

# **User's handbook Analogue Synthesized Microwave Radio Links**

**A4D-ES2G/1**  
**A4D-ES5G/1**  
**A4D-ES59G/1**  
**A4D-ES6G/1**  
**A4D-ES7G/1**  
**A4D-ES8G/1**  
**A4D-ES10G/1**  
**A4D-ES12G/1**  
**A4D-ES13G/1**  
**A4D-ES14G/1**





## Warning!

*The socket utilized for the unit power-supply must have the appropriate ground conductor.*

*The connection of the unit, to a socket without the ground conductor, will keep the whole equipment dangerous for people safety.*

*About the repair of the units refer to specialized personnel only.*

*Inside the apparatus there are voltages which could be dangerous for person.*  
*Before opening the cover, switch off the unit, disconnect the connection and the supply cable.*

*In case of electrical shock follow the instructions of first aid collected on page 3*

*Substitute the fuses interrupted with others of the same type and value.*



*The waste disposal of the devices must be executed in the respect of the enforced laws in the country uses.*

*Eurotek not assumed responsibility for waste disposal in contrast with enforced laws.*

### **LIFE SUPPORT APPLICATIONS.**

**Eurotek's products are not designed for use as critical components in life support devices or system without the express written approval of the Eurotek S.r.l. As used herein.**




- Life support devices or system are devices or system which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
- A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

*The information given in this documentation could have variations without forewarning.*

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## ***First aid: artificial breathing(mouth to mouth)***

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                       |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | <p>In case of electric shock you have to ensure the first aids to the patient, but to do this you have to consider two very important things:</p> <ul style="list-style-type: none"> <li>- <b>interrupt immediately the electric circuit;</b></li> <li>- <b>until the circuit has not been interrupted, do not touch the patient with bare hands;</b></li> </ul> <p>After doing this, without delay contact the nearest mobile unit of first aid and practice to the patient, in case of loss of consciousness, the breathing mouth to mouth is described following.</p> |                                                                                       |
| 2 | <ul style="list-style-type: none"> <li>- Put the patient lying on his back with the arms parallel to the body, ensure that he does not have the breathing tracts obstructed (chewing-gum, dental prosthesis, etc.), otherwise set him free from foreign bodies.</li> <li>-Kneel near the patient's head and putting a hand under his neck, incline as possible the head backwards.</li> </ul>                                                                                                                                                                            |    |
| 3 | <ul style="list-style-type: none"> <li>- Going on with keeping the patient's head inclined with a hand, use the other one to occlude the nostrils, if the breathing is done through the oral cavity, or the mouth if you want to do it through the nasal cavity.</li> <li>- While you are doing these steps begin with deep breathing in the auto oxygenation</li> <li>- Then practice the artificial breathing blowing in the chosen cavity beginning with ten expirations each minute to go on with twelve and fifteen.</li> </ul>                                     |   |
| 4 | <ul style="list-style-type: none"> <li>- During the execution of breathing you have to control observing that the patient's chest dilates, otherwise change cavity in which you blow the air because it could be obstructed.</li> </ul>                                                                                                                                                                                                                                                                                                                                  |  |
| 5 | <p>Do not ever stop the artificial breathing until the patient has recovered or has come the first aid unit.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                       |

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## **I – GENERAL NOTES**

The radio links in frequency modulation A4D-ESxG/1 have been designed and realized to have audio-video connections point to point.

The selectivity of the apparatus is guaranteed by working in double frequency conversion with first intermediate frequency at 1630 MHz obtained using auto-tuning oscillators to improve frequency stability, and by the use of STRIPLINE filters and Surface Acoustic Wave (SAW) filters.

The main requirements of the user which utilizes a radio link telecommunication system are the availability on time of the connection and naturally its quality:

- the necessity to be able to have reliable connections is ensured through the use of quality components and of solid state devices (in detail GaAs) for microwave parts (the low noise preamplifier uses last generation HEMT devices), the only components with mechanical motion parts are the relays used for monitoring guarantying the necessary galvanic insulation; the design of the apparatus has been moreover oriented to determine working points for the different devices which keep themselves in electrical and climatic conditions well inside the guaranteed working limits.

- the quality of signals taken by the radio links A4D-ESxG/1 is defined by chosen components which exploit completely the latest technologies as for the amplification chains at solid state as for conversion devices; the inevitable phase distortions due to filters, necessarily put on signals way, have been balanced with suitable equalizers partially accessible from outside.

Expressly realized following the recommendations of CCIR and Ministry of Communications Superior Institute of communications and information technologies, the frequency modulation radio links A4D-ESxG/1, give an interconnection with different devices and with existing communication nets respecting levels, modulations and impedances.

The modem circuits have been made using PLL (phase locked loop) technique which consent working stability over wide thermal excursions, while the employment of many integrated circuits rather than discrete components reduce the units encumbrance and consumption. A particular care has been taken in monitoring and controlling, letting a careful apparatus check during its normal working allowing so a quick verification of possible anomalies. The possibility to make light external regulations of phase/frequency and amplitude/frequency responses of the net FI, allows the compensation of little distortions due to external factors of the apparatus itself.

The indications about controls and external connections together with the presence of leds which show the state of the net, allows an easy inspection also by non specialized personnel.

The realization in sub-rack EIA 19" 1 unit allows integration with existing telecommunication systems and a very low encumbrance.

## II - CHARACTERISTICS

### II.1 – Net section performances:

|                                             |                                                            |               |
|---------------------------------------------|------------------------------------------------------------|---------------|
| <b>Frequency band</b>                       | 2300 ÷ 2700 MHz                                            | (A4D-ES2G/1)  |
|                                             | 5200 ÷ 5400 MHz                                            | (A4D-ES5G/1)  |
|                                             | 5900 ÷ 6400 MHz                                            | (A4D-ES59G/1) |
|                                             | 6400 ÷ 7200 MHz                                            | (A4D-ES6G/1)  |
|                                             | 7000 ÷ 8000 MHz                                            | (A4D-ES7G/1)  |
|                                             | 8000 ÷ 8500 MHz                                            | (A4D-ES8G/1)  |
|                                             | 10300 ÷ 10680 MHz                                          | (A4D-ES10G/1) |
|                                             | 11100 ÷ 11400 MHz                                          | (A4D-ES12G/1) |
|                                             | 12700 ÷ 13300 MHz                                          | (A4D-ES13G/1) |
|                                             | 14260 ÷ 14500 MHz                                          | (A4D-ES14G/1) |
| <b>Output power</b><br>(tolerance +/- 1 dB) | + 33 dBm                                                   | (A4D-ES2G/1)  |
|                                             | + 30 dBm                                                   | (A4D-ESxxG/1) |
| <b>Noise Figure</b>                         | better than 6 dB at - 40 dBm                               |               |
| <b>Video channel band</b>                   | from 25Hz to 5MHz within 0,5 dB                            |               |
| <b>Video channel deviation</b>              | 8 MHz p.p.                                                 |               |
| <b>Differential gain</b>                    | 2 %                                                        |               |
| <b>Differential phase</b>                   | 2 degrees                                                  |               |
| <b>Video emphasis</b>                       | CCIR 405-1 (disconnectable)                                |               |
| <b>Video interface</b>                      | 1 V p.p. 75 Ohm                                            | conn. 1,6/5,6 |
| <b>Audio channels band</b>                  | 80 Hz at 14,5 KHz +/-0,5 dB                                |               |
| <b>Deviation on subcarriers</b>             | 1 channel 300KHz eff.                                      |               |
|                                             | 2 or more channels 200 KHz eff.                            |               |
| <b>Audio subcarrier deviation</b>           | 70 KHz eff +9 dBm 600 Ohm                                  |               |
| <b>Audio subcarrier frequency*</b>          | 7020 and 7500 KHz or 8065 and 8590 KHz or 7500 and 8065KHz |               |
| <b>Audio emphasis</b>                       | 50 µS (disconnectable)                                     |               |
| <b>FI band</b>                              | from 60 to 80 MHz +/- 0.5 dB                               |               |
|                                             | from 62 to 78 MHz within 3 nS                              |               |
| <b>FI connections</b>                       | +5 dBm at 75 Ohm                                           |               |
| <b>Output interface</b>                     | “N” female connector                                       |               |
|                                             | (A4D-ES2T/1 A4D-ES5R/1)                                    |               |
|                                             | “N” female connector or PDR70 WR137                        |               |
|                                             | (A4D-ES5G/1; A4D-ES59G/1; A4D-ES6G/1)                      |               |
|                                             | PDR84 WR112                                                |               |
|                                             | (A4D-ES7G/1; A4D-ES8G/1)                                   |               |
|                                             | PBR120 WR75                                                |               |
|                                             | (A4D-ES10G/1) (A4D-ES12G/1)                                |               |
|                                             | (A4D-ES13G/1) (A4D-ES14G/1)                                |               |

\*Note: you can choose audio sub-carriers frequencies among those listed; in a sub-rack EIA 19” are available only two audio channels, for further two audio channels another sub-rack EIA 19” is necessary.

## **II.2 – Working climatic conditions for InDoor Unit (IDU):**

Working climatic conditions for indoor unit are:

**Normal:** From +5° to +40° Celsius

**Extreme:** From –5° to +45° Celsius

## **II.3 – Working climatic conditions for OutDoor Unit (ODU):**

Working climatic conditions for outdoor unit are:

**Normal:** From -20° to +40° Celsius

**Extreme:** From –30° to +50° Celsius

## **II.4 – Power supplies:**

Power supply section of each devices has two different inputs: one in alternate current (see fig. on page 16 letter “N”) and another one for direct current (see fig. on page 16 letter “M”).

In this way it's possible to supply our radio links using at the same time, either with normal voltage 110-230V or with a voltage in direct current at 24V as for example the one of batteries plug, so that in the case of a fail of one of two supplies, the devices will continue working with the one that it still on (redundant power supply circuit); when this is happens, the commutation from one supply to another changes automatically.

The switch on button (see fig. on page 16 letter “O”), works only on the alternate current power supply (line 110/230V), while for the use in direct current it is only necessary that it is present in the special connector (see fig. on page 16 letter “M”), in the case that both the power supply parts are available, a device placed inside absorbs power from the 230V line.

Power supply characteristics are reported here below.



|                     |         |                                           |
|---------------------|---------|-------------------------------------------|
| <b>TRANSMITTER:</b> | line    | 110/230 Vca +/-10% 50Hz 45W               |
|                     | battery | 24 Vcc 1.8 A -20%/+30% negative on ground |
| <b>RECEIVER:</b>    | line    | 110/230 Vca +/-10% 50Hz 30W               |
|                     | battery | 24 Vcc 0.8A -20%/+30% negative on ground  |

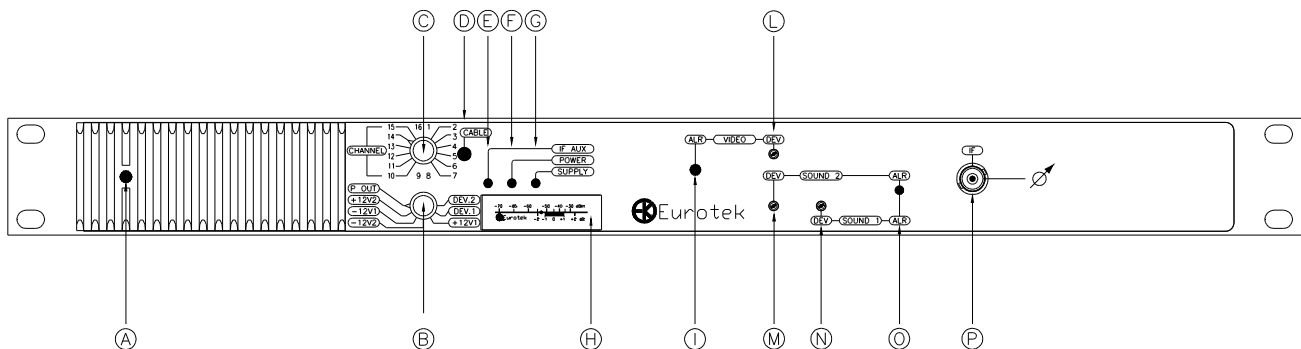
The earth of the radio link is continuously connected to ground through a terminal inside the connection of the protection circuit.

## **II.5 – Mechanical specifications:**

|                |                     | <b>IDU</b>     | <b>ODU</b> |
|----------------|---------------------|----------------|------------|
| <b>Height:</b> |                     | 44 mm ( 1U )   | 120 mm     |
| <b>Width:</b>  |                     | 482 mm ( 19 ") | 76 mm      |
| <b>Depth:</b>  |                     | 312 mm         | 252 mm     |
| <b>Weight</b>  | <i>TRANSMITTER:</i> | 2,7 Kg         | 2,1 Kg     |
| <b>Weight</b>  | <i>RECEIVER:</i>    | 2,8 Kg         | 2 Kg       |

### **III – DESCRIPTION**

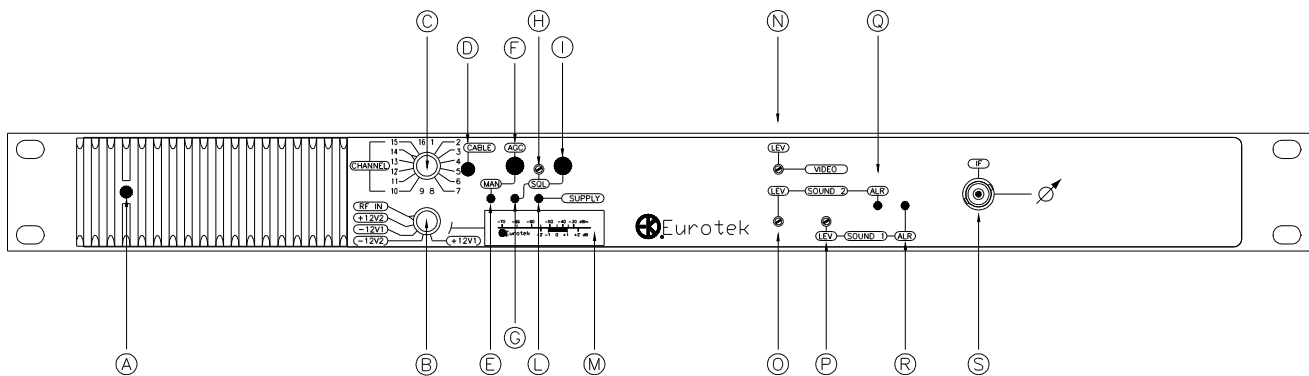
#### **III.1 – Front view of transmitting IDU:**



#### **III.2 – Description of transmitter IDU front-panel:**

- A) Power supply indicator (green Led)
- B) Reading device selector (H) (see paragraph III.9)
- C) Selector for choice of transmission channel
- D) Led for communication fault between IDU and ODU
- E) Input auxiliary IF indicator selected (yellow Led)
- F) Power transmitter alarm indicator: -3dB compared with nominal power (red Led)
- G) Power supply alarm indicator (red Led)
- H) Indicator device (see paragraph III.9)
- I) Unlock PLL modulator 70 MHz indication (red Led)
- L) Sensibility of modulation adjustment of 70 MHz modulator
- M) Sensibility of modulation adjustment of modulator subcarrier audio 2
- N) Sensibility of modulation adjustment of modulator subcarrier audio 1
- O) Unlock of at least one of two audio sub-carriers indication (red Led)
- P) Monitory FI 70 MHz at modulator output (+5 dBm)

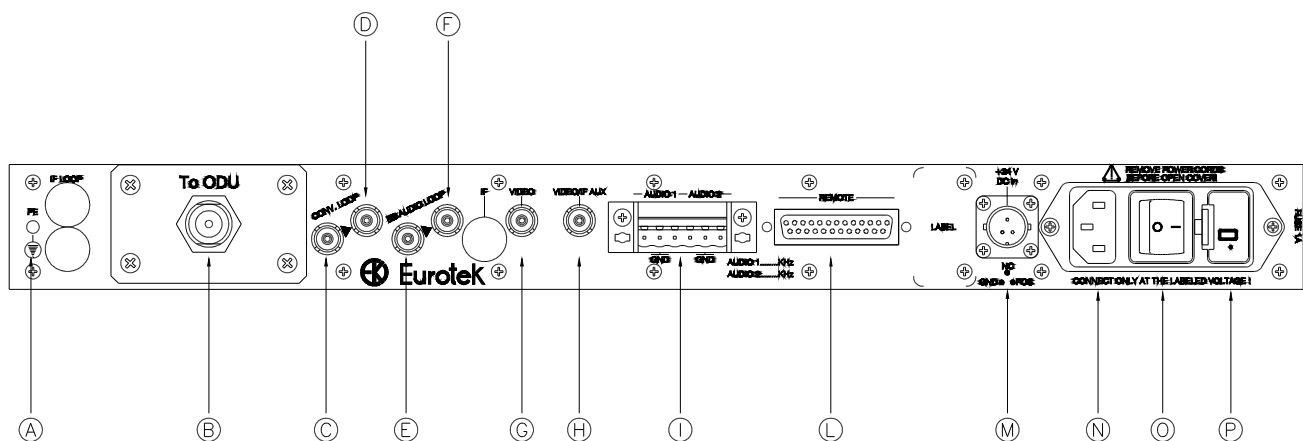
### **III.3 – Front view of receiving IDU:**



### **III.4 – Description of receiving IDU front-panel:**

- A) Power supply indicator (green Led)
- B) Reading device selector (M) (see paragraph III.12)
- C) Selector for choice of reception channel (with ODU arranged only)
- D) Communication fault between IDU and ODU (red Led)
- E) IF gain manual adjustment indicator (yellow Led)
- F) IF gain manual/automatic control selection
- G) Receiver in squelch indication (red Led)
- H) Squelch level adjustment
- I) Enable/disable squelch circuit
- L) Power supply alarm indicator (red Led)
- M) Indicator device (see paragraph III.12)
- N) Video level output adjustment
- O) Audio 2 level output adjustment
- P) Audio 1 level output adjustment
- Q) Alarm sub-carrier 2 indication (red Led)
- R) Alarm sub-carrier 1 indication (red Led)
- S) Monitor FI received (+5 dBm)

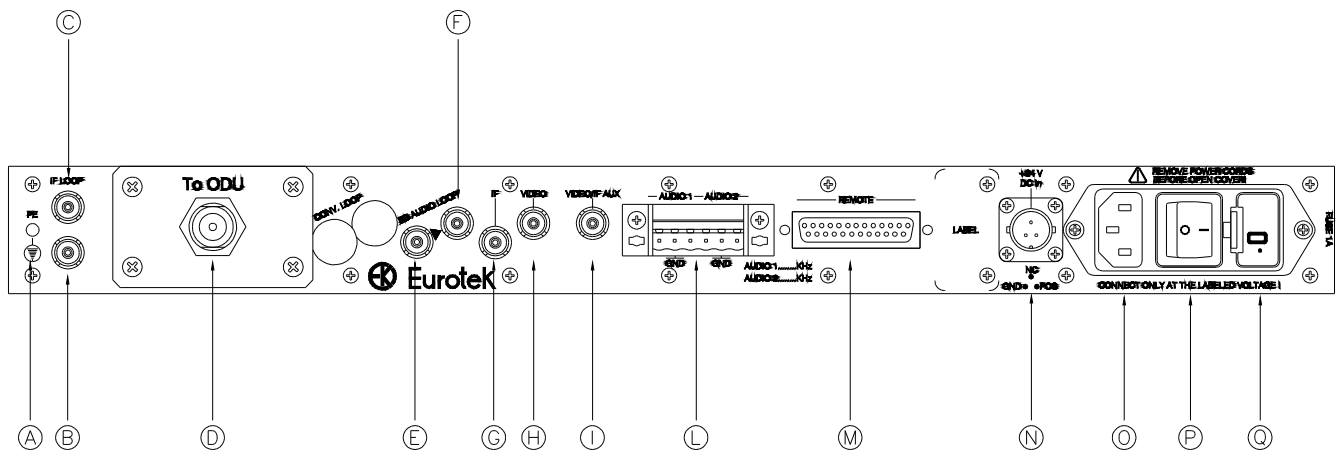
### III.5 – Back view of transmitting IDU:



### III.6 – Description of connections on the back-panel of the transmitting IDU:

- A) Ground clamp (4MA)
- B) Link to ODU through type “N” connector
- C) IF output modulator for converter IF>RF
- D) External unit IF input
- E) Base band output from audio modulators
- F) Base band input for audio modulators
- G) Video input
- H) Auxiliary IF input
- I) Balanced audio inputs
- L) Remote interface connector (see page 45)
- M) Direct current input supply (24V with negative not galvanic insulated)
- N) Alternate current input supply (110/230V)
- O) Alternate current supply switch
- P) Fuses site (n°2 fuses - 1A) and 110/230V selector.

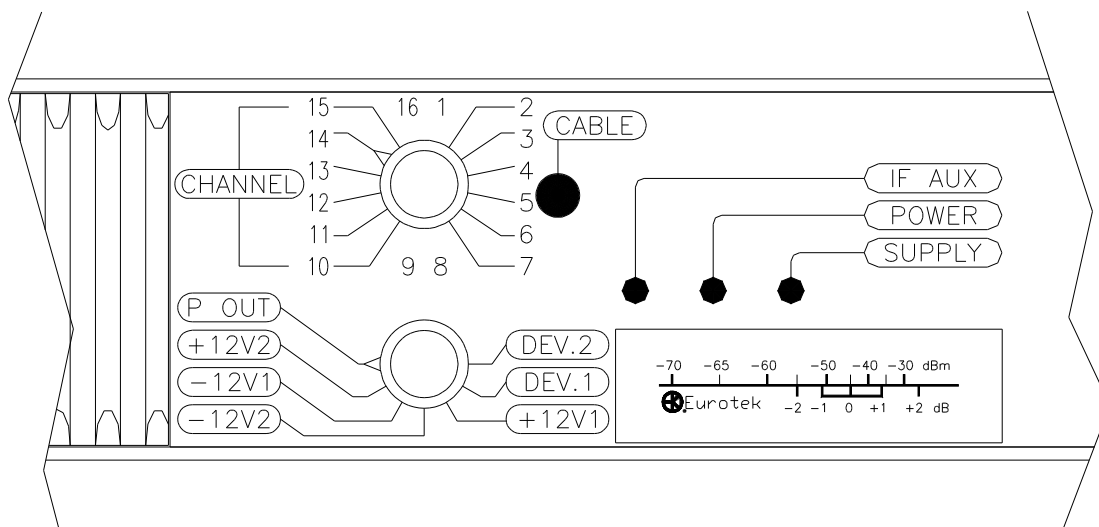
### **III.7 – Back view of receiving IDU:**



### **III.8 - Description of connections on the back-panel of the receiving IDU:**

- A) Ground clamp (4MA)
- B) ODU IF output through type “N” connector
- C) IF input from modulator
- D) Link to ODU
- E) Base band output for audio demodulators
- F) Base band input for audio demodulators
- G) Auxiliary IF output
- H) Video output
- I) Video output
- L) Balanced audio outputs
- M) Remote interface connector (see page 45)
- N) Direct current input supply (24V with negative not galvanic insulated)
- O) Alternate current input supply (110/230V)
- P) Alternate current supply switch
- Q) Fuses site (n°2 fuses - 1A) and 110/230V selector.

### **III.9 - Measures that can be carried out with transmitting IDU device indicator:**



*Note: reading the device measure points is possible to control the state of the apparatus; through the knob you can select the following checks:*

#### **P OUT: SELECTION OF POWER READING**

During standard working, the device indicator has to go into the green label between -1 and +1.

#### **+12V2: VERIFY OF POSITIVE SUPPLY ON POWER SUPPLY 2 [NOT ACTIVE]**

During standard working, the device indicator has to go into the green label between -1 and +1.

#### **-12V1: VERIFY OF NEGATIVE SUPPLY ON POWER SUPPLY 1**

During standard working, the device indicator has to go into the green label between -1 and +1.

#### **-12V2: VERIFY OF NEGATIVE SUPPLY ON POWER SUPPLY 2 [NOT ACTIVE]**

During standard working, the device indicator has to go into the green label between -1 and +1.

#### **+12V1: VERIFY OF POSITIVE SUPPLY ON POWER SUPPLY 1**

During standard working, the device indicator has to go into the green label between -1 and +1.

#### **DEV.1: INDICATION OF DEVIATION LEVEL AUDIO CHANNEL 1**

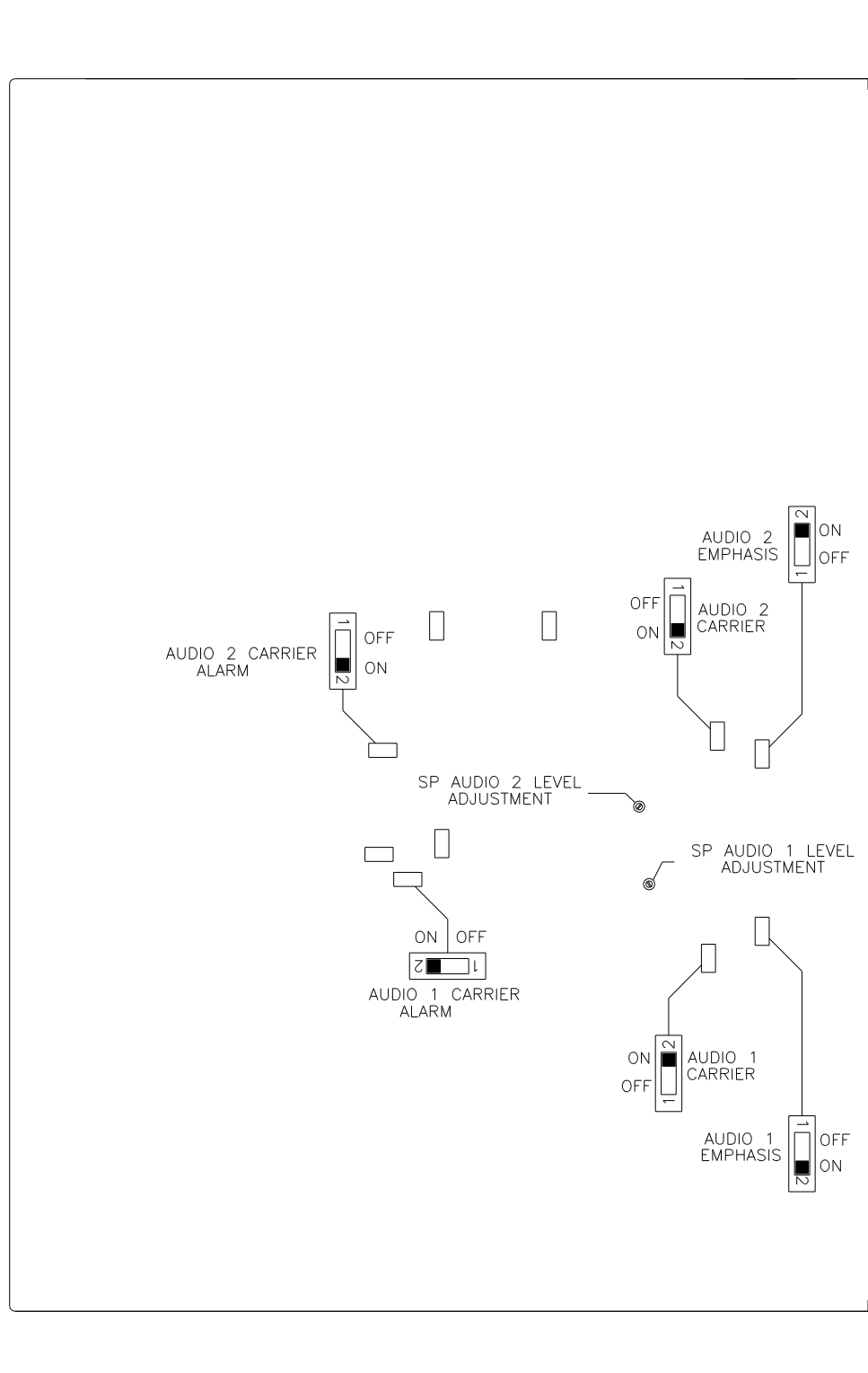
To have a deviation of 70KHz *eff.* the device indicator has to go on 0.

#### **DEV.2: INDICATION OF DEVIATION LEVEL AUDIO CHANNEL 2**

To have a deviation of 70KHz *eff.* the device indicator has to go on 0.

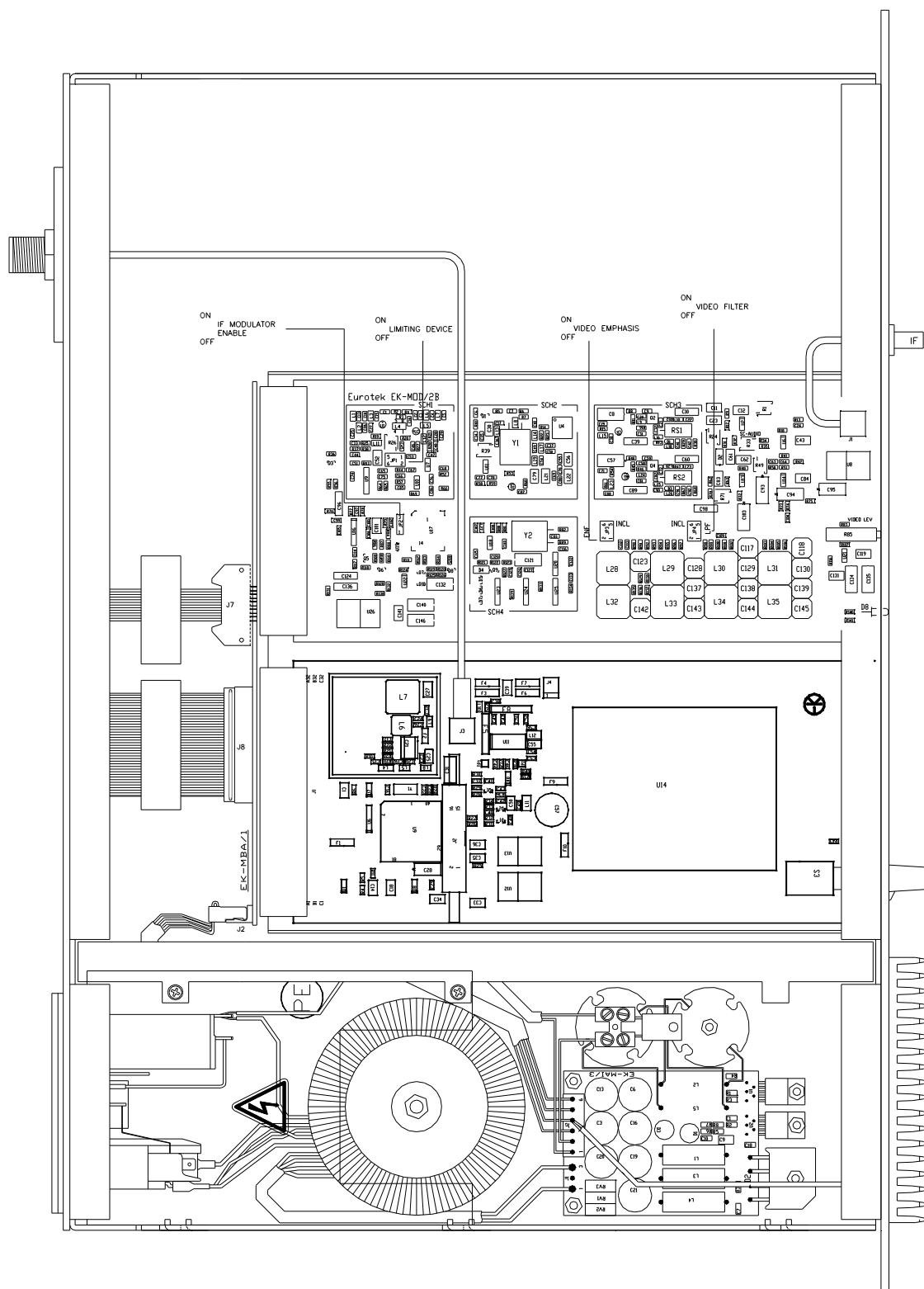
### **III.10 - Position diagram of jumpers on the transmitting IDU:**

*Note: Remember to switch OFF audio alarm when the respective audio carrier is out.*



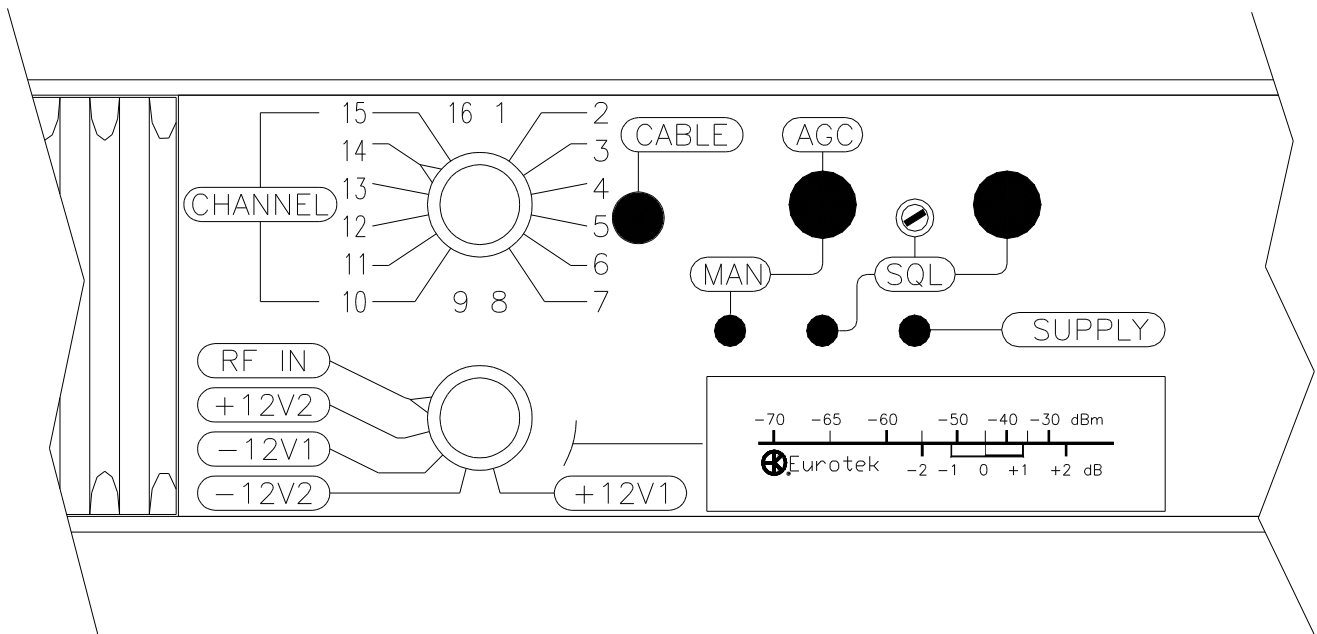
### **III.11 - Internal lay-out of transmitting IDU:**

*Note: remove the cover to change the jumpers position*





### **III.12 - Measures that can be carried out with receiving IDU device indicator:**



*Note: reading the device measure points it's possible to control the state of the apparatus; through the knob you can select the following checks*

#### **RF IN: INDICATION OF THE VALUE OF THE RECEIVED FIELD**

During standard working in the device scale between -70 and -30 dBm will be indicated the value of the received field.

#### **+12V2: VERIFY OF POSITIVE SUPPLY ON POWER SUPPLY 2 [NOT ACTIVE]**

During standard working, the device indicator has to go into the green label between -1 and +1.

#### **-12V1: VERIFY OF NEGATIVE SUPPLY ON POWER SUPPLY 1**

During standard working, the device indicator has to go into the green label between -1 and +1.

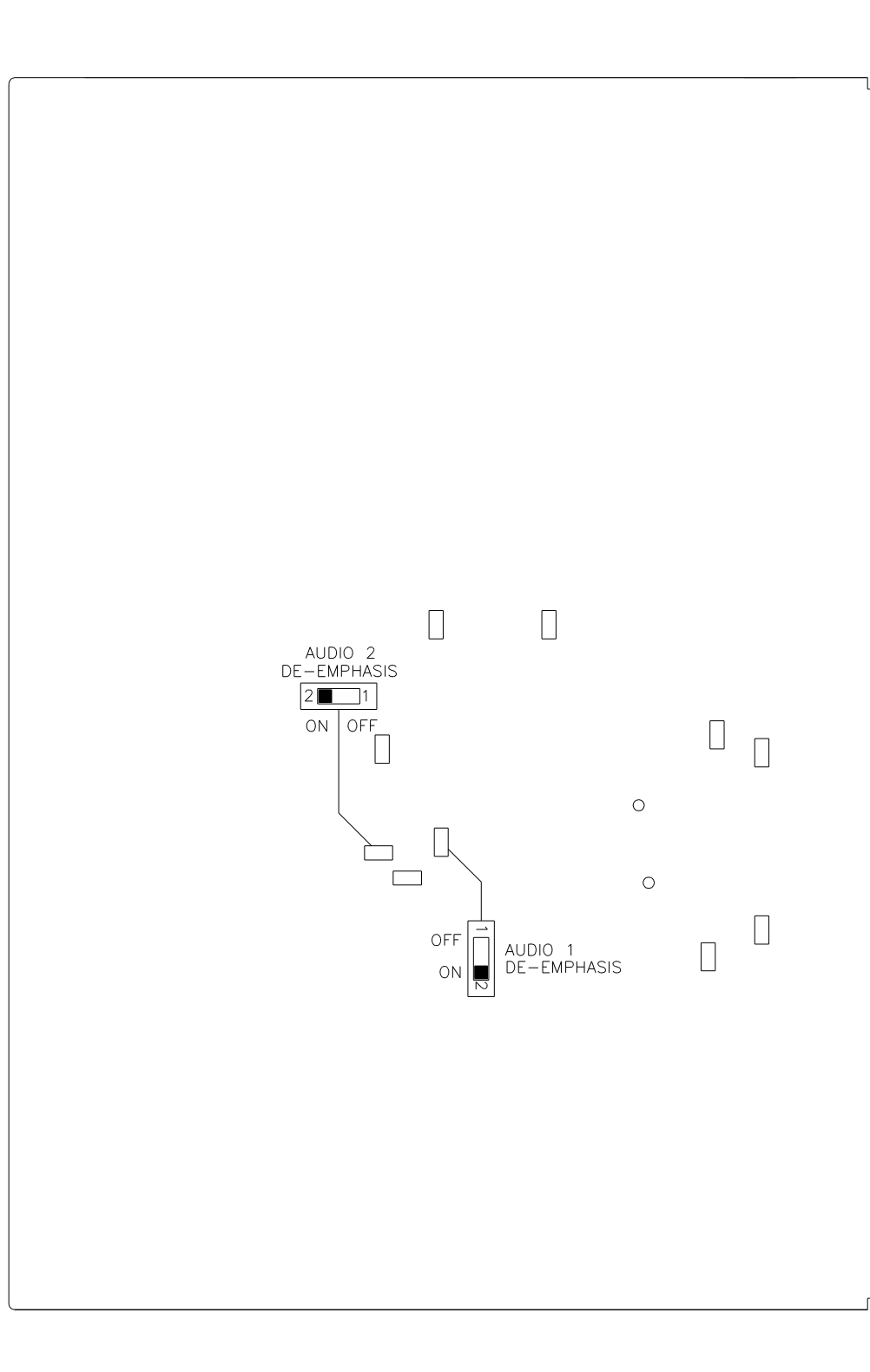
#### **-12V2: VERIFY OF NEGATIVE SUPPLY ON POWER SUPPLY 2 [NOT ACTIVE]**

During standard working, the device indicator has to go into the green label between -1 and +1.

#### **+12V1: VERIFY OF POSITIVE SUPPLY ON POWER SUPPLY 1**

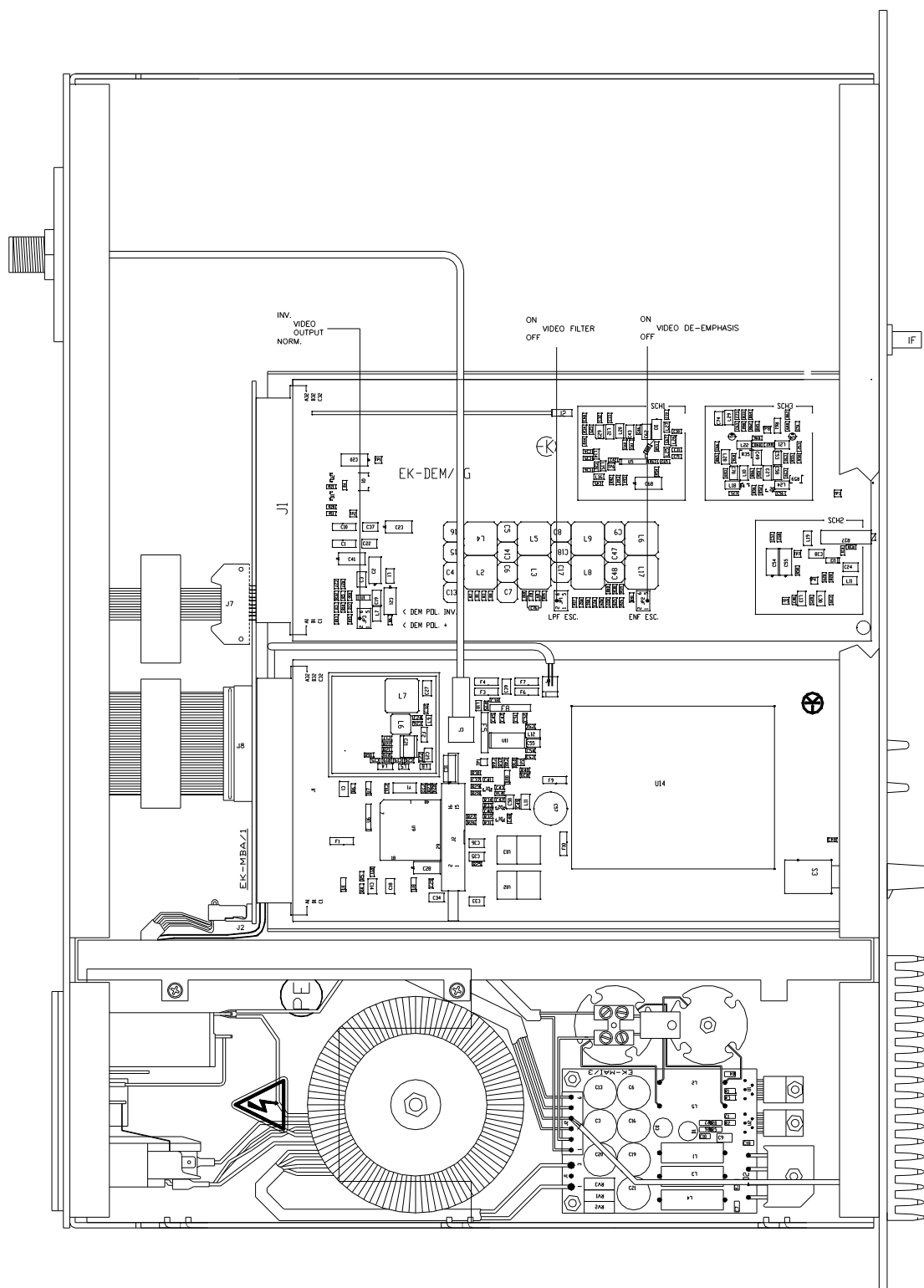
During standard working, the device indicator has to go into the green label between -1 and +1.

**III.13 - Position diagram of jumpers on the receiving IDU:**



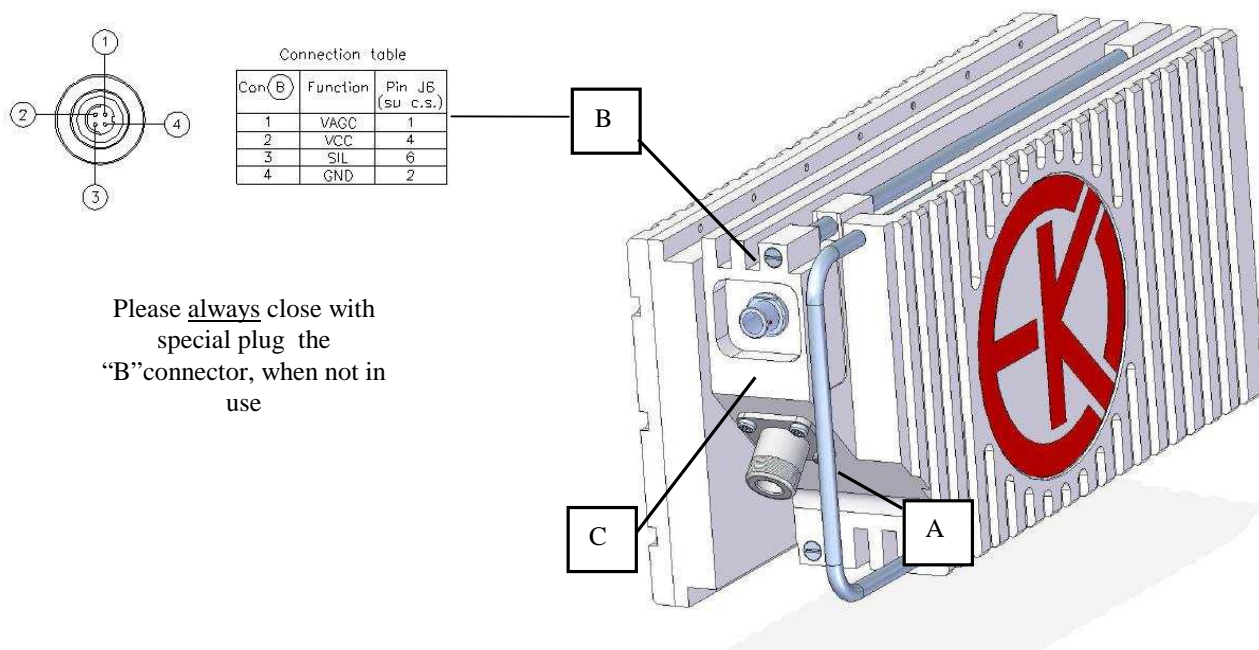
**III.14 - Internal lay-out of receiving IDU:**

*Note: remove the cover to change the jumpers position.*



## IV Odu description

### IV.1 Rear description suitable for receiving ODU:



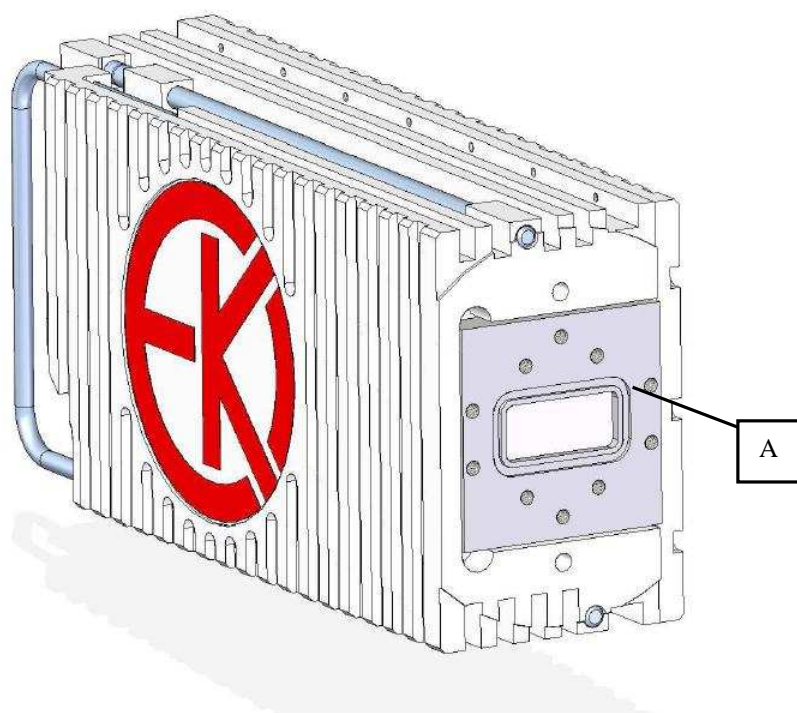
A) ODU<sup>1</sup> support handle

B) Link connector to EK-TMS/2 unit measurement

C) Link connector to IDU (receiver or transmitter)

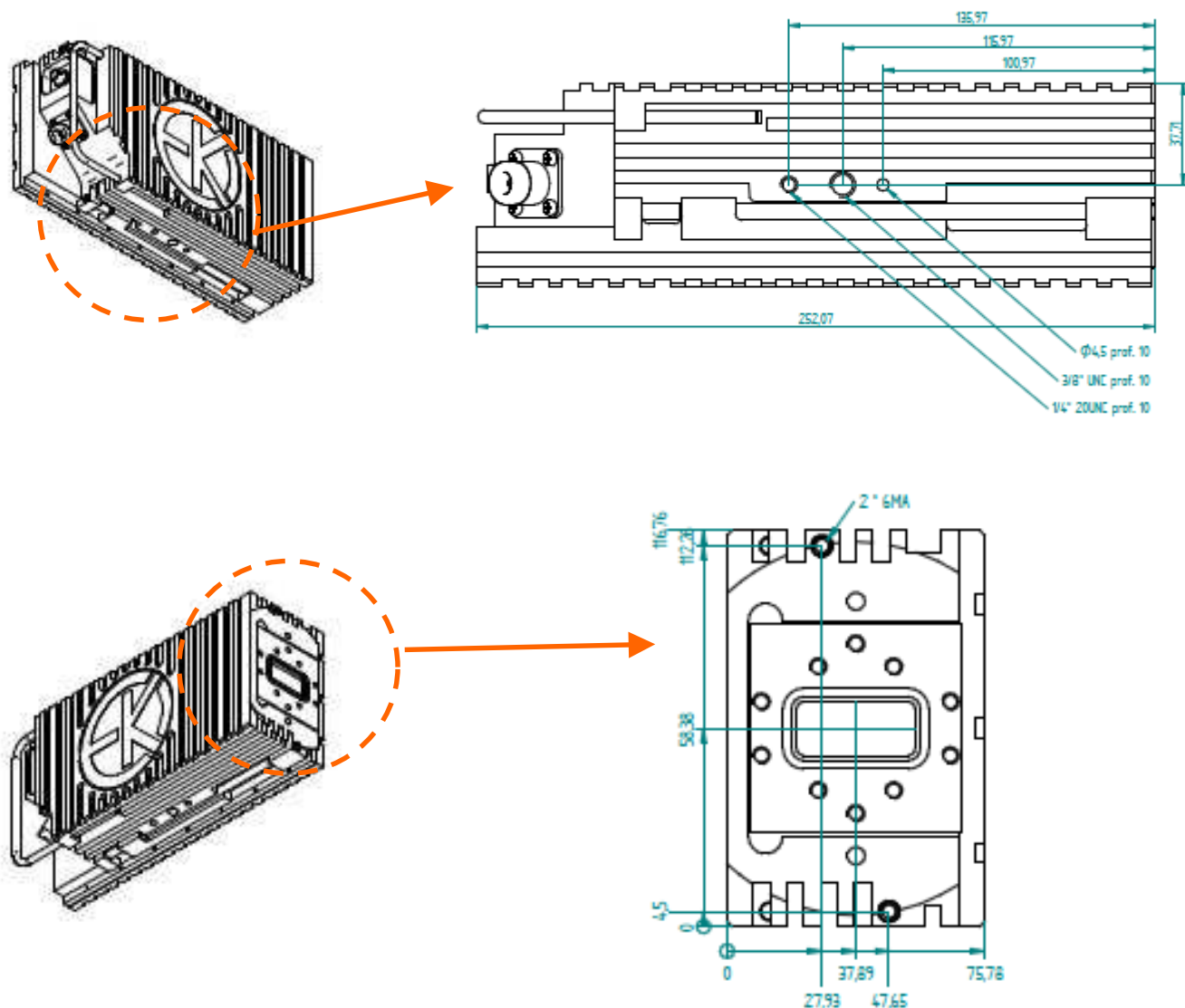
1 – Waveguide orientation in output (when it is present), is parallel to the handle "A"; so pay attention, during the installation, that the handles of two ODU, either the receiving or the transmitting, are oriented in the same way. This in case that the Units are linked to antenna's systems with direct connection to feed in round waveguide.

**IV.2 Front description suitable for receiving ODU:**

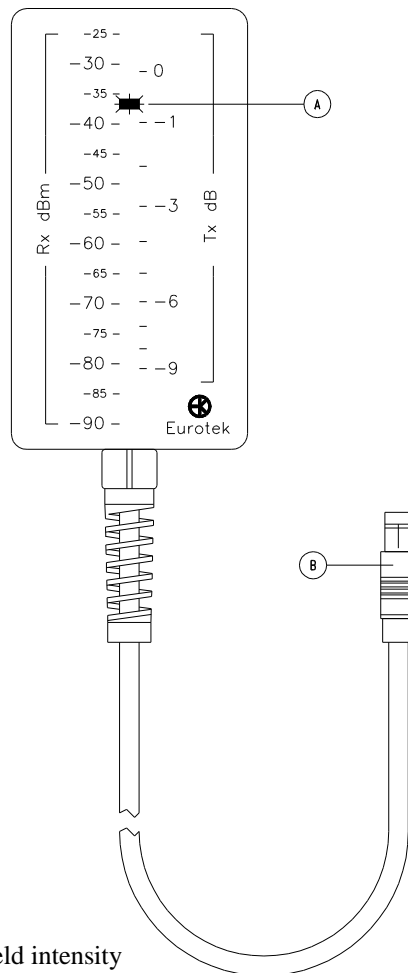


A) ODU wave guide flange (7GHz in the above picture)

### IV.3 ODU Overall dimensions



**IV.4 EK-TMS/2 unit measurement description:**

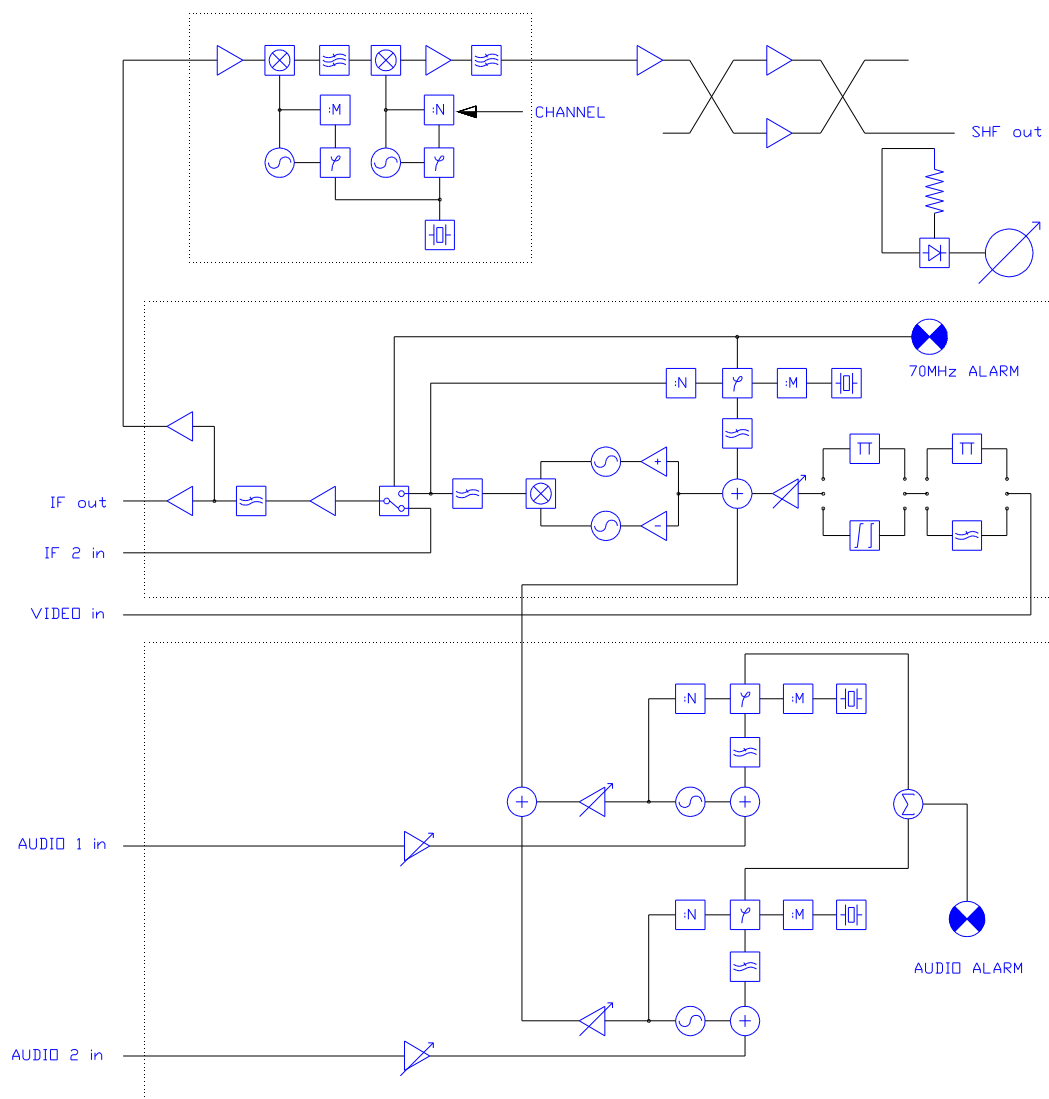


- A)** The device indicates:
- in the receiving ODU, the received field intensity
  - in the transmitting ODU, the transmitted power

Link connector to ODU (see letter B page 12)

## V - WORKING DESCRIPTION

### V.1 – IDU-ODU transmitting block diagram:





## **V.2 – Transmitting working description :**

Video signal in input is filtered to limit its bandwidth to 5,5 MHz and, if opportunely selected, emphasized according to CCIR 405-1 recommendation; a trimmer on the front panel allows to adjust video modulation sensitivity.

Then video signal is mixed with sub-carriers of FDM system modulated by audio signals and stabilized in frequency using phase-locked loop circuits; it is possible to set an emphasis at 50  $\mu$ S.

Audio modulation sensitivity is adjustable using a trimmer placed in the front panel.

The base-band signal is sent to two amplifiers, an inverting one and a non-inverting one, that drive two oscillators; output signals from oscillators are mixed and filtered to obtain a carrier at 70 MHz modulated by base-band signal.

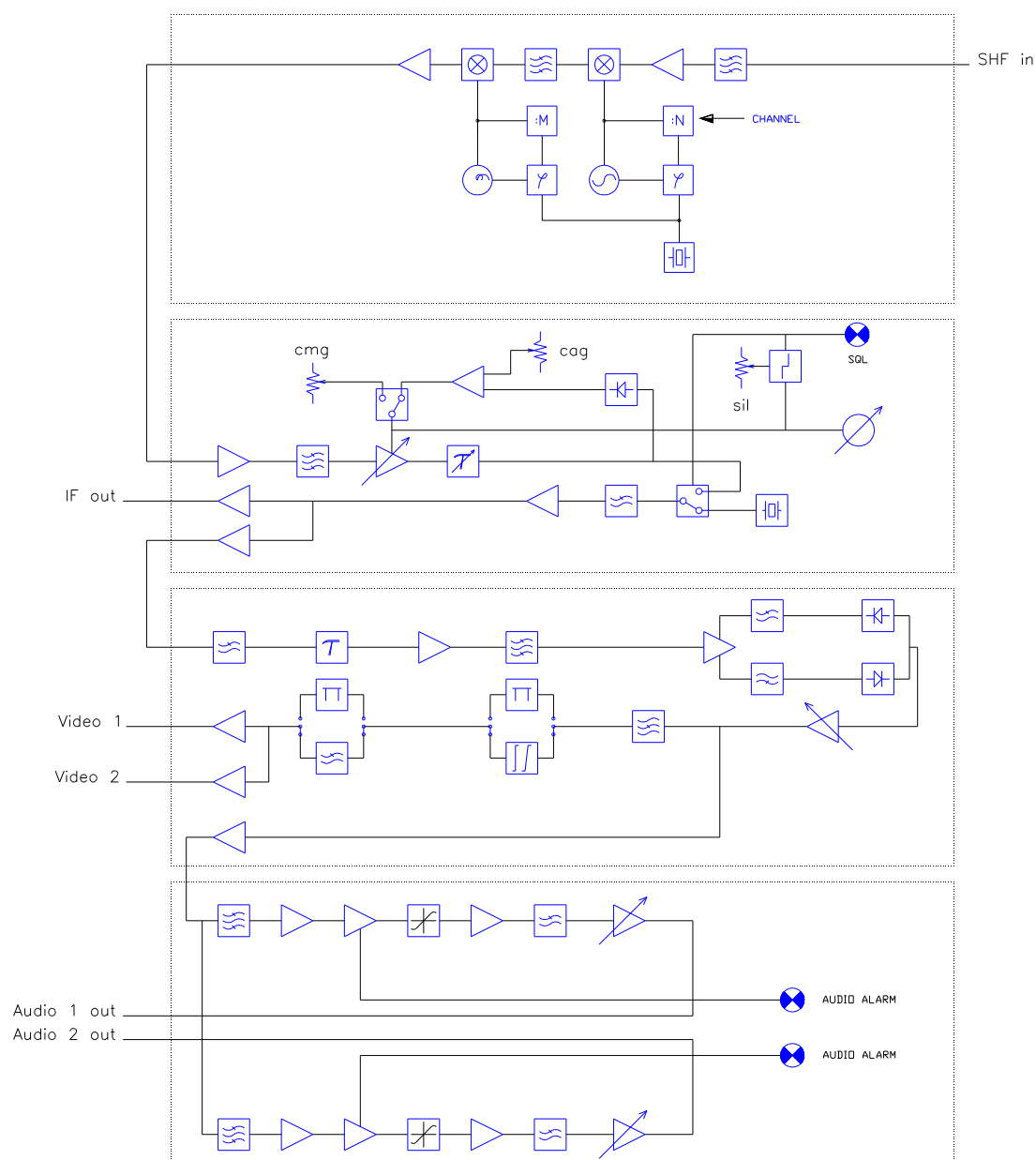
It is also available an auxiliary IF input at 70 MHz that, if its power level is upper than -6dBm, is carried out automatically at IF output port,( we must connect the pin 10 with the pin 1 of the remote connector) replacing modulator output signal; to indicate that auxiliary IF signal is carried out, a yellow led is alight on the front panel.

IF signal is amplified and sent to an auxiliary output port; through a 75 Ohm coaxial cable the signal at 70 MHz is sent to ODU to a double conversion synthesized converter; here the signal is mixed and filtered to obtain an intermediate frequency of 1630 MHz and then again mixed with a signal generated by a local oscillator at now the signal is filtered and sent to the power amplifier.

A detector on power amplifier output allows to see output power level on the front panel indicator and a red led is a light when output power is 3 dB lower than the nominal one.

The right working of all parts of the transmitter is checked by a microprocessor that keeps in memory channels frequencies and manages the synthesized converter.

**V.3 – IDU-ODU receiving block diagram:**



#### **V.4 - Receiving working description:**

The received signal is frequency limited by input filter of the synthesized converter at double conversion; then the signal is firstly mixed with the signal generated by a local oscillator, whose working frequency is set by the channel knob on IDU front panel, to obtain the intermediate frequency of 1630 MHz. The signal is filtered and mixed with the signal generated by a local oscillator at 1630 MHz to obtain the output IF signal at 70 MHz.

Using a SAW filter (Surface Acoustic Wave) is marked the selectivity of the radio link; there are also equalization cells for group delay due to filters.

The amplification chain with variable gain compensates the fluctuation of RF attenuation and keeps at the nominal power level the IF output one.

IF signal is amplitude limited before to arrive to the discriminator; from its output the base-band signal is sent to an amplifier, to a de-emphasizer and filtered to eliminate the FDM audio part.

The audio sub-carriers are filtered and then demodulated to be available at their output ports.

## **VI - INSTALLATION ARRANGEMENTS**

### **VI.1 – Thermal dissipation:**

To favour thermal exchange between IDU part and environment, it is necessary to place each unit spacing out it as far as a rack 1U height both above and under it, always placing the apparatus horizontally.

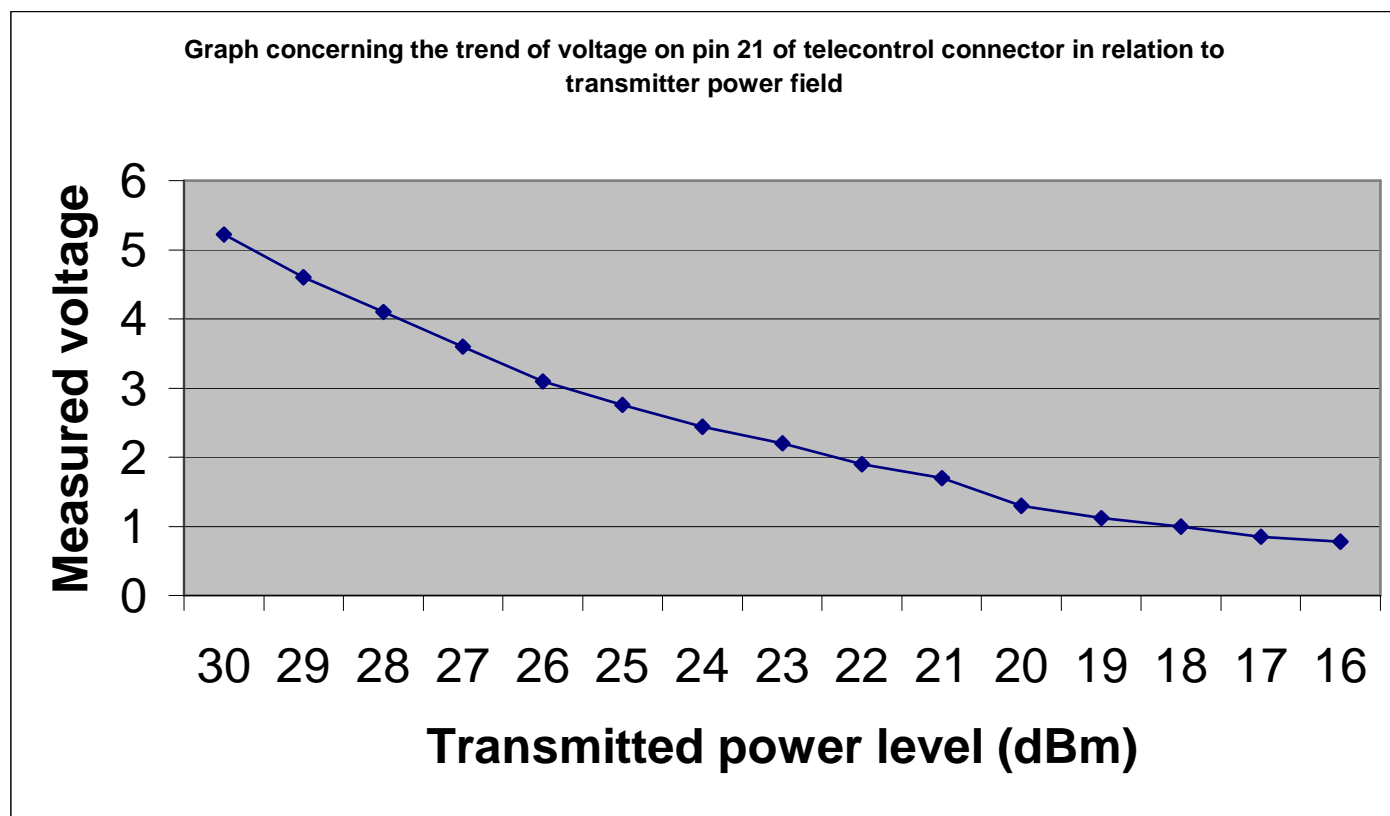
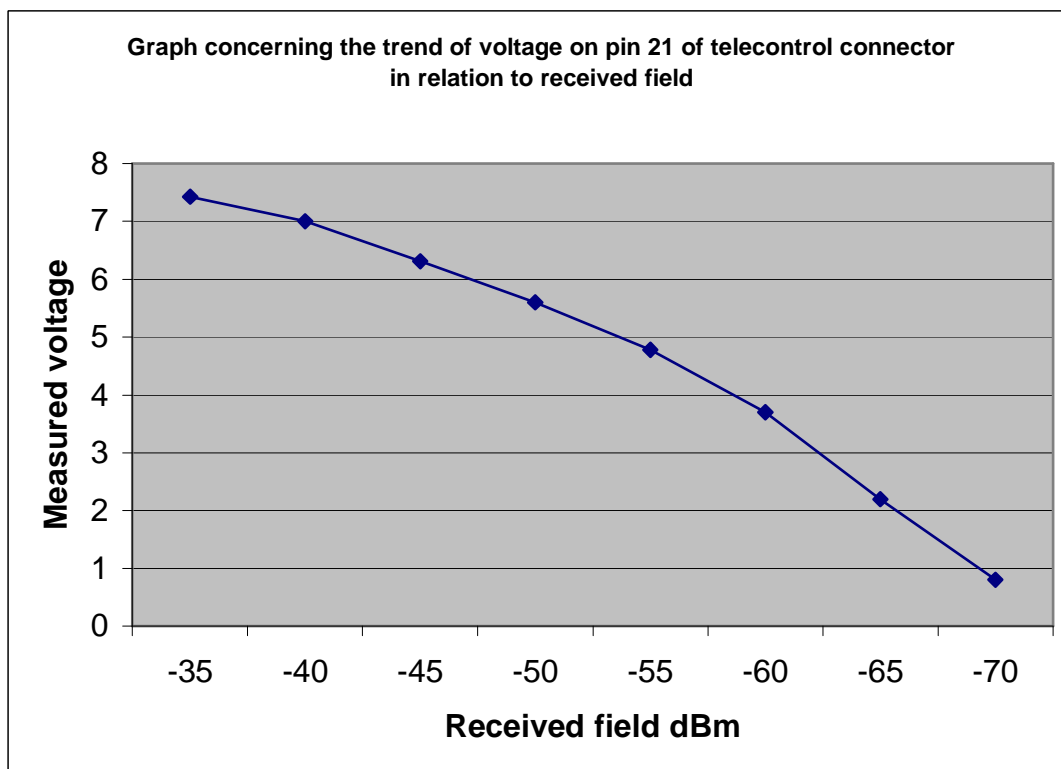
### **VI.2 – Pins of telecontrol connector:**

| <b>Pin</b> | <b>Tx function</b> | <b>Rx function</b> | <b>Contact type</b> |
|------------|--------------------|--------------------|---------------------|
| 1          | GND                | GND                | GND                 |
| 2          |                    | Manual             | N.A.                |
| 3          | IF2                |                    | N.A.                |
| 4          | Not connected      | Not connected      | Not connected       |
| 5          | Mod. unlock        |                    | N.A.                |
| 6          | Not connected      | Not connected      | Not connected       |
| 7          | Audio all.         | Audio all.         | N.C.                |
| 8          | Pwr out            | Squelch            | N.C.                |
| 9          | Pwr supply         | Pwr supply         | N.A.                |
| 10         | IF2                | Not connected      | Command O.C.        |
| 11         | Relais common      | Relais common      | Relais common       |
| 12         | + 12 V2            | + 12 V2            | + 12 V2             |
| 13         | - 12 V2            | - 12 V2            | - 12 V2             |
| 14         | GND                | GND                | GND                 |
| 15         |                    | Manual             | N.C.                |
| 16         | IF2                |                    | N.C.                |
| 17         | Not connected      | Not connected      | Not connected       |
| 18         | Mod. unlock        |                    | N.C.                |
| 19         | Audio all.         | Audio all.         | N.A.                |
| 20         | Pwr out            | Squelch            | N.A.                |
| 21         | Power indication   | Field indication   | See graph.pag 46    |
| 22         | + 12 V1            | + 12 V1            | + 12 V1             |
| 23         |                    | Not connected      | Not connected       |
| 24         | Relais common      | Relais common      | Relais common       |
| 25         | - 12 V1            | - 12 V1            | - 12 V1             |

N.A. = normally open contact

N.C. = normally closed contact

O.C. = active open collector closed on ground



VI.3 – ODU IDU CONNECTION

**VERY IMPORTANT!**

**In place where high emissions of low frequencies signal are present (ex. FM signal), customer's MUST use a coaxial cable Double Shield (e.g.: 1/4" CELLFLEX) in order to connect ODU to IDU**

**VII - CANALIZATION**

**VII.1 - Canalization not available. Please contact EUROTEK offices.**

**Eurotek S.r.l.**

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