DANIELS™
ELECTRONICS LTD.

21.4 MHZ IF / AUDIO MAIN BOARD INSTRUCTION MANUAL

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IF / Audio Main Board #43-910719a

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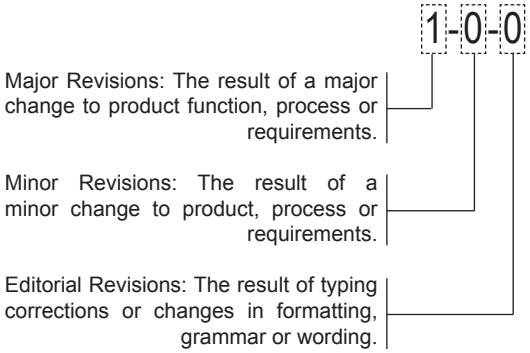

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For example:
If the current revision = 2-1-1 Then the next major revision = 3-0-0
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The complete revision history is provided at the back of the document.

NOTE

The user's authority to operate this equipment could be revoked through any changes or modifications not expressly approved by Daniels Electronics Ltd.

The design of this equipment is subject to change due to continuous development. This equipment may incorporate minor changes in detail from the information contained in this manual.

Contents

GENERAL INFORMATION

INTRODUCTION

The 21.4 MHz IF / Audio Main Board is the main board for all Daniels MT-3 Receivers up to 512 MHz. This board provides interconnects for Daniels Synthesized and Crystal Controlled Oscillators, and Daniels high performance and low current Front Ends. An F48 type connector plugs into Daniels M3 Motherboard. The 21.4 MHz IF / Audio Main Board is configurable at the factory for either narrow band or wide band channels. Different bands within a frequency range do not require a configuration change.

THEORY OF OPERATION

GENERAL

The 21.4 MHz IF / Audio Main Board processes the low level RF signal from the Front End. This processing includes: selective filtering, IF amplification, and final audio demodulation / amplification. This board provides a high degree of receiver flexibility by providing a number of different audio paths, audio levels, and control interconnect options. Refer to the 21.4 MHz IF / Audio Main Board Schematic Diagram.

POWER SUPPLIES

The receiver operates from a main +9.5 Vdc source (from the system monitor) applied to B6 / Z6 at the main 48 pin connector. This source directly provides power to the Front End, plug-in local oscillator module, IF amplifier, operational amplifiers, high level audio drive (U9), and internal regulators. Regulator IC U1 provides +6.0 Vdc to the IF / Audio Main Board demodulation IC U2. Switching inverter supply U12 provides -6.0 Vdc to the squelch detection circuitry (U14, U16). Operational amplifier U13B provides + 4.75 Vdc for virtual ground generation.

RF INPUT AND MIXER

SMB connector J7 provides RF signal input from the Front End to the first IF Amplifier. The doubly balanced mixer M1 is required for older style Front Ends. For newer style Front Ends the mixer is replaced with either a jumper or an IF Buffer board. SMB connector J8 provides local oscillator power from the synthesizer module to the LO mixer port. For newer style Front Ends the synthesizer is connected to the Front End. The mixer M1 frequency translates the desired channel signal to a common IF frequency of 21.4 MHz. Capacitor C15 and inductor L1, together with resistors R9 and R10, provide a constant 50Ω wideband impedance to the double balanced M1 mixer output.

IF BUFFER BOARD

Active IF Buffer Board

The active IF Buffer board is required for Enhanced Front Ends only, and must be installed for proper impedance matching when an Enhanced Front End is used. SMB connector J7 provides IF signal input from the Front End to the IF Port at 21.4 MHz. The IF Buffer board provides the mixer on the Front End with a constant 50Ω load while providing a 50Ω input impedance to the IF / Audio Main Board. L3 and C4 are series resonant at the IF frequency and provide a signal path to the FET amplifier. C5 and L4 provide a shunt for frequencies other than the IF. The IF Buffer board draws 30 mA of current.

Passive IF Buffer Board

The passive IF Buffer board is required in any low current receiver that will be receiving high levels of RF at the antenna. One example would be when a handheld is very close to the repeater site. It should be noted that the sensitivity of the receiver may be reduced when the passive IF Buffer board is installed.

First IF Amplifier

MOSFET Q1 provides linear 21.4 MHz IF amplification, while crystal filters XF1 through XF4 provide the optimum bandpass characteristics for good selectivity and low distortion. Potentiometer R13 is used to bias Q1 to an operating point drain current of 7.5 mA. The 21.4 MHz IF amplifier provides an overall gain of approximately 14 dB, including crystal filter losses.

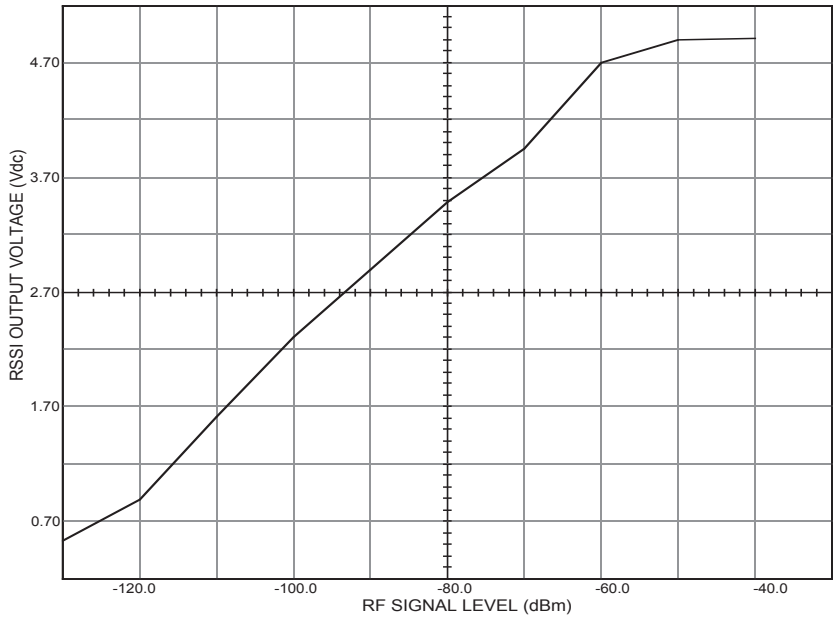
Second IF / Demodulation

The 21.4 MHz output of the IF amplifier is fed into the second mixer of U2, a low power, FM IF IC. This IC consists of an oscillator, mixer, limiting IF amplifier, quadrature discriminator, and received signal strength indicator (RSSI). A second local oscillator source of 21.855 MHz, derived from a fundamental mode on-chip oscillator (crystal X1), mixes with the 21.4 MHz first IF to produce a 455 kHz second IF.

Second IF filtering is achieved through the use of CF1, a multi-element 455 kHz ceramic filter. Inductor L5, capacitor C137 and resistor R16 form the passive quadrature discriminator tuned circuit. Recovered audio is output on pin 9 of IC U2.

Received Signal Strength Indicator (RSSI)

A received signal strength indicator (RSSI) output is provided at pin 13 of IC U2. This pin sources up to 60 µA over a linear 60 dB of input signal range. Operational amplifier U3A translates the RSSI current to a +1 to +5 Vdc output range that is made available at B24. This signal can be used for accurate signal strength measurements making the RSSI function useful for path diagnostics or receiver voting systems. Operational amplifier U3B inverts, scales and level shifts the RSSI output signal to achieve a signal range suitable for triggering the receiver squelch on the basis of received signal carrier strength.
It should be noted that noise triggered squelch is normally employed in the receivers due to less variation in squelch threshold caused by changes in received signal modulation. RSSI based squelch does however offer squelch hysteresis ranges of up to 60 dB which may find limited application in specialized radio systems. Jumpers JU30 and JU31 provide selection of the desired squelch source signal option. RSSI based squelch also improves the unsquelch (turn on) time for narrow band receivers driven by an over-deviated signal.



Note: Standard input signal used (1kHz tone, 3 kHz deviation).

AUDIO PROCESSING

Recovered audio from pin 9 of U2 supplies both audio and squelch circuitry. Operational amplifier U18A is AC coupled to the recovered audio line providing low pass filtering with a cutoff frequency of approximately 8 kHz, together with amplification of the recovered audio signal. The output of U18A provides a flat audio response which can be routed, via jumpers JU10, JU11 and JU12, through a voice band filter and/or connected directly through the audio squelch gate U7.

Operational amplifier U18B provides unity gain, direct DC coupling of the discriminator output which is enabled by installing jumper JU25 and removing jumper JU37.

Operational amplifier U19A is AC coupled to the recovered audio line providing the standard 6 dB per octave de-emphasis response from 300 Hz to 3 kHz. The de-emphasis audio output can be routed, via jumpers JU13, JU14 and JU15, through a voice band filter and/or connected directly through the audio squelch gate U7.

Operational amplifier U8A provides adjustable (R66) flat audio gain. With a standard input signal applied (-70 dBm on-channel signal modulated with a 1 kHz tone to 60% system deviation) , the flat audio output of U8A can provide up to 7 Vpp into a 10 kΩ load connected to pin B22 of the main 48 pin connector.

Operational amplifier U8B provides adjustable (R58) de-emphasis audio gain. With a standard input signal applied, the de-emphasis audio output of U8B can provide up to 7 Vpp into a 10 kΩ load connected to pin B20 of the main 48 pin connector.

High level drive IC U9 is used to drive the 600 Ω line transformer T1 through jumper JU22 to a level of +3 dBm. With JU19 installed, U9 can also be used to drive an external 4 to 16 Ω speaker connected to main connector pin B4 with up to 750 mW audio power. Jumpers JU16 and JU17 select the high level drive source from either the de-emphasis or flat audio signal path. Potentiometer R64 adjusts the gain of the high level drive to a maximum undistorted level of +3 dBm into a 600 Ω load connected to main connector pins B26 and Z26.

Jumper JU24, when installed, unbalances the 600 Ω line transformer for single ended audio routing applications. For low power applications, a 4 mA reduction in receiver current is possible by removing jumper JU18, thus disabling the high level amplifier U9. Outputs of operational amplifiers U8B (de-emphasis) or U8A (flat audio) can then be used to drive the 600 Ω line transformer by installing jumper JU20 or JU23, provided that the 600 Ω line transformer output is adjusted for an output less than -8.0 dBm.

Post Discriminator Filtering

The 21.4 MHz IF / Audio Main Board circuitry includes two active filters; a 4 pole Butterworth low pass subtone filter with a cutoff frequency of 250 Hz and a 6 pole voice band high pass Butterworth filter with a cutoff frequency of 300 Hz. Both active filters are normally disabled to conserve supply current unless required for a particular application. Operational amplifiers U4A and U4B form a 4 pole subtone low pass filter that is used to remove modulation components above 250 Hz. Enabled via installation of jumpers JU6 and JU7, the subtone filter provides an output at main connector pin B10 that can be used to drive external sub-audible tone decoders. Alternatively, with the installation of jumper JU38, the subtone filter output can be output on pin B-14.

Operational amplifiers U5 and U6 form a 6 pole voice band high pass filter that is used to remove modulation components below 300 Hz. Enabled by the installation of jumpers JU8 and JU9, the voice band high pass filter provides an output that can be routed through either the flat or de-emphasis audio paths via jumpers JU12 or JU15. The primary purpose of the voice band high pass filter is for the effective removal of low frequency modulation components, such as sub audible tones (CTCSS) from the receiver audio path. This may be required in certain repeater applications where sub-audible tones are detected and regenerated independent of the receiver.

SQUELCH CIRCUITRY

The 21.4 MHz IF /Audio board has two squelch detection methods: one based on noise operated squelch and the other based on carrier level (RSSI) operated squelch. Both methods provide the COR function (Carrier Operated Relay) in a flexible and efficient manner. Noise operated squelch is the preferred and standard method normally employed.

The demodulated signal at pin 9 of U2 contains noise, second local oscillator bleed through, and the desired voice band demodulation products. Noise based squelch works on the simple principle that receiver noise power varies with received signal strength (FM quieting effect). The demodulated signal from pin 9 of U2 is filtered by a selective passive filter consisting of C106, C107, C108, L7 and L8. This filter removes modulation components below 10 kHz, leaving band limited noise from 10 kHz to 100 kHz. It is important to remove modulation components below 10 kHz in order to prevent variations in squelch trigger point due to modulation changes in the received signal.

Band limited noise is then presented to operational amplifier U13A, where it is amplified with gain as a function of ambient temperature. This temperature compensation is necessary to account for changes in receiver noise over the wide operating temperature range capability of the Receiver family. The temperature compensated, band limited noise is connected to a “True RMS” power detector U14; the output of which is directly proportional to RMS noise power. Operational amplifier U16A is configured as a comparator monitoring the output of power detector U14. The trigger point of this comparator is established by the DC level at the non inverting input (pin 3). This level is set by the “Squelch Threshold Adjust” potentiometer R88 from the stable +2.5 Vdc reference U15. As the level of a received signal increases, the noise power decreases, which results in a lower output from the RMS detector U14. This causes the output of comparator U16A to go to the positive rail (approximately +8.5 Vdc) turning on transistor Q9 which further lowers the level at the inverting input of U16A by an amount established by the “Squelch Hysteresis Adjust” potentiometer R115. The positive feedback set up by Q9 requires the received signal to decrease in level (increasing noise power) to a point higher than the original squelch trigger point before the receiver will return to a squelched condition, indicated by U16A’s output going to the negative supply rail (approximately -5.7 Vdc). This provides a controlled amount of squelch hysteresis that prevents oscillating action of the squelch comparator circuitry. The amount of squelch hysteresis is normally factory set for 6 dB centered about the squelch threshold point. The squelch threshold setting is normally established as being the point of receiver 12 dB SINAD. The output of U16A is buffered by comparator U16B before being connected to squelch gate U7. When the output of comparator U16A to go to the positive rail, the output of comparator U16B also goes to the positive rail which, baring an active mute line, turns on squelch gate U7. The receiver is now in an active or unsquelched state.

A receiver mute line brought out through main connector pin B28, when pulled low, acts to permanently squelch the receiver (depending on jumper JU40 and the state of the receiver squelch override line) by turning transistor Q10 on. Transistor Q10 pulls the inverting input (pin 6) of U16B to approximately +6.5 Vdc which mutes the receiver by causing the output of U16B to go low, opening squelch gate U7.

Jumper JU40 controls whether the mute line takes precedence over the squelch override line or vice versa. Jumper JU40 is normally installed giving the squelch override line precedence over the mute line so if both the mute and squelch override lines are active the receiver will become unsquelched. To give the mute line precedence, remove jumper JU40.

A receiver squelch override line brought out through main connector pin Z14, when pulled low, acts to permanently unsquelch the receiver (depending on jumper JU40 and the state of the receiver mute line) by turning transistors Q8 and Q11 on. Transistor Q8 pulls the non-inverting input (pin 3) of U16A to the +9.5 Vdc supply which causes the output of U16A to go to the positive rail which, baring an active mute line, unsquelches the receiver. Similarly, if jumper JU40 is installed, transistor Q11 pulls the non-inverting input (pin 5) of U16B to the +9.5 Vdc supply which causes the output of U16B to go to the positive rail which unsquelches the receiver regardless of the state of the mute line.

COR Outputs

The IF / Audio Main Board employs four methods of interfacing internal squelch circuitry to external devices, such as transmitters, site controllers, etc. These four methods of COR (Carrier Operated Relay) control include; an open collector priority COR signal (Q12), an open drain power MOSFET (Q5), an optional opto-isolated transistor (U17) and an optionally installed relay (RLY1).

The priority COR signal, an open collector output (Q12) capable of sinking up to 50 mA when active, is available at pin Z24 of the main connector. Jumper JU39 allows for internal pull-up to either +6.0 Vdc or +9.5 Vdc. The priority COR signal is derived from the output of comparator U16A so priority COR will become active anytime the Receiver receives a signal strong enough to trigger the comparator or the squelch override line is activated. Priority COR is not affected by the receiver's mute line.

The other three COR outputs are all affected by the receiver's mute line, consequently, they only become active when the Receiver is unsquelched.

MOSFET Q5 provides an open drain output capable of sinking up to 2 amps when active (unsquelched receiver) through main connector pins B12 / Z12. Jumpers JU26 and JU27 allow internal pull-up to either +6.0 Vdc or +9.5 Vdc respectively. Power MOSFET Q5 is rated for 60 Vdc maximum drain-to-source potential when in the off state (squelched receiver).

Opto-isolator U17 (optional) may be enabled by installing jumper JU28. U17 can typically switch up to 100 mA of current while providing a high degree of electrical isolation at main connector pins B18 / Z18.

Optional relay RLY1 is enabled by installing jumper JU29 and installing RLY1. RLY1 provides double pole, double throw connections at the main connector pins D2, D6, D4, D8, D10, and D12.

CHANNEL SELECTION

Synthesized receiver channel selection is achieved by setting a channel code number on four BCD frequency select switches or by selecting one of 16 pre-programmed channel code numbers via the Channel Select Lines. Seven backplane connections are used to communicate with the synthesizer unit. Pins D28, D30, and D32 are used (in house) to program the synthesizer with up to 15 channels. Channel Select Lines CSEL0 (LSB) through CSEL3 (MSB) are used once the synthesizer is programmed to select one of 16 channels. If the Channel Select Lines are all low (channel 1) the channel code number for the synthesizer is read from switches FSW1 (most significant) through FSW4 (least significant) and the desired local oscillator frequency is generated; otherwise one of the 15 pre-programmed frequencies is selected. The BCD switches can be changed at any time however the low current synthesizer, due to the fact that it places itself in a sleep mode to conserve power, will not change frequency unless the receiver power is cycled or the Channel Select lines are changed. Since the resulting frequency is dependent on the receiver model, refer to the section on frequency selection in the Receiver Manual or to the channel designation tables for that particular receiver.

The crystal control module is a direct replacement for the synthesizer module and therefore uses the same connections as the synthesizer to connect to the IF / Audio Main Board. The channel select lines and switches FSW1 to FSW4 are not used by the crystal control module as the receiver's operating frequency is determined by the crystal control module's crystal frequency. Refer to the manual for the crystal control module that came with your receiver for formulas used to calculate the frequency.

FRONT END MODULE

The Front End operates from the +9.5 Vdc supply point J6-2 on the IF / Audio Main Board. Ground return is supplied via direct mounting to the receiver chassis and coaxial cable interconnection. The RF input signal connected to the receiver front panel type N connector is fed to the Front End SMA input connector (J3) by a short coaxial cable. The Front End output is routed by coaxial cable to the mixer RF input, SMB connector J7, on the IF / Audio Main Board. Refer to the manual for the Front End that came with your receiver for more information.

OS-3/xxx Synthesizer

The Synthesizer Module produces a low distortion, high stability unmodulated (receiver) RF signal. It achieves a ±1 ppm frequency stability from -40°C to +60°C with its own internal reference, or it can be slaved to an external reference signal of desired stability. Refer to the manual for the synthesizer that came with your receiver for more information.

OC-3/xxx Crystal Control Module

The Crystal Control Module produces a low distortion, high stability, unmodulated (receiver) RF signal. Refer to the manual for the crystal oscillator that came with your receiver for more information.

21.4 MHZ MAIN BOARD ALIGNMENT

GENERAL

Receiver alignment is simplified by using an MT-3 subrack, SM-3 system monitor, and RF extender card/cable to provide receiver power and signal interconnection. Alternatively, +9.5 Vdc may be applied directly to a receiver module through positive connection to pins B6 / Z6, and negative connection to pins B30 / Z30 / B32 / Z32. Receiver balanced audio (600 Ω) is available at pins B26 and Z26.

Throughout the alignment procedure reference is made to a “standard signal level”. This refers to an external generator signal source with FM modulation, 1 kHz tone, and 60% system deviation (1.5 or 3.0 kHz) connected to the receiver RF input type N connector (if a carrier frequency is not given, it can be assumed to be the selected receiver channel frequency). All audio distortion measurements are made at 1 kHz, and band limited from 300 Hz to 3.4 kHz.

Before proceeding with receiver alignment, check that the appropriate jumpers are installed. The standard jumper configuration given is normally employed for receiver alignment. It is assumed that a complete receiver alignment is being performed, and that all receiver components, IF / Audio Main Board, synthesizer or crystal control module and Front End are installed.

The extruded receiver case should be removed to expose all receiver circuitry. In addition, the removal of the Front End is required for C130 second local oscillator frequency adjustment . All jumpers and test points are clearly marked. All adjustments to the IF / Audio Main Board, with the exception of the 2nd LO frequency adjustment, are made on the surface mount component side of the IF / Audio Main Board.

Complete receiver alignment should follow the specific logical sequence as documented.

Refer to 21.4 MHz IF / Audio Main Board Component Layout (Top) and 21.4 MHz IF / Audio Main Board Component Layout (Bottom) for location of test and tuning points.

REPAIR NOTE

The 21.4 MHz IF / Audio Main Board employs a high percentage of surface mount components which should not be removed or replaced using an ordinary soldering iron. Removal and replacement of surface mount components should be performed only with specifically designed surface mount rework and repair stations complete with Electrostatic Discharge (ESD) protection.

When removing Surface Mount Solder Jumpers, it is recommended to use clean solder wick braid in place of vacuum type desoldering tools. When connecting Surface Mount Solder Jumpers, use a minimal amount of solder on the pads. These precautions will help prevent damage to the circuit boards.

RECOMMENDED TEST EQUIPMENT

Alignment of the receiver requires the following test equipment or its equivalent.

Power supply - Regulated +9.5 Vdc at 2 A.	Phillips PM 2811
Oscilloscope / Multimeter	Fluke 97 Scopemeter
Radio communications test set	Marconi Instruments 2955R
Alignment Tool	Johanson 8764
Alignment Tool	Johanson 8766
Alignment Tool	Johanson 4192
Alignment Tool	Coilcraft 37-1409

It is recommended that the radio communications test set be frequency locked to an external reference (WWVH, GPS, Loran C) so that the high stability local oscillator may be accurately set to within its ±1 ppm frequency tolerance.

STANDARD FACTORY SETTINGS AND JUMPER CONFIGURATION

The 21.4 MHz IF/Audio Main Board is factory configured as follows:

Audio de-emphasis response enabled (JU14).
Flat audio response enabled (JU11).
600 Ω balanced de-emphasis high level drive (JU17, JU18, JU22 and JU35 [Narrow Band Only]).
Noise based squelch (JU30).
Squelch Override precedence (JU40).

The corresponding jumper settings are:

Jumper JU1:	installed	Mixer bypass (mixer installed for older Front Ends only)
Jumper JU2:	installed	Installed if L3 is not a transformer
Jumper JU3:	installed	IF output disconnect (for testing purposes)
Jumper JU4:	installed	Demod input disconnect (for testing purposes)
Jumper JU5:	not installed	AC / DC couple amplified discriminator output
Jumper JU6:	not installed	Subtone filter input enable
Jumper JU7:	not installed	Subtone filter power enable
Jumper JU8:	not installed	Voice band filter +9.5 Vdc power enable
Jumper JU9:	not installed	Voice band filter +4.75 Vdc power enable
Jumper JU10:	not installed	Unfiltered audio voice band filter input selec
Jumper JU11:	installed	Unfiltered flat audio select
Jumper JU12:	not installed	Voice band filtered flat audio select
Jumper JU13:	not installed	De-emphasized audio voice band filter input select
Jumper JU14:	installed	De-emphasized audio select
Jumper JU15:	not installed	Voice band filtered De-emphasized audio input select
Jumper JU16:	not installed	Flat audio high level drive select
Jumper JU17:	installed	De-emphasized audio high level drive select
Jumper JU18:	installed	High level drive power enable
Jumper JU19:	not installed	Auxiliary speaker output
Jumper JU20:	not installed	Balanced audio, low level de-emphasized audio select
Jumper JU21:	not installed	Balanced audio bypass
Jumper JU22:	installed	Balanced audio, high level drive select
Jumper JU23:	not installed	Balanced audio, low level flat audio select
Jumper JU24:	not installed	Unbalanced audio output enable
Jumper JU25:	not installed	Direct discriminator output enable
Jumper JU26:	not installed	+6.0 Vdc COR pull-up
Jumper JU27:	not installed	+9.5 Vdc COR pull-up
Jumper JU28:	not installed	Opto-isolated COR enable
Jumper JU29:	not installed	Relay COR enable
Jumper JU30:	installed	Noise based squelch select
Jumper JU31:	not installed	Signal strength squelch select
Jumper JU32:	not installed	Squelch override zener diode bypass
Jumper JU33:	not installed	Mute zener diode bypass
Jumper JU34:	installed	OS-3 synthesizer mute control enable
Jumper JU35:	installed	High level drive gain select (Narrow Band)
Jumper JU35:	not installed	High level drive gain select (Wide Band)
Jumper JU36:	installed	Fuse bypass
Jumper JU37:	installed	Amplified Discriminator output enable
Jumper JU38:	not installed	LPF discriminator output to Discriminator output routing.
Jumper JU39:	not installed	+6.0 / +9.5 Vdc Priority COR pull-up select
Jumper JU40:	installed	Squelch override precedence enable
Jumper JU41:	not installed	45 MHz IF narrow band matching
Jumper JU42:	not installed	Installed for 45 MHz only
Jumper JU43:	not installed	Squelched discriminator audio ENA
Jumper JU44:	not installed	Squelched discriminator audio ENB

TEST POINTS

TP1	+5.8 Vdc ± 0.2 Vdc. U1 positive regulator output.
TP2	-5.8 Vdc ± 0.2 Vdc. U12 negative regulator output.
TP3	+4.75 Vdc ± 0.1 Vdc. Virtual ground reference source.
TP4	21.4 MHz IF injection point.
TP5	+8.75 Vdc ± 0.1 Vdc. MOSFET Q1 operating point.
TP6	Second IF sample input / output
TP7	455 kHz Filter input / second mixer output.
TP8	RSSI output. + 1.0 Vdc to +5.0 Vdc depending on received signal strength.
TP9	Unfiltered, recovered audio. ≈ 200 mV pk-pk with standard input signal applied.
TP10	COR internal logic line. ≈ -5.7 Vdc squelched, ≈ +8.5 Vdc unsquelched.
TP11	Squelch noise temperature compensated amplifier output.
TP12	Squelch noise power level. 0.0 to +1.5 Vdc (depending on signal strength).
TP13	+2.50 Vdc ± 0.02 Vdc. U15 squelch threshold reference.

POWER SUPPLIES

A check of all DC power supply levels is recommended before receiver alignment is performed. All supply and reference voltages are fixed with no provision made for adjustment. The following test points and their respective levels apply:

Note: Total receiver current should be less than approximately 100 mA for a synthesized unit and 45 mA for a crystal controlled unit. Higher currents indicate that immediate corrective action/repair is required.

TP1	+5.8 Vdc ± 0.2 Vdc. U1 positive regulator output.
TP2	-5.8 Vdc ± 0.2 Vdc. U12 negative regulator output.
TP3	+4.75 Vdc ± 0.1 Vdc. Virtual ground reference source.
TP13	+2.50 Vdc ± 0.02 Vdc. U15 squelch threshold reference.

Note: That incorrect bias adjustment (R13) of IF amplifier MOSFET Q1 can add significantly to the overall receiver current figure.

Total typical receiver current consumption, 90 mA for a low current synthesized receiver, 344 mA for an enhanced synthesized receiver and 44 mA for a crystal controlled receiver. The current consumption may be broken down as follows:

IF / Audio Main Board:	approx. 22 mA
FE-3 Low Current Front End:	approx. 8 mA
FE-3H Enhanced Front End:	approx. 160 mA
OS-3 Synthesizer:	approx. 60 mA
OS-3H Enhanced Synthesizer:	approx. 160 mA (Operate Mode)
OC-3 Crystal Control Module:	approx. 14 mA

IF AMPLIFIER BIAS CURRENT ADJUSTMENT

Monitor test point TP5 and adjust MOSFET bias potentiometer R13 until a DC level of +8.75 Vdc is achieved. This corresponds to an IF amplifier drain current of 7.5 mA, and prepares the IF amplifier for following alignment steps.

Note: An incorrectly set bias point can add substantially to the overall receiver current consumption.

SECOND IF / DEMODULATION

Adjustment of the second local oscillator frequency (21.855 MHz) is most easily performed by employing the communications monitor as a sensitive receiver with the 21.855 MHz signal taken from a small loop antenna placed near crystal X1. A short length of wire connected to a coaxial cable works well. Adjust variable capacitor C130 until an oscillator frequency of 21.855 MHz is achieved.

If the squelch circuitry has been incorrectly adjusted, it may be necessary to depress the squelch override switch on the receiver front panel continuously (or ground pin Z14) for the following receiver adjustments.

Terminate the balanced audio output lines B26 and Z26 with a 600 Ω 1/4 watt resistor. Connect the communications monitor AF high impedance input across this resistor. Adjust potentiometer R64 (High level drive adjust) to approximately mid-range position. Remove jumper JU3 and inject a 21.4 MHz standard input signal to TP6. Adjust quadrature detector coil L5 until the balanced audio output provides maximum signal level with a harmonic distortion content of less than 1.0%. It may be necessary to reduce the high level drive setting (R64) in order to prevent audio output stage clipping. Maximum AF signal and minimum harmonic distortion should occur simultaneously. All distortion measurements should be made through a 300 Hz to 3.0 kHz band pass filter to remove low frequency noise originating from the RF communications monitor signal source. This filter is usually selectable on most communications monitors.

Adjust the high level drive potentiometer (R64) to obtain -8 dBm (308 mVrms) across the external 600Ω termination resistor. A level of -8 dBm is the standard factory setting for the balanced output. This level may be increased to a maximum of +3 dBm. Monitor de-emphasis audio output at pin B20 and adjust the de-emphasis audio level potentiometer (R58) until a level of 100 mVrms is obtained. Monitor flat audio at pin B22 and adjust the flat audio level potentiometer (R66) until a level of 100 mVrms is obtained.

First IF Amplifier Stage

Check the IF amplifier current drain by verifying that TP5 is at 8.75 Vdc ± 0.1 Vdc. Return to the alignment procedure IF Amplifier Bias Current Adjustment if the measured voltage at TP5 is not within the specified range.

Reconnect jumper JU3 and inject a standard input signal, at the desired receive frequency, to the front panel RF type N input connector. It is assumed that the Front End has been previously aligned to the desired receive frequency and that the local oscillator is installed and operating at the required frequency. Continue to sample the balanced audio output for distortion and SINAD measurements.

Individually adjust L2, C17, C19, C27, and C29 until the lowest possible distortion is achieved. There will be some component adjustment interaction, making it necessary to readjust the IF trimmer capacitors more than once in order to achieve the simultaneous goal of low distortion and high IF sensitivity. Lower the RF generator signal level to establish a 12 dB receiver SINAD measurement. A receiver SINAD reading of approximately -118 dBm (or better) for 12 dB SINAD should be easily achieved. Return to a standard input signal and reconfirm distortion less than 1.5%. Slight readjustment to C27, and the local oscillator frequency may be necessary to achieve the desired result.

Readjust and peak the Front End as described in the manual for the Front End that came with your receiver if a receiver sensitivity of approximately -118 dBm cannot be achieved.

Squelch Circuit

Receiver squelch action is normally factory set to establish a squelch hysteresis window of 6 dB centered about the point of receiver 12 dB SINAD sensitivity. A typical Receiver, with a typical 12 dB SINAD sensitivity of -118 dBm, would be set to unsquelch (active COR) at -115 dBm, and squelch at -121 dBm, providing a squelch hysteresis window of 6 dB. The receiver employs independent squelch threshold and hysteresis control, allowing flexibility in setting the receiver squelch action.

Adjustment to the squelch circuitry should be the last receiver alignment step performed. It is important to set up the Front End and local oscillator correctly before proceeding with any squelch adjustments.

Check that jumper JU30 is installed, selecting noise based squelch. Rotate the squelch hysteresis adjust potentiometer (R115) fully counter clockwise (minimum hysteresis, full travel of the 11 turn adjustment range). This corresponds to no squelch hysteresis; a condition acceptable for initial alignment purposes only. Rotate the squelch threshold potentiometer (R88) fully clockwise until the end of travel is reached. Inject a standard signal at the desired squelch threshold level; the point at which the receiver becomes active. Slowly adjust the squelch threshold potentiometer (R88) counter clockwise until the receiver unsquelches. Advance R115 (hysteresis) clockwise until sufficient hysteresis prevents any oscillating COR action at the squelch threshold point. Cycle the RF source off and on while adjusting R88 (threshold) until squelch triggering occurs at the desired signal level. Adjust R115 (hysteresis) clockwise to increase the squelch hysteresis window. Slowly lower the RF source signal level and monitor the point at which the receiver squelches. Increase or decrease R115 (hysteresis) to achieve the desired hysteresis window.

It is important to note that some RF signal sources exhibit transient behavior at their output as signal levels are increased or decreased. This is due to mechanical switching of generator output attenuators. This has an effect of causing premature receiver squelch drop out, which may be simply rectified by depressing the receiver squelch override switch as the transient generator signal level is traversed.

LOW FREQUENCY MODULATION CONFIGURATION

Low frequency signals such as digital codedsquelch (DCS) or LTR™ trunking can be picked up at the receiver's DISCRIMINATOR OUTPUT (pin B14), or on the subrack connectors J1, P1 and J7 as RX A DISC O/P (pin B10) or RX B DISC O/P (pin C28).

Receiver PCB version 43-910710 through 43-910712:	Install JU5 on the receiver main board (this is actually done by replacing C54 with a short circuit) and change C48 to a 10 uF. These changes provide a low frequency AC coupled output which is required for low frequency use.
Receiver PCB version 43-910713 through 43-910716:	Remove C54 and JU5 from the main board, and install JU25. These changes provide a DC coupled output which is required for low frequency use.
Receiver PCB version 43-910717:	Remove JU5, JU37, and JU38 from the main board, and install JU25. These changes provide a DC coupled output which is required for low frequency use.
Receiver PCB version 43-910718 through 43-910719:	Remove JU5, JU37, JU38, JU43, and JU44 from the main board, and install JU25. These changes provide a DC coupled output which is required for low frequency use.

For all versions:	Install JU26 if the receiver is to be used with a Zetron or IDA trunking controller. This jumper connects a pull-up resistor to the Normal COR output.

21.4 MHZ IF / AUDIO BOARD INTERCONNECT PIN DEFINITIONS

The IF / Audio Main Board employs a 48 pin Eurostandard connector for interfacing to all transmitter power, audio, and control functions. The following are the IF / Audio Main Board back plane connections to the M-3 Motherboard.

Pin	Name	Pin	Name	Pin	Name
D2	Relay 1, normally open	B2	+13.8 Vdc	Z2	+13.8 Vdc
D4	Relay 1, common	B4	Auxiliary Speaker Output	Z4	+6.0 Vdc Output
D6	Relay 1, normally closed	B6	+9.5 Vdc	Z6	+9.5 Vdc
D8	Relay 2, normally closed	B8	No Connect	Z8	No Connect
D10	Relay 2, common	B10	Disc Output (LPF)	Z10	Spare
D12	Relay 2, normally open	B12	COR (Normal)	Z12	COR (Normal)
D14	IMC1	B14	Disc Output (Buffered)	Z14	Squelch Override
D16	IMC2	B16	No Connect (MT-2 +9.5V)	Z16	No Connect (MT-2 +9.5V)
D18	IMC3	B18	COR (Opto-isolated)	Z18	COR (Opto-isolated)
D20	Channel Select 0 (LSB)	B20	De-emphasis Audio Output	Z20	No Connect
D22	Channel Select 1	B22	Flat Audio Output	Z22	Receiver I/O Spare
D24	Channel Select 2	B24	Signal Strength (RSSI)	Z24	Priority COR (MT-2 AFC)
D26	Channel Select 3 (MSB)	B26	Balanced Output 1	Z26	Balanced Output 2
D28	Synth Tx Data (Output)	B28	Mute	Z28	No Connect (MT-2 Hst Ovd)
D30	Synth Rx Data (Input)	B30	Ground	Z30	Ground
D32	Synth Bootstrap (Input)	B32	Ground	Z32	Ground

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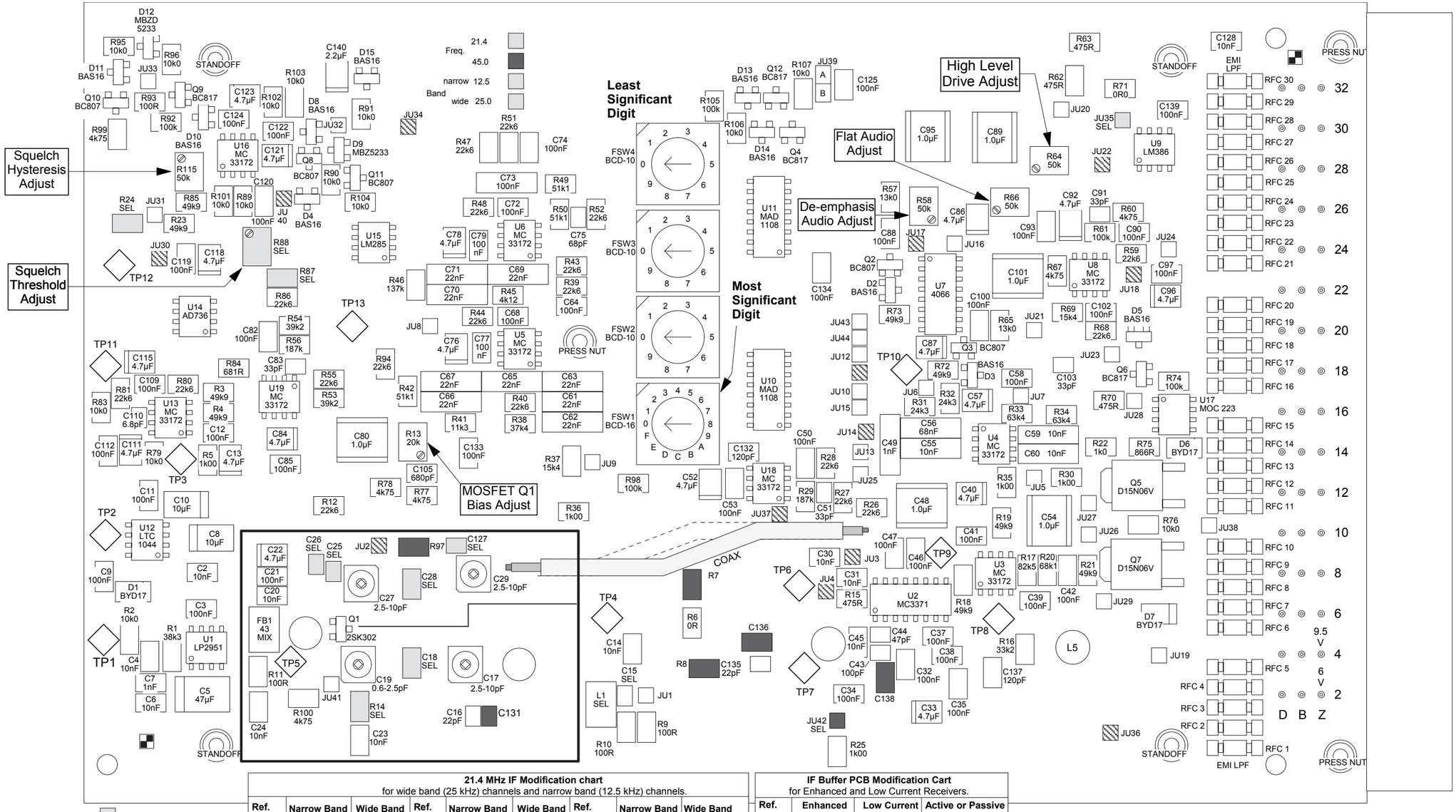
ILLUSTRATIONS AND SCHEMATICS

PRINTED CIRCUIT BOARD NUMBERING CONVENTION

Daniels Electronics Ltd. has adopted a printed circuit board (PCB) numbering convention in which the last two digits of the circuit board number represent the circuit board version. All PCB's manufactured by Daniels Electronics Ltd. are identified by one of the following numbering conventions:

PCB number	43-912010
	Indicates circuit board version 1.0
PCB number	50002-02
	Indicates circuit board version 2 (no decimal version)

RECEIVER MAIN BOARD COMPONENT LAYOUT - BOTTOM



SELECT

INSTALL JUMPERS

NOT INSTALLED

21.4 MHz IF Modification chart
for wide band (25 kHz) channels and narrow band (12.5 kHz) channels.

Ref. Desig.	Narrow Band 12.5 kHz	Wide Band 25 kHz	Ref. Desig.	Narrow Band 12.5 kHz	Wide Band 25 kHz	Ref. Desig.	Narrow Band 12.5 kHz	Wide Band 25 kHz
C18,28	15pF	6.8pF	R14	1k00	1k50	JU42	Not Installed	Not installed
C25	27pF	56pF	R24	6k81	49k9	JU35	Installed	Not Installed
C26	82pF	22pF	R87	82k5	51k1	21.4Freq	Installed	Installed
C127	10pF	6.8pF	R88	20k Pot	50k Pot	45 Freq	Not Installed	Not Installed
						12.5 Band	Installed	Not Installed
						25 Band	Not Installed	Installed

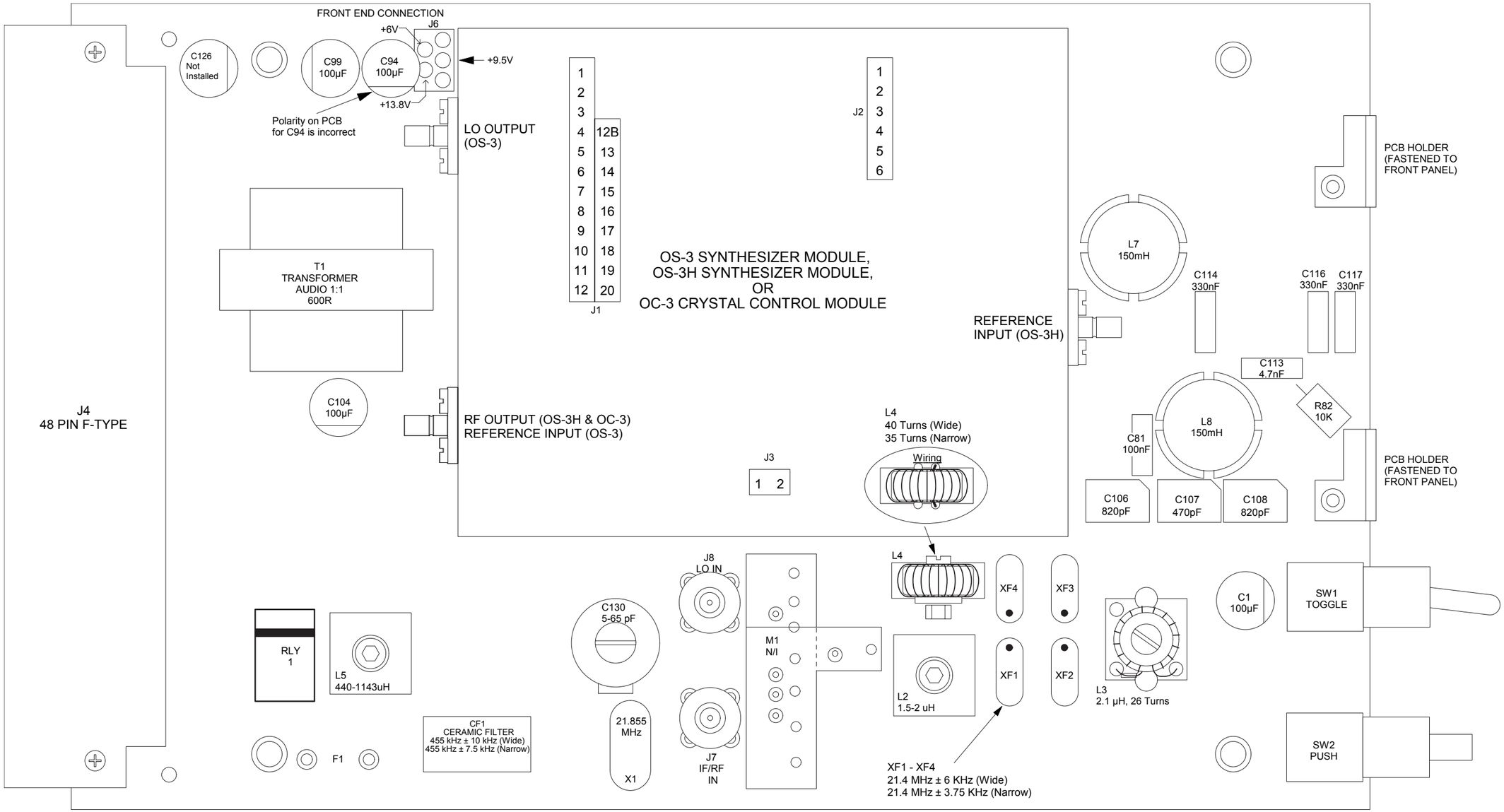
IF Buffer PCB Modification Cart
for Enhanced and Low Current Receivers.

Ref. Desig.	Enhanced (Active)	Low Current (Passive)	Active or Passive Not Installed
C15	Not Installed	82pF	82pF
JU1	Not Installed	Not Installed	Installed
L1	Not Installed	680nH	680nH

DANIELS ™ ELECTRONICS LTD.

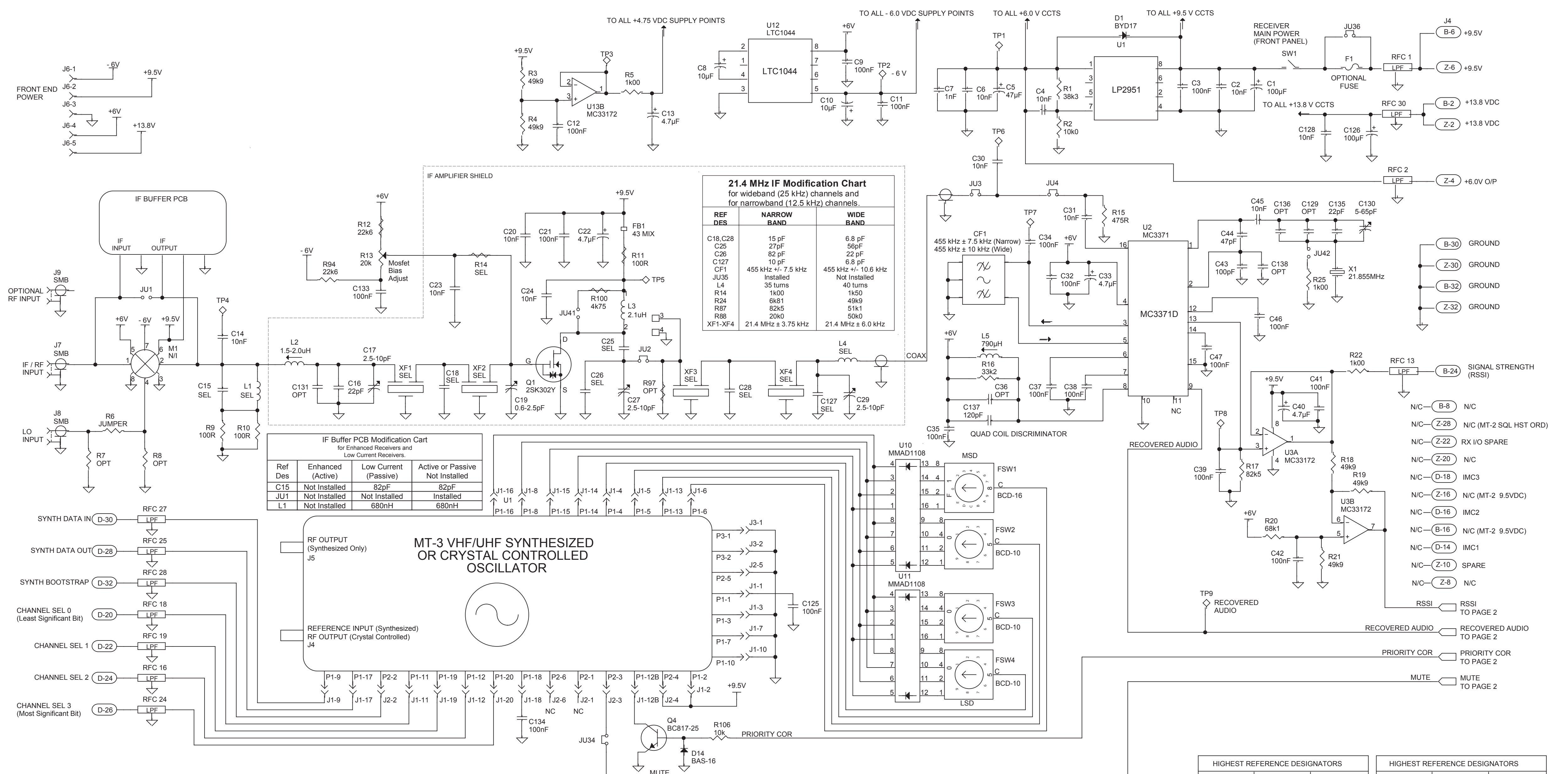
TITLE: 21.4 MHz IF/AUDIO RECEIVER BOARD BOTTOM	
DATE: 27 FEBRUARY 1996	BOARD NO: 43-910719A
DWG No: 01-B-03-01	REV DATE: 04 NOVEMBER 2004

RECEIVER MAIN BOARD COMPONENT LAYOUT -TOP



DANIELS ™ ELECTRONICS LTD.	A A A A
TITLE: 21.4 MHz IF/AUDIO RECEIVER BOARD TOP	
DATE: 11 JANUARY 1996	BOARD NO: 43-910719A
DWG No: 01-T-03-01	REV DATE: 09 SEPTEMBER 2004

RECEIVER MAIN BOARD SCHEMATIC DIAGRAM PAGE 1 OF 2



21.4 MHz IF Modification Chart
for wideband (25 kHz) channels and
for narrowband (12.5 kHz) channels.

REF DES	NARROW BAND	WIDE BAND
C18,C28	15 pF	6.8 pF
C25	27pF	56pF
C26	82 pF	22 pF
C127	10 pF	6.8 pF
CF1	455 kHz +/- 7.5 kHz	455 kHz +/- 10.6 kHz
JU35	Installed	Not Installed
L4	35 turns	40 turns
R14	1k00	1k50
R24	6k81	49k9
R87	82k5	51k1
R88	20k0	50k0
XF1-XF4	21.4 MHz ± 3.75 kHz	21.4 MHz ± 6.0 kHz

IF Buffer PCB Modification Cart
for Enhanced Receivers and
Low Current Receivers.

Ref Des	Enhanced (Active)	Low Current (Passive)	Active or Passive Not Installed
C15	Not Installed	82pF	82pF
JU1	Not Installed	Not Installed	Installed
L1	Not Installed	680nH	680nH

COMPONENT LOCATION TABLE

DES	PG	LC
C1	1	M2
C2	1	M2
C3	1	L2
C4	1	K2
C5	1	K2
C6	1	J2
C7	1	J2
C8	1	H2
C9	1	I2
C10	1	I2
C11	1	J2
C12	1	G2
C13	1	G2
C14	1	C4
C16	1	E5
C17	1	E5
C18	1	F5
C19	1	F5
C20	1	F3
C21	1	G3
C22	1	G3
C23	1	F4
C24	1	F4
C25	1	G4
C26	1	G5
C27	1	G5
C28	1	H5
C29	1	I5
C30	1	K2
C31	1	L3
C32	1	K4
C33	1	L4
C34	1	K3
C35	1	J5
C36	1	K5
C37	1	K5
C38	1	L5
C39	1	M5
C40	1	M5
C41	1	N5
C42	1	N6
C43	1	M3
C44	1	M3
C45	1	M3
C46	1	M4
C47	1	M4
C48	2	J2
C49	2	K2
C50	2	K2
C51	2	K2
C52	2	L2
C53	2	L2
C54	2	L2
C55	2	K4
C56	2	K3
C57	2	J3
C58	2	K3
C59	2	L3
C60	2	L4
C61	2	B3
C62	2	B3
C63	2	B3
C64	2	B3
C65	2	C3
C66	2	C2
C67	2	C3
C68	2	C3
C69	2	D3
C70	2	D2
C71	2	D3
C72	2	D3
C73	2	E3
C74	2	E3
C75	2	F2
C76	2	C2
C77	2	C2
C78	2	E2
C79	2	E2
C80	2	B5
C81	2	C5
C82	2	D5
C83	2	D4
C84	2	D5
C85	2	D5
C86	2	H4
C87	2	H6
C88	2	I5
C89	2	K5
C90	2	K5
C91	2	L4
C92	2	L4
C93	2	L4
C94	2	M4
C95	2	J5
C96	2	K6
C97	2	K6
C99	2	L6
C100	2	I5
C101	2	J6
C102	2	K7
C103	2	K6
C104	2	L7
C105	2	C6
C106	2	D6
C107	2	D6
C108	2	D6
C109	2	E6
C110	2	E4
C111	2	E6
C112	2	E6
C113	2	B8
C114	2	B7
C115	2	B9
C116	2	B8
C117	2	B8
C118	2	C7
C119	2	C7
C120	2	D9
C121	2	D9
C122	2	E9
C123	2	D8
C124	2	D8
C125	1	I7
C126	1	N2
C127	1	I5
C128	1	N2
C129	1	N3
C130	1	N3
C131	1	D5
C132	2	J2
C133	1	E4
C134	1	F8
C135	1	N3
C136	1	M3
C137	1	K5
C138	1	M3
C139	2	L6
C140	2	I8
CF1	1	J3
D1	1	L1
D2	2	I6
D3	2	H6
D4	2	E8
D5	2	L7
D6	2	N7
D7	2	L8
D8	2	F9
D9	2	F9
D10	2	F8
D11	2	G7
D12	2	H8
D13	2	I9
D14	1	H8
D15	2	H8
F1	1	N2
FB1	1	G3
FSW1	1	J5
FSW2	1	J6
FSW3	1	J7
FSW4	1	J7
J1-1	1	H7
J1-2	1	H8
J1-3	1	H7
J1-4	1	G6
J1-5	1	G6
J1-6	1	H6
J1-7	1	H7
J1-8	1	F6
J1-9	1	D8
J1-10	1	H7
J1-11	1	E8
J1-12	1	F8
J1-12B	1	G8
J1-13	1	H6
J1-14	1	G6
J1-15	1	G6
J1-16	1	F6
J1-17	1	E8
J1-18	1	F8
J1-19	1	E8
J1-20	1	F8
J2-1	1	G8
J2-2	1	E8
J2-3	1	G8
J2-4	1	H8
J2-5	1	H6
J2-6	1	G8
J3-1	1	H6
J3-2	1	H6
J4 B2	1	O2
J4 B4	2	O5
J4 B8	1	O5
J4 B10	2	O3
J4 B12	2	O6
J4 B14	2	O2
J4 B16	1	O6
J4 B18	2	O6
J4 B20	2	O3
J4 B22	2	O5
J4 B24	1	O4
J4 B26	2	O4
J4 B28	2	O9
J4 B30	1	O3
J4 B32	1	O4
J4 D2	2	O7
J4 D4	2	O8
J4 D6	2	O7
J4 D8	2	O8
J4 D10	2	O8
J4 D12	2	O9
J4 D14	1	O6
J4 D16	1	O6
J4 D18	1	O5
J4 D20	1	B7
J4 D22	1	B7
J4 D24	1	B7
J4 D26	1	B8
J4 D28	1	B6
J4 D30	1	B6
J4 D32	1	B6
J4 Z2	1	O2
J4 Z4	1	O3
J4 Z6	1	O2
J4 Z8	1	O6
J4 Z10	1	O6
J4 Z12	2	O6
J4 Z14	2	O9
J4 Z16	1	O6
J4 Z18	2	O6
J4 Z20	1	O5
J4 Z22	1	O5
J4 Z24	2	O10
J4 Z26	2	O4
J4 Z28	1	O5
J4 Z30	1	O3
J4 Z32	1	O4
J6-1	1	B2
J6-2	1	B2
J6-3	1	B2
J6-4	1	B2
J6-5	1	B2
J7	1	B4
J8	1	B5
J9	1	B4
JU1	1	C4
JU2	1	G4
JU3	1	K3
JU4	1	K3
JU5	2	L2
JU6	2	J3
JU7	2	K3
JU8	2	B2
JU9	2	B4
JU10	2	G2
JU11	2	G2
JU12	2	G2
JU13	2	G3
JU14	2	G3
JU15	2	G3
JU16	2	I5
JU17	2	I5
JU18	2	L5
JU19	2	M5
JU20	2	M4
JU21	2	N4
JU22	2	M4
JU23	2	M4
JU24	2	N4
JU25	2	K2
JU26	2	M5
JU27	2	N5
JU28	2	M7
JU29	2	L8
JU30	2	C8
JU31	2	D7
JU32	2	F9
JU33	2	H8
JU34	1	G8
JU35	2	L5
JU36	1	N1
JU37	2	L2
JU38	2	N2
JU39	2	J9
JU40	2	E8
JU41	1	G4
JU42	1	N3
JU43	2	J2
JU44	2	J1
L2	1	D4
L3	1	G4
L4	1	I4
L5	1	K4
L7	2	D6
L8	2	D6
M1	1	C4
Q1	1	F4
Q2	2	I6
Q3	2	I6
Q4	1	G8
Q5	2	M7
Q6	2	L7
Q7	2	K8
Q8	2	E9
Q9	2	F8
Q10	2	G8
Q11	2	F9
Q12	2	I9
R1	1	K2
R2	1	K2
R3	1	F2
R4	1	F2
R5	1	G2
R6	1	B5
R7	1	B5
R8	1	C5
R9	1	C5
R10	1	D5
R11	1	G3
R12	1	E3
R13	1	E3
R14	1	F3
R15	1	L3
R16	1	K5
R17	1	M5
R18	1	N5
R19	1	N6
R20	1	M6
R21	1	N6
R22	1	N4
R23	2	D7
R24	2	D7
R25	1	N4
R26	2	J2
R27	2	K2
R28	2	K2
R29	2	L1
R30	2	M2
R31	2	J4
R32	2	K4
R33	2	L3
R34	2	L3
R35	2	M3
R36	2	A3
R37	2	B3
R38	2	B2
R39	2	B3
R40	2	C3
R41	2	C3
R42	2	C2
R43	2	C3
R44	2	D3
R45	2	D3
R46	2	D2
R47	2	D3
R48	2	E3
R49	2	E3
R50	2	F3
R51	2	F3
R52	2	F3
R53	2	C5
R54	2	C5
R55	2	C5
R56	2	D4
R57	2	J3
R58	2	J4
R59	2	K5
R60	2	K5
R61	2	L4
R62	2	M4
R63	2	M4
R64	2	K6
R65	2	I5
R66	2	J6
R67	2	K6
R68	2	J7
R69	2	K6
R70	2	M4
R71	2	L6
R72	2	H6
R73	2	I6
R74	2	L7
R75	2	M7
R76	2	N5
R77	2	C6
R78	2	C6
R79	2	D6
R80	2	E6
R81	2	E5
R82	2	E5
R83	2	E5
R84	2	B8
R85	2	C8
R86	2	C8
R87	2	C8
R88	2	C9
R89	2	C9
R90	2	F9
R91	2	G9
R92	2	E8
R93	2	F8
R94	1	D4
R95	2	H8
R96	2	H8
R97	1	H5
R98	2	J2
R99	2	G8
R100	1	G4
R101	2	E8
R102	2	E7
R103	2	E8
R104	2	E9
R105	2	I9
R106	1	H8
R107	2	J9
R115	2	F8
RFC1	1	N2
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RFC3	2	N7
RFC4	2	N5
RFC5	2	N8
RFC6	2	N7
RFC7	2	N8
RFC8	2	N3
RFC10	2	N9
RFC11	2	N6
RFC12	2	N2
RFC13	1	O4
RFC14	2	N6
RFC15	2	N6
RFC16	1	C7
RFC17	2	N3
RFC18	1	C7
RFC19	1	C7
RFC20	2	N5
RFC21	2	N10
RFC22	2	N4
RFC23	2	N4
RFC24	1	C8
RFC25	1	C6
RFC26	2	N9
RFC27	1	C6
RFC28	1	C6
RFC29	2	N9
RFC30	1	N2
RLY1	2	L8
SW1	1	M2
SW2	2	M9
T1	2	N4
TP1	1	K1
TP2	1	J2
TP3	1	G2
TP4	1	C4
TP5	1	G4
TP6	1	K2
TP7	1	K3
TP8	1	M5
TP9	1	M7
TP10	2	G6
TP11	2	F4
TP12	2	C8
TP13	2	C8
U1	1	L2
U2	1	L3
U3A	1	M5
U3B	1	N6
U4A	2	K3
U4B	2	L3
U5A	2	B3
U5B	2	C3
U6A	2	F3
U6B	2	E3
U7	2	H4
U8A	2	K7
U8B	2	K5
U9	2	L6
U10	1	J5
U11	1	J7
U12	1	H1
U13A	2	E6
U13B	1	G2
U14	2	B7
U15	2	C9
U16A	2	D8
U16B	2	F7
U17	2	M6
U18A	2	L2
U18B	2	J2
U19A	2	D5
U19B	2	C4
X1	1	N4
XF1	1	E5
XF2	1	F5
XF3	1	H5
XF4	1	I5

TP	LEVEL	FUNCTION
1	+6.00V+/-0.1V	SUPPLY
2	-6.00V+/-0.1V	SUPPLY
3	+4.75V+/-0.1V	SUPPLY
4	21.4 MHz	1st IF INPUT
5	+8.75V+/-0.1V	FET
6	IF SAMPLING / INJECTION	
7	455 KHZ FILTER SOURCE	
8	UNFILTERED RSSI	
9	UNFILTERED RECOVERED AUDIO	
10	COR LOGIC - INTERNAL	
11	SQUELCH NOISE SOURCE	
12	SQUELCH NOISE LEVEL	
13	+2.50V +/- 0.02V	SQ. TRIG REF

JUMPER FUNCTIONS	
JU1	ONBOARD MIXER BYPASS
JU2	IF TRANSFORMER BYPASS
JU3	IF AMPLIFIER CONNECT / DISCONNECT
JU4	2ND IF DEMOD CONNECT / DISCONNECT
JU5	DISCRIMINATOR OUTPUT AC / DC COUPLING
JU6	SUBTONE FILTER AUDIO CONNECT
JU7	SUBTONE FILTER ENABLE
JU8	VOICE BAND HIGH PASS FILTER ENABLE
JU9	VOICE BAND FILTER OFFSET ENABLE
JU10	FLAT AUDIO HIGH PASS FILTER CONNECT
JU11	NORMAL FLAT AUDIO O/P CONNECT
JU12	HIGH PASS FILTER OUT TO FLAT AUDIO
JU13	DE-EMPHASIS TO HIGH PASS FLTR CONN
JU14	NORMAL DE-EMPH AUDIO OUTPUT CONN
JU15	HPASS FLTR OUT TO DE-EMP AUDIO PATH
JU16	FLAT AUDIO HIGH LEVEL DRIVE
JU17	DE-EMPH AUDIO HIGH LEVEL CONNECT
JU18	HIGH LEVEL DRIVE SUPPLY ENABLE

JUMPER FUNCTIONS	
JU19	AUX SPEAKER OUTPUT CONNECT
JU20	DE-EMP AUDIO XFMR CONNECT
JU21	IF AMPLIFIER CONNECT / DISCONNECT
JU22	HIGH LEVEL DRIVE XFMR BYPASS
JU23	FLAT AUDIO XFMR CONNECT
JU24	XFMR OUTPUT UNBALANCED CONNECT
JU25	DIRECT DISCRIMINATOR
JU26	6 VOLT COR PULLUP CONNECT
JU27	9.5 VOLT COR PULLUP CONNECT
JU28	OPTO ISOLATOR ENABLE
JU29	RELAY DRIVER ENABLE
JU30	NOISE TRIGGERED SQUELCH CONNECT
JU31	RSSI TRIGGERED SQUELCH CONNECT
JU32	SQUELCH OVERRIDE LEVEL SHIFT
JU33	RX MUTE LEVEL SHIFT
JU34	OUT-OF-LOCK MUTE ENABLE
JU35	HIGH LEVEL DRIVE GAIN SELECT
JU36	FUSE BYPASS

JUMPER FUNCTIONS	
JU37	AMPLIFIED DISCRIMINATOR O/P SELECT
JU38	LPF DISCRIMINATOR O/P ROUTING
JU39	+6.0/9.5 V PRIORITY COR PULLUP SELECT
JU40	SQUELCH OVERRIDE PRECEDENCE ENABLE
JU41	45 MHz IF NARROW BAND MATCHING
JU42	INSTALLED FOR 45 MHz ONLY
JU43	SQUELCH DISCRIMINATOR AUDIO EN. A
JU44	SQUELCH DISCRIMINATOR AUDIO EN. B
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-

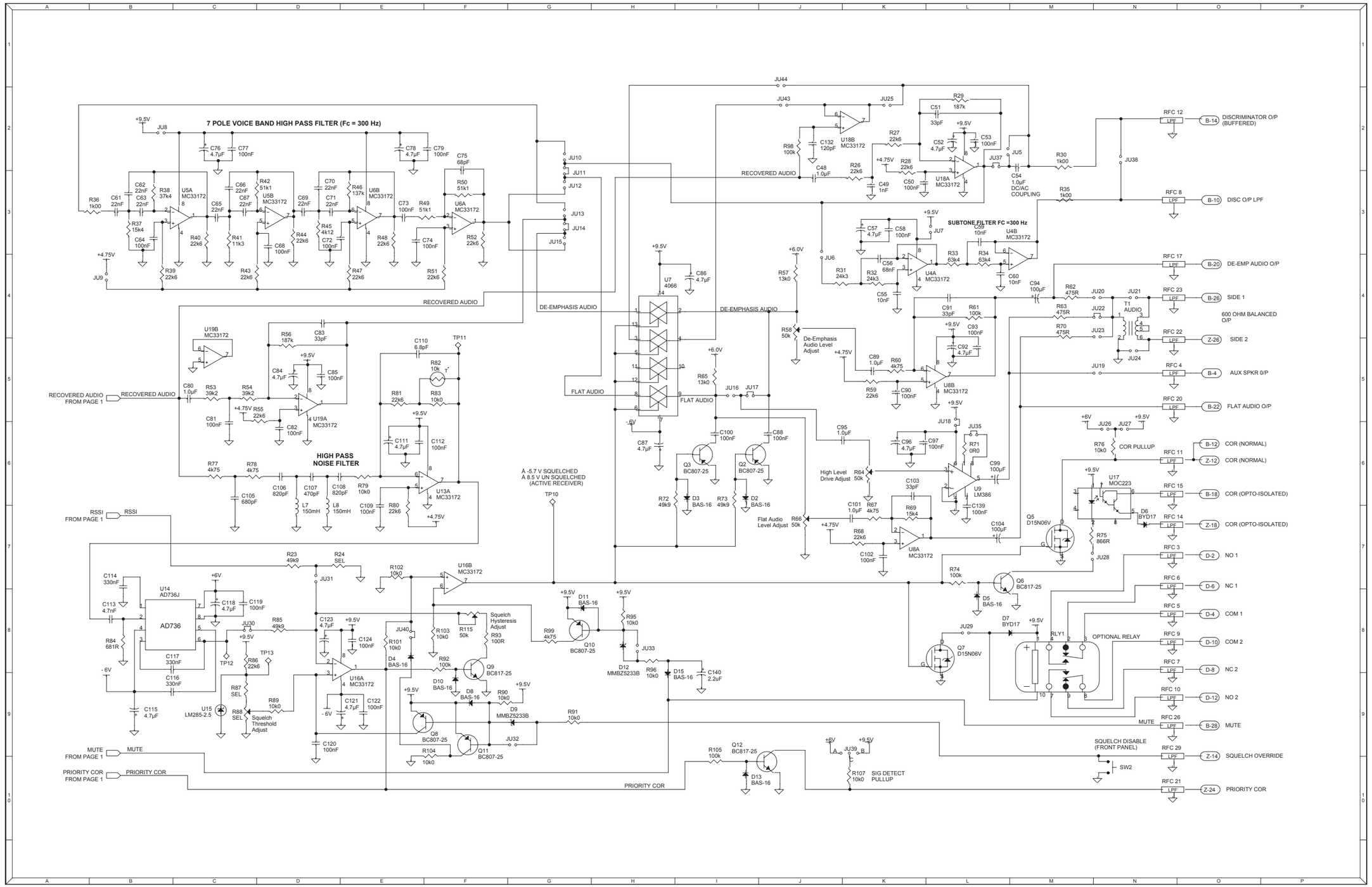
HIGHEST REFERENCE DESIGNATORS		
C140	CF1	D15
F1	FB1	FSW4
J9	JU44	L8
M1	Q12	R115
REFERENCE DESIGNATORS NOT USED		
L6	C98	R108-R114
J5	-	-
-	-	-
-	-	-

HIGHEST REFERENCE DESIGNATORS		
RFC 30	RLY1	SW2
T1	TP13	U19
X1	XF4	-
-	-	-
REFERENCE DESIGNATORS NOT USED		

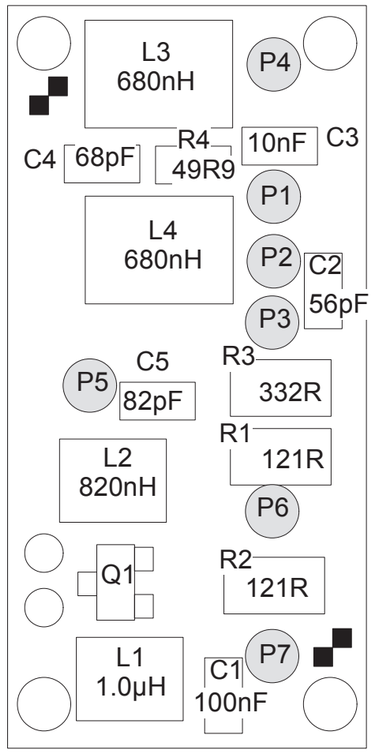
DANIELS ELECTRONICS LTD. VICTORIA B.C.

TITLE: 21.4 MHz FM IF/AUDIO MAIN BOARD SCHEMATIC DIAGRAM		
DATE: 18 FEBRUARY 1991	DWN BY: S. SHANNON	APRVD:
DWG No: 01-S-05-01-2	REVISED BY: EVA DANIELS	
BOARD No: 43-910719A REV: 1.9A	DWG REV DATE: 22 JUNE 2005	

RECEIVER MAIN BOARD SCHEMATIC DIAGRAM PAGE 2 OF 2

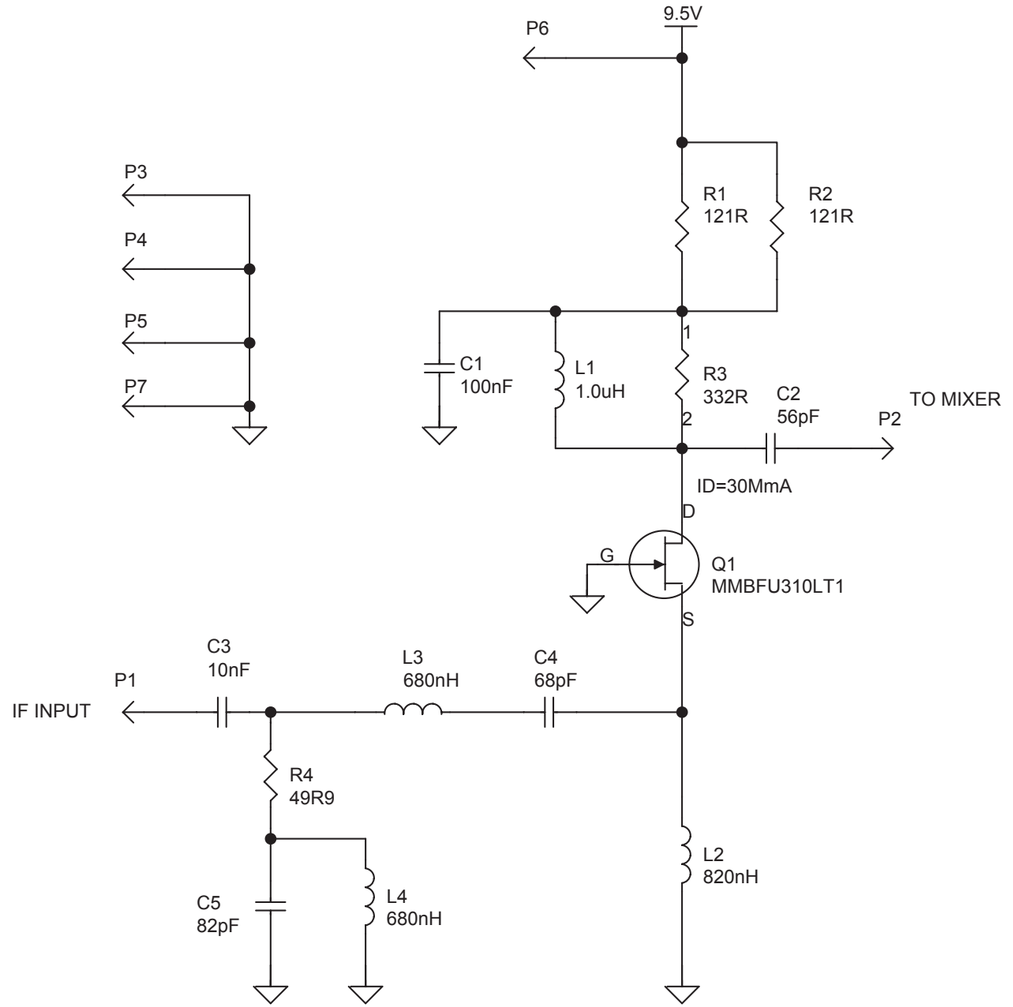


MT-3 RX ACTIVE IF BUFFER BOARD COMPONENT LAYOUT



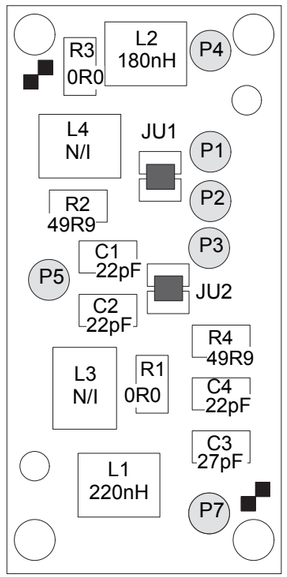
50032-01-01-T-01-01

MT-3 RX ACTIVE IF BUFFER BOARD SCHEMATIC DIAGRAM



50032-01-S-01-01

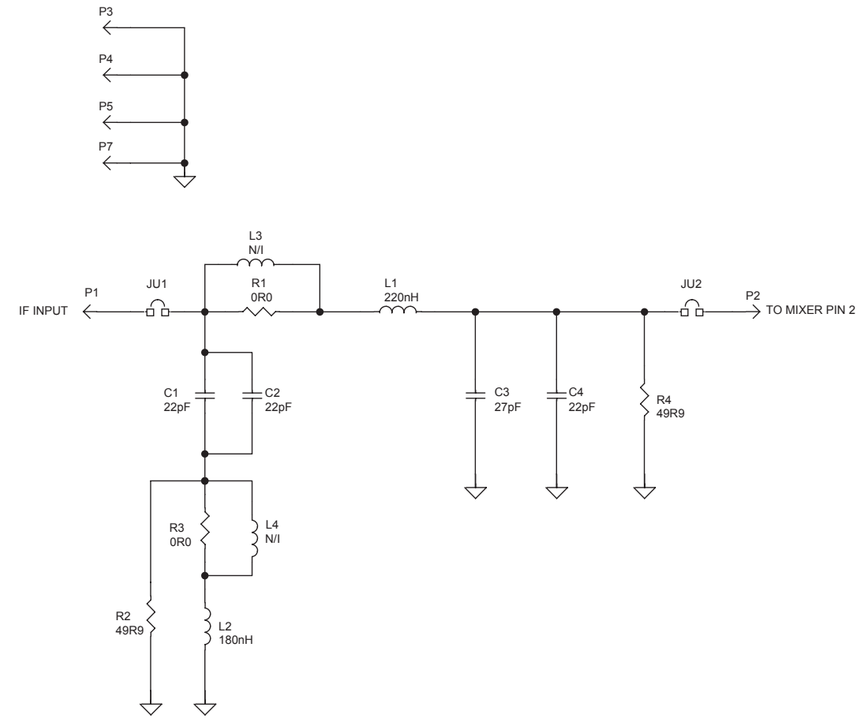
MT-3 RX PASSIVE IF BUFFER BOARD COMPONENT LAYOUT



DANIELS ™ ELECTRONICS LTD.										
1 A	2 A	3 B	4 A	5 A	6 A	7	8	9	10	
11	12	13	14	15	16	17	18	19	20	
21	22	23	24	25	26	27	28	29	30	

TITLE: LOW CURRENT RECEIVER PASSIVE IF BUFFER BOARD	
DATE: 10 DECEMBER 1998	BOARD NO: 50067-01
DWG No: 01-T-03-01	REV DATE: 26 JANUARY 2004

MT-3 RX PASSIVE IF BUFFER BOARD SCHEMATIC DIAGRAM



HIGHEST REFERENCE DESIGNATORS		
C4	JU2	L4
P7	R4	-----
-----	-----	-----
UNUSED REFERENCE DESIGNATORS		
P6	-----	-----
-----	-----	-----
-----	-----	-----

DANIELS™ ELECTRONICS LTD		VICTORIA BC.
TITLE: LOW CURRENT RECEIVER PASSIVE IF BOARD SCHEMATIC DIAGRAM		
DATE: 5 MARCH 1999	DWN BY: DALE REITSMA	APRVD:
DWG No.: 01-S-03-01		REVISED BY: N BEREKOFF
BOARD No.: 50067-01	REV: 01	DWG REV DATE: 26 JANUARY 2004

PARTS LISTS

21.4 MHZ RECEIVER MAIN BOARD ELECTRICAL PARTS LIST

Ref Desig	Description	Part Number	Wideband	Narrowband
C1	CAP., 100uF DIP. TANT.,20%,20V	1054-7M107M20	•	•
C2	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C3	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C4	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C5	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•
C6	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C7	CAP., SM, 1nF CER., 1206, C0G	1008-3B102K1G	•	•
C8	CAP., SM, 10uF TANT., 20%, 16V	1055-6C106M16	•	•
C9	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C10	CAP., SM, 10uF TANT., 20%, 16V	1055-6C106M16	•	•
C11 - C12	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C13	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C14	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C15*	CAP., SM, 82pF CER., 0805, C0G	1008-1A820J1G	•	•
C16	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G	•	•
C17	CAP., SM TRIMMER, 2.5-10pF	1088-1A2R510R	•	•
C18	CAP., SM, 6.8pF CER., 0805,C0G	1008-0A689J1G	•	
	CAP., SM, 15pF CER., 0805, C0G	1008-1A150J1G		•
C19	CAP., SM TRIMMER, 0.6-2.5pF	1088-1A0R62R5	•	•
C20	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C21	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C22	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C23 - C24	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•

*C15 - Removed when Active Buffer Board installed

21.4 MHz Receiver Main Board Electrical Parts List cont'd

Ref Desig	Description	Part Number	Wideband	Narrowband
C25	CAP., SM, 27pF CER., 0805, C0G	1008-1A270J1G		•
	CAP., SM, 56pF CER., 0805, C0G	1008-1A560J1G	•	
C26	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G	•	
	CAP., SM, 82pF CER., 0805, C0G	1008-1A820J1G		•
C27	CAP., SM TRIMMER, 2.5-10pF	1088-1A2R510R	•	•
C28	CAP., SM, 6.8pF CER., 0805,C0G	1008-0A689J1G	•	
	CAP., SM, 15pF CER., 0805, C0G	1008-1A150J1G		•
C29	CAP., SM TRIMMER, 2.5-10pF	1088-1A2R510R	•	•
C30 - C31	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C32	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C33	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C34 - C39	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C40	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C41 - C42	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C43	CAP., SM, 100pF CER., 0805,C0G	1008-2A101J1G	•	•
C44	CAP., SM, 47pF CER., 0805, C0G	1008-1A470J1G	•	•
C45	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C46 - C47	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C48	CAP., SM,1.0uF,CER/2225,50,X7R	1008-6H105J5R	•	•
C49	CAP., 1nF FILM, MMK5, 10%, 63V	1016-3A102K63	•	•
C50	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C51	CAP., SM, 33pF CER., 0805, C0G	1008-1A330J1G	•	•
C52	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C53	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C54	CAP., SM,1.0uF,CER/2225,50,X7R	1008-6H105J5R	•	•
C55 - C56	CAP., 10nF FILM, MMK5, 10%,63V	1016-4A103K63	•	•
C57	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C58	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C59 - C60	CAP., 10nF FILM, MMK5, 10%,63V	1016-4A103K63	•	•
C61 - C63	CAP., 22nF FILM, MMK5, 10%,63V	1016-4A223K63	•	•
C64	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C65 - C67	CAP., 22nF FILM, MMK5, 10%,63V	1016-4A223K63	•	•
C68	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C69 - C71	CAP., 22nF FILM, MMK5, 10%,63V	1016-4A223K63	•	•
C72	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C73	CAP., 100nF FILM, MMK5,10%,63V	1016-5A104K63	•	•
C74	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C75	CAP., SM, 68pF CER., 0805, C0G	1008-1A680J1G	•	•
C76	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C77	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•

21.4 MHz Receiver Main Board Electrical Parts List cont'd

Ref Desig	Description	Part Number	Wideband	Narrowband
C78	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C79	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C80	CAP., SM,1.0uF,CER/2225,50,X7R	1008-6H105J5R	•	•
C81	CAP., 100nF FILM, MMK5,10%,63V	1016-5A104K63	•	•
C82	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C83	CAP., SM, 33pF CER., 0805, C0G	1008-1A330J1G	•	•
C84	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C85	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C86 - C87	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C88	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C89	CAP., SM,1.0uF,CER/2225,50,X7R	1008-6H105J5R	•	•
C90	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C91	CAP., SM, 33pF CER., 0805, C0G	1008-1A330J1G	•	•
C92	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C93	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C94	CAP., 100uF DIP. TANT.,20%,20V	1054-7M107M20	•	•
C95	CAP., SM,1.0uF,CER/2225,50,X7R	1008-6H105J5R	•	•
C96	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C97	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C99	CAP., 100uF DIP. TANT.,20%,20V	1054-7M107M20	•	•
C100	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C101	CAP., SM,1.0uF,CER/2225,50,X7R	1008-6H105J5R	•	•
C102	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C103	CAP., SM, 33pF CER., 0805, C0G	1008-1A330J1G	•	•
C104	CAP., 100uF DIP. TANT.,20%,20V	1054-7M107M20	•	•
C105	CAP., SM, 680pF CER., 1206,C0G	1008-2B681J1G	•	•
C106	CAP., 820pF FILM, KP, 1%, 400V	1018-2A8201FD	•	•
C107	CAP., 470pF FILM, KP, 1%, 630V	1018-2A4701FE	•	•
C108	CAP., 820pF FILM, KP, 1%, 400V	1018-2A8201FD	•	•
C109	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C110	CAP., SM, 6.8pF CER., 0805,C0G	1008-0A689J1G	•	•
C111	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C112	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C113	CAP., 4.7nF FILM, MMK5,10%,63V	1016-3A472K63	•	•
C114	CAP., 330nF FILM, MMK5,10%,50V	1016-5B334K50	•	•
C115	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C116 - C117	CAP., 330nF FILM, MMK5,10%,50V	1016-5B334K50	•	•
C118	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C119	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C120	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•

21.4 MHz Receiver Main Board Electrical Parts List cont'd

Ref Desig	Description	Part Number	Wideband	Narrowband
C121	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C122	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C123	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C124 - C125	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C127	CAP., SM, 6.8pF CER., 0805,C0G	1008-0A689J1G	•	
	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G		•
C128	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C130	CAP.,TRIM. 5-65pF, YELLOW 250V	1081-B5R065Q2	•	•
C132	CAP., SM, 120pF CER., 1206,C0G	1008-2B121J1G	•	•
C133 - C134	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C135	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G	•	•
C137	CAP., SM, 120pF CER., 1206,C0G	1008-2B121J1G	•	•
C139	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C140	CAP., SM, 2.2uF TANT., 10%,20V	1055-5B225K20	•	•
CF1	FILTER,CF/BP,455kHz,+-10,6ELEM	1340-500C455D	•	
	FILTER,CF/BP,455kHz,+-7.5,6ELM	1340-500C455E		•
D1	DIODE, BYD17J, RECTIFIER,SOD87	2101-BYD17J00	•	•
D2 - D5	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000	•	•
D6 - D7	DIODE, BYD17J, RECTIFIER,SOD87	2101-BYD17J00	•	•
D8	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000	•	•
D9	DIODE, MBZ5233B,6.0V ZEN.SOT23	2102-MBZ5233B	•	•
D10 - D11	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000	•	•
D12	DIODE, MBZ5233B,6.0V ZEN.SOT23	2102-MBZ5233B	•	•
D13 - D15	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000	•	•
FB1	FERRITE BEAD, SM,43MIX,.18x.12	1213-43181200	•	•
FSW1	SWITCH, SM, BCD-16 STEPS,5 PIN	5274-16BCD005	•	•
FSW2 - FSW4	SWITCH, SM, BCD-10 STEPS,5 PIN	5274-10BCD005	•	•
J1 1-12	SOCK. STRIP-L/P,1ROW x12PIN,Au	5016-SL112G08	•	•
J1 12B-20	SOCK. STRIP-L/P,1ROW x 9PIN,Au	5016-SL109G08	•	•
J2	SOCK. STRIP-L/P,1ROW x 6PIN,Au	5016-SL106G08	•	•
J3	SOCK. STRIP-L/P,1ROW x 2PIN,Au	5016-SL102G08	•	•
J4	CONNECTOR, F/48 MALE, R/A PCB	3720-6048M0RA	•	•
J8	CONN., SMB, JACK,PC MNT,STRHT.	5122-J20S00BG		•
L1*	INDUCTOR, SM, 680nH, 10%, 1812	1255-2GR6800M	•	•
L2	INDUCT/VAR., 1.5-2.0uH,SHIELD.	1262-113C017S	•	•
L3	INDUCT./TOROID,26T,28AWG,T37-6	1290-84260028	•	•

*L1 - Removed when Active Buffer Board installed

21.4 MHz Receiver Main Board Electrical Parts List cont'd

Ref Desig	Description	Part Number	Wideband	Narrowband
L4	INDUCT./TOROID,35T,28AWG,T37-6	1290-84350028		•
	INDUCT./TOROID,40T,28AWG,T37-6	1290-84400028	•	
L5	INDUCTOR/VAR., 440-1143uH,SHLD	1262-115F790S	•	•
L7 - L8	INDUCTOR, AUD. 150mH,FERR/CORE	1242-8RPC154K	•	•
PCB	PCB, IF/AUDIO,MT-3 FM RECEIVER	4311-10910719	•	•
Q1	MOSFET, 2SK302Y, RF AMP.,SOT23	2143-2SK302Y0	•	•
Q2 - Q3	TRANSISTOR, BC807-25,PNP,SOT23	2120-BC807025	•	•
Q4	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•
Q5	MOSFET, D15N06V, N-CHAN., DPAK	2144-D15N06V0	•	•
Q6	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•
Q7	MOSFET, D15N06V, N-CHAN., DPAK	2144-D15N06V0	•	•
Q8	TRANSISTOR, BC807-25,PNP,SOT23	2120-BC807025	•	•
Q9	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•
Q10 - Q11	TRANSISTOR, BC807-25,PNP,SOT23	2120-BC807025	•	•
Q12	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•
R1	RES., SM, 38K3 1206, 1%,100ppm	1150-4B3832FP	•	•
R2	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R3 - R4	RES., SM, 49K9 1206, 1%,100ppm	1150-4B4992FP	•	•
R5	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•
R6	RES., SM, ZERO OHM JUMPER,1206	1150-0B0R0000	•	•
R9 - R11	RES., SM, 100R 1206, 1%,100ppm	1150-2B1000FP	•	•
R12	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R13	POT.,SM/4mmSQ,20K,MULT/TRN,TOP	1174-DM3203W0	•	•
R14	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP		•
	RES., SM, 1K50 1206, 1%,100ppm	1150-3B1501FP	•	
R15	RES., SM, 475R 1206, 1%,100ppm	1150-2B4750FP	•	•
R16	RES., SM, 33K2 1206, 1%,100ppm	1150-4B3322FP	•	•
R17	RES., SM, 82K5 1206, 1%,100ppm	1150-4B8252FP	•	•
R18 - R19	RES., SM, 49K9 1206, 1%,100ppm	1150-4B4992FP	•	•
R20	RES., SM, 68K1 1206, 1%,100ppm	1150-4B6812FP	•	•
R21	RES., SM, 49K9 1206, 1%,100ppm	1150-4B4992FP	•	•
R22	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•
R23	RES., SM, 49K9 1206, 1%,100ppm	1150-4B4992FP	•	•
R24	RES., SM, 49K9 1206, 1%,100ppm	1150-4B4992FP	•	
	RES., SM, 6K81 1206, 1%,100ppm	1150-3B6811FP		•
R25	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•
R26	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•

21.4 MHz Receiver Main Board Electrical Parts List cont'd

Ref Desig	Description	Part Number	Wideband	Narrowband
R27 - R28	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R29	RES., SM, 187K 1206, 1%,100ppm	1150-5B1873FP	•	•
R30	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•
R31 - R32	RES., SM, 24K3 1206, 1%,100ppm	1150-4B2432FP	•	•
R33 - R34	RES., SM, 63K4 1206, 1%,100ppm	1150-4B6342FP	•	•
R35 - R36	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•
R37	RES., SM, 15K4 1206, 1%,100ppm	1150-4B1542FP	•	•
R38	RES., SM, 37K4 1206, 1%,100ppm	1150-4B3742FP	•	•
R39 - R40	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R41	RES., SM, 11K3 1206, 1%,100ppm	1150-4B1132FP	•	•
R42	RES., SM, 51K1 1206, 1%,100ppm	1150-4B5112FP	•	•
R43	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R44	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R45	RES., SM, 4K12 1206, 1%,100ppm	1150-3B4121FP	•	•
R46	RES., SM, 137K 1206, 1%,100ppm	1150-5B1373FP	•	•
R47 - R48	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R49 - R50	RES., SM, 51K1 1206, 1%,100ppm	1150-4B5112FP	•	•
R51 - R52	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R53 - R54	RES., SM, 39K2 1206, 1%,100ppm	1150-4B3922FP	•	•
R55	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R56	RES., SM, 187K 1206, 1%,100ppm	1150-5B1873FP	•	•
R57	RES., SM, 13K0 1206, 1%,100ppm	1150-4B1302FP	•	•
R58	POT.,SM/4mmSQ,50K,MULT/TRN,TOP	1174-DM3503W0	•	•
R59	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R60	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP	•	•
R61	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP	•	•
R62 - R63	RES., SM, 475R 1206, 1%,100ppm	1150-2B4750FP	•	•
R64	POT.,SM/4mmSQ,50K,MULT/TRN,TOP	1174-DM3503W0	•	•
R65	RES., SM, 13K0 1206, 1%,100ppm	1150-4B1302FP	•	•
R66	POT.,SM/4mmSQ,50K,MULT/TRN,TOP	1174-DM3503W0	•	•
R67	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP	•	•
R68	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R69	RES., SM, 15K4 1206, 1%,100ppm	1150-4B1542FP	•	•
R70	RES., SM, 475R 1206, 1%,100ppm	1150-2B4750FP	•	•
R71	RES., SM, ZERO OHM JUMPER,1206	1150-0B0R0000	•	•
R72 - R73	RES., SM, 49K9 1206, 1%,100ppm	1150-4B4992FP	•	•
R74	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP	•	•
R75	RES., SM, 866R 1206, 1%,100ppm	1150-2B8660FP	•	•
R76	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R77	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP	•	•

21.4 MHz Receiver Main Board Electrical Parts List cont'd

Ref Desig	Description	Part Number	Wideband	Narrowband
R78	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP	•	•
R79	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R80 - R81	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R82	THERMISTOR, 10K, NTC,10%,AXIAL	1180-4RDG103K	•	•
R83	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R84	RES., SM, 681R 1206, 1%,100ppm	1150-2B6810FP	•	•
R85	RES., SM, 49K9 1206, 1%,100ppm	1150-4B4992FP	•	•
R86	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R87	RES., SM, 82K5 1206, 1%,100ppm	1150-4B8252FP		•
	RES., SM, 51K1 1206, 1%,100ppm	1150-4B5112FP	•	
R88	POT.,SM/4mmSQ,20K,MULT/TRN,TOP	1174-DM3203W0		•
	POT.,SM/4mmSQ,50K,MULT/TRN,TOP	1174-DM3503W0	•	
R89 - R91	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R92	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP	•	•
R93	RES., SM, 100R 1206, 1%,100ppm	1150-2B1000FP	•	•
R94	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•
R95 - R96	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R98	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP	•	•
R99 - R100	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP	•	•
R101 - R102	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R103 - R104	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R105	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP	•	•
R106 - R107	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R115	POT.,SM/4mmSQ,50K,MULT/TRN,TOP	1174-DM3503W0	•	•
RFC30	FILTER, SM, EM1/LPF, 360pF,FER	1306-T361F2D5	•	•
RLY1	RELAY, 9VDC, 2 FORM C,PCB MNT.	5310-2C09P005	•	•
SW1	SWITCH, TOG./SPDT,O-N-O,PCB/RA	5215-T1011A02	•	•
SW2	SWITCH, PB, SPDT/MOM., PCB-R/A	5234-310A01TB	•	•
T1	TRANSFORMER, AUDIO,600R,1:1	1280-600P6005	•	•
U1	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•
U2	IC, MC3371, FM RX W/RSSI,SO-16	2351-33710N16	•	•
U3 - U6	IC, MC33172, DUAL OP AMP, SO-8	2302-33172N08	•	
U7	IC, 4066, QUAD ANLG. SW, SO-14	2375-40660N14	•	•
U8	IC, MC33172, DUAL OP AMP, SO-8	2302-33172N08		•
U9	IC, LM386, L/V AUDIO AMP.,SO-8	2323-386M1N08	•	•
U10 - U11	IC, MMAD1108,8 DIODE/ARY.,SO16	2331-11080N16	•	•
U12	IC,ICL7660S,VOLT. CONVTR.,SO-8	2312-10440N08	•	•

21.4 MHz Receiver Main Board Electrical Parts List cont'd

Ref Desig	Description	Part Number	Wideband	Narrowband
U13	IC, MC33172, DUAL OP AMP, SO-8	2302-33172N08		•
U14	IC, AD736J,RMS-DC CONVTR.,SO-8	2314-73600N08	•	•
U15	IC, LM285-2.5,2.5VDC REF.,SO-8	2306-28525N08	•	•
U16	IC, MC33172, DUAL OP AMP, SO-8	2302-33172N08		•
U17	IC, MOC223, OPTOCOUPLER, SO-8	2335-22300N08	•	•
U18 - U19	IC, MC33172, DUAL OP AMP, SO-8	2302-33172N08	•	
X1	CRYSTAL, FUND/21.855MHz, 20ppm	1505-21855020	•	•
XF1 - XF4	FILTER, XTAL,21.4M,+-3.75,PAIR	1332-2144075D		•

21.4 MHZ RECEIVER MAIN BOARD MECHANICAL PARTS LIST

Description	Part Number	Qty
COAX, CONFORMABLE,50 OHM,0.083	7482-5024T083	0.047
CONN., SMB, JACK,PC MNT,STRHT.	5122-J20S00BG	1
DIVIDER, MT-3 RX IF,COMP. SIDE	3702-67301020	1
DIVIDER, MT-3 RX IF,SOLDR.SIDE	3702-67301010	1
LABEL SET, FOIL,RF MODULE INFO	3501-27101000	1
LABEL, FOIL,RX PT15 COMPLIANCE	3501-43101010	1
NUT, PRESS,M2.5,5.6mmOD,PC MNT	5833-T2M55615	3
NUT, PRESS,M2.5,5.6mmOD,PC MNT	5833-T2M55615	3
SCREW, M2.5 x 12 PAN/PHIL, A2	5812-2M5PP12S	2
SCREW, M2.5 x 12 PAN/PHIL, A2	5812-2M5PP12S	2
SCREW, M3 x 6,OVAL C/S/PHIL,A2	5812-3M0VP06S	2
SCREW, M3 x 8,OVAL C/S/PHIL,A2	5812-3M0VP08S	7
SEAL, SLOTTED, .234-64 UNS-2	1083-S234T640	5
SHIELD, MT-3 RCVR. IF,S/M SIDE	3702-67301006	1
SHIELD, MT-3 RCVR. IF,T/H SIDE	3702-67301016	1
STANDOFF, 7/32OD,1/4L,M3,SWAGE	5917-7B4BM30T	4
TUBING, TFE-260C,24AWG T/W,CLR	7610-260C24TW	0.004

21.4 MHZ ACTIVE IF BUFFER BOARD PARTS LIST

Ref Desig	Description	Part Number
C1	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C2	CAP., SM, 56pF CER., 0805, C0G	1008-1A560J1G
C3	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R
C4	CAP., SM, 68pF CER., 0805, C0G	1008-1A680J1G
C5	CAP., SM, 82pF CER., 0805, C0G	1008-1A820J1G
L1	INDUCTOR,SM,1.0uH CER,10%,1008	1256-3B1R000K
L2	INDUCTOR,SM,820nH CER,10%,1008	1256-2BR8200K
L3 - L4	INDUCTOR, SM, 680nH, 10%, 1812	1255-2GR6800M
P1 - P3	INTERCONNECT/LP,1ROW x 3PIN,Au	5015-IL103G07
P4 - P7	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07
PCB	PCB, IF BUFFER, MT-3 RECEIVER	4311-13500321
Q1	JFET, MMBFU310L,RF,N-CH,SOT-23	2141-MBFU310L
R1 - R2	RES., SM, 121R 1206, 1%,100ppm	1150-2B1210FP
R3	RES., SM, 332R 1206, 1%,100ppm	1150-2B3320FP
R4	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP

21.4 MHZ PASSIVE IF BUFFER BOARD PARTS LIST

Ref Desig	Description	Part Number
C2	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C3	CAP., SM, 27pF CER., 0805, C0G	1008-1A270J1G
C4	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
L1	INDUCTOR,SM,220nH CER,10%,1008	1256-2BR2200K
L2	INDUCTOR,SM,180nH CER,10%,1008	1256-2BR1800K
P1 - P3	INTERCONNECT/LP,1ROW x 3PIN,Au	5015-IL103G07
P4 - P7	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07
R1	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000
R2	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP
R3	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000
R4	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP

FRONT PANEL PARTS LIST

Description	Part Number	UOM	Qty
CASE, 14HP RF PLUG-IN, MT-3 RX	3702-62501010	EA	1
FASTENER, QUICK RELEASE, GRAY	3702-10000120	EA	4
GASKET, BeCu,3FINGER,.71”,CLIP	5630-12023250	EA	2
HANDLE, FRONT PANEL, 14HP,GREY	3702-10000614	EA	1
HOLDER, PCB/EXTRACTOR,DIE CAST	3702-33160011	EA	2
HOLE PLUG, .250” HOLE,NYL.,BLK	5671-250N062B	EA	1
LOCKWASHER, M3, SPLIT,A2 STEEL	5814-3M0LK00S	EA	4
NAMEPLATE, BLANK, 14HP, ALUM.	3702-10001214	EA	1
NUT, M2.5, SQUARE-5mm, ZINC	5813-2M5SQ50Z	EA	2
PANEL, REAR,POS.1,14HP EXTRSN.	3702-63001101	EA	1
PANEL/FRNT,W/IDENT:RX/EXTR,CLR	3802-61001071	EA	1
SCREW, M2.5 x 14 FLAT/PHIL, A2	5812-2M5FP14S	EA	2
SCREW, M2.5 X 6, PAN/PHIL., A2	5812-2M5PP06S	EA	2
SCREW, M2.5x8,OVAL C/S/PHIL,A2	5812-2M5VP08S	EA	2
SCREW, M3 x 8, PAN/PHIL, BLACK	5812-3M0PP08T	EA	4
SCREW, M3 x 8,OVAL C/S/PHIL,A2	5812-3M0VP08S	EA	1

REVISION HISTORY

Revision	Date	ECO	Description
1	June 97		Issue 1
	August 97		17 x 22 schematic (DWG #RX214M3D) replaced with 11 x 17 schematic (DWG # RX214M3E, 2 pages). Updated parts list with correct description and part number for Receiver Case.
2	May 98	524	• 21.4 MHz RX IF/Audio Main Board (Narrowband only) R87 was 51k1 (1150-3B5112FP) now 82k5 (1150-4B8252FP) R88 was 50k0 (1174-DM3503W0) now 20k0 (1174-DM3203W0) R93 was 4k75 (1150-3B4751FP) now 1k00 (1150-3B1001FP). • Added IF Buffer Board parts list.
	Aug 98		Type KS film capacitors have been obsoleted. replaced with the type KP film capacitors. C107, 108 were 825pF film, KS now 820pF, film. 107 was 475pF KS now 470pF.
	Oct 98	558	The new transformer (ATC Frost) dosen't need the teflon washers for installation. Removed washers, TFE 00361D 1/80D .02T from BOM.
	Jan 99		Corrected part number for L4 on the 21.4 MHz FM IF/Audio Main Board Electrical Parts List. (NarrowBand).
	Feb 99		Corrected part number for L3 on the Main Board Parts List.
	Jun 99	5012	The aluminum extrusions are no longer subcontracted parts. Case, 14HP RF plug-in, MT-3 RX was 3802-62501010 now 3702-62501010
	May 00	604	Widening the squelch window for RSS1 based squelch narrowband receivers. R24 was 49K9 now 6K81.
	June 00	608	To improve the attenuation of the lower frequencies when testing the audio response. replaced C98 (10uF) with a zero ohm jumper (R71).
	Feb 01	5073	RLY 1 is no longer optional, it is installed all the time.
	April 01	AR 319	Changed TP18 TP2 from 6.0 +/- 0.1vdc to 5.8 +/- 0.2vdc on Schematic.
	Sept 01	675	C110 was 33pF now 6.8pF C116 and C117 were 100nF now 330nF R84 was 22K6 now 681R.
	Jan 2002		Correct part description and part number for C101 to Surface Mount 1.0µF capacitor.
	Mar 02	707	The CFM 455D and CFM 455E are obsolete and replaced with CFWLA455KDFA and CFWLA455KEFA The Teflon washers are no longer required.
	May 02	708	• R93 changed value to provide squelch window tunable from 2 to 26db • R93 was a select value and now 100R.

Revision	Date	ECO	Description
3-0-0	Aug 03	---	New Revision Moved to new instruction manual format.
3-1-0	Jan 04	---	• Corrected error in Wide Band / Narrow Band parts list (columns reversed) • Updated Schematic Diagrams • Updated descriptions of Active and Passive IF Buffer Boards • Included parts list and diagrams for Passive IF Buffer Board
3-2-0	Jan 2005	829	• Update manual, drawings and parts lists.
3-3-0	Jun 2005	833	Updated front panel parts list. Removed reference to MT2 on schematic.