RACK MOUNT TRANSMITTER (RFX-RMT)

OPERATORS MANUAL

CONTENTS

1. GENERAL SAFETY INFORMATION

The information that follows, together with local site regulations, should be studied by personnel concerned with the operation or maintenance of the equipment, to ensure awareness of potential hazards.

WARNING- RF Power Hazard: High levels of RF power are present in the unit. Exposure to RF or microwave power can cause burns and may be harmful to health.

Switch off supplies before removing covers or disconnecting any RF cables, and before inspecting damaged cables or antennas.

Avoid standing in front of high gain antennas (such as a dish) and never look into the open end of a waveguide or cable where RF power may be present.

Users are strongly recommended to return any equipment that requires RF servicing to RF Central.

WARNING- GaAs / BeO Hazard: Certain components inside the equipment contain Gallium Arsenide and Beryllium Oxide that are **toxic substances.** Whilst safe to handle under normal circumstances, individual components **must not** be cut, broken apart, incinerated or chemically processed. In the case of Beryllium Oxide, a white ceramic material, the principal hazard is from the dust or fumes which are carcinogenic if ingested, inhaled or entering damaged skin.

Please consult your local authority before disposing of these components.

CAUTION- Tantalum Capacitors: When subjected to reverse or excess forward voltage, ripple current or temperature these components may rupture and could potentially cause personal injury.

CAUTION: This system contains MOS devices. Electro-Static Discharge (ESD) precautions should be employed to prevent accidental damage.

1.1 Health & Safety

Exposure to Non-Ionizing (RF) Radiation/Safe Working Distances

The safe working distance from a transmitting antenna may be calculated from the relationship:

$$D = \sqrt{\frac{P_T . G_R}{4\pi . w}}$$

In which D = safe working distance (meters)
PT = transmitter or combiner power output (watts)
GR = antenna gain ratio = anti log (gain dBi ÷10)
w = power density (watts/square meter)

The RF power density value is determined by reference to safety guidelines for exposure of the human body to non-ionizing radiation. It is important to note that the guidelines adopted differ throughout the world and are from time-to-time re-issued with revised guidelines. For RF Central use, a maximum power density limit of 1w/m² is to be applied when calculating minimum safe working distances.

Important Note: It must be remembered that any transmitting equipment radiating power at frequencies of 100 kHz and higher, has the potential to produce thermal and athermal effects upon the human body.

To be safe:

a) Operators should not stand or walk in front of any antenna, nor should they allow anyone else to do so.

b) Operators should not operate any RF transmitter or power amplifier with any of its covers removed, nor should they allow anyone else to do so.

Worked examples

Antenna			**Transmitter Power**			
Type	**Gain (dBi)**	**Gain Ratio**	**2W**	**4W**	**10W**	**30W**
OMNI	4	2.5	1	1	1.5	2.5
HELIX	20	100	4	5.6	9	15.5
PARABOLIC DISH	35	3,162	22.5	32	50	87
			MINIMUM SAFE DISTANCE (METERS)			

1.2 Maximum RF Power Density Limits

The RF Radiation Power Density limit figure recommended by RF Central is based upon guideline levels published in:

a. IEEE standard C95.1 1999 - IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

b. Guidelines for Limiting Exposure to Time-varying Electric, Magnetic & Electromagnetic Fields (up to 300 GHz) published in 1998 by the Secretariat of the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Both documents define guideline RF power density limits for "Controlled" and "Uncontrolled" environments. An uncontrolled environment is defined as one in which the person subjected to the RF radiation may be unaware of and has no control over the radiation energy received. The uncontrolled environment conditions can arise, even in the best-regulated operations and for this reason the limits defined for the uncontrolled environment have been assumed for the RF Central recommended limit.

Documents a) and b) also show the RF power density guidelines to be frequency dependent. Different power density / frequency characteristics are presented in the two documents. To avoid complexity and to avoid areas of uncertainty, RF Central recommends the use of a single power density limit across the frequency range 100 kHz to 300 GHz. The 1w/m² power density limit we recommend satisfies the most stringent of the guidelines published to date.

Footnote: The IICNIRP document may be freely downloaded from the internet at www.icnirp.de/documents/emfgdl.pdf (PDF file).

1.3 Issue Status

Issue	Date	Changes
Issue 1.0	30th September 2005	first issue
Issue 1.1	27th October 2005	second issue – revised menu drawings

2. INTRODUCTION

This manual is to be used in conjunction with the RFX-RMT rack-mount switchable Analog/digital transmitter. When in digital mode the RFX-RMT offers significant features including ASI and component video inputs together with 4 audios (Analog, AES digital, or SDI embedded).

The RFX-RMT transmitter is designed for permanent rack-mounted applications, such as ENG truck/vehicle or fixed link applications. The unit features a comprehensive range COFDM modulation formats (QPSK 16QAM, and 64QAM) and the MPEG coding format may be set directly from the front panel control keys and LCD display.

The transmitter comprises a 19” inch rack mount (2 ‘U’) unit that contains both a digital and an Analog section, with common power supplies and an RF power amplifier.

The digital section of the transmitter comprises an audio encoder, video encoder and COFDM modulator. The Analog section comprises an integral FM modulator for one video channel with two associated audio channels.

The RFX-RMT transmitter is most commonly used with a separate power amplifier for high power ENG applications.

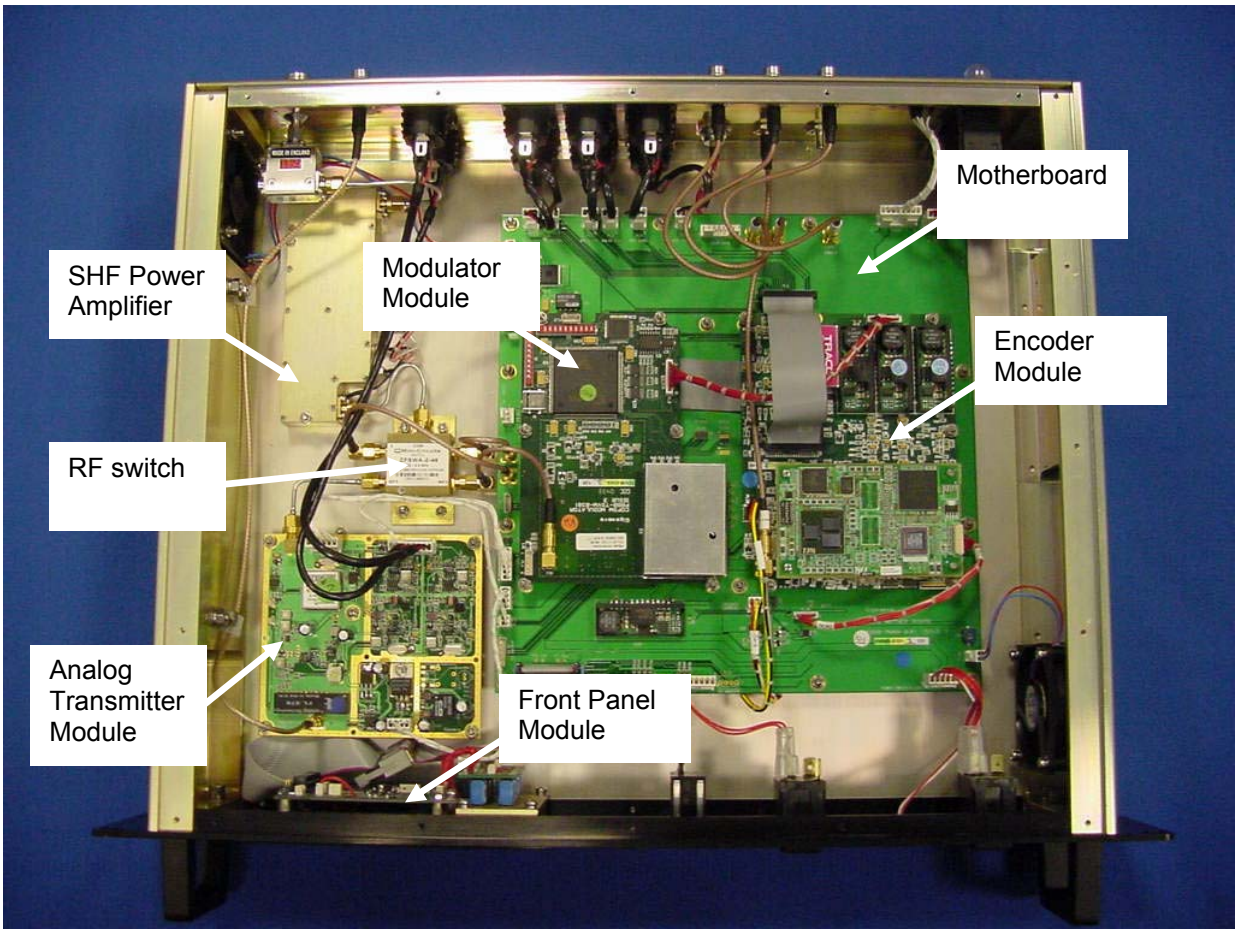
At the receive site a range of RF Central Analog/digital receivers may be used. For example the RFX-MVRX is a two box rugged portable systems offering the features of triax remote. Alternatively, the RFX-RMR switchable Analog/digital rack mounted receiver may be used. Please consult the separate manual for information detailing the operation of receivers.

3. SPECIFICATIONS

Frequency Band	1.97 – 2.50GHz band
Frequency Selection	As per US BAS allocation (current and future plans)
Transmit Power	500mW nominal
Digital Specifications	
Modulation	COFDM DVB-T 2k
Modulation Modes	QPSK, 16QAM, 64QAM FEC: $^{1}/_{2}$ $^{2}/_{3}$ $^{3}/_{4}$ $^{5}/_{6}$ $^{7}/_{8}$ Guard interval: $^{1}/_{32}$ $^{1}/_{16}$ $^{1}/_{8}$ $^{1}/_{4}$
Data Rate	4.98 to 31.7 Mbit/s
Bandwidth	8MHz (7 & 6MHz options available)
Encoding Options	MPEG 2: 4:2:0/4:2:2 high quality video (DVB standard)
Latency	Selectable to less than 2 frames minimum, Tx to Rx
Video Input	Digital: SDI 270Mbit/s Analog: YUV, Y/C or Composite (NTSC/PAL)
Audio Input	Digital AES/EBU 2 x stereo Digital SDI embedded Analog 2 x stereo / 4 x mono inputs, mic/line selectable
ASI Data Input	ASI transport stream, 188/204/byte, automatic selection of burst, byte or packet mode
Aux Data Input	Aux. RS232 data
Analog Specifications	
Modulation	FM
Deviation	Adjustable to current and future BAS channel plans
Spurious	Better than –60dBm
Bandwidth	8MHz (7 & 6MHz options available)
Video Input	Analog: Composite (NTSC)
Audio Input	Analog: 1 x stereo / 2 x mono inputs, line level
Audio Sub-carriers	Factory pre-set to 4.83 and 5.80MHz. Programmable +/- 100kHz via front panel
General	
Power Requirement	11-18VDC (Digital mode = 3A at 12VDC, Analog mode = 2A at 12VDC)
Size	19 inch rack mount x 2'U'. Depth = 14 inches
Weight	14 lbs.
Environmental	Temperature: -4° to +122°F Altitude: 14,500 ft. Humidity: 95% long term

Specifications may alter at the discretion of RF Central or to meet customer specific requirements.

4. OVERVIEW OF RFX-RMT TRANSMITTER



The RFX-RMT transmitter comprises seven main modules or assemblies:-

1. **Motherboard.** This board accommodates the digital encoder and modulator boards, as well as providing DC, signal and I2C communications routing to/from all other modules.

2. **Encoder module.** This module accepts all signals provided for digital transmission and uses MPEG2 encoding/multiplexing techniques to produce a digital transport stream for the modulator module

3. **Modulator module.** This module accepts the digital transport stream from the encoder module and uses digital COFDM modulation techniques to produce a digital RF signal and the required RF frequency

4. **RF switch.** This switch is controlled via the front panel and is used to select either the RF signal from the digital modulator module or from the Analog transmitter module.

5. **Power Amplifier.** This module accepts the Analog or digital RF signal at a level of –10dBm (nominal) and amplifies the signal to a level of 500mW (+27dBm) nominal.

6. **Analog transmitter module.** This module accepts an Analog composite video signal (NTSV) plus up to 2x Analog audio signals (line level) and uses conventional FM modulation techniques to produce an RF signal complete with audio sub-carriers at the required RF frequency.

7. **Front panel module.** This module contains a microprocessor plus six push buttons and an LCD display for overall monitoring and control of the RFX-RMT transmitter.

5. FRONT PANEL CONTROLS

Front panel view of the RFX-RMT

The front panel of an RFX-RMT transmitter comprises quantity 2x 2-way switches (On/Off and Analog/Digital), 1x 10-way rotary switch (BAS channel number), six push button switches (used to navigate the various RFX-RMT menus) and an LCD display.

Also fitted are three LEDs – 'DC' (Green), 'Status' (bi-color green/red), and 'Local' (bi-color green and amber)

On/Off Switch Down for Off, up for On

Digital/Analog switch Down= Analog transmission, Up = Digital transmission. Please note that this function can also be controlled via the push buttons and RFX-RMT menus.

Channel Rotary, 0-10. 1= BAS channel 1, 2 = BAS channel 2, etc to 0 = BAS channel 10. Please note that the BAS channels can be switched between the 'current' plan and the 'new' plan via the push buttons and RFX-RMT menus. The exact frequency selected by either method is shown on the top menu page on the LCD display.

'DC' LED Lit green whenever a correct DC voltage is presented to the RFX-RMT transmitter. This LED will be lit irrespective of whether the unit is switched 'on' or 'off'.

Status LED Stable Green indicates that the RFX-RMT is functioning correctly. A flashing green light indicates that the RFX-RMT is functioning correctly but that no video signal is present whilst the unit is switched into 'digital transmission' mode. A stable red light indicates that the unit has an alarm condition.

Local LED Indicates whether the 'channel' and 'Analog/digital' switching controls are being accepted from the front panel rocker switches or from the push button menu. Green light = rocker switch operation, amber light = push button menu operation.

Full details of the push button menu structure can be found in section 8.

6. REAR PANEL CONNECTIONS

Rear Panel view of RFX-RMT showing all connections

6.1.1a Video for Digital Transmit Section (BNC connectors)

Connectors for either SDI digital, composite Analog or component Analog (Y/C or YUV) video or ASI transport stream. Selected via front panel keypad.

75Ω BNC connectors (female)

6.1.1b Video for Analog Transmit Section (BNC connector)

Connector for composite video input.

75Ω BNC connector (female)

6.1.2 Analog Audio for Digital Transmit Section (XLR connectors)

Line / Mic Hi Z

The four channels of Analog audio are connected via four 3pin XLR Female connectors. The connectors are designated Ch1, Ch2, Ch3, and Ch4. These inputs can be independently selected for Line or Mic level inputs with adjustable gain, via the front panel keypad

Pin	
1	Analog Ground
2	Ch1/ A / Left +
3	Ch1/ A / Left -

6.1.3 Digital Audio for Digital Transmit Section (XLR connectors)

The two channels of AES EBU stereo digital audio are connected via two 3pin XLR Female Connectors. The connectors are designated Ch1 and Ch2.

Pin	
1	Ground
2	Hot/ +
3	Return/ -

6.1.4 Analog Audio for Analog Transmit Section (XLR connectors)

Line Level/ 600Ω balanced Z

The two channels of Analog audio are connected via two 3pin XLR Female connectors. The connectors are designated Ch1 and Ch2.

Pin	
1	Analog Ground
2	Ch1/ A / Left +
3	Ch1/ A / Left -

6.1.5 Power Connector

Connector Type: 4 pin XLR connector (male)

Input range: 11 to 18V DC nominal

Pin	Function
1	+12VDC
2	Not Used
3	Not Used
4	0V

6.1.6 RF O/P

Connector Type: 50Ω 'N' type (female)

6.1.7 User data (future option)

Connector Type: 7 pin LEMO connector EGG.1B.307.CLN

User data selectable as RS485 or RS232
(future option)

	RS232 CONNECTIONS	RS485 CONNECTIONS
Pin		
1	Not Used	Not Used
2	Not Used	Not Used
3	User Data	User Data (-)
4	Not Used	Not Used
5	Ground	Ground
6	Not Used	Not Used
7	Not Used	User Data (+)

6.1.8 Remote Monitoring and Control (future option)

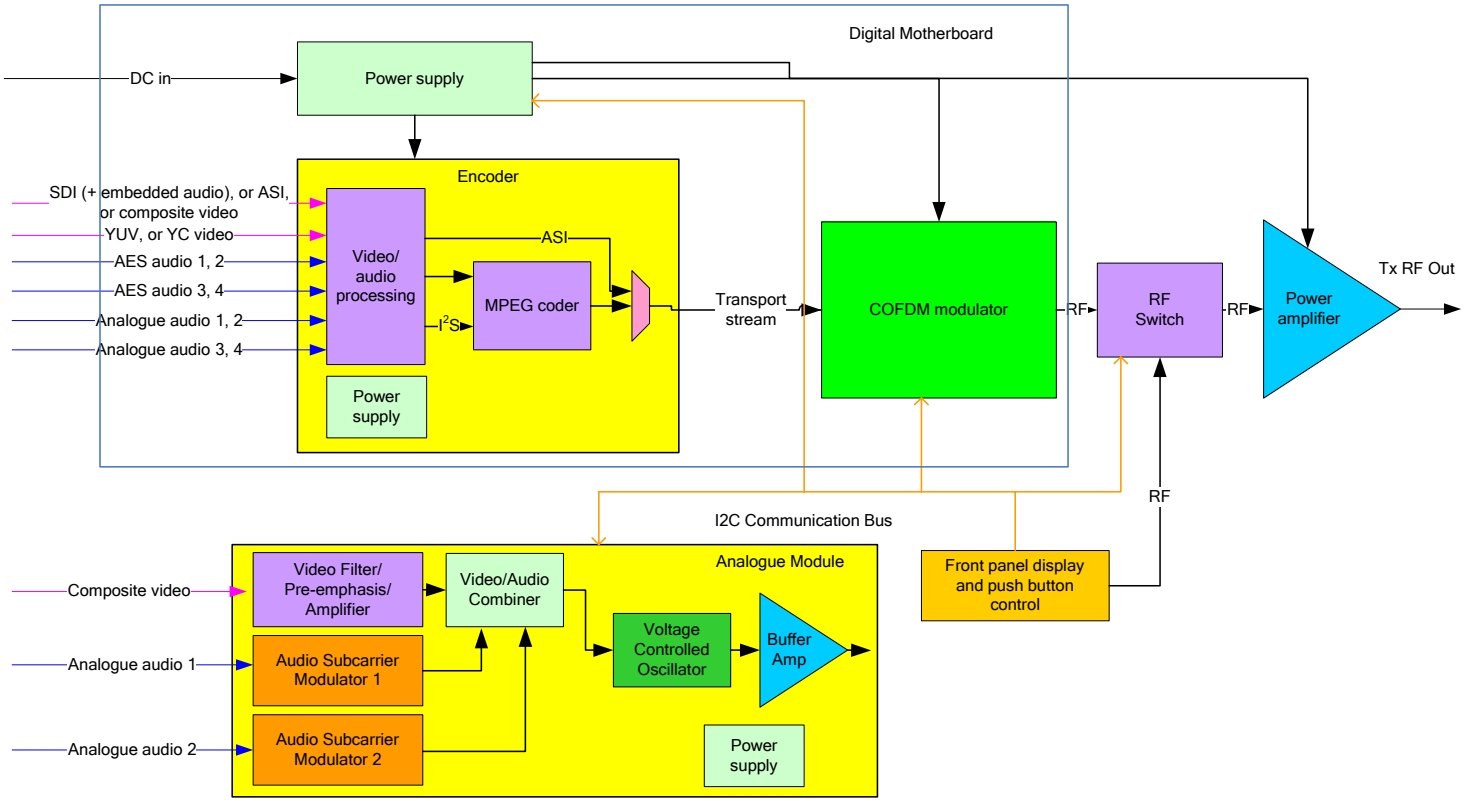
Connector Type: 9-way ‘D’ type, female

Remote Control and Monitoring interface selectable as RS485 or RS232
(Future option)

	RS232 CONNECTIONS		RS485 CONNECTIONS	
Pin		**Direction**		**Direction**
1	Not Used		Not Used	
2	Data Tx	Out from Unit	Data Tx (-)	Out from Unit
3	Data Rx	Into Unit	Data Rx (-)	Into Unit
4	Not Used		Not Used	
5	Ground		Ground	
6	Not Used		Data Tx (+)	Out from Unit
7	Not Used		Data Rx (+)	Into Unit
8	Not Used		Not Used	
9	Not Used		Not Used	

7. CIRCUIT DESCRIPTIONS

RFX-RMT Simplified block diagram



7.1 Audio / Video Encoder

The Encoder board consists of the following main functions:

- SDI to Digital desterilizer. Converts the SMPTE-259M-C serial digital video input to an 8-bit parallel digital video bus.

- Analog to Digital Video Converter, 10 bit over sampling ADC
  Takes either Composite Video (75 Ω, 1v p-p) (CVBS); YC or YUV inputs in either PAL / NTSC format, and converts to an 8bit parallel digital video bus.

- FPGA selects the required 8-bit parallel digital video bus from either the SDI or Analog input, packets this data for input to the MPEG2 encoder. A relay is used to route the input from the BNC (either SDI or CVBS) to either the SDI desterilizer or the PAL/NTSC decoder.

- Audio Analog to Digital Converter, 48 kHz, 24 bit. Four high impedance Analog inputs. The channels are first buffered by a variable gain stage to cater for either Mic or Line level inputs. A switchable 20dB stage is also included to cater for low level Mic inputs. The audio channels are then converted into digital signals and passed to the MPEG2 Encoder.

- Audio SDI de-embedder. Extracts digital audio from the SDI stream

- MPEG2 Encoder. Compresses the video and audio. The encoder uses a suite of MPEG2 compliant compression techniques, where the data bit rate is reduced by processing over multiple picture frames. The absolute picture (Intra frame) is interleaved with pictures that are created using difference data (Predicted frame) with Bi-directionally predicted frames (4:2:2 Only) in conjunction with motion compensation; thus low data rates down to 4 Mbps, can be achieved.

  The encoder includes special modes which are optimized for low delay (latency).

  The encoding parameters are loaded into the encoder at power up. These are selected from one of the 'preset' encoder memories. See 0 and Appendix B

- ASI routing.
  As an alternative to the internal MPEG encoder an external ASI data stream may be used. The ASI input to the front panel is converted to parallel, and automatically selected for 188/204/byte mode inputs, the signal is then configured for the modulator input format and routed direct to the transport stream output, bypassing the MPEG2 coder.

- DC Power Supplies
  Switching DC/DC converters are used to generate the various supplies from the incoming 9-18V battery supply. These include 2.5, 3.3V, 5V, 8V and +/-5V supplies.

There are no field replaceable parts on the Encoder board. If a fault occurs with the board contact RF Central for technical assistance.

7.2 COFDM Modulator

The normal scheme of COFDM modulation adopted by RF Central for the RFX-RMT is 2k carriers with 8MHz RF bandwidth.

The COFDM modulator has been designed to take its input from the MPEG2 encoder, or from an external ASI. This Transport stream is then modulated directly to the output frequency band (e.g. 2GHz). This method reduces the occurrence of inter-modulated harmonic frequencies and requires less up-converters

The COFDM modulator RF output is via the SMB connector. This output is then fed, via the Analog/digital RF switch, into the power amplifier. The nominal RF output level from the Modulator is –9dBm.

- When the traffic being carried by the Tx is video and audio, the modulator is automatically configured to match the data rate of the MPEG2 Encoder as defined by the selected parameter set.
- When the traffic being carried by the Tx is ASI, the modulator may be set for modulation, FEC and guard interval, according to the chart in Appendix B

There are no field replaceable parts on the COFDM modulator. If a fault occurs with the board please contact RF Central for technical assistance.

7.3 Analog Transmitter Module

The RMTX-0101 Analog transmitter module provides the Analog transmitter function of the RFX-RMT Digital / Analog transmitter system rack assembly. The board facilitates one (NTSC) video input and two audio inputs. Operation and frequency selection is via front panel control. The R.F. output of the board is routed to the RF switch, which selects the Analog or digital operation mode, and is then amplified to a suitable level for transmission by the common power amplifier. The RMTX-0101 board is disabled during system digital operation. On-board bi-color LED's are provided for R.F. and power supply monitor functions.

Function.

The functions of the board are:

1. Convert the unbalanced NTSC video input to a frequency (FM) modulated carrier over a frequency band of 1950 – 2500MHz. A bi-color LED is provided 'on board' to indicate 'lock' of the R.F. phase locked loop (PLL) synthesizer. The PLL status is also reported to the front panel display and can be verified by selecting the appropriate menu.

2. Convert two balanced line level (+9dBm 600 ohms) audio inputs to frequency modulated sub-carriers at nominally 4.83 and 5.8MHz. The independent operation of the two sub carriers is available via front panel control. The sub-carrier frequencies can be adjusted over a +/- 100 kHz range via front panel control, to facilitate regional and customer requirements.

Video and R.F output circuit operation.

The 75 ohm unbalanced video input is connected via board mounted SMB socket SK1. The signal is attenuated and matched by the pin attenuator R1, R2, R3, before low pass filter FL1. The output of the filter is attenuated by pi attenuator then passed to the pre-emphasis network consisting of R7-R9, C2-C4, and RV2.

The two audio sub-carriers are summed with the video at this point before video amplifier IC3. The gain of the stage is adjusted as a function of the R.F. VCO (voltage-controlled oscillator X1) tuning voltage, to compensate variation in modulation sensitivity across the 1950 – 2500MHz band.

The threshold and gain of the compensation is adjusted by RV3, RV4. These adjust the voltage at TR1 gate, which varies the drain – source 'ON' resistance and hence, since this forms part of the feedback circuit of IC3, adjusts the gain of the stage to maintain a constant F.M. deviation. NOTE: RV3 and RV4 SHOULD NOT BE ADJUSTED without access to the appropriate procedure and test equipment.

The second video amplifier IC4 is arranged with video invert switch S1 so that the F.M. polarity can be set to be positive (i.e. an increase in R.F. output frequency with positive going video), or negative (i.e. a decreasing R.F. frequency with positive going video). The gain of this stage is fixed. The F.M. deviation is set by RV1, which varies the amplitude of the signal which is A.C. coupled via C39 to the VCO tuning port.

The VCO R.F. output is attenuated by 6dB (R32, R33, R34) and then split by the 50 ohm 6dB splitter R35, R37, R38. One output from the splitter provides a sample frequency to the phase locked loop synthesizer, (IC6), the other the R.F. output. This is attenuated a further 10dB (R38, R39, R40) which maintains a 'good' 50 ohm match to the R.F. output and high isolation to the VCO output, which is sensitive to changes. The R.F. is then A.C. coupled via C29 to the on board SMA socket SK2. The nominal output level is –9dBm.

R.F. phase locked loop and lock detect monitoring

The required transmitter RF frequency output band is achieved by varying the tuning voltage of VCO (voltage-controlled oscillator) X1. As the tuning volts increases, the RF output frequency increases. The RF output frequency of the transmitter board is set via the front panel display and control edit functions.

These provide clock, data and latch enable inputs for the phase locked loop circuit IC6. (Also the common bus clock and data and separate latch enable for the two audio modulator PLL's). The VCO R.F. output is attenuated and then split as described in the video and R.F. section above. The A.C. coupled R.F. sample is applied to IC6 RF input.

The PLL has a reference frequency crystal (X2) oscillator of 8MHz. The difference between sample frequency and that set at the front panel results in a voltage offset at IC6 charge pump output. This voltage is high when the sample frequency is high compared to the set frequency and low when the sample frequency is low. This is filtered, inverted and amplified by the loop filter circuit IC5 and applied to the VCO tuning port.

The response time of the loop filter (frequency response) is determined primarily by the required low frequency response of the video signal. Consequently, the typical loop filter response results in a 'lock time' (i.e. the time delay between power – up and PLL 'lock') of several seconds. (This is also true of the audio PLL synthesizers). When the required R.F. frequency is obtained, the PLL output 'rests' at the loop filter D.C. reference voltage at IC5 non – invert input. (~2.5v). The filtered D.C. VCO tuning voltage now stabilizes and the required R.F. carrier 'center' frequency is obtained.

The 'lock detect' output now goes 'high' and the bi – color 'lock' LED driven by IC1 switches from red to green, to indicate that the PLL is now locked. This also provides the lock detect output to the front panel display as described in the Function section above.

A1 and A2 audio modulators

The A1and A2 audio modulators are identical apart from some frequency specific components in the VCO circuits and the nominal required H.F. output frequency.

The balanced line level audio input is attenuated and then applied to the low noise amplifier (IC8, IC12). The output of the amplifier is connected to the F.M. deviation setting pot (RV5, RV7). This is adjusted for a peak-to-peak F.M. deviation of 200 KHz at the nominated audio input level. The second amplifier (IC9, IC13) incorporates the audio pre-emphasis components (R71, R133, and C58 for A1 and R104, R129 and C88 for A2) for the required 75uS characteristic. The audio output from IC9, IC13 is A.C. coupled to the varactor tuning diode D3, D4. This is the control element for the VCO circuit formed by TR8 (A1) and TR10 (A2) and its associated components.

The frequency of the oscillator circuit is directly proportional to the voltage applied to the tuning diode, which varies the device capacitance. The oscillator output is buffered by TR9, TR11 to reduce loading effects. The buffer output is A.C. coupled to the level pot RV6, RV8. This is set to obtain a sub-carrier of –30dBc (i.e. 30dB lower than the main R.F. carrier level). The buffered oscillator output also supplies the PLL sample frequency. The audio modulator PLL's IC11, IC15 and loop filters IC10, IC14 operate as in the R.F. PLL description in the R.F. phase locked loop section above. The reference frequency for the audio PLL's is 12MHz crystal X3, X4.

The audio sub-carrier frequencies can be adjusted via the front panel display and controls and switched on / off independently. The sub-carriers are switched on via TR12, TR13. A logic ‘low’ level on PL1 pins 7 and 8 respectively switches on the A1 and A2 modulator oscillator circuits.

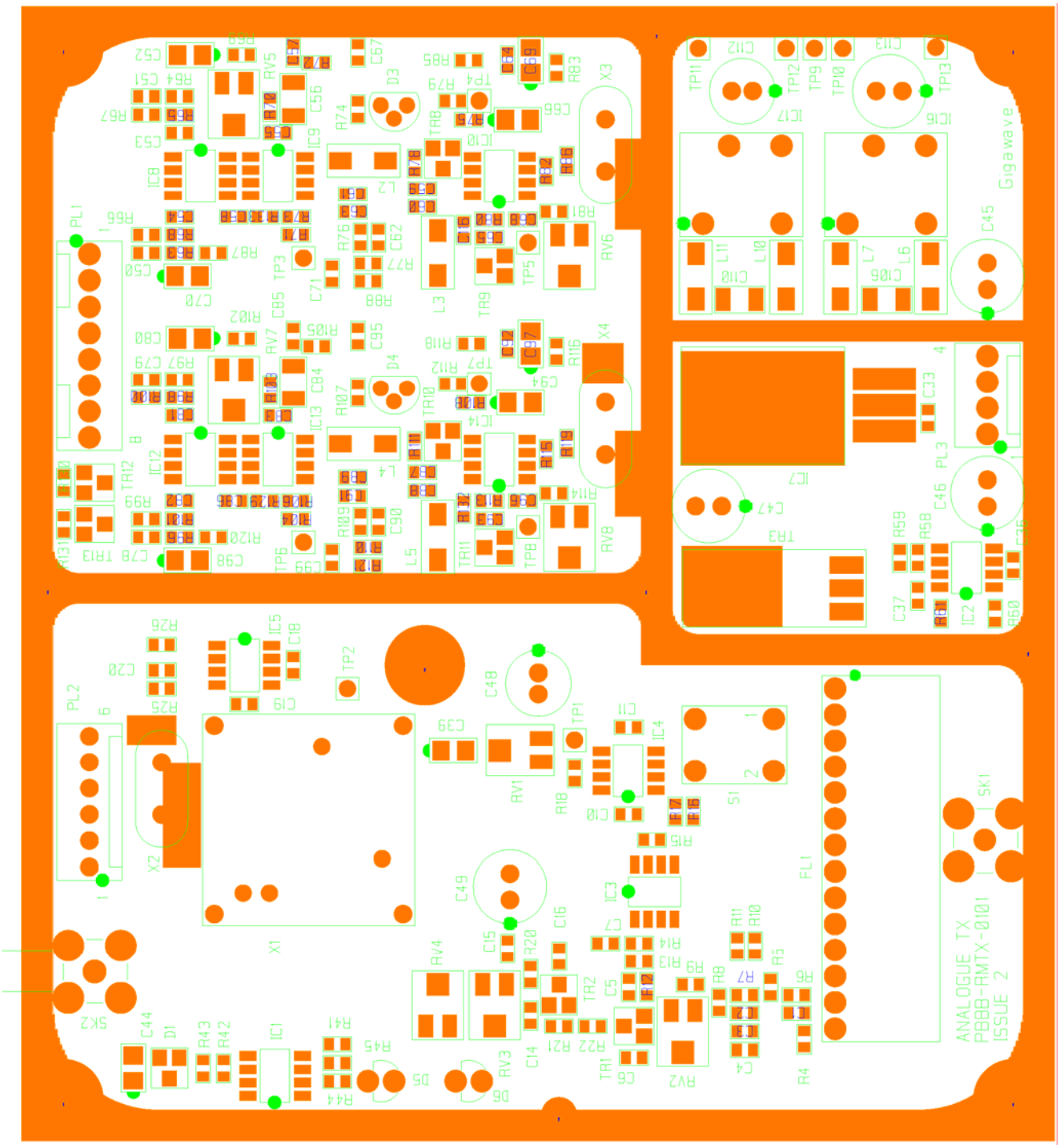
Power supplies and monitoring

The +12v input supply is filtered and regulated by IC7, +5v linear regulator. This provides the +5 volt supply to the transmitter board circuits and is also the reference voltage for the discrete ‘low drop out’ 10.5-volt regulator circuit comprising TR3, TR6, TR7 and associated components.

The +10.5v supply provides the board circuits and the DC /DC converter IC16. The converter provides the –4.3v supplies for the board.
The +5v supply is current limited by the inclusion of R56, R57 in the supply to IC7. The +10.5v supply is current limited by TR4 and sense resistors R46, R47. Supply over voltage protection is controlled by TR5. The +10.5v regulator circuit is turned off if the input supply exceeds ~15.5v.

The input supply monitor circuit (IC12) and ‘12v OK’ bi – color LED are designed to indicate supply OK between 10.5 and 15.5v. Over this range the LED will be illuminated green. Above and below these limits the LED will illuminate red.

A component layout diagram for the Analog transmitter module is shown on the following page to assist with faultfinding or module re-alignment.



Schematic layout of Analog transmitter module, RFX-RMT transmitter

7.4 Power Amplifier

The function of the power amplifier is to amplify the signal from the COFDM modulator to a suitable level for transmission. The amplifier is required to be highly linear to accommodate the high order modulation modes employed for digital system operation, with very low distortion (low inter-modulation between carriers). The nominal output power is +27dBm (500mW) (band specific).

The status of the PA is shown by LED mentioned in clause 0, and also displayed in the status menu 0

To ensure good RF practice, when power is applied to the RFX-RMT, always make sure that there is a suitable load or antenna connected to the RF output.

There are no field replaceable parts in the Power amplifier. If a fault occurs with this module please contact RF Central for technical assistance.

8. CONFIGURING THE TRANSMITTER

8.1 Status Monitoring

The red/green 'status' LED on the front panel indicates the condition of the RFX-RMT, if a fault or warning exists the LED will indicate Red and the Status menu will indicate the nature of the fault / warning. During initialization of the unit the Status LED will be off.

8.2 Top level Menu

Six charts showing the menu trees of the RFX-RMT are included in this manual. These are for:

- Operations menu – MPEG encoder mode
- Engineering menu – MPEG encoder mode
- Operations menu – ASI mode
- Engineering Menu – ASI mode
- Operations menu – Analog Tx mode
- Engineering menu – Analog Tx mode

The RFX-RMT is configured using an LCD display and six push buttons. These are arranged as four navigation buttons (A, B, ▲ and ▼), plus **E**nter and **C**lear buttons.

The **E**nter button is used to store the modified parameter in non-volatile memory; this parameter will then be used to configure the RFX-RMT and will also become the default value when next powered on.

The **C**ancel button can be used to exit a menu without storing the parameter in memory.

Various menu levels are provided to allow the operator to access the different hardware and operating parameters:

Initialization Menu
At switch on the status of the initialization is displayed. If any errors are found with the initialization of the major functions; Video, Audio, Encoder and Modulator, an error message will be displayed. During initialization the Status LED will be off.

Top level and Current Operational State

This is the display screen during normal operation of the RFX-RMT and indicates the Tx frequency (Channel number or Manual frequency), the current operating mode (Analog or digital), and the MPEG/COFDM parameters in use (digital operation). The B button is used to show other current parameters (digital = bit rate, encoder memory, video input mode, audio input mode, Analog = RF frequency, sub-carrier frequencies).

The ▲▼ buttons are used to select the required sub-menus; Ch/Freq, Tx mode (Analog/digital) and Status. The **E**nter button is then used to allow changes to be made.
During normal operation the Status LED will be green indicating 'healthy' state of the RFX-RMT

Ch / Frequency Menu
This menu is used to select one of the sixteen pre-channels (CH1 – Ch10) or 'manual' frequency.

The 'Man' setting allows the transmit frequency to be set in 0.5MHz steps anywhere within the Tx operating band. The **E**nter button allows the A/B buttons to select the required digit, the ▲▼ buttons then select the required value. The **E**nter button then stores the value and returns to the Main menu.

8.3 Operational menu –MPEG2 mode

Encoder Menu
Using the ▲▼ buttons, this menu is used to select the required MPEG encoder operating parameters. These are held in 16 non-volatile memories (0 – 15). The display will also indicate the modulation mode (QPSK, 16QAM, 64QAM) and the transport stream data rate.

A chart of typical 16 encoder memory pre-sets is given in Appendix A. Note that some transmitters may have different configurations according to individual customer requirements. Please consult the documentation supplied with the equipment for the details applicable to your system (a separate sheet is supplied).

Audio 1 Menu

The Audio menus are split into two levels:-
- Select Input
- Set Level.

The ▲▼ buttons and **E**nter are used to select the required audio sub menu.
The audio input can be set for either Line or Mic input; selecting Mic gives a fixed +20dB gain.

There is also a level adjustment providing a ± 20dB in 0.5dB steps. This level adjustment is intended to cater for variations in camera audio output levels; it is NOT intended to use these adjustments to set microphone sound level. It is assumed that the mic pre-amp and limiter within the camera is used for this purpose.

Audio 2, 3, 4 Menus
As Audio 1

Status Menu
The status menu is used to confirm the condition of the RFX-RMT. If the Status LED is red indicating a fault or warning, the Status menu will indicate the nature of the problem.
The ▲▼ buttons are used to scroll through the various functions:

Signal Input	- a valid video input is present
TS Present	- the MPEG encoder is generating Transport Stream
TS Rate	- TS data rate matches the modulator data rate
Synth Locked	- the RF synthesizer is locked to correct frequency
PA Enabled/Disabled	- the RF PA is powered or disabled
RF Output	- RF is present on the output
PA not inhibited	-the PA is active

8.4 Engineering Menu – MPEG2 mode

The Engineering menu provides the method of system configuration; there are no user adjustments or setups internal to the Tx.

The engineering menu is entered by pressing the ◄ and 'C' buttons simultaneously for 2 to 10 seconds, then releasing the 'C' button.

Control Mode

The RFX-RMT may be configured such that the selection of channel frequency and operating mode (Analog or digital) is selected from the push button menu or via the two front-panel rocker switches

FW Inventory
The firmware version for the encoder and main unit controller can be obtained from this menu. In future the version number of the MPEG encoder parameter sets will also be displayed.

Channel Plan

The RFX-RMT transmitter can be switched between two different sets of 10 preset RF frequencies known as the 'Old' BAS channel plan and the 'New' BAS channel plan.

The ▲▼ buttons are used to select the channel plan menu. The **E**nter button then allows the ▲▼ buttons to select the required plan. The **E**nter button then stores the plan and returns to the Main menu.

Video Input
The RFX-RMT can accept either CVBS, YC, YUV inputs in either Analog PAL (625) or NTSC (525). Alternatively using the BNC 75Ω connector, SDI digital video, or CVBS Analog video can be input.

The video input may be selected to CVBS/YC/YUV, Analog, or SDI digital, or internal test color bars

The **E**nter button allows the ▲▼ buttons to select the required value. The **E**nter button then stores the value and returns to the Main menu.

In the event that BARS is selected, a sub menu allows ALT BARS, or 75% or 100% BARS to be selected.

Video Format
The video format may be selected PAL or NTSC

The **E**nter button allows the ▲▼ buttons to select the required value. The **E**nter button then stores the value and returns to the Main menu.

Audio Input
The audio input may be selected to Analog, AES digital, or SDI embedded or internal test tones

The **E**nter button allows the ▲▼ buttons to select the required value. The **E**nter button then stores the value and returns to the Main menu.

ASI/MPEG

The RFX-RMT operating mode may be selected for either ASI input or video/audio input.

The **E**nter button allows the ▲▼ buttons to select the required value. The **E**nter button then stores the value and returns to the Main menu, after which the menu tree becomes appropriate to the mode selected (ASI or MPEG)

Prog Channels
Each of the ten frequency channels can be independently allocated the required frequency in 0.5MHz steps.

The ▲▼ buttons are used to select the Channel to be assigned. The **E**nter button then allows the four **A B** ▲▼ to edit the required frequency. The **E**nter button then stores the value and returns to the Main menu.

8.5 Operational Menu – ASI mode

Ch / Frequency Menu

This menu is the same as the equivalent in the MPEG Operations menu

Status Menu

This menu is the same as the equivalent in the MPEG Operations menu

8.6 Engineering Menu – ASI mode

The engineering menu is entered by pressing the ◄ and 'C' buttons simultaneously for 2 to 10 seconds, then releasing the 'C' button.

Control Mode
This menu is the same as the equivalent in the MPEG Operations menu

FW Inventory
This menu is the same as the equivalent in the MPEG Operations menu

Channel Plan
This menu is the same as the equivalent in the MPEG Operations menu

Prog Channels
This menu is the same as the equivalent in the MPEG Operations menu

Modulation Mode
The modulation mode may be selected QPSK/16QAM/64QAM according to the chart in Appendix B

The **E**nter button allows the ▲▼ buttons then select the required value. The **E**nter button then stores the value and returns to the Main menu.

Code Rate (FEC)
The FEC may be selected according to the chart in Appendix B

The **E**nter button allows the ▲▼ buttons to select the required value. The **E**nter button then stores the value and returns to the Main menu.

Guard Interval
The guard interval may be selected according to the chart in Appendix B

The **E**nter button allows the ▲▼ buttons to select the required value. The **E**nter button then stores the value and returns to the Main menu.

ASI/MPEG
The RFX-RMT operating mode may be selected for either ASI input or video/audio input.

The **E**nter button allows the ▲▼ buttons to select the required value. The **E**nter button then stores the value and returns to the Main menu, after which the menu tree becomes appropriate to the mode selected (ASI or MPEG)

8.7 Operations Menu – Analog mode

Ch / Frequency Menu

This menu is the same as the equivalent in the MPEG Operations menu

Status Menu

This menu is the same as the equivalent in the MPEG Operations menu

8.8 Engineering Menu – Analog mode

The Engineering menu provides the method of system configuration; there are no user adjustments or setups internal to the Tx.

The engineering menu is entered by pressing the ◄ and 'C' buttons simultaneously for 2 to 10 seconds, then releasing the 'C' button.

Control Mode

The RFX-RMT may be configured such that the selection of channel frequency and operating mode (Analog or digital) is selected from the push button menu or via the two front-panel rocker switches

Prog Channels

Each of the ten frequency channels can be independently allocated the required frequency in 1MHz steps.

The ▲▼ buttons are used to select the Channel to be assigned. The **E**nter button then allows the four **A B** ▲▼ to edit the required frequency. The **E**nter button then stores the value and returns to the Main menu.

Audio sub-carrier frequencies

Each of the Analog audio sub-carrier frequencies can be adjusted from their factory settings (4.83/5.8MHz) by +/- 200 kHz

The ▲▼ buttons are used to select the sub-carrier to be adjusted. The **E**nter button then allows the four **A B** ▲▼ to edit the required frequency. The **E**nter button then stores the value and returns to the Main menu.

Channel Plan

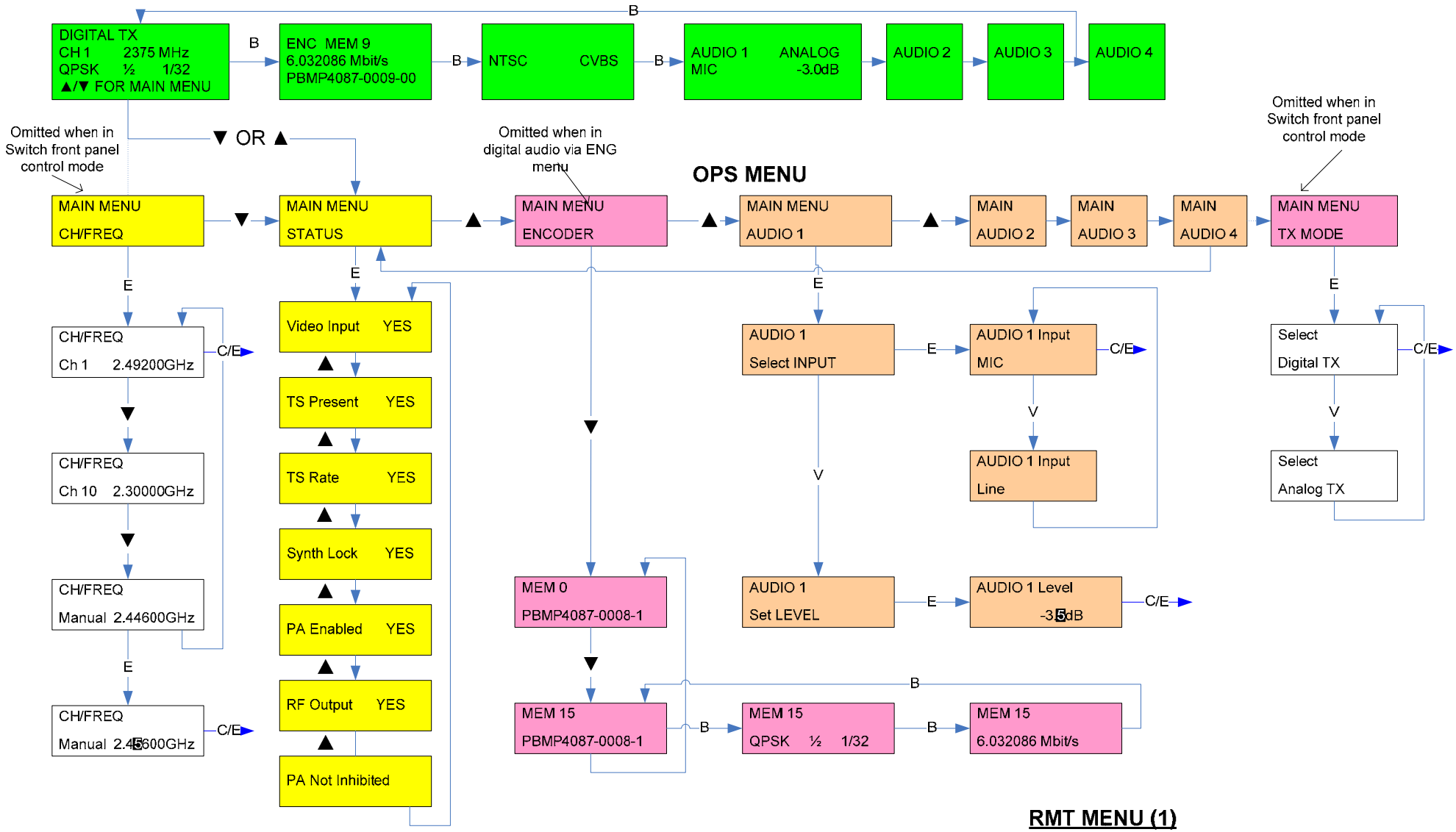
The RFX-RMT transmitter can be switched between two different sets of 10 preset RF frequencies known as the ‘Old’ BAS channel plan and the ‘New’ BAS channel plan.

The ▲▼ buttons are used to select the channel plan menu. The **E**nter button then allows the ▲▼ buttons to select the required plan. The **E**nter button then stores the plan and returns to the Main menu.
.

Key: E = Enter
E/C = Enter or Cancel
A = ◀
B = ▶

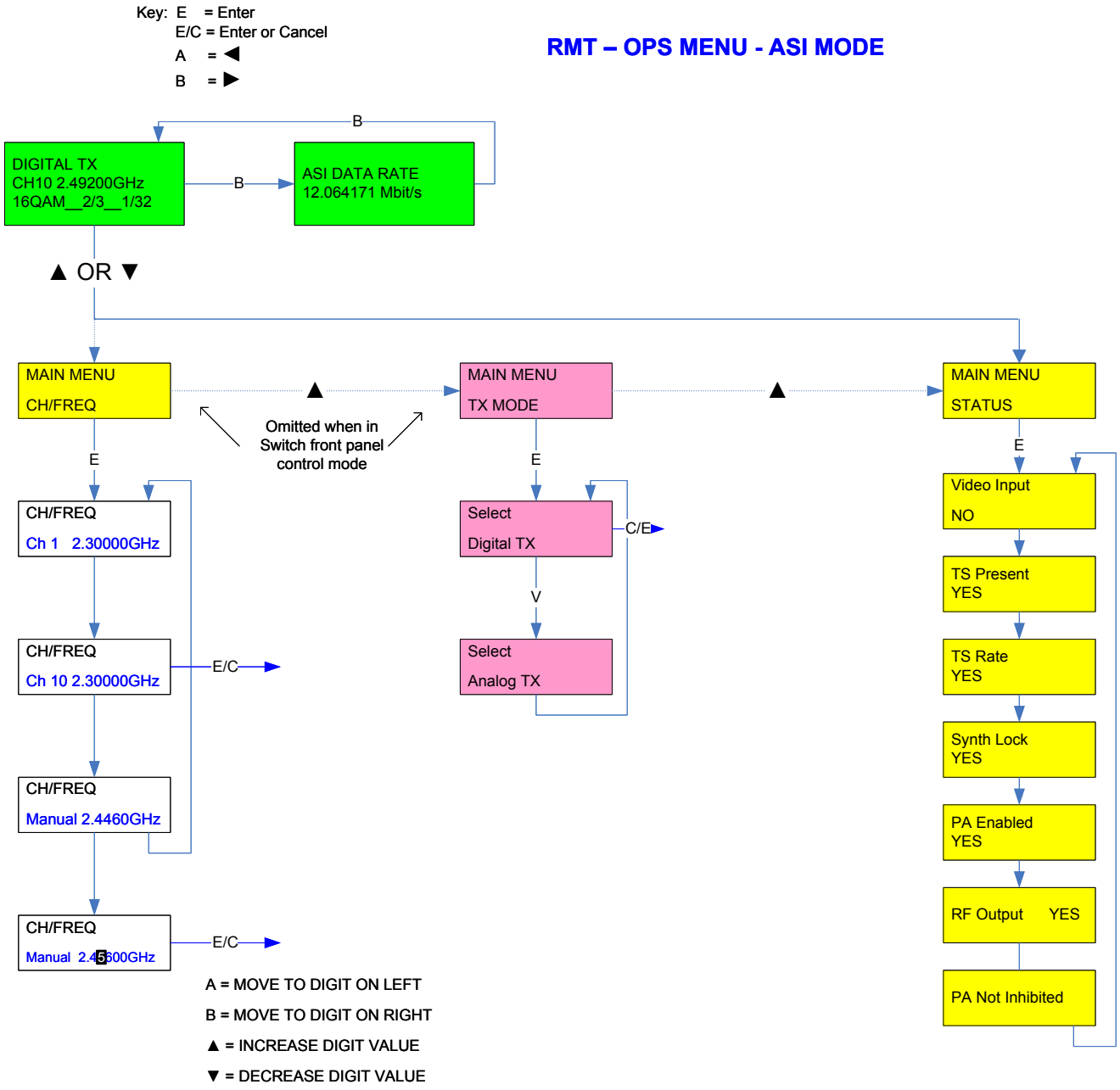
RMT – OPS MENU - DIGITAL MPEG ENCODER MODE

CURRENT OPERATIONAL STATE



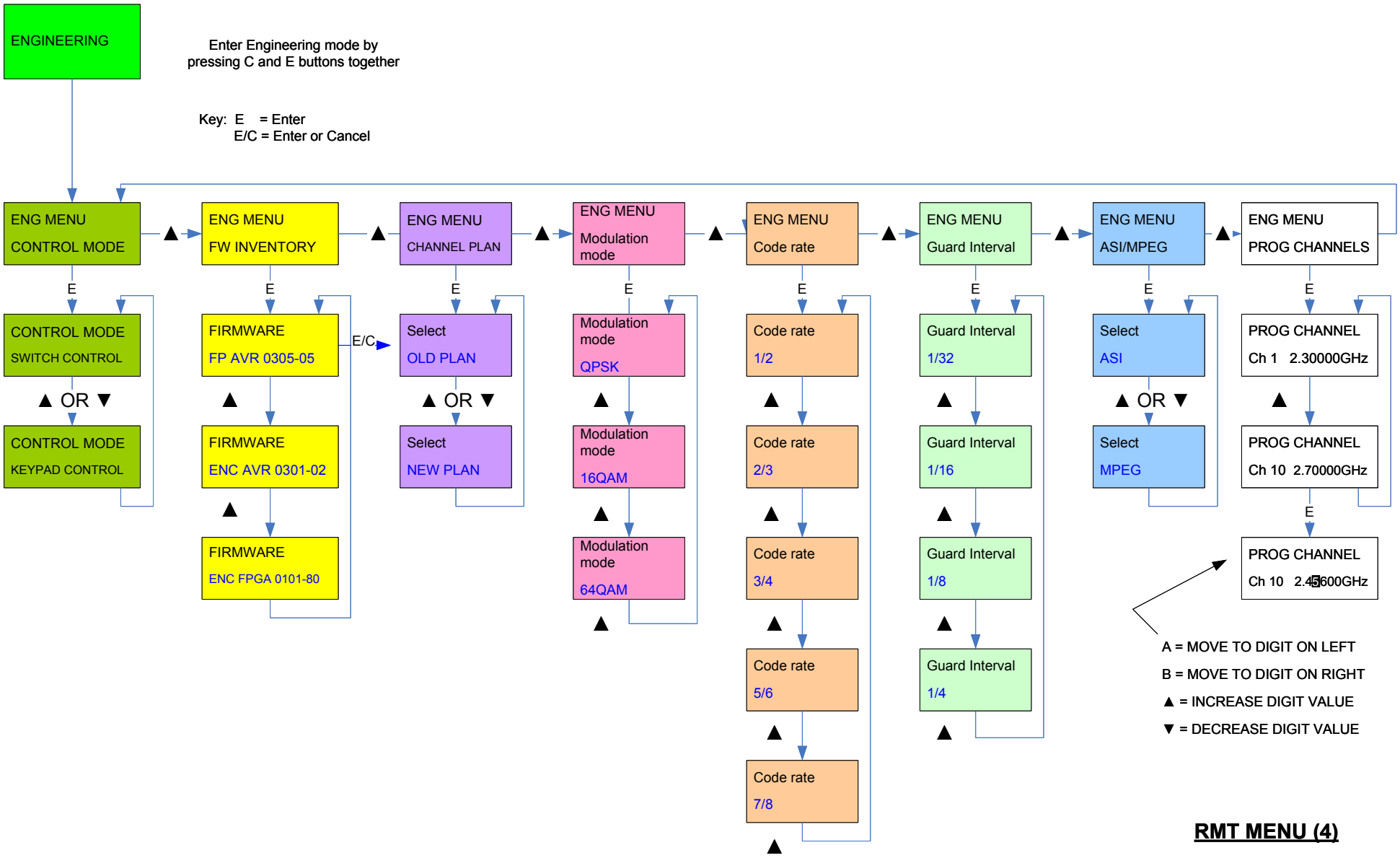
RMT MENU (1)

RMT – OPS MENU - ASI MODE

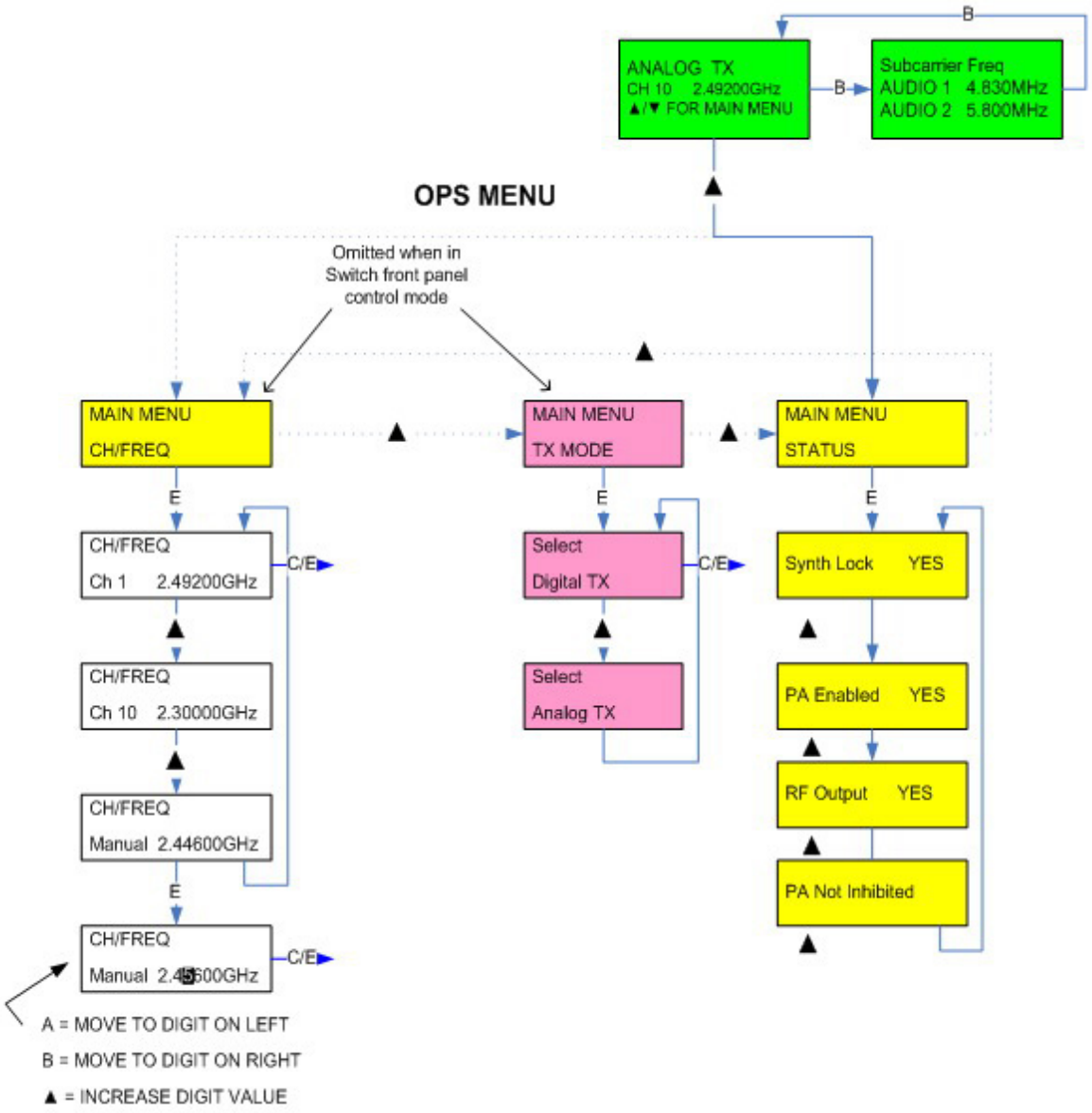


RMT MENU (3)

RMT – ENG MENU - ASI MODE

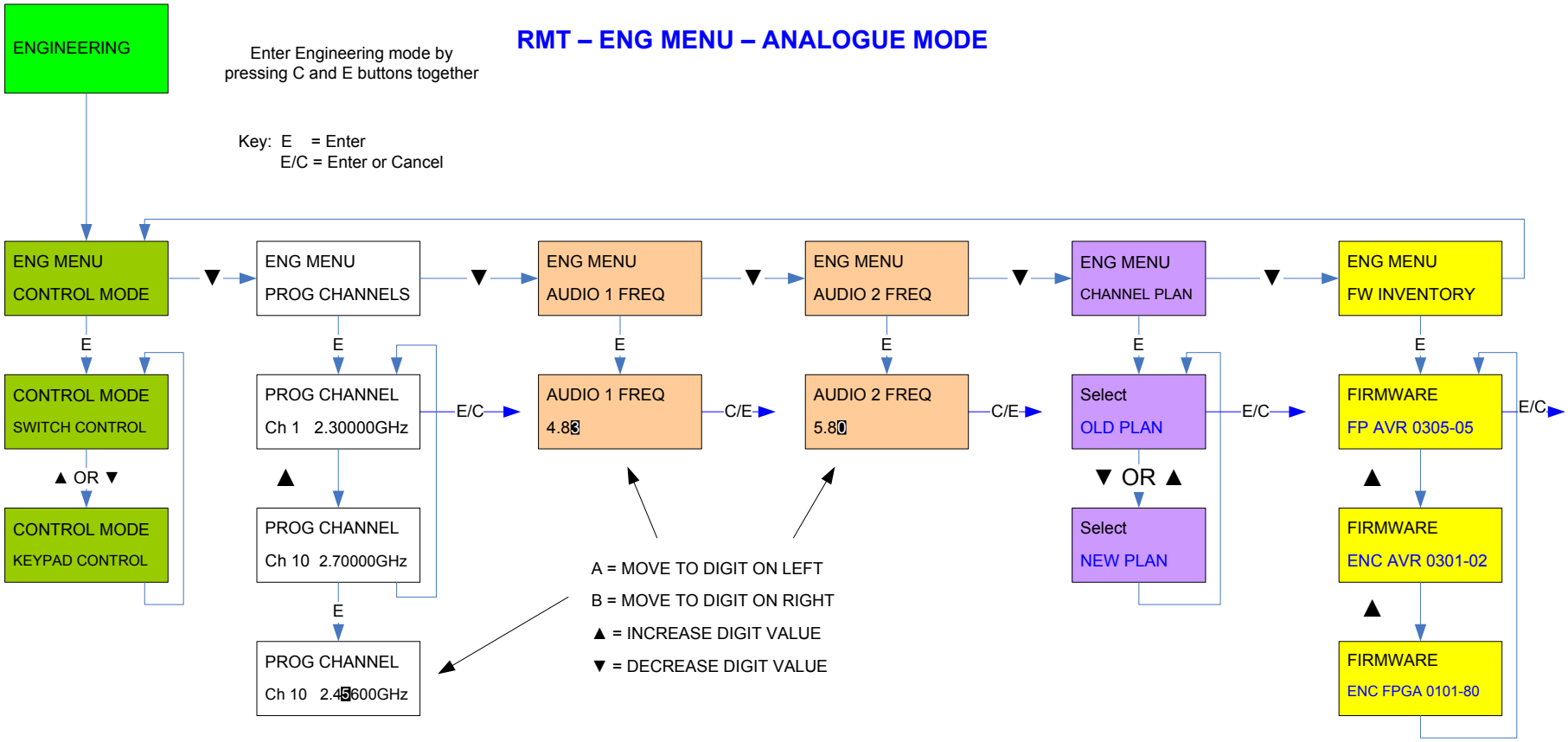


RMT MENU (4)


B
ANALOG TX
CH 10 2.49200GHz
▲/▼ FOR MAIN MENU
B
Subcarrier Freq
AUDIO 1 4.830MHz
AUDIO 2 5.800MHz
OPS MENU
Omitted when in
Switch front panel
control mode
MAIN MENU
CH/FREQ
MAIN MENU
TX MODE
MAIN MENU
STATUS
E
E
E
CH/FREQ
Ch 1 2.49200GHz
C/E
CH/FREQ
Ch 10 2.30000GHz
CH/FREQ
Manual 2.44600GHz
E
CH/FREQ
Manual 2.45600GHz
C/E
Select
Digital TX
C/E
Select
Analog TX
Synth Lock YES
PA Enabled YES
RF Output YES
PA Not Inhibited
A = MOVE TO DIGIT ON LEFT
B = MOVE TO DIGIT ON RIGHT
▲ = INCREASE DIGIT VALUE

RMT MENU (5)

RMT – ENG MENU – ANALOGUE MODE



RMT MENU (6)

9. PREPARING FOR OPERATION

EQUIPMENT PREPARATION

Before leaving the equipment base to undertake an operation it is recommended that the following equipment checks be made.

The RFX-RMT Transmitter

Antennas

The RFX-RMT can be used with a variety of RF Central antennas

- RFX-OMIN antennas are typically used for ground based mobile operations, or helicopter air to ground
- GPS controlled antenna for helicopter air to ground
- PA series Low profile antennas are used for up-linking ground to air, or on-board linking
- HX series antennas offer increased gain and directivity
- RFX-BEAM fan-beam antennas offer increased gain and 90-degree sector coverage.
- Parabolic antennas offer the highest gain, and longest operation range

Full details are given in the RF Central Antennas data sheets

Checks

The transmitter may be powered from an external DC PSU, or by batteries. Check that any batteries to be used are fully charged and that an emergency spare battery is available and fully charged.

Confirm the correct Encoder mode of operation is selected. 0

Confirm the correct frequency is selected. 0

Confirm the correct Video input type is selected. 0

Confirm the correct Audio level is selected. 0

Confirm the correct Audio input type is selected. 0

Check that the Video, audio, DC and RF cables are in good condition.

The Receiving Equipment

The RFX-RMT transmitter may be used with a variety of RF Central digital receivers including

- RFX-MVRX receiver, a two box radio offering the convenience of triax remote
- Compatible RFX-RMR series rack-mounted switchable Analog/digital receiver

Full details of the operation of the receivers are given in the associated manuals

When used with the RFX-RMT transmitter, RFX-MVRX and RFX-RMR digital receiving equipment produces four audio channels (Analog and AES3 digital) together with SDI and composite video outputs. These receivers also have an ASI output.

Check that audio, video, and DC cables of sufficient total length and are in good condition. If extension cables are necessary ensure that the connectors are compatible and of good quality to avoid problems at site.

Check that the receiving antenna/Receiver interfaces are clean and free from dust and other unwanted materials.

If tripods are to be used to mount the equipment, make sure that some means of securing the tripod or of weighting it down is provided. Gusty wind conditions may put installations at risk, particularly when parabolic antenna dishes are to be used.

Make sure that all batteries to be used are fully charged and, whenever possible, provide a spare with cable to connect it to the receiver.

Check that the receiver channel frequencies are compatible with those of the RFX-RMT Transmitter and set the channel selector switch to the channel number required. The receiver is labeled with channel number and frequency information.

Transmitter / Receiver tests

Whenever practical, set up the system and try it before leaving for site to ensure that all components of the system are working. Checking at base, where adjustments and corrective actions can be made, will pay off when setting up at site.

10. System Remote Monitoring and Setup

Using a PC running Hyper Terminal or other terminal emulator, the RFX-RMT can be configured without the use of the operator controls and LCD display. The current configuration can also be obtained via this RS232/RS485 interface.

(Please note that this feature is currently a future option for the RFX-RMT)

Appendix A

RFX-RMT MPEG Encoder Parameter Sets

Set	Part Number	Rate (Mbit/s)	COFDM Mode	MPEG	Video Rate (Mbit/)	Video LPF	Low Delay Mode	Audio Rate (kbit/)
0	PBMP-4087-0008-10	18.096257	64-QAM, 1/2, 1/32	422@ML, GOP4	15.05	No	No	192
1	PBMP-4087-0010-10	18.096257	64-QAM, 1/2, 1/32	MP@ML, GOP16	16.00	No	Yes	192
2	PBMP-4087-0006-10	18.096257	64-QAM, 1/2, 1/32	422@ML, GOP4	16.00	No	No	192
3	PBMP-4087-0009-10	12.064171	64-QAM, 1/2, 1/32	SP@ML, Infinite GOP, Intra-slice	12.00	No	Yes	192
4	PBMP-4087-0009-08	12.064171	16-QAM, 1/2, 1/32	422P@ML, GOP4	9.75	Yes	No	192
5	PBMP-4087-0011-08	12.064171	16-QAM, 1/2, 1/32	SP@ML, Infinite GOP, Intra-slice	8.50	Yes	Yes	192
6	PBMP-4087-0010-08	12.064171	16-QAM, 1/2, 1/32	422P@ML, GOP4	10.00	Yes	No	192
7	PBMP-4087-0012-08	12.064171	16QAM, 1/2, 1/32	422P@ML, GOP16	9.50	Yes	No	192
8	PBMP-4087-0012-02	9.048128	QPSK, 3/4, 1/32	422P@ML, GOP16	7.25	Yes	No	192
9	PBMP-4087-0010-02	9.048128	QPSK, 3/4, 1/32	422P@ML, GOP 4	7.50	Yes	No	192
10	PBMP-4087-0009-02	9.048128	QPSK, 3/4, 1/32	422P@ML, GOP4	7.50	Yes	No	192
11	PBMP-4087-0011-02	9.048128	QPSK, 1/2, 1/32	422P, GOP16	7.00	Yes	No	192
12	PBMP-4087-0009-00	6.032086	QPSK, 1/2, 1/32	422P@ML, GOP16	4.50	Yes	Yes	128
13	PBMP-4087-0012-00	6.032086	QPSK, 1/2, 1/32	MP@ML, GOP4	4.50	Yes	No	192
14	PBMP-4087-0011-00	6.032086	QPSK, 1/2, 1/32	SP@ML, Infinite GOP, Intra-slice	3.00	Yes	Yes	128
15	PBMP-4087-0010-00	6.032086	QPSK, 1/2, 1/32	MP@ML, GOP4	4.75	Yes	No	192

Note: The above parameters are typical for the RFX-RMT and are issued for guidance only. Some transmitters may have different configurations according to individual customer requirements. .

Appendix B

Table of DVB-T non-hierarchical bit rates

Modulation	Code rate	Bit rate (Mbit/s) at each guard interval (symbol fraction)			
QPSK		1/32	1/16	1/8	1/4
	1/2	6.03	5.85	5.53	4.98
	2/3	8.04	7.81	7.37	6.64
	3/4	9.05	8.78	8.29	7.46
	5/6	10.1	9.76	9.22	8.29
	7/8	10.6	10.2	9.68	8.71
16-QAM		1/32	1/16	1/8	1/4
	1/2	12.1	11.7	11.1	9.95
	2/3	16.1	15.6	14.7	13.3
	3/4	18.1	17.6	16.6	14.9
	5/6	20.1	19.5	18.4	16.6
	7/8	21.1	20.5	19.4	17.4
64-QAM		1/32	1/16	1/8	1/4
	1/2	18.1	17.6	16.6	14.9
	2/3	24.1	23.4	22.1	19.9
	3/4	27.1	26.3	24.9	22.4
	5/6	30.2	29.3	27.6	24.9
	7/8	31.7	30.7	29.0	26.1

Rack Mounted Transmitter Controller (RFX-RMTC)

OPERATORS MANUAL

CONTENTS

1 GENERAL SAFETY INFORMATION

The information that follows, together with local site regulations, should be studied by personnel concerned with the operation or maintenance of the equipment, to ensure awareness of potential hazards.

WARNING- RF Power Hazard: High levels of RF power are present in the unit. Exposure to RF or microwave power can cause burns and may be harmful to health.
Switch off supplies before removing covers or disconnecting any RF cables, and before inspecting damaged cables or antennas.

Avoid standing in front of high gain antennas (such as a dish) and never look into the open end of a waveguide or cable where RF power may be present.

Users are strongly recommended to return any equipment that requires RF servicing to RF Central.

WARNING- GaAs / BeO Hazard: Certain components inside the equipment contain Gallium Arsenide and Beryllium Oxide that are **toxic substances.** Whilst safe to handle under normal circumstances, individual components **must not** be cut, broken apart, incinerated, or chemically processed. In the case of Beryllium Oxide, a white ceramic material, the principal hazard is from the dust or fumes, which are carcinogenic if ingested, inhaled, or entering damaged skin.

Please consult your local authority before disposing of these components.

CAUTION- Tantalum Capacitors: When subjected to reverse or excess forward voltage, ripple current or temperature these components may rupture and could potentially cause personal injury.

CAUTION: This system contains MOS devices. Electro-Static Discharge (ESD) precautions should be employed to prevent accidental damage.

1.1 Health & Safety
Exposure to Non-Ionizing (RF) Radiation/Safe Working Distances

The safe working distance from a transmitting antenna may be calculated from the relationship:

$$D = \sqrt{\frac{P_T . G_R}{4\pi . w}}$$

In which D = safe working distance (meters)
PT = transmitter or combiner power output (watts)
GR = antenna gain ratio = anti log (gain dBi ÷10)
w = power density (watts/square meter)

The RF power density value is determined by reference to safety guidelines for exposure of the human body to non-ionizing radiation. It is important to note that the guidelines adopted differ throughout the world and are from time-to-time re-issued with revised guidelines. For RF Central use, a maximum power density limit of 1w/m² is to be applied when calculating minimum safe working distances. Appendix A refers.

Important Note: It must be remembered that any transmitting equipment radiating power at frequencies of 100 KHz and higher, has the potential to produce thermal and athermal effects upon the human body.

To be safe:

a) Operators should not stand or walk in front of any antenna, nor should they allow anyone else to do so.

b) Operators should not operate any RF transmitter or power amplifier with any of its covers removed, nor should they allow anyone else to do so.

Worked examples

Antenna			**Transmitter Power**			
Type	**Gain (dBi)**	**Gain Ratio**	**2W**	**4W**	**10W**	**30W**
OMNI	4	2.5	1	1	1.5	2.5
HELIX	20	100	4	5.6	9	15.5
PARABOLIC DISH	35	3,162	22.5	32	50	87
			MINIMUM SAFE DISTANCE (METERS)			

1.2 Maximum RF Power Density Limits

The RF Radiation Power Density limit figure recommended by RF Central is based upon guideline levels published in:

a. IEEE standard C95.1 1999 - IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

b. Guidelines for Limiting Exposure to Time-varying Electric, Magnetic & Electromagnetic Fields (up to 300 GHz) published in 1998 by the Secretariat of the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Both documents define guideline RF power density limits for "Controlled" and "Uncontrolled" environments. An uncontrolled environment is defined as one in which the person subjected to the RF radiation may be unaware of and has no control over the radiation energy received. The uncontrolled environment conditions can arise, even in the best-regulated operations and for this reason the limits defined for the uncontrolled environment have been assumed for the RF Central recommended limit.

Documents a) and b) also show the RF power density guidelines to be frequency dependent. Different power density / frequency characteristics are presented in the two documents. To avoid complexity and to avoid areas of uncertainty, RF Central recommends the use of a single power density limit across the frequency range 100 kHz to 300 GHz. The 1w/m² power density limit we recommend satisfies the most stringent of the guidelines published to date.

Footnote: The IICNIRP document may be freely downloaded from the internet at www.icnirp.de/documents/emfgdl.pdf (PDF file)

1.3 Issue Status

Issue	Date	Changes
1.0	10/24/05	Initial Issue
1.1	12/05/05	Revised to include enlarged encoder parameter sets, encoder PIDs, operator menus redrawn
1.2	12/14/06	Added calibration procedure with photos

2 Introduction

This manual is to be used in conjunction with the RFX-RMTC unit.

The RFX-RMTC is a rack mountable antenna controller intended for used with an RFX-RMT transmitter and RFX-MMPA mast mounted amplifier and antenna switch. The combination of these units comprise an ENG transmit system capable of a minimum of 100mW to at least five watts of output. It also incorporates all power supplies as well as controls to select and monitor forward and reverse power of either of two antenna outputs and can also control the polarity of one antenna.

3 Specifications

Input	RF from RFX-RMT (500mW maximum)
Transmit Power (system)	100mW to 5W minimum (Front panel adjustable)
Transmit Antenna	Omni or Directional selected by front panel switch
Connections	RF In, RF Out, 12v DC for RFX-RMT, Antenna control, PA Sense
Power Requirements	Nominal 85 to 264v AC (Universal Input)
Mechanical Interface	Rack mounted 1 RU (1.75”)
Size	19 X 12 X 1.75 inches
Weight	10 lbs
Environmental	Temperature: -4° to +122° F Altitude: 14,500 ft. Humidity: 95% humidity long term

4 Installation

Installation is simple and straightforward.

4.1 RF Input Connection

Connect the RF output an RFX-RMT to the RF Input of the RFX-RMTC using a suitable length of low loss coax terminated with N connectors.

4.2 DC Connection

Connect the DC input of the RFX-RMT to the DC output of the RFX-RMTC. This cable should be a minimum of 16 gauge terminated with four pin XLR connectors on each end. A male connector is required for the DC output of the RFX-RMTC and a female connector is used on the RFX-RMT DC input. Pin 1 of each connector is ground and pin 4 on each end is +12vDC. This output is capable of supplying a maximum of 4A.

4.3 RF Output Connection

Connect the RF output to the RFX-MMPA mast mounted amplifier using a high quality 50Ω coax such as Belden 9913 or Times Microwave LMR-400.

4.4 PA Sense Connection

Connect the PA Sense 4 pin connector to the mating connector on the mast-mounted amplifier.

4.5 Antenna Control Connection

Connect the antenna control output to a remote controllable directional antenna. A wiring diagram can be found in section 6. This output can be set for a switched ground or switched 24v DC. This jumper can be found on the interface board behind the antenna polarity switch.

4.6 AC Input Connection

Connect the unit to a suitable AC supply using a grounded IEC cord.

5 CALIBRATION

5.1 Preparation

Do not apply power until told to do so. Verify that all cables have been correctly connected between the RFX-MMPA and RFX-RMTC. Gather the following tools and test equipment:

#2 Phillips Screwdriver
1/8 flat blade screwdriver (Greenie)
DVM
Thruline Watt Meter with slug to cover 2 GHz at 10 or 25 watts.
High Frequency 50Ω dummy load.

Remove the top cover using the Phillips screwdriver to access the calibration pots. Connect the Thruline Watt Meter between the output of the RFX-MMPA and dummy load. Follow the steps below in the order listed. Refer to the photos and insets for the adjustment pots.

5.2 Set Voltage to mast mount amplifier

Attach the DVM probes to the outermost pins of the five pin Molex connector as shown. These pins are the voltage monitor points from the RFX-MMPA. When looking from the front of the unit, the negative probe goes on the left side and the positive to the right.

Apply power to the unit and verify that the voltage returning from the RFX-MMPA does not exceed 12v. If the voltage is not within ±0.25v adjust the output of the 15v power supply using the voltage pot on the 15v power supply until the voltage is 12v.

5.3 Calibrate Voltage Readout

Set the rotary switch to the “12v RET” position. Adjust the Voltage Calibrate pot on the meter board so that the display indicates the same voltage measured in step 5.2 above.

5.4 Set Maximum Power Output

Set the “TX POWER” control fully clockwise. Adjust the “HI PWR” pot on the attenuator board for an indicated 8 watts output on the watt meter.

5.5 Calibrate Power Meter

Set the meter switch to “FWD PWR”. Adjust the “FWD PWR” pot on the meter board so that the meter indicates the power measured on the watt meter.

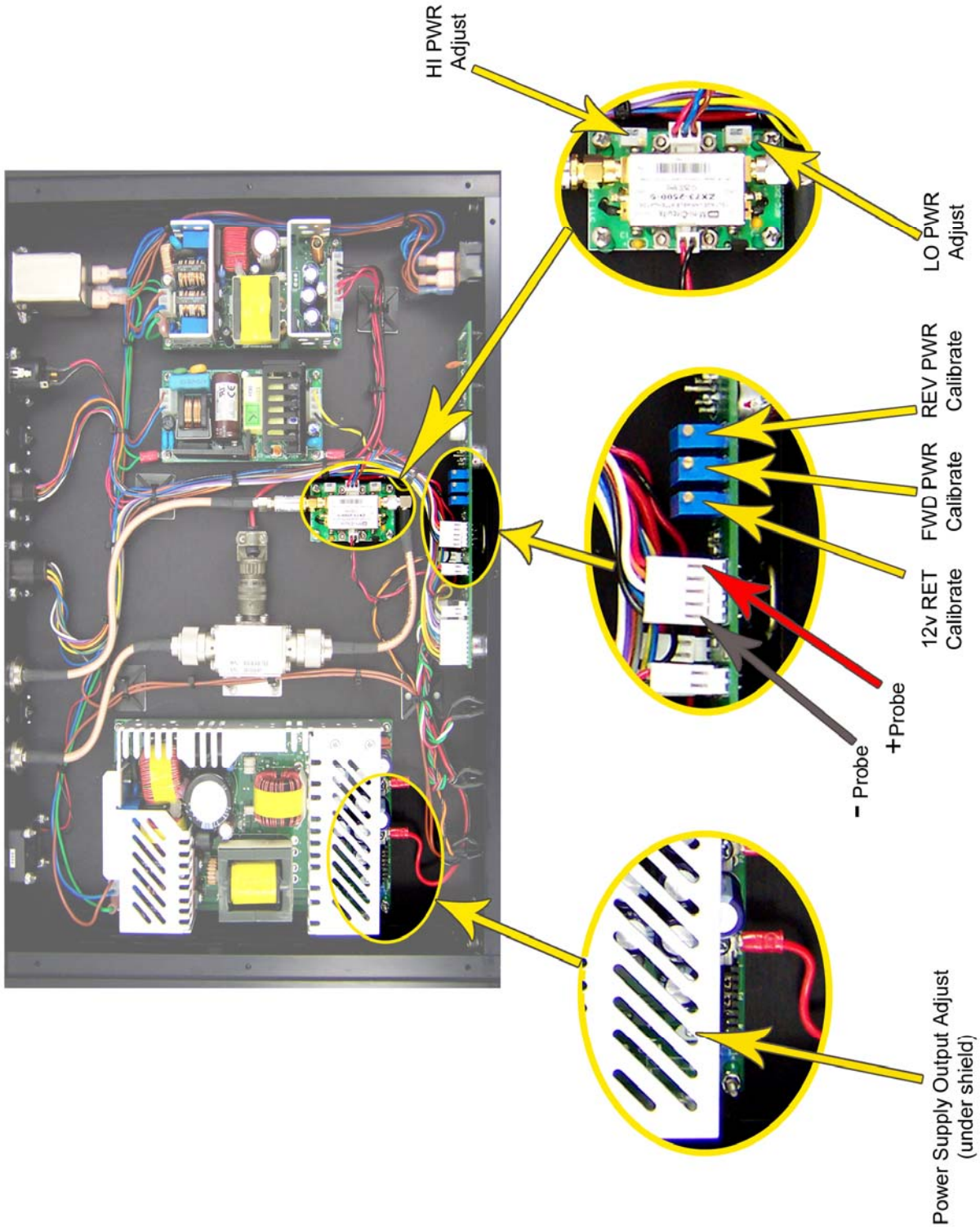
Set the meter switch to “REV PWR” and the watt meter slug for reflected power. Adjust

the “REV PWR” pot on the meter board so that the meter indication matches the reflected power as shown on the watt meter.

5.6 Minimum Power Output

Set the TX POWER control fully counter clockwise and the reset the watt meter to read forward power. Adjust the “LO PWR” pot on the attenuator board for minimum power

5.7 Calibration Adjustment Locator



6 OPERATION

Operation is also very simple and straightforward.

6.1 Antenna Selector Switch

By selecting either Omni or Directional RF energy is supplied to the corresponding output on the rear panel. An omni antenna should be connected to the Omni RF connector while a directional antenna should be connected to the Directional RF connector.

6.2 Antenna Polarity Switch

If a remotely controlled directional antenna is used and connected to both the Directional RF output and the Antenna Control connector then this switch can be used to select the transmit polarity of the dish. The choices are H, V, RC, LC and correspond to Horizontal, Vertical, Right Hand Circular and Left Hand Circular polarities.

6.3 TX Power

This control allows the output of the RFX-RMTC amplifier to be continuously varied over the range of 100mW to 5W. Power output can be read on the power meter.

6.4 Meter Switch & readout

The meter reads the forward or reverse power of the amplifier RF output. Select FWD PWR for Forward or REV PWR for the reverse power. High reverse power readings are an indication of high VSWR and usually mean there is a problem in the antenna or feed line. By selecting 12v RET the voltage to the amplifier can be measured.

7 Connector Pin Outs

7.1 DC Power cable

XLR Male to RFX-RMAC XLR Female to RFX-RMT

Pin	
1	Ground
2	
3	
4	+12V

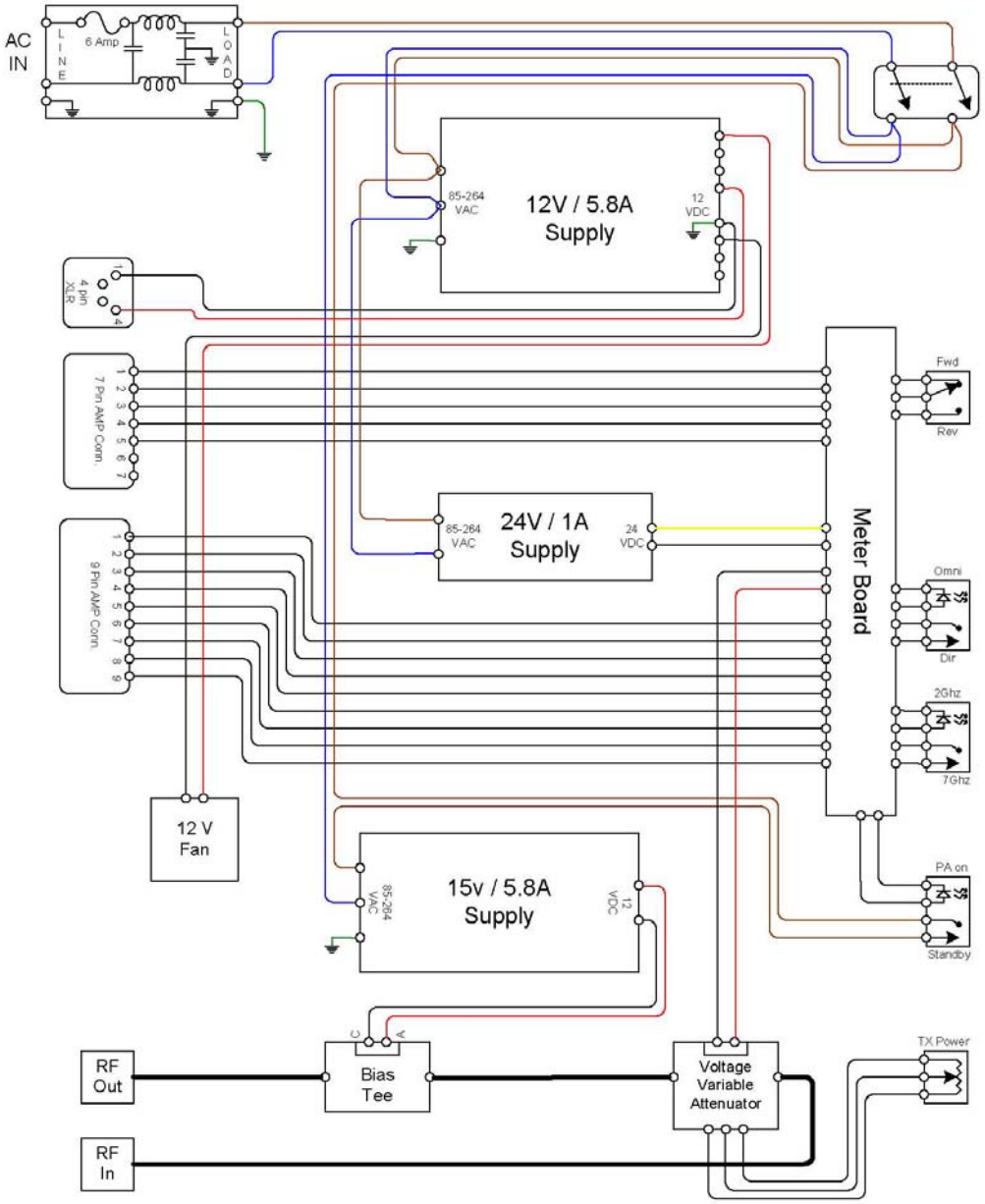
7.2 Antenna Control Connector

9 Pin Amp Connector, see Section 9 for chart.

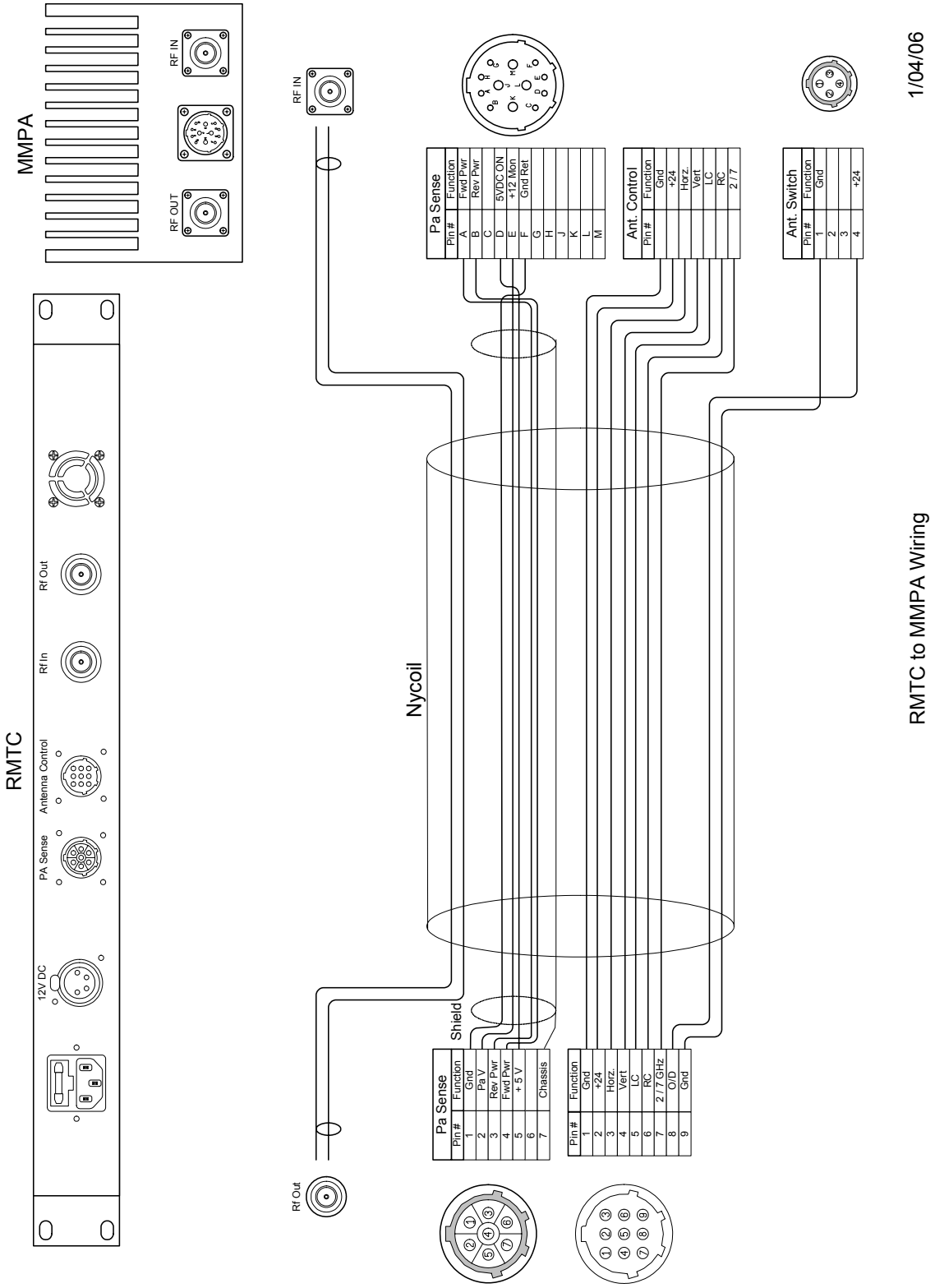
7.3 PA Sense Connector

7 Pin Amp Connector, see Section 9 for chart.

8 Block Diagram



9 MMPA Interconnect



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