PG4 Wireless Reciever Service Manual

25A1104

PG4 WIRELESS RECEIVER

PRODUCT DESCRIPTION

The Shure Model PG4 is a dual conversion super heterodyne, predictive diversity, microprocessor-controlled UHF receiver, operating over the frequency range of 536 MHz to 865 MHz. Power is supplied to the receiver by external dc supply with country specific approvals. The PG series is Shure's most basic, lowest price tier, frequency agile wireless series. This product is intended for use in low cost entry-level presentation and amateur performance markets.

FEATURES

Frequency agility across a wide range of frequencies (up to 12 MHz for USA models) allows flexibility to the user to continue wireless operation as the wireless spectral landscape continues to change.

- ·Predictive Diversity provides RF reliability
- ·One seven-segment LED display on the receiver to display channel.

User interface operations include:

- ·Channel Select

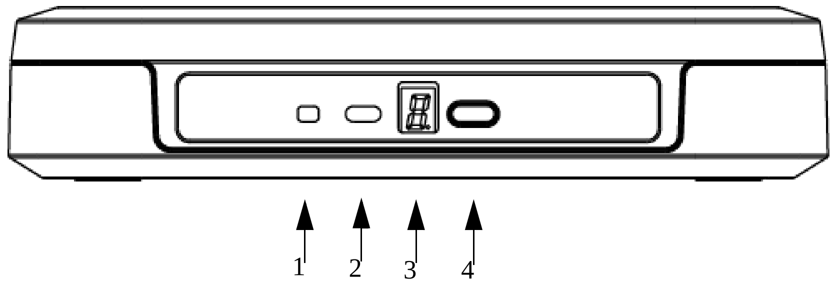
Functions include:

- ·RF Ready Light (green LED)
- ·Bi-color LED for audio presence/peak
- ·Fixed volume audio outputs
- ·XLR and ¼" audio outputs
- ·Fixed internal Receiver Antennas

25A1104(Rev.1)

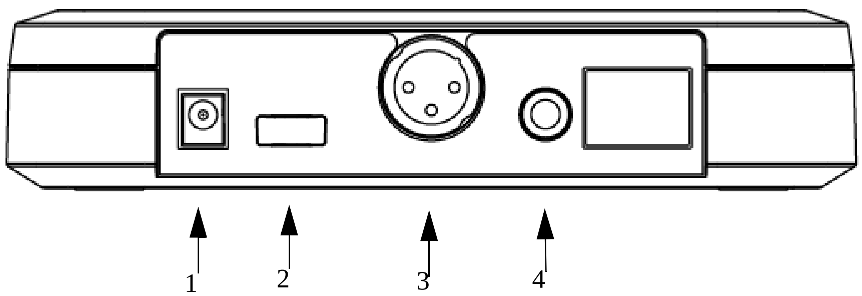
DETAILED DESCRIPTION

Front Panel



1 **audio** LED
  Indicates strength of incoming audio signal: green for normal, amber for strong, red for peak.
2 **ready** LED
  Green light indicates system is ready for use.
3 LED screen
4 **channel** button

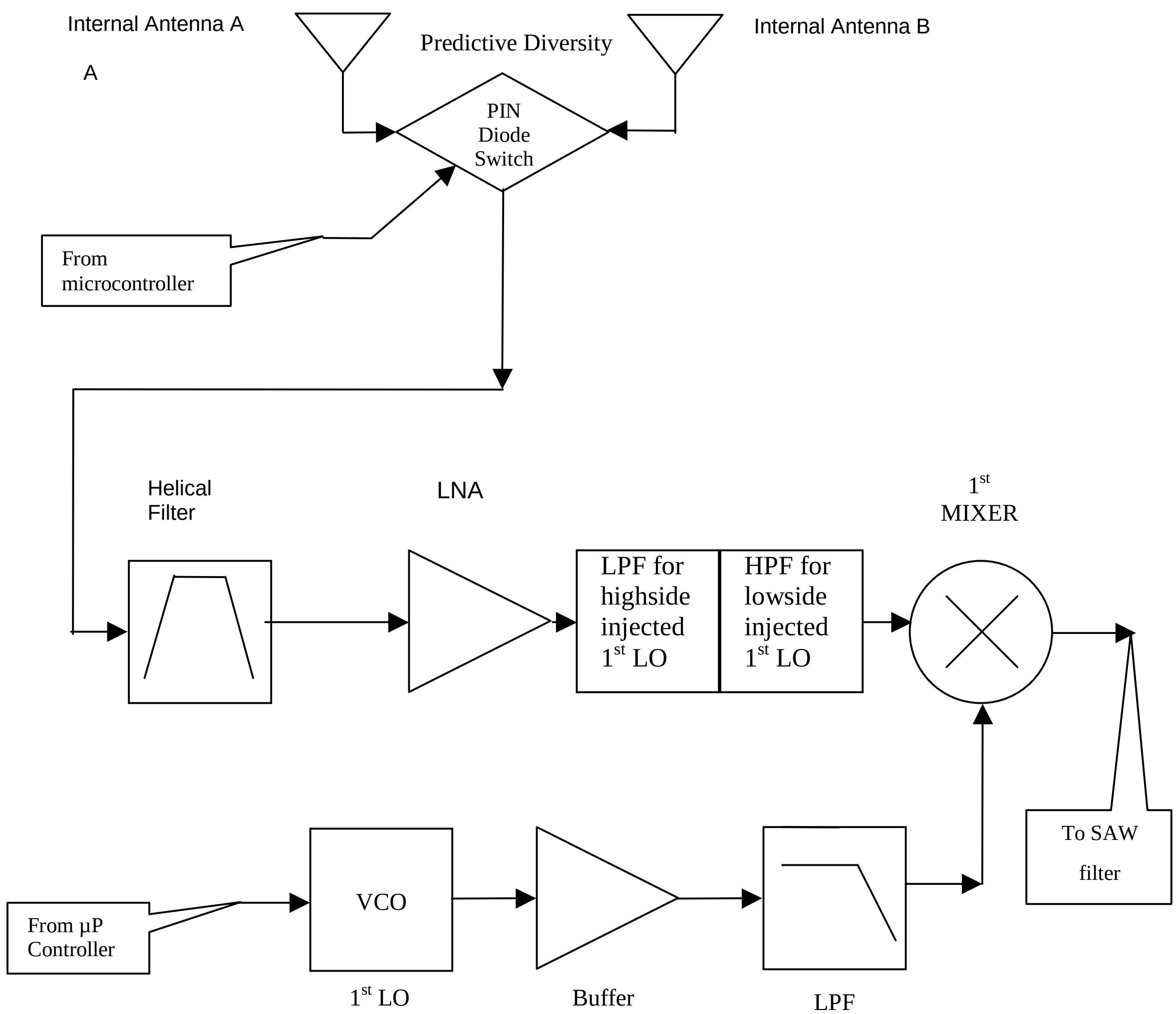
Back Panel



1 AC adapter jack
2 Adapter cord tie-off
3 XLR balanced microphone output jack
4 1/4” unbalanced output jack

General block diagram description.

The receiver consists of the following components: Image filters, predictive diversity circuitry, down-converter, first IF strip, SAW filter, second mixer, second IF strip, ceramic filter, detector, RSSI buffer, low pass filter, RMS detector and expander, mute circuit, balanced and unbalanced audio outputs, tonekey detection circuit, noise squelch circuit, microprocessor and several voltage regulators. The PG4 receiver has two internal antennas mounted to the circuit board via antenna connectors..



RF Strip

The receiver incorporates Shure's patented Predictive Diversity scheme. The microprocessor's A/D input is continuously monitoring buffered RSSI output from the TP_RSSI_A2D test point. It uses a dynamically adaptive threshold to control dual PIN diode D510, to switch between the internal antennas. The received RF signal enters an image rejection helical filter (FL510). The filter FL510 in conjunction with a discrete filter post LNA attenuates the 1st LO frequency from reaching the antenna ports. The RF signal is then down-converted with IC520, an integrated receiver front-end chip that includes: LNA (low noise amplifier), a GaAs FET mixer, and an IF buffer stage. The 50-Ohm impedance of the mixer output's buffer stage is matched to the SAW filter FL600. The signal enters the 1st first IF amplifier, which consists of Q603, and then it is filtered via a secondary LC filter comprised of C533, L523, C607, and C608. The second mixer is part of IC610, which also contains the 2nd IF amplifier, limiter, FM detector, and wide dynamic range RSSI circuitry. The second mixer down-converts the first IF signal (110.6 MHz) down to the second IF frequency of 10.7 MHz. The second IF signal is filtered with 10.7MHz ceramic filters FL620 and FL625 and then demodulated with IC610 and quadrature coil L610. The audio output from the detector chip is injected to an adjustable audio gain stage and also to the noise squelch stage. The RSSI output from the detector chip is connected to an input of the A/D converter of the microprocessor for control of the predictive diversity circuit.

The first, the second VCO's and PLL

The first VCO is a two-stage design composed of an oscillator stage and a buffer stage. Its frequency is controlled with the synthesizer chip IC1. The first stage (Q724) is a common emitter Colpitts oscillator. The air wound resonator L720 is coupled to the transistor with C723, and to the modulation varactor diode by C721. Inductor L720, capacitor C720, and trimmer CV720 form the resonant tank. Trimmer capacitor CV720 sets the VCO tuning voltage. It is used to tune out parts tolerances and process variances to insure adequate VCO frequency coverage. The buffer stage Q712 is a common emitter stage. It has a resonant tank at the collector that consists of L710, C730, and part of the capacitance of C729. The latter also forms an impedance matching network to match to the 50 Ohm input impedance of the low pass filter. The local oscillator signal is then divided into the mixer injection path C522, and the synthesizer path R706, R717 and C716. The second local oscillator consists of a single stage Colpitts oscillator (Q760). The second LO resonant tank consists of L756 and C756, and is coupled via C755 to the varactor diode D755 that receives a control voltage from the phase locked loop. Capacitor C758 couples the tank to the oscillator. The output tank and matching capacitors C762 and C763, provide 2nd LO output to the PLL chip, and via low pass filter C763, L763, C765, to the second mixer. The synthesizer chip IC1 is a dual synthesizer that consists of two dual modulus prescalers, two separate high-resolution synthesizers, a reference crystal divider, and charge pumps with selectable current levels. Y707 a 16 MHz crystal maintains the frequency reference for the PLL.

DC Power Supply Section

The receiver works with a PS20 power supply that is connected to CON400. Diode D400 provides reverse polarity protection. RF chokes; E398, E400, E399 and E401 provide RF isolation between the power supply and the receiver. IC400 is the first voltage regulator stepping down the PS20's unregulated voltage to a constant, low ripple, 9V DC voltage used by the audio section of the receiver. The 9 V is then down regulated to 5V with IC401, to be used in the RF sections. The regulated 5V is then down regulated to 3.3V with (IC430) and used for the digital circuit blocks and pin diode switching.

Audio Section

The audio travels from the FM detector output (IC610 pin 7) to an adjustable gain stage (IC200-4) which is used to exactly match the audio level seen by the expander to that seen by the compressor in the transmitter. In parallel with this, a second path enters a trim stage (IC200-2) and a high-pass filter (IC200-3). This makes up the noise detection circuit. The filtered signal is rectified and averaged. The resulting dc is sent to the micro-controller (NOISE_A2D, TP_N) for squelch control.

The output of IC200-4 is then split into two paths. The first path enters a crystal filter (Y285) used for tone key detection. The filtered signal is rectified and averaged. The resulting dc is sent to the micro-controller (TONEKEY_A2D, TP_TK) for tone key detection. The second path (main audio path) connects to a low-pass filter (IC200-1), used to protect the RMS detector from high frequency tone-key and RF noise. This filter is in combination with a secondary audio muting circuit (Q113) that increases the muting ability of the receiver with rail-to-rail noise present.

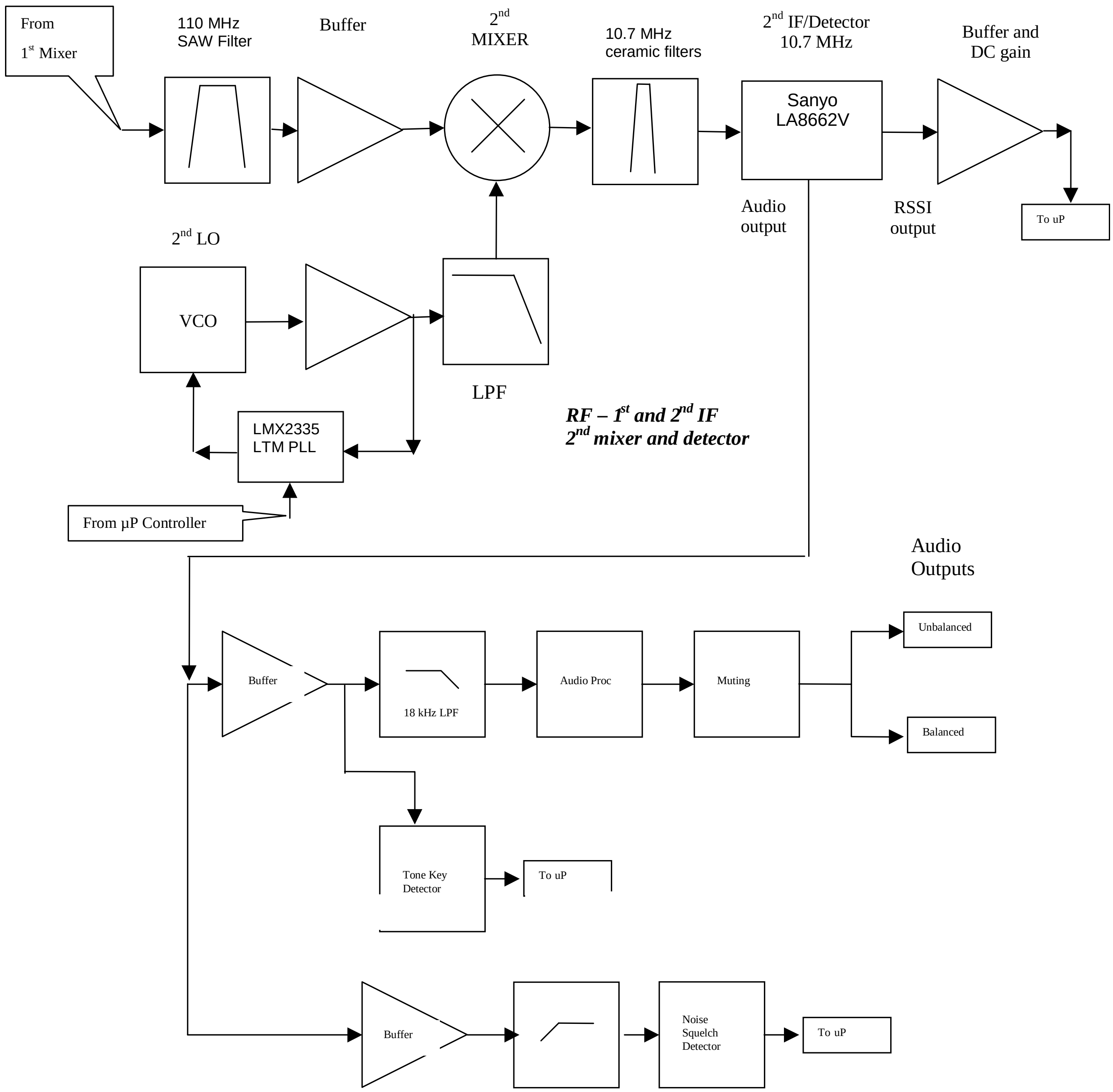
The audio then splits down two paths: the RMS detector and the VCA.

The RMS detector produces a DC voltage that varies 6mV per dB of input signal. The detector output is fed to the expansion threshold stage (IC260-3). This stage provides the transition from compressed to uncompressed signal. At low levels, the audio is not expanded because D134 is turned off. As the AC level increases, the output of IC260-3 decreases enough to turn the diode on. As D134 conducts, the compression ratio changes from 1:1 to 1:5. Once D134 is turned fully on, the audio expansion ratio remains fixed at 1:5. An additional diode in the bias network (D122) provides temperature compensation for changes in the Vy, or "cut-in" voltage of D134. After the expansion threshold stage, the DC control signal is attenuated by a buffer stage (IC260-4). This DC voltage is fed to the VCA control port Ec+. Ec- is fed the VREF voltage. Together these voltages determine the gain of the expander. The audio exiting the VCA is amplified by IC260-2, and travels via the de-emphasis circuitry to the outputs.

The audio peak level is determined by comparing the DC level at the output of the expansion threshold stage (AUDIO_A2D) to VREF.

The signal then enters the balanced and unbalanced output stages. The balanced output is set for mic level, where mic level is 14dB down from line level.

RF & AUDIO BLOCK DIAGRAM



Audio & Muting Circuitry

Digital Section

The Freescale 8Kb FLASH microprocessor was chosen to maximize its benefits and to reduce system cost. The internal ADC converters are utilized to sample DC voltages to handle switching diversity, audio metering, audio muting, noise squelching, and tone-key detection. RF band detection uses four digital inputs. In addition, the Freescale microprocessor controls the 7-segment LED display and handles the user interface channel selection.

Display Circuitry

1 Software Version

To verify which software version is loaded, use the following procedure:

Hold the select button while plugging in the device. While continuing to hold the select button down, the display should start flashing and sequentially read out a repeating message similar to this one:

"b01-15-12c0-34c0"

This can be decoded as follows:
b:this is a receiver software load. (a indicates a transmitter load)
01-:major version number.
15-minor version number.
12c0-software audio trim level
34c0-software predictive diversity rssi trim level

ACCESSING DIFFERENT MODES

NORMAL MODE

UNDER USUAL USAGE CONDITIONS, THE DEVICE WILL POWER ON IN NORMAL MODE. BENCH TESTING SHOULD NOT BE DONE IN NORMAL MODE. SINCE THE ATE MODE PROVIDES A SPECIAL FREQUENCY MAP, THE FREQUENCIES WILL BE DIFFERENT IN NORMAL MODE.

ATE MODE

A Microwire serial bus using three pins, TP_ATELE, TP_ATEDATA, and TP_ATECLK will control the ATE mode. This interface can be used to control and test all microprocessor-based functions of the board.

These ATE frequencies are shown in **Table 1**

Table 1

		1, 2, 3				b, c, d						
ATE Mode Test Frequencies (MHz)		**H7**	**K7**	**M7**	**M10**	**P11**	**Q11**	**R10**	**R11**	**R12**	**JB**	**T10**
PG4	1 Flow b	536.000	589.500	662.000	674.000	702.000	740.000	799.700	770.000	794.000	806.000	854.000
	2 Fmid c	542.000	594.500	668.000	681.500	708.000	746.000	806.000	777.000	799.700	808.000	859.500
	3 Fhigh d	548.000	602.000	674.000	686.000	714.000	751.700	812.000	781.700	806.000	809.850	864.800

RF BAND RESISTORS

Four resistors Ra, Rb, Rc, and Rd are responsible to start the microcontroller in a RF band.

Table 2 shows the reference designators and how the voltages at the test points reflect the operating RF band.

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Table 2

PG4 Reference Designators			
Rd	Rc	Rb	Ra
R316	R315	R314	R313

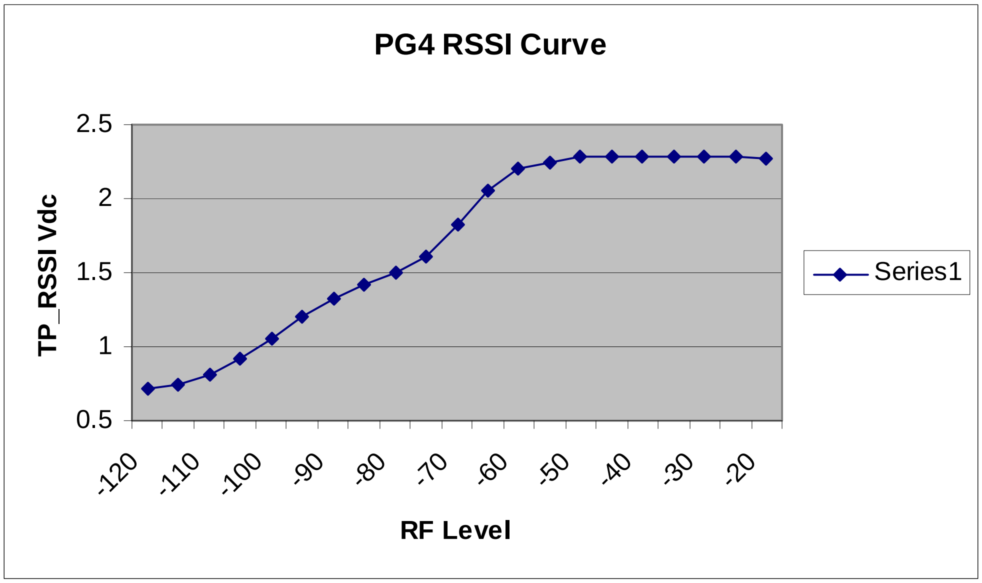
Table 3 shows the variant resistor installation options for each band. When a resistor is installed the microprocessor will read a logic low, otherwise it will read a logic high..

Table 3

RF BAND	Board ID	Rd	Rc	Rb	Ra
H7	A				
K7	B				Installed
M7	C			Installed	
M10	D			Installed	Installed
P11	E		Installed		
Q11	F		Installed		Installed
R10	G		Installed	Installed	
R11	H		Installed	Installed	Installed
R12	J	Installed			
JB	K	Installed			Installed
T10	L	Installed		Installed	
Reserved	M	Installed		Installed	Installed
Reserved	N	Installed	Installed		

Microcontroller Netnames and Programming Testpoint List

Pin	Port	Name	Testpoint
1	RESETn	Reset	TP_RST
2	PTC0/TxD2	Seven Segment A	
3	PTC1/RxD2	Seven Segment B	
4	PTC2/SDA1	Seven Segment C	
5	PTC3/SCL1	Seven Segment D	
6	PTC4	Seven Segment E	
7	PTC5	Seven Segment F	
8	PTC6	Seven Segment G	
9	PTC7	NC	
10	PTE0/TxD1	Select Button	
11	PTE1/RxD1	NC	
12	IRQ	NC	
13	PTE2/SS1n	Ra	
14	PTE3/MISO1	Rb	
15	PTE4/MOSI1	Rc	
16	PTE5/SPSCK1	Rd	
17	VSS1	EGND	
18	VSS2	EGND	
19	VDD	+3.3Vdd	
20	PTD0/TPM1CH0	RF LED	
21	PTD1/TPM1CH1	Red LED (Active High)	
22	PTD2/TPM1CH2	Green LED (Active High)	
23	PTD3/TPM2CH0	ANT_A	
24	PTD4/TPM2CH1	ANT_B	
25	PTB0/AD1P0	NOISE_A2D	
26	PTB1/AD1P1	TONEKEY_A2D	
27	PTB2/AD1P2	RSSI_A2D	
28	PTB3/AD1P3	AUDIO_A2D	
29	PTB4/AD1P4	NC	
30	PTB5/AD1P5	NC	
31	PTB6/AD1P6	NC	
32	PTB7/AD1P7	NC	
33	VREFH	+3.3Vdd	
34	VREFL	EGND	
35	PTA0/nKBI1P0	CLOCK	
36	PTA1/nKBI1P1	DATA	
37	PTA2/nKBI1P2	LE	
38	PTA3/nKBI1P3	AUDIO_MUTE	
39	PTA4/nKBI1P4	NC	
40	PTA5/nKBI1P5		TP_ATECLK
41	PTA6/nKBI1P6		TP_ATEDATA
42	PTA7/nKBI1P7		TP_ATELE
43	VDDAD	+3.3Vdd	
44	VSSAD	EGND	
45	PTG0/BKGD/MS		TP_BKGD
46	PTG1/XTAL	Crystal	
47	PTG2/EXTAL	Crystal	
48	PTG3	PLL_LD	



The microprocessor reads the RSSI level from an ADC several times a second when the PG4 is unmuted, to predict if a switch is necessary to avoid an audible dropout. Thresholds were calculated from the above RSSI curve.

NOTES

GENERAL INFORMATION LOOKUP TABLE

	Fc (MHz)		1st Image Band (MHz)		Local oscillators	
Band	Low	High	Low	High	1st LO	2nd LO
H7	536	548	757.2	769.2	Fc+110.6	99.9MHz
K7	590	602	811.2	823.2	Fc+110.6	99.9MHz
M7	662	674	883.2	895.2	Fc+110.6	99.9MHz
M10	674	686	895.2	907.2	Fc+110.6	99.9MHz
P11	702	714	480.8	492.8	Fc-110.6	121.3MHz
Q11	740	752	518.8	530.8	Fc-110.6	121.3MHz
R11	770	782	548.8	560.8	Fc-110.6	121.3MHz
R12	794	806	572.8	584.8	Fc-110.6	121.3MHz
R10	800	812	578.8	590.8	Fc-110.6	121.3MHz
JB	806	810	584.8	588.8	Fc-110.6	121.3MHz
T10	854	865	632.8	643.8	Fc-110.6	121.3MHz

REQUIRED TEST EQUIPMENT (OR APPROVED EQUIVALENT OR SUPERIOR MODELS):

RF Signal Generator	Agilent E4420B
Audio Analyzer	HP 8903B
Power Supply	PS20
BNC (M) to BNC (M) cable (2)	Shure PT1838A
BNC (F) to 1/4” adapter	Shure PT1838C
Matching UA820 Antenna	Frequency Dependent

LISTENING TEST

Before completely disassembling the receiver, operate it to determine whether it is functioning normally and try to duplicate the reported malfunction. Refer to pages 2 and 3 for operating instructions, troubleshooting, and specifications.

Review any customer complaint or request, and focus the listening test on any reported problem. The following, more extensive, functional tests require partial disassembly.

FUNCTIONAL TEST

NOTE: for these tests a tonekey generator must be used. If none is available, the unit must be opened and the tone key must be disabled.

1. Apply +12 Vdc to the power input of the receiver (PS20).
2. Set up the Audio Analyzer as follows:
   - Engage A-weighting filter
   - Engage 30kHz LPF filter
3. Set up RF signal generator as follows:
   - Frequency = F_0 (refer to the frequency tables on page 21)
   - Amplitude = 0 dBm radiated
   - FMrate = 1kHz
   - Deviation = (see table next page)

Deviation

Q11	All other frequencies
27.5 kHz	37.5 kHz

TONE KEY INDICATOR

1. Modulate the RF signal with 32.768 kHz tone key generator. (If using an HP E4400B RF Generator use the Dual-Sine wave feature by pressing: more, FM Waveform (Sine), and Dual-Sine). Set the following:
    - FM Tone 2 Rate = 32.768kHz
    - FM Tone 2 Amplitude = (see table below)

FM Tone 2 Amplitude

Q11	All other frequencies
16%	12%

2. Connect an antenna to the RF signal generator output.
3. Verify that the 1kHz tone audio output is audible and the red "peak" LED is lit on the receiver.

AUDIO OUTPUT LEVEL AND DISTORTION

1. Attach audio analyzer to ¼" output and measure output level to be -3.3dBu +/- 2.5dB.
2. Measure Audio output of XLR to be -17.0dBu +/- 1.5dB.
3. Engage the A-weighting and 30 kHz LP filters on the HP8903.
4. Measure distortion to be less than 1%.

FREQUENCY RESPONSE USING AN RF GENERATOR.

1. Disengage all filters on the audio analyzer.
2. Set the audio analyzer to measure AC level in dB's.
3. Connect the audio analyzer input to the ¼" output of the receiver.
4. Record this level by engaging the "**ratio"** button on the audio analyzer.
5. Change modulation to 20kHz on the RF generator.
6. Measure ¼" output to be -21dBu +/- 3dB.
7. Change modulated frequency on the RF generator to 400Hz.
8. The audio output level should be +5dB ± 1dB relative to the 1kHz level.

RF POWER AND SQUELCH LEVEL

1. Disengage the "**ratio**" button on the audio analyzer.
2. Change modulated frequency on the RF signal generator to 1kHz.
3. Engage the 400Hz filter and 30kHz filter on the audio analyzer.
4. Set RF level to -110 dBm. The Receiver should be squelched.

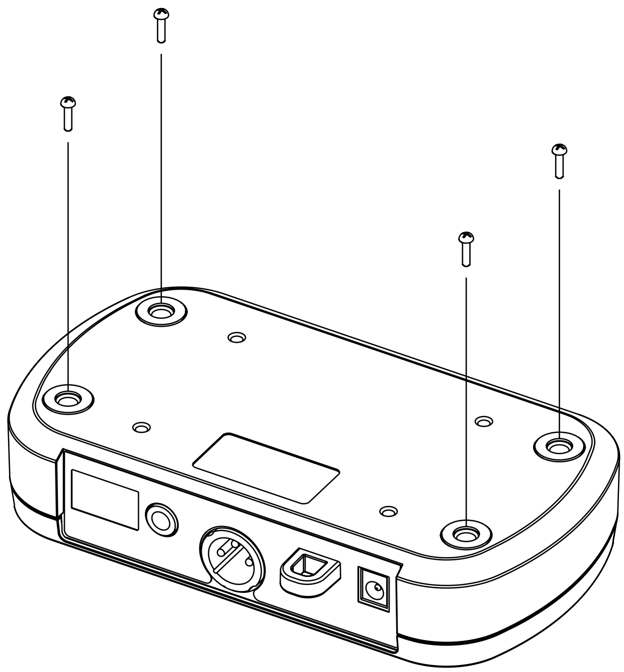
IF ALL TESTS PASSED, THIS MEANS THE UNIT IS PROPERLY FUNCTIONING, AND NO ALIGNMENT IS REQUIRED.

ASSEMBLY AND DISASSEMBLY

!CAUTION!
Observe precautions when handling this static-sensitive device.

ASSEMBLY INSTRUCTIONS (REVERSE FOR DISASSEMBLY)

1.



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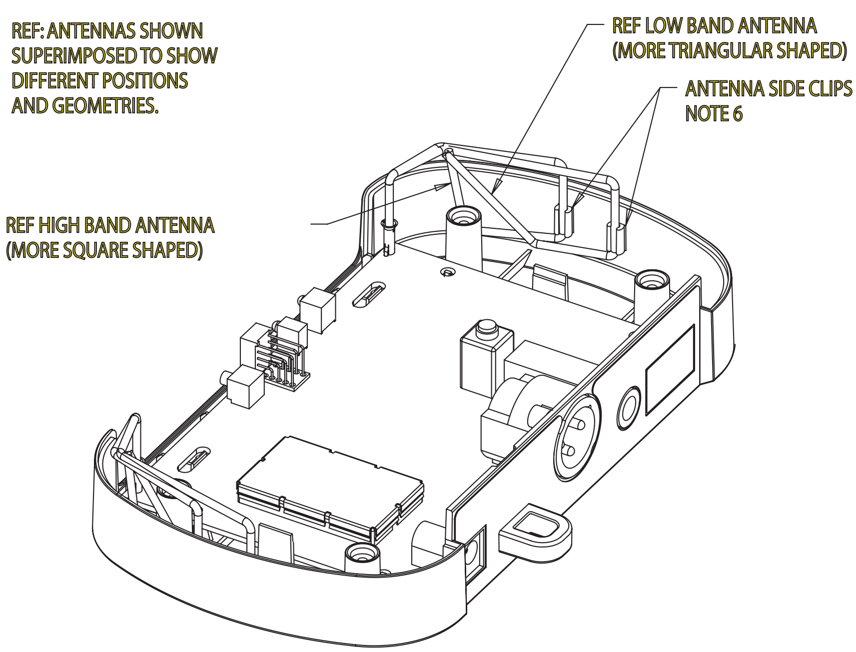

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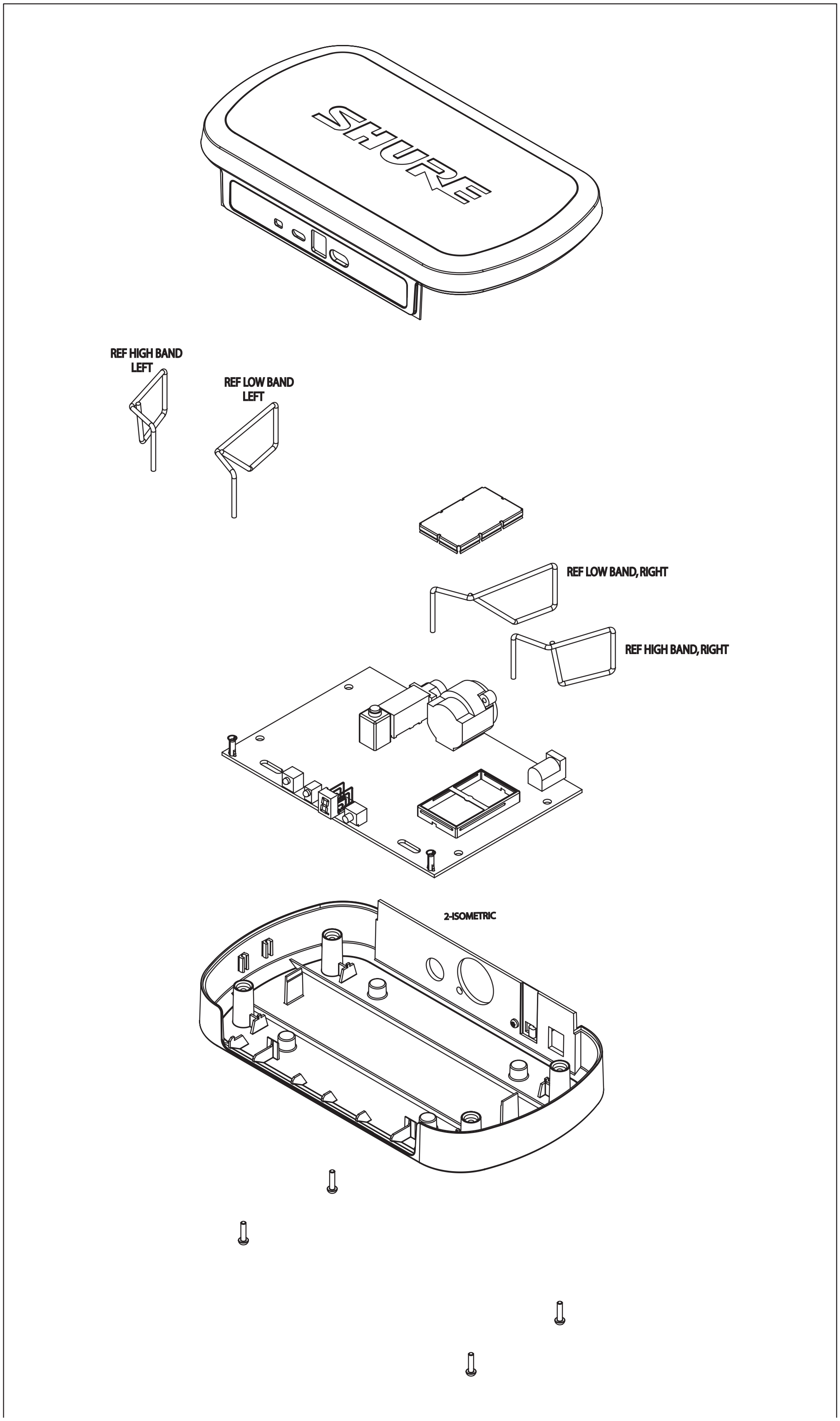
SHURE
REF HIGH BAND
LEFT
REF LOW BAND
LEFT
REF LOW BAND, RIGHT
REF HIGH BAND, RIGHT
2-ISOMETRIC

SERVICE PROCEDURES

MEASUREMENT REFERENCE

NOTE: Audio levels in dBu are marked as dBm on the HP8903.

dB Conversion Chart

0dBV = 2.2 dBu
0dBu = 0dBm assuming the load = 600 ohms

Be aware that dBu is a measure of voltage and dBm is a measure of power. The HP8903, for example, should be labeled dBu instead of dBm since it is a voltage measurement. These two terms are often used interchangeably even though they have different meanings.

REQUIRED TEST EQUIPMENT (OR APPROVED EQUIVALENT OR SUPERIOR MODELS):

RF Generator	Agilent E4400B
Digital multi-meter	Fluke 87
Audio Analyzer	HP 8903B
1 GHz Frequency Counter	HP 53181A
Spectrum Analyzer	HP 8591A
Power Supply	PS20
Shielded Test Lead	Shure PT1838F
BNC (M) to BNC (M) cable (2)	Shure PT1838A
BNC (F) to ¼" adapter	Shure PT1838C
BNC (M) to unterminated	Shure PT1824
Matching PG1/PG2 Transmitter	PG1/PG2
XLR (F) to Banana Plug Adapter	Shure PT1841
Toray non-inductive tuning tool - White	Shure PT1838M
Toray non-inductive tuning tool - Blue	Shure PT1838K
Toray non-inductive tuning tool - Pink	Shure PT1838L
Non-inductive hex tuning tool	Shure PT1838N
Jumper wires	

ALIGNMENT AND MEASUREMENT PROCEDURE

General notes

The following procedures are intended for a "bench" testing environment only.

The alignment procedure is sequential and does not change unless specified. Use an RG-178/U BNC male to unterminated cable for all RF connections to the antenna inputs. Keep the test cables as short as possible (less than 3 feet in length). Include the insertion loss of the cables and the connectors when performing all RF measurements. DC voltages may present at RF test points. Use DC blocks to protect the test equipment, if necessary.

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Table 4

		1, 2, 3				b, c, d						
ATE Mode Test Frequencies (MHz)		**H7**	**K7**	**M7**	**M10**	**P11**	**Q11**	**R10**	**R11**	**R12**	**JB**	**T10**
PG4	1 Flow b	536.000	589.500	662.000	674.000	702.000	740.000	799.700	770.000	794.000	806.000	854.000
	2 Fmid c	542.000	594.500	668.000	681.500	708.000	746.000	806.000	777.000	799.700	808.000	859.500
	3 Fhigh d	548.000	602.000	674.000	686.000	714.000	751.700	812.000	781.700	806.000	809.850	864.800

VOLTAGE REGULATION CHECK

With power applied properly, and the unit switched on, measure the DC voltages at the following test points. All test points are located on the top side of the PCB. Refere to the component diagram.

Test Points	Voltages
TP_9V	+9.0 ± 0.2 Vdc
TP_5V	+5.0 ± 0.1 Vdc
TP_5VPLL	+5.0 ± 0.2 Vdc
TP_3.3V	+3.3 ± 0.2 Vdc
TP_VREF	+4.5 ± 0.2 Vdc

ATE MODE SETUP AND USE

There are three different ATE mode test frequencies available in every frequency group, which are Flow, Fmid and Fhigh. The Fmid frequency may not be the center of the band. It is selected for the best tuning of FL510 filter. Set the receiver into ATE mode by shorting "ATE LE" to GND and then apply power to the receiver's DC jack. Press the channel button until you observe the 7-segment LED display providing a selection of 1, 2, 3 for frequency groups H7,K7, M7, M10 and b, C, d for frequency groups P11, Q11, R11, R12, R10, JB, T10. For example, when the 7-segment LED display's a "1" this is Flow, "2" is Fmid and "3" Fhigh. When you depress the channel button for approximately 3-seconds the receiver enters into a micro controller reference level programming mode. When a "C" is displayed, press and release the channel button several times so you can observe the 7-segment LED display providing a selection of a blinking C, A or P. The "C" is to cancel the micro controller reference level-programming mode (do not confuse this "C" for Fmid for groups P11, Q11, R11, R12, R10, JB, T10). The "A" is to set the audio LED reference level. The "P" is to set the predictive no switch level. Once the respective C, A or P is selected and left blinking, the micro will perform the respective operation when the 7-segment LED display returns to the previous 1, 2 or 3 display.

INITIAL SETUP

Disabling diversity: For Channel A to be active, short TP2 to ground and connect TP3 to 3.3Vdc. For Channel B to be active, short TP3 to ground and connect TP2 to 3.3Vdc.

Set the receiver into ATE mode and to Fhigh. This sets the receiver to the highest operating frequency.(see table 4 for reference)

POWER TEST SECTION

1. Measure +9.0 Vdc + 0.2 /-0.2 Vdc at test point "TP_9V"
2. Measure +5.0 Vdc + 0.1 /-0.1 Vdc at test point "TP_5V"
3. Measure +5.0 Vdc + 0.2 /-0.2 Vdc at test point "TP_5VPLL"
4. Measure +3.3 Vdc + 0.2 /-0.2 Vdc at test point "TP3.3V"
5. Measure +4.5 Vdc + 0.2 /-0.2 Vdc at test point "TP_VREF"
6. The dc current drain should be 120 mA +/- 25 mA.

1ST LOCAL OSCILLATOR

1. Adjust CV720 to set voltage at TP1 to +3.75 Vdc ± 0.1 Vdc.
2. Attach a frequency counter to TP600. Verify frequency is:

(fo + 110.6 MHz) ± 5.0 kHz for frequency groups H7,K7, M7, M10
(fo - 110.6 MHz) ± 5.0 kHz for frequency groups P11, Q11, R11, R12, R10, JB, T10

2ND LOCAL OSCILLATOR

1. Verify the voltage at TP750 is between +1Vdc and +4Vdc

FRONT END RF FILTERS

1. Connect the RF generator output via RF test cable to +CON500 and ground for Channel A input.
2. Set receiver to Fmid.
3. Connect TP2 to GND and TP3 to 3.3Vdc so as, to defeat diversity switching.
4. Set RF generator to the corresponding Fmid frequency and set the amplitude to -70 dBm with no modulation.
5. Connect DC voltmeter to TPRSSI_A2D (Pin 6 of IC610).
6. Measure the DC voltage at TPRSSI_A2D (Pin 6 of IC610) while tuning FL510 so as to achieve the maximum DC voltage level at TPRSSI_A2D.

PREDICTIVE DIVERSITY THRESHOLD SETTING

1. Set RF generator amplitude to -90 dBm. Enter into the micro controller reference level-programming mode. Sequence through the three selections until the "P" is flashing. Let the "P" flash until it times out and the LED display returns to Fmid. This is to set the predictive no-switch level.

QUAD COIL TUNE-UP

1. Verify the receiver is set to ATE mode Fmid frequency.
2. For all groups except Q11 set the RF generator amplitude to -70 dBm with FM modulation at 1 kHz and deviation = 33 kHz with audio analyzer HP8903B. Engage the A-weighting and 30 kHz LPF filters on the HP 8903B. Adjust L610 for maximum AC level at TPR (Pin 7 of IC610). Typically = 150mVrms. Low limit = 120mVrms. There is no high limit.
3. For Q11 only set the RF generator amplitude to -70 dBm with FM modulation at 1 kHz and deviation = 23 kHz with audio analyzer HP8903B. Engage the A-weighting and 30 kHz LPF filters on the HP 8903B. Adjust L610 for maximum AC level at TPR (Pin 7 of IC610). For the Q11 frequency band the low limit = 95mVrms. There is no high limit.
4. For all groups measure THD at TPR (Pin 7 of IC610). Typically = 0.5 %. If the THD is > 1.0%, adjust L610 again to minimize THD at TPR.

CHANNEL A SENSITIVITY CHECK

1. Set RF generator amplitude to -100 dBm. Measure SINAD (Sinad = signal + noise + distortion/ noise + distortion) at TPR (Pin 7 of IC610) to be greater then 12 dB.
2. Set receiver to ATE mode Flow frequency. Set RF generator frequency to corresponding frequency and the amplitude to -95 dBm. Measure SINAD at TPR (Pin 7 of IC610) to be greater than 12dB, if not, go back to previous Front-end RF filter alignment section and repeat the procedure.
3. Set the receiver to ATE mode Fhigh frequency. Set RF generator frequency to corresponding frequency and the amplitude to -95 dBm. Measure SINAD at TPR (Pin 7 of IC610) to be greater then 12 dB, if not, go back to previous Front-end RF filter alignment section and repeat the procedure.

CHANNEL B SENSITIVITY CHECK

1. Set the receiver to ATE mode Fmid frequency.
2. Connect the RF generator to Ch. B (CON505 and ground).
3. Connect TP2 to 3.3Vdc and TP3 to GND so as, to defeat diversity switching.

4. Set signal generator level= -100 dBm.
5. Set signal generator to corresponding frequency.
6. Measure SINAD at TPR (Pin 7 of IC610) to be equal to or greater than 12 dB.

TONEKEY LEVEL DETECTION

1. Verify the receiver is set to ATE mode Fmid frequency.
2. Set the RF generator's amplitude to -70dBm and carrier frequency to ATE Fmid frequency.
3. Apply a dual-sine modulation function with FM rate1=1KHz and FM rate2=32.768KHz and ampl=12%. Set the deviation to 37.5KHz. For the Q11 band Apply a dual-sine modulation function with FM rate1=1KHz and FM rate2=32.768KHz and ampl=16%. Set the deviation to 27.5KHz. Verify test point TP_TK measures between 1.00Vdc to 3.5 Vdc.

NOISE SQUELCH ALIGHNMENT

1. Verify the receiver is set to ATE mode Fmid frequency.
2. Verify RF generator is set to the ATE Fmid frequency a dual-sine modulation function with FM rate1 = 1KHz and FM rate2 = 32.768KHz and ampl=12%. Set the deviation to 37.5KHz. *For the Q11 band Apply a dual-sine modulation function with FM rate1 = 1KHz and FM rate2 = 32.768KHz and ampl=16%. Set the deviation to 27.5KHz. Set the RF signal generator amplitude to -95dBm.
3. Adjust the RF input level to find the 30dB SINAD point (A-weighted), measured at TPR. (note that the 30 dB SINAD at TPR corresponds to approximately 40 dB SINAD at ¼" or XLR outputs).
4. Adjust TR220 for 1 Vdc ± 0.2Vdc at TP_N (Noise_A2D).

AUDIO ALIGNMENT

1. Verify RF generator is set to the ATE Fmid frequency a dual-sine modulation function with FM rate1 = 1KHz and FM rate2 = 32.768KHz and ampl=12%. Set the deviation to 37.5KHz. *For the Q11 band Apply a dual-sine modulation function with FM rate1=1KHz and FM rate2=32.768KHz and ampl=16%. Set the deviation to 27.5KHz.
2. Set the RF signal generator amplitude to -70dBm.
3. Adjust TR100 for -3.3dBu ± 0.25dBu at the ¼" output (TPUNBAL).

AUDIO PEAK LIGHT REFERENCE SETTING PROCEDURE

1. Apply a dual-sine modulation function with FM rate1 = 1KHz and FM rate2 = 32.768KHz and ampl=12%. Set the deviation to 47.0KHz.
2. Enter into the micro controller reference level-programming mode. Sequence through the three selections until the "A" is flashing. Let the "A" flash until it times out and the LED display returns to Fmid. This is to set the audio LED peak light threshold.

The Alignment is now completed.

NOTES

AGENCY APPROVALS

FCC DD4 PG4 (Part 15 "Declaration of Conformity" filed)
IC RSS-123 (Canada # 616A-PG4) Professional Only
CE (Declaration of Conformity to latest version of ETSI EN 301-389)

ADDITIONAL PRODUCT PERFORMANCE CHARACTERISTICS (NOT TESTED IN PRODUCTION):

General notes: A-weighting filter, RF testing level = -70 dBm, 33kHz Deviation @ 1 kHz modulation frequency, unless otherwise specified.

Audio & RF tests at the detector output:

Audio level : 100 mV RMS min
S/N Ratio: 50 dB min. (60dB typical)
Frequency response: (100 Hz - 15 kHz) [+/-4.0 dB]

IF Bandwidth test at the detector output:

THD at fc+25 kHz: 2 % max.
THD at fc-25 kHz: 2 % max.

Image Response tests:

1st image rejection: 40 dB min. (50 dB typical)
2nd image rejection: 70 dB min.
½ first IF response test: 50 dB min.
2/3 first IF response test: 50 dB min.
½ 2nd IF test: 70 dB min.
2/3 2nd IF test: 70 dB min.
Response at Fo +/- digital clocks and their harmonics: 60 dB min.
Parasitic spurious: 50 dB min.

RF conductive tests:

First LO and its harmonics at the antenna port: -70 dBm max.
Second LO and its harmonics at the antenna port: -80 dBm max.

Overload test:

No receiver performance degradation should be observed at RF input levels up to -25 dBm. (THD, SINAD and S/N)
Intermodulation, THD, SINAD and S/N degradation is expected at RF input levels between
-20 to 6 dBm, however the receiver should receive the signal as expected.

Intermodulation tests:

Receiver's response to the 3rd and 5th order IM products outside of the bandwidth of the
second IF filters (e.g.: f (on channel) = 800MHz, F(IM1) = 801 MHz, F(IM2) = 802MHz) should be better than 50 dB.

Basic stability tests:

At the threshold of receiver's sensitivity, there should be no extraneous noises being generated within the receiver's circuitry. There should be no parasitic oscillations present during tests with a spectrum analyzer along receiver's signal path (RF band, 1st mixer, 1st IF, Second Mixer, Second IF, Detector, audio and noise circuitry).

RSSI tests:

RSSI total dynamic range: -100 to -60 dBm

FREQUENCY TABLES

Group A		Group B		Group C		Group D		Group E		Group F	
N. & S. America		N. & S. America		N. & S. America		Australia / France		China		China / Korea	
H7	536 - 548	K7	590 - 602	M7	662-674	M10	674-686	P11	702-714	Q11	740-752
CH	Freq	CH	Freq	CH	Freq	CH	Freq	CH	Freq	CH	Freq
1	536.075	1	590.075	1	662.075	1	674.025	1	702.075	1	740.125
2	547.925	2	601.925	2	673.925	2	677.900	2	703.275	2	741.325
3	537.275	3	591.275	3	663.275	3	682.775	3	706.025	3	744.075
4	546.725	4	600.725	4	672.725	4	684.700	4	707.925	4	745.975
5	540.025	5	594.025	5	666.025	5*	685.900	A	708.075	A	746.025
6	543.975	6	597.975	6	669.975	6	674.225	b	709.975	b	747.925
7	541.925	7	595.925	7	667.925	7	676.500	C	712.725	C	750.675
8	542.075	8	596.075	8	668.075	8	680.025	d	713.925	d	751.875
9	547.175	9	601.175	9	673.175	9	684.500				
0	536.825	0	590.825	0	662.825	0**	685.700				

Group G		Group H		Group J		Group K		Group L			
Australia / EU		China		Thailand / Taiwan		Japan		T10		US	
R10	800-812	R11	770-782	R12	794-806	JB	806-810	T10	854 - 865	FCC ISM	902 - 928
CH	Freq	CH	Freq	CH	Freq	CH	Freq	CH	Freq	CH	Freq
1	802.525	1	770.075	1	794.075	1	806.125	1	855.275	1	902.000
2	800.525	2	771.275	2	795.275	2	806.375	2	856.575	2	905.250
3	807.400	3	774.025	3	798.025	3	807.125	3	858.650	3	908.500
4	810.275	4	775.925	4	799.925	4	807.750	4	863.475	4	911.750
5*	811.550	A	776.075	A	800.075	5	809.000	5*	864.700	5	915.000
6	801.100	b	777.975	b	801.975	6	809.500	6	854.900	6	918.250
7	802.325	C	780.725	C	804.725	A	806.250	7	857.950	7	921.500
8	808.600	d	781.925	d	805.925	b	807.500	8	861.750	8	924.750
9	810.550					C	809.625	9	863.500	9	928.000
0**	813.800					d	808.625	0**	864.825	0	

* Compatible with each of channels 1-4

** Compatible with each of channels 6-9

Highlighted Channels are compatible with each other

PRODUCT SPECIFICATIONS

System	**Working Range**	75m (250 ft.) Note: actual range depends on RF signal absorption, reflection, and interference
	Audio Frequency Response +/– 2 dB	Minimum: 45 Hz Maximum: 15 kHz (Overall system frequency depends on microphone element.)
	Total Harmonic Distortion Ref. +/– 33 kHz deviation, 1 kHz tone	0.5%, typical
	Dynamic Range	>100 dB A-weighted, typical
	Operating Temperature Range	–18°C (0°F) to +57°C (+135°F) Note: battery characteristics may limit this range
	Transmitter Audio Polarity	Positive pressure on microphone diaphragm (or positive voltage applied to tip of WA302 phone plug) produces positive voltage on pin 2 (with respect to pin 3 of low impedance output) and the tip of the high impedance 1/4-inch output.
PG1 Bodypack Transmitter	**Audio Input Level**	-10 dBV maximum at "mic" gain position +10 dBV maximum at 0dB gain position +20 dBV maximum at -10dB gain position
	Gain Adjustment Range	30 dB
	Input Impedance	1 mΩ
	RF Transmitter Output	10 mW maximum (dependent on applicable country regulations)
	Dimensions	110 mm H x 64 mm W x 21 mm D (4.3 in. x 2.5 in. x 0.8 in.)
	Weight	75 grams (2.6 oz.) without battery
	Housing	Molded ABS
	Power Requirements	One 9V size alkaline or rechargeable battery
	Battery Life	>8 hours (alkaline)
PG2 Handheld Transmitter	**Audio Input Level**	+2 dBV maximum at -10dB position -8 dBV maximum at 0dB position
	Gain Adjustment Range	10dB
	RF Transmitter Output	10 mW maximum (dependent on applicable country regulations)
	Dimensions including PG58 cartridge	224 mm L x 53 mm Dia. (8.8 in. x 2.10 in.)
	Weight	218 grams (7.7 oz.) without battery
	Housing	Molded ABS handle and battery cup
	Power Requirements	One 9V size alkaline or rechargeable battery
	Battery Life	>8 hours (alkaline)
PG4 Receiver	**Dimensions**	189mm L x 105mm W x 40 mm D (7.45 in. x 4.15 in. x 1.59 in.)
	Weight	209.79 g (7.4 oz.)
	Housing	Molded ABS Plastic
	Audio Output Level Ref. +/– 33 kHz deviation with 1 kHz tone	XLR connector (into 100 Ω load): –19 dBV, typical 1/4 inch connector (into 100 Ω load): –5 dBV, typical
	Output Impedance	XLR connector: 200 Ω 1/4 inch connector: 1kΩ
	XLR output	Impedance balanced Pin 1: Ground (cable shield) Pin 2: Audio Pin 3: No Audio
	Sensitivity	–105 dBm for 12 dB SINAD, typical
	Image Rejection	>50 dB, typical
	Power Requirements	12–18 Vdc at 160 mA, supplied by external power supply

Current draw and DC regulator tests

1. Connect the PS20 DC power supply to CON400.
2. Verify current draw is 120mA +/- 25mA.
3. If the current draw is above or below above specification disconnect the 9Vdc, 5Vdc and 3.3Vdc regulated power supply feed points to each section of the receiver to deductively troubleshoot which section is causing the excessive current drain.

DC regulated Power supply voltages

CHECK FOR 9.0VDC (±0.2 VDC) AT TP_9V (PIN 4 OF IC400):

1. If not, check for 12Vdc minimum at the output of CON400. If the output of CON400 is not 12Vdc minimum check the external power supply for proper operation.
2. Check for 12Vdc minimum at the input of Pin 3 of IC400. If the input of Pin 3 of IC400 is not 12Vdc minimum verify the electrolytic capacitor (C399 and/or C406) is not reversed.
3. Check D400 for proper placement and operation.
4. Check for solder bridges or shorted foil traces (defective PCB).
5. Disconnect the 9Vdc power supply feed points from each section of the receiver to deductively troubleshoot which section may be loading down the regulator output.
6. Lastly, replace IC400.

CHECK FOR 5.0VDC (±0.1 VDC) AT TP_5V (PIN 2&4 OF IC401):

1. If 5.0Vdc is not measured at TP_5V, verify that the electrolytic capacitor C405 is not reversed.
2. Disconnect the 5Vdc-power supply feed points from each section of the receiver to deductively troubleshoot which section may be loading down the regulator output.
3. Lastly, replace IC401.

CHECK FOR 3.3VDC (±0.2 VDC) AT TP_3.3V (PIN 4 OF IC430):

1. If 3.3Vdc is not measured at TP_3.3V, verify that the electrolytic capacitors C430, 431,432 are not shorted out.
2. Disconnect the 3.3Vdc-power supply feed points from each section of the receiver to deductively troubleshoot which section may be loading down the regulator output.
3. Lastly, replace IC430.
4.

Initial Setup:

ATE mode setup & use:

There are three different ATE mode test frequencies available in every frequency group, which are Flow, Fmid and Fhigh. The Fmid frequency may not be the center of the band. It is selected for the best tuning of FL510 filter. Set the receiver into ATE mode by shorting "ATE LE" to GND and then apply power to the receiver's DC jack. Press the channel button until you observe the 7-segment LED display providing a selection of **1, 2, 3** for frequency groups H7, K7, M7, M10, R10, and T10 and **b, C, d** for frequency groups P11, Q11, R11, R12, and JB. For example, when the 7-segment LED display's a "1" this is **Flow**, "2" is **Fmid** and "3" **Fhigh**. When you depress the channel button for approximately 3-seconds the receiver enters into a micro controller reference level programming mode. When a "C" is displayed, press and release the channel button several times so you can observe the 7-segment LED display providing a selection of a blinking C, A, or P. The "C" is to cancel the micro controller reference level-programming mode (do not confuse this "C" for **Fmid** for groups P11, Q11, R11, R12, JB). The "A" is to set the audio LED reference level. The "P" is to set the predictive no switch level. Once the respective C, A, or P is selected and left blinking, the micro will perform the respective operation when the 7-segment LED display returns to the previous 1, 2, or 3 display.

Disabling diversity:

For Channel A to be active, short TP2 to ground and connect TP3 to 3.3Vdc. For Channel B to be active, short TP3 to ground and connect TP2 to 3.3Vdc.

·Use RG58, RG174 or any other low loss, 50 ohms cable for all RF input connections. Keep the test cables as short as possible between the RF generator and receiver. Note: any external "ON Channel" interference in the frequency of operation under test can cause erratic and poor measurements. Verify using a spectrum analyzer that the frequency of operation under test has no interference down to -90dBm.

·Remove both CH. A & B internal antennas from CON500 & CON505.

·Set the receiver into ATE mode and to “2” (Fmid). This sets the receiver to the center operating frequency and set the amplitude to -50dBm. Conductively inject the output of the RF generator to the respective antenna input under test. For CH. A inject into TP4 and for CH. B inject into TP5. No modulation is required unless specified.

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Use a high impedance probe (FET Probe) & Spectrum Analyzer for all RF power measurements.

RF Troubleshooting

RF FRONT-END TO FIRST MIXER INPUT TROUBLESHOOTING:

1. The RF output at D510 should measure approximately -55dBm. If the RF amplitude is low check your signal path to the input of D510. If the RF level is ok at the input of D510 verify that 3.3Vdc is present at pin 3. If so, replace D510.
2. The LNA input at pin 1 of IC520 should measure no less than approximately -55dBm. If so, check FL510 for proper tuning & soldering and verify that C510, C511 and L511/C51 are the correct values.
3. Pin 11 of IC520 should measure approximately 15dB greater than the LNA input at pin 1. If the RF amplitude is low first verify that pins 3 and 4 of IC520 measure about 3.5Vdc. If so, check C540, L540, L520, L545, C545, and L519 for poor soldering and validate for correct part values. Lastly, if the RF amplitude is not approximately 15dB greater at pin 16 of IC520 (LNA output) as compared to pin 1 (LNA input) replace IC520.

First mixer output (1st IF) & 1st LO troubleshooting:

Note for:

(Fo + 110.6MHz) ± 5.0 kHz for frequency groups H7,K7, M7, M10

(Fo - 110.6MHz) ± 5.0 kHz for frequency groups P11, Q11, R11, R12, R10, JB, T10

1. First check pin 6 of IC520 (1st IF output) it should measure 110.6MHz at approximately -35dBm. If the 1st IF output amplitude is low verify that the 1st LO amplitude is no less than -5dBm at pin 8 of IC520.
2. If the 1st LO amplitude is low check the values and correct placement of all components leading back through the circuit path to the collector of Q712. The 1st LO amplitude at the collector of Q712 should be no less than 0dBm(typ=+4.5dBm).
3. Verify that the 1st LO frequency is correct. If not, verify the correct channel setting. If channel setting is correct, measure for 16 MHz +/- 160 Hz on pin 7 of IC1. If this frequency is deviated this can result in an offset in the 1st LO frequency. If so, replace Y707.
4. If the 1st LO frequency is not present at pin 8 of IC520 verify that the tuning voltage of approximately 3.75Vdc is measured at TP1. If TP1 measures 0Vdc or near 5Vdc the VCO is not operating properly. Verify that pins 1 & 16 of IC1 measure approximately 4.5Vdc. If not, troubleshoot back through pins 2&4 of IC401 and verify that the electrolytic capacitor C405 is not reversed. If none of the above is a problem possibly either IC1 is defective or IC300 is not properly programmed or defective.

2nd mixer input & 2nd LO output troubleshooting:

Note for:

Board groups H7, K7, M7, M10 the 2nd LO is low side injected (1st IF -99.9MHz).

Board groups P11, Q11, R11, R12, R10, JB, T10 the 2nd LO is high side injected (121.3MHz - 1stIF).

(Three sections to look at: 1st IF, 2nd LO and 2nd IF)

1. Verify that the 5Vdc supply is at pin 5 of IC610. If not, verify for correct placement and component values associated with the 5Vdc supply to IC610.
2. Verify pin 12 of IC610 (2nd IF input into detector) measures 10.7MHz at approximately -15dBm. If the 10.7MHz amplitude is low or is not present check back through FL635 & FL620 to pin 14 of IC610 (2nd IF output from detector). If the 10.7MHz signal at pin 14 of IC610 is very weak or not present proceed with 1stIF & 2ndLO troubleshooting sections. If the 1st IF and 2nd LO signals test fine at IC610 but the 10.7MHz signal at pin 14 of IC610 is very weak or not present replace IC610.
3. Verify pin 16 of IC610 (1stIF input into detector) measures 110.6MHz at approximately -10dBm. If not, verify the voltage on the collector of Q603 measures approximately 5Vdc. If not, troubleshoot back through the 5Vdc-supply circuit. If the voltage was correct on the collector of Q603 verify the base measures approximately 3.2Vdc and the emitter measures approximately 1.08Vdc. If not check for correct component placement and values around Q603. If the base and

emitter dc measurements are not correct replace Q603. If the voltages on Q603 were correct troubleshoot for correct component placement and values back through the SAW filter FL600.

4. Verify pin 4 of IC610 (2nd LO input) measures the respective 2nd LO frequency at approximately -12dBm. If the 2nd LO amplitude is low check the values and correct placement of all components leading back through the circuit path to the collector of Q760. The approximate dc voltage measurements for Q760 are collector=4.6Vdc, base=1.5Vdc and emitter=1Vdc. If any of these dc measurements are not correct verify all components are correctly placed around Q760. Lastly replace Q760.
5. If the 2nd LO frequency is not present at pin 4 of IC610 verify that the tuning voltage of approximately 2.5Vdc is measured at TP750 in the 2nd LO VCO. If TP750 measures 0Vdc or near 5Vdc the 2nd LO VCO is not operating properly. Verify that pins 1 & 16 of IC1 measure approximately 4.5Vdc. If not, troubleshoot back through Q430 and the 5Vdc-supply circuit. Verify the correct placement and values of all components leading back through the 2nd LO circuit path. If none of the above is a problem possibly either IC1 is defective or IC300 is not properly programmed or defective.

Audio output troubleshooting from detector (IC610)

Set up:

Apply 1KHz modulation at 33Khz deviation to the external modulation input of the RF generator. Use A-weighting and 30Khz low pass filters for all audio measurements unless specified otherwise. Set the RF generator output to -50dBm.

Low audio out of detector output (pin7 of IC610):

1. First verify that L610 is tuned for maximum audio output at pin7 of IC610. Tune the core of L610 from top to bottom of the core shaft and back again for max audio output. This is to verify that a double audio peak is not detected. A maximum audio level at pin 7 of IC610 should only occur at one core rotation position within the shaft of L610. If more than one audio peak is detected replace L610. If not, measure the 10.7Mhz 2ndIF signal at pin 12 of IC610 using a FET probe and spectrum analyzer centered at 10.7MHz with a span set to 100KHz (10KHz/division). Observed on the spectrum analyzer, the 1Khz modulated 10.7Mhz signal should occupy approximately 6 1/2 divisions across the grid (each division is equal to 10KHz) which represents +/-33KHz deviation. This measurement should also be the same when measured at pin14 of IC610.
2. If the proper 10.7Mhz signal response as described above, is observed on the spectrum analyzer and the audio output at pin7 of IC610 is very low or not present replace IC610. If the proper 10.7Mhz signal response is NOT observed refer to the RF troubleshooting sections above.

Poor THD measurement out of detector output (pin7 of IC610):

1. First verify that L610 is tuned for maximum audio output at pin7 of IC610 by adjusting L610. Also, verify that the 10.7MHz 2nd IF signal is properly modulated as described in section above.
2. If the THD is still poor verify that the 1st LO has not deviated more than 12 **P**arts **P**er **M**illion (PPM). As an example, a 1st LO of 600 MHz (600,000,000 cycles per second) with a tolerance of 12 PPM could vary in frequency by +/- 7.2KHz. Since there are 600 "one million" units in 600MHz, the 600 units multiplied by the tolerance +/- 12 PPM equals 7.2KHz. The exact frequency offset could be between 600,005,400Hz and 599,994,600Hz. This offset outside of the 12PPM tolerance would cause an increased distortion reading throughout the audio chain. If this is observed replace Y707. If this is NOT the case replace IC610.

Poor (SINAD) measurement out of detector output (pin7 of IC610):

Note: any external "ON Channel" interference in the frequency of operation under test can cause erratic and poor SINAD measurements.

1. Verify using a spectrum analyzer that frequency of operation under test has no interference down to -100dBm. Verify that the unit under test has been properly tuned up by performing the RF alignment procedures.
2. Set the RF generator to -105dBm. Measure the SINAD out of the detector at pin7 of IC610. The SINAD measurement should measure approximately equal to or greater than 12dB at this level. If not refer to the RF troubleshooting sections above to isolate where signal degradation is occurring.

TR100 trim does not change level

1.) Confirm audio signal at TP_R.
2.) Check for insufficient solder on the trimmer.
3.) Confirm 4.5Vdc at IC200 pin 14.
4.) Check that R100, R101, R102, C101 and C102 are placed and are the correct values.

Fails Audio at TPE

1.) Check IC200 pin 14 for audio
2.) Check for 9VDC supply at IC200 pin 4
3.) Check placement and values of R100, R110, R111, R112, R115, C111, C112, and C113.

Fails/Weak Audio at TPBAL2/TPBAL3

1.) Confirm audio at TPE
2.) Confirm 4.5VDC at TP_Vref
3.) Confirm tone key in RF signal or R280 is shorted to disable TK
4.) Check and confirm values of C144, C150, R150, R153
5.) Check other components in vicinity

Fails Tone Key at TP_TK

1.) Confirm 4.5VDC at IC232 pins 1,5, and 7.
2.) Check RF signal for 32.768kHz tone key frequency
3.) Check RF signal for -20dBc tone key level
4.) Check placement of and values of C277, C278, R278, R279, R295, and R296
5.) TP_TK should measure > 0.5VDC with tone key present in RF signal

NOTES

REPLACEMENT PARTS

PRODUCT CHANGES

PARTS DESIGNATIONS

The following comments apply to the parts list and the schematics:

Resistors: Unless otherwise noted, all resistors are surface-mount with 1/10 W rating and 1% tolerance.

Capacitors: Unless otherwise noted, non-polarized capacitors are surface-mount NPO dielectric types with a 100 V capacity and a 5% tolerance, and polarized capacitors are tantalum types.

PG4 MODEL VARIATION

COUNTRY CODE	FREQUENCY RANGE	COUNTRY DESIGNATION	PC BOARD ASSEMBLY
H7	536-548 MHz	N. & S. AMERICA	200H710998
K7	590-602 MHz	N. & S. AMERICA	200K710998
M7	662-674 MHz	N. & S. AMERICA	200M710998
M10	674-686 MHz	FRANCE	200M1010998
P11	702-714 MHz	CHINA	200P1110998
Q11	740-752 MHz	CHINA / KOREA	200Q1110998
R10	800-812 MHz	EU	200R1010998
R11	770-782 MHz	CHINA	200R1110998
R12	794-806 MHz	THAILAND	200R1210998
JB	806-810 MHz	JAPAN	200JB10998
T10	854-865 MHz	UK	200T1010998

ANTENNA PART NUMBERS

Antenna Part Numbers	H7	K7	M7	M10	P11	Q11	R10	R11	R12	JB	T10
CH A	44Y8034				44Y8036						
CH B	44Z8034				44Z8036						

PG4 HARDWARE REPLACEMENT PART

Reference Designator	Description	Shure Part Number
A1	PG4 RECEIVER CASE ASSEMBLY	95B9138
MP1	SHIELD,COVER,SMALL,STEEL,TINNED	53A8602
MP2	FENCE,SHIELD,STEEL,PLATED,TIN	53C8538
MP3	RoHS SCREW,THD-FRM,HD,PAN,PH,STL,YWL	30A1245B

PG4 PCB REPLACEMENT COMPONENTS

Reference Designator	Description	Shure Part Number
CON145	JACK,PHONE,STEREO,RIGHT ANGLE,1/4"	95A8329
CON155	CONNECTOR,MALE,RIGHT ANGLE,3 PIN	95A8744
CON400	JACK,POWER,DC,.080 DIA.	95A8328
CON402	HEADER,SHROUDED,TOP ENTRY,2 POSITION	95A8272
CON500 CON505	CONNECTOR,ANTENNA,BRASS,PLATED	56B8104
C121 C144 C228 C405 C406 C715 C775 C776	CAPACITOR,TANTALUM,SMD1411,10uF,16V,10%	151AD106KB
C145 C399	CAPACITOR,ELECTROLYTIC,SMD,1uF,50V,10%	151BG105KB
C150 C152 C504 C509	CAPACITOR,ELECTROLYTIC,SMD,47uF,50V,20%	151BG476MF
C277	CAPACITOR,X5R,SMD 805,4.7uF,10V,10%	150XB475KA
C623	CAPACITOR,ELECTROLYTIC,SMD,100uF,35V,20%	151BF107MF
C714	CAPACITOR,TANTALUM,SMD1206,.47uF,16V,10%	151AD474KA
C717 C752	CAPACITOR,TANTALUM,SMD1206,.1uF,35V,10%	151AG104KA
C751	CAPACITOR,TANTALUM,SMD1411,4.7uF,16V,10%	151AD475KB
CV720	CAPACITOR,TRIM,SMD,.65-2.5pF	152A04
D122 D134 D162 D228 D278	DIODE,SIGNAL,SWITCHING,SOT-23,100VDC	184A08
D400	DIODE,SCHOTTKY,100V/1A,SMB	184A75
D510	DIODE,ATTENUATOR,PIN,COMMON ANODE,SOT23	184A40
D720	DIODE,CAPACITANCE,VARIABLE,SC79-2	184A72
D755	DIODE,TUNING,RF,SOD-323,30VDC	184A36
DS300	LED, GREEN, DISPLAY, SING DIGIT NUA	86A8448
DS320	LED,GREEN,T-1,RT ANG,REVERSE	86B8449
DS322	LED,RED/GREEN,BI-COLOR,RT ANGLE	86C8452
E398 E399 E400 E401 E700	FERRITE,BEAD,SMD 805,600 OHM	162A77
E515 E517 E600	BEAD,FERRITE,SMD 603,600 OHM	162A46
FL510	FILTER,HELICAL,HR-5W,PINS 4&9 GND,542MHz	86J9029
FL600	FILTER,SAW,110.592MHz	162A68
FL620 FL625	FILTER,CERAMIC,10.7MHz	86A9021
L610	COIL,QUADRATURE,10.7MHz	82A8004
L720	INDUCTOR,SPRING,MICRO,AIR CORE,5.4nH	162D61
Q113 Q160 Q161	TRANSISTOR,TMOS,SOT-23,FET,2N7002	183A30
Q162	TRANSISTOR,LOW NOISE,SOT-23,NPN,5089	183A38
Q712 Q724 Q760	TRANSISTOR,HIGH FREQ,3 PIN MINI MOLD,NPN	183A66
Q603	TRANSISTOR,HIGH FREQ,NPN,SOT-343	183A80
TR100 TR220	P0TENTIOMETER,TRIM METAL-GLAZE,LINE,100K	146E10
IC1	SYNTHESIZER,DUAL,POWER,LOW,LMX2335LTM	188B388
IC100	COMPANDER,16 PIN QSOP	188A671
IC200 IC260	AMPLIFIER,OPERATIONAL,QUAD,SO-14,MC33179	188A49
IC232	AMPLIFIER,OPERATIONAL,DUAL,SO-8,SC79161	188A18
IC300	MICROCONTROLLER,16K FLASH,1K RAM,48QFN	188A669
IC400	REGULATOR,VOLT,POSITIVE,DPAK,MC33269DT	188A272
IC401	REGULATOR,LOW DROPOUT,5V,SOT23	188D526
IC430	REGULATOR,CMOS LDO,3.3V,SC-70-5	188A590
IC520	LNA/MIXER,LOW CURRENT,SO-14,RF2418	188A127
IC610	DETECTOR,FM IF,WIDE BAND,SSOP16	188A573
SW310	SWITCH,MOMENTARY,RT ANG,GRAY BUTTON,SPST	55D8105
Y285	CRYSTAL,32.768KHz	40A8010
Y707	CRYSTAL,QUARTZ,16MHz,5X3.2mm	140A35

PG4 FREQUENCY DEPENDENT PARTS**

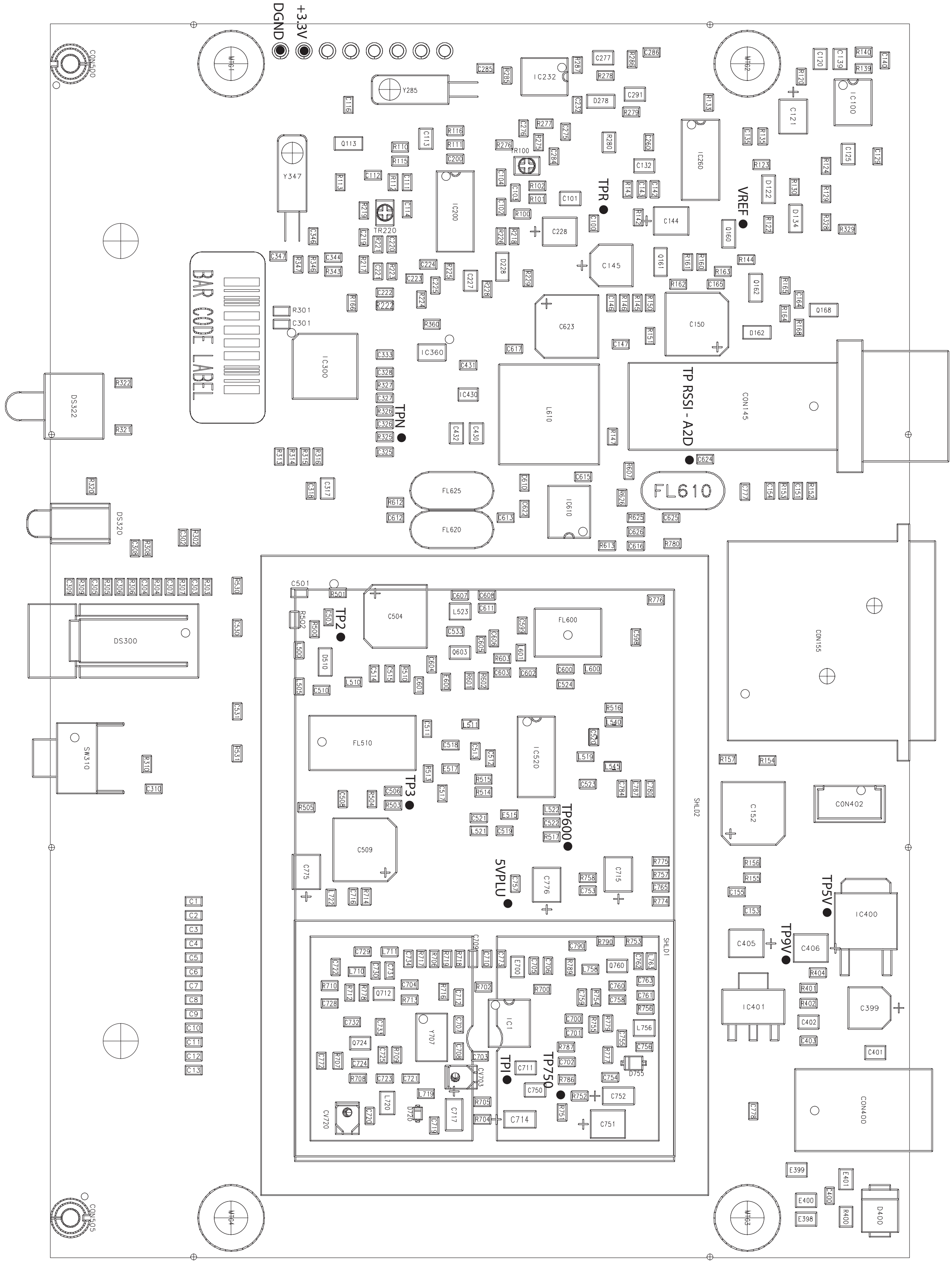
Frequency Code	H 7	K7	M 7	M 10	P 11	Q 11	R 10	R 11	R 12	JB	T 10
C1	2.7 pf	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP
C10	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	2.7 pf	DNP
C11	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	2.7 pf
C2	DNP	2.7 pf	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP
C3	DNP	DNP	2.7 pf	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP
C346	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP
C347	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP
C4	DNP	DNP	DNP	2.7 pf	DNP	DNP	DNP	DNP	DNP	DNP	DNP
C5	DNP	DNP	DNP	DNP	2.7 pf	DNP	DNP	DNP	DNP	DNP	DNP
C51	DNP	DNP	100 pf	100 pf	DNP	DNP	DNP	DNP	DNP	DNP	DNP
C511	100 pf	100 pf	3.9 pf	2.7 pf	100.0 pf	100.0 pf	100.0 pf	100.0 pf	100.0 pf	100.0 pf	100.0 pf
C522	2.7 pf	2.7 pf	2.2 pf	2.2 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.2 pf
C540	6.8 pf	6.8 pf	6.8 pf	6.8 pf	DNP	DNP	DNP	DNP	DNP	DNP	DNP
C545	6.8 pf	6.8 pf	6.8 pf	6.8 pf	DNP	DNP	DNP	DNP	DNP	DNP	DNP
C6	DNP	DNP	DNP	DNP	DNP	2.7 pf	DNP	DNP	DNP	DNP	DNP
C7	DNP	DNP	DNP	DNP	DNP	DNP	2.7 pf	DNP	DNP	DNP	DNP
C720	DNP	DNP	DNP	DNP	10 pf	18 pf	DNP	DNP	DNP	DNP	0.5 pf
C721	5.6 pf	4.7 pf	5.6 pf	4.7 pf	8.2 pf	4.7 pf	4.7 pf	5.6 pf	5.6 pf	4.7 pf	5.6 pf
C723	3.9 pf	2.7 pf	2.7 pf	2.7 pf	5.6 pf	3.9 pf	2.7 pf	3.9 pf	2.7 pf	2.7 pf	3.3 pf
C724	2.2 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	18 pf
C725	2.2 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.7 pf	2.2 pf
C729	5.6 pf	5.6 pf	4.7 pf	4.7 pf	10.0 pf	5.6 pf	4.7 pf	5.6 pf	4.7 pf	4.7 pf	4.7 pf
C730	4.7 pf	4.7 pf	5.6 pf	5.6 pf	10.0 pf	5.6 pf	5.6 pf	4.7 pf	5.6 pf	5.6 pf	5.6 pf
C734	5.6 pf	5.6 pf	4.7 pf	4.7 pf	5.6 pf	4.7 pf	5.6 pf	4.7 pf	5.6 pf	5.6 pf	4.7 pf
C756	20.0 pf	20.0 pf	20.0 pf	20.0 pf	12.0 pf	12.0 pf	12.0 pf	12.0 pf	12.0 pf	12.0 pf	12.0 pf
C762	47.0 pf	47.0 pf	47.0 pf	47.0 pf	33.0 pf	33.0 pf	33.0 pf	33.0 pf	33.0 pf	33.0 pf	33.0 pf
C763	120.0 pf	120.0 pf	120.0 pf	120.0 pf	82.0 pf	82.0 pf	82.0 pf	82.0 pf	82.0 pf	82.0 pf	82.0 pf
C765	27.0 pf	27.0 pf	27.0 pf	27.0 pf	47.0 pf	47.0 pf	47.0 pf	47.0 pf	47.0 pf	47.0 pf	47.0 pf
C8	DNP	DNP	DNP	DNP	DNP	DNP	DNP	2.7 pf	DNP	DNP	DNP
C9	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	2.7 pf	DNP	DNP
FL510	86J9029	86K9029	86L9029	86L9029	86D9029	80H9029	80E9029	80M9029	80G9029	80G9029	80F9029
L511	1.2 nH	1.2 nH	DNP	DNP	18 nH	18 nH	18 nH	18 nH	18 nH	18 nH	18 nH
L711	12 nH	12 nH	10 nH	10 nH	12 nH	12 nH	10 nH	12 nH	10 nH	10 nH	10 nH
L720	5.4 nH	5.4 nH	3.85 nH	3.85 nH	5.4 nH	5.4 nH	5.4 nH	5.4 nH	5.4 nH	5.4 nH	3.85 nH
L756	68 nH	68 nH	68 nH	68 nH	56 nH	56 nH	56 nH	56 nH	56 nH	56 nH	56 nH
R101	75 k	75 k	75 k	75 k	75 k	49.9 k	75 k	75 k	75 k	75 k	75 k
R219	15 k	15 k	15 k	15 k	15 k	8.25 k	15 k	15 k	15 k	15 k	15 k
R313	0 k	DNP	0 k	DNP	0 k	DNP	0 k	DNP	0 k	DNP	0 k
R314	DNP	DNP	0 k	0 k	DNP	DNP	0 k	0 k	DNP	DNP	0 k
R315	DNP	DNP	DNP	DNP	0 k	0 k	0 k	0 k	DNP	DNP	DNP
R316	DNP	DNP	DNP	DNP	DNP	DNP	DNP	DNP	0 k	0 k	0 k
R719	22.1	33.2	33.2	33.2	49.9	22.1	33.2	33.2	33.2	33.2	33.2

UNPLACED COMPONENT LIST**

C103	**C114**	**C165**	**C346**	**C347**	**C520**	**C521**	C600	**C602**
C611	C612	C622	CV703	**FL610**	IC360	L540	L545	Q168
R168	R280	R346	R347	R360	R400	R612	R613	R776
R790	SHLD2	Y347						

NOTE: APPLIES TO ALL FREQUENCY CODES

PCB LAYOUT



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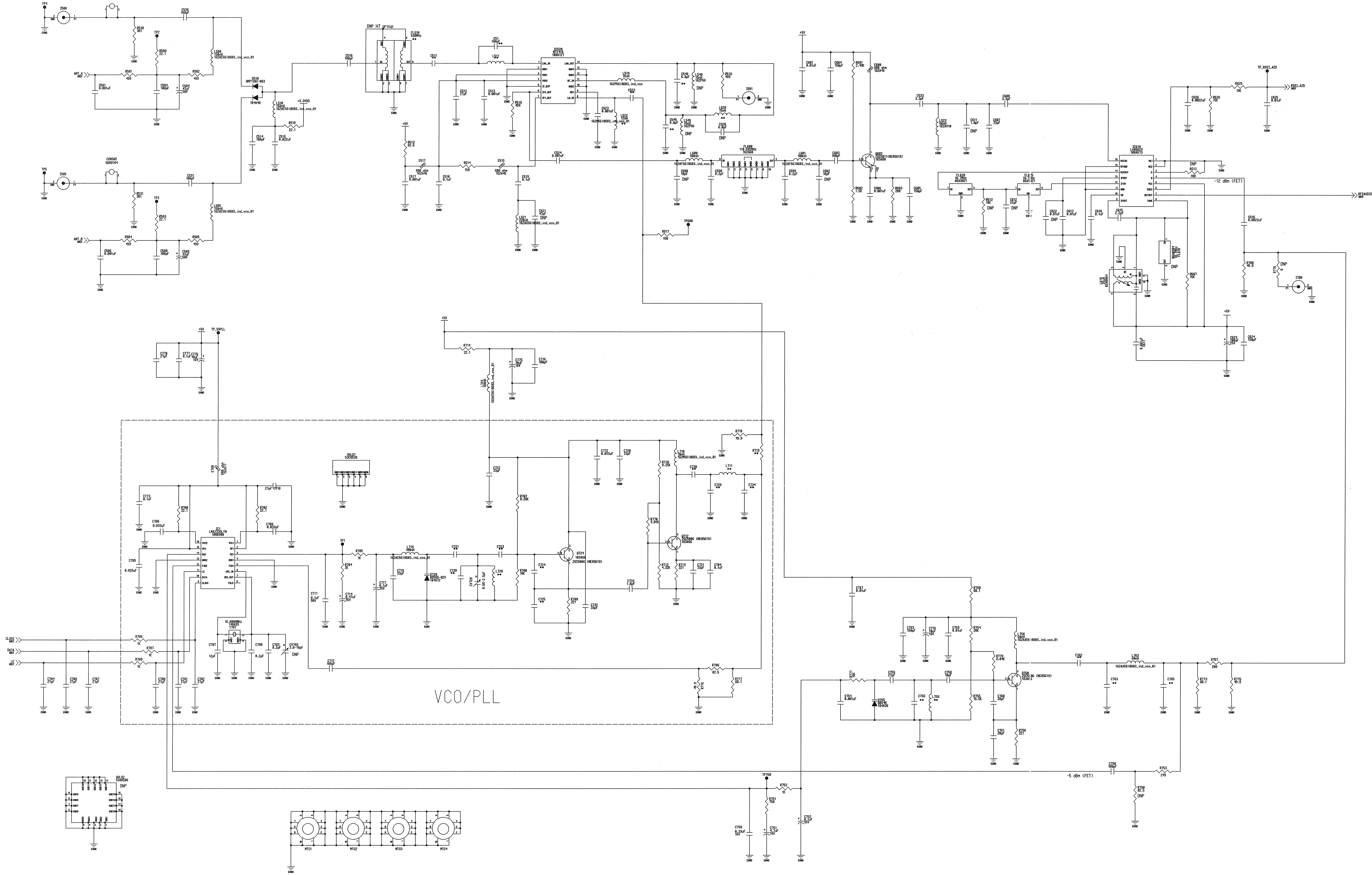
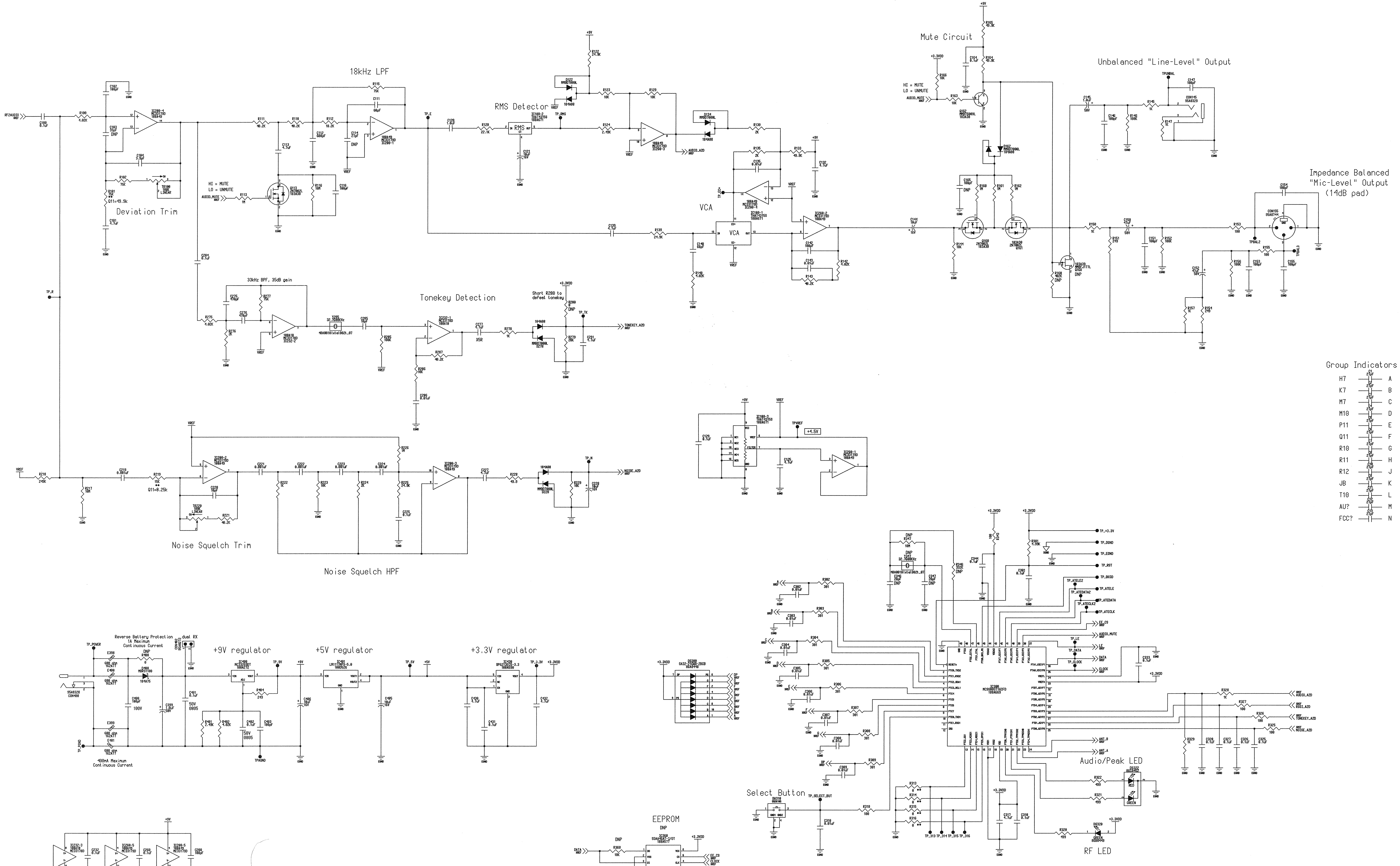


DNP H7 group
VCO/PLL
-12 dBm (FET)
-5 dBm (FET)
CLOCK
DATA
LE
ANT_A
ANT_B



NOTES:

1) ALL RESISTORS TO BE 1/10 WATT, 1%, 0603 UNLESS OTHERWISE

2) ALL NON-POLARIZED CAPACITORS (besides 4.7uF 0805) ARE 0603 UNLESS OTHERWISE SPECIFIED.