MAINTENANCE MANUAL FOR 21.4 MHz RECEIVER IF MODULE 12.5/25 kHz CHANNEL SPACING 19D902783G7

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DESCRIPTION

The MASTR III Receiver IF Module provides amplification and demodulation of the 21.4 MHz Intermediate Frequency signal. The IF Module also includes the receiver squelch circuitry. However, it does not include de-emphasis or squelch audio gating circuits. Figure 1 is a block diagram showing the functional operation of the IF Module.

The IF Module circuitry contains the following:

- A 50 ohm input impedance IF Amplifier
- A chain of two crystal filters and an integrated circuit IF amplifier
- An integrated circuit containing a crystal oscillator, mixer, limiter, and quadrature detector
- A variable gain AF amplifier
- A squelch circuit
- A fault detector circuit
- An integrated circuit voltage regulator
- An address decoder

ERICSSON

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Printed in U.S.A.

TABLE 1 - GENERAL SPECIFICATIONS

ITEM	SPECIFICATION
I.F. frequency	21.4 MHz
Input Impedance	50 ohm
l2 dB SINAD	-120 dBm (25 kHz); -119 dBm (12.5 kHz)
Adj. CH SEL	-90 dB (25 kHz); -80 dB (12.5 kHz)
Image	-100 dB
3rd order Intercept Pt	23 dBm (25 kHz); 11 dBm *(12.5 kHz) *@ 50 kHz offset
Variation of Sensitivity with Signal Frequency	2 kHz (25 kHz); 1 kHz (12.5 kHz)
2nd I.F. frequency	455 kHz
2nd L.O. frequency	20.945 MHz
AF output (J2 pin 31C)	1 Vrms adjustable (with standard input signal)
AF output impedance	1k ohm
AF distortion	5% (25 kHz); 5% (12.5 kHz)
AF response	
10 Hz	-3 dB
300 Hz	±1 dB
1000 Hz	0 dB reference
3 kHz	±1 dB
Hum & Noise	-55 dB (25 kHz); -50 dB (12.5 kHz)
RSSI output (J2 pin 20C)	0.7 to 2.7 Vdc prop to log (sig level)
RSSI time constant	5 ms
SQ Threshold Sensitivity	-123 dBm (25 kHz); -122 dBm (12.5 kHz)
SQ Maximum Sensitivity	-110 dBm (25 kHz); -109 dBm (12.5 kHz)
SQ Clipping	3 kHz
SQ Attack	150 ms
SQ Close	250 ms
SQ output (J2 pin 26C)	5V logic (low = squelched)
Fault output (J2 pin IIC)	5V logic (low = fault)
DC Supply	13.8V, 150 mA max.; 12.0V, 18 mA max.

CIRCUIT ANALYSIS

INPUT AMPLIFIER NETWORK

The input amplifier, consisting of Q2 and T1, provides a 50 ohm load for the receiver RF module.

Capacitor C1 provides AC coupling and a DC block on the input line (J1). This DC block protects the module in the event of a failure in a preceding module.

C1 and L9 are series-resonant at 21.4 MHz and provide a low-impedance path from J1 to amplifier Q2. C89 and L8 are parallel-resonant at 21.4 MHz and provide a path to the 50-ohm lead, R105, for mixer products other than 21.4 MHz.

CRYSTAL FILTERS, IF AMPLIFIERS

Y1, Y2, U1, and associated circuitry provide IF filtering and amplification at 21.4 MHz. Filters Y1 and Y2 are both 4-pole bandpass filters with a center frequency of 21.4 MHz and a bandwidth of ±6.5 kHz. Amplifier UI is an integrated-circuit amplifier. U1 provides 30 dB of gain. The amplifier and filters have terminal impedances of 50 ohms. In-circuit gain measurements can be made using a high impedance probe.

Inductors L3, L5 and associated resistors and capacitors provide power supply decoupling. R3 provides a path to the input of the Fault Detector circuit. This input enables the Fault Detector circuit to monitor the DC voltage of U1.

The RF level detector consists of transistor Q1 along with associated resistors and capacitors. This detector plays no role in the normal operation of the IF Module, but aids in unit testing and module troubleshooting.

OSCILLATOR/MIXER/DETECTOR

Integrated circuit U3 provides several functions including 2nd mixer, if amplifier and limiter, and quadrature detector.

The 20.945 MHz crystal oscillator provides local oscillator injection to the mixer in U3. This mixer converts the 21.4 MHz IF signal to 455 kHz. C20 and C21 are oscillator feedback capacitors and have been chosen to provide the proper capacitance for crystal Y3. The proper oscillator output level is difficult to measure directly without affecting the oscillation.

A preferable measurement is at TP3 which should read about 10 mV pk. (Measured using a 10 megohm 11 pF oscilloscope probe.)

The mixer is internally connected to the crystal oscillator. Pins 1 and 20 of U3 are the mixer input and output respectively. Typical mixer conversion loss is about 2 dB.

In the 12.5 kHz mode, the output of the mixer drives the IF amplifier via analog switch U11-2, filter FL1 and analog switch U11-3. In the 25 kHz mode, the mixer output is routed through analog switch U11-1 and C85 to the IF amplifier. The analog switches are controlled by the signal at point 'A'; high for 25 kHz, low for 12.5 kHz.

The IF amplifier output drives the limiter via the 6-pole ceramic filter FL2.

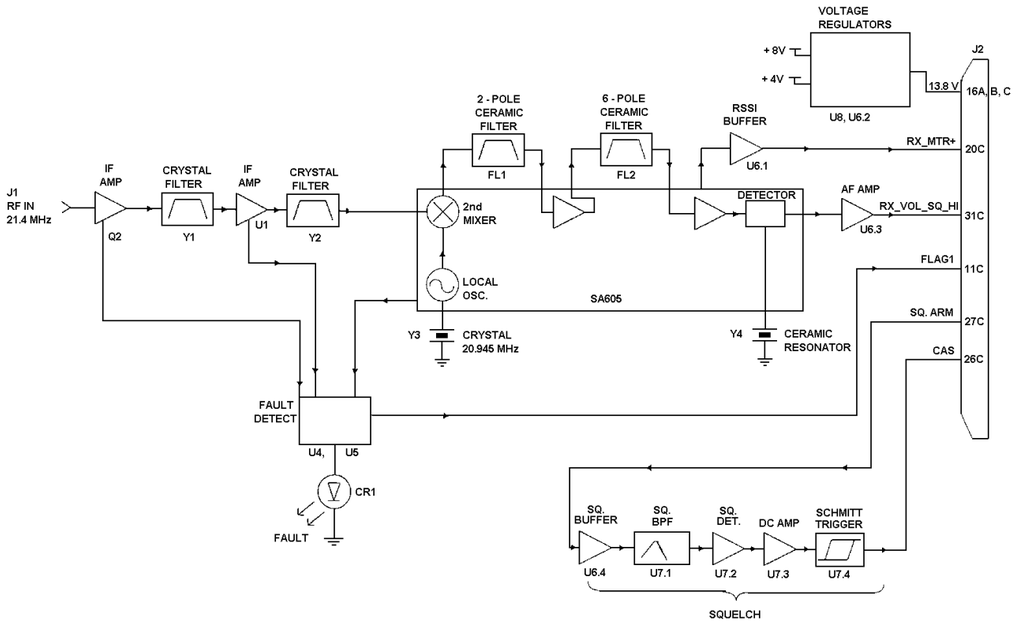
A received-signal-strength indicator (RSSI) is provided at U3 Pin 7. This indicator signal is generated within the limiter circuitry and provides an output current proportional to the logarithm of the input signal strength. This current develops a voltage across R18. The voltage varies from about 1 Vdc for noise input, to about 1.4 Vdc for a 12 dB SINAD signal, to a maximum of about 4.8 Vdc for a high signal level (70 dB stronger than that required for 12 dB SINAD).

The quadrature detector provides a demodulated audio frequency output. The input to the detector is internally connected to the limiter and is not externally available. The output of the detector is U3 pin 9. C28 provides low-pass filtering to remove 455 kHz feedthrough. Ceramic resonator Y4 provides the frequency selective component needed for FM demodulation. Y4 replaces the typical LC resonant circuit found in most quadrature detectors. In contrast to the typical LC network, Y4 requires no adjustment.

The DC supply to U3 is provided through voltage dropping resistor R11 to U3 pin 6. R12 provides a path to the input of the Fault Detection circuit. This enables the Fault Detector to monitor the DC voltage on U3.

AUDIO AMPLIFIER

Operational amplifier U6.3 provides audio frequency amplification. Its gain is set by its associated resistors, including variable resistor VR1. VR1 allows for adjusting the AF output level to 1 Vrms with a standard input signal to the module (1 kHz AF, 3 kHz peak deviation). In the 12.5 kHz mode, the demodulated audio is at a lower level than in the 25 kHz mode. The gain of amplifier U6.3 is, therefore, increased to give the same 1V rms output with a standard input signal to the module of 1.5 kHz deviation. This is done by transistor switch Q6 connecting R1 across R40. U6.2 is used as a voltage regulator to provide 4 Vdc for biasing the operational amplifier.



21.4 MHz IF MODULE - BLOCK DIAGRAM

SQUELCH

Buffer Amplifier

Integrated circuit U6.4 is configured as a unity gain buffer amplifier. It provides a high input impedance to minimize loading of the previous circuits.

Bandpass Filter

The audio frequency bandpass filter consists of U7.1 and its associated circuitry. The purpose of this filter is to reject all voice frequencies and allow only demodulated noise to pass. The functioning of the squelch circuit depends upon the presence or absence of this noise. (When a signal is being received, i.e. the receiver is quiet, the squelch circuit senses the absence of noise and unsquelches the radio.)

Noise Detector

U7.2 along with associated components act as a noise detector. The rectified output of U7.2 charges C11/C44 to a nearly constant DC voltage.

DC Amplifier

U7.3 is configured as a basic amplifier with a gain of 3.

Schmitt Trigger

U7.4 is configured as an amplifier with positive feedback. This arrangement provides hysteresis in the output versus input characteristic. This eliminates the possibility of the squelch circuit repeatedly cutting in and out when the input signal is near a threshold. R56 and R57 act as a voltage divider to provide a 5 volt logic level output. (Logic High = unsquelched)

FAULT DETECTOR

U4 and U5 are voltage comparators. These are configured into four "window detectors" which sense the presence of voltages within specified ranges (windows).

The four window detector circuits are U4.1 & U4.2, U4.4 & U4.3, U5.1 & U5.2, and U5.4 & U5.3. These monitor DC operating voltages on U6.2, U1, Q2, and U3 respectively. R29 and R30 comprise a voltage divider to provide a 5 volt logic level output. A fault is indicated when the output drops to zero.

Diode D1 and transistor Q3 monitor the output of the 8V regulator. DI is a 8.2 volt breakdown diode. If the regulator output voltage should rise above 8.9 V (8.2 + 0.7 base-emitter drop) Q1will turn on and a fault will be indicated.

Transistors Q4 and Q5 are drivers for the front panel LED CRI. These are powered from the +13.8 Vdc line before the 8V regulator. Therefore, if the regulator opens, a fault will still be indicated.

VOLTAGE REGULATOR

U8 is a monolithic integrated-circuit voltage regulator providing 8 Vdc. This powers all circuitry in the module with the exception of Q2, the front panel LED and its drivers.

ADDRESS DECODER

The address decoder consists of U2, an 8-stage shift register, and U9, a BCD-to-decimal decoder. When A2, A1 and A0 are ’1’, ’1’, ’0’, respectively and the ENABLE line is high, Q7 on U9 goes high. This enables data input to U2 to propagate through it, controlled by the clock pulses on U2-3. When the ENABLE signal goes low, U9-4 goes low, and the shift-register outputs are latched. Q1 on U2 is then high for the 12.5 kHz mode, and low for the 25 kHz mode.

MAINTENANCE

RECOMMENDED TEST EQUIPMENT

The following test equipment is required to test the IF Module.

1. FM Signal Generator; HP 8640B, HP 8657A, or equivalent
2. AF Generator or Function Generator
3. Audio Analyzer; HP 8903B, HP 339A, or equivalent
4. Oscilloscope
5. Frequency Counter; Racal-Dana 9919 or equivalent
6. DC Meter for troubleshooting
7. Power Supply; 13.8 Vdc @ 150 mA
8 Power Supply; 12 Vdc @20 mA

ALIGNMENT PROCEDURE

1. Apply 13.8 Vdc and 12 Vdc supplies to module.
2. Verify 13.8 V DC current consumption is between 90 and 150 mA, and 12 Vdc current is between 12 and 18 mA.
3. Verify fault output is 0 to 0.5 Vdc and front panel LED is off.

4. Apply a standard input signal to the module input. (-60 dBm, 21.4 MHz signal modulated with 1 kHz AF, 3 kHz peak deviation)

5. Monitor TP5 with a high-impedance probe connected to the frequency counter. Adjust L10 for a reading of 455 kHz ± 100 Hz.

6. Set VRI for 1 Vrms ±3% at module output (pin 31C on 96 pin connector J2).

TROUBLESHOOTING

When troubleshooting the module, it is most convenient if the standard test fixture is used. The following conditions are with the module in the 25 kHz mode. This can be set up using a PC with the necessary software connected to the test fixture. Alternatively, a wire link can be soldered between holes H1 and H2 on the PC board.

IF amplifier Q2 has a nominal 8 dB gain. U1 has a nominal gain of 30 dB. The mixer has about 2 dB loss with proper LO injection. The proper crystal oscillator level is 10 mV pk measured at TP3.

The following four test points are provided on the PWB for additional test capability:

TP1: 60 mV pk @ 21.4 MHz with -30 dBm input signal

TP3: 10 mV pk @ 20.945 MHz independent of input signal

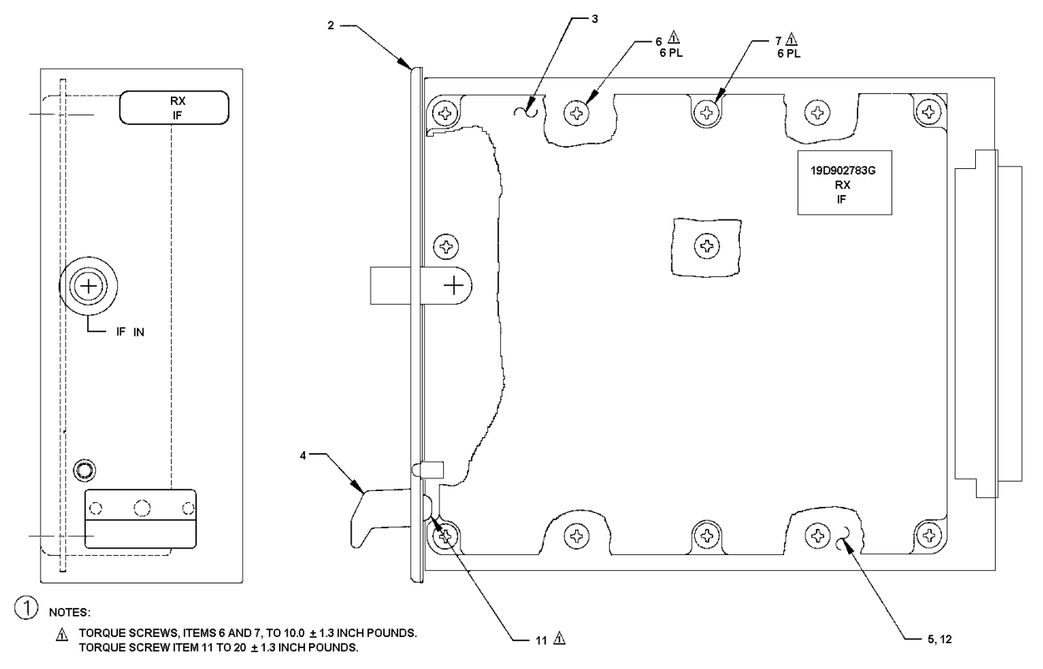
TP4: 20 mV pk @ 455 kHz with -60 dBm input signal

TP5: 750 mV pk @ 455 kHz with -60 dbm input signal

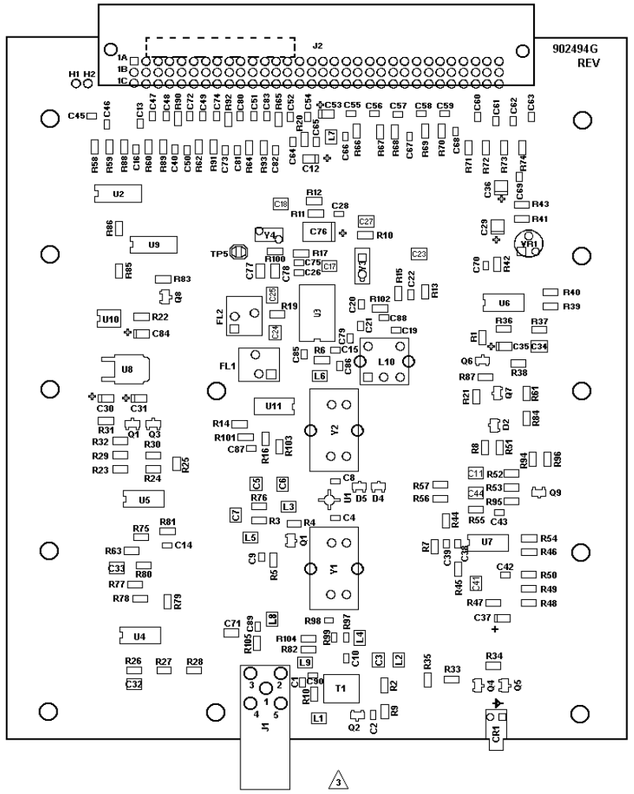
All RF voltages measured with 10 Megohm, 11 pF probe.

TROUBLE SHOOTING GUIDE

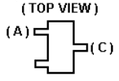
SYMPTOM	CHECK (CORRECT READING SHOWN)	INCORRECT READING INDICATES DEFECTIVE COMPONENT
Fault indicator on	Check DC voltages +8V at U8 Pin 1 +4v at U6 Pin 7 5.5V at U1 output pin 6V at U3 Pin 5	If DC voltages not correct U8 or associated components U6 or associated components U1 or associated components U3 or associated components If DC voltages correct U4, U5, U6, DI, Q3, Q4, Q5
No audio - no noise	With no signal applied to module IF input Check for AF noise @ C29 ; 200mV Check for AF noise @ U6 Pin 14:1 V	U3 or associated components U6 or associated components
Noise only - no demodulated audio	Check crystal oscillator: TP3 10 mVpk 20.945 MHz Apply-30 dBm 21.4 MHz input, check TPl 60 mVpk Apply-60 dBm 21.4 MHz input, check TP4 20 mVpk	U3, Y3 or associated components Q2, Y1, U1 or associated components U3, FL1 or associated components
Poor 12 dB SINAD	Check crystal oscillator: TP3 10 mVpk 20.945 MHz Apply-30 dBm 21.4 MHz input, check TP1 60 mVpk Apply-60 dBm 21.4 MHz input, check TP4 20 mVpk	U3, Y3 or associated components Q6, Y1, U1 or associated components U3, FL1 or associated components
No squelch function	With squelch pot maximum, or with module AUDIO/ SQUELCH/HI connected to SQUELCH/ARM input and with no signal to module IF input: Check Presence of 1 Vpk noise at U6 Pin 14	U6 or associated components
	Check presence of 1 Vpk noise U7 at Pin 1 Check DC voltage U7 at Pin 8: 7V Check DC voltage U7 at Pin 14: 0.5V	U7 or associated components



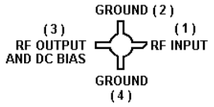
RECEIVER IF MODULE
19D902783G7
(19D902783, Sh. 1, Rev. 3)



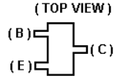
LEAD IDENTIFICATION FOR
D1, D2, D4, D5
(SOT) DIODES
(TOP VIEW)



LEAD IDENTIFICATION FOR
U1
(TOP VIEW)



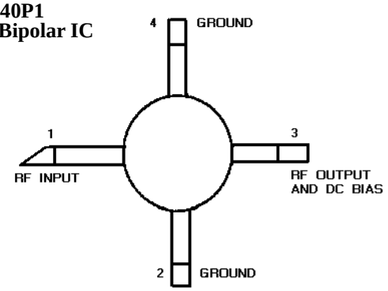
LEAD IDENTIFICATION FOR
Q1-Q9
(SOT) TRANSISTORS
(TOP VIEW)



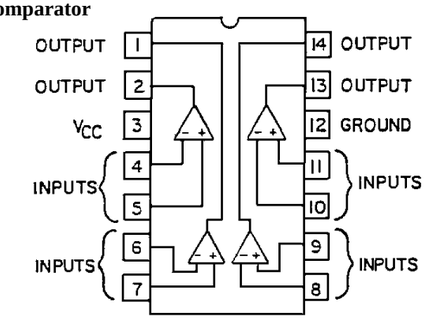
CAUTION
OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES

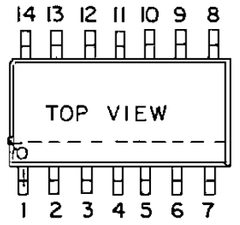
RECEIVER IF MODULE
19D902494G7
(19D902494, Sh.3, Rev. 2)

U1
344A3740P1
Silicon Bipolar IC



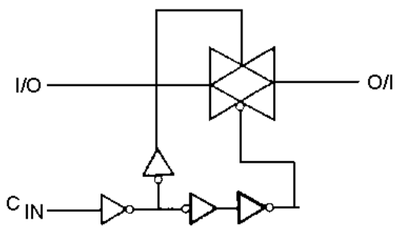
U4 & U5
19A704125P1
Quad Comparator



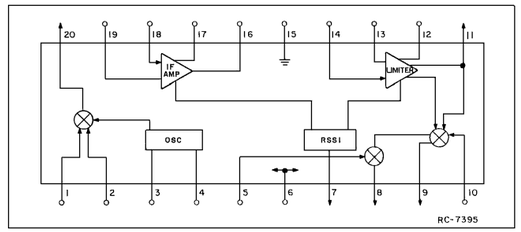


U11
RYT3066018/C
Bilateral Switch

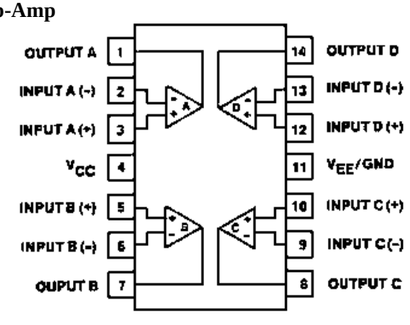
LOGIC DIAGRAM (PER CHANNEL)



U3
19A705535P3
FM Receiver



U6 & U7
19A701789P4
Quad Op-Amp

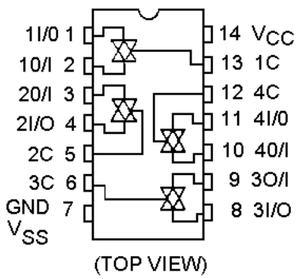


U8
19A704971P10
Voltage Regulator

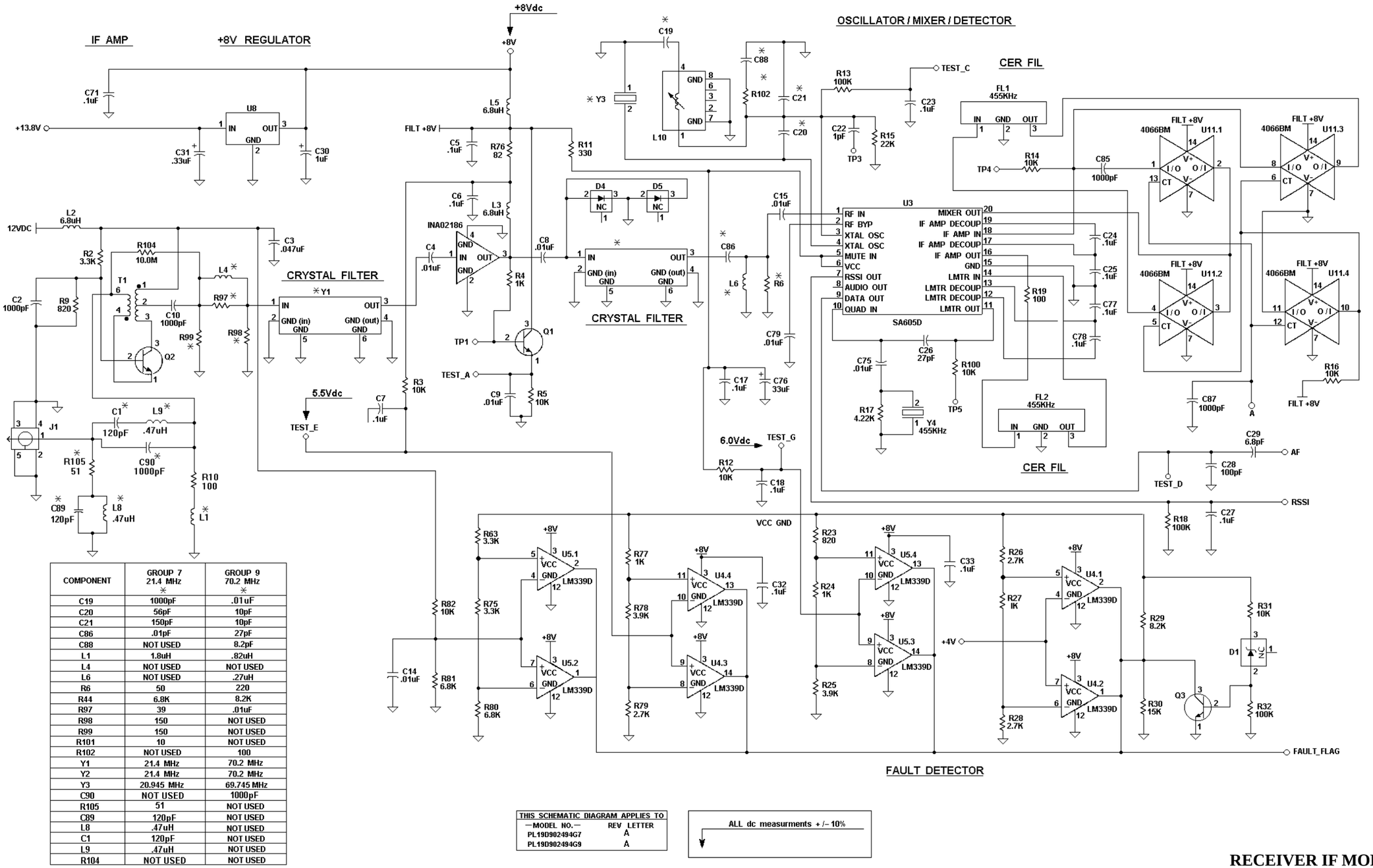
(Heatsink surface connected to Pin 2)

PIN 1. INPUT
2. GROUND
3. OUTPUT

PIN ASSIGNMENT



(TOP VIEW)

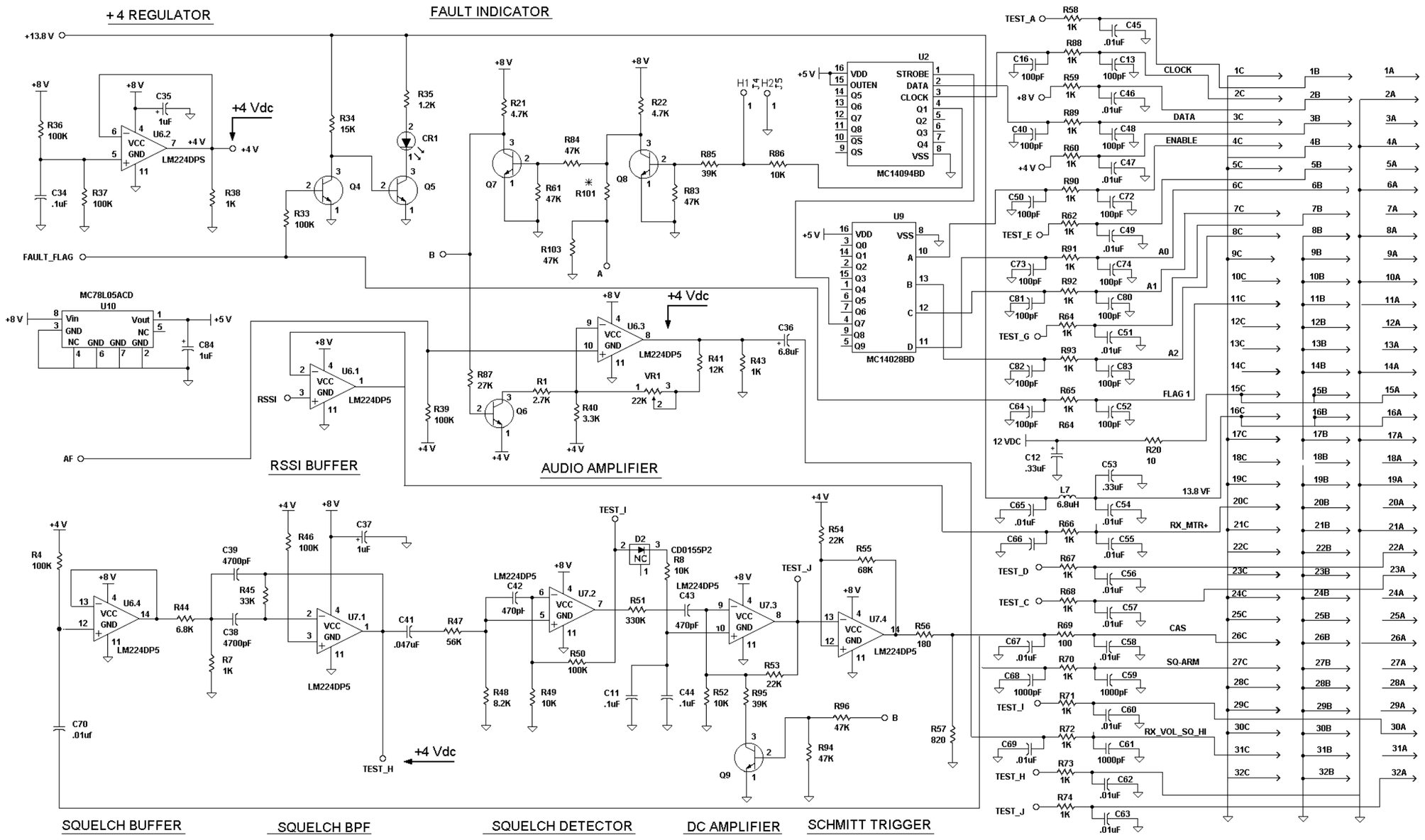


COMPONENT	GROUP 7 21.4 MHz	GROUP 9 70.2 MHz
C19	1000pF	.01uF
C20	56pF	10pF
C21	150pF	10pF
C86	.01pF	27pF
C88	NOT USED	8.2pF
L1	1.8uH	.82uH
L4	NOT USED	NOT USED
L6	NOT USED	.27uH
R6	50	220
R44	6.8K	8.2K
R97	39	.01uF
R98	150	NOT USED
R99	150	NOT USED
R101	10	NOT USED
R102	NOT USED	100
Y1	21.4 MHz	70.2 MHz
Y2	21.4 MHz	70.2 MHz
Y3	20.945 MHz	69.745 MHz
C90	NOT USED	1000pF
R105	51	NOT USED
C89	120pF	NOT USED
L8	.47uH	NOT USED
C1	120pF	NOT USED
L9	.47uH	NOT USED
R104	NOT USED	NOT USED

THIS SCHEMATIC DIAGRAM APPLIES TO	
—MODEL NO.—	REV LETTER
PL19D902494G7	A
PL19D902494G9	A

ALL dc measurments +/– 10%

RECEIVER IF MODULE
19D902494G7
(188D5586, Sh. 1, Rev. 2)



RECEIVER IF MODULE
19D902494G7
(188D5586, Sh. 2, Rev. 2)

RECEIVER IF MODULE
19D902783G7
ISSUE 1

SYMBOL	PART NUMBER	DESCRIPTION
		19D902783G7
		- - - - - - - MISCELLANEOUS - - - - - - - - -
2	19D902508P1	Chassis.
3	19D902509P1	Cover.
4	19D902555P1	Handle.
6	19A702381P506	Screw, thread forming: TORX, No. M3.5-.6 x 6.
7	19A702381P513	Screw, thread forming: TORX, No. M3.5 - 0.6 X 13.
8	19B235310P1	Nameplate.
11	19A702381P508	Screw, thd. form: No. 3.5-0.6 x 8.
		19D902494G7
		- - - - - - - - - - CAPACITORS - - - - - - -
C1	19A702236P52	Ceramic: 120 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C2	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C3	19A702052P22	Ceramic: 0.047 µF ±10%, 50 VDCW.
C4	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C5 thru C7	19A702052P26	Ceramic: 0.1+ or µF ±10%, 50 VDCW.
C8 and C9	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C10	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C11	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C12	19A705205P12	Tantalum: .33 µF, 16 VDCW; sim to Sprague 293D.
C14 and C15	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C16	19A702236P50	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C17 and C18	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C19	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C20	19A702236P44	Ceramic: 56 pF ±10%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C21	19A702236P54	Ceramic: 150 pF ±10%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C22	19A702061P1	Ceramic: 1 pF ±0.5% pF, 50 VDCW.
C23 thru C25	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C26	19A702061P33	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C27	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C28	19A702236P50	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C29	19A705205P5	Tantalum: 6.8 µF, 10 VDCW; sim to Sprague 293D.
C30	19A705205P2	Tantalum: 1 µF, 16 VDCW; sim to Sprague 293D.
C31	19A705205P12	Tantalum: .33 µF, 16 VDCW; sim to Sprague 293D.
C32 thru C34	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C35	19A705205P2	Tantalum: 1 µF, 16 VDCW; sim to Sprague 293D.
C36	19A705205P5	Tantalum: 6.8 µF, 10 VDCW; sim to Sprague 293D.
C37	19A705205P2	Tantalum: 1 µF, 16 VDCW; sim to Sprague 293D.
C38 and C39	19A702052P10	Ceramic: 4700 pF ±10%, 50 VDCW.
C40	19A702236P50	Ceramic: 10 0 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C41	19A702052P22	Ceramic: 0.047 µF ±10%, 50 VDCW.
C42 and C43	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C44	19A702052P26	Ceramic: 0.1µF ±10%, 50 VDCW.
C45 thru C47	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C48	19A702236 P50	Ceramic: 10 0 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C49	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C50	19A702236P50	Ceramic: 10 0 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C51 and C52	19A702052P14	Ceramic: 0.01µF±10%, 50 VDCW.
C53	19A705205P12	Tantalum: .33 µF, 16 VDCW; sim to Sprague 293D.
C54 and C55	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C56	19A702236P50	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0+ or -30 PPM/°C.
C57 and C58	19A702052P14	Ceramic: 0.01 µF±10%, 50 VDCW.
C59	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C60	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C61	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C62 thru C67	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C68	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C69 and C70	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C71	19A702052P33	Ceramic: 0.1 µF ±10%, 50 VDCW.
C73 and C74	19A702236P50	Ceramic: 10 0 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C75	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C76	19A705205P15	Tantalum: 33 µF, 16 VDCW; sim to Sprague 293D.
C77 and C78	19A702052P33	Ceramic: 0.1µF ±10%, 50 VDCW.
C79	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C80 thru C83	19A702236P50	Ceramic: 10 0 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C84	19A705052P2	Tantalum: .1 µF, 16 VDCW; sim to Sprague 293D.
C85	19A702052P5	Ceramic: 10 00 pF ±10%, 50 VDCW.
C86	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C87	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C89	19A702236P52	Ceramic: 120 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C90	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
		- - - - - - - - - - DIODES - - - - - - - - - -
CR1	19A703595P10	Optoelectric: Red LED; sim to HP HLMP-1301-010.
		- - - - - - - - - - DIODES - - - - - - - - - -
D1	19A700083P105	Silicon: Zener; 8.2 Volt.
D2	19A700155P2	Silicon: 100 mA, 35 PIV; sim to BAT 18.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL1 and FL2	19A702171P2	Bandpass Filter: 455 ± 0.5 kHz, 3 dB BW ± 0.5 kHz, 9 dB BW ± 7 kHz; sim to Toko SHCFM2-455D.
		- - - - - - - - - - JACKS - - - - - - - - - -
J1	19A115938P24	Coaxial Connector.
J2	19B801587P7	Connector, DIN: 96 male contacts, right angle mounting; sim to AMP 650887-1.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19A705470P28	Coil: 1.8 µH, ±20%; sim to Toko 380LB-1R8M.
L2 and L3	19A705470P35	Coil: 6.8 µH, ±20%; sim to Toko 380LB-6R8M.
L5	19A705470P35	Coil: 6.8 µH ±20%; sim to Toko 380LB-6R8M.
L7	19A705470P35	Coil: 6.8 µH ±20%; sim to Toko 380LB-6R8M.
L8 and L9	19A705470P21	Coil, RF: 0.47 µH, ±20%; sim to Toko 380NB-R42M.
L10	19A703311P1	Coil, RF: sim to Toko American KON-K6572BA.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A704708P2	Silicon, NPN: sim to NEC 2SC3356.
Q3 thru Q9	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	19B800607P272	Metal filter: 2.7 K ohms ±5%, 1/8 w.
R2	19B800607P332	Metal film: 3.3K ohms ±5%, 1/8 w.
R3	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R4	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R5	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R6	19B800607P510	Metal film: 51 ohms ±5%, 1/8 w.
R7	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R8	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R9	19B800607P821	Metal film: 820 ohms ±5%, 1/8 w.
R10	19B800607P101	Metal film: 100 ohms ±5%, 1/8 w.
R11	19B800607P331	Metal film: 330 ohms ±5%, 1/8 w.
R12	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R13	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R14	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R15	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w.
R16	19B800607P103	Metal film: 10 ohms ±5%, 1/8 w.
R17	19A702931P261	Metal film: 4220 ohms ±1%, 200 VDCW, 1/8 w.
R18	19A702931P401	Metal film: 100K ohms ±1%, 200 VDCW, 1/8 w.
R19	19B800607P101	Metal film: 100 ohms ±5%, 1/8 w.
R20	19B800607P100	Metal film: 10 ohms ±5%, 1/8 w.
R21 and R22	19B800607P472	Metal film: 4.7K ohms ±5%, 1/8 w.
R23	19B800607P821	Metal film: 820 ohms ±5%, 1/8 w.
R24	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R25	19B800607P392	Metal film: 3.9K ohms ±5%, 1/8 w.
R26	19B800607P272	Metal film: 2.7K ohms ±5%, 1/8 w.
R27	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R28	19B800607P272	Metal film: 2.7K ohms ±5%, 1/8 w.
R29	19B800607P822	Metal film: 8.2K ohms ±5%, 1/8 w.
R30	19B800607P153	Metal film: 15K ohms ±5%, 1/8 w.
R31	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R32 and R33	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R34	19B800607P153	Metal film: 15K ohms ±5%, 1/8 w.
R35	19B800607P122	Metal film: 1.2K ohms ±5%, 1/8 w.
R36 and R37	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R38	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R39	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R40	19B800607P332	Metal film: 3.3K ohms ±5%, 1/8 w.
R41	19B800607P123	Metal film: 12K ohms ±5%, 1/8 w.
R42	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R43	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R44	19B800607P682	Metal film: 6.8K ohms ±5%, 1/8 w.
R45	19B800607P333	Metal film: 33K ohms ±5%, 1/8 w.
R46	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R47	19B800607P563	Metal film: 56K ohms ±5%, 1/8 w.
R48	19B800607P822	Metal film: 8.2K ohms ±5%, 1/8 w.
R49	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R50	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R51	19B800607P334	Metal film: 330K ohms ±5%, 1/8 w.
R52	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R53 and R54	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w.
R55	19B800607P683	Metal film: 68K ohms ±5%, 1/8 w.
R56	19B800607P181	Metal film: 180 ohms ±5%, 1/8 w.
R57	19B800607P821	Metal film: 820 ohms ±5%, 1/8 w.
R58 thru R60	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R61	19B800607P473	Metal film: 47K ohms ±5%, 1/8 w.
R62	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R63	19B800607P332	Metal film: 3.3K ohms ±5%, 1/8 w.
R64 thru R66	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R67	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R68	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R69	19B800607P101	Metal film: 100 ohms ±5%, 1/8 w.
R70 thru R74	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R75	19B800607P332	Metal film: 3.3K ohms ±5%, 1/8 w.
R76	19B800607P820	Metal film: 82 ohms ±5%, 1/8 w.
R77	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R78	19B800607P392	Metal film: 3.9K ohms ±5%, 1/8 w.
R79	19B800607P272	Metal film: 2.7K ohms ±5%, 1/8 w.
R80 and R81	19B800607P682	Metal film: 6.8K ohms ±5%, 1/8 w.
R82	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R83 and R84	19B800607P473	Metal film: 47K ohms ±5%, 1/8 w.
R85	19B800607P393	Metal film: 39K ohms ±5%, 1/8 w.
R86	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R87	19B800607P273	Metal film: 27K ohms ±5%, 1/8 w.
R88 thru R93	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R94	19B800607P473	Metal film: 47K ohms ±5%, 1/8 w.
R95	19B800607P393	Metal film: 39K ohms ±5%, 1/8 w.
R96	19B800607P473	Metal film: 47K ohms ±5%, 1/8 w.
R97	19B801251P390	Metal film: 39 ohms ±5%, 1/10 w.
R98 and R99	19B801251P151	Metal film: 150 ohms ±5%, 1/10 w.
R100	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R101	19B800607P100	Metal film: 10 ohms ±5%, 1/8 w.
R103	19B800607P473	Metal film: 47K ohms ±5%, 1/8 w.
R105	19B800607P510	Metal film: 51 ohms ±5%, 1/8 w.
		- - - - - - - - - TEST POINT - - - - - - - - - -
TP5	344A3367P1	Test Point.
		- - - - - - - - - TRANSFORMERS - - - - - - - -
T1	REGUA10003/1	Transformer.
		- - - - - - - INTEGRATED CIRCUITS - - - - - -
U1	344A3740P1	Linear: Amp; sim to INA-02186.
U2	RYT3066014/C	8-Bit Sipo Shift Latch Register CMOS
U3	19A705535P3	Linear: RF/IF Signal Processor; sim to SA605N.
U4 and U5	19A704125P1	Linear: Quad Comparator; sim to LM339D.
U6 and U7	19A701789P4	Linear: Op Amp; sim to LM224D.
U8	19A704971P10	Linear: 8V; Voltage Regulator.
U9	RYT3116009	Login CMOS
U10	19A704971P9	Voltage Regulator: +5V.
U11	RYT3066018/C	Switch, Bilateral: CMOS QUAD.
		- - - - - VARIABLE RESISTOR - - - - - - -
VR1	19B800779P12	Resistor, variable.
		- - - - - - - - - - CRYSTALS - - - - - - - - -
Y1	19A149974G7	Filter, Crystal: 21.4 MHz.
Y2	19A149974G8	Filter, Crystal: 21.4 MHz.
Y3	19A702289G8	Crystal: 20.945 MHz.
Y4	19A149976P1	Discriminator: 455 kHz.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES