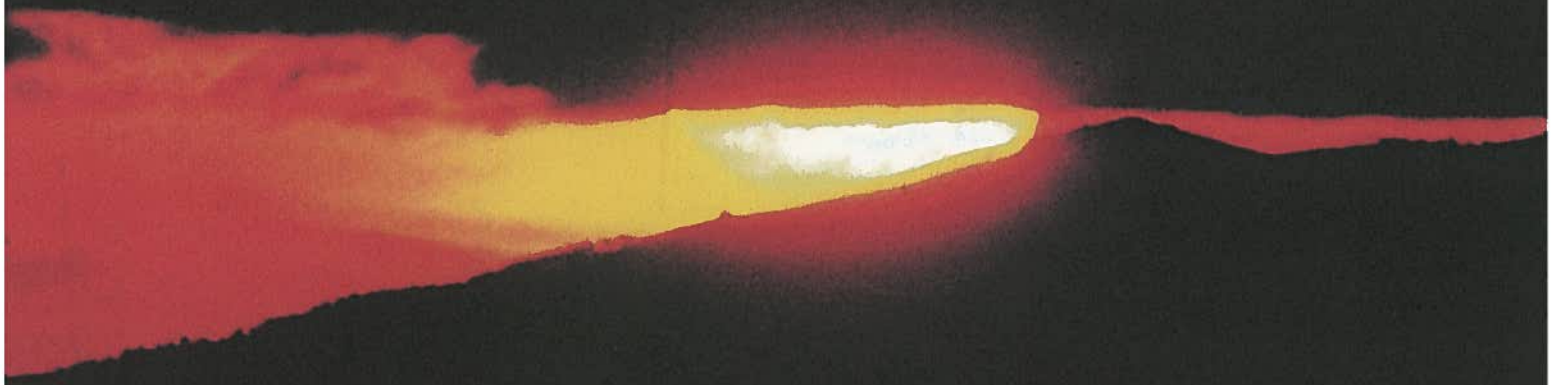
TECHNICAL MANUAL

DIGITAL TRANSMITTERS
VHF EM9000-2G
UHF EM9010-2G

Code: *40500068 V1.10* ***Ref.:*** *NTEGB EM90x0-2G*



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VHF DIGITAL TRANSMITTER Overall view				44000225 Indice rév. :V1.02 Date rév. : 01/03/11
Rèf. s/ens. : EM9000A-2G	Code s/ens. : 84500142	Rèf. ens. : EM9000-2G	Code ens. : 80000086	Page : 1/1
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UHF DIGITAL TRANSMITTER Overall view				**44000312** Indice rév. :V1.00 Date rév. : 02/03/11
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V1.04	Pages A to 172.	18/05/11	BP
V1.05	Pages A to 172.	06/06/11	BP
V1.06	§5.9 Procedure for VoIP operation	12/07/11	JPD
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NOTA: *Any user who has suggestions for modifying or improving this document is requested to send their observations to the following address:*

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LIST OF SLIDES

➢ LIST OF PHOTOS

TELERAD code	*Name*	*Assembly or Sub-assembly*
44000225	¾ photo of EM9000A-2G VHF transmitter	EM9000A-2G
44000226	Front and Rear Photo of EM9000A-2G	EM9000A-2G
44000227	Photo from above of EM9000A-2G	EM9000A-2G
44000312	¾ photo of EM9010A-2G UHF transmitter	EM9010A-2G
44000314	Front and Rear Photo of EM9010A-2G	EM9010A-2G
44000299	Photo from above of EM9010A-2G	EM9010A-2G

➢ LIST OF MECHANICAL PLATES

TELERAD code	*Name*	*Assembly or Sub-assembly*
45000060	Mechanical dimensions / weight 1/1	EM9000-2G
45000064	Mechanical dimensions / weight 1/1	EM9010-2G

➢ LIST OF INTERCONNECTION PLATES

TELERAD code	*Name*	*Assembly or Sub-assembly*
45500036	Uninterruptible power supply interconnection 1/1	ALIN26270/72
45500037	Continuous power supply interconnection 1/1	ALDC26264
45500040	VHF transmitter general interconnection	EM9000-2G
45500045	UHF transmitter general interconnection	EM9010-2G

➢ LIST OF BLOCK DIAGRAM PLATES

TELERAD code	*Name*	*Assembly or Sub-assembly*
46000124	VHF transmitter general diagram 1/1	EM9000-2G
46000125	Uninterruptible power supply module diagram 1/1	ALIN26270/ ALIN26272
46000126	Front panel PCB diagram 1/1	PAVE41160
46000127	VHF amplifier module diagram 1/1	AMPV26260
46000128	Control PCB diagram 1/2	CTRL11217

TELERAD code	*Name*	*Assembly or Sub-assembly*
46000129	Control PCB diagram 2/2	CTRL11217
46000130	µC/DSP module general diagram 1/1	MIPR11005
46000131	µC/DSP module diagram 1/1	MIPR11005
46000132	VHF synthesizer module diagram 1/1	SVHF25077
46000133	Continuous power supply module diagram 1/1	ALDC26264
46000145	UHF synthesizer module diagram 1/1	SUHF25078
46000147	UHF transmitter general diagram 1/1	EM9010-2G
46000148	UHF amplifier module diagram 1/1	AMPU26246

➢ LIST OF LAYOUT VIEW SLIDES

TELERAD code	*Name*	*Assembly or Sub-assembly*
46500142	Synthesizer module layout 1/1	SVHF25077/ SUHF25078
46500150	Control PCB layout 1/1	CTRL11217
46500151	Front panel PCB layout 1/1	PAVE41160
46500155	Side A µC/DSP PCB layout 1/2	MIPR11005
46500156	Side B µC/DSP PCB layout 2/2	MIPR11005
46500178	Side A UHF amplifier module 1/2	AMPU26246
46500179	Side B UHF amplifier module 2/2	AMPU26246
46500180	Side A VHF amplifier module 1/2	AMPV26260
46500181	Side B VHF amplifier module 2/2	AMPV26260
46500195	Continuous power supply module layout 1/1	REAL16102
46500211	Cold plate power supply module layout 1/1	ALPF26271/ ALPF26273
46500212	Uninterruptible power supply module layout 1/1	RALI16105/ RALI16107

CHAPTER 1. INTRODUCTION

1.1 ABOUT TELERAD

With over 40 years' experience, TELERAD offers a very high quality range of Ground to Air radiocommunication equipment in the civil (VHF) or military (UHF) frequency range, as well as associated peripheral equipment. All this equipment is in compliance with the international standards in force and provides comprehensive, reliable and upgradeable system solutions.

For any additional information, please contact the company at the following address:

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A hotline may also be made available if required. Please contact the sales department.

1.2 TARGETED USERS

This document is intended for maintenance technicians who wish to install or adjust the equipment, put it into service and monitor it in operation. It also allows authorised personnel to carry out level 3 operations on the equipment (repairing a sub-assembly, a PCB or a module).

1.3 ABOUT THIS MANUAL

This document is a technical manual. It contains all the required information for the start-up, operation, preventive and corrective maintenance of the **EM9000-2G VHF or EM9010-2G UHF transmitter**.

1.3.1 Manual structure

This manual is structured as follows:

- **Chapter 1: Introduction.** The first chapter gives a presentation of this document, the conventions used, the safety and transport instructions, the standards with which it complies, and traceability and legal information.

- **Chapter 2: Presentation.** Presentation of the EM9000-2G VHF and EM9010-2G UHF transmitters**,** the available options, the compatible equipment, and of the electrical, mechanical and environmental characteristics.

- **Chapter 3: Operational description.** Contains a simplified description of the operation of EM9000-2G VHF and EM9010-2G UHF transmitters.

- **Chapter 4: Description of the equipment.** Complete description of the EM9000-2G VHF and EM9010-2G UHF transmitters: front and rear panel and connectors.

- **Chapter 5: Installation – Configuration – Commissioning.** Allows mechanical installation and commissioning of the EM9000-2G VHF and EM9010-2G UHF transmitters. It also contains a comprehensive description of the jumpers and switches of the sub-assemblies.

- **Chapter 6: Operation.** Presentation of local or remote operating principles. Details of hardware and software commands.

- **Chapter 7: Maintenance.** Preventive maintenance, corrective maintenance, locating failures, operating procedures presented in the form of maintenance, sub-assembly disassembly / reassembly, verification and adjustment sheets.

- **Chapter 8: Parts list.** List at sub-assembly level of the components of the EM9000-2G VHF and EM9010-2G UHF transmitters.

- **Chapter 9: Plates.** List of photos, mechanical, interconnection, block diagram and layout plates provided in the appendix.

- **Appendix A: Glossary:** List of terms, abbreviations and acronyms used in this document.

- **Appendix B: EC certificate of conformity.**

1.3.2 Conventions used in this manual

Indicates a remark giving additional information

Cross-reference to a section in this manual or another document.

1.4 SAFETY RULES

Besides the quality criteria and high performance standards retained by TELERAD in designing its equipment, the company also gives great importance to user safety by constantly keeping its product design, manufacturing and test in compliance with the safety standards in force.

As such, the EM9000-2G VHF and EM9010-2G UHF transmitters comply with the current EC standards. To maintain this level of safety, the user must comply with the safety guidelines described in this manual before switching on the equipment for the first time. If these rules are not followed or the equipment is used for a purpose for which it is not designed (incorrect use), TELERAD cannot be held responsible for risks related to equipment damage or physical injury.

1.4.1 Information regarding safety

The equipment is designed to operate entirely safely when it is installed and used in compliance with the instructions for use and the general safety rules.
The directives contained in this section explain the potential risks related to use of the equipment, and provide safety rules intended to reduce these risks.

Scrupulously respecting the information contained in this section and the specific instructions supplied with the equipment enables you to protect yourself from the risks, and create a safe working environment.

1.4.1.1 Installation requirements

The equipment operates in a safe manner when it is used according to the fixed electrical magnitudes, and in compliance with its instructions for use.

1.4.1.2 Servicing

The internal components of the equipment may only be serviced by trained and qualified staff.
Opening or removing covers bearing danger symbols or stickers exposes you to electric shocks.

1.4.1.3 Ventilation

The equipment's ports and openings are intended for ventilation, and must never be blocked or covered. They ensure reliable operation of the product and protect it against excessive temperatures.
Allow sufficient air circulation around the equipment, to ensure adequate cooling. Avoid direct exposure to radiant heat sources.

1.4.1.4 Water and humidity

Do not use the equipment in a humid environment.

1.4.1.5 Protection through earthing

The terminal on the rear, identified with the symbol is the main protective earth terminal.
The minimum cross-section of the wire used must be 2.5 mm².
This connection must be made before any other connection, and must be disconnected last. It is also recommended to check the earth continuity regularly.
When the equipment has a Mains power input, it is fitted with a three-pin plug with an earth.
Earthing is a safety element. Do not nullify the protection by connecting the plug to a socket that does not have an earth connection.

1.4.2 Symbols used

The following list gives the symbols used in this manual and the equipment, along with their explanation. They are divided into two groups:

- safety symbols,
- operational symbols.

1.4.2.1 Safety symbols

Indicates dangerous voltage.

This symbol, present both on the equipment and throughout the instructions, gives an ATTENTION or ATTENTION DANGER message. When this symbol is present during operating phases, maintenance and repair phases, carefully read the corresponding paragraph of the instructions first.

If the fan does not work correctly, there is a risk of a significant increase in the temperature of certain components. The risk is indicated by an attached sticker that can be seen when the cover is removed. The operator must wait for the equipment to cool down before carrying out maintenance operations.

Indicates the risk of physical injury during equipment handling due to its heavy weight.

Indicates a risk of fire to the equipment.

Indicates danger of serious injury or death.

Indicates risk of damage to equipment by electrostatic discharge (ESD).

1.4.2.2 Operational symbols

Indicates that the equipment must be supplied with alternating current (AC) at the indicated terminal.

Indicates that the equipment must be supplied with direct current (DC) at the indicated terminal.

Indicates an input terminal when distinction between inputs and outputs is required.

Indicates an output terminal when distinction between inputs and outputs is required.

Indicates that the equipment power supply is On.

Indicates that the equipment power supply is Off.

Indicates that the equipment power supply is On/Off.

Indicates the equipment terminal connected to ground or chassis.

This symbol indicates an earthed connection. This connection is the main protective earth. It must be made before any other connection, and must be disconnected last.

The minimum cross-section of the earth wire must be 2.5mm².

It is also recommended to check the earth continuity regularly.

1.4.3 Safety instructions

1.4.3.1 General

The following general safety precautions must be respected during the equipment use, maintenance and repair phases. Failure to respect these precautions or any other warning present in the instructions constitutes a violation of the safety standards applied to the design, manufacture and use of the equipment.
TELERAD may not be held responsible for the user's failure to respect these instructions.
The purpose of reading and respecting the recommendations contained in these instructions is to reduce the risk of injury.

1.4.3.2 Electrical risks

PRESENCE OF HIGH VOLTAGE

High voltages are required when using this equipment. These are dangerous voltages, given that a voltage of 110V may cause death. Personnel must follow all of the following safety measures at all times:

- **unplug** the energy source before changing an electrical component,
- **be wary of** electrical safety devices (e.g. circuit breakers, drawer and door devices),
- **unplug** power supplies, both external and internal (batteries) to perform operations on the inside of the hardware,
- **understand** that safety devices are designed for standard openings. Dangerous circuits may be reached in the event of disassembly,
- **discharge** capacitors. Dangerous voltages may remain in the capacitors after the hardware is removed from service.

It is prohibited to enter a room alone to carry out inspections or maintenance work on high-risk equipment.

NOTA : *Do not be fooled by the term "Low Voltage" (LV). 50 volts are sufficient to cause death.*

EARTH CONNECTION

This equipment may have a significant earth leakage current. To reduce the risk of electric shock, the equipment chassis must be connected to earth, by a low impedance cord, with a minimum cross-section of 2.5mm² using the appropriate marked terminal .
In particular, when the equipment is installed in a rack, check that its earth terminal is indeed connected to the rack chassis, which shall itself be connected to earth. This terminal must be connected first and disconnected last, and must be connected to a conductor with a cross-section suited to the default current.

POWER SUPPLY CORD SELECTION

Select a power supply cord that offers all safety guarantees according to the legislation in force in the country in which the equipment is used, and which is suited to the equipment in terms of current.
An unsuitable cord may result in either:

- damage to the device due to electrical discharges, or
- the equipment catching fire.

POWER SUPPLY VOLTAGES

Before powering on the device, check that the power supply voltages, mains and/or battery, correspond to those values recommended by TELERAD (refer to the characteristics section).
If batteries are used, they must not be exposed to extreme temperatures. Do not short circuit them. Comply with their technical characteristics, as well as their expiry date. Comply with the environmental standards in force during recycling.

PROTECTION AGAINST LIQUIDS

In order to avoid any risk of short-circuit, fire or any other internal damage, do not spill any liquids inside the device, and protect it from rain and from contact with liquids of any kind.

PROTECTION AGAINST METAL OBJETS

Do not insert any metal conductors into the equipment.

PROTECTION AGAINST DAMAGED CABLES OR PLUGS

Do not use damaged cables or plugs.

PRESENCE OF AN ON/OFF SWITCH

If the device is not fitted with a mains On/Off switch, the mains cord may be considered a circuit breaker. In this case it must be easy to access and disconnect.
If there is a mains On/Off switch but access to it is impractical, or when the device's mains plug is fitted with a locking clamp, it is essential to add a circuit breaker in the power supply circuit, which can be easily accessed by the user. If the equipment is used in a Main / Stand-by type configuration, each item of equipment must have an independent circuit breaker.

PROTECTION FROM THE ELECTRICITY NETWORK

The electricity network powering the equipment must be protected against voltage surges (network variation), including those related to weather conditions (storms, lightning, etc.)
If there is no such protection, this may result in damage to the equipment, destruction or a fire.

PROTECTION AGAINST RF RADIATION

If using TELERAD transmitter-type equipment, and in order to avoid any risk of burns by RF radiation or by the presence of high RF voltage when the device is transmitting:

- do not unplug the antenna cable.
- do not touch the Antenna output connector.

The antenna cable must be connected or disconnected with the equipment powered off.

PROTECTION OF MAINTENANCE STAFF

Unless otherwise specified by TELERAD, the equipment must be powered off before any operations, with the power cord disconnected. Only certified, qualified and trained staff may open, adjust and replace the PCBs or equipment modules.
Under certain conditions, dangerous voltages may remain even when the power cord is disconnected. In order to avoid injury, always disconnect and discharge the circuits before touching them.

When replacing a defective part, refer to the removal/reassembly sheets of this manual, as well as the adjustment sheets and verification sheets for the smooth functioning of the equipment (refer to CHAPTER 7 "MAINTENANCE").

Do not undertake repair or internal adjustment without the presence of another person capable of administering first aid resuscitation.
Due to the risk of creating additional dangers, do not use substitute parts and do not make any unauthorised modification to the equipment. When spare parts are required, ensure that the maintenance staff use the spare parts specified in the maintenance manual and/or in the illustrated catalogue.

In event of the equipment falling or sustaining damage, of unusual smells, smoke or overheating, immediately switch off the equipment and unplug the power cord.
Only people who are qualified and trained to maintain equipment and trained to handle products liable to produce dangerous energy levels must install accessories in safety locking zones.

PROTECTION AGAINST ELECTROSTATIC DISCHARGE (ESD)

The certified staff replacing the PCB or module or performing any other operation on these sub-assemblies must be equipped with an antistatic bracelet on one wrist, connected to an earth socket via the bracelet cord.
To avoid the risk of damage linked to electrostatic discharges, it is strongly recommended to avoid any physical contact with the connector pins.
Do not remove an electronic circuit that is sensitive to static electricity from its protective packaging before being ready to install it,
To divide the static electricity between the work surface and the electronic circuit, touch the work surface with one hand and hold the electronic circuit with the other hand,
Once the electronic circuit is removed from its protective packaging, do not put it down or let go of it before it is installed in the equipment or put back in its protective packaging,
Use the electronic circuit's protective packaging as an assembly surface.

ELECTRIC SHOCK: FIRST AID

The rules for first aid are both theoretical and practical. These rules concern all staff: whether they are installing, operating or maintaining this radio equipment.
Everyone must be ready to give first aid to avoid any loss of human life.
You must always remain calm.
Generally, an electric shock does not kill instantly; the victim may be saved, even if they are not breathing.
First aid involves protecting, examining, alerting and rescuing.

- **1st action: PROTECT**
  Analyse the environment. If the victim is at a height, anticipate their falling when the electric circuit is cut.
  Switch off the current.

or

If the rescuer cannot switch off the current, they must:

1) protect themselves: protect their hands with a dry non-conducting material (e.g. rubber gloves, cloth) and stand on an insulator (e.g. wooden or plastic stool),
2) move the victim away: use a dry non-conducting pole to remove the victim from any contact with the electric circuit. In particular, move the victim away from any metal or damp elements. Metal and water are electrical conductors,
3) mark out the area to avoid further complications of the accident.

- **2nd action: EXAMINE**
  Check for consciousness and breathing before giving the alert.
  Lay the victim on their back.
  Ask simple questions and hold the victim's hands. Check that the victim is conscious.
  e.g. "Can you hear me? If you can hear me, squeeze my hands!".
  If the victim responds, they are conscious and breathing (case 1).

or

If the victim does not respond, they are unconscious. You must check their breathing:

loosen their clothing (collar, tie, belt),
carefully tip the head back to clear the airways,
to do so, place a hand on the forehead, with the index and middle fingers of the other hand placed under the chin, pushing to tip the head backwards,
open the mouth and look inside to inspect it; with the hand that was on the forehead, remove anything that is liable to cause problems breathing,
put your ear and cheek close to the victim's nose and mouth to feel if they are breathing. Watch for the stomach and/or chest expanding,
hold this position for approximately 6 to 10 seconds.

After this examination, the rescuer knows that either:
- ✓ the victim is unconscious and breathing (case 2), or
- ✓ the victim is unconscious and not breathing (case 3).

- **3rd action: RAISE THE ALERT or HAVE SOMEONE RAISE THE ALERT**

Dial the emergency telephone number:

For France:
15 ➔ Emergency Medical Services
18 ➔ Fire brigade
15 ➔ Emergency call from a mobile phone

Give the following information:
the precise location: address, building, floor, corridor, room,
the number of victims
the condition of the victim(s) (e.g. unconscious person, not breathing, etc.).
Do not hang up first.
Facilitate the arrival of the emergency services as close as possible to the victim.
Debrief the emergency services when they arrive.

- **4th action: GIVE FIRST AID**

Case 1: the victim responds and is breathing:
wait for the emergency services.
Case 2: the victim does not respond and is breathing:
place the victim on their side in the recovery position (see below).
the recovery position is used in the event of a fall or injury,
it helps prevent the victim from choking due to obstruction of the tongue or regurgitations.

RECOVERY POSITION

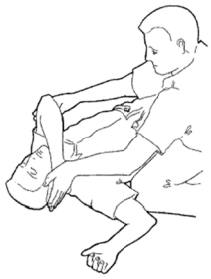
1

Place yourself on the side towards which you intend to turn the victim. Stretch the closest arm out at a right angle to the body, sliding it on the floor.

2

Kneel by their waist. Grasp the victim's opposite arm.

3



Place the back of the victim's hand against their cheek, on your side.

4

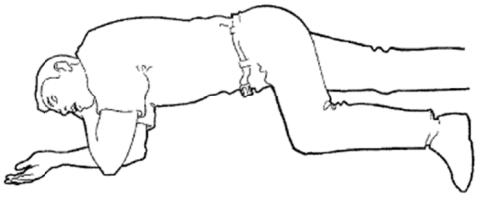
With the other hand, take the opposite leg, just behind the knee, and lift it, keeping the foot on the floor. This allows you to use it for leverage. Move far enough back, to the victim's elbow.

5

Pull on the leg, to roll the victim towards you, until the knee touches the floor.

6

Gently remove your hand from under the victim's head.



Final position:
Check that the victim is still breathing, by placing your hands on either side of the thorax.

Case 3: the victim does not respond and is not breathing.
Immediately begin cardiopulmonary resuscitation (CPR): mouth to mouth insufflation and external cardiac massage.
Place the victim on a hard surface.
Alternate 15 chest compressions (external cardiac massage) followed by two insufflations (mouth to mouth).

MOUTH TO MOUTH

1

Kneel next to the victim, near their face.
With your hand placed on the victim's forehead, block the nose by pinching it between thumb and index finger, while keeping the head tipped back.
With your hand placed under the victim's chin, slightly open their mouth, keeping the chin raised.
After breathing in, not too deeply, place your open mouth around the victim's mouth, pressing hard to avoid leakage.
Insufflate progressively over two seconds, until the victim's chest starts to rise.

2

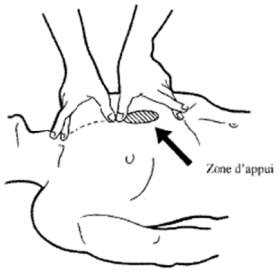
3

Straighten up slightly and catch your breath, watching the victim's chest sink; the victim's expiration is passive.

EXTERNAL CARDIAC MASSAGE

1 As far as possible, bare the victim's chest.

2

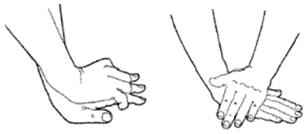


Determine the pressure area, by finding the middle of the sternum.

3

Place the heel of the hand just below the identified area.

4



Place the other hand on top of the first.

5

Perform sternal compressions, keeping the arms straight. Between each compression, the hands stay in contact with the sternum, and the thorax must return to its initial position.

6 Every eight cycles, check if the victim has started breathing again. One cycle = fifteen compressions + two insufflations

it is recommended that two rescuers perform CPR. One rescuer performs the heart massage, and the other insufflates. The rescuers are on either side of the victim. With two rescuers, they can alternate more quickly between insufflations and compressions, which is more effective.

	Any first aid, be it the recovery position or CPR, must not be interrupted before the emergency services arrive.

1.4.3.3 Risks related to the work environment

EXPLOSIVE ATMOSPHERE

Do not use the equipment in the presence of inflammable gases or smoke. Using electrical equipment in such environments is a significant safety risk.
In case of fire, the equipment may produce harmful products (gas, fumes) that could be a health hazard.

AMBIENT TEMPERATURE

Do not install the equipment near a heat source.
Do not leave the equipment in direct sunlight.

INSTALLATION OUTSIDE THE RACK

When using the device outside the rack, ensure that it is placed on a flat, sufficiently strong, stable and vibration-free surface at least ten centimetres away from the wall or any other equipment to facilitate air circulation with or without a ventilation system.

INSTALLATION IN A RACK

Ensure that the rack is stable before installing the equipment.
Do not move a rack by yourself. TELERAD recommends that this task be carried out by a minimum of two people.

IRRITATIONS / ALLERGIES

In case of irritation or allergy resulting from the use of the equipment, immediately consult a doctor.

PROTECTION AGAINST ELECTROSTATIC DISCHARGE (ESD)

Certain equipment, such as transmitters, may increase electromagnetic radiation when being used. It is recommended that pregnant women and people with pacemakers keep away from these high-risk zones.

CONDENSATION

When there is heavy condensation resulting from the equipment being moved (e.g. from a hot to a cold area), do not use the equipment until it is fully dry.

For more information on the equipment's moisture resistance, refer to its climatic characteristics. (§ 2.3.3 "Climatic characteristics").

SERVICING

Do not use the equipment in a dusty place, as dust particles can hinder its normal functioning.

To clean the equipment, refer to the maintenance and cleaning sheets of this manual (§ 7.4 "Maintenance and cleaning operations").

Disconnect the equipment before cleaning. Do not use liquid or aerosol cleaners. Use a damp cleaning cloth.

TEMPERATURE

When using TELERAD transmitter-type equipment, the radiator of the RF power amplifier module may reach high temperatures under certain transmission conditions. To avoid any risks of burns, do not touch the RF power amplifier module when the equipment is transmitting and at least for 10 minutes after it switches to standby mode.

VENTILATION

Do not plug the holes or blades of the equipment. They allow free circulation of air and help cool down the system.

1.4.3.4 Risks related to transportation

HANDLING

Certain equipment designed by TELERAD may be very heavy. In this case do not transport the equipment without using appropriate lifting devices.

Refer to the mechanical characteristics of the equipment for information on its weight. (§ 2.3.3 "Mechanical characteristics").

PACKAGING

The equipment is delivered in a protective packaging. Keep this packaging for reuse when sending the equipment back to TELERAD.

1.5 TRANSPORT AND STORAGE

1.5.1 General information

Given the great diversity of structures, regulations, weather conditions and transport conditions, this chapter limits itself to recalling the general principles relating to the packaging of electronic hardware and its components, with a view to transporting or storing them.
Just a few precautions specific to the hardware are given.
Particular directives (type and quantity of desiccant, frequency of inspections, etc.), are left to users' discretion.

NOTE : *As far as possible, keep the original reusable packaging.*

1.5.2 Packing – Pre-packaging

This operation consists in protecting the hardware and components to be packaged, by suitable physicochemical and/or mechanical means.
Depending on their nature, they must be supported with an appropriate system, and protected by a plastic heat-sealed envelope containing sufficient amounts of desiccant.

1.5.3 Packaging

This operation consists in protecting the previously-packed hardware and components from shocks that occur during handling, and from various damaging external factors during storage.

1.5.3.1 Hardware and mechanical elements

Each element must have a rigid box (polystyrene, wood or cardboard) suited to the transport and storage conditions.
The item shall be fixed in place with soft material that cushions against shocks, or properly fixed inside the box.

1.5.3.2 Desiccation

Condensation of humidity, in a closed container, is essentially caused by the outside temperature dropping, resulting in lowering of the pressure of the internal atmosphere, encouraging the penetration of damp air.
The relative humidity of the internal atmosphere of packaging must be lower than 30%. All packaging must therefore contain a quantity of desiccant related to the climatic conditions encountered.

Desiccant sachets must be insulated from metal objects (risk of corrosion).

1.5.3.3 Marking

All packaging must at least have identification marking specifying its content, (description, reference, quantity) independent of any other regulatory markings.

1.5.4 Transportation

All TELERAD products are supplied in specific protective packaging, and must be transported without this being modified in any manner whatsoever.
In the event of loss, damage or breakage of the equipment during transport, please inform the transport company or shipping agent by a written report.

1.5.5 Storage

Store equipment in a cool (preferably below 30°C) and ventilated place, away from humidity, heat sources, naked flames, food products or drinks. Keep equipment in its original packaging until used, and do not pile up equipment haphazardly.

1.6 CONFORMITY

The EM9000-2G VHF and EM9010-2G UHF transmitters are compliant with the standards currently in force relating to EMC, low voltage, radiocommunication, and worker safety aspects.

1.6.1 Reference directives

- **Electromagnetic compatibility (EMC):**
  Directive 89/336/EEC amended by directives 91/263/EEC, 92/31/EEC and 93/68/EEC relating to electromagnetic compatibility of electrical and electronic apparatus.

  Associated standards:
  EN 301 489-1 V1.8.1 (04/2008): Electromagnetic compatibility and radio spectrum matters (ERM). Electromagnetic compatibility (EMC) standard for radio equipment and services;
  Part 1: Basic technical requirements.

  EN 301 489-22 V1.3.1 (11/2003): Electromagnetic compatibility and radio spectrum matters (ERM). Electromagnetic compatibility (EMC) standard for radio equipment and services;
  Part 22: Specific conditions for ground-based VHF aeronautical mobile and fixed radio equipment.

- **Low voltage:**
  Directive 73/23/EEC, amended by directive 93/68/EEC relating to electrical equipment designed for use within certain voltage limits.

  Associated standards:
  EN 60950-1 (2006 + A11: 2009): IT equipment – Safety –
  Part 1: General requirements.

- **Radiocommunication:**
  Directive R&TTE 1999/5/EC relating to radio equipment and telecommunications terminal equipment and mutual recognition of their conformity.

Associated standards:

EN 300 676-1 V1.5.1 (07/2010): Electromagnetic compatibility and radio spectrum matters (ERM). Ground-based VHF hand-held, mobile and fixed radio transmitters, receivers and transceivers for the VHF aeronautical mobile service using amplitude modulation – **Part 1:** Technical characteristics and methods of measurement.
It covers A3E and ACARS modes of the EM9000-2G.

EN 300 676-2 V1.4.1 (04/2010): Electromagnetic compatibility and radio spectrum matters (ERM). Ground-based VHF hand-held, mobile and fixed radio transmitters, receivers and transceivers for the VHF aeronautical mobile service using amplitude modulation – **Part 2:** Harmonised EN covering essential requirements under Article 3.2 of the R&TTE Directive.

EN 302 617-1 V1.1.1 (01/2009): Electromagnetic compatibility and radio spectrum matters (ERM). Ground-based UHF hand-held, mobile and fixed radio transmitters, receivers and transceivers for the VHF aeronautical mobile service using amplitude modulation – **Part 1:** Technical characteristics and methods of measurement.
It covers A3E and ACARS modes of the EM9010-2G.

EN 302 617-2 V1.5.1 (10/2010): Electromagnetic compatibility and radio spectrum matters (ERM). Ground-based VHF hand-held, mobile and fixed radio transmitters, receivers and transceivers for the VHF aeronautical mobile service using amplitude modulation – **Part 2:** Harmonised EN covering essential requirements under Article 3.2 of the R&TTE Directive.

EN 301 841-1 V1.3.1 (06/2010): Electromagnetic compatibility and radio spectrum matters (ERM). VHF air-ground Digital Link (VDL) Mode 2; Technical characteristics and methods of measurement for ground-based equipment – **Part 1:** Physical layer and MAC sub-layer.

EN 301 842-2 V1.6.1 (12/2010): Electromagnetic compatibility and radio spectrum matters (ERM). VHF air-ground Digital Link (VDL) Mode 4; Technical characteristics and methods of measurement for ground-based equipment – **Part 2:** General description and data link layer.

EN 300 086-1 V1.4.1 (06/2010): Electromagnetic compatibility and radio spectrum matters (ERM). Land mobile service. Radio equipment with an internal or external RF connector intended primarily for analog speech – **Part 1:** Technical characteristics and methods of measurement.
It covers F3E mode of the device.

EN 300 162-1 V1.4.1 (05/2006): Electromagnetic compatibility and radio spectrum matters (ERM). Radiotelephone transmitters and receivers for the maritime mobile service operating in VHF bands – **Part 1:** Technical characteristics and methods of measurement.
It covers the maritime G3E mode of the device.

EUROCAE ED-137-1 (05/2009): Interoperability Standard for VoIP ATM Components – **Part 1:** Protocol in radio equipment.

EUROCAE ED-137-4 (05/2009): Interoperability Standard for VoIP ATM Components – **Part 4:** SNMP layer.

- **Worker safety:**
  Directive 2004/40/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields).

  Associated standards:
  EN 50371 (2002): Generic standard to demonstrate the compliance of low power electronic and electrical devices with the basic restrictions related to human exposure to electromagnetic fields (10 MHz-300 GHz) - General public.

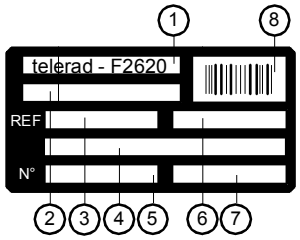
1.6.2 CE certification

The certificate of conformity CE provided in appendix A2 attests to the conformity of the equipment with European standards in force.

1.6.3 Equipment traceability

Each equipment unit manufactured by TELERAD is fitted with a unique **brand plate** to ensure traceability throughout its service life.

Below is a description of the brand plate.



① *Telerad reference*. Always contains: telerad – F2620.
② *Contract number*. Contains the customer contract number.
③ *Equipment reference*. Contains the equipment reference as defined by Telerad.
④ *Reserved space*. Reserved for marking military equipment.
⑤ *Serial number*. Contains the equipment serial number.
⑥ *Reserved space*. Reserved for marking military equipment.
⑦ *Date*. Contains the equipment delivery date.
⑧ *Bar code*. Allows the equipment to be traced.

1.7 WARRANTY

TELERAD shall not be held liable for any damage resulting from the modification of the as-delivered configuration. This shall include damages resulting from an accident, incorrect use, deliberate damages or damages due to the environment.
Lastly, the environment for the use of TELERAD products must be compliant with the climatic specifications described in this manual.

1.8 COPYRIGHT

This manual is the property of TELERAD. All rights reserved. It shall not be reproduced in any form without the prior written permission of TELERAD.

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The information contained in this document is deemed to be reliable. However, TELERAD shall reserve the right to modify this information at any time without prior notice.

1.9 REFERENCE DOCUMENTS

[1]	ICDFR 40600034 V1.00 Série 9000-2G MAINTENANCE	Interface Control Document relating to the local operation and configuration link from the RS232 front panel interface.
[2]	ICDFR 40600035 V1.00 Série 9000-2G agent SNMP	Interface Control Document relating to the SNMP protocol supervision link.
[3]	ICDFR 40600036 V1.00 Série 9000-2G JBUS	Interface Control Document relating to the JBUS protocol supervision link
[4]	NMAFR 40400914 V1.05 CPV9000	Maintenance instructions for the CPV9000 transmission coupling unit.
[5]	KITGB 40700003 V1.02 9000-2G Series	Procedure for software release through a Web server page.

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CHAPTER 2. PRESENTATION

2.1 GENERAL

The multi-mode EM9000-2G VHF and EM9010-2G UHF transmitters have been developed to fulfil new civil aviation voice and data transmission telecommunication requirements, firstly, in the 118-144MHz frequency range, can be optionally extended to 112-156MHz, and secondly for military aviation telecommunications, in the 225-400MHz frequency range, can be optionally extended to 225-406.1MHz with the F3E option.

They have evolved significantly from the first generation of series 9000 transmitters, to respond to the obsolescence of certain components, and also to best adapt to technological change in terms of network communications. However, they remain totally compatible with them in terms of connection and operation.

Designed for communication stations on the ground, they are a multi-mode and multi-frequency unit suited to various configurations, and of course support the traditional AM modulation mode (A3E).

Thanks to their modular design, maintenance of the equipment, by replacing defective subsets, is quick and easy.

There are two versions in each family of transmitters, with or without a Mains input:

- EM9000A-2G: VHF version with DC and mains inputs.
- EM9000C-2G: VHF version with DC input only.
- EM9010A-2G: UHF version with DC and mains inputs.
- EM9010C-2G: UHF version with DC input only.

In the following, terms as ***optional*** and ***pending*** are used to present some functionalities of the equipment. The common meaning for those terms is:

Optional: Functionality available with charge, not present by default on the radio.
Pending: Functionality not available, but for which the hardware of the equipment has been planned and designed.

The main characteristics of these transmitters are:

Frequency range:
- For the EM9000-2G: 118-144 MHz, *optional: 112-156 MHz.*
- For the EM9010-2G: 225-400 MHz.

Operating modes:

- For both VHF and UHF transmitters:
  - Voice in A3E mode, over different channel spacing (8.33 kHz or 25 kHz in VHF), (8.33 kHz, 12.5 kHz or 25 kHz in UHF),
  - *Optional: Voice transmission in F3E mode.*

- For the EM9000-2G VHF transmitter only:
  - *Provisions for voice transmission in G3E.*
  - *Provisions for data transmission in ACARS, VDL2 or VDL4 modes.*

- For the EM9010-2G UHF transmitter only:
  - *Provisions for data transmission in UDL2 mode.*

Other functions:

- Local or remote operation,
- Remote configuration and supervision by PC (through SNMP or JBUS RS485 protocol),
- Local configuration with Screen/Keyboard, or by ASCII/PC RS232 terminal,
- Complete IP interface for VoIP protocol,
- Digital processing of audio signal,
- Built-in tests,
- Internal protection against voltage surges, high temperatures and SWR,
- Direct current $+24V_{DC}$ input for the VHF EM9000-2G transmitter and $+28V_{DC}$ input for the UHF EM9010-2G transmitter from external batteries (operation ensured between 21V and 31V).
- On version A, Mains input also available (takes priority over the Battery input), automatic switching Mains ⇨ Battery in the event of mains failure.

2.2 PRESENTATION OF THE EQUIPMENT

2.2.1 Presentation of hardware

The multi-mode EM9000-2G VHF and EM9010-2G UHF transmitters are multi-module systems designed to be installed in a standard 19" rack, taking up a height of 3U.

They both have an identical structure, made up of a mechanical chassis to which the following modules and PCBs are fixed:

- The power supply module, located on the right side of the device. It is made up of a Mains and Battery monitoring and switching PCB *(in all versions)*, and an AC/DC convertor providing $+24V_{DC}$ from the Mains *(in EM9000A-2G and EM9010A-2G versions only)*. It is connected to the control PCB by a ribbon cable, and also to the VHF *(EM9000-2G)* or UHF *(EM9010-2G)* amplifier module by a power cord.
- The control PCB, located at the bottom of the device. It represents the node interconnecting the other elements of the transmitter.
- The Microprocessor-DSP module forming the management centre of the system, fitted on a mechanical support, perpendicular to the control PCB. It is connected to the control PCB by two more ribbon cables.

- The synthesizer module supplying the carrier, installed on the same mechanical support as the Microprocessor-DSP module, and hence also perpendicular to the control PCB. It is connected to the control PCB by a fourth ribbon cable.
- The amplifier module, VHF for the EM9000-2G, UHF for the EM9010-2G, which constitutes the left side of the equipment. It is also linked to the control PCB by two ribbon cables, but also to the power supply module by a power cord.
- The front panel management PCB, which groups together the local commands and signals. It is also linked to the control PCB, by a seventh ribbon cable.
- The display PCB that manages the Front panel Screen/Keyboard. This PCB is connected directly to the front panel management PCB.

A removable cover protects these sub-assemblies from the environment.

Functionally, each transmitter ensures:

- Modulation of the voice that it receives from the controller via a radio network (VCSS), or of the data that it receives from the upper layer of a communication system.
- Management of the various Human-Machine Interfaces (HMI) allowing configuration, operation, testing and local and remote supervision.
- Self-monitoring.

2.2.2 Presentation of software

The onboard software in the multi-mode EM9000-2G VHF or EM9010-2G UHF transmitter is designed around a real-time multi-process kernel used by the microcontroller of the Microprocessor/DSP module. After reading the configuration parameters, the microcontroller downloads the DSP software into its memory.

It is structured into a set of applications, which the aforementioned kernel manages and shares the resources required for them to execute correctly. These applications are themselves distributed in 2 important hardware components: a 32-bit MOTOROLA PowerQUICC I (MPC885) microcontroller, and a 16-bit ANALOG DEVICE (AD2191) DSP.

There are 4 applications, broken down as follows:

- 3 applications managed by the microcontroller:
  - Management of asynchronous serial, Ethernet and parallel links for communication with control components outside the transmitter,
  - Control and monitoring of the transmitter,
  - Management of the transmitter's HMI.

- 2 applications managed by the DSP:
  - Management of modulation
  - Management of the CODECs.

2.2.3 Different versions

Reference	*Name*	*TLD code*	*Description*
EM9000-2G	Digital VHF transmitter	80000086	Multi-mode VHF transmitter operating in A3E mode, (*F3E optional).*
EM9010-2G	Digital UHF transmitter	80300035	Multi-mode UHF transmitter operating in A3E mode, (*F3E optional).*

2.2.4 Sub-assemblies

2.2.4.1 Sub-assemblies common to the two transmitters

Reference	*Name*	*TLD code*	*Description*
PAVE41160	Front Panel	50001397	Mechanical support for screen, pushbuttons and indicator lights
CHEM41161	Chassis	50001398	Mechanical support for PCBs and modules
CTRL11217	Control PCB	51001183	AF interface, A/D conversions, electrical interfaces, generation of I and Q modulation commands, slaving, SWR protection, self-protection.
ALDC26264	DC power supply *(EM9000C-2G and EM9010C-2G versions only)*	52000642	Supply of internal DC voltage from the Battery input.
MIPR11005	Programmed µP / DSP PCB	53500015	µP processing and DSP

2.2.4.2 Sub-assemblies specific to the EM9000-2G

Reference	*Name*	*TLD code*	*Description*
SVHF25077	VHF synthesizer	52000620	Carrier generation
AMPV26260	VHF amplifier module	52000634	Modulated carrier power amplifier, RF filter, directional coupler, demodulated generation of I and Q signals.
ALIN26270	AC/DC power supply *(EM9000A-2G version)*	52000649	Supply of internal 24V, Mains/Battery monitoring and switching.

2.2.4.3 Sub-assemblies specific to the EM9010-2G

Reference	*Name*	*TLD code*	*Description*
SUHF25078	UHF synthesizer	52000621	Carrier generation
AMPU26246	UHF amplifier module	52000597	Modulated carrier power amplifier, RF filter, directional coupler, demodulated generation of I and Q signals.
ALIN26272	AC/DC power supply *(EM9010A-2G version)*	52000650	Supply of internal 28V, Mains/Battery monitoring and switching.

2.2.5 Options

2.2.5.1 EM9000-2G options

Reference	*Name*	*TLD code*	*Option type*	*Description*
ption A	EM9000A-2G	84500142	Compulsory	Multi-mode VHF transmitter with mains and battery inputs.
Option B	EM9000C-2G	84500143	Compulsory	Multi-mode VHF transmitter with battery input only.

2.2.5.2 EM9010-2G options

Reference	*Name*	*TLD code*	*Option type*	*Description*
ption A	EM9010A-2G	84500144	Compulsory	Multi-mode UHF transmitter with mains and battery inputs.
Option B	EM9010C-2G	84500145	Compulsory	Multi-mode UHF transmitter with battery input only.

2.2.6 Set of mobile plugs

Reference	*Name*	*TLD code*	*Description*
JFMEM90X0-2G	Set of EMC cables for EM90X0-2G	57001018	Set of mobile plugs and covers for connection of the equipment to its environment

2.2.7 Compatible equipment

Reference	*Name*	*TLD code*	*Description*
RE9000-2G	Digital VHF receiver	80100067	Multi-mode VHF receiver operating in A3E mode, *(F3E, ACARS and VDL2 optional or pending)*, in connection with the EM9000-2G
RE9010-2G	Digital UHF receiver	80100070	Multi-mode UHF receiver operating in A3E mode, *(F3E and UDL2 optional or pending)*, in connection with the EM9010-2G
PCR9008	Operator Console	60000011	Operator Console for remote operation in AM mode
BNS9008	Main / Stand-by Switching unit	81400040	Switching unit for 2 transmitters, one of which is a back-up for the other
CPV9000	2-transmitter coupling unit	80700103	Coupling unit for 2 transmitters operating on the same frequency

2.3 EQUIPMENT SPECIFICATIONS

2.3.1 Electrical characteristics

2.3.1.1 General characteristics

Characteristics	*Value*	
Operating modes .....:	***EM9000-2G VHF transmitter:***	***EM9010-2G UHF transmitter:***
	Basic: A3E.	Basic: A3E.
	Optional: F3E.	Optional: F3E.
	Pending: G3E / ACARS / VDL2 / VDL4.	*Pending: UDL2.*
Power supply.....:	Mains Input (version A only): 120/240V_{AC} ±10% at 47-63 Hz. Battery Input (versions A and C): ***EM9000-2G VHF transmitter:*** +24 V_{DC} (21-31 V_{DC}) ***EM9010-2G UHF transmitter:*** +28 V_{DC} (21-31 V_{DC})	
Consumption.....:	*(50W 80% AM-modulated carrier, typical values)* On +24V_{DC} / +28 V_{DC} Battery input: 14 A On 115V_{AC} Mains input: 3.9 A On 230V_{AC} Mains input: 2.2 A	
Antenna SWR .....:	Operation at nominal power until SWR of 2.	
Power reduction.....:	Gradual reduction in power: ❑ For an SWR > 2, ❑ For a power supply module or RF amplifier module temperature > 70°C, ❑ For a power supply voltage < 23.5V_{DC}.	
Local maintenance.....:	Various possible means of access: ❑ Front panel Screen / Keyboard ❑ Maintenance Connector by RS232 port 2 built-in Tests: continuous (CBIT) and initiated (IBIT) with results displayed on the local screen. Software update option. Configuration of operating parameters: Mode, Operational frequency, Output power, AF line sensitivity, PTT in band, DATA and JBUS parameters, service parameters. Measurements: Direct RF output power, RF power reflected by the antenna, SWR, AF input power, Power supply voltage, Temperature of VHF or UHF amplifier module and of Power supply module.	
Remote supervision .....:	By Ethernet connection, using SNMP protocol *Optional: Via RS485 serial link, using JBUS protocol.*	

2.3.1.2 Specifications for the EM9000-2G

2.3.1.2.1 A3E specifications

Measurement conditions as per EN 300 676-1 V1.5.1 and EN 300 676-2 V1.4.1 ETSI standards.

Characteristics	*Value*
Mode .....:	A3E
Frequency range .....:	Standard: 118-144 MHz *Optional: Extended to 112-156 MHz.*
Frequency stability .....:	< ±0.3 ppm (from -20°C to +55°C)
Channel spacing.....:	25 kHz and 8.33 kHz
Output power.....:	Programmable from 2 to 50W on 50Ω (33 to 47dBm), by 0.5dB steps.
Cyclical ratio.....:	100% between -20°C and +35°C in normal power supply conditions. Tx/Rx cycle: 1min/5mins in extreme temperature conditions.
Operation with multiple carriers (Offset frequency mode)	Compliant with ICAO appendix 10. 25kHz channel: Possible operation of up to 5 carriers, spaced by ±2.5kHz, ±4kHz, ±5kHz, ±7.3kHz, ±7.5kHz and ±8kHz. 8.33kHz channel: 2 carriers only, spaced by ±2.5kHz
Modulation.....:	Type: AM-DSB/WC, Ratio: ≥ 85%
Harmonic distortion *(m = 85%)*.....:	≤ 3%
Input AF level .....:	Adjustable from -30dBm to 0dBm, in 3dB steps. Maximum admissible level: +10dBm / 600Ω.
Regulation of compressor .....:	< 0.5dB for 30dB variation in the AF input level, at the compressor's action threshold.
AF bandwidth *(Ref 1kHz)*.....:	Channels at 25 kHz: -3dB from 300-3400Hz, < -40dB at 5kHz. Channels at 8.33 kHz: -3dB from 300-2500Hz, < -40dB at 3.2kHz.
Adjacent Channel Power (ACP) .....: *(channels at 8.33 and 25kHz)*	< -70dBc.
Spectral purity .....:	Harmonic lines < -36 dBm. Non-harmonic lines <-54 dBm.
Wide band noise (*at 1% of the carrier*):	< -150dBc/Hz.
Standby/Transmission switching time:	< 25ms.
PTT protection.....:	Programmable from 0 (deactivated) to 300s, by 5s step.

2.3.1.3 F3E specifications

Measurement conditions as per EN 300 086-1 V1.4.1 ETSI standard.

Note: *Do not take the following electrical characteristics into account if the F3E option has not been installed in the EM9000-2G transmitter.*

Characteristics	*Value*
Mode.....:	F3E.
Frequency range.....:	Standard: 118-144 MHz . *Optional: Extended to 112-156 MHz.*
Frequency stability.....:	< ±0.3 ppm (from -20°C to +55°C).
Channel spacing.....:	25 kHz.
Output power	Programmable from 7.5W to 75W on 50Ω (38.8dBm to 48.8dBm), by 0.5dB steps.
Cyclical ratio.....:	100% between -20°C and +35°C in normal power supply conditions. Tx/Rx cycle: 1min/5mins in extreme temperature conditions.
Modulation.....:	Type: FM, Frequency deviation: ±5.6kHz..
Harmonic distortion.....: ***(ΔF = 5.6kHz)***	< 10%.
Input AF level.....:	Adjustable from -30dBm to 0dBm, in 3dB steps. Maximum admissible level: +10dBm / 600Ω.
Regulation of compressor.....:	< 0.5dB for 30dB variation in the AF input level, at the compressor's action threshold.
AF bandwidth *(Ref 1kHz)*.....:	> -3dB from 300-3,400Hz, < -40dB at 5kHz.
Adjacent Channel Power (ACP).....:	≤ -60dBc.
Spectral purity.....:	Harmonic lines < -36 dBm. Non-harmonic lines <-54 dBm.
Wide band noise (*at 1% of the carrier*)	< -150dBc/Hz.
Standby/Transmission switching time	< 25ms.
PTT protection.....:	Programmable from 0 (deactivated) to 300s, by 5s step.

2.3.1.4 Specifications for the EM9010-2G

2.3.1.4.1 A3E specifications

Measurement conditions as per EN 302 617-1 V1.1.1 and EN 302 617-2 V1.5.1 ETSI standards for the 25kHz channels.

Characteristics	*Value*
Mode.....:	A3E.
Frequency range.....:	Standard: 225-400 MHz.
Frequency stability.....:	< ±0.3 ppm (from -20°C to +55°C).
Channel spacing.....:	25 kHz, 12.5 kHz and 8.33 kHz.
Output power.....:	Programmable from 5 to 50W on 50Ω (37 to 47dBm), by 0.5dB steps.
Cyclical ratio.....:	100% between -20°C and +35°C in normal power supply conditions.
Operation with multiple carriers .....: (Offset frequency mode)	In compliance with ICAO appendix 10. 25kHz channel: Possible operation of up to 5 carriers, spaced by ±2.5kHz, ±5kHz, ±7.3kHz and ±7.5kHz. 8.33kHz channel: no offset frequency mode available.
Modulation.....:	Type: AM-DSB/WC, Ratio: ≥ 85%.
Harmonic distortion *(m = 85%)*.....:	≤ 3%.
Input AF level .....:	Adjustable from -30dBm to 0dBm, in 3dB steps. Maximum admissible level: +10dBm / 600Ω.
Regulation of compressor .....:	< 0.5dB for 30dB variation in the AF input level, at the compressor's action threshold.
AF bandwidth *(Ref 1kHz)*.....:	Channels at 25 and 12.5 kHz: > -3dB from 300-3400Hz, < -40dB at 5kHz. Channels at 8.33 kHz: > -3dB from 300-2500Hz, < -40dB at 3.2kHz.
Adjacent Channel Power .....:	Channels at 25kHz: ≤ -70dBc. Channels at8.33 and 12.5kHz: ≤ -60dBc.
Spectral purity.....:	Harmonic lines < -80 dBc. Non-harmonic lines <-80 dBc.
Wide band noise (*at 1% of the carrier*)	< -150dBc/Hz.
PTT protection.....:	Programmable from 0 (deactivated) to 300s, by 5s steps.

2.3.1.5 F3E specifications

Measurement conditions as per EN 300 086-1 V1.4.1 ETSI standard.

Note: *Do not take the following electrical characteristics into account if the F3E option has not been installed in the EM9010-2G transmitter.*

Characteristics	*Value*
Mode.....:	F3E.
Frequency range.....:	Standard: 225-400 MHz.
Frequency stability.....:	< ±0.3 ppm (from -20°C to +55°C).
Channel spacing.....:	25 kHz and 12.5 kHz.
Output power.....:	Programmable from 7.5W to 75W on 50Ω (38.8dBm to 48.8dBm), by 0.5dB steps.
Cyclical ratio.....:	100% between -20°C and +35°C in normal power supply conditions. Tx/Rx cycle: 1min/5mins in extreme temperature conditions.
Modulation.....:	Type: FM, Frequency deviation: ±5.6kHz.
Harmonic distortion *(ΔF = 5.6kHz)*	< 10%.
Input AF level.....:	Adjustable from -30dBm to 0dBm, in 3dB steps. Maximum admissible level: +10dBm / 600Ω.
Regulation of compressor.....:	< 0.5dB for 30dB variation in the AF input level, at the compressor's action threshold.
AF bandwidth *(Ref 1kHz)*.....:	Channels at 12.5 and 25 kHz:: > -3dB from 300-3400Hz, < -40dB at 5kHz.
Adjacent Channel Power.....:	Channels at 12.5 and 25 kHz: ≤ -60dBc.
Spectral purity.....:	Harmonic lines: < -80dBc. Non-harmonic lines: < -110dBc beyond 5 MHz.
Wide band noise (at 1% of the carrier):	< -150dBc/Hz.
Standby/Transmission switching time:	< 25ms.
PTT protection.....:	Programmable from 0 (deactivated) to 300s, by 5s steps.

2.3.2 Mechanical characteristics

- *Mechanical dimensions of the EM9000-2G.....: see plate 45000060.*
- *Mechanical dimensions of the EM9010-2G.....: see plate 45000064.*

Weight .....: < 14 kg.

Since the equipment weighs approximately 14 kg, it is advisable to handle with care to avoid any injury to the back or any other body part.

2.3.3 Climatic and environmental specifications

Operating temperature .....: between -20°C and +55°C.
Relative humidity .....: 95% at 40°C (without condensation).
Storage temperature .....: from –40°C to +80°C.

CHAPTER 3. OPERATIONAL DESCRIPTION

3.1 SIMPLIFIED OPERATION

See Plate 46000124 EM9000-2G general diagram.
See Plate 46000147 EM9010-2G general diagram.

3.1.1 Presentation

The **EM9000-2G VHF** transmitter is a multi-mode transmitter that can operate in A3E and F3E. In accordance with these modes, it performs AM and FM type modulations.
The software and hardware resources of this equipment already allow future developments towards G3E, ACARS, VDL2 and VDL4 modes to be supported. In this case, the associated modulations are emphasized FM, AM-MSK, D8PSK and GFSK type.

The **EM9010-2G UHF** transmitter is also a multi-mode transmitter that also operates in A3E and F3E. It performs AM and FM type modulations.
Its software and hardware resources allow it to support future developments towards UDL2 mode, if necessary. In this case, the associated modulation is D8PSK type.

In each case, the transmitter is under complete digital control (microcontroller and DSP).
It also has two independent Ethernet ports, one to connect to a network, through the SNMP protocol, and the second allowing transfer of Voice over IP (VoIP).

3.1.2 Architecture

The EM9000-2G and EM9010-2G transmitters are made up of 8 main PCBs and modules, each with a specific function:

PCBs or Modules common to the 2 units:

PAVE41160	Front Panel
CHEM41161	Chassis
MIPR11005	µP / DSP programmed management PCB
CTRL11217	AF command PCB
ALDC26264	DC/DC power supply + REAL16102 switching PCB *(EM9000C-2G and EM9010C-2G versions)*

PCBs or Modules specific to the EM9000-2G:

SVHF25077	VHF synthesizer module
AMPV26260	VHF amplifier module
ALIN26270	AC/DC converter power supply + RALI16105 switching PCB *(EM9000A-2G version)*

PCBs or Modules specific to the EM9010-2G:

SUHF25078	UHF synthesizer module
AMPU26246	UHF amplifier module
ALIN26272	AC/DC converter power supply + RALI16107 switching PCB *(EM9010A-2G version)*

3.1.3 Functional description

3.1.3.1 Front panel PCB (PAVE41160)

The PAVE41160 front panel PCB first of all allows the unit's activity to be visualised through various indicator lights:

- Indication of the state of the power supplies (Presence of Mains and/or Battery inputs (version A only), device powered on),
- Indication of status of radio (Status, Alarm, Carrier Presence, Modulation Presence, Presence of SWR > 2),
- Indication of the activity of the serial links (JBUS, DATA).

It also provides an "RF Test" BNC connector, and gives the option to program the transmitter's operating parameters through a local screen/keyboard managed by the Display PCB, or through a Maintenance RS232 Sub-D connector.
Lastly, it allows local operation of the transmitter, through the AF microphone input and headphone output interfaces.

3.1.3.2 Chassis (CHEM41161)

This ensures the mechanical cohesion of the equipment, and also serves as a support to attach all the PCBs and modules that make up the transmitter. Internal organisation is such that, apart from the Maintenance connector available from the front panel, all of the power supply, antenna, operation and supervision connectors are located on the rear panel of the chassis, which means the equipment can be connected quickly, and is easy to control remotely.

3.1.3.3 µP / DSP PCB (MIPR11005)

Fitted with a microcontroller and a DSP, this PCB is the core of the transmitter. The main role of the microcontroller is to manage the different external communication ports (serial links, Ethernet port, etc.), and also the HMI, and the radio in general (programming the synthesizer, internal protection, built-in tests).

The DSP, for its part, takes charge of all modulation (AM, AM-MSK, D8PSK, FSK, GFSK) and data or voice encoding (ACARS, VDL2, VDL4, VoIP).

3.1.3.4 Control PCB (CTRL11217)

The essential function of the CTRL11217 PCB is to protect the VHF amplifier module, through slaving, SWR or temperature information.
It also contains the electrical interfaces and the connectors of the DATA and JBUS ports, as well as the AF interfaces, local and remote commands and information (600Ω AF line transformer, PTT management *(local, remote, test)*, microphone input, headphone output, test commands *(local and remote)*, measurements converter, information about carrier and modulation presence, management of internal protection (*temperature, internal voltages, PTT protection, slaving voltages)*).
Lastly, it constitutes the connection node with the other sub-assemblies.

3.1.3.5 VHF synthesizer module (SVHF25077) *(EM9000-2G only)*

The SVHF25077 module synthesizes a non-modulated VHF carrier which it then supplies to the AMPV26260 amplifier module.

3.1.3.6 UHF synthesizer module (SUHF25078) *(EM9010-2G only)*

The SUHF25078 module synthesizes a non-modulated UHF carrier which it then supplies to the AMPU26246 amplifier module.

3.1.3.7 VHF amplifier module (AMPV26260) *(EM9000-2G only)*

The AMPV26260 amplifier module is mainly made up of:

- Several power stages (exciter, pre-amplifier and amplifier),
- An I/Q modulator for carrier modulation,
- An I/Q demodulator to obtain feedback information from the slaving Cartesian loops,
- A power filter to filter carrier harmonics,
- Lastly, a directional coupler allowing "Direct power" and "Reflected power" type information to be obtained, to calculate the transmitted power, the modulation rate and the SWR.

3.1.3.8 UHF amplifier module (AMPU26246) *(EM9010-2G only)*

The AMPU26246 amplifier module has exactly the same structure as the VHF amplifier above. We therefore find the power stages, the I/Q modulator, the I/Q demodulator, the power filter and the directional coupler.

3.1.3.9 Uninterruptible power supply modules (ALIN26270) and (ALIN26272)

Present only on the EM9000A-2G version for the ALIN26270 module, and on the EM9010A-2G version for the ALIN26272 module, each one takes the Mains input and converts from the AC mains input to an internal $+24V_{DC}$ (EM9000A-2G) or $+28V_{DC}$ (EM9010A-2G) power supply.
Each module contains an RALI16105 (ALIN26270) or RALI16107 (ALIN26272) PCB whose role is to constantly monitor the "Mains" and "Battery" sources of the internal power supply, and automatically switch to the "Battery" source in the event of the "Mains" source being lost. If two sources are present, priority is given to the "Mains" source.
In order for the transmitter to operate in the best possible conditions, this PCB also manages a transmitter Inhibition command, active when the source selected is "Battery" and when the input voltage becomes lower than 18V *(Protection of batteries against a very low voltage)*.

3.1.3.10 DC power supply module (ALDC26264)

Present only in the EM9000C-2G and EM9010C-2G versions of the transmitters, this module is made up principally of the REAL16102 PCB, which represents a simplified version of the above RALI16105 or RALI16107 PCBs, associated with the rear connector. Its role is to constantly monitor the "Battery" source of the $+V_{DC}$ power supply, and to activate the transmitter inhibition command when this source becomes lower than 18V *(Protection of batteries against a very low voltage)*

CHAPTER 4. PRESENTATION OF EQUIPMENT

4.1 GENERAL DESCRIPTION

4.1.1 Presentation of front panel

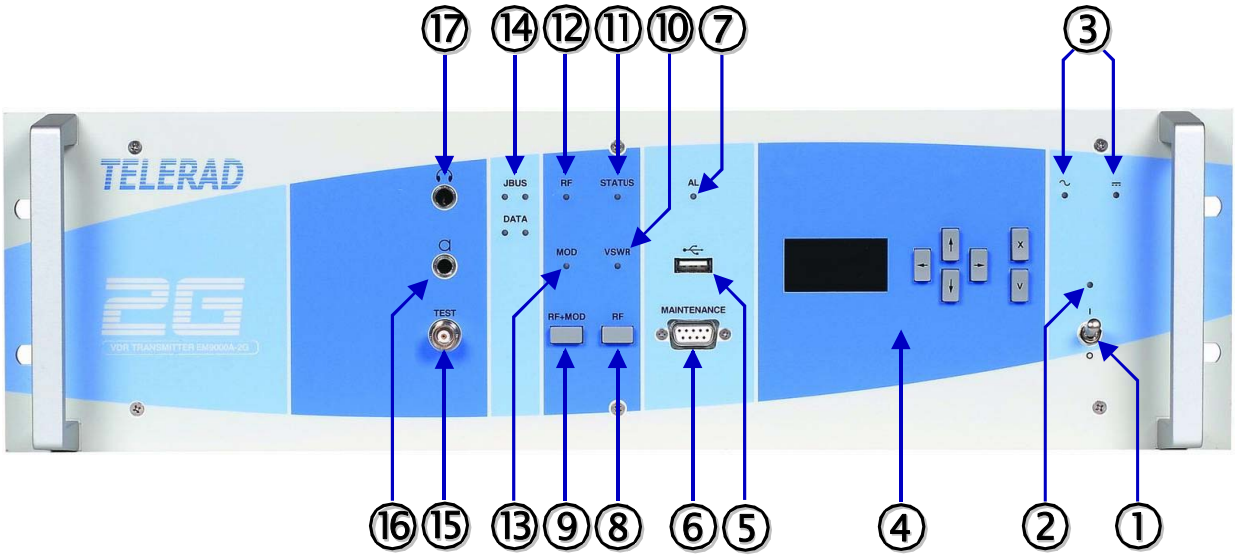


Figure 1 – Front panel

No.	***Front panel component:***	***Description:***
①	**On / Off Switch**	Locking switch allowing the transmitter to be powered on or off.
②	**+V= light indicator**	Indicates that the transmitter is powered on ($+V_{DC}$ present on the PCBs and modules).
③	**MAINS and BATTERY light indicators**	These light indicators indicate the presence of active power supply sources connected to the transmitter.
④	**Screen / Keyboard**	This local HMI mainly allows: • the transmitter's configuration parameters to be viewed and programmed, • displaying measurements, • launching the built-in test.
⑤	**USB connector**	*Provision for USB key connection*
⑥	**RS232 MAINTENANCE connector**	9-contact female Sub-D connector for connection to an ASCII terminal or a PC emulating a terminal.

No.	*Front panel component:*	*Description:*
⑦	● **ALARM light indicator**	This light indicator indicates an operating fault in the transmitter. It is on in one of the following conditions: • "Hardware" transmission inhibition, including the conditions: - ***REAL16102/RALI16105/RALI16107 PCB inhibition**, if the power supply level drops below 19V,* - ***Inhibition on PLL unlocking** or **RF Master Oscillator level too weak** in the synthesizer,* - ***Inhibition through external Inhibition Command** present on the operating connector,* • "Software" transmission inhibition, including the conditions: - ***DSP Alarm** on Reset or on "watchdog" triggering,* - ***CODEC or A/D converter or I/O expander or internal voltages Alarm,*** - ***High temperature** of the **AMPV26260** VHF or **AMPU26246** UHF Amplifier module or of the **ALIN26270** or **ALIN26272** power supply module, or of the **MIDS11216** microprocessor module.* - ***PTT protection** active.* • Low or High voltage detection *(cf.§ 0),* • Change of frequency *(Inhibition for **100ms**),* • Loss of direct power transmitted without SWR detected (< -2dB of P_n during testing, < -3dB of P_n during operation), • Loss of modulation (< 75% during testing, < 30% during operation), • Detection of operation on infinite SWR, • Fault detected by the built-in test, • Software updates in progress *(Test leds running during the software upload).*
⑧	**Test RF pushbutton**	Allows a non-modulated Carrier to be generated on the Antenna output of the transmitter, as well as on the "RF Test" output. Used to measure the Carrier frequency using an external frequency meter.
⑨	**Test RF+MOD pushbutton**	Allows a test of the transmitter to be triggered, the conditions of which depend on the operating mode: • A3E mode: Transmission of a **Carrier 85% AM-modulated** by a **1kHz internal AF.** • F3E mode: Transmission of a **Carrier Δf = ±5.6kHz FM-modulated** by a **1kHz internal AF.**
⑩	● **SWR presence light indicator**	Indicates the instantaneous detection by the transmitter of an SWR level ≥ 2.

No.	*Front panel component:*	*Description:*
⑪	● **STATUS light indicator**	Indicates the status of the transmitter and is on as soon as the transmitter is ready to transmit. The conditions for the indicator light to turn off are: • ***On/Off Command*** set to ***"OFF".*** • "Hardware" transmission inhibition, including the conditions: - ***REAL16102/RALI16105/RALI16107 PCB inhibition****, if the power supply level drops below 19V,* - ***Inhibition through external Inhibition Command*** *present on the operating connector,* • "Software" transmission inhibition, including the conditions: - ***DSP Alarm*** *on Reset or on "watchdog triggering,* - ***Inhibition on PLL unlocking*** *or* ***RF Master Oscillator level too weak*** *in the synthesizer,* - ***High temperature*** *of the* ***AMPV26260*** *VHF or* ***AMPU26246*** *UHF Amplifier module or of the* ***ALIN26270*** *or* ***ALIN26272*** *power supply module,* - ***PTT protection*** *active.* • Change of operational frequency,
⑫	● **CARRIER PRESENCE light indicator**	Indicates that the transmitter detects a Carrier on its Antenna output *(Detection level: P_n – 3dB during operation, P_n – 2dB during testing).*
⑬	● **MODULATION PRESENCE light indicator**	Indicates that the transmitter detects a modulated Carrier on its Antenna output. The detection condition depends on the Operating mode: • A3E mode: modulation > 30% during operation and 75% during testing. • F3E mode: Idem.
⑭	● **TxD and** ● **RxD for JBUS and DATA links light indicators**	These light indicators blink following the rhythm of the activity when the JBUS (J2 connector) and DATA (J5 connector) links are transmitting and receiving data.
⑮	**RF TEST BNC connector**	This connector provides a sample of the output of the AMPV26260 VHF or AMPU26246 UHF amplifier module. By connecting an external frequency meter, it is possible to measure its frequency, and, if necessary, to adjust its precision. Output level: ≈ 0dBm at P_n = 50W/50Ω).
⑯	**Jack Connector MICROPHONE** ☋	Jack connector for microphone plug type ELNO JK33 (ref. TLD: 150 00164, PL 68-301 plug (ref. TLD: 150 00145), 5.25 mm. diameter It allows the transmitter to be used from the front panel, but only in A3E mode.

No.	*Front panel component:*	*Description:*
⑯	**Jack Connector MICROPHONE (cont.)**	Two kinds of microphones can be used: - ***Dynamic microphone*** *low level,* - ***Static microphone*** *high level, carbon compatible.* The selection is made through a software command.

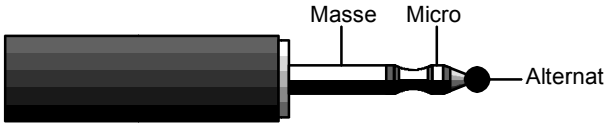


Figure 2 – JACK connector for microphone

⑰	**HEADPHONE Jack connector**	Jack connector for headphone plug type ELNO JK34 (ref. TLD: 150 00163), PL55-300 (ref. TLD: 150 00146) or RR60900 (TOTEM), 6.35 mm diameter. It allows the demodulated AF signal to be listened to locally. The Loudspeaker output (12) is automatically cut off as soon as headphones are connected. Headphone impedance: 600Ω.

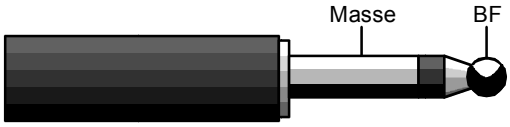


Figure 3 – JACK connector for headphones

4.1.1.1 Management of the « Alarm » led vs the power supply voltage :

The transmitter can go on transmission only if the power supply voltage is between two values, a minimum and a maximum. The following flowchart displays how the alarm led is managed depending on the supply voltage changes, as well as the going-on-transmission enabling or disabling :

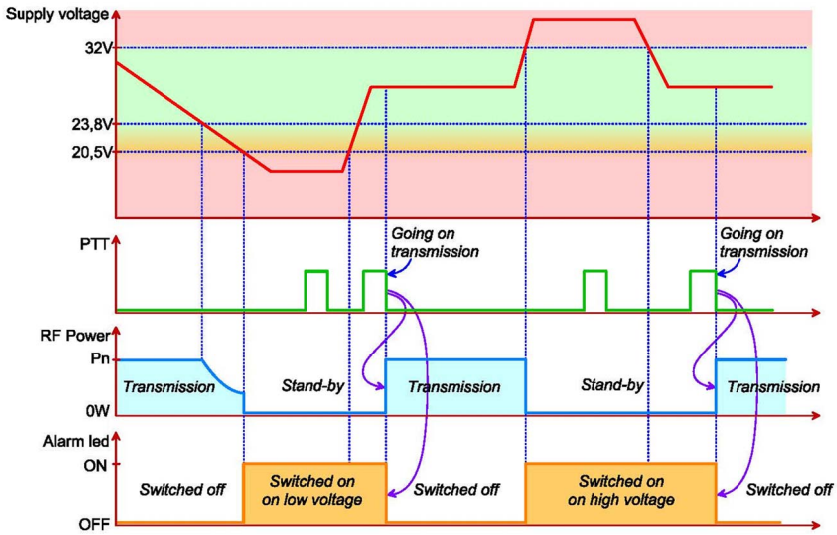


Figure 4 - Management of the "ALARM" led

4.1.2 Presentation of rear panel

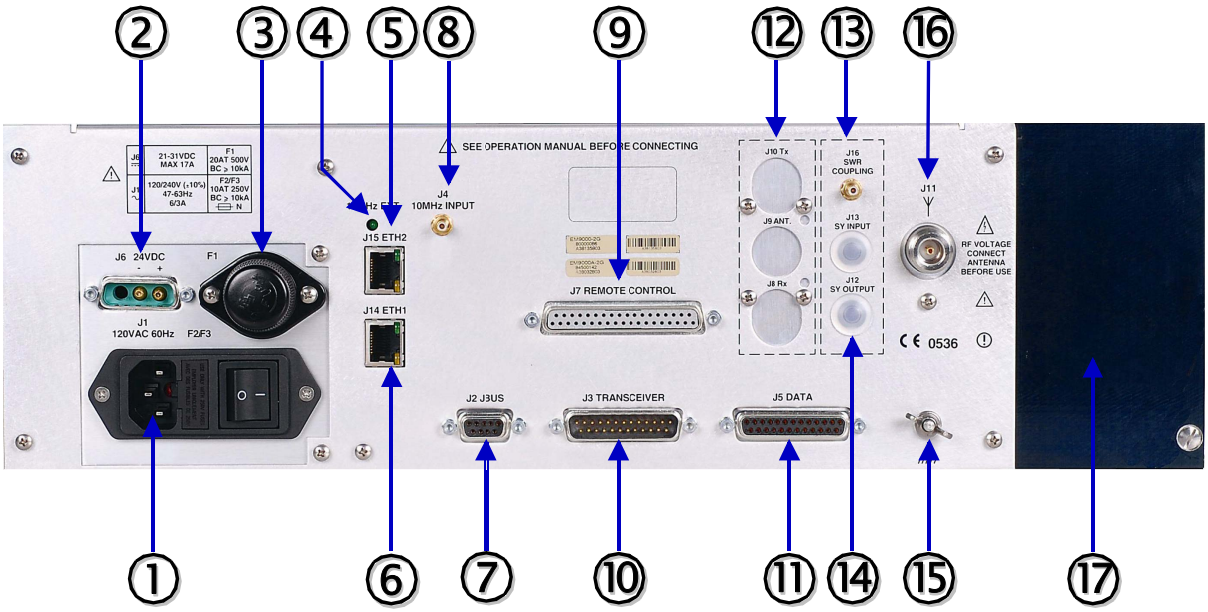


Figure 5 – Rear panel

No.	***Rear panel component:***	***Description:***
①	**J1 Connector : Mains power supply input**	$110V_{AC}$ / $220V_{AC}$ mains power supply input, only present on EM9000A-2G and EM9010A-2G versions. It includes: ▪ A CEI950 Phase/Neutral/Earth 3-pin plug, ▪ A mains EMC filter, ▪ An On ⏽ / Off ○ switch, ▪ Two 10A/250V slow-blow fuses, on phase and neutral, *Reference FST5x20/10A (Telerad code: 210 00012).*
②	**J6 Connector: Battery power supply input**	$+V_{DC}$ battery input connector, present on all EM9000C-2G, EM9000A-2G, EM9010C-2G and EM9010A-2G versions. Receives the $+V_{DC}$ power supply from a battery or external power station, required for the transmitter to operate. On the EM9000A-2G and EM9010A-2G versions, in the event of failure of the Mains input, the transmitter automatically switches over to this input.
③	**F1 Fuse: Battery input protection**	Battery input protective fuse. It is a 20A slow-blow fuse, with dimensions 10.3x38mm, on the positive of the DC power supply. *Reference D20TD/20A (Telerad code: 210 00126).*
④	**● EXTERNAL 10MHz light indicator**	This light indicator is lit when an external 10MHz oscillator is present and used as a reference to generate the RF Masre Oscillator.

No.	*Rear panel component:*	*Description:*
⑤	**J15 Connector: fitted with 2 light indicators TxD and RxD for ETHERNET 2 link**	RJ45 connector representing the data transfer DTE/DCE interface with the upper layers of a communication system. It is used within the context of data transfer using the VoIP or SNMP protocol. The associated indicator lights view activity on this port.
⑥	**J14 Connector: fitted with 2 light indicators TxD and RxD for ETHERNET 1 link**	Same as connector J15. It is used within the context of data transfer using the VoIP or SNMP protocol. The associated indicator lights view activity on this port.
⑦	**J2 Connector: JBUS link**	9-contact female Sub-D connector allowing the transmitter to be connected to a remote supervision system operating using the JBUS protocol.
⑧	**J4 Connector: 10MHz INPUT**	SMA type connector that receives an external 10MHz reference oscillator, which can be used by the SVHF25077 or SUHF25078 Synthesizer modules to generate the RF Master Oscillator.
⑨	**J7 Connector: OPERATION**	37-contact female Sub-D connector supplying, on the input, all the remote transmitter operating commands, and also of any associated receiver, in the event of a Transceiver type configuration, and, on the output, all the information required to control the operation of the transmitter, as well as that of any associated receiver, in the event of a Transceiver type configuration.
⑩	**J3 Connector: TRANSCEIVER**	In the event of a Transceiver type configuration, 25-contact male SUB-D connector linked to the receiver. Internally linked inside the transmitter to part of the signals of the J7 operating connector, it supplies on the input all the remote operating commands of the associated receiver, and on the output all the information required to control its operation.
⑪	**J5 Connector: DATA**	25-contact female Sub-D connector representing the data transfer DTE/DCE interface with the upper layers of a communication system. It is only used in data transmission digital modes, to send the data received from the application level. The electrical interface is RS485 type.
⑫	**J8 *Rx*, J9 *ANT.*, J10 *Tx* connectors: Antenna coaxial relay for Transmission/Reception configuration**	N female connectors allowing connection of a transceiver assembly to a transmission/reception antenna. The receiver's antenna input is connected to J8, the transmitter's antenna output to J10, and the transmission/reception antenna to J9. The relay power supply and the command signal *(deduced from the PTT command)* are supplied by the transmitter.

No.	*Rear panel component:*	*Description:*
⑬	**J16 connector: SWR COUPLING**	In the case of a coupled configuration of two transmitters, SMB connector linking the SWR detections of each transmitter together, so that the power reduction of one of the two transmitters, linked to an SWR detection, is transmitted to the other transmitter, and thus maintains the balance of the coupling. *For the principle of the coupling of two transmitters, refer to TELERAD CPV9000 transmission coupling unit manual (Telerad ref: NMAFR 40400914 V1.05 CPV9000).*
⑭	**J12 *SY OUTPUT*, J13 *SY INPUT* connectors: RF MASTER OSCILLATOR INPUT/OUTPUT**	Also used in the case of a coupled configuration of two transmitters, each transmitter transmits its RF Master Oscillator to the coupler *(CPV9000)* through the "SY OUTPUT" BNC connector, and the coupler sends the comon RF Master Oscillator to the two transmitters on their "SY INPUT" BNC connector. *For the principle of the coupling of two transmitters, refer to TELERAD CPV9000 transmission coupling unit manual (Telerad ref: NMAFR 40400914 V1.05 CPV9000).*
⑮	**Protective earth terminal**	4mm diameter wing screw, allowing protective earthing of the equipment chassis. The minimum cross-section of the wire used must be 2.5mm². This connection must be made before any other connection, and must be disconnected last. It is also recommended to check the earth continuity regularly.
⑯	**J11 connector: ANTENNA OUTPUT**	N female connector allowing connection of the transmitter to a transmission antenna. *Always connect this connector to the transmission antenna before the equipment is used: Presence of RF voltages tha can cause serious burns.*
⑰	**Radiator**	Radiator associated with AMPV26260 VHF or AMPU26246 UHF Amplifier module, allowing it to be cooled by natural ventilation. *The radiator may be hot and cause burns.*

4.2 DESCRIPTION OF CONNECTORS

4.2.1 Front panel connectors

4.2.1.1 MAINTENANCE connector

9-contact female SUB-D connector .....DEP09S300……..... Ref. Telerad (150 00385)
SUB-D 9 male contact mobile plug .....DEP09P……..... Ref. Telerad (150 00023)
Protective cover .....8630-3637A ..... Ref. Telerad (150 00152)

The table below gives the list of signals available on this connector:

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
1	/	Not used	/	/	/
2	I	RxD	J	RS232 maintenance serial link: Data reception. Input level: ±12V.	127
3	O	TxD	K	RS232 maintenance serial link: Data transmission. Output level: max. ±15V.	128
4	O	DTR	L	RS232 maintenance serial link: Data terminal ready. Output level: +12V.	123
5	I	Logic ground	GND1	Linked to the ground of the transmitter	/
6	I	DSR	M	RS232 maintenance serial link: Data set ready. Input level: +9V to +12V when a RS232 terminal is present.	127
7,8,9	/	Not used	/	/	/

4.2.2 Rear panel connectors

4.2.2.1 J1 MAINS POWER SUPPLY connector

Note: *This connector is only present on the EM9000A-2G and EM9010A-2G versions of the digital transmitters.*

Filtered mains connector……..FN 282-6-06 ..... Ref. Telerad (370 00207)
Mobile plug: see standard mains cord…3020-4360B..... Ref. Telerad (275 00011)
(Length 2.5m, fitted with IEC female connector)

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
1	I	Neutral	/	Marked N on the mobile plug, it corresponds to the mains return circuit	/
2	I	Phase	/	Marked L on the mobile plug, it corresponds to the mains phase providing alternating current	/
3	I	Earth	/	Marked ⏚ on the mobile plug, it earths the connected device.	/

The "Phase" and "Neutral" inputs are protected by 10A/250V slow-blow fuses, dimensions 5x20mm, reference FST5x20/10A (Telerad Code: 210 00012).

4.2.2.2 J6 $+V_{DC}$ BATTERY POWER SUPPLY connector

3-contact male SUB-D15 connector part……CBD 3W3 M0000Z ..... Ref. Telerad (150 01033)
3-contact female SUB-D15 mobile plug part…..CBD 3W3 F0000X..... Ref. Telerad (150 01034)
Metal protective cover ……FMH2……. ..... Ref. Telerad (150 01121)

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
A1	I	+V = Battery	$+V_{DC}$	$+24V_{DC}$ (VHF transmitter) or $+28V_{DC}$ (UHF transmitter) input, current protected by external fuse, and voltage protected by Tranzorb SM6T33A.	/
A2	I	Electrical ground	GND	Input – of the power supply linked to the electrical ground of the equipment.	/
A3	/	/	/	Not used	/

The "+V= Battery" $+V_{DC}$ input is protected by a 20A/250V F1 slow-blow fuse with dimensions 10.3x38mm, reference D20TD/20A (Telerad Code: 210 00126).

4.2.2.3 J2 SUPERVISION connector

9-contact female SUB-D connector .....DEP09S500…..... Ref. Telerad (150 00503)
9 contact male SUB-D mobile plug .....DEP09P……..... Ref. Telerad (150 00023)
Protective cover .....8630-3637A ..... Ref. Telerad (150 00152)

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
1-2	/	Not used	/	/	/
3	I	Ground	GND	General ground for the equipment	/
4	O	TxD2 A	AA1	JBUS link: Data Transmission +. RS485 not inverted output. Logical level: 0/5V.	114
5	O	TxD2 B	AA2	JBUS link: Data Transmission -. RS485 inverted output. Logical level: 0/5V.	114
6-7	/	Not used	/	/	/
8	I	RxD2 A	AB1	JBUS link: Data Reception +. RS485 not inverted input. Logical level: 0/5V.	115
9	I	RxD2 B	AB2	JBUS link: Data Reception -. RS485 inverted input. Logical level: 0/5V.	115

4.2.2.4 J3 TRANSCEIVER connector

25-contact male SUB-D connector .....DEP-25P-500 ..... TELERAD P/N (150 00408)
25-contact female SUB-D mobile plug.....DEP25S..... TELERAD P/N (150 00275)
Protective cover .....8630-3639A ..... TELERAD P/N (150 00153)

☞ ***Notes:*** *All the signals present on this connector relate to a receiver, and are directly linked to the **J7** operating connector of the transmitter, in order to allow complete operation of a transceiver assembly from a single connector. They are also **compatible pin to pin** with the **J3** operating connector of an RE9000-2G or RE9010-2G receiver.*

For connection in Transceiver configuration, see § 5.6 "Connection in transceiver configuration".

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
1	I	Ground	GND	General ground for the equipment	/
2	I	AF+ reception input	CW1	AF+ reception signal on 600Ω symmetrical transformer on 2 wires (see contact no. 15). Output level programmable by the receiver: between –11 and +10 dBm/600Ω.	116
3	I	Field Voltage	CU1	Direct current analog voltage whose value depends on the level of the signal received on the receiver's antenna input. Level: between 1 and 3V, corresponding to a received level between –110dBm and +10dBm (0.7µV and 0.7V / 50Ω).	117
4	I	AF recorder	CV2	600Ω asymmetric AF output to recorder. Level: 0dBm for 30% modulation of carrier.	117
5	I	Information Call A	BX	Side A of a call contact, potential-free. Contact closed on pin no. 17 for call present.	118
6	I	Receiver Alarm Information	CN2	Indicates an operating fault in the receiver. Supplied in the form of saturated open collector to ground for "Alarm".	119
7	O	Output power supply +V=.	PWR9	In a Transceiver configuration, $+V_{DC}$ output protected by 1.5A *(F7)* and Tranzorb *(CR161)* resettable fuse. A 1N4007 diode *(CR151)* protects the transmitter against a return of the power supply from the receiver to the transmitter. Level: between 21 and 31V.	122
8	O	JBUS A inhibition	DH1	In a Main/Stand-by configuration, command to inhibit the receiver that is not selected, with regard to JBUS commands. RS485 input not reversed. Logical level: 0/5V.	114
9	I	RxD4A Transceiver Link	Z1	Transceiver Link: Data Reception +. RS485 not inverted output. Logical level: 0/5V.	115
10	I	CSMA Channel access busy	CJ1	Used in ACARS and VDL2 modes when they are available. Indicates to the upper level that the channel is not available. Supplied by the associated receiver in the form of saturated open drain to ground for "channel obstructed".	119
11	O	Receiver On/Off Command	CM1	Remote On/Off Control of the receiver authorising it to receive or not, in A3E mode. Connected to ground for "On"	11
12	O	TxD4A Transceiver Link	Q1	Transceiver Link: Data Transmission +. RS485 not inverted output. Logical level: 0/5V.	114
13	O	Receiver desensitisation	DL	Desensitisation command. Acts on the receiver's AGC command, to desensitise it. Connected to ground for active command.	11

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
14	I	Receiver On/Off Information	CL1	Status of previous remote On/Off command, viewed by the receiver. Supplied in the form of saturated open collector to ground for "On".	119
15	I	AF - reception input	CW2	AF - reception signal. See contact no. 2.	116
16	I	Receiver Proper operation information	CN1	Indicates that the receiver is functioning normally. Supplied in the form of saturated open collector to ground for "OK".	119
17	I	Information Call B	BY	Side B of a call contact, potential-free. Contact closed on pin no. 5 for call present.	118
18	O	PTT feedback/ CSMA transmission request	CI1	In A3E or F3E mode: PTT feedback. In ACARS, VDL2 or UDL2 mode: CSMA transmission request by the associated transmitter. Supplied in the form of saturated open collector to ground for transmission (A3E, F3E), or CSMA transmission request (ACARS, VDL2, UDL2)	10
19	I	CSMA transmission authorisation	CK1	In ACARS, VDL2 or UDL2 mode, indication to the associated transmitter that the channel is free for transmission. Supplied in the form of ground contact for "channel free".	11
20	O	JBUS B inhibition	DH2	Same as pin no. 8. RS485 inverted input. Logical level: 0/5V.	114
21	I	RxD4B Transceiver Link	Z2	Transceiver Link: Data Reception -. RS485 inverted output. Logical level: 0/5V.	115
22	O	Remote squelch command	BN1	Remote squelch command. Supplied in the form of ground contact for "Squelch active".	10
23	I	Logic ground	GND	General ground for the equipment	/
24	O	TxD4B Transceiver Link	Q2	Transceiver Link: Data Transmission -. RS485 inverted output. Logical level: 0/5V.	114
25	I	Receiver presence	DK	In a Transceiver configuration, used by the associated transmitter to detect the presence of the receiver. Supplied in the form of ground contact for “Receiver present”.	114

4.2.2.5 J4 10MHz INPUT connector

Female SMA type coaxial connector.
Used to connect an external 10 MHz reference.
Level: 4 dBm ± 3dB.

4.2.2.6 J5 DATA connector

25-contact female SUB-D connector .....DBP-25S-500..... Ref. Telerad (150 00229)
25-contact male SUB-D mobile plug.....DBP-25P ..... Ref. Telerad (150 00149)
Protective cover .....8630-3639A…….. Ref. Telerad (150 00153)

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
1	/	Not used	/	/	/
2	O	TXD3 A serial link	L1	DATA link: Data Transmission+. RS485 not inverted output. Logical level: 0/5V.	114
3	I	RXD3 A serial link	M1	DATA link: Data Reception +. RS485 not inverted input. Logical level: 0/5V.	115
4	O	Serial link RTS3 A	N1	DATA link: Request To Send+ RS485 not inverted output. Logical level: 0/5V.	114
5	I	Serial link CTS3 A	O1	DATA link: Clear To Send+ RS485 not inverted output. Logical level: 0/5V.	115
6	I	1PPS A	P1	Synchronisation 1 Pulse Per Second. RS485 not inverted output. Logical level: 0/5V.	115
7	I	Ground	GND	General ground	/
8	O	+5V digital	PWR2	Digital +5V power supply output protected by 1.1A resettable fuse.	
14	O	TXD3 B serial link	L2	DATA link: Data Transmission -. RS485 inverted output. Logical level: 0/5V.	114
15	I	RXD3 B serial link	M2	DATA link: Data Reception -. RS485 inverted input. Logical level: 0/5V.	115
16	O	Serial link RTS3 B	N2	DATA link: Request To Send-. RS485 inverted output. Logical level: 0/5V.	114
17	I	Serial link CTS3 B	O2	DATA link: Clear To Send-. RS485 inverted output. Logical level: 0/5V.	115
18	I	1PPS B	P2	Synchronisation 1 Pulse Per Second. RS485 inverted output. Logical level: 0/5V.	115
9 to 13, 19 to 25	/	Not used	/	/	/

4.2.2.7 J7 OPERATING UNIT connector

25-contact male SUB-D connector…….DEP25P-500 ..... Ref. Telerad (150 00408)
25-contact female SUB-D mobile plug.….DEP25S ..... Ref. Telerad (150 00275)
Protective cover ..... 8630-3639A ..... Ref. Telerad (150 00153)

☞ ***Note:*** *In the following table, the first group of contacts represents the pin configuration for operation of a receiver in a Transceiver configuration. The second group of contacts represents the signals common to the transmitter and the receiver in a Transceiver configuration, or to the transmitter alone. The third group of contacts represents the pin configuration for operation of a transmitter.*

The greyed-out contacts represent the minimum connection required for operation of the transmitter.

1st group: Signals relating to a receiver, in Transceiver configuration:

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
1	I	Ground	GND	General ground for the equipment	/
2	O	AF+ reception output	CW1	AF+ Reception signal. Output to 600Ω symmetrical transformer on 2 wires (see contact no. 21). Output level programmable by the receiver: between –11 and +10 dBm/600Ω.	116
3	O	Field Voltage	CU1	Direct current analog voltage whose value depends on the level of the signal received on the receiver's antenna input. Level: between 1 and 3V, corresponding to a received level between –110dBm and +10dBm (0.7µV and 0.7V / 50Ω).	117
5	O	Information Call A	BX	Side A of a call contact, potential-free. Contact closed on pin no. 23 for call present.	118
19	O	Remote squelch command	BN1	Remote squelch command. Ground for "Squelch inactive".	11
21	O	AF- reception output	CW2	AF- reception signal. See contact no. 2.	116
23	O	Information Call B	BY	Side B of a call contact, potential-free. Contact closed on pin no. 5 for call present.	118
28	I	Receiver desensitisation	DL	Desensitisation command. Acts on the receiver's AGC command, to desensitise it. Connected to ground for active command.	11

2nd group: Signals common to a transmitter and a receiver in Transceiver configuration, or to the transmitter alone:

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
4	O	Tx + Rx AF recorder	DM	600Ω asymmetric AF output to recorder. Level: 0dBm for 80% modulation in transmission, 30% modulation in reception.	120
8	I	Tx + Rx JBUS A inhibition	DH1	In a Main/Stand-by configuration, command to inhibit the transmitter, and receiver of a transceiver configuration, that are not selected, with regard to JBUS commands. RS485 not inverted input. Logical level: 0/5V.	56
11	I	Tx + Rx On/Off Command	CM1	In A3E mode, remote On/Off Command of the transmitter and receiver of a transceiver configuration, authorising to transmit or not, and to receive or not. Connected to ground for "On"	11
20	O	Tx + Rx On/Off Information	CL4	Status of above remote On/Off command , or of the software On/Off command seen by the transmitter and receiver, in a transceiver configuration. Output on saturated open collector to ground for "On".	51
22	O	Tx + Rx Proper Operation Information	CN6	Indicates that the transmitter and receiver of a transceiver configuration are functioning correctly. Output on saturated open collector to ground for "OK".	51
26	I	Tx + Rx JBUS B inhibition	DH2	Same as pin no. 8. RS485 inverted input. Logical level: 0/5V.	56

3rd group: Signals relating to the transmitter:

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
6	O	Transmitter Alarm Information	CN4	Indicates an operating fault in the transmitter Output on saturated open collector to ground for "Alarm".	121
7	O	Power supply output +V=	PWR4	$+V_{DC}$ output protected by 1.5A resettable fuse *(F3)* and Tranzorb *(CR41)*. A 1N4007 diode *(CR43)* protects the transmitter against a return of the power supply from external equipment through this pin. Level: between 21 and 31V.	122
9	I	Carrier Test remote command	BR2	Remote command allowing triggering of a non-modulated carrier transmission test. Wired in logical OR with the local command available on the front panel of the transmitter. Connected to ground for "Carrier Test".	
10	/	Not used	/	/	/
12	I	Synthesizer Inhibition Command	BM1	In a configuration with two coupled transmitters, this command allows the RF Master Oscillator not adopted by the coupler to be inhibited. Connected to ground for "Inhibition".	
13	O	SWR information	BP1	Indicates the presence of SWR ≥ 2 on the transmitter antenna output. This information is stored when SWR appears and reset to zero on each change to PTT or on "Off/On" transition of the On/Off command. Connected to ground for "SWR ≥ 2".	51
14	O	External fan command	CR1	Allows an external fan to be started in the event that natural ventilation by the radiator becomes insufficient. Output on saturated open power collector to ground for "command active".	124
15	O	Carrier Presence Information	BS1	Indicates that the transmitter has detected a carrier on its antenna output. The detection threshold corresponds to P_n – 3dB. Output on saturated open collector to ground for "Carrier Present".	119
16	I	AF+ modulation input	DN	Remote AF+ modulation signal. Input to 600Ω symmetrical transformer on 2 wires (see contact no. 35). Input level programmable by the transmitter: between -30 and 0 dBm/600Ω.	125
35	I	AF- modulation input	DO	Remote AF- modulation signal. See contact no. 16.	125
17	I	Logic ground	GND	General ground for the equipment	/

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
18	O	Modulation Information	BT1	Indicates that the transmitter has detected a modulated carrier on its antenna output. The detection threshold corresponds to 30% of modulation. Output on saturated open collector to ground for "Modulation Present".	119
24	O	PTT feedback	DQ	Indicates the transmitter's standby or transmission status. Signal in phase on switching to transmission, delayed by 700µs on switching to standby, it is used internally to command the antenna coaxial relay optionally present on the rear of the transmitter. Output on saturated open collector to ground for "Transmission".	/
25	I	Transmitter Test remote command	BZ2	Remote command allowing triggering of a modulated carrier transmission test. Wired in logical OR with the local command available on the front panel of the transmitter. Connected to ground for "Test".	11
27	I	Normal power command	BN2	In a configuration with two coupled transmitters, in the event of failure of one of the two transmitters, it allows the uninhibited transmitter to be forced to its 50W nominal power. Connected to ground for "Nominal power".	11
29	I	Logic ground	GND	General ground for the equipment	/
30	O	Synthesizer Alarm Information	G1	Indicates that the SVHF25077 synthesizer module associated with the transmitter is unlocked or that the RF Master Oscillator level is too weak. Output on saturated open drain to ground for "Alarm".	
31	/	Not used	/	/	/
32	I	Remote PTT command	BP	Corresponds to the PTT command coming from the VCSS. Contact to ground for "Transmission".	125
33	I	Transmission Inhibition Command	BQ1	Forces the transmitter into standby in all modes. Connected to ground for "Inhibition".	11
34	/	Not used	/	/	/
36	I	PTT protection locking command	BO1	Inhibits the PTT protection locally or remotely activated by software. Connected to ground for "PTT protection inhibition".	11
37	I	Ground	GND	General ground for the equipment	/

4.2.2.8 J8, J9 and J10 COAXIAL RELAY connectors

N female coaxial connectors	R161 252	Ref. Telerad (16000133)
N male coaxial mobile plugs	UG1185A/U	Ref. Telerad (16000047)

☞ ***Note:*** *This relay is available as an option in two versions:*
- *Option B: electromechanical relay. Ref Telerad: RECX56016, code: 58500053.*
- *Option C: fast static relay. Ref Telerad: RECX56012, code: 58500046.*

4.2.2.9 J11 RF ANTENNA connector

N female coaxial connector	R161 252	Ref. Telerad (16000133)
N male coaxial mobile plug	UG1185A/U	Ref. Telerad (16000047)

Allows the transmitter to be connected to an antenna through a suitable 50Ω coaxial cable.

4.2.2.10 J12 SY OUTPUT connector

Female BNC coaxial connector fitted on W6-equipped coaxial cable	R141306	Ref. Telerad (280 01116)
Male BNC coaxial mobile plug	R141007	Ref. Telerad (160.00046)

Used in a configuration with two coupled transmitters, it allows the RF Master Oscillator of the corresponding transmitter to be provided to the associated CPV9000 coupling unit.

4.2.2.11 J13 SY INPUT connector

Female BNC coaxial connector fitted on W7-equipped coaxial cable	R141306	Ref. Telerad (280 01117)
Male BNC coaxial mobile plug	R141007	Ref. Telerad (160.00046)

Used in a configuration with two coupled transmitters, it allows recovery of the RF Master Oscillator provided to the 2 transmitters by the associated CPV9000 coupling unit.

4.2.2.12 J14 and J15 ETHERNET connectors

Female RJ45 connector MODS-F-8P8C-1-S4-G-Y-TH Ref. Telerad (150.01349)
Ethernet link connectors for data transfer using SNMP or VoIP protocol.

4.2.2.13 J16 SWR COUPLING connector

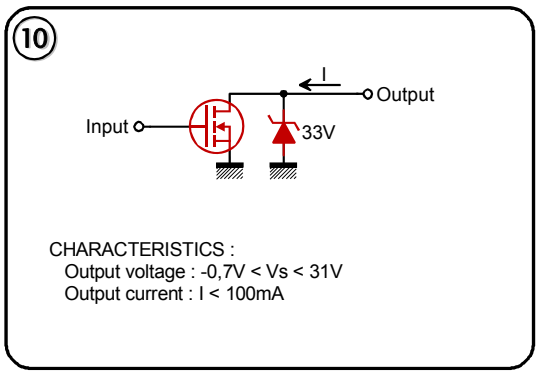
SMB female coaxial connector	R114305	Ref. Telerad (160.00073)
SMB male coaxial mobile plug	R114003	Ref. Telerad (160.00095)

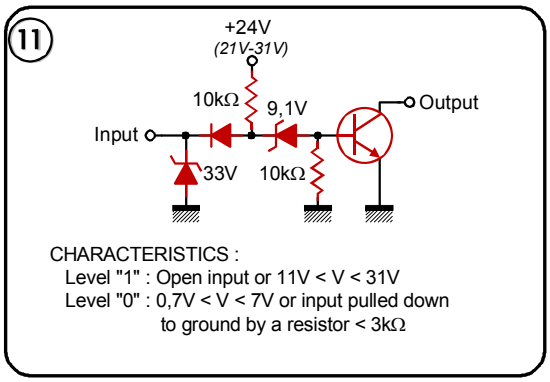
Used in a configuration with two coupled transmitters, it allows the SWR presence information to be shared between the 2 transmitters associated with the CPV9000 coupling unit, in order to maintain balanced coupling.

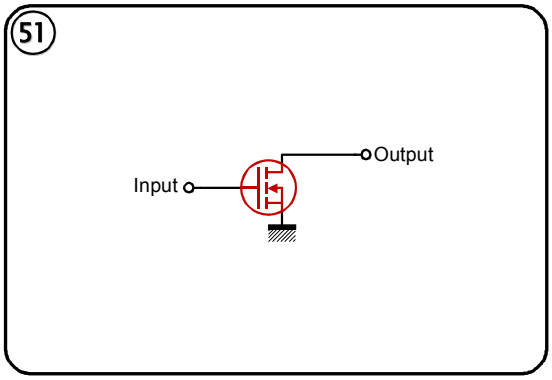
4.2.2.14 Grounding Terminal

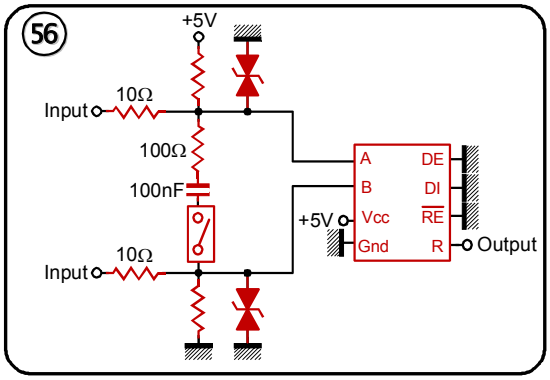
4mm diameter wing screw for grounding by attachment to fork.

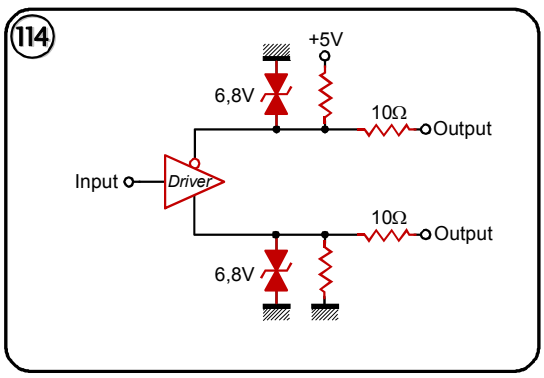
4.3 ELECTRICAL INTERFACES USED

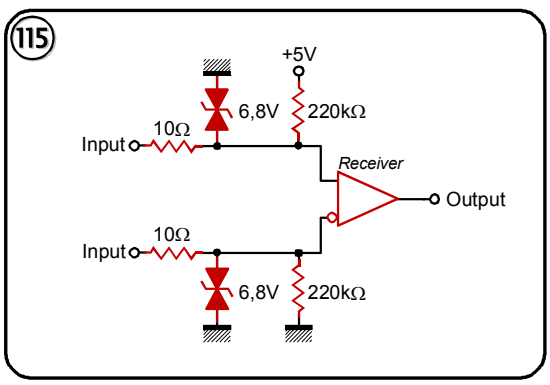












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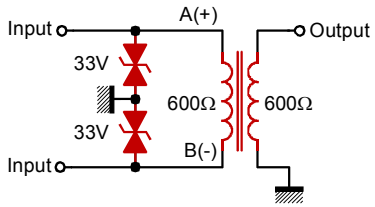

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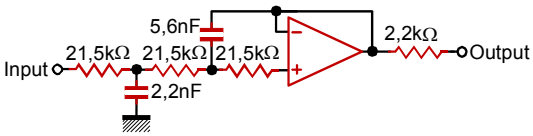

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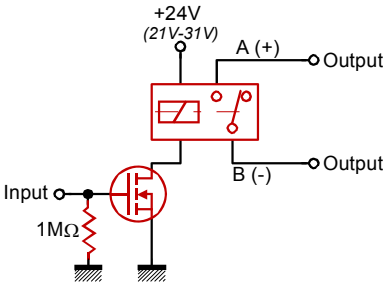

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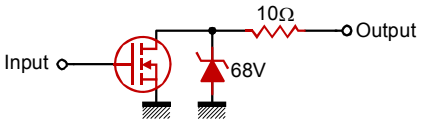

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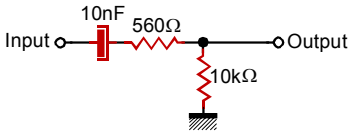

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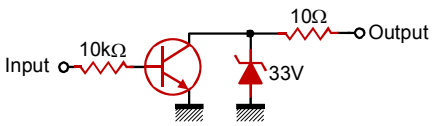

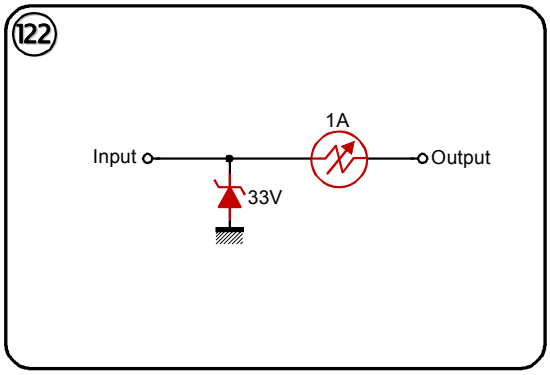
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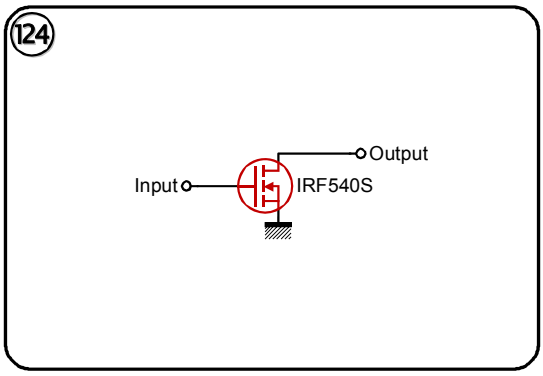
Output
33V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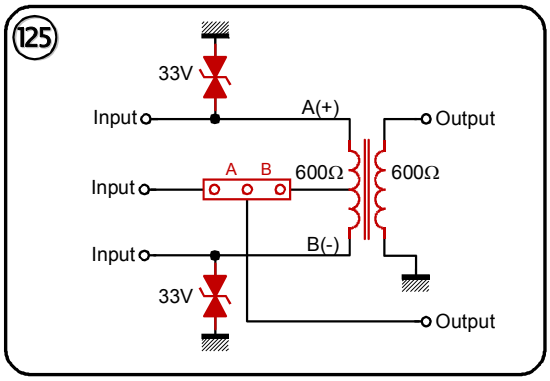
Input
IRF540S


125
33V
Input
A(+)
Output
A
B
600Ω
600Ω
Input
B(-)
Input
33V
Output

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CHAPTER 5. INSTALLATION – CONFIGURATION – COMMISSIONING

5.1 CHOICE OF SITE

This equipment is to be installed in a rack in the dedicated service room.
Ensure that the rack is stable before installing the equipment.
Do not move a rack by yourself. TELERAD recommends that this task be carried out by a minimum of two people.
If using the device outside the rack, see § 2.3.2 "Mechanical installation".

5.2 INSTALLATION

The paragraphs below present the operations to be performed to correctly install the EM9000-2G or EM9010-2G transmitter.

5.2.1 Unpacking

The EM9000-2G or EM9010-2G transmitter is delivered in packaging intended to protect it from shocks that occur during handling, and from various damaging external factors during storage.
It is installed in a rigid box (wood or cardboard) suited to these transport and storage conditions, and is fixed in place with soft material that cushions against shocks, or properly fixed inside the box.
Keep the packaging for reuse when sending the equipment back to TELERAD.
When unpacking, avoid touching the pins of the connectors on the front or rear of the equipment, particularly if not wearing an antistatic bracelet on one wrist, connected to an earth socket using the bracelet cord.

5.2.2 Electrical protection of the equipment

5.2.2.1 Protection through earthing

The terminal on the rear of the equipment, identified with the symbol is the main protective earth terminal.
The minimum cross-section of the wire used must be 2.5 mm².
This connection must be made before any other connection, and must be disconnected last. It is also recommended to check the earth continuity regularly.
When the equipment has a Mains power input, it is fitted with a three-pin plug with an earth.
Earthing is a safety element. Do not nullify the protection by connecting the plug to a socket that does not have an earth connection.

5.2.2.2 Protection by circuit breakers

In order to comply with the electrical safety rules, the power supply inputs of the EM9000-2G or EM9010-2G transmitter must be protected by external circuit breakers. The following table indicates the recommended range and type of circuit breaker:

Type	*Name*	*Ref.*	*Range*	*Protection*
Circuit breaker	20723	18000244	1 contact + neutral $6A_{AC}$ / $220V_{AC}$	$220V_{AC}$ mains input
Circuit breaker	C32H-16A-DC-20536	18000177	1 Contact $16A_{DC}$ / $127V_{DC}$	$+V_{DC}$ battery input

5.2.3 Configuration

There is a default factory hardware configuration for the transmitter.
Check that this default configuration complies with the required use, or else modify it as required (refer to § 5.3 "Description and configuration of jumpers and switches").
After installing the equipment in its location and turning it on, it is then possible to configure the transmitter using software. Software configuration of the transmitter applies to two categories of parameters:

- ***System parameters,*** corresponding to the general functions of the transmitter: Transceiver Configuration, DATA link speed, JBUS link speed, address and Idle characters.

- ***Operating parameters,*** fixing the equipment operating conditions: Mode, frequency, output power, AF line sensitivity, PTT-in-band (in A3E mode).

The EM9000-2G or EM9010-2G transmitter can be configured using software, in four different ways:

- Through the Maintenance port (refer to ICDFR 40600034 V1.00 Série 9000-2G MAINTENANCE),
- Through the JBUS port (refer to ICDFR 40600036 V1.00 Série 9000-2G JBUS).
- Through the SNMP port (refer to ICDFR 40600035 V1.00 Série 9000-2G agent SNMP).
- Through the front panel screen / keyboard local interface (refer to § 6.3 "Local operation of equipment").

5.2.4 Mechanical installation

The EM9000-2G or EM9010-2G transmitter is generally installed in a 19" rack, on two fixed support brackets.
Four crosshead screws allow the front panel of the transmitter to be fixed to the frame of the rack.
When the equipment is used outside a rack, it must be placed on a flat, stable, resistant, vibration-free surface at least 10 cm or so from the wall or any other equipment to allow free circulation of air, with or without a ventilation system.
The equipment must be installed by qualified staff.

5.3 DESCRIPTION AND CONFIGURATION OF JUMPERS AND SWITCHES

5.3.1 CTRL11217 PCB

See Layout diagram – Control PCB – Plate 46500150.

Identification	*Signal*	*Characteristics*		*By default*
J1 5-6	20ms delay for changing to transmission	***Present*** ***Absent***	Switching to transmission delayed by 20ms after activation of PTT, Switching to transmission follows PTT,	A
J3	Opening I and Q Cartesian loops	***A*** (1-2) ***B*** (2-3)	I and Q slaving loops are closed, I and Q slaving loops are open	A
J5	Cut-off of I reference from DSP	***A*** (1-2) ***B*** (2-3)	I reference is external, I reference comes from the DSP.	B
J6	Phantom PTT	***A*** (1-2) ***B*** (2-3)	Remote PTT comes from the command present on the operating connector, Remote PTT comes from the middle point of the AF transformer.	A
J7	Cut-off of Q reference from DSP	***A*** (1-2) ***B*** (2-3)	Q reference is external, Q reference comes from the DSP.	B
J30 3-4 5-6 7-8 9-10	Internal power supplies cut-off connector	***Present*** / ***Absent***	**P:** +3.3V supplied to PCB / **A:** +3.3V isolated. **P:** +5V supplied to PCB / **A:** +5V isolated. **P:** +15V supplied to PCB / **A:** +15V isolated. **P:** -15V supplied to PCB / **A:** -15V isolated.	P P P P

5.3.2 PAVE41160 Front panel PCB

See Layout diagram – Front panel PCB – Plate 46500151.

Identification	*Signal*	*Characteristics*		*By default*
J1	ON/OFF switch connector link	***Present*** ***Absent***	The ON/OFF switch is connected The ON/OFF switch is not connected	Present
J3	Mic/Headphone connector link	***Present*** ***Absent***	The mic/headphone input/output is connected The mic/headphone input/output is not connected	Present

5.3.3 MIPR11005 Microcontroller – DSP PCB

See Layout diagram (1/2) – Front panel PCB – Plate 46500155.
See Layout diagram (2/2) – Front panel PCB – Plate 46500156.

Identification	*Signal*	*Characteristics*		*By default*
S1-1	DSP "Watchdog"	ON OFF	The DSP "Watchdog" is disabled The DSP "Watchdog" is enabled	OFF
S1-2	Viewing "Debug" information	ON OFF	"Debug" info is not sent on the Maintenance link "Debug" info is sent on the Maintenance link	ON
S1-3	Not used	ON OFF	N/A N/A	ON
S1-4	Not used	ON OFF	N/A N/A	ON

5.3.4 AMPV26260 VHF Amplifier, AMPU26246 UHF Amplifier, SVHF25077 VHF Synthesizer, SUHF25078 UHF Synthesizer, and ALIM26265 Power supply Modules

No jumpers or switches present on the PCB.

5.4 ASSEMBLY OF COAXIAL RELAYS

When the transmitter is used in "Transceiver" configuration, it is possible to use an antenna coaxial relay allowing the use of a Transmission / Reception antenna.
In this case, the relay is installed directly in the transmitter *(refer to "Description of COAXIAL RELAY connectors J8, J9 and J10", § 4.2.2.8),* in a position provided for this purpose.
The transmitter itself commands and supplies the power for the antenna's coaxial relay, via a **J1** BERG connector located on the ASSE11217 PCB, the pin configuration of which is as follows:

No.	*I/O*	*Signal*	*Signal ID*	*Characteristics*	*No. Int.*
1	O	Logic ground	GND	General ground for the equipment	
2	/	Keying	/	/	/
3	O	Coaxial relay power supply	+V=	$+V_{DC}$ power supply of the coil of the antenna's coaxial relay.	
4	O	PTT feedback	/	Command of the antenna's coaxial relay. It corresponds to the PTT feedback signal, in phase with PTT on switching to transmission, delayed by 700µs on switching to standby.	/
5	I	Logic ground	GND	General ground for the equipment	11
6	I	20ms delay	/	When it is linked to pin 5, it allows the change to transmission to be delayed by 20ms, to take into consideration the switching delay of an electromechanical relay.	/

Note: *This relay is available as an option in two versions:*
- *Option B: electromechanical relay. Ref Telerad: RECX56016, code: 58500053.*
- *Option C: fast static relay. Ref Telerad: RECX56012, code: 58500046.*

See § 7.5.12 Sheet D8: "Disassembly/reassembly of the coaxial relay".

5.5 MINIMUM CONNECTION FOR COMMISSIONING

In the event of simplified use of the transmitter, it is possible to connect just part of the signals present on all the rear panel connectors. This minimum connection is as follows:

- Connect the earth using the wing screw,
- Connect the mains power supply to **J1** (depending on the version), and/or battery power supply to **J6.**
- Connect the antenna or a suitable 50Ω power load to the **J11** connector,
- In analog mode, connect the operating unit to the **J7** connector, with the following minimum cabling:
  - ✓ On/Off Command *(contact no. 11).*
  - ✓ AF modulation on 2 wires *(contacts no. 16 and 35),*
  - ✓ Remote PTT command *(contact no. 32),*
  - ✓ Electrical ground *(contact no. 37),*
  - ✓ (refer to § 4.2.2.7 "J7 OPERATING UNIT connector".

- In digital mode, connect the operating unit to the **J5** connector *(refer to § 4.2.2.6 "J5 DATA Connector"*.

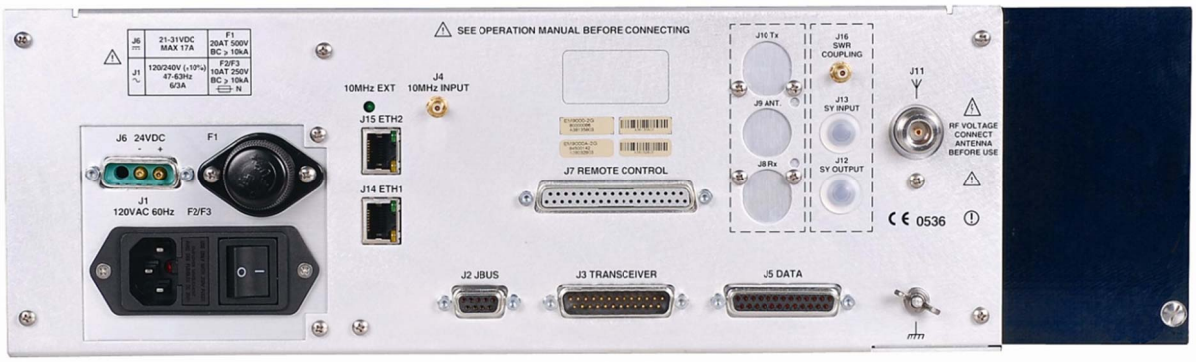

Figure 6 – Rear panel

5.6 CONNECTION IN TRANSCEIVER CONFIGURATION

When using the transmitter in Transceiver configuration, i.e. combined with a receiver, in addition to the minimum connection previously described, there must also be the connection between the TRANSCEIVER **J3** connector of the transmitter and the REMOTE CONTROL **J3** connector of the receiver.

In this case, the REMOTE CONTROL **J7** connector is the only connector linked to the VCSS. It contains on the one hand the transmitter's own commands and information, and on the other, the commands and information relating to the receiver, transmitted to the latter through the TRANSCEIVER **J3** connector *(see § 4.2 "Description of connectors").*

In analog mode, on the **J7** connector in addition to the previous minimum connection, there must be the signals relating to the receiver:

- ✓ AF reception on 2 wires *(contacts no. 2 and 21),*
- ✓ Call contact on 2 wires *(contacts no. 5 and 23),*
- ✓ Electrical ground *(contact no. 1),*
- ✓ (Refer to § 4.2.2.7 "J7 OPERATING connector")

There are three possible ways to connect to the antenna:

- ***Configuration 1:*** use of the antenna's coaxial relay built into the transmitter, combined with a transmission/reception antenna. In this case, the connection is as follows:

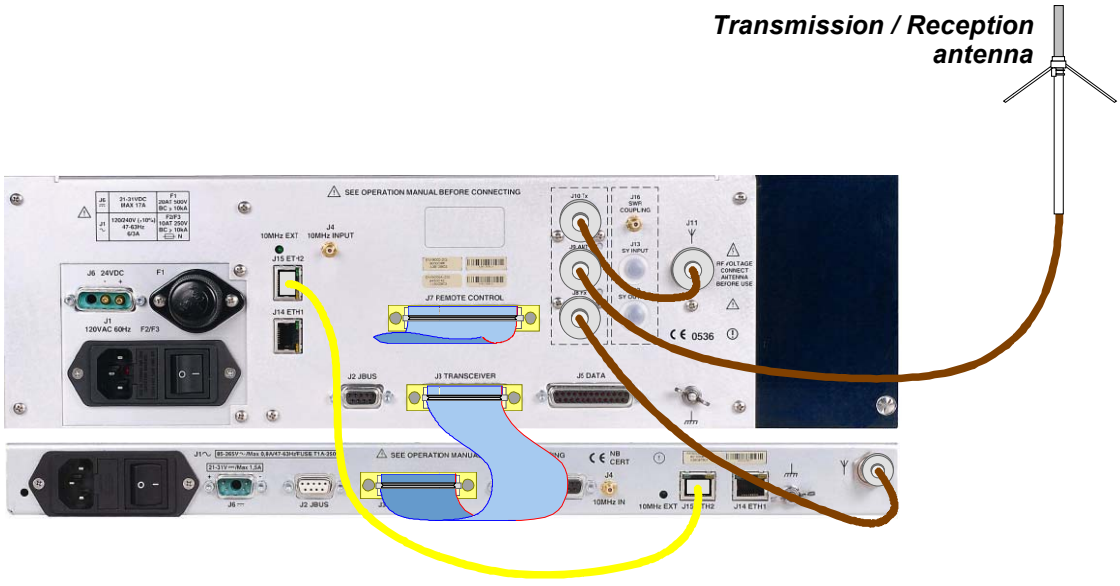

Figure 7 – Connection in transceiver configuration 1

☞ ***Note :*** *To correctly configure the transmitter about the coaxial relay presence, please refer to sheet D8 for Disassembly/Reassembly of an antenna coaxial relay § 7.5.12*

- ***Configuration 2:*** use of an external antenna coaxial relay, combined with a transmission/reception antenna.

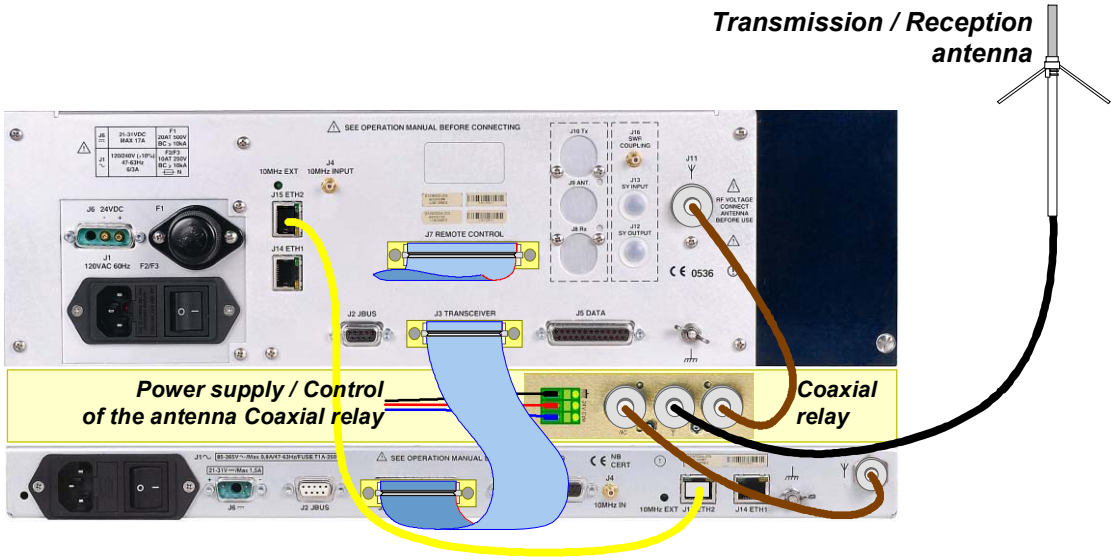

Figure 8 – Connection in transceiver configuration 2

Note : To correctly configure the transmitter about the external coaxial relay, connect an RS232 terminal on the front panel Maintenance connector, enter the control ***Login admin admin*** *(administrator login), then :*

- *If the relay is of electromechanical type : put a jumper between pins J1-5 and J1-6 of the CTRL11217 board J1 connector, then enter the* ***RELAY ON*** *control.*
- *If the relay is of static type : enter only the* ***RELAY OFF*** *control (no jumper between pins J1-5 and J1-6 of the J1 connector on the CTRL11217 board).*

- ***Configuration 3:*** use of two separate antennas,

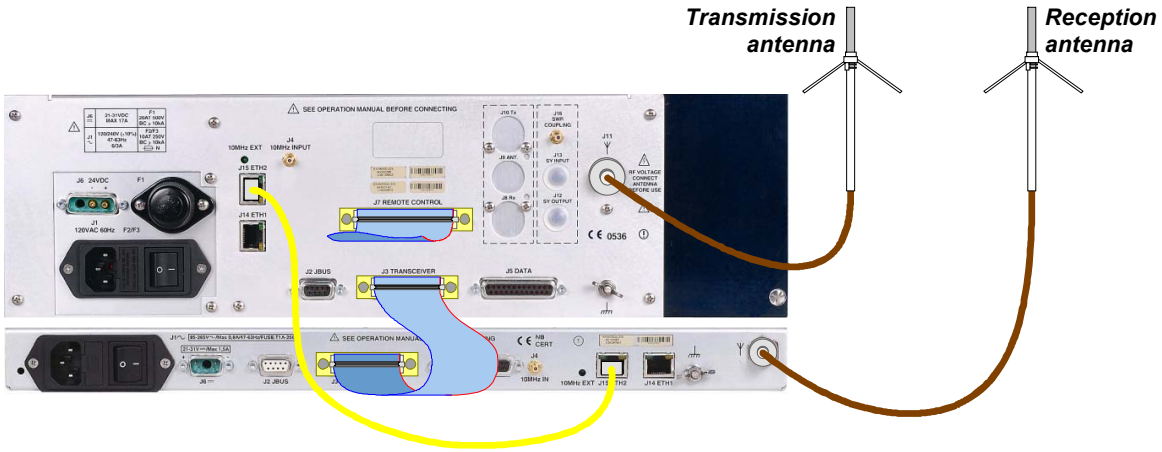

Figure 9 – Connection in transceiver configuration 3

5.7 BASIC COMMISSIONING

In the case of the EM9000-2G or EM9010A-2G transmitters, once the rear panel connections are made, check that the yellow "Mains Presence" and/or "Battery Presence" indicator lights are on (the Mains On / Off switch of the rear **J1** connector is supposed to be in the On position |).
For all EM9000C-2G, EM9000A-2G, EM9010C-2G and EM9010A-2G versions, then place the front panel On / Off switch in the On position |. The transmitter then performs the following steps:

1. Test of all the front panel indicator lights, which stay lit for approximately 25s.
   - "+V_{DC} Presence" (○⇨●),
   - "Mains Presence" (○⇨●), "Battery Presence" (○⇨●),
   - "Alarm" (○⇨●),
   - "Status" (○⇨●),
   - "SWR" (○⇨●),
   - "RF Info" (○⇨●),
   - "MOD Info" (○⇨●),
   - "JBUS TxD" (○⇨●), "JBUS RxD" (○⇨●),
   - "DATA TxD" (○⇨●) and "DATA RxD" (○⇨●),
   - The screen stays black.

2. At the same time, Launch of the internal “Boot Loader” authorising either downloading of new software via the network access, or loading of the application contained in the Flash memory.

3. In the standard case, loading of the embedded real-time multitasking application.

4. Launch of the initiated built-in test, with internal analysis of the results.

5. If the results of the test are correct, the indicator lights go out and then the default operating menu is displayed on the screen.

The transmitter can now be accessed by the user.
Perhaps the remote **ON/OFF** command present on the REMOTE CONTROL connector is not connected (command on **"OFF"** state). In this case, the STATUS indicator light is off (○⇨○)).
Set the remote **ON/OFF** command to **"ON",** either by hardware (*pin J7-11 to ground*), or by software (*refer to §.6.3.1.3.7.1.1 "Setup/HW Config./ON-OFF" menu)*, and check that the transmitter switches to transmission as soon as one of the two front panel test pushbuttons is pressed (STATUS indicator light on (○⇨●), RF Test: RF indicator light turns on (○⇨●), RF+MOD Test: RF and MOD indicator lights turn on (○⇨●)(○⇨●), SWR indicator light off (○⇨○)).

☞ ***Note:*** *remember the function of each test pushbutton:*
- ***RF test pushbutton:*** *allows a Non-modulated Carrier to be generated on the Antenna output of the transmitter, as well as on the "RF Test" output.*
- ***RF+MOD test pushbutton:*** *Allows a test of the transmitter to be triggered, the conditions of which depend on the operating mode:*
  - ***A3E mode:*** *Transmission of a Carrier 85% AM-modulated by a 1kHz internal AF.*
  - ***F3E mode (option):*** *Transmission of a Carrier Δf = ±5.6kHz FM-modulated by a 1kHz internal AF.*

Then enter the operating configuration in the transmitter, using the local screen/keyboard (refer to the following table):

Parameter	*Range*	*See §*	*Comments*
Output power	33 to 47dBm/50Ω (2 to 50W) in A3E and F3E.	6.3.1.3.2	Female N connector
Input LF line sensitivity	-30 to 0dBm, by 1dB steps	6.3.1.3.4.1	600Ω symmetrical transformer
Mode (EM9000-2G)	A3E, *F3E*	6.3.1.3.5	As per ICAO standards
Mode (EM9010-2G)	A3E, *F3E*	6.3.1.3.5	As per ICAO standards
Frequency (EM9000-2G)	118,000-144,000 MHz (optional: 112-156MHz)	6.3.1.3.6	As per ICAO standards
Frequency (EM9010-2G)	225,000-400,000 MHz (optional: 225-406MHz)	6.3.1.3.6	As per ICAO standards
IP Parameters (Ethernet)	ETH: IP address and subnet mask	6.3.1.3.7	According to user

☞ ***Note:*** *See § 6.3.1 "Local operation through the front panel screen/keyboard interface" for more information.*

5.8 PRELIMINARY ADJUSTMENTS

There is a preliminary adjustment to be made before putting the transmitter into operation: checking the accuracy of the local oscillator.

This adjustment is made through software, using the front panel screen/keyboard interface
(refer to § 7.7.4 Sheet R1: "Adjusting the local oscillator").

5.9 EQUIPMENT COMMISSIONING IN VoIP CONFIGURATION

The commissioning of the EM9000-2G or EM9010-2G transmitter in VoIP configuration needs to follow the next steps :

- Connection to network,
- Configuration of the network parameters,
- Configuration of the operating mode,
- Configuration of the SIP parameters,
- Normal users names listing,
- Emergency users names listing,
- Commissioning.

5.9.1 Connection to a network

Transmitter's operation in voice over IP is available only through the ETH1 **J14 connector** (Voice over IP on **J15** connector not yet available).
So, the very first step consists in connecting the transmitter to the used Ethernet network, through a link between a hub or a switch and the **J14** connector of the transmitter.

Then the equipment must be configured such a way it can operate in VoIP mode. In the following paragraphs, some parameters can be configured by using either the local HMI or an RS232 terminal

connected to the « MAINTENANCE » connector on the front panel. Some others can be configured only by the terminal.
In case this terminal is used, the user must be first logged in administrator by entering the control :

- **Login admin admin.**

5.9.2 Configuration of the network parameters

By using the local HMI or the terminal, enter the transmitter's IP network parameters :
Using the IHM, select the ***« SETUP/IP/ETH1 »*** menu.
Using the terminal, enter the following controls :

1. **ETH1 IP** control to define the IP address of the transmitter :
   - **ETH1 IP 172.16.10.1**
2. **ETH1 MASK** control to define the subnet mask of the transmitter :
   - **ETH1 MASK 255.255.0.0**
3. **ETH1 GATEWAY** control to define the IP address of the default gateway of the transmitter:
   - **ETH1 GATEWAY 172.16.10.254**

5.9.3 Configuration of the operating mode

Always by using the local HMI or the terminal, enter the operating mode to be Voice over IP.
Using the HMI, select the ***« AUDIO/VOIP »*** menu.
Using the terminal, enter the control :

- **AUDIO VOIP**

5.9.4 Configuration of the SIP parameters

Establishing a communication link between the transmitter and a user (for example a VCSS) through an Ethernet network is done by generating a ***SIP protocol*** *(Session Initiation Protocol)* between both equipment. This protocol is used only for establishing a network connection between the transmitter and the user, and this connection is done only when initiated by the user, never by the transmitter.
Data exchange on the network, that carry *the digitalized voice as well as the PTT control* will be realized by using a second real time protocol : ***the RTP protocol*** *(Real Time Protocol).*

So the **SIP** protocol parameters must be defined during the communication setting. A difference with the previous parameters is that these ones are available only by using the RS232 terminal :

1. Define the name of EM9000-2G or EM9010-2G transmitter such as the SIP user :
   - **SIP USERNAME <name of the EM9000-2G or EM9010-2G>**
2. Define the SIP communication port on the transmitter side :
   - **SIP PORT <port>**

Those parameters allow to *set a **SIP** connection,* whose the **SIP URI** (Uniform Resource Identifier) is of type :
sip:< name of EM9000-2G/EM9010-2G>@<IP address of EM9000-2G/EM9010-2G>:Port

5.9.5 Normal users name listing

So the SIP protocol allows establishing a communication between the transmitter and a user. In fact it is possible to define a list of several users able to use the transmitter resource, accessible through the network. These users are generally VCSS used for Air Traffic management, and are divided into two categories : the ***Normal users*** and the ***High priority users.***
This paragraph defines a users name list corresponding to the **VCSS having a Normal priority,** that can communicate with the EM9000-2G or EM9010-2G transmitter, through Adding and Suppressing controls. These parameters are available only by using an RS232 terminal :

1. VCS (Voice Communication System) control for adding a Normal user :
   - **VCS NORMAL ADD <name of the VCSS>**
2. VCS (Voice Communication System) control for suppressing a Normal user :
   - **VCS NORMAL REM < name of the VCSS>**
3. VCS (Voice Communication System) control for suppressing all the Normal users :
   - **VCS NORMAL REM**

5.9.6 High priority users name list

This paragraph defines a users name list corresponding to the **VCSS having a High priority,** that can communicate with the EM9000-2G or EM9010-2G transmitter, through Adding and Suppressing controls. These parameters are available only by using an RS232 terminal :

4. VCS (Voice Communication System) control for adding a High priority user :
   - **VCS EMERGENCY ADD <name of the VCSS>**
5. VCS (Voice Communication System) control for suppressing a High priority user :
   - **VCS EMERGENCY REM < name of the VCSS>**
6. VCS (Voice Communication System) control for suppressing all the High priority users :
   - **VCS EMERGENCY REM**

5.9.7 Commissioning

After the transmitter has been configured to operate in VoIP mode through the previous steps, it allows the *reception of VoIP type frames containing the digitalized voice and PTT,* that it translates to ***an analog signal for audio*** and ***a logical signal for PTT.***

To do that, it uses a specific *Digital-to-Analog decoder*, previously configured by using the **CODEC** control of the terminal :

- **CODEC** G711 A law control for Europe : **CODEC PCMA**
- **CODEC** G711 µ law control for United States : **CODEC PCMU**

5.10 EQUIPMENT COMMISSIONING IN SNMP CONFIGURATION

5.10.1 Presentation

The radio equipments EM9000-2G and EM9010-2G include 2 Ethernet links. These ports allow to connect them to a IP network. So it is possible to remotely control and remotely monitor the equipments through an SNMP protocol.
There are no priority between the different sources of control (Front panel, JBUS 1, SNMP), so the last command correctly received will be executed, whatever its origin.

5.10.2 SNMP protocol

The equipments are compliant with the 3 versions of SNMP Protocol (v1, v2c and v3).

The MIB used by the SNMP agent on the EM9000-2G or EM9010-2G transmitter is available in the following file :

```
TELERAD-EM90X02G-MIB.TXT    For transmitters of 9000-2G series
```

5.10.3 Parameters to be monitored and controlled

Equipment characteristics supplies the main characteristics of the radio equipments
mains : presence of a Power supply module maxFrequency : Maximum RF frequency authorized minFrequency : Minimum RF frequency authorized frequencyRange : Frequency range used (VHF/UHF) softIdentMidsMicro : Software version mibVersion : MIB version description : brieve description of the radio modelName : Radio name
Equipment status : supplies the status of the radio equipments
externalFan : External cooling fan onOffPtt : radio equipment in transmission inServiceTime : Time of operation since the first start eqptMgtMode : Local or Remote operation of the radio onOffControlStatus : Transmission authorized operationalStatus : Proper operation of the radio
Mode of operation : used to visualize and modify the operating parameters of the equipments
power : Output power of the transmitter offsetChannel : Frequency offset in transmission frequency : RF frequency communicationModes : type of modulation used
Equipments configuration : used to visualize and modify the hardware configuration parameters
voip : radio in VoIP mode lineInputSensitivity : Audio line input level in analog mode. pttSafetyTimeOut : PTT security enabled onOffControl : Enable or disable transmission. onOffPriorityManagement Command to enable/disable transmission controlled either by a hardware discrete signal or by a software one.
Tests : used to visualize the tests reports, and run the tests on the equipments
statusExternalCbit : External default outside the transmitter detected statusPowerSupply24vCbit : Power supply default detected statusSynthesizerCbit : Synthesizer default detected statusAmpxCbit : RF module default detected statusCtrlCbit : CTRL board default detected statusMidsCbit : MIDS module default detected statusCbit : Default detected statusIbit : Default detected after an Initiated Test triggerIbit : IBIT test initiated tone : Continuous test of transmission initiated (RF) cw : Continuous test of transmission initiated (RF+ Modulation)
Measurements : used to make measurements on the equipments
powerSupply24v : Power supply powerSupplyTemperature : Temperature of the power supply module rfTemperature : Temperature of the RF module modulationDepth : Modulation ratio in AM

lineLevel : Audio input level swr : SWR measurement reflectedPower : Reflected power forwardPower : Direct power
Reset commands : used to reset the equipments
resetFactorySetup : Reset the equipment with the default parameters resetSoftware : Restart the radio

5.10.4 Equipments configuration

The following parameters have to be configurated, before the equipments are used :

- ***The Network parameters :*** IP Address, Subnet mask,
- ***The SNMP parameters :*** SNMP Port, SNMP protocol version to be used, communities (v1 and v2c), the users and their password (v3)

Parameter	Default value
SNMP Port	161
SNMP protocol version	the 3 available versions
Read community (v1/v2c)	public
Write community (v1/v2c)	private
Read user (v3)	user1
Read password (v3)	notpassword
Write user (v3)	user2
Write password (v3)	notpassword

These parameters can be configurated by an RS232 terminal connected to the equipment front panel Maintenance connector.

☞ ***Remark about SNMPv3 :*** *The SNMP agent embedded in the radio equipments uses only the authentification mechanism, base on the MD5 algorithm. The cypher mechanism is not used.*

5.11 PROCEDURE FOR SOFTWARE UPLOAD

For more details about the procedure, please refer to the document [5] ***KITGB 40700003 V1.02 9000-2G Series :*** *Document describing the procedure for uploading and/or releasing the software embedded into the MIDS11216 board, through a Web server interface.*

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CHAPTER 6. OPERATION

6.1 PRESENTATION

This chapter provides the information required for programming and operation of the EM9000-2G and EM9010-2G transmitters :

1. Either locally:
   - via the front panel screen/keyboard,
   - via an RS232 terminal connected to the front panel Maintenance connector.

2. Or remotely:
   - via the JBUS link,
   - via the SNMP link.

6.2 COMMANDS AVAILABLE FOR OPERATION

6.2.1 Local commands through the screen/keyboard interface

Command	*Paragraph*
Main menu: Change Control to Local?	6.3.1.3.1
POWER: Output power	6.3.1.3.2
PRESET: Operation of pre-programmed channels	6.3.1.3.3
Select: Selection of an operating pre-programmed channel	6.3.1.3.3.1
Create/Modify: Creation / modification of a pre-programmed channel	6.3.1.3.3.2
Clear: Clearing a pre-programmed channel or all channels	6.3.1.3.3.3
AUDIO: Type of audio signal	6.3.1.3.4
Analog/Line level: Selection of an analog AF signal and its line level	6.3.1.3.4.1
VoIP: Selection of a Voice over IP signal	6.3.1.3.4.2
MODE: Choice of operating mode	6.3.1.3.5
A3E: carrier AM modulation	6.3.1.3.5.1
F3E: carrier FM modulation	6.3.1.3.5.2
FREQ: Selection of the operational frequency and of the offset frequency	6.3.1.3.6
SETUP: Configuration of the transmitter	6.3.1.3.7
HW Config.: Hardware configuration of the unit	6.3.1.3.7.1
ON/OFF: Selection of the On/Off Command	6.3.1.3.7.1.1
PTT TO: Selection of the PTT time-out	6.3.1.3.7.1.2
Display: Selection of display parameters	6.3.1.3.7.2
Language: Selection of display language	6.3.1.3.7.2.1
Brightness: Adjustment of brightness	6.3.1.3.7.2.2
IP: IP parameters	6.3.1.3.7.3
ETH1: Ethernet channel no. 1 parameters (Address and Mask)	6.3.1.3.7.3.1
ETH2: Ethernet channel no. 2 parameters (Address and Mask)	6.3.1.3.7.3.2
JBUS: JBUS no. 1 and no. 2 parameters (Address and Speed)	6.3.1.3.7.4
Remote ctl: Activation of remote control of the equipment	6.3.1.3.7.5

Command	*Paragraph*
MAINT: Transmitter maintenance	6.3.1.3.8
Measures: Transmitter measurements	6.3.1.3.8.1
Test: Transmitter testing	6.3.1.3.8.2
CBIT: Transmitter continuous test (CBIT)	6.3.1.3.8.2.1
IBIT: Transmitter initiated test (IBIT) and viewing report	6.3.1.3.8.2.2
TCXO: Adjustment of frequency master oscillator	6.3.1.3.8.3
About: Information about the model, serial no. and software version	6.3.1.3.8.4

6.2.2 Local commands through the RS232 terminal

6.2.2.1 List of user commands accessible without Login

Command	*Para-graph*
AUDIO: Selection of audio source (VOIP or ANALOG)	6.3.2
AUDIO?: Reading the selected audio source	6.3.2
CBIT?: Displaying the continuous testing	6.3.2
ETH1: Channel no. 1 manual IP parameters *(**GATEWAY:** default IP gateway, **IP:** IP address, **MASK:** IP subnet mask)*	6.3.2
ETH1?: Reading channel no. 1 manual IP parameters	6.3.2
ETH2: Channel no. 2 manual IP parameters *(**IP:** IP address, **MASK:** IP subnet mask s)*	6.3.2
ETH2? : Reading channel no. 2 manual IP parameters	6.3.2
FREQ: Programming operational frequency in MHz (xxx.xxx), and the frequency offset in kHz *(**OFFSET:** ±8/±7.5/±7.3/±5/±4/±2.5/0 in VHF, ±7.5/±7.3/±5/±2.5/0 in UHF)*	6.3.2
FREQ?: Reading the operational frequency, and the frequency offset (Climax)	6.3.2
HELP?: Help menu	6.3.2
IBIT: Launching the initiated test	6.3.2
IBIT?: Results of the initiated test	6.3.2
JBUS: No. 1 or no. 2 JBUS link parameters **(ADDR**: *Address, **BAUD :** Speed, **IDLE:** Idle characters)*	6.3.2
JBUS?: Reading the no. 1 or no. 2 JBUS link parameters ()	6.3.2
LINE: Modulating AF line sensitivity (0 to -30dBm by 3dB steps)	6.3.2
LINE?: Reading the modulating AF line sensitivity	6.3.2
LOGIN: Equipment login	6.3.2
MEAS?: Reading measurements	6.3.2
MODE: Selecting operating mode (A3E, F3E)	6.3.2
MODE?: Viewing operating mode	6.3.2
POWER: Output power (33 (VHF) or 37 (UHF) to 47dBm by 0.5dB steps)	6.3.2
POWER?: Reading output power	6.3.2
PRESET-CLR: Clearing one preset channel, or all	6.3.2
PRESET-DEF: Creation or modification of a preset channel	6.3.2
PRESET-SEL: Selection of a preset channel for operation	6.3.2
PRESET?: Channel no. to be consulted (1 to 128/ALL)	6.3.2

Command	*Para-graph*
PTT: PTT protection time-out (0 to 5mins by steps of 5s)	6.3.2
PTT?: Reading the PTT protection time-out	6.3.2
RADIO: Transmitter On/Off command (ON/OFF) and its priority (SOFT/HARD)	6.3.2
RADIO?: Status of transmitter On/Off command and its priority	6.3.2
RSTAT?: Status of the radio (PTT status, status of the station, status of inhibitions, number of startups, status of fan)	6.3.2
STAT?: Status of the station	6.3.2
VER?: Embedded software versions and device type	6.3.2

6.2.2.2 List of user commands accessible with administrator Login

Having entered the command ***Login: admin admin,*** the previous list of commands remains valid in this context, to which the following list is added:

Command	*Para-graph*
CODEC : Coder/Decoder of the digitalized audio frame (**PCMA :** G711 A law european decoder, **PCMU :** G711 µ law american decoder)	6.3.2
LEARN: Launching phase and attenuation learning	6.3.2
LEARN?: Reading attenuation and phase learning data	6.3.2
MAINS: Mains input presence (EM9000A-2G and EM9010A-2G versions)	6.3.2
MAINS?: Reading whether the mains input is present or not	6.3.2
MIC: Microphone sensitivity (1 or 100mV)	6.3.2
MIC?: Reading the selected sensitivity of the microphone	6.3.2
RELAY: Presence of an electromechanical relay in the transmitter (ON/OFF)	6.3.2
RELAY?: Reading the presence of an electromechanical relay in the transmitter.	6.3.2
RST: Restarting the transmitter (FACT/WARM)	6.3.2
RTP: Setting RTP parameters *(**PORT** RTP Port no., **PTTSUM:** PTT summed for VoIP (ON/OFF), **JITTER:** RTP delay for VoIP (voice transmission delay))*	6.3.2
RTP?: Reading RTP (Real-time Transport Protocol) port parameters for VoIP	6.3.2
SIP: Programming SIP parameters *(**CHECKVCS**: Checking VCS during the SIP connection (ON/OFF), **NBCON:** Maximum number of SIP connections for the same VCS, **PORT:** SIP Port no. for VoIP, **USERNAME:** SIP username for VoIP)*	6.3.2
SIP?: Reading SIP (Simple Internet Protocol) port parameters for VoIP.	6.3.2
SNMP: Programming SNMP (Simple Network Management Protocol) parameters *(**PORT:** SNMP Port no., **RCOM:** SNMP community being read, **SECLVL:** SNMP security level (0 to 10), **TPORT:** SNMP Trap Port no., **WCOM:** SNMP community being written)*	6.3.2
SNMP?: Reading the SNMP link parameters	6.3.2
TCXO: Adjustment of the Local Oscillator (1 to 255 by steps of ±1/AUTO)	6.3.2
TCXO?: Reading the Local Oscillator adjustment value.	6.3.2
UPLOAD: Programming the transmitter	6.3.2
VCS NORMAL : Add ***(ADD) /*** Remove ***(REM)*** a Normal priority Voice Communication System (VCS) from the list.	6.3.2
VCS EMERGENCY : Add ***(ADD) /*** Remove ***(REM)*** a High priority Voice Communication System (VCS) from the list.	6.3.2
VCS?: Views the list of VCS authorised to connect.	6.3.2

6.2.3 Remote commands through the JBUS link

6.2.3.1 Commands accessible in Read/Write :

Command	*Para-graph*
AF line level programming (0 to 10 for 0 to -30dBm by 3dB step)	6.4.1
Channel spacing programming in kHz	6.4.1
IBIT test launching	6.4.1
Offset frequency programming in kHz	6.4.1
ON command priority (Hard/Soft)	6.4.1
ON Soft command (Off/On)	6.4.1
Operating frequency programming in MHz (xxx.xxx)	6.4.1
Output power (0, 1 or 2 for 47, 44 or 41 dBm)	6.4.1
Shuttle	6.4.1

6.2.3.2 Commands accessible in Read only :

Command	*Para-graph*
Continuous test (OK, Alarm) (status of the Alarm led)	6.4.1
Continuous test for Synthesizer (OK, Alarm)	6.4.1
Control of the radio (Local, Remote)	6.4.1
IBIT test report availability (Available, Not available)	6.4.1
IBIT test report (OK, Alarm)	6.4.1
JBUS table read at least once	6.4.1
Measured transmission AF line level (+10 to -30dBm)	6.4.1
Operating mode (0 : A3E, 1 à 7 : Futur modes)	6.4.1
Programmed output power (0, 1 or 2 for 47, 44 or 41 dBm)	6.4.1
Shuttle	6.4.1
Status of the active ON command (Off/On)	6.4.1
Status of the PTT (transmission/standby)	6.4.1
Status of the radio inhibition (not inhibited, inhibited)	6.4.1
Status of SWR information (Present, Absent)	6.4.1
Type of equipment (T/R, TR, RE, other)	6.4.1
Value of channel spacing (25kHz or 8.33kHz)	6.4.1
Value of offset frequency in kHz	6.4.1
Value of the operating frequency in MHz (xxx.xxx)	6.4.1
Value of power supply voltage +V= (0 to 511 for 0 to 51.1V)	6.4.1
Value of the programmed AF line level (0 to 10 for 0 to -30dBm by 3dB step)	6.4.1
Value of SWR (10 to 100 for SWR = 1 to 10 (10 or more = infinite SWR))	6.4.1

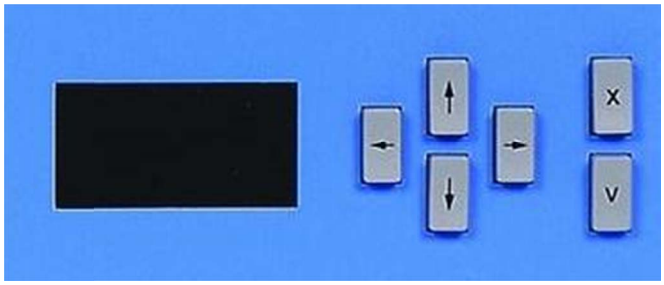
6.2.4 Remote commands through the SNMP link

See the MIB described in § 5.10 "EQUIPMENT COMMISSIONING IN SNMP CONFIGURATION".

6.3 LOCAL OPERATION OF THE EQUIPMENT

6.3.1 Local commands through the front panel screen/keyboard interface

The front panel screen / keyboard interface looks like this:

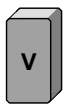


6.3.1.1 Screen operating

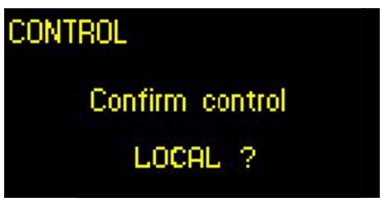
The screen of the EM9000-2G or EM9010-2G transmitter is a 128x64 pixel OLED screen, 20x40mm in size, for which each pixel can be accessed and lit independently. It allows the user to:

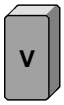
- configure and monitor the transmitter locally,
- view the mode and the various operating parameters.

By default, the equipment is systematically placed under remote control, through a JBUS or SNMP link. Pressing any key on the keyboard allows part of the operating screen to be displayed, and gives the option to take back local control of the equipment:

By pressing the validation key 

on the keyboard, the screen displays a request to confirm the change to local mode:



By pressing the validation key 

on the keyboard, the equipment changes to local mode, and the screen displays the complete operating menu:

After 5 minutes of inactivity, a standby message is displayed randomly on the screen, and control of the equipment automatically changes back to remote:

The operating screen is divided into functional zones, which are accessed using the keys on the keyboard.

When a zone can be activated, it is outlined with a rectangle.

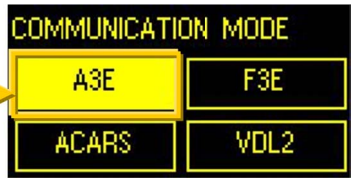
Example of a zone that can be activated:

When it is activated, the zone is displayed in reverse video. It will then be possible to access sub-menus and parameters or to modify a value if necessary.

Example of activated zone:

1 – Sub-menu:

2 - Parameter:



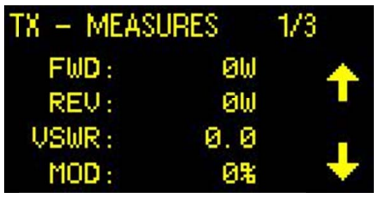
3 – Parameter value:

There are various types of screens:

Screen with zones that can be activated:
(Example: Main menu).

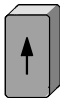
Parameter value entry screen:
(Example: Output power).

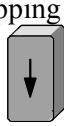
Information display screens:
(*Example: Measurements).*

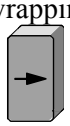


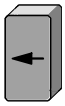
6.3.1.2 Keyboard operating

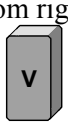
The front panel keyboard is made up of 6 pushbuttons:

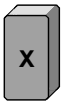
The  button allows you to move from active zone to active zone towards the top of the screen, by wrapping around (moves from the first line to the last line).

The  button allows you to move from active zone to active zone towards the bottom of the screen, by wrapping around (moves from the last line to the first line).

The  button allows you to move from active zone to active zone towards the right then towards the bottom of the screen, wrapping around (moves from the last zone in the bottom right to the first zone in the top left).

The  button allows you to move from active zone to active zone towards the left then towards the top of the screen, wrapping around (moves from the first zone in the top left to the last zone in the bottom right).

The  button allows you to either select a zone that can be activated, or to validate a change of value of a particular parameter.

Lastly, the 

button allows you to cancel either the selection of a zone that can be activated, or the modification of a parameter value. In all cases, pressing this button takes you back either to the main operating screen, or to the previous menu in the tree structure.

6.3.1.3 Description of commands

6.3.1.3.1 Main menu

When the EM9000-2G or EM9010-2G transmitter is powered on, it first launches its startup sequence for a few seconds, then displays the main operating screen on the front panel display. This menu indicates the current operating parameters.
Having selected local control of the equipment, from this main screen and using the keys on the local keyboard, it will then be possible to select a zone and to modify the value.

The accessible zones are the following:

POWER Zone: Allows you to access the output power selection menu.

PRESET Zone: Displays the no. of the selected preset channel, and gives access to the channel entry, modification and deletion menu.

AUDIO Zone: Displays the type of AF transmitted by the transmitter, and gives access to the menu to modify the AF type.

CENTRAL Zone: Displays the selected modulation mode, which cannot be modified, and the operational frequency, coded as per the OACI recommendation from the 8.33kHz or 25kHz channel viewpoint.

Mode Zone: Gives access to the transmitter operating mode selection menu.

Freq Zone: Gives access to the operational frequency modification menu, coded as per the OACI recommendation from the 8.33kHz or 25kHz channel viewpoint.

Setup Zone: Gives access to different transmitter configuration menus.

Maint Zone: Gives access to different transmitter test and maintenance menus, including the measurements screen.

The menu navigation flowchart is as follows:

Erreur ! Liaison incorrecte.

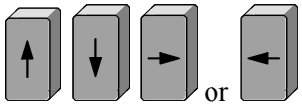
6.3.1.3.2 "POWER" Menu

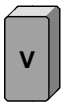
Purpose: This menu allows you to access the parameter to adjust the transmitter output power.

Value: The output power parameter can be adjusted from 33 to 47 dBm, by 0.5dB steps for the EM9000-2G VHF transmitter and from 37 to 47dBm, by 0.5dB steps for the EM9010-2G UHF transmitter:

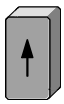
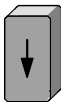
Value	**VHF: 33 to 47 by steps of 0.5**	**UHF: 37 to 47 by steps of 0.5**
Meaning	P_{output} = 33 dBm (2W) to 47dBm (50W)	P_{output} = 37 dBm (5W) to 47dBm (50W)

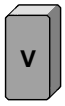
Procedure: The procedure to access the "POWER" menu is as follows:

Using the  keys on the keyboard, select the **POWER** zone.

When this is displayed in reverse video, press the 

key to enter the "POWER LEVEL" menu.

Using the  and  keys, adjust the reduction level.

Press the 

key to return to the main menu.

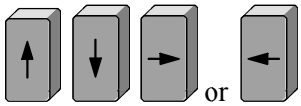
6.3.1.3.3 "PRESET" Menu (Preset channels)

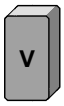
Purpose: This menu allows you to create/modify/clear/select a preset channel. These channels can then be used to establish the operating parameters of the transmitter.

Value: The parameters associated with this menu are:

Parameter	**SELECT**	**CREATE/MODIFY**	**CLEAR**
Value	Selects a preset channel from among 128.	Creates or modifies a preset channel from among 128.	Removes the specified preset channel or all channels.

Procedure: The procedure to access the "PRESET" menu is as follows:

Using the  keys on the keyboard, select the **PRESET** zone.

When this is displayed in reverse video, press the  key to enter the "PRESET" menu.

6.3.1.3.3.1 "PRESET / Select" Menu

Purpose: This sub-menu allows a preset channel number to be selected, in order to fix the operating parameters of the transmitter.

Value: The parameter associated with this sub-menu is:

Parameter	**SELECT**
Value	Channel number between 001 and 128.

Procedure: The procedure to access the "Select" sub-menu is as follows:

Press the V key to enter the "Select" menu. If no channel has been preset, the screen displays the following message:

Otherwise, using the ↑ and ↓ keys, select a channel number.

Press the V key to validate the input. A confirmation screen displays the following message:

Press the V key to confirm the input. The main menu is displayed again with the selected channel number:

Press the X key to cancel the input. The screen returns to the "PRESET" menu:

6.3.1.3.3.2 "PRESET / Create/Modify" Menu

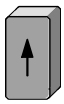
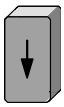
Purpose: This sub-menu allows:

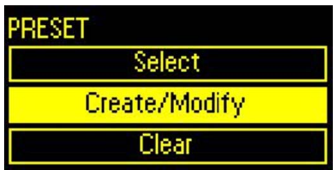
- a preset channel to be created, by fixing the associated parameters,
- an existing channel to be modified, by changing the value of one or more of its parameters.

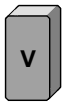
Value: The parameters associated with a preset channel are:

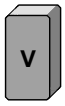
Parameter	***MODE***	***FREQUENCY***	***FREQUENCY OFFSET***
Value	*A3E or F3E*	*118 to 144 MHz in VHF.* *225 to 400 MHz in UHF.*	*0, ±2.5, ±4, ±5, ±7.3, ±7.5, ±8 kHz in VHF (2 to 5 carriers).* *0, ±2.5, ±5, ±7.3, ±7.5 kHz in UHF. (2 to 4 carriers).*

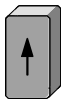
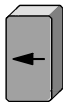
Procedure: The procedure to access the "Select" sub-menu is as follows:

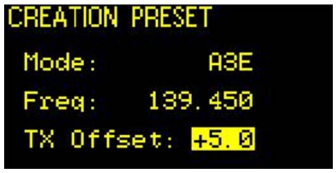
Using the  and  keys, select the "Create/Modify" sub-menu:

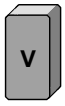


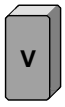
Press the  key to enter the "Create/Modify" sub-menu. **If this is a creation,** the screen displays:

Press the  key to enter the parameter entry menu:

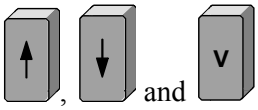
Using the  or  keys on the keyboard, select the value of the Mode, Frequency and Frequency offset parameters :



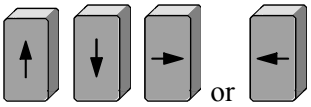
Press the  key to validate the parameter input. A confirmation screen appears:

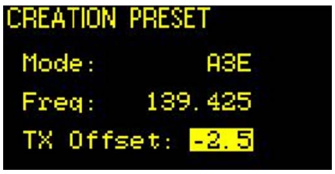
Press the  key to confirm. The "PRESET" sub-menu is displayed on the screen again:

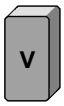
If this is a modification, the screen displays:

Using the 

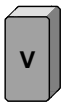
keys, select a channel number, then validate. The screen displays the parameters of the selected channel:

Using the  keys on the keyboard, modify the value of the Mode, Frequency or Frequency offset parameters:

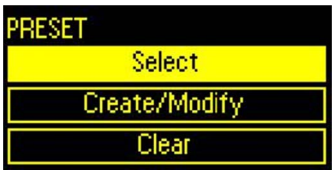


Press the 

key to validate the input. A confirmation screen displays the following message:

Press the 

key to confirm. The "PRESET" sub-menu is displayed on the screen:



6.3.1.3.3.3 "PRESET / Clear" Menu

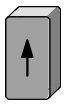
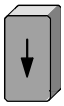
Purpose: This sub-menu allows:

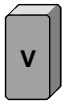
- a preset channel to be cleared by specifying its number,
- all preset channels to be cleared.

Value: The parameters associated with a preset channel are:

Parameter	***CLEAR ONE PRESET***	***CLEAR ALL PRESETS***
Value	*Number of preset channel to be cleared*	*No specific value*

Procedure: The procedure to access the "Clear" sub-menu is as follows:

Using the  and  keys, select the "Clear" sub-menu:

Press the 

key to enter the "Clear" sub-menu. The screen displays:

6.3.1.3.3.3.1 Clearing a single channel

Press the V key to enter the "Clear one preset" sub-menu. The screen displays:

Using the ↑ and ↓ keys, select the number of the channel to be cleared. The only numbers proposed by the transmitter are the existing channels:

Press the V key to validate the input. A confirmation screen appears:

Press the V key to confirm. The "PRESET" sub-menu is displayed on the screen again:

6.3.1.3.3.3.2 Clearing all channels

Using the → and ← keys, select the "Clear all Presets" sub-menu. The screen displays:

Press the V key to enter the "Clear all presets" sub-menu. A confirmation screen appears:

Press the V key to confirm. The "PRESET" sub-menu is displayed on the screen again:

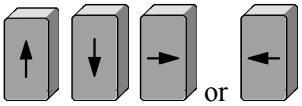
6.3.1.3.4 "AUDIO" menu

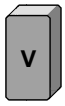
Purpose: This menu allows the type of modulating AF supplied to the transmitter to be selected.

Value: The values of the parameter associated with the AF type are:

Value	**ANALOG**	**VoIP**
Meaning	The AF is supplied in the form of an analog voltage centred on ground. It is available on the **J7** operating connector.	The AF is digitally received by the transmitter. It is supplied in the form of a data frame in the VoIP network protocol. It is available on one or other of the **J14** or **J15** Ethernet connectors.

Procedure: The procedure to access the "AUDIO" menu is as follows:

Using the  keys on the keyboard, select the **AUDIO** zone.

When this is displayed in reverse video, press the 

key to enter the "AUDIO" menu.

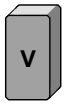
6.3.1.3.4.1 "AUDIO/ANALOG" Menu

Purpose: This menu allows the type of analog AF to be selected, as well as its level, expected at the transmitter input:

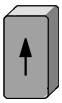
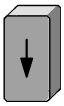
Value: The values of the parameter associated with the input AF level are:

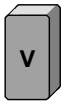
Value	**LINE LEVEL IN**
Meaning	From 0 to -30dBm by steps of 3dB.

Procedure: The procedure to access the "AUDIO/ANALOG" menu is as follows:

Press the 

key to enter the "AUDIO/ANALOG" sub-menu. The screen displays the entry parameter for the AF line level at the transmitter input:

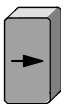
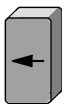
Using the  and  keys, select the desired value of the input AF:

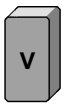
Press the 

key to validate the input. The operating menu appears with the AF level displayed "-12dBm":

6.3.1.3.4.2 "AUDIO/VOIP" Menu

Purpose: This menu allows the type of VoIP AF, from one of the Ethernet channels, to be selected.
Value: No associated parameter.
Procedure: The procedure to access the "AUDIO/VOIP" menu is as follows:

Using the  and  keys, select the "VOIP" sub-menu. The screen displays:

Press the 

key to validate the selection. The operating menu appears with the indication "Voip":

6.3.1.3.5 "MODE" Menu

Purpose: This menu allows the selected modulation mode for operation of the transmitter to be adopted.

Value: The values of the parameter associated with the mode are:

Value	*A3E*	*F3E (optional)*
Meaning	AM Modulation	FM Modulation

Note:
Several analog or digital modulation modes are being developed or are pending on the station, but are not available for the moment.

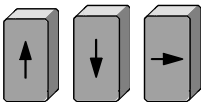
Being developed :

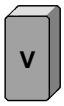
Value	*ACARS*	*VDL2*
Meaning	*AM-MSK Modulation*	*D8PSK Modulation*

Pending :

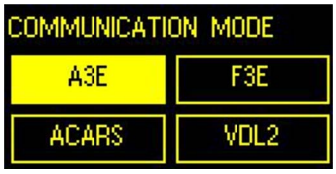
Value	*G3E*	*VDL4*
Meaning	*Emphasized FM Modulation*	*GFSK Modulation*

Procedure: The procedure to access the "MODE" menu is as follows:

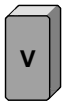
Using the  keys on the keyboard, select the **Mode** zone.

When this is displayed in reverse video, press the 

key to enter the "MODE" menu.

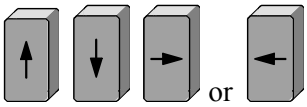


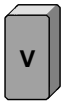
6.3.1.3.5.1 Selection of A3E mode

Press the 

key to validate the selection. The operating menu appears with the indication "A3E" in the central zone:

6.3.1.3.5.2 Selection of F3E mode

Using the  keys on the keyboard, select the "F3E" zone.

Press the  key to validate the selection. The operating menu appears with the indication "F3E" in the central zone:

6.3.1.3.5.3 Selection of ACARS or VDL2 modes

These modes are being developed. Selecting one of them results in the following screen being displayed.

6.3.1.3.6 "FREQ" Menu

Purpose: This menu allows the transmitter's operational frequency to be entered. This must comply with the ICAO recommendation, Appendix 10, relating to coding of frequencies as a function of the operating channel widths and the modulation mode.

Equipment	*Frequency band*	*Modulation mode*	*Channel width*
EM9000-2G	VHF	A3E	8.33kHz and 25kHz
		F3E	25kHz
EM9010-2G	UHF	A3E	8.33kHz, 12.5kHz and 25kHz
		F3E	12.5kHz and 25kHz

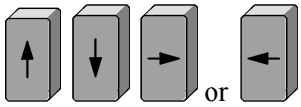
Value: The first table below describes the possible frequency values for the 1st one hundred kHz of the VHF range, and the second for the 1st one hundred kHz of the UHF range. This rule will then be applicable for all the other frequencies of the respective bands:

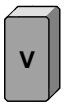
VHF frequency coding for 25kHz channel	*VHF frequency coding for 8.33kHz channel*	*Operational frequency (in MHz)*
118.000	118.005	118,00000
	118.010	118,00833
	118.015	118,01666
118.025	118.030	118,02500
	118.035	118,03333
	118.040	118,04166
118.050	118.055	118,05000
	118.060	118,05833
	118.065	118,06666
118.075	118.080	118,07500
	118.085	118,08333
	118.090	118,09166

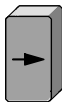
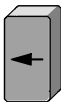
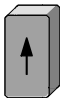
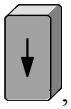
UHF frequency coding for 25kHz channel	*UHF frequency coding for 12.5kHz channel*	*UHF frequency coding for 8.33kHz channel*	*Operational frequency (in MHz)*
225.000	225.000	225.005	225,00000
		225.010	225,00833
	225.012		225,01250
		225.015	225,01666
225.025	225.025	225.030	225,02500
		225.035	225,03333
	225.037		225,03750
		225.040	225,04166
225.050	225.050	225.055	225,05000
		118.060	225,05833
	225.062		225,06250
		225.065	225,06666
225.075	225.075	225.080	225,07500
		225.085	225,08333
	225.087		225,08750
		225.090	225,09166

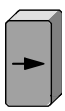
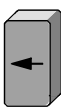
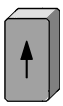
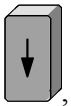
6.3.1.3.6.1 "Freq" menu in A3E mode

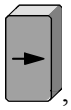
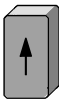
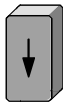
Procedure: The procedure to access the "FREQ" menu in A3E mode is as follows:

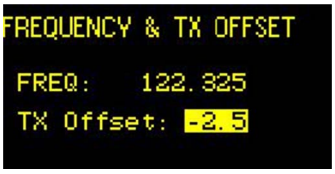
Using the  keys on the keyboard, select the **Freq** zone.

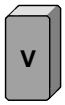
When this is displayed in reverse video, press the  key to enter the "FREQUENCY & TX OFFSET" menu. The following screen appears:

Using the  and  keys, then  and  , select then modify a particular digit of the frequency.

Using the  and  keys, then  and  , select the frequency offset.

Using the  ,  and  keys, modify the Tx offset value:



Press the  key to return to the main operating menu.

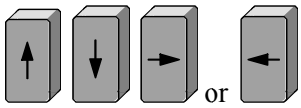
Note: *The tables below give the frequency offset values according to the frequency range, the channel width and the number of carriers.*

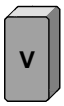
UHF RANGE (EM9010-2G TRANSMITTER)		
Channel width	***Number of carriers***	***Frequency offset***
25 kHz	2	± 5kHz
	3	0kHz and ± 7.3kHz
	4	± 2.5kHz and ± 7.5kHz
12.5 kHz	No Offset frequency mode	
8.33 kHz	No Offset frequency mode	

VHF RANGE (EM9000-2G TRANSMITTER)		
Channel width	***Number of carriers***	***Frequency offset***
25 kHz	2	± 5kHz
	3	0kHz and ± 7.3kHz
	4	±2.5kHz and ± 7.5kHz
	5	0kHz, ±4kHz and ±8kHz
8.33 kHz	2	± 2.5kHz

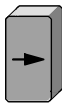
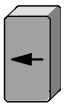
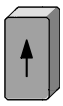
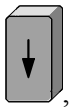
6.3.1.3.6.2 "Freq" menu in F3E mode

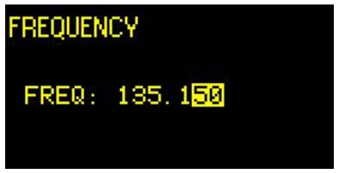
Procedure: The procedure to access the "FREQ" menu in F3E mode is as follows:

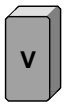
Using the  keys on the keyboard, select the **Freq** zone.

When this is displayed in reverse video, press the 

key to enter the "FREQUENCY" menu. In F3E mode, there is no frequency offset option, and hence the following screen is displayed:

Using the  and  keys, then  and  , select then modify a particular digit of the frequency.



Press the 

key to return to the main operating menu.

6.3.1.3.7 "SETUP" Menu

Purpose:
This menu allows configuration of the transmitter parameters not directly linked to the main operating menu. The base "SETUP" menu is itself broken down into several sub-menus, each dedicated to a particular set of parameters.

Value: The values of the sub-menus associated with the "SETUP" menu are:

Value	*HW CONFIG.*	*DISPLAY*
Meaning	Allows the "On/Off Command" and "PTT security" parameters to be accessed	Allows the menu "display language" and screen "brightness" adjustment to be accessed

Value	*IP*	*JBUS*	*REMOTE CTL*
Meaning	Allows the "Internet access configuration" parameters to be accessed	Allows the "JBUS 1 and 2 links configuration" parameters to be accessed	Allows the "Equipment remote control" parameter to be accessed

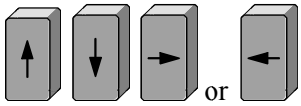
6.3.1.3.7.1 "SETUP / HW Config." Menu

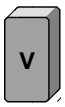
Purpose: The purpose of this menu is to specify:
- The parameters related to the transmitter "On/Off command", on the one hand,
- The PTT security time-out, on the other.

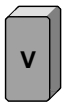
Value: The parameters associated with the "HW CONFIG." menu are:

Value	*ON/OFF*	*PTT TO*
Meaning	Allows the transmitter software "On/Off Command" to be activated or deactivated, and the priority to be selected.	Allows the duration of the PTT command to be fixed before activation of protection.

Procedure: The procedure to access the "HW CONFIG." menu is as follows:

Using the  keys on the keyboard, select the **Setup** zone.

When this is displayed in reverse video, press the  key to enter the "SETUP" menu.

Press the  key to enter the "HARDWARE CONFIG." menu.

6.3.1.3.7.1.1 "SETUP / HW Config./ ON/OFF" Menu / ON/OFF »

Purpose: The purpose of this menu is to activate or deactivate the transmitter software "On/Off Command", and to fix the priority between the software command and the hardware command:

Value: The parameters associated with the "ON/OFF" menu are:

For the status of the software command:

Value	*ON*	*OFF*
Meaning	Allows the transmitter software "On/Off Command" to be activated	Allows the transmitter software "On/Off Command" to be deactivated

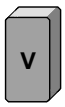
For the command priority:

Value	*SOFT*	*HARD*
Meaning	Allows priority to be given to the transmitter software "On/Off Command"	Allows priority to be given to the transmitter hardware "On/Off Command"

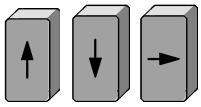
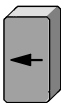
Note:
*Remember that the hardware "On/Off Command" is accessible on the **J7-11** contact of the operating connector.*

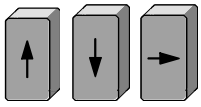
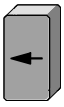
Procedure: The procedure to access the "ON/OFF" menu is as follows:

Enter the "HARDWARE CONFIG." menu as per the procedure described in § 6.3.1.3.7.1 "SETUP / HW Config." Menu

Press the 

key to enter the "ON/OFF COMMAND" menu.

Press the  or  keys on the keyboard, to select the status of the software "On/Off Command" and/or to access the "Prio" parameter:

Press the  or  keys on the keyboard, to select the priority of the "On/Off Command":

6.3.1.3.7.1.2 "SETUP / HW Config./ PTT TO" Menu / PTT TO »

Purpose: The purpose of this menu is to fix the maximum duration of the PTT command before activation of protection.

Value: The parameter associated with the "PTT TO" menu is:

Value	*0 to 300s, by steps of 5s*
Meaning	Fixes the PTT protection activation delay from 0 to 300 seconds, by steps of 5 seconds. The value "0" corresponds to: no protection active.

Procedure: The procedure to access the "PTT TO" menu is as follows:

After entering the "HARDWARE CONFIG." menu as per the procedure described in § 6.3.1.3.7.1 "SETUP / HW Config." Menu., press the → or ← keys on the keyboard, to select the "PTT TO" parameter:

Press the V key to enter the "PTT TIMEOUT" menu.

Press the ↑ or ↓ keys on the keyboard, to modify the delay value:

Press the V key to return to the "HARDWARE CONFIG." menu:

6.3.1.3.7.2 "SETUP/ Display" Menu

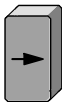
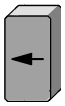
Purpose: The purpose of this menu is to:

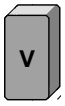
- Specify the menu display language, on the one hand,
- Adjust the display screen brightness, on the other.

Value: The parameters associated with the "DISPLAY" menu are:

Value	*Language*	*Brightness*
Meaning	Allows the menu display language to be specified as French or English.	Allows the display screen brightness to be adjusted by a bar graph.

Procedure: The procedure to access the "DISPLAY" menu is as follows:

Select the "SETUP" menu, then using the  or  keys on the keyboard, select the **Display** zone:

When this is displayed in reverse video, press the 

key to enter the "DISPLAY SETTINGS" menu.

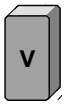
6.3.1.3.7.2.1 "SETUP / Display / Language" Menu

Purpose: The purpose of this menu is to select the menu display language.

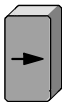
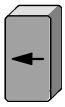
Value: The parameters associated with the "LANGUAGE" menu are:

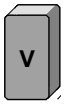
Value	*English*	*Français*
Meaning	The menus are displayed in English (default value)	The menus are displayed in French

Procedure: The procedure to access the "SELECT LANGUAGE" menu is as follows:

Enter the "DISPLAY SETTINGS" menu as per the procedure described in § 6.3.1.3.7.2 "SETUP/ Display" Menu, then press the 

key to enter the "SELECT LANGUAGE" menu:

Press the  or  keys on the keyboard, to select the display language:

Press the 

key on the keyboard to return to the "DISPLAY SETTINGS" menu:

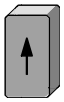
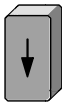
6.3.1.3.7.2.2 "SETUP / Display / Brightness" Menu

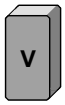
Purpose: The purpose of this menu is to allow the menu display screen brightness to be adjusted

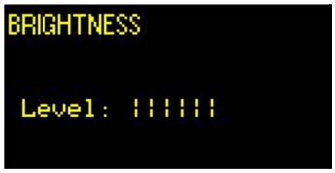
Value: The parameter associated with the "BRIGHTNESS" menu is displayed in the form of a bar graph the length of which is proportional to the brightness:

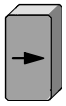
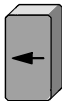
- Short: low brightness,
- Long: high brightness.

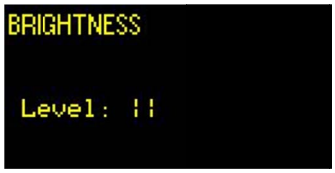
Procedure: The procedure to access the "BRIGHTNESS" menu is as follows:

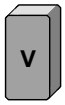
After entering the "DISPLAY SETTINGS" menu as per the procedure described in § 6.3.1.3.7.2 "SETUP/ Display" Menu, press the  or  keys on the keyboard, to select the "Brightness" parameter.

Press the  key to enter the "BRIGHTNESS" menu:



Press the  or  keys on the keyboard, adjust the brightness:



Press the  key to return to the "DISPLAY SETTINGS" menu:

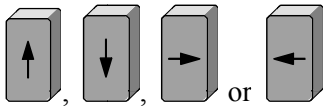
6.3.1.3.7.3 "SETUP / IP" Menu

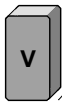
Purpose: The purpose of this menu is to configure the IP parameters, used for Ethernet links (connectors **J14** and **J15**).

Value: The parameters associated with the "IP" menu are:

Value	*ETH1*	*ETH2*
Meaning	Allows the parameters for Ethernet link no. 1 (connector **J14**) to be configured	Allows the parameters for Ethernet link no. 2 (connector **J15**) to be configured

Procedure: The procedure to access the "IP" sub-menu is as follows:

Select the "SETUP" menu, then using the  , , or keys on the keyboard, select the **IP** zone:

When this is displayed in reverse video, press the  key to enter the "IP CONFIGURATION" menu.

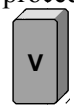
6.3.1.3.7.3.1 "SETUP/ IP/ ETH1" Menu

Purpose: This menu allows configuration of the parameters for Ethernet link no. 1.

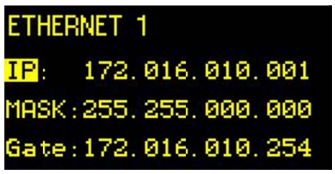
Value: The parameters associated with the "ETH1" menu are:

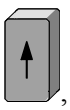
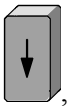
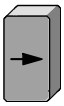
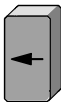
Value	*IP*	*Mask*	*Gate*
Meaning	Fixes the IP address according to the format: xxx.xxx.xxx.xxx, where each xxx field can go from 000 to 255.	Fixes the subnet mask address according to the format: xxx.xxx.xxx.xxx, where each xxx field can go from 000 to 255.	Fixes the gateway address according to the format: xxx.xxx.xxx.xxx, where each xxx field can go from 000 to 255.

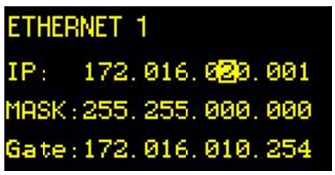
Procedure: The procedure to access the "ETH1" menu is as follows:

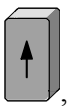
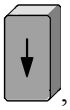
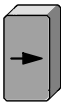
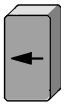
Enter the "IP CONFIGURATION" menu as per the procedure described in § 6.3.1.3.7.3 "SETUP / IP" Menu, then press the 

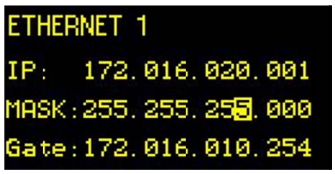
key to enter the "ETHERNET 1" menu:

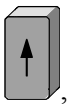
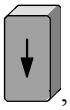
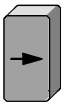
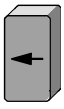


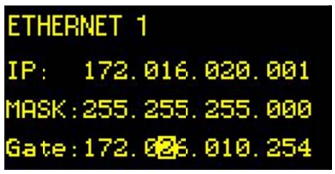
Using the  ,  ,  and  keys on the keyboard, modify the IP address:

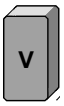


Using the  ,  ,  and  keys on the keyboard, modify the subnet mask address:



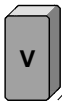
Using the  ,  ,  and  keys on the keyboard, modify the Gateway address:



Press the 

key on the keyboard, to validate the modifications. These are stored in Flash memory, ***but are not taken into account dynamically.*** The following message is displayed:

To take the new parameters of Ethernet link no.1 into account, ***the radio equipment must be restarted.*** The following message is displayed to indicate this requirement:

Press the 

key on the keyboard to return to the "IP CONFIGURATION" menu:

6.3.1.3.7.3.2 "SETUP/ IP/ ETH2" Menu

Purpose: This menu allows configuration of the parameters for Ethernet link no. 2. It resembles the previous menu in every way.

Remark : The IP address of the ETH2 interface must obligatory indicate a sub-network different from the one of the ETH1interface. If not, it will be impossible to exchange data with the radio.

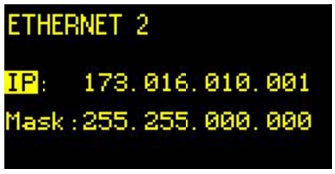
Value: The parameters associated with the "ETH2" menu are:

Value	*IP*	*Mask*
Meaning	Fixes the IP address according to the format: xxx.xxx.xxx.xxx, where each xxx field can go from 000 to 255.	Fixes the subnet mask address according to the format: xxx.xxx.xxx.xxx, where each xxx field can go from 000 to 255.

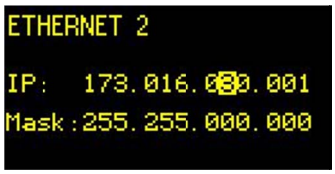
Procedure: The procedure to access the "ETH2" menu is as follows:

After entering the "IP CONFIGURATION" menu as per the procedure described in § 6.3.1.3.7.3 "SETUP / IP" Menu, press the → or ← keys on the keyboard, to select the "ETH2" parameter:

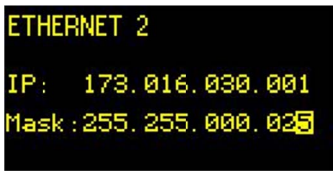
Press the V key to enter the "ETHERNET 2" menu:



Using the ↑, ↓, →, and ← keys on the keyboard, modify the IP address:



Using the ↑, ↓, →, and ← keys on the keyboard, modify the subnet address:



Press the V key on the keyboard, to validate the modifications. These are stored in Flash memory, ***but are not taken into account dynamically.*** The following message is displayed:

To take the new parameters of Ethernet link no.2 into account, ***the radio equipment must be restarted.*** The following message is displayed to indicate this requirement:

Press the V key on the keyboard to return to the "IP CONFIGURATION" menu:

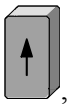
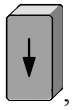
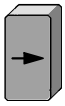
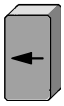
6.3.1.3.7.4 "SETUP / JBUS" Menu

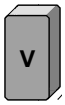
Purpose: The purpose of this menu is to configure the JBUS parameters, used for JBUS links no. 1 and no. 2 (connectors **J5** and **J2**).

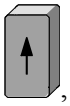
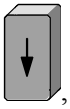
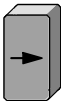
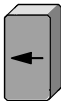
Value: The parameters associated with the "JBUS" menu are the same for the two JBUS links, and correspond to:

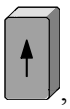
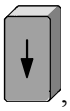
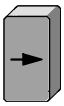
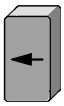
Value	*Address*	*Baud rate*	*Idle*
Meaning	Allows the address of the JBUS links 1 and 2 to be configured, from 000 to 255.	Allows the speed of the JBUS links 1 and 2 to be configured, to 1200, 2400, 9600, 19200, 38400, 57600 and 115200 Baud.	Allows the number of idle characters to be configured, from 003 to 255.

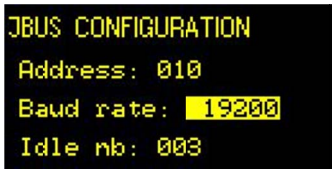
Procedure: The procedure to access the "JBUS" sub-menu is as follows:

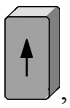
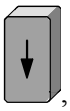
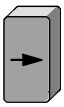
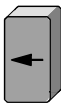
Select the "SETUP" menu, then using the  ,  ,  or  keys on the keyboard, select the **JBUS** zone.

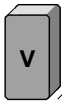
When this is displayed in reverse video, press the  key to enter the "JBUS CONFIGURATION" menu.

Using the  ,  ,  and  keys on the keyboard, modify the JBUS address:

Using the  ,  ,  and  keys on the keyboard, modify the JBUS speed.



Using the  ,  ,  and  keys on the keyboard, modify the number of idle characters.

Press the  key on the keyboard to return to the "SETUP" menu.

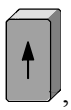
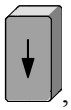
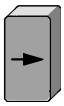
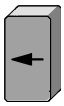
6.3.1.3.7.5 "SETUP/ REMOTE CTL" Menu

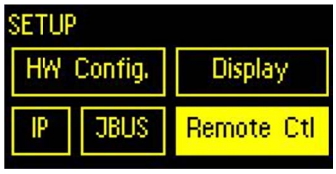
Purpose: The purpose of this menu is to place the radio equipment under remote control again, i.e. under the control of a supervisor.

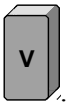
When the transmitter is under local control, note that it automatically changes back to remote controlled mode after 5 minutes of inactivity on the local keyboard.

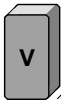
Value: No parameter.

Procedure: The procedure to access the "REMOTE CTL" sub-menu is as follows:

Select the "SETUP" menu, then using the  ,  ,  or  keys on the keyboard, select the **Remote Ctl** zone.



When this is displayed in reverse video, press the  . A screen requesting confirmation is displayed.

Press the  key on the keyboard to return to the operating menu. The operating menu displays the question: Change control to local? until the screen goes to standby.

6.3.1.3.8 "MAINT" menu

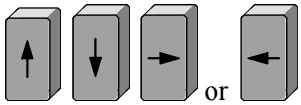
Purpose: This menu allows:

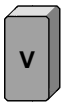
- equipment maintenance help screens to be provided in the form of measurement screens,
- different types of test to be managed: continuous or initiated,
- the accuracy of the frequency master oscillator to be adjusted,
- information relating to the equipment to be obtained: model, serial number, onboard software version.

Value: The values of the sub-menus associated with the "MAINT" menu are:

Value	**Measures**	**Test**	**TCXO**	**About**
Meaning	Allows the measurement screens to be accessed	Allows the test reports to be accessed	Allows the frequency master oscillator to be adjusted	Allows the general information to be accessed

Procedure: The procedure to access the "MAINT" menu is as follows:

Using the  keys on the keyboard, select the **Maint** zone.

When this is displayed in reverse video, press the  key to enter the "MAINTENANCE" menu.

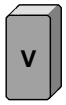
6.3.1.3.8.1 "MAINT / MEASURES" Menu

Purpose: This menu allows the measurement screens to be accessed.

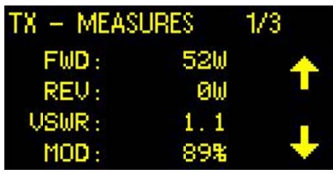
Value: The transmitter parameters displayed in the "MEASURES" menu are:

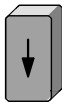
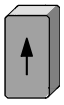
Parameter	Name	Value
Page 1: Output power		
Direct power	FWD	33 to 47dBm
Reflected power	REV	-∞ to 37dBm
Stationary wave ratio	VSWR	1 to +∞
Modulation depth	MOD	0 to 100%
Page 2: Temperatures		
AMPV26260 Amplifier Module Temperature	PA	0 to 100°C
ALIN26270 Power Supply Module Temperature	PS	0 to 100°C
Page 3: AF level/Power supply		
Input AF line level	LINE	-30 to 0dBm
$+V_{DC}$ power supply	+V=	21 to 31V

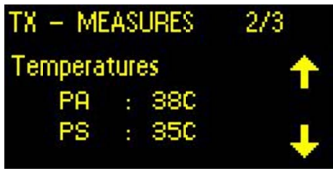
Procedure: The procedure to access the "MEASURES" menu from the "MAINTENANCE" menu is as follows:

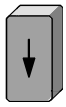
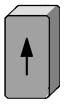
After entering the "MAINTENANCE" menu as per the procedure described in § 6.3.1.3.8 "MAINT" menu, press the 

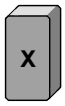
key on the keyboard, to display the 1st measurements page:



Press the  key to display the 2nd page of measurements, or the  key to display the 3rd page of measurements:



Press the  key to display the 3rd page of measurements, or the  key to display the 2nd page of measurements:

Press the 

key to return to the "MAINTENANCE" menu.

6.3.1.3.8.2 "MAINT / TEST" Menu

Purpose: This menu allows two types of tests built into the transmitter to be accessed, and the associated test reports to be viewed.

Value: The parameters associated with the "TEST" sub-menu of the "MAINT" menu are:

Value	**IBIT** *(Initiated Built-In Test)*	**CBIT** *(Continuous Built-In Test)*
Meaning	Test triggered by the user on request	Continuous testing of certain resources of the transmitter

Procedure: The procedure for accessing the "TEST" sub-menu of the "MAINT" menu is as follows:

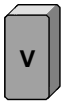
After entering the "MAINTENANCE" menu as per the procedure described in § 6.3.1.3.8 "MAINT" menu, press the → or ← keys on the keyboard, to select the **Test** zone.	
Press the v key to enter the "TESTS" menu.	

6.3.1.3.8.2.1 "MAINT / TEST / CBIT" Menu

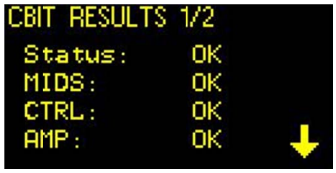
Purpose: This menu allows the result of the transmitter's continuous test to be displayed.

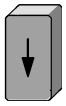
Value: No parameters.

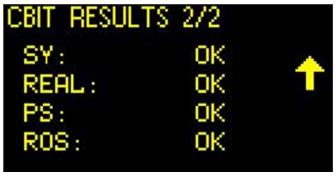
Procedure: The procedure to display the continuous test is as follows:

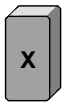
After entering the "TESTS" menu as per the procedure described in § 6.3.1.3.8.2 "MAINT / TEST" Menu, press the 

key on the keyboard to view the first page of the initiated test report:



Press the  key to view the second page of the initiated test report:



Press the 

key to return to the "TESTS" menu.

6.3.1.3.8.2.2 "MAINT / TEST / IBIT" Menu

Purpose: This menu allows the transmitter's initiated test to be accessed.

Value: The parameters associated with the "IBIT" sub-menu of the "TEST" menu are:

Value	**LAUNCH IBIT**	**IBIT RESULTS**
Meaning	Launching the initiated test	Display of the results of the initiated test

6.3.1.3.8.2.2.1 "MAINT / TEST / IBIT / LAUNCH IBIT" Menu

Purpose: This menu allows the transmitter's initiated test to be launched.

Value: No parameters.

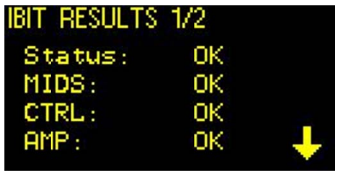
Procedure: The procedure to launch the initiated test is as follows:

After entering the "TESTS" menu as per the procedure described in § 6.3.1.3.8.2 "MAINT / TEST" Menu, press the → or ← keys on the keyboard to select the **IBIT** zone:

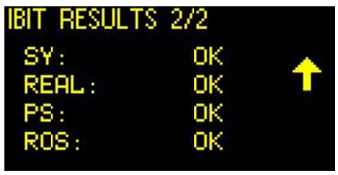
Press the V key to enter the "IBIT" page.

Press the V key to launch the "IBIT" initiated test.

At the end of the test, the result of the initiated test is displayed automatically:



Then :

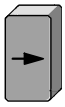
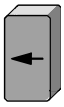


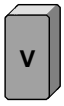
6.3.1.3.8.2.2.2 "MAINT / TEST/ IBIT / IBIT RESULTS" Menu

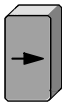
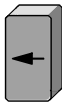
Purpose: This menu allows the result of the transmitter's initiated test to be displayed.

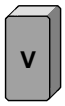
Value: No parameters.

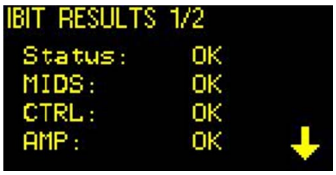
Procedure: The procedure to display the results of the initiated test is as follows:

After entering the "TESTS" menu as per the procedure described in § 6.3.1.3.8.2 "MAINT / TEST" Menu, press the  or  keys on the keyboard to select the **IBIT** zone.

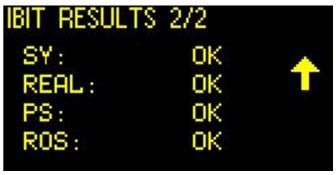
When this is in reverse video, press the  key to enter the "IBIT" page.

Press the  or  keys on the keyboard to select the **IBIT Results** zone.

Press the  key to display the initiated test report, page 1/2 :



Then page 2/2 :



6.3.1.3.8.3 "MAINT / TCXO" Menu

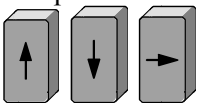
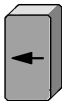
Purpose: This menu allows the accuracy of the frequency master oscillator generating the carrier to be adjusted.

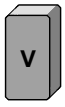
Value: The parameter associated with the "TCXO" sub-menu of the "MAINT" menu is:

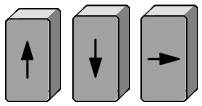
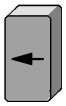
Value	***001 to 255***
Meaning	Frequency master oscillator adjustment value. Values between 001 and 127 reduce the frequency. Values between 127 and 255 increase the frequency.

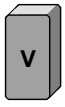
☞ *The electronic potentiometer (EEPOT) used for this adjustment is made up of 255 steps, and allows compensation of ±5ppm, i.e. an accuracy of about 0.04 ppm per step (≅ 5Hz in VHF, and between 9 and 16Hz in UHF).*

Procedure: The procedure for accessing the "TCXO" sub-menu of the "MAINT" menu is as follows:

After entering the "MAINTENANCE" menu as per the procedure described in § 6.3.1.3.8 "MAINT" menu, press the  or  keys on the keyboard, to select the **TCXO** zone.

Press the  key to enter the TCXO adjustment page.

Using the  and  keys, modify the adjustment value.

Press the  key to return to the "MAINTENANCE" menu.

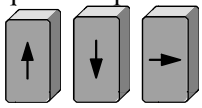
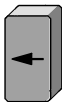
6.3.1.3.8.4 "MAINT / About" Menu

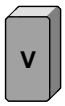
Purpose: This menu allows information relating to the transmitter to be viewed, such as the model, serial number or the onboard software version. This information is *read-only,* and therefore cannot be modified.

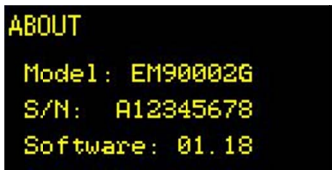
Value: The parameters associated with the "ABOUT" sub-menu of the "MAINT" menu are:

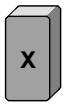
Value	***Model***	***S/N***	***Software***
Meaning	Transmitter type: EM90002G or EM90102G	Serial number of the CTRL11217 PCB	Embedded software version

Procedure: The procedure for accessing the "ABOUT" sub-menu of the "MAINT" menu is as follows:

After entering the "MAINTENANCE" menu as per the procedure described in § 6.3.1.3.8 "MAINT" menu, press the  or  keys on the keyboard, to select the **About** zone.

Press the  key to enter the information display page:



Press the  key to return to the "MAINTENANCE" menu.

6.3.2 Local operation through the front panel RS232 interface

The front panel RS232 interface allows connection of either an RS232 terminal, or a PC emulating a terminal.

Refer to § 4.1.1 "Front panel connectors", for the pin configuration of the 9-contact RS232 SUB-D connector.

Refer to § 6.2.2 "Local commands through the RS232 terminal", to obtain the list of local commands available from the front panel MAINTENANCE connector.

For details of the commands, refer to the document [1] ***ICDFR 40600034 V1.00 Série 9000-2G MAINTENANCE:*** *Interface Control Document relating to the local operation link from the RS232 front panel interface.*

6.4 REMOTE OPERATION OF EQUIPMENT

6.4.1 Remote operation through the JBUS link

The JBUS interface allows the transmitter to be supervised from a remote Master Supervisor, through a RS485 type electrical interface.

Refer to § 4.2.2 "Rear panel connectors – J2 Supervision connector", for the pin configuration of the 9-contact JBUS interface SUB-D connector.

Refer to § 6.2.3 "Remote commands through the JBUS link", to obtain the list of remote commands available from the rear panel JBUS connector.

*For the details of the JBUS tables available to read and available to write, refer to the document [3] **ICDFR 40600036 V1.00 Série 9000-2G JBUS:** Interface Control Document relating to the JBUS protocol supervision link.*

6.4.2 Remote operation through the SNMP link

The SNMP interface allows the transmitter to be supervised from a networked Supervisor, through an Ethernet type electrical interface.

Refer to § 4.2.2 "Rear panel connectors – J14 and J15 Ethernet connectors", for the pin configuration of the RJ45 interface connectors.

Refer to § 0 "Remote commands through the JBUS SNMP", to obtain the list of remote commands available from the rear panel RJ45 connectors.

For details of the commands accessible through the SNMP protocol, refer to the document [2] ***ICDFR 40600035 V1.00 Série 9000-2G agent SNMP :*** *Interface commands document relating to the SNMP protocol supervision link.*

CHAPTER 7. MAINTENANCE

7.1 MAINTENANCE CONCEPT

7.1.1 Reminder of safety rules

Maintenance operations may result in handling the equipment, opening it, as well as replacing or checking certain modules or PCBs.

Before any handling, carefully read in this manual § 1.4 "Safety rules".

7.1.2 Preventive maintenance

Preventive maintenance consists in performing a series of periodical checks and operations that aim at keeping the equipment operating smoothly.

List of preventive maintenance operations:

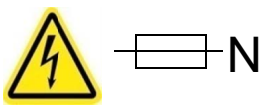
Identification	*Frequency*						*Type*	*Degree*			*Guide Sheet*	
	M	**Q**	**B**	**A**	**C**	**R**		**1**	**2**	**3**	**No.**	**§**
1		X					Overall cleaning	X		X	E1	7.4.4
2		X			X	X	Testing of overall operation			X	V1	7.6.4

M: Monthly, **Q**: Quarterly, **B**: Bi-annually, **A**: Annually, **C**: Before first connection, **R**: After repair

7.1.3 Corrective maintenance

7.1.3.1 Type of protective fuses

Protective fuses present on the power supply inputs.



DOUBLE POLE / FUSE ON NEUTRAL.

If this symbol is present on the rear of the device, then there is also a fuse on Neutral. Risk of electric shock.

Mains Input: 10A/250V slow-blow fuses, dimensions 5x20mm on phase and neutral.
Reference FST5x20/10A (Telerad Code: 210 00012).

Battery Input: 20A/250V slow-blow fuse, dimensions 10.3x38mm on positive.
Reference D20TD/20A (Telerad Code: 210 00126).

7.1.3.2 Corrective maintenance operations

Corrective maintenance involves the replacement of the defective PCBs after a fault has been detected. Faults may be detected in a number of ways:

- Equipment operation is impossible,
- Front panel alarm indicator light,
- IBIT and CBIT built-in tests,
- Detection of fault by supervision.

To access the transmitter's internal PCBs or modules, be sure first of all to cut the DC power supply with the front panel On/Off switch, then cut the mains power supply with the rear panel On/Off switch (for EM9000A-2G and EM9010A-2G versions), then gently disconnect the various connectors from the rear panel. Then slide out the equipment on the support guides, place it on a clean flat surface, and unscrew the top cover.
The following guide sheets give the disassembly and reassembly procedures for PCBs or modules.

Generally speaking, before equipment is ever opened for operations, comply with the electrical safety rules indicated in § 1.4.3.2 "ELECTRICAL RISKS".

7.2 ELEMENTS FOR MAINTENANCE HELP

Most of the transmitter's PCBs or modules have indicator lights representing the logic state of the signals; they provide information about their validity.

7.2.1 ALIN26270 or ALIN26272 power supply module

No indicator lights for RALI16105 or RALI16107 PCBs.

7.2.2 CTRL11217 control and management PCB

The following table indicates the indicator lights present on the PCB and their meaning:

Indicator light	*Meaning*	*On*
S1	Yellow light indicating validation of P_{DIR} and P_{RFL} info	Not valid
DS2	Red light indicating cut-off of the I channel	Cut-off
DS3	Red light indicating cut-off of the Q channel	Cut-off
DS4	Green light indicating presence of +3.3V internal voltage	Present
DS5	Green light indicating presence of +5V internal voltage	Present
DS6	Green light indicating presence of +V= internal voltage	Present
DS7	Green light indicating presence of +15V internal voltage	Present
DS8	Green light indicating presence of -15V internal voltage	Present

7.2.3 MIPR11005 microcontroller and DSP PCB

The following table indicates the indicator lights present on the PCB and their meaning:

Indicator light	*Meaning*	*On*
S1	Red light indicating µC "Hardware Reset"	Reset
DS2	Red light indicating DSP_RESET# DSP Reset	Reset
DS3	Green light indicating operation on external 10MHz	Present
DS4	Green light indicating activity on µC data bus	Busy
DS5	Green light indicating TxD activity on the µC SCC2 link	Active
DS6	Green light indicating TxD activity on the µC SCC3 link	Active
DS7	Green light indicating TxD activity on the µC SCC1 link	Active
DS8	Green light indicating TxD activity on the µC SCC4 link	Active

7.2.4 PAVE41160 front panel PCB

The indicator lights present on the PCB are those visible on the front panel.
See § “Presentation of front panel”.

7.2.5 SVHF25077 or SUHF25078 synthesizer modules

The following table indicates the indicator lights present on the PCB and their meaning:

Indicator light	*Meaning*	*On*
DS1	Red light indicating MN3 PLL F_{op} alarm	Alarm
DS2	Green light indicating locked MN9 10MHz PLL	OK

7.2.6 AMPV26260 VHF or AMPU26246 UHF Amplifier modules

No indicator lights present on the amplifier modules.

7.3 FAULT LOCALISATION

The fault can be quickly located in the PCBs or modules using the test menu available on the front panel HMI (See § 6.3.1.3.8.2.1 "Maint/Test/CBIT").
The report analysis specifies the faulty PCB(s) or module(s):

- The first page gives the status of the following PCBs and modules:
  - The transmission function as a whole: OK or DEF.
  - The MIPR11005 microcontroller/DSP PCB: OK or DEF.
  - The CTRL11217 control PCB: OK or DEF.
  - The AMPV26260 or AMPU26246 amplifier module: OK or DEF.

- The second page gives the status of the following PCBs and modules:
  - The SVHF25077 or SUHF25078 synthesizer module: OK or DEF.
  - The ALIN26270 *(EM9000A-2G version)* or ALIN26272 *(EM9010A-2G version)* or ALDC26264 *(EM9000C-2G and EM9010C-2G versions)* power supply module: OK or DEF.
  - The PS module (Power Supply) : OK or DEF.
  - The ENV. Condition (Environment outside the equipment) : OK or DEF.

7.4 MAINTENANCE AND CLEANING OPERATIONS

7.4.1 Frequency table

Operations	*Frequency*
Cleaning the equipment	Annually

7.4.2 Maintenance operations directory

Sheet E1: Cleaning the equipment.

7.4.3 List of required tools

- Dry cloth.
- Cleaning brush.
- Computer equipment cleaner.

7.4.4 E1 guide sheet

EQUIPMENT:	MAINTENANCE SHEET
VHF DIGITAL TRANSMITTER UHF DIGITAL TRANSMITTER	**E1** **Folio** 1/1
SCOPE: Cleaning the equipment.	**Staff:** 1st and 2nd lines

SAFETY INSTRUCTIONS:

Power off the equipment.

The person handling the equipment must be equipped with a ground bracelet.

PROCEDURE:

1) Gently disconnect the various connectors from the rear panel of the transmitter.
2) If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.
3) Using a dry cloth, remove all traces of dust on the top cover (and possibly the bottom cover), as well as on the front and rear panels.
4) Using a brush, clean the contacts of the various front and rear panel connectors.
5) If necessary, replace the equipment in the rack, then connect all the connectors.

7.5 DISASSEMBLY / REASSEMBLY OPERATIONS

7.5.1 Frequency table

Operations	*Frequency*
Disassembly / Reassembly of AMPV26260 VHF or AMPU26246 UHF module	On detection of failure (for disassembly), or after repair (for reassembly)
Disassembly / Reassembly of ALIN26270 or ALIN26272 Power supply module	
Disassembly / Reassembly of REAL16102 Power supply module	
Disassembly/ Reassembly of PAVE41160 front panel PCB	
Disassembly/ Reassembly of CTRL11217 control PCB	
Disassembly / Reassembly of MIPR11005 microcontroller/DSP PCB	
Disassembly / Reassembly of Synthesizer module SVHF25077 or SUHF25078	
Disassembly / Reassembly of antenna's coaxial relay	

7.5.2 Maintenance operations directory

Sheet D1: Disassembly / Reassembly of AMPV26260 VHF or AMPU26246 UHF amplifier module
Sheet D2: Disassembly / Reassembly of ALIN26270 or ALIN26272 Power supply module
Sheet D3: Disassembly/ Reassembly of REAL16102 Power supply PCB.
Sheet D4: Disassembly/ Reassembly of PAVE41160 front panel PCB.
Sheet D5: Disassembly/ Reassembly of CTRL11217 control PCB.
Sheet D6: Disassembly / Reassembly of MIPR11005 microcontroller/DSP PCB.
Sheet D7: Disassembly / Reassembly of Synthesizer module SVHF25077 or SUHF25078.
Sheet D8: Disassembly / Reassembly of antenna's coaxial relay.

7.5.3 List of required tools

- 1 5mm-diameter Phillips screwdriver.
- 1 8mm open-end wrench.
- 1 5mm-diameter elbow tubular wrench.
- 1 5.5mm-diameter elbow tubular wrench.

7.5.4 General note regarding disassembly of PCBs or modules

Unless otherwise indicated by TELERAD, before disassembling a PCB or module, always check that the equipment is powered off, and that its power supply cable is disconnected from the source.

7.5.5 D1 guide sheet

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D1** **Folio** 1/2
SCOPE: Disassembly / Reassembly of AMPV26260 VHF or AMPU26246 UHF amplifier module	**Staff:** 1st and 2nd lines

SAFETY INSTRUCTIONS:

Refer to § 7.5.4 "General note regarding disassembly of PCBs or modules".

DISASSEMBLY PROCEDURE:

1) Gently disconnect the various connectors from the rear panel of the transmitter.

2) If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.

3) Using the Phillips screwdriver, remove the top cover (11 screws).

4) Disconnect the 2 Subclic connectors corresponding to the master oscillator for one *(CX91365 cable, J22 connector),* and to the RF test for the other *(CX92135 cable, J16 connector).*

5) Disconnect the 14-contact CTRL/HF1 ribbon cable linking to the CTRL11217 PCB *(CY96268 cable, J18 connector).*

6) Disconnect the 20-contact CTRL/HF2 ribbon cable linking to the CTRL11217 PCB *(CY91326 cable, J19 connector).*

7) Disconnect the 6-contact RALI/HF power supply cable *(J20 connector)* linking to the RALI16105 PCB *(EM9000A-2G version),* the RALI16107 PCB *(EM9010A-2G version),* or the REAL16102 PCB *(EM9000C-2G and EM9010C-2G versions).*

8) Using the Phillips screwdriver, unscrew the:
   - 2 screws attaching the module to the front panel,
   - 1 screw attaching the module to the top of the chassis,
   - 4 screws attaching the module to the bottom of the chassis,
   - 3 screws attaching the module to the rear of the chassis,

9) Remove the complete AMPV26260 or AMPU26246 module (PCBs + shielding + radiator).

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D1** **Folio** 2/2
SCOPE: Disassembly / Reassembly of AMPV26260 VHF or AMPU26246 UHF amplifier module	**Staff:** 1st and 2nd lines

REASSEMBLY PROCEDURE:

1) Place the AMPV26260 or AMPU26246 module to be installed in its location, on the left side of the transmitter, starting by putting the antenna output N connector in place.

2) Using the Phillips screwdriver, tighten the:
   - 3 screws attaching the module to the rear of the chassis, being sure to align the attachment holes properly,
   - 4 screws attaching the module to the bottom of the chassis,
   - 1 screw attaching the module to the top of the chassis,
   - 2 screws attaching the module to the front panel,

3) First reconnect the ribbon cables linking to the CTRL11217 PCB *(CY96268 cable to J18 connector and CY91326 cable to J19 connector).*

4) Then reconnect the 2 Subclic connectors corresponding to the master oscillator and the RF test output, being sure to keep them lined up and pushed back in straight *(CX91365 cable to J22 connector and CX92135 cable to J16 connector)*.

5) Reconnect the power supply cable.

6) Lastly, screw the top cover back on (11 screws).

7) Replace the transmitter in the rack if necessary, then gently reconnect the various connectors on the rear panel of the transmitter.

7.5.6 D2 guide sheet

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D2** **Folio** 1/1
SCOPE: Disassembly / Reassembly of ALIN26270 or ALIN26272 Power supply module	**Staff:** 1st and 2nd lines

SAFETY INSTRUCTIONS:

Refer to § 7.5.4 "General note regarding disassembly of PCBs or modules".

DISASSEMBLY PROCEDURE:

1) Gently disconnect the various connectors from the rear panel of the transmitter.
2) If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.
3) Using the Phillips screwdriver, remove the top cover (11 screws).
4) Disconnect the 6-contact RALI/HF power supply cable linking to the AMPV26260 or AMPU26246 amplifier module.
5) Using the Phillips screwdriver, unscrew the:
   - 2 screws attaching the module to the front panel,
   - 3 screws attaching the module to the bottom of the chassis,
   - 4 screws attaching the module to the rear of the chassis,
   - 2 screws attaching the module to the side of the chassis,
6) Gently remove the complete ALIN26270 or ALIN26272 module until you access the ribbon cable linking to the CTRL11217 PCB *(CY31372 cable)*.
7) Disconnect the *CY31372* ribbon cable on the RALI16106 or RALI16105 PCB side.
8) Completely remove the ALIN26270 or ALIN26272 module.

REASSEMBLY PROCEDURE:

1) Connect the *CY31372* ribbon cable linking the RALI16105 or RALI16107 PCB and the CTRL11217 PCB.
2) Install the ALIN26270 or ALIN26272 module in its location, on the right side of the transmitter, starting by putting the rear of the module in place.
3) Using the Phillips screwdriver, tighten the:
   - 2 screws attaching the module to the side of the chassis,
   - 4 screws attaching the module to the rear of the chassis, being sure to align the attachment holes properly,
   - 3 screws attaching the module to the bottom of the chassis,
   - 2 screws attaching the module to the front panel,
4) Reconnect the power supply cable.
5) Screw the top cover back on (11 screws).
6) Replace the transmitter in the rack if necessary, then gently reconnect the various connectors on the rear panel of the transmitter.

7.5.7 D3 guide sheet

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D3** **Folio** 1/1
SCOPE: Disassembly/ Reassembly of REAL16102 Power supply PCB	**Staff:** 1st and 2nd lines

SAFETY INSTRUCTIONS:

Refer to § 7.5.4 "General note regarding disassembly of PCBs or modules".

DISASSEMBLY PROCEDURE:

1) Gently disconnect the various connectors from the rear panel of the transmitter.
2) If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.
3) Using the Phillips screwdriver, remove the top cover (11 screws).
4) Disconnect the 6-contact REAL/RF power supply cable linking to the AMPV26260 or AMPU26246 amplifier module.
5) Disconnect the *CY31372* ribbon cable on the REAL16102 PCB side.
6) Using the Phillips screwdriver, unscrew the attachment screws on the right side of the transmitter, on which the REAL16102 PCB is installed.
7) Gently remove the side + REAL16102 PCB assembly.
8) Using the Phillips screwdriver, unscrew the REAL16102 PCB's 4 attachment screws on the mechanical side.

REASSEMBLY PROCEDURE:

1) Offer up the REAL16102 PCB onto its supports, on the mechanical side, then using the Phillips screwdriver, tighten the 4 attachment screws.
2) Install the side + REAL16102 PCB assembly, starting by putting the rear of the side in place.
3) Using the Phillips screwdriver, screw back on the right side of the transmitter, fitted with the REAL16102 PCB.
4) Reconnect the *CY31372* ribbon cable linking the CTRL11217 PCB and the REAL16102 PCB.
5) Reconnect the 6-contact REAL/RF power supply cable.
6) Screw the top cover back on (11 screws).
7) Replace the transmitter in the rack if necessary, then gently reconnect the various connectors on the rear panel of the transmitter.

7.5.8 D4 guide sheet

EQUIPMENT:	MAINTENANCE SHEET
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D4** **Folio** 1/2
SCOPE: Disassembly/ Reassembly of PAVE41160 front panel PCB.	**Staff:** 1st and 2nd lines

SAFETY INSTRUCTIONS:

Refer to § 7.5.4 "General note regarding disassembly of PCBs or modules".

DISASSEMBLY PROCEDURE:

1) Gently disconnect the various connectors from the rear panel of the transmitter.
2) If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.
3) Using the Phillips screwdriver, remove the top cover (11 screws).
4) Disassembling the PAVE41160 PCB requires the transmitter front panel assembly to be disassembled in advance. To do so:
   - Disconnect the USB cable linking with the MIPR11005 PCB *(W3 cable, TLD reference: 39013846)*,
   - Using the side extractors, disconnect the miniature connector linking to the CTRL11217 PCB *(W4 cable, TLD reference: 28001804)*,
   - Disconnect the AMPV26260 or AMPU26246 module RF Test coaxial cable *(CX92135 cable, module J16 connector)*,
   - Unscrew the 6 screws attaching the front panel to the chassis,
   - Remove the front panel by pulling forwards gently.
5) Once the front panel is removed, disconnect the J1 connector linking with the front panel On/Off switch.
6) Disconnect the connector linking with the front panel microphone input and headphone output.
7) Using the Phillips screwdriver, unscrew the 2 screws attaching the 9-pin Maintenance SUB-D connector to the front panel.
8) Using the 5.5mm elbow tubular wrench, unscrew the 7 nuts attaching the PAVE41160 PCB to the chassis of the transmitter.

Be careful not to undo the 4 retaining nuts of the display itself, which attach the display to the PAVE41160 PCB.

9) Remove the PAVE41160 front panel PCB.

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D4** **Folio** 2/2
SCOPE: Disassembly/ Reassembly of PAVE41160 front panel PCB	**Staff:** 1st and 2nd lines

REASSEMBLY PROCEDURE:

1) Offer up the PAVE41160 PCB onto its mounting supports, being careful to place keys and indicator lights properly into their respective locations, and passing the USB connection cord through the PCB opening provided for this purpose.
2) Using the 5.5mm elbow tubular wrench, tighten the 7 nuts attaching the PAVE41160 PCB to the chassis of the transmitter.
3) Using the Phillips screwdriver, tighten the 2 screws attaching the 9-pin Maintenance SUB-D connector to the front panel, being sure to properly place the attachment washers between the connector and the front panel.
4) Reconnect the connector linking with the front panel microphone input and headphone output.
5) Reconnect the connector linking with the front panel On/Off switch.
6) Reassemble the front panel. To do so:
   - Replace the front panel on the transmitter chassis.
   - Tighten the 6 screws attaching the front panel to the chassis,
   - Reconnect the USB cable linking with the MIPR11005 PCB *(W3 cable, TLD reference: 39013846)*, red wire to pin 1 of the connector.
   - Reconnect the miniature connector linking with the CTRL11217 PCB *(W4 cable, TLD reference: 28001804)*,
   - Reconnect the AMPV26260 or AMPU26246 module RF Test coaxial cable *(CX92135 cable, module J16 connector),* passing it between the Amplifier module and the CTRL11217 PCB,
7) Screw the top cover back on (11 screws).
8) Replace the transmitter in the rack if necessary, then gently reconnect the various connectors on the rear panel of the transmitter.

7.5.9 D5 guide sheet

EQUIPMENT:	MAINTENANCE SHEET
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D5** **Folio** 1/2
SCOPE: Disassembly/ Reassembly of CTRL11217 control PCB.	**Staff:** 1st and 2nd lines

SAFETY INSTRUCTIONS:
Refer to § 7.5.4 "General note regarding disassembly of PCBs or modules".

DISASSEMBLY PROCEDURE:

1) Gently disconnect the various connectors from the rear panel of the transmitter.
2) If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.
3) Using the Phillips screwdriver, remove the top cover (11 screws).
4) Disconnect the 2 ribbon cables linking to the AMPV26260 or AMPU26246 amplifier module *(CY96268 and CY91326 cables)*.
5) Disconnect the ribbon cable linking to the J7 operating connector *(CY99252 cable)*.
6) Disconnect the ribbon cable linking to the SVHF25077 or SUHF25078 module *(CY91371 cable)*.
7) Disconnect the ribbon cable linking to the RALI16105, RALI16107 or REAL16102 PCB *(CY31372 cable)*.
8) Using the side extractors, disconnect the miniature connector of the ribbon connection to the PAVE41160 front panel *(W4 cable, TLD reference: 28001804)*.
9) Using the side extractors, disconnect the 2 miniature connectors of the ribbon connection with the MIPR11005 microcontroller/DSP PCB *(W1 and W2 cables, TLD reference: 28001706)*.
10) Disconnect the coaxial cable linking to the J16 SWR coupling connector *(CX91368 cable)*.
11) Using a 5mm elbow tubular wrench, undo the 6 nuts attaching the three JBUS (J2), TRANSCEIVER (J3) and DATA (J5) angled SUB-D connectors to the chassis.
12) Using the Phillips screwdriver, unscrew the 5 crosshead screws attaching the CTRL11217 PCB to the chassis.
13) Extract the PCB, first lifting the side towards the front panel, and checking that no cord or ribbon cable remains attached when moving it.
14) Put aside the shielding of the connectors.

REASSEMBLY PROCEDURE:

1) Be sure to remove all the ribbon cables linking to the CTRL11217 PCB in order to free up its layout room as much as possible.
2) Insert the CTRL11217 PCB flat, to fit it on its chassis mounting supports, being sure to place the power supply cord in the notch provided for this purpose.
3) Before positioning the angled SUB-D connectors into their respective locations, place the shielding for each one, then slide the PCB backwards until this shielding is seated up against the chassis.
4) Using the Phillips screwdriver, tighten the 5 crosshead screws attaching the CTRL11217 PCB to the chassis.
5) Using a 5mm elbow tubular wrench, tighten the 6 nuts attaching the 3 angled SUB-D connectors to the chassis.

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D5** **Folio** 2/2
SCOPE: Disassembly/ Reassembly of CTRL11217 control PCB.	**Staff:** 1st and 2nd lines

REASSEMBLY PROCEDURE: (cont.)

6) Reconnect the ribbon cable linking to the J7 operating connector *(CY99252 cable).*
7) Reconnect the 2 miniature connectors of the ribbon connection with the MIPR11005 microcontroller/DSP PCB *(W1 and W2 cables, TLD reference: 28001706),* and check that the extractors are in the locked position on the 2 connectors.
8) Reconnect the miniature connector of the ribbon connection to the PAVE41160 front panel *(W4 cable, TLD reference: 28001804),* and check that the extractors are in the locked position on the connector.
9) Reconnect the ribbon cable linking to the RALI16105, RALI16107 or REAL16102 PCB *(CY31372 cable).*
10) Reconnect the ribbon cable linking to the SVHF25077 or SUHF25078 module *(CY91371 cable).*
11) Reconnect the 2 ribbon cables linking to the AMPV26260 or AMPU26246 amplifier module *(CY96268 and CY91326 cables).*
12) Reconnect the coaxial cable linking to the J16 SWR coupling connector *(CX91368 cable).*
13) Using the Phillips screwdriver, screw the top cover back on (11 screws).
14) Replace the transmitter in the rack if necessary, then gently reconnect the various connectors on the rear panel of the transmitter.

7.5.10 D6 guide sheet

EQUIPMENT:	MAINTENANCE SHEET
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D6** **Folio** 1/2
SCOPE: Disassembly / Reassembly of MIPR11005 microcontroller/DSP PCB	**Staff:** 1st and 2nd lines

SAFETY INSTRUCTIONS:

Refer to § 7.5.4 "General note regarding disassembly of PCBs or modules".

DISASSEMBLY PROCEDURE:

1) Gently disconnect the various connectors from the rear panel of the transmitter.
2) If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.
3) Using the Phillips screwdriver, remove the top cover (11 screws).
4) Using the side extractors, disconnect the 2 miniature connectors of the ribbon connection with the CTRL11217 control PCB *(W1 and W2 cables, TLD reference: 28001706)*.
5) Disconnect the USB cable linking with the front panel *(W3 cable, TLD reference: 39013846)*,
6) Disconnect the ribbon cable linking the SVHF25077 or SUHF25078 synthesizer module with the CTRL11217 PCB, on the synthesizer module side *(CY91371 cable)*.
7) Disconnect the SVHF25077 or SUHF25078 synthesizer module J2 Subclic connector making the external 10MHz input coaxial connection with the rear panel J4 connector *(CX91367 cable)*.
8) Disconnect the SVHF25077 or SUHF25078 synthesizer module J3 Subclic connector making the master oscillator output coaxial connection to the AMPV26260 or AMPU26246 amplifier module J22 connector *(CX91365 cable)*.
9) Using the Phillips screwdriver, unscrew the 2 crosshead screws attaching the metal support of the SVHF25077 or SUHF25078 PCB and the MIPR11005 PCB to the rear panel.
10) Using a 5.5mm elbow tubular wrench, undo the 2 nuts attaching the same metal support of the SVHF25077 or SUHF25078 PCB and the MIPR11005 PCB to the bottom of the chassis.
11) Extract the metal support/SVHF25077 or SUHF25078 module/MIPR11005 PCB assembly from the transmitter.
12) Disconnect the MIPR11005 PCB J3 Subclic connector making the 10MHz input coaxial connection to the J6 connector of the SVHF25077 or SUHF25078 synthesizer module *(CX91366 cable)*.
13) Using the Phillips screwdriver, unscrew the 6 crosshead screws attaching the MIPR11005 PCB to the metal support, then extract the PCB.

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D6** **Folio** 2/2
SCOPE: Disassembly / Reassembly of MIPR11005 microcontroller/DSP PCB	**Staff:** 1st and 2nd lines

REASSEMBLY PROCEDURE:

1) Place the MIPR11005 PCB on the metal support attachment spacers, then tighten the 6 crosshead screws attaching the PCB, using the Phillips screwdriver.
2) Reconnect the Subclic connector of the coaxial connection between the MIPR11005 PCB and the SVHF25077 or SUHF25078 synthesizer module *(CX91366 cable),* angled Subclic connector on the MIPR11005 PCB side.
3) Replace the metal support/SVHF25077 or SUHF25078 Module/MIPR11005 PCB assembly in the transmitter, being sure to fit the two RJ45 connectors on the rear panel properly.
4) Using the Phillips screwdriver, tighten the 2 crosshead screws attaching the metal support of the SVHF25077 or SUHF25078 PCB and the MIPR11005 PCB to the rear panel.

5) Using the 5.5mm elbow tubular wrench, tighten the 2 nuts attaching the same metal support of the SVHF25077 or SUHF25078 PCB and the MIPR11005 PCB to the bottom of the chassis.
6) Reconnect the SVHF25077 or SUHF25078 synthesizer module J3 Subclic connector making the coaxial connection to the AMPV26260 or AMPU26246 amplifier module J22 connector *(CX91365 cable)*.
7) Reconnect the SVHF25077 or SUHF25078 synthesizer module J2 Subclic connector making the coaxial connection with the rear panel J4 connector *(CX91367 cable)*.
8) Reconnect the ribbon cable linking the SVHF25077 or SUHF25078 synthesizer module with the CTRL11217 PCB *(CY91371 cable)*.
9) Reconnect the USB cable linking with the front panel *(W3 cable, TLD reference: 39013846)*,
10) Reconnect the 2 miniature connectors of the ribbon connection with the CTRL11217 control PCB *(W1 and W2 cables, TLD reference: 28001706),* and check that the extractors are in the locked position on the 2 connectors.
11) Using the Phillips screwdriver, screw the top cover back on (11 screws).
12) Replace the transmitter in the rack if necessary, then gently reconnect the various connectors on the rear panel of the transmitter.

7.5.11 D7 guide sheet

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D7** **Folio** 1/2
SCOPE: Disassembly / Reassembly of Synthesizer module SVHF25077 or SUHF25078.	**Staff:** 1st and 2nd lines

SAFETY INSTRUCTIONS:

Refer to § 7.5.4 "General note regarding disassembly of PCBs or modules".

DISASSEMBLY PROCEDURE:

1) Gently disconnect the various connectors from the rear panel of the transmitter.
2) If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.
3) Using the Phillips screwdriver, remove the top cover (11 screws).
4) Using the side extractors, disconnect the 2 miniature connectors of the ribbon connection connecting the MIPR11005 PCB with the CTRL11217 control PCB *(W1 and W2 cables, TLD reference: 28001706)*.
5) Disconnect the USB cable linking the MIPR11005 PCB with the front panel *(W3 cable, TLD reference: 39013846)*,
6) Disconnect the ribbon cable linking the SVHF25077 or SUHF25078 synthesizer module with the CTRL11217 PCB, on the synthesizer module side *(CY91371 cable)*.
7) Disconnect the SVHF25077 or SUHF25078 synthesizer module J2 Subclic connector making the external 10MHz input coaxial connection from the rear panel J4 connector *(CX91367 cable)*.
8) Disconnect the SVHF25077 or SUHF25078 synthesizer module J3 Subclic connector making the master oscillator output coaxial connection to the AMPV26260 amplifier module J22 connector *(CX91365 cable)*.
9) Using the Phillips screwdriver, unscrew the 2 crosshead screws attaching the metal support of the SVHF25077 or SUHF25078 PCB and the MIPR11005 PCB to the rear panel.
10) Using a 5.5mm elbow tubular wrench, undo the 2 nuts attaching the same metal support of the SVHF25077 or SUHF25078 PCB and the MIPR11005 PCB to the bottom of the chassis.
11) Extract the metal support/SVHF25077 or SUHF25078 module/MIPR11005 PCB assembly from the transmitter.
12) Disconnect the SVHF25077 or SUHF25078 synthesizer module J6 Subclic connector making the 10MHz output coaxial connection to the MIPR11005 PCB J3 connector *(CX91366 cable)*.
13) Using the 5.5mm elbow tubular wrench, unscrew the 4 nuts attaching the SVHF25077 or SUHF25078 module to the metal support, then extract the PCB.

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D7** **Folio** 2/2
SCOPE: Disassembly / Reassembly of Synthesizer module SVHF25077 or SUHF25078	**Staff:** 1st and 2nd lines

REASSEMBLY PROCEDURE:

1) Place the SVHF25077 or SUHF25078 module on its metal support then, using the 5.5mm elbow tubular wrench, tighten the 4 nuts attaching the module.
2) Reconnect the J6 Subclic connector of the SVHF25077 or SUHF25078 synthesizer module with the J3 connector of the MIPR11005 PCB *(CX91366 cable),* angled Subclic connector on the MIPR11005 PCB side.
3) Replace the metal support/SVHF25077 or SUHF25078 Module/MIPR11005 PCB assembly in the transmitter, being sure to fit the two RJ45 connectors of the MIPR11005 PCB on the rear panel properly.
4) Using the Phillips screwdriver, tighten the 2 crosshead screws attaching the metal support of the SVHF25077 or SUHF25078 PCB and the MIPR11005 PCB to the rear panel.
5) Using the 5.5mm elbow tubular wrench, tighten the 2 nuts attaching the same metal support of the SVHF25077 or SUHF25078 PCB and the MIPR11005 PCB to the bottom of the chassis.
6) Reconnect the SVHF25077 synthesizer module J3 Subclic connector making the coaxial connection to the AMPV26260 or AMPU26246 amplifier module J22 connector *(CX91365 cable)*.
7) Reconnect the SVHF25077 or SUHF25078 synthesizer module J2 Subclic connector making the coaxial connection with the rear panel J4 connector *(CX91367 cable)*.
8) Reconnect the ribbon cable linking the SVHF25077 or SUHF25078 synthesizer module with the CTRL11217 PCB *(CY91371 cable).*
9) Reconnect the USB cable linking with the front panel *(W3 cable, TLD reference: 39013846)*,
10) Reconnect the 2 miniature connectors of the ribbon connection with the CTRL11217 control PCB *(W1 and W2 cables, TLD reference: 28001706),* and check that the extractors are in the locked position on the 2 connectors.
11) Using the Phillips screwdriver, screw the top cover back on (11 screws).
12) Replace the transmitter in the rack if necessary, then gently reconnect the various connectors on the rear panel of the transmitter.

7.5.12 D8 guide sheet

EQUIPMENT:	MAINTENANCE SHEET
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D8** **Folio** 1/3
SCOPE: Disassembly / Reassembly of antenna's coaxial relay	**Staff:** 1st and 2nd lines

SAFETY INSTRUCTIONS:

Refer to § 7.5.4 "General note regarding disassembly of PCBs or modules".

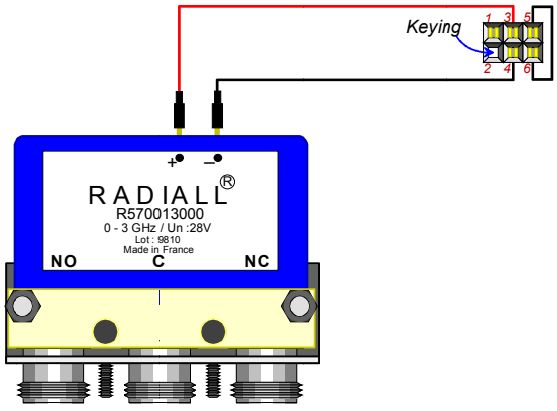
PROTECTIVE PLATE DISASSEMBLY PROCEDURE:

1) Gently disconnect the various connectors from the rear panel of the transmitter.
2) If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.
3) Using the Phillips screwdriver, remove the top cover (11 screws).
4) Using the Phillips screwdriver and the 5.5mm elbow tubular wrench, unscrew the 4 CM 3x8 screws attaching the blocking kit *(TLD reference: 55000293).*
5) Remove the blocking plate, being careful to recover the 4 W3 grower washers.

RECX56016 ELECTROMECHANICAL RELAY ASSEMBLY PROCEDURE
(TLD Reference: 58500053) :

1) Offer up the two fastening lugs of the electromechanical relay support bracket into the holes provided for this purpose on the rear panel of the transmitter.
2) Place 1 W3 Grower washer then 1 HU3 nut on each of the 2 lugs.
3) Using a 5.5mm elbow tubular wrench, tighten the 2 nuts to hold the relay in place.
4) Place the relay power supply and command connector on the **J1** connector of the CTRL11217 PCB, taking the keying into account *(J1-2 pin).*

See pin configuration below:



5) Reassemble the transmitter top cover (11 screws).
6) Install the CX99348 coaxial cord *(reference TLD: 28001229)* between the **J10** connector marked ***TX,*** corresponding to the **NO** side of the relay, and the **J11** antenna connector.
7) Connect an RS232 terminal on the front panel Maintenance connector of the transmitter, enter the **Login admin admin** control *(Administrator login),* then **RELAY ON** *(to specify to the transmitter the presence of the electromechanical relay).*

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D8** **Folio** 2/3
SCOPE: Disassembly / Reassembly of antenna's coaxial relay	**Personnel :** 1st and 2nd lines

RECX56012 STATIC RELAY ASSEMBLY PROCEDURE
(TLD Reference: 58500046) :

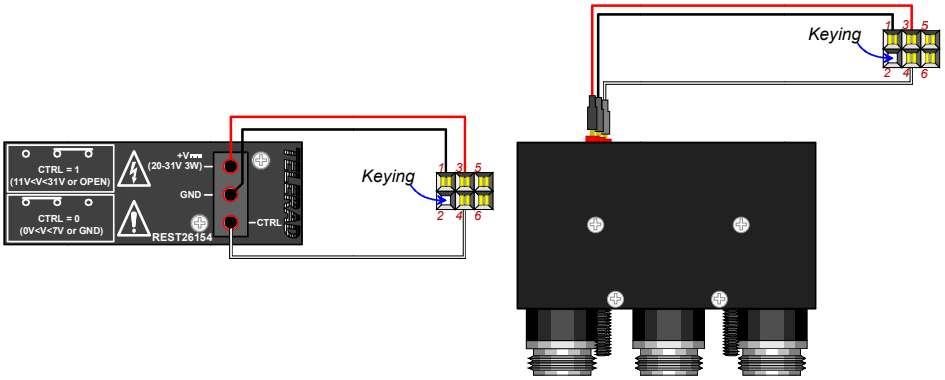
1) Offer up the 4 fastening lugs of the ***REST26154*** static relay into the holes provided for this purpose on the rear panel of the transmitter, ***the part of the relay representing the drawings of the contact upwards.***

2) Place 1 W2.5 Grower washer then 1 HU2.5 nut on each of the 4 lugs.

3) Using a 5 mm elbow tubular wrench, tighten the 4 nuts to hold the relay in place.

4) Place the relay power supply and command connector on the **J1** connector of the CTRL11217 PCB, taking the keying into account *(J1-2 pin)*.

See pin configuration below:



5) Reassemble the transmitter top cover (11 screws).

6) Install the CX99348 coaxial cord *(TLD reference: 28001229)* between the **J10** connector marked ***TX***, and the **J11** antenna connector.

7) Connect an RS232 terminal on the transmitter's front panel Maintenance connector, enter the **Login admin admin** control *(Administrator Login),* then **RELAY OFF** *(the transmitter behavior is the same with a static relay or without any relay).*

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**D8** **Folio** 3/3
SCOPE: Disassembly / Reassembly of antenna's coaxial relay	**Staff:** 1st and 2nd lines

COAXIAL RELAY DISASSEMBLY PROCEDURE

1) Gently disconnect the various connectors from the rear panel of the transmitter.

2) If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.

3) Using the Phillips screwdriver, remove the top cover (11 screws).

4) For the ***RECX56016*** electromechanical relay, undo the 2 nuts attaching the relay, using a 5.5mm elbow tubular wrench.

5) For the ***RECX56012*** static relay, undo the 4 nuts attaching the relay, using a 5 mm elbow tubular wrench.

6) Remove the relay.

7) Put the blocking plate in place.

8) Using the Phillips screwdriver and the 5.5mm elbow tubular wrench, tighten the 4 CM 3x8 screws attaching the blocking kit *(TLD reference: 55000293),* checking that the 4 W3 grower washers are present under the screw heads before tightening.

9) Reconnect the antenna cable directly to the transmitter **J11** antenna connector.

7.6 OPERATION CHECKS

7.6.1 Frequency table

Operations	*Frequency*
Brief check that the transmitter operates in AM mode	Monthly
In-depth check that the transmitter operates in AM mode	Annually or after repair

7.6.2 Maintenance operations directory

Note: *As only the A3E mode is proposed basically, the brief and in-depth checks of the transmitter only relate to this mode.*

Sheet V1: Brief check that the transmitter works in A3E mode.
Sheet V2: In-depth check that the transmitter works in A3E mode.

7.6.3 List of required measurement devices

- 1 Wattmeter.
- 1 50Ω load, 30dB attenuator.
- 1 LF generator.
- 1 LF analyzer.
- 1 modulation analyzer.
- 1 frequency meter.
- 1 spectrum analyzer.

Note: *All these devices may be replaced by a single integrated radio test device, including all these functions.*

- 1 BTEM9000 test bench.
- 1 vector analyzer.
- 1 $24V_{DC}$ / 30A laboratory power supply *(for EM9000C-2G version)* or a $28V_{DC}$ / 30A laboratory power supply *(EM9010C-2G versions)*.

7.6.4 V1 guide sheet

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**V1** **Folio** 1/1
SCOPE: Brief check that the transmitter works in A3E mode.	**Staff:** 2nd and 3rd lines

PROCEDURE:

- When the transmitter is powered on and in operation, check the following points:
  1. The "+V_{DC} power supply" indicator light is on (○⇨●),
  2. For the EM9000A-2G and EM9010A-2G versions, at least one of the "Mains Presence" or "Battery Presence" indicator lights is on (○⇨●),
  3. The "Alarm" indicator light is off (●⇨○),
  4. The "Status" indicator light is on (○⇨●),
  5. The "RF" and "MOD" indicator lights blink following the rhythm of the transmitted AF (●⇨○⇨●),
  6. The "SWR" indicator light is off (●⇨○),

- Connect headphones to the front panel headphone output, and check that when the "RF" and "MOD" indicator lights are on, an AF signal is audible in the headphones.

- Using the screen/keyboard local interface, select the measurement screens (see § "Maint / Measures" Menu). From the available parameters, check:
  1. The direct output power, around 50W,
  2. The SWR level, between 1 and 1.5,
  3. The modulation rate, varying with the transmitted AF,
  4. The temperature of the AMPV26260 or AMPU26246 amplifier modules, and the ALIN26270 power supply module, below 70°C,
  5. The input AF line level,
  6. The internal power supplies: they must all be within tolerance.

- Select the IBIT initiated test results screen (see § "Maint / Test / IBIT / IBIT Results" menu), and check that all the sub-assemblies are declared "OK".

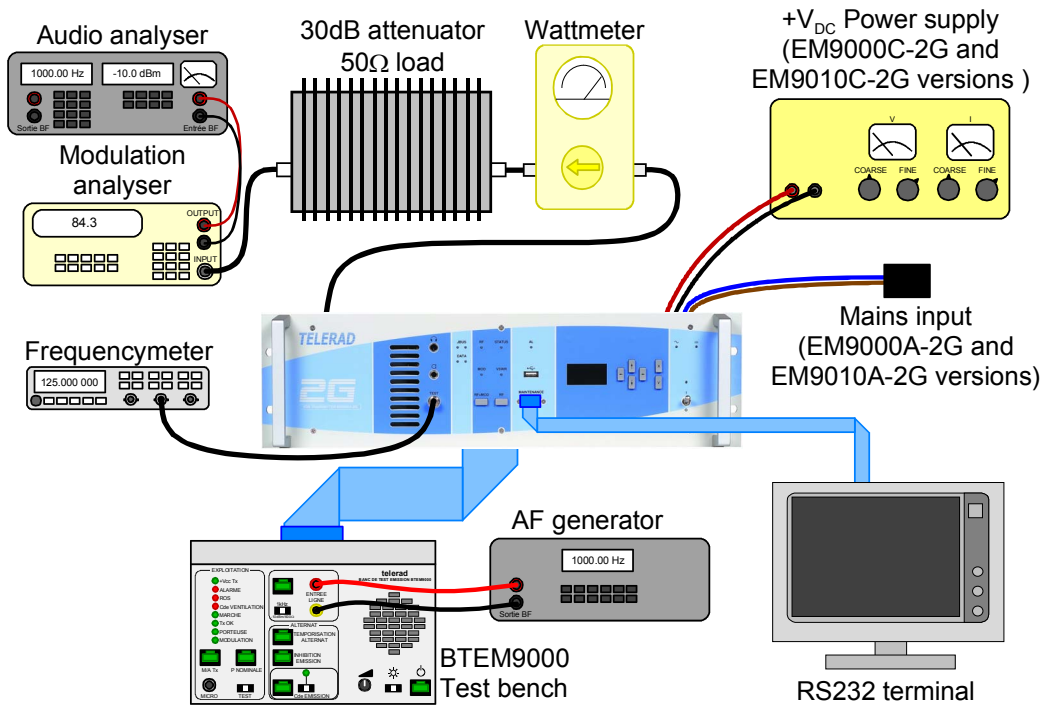
It is possible to obtain more recent information by launching an IBIT initiated test (see § 6.3.1.3.8.2.2.1 "Maint / Test / IBIT / Launch IBIT" menu"), but this may constitute a risk of disruption to operation.

- To obtain more precise information, on each PCB or module, select the CBIT continuous test screen (see § 6.3.1.3.8.2.1 "Menu "Maint / Test / CBIT"), and check that all the indications are "OK".

7.6.5 V2 guide sheet

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**V2** **Folio** 1/9
SCOPE: In-depth check that the transmitter works in A3E mode.	**Staff:** 2nd and 3rd lines

INSTALLATION DIAGRAM :



PROCEDURE:

Preliminary operations:

- Gently disconnect the various connectors from the rear panel of the transmitter.
- If the equipment is installed in a rack, remove it from the rack, and place it on a clean flat surface.
- Connect the measurement device as per the diagram above:
  - 1 VHF or UHF wattmeter to the antenna output, followed by a 50Ω load,
  - 1 power supply to the battery input (and/or a cord connected to the mains for EM9000A-2G and EM9010A-2G versions),
  - 1 BTEM9000 test bench on "Remote Control" connector,
  - 1 AF generator connected to the test bench,
  - 1 frequency meter on the front panel RF Test output.

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**V2** **Folio** 2/9
SCOPE: In-depth check that the transmitter works in A3E mode	**Staff:** 2nd and 3rd lines

Preliminary operations: (cont.)

- Power on the transmitter, and check the following points:
  - The "+V_{DC} power supply" indicator light is on (○⇨●),
  - For the EM9000A-2G and EM9010A-2G versions, at least one of the "Mains Presence" or "Battery Presence" indicator lights is on (○⇨●),
  - The "Alarm" indicator light is off (●⇨○),
  - The "Status" indicator light is on (○⇨●),
  - The "RF" and "MOD" indicator lights are off (●⇨○),
  - The "SWR" indicator light is off (●⇨○),

General check of correct operation:

- Press the "RF" front panel pushbutton and check that:
  1. The "RF" indicator light comes on (○⇨●),
  2. The "MOD" indicator light stays off (○⇨○),
  3. The "SWR" and "ALARM" indicator lights stay off (○⇨○),
- Press the "RF+MOD" front panel pushbutton and check that:
  1. The "RF" and "MOD" indicator lights come on (○⇨●),
  2. The "SWR" and "ALARM" indicator lights stay off (○⇨○),
  3. A 1kHz LF is audible in the BTEM9000 loudspeaker.
- Using the local screen/keyboard, select the CBIT continuous test menu *(see § 6.3.1.3.8.2.1 "Maint / Test / CBIT" menu)*, and check that all the indications are "OK".
- Select the IBIT initiated test menu and launch the test *(see § 6.3.1.3.8.2.2.1 "Maint / Test / IBIT / Launch IBIT" Menu)*.
- At the end of the test, check that all the sub-assemblies are declared "OK" *(see § 6.3.1.3.8.2.2.2 "Maint / Test / IBIT / IBIT Results" Menu)*.

Checking operational frequency:

- Using the local screen / keyboard, set the transmitter to the median frequency of 125MHz for the EM9000-2G, or 300MHz for the EM9010-2G, for a 25kHz channel (F_{op} = 125.000 or 300.000), then with the frequency meter, check the operational frequency of the transmitter. If needed, adjust the frequency (see R1 adjustment procedure).

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**V2** **Folio** 3/9
SCOPE: In-depth check that the transmitter works in A3E mode	**Staff:** 2nd and 3rd lines

Checking operational frequency: (cont.)

- Set the transmitter to the same 125MHz or 300MHz frequency for an 8.33kHz channel (F_{op} = 125.005 or 300.005), then with the frequency meter, check that the operational frequency is the same as before.

- Set the transmitter to the 125.00833MHz or 300.00833MHz frequency (F_{op} = 125.010 or 300.010), and check that the operational frequency is in fact offset by 8.33kHz.

Checking transmission:

- Return to the 125MHz or 300MHz frequency for a 25kHz channel.

- On the test bench, press the "On/Off Tx" pushbutton to switch the On/Off command to **"Off"** *(associated indicator light off):*
  - On the transmitter front panel, check that the "Status" indicator light turns off (●⇨○).
  - On the test bench, press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on),* and check that the ***transmitter stays in standby*** *(inhibition of remote PTT).*
  - Release the "PTT Ctrl" pushbutton *(associated indicator light off)* then, on the front panel of the transmitter, press the "RF" test pushbutton, and check that the ***transmitter switches to transmission*** *(local PTT taken into account).*
  - Release the "RF" test pushbutton.

- On the test bench, press the "On/Off Tx" pushbutton to switch the On/Off command to **"On"** *(associated indicator light on).*
  - On the transmitter front panel, check that the "Status" indicator light turns back on (○⇨●).
  - On the test bench, press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on),* and check that the ***transmitter switches to transmission*** *(remote PTT taken into account).*
  - Release the "PTT Ctrl" pushbutton *(associated indicator light off)* then, on the front panel of the transmitter, press the "RF" test pushbutton, and check that the ***transmitter switches to transmission*** *(local PTT taken into account).*
  - Release the "RF" test pushbutton.

- On the test bench, press the "PTT TIMEOUT" pushbutton to limit the PTT duration *(associated indicator light on).*

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**V2** **Folio** 4/9
SCOPE: In-depth check that the transmitter works in A3E mode.	**Staff:** 2nd and 3rd lines

Checking transmission: (cont.)

The PTT duration can be set from 0 to 300 seconds, by 5sec steps, from the front panel HMI (see § 6.3 "LOCAL OPERATION FOR THE EQUIPMENT").

- On the test bench, press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on).*
- Check that the transmitter switches to transmission then ***at the end of the specified time, switches to standby mode.***
- Release the "PTT Ctrl" pushbutton then press it again, and check that transmitter ***switches back to transmission for the specified time.***
- Release the "PTT Ctrl" and "PTT TIMEOUT" pushbuttons *(associated indicator lights off).*

- On the test bench, press the "TRANSMISSION INHIBITION" pushbutton *(associated indicator light on).*
  - On the transmitter front panel, check that the "Status" indicator light turns off (● ⇨ ○).
  - On the test bench, press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on),* and check that the ***transmitter stays in standby*** *(inhibition of remote PTT).*
  - Release the "PTT Ctrl" pushbutton *(associated indicator light off)* then, on the front panel of the transmitter, press the "RF" test pushbutton, and check that the ***transmitter also stays in standby*** *(inhibition of local PTT).*
  - Release the "RF" test pushbutton.
- Release the "TRANSMISSION INHIBITION" pushbutton *(associated indicator light off).*

Output power check:

The output power can be set from 2 to 50W, by 0.5dB steps, from the front panel HMI (see § 6.3 "LOCAL OPERATION FOR THE EQUIPMENT").

- Using the front panel HMI, set the transmitter output power to 50W.

- On the test bench, press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on).*

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**V2** **Folio** 5/9
SCOPE: In-depth check that the transmitter works in A3E mode.	**Staff:** 2nd and 3rd lines

Output power check: (cont.)

- Using the wattmeter, check that the radiated power corresponds to the set power.

☞ *It is possible to view the output power from the front panel HMI, in the "MEASURES" menu page 1 (see § 6.3.1.3.8.1 "Maint / MEASURES" menu).*

- Using the front panel HMI, set the transmitter output power to 25W.
- Using the wattmeter or the "MEASURES" menu, check that the radiated power corresponds to the set power.
- On the test bench, press the "NOMINAL P" pushbutton *(associated indicator light on)*.
- Using the wattmeter or the "MEASURES" menu, check that the radiated power changes to 50W.
- Release the "NOMINAL P" pushbutton *(associated indicator light off),* and check that the radiated power returns to the set power.
- Release the "PTT Ctrl" pushbutton to switch the transmitter to standby mode *(associated indicator light off)*.

Checking the AF compressor:

- Connect an AF generator to the two "LINE INPUT" banana plugs of the BTEM9000 test bench *(600Ω input)*.
- On the test bench, press the pushbutton associated with the AF line input, to authorise modulation *(associated indicator light on)*.
- Using the front panel HMI, set the line sensitivity to -10dBm.

☞ *It is possible to set the LF line sensitivity from the front panel local screen, in the "LINE" menu (see § 6.3.1.3.4.1 "AUDIO / ANALOG / LINE" menu)*

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**V2** **Folio** 6/9
SCOPE: In-depth check that the transmitter works in A3E mode.	**Staff:** 2nd and 3rd lines

Checking the LF compressor: (cont.)

- On the test bench, press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on)*.

- Using the AF generator send a 1kHz AF, and vary its level from -20 to 0dBm.
- Using the modulation analyzer, record the associated modulation rate.

☞ *It is possible to view the modulation rate from the front panel local screen, in the "MEASURES" menu page 1 (see § 6.3.1.3.8.1 "Maint / MEASURES" menu).*

- Check that this rate varies linearly from around 8 to 85% with the AF level varying from -20 to -10dBm, then holds at around 85% when the AF level varies from -10 to 0dBm.
- Release the "PTT Ctrl" pushbutton to switch the transmitter to standby mode *(associated indicator light off)*.

Checking the audio bandwidth:

- With the modulated RF output of the attenuated 50Ω load linked to the modulation analyzer, and the analyzer equipped with a demodulated AF output, connect this AF output to the input of the AF analyzer.
- Using the AF generator, send a 1kHz AF to the BTEM9000 test bench input, with a -10dBm level *(transmitter AF compressor action threshold)*.
- On the test bench:
  - Check that the pushbutton associated with the AF line input is pressed, to authorise modulation *(associated indicator light on)*.
  - Press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on)*.

- On the modulation analyzer, check that the rate is roughly 85%.
- On the AF analyzer, select the AF input measurement function in relative mode, and adjust the relative 0dB as a reference.
- Set the modulation AF to 300Hz, and check that the variation is < -3dB.
- Then set the modulation AF to 3,400Hz, and check that the variation is also < -3dB.
- Release the "PTT Ctrl" pushbutton to switch the transmitter to standby mode *(associated indicator light off)*.

- Using the local HMI, set the 125MHz frequency in an 8.33kHz channel, *(set F_{op} = 125.005)*.
- Using the AF generator, again set a 1kHz AF with a -10dBm level.

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**V2** **Folio** 7/9
SCOPE: In-depth check that the transmitter works in A3E mode	**Staff:** 2nd and 3rd lines

Checking the audio bandwidth: (cont.)

- On the test bench, press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on)*.
- On the AF analyzer, repeat the relative 0dB as a reference.
- Set the modulation AF to 300Hz, and check that the variation is < -3dB.
- Then set the modulation AF to 2500Hz, and check that the variation is also < -3dB.
- Then set the modulation AF to 3200Hz, and check that the variation is > -40dB.
- Release the "PTT Ctrl" pushbutton to switch the transmitter to standby mode *(associated indicator light off)*.

Checking the SNR (Signal/Noise ratio) :

- Using the AF generator, send a 1kHz AF to the BTEM9000 test bench input, with a -10dBm level *(transmitter AF compressor action threshold)*.
- On the test bench:
  - Check that the pushbutton associated with the AF line input is pressed, to authorise modulation *(associated indicator light on)*.
  - Press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on)*.
- On the AF analyzer, select the AF input measurement function in relative mode, and adjust the relative 0dB as a reference.
- Press the pushbutton associated with the AF line input, to remove modulation *(associated indicator light off)*.
- With the transmitter still in transmission, but unmodulated, read the noise level on the AF analyzer.
- The difference in relation to the initial relative 0dB gives the SNR.
- Release the "PTT Ctrl" pushbutton to switch the transmitter to standby mode *(associated indicator light off)*.

Checking distortion level:

- Using the AF generator, send a 1kHz AF to the BTEM9000 test bench input, with a -10dBm level *(transmitter AF compressor action threshold)*.
- On the test bench:
  - Check that the pushbutton associated with the AF line input is pressed, to authorise modulation *(associated indicator light on)*.
  - Press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on)*.

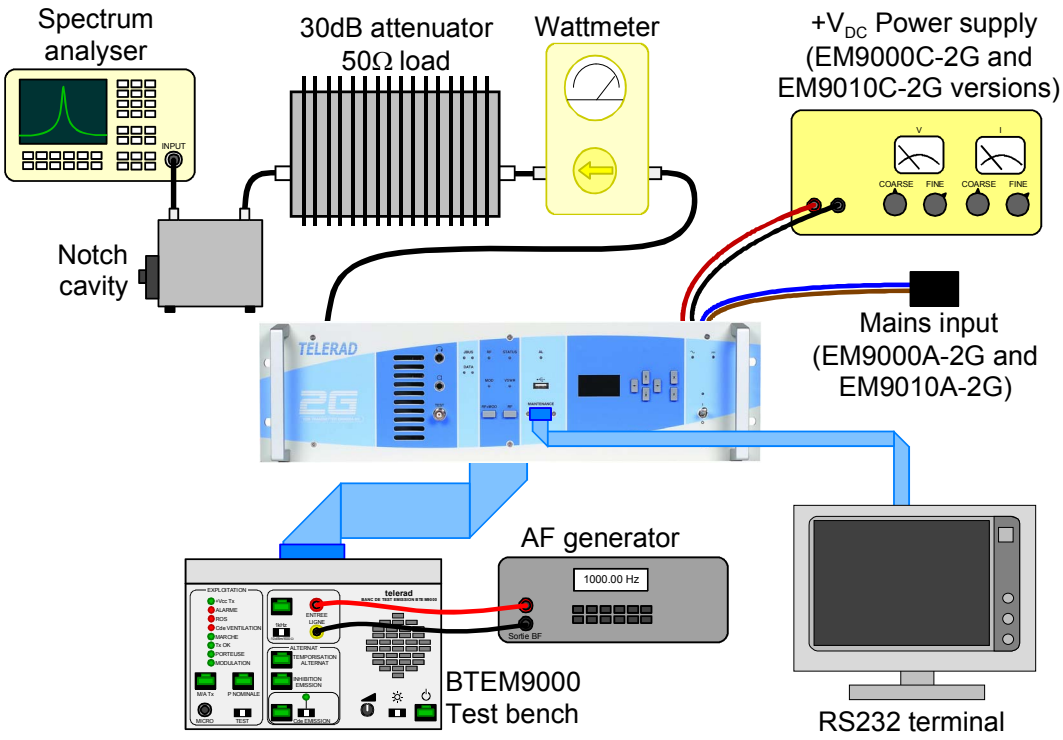
EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**V2** **Folio** 8/9
SCOPE: In-depth check that the transmitter works in A3E mode	**Staff:** 2nd and 3rd lines

Checking distortion level: (cont.)

- On the AF analyzer, select the Distortion function, and check that this is around 1%.
- Release the "PTT Ctrl" pushbutton to switch the transmitter to standby mode *(associated indicator light off)*.

Checking the spectrum:

New installation diagram:



- Disconnect the modulation analyzer from the modulated RF output of the 30dB attenuator 50Ω load, and connect the spectrum analyzer in its place.
- Using the local HMI, return to the 125MHz frequency in a 25kHz channel.
- Using the AF generator, send a 1kHz AF to the BTEM9000 test bench input, with a -10dBm level *(transmitter AF compressor action threshold)*.

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**V2** **Folio** 9/9
SCOPE: In-depth check that the transmitter works in A3E mode	**Staff:** 2nd and 3rd lines

Checking the spectrum: (cont.)

- On the test bench:
  - Check that the pushbutton associated with the AF line input is pressed, to authorise modulation *(associated indicator light on)*.
  - Press the "PTT Ctrl" pushbutton to switch the transmitter to transmission *(associated indicator light on)*.
- On the spectrum analyzer, centre the screen on the operational frequency, in a 20kHz "Span", and check that the spectrum of the modulated carrier remains within the screen *(no AF harmonic lines outside the channel)*.
- Release the "PTT Ctrl" pushbutton to switch the transmitter to standby mode *(associated indicator light off)*.

- Insert an adjustable rejection cavity between the modulated RF output of the 30dB attenuator 50Ω load and the spectrum analyzer input, checking ***that it is not fixed on the operational frequency.***
- In order to operate pure carrier, press the pushbutton associated with the AF line input to remove modulation *(associated indicator light off)*.

- On the spectrum analyzer, enter the "Start Frequency" at 1MHz, and the "Stop Frequency" at 500MHz.
- Press the "PTT Ctrl" pushbutton to switch the transmitter to transmission (*associated indicator light on*), and place the carrier line at the top of the screen *(relative 0dB)*.
- Adjust the rejection cavity to the operational frequency, observing the carrier line on the screen, attenuated by at least 30dB.

- On the spectrum analyzer, using the "Reference Level" button, increase the trace on the screen by 30dB: the top of the screen therefore goes to -30dBc *(30dB downwards offset of the analyzer dynamics)*.
- Using the "Residual Bandwith", "Video" and "Attenuation" keys, adjust the trace in order to be able to observe at least harmonic lines 2 and 3 of the carrier, being certain that their level is not distorted by saturation of the analyzer input stage.

- Check that these lines remain lower than -36dBm *(EN300676 ETSI standard specifications)*.
- Release the "PTT Ctrl" pushbutton to switch the transmitter to standby mode *(associated indicator light off)*.

7.7 ADJUSTMENT OPERATIONS

☞ *All the following adjustments may be carried out with the transmitter in the rack or on a table.*

7.7.1 Frequency table

Operations	*Frequency*
Local oscillator adjustment	Annually or after repair
Phase and attenuation learning	After replacing the CTRL11217 PCB or the AMPV26260 or AMPU26246 module
CTRL11217 board adjustment	After replacing the CTRL11217 PCB or the AMPV26260 or AMPU26246 module

7.7.2 Maintenance operations directory

Sheet R1: Local oscillator adjustment.
Sheet R2: Phase and attenuation learning.
Sheet R3: CTRL11217 PCB adjustment.

7.7.3 List of required tools

- 1 +24V_{DC} / 30A laboratory power supply *(for EM9000C-2G version)* or +28V_{DC} / 30A laboratory power supply *(for EM9010C-2G version).*
- 1 frequency meter
- 1 modulation analyser..
- 1 5dB attenuator load.
- 1 stub RF.
- 1 cable equipped with « grip-wires ».
- 1 50Ω load.

7.7.4 R1 guide sheet

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**R1** **Folio** 1/1
SCOPE: Local oscillator adjustment	**Staff:** 1st and 2nd lines

PRELIMINARY CONDITIONS:

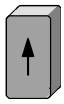
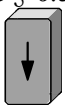
- The transmitter must be powered on.

PROCEDURE:

Installation diagram:

- Connect the frequency meter to the "RF TEST" BNC output on the front panel of the transmitter.
- Press the "RF" front panel pushbutton to switch the transmitter to unmodulated transmission, and read the frequency value on the frequency meter.

- If the accuracy is worse than 1ppm (1 part per million = 1.10^{-6}), then select the frequency adjustment menu *(see § 6.3.1.3.8.3 "Maint / TCXO" menu)* using the local HMI

- Using the  and  keys on the keyboard, adjust the precision of the local oscillator until better than 1ppm is obtained.

☞ *The electronic potentiometer (EEPOT) used for this adjustment is made up of 255 steps, and allows compensation of ±5ppm, i.e. a precision of about 0.04 ppm per step.*

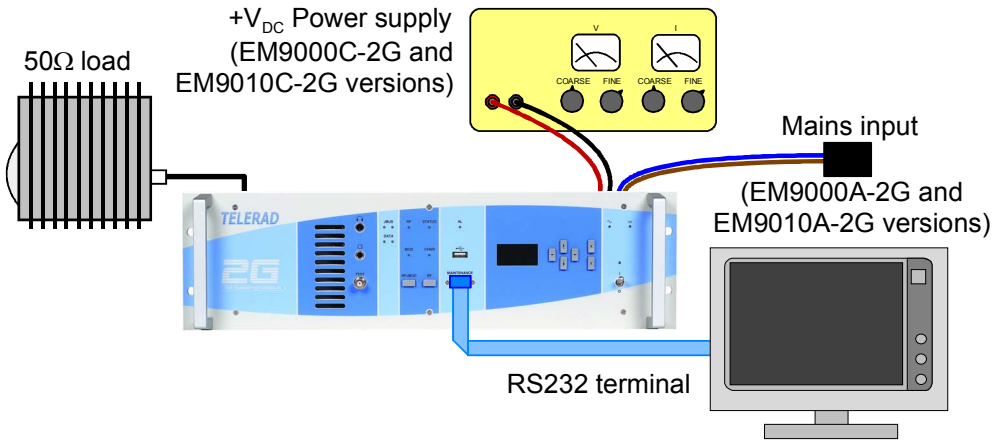
7.7.5 R2 guide sheet

EQUIPMENT:	MAINTENANCE SHEET
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**R2** **Folio** 1/2
SCOPE: Phase and attenuation learning.	**Staff:** 1st and 2nd lines

PRELIMINARY CONDITIONS:

- It has been previously detected that the CTRL11217 control PCB or the AMPV26260 (EM9000-2G) VHF or AMPU26246 (EM9010-2G) UHF amplifier module are defective, and they have been subject to replacement by standard exchange *(see § 7.5.5 Sheet D1: "Disassembly / Reassembly of AMPV26260 VHF or AMPU26246 UHF amplifier module", and § 7.5.8 Sheet D4: "Disassembly/ Reassembly of CTRL11217 control PCB".)*
- The CTRL11217 PCB has been previously adjusted *(see § 7.7.6 Sheet R3: "CTRL11217 PCB adjustments, steps 1 to 6")*.
- The transmitter must be powered on.

- Installation diagram:



PROCEDURE:

Phase and attenuation learning:

The Phase and Attenuation learning sequence is not directly accessible from the local HMI. So an RS232 terminal must be connected on the MAINTENANCE connector on the front panel of the transmitter (see [1] ICDFR 40600034 V1.00 Série 9000-2G MAINTENANCE)

- On the RS232 terminal, enter the « LOGIN : admin admin » command to be able to access the learning sequence.
- Enter the "LEARN" command, then validate with "O" or "Y".
- Learning the phase, then the attenuation, is launched automatically by the transmitter

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**R2** **Folio** 2/2
SCOPE: Phase and attenuation learning (cont.)	**Staff:** 1st and 2nd lines

☞ ***Learning the phase*** *consists in compensating for the propagation delay of the I and Q signals through the AMPV26260 or AMPU26246 amplifier module, such that the I and Q information demodulated by the Directional Coupler located at the output of the amplifier module remains in phase with the I and Q reference information from the MIPR11005 PCB DSP.*
It is either performed in the VHF band (EM9000-2G), or the UHF band (EM9010-2G), by 100kHz steps, and, as a result, can last around ten minutes.

☞ ***Learning the attenuation*** *consists in compensating for the variations in dynamic gain of the AMPV26260 amplifier module in the VHF band or of the AMPU26246 module in the UHF band, so as to maintain the transmitter's SNR more or less constant in the entire VHF or UHF band.*
It is either performed in the VHF band (EM9000-2G), or the UHF band (EM9010-2G), by 1MHz steps, and, as a result, takes less time than learning the phase, but can nevertheless take a few minutes.

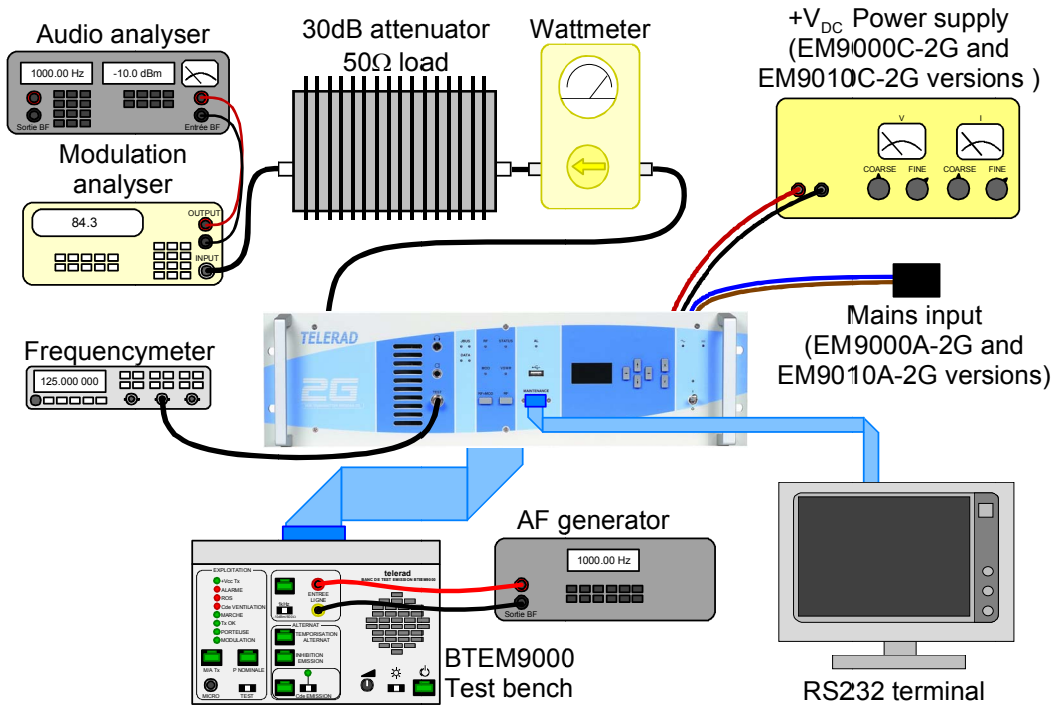
7.7.6 R3 guide sheet

EQUIPMENT:	MAINTENANCE SHEET
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**R3** **Folio** 1/4
SCOPE: CTRL11217 PCB adjustments	**Staff:** 1st and 2nd lines

PRELIMINARY CONDITIONS:

- It has been previously detected that the CTRL11217 control PCB or the AMPV26260 (EM9000-2G) VHF or AMPU26246 (EM9010-2G) UHF amplifier module are defective, and they have been subject to replacement by standard exchange *(see § 7.5.5 Sheet D1: "Disassembly / Reassembly of AMPV26260 VHF or AMPU26246 UHF amplifier module", and § 7.5.8 Sheet D4: "Disassembly/ Reassembly of CTRL11217 control PCB".)*

- Installation diagram:



- On the BTEM 9000 test bench, verify that the « PTT Ctrl » button is on standby and the « TX INH. » is active.
- Adjust the **R66** (ρ = 1/3 adjusting) and **R113** (Reflected power adjusting) potentiometers of the CTRL11217 PCB on their very left position.
- Verify the jumpers configuration : **J3** in A, **J5** in B, **J6** in A, **J7** in B, **J33** in 3-4, 5-6, 7-8, 9-10.

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**R3** **Folio** 2/4
SCOPE: CTRL11217 PCB adjustments (cont.)	**Staff:** 1st and 2nd lines

PROCEDURE :

1. Preliminary controls :

- Switch on the equipment and verify the status of all the front panel indicator lights.
- Using the local HMI, configure the equipment with the following values :
- Mode : A3E,
- Frequency : 125kHz *(EM9000-2G)* or 321,5 kHz *(EM9010-2G),*
- AF line level :0dBm,
- Output power : 50W.
- Connect a voltmeter between pins **J30-1** (+) and **J30-11** (-), and verify that the power supply voltage is above $+24V_{DC}$ *(EM9000-2G)* or $+28V_{DC}$ *(EM9010-2G)*.

2. RF temperature adjustment :

- Connect a voltmeter between **J29-5** (+) and **J29-3** (-).
- Read the value then subtract 2,731. This value is called V_1.
- Connect a voltmeter between **J29-1** (+) and ground in **J29-7** (-).
- Adjust **R293** to obtain on the voltmeter : $\mathbf{V_1 \times 10 + 3}$

3. Power supply temperature adjustment :

- Connect a voltmeter between **J29-6** (+) and **J29-4** (-).
- Read the value then subtract 2,731. This value is called V_2.
- Connect a voltmeter between **J29-2** (+) and ground in **J29-7** (-).
- Adjust **R317** to obtain on the voltmeter : $\mathbf{V_2 \times 10 + 3}$

4. Idemod and Qdemod offsets adjustment :

- Disconnect the 20 pins flat cable between the RF amplifier and connector **J21** of the CTRL11217 PCB.
- Connect a voltmeter between **J27-1** (+) and **J27-2** (-).
- Adjust **R153** to obtain **0mV** on the voltmeter.
- Connect a voltmeter between **J27-3** (+) and **J27-2** (-).
- Adjust **R196** to obtain **0mV** on the voltmeter.
- Re-connect the 20 pins flat cable between the RF amplifier and connector **J21** of the CTRL11217 PCB.

EQUIPMENT:	MAINTENANCE SHEET
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**R3** **Folio** 3/4
SCOPE: CTRL11217 PCB adjustments (cont.)	**Staff:** 1st and 2nd lines

PROCEDURE :

5. Iref and Qref references offsets adjustment as well as PDIR gain :

- On the RS232 terminal, enter the « LOGIN : admin admin » command, to be able to access the learning sequence.
- Enter the « LEARN » command, but **do not validate** by « Y ».
- Connect a voltmeter between **TP6** (+) and ground in **J28-7** (-).
- Adjust **R296** to obtain **0mV** on the voltmeter.
- Connect a voltmeter between **J26-1** (+) and ground in **J26-2** (-).
- Adjust **R246** to obtain **50W** at the **J11** output of the RF amplifier.
- Adjust **R95** to obtain **1V** on the voltmeter.
- Connect a voltmeter between **TP7** (+) and ground in **J28-7** (-).
- Adjust **R246** to obtain **0mV** on the voltmeter.
- Leave the Learning mode by entering « N » on the RS232 terminal.

6. PDIR and PRFL offsets adjustment :

- Connect a voltmeter between **J26-1** (+) and ground in **J26-2** (-).
- Adjust **R93** to obtain **+10mV** on the voltmeter.
- Connect a voltmeter between **J26-3** (+) and ground in **J26-2** (-).
- Adjust **R111** to obtain **-10mV** on the voltmeter.

7. Learning sequence :

- Launch the Phase and Attenuation learning sequence *(see adjustment sheet R2 : Phase and Attenuation learning).*

8. AM reference and modulation ratio adjustment :

- Connect a voltmeter between **TP6 ou TP7** (+) and ground in **J28-7** (-).
- Press the « RF+MOD » test pushbutton on the front panel of the equipment.
- Adjust **R46** to obtain **1,414V** on the voltmeter.

The modulation ratio can be displayed on the local HMI, in the menu « MEASURES » page 1 (see § 6.3.1.3.8.1 Menu "Maint / MEASURES").

- On the local HMI, Display the Measures screen.
- Adjust **R53** to obtain **85%** of modulation on the Measures screen or on the modulation analyser.

EQUIPMENT:	**MAINTENANCE SHEET**
VHF MULTIMODE TRANSMITTER EM9000-2G - UHF MULTIMODE TRANSMITTER EM9010-2G	**R3** **Folio** 4/4
SCOPE: CTRL11217 PCB adjustments (cont.)	**Staff:** 1st and 2nd lines

PROCEDURE :

9. Nominal power adjustment :

- Press the « RF » test pushbutton on the front panel of the equipment to go on transmission with a non-modulated carrier.
- Connect **TP7** (+) to ground in **J28-7** (-) by a wire equipped with 2 “grip-wires”.
- Adjust **R144** to obtain **25W** at the **J11** output of the RF amplifier.
- Disconnect the wire between **TP7** (+) and ground in **J28-7** (-).
- Connect **TP6** (+) to ground in **J28-7** (-) by a wire equipped with 2 “grip-wires”.
- Adjust **R185** to obtain **25W** at the **J11** output of the RF amplifier.
- Disconnect the wire between **TP6** (+) and ground in **J28-7** (-).

10. PDIR and PRFL gain adjustment :

- Press the « RF » test pushbutton on the front panel of the equipment to go on transmission with a non-modulated carrier.
- On the local HMI, display the Measures screen.
- Verify the value for the direct power.
- Re-adjust **R95** to display the real power value on the Measures screen.
- Disconnect the 50Ω load from the **J11** output such a way to obtain an ∞ **SWR.**
- Connect a 1st voltmeter between **J26-1** (+) and ground in **J26-2** (-).
- Connect a 2nd voltmeter between **J26-3** (+) and ground in **J26-2** (-).
- Adjust **R113** to obtain on the voltmeter : $\mathbf{V_{J26-3} = V_{J26-1}}$.

11. SWR = 2 protection adjustment :

- Connect a voltmeter between **J28-3** (+) and ground in **J28-7** (-).
- Adjust **R82** to obtain **6,66V** on the voltmeter.
- Connect a 5dB load and a stub on the **J11** output of the RF amplifier such **a** way to obtain an **SWR of 2**.
- Connect a 1st voltmeter between **TP8** (+) and ground in **J28-7** (-).
- Connect a 2nd voltmeter between **J26-1** (+) and ground in **J26-2** (-).
- Press the « RF » test pushbutton on the front panel of the equipment to go on transmission with a non-modulated carrier.
- With the stub, find for the point where the voltage displayed on the voltmeter is maximum.
- Adjust **R66** to obtain in **TP8 :** $\mathbf{V_{TP8} = V_{J26-1}.x}$ **[1/3].**
- Press the « RF+MOD » test pushbutton on the front panel of the equipment to go on transmission with a modulated carrier.
- With the stub, verify that the SWR indicator light on the front panel of the equipment remains off. If necessary, re-adjust with **R66.**
- Verify the adjustment at min and max frequencies. If necessary, re-adjust with **R66.**

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CHAPTER 8. PARTS LIST

8.1 LEVEL 1 PARTS LIST

8.1.1 EM9000-2G VHF transmitter

VHF DIGITAL TRANSMITTER	**EM9000-2G**	**(80000086)**
FRONT PANEL PCB	PAVE41160	(50001397)
MECHANICAL CHASSIS	CHEM41161	(50001398)
CONTROL PCB	CTRL11217	(51001183)
VHF AMPLIFIER MODULE	AMPV26260	(52000634)
SYNTHESIZER MODULE	SVHF25077	(52000620)
MICROCONTROLLER/DSP PCB	MIPR11005	(53500015)
DIGITAL TRANSMITTER MAINS INPUT	**EM9000A-2G**	**(84500142)**
POWER SUPPLY MODULE	ALIN26270	(52000649)
SPECIFIC COMPONENTS	ELSP EM9000A-2G	(58001088)
DIGITAL TRANSMITTER BATTERY INPUT	**EM9000C-2G**	**(84500143)**
POWER SUPPLY MODULE	ALDC26264	(52000642)
SPECIFIC COMPONENTS	ELSP EM9000C-2G	(58001130)

8.1.2 EM9010-2G UHF transmitter

UHF DIGITAL TRANSMITTER	**EM9010-2G**	**(80300035)**
MECHANICAL CHASSIS	CHEM41161	(50001398)
FRONT PANEL PCB	PAVE41160	(50001397)
CONTROL PCB	CTRL11217	(51001183)
UHF AMPLIFIER MODULE	AMPU26246	(52000597)
UHF SYNTHESIZER MODULE	SUHF25078	(52000621)
MICROCONTROLLER/DSP PCB	MIPR11005	(53500015)
DIGITAL TRANSMITTER MAINS INPUT	**EM9010A-2G**	**(84500144)**
POWER SUPPLY MODULE	ALIN26272	(52000650)
SPECIFIC COMPONENTS	ELSP EM9010A-2G	(58001091)
DIGITAL TRANSMITTER BATTERY INPUT	**EM9010C-2G**	**(84500145)**
POWER SUPPLY MODULE	ALDC26264	(52000642)
SPECIFIC COMPONENTS	ELSP EM9010C-2G	(58001131)

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CHAPTER 9. DIAGRAMS

9.1 LIST OF PHOTOS

TELERAD code	*Name*	*Assembly or Sub-assembly*
44000225	¾ photo of EM9000A-2G VHF transmitter	EM9000A-2G
44000226	Front and Rear Photo of EM9000A-2G	EM9000A-2G
44000227	Photo from above of EM9000A-2G	EM9000A-2G
44000312	¾ photo of EM9010A-2G UHF transmitter	EM9010A-2G
44000314	Front and Rear Photo of EM9010A-2G	EM9010A-2G
44000299	Photo from above of EM9010A-2G	EM9010A-2G

9.2 LIST OF MECHANICAL PLATES

TELERAD code	*Name*	*Assembly or Sub-assembly*
45000060	Mechanical dimensions / weight 1/1	EM9000-2G
45000064	Mechanical dimensions / weight 1/1	EM9010-2G

9.3 LIST OF INTERCONNECTION PLATES

TELERAD code	*Name*	*Assembly or Sub-assembly*
45500036	Uninterruptible power supply interconnection 1/1	ALIN26270/72
45500037	Continuous power supply interconnection 1/1	ALDC26264
45500040	VHF transmitter general interconnection	EM9000-2G
45500045	UHF transmitter general interconnection	EM9010-2G

9.4 LIST OF BLOCK DIAGRAM PLATES

TELERAD code	*Name*	*Assembly or Sub-assembly*
46000124	VHF transmitter general diagram 1/1	EM9000-2G
46000125	Uninterruptible power supply module diagram 1/1	ALIN26270/ ALIN26272
46000126	Front panel PCB diagram 1/1	PAVE41160
46000127	VHF amplifier module diagram 1/1	AMPV26260
46000128	Control PCB diagram 1/2	CTRL11217
46000129	Control PCB diagram 2/2	CTRL11217
46000130	µC/DSP module general diagram 1/1	MIPR11005
46000131	µC/DSP module diagram 1/1	MIPR11005
46000132	VHF synthesizer module diagram 1/1	SVHF25077
46000133	Continuous power supply module diagram 1/1	ALDC26264
46000145	UHF synthesizer module diagram 1/1	SUHF25078
46000147	UHF transmitter general diagram 1/1	EM9010-2G
46000148	UHF amplifier module diagram 1/1	AMPU26246

9.5 LIST OF LAYOUT VIEW SLIDES

TELERAD code	*Name*	*Assembly or Sub-assembly*
46500142	Synthesizer module layout 1/1	SVHF25077/ SUHF25078
46500150	Control PCB layout 1/1	CTRL11217
46500151	Front panel PCB layout 1/1	PAVE41160
46500155	Side A µC/DSP PCB layout 1/2	MIPR11005
46500156	Side B µC/DSP PCB layout 2/2	MIPR11005
46500178	Side A UHF amplifier module 1/2	AMPU26246
46500179	Side B UHF amplifier module 2/2	AMPU26246
46500180	Side A VHF amplifier module 1/2	AMPV26260
46500181	Side B VHF amplifier module 2/2	AMPV26260
46500195	Continuous power supply module layout 1/1	REAL16102
46500211	Cold plate power supply module layout 1/1	ALPF26271/ ALPF26273
46500212	Uninterruptible power supply module layout 1/1	RALI16105/ RALI16107

APPENDIX A. LIST OF ABBREVIATIONS

Acronym	Description
AC	Alternating current
ACARS	Air Communication And Reporting System
A/D	Analog-to-Digital
AGC	Automatic Gain Control
AM	Amplitude Modulation
AM-DSB/WC	Amplitude Modulation-Double Side Band / With Carrier
AM-MSK	Amplitude Modulation-Minimum Shift Keying
ASCII	American Standard Code for Information Interchange
ATM	Air Traffic Management
BER	Bit Error Rate
BNC	Bayonet Nut Connector
BSS	Basic Service Set
CBIT	Continuous Built-In Test
CODEC	COder - DECoder
CPLD	Complex Programmable Logic Device
CSMA	Carrier Sense Multiple Access
D8PSK	Differential 8-Phase Shift Keying
dB	Decibel
dBm	Decibel with reference to a power of 1mW
DC	Direct Current
DCE	Data Circuit-Terminating Equipment
DHCP	Dynamic Host Configuration Protocol
DMA	Direct Memory Access
DSP	Digital Signal Processor
DTE	Data Terminal Equipment
EC	European Conformity
EMC	Electromagnetic Compatibility
EEPOT	Electrically Erasable POTentiometer
EEPROM	Electrically Erasable Programmable Read Only Memory
ERM	Electromagnetic compatibility and Radio spectrum Matters
ESD	Electro-Static Discharge
ETSI	European Telecommunications Standards Institute
FIFO	First In First Out
FSK	Frequency Shift Keying
GFSK	Gaussian Frequency Shift Keying
HDLC	High Data Link Communication
HMI	Human Machine Interface
HW	Hardware
IBIT	Initiated Built-In Test
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
IIC (I2C)	Inter Integrated Circuit
IP	Internet Protocol
JTAG	Joint Test Action Group
LED	Light-Emitting Diode
LF	Low Frequency

Acronym	Description
LO	Local Oscillator
LV	Low Voltage
MAC	Media Access Control
MMI	Man-Machine Interface
MMU	Management Memory Unit
OLED	Organic Light-Emitting Diode
PC	Personal Computer
PCMCIA	Personal Computer Memory Card International Association
PLL	Phase Locked Loop
ppm	Parts per million
R&TTE	Radio and Telecommunications Terminal Equipment (Directive)
RAM	Random Access Memory
RISC	Reduced Instruction Set Computing
RF	Radio Frequency
ROM	Read Only Memory
RSS	Really Simple Syndication protocol
RTP	Real-time Transport Protocol
RxD	Received Data
S/N	Signal/Noise ratio
SCC	Serial Communication Controller
SIP	Session Initiation Protocol
SIU	System Interface Unit
SMC	Serial Management Controller
SNMP	Simple Network Management Protocol
SPI	Serial Peripheral Interface
SPORT	Serial PORT
SQL	Squelch
STDMA	Self-organized Time Division Multiple Access
SW	Software
SWR	Stationary Wave Ratio
TDM	Time-Division Multiplexed
TDMA	Time Division Multiple Access
TLD	Telerad
TQFP	Thin Quad Flat Pack
TxD	Transmitted Data
UART	Universal Asynchronous Receiver Transmitter
UHF	Ultra High Frequency
USB	Universal Serial Bus
VCSS	Voice Communication Switching System
VDL	VHF Data Link
VHF	Very High Frequency
VoIP	Voice over Internet Protocol
µP	Microprocessor

APPENDIX B. R&TTE DECLARATION OF CONFORMITY

B.1. R&TTE Declaration of conformity for the EM9000A-2G VHF transmitter

TELERAD

R&TTE DECLARATION OF CONFORMITY

Ref: DoC EM9000-2G Rev 1.0

We:

TELERAD
2 avenue de la Butte aux Cailles
64600 ANGLET, FRANCE

Represented by:

Patrice MARIOTTE
Director of Engineering & Operations

Declare under our sole responsability that the product:

VHF Transmitter
TELERAD
EM9000A-2G
(Product name, Trade name, Type or model)

to which this declaration relates is in conformity with the essential requirements and other relevant requirements of the R&TTE Directive (1999/5/EC) of 9 March 1999.

The product is in conformity with the following standards and/or other normative documents.

Directives	Standards	Technical documentation
Health & Safety (Article 3.1a of the R&TTE Directive) Low Voltage Directive N° 2006/95/EC of 12 December 2006	EN 60950-1:2006 + A11:2009	Series 90x0-2G Technical File: DTC EM90X0-2G Electrical safety reports (NB 0536): RS-030-PTC-10-102538-2-A FS-030-PTC-10-102538-1
EMC (Article 3.1b of the R&TTE Directive) EMC Directive N°2004/108/EC of 15 December 2004	EN 301489-1 V1.8.1:2008 EN 301489-22 V1.2.1:2002 EN 50371:2002 EN 61000-4-3(06) EN 61000-4-2(09) EN 61000-4-4(04) EN 61000-4-5(06) EN 61000-4-11(04) EN 61000-3-3(95) + A1(01)+A2(05) EN 61000-3-2(06) EN 55022(06) + A1(07)	Series 90x0-2G Technical File: DTC EM90X0-2G EMC test reports (NB 0536): RC-030-PTC-10-102538-3-A
SPECTRUM (Article 3.2 of the R&TTE Directive)	EN 300676-2 V1.4.1:2010 EN 300676-1 V1.5.1:2010	Test report: EM9000-2G Performance Test Records

Place and date: Anglet...on...4 March 2011

Patrice MARIOTTE
Director of Engineering & Operations

2 AVENUE DE LA BUTTE AUX CAILLES - BP 302 - 64603 ANGLET CEDEX - FRANCE
Tél : +33 (0)5 59 58 55 00 - Fax : +33 (0)5 59 58 55 01 - Email : courrier@telerad.fr

s.a. telerad au capital de 1 500 000 Euros - 341 143 915 r.c.s. bayonne - siret 341 143 915 00013 - ape 2651A - N° T.V.A/V.A.T N° FR 83 341 143 915

B.2. R&TTE Declaration of conformity for the EM9010A-2G UHF transmitter

TELERAD

R&TTE DECLARATION OF CONFORMITY

Ref: DoC EM9010-2G Rev 1.0

We:

TELERAD
2 avenue de la Butte aux Cailles
64600 ANGLET, FRANCE

Represented by:

Patrice MARIOTTE
Director of Engineering & Operations

Declare under our sole responsability that the product:

UHF Transmitter
TELERAD
EM9010A-2G
(Product name, Trade name, Type or model)

to which this declaration relates is in conformity with the essential requirements and other relevant requirements of the R&TTE Directive (1999/5/EC) of 9 March 1999.

The product is in conformity with the following standards and/or other normative documents.

Directives	Standards	Technical documentation
Health & Safety (Article 3.1a of the R&TTE Directive) Low Voltage Directive N° 2006/95/EC of 12 December 2006	EN 60950-1:2006 + A11:2009	Series 90x0-2G Technical File: DTC EM90X0-2G Electrical safety reports (NB 0536): RS-030-PTC-10-102538-1-A FS-030-PTC-10-102538-1
EMC (Article 3.1b of the R&TTE Directive) EMC Directive N°2004/108/EC of 15 December 2004	EN 301489-1 V1.8.1:2008 EN 301489-22 V1.2.1:2002 EN 50371:2002 EN 61000-4-3(06) EN 61000-4-2(09) EN 61000-4-4(04) EN 61000-4-5(06) EN 61000-4-11(04) EN 61000-3-3(95) + A1(01)+A2(05) EN 61000-3-2(06) EN 55022(06) + A1(07)	Series 90x0-2G Technical File: DTC EM90X0-2G EMC test reports (NB 0536): RC-030-PTC-10-102538-4-A
SPECTRUM (Article 3.2 of the R&TTE Directive)	EN 302617-2 V1.1.1:2010 EN 302617-1 V1.1.1:2009	Test report: EM9010-2G Performance Test Records

Place and date: Anglet on 4 March 2011

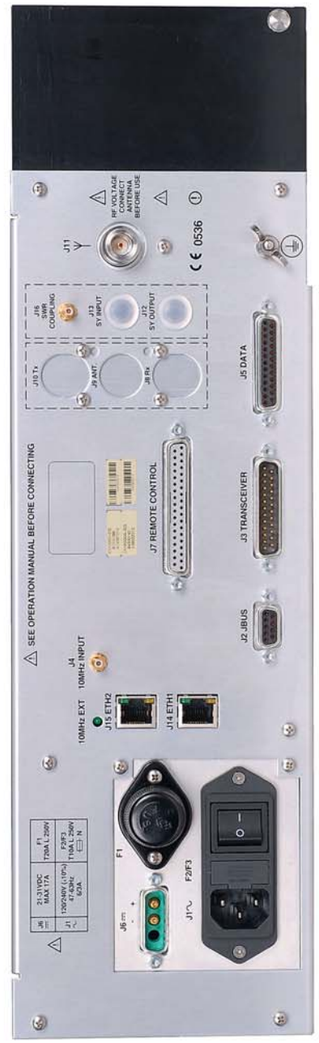
Patrice MARIOTTE
Director of Engineering & Operations

2 AVENUE DE LA BUTTE AUX CAILLES - BP 302 - 64603 ANGLET CEDEX - FRANCE
Tél : +33 (0)5 59 58 55 00 - Fax : +33 (0)5 59 58 55 01 - Email : courrier@telerad.fr

s.a. telerad au capital de 1 500 000 Euros - 341 143 915 r.c.s. bayonne - siret 341 143 915 00013 - ape 2651A - N° T.V.A/V.A.T N° FR 83 341 143 915

FRONT VIEW

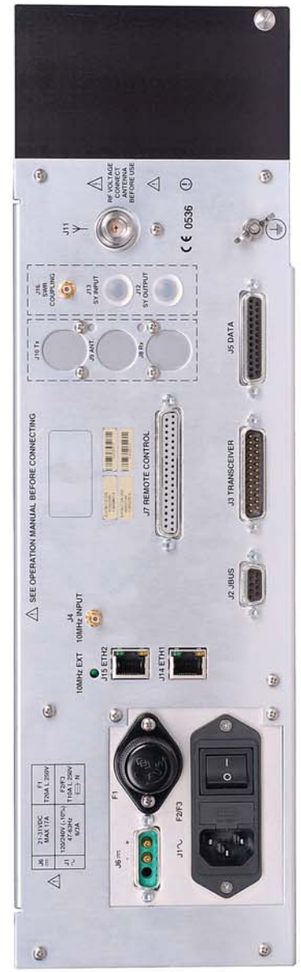
REAR VIEW



VHF DIGITAL TRANSMITTER Front and rear views				44000226 Indice rév. :V1.02 Date rév. : 01/03/11
Rèf. s/ens. : EM9000A-2G	Code s/ens. : 84500142	Rèf. ens. : EM9000-2G	Code ens. : 80000086	Page : 1/1
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE			email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

FRONT VIEW

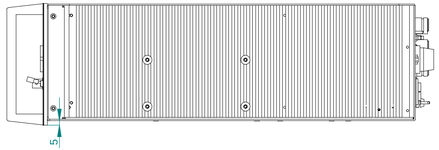
REAR VIEW

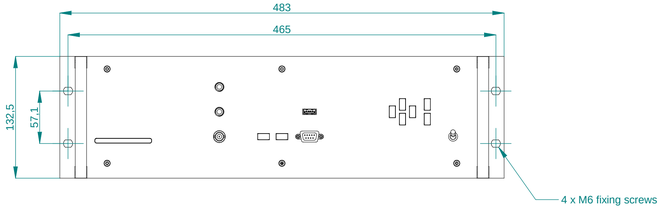


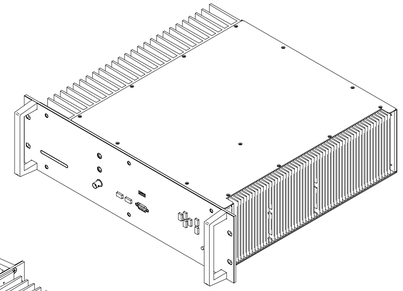
UHF DIGITAL TRANSMITTER Front and rear views				44000314 Indice rév. :V1.00 Date rév. : 02/03/11
Rèf. s/ens. : EM9010A-2G	Code s/ens. : 84500144	Rèf. ens. : EM9010-2G	Code ens. : 80300035	Page : 1/1
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE			email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

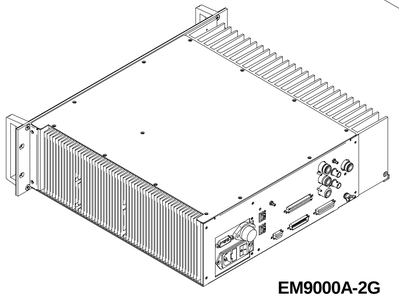
VHF DIGITAL TRANSMITTER Top view				44000227 Indice rév. :V1.01 Date rév. : 09/12/10
Rèf. s/ens. : EM9000A-2G	Code s/ens. : 84500142	Rèf. ens. : EM9000-2G	Code ens. : 80000086	Page : 1/1
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE			email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

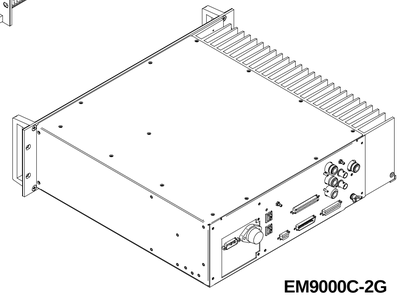
UHF DIGITAL TRANSMITTER Top view				44000299 Indice rév. :V1.01 Date rév. : 02/03/11
Rèf. s/ens. : EM9010A-2G	Code s/ens. : 84500144	Rèf. ens. : EM9010-2G	Code ens. : 80300035	Page : 1/1
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE			email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01





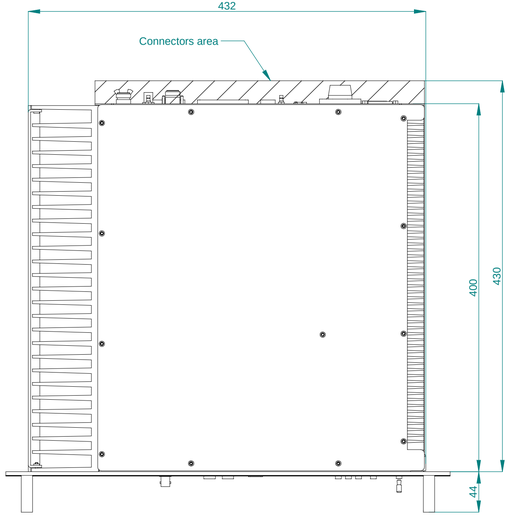




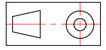


EM9000A-2G

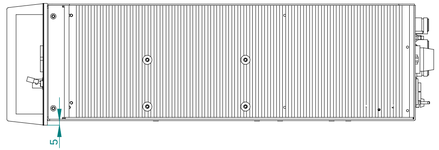
EM9000C-2G

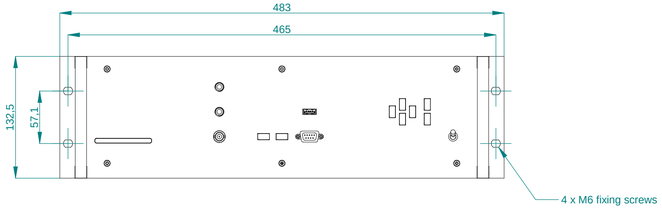


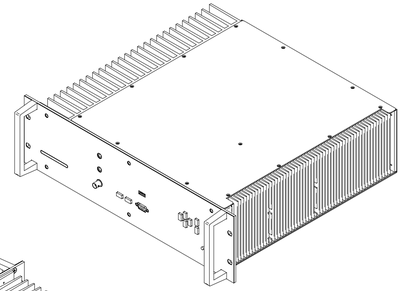
- Sides : mm
- Weight : 13Kg

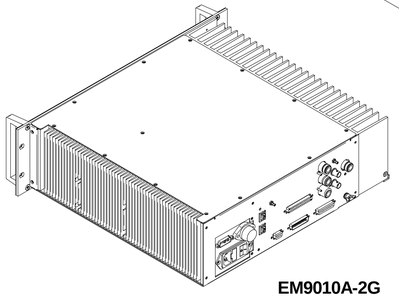


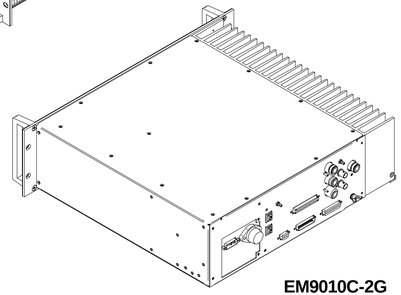
2G VHF DIGITAL TRANSMITTER (VDT) **Mechanicals dimensions/weight (1/1)**				**45000060** Rév. doc. :V1.00 Rév. date : 08/07/2011
Réf. S/Ensemble : EM9000A-2G EM9000C-2G	Code S/Ensemble : 84500142 84500143	Réf. Ensemble : EM9000-2G	Code Ensemble : 80000086	
TELERAD 2 Avenue de la Butte aux Cailles, B.P.302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr		TEL: +33 5 59 58 55 00 FAX: +33 5 59 58 55 01





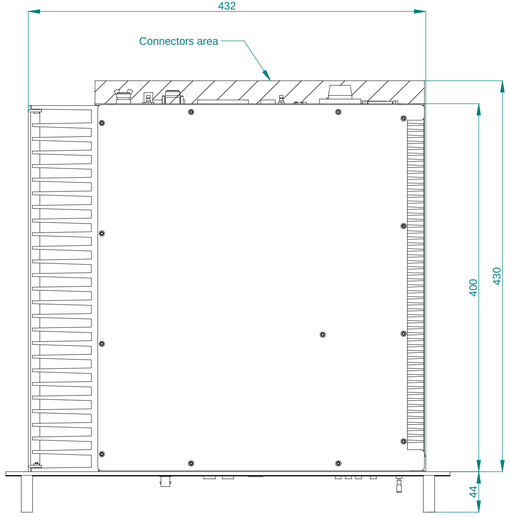




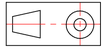


EM9010A-2G

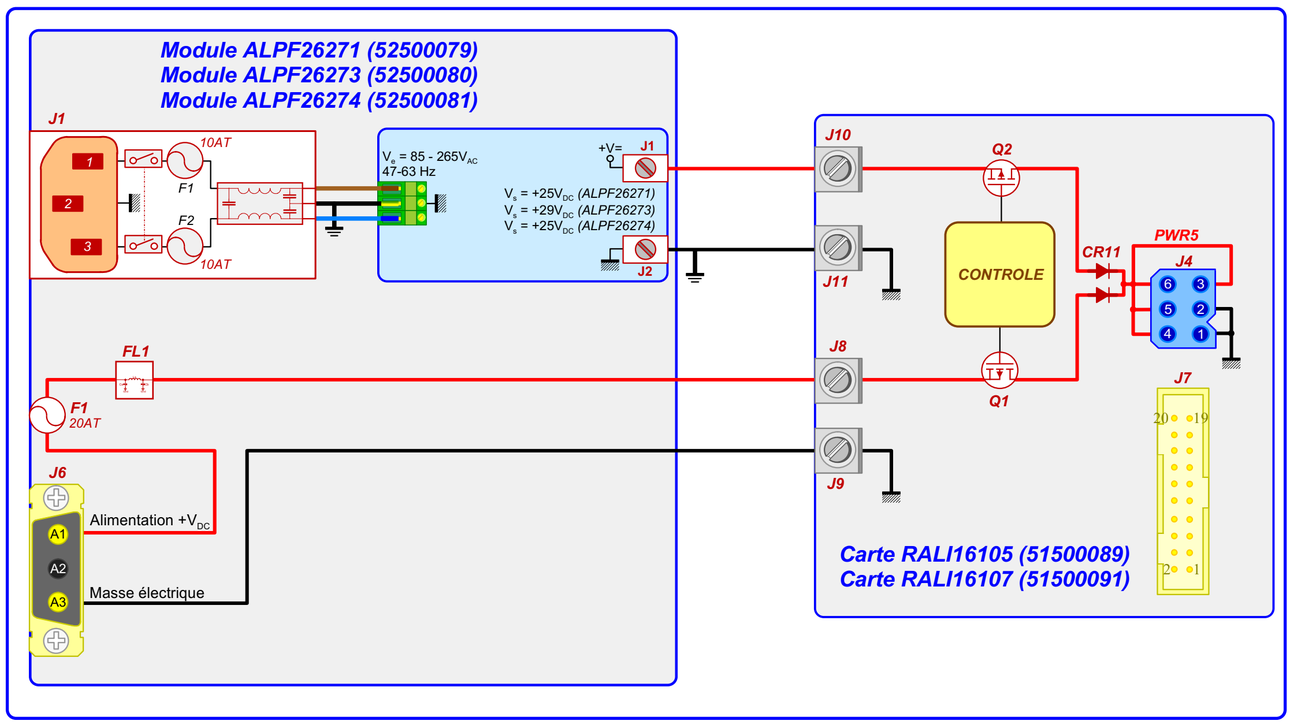
EM9010C-2G



- Sides : mm
- Weight : 13Kg



2G UHF DIGITAL TRANSMITTER (UDT) Mechanicals dimensions/weight (1/1)			45000064 Rév. doc. :V1.00 Rév. date : 08/07/2011
Réf. S/Ensemble : EM9010A-2G EM9010C-2G	Code S/Ensemble : 84500144 84500145	Réf. Ensemble : EM9010-2G	Code Ensemble : 80300035
TELERAD 2 Avenue de la Butte aux Cailles, B.P.302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL: +33 5 59 58 55 00 FAX: +33 5 59 58 55 01

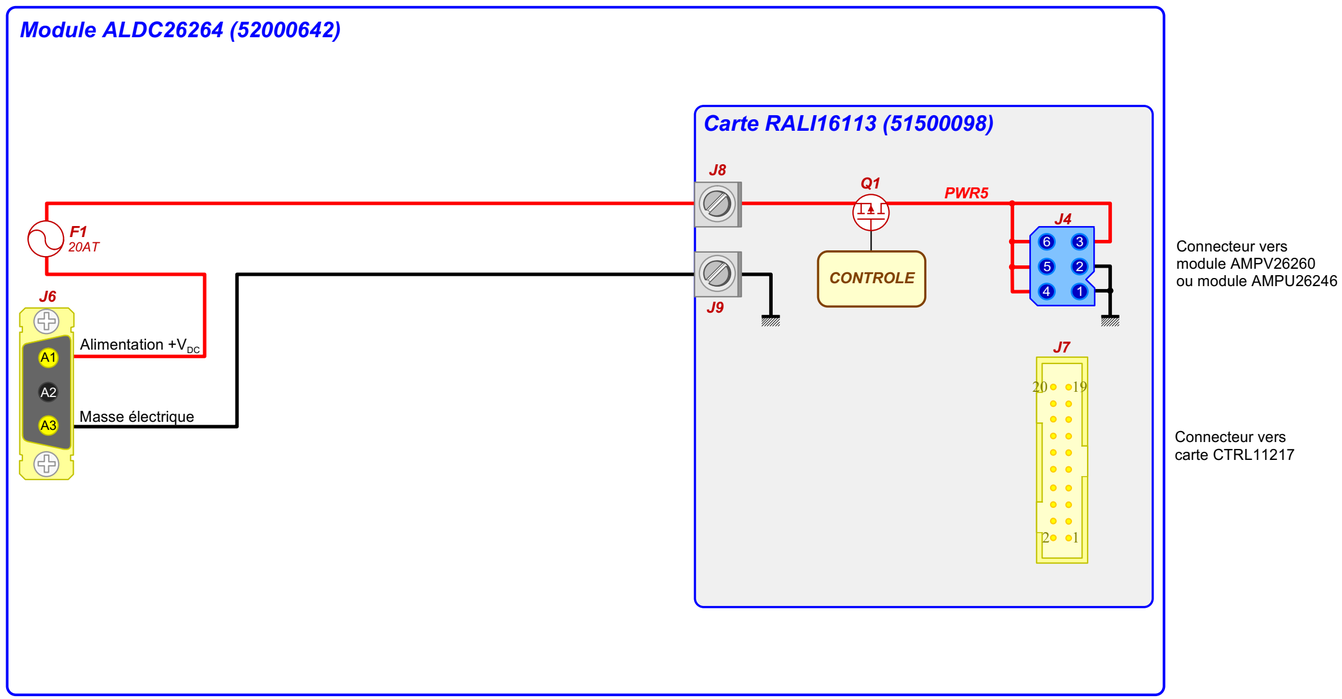


MODULE ALIMENTATION CONTINUE
Schéma d'interconnexion (1/1)

45500036
Indice rév. : V1.01
Date rév. : 18/01/10

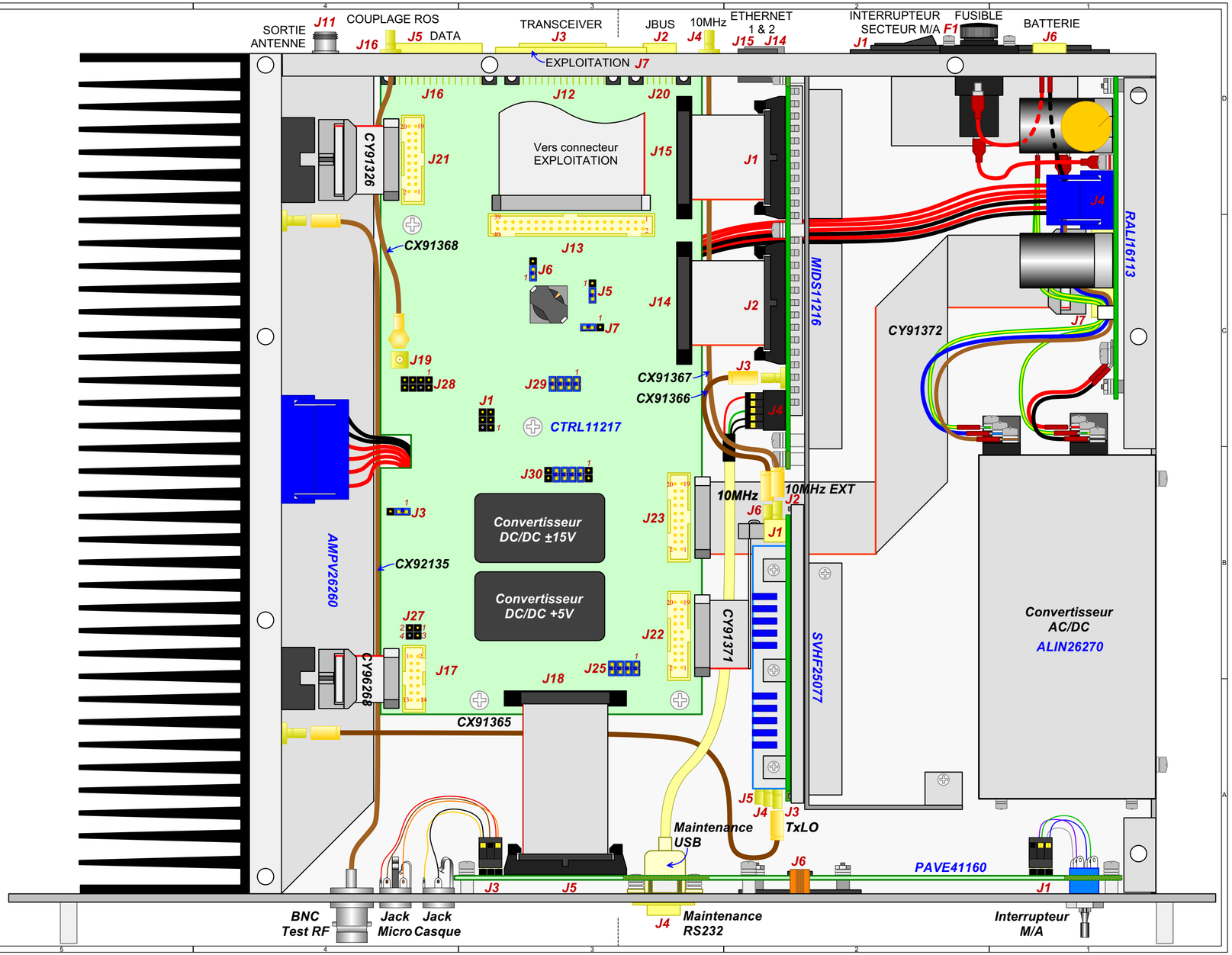
Réf. s/ens. :	Code s/ensemble :	Réf. ens. :	Code ensemble :
ALIN26270 (24V)	52000649	EM9000A-2G	84500142
ALIN26272 (28V)	52000650	EM9010A-2G	84500144
		TRG4000T	84500160
ALIN26274 (25V)	52000651	CM-300 VDT V2	80000088
		CM-300 UDT V2	80300036
		CM-350 VDT V2	80000089

TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
Addresse email : courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01



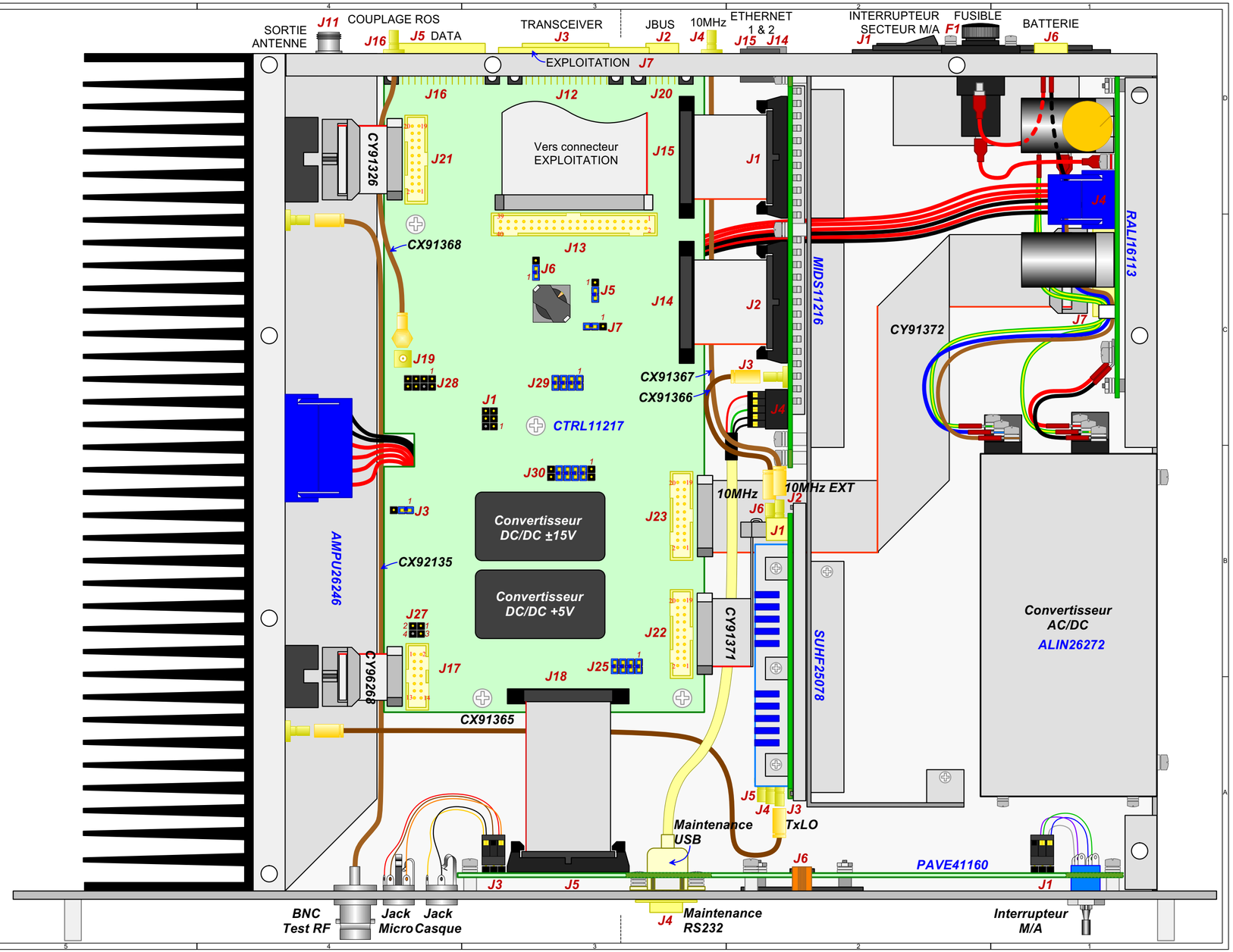
MODULE ALIMENTATION CONTINUE Schéma d'interconnexion (1/1)			45500037 Indice rév. : V1.03 Date rév. : 04/07/11
Rèf. s/ensemble : ALDC26264	Code s/ensemble : 52000642	Réf. ensemble : EM9000C-2G EM9010C-2G	Code ensemble : 84500143 84500145

TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
Addresse email : courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01

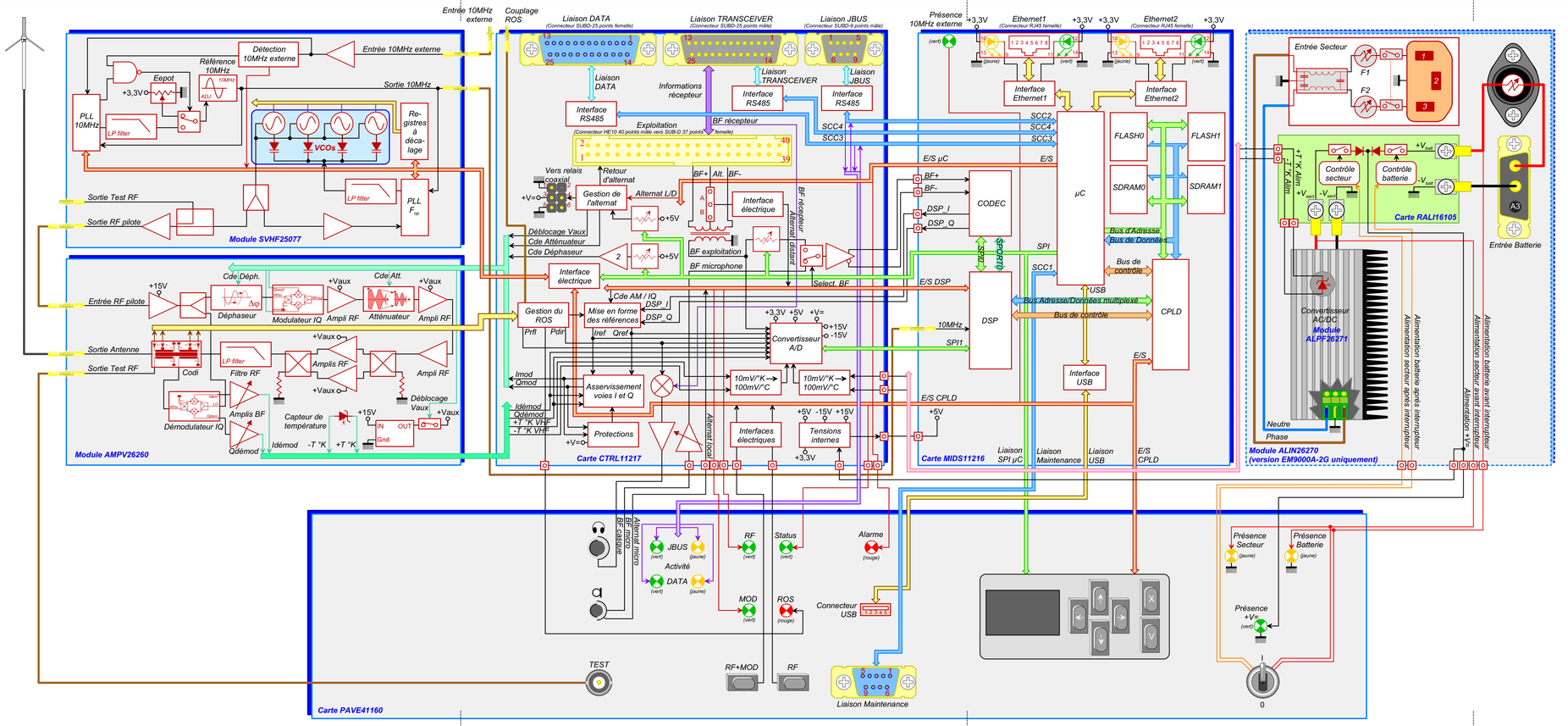


EMETTEUR NUMERIQUE VHF 2G Schéma d'interconnexion (1/1)			45500040 Indice rév. : V1.01 Date rév. : 04/07/11
Rèf. s/ens. :	Code s/ens. :	Rèf. ens. : EM9000-2G	Code ens. : 80000086

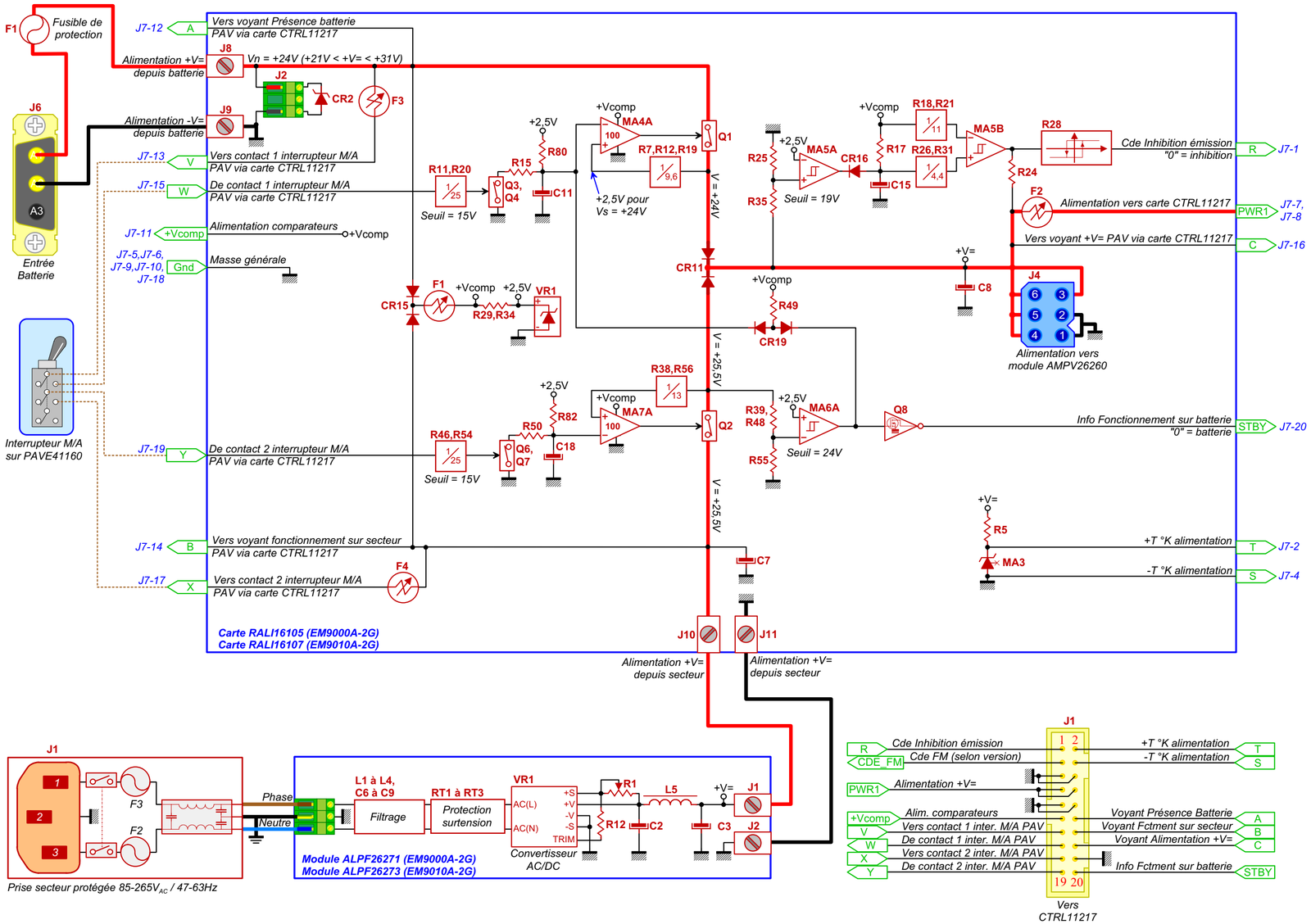
TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
addresse email courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01



EMETTEUR NUMERIQUE UHF 2G Schéma d'interconnexion (1/1)			45500045 Indice rév. : V1.01 Date rév. : 04/07/11
Réf. s/ens. :	Code s/ens. :	Réf. ens. : EM9010-2G	Code ens. : 80300035
TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		addresse email courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01



EMETTEUR NUMERIQUE VHF EM9000-2G Schéma synoptique général (1/1)			46000124 Indice rév. : V1.00 Date rév. : 23/02/11
Réf. s/ensemble : EM9000A-2G EM9000C-2G	Code s/ensemble : 84500142 84500143	Réf. ensemble : EM9000-2G	Code ensemble : 80000086
TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		Adresse email : courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

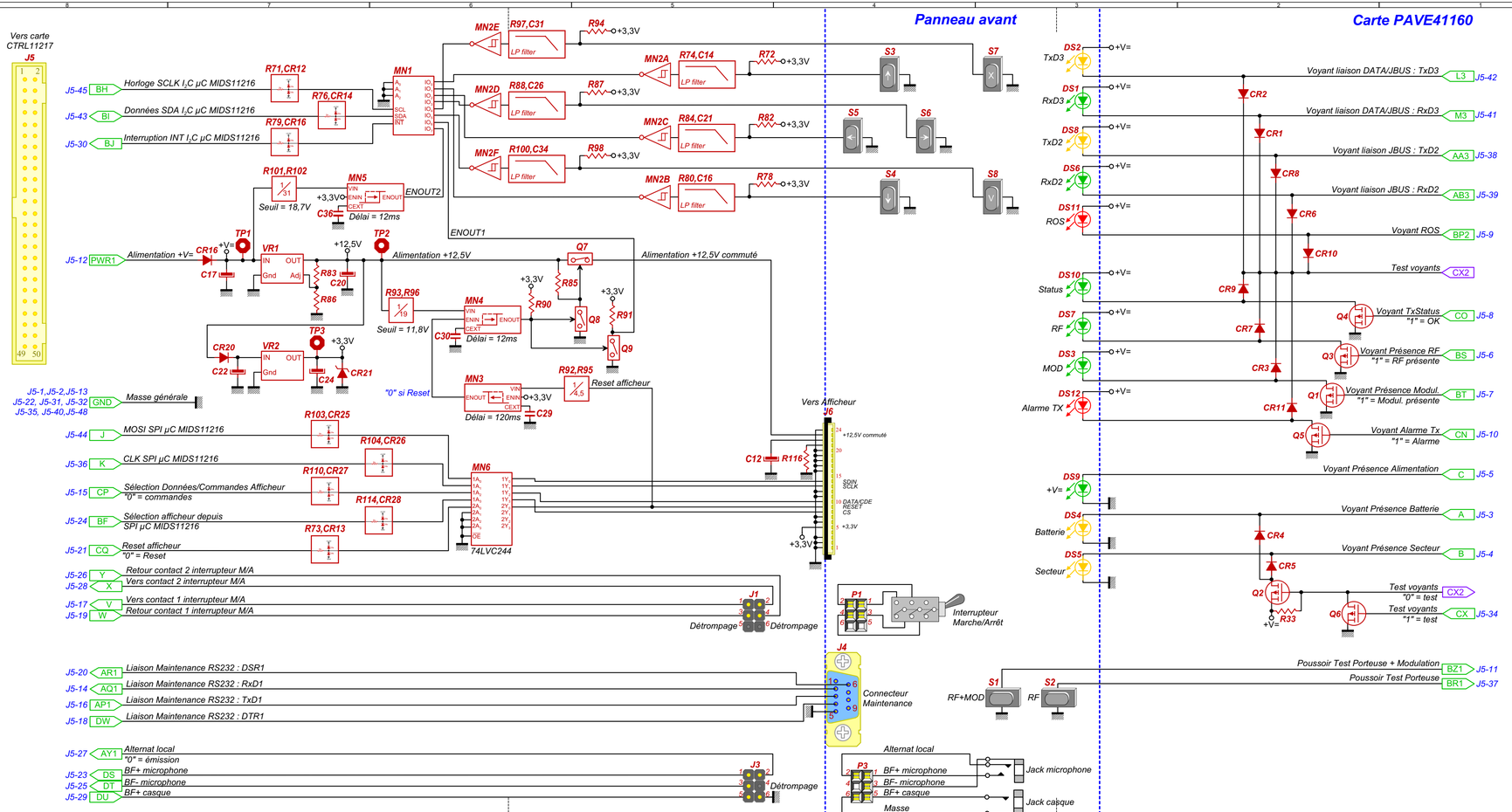


MODULE ALIMENTATION
Schéma synoptique (1/1)

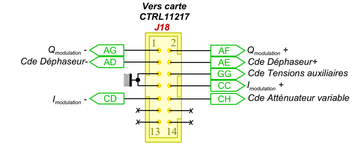
46000125
Indice rév. : V1.01
Date rév. : 04/07/11

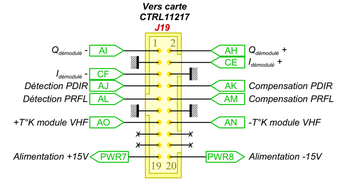
Rèf. s/ensemble : ALIN26270 ALIN26272	Code s/ensemble : 52000649 52000650	Rèf. ensemble : EM9000A-2G EM9010A-2G	Code ensemble : 84500142 84500144

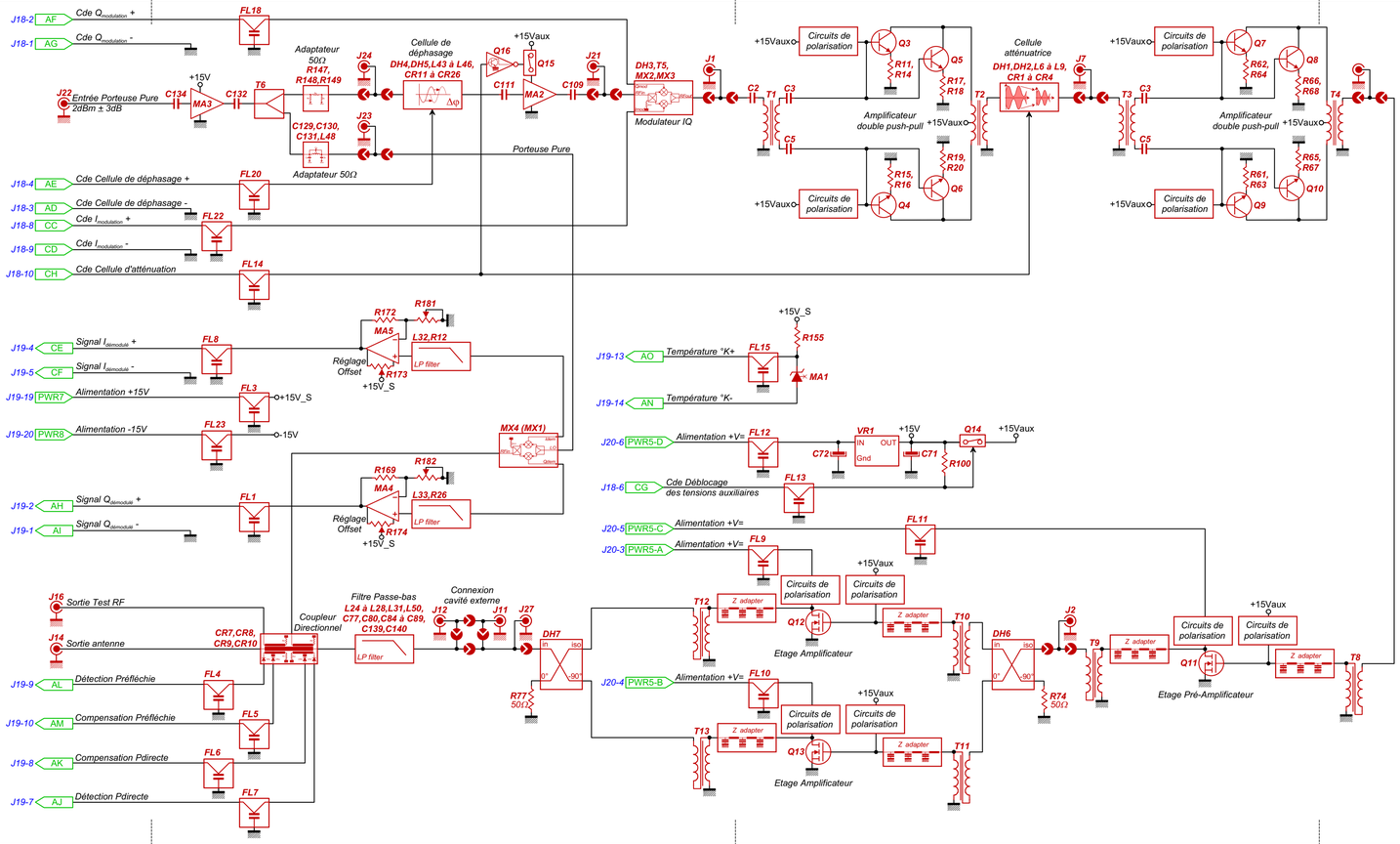
TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
Addresse email : courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01



CARTE PANNEAU AVANT Schéma synoptique (1/1)			46000126 Indice rév. : V1.00 Date rév. : 23/02/11
Réf. s/ensemble : PAVE41160	Code s/ensemble : 50001397	Réf. ensemble : EM9000-2G	Code ensemble : 80000086
TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		Adresse email : courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01







Module Amplificateur VHF Schéma synoptique (1/1)			46000127 Indice rév. : V1.00 Date rév. : 23/02/11
Réf. s/ensemble : AMPV26260	Code s/ensemble : 52000634	Réf. ensemble : EM9000-2G	Code ensemble : 80000086
TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		Adresse email : courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

CARTE DE CONTRÔLE ET D'ASSERVISSEMENT

Schéma synoptique : Liaisons séries DATA, JBUS, TRANSCEIVER, Liaisons Inter-connecteurs, Connectique interne/externe, (1/2)

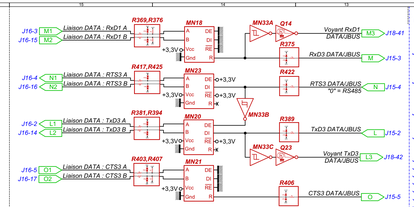
46000128

Indice rév. : V1.00
Date rév. : 23/02/11

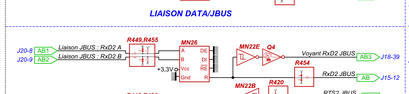
Réf. s/ensemble : CTRL11217	Code s/ensemble : 51001183	Réf. ensemble : EM9000-2G EM9010-2G	Code ensemble : 80000086 80300035

TELERAD — 2, Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
Adresse email : courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01

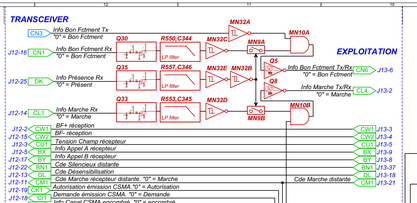
LIAISON DATA/JBUS



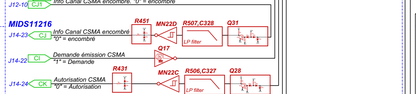
LIAISON TRANSCEIVER



TRANSCEIVER

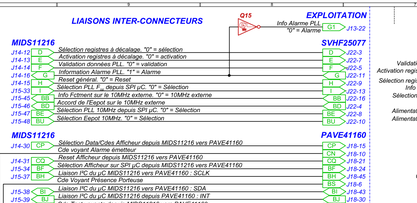


EXPLOITATION



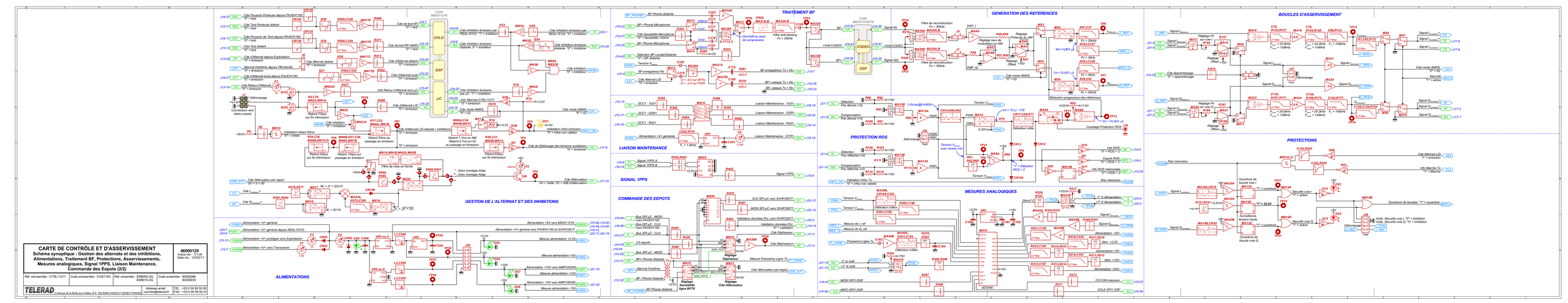
LIAISONS INTER-CONNECTEURS

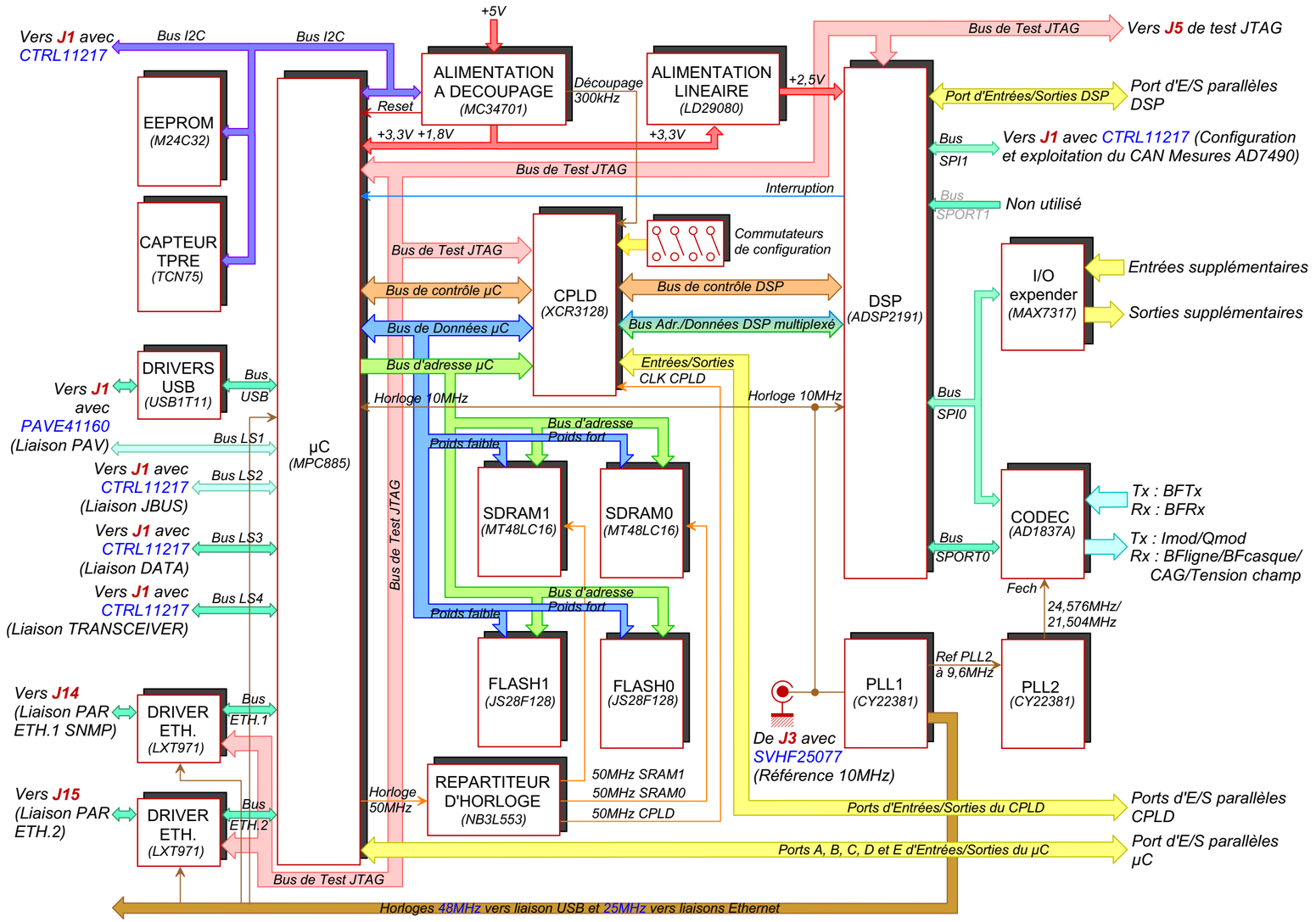
LIAISONS INTER-CONNECTEURS



EXPLOITATION

Info Alarme PLL
"0" = Alarme
Q15
G1
Reset général
Validation données PIL
Activation registres à décalage
Sélection registres à décalage
Sélection PLL F_ SPI µC
Alimentation +V= général
Alimentation +V= général
Liaison SPI µC
Liaison SPI µC MIDS11216 (MOSI :I) (S), SCK :I1 (S))
Info Fotment sur 10MHz externe
Accord Expoit 10MHz
Sélection PLL 10MHz SPI µC
Sélection Expoit 10MHz
Info Alarme PLL F_ spi µC
Alimentation +V=
Alimentation +V=
Alimentation +V=


CARTE DE CONTRÔLE ET D'ASSERVISSEMENT
Schéma synoptique : Gestion des alternats et des inhibitions, Alimentations, Traitement BF, Protections, Asservissements, Mesures analogiques, Signal 1PPS, Liaison Maintenance, Commande des Eepots (2/2)
46000129
Indice rév. : V1.00
Date rév. : 23/02/11
Réf. sérvesmble : CTRL11217
Code ensemble : 51001183
Réf. ensemble : EM6000-2G EM6010-2G
Code ensemble : 80000086 80300035
TELERAD
2 Avenue de la Butte aux Cailles, B.P. 302 44603 ANGLET CEDEX FRANCE
Adresse email : courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01
Carte MEDI11216
CPLD
DSP
µC
GESTION DE L'ALTERNAT ET DES INHIBITIONS
ALIMENTATIONS
TRAITEMENT BF
Carte MEDI11216/TX
CODEC
DSP
GENERATION DES REFERENCES
Réduction progressive des références
PROTECTION ROS
LIAISON MAINTENANCE
SIGNAL 1PPS
COMMANDE DES EEPOTS
MESURES ANALOGIQUES
BOUCLES D'ASSERVISSEMENT
PROTECTIONS



MODULE MICRO-PROCESSEUR/DSP Schéma synoptique général (1/1)			46000130 Indice rév. : V1.00 Date rév. : 23/02/11
Rèf. s/ensemble : MIPR11005 MIPR11006	Code s/ensemble : 53500015 53500016	Rèf. ensemble : EM9000-2G EM9010-2G RE9000-2G RE9010-2G	Code ensemble : 80000086 80300035 80100067 80100070

TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
Adresse email : courrier@telerad.fr
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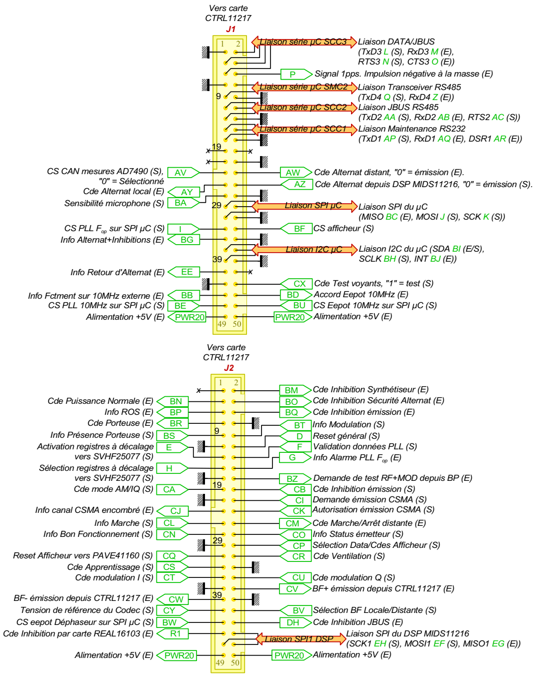
Vers carte CTRL11217
J1
1 2
Liaison série µC SCC3
Liaison DATA/JBUS
(TxD3 L (S), RxD3 M (E),
RTS3 N (S), CTS3 O (E))
P
Signal 1pps. Impulsion négative à la masse (E)
Liaison série µC SMC2
Liaison Transceiver RS485
(TxD4 Q (S), RxD4 Z (E))
9
Liaison série µC SCC2
Liaison JBUS RS485
(TxD2 AA (S), RxD2 AB (E), RTS2 AC (S))
Liaison série µC SCC1
Liaison Maintenance RS232
(TxD1 AP (S), RxD1 AQ (E), DSR1 AR (E))
19
x
CS CAN mesures AD7490 (S),
"0" = Sélectionné
AV
AW
Cde Alternat distant, "0" = émission (E).
AZ
Cde Alternat depuis DSP MIDS11216, "0" = émission (S).
Cde Alternat local (E)
AY
Sensibilité microphone (S)
BA
29
Liaison SPI µC
Liaison SPI du µC
(MISO BC (E), MOSI J (S), SCK K (S))
CS PLL F_{op} sur SPI µC (S)
I
BF
CS afficheur (S)
Info Alternat+Inhibitions (E)
BG
Liaison I2C µC
Liaison I2C du µC (SDA BI (E/S),
SCLK BH (S), INT BJ (E))
39
Info Retour d'Alternat (E)
EE
CX
Cde Test voyants, "1" = test (S)
Info Fctment sur 10MHz externe (E)
BB
BD
Accord Eepot 10MHz (E)
CS PLL 10MHz sur SPI µC (S)
BE
BU
CS Eepot 10MHz sur SPI µC (S)
Alimentation +5V (E)
PWR20
PWR20
Alimentation +5V (E)
49 50
Vers carte CTRL11217
J2
1 2
BM
Cde Inhibition Synthétiseur (E)
Cde Puissance Normale (E)
BN
BO
Cde Inhibition Sécurité Alternat (E)
Info ROS (E)
BP
BQ
Cde Inhibition émission (E)
Cde Porteuse (E)
BR
BT
Info Modulation (S)
9
Info Présence Porteuse (S)
BS
D
Reset général (S)
Activation registres à décalage vers SVHF25077 (S)
E
F
Validation données PLL (S)
G
Info Alarme PLL F_{op} (E)
Sélection registres à décalage vers SVHF25077 (S)
H
BZ
Demande de test RF+MOD depuis BP (E)
19
Cde mode AM/IQ (S)
CA
CB
Cde Inhibition émission (S)
CI
Demande émission CSMA (S)
Info canal CSMA encombré (E)
CJ
CK
Autorisation émission CSMA (S)
Info Marche (S)
CL
CM
Cde Marche/Arrêt distante (E)
Info Bon Fonctionnement (S)
CN
CO
Info Status émetteur (S)
29
CP
Sélection Data/Cdes Afficheur (S)
Reset Afficheur vers PAVE41160 (S)
CQ
CR
Cde Ventilation (S)
Cde Apprentissage (S)
CS
Cde modulation I (S)
CT
CU
Cde modulation Q (S)
CV
BF+ émission depuis CTRL11217 (E)
39
BF- émission depuis CTRL11217 (E)
CW
Tension de référence du Codec (S)
CY
BV
Sélection BF Locale/Distante (S)
CS eepot Déphaseur sur SPI µC (S)
BW
DH
Cde Inhibition JBUS (E)
Cde Inhibition par carte REAL16103 (E)
R1
Liaison SPI1 DSP
Liaison SPI du DSP MIDS11216
(SCK1 EH (S), MOSI1 EF (S), MISO1 EG (E))
Alimentation +5V (E)
PWR20
PWR20
Alimentation +5V (E)
49 50

MODULE MICRO-PROCESSEUR/DSP

Schéma synoptique (1/1)

46000131
Indice rév. : V1.00
Date rév. : 23/02/11

Rèf. s/ensemble : MIPR11005	Code s/ensemble : 53500015	Rèf. ensemble : EM9000-2G	Code ensemble : 80000086

TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
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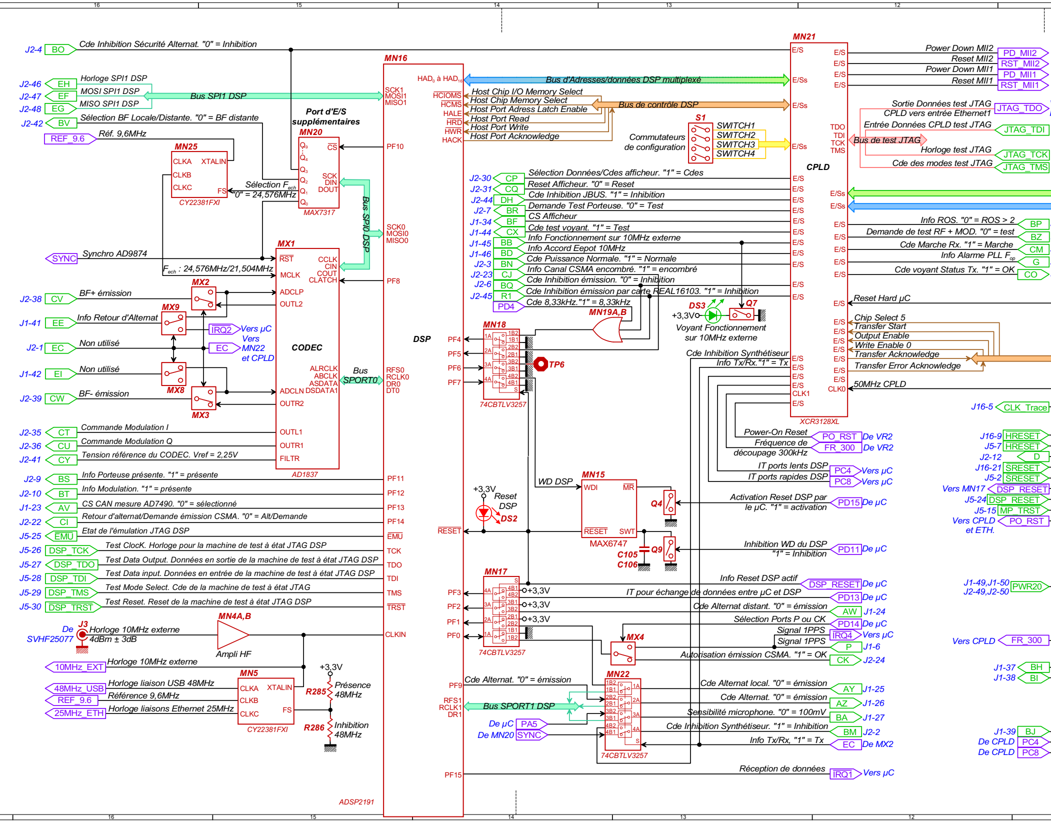
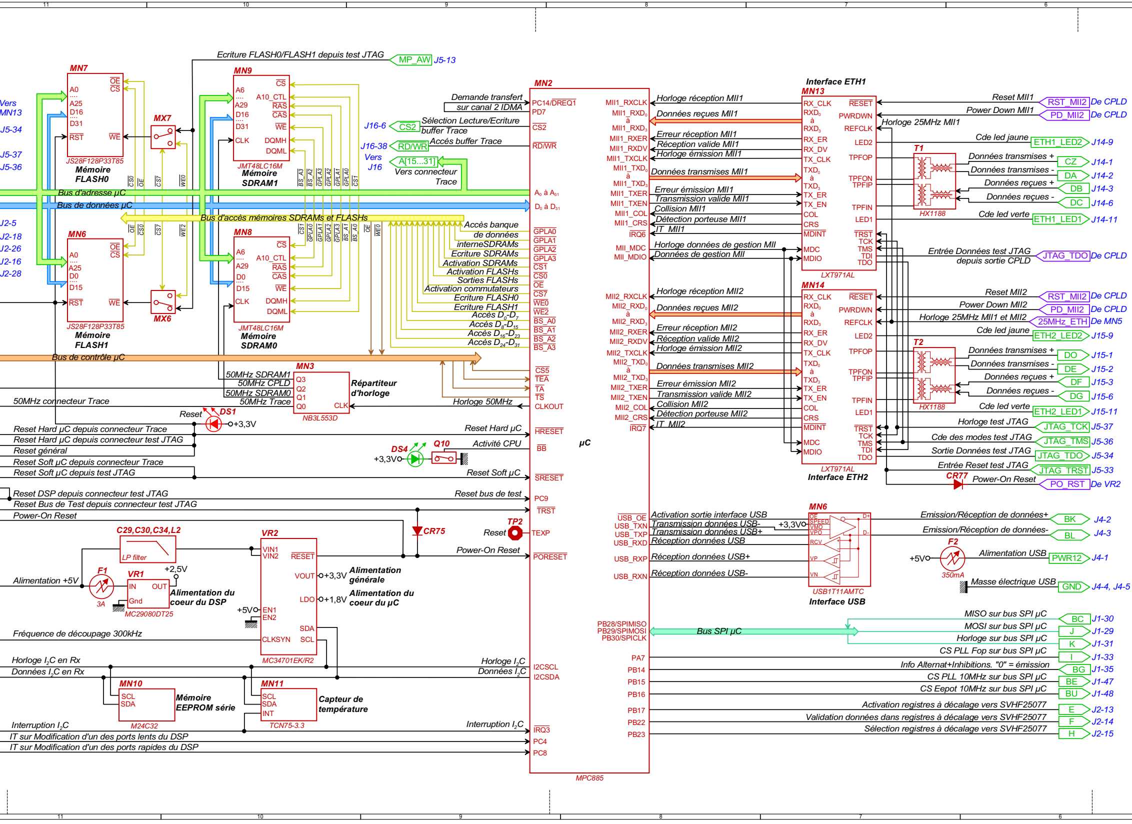
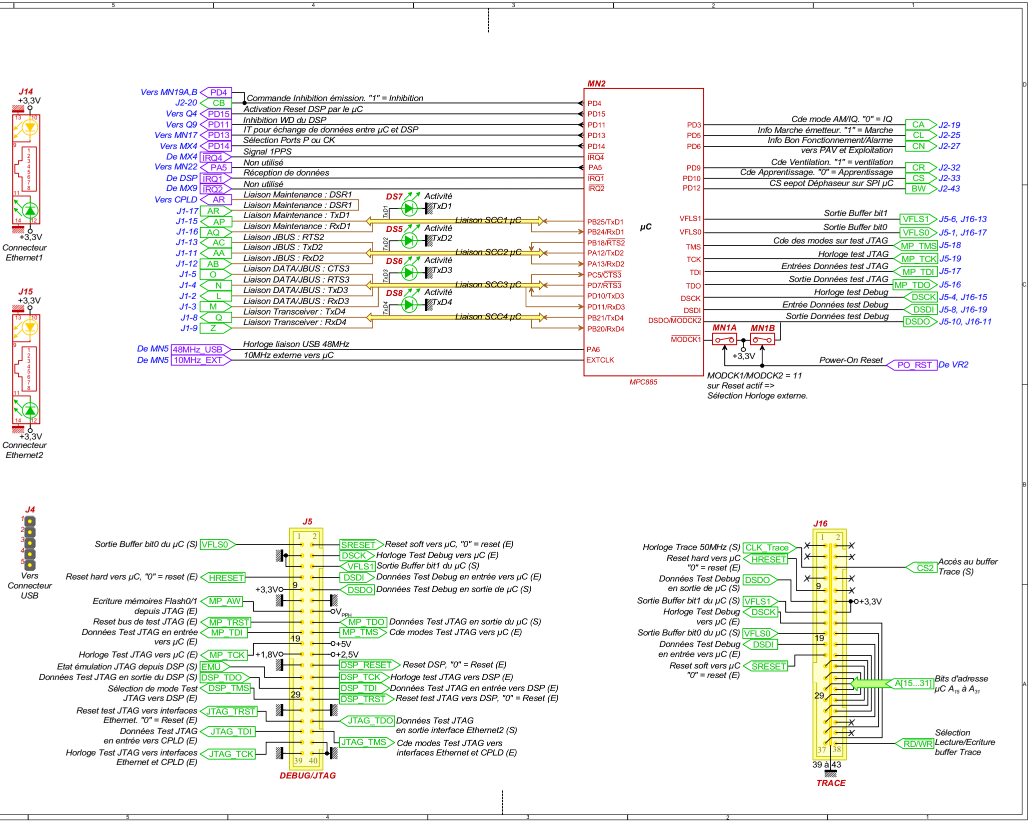
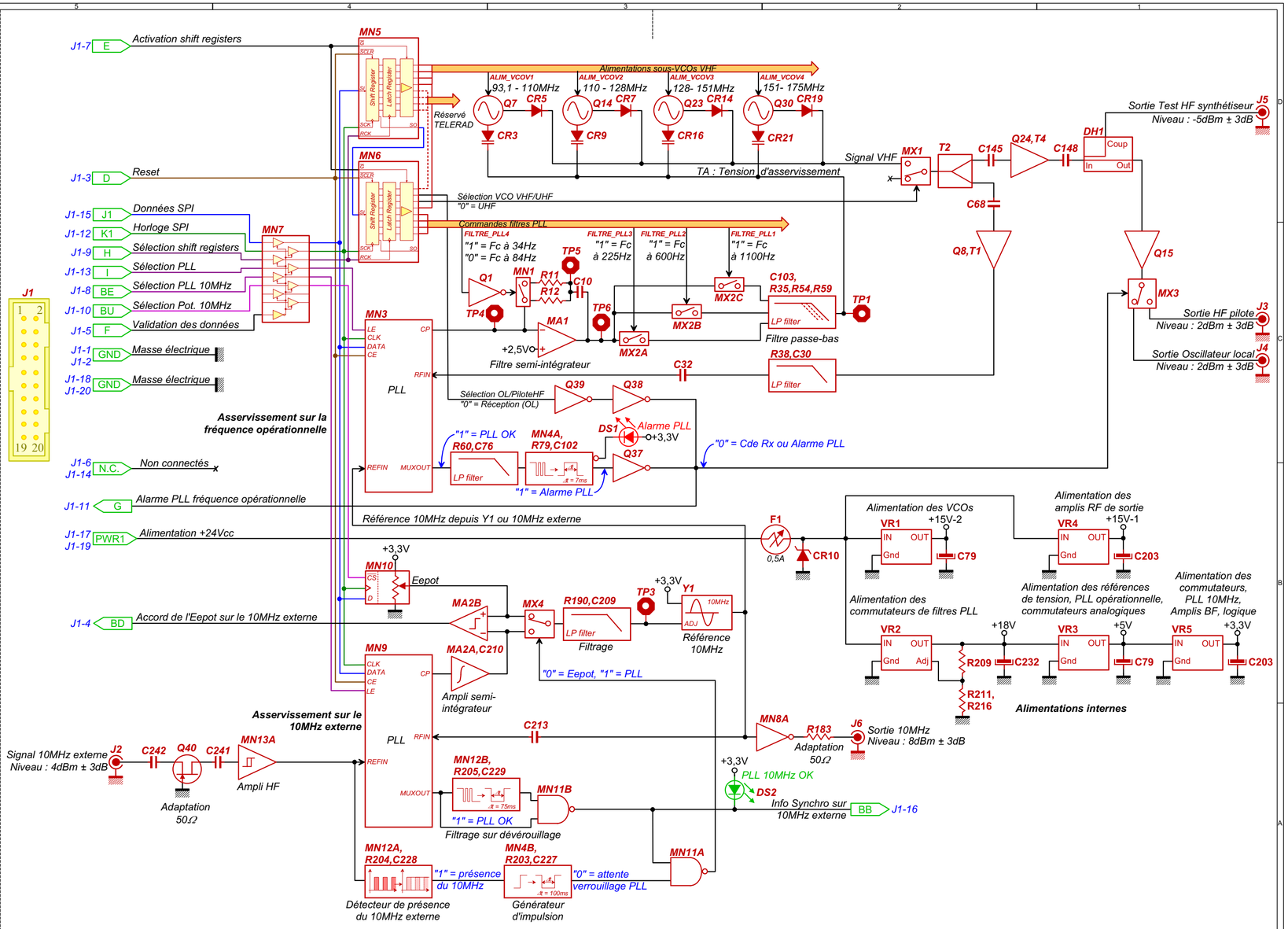

16
15
14
13
12
J2-4 BO Cde Inhibition Sécurité Alternat. "0" = Inhibition
J2-46 EH Horloge SPI1 DSP
J2-47 EF MOSI SPI1 DSP
J2-48 EG MISO SPI1 DSP
Bus SPI1 DSP
J2-42 BV Sélection BF Locale/Distante. "0" = BF distante
REF_9.6 Réf. 9,6MHz
Port d'E/S supplémentaires
MN20
MAX7317
MN25
CLKA XTALIN CLKB CLKC FS
CY22381FXI
Sélection Fech "0" = 24,576MHz
Bus SPI0 DSP
SYNC Synchro AD9874
Fech : 24,576MHz/21,504MHz
MX1
RST MCLK CCLK CIN COUT CLATCH
ADCLP OUTL2
CODEC
ALRCLK ABCLK ASDATA ADCLN DSDATA1 OUTR2
OUTL1 OUTR1 FILTR
AD1837
Bus SPORT0
J2-38 CV BF+ émission
MX2
MX9
J1-41 EE Info Retour d'Alternat
IRQ2 Vers µC
J2-1 EC Non utilisé
EC Vers MN22 et CPLD
J1-42 EI Non utilisé
MX8
J2-39 CW BF- émission
MX3
J2-35 CT Commande Modulation I
J2-36 CU Commande Modulation Q
J2-41 CY Tension référence du CODEC. Vref = 2,25V
J2-9 BS Info Porteuse présente. "1" = présente
J2-10 BT Info Modulation. "1" = présente
J1-23 AV CS CAN mesure AD7490. "0" = sélectionné
J2-22 CI Retour d'alternat/Demande émission CSMA. "0" = Alt/Demande
J5-25 EMU Etat de l'émulation JTAG DSP
J5-26 DSP_TCK Test ClocK. Horloge pour la machine de test à état JTAG DSP
J5-27 DSP_TDO Test Data Output. Données en sortie de la machine de test à état JTAG DSP
J5-28 DSP_TDI Test Data input. Données en entrée de la machine de test à état JTAG DSP
J5-29 DSP_TMS Test Mode Select. Cde de la machine de test à état JTAG
J5-30 DSP_TRST Test Reset. Reset de la machine de test à état JTAG DSP
J3 De SVHF25077 Horloge 10MHz externe 4dBm ± 3dB
MN4A,B Ampli HF
10MHz_EXT Horloge 10MHz externe
MN5
48MHz_USB Horloge liaison USB 48MHz
REF_9.6 Référence 9,6MHz
25MHz_ETH Horloge liaisons Ethernet 25MHz
CY22381FXI
+3,3V
R285 Présence 48MHz
R286 Inhibition 48MHz
MN16
DSP
ADSP2191
HAD0 à HAD15
SCK1 MOSI1 MISO1
HCIOMS HCMS HALE HRD HWR HACK
PF10
SCK0 MOSI0 MISO0
PF8
PF4 PF5 PF6 PF7
RFS0 RCLK0 DR0 DT0
PF11 PF12 PF13 PF14
RESET
EMU TCK TDO TDI TMS TRST
CLKIN
PF3 PF2 PF1 PF0
PF9
RFS1 RCLK1 DR1
PF15
Bus d'Adresses/données DSP multiplexé
Host Chip I/O Memory Select
Host Chip Memory Select
Host Port Adress Latch Enable
Host Port Read
Host Port Write
Host Port Acknowledge
Bus de contrôle DSP
S1
Commutateurs de configuration
SWITCH1 SWITCH2 SWITCH3 SWITCH4
MN21
CPLD
XCR3128XL
E/S E/Ss TDO TDI TCK TMS CLK1 CLK0
Power Down MII2 PD_MII2
Reset MII2 RST_MII2
Power Down MII1 PD_MII1
Reset MII1 RST_MII1
Sortie Données test JTAG CPLD vers entrée Ethernet1 JTAG_TDO
Entrée Données CPLD test JTAG JTAG_TDI
Bus de test JTAG
Horloge test JTAG JTAG_TCK
Cde des modes test JTAG JTAG_TMS
J2-30 CP Sélection Données/Cdes afficheur. "1" = Cdes
J2-31 CQ Reset Afficheur. "0" = Reset
J2-44 DH Cde Inhibition JBUS. "1" = Inhibition
J2-7 BR Demande Test Porteuse. "0" = Test
J1-34 BF CS Afficheur
J1-44 CX Cde test voyant. "1" = Test
J1-45 BB Info Fonctionnement sur 10MHz externe
J1-46 BD Info Accord Eepot 10MHz
J2-3 BN Cde Puissance Normale. "1" = Normale
J2-23 CJ Info Canal CSMA encombré. "1" = encombré
J2-6 BQ Cde Inhibition émission. "0" = Inhibition
J2-45 R1 Cde Inhibition émission par carte REAL16103. "1" = Inhibition
PD4 Cde 8,33kHz."1" = 8,33kHz
Info ROS. "0" = ROS > 2 BP
Demande de test RF + MOD. "0" = test BZ
Cde Marche Rx. "1" = Marche CM
Info Alarme PLL Fop G
Cde voyant Status Tx. "1" = OK CO
Reset Hard µC
Chip Select 5
Transfer Start
Output Enable
Write Enable 0
Transfer Acknowledge
Transfer Error Acknowledge
50MHz CPLD
DS3 Q7
+3,3V
Voyant Fonctionnement sur 10MHz externe
MN19A,B
MN18
74CBTLV3257
TP6
Cde Inhibition Synthétiseur
Info Tx/Rx."1" = Tx
Power-On Reset PO_RST De VR2
Fréquence de découpage 300kHz FR_300 De VR2
IT ports lents DSP PC4 Vers µC
IT ports rapides DSP PC8 Vers µC
J16-5 CLK_Trace
J16-9 HRESET
J5-7 HRESET
J2-12 D
J16-21 SRESET
J5-2 SRESET
Vers MN17 DSP_RESET
J5-24 DSP_RESET
J5-15 MP_TRST
Vers CPLD et ETH. PO_RST
WD DSP
MN15
WDI MR RESET SWT
MAX6747
+3,3V Reset DSP DS2
Q4 Activation Reset DSP par le µC. "1" = activation PD15 De µC
Q9 C105 C106 Inhibition WD du DSP "1" = Inhibition PD11 De µC
MN17
74CBTLV3257
+3,3V
Info Reset DSP actif DSP_RESET De µC
IT pour échange de données entre µC et DSP PD13 De µC
Cde Alternat distant. "0" = émission AW J1-24
Sélection Ports P ou CK PD14 De µC
Signal 1PPS IRQ4 Vers µC
Signal 1PPS P J1-6
MX4
Autorisation émission CSMA. "1" = OK CK J2-24
J1-49,J1-50 J2-49,J2-50 PWR20
Vers CPLD FR_300
J1-37 BH
J1-38 BI
Cde Alternat. "0" = émission
MN22
74CBTLV3257
Bus SPORT1 DSP
De µC PA5
De MN20 SYNC
Cde Alternat local. "0" = émission AY J1-25
Cde Alternat. "0" = émission AZ J1-26
Sensibilité microphone. "0" = 100mV BA J1-27
Cde Inhibition Synthétiseur. "1" = Inhibition BM J2-2
Info Tx/Rx, "1" = Tx EC De MX2
J1-39 BJ
De CPLD PC4
De CPLD PC8
Réception de données IRQ1 Vers µC


11
10
9
8
7
6
Ecriture FLASH0/FLASH1 depuis test JTAG
MP_AW
J5-13
MN7
A0
A25
D16
D31
OE
CS
RST
WE
JS28F128P33T85
Mémoire FLASH0
MX7
MN9
A6
A29
D16
D31
CLK
CS
A10_CTL
RAS
CAS
WE
DQMH
DQML
JMT48LC16M
Mémoire SDRAM1
Vers MN13
J5-34
J5-37
J5-36
Bus d'adresse µC
Bus de données µC
Bus d'accès mémoires SDRAMs et FLASHs
J2-5
J2-18
J2-26
J2-16
J2-28
MN6
A0
A25
D0
D15
OE
CS
RST
WE
JS28F128P33T85
Mémoire FLASH1
MX6
MN8
A6
A29
D0
D15
CLK
CS
A10_CTL
RAS
CAS
WE
DQMH
DQML
JMT48LC16M
Mémoire SDRAM0
CS0
OE
CS7
WE0
WE2
BS_A3
BS_A2
GPLA3
GPLA2
GPLA1
GPLA0
CS1
BS_A1
BS_A0
Bus de contrôle µC
Demande transfert sur canal 2 IDMA
J16-6
CS2
Sélection Lecture/Ecriture buffer Trace
J16-38
RD/WR
Accés buffer Trace
Vers J16
A[15...31]
Vers connecteur Trace
Accès banque de données
interneSDRAMs
Ecriture SDRAMs
Activation SDRAMs
Activation FLASHs
Sorties FLASHs
Activation commutateurs
Ecriture FLASH0
Ecriture FLASH1
Accès D_0-D_7
Accès D_8-D_{15}
Accès D_{16}-D_{23}
Accès D_{24}-D_{31}
MN3
50MHz SDRAM1
50MHz CPLD
50MHz SDRAM0
50MHz Trace
Q3
Q2
Q1
Q0
CLK
Répartiteur d'horloge
NB3L553D
50MHz connecteur Trace
Horloge 50MHz
Reset
DS1
+3,3V
Reset Hard µC depuis connecteur Trace
Reset Hard µC depuis connecteur test JTAG
Reset général
Reset Soft µC depuis connecteur Trace
Reset Soft µC depuis test JTAG
Reset Hard µC
DS4
Q10
+3,3V
Activité CPU
Reset Soft µC
Reset DSP depuis connecteur test JTAG
Reset Bus de Test depuis connecteur test JTAG
Reset bus de test
Power-On Reset
CR75
TP2
Reset
C29,C30,C34,L2
LP filter
VR2
VIN1
VIN2
RESET
VOUT
+3,3V
Alimentation générale
LDO
+1,8V
Alimentation du coeur du µC
EN1
EN2
+5V
SDA
SCL
CLKSYN
MC34701EK/R2
Power-On Reset
F1
3A
Alimentation +5V
VR1
+2,5V
IN
OUT
Gnd
Alimentation du coeur du DSP
MC29080DT25
Fréquence de découpage 300kHz
Horloge I2C en Rx
Données I2C en Rx
Horloge I2C
Données I2C
MN10
SCL
SDA
Mémoire EEPROM série
M24C32
MN11
SCL
SDA
INT
Capteur de température
TCN75-3.3
Interruption I2C
Interruption I2C
IT sur Modification d'un des ports lents du DSP
IT sur Modification d'un des ports rapides du DSP
MN2
PC14/DREQ1
PD7
CS2
RD/WR
A_0 à A_{31}
D_0 à D_{31}
GPLA0
GPLA1
GPLA2
GPLA3
CS1
CS0
OE
CS7
WE0
WE2
BS_A0
BS_A1
BS_A2
BS_A3
CS5
TEA
TA
TS
CLKOUT
HRESET
BB
µC
SRESET
PC9
TRST
TEXP
PORESET
I2CSCL
I2CSDA
IRQ3
PC4
PC8
MPC885
MII1_RXCLK
MII1_RXD0
à
MII1_RXD3
MII1_RXER
MII1_RXDV
MII1_TXCLK
MII1_TXD0
à
MII1_TXD3
MII1_TXER
MII1_TXEN
MII1_COL
MII1_CRS
IRQ6
MII_MDC
MII_MDIO
MII2_RXCLK
MII2_RXD0
à
MII2_RXD3
MII2_RXER
MII2_RXDV
MII2_TXCLK
MII2_TXD0
à
MII2_TXD3
MII2_TXER
MII2_TXEN
MII2_COL
MII2_CRS
IRQ7
USB_OE
USB_TXN
USB_TXP
USB_RXD
USB_RXP
USB_RXN
PB28/SPIMISO
PB29/SPIMOSI
PB30/SPICLK
PA7
PB14
PB15
PB16
PB17
PB22
PB23
Horloge réception MII1
Données reçues MII1
Erreur réception MII1
Réception valide MII1
Horloge émission MII1
Données transmises MII1
Erreur émission MII1
Transmission valide MII1
Collision MII1
Détection porteuse MII1
IT MII1
Horloge données de gestion MII
Données de gestion MII
Horloge réception MII2
Données reçues MII2
Erreur réception MII2
Réception valide MII2
Horloge émission MII2
Données transmises MII2
Erreur émission MII2
Transmission valide MII2
Collision MII2
Détection porteuse MII2
IT MII2
Interface ETH1
MN13
RX_CLK
RXD0
à
RXD3
RX_ER
RX_DV
TX_CLK
TXD0
à
TXD3
TX_ER
TX_EN
COL
CRS
MDINT
MDC
MDIO
RESET
PWRDWN
REFCLK
LED2
TPFOP
TPFON
TPFIP
TPFIN
LED1
TRST
TCK
TMS
TDI
TDO
LXT971AL
MN14
RX_CLK
RXD0
à
RXD3
RX_ER
RX_DV
TX_CLK
TXD0
à
TXD3
TX_ER
TX_EN
COL
CRS
MDINT
MDC
MDIO
RESET
PWRDWN
REFCLK
LED2
TPFOP
TPFON
TPFIP
TPFIN
LED1
TRST
TCK
TMS
TDI
TDO
LXT971AL
Interface ETH2
T1
HX1188
T2
HX1188
Reset MII1
RST_MII2
De CPLD
Power Down MII1
PD_MII2
De CPLD
Horloge 25MHz MII1
Cde led jaune
ETH1_LED2
J14-9
Données transmises +
CZ
J14-1
Données transmises -
DA
J14-2
Données reçues +
DB
J14-3
Données reçues -
DC
J14-6
Cde led verte
ETH1_LED1
J14-11
Entrée Données test JTAG depuis sortie CPLD
JTAG_TDO
De CPLD
Reset MII2
RST_MII2
De CPLD
Power Down MII2
PD_MII2
De CPLD
Horloge 25MHz MII1 et MII2
25MHz_ETH
De MN5
Cde led jaune
ETH2_LED2
J15-9
Données transmises +
DO
J15-1
Données transmises -
DE
J15-2
Données reçues +
DF
J15-3
Données reçues -
DG
J15-6
Cde led verte
ETH2_LED1
J15-11
Horloge test JTAG
JTAG_TCK
J5-37
Cde des modes test JTAG
JTAG_TMS
J5-36
Sortie Données test JTAG
JTAG_TDO
J5-34
Entrée Reset test JTAG
JTAG_TRST
J5-33
CR77
Power-On Reset
PO_RST
De VR2
Activation sortie interface USB
Transmission données USB-
Transmission données USB+
Réception données USB
Réception données USB+
Réception données USB-
+3,3V
MN6
OE
SPEED
VMO
VPO
RCV
VP
VM
D+
D-
USB1T11AMTC
Interface USB
Emission/Réception de données+
BK
J4-2
Emission/Réception de données-
BL
J4-3
F2
+5V
350mA
Alimentation USB
PWR12
J4-1
Masse électrique USB
GND
J4-4, J4-5
Bus SPI µC
MISO sur bus SPI µC
BC
J1-30
MOSI sur bus SPI µC
J
J1-29
Horloge sur bus SPI µC
K
J1-31
CS PLL Fop sur bus SPI µC
I
J1-33
Info Alternat+Inhibitions. "0" = émission
BG
J1-35
CS PLL 10MHz sur bus SPI µC
BE
J1-47
CS Eepot 10MHz sur bus SPI µC
BU
J1-48
Activation registres à décalage vers SVHF25077
E
J2-13
Validation données dans registres à décalage vers SVHF25077
F
J2-14
Sélection registres à décalage vers SVHF25077
H
J2-15


MN2
µC
MPC885
PD4
PD15
PD11
PD13
PD14
IRQ4
PA5
IRQ1
IRQ2
PB25/TxD1
PB24/RxD1
PB18/RTS2
PA12/TxD2
PA13/RxD2
PC5/CTS3
PD7/RTS3
PD10/TxD3
PD11/RxD3
PB21/TxD4
PB20/RxD4
PA6
EXTCLK
PD3
PD5
PD6
PD9
PD10
PD12
VFLS1
VFLS0
TMS
TCK
TDI
TDO
DSCK
DSDI
DSDO/MODCK2
MODCK1
Vers MN19A,B PD4 Commande Inhibition émission. "1" = Inhibition
J2-20 CB Activation Reset DSP par le µC
Vers Q4 PD15 Inhibition WD du DSP
Vers Q9 PD11 IT pour échange de données entre µC et DSP
Vers MN17 PD13 Sélection Ports P ou CK
Vers MX4 PD14 Signal 1PPS
De MX4 IRQ4 Non utilisé
Vers MN22 PA5 Réception de données
De DSP IRQ1 Non utilisé
De MX9 IRQ2
Vers CPLD AR Liaison Maintenance : DSR1
J1-17 AR Liaison Maintenance : DSR1
J1-15 AP Liaison Maintenance : TxD1
J1-16 AQ Liaison Maintenance : RxD1
J1-13 AC Liaison JBUS : RTS2
J1-11 AA Liaison JBUS : TxD2
J1-12 AB Liaison JBUS : RxD2
J1-5 O Liaison DATA/JBUS : CTS3
J1-4 N Liaison DATA/JBUS : RTS3
J1-2 L Liaison DATA/JBUS : TxD3
J1-3 M Liaison DATA/JBUS : RxD3
J1-8 Q Liaison Transceiver : TxD4
J1-9 Z Liaison Transceiver : RxD4
DS7 Activité TxD1
DS5 Activité TxD2
DS6 Activité TxD3
DS8 Activité TxD4
Liaison SCC1 µC
Liaison SCC2 µC
Liaison SCC3 µC
Liaison SCC4 µC
De MN5 48MHz_USB Horloge liaison USB 48MHz
De MN5 10MHz_EXT 10MHz externe vers µC
Cde mode AM/IQ. "0" = IQ CA J2-19
Info Marche émetteur. "1" = Marche CL J2-25
Info Bon Fonctionnement/Alarme vers PAV et Exploitation CN J2-27
Cde Ventilation. "1" = ventilation CR J2-32
Cde Apprentissage. "0" = Apprentissage CS J2-33
CS eepot Déphaseur sur SPI µC BW J2-43
Sortie Buffer bit1 VFLS1 J5-6, J16-13
Sortie Buffer bit0 VFLS0 J5-1, J16-17
Cde des modes sur test JTAG MP_TMS J5-18
Horloge test JTAG MP_TCK J5-19
Entrées Données test JTAG MP_TDI J5-17
Sortie Données test JTAG MP_TDO J5-16
Horloge test Debug DSCK J5-4, J16-15
Entrée Données test Debug DSDI J5-8, J16-19
Sortie Données test Debug DSDO J5-10, J16-11
MN1A
MN1B
+3,3V
Power-On Reset PO_RST De VR2
MODCK1/MODCK2 = 11
sur Reset actif =>
Sélection Horloge externe.
J14
+3,3V
Connecteur Ethernet1
J15
+3,3V
Connecteur Ethernet2
J4
1
2
3
4
5
Vers Connecteur USB
J5
DEBUG/JTAG
Sortie Buffer bit0 du µC (S) VFLS0
SRESET Reset soft vers µC, "0" = reset (E)
DSCK Horloge Test Debug vers µC (E)
VFLS1 Sortie Buffer bit1 du µC (S)
Reset hard vers µC, "0" = reset (E) HRESET
DSDI Données Test Debug en entrée vers µC (E)
+3,3V
DSDO Données Test Debug en sortie de µC (S)
Ecriture mémoires Flash0/1 depuis JTAG (E) MP_AW
V_{PPH}
Reset bus de test JTAG (E) MP_TRST
MP_TDO Données Test JTAG en sortie du µC (S)
Données Test JTAG en entrée vers µC (E) MP_TDI
MP_TMS Cde modes Test JTAG vers µC (E)
+5V
Horloge Test JTAG vers µC (E) MP_TCK
+1,8V
+2,5V
Etat émulation JTAG depuis DSP (S) EMU
DSP_RESET Reset DSP, "0" = Reset (E)
Données Test JTAG en sortie du DSP (S) DSP_TDO
DSP_TCK Horloge test JTAG vers DSP (E)
Sélection de mode Test JTAG vers DSP (E) DSP_TMS
DSP_TDI Données Test JTAG en entrée vers DSP (E)
DSP_TRST Reset test JTAG vers DSP, "0" = Reset (E)
Reset test JTAG vers interfaces Ethernet. "0" = Reset (E) JTAG_TRST
JTAG_TDO Données Test JTAG en sortie interface Ethernet2 (S)
Données Test JTAG en entrée vers CPLD (E) JTAG_TDI
JTAG_TMS Cde modes Test JTAG vers interfaces Ethernet et CPLD (E)
Horloge Test JTAG vers interfaces Ethernet et CPLD (E) JTAG_TCK
1 2
9
19
29
39 40
J16
TRACE
Horloge Trace 50MHz (S) CLK_Trace
Reset hard vers µC "0" = reset (E) HRESET
CS2 Accès au buffer Trace (S)
Données Test Debug en sortie de µC (S) DSDO
+3,3V
Sortie Buffer bit1 du µC (S) VFLS1
Horloge Test Debug vers µC (E) DSCK
Sortie Buffer bit0 du µC (S) VFLS0
Données Test Debug en entrée vers µC (E) DSDI
Reset soft vers µC "0" = reset (E) SRESET
A[15...31] Bits d'adresse µC A_{15} à A_{31}
Sélection Lecture/Ecriture buffer Trace RD/WR
1 2
9
19
29
37 38
39 à 43



MODULE SYNTHETISEUR VHF
Schéma synoptique (1/1)

46000132
Indice rév. : V1.00
Date rév. : 23/02/11

Rèf. s/ensemble : SVHF25077	Code s/ensemble : 52000620	Réf. ensemble : EM9000-2G RE9000-2G	Code ensemble : 80000086 80100067

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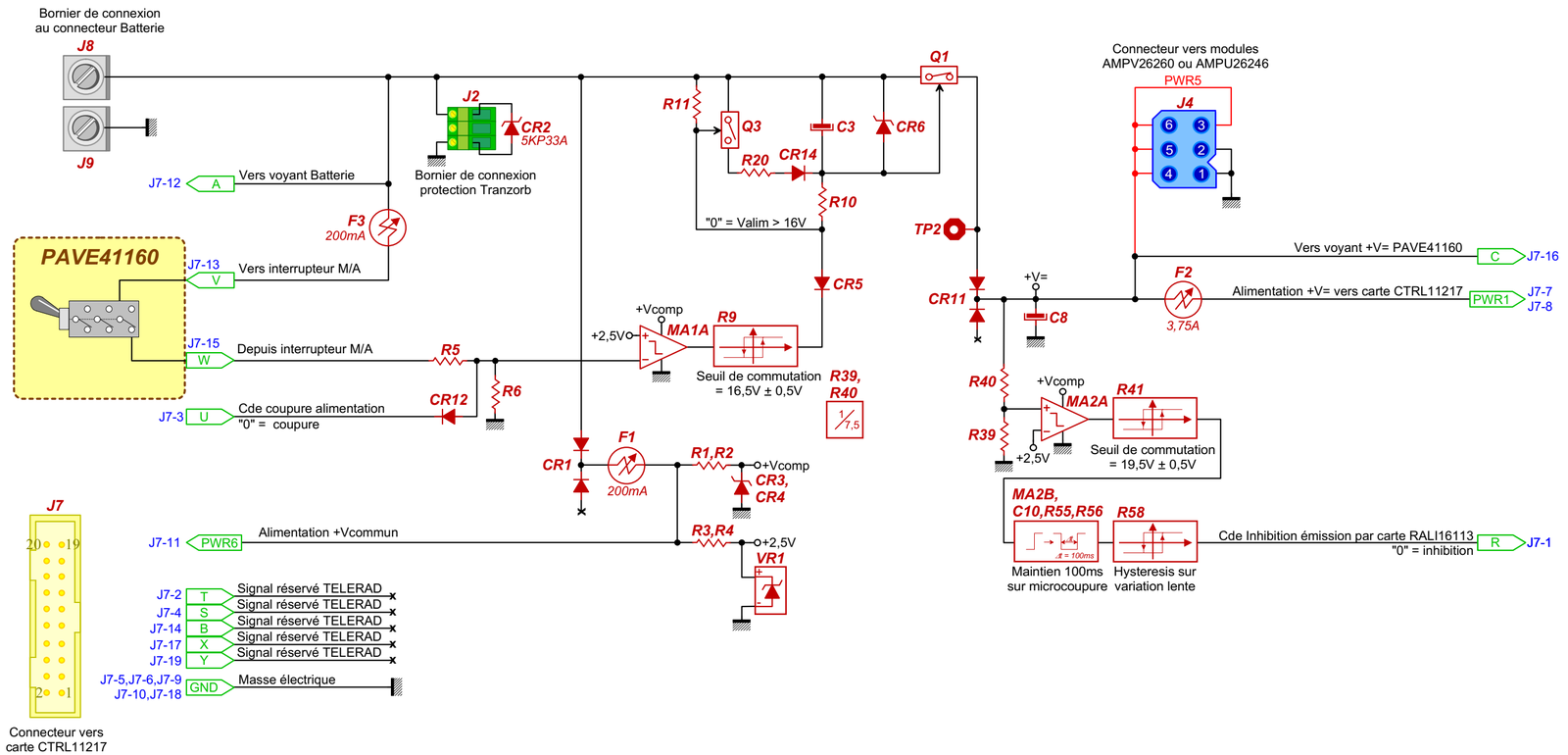

CARTE DE COMMUTATION D'ALIMENTATION Schéma synoptique (1/1)			46000133 Indice rév. : V1.01 Date rév. :04/07/11
Réf. s/ensemble : RALI16113	Code s/ensemble : 51500098	Réf. ensemble : EM9000C-2G EM9010C-2G	Code ensemble : 84500143 84500145
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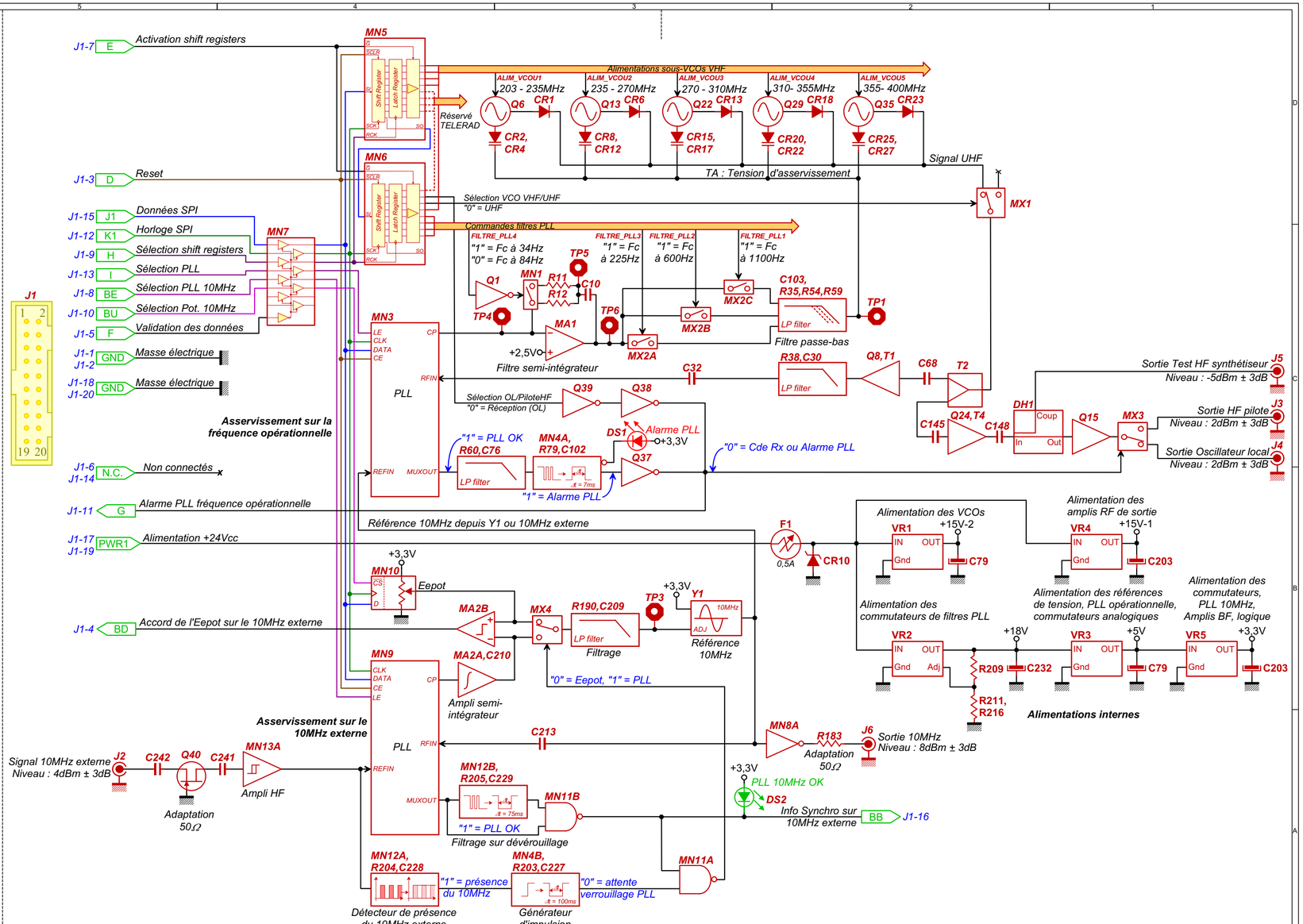

MODULE SYNTHETISEUR UHF
Schéma synoptique (1/1)

46000145
Indice rév. : V1.00
Date rév. : 23/02/11

Réf. s/ensemble : SUHF25078	Code s/ensemble : 52000621	Réf. ensemble : EM9010-2G RE9010-2G	Code ensemble : 80300035 80100070

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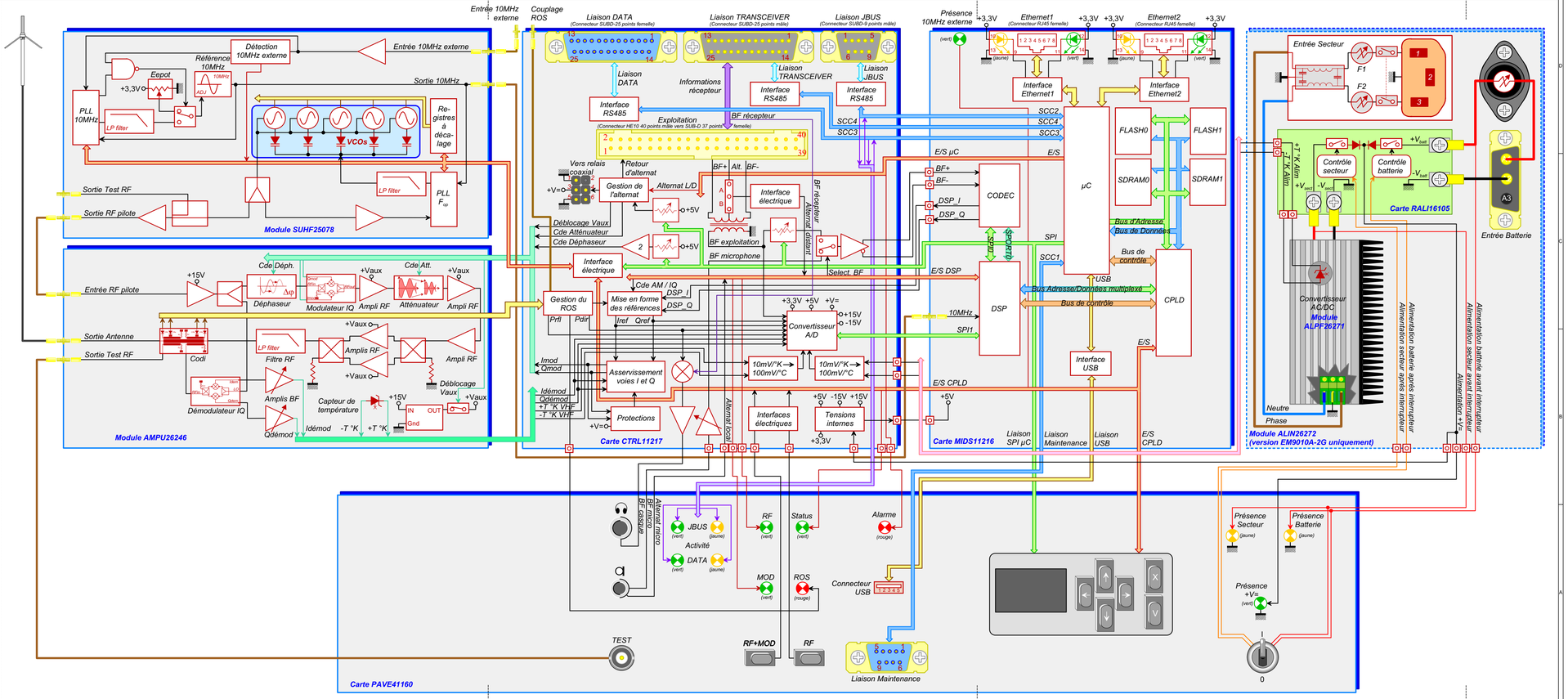
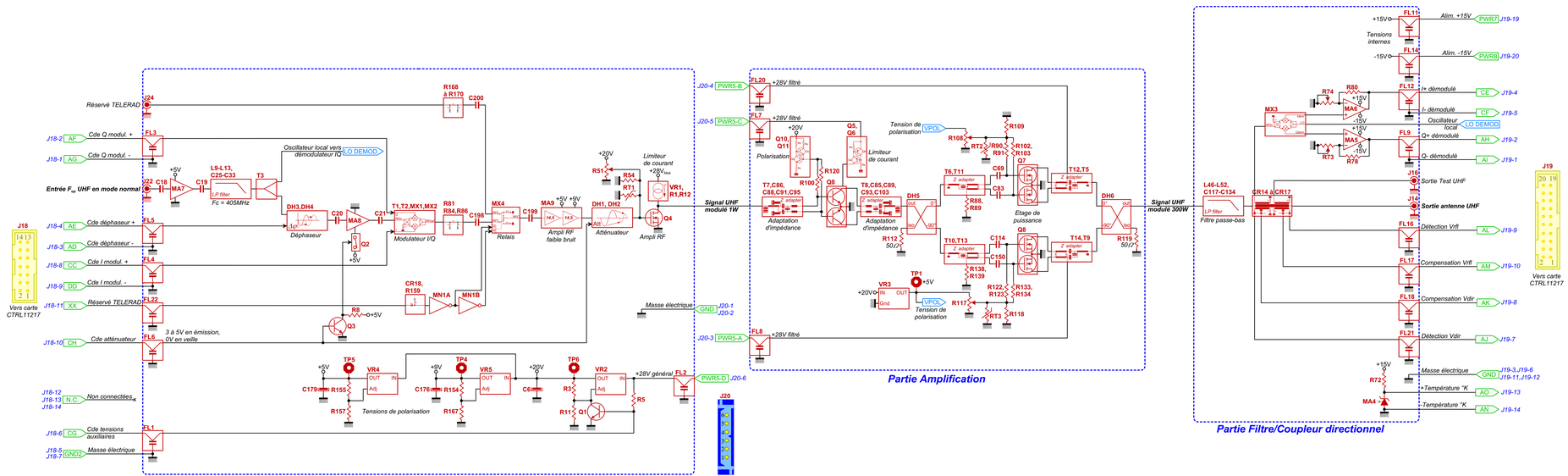


EMETTEUR NUMERIQUE UHF EM9010-2G Schéma synoptique général (1/1)			46000147 Indice rév. : V1.00 Date rév. : 23/02/11
Réf. s/ensemble : EM9010A-2G EM9010C-2G	Code s/ensemble : 84500144 84500145	Réf. ensemble : EM9010-2G	Code ensemble : 80300035
TELERAD, 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		Adresse email : courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01



MODULE AMPLIFICATEUR UHF Schéma synoptique (1/1)			46000148 Indice rév. : V1.00 Date rév. : 23/02/11
Réf. s/ensemble : AMPU26246	Code s/ensemble : 52000597	Réf. ensemble : EM9010-2G	Code ensemble : 80300035
TELERAD 2 Avenue de la Butte aux Cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		Addresse email : courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

CARTE SYNTHETISEUR V/UHF

Schéma d'implantation faces A et B (1/1)

46500142
Indice rév. : V1.08
Date rév. : 06/04/11

Rèf. s/ensemble :	Code s/ensemble :	Rèf. ensemble : /	Code ensemble : /
SYVU25076	52000614	EM9000-2G	80000086
SYVU25077	52000620	CM-300 VDT V2	80000088
		CM-350 VDT V2	80000089
		RE9000-2G	80100067
		CM-300 VDR V2	80100071
SYVU25078	52000621	RE9010-2G	80100070
		EM9010-2G	80300035
		CM-300 UDT V2	80300036
		CM-300 UDR V2	80400032
SYTR25081	52000640	TRN4000	82300077

Rèf. CI nu : SYVU5214D | Code CI nu : 29001760

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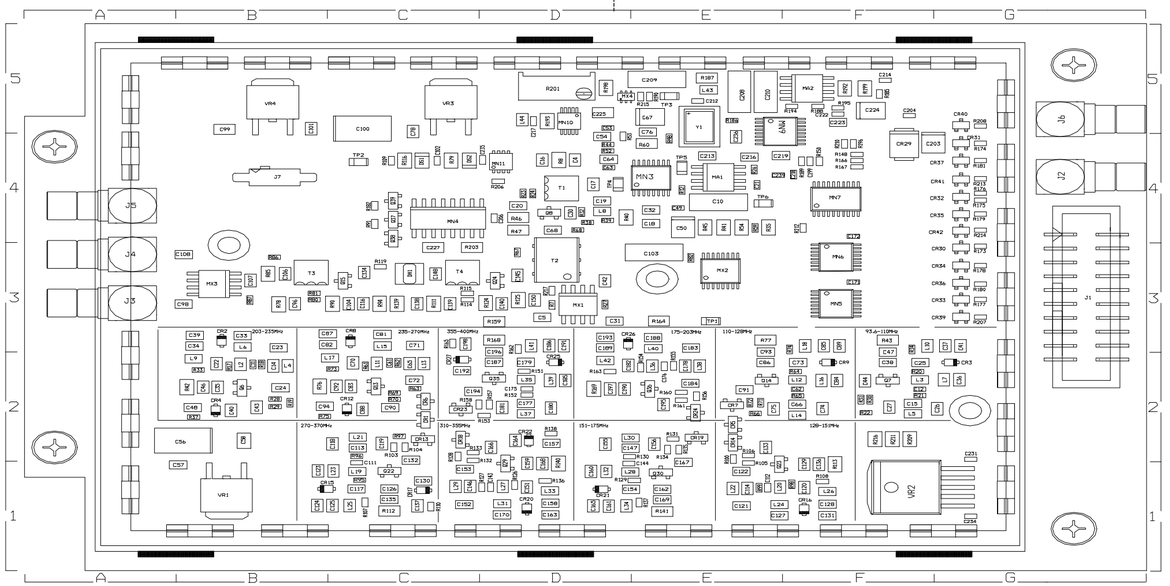
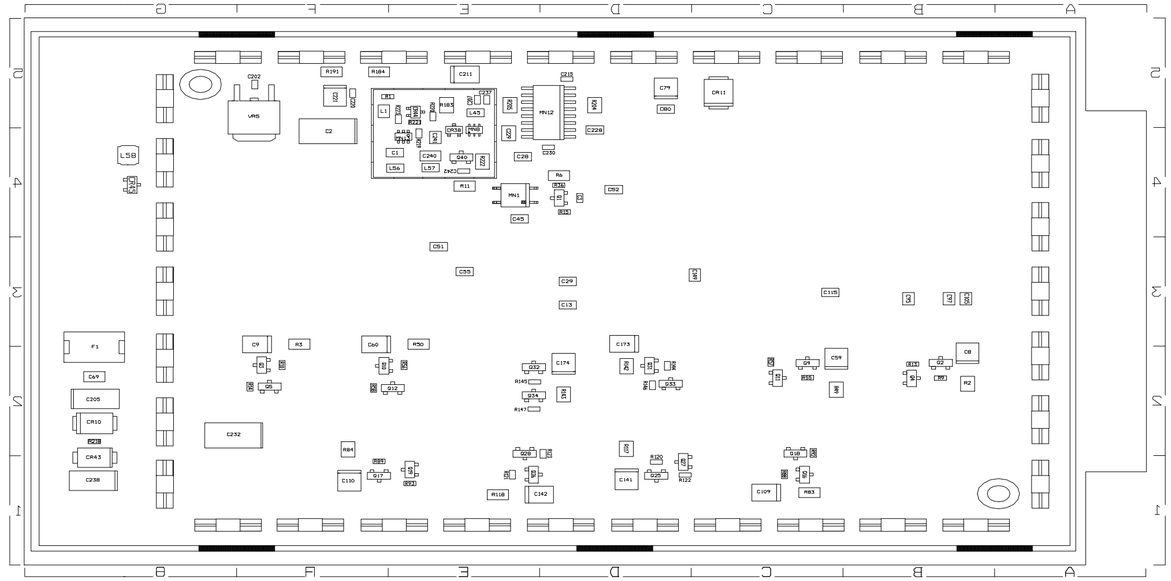
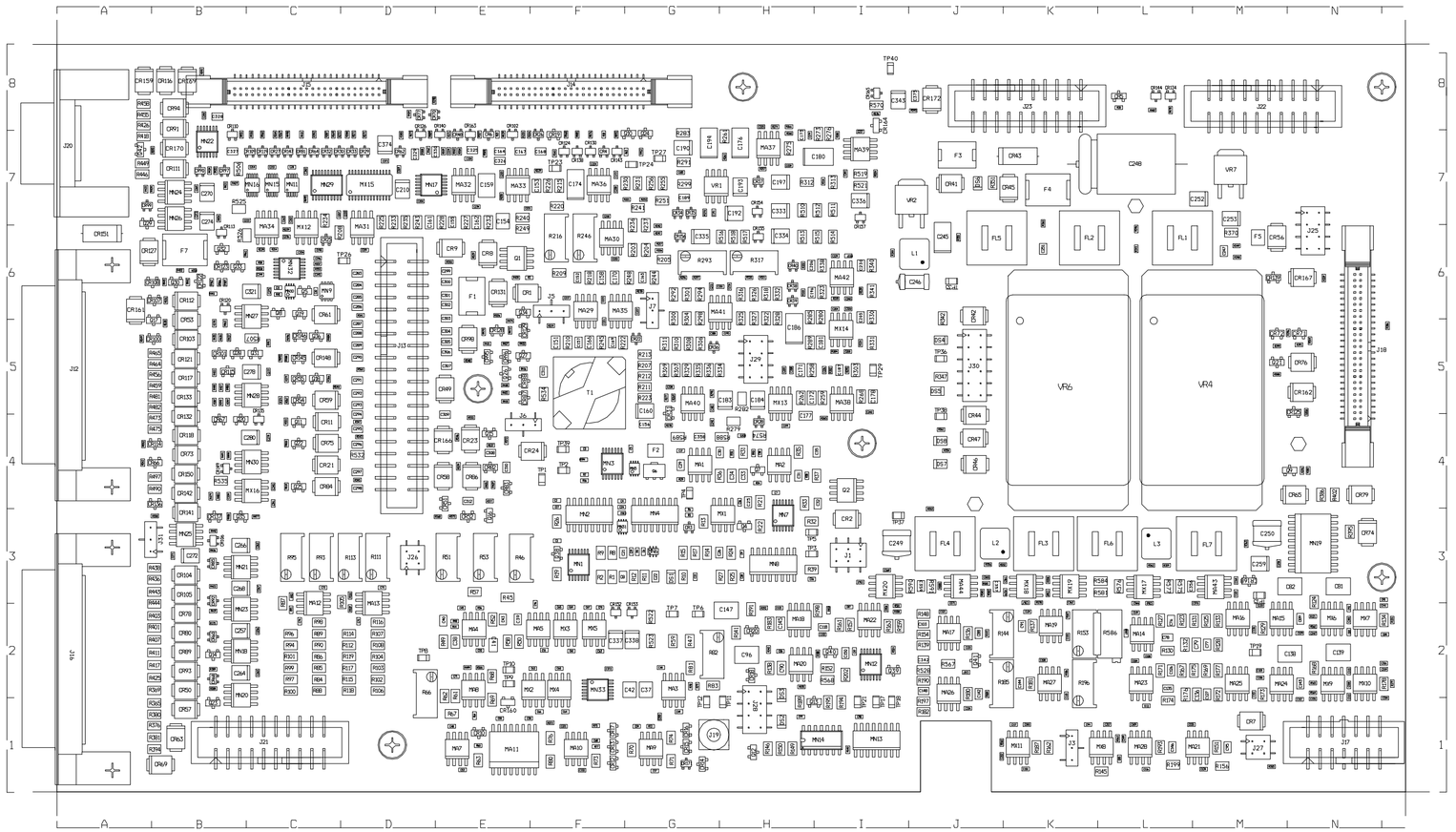




SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES



SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES

CARTE DE CONTROLE ET DE GESTION BF Schéma d'implantation face A (1/1)			46500150 Indice rév. : V1.05 Date rév. : 06/04/11
Rèf. s/ensemble : CTRL11217 CTRL11218	Code s/ensemble : 51001183 51001248	Rèf. ensemble : EM9000-2G EM9010-2G CM-300 VDT V2 CM-350 VDT V2 CM-300 UDT V2	Code ensemble : 80000086 80300035 80000088 80000089 80300036
Rèf. CI nu : CTRL1328C	Code CI nu : 29001741		

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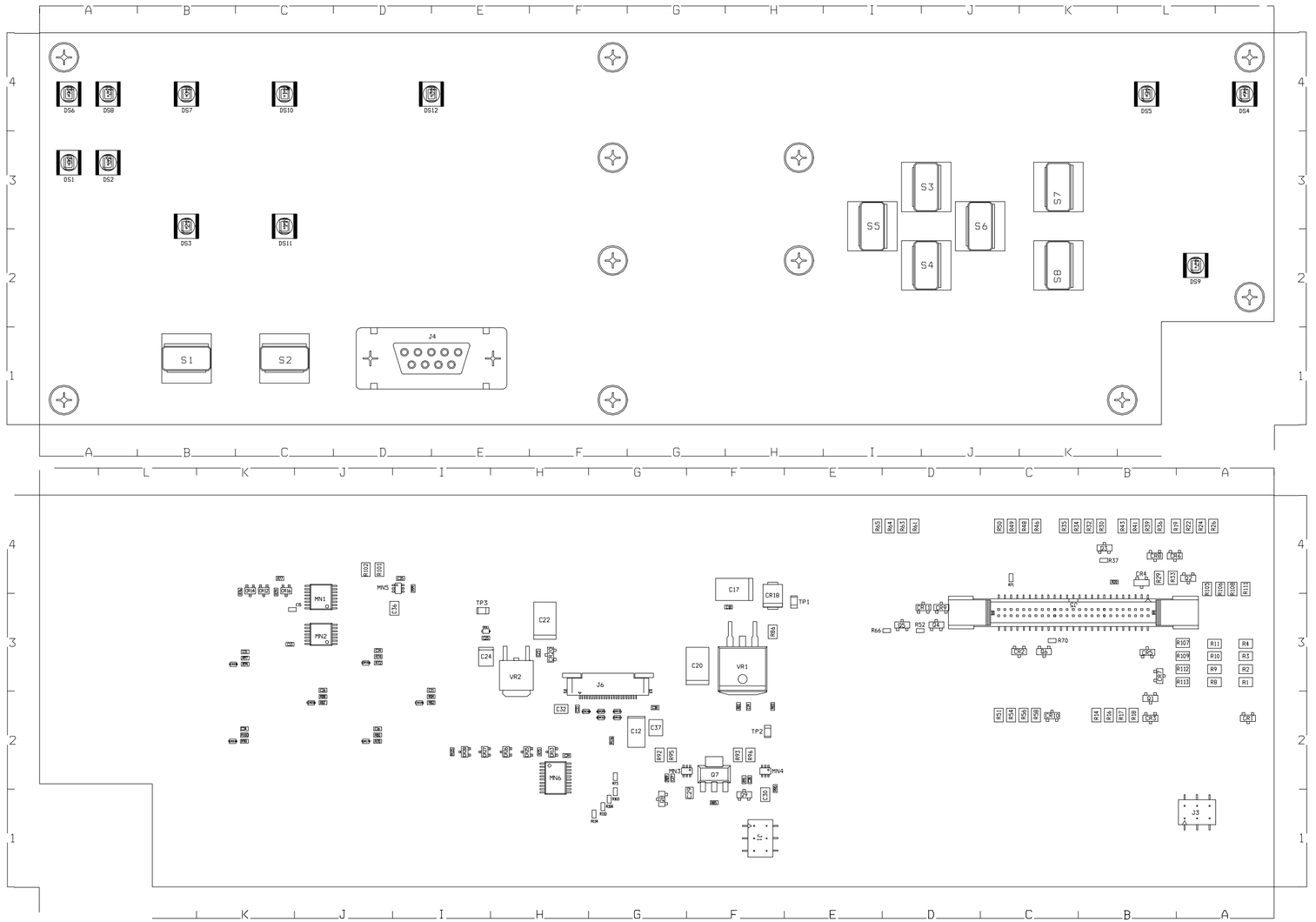

SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES

CARTE PANNEAU AVANT Schéma d'implantation faces A et B (1/1)			46500151 Indice rév. : V1.02 Date rév. : 06/04/11
Rèf. s/ensemble : PAVE41160	Code s/ensemble : 50001397	Rèf. ensemble : EM9000A-2G EM9010A-2G EM9010C-2G TRG4000T AC/DC TRG4000T DC	Code ensemble : 84500142 84500144 84500145 84500160 84500161
Rèf. CI nu : PAVE1346B	Code CI nu : 29001748		

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CARTE MICRO-PROCESSEUR / DSP
Schéma d'implantation face A (1/2)

46500155
Indice rév. : V1.03
Date rév. : 06/04/11

Rèf. s/ensemble : MIDS11216	Code s/ensemble : 51001181	Réf. ensemble : CM-300 VDT V2	Code ensemble : 80000088
		CM-350 VDT V2	80000089
		CM-300 VDR V2	80100071
		CM-300 UDT V2	80300036
		CM-300 UDR V2	80400032
		VOAD9000	82200037
		TRN4000	82300077
		EM9000A-2G	84500142
		EM9010A-2G	84500144
		EM9010C-2G	84500145
		TRG4000T AC/DC	84500160
		TRG4000T DC	84500161
Rèf. CI nu : MIDS1345B	Code CI nu : 29001708		

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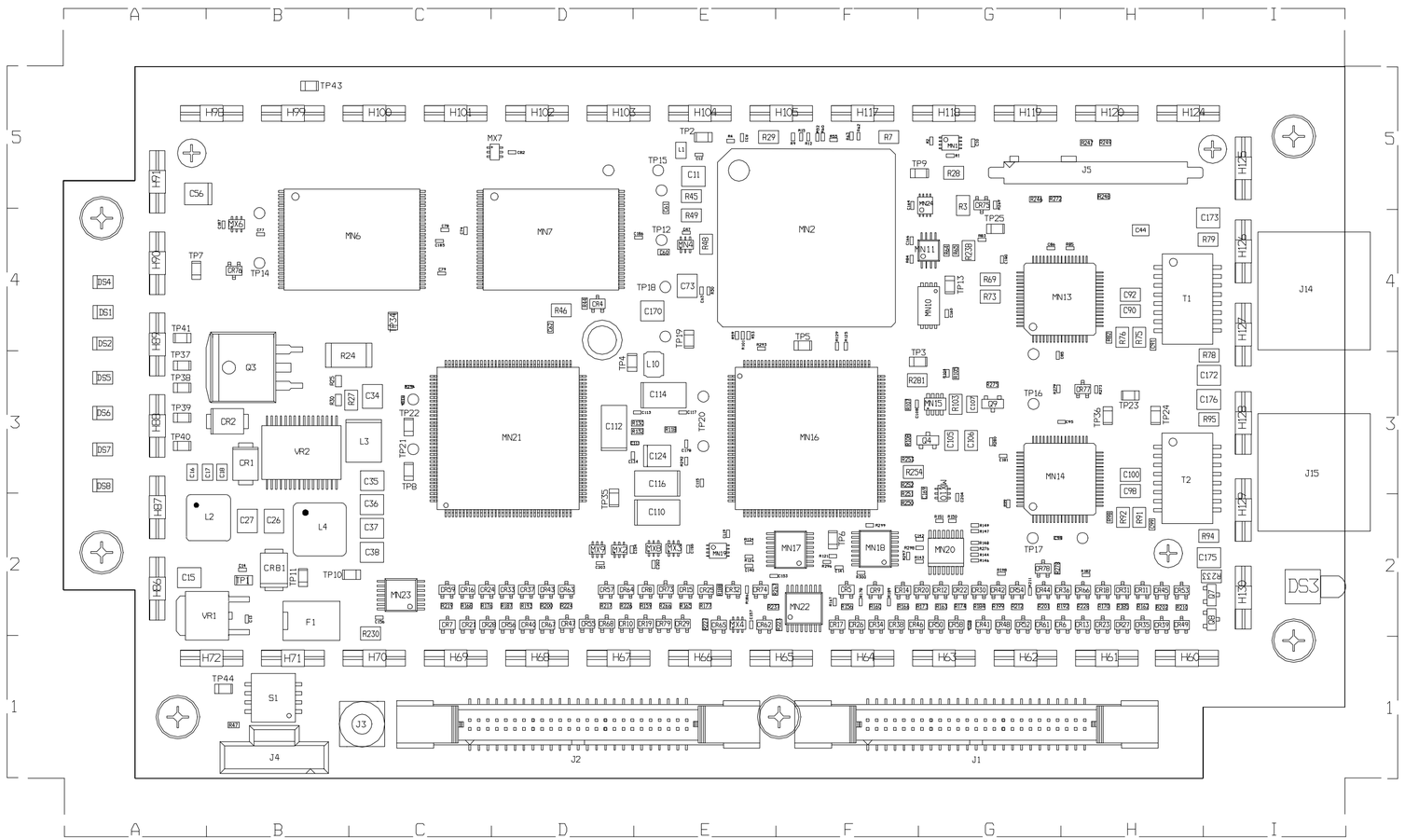
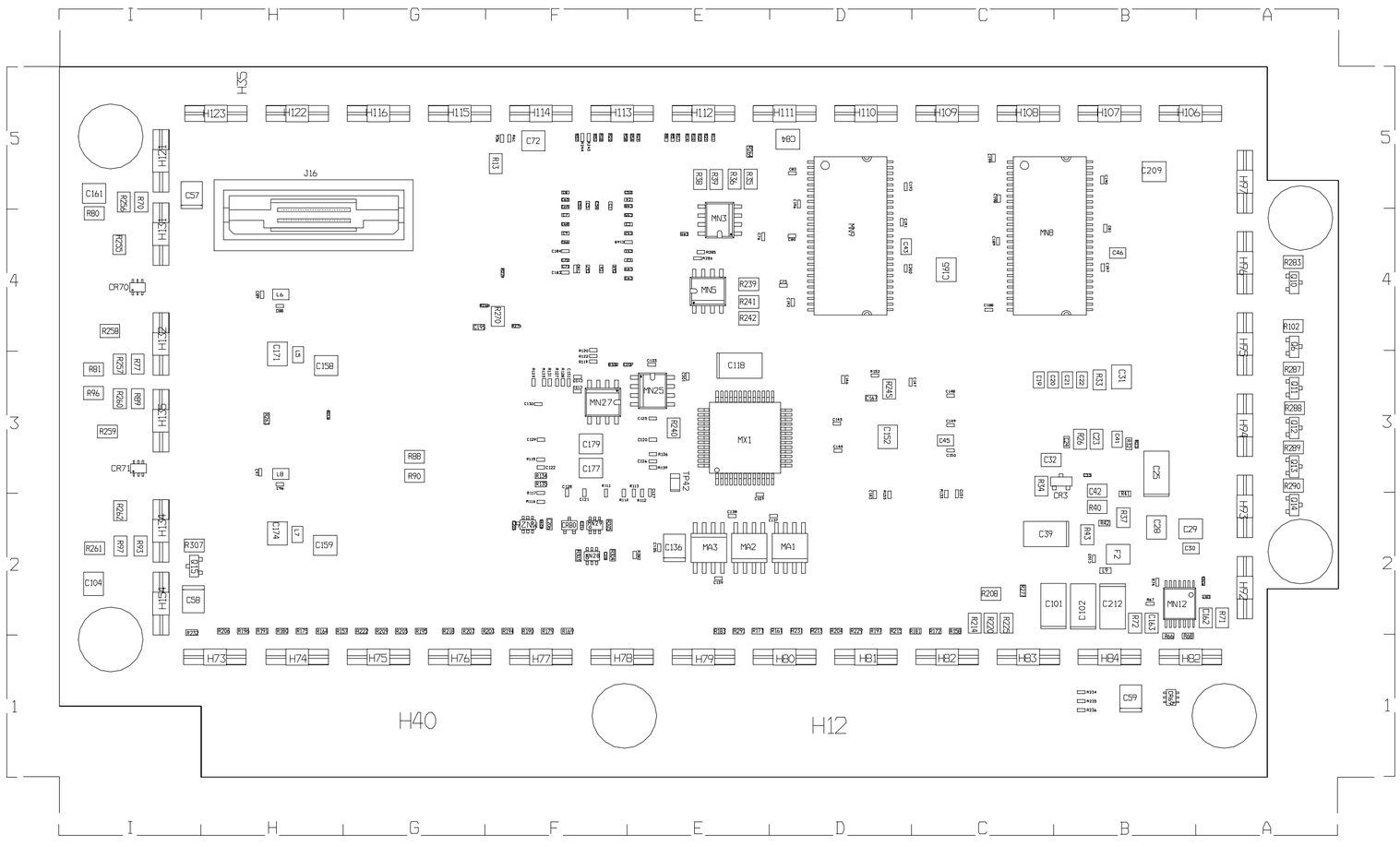


SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES



SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES

CARTE MICRO-PROCESSEUR / DSP Schéma d'implantation face B (2/2)			46500156 Indice rév. : V1.03 Date rév. : 06/04/11
Rèf. s/ensemble : MIDS11216	Code s/ensemble : 51001181	Rèf. ensemble : CM-300 VDT V2 CM-350 VDT V2 CM-300 VDR V2 CM-300 UDT V2 CM-300 UDR V2 VOAD9000 TRN4000 EM9000A-2G EM9010A-2G EM9010C-2G TRG4000T AC/DC TRG4000T DC	Code ensemble : 80000088 80000089 80100071 80300036 80400032 82200037 82300077 84500142 84500144 84500145 84500160 84500161
Rèf. CI nu : MIDS1345B	Code CI nu : 29001708		

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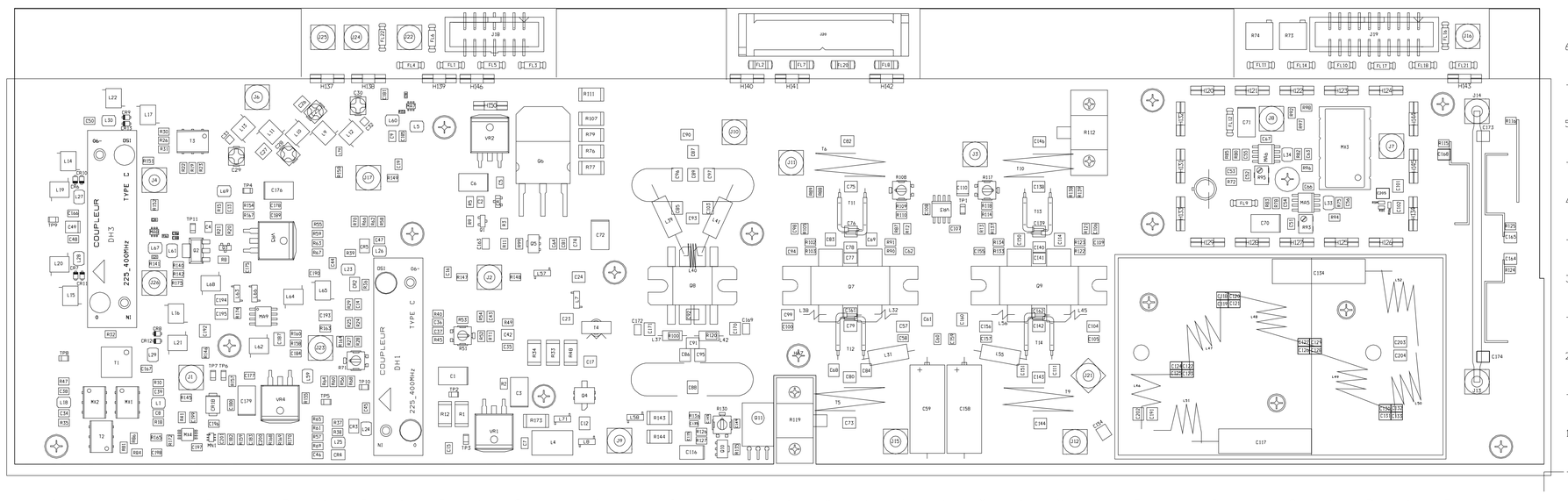

SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES

MODULE AMPLIFICATEUR UHF NUMERIQUE Schéma d'implantation face A (1/2)			46500178 Indice rév. : V1.03 Date rév. : 06/04/11
Réf. s/ensemble : AMPU26246 AMPU26258	Code s/ensemble : 52000597 52000632	Réf. ensemble : EM9010-2G TRN4000	Code ensemble : 80300035 80300036 82300077
Réf. CI nu : AMPU6257B	Code CI nu : 29001645		

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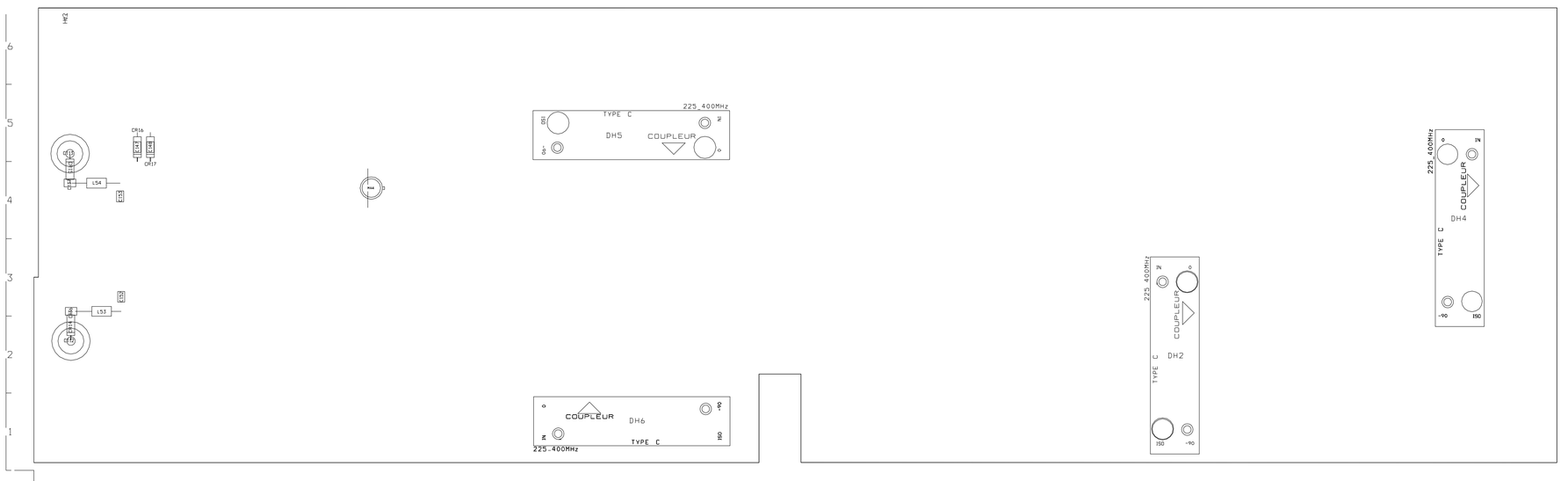

SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES

MODULE AMPLIFICATEUR UHF NUMERIQUE Schéma d'implantation face B (2/2)			46500179 Indice rév. : V1.03 Date rév. : 06/04/11
Réf. s/ensemble : AMPU26246 AMPU26258	Code s/ensemble : 52000597 52000632	Réf. ensemble : EM9010-2G TRN4000	Code ensemble : 80300035 80300036 82300077
Réf. CI nu : AMPU6257B	Code CI nu : 29001645		

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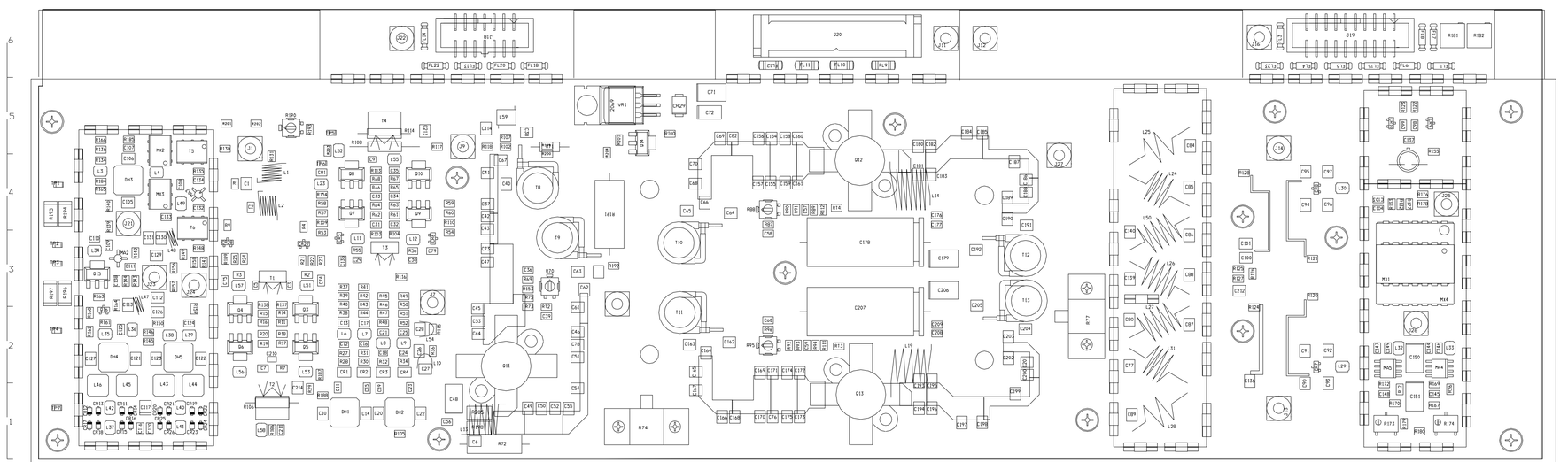
FAX : +33 5 59 58 55 01



SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES

MODULE AMPLIFICATEUR VHF NUMERIQUE Schéma d'implantation face A (1/2)			46500180 Indice rév. : V1.02 Date rév. : 06/04/11
Réf. s/ensemble : AMPV26260	Code s/ensemble : 52000634	Réf. ensemble : EM9000-2G CM-300 VDT V2 CM-350 VDT V2	Code ensemble : 80000086 80000088 80000089
Réf. CI nu : AMPV6256A	Code CI nu : 29001728		

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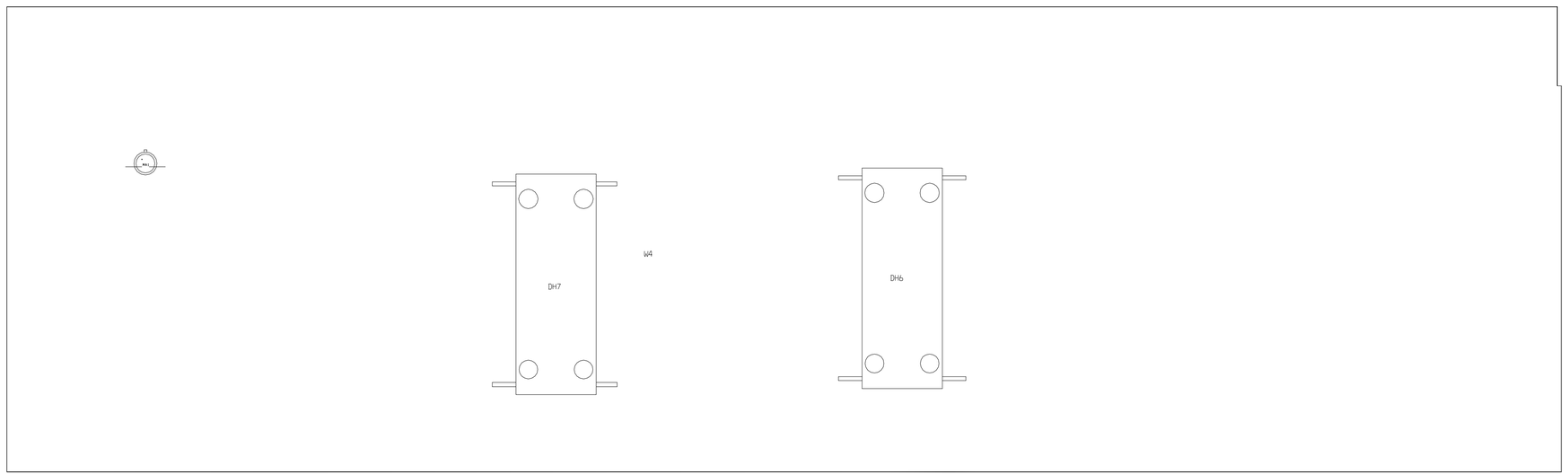
FAX : +33 5 59 58 55 01



SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES

MODULE AMPLIFICATEUR VHF NUMERIQUE Schéma d'implantation face B (2/2)			46500181 Indice rév. : V1.02 Date rév. : 06/04/11
Réf. s/ensemble : AMPV26260	Code s/ensemble : 52000634	Réf. ensemble : EM9000-2G CM-300 VDT V2 CM-350 VDT V2	Code ensemble : 80000086 80000088 80000089
Réf. CI nu : AMPV6256A	Code CI nu : 29001728		

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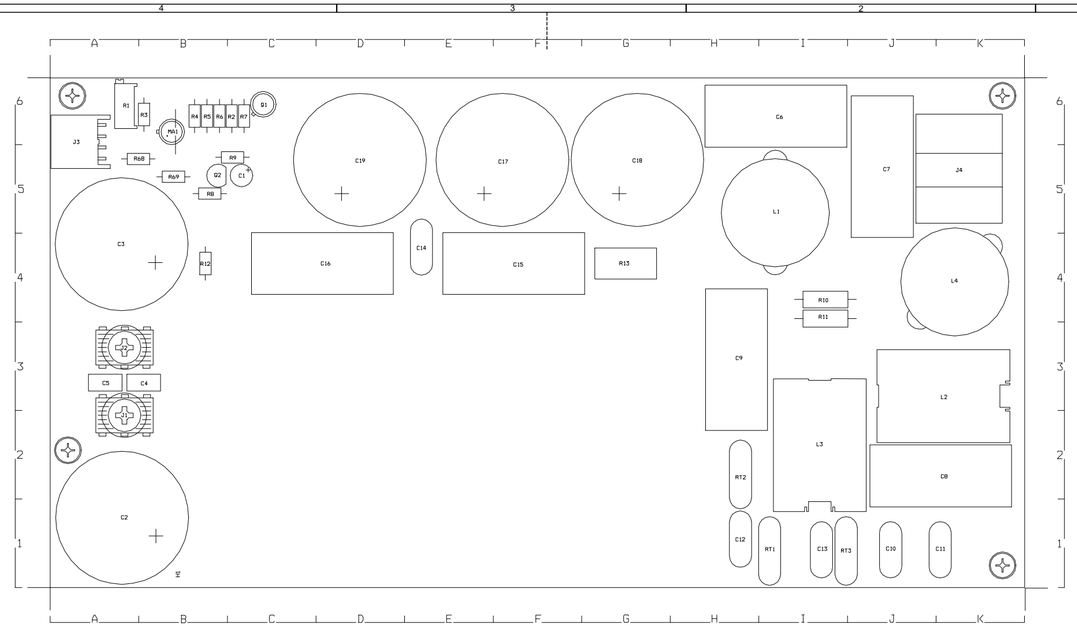
Adresse email : courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01



SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES

MODULE ALIMENTATION A PLAQUE FROIDE 500W Schéma d'implantation faces A et B (1/1)			46500211 Indice rév. : V1.02 Date rév. : 06/04/11
Rèf. s/ensemble : ALPF26271 ALPF26273 ALPF26274	Code s/ensemble : 52500079 52500080 52500081	Rèf. ensemble : EM9000A-2G EM9010A-2G TRG4000T AC/DC CM-300 VDT V2 CM-350 VDT V2 CM-300 UDT V2	Code ensemble : 84500142 84500144 84500160 80000088 80000089 80300036
Rèf. CI nu : ALPF6267A	Code CI nu : 29001738		

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TEL : +33 5 59 58 55 00
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CARTE RELAIS ALIMENTATION INITERRUPTIBLE
Schéma d'implantation face A (1/1)

46500212
Indice rév. : V1.02
Date rév. : 06/04/11

Rèf. s/ensemble :	Code s/ensemble :	Rèf. ensemble :	Code ensemble :
RALI16105	51500089	EM9000A-2G	84500142
RALI16107	51500091	EM9010A-2G	84500144
		TRG4000T AC/DC	84500160
RALI16108	51500092	ALIM26265	52000643
RALI16109	51500093	ALIM26263	52000641
RALI16111	51500095	CM-300 VDT V2	80000088
		CM-350 VDT V2	80000089
		CM-300 UDT V2	80300036

Rèf. CI nu : RALI6266A	Code CI nu : 29001739		

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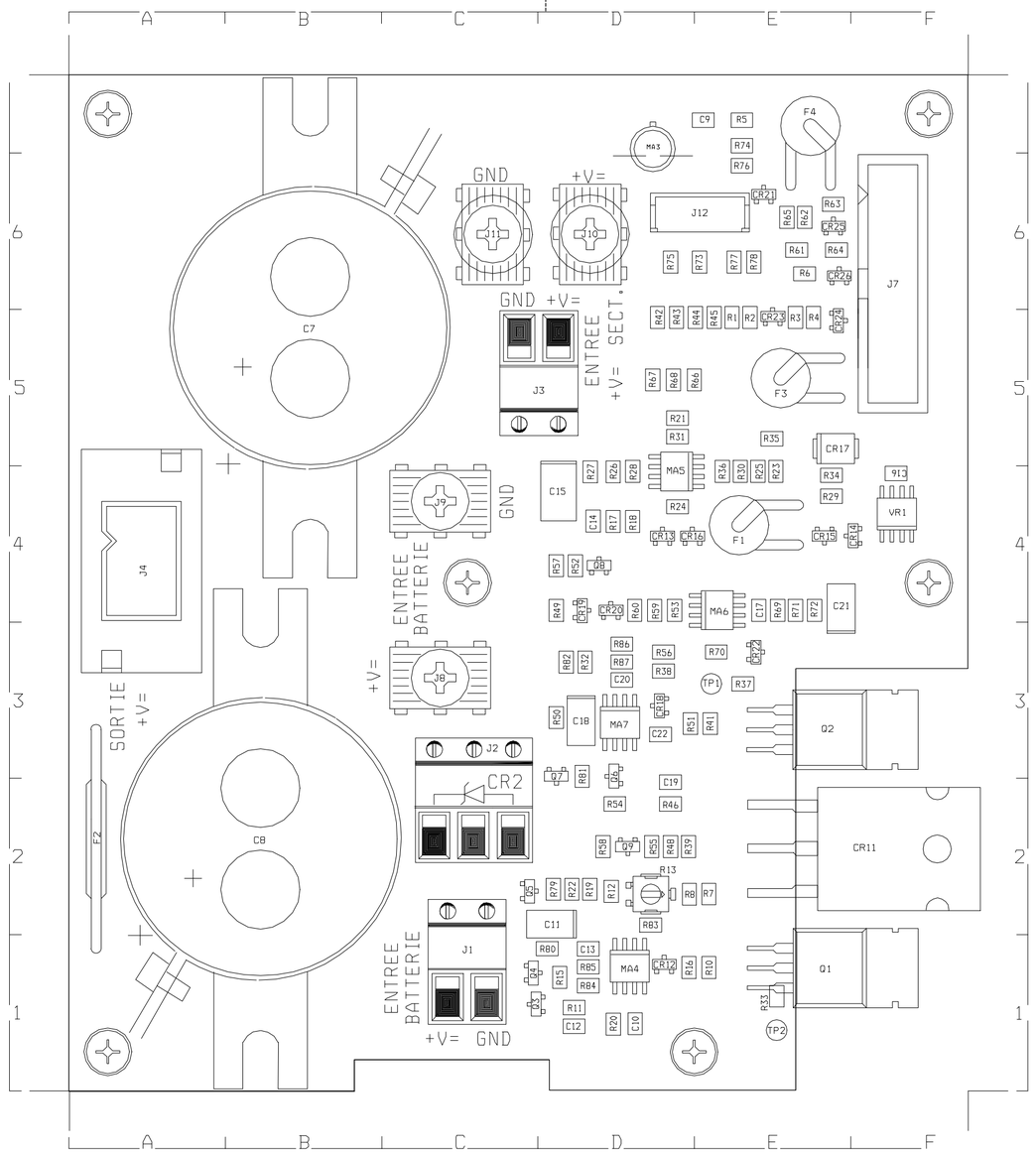
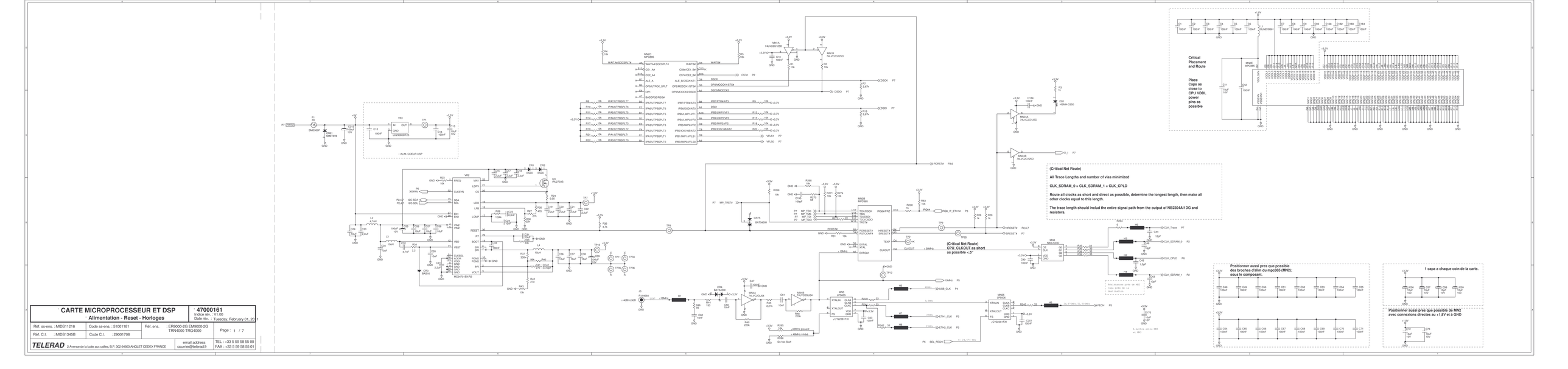
Adresse email : courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01

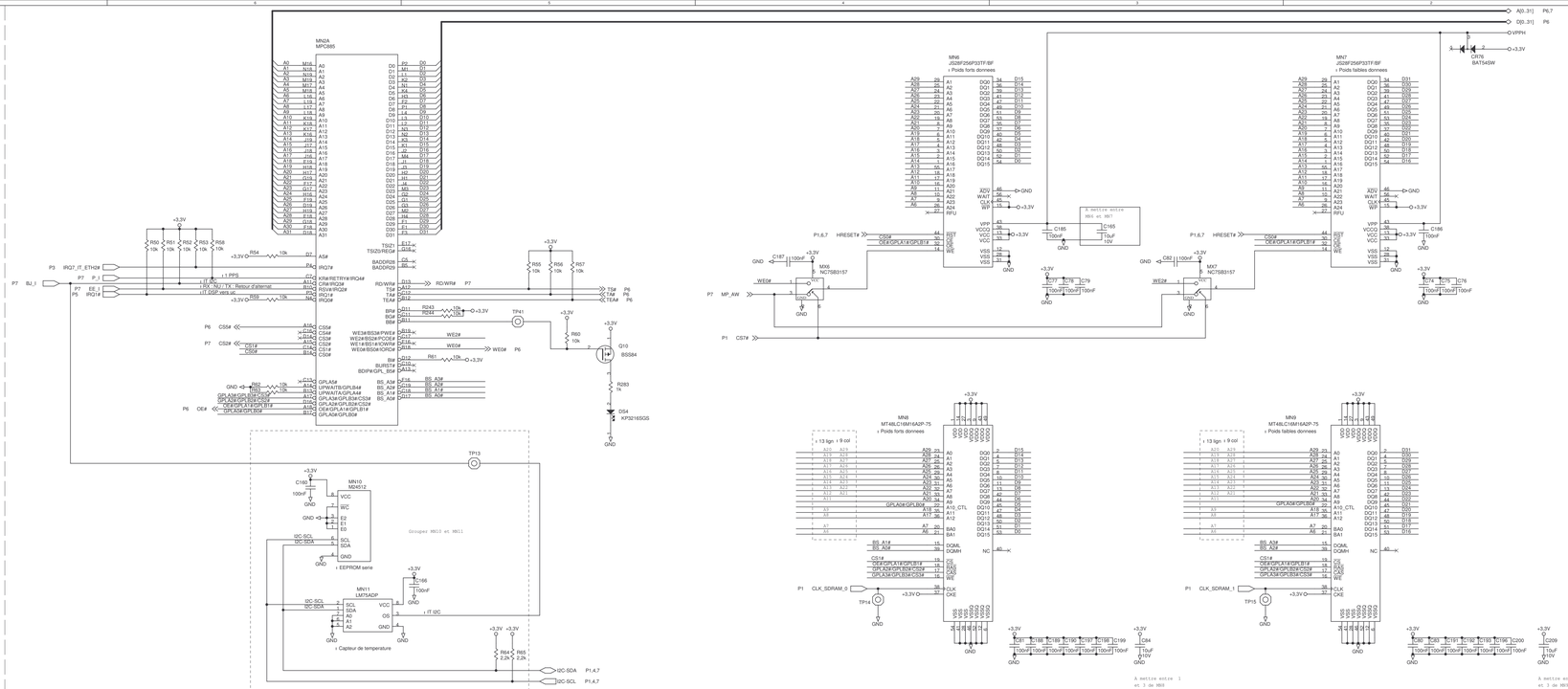


SUIVANT LES VERSIONS TOUS LES COMPOSANTS REPRESENTES SUR LA CARTE NE SONT PAS UTILISES



CARTE MICROPROCESSEUR ET DSP	47000161	
Alimentation - Reset - Horloges	Indice rév. : V1.00 Date rév. : Tuesday, February 01, 2011	
Réf. ss-ens. : MIDS11216	Code ss-ens. : 51001181	Réf. ens. : ER9000-2G EM9000-2G TRN4000 TRG4000
Réf. C.I. : MIDS13458	Code C.I. : 29001708	Page : 1 / 7

TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
email address courrier@telerad.fr
TEL. : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01


MN2A
MPC885
A[0..31]
D[0..31]
P6,7
P6
VPPH
+3.3V
CR76
BAT54SW
MN6
J52BF256P33TF/BF
Poids forts données
MN7
J52BF256P33TF/BF
Poids faibles données
A mettre entre
MN6 et MN7
C185
C165
10uF
10V
MX6
NC7SB3157
MX7
NC7SB3157
HRESET#
CS5#
OE#/GPLA14/GPLB14
C187
C82
100nF
C77
C78
C79
C76
C75
100nF
MN8
MT48LC16M16A2P-75
Poids forts données
MN9
MT48LC16M16A2P-75
Poids faibles données
13 lgn. / 9 col
CLK_SDRAM_0
CLK_SDRAM_1
TP14
TP15
C84
C85
C86
C87
C88
C89
C190
C191
C192
C193
C194
C195
C196
C197
C198
C199
C200
C209
10uF
100nF
A mettre entre 1
et 3 de MN8
A mettre entre 1
et 3 de MN9
P3 IRQ7_IT_ETH#
P7 P_I
P7 EE_I
P5 IRQ1#
P7 BJ_I
1 PPS
I2C Bus
SDA : TX - Retour d'alternat
SCL : RX - Retour d'alternat
I2C GDP vers uc
RS0
RS1
RS2
RS3
RS8
10k
RS4
RS5
RS6
RS7
RS9
RS10
RS11
RS12
RS13
RS14
RS15
RS16
RS17
RS18
RS19
RS20
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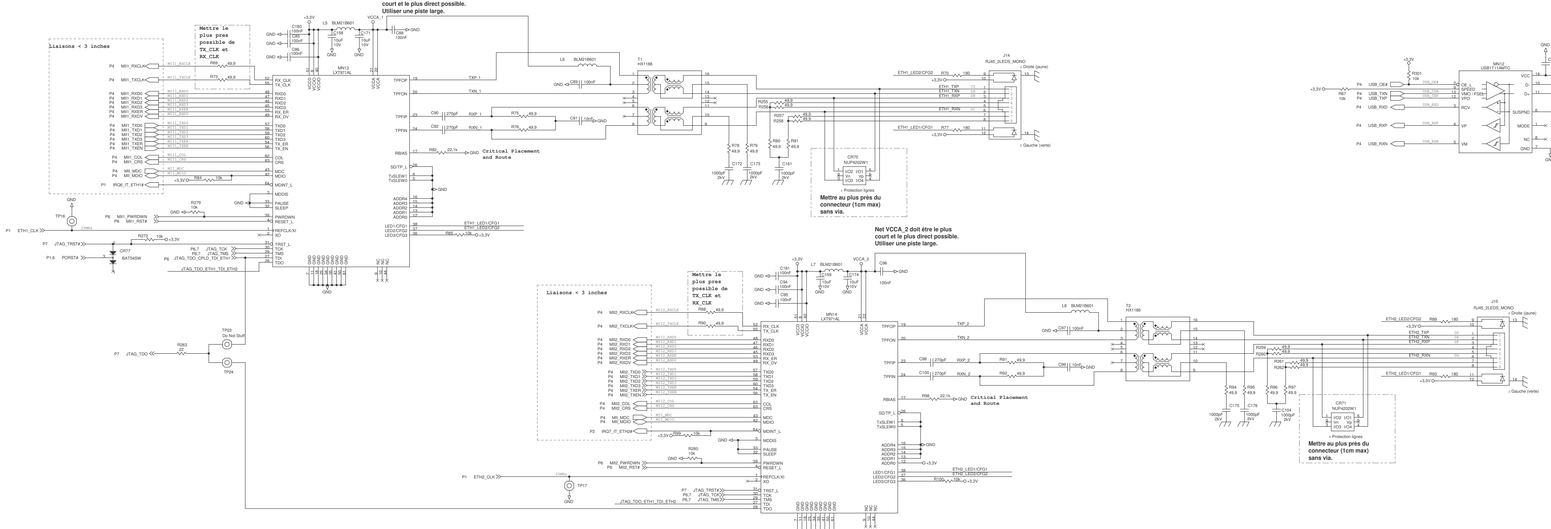
RS47
RS48



' CARTE MICROPROCESSEUR ET DSP ' Ethernet - USB			' 47000163 Indice rév. : V1.00 Date rév. : Tuesday, February 01, 2011	
Réf. ss-ens. : MIDS11216	Code ss-ens. : 51001181	Réf. ens.	: EP9000-2G EM9000-2G TRN4000 TRG4000	Page : 3 / 7
Réf. C.I. : MIDS13458	Code C.I. : 29001708			

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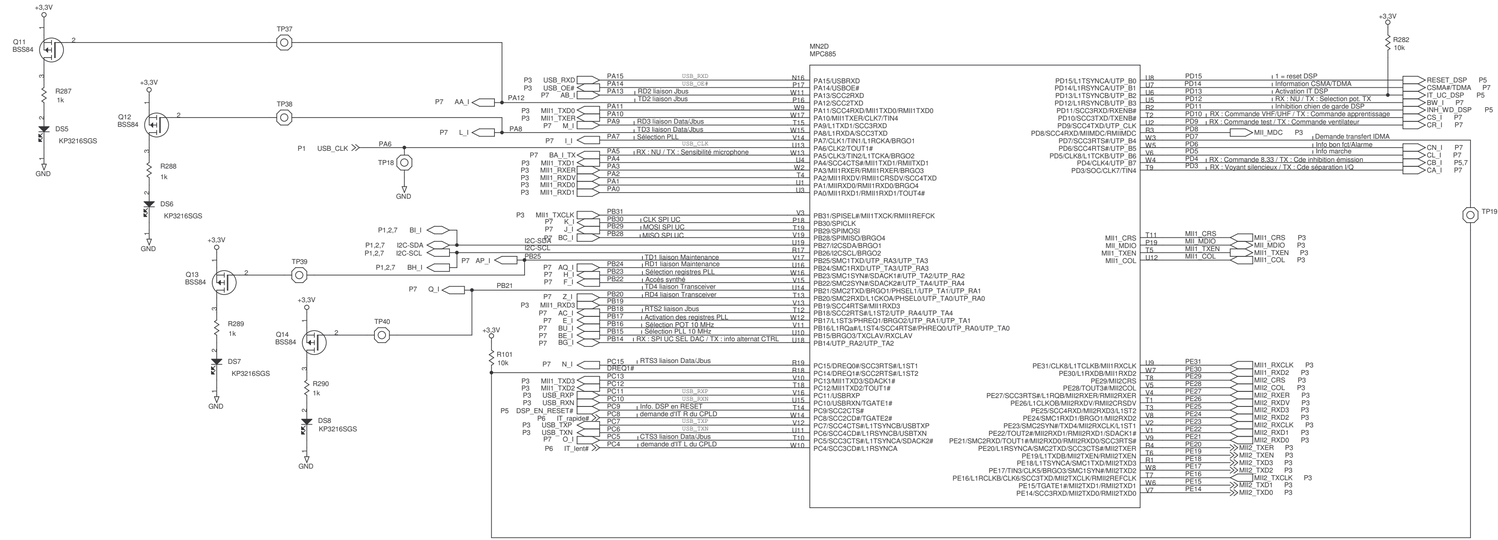
email address courrier@telerad.fr

TEL. : +33 5 59 58 55 00

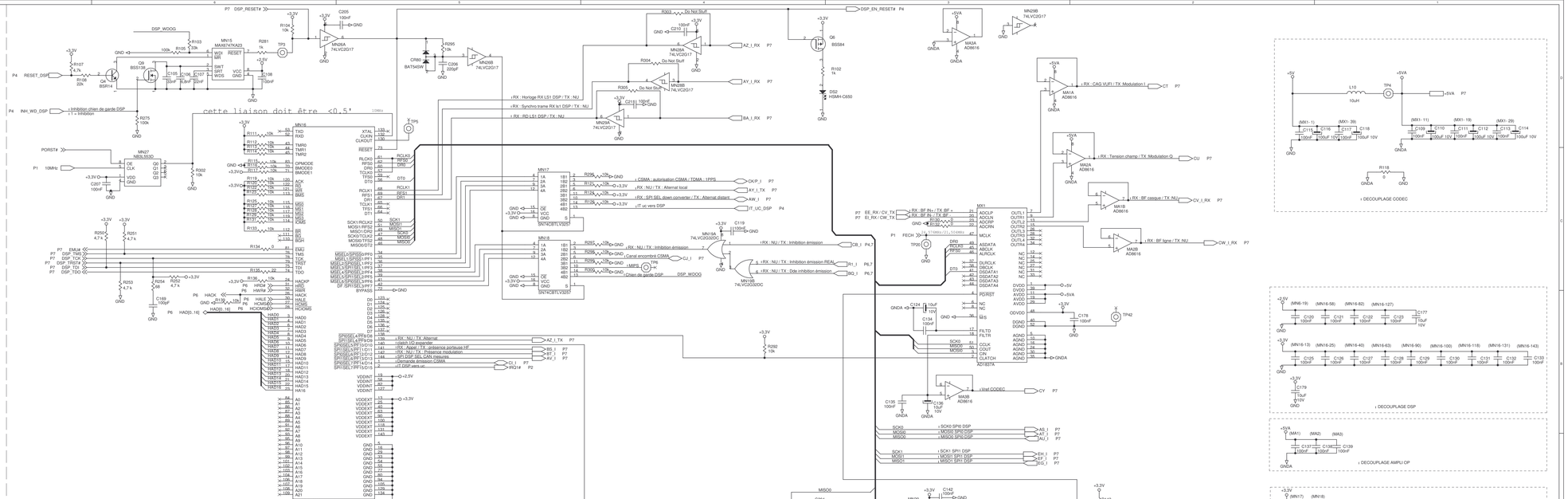
FAX : +33 5 59 58 55 01



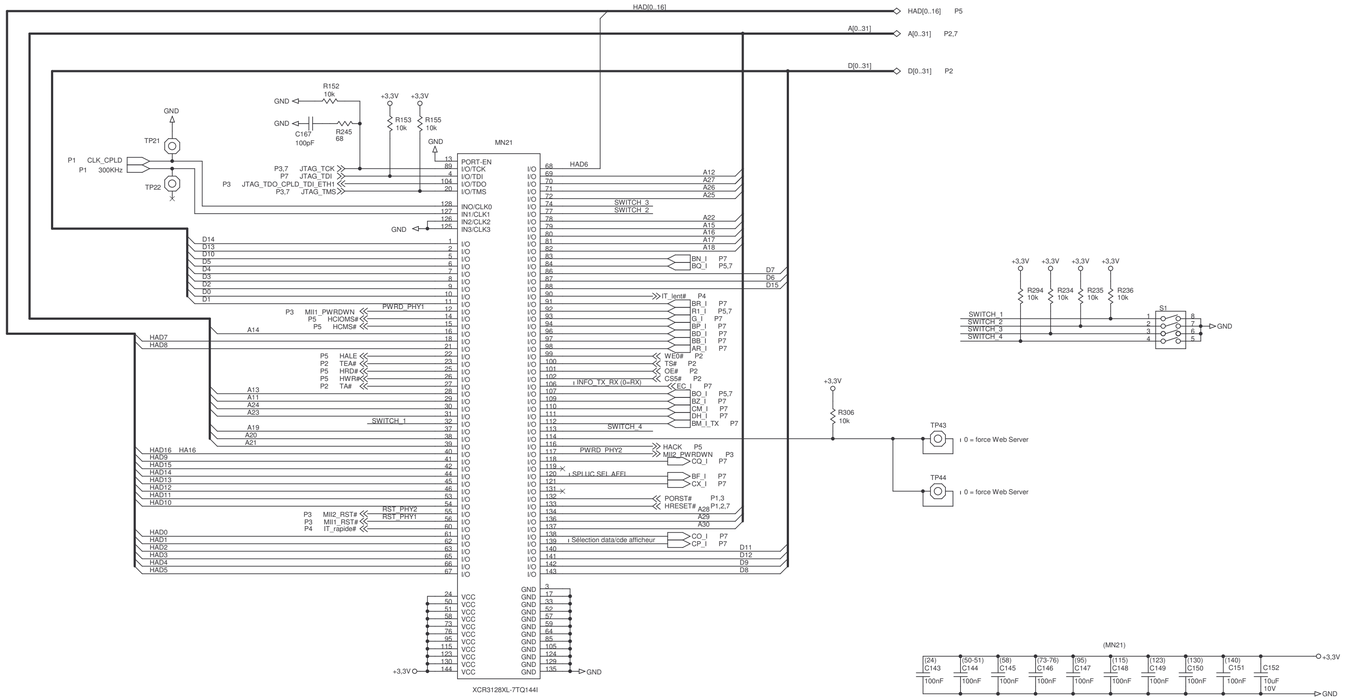
(Critical Net Route)

PB27 (I2CSDA) & PB26 (I2CSCL) should be as short as possible and routed as a matched pair

CARTE MICROPROCESSEUR ET DSP		**47000164**	
IO MPC885		Indice rév. : V1.00 Date rév. : Tuesday, February 01, 2011	
Réf. ss-ens. : MIDS11216	Code ss-ens. : 51001181	Réf. ens. : ER9000-2G EM9000-2G TRN4000 TRG4000	Page : 4 / 7
Réf. C.I. : MIDS1345B	Code C.I. : 29001708		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

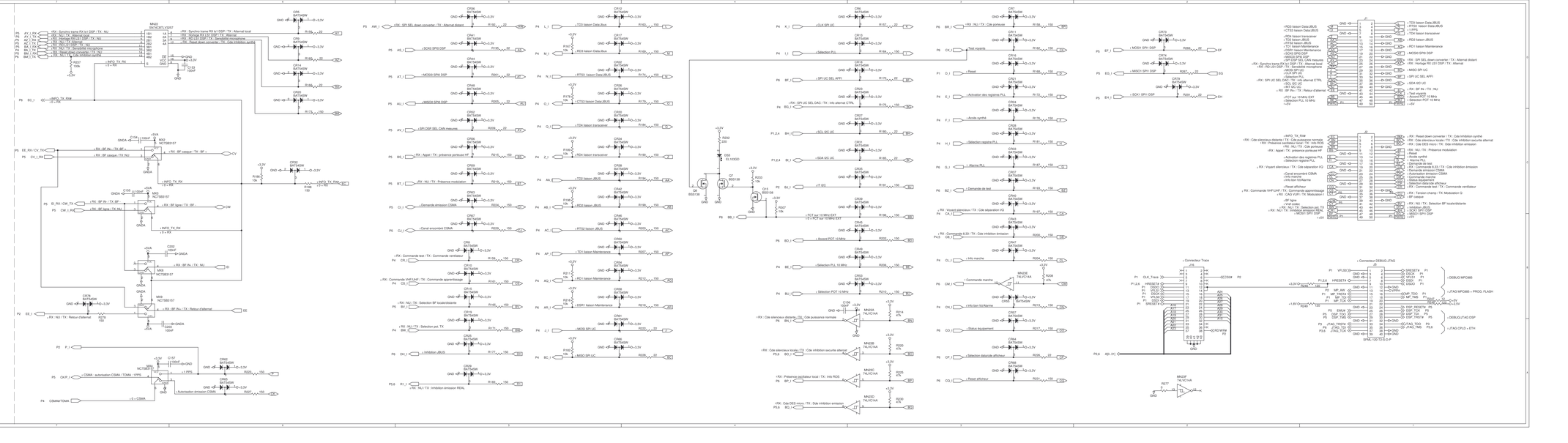


CARTE MICROPROCESSEUR ET DSP		**47000165**	
DSP		Indice rév. : V1.00	
		Date rév. : Tuesday, February 01, 2011	
Réf. ss-ens. : MIDS11216	Code ss-ens. : 51001181	Réf. ens. : ER9000-2G EM9000-2G TRN4000 TRG4000	Page : 5 / 7
Réf. C.I. : MIDS1345B	Code C.I. : 29001708		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

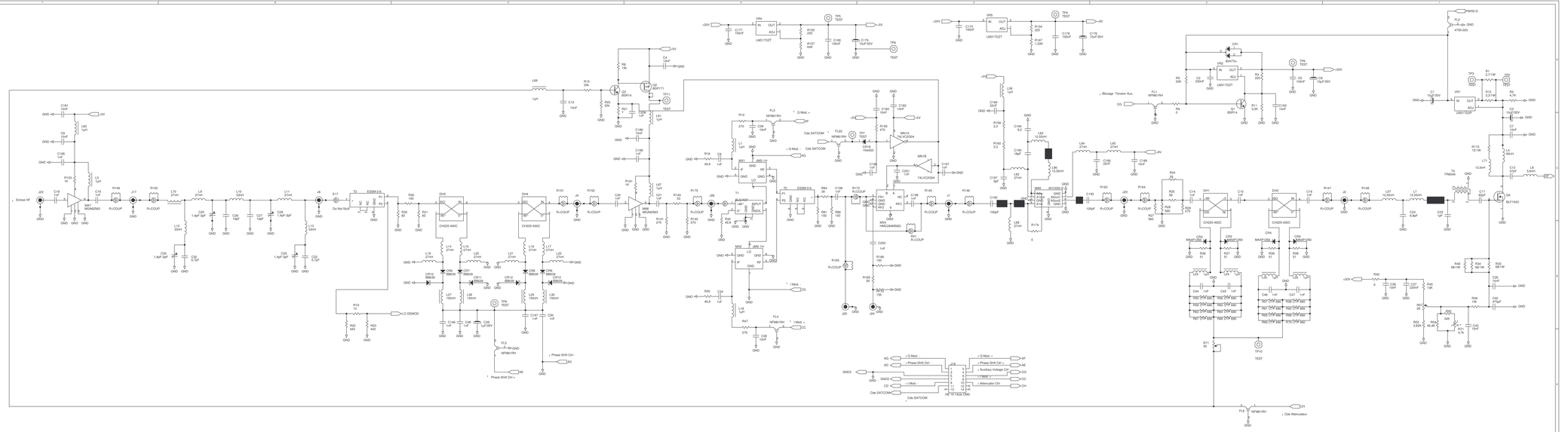


CARTE MICROPROCESSEUR ET DSP **CPLD**		**47000166** Indice rév. : V1.00 Date rév. : Tuesday, February 01, 2011	
Réf. ss-ens. : MIDS11216	Code ss-ens. : 51001181	Réf. ens. : ER9000-2G EM9000-2G TRN4000 TRG4000	Page : 6 / 7
Réf. C.I. : MIDS1345B	Code C.I. : 29001708		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

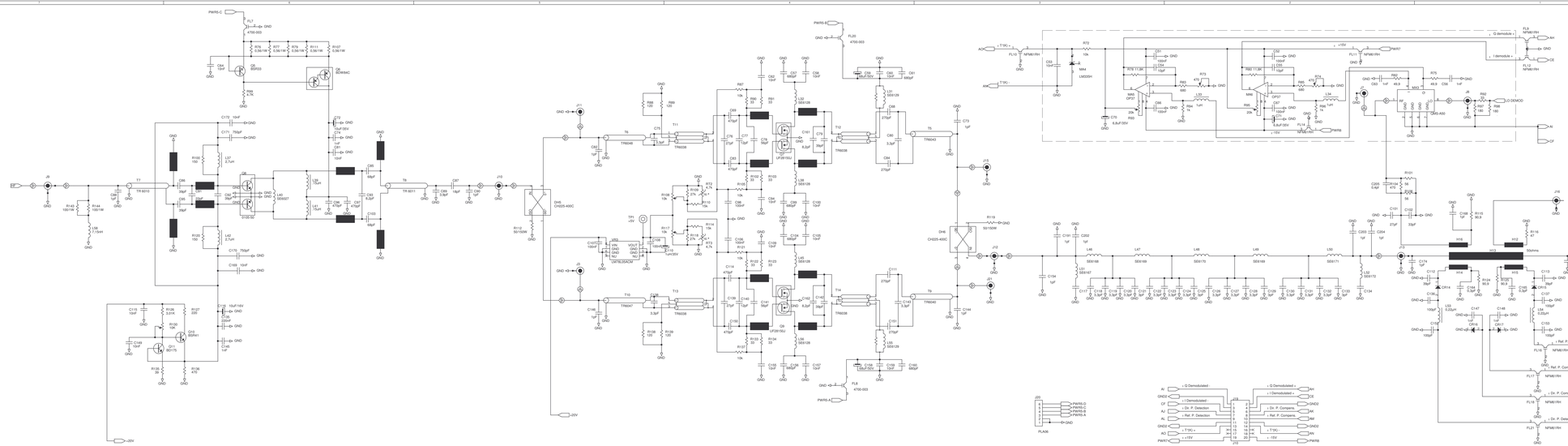
' CARTE MICROPROCESSEUR ET DSP ' Connecteurs			' 47000167 Indice rév. : V1.00 Date rév. : Tuesday, February 01, 20
Réf. ss-ens. : MIDS11216	Code ss-ens. : 51001181	Réf. ens. : EF9000-2G EM9000-2G TRN4000 TRG4000	Page : 7 / 7
Réf. C.I. : MIDS13458	Code C.I. : 29001708		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64403 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL. : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01



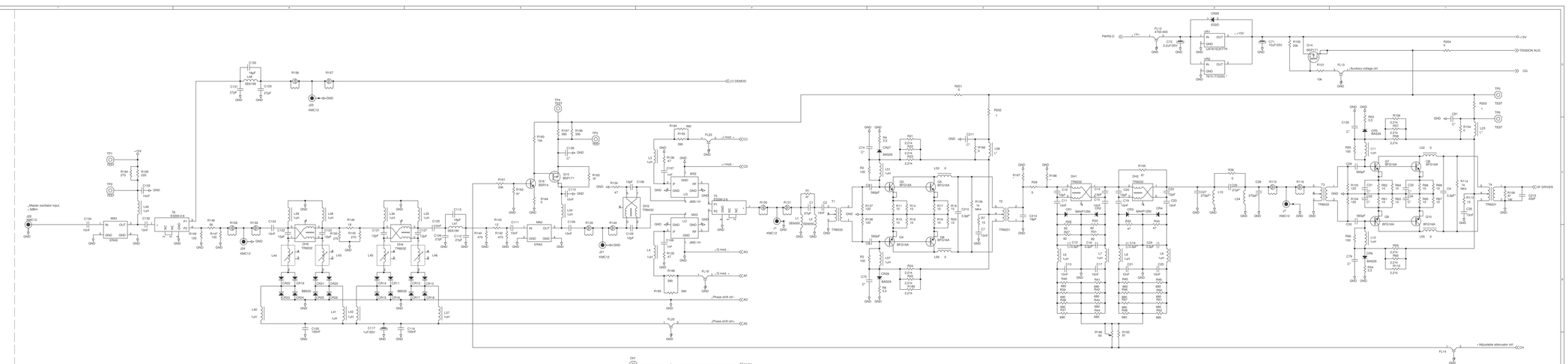
Indice rév. : V2.00



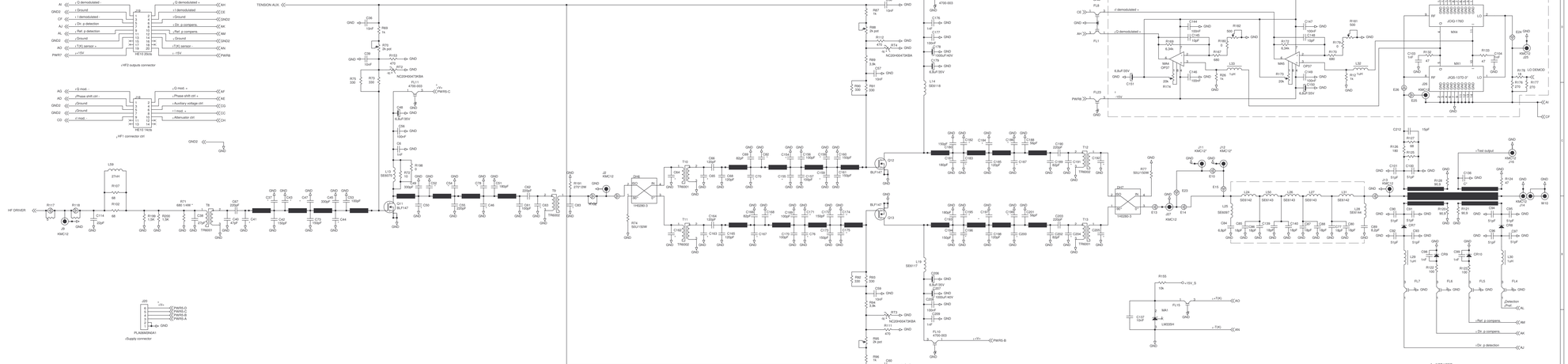
	MODULE RF : UHF / 300W **Schema électrique 1/2**		**47000196** Indice rév. : V3.00 Date rév. Monday, September 20, 20 0
Réf. ss-ens. : AMPU02246	Code ss-ens. : 52000632 52000597	Réf. ens. : TRN4000 EM9010	Page : 1 / 2
Réf. C.I. : AMPU6257B	Code C.I. : 29001645		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01



-	**MODULE RF : UHF / 300W** **Schema électrique 2/2**		' 47000197 Indice rév. : V3.00 Date rév. Monday, September 20, 20 0
Réf. ss-ens. : AMPU2658	Code ss-ens. : 52000632 52000597	Réf. ens. : TRN4000 EM9010	Page : 2 / 2
Réf. C.I. : AMPLI2527A	Code C.I. : 290016445		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01



AMPLIFICATEUR VHF 108 - 163MHz (SERIE 2G)			' 47000236	
Schéma Electrique 1/2			Indice rév. : V1.01 Date rév. : 05/10/2009	
Réf. ss-ens. : AMPV26260	Code ss-ens. : 52000634	Réf. ens. : EM9000 - 2G		Page : 1 / 2
Réf. C.I. : AMPV6256A	Code C.I. : 29001728			
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01	



AMPLIFICATEUR VHF 108 - 163MHz (SERIE 2G)			**47000237**
Schéma Electrique 2/2			Indice rév. : V1.01 Date rév. : 05/10/2009
Réf. ss-ens. : AMPV26260	Code ss-ens. : 52000634	Réf. ens. : EM9000 - 2G	Page : 2 / 2
Réf. C.I. : AMPV6256A	Code C.I. : 29001728		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

ALIMENTATION A PLAQUE FROIDE 500W

Schéma électrique

47000239

Indice rév. : V1.02

Date rév. : 18/01/2010

Réf. ss-ens. : ALPF26271	Code ss-ens. : 52500079	Réf. ens. : EM9000 - 2G	
Réf. ss-ens. : ALPF26273	Code ss-ens. : 52500080	Réf. ens. : EM9010 - 2G	
Réf. ss-ens. : ALPF26274	Code ss-ens. : 52500081	Réf. ens. : CM300 xDT V2	Page : 1 / 2
Réf. C.I. : ALPF6267A	Code C.I. : 29001738		

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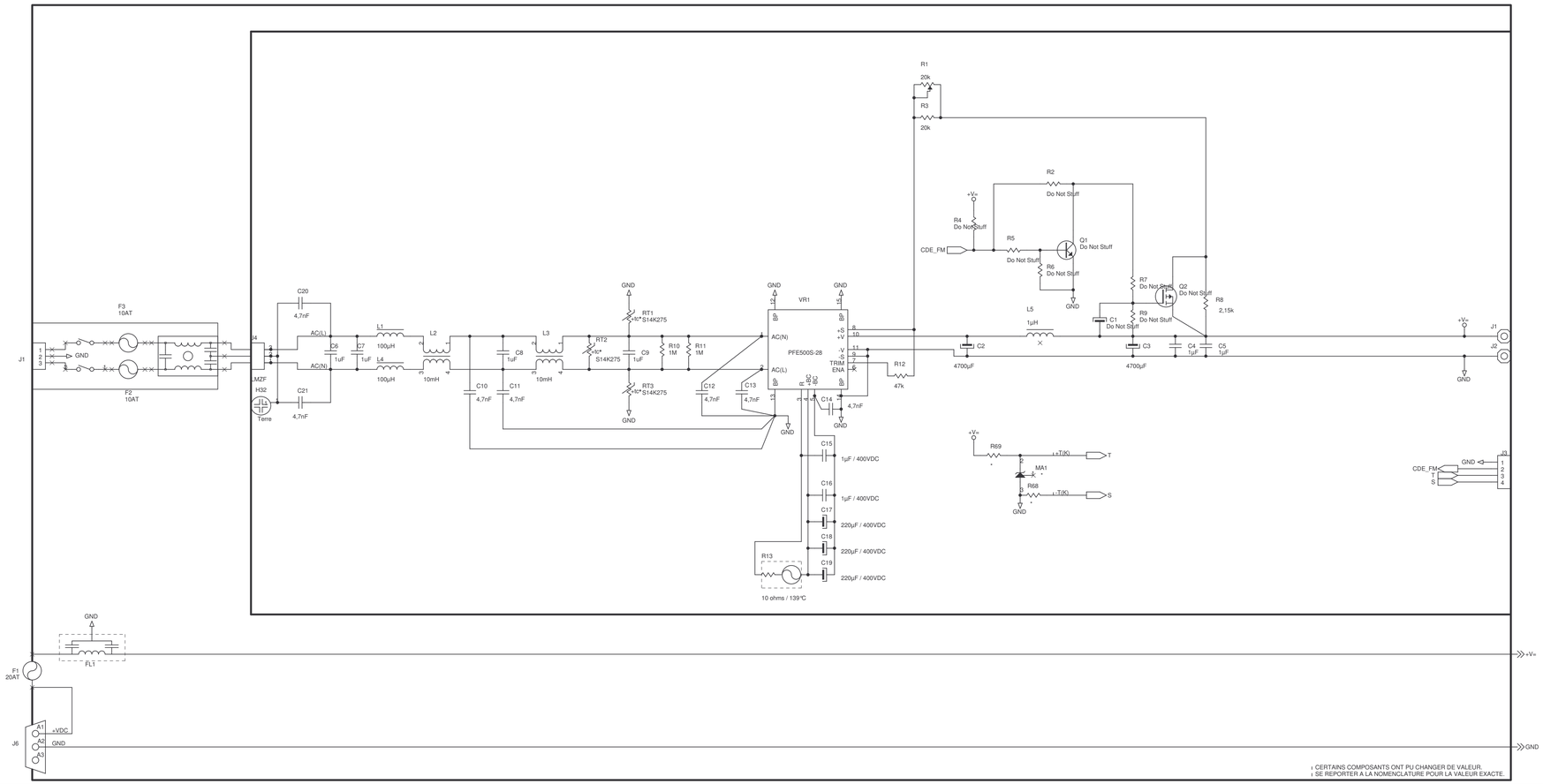
email address courrier@telerad.fr

TEL : +33 5 59 58 55 00

FAX : +33 5 59 58 55 01



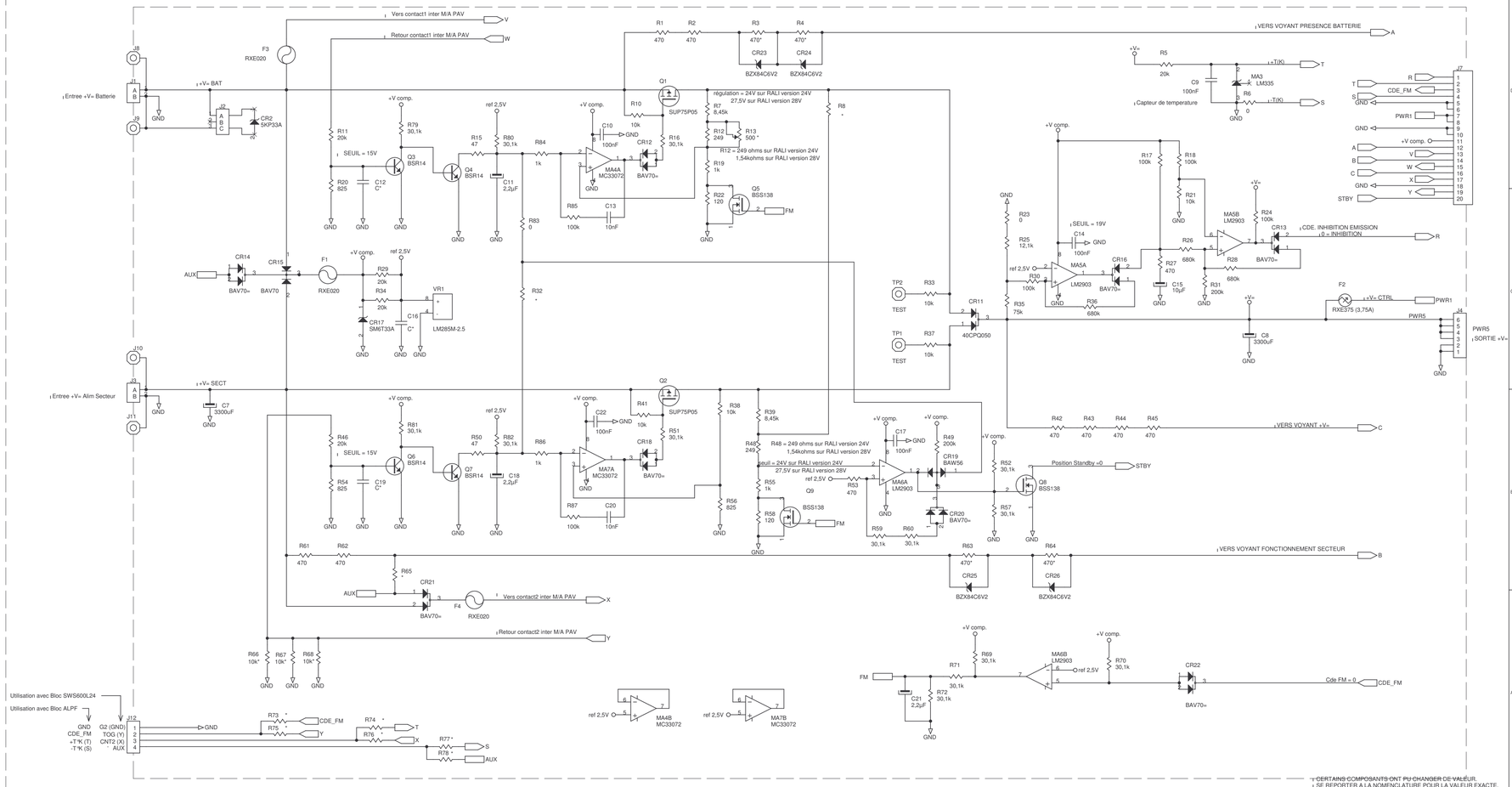
CARTE RELAIS ALIMENTATION ININTERRUPTIBLE

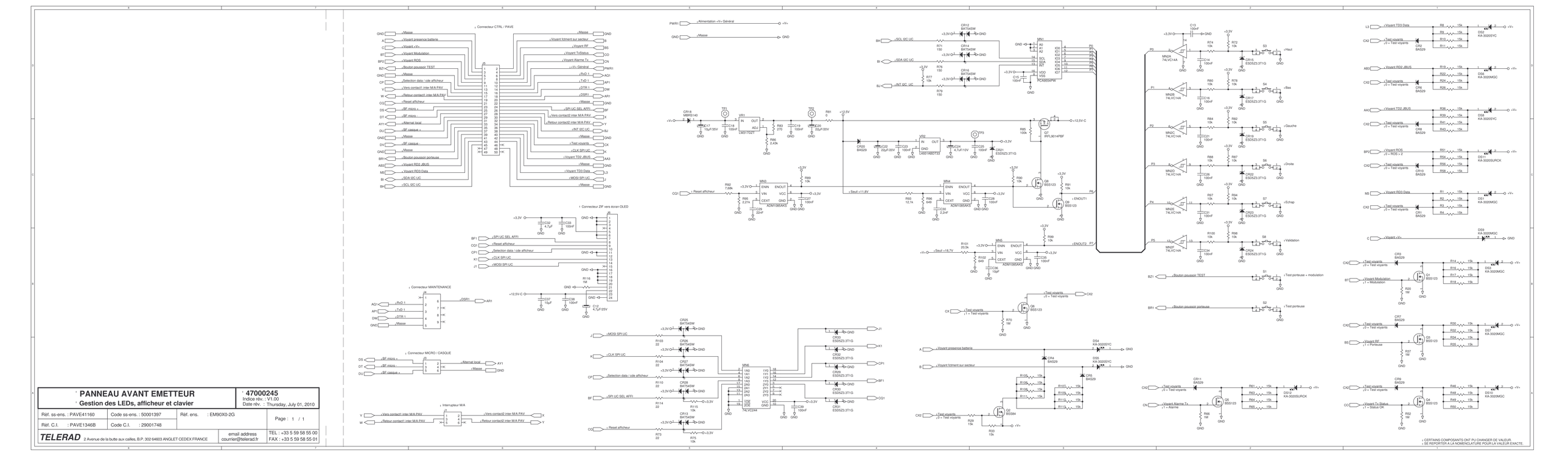
Schéma électrique

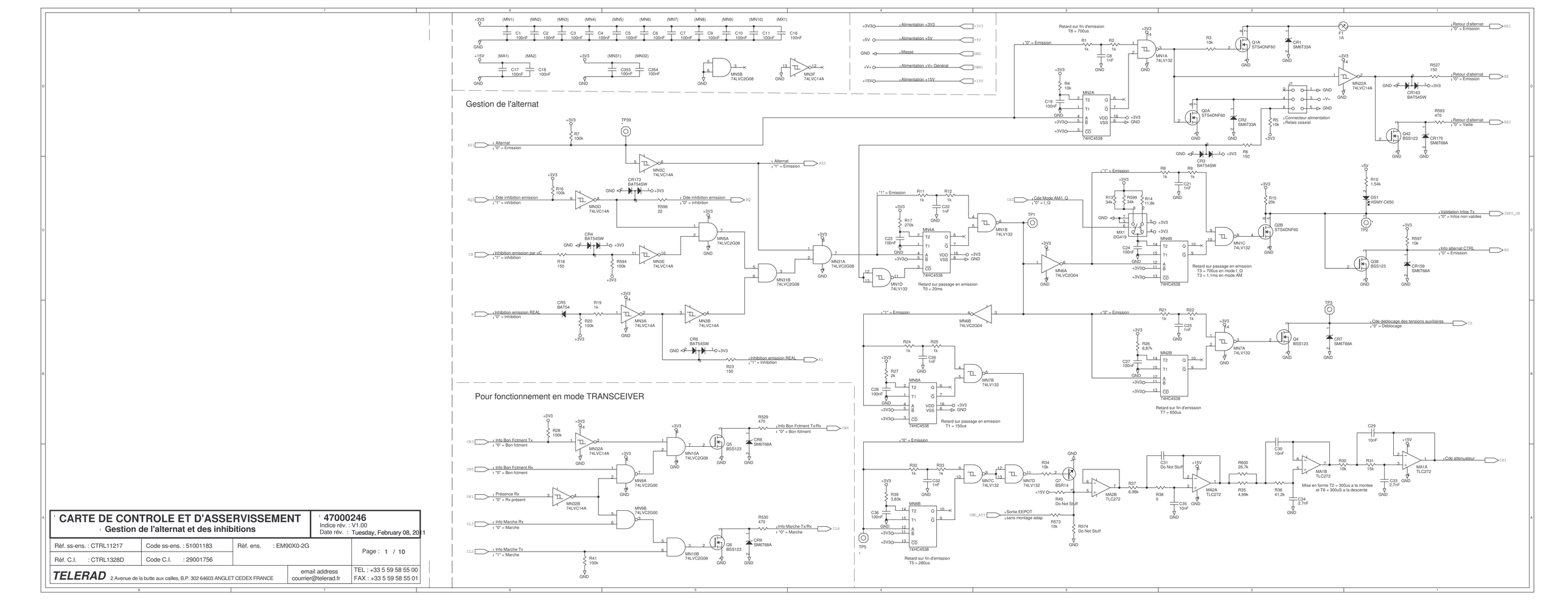
47000240
Indice rév. : V1.02
Date rév. : 06/05/2011

Réf. ss-ens. : RALI16105 (24V)	Code ss-ens. : 51500089	Réf. ens. : EM9000-2G	
Réf. ss-ens. : RALI16107 (28V)	Code ss-ens. : 51500091	Réf. ens. : EM9010-2G	
Réf. ss-ens. : RALI16108 (24V)	Code ss-ens. : 51500092		
Réf. ss-ens. : RALI16109 (28V)	Code ss-ens. : 51500093		
Réf. ss-ens. : RALI16111 (24V)	Code ss-ens. : 51500095		
Réf. ss-ens. : RALI16113 (DC)	Code ss-ens. : 51500098		
Réf. C.I. : RALI6266A	Code C.I. : 29001739		Page : 1 / 2

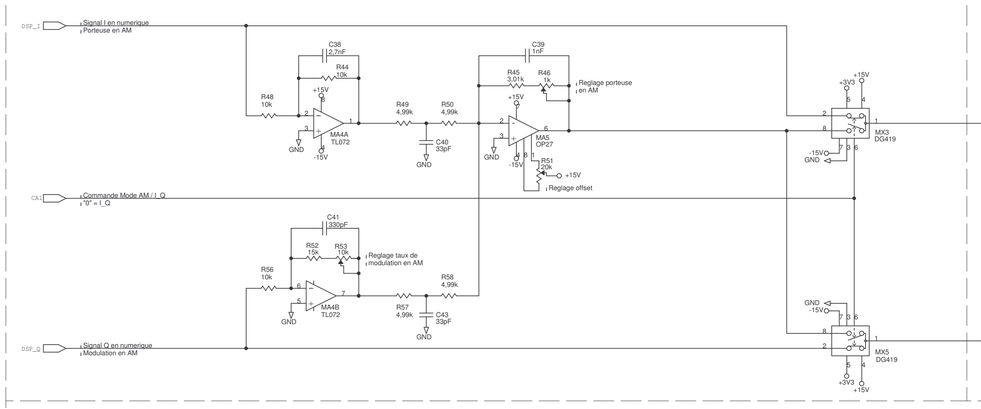
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
email address courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01



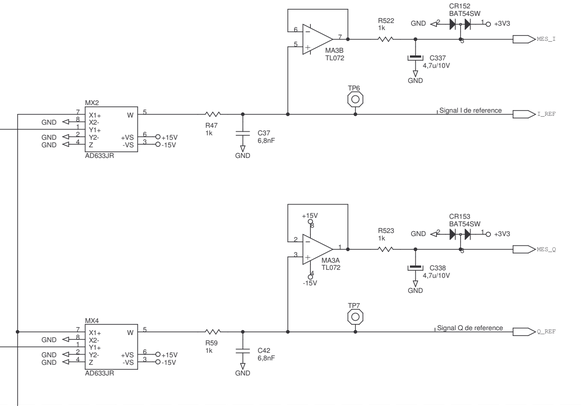

Connecteur CTRL / PAVE
Connecteur ZIF vers écran OLED
Connecteur MAINTENANCE
Connecteur MICRO / CASQUE
Interrupteur M/A
PANNEAU AVANT EMETTEUR
Gestion des LEDs, afficheur et clavier
47000245
Indice rév. : V1.00
Date rév. : Thursday, July 01, 2010
Réf. ss-ens. : PAVE41160
Code ss-ens. : 50001397
Réf. ens. : EM90X0-2G
Page : 1 / 1
Réf. C.I. : PAVE1346B
Code C.I. : 29001748
TELERAD
2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
email address
courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01
CERTAINS COMPOSANTS ONT PU CHANGER DE VALEUR.
SE REPORTER A LA NOMENCLATURE POUR LA VALEUR EXACTE.


Gestion de l'alternat
Pour fonctionnement en mode TRANSCEIVER
CARTE DE CONTROLE ET D'ASSERVISSEMENT
Gestion de l'alternat et des inhibitions
47000246
Indice rév. : V1.00
Date rév. : Tuesday, February 08, 2011
Réf. ss-ens. : CTRL11217
Code ss-ens. : 51001183
Réf. ens. : EM90X0-2G
Page : 1 / 10
Réf. C.I. : CTRL1328D
Code C.I. : 29001756
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE
email address
courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01

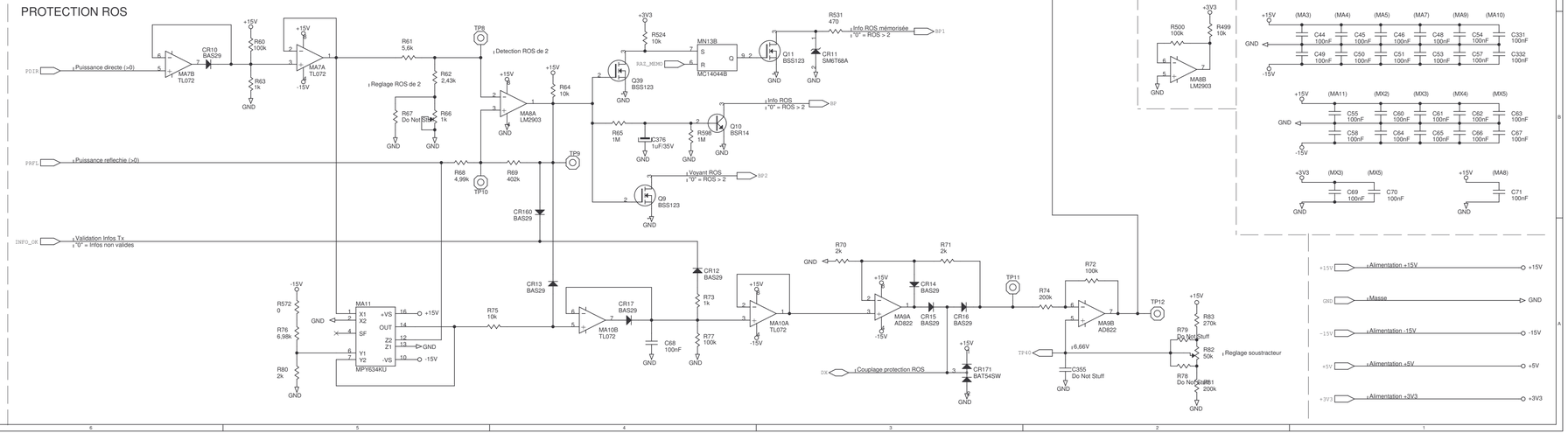
SELECTION DES REFERENCES



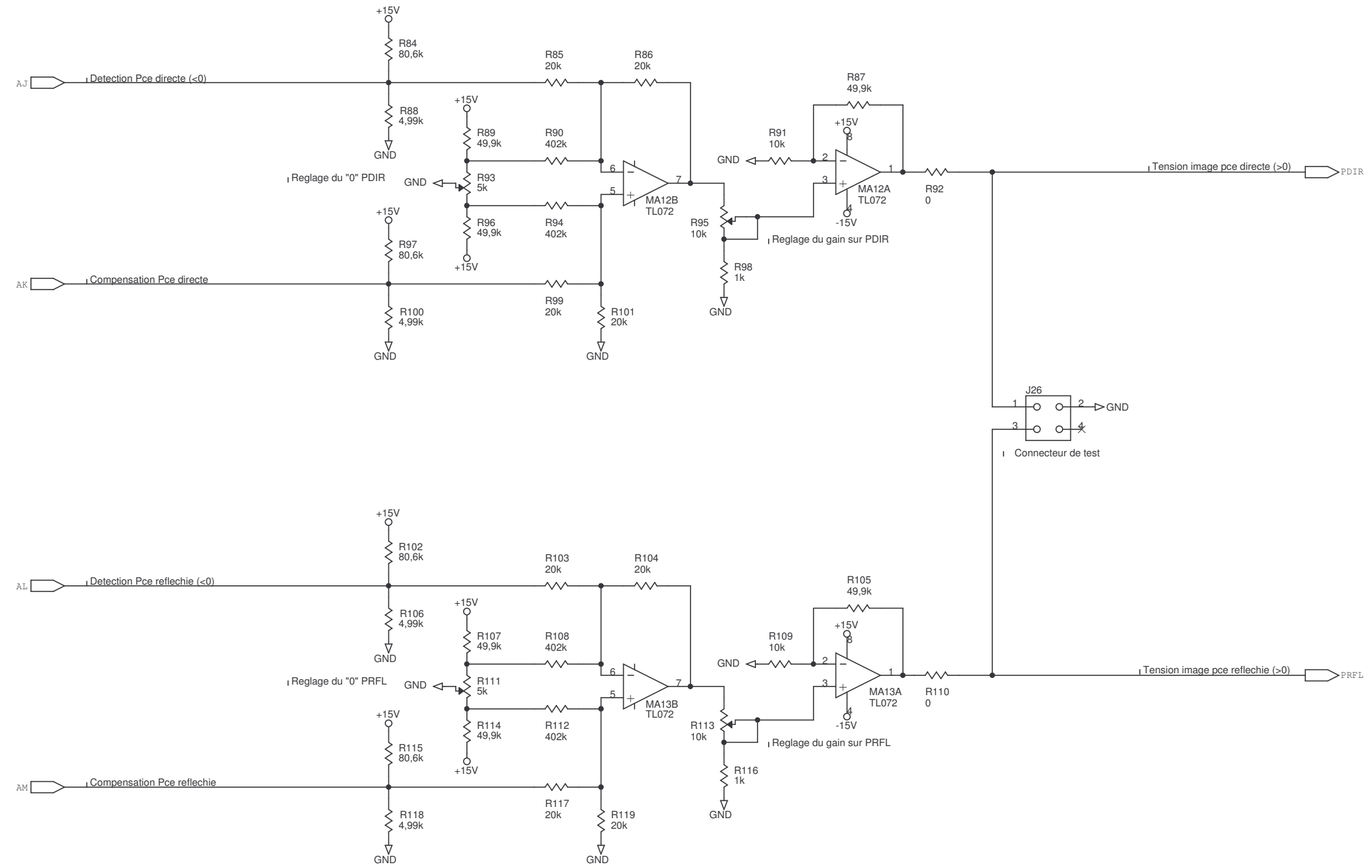
AJUSTEMENT DES REFERENCES



PROTECTION ROS



CARTE DE CONTROLE ET D'ASSERVISSEMENT Protection ROS et ajustement des références		**47000247** Indice rév. : V1.00 Date rév. : Tuesday, February 08, 2011	
Réf. ss-ens. : CTRL11217	Code ss-ens. : 51001183	Réf. ens. : EM90X0-2G	Page : 2 / 10
Réf. C.I. : CTRL1328D	Code C.I. : 29001756		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01



CARTE DE CONTROLE ET D'ASSERVISSEMENT

Interface CODI

47000248
Indice rév. : V1.00
Date rév. : Friday, April 22, 2011

Rèf. ss-ens. : CTRL11217	Code ss-ens. : 51001183	Rèf. ens. : EM90X0-2G	Page : 3 / 10
Rèf. C.I. : CTRL1328D	Code C.I. : 29001756		

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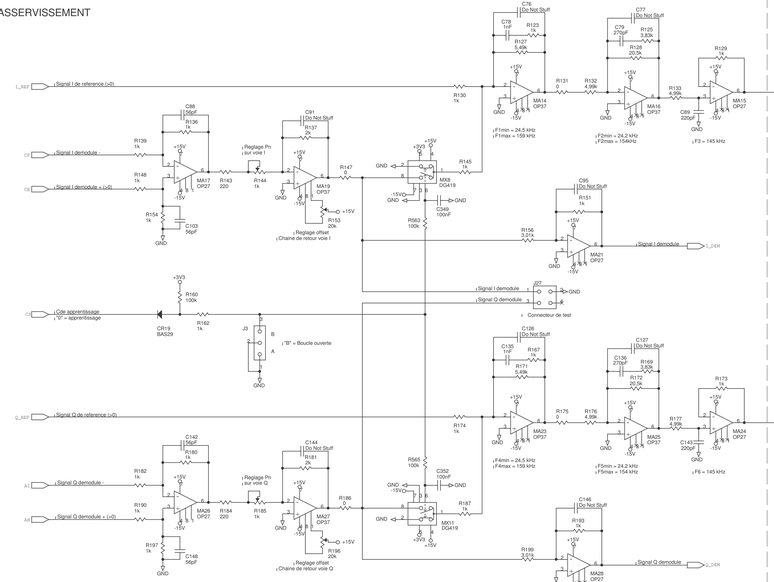
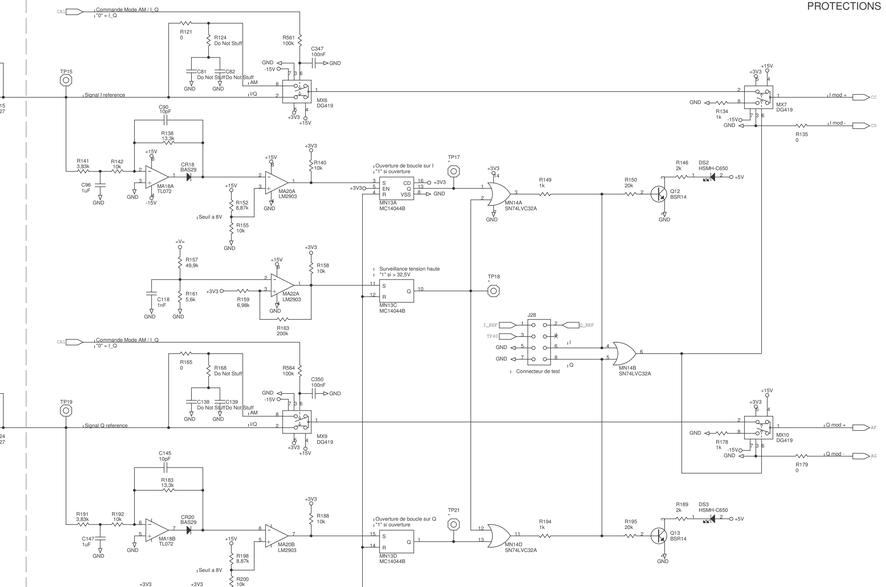
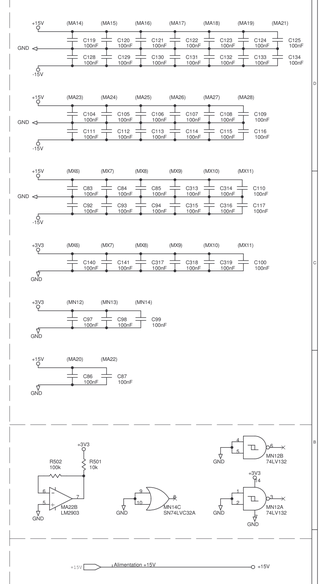
email address courrier@telerad.fr
TEL : +33 5 59 58 55 00
FAX : +33 5 59 58 55 01

ASSERVISSEMENT



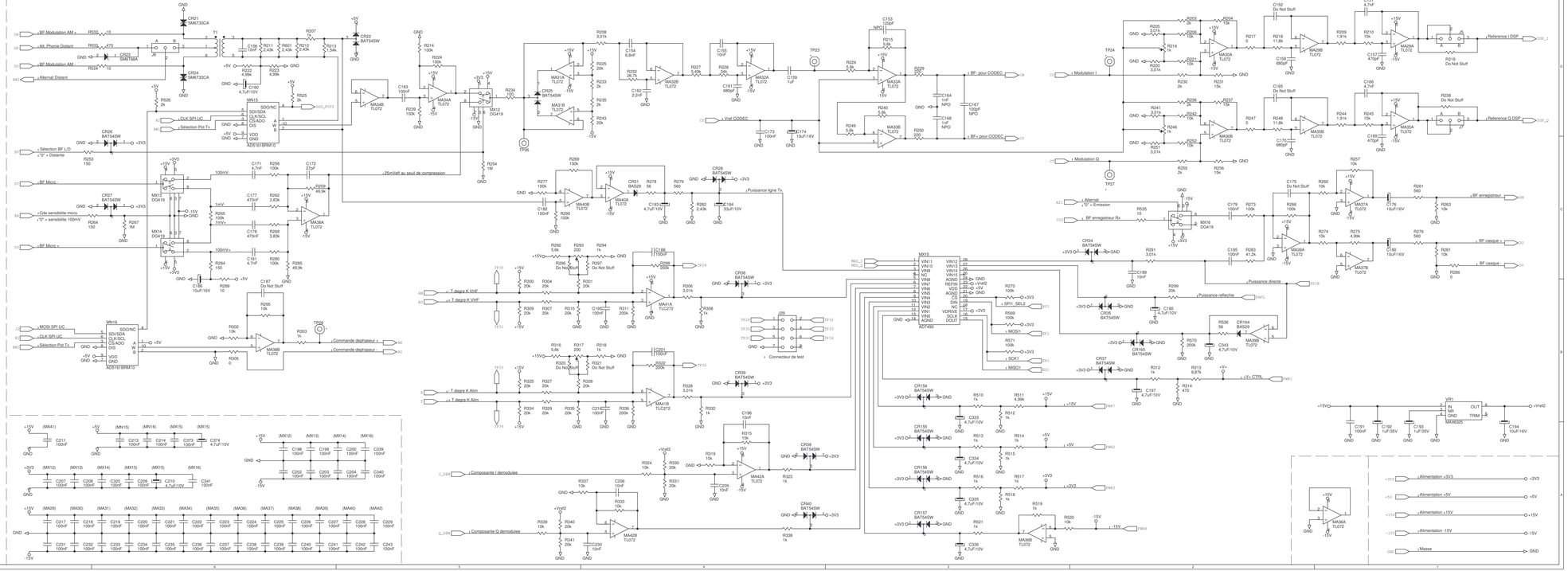
PROTECTIONS



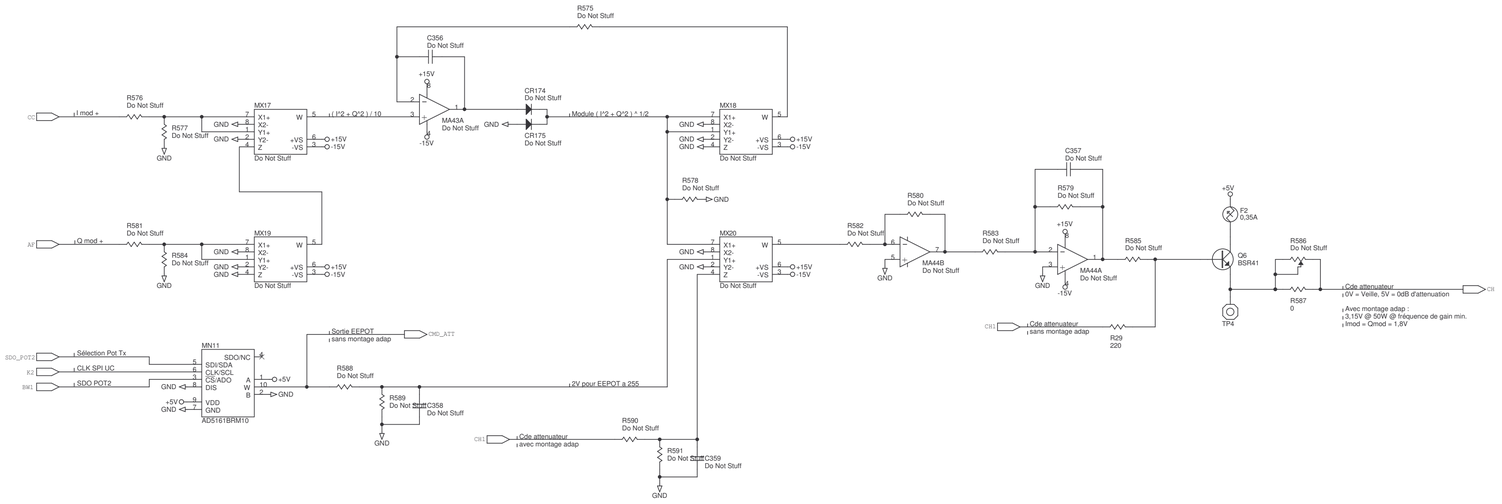


CARTE DE CONTROLE ET D'ASSERVISSEMENT **Boucle d'assservissement**			**47000249** Indice rév. : V1.00 Date rév. : Tuesday, February 08, 2011
Réf. ss-ens. : CTRL11217	Code ss-ens. : 51001183	Réf. ens. : EM90X0-2G	Page : 4 / 10
Réf. C.I. : CTRL1328D	Code C.I. : 29001756		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

Indice rév. : V1.00



CARTE DE CONTROLE ET D'ASSERVISSEMENT		**47000250**	
Traitement BF et mesures analogiques		Date rév. : Tuesday, February 08, 2011	
Réf. ss-ens. : CTRL11217	Code ss-ens. : 51001183	Réf. ens. : EM90X0-2G	Page : 5 / 10
Réf. C.I. : CTRL1328D	Code C.I. : 29001756		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01



CARTE DE CONTROLE ET D'ASSERVISSEMENT

Commande du circuit atténuateur

47000251

Indice rév. : V1.00

Date rév. : Tuesday, February 08, 2011

Réf. ss-ens. : CTRL11217	Code ss-ens. : 51001183	Réf. ens. : EM90X0-2G	Page : 6 / 10
Réf. C.I. : CTRL1328D	Code C.I. : 29001756		

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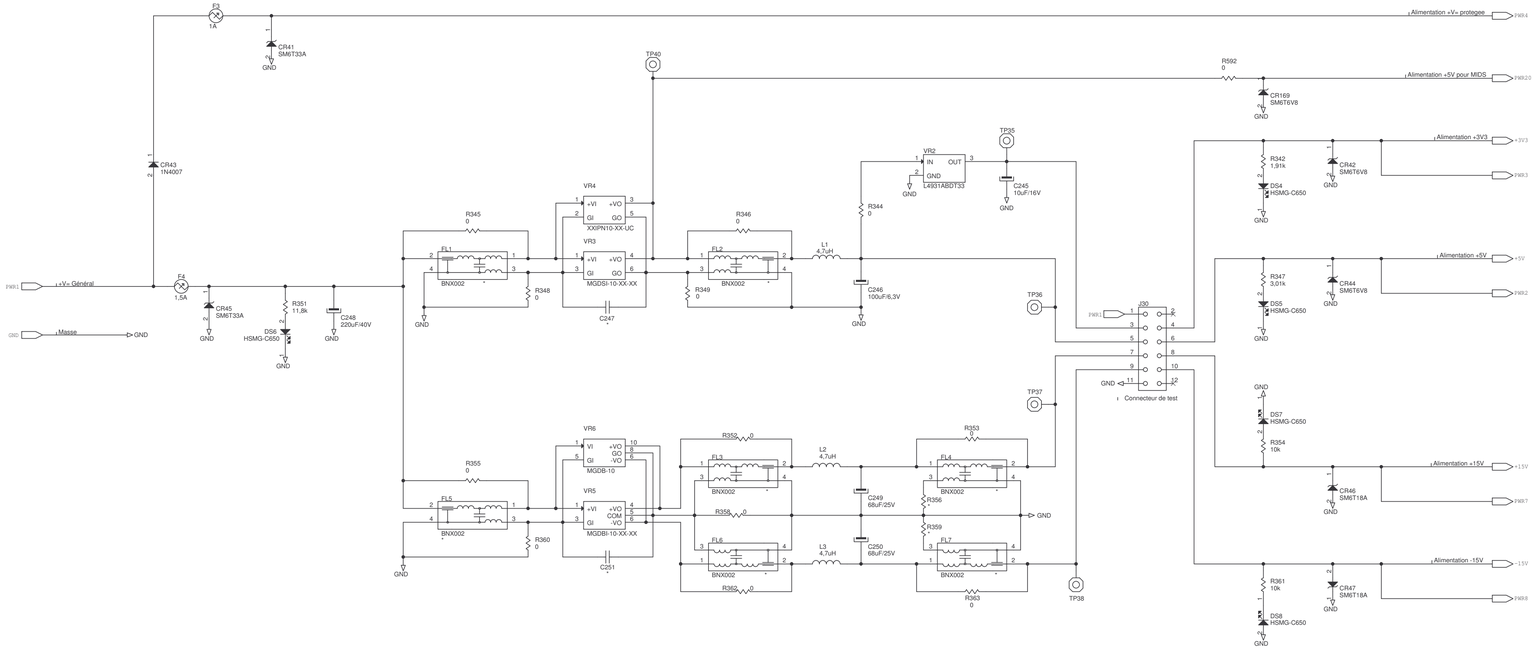
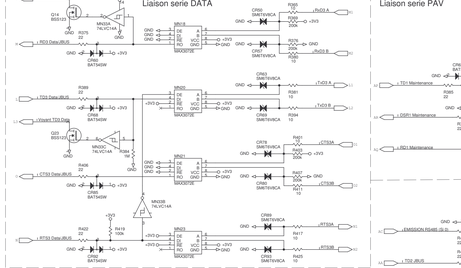
FAX : +33 5 59 58 55 01

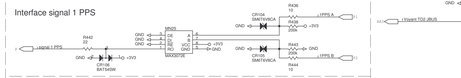


CARTE DE CONTROLE ET D'ASSERVISSEMENT **Alimentations**			**47000252** Indice rév. : V1.02 Date rév. : Monday, July 11, 2011
Réf. ss-ens. : CTRL11217	Code ss-ens. : 51001183	Réf. ens. : EM90X0-2G	Page : 7 / 10
Réf. C.I. : CTRL1328D	Code C.I. : 29001756		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

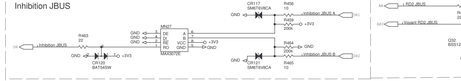
Liaison serie DATA



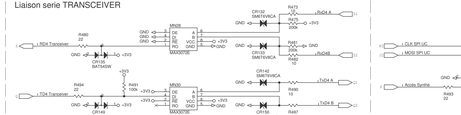
Interface signal 1 PPS



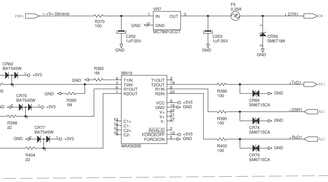
Inhibition JBUS



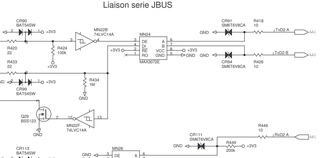
Liaison serie TRANSCEIVER



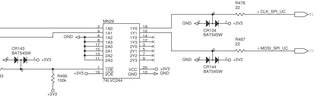
Liaison serie PAV



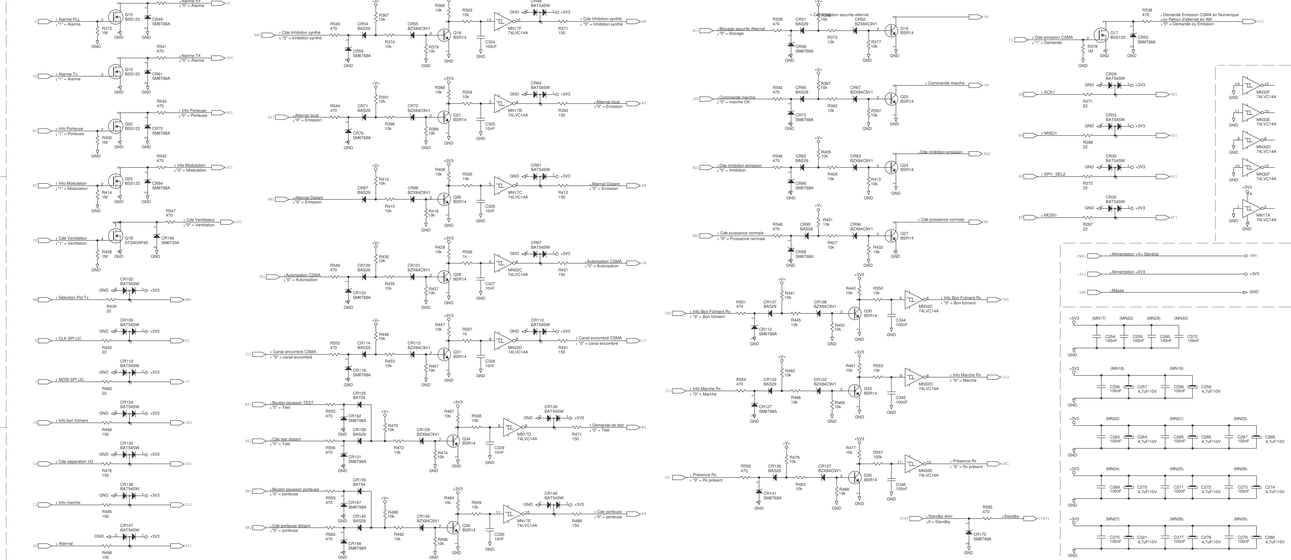
Liaison serie JBUS



Circuit d'isolation du SPI PLL



Interface standard



CARTE DE CONTROLE ET D'ASSERVISSEMENT Interfaces et liaisons séries		' 47000253 Indice rév. : V1.00 Date rév. : Tuesday, February 08, 2011	
Réf. ss-ens. : CTRL11217	Code ss-ens. : 51001183	Réf. ens. : EM60X0-2G	Page : 8 / 10
Réf. C.I. : CTRL1328D	Code C.I. : 29001756		

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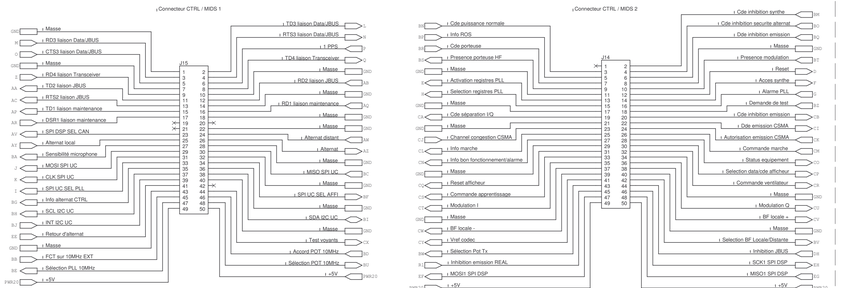
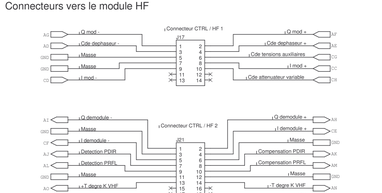
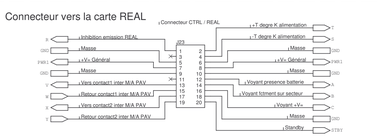
Connecteurs vers la carte MIDS



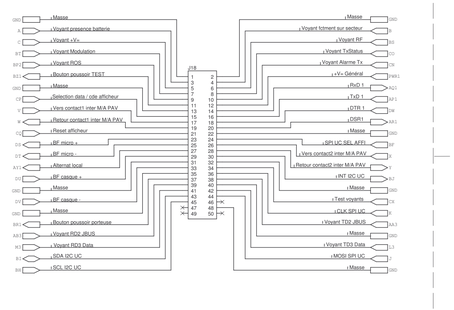
Connecteurs vers le module HF



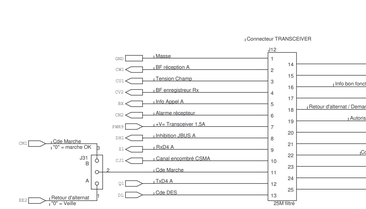
Connecteurs vers la carte REAL

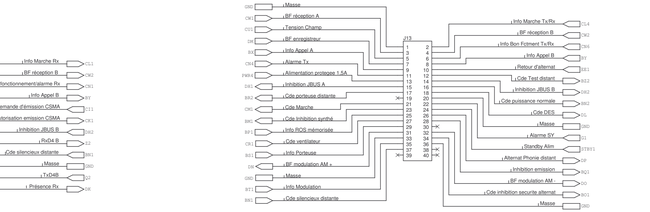


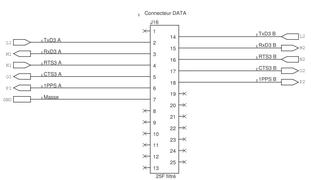
Connecteur vers le panneau avant

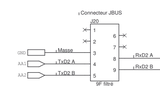


Connecteurs vers le panneau arrière

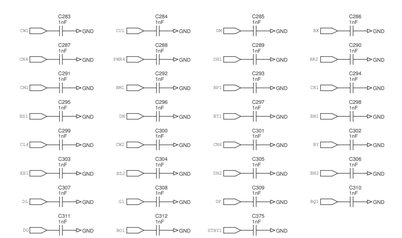




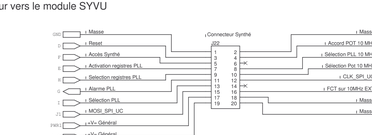


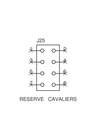


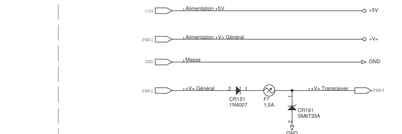
Filtrage du connecteur EXPLOITATION



Connecteur vers le module SYVU







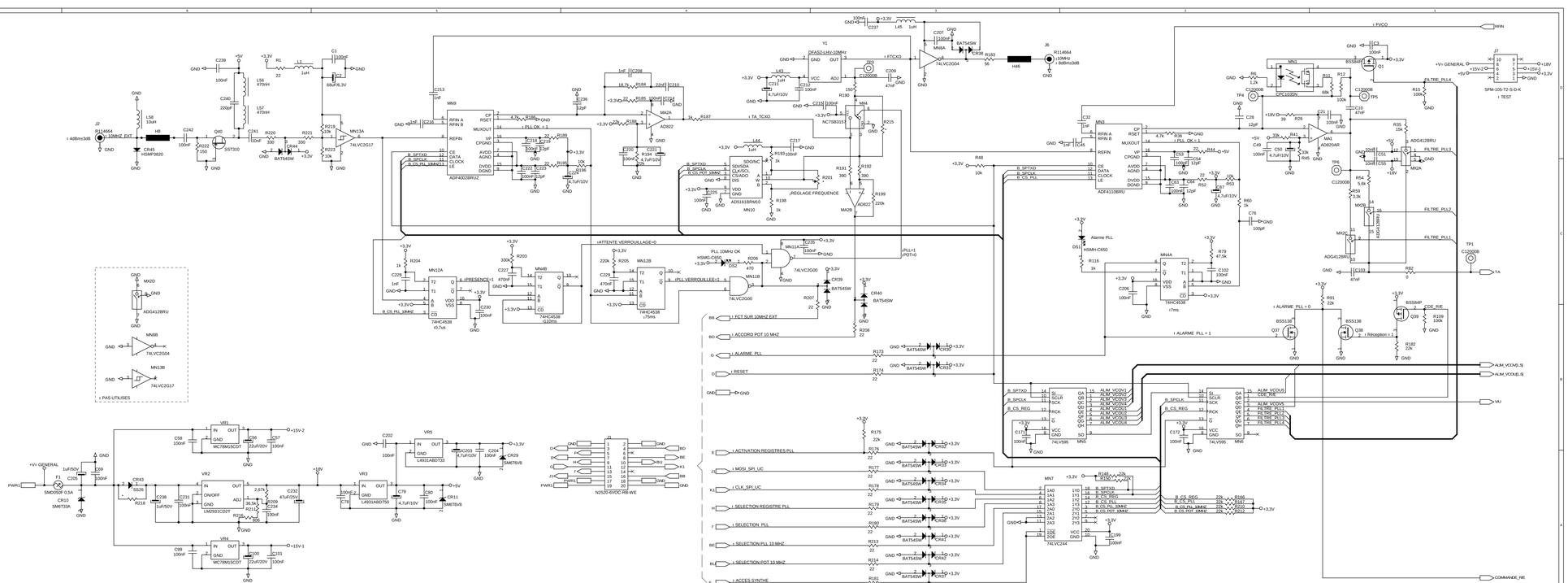
CARTE DE CONTROLE ET D'ASSERVISSEMENT **Connecteurs**			**47000254** Indice rév. : V1.00 Date rév. : Tuesday, February 08, 2011
Réf. ss-ens. : CTRL11217	Code ss-ens. : 51001183	Réf. ens. : EM90X0-2G	Page : 9 / 10
Réf. C.I. : CTRL1328D	Code C.I. : 29001756		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

SYNTHETISEUR UHF PLL	47000265 Indice rév. :V1.05 Date rév. : Friday, September 10, 2010	
Réf. ss-ens. :SUHF25078	Code ss-ens. :52000621	Réf. ens. :EM/RE9010-2G
Réf. C.I. :SYVU5214D	Code C.I. :29001604	Page : 1 / 3
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE	email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

SYNTHETISEUR VHF PLL	47000267 Indice rév. :V1.05 Date rév. : Friday, September 10, 2010	
Réf. ss-ens. :SVHF25077	Code ss-ens. :52000620	Réf. ens. :EM/RE9000-2G
Réf. C.I. :SYVU5214D	Code C.I. :29001604	Page : 1 / 3
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE	email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

SYNTHETISEUR UHF PLL	47000269 Indice rév. :V1.05 Date rév. : Friday, September 10, 2010	
Réf. ss-ens. :SYTR25081	Code ss-ens. :52000640	Réf. ens. :TRN4000
Réf. C.I. :SYVU5214D	Code C.I. :29001604	Page : 1 / 3
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE	email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

SYNTHETISEUR V-UHF PLL	47000185 Indice rév. : V1.05 Date rév. : Friday, September 10, 2010	
Réf. ss-ens. :SYVU25076	Code ss-ens. : 52000614	Réf. ens. :EM/RE9000/9010-2G
Réf. C.I. :SYVU5214D	Code C.I. : 29001604	Page : 1 / 3
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE	email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01


+ PAS UTILISES
+ FILTRE PLL4
SFM-105-T2-S-D-K
+ TEST
+ EVCO
RFIN
+ FILTRE PLL3
+ FILTRE PLL2
+ FILTRE PLL1
TP1
C13000B
TA
+ ALARME PLL = 0
+ ALARME PLL = 1
+ Réception = 1
ALIM_VCOVL[5..0]
VAU
COMMANDE_RE
+ ACTIVATION REGISTRES PLL
+ MOSI_SPI_UC
+ CLK_SPI_UC
+ SELECTION REGISTRE PLL
+ SELECTION_PLL
+ SELECTION PLL 10 MHZ
+ SELECTION POT 10 MHZ
+ ACCES SYNTHE
+ ACCORD POT 10 MHZ
+ ALARME_PLL
+ RESET
+ FCT SUR 10MHZ EXT
+ PLL OK = 1
+ TCXO
+ FTCXO
+ ATTENTE VERROUILLAGE=0
+ PRESENCE=1
+ PLL VERROUILLEE=1
+ PLL=1
POT=0
+ REGLAGE FREQUENCE
+ 5V
+ 3,3V
+ 10V
+ 15V-1
+ 15V-2
+ 18V
+ 1,8V
+ 5V GENERAL
+ 5V-2
+ 3,3V-2
+ 18V-2
+ 15V-2
+ 3,3V-2
+ 1,8V-2
+ 5V-1
+ 3,3V-1
+ 18V-1
+ 15V-1
+ 3,3V-1
+ 1,8V-1

SYNTHETISEUR UHF VCOU			47000266 Indice rév. :V1.05 Date rév. : Friday, September 10, 2010
Réf. ss-ens. :SUHF25078	Code ss-ens. :52000621	Réf. ens. :EM/RE9010-2G	Page : 2 / 3
Réf. C.I. :SYVU5214D	Code C.I. :29001604		
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SYNTHETISEUR VHF VCOV			47000268 Indice rév. :V1.05 Date rév. : Friday, September 10, 2010
Réf. ss-ens. :SVHF25077	Code ss-ens. :52000620	Réf. ens. :EM/RE9000-2G	Page : 2 / 3
Réf. C.I. :SYVU5214D	Code C.I. :29001604		
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SYNTHETISEUR UHF VCOU			47000270 Indice rév. : V1.05 Date rév. : Friday, September 10, 2010
Réf. ss-ens. :SYTR25081	Code ss-ens. :52000640	Réf. ens. :TRN4000	Page : 2 / 3
Réf. C.I. :SYVU5214D	Code C.I. :29001604		
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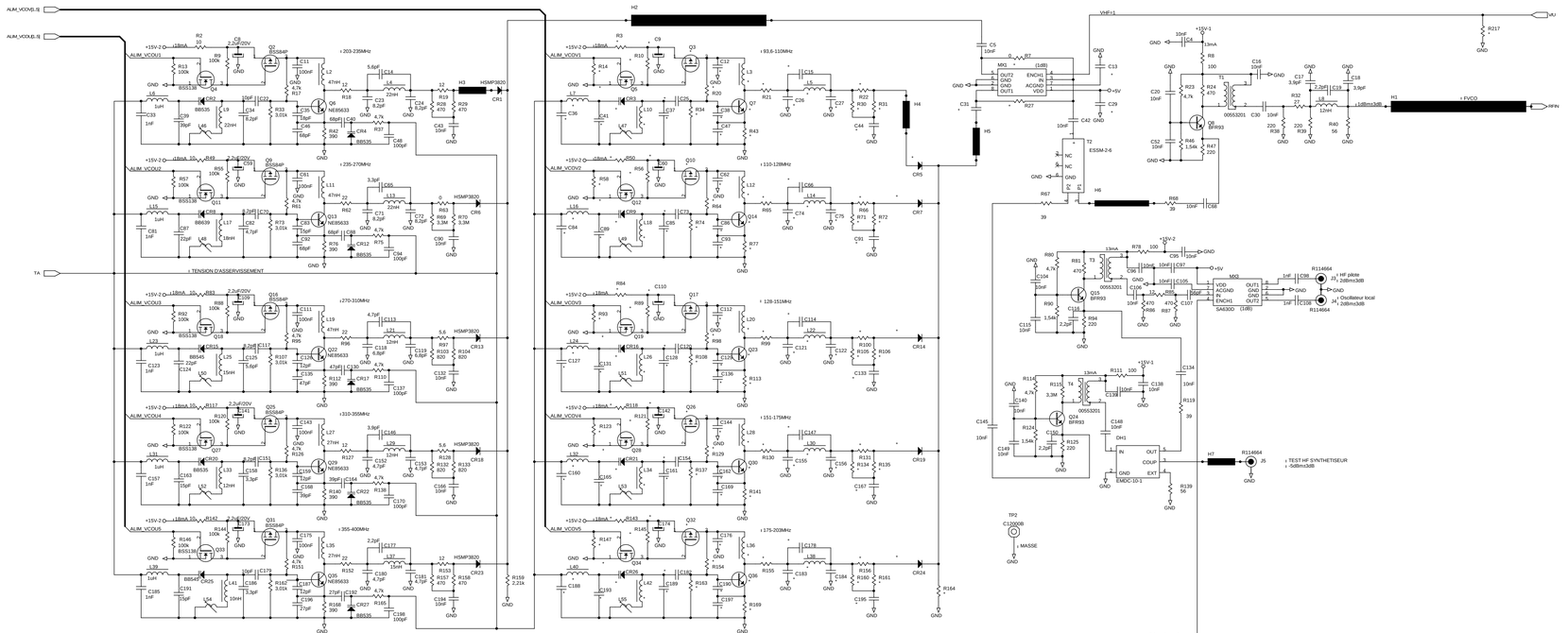
SYNTHETISEUR V-UHF VCOVU			47000186 Indice rév. : V1.05 Date rév. : Friday, September 10, 2010
Réf. ss-ens. :SYVU25076	Code ss-ens. :52000614	Réf. ens. :EM/RE9000/9010-2G	Page : 2 / 3
Réf. C.I. :SYVU5214D	Code C.I. :29001604		
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE		email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01



SYNTHETISEUR UHF PLL	47000265 Indice rév. :V1.05 Date rév. : Tuesday, August 31, 2010	
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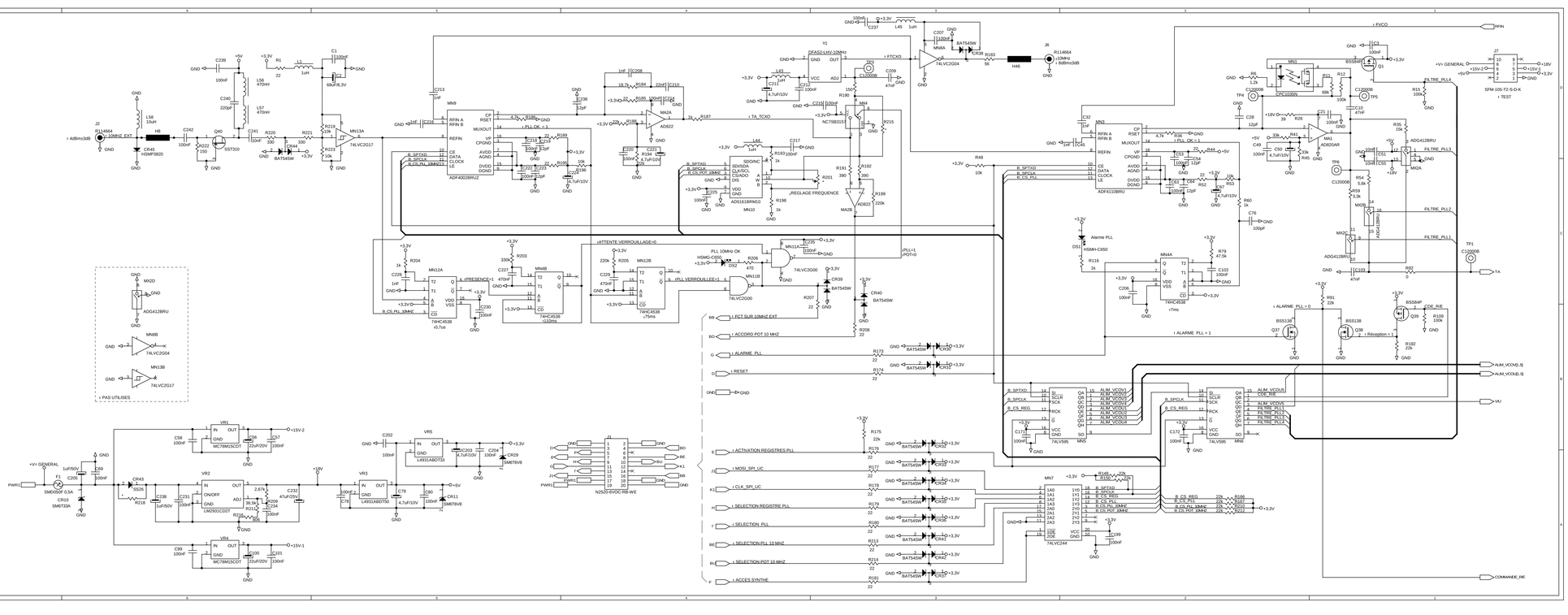
Réf. C.I. :SYVU5214D	Code C.I. :29001604	Page : 1 / 3
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE	email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

SYNTHETISEUR VHF PLL	47000267 Indice rév. :V1.05 Date rév. : Tuesday, August 31, 2010	
Réf. ss-ens. :SVHF25077	Code ss-ens. :52000620	Réf. ens. :EM/RE9000-2G
Réf. C.I. :SYVU5214D	Code C.I. :29001604	Page : 1 / 3
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE	email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

SYNTHETISEUR UHF PLL	47000269 Indice rév. :V1.05 Date rév. : Tuesday, August 31, 2010	
Réf. ss-ens. :SYTR25081	Code ss-ens. :52000640	Réf. ens. :TRN4000
Réf. C.I. :SYVU5214D	Code C.I. :29001604	Page : 1 / 3
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE	email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01

SYNTHETISEUR V-UHF PLL	47000185 Indice rév. :V1.05 Date rév. : Tuesday, August 31, 2010	
Réf. ss-ens. :SYVU25076	Code ss-ens. : 52000614	Réf. ens. :EM/RE9000/9010-2G
Réf. C.I. :SYVU5214D	Code C.I. : 29001604	Page : 1 / 3
TELERAD 2 Avenue de la butte aux cailles, B.P. 302 64603 ANGLET CEDEX FRANCE	email address courrier@telerad.fr	TEL : +33 5 59 58 55 00 FAX : +33 5 59 58 55 01



SYNTHETISEUR UHF VCOU			47000266 Indice rév. :V1.05 Date rév. : Friday, September 10, 2010
Réf. ss-ens. :SUHF25078	Code ss-ens. :52000621	Réf. ens. :EM/RE9010-2G	Page : 2 / 3
Réf. C.I. :SYVU5214D	Code C.I. :29001604		
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SYNTHETISEUR VHF VCOV			47000268 Indice rév. :V1.05 Date rév. : Friday, September 10, 2010
Réf. ss-ens. :SVHF25077	Code ss-ens. :52000620	Réf. ens. :EM/RE9000-2G	Page : 2 / 3
Réf. C.I. :SYVU5214D	Code C.I. :29001604		
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SYNTHETISEUR UHF VCOU			47000270 Indice rév. : V1.05 Date rév. : Friday, September 10, 2010
Réf. ss-ens. :SYTR25081	Code ss-ens. :52000640	Réf. ens. :TRN4000	Page : 2 / 3
Réf. C.I. :SYVU5214D	Code C.I. :29001604		
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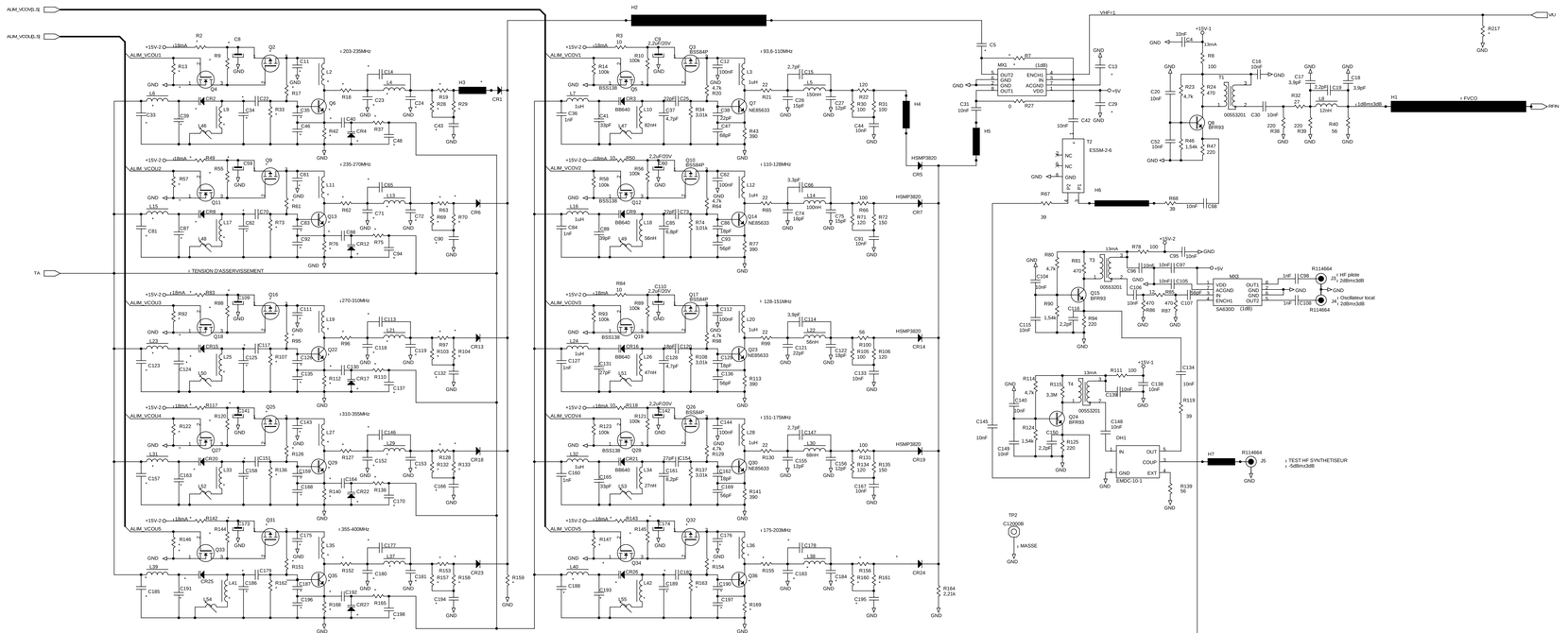
SYNTHETISEUR V-UHF VCOVU			47000186 Indice rév. : V1.05 Date rév. : Friday, September 10, 2010
Réf. ss-ens. :SYVU25076	Code ss-ens. :52000614	Réf. ens. :EM/RE9000/9010-2G	Page : 2 / 3
Réf. C.I. :SYVU5214D	Code C.I. :29001604		
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