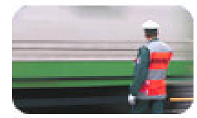
SPECTRA ENGINEERING PTY

Base Station, Repeater, Receiver and Transmitter

MX800



Technical Manual

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All performance figures quoted are typical and are subject to normal manufacturing and service tolerances.

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FCC Interference Warning

Note: The equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial or residential environment. This equipment generates, uses and can radiate radio frequency energy. If not installed and used in accordance with this instruction manual, may cause harmful interference to radio communication.

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Record Of Changes

Any changes to this manual are recorded on this list. Spectra Engineering may issue replacement pages to you from time to time. If any updates are issued, you will also receive a replacement for this page.

Date	Version	Chapter Changes	Pages Changed
May 1997	1.0	All - Initial Release	All
July 1997	1.1	MX800 Software	Software Only
Aug. 1997	1.2	DIP switch settings	Appendix C
		MX800 Configuration guide	Appendix D
Jan. 1998	1.3	Additional features added	
April 1998	2.0	General Revision	All
May 1998	2.01	Minor corrections	i,ii,iii,10,15
May 1998	2.02	Master doc	All
Oct 1998	2.03	Minor Corrections	i,ii,9,27,29,30,35
April 1999	3.0	Local control features added	All
Dec 1999	3.1	Options chapter added	All
June 2000	4.0	Document reformatted	All
Aug 2000	4.01	MX800 Configuration Guide	70
Nov 2000	4.1	Minor Revision	All
Sept 2001	4.1.1	Minor Revisions	All
Sept 2002	4.1.2	Minor Revisions	15,71,82,90,92,96
Jan 2003	4.1.3	Minor Corrections	22,25,40,71
June 2004	4.1.4	Minor Revision	
August 04	4.2.0	Revisions	All
Oct 04	4.2.1	Minor Revision	56
Nov 05	4.2.2	Minor Revision	All
		Add T19/26 Micro Drawing	
		Add RV1 to TX alignment	73-75
30/03/06		Updated Binary bits in table.	95
21/04/06		Updated options section	

SAFETY SUMMARY

Although there are no dangerous mains voltages present within the equipment, the following general safety precautions as would normally apply, should be observed during all phases of operation, service and repair of this equipment.

AROUND THE EQUIPMENT
To minimise any possible shock hazard from an external power supply or lightning strike, the chassis or equipment cabinet must be connected to an electrical ground. Provide adequate ventilation around the rear of the equipment.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE
Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

DO NOT ATTEMPT INTERNAL SERVICE WHILE TRANSMITTING
Thermal or RF burns may result from touching certain components within the power amplifier module while transmitting or operating the transmitter.

DO NOT SUBSTITUTE PARTS OR MODIFY THE EQUIPMENT
Because of the danger of introducing additional hazards, do not install substitute or lower voltage parts to the equipment. Return to your authorised distributor.

EXERCISE CAUTION AND CORRECT DISPOSAL OF RF POWER DEVICES
Most RF power transistors and some RF power hybrids contain Beryllium Oxide. Although they are normally safe, if physically damaged toxic dust may be released. Consult your local authority for correct disposal thereof.

WARRANTY CONDITIONS & PRECAUTIONS

The following conditions are not covered by the warranty of the MX800. Please ensure that the MX800 is not subject to;

1. Over voltage or Reverse Power Supply Voltage.

2. Operation in locations subject to abnormal environmental conditions such as extreme temperatures or ingress of moisture.

3. Operation of the MX800 Transmitter output into an open or short circuit or an incorrectly terminated load.

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1. General Description

The MX800 series employs state of the art design and construction methods to deliver a range of high performance, ultra reliable radio transceivers. They are ideally suited for use in VHF or UHF two way voice radio systems, however, the MX800 can perform in a range of applications where the added advantage of linear frequency and phase response from DC to 3.4kHz can be utilised. The MX800 uses a two-point modulation method synthesiser for extended low end VF transmit frequency response. The Receiver, Exciter and Power Amplifier are contained in their own specialised aluminium module and can be easily removed from the main chassis.

The flexibility of the MX800 series allows it to be configured for a wide range of applications.

Standard MX800 applications include:

Conventional 2-Way voice base station

Full duplex or simplex base station

Radio modem base station

Direct FSK or SELCALL baseband repeater

Trunking base station for MPT1327, LTR, SmartTrunk and others

Analog Cellular base station

POCSAG paging transmitter to 2400 BPS

POCSAG repeater

DC-coupled Direct FSK modulation system

Voice repeater

Wide band data repeater

DC-coupled repeater

Point to point link

Fast 25mS repeater for multi hopping

Cross band link or repeater

Simulcast transmitter

Quasi-Sync offset transmitter

The MX800 incorporates special technical features, of which the key ones are listed below:

Extremely low conducted emissions

Extremely low transmitter spurious

Fast transmitter on time

Transmitter frequency response down to DC

Low group delay distortion

Very Wide RF switching bandwidth

No re-tune receiver or transmitter

Fully software programmable

Built in diagnostics

Trunking control and VF routing interface

Built in community multi-tone style repeater

High stability reference input for Simulcast systems

In addition, the MX800 can be fitted with many options, not being limited to the following:

Programmable channel spacing

Programmable CTCSS / DCS encoder and decoder

Isolated VF and E&M lead interfaces

Simplex antenna changeover relay

VF audio delay for noiseless mute/squelch/repeater function

Low receiver standby current consumption

External reference oscillator input

Local speaker and microphone

Push wheel channel selector

High stability options

Audio Facilities board covers many new features

Internal Modem or Ethernet interface

Special high performance receiver options

Other custom features on special request

For further information, please contact Spectra Engineering.

1.1 Physical Description

The MX800 is a compact lightweight standard 19" rack mounting transceiver. It is designed to mount horizontally in a 19" rack frame and occupies 2RU (89mm). The depth of the unit is 330mm and the weight is less than 9kg.

The unit consists of four main sub assemblies an Exciter Module, a Receiver Module, a Power Amplifier Module and a Micro Controller board. These modules are housed in a fully welded steel case.

The MX800 features a high degree of RFI and EMI screening throughout the design and construction. The receiver and exciter (low power transmitter) modules are contained in solid aluminium enclosures, and for additional screening each interface pin in the modules is individually filtered. The PA module is contained in a special compact efficient extrusion for minimum harmonic radiation. This design results in low conducted and radiated emissions and minimal susceptibility to RFI and EMI.

User interface is via the front and rear panels. The rear panel provides access to all connectors and the standard front panel provides 6 LED indicators of the radio status. The local control option front panel has additional speaker, microphone and (optionally) channel select functions. Other variations can accommodate serial and monitor ports, as well as VF line level adjustment on the front panel.

1.1.1 Front Panel

1.1.1.1 Standard Front Panel

The MX800 standard front panel is illustrated below. Custom versions of the front panel can be supplied to OEM customers.

Table 1-1 below explains the functions of the front panel LED's. Each LED indicates the status of the MX800 in real time.

LED	FUNCTION
POWER	Indicates the power supply voltage is within software selectable limits.
RX	The receiver is receiving a signal or the receiver’s squelch is open.
TX	The transmitter is transmitting RF power.
CTCSS	A valid Continuous Tone Coded Squelch Signal has been detected.
AUX	An Aux function is selected or the PLL is unlocked.
ALARM	A prearranged alarm condition exists.

Table 1-1 LED Functions

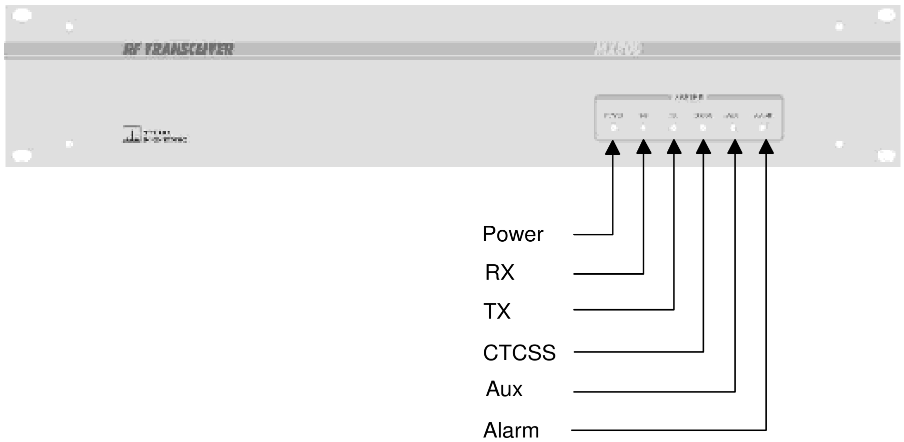

Figure 1-1 Standard Front Panel

1.1.1.2 Local Control Front Panel

The Local Control Front Panel is illustrated in Figure 1-2 below.

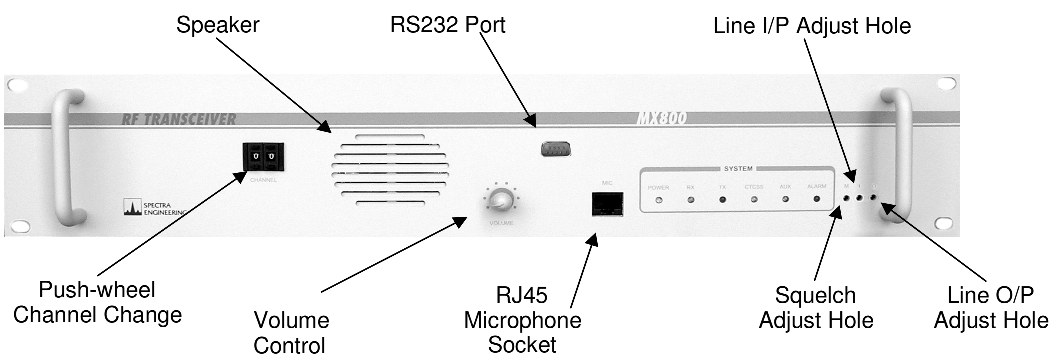

Figure 1-2 Local Control Front Panel

It has the same LED indicators as the standard front panel as well as the following features

Loudspeaker and Volume Control
A 1 Watt loudspeaker is provided to monitor 'on air' received audio as well as transmit audio from line. Volume control is provided by means of a potentiometer or a 3-position toggle switch adjacent to the loudspeaker. This switch is biased in the centre position. To raise or lower the volume the switch is momentarily moved up or down respectively. For each switch closure the volume is incremented or decremented a fixed amount. Newer versions of the MX800 Micro Controller PCB support a conventional rotary volume control. The newer versions are also backward compatible in that the

circuitry can still support the older up/down control method as well as the new chassis can still accommodate the older revision board.
The speaker has a link selectable connection to a tone output from the microcontroller. This may be used in conjunction with the appropriate software configuration to generate an alert tone to the user.

Microphone Socket
An RJ45 socket is provided on the front panel for connection of a microphone.

Channel Change Control
Twin push-wheel switches can be optionally fitted to the front panel to allow selection of the operating channel. This switch replaces the channel select function normally accessible on CN3 on the rear panel. 100 channels are selectable. Refer to section 2.2.2.3 for channel select method.

RS232 and Monitor Ports
Provision is made to optionally fit these two connectors on the front panel instead of on the rear panel. The pin-out and functions of these two ports remain unchanged when this is done.

Mute / Squelch Adjustment
Provision is made to optionally locate the mute / squelch control potentiometer behind the front panel. A screwdriver hole is provided in the front panel to access this adjustment.

Line Level Adjustments
Provision is made to optionally locate the line I/O level control potentiometers behind the front panel. A screwdriver hole is provided in the front panel to access each of these adjustments.

Note *Note that it is possible to select some features of the Local Control Option and omit others. For example operating channel select from the front panel may not be required (or permitted) and the Local Control Option may be ordered without this feature Refer to section 3.*

1.1.1 Rear Panel

Figure 1-3 below and Table 1-2 Details the functions of each connector.

Connector #	Conn Type	Function	Description
CN5	3 PIN	DC Power input	13.8 Volt DC power input. Also +28 Volt input on spare pin if required.
CN6	N TYPE	Simplex relay out or N type RX input	Location for internal simplex relay. The antenna for RX / TX connects to this point. Alternatively an N-Type connector can be used for the input to the receiver for full duplex operation.
CN7	BNC	RX input	Standard BNC connector for the input to the receiver for full duplex operation.
CN8	N TYPE	TX output	The RF power output from the transmitter for full duplex operation.
CN9	RJ45	Spare	Knockout provision for RJ45 connector.
CN3	DB25-F	Parallel I/O	Provides one 8 bit input port. One parallel 8 bit BCD or Binary channel select input and one 8-bit output port.
CN1	DB15-F	Line I/O	Provides the necessary analog receiver and transmitter interface for system interfacing.
CN4	DB9-M	RS-232 serial port	9600 Baud serial port for frequency programming, channel selection and alarm and status monitoring.
CN2	DB9-F	Monitor port	Provision for special monitoring of certain internal signals.

Table 1-2 Rear Panel Connections

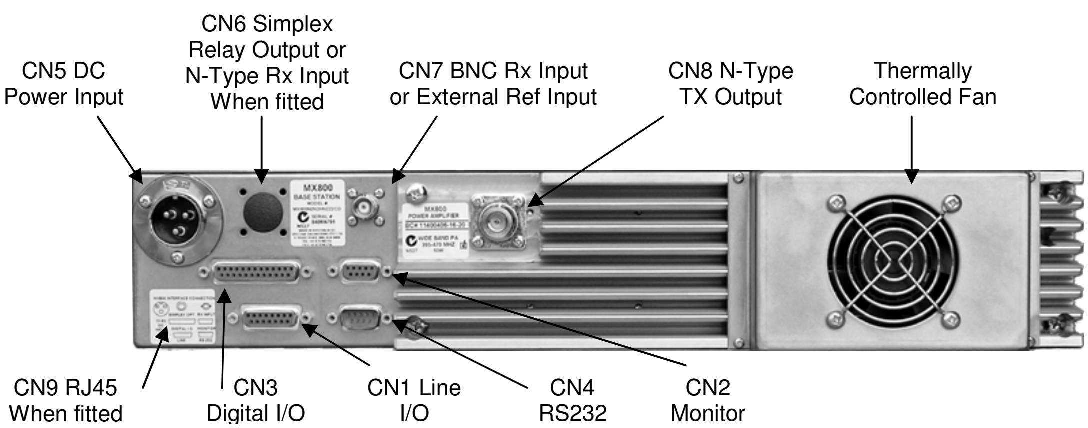

Figure 1-3 MX800 Rear Panel

1.1.2 Side Panel

The MX800 side view is illustrated in Figure 1-4 below. Two mounting holes in each side make provision for fitting a slider rail bracket.

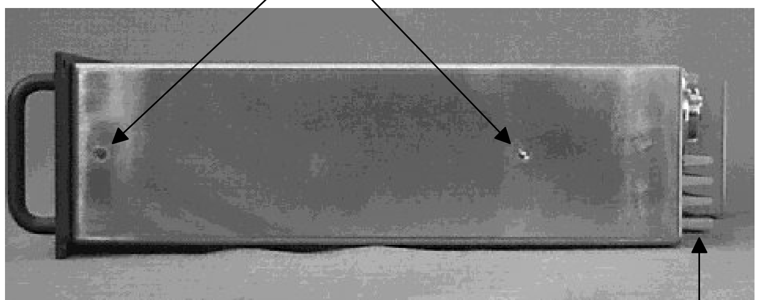

Figure 1-4 MX800 Side Panel

1.2 Module Functional Description

1.2.1 Exciter Module

The Exciter module generates the low level, on frequency, RF transmitter signal that is later amplified to nominal output power level by the Power Amplifier module. The exciter consists of a Voltage Controlled Oscillator (VCO) and associated main RF board, which, in conjunction with the reference oscillator and the PLL circuitry, forms a two-point modulation programmable frequency synthesiser. Frequency programming data is received from the Micro Controller via an 3 wire serial data bus.

The exciter module features a modulation bandwidth from DC with an ultra wide RF bandwidth of 20MHz to 1000MHz at an average RF output power of 300mW. To change from one band to another, all that is required is to change the plug in VCO board and reprogram the radio. No other manual adjustment or change is required.

Should a high stability reference be required, the exciter can be fitted with a connector for an external reference oscillator input.

The fractional N synthesiser provides ultra low spurii while still maintaining fast lock times even at 6.25kHz step size.

An optional built in turn around mixer (TRM) provides advanced diagnostics such as receiver sensitivity tests.

1.2.2 Receiver Module

The receiver module accepts the low level RF input signal and amplifies, filters and conditions the signal prior to detecting the wanted audio component. The Receiver module features the same advanced synthesiser and wide bandwidth as the exciter. Only the front-end bandpass filter and VCO need to be changed in order to support different frequency bands, resulting in significant flexibility and end-user cost savings. The purpose built front end bandpass filter has a wide no-adjust bandwidth equal to the band allocation (refer to section 7.4 for details of the band allocations).

The receiver has high sensitivity while maintaining excellent intermodulation immunity and adjacent channel rejection. A dual first IF filter provides excellent rejection to common known spurious responses. High blocking of over 100dB typical ensures that strong interfering signals do not desensitise the receiver when receiving weak signals.

1.2.3 Power Amplifier Module

RF from the Exciter passes via a coaxial cable to the input of the PA Module and is first attenuated by a 50 ohm pad, which is used to provide a good 50 ohm source impedance for the first LDMOS driver amplifier. The RF is amplified to around 5 Watts at the driver output, and is band dependant. Note: this point does not have 50 ohm impedance and the drive power cannot be measured directly with a 50 ohm Wattmeter. The signal from the driver is then matched by a broadband network to drive the low input impedance associated with the final transmit LDMOS power amplifier transistor. The transistor's low Drain impedance is then also matched back to 50 ohms by a broadband matching network covering a very wide bandwidth. Prior to transmission, a low loss 13 element elliptical low pass filter, filters out the unwanted harmonics to less than –90 dBc.

A dual directional coupler consists of coupled microstrip transmission lines fabricated on the PCB artwork. The sampled RF energy is rectified to provide a proportional DC voltage output.

The PTT signal enables the amplifier circuit by providing bias to the transistors. A thermistor TS1, physically located on the PA heatsink monitors the heatsink's temperature and is monitored by the Micro Controller.

The PA is very compact and efficient for high reliability and low cost. The heatsink has minimal temperature rise even under continuous operation, ensuring the best MTBF obtainable for a practical design.

1.2.4 Micro Controller Board

The Micro Controller Board is physically located behind the rear panel connectors and all signal connections (apart from the RF connections) external to the transceiver are made via the controller card. User settable jumpers and DIP switches are located on the card as are level adjustment potentiometers.

The Micro Controller controls the operation of the RF modules and acts as the interface between the user connections, indicators and the RF modules. It processes transmit and received audio to and from the Exciter and Receiver modules as well as providing the digital I/O functions of the transceiver.

The circuit board has an onboard EEROM in which is stored all of the user channel related data such as frequencies, CTCSS tones etc. A serial port at the rear (or optionally the front) of the MX800 provides access to the Controller card and in conjunction with the Spectra Engineering "MXTOOLS" programming utility allows the user to create and change this channel related information.

Special functions capable of being carried out by this card include non-predictive full duplex CTCSS encoding/decoding, DCS encoding/decoding as well as FFSK and 4-level FSK modems. Digipots under the control of the processor ensure that user set up levels for TX deviation and power levels are correctly set for each channel.

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2. Installation and Operation

2.1 Installation

MX800 series radios are securely packed for transport with special end packers within a pasteboard container. Before unpacking the MX800 radio, please inspect the packaging for signs of damage and report any damage to your MX800 distributor.

Upon unpacking of the MX800 radio, please ensure that all items shipped were received, report any missing items to your MX800 distributor.

All ports on the rear of the radio should be carefully examined to ensure that packaging has not become wedged inside them. It is very important to examine the fan as operation of the radio will be affected if any packaging or shipping damage causes the fan to stop working.

If you intend to install the radio in an equipment rack consult the suppliers instructions for your system. Spectra Engineering recommends that the radio be secured into the rack system using four screws through the mounting holes in the front panel near the handles. If the radio is to be used in a stand-alone configuration, ensure that it is in a secure, dry location with sufficient air space around it to allow for adequate ventilation. It is recommended that the chassis is earthed to the equipment rack.

Equipment connection details are located in Appendix 7.1. The MX800 will draw approximately 10A (band dependent) on transmit and the gauge of the DC cable fitted to the 12V supply connector should be adequate to ensure less than 0.5V volt drop at this current.

2.2 Operation

The MX800 can operate in local control mode via the front panel controls, stand alone repeater mode, or may be remotely controlled through the line port. Setting up the MX800 to operate in the wanted mode is straightforward and involves four main steps.

1. Using the MX800 programming utility 'MXTOOLS' to set the software configurable parameters.
2. Setting the hardware jumpers on the Micro Controller for the required options.
3. Adjusting the levels where necessary.
4. Making the necessary electrical connections to the radio and your system.

Note that generally if the requirements have been fully specified at time of purchase steps 1 to 3 will already have been done at the factory. In the following sections the hardware aspects of the set up procedure are described.

2.2.1 MXTOOLS Utility

MXTOOLS is a programming utility used to program channel data, configure and perform remote diagnostics on the MX800. It runs on a PC compatible computer and the MXTOOLS Inbuilt help menus cover use of the program.

2.2.1.1 MX800 Networking

See New Option T31 & T34 also.

At sites where more than one MX800 is located it is possible to "bus" the RS232 lines to allow up to 16 MX800s at one site to be addressed on a single RS232 port. Hardware facilities provided on the MX800 Micro controller card provide isolation between transmit ports. When MX800s are bussed in this way JMP24 in each radio must be set so that

1. At least one radio and no more than four are set as masters.
2. All other radios are set as slaves.

Refer to Table 2-1, in section 2.2.2.1 for details.

In addition to this, each radio must be assigned a unique address. This address is assigned as a binary code through CN3. Four address lines are available on input port A where bit 4 is the LSB and bit 7 is the MSB. These lines should be pulled high or low depending upon the setting of JMP19. Default is active low so that GND = Logic 1, Refer section 2.2.2.5.

The RS232 cable should be made up such that all MX800 transmit ports (TXD) are common and connected to the PC receive port (RXD) and all MX800 receive ports (RXD) are common and connected to the PC transmit port (TXD).

MXTOOLS automatically polls the bussed radios to determine which addresses are active when the "Use Network" button is selected in the initial connect screen (MXTOOLS version 2.8.1 or later).

Refer application note AN-MX800-002 for more details on networking, available from www.Spectraeng.com.au web site.

2.2.2 Setting to Work

The following sections describe the steps necessary to set the MX800 to operate as required.

2.2.2.1 Setting Micro Controller Jumpers

The micro controller layout is contained in the drawing section and the position of the jumpers and DIP switches (highlighted) are shown below. The jumpers and switches are used for setting the general configuration of the audio processing for both the TX and RX paths as well as various miscellaneous functions.

Table 2-1 below summarises the functions of the jumpers.

JMP	Function / Description	Default Selection	Default Position
JMP 1	Selects either default RUN or EMULATE mode for the micro processor.	Run	2-3
JMP 2	Enables the WATCHDOG auto reset function in the microprocessor.	Enabled	1-2
JMP 3	Enables or disables the PRE-EMPHASIS for the TX audio.	Enabled	1-2
JMP 4	Enables or disables the COMPRESSOR for the TX audio.	Enabled	1-2
JMP 5	Enables or disables the HIGH PASS FILTER for the RX audio.	Enabled	2-3
JMP 6	Enables or disables the LOW PASS FILTER for the RX audio.	Enabled	2-3
JMP 7	Enables or disables the DE-EMPHASIS processing for the RX audio.	Enabled	2-3
JMP 8	Enables a direct connection to the TX modulator. Select either Wide Band or Wide Band filtered and limited or nil.	DC-FM	1-2
JMP 9	TX VF Loopback control. Trunking LIFUISEN function. The function polarity or nil can be selected.	Active low	1-2
JMP 10	Controls the direction of the RS-232 TX and RX data.	Swap	2-3

JMP 11	Controls the direction of the RS-232 TX and RX data.	Swap	2-3
JMP 12	Trunking RX Talk function. Disables RX VF to line and TTR VF. The function polarity or nil can be selected.	Active low	1-2
JMP 13	Enables or disables the HIGH PASS FILTER for the TX audio.	Enabled	1-2
JMP 14	Repeater enable. Trunking LIFULOCEN function. The function polarity or nil can be selected. Note that this control is in parallel with DIP S/W 2/3	Active low	1-2
JMP15	Selects the connection for the common pin on the digital I/O connector to either ETH or + 5 volts.	ETH	2-3
JMP16	Enables or disables the Low frequency HPF used for the Repeater VF routing.	Enabled	1-2
JMP17	Selects the Mute / Squelch output polarity to either normally high or low.	Active low	1-2
JMP 18	Trunking TX Talk function. Disables TX VF to line and TTR VF. The function polarity or nil can be selected.	Active low	1-2
JMP 19	Selects either internal pull up to 5V or internal pull down to ETH for digital input on D25 connector	Pull up	2-3

JMP 22	Microphone gain. Fit this jumper to increase Mic gain 33dB	Low gain	Not fitted
JMP 23	Enable tone to speaker. Fit this jumper to enable tone	Disabled	Not fitted
JMP 24	RS232 port termination. This jumper allows an internal termination to be selected or not for bussed RS232 connections. Up to 16 units may be bussed. All bussed bases are ‘listeners’ on the modem RS232 TX port. All bussed bases have their RS232 TX ports diode to the modem Rx port. Normal: Non-bussed mode. No resistor fitted. D10 out of circuit. Master: Bussed mode. 4K7 resistor across D10. Configure at least one and no more than four MX800 in this mode when multiple units connected. Slave: Bussed mode. D10 fitted, no resistor. Configure balance of bussed units in this mode.	Normal	1-2 1-2 2-3 3-4
JMP 25	Mute defeat enable. Mute defeat cannot be used if RX TALK line is required. To use mute defeat remove JMP12 and fit JMP 25. The control signal polarity can be inverted by changing the position of JMP25. Active low control: JMP25 2-3 Active high control: JMP25 1-2	Disabled	Not fitted
JMP 26	CTCSS output / TX VF Loopback control	TX VF Loopback	2-3
JMP 27	CTCSS input / WB DC-FM input	WB DC-FM input	2-3

Table 2-1 Micro Controller Jumpers

When the MX800 option card is not fitted there is no connection made to SKK (Aux 2 connector) on the micro controller. Links should be placed across SKK1-2 (Discriminator audio), SKK11-12 (TX supply) and SKK13-14 (RX supply). These links are normally fitted in production.

2.2.2.2 Select Operating Mode

The MX800 can operate in a number of different modes. The primary alternatives are full duplex, which is the default mode, repeater and simplex. Using MXTOOLS the operating mode is programmed for each channel. When a channel is selected in operation the MX800 adopts the mode programmed for that channel.

The operating mode programmed in the software can be modified by the settings of DIP switch 2. The functions of this switch are detailed in Table 2-2 below.

SW 2	Function	Description	Def Select
1	PTT Delay	Enables 50mS delay of PTT for use with simplex function.	OFF
2	Simplex Enable	Enables simplex function*	OFF
3	TX Timer	Sets programmable TX time out timer on	ON
4	Repeater Enable	Enables repeater function*	OFF
5	TX VCO on continuously	Switches TX VCO on continuously	OFF
6	Scan on	Selects the receiver to enable the scanning of programmed scan channels	OFF

Table 2-2 DIP Switch 2 Settings

Note *The Repeater Enable functions as follows:*
If the switch is ON and the channel is programmed as a repeater channel (using MXTOOLS) the MX800 will act as a repeater. If the switch is OFF the MX800 will remain in full duplex mode even if the channel is programmed as a repeater. The Simplex Enable operates in a similar way.

In the case of the Repeater Enable function, the Repeater Enable on Pin 8 of the DB15 Line connector is effectively in parallel with SW2/4. If SW2/4 is OFF the function may be controlled through this external line. JMP 14 selects the control polarity in that case.

2.2.2.3 Select Operating Channel

The MX800 has a channel capacity of 255. The RF and CTCSS frequencies for each channel are programmed using MXTOOLS Channel Information screen. There are four ways of selecting the operating channel.

1. *DIP Switch 8-way*. DIP switch SW1 provides a binary channel selection facility. When a switch is ON it is read as a logical 1. When all switches are off the software channel select mode is enabled.
2. *Rear channel select port*. Digital input port B provides an 8 way Binary or BCD channel select input. Binary or BCD coding is selected using MXTOOLS. If Binary is selected 255 channels are accessible. If BCD is selected 99 channels are accessible.
3. *Software channel select.* If DIP switch SW1is set to 0 then it is possible to send a software command to the radio to select the channel.
4. *Front panel Push-wheel switches*. If this option is fitted the rear channel select port is internally wired to the Push-wheel switches however the rear channel select function is still in parallel with the Push-wheel. The rear select method should not be used in this case. There are 100 channels selectable from the front panel. The same rules apply to this channel select method as apply to the rear port described below. BCD Coding is selected using MXTOOLS.

The following rules apply.

(The assumptions of logic levels are base on factory default setup. The Active state is Low)

DIP1 switches have priority over channel change. If any of DIP1 switches are set to ON (logic low) the rear inputs and the software Channel command will be ignored.

If DIP1 switches are set to OFF (logic high) then both the software commands and the rear input port would select the channel. In this case the most recent event will take priority. For example, if the rear input port is set to CH10 and a software command arrives to send it to CH15, the radio will go to CH15. If the rear input port is now changed to CH11 the radio will switch to CH11.

If DIP switches are set to OFF and the radio is powered up, the channel selected on the rear port will be adopted.

If DIP1 switches and the rear port are both set to OFF (logic High), on power up, the radio will adopt the last software channel selected. This may be the software channel set at the factory if the user has not used the software channel select feature before.

2.2.2.4 Configure Alarms/M Lead

The MX800 has 3 open collector outputs. Two of these are assigned as alarm outputs and one (output 1) may be configured as either an alarm output or an M Lead output. If the output one is configured as an M Lead, this line is active when mute is open and CTCSS/DCS is decoded. These outputs are assigned in the Configuration screen of MXTOOLS.

2.2.2.5 Configure Digital I/O

The MX800 has 16 digital inputs and 8 general-purpose outputs. The inputs are +5V CMOS logic compatible and are buffered by a 10K resistor in series with each input. JMP19 on the Micro-Controller selects whether these inputs are internally pulled up or internally pulled low. The active state of the input is set up through MXTOOLS. Of the 16 inputs the 8 input port B inputs are allocated to the Channel Select function. Two of the input port A inputs (bit 0 and bit 1) are allocated to a power control function (see Table 2-3 below), two (bit 2 RX and bit 3 TX) are allocated to CTCSS control and the other 4 are allocated as address bits for the MX800 network mode (software V2.8.1 and higher).

Bit 1	Bit 0	RF O/P Power
0	0	100%
0	1	50%
1	0	20%
1	1	10%

Table 2-3 Power Control Function Settings

An auxiliary voltage (either +5V or GND dependant upon the setting of JMP15) is available on CN3 pin one for wiring convenience.

The 8 general-purpose outputs are +5V CMOS logic compatible and are buffered by a series 1K resistors.

2.2.3 Adjustments

There are two categories of adjustable parameters in the MX800. Those that are controlled by conventional potentiometers, which may be manually adjusted, and those controlled by digital potentiometers, which are under the control of the Micro Controller. The latter category of items comprises TX power, TX VCO deviation, TX reference oscillator deviation and TX reference oscillator frequency. All of these are adjusted with the aid of MXTOOLS and all except TX power should only be adjusted as a part of a full TX VF path alignment procedure.

Following adjustment of a digipot controlled parameter the value must then be saved to the radio to make the change permanent.

Refer to section 5 ‘Alignment and Testing’ for details.

3. Options

3.1 T01 Programmable Channel Spacing

3.1.1 Description

The MX800 receiver is available in five different channel spacing options. For applications in systems that require both 12.5kHz and 25kHz channel spacing option T01 allows channels to be programmed for either bandwidth. Switchable IF filters in the receiver and automatic 12.5kHz/25kHz gain compensation in the audio paths make the change in bandwidth transparent to the user.

This option has become Spectra's standard build , therefore it is not necessary to specified this option at order placement. Once the switchable IF bandwidth receiver is fitted, the programmable channel spacing option must be selected on the MXTOOLS Configuration screen (Hardware Settings tab) and each channel is programmed as either 12.5kHz/25kHz via the Channel Edit screen.

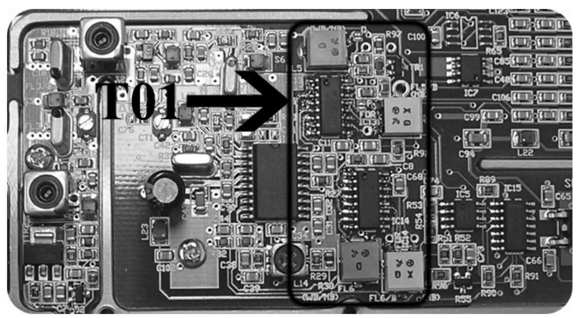


Figure 3-1 MX800 T01 Option, Programable bandwidth fitted to RX module.

3.1.2 Installation

This option is factory fitted.

3.2 T02 Programmable CTCSS encoder/decoder

3.2.1 Description

Provision is made in the MX800 to fit a CTCSS encoder/decoder. The decoder is non-predictive and any valid CTCSS tone can be decoded. Any standard TX CTCSS tone may be associated with the programmed decode tone through the Channel Edit screen in MXTOOLS. Multiple CTCSS tones are programmable for any channel providing "Community Repeater" functionality.

This option may be fitted at order placement or retro fitted subsequently.

3.2.2 Installation

Components Required:

1. PART# C051 FX805 or MX805AP IC. Qty-1

Method:

1. Remove the cover to the MX800 radio.
2. Locate the socket for IC25 and install the MX805AP IC into this socket ensuring correct IC pin orientation.

MX800 Controller Setup:

1. The RF channels that are required to be CTCSS controlled should be programmed with the required CTCSS Subtone in the TX and/or RX channel fields.

MX800 Testing:

1. The Option T02 will require a ‘Peak Deviation and Modulation Balance Alignment’ as per Section 5 of the Technical manual. This alignment is to be performed without the CTCSS frequencies programmed into the alignment channel, as the subtone levels will give a false indication of the peak deviation levels.

3.3 T03 Programmable DCS/CTCSS encoder/decoder

3.3.1 Description

Provision is made in the MX800 to fit a full duplex DCS encoder/decoder. There are 83 digital codes available. Any standard DCS code or CTCSS tone may be assigned to any of the transmit or receive channels through the Channel screen in MXTOOLS. Multiple CTCSS tones are programmable for any channel providing "Community Repeater" functionality.

The DCS encoding function provides continuous, repetitive digital word modulation to the transmitter. The decode function controls receiver muting to eliminate all calls that are not coded with the assigned DCS code.

This option may be fitted at order placement or retro fitted subsequently. The DCS PCB assembly is fitted in place of IC25 (MX805AP). Once the DCS option is fitted the "DCS option fitted" check box is ticked in the MXTOOLS Configuration screen and the encode and decode codes are programmed through the Channel Edit screen.

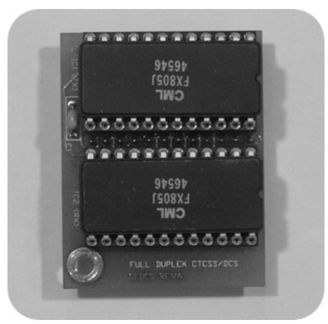


Figure 3-2MX800 DCS Option T03

Refer circuit diagram CS001-4

3.3.2 Installation

Components Required:

1. DCS daughter board, complete with MX805AP IC's. Qty-1
2. 3x8mm standoff post. Qty-1

Method:

1. Remove the cover to the MX800 radio.
2. Locate the socket for IC25, if necessary remove the IC from the socket.
3. Remove the 3x5mm screw that is located on the left hand edge and toward the front of the Motherboard from IC25 socket. **Do not discard this screw**.

4. Install the 3x8mm standoff post into the motherboard-mounting hole. **Do not over-tighten this standoff**.

5. Install the DCS daughter board into the socket for IC25 ensuring that the daughter board has correct orientation with respect to pin numbering.

6. Install the 3x5mm screw (removed from step3) to secure the DCS daughter board.

MX800 Controller Setup:

1. The DCS option is activated in the MXTOOLS 'Configuration' heading, within the 'Hardware' folder with 'DCS Option Installed' selected.

2. The RF channels that are required to be DCS controlled should be programmed with the required DCS code in the TX and/or RX channel fields.

MX800 Testing:

1. If the MX800 had a CTCSS Option previously fitted, test the radio for correct operation of the DCS Option in both the Transmit and Receive modes.

2. If the Option T03 is not replacing a CTCSS Option then a 'Peak Deviation and Modulation Balance Alignment' as per Section 5 of the Technical manual will be necessary. This alignment is to be performed without the CTCSS/DCS frequencies programmed into the alignment channel, as the subtone levels will give a false indication of the peak deviation levels.

3.4 T04 Balanced and Isolated VF

3.4.1 Description

Standard VF connections to line are 600ohm 4-wire unbalanced. Option T04 may be fitted if transformer balanced and isolated VF inputs and outputs are required. A transformer PCB is fitted internally at the rear of the MX800. This PCB has a RJ45 connector (CN9), which protrudes through the rear panel when this option is fitted, and the balanced VF outputs are made available via this connector.

Note that theses connections are essentially in parallel with the standard VF connections on CN1. The VF lines on CN1 are still connected when option T04 is fitted and care should be taken that the TX VF line is not doubly terminated or that two VF sources are not presented to the transmitter.

Pin No	Function
1	600ohm balanced RX VF leg a
2	600ohm balanced RX VF leg b
3	600ohm balanced TX VF leg a
4	600ohm balanced TX VF leg b
5	NC
6	NC
7	NC
8	NC

Table 3-1 CN9 Connections

The RJ45 pins are numbered as shown in Figure 3-3 below.

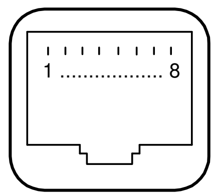


Figure 3-3 CN9 RJ45 Pin-out Detail (View from Rear of MX800)

Refer circuit diagram CS018-1

3.4.2 Installation

Components Required:

1. Option board T04. Qty-1
2. 3x5mm machine screw. Qty-3
3. 10way Female-to-Female connector assy. Qty-1
4. 16way Female-to-Female connector assy. Qty-1
5. Rear connector layout label. Qty-1

Test Equipment Required:

1. Communications Test Set
2. MX800 Radio Interface Box

Method:

1. Remove the cover to the MX800 radio.

2. Remove the rear connector label from the back panel of the MX800.

3. Punch out the small indented rectangle on the rear LHS of the MX800.

4. Remove the connectors from the Motherboard headers SKE, SKF and SKH.

5. Carefully locate the T04 or T05 option board into position at the rear RHS of the radio with the RS232 cable lying underneath the option board.

6. Secure the option board with the qty3 3x5mm machine screws

7. Install the 10way Monitor cable to SK4 on the option board.

8. Install the 10way cable Assy to SK3 on the option board and to SKE on the Motherboard.

9. Install the 16way VF cable to SK2 on the option board.

10. Install the 16way cable Assy to SK1 on the option board and to SKH on the Motherboard.

11. Reconnect the 25way Digital Interface cable to SKF on the Motherboard.

12. Install the rear connector layout label onto the PA heatsink underneath the RF ‘N-type’ connector.

MX800 Testing

1. Connect a Communications Test Set via the RIB to the MX800 balanced audio RJ45 connector as per paragraph 3.4 of the MX800 Technical Manual.

2. Set the switches on the RIB to measure **balanced** audio.

3. Set the test set to measure Rx line level and adjust RV5 or RV5B for the level that is require if necessary.

4. Set the test set to measure TX modulation level. Set the audio generator output level as per the required line level and measure the TX modulation depth. Adjust RV4 or RV4B for the modulation depth that is require if necessary.

5. Replace the MX800 cover.

3.5 T05 Balanced and Isolated VF plus E&M

3.5.1 Description

Option T05 provides the balanced and isolated VF I/O as per option T04 as well as isolated E (PTT) and M (Mute) leads.

Note *Jumpers referred to in the table below are those on this option PCB.*

The E lead is opto isolated and may be asserted by applying a DC voltage between 5V and 48V with any polarity between CN9 Pins 7&8 (JMP1 in position 2-3, JMP2 removed). Provision is also made to internally source the activation voltage (+12V DC) in which case the E lead is asserted by grounding CN9 Pin8 (JMP1 in position 1-2, JMP2 fitted.)

The M lead is relay isolated and the common and normally open contacts are brought out via CN9. If the internal +12V DC is being used as the activation voltage for the E lead (JMP1 in position 1-2) then the normally closed contact is also available at CN9. The relay contacts are rated at 500mA.

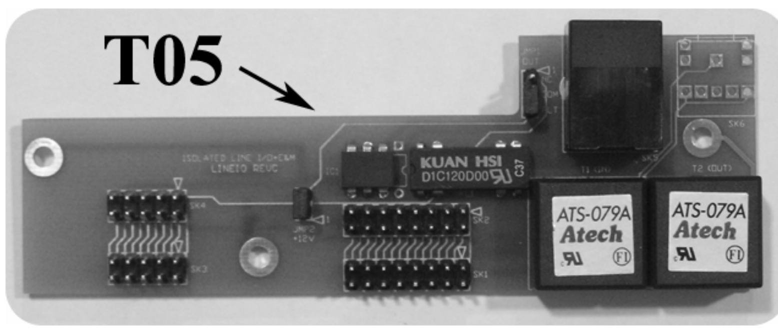


Figure 3-4 MX800 Option T05 Balanced & Isolated VF I/O with E&M leads

Pin No	Function
1	600ohm balanced RX VF leg a
2	600ohm balanced RX VF leg b
3	600ohm balanced TX VF leg a
4	600ohm balanced TX VF leg b
5	M Lead common
6	M Lead normally open
7	E Lead leg a/M lead normally closed
8	E Lead leg b

Table 3-2 CN9 Connections

The RJ45 pins are numbered as shown below.

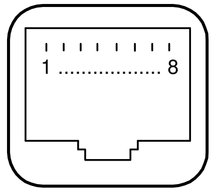


Figure 3-5 CN9 RJ45 Pin-out Detail (View from Rear of MX800)

Refer circuit diagram CS018-1

3.5.2 Installation

Components Required:

6. Option board T05. Qty-1
7. 3x5mm machine screw. Qty-3
8. 10way Female-to-Female connector assy. Qty-1
9. 16way Female-to-Female connector assy. Qty-1
10. Rear connector layout label. Qty-1

Test Equipment Required:

As for Option T04 ***(see section 3.4.2)***

Method:

As for Option T04 ***(see section 3.4.2)***

MX800 Testing:

1. Connect a Communications Test Set via the RIB to the MX800 balanced audio RJ45 connector as per paragraph 3.4 of the MX800 Technical Manual.
2. Set the switches on the RIB to measure balanced audio and E&M.
3. Set the test set to measure Rx line level and adjust RV5 or RV5B for the level that is require if necessary.
4. Set the test set to measure TX modulation level and set the audio generator output level as per the required line level.

5. PTT the MX800 and measure the TX modulation depth. Adjust RV4 or RV4A for the modulation depth that is require if necessary.

6. To check the Rx isolated mute output, switch the RF level on the Comm.'s test set to ON. The Mute LED on the RIB should be ON. The LED should go OFF when the RF output from the test set is switched OFF.

7. Replace the MX800 cover.

3.6 T06 Simplex Changeover Relay

3.6.1 Description

For simplex applications an internally mounted coaxial changeover relay can be provided. This mounts on the rear panel and the common port protrudes through the chassis providing the simplex antenna connection. The relay normally closed port is internally connected to the MX800 receiver and the normally open port is connected to the transmitter via the standard RX connector hole in the chassis (the RX connector is removed) using a special cable assembly. The relay also has control connections to the micro controller PCB.

Once the relay option is fitted the channels are programmed as simplex channels through the Channels Edit screen of MXTOOLS. Switches SW2/1 & SW2/2 on the micro controller are switched ON to delay the transmitter PTT (to allow the relay to changeover) and set the simplex operating mode respectively.

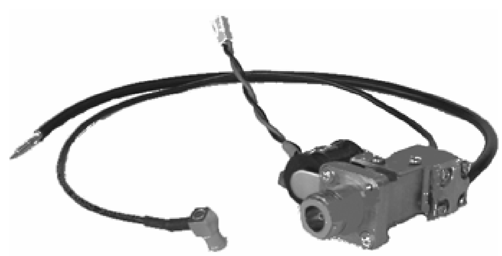


Figure 3-6 T06 Simplex Changeover Relay

3.6.2 Installation

Components Required:

1. Coaxial Relay Assy complete with Rx cable connected.	Qty-1
2. RG58 cable Assy complete with ‘N’ Type connector fitted.	Qty-1
3. 13mm hole grommet.	Qty-1
4. 3x8mm pozi-drive screw.	Qty-2
5. Rear Connector Label	Qty-1

Test Equipment Required:

1. Communications Test Set
2. MX800 Radio Interface Box

Method:

1. Remove the cover to the MX800 radio.
2. Remove the existing Receiver coaxial feeder cable assy.
3. Install the 13mm grommet into the 13mm hole where the BNC Rx connector is normally located.
4. Place the RG58 cable Assy through the grommet so that the ‘N’ Type connector will mate with the ‘N’ Type female connector on the PA module.
5. Remove the 4x Phillips screws and connector cover from the TX side of the coax relay assy.
6. Solder the centre of the RG58 Cable Assy to the centre pin on the TX side of the coaxial relay. The outer sheath of the coax cable should be placed such that it sits equal with the outer edge of the relay body.
7. Place the connector cover over the TX cable on the relay and screw the cover in place. Take extreme care to not over-tighten the screws and prevent stripping of the threads in the relay body.
8. Install the relay Assy into the MX800 with the relay coil on the opposite side of the relay to the DC power connector. Secure with the 2 of 3x8mm screws provided.
9. Route the Rx coaxial cable to the Rx unit input RF connector.

10. Connect RG58 cable Assy to the PA output.

11. Replace the rear connector label with the label supplied.

MX800 Controller Setup:

1. The MX800 RF channels that are required to be simplex should be programmed as ‘SIMPLEX’ within the channel edits screen of Mxtools and then downloaded to the MX800.

2. Switches SW2/1 and SW2/2 on the microcontroller board are switched ‘ON’ as per Section 3.6 of the MX800 Manual.

MX800 Testing:

1. Connect a Communications Test Set via the RIB to the MX800.

2. Set the switches on the RIB to Line Audio and E&M.

3. Set the test set to measure Rx line level and ensure that the Receiver is operating correctly.

4. Set the test set to measure TX modulation level and set the audio generator output level as per the required line level.

5. PTT the MX800 and measure the TX Power and modulation depth. Ensure that the coaxial relay operates correctly and that the full RF power is measured on the test set.

6. Operate the PTT in quick succession and ensure that the coaxial relay operates in unison with the PTT switch.

7. Replace the MX800 cover.

3.7 T07 Turn Around Mixer

This option is not currently available. This option has the ability to take some of the RF signal from the exciter and convert it to a suitable frequency for injection into the receiver. The received RF signal level is user settable such it can used to test the performance and sensitivity of the receiver for the purpose of advanced automated self testing and diagnostics. Provides additional advanced B.I.T.E. (Built In Test Equipment) capability over that as provided as standard. Consult Spectra regarding your application.

3.8 T08 VF Delay

3.8.1 Description

This option provides a 40mS delay to the received audio. When the option is fitted delayed audio is fed to the line and talkthrough paths but discriminator audio (output on CN1 Pin4) is undelayed.

This option is intended for two main applications. Firstly when the delay is fitted, the mute (squelch) "crash" characteristically heard when a mobile releases its PTT but the repeater tail continues, it is eliminated. Secondly systems (including trunking systems) which have mixed voice and data on a channel can delay the VF signal to line and air so that in the event that a data stream is detected (by the data controller) the VF to line and air can be disconnected for the duration of the data burst thus avoiding radio system user annoyance. Internal switches in the MX800 may be used to disconnect the audio under the control of the RX TALK line (CN1 Pin7) the sense of which may be inverted using JMP12 on the micro controller.

This option may be fitted at order placement or retro fitted subsequently. The Option PCB assembly is fitted above the Micro controller on four hex pillars. A 16-way ribbon connection is made from the Option PCB to SKK on the micro controller card. The links on the Option card are set as below. Once the delay option is fitted the "Delayed Audio Option" check box is ticked in the MXTOOLS Configuration *screen* (Hardware settings tab).

Note that this options PCB is also used for T09, CTCSS Suppression Upgrade Filter and T10, the Low Standby Current Mode and all three are independent and may be used separately or together. If the option PCB is ordered for one particular option it may or may not be populated for the other options.

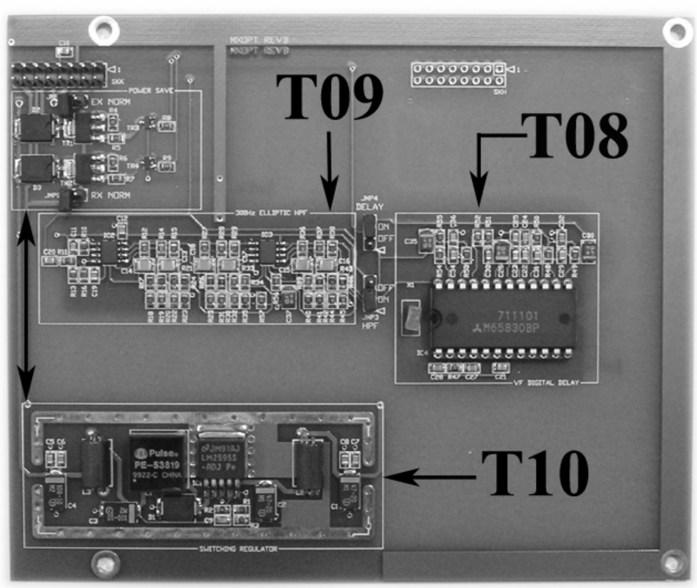


Figure 3-7MX800 T08,T09,T10 Option board complete

JMP	Function/Description	Option Active	Option Disabled
JMP 1	Low standby current mode switched exciter power	Out	In
JMP 2	Low standby current mode switched receiver power	Out	In
JMP 3	300Hz Elliptic filter	1-2	2-3
JMP 4	RX audio delay	2-3	1-2

Table 3-3 Option PCB Link Settings

Refer circuit diagram CS022-1B

3.8.2 Installation

Components Required:

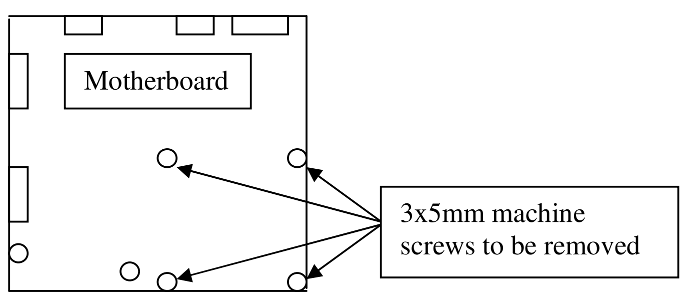
1. Option board 'MXOPT' fitted for VF Delay option. Qty-1
2. 16way female-to-female IDC Cable Assy. Qty-1
3. 3x20mm Standoff posts. Qty-4

Test Equipment Required:

1. Communications Test Set
2. MX800 Radio Interface Box

Method:

1. Remove the cover to the MX800 radio.
2. Remove qty4 of the Motherboard securing screws as shown.



3. Install the qty 4 3x20mm standoff posts into the vacant screw positions.
4. Remove the Link jumpers off connector SKK.

5. Install the Option PCB onto the 4 standoffs with the 16way connector closest to DIP2 on the Motherboard. Secure with the qty4 3x5mm machine screws previously removed.

6. Install the 16way-ribbon cable between connector SKK on the Motherboard and SKK on the Option board, taking note that the cable is correctly orientated.

7. Check that the option board jumpers are in the following positions;

    1. JMP1 IN
    2. JMP2 IN
    3. JMP3 OFF
    4. JMP4 ON

MX800 Controller Setup:

1. The VF Delay option is activated in the MXTOOLS ‘Configuration’ heading. Within the ‘Hardware’ folder select ‘Delayed Audio Option’.

2. Download the Configuration change to the MX800.

MX800 Testing:

1. Connect a Communications Test Set via the RIB to the MX800.

2. Set the switches on the RIB to Line Audio and E&M.

3. Set the test set to measure Rx line level and ensure that the Receiver is operating correctly.

4. Whilst listening to the RX audio output, switch the RF output on the Comm.'s test set on and off and note that there is NO distinctive ‘Click’ in the audio when the RF is switched OFF.

5. Replace the MX800 cover.

3.9 T09 300Hz Upgrade HPF Filter

3.9.1 Description

This option provides upgraded CTCSS tone suppression on the RX VF. When this option is fitted the standard 300Hz filter is removed from circuit by changing the position of JMP5 on the micro controller to position 1-2.

This option may be fitted at order placement or retro fitted subsequently. The Option PCB assembly is fitted above the Micro controller on four hex pillars. A 16-way ribbon connection is made from the Option PCB to SKK on the micro controller card. The links on the Option card are set as below. This option is purely a hardware change and no configuration is required using MXTOOLS.

Note that this options PCB is also used for T08, VF Delay and T10, the Low Standby Current Mode and all three are independent and may be used separately or together. If the option PCB is ordered for one particular option it may or may not be populated for the other options.

JMP	Function/Description	Option Active	Option Disabled
JMP 1	Low standby current mode switched exciter power	Out	In
JMP 2	Low standby current mode switched receiver power	Out	In
JMP 3	300Hz Elliptic filter	1-2	2-3
JMP 4	RX audio delay	2-3	1-2

Table 3-4 Option PCB Link Settings

3.9.2 Installation

Components Required:

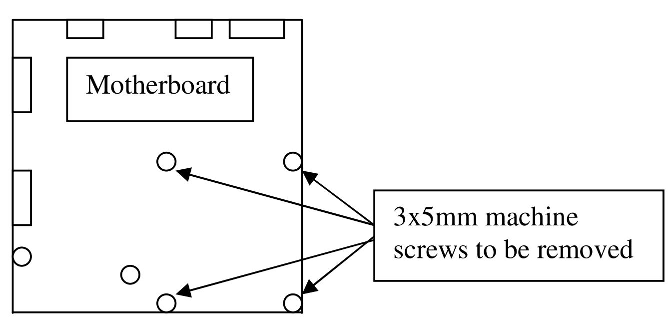
1. Option board 'MXOPT' fitted for 300Hz HPF Option. Qty-1
2. 16way female-to-female IDC Cable Assy. Qty-1
3. 3x20mm Standoff posts. Qty-4

Test Equipment Required:

1. Communications Test Set
2. MX800 Radio Interface Box

Method:

1. Remove the cover to the MX800 radio.
2. Remove qty4 of the Motherboard securing screws as shown.



3. Install the qty 4 3x20mm standoff posts into the vacant screw positions.

4. Remove the Link jumpers off connector SKK.

5. Install the Option PCB onto the 4 standoffs with the 16way connector closest to DIP2 on the Motherboard. Secure with the qty4 3x5mm machine screws previously removed.

6. Install the 16way-ribbon cable between connector SKK on the Motherboard and SKK on the Option board, taking note that the cable is correctly orientated.

7. Check that the option board jumpers are in the following positions;

    1. JMP1 IN
    2. JMP2 IN
    3. JMP3 ON
    4. JMP4 OFF

MX800 Controller Setup:

Change the Motherboard jumper JMP5 to position 1-2 (OFF).

MX800 Testing:

Connect a Communications Test Set via the RIB to the MX800.

Set the switches on the RIB to Line Audio and E&M.

Using Mxtools program the appropriate RX CTCSS Tone required.

Set the Comm.'s test set to measure Rx line level and ensure that the Receiver is operating correctly and there is no CTCSS component on the Rx audio.

Replace the MX800 cover.

3.10 T10 Power Save Mode

3.10.1 Description

For solar powered sites and other power critical applications the MX800 is capable of a Power Save (Low Standby Current) Mode. This option can be implemented in three stages. Stage one implementation replaces the micro controller linear voltage regulators with switching regulators. Response times are unaffected. Stage two involves removing power from the exciter when the radio is in standby mode. In this case RX responses times are unaffected. In stage three the RX power is cycled on and off at a user selectable duty cycle. Essentially the choice of mode of operation involves a compromise between response time and average current consumption. Current consumption of 250mA is achievable with a typical response time in the order of 1sec.

Condition	Description	Approx Average Current Drain mA
Standard	Standard MX800 (TX VCO on continuously)	525
Standard	Standard MX800 (TX VCO switched)	490
Stage 1a	Standard MX800 (TX VCO on continuously) option board fitted	475
Stage 1b	Standard MX800 (TX switched) option board fitted	440
Stage 2	TX exciter inc TX VCO powered down	370
Stage 3 RX 100% duty	TX exciter inc TX VCO powered down RX module power duty cycled	370
Stage 3 RX 50% duty	TX exciter inc TX VCO powered down RX module power duty cycled	255*
Stage 3 RX 25% duty	TX exciter inc TX VCO powered down RX module power duty cycled	198*

*Average current calculation is based on RX off current drain of 140mA and RX on current drain of 370mA.

Table 3-5 Current Consumption Details

This option may be fitted at order placement or retro fitted subsequently. The Option PCB assembly is fitted above the Micro controller on four hex pillars. A 16-way ribbon connection is made from the Option PCB to SKK on the micro controller card. The links on the Option card are set as below. Once the power save option is fitted the "Power Save Option Board Installed" and "Power Save Exciter Module" check boxes are ticked in the MXTOOLS Configuration screen (Hardware settings tab). In addition three timers need to be set. "Idle Time to Power Save" is entered in seconds and defines how long the radio will wait following the most recent activity before reverting to standby mode. "RX Module On Time" and "RX Module OFF Time" define the duty cycle of the receiver module.

Note that this options Printed Circuit Board is also used for T08, VF Delay and T09, CTCSS Suppression Upgrade Filter and all three are independent and may be used separately or together. If the option PCB is ordered for one particular option it may or may not be populated for the other options. If the option is being retrofitted the two main 5 Volt 78M05 regulators on the Microcontroller board must be removed and subsequently replaced if de-installing.

JMP	Function/Description	Option Active	Option Disabled
JMP 1	Low standby current mode switched exciter power	Out	In
JMP 2	Low standby current mode switched receiver power	Out	In
JMP 3	300Hz Elliptic filter	1-2	2-3
JMP 4	RX audio delay	2-3	1-2

Table 3-6 Option PCB Link Settings

Refer circuit diagram CS022-1

3.10.2 Installation

Components Required:

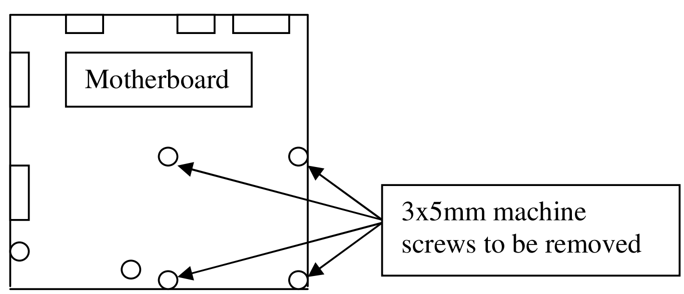
1. Option board 'MXOPT' fitted for Power Save Mode. Qty-1
2. 16way female-to-female IDC Cable Assy. Qty-1
3. 3x20mm Standoff posts. Qty-4

Test Equipment Required:

1. Communications Test Set
2. MX800 Radio Interface Box

Method:

1. Remove the cover to the MX800 radio.
2. Remove the Motherboard from the MX800 radio.
3. Remove IC's 21 and 27 from the Motherboard.
4. Reinstall the Motherboard into the MX800 radio and using the qty 4 3x20mm standoff posts in the positions indicated below:



5. Remove the Link jumpers off connector SKK.
6. Install the Option Printed Circuit Board onto the 4 standoffs with the 16way connector closest to DIP2 on the Motherboard. Secure with the qty4 3x5mm machine screws previously removed.
7. Install the 16way-ribbon cable between connector SKK on the Motherboard and SKK on the Option board, taking note that the cable is correctly orientated.

8. Check that the option board jumpers are in the following positions;

    1. JMP1 OUT
    2. JMP2 OUT
    3. JMP3 OFF (2-3)
    4. JMP4 OFF (1-2)

MX800 Controller Setup:

1. The Power Save option is activated in the MXTOOLS 'Configuration' heading. Within the 'Power Save Mode Settings' folder select 'Power Save Option Board Installed'.

2. Setup the power save mode settings as required.

3. Download the Configuration change to the MX800.

MX800 Testing:

1. Connect a Communications Test Set via the RIB to the MX800.

2. Set the switches on the RIB to Line Audio and E&M.

3. Check that all the Transmit parameters (i.e. TX power, modulation, freq. error) are correct. Correct any anomalies where necessary.

4. Set the test set to measure Rx parameters and ensure that the Receiver is operating correctly.

5. Replace the MX800 cover.

3.11 T11 Combined Options

This option combines the functions and features of T08, T09 and T10

3.12 T12 External Reference Oscillator Input

3.12.1 Description

The MX800 receiver and transmitter modules have separate reference oscillators. In normal operation to achieve a low frequency transmitter modulator frequency response to DC, the MX800 normally uses a two-point modulation method. For two-point modulation, the TX reference oscillator and the VCO are both modulated together and in phase. Option T12 provides for the TX reference frequency to be externally injected. An SMB connector is fitted to the exciter and an internal cable is provided from there to a chassis mount N Type connector into which the external reference frequency is injected. As two-point modulation is not possible with this configuration, the transmitter frequency response is only specified to 67Hz for this option.

The N Type connector will be required to be used for the RX I/P in which case the BNC becomes the external reference I/P.

A range of reference frequencies from 1MHz to 16MHz can be used with this option. With MXTOOLS, check your exact frequency can be programmed and accepted.

3.12.2 Installation

Components Required:

1.	BNC to Right Angle SMB Coaxial Cable Assy.	Qty-1
2.	N-Type to Right Angle SMB Coaxial Cable Assy.	Qty-1
3.	SMB right angle PCB mounted connector.	Qty-1
4.	Rear connector layout label	Qty-1
5.	3x8mm machine screws	Qty-4
6.	Rear Connector label	Qty-1

Test Equipment Required:

1. Communications Test Set
2. MX800 Radio Interface Box

Method – MX800 Chassis:

1. Remove the cover to the MX800 radio.
2. Remove the ribbon cable from the Exciter module.
3. Remove the coaxial cable Assy from the Exciter module.
4. Remove the Exciter module from the chassis by unscrewing the 2 M4x35mm screws.
5. Remove the receiver coaxial cable Assy from the chassis – Do not discard the 2.5x5mm screws.
6. Remove the 16mm plug from the Simplex relay position.
7. Install the N-type coaxial cable Assy into the 16mm hole and secure with the 3x8mm machine screws. Route this cable to the receiver module and connect to the receiver-input connector.
8. Install the BNC-type coaxial cable Assy into the 13mm hole and secure with the qty4 2.5x5mm screws. Route this cable underneath the PA module to the location of the exciter External Reference input connector.

9. Re-install the exciter module (after it has been modified for this option) with the qty2 4x35mm machine screws.

10. Connect all the necessary connectors to the exciter module.

11. Replace the rear connector label with that supplied.

Method – Exciter Module:

1. Remove the cover to the exciter module.

2. Remove the exciter Printed Circuit Board from the base unit.

3. Remove the following components from the exciter board:

    - X1 - TCXO
    - R30 & R31
    - TR7

4. Install and solder the right angle SMB PCB mounted connector into the CN3 position on the exciter Printed Circuit Board.

5. Re-install the exciter Printed Circuit Board onto the base unit.

6. Re-install the cover to the exciter module.

MX800 Controller Setup

1. The TX external reference frequency that will be used is required to be programmed into the radio via MXTOOLS. This can be achieved in the MXTOOLS ‘Configuration’ heading under the ‘Hardware’ folder, insert the required frequency into the ‘TX Reference Frequency’ box.

2. Download the Configuration change to the MX800.

MX800 Testing:

1. Connect a Communications Test Set via the RIB to the MX800.

2. Set the switches on the RIB to Line Audio and E&M.

3. Connect the External Reference source to the MX800 BNC connector.

4. Check that the exciter VCO is in ‘lock’.

5. Check that all the Transmit parameters (i.e. TX power, modulation, freq. error) are correct. Correct any anomalies where necessary.

6. Set the test set to measure Rx parameters and ensure that the Receiver is operating correctly.

7. Replace the MX800 cover.

3.13 T13 Local Speaker, Mic Socket and Front Panel Mute

3.13.1 Description

For applications needing a user interface at the base station the MX800 is available with the Local Control option. The full implementation is described in section 1.1.1.2 this section describes the part fitted under option T13.

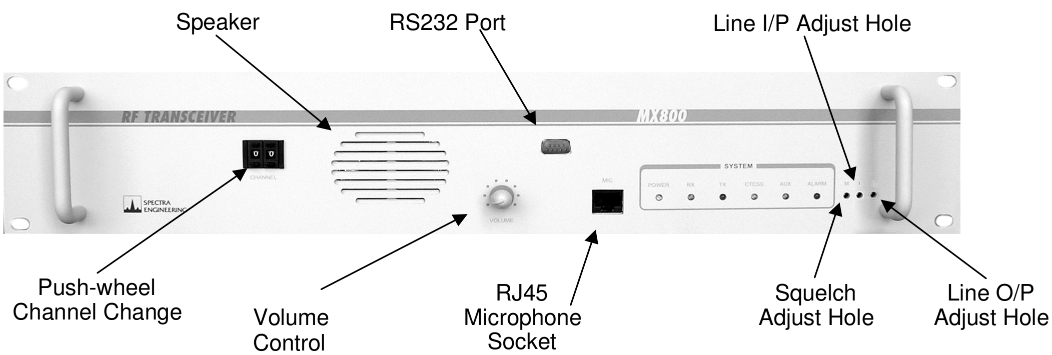


Figure 3-8 Front Panel with Speaker, Mic and Mute

Loudspeaker and Volume Control
A 1 Watt loudspeaker is provided to monitor 'on air' received audio as well as transmit audio from line. Volume control is provided by means of a volume pot or a 3-position toggle switch adjacent to the loudspeaker. This switch is biased in the centre position. To raise or lower the volume the switch is momentarily moved up or down respectively. For each switch closure the volume is incremented or decremented a fixed amount.
The speaker has a link selectable connection to a tone output from the micro controller. This may be used in conjunction with the appropriate software configuration to generate an alert tone to the user.

Microphone Socket
An RJ45 socket is provided for connection of a microphone. This socket is wired compatibly with the Motorola GM300 microphone.

Mute / Squelch Adjustment
Provision is made to optionally locate the squelch control potentiometer behind the front panel. A screwdriver hole is provided in the front panel to access this adjustment.

Pin No	Function	Comment
8	PB1	5V CMOS input
7	PB2	5V CMOS input
6	Hook/monitor	For quiet base
5	Mic ETH	
4	Mic VF in. High or low level	Set JMP22 IN for low gain dynamic Mic
3	Mic PTT.	Pulled to +5V via 10K
2	+5 volts out	Current limited via 220R
1	Low level muted RX VF	Fixed level out.

Table 3-7 MX800 Mic Socket Pinout

The RJ45 pins are numbered as shown in Figure 3-4 below.

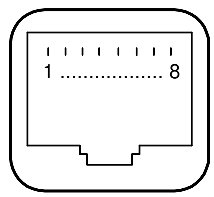


Figure 3-9 RJ45 socket viewed from front of MX800

Refer circuit diagram CS001-6 sheet 6 of 6

3.13.2 Installation

CAUTION: COMPONENTS USED ARE STATIC DAMAGE SENSITIVE!

Components Required:

1. Front Panel and matching Handles. Qty-1
2. Loudspeaker. Qty-1
3. MCP6002D Integrated Circuit. Qty-3
4. TDA8551 Integrated Circuit. Qty-1
5. RJ45 PCB mounted Microphone socket. Qty-1
6. 16mm Volume Pot or SPDT momentary Volume switch. Qty-1
7. 100kohm 10turn PCB mounted squelch potentiometer. Qty-1
8. 100kohm SMD potentiometer. Qty-1

9. Jumper link connector. Qty-1

Test Equipment Required:

1. Communications Test Set
2. Jumper link

Installation Method – MX800 Chassis:

1. Remove the cover to the MX800 radio.
2. Remove the motherboard from the chassis.
3. Remove the Exciter and receiver modules from the chassis by unscrewing the 2 M4x35mm screws on each module.
4. Remove the front panel from the chassis by unscrewing the qty4 screws securing the handles to the front panel – Do not discard the screws.
5. Place the loudspeaker in the speaker indentation on the front of the chassis. The speaker wires should be in the upper most position.
6. Place the front panel on the front of the chassis to hold the speaker in position and secure the front panel with the matching handles and the previously removed screws. Ensure that the front panel holes are aligned with the corresponding chassis holes and fully tightened handle screws.
7. Re-install the exciter and receiver modules into the chassis.
8. Re-install the motherboard (after it has been modified for this option) into the chassis being careful to align the front panel hole positions with the corresponding motherboard components.
9. Re-connect all of the modules and chassis mounted connectors to the motherboard via their appropriate cable assembly's.

Installation Method Motherboard:

1. Install the MCP6002 IC's onto circuit board designations IC61, IC62 & IC64.
2. Install the TDA8551 IC onto circuit board designations IC60.
3. Remove the SMB potentiometer located on circuit board designation RV6 and re-install it onto board reference RV10.
4. Install the 100kohm SMB potentiometer onto circuit board designation RV11.
5. Install the 100kohm PCB potentiometer onto circuit board designation RV6B (Mute).

6. Install and solder the RJ45 connector into the SKL (MIC) position on the motherboard board.

7. Install and solder the 16mm Volume Pot (RV9) or SPDT switch into the SW1 (VOL) position on the motherboard board.

8. Link the necessary links near RV9 as instructed on motherboard.

9. Install the jumper link to JMP25 (Tone to Speaker) on the motherboard.

MX800 Software Controller Setup:

There is no specific Controller setup required.

MX800 Testing – Speaker:

1. Connect a Communications Test Set (CTS) and the necessary I/O connection to the MX800.

2. Connect Dummy load to MX800 RF out put (CN8)

3. Connect the MX800 Rx input to the RF out (or Duplex out) of the CTS.

4. Set-up the CTS for operation with the audio generator set to 1kHz @ -10 dBm and the audiometer to show Audio input level.

5. Disconnect Speaker from SKM and Connect CTS Audio in to the speaker output connector SKM (SPKR).

6. Operate the volume control for maximum audio output, monitor this on the CTS and then adjust RV10 until the audio level is +5dBm. Reduce the audio level using the volume control and connect the MX800 speaker to SKM.

MX800 Testing – Microphone:

1. Connect a Communications Test Set (CTS) and the necessary MX800 I/O connection. Connect a Microphone cable to the Microphone socket of the MX800 so that you can inject into pins 4 (Mic Audio) & 5 (GND). You'll also need to connect a switch or be able to short pins 3 & 5.

2. Set-up the CTS for duplex operation with the audio generator set to -20 dBm and the audiometer to show output line level. With Rx line (CN1 pin 15) audio connect to CTS audio input.

3. PTT the MX800 and adjust RV11 for –10dBm on the audio level meter.

4. Set the audio generator for –50dBm and install a jumper link onto JMP22 on the motherboard. The audio meter should read approx. –9dBm and reducing the audio generator level in 1dB increments the meter level should also reduce, increasing the level should cause the audio cct to limit the audio level to approx. –8dBm.

5. Remove the Link from JMP22 and increase the audio generator level to – 10 dBm.

6. Set the test set to display TX modulation depth and measure the modulation level. The modulation level should be approximately equal to the nominal deviation level for the Transmitter. I.e. 3kHz wide band and 1.5kHz Narrow band.

7. Remove the Microphone cable from the MX800 MIC socket.

MX800 Testing – Rx Mute:

1. Connect a Communications Test Set (CTS) and the necessary MX800 I/O connection.

2. Set the test set to measure SINAD and reduce the RF generator until 8db SINAD is reached.

3. Adjust the front panel Mute control so that the RX just goes into the muted condition.

Testing in now complete.

3.14 T14 Local Channel Change

3.14.1 Description

For applications needing a user interface at the base station the MX800 is available with the Local Control option. The full implementation is described in section 1.1.1.2, this section describes the part fitted under option T14.

Channel Change Control
Twin push wheel switches can be optionally fitted to the front panel to allow selection of the operating channel. When fitted this switch is wired to the channel select pins on SKF/E, the rear channel select port, and replaces the channel select function normally accessible on the rear digital I/O connector. 99 channels are selectable. Refer to section 2.2.2.3 for more details on alternative channel select methods.

3.14.2 Installation

Components Required:

1. Local Channel Change Switch and Cable Assembly. Qty-1

2. Front Panel and matching Handles. Qty-1

Test Equipment Required:

1. Communications Test Set

2. MX800 Radio Interface Box

Method:

1. Remove the cover to the MX800 radio.

2. Remove the motherboard from the chassis.

3. Remove the Exciter and receiver modules from the chassis by unscrewing the 2 M4x35mm screws on each module.

4. Remove the existing front panel from the chassis by unscrewing the qty4 screws securing the handles to the front panel – *Do not discard the screws.*

5. Place the upgrade front panel on the front of the chassis and secure with the matching handles and the previously removed screws. Ensure that the front panel holes are aligned with the corresponding chassis holes and fully tightened handle screws.

6. Install the local channel change switches into the front panel hole and secure into position hot melt glue.

7. Route the switch Assy cable along the front of the chassis and to the rear of the motherboard standoff posts closest to the front of the chassis. Secure into position with a small piece of tape.

8. Re-install the exciter and receiver modules into the chassis.

9. Re-install the motherboard into the chassis being careful to align the front panel hole positions with the corresponding motherboard components.

10. Re-connect all of the modules and chassis mounted connectors/switches to the motherboard via their appropriate cable assembly's.

MX800 Controller Setup:

1. The Local Channel Change option is activated in the MXTOOLS 'Configuration' heading, within the 'Software' folder with 'Channel Select Input' selection of 'BCD'.

2. Download the configuration change to the MX800.

MX800 Testing:

1. Connect a Communications Test Set and the RIB to the MX800.

2. Set the switches on the RIB to Line Audio and Line E&M.

3. Set MXTOOLS into Diagnostics mode and 'Start' the diagnosis process.

4. Change the channel on the local channel switches and check that the channel selected on the BCD switch is in fact the channel that the Diagnostics screen indicates.

5. Reset the MX800 operating channel to the required position.

3.15 T16 1PPM Frequency Stability

12.5kHz channels Frequency band K to X (320-950MHz)
25.0kHz channels Frequency band R to X (805-950MHz)

This option provides for 1PPM frequency stability for narrowband MX800s in the K to X bands. This frequency stability is specified from –30° C to +60° C.. 1PPM stability can additionally be used on any frequency band above 66 MHz but the DC-FM transmitter modulation feature is not fully specified below 400 MHz. Typically, this results in only some minor drop of the low freq response or ability to set up the Transmitter modulation balance.

Also see section 3.12 and section 7.5.13

3.16 U69 Extended Temperature Range Verification

The MX800 is optionally available in an extended operating temperature range version, extending the temperature range over –30° C to –10° C. Additional testing and operational verification is done in an environmental chamber at –30C for 24 Hours. An additional factory test report sheet is provided at his temperature. Frequency stability is specified at 2.5PPM for this option.

3.17 T19/26 Line Interface Board.

The MX800 T19 / T26 option board provides the radio base station with utmost flexibility in system design and capabilities, with an extensive range of new features.

Please consult Spectra, for the availability of these features or software upgrades. Not all features are currently available.

- 2Wire (VF Hybrid) or 4Wire Selection, Balanced Audio, Dual E+M,
- VF Delay (To replace option T08)
- Base Station Variable Tone Voting
- Base Station Stepped Tone Voting
- Status Tone Encoding And Decoding (T19 only)
- Five Tone Encoded / Decoder (T19 only)
- DTMF Decoder
- Remote Control Capabilities
- Fast CTCSS Decoder
- VF Line compensation for SINAD Voters
- Real-time Clock

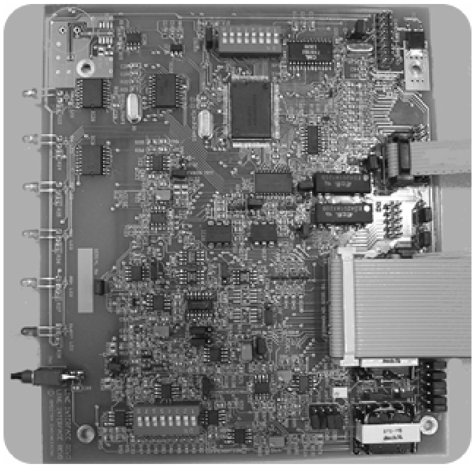


Figure 3-10 MX800 T19/T26Option Board

Due to ongoing development please refer to www.spectraeng.com.au for the latest information regarding this option.

Note *These are software selectable provided the correct option board is selected/used, and not all option can be used in conjunction with each other. Some parts many not be populated.*
Jumpers referred below are those on this option PCB.

3.17.1 Installation

CAUTION: COMPONENTS USED ARE STATIC DAMAGE SENSITIVE!

Components Required:

1.	T26/19 Option PCB & RJ45 Daughter PCB.	Qty-1
2.	M3X 25mm Standoff posts.	Qty-4
3.	M3X 3mm screws	Qty-3
4.	CABLE IDC SKT - IDC SKT 16W 125mm cable Assy.	Qty-1
5.	CABLE IDC SKT-IDC SKT 10WAY 150mm cable Assy.	Qty-1
6.	CABLE IDC SKT-IDC SKT 16WAY 170mm cable Assy.	Qty-1
7.	CABLE IDC SKT-IDC SKT 10W 330mm cable Assy.	Qty-1
8.	CABLE IDC DB9M-IDC SKT 10W 195mm cable Assy.	Qty-1
9.	CABLE IDC DB15F-IDC SKT 16W 210mm cable Assy.	Qty-1
10.	CABLE IDC SKT-IDC SKT 16WAY 210mm cable Assy.	Qty1

Test Equipment Required:

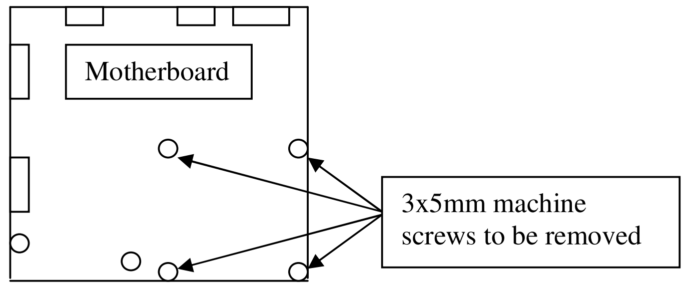
1. Communications Test Set
2. MX800 Radio Interface Box

Note# *When installing cables insure that they are fitted with the correct orientation.*

Method:

1. Remove the cover to the MX800 radio.
2. Remove mother board from chassis of radio. Note cable connection and orientation.
3. Install the CABLE IDC SKT-IDC SKT 10W 330mm cable Assy between connector SKI on the Motherboard (going under nether mother board) and SKU/B on the Option board, taking note that the cable is correctly orientated. This cable lays under the mother board. Issue cable is not crushed when refitting mother board.

4. Refit mother board to chassis. Don’t refit the four screws indicated bellow on the motherboard and fit Qty 4 3x20mm standoff posts in the positions where the screws where removed.



5. Punch out the Rj45 square on the rear of radio.

6. Install RJ45 daughter board in the rear of chassis, locate the Rj45 socket into punch hole. Locate mount holes over chassis stand off. Secure with 3x 3mm screws.

7. Remove the Link jumpers off Mother board connector SKK.

8. Install the CABLE IDC SKT - IDC SKT 16W 125mm cable Assy between connector SKK on the Motherboard and SKK on the Option board.

9. Install the CABLE IDC SKT-IDC SKT 16WAY 210mm cable Assy. between connector AUX3 (SKX) on the Motherboard and SKX on the Option board. This cable will be under option PCB when mounted.

10. Install the Option Printed Circuit Board onto the 4 standoffs with the 16way connector closest to DIP2 on the Motherboard. Secure with the qty4 3x5mm machine screws previously removed.

11. Install the CABLE IDC SKT-IDC SKT 16WAY 170mm cable Assy. between connector SKH on the Motherboard and SKH on the Option board.

12. Install the CABLE IDC SKT-IDC SKT 10WAY 150mm cable Assy. between connector SKV on the Motherboard and SKV on the Option board.

13. Remove and replace CN1 with CABLE IDC DB9M-IDC SKT 10W 195mm cable Assy. Connect to SKU on the Option board.

14. Remove and replace CN4 with CABLE IDC DB15F-IDC SKT 16W 210mm cable Assy. Connect to SKH/B on the Option board.

15. Check that the option board jumpers are in the correct positions for application.

16. See the appropriate application section for Setup procedure.

3.17.2 2Wire or 4Wire Selection, Balanced VF

3.17.2.1 Description

Option T19 and T26 both provide the user to be able to select between 2 wire or 4 wire systems, they also both have balanced and isolated VF I/O as well as isolated E (PTT) and M (Mute) leads. The T19 has dual E&M leads, this provide a Qualified and Non-qualified M leads as well as E leads with subtones and with out subtones. The second E&M connection points are found on CN3 DB25 connector.

The E lead is opto isolated and may be asserted by applying a DC voltage between 5V and 48V with any polarity between CN9 Pins 7&8 (JMP4 & JMP5 removed).

Provision is also made to internally source or Earth (JMP4 and JMP5) so that the activation can be done Via CN9 Pin8 (+12V DC) or (GND), in which case the E lead is asserted by grounding or pulled up to 5V (depend on JMP4 & JMP5 settings) on CN9 Pin8

The M lead is relay isolated and the common and normally open contacts are brought out via CN9 Pins 5&6. The relay contacts are rated at 500mA.

Note# In REV C PCB for 2 wire mode, to have the correct matching for 600R please fit a 560R resistor is in parallel to R77(above IC4) and across R130 & R129 (Right hand side of PCB above RV4)

3.17.3 VF Delay

3.17.3.1 Description

This option provides a 40mS delay to the received audio. When the option is fitted delayed audio is fed to the line and talk through paths but discriminator audio (output on CN1 Pin4) is undelayed.

This option is intended for two main applications. Firstly when the delay is fitted the mute "crash" characteristically heard when a mobile releases its PTT but the repeater tail continues, it is eliminated. Secondly systems (including trunking systems) which have mixed voice and data on a channel can delay the VF signal to line and air so that in the event that a data stream is detected (by the data controller) the VF to line and air can be disconnected for the duration of the data burst thus avoiding radio system user annoyance. Internal switches in the MX800 may be used to disconnect the audio under the control of the RX TALK line (CN1 Pin7) the sense of which may be inverted using JMP12 on the micro controller.

This option may be fitted at order placement or retro fitted subsequently. The Option PCB assembly is fitted above the Micro controller on four hex pillars. A 16-way ribbon connection is made from the Option PCB to SKK on the micro controller card. The links on the Option card are set as below. Once the delay option is fitted the "Delayed Audio Option" check box is ticked in the MXTOOLS Configuration screen (Hardware settings tab).

This option is not currently available. Due to ongoing development please refer to www.spectraeng.com.au for the latest information regarding this option.

3.17.4 Variable & Stepped Tone Encoder

3.17.4.1 Description

Variable tone voting is a method of conveying the received signal strength information to a central arbiter so that an informed decision can be made as to which base station will use its received audio.

There are two methods of this type of encoder, Variable tone that works by superimposing a sliding scale audio tone on the received audio at each site, and stepped tone that works by superimposing a fixed audio tones per decision block. This tone frequency being related to the received signal strength (RSSI). The tone is removed at the central site and the best audio is turned around for retransmission. This requires a VF connection between each base station and the central arbiter.

Prior to a tone being superimposed the receiver VF is notch filtered at the tone frequency.

A Second PTT function designed for mobile voting systems transmits carrier with no modulation (including no CTCSS) to allow mobiles to vote without lifting the mute in the mobile.

3.17.4.2 Voting Law

The table below shows the default voting decisions points programmed into the MX800 T19 / T26 option board. These are the corresponding signal points where by under control of the microprocessor to generates the appropriate audio tone.

Level 0 refers to the signal level when the mute opens and is less than Level 1. The option board incorporates a signal noise measurement circuit that needs to be calibrated for the board to perform optimally.

RF Signal Decision Points	**Level (uV)**	**Frequency (Hz)**
Squelch closed	N / A	2710
Level 0 signal	> 0	2732
Level 1 signal	> 0.6	2792
Level 2 signal	> 1.0	2856
Level 3 signal	> 2.0	2913
Level 4 signal	> 5.0	2973

Table 3-8 Signal decision levels/points and coresponding tones.

3.17.4.3 Configuration

The configuration procedure for the Variable tone encoder consists of setting up the software and adjusting the noise circuit for maximum range. The configuration screen is entered via the menu system using options ‘C’ for configuration, then ‘E’ for encoder and then ‘1’ for Variable tone encoder.

When the Variable tone encoder is initially enabled it is configured with the system defaults as shown above, or a previously configured Variable tone voting law. The user can change the number of Variable tone levels, the Variable tone decision points and tone frequencies. If the user decides to change any setting all the Variable tone settings will need to be entered.

The number of levels refers to the number of decision points once the mute is opened. Level 0 is the receiver signal level when the mute just opens; use the appropriate units for the decision point. The units for the Variable tone decision points can either be in microvolts (uV) or decibels (dBm).

3.17.4.4 Adjustment

The process for adjusting the noise measurement circuit for range is to inject a signal of about 0.6uV (or approximately -111.4 dBm) into the receiver and measure the filtered noise signal on the pad between R131 and C67. The voltage should be around 0.7V, use variable resistor RV6 to adjust the gain.

The Variable tone encoder tone level can be adjusted using variable resistor RV1. This is typically –20dBm tone level.

The line output level is adjusted using variable resistor RV4, for the desired level. This is typically –10dBm audio level.

3.17.4.5 Calibration

Once the board has been configured for Variable tone voting, calibration is performed using screen prompts in the calibration menu. Enter using the menu system option ‘R’ for calibration then ‘N’ for noise-floor measurements. The user will then be prompted to adjust the receiver signal to match the calibration points.

After calibrating the noise floor decision points, the frequency compensation adjustments will need to be performed. This is done through the menu system using options ‘R’ then ‘C’. The user will then be prompted to turn off the receiver signal source to initiate the calculations.

3.17.4.6 Software Setup

The T19 / T26 option board has a software menu system which is used to configure, calibrate and test the board. The menu system is entered through a terminal emulator program.
The settings are 9600-baud, no parity, 8 data bits and 1 stop bit.
HyperTerminal, which is included with Windows, is a suitable program for this purpose.
The command ‘RMENU↵’ is entered on the terminal, this command is not case sensitive. The user will then be presented with a menu system from which various settings and configurations can be selected. To exit the menu system the <ESC> key can be pressed.

3.17.5 Variable Tone Setup Procedure

This section provides a set by step approach to enable the option board for uses as a Variable Tone encoder T26

1. Connected option Board via the Rs232 port, run terminal software.
2. Type "RMENU↵" to access inbuilt software menu.
3. Select Configuration Menu (C)
4. Select encoder Menu (E)
5. Select the type of encoder required.
6. Press the Escape Key.

RX Alignments

1. Using a 600ohm termination monitor RX line output level. This output is located on the rear of the MX800, RJ45 Line I/O connector pin 1 & 2 (balanced audio)
2. Remove JMP20
3. Set the receiver modulation frequency to 1 kHz and the FM deviation to nominal for the particular RF receiver frequency of the test channel. At a RF level of –60 dBm.
4. Adjust Line Output level RV4 to obtain nominal line output level (-10dBm is the default level).
5. Set the RF level to 0.6uV on the comm.’s test set.
6. Using a DVM, monitor the DC volt level at junction of R131 and C67, Adjust RV6 so that DVM reads 0.7VDC.
7. Remove RF signal from receiver.
8. Insert JMP20 in positions 1-2
9. Adjust RV1 to obtain Variable Tone level (-20dBm is the default level).
10. Type "RMENU↵" to access inbuilt software menu.
11. Select Calibration Menu. (R)
12. Select Variable Tone Calibration points (N)
13. Follow on screen instructions.
14. Exit menu system and cycle power to radio.
15. Insure front panel signal Leds (RSSI Leds) and Key tone changes at the correct RF level points, see table above. *(Note# Sixth led will not light due to only 5 RF level points are used in this setup)*

TX Alignments

1. PTT the transmitter.
2. Set the transmitter modulation frequency to 1 kHz, -10dBm level injected in through the rear RJ45 connector, pin3 & 4. (Balanced audio)
3. Disable Notch Filter JMP9 (Position 1-2)
4. Disable AGC on Option Board JMP13 (Position 2-3)
5. Adjust TX input line gain RV5 to obtain 1 Vp-p at IC13 pin 1.
6. Monitor TX modulation depth and insure it is equal to the nominal deviation level. If not just RV4 on the motherboard to obtain correct level.

3.17.6 Status Tone Encoding And Decoding (T19 only)

This power full option board allow the user to be able to monitor the status of the MX800. This option works by superimposing fixed audio tones per status to line. Providing status on mute open or closed. This signal then can be send down a 2 or 4 wire line system. The decoder then processes the status tones and applies the various functions as need. I.e. Programmable PTT tones, PTT ON & PTT OFF.

RX mute status tone encoder provides tone either when mute is open or when mute is closed depending upon system requirement. Speech or noise components on the turn frequency can optionally be notched out.

Setup

This section provides a step by step approach to enable the option board for uses as a Status Tone Encoding And Decoding

Programming

1. Connected option Board Via the RS232 port, run terminal software.
2. Type "RMENU↵" to access inbuilt software menu.
3. Select Configuration Menu (C)
4. Select encoder Menu (E)
5. Select the type of encoder required.
6. Press the Escape Key.
7. Repeat steps 2 & 3
8. Select Decoder Menu (D)
9. Select (1) and enter the PTT decode tone.
10. Also enable AGC (2) And Bandpass filter (3)
11. Programming is complete.

TX Alignments

1. PTT the transmitter.
2. Using a signal generator, apply a 1kHz Tone with the line up level as required (default -10dBm), injected into the rear RJ45 connector, pin3 & 4. (Balanced audio)
3. Disable AGC on Option Board JMP13 (Position 2-3)
4. Adjust TX input line gain RV5 to obtain 1 Vp-p at IC13 pin 1.
5. Monitor TX modulation depth and insure it is equal to the nominal deviation level. If not just RV4 on the motherboard to obtain correct level.
6. Enable AGC by linking in Jmp13 in position [1-2]
7. Using a signal generator, apply a Key tone to Audio level @-10dB.
   [–10dBm0] (Default –20dBM)
8. Adjust RV7 so that the combined audio and key tone signal are set to the required onset compression level.
   1Vp-p at IC13 pin 1. (JMP9 2-3)
   (Default compression level are, audio -20dBm and key tone signal is set to -30dBm)
9. Monitor TX modulation depth and insure it is equal to the nominal deviation level. If not adjust RV4 on the motherboard to obtain correct level.

RX Alignments

1. Using a 600ohm termination monitor RX line output level. This output is located on the rear of the MX800, RJ45 Line I/O connector pin 1 & 2 (balanced audio)
2. Set the receiver modulation frequency to 1kHz and the FM deviation to nominal for the particular RF receive frequency of the test channel. At a RF level of –60 dBm.
3. Remove JMP20 and adjust Line Output level RV4 to obtain nominal line output level (-10dBm is the default level).
4. Fit JMP20 in positions [1-2] and remove JMP7
5. Adjust RV1 for so that the ratio of Key tone to Audio level @-10dB. (–10dBm0)
6. Fit JMP7 in positions [2-3]

Two wire Mode only

7. Using an oscilloscope, monitor the audio on IC4 pin1 also insure that Pin1&2 of SK5 Terminated to a 600ohms load.
8. Adjust RV2 for minimal Audio level on IC4 pin1. (Aprox <5mV)

3.17.7 Five Tone Encoded / Decoder

3.17.7.1 Description

The T19 option board is equipped for 5 or 6 tones Selcall operation according to CCIR, EEA, ZVEI 1, ZVEI 2 and other standards. This provides a flexible predictive or non-predictive all-tone decoding, plus able to transpond all 5/6 tones and all-system group-call and ANI operations. The Selcall encoder / decoder IC is under the control of the microprocessor.

This option is not currently available. Due to ongoing development please refer to www.spectraeng.com.au for the latest information regarding this option.

3.17.8 DTMF Decoder

This option is not currently available. Due to ongoing development please refer to www.spectraeng.com.au for the latest information regarding this option.

3.17.9 Remote Control Capabilities

This option is not currently available. Due to ongoing development please refer to www.spectraeng.com.au for the latest information regarding this option.

3.17.10 Fast CTCSS Decoder

This option is not currently available. Due to ongoing development please refer to www.spectraeng.com.au for the latest information regarding this option.

3.17.11 T19/26 Pinouts

CN3 Pin No	Function
11	M2 Lead
24	M2 Lead normally open
25	E2 lead A
12	E2 lead B
13	ETH/ +5V (Set via MX800 JMP15)
1	600ohm balanced RX VF leg a
14	600ohm balanced RX VF leg b
2	600ohm balanced TX VF leg a
15	600ohm balanced TX VF leg b
3	M1 Lead common
16	M1 Lead normally open
4	E1 Lead leg a/M lead normally closed
17	E1 Lead leg b
21	INPUT PORT B. BCD Channel Select Units bit 0. / Binary Bit 0.
8	INPUT PORT B. BCD Channel Select Units bit 1. / Binary Bit 1.
20	INPUT PORT B. BCD Channel Select Units bit 2. / Binary Bit 2.
7	INPUT PORT B. BCD Channel Select Units bit 3. / Binary Bit 3.
19	INPUT PORT B. BCD Channel Select Tens bit 0. / Binary Bit 4.
6	INPUT PORT B. BCD Channel Select Tens bit 1. / Binary Bit 5.
18	INPUT PORT B. BCD Channel Select Tens bit 2. / Binary Bit 6.
5	INPUT PORT B. BCD Channel Select Tens bit 3. / Binary Bit 7.

Table 3-9 CN3 Connections

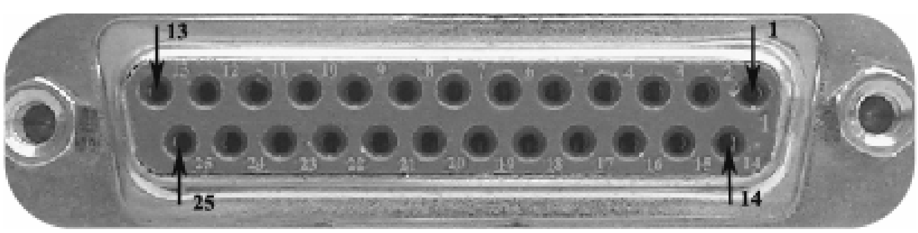


Figure 3-11 CN3 Pin-out Detail (View from Rear of MX800)

Pin No	Function
1	600ohm balanced RX VF leg a
2	600ohm balanced RX VF leg b
3	600ohm balanced TX VF leg a
4	600ohm balanced TX VF leg b
5	M1 Lead common
6	M1 Lead normally open
7	E1 Lead leg a/M lead normally closed
8	E1 Lead leg b

Table 3-10 CN9 Connections

The RJ45 pins are numbered as shown below.

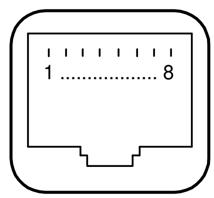


Figure 3-12 CN9 RJ45 Pin-out Detail (View from Rear of MX800)

3.17.12 T19/T26 Jumper Settings

JMP Number	Jumper description	Default Jumper Position For T19/T26
JMP1	Decoder select	2-3
JMP2	M1 Source jumper	N/F (Unlinked)
JMP3	M2 Source jumper	N/F (Unlinked)
JMP4	E2 Source jumper	N/F (Unlinked)
JMP5	E1 Source jumper	N/F (Unlinked)
JMP6	RX Line compensation IN/OUT	1-2
JMP7	RX Low pass filter IN/OUT	2-3
JMP8	RX Notch filter IN/OUT	1-2
JMP9	TX Notch filter IN/OUT	1-2
JMP10	2W/4W Selection	1-2 (4Wire mode)
JMP11	2W/4W Selection	1-2 (4Wire mode)
JMP12	2W/4W Selection	1-2 (4Wire mode)
JMP13	AGC IN/OUT	2-3
JMP14	High Pass Filter IN/OUT	2-3
JMP15	2W/4W Selection	1-2 (4Wire mode)
JMP16	2W Isolation Balance	N/F (Unlinked)
JMP17	2W Isolation Balance	N/F (Unlinked)
JMP18	2W Isolation Balance	N/F (Unlinked)
JMP19	2W Isolation Balance	N/F (Unlinked)
JMP20	Tone Generation path	1-2
JMP21	CNVSS	Connected (CNVSS)
JMP22	2W/4W Selection	1-2 (4Wire mode)
JMP23	2W/4W Selection	1-2 (4Wire mode)
JMP24	4W Selection	Linked
JMP25	4W Selection	Linked
JMP26	RX DISC Audio Break Point	1-2
JMP27	TX Audio Break Point	Connected
JMP28	AGC Ratio	NF (Unlinked)
JMP29	RS232	Swap
JMP30	RS232	Swap
JMP31	D-A Section path RX/TX	N/F (Unlinked)

Table 3-11 T19/26 Factory Default Jumper Setting.

3.18 T29 Balanced and Isolated VF plus E&M

3.18.1.1 Description

Option T29 provides the balanced and isolated VF I/O as well as isolated E (PTT) and M (Mute) leads, as per option T05. The option has been design to be compatible with Omitronics interface connections.

Note *Jumpers referred to in the table below are those on this option PCB.*

The E lead is opto isolated and may be asserted by applying a DC voltage between 5V and 48V with any polarity between CN9 Pins 1&2 (JMP1 in position 2-3).

Provision is also made to internally source the activation voltage (+12V DC) in which case the E lead is asserted by grounding CN9 Pin2 (JMP1 in position 1-2)

The M lead is relay isolated and the common and normally open contacts are brought out via CN9. If the internal +12V DC is being used as the activation voltage for the E lead (JMP3 in position 1-2) then the normally closed contact is also available at CN9 pin 8. The relay contacts are rated at 500mA.

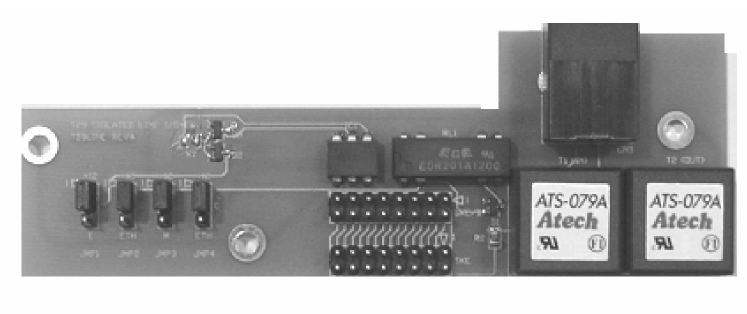


Figure 3-13 MX800 T29 otpion board

Pin No T29	Function
5	600ohm balanced RX VF leg a
4	600ohm balanced RX VF leg b
6	600ohm balanced TX VF leg a
3	600ohm balanced TX VF leg b
7	M Lead common
8	M Lead normally open
2	E Lead leg a/M lead normally closed
1	E Lead leg b

Table 3-12 T29 RJ45 Pin outs.

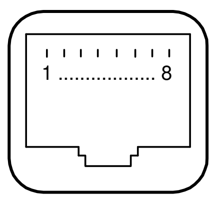


Figure 3-14 CN9 RJ45 Pin-out Detail (View from Rear of MX800)

JMP	Factory Default setting
1	Position 2-3
2	Not fitted
3	Position 2-3
4	Not fitted

Table 3-13 T29 Factory Default Jumper Setting.

3.19 T31 Network Adapter

The T31 network adapter is a small circuit board that is installed inside the MX800 transceiver to enhance serial communications to the MX800. This is achieved because the board implements a protocol especially designed for efficient multi-drop serial communications.

The T31 board intercepts the serial data port of the MX800 encoding and decoding the external data stream, converting it to/from standard MX800 data required by the MX800 Micro-controller board. It also intercepts the MX800's DB25 Digital I/O connector and provides additional digital inputs to allow more than the standard 16 network addresses to be set externally. The additional pins required to support the additional network address inputs are available externally on a DB44 high density connector that replaces the standard DB25 female connector (CN3) of the MX800. CN2 is also located on the board and it's connection to the MX800 Micro-controller board provides the power supply for the T31 option board.

Standard MX800 data when using Mxtools software will pass seamlessly through the T31 board without any conversion.

Due to ongoing development please refer to www.spectraeng.com.au for the latest information regarding this option.. A technical manual is available for this option please contact sales@specteng.com.au for a copy of this manual.

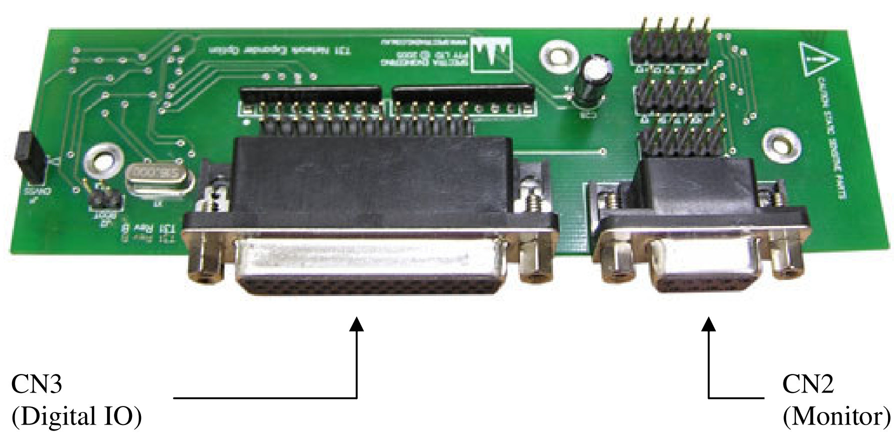


Figure 3-15 T31 Option Board

3.19.1 Optional Dongles

There are two different dongles available that can be plugged directly into CN3 (T31's DB44) to allow external selection of the MX800's operating channel and it's T31 network address. The dongles can be set and be used as a method to ensure that a pre-programmed radio is set to the right channel and network address at a particular location, allowing a plug-and-go operation for non technical personnel to carry out equipment changeovers.

3.19.2 U72 Dongle

The U72 has a single DB44 male connector and four rotary switches. Two of the switches allow the selection of a pre-programmed MX800 channel and the other two allow the selection of the extended network address.

Figure 3-16 U72 Dongle

3.19.3 U73 Dongle with Digital IO Port Replicator

The U73 dongle allows not only the selection of the network address and channel, but also provides all of the connections normally provided by CN3 on the standard MX800.

Pinouts of the female DB25 connector provided on the U73 are detailed in T31 Technical manual. Please contact sales@specteng.com.au for a copy of this manual.

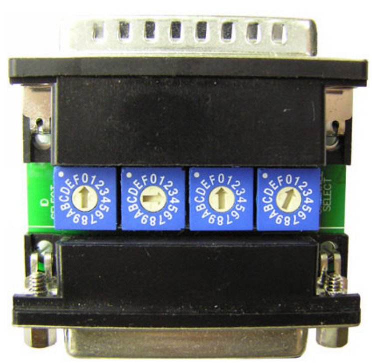


Figure 3-17 U73 Dongle

3.20 T34 Ethernet option

The T34 Ethernet Option is a small circuit board that is installed inside the MX800 transceiver to allow diagnostic data from the MX800 to be sent over a UTP Ethernet link.

The T34 includes a web server to output web pages for analysing the health of the host MX800 using a standard HTML web browser.

The T34 board intercepts the serial data port of the MX800 and converts the MX800 data to and from IP packets that are transferred over the Ethernet link.

When using the Mxtools software, the T34 board sends and receives data to the MX800 motherboard normally as long as communication via the Ethernet connection with the MX800 is inactive.

A technical manual is available for this option please contact sales@specteng.com.au for a copy of this manual.

4. Technical Description

The internal design of the MX800 is of a modular nature allowing for simple configuration and maintenance while ensuring minimal downtime. For reference purposes, the top view of a typical MX800 with top cover removed is shown in Figure 4-1 below. The standard unit without speaker and microphone is illustrated.

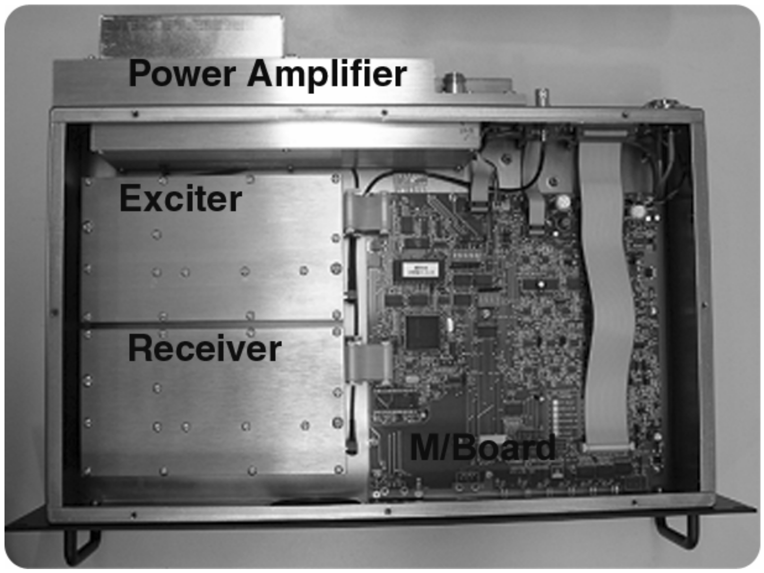


Figure 4-1 MX800 Top View

4.1 Exciter Module

Refer:
Exciter Block Diagram: BD002
Exciter Circuit Diagram: CS002-1
TX VCO Circuit Diagram: CS004-1 (Bands A to Q)
CS011-1 (Bands R to X)

RF from the VCO on SKU-1 at a nominal level of +3dBm is applied to the fractional-N synthesiser IC10 main divider input. This signal is compared with the reference oscillator frequency and the correction voltage from the synthesiser's charge pump output is filtered then amplified by the non inverting low noise op amp IC9A. This correction voltage is fed back to the VCO to maintain loop lock as well as being fed to the Micro Controller via SKD-14. A lock detect signal from IC10 is also fed to the Micro Controller via SKD-16. The op amp uses a 25 volt power supply (generated on the Micro Controller) so as to provide a wide tuning range voltage to the frequency control varicaps located on the VCO board. Frequency programming data for the exciter is sent to the synthesiser chip from the Micro Controller via a serial data line on SKD-18 under the control of the Clock (SKD-15) and Strobe (SKD-17) lines.

Provision is made for the optional injection of an external reference frequency. If this option is selected CN3 is fitted and X1 is not fitted. Components R30 and TR7 are also omitted.

A second RF output from the VCO on SKT-6 also at +3dBm is used as the main transmit RF amplifier signal source. This main signal is first buffered by a very high isolation circuit consisting of a 10dB pad and a MMIC amplifier (IC1). The signal is further amplified by IC2 and a variable gain wide band amplifier with 40dB control range and power output of 300mW. The drive power of this stage is used to set the output power to the main power amplifier under the control of the DC voltage on SKD-4 from the Micro Controller board.

The VCO boards and synthesiser circuits are the same for the exciter and receiver modules. The VCO consists of a 10mm ceramic coaxial resonator with common base oscillator for low phase noise for bands 805-960 MHz. Frequencies below 520 MHz use a LC tank circuit. The power supply to the VCO consists of an 8-volt regulator and active filter for maximum noise rejection. It is controlled by the Micro Controller through SKD-7, which connects to switch TR6. For standard modulation, transmit audio is fed on SKD-8 to the conventional point of the VCO varactor. For 2 point modulation, audio is also fed via SKD-19 to the voltage control pin of the VC-TXCO, this in effect cancels out the PLL error that would otherwise have occurred for low audio frequencies, hence resulting in a flat VF response.

4.2 Receiver Module

Refer:

Receiver Block Diagram:	BD001
Receiver Front End Circuit Diagram:	CS003-2
Receiver IF Circuit Diagram:	CS003-1 (Rev F)
	CS017-1 & CS017-2 (Rev G-I)
RX VCO Circuit Diagram:	CS005-1 (Band A to Q)
	CS012-1 (Band R to X)

The receive signal from the antenna enters on CN1 a 3 section Bandpass filter which provides the initial filtering for the front-end amplifier. The front-end amplifier IC12 is a broadband high performance MMIC with a gain of 18dB, noise figure of 3dB and 3rd order intermodulation intercept of +36dB. A 4dB pad and a second 3 section BPF follow this, and a high level double balanced mixer M1.

The receiver uses high side local oscillator injection for bands A to M and low side injection for all other bands. RF from the VCO main output on SKT-6 is buffered and amplified to +17dBm by IC4 and injected in the high level mixer which down converts the signal to the first IF frequency of 90 MHz (45MHz for bands A, B and 70MHz for bands A4). This IF signal from the mixer is terminated by a bi-directional constant impedance network and is then amplified by a bipolar amplifier TR2 with a gain of 15dB and 3rd order intermodulation intercept +35dB. This provides a high degree of intermodulation rejection for the receiver. A 4-pole crystal filter FL3A/B with its associated matching networks follows this stage. The signal is further amplified and filtered by a transistor amplifier TR3 and its associated 2 pole crystal filter FL4 before being fed into the main IF demodulator chip IC1 with a second IF frequency of 455kHz. The resulting audio is passed out to the Micro Controller board on SKD-3. The Received Signal Strength Indication (RSSI) from IC1 is buffered by IC5A and connected to the Micro Controller board via SKD-4.

RF from the VCO on SKU-1 at a nominal level of +3dBm is applied to the fractional-N synthesiser (IC10) main divider input. This signal is compared with the reference oscillator frequency and the correction voltage from the synthesiser's charge pump output is filtered then amplified by the non inverting low noise op amp (IC11A). This correction voltage is fed back to the VCO to maintain loop lock as well as being fed to the Micro Controller via SKD-14. A lock detect signal from IC10 is also fed to the Micro Controller via SKD-16. The op amp uses a 25 volt power supply (generated on the Micro Controller) so as to provide a wide tuning range voltage to the frequency control varicaps located on the VCO board. Frequency programming data for the receiver is sent to the synthesiser chip from the Micro Controller via the a serial data line on SKD-18 under the control of the Clock (SKD-15) and Strobe (SKD-17) lines

The Micro Controller through an enable signal on SKD-8 controls the local oscillator signal to the mixer. This signal switches the supply to the local oscillator amplifier and is used to enable or disable the receiver.

Provision is made for the optional injection of an external reference frequency. If this option is selected CN3 is fitted.

4.3 Power Amplifier Module

The MX800 now supports Spectra Engineering new full switching bandwidth Power Amplifier Module (Wide Band PA). Which requires no tuning, equals, exceeds or covers several of Spectra's band allocations, (refer to section 7.4 for details of the band allocations). This new generation Power Amplifier features much wider RF Bandwidth, higher efficiency, greater stability out of band and to zero power levels.

This PA is now being rolled out as the standard production PA.
Please see superseded technical section 8.1.1 for older hybrid type PA.

Wide Band PA (50 Watt Model)
RF from the Exciter passes via a coaxial cable to the input of the PA Module and is first attenuated by a 50 ohm pad, which is used to provide a good 50 ohm source impedance for the first LDMOS driver amplifier. The RF is amplified to around 5 Watts at the driver output, and is band dependant. Note: this point does not have 50-ohm impedance and the drive power cannot be measured directly with a 50 ohm Wattmeter. The signal from the driver is then matched by a broadband network to drive the low input impedance associated with the final transmit LDMOS power amplifier transistor. The transistor's low Drain impedance is then also matched back to 50 ohms by a broadband matching network covering a very wide bandwidth. Prior to transmission, a low loss 13 element elliptical low pass filter, filters out the unwanted harmonics to less than –90 dBc.

A dual directional coupler consists of coupled microstrip transmission lines fabricated on the PCB artwork. The sampled RF energy is rectified to provide a proportional DC voltage output.

The PTT signal enables the amplifier circuit by providing bias to the transistors. A thermistor TS1, physically located on the PA heatsink monitors the heatsink's temperature and is monitored by the Micro Controller.

4.4 Micro Controller Board

Refer:

Block Diagram	BD003 (Rev A to H)
	BD005 (Rev I upwards)
Circuit Diagram	CS001-1/6

The MX800 Micro Controller Board has 4 main functions
- Overall radio management
- TX and RX signal processing
- RF power control
- User interface

4.4.1 Overall Radio Management

In addition to analogue signal processing circuitry the Micro Controller board accommodates an 80C552 microprocessor IC1, a 64kbyte EPROM IC3, 32kbyte RAM IC4, a 16kbyte EEPROM as well as address decoding, I/O latches and other miscellaneous circuitry. The Micro Controller is responsible for ensuring that the radio acts as programmed by the user. It stores the user-entered parameters for each channel in EEPROM. This information includes RX and TX RF frequencies; RX and TX CTCSS frequencies as well as RF output power and operating mode. An 8-channel analogue to digital converter allows the microprocessor to read 8 analogue values internal to the radio, which in conjunction with the digital inputs to the microprocessor allow the operating status of the radio to be monitored and controlled.

The following analogue items are read:

Port	Parameter
ADC0	Received Signal Strength Indication (RSSI)
ADC1	Detected Discriminator output level
ADC2	DC operating voltage
ADC3	RX VCO tuning Voltage
ADC4	TX VCO tuning Voltage
ADC5	PA temperature
ADC6	PA forward power
ADC7	PA reflected power

Table 4-1 Microprocessor Port Parameters

The Micro Controller sends programming data to the synthesiser ICs on the Receiver and Exciter modules each time the channel is changed as well as on PTT. This information is communicated to the Receiver and Exciter modules by way of bussed data and clock lines on SKC/D-18 and SKC/D-15 (Exciter/Receiver) and an individual module strobe on SKC/D-17. A lock detect signal from each module on SKC/D-16 is read by the micro controller.

In addition to the synthesiser programming bus an I^2C bus goes to each of the modules. This bus is currently unused.

IC25 is a non-predictive, full duplex CTCSS encoder/decoder, which is under the control of the microprocessor.

4.4.2 TX Signal Processing

TX audio may be sourced from a number of different paths. These include VF from line, Talk through audio, the microphone, and DC FM/Wideband input, Tone generator from micro controller, Test TX VF inject from the Monitor port, CTCSS generator and the internal RF modem.

The TX VF path is readily user configurable with most major functional blocks being possible to either select or bypass by means of links (refer to 2.2.2.1 for details of link settings). The VF from line enters the board on SKH-14 and RV4 (TX VF gain) provides gain adjustment to accommodate different line levels. This is followed by a selectable compressor (IC34A) with 30dB dynamic range. The output of the compressor apart from being fed to the main TX audio path is also connected to the input side of the 'Line' FFSK modem and via a gain control pot the speaker amp (IC60). Following the main TX audio path, IC36B serves to switch the VF further on the TX audio path or, under the control of the external input on SKH-13, to loop it back to the line output via RV7 which provides level adjustment for the looped back signal. From this switch the VF passes though a second switch IC32B under the control of the Micro Controller and the external TX talk line on SKH-10. This switch is used to disable the line TX VF path. From here the VF passes through a pre-emphasis stage C66, R67 and a 300Hz high pass filter (IC30B and IC29A) each of which is selectable through links. The output of this filter is fed to IC30A a summer/limiter amp.

The summing point of this amp also serves to combine the audio from the talk through path which is level adjusted by RV3, the microphone which is processed through a similar compression, preemphasis and filtering chain as the line VF, the tone (Morse code) signal from the microprocessor, the DC FM input which enters the board on SKH-6 and the Test TX VF injection from SKE-2. The latter three inputs are all at fixed levels. RV2 on IC30A provides overall gain adjustment. Following the limiter amp is the TX VF low pass filter. The standard Bessel filter has a 3.4kHz cut off frequency. A second summing amplifier IC24B follows which combines the CTCSS, optional modem (IC52 and IC54) and Wideband audio inputs with the TX VF. Level adjustment of the CTCSS signal is in three 0.85dB steps either above or below the nominal level (10% of max dev). These level steps are set up using the Configure screen of MXTOOLS. The output of this final stage is fed to two microprocessor-controlled digipots, which serve to adjust the modulating signal level to the VCO and the reference oscillator. A third digipot is used to provide an offset null for the reference oscillator centre frequency. Adjustment of these levels is also by way of MXTOOLS using the Channel Edit screen.

4.4.3 RX Signal Processing

In a similar fashion to the TX audio path the major functional elements of the RX audio path are capable of being selected or bypassed by means of links.

Discriminator audio enters the board on SKD-3 and is fed to a selectable 300Hz highpass filter comprising IC37 and IC38B. This output or an unfiltered version of the discriminator audio is fed via a switch IC32A to the TTR path. The switch is used to disable talk through audio under the control of the microprocessor and the external TX talk line on SKH-10. Following the HPF a selectable 3.4kHz cut-off low pass filter IC38A and IC39B connects to the de-emphasis circuit IC39A. From here the audio passes through the mute switch IC32C that is under control of the microprocessor and on to the RX talk switch IC36C, which is controlled externally from SKH-3. This second switch is used to disable RX audio to line. A final switch IC36A selects between RX audio and TX looped back audio for output to line via amplifiers IC40A and IC40B. Secondary inputs to these amplifiers are the TX audio from the line modem and microphone audio to line. The output on SKH-2 forms an unbalanced 600Ω VF output to line and, alternatively, outputs SKH-2 and SKH-11 form a differential output.

Discriminator audio is also fed via a low pass filter IC31 to the CTCSS decoder as well as to a level detector D9 the output of which is connected to ADC1 on the microprocessor.

Discriminator audio is also fed to the mute detection circuit. This comprises a high pass filter IC41 followed by RV6/6B, which sets the mute threshold. Following amplification by IC42A and rectification by IC42B and IC43A a comparator, IC43B, determines when the detected signal passes a fixed threshold. The output of the comparator is fed to the microprocessor and via a selectable inverter to SKH-4.

Discriminator audio is also fed to RX port of the RF modem IC54.

4.4.4 RF Power Control

Forward power is controlled by the microprocessor through two mechanisms. Based on pre-programmed per channel adjustments the microprocessor sets the digipot IC10 to a reference setting. IC23A serves as a comparator and, with the non-inverting input connected to the wiper of the digipot, is set up with a reference voltage. The detected actual PA forward power is fed to the inverting input of IC23A. The error voltage at the output of IC23A is fed to the exciter output power control circuit via SKC-4 and the action of the control loop is to set the RF power such that the actual detected volts equals the reference volts. The digipot setting is static for each channel unless the required forward power is changed.

The voltage to the top of the digipot is set up by the microprocessor through the Pulse Width Modulator output PWM1. On PTT the ON duty cycle of the PWM1 output is progressively increased and the filtered result of this forms a ramp to the top of the power control digipot. Once 100% duty cycle is reached full power is produced. This results in a fast but controlled RF power rise characteristic.

4.4.5 User Interface

All user interfaces to the MX800 except the RF connections is made by way of the Micro Controller board.

Output latch IC18 drives the six LED indicators on the front panel. The function is described in section 1.1.1.

Input latch IC14 serves to accept the programmed status of the 8-bit binary channel select DIP switch SW1. Refer section 7.3 for programming instructions.

Input latch IC13 serves to accept the programmed status of the 6-bit binary mode select DIP switch SW2. Refer section 2.2.2.2 for mode selection instructions.

Input latches IC48 and IC47 provide two eight bit +5V CMOS compatible digital input ports (ports A and B respectively). The inputs may be either internally pulled high and active low or internally pulled low and active high. Port B inputs are configured as external channel select inputs. The inputs are buffered by 10kΩ series resistors.

Output latch IC46 provides 8 uncommitted +5V CMOS compatible digital outputs. Each output is buffered by a 1kΩ series resistor.

IC60 is a 1-Watt speaker amplifier, which drives the internal speaker. This IC includes the volume control function connecting to the front panel.

Microphone audio is fed via amplifier IC61A to a compressor (IC34B). This VF is pre-emphasised and filtered before being fed to the main TX VF path.

IC22 provides CMOS to RS232 conversion for the serial port.

5. Alignment and Testing

The MX800 test and alignment procedures are divided into two main sections. The first section is a transceiver level procedure, which assumes that the radio is fitted with working modules. The second section contains the individual module test procedures.

5.1 Transceiver Setup, Calibration and Alignment

This section explains how to setup, calibrate and align the complete MX800 Base Station. A number of procedures are required to fully initialise the MX800. The following test equipment will be needed:

MXTOOLS (MX800 Base Station Programming Utility)

RF Test Set (HP 8920) or equivalent

CRO (Cathode Ray Oscilloscope)

RF Power Meter (Watts)

RF Signal Generator

Multimeter

+13.8V DC power supply

The order of some, but not all, of the procedures is important to ensure correct setup of the radio. The order of the procedures as described is recommended and those that are critical are mentioned. If the radio has been previously setup and the user intends to recalibrate and align the radio then steps 5.1.1, 5.1.2 and 5.1.3 can be ignored as the model number, serial number, configuration and channel information will have already been loaded.

5.1.1 Sending Model Number and Serial Number to the Radio

The model number is entered or updated using MXTOOLS. To edit the model number select ‘Radio Model Number’, under the ‘Setup’ menu. This brings up a dialog box that the user can then enter the model number, according to the configuration of the radio.

The user cannot alter the serial number, as this is factory set.

5.1.2 Sending Configuration Information

Firstly the configuration file for the radio needs to be setup. Using MXTOOLS the configuration information needs to be filled out on the Configuration Screen. This information needs to be saved to a configuration file. If an existing radio already contains the desired configuration then this configuration can be downloaded and saved. This configuration information then needs to be 'Sent to the MX800'. A warning message will appear that indicates that the MX800 Base Station has not yet been calibrated, this may be ignored.

Once the configuration information has been sent then all of the programmable parameters within the MX800 Base Station are initialised.

5.1.3 Sending Channel Information

The channel information setup is similar to that of the configuration. The channel frequencies, subtones and other parameters are setup in the Channel Screen in MXTOOLS. At this stage it is not necessary to set the values of the digital potentiometers. This will be done in the following procedures. After entering in the channel details this information then needs to be saved to a file. If another radio already contains the desired frequencies then these can be downloaded from that radio and saved to a file. The digital potentiometer values from one radio to the next will differ so it is advisable to save the information in a new channel file and not save over the top of any backup copies of existing radios. The saved channel information is then sent to the MX800.

After sending the configuration and channel information the MX800 is fully programmed and will now operate. Without sending both the configuration and channel information the radio will not function, and thus the following procedures will not be able to be completed.

Note *The buttons for sending and loading of channel information may be disabled if MXTOOLS did not successfully 'Connect to MX800'. If this is the case simply choose to 'Connect to the Radio' after the configuration information is sent.*

5.1.4 Setting Alignment Channel

When setting up the radio it is recommended that all measurement and adjustments are done on a channel that is in the centre of the frequency spread of the channels. This minimises any errors due to frequency changing. Alternatively if the frequency spread of the channels is too large then you may wish to calibrate and align every channel. (In most cases this will not be necessary.) Both individual and group alignment will be covered.

The channel may be selected via the Channel Screen in MXTOOLS using the software channel select or in hardware via the internal channel DIP switch or via the rear channel select. (Refer to section 2.2.2.3 for additional help.) This channel will then be used when performing the following procedures.

5.1.5 Power Calibration

DO NOT USE THIS PROCEDURE TO SET THE TX OUTPUT POWER. REFER SECT 5.1.8 TX POWER ADJUST TO DO THIS.

Power calibration affects the forward and reflected power meters on the Diagnostics Screen as well as the low forward power trip point for the MX800. This procedure requires a power meter and the relevant leads to connect the transmitter output to the meter. Power calibration is done using MXTOOLS via the Calibration Screen. To complete the power calibration, follow the instructions that MXTOOLS provides.

Once power calibration has been completed the configuration information must be sent again. Check that the low forward power trip point is set correctly. The calibration affects the low forward power trip point and thus the configuration information must be sent to update it according to the new calibration information.

5.1.6 RSSI Calibration

The RSSI calibration is used to calibrate the RSSI meter on the MXTOOLS Diagnostics Screen. The procedure requires an RF signal generator and the relevant leads to connect the signal generator to the RF input of the MX800 Base Station. RSSI calibration is done via the MXTOOLS Calibration Screen. To complete the RSSI calibration, follow the instructions that MXTOOLS provides.

5.1.7 Temperature Calibration

The temperature calibration is used to calibrate the temperature meter on the MXTOOLS Diagnostics Screen and the temperature controlled switch/alarm points. The procedure requires dummy cable for SKB on the micro controller having a 2060-ohm resistor between pins 4 and 6 of this connector of the MX800 Base Station. Temperature calibration is done via the MXTOOLS Calibration Screen. To complete the temperature calibration, follow the instructions that MXTOOLS provides.

5.1.8 TX Power Adjustment

The transmitter power setup is used to set the correct power for each channel. This can be done on a per channel basis or all channels can be set at once. Power setup is done using the Channel Screen in MXTOOLS. To complete this test the transmitter output needs to be connected to a power meter.

To set all channels at once select the 'Lock Data' option on the Channel Screen. Click on the alignment channel to bring up the Channel Edit Screen and allow editing of the channel parameters.

Note *If the 'Lock Data' option is selected then any changes made to the current channel are duplicated on all channels.*

Select the 'Continuous Update' option on the Channel Edit Screen. This allows real time updating of the potentiometer values to the radio. Thus any changes made will be immediately reflected in the radio. Alter the Transmit Power potentiometer until the power meter reads the required output power. Choose 'OK' to accept the changes made and then from the Channel Screen choose 'Send Data to MX800'. This then saves the changes that you have made to the radio.

To calibrate each channel individually make sure the 'Lock Data' option is not selected and repeat the above procedure for each channel.

5.1.9 Peak Deviation and Modulation Balance

This procedure is used to set the peak deviation and modulation balance for each channel. This can be done on a per channel basis or all channels can be set at once. The alignment is done using the Channel Screen in MXTOOLS. To carry out this procedure the demodulated output of the transmitter output needs to be connected to a CRO or some other piece of equipment giving a visual display of the demodulated output. IF Bandwidth of the RF test set should be set at 20kHz or greater (230kHz on the HP 8920) and de-emphasise should be off. The audio filters should be set at <20Hz HPF and 15kHz LPF.

To alter all channels at once use the 'Lock Data' option as described in the power setup procedure. The correct peak deviation is dependent on whether the radio is narrow, medium or wide band and also whether the CTCSS option is installed. The following table specifies the peak deviation in each case.

Bandwidth	CTCSS Option	Peak Deviation (Hz)
Narrow (12.5kHz spacing)	YES	2150
	NO	2400
Medium (20kHz spacing)	YES	3440
	NO	3840
Wide (25kHz spacing)	YES	4300
	NO	4800

Table 5-1 Peak Deviation Settings

The setting of the peak deviation is done at 1kHz. The modulation balance is done at 400Hz. The transmitter modulating audio for this test is connected to the WB/DC-FM input with JMP8 set to 1-2. This input is located on the rear of the MX800, on the Line I/O connector pin 13 of the DB15F connector.

Procedure:

1. Disable the CTCSS if present. This is either done through the digital input port at the rear or temporarily disabling it in the Channel Information Screen.
2. PTT transmitter.
3. Set the transmitter modulation frequency to 1kHz, +10dBm injected in through the WB/ DCFM input, CN1 pin13 with JMP8 set to 1-2. Note that signals injected into this port must be A/C coupled (1UF cap) as this point is biased at 2.5VDC.
4. Adjust the VCO Deviation digital potentiometer using MXTOOLS until the correct deviation is obtained. (See Table 5-1 Peak Deviation Settings).
5. Set the transmitter modulation frequency to 400Hz, +10dBm, injected in through the WB/ DCFM input.
6. Adjust the Reference Deviation digital potentiometer until the top of the waveform is flat. If the waveform top droops increase the level (see Figure 5-1) and if it peaks reduce the level (see Figure 5-2).
7. Repeat steps 3 through to 6 until the correct peak deviation and modulation balance is obtained.

Examples of incorrect, observed waveforms are as follows:

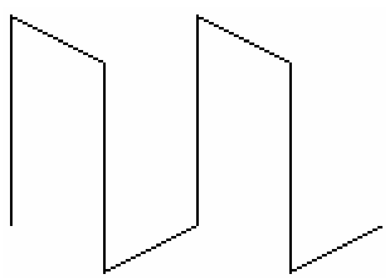


Figure 5-1 Under (increase level)

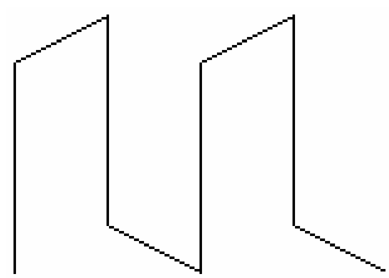


Figure 5-2 Over (decrease level)

The waveform when correctly aligned should look as follows:

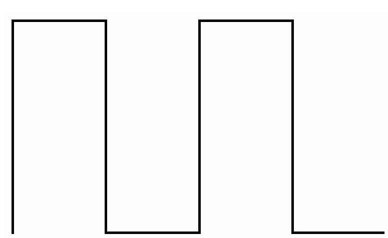


Figure 5-3 Correctly Aligned Waveform

Choose ‘OK’ to accept the changes made and then from the Channel Screen choose ‘Send Data to MX800’. This then saves the changes that you have made to the radio.

After balancing and setting the correct peak deviation is necessary to align the reference oscillator and re-check the deviation alignment, as the reference oscillator alignment affects the deviation. This may require running through the deviation alignment again after the oscillator alignment procedure.

5.1.10 TX Centre Frequency Alignment

The reference oscillator alignment is used to set the correct centre frequency for each channel. This can be done on a per channel basis or all channels can be set at once. Oscillator alignment is done using a digital potentiometer adjustment through the Channel Screen in MXTOOLS. To carry out this procedure the transmitter output needs to be connected to a RF test set displaying the frequency error. This procedure should be done after the deviation alignment procedure has been done. Transmitter modulation should be disabled.

To alter all channels at once use the ‘Lock Data’ option as described in the power setup procedure. Alter the Reference Oscillator Frequency potentiometer until the channel is “on frequency”. Choose ‘OK’ to accept the changes made and then from the Channel Screen choose ‘Send Data to MX800’. This then saves the changes that you have made to the radio.

To calibrate each channel individually make sure the ‘Lock Data’ option is not selected and repeat the above procedure for each channel.

5.1.11 TX Line Input Level and Nominal Deviation Alignment

There are three manual potentiometers associated with the TX deviation on the motherboard. These are set by injecting the correct audio levels and adjusting the potentiometers. The transmitter modulating audio is to be connected to either the WB/DC-FM input or the TX VF input as described in the procedures.

The required nominal deviation is dependent on whether the radio is narrow, medium or wide. The following table lists the required level for each case:

Bandwidth	**FM Deviation (kHz)**
Narrow (12.5kHz spacing)	1.5
Medium (20kHz spacing)	2.4
Wide (25kHz spacing)	3.0

Table 5-2 Nominal Deviation

The first potentiometer RV2 sets the TX Limiter Gain. The transmitter modulating audio for this test is connected to the WB/DC-FM input with

JMP8 set to 1-2. This input is located on the rear of the MX800, on the Line I/O connector pin 13 of the DB15F connector

Procedure:

1. PTT the transmitter.

2. Set the transmitter modulation frequency to 1kHz, 1Vp-p injected in through the WB/ DCFM input, CN1 pin13 with JMP8 set to 1-2. Note that signals injected into this port must be A/C coupled (1UF cap) as this point is biased at 2.5VDC.

3. Adjust TX Limiter gain RV2 to obtain the nominal deviation. .

   OR

   (T98 Adjust TX Limiter gain RV2 until onset of clipping of waveform peaks)

The potentiometers RV4 & RV1 sets the TX VF line input level and nominal dev respectively. The transmitter modulating audio for this test is connected to the TX VF input. This input is located on the rear of the MX800, on the Line I/O connector pin 9 of the DB15F connector

Procedure:

1. PTT the transmitter.

2. Set the transmitter modulation frequency to 1kHz, at nominal line input level (-10dBm is default level) injected in through the TX VF input.

3. Adjust TX VF gain RV4 to onset of compression

   OR

   For T98 option adjustment.

   Set the transmitter modulation frequency to 1kHz, at 4db above nominal line input level (-6dBm for -10dBm default level) injected in through the TX VF input. Adjust RV4 for the onset of compression.]

4. Set the transmitter modulation frequency to 1kHz, at nominal line level (-10dBm) and adjust RV1 to obtain the nominal deviation.).

The third potentiometer RV3 sets the TTR Gain.

Procedure:

1. Remove TX PTT.

2. Enable the repeater. The repeater may be enabled by turning on switch 4, of DIP2, inside the radio. Alternatively the repeater may be enabled/disabled via the repeater enable pin 8 of the Line I/O connector. The polarity of the repeater enable function is dependent on how the internal LIFULOCEN jumper is set (JMP14).
3. Set the receiver modulation frequency to 1kHz and the FM deviation to that specified in Table 2 - Nominal Deviation, for the particular RF receive frequency of the test channel.
4. Adjust TTR Deviation RV3 to obtain the same deviation as input to the RX. (See Table 5-2 Nominal Deviation).

Note *The test channel must be programmed as a repeater channel so this potentiometer can be setup. If not then temporarily alter the channel settings using the Channel Edit Screen in MXTOOLS.*

5.1.12 RX Line Output Level Adjustment

The fourth potentiometer RV5 sets the RX Line output level.

Procedure:

5. Disable the repeater (switch SW4/DIP2 OFF).
6. Using a 600ohm termination monitor RX line output level. This output is located on the rear of the MX800, on the Line I/O connector pin 15 of the DB15F.
7. Set the receiver modulation frequency to 1kHz and the FM deviation to nominal for the particular RF receive frequency of the test channel.
8. Adjust Line Output level RV5 to obtain nominal line output level (-10dBm is the default level).

5.1.13 TX VF Loop Back Level

Under control of the TX VF Loopback Control line (LIFUSEN) the TX line input may be looped back to the RX Line output. The fifth potentiometer RV7 sets the loop-back level.

Procedure:

9. Enable the TX VF Loopback using JMP9.
10. Set the transmitter modulation frequency to 1kHz, -10dBm, injected in through the TX VF input.
11. Adjust RV7 to obtain an RX Line output level of –10dBm.
12. Restore JMP9

5.1.14 Mute Threshold Setting

The Mute Threshold Setting RV6 is used to set the level at which the mute opens.

Force the mute open using the Remote Screen in MXTOOLS.

Inject the correct RF frequency into the receiver for the test channel.

Set the receiver modulation frequency to 1kHz at nominal deviation.

Alter the amplitude of the RF signal until the RX audio has an 8dB SINAD.

Set the mute back to normal using the Remote Screen in MXTOOLS.

Adjust the mute level potentiometer, RV6, until the mute opens then wind it back until it just closes.

5.2 Module Level Test Procedures

The following alignment and testing procedures are based upon using a working transceiver as the test environment. It is also assumed that test fixtures to the radio are available to exercise control lines and monitor outputs and that a PC with MXTOOLS is connected to the radio.

There are four modules in the MX800 - the Exciter, Receiver, Power Amplifier and Micro Controller. The Exciter and the Receiver have VCO daughter boards. Receiver and Exciter VCO's are similar.

5.2.1 Exciter Module

Test Equipment:

Tested MX800 with Exciter removed

Tested TX VCO board (in wanted band)

PC with MXTOOLS software

RF Communications test set

Multimeter

Oscilloscope

+13.8VDC power supply

Preliminaries:

Program upper, middle and lower frequencies of band (refer section 7.4 for band split details) into 3 channels in MXTOOLS channel screen
(Note that 'Continuous Update Enabled' on the MXTOOLS channel screen should be ticked for these tests).

Remove top cover from Exciter module under test and fit known working VCO tuned for the band to be tested.

Connect Exciter to working Micro Controller via 16-way ribbon cable.

Disconnect Exciter RF drive output CN1 from PA.

13. Switch DC power on and check that the output voltage on pin 1 of IC5 is 5V +/- 0.2V and that the output voltage on pin 1 of IC3 and IC8 is 8V +/-0.2V. Assert PTT and check that 8V is switched through to SKU-3.
14. Check reference oscillator signal on centre pin pad of CN3 is > 3Vp-p.
15. Select mid channel. Connect comms test set RF input port to CN1. Assert PTT and check that Lock Detect (LD) on SKD-16 goes high indicating that the loop is locked. Check that the power control volts on SKD-4 is >10V and that the RF output on CN1 is >300mW. In the channel screen on MXTOOLS adjust the power digipotentiometer slider to 0 and check that the power control volts on SKD-4 goes to 0 and that the RF power out drops to <1mW. Set digipotentiometer slider back to mid position.

16. Select lowest channel. Assert PTT, check that LD goes high and check that the VCO tuning volts on SKD-14 is > 2V. Select highest channel. Assert PTT, check that LD goes high and check that the VCO tuning volts on SKD-14 is <18V. Check that RF output is >300mW in both cases.
17. Select mid channel. Assert PTT, note RF output carrier frequency and check that by adjusting the Reference Oscillator Frequency digipotentiometer slider on the MXTOOLS channel screen that the carrier frequency can be adjusted + and - 3ppm of the nominal frequency.
18. Select mid channel. Assert PTT carry out 5.1.9 of the TX VF alignment procedure to check the function of the VCO and Reference oscillator modulation inputs.

5.2.2 Receiver Module

Test Equipment:

Tested MX800 with Receiver removed

Tested RX VCO board (in wanted band)

PC with MXTOOLS software

RF Communications test set

Spectrum analyser with tracking generator

Multimeter

High frequency (89.545MHz) pick up loop.

Oscilloscope

+13.8VDC power supply

Preliminaries:

Program upper, middle and lower frequencies of band (refer section 7.4 for band split details) into 3 channels in MXTOOLS channel screen
(Note that 'Continuous Update Enabled' on the MXTOOLS channel screen should be ticked for these tests).

Remove top cover from Receiver module under test and fit known working VCO tuned for the band to be tested

Connect Receiver to working Micro Controller via 16-way ribbon cable.

Procedure:

The test procedure for the Receiver is divided into the front-end alignment and the IF alignment procedures.

Front End Alignment:

16. Switch DC power on. Check that the output voltage on pin 1 of IC8 is 5V +/- 0.2V, on pin 1 of IC2 is 8V +/-0.2V, on output of IC9 (on C66) is 8V +/- 0.2V and on pin 1 of IC3 is 9V +/- 0.2V.
17. Remove jumper E and D. Install jumper C. Connect tracking generator output to CN1 and spectrum analyser input to CN4. Set tracking generator to sweep the band. Adjust A4, A10 and A16 for a symmetrical passband around the band centre frequency. Check that the gain over the band is 12dB and that the ripple is <+/- 1.5dB. Check that the attenuation at the first IF image is >50dB.
18. Remove jumper C and I. Install jumper E and H. Connect tracking generator output to CN4 and spectrum analyser input to CN5. Set tracking generator to sweep the band. Adjust B4, B10 and B16 for a symmetrical passband around the band centre frequency. Check that the maximum loss over the band is < 3dB and that the attenuation at the first IF image is >50dB.
19. Remove jumper E. Install jumper D. Connect spectrum analyser input to CN5 and tracking generator output to CN1. Set tracking generator to sweep the band. Check for symmetrical passband around band centre frequency. Check that the gain over the band is 10dB and that the ripple is <1.5dB. Remove Jumper H. Install Jumper J.

IF Alignment:

20. Select the mid channel. Check that LD on SKD-16 goes high indicating that the synthesiser is in lock. Remove S3 (0Ω local oscillator connection to mixer) and solder a 50Ω coax test lead across C60 position (note C60 position is near a retaining screw and C60 is not fitted). Connect a comms test set to this lead and check that RF local oscillator power is +17dBm +/- 2dB. Measure local oscillator frequency, this should be F_{RX} -90MHz. Using a non-metallic trimmer tool carefully adjust the TCXO (X2) frequency until the correct frequency is obtained. Remove the test lead and solder S3 back in position.
21. Place the high frequency pick up loop in close proximity to IC1 in order to pick up the second IF oscillator frequency (note do not probe directly on the chip as test lead capacitance will affect oscillator frequency). Adjust CT1 for 89.545MHz.
22. Inject an RF signal at -80dBm (unmodulated) at F_{RX} into CN5 (Jumper I out, Jumper J in). Measure DC voltage at VF output SKD-3, adjust L14 for 2.5VDC on this point.
23. Inject an RF signal at -80dBm with standard modulation at F_{RX} into CN5, monitor line RX out and adjust T1 and T2 for minimum distortion. Reduce RF signal level and check that sensitivity is better than -112dBm for 12dB SINAD.

24. Remove Jumper J and fit Jumper I. Inject an RF signal with standard modulation at F_{RX} into CN1, monitor line RX out and check that sensitivity is better than -117dBm for 12dB SINAD. Repeat test for band upper and lower frequencies.

5.2.3 Power Amplifier Module

Test Equipment:

Tested MX800 with PA removed

PC with MXTOOLS software

RF Power Meter

RF Signal Generator

Multimeter

+13.8VDC 15A power supply

Preliminaries:

Program upper, middle and lower frequencies of band into 3 channels in MXTOOLS channel screen.

(Note that 'Continuous Update Enabled' on the MXTOOLS channel screen should be ticked for these tests)

Do not connect Exciter RF drive output CN1 to PA.

Procedure:

25. Remove PA top cover. Measure resistance of thermistor between CN4-6 and CN4-4, this should be approximately 2kΩ. Connect DC power lead and 10-way connector from MX800. Connect PA RF output to RF power meter and PA RF input (CN1) to RF signal generator.
26. Set signal generator to centre frequency of PA under test and reduce RF drive level (from signal generator) to zero. Switch DC power on and check that supply is present on L6. Assert PTT (check that no output RF power is emitted from the PA) check that the 13.8V supply is switched through to source of TR1 and TR2.
27. With PTT ON measure the PA bias current at the Gates of the FET's. The Bias current is band dependent. This is done by monitoring the current drain of the whole PA with CN1 disconnected. Link the gate of TR2 to GND. Measure current consumption (VHF Low Band 400mA, VHF High Band 200mA ,UHF 400mA.) This can be adjust by RV2. Measure gate volts ≈ 3.4V
    Remove link from TR2. Measure current consumption, adjust RV1 so that current is 2Amp total (VHF High & UHF) and for VHF Low 1Amp. Measure gate volts ≈ 3.9V
28. With PA transmitting at 50W into 50Ω load measure DC volts FWD power sense CN4-8 and REFL power sense CN4-5. These voltages

should be approx. 2.8V and <250mV respectively. Reduce RF drive until PA output is 10W and disconnect PA RF output cable. Measure DC voltage on CN4-8 and CN4-5 again. These should now both read lower approximately 1V. Remove PTT.

5.2.4 VCO Board

Test Equipment:

Tested MX800 with Exciter VCO removed

PC with MXTOOLS software

RF Communications test set

Multimeter

Oscilloscope

+13.8VDC power supply

Preliminaries:

Program upper, middle and lower frequencies of band (refer section 5.4 for band split details) into 3 channels in MXTOOLS channel screen. (Note that 'Continuous Update Enabled' on the MXTOOLS channel screen should be ticked for these tests)

Remove top cover from Exciter module and fit VCO under test. As the TX and RX VCO's are identical the RX VCO may also be tested in an exciter. As the receiver VCO operates at F_{RX} - 90MHz the frequencies

Connect Exciter to working Micro Controller via 16-way ribbon cable.

Disconnect Exciter RF drive output CN1 from PA.

Procedure:

1. Select mid channel. Connect SKU from exciter to VCO, switch DC power on, assert PTT and measure RF output power on VCO SKT-6. This should be 0dBm to +3dBm. Measure RF output level on SKU-1. This should be 0dBm to +3dBm (Note that if SKU-1 is disconnected from the exciter the loop will lose lock). Reconnect SKT and SKU to exciter.
1. Select lower channel. Assert PTT and check that loop is locked. Adjust trim cap CT1 on VCO for 3VDC (2VDC for N2 band) on SKT-1. Select upper channel. Check that the loop is locked and that the voltage on SKT-1 is <18VDC.
1. The following test is not required for the RX VCO. Connect Exciter output to comms test set. Inject 1kHz tone at nominal line input level and check that Exciter RF output is modulated and that the depth of modulation can be controlled through the MXTOOLS channel screen.

5.2.5 Microcontroller Module

Comprehensive testing of the Micro Controller can only be carried out at the Factory. The procedures in sections 5.1.10 to 5.1.13 provide alignment instructions for the workshop adjustable parameters.

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6. MX800 Base Station Fault Finding Procedure

The following test equipment may be required for the following tests:

MXTOOLS (MX800 Base Station Programming Utility)

RF Test Set (eg HP 8920 or equivalent)

CRO (Cathode Ray Oscilloscope)

RF Power Meter (capable of measuring to 60 Watts continuously)

Multimeter

+13.8V DC Power Supply (capable of supplying 15Amps)

Network Analyser

MX800 test jig (Optional)

6.1 MX800 Base Station

(The following tests will help diagnose faulty modules)

Check that all of the required connections to the MX800 Radio are made.

Check that all of the interconnecting cables to each of the modules and to the Motherboard are correctly installed.

Check voltage supply to the MX800 by measuring both sides of Fuse 1 located on the Microcontroller PCB. Replace fuse if necessary.

Check that the power LED is lit. If not then go to section 6.2.

Using MXTOOLS check that the frequency tables and configuration settings are correct.

6.1.1 Transmitter Section

Connect the output of the Power Amplifier Module to a Comms test set or a RF power meter.

Using MXTOOLS Diagnostic's check the TXVCO locking voltage is between 2 – 18 V and there is no TXVCO 'Unlock' alarm displayed.

If the locking voltage is out of spec or an 'Unlock' alarm is displayed then go to section 6.4

Key up the transmitter using the software PTT in MXTOOLS or by shorting pins 10 (Earth) & 12 (PTT) of CN1 the 15-way connector at the rear of the radio to ground.

If the output power of the MX800 is LOW then using MXTOOLS check that the 'Transmit Power' control is not on a low setting.

Adjust the 'Transmit Power' control towards maximum looking for an increase in the RF power output level. If there is no substantial change go to the diagnostics screen and check that the Forward power and the Reflected power levels are not abnormal. **NOTE**, *if there is a high reflected power indication the MX800 firmware would hold the PA power low.*

If the Diagnostics shows abnormal, then check the voltage on pin 62 of IC1 on the Mother Board. If the voltage is low i.e. <200mV then the likely fault is IC1. If the voltage is >200mV then the likely fault is within the PA module.

If the Diagnostics shows normal, then check the RF level from the Exciter module by connecting a Power Meter directly to the Exciter RF connector. Adjust the ‘Transmit Power’ control in MXTOOLS to maximum, the RF level should be >+23dBm (200mW). If not go to section 6.4, if so the PA is probably faulty and go to section 6.5

If there is NO RF power output, check that the ‘Transmit Power’ control in MXTOOLS has not been set to zero (0) or is at a very low level. If **so,** apply a PTT and increase the power control until the desired power is achieved. If **not**, apply a PTT then check that pin 21 of IC1 is LOW, collector of TR3 is LOW and pin 13 of IC7 is HIGH. If these are OK, then the Exciter or PA may be faulty. Go to section 6.4, or section 6.5.

Inject a 1 kHz tone @ –10dBm via pin 9 of the 15-way connector at the rear of the radio and check for 1.5 kHz (NB)/ 3 kHz (WB) peak to peak demodulated deviation.

If the audio deviation is incorrect then go to the Transmitter alignment procedure in section 5.

If there is no audio modulation then check the audio level on pin 13, IC11on the Microcontroller PCB.

If there is no audio on the above test point then go to section 6.2 else go to section 6.4

6.1.2 Receiver Section

Using MXTOOLS Diagnostic’s check the RXVCO locking voltage is between 2 – 18 V and there is no RXVCO ‘Unlock’ alarm displayed.

If the Rx locking voltage is out of spec then go to section 6.3.

Inject a –60 dBm RF test signal on the receiver frequency modulated with a 1kHz tone @ 1.5 kHz (NB) / 3 kHz (WB) deviation into the RX Input connector on the rear of the radio.

Check for an audio signal @ -10dBm on pin 15 of the DB15 connector on the rear of the MX800.

If there is an audio signal @ -10dbm check the receiver for correct SINAD, SNR, Audio Distortion and Mute operation. Refer Section 6.3.

If there is no audio signal, inject the test signal directly into the RX module and re-test for an audio signal on the MX800 test jig.

Replace the RX input coax cable if faulty.

Check for an audio signal on pin 2 of SKK on the Microcontroller PCB. If the audio signal were not present then it would indicate a receiver fault, go to section 6.3.

If there were a signal present at this point then it would indicate a fault with the Mother Board audio or mute operation, go to section 6.2.

6.2 Microcontroller PCB

- Check fuse. If blown, replace with a 5x20 mm 3A fast blow fuse.
- Check all jumpers and switch settings are in the correct position for your requirements.
- The Microcontroller PCB requires specialised test software to check all the hardware input and output ports. Please return the Microcontroller PCB the your nearest Customer Service Centre.

6.3 Receiver Module

6.3.1 VCO Locking.

- Check all Hardware settings in MXTOOLS are correct.

Check the value of X3 (13 MHz or 14.4 MHz) is the same as the Rx Reference Freq. in the 'Hardware Settings' in MXTOOLS' configuration menu.

Connect a DVM (digital voltmeter) to the RX VCO TP and check the RX locking voltage is between 2 – 18 V at the RX VCO TP on the Microcontroller PCB.

Check that +12V(SKD-2) and 28V(SKD-13) supply lines are present.

If the RX locking voltage is out of spec then slowly adjust CT1 on the RX VCO a full 360°, and check for a change in the locking voltage.

If there is a change in the locking voltage then realign the VCO voltage to 9V at the centre frequency of the receiver band.

If there is no change in the RX VCO locking voltage, then check that the VCO supply voltage at SKU-3 is approx. 7V and with a CRO check the TCXO is oscillating on pin 8 of IC10.

If all the above tests do not pass then the VCO or IC10 may be faulty. Return the Receiver Module to your Service Centre.

6.3.2 RX Front End

Solder a 2-way Berg header onto a flying coax lead. Remove solder link I near the mixer (M1) and then fit solder link J. Inject a RF signal into CN5. Check the sensitivity is better than –110 dBm.

If the sensitivity is OK past this point, then check that the supply voltage to IC12 is approx. 8V. If the supply is OK, then replace IC12. If this does not repair the receiver then the alignment may be incorrect or other components on the front end may be faulty. Go to Section 5.2.2.

6.3.3 IF Section

If the Receiver has low sensitivity past this point then increase the RF level to –60 dBm and check the RX DISC voltage is set to 2.50V. Adjust L14 if necessary.

Connect a coax lead with a pickup loop around the end from the antenna input on the HP8920A to the case of X1. Set the HP8920 to TX test, change the Tune Mode to Manual and change the centre frequency of the comms test set to 44.545MHz for A to B Band and 89.545MHz for C Band and above.

If CT1 cannot be adjusted to match the above frequencies then X1 may be faulty.

Set the centre frequency of the HP8920A to the RX freq. + 45MHz for A to B band or RX freq. + 90MHz for C to M Band or RX freq. – 90MHz for N band and above.

Adjust the TCXO to within +/- 20Hz.

If the RX centre frequency cannot be adjusted the TCXO may be faulty.

Adjust T1 and T2 for minimum distortion, less than 1%.

If the distortion is high then FL3A, FL3B or FL4 may be faulty.

If the sensitivity is still poor then return the Module to your Service Centre.

6.4 Exciter Module

6.4.1 VCO Locking.

Check the reference frequency of X3 (13 MHz or 14.4 MHz) is the same as the TX Reference Freq. in the 'Hardware Settings' in MXTOOLS' configuration menu.

Connect a DVM to the 'TX VCO' TP on the Microcontroller PCB and check the TX locking voltage is between 2 – 18 V.

Check that +12V(SKD-2) and 28V(SKD-13) supply lines are present.

If the TX locking voltage is out of spec then slowly adjust CT1 on the TX VCO a full 360°, and check for a change in the locking voltage.

If there is a change in locking voltage, then realign the VCO voltage to 9V at centre frequency of the VCO frequency band.

If there is no change in the TX VCO locking voltage then check the VCO supply voltage at SKU-3 is approx. 7V and with a CRO check the TCXO is oscillating on pin 8 of IC 10.

If all the above tests pass then the VCO or IC10 may be faulty. Return the Exciter Module to your nearest Customer Service Centre.

6.4.2 RF Power

Using MXTOOLS increase the 'Transmit Power' control to maximum and check that the output power is greater than +24 dBm.

If the Exciter power is low, check for the +8 V supply voltage at the outputs of IC2 and TR4.

Use a RF probe to check for gain through IC2 and TR4.

Lift R2 and solder a flying lead to the junction of R1 and R2, check the output power of the VCO is between 0 and +3dBm.

If all the above tests pass, then return the Exciter Module to your nearest Customer Service Centre.

6.5 Power Amplifier

First do a visual check of all the components on the PA looking for any damaged components.

Connect the input of the PA to signal generator with the RF output switched off.

With PTT off measure the +13.8V supply at the Source of the driver and output FET . If out of spec then check voltage at CN2-2, no volts then check supply cable.

With PTT ON measure the PA bias current at the Gates of the FET's. The Bias current is band dependent. This is done by monitoring the current drain of the whole PA with CN1 disconnected. Link the gate of TR2 to GND. Measure current consumption (VHF High Band 200mA , VHF low And UHF 400mA.) This can be adjust by RV2. Measure gate volts ≈ 3.4V Remove link from TR2. Measure current consumption, adjust RV1 so that current is 2Amp total (VHF & UHF) and VHF Low 1Amp. Measure gate volts ≈ 3.9V

Connect the RF output Connector CN3 with a coax lead to a power meter. Turn ON the supply voltage and the signal generator RF output, PTT the PA and increase the generator output (*Don't exceed +24 dBm*) whilst measuring the output power output (≥50watts@ +24dBM).

If output power is low then turn the supply voltage OFF and lift one side of the capacitors connecting to the directional coupler and solder a flying lead to the lifted side. Connect the earth of the flying lead to the earth of the PA.. Connect Power metre to flying lead.

Turn ON the supply voltage and the signal generator RF output, PTT the PA and increase the generator output (*Don't exceed +24 dBm*) whilst measuring the output power output (≥55watts@ +24dBM).

If all the above tests didn't pass then the TR1 or TR2 may be faulty. Return to your nearest Customer Service Centre

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7. Appendices

7.1 MX800 Interface Connections

The user connections to the MX800 are all made via the rear panel where the following connectors are located.

No	Conn Type	Function	Description
CN1	DB15-F	Line I/O	Provides the necessary analog receiver and transmitter interface for system interfacing.
CN2	DB9-F	Monitor port	Provision for monitoring status certain internal signals
CN3	DB25-F	Parallel I/O	Provides two 8 bit input ports, where one is used as the parallel BCD channel select. Also one 8-bit output port.
CN4	DB9-M	RS-232 serial port	9600 Baud serial port for frequency programming, channel selection and alarm and status monitoring.
CN5	3 PIN	DC Power input	13.8 Volt DC power input. Also +28 Volt input on spare pin.
CN6	N TYPE	Simplex relay out or N type RX input	Location for internal simplex relay. The antenna for RX / TX connects to this point. Alternatively a N-Type connector can be used for the input to the receiver for full duplex operation
CN7	BNC	RX input	Standard BNC connector for the input to the receiver for full duplex operation.
CN8	N TYPE	TX output	The RF power output from the transmitter for full duplex operation.
CN9	RJ45	Optional Bal line I/O	Optional balanced and isolated Line TX and RX VF and isolated E & M signals

Table 7-1 MX800 Interface Connectors

7.1.1 CN1 DB15 Female Line I/O Connector

This connector provides the primary interface to the transceiver. Pin connection and function details are shown in Table 7-2 below.

Pin no	Function
1	O/C ALARM OUTPUT #2. Open collector output sinks current to earth when an alarm condition occurs. The function of the alarm and the trip points as appropriate are programmable via the utility program. Selectable Alarm functions are Low Fwd Power, High Refl Power, Low Supply Volts, High Supply Volts, High PA Temp, TX Unlocked and RX Unlocked.
2	TX VF LOOP BACK. When this input is active the line TX audio path is looped to the line RX audio output. The polarity is selectable via the internal jumper JMP9. If this function is not required then remove jumper JMP9 or place it in position 1&2. An internal trimmer pot RV7 sets the loop back gain / loss level. CTCSS O/P. This function is enabled Via JMP26. This then disable the TX VF LOOP BACK function. The Receivers demodulated filtered RX Subtone audio output from op-amp, Fixed level. AC coupled.
3	RECEIVER AUDIO 5Ω. Low impedance differential audio output from op-amp.
4	RX DISCRIMINATOR. The receiver discriminator audio output is buffered, unfiltered and DC coupled to this point. Output impedance is low.
5	O/C ALARM OUTPUT #3. Open collector output sinks current to earth when an active condition occurs. The function of the alarm and the trip points as appropriate are programmable via the utility program. Selectable Alarm functions are Low Fwd Power, High Refl Power, Low Supply Volts, High Supply Volts, High PA Temp, TX Unlocked and RX Unlocked.
6	O/C ALARM OUTPUT #1. ./M-lead. This output is configurable via MXTOOLS as either an M-lead or a third alarm output. Open collector output sinks current to earth when an alarm condition occurs. The function of the alarm and the trip points as appropriate are programmable via the utility program. Selectable Alarm functions are Low Fwd Power, High Refl Power, Low Supply Volts, High Supply Volts, High PA Temp, TX Unlocked and RX Unlocked.
7	RX TALK. This control line enables or disables RX VF to line and TTR VF. The polarity is selectable via the internal jumper JMP12. If this function is not required then remove jumper JMP12 or place it in position 1&2.
8	REPEATER ENABLE. On/off mode control of internal repeater function. The polarity is selectable via the internal jumper JMP14. If this function is not required then remove jumper JMP14 or place it in position 1&2.
9	TRANSMIT AUDIO INPUT 600Ω. Transmitter audio input to op-amps etc. Nominal line input level is -10dBm. Can handle levels between -15dBm and +6dBm. Unbalanced input with common return to analog Earth.
10	ANALOG EARTH. General analog earth common for VF input and output.
11	TX TALK. Enables or disables TX VF from line as well as TTR VF. The polarity is selectable via the internal jumper JMP18. If this function is not required then remove jumper JMP18 or place it in position 1&2.
12	TX PTT IN. (E-LEAD). The standard PTT input is active low and may be driven from standard +5V logic outputs or open collector

13	TX DC-FM INPUT OR WIDE BAND INPUT. Select the internal jumper JMP8 to configure this input as either the *DC-FM input* or *Wide Band input*. Remove jumper if not used. *DC-FM input (JMP8 in position 1-2)* Audio or data may be connected to this point. In order to conform to transmitter bandwidth emissions limits, this input is hard limited to the peak deviation and Bessel filtered -3dB @ 3400Hz for minimum group delay distortion. Input impedance is >10KΩ. Input sensitivity is nominally 1Vp-p but depends upon RV2 adjustment. If this input is not used then jumper # JMP8 on the Micro Controller board should be removed to avoid any pickup of stray signals, or alternatively do not connect any wires to this pin. Avoid the use of ribbon cables longer than 30-50cm as this may result in excess coupling or crosstalk. *WIDEBAND input: (JMP8 in position 2-3)* Wide band audio or data may be connected to this point. WARNING: In order to conform to transmitter bandwidth emissions limits, the signal MUST be pre-filtered and level controlled, failure to do this WILL result in non-compliance of the TX emission spectrum. This input mode is not normally used except in special cases. CTCSS *Input: (JMP27 in positions 1-2)* TX Subtone audio may be injected into this connection point. Input sensitivity is Fixed at 1Vp-p. AC coupled
14	RX MUTE / SQUELCH MONITOR. The RF mute status may be monitored by reading this voltage. +5volt logic signal indicates mute status. This output is not CTCSS dependent. Output impedance approx 100Ω. The polarity is selectable via the internal jumper JMP17.
15	RECEIVER AUDIO 600Ω. Receiver audio output from op-amp. Default nominal line level is set to -10dBm. Unbalanced output with common return to analog Earth.

Table 7-2 CN1 Connections

7.1.2 CN2 DB9 Female Monitor Connector

This port provides monitor and test functions for the MX800. It may be optionally located on the front panel of the MX800. The functions of the pins are described in Table 7-3 below.

Pin No	Function
1	EARTH. General earth common for VF input and output.
2	RX RSSI OUTPUT. The receiver's received signal strength indicator voltage is proportional to the log of the signal level at the antenna input. Voltage range is 0 to 5 volts. Output impedance is low. Dynamic range > 60dB.
3	EXTERNAL PTT INPUT OR MONITOR POINT. Input or output. Wired in parallel with the normal PTT via a 10K isolating resistor This input can override the normal PTT input on the DB15. Refer CCT.
4	TX FORWARD POWER. The voltage from the forward power directional coupler in the Power Amplifier goes directly to this pin via a buffer. The voltage should be about 3-4 Volts for 50 Watts.
5	+12 VOLTS OUTPUT. +12 Volt output to power small external devices or interfaces. Max load 500mA.
6	TX REFLECTED POWER. The voltage from the reflected power directional coupler in the Power Amplifier goes directly to this pin via a buffer. For a 50Ω terminated PA the voltage should be less than 200mV
7	MUTED RX VF. Monitor point and buffered output from the muted RX VF section.
8	FINAL TX VF MONITOR. Monitor point for buffered audio fed to TX VCO input.
9	TEST TX VF INJECT. Wide band audio or data may be connected to this point. In order to conform to transmitter bandwidth emissions limits, this input is hard limited to the nominal deviation and Bessel filtered -3dB @ 3400Hz for minimum group delay distortion. Input impedance is >10KΩ AC coupled. If this input is not used then do not connect any wires to this pin. Also avoid the use of ribbon cables longer than 30-50cm as this may also result in excess coupling or crosstalk.

Table 7-3 CN2 Connections

7.1.3 CN3 DB25 Female Digital I/O Connector

Each CMOS logic input is protected by a 10K Ohm series resistor to the input of the logic chip. There is also a 10K Ohm pull up/down resistor at each input so as to default the input value to that set by JMP19. Each logic output is protected by a 1K-Ohm series resistor from the output of the logic chip.

Pin No	Function
13	DIGITAL EARTH or +5VDC output. JMP15 selectable.
25	INPUT PORT A. 8-bit Logic Input bit 0. (Power control bit 0)or Digital CTCSS Control bit 0
12	INPUT PORT A. 8-bit Logic Input bit 1. (Power control bit 1)or Digital CTCSS Control bit 1
24	INPUT PORT A. 8-bit Logic Input bit 2. (RX CTCSS control)or Digital CTCSS Control bit 2
11	INPUT PORT A. 8-bit Logic Input bit 3. (TX CTCSS control)or Digital CTCSS Control bit 3
23	INPUT PORT A. 8-bit Logic Input bit 4. (N/W address bit 0)
10	INPUT PORT A. 8-bit Logic Input bit 5. (N/W address bit 1)
22	INPUT PORT A. 8-bit Logic Input bit 6. (N/W address bit 2)
9	INPUT PORT A. 8-bit Logic Input bit 7. (N/W address bit 3)
21	INPUT PORT B. Channel Select BCD Units bit 0. / Binary Bit 0.
8	INPUT PORT B. Channel Select BCD Units bit 1. / Binary Bit 1.
20	INPUT PORT B. Channel Select BCD Units bit 2. / Binary Bit 2.
7	INPUT PORT B. Channel Select BCD Units bit 3. / Binary Bit 3.
19	INPUT PORT B. Channel Select BCD Tens bit 0. / Binary Bit 4.
6	INPUT PORT B. Channel Select BCD Tens bit 1. / Binary Bit 5.
18	INPUT PORT B. Channel Select BCD Tens bit 2. / Binary Bit 6.
5	INPUT PORT B. Channel Select BCD Tens bit 3. / Binary Bit 7.
17	OUTPUT PORT C. 8-bit Logic Output bit 7.
4	OUTPUT PORT C. 8-bit Logic Output bit 6.
16	OUTPUT PORT C. 8-bit Logic Output bit 5.
3	OUTPUT PORT C. 8-bit Logic Output bit 4.
15	OUTPUT PORT C. 8-bit Logic Output bit 3.(Digital CTCSS Control bit 3)
2	OUTPUT PORT C. 8-bit Logic Output bit 2. (Digital CTCSS Control bit 2)
14	OUTPUT PORT C. 8-bit Logic Output bit 1. (Digital CTCSS Control bit 1)
1	OUTPUT PORT C. 8-bit Logic Output bit 0. (Digital CTCSS Control bit 0)

Table 7-4 CN3 Connections

Note *When the front panel channel select option is fitted, input port should not be used from the external connector CN3 as it is wired to the thumbwheel switch.*

7.1.4 CN4 DB9 Male RS232 Connector

RS232 serial port to the MX800. It may be optionally located on the front panel of the MX800. Only 3 wires are required for the MX800 TXD, RXD and ground. The function of TXD and RXD pins can be interchanged by changing jumpers JMP10 and JMP11. Table 7-5 below illustrates this.

Name	Function	JMP 10/11	
	(Referred to MX800)	2-3	1-2
		CN4 Pin no	CN4 pin no
TD	Transmitted Data	3	2
RD	Received Data	2	3
SG	Signal Ground	5	5

Table 7-5 CN4 Connector Jumpers

Note *Both JMP10 and JMP11 must be set to the same positions. In position 2-3 the radio will require a serial cable with the TXD and RXD lines cross-connected. In position 1-2 a one to one cable is required.*

7.1.5 CN6 Simplex Relay/External Reference

This is an N type connector, which acts as the RF I/O port for simplex operation. Optionally the RX input for duplex operation may use this port instead of the BNC port or if an external reference is required this port can be used.

7.1.6 CN7 RX Input

This is a BNC connector used as the RX RF input.

7.1.7 CN8 TX Output

This is an N type connector used as the TX RF power output.

7.1.8 CN9 RJ45

This connector may optionally be fitted. The function depends upon which option board is fitted. A standard option is the isolated line I/O and this connector is used for this function when this option is fitted. See Options section for connection details.

A rectangular knock out section in the chassis provides for mounting of the connector should it be required.

7.1.9 CN5 DC Power Input

DC power is connected to the transceiver through this connector. The transceiver is fitted with a 3-pin male connector. For 50W transceivers pins 2 and 3 are used for the 12V DC pin 1 is unused. The power lead to the transceiver should be made from a gauge of wire suitable to ensure less than 0.5V drop at 10A for the required length of the lead.

PIN No	Function
1	Unused
2	Ground
3	+ 13.8VDC

Table 7-6 CN5 DC Power Input Connections

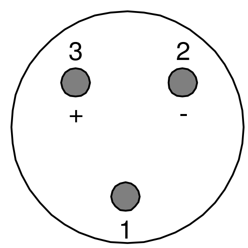


Figure 7-1 CN5 DC Input (View from rear of MX800)

7.2 MX800 Specifications

Minimum performance to exceed the following for 30 MHz to 960 MHz*:

AS4295-1995

ETS 300 086 Jan 1991,ETS 300 113

FCC Part 90

TIA/EIA-603

BAPT 225 ZV 1/2098 (German Soft keying)

CEPT T/R 24-01 E Sept 1988

EC Marking, EC EMC Directive 89/336/EEC

RFS25, RFS26, RFS32

*Conforms but may not be approved.

Consult Spectra Engineering regarding current type approvals and for latest and current MX800 Specification Data sheet.

7.2.1 Operating Frequency Bands

The MX800 is available in a number of models, which cover the range of operating frequency bands. As the transmitters and receivers are functionally independent the radios may be cross-banded if required. Refer to section 7.4 for details of the band breakdown.

7.2.2 General

Parameter	Specification
MX800 Rack Size:	2RU Case, 330mm deep including fan.
MX800 Overall Physical Size	89mm high, 360mm deep, 483mm wide
Weight	< 9kG
Supply Voltage:	13.8V +/- 20%.
Power Consumption:	<600 mA receive, typical 460mA. (TX VCO off)
	<11A for 50W TX RF @13.8VDC.
Operating Temperature:	-10 to +60 C.
Individual Module Dimensions:	TX & RX W=100, L=180, H = 30mm.
	PA W=78, L=300, H = 60mm.
Standard LED indicators:	Power, TX, RX, CTCSS, Aux, Alarm.
Speaker output	1 Watt
Frequency Range:	Coverage 30-960 MHz.
Synthesis Method:	Non mixing PLL Fractional N synthesiser.
Modulation:	Direct FM, two point method
	+/-2.5 kHz narrow band, +/- 5 kHz wide band
Channel Spacing:	50kHz, 30kHz, 25kHz, 20kHz or 12.5kHz.
Synthesiser Step Size:	25, 12.5,10, 7.5 or 6.25kHz.
Channels:	255 Software, DIP switch and rear port selectable.1-99 through rear port if configured for BCD parallel selection.

Table 7-7 General Specifications

7.2.3 Transmit

Measured in accordance with TIA/EIA-603 standards.

Parameter	Specification
RF Power Output:	5W to 50W (30-520 MHz). 0W to 1W (395-520MHz). (800-960 MHz).
Frequency Stability:	20PPM, 2.5PPM, 1.5PPM(std) or 1.0PPM.
Audio response:	Flat within +1, -3dB across bandwidth
Audio Bandwidth VF input:	300Hz to 3400Hz Bessel LPF
Audio Bandwidth DC FM input:	DC to 3400Hz base band (-3dB)
Modulation Distortion:	Less than 2% at 60% deviation.
S/N Ratio:	Better than 50dB, wide band.
	Better than 44dB, narrow Band.
Spurii:	Better than –90dBc.
RF Switching Bandwidth Exciter:	Same as band allocation.
RF Switching Bandwidth PA:	Band dependent , typ >35Mhz
Duty Cycle:	100% for 50W RF output with thermally controlled fan.
RF Rise Time:	4mS with continuous VCO selected (Controlled RF envelope).

Table 7-8 Transmit Specifications

7.2.4 Receive

Measured in accordance with TIA/EIA-603 standards.

Parameter	Specification
Sensitivity:	Better than -117dBm for 12dB (25 kHz spacing), De-emphasis. Typical -120dBm
Selectivity 30-50MHz:	More than 90 dB for 25 kHz adj channel, more than 80 dB for 12.5 kHz adj channel,.
Selectivity 66-520MHz:	More than 80 dB for 25 kHz adj channel, more than 75 dB for 12.5 kHz adj channel,.
Selectivity 805-960MHz:	More than 70 dB for 25 kHz adj channel more than 65 dB for 12.5 kHz adj channel.
Spurious Resp:	Better than 90dB.
Intermodulation:	Better than 80dB.@ 100kHz/200kHz offset
Blocking:	Better than 100dB at +/- 1MHz point.
Distortion:	Less than 2% at 60% deviation.
S/N Ratio:	Better than 50dB wide band. Better than 44dB narrow band.
Receiver Front End BW:	Equal to band allocation, no retuning.
Discriminator Audio Bandwidth:	DC to 3400Hz (-3dB)
Audio Bandwidth VF output:	300Hz to 3000Hz, +1/-3dB
Squelch Opening Time:	Less than 20mS @ 20dB SINAD.
Squelch Closing Time:	Less than 100mS.
Conducted Spurious:	Less than -57dBm, typ -90dBm.

Table 7-9 Receive Specifications

7.2.5 Ancillaries

Parameter	Specification
TX Timer:	Programmable, on/off selectable
VF Level to Line:	+6 to -15dBm, 600 ohms unbalanced or differential
VF Level from Line:	+6 to -15dBm, 600 ohms unbalanced, with Compressor enabled.
Pre-Emphasis Accuracy:	Within +1,-3dB of 6dB per octave curve
De-Emphasis Accuracy:	Within +1,-3dB of 6dB per octave curve
VF Compressor Range:	>30dB for line input
Digital Outputs:	1K-ohm 5V source/sink available
Alarm Output:	Open collector
PTT Input:	+5V Logic active low
Channel Select:	8 way Dip switch or RS232 or BCD/Binary
Repeater Tail Timer:	Programmable

Table 7-10 Ancilary Specifications

7.3 Channel Select DIP Switch Settings

Refer to section 2.2.2.3 for a description on the alternative methods to select the operating channel. If a hardware channel select method is chosen the following table shows how to set the switches for each channel. Select the fixed channel for the MX800 by using the DIP switch DIP1 located on the Micro Controller Board. Channel 1 to 255 is available in binary selection. Switch position 1 is channel 1, position 2 is channel 2, position 3 is channel 4, position 4 is channel 8, position 5 is channel 16, position 6 is channel 32, position 7 is channel 64, position 8 is channel 128.

A table of DIP switch 1 settings follows, where switch ON is indicated by an "x" in a cell and no entry in a cell represents a switch OFF.

CH	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
0								
1	X							
2		X						
3	X	X						
4			X					
5	X		X					
6		X	X					
7	X	X	X					
8				X				
9	X			X				
10		X		X				
11	X	x		X				
12			X	X				

CH	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
13	X		X	X				
14		X	X	X				
15	X	X	X	X				
16					X			
17	X				X			
18		X			X			
19	X	X			X			
20			X		X			
21	X		X		X			
22		X	X		X			
23	X	x	X		X			
24				X	X			
25	X			X	X			

CH	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
26		X		X	X			
27	X	X		X	X			
28			X	X	X			
29	X		X	X	X			
30		X	X	X	X			
31	X	X	X	X	X			
32						X		
33	X					X		
34		X				X		
35	X	X				X		
36			X			X		
37	X		X			X		
38		X	X			X		
39	X	X	X			X		
40				X		X		
41	X			X		X		
42		X		X		X		
43	X	X		X		X		
44			X	X		X		
45	X		X	X		X		
46		X	X	X		X		
47	X	X	X	X		X		
48					X	X		
49	X				X	X		
50		X			X	X		
51	X	X			X	X		
52			X		X	X		
53	X		X		X	X		
54		X	X		X	X		
55	X	X	X		X	X		
56				X	X	X		
57	X			X	X	X		
58		X		X	X	X		
59	X	X		X	X	X		
60			X	X	X	X		
61	X		X	X	X	X		
62		X	X	X	X	X		
63	X	X	X	X	X	X		
64							X	
65	X						X	
66		X					X	
67	X	X					X	
68			X				X	
69	X		X				X	
70		X	X				X	
71	X	X	X				X	
72				X			X	
73	X			X			X	
74		X		X			X	
75	X	X		X			X	
76			X	X			X	
77	X		X	X			X	
78		X	X	X			X	

CH	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
79	X	X	X	X			X	
80					X		X	
81	X				X		X	
82		X			X		X	
83	X	X			X		X	
84			X		X		X	
85	X		X		X		X	
86		X	X		X		X	
87	X	X	X		X		X	
88				X	X		X	
89	X			X	X		X	
90		X		X	X		X	
91	X	X		X	X		X	
92			X	X	X		X	
93	X		X	X	X		X	
94		X	X	X	X		X	
95	X	X	X	X	X		X	
96						X	X	
97	X					X	X	
98		X				X	X	
99	X	X				X	X	
100			X			X	X	
101	X		X			X	X	
102		X	X			X	X	
103	X	X	X			X	X	
104				X		X	X	
105	X			X		X	X	
106		X		X		X	X	
107	X	X		X		X	X	
108			X	X		X	X	
109	X		X	X		X	X	
110		X	X	X		X	X	
111	X	X	X	X		X	X	
112					X	X	X	
113	X				X	X	X	
114		X			X	X	X	
115	X	X			X	X	X	
116			X		X	X	X	
117	X		X		X	X	X	
118		X	X		X	X	X	
119	X	X	X		X	X	X	
120					X	X	X	
121	X			X	X	X	X	
122		X		X	X	X	X	
123	X	X		X	X	X	X	
124			X	X	X	X	X	
125	X		X	X	X	X	X	
126		X	X	X	X	X	X	
127	X	X	X	X	X	X	X	
128								X
129	X							X
130		X						X
131	X	X						X

CH	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
132			X					X
133	X		X					X
134		X	X					X
135	X	X	X					X
136				X				X
137	X			X				X
138		X		X				X
139	X	X		X				X
140			X	X				X
141	X		X	X				X
142		X	X	X				X
143	X	X	X	X				X
144					X			X
145	X				X			X
146		X			X			X
147	X	X			X			X
148			X		X			X
149	X		X		X			X
150		X	X		X			X
151	X	X	X		X			X
152				X	X			X
153	X			X	X			X
154		X		X	X			X
155	X	X		X	X			X
156			X	X	X			X
157	X		X	X	X			X
158		X	X	X	X			X
159	X	X	X	X	X			X
160						X		X
161	X					X		X
162		X				X		X
163	X	X				X		X
164			X			X		X
165	X		X			X		X
166		X	X			X		X
167	X	X	X			X		X
168				X		X		X
169	X			X		X		X
170		X		X		X		X
171	X	X		X		X		X
172			X	X		X		X
173	X		X	X		X		X
174		X	X	X		X		X
175	X	X	X	X		X		X
176					X	X		X
177	X				X	X		X
178		X			X	X		X
179	X	X			X	X		X
180			X		X	X		X
181	X		X		X	X		X
182		X	X		X	X		X
183	X	X	X		X	X		X
184				X	X	X		X

CH	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
185	X			X	X	X		X
186		X		X	X	X		X
187	X	X		X	X	X		X
188			X	X	X	X		X
189	X		X	X	X	X		X
190		X	X	X	X	X		X
191	X	X	X	X	X	X		X
192							X	X
193	X						X	X
194		X					X	X
195	X	X					X	X
196			X				X	X
197	X		X				X	X
198		X	X				X	X
199	X	X	X				X	X
200				X			X	X
201	X			X			X	X
202		X		X			X	X
203	X	X		X			X	X
204			X	X			X	X
205	X		X	X			X	X
206		X	X	X			X	X
207	X	X	X	X			X	X
208					X		X	X
209	X				X		X	X
210		X			X		X	X
211	X	X			X		X	X
212			X		X		X	X
213	X		X		X		X	X
214		X	X		X		X	X
215	X	X	X		X		X	X
216				X	X		X	X
217	X			X	X		X	X
218		X		X	X		X	X
219	X	X		X	X		X	X
220			X	X	X		X	X
221	X		X	X	X		X	X
222		X	X	X	X		X	X
223	X	X	X	X	X		X	X
224						X	X	X
225	X					X	X	X
226		X				X	X	X
227	X	X				X	X	X
228			X			X	X	X
229	X		X			X	X	X
230		X	X			X	X	X
231	X	X	X			X	X	X
232				X		X	X	X
233	X			X		X	X	X
234		X		X		X	X	X
235	X	X		X		X	X	X
236			X	X		X	X	X
237	X		X	X		X	X	X

CH	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
238		X	X	X		X	X	X
239	X	X	X	X		X	X	X
240					X	X	X	X
241	X				X	X	X	X
242		X			X	X	X	X
243	X	X			X	X	X	X
244			X		X	X	X	X
245	X		X		X	X	X	X
246		X	x		X	X	X	X

CH	SW1	SW3	SW3	SW4	SW5	SW6	SW7	SW8
247	X	X	X		X	X	X	X
248				X	X	X	X	X
249	X			X	X	X	X	X
250		X		X	X	X	X	X
251	X	X		X	X	X	X	X
252			X	X	X	X	X	X
253	X		X	X	X	X	X	X
254		X	X	X	X	X	X	X
255	x	X	x	X	X	X	X	X

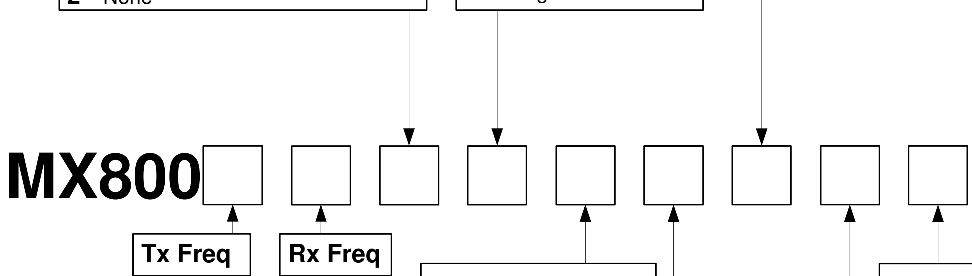
7.4 MX800 Model Number Configuration Guide

The MX800 build can be specified by the model number. The diagram below shows how the model number is derived from the wanted options. Consult Spectra for availability details on specific configurations and options.

Tx Power
- **E** 1 Watt (Extra Low, Bands N - Q)
- **L** 5 Watt (Low, N - Q3)
- **N** 15 Watt (800 MHz Normal)
- **I** 25 Watt (Intermediate)
- **M** 35 Watt (800 MHz Medium)
- **H** 50 Watt (High)
- **Z** None

Channel Allocation
- **N** 12.5 kHz (Narrow)
- **M** 20 kHz (Medium)
- **W** 25 kHz (Wide)
- **D** 30 kHz (Data)
- **C** 50 kHz (Cellular)
- **P** 12.5/25 kHz Programmable

Frequency Stability
- **1** 1.0 ppm (-30 to 60°C)
- **2°** 1.5 ppm (-10 to 60°C) & 2.5 ppm (-30 to -10°C)
- **4** 20 ppm (-30 to 60°C)
- **5** 2.5 ppm (-10 to 60°C) & 5 ppm (-30 to -10°C)



Options
- **Z** No options
- **S** Options fitted (Specify separately)

RF Config
- **D** Duplex
- **S** Simplex

Controller Options
- **Z** Standard Controller
- **L** LC Controller

Front Panel
- **S** Standard
- **C** Custom

Band	Frequency
A2	30-39 MHz
A3	39-50 MHz
A	66-80 MHz
B°	70-88 MHz
C	135-160 MHz
D	155-180 MHz
D3°	148-174 MHz
E	177-207 MHz
E2	177-185 MHz
F	195-225 MHz
G	220-250 MHz
H	245-275 MHz
I	270-300 MHz
J	295-325 MHz
K	320-350 MHz
L	345-375 MHz
M	370-400 MHz
N	395-430 MHz
N2°	400-435 MHz
O	425-460 MHz
O2	435-470 MHz
P	455-490 MHz
P2°	450-485 MHz
P3	475-495MHz
Q°	485-520 MHz
Q2	500-532 MHz
Q3	485-505 MHz

Band	Frequency
R	805-825 MHz
R2	746-764 MHz
R3	776-794 MHz
S	824-849 MHz
T	850-870 MHz
U	872-905 MHz
V	890-915 MHz
V2	900-925 MHz
W	917-950 MHz
X	925-960 MHz
Z	None

Notes:
1. Band E, L2, R3, Q2 receive only
2. Band E2, R2, V2 transmit only
3. ^{0} Indicates preferred band
4. Band A2, A3: 4 MHz Rx VCO Sw BW

Due to ongoing development please refer to www.spectraeng.com.au for the latest revision of this document page.

7.5 MX800 System Applications

Comprehensive standard features along with a wide range of options and accessories available to it mean that the MX800 is capable of being used in many different applications. The most common of which are mentioned below together with notes where applicable on the relevant aspect of the MX800.

Figure 7-2 MX800 Setup in system rack

7.5.1 Conventional base station/repeater

Upper tier RF performance figures make the MX800 an excellent choice for a conventional base station or repeater. The PA is continuously rated and receiver figure of merit parameters such a sensitivity, intermodulation and selectivity are all of a high standard. Independently adjustable PTT and CTCSS tails mean that the mute crash can be eliminated in mobiles when base transmit CTCSS is used. A 40ms RX audio delay option (T08) similarly facilitates the elimination of the mute crash in the base station side.

As standard feature when the CTCSS encode/decode option is selected is multiple tone groups. In excess of 25 tones can be selected as valid CTCSS tones on a shared RF channel. Provision is made in the programming software to enter tone pairs for each group without restriction on how the tones are selected.

Many other attributes of the MX800 and its options are useful in conventional base/repeater systems. For example:-

- ♦ Programmable channel bandwidth
- ♦ DCS / Digital Private Line
- ♦ Range of front panel functions available
- ♦ Optional two wire four wire operation
- ♦ Tone PTT with programmable PTT tone
- ♦ Optional balanced and isolated VF I/O and signaling lines

7.5.2 Link transceiver

In the UHF bands (400 to 520 MHz) the MX800 is available in 1W and 50W. The 1W version being intended for link transceiver application. Transmit and receive audio is conveniently brought out to the D15 connector on the rear of the radio along with the mute and PTT signals. In addition, provision is made to inject an Analog CTCSS tone into the transmit leg of the link and a 300Hz low pass filtered CTCSS signal is available at the RX leg of the link to recover the tone. Hence the Analog CTCSS tone can be transferred (or cross banded) from one MX800 to another. On an RF path with good signal to noise ratio, this enables CTCSS synchronization across the link in the situation where multiple tone group operate at two different sites. Spectra Engineering plans to upgrade this function with a digital 4 bit interface such that the operating CTCSS group is decoded at the repeater and re-encoded or cross encoded across the link, and the process repeated in reverse at the remote end.

7.5.3 Data transceiver

The MX800 transmit audio path is user configurable to a very large degree. TX modulation signals can be injected with or without processing depending upon the individual application. The transmitter low pass filter (the deviation limiter which sets the modulation bandwidth and ensures compliance with regulatory requirements) is a Bessel filter with linear phase characteristics. Fast transmitter key-up time and mute action mean reduced signalling turn around overheads for data messages and better throughput especially in a Simplex system with predominantly short messages.

7.5.4 Paging transmitter

Due to the two point modulation method employed in the MX800, the transmit modulation frequency response can go down to DC as correctly required for POCSAG or other FSK based modulation systems. In addition it has a DC coupled FM modulator input biased to a voltage of 2.5 volts for carrier frequency Fo. A square wave input signal of 0 to 5V injected on this point drives the modulator to the positive and negative extremes of the deviation limiter. In this case set to +/- 4.5kHz. This means that it can transmit typical POCSAG paging signals. The modulation rise time is controlled by the frequency response of the transmit audio path low pass filter and is suitable for data rates of up to 2400 baud.

A typical system arrangement is shown in drawing *SC004-1A*.

SYSTEM ALIGNMENT

The FSK link deviation should be set to 60% of maximum deviation.

The paging transmitter alignment is similar to the standard alignment in paragraphs 5.1.9 and 5.1.10 in the MX800 technical manual. In 5.1.9 “Procedure” item 3 set the peak deviation to +/-4.5kHz (instead of +/-4.8kHz). In item 5 set the TX modulation frequency to half the data rate of the POCSAG data eg 600Hz for 1200-baud data etc.

Other than these changes the TX alignment is as per the technical manual.

7.5.5 Trunking Base Station

The MX800 is widely used as a trunking base station. A one hundred percent continuously rated transmitter is vital in the high duty cycle environment of a trunking systems. MPT 1327 control channels are permanently keyed up. Optionally the FSK signalling of MPT systems can be injected flat into an non pre-emphasized input and received on an non de-emphasized output which allows the signalling to go flat to air. As a compact two RU height enclosure the MX800 permits a high channel density for a given rack height.

LTR trunking systems make use of a digital sub audible signalling scheme. Once again the low frequency modulation capabilities (down to DC) of MX800 are vital in ensuring that the signalling takes place and a low bit error rate. A marginal system will result if the Transmitter modulation response can not go below 10Hz.

7.5.6 Systems base

Typical small systems environments. Once again the user interface presented at the rear of the radio and the software programmable functions through MXTOOLS give systems designers and large degree of control over the base station.

In a system, which operates in one RF band, it is particularly convenient and cost-effective if all base stations can be made and programmed identically. This reduces the number of spare base stations required to maintain the system. MX800 supports this mode of operation in as much as the operating characteristics of up to 255 channels can be pre-programmed in all of the base stations, and insertion of an on-site channel selector and configuration plug selects the particular operating parameters for that base station in that location. Spectra will introduce additional features in this area.

7.5.7 Repeater with Morse ID

A programmable built in Morse ID encoder makes it convenient to use the MX800 as a UHF CB repeater, Amateur repeater or auto identified repeater.

7.5.8 Simplex base station

Option T06 for the MX800 is a coaxial changeover relay. In a Simplex system with a single antenna and common transmit and receive frequencies this can be used for connection of the transmitter and or receiver to the antenna. Provision is made in the programming to introduce a 50ms delay on transmit to allow the relay to changeover prior to RF ramp up.

7.5.9 Duplicated base station

Spectra engineering has current plans for the development of an Automatic Changeover Units to facilitate duplicated base station operation.

This option is not currently available. Due to ongoing development please refer to www.spectraeng.com.au for the latest information regarding this option.

7.5.10 Power Save base station

For solar powered sites and other power critical applications the MX800 is capable of a Power Save (Low Standby Current) Mode. This option can be implemented in three stages. Stage one implementation replaces the micro controller linear voltage regulators with switching regulators. Response times are unaffected. Stage two involves removing power from the exciter when the radio is in standby mode. In this case RX responses times are unaffected. In stage three the RX power is cycled on and off at a user selectable duty cycle. Essentially the choice of mode of operation involves a compromise between response time and average current consumption. Current consumption of 250mA is achievable with a typical response time in the order of 1sec.

7.5.11 Tone key base station

T19/T26 is a new Spectra Engineering development, which incorporates a number of features and functions, of which are covered in section 3.18

7.5.12 Voting base station

As noted in section 3.17 the MX800 with option to T19 can provide a Variable tone encoder. This encoder is compatible with a commonly used Variable tone-voting arbitrator.

MX800 can also be used with a SINAD voting arbitrator. Mute status of the receiver can optionally be signalled to the voting arbitrator via tone or through DC key E & M signalling.

Spectra engineering has current plans to implement the base station component of a race voting system using a Central arbiter.

7.5.13 Simulcast base station

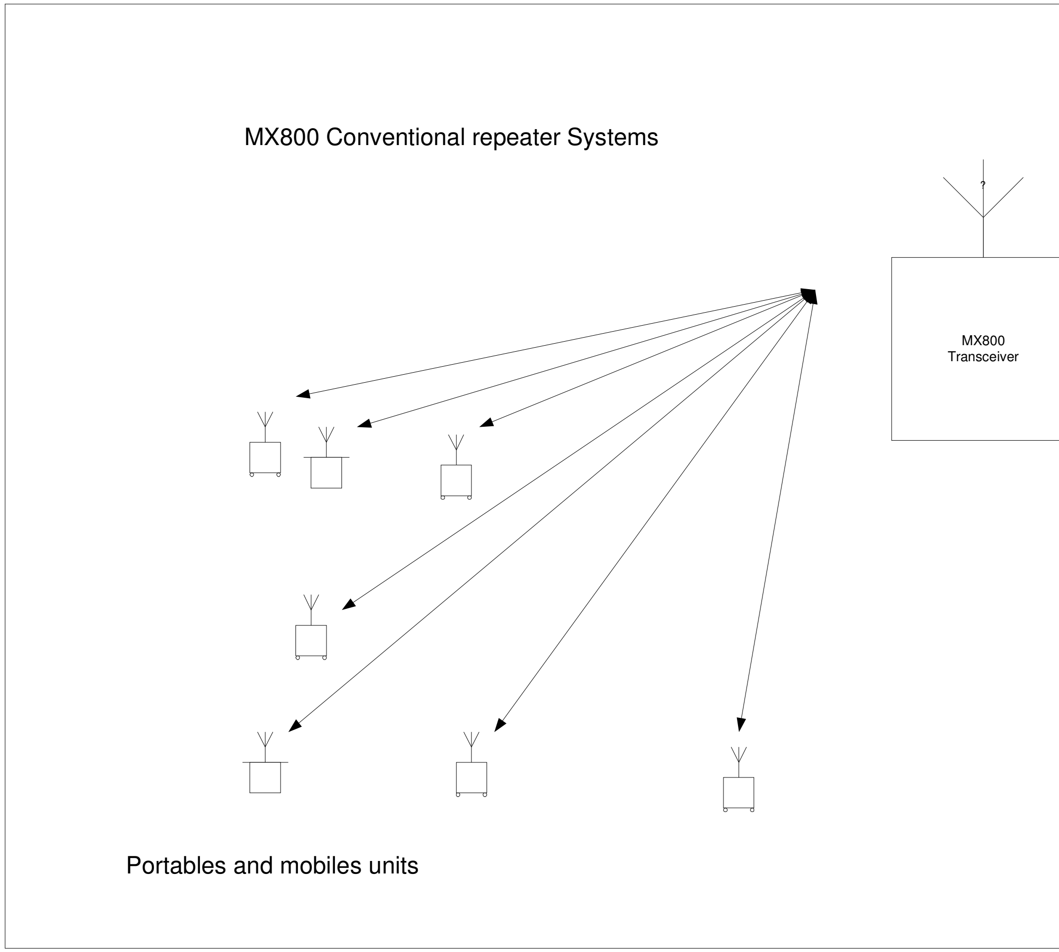
Precise control of transmitter RF frequency is essential in simulcasts systems. Option T12 provides an external TX reference oscillator input for injection of highly stable oscillator. Almost any frequency may be injected.

In addition, each transmitter channel frequency can be offset individually by small amounts if the internal reference frequency is used. The 1PPM frequency Stability option is specified for a minimum of 8PPM adjustment.

Take care if too much offset is used as this may effect the modulation symmetry. The use of this feature and a low frequency carrier dithering has proven to eliminate the previous requirements of extremely high stability reference frequency inputs.

The MX800 has been widely installed for the use in simulcast systems. These DSP based systems provide automatic compensation for changes in modulation delay characteristics.

Drawing No.	**Description**
SC001-1A	MX800 Conventional Systems Examples
SC001-2A	MX800 Conventional Systems Examples
SC003-1A	MX800 T19/T26 option Board Example
SC004-1A	MX800 Paging Configuration Example
SC006-1A	MX800 Link System Configuration Example



TITLE	MX800 Conventional Systems Examples				
SPECTRA ENGINEERING PTY LTD				DRAWN	AJCC
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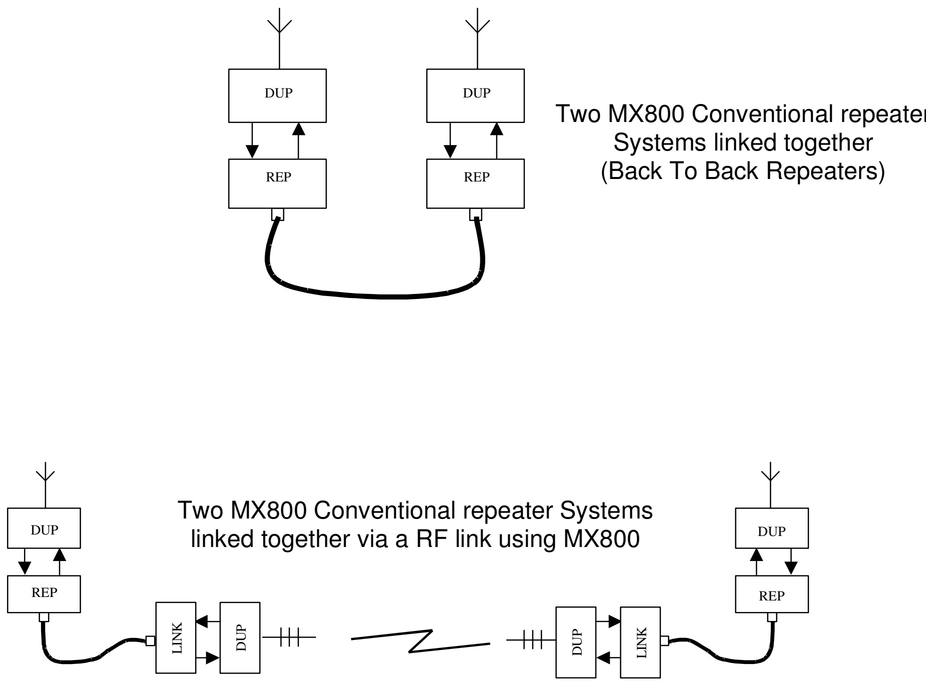
SHEET	1 0F 1	DATE	08/03/04	APPROVED	



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DOC No	SC001-2A	REV	A	CHECKED	
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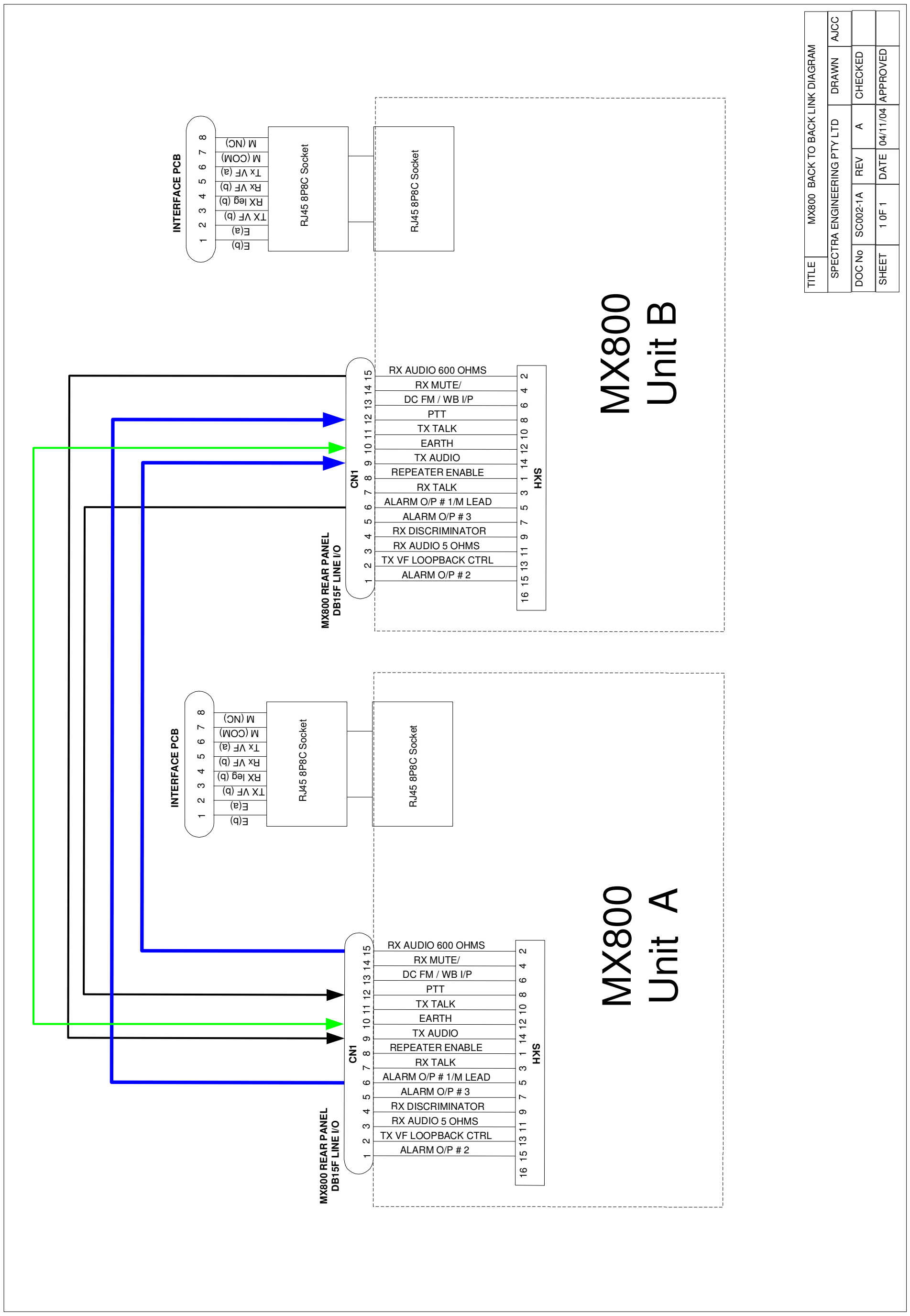
MX800
Unit B
MX800
Unit A
INTERFACE PCB
E(b)
E(a)
TX VF (b)
RX leg (b)
Rx VF (b)
Tx VF (a)
M (COM)
M (NC)
RJ45 8P8C Socket
MX800 REAR PANEL
DB15F LINE I/O
CN1
SKH
RX AUDIO 600 OHMS
RX MUTE/
DC FM / WB I/P
PTT
TX TALK
EARTH
TX AUDIO
REPEATER ENABLE
RX TALK
ALARM O/P # 1/M LEAD
ALARM O/P # 3
RX DISCRIMINATOR
RX AUDIO 5 OHMS
TX VF LOOPBACK CTRL
ALARM O/P # 2
TITLE
MX800 BACK TO BACK LINK DIAGRAM
SPECTRA ENGINEERING PTY LTD
DRAWN
AJCC
DOC No
SC002-1A
REV
A
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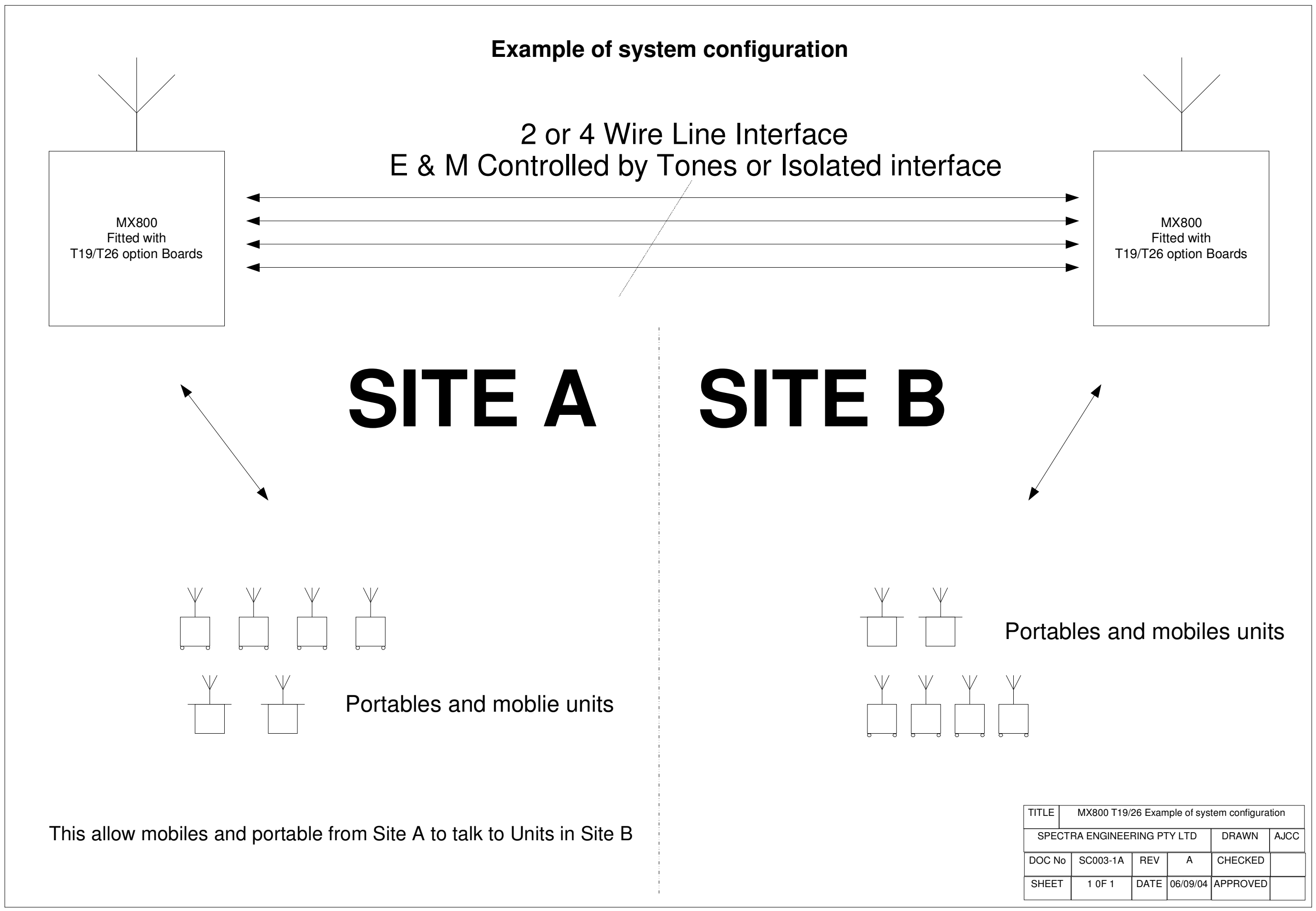
Example of system configuration
2 or 4 Wire Line Interface
E & M Controlled by Tones or Isolated interface
MX800
Fitted with
T19/T26 option Boards
MX800
Fitted with
T19/T26 option Boards
SITE A
SITE B
Portables and moblie units
Portables and mobiles units
This allow mobiles and portable from Site A to talk to Units in Site B
TITLE
MX800 T19/26 Example of system configuration
SPECTRA ENGINEERING PTY LTD
DRAWN
AJCC
DOC No
SC003-1A
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SHEET
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DATE
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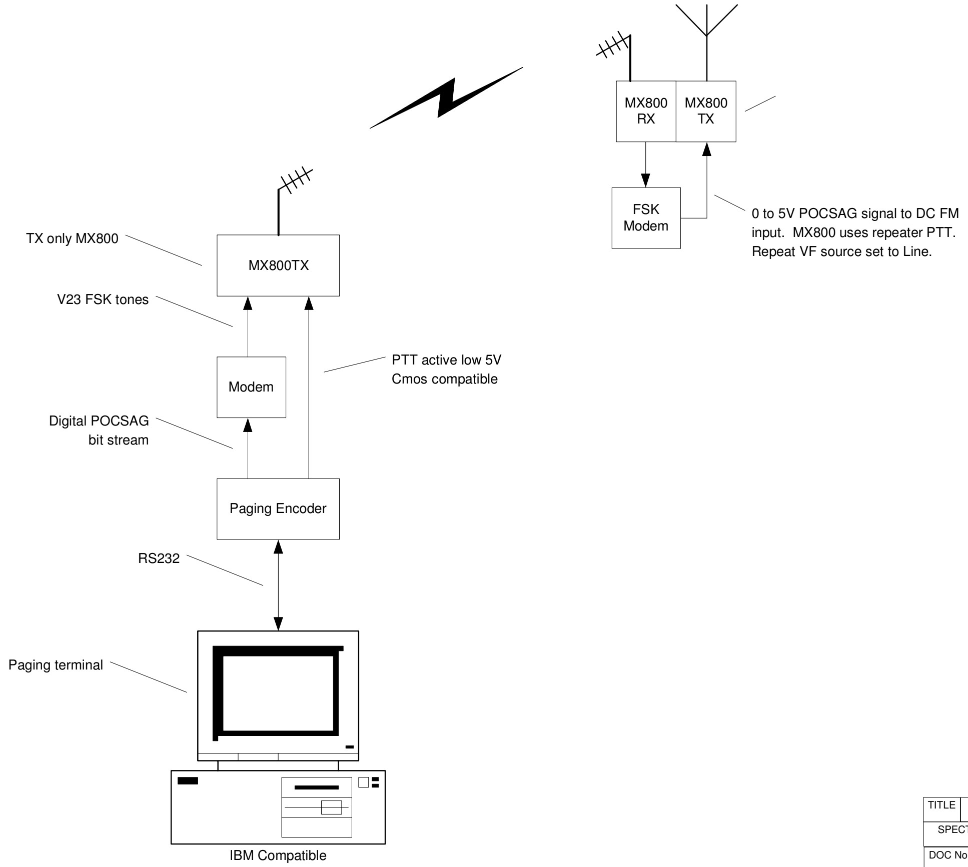

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SPECTRA ENGINEERING PTY LTD				DRAWN	AJCC
DOC No	SC004-1A	REV	A	CHECKED	
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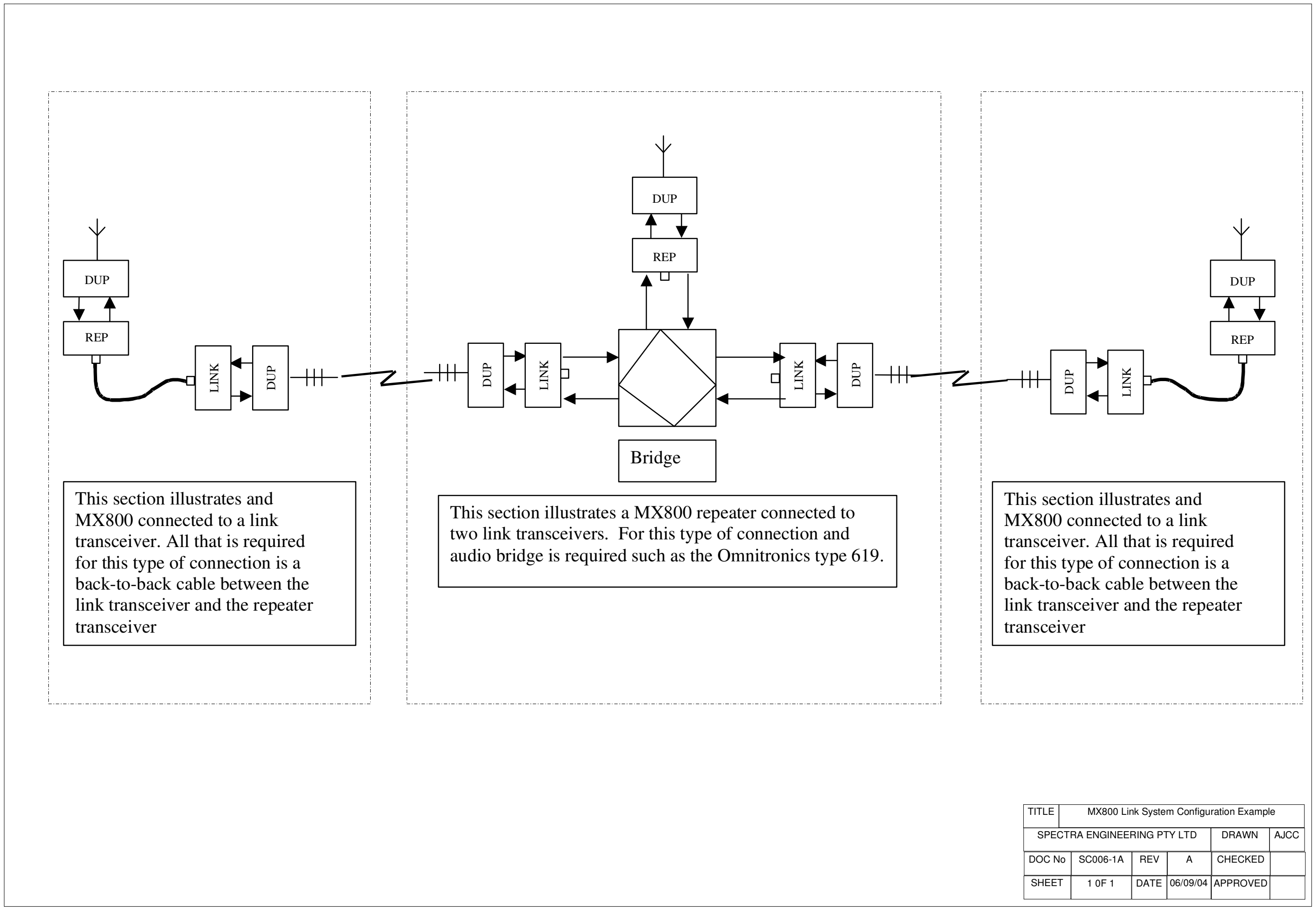
DUP
REP
LINK
DUP
DUP
LINK
DUP
REP
LINK
DUP
DUP
LINK
DUP
REP
Bridge
This section illustrates and MX800 connected to a link transceiver. All that is required for this type of connection is a back-to-back cable between the link transceiver and the repeater transceiver
This section illustrates a MX800 repeater connected to two link transceivers. For this type of connection and audio bridge is required such as the Omnitronics type 619.
This section illustrates and MX800 connected to a link transceiver. All that is required for this type of connection is a back-to-back cable between the link transceiver and the repeater transceiver
TITLE
MX800 Link System Configuration Example
SPECTRA ENGINEERING PTY LTD
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8. Superseded Technical Information

8.1 Power Amplifier Module

8.1.1 Technical Description

RF from the Exciter on CN1 is first attenuated by a 50-ohm pad, which is used to provide good 50-ohm source impedance for the high power hybrid amplifier IC1. The RF is amplified to between 5 and 13 watts at the hybrid 50-ohm output. The signal from the hybrid is then matched by a broadband network to drive the low input impedance associated with the final transmit power amplifier transistor TR1. The transistor's low collector impedance is then also matched back to 50 ohms by a broadband matching network. Trimmer capacitors enable adjustment of the power amplifier over a wide bandwidth so as to maintain good conversion efficiency. Prior to transmission a low loss 13 element elliptical low pass filter, filters out the unwanted harmonics to less than -90dBc.

A dual directional coupler consists of coupled microstrip transmission lines S5, S6 and S7 fabricated on the PCB artwork. The sampled RF energy is rectified to provide a proportional DC voltage output on CN4-8 (FWD) and CN4-5 (REFL).

TR2 serves to switch the DC supply to the Hybrid under control of the PTT line from the Micro Controller on CN4-2. A thermistor TS1, physically located on the PA heatsink to monitor the heatsink temperature, is connected to the Micro Controller via CN4-4/6

8.1.2 PA Module Test Procedure

Test Equipment:

Tested MX800 with PA removed

PC with MXTOOLS software

RF Power Meter

RF Signal Generator

Multimeter

+13.8VDC 15A power supply

Preliminaries:

Program upper, middle and lower frequencies of band into 3 channels in MXTOOLS channel screen. Although the PA will function over a wider bandwidth, the nominal switching bandwidth of the PA is 10MHz. The recommended procedure is to centre this 10MHz around the centre of the user frequencies. (Note that 'Continuous Update Enabled' on the MXTOOLS channel screen should be ticked for these tests)

Do not connect Exciter RF drive output CN1 to PA.

Procedure:

1. Remove PA top cover. Measure resistance of thermistor between CN4-6 and CN4-4, this should be approximately 2kΩ. Connect DC power lead and 10-way connector from MX800. Connect PA RF output to RF power meter and PA RF input (CN1) to RF signal generator.
2. Set signal generator to centre frequency of PA under test and reduce RF drive level (from signal generator) to zero. Switch DC power on and check that supply is present on L9. Assert PTT (check that no output RF power is emitted from the PA) check that the 13.8V supply is switched through to the Hybrid on pin adjacent to RF input and that 5V is switched to the Hybrid on the next pin along (pins not numbered on Hybrid).
3. With PTT ON measure the PA bias current at the Gates of the FET's. The Bias current is band dependent. This is done by monitoring the current drain of the whole PA with CN1 disconnected. Link the gate of TR2 to GND. Measure current consumption (VHF High Band 200mA ,UHF 400mA.) This can be adjust by RV2. Measure gate volts ≈ 3.4V Remove link from TR2. Measure current consumption, adjust RV1 so that current is 2Amp total (VHF & UHF). Measure gate volts ≈ 3.9V

4. With PA transmitting at 50W into 50Ω load measure DC volts FWD power sense CN4-8 and REFL power sense CN4-5. These voltages should be approx. 2.8V and <250mV respectively. Reduce RF drive until PA output is 10W and disconnect PA RF output cable. Measure

DC voltage on CN4-8 and CN4-5 again. These should now both read lower approximately 1V. Remove PTT.

8.1.3 PA Fault Finding Procedure

First do a visual check of all the components on the PA looking for any damaged components.

Connect the input of the PA to signal generator with the RF output switched off.

With PTT off measure the +13.8V supply at the collector of the output transistor.

Key up the PA and check the supply voltages on the hybrid module. Refer to your circuit diagram for test points.

Turn the supply voltage OFF and lift the RF output lead of the hybrid and solder a flying lead to the lifted leg. Connect the earth of the flying lead to the earth of the PA.

Connect the Flying lead to a power meter. Turn ON the supply voltage and the signal generator RF output, PTT the PA and increase the generator output whilst measuring the hybrid power output.

The hybrid may be faulty if it has an output of less than 5W.

The PA RF transistor may be faulty if the hybrid has an output power of greater than 5W.

See section 9.1 for superseded PA Drawings

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9. Drawings

Drawing No.	Description	Band
Figure 8.1	Receiver Component Overlay	All
Figure 8.2	Exciter Component Overlay	All
Figure 8.3	Power Amplifier Component Overlay	N to Q
Figure 8.4	Micro Controller Component Overlay	All
Figure 8.5	VCO Component Overlay	A to Q3
Figure 8.6	VCO Component Overlay	R to X
Figure 8.7	High Spec Rx VCO Component Overlay	A to Q
BD001-1	Receiver Block Diagram	All
BD002-1	Exciter Block Diagram	All
BD003-1/2	Micro Controller Block Diagram	All
BD004-1	Power Amplifier Block Diagram	All
IC001-1	MX800 Interconnection Diagram	All
CS001-1/6	Micro Controller Board Circuit Diagram	All
CS002-1	Exciter Circuit Diagram	All
CS003-2	Receiver Front End Circuit Diagram	All
CS004-1	TX VCO Circuit Diagram	A to Q
CS005-1	RX VCO Circuit Diagram	A to Q2
CS010-1	PA 35W Circuit Diagram	R to X
CS011-1	TX VCO Circuit Diagram	R to X
CS012-1	RX VCO Circuit Diagram	R to X
CS015-1/2	Receiver Module Mixer and Programmable 45MHz IF Section	A & B
CS016-1	Power Amplifier 50W Circuit Diagram	A & B
CS017-1/2	Receiver Module Mixer and Programmable IF Section	All (except A&B bands)
CS018-1	Isolated Interface Option	All
CS021-1	Trunk Interface Circuit diagram	All
CS022-1	T11 option PCB Circuit diagram	All
CS023-1	HP Rx VCO Circuit Diagram	A to Q
CS025-1/2	Receiver Module Mixer and Programmable 70 MHz IF Section	A3
CS028-1	Wide Band Power Amplifier 50W Circuit Diagram	R2
CS029-1	Wide Band Power Amplifier 50W Circuit Diagram	N to Q
CS031-1	Wide Band Power Amplifier 50W Circuit Diagram	A to B
CS033-1	Wide Band Power Amplifier 50W Circuit Diagram	K to M
CS035-1	T29 isolated interface Circuit Diagram	ALL
CS037-1	T19/T26 Line encoder/decoder interface	All

Drawing No.	Description	Band
CS037-2	T19/T26 Line encoder/decoder logic CCT diagram	All
CS038-1	Wide Band Power Amplifier 50W Circuit Diagram	C to E2
CS039-1	Wide Band Power Amplifier 50W Circuit Diagram	E to G
CS040-1	Wide Band Power Amplifier 50W Circuit Diagram	H to J
CS041-1	Wide Band Power Amplifier 50W Circuit Diagram	A2
CS042-2	Wide Band Power Amplifier 50W Circuit Diagram	A3
	DCS option PCB	All
EV0001-1	MX800 Transceiver Final Assembly	All
EV0002-1	MX800 PA Sub-Assembly	All
EV0003-1	MX800 Rx & Exciter Module Sub-Assembly	All
EV0004-1	MX800 Internal Power Cable Assembly	All

Table 9-1 Drawings

9.1 Superseded Drawings

Consult Spectra Engineering regarding obtain Superseded Drawings.

Drawing No.	Description	Band
CS003-1	Receiver Module old, Superseded by CS017	
CS006-1	Power Amplifier 50W Circuit Diagram	C to D3
CS007-1	Power Amplifier 50W Circuit Diagram	E to F
CS013-1	Power Amplifier 50W Circuit Diagram	G to I
CS008-1	Power Amplifier 50W Circuit Diagram	J to M
CS009-1	Power Amplifier 50W Circuit Diagram	N to Q
CS010-1	Power Amplifier 50W Circuit Diagram	R to X
CS014-1	Power Amplifier 5W Circuit Diagram	N to Q
CS020-1	Power Amplifier 50W Circuit Diagram	A2 & A3
CS024-1	Power Amplifier 25W / 50W Circuit Diagram	N to Q
CS026-1	Power Amplifier 50W Circuit Diagram	C to D3
CS032-1	VF Receiver Limiter Circuit Diagram	All

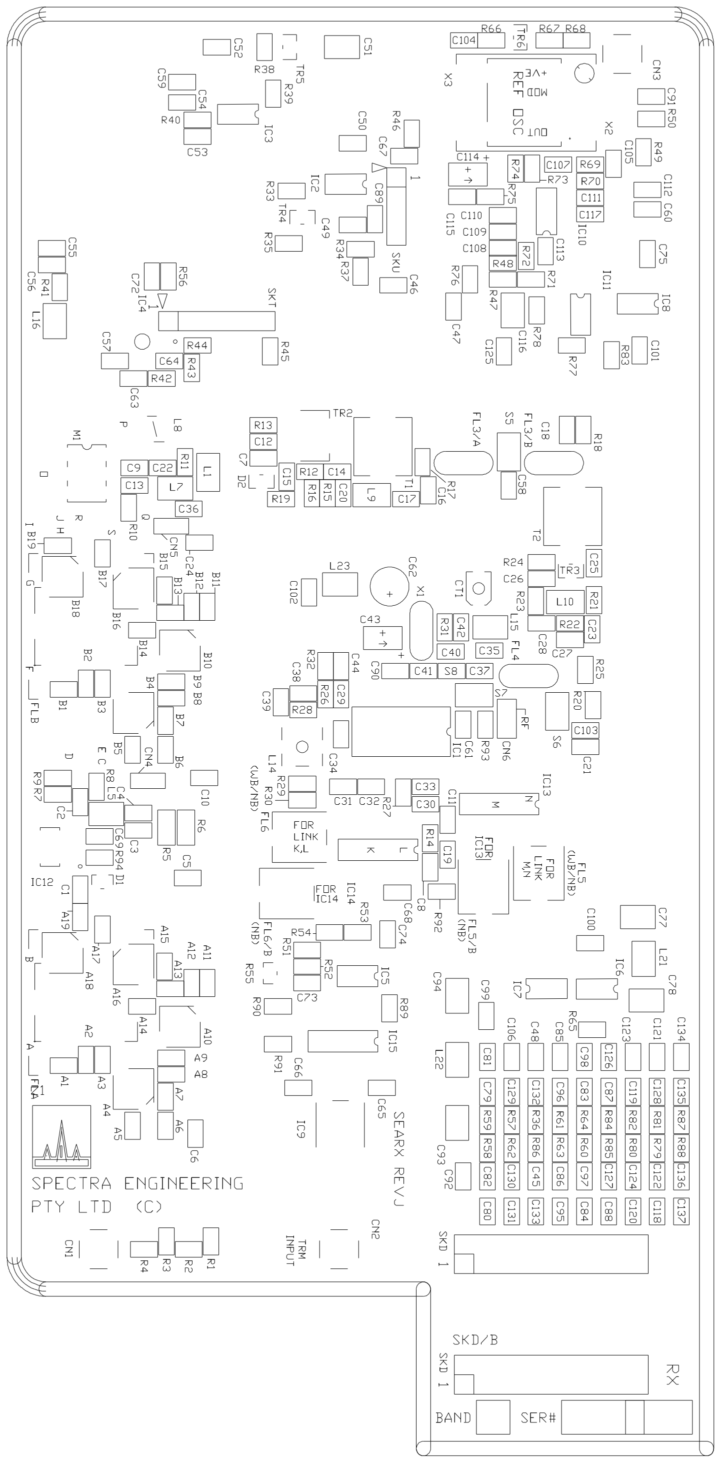

Figure 9-1 Receiver Component Overlay

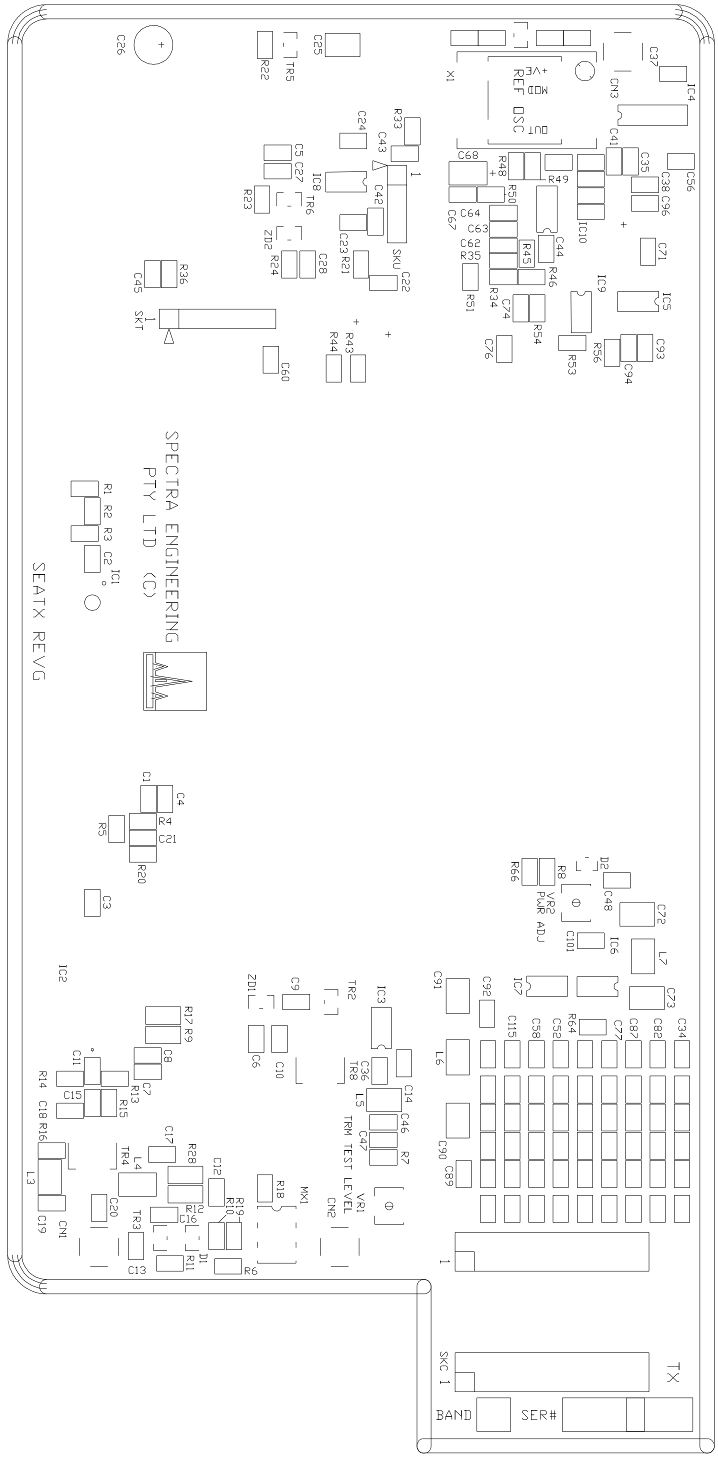

Figure 9-2 Exciter Component Overlay

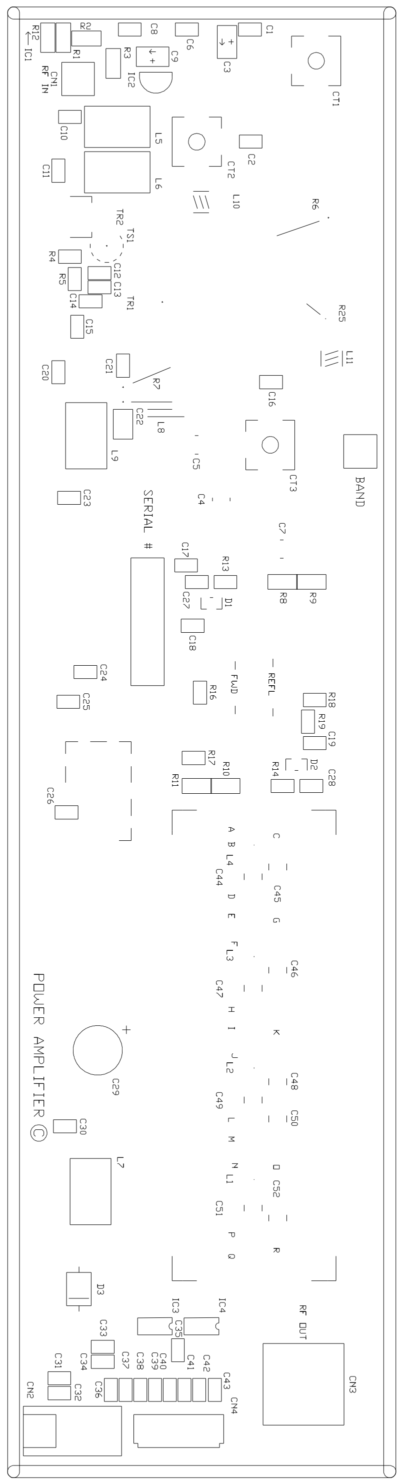

Figure 9-3 PA Component Overlay - Superseded Version

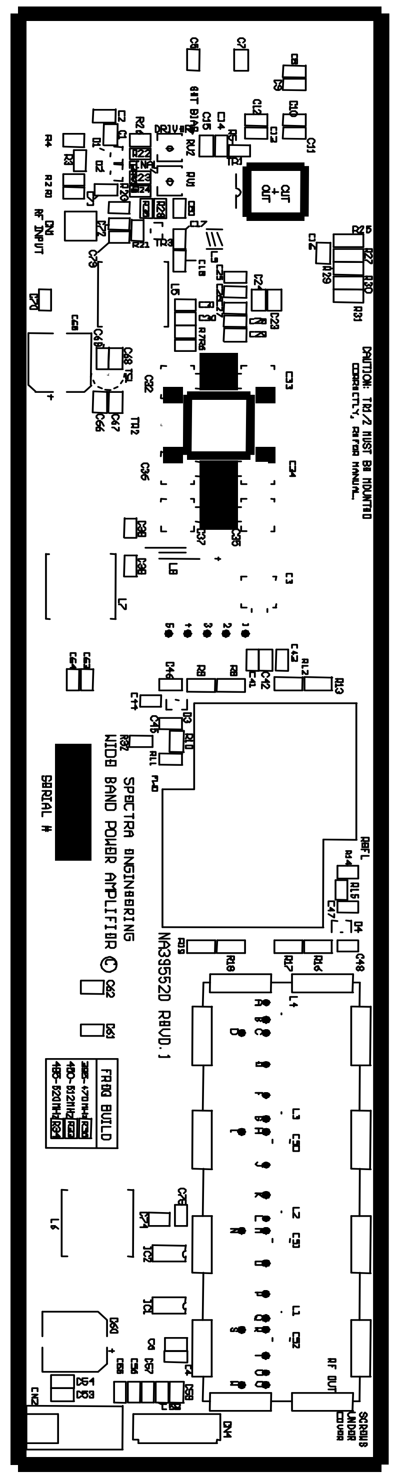

Figure 9-4 PA Component Overlay –New Wide Band PA Version

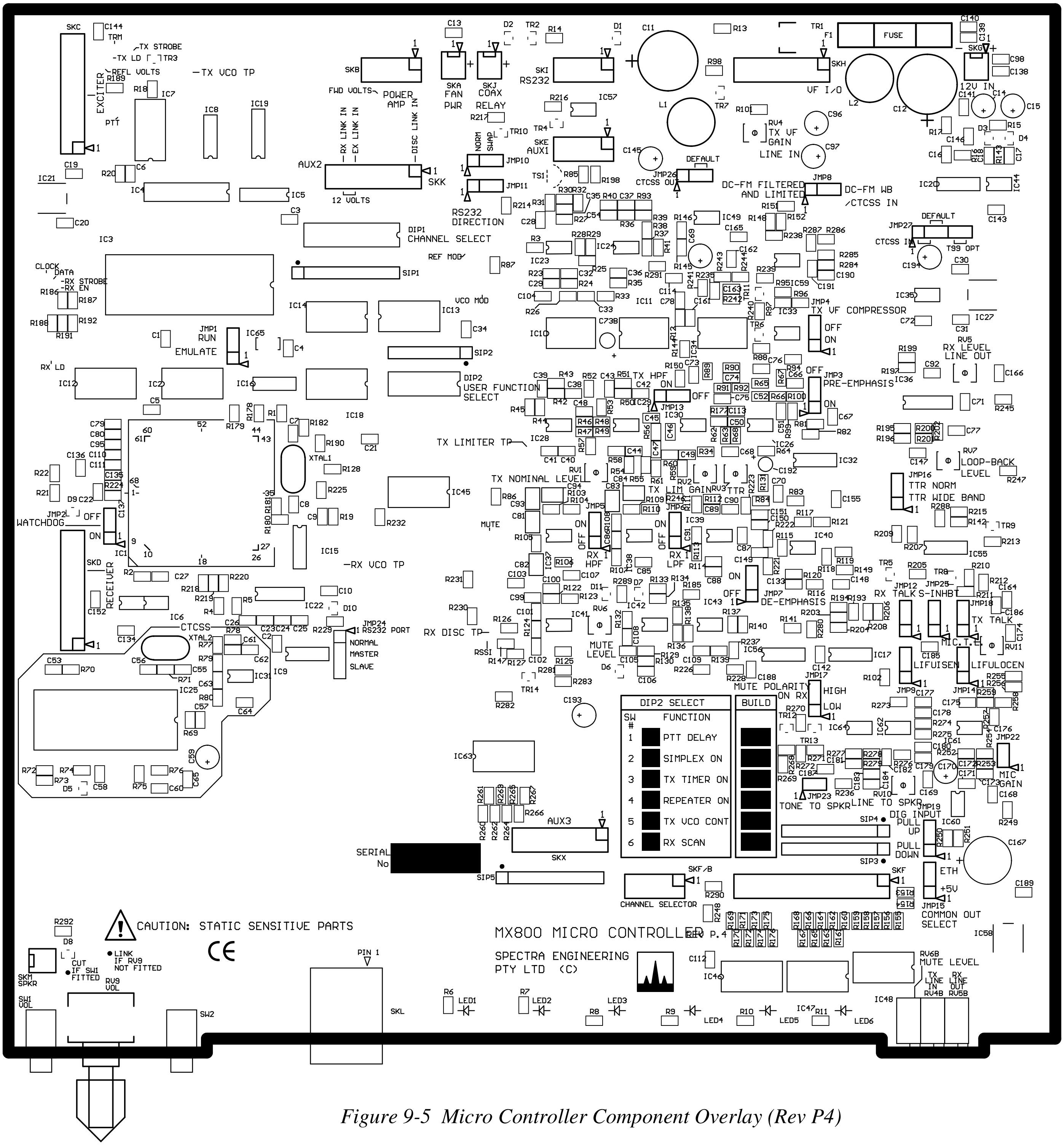

Figure 9-5 Micro Controller Component Overlay (Rev P4)

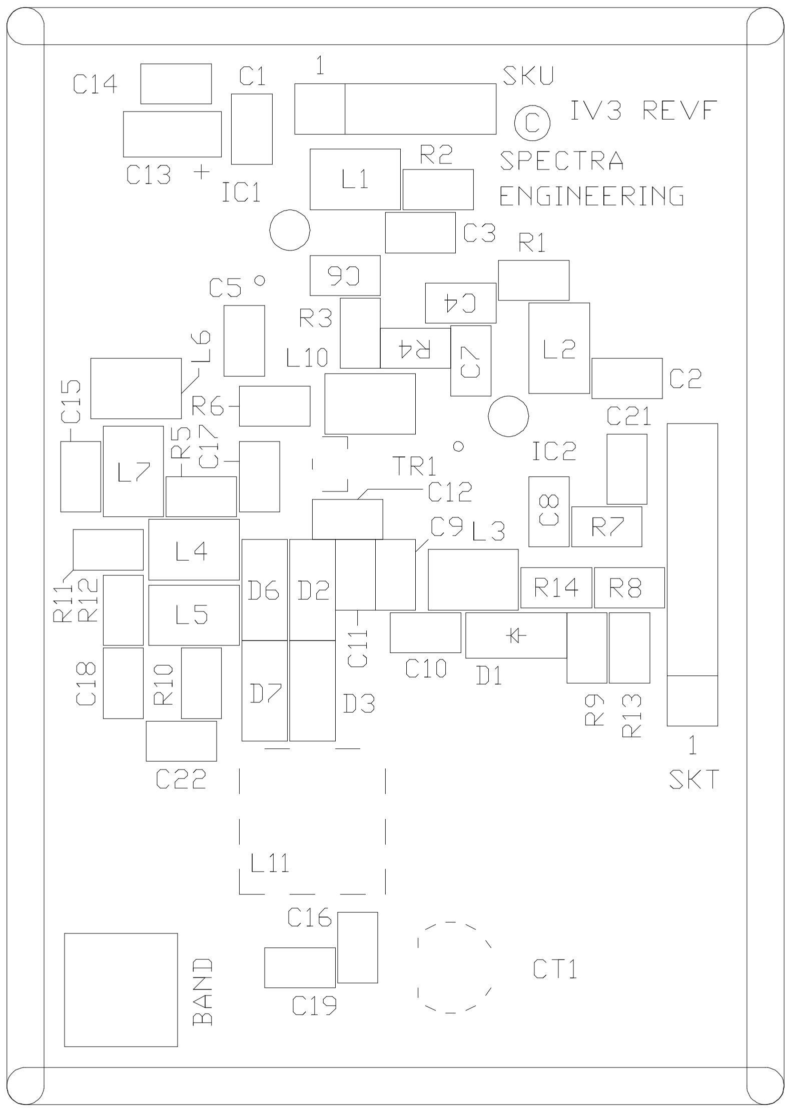

Figure 9-6 Tx and Rx VCO Component Overlay Bands A to Q3

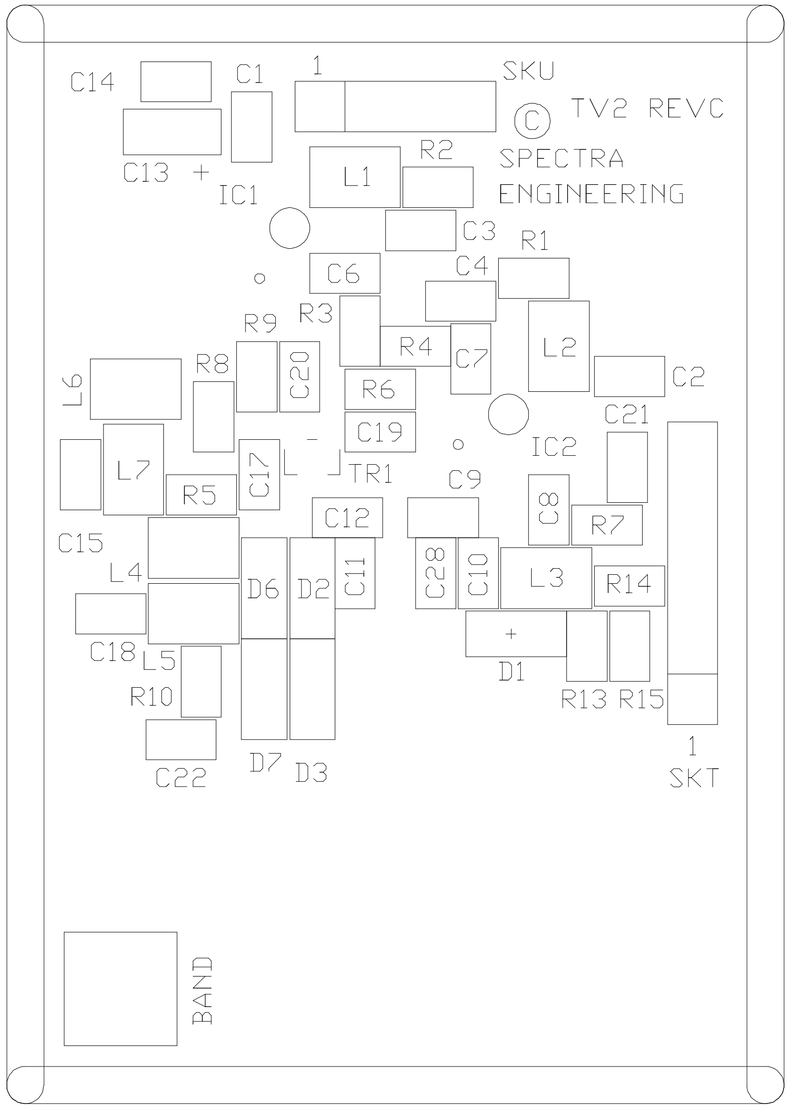

Figure 9-7 Tx and Rx VCO Component Overlay Bands R to X

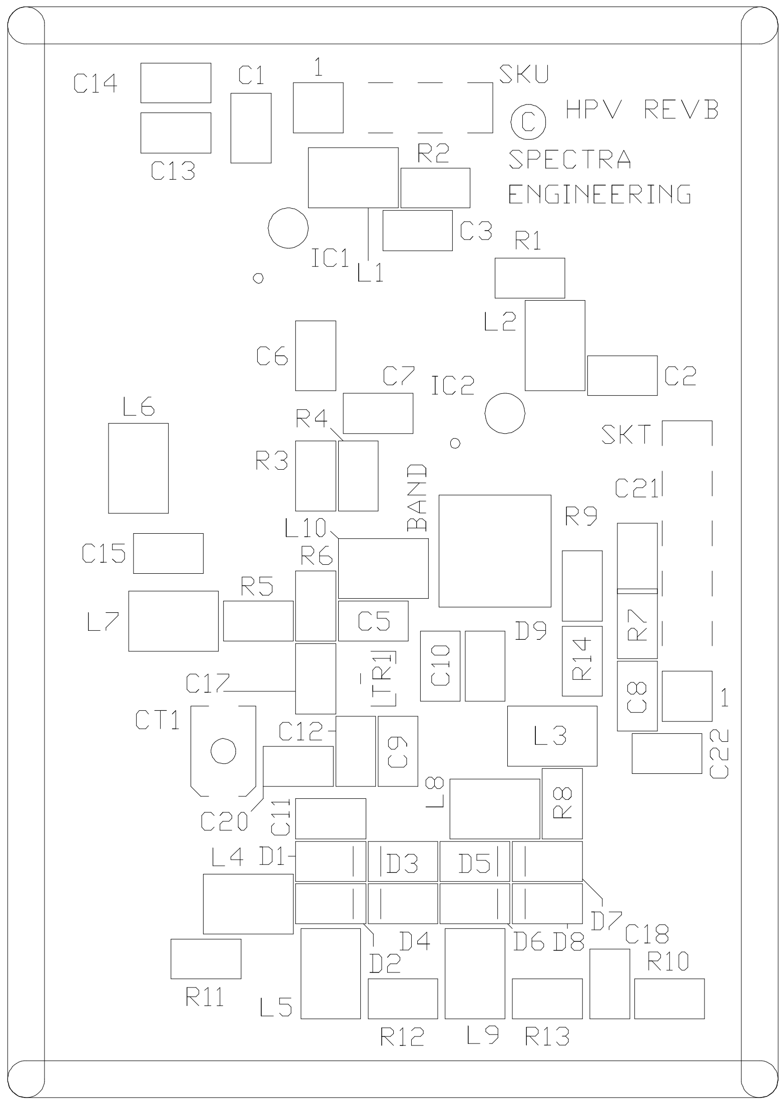

Figure 9-8 HP Rx VCO Component Overlay Bands A to Q

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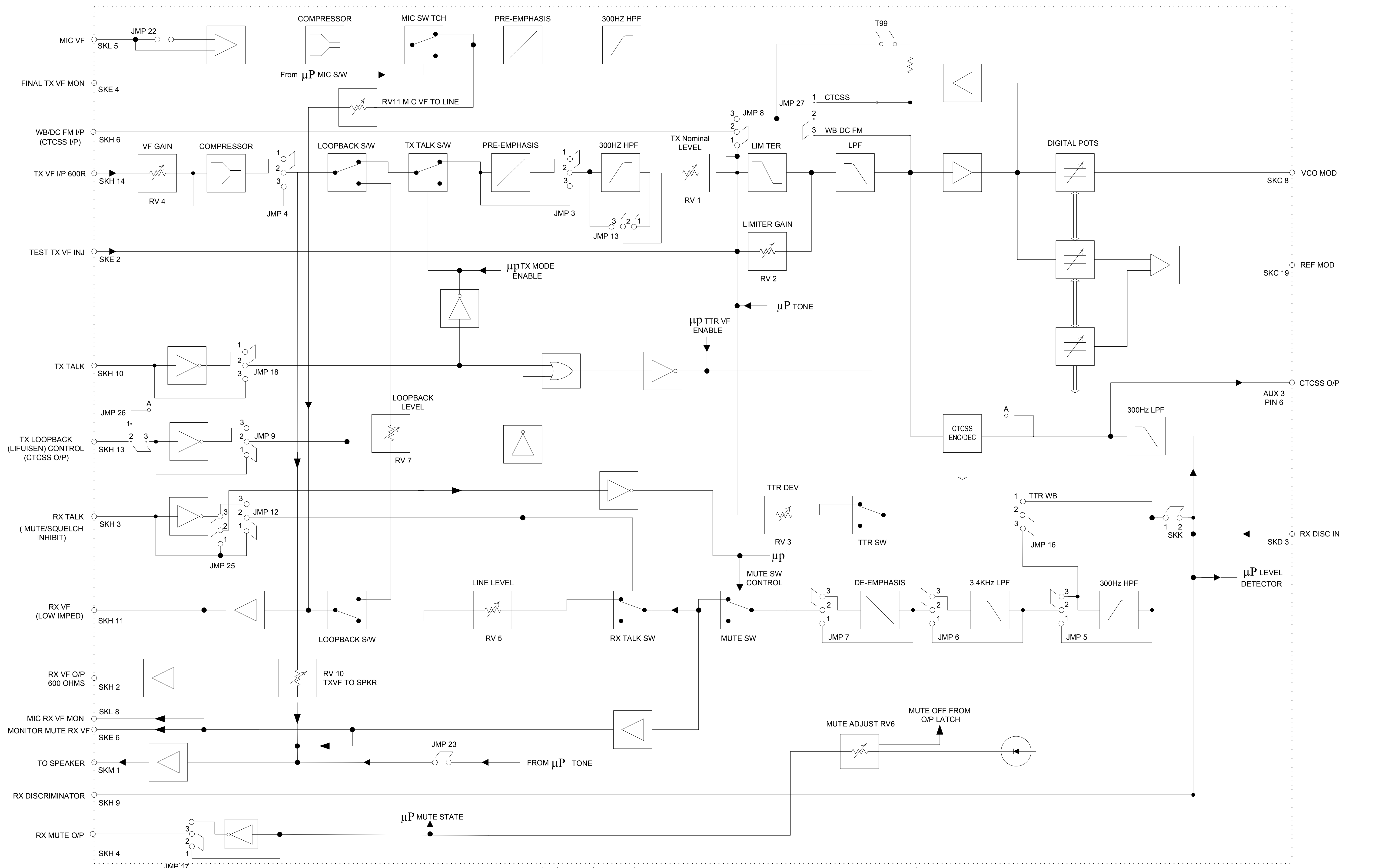

No	MADE BY	DATE	REMARKS

REVISIONS

DESIGNED.	Gary Jacobs
DRAWN.	Anthony Chadd
CHECKED.	
APPROVED.	
DATE.	19/06/06
SCALE.	

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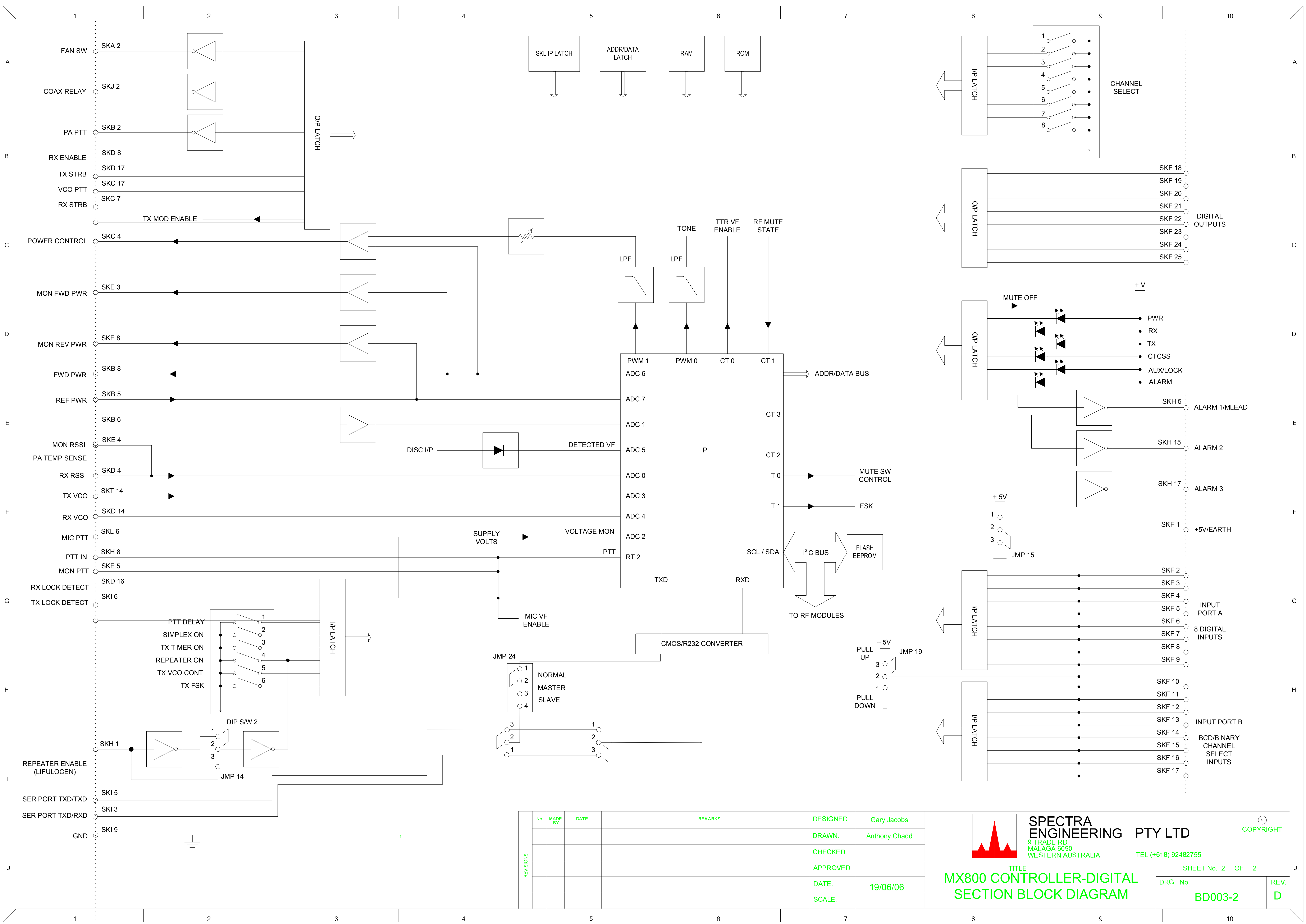
TITLE
MX800 CONTROLLER ANALOG SECTION

SHEET No. 1 OF 2
DRG. No. BD003-1
REV. J



FAN SW
SKA 2
COAX RELAY
SKJ 2
PA PTT
SKB 2
RX ENABLE
SKD 8
TX STRB
SKD 17
VCO PTT
SKC 17
RX STRB
SKC 7
TX MOD ENABLE
O/P LATCH
POWER CONTROL
SKC 4
MON FWD PWR
SKE 3
MON REV PWR
SKE 8
FWD PWR
SKB 8
REF PWR
SKB 5
SKB 6
MON RSSI
SKE 4
PA TEMP SENSE
RX RSSI
SKD 4
TX VCO
SKT 14
RX VCO
SKD 14
MIC PTT
SKL 6
PTT IN
SKH 8
MON PTT
SKE 5
RX LOCK DETECT
SKD 16
TX LOCK DETECT
SKI 6
PTT DELAY
SIMPLEX ON
TX TIMER ON
REPEATER ON
TX VCO CONT
TX FSK
I/P LATCH
DIP S/W 2
SKH 1
REPEATER ENABLE
(LIFULOCEN)
JMP 14
SER PORT TXD/TXD
SKI 5
SER PORT TXD/RXD
SKI 3
GND
SKI 9
SKL IP LATCH
ADDR/DATA LATCH
RAM
ROM
TONE
TTR VF ENABLE
RF MUTE STATE
LPF
LPF
PWM 1
PWM 0
CT 0
CT 1
ADC 6
ADC 7
ADC 1
ADC 5
ADC 0
ADC 3
ADC 4
ADC 2
RT 2
P
CT 3
CT 2
T 0
T 1
SCL / SDA
TXD
RXD
ADDR/DATA BUS
MUTE SW CONTROL
FSK
DISC I/P
DETECTED VF
SUPPLY VOLTS
VOLTAGE MON
PTT
MIC VF ENABLE
I^2C BUS
FLASH EEPROM
TO RF MODULES
CMOS/R232 CONVERTER
JMP 24
NORMAL
MASTER
SLAVE
PULL UP
+ 5V
JMP 19
PULL DOWN
CHANNEL SELECT
I/P LATCH
SKF 18
SKF 19
SKF 20
SKF 21
SKF 22
SKF 23
SKF 24
SKF 25
DIGITAL OUTPUTS
+ V
MUTE OFF
PWR
RX
TX
CTCSS
AUX/LOCK
ALARM
SKH 5
ALARM 1/MLEAD
SKH 15
ALARM 2
SKH 17
ALARM 3
+ 5V
SKF 1
+5V/EARTH
JMP 15
SKF 2
SKF 3
SKF 4
SKF 5
SKF 6
SKF 7
SKF 8
SKF 9
INPUT PORT A
8 DIGITAL INPUTS
SKF 10
SKF 11
SKF 12
SKF 13
SKF 14
SKF 15
SKF 16
SKF 17
INPUT PORT B
BCD/BINARY CHANNEL SELECT INPUTS
No
MADE BY
DATE
REMARKS
REVISIONS
DESIGNED. Gary Jacobs
DRAWN. Anthony Chadd
CHECKED.
APPROVED.
DATE. 19/06/06
SCALE.
SPECTRA ENGINEERING PTY LTD
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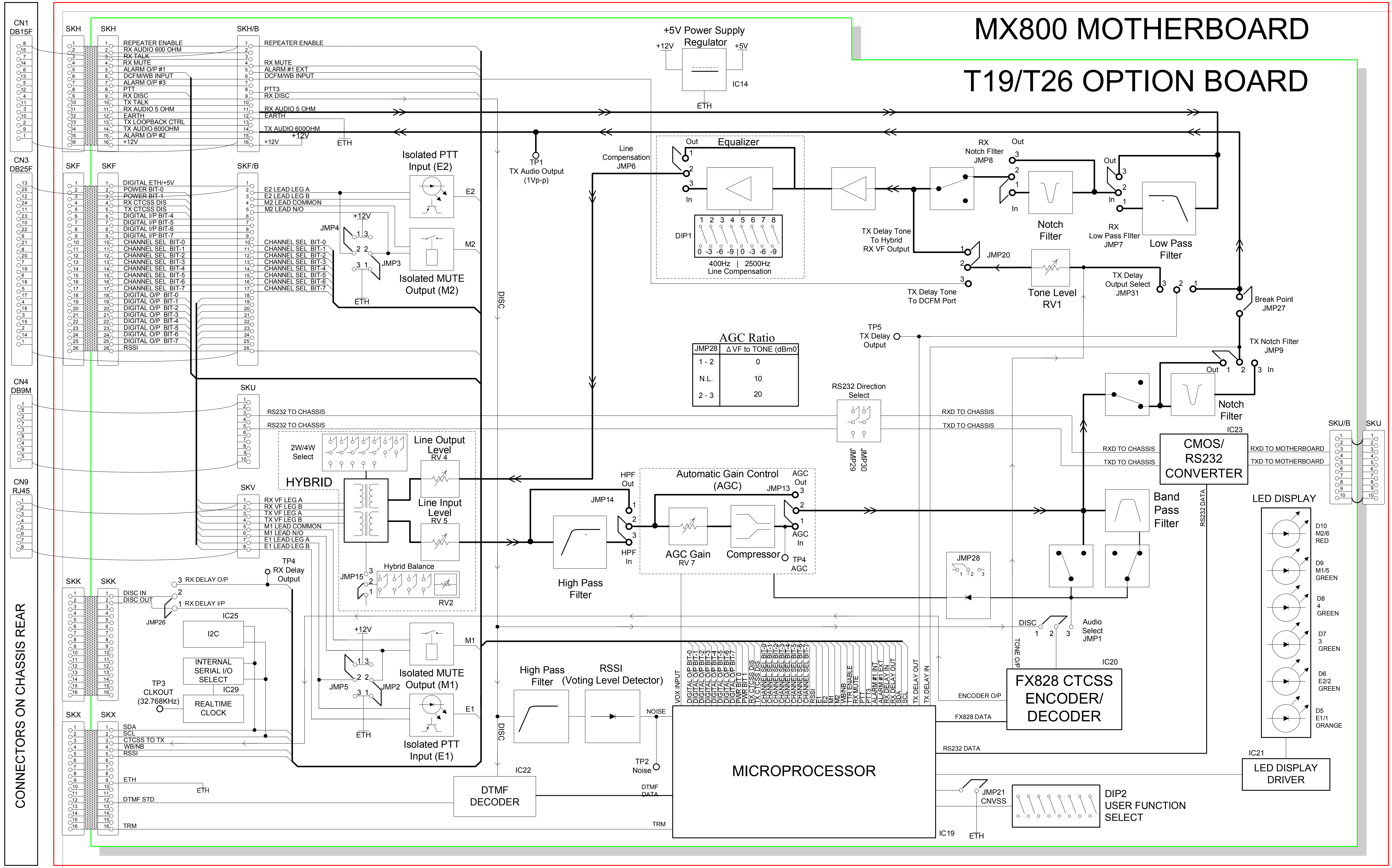
TITLE
MX800 CONTROLLER-DIGITAL SECTION BLOCK DIAGRAM
SHEET No. 2 OF 2
DRG. No. BD003-2
REV. D



No	MADE BY	DATE	REMARKS

REVISIONS

DESIGNED. Gary Jacobs
DRAWN. Steven Edwards
CHECKED.
APPROVED.
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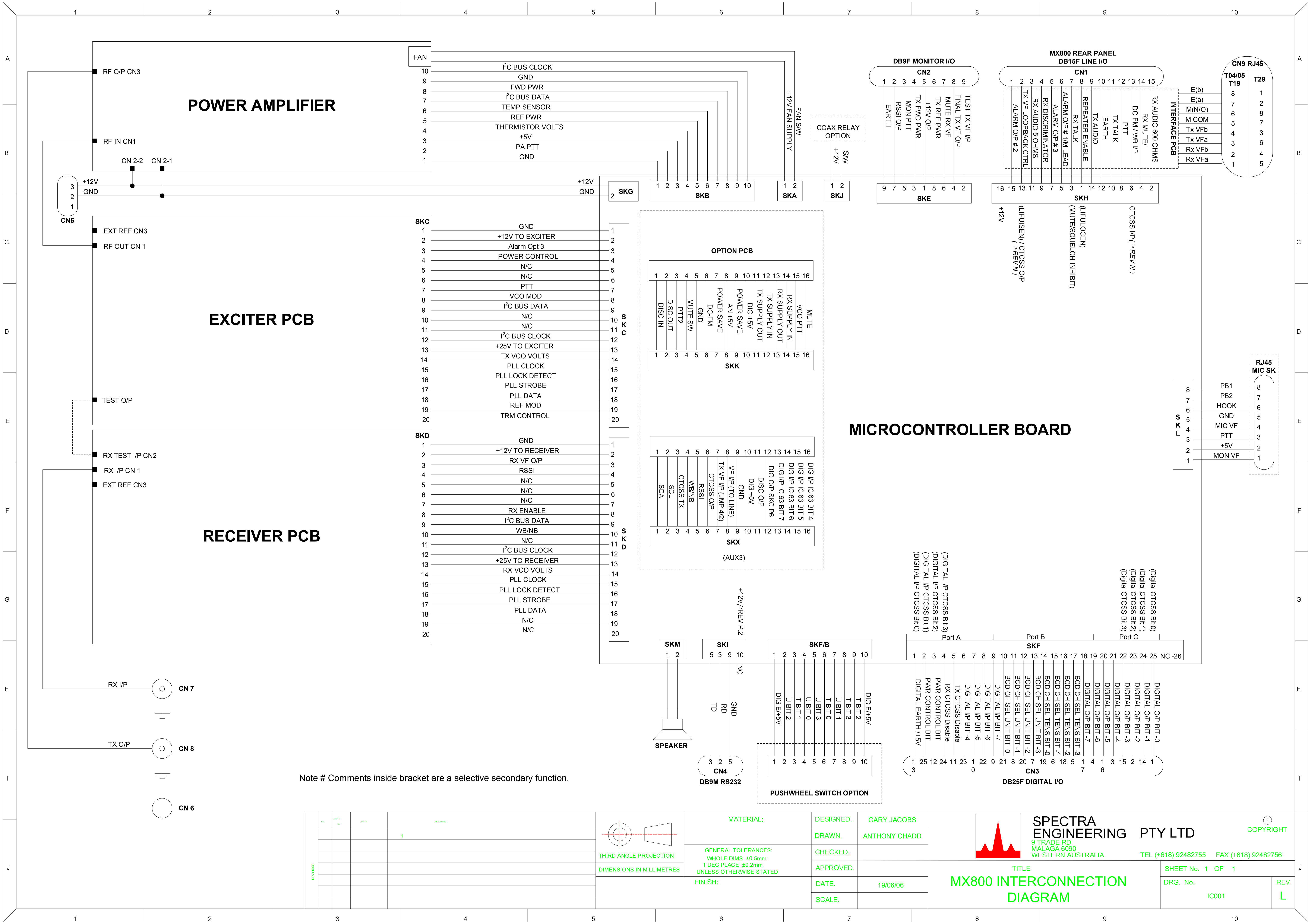
TITLE
T19/T26 Option Board Block Diagram

SHEET No. 1 OF 1
DRG. No. BD004
REV. B


POWER AMPLIFIER
EXCITER PCB
RECEIVER PCB
MICROCONTROLLER BOARD
OPTION PCB
FAN
RF O/P CN3
RF IN CN1
CN 2-2
CN 2-1
CN5
EXT REF CN3
RF OUT CN 1
TEST O/P
RX TEST I/P CN2
RX I/P CN 1
RX I/P
TX O/P
CN 7
CN 8
CN 6
SPEAKER
SKA
SKB
SKC
SKD
SKE
SKF
SKG
SKH
SKI
SKJ
SKK
SKL
SKM
SKX
SKF/B
(AUX3)
COAX RELAY OPTION
DB9F MONITOR I/O
CN2
MX800 REAR PANEL DB15F LINE I/O
CN1
INTERFACE PCB
CN9 RJ45
RJ45 MIC SK
CN4
DB9M RS232
CN3
DB25F DIGITAL I/O
PUSHWHEEL SWITCH OPTION
Note # Comments inside bracket are a selective secondary function.
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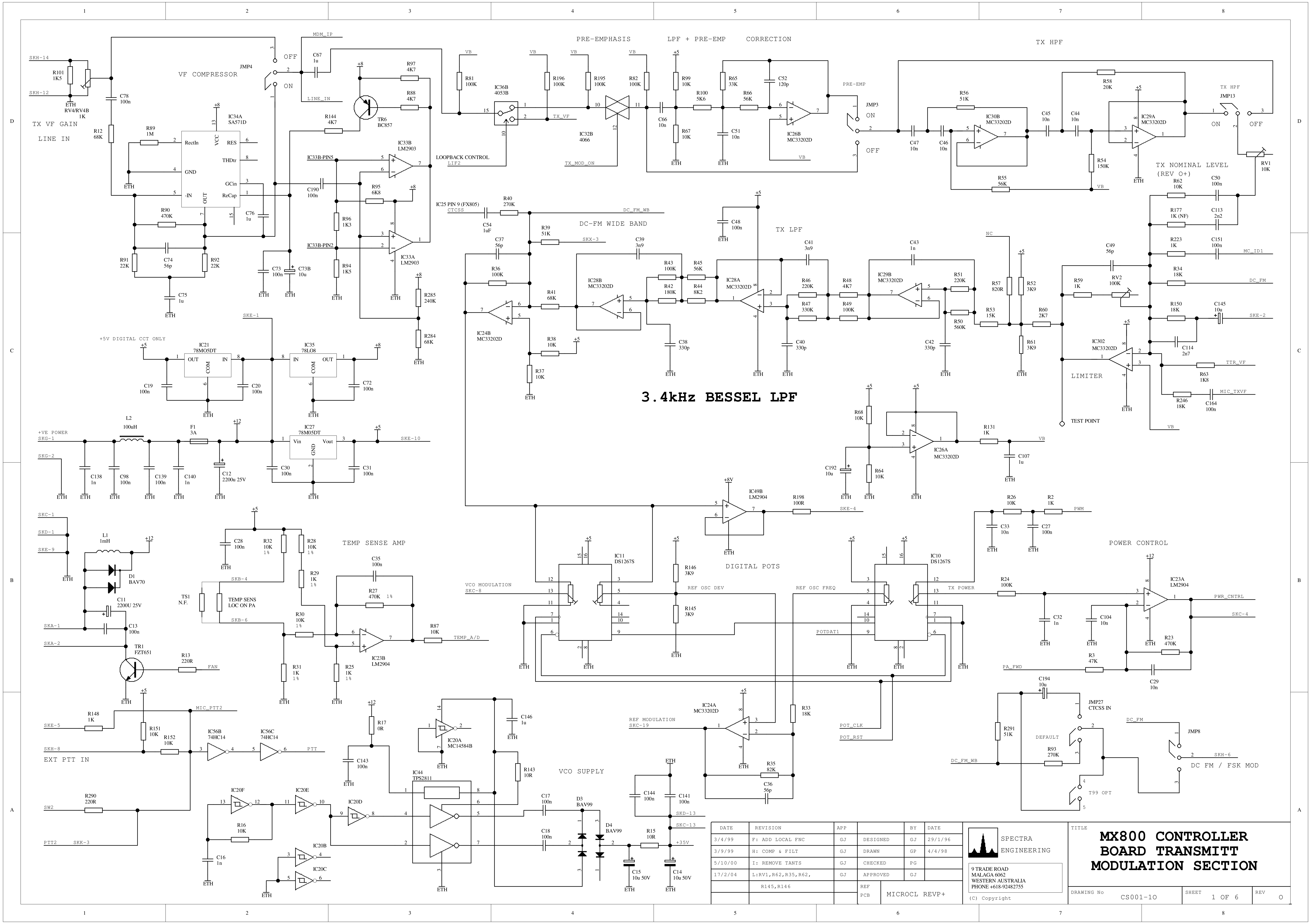
TITLE
MX800 INTERCONNECTION DIAGRAM
SHEET No. 1 OF 1
DRG. No. IC001
REV. L
DESIGNED. GARY JACOBS
DRAWN. ANTHONY CHADD
CHECKED.
APPROVED.
DATE. 19/06/06
SCALE.
MATERIAL:
FINISH:
GENERAL TOLERANCES:
WHOLE DIMS ±0.5mm
1 DEC PLACE ±0.2mm
UNLESS OTHERWISE STATED
THIRD ANGLE PROJECTION
DIMENSIONS IN MILLIMETRES



MX800 CONTROLLER
BOARD TRANSMITT
MODULATION SECTION
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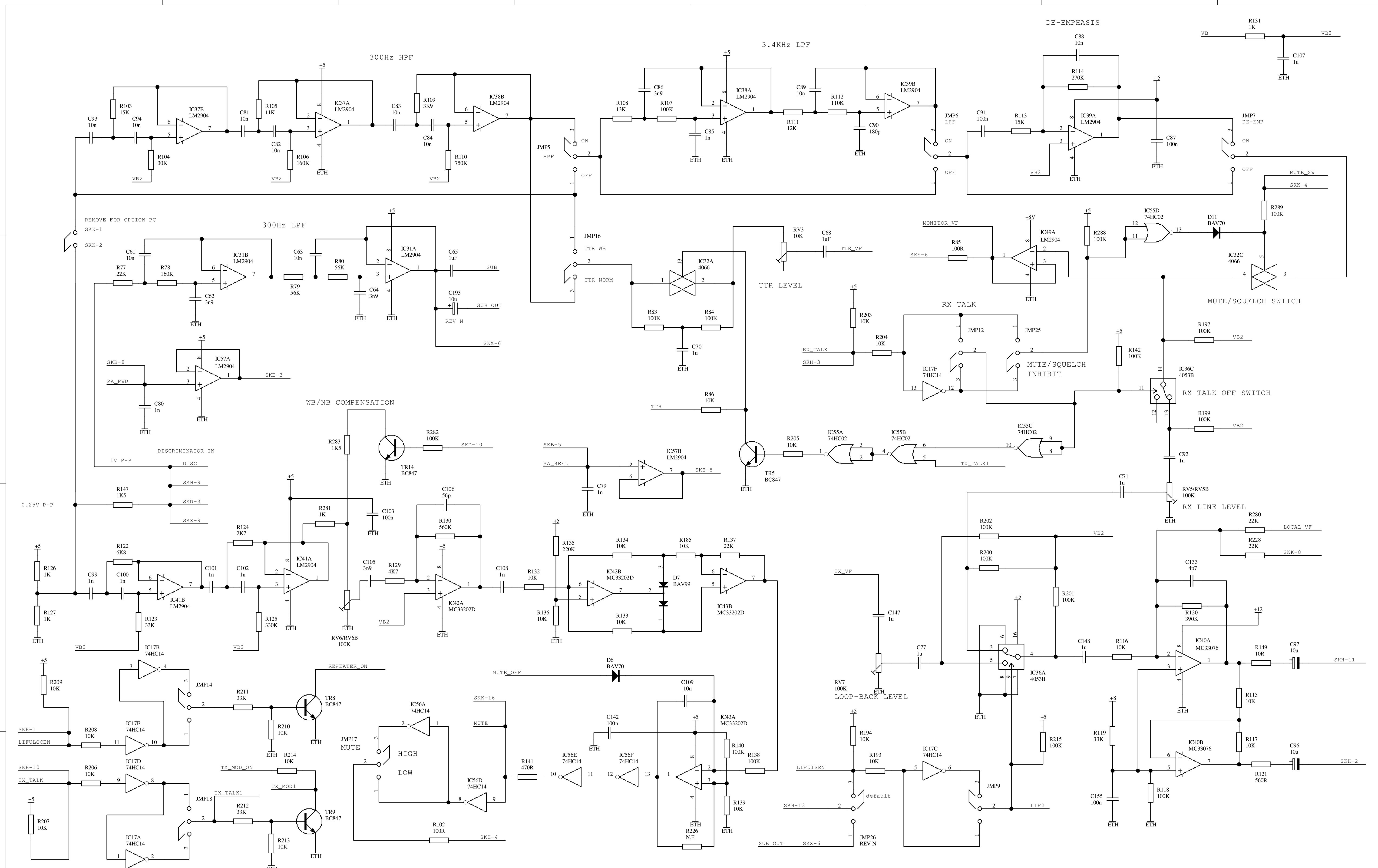
PHONE +618-92482755
(C) Copyright
DRAWING No CS001-10
SHEET 1 OF 6
REV 0
REF PCB MICROCL REVP+
DATE REVISION APP
3/4/99 F: ADD LOCAL FNC GJ
3/9/99 H: COMP & FILT GJ
5/10/00 I: REMOVE TANTS GJ
17/2/04 L:RV1,R62,R35,R62, R145,R146
DESIGNED GJ 29/1/96
DRAWN GP 4/4/98
CHECKED PG
APPROVED GJ
VF COMPRESSOR
TX VF GAIN
LINE IN
PRE-EMPHASIS
LPF + PRE-EMP
CORRECTION
TX HPF
TX NOMINAL LEVEL
(REV O+)
DC-FM WIDE BAND
TX LPF
3.4kHz BESSEL LPF
LIMITER
TEST POINT
LOOPBACK CONTROL
DIGITAL POTS
POWER CONTROL
TEMP SENSE AMP
VCO SUPPLY
DC FM / FSK MOD
EXT PTT IN
+5V DIGITAL CCT ONLY
+VE POWER
VCO MODULATION
REF OSC DEV
REF OSC FREQ
REF MODULATION
TX POWER
TEMP SENS LOC ON PA



NOTES:

1. ALL JUMPERS AND LINKS SHOWN IN CONVENTIONAL MODE OF OPERATION.

DATE	REVISION	APP
5/3/03	M: REMOVE JMP20,21	GJ
2/09/98	G: UPDATE CTCSS LPF AND HPF	GJ
3/4/99	F: ADD LOCAL FNC	GJ
18/9/99	I: ADD MUTE OFF FNC REV K PCB	GJ
6/10/00	J: TANT REMOVE	GJ
2/09/01	K: JUMP16,20,21 PIN#	GJ

	BY	DATE
DESIGNED	GJ	29/1/96
DRAWN	GP	4/4/98
CHECKED	PG	
APPROVED	GJ	

REF DWGS: MICROCL REVN+

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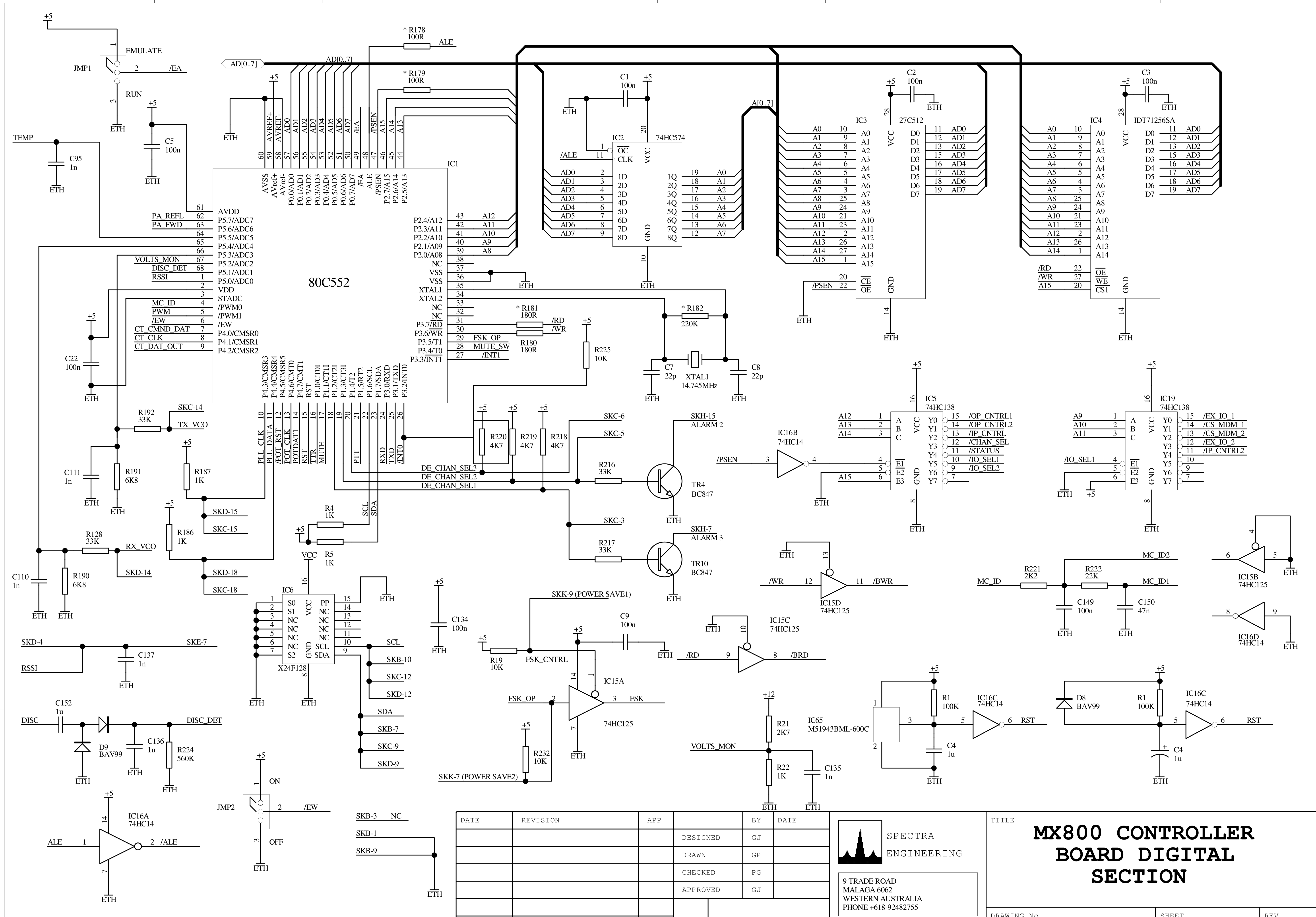
TITLE: **MX800 CONTROLLER BOARD RECEIVER DEMODULATION SECTION**

DRAWING No: CS001-20 | SHEET: 2 OF 6 | REV: O



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	
			DRAWN	GP	
			CHECKED	PG	
			APPROVED	GJ	
			PCB		

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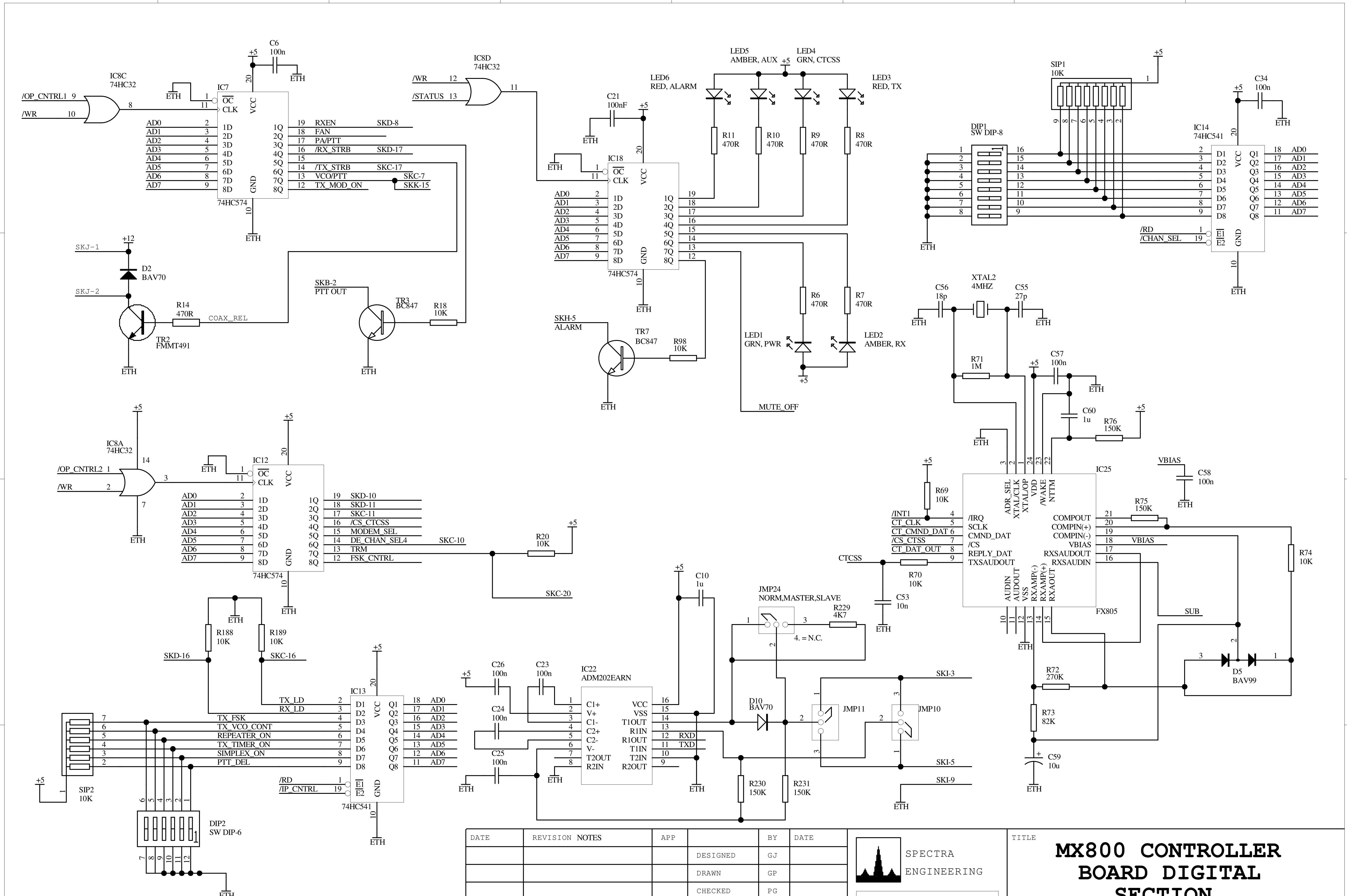
TITLE

MX800 CONTROLLER BOARD DIGITAL SECTION

DRAWING No CS001-3J

SHEET 3 OF 6

REV J



NOTES:

1. REMOVE R229 IF MORE THAN 4 UNITS ON AN RS232 BUSS

DATE	REVISION NOTES	APP		BY	DATE
			DESIGNED	GJ	
			DRAWN	GP	
			CHECKED	PG	
			APPROVED	GJ	
			PCB		

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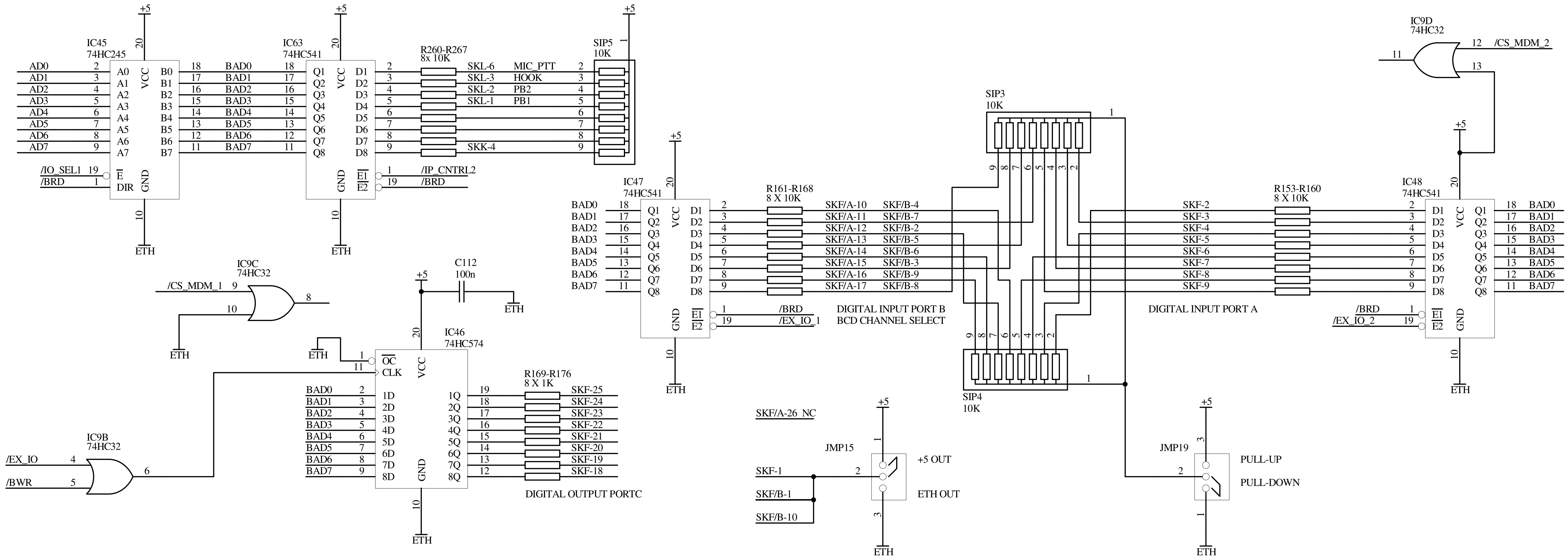
TITLE

MX800 CONTROLLER BOARD DIGITAL SECTION

DRAWING No CS001-4J | SHEET 4 OF 6 | J



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	
			DRAWN	GP	
			CHECKED	PG	
			APPROVED	GJ	
			PCB		

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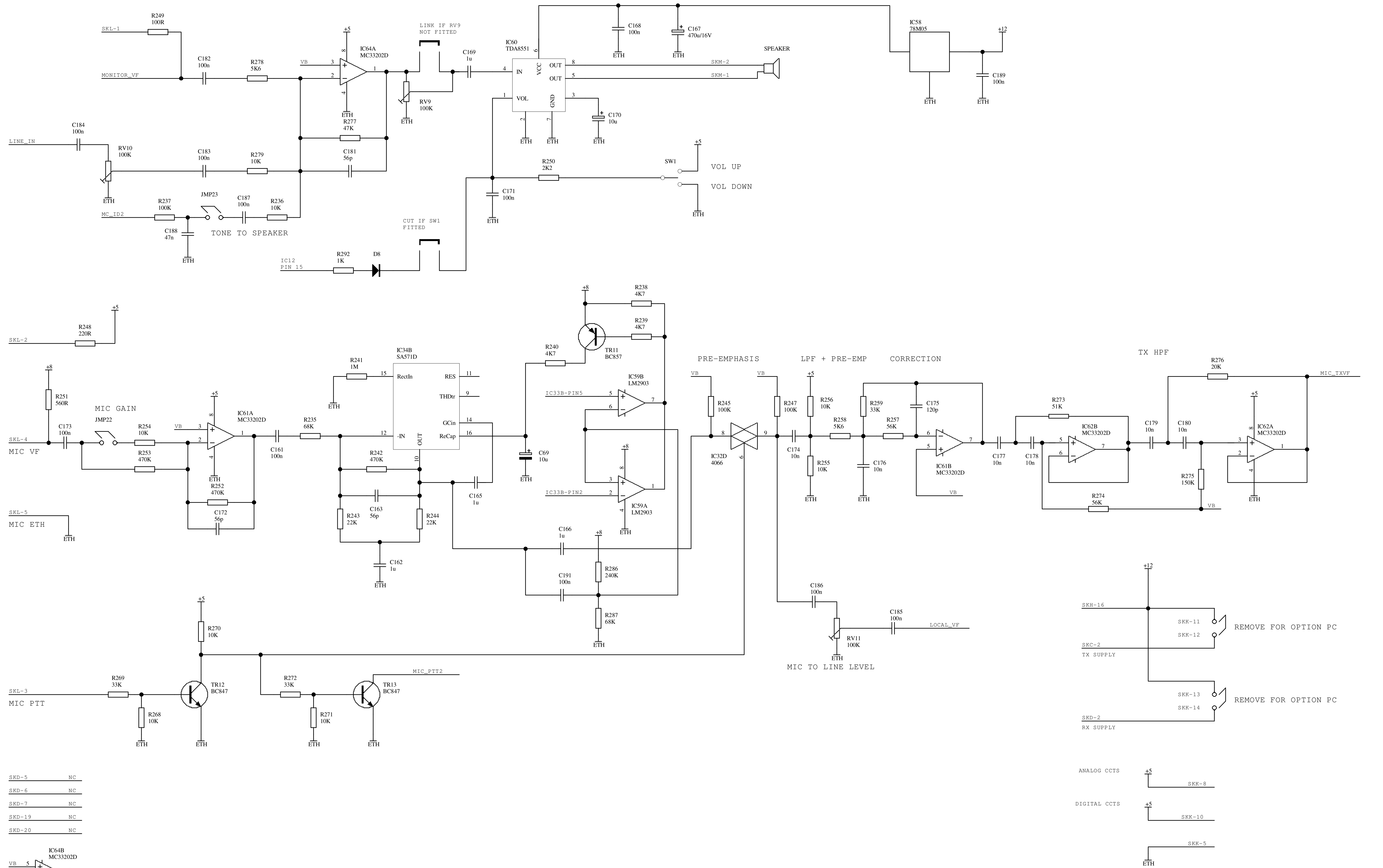
TITLE
MX800 CONTROLLER BOARD DIGITAL SECTION

DRAWING No CS001-5I
SHEET 5 OF 6
REV I



DATE	REVISION	APP		BY	DATE
3/9/99	C: COMP CHANGE	GJ	DESIGNED	GJ	29/1/96
6/10/00	D: TANT REMOVE	GJ	DRAWN	GP	4/4/98
24/9/01	E: R278,C169	GJ	CHECKED	PG	
22/01/03	F:SKL PIN # SWAP	GJ	APPROVED	GJ	
			REF PCB	MICROCL REVL+	

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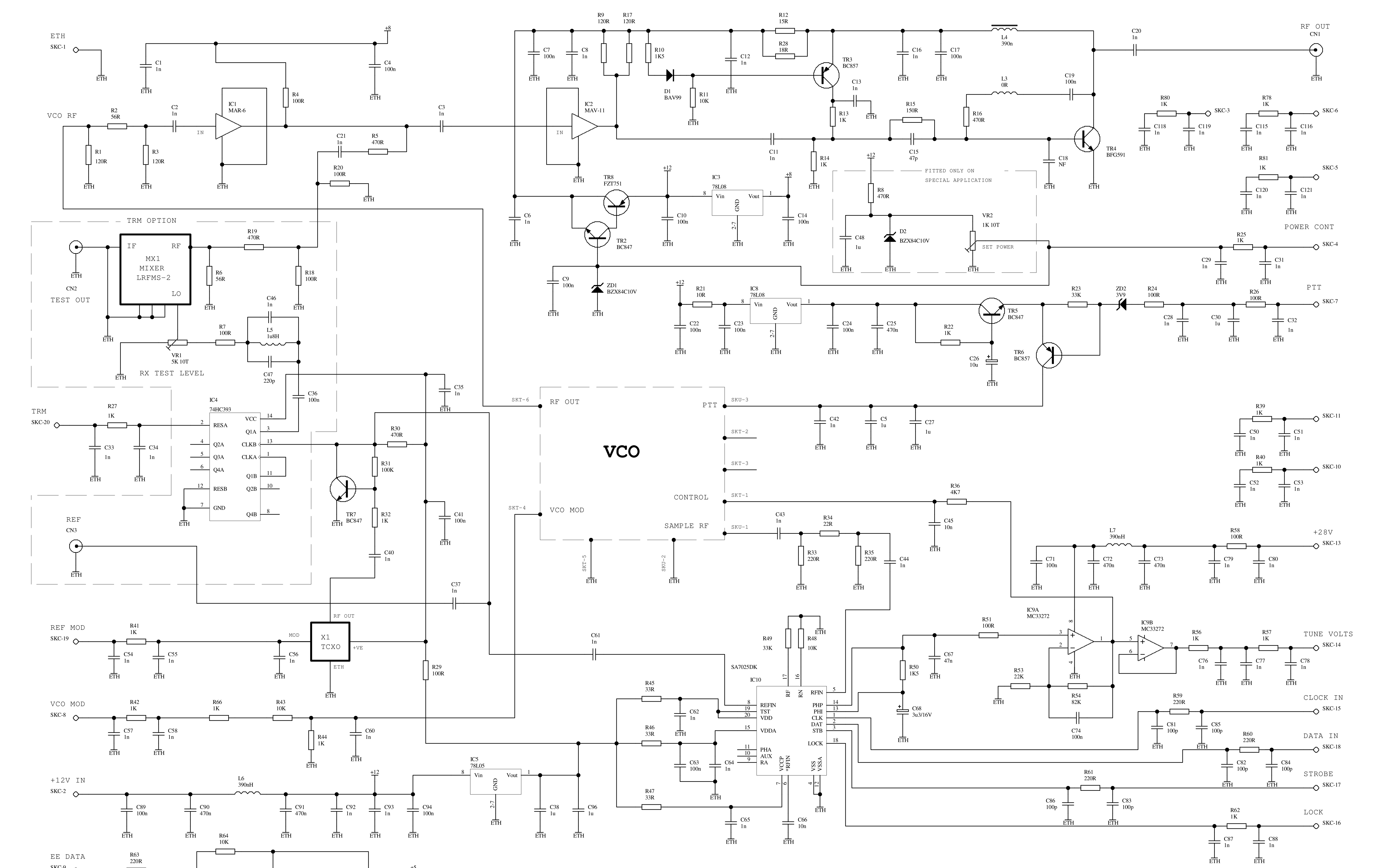
9 TRADE ROAD
MALAGA 6062
WESTERN AUSTRALIA
PHONE +618-92482755

TITLE

MX800 CONTROLLER BOARD LOCAL VF SECTION

DRAWING No CS001-6G | SHEET 6 OF 6 | REV G



NOTE:

1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION

DATE	REVISION	APP
15/2/98	B: DEL SPARE COMP	
1/3/00	C: PLL OPTIMIZE	
22/8/00	D: TANT REMOVE	
16/6/03	E: EE CLK & DATA	

	BY	DATE
DESIGNED	GJ	29/1/96
DRAWN	GJ	11/6/97
CHECKED		
APPROVED		

REF PCB EXMOD-2 REVE

SPECTRA ENGINEERING

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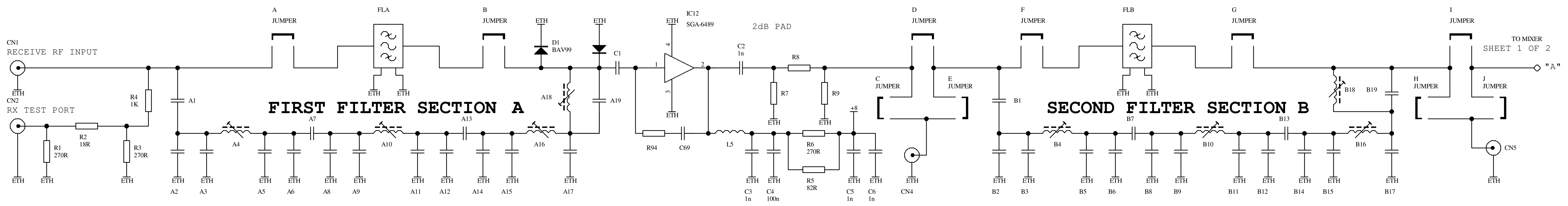
WESTERN AUSTRALIA
PHONE +618-92482755

TITLE

MX800 EXCITER MODULE 20MHz to 1000MHz CIRCUIT DIAGRAM

DRAWING No CS002-1G | SHEET 1 OF 1 | REV G



COMPONENT VALUES FOR DISCRETE BAND PASS FILTER SECTION A & B

BAND	FILTER BW	IF	A1 B1	A2 B2	A3 B3	A4 B4	A5 B5	A6 B6	A7 B7	A8 B8	A9 B9	A10 B10	A11 B11	A12 B12	A13 B13	A14 B14	A15 B15	A16 B16	A17 B17	A18 B18	A19 B19	R7 R9	R8	R94	C1	C69	L5	NOTES
A2	30-39MHz	90MHz	560p	220p	-	6.5T	68p	470p	560p	120p	-	6.5T	-	120p	560p	-	470p	6.5T	150p 270p	- 3.5T	180p 330p	470R	12R	560R	10n	1n	1u2	B18=45MHz NOTCH
A3	39-50MHz	70MHz	330p 220p	27p	120p	5.5T	NIL 47p	330p	470p	47p	-	5.5T	-	47p	470p	39p	330p	5.5T	220p 120p	3.5T	120p 470p	470R	12R	560R	10n	1n	1u2	A18=70MHz NOTCH B18=35MHz NOTCH
A	66-80MHz	45MHz	56p	-	56p	5.5T	-	56p	56p	-	56p	5.5T	56p	-	56p	-	56p	5.5T	56p	5.5T	150p	470R	12R	560R	1n	1n	390n	A18,B18=45MHz NOTCH
B	70-88MHz	45MHz																										
C	135-160MHz	90MHz																										
D	155-180MHz	90MHz	18p	-	10p	5.5T	2p2	12p	12p	3p9	10p	5.5T	10p	3p9	12p	-	12p	5.5T	- 8p2	5.5T	39p	470R	12R	560R	1n	1n	390n	A18,B18=90MHz NOTCH
D3	148-174MHz	90MHz																										
E	175-200MHz	90MHz	22p 15p	-	8p2	5.5T	-	8p2	5p6	2p7	8p2	5.5T	8p2	2p7	5p6	-	8p2	5.5T	3p9 8p2	-	15p							
F	195-225MHz	90MHz	15p	-	6p8	5.5T	-	6p8	3p9	-	8p2	5.5T	8p2	-	3p9	-	6p8	5.5T	6p8	-	15p							
G	220-250MHz	90MHz	10p	-	3p9	5.5T	-	3p9	2p2	-	5p6	5.5T	5p6	-	2p2	-	3p9	5.5T	3p9	-	10p							
H	245-275MHz	90MHz																										
I	270-300MHz	90MHz																										
J	295-325MHz	90MHz	6p8	-	2p7	5.5T	-	2p2	1p2	-	3p9	5.5T	3p9	-	1p2	-	2p2	5.5T	2p7	-	6p8	470R	12R	560R	1n	1n	390n	
K	320-350MHz	90MHz	10p	-	15p	2.5T	_	10p	3p9	5p6	8p2	2.5T	8p2	5p6	3p9	-	10p	2.5T	15p	-	10p							
L	345-375MHz	90MHz	6p8	-	12p	2.5T	8p2	1p8	3p3	8p2	2p7	2.5T	2p7	8p2	3p3	1p8	8p2	2.5T	12p	-	6p8	470R	12R	-	1n	-	390n	
M	370-400MHz	90MHz	10p 6p8	-	8p2 10p	2.5T	-	8p2	3p3	8p2	1p2	2.5T	1p2	8p2	3p3	-	8p2	2.5T	8p2 10p	-	5p6 6p8	470R	12R	-	1n	-	390n	
N	395-430MHz	90MHz	5p6	-	8p2	2.5T	6p8	-	2p7	8p2	-	2.5T	-	8p2	2p7	-	6p8	2.5T	8p2 15p	- 2.5T	5p6 22p	220R	22R	-	1n	-	390n	B18=IMAGE NOTCH @240MHz
N2	400-435MHz	90MHz																										
O	425-460MHz	90MHz	4p7	8p2	-	2.5T	-	5p6	2p2	5p6	2p2	2.5T	2p2	5p6	2p2	-	5p6	2.5T	8p2 12p	- 2.5T	6p8 18p	220R	22R	-	1n	-	390n	B18=IMAGE NOTCH @268MHz
P	455-490MHz	90MHz	3p9	5p6	-	2.5T	-	5p6	1p8	4p7	1p2	2.5T	1p2	4p7	1p8	-	5p6	2.5T	5p6 10p	- 2.5T	3p9 15p	220R	22R	-	1n	-	390n	B18=IMAGE NOTCH @295MHz
P2	450-485MHz	90MHz																										
P3	475-495MHz	90MHz	3p3	-	5p6	2.5T	1p5	3p3	1p5	2p7	3p3	2.5T	3p3	2p7	1p5	1p5	3p3	2.5T	5p6 8p2	- 2.5T	3p3 15p							B18=IMAGE NOTCH @310MHz
Q	485-520MHz	90MHz	4p7	-	6p8	2.5T	-	3p9	1p2	2p2	3p3	2.5T	3p3	2p2	1p2	-	3p9	2.5T	6p8 8p2	- 2.5T	4p7 12p	220R	22R	-	1n	-	390n	B18=IMAGE NOTCH @330MHz
Q2	500-532MHz	90MHz																										
Q3	480-512MHz	90MHz	3p3	-	5p6	2.5T	1p5	3p3	1p2	1p8	3p3	2.5T	3p3	1p8	1p5	1p5	3p3	2.5T	5p6 8p2	- 2.5T	3p3 15p							B18=IMAGE NOTCH @321MHz
R3	776-794MHz	90MHz	3p3	-	2p7	2.5T	-	1p	0p47	-	1p5	2.5T	1p5	-	0p47	-	1p	2.5T	2p7	1.5T	6p8							A18,B18=600MHz NOTCH 750-800MHz Range L5=82nH
R	805-825MHz	90MHz	22p	5p6	1p	1.5T	0p47	1p2	0p47	-	1p	2.5T	0p47	0p47	0p47	1p5	1p5	1.5T	4p7	1.5T	5p6	470R	12R	-	1n	-	390n	A18,B18=635MHz NOTCH FLA/FLB= DFC3R815P020BHD
S	824-849MHz	90MHz	22p	5p6	1p	1.5T	0p47	1p2	0p47	-	1p	2.5T	0p47	0p47	0p47	1p5	1p5	1.5T	4p7	1.5T	5p6	470R	12R	-	1n	-	390n	A18,B18=657MHz NOTCH FLA/FLB= DFC3R836P025BHD
T	850-870MHz	90MHz	22p	5p6	1p	1.5T	0p47	1p2	0p47	-	1p	2.5T	0p47	0p47	0p47	1p5	1p5	1.5T	4p7	1.5T	5p6	470R	12R	-	1n	-	390n	A18,B18=680MHz NOTCH FLA/FLB= DFC3R860P020BHD
U	872-905MHz	90MHz	22p	5p6	1p	1.5T	0p47	1p2	0p47	-	1p	2.5T	0p47	0p47	0p47	1p5	1p5	1.5T	4p7	1.5T	5p6	470R	12R	-	1n	-	390n	A18,B18=600MHz NOTCH FLA/FLB= DFC3R888P033BHD
V	890-915MHz	90MHz	22p	5p6	1p	1.5T	0p47	1p2	0p47	-	1p	2.5T	0p47	0p47	0p47	1p5	1p5	1.5T	4p7	1.5T	5p6	470R	12R	-	1n	-	390n	FLA/FLB= DFC3R902P025BHD
W	917-950MHz	90MHz																										FLA/FLB= DFC3R933P033BHD
X	925-960MHz	90MHz	22p	4p7	-	1.5T	-	1p5	0p47	-	0p47	2.5T	-	0p47	0p47	1p5	1p2	1.5T	4p7	1.5T	5p6	470R	12R	-	1n	-	390n	FLA/FLB= DFC3R942P035BHD

DATE	REVISION	APP
7-6-98	E: ADD NEW BANDS	RL
16-8-99	F: CHANGE VALUES	RL
10-2-00	G: N2&K ADJUST	RM
3-7-01	H-K: trim values	GJ
13-11-01	J: Add R3 band	GJ

	BY	DATE
DESIGNED	GJ	29/1/96
DRAWN	GJ	7-6-98
CHECKED		
APPROVED		
REF PCB	SEARX REVH+	

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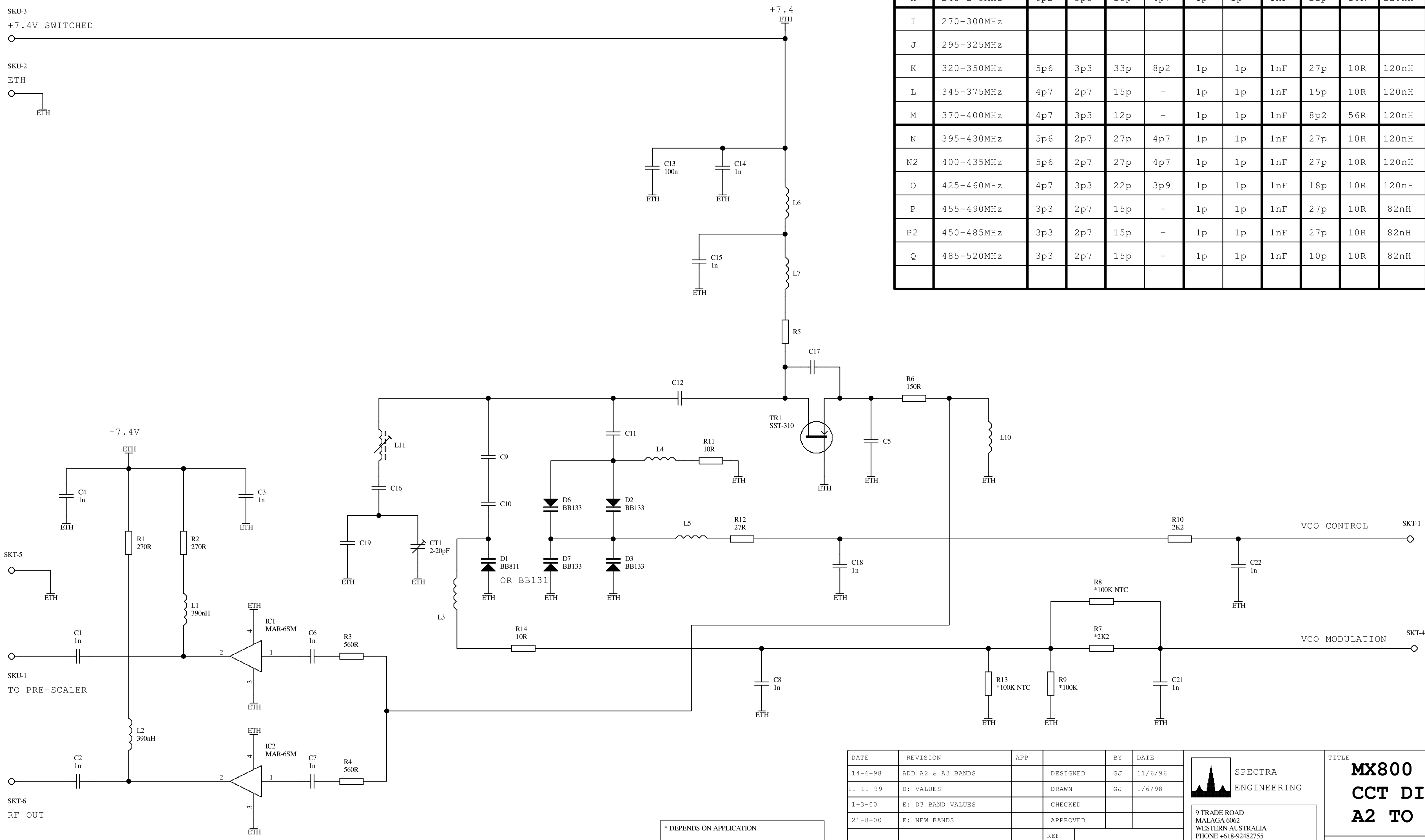
TITLE
MX800 RECEIVER MODULE FRONT END SECTION

DRAWING No CS003-2L | SHEET 2 OF 2 | REV L

VCO COMPONENT VALUES (Switching BW = Max)

BAND	FREQ RANGE	C11	C17	C12	C5	C9	C10	C16	C19	R5	L3,4 ,5	L6,7 ,10	L11	NOTES
A2	30-39MHz	56p	33p	33p	39p	3p3	22p	100n	-	220R	3u3H	3u3H	15.5T	CT1=15.5T R11,12,14=56R
A3	39-50MHz	47p	15p	22p	33p	3p3	12p	100n	-	220R	3u3H	3u3H	11.5T	CT1=11.5T R11,12,14=56R
A	66-80MHz													Same as 'B' band
B	70-88MHz	4p7	15p	18p	15p	3p3	10p	1nF	1nF	100R	680nH	3u3H	11.5T	NIL CT1 D1=BB619/BB133
C	135-160MHz	27p	5p6	22p	10p	1p8	3p9	1nF	18p	100R	680nH	3u3H	4.5T	L7=1u8H
D	155-180MHz	27p	5p6	22p	10p	1p8	3p9	1nF	18p	100R	680nH	3u3H	4.5T	L7=1u8H
D3	148-174MHz	27p	5p6	22p	10p	1p8	3p9	1nF	18p	100R	680nH	3u3H	4.5T	L7=1u8H
E	175-200MHz	6p8	3p9	10p	3p9	1p	1p5	1nF	1nF	220R	390nH	3u3H	3.5T	L7=1u8H NIL CT1
F	195-225MHz	6p8	3p3	6p8	4p7	1p	1p5	1nF	15p	10R	220nH	3u3H	3.5T	
G	220-250MHz	6p8	3p3	6p8	4p7	1p	1p5	1nF	15p	10R	220nH	3u3H	3.5T	
H	245-275MHz	8p2	3p3	15p	4p7	1p	1p	1nF	22p	10R	220nH	3u3H	2.5T	
I	270-300MHz													
J	295-325MHz													
K	320-350MHz	5p6	3p3	33p	8p2	1p	1p	1nF	27p	10R	120nH	390nH	1.5T	R6=270R
L	345-375MHz	4p7	2p7	15p	-	1p	1p	1nF	15p	10R	120nH	390nH	1.5T	
M	370-400MHz	4p7	3p3	12p	-	1p	1p	1nF	8p2	56R	120nH	390nH	1.5T	
N	395-430MHz	5p6	2p7	27p	4p7	1p	1p	1nF	27p	10R	120nH	390nH	6mm L	
N2	400-435MHz	5p6	2p7	27p	4p7	1p	1p	1nF	27p	10R	120nH	390nH	6mm L	
O	425-460MHz	4p7	3p3	22p	3p9	1p	1p	1nF	18p	10R	120nH	390nH	6mm L	
P	455-490MHz	3p3	2p7	15p	-	1p	1p	1nF	27p	10R	82nH	390nH	6mm L	NIL D6,D7
P2	450-485MHz	3p3	2p7	15p	-	1p	1p	1nF	27p	10R	82nH	390nH	6mm L	NIL D6,D7
Q	485-520MHz	3p3	2p7	15p	-	1p	1p	1nF	10p	10R	82nH	390nH	6mm L	NIL D6,D7



* DEPENDS ON APPLICATION

DATE	REVISION	APP
14-6-98	ADD A2 & A3 BANDS	
11-11-99	D: VALUES	
1-3-00	E: D3 BAND VALUES	
21-8-00	F: NEW BANDS	

	BY	DATE
DESIGNED	GJ	11/6/96
DRAWN	GJ	1/6/98
CHECKED		
APPROVED		
REF PCB	IV3 REVF	

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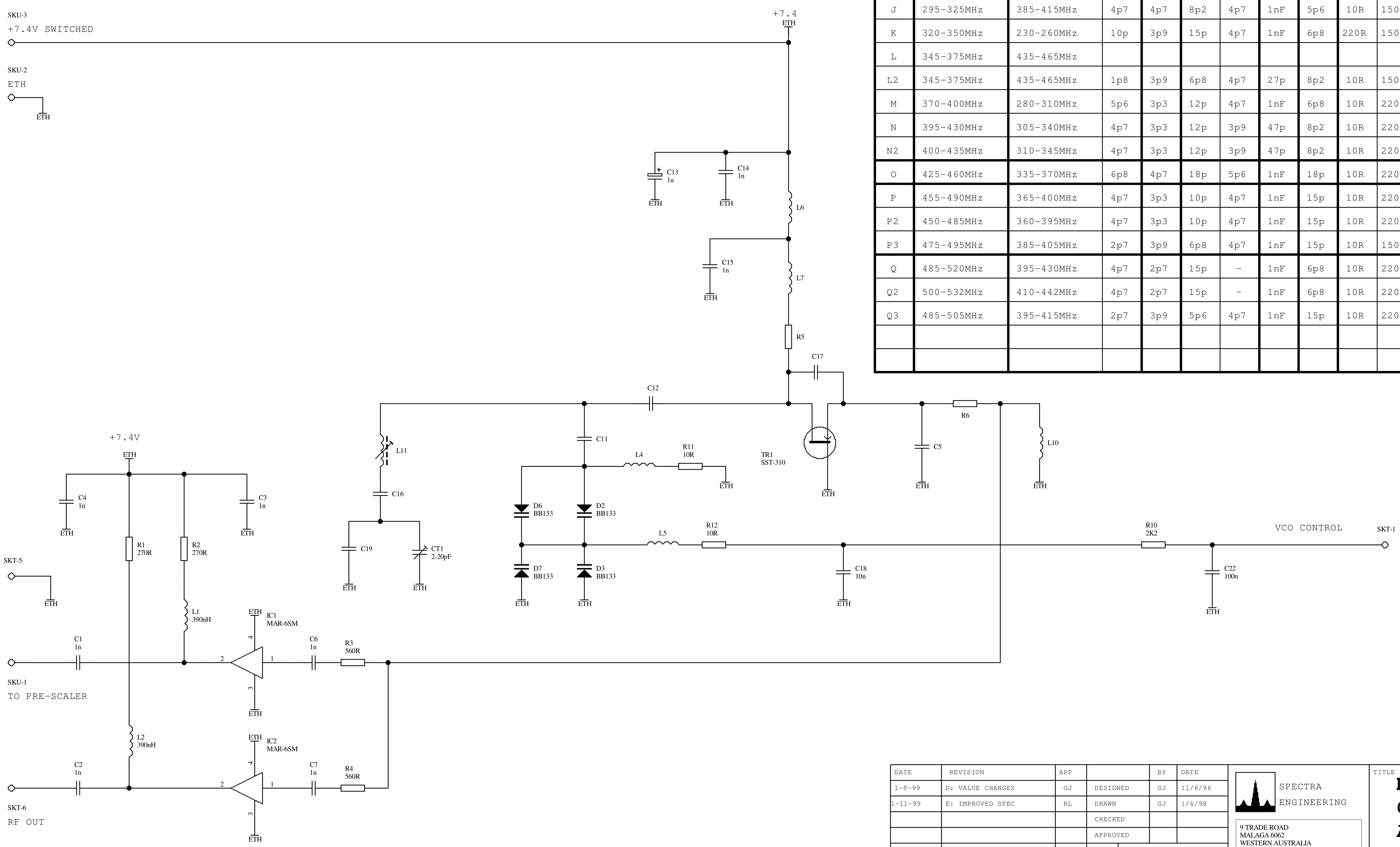
TITLE
MX800 TX VCO CCT DIAGRAM, BAND A2 TO Q (30-520 MHz)

DRAWING No CS004-1I | SHEET 1 OF 1 | REV I

VCO COMPONENT VALUES (SWITCHING BW = MAX)

BAND	FREQ RANGE	LO INJECT	C11	C17	C12	C5	C16	C19	R5	R6	L4,5	L6,7,10	L11	NOTES
A	66-80MHz	111-125MHz	5p6	4p7	6p8	6p8	1nF	1nF	10R	220R	680nH	390nH	8.5T	
B	70-88MHz	115-133MHz	5p6	4p7	6p8	6p8	1nF	1nF	10R	220R	680nH	390nH	8.5T	
C	135-160MHz	225-250MHz	10p	4p7	15p	4p7	33p	6p8	68R	220R	220nH	390nH	3.5T	
D	155-180MHz	245-270MHz	10p	4p7	15p	4p7	33p	6p8	68R	220R	220nH	390nH	3.5T	
D3	148-174MHz	238-264MHz	10p	4p7	15p	4p7	33p	6p8	68R	220R	220nH	390nH	3.5T	
E	175-200MHz	265-290MHz												
F	195-225MHz	285-315MHz	5p6	2p7	15p	4p7	1nF	6p8	10R	150R	150nH	390nH	2.5T	
G	220-250MHz	310-340MHz												
H	245-275MHz	335-365MHz	5p6	3p3	15p	4p7	1nF	22p	10R	270R	390nH	390nH	1.5T	
I	270-300MHz	360-390MHz												
J	295-325MHz	385-415MHz	4p7	4p7	8p2	4p7	1nF	5p6	10R	150R	220nH	390nH	1.5T	
K	320-350MHz	230-260MHz	10p	3p9	15p	4p7	1nF	6p8	220R	150R	220nH	390nH	3.5T	
L	345-375MHz	435-465MHz												
L2	345-375MHz	435-465MHz	1p8	3p9	6p8	4p7	27p	8p2	10R	150R	390nH	390nH	1.5T	SW BW=10MHz
M	370-400MHz	280-310MHz	5p6	3p3	12p	4p7	1nF	6p8	10R	220R	220nH	390nH	2.5T	
N	395-430MHz	305-340MHz	4p7	3p3	12p	3p9	47p	8p2	10R	220R	82nH	390nH	2.5T	
N2	400-435MHz	310-345MHz	4p7	3p3	12p	3p9	47p	8p2	10R	220R	82nH	390nH	2.5T	
O	425-460MHz	335-370MHz	6p8	4p7	18p	5p6	1nF	18p	10R	220R	220nH	390nH	1.5T	
P	455-490MHz	365-400MHz	4p7	3p3	10p	4p7	1nF	15p	10R	220R	220nH	390nH	1.5T	
P2	450-485MHz	360-395MHz	4p7	3p3	10p	4p7	1nF	15p	10R	220R	220nH	390nH	1.5T	
P3	475-495MHz	385-405MHz	2p7	3p9	6p8	4p7	1nF	15p	10R	150R	390nH	390nH	1.5T	SW BW=20MHz
Q	485-520MHz	395-430MHz	4p7	2p7	15p	-	1nF	6p8	10R	220R	220nH	390nH	1.5T	
Q2	500-532MHz	410-442MHz	4p7	2p7	15p	-	1nF	6p8	10R	220R	220nH	390nH	1.5T	
Q3	485-505MHz	395-415MHz	2p7	3p9	5p6	4p7	1nF	15p	10R	220R	390nH	390nH	1.5T	SW BW=20MHz



DATE	REVISION	APP		BY	DATE
1-8-99	D: VALUE CHANGES	GJ	DESIGNED	GJ	11/6/96
1-11-99	E: IMPROVED SPEC	RL	DRAWN	GJ	1/6/98
			CHECKED		
			APPROVED		
			REF PCB	IV3 REVF	

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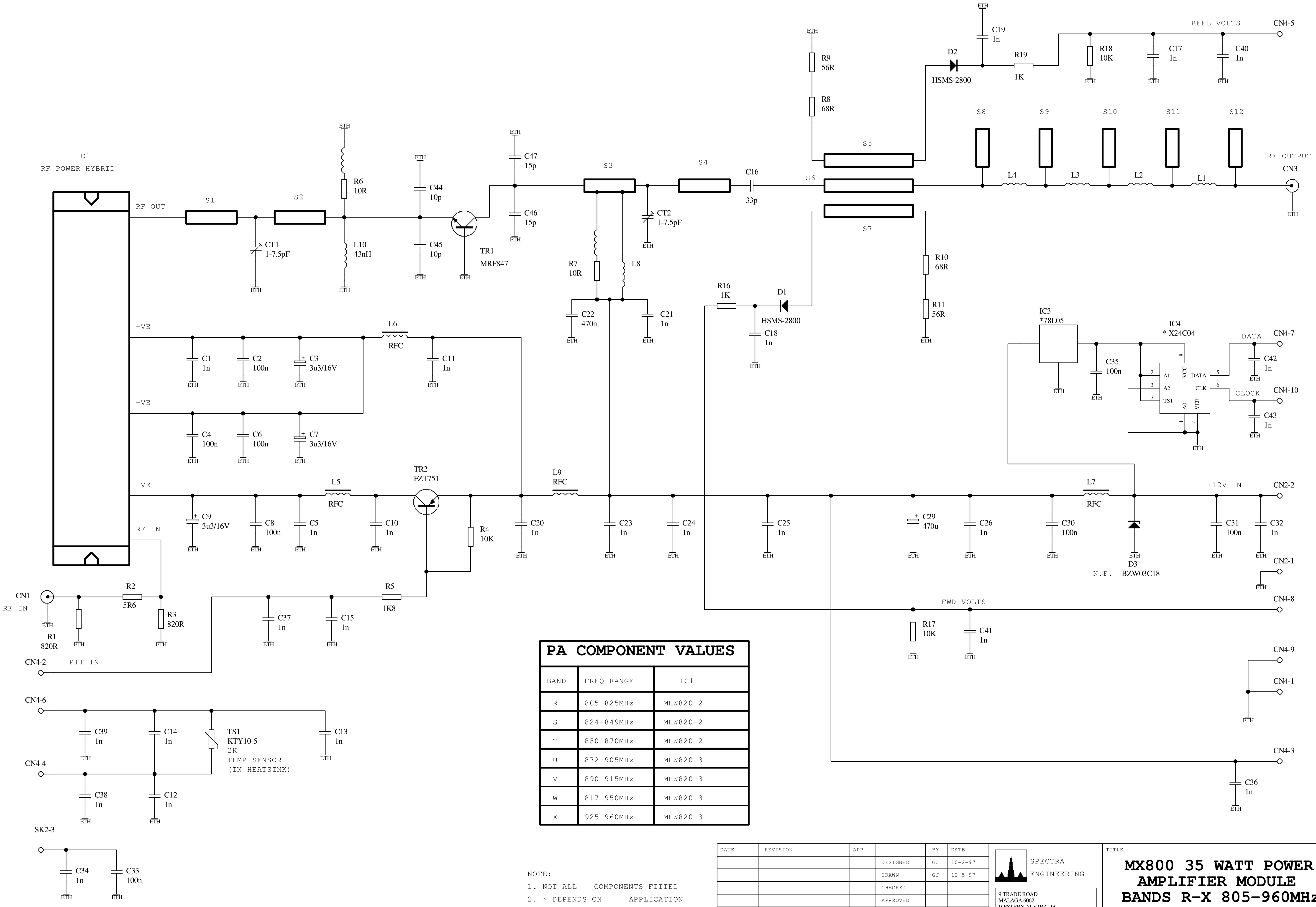
TITLE
MX800 RX VCO CCT DIAGRAM, BAND A TO Q (66-520 MHz)

DRAWING No CS005-1F | SHEET 1 OF 1 | REV F



PA COMPONENT VALUES

BAND	FREQ RANGE	IC1
R	805-825MHz	MHW820-2
S	824-849MHz	MHW820-2
T	850-870MHz	MHW820-2
U	872-905MHz	MHW820-3
V	890-915MHz	MHW820-3
W	817-950MHz	MHW820-3
X	925-960MHz	MHW820-3

NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	10-2-97
			DRAWN	GJ	12-5-97
			CHECKED		
			APPROVED		
			REF / PCB	PA800960 REVB	

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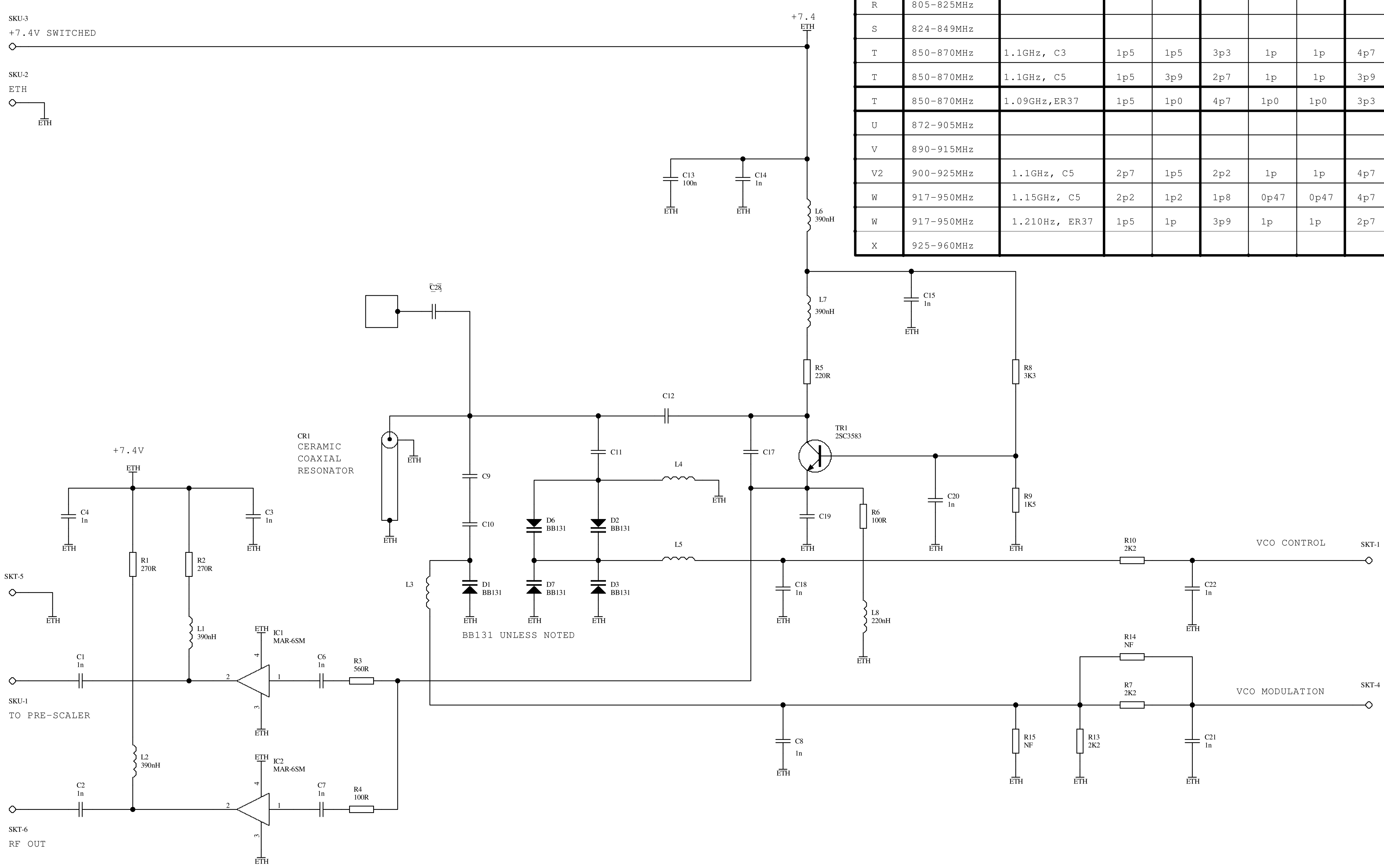
TITLE

MX800 35 WATT POWER AMPLIFIER MODULE BANDS R-X 805-960MHz

DRAWING No CS010-1A | SHEET 1 OF 1 | REV A

VCO COMPONENT VALUES

BAND	FREQ RANGE	CR1	C11	C12	C17	C9	C10	C19	L3,4,5	NOTES
R2	746-764MHz	950MHz, C3	2p2	1p8	3p3	1p0	1p0	5p6	56nH	R13=2K2 R4=100R
R2	746-764MHz	940MHz, ER37	1p8	1p8	3p3	1p0	1p0	5p6	120nH	R13=2K2 D6,D7 NF D1,D2,D3=BB149
R	805-825MHz									
S	824-849MHz									
T	850-870MHz	1.1GHz, C3	1p5	1p5	3p3	1p	1p	4p7	33nH	
T	850-870MHz	1.1GHz, C5	1p5	3p9	2p7	1p	1p	3p9	120nH	C28=1n R13=2K2
T	850-870MHz	1.09GHz,ER37	1p5	1p0	4p7	1p0	1p0	3p3	120nH	D6,D7 NF D1,D2,D3=BB149
U	872-905MHz									
V	890-915MHz									
V2	900-925MHz	1.1GHz, C5	2p7	1p5	2p2	1p	1p	4p7	120nH	R13=2K2, NIL D6,D7
W	917-950MHz	1.15GHz, C5	2p2	1p2	1p8	0p47	0p47	4p7	120nH	R13=2K2 NIL D6,D7
W	917-950MHz	1.210Hz, ER37	1p5	1p	3p9	1p	1p	2p7	120nH	R13=2K2 D1=BB149 D6,D7=BB131
X	925-960MHz									



NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION

DATE	REVISION	APP		BY	DATE
12-9-01	B: ADD NEW BAND	GJ	DESIGNED	GJ	11/6/96
			DRAWN	GJ	16/3/97
			CHECKED		
			APPROVED		
			REF PCB	TV2 REVB	

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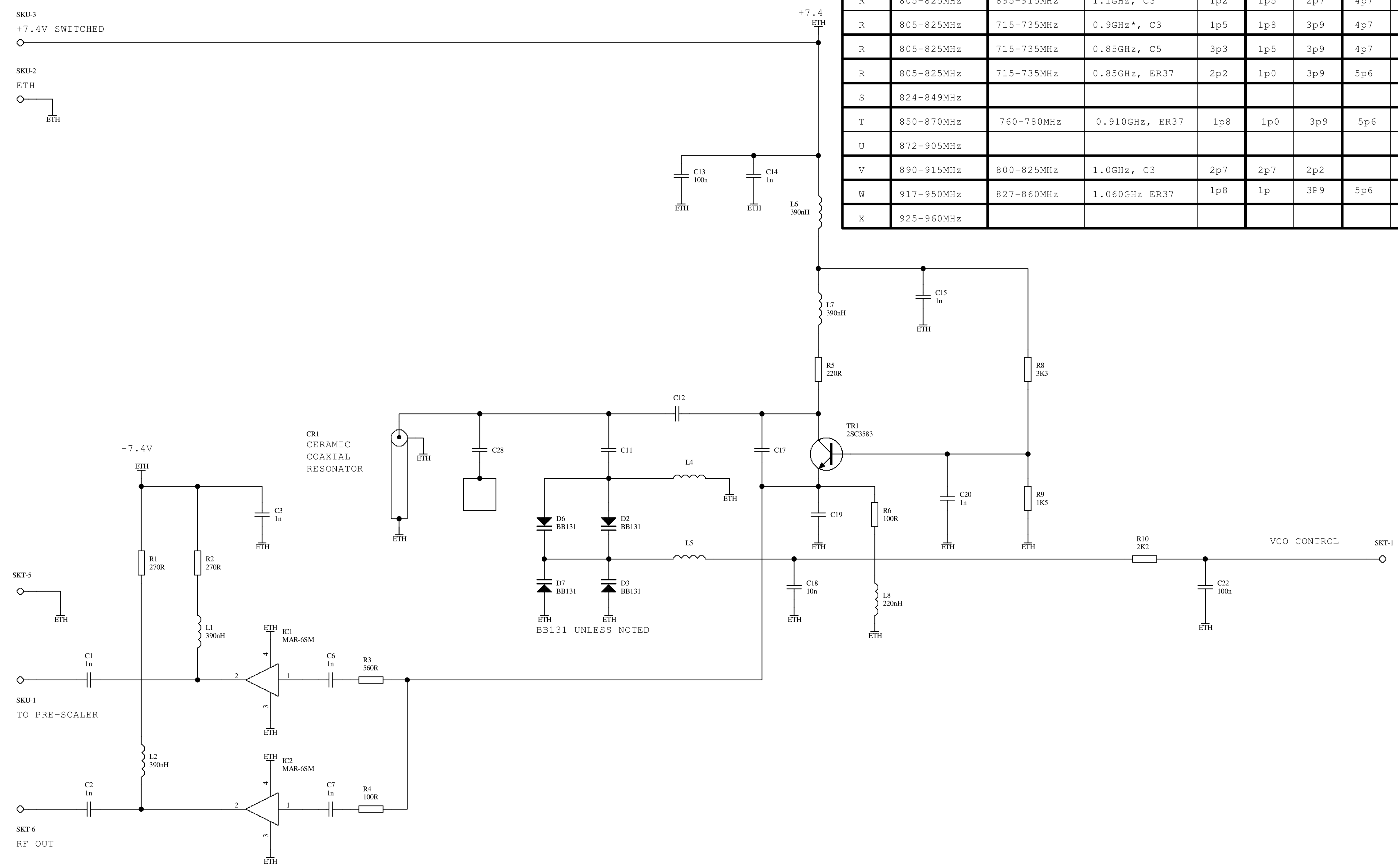
TITLE
MX800 TX VCO CCT DIAGRAM, BAND R TO X (746-960 MHz)

DRAWING No CS011-1E | SHEET 1 OF 1 | REV E

VCO COMPONENT VALUES

BAND	FREQ RANGE	LO INJECT	CR1	C11	C12	C17	C19	C28	L4/5	NOTES
R3	776-794MHz	686-704MHz	0.8GHz, C3	1p8	1p5	4p7	4p7	-	56nH	FR4 PCB C19=8p2
R3	776-794MHz	686-704MHz	0.79GHz, ER37	1p8	1p0	3p9	5p6	-	120nH	FR4 PCB, D2,D3=NF D6,D7=BB149
R	805-825MHz	895-915MHz	1.1GHz, C3	1p2	1p5	2p7	4p7	-	33nH	FR4 PCB
R	805-825MHz	715-735MHz	0.9GHz*, C3	1p5	1p8	3p9	4p7	-	33nH	FR4
R	805-825MHz	715-735MHz	0.85GHz, C5	3p3	1p5	3p9	4p7	3p3	120nH	CERAMIC PCB
R	805-825MHz	715-735MHz	0.85GHz, ER37	2p2	1p0	3p9	5p6	1p0	120nH	D2,D3 NF D6,D7=BB149
S	824-849MHz									
T	850-870MHz	760-780MHz	0.910GHz, ER37	1p8	1p0	3p9	5p6	1p0	120nH	D2,D3 NF L7=180nH D6,D7=BB149 R5=180R
U	872-905MHz									
V	890-915MHz	800-825MHz	1.0GHz, C3	2p7	2p7	2p2		-	120nH	CERAMIC PCB
W	917-950MHz	827-860MHz	1.060GHz ER37	1p8	1p	3P9	5p6	1p	120nH	D2,D3 NF L7=180nH D6,D7=BB149 R5=180R
X	925-960MHz									



DATE	REVISION	APP
1-8-99	B: FILT CHANGE	GJ
12-9-01	C: NEW BAND	GJ
10-10-02	D: LX & R10	GJ

	BY	DATE
DESIGNED	GJ	11/6/96
DRAWN	GJ	16/3/97
CHECKED		
APPROVED		

REF PCB TV2 REVF

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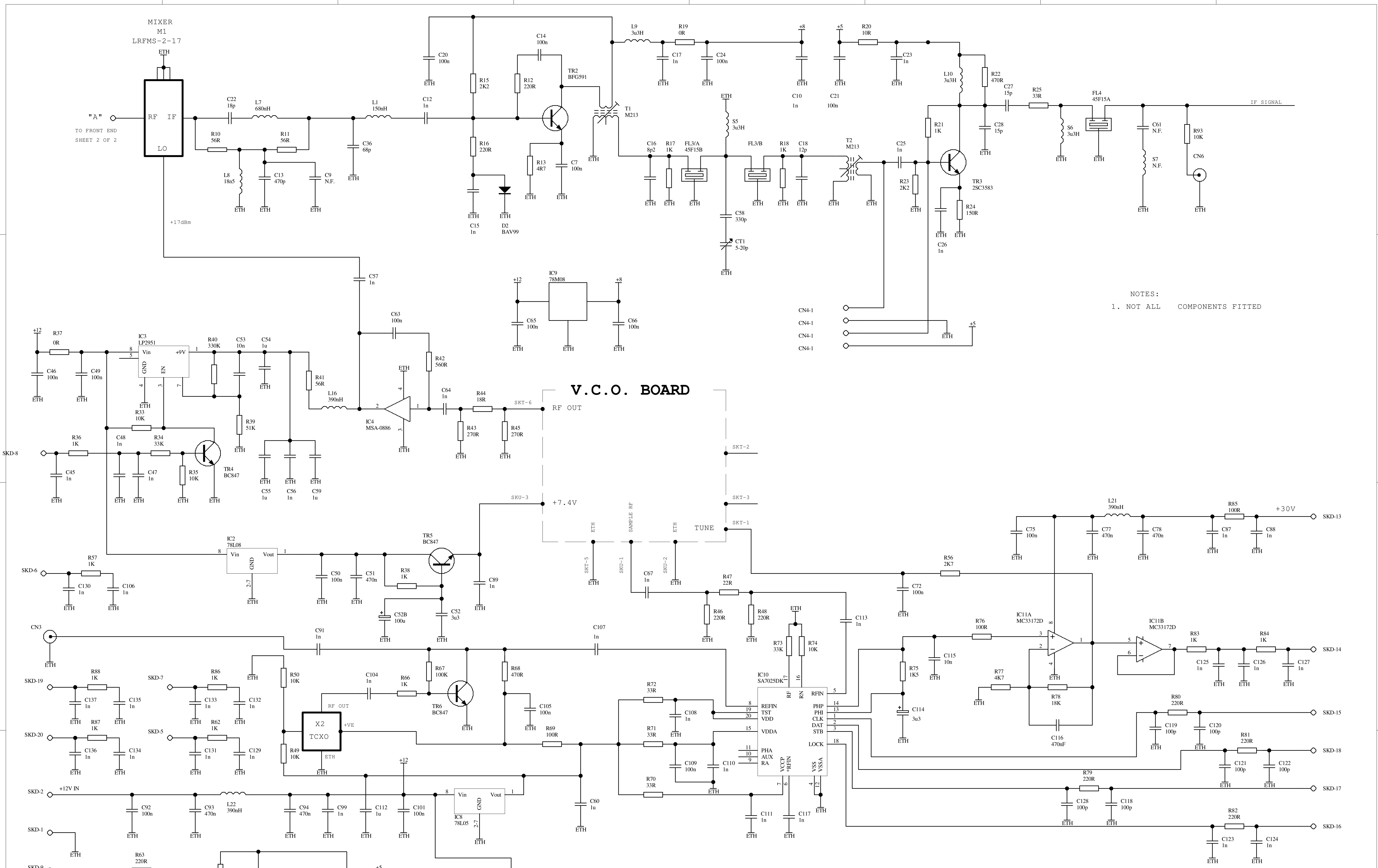
TITLE
MX800 RX VCO CCT DIAGRAM, BAND R TO X (805-960 MHz)

DRAWING No CS012-1G | SHEET 1 OF 1 | REV G



NOTES:
1. NOT ALL COMPONENTS FITTED

DATE	REVISION	APP		BY	DATE
28/8/00	C: Tant remove	GJ	DESIGNED	GJ	11/6/99
22/01/03	D: IC6 PINS	GJ	DRAWN	GJ	11/6/97
			CHECKED		
			APPROVED		
			REF PCB	SEARX REV H+	

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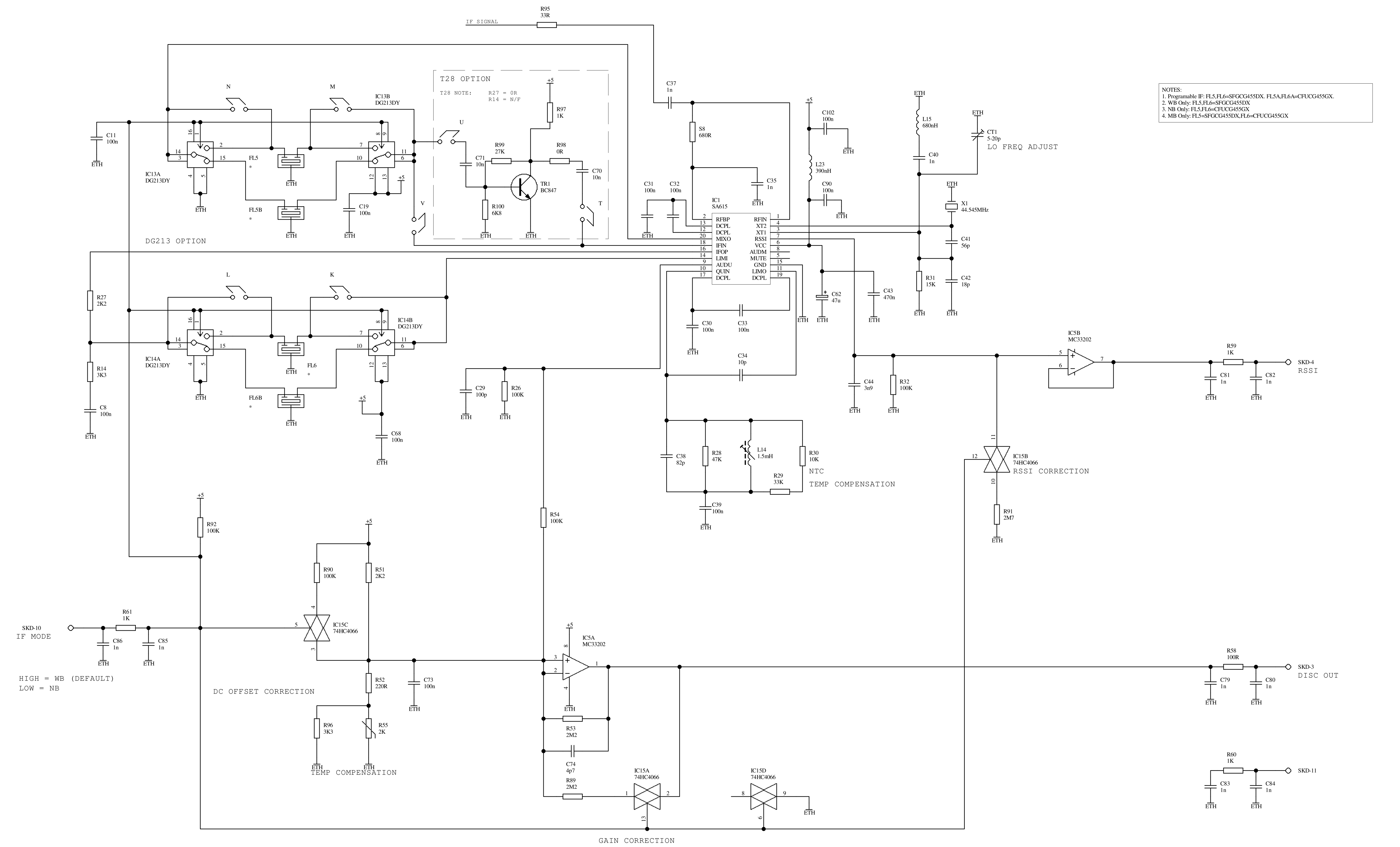
TITLE
MX800 RECEIVER MODULE MIXER & IF SECTION 45MHZ FOR BANDS A,B

DRAWING No	SHEET	REV
CS015-1G	1 OF 2	G



NOTES:
1. Programable IF: FL5,FL6=SFGCG455DX. FL5A,FL6A=CFUCG455GX.
2. WB Only: FL5,FL6=SFGCG455DX
3. NB Only: FL5,FL6=CFUCG455GX
4. MB Only: FL5=SFGCG455DX,FL6=CFUCG455GX

DATE	REVISION	APP		BY	DATE
28/8/00	C: Tant remove	GJ	DESIGNED	GJ	11/6/99
			DRAWN	GJ	1/8/99
			CHECKED		
			APPROVED		
			REF PCB		

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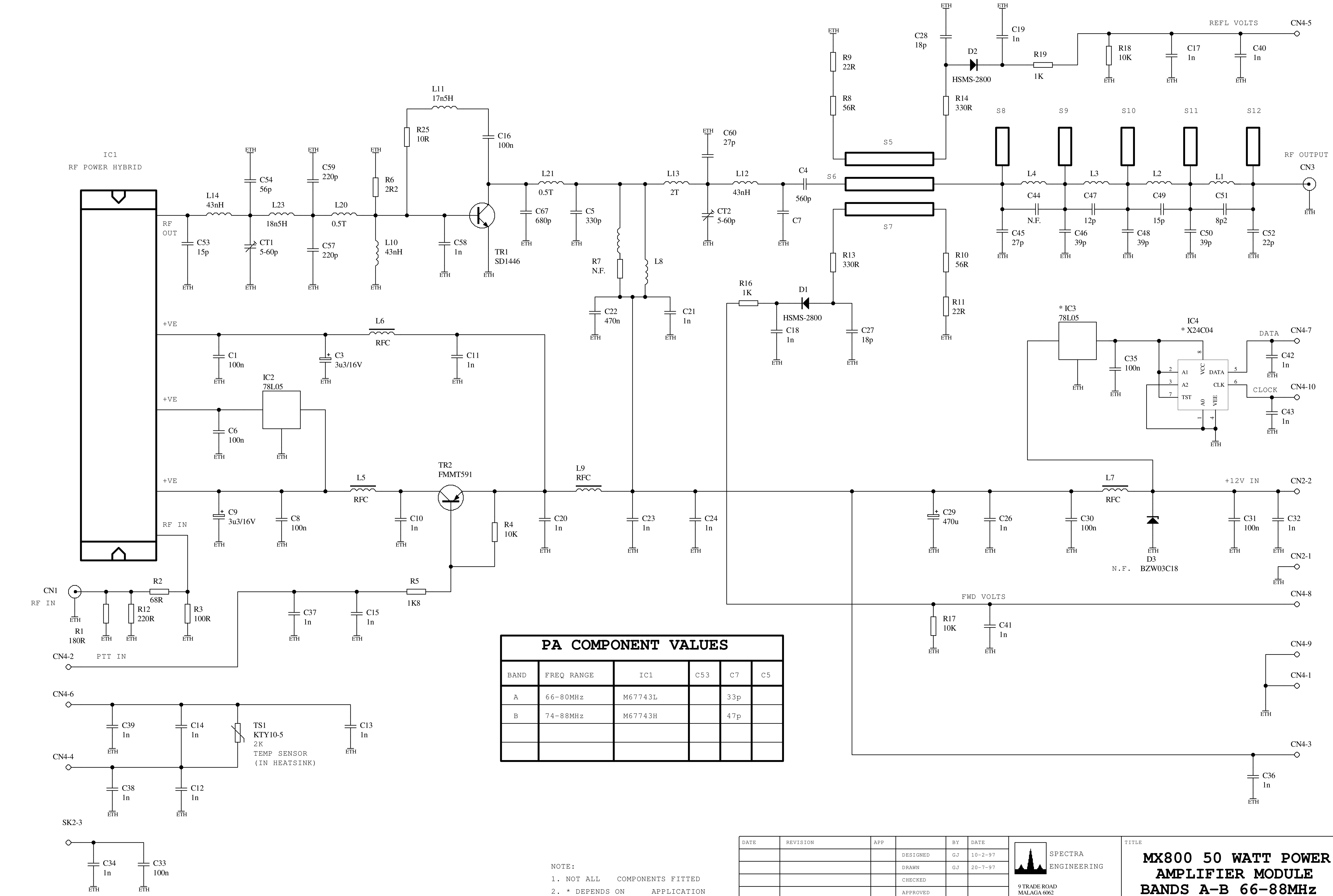
TITLE
MX800 RECEIVER MODULE MIXER & PROGRAMMABLE 45MHZ IF FOR BANDS A,B

DRAWING No CS015-2E
SHEET 2 OF 2
REV E



PA COMPONENT VALUES

BAND	FREQ RANGE	IC1	C53	C7	C5
A	66-80MHz	M67743L		33p	
B	74-88MHz	M67743H		47p	

NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION
3. CONNECT PADS G,N,O,P,J

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	10-2-97
			DRAWN	GJ	20-7-97
			CHECKED		
			APPROVED		
			REF DWGS		

SPECTRA
ENGINEERING
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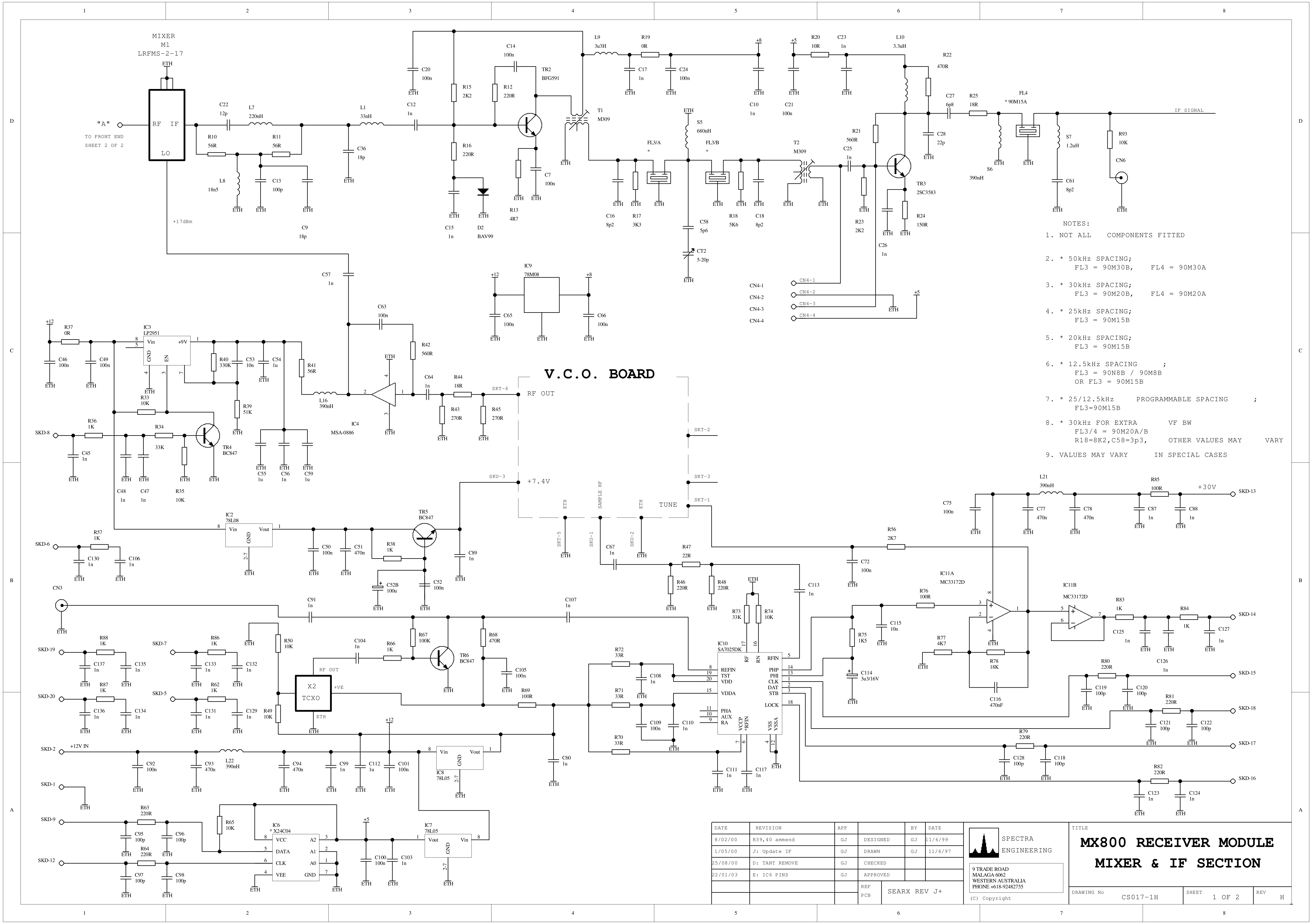
MALAGA 6062
WESTERN AUSTRALIA
PHONE (618) 92482755
FAX (618) 92482756

TITLE
MX800 50 WATT POWER AMPLIFIER MODULE BANDS A-B 66-88MHz

DRAWING No CS016-1A | SHEET 1 OF 1 | REV A


MX800 RECEIVER MODULE
MIXER & IF SECTION
SPECTRA ENGINEERING
9 TRADE ROAD
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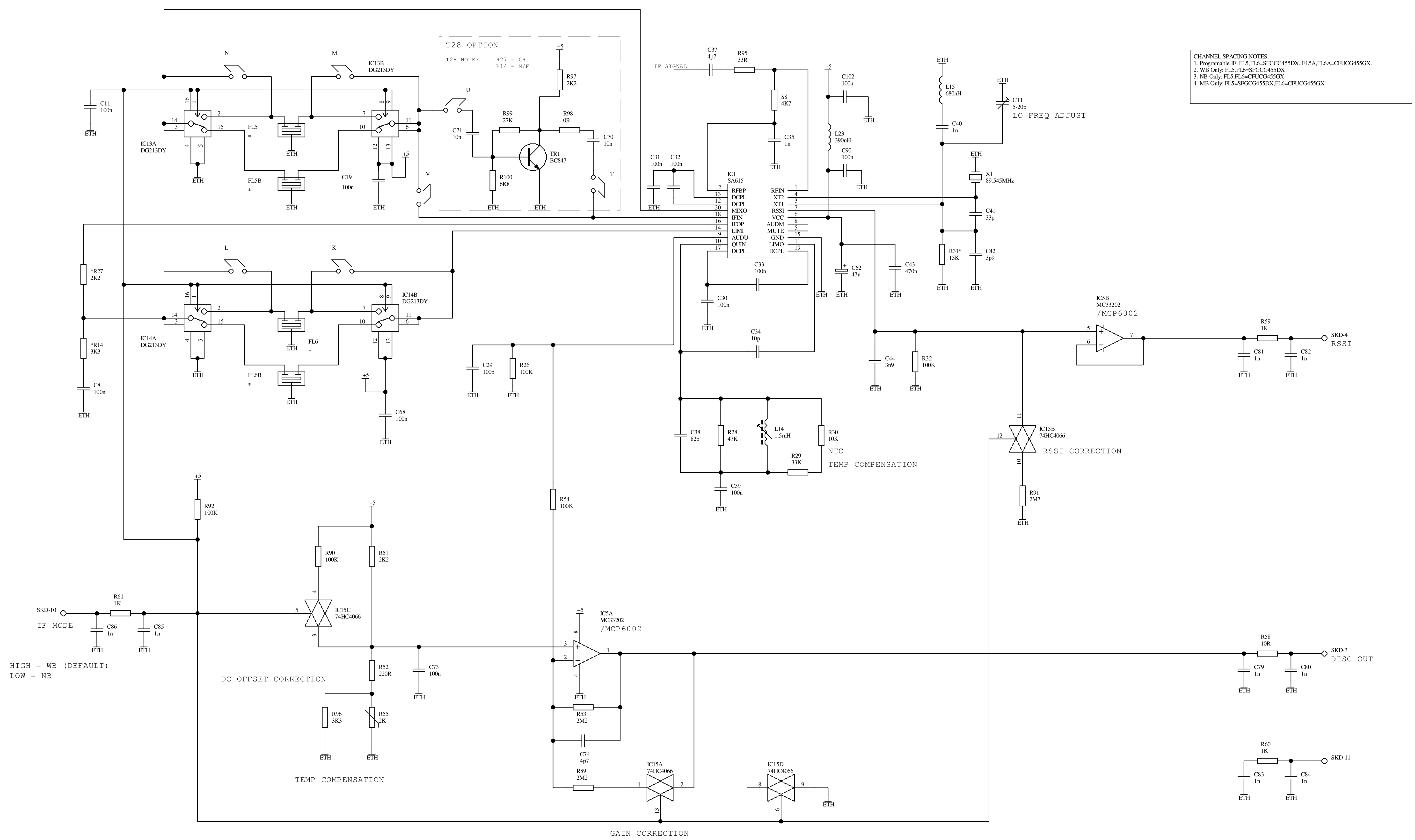
WESTERN AUSTRALIA
PHONE +618-92482755
(C) Copyright
DRAWING No CS017-1H
SHEET 1 OF 2
REV H
DATE | REVISION | APP
8/02/00 | R39,40 ammend | GJ
1/05/00 | J: Update IF | GJ
25/08/00 | D: TANT REMOVE | GJ
22/01/03 | E: IC6 PINS | GJ
DESIGNED GJ 11/6/99
DRAWN GJ 11/6/97
CHECKED
APPROVED
REF PCB SEARX REV J+
NOTES:
1. NOT ALL COMPONENTS FITTED
2. * 50kHz SPACING; FL3 = 90M30B, FL4 = 90M30A
3. * 30kHz SPACING; FL3 = 90M20B, FL4 = 90M20A
4. * 25kHz SPACING; FL3 = 90M15B
5. * 20kHz SPACING; FL3 = 90M15B
6. * 12.5kHz SPACING ; FL3 = 90N8B / 90M8B OR FL3 = 90M15B
7. * 25/12.5kHz PROGRAMMABLE SPACING ; FL3=90M15B
8. * 30kHz FOR EXTRA VF BW FL3/4 = 90M20A/B R18=8K2,C58=3p3, OTHER VALUES MAY VARY
9. VALUES MAY VARY IN SPECIAL CASES
MIXER M1 LRFMS-2-17
"A" TO FRONT END SHEET 2 OF 2
+17dBm
IF SIGNAL
V.C.O. BOARD
RF OUT
+7.4V
TUNE
SAMPLE RF
X2 TCXO
+12V IN



NOTES:

1. * VALUE MAY VARY

DATE	REVISION	APP
2/5/00	C: Update IF	GJ
25/8/00	D: Tant remove	GJ
4/10/01	E: R58 to 10R	GJ

	BY	DATE
DESIGNED	GJ	11/6/99
DRAWN	GJ	1/8/99
CHECKED		
APPROVED		

REF PCB: SEARX REVJ+

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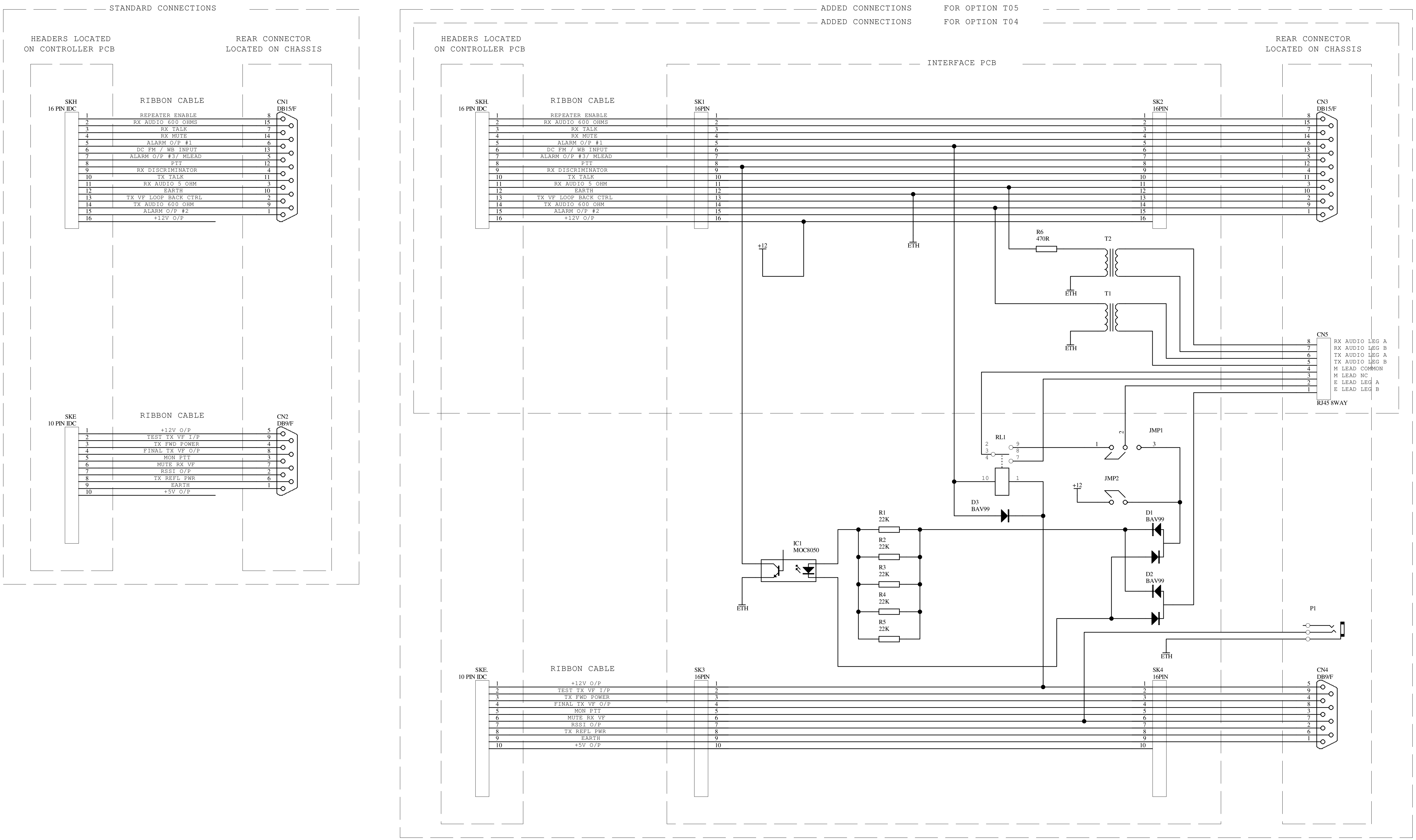
TITLE

MX800 RECEIVER MODULE MIXER & PROGRAMMABLE IF SECTION

DRAWING No CS017-2G | SHEET 2 OF 2 | REV G



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	22-4-99
			DRAWN	GJ	8-8-99
			CHECKED		
			APPROVED		
			REF PCB		

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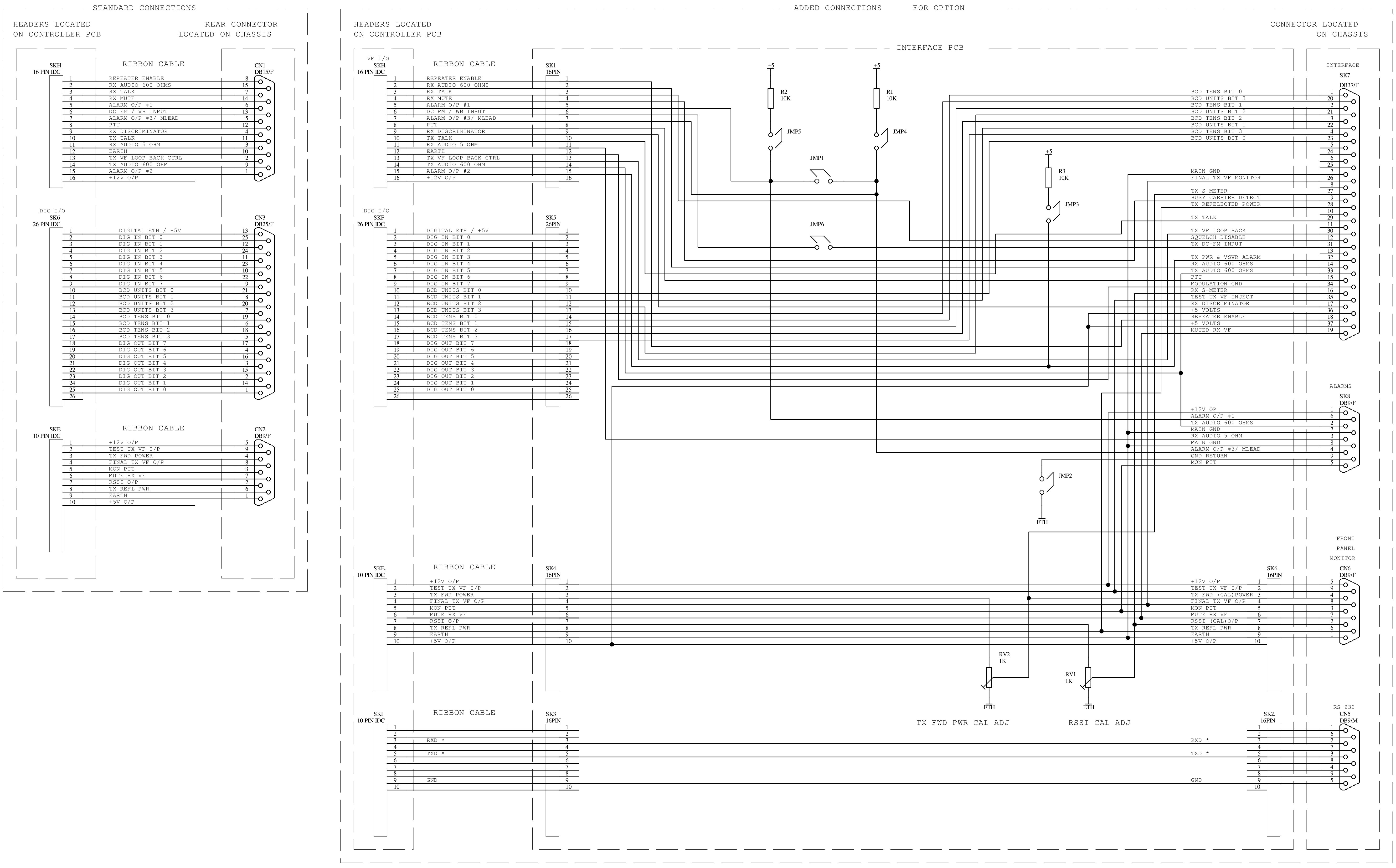
TITLE

MX800 ISOLATED INTERFACE OPTION CCT DIAGRAM

DRAWING No CS018-1E | SHEET 1 OF 1 | REV E



DATE	REVISION	APP		BY	DATE
			DESIGNED		
			DRAWN		
			CHECKED		
			APPROVED		
			REF PCB		

SPECTRA ENGINEERING

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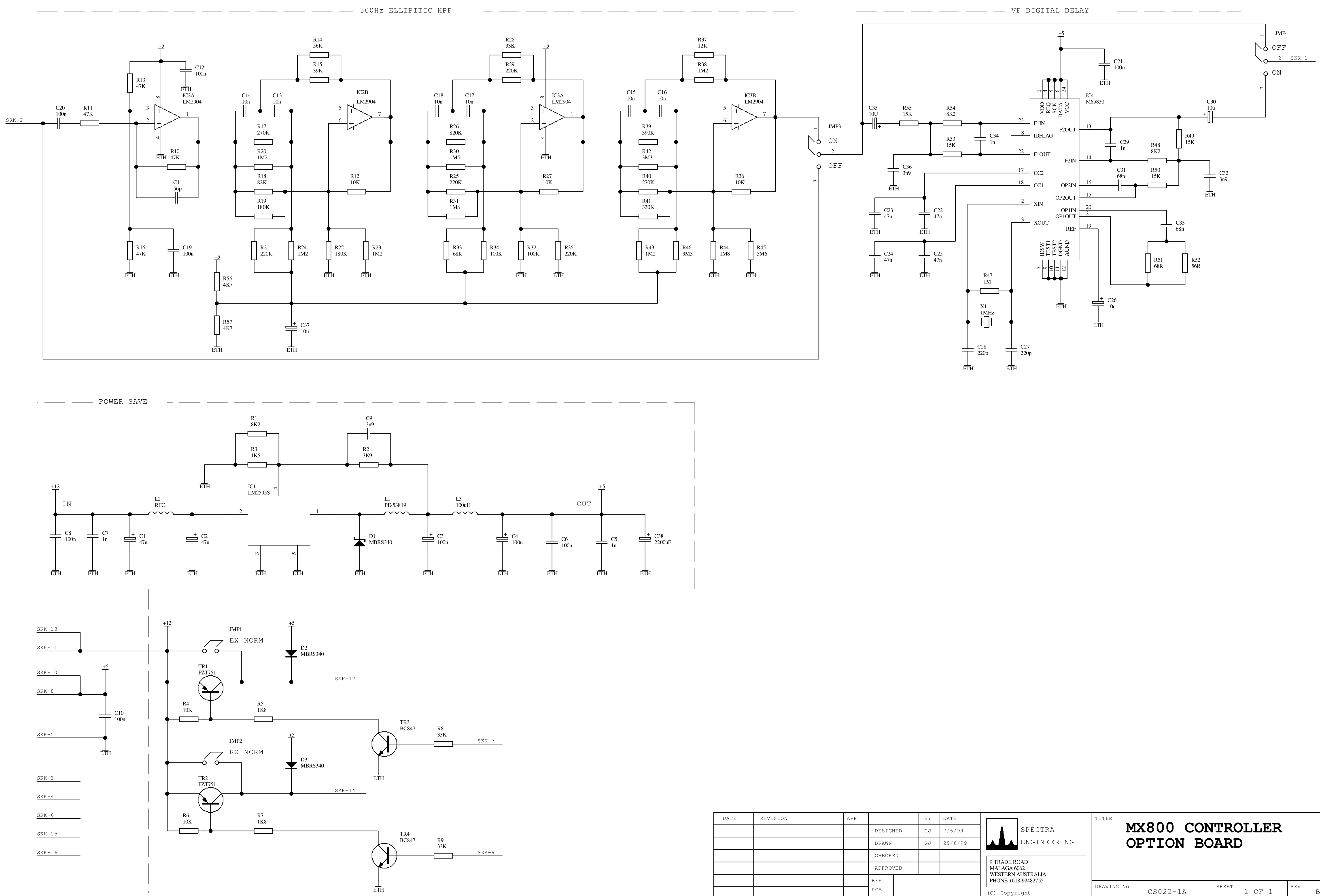
TITLE

MX800 TRUNK INTERFACE CCT DIAGRAM FOR DB37F

DRAWING No CS021-1A | SHEET 1 OF 1 | REV A



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	7/6/99
			DRAWN	GJ	29/6/99
			CHECKED		
			APPROVED		
			REF PCB		

SPECTRA ENGINEERING

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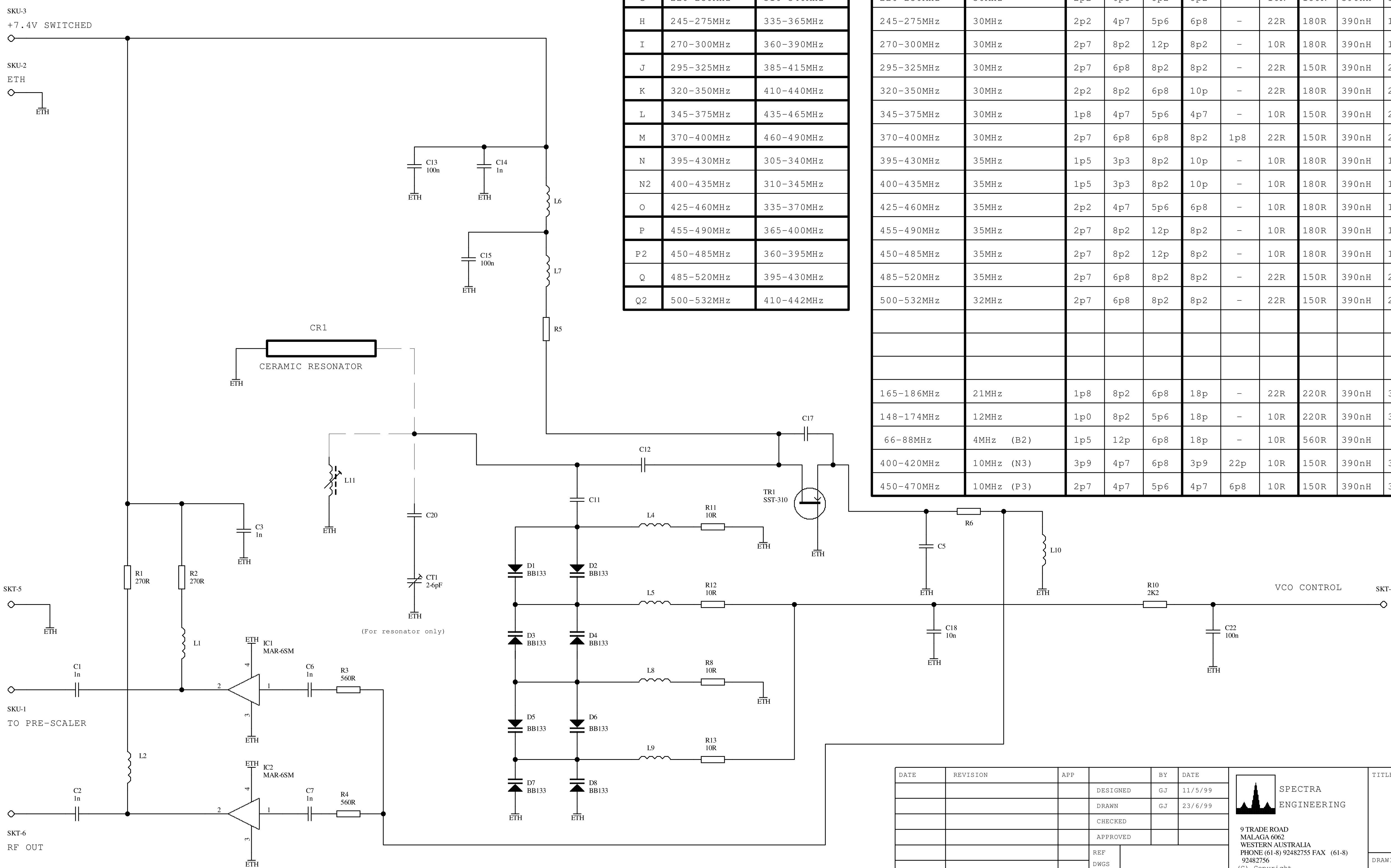
TITLE

MX800 CONTROLLER OPTION BOARD

DRAWING No CS022-1A | SHEET 1 OF 1 | REV B



NOMINAL BAND

BAND	FREQ BAND	LO INJECT
A2	30-39MHz	120-129MHz
A3	39-50MHz	109-120MHz
A	66-80MHz	111-125MHz
B	70-88MHz	115-133MHz
C	135-160MHz	225-250MHz
D	155-180MHz	245-270MHz
D3	148-174MHz	238-264MHz
E	177-207MHz	267-297MHz
F	195-225MHz	285-315MHz
G	220-250MHz	310-340MHz
H	245-275MHz	335-365MHz
I	270-300MHz	360-390MHz
J	295-325MHz	385-415MHz
K	320-350MHz	410-440MHz
L	345-375MHz	435-465MHz
M	370-400MHz	460-490MHz
N	395-430MHz	305-340MHz
N2	400-435MHz	310-345MHz
O	425-460MHz	335-370MHz
P	455-490MHz	365-400MHz
P2	450-485MHz	360-395MHz
Q	485-520MHz	395-430MHz
Q2	500-532MHz	410-442MHz

VCO COMPONENT VALUES

FREQ RANGE	SWITCHING BW	C11	C17	C12	C5	C20	R5	R6	L1,L2 L6,L10	L4,L5 L8,L9	L7	CR1/L11	NOTES: TYP A.C.R.@25kHz
30-39MHz	4MHz	1p5	12p	6p8	18p	-	56R	560R	390nH	1u8H	1u5H	9.5T AL	94dB
39-50MHz	4MHz	1p5	12p	6p8	18p	-	56R	560R	390nH	1u8H	1u5H	9.5T AL	94dB
66-80MHz	14MHz	4p7	6p8	8p2	12p	-	68R	220R	390nH	1u5H	1u5H	9.5T AL	88dB
70-88MHz	18MHz	4p7	6p8	8p2	12p	-	68R	220R	390nH	1u5H	1u5H	9.5T AL	88dB
135-160MHz	25MHz	2p7	6p8	8p2	15p	-	22R	220R	390nH	390nH	390nH	4.5T AL	86dB
155-180MHz	25MHz	2p7	6p8	12p	15p	-	22R	220R	390nH	390nH	390nH	3.5T AL	85dB
148-174MHz	26MHz	2p7	6p8	12p	15p	-	22R	220R	390nH	390nH	390nH	3.5T AL	85dB
175-200MHz	30MHz	2p7	4p7	6p8	5p6	-	22R	220R	390nH	390nH	390nH	3.5T AL	85dB
195-225MHz	30MHz	1p2	4p7	3p9	6p8	-	22R	220R	390nH	220nH	390nH	3.5T AL	85dB
220-250MHz	30MHz	2p2	6p8	8p2	8p2	-	10R	180R	390nH	180nH	390nH	2.5T AL	85dB
245-275MHz	30MHz	2p2	4p7	5p6	6p8	-	22R	180R	390nH	180nH	390nH	2.5T AL	85dB
270-300MHz	30MHz	2p7	8p2	12p	8p2	-	10R	180R	390nH	180nH	390nH	1.5T AL	84dB
295-325MHz	30MHz	2p7	6p8	8p2	8p2	-	22R	150R	390nH	220nH	390nH	1.5T AL	84dB
320-350MHz	30MHz	2p2	8p2	6p8	10p	-	22R	180R	390nH	220nH	390nH	1.5T AL	84dB
345-375MHz	30MHz	1p8	4p7	5p6	4p7	-	10R	150R	390nH	220nH	390nH	1.5T AL	84dB
370-400MHz	30MHz	2p7	6p8	6p8	8p2	1p8	22R	150R	390nH	220nH	390nH	2.5T AL	84dB FIT CT1
395-430MHz	35MHz	1p5	3p3	8p2	10p	-	10R	180R	390nH	180nH	390nH	2.5T AL	85dB
400-435MHz	35MHz	1p5	3p3	8p2	10p	-	10R	180R	390nH	180nH	390nH	2.5T AL	85dB
425-460MHz	35MHz	2p2	4p7	5p6	6p8	-	10R	180R	390nH	180nH	390nH	2.5T AL	85dB
455-490MHz	35MHz	2p7	8p2	12p	8p2	-	10R	180R	390nH	180nH	390nH	1.5T AL	84dB
450-485MHz	35MHz	2p7	8p2	12p	8p2	-	10R	180R	390nH	180nH	390nH	1.5T AL	84dB
485-520MHz	35MHz	2p7	6p8	8p2	8p2	-	22R	150R	390nH	220nH	390nH	1.5T AL	84dB
500-532MHz	32MHz	2p7	6p8	8p2	8p2	-	22R	150R	390nH	220nH	390nH	1.5T AL	83dB
165-186MHz	21MHz	1p8	8p2	6p8	18p	-	22R	220R	390nH	390nH	390nH	3.5T AL	80dB@12.5kHz
148-174MHz	12MHz	1p0	8p2	5p6	18p	-	10R	220R	390nH	390nH	390nH	4.5T AL	89dB,80dB@12.5kHz
66-88MHz	4MHz (B2)	1p5	12p	6p8	18p	-	10R	560R	390nH	1u8H	1u5H	9.5T AL	94dB
400-420MHz	10MHz (N3)	3p9	4p7	6p8	3p9	22p	10R	150R	390nH	390nH	390nH	380MHz	92dB
450-470MHz	10MHz (P3)	2p7	4p7	5p6	4p7	6p8	10R	150R	390nH	390nH	390nH	440MHz	92dB

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	11/5/99
			DRAWN	GJ	23/6/99
			CHECKED		
			APPROVED		
			REF DWGS		

SPECTRA ENGINEERING
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WESTERN AUSTRALIA
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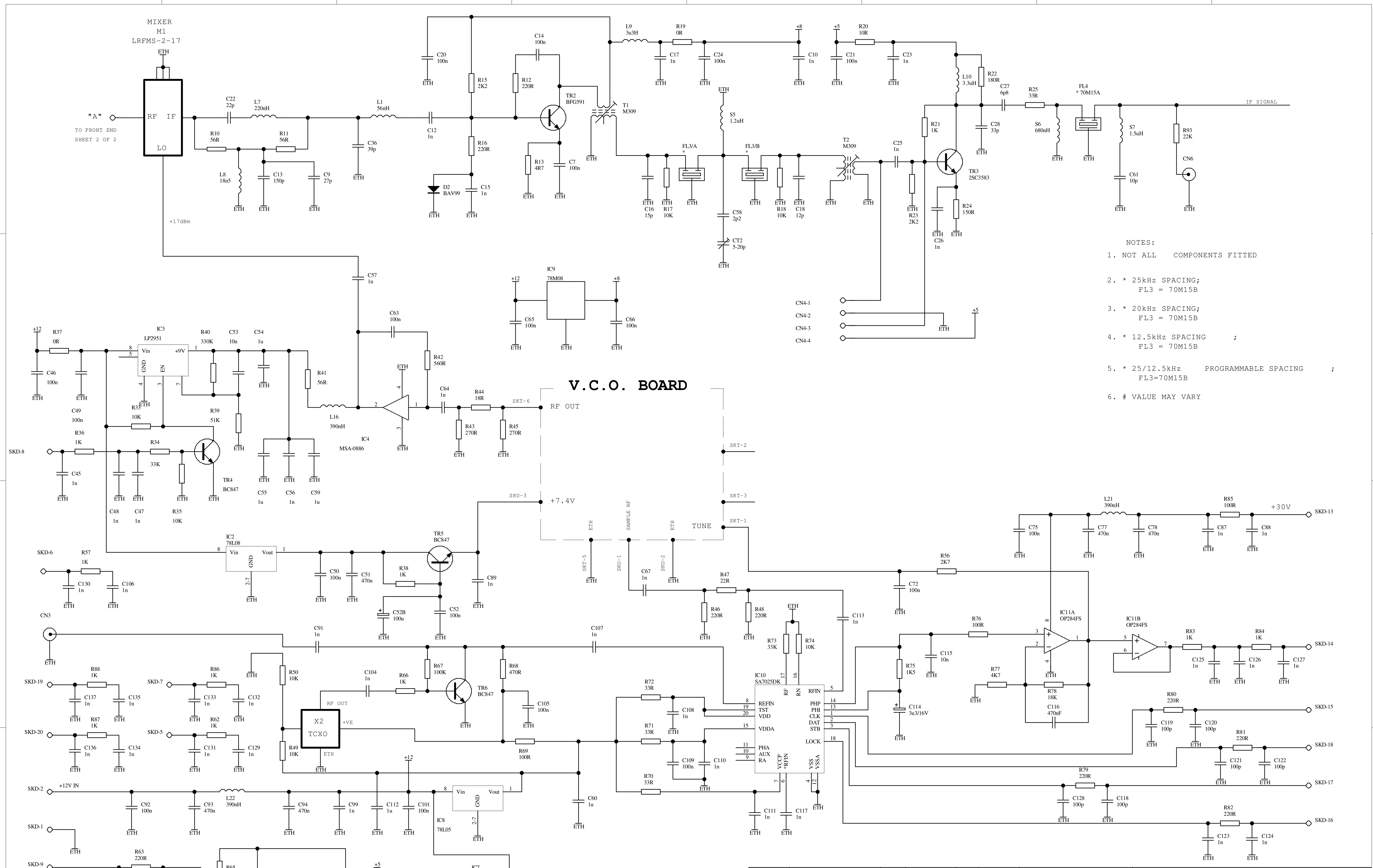
TITLE

MX800 HP RX VCO CCT DIAGRAM BAND A TO Q (30-532 MHz)

DRAWING No CS023-1F.S01 | SHEET 1 OF 1 | REV F



NOTES:

1. NOT ALL COMPONENTS FITTED
2. * 25kHz SPACING;
   FL3 = 70M15B
3. * 20kHz SPACING;
   FL3 = 70M15B
4. * 12.5kHz SPACING ;
   FL3 = 70M15B
5. * 25/12.5kHz PROGRAMMABLE SPACING ;
   FL3=70M15B
6. # VALUE MAY VARY

DATE	REVISION	APP		BY	DATE
22/01/03	B: IC6 PINS	GJ	DESIGNED	GJ	11/6/99
			DRAWN	GJ	28/7/00
			CHECKED		
			APPROVED		
			REF PCB	SEARX REV J+	

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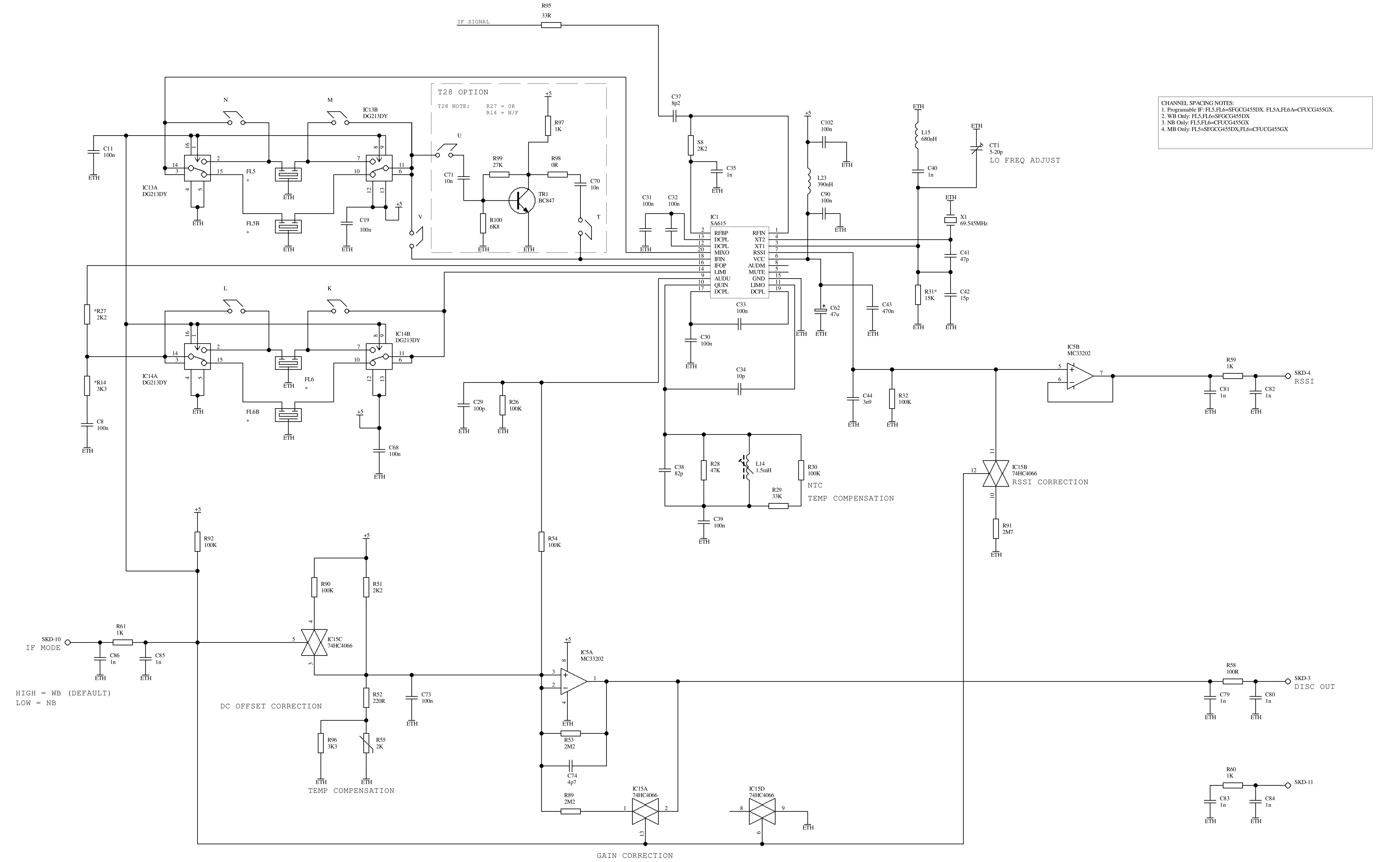
TITLE
MX800 RECEIVER MODULE MIXER & PROGRAMMABLE 70MHZ IF FOR BAND A3

DRAWING No CS025-1D | SHEET 1 OF 2 | REV D



NOTES:

1. * VALUE MAY VARY

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	11/6/99
			DRAWN	GJ	28/7/00
			CHECKED		
			APPROVED		
			REF PCB	SEARX REVJ+	

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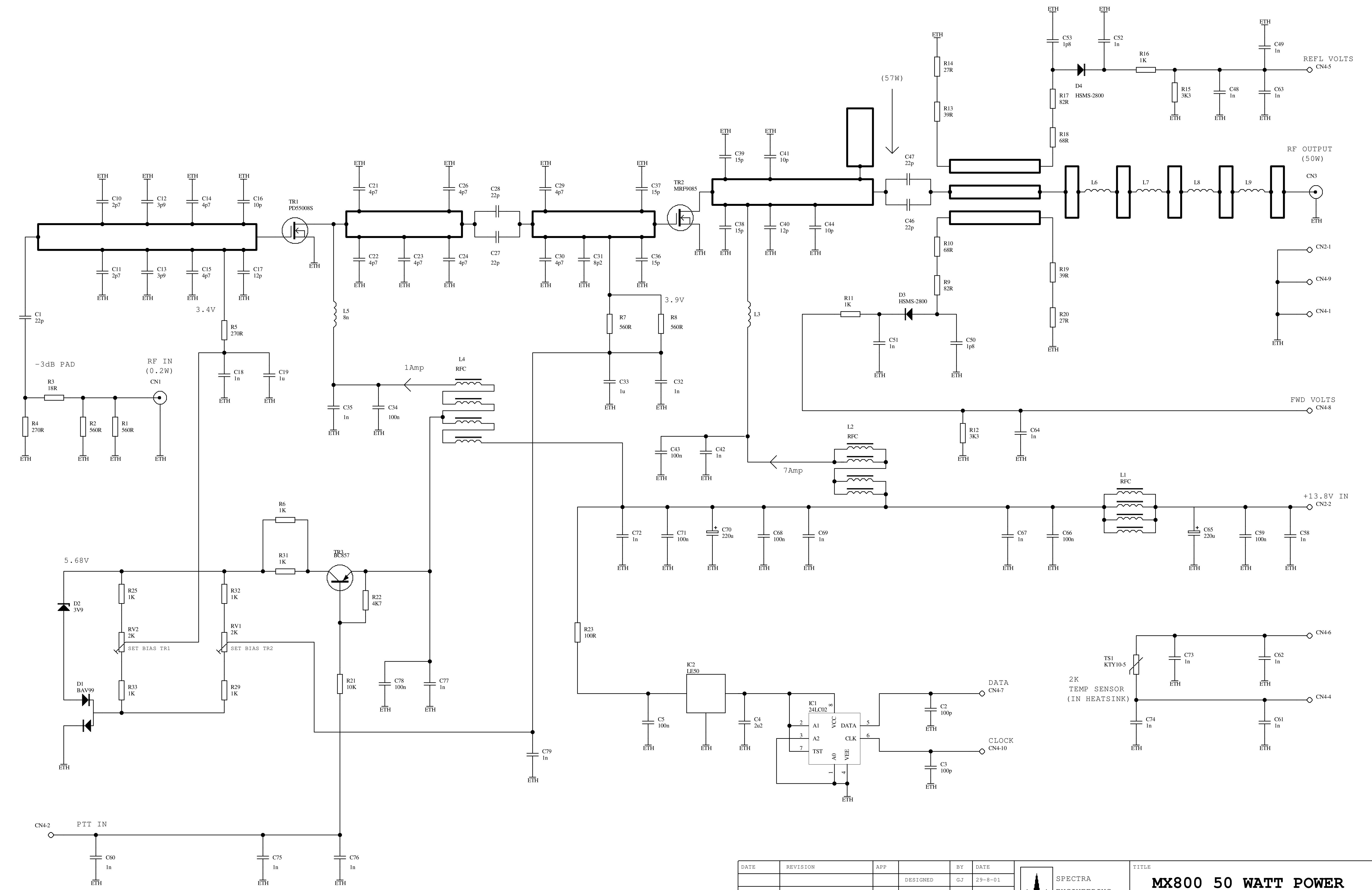
TITLE

MX800 RECEIVER MODULE MIXER & PROGRAMMABLE 70MHZ IF SECTION

DRAWING No CS025-2C | SHEET 2 OF 2 | REV C



NOTE:

1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION
3. LPF LINKS: C,E,H,J,I,O,N,P,Z, U,X,Y

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	29-8-01
			DRAWN	JJ	5-09-01
			CHECKED		
			APPROVED	GJ	7-09-01
			REF DWGS		

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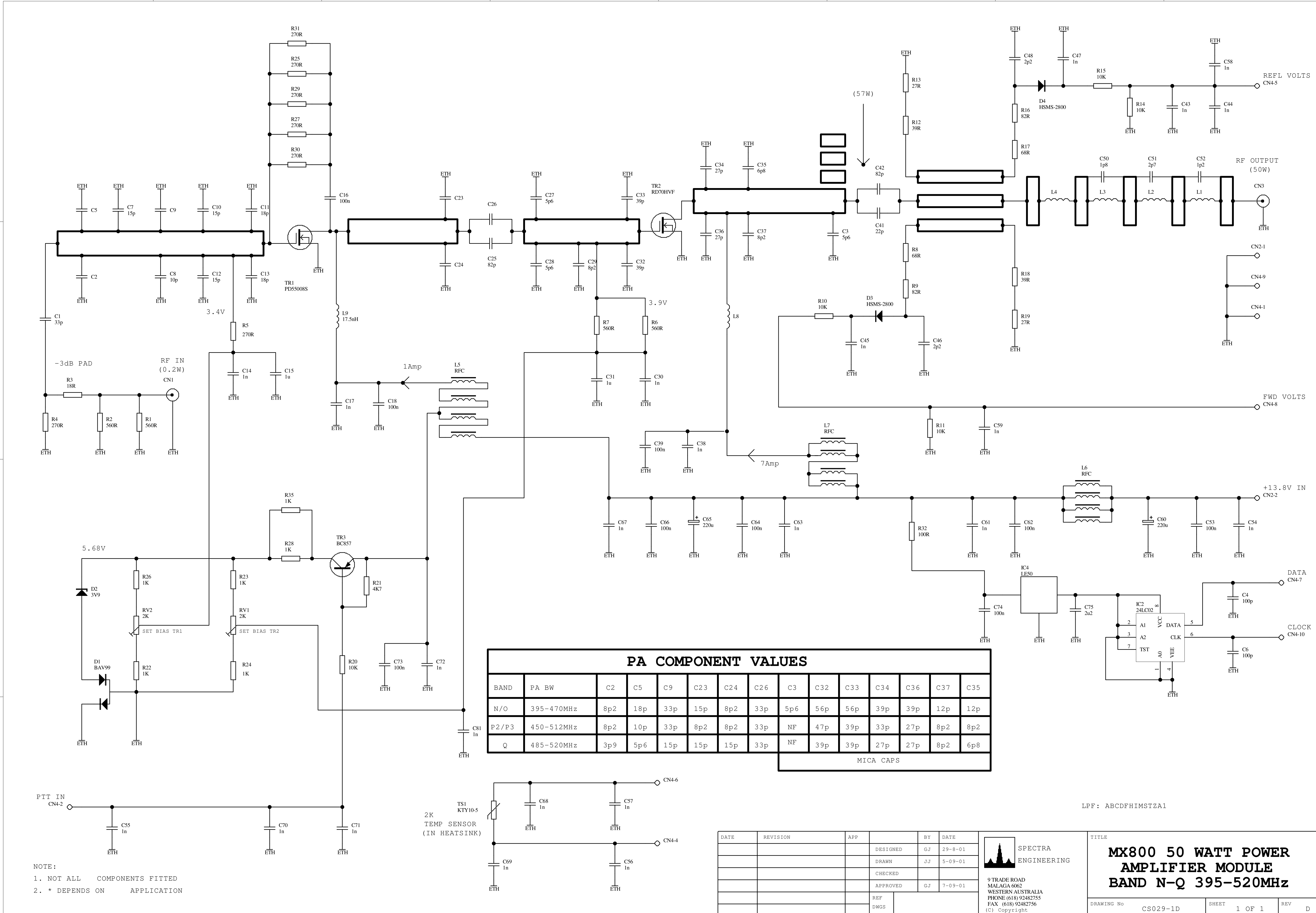
FAX (618) 92482756

TITLE

MX800 50 WATT POWER AMPLIFIER MODULE BAND R2 746-764MHz

DRAWING No CS028-1B | SHEET 1 OF 1 | REV B



PA COMPONENT VALUES

BAND	PA BW	C2	C5	C9	C23	C24	C26	C3	C32	C33	C34	C36	C37	C35
N/O	395-470MHz	8p2	18p	33p	15p	8p2	33p	5p6	56p	56p	39p	39p	12p	12p
P2/P3	450-512MHz	8p2	10p	33p	8p2	8p2	33p	NF	47p	39p	33p	27p	8p2	8p2
Q	485-520MHz	3p9	5p6	15p	15p	15p	33p	NF	39p	39p	27p	27p	8p2	6p8
									MICA CAPS					

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	29-8-01
			DRAWN	JJ	5-09-01
			CHECKED		
			APPROVED	GJ	7-09-01
			REF DWGS		

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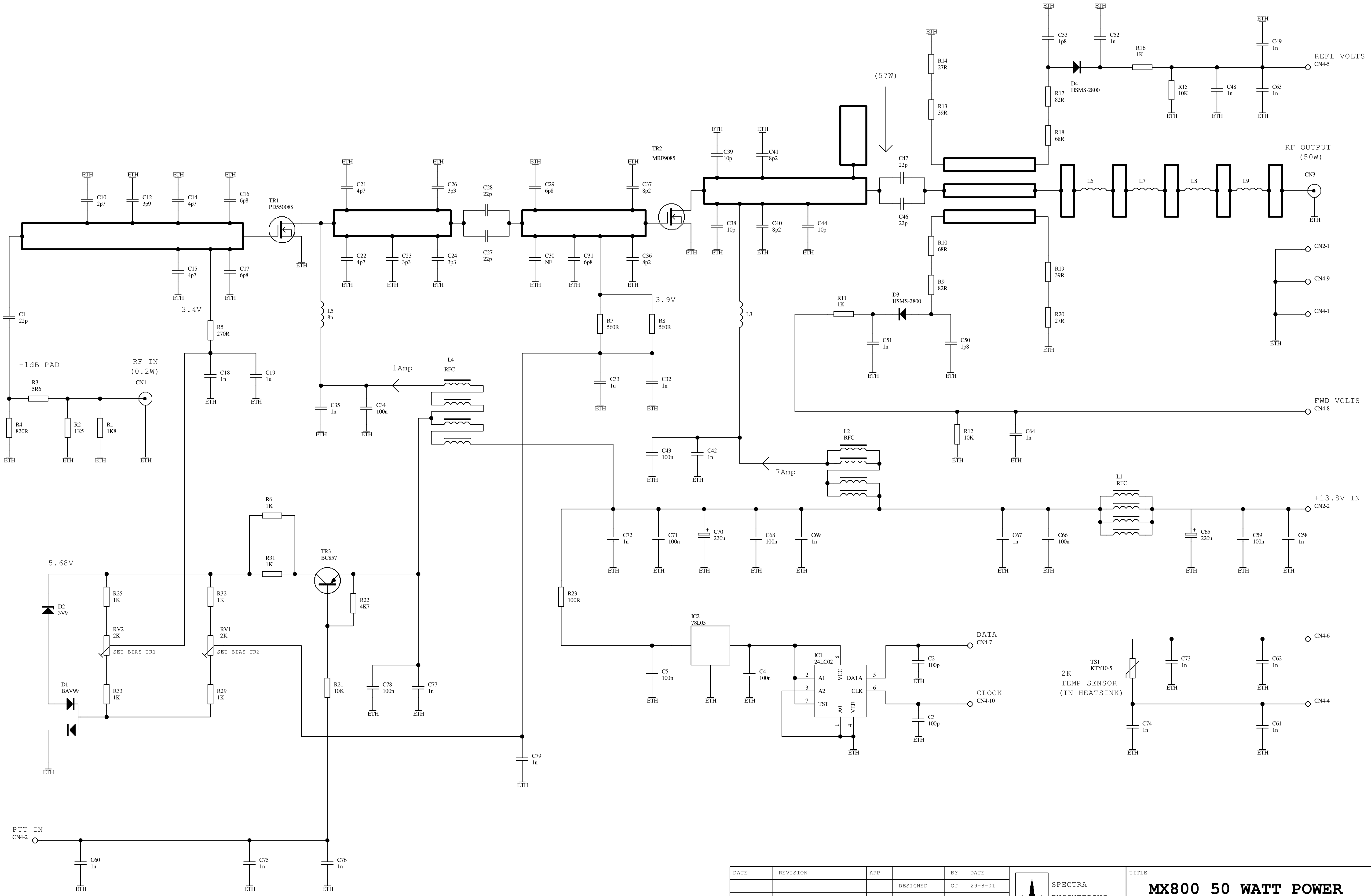
TITLE

MX800 50 WATT POWER AMPLIFIER MODULE BAND N-Q 395-520MHz

DRAWING No CS029-1D | SHEET 1 OF 1 | REV D



NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION
3. LPF LINKS: B,C,G,J,N,P,R,S,U,Y

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	29-8-01
			DRAWN	JJ	5-09-01
			CHECKED		
			APPROVED	GJ	7-09-01
			REF DWGS		

SPECTRA ENGINEERING
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MALAGA 6062
WESTERN AUSTRALIA
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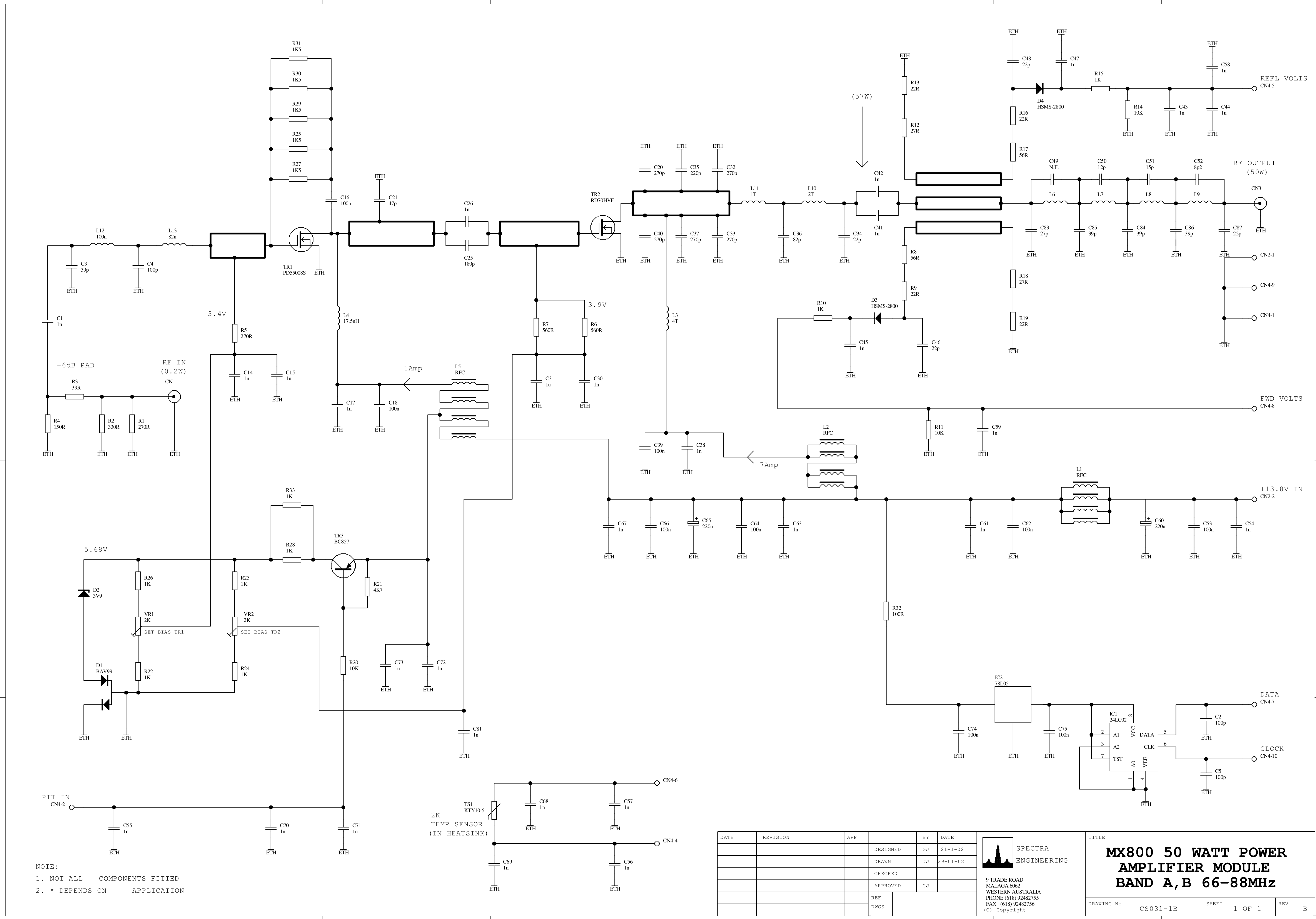
FAX (618) 92482756

TITLE

MX800 50 WATT POWER AMPLIFIER MODULE BAND T 850-870MHz

DRAWING No CS030-1C | SHEET 1 OF 1 | REV C



REFL VOLTS
CN4-5
RF OUTPUT
(50W)
CN3
(57W)
FWD VOLTS
CN4-8
+13.8V IN
CN2-2
DATA
CN4-7
CLOCK
CN4-10
CN2-1
CN4-9
CN4-1
RF IN
(0.2W)
CN1
-6dB PAD
3.4V
3.9V
1Amp
7Amp
5.68V
SET BIAS TR1
SET BIAS TR2
PTT IN
CN4-2
CN4-6
CN4-4
2K
TEMP SENSOR
(IN HEATSINK)
TR1
PD55008S
TR2
RD70HVF
TR3
BC857
IC1
24LC02
IC2
78L05
NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION
DATE
REVISION
APP
BY
DESIGNED GJ 21-1-02
DRAWN JJ 29-01-02
CHECKED
APPROVED GJ
REF
DWGS
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ENGINEERING
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MALAGA 6062
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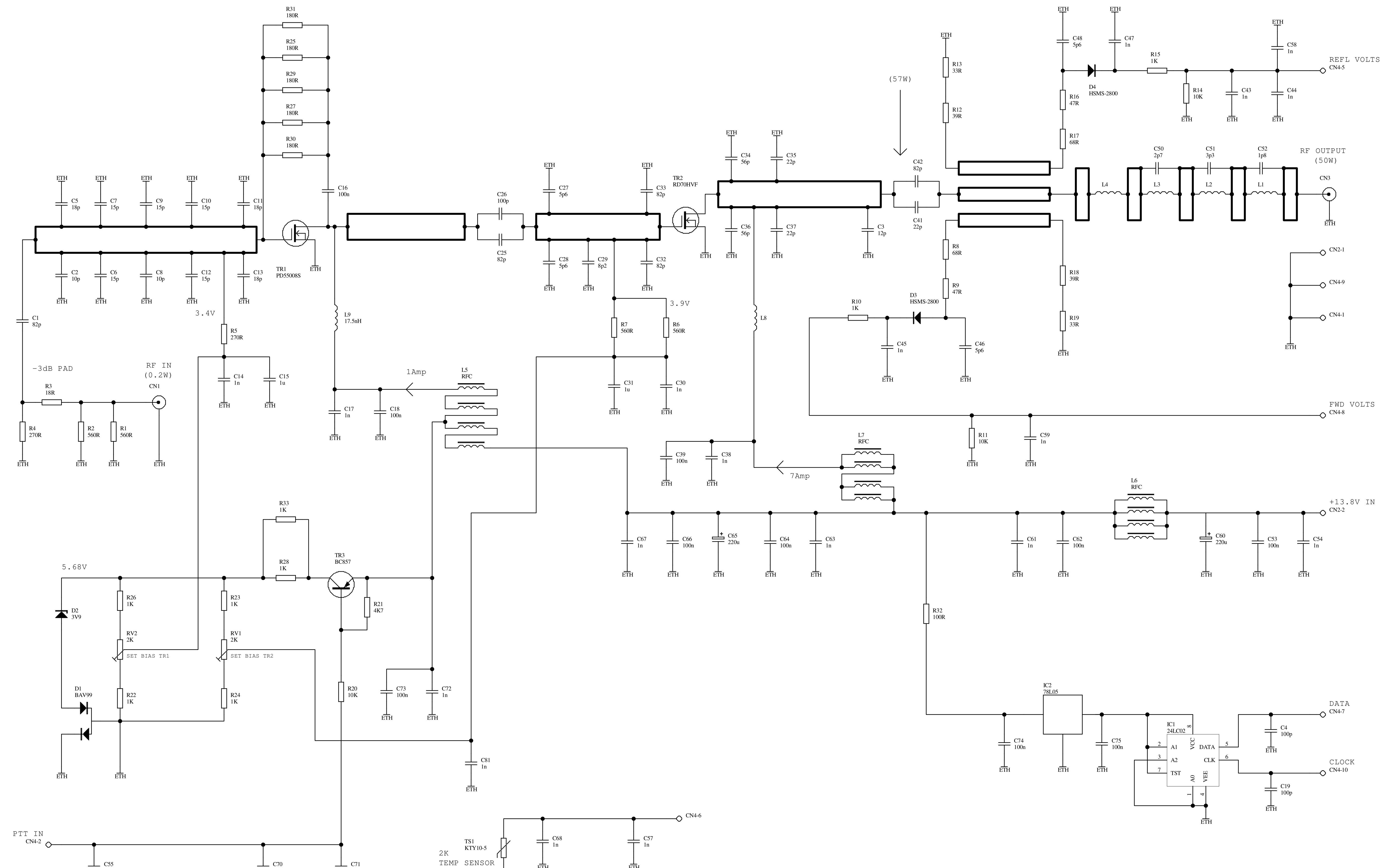
TITLE
MX800 50 WATT POWER
AMPLIFIER MODULE
BAND A,B 66-88MHz
DRAWING No CS031-1B
SHEET 1 OF 1
REV B



NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	29-8-01
			DRAWN	JJ	5-09-01
			CHECKED		
			APPROVED	GJ	7-09-01
			REF DWGS		

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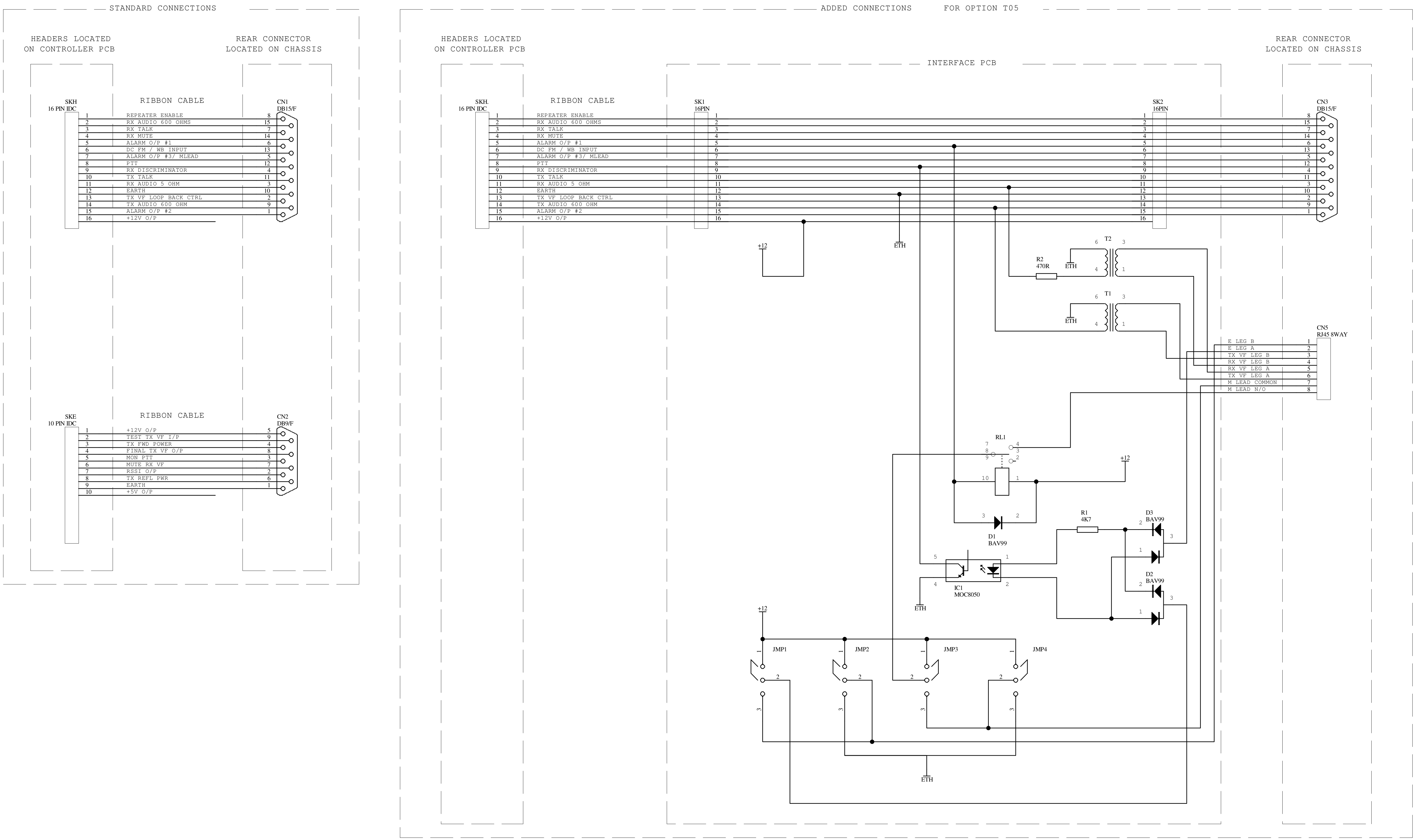
TITLE
MX800 50 WATT POWER AMPLIFIER MODULE BAND K-M 320-400MHz

DRAWING No CS033-1D | SHEET 1 OF 1 | REV D



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	22-4-99
			DRAWN	GJ	8-8-99
			CHECKED	SE	
			APPROVED		
			REF PCB		

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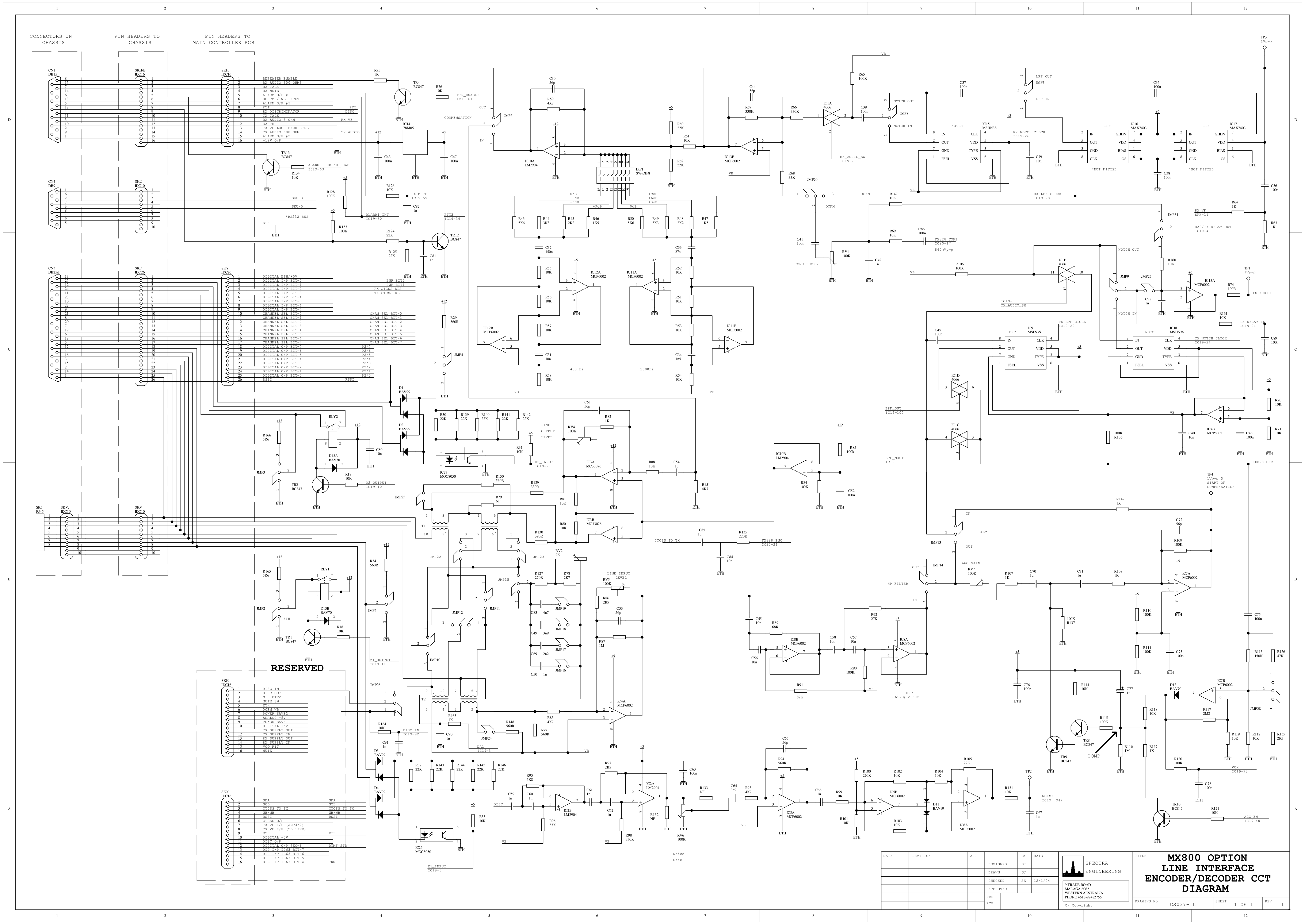
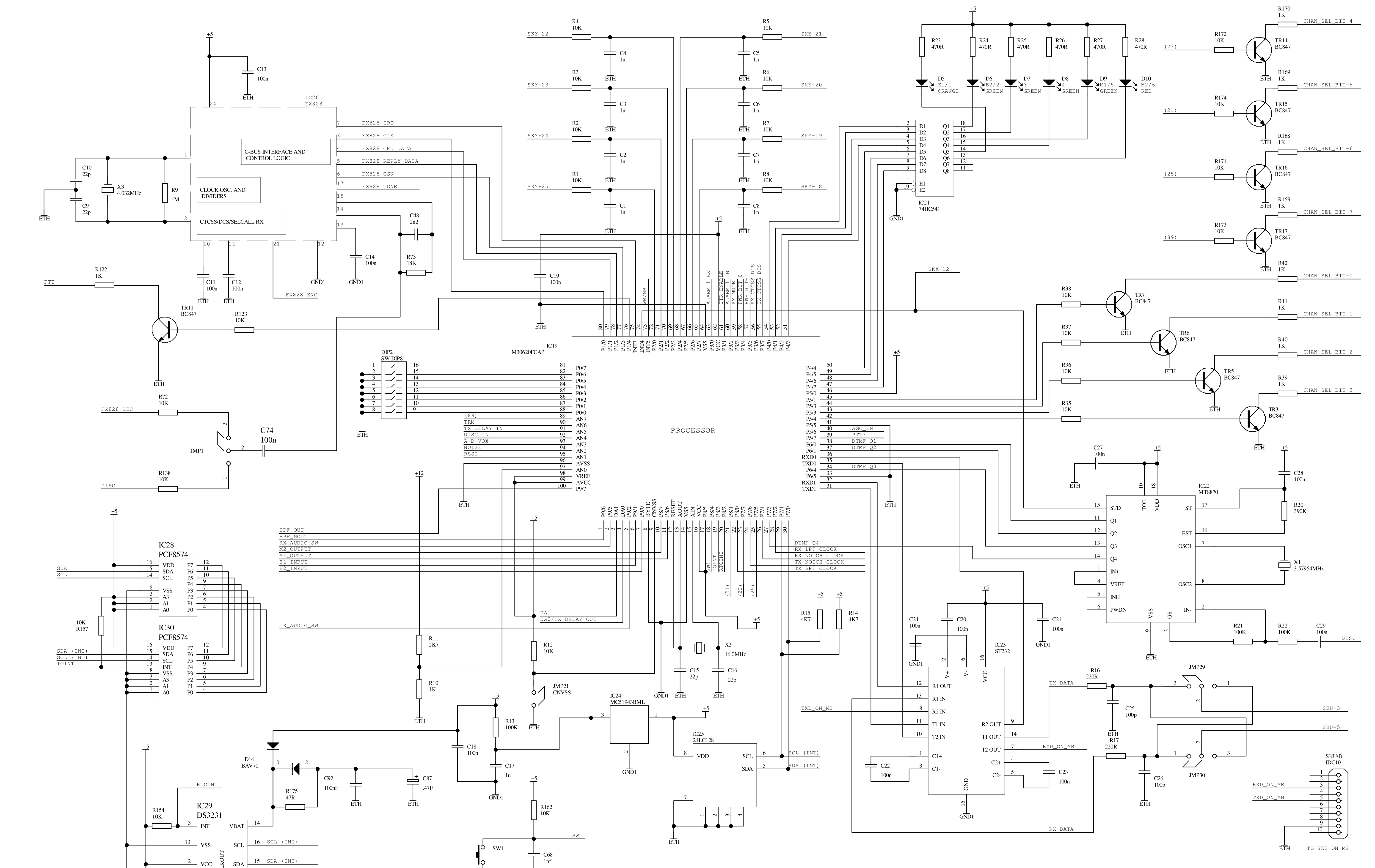
TITLE

MX800 ISOLATED T29 INTERFACE OPTION CCT DIAGRAM

DRAWING No CS035-1B | SHEET 1 OF 1 | REV B


MX800 OPTION
LINE INTERFACE
ENCODER/DECODER CCT
DIAGRAM
SPECTRA ENGINEERING
9 TRADE ROAD
MALAGA 6062
WESTERN AUSTRALIA
PHONE +618-92482755
DESIGNED GJ
DRAWN GJ
CHECKED SE 12/1/04
APPROVED
DRAWING No CS037-1L
SHEET 1 OF 1
REV L
(C) Copyright
CONNECTORS ON CHASSIS
PIN HEADERS TO CHASSIS
PIN HEADERS TO MAIN CONTROLLER PCB
RESERVED



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	
			DRAWN	MS	
			CHECKED	SE	
			APPROVED		
			REF		
			PCB		

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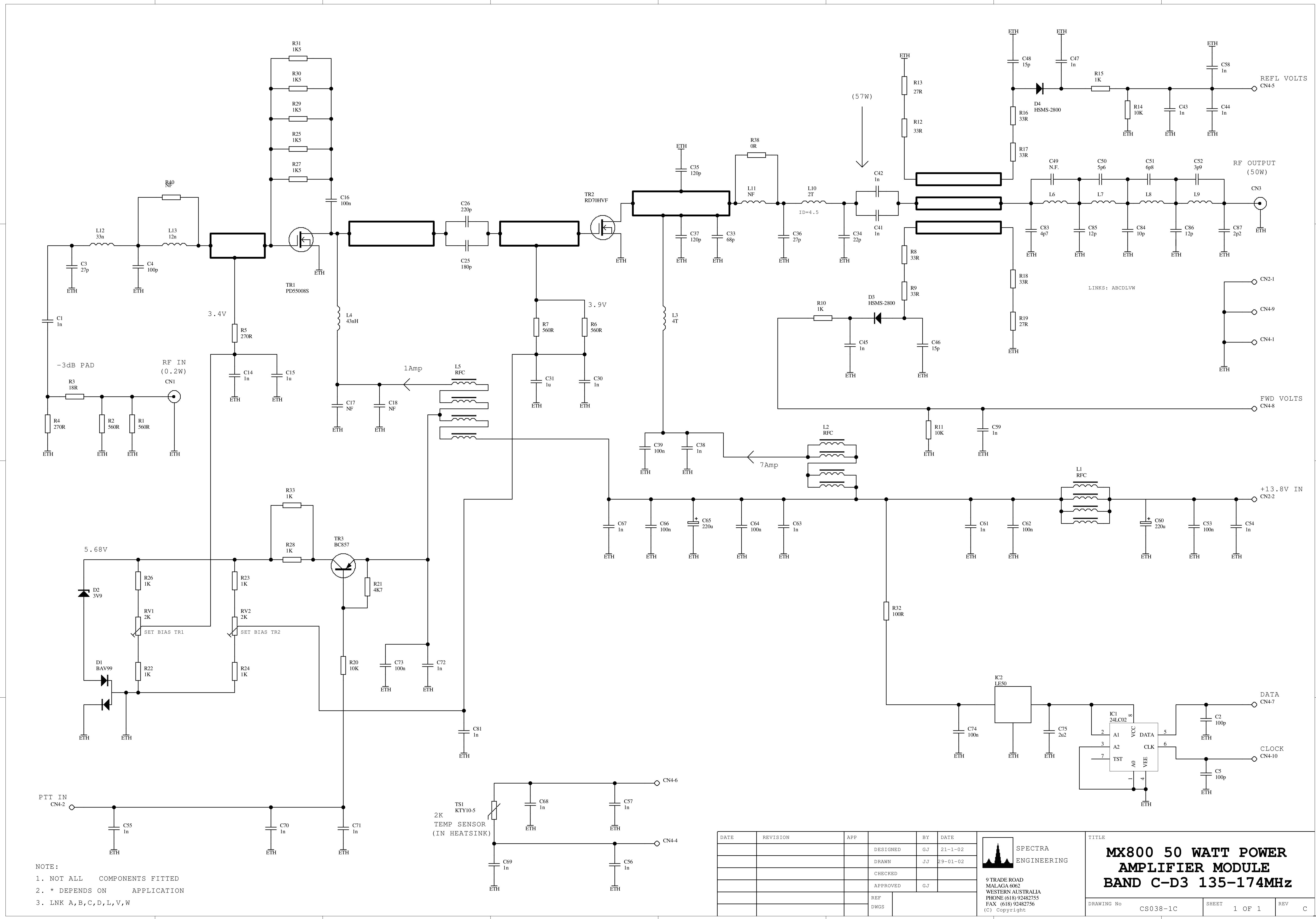
TITLE

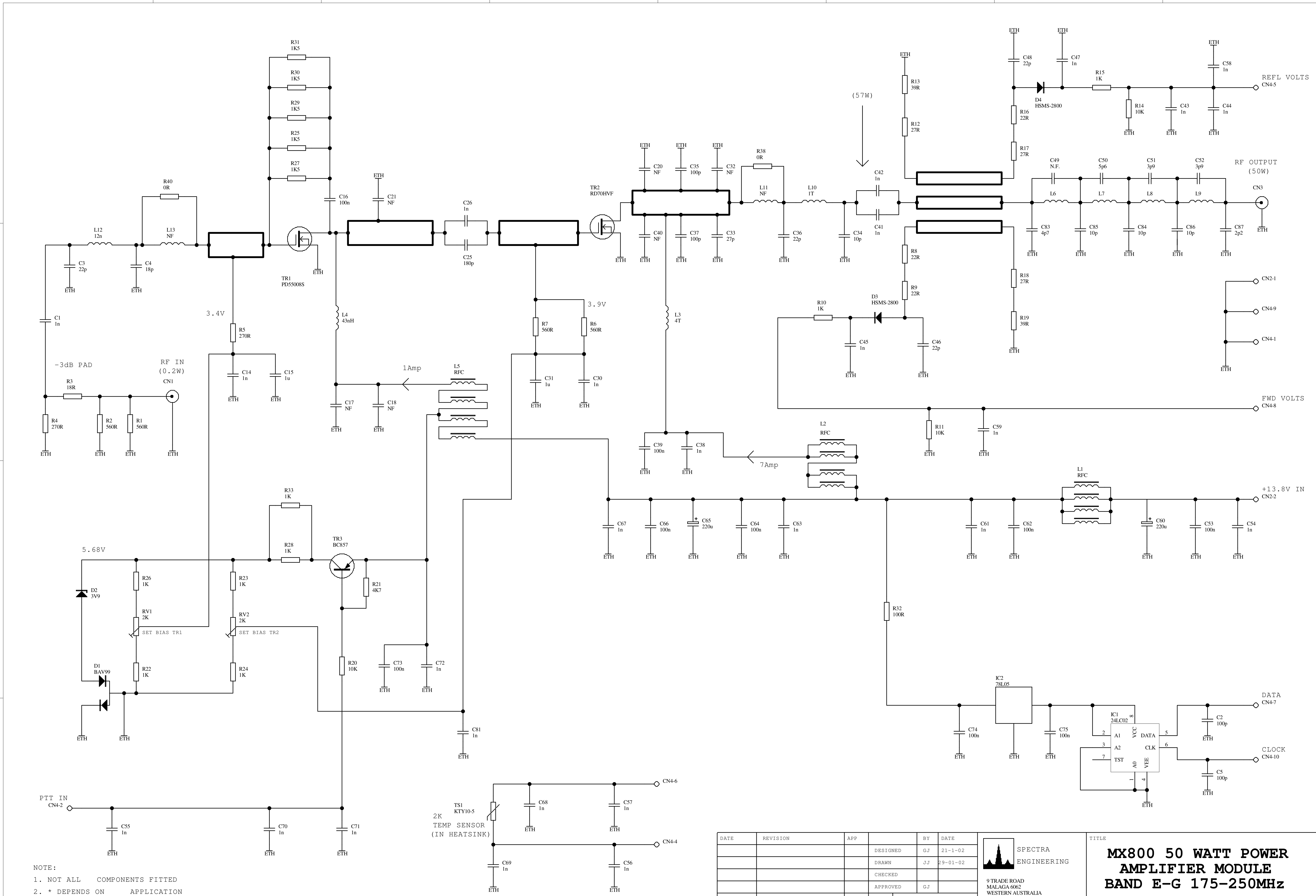
MX800 OPTION LINE INTERFACE ENCODER/DECODER LOGIC CCT DIAGRAM

DRAWING No CS037-2J

SHEET 2 OF 2

REV J


MX800 50 WATT POWER
AMPLIFIER MODULE
BAND C-D3 135-174MHz
SPECTRA ENGINEERING
9 TRADE ROAD
MALAGA 6062
WESTERN AUSTRALIA
PHONE (618) 92482755
FAX (618) 92482756
(C) Copyright
DRAWING No CS038-1C
SHEET 1 OF 1
REV C
DESIGNED GJ 21-1-02
DRAWN JJ 29-01-02
APPROVED GJ
NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION
3. LNK A,B,C,D,L,V,W
REFL VOLTS
RF OUTPUT (50W)
FWD VOLTS
+13.8V IN
DATA
CLOCK
PTT IN
RF IN (0.2W)
-3dB PAD
(57W)
1Amp
7Amp
3.4V
3.9V
5.68V
SET BIAS TR1
SET BIAS TR2
2K TEMP SENSOR (IN HEATSINK)
LINKS: ABCDLVW
TR1 PD55008S
TR2 RD70HVF
TR3 BC857
IC1 24LC02
IC2 LE50
D3 HSMS-2800
D4 HSMS-2800



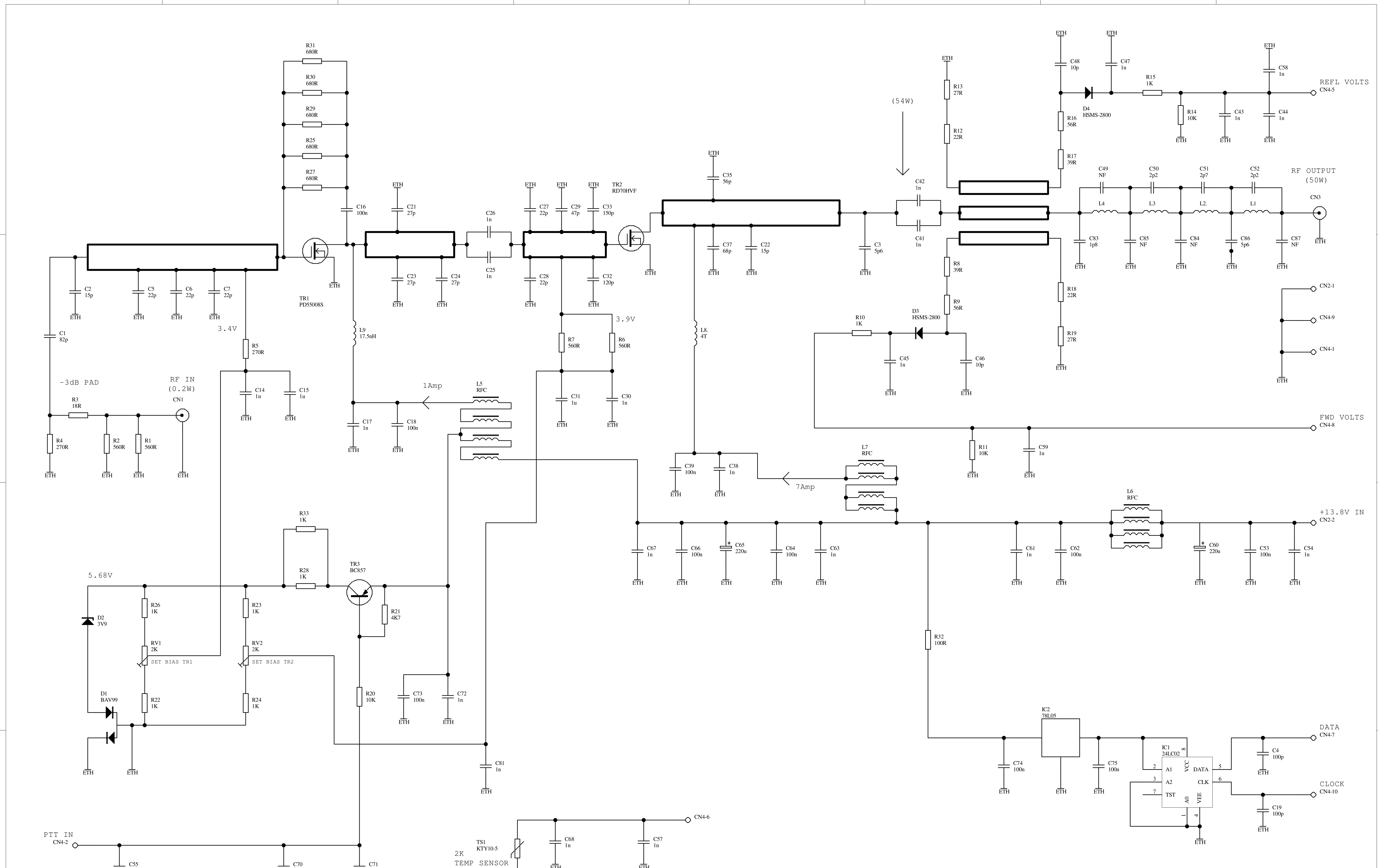
NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION
3. LNK A,B,C,M,R,V,W

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	21-1-02
			DRAWN	JJ	29-01-02
			CHECKED		
			APPROVED	GJ	
			REF DWGS		

SPECTRA ENGINEERING
9 TRADE ROAD
MALAGA 6062
WESTERN AUSTRALIA
PHONE (618) 92482755
FAX (618) 92482756

TITLE
MX800 50 WATT POWER AMPLIFIER MODULE BAND E-G 175-250MHz

DRAWING No CS039-1B | SHEET 1 OF 1 | REV B



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	21-1-02
			DRAWN	JJ	29-01-02
			CHECKED		
			APPROVED	GJ	
			REF DWGS		

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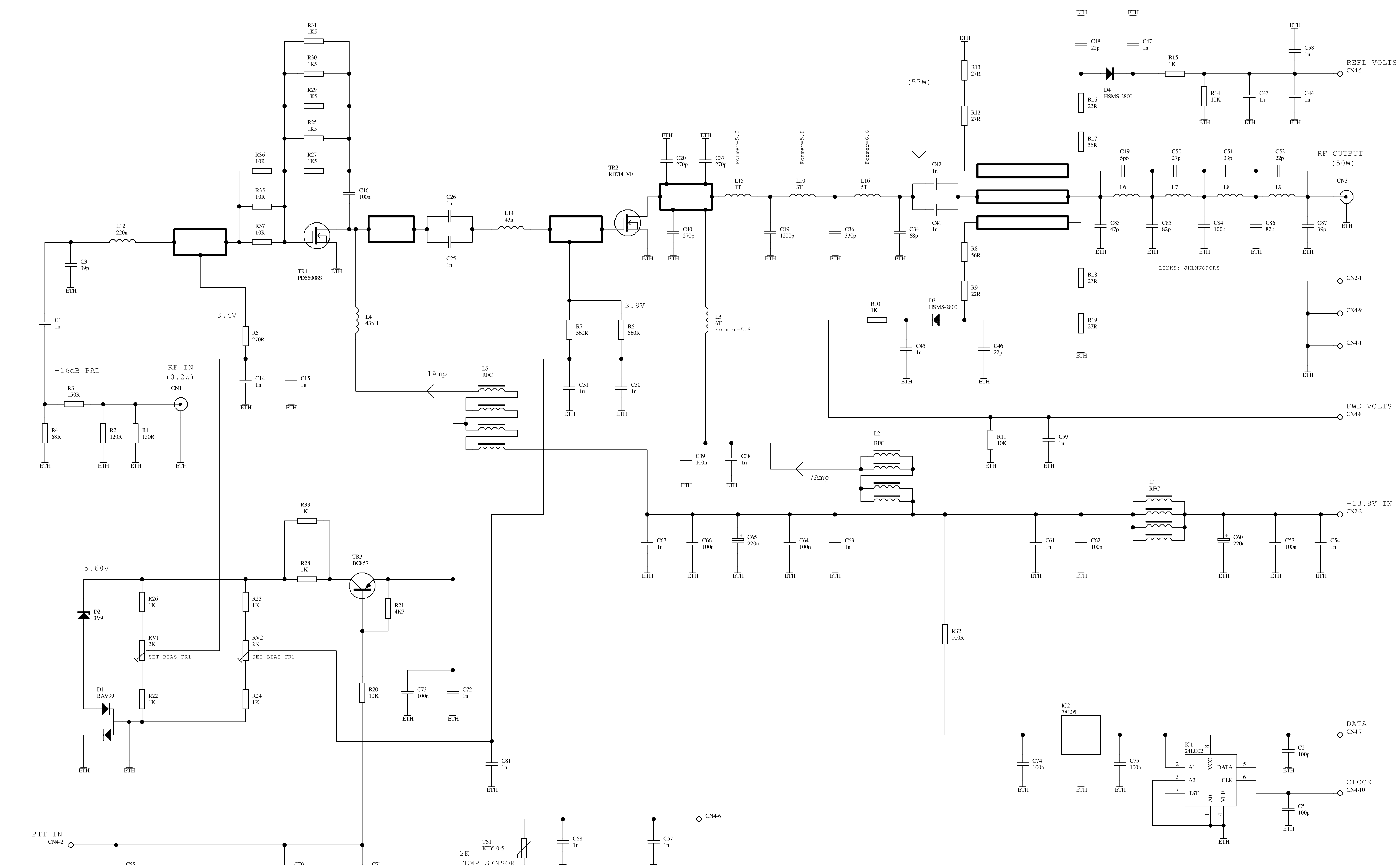
TITLE

MX800 50 WATT POWER AMPLIFIER MODULE BAND H-J 245-320MHz

DRAWING No CS040-1B | SHEET 1 OF 1 | REV B



NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	21-1-02
			DRAWN	JJ	29-01-02
			CHECKED		
			APPROVED	GJ	
			REF DWGS		

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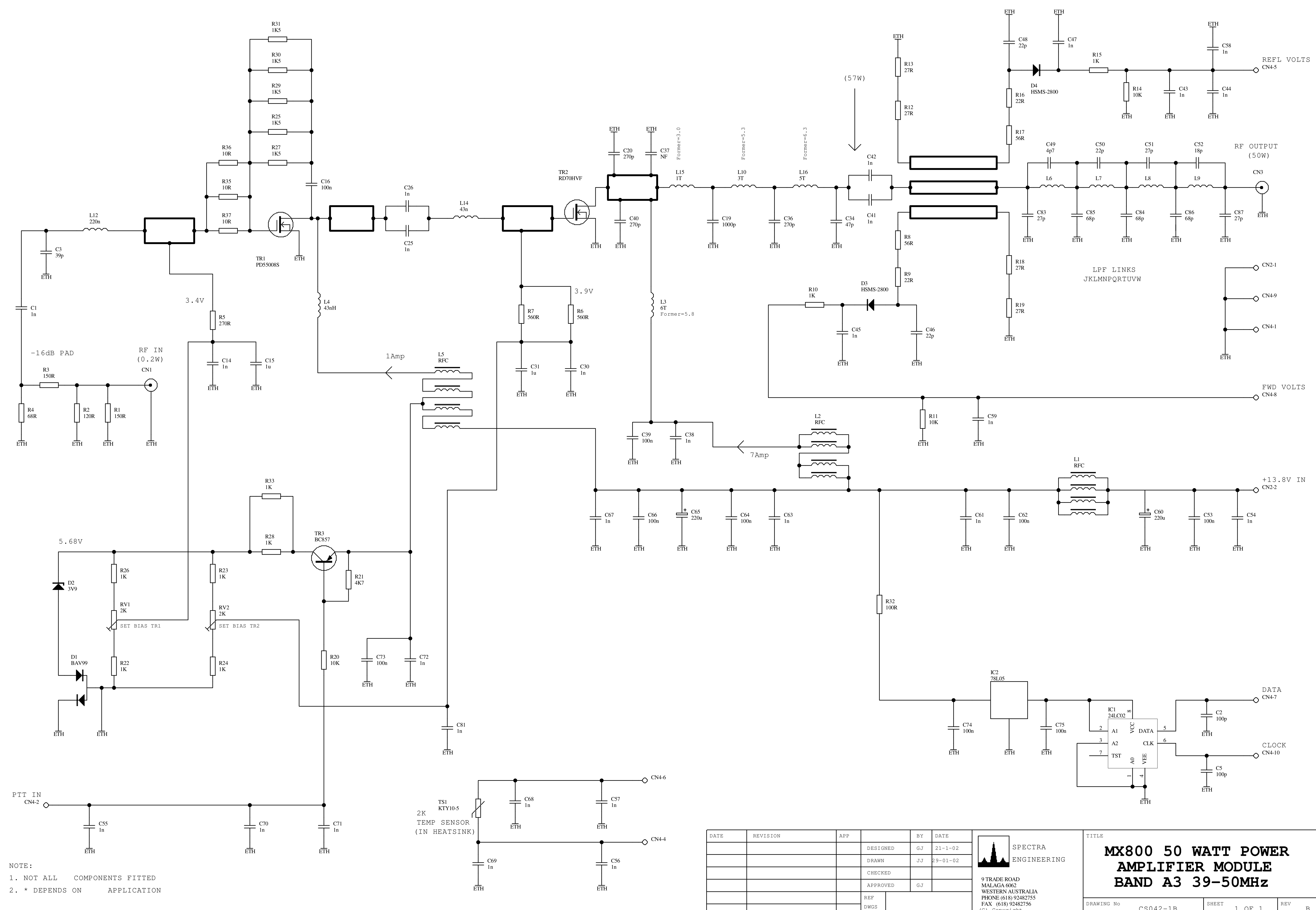
TITLE

MX800 50 WATT POWER AMPLIFIER MODULE BAND A2 30-40MHz

DRAWING No CS041-1B | SHEET 1 OF 1 | REV B



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	21-1-02
			DRAWN	JJ	29-01-02
			CHECKED		
			APPROVED	GJ	
			REF DWGS		

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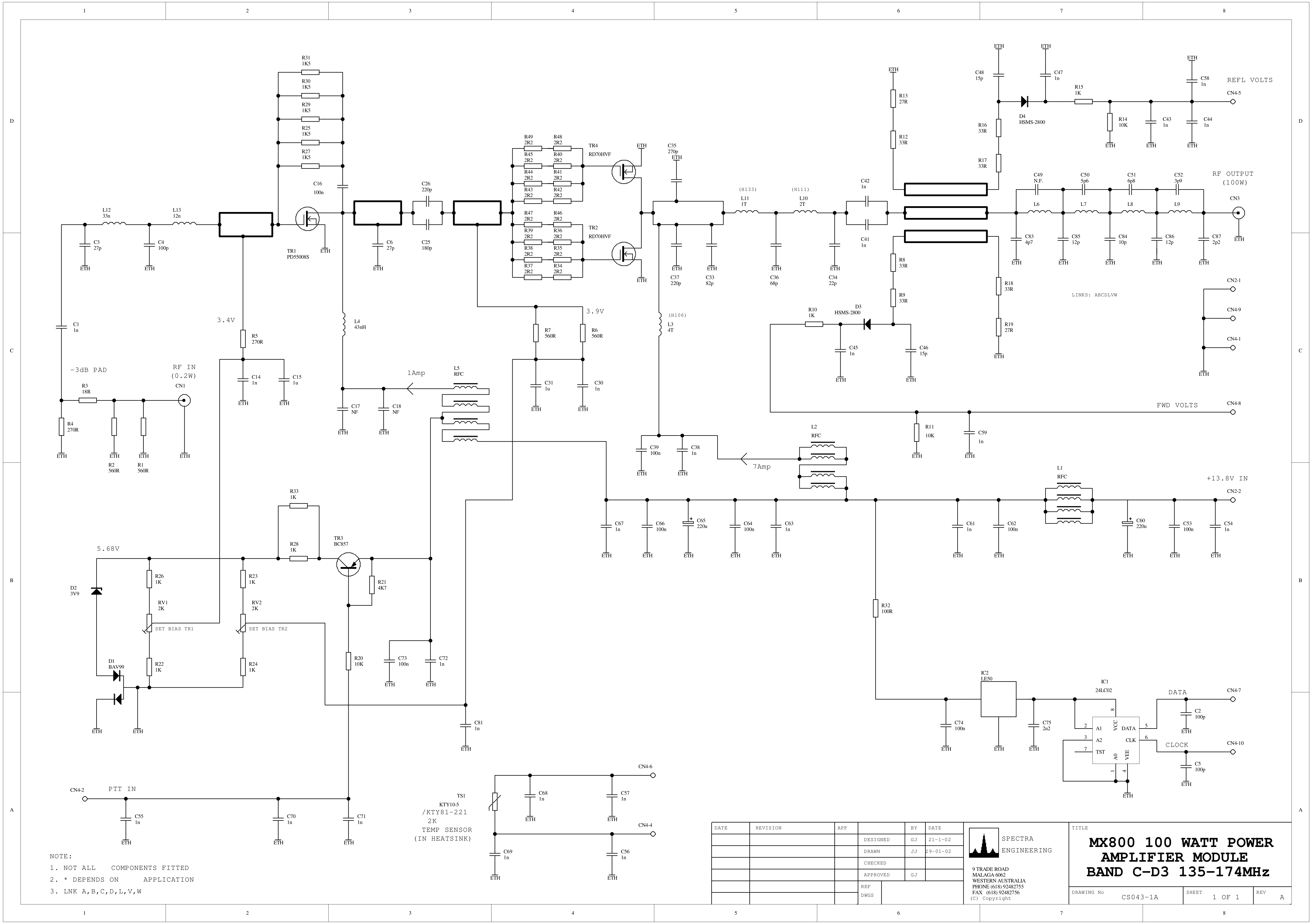
TITLE

MX800 50 WATT POWER AMPLIFIER MODULE BAND A3 39-50MHz

DRAWING No CS042-1B | SHEET 1 OF 1 | REV B


MX800 100 WATT POWER
AMPLIFIER MODULE
BAND C-D3 135-174MHz
SPECTRA ENGINEERING
9 TRADE ROAD
MALAGA 6062
WESTERN AUSTRALIA
PHONE (618) 92482755
FAX (618) 92482756
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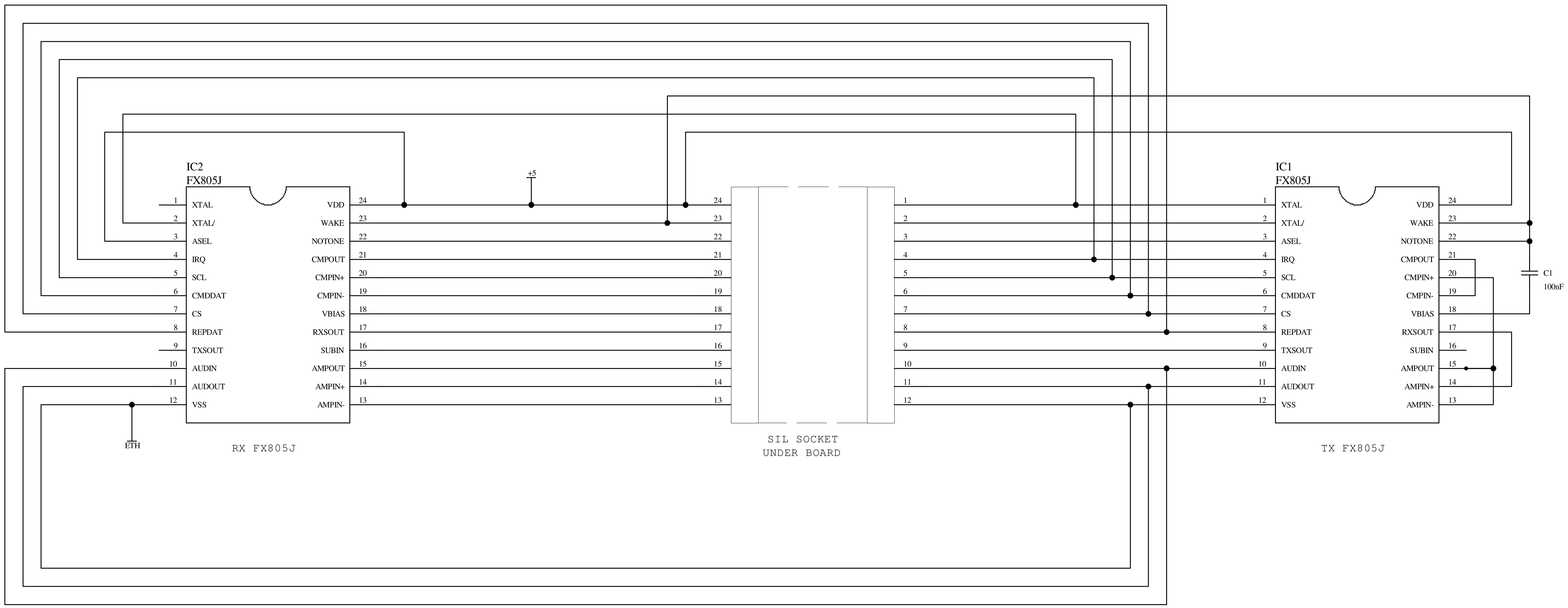
DESIGNED GJ 21-1-02
DRAWN JJ 29-01-02
CHECKED
APPROVED GJ
DRAWING No CS043-1A
SHEET 1 OF 1
REV A
RF IN (0.2W)
-3dB PAD
RF OUTPUT (100W)
REFL VOLTS
FWD VOLTS
+13.8V IN
DATA
CLOCK
PTT IN
LINKS: ABCDLVW
TEMP SENSOR (IN HEATSINK)
SET BIAS TR1
SET BIAS TR2
NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION
3. LNK A,B,C,D,L,V,W



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	11/5/99
			DRAWN	SE	23/8/04
			CHECKED		
			APPROVED		
			REF DWGS		

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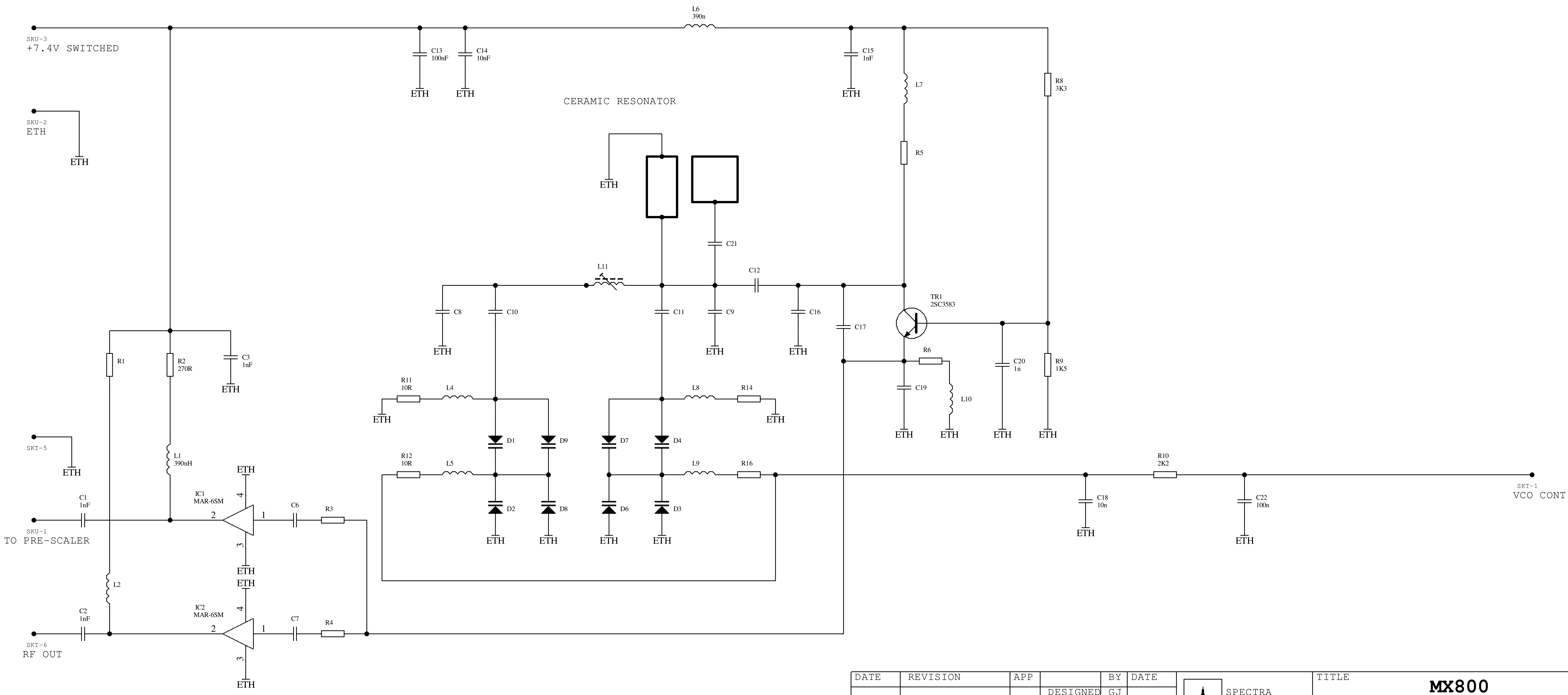
TITLE

MX800 FULL DUPLEX CTCSS / DCS OPTION

DRAWING No CS050-1 | SHEET 1 OF 1 | REV A

NOMINAL BAND				VCO COMPONENT VALUES																															
BAND	FREQ BAND	VCO Freq	SW BW	CR1	R1	R3	R4	R5	R6	R10	R14	R16	C6	C7	C8	C9	C10	C11	C12	C16	C17	C19	C21	C23	L2	L4, L5	L7	L8, L9	L10	L11	D1, D2	D3, D4	D6, D7	D8, D9	NOTES:
J	295-327MHz	385-417MHz	32MHz	N.F.	180R	560R	220R	120R	150R	2K2	10R	10R	3p3	3p3	3p3	3p3	3p9	3p9	3p3	N.F.	5p6	5p6	N.F.	N.F.	0R	390n	390n	390n	390n	2.5T	BB149	BB149	N.F.	N.F.	
L	345-375MHz	435-465MHz	30MHz	N.F.	180R	560R	220R	120R	150R	0R	10R	10R	3p3	3p3	2p7	2p7	3p3	3p3	3p3	N.F.	6p8	6p8	N.F.	N.F.	0R	390n	390n	390n	390n	2.5T	BB149	BB149	N.F.	N.F.	
N2	400-435MHz	310-345MHz	35MHz	N.F.	180R	560R	220R	120R	150R	2K2	10R	10R	3p9	3p9	3p3	3p3	4p7	4p7	3p9	N.F.	6p8	6p8	N.F.	N.F.	0R	390n	390n	390n	390n	3.5T	BB133	BB133	N.F.	N.F.	
O2	435-470MHz	345-380MHz	35MHz	N.F.	180R	560R	220R	120R	150R	2K2	10R	10R	3p9	3p9	3p9	3p9	4p7	4p7	3p3	N.F.	8p2	8p2	N.F.	N.F.	0R	390n	390n	390n	390n	2.5T	BB133	BB133	N.F.	N.F.	
P2	450-485MHz	360-395MHz	35MHz	N.F.	180R	270R	220R	120R	150R	2K2	10R	10R	3p3	3p3	3p9	3p9	4p7	4p7	3p3	N.F.	5p6	5p6	N.F.	N.F.	0R	390n	390n	390n	390n	2.5T	BB149	BB149	N.F.	N.F.	
Q	485-520MHz	395-430MHz	35MHz	N.F.	180R	560R	220R	120R	150R	2K2	10R	10R	3p3	3p3	3p3	3p3	3p9	3p9	3p3	N.F.	5p6	5p6	N.F.	N.F.	0R	390n	390n	390n	390n	2.5T	BB149	BB149	N.F.	N.F.	
R	805-825MHz	715-735MHz	20MHz	850MHz	270R	560R	100R	180R	100R	2K2	10R	10R	1n	1n	N.F.	N.F.	N.F.	2p2	1p0	N.F	3p9	5p6	N.F.	N.F.	390n	N.F.	180n	120n	220n	N.F.	N.F.	N.F.	BB149	N.F.	
T	850-870MHz	760-780MHz	20MHz	910MHz	270R	560R	100R	180R	100R	2K2	0R	0R	1n	1n	N.F.	N.F.	N.F.	1p8	1p0	N.F.	3p9	5p6	N.F.	N.F.	390n	N.F.	180n	120n	220n	N.F.	N.F.	BB149	N.F.	N.F.	
W	917-950MHz	827-860MHz	33MHz	1060MHz	270R	560R	100R	82R	82R	2K2	0R	0R	1n	1n	N.F.	N.F.	N.F.	1p5	1p0	N.F.	3p3	4p7	N.F.	0p47	390n	N.F.	180n	120n	220n	N.F.	N.F.	N.F.	BB149	N.F.	



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	
			DRAWN	GJ	
			CHECKED		
			APPROVED		
			PCB DWGS	NVCO	

SPECTRA ENGINEERING

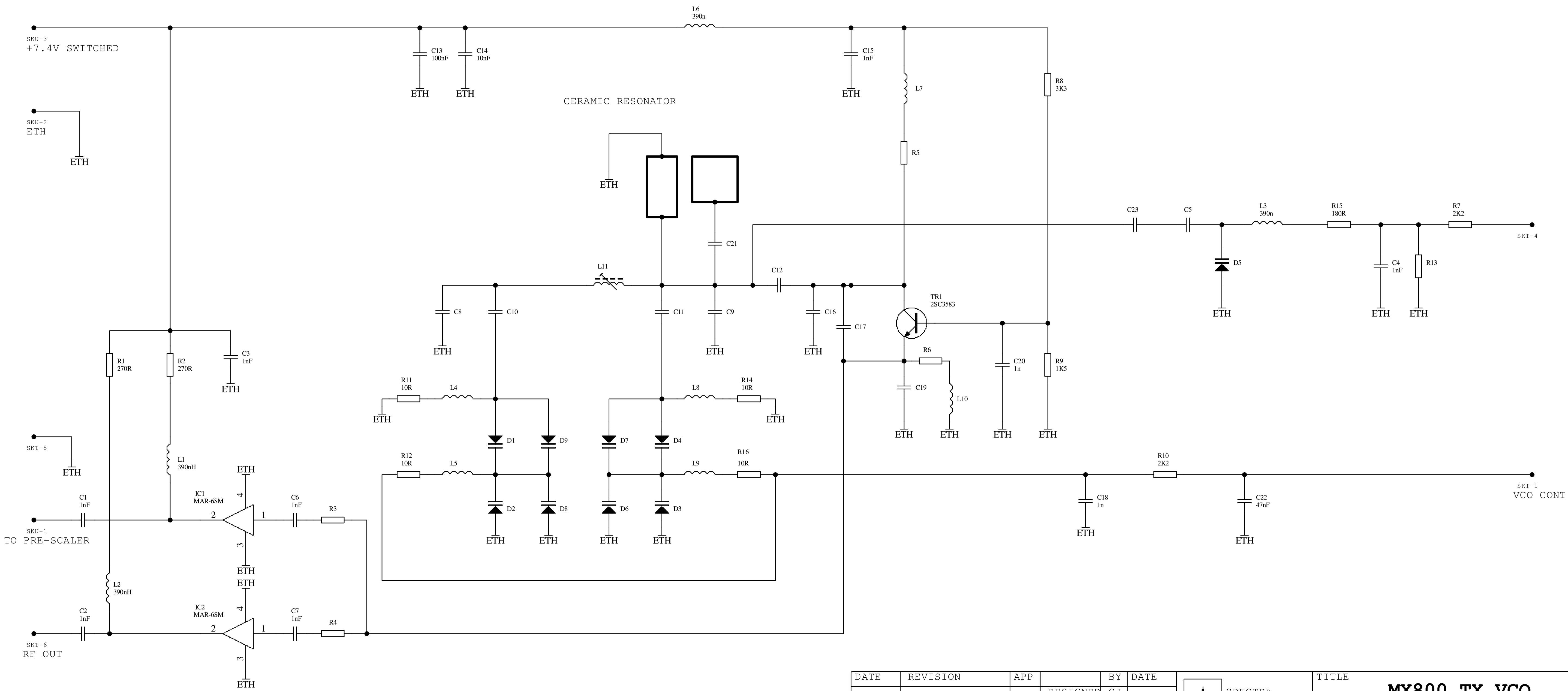
9 TRADE ROAD
MALAGA 6062
WESTERN AUSTRALIA
PHONE (61-8) 92482755 FAX (61-8) 92482756

TITLE

MX800 CCT DIAGRAM V3, RX VCO

DRAWING No CS051-1 | SHEET 1 OF 1 | REV A

NOMINAL BAND			VCO COMPONENT VALUES																							
BAND	FREQ BAND	SW BW	CR1	R3	R4	R5	R6	R13	C5	C8	C9	C10	C11	C12	C16	C17	C19	C21	C23	L4, L5	L7	L8, L9	L10	D1, D2	D3, D4	D6, D7	D8, D9	D5	L11	NOTES
L3	350-385Mhz	35Mhz	N.F.	560R	220R	220R	150R	N.F.	2p2	3p3	3p3	4p7	4p7	3p9	N.F.	6p8	6p8	N.F.	1p	390nH	390nH	390nH	390nH	BB133	BB133	N.F.	N.F.	BB131	New 10mm Coil 2.5T	
M	370-400Mhz	30Mhz	N.F.	560R	220R	220R	150R	N.F.	2p2	3p3	3p3	3p9	3p9	3p3	N.F.	6p8	6p8	N.F.	1p	390nH	390nH	390nH	390nH	BB133	BB133	N.F.	N.F.	BB131	New 10mm Coil 2.5T	
N2	400-435Mhz	35Mhz	N.F.	560R	220R	220R	150R	N.F.	2p2	3p3	3p3	3p9	3p9	3p3	N.F.	6p8	6p8	N.F.	1p	390nH	390nH	390nH	390nH	BB149	BB149	N.F.	N.F.	BB131	New 10mm Coil 2.5T	
O/O2	425-470Mhz	45Mhz	N.F.	560R	220R	220R	150R	N.F.	2p2	3p9	3p9	4p7	4p7	3p9	N.F.	6p8	6p8	N.F.	1p	390nH	390nH	390nH	390nH	BB133	BB133	N.F.	N.F.	BB131	New 10mm Coil 1.5T	
P/P2	450-490Mhz	40Mhz	N.F.	560R	220R	220R	150R	N.F.	2p2	3p3	3p3	3p9	3p9	3p9	N.F.	6p8	6p8	N.F.	1p	390nH	390nH	390nH	390nH	BB133	BB133	N.F.	N.F.	BB131	New 10mm Coil 1.5T	
Q	485-520Mhz	35Mhz	N.F.	560R	220R	220R	150R	N.F.	2p2	3p3	3p3	3p3	3p3	3p9	N.F.	6p8	6p8	N.F.	1p	390nH	390nH	390nH	390nH	BB133	BB133	N.F.	N.F.	BB131	New 10mm Coil 1.5T	
R	805-825Mhz	20Mhz	1060Mhz	560R	100R	220R	100R	2K2	1p	N.F.	N.F.	N.F.	1p8	1p8	N.F.	3p3	3p3	N.F.	1p	N.F.	390nH	120nH	220nH	N.F.	BB131	N.F.	N.F.	BB131	N.F.	
R2	746-764Mhz	18Mhz	940Mhz	560R	100R	220R	100R	2K2	1p	N.F.	N.F.	N.F.	1p8	1p8	N.F.	3p3	3p3	N.F.	1p	N.F.	390nH	120nH	220nH	N.F.	BB131	N.F.	N.F.	BB131	N.F.	
T	850-870Mhz	20Mhz	1090Mhz	560R	100R	220R	100R	2K2	1p	N.F.	N.F.	N.F.	1p5	1p	N.F.	4p7	3p3	N.F.	1p	N.F.	390nH	120nH	220nH	N.F.	BB131	N.F.	N.F.	BB131	N.F.	
W	917-950Mhz	33Mhz	1240MHz	560R	100R	82R	68R	2K2	1p	N.F.	N.F.	N.F.	1p2	1p	N.F.	3p3	2p7	N.F.	1p	N.F.	180nH	120nH	220nH	N.F.	BB131	N.F.	N.F.	BB149	N.F.	



DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	
			DRAWN	GJ	
			CHECKED		
			APPROVED		
			PCB DWGS	NVCO	

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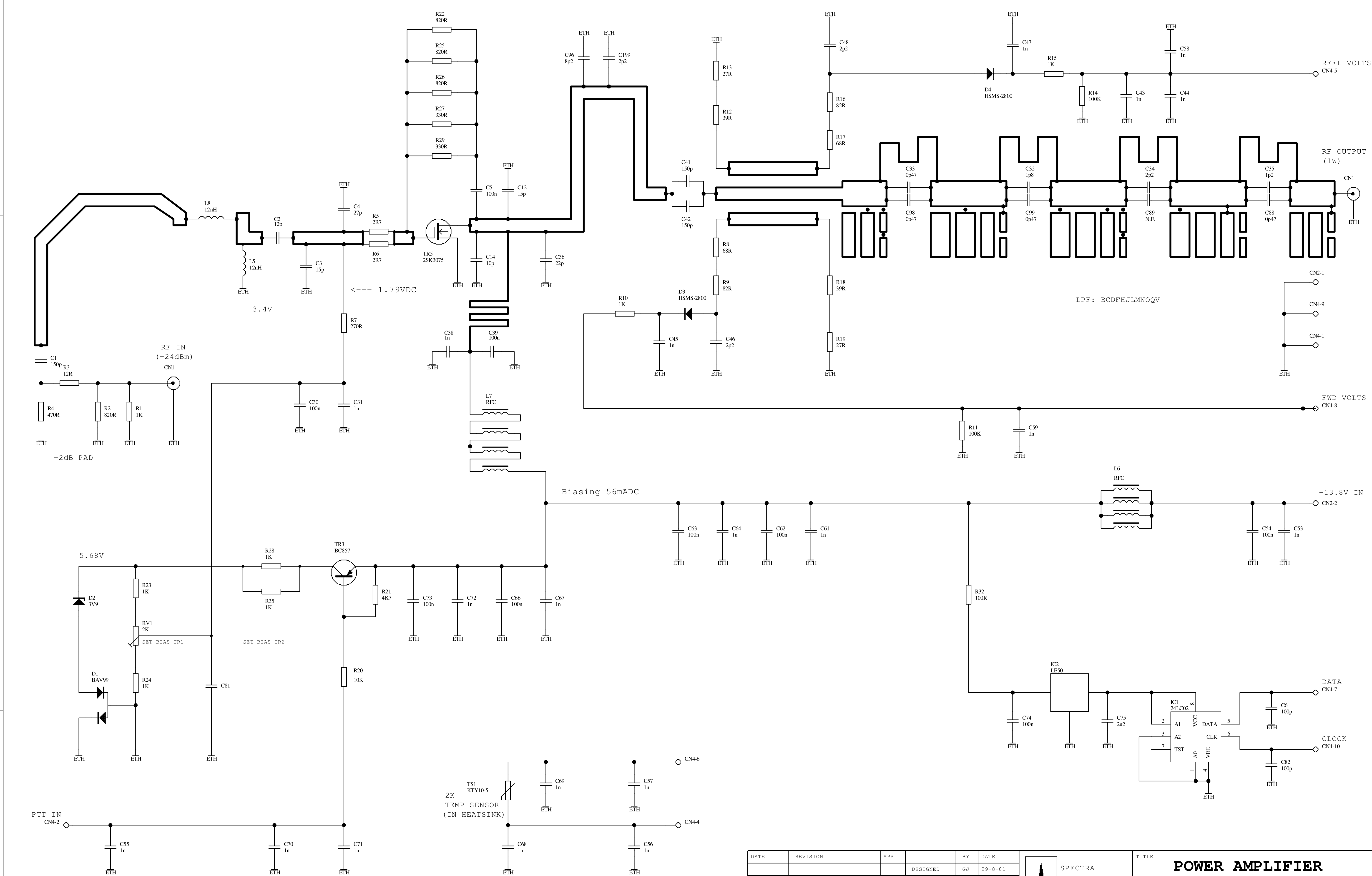
TITLE
MX800 TX VCO CCT DIAGRAM V3, BAND I TO X (270 - 960MHz)

DRAWING No CS052-1 | SHEET 1 OF 1 | REV A



NOTE:
1. NOT ALL COMPONENTS FITTED
2. * DEPENDS ON APPLICATION

DATE	REVISION	APP		BY	DATE
			DESIGNED	GJ	29-8-01
			DRAWN	JJ	5-09-01
			CHECKED		
			APPROVED	GJ	7-09-01
			REF DWGS		

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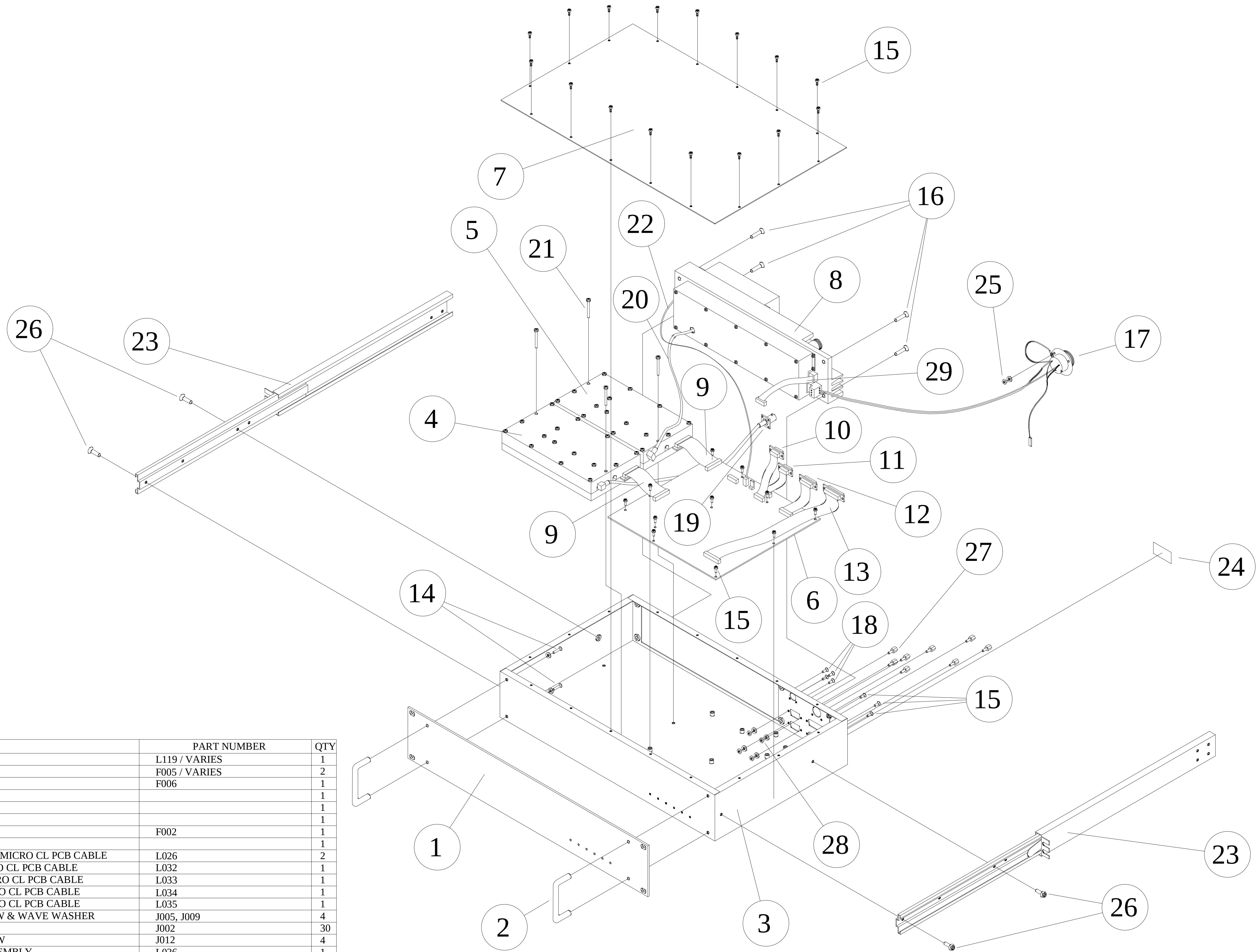
TITLE
POWER AMPLIFIER 1 WATT WIDEBAND 400-520MHz

DRAWING No CS243-1C | SHEET 1 OF 1 | REV C



No.	DESCRIPTION	PART NUMBER	QTY
1	FRONT PANEL	L119 / VARIES	1
2	'D' HANDLE	F005 / VARIES	2
3	CHASSIS	F006	1
4	RX MODULE		1
5	EXITER MODULE		1
6	MICRO CL PCB ASSEMBLY		1
7	LID	F002	1
8	PA MODULE		1
9	RX & EXCITER MODULE TO MICRO CL PCB CABLE	L026	2
10	AUX CONNECTOR TO MICRO CL PCB CABLE	L032	1
11	RS232 CONNECTOR TO MICRO CL PCB CABLE	L033	1
12	DB15 CONNECTOR TO MICRO CL PCB CABLE	L034	1
13	DB25 CONNECTOR TO MICRO CL PCB CABLE	L035	1
14	M4 x 10 P/H STEEL NP SCREW & WAVE WASHER	J005, J009	4
15	M3 x 5 P/H STEEL NP SCREW	J002	30
16	M5 x 12 P/H STEEL NP SCREW	J012	4
17	INTERNAL PWR CABLE ASSEMBLY	L036	1
18	M 2.5 x 5 P/H STEEL NP SCREW	J007	4
19	BNC CONNECTOR TO RX MODULE CABLE	L037	1
20	PA TO EXCITER CABLE COAX	L027	1
21	M4 x 35 P/H STEEL NP SCREW	J004	4
22	FAN CABLE ASSEMBLY		1
23	SLIDE RAIL 'SLIM TRACK'		2
24	ID LABEL		1
25	M3 HEX NUT AND WAVE WASHER		1
26	M4 x 6 P/H STEEL NP SCREW		4
27	UNC 4-40 HEX STANDOFF/RETAINER	H011	8
28	UNC 4-40 HEX NUT WITH WASHER	H011	8
29	PA CONTROL CABLE	L025	1

DATE	REVISION	APP		BY	DATE
			DESIGNED	G.J.	1-8-96
			DRAWN	F.H.	24/01/98
			CHECKED		
			APPROVED		
			REF DWGS		

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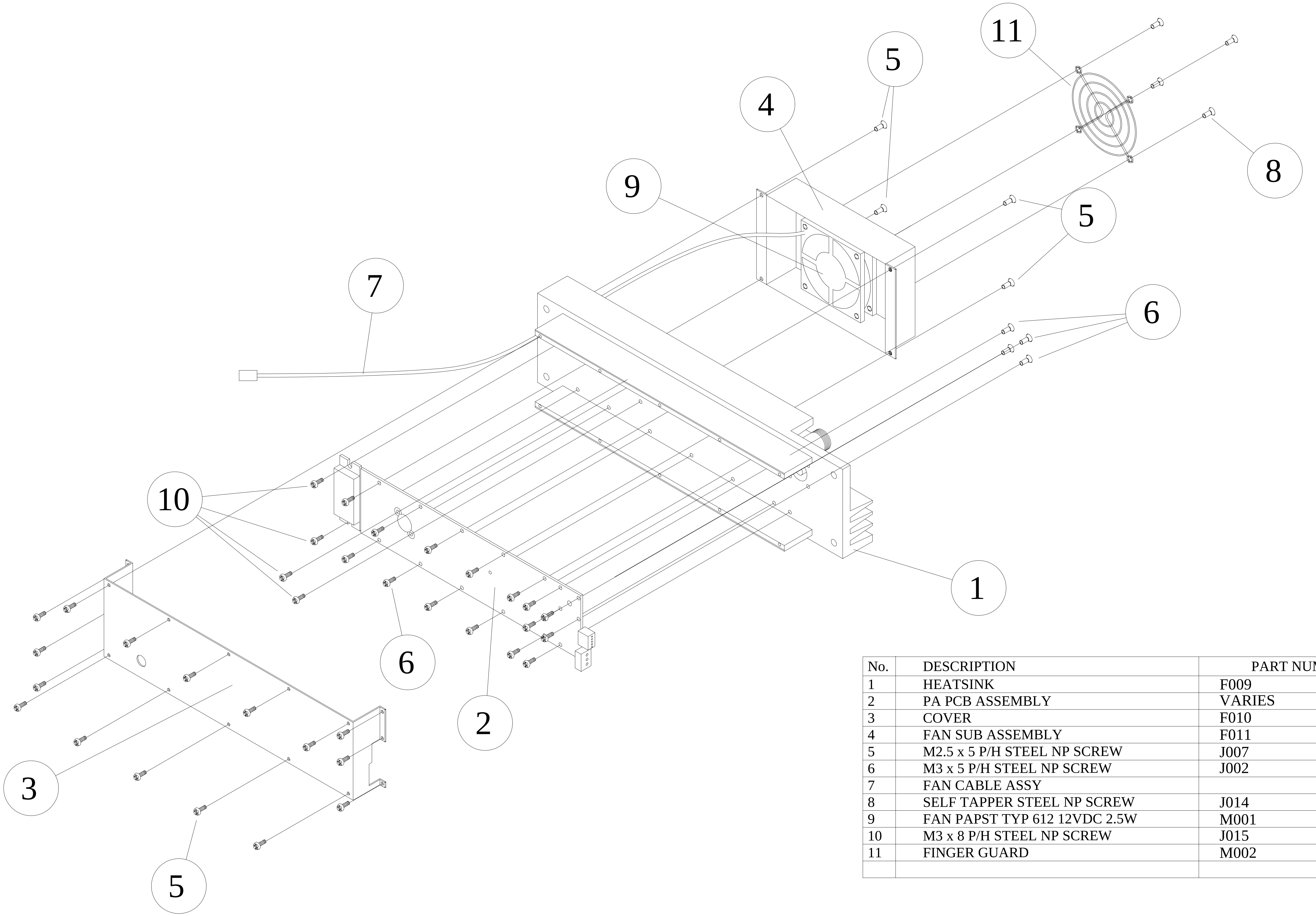
TITLE
MX800 TRANSCEIVER FINAL ASSEMBLY DWG

DRAWING No EV0001.DWG
SHEET 1 OF 1
REV A



No.	DESCRIPTION	PART NUMBER	QTY
1	HEATSINK	F009	1
2	PA PCB ASSEMBLY	VARIES	1
3	COVER	F010	1
4	FAN SUB ASSEMBLY	F011	1
5	M2.5 x 5 P/H STEEL NP SCREW	J007	20
6	M3 x 5 P/H STEEL NP SCREW	J002	23
7	FAN CABLE ASSY		1
8	SELF TAPPER STEEL NP SCREW	J014	4
9	FAN PAPST TYP 612 12VDC 2.5W	M001	1
10	M3 x 8 P/H STEEL NP SCREW	J015	4
11	FINGER GUARD	M002	1

DATE	REVISION	APP		BY	DATE
			DESIGNED	G.J.	1-8-96
			DRAWN	F.H.	24/01/98
			CHECKED		
			APPROVED		
			REF DWGS		

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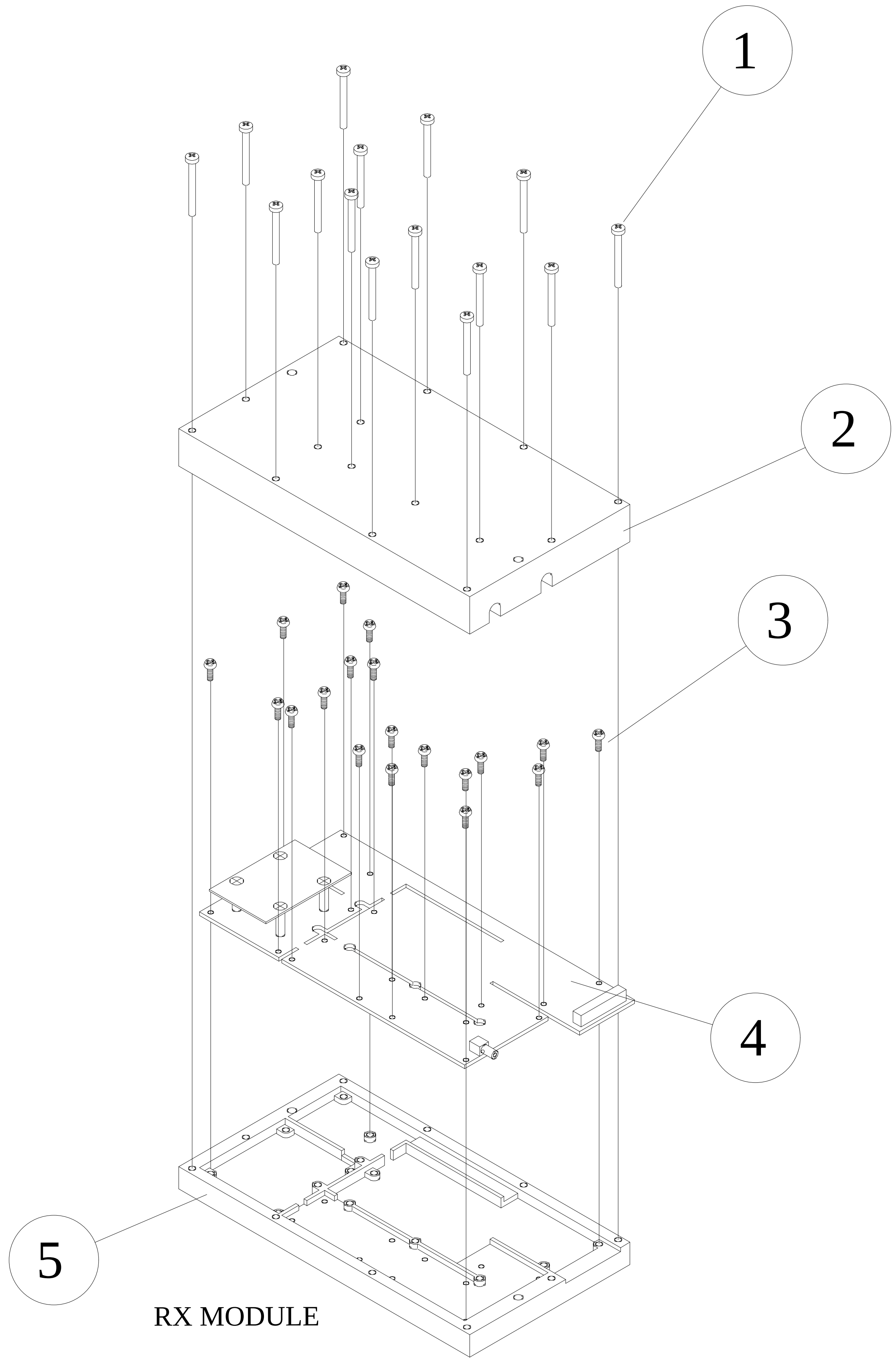
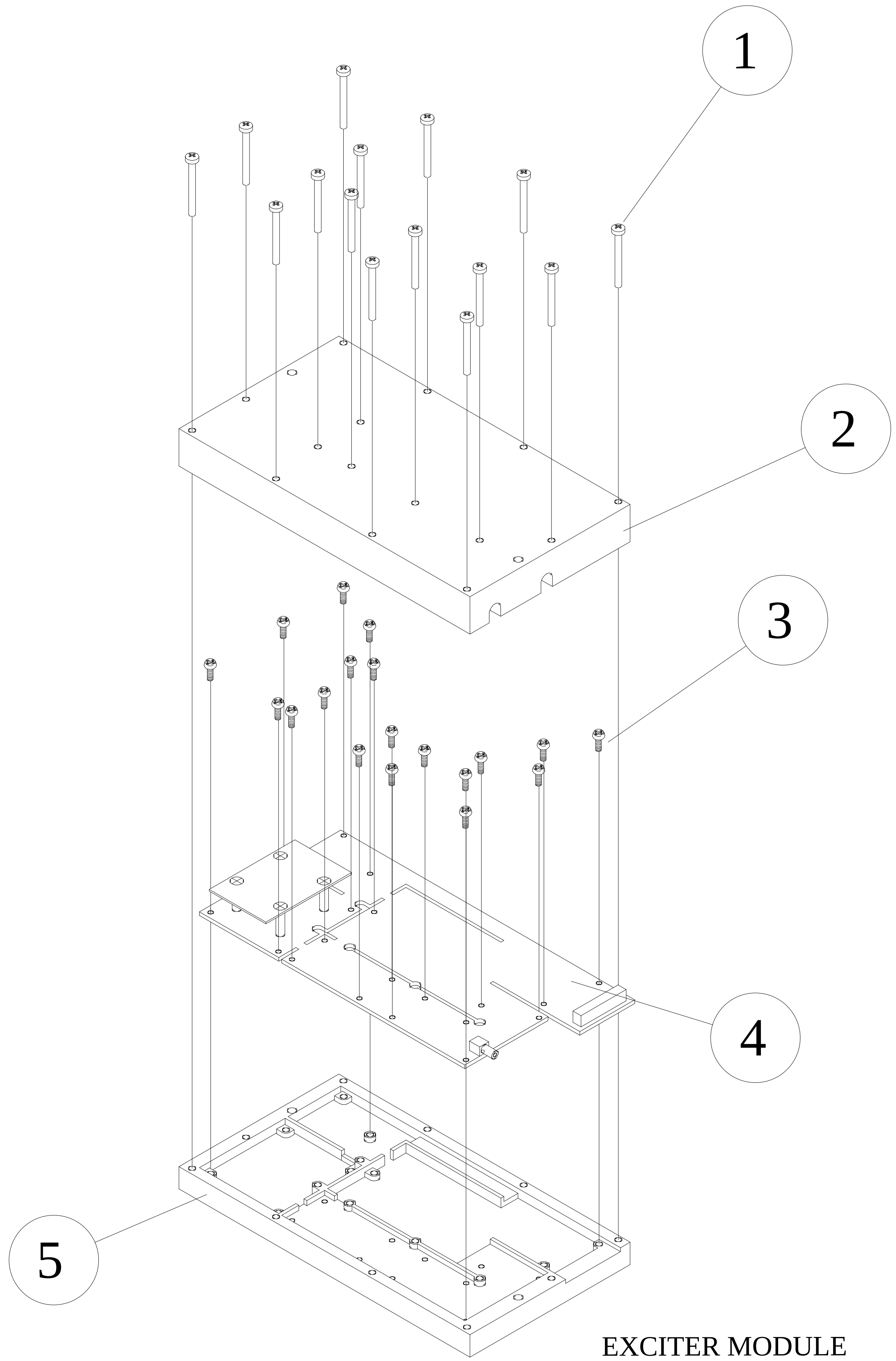
TITLE

MX800 TRANSCEIVER PA SUB ASSEMBLY

DRAWING No	SHEET	REV
EV0002.DWG	1 OF 1	A





No.	DESCRIPTION	PART NUMBER	QTY
1	M3 x 25 P/H STEEL NP SCREW	J013	15
2	COVER	F007	1
3	M2.5 x 5 P/H STEEL NP SCREW	J007	19
4	RX/EXCITER PCB ASSEMBLY	VARIES	1
5	BASE	F008	1

DATE	REVISION	APP

	BY	DATE
DESIGNED	G.J.	1-8-96
DRAWN	F.H.	24/01/98
CHECKED		
APPROVED		
REF DWGS		

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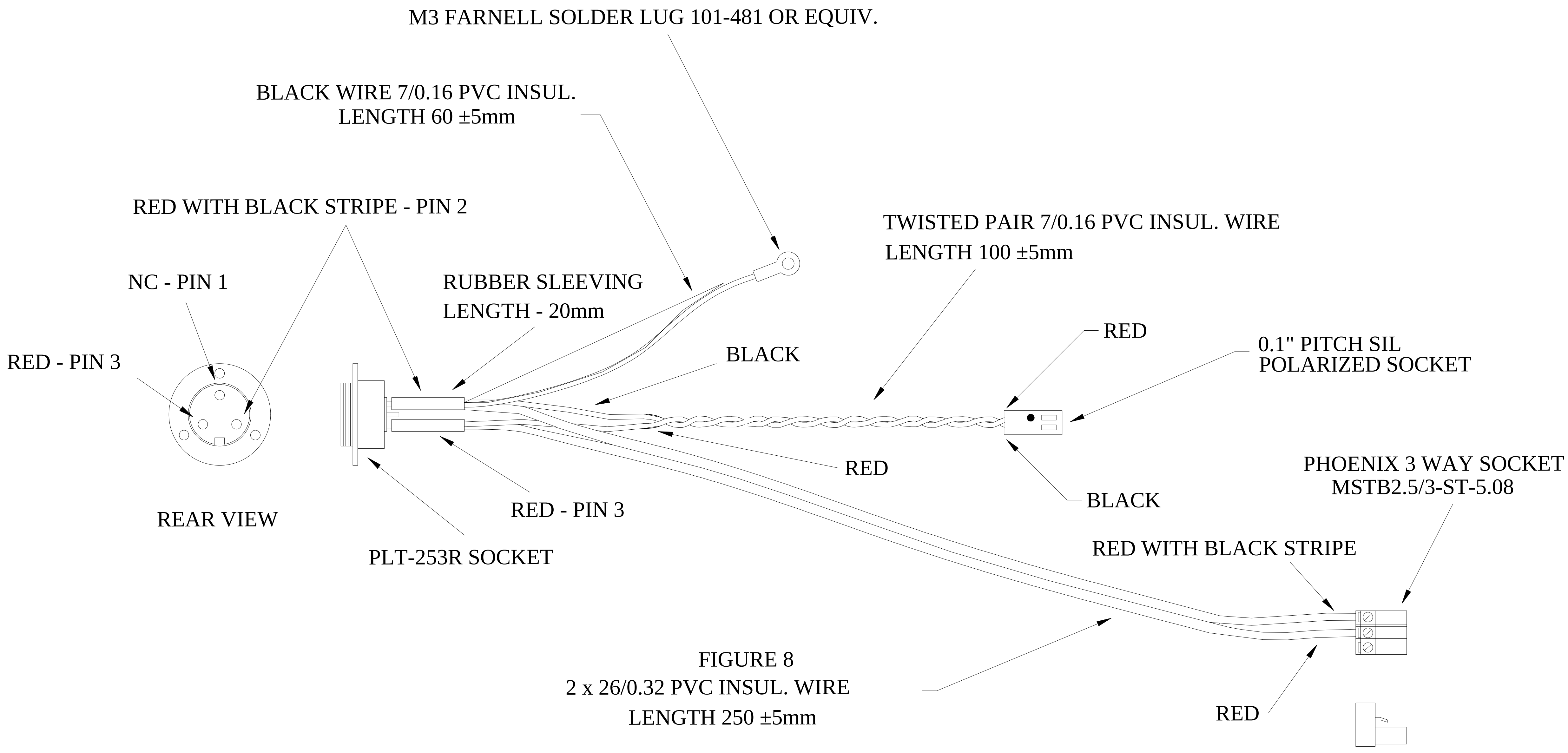
TITLE
RX/EXCITER MODULE SUB ASSEMBLY

DRAWING No EV0003.DWG | SHEET 1 OF 1 | REV A



DATE	REVISION	APP		BY	DATE
			DESIGNED	G.J.	1-8-96
			DRAWN	F.H.	24/01/98
			CHECKED		
			APPROVED		
			REF DWGS		

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TITLE

INTERNAL POWER CABLE ASSEMBLY

DRAWING No	SHEET	REV
EV0004.DWG	1 OF 1	A