

INSTRUCTION MANUAL
FOR
3300 TRANSPONDER TEST SET

3300 Revision	1	2							
DATE	8-23-00	11-01-08							

TKM, INC
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SCOTTSDALE, AZ 85260

TABLE OF CONTENTS

Cover Page	
Table of Contents	
Product Description and Specifications	1
Specifications	2
Operation	2
Transponder Test Procedure	6
Theory of Operation	8
Alignment and Test	11
Final Test	12
Warranty	13
Schematics, Layouts, and Parts Lists	14
Top Assembly	15
PS/RF Assembly	17
Interrogation Circuits	19
Reply Circuit	20
Display Board	23
RF Circuits	26
Power Supply	37

PRODUCT DESCRIPTION AND SPECIFICATIONS

The MICHEL 3300 Transponder Test Set is designed to provide a convenient way to verify conformance with ATC Transponder performance criteria. The unit is capable of measuring performance by direct connection to the transponder or by radiated signal.

The 3300 consists of an interrogation section and a reply section. The lower half of the unit is devoted to the selection of interrogation parameters.

The following interrogation parameters are selectable by setting the function switch to the parameter to be changed and using the UP and DN buttons to set the desired value.

- PRF
- P1 Level
- P2 Level
- P3 Level
- P2 Position
- P3 Position
- Pulse Width
- Carrier Frequency
- P4 Position
- P4 Level

The upper half of the unit is devoted to the display of reply parameters. The following parameters can be displayed by selecting the desired reply parameter with selector switch.

- Frequency Error
- Power Level
- Percent Reply
- Transponder Delay
- Identification code
- Altitude
- Pulse Width

In addition the presence of the Reply pulses are displayed on a row of LED's at the top of the unit. For detailed evaluation of the signal characteristics Interrogation and Reply outputs are provided. The unit contains an internal battery for ramp use. Accessories include a battery charger and an antenna.

Note: Capabilities of the TKM, Inc. Michel 3300 Transponder Tester include testing of Mode A and Mode C transponders to meet the requirements 14 CFR, Part 43, Appendix F, Section 43.1

SPECIFICATIONS:**INTERROGATION SPECS.**

FUNCTION	RANGE	RESOLUTION	TOLERANCE
PRF	235 to 1700 I/S	100 I/S	+/- 2%
P1 LEVEL	-10 to -94 dbm	1 db	+/- 1.5 db
P2 LEVEL (ref P1)	+3 to -12 db	1 db	+/- .5 db
P3 LEVEL (ref P1)	+3 to -12 db	1 db	+/- .5 db
P2 POSITION	-35 to + .35 us	.05 u S	+/- .05 uS
P3 POSITION	-7 to + .7 us	.1 u S	+/- .05 uS
PULSE WIDTH	.3 to 1.7 u S	.1 u S	+/- .05 uS
FREQUENCY	1024 to 1038 MHz	1 MHz	+/- .1 MHz
P4 POSITION (ref P1)	2 to 17 u S	1.0 u S	+/- .05 uS
P4 level	-10 to -95 dbm	1 db	+/- 1.5 db

REPLY SPECS.

FREQUENCY	-10 to + 10 MHz	.1 MHz	+/- .2 MHz
POWER *	0 to 57 dbm	.5 db	1 db
% REPLY	0 to 100	1	+/- 2 %
DELAY (P3 to F1)	2 to 5 u S	.1 u S	+/- .1 u S
1D	0000 to 4095	1	N/A
ALT	-1,000 to +50,000	100 ft.	N/A
PULSE WIDTH	.3 to .7 u S	.02 u S	.04 u S

Power is calibrated to +/- .5 db at -52 dbm and -20 dbm. With PRF = 235 I/S.

Frequency is calibrated with PRF = 235 I/S.

OPERATION

The 3300 is designed to operate with a direct connection to the transponder or with radiation coupling. The lower half of the front panel is dedicated to selection of the interrogation parameters and the upper half is dedicated to the display of the reply parameters.

The interrogation parameters are adjusted by setting the selector switch to the function to be adjusted. The UP-DN buttons are used to set the parameter to the desired value. The A- AC-C switch is used to select the operating mode.

Off is the power off condition. When the external charger is connected the internal batteries will be charged regardless of the position of the switch.

DISPLAY BRIGHTNESS will normally be set to the dim level at power up; however if the UP button is held during power up the display will be set to the bright level.

PRF is the rate at which interrogations are made impulse groups per second. At power up the PRF is 235 and can be adjusted up to 1700 in increments of 100.

P11vl is the level of the P1 pulse displayed in dbm. The initial value is -30 dbm and is adjustable from -10 to -94 dbm in 1 db. increments. Levels below -80 dbm are below transponder threshold and are not accurately controlled. If low levels of interrogation are required an attenuator on the output is recommended.

P21vl is the level of the P2 pulse relative to the P1 pulse displayed in db. The initial value is -12 and is adjustable from -12 to +3 db in 1 db increments.

P31vl is the level of the P3 pulse relative to the P1 pulse displayed in db. The initial value is 0 and is adjustable from -12 to +3 db.

P2pos is the position deviation of the P2 pulse with respect to its nominal position of 2 uS after P1. The position deviation is displayed in uS from -.35 to +.35 in .05 increments. The initial value is 0.

P3pos is the position deviation of the P3 pulse with respect to its nominal position. In the A mode the nominal position is 8 uS after P1 and in C mode is 21 uS after P1. The position deviation is displayed from -.7 to +.7 uS in .1 increments. The initial value is 0.

WIDTH is the width of all pulses in an interrogation group. The pulse width is adjustable from .3 to 1.7 uS in .1 uS increments. The initial value is .8 uS.

FREQ is rf frequency of the interrogation and is adjustable from 1024 to 1039 MHz. in 1 MHz increments. The initial value is 1030 MHz.

P4pos is the position of an interfering pulse prior to the actual P1 pulse. P4pos is the position of the pulse displayed in uS and is adjustable from 2 to 17 uS prior to P1 in uS increments. The initial value is 2.

P41vl is the level of the P4 pulse in dbm. The level is adjustable from -94 to -10 dbm. The initial level is -94.

A-AC-C switch selects the operating mode. In the AC mode the interrogations alternate between A and C.

The reply parameters are displayed in the upper readout. The associated selector switch allows the display of the various reply characteristics. The top row of LED's indicate the presence of individual reply pulses.

FREQ is a readout of transponder frequency error displayed in MHz. Nominal transponder frequency is 1090 MHz. The 3300 contains a frequency discriminator and a scanning receiver. The receiver scans the incoming signal between 1080 and 1100 MHz to find a discriminator null. The unit may require several seconds to find the null and may have an uncertainty of +/-200 KHz due to the nature of transponder signal characteristics.

PWR displays the peak power level of input signal in dbm. Table 1 gives the relationship between dbm and watts in the high pressure range.

%REP displays the percentage of successful interrogations.

P3-F1 displays the time between the P3 interrogation pulse and the F1 Reply pulse.

IDENT displays the decoded identification code from the transponder.

ALT displays the decoded altitude code from the transponder.

PW displays the reply pulse width in uS.

TABLE 1

- Dbm	Power (Watts)
47	50
47.5	56
48	63
48.5	71
49	79
49.5	89
50	100
50.5	112
51	126
51.5	141
52	158
52.5	178
53	199
53.5	223
54	251
54.5	282
55	316
55.5	355
56	398
56.5	446
57	501

DIRECT CONNECTION

For direct connection to the transponder a short length of RG58 A/U (less than 2 feet) should be used. It should be noted that the only valid way to check transmitter frequency on the older transponders is to measure with the aircraft antenna connected and use radiation coupling.

RADIATION COUPLING

Using the $\frac{1}{4}$ wave monopole supplied with the 3300 it has been empirically determined that the loss between the transponder and the 3300 at 3.0 feet is 30 db. Under these conditions a transponder with a -71 dbm receiver threshold will have a -41 dbm threshold and a 200 watt transponder will indicate 23 dbm on the 3300.

Figure 1 shows a typical radiation test configuration. The 3300 can be placed on a tripod and the distance from the transponder antenna should be set to 3 feet.

Since the transponder radiation pattern is affected by the geometry of the aircraft, it is advisable to measure power at various azimuth locations and use the measurement at an average location.

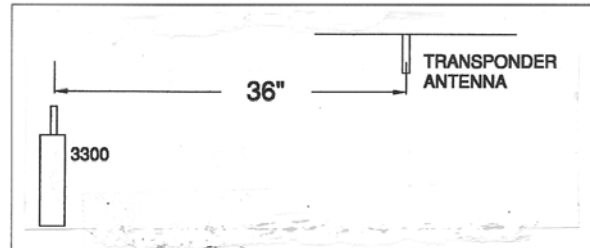


Figure 1. Typical Radiation Test Configuration

TRANSPONDER TEST PROCEDURE

The following procedure can be followed to verify transponder performance. This procedure is intended for ramp testing but because the 3300 has a wide dynamic operating range it can be used for bench testing with direct connection to the transponder without the requirement for attenuation between the units.

The 3300 can be handheld or tripod mounted for ramp measurements. For repeatable measurements the tripod mount is recommended. The configuration shown in Figure 1 has demonstrated a 30 db. space loss.

The test values given in the following procedure reflect the 30 db adjustment for space loss.

The following procedures are based on the reset conditions which occur whenever the 3300 is first turned on.

(a) Radio Reply Frequency:

For all classes of ATCRBS transponders the reply frequency shall be 1090 +/-3 MHz. To verify frequency, select PRF on the lower switch and FREQ on the upper switch. Set PRF to 235. Select Mode A with the A/C switch. Set the transponder ident code to 3333. The 3300 will then search for the reply frequency in 0.1 MHz steps. To expedite the search, momentarily select PWR on the upper switch and the frequency search will start at center frequency. After the search has reached a nearly stable value (about .1 or .2 MHz jitter)* the readout will indicate the reply frequency error.

(b) Suppression:

Set the lower selector switch to P2lvl and set the readout to zero. Set the upper selector switch to %RPL.

Set the lower selector switch to PRF and verify a reading of 235. Set the lower selector switch to P1lvl and scan from -30 to -10 as indicated on the readout. The %RPL readout should remain at zero.

Set the lower selector switch to P2lvl and set the readout to -9. Set the lower selector switch to P1lvl and scan from -30 to -10 as indicated on the readout. The %RPL readout should remain above 90. Note that if the transponder under test does not have sufficient sensitivity the %RPL may not work as low as 30. The following test will verify sensitivity.

- On occasion slightly large excursions may be noted but should be ignored.

(c) Receiver Sensitivity

Set the lower selector switch to PRF and set PRF to 235. Select %RPL with the upper selector switch. Select Mode A. Set the lower selector switch to P1lvl.

Set P1lvl to -20. Scan P1lvl down until %RPL drops below 90. Increase P1lvl by 1 db to verify that %RPL goes over 90. The receiver sensitivity is the P1lvl reading plus 30 and should be 73 ± 4 . Because of the uncertainty of the space loss an additional ± 3 db tolerance is allowed.

Repeat the above test but with Mode C selected. The difference between the Mode A and Mode C levels should not exceed 1 db.

(d) RF Peak Power

Set the lower selector switch to PRF and set PRF to 235. Select Mode A and set the transponder ident code to 3333. Set the upper selector switch to PWR. Set the lower selector switch to P1lvl and set P1lvl to -10. By adding 30 to the power reading and using Table 1 the power level can be determined. The power level should be in accordance with the class of the transponder under test. Again because of uncertainty of space loss a ± 3 db error is reasonable.

The preceding tests are required by Section 91.413 of the FAA Rules. Other tests such as Altitude, Ident verification, receiver tuning etc. can be performed in the radiation test.

Framing Pulses

Framing pulse spacing can be evaluated within $\pm .25$ μ S by observing the row of LED's. The acceptance window of the reply pulses is .5 μ S in width so that if a pulse position is more than .25 μ S in error the LED will not be lighted. Since the framing pulses are nominally spaced at 20.3 μ Sec the measurable error is $\pm 1.2\%$. Also by noting the proper operation of the S pulse the accuracy can be increased to $\pm 1\%$.

THEORY OF OPERATION

The 3300 TRANSPONDER TEST SET incorporates FPGA's (field programmable gate arrays) and other complex integrated circuits to perform interrogation and reply measurements for ATC transponders. A block diagram of the unit is shown in Figure 2.

Interrogation Display and Function Select (ref: DISPLAY BD., page 23).

Function selection is made by grounding the associated control line as selected with the INTERROGATION selector switch (lower switch). UP/DN selection and A/C selection is also made by grounding the associated control line.

The interrogation display is multiplexed and controlled by outputs of U1 on the CONTROL board.

Digital Interrogation Circuits (ref: INTERROGATION CIRCUITS, page 19). The digital interrogation circuits are contained in U1, U2 and U3. U4 is a serial PROM which loads the circuit configuration into U1 on power-up. U5 is a 20 MHz master oscillator.

U1 contains the interrogation logic. U3 is a PROM which translates the binary signals from U1 into 7 segment display signals for the Interrogation display.

Interrogation Frequency Synthesizer (ref: RF CIRCUITS, Page 26). The Frequency Synthesizer (U5) receives inputs from the CONTROL board and in turn supplies a control voltage to the 1030 MHz VCO (Q11). U5 contains a reference frequency divider to divide the 20 MHz input by 20; a variable divider to divide the buffered oscillator signal by 1024 to 1039 in increments of 1; and a phase/frequency detector to obtain the desired control voltage for the VCO. R71, C115 and C116 provide filtering of the VCO control voltage.

1030 MHz Oscillator (ref: RF CIRCUITS, Page 26). The 1030 MHz Oscillator is comprised of Q11 and associated components. Frequency is controlled by L40, C129 and D07. Coarse tuning is accomplished by adjusting the width of L40. Q9, Q10 and associated components are buffer amplifiers to prevent frequency pulling with modulation. RF output level to the Step Attenuator is adjusted by R59.

Level Decoder (ref: CONTROL Board, Page19). The Level Decoder (U2) gets binary level information from U1 and outputs control voltages to the Step Attenuator on an individual pulse basis.

Step Attenuator (ref: RF Circuits, Page 26, 27). The Step Attenuator consists of 8 steps. The Attenuator consists of U6 thru U15 and associated components. The steps include 1, 2, 4, 4, 10, 20, 20 and 20 db sections. The Step Attenuator is normally set for maximum attenuation with the control lines set to 0 VDC. Control lines selected by the Level Decoder are set high to output the desired RF pulse level.

1030 MHz Bandpass Filter (ref: RF Circuits, page 27). The Bandpass filter (U29) attenuates carrier harmonics and is primarily used to protect the Step Attenuator from the transponder reply pulses.

Input Attenuator (ref: RF Circuits, page 27). The Input Attenuator (R11, R17 and the other associated resistors) provides 50 db attenuation to reduce the Reply pulse power to level which allows linear operation of the Mixer and Receiver circuits.

Mixer (ref: RF Circuits, page 27). The Mixer (U23) combines the reply pulses and a local oscillator signal of approximately 937 MHz to provide an intermediate frequency of 153 MHz.

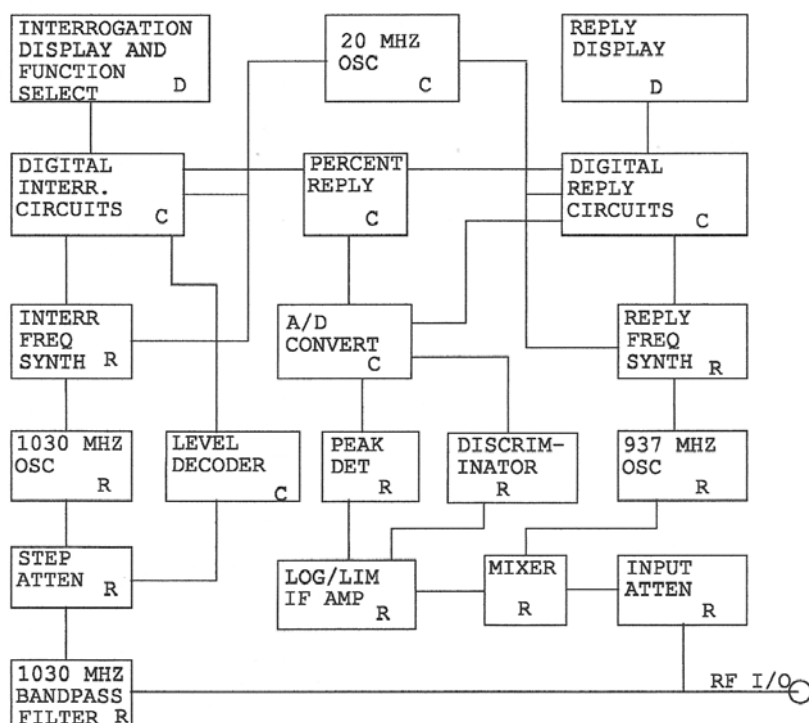
LOG/LIM IF Amplifier (RF Circuits, page 27). The Log/lim IF Amplifier (U1) receives a preamplified signal from U22 and outputs a video pulse proportional to the logarithm of the input level and an if pulse of constant amplitude. The video pulse is supplied as a REPLY output signal. The IF pulse is used to detect reply frequency.

In order to prevent noise from giving erroneous frequency readings the limiting section of the circuit is only activated after a pulse is received. Q15 is used as a gate for the limiting section.

Peak Detector (ref: RF Circuits, page 27) The peak detector utilizes a high speed comparator (U25) and charges C123 with emitter follower Q18 to provide the charge current. The voltage on C123 is compared to the peak of the video pulse to determine whether more charge is required.

Discriminator (ref: RF Circuits, page 27). The limited output of U1 is amplified by U28 and output to two tank circuits: C17, L42, C20 and C35, L41, C21. The first tank is resonant at 163 MHz and the second at 147 MHz. The signals are detected and input to U26 and U27 to obtain a DC voltage equivalent to the peak value of each signal. The signals are then coupled to an instrumentation amplifier made of sections of U3 and U4. The output signal from the instrumentation amplifier is the frequency error signal with a center frequency value of 2.5 VDC.

Figure 2. 3300 BLOCK DIAGRAM



LOCATION CODE: D-DISPLAY BD.; C-CONTROL BD.; R-RF CIRCUITS

A/D Converter (ref: CONTROL Bd. Page 20). The A/D Converter (U8) selects the input signal as indicated by the Digital Reply Circuits and outputs a binary code for the signal amplitude back to the Digital Reply Circuits.

Reply Display (ref: DISPLAY BD., page 20). The reply parameter to be displayed is selected by S1(the upper switch). D16, D17, D18 and D19 display the selected parameter value. D1 thru D15 indicate the status of individual reply pulses.

Digital Reply Circuits (ref: CONTROL BD. Page 20). The Digital Reply Circuits convert the A/D binary signals into 7 segment display signals and output them to the DISPLAY BD. The Percent Reply is derived by setting a flip-flop high with each interrogation and setting it low with each reply; the resulting signals is integrated in the RF Circuits and coupled back to the A/D Converter.

Reply Frequency Synthesizer (ref: RF Circuits, page 20). The Frequency Synthesizer (U2) receives inputs from the CONTROL board and in turn supplies a control voltage to the 937 MHz VCO (Q13). U5 contains a reference frequency divider to divide the 20 MHz input by 20; a variable divider to divide the buffered oscillator signal by 1024 to 1039 in increments of 1; and a phase/frequency detector to obtain the desired control voltage for the VCO. R71, C115 and C116 provide filtering of the VCO control voltage

ALIGNMENT,TEST AND CALIBRATION

It is recommended that this unit be sent in annually for calibration.

Alignment of the 3300 is confined to the RF Circuits. Some of the alignments require the removal of the cover on the RF Circuits but these adjustments are only required if some repair was performed.

Alignment

1. Turn on power with lower selector switch to PRF.
2. Adjust width of L40 to obtain a voltage of 2.3 +/- .2 vdc on R71.
3. Monitor the RF level on the RF output and adjust R59 to obtain -30 dbm.
This measurement can be made with a spectrum analyzer with a 5 MHz resolution bandwidth or by applying +5 vdc to the D0 through D7 pins of P5 and monitoring the RF level with any RF power meter; the power should be set to -10 dbm when using this method.
4. Set the upper selector switch to PWR. Adjust the width of L53 to obtain a voltage of 2.3 +/- .2 vdc on R1.
5. Connect a transponder of known output power to the 3300. Select Mode A with the transponder ident code set to 3333. Adjust R99 to obtain a power

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ALIGNMENT AND TEST

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Alignment

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This measurement can be made with a spectrum analyzer with a 5 MHz resolution bandwidth or by applying +5 vdc to the D0 through D7 pins of P5 and monitoring the RF level with any RF power meter; the power should be set to -10 dbm when using this method.
4. Set the upper selector switch to PWR. Adjust the width of L53 to obtain a voltage of 2.3 +/- .2 vdc on R1.
5. Connect a transponder of known output power to the 3300. Select Mode A with the transponder ident code set to 3333. Adjust R143 to obtain a power reading equal to the transponder power output. Insert a 40 db attenuator in series with RF input and adjust R99 to get a power reading 40 db less than

the transponder power output. Repeat this step until both power readings are correct.

6. With transponder directly connected to the 3300 monitor the transponder frequency with a spectrum analyzer. For this measurement the analyzer resolution may be less than 5 MHz. Adjust R101 to match the frequency error as measured on the spectrum analyzer.

FINAL TEST

The following parameters should be verified for final approval of equipment performance.

1. VSWR: Return Power at least 18 db down.
2. Carrier Leakage: -83 dbm max.(Conducted and Radiated)
3. P2 and P3 levels @ +/- 1 db @ 0,-9 dbm.
4. Pulse Width: +/- .05 uS.
5. P4 Level: +/- 2 db.
6. Pulse position: +/- .05 uS.
7. Carrier Frequency: +/- 100KHz.
8. PRF: +/- 1%.
9. INTER Output: OK
10. REPLY Output: OK
11. Battery: 1 hour min.
12. Low Battery Indication: OK
13. Reply POWER: @ 53 and 13 +/- .5 dbm
14. %REPLY: 0 and 100 +/- 1
15. Reply Frequency +/- 200 KHz.
16. IDENT Code Readout: OK
17. ALTitude Code Readout: OK
18. Delay Readout: +/- .1 uS
19. Pulse Width Readout: +/- .05 uS @ 13 dbm Reply Power.

WARRANTY

TKM products are warranted against defects in workmanship and material under normal use for which intended for two years from date of purchase. The battery is warranted for 60 days from date of purchase. Proof of purchase will be required along with a completed warranty application to activate warranty. TKM WILL NOT SERVICE ANY UNITS UNDER WARRANTY WITHOUT THE PROPER DOCUMENTATION ON FILE.

TKM's limit of liability shall be to repair or replace the product at their discretion. Transportation shall be prepaid to the TKM factory or authorized service facility. TKM shall not be liable for any consequential damage expense. TKM does not accept any repairs sent C.O.D., all units must be returned prepaid. TKM will pay return freight for all repairs covered under warranty within the U.S. The customer remains responsible for the charges from point of export for all international shipments, including any customs brokerage charges incurred.

This warranty shall not apply to any product which has been repaired or altered in any way so as to adversely affect its performance or reliability, or which has been subject to misuse, contamination, negligence, accident, shipping damage, improper installation or operation.

This warranty is in lieu of all other warranties, implied or expressed. TKM reserves the right to make design changes additions to and improvements in its products without obligation to install such in products previously manufactured.

This warranty shall, at TKM's option, become void if the ownership is changed, unless the prior owner or proposed owner obtains approval of continuation of warranty prior to the change of ownership.

CUSTOMER SERVICE

TKM's business hours are Monday – Friday 7:30 AM – 4:00 PM. We are closed weekends and Holidays. If you need assistance with your TKM product, or need to obtain a RA number please call during these hours.

TKM PHONE	1-480-991-5351 1-800-233-4183
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TKM FAX	1-480-991-3759
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TKM SHIPPING ADDRESS:

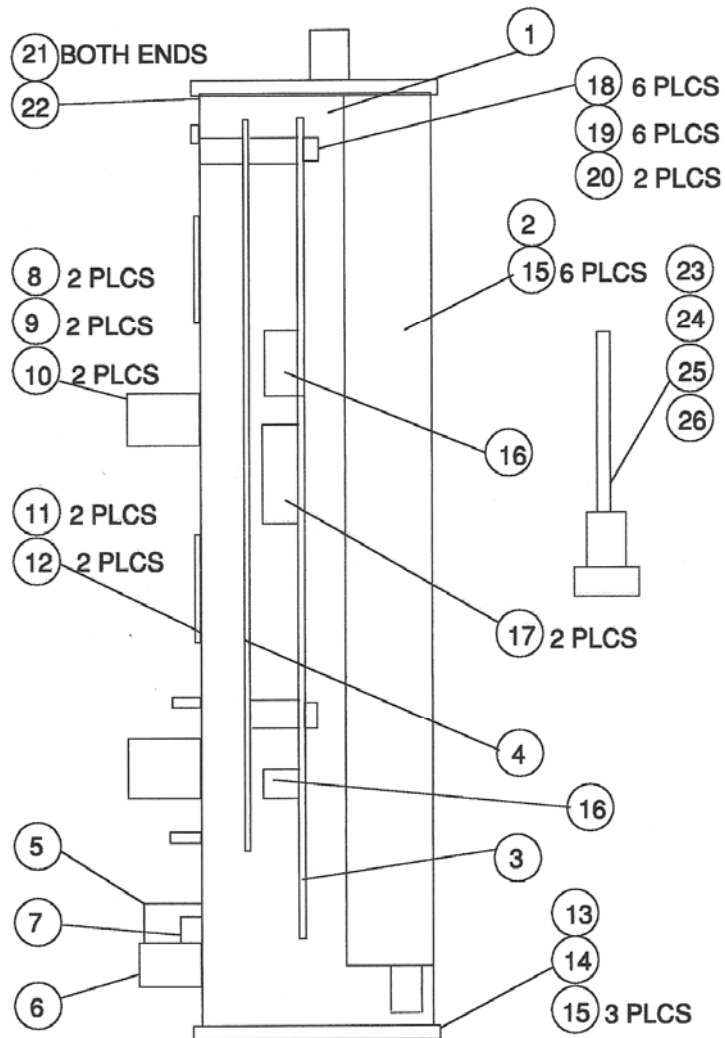
TKM, INC
14811 N. 73RD STREET
SCOTTSDALE, AZ 85260

SCHEMATICS, LAYOUTS and PARTS LISTS

The following section provides detail information of the 3300 design.

The sections include the following assembly information:

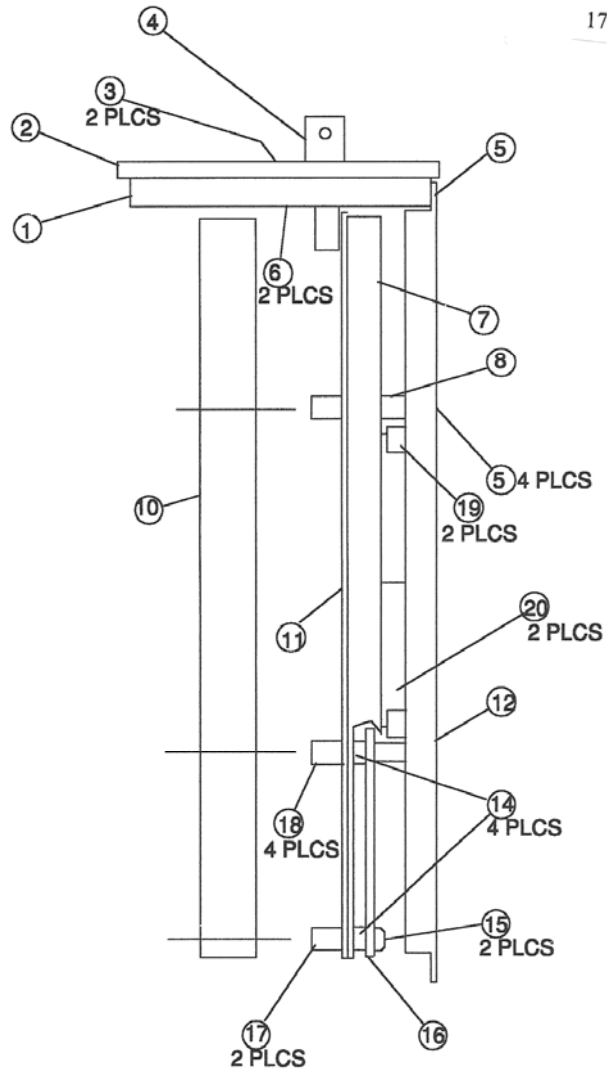
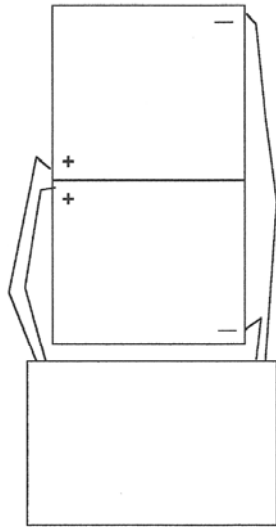
- 1) Top Assembly
- 2) PS/RF Assembly
- 3) Control Board Assembly
 - Interrogation Circuits
 - Reply Circuits
- 4) Display Board Assembly
- 5) RF Circuits Assembly
- 6) Power Supply



AT3300	SCALE	TOLERANCES .XX +/- .015 .XXX +/- .007 ANGLES +/- 1 DEG Hole dia: +/- .002		TKM, Inc	
	MAT'L			SCOTTSDALE, ARIZONA	
	FINISH	DRAWN BY WM	DATE	ASSEMBLY, TOP 3300	
		APPROVED	8-23-00	AT3300	REV
		APPROVED	USED ON	SHEET 1 OF 1	

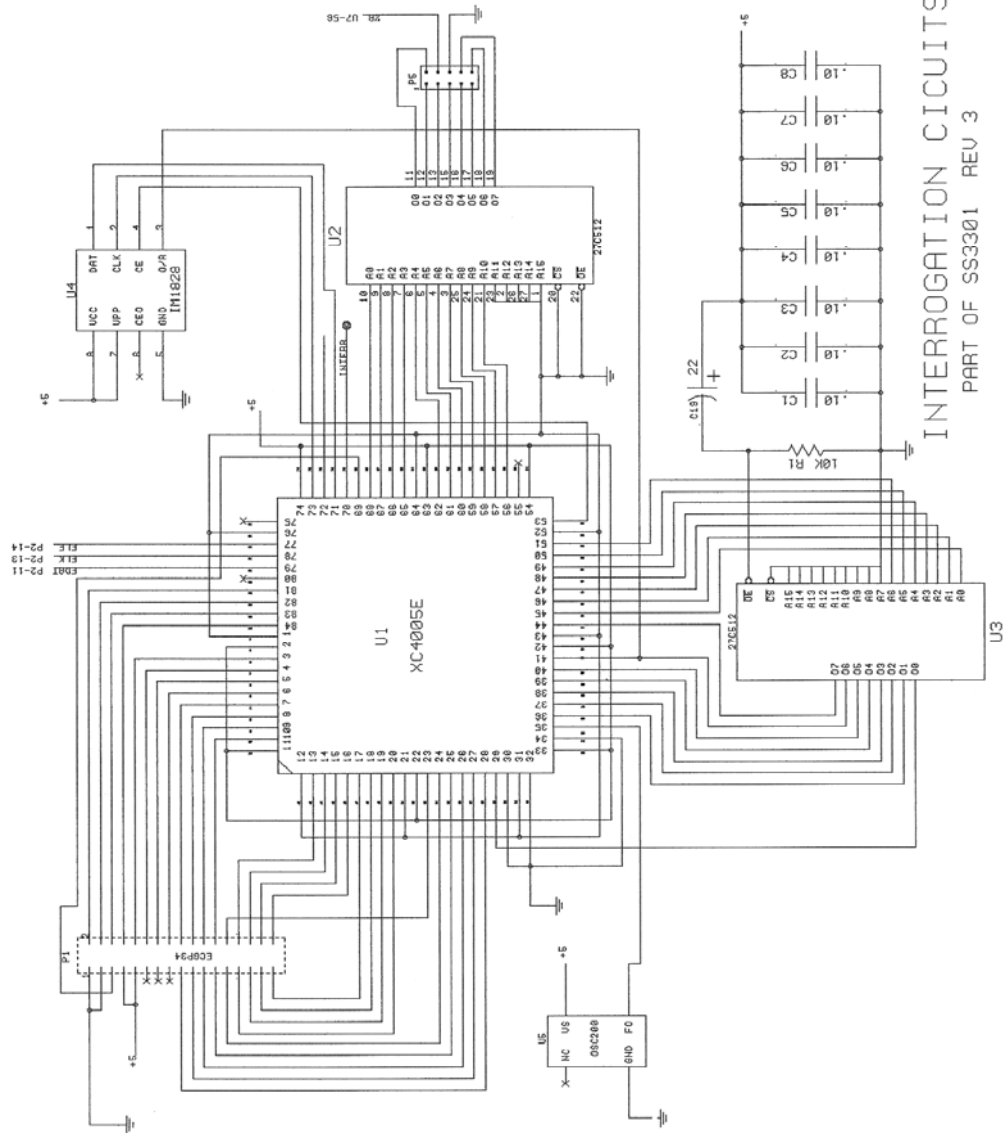
Ref#	Part #	Description	Qty
01	SM3001-2	SHEET METAL CASE, TRANSP. TEST SET	1
02	SS3320-	SUB-ASSEMBLY PS/RF	1
03	SS3301-	SUB-ASSEMBLY CONTROL BOARD	1
04	SS3302-1	SUB-ASSEMBLY BOARD, DISPLAY, 3300	1
05	EC1022-	CONNECTOR COAX CONN; UG/1094; SHORT	1
06	EC1022-	CONNECTOR COAX CONN; UG/1094; SHORT	1
07	MP3301-	MISC. PARTS POWER JACK, 2.1 mm. MALE	1
08	MP1145-	MISC. PARTS KNOB CAP 14.5 mm	2
09	MP1147-	MISC. PARTS KNOB, POINTER, 14.5mm	2
10	MP1148-	MISC. PARTS NUT COVER, POINTER, 14.5mm	2
11	HM3080-	HARDWARE; MACHINE Bezel, 3300	2
12	PL3310-	PLASTIC FILTER, DISPLAY	2
13	SM2211-	SHEET METAL PLATE, END	1
14	SM2207-	SHEET METAL PLATE, BACKUP	1
15	NB403F-	FASTENERS 4-40x3/16 Ph Fl 100, MS246	9
16	EC1001-	CONNECTOR 10 PIN; RIBBON CONN	4
17	EC1002-	CONNECTOR 14 PIN; RIBBON CONN	2
18	HS1500-	SPACER/STANDOFF 3/16 HEX; 4-40 X 7/16	6
19	NB403P-	FASTENERS 4-40x3/16 Ph Pan, MS51957-	6
20	NB408A-	FASTENERS 4-40x1/2 SOC. SET SCREW	2
21	MP1100-	MISC. PARTS SHIELDING GASKETS .5"	1
22	MP1110-	MISC. PARTS COPPER Tape 1/2"	1
23	HM3310-1	HARDWARE; MACHINE COLLAR, ANTENNA	1
24	HM3311-1	HARDWARE; MACHINE INSULATOR, ANTENNA	1
25	HM3312-1	HARDWARE; MACHINE ANTENNA	1
26	EC1804-	CONNECTOR COAX CONN; 79-59	1
27	MP3302-	MISC. PARTS CHARGER, 12 VDC, 500 ma.	1

BATTERY CONNECTION

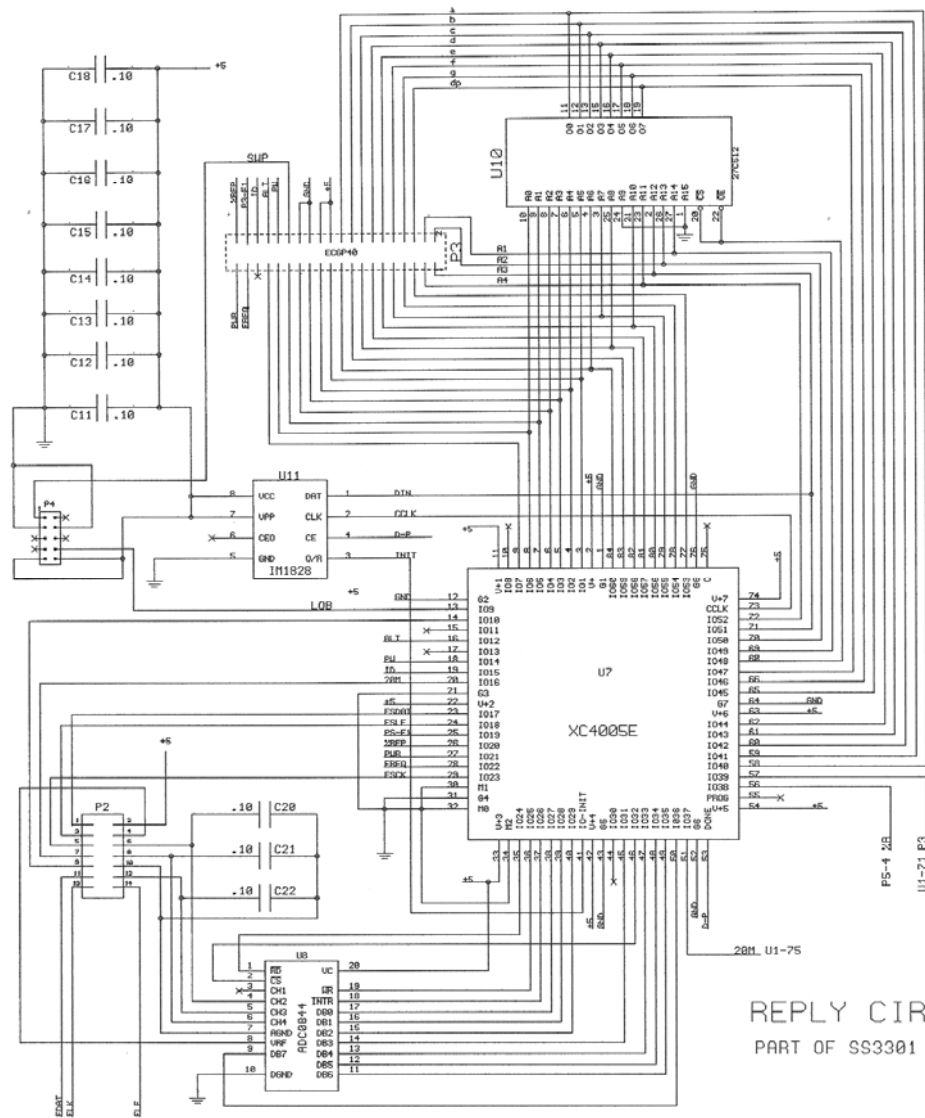


SS3320	SCALE	TOLERANCES .XX +/- .015 .XXX +/- .007 ANGLES +/- 1 DEG FRACT +/- 1/32		TKM, Inc SCOTTSDALE, ARIZONA		
	MAT'L					
	FINISH	DRAWN BY WM	DATE	PS/Rf ASSEMBLY		REV
		APPROVED	08-24-99	SS3320		
		APPROVED	USED ON	SHEET 1 OF 2		

Ref#	Part #	Description	Qty
01	SM2206-	SHEET METAL PLATE, BACKUP	1
02	SM2211-	SHEET METAL PLATE, END	1
03	NB407F-	FASTENERS 4-40x7/16 Ph Fl 100, MS246	2
04	EC3301-	CONNECTOR BNC, Bulkhead, RG188	1
05	NB403F-	FASTENERS 4-40x3/16 Ph Fl 100, MS246	1
06	NB400K-	FASTENERS 4-40 KEPS NUT	2
07	SM3304-	SHEET METAL BASE, RF BOARD	1
08	HS3301-	SPACER/STANDOFF 3/16 HEX, 4-40 X .53	2
09	NB402P-	FASTENERS 4-40 X 1/8, SS PAN HD	6
10	SM3306-	SHEET METAL SHIELD, RF	1
11	SS3305-4	SUB-ASSEMBLY ASSEMBLY, RF	1
12	SM3301-	SHEET METAL SM2201, GREEN	1
13	HS1012-	SPACER/STANDOFF 3/16 HEX X .312; 4-40 THD	2
14	HS2220-	SPACER/STANDOFF .187 RD X.110 X .125 THRU	2
15	NB406P-	FASTENERS 4-40 X .375, PAN HD	2
16	SS3310-	SUB-ASSEMBLY ASSEMBLY, PS	1
17	HS1001-	SPACER/STANDOFF 3/16H X 1/4" 4-40 THD	2
18	HS3302-	SPACER/STANDOFF M/F 4-40:3/16 HEX,.25-.375	4
19	SM3303-	SHEET METAL HOLDER, BATT	2
20	BA3300-	BATTERY 6V Nicad (5 AA) 800 mah.	2
21	NB202F-	FASTENERS 2-56 X 1/8 Phil FH	11
22	NB400N-	FASTENERS 4-40 SM PATRN NUT, NAS-671	4



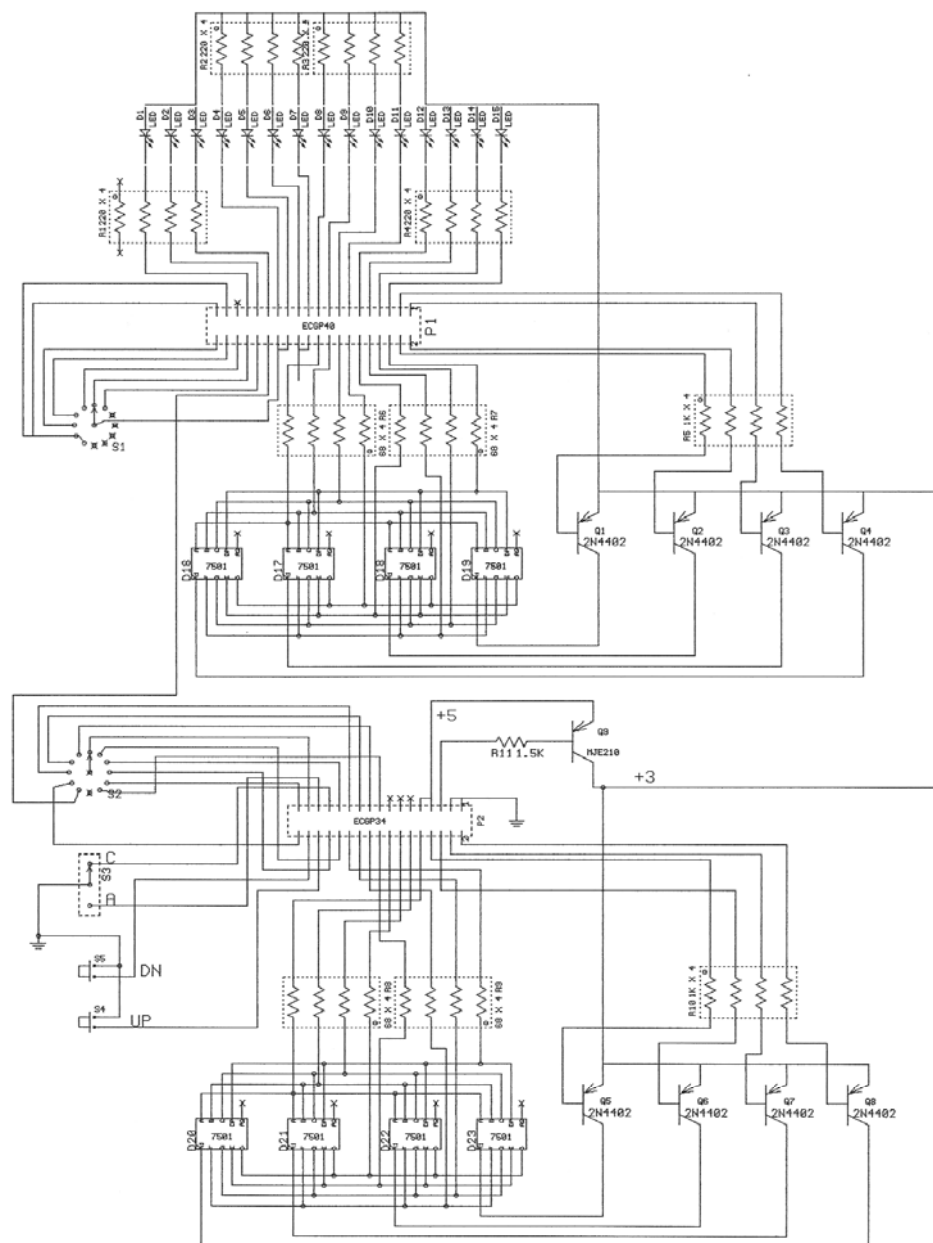
INTERROGATION CIRCUITS
PART OF SS3301 REV 3



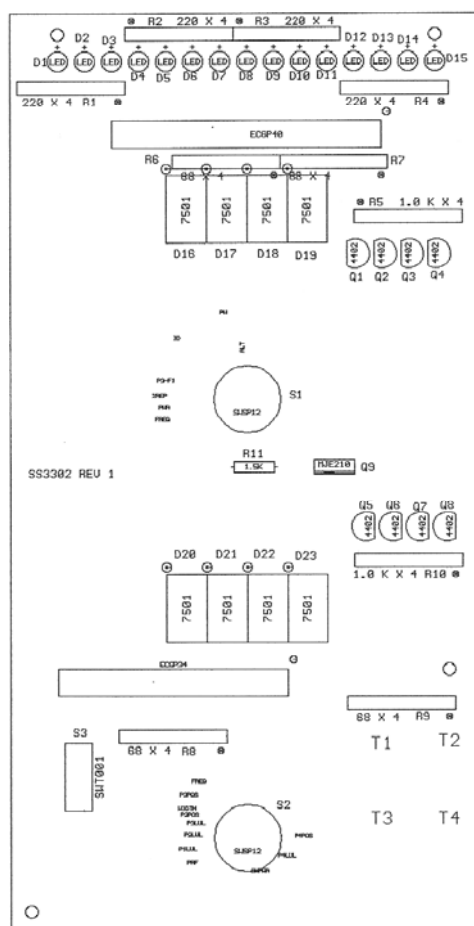
REPLY CIRCUIT:
PART OF SS3301 REV 3



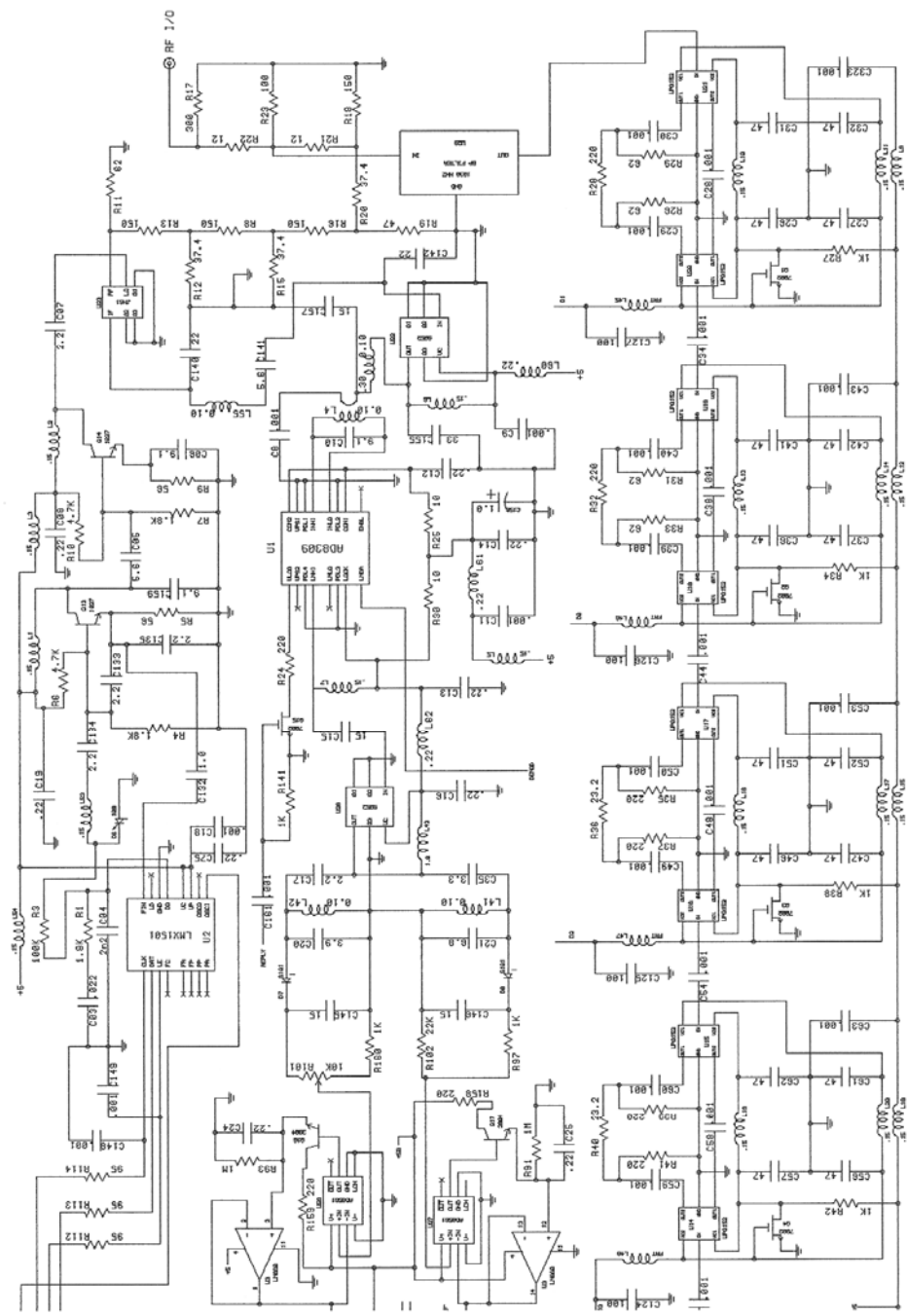
Ref#	Part #	Description	Qty
C01	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C02	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C03	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C04	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C05	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C06	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C07	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C08	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C11	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C12	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C13	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C14	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C15	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C16	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C17	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C18	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C19	CR1024-	CAP; MONO-CERAMIC .001uF; 100V	1
C19	CE2263-	CAP; ALUM ELECT. 22 uF, 35 V, LOW	1
C20	CR1024-	CAP; MONO-CERAMIC .001uF; 100V	1
C21	CR1024-	CAP; MONO-CERAMIC .001uF; 100V	1
C22	CR1024-	CAP; MONO-CERAMIC .001uF; 100V	1
P1	ECGP34-	CONNECTOR 34 PIN BOARD	1
P2	ECGP14-	CONNECTOR 14 PIN Board Plug	1
P3	ECGP40-	CONNECTOR 40 PIN BOARD	1
P4	ECGP10-	CONNECTOR 10 PIN BOARD PLUG	1
P5	ECGP10-	CONNECTOR 10 PIN BOARD PLUG	1
R1	RC0103-	RESISTOR; CARB. 10 Kohm; 5%; 1/4 watt	1
R2	RC0472-	RESISTOR; CARB. 4.7 Kohm; 5%; 1/4 watt	1
R3	RC0100-	RESISTOR; CARB. 10 Ohm; 5%; 1/4 watt	1
R4	RC0100-	RESISTOR; CARB. 10 Ohm; 5%; 1/4 watt	1
R5	RC0472-	RESISTOR; CARB. 4.7 Kohm; 5%; 1/4 watt	1
R6	RC0471-	RESISTOR; CARB. 470 Ohm; 5%; 1/4 watt	1
U1	IC4005-	INT. CKT; CMOS FPGA, 84 PIN	1
U10	IMC512-	INT. CKT.; MISC. 64K X 8 EPROM	1
U11	IM1828-	INT. CKT.; MISC. SERIAL PROM; 128K	1
U2	IMC512-	INT. CKT.; MISC. 64K X 8 EPROM	1
U3	IMC512-	INT. CKT.; MISC. 64K X 8 EPROM	1
U5	OSC200-	OSCILLATOR CLOCK, 20 MHz	1
U7	IC4005-	INT. CKT; CMOS FPGA, 84 PIN	1
U8	IM0844-	INT. CKT.; MISC. ADC0844 A to D CONV	1



DISPLAY BOARD - SS3302 REV 1

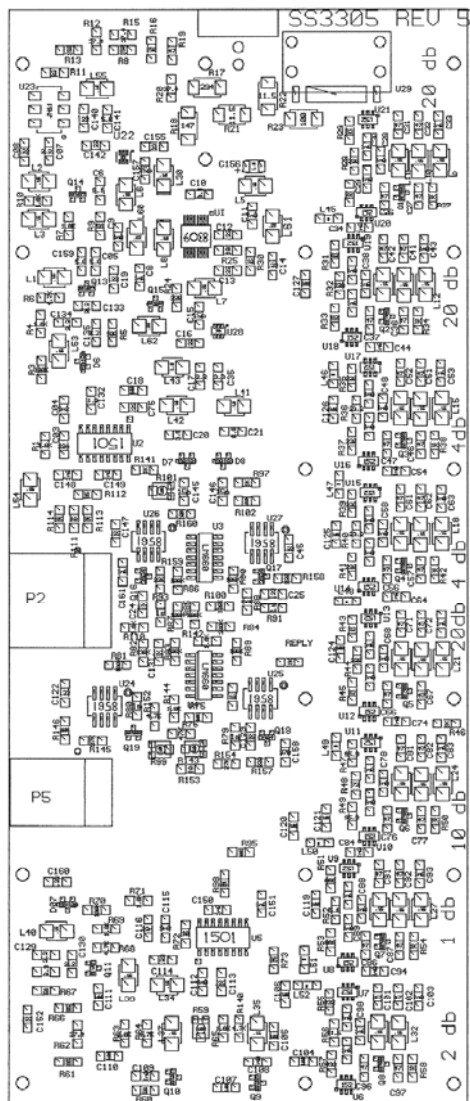


Ref#	Part #	Description	Qty
D1	DDSLED-	DIODE LED, RED	1
D10	DDSLED-	DIODE LED, RED	1
D11	DDSLED-	DIODE LED, RED	1
D12	DDSLED-	DIODE LED, RED	1
D13	DDSLED-	DIODE LED, RED	1
D14	DDSLED-	DIODE LED, RED	1
D15	DDSLED-	DIODE LED, RED	1
D16	DL7501-	LED; 7 SEGMENT RED; 7 SEGMENT LED	1
D17	DL7501-	LED; 7 SEGMENT RED; 7 SEGMENT LED	1
D18	DL7501-	LED; 7 SEGMENT RED; 7 SEGMENT LED	1
D19	DL7501-	LED; 7 SEGMENT RED; 7 SEGMENT LED	1
D2	DDSLED-	DIODE LED, RED	1
D20	DL7501-	LED; 7 SEGMENT RED; 7 SEGMENT LED	1
D21	DL7501-	LED; 7 SEGMENT RED; 7 SEGMENT LED	1
D22	DL7501-	LED; 7 SEGMENT RED; 7 SEGMENT LED	1
D23	DL7501-	LED; 7 SEGMENT RED; 7 SEGMENT LED	1
D3	DDSLED-	DIODE LED, RED	1
D4	DDSLED-	DIODE LED, RED	1
D5	DDSLED-	DIODE LED, RED	1
D6	DDSLED-	DIODE LED, RED	1
D7	DDSLED-	DIODE LED, RED	1
D8	DDSLED-	DIODE LED, RED	1
D9	DDSLED-	DIODE LED, RED	1
P1	ECGP40-	CONNECTOR 40 PIN BOARD	1
P2	ECGP34-	CONNECTOR 34 PIN BOARD	1
Q1	QX4402-	TRANSISTOR 2N4402	1
Q2	QX4402-	TRANSISTOR 2N4402	1
Q3	QX4402-	TRANSISTOR 2N4402	1
Q4	QX4402-	TRANSISTOR 2N4402	1
Q5	QX4402-	TRANSISTOR 2N4402	1
Q6	QX4402-	TRANSISTOR 2N4402	1
Q7	QX4402-	TRANSISTOR 2N4402	1
Q8	QX4402-	TRANSISTOR 2N4402	1
Q9	QX0210-	TRANSISTOR MJE210	1
R1	RR2214-	RESISTOR NETWORK 220 X 4 ISOL.	1
R10	RR1024-	RESISTOR NETWORK RES. NTRK. 1K X 4, ISO	1
R11	RC0152-	RESISTOR; CARB. 1.5 Kohm; 5%; 1/4 watt	1
R2	RR2214-	RESISTOR NETWORK 220 X 4 ISOL.	1
R3	RR2214-	RESISTOR NETWORK 220 X 4 ISOL.	1
R4	RR2214-	RESISTOR NETWORK 220 X 4 ISOL.	1
R5	RR1024-	RESISTOR NETWORK RES. NTRK. 1K X 4, ISO	1
R6	RR6804-	RESISTOR NETWORK 68 Ohm X 4	1
R7	RR6804-	RESISTOR NETWORK 68 Ohm X 4	1
R8	RR6804-	RESISTOR NETWORK 68 Ohm X 4	1
R9	RR6804-	RESISTOR NETWORK 68 Ohm X 4	1
S1	SW1700-1	SWITCHES 12 POS; ROTARY	1
S2	SW1700-1	SWITCHES 12 POS; ROTARY	1
S3	SWSPDT-	SWITCHES SPDT TOGGLE SWITCH	1
S4	SWPB01-	SWITCHES PUSH BUTTON, SPST	1
S5	SWPB01-	SWITCHES PUSH BUTTON, SPST	1



RF CIRCUITS SS3305 REV 3

Page 3



BOARD, RF - 3305 REV !

Ref#	Part #	Description	Qty
C03	CS0223-	CAP; SMT; CER; .022 UF, X7R, 10%, 1206	1
C04	CS0222-	CAP; SMT; CER; 2200 PF, X7R, 10%, 1206	1
C05	CS02R2-	CAP; SMT; CER; 2.2 PF, NPO, 5%, 1206	1
C06	CS09R1-	CAP; SMT; CER; 9.1 pF, 5%, 1206	1
C07	CS02R2-	CAP; SMT; CER; 2.2 PF, NPO, 5%, 1206	1
C08	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C10	CS05R6-	CAP; SMT; CER; 5.6pF; 100V; 1206	1
C100	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C101	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C102	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C103	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C104	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C105	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C106	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C107	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C108	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C109	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C11	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C110	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C111	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C112	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C113	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C114	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C115	CS0222-	CAP; SMT; CER; 2200 PF, X7R, 10%, 1206	1
C116	CS0223-	CAP; SMT; CER; .022 UF, X7R, 10%, 1206	1
C119	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C12	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C120	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C121	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C122	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C123	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C124	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C125	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C126	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C127	CS0101-	CAP; SMT; CER; 100PF; 100V; 1206	1
C128	CS02R2-	CAP; SMT; CER; 2.2 PF, NPO, 5%, 1206	1
C129	CS02R2-	CAP; SMT; CER; 2.2 PF, NPO, 5%, 1206	1
C13	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C130	CS02R2-	CAP; SMT; CER; 2.2 PF, NPO, 5%, 1206	1
C131	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C132	CS01R0-	CAP; SMT; CER; 1.0 pF, 5%, 1206	1
C133	CS02R2-	CAP; SMT; CER; 2.2 PF, NPO, 5%, 1206	1
C134	CS02R2-	CAP; SMT; CER; 2.2 PF, NPO, 5%, 1206	1
C135	CS02R2-	CAP; SMT; CER; 2.2 PF, NPO, 5%, 1206	1
C14	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C140	CS0220-	CAP; SMT; CER; 22 PF; 100V	1
C141	CS05R6-	CAP; SMT; CER; 5.6pF; 100V; 1206	1
C142	CS0220-	CAP; SMT; CER; 22 PF; 100V	1
C145	CS0150-	CAP; SMT; CER; 15pf; 100V; 1206	1
C146	CS0150-	CAP; SMT; CER; 15pf; 100V; 1206	1

Ref#	Part #	Description	Qty
C147	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C148	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C149	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C15	CS0150-	CAP; SMT; CER; 15pf; 100V; 1206	1
C150	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C151	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C152	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C155	CS0330-	CAP; SMT; CER; 33 pF, 5%, 1206	1
C156	CX0105-	CAP; SMT; TANT 1.0 uF; 35 V	1
C157	CS0150-	CAP; SMT; CER; 15pf; 100V; 1206	1
C16	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C17	CS02R2-	CAP; SMT; CER; 2.2 PF, NPO, 5%, 1206	1
C18	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C19	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C20	CS05R6-	CAP; SMT; CER; 5.6pF; 100V; 1206	1
C21	CS05R6-	CAP; SMT; CER; 5.6pF; 100V; 1206	1
C23	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C24	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C25	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C26	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C27	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C28	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C29	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C30	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C31	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C32	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C34	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C35	CS03R3-	CAP; SMT; CER; 3.3 PF, 1206, 10%	1
C36	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C37	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C38	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C39	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C40	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C41	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C42	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C43	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C44	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C45	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C46	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C47	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C48	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C49	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C50	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C51	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C52	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C53	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C54	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C56	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C57	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C58	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1

Ref#	Part #	Description	Qty
C59	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C60	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C61	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C62	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C63	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C64	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C66	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C67	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C68	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C69	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C70	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C71	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C72	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C73	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C74	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C75	CS0224-	CAP; SMT; CER; .22 uF; 50 V; 1206 case	1
C76	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C77	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C78	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C79	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C8	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C80	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C81	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C82	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C83	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C84	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C86	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C87	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C88	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C89	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C9	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C90	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C91	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C92	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C93	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C94	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C96	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C97	CS0470-	CAP; SMT; CER; 47pF; 100V; 1206	1
C98	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
C99	CS0102-	CAP; SMT; CER; .001 uF; 100V; 1206	1
D5	DS2101-	DIODE; SMT Tuning, SOT-23, 7 pF	1
D6	DS2101-	DIODE; SMT Tuning, SOT-23, 7 pF	1
D7	DS0101-	DIODE; SMT MMBD101	1
D8	DS0101-	DIODE; SMT MMBD101	1
L1	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L10	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L11	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L12	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L13	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L14	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1

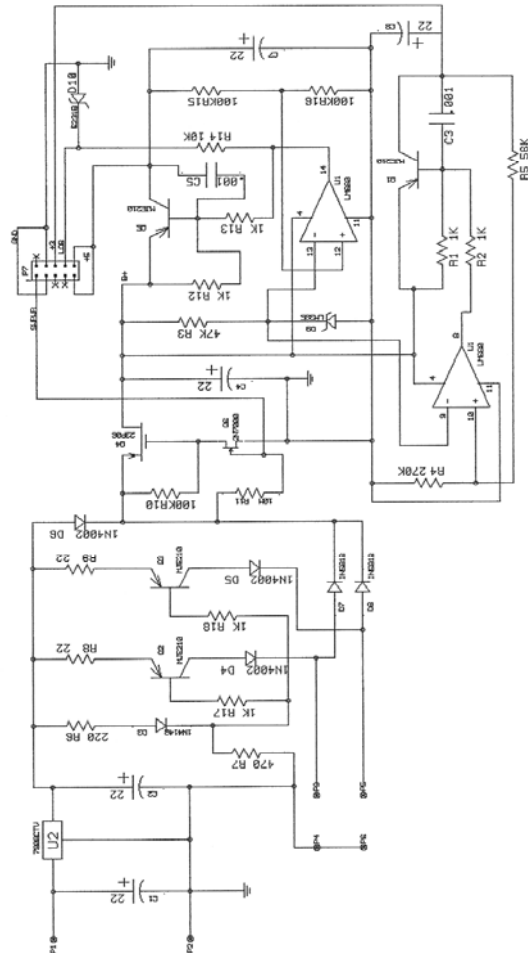
Ref#	Part #	Description	Qty
L15	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L16	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L17	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L18	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L19	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L2	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L20	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L21	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L22	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L23	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L24	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L25	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L26	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L27	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L28	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L29	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L3	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L31	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L32	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L33	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L34	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L35	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L36	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L37	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L39	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L4	LS0R22-	IND; FIXED; SMT .22 uH, 1210, 10%	1
L40	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L41	LS0R10-	IND; FIXED; SMT .10 uH, 1210, 10%	1
L42	LS0R10-	IND; FIXED; SMT .10 uH, 1210, 10%	1
L43	LS01R0-	IND; FIXED; SMT 1.0 uH, 1210, 10%	1
L45	LFRRIT-	INDUCTOR; FIXED BEAD; SMT; 1206	1
L46	LFRRIT-	INDUCTOR; FIXED BEAD; SMT; 1206	1
L47	LFRRIT-	INDUCTOR; FIXED BEAD; SMT; 1206	1
L48	LFRRIT-	INDUCTOR; FIXED BEAD; SMT; 1206	1
L49	LFRRIT-	INDUCTOR; FIXED BEAD; SMT; 1206	1
L5	LS0R15-	IND; FIXED; SMT .15 uH, 1210, 10%	1
L50	LFRRIT-	INDUCTOR; FIXED BEAD; SMT; 1206	1
L51	LFRRIT-	INDUCTOR; FIXED BEAD; SMT; 1206	1
L52	LFRRIT-	INDUCTOR; FIXED BEAD; SMT; 1206	1
L53	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L54	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L55	LS0R10-	IND; FIXED; SMT .10 uH, 1210, 10%	1
L6	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L60	LS0R22-	IND; FIXED; SMT .22 uH, 1210, 10%	1
L61	LS0R22-	IND; FIXED; SMT .22 uH, 1210, 10%	1
L62	LS0R22-	IND; FIXED; SMT .22 uH, 1210, 10%	1
L7	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
L9	LS0154-	IND; FIXED; SMT .15 uH; 10% SMT	1
P2	ECGP14-	CONNECTOR 14 PIN Board Plug	1
P5	ECGP10-	CONNECTOR 10 PIN BOARD PLUG	1

Ref#	Part #	Description	Qty
Q1	QS7002-	TRANSISTOR; SMT 2N7002LT1, N CHAN.	1
Q10	QS1027-	TRANSISTOR; SMT NPN RF Amp; MRF1027T1	1
Q11	QS1027-	TRANSISTOR; SMT NPN RF Amp; MRF1027T1	1
Q13	QS1027-	TRANSISTOR; SMT NPN RF Amp; MRF1027T1	1
Q14	QS1027-	TRANSISTOR; SMT NPN RF Amp; MRF1027T1	1
Q15	QS7002-	TRANSISTOR; SMT 2N7002LT1, N CHAN.	1
Q16	QS3904-	TRANSISTOR; SMT MMBT3904	1
Q17	QS3904-	TRANSISTOR; SMT MMBT3904	1
Q18	QS3904-	TRANSISTOR; SMT MMBT3904	1
Q19	QS7002-	TRANSISTOR; SMT 2N7002LT1, N CHAN.	1
Q2	QS7002-	TRANSISTOR; SMT 2N7002LT1, N CHAN.	1
Q3	QS7002-	TRANSISTOR; SMT 2N7002LT1, N CHAN.	1
Q4	QS7002-	TRANSISTOR; SMT 2N7002LT1, N CHAN.	1
Q5	QS7002-	TRANSISTOR; SMT 2N7002LT1, N CHAN.	1
Q6	QS7002-	TRANSISTOR; SMT 2N7002LT1, N CHAN.	1
Q7	QS7002-	TRANSISTOR; SMT 2N7002LT1, N CHAN.	1
Q8	QS7002-	TRANSISTOR; SMT 2N7002LT1, N CHAN.	1
Q9	QS1027-	TRANSISTOR; SMT NPN RF Amp; MRF1027T1	1
R1	RS0182-	RES; SMT; FILM; 1.8K; 1/4W 5%; 1206	1
R10	RS0472-	RES; SMT; FILM; 4.7K; 1/4W 5%; 1206	1
R100	RS0104-	RES; SMT; FILM; 100K; 1/4W 5%; 1206	1
R101	PS0103-	POT; SMT; 10 Kohm, 3 mm.	1
R102	RS0223-	RES; SMT; FILM; 22K, 5%, 1206	1
R11	RS0620-	RES; SMT; FILM; 62 Ohm 5%; 1206	1
R110	RS0182-	RES; SMT; FILM; 1.8K; 1/4W 5%; 1206	1
R111	RS0100-	RES; SMT; FILM; 10 OHM; 5%; 1206	1
R112	RS0950-	RES; SMT; FILM; 95 OHM, 1206, 5%	1
R113	RS0950-	RES; SMT; FILM; 95 OHM, 1206, 5%	1
R114	RS0950-	RES; SMT; FILM; 95 OHM, 1206, 5%	1
R12	RS37R4-	RES; SMT; FILM; 37.4 OHM 1206	1
R13	RS0151-	RES; SMT; FILM; 150 OHM; 5%; 1206	1
R140	RS0472-	RES; SMT; FILM; 4.7K; 1/4W 5%; 1206	1
R141	RS0100-	RES; SMT; FILM; 10 OHM; 5%; 1206	1
R142	RS0182-	RES; SMT; FILM; 1.8K; 1/4W 5%; 1206	1
R143	PS0503-	POT; SMT; 50 Kohm, 3 mm.	1
R144	RS0182-	RES; SMT; FILM; 1.8K; 1/4W 5%; 1206	1
R145	RS0273-	RES; SMT; FILM; 27K; 1/4W 5%; 1206	1
R146	RS0683-	RES; SMT; FILM; 68K; 1/4W 5%; 1206	1
R15	RS37R4-	RES; SMT; FILM; 37.4 OHM 1206	1
R151	RS0100-	RES; SMT; FILM; 10 OHM; 5%; 1206	1
R152	RS0472-	RES; SMT; FILM; 4.7K; 1/4W 5%; 1206	1
R153	RS0100-	RES; SMT; FILM; 10 OHM; 5%; 1206	1
R154	RS0273-	RES; SMT; FILM; 27K; 1/4W 5%; 1206	1
R157	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R158	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R159	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R16	RS0151-	RES; SMT; FILM; 150 OHM; 5%; 1206	1
R160	RS0103-	RES; SMT; FILM; 10K; 1/4W 5%; 1206	1
R17	RX0301-	RES., SMT, .7 W 300 OHM, 5%, 2010	1
R18	RX0151-	RES., SMT, .7 W 150 OHM, 5%, 2010	1

Ref#	Part #	Description	Qty
R19	RS0470-	RES; SMT; FILM; 47 ohm, 1206, 5%	1
R20	RS37R4-	RES; SMT; FILM; 37.4 OHM 1206	1
R21	RX0120-	RES., SMT, .7 W 12 OHM, 5%, 2010	1
R22	RX0120-	RES., SMT, .7 W 12 OHM, 5%, 2010	1
R23	RX0101-	RES., SMT, .7 W 100 OHM, 5%, 2010	1
R24	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R25	RS0100-	RES; SMT; FILM; 10 OHM; 5%; 1206	1
R26	RS0620-	RES; SMT; FILM; 62 Ohm 5%; 1206	1
R27	RS0103-	RES; SMT; FILM; 10K; 1/4W 5%; 1206	1
R28	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R29	RS0620-	RES; SMT; FILM; 62 Ohm 5%; 1206	1
R3	RS0104-	RES; SMT; FILM; 100K; 1/4W 5%; 1206	1
R30	RS0100-	RES; SMT; FILM; 10 OHM; 5%; 1206	1
R31	RS0620-	RES; SMT; FILM; 62 Ohm 5%; 1206	1
R32	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R33	RS0620-	RES; SMT; FILM; 62 Ohm 5%; 1206	1
R34	RS0103-	RES; SMT; FILM; 10K; 1/4W 5%; 1206	1
R35	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R36	RS23R2-	RES; SMT; FILM; 23.2 OHM; 1206	1
R37	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R38	RS0103-	RES; SMT; FILM; 10K; 1/4W 5%; 1206	1
R39	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R4	RS0182-	RES; SMT; FILM; 1.8K; 1/4W 5%; 1206	1
R40	RS23R2-	RES; SMT; FILM; 23.2 OHM; 1206	1
R41	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R42	RS0103-	RES; SMT; FILM; 10K; 1/4W 5%; 1206	1
R43	RS0620-	RES; SMT; FILM; 62 Ohm 5%; 1206	1
R44	RS0221-	RES; SMT; FILM; 220 OHM; 1/4W 5%; 1206	1
R45	RS0620-	RES; SMT; FILM; 62 Ohm 5%; 1206	1
R46	RS0103-	RES; SMT; FILM; 10K; 1/4W 5%; 1206	1
R47	RS0950-	RES; SMT; FILM; 95 OHM, 1206, 5%	1
R48	RS0750-	RES; SMT; FILM; 75 OHM, 1206	1
R49	RS0950-	RES; SMT; FILM; 95 OHM, 1206, 5%	1
R5	RS0560-	RES; SMT; FILM; 56 OHM; 1/4W 5%; 1206	1
R50	RS0103-	RES; SMT; FILM; 10K; 1/4W 5%; 1206	1
R51	RS8660-	RES; SMT; FILM; 866 ohm 1%; 1206	1
R52	RS05R6-	RES; SMT; FILM; 5.6 OHM, 1206, 5%	1
R53	RS8660-	RES; SMT; FILM; 866 ohm 1%; 1206	1
R54	RS0103-	RES; SMT; FILM; 10K; 1/4W 5%; 1206	1
R55	RS4320-	RES; SMT; FILM; 432 ohm; 1206	1
R56	RS11R5-	RES; SMT; FILM; 11.5 OHM; 1%; 1206	1
R57	RS4320-	RES; SMT; FILM; 432 ohm; 1206	1
R58	RS0103-	RES; SMT; FILM; 10K; 1/4W 5%; 1206	1
R59	PS0101-	POT; SMT; 100 OHM, 3 mm	1
R6	RS0472-	RES; SMT; FILM; 4.7K; 1/4W 5%; 1206	1
R60	RS0560-	RES; SMT; FILM; 56 OHM; 1/4W 5%; 1206	1
R61	RS0950-	RES; SMT; FILM; 95 OHM, 1206, 5%	1
R62	RS37R4-	RES; SMT; FILM; 37.4 OHM 1206	1
R63	RS0182-	RES; SMT; FILM; 1.8K; 1/4W 5%; 1206	1
R64	RS0472-	RES; SMT; FILM; 4.7K; 1/4W 5%; 1206	1

Ref#	Part #	Description	Qty
R65	RS0182-	RES; SMT; FILM; 1.8K; 1/4W 5%; 1206	1
R66	RS0950-	RES; SMT; FILM; 95 OHM, 1206, 5%	1
R67	RS0560-	RES; SMT; FILM; 56 OHM; 1/4W 5%; 1206	1
R68	RS0472-	RES; SMT; FILM; 4.7K; 1/4W 5%; 1206	1
R69	RS0182-	RES; SMT; FILM; 1.8K; 1/4W 5%; 1206	1
R7	RS0182-	RES; SMT; FILM; 1.8K; 1/4W 5%; 1206	1
R70	RS0104-	RES; SMT; FILM; 100K; 1/4W 5%; 1206	1
R71	RS0182-	RES; SMT; FILM; 1.8K; 1/4W 5%; 1206	1
R72	RS0100-	RES; SMT; FILM; 10 OHM; 5%; 1206	1
R75	RS0473-	RES; SMT; FILM; 47K; 1/4W 5%; 1206	1
R76	RS0273-	RES; SMT; FILM; 27K; 1/4W 5%; 1206	1
R79	RS0105-	RES; SMT; FILM; 1 MEG; 1/4W 5%; 1206	1
R8	RS0151-	RES; SMT; FILM; 150 OHM; 5%; 1206	1
R80	RS0105-	RES; SMT; FILM; 1 MEG; 1/4W 5%; 1206	1
R81	RS0204-	RES; SMT; FILM; 200K, 1206, 1/4 W	1
R82	RS0204-	RES; SMT; FILM; 200K, 1206, 1/4 W	1
R83	RS0105-	RES; SMT; FILM; 1 MEG; 1/4W 5%; 1206	1
R84	RS0204-	RES; SMT; FILM; 200K, 1206, 1/4 W	1
R85	RS0204-	RES; SMT; FILM; 200K, 1206, 1/4 W	1
R86	RS0104-	RES; SMT; FILM; 100K; 1/4W 5%; 1206	1
R87	RS0104-	RES; SMT; FILM; 100K; 1/4W 5%; 1206	1
R88	RS0104-	RES; SMT; FILM; 100K; 1/4W 5%; 1206	1
R89	RS0104-	RES; SMT; FILM; 100K; 1/4W 5%; 1206	1
R9	RS0560-	RES; SMT; FILM; 56 OHM; 1/4W 5%; 1206	1
R90	RS0104-	RES; SMT; FILM; 100K; 1/4W 5%; 1206	1
R91	RS0105-	RES; SMT; FILM; 1 MEG; 1/4W 5%; 1206	1
R93	RS0105-	RES; SMT; FILM; 1 MEG; 1/4W 5%; 1206	1
R95	RS0101-	RES; SMT; FILM; 100 OHM; 1/4W 5%; 1206	1
R97	RS0102-	RES; SMT; FILM; 1K; 1/4W 5%; 1206	1
R98	RS0101-	RES; SMT; FILM; 100 OHM; 1/4W 5%; 1206	1
R99	PS0103-	POT; SMT; 10 Kohm, 3 mm.	1
U02	IS1501-	INT. CKT.; SMT FREQ. SYNTH	1
U1	IS8309-	INT. CKT.; SMT LOG Amp./Limiter	1
U10	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U11	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U12	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U13	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U14	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U15	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U16	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U17	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U18	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U19	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U20	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U21	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U22	IS0052-	INT. CKT.; SMT 52063	1
U23	ISJMS1-	INT. CKT.; SMT MIXER; JMS-1	1
U24	IS8561-	INT. CKT.; SMT COMPARITOR, FAST	1
U25	IS8561-	INT. CKT.; SMT COMPARITOR, FAST	1
U26	IS8561-	INT. CKT.; SMT COMPARITOR, FAST	1

Ref#	Part #	Description	Qty
U27	IS8561-	INT. CKT.; SMT COMPARITOR, FAST	1
U28	IS0052-	INT. CKT.; SMT 52063	1
U29	FL1030-	FILTER 1030 MHZ, 3 POLE	1
U3	IS0660-	INT. CKT.; SMT LM660 QUAD OP AMP	1
U4	IS0660-	INT. CKT.; SMT LM660 QUAD OP AMP	1
U5	IS1501-	INT. CKT.; SMT FREQ. SYNTH	1
U6	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U7	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U8	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1
U9	ISG152-	INT. CKT.; SMT SPDT MMIC SWITCH	1



POWER SUPPLY - SS3310REV 1

Ref #	Part #	Description	Qty
C01	CE2263-	CAP; ALUM ELECT. 22 uF, 35 V, LOW	1
C02	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
C03	CE2263-	CAP; ALUM ELECT. 22 uF, 35 V, LOW	1
C04	CR1034-	CAP; MONO-CERAMIC .01; 50V AXIAL	1
C05	CE2263-	CAP; ALUM ELECT. 22 uF, 35 V, LOW	1
C06	CR1024-	CAP; MONO-CERAMIC .001uF; 100V	1
C07	CE2263-	CAP; ALUM ELECT. 22 uF, 35 V, LOW	1
C08	CE2263-	CAP; ALUM ELECT. 22 uF, 35 V, LOW	1
C09	CR1034-	CAP; MONO-CERAMIC .01; 50V AXIAL	1
C10	CR1043-	CAP; MONO-CERAMIC .1uF; 50V	1
D03	DD4148-	DIODE 1N4148	1
D04	DD4002-	DIODE 1N4002	1
D05	DD4002-	DIODE 1N4002	1
D06	DD4002-	DIODE 1N4002	1
D07	DD5819-	DIODE 1N5819	1
D08	DD5819-	DIODE 1N5819	1
D09	DD0385-	DIODE REFERENCE 2.5V	1
D10	DD5231-	DIODE ZENER; 1N5231	1
P7	ECGP10-	CONNECTOR 10 PIN BOARD PLUG	1
Q1	QX0210-	TRANSISTOR MJE210	1
Q2	QX0210-	TRANSISTOR MJE210	1
Q3	QX0210-	TRANSISTOR MJE210	1
Q4	QX2306-	TRANSISTOR 23P06	1
Q5	QX0210-	TRANSISTOR MJE210	1
Q6	QX7000-	TRANSISTOR 2N7000	1
R01	RC0102-	RESISTOR; CARB. 1 Kohm; 5%; 1/4 watt	1
R02	RC0102-	RESISTOR; CARB. 1 Kohm; 5%; 1/4 watt	1
R03	RC0473-	RESISTOR; CARB. 47 Kohm; 5%; 1/4 watt	1
R04	RC0124-	RESISTOR; CARB. 120K 1/4W 5%	1
R05	RC0513-	RESISTOR; CARB. 51K; 1/4W; 5%	1
R06	RC0221-	RESISTOR; CARB. 220 Ohm; 5%; 1/4 watt	1
R07	RC0471-	RESISTOR; CARB. 470 Ohm; 5%; 1/4 watt	1
R08	RC0220-	RESISTOR; CARB. 22 Ohm; 5%; 1/4 watt	1
R09	RC0220-	RESISTOR; CARB. 22 Ohm; 5%; 1/4 watt	1
R10	RC0104-	RESISTOR; CARB. 100K 5% 1/4W	1
R11	RC0105-	RESISTOR; CARB. 1 Megohm; 5%; 1/4 watt	1
R12	RC0102-	RESISTOR; CARB. 1 Kohm; 5%; 1/4 watt	1
R13	RC0471-	RESISTOR; CARB. 470 Ohm; 5%; 1/4 watt	1
R14	RC0103-	RESISTOR; CARB. 10 Kohm; 5%; 1/4 watt	1
R15	RC0104-	RESISTOR; CARB. 100K 5% 1/4W	1
R16	RC0104-	RESISTOR; CARB. 100K 5% 1/4W	1
R17	RC0102-	RESISTOR; CARB. 1 Kohm; 5%; 1/4 watt	1
R18	RC0102-	RESISTOR; CARB. 1 Kohm; 5%; 1/4 watt	1
R19	RC0105-	RESISTOR; CARB. 1 Megohm; 5%; 1/4 watt	1
R20	RC0182-	RESISTOR; CARB. 1.8 Kohm; 5%; 1/4 watt	1
R21	RC0182-	RESISTOR; CARB. 1.8 Kohm; 5%; 1/4 watt	1
U1	IM0660-	INT. CKT.; MISC. LMC660	1
U2	IM7809-	INT. CKT.; MISC. 9 VOLT, 3 TERM REG	1