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LX Wireless System

SERVICE MANUAL CHANGE NOTICE

LX2 WIRELESS HAND-HELD TRANSMITTER

Changes and corrections have been made to the Service Manual for the LX2 Hand-Held Transmitter. To update your Service Manual, remove the pages identified in the tables below and replace them with the pages attached to this Change Notice. Note that there are no changes to pages not specifically identified in the tables below.

LX2 HAND-HELD TRANSMITTER SERVICE MANUAL REVISION HISTORY

Release	Part Number	Date Code
Original	25A1006	QH
Revision 1	25B1006	QL
Revision 2	25C1006	SC
Revision 3	25D1006	SI
Revision 4	25D1006	TF
Revision 5	25D1006	BB
Revision 6	25D1006	BK
Revision 7	25D1006	CG

CHANGES EFFECTIVE **JULY 10, 2003**

REMOVE these pages from the LX2 Service Manual	INSERT these new Revision pages into the LX2 Service Manual
35	35

LX2 Hand-Held Transmitter

Characteristics

General

The Shure LX2 Hand-Held Transmitter is part of a wireless system designed for public address, educational radio and television broadcasting, school and community theater productions, and similar applications. The LX2 is intended for use with the matching LX3 and LX4 receivers.

Controls and Connectors

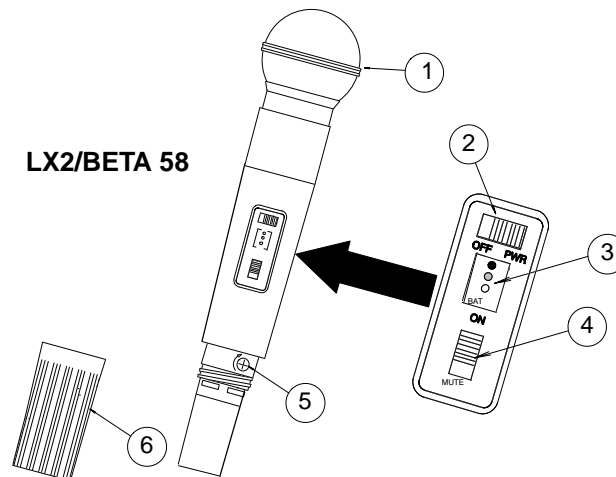


Figure 1. Identification of Controls and Connectors

- | | |
|-------------------------|-----------------------|
| 1. Grille | 4. ON/MUTE mic switch |
| 2. OFF/PWR power switch | 5. Audio gain control |
| 3. Battery LEDs | 6. Battery cup |

Service Note: Shure recommends that all service procedures be performed by a Factory-Authorized Service Center or that the product be returned directly to Shure Brothers Inc.

Licensing: Operation may require a user license. Frequency or power-output modifications may violate this product's approvals. Contact your country's communications authorities.

Circuit Description

The Shure LX2 Hand-Held Transmitter contains three circuit boards; an audio section, an rf section, and a microphone head interface board. It is intended for use with the matching LX3 and LX4 receivers.

Audio Section

Audio signals from the microphone head enter the transmitter via a printed circuit board (pcb) with spring contacts, which also interconnects the audio and rf printed circuits.

The audio signal next enters a preamplifier stage consisting of one section of operational amplifier (U102C). The voltage gain of this stage may be adjusted over a 40 dB range by means of an externally-accessible potentiometer (R125) to enable the user to compensate for variations in sound level at the microphone.

The preamplified audio signal is then passed through a passive pre-emphasis network consisting of R142, C110, C111, R112, and R115, that has a pole at 63 microseconds and a zero at 12 microseconds.

Audio Signal Compression

The signal then enters the NE571D integrated circuit compander (U101A). This provides 2:1 logarithmic compression of the audio signal. A lower noise floor is achieved by U102A. An internal potentiometer (R130) is provided for nulling system audio distortion. Operational amplifier U102B operates as a two-pole active low-pass filter to restrict the bandwidth of the system to audio frequencies.

Reverse Battery Protection and Low Battery Warning

The NE571D also contains an identical second channel (U101B), which in this case is used to supply regulated, low-noise 5 Vdc bias to various audio and rf circuit points. Transistor Q105 provides reverse battery protection to the circuit. Q110 drives a green LED (D103) that serves as a power ON indicator. Q107 drives an amber LED (D102) that provides a low battery warning signal to the user. Q106 and Q108 drive a red LED (D101) that serves as a final low battery indicator.

Rf: Domestic (FCC/IC)

Processed audio enters R201, an internal potentiometer that is adjusted for 15 kHz deviation (100% modulation) with a -2.2 dBV, 1 kHz tone at the output of the audio section. The audio is then fed to varactor diode D201, which is part of the modulated oscillator-tripler stage (Q201).

The base-emitter circuit of Q201 operates as a crystal-controlled Colpitts oscillator in the 20 MHz region. Fundamental-mode crystal Y201 is tuned 10 kHz below series resonance by the series combination of frequency-netting coil L201, diode D201, capacitor C203, and capacitor divider C206 and C207.

Frequency Stability

To ensure frequency stability with changes in battery voltage, regulated 5 Vdc bias is applied to the varactor diode and to the base of Q201. Temperature compensation is provided by C206 and C207.

The collector circuit of Q201 is tuned to the third harmonic of the oscillator frequency (approximately 60 MHz) by means of L202 and C208. C210 couples rf energy to a second tuned circuit consisting of L203, C214, and C215, which also forms a capacitively-tapped voltage divider for matching into the base of Q202, operating as a buffer amplifier.

Regulated dc bias is again employed to minimize changes in loading on the oscillator stage and stabilize drive levels. The collector circuit of Q202 is again tuned to the third harmonic of the oscillator frequency by L204 and C216. C219 couples rf energy to another tuned circuit consisting of L205, C222, and C224, which also forms a capacitively-tapped voltage divider for matching into the base of Q203.

Frequency Tripler

The third stage (Q203) is operated as a frequency tripler with the collector circuit tuned to the output frequency (for example, 180 MHz). In this case L206, C226, C229, L207, C230, and C232 perform tuning and impedance matching functions. As in the preceding stage, regulated dc bias is applied to the base circuit to stabilize the drive level, and the output is double-tuned to provide spectral purity.

The final output stage (Q204) is operated as a tuned amplifier. Resistive loading on the input enhances stability. The output circuit consists of a tuned tank circuit (L209, C237, and C239) which also provides impedance matching to the output low-pass filter (C239, L210, and C241). L211 and C242 match the antenna to the filter.

Stable Operation

To promote stable operation, the LX2 is designed to minimize the production and radiation of spurious emissions and harmonic energy. In addition to the features described previously, the collector of each rf stage is separately decoupled from the 9 Vdc supply using ferrite chokes, resistors, and bypass capacitors of the appropriate value. The base circuits are similarly decoupled except that they use resistor-capacitor (R-C) networks that are more appropriate, due to the higher impedance level. The use of surface mount components results in better performance because of a reduction in stray inductances and unwanted radiation from component leads. Double-sided printed circuit board construction improves ground-plane performance.

Rf: Euro (ETSI)

Audio Input

Processed audio enters R201, an internal potentiometer that is adjusted for 15 kHz deviation (100% modulation) when the audio section provides a -2.2 dBV, 1 kHz tone.

Oscillation

The audio then goes to varactor diode D201, which is part of the modulated oscillator-tripler stage (Q201). The latter's base-emitter circuit operates as a crystal-controlled Colpitts oscillator in the 20 MHz region. Fundamental-mode crystal Y201 is tuned 10 kHz below series resonance by the series combination of frequency-netting coil L201, diode D201, capacitor C203, and capacitor divider C206 and C207.

Frequency Stability

To ensure frequency stability despite changes in the battery voltage, regulated 5 Vdc bias is applied to the varactor diode and to the base of Q201. C203, C206, and C207 provide temperature compensation.

Tuned Circuits

Stage 1: The collector circuit of Q201 is tuned to the third harmonic of the oscillator frequency (approximately 60 MHz) by L202, C208, C244, C210, L203, C214, C213, and C215. The latter components also form a capacitively-tapped voltage divider for matching into the base of Q202. The output is double-tuned to provide high spectral purity. Regulated dc bias is again employed to minimize changes in loading on the oscillator stage and to stabilize the drive levels.

Stage 2: Q202 operates as a buffer with the collector circuit tuned to the output frequency (for example, 60 MHz). In this case, L204, C216, C245, C218, L205, C222, C221, and C224 perform tuning and impedance-matching functions. As in the preceding stage, regulated dc bias is applied to the base circuit to stabilize the drive level, and the output is double-tuned to provide spectral purity.

Stage 3: Q203 operates as a frequency tripler, with the collector circuit tuned to the output frequency (for example, 180 MHz). In this case, L206, C226, C227, C229, L207, C230, and C232 perform tuning and impedance-matching.

Stage 4: Q204 operates as a tuned amplifier. Resistive loading on the input provides stability. The output circuit consists of a resonant tank circuit (L203 and C213) capacitively coupled to a low-pass filter (C219, L206, and C218). C213 and C219 provide a capacitively-tapped voltage divider for matching into the low-pass filter.

Final Output

Transmitter: The transmitter can deliver up to +11.5 dBm (14 mW) to the antenna. No user adjustments permit this value to be exceeded. Testpoint TP6 provides a termination point for the 50 Ω output. C243 and L211 act as a series-resonating network for the battery, which acts as the antenna. The unit should be powered exclusively by a 9 Vdc dry battery. An alkaline type such as the Duracell MN1604 is recommended.

Voltage Measurements

With 9 Vdc applied to the unit, the following voltages should appear at the terminals of the output transistor:

- $V_c = 8.83$ Vdc
- $V_b = .097$ Vdc
- $V_e = .32$ Vdc
- Base current = 0.27 μ Adc
- Emitter current = 9.67 mAdc
- Collector current = 9.67 mAdc
- Power input = 87 mW

The output power is +9.5 dBm (8.9 mW) into a 50 Ω load, at a frequency of 169.445 MHz. At the lowest acceptable battery voltage of 6 Vdc, the final collector current drops to 8.84 mAdc and the output power to +7.3 dBm (5.4 mW).

Spurious Emissions

To promote stable operation and to minimize the production and radiation of spurious emissions and harmonic energy, the collector of each rf stage is separately decoupled from the 9 Vdc supply by ferrite chokes, resistors, and bypass capacitors. The base circuits are similarly decoupled, except for using resistor-capacitor (R-C) networks whose higher-impedance levels are more appropriate.

Power Section

The transmitter delivers a maximum of +3 dBm (2 mW) ERP, to comply with ETSI Class 1 or 2 limits. There are no user adjustments which would permit this value to be exceeded. The low effective radiated power is due to the low radiation resistance of the battery antenna, which is only a small fraction of a wavelength at this frequency.

The transmitter is intended to be powered exclusively by a 9 Vdc dry battery (alkaline type recommended) such as a Duracell MN1604, which also serves as the antenna. The ground plane of the circuit board serves as an untuned counterpoise.

Notes:

Preliminary Tests

Listening Test

Before completely disassembling the transmitter, operate it to determine whether it is functioning normally and try to duplicate the reported malfunction. Refer to the product's *User Guide* 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.

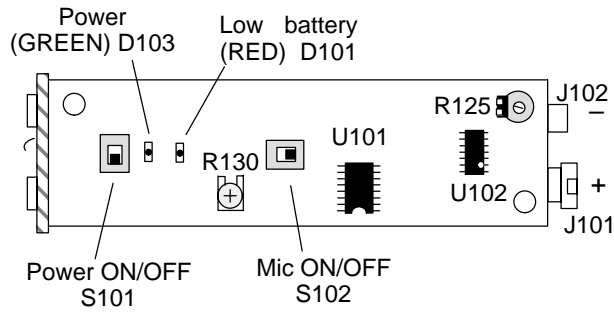
Functional Tests

Refer to the *Disassembly* section to partially disassemble the transmitter for the following functional tests.

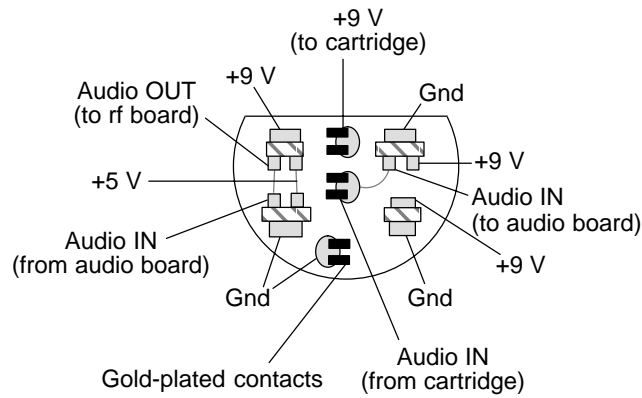
Use dc blocks at all rf outputs to protect test equipment.

Test Component Locations

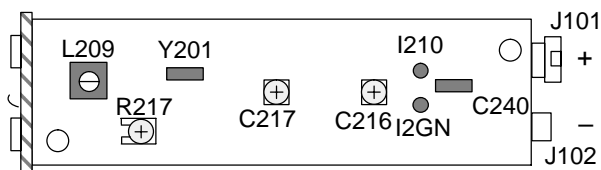
Audio Board (top)



Head Board (front view)



Rf Board (top) (FCC/IC)



Rf Board (top) (ETSI)

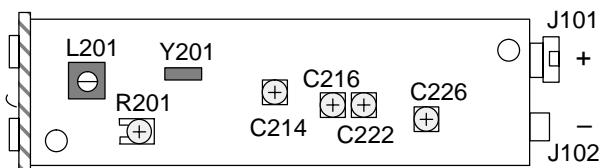
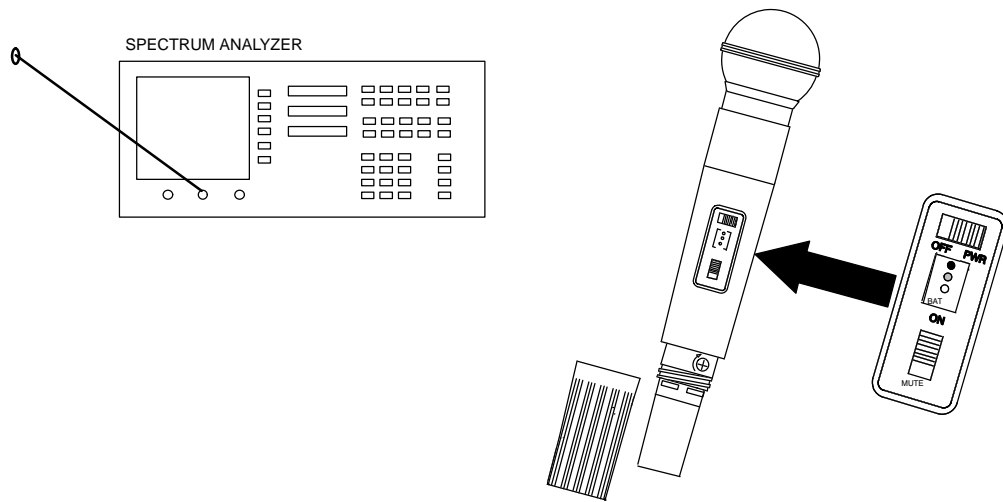


Figure 2. Test Component Locations

Rf Tests



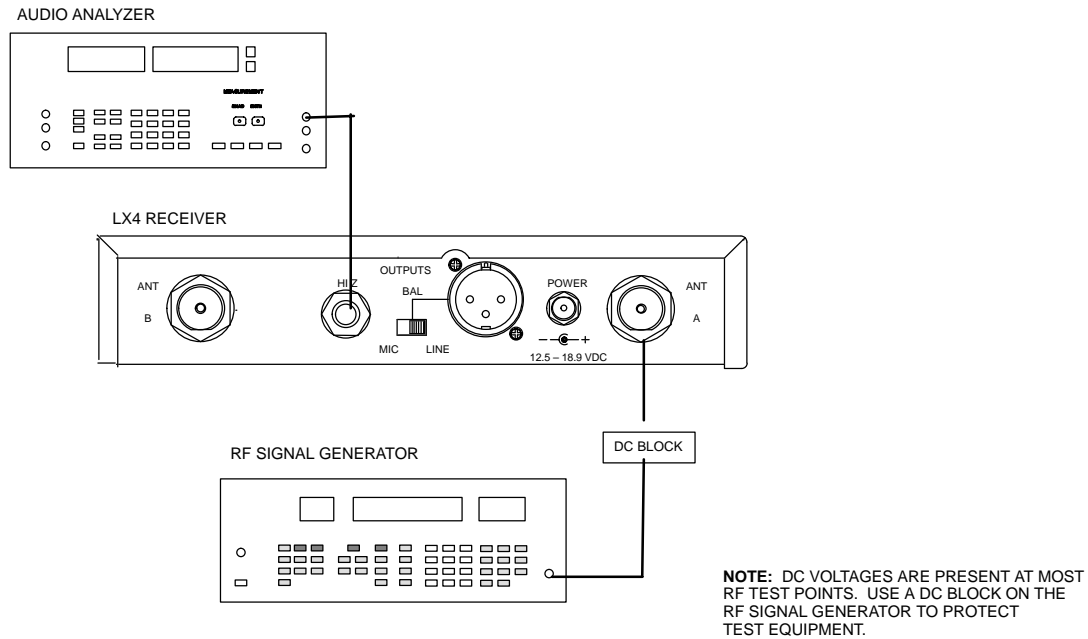
LX2 Transmitter		Spectrum Analyzer	
Power switch:	PWR	Center frequency:	transmitter frequency
Mute switch:	MUTE	Span:	30 MHz
		Reference level:	+ 20 dBm
		Scale:	10 dB/div

Figure 3. Rf Functional Test Set-Up

1. Install a new 9 Vdc battery and turn on the LX2.
2. Measure the current drain: it should not exceed 35 mA.
3. Maximize the signal received on the spectrum analyzer by attaching a telescoping whip antenna. Then measure the near-field output power. It should measure ≥ 3 dBm .
4. Verify that the carrier frequency of the transmitter varies from its nominal value by no more than ± 6 kHz.
5. Check for an intermittent problem by shaking the transmitter and tapping on it, keeping the transmitter a constant distance from the spectrum analyzer. Verify that the output power on the spectrum analyzer shows no large and sudden drops in power level. It will, however, vary a few dB according to hand position.
6. Turn the LX2 OFF.

Audio Tests

Check the Matching Receiver

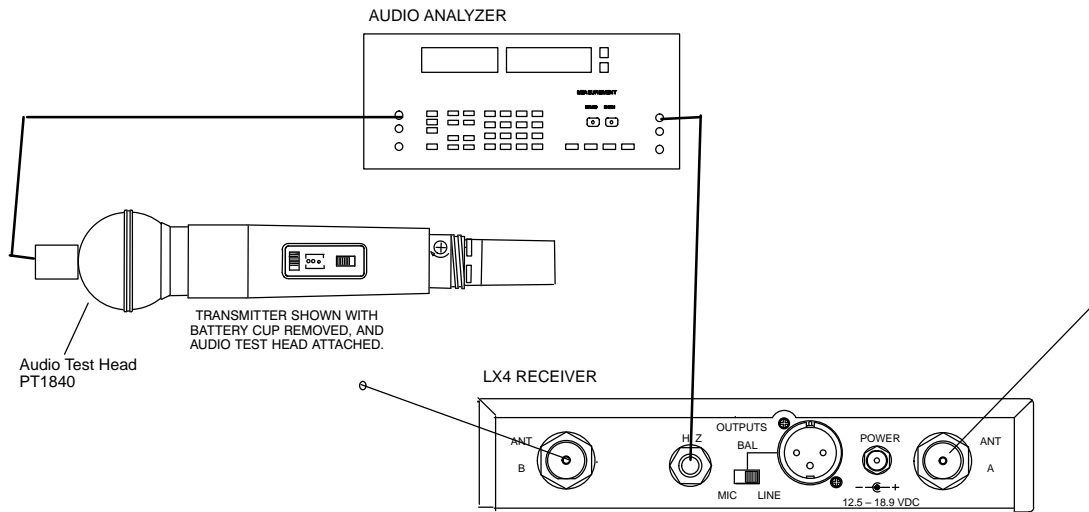


LX4 Receiver		Audio Analyzer		Rf Signal Generator	
Power switch:	ON	Frequency:	1 kHz	Amplitude:	-20 dBm
Gain:	Max	Filters:		Modulation::	1 kHz
Squelch:	Mid	Low-Pass (30 kHz):	ON	Deviation:	15 kHz
		High-Pass (400 Hz):	ON	Frequency:	LX2 operating frequency

Figure 4. Matching Receiver Functional Test

1. Connect the matching receiver's antenna input to the rf signal generator. Set the rf signal generator's amplitude to -20 dBm, modulation to 1 kHz, deviation to 15 kHz, and set the frequency to the LX2 unit's operating frequency.
2. Connect the audio from the unbalanced output to the audio analyzer with a 3.3 kΩ load. Turn the volume control to maximum.
3. Engage the audio analyzer's 400 Hz high-pass filter and 30 kHz low-pass filter..
4. For the LX4, verify the following:
 - audio level is 400 mVrms (± 90 mV)
 - total harmonic distortion (THD) is $< 0.75\%$

Check the Transmitter



LX2 Transmitter		LX4 Receiver		Audio Analyzer	
Power switch:	PWR	Power switch:	ON	Frequency:	1 kHz
Gain:	Min	Gain:	Max	Amplitude:	.775 V
Mute switch:	MUTE	Squelch:	Mid	Filters:	
				Low-Pass (30 kHz):	ON
				High-Pass (400 Hz):	ON

Figure 5. Transmitter Functional Test

1. Disconnect the rf signal generator from the receiver and turn the rf power off. Monitor the receiver's unbalanced audio output with a 3.3 k Ω load and the audio analyzer. Turn the receiver's volume control to its maximum setting.
2. Use an audio test head to input audio into the hand-held transmitter.
3. Turn the LX2 ON.
4. Inject a 0.775 V, 1 kHz signal from the audio analyzer into the audio test head. Transmitter gain should be set to minimum. Verify the following:
 - the amplitude from the receiver's unbalanced output equals 400 mVrms (± 90 mV)
 - total harmonic distortion (THD) is $< 0.75\%$
5. Change the frequency of the audio generator to 100 Hz and disengage the 400 Hz high-pass filter from the audio analyzer. Verify that the audio level is -5 dB (± 0.5 dB) relative to the level measured above.
6. Change the frequency of the audio generator to 10 kHz and reengage the 400 Hz high-pass filter. Verify that the audio level, relative to that measured above, is 0 dB, ± 2 dB.

Tested Units

If the system components pass the RF and Audio tests, then the system is functioning correctly and does not require tuning and alignment.

Disassembly and Assembly



Disassembly

To access the printed circuit boards of the unit, open the case:

1. Make sure the PWR/OFF switch is in the OFF position.
2. Unscrew the battery cup to access and remove the battery.
3. Unscrew the microphone cartridge and grille assembly.
4. If removal of the microphone-transmitter subassembly is necessary, use snap ring pliers to remove the retaining ring from inside the microphone handle.
5. To remove the bezel, carefully insert a small screwdriver into the microphone handle. Press against the plastic bezel tab and lift upward. Remove the bezel, associated nameplate, and switch actuators.
6. Remove the transmitter subassembly (audio, rf, and head circuit board) from the handle while noting the internal guides they were positioned on.

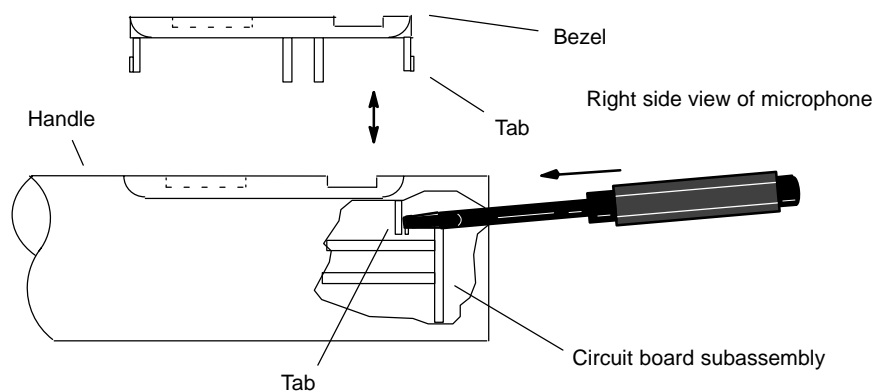


Figure 6. Bezel Removal

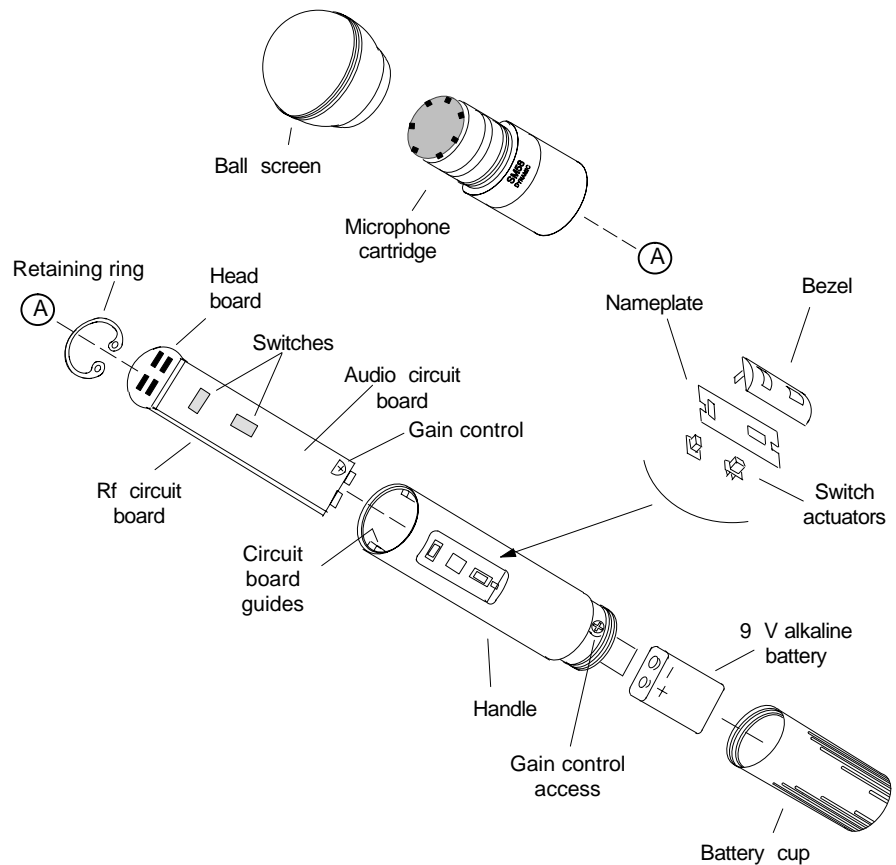


Figure 7. LX2 Hand-Held Transmitter, exploded view.

Reassembly

1. Make sure the PWR/OFF switch is in the OFF position.
2. Replace the transmitter subassembly (audio, rf, and head circuit board) into the handle. Position it using the internal guides.
3. Carefully replace the nameplate, switch actuators, and bezel.
4. Replace the retaining ring.
5. Replace and screw in the microphone cartridge and grille assembly.
6. Replace the battery.
7. Replace and screw in the battery cup.

Service Procedures

Measurement Reference

dBu is a measure of *voltage*, and dBm is a measure of *power*.

For example, the HP8903 should be labeled dBu instead of dBm because it is a voltage measurement. These two terms are often used interchangeably even though they have different meanings.

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

dB Conversion Chart

$$0 \text{ dBV} = 2.2 \text{ dBu}$$

$$0 \text{ dBu} = 0 \text{ dBm, assuming the load} = 600 \Omega$$

Test Equipment

Most test equipment needed is described in the Shure *Wireless Service Equipment Manual*. The following test equipment (or approved equivalent) is also needed.

Table 1
Test Equipment

Equipment Type	Model
Audio analyzer	*Hewlett-Packard 8903B
Digital multimeter	Fluke 87
Cable	PT1843
Frequency counter	Hewlett-Packard 53181A
Rf signal generator	Hewlett-Packard 8656B
Spectrum analyzer	Hewlett-Packard 8590L
Shure LX4 receiver	Shure LX4
Audio test head adapter ring	PT1838Y
Audio Test Head	PT1840

*Audio levels in dBu are marked as dBm on the HP8903B.

Changing the Frequency

System Operating Frequencies

The LX2 Hand-Held Transmitter printed circuit board (pcb) is marked with a group letter that identifies the range of frequencies it can operate within.

The operating frequency may be changed to a different frequency within the same group. Before changing the operating frequency, refer to the *Functional Test* section and check the transmitter for proper operation.

Shure LX2 Hand-Held Transmitter

Change the frequency by changing the crystal on the rf board. For proper operation, the crystal must be obtained from Shure and must operate within the frequency range of the pcb. Use the following equation to determine the operating frequency:

$$\text{Carrier frequency} = 9 \times (\text{nominal crystal frequency in MHz}) - .09 \text{ MHz}$$

After the new crystal is installed, operational tests and alignment procedures must be performed to ensure that the transmitter is operating correctly. The pcb label should also be updated to show the new frequency and letter identification code.

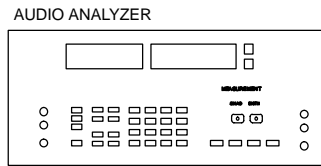
Table 2
Wireless Frequency Selections, Domestic (FCC/IC)

Group Code	Frequency-Code	Frequency (MHz)	Printed Circuit Board Assembly
A	V	169.445	T90__8644
	AD	169.505	
	AC	170.245	
	AH	170.305	
	AB	171.045	
	AG	171.105	
	W	171.845	
	AA	171.905	
	AZ	174.500	
	CA	176.200	
	CC	177.600	
	CD	180.400	
	CE	182.200	
	CF	183.600	
	B	CG	
CH		186.600	
CJ		189.000	
CK		190.600	
CL		192.200	
CM		192.600	
CN		195.000	
C	CP	196.600	
	CS	200.300	
	CQ	202.200	
	CR	203.000	
	CT	206.000	
	CV	208.200	
CU	209.000		

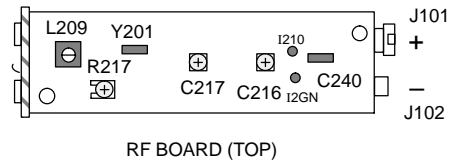
Table 3
Wireless Frequency Selections, Euro (ETSI)

Group Code	Frequency Code	Frequency (MHz)	Printed Circuit Board Assembly
A	AQ	173.800	T90__8704
	EA	173.800	
B	AY	174.100	
	EB	174.100	
	EC	174.500	
	ZZ	174.500	
	EE	175.000	
	J/BB	175.000	
	NB	175.000	
	NC	176.200	
	ND	176.600	
	K	177.000	
	NE	177.600	
C	NH	182.000	
	NJ	183.200	
	NK	183.600	
	NL	184.600	
	S	184.800	
D	NM	186.350	
	NP	189.000	
	NR	190.600	
E	EG	191.900	
	NX	197.600	
	NY	198.600	
	EK	200.300	
	NZ	200.350	
F	PU	201.650	
	PB	203.000	
	PC	204.200	
	PD	204.600	
H	EH	208.300	
	EJ	216.100	
	PN	216.300	
	PP	217.000	
	PQ	218.200	
	PR	218.600	
	PS	219.600	
K	PT	221.350	
	PV	232.825	
	PX	233.125	
	PY	234.625	
	PZ	237.325	

Alignment



NOTE: Whenever soldering is performed on the circuit boards, always power off the unit.

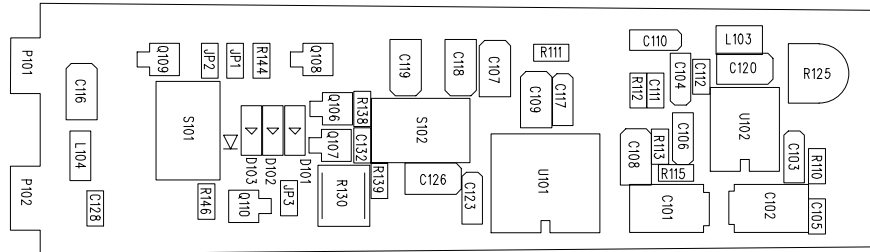


LX2 Transmitter		Audio Analyzer	
Power supply:	9 Vdc	Filters:	
Power switch:	PWR	400 Hz High-Pass:	ON
Mic switch:	MUTE	30 kHz Low-Pass:	ON
Gain:	Mid		

Figure 8. Rf Alignment Test Set-Up (Domestic)

- The alignment procedure is sequential and does not change, unless specified.
 - Use RG58 or any other low-loss, 50 Ω test cables for all rf connections.
 - Keep the test cables as short as possible.
 - Include the insertion loss of the cables and the connectors for all rf measurements.
 - Dc voltages are present at most rf test points. Use dc blocks to protect the test equipment, if necessary.
1. Connect a 9 Vdc power supply to the battery terminals.
 2. Make sure the mic ON/MUTE switch is in the MUTE position.
 3. Set the audio gain potentiometer (R125) at mid-range.
 4. Activate the 400 Hz high-pass and 30 kHz low-pass filters on the audio analyzer.

Power and Display Check



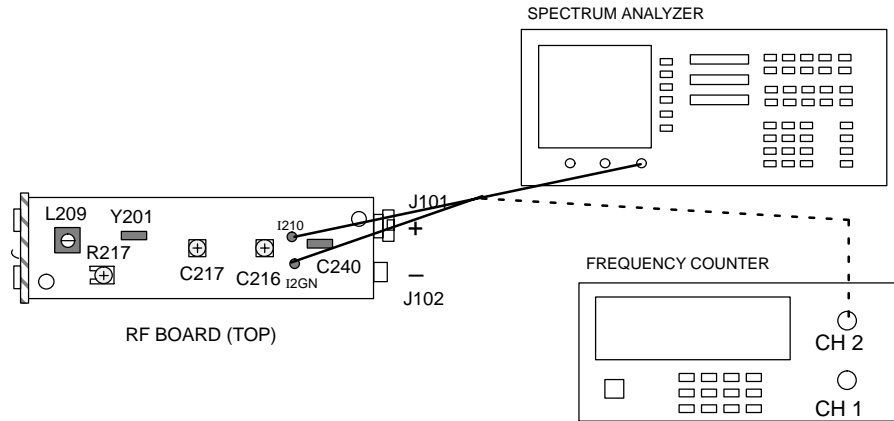
LX2 Transmitter	
Power supply:	9 Vdc
Power switch:	PWR
Mic switch:	MUTE
Gain:	Mid

Figure 9. Power and Display Check Test Set-Up

1. Make sure the power OFF/PWR switch is in the PWR position.
2. With the 9.0 Vdc power supply connected, the green LED should be illuminated.
3. Reduce the power supply to 6.6 Vdc. The yellow battery LED should be illuminated.
4. Reduce the power supply to 6.0 Vdc. The red battery LED should be illuminated.
5. Return the power supply to 9.0 Vdc.
6. Make sure the mic ON/MUTE switch is in the MUTE position.
7. Connect the positive (+) lead of a 9.0 Vdc power supply to the positive battery terminal on the audio board. Connect the negative (-) lead to the battery terminal (audio board ground). The green power LED should now be illuminated. If not, there is a circuit malfunction.
8. Temporarily reverse the polarity of the 9.0 Vdc power supply. The green power LED should be extinguished, and no current should be drawn from the supply. Otherwise, there is a problem with the reverse polarity protection circuit. Return the polarity of the 9.0 Vdc power supply to normal.

Rf Alignment: Domestic (FCC/IC)

During rf alignment, the transmitter output is terminated in a 50 Ω , nonreactive load RG174 cable and monitored with a spectrum analyzer. No modulation is applied during rf alignment.



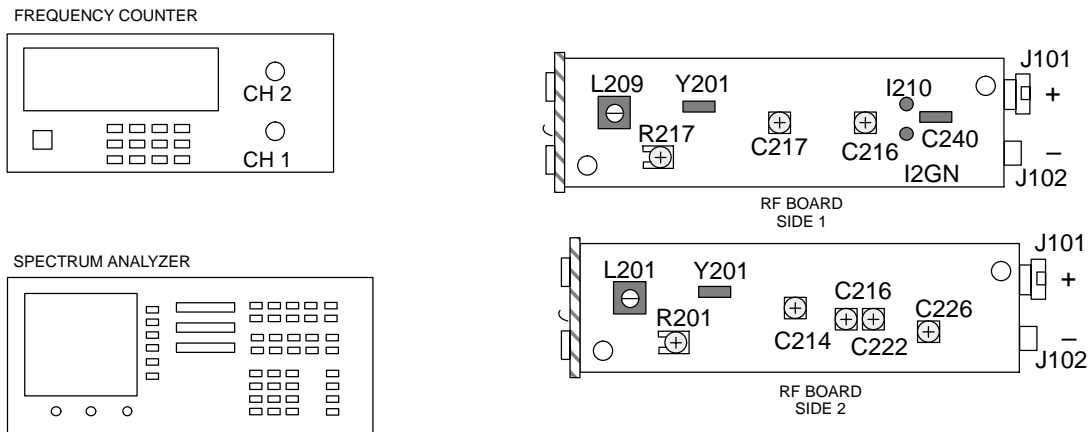
LX2 Transmitter		Spectrum Analyzer	
Power supply:	9 Vdc	Center frequency:	carrier
Power switch:	PWR	Span:	1 MHz
Mute switch:	MUTE	Reference level:	+ 20 dBm
		Scale:	10 dB/div

Figure 10. Rf Alignment (FCC/IC)

1. Remove C240 on rf circuit board.
2. Tack-solder the 50 Ω test cable to side 1 of the rf circuit board:
 - Connect the center conductor to the solder pad, I210.
 - Connect the shield to I2GN (ground).
3. Connect the 50 Ω test cable to the spectrum analyzer.
4. Peak C216 and C217 for maximum output power on the spectrum analyzer. Output should be 15 ± 2 dBm, including cable losses. If the correct power cannot be attained, see the *Bench Checks* section.
5. Connect the 50 Ω test cable to the frequency counter. Adjust L209 to set the carrier frequency to within ± 1 kHz of designated value. If correct frequency cannot be attained, see the *Bench Checks* section.
6. Reconnect the 50 Ω test cable to the spectrum analyzer.
7. Confirm that the output power remained within specification. If not, readjust C216 and C217.

Final Output Power / Frequency Calibration (Domestic)

This procedure correctly aligns the transmitter's operating (output) frequency.

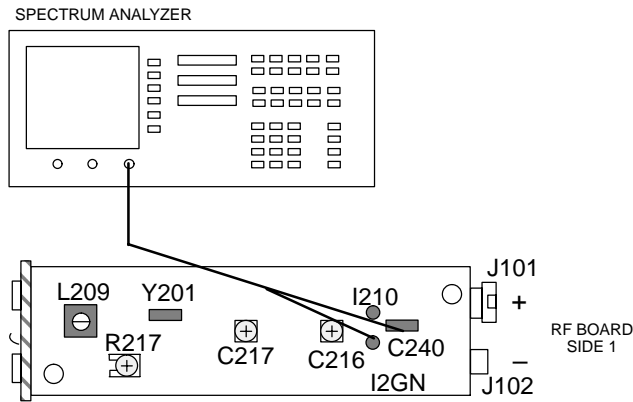


LX2 Transmitter		Spectrum Analyzer	
Power supply:	9 Vdc	Carrier frequency:	carrier
Power switch:	PWR	Span:	1 MHz
Mute switch:	MUTE	Reference level:	+ 20 dBm
Gain:	Mid	Scale:	10 dB/div

Figure 11. Final Output Power / Frequency Calibration Test Set-Up

1. Connect the 50 Ω test cable to the frequency counter. With a pink Toray driver, adjust L209 to set the rf carrier frequency to within ± 1 kHz of the operating frequency of the unit under test.
2. Reconnect the 50 Ω test cable to the spectrum analyzer. Peak C226 for maximum output power on the spectrum analyzer.
3. Confirm that the output power is 15 dBm (± 2 dBm).

Spurious Emissions and Current Drain: Domestic



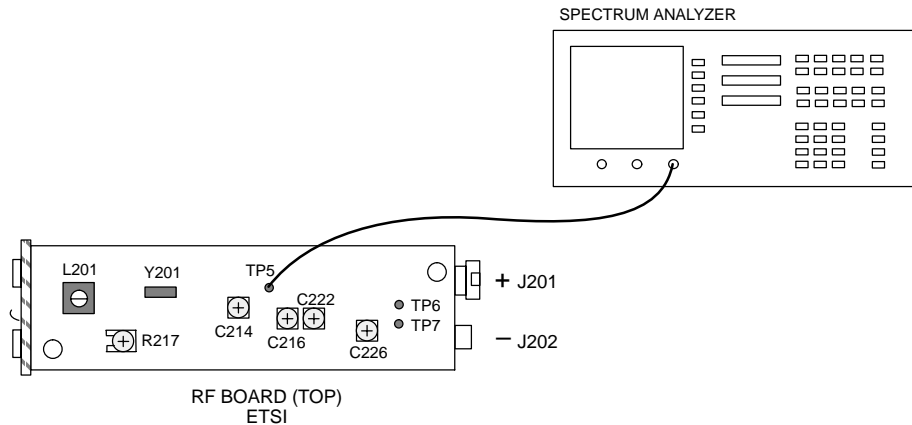
LX2 Transmitter	Spectrum Analyzer
Power supply: 9 Vdc	Scale: 10 dB/div
Power switch: ON	Start frequency: 10 MHz
Mute switch: MUTE	Stop frequency: 1 GHz
	Reference level: 20 dBm

Figure 12. Spurious Emissions and Current Drain Test Set-Up

1. Set the spectrum analyzer as follows. Set the scale to 10 dB/div, the start frequency to 10 MHz, the stop frequency to 1 GHz, and the reference level to 20 dBm.
2. Check the level of spurious emissions. All spurious emissions must be at least 30 dB below the carrier level. If necessary, retune C216.
3. With a digital multimeter, measure the current drain of the transmitter: it should be less than 35 mA. If it is too high, try detuning C216, but make sure that the power and spurious response remain within specification.
4. Check that 9 Vdc (± 0.35 Vdc) is present at the head board +9 V location (I133 on the audio board).

Rf Alignment: Euro (ETSI)

Do not apply modulation during the following rf alignment procedures. If you cannot achieve any of the settings described in this procedure, consult the *Bench Checks* section.



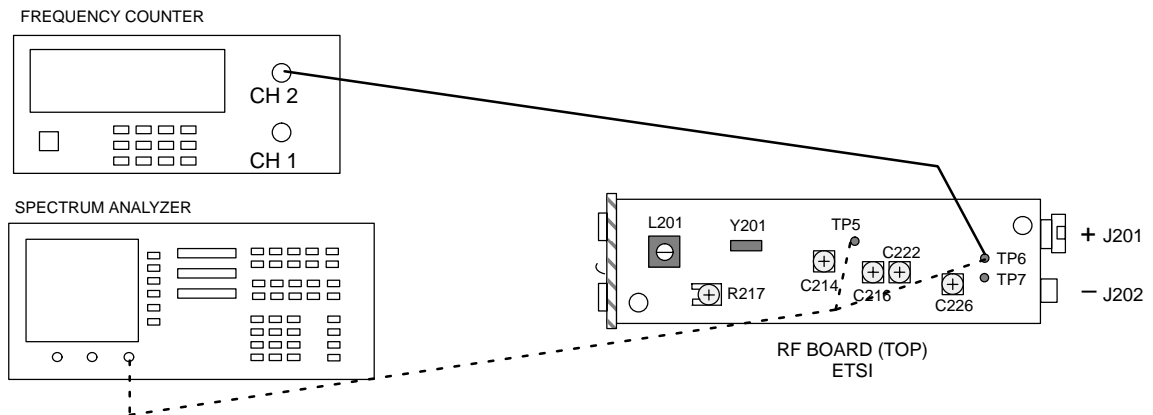
LX2 Transmitter		Spectrum Analyzer	
Power source:	9 Vdc	Center frequency:	1/3 of the transmitter freq
Power switch:	PWR	Span:	30 MHz
Mute switch:	MUTE	Reference level:	+ 20 dBm
		Scale:	10 dB/div

Figure 13. Rf Alignment (Euro)

Note: See the Service Equipment Manual for conversion of a 50 Ω BNC cable-to-RGU174 cable to a high impedance probe.

- Tack-solder the high-impedance probe to the rf circuit board bottom:
 - Connect the center conductor to TP5 (base of Q202).
 - Connect the shield to circuit ground.
- Carefully remove C242 from the rf board. This disconnects the battery (antenna) to allow accurate conductive-power measurements.
- Connect the high-impedance probe to the spectrum analyzer.
- Verify that the mic switch is in the MUTE position.
- On the spectrum analyzer, set the center frequency to one-third the frequency of the transmitter. Set the span to 30 MHz, the reference level to +20 dBm, and the scale to 10 dB/div.

Final Output Power / Frequency Calibration (Euro)



LX2 Transmitter		Spectrum Analyzer	
Power source:	9 Vdc	Center frequency:	1/3 of the transmitter freq
Power switch:	PWR	Span:	30 MHz
Mute switch:	MUTE	Reference level:	+ 20 dBm
		Scale:	10 dB/div

Figure 14. Final Output Power / Frequency Calibration Test Set-Up

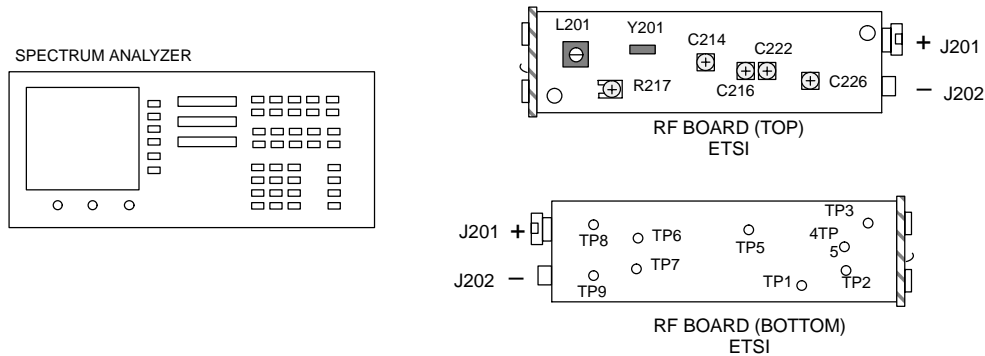
Note: See the Service Equipment Manual for conversion of a 50 Ω BNC cable to RGU174 cable to a high impedance probe.

1. With a yellow Toray non-conductive screwdriver, adjust C214 for maximum (peak) output power on the spectrum analyzer. For better resolution while tuning, switch the scale to 2 dB/div and adjust the reference level to the center of the screen.
2. Remove the high-impedance probe. Connect the standard 50 Ω test cable to TP6 (before antenna-matching).
3. Connect the BNC end of the cable to the spectrum analyzer.
4. Set the center frequency to the frequency of the transmitter.
5. Adjust C216 and C222 for maximum (peak) output power on the spectrum analyzer.

Note: C216 is not tunable on earlier ETSI-approved units.

6. Connect the 50 Ω test cable to the frequency counter. With a pink Toray driver, adjust L201 to set the RF carrier frequency to within ±1 KHz of the operating frequency UNDER test.
7. Reconnect the 50 Ω test cable to the spectrum analyzer. Peak C226 for maximum output power on the spectrum analyzer.
8. Confirm that the output power is 9.5 dBm (±2 dBm).

Spurious Emissions and Current Drain: Euro

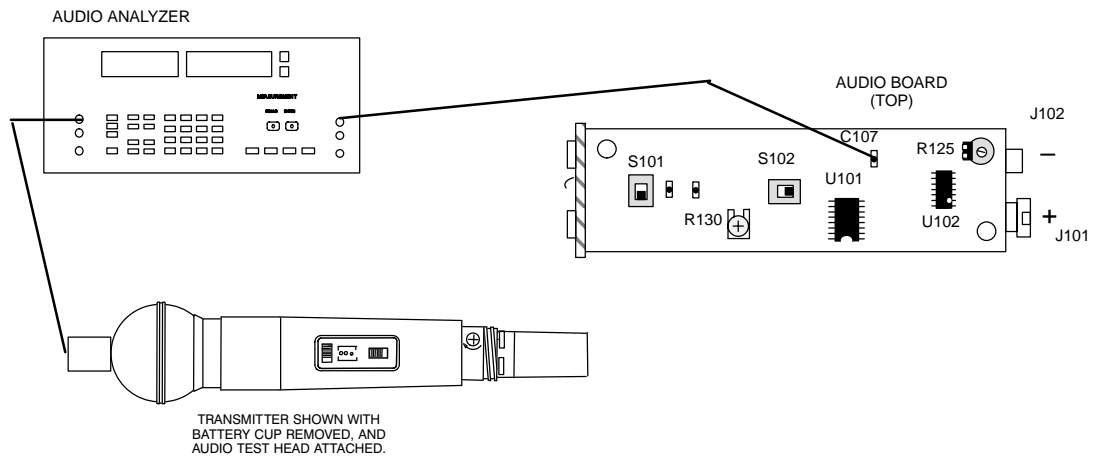


LX2 Transmitter		Spectrum Analyzer	
Power supply:	9 Vdc	Scale:	10 dB/div
Power switch:	PWR	Start frequency:	10 MHz
Mute switch:	MUTE	Stop frequency:	1 GHz
		Reference level:	20 dBm

Figure 15. Spurious Emissions and Current Drain Test Set-Up

1. Set the spectrum analyzer as follows. Set the scale to 10 dB/div, the start frequency to 10 MHz, the stop frequency to 1 GHz, and the reference level to 20 dBm.
2. Check the level of spurious emissions. All spurious emissions must be at least 44 dB below the carrier level. If necessary, retune C226.
3. With a digital multimeter, measure the current drain of the transmitter: it should be less than 35 mA. If it is too high, try detuning C226, but make sure that the power and spurious response remain within specification.
4. Check that 9 Vdc (± 0.35 Vdc) is present at the head board +9 V location (I133 on the audio board).

Audio Alignment: Domestic and Euro

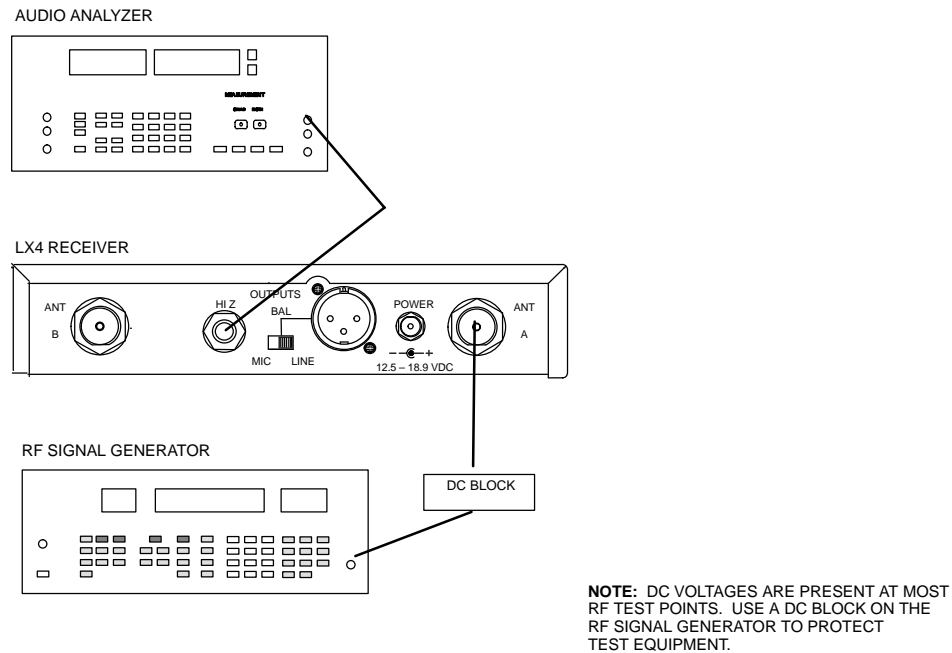


LX2 Transmitter		Audio Analyzer	
Power supply:	9 Vdc	Frequency:	1 kHz
Power switch:	PWR	Amplitude:	230 mV
Mic switch:	ON	Filters:	
Gain:	Mid	400 Hz High-Pass:	ON
		30 kHz Low-Pass:	ON

Figure 16. Audio Alignment Test Set-Up

1. Put the mic (mute) switch in the ON position.
2. Turn the LX2 power OFF.
3. Replace C240 for domestic, C242 for Euro, on the rf pcb.
4. Use a soldering iron to remove the 50 Ω test cable.
5. Turn the LX2 power ON.
6. Insert the pcb assembly through the brass ring and screw on the audio test head.
7. Set the audio analyzer output to a frequency of 1 kHz and an amplitude of 230 mV.
8. Connect the output of the audio analyzer to the audio test head.
9. Adjust R125 (gain) for 775 ± 0 mV (0.775 V) or 0 dBu $\pm .1$ dBu at the anode (+) side of C107 on the audio board.

Deviation Reference Voltage (Domestic and Euro)

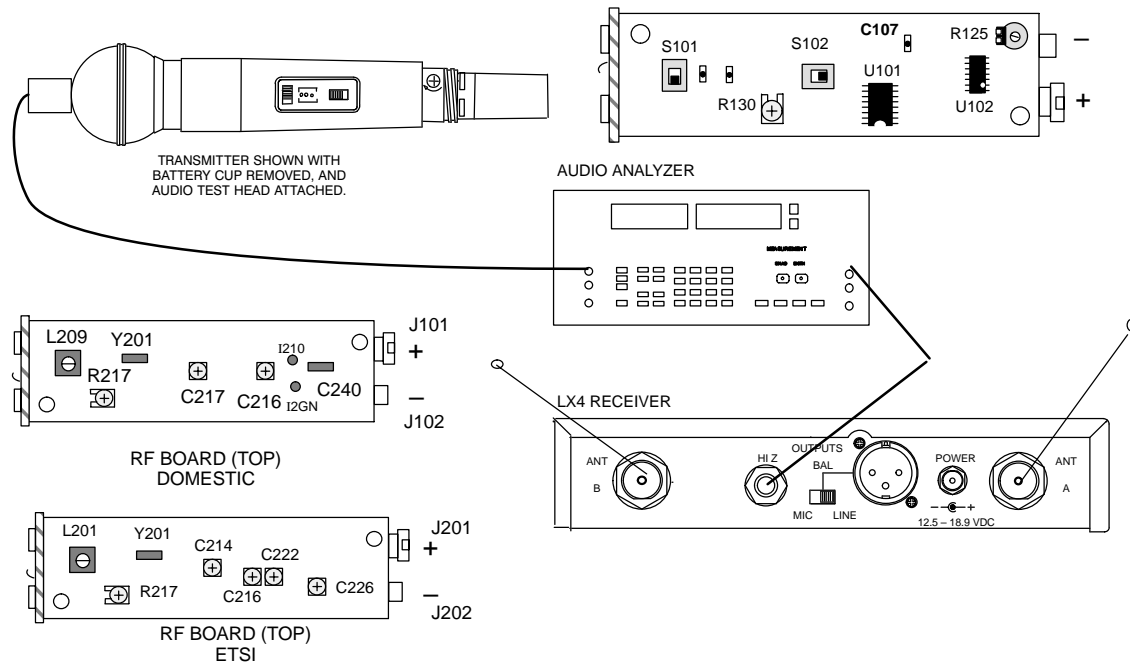


LX2 Transmitter		LX4 Receiver		Audio Analyzer		Rf Signal Generator	
Power switch:	OFF	Power switch:	ON	Frequency:	1 kHz	Frequency:	carrier
Mute switch:	ON	Gain:	Max	Filters:		Modulation:	FM
		Squelch:	Mid	Low-Pass (30 kHz):	ON	Modulation source:	1 kHz
				High-Pass (400 Hz):	ON	Output amplitude:	-38 dBm

Figure 17. Deviation Reference Voltage Test Set-Up

1. Turn the LX2 power OFF.
2. Set the rf signal generator with the frequency the same as the carrier, modulation at FM, modulation source at INT 1 kHz, the FM deviation at ± 15 kHz, and the amplitude at -38 dBm.
3. Connect the output of the rf signal generator to either antenna input of a receiver. Use a receiver that is the same frequency as the LX2, such as the LX3 or LX4 that came with the LX2.
4. Set the volume control on the front panel of the receiver to the maximum position (full clockwise rotation) and apply power to the receiver. Set the squelch control of the receiver at midrange.
5. Measure the rms voltage developed across the Hi-Z output, terminated in 3.3 k Ω , of the receiver. The measured rms voltage should be approximately 0.389 V rms. This is the audio output voltage that corresponds to a deviation level of 15 kHz. Record this voltage as the **Deviation Reference Voltage**.
6. Turn off the rf output on the rf signal generator.

Deviation Adjustment (Domestic and Euro)

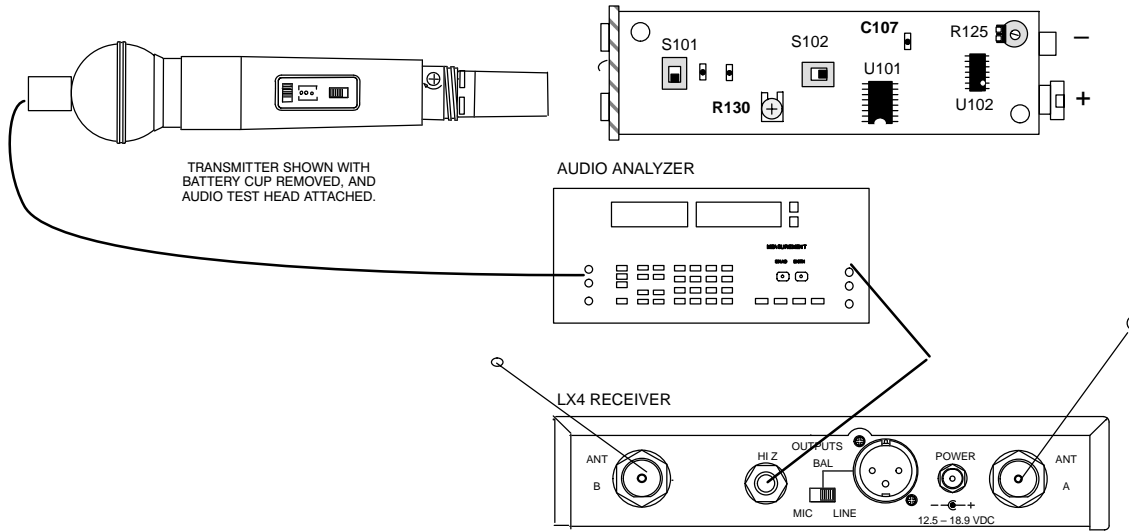


LX2 Transmitter	LX4 Receiver	Audio Analyzer	Rf Signal Generator
Power supply: 9 Vdc	Power switch: ON	Frequency: 1 kHz	Frequency: carrier
Power switch: PWR	Gain: Max	Filters:	Modulation: FM
Mute switch: ON	Squelch: Mid	Low-Pass (30 kHz): ON	Modulation source: 1 kHz
		High-Pass (400 Hz): ON	Rf output: OFF

Figure 18. Deviation Adjustment Test Set-Up

1. Make sure the rf output on the rf signal generator is turned OFF.
2. Connect the output of the audio analyzer to the test head.
3. Turn the LX2 power ON.
4. Set the frequency of the audio analyzer to 1 kHz. Make sure that the level at the anode (+) of C107 is still $0.775\text{ V} \pm 50\text{ mV}$.
5. Disconnect any cables from the antenna inputs of the receiver and place an antenna on the receiver.
6. Measure the rms voltage at the unbalanced Hi-Z output of the receiver. Adjust R217 (domestic) or R201 (Euro) to $0 \pm 1\text{ dB}$ relative to the deviation reference voltage measured above as the **Deviation Reference Voltage**. The deviation reference voltage was established earlier using the calibrated rf signal generator.

Distortion Adjustment (Domestic and Euro)



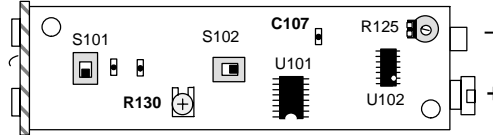
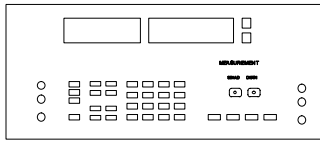
LX2 Transmitter		LX4 Receiver		Audio Analyzer	
Power supply:	9 Vdc	Power switch:	ON	Frequency:	1 kHz
Power switch:	PWR	Gain:	Max	Filters:	
Mute switch:	MUTE	Squelch:	Mid	Low-Pass (30 kHz):	ON
				High-Pass (400 Hz):	ON

Figure 19. Deviation Adjustment Test Set-Up

1. Set the audio analyzer for DISTN (distortion, THD).
2. Adjust R130 for minimum distortion out of the receiver. System distortion should be less than 1%.

Audio Frequency Response (Domestic and Euro)

AUDIO ANALYZER



LX2 Transmitter		Audio Analyzer	
Power supply:	9 Vdc	Frequency:	100 Hz
Power switch (S101):	PWR	Amplitude:	230 mV
Mic switch (S102):	ON	Filters:	
		400 Hz High-Pass:	OFF
		30 kHz Low-Pass:	ON

Figure 20. Frequency Response Test Set-Up

Note: Press the LOG/LIN button on the audio analyzer to measure in dB. Then press the RATIO button to perform the relative measurement in the next section.

1. Remove the 400 Hz high pass filter from the audio analyzer.
2. Change the frequency of the audio analyzer to 100 Hz.
3. Verify that the audio level is equal to -0.5 ± 0.5 dB relative to the level measured at the anode (+) of C107 at 1 KHz.
4. Activate the 400 Hz high-pass filter on the audio analyzer.
5. Change the frequency of the audio analyzer to 10 kHz. Verify that the audio level is equal to $+3.0 \pm 0.5$ dB relative to the level measured at the anode (+) of C107 at 1 KHz.
6. Turn the LX2 power OFF.

Bench Checks

Power Input Problem

Dc Input

- ✓ Verify that $9.0 \text{ Vdc} \pm 0.35 \text{ Vdc}$ is present at the 9.0 Vdc test point (U101, pin 13). If this voltage is low, check N33.
- ✓ Check the power switch bias on Q105 and L101.
- ✓ Make sure the circuit board ground is 0.0 Vdc.
- ✓ If there is a short from 9.0 Vdc to ground, try to isolate different parts of the circuit; narrow it down to the rf or audio section.
- ✓ Look for foil shorts, solder bridges, and capacitors that have been installed backwards.
- ✓ Check for $5.0 \text{ Vdc} \pm 0.25 \text{ Vdc}$ at N147. If voltage is low, check the +5.0 Vdc test point (U101, pin 7). If the voltage is not correct, check U101, pin 13 for 9.0 Vdc; also check the values of R133, R135, and R137.
- ✓ If dc voltages are being measured at points that have rf present, use a 10 k Ω resistor at the probe to prevent loading the circuit.

Excessive Current Drain

Domestic (FCC/IC)

- ✓ Readjust C216 for lower current drain while maintaining output power to specification.
- ✓ If current drain is still excessive, there may be a short, wrong resistor values, or a defective capacitor.
- ✓ Make sure that R219 is the correct value for the frequency group.
- ✓ Last of all, try changing Q204.

Euro (ETSI)

- ✓ Readjust C226 for lower current drain while maintaining output power to specification.
- ✓ If current drain is still excessive, there may be a short, wrong resistor values, or a defective capacitor.
- ✓ Make sure that R218 is the correct value for the frequency group.
- ✓ Last of all, try changing Q204.

Audio

Loss

- ✔ Make sure mic switch is ON.
- ✔ Determine where the signal is being lost. Verify audio at U102, pin 7. Then check dc bias at U102, pins 5, 6, and 7. They should be about half of the supply voltage, or around 4.5 Vdc. This bias comes from the 9.0 Vdc line through voltage divider R103/R105, then through R106 to pin 5.
- ✔ Look for open vias, foil shorts, incorrect parts, and bad connections.
- ✔ If there is audio at pin 7, but not at pin 14, check again for db bias.
- ✔ Pins 12 and 13 should read approximately 1.8 Vdc, while pin 14 should read about 3.7 Vdc. Dc bias comes from U101, pin 9, through R107 to U102, pin 12.
- ✔ Next, check parts in the feedback path from pin 14 to pin 13, parts connected to pin 7, and connections from U102 to U101. Also check the connections from U102, pin 14, to the next stage and to the limiter (Q103), and U101, pin 15.
- ✔ The last stage is to check U102, pins 8, 9, and 10. Dc bias should be about 4.0 Vdc for all three pins. Dc bias comes from the 5.0 Vdc line through R104 to U102, pin 10. Check values in feedback from pin 8 to pin 9, and the path to Q104 and Q101, pin 16.

Distortion

- ✔ Make sure the analyzer's 400 Hz high pass and 30 kHz low pass filters are in. U101, pin 9, should read about 1.8 Vdc.
- ✔ The dc level on the wiper of R130 should change from about 1.5 Vdc to 3.5 Vdc when you turn R130. If not, check, R129, C125, R141, R140, R126, and the parts tied to U101, pin 9. Make sure the audio level is correct.
- ✔ Last of all, try replacing D201 and Y201.

RF Problems: Deviation

Domestic (FCC/IC)

- ✓ There must be a good carrier to get any deviation.
- ✓ If R217 cannot be adjusted to obtain 15 kHz deviation, try to isolate the problem to the audio or rf section. Check for -2.2 dBv at I118; if not, refer to the Audio section of the circuit description.
- ✓ If the level is correct at I118, check R217, C220, C227, R208, R216, D201, L209, and C214. The value of C214 is critical to the deviation sensitivity.
- ✓ Last of all, try replacing D201 and Y201.

Euro (ETSI)

- ✓ There must be a good carrier to get any deviation.
- ✓ If R201 cannot be adjusted to obtain 15 kHz deviation, try to isolate the problem to the audio or rf section. Check for -2.2 dBv at I118; if not, refer to the Audio section of the circuit description.
- ✓ If the level is correct at I118, check R201, C201, C202, R202, R203, D201, L201, and C203. The cathode of D201 should be getting 5.0 Vdc bias from the 5.0 Vdc line through R202 and R203. The value of C203 is critical to the deviation sensitivity.
- ✓ Last of all, try replacing D201 and Y201.

Low Output Power

Domestic (FCC/IC)

- ✓ The output of the transmitter should be terminated in a $50\ \Omega$ load from I210 to ground during testing. If the unit is being tested as a two board assembly with the rf and audio boards soldered together, temporarily remove C240 to disconnect the battery antenna. The rf levels shown on the schematic were measured with a FET probe without an rf ground and are only approximate.
- ✓ Probe the output after the oscillator stage (I230). If there is none, refer back to the "Distortion" section.
- ✓ Make sure that when C217 is rotated 360 degrees, two separate peaks in the carrier output amplitude are produced. If there is only one peak, make sure the C217 is the correct color (value). Check values of L205, C225, C234, L202, C233; and check bias on Q201. Last of all, replace Q201.
- ✓ Repeat the procedure for the second rf stage. C216 should also be turned one complete rotation to check for two peaks in the output power. If only one peak is observed, make sure that C216 is the correct color (value). Check values of L204, C238, C236, L210, C235, C222, C226; and check bias on Q203. Last of all, replace Q203.
- ✓ Repeat the procedure for the last rf power amp stage. Check the dc bias on Q204 and values of all parts from the base of Q204 to I210. Last of all, replace Q204.

- ✓ If the power is slightly low and the spurious level is high, check for wrong or open coils at L202, L210, and L206.

Note: In addition to the frequency determining components discussed above, bypass capacitors can affect the tuning and power gain of rf stages. Emitter bypass capacitors C226 and C223 can be probed with the FET probe. If the rf level measured on each side of the part is not comparable, a defective capacitor is indicated. The bypasses on the collector circuits C207 and C208 can be checked in the same way.

Euro (ETSI)

- ✓ The output of the transmitter should be terminated in a 50 Ω load from TP6 to ground during testing. If the unit is being tested as a two board assembly with the rf and audio boards soldered together, temporarily remove C242 to disconnect the battery antenna.
- ✓ Probe the output after the oscillator stage (TP5). If there is none, refer back to the "Distortion" section.
- ✓ Make sure that when C214 is rotated 360 degrees, two separate peaks in the carrier output amplitude are produced. If there is only one peak, make sure the C214 is the correct value. Check values of L202, C208, C244, C210, L203, C213, and C215; and check bias on Q201. Last of all, replace Q201.
- ✓ Repeat the procedure for the next rf stage. C222 should also be turned one complete rotation to check for two peaks in the output power. If only one peak is observed, make sure that C222 is the correct value. Check values of L204, C216, C245, C219, L205, C221, and C224; and check bias on Q202. Last of all, replace Q202.
- ✓ Repeat the procedure for the third rf stage. C226 should also be turned one complete rotation to check for two peaks in the output power. If only one peak is observed, make sure that C226 is the correct value. Check values of L206, C227, C229, L207, C230, and C232; and check bias on Q203. Last of all, replace Q203.
- ✓ Repeat the procedure for the last rf power amp stage. Check the dc bias on Q204 and values of all parts from the base of Q204 to TP6. Last of all, replace Q204.
- ✓ If the power is slightly low and the spurious level is high, check for wrong or open coils at L205, L207, and L210.

Note: In addition to the frequency determining components discussed above, bypass capacitors can affect the tuning and power gain of rf stages. Collector bypass capacitors C220, C227, and C234 can be probed with the FET probe. If the rf level measured on each side of the part is not comparable, a defective capacitor is indicated. The bypasses on the collector of Q203 (C228) can be checked in the same way. Also, the rf level measured with the FET probe should drop approximately 10 dB from the collector of one transistor to the base of the next transistor. If the drop is higher than 12 dB, thoroughly check the stage with the excessive loss in power.

Notes:

Replacement Parts and Drawings

Parts Designations

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

Resistors: Unless otherwise noted, all resistors are surface-mount with $\frac{1}{10}$ 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.

Table 4
Replacement Parts

Reference Designation	Description	Shure Part Number
A1	Programmed circuit board assembly (Domestic)	T90_8644 [See Table 9, p. 36, to determine the group-letter in the underlined space. e.g. T90 <u>CA</u> 8644].
A2	Programmed circuit board assembly (Euro)	T90-8704 [See Table 9, p. 36, to determine the group-letter in the underlined space. e.g. T90 <u>NX</u> 8704].
MP1	Battery cup (painted)	65A8241A
MP2	Battery snap (negative)	56A318
MP3	Battery snap (positive)	56A317
MP4	Bezel *** OLD Version ***	65A8242 not available
MP5	Compression disc	38A180
MP6	Contact (head board)	53F2039A
MP7	Handle *** OLD Version ***	65A8220A not available
MP8	Handle Current type. Uses oval Bezel and Actuators. *** Must replace Actuators and Bezel if replacing from Old version Handle ***	65C8427A
MP9	Bezel *current oval type*	65C8299
MP10	Actuator *current oval type*	65C8298
MP11	Retaining metal clip ring	30A1314
MP12	Kit contains: (2)Current type Actuators, clip ring and (3)gold mic contacts	RPW614
MP13	Actuator *old type*	65A8225
Y1	Crystal	40_8006A [See Table 2, p. 15 (Domestic) or Table 3, p. 16 (Euro) to determine the crystal code in the underlined space. e.g. 40 <u>NH</u> 8006A]

Table 5
Audio Board Components: Side 1

Reference Designation	Description	Shure Part Number
S101, 102	Switch	55A178
D101	LED, red	184A18
D102	LED, amber	184B18
D103	LED, green	184D18
R125	Potentiometer 20 k	46B8049
R130	Potentiometer 20 k	146F02
Q106, 107, 108, 109, 110	Transistor	183A38
Q103, 104	Transistor	183A01
Q105	Transistor	183A07
Q201, 203, 204	Transistor	183A03
U101	Compander	188A01
U102	Opamp	188A49

Table 6
Rf Board Components:
DOMESTIC (FCC/IC)

Reference Designation	Description	Shure Part Number
C216	Trim cap. 3 – 10 pF / 100 V	152C02
L209	Coil, rf *	82–8015
R217	Potentiometer 25% 10 k	146E02
C217	Trim cap. 8.5–40 pF / 100 V	152F02

*See Frequency Dependent Table.

Table 7
Frequency Dependent Tables
Rf Board Components:
DOMESTIC (FCC/IC)

Reference Designation	Description	Shure Part Number
Group A		
L209	Coil, rf	82A8015
Group B		
L209	Coil, rf	82B8015
Group C		
L209	Coil, rf	82C8015

Shure LX2 Hand-Held Transmitter

Table 8
Rf Board Components:
EURO (ETSI)

Reference Designation	Description	Shure Part Number
R201	Potentiometer 1% 10 k	146E02

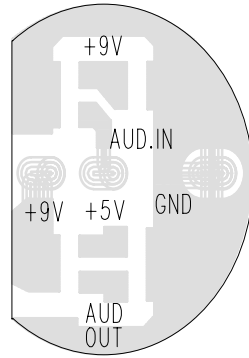
Table 9
Frequency Dependent Tables
Rf Board Components:
EURO (ETSI)

Group	Frequency Range	C208	C244	C210	C213	C215
A	169.000–174.000 MHz	15 pF	—	1.0 pF	33 pF	100 pF
B	174.000–181.000 MHz	12 pF	1.0 pF	1.0 pF	33 pF	100 pF
C	181.000–188.000 MHz	12 pF	—	1.0 pF	27 pF	100 pF
D	188.000–195.000 MHz	12 pF	—	1.0 pF	22 pF	100 pF
E	195.000–202.000 MHz	10 pF	0.5 pF	0.5 pF	22 pF	100 pF
F	202.000–209.000 MHz	8.2 pF	1.0 pF	1.0 pF	22 pF	100 pF
G	209.000–216.000 MHz	6.8 pF	1.5 pF	0.5 pF	18 pF	82 pF
H	216.000–223.000 MHz	6.8 pF	1.0 pF	0.5 pF	18 pF	82 pF
K	230.000–240.000 MHz	6.8 pF	—	0.5 pF	15 pF	82 pF

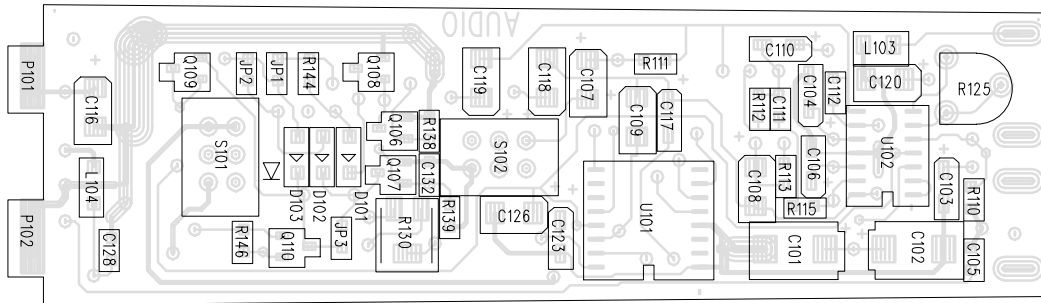
Group	C245	C221	C224	C227	C230	C232	C234	C239	C241	C242
A	8.2 pF	33 pF	100 pF	4.7 pF	27 pF	27 pF	15 pF	27 pF	22 pF	12 pF
B	6.8 pF	33 pF	100 pF	4.7 pF	18 pF	27 pF	22 pF	22 pF	33 pF	8.2 pF
C	6.8 pF	27 pF	100 pF	4.7 pF	15 pF	27 pF	22 pF	18 pF	33 pF	6.8 pF
D	5.6 pF	22 pF	100 pF	—	15 pF	22 pF	18 pF	15 pF	6.8 pF	3.3 pF
E	5.6 pF	22 pF	100 pF	—	12 pF	22 pF	8.2 pF	15 pF	10 pF	6.8 pF
F	3.3 pF	22 pF	100 pF	—	12 pF	22 pF	27 pF	18 pF	18 pF	5.6 pF
G	3.3 pF	18 pF	82 pF	—	12 pF	18 pF	15 pF	18 pF	18 pF	4.7 pF
H	1.0 pF	18 pF	82 pF	—	12 pF	18 pF	15 pF	15 pF	15 pF	4.7 pF
K	—	15 pF	82 pF	—	10 pF	15 pF	15 pF	12 pF	12 pF	3.3 pF

Group	R226	L206	L209	L211	L201	
					Part #	Group
A	750 Ω	.056 uH	.150 uH	.220 uH	82A8015	R250
B	1000 Ω	.056 uH	.150 uH	.220 uH	82A8015	R251
C	1000 Ω	.056 uH	.150 uH	.220 uH	82A8015	R252
D	1210 Ω	.056 uH	.150 uH	.220 uH	82B8015	R253
E	1000 Ω	.056 uH	.150 uH	.180 uH	82B8015	R254
F	1330 Ω	.056 uH	.100 uH	.180 uH	82B8015	R255
G	1330 Ω	.047 uH	.100 uH	.180 uH	82C8015	R256
H	1000 Ω	.047 uH	.100 uH	.180 uH	82C8015	R257
K	1000 Ω	.047 uH	.100 uH	.180 uH	82C8015	R256 & R257

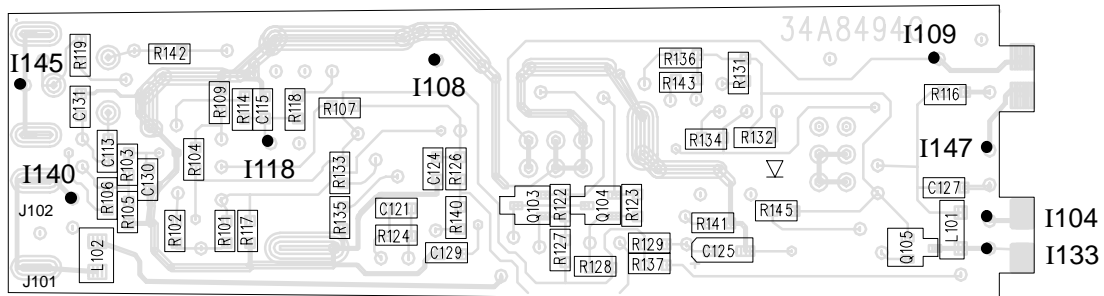
Shure LX2 Hand-Held Transmitter



**LX2 Hand-Held Transmitter
Head Board
DOMESTIC and EURO**

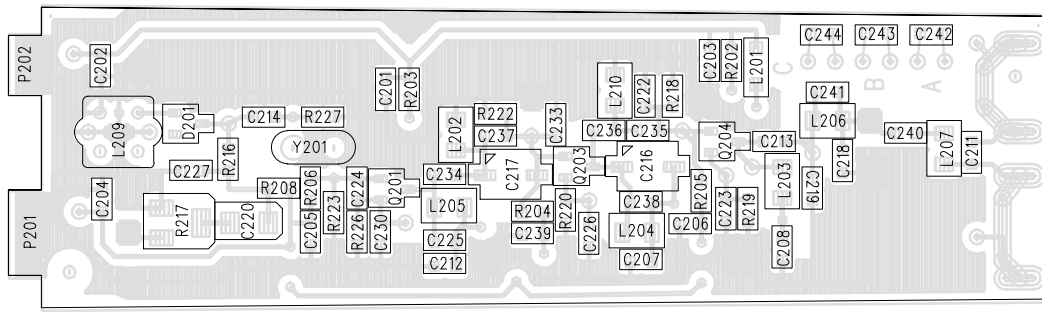


Side 1

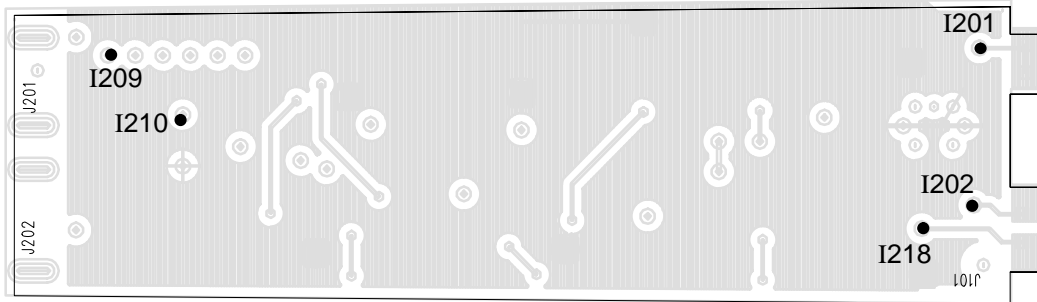


Side 2

**LX2 Hand-Held Transmitter
Audio Board
DOMESTIC (FCC/IC approved)**



Side 1

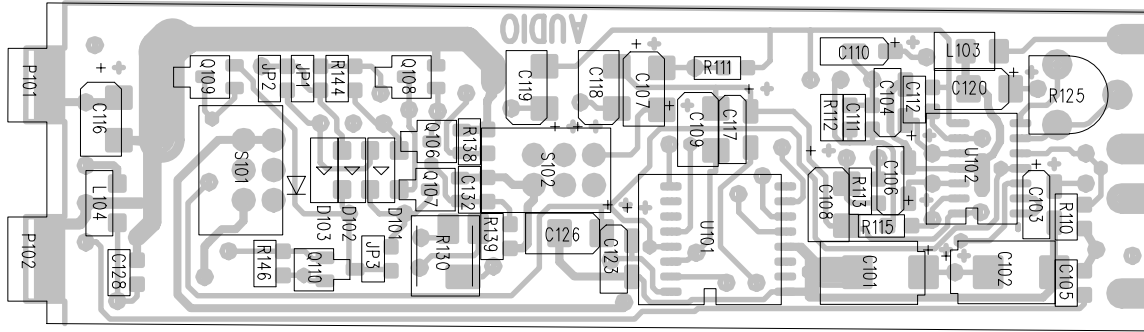


Side 2

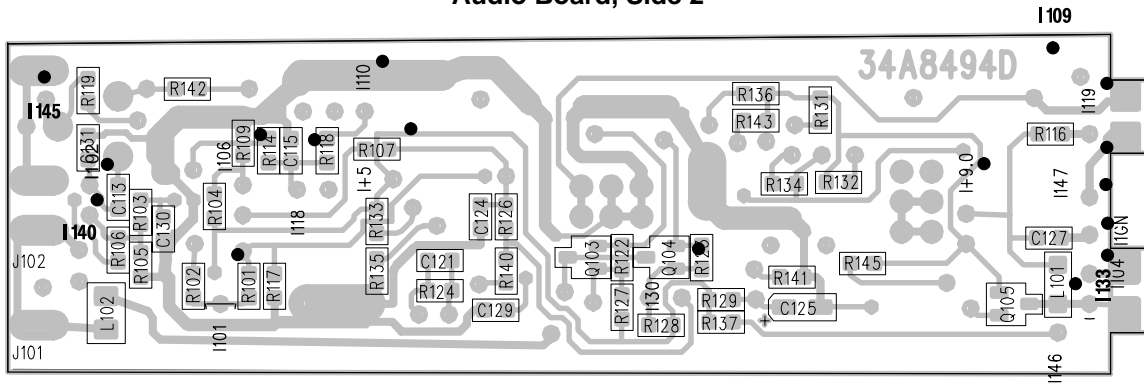
**LX2 Hand-Held Transmitter
Rf Board:
Domestic
(FCC/IC approved)**

Shure LX2 Hand-Held Transmitter

**Euro (ETSI)
Audio Board, Side 1**

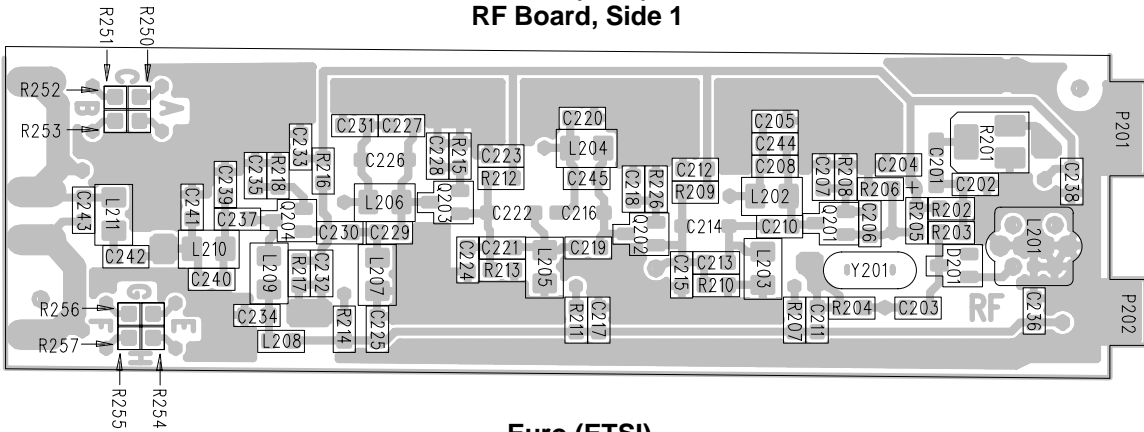


**Euro (ETSI)
Audio Board, Side 2**

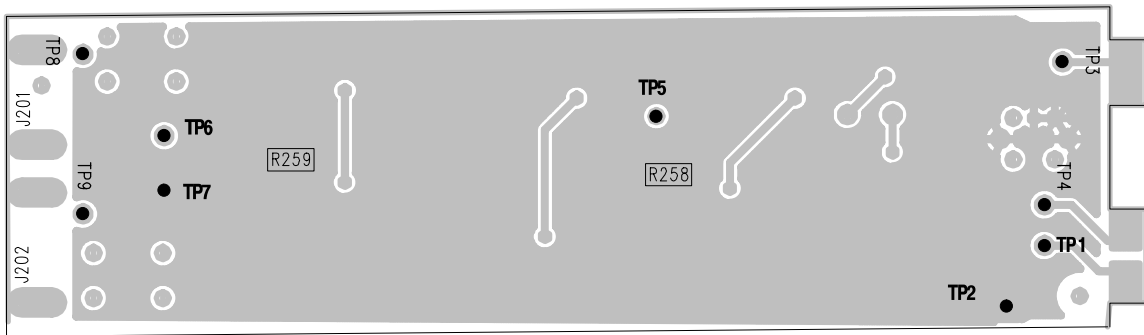


**LX2 Hand-Held Transmitter
Euro (ETSI)
Printed Circuit Boards**

**Euro (ETSI)
RF Board, Side 1**

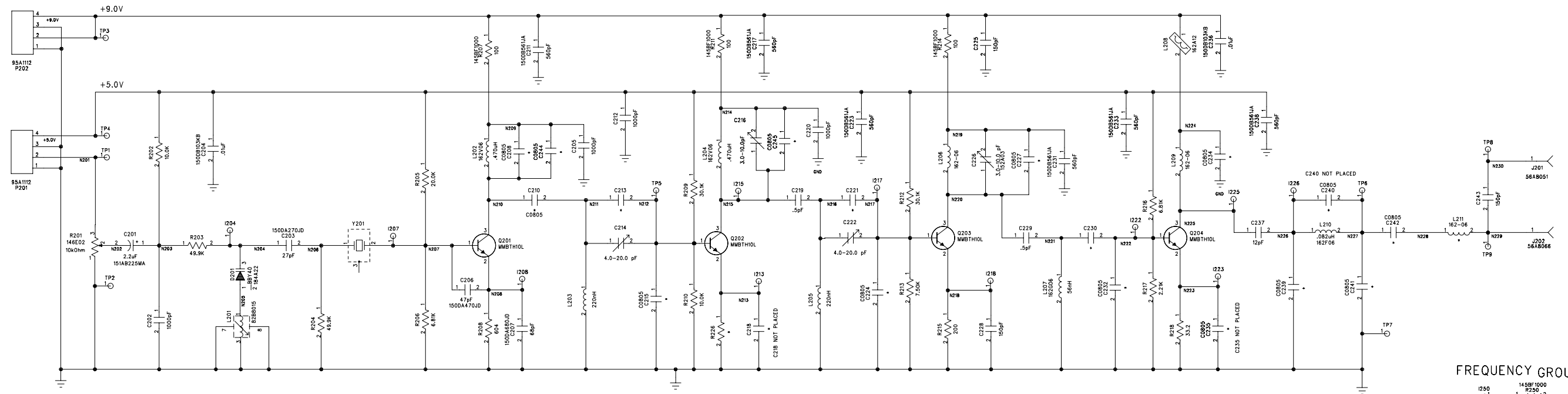


**Euro (ETSI)
RF Board, Side 2**



**LX2 Hand-Held Transmitter
Euro (ETSI)
Printed Circuit Boards**

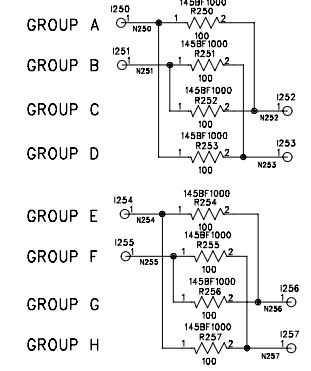
Shure LX2 Hand-Held Transmitter



FREQUENCY DEPENDENT PARTS BY GROUP AND COMPONENT NO.

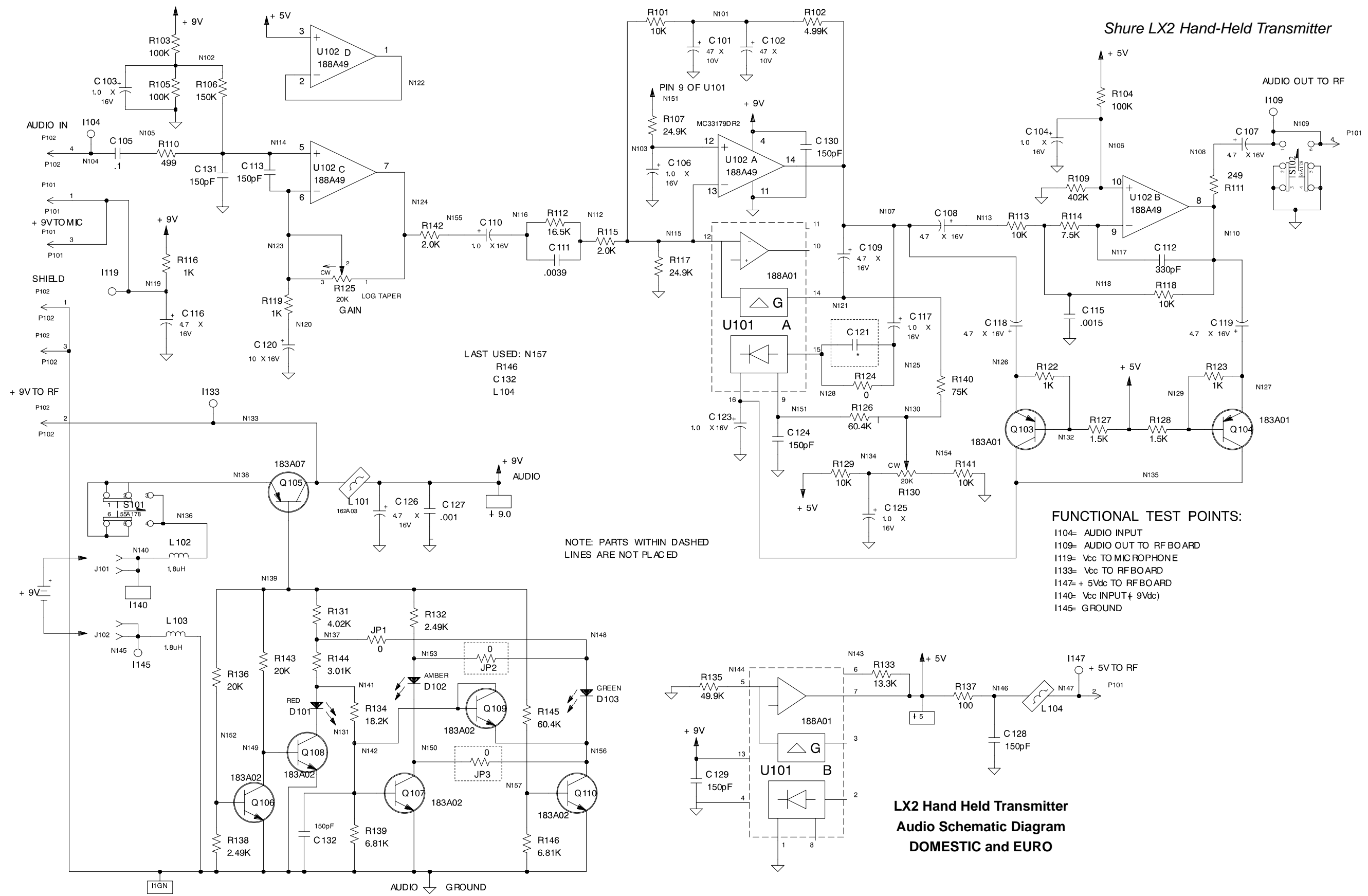
VARIABLE COMPONENTS	FREQUENCY RANGE	C208 pF	C244 pF	C210 pF	C213 pF	C215 pF	C245 pF	C221 pF	C224 pF	C227 pF	C230 pF	C232 pF	C234 pF	C239 pF	C241 pF	C242 pF	R226 OHMS	L206		L209		L211		L201		GROUP
																		PART NO.	uH	PART NO.	uH	PART NO.	uH	SHURE PART NO.	145BF1000	
GROUP A	169.000 – 174.000 MHz	15	--	1.0	33	100	8.2	33	100	4.7	27	27	15	27	22	12	750	162G06	.056	162E06	.150	162C06	.220	82A8015	R250	
GROUP B	174.000 – 181.000 MHz	12	1.0	1.0	33	100	6.8	33	100	4.7	18	27	22	22	33	8.2	1000	162G06	.056	162E06	.150	162C06	.220	82A8015	R251	
GROUP C	181.000 – 188.000 MHz	12	--	1.0	27	100	6.8	27	100	4.7	15	27	22	18	33	6.8	1000	162G06	.056	162E06	.150	162C06	.220	82A8015	R252	
GROUP D	188.000 – 195.000 MHz	12	--	1.0	22	100	5.6	22	100	--	15	22	18	15	6.8	3.3	1210	162G06	.056	162E06	.150	162C06	.220	82B8015	R253	
GROUP E	195.000 – 202.000 MHz	10	0.5	0.5	22	100	5.6	22	100	--	12	22	8.2	15	10	6.8	1000	162G06	.056	162E06	.150	162D06	.180	82B8015	R254	
GROUP F	202.000 – 209.000 MHz	8.2	1.0	1.0	22	100	3.3	22	100	--	12	22	27	18	18	5.6	1330	162G06	.056	162B06	.100	162D06	.180	82B8015	R255	
GROUP G	209.000 – 216.000 MHz	6.8	1.5	0.5	18	82	3.3	18	82	--	12	18	15	18	18	4.7	1330	162H06	.047	162B06	.100	162D06	.180	82C8015	R256	
GROUP H	216.000 – 223.000 MHz	6.8	1.0	0.5	18	82	1.0	18	82	--	12	18	15	15	15	4.7	1000	162H06	.047	162B06	.100	162D06	.180	82C8015	R257	

FREQUENCY GROUPS



LX2 Hand-Held Transmitter:
Rf Schematic Diagram
EURO (ETSI approved)

Printed in U.S.A.



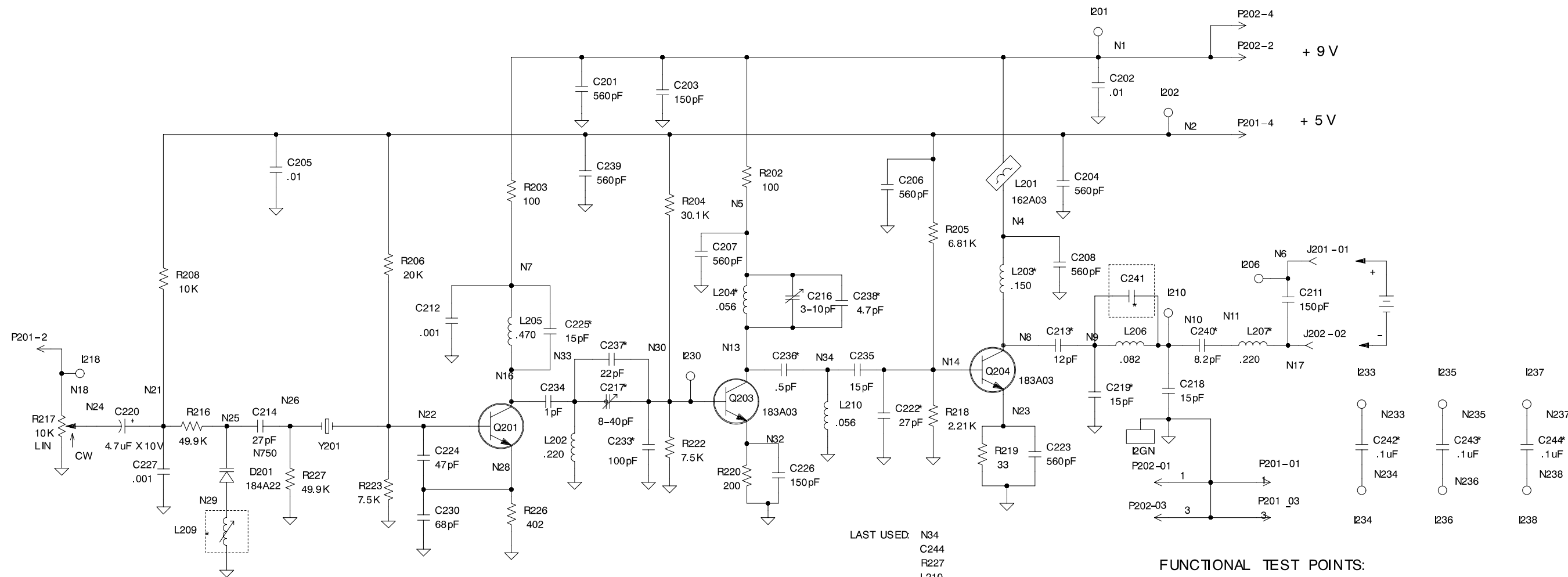
Shure LX2 Hand-Held Transmitter

- FUNCTIONAL TEST POINTS:**
- I104= AUDIO INPUT
 - I109= AUDIO OUT TO RF BOARD
 - I119= Vcc TO MICROPHONE
 - I133= Vcc TO RFBOARD
 - I147= + 5Vdc TO RFBOARD
 - I140= Vcc INPUT ≠ 9Vdc)
 - I145= GROUND

NOTE: PARTS WITHIN DASHED LINES ARE NOT PLACED

**LX2 Hand Held Transmitter
Audio Schematic Diagram
DOMESTIC and EURO**

Shure LX2 Hand-Held Transmitter



* FREQUENCY DEPENDENT PARTS BY GROUP AND COMPONENT NO.

VARIABLE COMPONENTS	FREQUENCY RANGE	L204		L203		L207		L209 SHURE PART NO.	C213		C233		C222		FREQ. DESIGNATOR	
		PART NO.	uH	PART NO.	uH	PART NO.	uH		PART NO.	pF	PART NO.	pF	PART NO.	pF	PART NO.	pF
GROUP A	169.000 - 184.000 MHz	162G06	.056	162E06	.150	162C06	.220	82A8015	150DB120JA	12	150DB101JA	100	150DB270JA	27	C242	0.1 uF
GROUP B	184.000 - 199.000 MHz	162G06	.056	162B06	.100	162D06	.180	82B8015	150DB120JA	12	150DB101JA	100	150DB220JA	22	C243	0.1 uF
GROUP C	199.000 - 216.000 MHz	162H06	.047	162B06	.100	162D06	.180	82C8015	150DB100CA	10	150DB820JA	82	150DB180JA	18	C244	0.1 uF

VARIABLE COMPONENTS	FREQUENCY RANGE	C217		C219		C237		C236		C240		C238		C225	
		PART NO.	pF	PART NO.	pF	PART NO.	pF	PART NO.	pF	PART NO.	pF	PART NO.	pF	PART NO.	pF
GROUP A	169.000 - 184.000 MHz	152F02	8-40	150DB150JA	15	150DB220JA	22	150DB509BA	0.5	150DB828CA	8.2	150DB478CA	4.7	150DB150JA	15
GROUP B	184.000 - 199.000 MHz	152D02	4-20	150DB150JA	15	150DB220JA	22	150DB509BA	0.5	150DB100JA	10	N/A	--	150DB120JA	12
GROUP C	199.000 - 216.000 MHz	152D02	4-20	150DB120JA	12	150DB180JA	18	150DB108BA	1.0	150DB688CA	6.8	N/A	--	150DB828CA	8.2

FUNCTIONAL TEST POINTS:

- I201 = +9 Vdc
- I202 = +5 Vdc
- I218 = AUDIO INPUT
- I210 = RF OUTPUT (50 OHMS)
- I206 = RF OUTPUT (ANTENNA)

LX2 Hand-Held Transmitter:
Rf Schematic Diagram
DOMESTIC (FCC/IC approved)