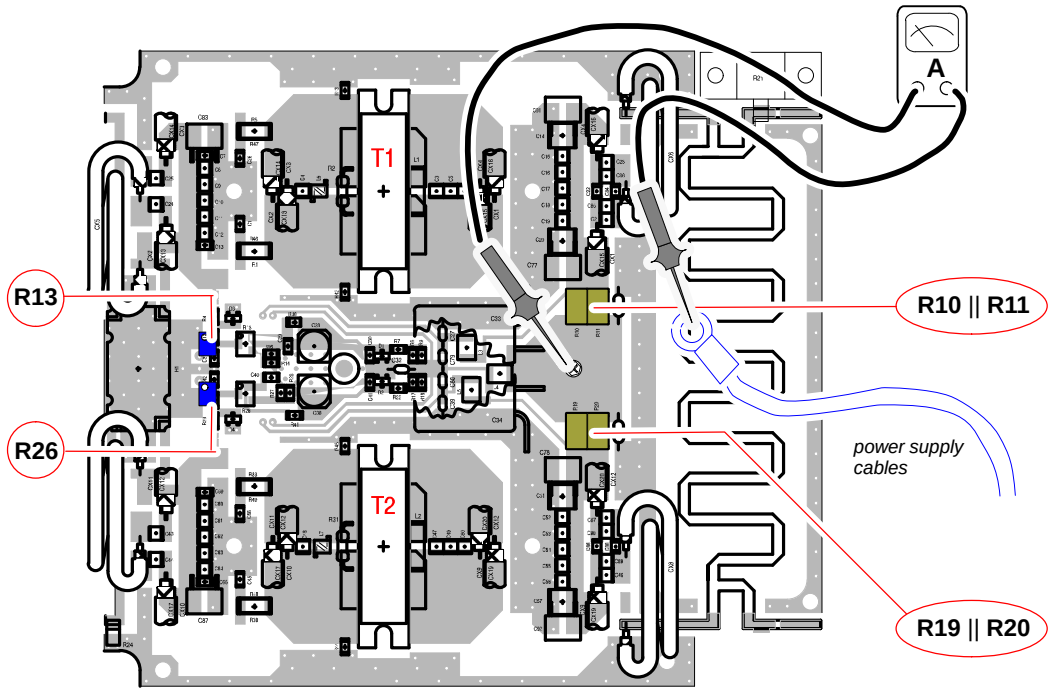


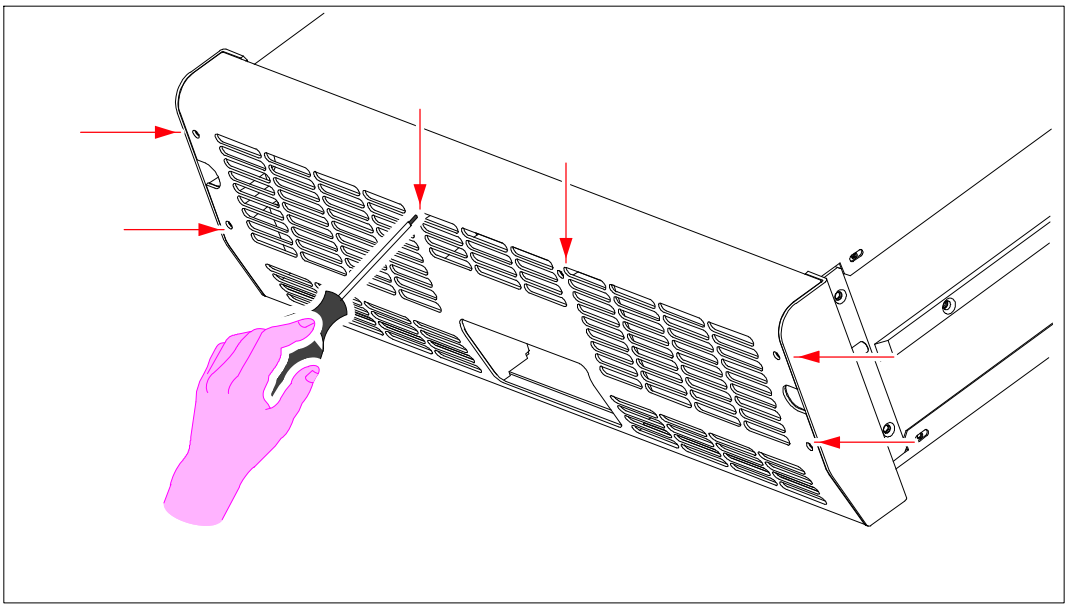
Fig. 3.7 − FINAL stage (450W VHF Amplifier p/n. 4040049011) layout

3.4.7 Replacing the fans

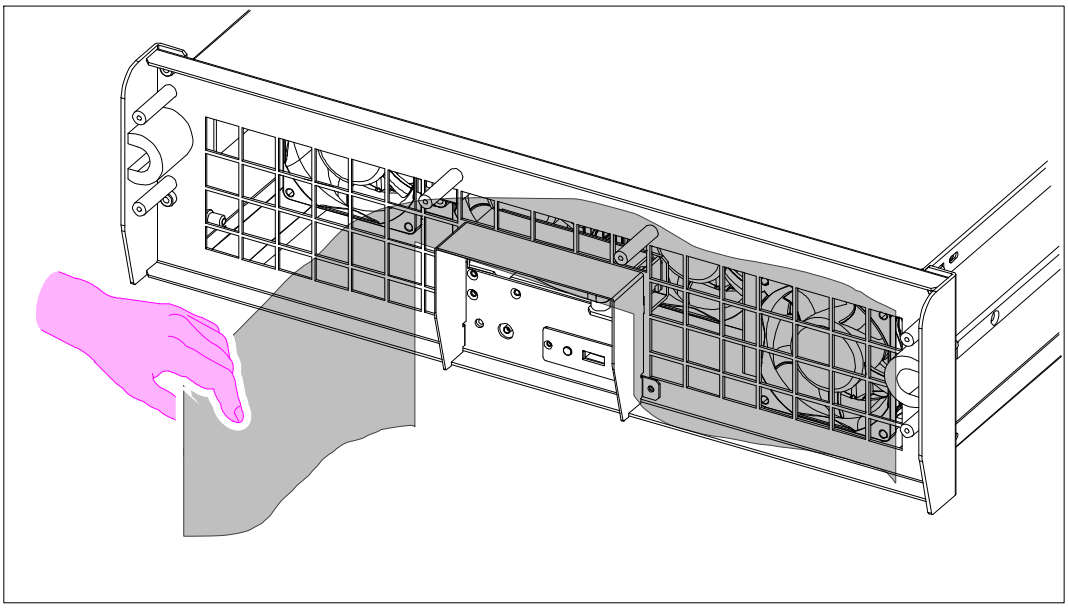
For replacing the fans of the unit it is necessary to extract it from the rack. Once it has been taken away, put it on a table and operate as indicated herer below:

No spaecial tools are necessary to carry out the operations, only the following tools are required:

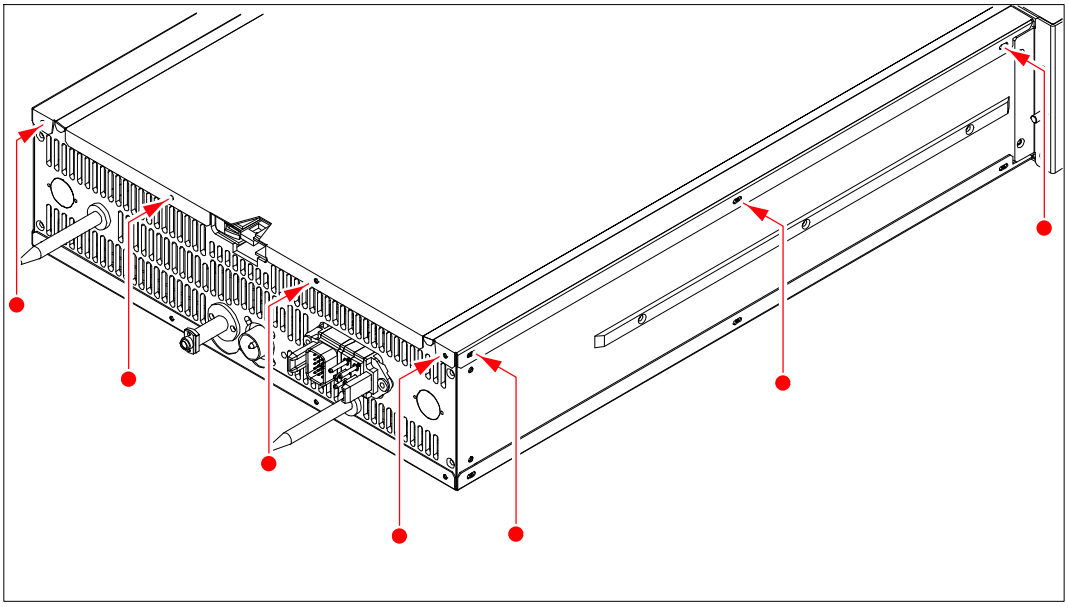
- a *torx screwdriver* (T10 type) for unscrewing the screws of the bottom panel;
- a *screwdriver* or a *hexagonal wrench* for 3M screws of the fans.



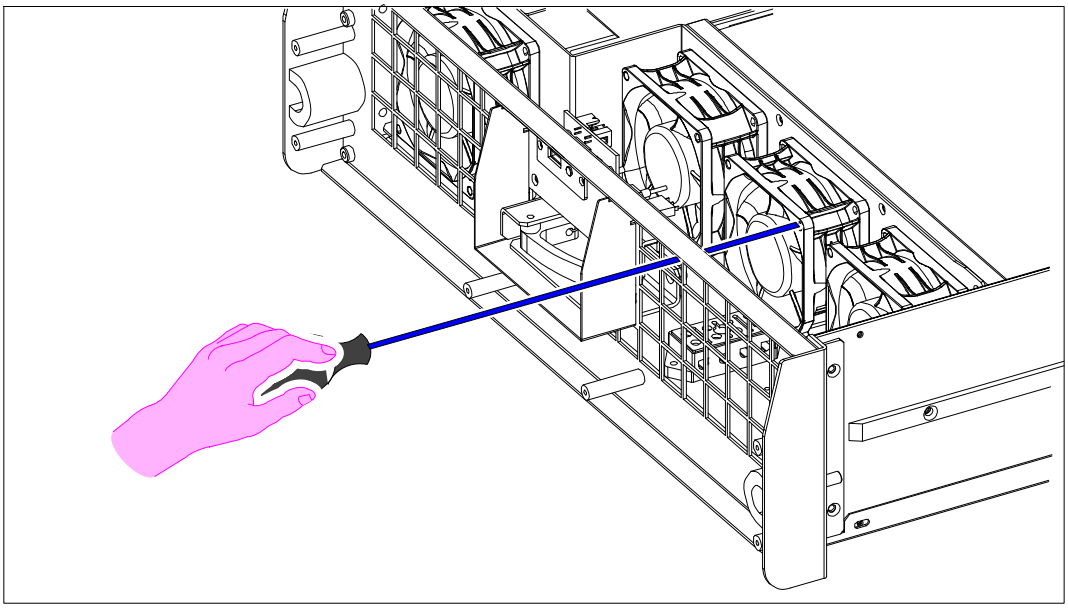
1. Completely unscrew the six screws of the front panel and take it away.



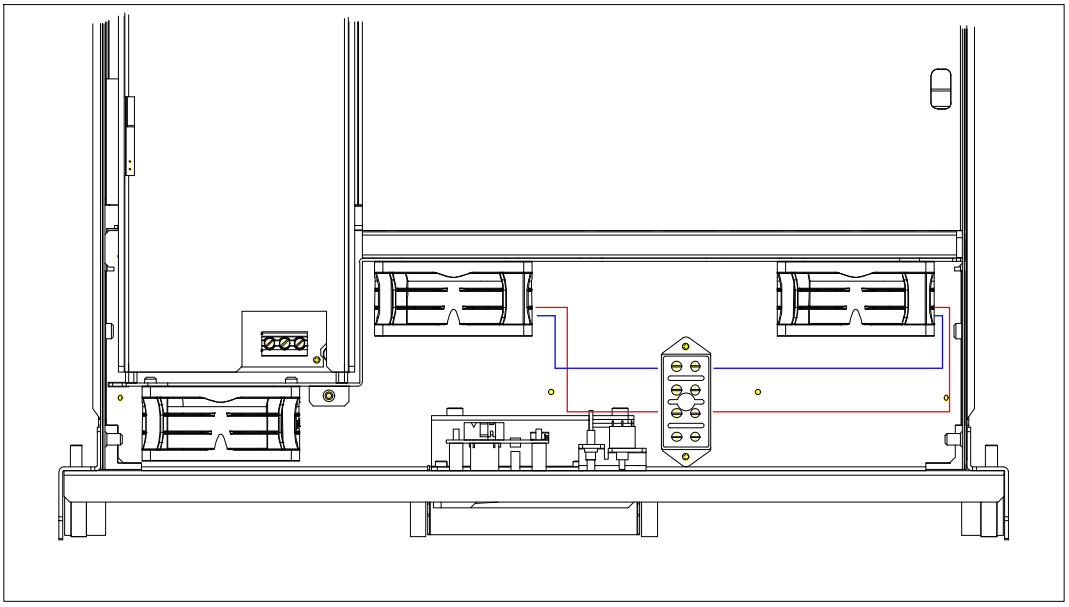
2. Remove the air filter.



3. Turn upside down the amplifier and unscrew the screws of the lower panel (3 screws on each side and 4 screw on the rear panel, pointed out by the red arrows).



4. Use a screwdriver of suitable lenght to unscrew the four screws fixing the fan to the frame.



5. Disconnect the electrical cables of the fan and remove it. Replace the fan and restore the electrical connections.
Put the lower panel back in its place.
Re−insert the air filter and put the front panel back in place.

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4. *WIRING DIAGRAMS*

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REAR PANEL

FRONT PANEL

RF OUT J2

RF INPUT J5

W300

J14

J2 (GR5)

J3 (GR4)

GR1
4420300012
VHF RF AMPLIFIER

J6 (GR4)

W301

J4 RF MONITOR

J2(GR4)

W504

W507

S1

J3

SC1
4070002410
MODULE STATUS INTERFACE

J1 J2

W502 W508

K3 (SC8) K4 (SC7) TB1 (SC9) TB1

J1(GR4)

11 12

C1 C2

W503

6 5 2 4

K13 K14 K15 K1 K2 K3 K4 K5 K6

+50V +12V +50V

J8

J1 RJ45
SC4
4050019810
CAN BUS INTERFACE

J3 I\O INTERFACE

J2

W501

J4

SC2-1
4050008918
POWER MOTHER BOARD

J9

J10

W506

J13 SC2-2
4050008918
POWER MOTHER BOARD

J8 S1 J11 J9

SC3
4030002210
CONTROL MODULE INTERFACE

J5

W505

J7

J4

K16

GR2
142000002
PWR S. FAN

GR3
1769212300
FAN

GR6
1769212300
FAN

K1

W201

J2

SC5
4050019910
FAN CONTROL

J1

W200

K17

J3

W509

J1 K7 K8

J2 K9 K10

J3 K11 K12

supply supply

7 8

W203

J7 J8

AUX

GR5
EPSU3KWPZ001-4
AC\DC CONVERTER

J1

W500

K1

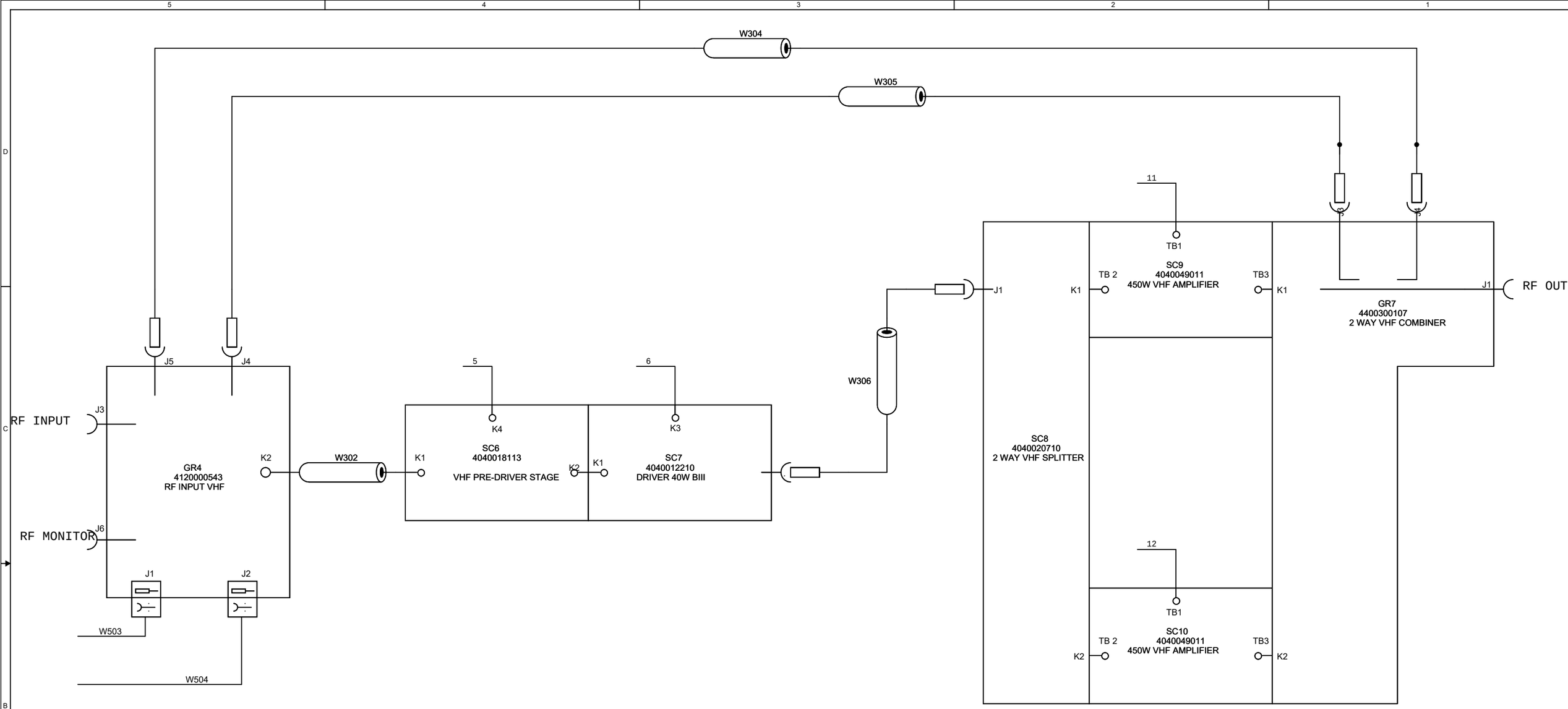
MAINS INPUT

1 N1 PE1 PE2

L N PE

SHEET	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	A	EMISSION	24/07/18
REV.																Rev.		Date

Arch.	Dwg. Mauro Tordini	Date 29/03/18	TITLE VHF AMPLIFIER 2 PALLET
	Chkd. Marco Chiesa	29/03/18	DWG. n° 5030321500 ID
itelco	Scale	Tolerance	Format A3 / Sheet 1 | 2



DWG. n°	TITLE
5030321500 ID	VHF AMPLIFIER 2 PALLET
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	Sheet 2 / 2

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