A total of 8 main operational functions are performed by the circuitry assembled on the module 4456. Please refer to the module 4456 block diagram.

### 3.10.1.1 Module 4456 – CIM3347 - Power Factor Corrector, PFC

The PFC circuit is a power supply built according with the “boost regulator in continuous mode (CCM)” topology. Under the CCM topology, is possible guarantee a power factor, cosφ above than 0.9. The PFC circuit is composed by a full diode bridge that performs a full-wave rectification on the AC signal, which than is routed to the boost inductor. The voltage is so boosted up to +385V. The power factor correction is obtained by the switching a MOSFET transistor, which controls the electrical current into the capacitors that are components of the output rectification filter. The switching operation is performed at the frequency of 100MHz.

#### 3.10.1.1.1. CIM3427 - PFC Control unit

The PFC switching operation is controlled by a bit stream. This control’s bit stream is generated by an integrated circuit with 2 loops that are self-protected against short circuits. The function of this control is to keep stable the +385V voltage at the PFC’s output.

### 3.10.1.2 CIM3447 – Full Bridge - +32 Volts Fixed

The full bridge circuitry is also located at the PCB CIM 3447 as part of the module 4456. This circuit is designed to step down the +385V to +32V keeping the same power rate, meaning it enable the voltage to delivery more electrical current. The full bridge topology is favorable to high power management operations. The circuit has 4 transistors technology IGBT, (Insulated Bipolar Gate Transistor). Via a step down high current transformer, the high voltage, 100 kHz, pulses are reduced down to +32V, in sequence than rectified and filtered, becoming the +32 FIXED voltage.

### 3.10.1.3 +15 Volts Direct

The +15V Direct is a linear power supply circuit located at the PCB CIM 3447. A power transformer is directly connected to the 208 VAC mains. From this power supply is extracted:

(A) +15VDc voltage that feeds the SCU (CIM 3297) exclusively,
(B) +18VDc routed to the control of the PFC circuit, located at CIM 3447
(C) +15VDc routed to the full bridge control, located also at the CIM 3447.

### 3.10.1.4 Full Bridge Control and Output Voltage Reading

The PCB CIM 3429, functionally associated to the CIM 3447, is in charge to generate the pulses that will control the full bridge circuitry. On this PCB is located the trim pot TPO-1 that adjust the +32V. On this PCB is also located the trim pot TPO-2 that adjust the over current protection. A third function is the voltage sensor reading circuit, which can be adjusted by the trim pot TPO-3. The output of this sensor is routed to the SCU, PCB CIM 3297.

### 3.10.1.5 Shut Down

When an abnormal failure situation occurs inside the exciter drawer, the SCU generate a SHUT DOWN command that is a +5V direct connected to the pin # 1 at the connector CON-5 located at the PCB CIM 3429. Since this voltage is present, the switching pulses will be inhibit and as consequence, all the DC output available at the sub-module 4456 will be disabled and be no longer available, exception for the +15Vdc DIRECT, that feeds the SCU.

*IMPORTANT: On maintenance situation the module 4456 the automatic operation, AUT, can be turned on a manual MAN, operation by changing the position of the jump CON-3. The SHUT DOWN command as a protection it is always set as 0V at the PCB CIM 3297.*

### 3.10.1.6 Re-powering the Transmitter ON

Considering the UHF exciter drawer the +32V ON/OFF associated to the sub-module 4456 is used exclusively to feed the 75W RF pallet amplifiers, sub-module 4451.

From the +32V FIXED output, derives the +32V ON/OFF which is controlled by the SCU via the re-power up command. During normal conditions the re-power up command send a +5V voltage to the pin #2 at the connector CON-5 located at the PCB CIM 3429, part of the sub-module 4456. At the presence of this command, one transistor will be saturated and as consequence, the +32V ON/OFF out put will be enabled.

The re-power up +5V command will always be present as an output from the PCB CIM 3297.

### 3.10.1.7 Buck Converters

There are 3 buck converters located at the sub-module 4456. The +32V FIXED feeds these 3 circuits simultaneously, responsible for the following DC voltages:

- +2.5V @ 5A – PCB CIM 3460.
- +5V @ 5A – PCB CIM 3459.
- +15V @ 2A and -15V @ 200mA – CIM 3461

### 3.10.1.8 Module 4456 – Technical Specifications

| FEATURE | SPECIFICATION |
|---|---|
| GENERAL | |
| INPUT AC VOLTAGE | 180 TO 260VAC |
| SWITCHING FREQUENCY | PFC = 100kHz<br>FULL BRIDGE = 100kHz |
| LINE REGULATION | BETTER THAN 2% FOR ALL OUTPUTS |
| OUTPUT NOMINAL VOLTAGES AND CURRENTS | +32V / 2A<br>+32V RESTARTED / 15A<br>+15V / 2A<br>-15V / 200mA<br>+5V / 5A<br>+2.5V / 5A |
| RIPPLE | BETTER THAN 250mV |
| LOAD REGULATION | BETTER THAN 2% FOR ALL OUTPUS |
| EFFICIENCY | BETTER THAN 80% |
| OUTPUT OVERCURRENT LIMIT | 30% UPPER NOMINAL VALUE |
| SHUTDOWN VOLTAGE | HIGH LEVEL: > 0.7 TO 5Vdc<br>LOW LEVEL: < 0.7Vdc |

## 3.11. PCB CIM3297 – Subordinate Control Unit (SCU) on Module 4456

The module 4456 is equipped with its own control unit. This control unit is assembled as the same of the master control unit MCU, both CIM3297, however the software that runs each one are not the same. The SCU is on constant two ways communication with the MCU.


Fig.3.14: SCU assembled at the exciter drawer GV4456 – module 4456

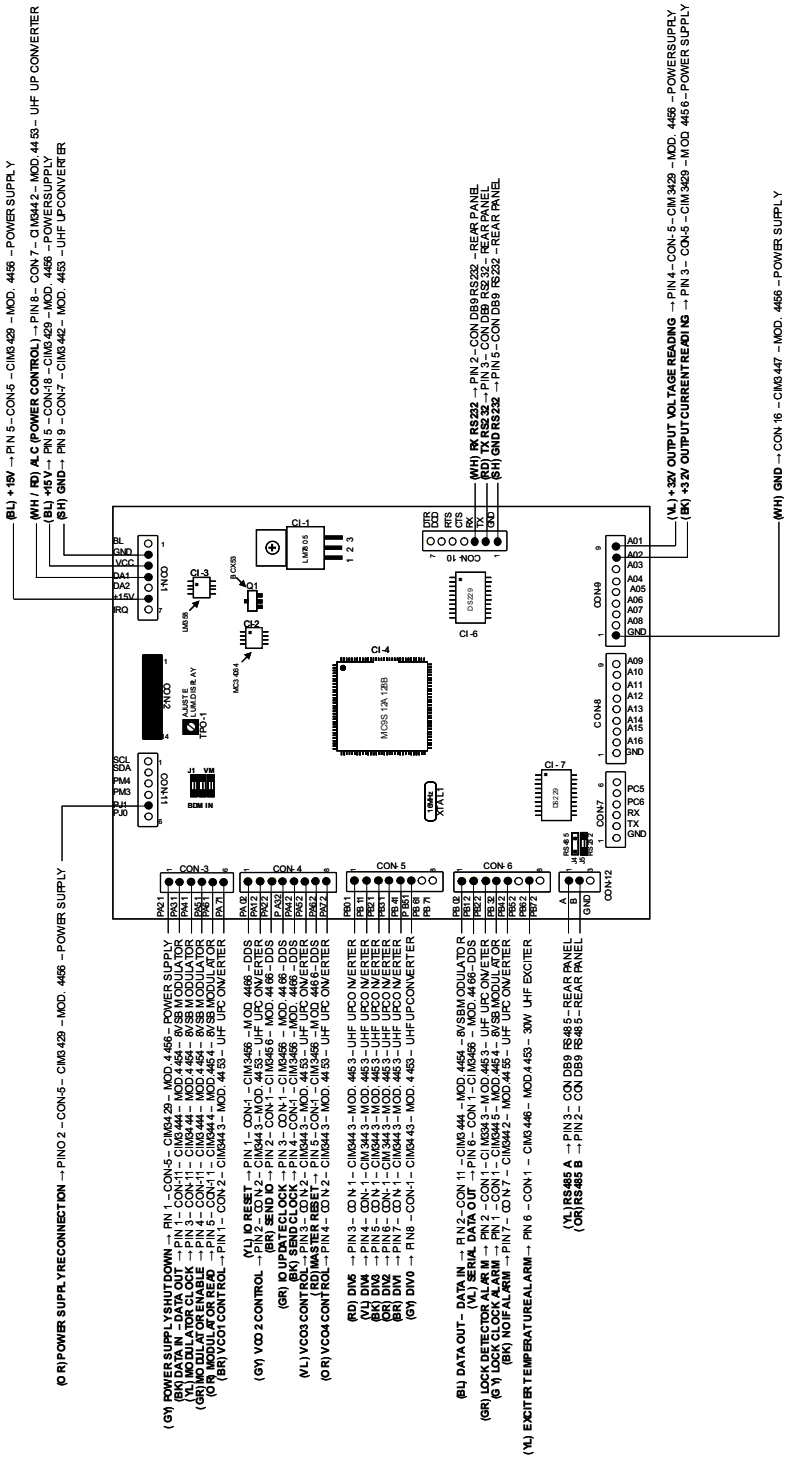



Fig. 3.15: Pin-To-pin recognition from PCB CIM 3297, SCU version

Assemble on the PCB CIM 3297 on the 20W UHF ATSC exciter drawer, module 4456, are the following controlling functions:

### 3.11.1. Digital Control

The CI-4, (MC9S12A128B) is the microcontroller that manages all the sub-modules assemble on the module 4452. CI-4 is factory pre-programmed, carrying an assigned number and software version. Regarding to the UHF exciter, the software number is AT1002 version 1.0, when available further upgrades will be issued as new version numbers.

IMPORTANT: In the case of substitution of the microcontroller, on this PCB (CIM 3297) on the exciter UHF drawer, it is mandatory to correctly inform to the factory the software number and its version. These numbers are printed on the case of the component.

### 3.11.2. Analog Readings

As shown on Figure 10, to the connector CON-9 on the PCB CIM 3297, at the UHF exciter drawer, is directed analogs information referred to the power supply sub-module 4456 on the following parameters:

- +32Volt output.
- Current consumption at the same output.

From the connector CON-9 these readings feed the microcontroller CI-4, from where those are digitalized and processed. By software decision, the microcontroller sets the nominal value for these readings always +4V, meaning, to all nominal values the +4V will be assigned, and will be available at the CON-9. These values are transferred to the main LCD display on the MCU.

Several reference points are spread over the power supply sub-module 4456, delivering respective readings on voltage and current. By each one of these points there are trim pots. During the pre-adjust procedures, these trim pots should be adjusted to set +4V on the designated reference point. This +4V adjusted voltage will be read by the PCB CIM 3297. For instance: When +32V is reached, the voltage at pin #4, at the connector CON-18 at CIM 3429 should be adjusted to +4V, by trimming the trim pot TPO-3. The same voltage (+4V) is than transferred to the CIM 3297, at pin #1 at the connector CON-9. See session 3.1.6, sub-module 4456 description for more details.

### 3.11.3. Alarms Detection

At any time a UHF exciter drawer internal alarm is set the its correspondent SCU (PCB CIM 3297) immediately reduces to 0V (zero) the “trellis” level delivered to the up-converter, sub-module 4453, as consequence, the RF power at the out put connector is reduced to 0 watts. See also session 3.11.6. RF power control. The alarms that are available at the UHF exciter drawer, and can be processed by the PCB CIM 3297 are the following:

| Event | Location | Alarm set |
|---|---|---|
| • Drawer TEMPERATURE. | Sub-Module 4455 | Above 149°F (+65°C) |
| • Phase Lock Loops. | Sub-Module 4453 | Unlock |
| • 8VSB IF Signals (I/I’) or (Q/Q’). | Sub-Module 4454 | Absence of any |
| • Master clock | Sub-Module 4454 | Erratic |

All alarms listed above, are available at the connector CON-6 at the PCB CIM 3297, as digital format. Normal operation is logic level 1, (or +5V). Alarm is set, meaning abnormal operation is logic level 0, (or 0V).

In the sequence of the alarm processing, from the connector CON-6 the signals are routed to the microcontroller CI-4. Throughout of serial interface RS485 these alarms information are routed and displayed on the LCD at the front panel of the MCU unit termed as “drawer’s alarms”.

### 3.11.4. Communication to 8VSB Modulator

The communication link between the SCU (CIM 3297), and the 8VSB modulator (sub-module 4454, is performed by a set of connections that together are termed “serial interface gates”, SPI. These connections are present from the pin #2 up to the pin #5 at the connector CON-3 and also present at pin #1 at the connector CON-6. This communication link is needed to transfer information regarding dynamics parameters configuration, like; 8VSB signal pilot level.

### 3.11.5. Channel Programming, UHF/DTV/ATSC

The desired UHF channel programming is set directly on the exciter drawer, at the PCB CIM 3297. From the CIM 3297 data streams will be routed to the up-converter, sub-module 4453, and set the VCO, and set the PLL synthesizer division rate.

The UHF channel programming task is to decide which one out of 4 possible VCO’s will be activated. The VCO is digitally enabled, meaning logic level 0 (or 0V) meaning enable, and logic level 1 (or +5V) meaning disable. This information is available at pin #3 at connector CON-3 (for VCO1) and at pins # 2, 6 and 8 at the connector CON-4 for (VCO2, VCO3, VCO4).

The PCB CIM 3297 also is in charge to program the PLL division rate at the sub-module 4453. The rate number N vary from 0 up to 31. These numbers have digital format set by the streams DIV0 to DIV5, available at the pins #1 up to #7, at the connector CON-5.

For the first time, the channel programming is set from the factory (not accessed by the user) through the MCU, module 4459. Every time the equipment is turned on, the PCB CIM 3297 automatically select the correct VCO, and the PLL division rate number, on the sub-module 4453.

### 3.11.6. RF Power Control

The RF out put power adjust is made directly from the external LCD touch screen display located at the main control unit, MCU, module 4459. The chosen power level is digitally transmitted to the PCB CIM 3297at the UHF exciter drawer via a RS485 communication link. From digital format the information is converted to continuous analogs level of voltage, present at the pins #4 and #5 at the connector CON-1 located at the PCB CIM 3297. This set level is routed to the pin #8 at the connector CON-7 located at the up-converter, sub-module 4453. This specific set level is termed “trellis voltage” and is displayed to the out side world at the main LCD screen as V.P. Adj.

The trellis voltage is directly proportional to the RF power level at the output of the transmitter. As higher the trellis level is, higher the power will be. At the nominal level, the ALC voltage will be read into the interval between +4V and +5V.

Some fault events will trigger the ALC down to 0V, and as consequence the RF output power will also drop to 0 watts, by shutting down the RF power at the exciter drawer. On other words, the trellis voltage equal 0v. The above mentioned fault events are listed on the table below:

| Event | Location | Alarm set |
|---|---|---|
| • Drawer TEMPERATURE. | Module 4455 | Above 149°F (+65°C) |
| • Phase Lock Loops. | Module 4453 | Unlock |
| • 8VSB IF Signals (I/I') or (Q/Q'). | Module 4454 | Absence of any |
| • Master clock | Module 4454 | Erratic |
| • Fan fuse | Transmitter rack | Open |

The procedure described on this section is validated only if the transmitter operation mode is configured as AUTOMATIC MODE. (SetUp/Transmit/ReStart: AUTO).

At the time when the transmitter is powered ON, there is a 5s time lapse termed as RAMP TIME. During this period, the trellis voltage will raise from 0V up to the pre-set nominal level associated with the nominal transmitter output RF power.

### 3.11.6.1 Off-set Frequency Programming

The Linear ATSC/DTV UHF transmitter channel is factory set. On the top of the chosen frequency channel an off-set frequency can or not be added. If that is the case, the off-set frequency can be positive or negative on values between as low as 1Hz up to the maximum of 20 kHz.

The digital direct synthesizer circuit, DDS, sub-module 4466, generates the off-set frequency at steps of 1Hz. The chosen off-set value is however programmed at the PCB CIM 3297, which is than feed-backed to the DDS sub-module, throughout the pins #3, #4, #5 and #7 at the connector CON-4.

Every time when the transmitter is powered on, the PCB CIM 3297 at the exciter drawer automatically sets the programming for the up-converter sub-module 4466. The initial program set to the PCB CIM 3297 is made in the factory by means of the LCD touch screen display, but not accessible to the user during the transmitter field operation.

### 3.11.6.2 Re-powering the Power Supply

The SCU PCB located at the exciter drawer, CIM 3297, controls the exciter drawer power supply, sub-module 4456. The main commands are RE-POWERING, and SHUT DOWN, represented by +5V for able, or 0V for disable. These commands act as protection commands.

The RE-POWERING information (+5V), is available at the pin #5 at the connector CON-11. In case of the absence of this voltage, the sub-module 4456 interrupts the +32V ON/OFF power supply one, that feeds the 30W UHF ATSC driver power amplifier, sub-module 4455.

The SHUT DOWN information (+5V), is available at the pin #1 at the connector CON-3. In case of presence of this voltage, interrupts the power supplies drain with the voltages of +2.5V, +5V, +15V, -15V and +32V ON/OFF.

It is important to note that the +32V FIXED voltage (feeds the DC/DC converter, sub-module 4147, that is connected to the MCU), and the +15V DIRECT voltage (feeds the PCB CIM 3297 at the exciter drawer) are not affect by the SHUT DOWN command.

### 3.11.6.3 Serial RS485 Communication

The SCU (CIM 3297) is run by the MCU (Module 4459). The communication between these 2 command units is made via RS485 and on both units by the CON-12. For the SCU at the exciter drawer, the CON-12 is connected to the DB9 connector located at the drawer rear panel, labeled as RS485.


Fig.3.16: MCU-SCU communication access RS232 & RS485 connectors

### 3.11.6.4 Serial RS232 communication

It is possible to access the SCU's command at the exciter drawer locally. To perform this procedure, it is necessary to connect a PC that runs Windows Hype-Terminal at the DB9 connector located on the rear panel of the exciter drawer. This connector routes the external data stream to the internal connector CON-10 located at the SCU PCB CIM 3297 that is in fact the RS232's gate.

## 3.12. Module 4456 – sub-module 4470 – CIM3458 – Multiple Voltage Regulators

Some modules build-in to the exciter drawer module 4456, require specifics voltages values. These special voltages are provided by the voltage regulator PCB CIM3458, termed as sub-module 4470.

The regulator devices provide the following voltages according with the table below:

| Module 4470 – Voltage Regulators – CIM3458 / CIP8369 | | |
|---|---|---|
| **V in** | **REGULADOR ID** | **V out** |
| +2,5V (CON-4) | CI-2 | +1,2V (CON-9) |
| +5V (CON-3) | CI-1 | 3,3V (CON-8) |
| +15V (CON-2) | CI-3 | +8V (CON-7) |
| +15V (CON-6) | CI-4 | +12V (CON-6) |

## 3.13. GV4452 – Schematic Diagram: SEE ANNEX A

**3.11.2.** Module 4454 - 8VSB Modulator and MASTER Clock Generator
**3.11.3.** Module 4453 - IF/UHF Up-Converter
**3.11.4.** Module 4466 – DDS
**3.11.5.** Module 4464 - 20W UHF / ATSC
**3.11.6.** Module 4456 - Power Supply
**3.11.7.** PCB CIM3297 - Subordinate Control Unit (SCU)
**3.11.8.** PCB CIM3458 – Multiple voltage regulator

# Section 4 – Intermediate Directional Coupler, RF Power (1:2) Splitter & (2:1) Combiner

### Module 4488

## 4. General Description

The readings for direct and reverse RF power transmission on the exciter drawer on the ADVANCED TV line of transmitters are display on the frontal panel of the main control unit, module 4459.

The shown values for direct and reverse power levels are RMS values, referred to the 8VSB modulated carrier. The directional couplers are continuously delivering a DC voltage proportional to the each kind of power level.

Fig.4.1: Module 4488 - Intermediate Directional Coupler

The directional coupler is based on a 50Ω coaxial transmission line. By coupling, two other lines collect samples of the RF signal to be detected, DC converted, amplified and delivered to the MCU that read, interpret, process and display the results.

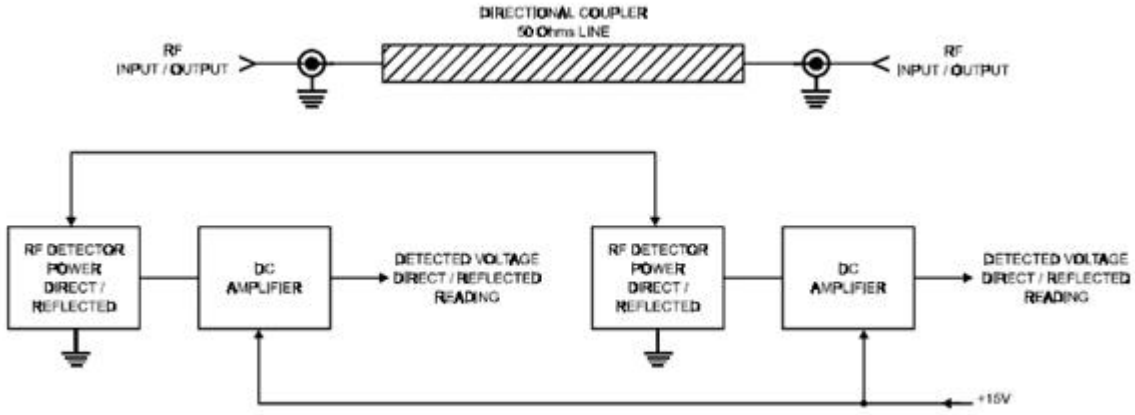



Fig.4.2: Module 4488 block diagram

## 4.1. Module 4166 - Directional Coupler Cells

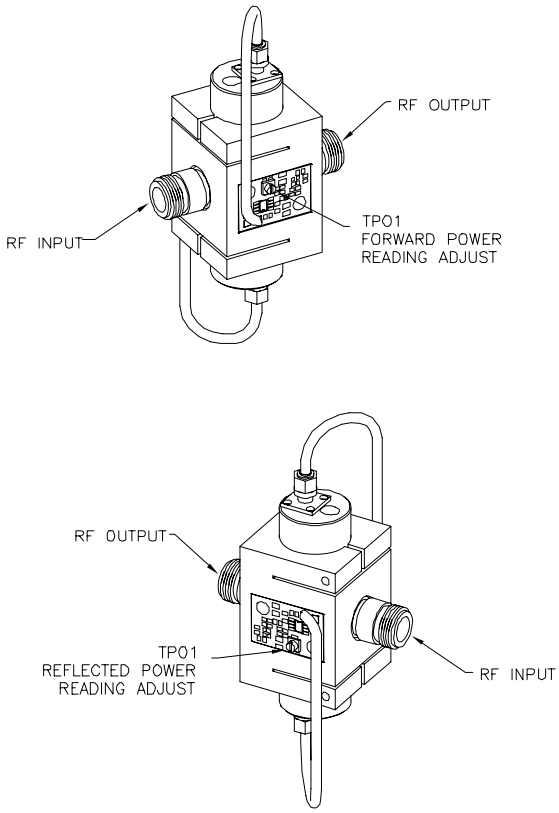



Fig. 4.2: Intermediate coupler cells – Module 4166 - spatial view, DP and RP sensors

The adjustments at the module 4166 are very simple; however they are very important for the correct performance of the entire equipment. The module come already adjusted from the factory according with ATSC procedures as stated on the recommendation A53/E.

If complementary adjustments become necessary, please contact the factory for a complete set of instructions and guidelines. Coupling wattmeter should NOT be used to measure ATSC power levels; instead LINEAR recommends absorption type wattmeter.

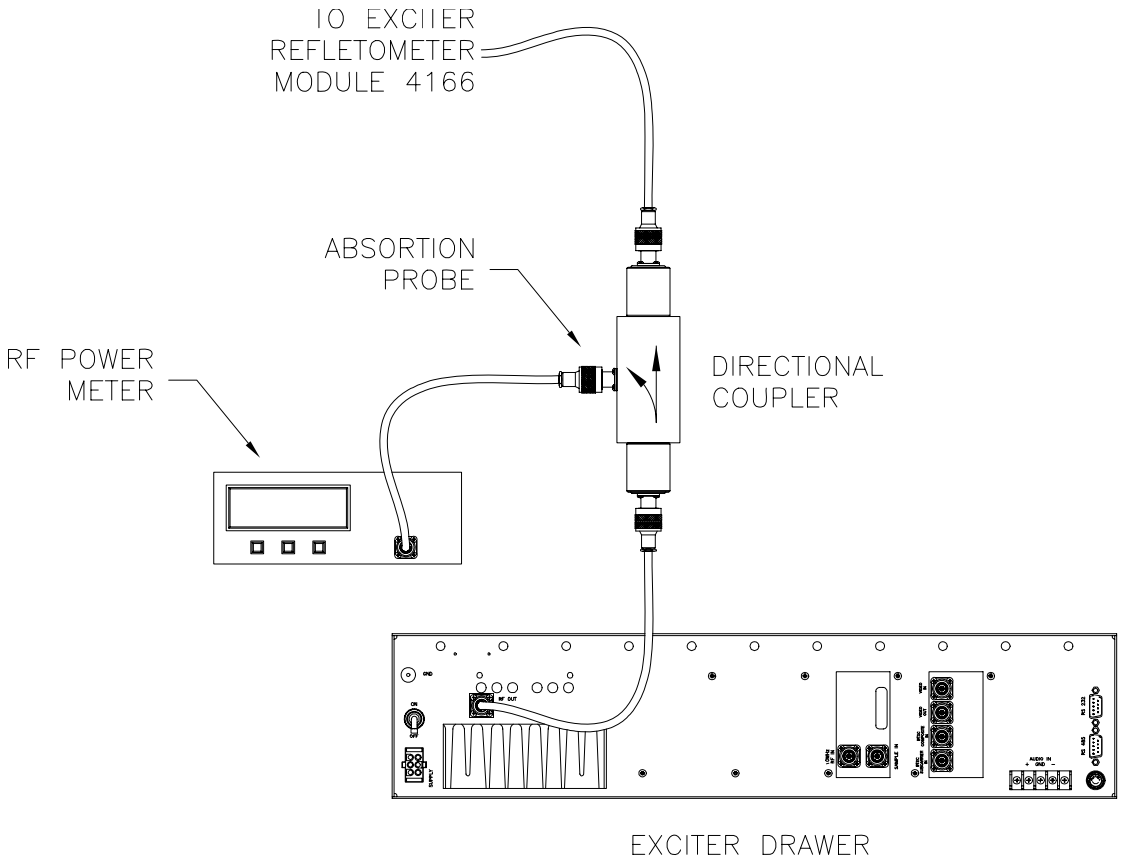



Fig. 4.3: Set up for adjustment on the power measurement directional coupler

## 4.2. Module 4482 – 1:2 RF Splitter & 2:1 RF Combiner

The splitter-combiner gizel networks are fully passive and are both assembled on the same mechanical structure, located at the rear of the rack structure.

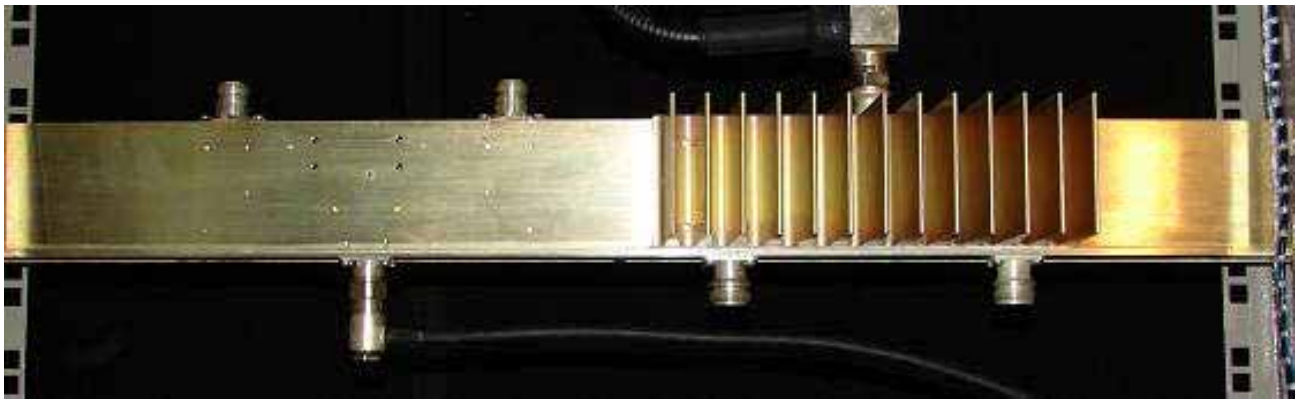


Fig.4.3: Module 4482 internal view, at right the combiner network

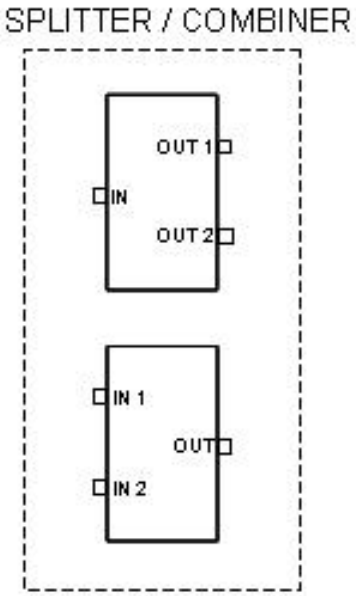
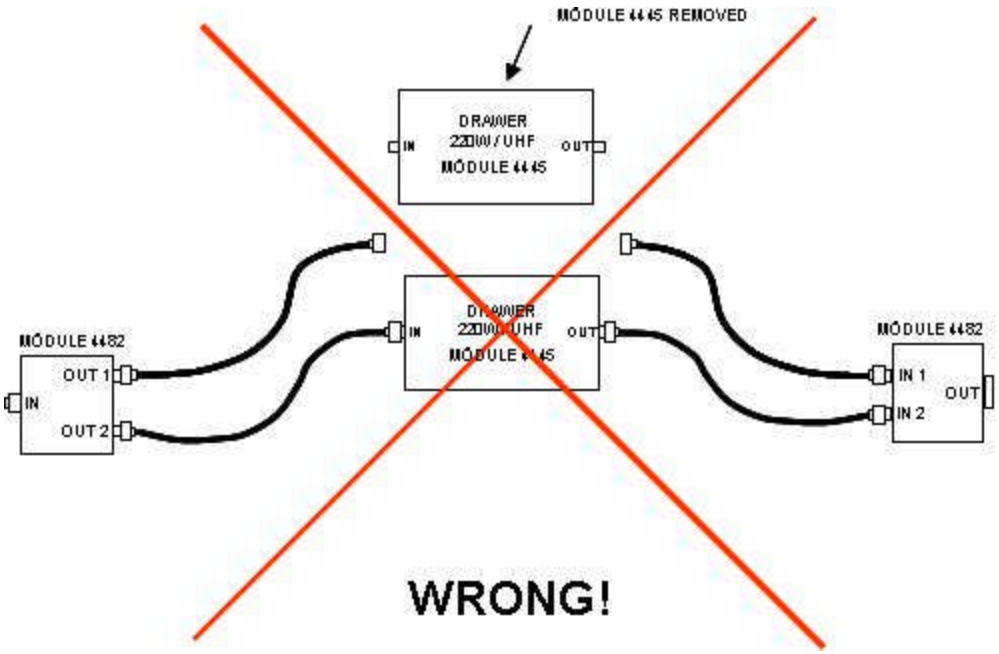
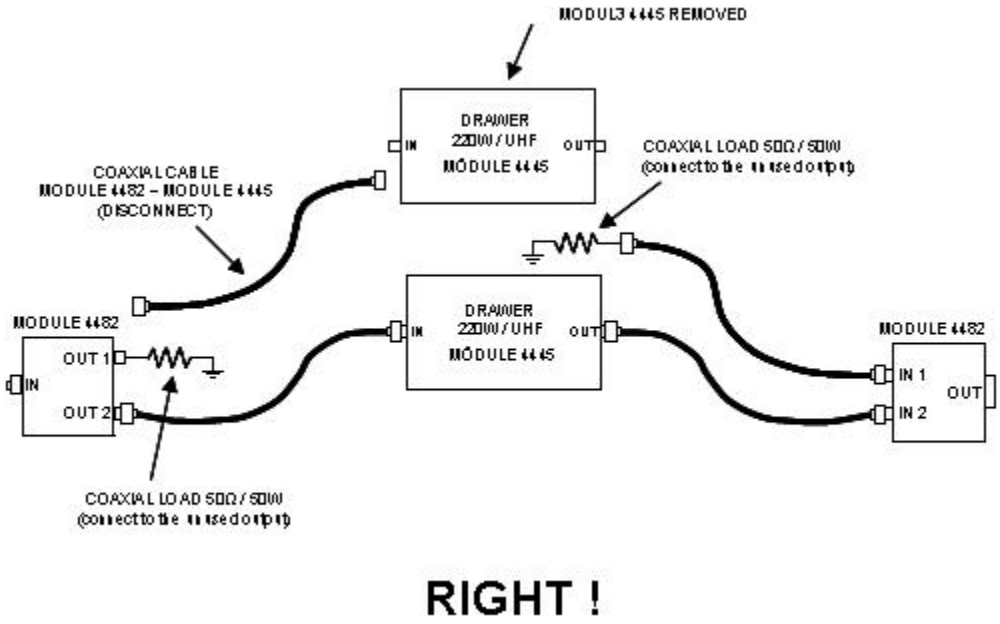



Fig.4.4: Module 4482 - block diagram

### 4.2.1. Care When Connecting the Splitter/Combiner Module



# Section 5 – 220w UHF ATSC Power Amplifier

## Unit/Drawer GAV4445

## 4. General Description

The unit GV5555 is a drawer that is powered by 208Vac voltage from the main breaker. The overall gain of this unit is in the range of 14dB up to 20dB depending of the assigned UHF channel. The amplification circuitry is factory tuned for one band among 4 UHF channels bands. It has stable input and output 50Ω impedance and it is ready to be combined with others same channel equal channels.

Fig.5.1: Top GAV4445 front view, bottom GAV4445 rear view.

The 220W UHF ATSC amplifier drawer is composed by the functional modules and sub-modules (see Fig.5.2) as follows:

a) 75W UHF ATSC pallet amplifier, total of 4. MODULE 4451.
b) Multiple voltage 60A switching power supply, MODULE 4275.
c) Subordinate control unity, SCU- printed circuit board CIM2452.
d) UHF Isolated [1:4] splitter, MODULE 4458.
e) UHF Isolated [4:1] combiner, MODULE 4446.

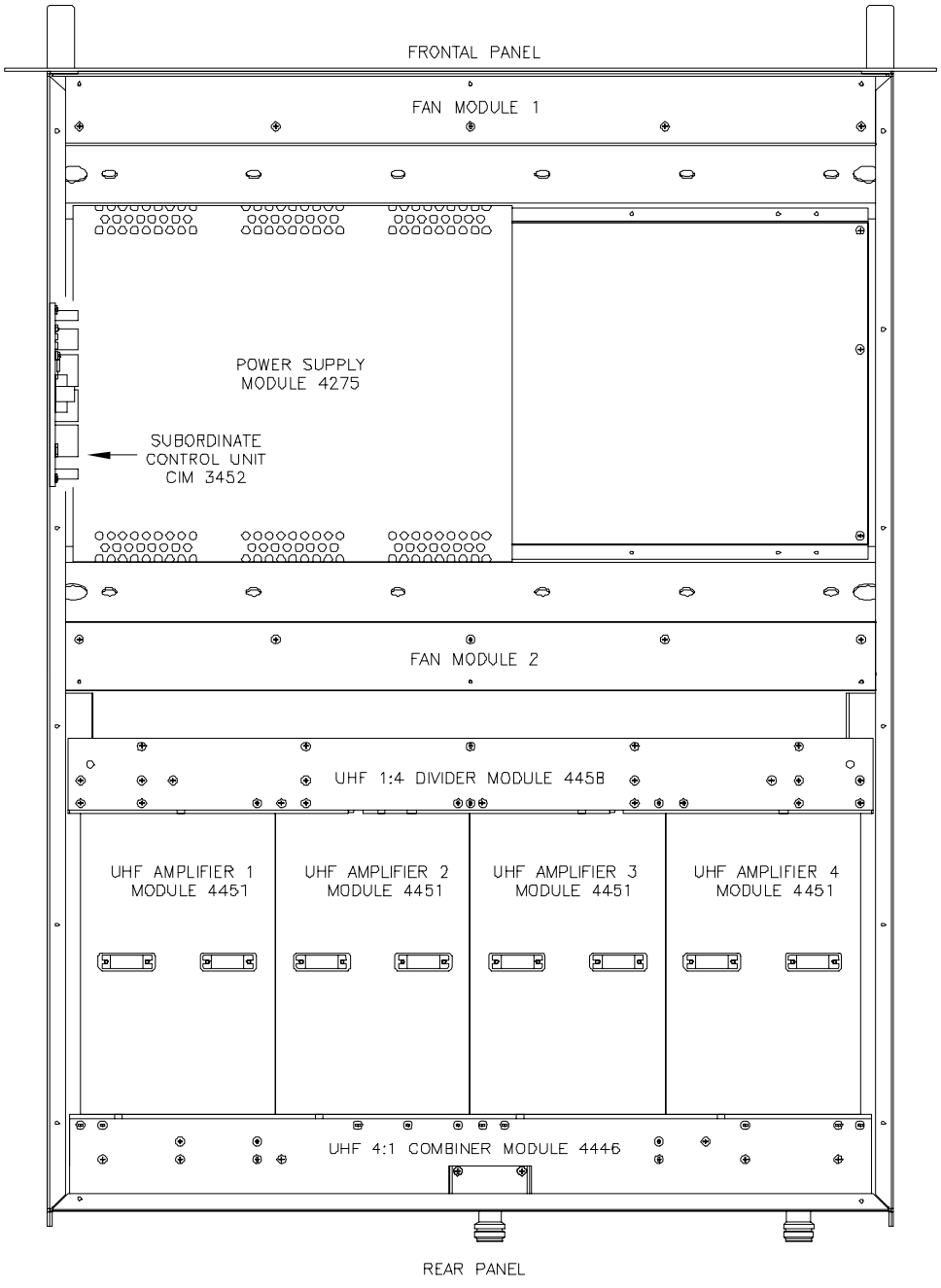
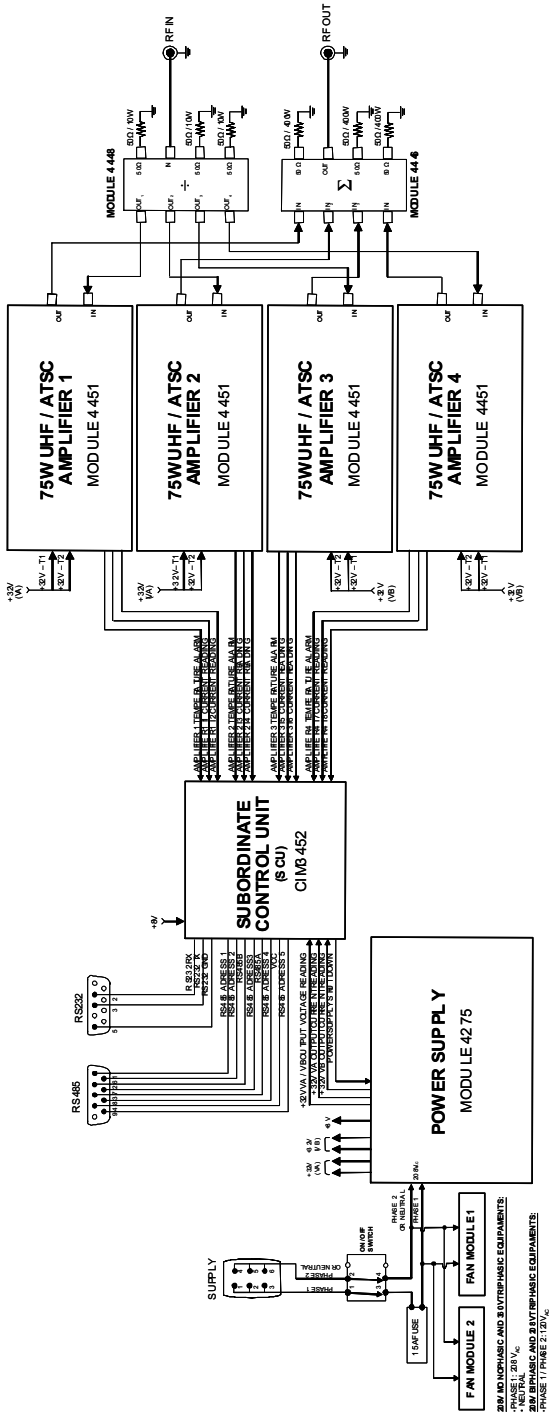



Fig.5.2: GAV4445 modules displacement

## 5. GAV4445 – 220w UHF ATSC Power Amplifier - Interconnection Diagram



## 6. GAV4445 - Module 4451 – 75W UHF ATSC Pallet Amplifier

### 6.1. General Functional Description

The 75W UHF/ATSC, sub-module 4451 is present on all the RF power amplifier drawers on the ADVANCED TV line of transmitter UHF models. On the module 4445, 250W ATSC UHF RF Power amplifier drawer, there are 4 sub-modules 4451 that combined are able to delivery 300W/UHF/ATSC.

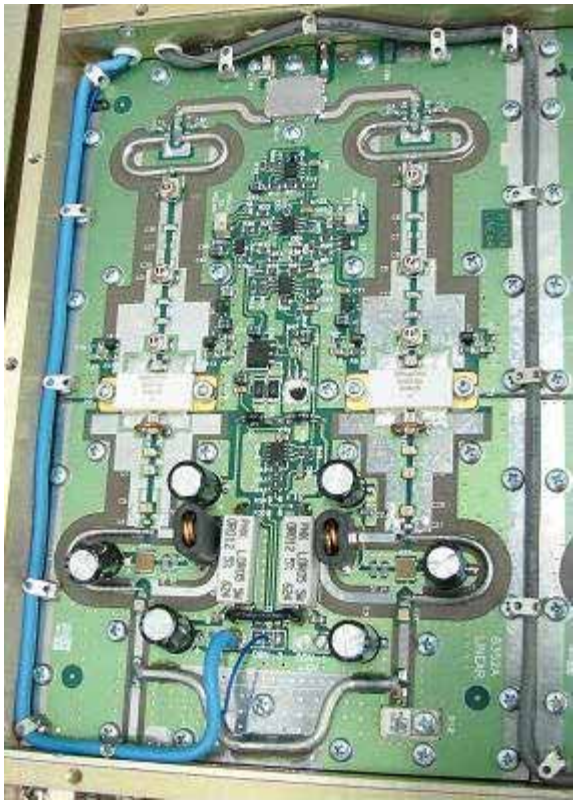
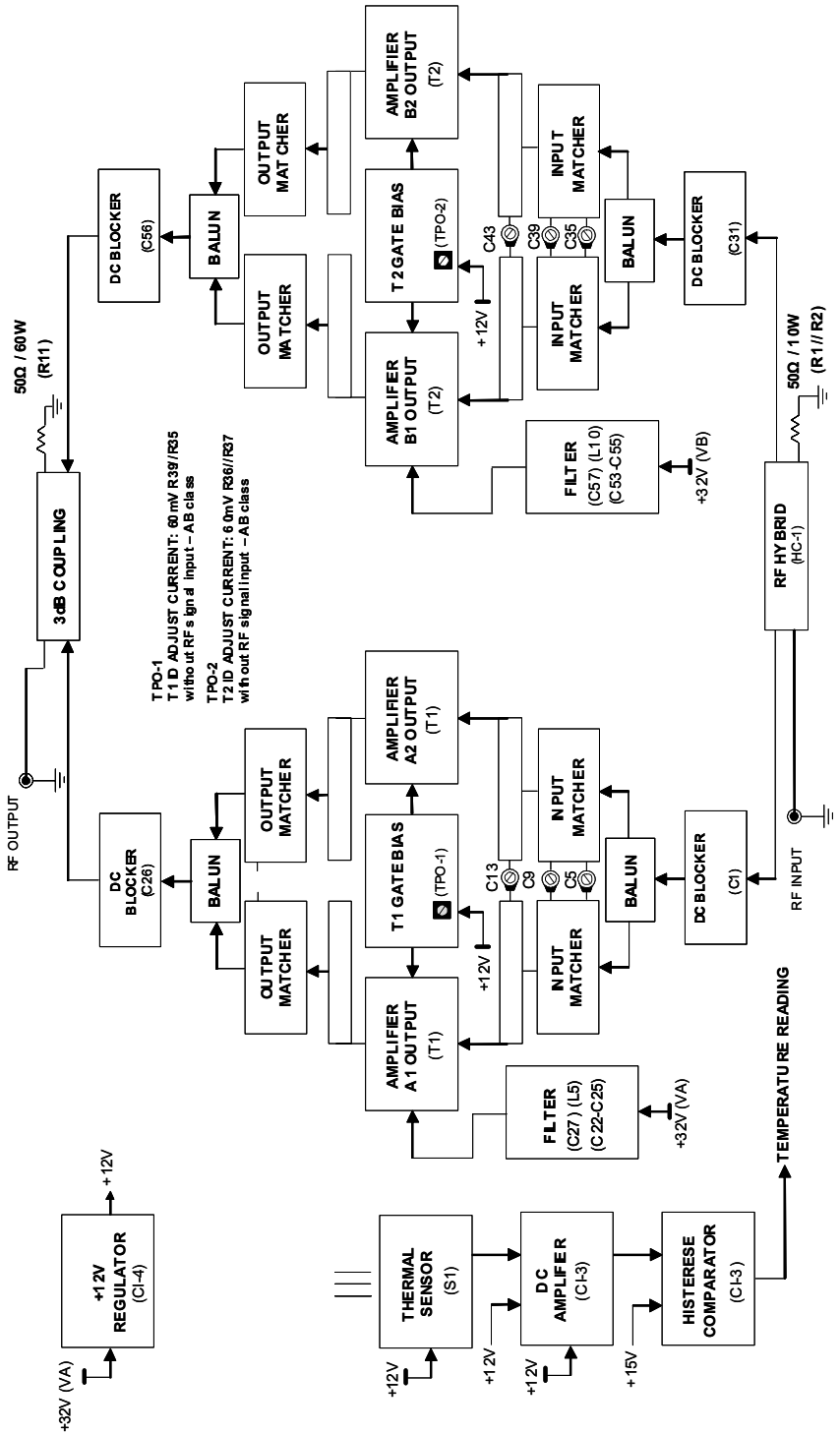


Fig.5.3: Module 4451 - 75W UHF ATSC pallet amplifier

The module 4451 is highly linear on all UHF frequency band. Despite that for performance optimization, the sub-module 4451 is built on the same PCB CIM 3440, and adjusted in one of the following bands:

- channels 14 to 25
- channels 26 to 38
- channels 39 to 53
- channels 54 to 69

## 6.2. Module 4451 – Block Diagram



The module 4451 is composed of 2 amplifier cells, polarized on class AB, on push-pull configuration, connected in parallel. Each cell carries 2 LDMOS transistors; assemble on the same die, delivering 37.5W each or 75W on total.

| 75W UHF / ATSC AMPLIFIER - 4451 | | |
|---|---|---|
| CIRCUIT | CIM | CIP |
| 75W UHF / ATSC AMPLIFIER | 3440 | 8352 |

## 6.3. Module 4451 –Technical Specifications

| FEATURE | SPECIFICATION |
|---|---|
| **INPUT** | |
| FREQUENCY | 470 - 862MHz |
| IMPEDANCE | 50 Ohms |
| RETURN LOSS | ³ 22dB |
| **OUTPUT** | |
| GAIN | 13 TO 16dB |
| RF POWER | UNTIL 75WRMS |
| HARMONICS | £ -60dB |
| SPURIOUS EMISSION | < -54dB |
| INTERMODULATION | < -46dB |
| IMPEDANCE | 50 Ohms |
| **GENERAL** | |
| VOLTAGE SUPPLY | +32V |
| CONSUMPTION | 12A (AB CLASS) |

## 6.4. Module 4451 – Tuning and DC Setup Instructions

The module 4451 can either be adjusted connected to the equipment or out of it. On both cases, it is mandatory to keep the RF out put correctly loaded (50Ω). A +32V/2A power supply must be ready to be driving the drawer, during the proposed adjustments, done under reduced RF power conditions. While doing one pallet adjustment, disconnect the DC main power out from the other modules 4451.

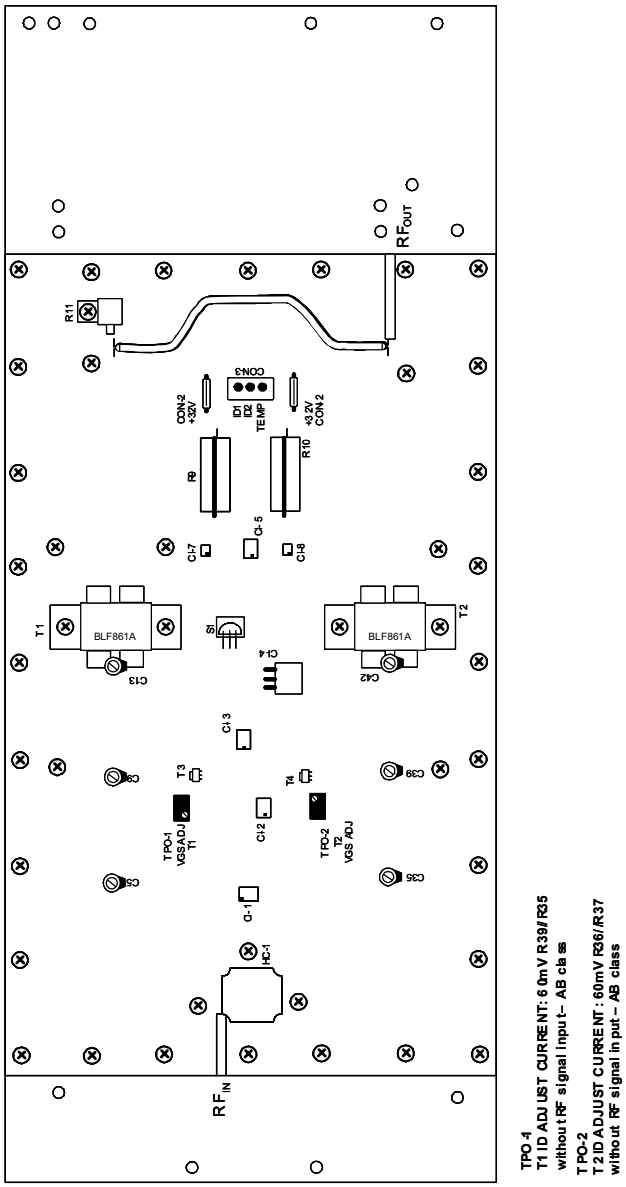



Fig.5.5: Module 4451 - Tests point and connections illustration

The adjustment procedures are maid one-by-one, an individual adjustment of each sub-module 4451. At the time that one sub-module is being adjusted, the others 3 should have disconnected its respective DC power supply.

## 6.4.5. Module 4451 – Drain Current Adjustment

No RF signal should be present at the input of the sub-module 4451 during the ID adjustment procedures. Power the sub-module on, and wait 3 minutes for thermal stability. Take a multi-meter, and set for mVdc scale, avoid using the auto-range scale.

- Transistor T1:

1) Turn the trim pot TPO-1 all course anti-clockwise, as result the ID at T1 will be set 0.
2) Set the multi-meter scale for 100mV, and measure the voltage drop over R9.
3) Slowly turn the TPO-1 clockwise up to the point where a 60mVdc is shown at the multi-meter screen.

- Transistor T2:

Same as T1, but consider R10 instead R9.

## 6.4.6. Module 4451 – Frequency Response

The module 4451, (PCB CIM 3440) is a broad-band UHF DTV amplifier for the band it was designed and adjusted for;

- Band 1: channel 14 up to 25.
- Band 2: channel 26 up to 38.
- Band 3: channel 39 up to 53.
- Band 4: channel 54 up to 69.

On the top of the band characteristics, there are also factories tuning optimization by channel. Even in the event of transistor exchange, there is no need to re-tuning the PCB/Circuit. The trimmer are all for frequency response adjustments. A flat response at higher gain is the target for this tuning procedure. See the hardware set up to perform this procedure.

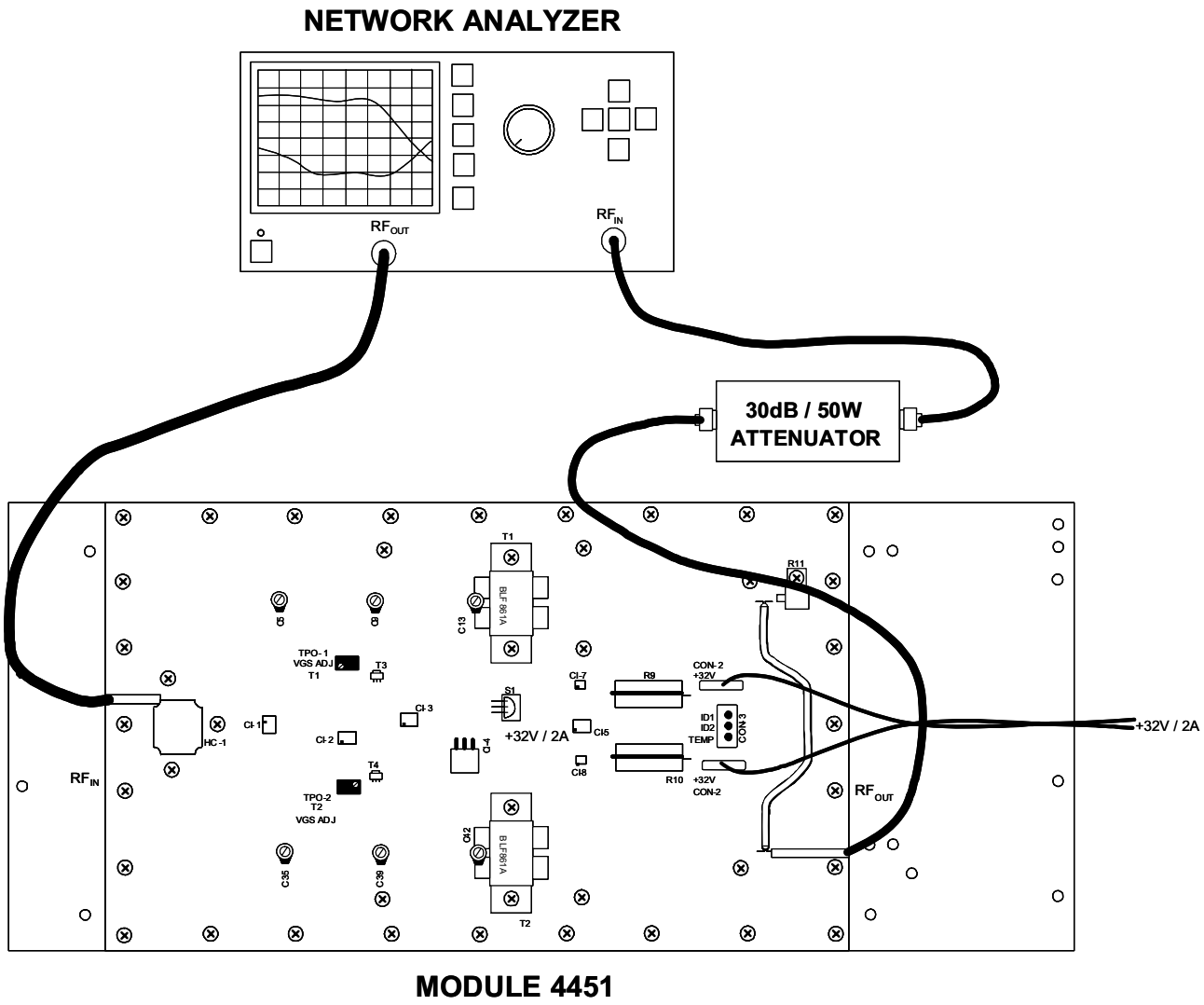



Fig. 5.6: Set up for tuning procedures – module 4451

Adjust the network analyzer for -20dBm RF out put level. Connect the RF signal to the RF input of the sub-module. Adjust the trimmer to reach the following nominal gains under flat response conditions:

- Channels 14 to 25: ..... 16dB
- Channels 26 to 38: .....15dB
- Channels 39 to 53: .....15dB
- Channels 54 to 69: .....14dB

## 7. GAV4445 – Board CIM3452 – Subordinate Control Unit, SCU

### 7.1. CIM3452 General Functional Description

For each GAV4445 installed on the series ADVANCED TV transmitters, there is also a SCU associated with, termed CIM3452.

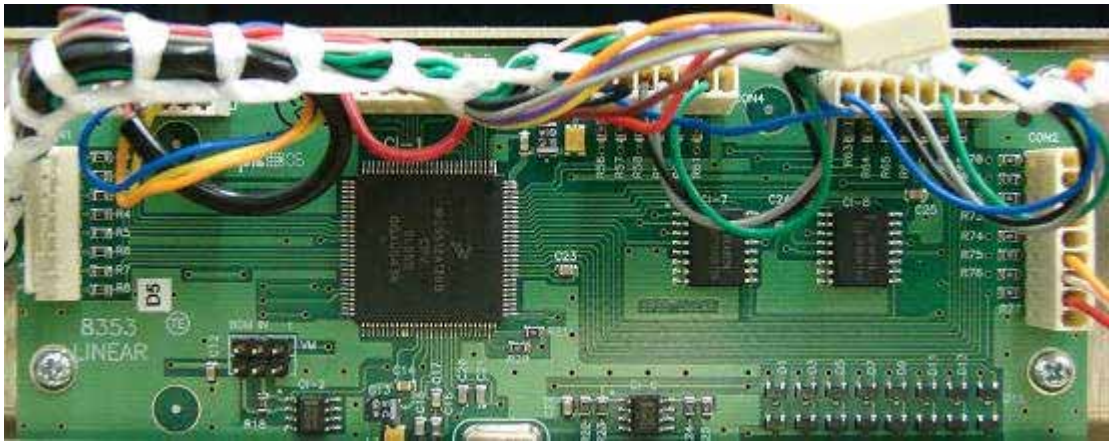



FIG. 5.7: Board CIM3452 installed on GAV4445 at bottom side, lateral right panel

The SCU installed on the RF power drawer, GAV4445, maintain a constant communication with the master control unit, MCU, module 4459. The SCU manage and monitor the drawer according with MCU commands.

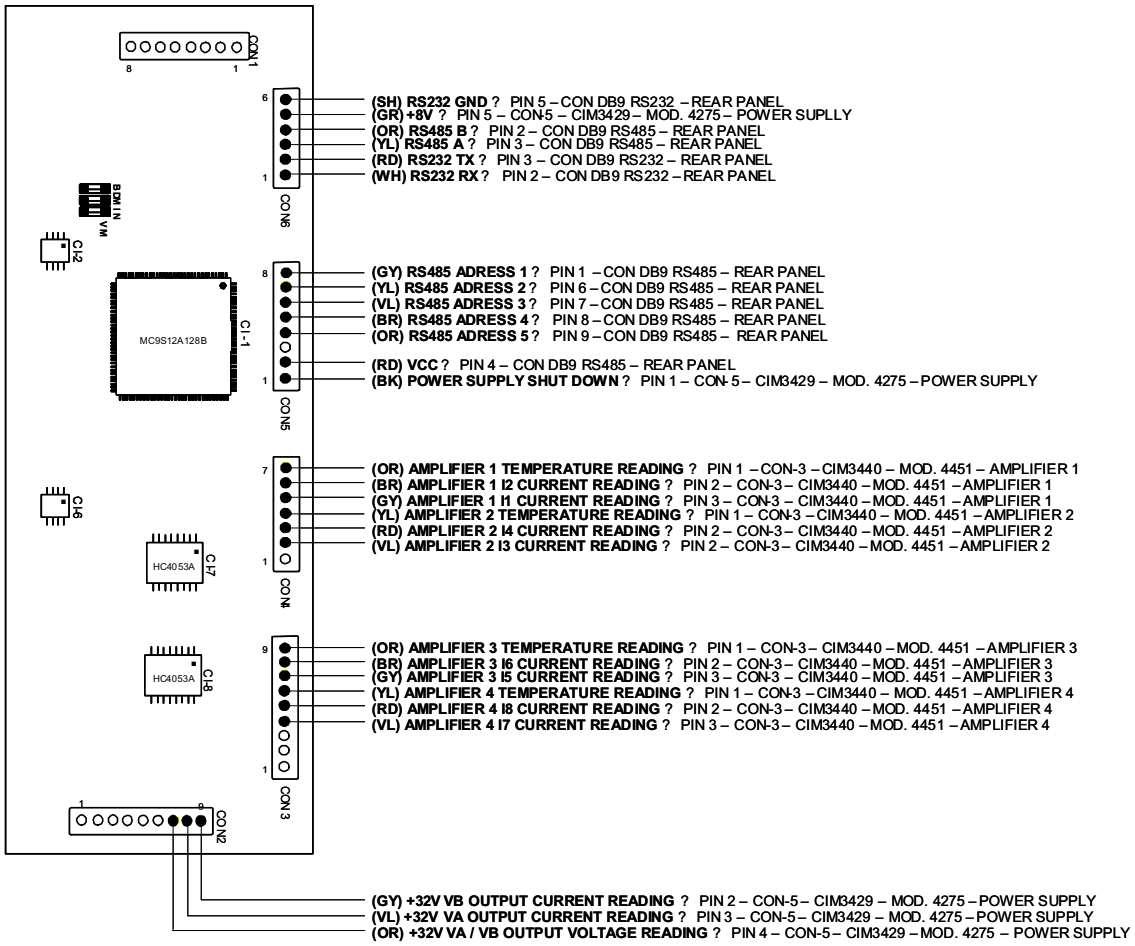



Fig.5.7: SCU – RF power drawer, PCB CIM 3452. Wiring and connection diagram

## 7.1.7. CIM3452 Controls

### 7.1.7.1 Digital Controls

The integrated circuit CI-1 (MC9S12A128B) is responsible to oversee all the command functions concerning to the RF power drawer. This integrated circuit is programmable on the factory, according with the number and the software version. For the power drawer on the ADVANCED TV line the microcontroller assembled at the PCB 3452 was termed PR1003 version 1.0. Future upgrades when happen, will generate new versions.

> ➢ In the case of substitution of the microcontroller, on this PCB (CIM 3452) on the RF power drawer, it is mandatory to correctly inform to the factory the software number and its version. These numbers are printed on the case of the component.

### 7.1.7.2 Analog Readings

At the connectors CON-2, C0N-3 and CON-4, on PCB CIM 3452, as part of the RF power amplifier drawer, analogs information is driven in regarding the following parameters generated out of the power supply, sub-module 4456. The CIM 3452 at the RF power amplifier drawer read the following analog parameters:

1. Voltage referring to +32V (VA/VB) out from the power supply, sub-module 4275.
2. Current out from VA power supply, sub-module 4275.
3. Current out from VB power supply, sub-module 4275.
4. Amplifier 1, temperature on sub-module 4451.
5. Amplifier 2, temperature on sub-module 4451.
6. Amplifier 3, temperature on sub-module 4451.
7. Amplifier 4, temperature on sub-module 4451.
8. Drain current on transistor T1 at amplifier 1 ( I1 ).
9. Drain current on transistor T2 at amplifier 1 ( I2 ).
10. Drain current on transistor T1 at amplifier 2 ( I3 ).
11. Drain current on transistor T2 at amplifier 2 ( I4 ).
12. Drain current on transistor T1 at amplifier 3 ( I5 ).
13. Drain current on transistor T2 at amplifier 3 ( I6 ).
14. Drain current on transistor T1 at amplifier 4 ( I7 ).
15. Drain current on transistor T2 at amplifier 4 ( I8 ).

All these analogs information get at the CON-2, CON-3 and CON-4 from where are routed to the microcontroller CI-1. Once there they are digitalized and processed. The resident software on this microcontroller states that the nominal value of all readings is 4V. On other words, at the connectors CON-2, CON-3 and CON-4 the available readings should be 4V for all nominal values displayed on the LCD display located on the front panel of the MCU. Test points are spread out through over the RF amplifier drawer. Each one of those has a trim pot associated with. These trim pots adjust the voltage associated to the parameter to be written by the PCB CIM 3452. These voltages are all set for 4V when the associated parameter is at its nominal value. For instance: regarding the +32V out of the sub-module 4275, the voltage read at the pin #4 at the connector CON-5, is set for 4V by the trim pot TPO-3. This same voltage also appears at the pin #7 at the connector CON-2, at the PCB CIM 3452.

### 7.1.7.3 Power Supply Shut Down Process

The PCB CIM 3452 sends to the power supply, sub-module 4375 the command-information SHUT DOWN, on the format of a +5V DC voltage. This voltage can be measured at the pin #1 at connector CON-5, and its presence disrupts the +32 supply, (VA and VB outputs). This routine will take place every time that a normal readings becomes an alarm. For instance: if the readings of temperature out of the RF pallet amplifier exceeds 65°C, an alarm status will be generated triggering the shut down command, and the subsequent +32V supply disruption.

### 7.1.7.4 Serial RS485 Communication

The PCB CIM 3452 located at the RF amplifier drawer, is subordinated to the PCB CIM 3297, located at the MCU (Module 4459). The communication between these 2 command units is made via RS485 and pins # 3, 4 and 5 at the connector CON-5 on each one of the PCBs is the gate for IN and OUT of data streams. For the RF power amplifier drawer, the pins # 3, 4, and 5 at the connectorCON-6, located on the PCB CIM 3452, is interconnected to the DB9 connector, and labeled as RS485 locates at the rear panel of the RF power amplifier drawer.

### 7.1.7.5 Serial RS232 Communication

It is possible to access the CIM 3425 at the RF power amplifier drawer locally. To proceed the local access connect a PC that is able to run the Windows Hype terminal at the connector DB9 labeled as RS232, located at the rear panel of the RF power amplifier drawer. This connector routes the external data stream to the internal pins #s 1, 2 and 6, at the connector CON-6 located at the PCB CIM 3452, built inside of the RF power amplifier drawer.

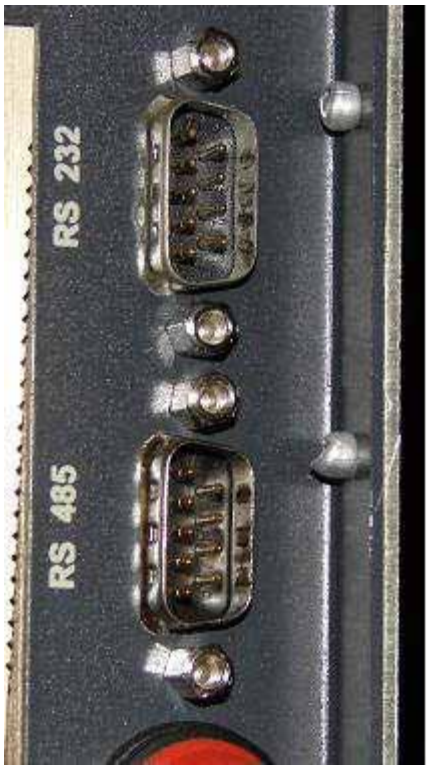



Fig.5.10: RS485 and RS 232 external connectors.

## 7.2. Board CIM3452 Schematic Diagram: SEE ANNEX A

# 8. GAV4445 - Module 4275 – Power Supply

## 8.1. Module 4275 – General Functional Description

Module 4275 is a switching high power DC supply, type full-bridge powered by 208 Vac, showing overall efficiency above 80%. As part of the power supply design, there is a power factor corrector, PFC, circuit. Besides correct the power factor to close to 1, this circuit also contributes to reduce the harmonic content returning from the unit into the AC mains.

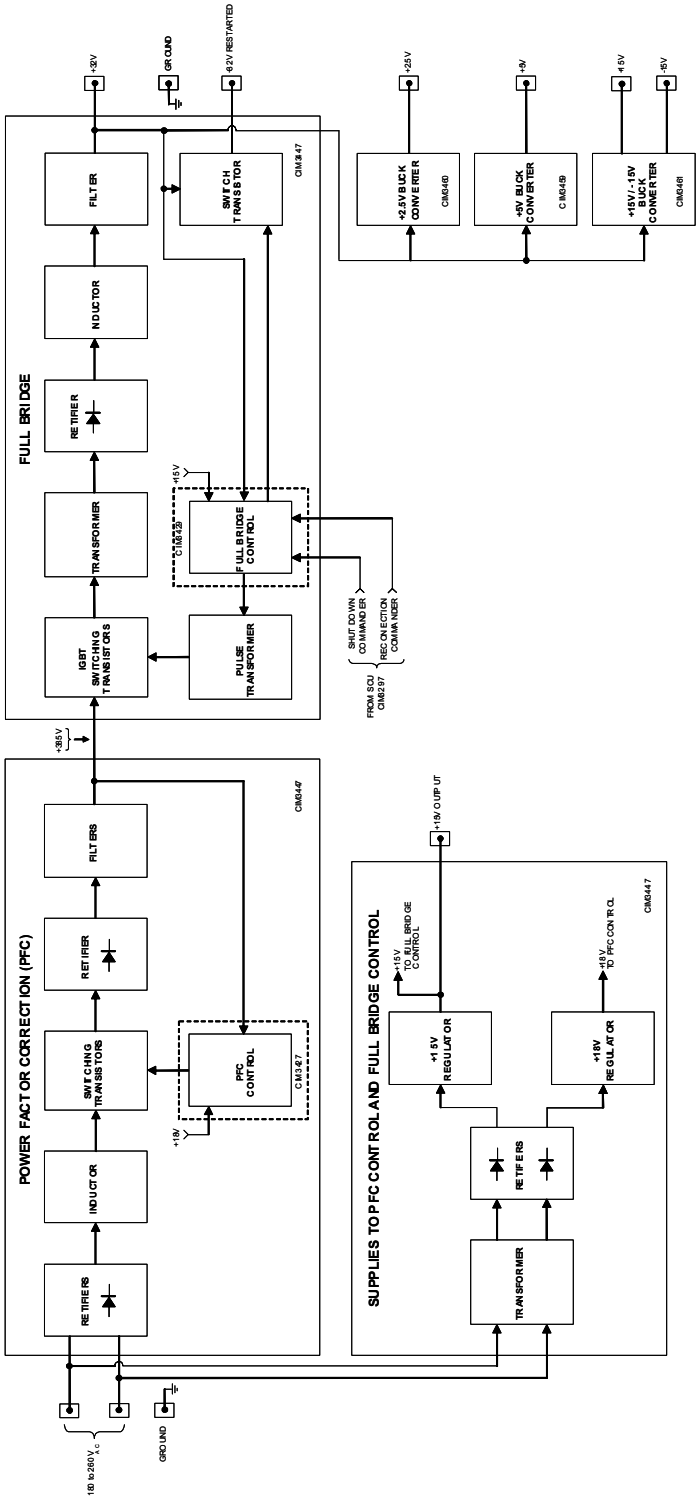
The sub-module 4275 deliveries two +32V voltage outputs, VA and VB. These two voltages feeds the 75W UHF amplifiers, sub-module 4451. This sub-module also delivery the +15V for the control unit SCU, CIM 3452, located on the power drawer.

The module 4275 is composed by the following PCB's:

| POWER SUPPLY - 4275 | | |
|---|---|---|
| CIRCUIT | CIM | CIP |
| POWER FACTOR CORRECTION (PFC) | 3238 | 8184 |
| FULL BRIDGE | | |
| FULL BRIDGE CONTROL | 3429 | 8339 |
| PFC CONTROL | 3427 | 8337 |


Fig.5.9: CIM3429 – Full Bridge Control PCB.

## 8.2. GAV4445 – Module 4275 – Block Diagram



## 8.3. CIM3238 – Power Phase Control Unit – PFC

The PFC circuit is located at PCB CIM 3238, at sub-module 4275. The PFC circuit is a power supply built according with the "boost regulator in continuous mode (CCM)" topology. Under the CCM topology, is possible guarantee a power factor, cosφ above than 0.9. The PFC circuit is composed by a full diode bridge that performs a full-wave rectification on the AC signal, which than is routed to the boost inductor. The voltage is so boosted up to +385V. The power factor correction is obtained by the switching a MOSFET transistor, which controls the electrical current into the capacitors that are components of the output rectification filter. The switching operation is performed at the frequency of 100MHz

### 8.3.8. CIM3427 – PFC Control Unit

The PCB CIM 3427 generates the control pulses for the PFC circuit. The PFC switching operation is controlled by a bit stream. This control's bit stream is generated by an integrated circuit with 2 loops that are self-protected against short circuits. The function of this control is to keep stable the +385V voltage at the PFC's output.

## 8.4. CIM3238 – Full Bridge

The full bridge circuitry is also located at the PCB CIM 3238 as part of the sub-module 4275. This circuit is designed to step down the +385V to +32V keeping the same power rate, meaning it enable the voltage to delivery more electrical current. The full bridge topology is favorable to high power management operations. The circuit has 4 transistors technology IGBT, (Insulated Bipolar Gate Transistor). Via a step down high current transformer, the high voltage, 100 kHz, pulses are reduced down to +32V, in sequence than rectified and filtered, becoming the two +32 FIXED voltages, (VA and VB).

## 8.5. CIM3238 – Self-powered Power Supply, and +15V DC Output

The PCB CIM 3238 also delivery voltages for the PFC control circuits and full bridge. From this circuit is also generate the +15V to the SCU, PCB CIM 3452. The +15V Direct is a linear power supply circuit. A power transformer is directly connected to the 208 VAC mains. From this power supply is extracted (A) +15VDc voltage that feeds the SCU (CIM 3297) exclusively, (B) +18VDc feeds the control of the PFC circuit. The voltage +15VDc feed the full bridge control, and the SCU, PCB CIM 3452.

## 8.6. CIM3429 – Full Bridge Control and Voltage Readings

The module 4275 also holds the PCB CIM 3429. This circuit is in charge to generate the pulses that will control the full bridge circuitry. On this PCB is located the trim pot TPO-1 that adjust the +32V. On this PCB is also located the trim pot TPO-2 that adjust the over current protection. A third function is the voltage sensor reading circuit, which can be adjusted by the trim pot TPO-3. The output of this sensor is routed to the SCU, PCB CIM 3452. This module also includes the PCB CIM3470. This module is responsible on readings for current flux on each of the 4 voltage outputs. Each current value is read undependably, thought the trimpot TPO1, TPO2, TPO3, and TPO4.

## 8.7. Shut Down Operation

The shut down command is generated by the SCU, PCB CIM 3452. When an abnormal failure situation occurs, the SCU generate a SHUT DOWN command that is a +5V direct connected to the pin # 1 at the connector CON-5 located at the PCB CIM 3429. Since this voltage is present, the switching pulses will be inhibit and as consequence, all the DC output will be disabled and be no longer available, exception for the +15Vdc DIRECT, that feeds the SCU.

On maintenance situation the sub-module 4275 the automatic operation, (independently of the SCU status), AUT, can be turned on a manual MAN, operation by changing the position of the jump CON-3. The AUT position must be re-state as soon as the maintenance is over. The shut down operation is fundamental to protect the power supply and the UHF amplifiers as well, sub-modules 4451.

## 8.8. Module 4275 – Technical Specifications

| FEATURE | SPECIFICATION |
|---|---|
| GENERAL | |
| INPUT AC VOLTAGE | 180 TO 260VAC |
| SWITCHING FREQUENCY | PFC = 100kHz<br>FULL BRIDGE = 100kHz |
| LINE REGULATION | BETTER THAN 2% FOR ALL OUTPUTS |
| OUTPUT NOMINAL VOLTAGES AND CURRENTS | +32V / 30A<br>+32V / 30A |
| RIPPLE | BETTER THAN 250mV |
| LOAD REGULATION | BETTER THAN 2% FOR ALL OUTPUS |
| EFFICIENCY | BETTER THAN 80% |
| OUTPUT OVERCURRENT LIMIT | 30% UPPER NOMINAL VALUE |
| SHUTDOWN VOLTAGE | HIGH LEVEL: > 0.7 TO 5Vdc<br>LOW LEVEL: < 0.7Vdc |

## 8.9. Module 4275 –Schematic Diagrams: SEE ANNEX A

# Section 6 – Output Directional Coupler, UHF Low Pass Filter & Band Pass Mask Filter

## 6.1. Module 4429 – Output Directional Coupler - General Description

The UHF output related power readings direct and reverse, are shown on the LCD screen at the MCU (module 4459) located on the frontal part of the ADVANCED TV line of transmitters. All the readings are RMS values of the 8VSB modulated carrier. The readings are analog DC signals sampled detected by the output directional coupler (module 4429), out from the direct and reverse output RF power.

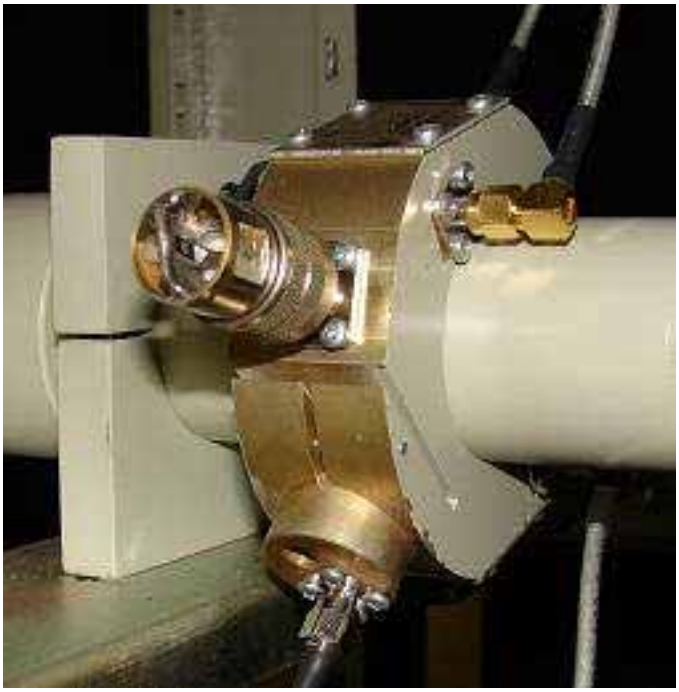


Fig.6.1: Module 4429 - Output Directional Coupler

The module 4429 is a piece of a 50Ω rigid transmission line in series with the UHF RF line up. Two samplers are than coupled to this transmission line out from where direct and reverse signals are detected and sent to the MCU unit for processing and displaying.

## 6.2. Module 4429 – Technical Specifications

| FEATURE | SPECIFICATION |
|---|---|
| DIRECTIVITY | UHF > 20dB<br>VHF BI > 23dB<br>VHF BIII > 23dB |

**DIRECTIVITY:** Is calculated in the following way:

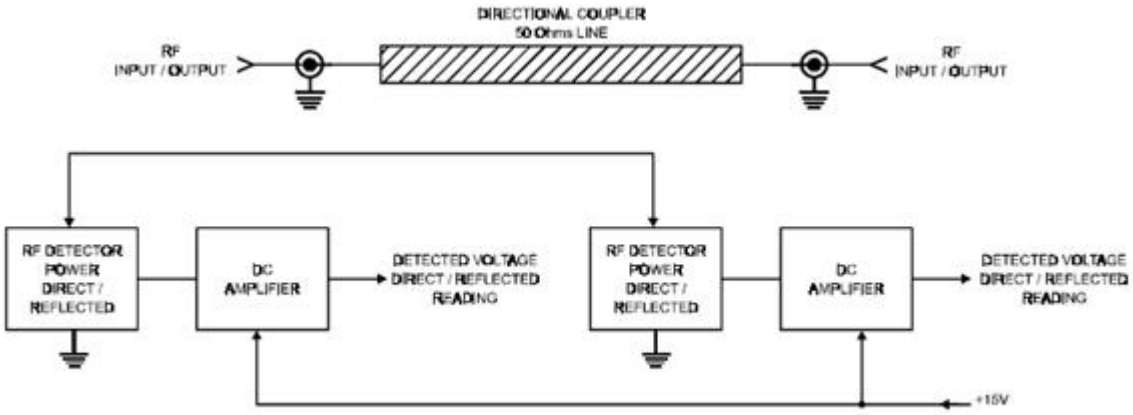
$$D = 20 \log \frac{E_{DIR}}{E_{REF}} \text{ ( dB )}$$

Where, $E_{DIR}$ is the voltage on the detector D1

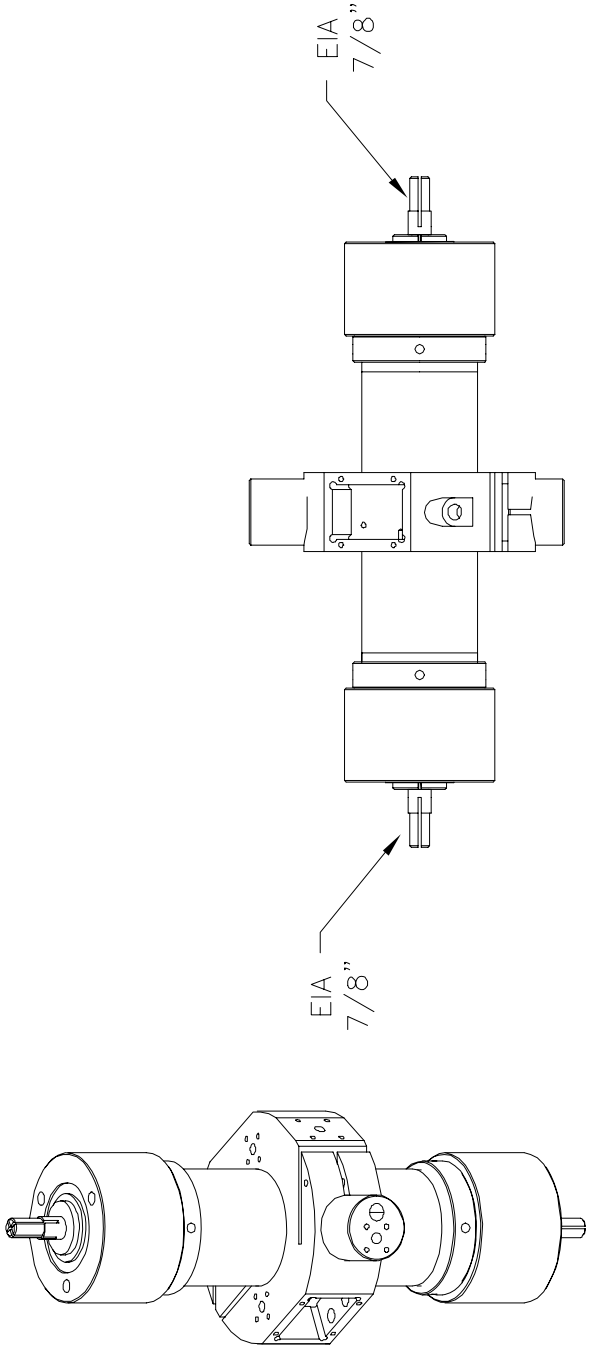
$E_{REF}$ is the voltage on the detector D2

| REFLECTOMETER - 4166 | | |
|---|---|---|
| **CIRCUIT** | **CIM** | **CIP** |
| REFLECTOMETER | 3128B | 8100C |

## 6.3. Module 4429 – Block Diagram



## 6.4. Module 4429 - Drawings



## 6.5. Module 4429 – Calibration

### 6.5.1. Introduction

The calibration procedure is quite simple however very important for the overall transmitter operation. Usually this procedure should not take place on the field. The criterions of calibration follow the recommendation as ATSC A53/E.

In case of re-calibration, it is mandatory the utilization of ***absorption type wattmeter***. LINEAR utilizes the Agilent model E4418B EPM series single power meter in conjunction with the 8481A power sensor. The wattmeter should be calibrated before the measurements following the manufacturer's instructions manual. See the recommended set up as follows:

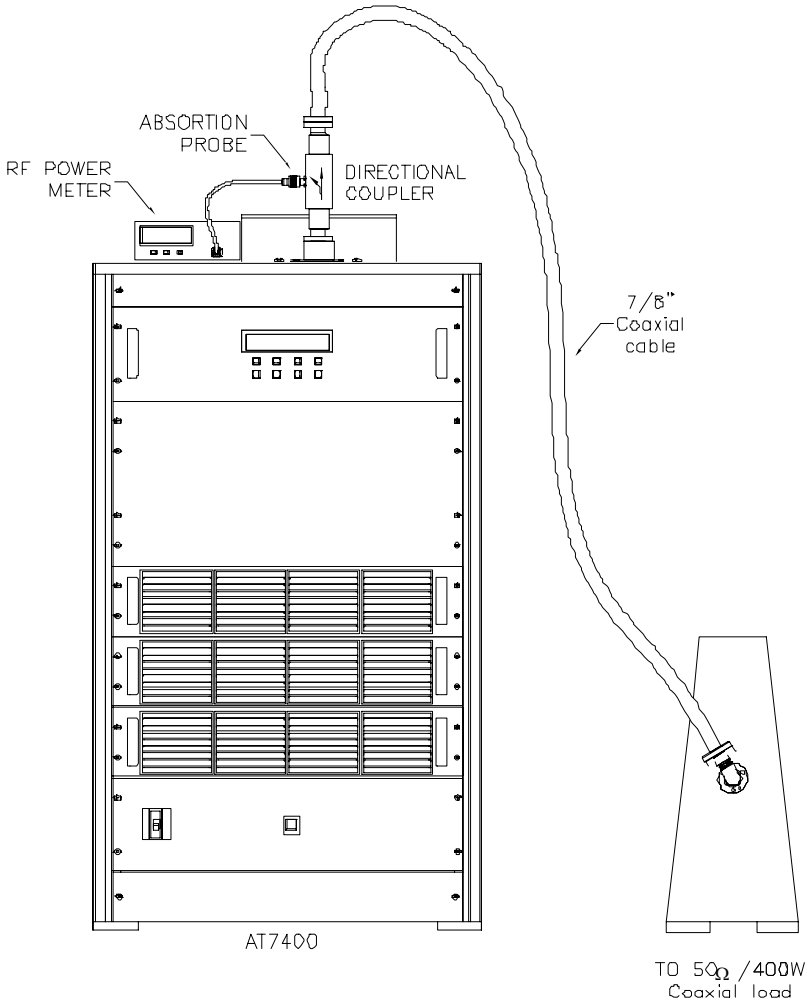



Fig. 6.3: RF power measurement calibration set up

### 6.5.2. Module 4429 – Calibration Step-by-Step

To reach the MAIN MENU screen, Fig.6.4, hit the CANCEL yellow key (not shown below) up to 4 times in sequence, any time.


Fig. 6.4: Main menu LCD screen at MCU unit

#### 6.5.2.1 Direct Power Calibration

1.
Using the keyboard (soft-keys) and LCD on the MCU, manage to disconnect the ALC operation. Follow the self-explanatory screen instructions. Start with the main menu screen, striking in sequence the gray keys as going to SETUP →TRANSMIT→ALC→OFF→ENTER.


Fig.6.8: Hit the SETUP soft-key to start the ALC-OFF operation

2.
Adjust the RF power via menu (ALC is OFF at this point) to the desired nominal level read at the calibrated external wattmeter.

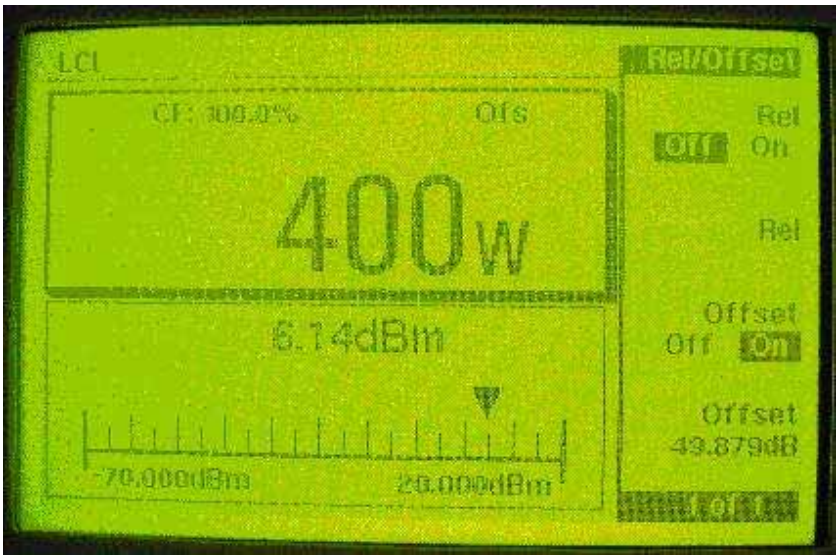



Fig.6.5: Reference output power reading on the power meter absorption

Check if the readings on the LCD screen of the transmitter are also displaying the same value. To get to this screen start out from the main menu and go to SETUP→POWER, reaching the POWER TRANSMITTER SETUP screen as shown on Fig.6.6 below:

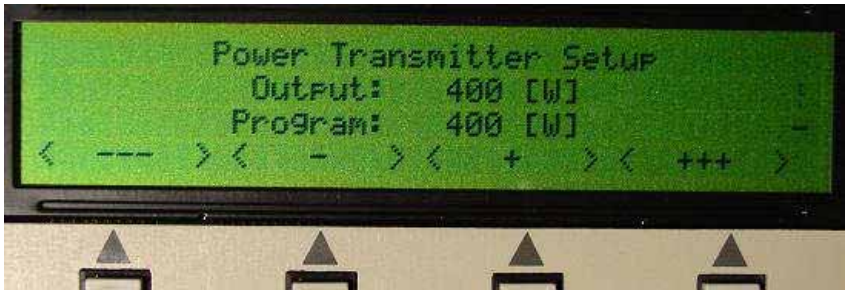



Fig.6.6: Power Setup Screen at the end, it must coincide with the external wattmeter reading

The [Output:] row may not be showing the desired output power. Next step one must make sure the [Program:] row show the desired output power. The setting of the desired output power operation is performed via the soft-keys that:

- increase; fast [+++], slowly [+], or
- decrease; fast [- - -], slowly [-]

3.
To make the power reading coincidence among the 3 readings, (a) the wattmeter, (b) the [program], and (c) [output] where (b) and (c) are present on the LCD screen, will be necessary adjust the DC level that represents the coupling coefficient between the sampler and the 50Ω transmission line at the output directional coupler hardware.

Look for the indication of FORWARD POWER opening the case of the output directional coupler, (Module 4429). On the PCB 3128A slowly twist the trim-pot TPO-1 up to the point where the (b) and (c) readings are showing equal numbers.

4.
Manage to re-state the ALC operation via soft-key and LCD screen at the MCU.

REMARK:
The calibration of the REVERSE POWER is too complex to be performed in the field without factory technical assistance. In this case please contact LINEAR at www.linear-tv.com

## 6.6. Output Filtering System

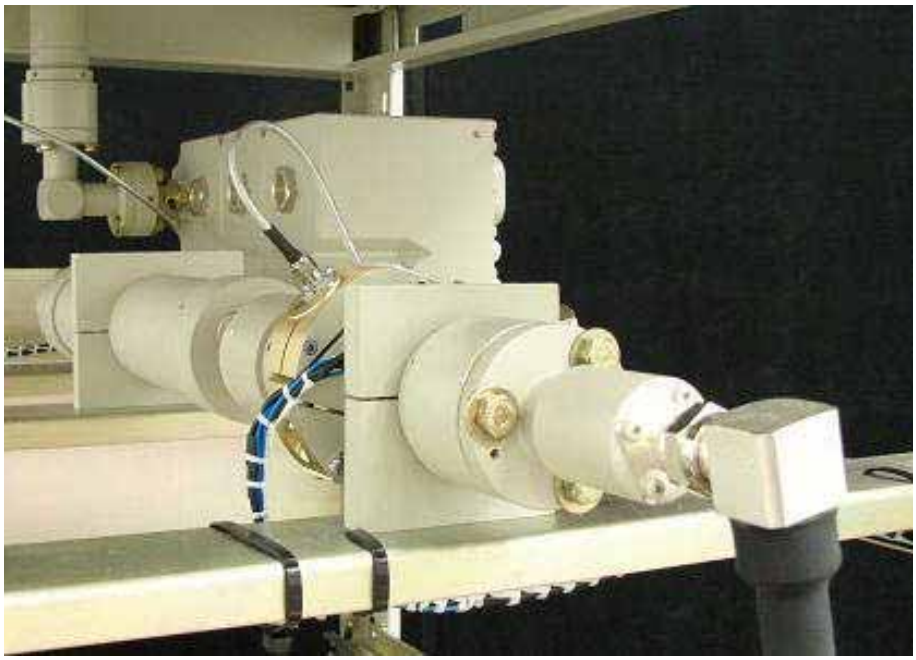


Fig. 6.8: Mechanical Assemble for; (a) output directional coupler, (b) low pass filter, (c) band pass filter

### 6.6.1. Module 4428 – UHF Low Pass Filter

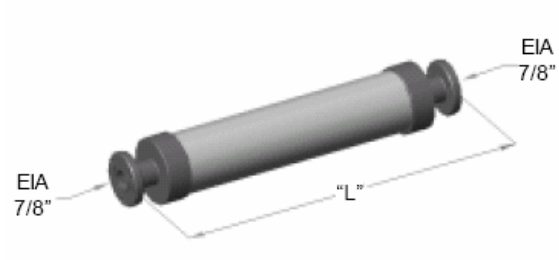



Fig.6.9: UHF low pass filter

The module 4428 is a 7/8" rigid transmission line, no tuning points. Depending of the UHF assigned band the filter is specified as:

- P/N 21802 for Channels 14 up to 39: …….....416.5 mm.
- P/N 23045 for Channels 40 up to 69: ……..….373.3 mm.

These filters have NO adjustment to be done. Pay attention for mechanical damages that may occur on the main line, or also on the IN/OUT connectors.

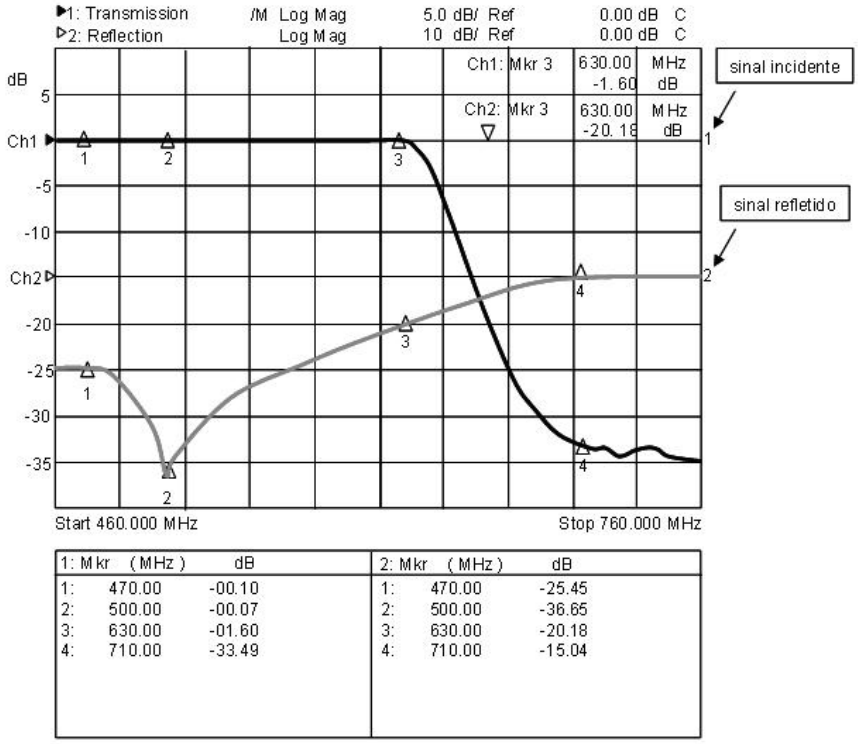



Fig.6.10: Module 4428 frequency response

## 6.6.2. Module FC6E80C – UHF Band Pass Filter – ATSC Mask Filter Featured

**Product Data Sheet** — **UHF Digital TV Filters**

# UHF DVB BANDPASS FILTER

400 W, 6 Poles (Cross Coupling)

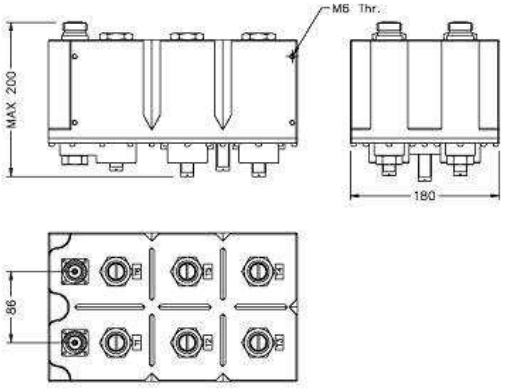
**FC6E80C**

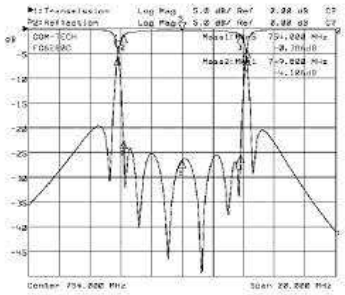
DVB Digital Video Broadcasting


**FEATURES**

- UHF 400 W DVB TV output filter
- Suitable for Non-Critical mask requirements
- 6 poles elliptical response
- Cross Coupling technique (two transmission zeros)
- Foreshorten folded combline structure
- Iris couplings with fine bandwidth regulation
- 3D Electromagnetic CAD
- High selectivity and lowloss (Typ. 0.42 dB @ 858 MHz)
- Temperature stabilized design (< 4 kHz / K)
- Very compact and lightweight

OUTPUT FILTERS



**SPECIFICATIONS** *(Values referred to 8 MHz DVB-T Standard)*

| | | | |
|---|---|---|---|
| Frequency Range | 470 – 862 MHz | Bandwidth | 6 to 8 MHz |
| Max Input Power | 400 W DVB | Selectivity | > 4 dB @ C.F. +/- 4.2 MHz |
| Insertion Loss | < 0.48 dB @ 858 MHz | | > 20 dB @ C.F. +/- 6 MHz |
| | < 0.40 dB @ 474 MHz | | > 35 dB @ V.C. +/- 12 MHz |
| | < 1.40 @ C.F. +/- 3.8 MHz | Temperature Stability | < 4 kHz / K |
| Return Loss | > 24 dB | Connectors | 7/16 Female |
| Group Delay Variation | < 200 nS | Weight (Approx) | 9 kg |
| | | Operating Temperature | -10 to +50 °C |

**AVAILABLE OPTIONS**

| | | | |
|---|---|---|---|
| A | SMA Output Monitor Probe | B | SMB Output Monitor Probe |
| H | EIA 7/8" Flange Connections | Z | Painted Black |

*Information contained in this datasheet is proprietary*
*Data subject to change without notice*
*Dimensions are in mm*

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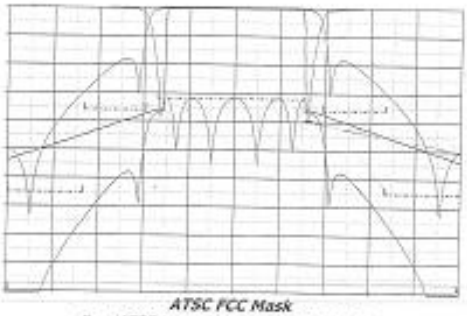
Appendix

# 3. ATSC TRANSMISSIONS

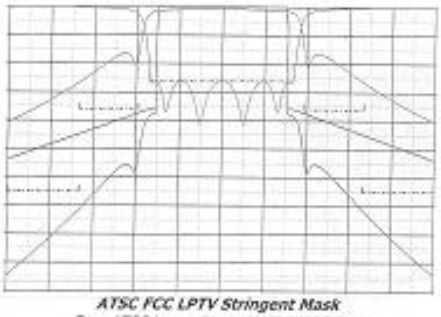
ATSC broadcast emission requirements have been defined by "FCC DTV Emission Mask", contained in the "ATSC Standard, Doc. A/64 Rev. A" document.
For low power ATSC transmitters and repeaters (LPTV = < 3 W VHF, < 30 W UHF) less restrictive masks have recently been approved called "Simple" Mask and "Stringent" Mask to improve the overall performance of these devices (FCC 04-220, September 30, 2004), ref. G. Sgrignoli, IEEE Trans. On Broadcasting, Vol. 49, No. 1, March 2003.
The choice of masks has been left to the operators, and although the minimum requirement is represented by the Simple Mask, the Stringent Mask is able to provide a better protection between the adjacent channels.
Therefore, COM-TECH has adopted the LPTV "Stringent" Mask as a conservative choice.

| | Att.@C.F.±3 MHz | Att.@C.F.±3.5 MHz | Att.@C.F.±6 MHz | Att.@C.F.±9 MHz |
|---|---|---|---|---|
| Typical TX spectrum | 36 dB | 36 dB | 45 dB | 54 dB |
| ATSC FCC Mask | 36 dB | 36 dB | 65 dB | 99 dB |
| ATSC FCC LPTV Stringent Mask | 36 dB | 36 dB | 65 dB | 65 dB |

The following diagrams show the typical output spectrum of a solid state ATSC DTV transmitter before and after the filter. The traced limits correspond to the masks.
In tracing the transmitter spectrum, reference was made to a state-of-the-art transmitter (latest generation of amplifiers in class AB with linearity pre-correction).
The reference spectrum includes shoulders of -36 dB @+/-3.5 MHz linearly decreasing until -54 dB @+/-9 MHz.



***ATSC FCC Mask***
*E.g.: ATSC transmitter with TCEE140C filter*



***ATSC FCC LPTV Stringent Mask***
*E.g.: ATSC transmitter with CL6K50C filter*

NOTES:
- The output spectrum may vary based on manufacturer, which is responsible for evaluating the case
- COM-TECH can provide 5 parameters for its filters upon request.

## FEATURES

- UHF 500W Digital TV band pass filter
- ATSC FCC Mask applications
- 6 poles elliptical response (cross coupling)
- Dual Cross technique (four transmission zeros)
- Combline topology
- High selectivity and low loss
  (Typ. 0.42dB@858 MHz)
- Temperature stabilized
- Very compact and lightweight

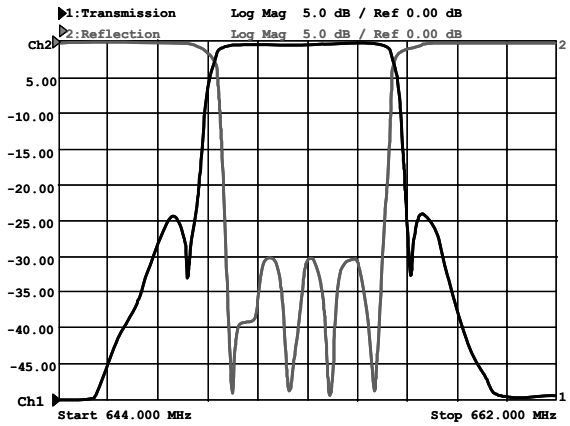
## SPECIFICATIONS

| | |
|---|---|
| Frequency Range | 470 to 862 MHz |
| Max Input Power | 500 W DTV (ATSC) |
| Band width | 6MHz |
| Input / Output Impedance | 50Ω |
| Input / Output Connectors | EIA 7/8" Female |
| Temperature Stability | < 4 kHz / K |
| Operating Temperature | -5 to +45 ºC |

## ATSC FCC MASK TUNNING DATA

| | |
|---|---|
| Inserction Loss | < 0.72 dB@C.F. (803 MHz)<br>< 1.22 dB@C.F. ±2.7 MHz |
| Selectivity | > 6 dB@C.F. ±3.5 MHz<br>> 26 dB@C.F. ±6 MHz<br>> 45 dB@C.F. ±9 MHz |
| Return Loss | >26 dB |
| Group Delay Variation | 150 ns |

## RESPONSE



# Section 7 – Energy Distribution and Control

## 7. General Description

The energy distribution circuits on the transmitter can be configured on the following possibilities:

- 208$V_{AC}$ -220 $V_{AC}$ – 240 $V_{AC}$ mono-phase.
- 208$V_{AC}$ -220 $V_{AC}$ – 240 $V_{AC}$ bi-phase.
- 208$V_{AC}$ -220 $V_{AC}$ – 240 $V_{AC}$ three-phase.
- 360$V_{AC}$ three-phase.

Fig.7.1: Energy Distribution – Bipolar Main Breaker on left, manual starter on the center and module 4147 – battery charger.

In all versions above, the NEUTRAL wire is present, however not always connected and so no need to integrate it within the grounding system of the station. It is however MANDATORY to connect the neutral cable on the 208Vac mono-phase, and 360Vac three-phase.

***WARNING: Do not operate without the GROUND connection. The absence of grounding is risky for personnel SAFE, equipment reliability besides jeopardize the quality of the DTV transmission.***

## 7.1. Energy AC Mains Connection

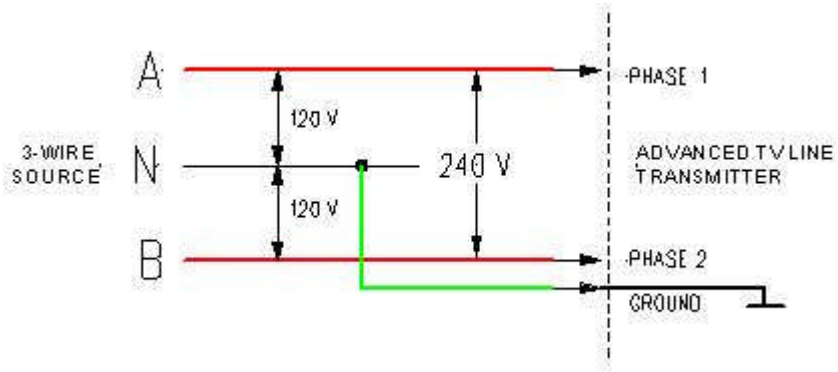



Fig.7.2: Typical 3 wires bi-phase AC energy source connection diagram

**OPTION 1 – INTERLOCK CLOSED BY A JUMPED WIRE**

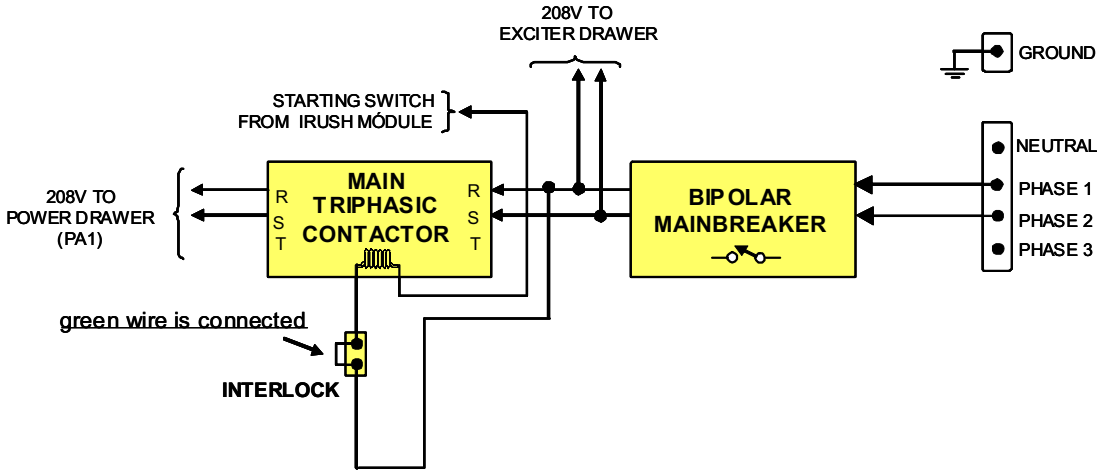



Fig. 7.3: Bi-phases type energy ADVANCE TV LINE internal up-front connection diagram, no isolation power-transformer required.

## 7.2. Energy Bi-Phase Distribution and Control – Block Diagram

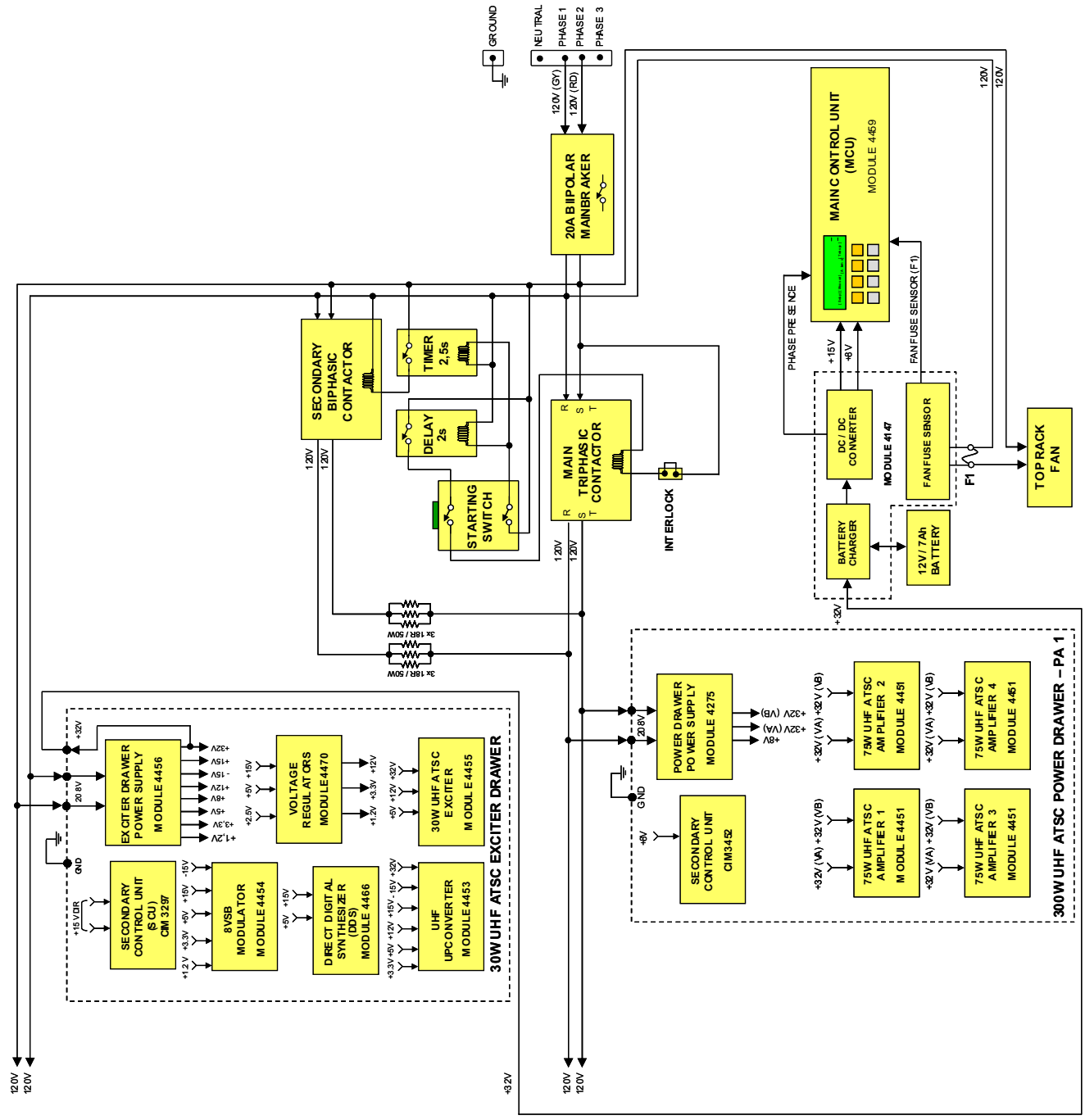



Fig.7.4: Energy Distribution and Control – block diagram - 240V bi-phase configuration.

### 7.2.2. Main Parts List for Bi-Phase Configuration

- 01 bi-polar breaker; 30A.
- 01 three-phase main breaker.
- 01 I Rush sub-module 4443.
- 01 interlock, or jump
- 01 battery 12V / 7Ah.
- 01 AC main sub– Module 4147.

#### 7.2.2.1 Bi-Polar Breaker

When turned ON, this device connects the 2 phases that are routed directly to the exciter drawer, module 4452, to the fan on the top of the transmitter rack, and to the I-Rush circuit.

#### 7.2.2.2 Three-phase Main Breaker

When it is turned ON, this device connects up to three phase, (R, S, T) to the power amplifier(s) drawer (s), module 4445.

#### 7.2.2.3 I Rush Module 4443

Rush module reduces the current peak when the transmitter is turned ON. This peak of current is generated by the switching power supplies, at the moment when the 20A bi-polar breaker is turned ON.

Fig. 7.5: I-Rush module 4443

Parts list for the module 4443 is as follows:

- Secondary breaker.
- Timer, 2.5 seconds.
- Mechanical delay 2 seconds.
- Two 18Ω/50W resistors in parallel.
- On ON/OFF switch with 2 independent contacts.

No matter which version is choose, 208/220/240 Vac will always be voltage to be delivered for the exciter drawer, and power amplifier drawers.


Fig. 7.6: On the right the drawer AC power connector, on the right AC mains reading on the center pins of the same connector.

### 7.2.3. Energy Distribution and Control - Operational Short Description

When ON the 30A breaker connects the 2 main phases to the main bi-phase breaker terminal. The main breaker will be switching ON, module 4443, only if:

(a) The phase detector, PCB CIM6241A sends the command signal confirming the presence of the all phases. 3 in sequence relay close-open-close noise is audible.
(b) The interlock is closed,
(c) The manual switch ON/OFF is pressed.

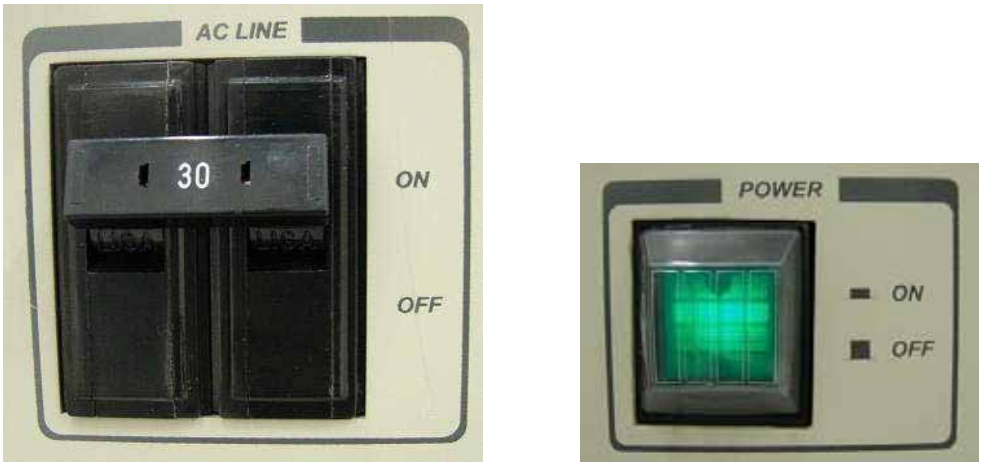



Fig. 7.7: Manual bi-polar energizer breaker and the manual start switch, both located on the bottom of the front panel.

When the POWER ON/OF switch is press, the 2.5s timer is activated energizing the coil of the secondary breaker. In sequence the 2 rush resistors are connected in series with the AC mains. 2.5s pass by and the breaker is disabled opening its contacts protection the rush resistors. At this point on time, the rush peak current is over and was avoided to cause over current stress over the mains, sometime activating the protection circuits

On long term the secondary breaker is no longer activate, leaving the main breaker is series with the R, S, T phases for when the command comes relay the 208Vac to the power drawer, module 4445.

I-Rush circuit can be energized on two different ways:

(a) 2 phase of 120Vac, when the equipment is wired up for 3 phases 208Vac, or
(b) With one 208/220Vac phase plus neutral, in case the equipment is wired up for 360Vac.

### 7.2.4. Module 4147: Battery Charger, DC-DC Converter, Fuses Sensor

The sub-module 4147 is responsible for the DC supply to the MCU, main control unit, module 4459. The sub-module 4147 is powered by either (a) +32V out from the exciter drawer, module 4452, or (b) from the 12V/7A battery located at the bottom of the rack transmitter.

The voltages delivered to this module are: +15V and +8V, both generated out from the DC-DC converter, the battery charger is also located on the same module. The +15V is also routed to power the 2 directional couplers, module 4166 and module 4429.

The fuse sensor detects if the 3A fuse is not open. This fuse protects the fan located on the top of the transmitter rack. When it is detected open, the MCU shut down the transmitter and alarm.

### 7.2.4.1 Sub-module 4147: Block Diagram

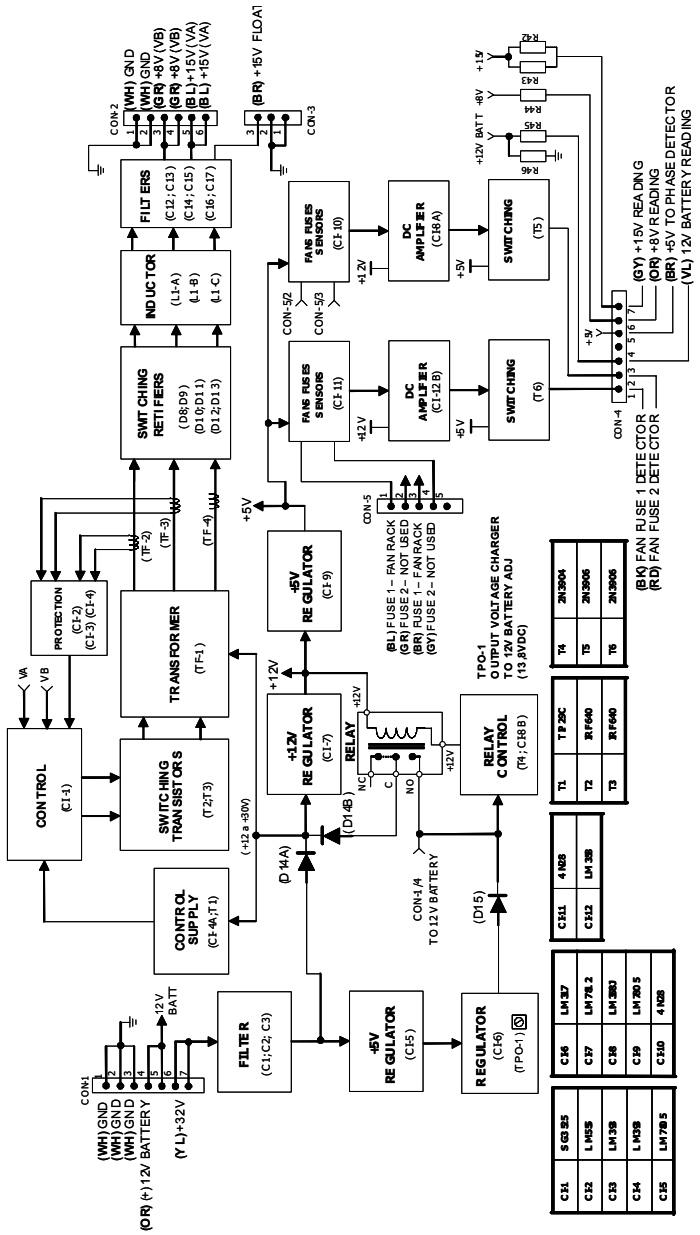



Fig.7.8: Module 4147 – Battery charger - Block Diagram

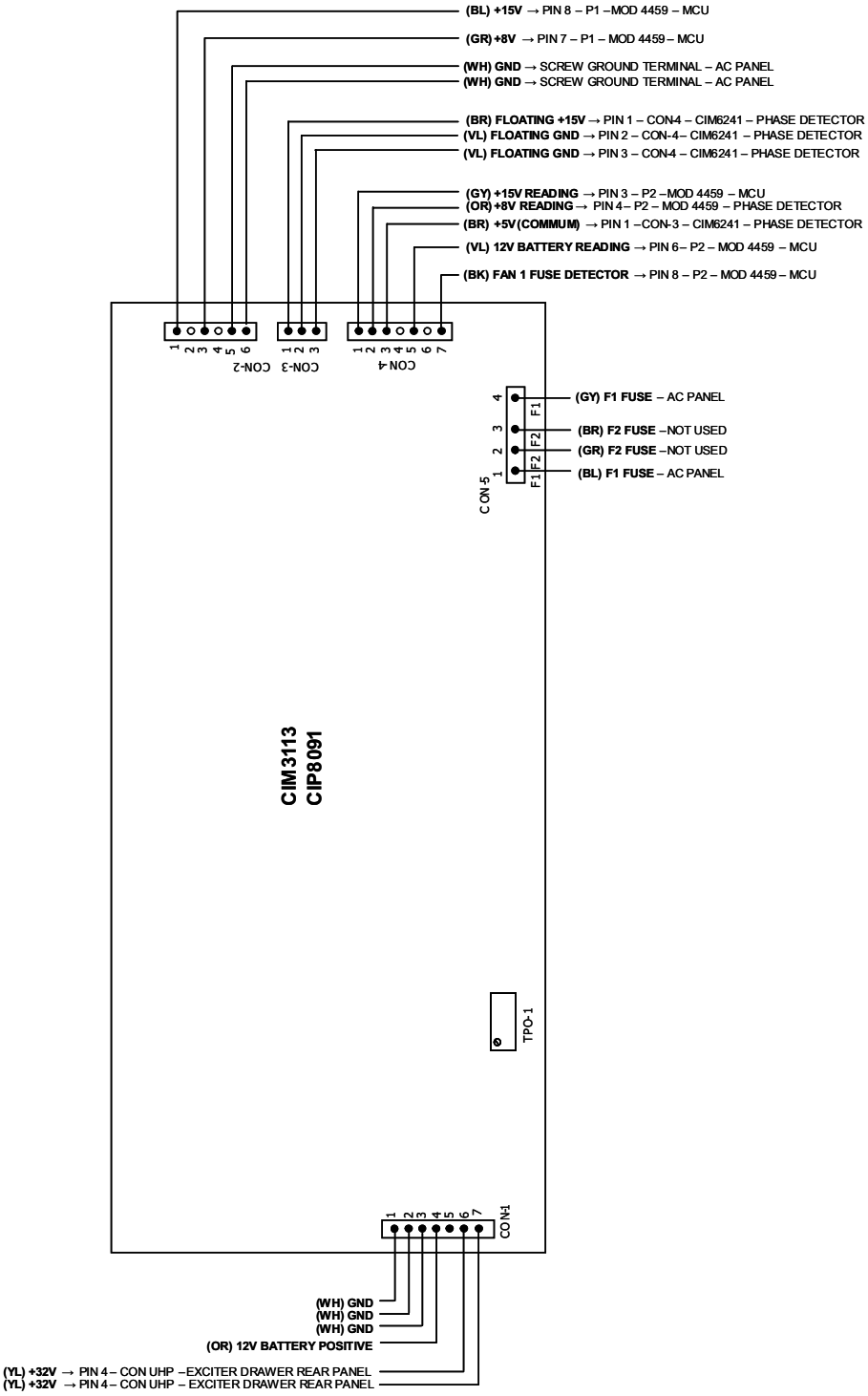



Fig. 7.9: Module 4147 - Connection diagram, CIM 3113 and CIP 8091

### 3.8.2. Battery 12V/7Ah

The 12V battery feeds the input of the DC-DC converter, module 4147, for continuous generation of voltages for the MCU even on absence of +32V that normally comes from the exciter drawer, sub-module 4452.

Fig.7.10: 12V/7AH Battery – shown with + cable disconnected

# ANNEX A

| ADVANCE TV Line Schematic Diagram Index | | |
|---|---|---|
| | **Reference** | **Description** |
| **1** | CIM 3112 | Keyboard |
| **2** | CIM 3113D | Switching Power Supply |
| **3** | CIM 3118 | DC Filter |
| **4** | CIM 3128B | RF Detector |
| **5** | CIM 3297 | Digital Control |
| **6** | CIM 3390 | UHF Amplifier |
| **7** | CIM 3427 | Switching Power Supply |
| **8** | CIM 3429 | Switching Power Supply |
| **9** | CIM 3440 | UHF Amplifier |
| **10** | CIM 3442 | Up-Converter |
| **11** | CIM 3443 | Local Oscillator |
| **12** | CIM 3444 | 8VSB Modulator |
| **13** | CIM 3445 | 172MHz Clock Generator |
| **14** | CIM 3446 | UHF Exciter Amplifier |
| **15** | CIM 3447 | Switching Power Supply |
| **16** | CIM 3452 | RF Power Control |
| **17** | CIM 3453 | SNMP Contoller |
| **18** | CIM 3456 | CIP8367 |
| **19** | CIM 3458 | CIP8369 |
| **20** | CIM 3459 | Switching Power Supply |
| **21** | CIM 3460 | Switching Power Supply |
| **22** | CIM 3461 | Switching Power Supply |
| **23** | CIM 4275 | Switching Power Supply 2kW |
| **24** | CIM 4451 | UHF Amplifier |
| **25** | CIM 6241A | ACPhase Detector |