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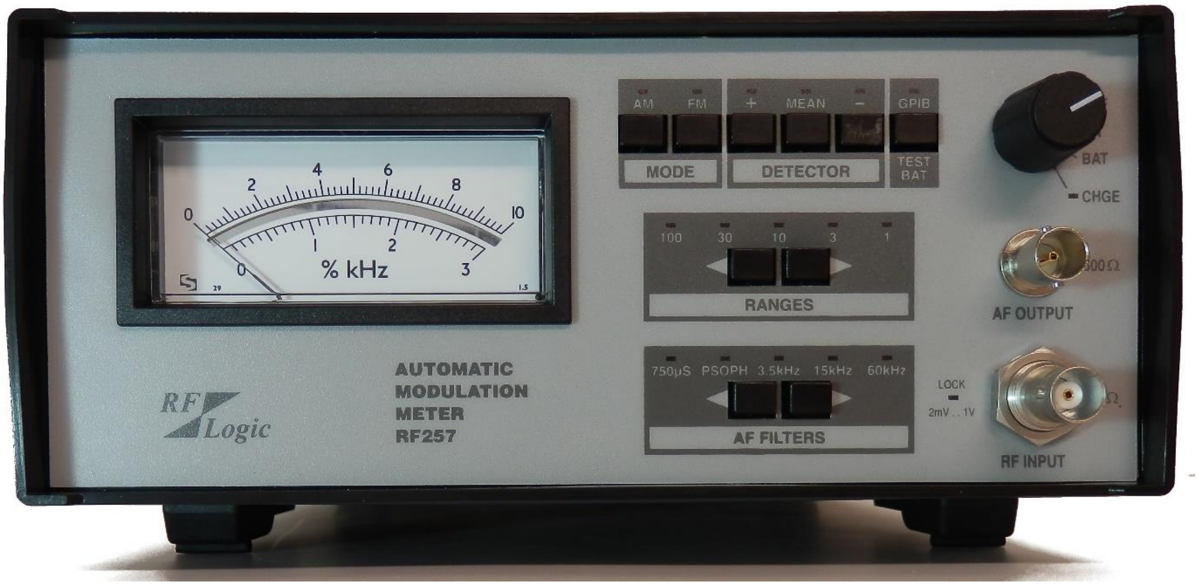
Electronic Product Design

Automatic Modulation Meter
Model RF257
Service Manual



Model RF257 Automatic Modulation Meter

The model RF257 modulation meter has been designed to simplify the task of modulation measurement. The model RF257 always locks to the highest level signal available, ignoring spurious signals and harmonics. AM and FM measurements can be made over the full frequency range of 1.5MHz to 2.0GHz. The unit operates usefully with reduced sensitivity to at least 4GHz.

FM measurement of peak positive, peak negative or mean deviation, with 5 deviation ranges from 1kHz to 100kHz full scale. AM measurement of peak, trough or mean in percentage modulation with 5 ranges from 1% to 100% full scale. The audio measurement bandwidth is selectable and the demodulated audio is available at the front panel. The IF is available on a BNC connector on the rear panel.

The unit is small and lightweight, making it ideal for the bench or field work, especially with the internal battery option installed.

Contents

Operating Instructions

Power Requirements.

AC MAINS OPERATION

WARNING

INCORRECT SUPPLY RANGE SELECTION COULD CAUSE SERIOUS DAMAGE TO THE INSTRUMENT

Two AC power ranges are available, 102V - 130V and 205V - 260V. Make sure any mains connection is removed from the unit. Remove the four bottom case screws and remove cover. Select the appropriate range on the mains selector switch. This is located adjacent to the mains transformer on the bottom PCB inside the instrument and is identified as W1. Replace bottom cove and screws.

Connect the power lead to the local AC supply socket. The instrument is switched on by switching the front panel rotary switch to 'ON'. The instrument is immediately ready for use; no warm-up time is required. At power on, the RF257 defaults to the FM 100kHz range with the mean detector and the 3.5kHz filter selected.

Input Signal.

Connect the signal source to the 'INPUT' socket, the 'LOCK' LED should immediately illuminate if the signal is within the range 2mV to 1V. The 'LOCK' LED shows that the instrument is correctly tuned to the incoming signal. The measuring circuits are inhibited when the 'LOCK' indicator is not lit. DO NOT APPLY MORE THAN 1V (2.8V p-p), the input circuitry will be damaged.

The instrument locks to the highest level signal applied to the input. It will not lock to a harmonic or other spurious signal provided that the intended carrier has the highest level signal and that it is within the specified frequency range. The tuning mechanism provides a continuous dynamic frequency lock that permits accurate modulation measurements to be taken even on a slowly sweeping carrier.

In general, the instrument provides good selectivity against interference from spurious signals. However, the broadband nature of the input circuit implies that the possibility of such interference cannot be completely eliminated. If it is suspected that a reading is being affected by high level interfering signals, make a check by disconnecting and reconnecting the signal source several times; any change in the modulation reading implies interference. Normal harmonic levels, even in the worst case, are unlikely to have any effect on measurements.

FM Measurement.

Select the FM mode with the 'MODE FM' pushbutton.

Select the appropriate 'RANGE' with the < > pushbuttons. Five ranges are available with full scale deviations of 1, 3, 10, 30 and 100kHz.

Select the required 'AF FILTER' with the < > pushbuttons. Five filter functions are available; three bandpass filters with nominal upper cut-off frequencies of 60kHz, 15kHz and 3.5kHz; a psophometric filter complying to the CCITT standard and a 750 µs de-emphasis network.

Select the required 'DETECTOR' mode with the '+', 'MEAN' and '-' pushbuttons. '+' gives peak positive deviation, '-' gives peak negative deviation and 'MEAN' gives the average of peak positive and peak negative deviations.

AM Measurement.

Select the AM mode with the 'MODE AM pushbutton.

Select the appropriate 'RANGE' with the < > pushbuttons. Five ranges are available with full scale modulation percentages of 1%, 3%, 10%, 30% and 100.0%. The demodulator is highly linear and allows accurate AM readings up to 100%.

Select the required 'AF FILTER' with the < > pushbuttons. Five filter functions are available; three bandpass filters with nominal upper cut-off frequencies of 60kHz, 15kHz and 3.5kHz; a psophometric filter complying to the CCITT standard and a 750 µs de-emphasis network.

Select the required 'DETECTOR' with the '+', 'MEAN' or '-' pushbuttons. '+' gives peak percentage modulation, '-' gives trough percentage modulation and 'MEAN' gives the average between the peak and trough modulation.

Internal Battery Operation (Option 03).

To operate from the internal battery, switch the front panel rotary switch to 'Bat'. This will give at least 8 hours of continuous use from a fully charged battery. The battery state during mains or battery operation can be determined by pressing the 'Bat Chk' pushbutton. A reading between 8 and 10 on the scale is required for normal operation. To charge the battery, switch the front panel rotary switch to 'Chge'. Allow 14 hours for a complete charge. A yellow LED shows that the battery is on charge. During normal mains operation the battery is trickle charged.

Demodulated Audio Output.

The demodulated audio output is available on the front panel via a BNC connector. This is a 600 Ω output impedance with a level of 0dBm for FSD.

IF Output.

The IF output is available on the rear panel via a BNC connector. This approximately 420kHz at a level of 100mV with a nominal 50 Ω output impedance.

RF257 Specification

RF Input

Frequency Range	1.5MHz to 2.0GHz and a useful response, with reduced sensitivity, to at least 4GHz.
Impedance	50 Ω nominal.
Level	2mV to 1V rms Full specification for noise, accuracy etc applies over the input range 10mV to 1.0V
Max Input	0.5W continuous.
Tuning	Automatic tuning selects the largest available signal. Correct operation requires spurious signals to be >10dB below the wanted signal.
Acquisition	Typically < 100ms. Settling time for the AF circuits is additional and is typically 1s for a reading > 75% of meter range.
L.O Feedout	-60dBm typically.

FM Measurement

FSD Ranges	Five ranges with full scale deviations of 1kHz, 3kHz, 10kHz,30kHz and 100kHz.
Modes	Peak Positive, Peak Negative and Mean deviation.
Accuracy	± 2% of Full scale ± 1% of reading with a 1kHz tone. See audio filter specification for additional error due to AF response. Residual FM is additional.
Residual FM	<20Hz at 100MHz <100Hz at 500MHz <200Hz at 1000MHz Measured with 3.5kHz AF bandwidth.
Distortion	<1% at 100kHz deviation with a 1kHz tone.

AM Measurement

FSD Ranges	Five ranges with full scale indications of 1%, 3%, 10%, 30%, 100%.
Modes	Peak, Trough and Mean of peak and trough.
Accuracy	± 2% of Full scale ± 2% of reading with a 1kHz tone. See audio filter specification for additional error due to AF response. Residual AM is additional.
Residual	AM <0.5% (15kHz bandwidth selected)
Distortion	<1% for 80% AM with a 1kHz tone.

Audio Filters

60kHz Filter	250Hz - 60kHz ± 0.5 dB 12Hz - 72kHz ± 3 dB typically. HF roll off at 80 dB/decade.
15kHz Filter	250Hz - 15kHz ± 0.5 dB 12Hz - 19.5kHz ± 3 dB typically. HF roll off at 60 dB/decade.
3.5kHz Filter	250Hz - 3.5kHz ± 0.5 dB 12Hz - 4.0kHz ± 3 dB typically. HF roll off at 100 dB/decade.
Psophometric	Complies with CCITT Volume V P53
De-emphasis	750µs de-emphasis. 3 dB bandwidth typically 12Hz - 212Hz. HF roll off at 12dB/decade.

Front Panel

AF Output	Front panel BNC. Level 0dBm approx. for FSD. Impedance 600 Ω nominal.
Display Type	Moving coil meter with 60mm mirror scale.
Overload	Fully protected against over-ranging.

Rear Panel

IF Output	Rear panel BNC. Level 100mV, 50 Ω nominal. Frequency is approximately 420kHz.

Power Requirements

AC Line	Internal selection of line voltage
115V	102V to 130V
230V	205V to 265V
Power	6VA Approx.
Frequency	48 to 60Hz.
Fuse	100mA fast blow on rear panel.

Environmental

Temperature

Operating	0°C to 55°C. Full specification over the range 5°C to 45°C.
Storage	-20°C to 55°C.
Humidity	Max 95% RH at 30°C.

Mechanical

Size	H105, W215, D305 mm
Weight	Approx. 1.7kg. Approx. 2.6kg with battery option.

Internal Battery (Option -03)

Discharge Time	>8 hours. Typically, 10 hours for a fully charged battery.
Recharge Time	14 hours.
Battery Test the display. A	Pressing the Bat Chk push button displays the battery condition on reading of between 8 and 10 is required for normal operation.
Fuse	1A slow blow on rear panel.

Technical Description

Introduction

The 257 technical description comprises a system description followed by a circuit description of each subassembly. The circuit description shows how the particular system functions are achieved.

System Description.

RF System.

The RF input is applied to a sampling mixer. This mixer allows a wide range of RF carrier frequencies to be covered with a single local oscillator of modest tuning range. The mixer is tolerant to overloading and is very linear. The lowest RF carrier frequency is determined by the fundamental frequency range of the local oscillator (L.O.). The highest RF carrier frequency is determined by the harmonics in the very narrow (250 picoseconds) sampling pulse. An incoming signal causes the L.O. frequency to change until the mixer output is at IF (420kHz), when the L.O. is locked.

The mixer output is fed via a buffer, a 1.5MHz low pass filter (to remove L.O. and RF carrier frequencies), and an a.g.c. stage to the IF amplifier.

The L.O. is controlled by a broadband phase sensitive detector which locks the oscillator to the highest amplitude signal in the IF passband via an integrator system

AM Demodulation.

The IF output is fed via a band pass filter which allows all relevant modulation side bands to pass to the AM demodulator

The AM demodulator is an active mean detector and is highly linear. The demodulated AF signal is fed to the AF Board and is also used to control the a.g.c. system.

FM Demodulation.

The FM demodulator is of the pulse integrating type and is highly linear. The output consists of twin current sources of opposite polarity.

The effective L.O. frequency (particular L.O. harmonic) may be above or below the RF carrier frequency, and this affects the sense of the IF deviations. A phase switch selects the output from the demodulator which is appropriate for the particular L.O. frequency.

Frequency Locking System

An output from the IF amplifier is limited to remove any AM. Normal and inverted outputs from the limiter are applied to a phase shifting network. An output from the centre of the network plus one of the inputs is fed to a phase sensitive detector. The detector is balanced when the two inputs are in quadrature, i.e. when the phase shifting network is at resonance (420kHz).

When the IF deviates from 420kHz, the phase sensitive detector is driven off balance, in a direction determined by the state of the phase switch. This causes the integrator voltage to rise or fall, as appropriate to adjust the L.O. frequency to bring back the IF to 420kHz.

To prevent the integrator saturating, a comparator circuit detects when the oscillator tuning voltage has exceeded the desired range. The comparator output triggers a monostable which resets the integrator to within the control range.

If the phase of the feedback is incorrect, the local oscillator will be moved away from the required frequency. The comparator will then operate and the monostable will clock a bistable; this reverses the phase of the reference signal into the phase discriminator, and also selects the appropriate FM demodulator output.

Lock Indication

A comparator inhibits the lock action if the a.g.c. voltage goes out of the proper operating range. A detector and comparator combination measures the signal level at the phase shifting network and inhibits the lock indication if an IF signal at 420kHz is not present. Besides controlling the lock indicator, the lock signal also inhibits the input to the AF system and disables the peak and trough detectors.

AF System

The required AM or FM audio signal is selected by a switch and fed through a 60kHz LPF which feeds a 15kHz LPF which feeds a 3.5kHz LPF which feeds into a pshophometric filter. The 60kHz LPF also feeds into a deemphasis circuit. The outputs from these filters are selected by a switch and fed into a switched gain stage with gains of x1 or x10 and x1, x3.3 or x10.

The switched gain stage output is fed through a 25Hz high pass filter (to remove any sub-audio components) to the audio detectors.

The peak and trough of the AF signal are separately detected. Switches at the output select the measurement mode:peak, trough and the mean between peak and trough. This drives the meter.

Circuit Description.

The following descriptions should be read in conjunction with the circuit diagrams which are located in section 8 of this manual.

RF Circuit

The sampling mixer D4 to D7 is fed from the L.O. via the driver amplifier T65 to T68, and the pulse generator using step recovery diode D3 and L9.

The FET buffer stage T1 prevents loading of the mixer. Inductor L2 with C5 to C7 form the 1.5MHz low pass filter and T2 is the gain control stage.

The IF amplifier comprises the FET input stage T3, emitter-coupled pairs T4, T5 and T6, T7 and tuned stage T10 driven by T8. The output to the limiter of the L.O. control system is provided by T9.

The filter (L3, C18, L4, L5 and C19) feeds the detectors and the driver (T11) for the IF socket. VR5 adjusts the filter shape for minimum AM on FM.

The AM demodulation is performed by transistors T12 and T14, with bias control provided by T13. The demodulator outputs appear as currents of opposite polarity. One is converted to a voltage by VR3 with T15 and is fed to the AF Board; VR3 sets the AM output amplitude. The other output is applied to C22, which is backed off by the a.g.c. reference current source (T17 to T19); VR6 sets the a.g.c. threshold. The potential on C22 is applied to the a.g.c. control FET T2. If the level of the IF signal applied to the demodulator is not correct the current into C22 will be greater or less than the back off current, and the signal level into the IF amplifier will be controlled accordingly.

The signal at T13 collector is a clipped version of the IF and feeds the limiting amplifier T25 to T27, C25, T28, T29 form a monostable with emitter current controlled by T32. VR4 controls the clipping level, which thus sets the FM demodulator output amplitude.

The pulse outputs at the collectors of T28, T29, are of opposite phase. When T31 is on, the output is fed via D19 and when T31 is off, the output is fed via D20.

Transistor T41 with associated diodes clips the IF signal to remove any AM and the clipped signal is applied to C33 of the series tuned circuit C33, L6. T42 provides an anti-phase signal which is applied to the other end of the tuned circuit (L6). Bistable ICI via T43 selects at TP3 either the in-phase or the anti-phase signal (at D27, D28) to be applied to the phase detector, with the quadrature signal at TP4 from the centre of the tuned circuit (C33/L6).

The phase detector consists of two series current switches, T44 controlled by T56, and T57 controlled by T55. The output current feeds the 'current mirror' circuit T51 and T52. Preset controls VR1 and VR2 set the gain and offset respectively. The current output is fed through the composite amplifier T58, T60, T61, T62, to the integrator capacitor C45 and via L12, L8, L7 to the varicap diodes D1, D2, D22, D23 causing the L.O. frequency to change.

The tuning voltage is monitored at the dual comparator T59, T54, T53. When the voltage is outside the normal range, monostable T47, T46 is triggered which, in turn, clocks the ICI. Also, the reset circuit T48 to T50 operates to reset the integrator at T58 base.

Transistors T20, T21 act as a dual comparator to detect if the a.g.c. voltage is within the working voltage range. Diodes D14, D21 detect the presence of a 420kHz IF signal at the tuned circuit C33/L6. This is combined with the a.g.c. detector output through D13, and is converted to a logic signal by T22, T23 to switch the Lock line and Lock LED.

AF Circuit

The audio inputs are fed via analogue switch U1a which selects AM or FM into the active filter U2a, U2b. This is a 3 pole 60kHz low pass filter with a gain of approximately 2.5. Trimmer CV1 is adjusted to give the 60kHz filter a flat response (within 0.5dB) to 60kHz. The output is fed into the analogue 8 input switch U4 and to the input of a 15kHz low pass filter U2c. The output of this filter is fed to the switch U4 and the input of a 3.5kHz low pass filter U2d and U3a. The output of the second stage (U3a) is fed to the analogue switch U4 and both first and second stage outputs feed the psophometric filter U3b and U3c. Potentiometer RV2 is used to adjust the gain of the psophometric filter to unity at 800Hz. The output of this filter is also fed into the analogue switch U4. The 60kHz filter output is also used to feed into de-emphasis filter R6, C9 to give 750µS de-emphasis. This along with three test points at various points along these filters is fed into the analogue switch U4.

Control of the analogue switch U4 is from U18 which has inputs from the front panel controls.

The analogue switch output U4 feeds an amplifier U3d which is selectable x1/x10. This feeds an amplifier U5a which has a gain of x1. These two gains are used to give the 10 and 100 ranges; driven by U15a, U15b and U15c which has inputs from the front panel as before. The output of this series of amplifiers is fed through a 25Hz active high pass filter U5b. The signal is then further amplified (U5c) to provide a 0dBm AF output from 600ohms (R33, R34 in parallel).

The output of U5c is then attenuated by R35 and R36 to be an equal in amplitude but inverted, version of the output of U5b. Potentiometer RV4 sets the amplitude to be identical. These two outputs feed the two peak detectors U6d, U16a, U6a and U6b, U16b, U6c. They are both the same: but since the output from U5c is an inverted version of U5b the upper one is in the peak mode and the lower one is the trough mode. If the input on U6 pin 10 exceeds the output voltage on U6 pin 9, then comparator U6d charges up C28 through R39 and D2. The voltage across R39 and C28 is buffered by voltage follower U6a, which feeds the output to switch U7 and the comparator U5d. This is speeded up by D1 and R40.

The long discharge time constant is provided by R41. Analogue switch U16a quickly discharges the hold capacitor C28 when the RF board is unlocked. A small negative offset voltage is provided by R47/R48 to override the op-amp U6a offset, and the overall offset is trimmed out by potentiometer RV5.

Analogue switch U7 selects either peak/trough/mean (via R42, R50) or the battery test voltage (adjusted with potentiometer RV10). The switch output is buffered to drive the meter.

The lock detector indicator input is on P4 pin 6. This is buffered and inverted and used to disable switches U1 and U4 when not locked.

Front panel lock LED drive is provided by U10a, U1b. The filter LEDs are driven from U12a and U10c which are decoded from the control lines. The range LEDs are driven from U12b and U10d which are decoded from the control lines. The AM and FM LEDs are driven from U13a and the peak/ trough/mean LEDs are driven from U13b.

Front panel switch decoding for the filters is done in the form of up/down buttons by U14, U18 and U25. The ranges are done in the same way by U14, U25 and U20. U20 also decodes the FM/AM and peak/mean/trough switches.

The mains transformer has two secondaries feeding a bridge rectifier, to generate positive and negative rails. On battery versions the positive regulator U21 is switched by W2 between 12.0 and 14.0V (in the charge mode). The potentiometer RV8 sets the actual voltages. The charge current is limited to about 150mA by R76.

When the unit is run from the battery the +12V rail is fed directly from the battery (i.e. unregulated) via W2c. The -15V rail is generated by an isolated inverter block XX1. The negative output is switched via W2a into the -12V regulator U22. The rails also feed regulators U23 and U24 to generate +5V and -5V respectively.

On mains only versions U21 is replaced with a LM2940 regulator which is a low drop out voltage +12V regulator. R76 is replaced with a link.

Control Lines

Tables follow to show decoding for FSD Ranges R1, 2, 3, AF Filters F1, 2, 3, Detectors D1, 2.

RANGE CONTROL LINES					
R3	R2	R1	FSD	U3d Gain	U5a Gain
0	0	0	1kHz	x10	x10
0	0	1	3kHz	x10	x3.3
0	1	0	10kHz	x1	x10
0	1	1	30kHz	x1	x3.3
1	0	0	100kHz	x1	x1

FILTER CONTROL LINES			
F3	F2	F1	Filter
0	0	0	60kHz Bandpass
0	0	1	15kHz Bandpass
0	1	0	3.5kHz Bandpass
0	1	1	Psophometric Filter
1	0	0	750µs De-emphasis
1	0	1	Test Point (15kHz)
1	1	0	Test Point (3.5kHz)
1	1	1	Test Point (Psophometric)

DETECTOR CONTROL LINES		
D2	D1	Detector Mode
0	0	Mean (of peak and trough or positive and negative)
0	1	Trough or negative deviation
1	0	Peak or positive deviation
1	1	Battery volts (Option)

Calibration

Test Equipment Required

1. Digital Voltmeter (DVM); ≤ 10M ohms input impedance.
2. 30MHz Oscilloscope with x10 probe.
3. 10MHz Frequency Counter.
4. Signal Generator, 1 - 2GHz (AM/FM/CW)
5. Signal Generator, 1 - 100MHz, AM/FM
6. Variable modulation frequency, 10Hz - 100kHz. FM 0 - 100kHz peak. AM 0 - 100%
7. AF Level Meter and distortion analyser.
8. Frequency Difference Meter and Reference Oscillator (Frequency Difference Method) or:-
9. Spectrum Analyser (Bessel Zero Method)
10. Ammeter, 0 to 500mA (Battery version only)

AF Board Test

IMPORTANT NOTICE
THIS BOARD HAS MAINS VOLTAGES ON IT.
TAKE CARE.

PSU Test

Set mains selector to 230V input. Monitor P5 pin 11 with oscilloscope or DVM, earth end to pin 16 of P5. Connect variac, set to zero output, to mains input. Switch unit on. Slowly increase the variac output and check that the voltage measured regulates at between +11.5V to +12.5V.

Check	pin 12 of P5	+5V
	pin 13 of P5	- 5V
	pin 14 of P5	-12V

Front Panel Interface Tests

Connect front panel board and check for normal response of switches and LEDs. Switch power off and then back on. Unit should power on set to FM, 100kHz range, 3.5kHz filter and Mean detector.

Set Potentiometers on AF Board

Select FM, range 100kHz, 3.5kHz filter, Mean detector and disconnect the RF Board at P4.

Monitor U7 pin 3 with DVM. Select "peak" (+) and adjust RV5 for 0.000V. Select "trough" (-) and adjust RV6 for 0.000V. Select "mean" and check reading is 0.000V.

Feed audio signal into P4 pin 1 at 800Hz. Select trough (-) and adjust AF level to read 1.000V on the DVM. Select peak and adjust RV4 to read the same. Select mean and check for

1.000V. Adjust RV7 for a reading of 10 on meter. (Meter should be horizontal and the correct way up to allow for balance of meter.)

Connect the RF board to P4. Connect signal generator (Item 5) to the RF257 RF I/P. Adjust the FM modulation to 100kHz at 800Hz AF. Attenuate the audio input until the DVM reads 0.300V. Select the 30 range and adjust RV11 for the DVM to read 1.000V

Attenuate the audio input until the DVM reads 0.333V. Select the 10 range and adjust RV10 for 1.000V

Attenuate the audio input until the DVM reads 0.300V. Select the 3 range and adjust RV3 for 1.000V on the DVM.

Attenuate the audio input until the DVM reads 0.333V. Select the 1 range and check for 1.00V ± 20mV

Select 100 range and adjust the AF input so that the DVM reads 1.000V. Select the psophometric filter and adjust RV2 for 1.000V on the DVM.

FM 60kHz Bandpass

Select ranges as follows:

FM 100kHz Mean 60kHz filter

Use the signal generator (item 5) to inject into the unit an RF signal deviated 80kHz at a 1kHz rate. Swing the AF from 20Hz to 70kHz and check that the reading on the meter remains within ± 0.5dB over the range 25Hz to 60kHz. Adjust CV1 to achieve this.

NOTE. 0.5dB = 2.5 divisions or 5% of reading

FM 15kHz Bandpass

Select 15kHz filter. Swing the AF from 20Hz to 20kHz and check that the reading remains within ± 0.5dB over the range 25Hz to 15kHz. The reading must fall by more than 0.5dB at 20kHz.

FM 3.5kHz Bandpass

Select 3.5kHz filter. Swing the AF from 20Hz to 4kHz and check that the reading remains within ± 0.5dB over the range 25Hz to 3.5kHz. The reading must fall by more than 0.5dB at 4kHz.

AM 60kHz Bandpass

Select ranges as follows:

AM 100% Mean 60kHz filter

Use the signal generator (item 5) to inject into the unit an RF signal amplitude modulated 80% with 1kHz audio. Swing the AF from 20Hz to 70kHz and check that the reading on the meter remains within ± 0.5dB over the range 25Hz to 60kHz. Adjust CV1 to achieve this.

AM 15kHz Bandpass

Select 15kHz filter. Swing the AF from 20Hz to 20kHz and check that the reading remains within ± 0.5dB over the range 25Hz to 15kHz. The reading must fall by more than 0.5dB at 20kHz.

FM 3.5kHz Bandpass

Select 3.5kHz filter. Swing the AF from 20Hz to 4kHz and check that the reading remains within ± 0.5dB over the range 25Hz to 3.5kHz. The reading must fall by more than 0.5dB at 4kHz.

Psophometric Filter

Select psophometric filter and set the AF to 800Hz. Monitor the AF output socket with an AF level meter (Item 6) set to ac dB, or use the DVM (Item 1) set to dB measurement. Select relative mode on AF meter or dvm to zero reading.

Check the AF response against the following table.

Freq Hz	Level dB Min	Level dB Max
800	-0.1	+0.1
600	-3.0	-1.0
500	-4.6	-2.6
400	-7.3	-5.3
300	-12.6	-8.6
200	-23.0	-19.0
150	-31.0	-27.0
100	-43.0	-39.0
1000	0.0	+2.0
1200	-1.0	+1.0
1500	-2.3	-0.3
2000	-4.0	-2.0
2500	-5.1	-3.1
3000	-7.6	-3.6
3500	-11.5	-5.5
4000	-18.0	-12.0
5000	-39.0	-32.0

De-Emphasis

Select 3.5kHz filter. Set AF to 1kHz. Select relative mode to zero AF meter or DVM reading. Select de-emphasis filter and check reading falls by between 13 and 14dB.

RF Board Test

Discriminator

Connect the signal generator, set to 1.5MHz at 0dBm level, to the INPUT socket. Connect the oscilloscope (item 2) using the x10 probe to TP5 (RF Board). Set the oscilloscope to 5V/cm DC. and increase the signal generator frequency to obtain the first lowest DC level on the oscilloscope (2.3MHz approx.). Remove the oscilloscope probe. Connect the frequency counter (item 3) to the IF OUTPUT socket and record the frequency.

Replace the x10 probe on TP5 and increase the signal generator frequency until a second low is found (3.2MHz approx.). Again, remove the probe and record the frequency at the IF output using the frequency counter.

Subtract the frequency counter readings obtained in (a) and (b) and divide the difference by 2. Adjust RV2 (RF Board) to alter the IF by the amount just calculated so that both the low points produce the same IF.

Reduce the signal generator frequency to 2MHz, reconnect the oscilloscope to TP5, and then adjust to find the first highest DC level (2.3MHz approx.). Disconnect probe and measure IF with frequency counter. Reconnect probe and then look for the second highest DC level (3.2MHz approx.).

Calculate the difference between the highest readings and divide by 2. Adjust RV1 (RF Board) to alter the IF by the amount just calculated so that both the high points produce the same IF.

If necessary, repeat the settings of (a) to (e) four or five times until both upper points are the same and both lower points are the same. The IF should then be between 400 and 480 kHz with a maximum of 5 kHz difference between the two upper points and between the two lower points; and a maximum of 10 kHz between the upper and lower points.

Lock LED

Connect the oscilloscope to TP1 (RF Board). Connect the signal generator, set to give 50mV at 5MHz, to the INPUT socket. Reduce output of signal generator until the a.g.c. at TP1 falls. Increase the level slightly until the voltage just rises, this should occur between 1mV and 2mV. Adjust RV6 (RF Board) until the Lock LED extinguishes and then bring it back slightly so that the LED is on. Note that the Lock LED should come on as the a.g.c. rises.

Set the signal generator to 1MHz and then increase the frequency until the Lock LED is fully illuminated; this should occur at a frequency of less than 5MHz.

Connect the oscilloscope to the junction of R1, R2 (input). Set the signal generator to 5MHz and then increase the signal level until the Lock indicator extinguishes; this should not occur until 2.8V p-p is reached on the oscilloscope. If 2.8V p-p is not reached increase the value of R7 and recheck.

AM Demodulator

Connect the calibrated signal generator* to the INPUT socket and set it to give 90% AM at a 1kHz rate. Adjust RV3 (RF Board) for a meter reading of 9 on the upper scale (mean mode still selected).

Tuned Circuit Adjustments

Connect the signal generator to the INPUT socket, set to give 100kHz deviation at a 1kHz rate. Connect the oscilloscope to the AF OUTPUT socket and set it to 0.1V/cm. Press the AM and 10 pushbuttons. Adjust RV5, L3 and L6 for a minimum reading on the oscilloscope or on the meter.

Connect a calibrated signal generator to the INPUT socket and set it to give 100kHz deviation at a 1kHz rate. Adjust RV4 (RF Board) for 100kHz on meter.

*If an accurately calibrated standard signal generator is not available, the following procedures should be used.

AM Calibration

The most accurate method of AM calibration is to set up 100% AM at 1kHz rate in the RF source by using the oscilloscope to set the AM trough to exactly zero. This setting is not dependent on the oscilloscope linearity. Note that it is valid to perform this setting operation by observing the IF output (420kHz). Set the AM Cal.Pot. (RV3 on RF Board) for 100% AM reading (Mean). If the modulation on the RF source is linear there will be no significant difference between Peak and Trough (less than 0.5%). Modulation depths of less than 100% may be used for calibration but achieving an accurately known depth of AM is more prone to error.

FM Calibration

Setting up a known FM deviation on the RF source may be achieved in several ways. Two simple methods are as follows:

Bessel Zero Method

This method involves the use of a selective receiver (preferably a spectrum analyser) to observe the nulling of the carrier or sidebands that occurs at known ratios of peak deviation to modulation rate. Suggested conditions are, set the modulation rate to exactly 1kHz (± 1Hz). Observe the level of the carrier frequency with the deviation at zero: Increase deviation until the third null of the carrier is reached and set the deviation to achieve a carrier null of 50dB or better. This setting corresponds to a deviation of 8.65kHz. Set the FM Cal.Pot. (RV4 on RF Board) to this reading on the 10kHz range, with Mean selected. Note that it is valid to observe the IF spectrum as well as the RF spectrum.

Frequency Difference Method

Connect the RF source and a reference oscillator of the same nominal carrier frequency to the inputs of the Frequency Difference Meter. With the deviation at zero, tune the reference oscillator for minimum reading on the meter (no greater than a few kHz). With a 1kHz modulation rate, increase deviation, which will cause the difference reading to rise. The difference reading corresponds to the average frequency deviation and for sinusoidal modulation is related to the peak deviation by a factor of / 2 = 1/0.636. Hence a frequency difference of 63.6kHz corresponds to a peak deviation of 100kHz. The calibrated RF source is now applied to the 257 and the FM Cal.Pot. (RV4 on RF Board) adjusted for correct reading on the appropriate range. A frequency counter driven from the filtered output of a mixer may be substituted for the Frequency Difference Meter, the RF source and reference being connected to the mixer input.

Additional Checks

Test and check to the instrument against the following table :-

MONITOR	TEST ITEM	INPUT	NOTES
AF Output	Distortion Analyser	40MHz, 80kHz FM at 1kHz	With all covers fitted, check distortion <1%
AF Output	Distortion Analyser	40MHz, 80% AM at 1kHz	With all covers fitted, check distortion <1%
AF Output	AC Voltmeter	40MHz, 100% AM at 1kHz	Switch off modulation. Check reading falls >50dB
AF Output	AC Voltmeter	40MHz, 100kHz FM at 1kHz	Switch off modulation. Check reading falls >50dB
-	-	2GHz unmodulated <1mV	Increase level until the lock LED lights. This should be <2mV
-	-	1GHz clean unmodulated signal	Check residual FM on meter <200Hz

Battery Tests (Option 03)

NOTE: DISCONNECT BATTERY IF FITTED

Connect a DVM and a dummy battery, a 2200uF 25V electrolytic capacitor with a 1K resistor shunted across it, across the output connections from the PCB to the battery. Switch the unit to 'charge' and set RV8 for 14.0V on the DVM. Check the yellow charge LED illuminates.

Switch unit to 'use mains' and connect an ammeter across the output connections to the battery from the PCB. Check the measured current is 15mA approx. Switch unit to 'charge' and check current is 180mA approx. NOTE: Do not leave in this mode for more than a few seconds as heatsink will get overly hot.

Connect a variable PSU to the disconnected battery wires set to +12.0V. Switch the unit to 'use battery' and check that the unit operates.

Measure	pin 11 of P5	+12V
	pin 12 of P5	+ 5V
	pin 13 of P5	- 5V
	pin 14 of P5	-12V

Check the unit will operate correctly over the range + 11.0V to + 14.0V.

Battery Monitor

Set the PSU voltage to 11.0V. Press the Batt Chk switch and adjust RV9 to give a reading of 8 on the meter.

Switch off the RF257 and reconnect the battery wires to the battery. Make sure the red wire goes to the positive of the battery.

Parts Lists

RF257-03 Complete Unit

Ref	Part No	Details	Per	Ref	Part No	Details	Per
A1	1004	Special Lead Assembly (257)	1	A13	1290	A4 Cover Boards	1
A2	1007	N04x1/4" Selftap 'B'Pan Hd BZP	8	A14	2199	Foam Spacer	8
A3	1013	12V 1.9Ah Sealed Battery	1	A15	2797	RG178BU Coaxial Cable	40
A4	1039	Instrument End Moulding	1	A16	520.135	6A 250V Cord set BLACK	1
A5	1080	255/7 RF PCB Cover Drg.890.506	1	A17	610.103	M3 X 6 Pan Hd. Pozi B.Z.P. Screw	10
A6	1089	12mm Flush Head Studs	6	A18	610.111	M3 B.Z.P. Nut	6
A7	1092	Battery Clamp Drg.890.511	2	A19	620.121	Rivit 1/8"	2
A8	1096	255/7 Rear Panel Drg.890.520	1	A20	620.122	Spire Clip for No6 UNC screws	4
A9	1099	255/7 Rear Panel Graphic Label	1	A21	900.303	257-03 AF Board (Complete)	1
A10	1101	No6x3/8" CSK Pozi	8	A22	900.308	255/7 Chassis Module	1
A11	1119	Insulated BNC Bulkhead socket	1	A23	900.310	257-03 Front Panel Module	1
A12	1193	257 Operators Handbook	1	A24	RF115v03	RF Board Assembly	1

900.308 Chassis Module

Ref	Part No	Details	Per	Ref	Part No	Details	Per
A1	1007	N04x1/4" Selftap 'B'Pan Hd BZP	1	A7	1194	5/32 X 3/8 Rivet	4
A2	1081	257 Centre Tray Drg.890.503	1	A8	610.112	M3 Solder Tag	1
A3	1086	255/257/267 Side Member	2	A9	620.121	Rivet 1/8"	6
A4	1087F	255/257 Top Cover Painted	1	A10	640.142	Folding feet type A (Set of 2)	1
A5	1088F	255/257 Bottom Cover Painted	1	A11	640.143	Fixed feet type A (Set of 2)	1
A6	1090	M3 x 8 PEM Standoff	10				

900.310 Front Panel Module

Ref	Part No	Details	Per	Ref	Part No	Details	Per
A1	900.132	257 Front Panel Board Assembly	1	A10	1079	257 Front Panel Drg.890.501	1
A2	330.140	Batt Version Switch assembly	1	A11	1039	Instrument End Moulding	1
A3	330.142	255/7 RF Input Lead	1	A12	530.106	BNC Bulkhead Socket 50ohm	1
A4	330.150	Earth lead assembly	1	A13	1100	Sifam cap,lined,black	1
A5	1002	1mA Meter	1	A14	640.112	Sifam collet knob,15mm	1
A6	2260	M3 x 10 Flush Head Stud	6	A15	610.111	M3 B.Z.P. Nut	2
A7	2902	M3 x 8 Hex Spacer	4	A16	610.119	M3 Plain Washer	4
A8	1091	257 RF Logic Graphic Label	1	A17	620.122	Spire Clip for No6 UNC screws	4
A9	2406	M3 x 6 Pan Head Pozi Screws	4				

900.132 Front Panel PCB Assembly

Ref	Part No	Details	Per	Ref	Part No	Details	Per
PCB	2899	257 Front Panel bare PCB	1	D18	420.102	L.E.D. HE Red 3mm	1
A1	660.112	Wire 7/0.2mm PVC 1.2mm Black	10	D19	420.102	L.E.D. HE Red 3mm	1
A2	660.114	Wire 7/0.2mm PVC 1.2mm Red	10	R1	130.127	680R Metal Film 250mW	1
A3	1209	3.2mm Fork Terminal Crimp	2	R2	130.107	820R Metal Film 250mW	1
A3	2901	8.6mm LED Standoff	18	R2	130.107	820R Metal Film 250mW	1
D1	420.107	L.E.D. Yellow 3mm	1	R4	130.107	820R Metal Film 250mW	1
D3	420.102	L.E.D. HE Red 3mm	1	R5	130.107	820R Metal Film 250mW	1
D4	420.102	L.E.D. HE Red 3mm	1	R6	130.107	820R Metal Film 250mW	1
D5	420.102	L.E.D. HE Red 3mm	1	R7	130.107	820R Metal Film 250mW	1
D6	420.102	L.E.D. HE Red 3mm	1	S1	330.149	257 40 way lead Assembly	1
D7	420.102	L.E.D. HE Red 3mm	1	W1	2119	Switch Push-Button	1
D8	420.102	L.E.D. HE Red 3mm	1	W2	2119	Switch Push-Button	1
D9	420.102	L.E.D. HE Red 3mm	1	W3	2119	Switch Push-Button	1
D10	420.102	L.E.D. HE Red 3mm	1	W4	2119	Switch Push-Button	1
D11	420.102	L.E.D. HE Red 3mm	1	W5	2119	Switch Push-Button	1
D12	420.102	L.E.D. HE Red 3mm	1	W6	2119	Switch Push-Button	1
D13	420.102	L.E.D. HE Red 3mm	1	W7	2119	Switch Push-Button	1
D14	420.102	L.E.D. HE Red 3mm	1	W8	2119	Switch Push-Button	1
D15	420.102	L.E.D. HE Red 3mm	1	W9	2119	Switch Push-Button	1
D16	420.102	L.E.D. HE Red 3mm	1	W10	2119	Switch Push-Button	1
D17	420.102	L.E.D. HE Red 3mm	1				

900.303 AF Board Assembly

Ref	Part No	Details	Per	Ref	Part No	Details	Per
PCB	710.160	255/257 AF PCB	1	C12	210.109	120pF Ceramic Plate 2% 100V	1
FX4	1006	No6x5/16"Selftap 'B'Pan Hd BZP	4	C13	5031	10nF Capacitor 50V 2% PPS Film	1
H1	1016	16/0.2 Black Wire	15	C14	5030	18nF Capacitor 50V 2% PPS Film	1
H2	1018	16/0.2 Red Wire	15	C15	5032	1n5F Capacitor 50V 2% PPS Film	1
BT	1098	0.25in Female Spade Connector	2	C16	5025	27nF Capacitor 50V 2% PPS Film	1
FX5	1189	Cardboard Shield 0.5 mm thick	65	C17	210.119	470pF Ceramic Plate 10% 100V	1
P4	1011	6 Way Header Harwin M20 Series	1	C18	210.118	220pF Ceramic Plate 2% 100V	1
W2	1011	6 Way Header Harwin M20 Series	2	C19	5033	100nF Capacitor 50V 2% PPS Film	1
CV1	1001	5.5-50pF Ceramic Trimmer	1	C20	5031	10nF Capacitor 50V 2% PPS Film	1
L3	1188	Link (Sleeve+tcw)	1	C21	5033	100nF Capacitor 50V 2% PPS Film	1
C1	210.128	560pF Ceramic Plate 2% 100V	1	C22	5027	22nF Capacitor 50V 2% PPS Film	1
C2	5024	47nF Capacitor 50V 2% PPS Film	1	C23	5031	10nF Capacitor 50V 2% PPS Film	1
C3	210.128	560pF Ceramic Plate 2% 100V	1	C24	5031	10nF Capacitor 50V 2% PPS Film	1
C4	5024	47nF Capacitor 50V 2% PPS Film	1	C25	5024	47nF Capacitor 50V 2% PPS Film	1
C5	220.123	1n2F Polystyrene 5% 160V	1	C26	5024	47nF Capacitor 50V 2% PPS Film	1
C6	2062	100p NP0 Capacitor 50V 0603	1	C27	260.103	1u0 Capacitor Tantalum 35V	1
C7	2062	100p NP0 Capacitor 50V 0603	1	C28	260.103	1u0 Capacitor Tantalum 35V	1
C8	210.126	180pF Ceramic Plate 2% 100V	1	C29	260.103	1u0 Capacitor Tantalum 35V	1
C9	5033	100nF Capacitor 50V 2% PPS Film	1	C30	260.103	1u0 Capacitor Tantalum 35V	1
C10	5032	1n5F Capacitor 50V 2% PPS Film	1	C31	240.107	100nF X7R MCL 50V	1
C11	5029	6n8F Capacitor 50V 2% PPS Film	1	C32	240.107	100nF X7R MCL 50V	1

Ref	Part No	Details	Per	Ref	Part No	Details	Per
C33	240.107	100nF X7R MCL 50V	1	D3	410.102	1N4148 GP Diode	1
C34	240.107	100nF X7R MCL 50V	1	D4	410.102	1N4148 GP Diode	1
C35	240.107	100nF X7R MCL 50V	1	D5	410.102	1N4148 GP Diode	1
C36	5031	10nF Capacitor 50V 2% PPS Film	1	D6	410.102	1N4148 GP Diode	1
C37	1063	1000uF 35V Radial Electrolytic	1	D7	1371	1N4002 Diode	1
C38	250.103	220nF Polyester 5% 100V	1	D8	1371	1N4002 Diode	1
C39	270.102	47uF 35V Axial Electrolytic	1	D9	1371	1N4002 Diode	1
C40	270.121	470uF 35V Radial Electrolytic	11	D10	1371	1N4002 Diode	1
C41	250.103	220nF Polyester 5% 100V	1	D11	410.102	1N4148 GP Diode	1
C42	260.101	10uF Capacitor Tantalum 25V	1	D12	1371	1N4002 Diode	1
C45	240.107	100nF X7R MCL 50V	1	D15	410.102	1N4148 GP Diode	1
C46	270.102	47uF 35V Axial Electrolytic	1	D16	410.102	1N4148 GP Diode	1
C48	260.101	10uF Capacitor Tantalum 25V	1	FX1	610.120	M3 x 10 Pan HD Pozi B.Z.P. Screw	3
C49	260.101	10uF Capacitor Tantalum 25V	1	FX2	610.111	M3 B.Z.P. Nut	3
C50	5027	22nF Capacitor 50V 2% PPS Film	1	FX3	610.118	M3 Crinkle B.Z.P. Washer	3
C52	260.104	22uF 16V Tantalum	1	FX6	650.126	Heatsink (Redpoint TV1505)	1
C53	240.107	100nF X7R MCL 50V	1	FX7	650.112	TO-220 Insulating Kit	2
C54	240.107	100nF X7R MCL 50V	1	H3	660.141	Wire Green/Yellow 24/0.2mm	8
C55	240.107	100nF X7R MCL 50V	1	H4	660.116	Wire 7/0.2mm PVC Yellow	14
C56	240.107	100nF X7R MCL 50V	1	M1	610.112	M3 Solder Tag	1
C57	240.107	100nF X7R MCL 50V	1	P2	520.177	Fixed Main Inlet P.C.B. Type	1
C58	240.107	100nF X7R MCL 50V	1	P3	520.202	40way Low Profile box Header	1
C59	240.107	100nF X7R MCL 50V	1	R1	130.103	1M0 Metal Film 250mW	1
C60	240.107	100nF X7R MCL 50V	1	R2	130.134	6K8 Metal Film 250mW	1
C63	240.107	100nF X7R MCL 50V	1	R3	130.134	6K8 Metal Film 250mW	1
C64	240.107	100nF X7R MCL 50V	1	R4	130.141	8K2 Metal Film 250mW	1
C65	240.107	100nF X7R MCL 50V	1	R5	130.141	8K2 Metal Film 250mW	1
C66	240.107	100nF X7R MCL 50V	1	R6	150.143	7K5 1% Metal Film 250mW	1
C67	240.107	100nF X7R MCL 50V	1	R7	150.142	9K1 1% Metal Film 250mW	1
C68	240.107	100nF X7R MCL 50V	1	R8	150.143	7K5 1% Metal Film 250mW	1
C69	240.107	100nF X7R MCL 50V	1	R9	150.143	7K5 1% Metal Film 250mW	1
C70	240.107	100nF X7R MCL 50V	1	R10	130.103	1M0 Metal Film 250mW	1
C71	240.107	100nF X7R MCL 50V	1	R11	130.106	10k Metal Film 250mW	1
C72	240.107	100nF X7R MCL 50V	1	R12	130.106	10k Metal Film 250mW	1
C73	240.107	100nF X7R MCL 50V	1	R13	130.106	10k Metal Film 250mW	1
C74	260.104	22uF 16V Tantalum	1	R14	130.106	10k Metal Film 250mW	1
C75	240.107	100nF X7R MCL 50V	1	R15	130.106	10k Metal Film 250mW	1
C76	240.107	100nF X7R MCL 50V	1	R16	130.106	10k Metal Film 250mW	1
C77	240.107	100nF X7R MCL 50V	1	R17	130.118	22K Metal Film 250mW	1
C78	240.107	100nF X7R MCL 50V	1	R18	130.130	47K Metal Film 250mW	1
C79	240.107	100nF X7R MCL 50V	1	R19	130.134	6K8 Metal Film 250mW	1
C80	240.107	100nF X7R MCL 50V	1	R20	130.159	3K9 Metal Film 250mW	1
C81	240.107	100nF X7R MCL 50V	1	R21	130.130	47K Metal Film 250mW	1
C82	240.107	100nF X7R MCL 50V	1	R22	130.130	47K Metal Film 250mW	1
C84	210.108	150pF Ceramic Plate 2% 100V	1	R23	130.130	47K Metal Film 250mW	1
C85	2062	100p NP0 Capacitor 50V 0603	1	R24	2269	15k 1% Resistor0805	1
D1	410.102	1N4148 GP Diode	1	R25	130.128	1k5 Metal Film 250mW	1
D2	410.102	1N4148 GP Diode	1	R26	130.103	1M0 Metal Film 250mW	1

Ref	Part No	Details	Per	Ref	Part No	Details	Per
R27	2677	27k 1% Resistor 0603	1	R100	150.143	7K5 1% Metal Film 250mW	1
R28	130.134	6K8 Metal Film 250mW	1	R101	130.141	8K2 Metal Film 250mW	1
R29	130.145	180K Metal Film 250mW	1	R102	130.141	8K2 Metal Film 250mW	1
R30	130.154	390K Metal Film 250mW	1	RN2	190.118	8x100K 2% SIL Resistor Network	1
R31	130.129	4K7 Metal Film 250mW	1	RV2	170.119	10K 200mW Sealed Pot.	1
R32	130.106	10k Metal Film 250mW	1	RV3	170.123	500R 200mW Sealed Pot.	1
R33	130.137	1k2 Metal Film 250mW	1	RV4	170.120	1k0 200mW Sealed Pot.	1
R34	130.137	1k2 Metal Film 250mW	1	RV5	170.122	1M0 200mW Sealed Pot.	1
R35	130.137	1k2 Metal Film 250mW	1	RV6	170.122	1M0 200mW Sealed Pot.	1
R36	130.120	1k0 Metal Film 250mW	1	RV7	170.123	500R 200mW Sealed Pot.	1
R37	140.107	10M 5% Metal Film 250mW	1	RV8	170.120	1k0 200mW Sealed Pot.	1
R38	130.125	100k Metal Film 250mW	1	RV9	170.122	1M0 200mW Sealed Pot.	1
R39	130.129	4K7 Metal Film 250mW	1	RV10	170.123	500R 200mW Sealed Pot.	1
R40	130.106	10k Metal Film 250mW	1	RV11	170.126	5K0 200mW Sealed Pot.	1
R41	130.103	1M0 Metal Film 250mW	1	ST1	2012	1n0 X7R Capacitor 50V 0603	1
R42	130.120	1k0 Metal Film 250mW	1	U1	470.167	74HC4053 Triple 2 Channel MUX	1
R43	140.107	10M 5% Metal Film 250mW	1	U2	450.102	TL074 Quad Op Amp	1
R44	130.125	100k Metal Film 250mW	1	U3	450.102	TL074 Quad Op Amp	1
R45	130.129	4K7 Metal Film 250mW	1	U4	470.174	74HC4051 8 Channel MUX	1
R46	130.103	1M0 Metal Film 250mW	1	U5	450.102	TL074 Quad Op Amp	1
R47	130.120	1k0 Metal Film 250mW	1	U6	450.102	TL074 Quad Op Amp	1
R48	130.114	220K Metal Film 250mW	1	U7	470.174	74HC4051 8 Channel MUX	1
R49	130.106	10k Metal Film 250mW	1	U9	470.152	74HCU04 Hex Inverter	1
R50	130.120	1k0 Metal Film 250mW	1	U10	470.152	74HCU04 Hex Inverter	1
R51	130.125	100k Metal Film 250mW	1	U11	470.175	74HC132 Quad 2I/P NAND Schmitt	1
R52	130.127	680R Metal Film 250mW	1	U12	470.176	74HC139 Dual 2 to 4 Decoder	1
R53	130.106	10k Metal Film 250mW	1	U13	470.176	74HC139 Dual 2 to 4 Decoder	1
R54	140.107	10M 5% Metal Film 250mW	1	U14	470.154	74HC32N Quad 2 I/P OR Gate	1
R55	130.103	1M0 Metal Film 250mW	1	U15	470.167	74HC4053 Triple 2 Channel MUX	1
R56	130.125	100k Metal Film 250mW	1	U16	470.177	74HC4016 Quad Analog Switch	1
R57	130.111	2K7 Metal Film 250mW	1	U18	470.164	74HC193 4 bit up/down Counter	1
R58	130.106	10k Metal Film 250mW	1	U19	470.164	74HC193 4 bit up/down Counter	1
R59	130.103	1M0 Metal Film 250mW	1	U20	470.165	4044 Quad R/S Latch	1
R60	130.125	100k Metal Film 250mW	1	U21	440.110	L200CV Adj. 2A Regulator	1
R61	130.103	1M0 Metal Film 250mW	1	U22	440.103	7912 -12V 1A Regulator	1
R62	130.103	1M0 Metal Film 250mW	1	U23	440.106	78L05 +5V 100mA Regulator	1
R63	130.125	100k Metal Film 250mW	1	U24	440.111	79L05 -5V 100mA Regulator	1
R70	130.106	10k Metal Film 250mW	1	U25	470.175	74HC132 Quad 2I/P NAND Schmitt	1
R72	130.106	10k Metal Film 250mW	1	U26	470.175	74HC132 Quad 2I/P NAND Schmitt	1
R75	130.109	470R Metal Film 250mW	1	W1	510.128	Slide Mains Selector	1
R76	130.166	2R7 Metal Film 250mW	1	X1	370.109	Mains Transformer	1
R77	130.101	3K3 Metal Film 250mW	1	XX1	3039	IL1215S DC to DC Converter	1
R78	130.120	1k0 Metal Film 250mW	1	Y1	550.104	Fuse Holder PCB Type Panel	1
R79	130.153	18K Metal Film 250mW	1	Y1	540.101	100mA Quick Blow 20mm	1
R93	130.125	100k Metal Film 250mW	1	Y2	550.104	Fuse Holder PCB Type Panel	1
R95	140.105	2M2 5% Metal Film 250mW	1	Y2	540.102	Fuse 1A 20mm Antisurge	1
R99	130.129	4K7 Metal Film 250mW	1				1

RF115v03 RF Board Assembly

Ref	Part No	Details	Per	Ref	Part No	Details	Per
PCB	4692v03	257 Mod Meter RF Board V03	1	C46	2012	1n0 X7R Capacitor 50V 0603	1
C1	2003	10n X7R Capacitor 50V 0603	1	C47	2062	100p NP0 Capacitor 50V 0603	1
C2	210.124	1p8F Ceramic Plate 2% 100V	1	C48	2062	100p NP0 Capacitor 50V 0603	1
C3	4668	2p7 NP0 Capacitor 0603	1	C49	2062	100p NP0 Capacitor 50V 0603	1
C4	2003	10n X7R Capacitor 50V 0603	1	C50	2062	100p NP0 Capacitor 50V 0603	1
C5	2011	22p NP0 Capacitor 50V 0603	1	C51	2003	10n X7R Capacitor 50V 0603	1
C6	2070	33p NP0 Capacitor 50V 0603	1	C52	210.119	470pF Ceramic Plate 10% 100V	1
C7	2070	33p NP0 Capacitor 50V 0603	1	C53	240.101	10nF ceramic disc -20+80% 50V	1
C8	2003	10n X7R Capacitor 50V 0603	1	C54	4662	1u0 X7R Capacitor 50V 0805	1
C9	2003	10n X7R Capacitor 50V 0603	1	C55	4660	10u Tantalum Capacitor 25V	1
C10	2003	10n X7R Capacitor 50V 0603	1	C56	2579	22u Tantalum 16V Case C	1
C11	2003	10n X7R Capacitor 50V 0603	1	C57	4464	4u7 X5R Capacitor 25V 0805	1
C12	4662	1u0 X7R Capacitor 50V 0805	1	C58	4660	10u Tantalum Capacitor 25V	1
C13	2595	47n X7R Capacitor 16V 0603	1	C59	4662	1u0 X7R Capacitor 50V 0805	1
C14	4668	2p7 NP0 Capacitor 0603	1	C60	4464	4u7 X5R Capacitor 25V 0805	1
C15	4660	10u Tantalum Capacitor 25V	1	C61	2796	4p7 NP0 Capacitor 50V 0603	1
C16	2066	330p NP0 Capacitor 50V 0603	1	C62	4464	4u7 X5R Capacitor 25V 0805	1
C17	4662	1u0 X7R Capacitor 50V 0805	1	C63	2012	1n0 X7R Capacitor 50V 0603	1
C18	4669	180pF NP0 Capacitor 0603	1	C65	2796	4p7 NP0 Capacitor 50V 0603	1
C19	4669	180pF NP0 Capacitor 0603	1	C66	2012	1n0 X7R Capacitor 50V 0603	1
C20	2003	10n X7R Capacitor 50V 0603	1	C67	2012	1n0 X7R Capacitor 50V 0603	1
C21	2595	47n X7R Capacitor 16V 0603	1	C68	2012	1n0 X7R Capacitor 50V 0603	1
C22	3071	47u Tantalum 16V Case C	1	C69	4660	10u Tantalum Capacitor 25V	1
C23	2003	10n X7R Capacitor 50V 0603	1	C70	2796	4p7 NP0 Capacitor 50V 0603	1
C24	2003	10n X7R Capacitor 50V 0603	1	C71	4464	4u7 X5R Capacitor 25V 0805	1
C25	2722	150p NP0 Capacitor 0603	1	C72	4662	1u0 X7R Capacitor 50V 0805	1
C26	3071	47u Tantalum 16V Case C	1	C73	2012	1n0 X7R Capacitor 50V 0603	1
C27	2003	10n X7R Capacitor 50V 0603	1	D1	4653	BBY40 VHF Varicap Diode	1
C28	2579	22u Tantalum 16V Case C	1	D2	4653	BBY40 VHF Varicap Diode	1
C29	4666	820pF NP0 Capacitor 0603	1	D3	410.121	Step Recovery Diode	1
C30	2595	47n X7R Capacitor 16V 0603	1	D4	4832	1PS70SB84 Schottky Diode	1
C31	2595	47n X7R Capacitor 16V 0603	1	D5	4832	1PS70SB84 Schottky Diode	1
C32	2595	47n X7R Capacitor 16V 0603	1	D6	4832	1PS70SB84 Schottky Diode	1
C33	4422	220pF NP0 Capacitor 50V 0603	1	D7	4832	1PS70SB84 Schottky Diode	1
C34	2579	22u Tantalum 16V Case C	1	D8	4661	BAS16 Signal Diode 85V 215mA	1
C35	4662	1u0 X7R Capacitor 50V 0805	1	D9	4661	BAS16 Signal Diode 85V 215mA	1
C36	2003	10n X7R Capacitor 50V 0603	1	D10	4661	BAS16 Signal Diode 85V 215mA	1
C37	4662	1u0 X7R Capacitor 50V 0805	1	D11	4661	BAS16 Signal Diode 85V 215mA	1
C38	2595	47n X7R Capacitor 16V 0603	1	D12	4661	BAS16 Signal Diode 85V 215mA	1
C39	2595	47n X7R Capacitor 16V 0603	1	D13	4661	BAS16 Signal Diode 85V 215mA	1
C40	2595	47n X7R Capacitor 16V 0603	1	D14	4661	BAS16 Signal Diode 85V 215mA	1
C41	2003	10n X7R Capacitor 50V 0603	1	D16	4661	BAS16 Signal Diode 85V 215mA	1
C42	4662	1u0 X7R Capacitor 50V 0805	1	D17	4661	BAS16 Signal Diode 85V 215mA	1
C43	2003	10n X7R Capacitor 50V 0603	1	D18	4661	BAS16 Signal Diode 85V 215mA	1
C44	2003	10n X7R Capacitor 50V 0603	1	D19	4661	BAS16 Signal Diode 85V 215mA	1
C45	3071	47u Tantalum 16V Case C	1	D20	4661	BAS16 Signal Diode 85V 215mA	1

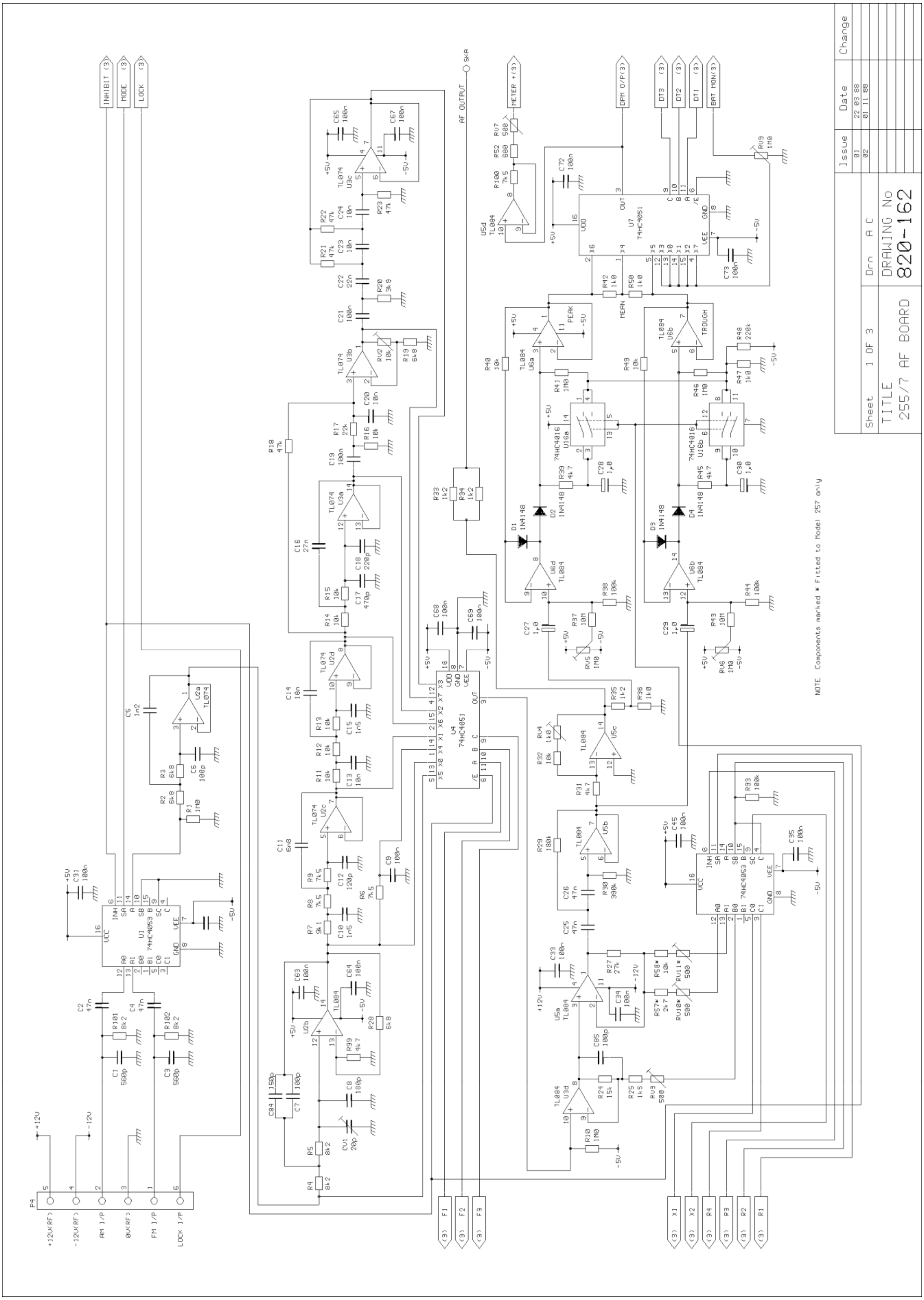
Ref	Part No	Details	Per	Ref	Part No	Details	Per
D21	4661	BAS16 Signal Diode 85V 215mA	1	R22	2022	100R 1% Resistor 0603	1
D22	4653	BBY40 VHF Varicap Diode	1	R23	2077	330R 1% Resistor 0603	1
D23	4653	BBY40 VHF Varicap Diode	1	R24	2083	3k3 1% Resistor 0603	1
D24	4661	BAS16 Signal Diode 85V 215mA	1	R25	4469	390R 1% Resistor 0603	1
D25	4661	BAS16 Signal Diode 85V 215mA	1	R26	2672	33R 1% Resistor 0603	1
D26	4661	BAS16 Signal Diode 85V 215mA	1	R27	4470	1k5 1% Resistor 0603	1
D27	4661	BAS16 Signal Diode 85V 215mA	1	R28	4470	1k5 1% Resistor 0603	1
D28	4661	BAS16 Signal Diode 85V 215mA	1	R29	2023	1k0 1% Resistor 0603	1
D29	4661	BAS16 Signal Diode 85V 215mA	1	R30	2189	15k 1% Resistor 0603	1
D30	4661	BAS16 Signal Diode 85V 215mA	1	R31	4663	10M 1% Resistor 0603	1
D31	4661	BAS16 Signal Diode 85V 215mA	1	R32	2085	1k2 1% Resistor 0603	1
D32	4661	BAS16 Signal Diode 85V 215mA	1	R33	2026	100k 1% Resistor 0603	1
D33	4661	BAS16 Signal Diode 85V 215mA	1	R34	2084	4k7 1% Resistor 0603	1
L1	340.103	Ferrite Core FX1898	1	R35	2028	10k 1% Resistor 0603	1
L2	310.118	220uH SC10 Choke 10% 0.2W	1	R36	2084	4k7 1% Resistor 0603	1
L3	4781	Toko 7P 7mm IF transformer	1	R37	2080	47k 1% Resistor 0603	1
L4	310.101	1mH SC10 Choke 10% 0.2W	1	R38	2522	8k2 1% Resistor 0603	1
L5	310.101	1mH SC10 Choke 10% 0.2W	1	R39	2028	10k 1% Resistor 0603	1
L6	4781	Toko 7P 7mm IF transformer	1	R40	2666	2k7 1% Resistor 0603	1
L7	4659	1uH Inductor 0805	1	R41	2085	1k2 1% Resistor 0603	1
L8	4659	1uH Inductor 0805	1	R42	2085	1k2 1% Resistor 0603	1
L9	4654	100nH 1812 MidiSpring Air core	1	R43	4665	750R 1% Resistor 0603	1
L10	340.103	Ferrite Core FX1898	1	R44	2026	100k 1% Resistor 0603	1
L11	340.102	Ferrite Bead FX1115	1	R45	2043	5k6 1% Resistor 0603	1
L12	4659	1uH Inductor 0805	1	R46	2189	15k 1% Resistor 0603	1
M1	4691	PFL2T Screening Can & Lid	1	R47	2026	100k 1% Resistor 0603	1
P1	1011	6 Way Header Harwin M20 Series	1	R48	2043	5k6 1% Resistor 0603	1
R1	130.123	100R Metal Film 250mW	1	R49	2082	22k 1% Resistor 0603	1
R2	130.123	100R Metal Film 250mW	1	R50	2082	22k 1% Resistor 0603	1
R3	2015	2k2 1% Resistor 0603	1	R51	2084	4k7 1% Resistor 0603	1
R4	2028	10k 1% Resistor 0603	1	R52	2084	4k7 1% Resistor 0603	1
R5	4470	1k5 1% Resistor 0603	1	R53	4470	1k5 1% Resistor 0603	1
R6	2026	100k 1% Resistor 0603	1	R54	4470	1k5 1% Resistor 0603	1
R7	2082	22k 1% Resistor 0603	1	R55	2310	220k 1% Resistor 0603	1
R8	2026	100k 1% Resistor 0603	1	R56	2082	22k 1% Resistor 0603	1
R9	2028	10k 1% Resistor 0603	1	R57	4663	10M 1% Resistor 0603	1
R10	2082	22k 1% Resistor 0603	1	R58	2030	1M0 1% Resistor 0603	1
R11	2023	1k0 1% Resistor 0603	1	R59	2309	150k 1% Resistor 0603	1
R12	2522	8k2 1% Resistor 0603	1	R60	4664	2M2 1% Resistor 0603	1
R13	2028	10k 1% Resistor 0603	1	R61	2026	100k 1% Resistor 0603	1
R14	3117	1k8 1% Resistor 0603	1	R62	2028	10k 1% Resistor 0603	1
R15	2028	10k 1% Resistor 0603	1	R63	2026	100k 1% Resistor 0603	1
R16	2083	3k3 1% Resistor 0603	1	R64	2080	47k 1% Resistor 0603	1
R17	2656	6k8 1% Resistor 0603	1	R65	2015	2k2 1% Resistor 0603	1
R18	2022	100R 1% Resistor 0603	1	R66	2015	2k2 1% Resistor 0603	1
R19	2082	22k 1% Resistor 0603	1	R67	2080	47k 1% Resistor 0603	1
R20	2027	560R 1% Resistor 0603	1	R68	2080	47k 1% Resistor 0603	1
R21	2028	10k 1% Resistor 0603	1	R69	2084	4k7 1% Resistor 0603	1

Ref	Part No	Details	Per	Ref	Part No	Details	Per
R70	2084	4k7 1% Resistor 0603	1	RV6	170.111	2k2 500mW Open Ceramic Pot	1
R71	2080	47k 1% Resistor 0603	1	SK A	1104	82 MCX PCB Receptacle Gold	1
R72	2080	47k 1% Resistor 0603	1	T1	4672	BF545B N JFET RF	1
R73	2026	100k 1% Resistor 0603	1	T2	4671	MMBFJ111 N JFET -35V	1
R74	2080	47k 1% Resistor 0603 NOT FITTED	1	T3	4672	BF545B N JFET RF	1
R75	2084	4k7 1% Resistor 0603	1	T4	4655	BC847 NPN Transistor 45V 100mA	1
R76	2083	3k3 1% Resistor 0603	1	T5	4655	BC847 NPN Transistor 45V 100mA	1
R77	2084	4k7 1% Resistor 0603	1	T6	4656	BC857 PNP Transistor 45V 100mA	1
R78	2656	6k8 1% Resistor 0603	1	T7	4656	BC857 PNP Transistor 45V 100mA	1
R79	2023	1k0 1% Resistor 0603	1	T8	4655	BC847 NPN Transistor 45V 100mA	1
R80	2086	680R 1% Resistor 0603	1	T9	4655	BC847 NPN Transistor 45V 100mA	1
R81	2028	10k 1% Resistor 0603	1	T10	4655	BC847 NPN Transistor 45V 100mA	1
R82	4469	390R 1% Resistor 0603	1	T11	4656	BC857 PNP Transistor 45V 100mA	1
R83	2080	47k 1% Resistor 0603	1	T12	4656	BC857 PNP Transistor 45V 100mA	1
R84	2082	22k 1% Resistor 0603	1	T13	4655	BC847 NPN Transistor 45V 100mA	1
R85	2083	3k3 1% Resistor 0603	1	T14	4655	BC847 NPN Transistor 45V 100mA	1
R86	3220	390k 1% Resistor 0603	1	T15	4656	BC857 PNP Transistor 45V 100mA	1
R87	2026	100k 1% Resistor 0603	1	T16	4652	MMBFJ310 N-Channel RF Amp	1
R88	3220	390k 1% Resistor 0603	1	T17	4655	BC847 NPN Transistor 45V 100mA	1
R89	3220	390k 1% Resistor 0603	1	T18	4655	BC847 NPN Transistor 45V 100mA	1
R90	4667	3M9 1% Resistor 0603	1	T19	4655	BC847 NPN Transistor 45V 100mA	1
R91	2082	22k 1% Resistor 0603	1	T20	4655	BC847 NPN Transistor 45V 100mA	1
R92	3220	390k 1% Resistor 0603	1	T21	4656	BC857 PNP Transistor 45V 100mA	1
R93	2023	1k0 1% Resistor 0603	1	T22	4656	BC857 PNP Transistor 45V 100mA	1
R94	2029	220R 1% Resistor 0603	1	T23	4655	BC847 NPN Transistor 45V 100mA	1
R95	2015	2k2 1% Resistor 0603	1	T24	4652	MMBFJ310 N-Channel RF Amp	1
R96	2022	100R 1% Resistor 0603	1	T25	4655	BC847 NPN Transistor 45V 100mA	1
R97	2084	4k7 1% Resistor 0603	1	T26	4655	BC847 NPN Transistor 45V 100mA	1
R98	2082	22k 1% Resistor 0603	1	T27	4656	BC857 PNP Transistor 45V 100mA	1
R99	2043	5k6 1% Resistor 0603	1	T28	4655	BC847 NPN Transistor 45V 100mA	1
R100	2084	4k7 1% Resistor 0603	1	T29	4655	BC847 NPN Transistor 45V 100mA	1
R101	2023	1k0 1% Resistor 0603	1	T30	4656	BC857 PNP Transistor 45V 100mA	1
R102	2015	2k2 1% Resistor 0603	1	T31	4656	BC857 PNP Transistor 45V 100mA	1
R103	2022	100R 1% Resistor 0603	1	T32	4655	BC847 NPN Transistor 45V 100mA	1
R104	2022	100R 1% Resistor 0603	1	T41	4656	BC857 PNP Transistor 45V 100mA	1
R105	2086	680R 1% Resistor 0603	1	T42	4655	BC847 NPN Transistor 45V 100mA	1
R106	2083	3k3 1% Resistor 0603	1	T43	4655	BC847 NPN Transistor 45V 100mA	1
R107	3005	180k 1% Resistor 0603	1	T44	4655	BC847 NPN Transistor 45V 100mA	1
R108	130.123	100R Metal Film 250mW	1	T45	4655	BC847 NPN Transistor 45V 100mA	1
R109	2081	47R 1% Resistor 0603	1	T46	4655	BC847 NPN Transistor 45V 100mA	1
R110	2084	4k7 1% Resistor 0603	1	T47	4655	BC847 NPN Transistor 45V 100mA	1
R111	2084	4k7 1% Resistor 0603	1	T48	4655	BC847 NPN Transistor 45V 100mA	1
R112	2015	2k2 1% Resistor 0603	1	T49	4656	BC857 PNP Transistor 45V 100mA	1
RV1	170.101	220R 500mW Open Ceramic Pot	1	T50	4656	BC857 PNP Transistor 45V 100mA	1
RV2	170.101	220R 500mW Open Ceramic Pot	1	T51	4656	BC857 PNP Transistor 45V 100mA	1
RV3	170.101	220R 500mW Open Ceramic Pot	1	T52	4656	BC857 PNP Transistor 45V 100mA	1
RV4	170.111	2k2 500mW Open Ceramic Pot	1	T53	4656	BC857 PNP Transistor 45V 100mA	1
RV5	170.112	470R 500mW Open Ceramic Pot	1	T54	4656	BC857 PNP Transistor 45V 100mA	1

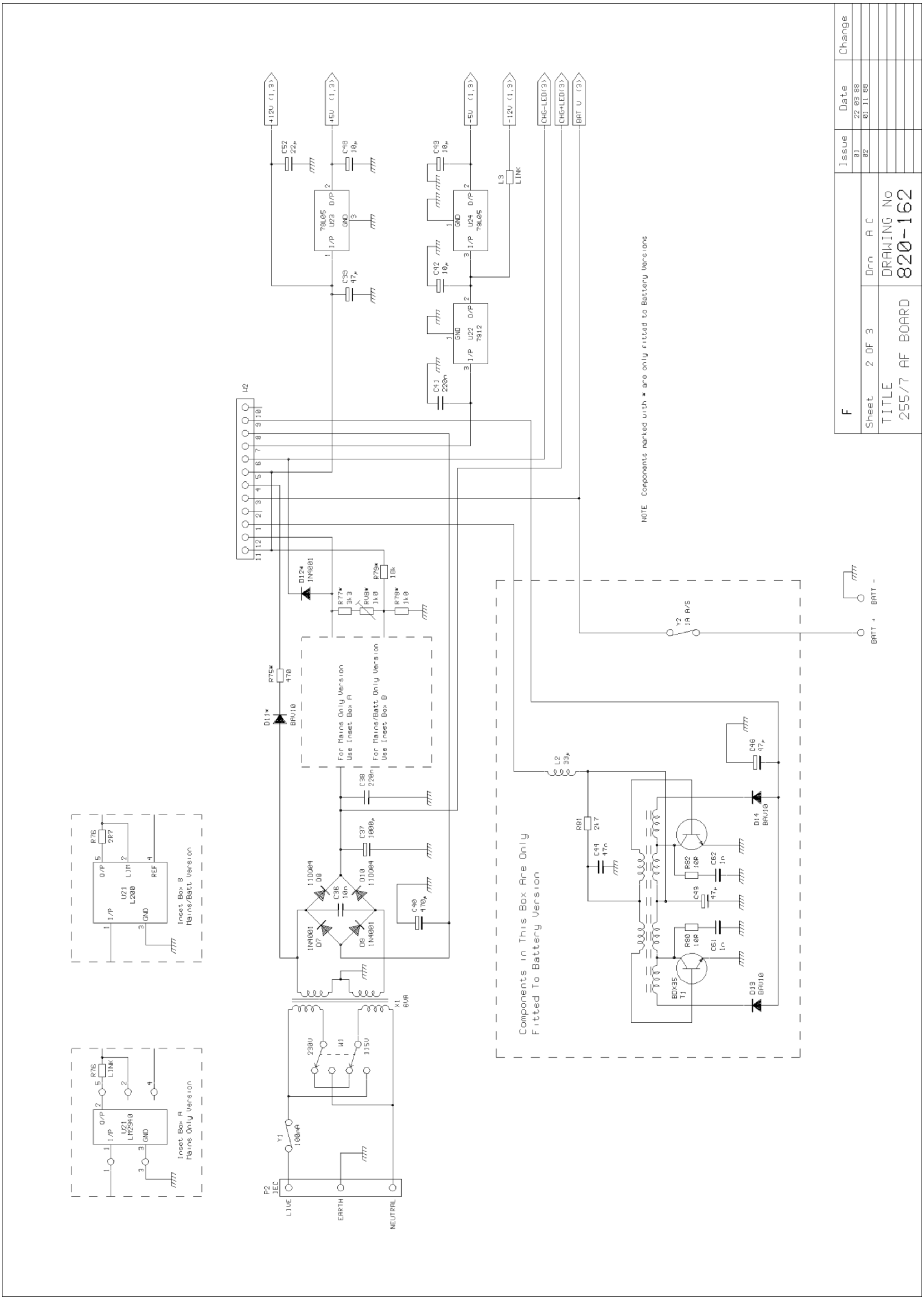
Ref	Part No	Details	Per	Ref	Part No	Details	Per
T55	4655	BC847 NPN Transistor 45V 100mA	1	T67	4657	MMBT2369A NPN Transistor 15V	1
T56	4655	BC847 NPN Transistor 45V 100mA	1	T68	4658	BFS17 NPN Transistor 15V 25mA	1
T57	4655	BC847 NPN Transistor 45V 100mA	1	TP1	620.101	PIN Solder Terminal	1
T58	4655	BC847 NPN Transistor 45V 100mA	1	TP2	620.101	PIN Solder Terminal	1
T59	4655	BC847 NPN Transistor 45V 100mA	1	TP3	620.101	PIN Solder Terminal	1
T60	4655	BC847 NPN Transistor 45V 100mA	1	TP4	620.101	PIN Solder Terminal	1
T61	4655	BC847 NPN Transistor 45V 100mA	1	TP5	620.101	PIN Solder Terminal	1
T62	4656	BC857 PNP Transistor 45V 100mA	1	U1	460.110	SN7472J JK Flip Flop	1
T65	4655	BC847 NPN Transistor 45V 100mA	1	U2	2249	78L05 5V Regulator SO8	1
T66	4656	BC857 PNP Transistor 45V 100mA	1	U3	4651	MC12080 1.1GHz Prescaler	1

Circuit Diagrams

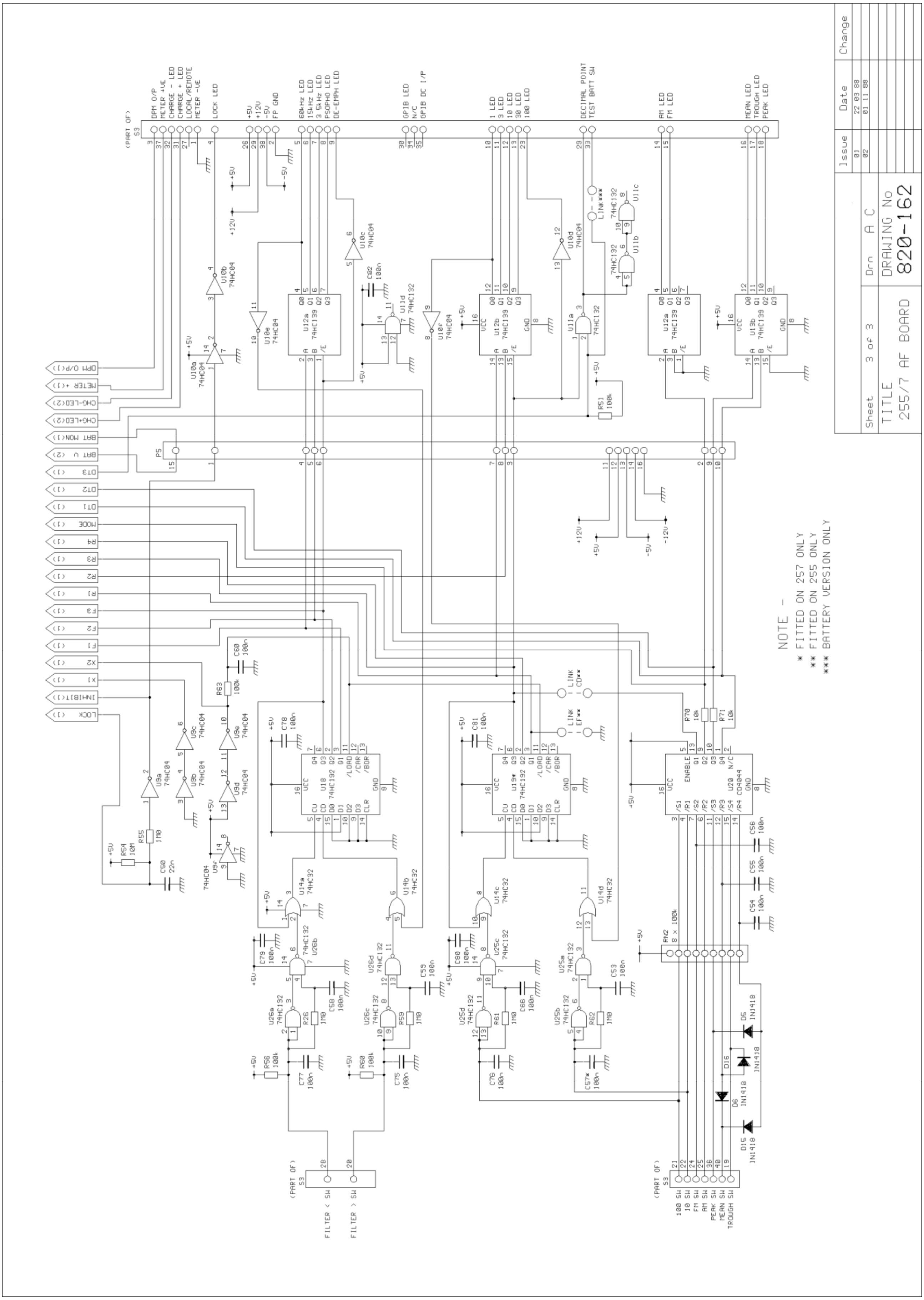
AF Board Circuit 1 of 3



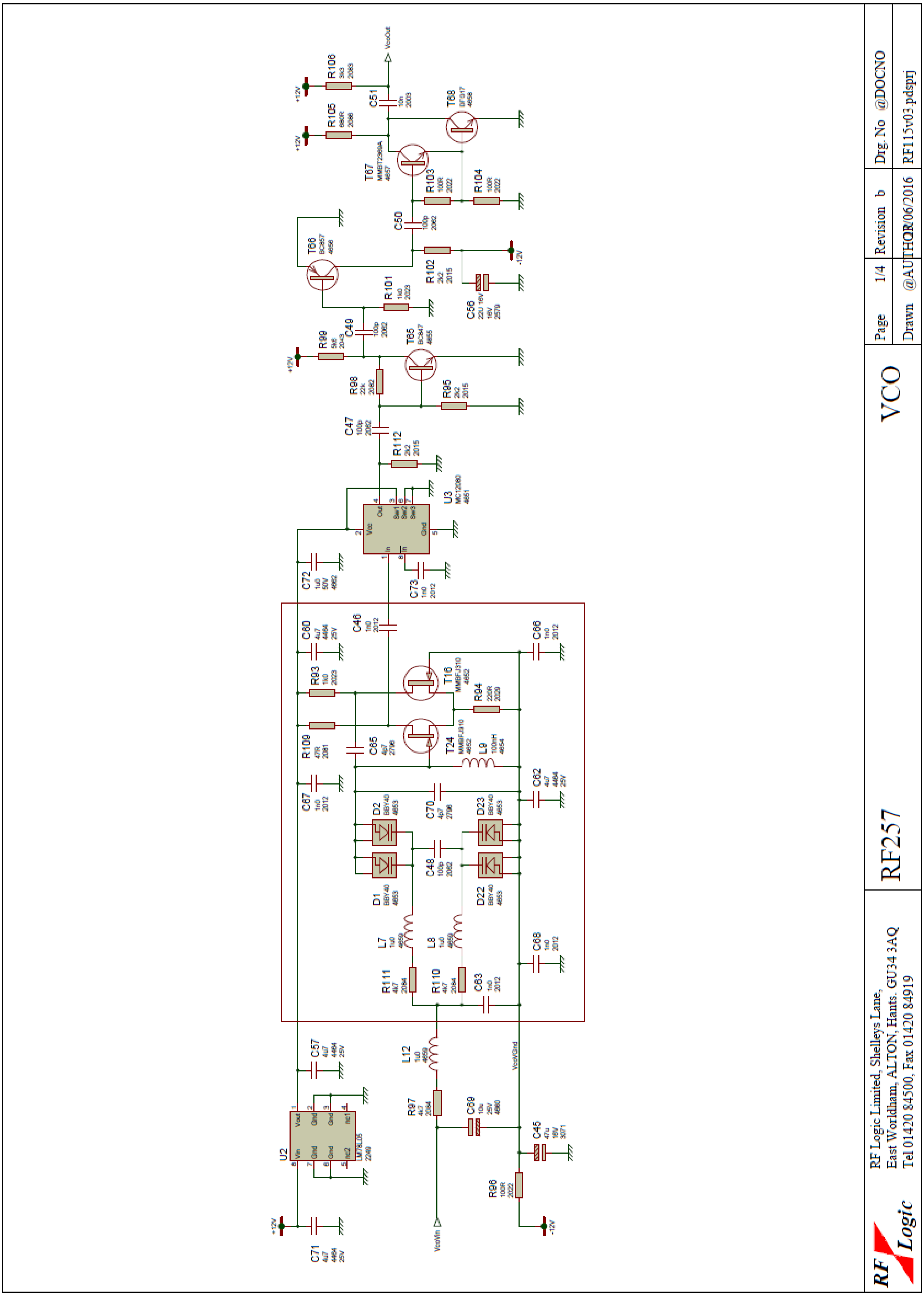
AF Board Circuit 2 of 3

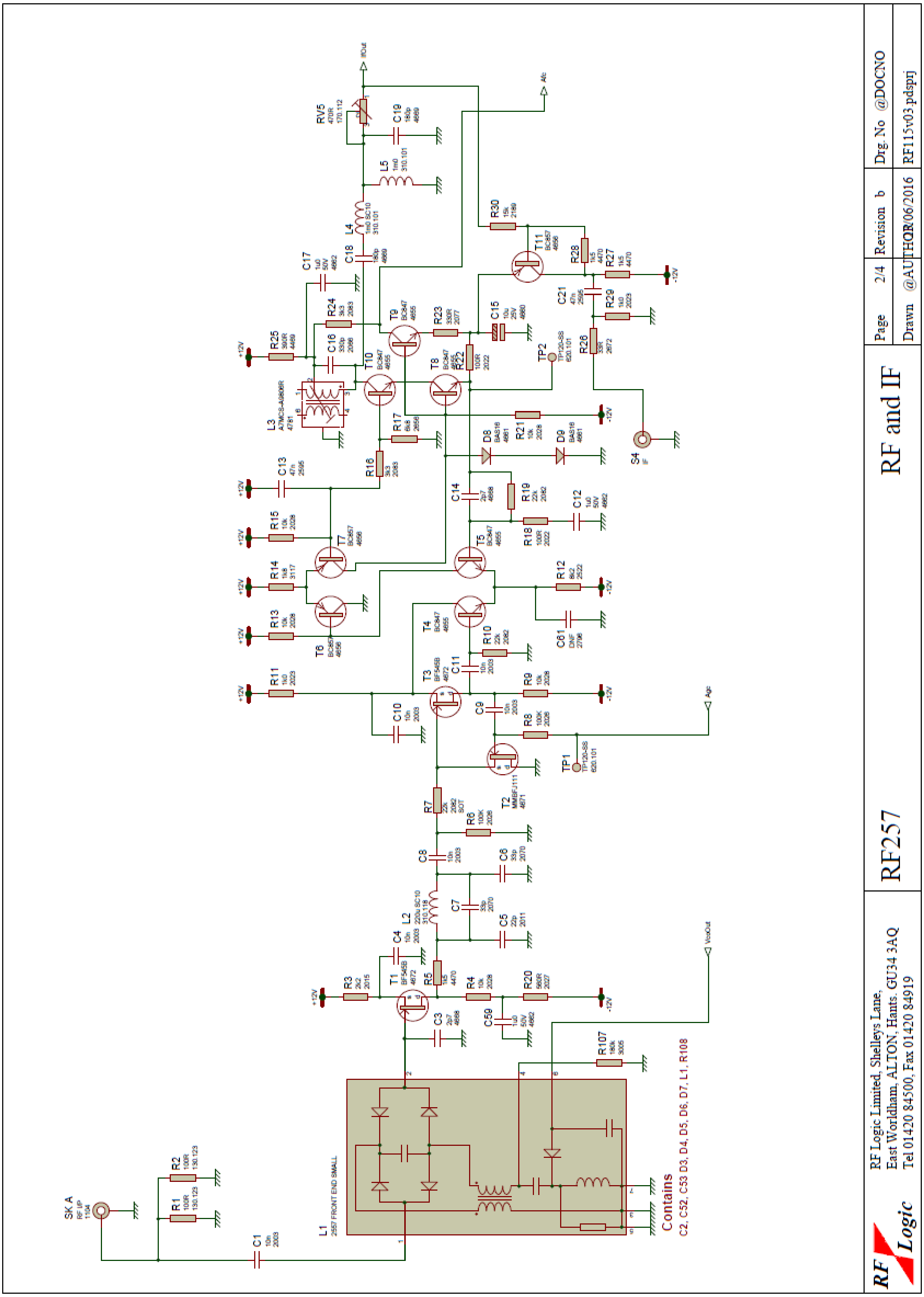


AF Board Circuit 3 of 3

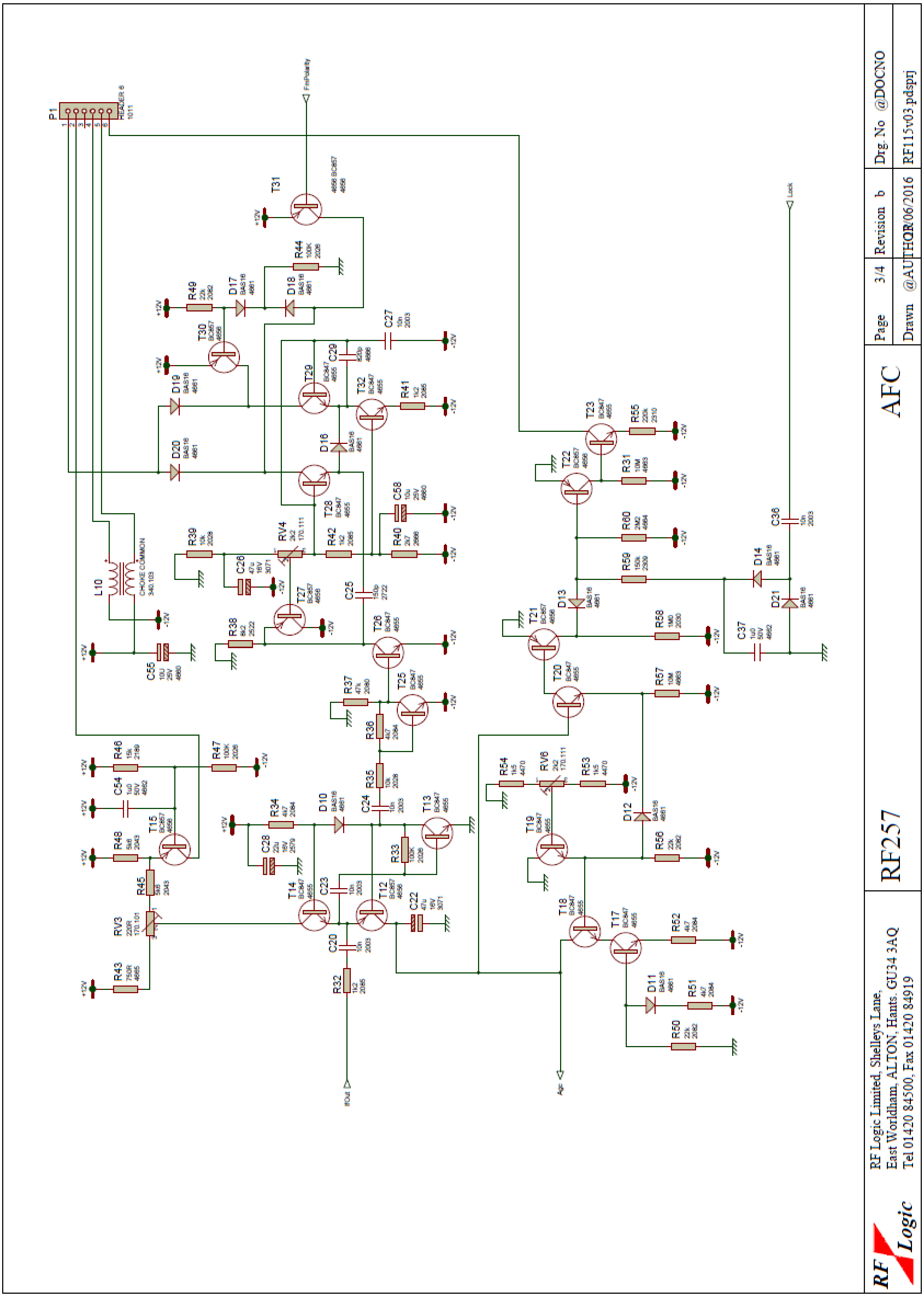


RF Board Circuit 1 of 4

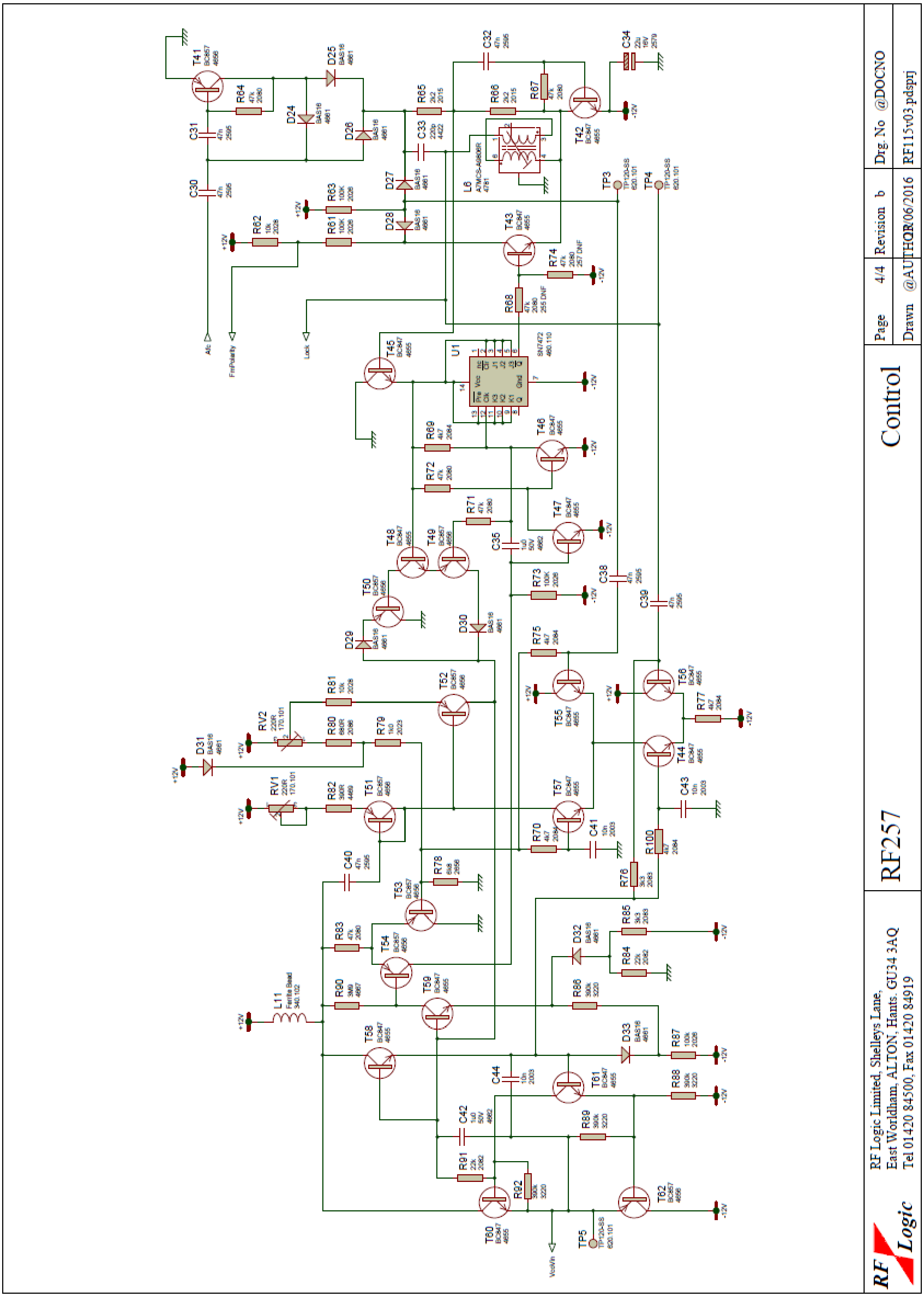



RF257
RF and IF
RF Logic Limited, Shelleys Lane,
East Worldham, ALTON, Hants, GU34 3AQ
Tel 01420 84500, Fax 01420 84919
Page 2/4
Revision b
Drg. No @DOCNO
Drawn @AUTHOR
RF115v03.pdsprj
Contains
C2, C52, C53 D3, D4, D5, D6, D7, L1, R108

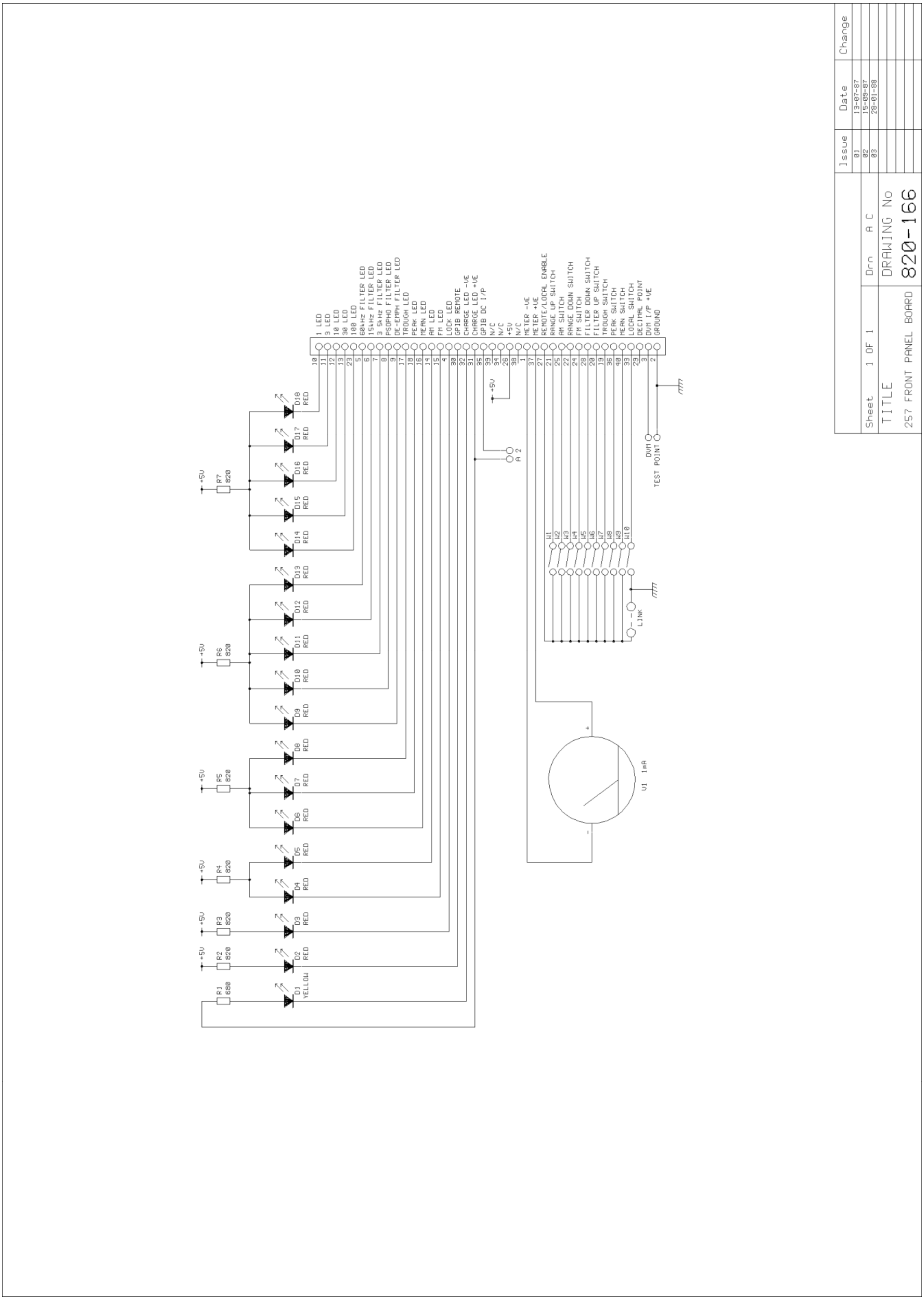
RF Board Circuit 3 of 4



RF Board Circuit 4 of 4

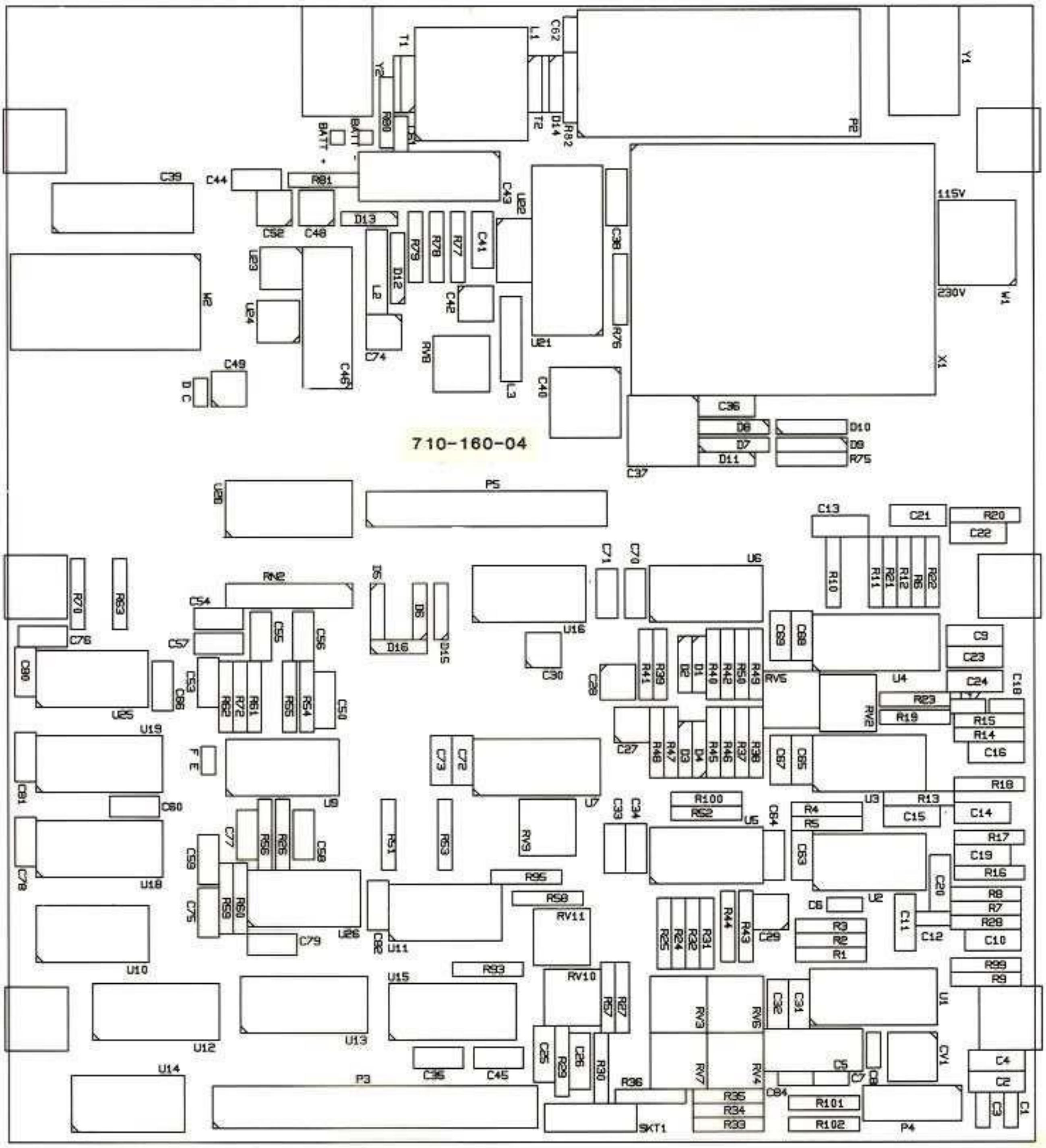


Front Panel Board Circuit



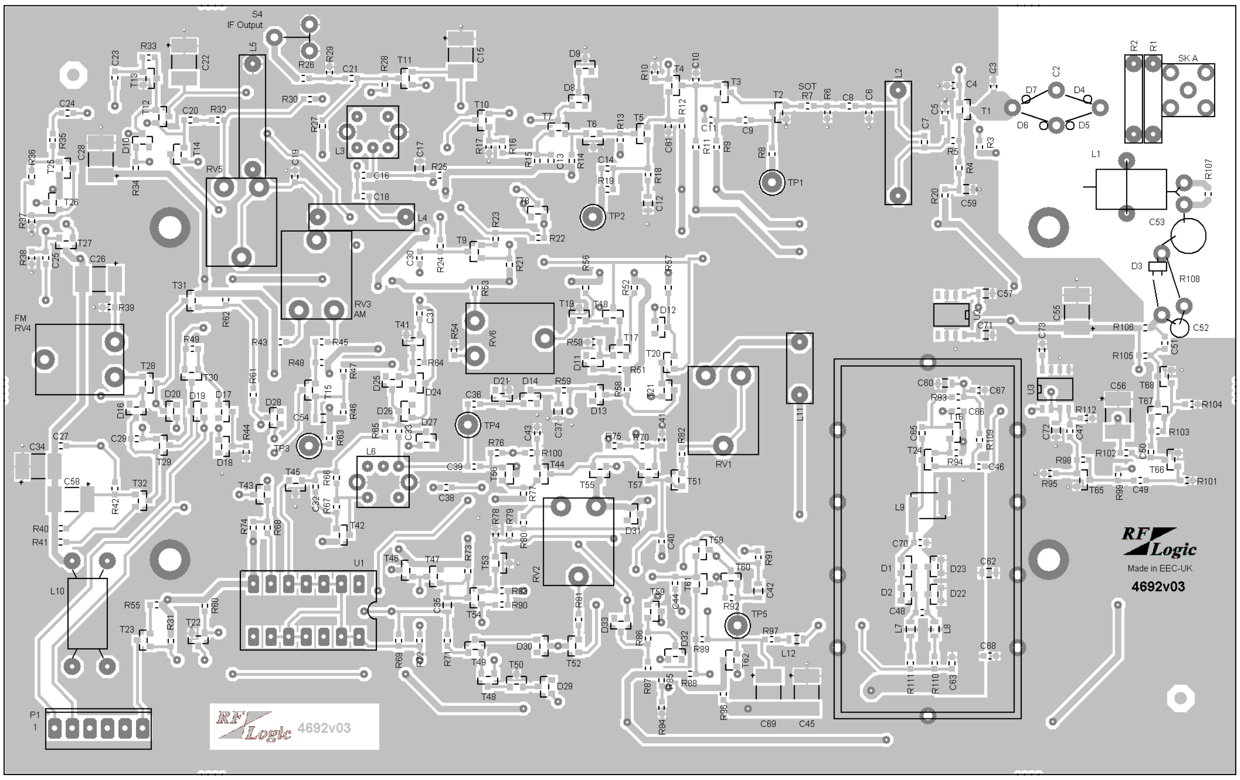
PCB Legends

AF Board Legend

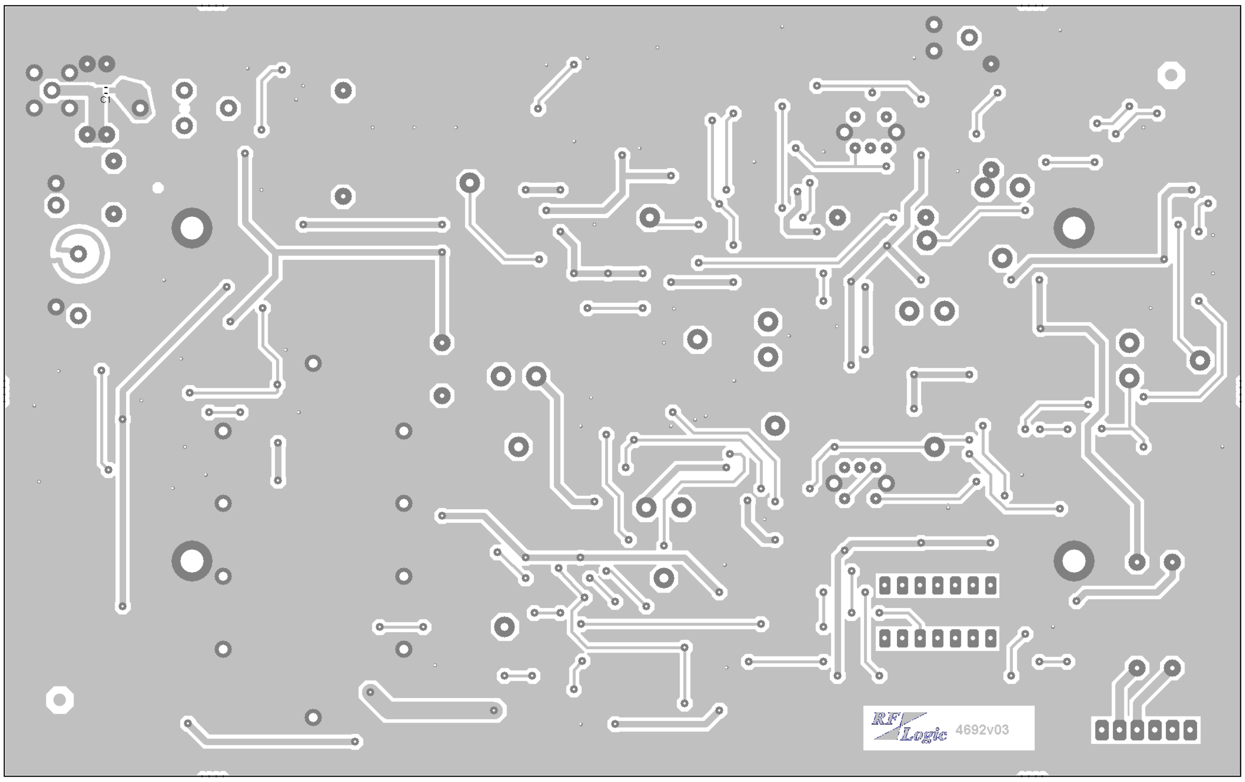


RF Board Legend

Top Side

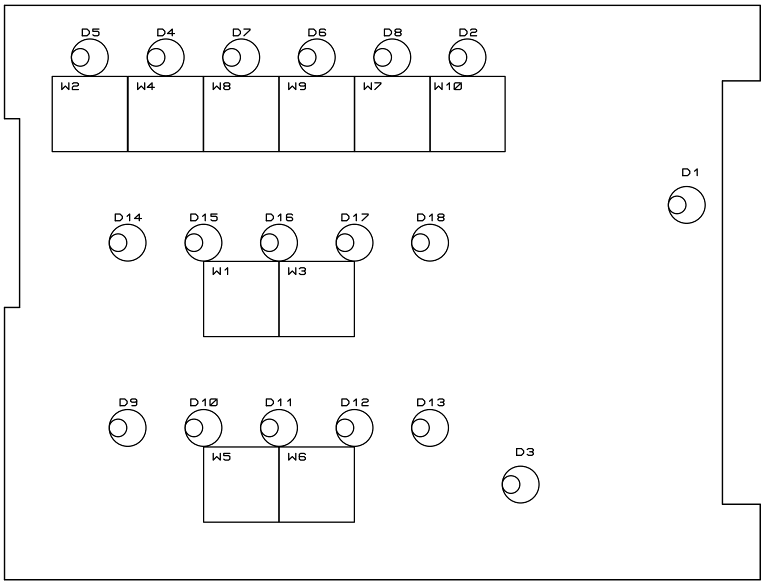


Bottom Side



Front Panel Board Legend

Front



Rear