Eddystone Broadcast

XE35/75/150/300 Series
35-300W FM Exciters
(Series 3)

Installation
and
Operation

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Bound at Rear

SECTION ONE : INTRODUCTION

! CAUTION !

These Exciters operate at **high RF power levels, internal supply energy levels and mains supply current levels**. They also incorporate devices containing **toxic BeO**. Installation, operation and maintenance of this unit must therefore, only be carried out by suitably qualified personnel, familiar with and fully utilising the safety procedures such equipment demands.

NO attempt at installation should be made without full reference to and compliance with SECTION TWO : INSTALLATION.

NO attempt at internal maintenance should be made without full reference to and compliance with the appropriate sections (fuse changing and internal option links which are detailed in INSTALLATION).

1.1 : GENERAL DESCRIPTION

The XE35/75/150/300 Series of FM Exciters provide output powers of up to 35W (XE35) 75W (XE75) 150W (XE150) or 300W (XE300) in the standard Band ll frequency range of 87.5-108MHz. They are capable of generating a standard mono or stereo FM signal from a variety of analogue or digital audio or data sources (including left/right audio, MPX, RDS, SCA, DARC etc.). It is important to note that the Exciter options supplied will depend on the user's actual requirements in this regard which, therefore, must be clearly specified at time of ordering.

The Exciters are totally self-contained (including forced air-cooling) and can be mounted within a standard 19 inch rack with at least 520mm depth and 2U height. All that is required is a connection to a mains supply, to source(s) of modulation and to an antenna or to an amplifier, such as the Eddystone Broadcast S7600 or S7900 Series, if greater output power is required. Remote control and monitoring of the Exciter can be by serial RS232 or TCP/IP connection (internal preset link) using asynchronous data. Basic parallel control and monitoring is also provided.

Two optional modules (normally of different types) can be fitted in any Exciter apart from those with the rear panel supply switch (see section 1.2) when only one can be fitted. These modules generally have input/output connections available on the rear panel of the Exciter. The Exciter will recognise any such module fitted and provide the appropriate control automatically on a 'Plug and Play' basis. One example is a Stereo Encoder module, which encodes left/right analogue or digital AES/EBU inputs into a stereo composite/MPX signal, which can modulate the Exciter

The Exciter consists of a number of modules described as follows (1.1.1 – 7 inc.). Front and rear views, block and circuit diagrams, showing these modules are bound at the rear of this manual (E2170-00GA, E2170-00BK and E2170-00CT).

1.1.1 : Front Panel Module

The Front Panel module provides all local control and monitoring of the Exciter functions. It also enables this control and monitoring to be performed remotely via an RS232 or TCP/IP serial interface.

The module is microprocessor based with a back illuminated, high contrast 4 line by 20 character display and separate 'MOD(ulation)', 'SYSTEM NORMAL' and 'MUTE' red/green indicators. A robust, sealed membrane keypad is provided with a sounder to indicate correct key entry. A connection is provided, from the module, to RS232 and TCP/IP monitor/control ports on the rear of the Exciter. Selection of TCP/IP or RS232 is done by connection to the Main or Input/Output Board respectively.

The Front Panel module also has a preset control, SET POWER, adjustable via an access hole in the front panel, for setting the Exciter output power level. Connectors providing samples of the composite/mpx baseband modulating signal and of the final RF output signal are provided, adjacent to the preset control, for temporary connection to external monitoring equipment (BASEBAND/RF MON).

Front Panel control and monitoring of the Exciter is via a two-way serial data link to the hardware control microprocessor on the Main Board (section 1.1.2).

1.1.2 : Main and Input/Output Boards

The Main Board contains all the basic baseband input circuitry (Composite/MPX, RDS, SCA and Mono) the modulator and associated frequency synthesiser, the main hardware control and monitor microprocessor and all connections to other boards, modules and options within the Exciter.

The associated Input/Output Board connects to a socket on the Main Board and carries all the parallel and RS232 serial control and monitoring connections to a 25 way 'D' socket and a 9 way 'D' plug respectively, on the rear panel. This Board provides protection and filtering for all these input/output circuits as well as the 'open collector' output transistors for the parallel status output connections.

All the baseband inputs to the Main Board (via the rear panel connectors) are summed together before being applied to the direct frequency modulator (i.e. modulation is directly applied to the 87.5 to 108MHz oscillator). The RDS/SCA inputs are all unbalanced and have 75Ω or 10kΩ input impedance setting options. The Mono signal has balanced (600Ω or 13.3kΩ) and unbalanced (600Ω or 20kΩ) setting options. The Composite input has balanced (75Ω or 13.3kΩ) and unbalanced (75Ω or 20kΩ) setting options. The options are set using links on the Main Board. All these inputs have separate input level setting controls adjustable via access holes on the rear panel. Additionally, the Mono signal input can have 25, 50, 75uS or no pre-emphasis applied, this again being set using links on the Main Board.

There is also a Composite output on the rear panel (with 75Ω output impedance). This only provides an output from an optional module, which generates a composite/mpx signal from an input to that module (the Stereo Encoder /S option, or the MPX/Composite /M option for example). This internally generated signal can be directed to the input summer (to modulate the Exciter directly) by having the rear panel 'Loop' switch in the upper 'Int' position. With the switch in the lower ''Ext' position the internally generated signal is normally taken out of the Composite output and directed via external units (such as an RDS generator) back into the Exciter's main Composite input.

The direct frequency modulator uses a low microphony transmission line resonator in a low noise transistor oscillator circuit. DC coupling of the audio modulating signals, right through to the final modulating varicap diodes, gives optimum frequency response and stereo separation over the whole audio range. Extra tuning varicap diodes, controlled by dc voltages derived from an output frequency, software based look-up table, give high linearity and near constant deviation sensitivity over the whole output frequency range. The output of the modulator is harmonically filtered, buffered and amplified to provide a low level drive for the 35/75/150/300W Amplifier Module (section 1.1.3).

The output frequency of the Exciter is set by a phase lock loop controlled by the Main Board microprocessor. The loop filter output controls the main tuning varicap diodes of the oscillator. This filter has two software switched time constants. A very long time constant is selected when the loop is settled in its normal modulating mode (optimising low frequency audio performance). A much shorter time constant is temporarily selected when the frequency is being changed, to ensure frequency changes can be made in a relatively short period. Whilst such changes are being made (or if the loop is out of lock for any other reason) the low level drive from the Main Board and the 35/75/150/300W Amplifier are both muted.

The output frequency is locked to a highly stable 12.8MHz Temperature Controlled Crystal Oscillator (TCXO) on the board. If required, this TCXO can be separately locked to an external 10MHz standard. This is done using a second phase lock loop, again controlled by the Main Board microprocessor. Locking to the external standard happens automatically if a signal of the correct frequency and level is applied to the rear panel External Standard input.

The microprocessor on the Main Board provides all control and monitoring of the hardware on the board, including analogue to digital conversion of power supply and modulation levels. It also interfaces, via serial data links, with other hardware control microprocessors on the Amplifier Control Board and optional modules (RS485 bus – sections 1.1.3, 1.1.5, 1.1.6 and 1.1.7) and on the Front Panel module (separate dedicated bus – section 1.1.1). The seven channel frequencies and settings of any optional modules are stored in its non-volatile 'flash' memory.

A separate hardware 'watchdog' circuit monitors the running of the microprocessor's program and provides warnings (on board led, to Front Panel and to rear panel output) if the program fails to run,

and also automatically mutes the Exciter's output. The microprocessor also generates a mute signal under various circumstances (e.g. when the synthesiser is out of lock) this signal being directed via the safety 'Interlock' relay. This relay will itself provide an over-riding mute signal if the external Interlock line is open-circuited, irrespective of any internal Exciter condition.

Two sockets are provided on the Main Board for the connection of optional modules (/S Stereo Encoder etc.). The connections are standardised and the microprocessor will automatically recognise and provide appropriate control and monitoring of whatever module is fitted to whatever socket ('Plug and Play' - this also applying to the sockets for connection to the Front Panel and Amplifier Modules). The optional module sockets both have a Composite/MPX output connection from the module, which is directed to a relay which can be set to select which of the two possible module outputs is directed to the rear panel Composite output connector and 'Loop' switch (and hence back to the modulator).

1.1.3 : 35/75/150/300W Amplifier Module, Control and Power Supply

The 35/75/150/300W Amplifier Module is fitted on a fan-cooled heatsink which runs between the front and rear panels. To reduce ingress of dust, nearly all of the forced air is directed over the heatsink fins with only a small 'bleed' of air over components mounted on the heatsink surface itself. The Module can provide at least 35W, 75W, 150W or 300W output, from the low level drive from the Main Board, using single ended driver and 'push-pull' output Mosfets. This output device is an integrated 50Ω gain block consisting of a dual RF Mosfet transistor with matching sections at its input and output. This 'pallet' is mounted on an aluminium block and is easily replaced as a unit if required.

The maximum output power level is determined by the Power Supply fitted (20V for the XE35, 28V for the 75W, 36V for 150W, 48V for 300W). The output power level is set by the bias voltage applied to the output Mosfet by the Control Board. A range of approximately 20W to 35W (XE35) 25W to 75W (XE75) 25W to 150W (XE150) or 30W to 300W (XE300) is provided.

The Amplifier Module also contains an output low pass filter in a separate screened section (nine section Tchebycheff giving a very high level of attenuation at harmonic frequencies) followed by a directional coupler to measure output forward and reverse power. Sensors to measure heatsink temperature and output Mosfet current are also provided. Voltages from the coupler and sensors are fed to the Control Board to enable accurate setting of forward output power, with a automatic reduction in that power if reverse power, heatsink temperature or output Mosfet current becomes excessive.

A low level sample of the output power is taken from the Amplifier Module (after the low pass filter section) to feed the front panel RF MON output connector.

As already described, the Control Board contains (analogue) circuitry to generate a control reference voltage to set the bias voltage applied to the output Mosfet in the Amplifier Module. This control voltage is initially set by the front panel SET POWER control to generate a desired power output level. Excessive reverse power, heatsink temperature or amplifier current, above preset 'trip' points, then automatically adjusts the set control voltage, gradually reducing the output power ('fold-back'). Various muting or external interlock conditions also over-ride the set control voltage, instantaneously reducing the power output to a minimum.

A microprocessor on the Control Board provides all monitoring of the hardware on the board, including analogue to digital conversion of forward/reverse power, heatsink temperature, amplifier current and set power level. It also interfaces, via a serial data link, with the hardware control microprocessor on the Main Board (RS485 bus – section 1.1.2). Digitised versions of all the mentioned levels and various fault conditions (low power, power fail etc.) are sent to the Main Board and then onwards for display on the Front Panel or remotely. A separate hardware 'watchdog' circuit monitors the running of the microprocessor's program and provides a Front Panel PA - CPU led warning if the program fails to run, and puts the adjacent PA - FWD, REV, TEMP and CURRENT leds all off (their indications would be invalid in this circumstance).

The Power Supplies are a universal input, switched mode designs, with a power rating and output voltage dependent on the maximum output power from the Exciter. Their single outputs are fed to the 12V Supply and Fan Control Board (section 1.1.4).

1.1.4 : 12V Supply and Fan Control Board

This board contains a 20W DC-DC converter, which provides a regulated +12V dc supply from the main Power Supply. The +12V supply is further processed and regulated to provide +5V, +22V and -12V at point of delivery. The board also provides accurately tapped outputs from the input 20-48V line and output 12V line to feed the A-D converter on the Main Board, thus enabling a display of these voltage levels on the Front Panel or remotely.

This board further provides the 15A fused supply to the 35/75/150/300W Amplifier Module and the fused supply for the amplifier fan. The 15A fuse is soldered-in and is intended to protect the Amplifier module only if there is a major power supply fault. The fan operates at 20V (XE35) 24V (XE75 and XE150) or 48V (XE300) and thus there is a factory-set link on the board, set according to the input supply to generate the correct fan supply. The fan supply return lead is feed through a current detector circuit on this board, which signals any low fan current state to the Main Board microprocessor.

1.1.5 : Stereo Encoder Module (/S option only)

This optional module converts either left/right analogue or AES/EBU digital stereo signal inputs to a standard composite/mpx signal, which can be used to modulate the Exciter. It also has switchable pre-emphasis, limiting and clipping functions and a rear panel output of the 19kHz pilot generated by the module. These inputs are selectable from the Exciter front panel, or remotely, in the situation where two optional modules are fitted (see sections 1.1.6 and 1.1.7)

The inputs to the module are via rear panel XLR sockets. The balanced left/right analogue inputs are on the Encoder Module itself with internal option links to set 600Ω or 20kΩ input impedance. These inputs may also be externally wired for unbalanced operation, the input impedance then being 600Ω or 13.3kΩ. A third pin on each socket is provided for cable screen grounding, either directly or through a capacitor (internal option link). The AES/EBU digital input is via the dual purpose MONO/AES socket (this standard mono input normally being re-directed to the digital input of the Encoder Board when that board is fitted). The digital input is balanced, transformer coupled, with an input impedance of approximately 110Ω. These three inputs have separate input level setting controls, adjustable via access holes on the rear panel of the Encoder Module.

Selection of the digital input is made automatically when a valid AES/EBU signal is detected by the serial input receiver. In this circumstance, the analogue left/right inputs are disconnected and the left /right analogue outputs of the dual D-A converter (fed by the digital receiver) are routed through to the following filtering, amplifying and signal processing stages in their place. When no valid digital input is present, the input selection defaults to the left/right analogue input.

The selected input signal, in left/right analogue form, is fed through pre-emphasis, limiter and clipper circuits in turn. The first circuit applies 25, 50 or 75uS or no pre-emphasis as selected via the Front Panel or remotely. The limiter and clipper circuits can also be similarly and independently selected on or off. The limiter provides automatic gain control, limiting the peak deviation to approximately 55kHz, the clipper provides a soft clipping action, clipping the deviation at about 70kHz.

A switching multliplexer is used to convert the processed left/right audio into a standard composite/mpx signal, which is further filtered and amplified before being fed to the Main Board. The 38kHz sub-carrier (switching signal) and 19kHz pilot tone are generated by a digital 'Walsh' function generator, a sample of the 19kHz being made available at the rear panel PILOT O/P connector. Note that the 19kHz pilot (in the composite/mpx output only) can be switched on or off from the Front Panel or remotely and that a warning is issued if the pilot fails.

A microprocessor on the Encoder Module provides all control and monitoring of the hardware on the board. It also interfaces, via a serial data link, with the hardware control microprocessor on the Main Board (RS485 bus – section 1.1.2). Encoder control settings made from the front panel (or remotely) are sent from the Main Board and then, after being stored for use in the Encoder Board microprocessor, reverted for display on the Front Panel (or, again, remotely) along with other Encoder status information.

1.1.6: Composite Input Module (/M Module only)

This optional module provides an additional Composite/MPX input, which is selectable from the Exciter front panel, or remotely, when two optional modules are fitted (see sections 1.1.5 and 1.1.7). This input is in addition to the standard Composite input, SK09, which is permanently connected.

The input to the module is via a rear panel, floating, 75Ω BNC socket. Internal option links are provided to set balanced 75Ω or 13.3kΩ input impedance or unbalanced 75Ω or 20kΩ. This input has a separate input level setting control, adjustable via an access hole on the rear panel of the Composite Input Module, adjacent to the connector.

The input signal is fed through a buffer circuit before being directed to the Main Board. The signal is also fed to a signal level detector and a 19kHz pilot detector on the Composite Board itself. These circuits provide a DC analogue level corresponding to the Composite input level and an indication that a 19kHz tone is present with the input signal.

A microprocessor on the Composite Input Module provides all control and monitoring of the hardware on the board. It also interfaces, via a serial data link, with the hardware control microprocessor on the Main Board (RS485 bus – section 1.1.2).

1.1.7 : Re-Broadcast Receiver Module (/R option only)

This optional module demodulates a wideband FM, input RF signal (in the range 87.5 to 108MHz) to provide a mono/composite/MPX baseband signal, which can be used to modulate the Exciter (i.e. re-broadcast). This input is selectable from the Exciter front panel, or remotely, when two optional modules are fitted (see sections 1.1.5 and 1.1.6).

The input to the module is via a rear panel 50Ω N Type socket. This input is passed through a pre-tuned passband filter to a passive double-balanced mixer. A single, fixed frequency, crystal oscillator provides the local oscillator injection for the mixer (10.7MHz below the RF input frequency). The 10.7MHz I.F. output from the mixer passes through a three-stage amplifier/ceramic filter to a integrated circuit which provides further amplification, limiting and quadrature F.M. detection. The audio output of the detector, after amplification, phase compensation, low pass filtering and buffering provides the composite/MPX output of the module, which is fed to the Main Board.

A microprocessor at the front of the Re-Broadcast Module provides all control and monitoring of the hardware on the board. The received signal strength, as a DC level, is fed to an A/D converter in the microprocessor. The presence of a signal, above a threshold level, is also signalled to the microprocessor, which interfaces, via a serial data link, with the hardware control microprocessor on the Main Board (RS485 bus – section 1.1.2).

1.2 : VARIANTS AND OPTIONS

The main variants and options (indicted by number or letter suffixes respectively) are as follows :-

E2170-01	Basic XE150 150W Exciter (spaces for two optional modules)
E2170-02	Basic XE300 300W Exciter (spaces for two optional modules)
E2170-03	Basic XE35 35W Exciter (spaces for two optional modules)
E2170-04	Basic XE75 75W Exciter (spaces for two optional modules)
E2170-05	Basic XE150 150W Exciter with rear mains supply switch (space for one optional module only)
E2170-06	Basic XE300 300W Exciter with rear mains supply switch (space for one optional module only)
E2170-07	Basic XE35 35W Exciter with rear mains supply switch (space for one optional module only)
E2170-08	Basic XE75 75W Exciter with rear mains supply switch (space for one optional module only)

/M	Fitted with MPX/Composite Input Module
/R	Fitted with Re-Broadcast Receiver
/S	Fitted with Analogue/AES/EBU Input Stereo Encoder

1.3 TECHNICAL SPECIFICATIONS

The XE35/75150/300 Series of FM Exciters is designed to meet or exceed ETSI Standards :-

EN 301 489-01 : ERM/EMC for Radio Equipment, Part 1, Common Technical Requirements.
EN 301 489-11 : ERM/EMC for Radio Equipment, Part 11,Special Conditions for FM Transmitters.
EN 302 018-02 : ERM (Spectral Occupancy) for the FM Radio Broadcast Services
EN 60215:1989 : Safety Requirements for Radio Transmitting Equipment.

'Overall' performance is specified with the RF output demodulated using a high quality FM/AM demodulator and a high quality stereo or mono decoder. Audio and composite/mpx test sources also exceed the rated Exciter performance by at least 10dB or equivalent.

The normal stereo signal generated by the Exciter or source consists of :-

±75kHz maximum deviation due to a mono signal
±67.5kHz maximum deviation due to left/right stereo signals
(less in both cases if RDS and/or SCA signals are also generated)
±6.75kHz deviation due to 19kHz pilot tone (stereo signals only)
giving a total maximum of approximately ±75kHz

Unless otherwise specified, 'overall' performance is specified at the above deviation levels with +8dBu/5.5V peak to peak test signal(s). Pre-emphasis is applied in the Exciter or test source and de-emphasis applied in the measuring equipment. Any other Exciter signal processing circuitry (e.g. limiters, clippers etc.) is switched off.

1.3.1: Common Specifications

RF Output Port	50Ω nominal, N Type Connector
Carrier Frequency	87.5-108MHz in 50kHz steps with seven stored channels (in programmable non-volatile 'flash' memory). The channels can be programmed and selected locally and remotely. Frequency change time approximately 15secs (RF output muted during change period). Performance equal to or better than :- Stability : ± 2ppm maximum over –5 to +50deg.C (±200Hz at 150MHz) Ageing : ±1ppm over first year (±150Hz at 150MHz) Adjustment : ±3ppm using internal trimmer (±5ppm using voltage trimmer) Variation : ±2ppm with 75kHz deviation applied (±200Hz at 150MHz) Under normal operating and maintenance conditions, the resulting frequency error should be less than ±200Hz, typically less than ±150Hz.
Output Power	With any load with a return loss >14dB (1.5:1 VSWR) any angle. XE35 Adjustable over range of at least 20W to 35W XE75 Adjustable over range of at least 25W to 75W XE150 Adjustable over range of at least 25W to 150W XE300 Adjustable over range of at least 30W to 300W Variation : Not more than ± 0.5dB under all specified operating conditions
Output Power Shutdown	Output power is automatically reduced or shutdown to ensure that any load producing reverse power greater than approximately 15W (XE35/75) or 30W (XE150/300) including open and short circuits, does not cause any damage to the Exciter. Excessive heatsink temperature (greater then +85 deg.C) or output amplifier current also automatically reduces or shutdowns the output power.
Reverse Intermodulation	Reverse intermodulation products will be better than or equal to –10dB, relative to the interfering incident signal, this being offset over the range ±300kHz to ±20MHz (but remaining within 87.5MHz to 108MHz).

Spurious and Harmonic Emissions	In the range 9kHz to 1000MHz : - Better than or equal to –75dBc - typically better than –85dBc In the range 87.5MHz to 137MHz : - Better than or equal to –85dBc at greater than 500kHz removed from carrier. Measured in a 10kHz bandwidth, with and relative to, an unmodulated carrier.
Adjacent Channel Spurious Emissions	Better than or equal to –20dBc at ±125kHz removed from carrier Better than or equal to –40dBc at ±150kHz removed from carrier. Better than or equal to –60dBc at ±175kHz removed from carrier Better than or equal to –80dBc at ±200kHz removed from carrier. Better than or equal to –85dBc at ±300kHz to ±500kHz removed from carrier. Measured in a 1kHz bandwidth, with a ±75kHz deviation, 400Hz mono signal. Spurious levels relative to peak signal carrier/sidebands (i.e. within a spectrum mask defined by above limits).
External Standard Input	10MHz Input via 50Ω BNC connector Input impedance : balanced 50Ω - Locking Range : greater than ±10Hz Input level for automatic locking to external standard : - +3dBm (300mV rms pd) to +13dBm (1V rms pd) sinewave.
Modulation	F3E (monophonic) or F8E (stereophonic) to CCIR recommendation 450-3 for pilot tone systems. RDS and SCA modulation facilities as also provided. Maximum deviation in excess of ±200kHz (at better than-40dB ,1% distortion) Deviation variation over carrier frequency range (fixed input level) : - Better than ±5% (±3.75kHz at 75kHz deviation) typically ±3% (±2.25kHz) Note that stereo modulation requires the /S option Stereo Encoder to be fitted or the use of an external stereo coder feeding the Exciter's Composite/MPX input.
Incidental Amplitude Modulation	Synchronous (AM due to FM):- Not greater than 0.3% with audio deviation (excluding pilot) of ±40kHz at a modulation frequency of 400Hz, equivalent to –50dB relative to 100% AM. Asynchronous (residual AM due to hum and noise with no FM modulation) :- Not greater than 0.2%, equivalent to –54dB relative to 100% AM. Both measured average ±peak, unweighted, in a 10Hz to 20kHz bandwidth, with pre-emphasis applied in the Exciter, but with no de-emphasis on the measuring equipment, which is used as an AM demodulator only. The rated performance is maintained from maximum to at least half rate output power.
Mono/AES Input (except when Stereo Encoder /S option is fitted - see section 1.3.2)	DC to 100kHz analogue mono input via 3 pole XLR connector Input impedance internally preset to :- balanced 600Ω or 20kΩ or unbalanced 600Ω or 13.3kΩ Input sensitivity for ±75kHz deviation at 400Hz +8dBm (600Ω input) : +8dBu : 5.5V peak to peak (adjustable from rear panel with maximum sensitivity typically –2dBu/1.8V). Pre-emphasis internally preset to :- none, 25uS, 50uS or 75uS. (continued on next page)

Mono/AES Input (except when Stereo Encoder /S option is fitted - see section 1.3.2) - continued from previous page	Overall frequency response : better than ±0.4dB over 5Hz - 15kHz (rel. 1kHz) Measured with deviation set to 18dB below ±75kHz (±9.4kHz) at 400Hz modulation - fixed test level to pre-emphasised input then causing deviation to rise with modulation frequency. Overall harmonic distortion : better than –60dB (0.1%) over 40Hz to10kHz (typ. –66dB). Measured in a bandwidth of twice the fundamental to 22kHz Overall signal to noise ratios better than : - RMS A weighted : 75dB RMS CCIR468-3 weighted : 65dB - RMS unweighted : 70dB Q-Peak CCIR468-3 weighted : 65dB - Q-Peak CCIR unweighted : 65dB All measured relative to deviation of ±75kHz and 400Hz modulation (set up with an RMS unweighted measurement).
Composite/MPX Input (stereo source)	DC to 100kHz input via floating 75Ω BNC connector. Input impedance internally preset to :- balanced 75Ω or 20kΩ (coaxial screen floating) or unbalanced 75Ω or 13.3kΩ (coaxial screen internally grounded) Input sensitivity for ±67.5kHz deviation (exc. pilot): +8dBu : 5.5V peak to peak (adjustable from rear panel with maximum sensitivity typically +4dBu/3.5V). Overall frequency response : better than ±0.2dB over 5Hz - 15kHz (rel. 1kHz) Measured with deviation (excluding pilot) set to 18dB below ±67.5kHz (±8.4kHz) at 400Hz modulation - fixed test level to pre-emphasised test source then causing deviation to rise with modulation frequency. Overall stereo separation : better than 48dB over 40Hz to 10kHz (typ. 55dB) Overall harmonic distortion : better than –60dB (0.1%) over 40Hz to 10kHz (typ. –66dB). Measured in a bandwidth of twice the fundamental to 22kHz. Overall signal to noise ratios better than : - RMS A weighted : 75dB RMS CCIR468-3 weighted : 65dB - RMS unweighted : 70dB Q-Peak CCIR468-3 weighted : 65dB - Q-Peak CCIR unweighted : 65dB All measured relative to deviation of ±67.5kHz (excluding pilot) and 400Hz modulation (set up with an RMS unweighted measurement).
RDS/SCA Inputs	57kHz to 100kHz inputs (3 total) via 75Ω BNC connectors Input impedances individually internally preset to unbalanced 75Ω or 10kΩ Input sensitivity for ±2.0kHz deviation (typical RDS): 1V peak to peak Input sensitivity for ±5.5kHz deviation (typical SCA): 2.8V peak to peak (each input separately adjustable from rear panel with maximum sensitivities of approximately 500mV and 1.4V peak to peak respectively).
Composite/MPX Output	DC to 100kHz output via 75Ω BNC connector Output impedance : unbalanced 75Ω . Output level for ±75kHz total deviation : - 5.5V peak to peak open circuit - matches Composite/MPX Input sensitivity for looping through zero gain external equipment (loop switch on 'Ext', all input impedances high). Note that this output is <u>only</u> provided from optionally fitted modules, which have a Composite/MPX output (such as the /S option Stereo Encoder). Performance of this output essentially matches that of the source module.

Status Indications	Four line by 20 character back-lit LCD display with selectable screens showing output frequency, forward and reverse power and instantaneous deviation level ; individual system normal status components ; settings of any optional modules fitted ; comprehensive bargraph and digital readout metering of analogue levels (including peak hold and kHz/percentage displays of deviation) ; frequency settings and status of all seven channels. Red/green/off led indicators of modulation level, system normal status and mute status. Red/green pass/fail led indicators of Amplifier Module output forward and reverse power, heatsink temperature, dc supply current and CPU status.
Local Control	Eight key sealed membrane keypad including : - main and mode screen dedicated keys, two cursor keys and four soft keys.
Remote Control and Monitoring	RS232 or TCP/IP (preset internal link setting) using 2400, 4800, 9600 or 19200 Baud asynchronous data (1 start, 8 data, 2 stop, no parity) rate selectable from front panel. All local control and monitoring is duplicated over the serial link. RS232 on nine way 'D' plug, TCP/IP on RJ45 socket. Basic parallel control/monitoring including a safety interlock and analogue output voltage levels indicating forward and reverse output power (on 25 way 'D' socket). Baseband and RF monitoring BNC outputs on front panel.
Environmental	Ambient Temperature (operating) : -5 to +50 deg.C Ambient Temperature (storage) : -20 to +70 deg.C Relative Humidity (operating) : Less than or equal to 95%, non condensing with the Exciter at a higher temperature than the ambient. Altitude (operating) : Up to 3000 metres a.s.l.
Mechanical	Width : 483mm (19 in.) Height : 88mm (2U) Depth : 520mm Weight : Approx. 15kg. Notes depths are intrusion into rack including cabling at the rear.
Power Supply	Single phase input on 10A IEC connector: - XE35/75/150/300 : 100-260VAC (47-63Hz) Power factor meets EN61500-3-2 Peak inrush current 14A -28A at 100V - 260VAC input XE35 : 1.4A at 100V to 0.5A at 260V (at 35W RF output) XE75 : 2A at 100V to 0.8A at 260V (at 75W RF output) XE150 : 3A at 100V to 1.2A at 260V (at 150W RF output) XE300 : 6A at 100V to 2.4A at 260V (at 300W RF output)

1.3.2: Stereo Encoder Module Specifications (/S option only)

Mono/AES Input	Standard AES/EBU serial, digital, stereo audio Input via 3 pole XLR connector. Sensitivity : adjustable from rear panel. Input impedance : 110Ω floating/balanced, transformer isolated Note that a valid AES/EBU signal at this input will take precedence over the left/right analogue inputs to the Stereo Encoder module. In this case, the specified overall performance and the pre-emphasis etc. selected will also apply to the digital signal (see below).
Left/Right Inputs	DC to 15kHz left/right analogue stereo inputs via two 3 pole XLR connectors (Note that a valid AES/EBU signal at the Mono/AES input will take precedence over these analogue inputs). Input impedance internally preset to balanced 600Ω or 20kΩ (600Ω or 13.3kΩ if externally unbalanced by grounding one balanced input side). Input sensitivity for ±67.5kHz deviation (excluding pilot) at 400Hz :- +8dBm (600Ω input) : +8dBu : 5.5V peak to peak (left and right separately adjustable from rear panel with maximum sensitivities typically -4dBu/1.4V). Pre-emphasis set from front panel or remotely to :- none, 25uS, 50uS or 75uS. Overall frequency response : better than ±0.4dB over 30Hz - 15kHz (rel. 1kHz) (integral lowpass filters provide greater than 60dB rejection at 19kHz). Measured with deviation (excluding pilot) set to 18dB below ±67.5kHz (±8.4kHz) at 400Hz modulation - fixed test level to pre-emphasised input then causing deviation to rise with modulation frequency. Overall stereo separation : - better than 48dB over 40Hz to 10kHz (typ. 60dB) Overall harmonic distortion : better than –58dB (0.13%) over 40Hz to 10kHz (typ. –64dB). Measured in a bandwidth of twice the fundamental to 22kHz. Overall signal to noise ratios : - Overall signal to noise ratios better than : - RMS A weighted : 70dB RMS CCIR468-3 weighted : 58dB - RMS unweighted : 65dB Q-Peak CCIR468-3 weighted : 58dB - Q-Peak CCIR unweighted : 58dB All measured relative to deviation of ±67.5kHz (excluding pilot) and 400Hz modulation (set up with an RMS unweighted measurement).
Pilot Tone Output and Deviation	19kHz ±2Hz output via 50Ω SMA connector Pilot deviation : ±6.75kHz (adjustable from the rear panel over at least ±6kHz to ±7.5kHz) Output Impedance : approximately 100Ω. Output level : approximately 5V peak to peak sinewave (open-circuit)
38kHz Sub-carrier Suppression	Better than 40dB relative to ±75kHz deviation (typically better than 60dB).
Limiter and Clipper	Separately selectable from front panel or remotely. Automatic level control circuit limiting maximum peak deviation to approximately ±55kHz. Soft clipping circuit operating at approximately ±70kHz.

1.3.3: Composite Input Module Specifications (/M option only)

Composite Input	DC to 100kHz input via floating 75Ω BNC connector. Input impedance internally preset to :- balanced 75Ω or 20kΩ (coaxial screen floating) or unbalanced 75Ω or 13.3kΩ (coaxial screen internally grounded) Input sensitivity for ±67.5kHz deviation (exc. pilot): +8dBu : 5.5V peak to peak (adjustable from rear panel with maximum sensitivity typically +4dBu/3.5V). Overall frequency response : better than ±0.2dB over 5Hz - 15kHz (rel. 1kHz) Measured with deviation (excluding pilot) set to 18dB below ±67.5kHz (±8.4kHz) at 400Hz modulation - fixed test level to pre-emphasised test source then causing deviation to rise with modulation frequency. Overall stereo separation : better than 48dB over 40Hz to 10kHz (typ. 55dB) Overall harmonic distortion : better than –60dB (0.1%) over 40Hz to 10kHz (typ. –66dB). Measured in a bandwidth of twice the fundamental to 22kHz. Overall signal to noise ratios better than : - RMS A weighted : 75dB RMS CCIR468-3 weighted : 65dB - RMS unweighted : 70dB Q-Peak CCIR468-3 weighted : 65dB - Q-Peak CCIR unweighted : 65dB All measured relative to deviation of ±67.5kHz (excluding pilot) and 400Hz modulation (set up with an RMS unweighted measurement).

1.3.4: Re-Broadcast Receiver Module Specifications (/R option only)

RF Input (rejection and selectivity measured with mono signal)	Single preset frequency within range 87.5 to 108MHz, via rear panel 50Ω 'N' Type coaxial connector (frequency must be specified at time of ordering). Operating input level : approximately -80dBm to at least –20dBm. (Ultimate signal to noise ratio reached at approximately –55dBm) Image rejection : an unwanted modulated signal, at 21.4MHz below the wanted signal frequency and of level 0dBm, will generate a final output equivalent to a signal at the wanted frequency of level lower than approximately –90dBm. I.F rejection : an unwanted modulated signal, at 10.7MHz and of level 0dBm, will generate a final output equivalent to a signal at the wanted frequency of level lower than approximately –90dBm. Adjacent channel selectivity : with a wanted signal modulated at 400Hz to give 75kHz deviation and of a level to give 60dB signal to noise ratio (RMS 'A' weighted) typically –80dBm, the relative levels of an unmodulated unwanted signal, at various offsets, required to produce a 6dB drop in signal to noise ratios, are as follows :- At +/- 500kHz unwanted level typically greater than +55dB relative to wanted. At +/- 400kHz unwanted level typically greater than +55dB relative to wanted. At +/- 250kHz unwanted level typically greater than +45dB relative to wanted.
Signal Level Indication	-95dBm to –50dBm (outside this range, indication is given as <-95dBm or >-50dBm) Signal present is also indicated when the signal is above a preset level of approximately –80dBm.
Exciter Output Power Muting	The re-broadcasted output signal from the Exciter is automatically muted when the received signal is not indicated as being present.
Re-Broadcasted Output Signal	With an RF input signal level of at least –50dBm :- Overall frequency response : better than ±0.3dB over 30Hz - 15kHz (rel. 1kHz) Measured with deviation (excluding pilot) set to 18dB below ±67.5kHz (±8.4kHz) at 400Hz modulation - fixed test level to pre-emphasised test source then causing deviation to rise with modulation frequency. Overall stereo separation : better than 45dB over 40Hz to 6kHz (typ. 55dB) dropping to better than 35dB at 10kHz. Overall harmonic distortion : better than –50dB (0.3%) over 40Hz to 10kHz (typ. –55dB). Measured in a bandwidth of twice the fundamental to 22kHz. Overall signal to noise ratios better than : - RMS A weighted : 70dB RMS CCIR468-3 weighted : 60dB - RMS unweighted : 65dB Q-Peak CCIR468-3 weighted : 60dB - Q-Peak CCIR unweighted : 60dB All measured relative to deviation of ±67.5kHz (excluding pilot) and 400Hz modulation (set up with an RMS unweighted measurement). The signal to noise ratios deteriorate by approximately 10dB when the input signal falls to about –80dBm (mono) or –60dBm (stereo).

SECTION TWO : INSTALLATION

! CAUTION !

These Exciters operate at **high RF power levels, internal supply energy levels and mains supply current levels**. They also incorporate devices containing **toxic BeO**. Before commencing installation, it is recommended that the complete INSTALLATION section is read and understood. **The instructions should then be strictly followed, by suitably qualified personnel, otherwise sub-standard or even dangerous operation may result.**

2.1 : PHYSICAL DIMENSIONS AND FITTING

2.1.1 Installation Accessories

Various installation accessories may be supplied as required. A list of these (including spare fuses) is given below. Actual requirements depend on the configuration of the equipment supplied (e.g. options fitted, number and type of modulating sources, separate to or already fitted into a 19 inch rack, whether or not leads are supplied ready made etc.). Note that extra, unlisted parts may be required for connections to any Amplifier that is supplied (see manuals supplied with them).

Typical Quantity	Description	Function
1	10A (C13) IEC mains connector.	For connection to lead from mains supply distribution point.
Length as req'd	3 core,1.0mm^2 per core, insulated cable (EPR insulated, HOFR sheathed)) or 3 core,1.5mm^2 per core, insulated cable (PVC insulated and sheathed)	Mains supply lead for operation in up to 50 deg.C ambients.
1	10A 'C' rated 2 pole miniature circuit breaker (MCB).	Fitted at mains supply distribution point to protect supply lead and mains input components in the Exciter.
1	N type 50Ω coaxial free plug plus low loss RF coaxial cable as req'd (rated in excess of Exciter output power at maximum ambient temperature)	For connection to RF output
1-5	BNC type 50Ω or 75Ω coaxial free plug(s) plus coaxial cable as req'd	For connection to Composite/RDS/SCA inputs and Composite output
1	BNC type 50Ω coaxial free plug plus RF coaxial cable as req'd	For connection to External Standard input
1	XLR 3 pin free plug plus screened cable as req'd	For connection to Mono or (on /S option) AES audio input.
1	9 Way D plug c/w cover.	For connection to leads from serial RS232 control/monitor ancillary equipment.
1	25 Way D plug c/w cover.	For connection to leads from parallel control/monitor ancillary equipment.
2 (Stereo Encoder /S option only)	XLR 3 pin free plugs plus screened cable as req'd	For connection to Left and Right Audio inputs
1 (Stereo Encoder /S option only)	SMA free plug plus coaxial cable as req'd	For connection to 19kHz Pilot output

Typical Quantity	Description	Function
1 (Composite Input /M option only)	BNC type 50Ω or 75Ω coaxial free plug(s) plus coaxial cable as req'd	For connection to Composite Input
1 (Re-Broadcast /R option only)	N type 50Ω coaxial free plug plus coaxial cable as req'd	For connection to Antenna Input
Length as req'd	Multi-core screened cable (number of cores as required).	Control/monitor leads.
Length as req'd	Heavy gauge grounding wire/strap.	For safety earth lead.
4	Screws c/w plastic cup washers and rack caged nuts.	For fixing unit into19 inch rack.
2	Side support 'L' brackets c/w fixing screws and washers.	For extra support to carry the Exciter's weight in the rack.
1	6.3A (T) HBC 5x20mm Fuse	For protection of ac supply input circuitry
1	1A (F) Fuses (for smd holders, 'Littelfuse' R451.1500)	For protection of driver amplifier within unit
1	15A (T) HBC 6.3x32mm (¼ x1¼ in) 'Pig-Tail' (wire-ended) Fuse	For protection of output amplifier circuitry

2.1.2 Rack Mounting

If the Exciter is not supplied ready mounted in a 19 inch rack, this will be required to be done at time of installation.

The 19 inch rack should ideally be of standard 600mm depth and requires at least 2U height. Additional height will be required if a second Exciter and/or an Amplifier are to be fitted into the same rack.

Additional bottom support 'L' brackets may also be required at each side, below the Exciter, to help carry its weight. The Exciter is then fixed to the front of the racking using four screws, plastic cup washers and caged nuts.

2.2 EXTERNAL CONECTIONS

All permanent external connections are made at the rear of the unit in accordance with system requirements. The connections required are made as described in the following sub sections.

2.2.1 Mains Supply Connector

This is a standard IEC connector PL03, at the right rear of the unit, intended for connection to a single phase (plus protective earth) supply. The input is protected by a 20mm 6.3A(T) HBC fuse fitted in a carrier in PL03.

! CAUTION ! – Certain variants have a rear panel on/off switch in-line with this connector (see section 1.2). Note that this switch interrupts the Neutral supply line only.

For the XE35, the supply is in the range 100-260VAC (47-63Hz) with no setting required. The maximum current drawn from the supply is in the order of 1.4A at 100V to 0.5A at 260V (at 35W RF output).

For the XE75, the supply is also in the range 100-260VAC (47-63Hz) with no setting required. The maximum current drawn from the supply is in the order of 2A at 100V to 0.8A at 260V (at 75W RF output).

For the XE150, the supply is in the range 100-260VAC (47-63Hz) with no setting required. The maximum current drawn from the supply is in the order of 3A at 100V to 1.2A at 260V (at 150W RF output).

For the XE300, the supply is also in the range 100-260VAC (47-63Hz) with no setting required. The maximum current drawn from the supply is in the order of 6A at 100V to 2.4A at 260V (at 300W RF output).

The mains supply lead to the Exciter must use at least **10A rated three core (P+N+protective earth)** insulated cable. **A double pole 10A (C rated) MCB must be provided at the supply distribution board (prefered) or a 10A HBC fuse in the associated plug at the supply outlet, to protect this lead.** Also, since the supply input circuitry contains a filter, which passes current to the Exciter chassis, **the chassis must be connected to a safety ground** via the earthing bolt provided adjacent to the mains supply input connector.

The supply lead terminates in a 10A (C13) IEC free socket at the Exciter end, which is wired as follows :-

L or Brown	Line
N or Blue	Neutral
⊥ or Green/Yellow	Protective Earth

Care MUST be taken to connect these leads to the supply as detailed in the above table. If a lead with different coloured wires is used, further advice MUST be taken.

Also ensure whilst making any connections to the mains supply, that the Amplifier's rear panel interlock circuit at SK12, pins 20 and 21, is open-circuit (i.e. Exciter muted).

2.2.2 RF Output Connector

! CAUTION !

When operating, high RF Voltages are present on this connector. Always ensure when making connections here, or working on any load connected, that the Exciter's mains supply is either disconnected or switched to 'off' at the distribution board (preferably being locked in that position).

This is an N Type coaxial socket SK15 at the rear of the unit. Care must be taken to use adequately rated (at maximum ambient temperature) low loss cable for the lead to the antenna, amplifier or load.

2.2.3 SCA1/RDS, SCA2 and SCA3 Input Connectors

These are 75Ω BNC type coaxial sockets SK08, SK07 and SK06 at the lower rear of the unit used for interconnection to RDS (Radio Data System) and/or SCA (Subsidiary Carrier Authority) modulating signals in the range 57 to 100kHz. 50Ω or 75Ω BNC plugs can be used for connections to these inputs, with matching screened coaxial cable, not exceeding three metres in length.

Each individual input can be internally set to unbalanced 75Ω or 10kΩ (see E2170-00GA) with its sensitivity set using the adjacent rear panel controls.

Input sensitivity for ±2.0kHz deviation (typical RDS): 1V peak to peak (500mV at maximum sensitivity)
Input sensitivity for ±5.5kHz deviation (typical SCA): 2.8V peak to peak (1.4V at maximum sensitivity)

Note that all three inputs are functionally identical, however, SK08 is marked RDS/SCA1 to aid connection to sources (the input designated for RDS may also typically be set for a higher sensitivity than inputs used for SCA sources).

2.2.4 Mono/AES Input Connector

This is a three pin XLR socket SK05 at the lower rear of the unit used for interconnection to a monophonic modulating signal or, when the /S Stereo Encoder option is fitted, for interconnection to a digital AES/EBU stereo/mono modulating signal. Single or twin screened cable, not exceeding three metres in length, should be used for the interconnecting lead.

The lead terminates in a three pin XLR plug at the Exciter end which is wired as follows :-

	Mono (/S option not fitted)	AES (/S option fitted)
Pin 1	Chassis ground via 10n/50V capacitor	
Pin 2	Signal (+)	Signal
Pin 3	Signal (-) balanced - or, Chassis ground unbalanced	Signal

On Mono (/S option not fitted) the input impedance can be set internally to balanced 600Ω or 20kΩ or unbalanced 600Ω or 13.3kΩ. The input sensitivity is set using the adjacent rear panel control, with pre-emphasis internally preset to none, 25uS, 50uS or 75uS - (see E2170-00GA).

Input sensitivity for ±75kHz deviation at 400Hz : +8dBm (600Ω input) : +8dBu : 5.5V peak to peak
(maximum sensitivity approximately -2dBm (600Ω input) : +2dBu : 1.8V peak to peak)

On AES (/S option fitted) the input is floating, transformer coupled with a 150n/50V DC blocking capacitor protecting the primary. The in-band input impedance is set to 110Ω. Digital Input sensitivity is set by the AES LVL control on the rear panel of the /S Stereo Encoder module (not by the control adjacent to the Mono/AES socket). Phase of the signal connections is not significant. Pre-emphasis is set as for the left/right analogue inputs (see 2.2.10)

2.2.5 Composite Input Connector

This is a floating 75Ω BNC coaxial socket SK09 at the lower rear of the unit used for interconnection to a composite/multiplex modulating signal in the range from DC up to 100kHz. A 50Ω or 75Ω BNC plug can be used for connection to this input, with matching screened coaxial cable, not exceeding three metres in length.

The input can be internally preset to balanced 75Ω or 20kΩ (coaxial screen floating) or unbalanced 75Ω or 13.3kΩ (coaxial screen internally grounded), with its sensitivity set using the adjacent rear panel control - (see E2170-00GA).

Input sensitivity for ±67.5kHz deviation (excluding pilot) : +8dBu : 5.5V peak to peak
(maximum sensitivity approximately : +4dBu : 3.5V peak to peak)

2.2.6 Composite Output Connector (and Loop Switch)

This is a 75Ω BNC coaxial socket SK10 at the lower rear of the unit used for interconnection to external equipment, typically for RDS insertion, after which it is routed back to the Exciter's Composite Input Connector (see 2.2.5) and thence to the modulator. **In this situation, the rear panel 'Loop' switch SW01 must be in the lower 'Ext' position**. A 50Ω or 75Ω BNC plug can be used for connection to this output, with matching screened coaxial cable, not exceeding three metres in length.

This output can only be sourced from an optionally fitted module which has a composite/mpx output, such as the /S Stereo Encoder. It cannot be sourced from the composite/mpx signal directly applied to the modulator within the Exciter.

When the composite/mpx signal from the optionally fitted module is to be routed directly to the modulator, the rear panel 'Loop' switch SW01 must be in the upper 'Int' position. This is the normal mode of operation.

The output is unbalanced 75Ω, at a level, for ±75kHz deviation, of 5.5V peak to peak (open circuit). This matches the input sensitivity of the Exciter's Composite Input Connector (see 2.2.5) when the external equipment has nominally 0dB insertion gain and all input impedances (external equipment and Exciter's Composite input) are set to high.

2.2.7 TCP/IP Connector

This is an RJ45 connector SK04 fitted at the rear of the unit. This enables all the control and monitoring detailed in Section 2.4 to be performed using TCP/IP (Transmission Control/Internet Protocol).

This arrangement requires the unit to be assigned a unique Internet Protocol address. When first connected to the network via its RJ-45 connector, the Exciter's TCP/IP adapter will attempt to acquire an IP address automatically (it's quite common to have networks configured to use 'DHCP', which provides these addresses on demand). The address to which a device has been assigned can then be determined and, if required, be overridden with a desired fixed value, using Eddystone supplied software.

Note that an internal lead connection determines if serial control and monitoring is via this RJ45 connector or via the rear panel (RS232) COM Port connector PL11 (see 2.2.12). For TCP/IP control, the 3 pin screened lead from the Front Panel board connector (6)CON05 must be plugged into the Main Board connector (5)CON07 (see E2170-00CT).

2.2.8 Baseband Monitor Connector

This is a 50Ω BNC coaxial socket SK01at the left hand side of the Exciter front panel. This provides a sample of the signal applied to the modulator within the Exciter. The output is unbalanced 75Ω, at a level, for ±75kHz total deviation, of 1.6V peak to peak (pd across 75Ω). This connector is for test purpose only with the test equipment and lead being disconnected when not in use. **NOTE that the performance of this output (noise/distortion/stereo separation etc.) is not necessarily equal to that of the modulated signal.**

2.2.9 RF Monitor Connector

This is a 50Ω BNC coaxial socket SK02 on the left hand side of the Exciter front panel. This provides an harmonically filtered sample of the Exciter's forward output power at a level, into 50Ω, approximately 44dB below the power being delivered into the load (e.g. approximately 1mW to10mW at maximum power output). This connector is for test purpose only with the test equipment and lead being disconnected when not in use. **NOTE that the levels of any harmonics present are not necessarily equal to those at the antenna.**

2.2.10 Left and Right Audio Input Connectors (/S Stereo Encoder version only)

These are two three pin XLR sockets at the rear of the unit (fitted to the rear of the /S Stereo Encoder module) used for interconnection to stereophonic modulating signal (or monophonic using a single input). Twin, separately screened cables, not exceeding three metres in length, should be used for the interconnecting leads.

Each lead terminates in a three pin XLR plug at the Exciter end which is wired as follows :-

Pin 1	Direct chassis ground – or, Chassis ground via 150n/50V capacitor
Pin 2	Signal (+)
Pin 3	Signal (-)

The input impedance can be set internally to balanced 600Ω or 20kΩ with pin 1 either connected directly to chassis ground or via a capacitor (see E2170-00GA). The input sensitivity of each input is set separately using the adjacent rear panel controls, with pre-emphasis set from the front panel to none, 25uS, 50uS or 75uS.

Input sensitivity for ±67.5kHz deviation (exc. pilot) at 400Hz :+8dBm (600Ω input) :+8dBu : 5.5V p to p (maximum sensitivity approximately : -4dBm (600Ω input) : -4dBu : 1.4 peak to peak)

Note that each input can be made unbalanced by externally connecting one of the balanced signal input lines to ground (pin 2 or pin 3 to pin 1). The input impedance then becomes 600Ω or 13.3kΩ.

2.2.11 Pilot Output Connector (/S Stereo Encoder version only)

This is a 50Ω SMA coaxial socket SK14 at the rear of the unit used for interconnection to external equipment, typically RDS generators, which generate a sub-carrier which requires phase locking to harmonics of the Stereo Encoder, 19kHz, pilot tone (57kHz in the case of RDS). An SMA plug is used for connection to this output, with matching screened coaxial cable, not exceeding three metres in length. The output is approximately 100Ω, at a level of 5V peak to peak, sinewave (open circuit).

2.2.12 COM Port Connector

This is a 9 Way D plug PL11 on the rear panel. This enables all the control and monitoring, detailed in Section 2.4, to be performed using a personal computer with its (RS232) COM port connected to this port. Multi-core screened cable, not exceeding 30 metres in length, should be used for the interconnecting lead. The lead terminates in a 9 Way free D socket at the Exciter end which is wired as follows :-

Pin 1	Not connected
Pin 2	Received Data (to Exciter)
Pin 3	Transmit Data (from Exciter)
Pin 4	Not Connected
Pin 5	Ground
Pin 6	Not Connected
Pin 7	Not Connected
Pin 8	Not Connected
Pin 9	Not Connected

Note that the assigned pin numbers and their functions are for a standard 9 pin plug on 'Data Terminal Equipment' (DTE) such as computers. Standard crossover or 'null modem' leads must thus be used for connection to a personal computer or PC. The length of the interconnecting lead may be extended by use of compatible RS422/485 or fibre-optic line drivers.

Note that an internal lead connection determines if serial control and monitoring is via this RS232 connector or via the rear panel TCP/IP connector SK04 (see 2.2.7). For RS232 control, the 3 pin screened lead from the Front Panel board connector (6)CON05 must be plugged into the Input/Output Board connector (14)CON03 (see E2170-00CT).

2.2.13 Status Connector

This is a 25 Way D socket SK12 at the rear of the unit. This is used to enable basic external monitoring and control. Multi-core screened cable, not exceeding 3 metres in length, should be used for the interconnecting lead.

The lead terminates in a 25 Way free D plug at the Amplifier end which is wired as follows :-

Pin 1	Channel 2 select input (momentary ground for >1second to select)	Only one input grounded at a time will be recognised
Pin 2	Channel 3 select input (momentary ground for >1second to select)	
Pin 3	Channel 4 select input (momentary ground for >1second to select)	
Pin 4	Channel 5 select input (momentary ground for >1second to select)	
Pin 5	Channel 6 select input (momentary ground for >1second to select)	
Pin 6	Channel 7 select input (momentary ground for >1second to select)	
Pin 7	Forward Power Low (approx. –2dB rel. set o/p - pulled to ground when good)	
Pin 8	Fwd Power Fail (approx. –12dB rel. max o/p - pulled to ground when good)	
Pin 9	Rev Power High (ap. 15W XE35/75, 30W XE150/300 - pulled to gnd when good)	
Pin 10	PLL Lock status output (pulled to ground when good)	
Pin 11	Heatsink Temperature status output (pulled to ground when good i.e.<85deg.C)	
Pin 12	Modulation (Deviation) status output (pulled to ground when good i.e <±80kHz)	
Pin 13	System Normal status output (pulled to ground when good)	
Pin 14	Chassis Ground for Channel select input	
Pin 15	Chassis Ground for Channel select input	
Pin 16	Forward power analogue monitor voltage output (0-5V into >1kΩ) approx. 0.8V at 35W, 1.3V at 75W, 2V at 150W and 3V at 300W (as applicable)	
Pin 17	Reverse power analogue monitor voltage output (0-5V into >1kΩ) approx. 0.2V at 4W, 0.4V at 8W, 0.7V at 15W and 1V at 30W (as applicable)	
Pin 18	Chassis Ground for Channel select input	
Pin 19	Chassis Ground for Channel select input	
Pin 20	Chassis Ground	
Pin 21	Safety Interlock input (ground to de-mute)	
Pin 22	Mute RF input (ground to mute) – for control not safety purposes	
Pin 23	+12v dc fused supply output (150mA maximum)	
Pin 24	CPU status output (pulled to ground when Main Board CPU good)	
Pin 25	Fan status output (pulled to ground when good)	

Any of the 'pulled to ground when good' status outputs required to be used, must be returned to a supply of no greater than 25V and must be limited to drawing no more than 50mA each by additional external resistance (100Ω is provided internally).

All of the 'ground to operate' inputs (except pin 21, the safety interlock) are internally pulled up to +5V via 12kΩ and must be fed from a voltage free source of less than 1kΩ to ground to operate (open circuit for a high non-operating state). These inputs are protected against constant application of up to ±25V dc directly applied.

For the safety interlock, a circuit has to be made between pins 20 and 21, which open-circuits to mute the Exciter or short-circuits to de-mute. If there are no external safety interlock switches, a short direct link is made, this being the state in which any connector is normally supplied. If connections need to be made to external safety switches, this link is removed and the switches are wired in a series loop to the connector so that if any switch opens, the link is broken. Note that the safety interlock provides the most direct, and thus safest, muting of output power. The Mute RF input pin 22 (ground to mute) is read by software (with a short delay) and thus is not so direct, being intended for control purposes only **and not as part of a safety interlock system**.

! CAUTION !

For the safety interlocks to work correctly, the external switches and link wiring must 'float' (i.e. must not be grounded at any point, apart from at the Exciter itself). The total loop resistance should not exceed approximately 10Ω. The external wiring may also be ferrite loaded for emc requirements.

2.2.14 External Standard Input Connector

This is a 50Ω BNC coaxial socket SK13 at the lower rear of the unit used for interconnection to a 10MHz external frequency standard (typically derived from the GPS system). A 50Ω BNC plug is used for connection to this 50Ω input, with matching screened coaxial cable, not exceeding three metres in length.

Connection to a source of 10MHz ±10Hz at a level of between +3dBm (300mV rms pd) and +13dBm (1V rms pd) sinewave will cause the internal frequency standard to be phase locked to the external source. The Exciter output frequency will be accurate (and as displayed) when the external source is precisely 10MHz.

The status of the external standard input function can be viewed by pressing [MODE] on the front panel keyboard, then the [soft key] under 'System', then the left hand [∧] and [∨] keys as required to obtain the 'Ext Standard' status display which indicates :-

'None' - no standard present (of sufficient level)
'Normal' - standard present and in lock
'Fail' - standard present but not locked

2.2.15 Composite Input Connector (/M Composite Input option only)

This is a floating 75Ω BNC coaxial socket on the rear of the optional module, used for interconnection to a composite/multiplex modulating signal in the range from DC up to 100kHz. A 50Ω or 75Ω BNC plug can be used for connection to this input, with matching screened coaxial cable, not exceeding three metres in length.

The input can be internally preset to balanced 75Ω or 20kΩ (coaxial screen floating) or unbalanced 75Ω or 13.3kΩ (coaxial screen internally grounded), with its sensitivity set using the adjacent rear panel control - (see E2170-00GA).

Input sensitivity for ±67.5kHz deviation (excluding pilot) : +8dBu : 5.5V peak to peak
(maximum sensitivity approximately : +4dBu : 3.5V peak to peak)

NOTE that this connector must not be used for the input from an external loop originating from the Composite Output Connector SK10. SK09 must be used in this circumstance as detailed in sections 2.2.5 and 2.2.6.

2.2.16 Antenna Input Connector (/R Re-Broadcast option only)

This is a 50Ω 'N' type coaxial socket on the rear of the optional module, used for interconnection to a Band ll receiving antenna (87.5 to108MHz) possibly via intermediate amplifiers, splitters etc. A 50Ω 'N' type plug is used for connection to this input, with matching low loss RF coaxial cable.

Operating input level : approximately -80dBm to at least –20dBm.

2.3 SETTING UP PROCEDURES

2.3.1 Fuses

If any problems occur after the Exciter has been installed and switched on, fuses may need to be checked and possibly replaced. However, a blown or high impedance fuse would generally indicate the presence of a fault, which would need correcting.

The type, function and access to fuses is as follows :

Type	Function	Access
6.3A (T) HBC 5x20mm Fuse	For protection of ac supply input circuitry. If this fuse blows, all Exciter operation ceases	FS1 at the right rear of the unit (being part of mains input socket PL03). **! CAUTION ! Ensure that the mains supply is either disconnected or is switched to 'off' at the distribution board (preferably being locked in that position).**
0.21A Hold SMD 030-2 Resettable Fuse	For protection of the +12V dc output on the rear panel Status connector SK12. If this fuse goes high impedance, any external equipment powered off this supply will cease operation.	Access to this fuse is not normally required (smd fuse is fitted to the Input/Output Board, on which SK12 is located). This fuse will automatically reset if the externally supplied equipment is momentarily disconnected or if the mains supply to the Exciter is interrupted.
0.21A Hold SMD 030-2 Resettable Fuse (XE35/75/150) or 0.35A Hold SMD 050-2 Resettable Fuse (XE300)	For protection of the rear panel fan and its supply leads. If this fuse goes high impedance, this fan will cease operation. The Fan led will go red. After a period, the Output Amplifier temperature will increase and the output power eventually turn done (with an over-temperature indication).	Access to this fuse is not normally required. This smd fuse is fitted on the narrow printed circuit board (Fan Control Board) immediately in front of the power supply unit (and behind the front panel). This fuse will automatically reset if the Fan is momentarily disconnected or if the mains supply to the Exciter is interrupted.
1.4A Hold SMD 200-2 Resettable Fuse	For protection of all circuitry supplied by the internal +12V dc supply. If this fuse goes high impedance, virtually all Exciter operation ceases (apart from the fan).	Access to this fuse is not normally required. This smd fuse is fitted on the narrow printed circuit board (Fan Control Board) immediately in front of the power supply unit (and behind the front panel). This fuse will automatically reset if the mains supply to the Exciter is interrupted.

Type	Function	Access
1A (F) Fuse (for smd holders 'Littelfuse' R451501)	For protection of Driver Amplifier circuitry. If fuse blows, there will be a substantial reduction in output power.	Remove top dust cover. Fuse is fitted in a surface mounted holder on the printed circuit board mounted at the rear of the main heatsink, immediately in front of the fan. **! CAUTION ! Ensure that the mains supply is either disconnected or is switched to 'off' at the distribution board (preferably being locked in that position).**
15A (T) HBC 6.3x32mm 'Pig Tail' (wire-ended) Fuse	For protection of the output and driver amplifier circuitry. If this fuse blows, the output power will reduce to zero. **! CAUTION ! This fuse is soldered to its retaining clips and is intended to blow <u>only</u> if there is a major power supply failure. This fuse should thus only be replaced when the fault has been investigated and corrected.**	Remove top dust cover. Fuse is soldered to clips on the narrow printed circuit board (Fan Control Board) attached to the side of the Power Supply Unit, immediately to the rear of the Front Panel. **! CAUTION ! Ensure that the mains supply is either disconnected or is switched to 'off' at the distribution board (preferably being locked in that position).**

<u>2.3.2 Internal Option Links</u>

The option links are detailed on diagram E2170-00GA bound at the rear. The links are either physically removable, two position, shorting types (LK) or miniature changeover switches (SW). A further option link cable is also fitted (see E2170-00CT) to determine the remote control interface (TCP/IP or RS232).

The links are found at the rear of the Main Board, the rear of the /S Stereo Encoder Board and the rear of the /M Composite Input Board. The cable link, when fitted, connects from the Front Panel Board to the rear of the Main Board or to the Input/Output Board. To access all of these, the top dust cover has to be removed.

! CAUTION ! Ensure that the Exciter's mains supply is either disconnected or switched to 'off' at the distribution board (preferably being locked in that position) before removing the top dust cover.

The /S Stereo Encoder Board, if fitted, is then immediately accessible, with the links just behind the Left and Right Inputs' XLR connectors. To access any Main Board links, the Encoder Board must be removed (two M3 screws holding Encoder Board sub-chassis to the rear panel, two M3 screws holding sub-chassis to support rail across main Board – connectors unplugged as required).

Similarly the /M Composite Input Board, if fitted, is also immediately accessible, with the links just behind the Inputs' BNC connector. To access any Main Board links, the Composite Input Board must also be removed (two M3 screws holding Composite Input Board sub-chassis to the rear panel, two M3 screws holding sub-chassis to support rail across main Board – connectors unplugged as required).

The /R Re-Broadcast Receiver Board has no links to set but, if fitted, will also need to be removed to access links on the Main Board.

To access most links on the Main Board, the Input/Output Board must be removed (4 screwlocks holding Status and COM Port connectors to rear panel, one M3 screw holding Input/output Board to support pillar on Main Board – connectors unplugged as required).

The /S Stereo Encoder Board option switches/links are as follows :-

Switch/Link	Function	Default (Factory) Setting
SW1/LK1	Left Channel Input Impedance – 600Ω or High Z	600Ω
SW2/LK2	Left Channel Ground – AC (capacitor) or DC (direct)	DC
SW3/LK3	Right Channel Input Impedance – 600Ω or High Z	600Ω
SW4/LK4	Right Channel Ground – AC (capacitor) or DC (direct)	DC

The /M Composite Input Board option switches/links are as follows :-

Switch/Link	Function	Default (Factory) Setting
SW1/LK1	Input Type – Balanced or Unbalanced	Balanced
SW2/LK2	Input Impedance – 75Ω or High Z	High Z

The Main Board option switches/links are as follows :-

Switch/Link	Function	Default (Factory) Setting
SW2*	MONO/AES Input Function – Mono or AES	Mono or AES (/S option)
SW3*	MONO/AES Input Function – Mono or AES	Mono or AES (/S option)
SW4	MONO Input Type – Balanced or Unbalanced	Balanced
SW5	MONO Input Impedance – 600Ω or High Z	600Ω
SW6	SCA3 Input Impedance - 75Ω or High Z	High Z (10kΩ)
SW7**	MONO Input Pre-emphasis – 50uS or Off	50uS
SW8**	MONO Input Pre-emphasis – 25uS or Off	Off
SW9	SCA2 Input Impedance - 75Ω or High Z	High Z (10kΩ)
SW10	SCA1/RDS Input Impedance - 75Ω or High Z	High Z (10kΩ)
SW11	Composite Input Type – Balanced or Unbalanced	Unbalanced
SW12	Composite Input Impedance - 75Ω or High Z	High Z

* Note : SW2 and SW3 - These links are only set to AES when the /S Stereo Encoder option module is fitted.

** Note : SW7 and SW8 - To select 75uS pre-emphasis set these links to 50uS and 25uS respectively. To select pre-emphasis off, set both these links to Off.

The cable link is as follows :-

Remote Control Option	Link Front Panel Connector (6)CON05 to :-
Serial RS232 via COM Port PL11	Input/Output Board Connector (14)CON03
TCP/IP via RJ45 Connector SK04	Main Board Connector (5)CON07

2.3.3 Output Frequency and Power Level Adjustment

If the Exciter is not supplied with preset frequency(ies) and output power level, its frequency channel stores will need to be loaded and its front panel POWER control will need to be set. If being used as a drive for an amplifier, the manual for the amplifier must be consulted for information on the level of drive output power required and **care must be taken that the maximum drive level for that amplifier is not exceeded.**

The procedure is as follows :

1) Ensure the Exciter has been installed as detailed in sections 2.1 and 2.2 and the internal option links are set as in 2.3.2 (as required).

2) Break the rear panel Interlock connection between pins 20 and 21 of SK12 and ensure all external sources of modulation are switched off.

3) Apply power to the Exciter (i.e. ensure the supply distribution 10A MCB, if fitted, is on and the rear panel switch, if fitted, is on)

4) Ensure that the power on audio tone sounds, the LCD display illuminates (briefly displaying Exciter type information) and all LED displays (except 'MOD') are on red, green or amber. If not, follow fuse checking procedure as detailed in section 2.3.1 (fault finding may be required if this occurs).

5) Check that the LCD display settles, showing the 'MAIN' screen which gives selected channel (frequency) forward and reverse output powers (both near zero because of interlock) and deviation bargraph (again near zero, showing internal pilot if present).

6) Set the Exciter's front panel POWER twenty-two turn control to fully anti-clockwise (i.e. minimum power setting).

7) Ensure that any connections to the Status Connector SK12 Channel select input pins 1-6, are not grounded, as this may prevent channels from being loaded with new frequencies.

8) The channel frequencies of the Exciters are set by pressing [MODE] on the front panel keyboard, then the [soft key] under 'Freq.', then the left hand [∧] and [∨] keys as required to obtain the 'Channel 0 (new freq. entry)' display. Channel 0 is a special channel only used to enter frequencies – it cannot be selected for transmission. If the frequency, in any channel number display, shows '……MHz', this indicates a clear entry or channel.

9) With Channel 0 selected, the four [soft key] switches set 10MHz, 1MHz, 100kHz and 10kHz, in order, from left to right below the LCD display. 10MHz settings are limited to 8, 9 and 10, any other will produce a cleared channel. The 10kHz setting is only 0kHz or 50kHz. The new frequency should generally be selected in 10MHz –1MHz –100kHz –10kHz order, as each digit entry will zero any lesser significant digits and/or determine their allowable range. Only settings between 87.5 and 108MHz will be selectable.

10) The channel frequencies (seven total) are stored in non-volatile 'flash' memory and are thus retained whilst power is removed. To load the frequency, entered in Channel 0, into one of the seven stored channels, press the left hand [∧] and [∨] keys as required to obtain the destination Channel number display. The presently selected channel (for transmission) will indicate '(int. selected)' or '(ext selected)' the other six will indicate '(stored frequency)' as well as 'Select' and 'Update' above the extreme left and right hand [soft keys].

11) The frequency in channel 0 can only be loaded into one of the six channels by pressing the [soft key] below 'Update'. The seventh, presently selected, channel cannot be over-written with a new frequency. To do this, first select another channel for transmission by pressing the

[soft key] below ‘Select’ when its’ screen is displayed. This will ‘free’ the previously transmitted channel for a frequency update (note the comments in section 2.3.5 about locked channels).

12) It is recommended that if only one frequency is required, then that frequency should be loaded into all seven channels. If required however, a channel can be cleared by updating it with ‘……MHz’ from channel 0. If selected for transmission a cleared channel will produce a muted output (although the Exciter will ‘rest’ at 98MHz).

13) If not already selected, select the channel required for transmission by pressing the [soft key] below ‘Select’ when its’ screen is displayed. The display will show ‘(int. selected)’. Press [MAIN] to return to the main screen which will show the selected channel and its’ frequency.

14) Reconnect the rear panel Interlock connection between pins 20 and 21 of SK12

15) Turn the Front Panel POWER control clockwise to increase the selected Exciter’s output power until the required ‘Fwd’ power is obtained, as indicated on the LCD display The displayed ‘Rev’ power depends on the return loss of the load presented to the Exciter’s RF output but should generally be less than one twentieth of the ‘Fwd’. To ensure complete accuracy, an external calibrated power meter should be used to measure the ’Fwd’ output power.

The Exciter will now be ready for operation with audio and or data sources applied to the rear panel inputs, the instantaneous deviation being displayed on the main screen bargraph. Input levels or the corresponding rear panel sensitivity controls may need adjusting to obtain the required deviation. Note that when the /S Stereo Encoder option is fitted, its Limiter and Clipper functions (on or off) will affect the deviation levels obtained from the Left/Right or digital AES inputs.

The Front Panel RF MON output can be used to check the close-in spectrum of the Exciter output signal, noting that any harmonic levels shown will not necessarily be the same as those present at the Exciter output. The Front Panel BASEBAND MON output can similarly be used to check the spectrum of the final modulating signal. Any test equipment should not however normally be left connected to these two outputs.

2.3.4 Channel and Frequency Selection and Setting During Operation

Channel frequencies may be loaded or altered whilst the Exciter is operating, delivering output power, as detailed in section 2.3.3, steps (8) to (11). The frequency of the channel on which the Exciter is operating however, cannot be altered, this channel frequency display showing ‘(int. selected’) or ‘(ext selected)’ see step (10).

To change the operating channel, press [MODE] on the front panel keyboard, then the [soft key] under ‘Freq.’, then the left hand [∧] and [∨] keys as required to obtain the channel and frequency required, and finally, the [soft key] below ‘Select’ (note ‘Select’ will not appear on special channel 0 or on the channel already selected). Note also the comments in section 2.3.5 about locked channels.

The front panel SYSTEM NORMAL LED will show red until the new frequency is ‘in lock’, this taking several seconds. After a total of about 12 seconds, RF will be output at the new frequency. However, if the frequency is ‘……MHz’ (the clear channel) the output will remain muted. Press [MAIN] to confirm operating channel and frequency.

2.3.5 External Channel and Frequency Selection and Locking

Channels 2-7 (not channel 1) may be selected externally by connecting the appropriate pin on the 25-way rear panel Status connector, SK12, to ground (see section 2.2.13) :-

CHANNEL	25-way pin number
1	None
2	1
3	2
4	3
5	4
6	5
7	6
GROUND	14, 15, 18, 19

A momentary grounding of greater than one second will select a channel. However, if the ground is maintained, the Exciter will remain locked to that channel and frequency, and selection of another, as described in section 2.3.4, will not be possible until that ground is removed.

This technique can be used to prevent unauthorised frequency changes being made from the front panel or remotely. The display for that channel number will indicate '(ext. selected)' whilst its external line is grounded, going back to '(int. selected)' when the ground is removed.

2.3.6 Stereo Encoder Settings (/S option only)

The settings of the Stereo Encoder when fitted (pre-emphasis off/25uS/50uS/75uS, limiter on/off, clipper on/off and pilot on/off) may be viewed and altered from the front panel.

To view or change any of these, press [MODE] on the front panel keyboard, then the [soft key] under 'Options', and finally the left hand [∧] and [∨] keys as required to display the function setting required.

To alter a setting, press the appropriately marked [soft key] and after a brief delay, the revised setting will be displayed and stored in non-volatile flash memory (and thus retained whilst power is removed).

Press [MAIN] to return to operating channel, frequency, power and deviation display.

Note that the limiter should normally be switched on if the clipper is in operation. The limiter operates at a lower deviation level than the clipper. It thus prevents the possibility of excessive distortion occurring if the clipper operates on high, non-limited levels of modulation rather than just the short transient peaks of modulation resulting from the finite attack time of the limiter circuit.

2.4 SERIAL REMOTE CONTROL AND MONITORING

2.4.1 Introduction

Serial control via the rear panel COM PORT connector (section 2.2.12) uses asynchronous data (1 start, 8 data, 1 stop bit, no parity) at 2400, 4800, 9600 or 19200 Baud. Control commands and status monitor requests are detailed in section 2.4.2. The content of status monitor information reverted from the Exciter is detailed in section 2.4.3. The same functions are also enabled using TCP/IP via a rear panel RJ45 connector (section 2.2.7). Selection of COM port or RJ45 connector is made using an internal link lead.

The individual data bytes are defined in ASCII form, to enable basic control and monitoring using a PC running a terminal program. However, a PC program with a dedicated textual and/or graphical user interface is required for proper implementation of a remote control and monitoring system. Eddystone Broadcast should be contacted for further information regarding such programs and hardware implementations using the RS232 and TCP/IP ports directly or via USB or TCP/IP adaptors.

2.4.2 Control Commands and Status Monitor Requests

All command and status monitor requests are initiated by the remote control unit (PC) – the Exciter never outputs any serial data via the COM PORT or TCP/IP connector unless requested to by that unit.

The remote control unit always sends a sequence of three bytes, waiting for each byte to be 'echoed' correctly before the next one is sent (which must be within 500mS of the previous one). A wait of 500mS is also recommended before the sequence is timed out and aborted. A new sequence of three bytes then can be attempted. Note that an echo will not be returned when an invalid sequence is detected by the Exciter.

The three bytes are :-

First byte	'Handshake' (always ASCII #) – indicates start of sequence
Second byte	'Command' – indicates form of control or status monitoring
Third byte	'Status Requests' (after ASCII ? Command) - gives details of status monitoring required or 'Controls' (after ASCII : ; < = > ' ( ) * Commands) - gives details of control required

Details of the Handshake, Command, Status Request and Control bytes are given in the following four tables. Typical examples of controller generated sequences are as follows :-

# ? 1	Request to revert the frequencies of Channel #1and #0
# (Q	Switches Stereo Encoder pilot on
#) R	Switches Stereo Encoder limiter off
# ' 5	Select Stereo Encoder 50uS pre-emphasis

Note that the Encoder commands are only operative (and send confirming 'echoes') if the Exciter being controlled has a Stereo Encoder fitted. Similarly, Option Set 1 or 2 commands are only valid if two options are fitted.

Note also that the channel or frequency control commands do not operate in isolation but instead must be performed in a defined sequence (similar to that when using the local front panel controls). This is to prevent unwanted or incorrect changes to the Exciter transmitted output frequency. Errors in sequences will result in no confirming 'echo' being returned and the sequence being aborted (see section 2.4.4).

Handshake (first byte sent from controller)			
Title	Function	Hex	ASCII
Async_Hshake	Remote input handshake	23	#

Remote Input Commands (second byte sent from controller)			
Title	Function	Hex	ASCII
Query_Status	Status query (request to revert)	3F	?
Freq_Set_10M	Channel 0 10MHz freq. (0, 8, 9, none)	3A	:
Freq_Set_1M	Channel 0 1MHz frequency (0-9)	3B	;
Freq_Set_100k	Channel 0 100kHz frequency (0-9)	3C	<
Freq_Set_10k	Channel 0 10kHz frequency (0 or 5)	3D	=
Channel_Set	Channel (1-7, update or select)	3E	>
Pre_Emph_Set	Encoder pre-emphasis (off,25,50,75uS)	27	‘
Pilot_Set	Encoder 19kHz pilot (on or off)	28	(
Limiter_Set	Encoder limiter (on or off)	29	)
Clipper_Set	Encoder clipper (on or off)	2A	*
Option_Set	Select Option (1 or 2)	2B	+

Remote Input Status Requests (third byte sent from controller after ? command)			
Title	Function	Hex	ASCII
Op_Stat	Revert output and type status	30	0
Chan1_Stat	Revert channels 1 and 0 frequencies	31	1
Chan2_Stat	Revert channels 2 and 0 frequencies	32	2
Chan3_Stat	Revert channels 3 and 0 frequencies	33	3
Chan4_Stat	Revert channels 4 and 0 frequencies	34	4
Chan5_Stat	Revert channels 5 and 0 frequencies	35	5
Chan6_Stat	Revert channels 6 and 0 frequencies	36	6
Chan7_Stat	Revert channels 7 and 0 frequencies	37	7
Ana1_Stat	Revert deviation/temperature/current	57	W
Ana2_Stat	Revert high/low voltages/signal level	58	X
Sys_Stat	Revert Exciter status	59	Y
Opt_Stat	Revert Options status	5A	Z

Remote Input Controls (third byte sent from controller after : ; < = > ‘ ( ) * commands)			
Title	Function	Hex	ASCII
Freq_10M_ -8/9/10/W	Set channel 0 10MHz Frequency	38 39 30(=10) or 57	8 9 0 or W*
Freq_1M_0-9	Set channel 0 1MHz Frequency	30-39	0-9
Freq_100k_0-9	Set channel 0 100kHz Frequency	30-39	0-9
Freq_10k_0/5	Set channel 0 10kHz Frequency	30 35	0 5
Channel_No_1-7	Set chan. number (for update/select)	31-37	1-7
Channel_Up	Update channel (with channel 0 freq.)	47	G
Channel_Sel	Select channel (for transmission)	49	I
Pre_Emph_Off	Set Stereo Encoder pre-emphasis off	52	R
Pre_Emph_25	Set Stereo Encoder pre-emphasis 25uS	32	2
Pre_Emph_50	Set Stereo Encoder pre-emphasis 50uS	35	5
Pre_Emph_75	Set Stereo Encoder pre-emphasis 75uS	37	7
Pilot_On	Set Stereo Encoder 19kHz pilot on	51	Q
Pilot_Off	Set Stereo Encoder 19kHz pilot off	52	R
Limiter_On	Set Stereo Encoder limiter on	51	Q
Limiter_Off	Set Stereo Encoder limiter off	52	R
Clipper_On	Set Stereo Encoder clipper on	51	Q
Clipper_Off	Set Stereo Encoder clipper off	52	R
Option_1	Select Option 1 (MPX output)	31	1
Option_2	Select Option 2 (MPX output)	32	2

*Note: Setting channel 0 10MHz frequency to ‘none’ (W) will blank the whole of channel 0, enabling other channels to be blanked later.

2.4.3 Reverted Status Monitor Information

The status of the Exciter is reverted in response to a ? command (see section 2.4.2). After the third byte is echoed back to the remote control unit, a further fifteen bytes are sent immediately from the Exciter, with no delays between individual bytes (each 1 start, 8 data, 1stop, no parity).

The first fourteen of the fifteen bytes contains the specific status information requested. The last byte is an exclusive OR checksum of those fourteen bytes. This checksum can be used by the remote control unit to check that the information has not become corrupted.

The meanings of the various bytes in the information string are defined in the table below.

Reverted Status Information (meanings of bytes reverted in response to **?** command)			
Title	Meaning	Hex	ASCII
Norm	Status normal	4E	N
N_Norm	Status not normal	4F	O
Stat_Low	Status low	4C	L
Stat_High	Status high	48	H
Fail	Status fail	46	F
Off	Status off	52	R
On	Status on	51	Q
Mute	Status muted	4D	M
Start	Status start	53	S
De_Sel	Status de-selected	44	D
Int_Sel	Status internally selected	49	I
Ext_Sel	Status externally selected	56	V
None	None	57	W
N_Known	Not known	58	X
N_Applic	Not applicable	5A	Z
Direct Display	Numerical values	30-39	0-9
Direct Display	Sign	2B 2D	+ -
Direct Display	Decimal point	2E	.
Direct Display	Blank	00	NUL
Direct Display	Less than	3C	<
Direct Display	Greater than	3E	>

Most meanings are general. A string of fourteen system status information bytes would typically contain several ‘N’s, each one indicating that a particular status (forward power, reverse power etc.) is ‘Normal’.

Direct display bytes give an immediate numerical display of power, current and temperature etc., even when using a basic terminal program.

If the Exciter contains no known good information about a particular status, the ‘X’ byte is reverted. This occurs if the Exciter is unable to interrogate individual modules within the unit and thus cannot determine their status.The ‘Revert Output Status Request’ (ASCII 0) returns the Exciter type and can be used by the Remote Control Unit to determine the power rating of the Exciter being interrogated.

The following six tables detail the contents of the various strings of reverted status information. The final column in each defines which ASCII values a particular byte can have. The table above defines the meanings of these values. The first byte in each table is the echo of the third byte sent from the remote control unit.

Reverted Output Data Block (15 extra bytes reverted in response to **# ? 0** sequence)		
Title	Status	Possible Values (ASCII)
Op_Data1	Output data status request byte	third byte echo fixed at 0
Op_Data2	Output forward power MSB (Watts)	Null (blank) 0 to 9 (inc) < (less than) or X
Op_Data3	Output forward power MSB-1 (Watts)	
Op_Data4	Output forward power LSB (Watts)	
Op_Data5	Output reverse power MSB (Watts)	
Op_Data6	Output reverse power MSB-1 (Watts)	
Op_Data7	Output reverse power LSB (Watts)	
Op_Data8	Output frequency MSB (10MHz)	8 9 0 (=10) W* or X
Op_Data9	Output frequency MSB-1 (1MHz)	0-9 W* or X
Op_Data10	Output frequency LSB+1 (100kHz)	0-9 W* or X
Op_Data11	Output frequency LSB (10kHz)	0 5 W* or X
Op_Data12	Exciter OS number MSB	0 to 9 (inc) and . (decimal point)
Op_Data13	Exciter OS number MSB-1	
Op_Data14	Exciter OS number LSB	
Op_Data15	Exciter type	$ (35W) / (75W) & (150W) ! (300W) or X
Op_Data16	Output data 8 bit EOR checksum (of 2-15 inc. only)	

*Note: 'none' (W) indicates a blank channel has been selected, causing the Exciter power output to be muted.

Reverted Channel Data Block (15 extra bytes reverted in response to **# ? 1** to **# ? 7** sequences)		
Title	Function	Possible Values (ASCII)
Chan_Data1	Channel number 1-7	third byte echo of 1-7
Chan_Data2	Channel frequency MSB (10MHz)	8 9 0 (=10) W* or X
Chan_Data3	Channel frequency MSB-1 (1MHz)	0-9 W* or X
Chan_Data4	Channel frequency LSB+1 (100kHz)	0-9 W* or X
Chan_Data5	Channel frequency LSB (10kHz)	0 5 W* or X
Chan_Data6	Channel selection state	D I V X
Chan_Data7	On-Air Channel number	1-7 or X
Chan_Data8	Channel 0 frequency MSB (10MHz)	8 9 0 (=10) W*
Chan_Data9	Channel 0 frequency MSB-1 (1MHz)	0-9 and W*
Chan_Data10	Channel 0 frequency LSB+1 (100kHz)	0-9 and W*
Chan_Data11	Channel 0 frequency LSB (10kHz)	0 5 and W*
Chan_Data12	Channel data spare	
Chan_Data13	Channel data spare	
Chan_Data14	Channel data spare	
Chan_Data15	Channel data spare	
Chan_Data16	Channel data 8 bit EOR checksum (of 2-15 inc. only)	

*Note: 'none' (W) indicates that the channel has no stored frequency (blank) Selecting a blank channel will cause the Exciter power output to be muted.

Note that the contents of the frequency entry channel 0 are also sent with any stored channel frequency being reverted.

Reverted Analogue#1 Data Block (15 extra bytes reverted in response to **# ? W** sequence)		
Title	Status	Possible Values (ASCII)
Ana1_Data1	Analogue#1 request byte	third byte echo fixed at W
Ana1_Data2	Deviation MSB (kHz)	Null (blank) 0 to 9 (inc) or X
Ana1_Data3	Deviation MSB-1 (kHz)	
Ana1_Data4	Deviation LSB (kHz)	
Ana1_Data5	Deviation MSB (percent)	
Ana1_Data6	Deviation MSB-1 (percent)	
Ana1_Data7	Deviation LSB (percent)	
Ana1_Data8	Temperature MSB (deg.C)	Null (blank) 0 to 9 (inc) + and - or X
Ana1_Data9	Temperature MSB-1 (deg.C)	
Ana1_Data10	Temperature LSB (deg.C)	
Ana1_Data11	Current MSB (Amps)	Null (blank) 0 to 9 (inc) < . (d.pt) or X
Ana1_Data12	Current MSB-1 (Amps)	
Ana1_Data13	Current LSB+1 (Amps)	
Ana1_Data14	Current LSB (Amps)	
Ana1_Data15	Spare	
Ana1_Data16	Analogue#1 status 8 bit EOR checksum (of 2-15 inc. only)	

Reverted Analogue#2 Data Block (15 extra bytes reverted in response to **# ? X** sequence)		
Title	Status	Possible Values (ASCII)
Ana2_Data1	Analogue#2 request byte	third byte echo fixed at X
Ana2_Data2	High voltage MSB (Volts)	Null (blank) 0 to 9 (inc) < > . (decimal point) or X
Ana2_Data3	High voltage MSB-1 (Volts)	
Ana2_Data4	High voltage LSB+1 (Volts)	
Ana2_Data5	High voltage LSB (Volts)	
Ana2_Data6	Low voltage MSB (Volts)	
Ana2_Data7	Low voltage MSB-1 (Volts)	
Ana2_Data8	Low voltage LSB+1 (Volts)	
Ana2_Data9	Low voltage LSB (Volts)	
Ana2_Data10	Received signal level MSB (dBm)	
Ana2_Data11	Received signal level MSB-1 (dBm)	
Ana2_Data12	Received signal level LSB+1 (dBm)	
Ana2_Data13	Received signal level LSB (dBm)	
Ana2_Data14	Spare	
Ana2_Data15	Spare	
Ana2_Data16	Analogue#2 status 8 bit EOR checksum (of 2-15 inc. only)	

Reverted Exciter Data Block (15 extra bytes reverted in response to **# ? Y** sequence)		
Title	Status	Possible Values (ASCII)
Ex_Data1	Exciter data status request byte	third byte echo fixed at Y
Ex_Data2*	Exciter system normal status	N O X
Ex_Data3	Exciter forward power status	N L F X
Ex_Data4	Exciter reverse power status	N H X
Ex_Data5	Exciter heatsink temperature	N H X
Ex_Data6	Exciter power amplifier current status	N H X
Ex_Data7	Exciter high voltage status	N L X
Ex_Data8	Exciter low voltage status	N L X
Ex_Data9	Exciter phase lock status	N F X
Ex_Data10	Exciter external standard status	N F W X
Ex_Data11	Exciter heatsink cooling fan status	N F Z X
Ex_Data12	Exciter Deviation	N L H X
Ex_Data13	Exciter Ext. Mute State	M S X
Ex_Data14	Exciter Interlock State	M S X
Ex_Data15	Spare	
Ex_Data16	Exciter status 8 bit EOR checksum (of 2-15 inc. only)	

*Note : Ex_Data2, Exciter system normal, will indicate 'not normal' (O) if <u>any</u> of Ex_Data3-11do <u>not</u> indicate 'normal' (N), 'none' (W) or 'not applicable' (Z).

Ex_Data2 is not affected by Ex_Data12-15.

Reverted Options Data Block (15 extra bytes reverted in response to **# ? Z** sequence)		
Title	Status	Possible Values (ASCII)
Opt_Data1	Options status request byte	third byte echo fixed at Z
Opt_Data2*	Stereo Encoder pre-emphasis	2 (25uS) 5 (50uS) 7 (75uS) R X Z*
Opt_Data3	Stereo Encoder 19kHz pilot	R Q X Z*
Opt_Data4	Stereo Encoder limiter	R Q X Z*
Opt_Data5	Stereo Encoder clipper	R Q X Z*
Opt_Data6	Stereo Encoder 19kHz pilot status	N F X Z*
Opt_Data7	Stereo Encoder AES signal status	N W X Z*
Opt_Data8	Spare	
Opt_Data9	Receiver signal status	N L X Z*
Opt_Data10	Spare	
Opt_Data11	Spare	
Opt_Data12	Spare	
Opt_Data13	Option 1 Type	W X 1 2 3 ***
Opt_Data14	Option 2 Type	W X 1 2 3 ***
Opt_Data15	Option (1 or 2) Selected	1 2 X Z**
Opt_Data16	Options status 8 bit EOR checksum (of 2-15 inc. only)	

*Note: 'not applicable' (Z) indicates that the option is not fitted.
** Note (Z) in this case means two options not fitted
*** '1' = Composite/MPX Input: '2' = Stereo Encoder: '3' = Re-Broadcast Receiver

2.4.4 Channel and Frequency Selection and Setting under Remote Control

Channel and frequency control commands do not operate in isolation but instead must be performed in a defined sequence (similar to that when using the local front panel controls – see sections 2.3.3, 2.3.4 and 2.3.5). This is to prevent unwanted or incorrect changes to the Exciter transmitted output frequency. Errors in sequences or content will result in no confirming 'echo' being returned and the sequence being aborted. Each command in a set or select sequence must also be sent within one second of the channel number command or, again, no confirming 'echo' will be returned and the sequence aborted.

To select a pre-programmed channel the sequence is as follows (channel 2 in this example):-

Command (ASCII)	Operation
# > 2	Set for channel 2
# > I	Select channel 2 for transmission

Note that if any one of channels 2-7 is 'locked' by the permanent grounding of a rear panel channel select line (see section 2.3.5) then the second of the above commands will not send a confirming 'echo' and the sequence will terminate with no action performed.

If possible, the actual frequency programmed in channel 2 should be remotely checked beforehand to ensure it is the frequency required (by sending # ? 2). Channels 1 and 3-7 can similarly be checked and selected by replacing '2' in the above sequences with 1 or 3-7 as required. Selecting a blank channel for transmission will cause the Exciter power output to be muted.

To re-program a channel with a new frequency, the new frequency must first be loaded into channel 0, similar to local operation as described in steps (8) – (13) of section 2.3.3. The sequence is as follows (loading 92.70MHz in this example) :-

Command (ASCII)	Operation
# : 9	Set Channel 0 10MHz frequency to 9
# ; 2	Set Channel 0 1MHz frequency to 2
# < 7	Set Channel 0 100kHz frequency to 7
# = 0	Set Channel 0 10kHz frequency to 0

Note that if the first command is # : W then channel 0 is cleared or blanked and the sequence terminated (although a confirming echo will be sent in this case). This blank channel 0 can then be used later to clear or blank other channels. Note also that attempts to load frequencies outside the range 87.5 to 108MHz will produce no confirming echo and abort the sequence.

To re-program a channel with the frequency previously loaded into channel 0, the sequence is as follows (channel 4 in this example):-

Command (ASCII)	Operation
# > 4	Set for channel 4
# > G	Load channel 4 with channel 0 frequency

Note that if channel 4 is already selected for transmission (i.e. is 'on-air') then the second of the above commands will not send a confirming 'echo' and the sequence will terminate with no action performed (the transmitted frequency cannot be altered directly).

If possible, the actual frequencies set in channels 0 and 4 should be remotely checked beforehand and afterwards to ensure the change is made correctly (by sending # ? 4 each time). Channels 1-3 and 5-7 can similarly be checked, re-programmed and checked again by replacing '4' in the above sequences with 1-3 or 5-7 as required.

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SECTION THREE : OPERATION

3.1 CONTROLS AND DISPLAYS

Marked	Type	Function
SET POWER	Preset (22T) Potentiometer	To set output power level (anti-clockwise to reduce power).
MOD	LED Display	Red indicates deviation above 80kHz Green indicates deviation between 15 and 80kHz Off indicates deviation below 15kHz Amber indicates 'Power-on-Reset' period
SYSTEM NORMAL	LED Display	Red indicates one or more system conditions are abnormal. Green indicates all significant system conditions are normal. Amber indicates 'Power-on-Reset' period
MUTE	LED Display	Red indicates that the Exciter is muted by the external Interlock circuit. Amber indicates that the Exciter is muted by the mute control input or that the 'Power-on-Reset' period is in progress. Green indicates normal operation.
FWD	P.A. LED Display	Red indicates forward output power fail (power fallen more than approximately 9-12dB below that required). Green indicates normal operation.
REV	P.A. LED Display	Red indicates reverse power to Exciter in excess of approx. 15W on XE35/75 (-7dB/75W, -3.7dB/35W) or 30W on XE150/300 (-10dB/300W, -7dB/150W) Green indicates normal operation.
TEMP	P.A. LED Display	Red indicates Exciter amplifier heatsink temperature greater than approximately 85 deg.C. Green indicates normal operation
CURRENT	P.A. LED Display	Red indicates current (to Amplifier Pallet) in excess of approx. 7A on XE35/75 or 11A on XE150/300 Green indicates normal operation.
CPU	P.A. LED Display	Red indicates amplifier module CPU (microcontroller) failure, other P.A. LED displays will automatically be turned off. Green indicates normal CPU operation.
CONTRAST	Preset (1T) Potentiometer	To set the contrast of Exciter's liquid crystal display (LCD) for best contrast in the prevailing viewing and ambient temperature conditions.
MAIN	Membrane Switch	To directly select the main LCD screen showing the Exciter's operating channel and frequency, output forward power, reverse power and the instantaneous deviation.
MODE	Membrane Switch	To select other Exciter functions ('modes') such as system status and meter monitoring, channel frequencies and any option settings and status.
∧	Membrane Switch	To step upwards through choices offered in the mode selected.
∨	Membrane Switch	To step downwards through choices offered in the mode selected.
Unmarked 'Soft' keys	Membrane Switches	To select various choices offered in the mode selected.
Unmarked Display	20 Character by 4 line LCD (back illuminated by-green LEDs)	Indicates present mode (middle of top line) with status, input parameters etc. and next key operation choices below.
O I	Rocker Switch (on rear panel (E2170-05, 06, 07 and 08 variants)	To switch mains supply on ('I') or off ('O')

Note an internal sounder indicates correct membrane switch key operation by a single beep or an invalid key input by a short series of beeps.

3.2 STATUS, PERFORMANCE AND LEVEL MONITORING

Once installed as described in Section 2, most operations only involve monitoring Exciter status, performance and levels etc. The membrane switches grouped around the LCD display are used to select which parameter(s) to monitor, the results being displayed on the LCD. The displays are grouped into 'modes' as follows. Note that a display '???' indicates that a particular status cannot be monitored by the Exciter's microcontroller, a permanent display of '???' indicates a fault.

3.2.1 MAIN Display Mode

To display the Exciter's selected ('on-air') channel, frequency and forward and reverse power, press [MAIN]. No matter what state the Exciter is in, pressing this key will always display these main Exciter parameters. An instantaneous but uncalibrated display of the deviation level, in bargraph form, is also provided in this mode to show modulation activity. MAIN mode is the normal mode in which the Exciter is left to operate.

3.2.2 MENU (of Modes) Display Mode

To display other Exciter statuses, levels etc., press [MODE], then press the [soft key] beneath the LCD display, corresponding to the group or mode required ('System' - 'Options' – 'Meter' – 'Freq'). An individual status or level within the selected group can then be displayed by pressing the [∧] or [∨] keys on the left hand side of the LCD display. No matter what state the Exciter is in, pressing [MODE] will always display the display mode menu.

3.2.3 SYSTEM Display Mode

If 'System' mode is selected, pressing the [∧] or [∨] keys steps through various system status conditions, showing 'Normal', 'Fail', 'High', 'Low', 'None' etc. Statuses which also have a varying level (e.g. forward and reverse power, deviation etc.) can be further checked by going directly to 'Meter' mode, where the actual level status presently be checked will be immediately displayed (see section 3.2.5).

An overall 'SYSTEM Normal' display is shown, on all 'System' mode selections, this changing to 'SYSTEM Not Normal' if any of the major individual statuses are not normal (i.e. forward and reverse power, heatsink temperature, amplifier current, high and low voltages, phase lock, external standard and heatsink cooling fan). This system normal indication corresponds with the front panel SYSTEM NORMAL LED (green for Normal, red for Not Normal). If this LED goes red, 'System' mode should be selected and the status(es) causing the warning should be determined by pressing the [∧] or [∨] keys to check them individually. Note that this LED will also go red during power-on-reset or during frequency changes whilst the phase lock loop is temporarily out of lock (not a fault).

On all 'System' mode selections, the display also shows the front panel software operating system number as X.X in the top right hand corner.

3.2.4 OPTIONS Display Mode

If 'Options' mode is selected, initially the options fitted, if any, will be displayed along with the maximum power level of the amplifier section (35W, 75W, 150W or 300W). If options are fitted (1 or 2), the type(s) will be displayed ('Enc' = Stereo Encoder, 'Comp' = (additional) Composite/MPX Input, 'RBR' = Receiver). If two options are fitted, the output of the option required to modulate the Exciter can be selected (if only one option is fitted, the Exciter will remain fixed to its Composite/MPX output)

If an option is fitted, pressing the [∧] or [∨] keys steps through any statuses pertaining to that option. Certain option statuses can be set from the front panel by pressing the [soft keys] as marked, below the LCD (e.g. the pre-emphasis setting of the Stereo Encoder - see section 2.3.6).

3.2.5 METER Display Mode

If 'Meter' mode is selected, pressing the [∧] or [∨] keys steps through various system status levels (forward and reverse power, heatsink temperature, amplifier current, high and low voltages etc.). Levels are shown simultaneously in horizontal bargraph form and as actual digital values.

Values are shown in 'real-time' apart from the digital display of deviation, which captures and then holds the peak level of deviation for a period of approximately 1 to 2 seconds. This level is shown both in kHz and in percentage (of 75kHz). The bargraph display of deviation remains 'real-time' with no peak hold.

Note that when 'Meter' mode is entered directly after checking a specific status in 'System' mode which has a variable level, such as heatsink temperature, then the first 'Meter' mode display will be of that level (see section 3.2.3). This allows rapid checking of any system status faults discovered.

3.2.6 FREQ Display Mode

If 'Frequency' mode is selected, pressing the [∧] or [∨] keys steps through the contents of the eight channel frequency stores. In this mode, the frequencies stored can also be altered and different channels selected for transmission (see sections 2.3.3/4/5) by pressing the [soft keys] as marked, below the LCD.

Note that channel 0 is solely for the entry of new frequencies in the range 87.5 to 108MHz (they cannot be directly entered into any other channel). The channel 0 setting can then be transferred into any of channel 1 to 7 that is displayed as having a 'stored frequency', i.e. one that is not presently selected for transmission.

The channel selected for transmission is displayed as 'ext. selected' when it has been selected by one of the external channel lines being held low (channels 2 to 6 only- see section 2.3.5). Otherwise it is displayed as 'int. selected' (i.e. selected from the front panel or remotely, or by one of the external channel lines which is no longer being held low).

Any of channels 1 to 7 can be selected for transmission unless the presently selected channel is displayed as 'ext. selected' – holding an external channel select line low 'locks' the Exciter onto that channel to prevent unauthorised changes to output frequency.

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