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UC UHF Wireless System

SERVICE MANUAL CHANGE NOTICE

UC1 UHF BODY-PACK TRANSMITTER

Changes or corrections have been made to this service manual. Update your service manual by replacing the pages listed in the table below with the ones attached to this change notice.

CHANGES EFFECTIVE [DATE]

REMOVE these pages from your current manual	INSERT the following revised pages attached to this notice
Revision 1 ALL	Revision 2 ALL
Revision 2 pages:13,15,17,20,22,27,29 and 30	Revision 3 pages:13,15,17,20,22,27,29 and 30

SERVICE MANUAL REVISION HISTORY

Release	Part Number	Date Code
Original	25A1043	RI
Revision 1	25B1043	SB
Revision 2	25C1043	TB
Revision 3	25C1043	TK

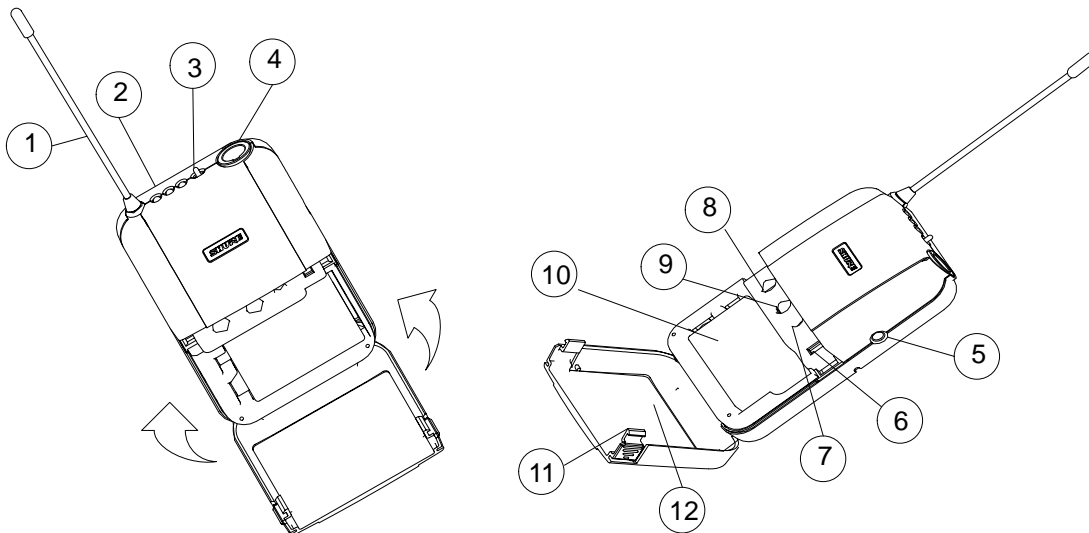
UC1 / UC1L Body-Pack Transmitter

Characteristics

General

The Shure UC1/UC1L Body-Pack Transmitter is microprocessor-controlled, operating in the 692–716 MHz and 774–862 MHz frequency ranges. The UC1/ UC1L is used in mid-level installed sound, rental, and concert sound applications. Six frequency range variations are available.

Controls and Connectors



- | | |
|---|--------------------------------|
| 1. Antenna | 7. Audio Gain Control |
| 2. Power/Battery Fuel Gauge LEDs | 8. Group Rotary Switch |
| 3. Power ON/OFF Switch | 9. Channel Rotary Switch |
| 4. Input Connector | 10. Battery Compartment |
| 5. Rf/Audio Mute Switch Input Connector | 11. Battery Cover Release Tabs |
| 6. Input Attenuation Control | 12. Battery Compartment Cover |

Figure 1. UC1 Controls and Connectors

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

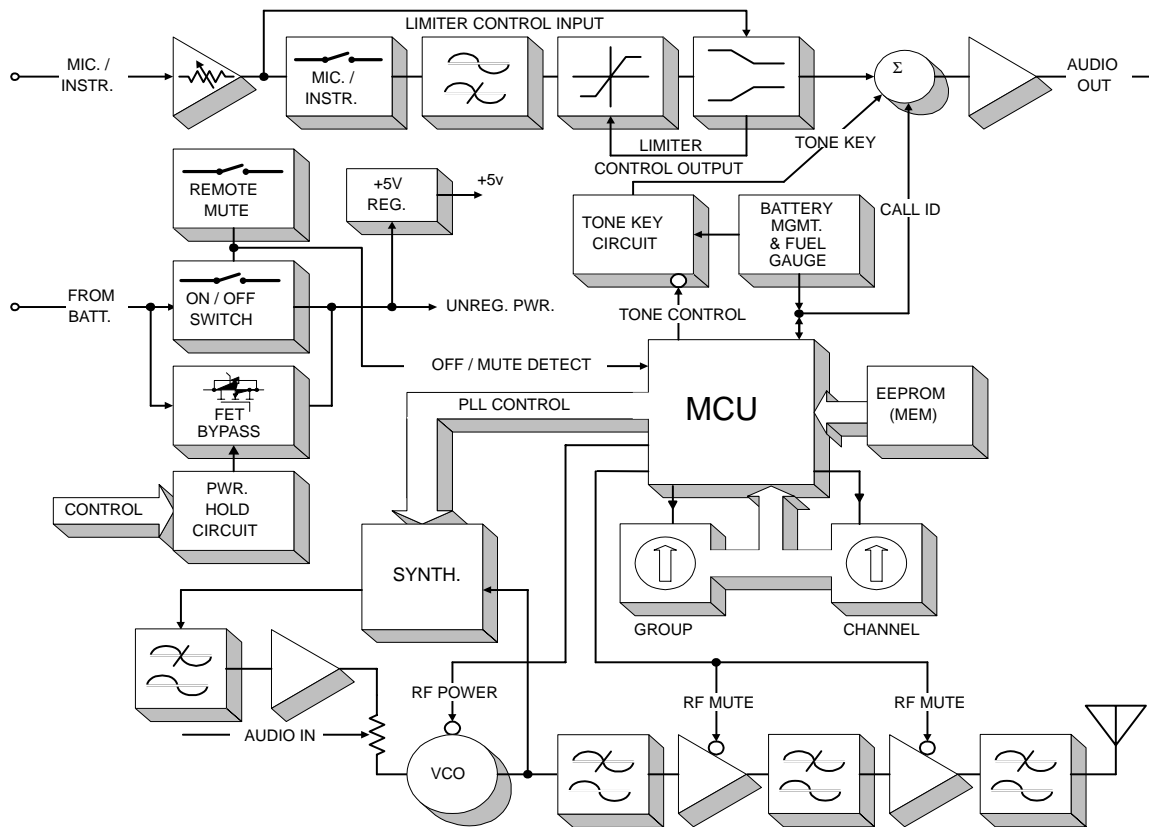


Figure 2. UC1 Circuit Block Diagram

Audio Section

Domestic Models

The audio signal enters the audio board at J204, pin 1. The signal then enters a switchable 20 dB pad made up of SW203, R203, R204, C204, and C206. The back-to-back diodes, U206, are used to keep the op-amp from snapping to the rail and reverse-phasing when the maximum input voltage range is exceeded.

The signal is ac-coupled through C205 into a 40 dB (30 dB for J frequencies) user-adjustable gain stage around amplifier U2. This gain stage is externally accessible to the user. Due to its topology, it is a unique stage because it is non-inverting and allows for a gain less than unity. Resistors R205 and R207 set up a half-supply bias, and R206 sets the ac input impedance.

The amplified audio signal then passes through a pre-emphasis network before entering the compression stage. R221, R222, C215, and C216 set up two corners for the pre-emphasis network. The pre-emphasis network feeds the NE575 compander, U203, which utilizes

an external amplifier, U202B. U203 performs a 2:1 logarithmic compression of the audio signal.

Transistors Q201 and Q202, with crystal Y201, form the tone key oscillator circuit that provides a stable, continuous 32.768 kHz sine wave. Q204 buffers the tone key signal before it is added to the audio signal. The tone key signal is used in the receiver to provide audio output only when the tone key signal is present in the transmitted signal. If the tone key or the transmitter is turned off, the receiver is muted.

Q211 acts as a switch for toggling the tone key ON/OFF. It is controlled from the microprocessor, via the TONEMUTE0 signal. The tone key signal, along with the processed audio signal, is then fed to a summing amplifier, U201A. After passing through the ac coupling capacitor, C240, the signal is then fed to the rf module.

The battery meter circuit is comprised of comparator U208 and LEDs D201, D202, D203, and various resistors. When the battery circuit is less than 6.5 Vdc, the output of U208, pin 13, changes low, the red LED illuminates, and the tone-key level increases. The receiver then utilizes the amplitude of the tone-key to indicate that the transmitter battery is low.

A 9 Vdc battery provides power to the audio printed circuit board (pcb) through switch SW202. FET Q217 provides electrical reverse battery protection. 9 Vdc enters U205, a low-dropout 5 Vdc regulator, and gives a clean regulated 5 Vdc supply to run the audio circuitry.

ETSI Models

This transmitter uses the same board as the non-ETSI system, except that it requires a different topology and different parts.

A limiter is inserted between the pre-emphasis and the compressor to limit the occupied bandwidth. The buffer after the gain stage, U201A, is now an inverter with pre-emphasis and 20 dB of attenuation.

Previously bypassed, the expander side of U203 is now activated and used as a limiter. A sample of the audio is taken from the limiter output (U203, pin 6) and sent to a control circuit which detects signals from a limiting threshold.

The comparator then sends a control signal to U202, pin 5, which clamps the signal.

Rf Section

Processed audio enters R149, an internal potentiometer that is adjusted for 45 kHz deviation (100% modulation for UA, MA, and MB frequencies), with a -7.2 dBV (0.355 Vrms) 1 kHz tone at the output of the front audio stage (U201, pin 1). For KK frequencies, R243 is adjusted for 40 kHz deviation. For JB frequencies, R149 is adjusted for 5 kHz deviation with -63.2 dBV, 1 kHz tone at the input to the transmitter.

Shure UC1 Body-Pack UHF Transmitter

The audio is then fed to the tuning voltage pin of the voltage-controlled oscillator (VCO) and modulates the carrier directly.

Using a phase-locked loop (PLL) frequency synthesized system eliminates the need for multiplier stages and results in a much higher degree of spectral purity. The VCO is shielded to prevent external rf fields from affecting its operation.

Regulated 5 Vdc power is provided to ensure frequency stability with changes in battery voltage.

The VCO can tune from 782 MHz to 810 MHz with a 1 Vdc to 4 Vdc tuning voltage range; different VCOs are required for MB and KK frequency models. At the output of the VCO, the rf signal splits into two paths.

The output of the VCO is coupled by C134 to the frequency control pin of the synthesizer, U104, pin 8. The internal circuitry of the synthesizer divides the signal, as necessary, to the desired reference frequency of 125 kHz. The synthesizer contains a reference oscillator circuit operating from a 4.0 MHz quartz crystal, Y101, that is adjusted by trimmer C123. The transmitter output frequency is user-selectable in 125 kHz increments, from 782 MHz to 806 MHz. Frequency range and increment size vary for each model.

Frequency selection is made via microprocessor U101, which interfaces the user by means of the mode/select switches. The output of the synthesizer is a series of pulses which are integrated by a passive loop filter, R121, C130, R122, C129, C130, R123, and C132, to produce a control voltage signal. The control voltage signal is then connected to the VCO through amplifier U106A, which is used to isolate the PLL filter from the audio modulation signals.

The VCO output is also coupled to an rf power amplifier through a resistive pad consisting of R127, R128, R129, and R130. The signal is then low-pass filtered through U107. The signal is coupled through C144.

Transistor Q102 acts as an rf pre-amplifier stage with typically 8 dB of gain. R131, R132, and R133 provide dc bias to Q102. C145, C146, C147, C149, C150, and L111 are used to decouple the rf off the emitter of Q102, Vcc, and +9 Vdc supply voltages.

C152 couples the output of Q102 to low-pass filter U108. The signal is then low-pass filtered through U108, and then coupled through C157.

Q104 acts as an rf amplifier stage with typically 16 dB of gain. L110, R136, R137, and R138 provide dc bias to Q102. C160, C161, C162, C163, C164, C165, and L114 are used to decouple the rf off the emitter of Q104, Vcc, and +9 Vdc supply voltages.

L115 and C167 match the output of Q104 to low-pass filter U109. The signal is coupled through C173 to the output antenna, W101.

The transmitter can deliver a maximum of +17 dBm (50 mW) to the 50 Ω antenna. During transmitter power-up and frequency selection, the rf power is muted by bringing the gate of Q103 and Q105 high. The RFUNMUTE signal is 5 Vdc. This provides approximately 45 dB rf attenuation until the PLL has locked.

The transmitter is unmuted by bringing the gate low (RFUNMUTE). During transmitter power OFF conditions, the rf power is first muted by bringing the base of Q103 and Q105 high. When the rf is muted this way, the carrier signal of the transmitter is not allowed to drift off frequency during power ON or OFF conditions.

When the external mute switch is closed, the ring and sleeve on the jack are connected, or the tip and sleeve can be connected, depending on how the switch is wired.

If the tip is connected to the sleeve, this grounds the IRQ signal line that is connected to the microprocessor. Then, the 33 kHz tone key signal is muted (TONEMUTE1). The transmitter rf power is muted by bringing the base of Q103 and Q104 high (RFMUTE1). Finally, the rf power is then turned off via the RFOFF1 signal. This is done by reducing the Vcc line to the VCO and the last rf amps.

If the ring is connected to the sleeve, this grounds the TKMUTE1. The TKMUTE1 grounds Q4 at the output of the tone key oscillator circuit. This mutes the audio signal immediately.

Transmitter Display Board

UHF Body-Pack Transmitter Digital Section

The digital section contains several circuitry blocks.

Microcontroller Section

The microcontroller section consists of a U101 microcontroller. The rotary switches indicate the UHF frequency group and channel. A 4.000 MHz oscillator provides the operating frequency to the microcontroller. The oscillator circuit includes C117, C118, and Y102. U103, R106, and C120 form the reset circuit. U103 is the reset IC that resets the U101 microcontroller if the 5 Vdc normal operating voltage falls below 4.3 Vdc. R115 and C119 form the power supply filter circuit.

Memory Section

The memory section consists of U102, a non-volatile Electrically Erasable / Programmable Read Only Memory (EEPROM) that stores the mapping of compatible groups and channels. The microcontroller serially communicates with this part via data and clock lines to read the frequency corresponding to the group and channel position. Ability to write to this memory occurs during factory programming only.

During normal usage, this memory is used as a look-up table only. Additional detail about the contents of EEPROM is covered in the following sections.

R103 and R108 resistors allow the clock and data lines to be driven independently of the microcontroller port pin states during in-circuit programming of EEPROM.

Battery Management Section

The microcontroller provides for low battery shutdown. The shutdown threshold is $1.88 \text{ Vdc} \pm 10\%$. A voltage lower than the shutdown threshold on pin 17 of the U101 microcontroller shuts down the transmitter. Resistors R104 and R105 divide down the battery voltage for the microcontroller. A battery voltage of less than 5.65 Vdc shuts down the transmitter.

This auto shutdown disables the audio tone key mix, mutes the rf power output, and power downs the rf output amplifier section. The current draw from a 9 Vdc battery in this state is 45 mA, and the battery fuel gauge is functional. Turning off the power switch must completely shut off the transmitter.

The audio circuit description provided the battery fuel gauge circuit description.

Rotary Switches for Frequency Selection

A 10-position Group switch, S101, and a 16-position Channel switch, S102, select the transmitter frequency. Both rotary switches share the same U101 microcontroller port pins, 3 through 6, for a multiplexed switch read operation.

Pins 7 and 8 of the U101 microcontroller select the individual switches. Resistors R109 through R112 are the pull-ups for the switch position read. Diode packs D101 through D104 isolate the switches during a multiplexed read operation.

The multiplexed switch read system does not allow switch change detection based on interrupts. Also, the switches cannot be constantly scanned to determine changes, because the scanning frequency being in audio range is difficult to filter out.

In a steady state, the switch selector common pins are inputs to the U101 microcontroller pins 7 and 8. Pins 3 through 6 are outputs. In this state, pins 4, 5, and 6 are held low, while pin 3 is held high. This forces a logic high level on the switch selector pins if the switches are set on odd positions. If the switches are set on even positions, the contact on pin 1 is open from the switch common pin, and the pull-down resistors, R114 and R115, force the logic low to pins 7 and 8 of U101.

Any switch change is made by a state toggle from odd to even, or vice versa. Only this change can be detected and is followed by a multiplexed switch read. In this case, U101 pins 7 and 8 become selectively grounded outputs to read the selected switch's state on pins 3 through 6.

A multiplexed switch read is preceded by tone key and rf mutes. This mutes the audio in the receiver to allow a quiet change to another frequency.

Power Switch and Remote Mute Switch Interface

When a transmitter is turned off, the PWRDN1 signal goes to logic low on U101, pin 19. The same signal is also forced low when a remote mute switch closes the tip contact to the sleeve ground.

The microcontroller treats both of these events in a similar manner. It immediately disables the tone key, and the power hold circuit automatically kicks in to bypass the power switch. Followed by 500 msec. of delay, the rf is muted and also turned off.

The power hold circuit is also disabled at this point. If it is the power off condition, then the transmitter is shut off. Otherwise, it is the remote mute condition, and the transmitter waits here for unmute to occur. PWRDN1 is pulled up back to logic high level when unmute occurs.

The rf section repowers and is unmuted, followed by tone key enable to completely recover from the remote mute condition. When a remote mute switch closes the ring contact to the sleeve ground, the TKMUTE1 signal goes to a logic low that immediately mutes the audio.

Notes

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Functional Test

Verify operation and reported malfunction, referring to the product *User Guide* for a description of the unit as well as information on its operation, troubleshooting, and technical data.

Disassembly and Assembly



! CAUTION !

Observe precautions when handling this static-sensitive device.

Disassembly

1. Open the battery compartment and remove the battery.
2. Remove the belt clip.
3. With the battery compartment open, remove the four screws from the back of the case.
4. Lift the top half of the transmitter case away to expose the printed circuit boards (pcbs).
5. Lift the pcbs out of the transmitter case.

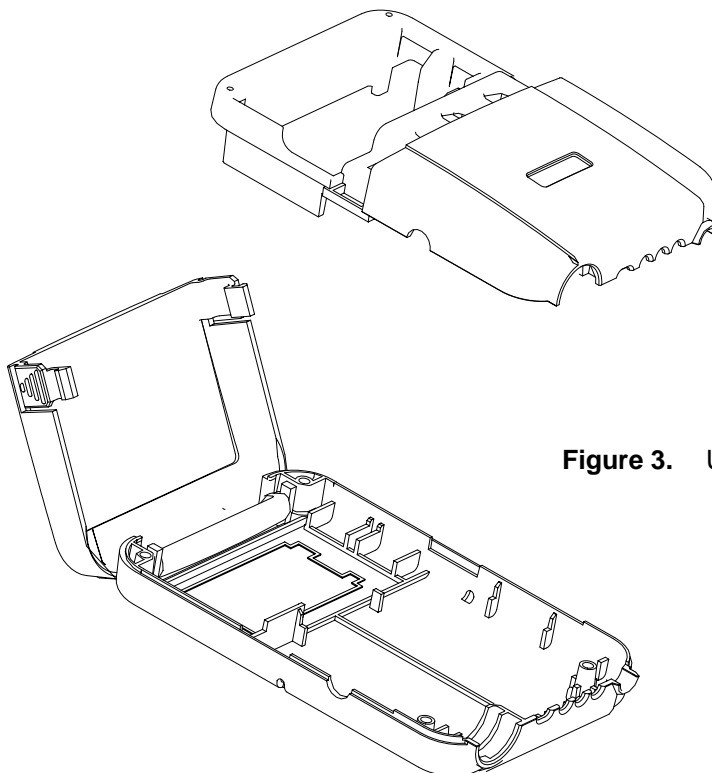


Figure 3. UC1 Disassembly

Reassembly

After completing all repairs and alignment, reassemble the UC1:

1. Place the printed circuit boards back into the case, making sure the multi-pin connectors on the board mate and the TINI QG/ LEMO connector is seated correctly.
2. Reassemble the transmitter by performing the disassembly steps in reverse order.

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 dBV	= 2.2 dBu
0 dBu	= 0 dBm, assuming the load = 600 Ω

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
PCB interconnect cable	PT1843
Japan Version Test Cable	PT-1838-AF
Japan Version Test Connector	PT-1838-AJ
Frequency counter	Hewlett-Packard 53181A
Rf signal generator	Hewlett-Packard 8656B
Spectrum analyzer	Hewlett-Packard 8590L
Shure UC4 receiver	Shure UC4
BNC(male) to unterminated 50 Ω test cable	PT-1824

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

Test Equipment Set-Up

The alignment procedure is sequential and does not change, unless specified.

1. Use PT1824 cable for all RF connections. except for the Japan frequencies, use PT1838-AF/AJ test adapter / cable.
2. Keep the test cables as short as possible (less than 12 inches).

3. Include the insertion loss of the cables and the connectors for all rf measurements.
4. Dc voltages are present at most rf test points. Use dc blocks to protect the test equipment, if necessary.

Test Set-Up

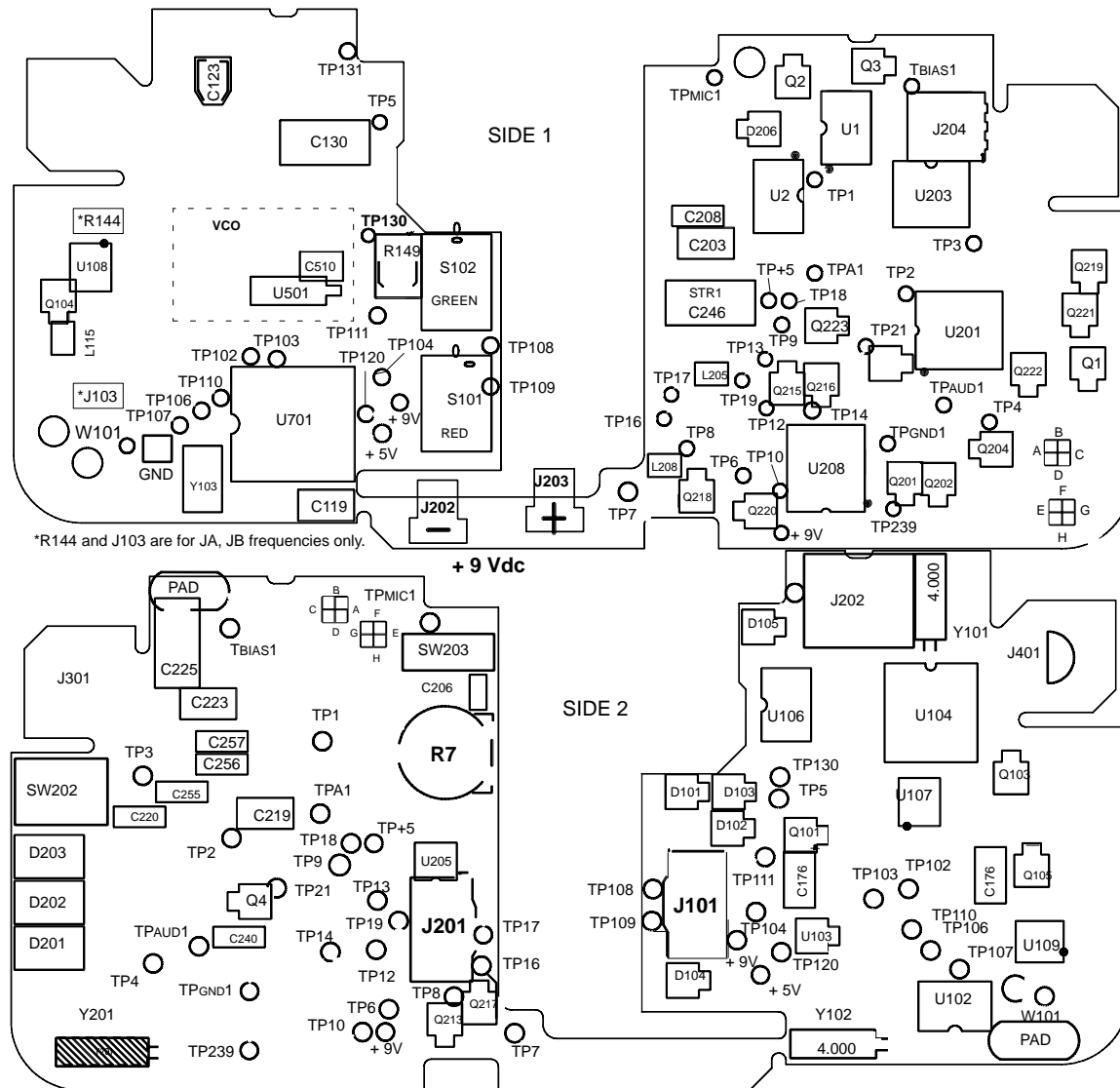


Figure 4. UC1 Major Test Component Locations

1. Remove the U1 antennas.
2. The attenuator switch (SW203) must be in the 0 dB position.
3. Use the PT1843 cable to connect the RF-digital board and the audio board through the 11-pin board interconnects (J101, J201, side 2).
4. Apply +9 Vdc across the battery terminals (J202, J203, side 1).
5. Set audio GAIN potentiometer (R7, side 2) to minimum (full counter-clockwise).

6. Rf power and tone key level measurements are made by connecting W101 (rf output) to the spectrum analyzer. Use the frequency counter to measure frequency. For JA, JB frequencies, connect J103 (rf output) to the spectrum analyzer and frequency counter.
7. See Table 2 for frequency settings.

Alignment

Alignment Set-Up

Table 2 lists the group carrier frequencies and tuning voltages for all the service tests that follow.

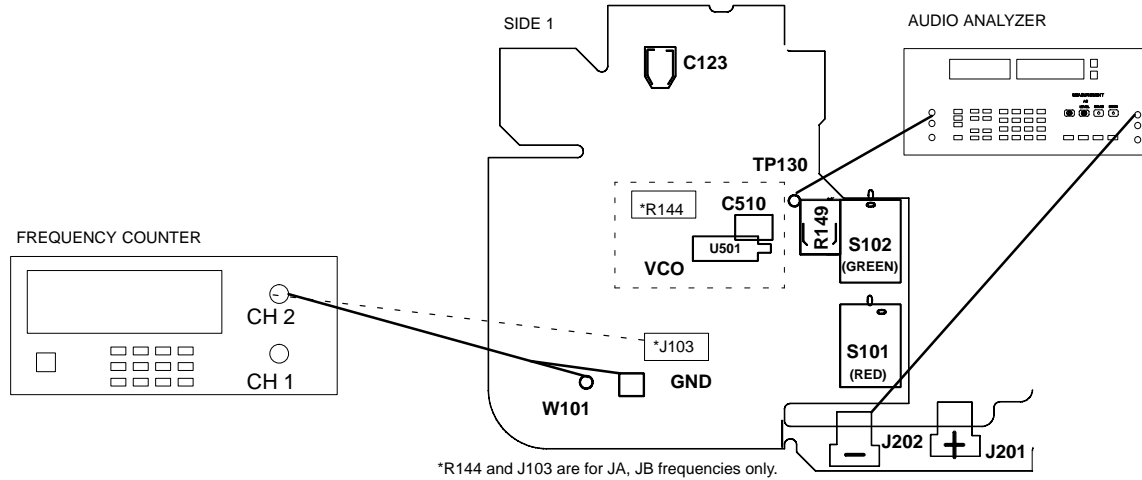
*Table 2
Group Carrier Frequencies and Tuning Voltages
(in order by carrier frequency)*

Group	Group Code	Group Switch (S101)	Channel Switch (S102)	Carrier Frequency (MHz)	VCO Tuning Voltage (TP130)	Deviation (kHz)
UA	A	4	0	805.500	3.7	45
UB	F	1	A	703.750	2.6	45
MB	B	1	3	805.500	2.2	15
MC	G	1	1	774.125	1.3 ±0.2	15
MD	B	3	7	805.500	2.2	15
JA	C	0	2	805.500	3.7	5
JB	D	4	2	807.500	3.8	5
KK	E	5	5	851.125	2.9	15

Frequency

Use this service procedure to correctly align the transmitter's operating (output) frequency. C510 tunes the voltage-controlled oscillator (VCO) to the operating frequency selected, with a 1 – 4 Vdc tuning range.

C123 adjusts the reference oscillator on the synthesizer.



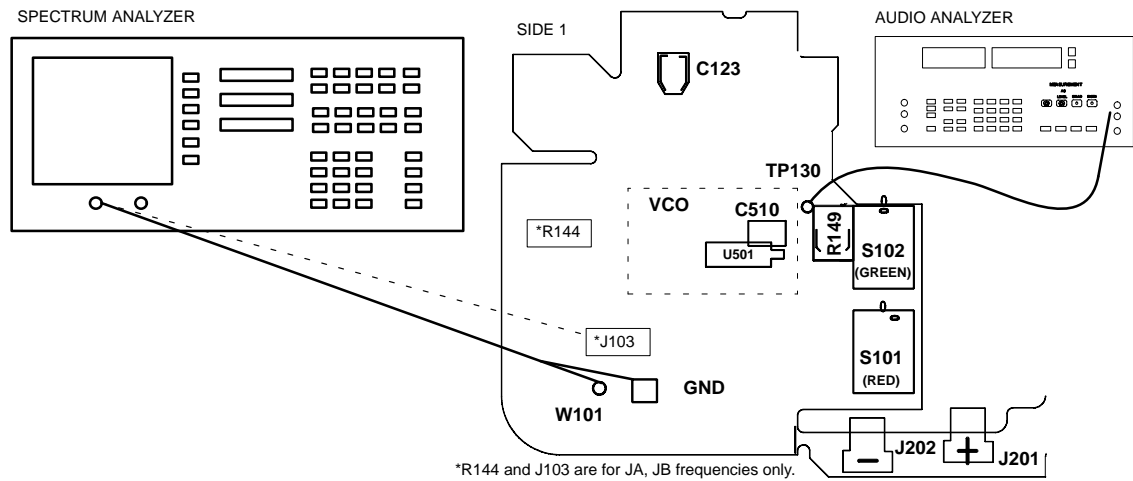
UC1 Transmitter		Frequency Counter		Audio Analyzer	
Power:	ON	Operating freq:	See Table 2	Connect + :	TP130
Operating freq:	See Table 2	Connect CH 2:	W101 and GND For JA, JB use J103	Connect - :	J202 (ground)
Input attenuation:	0dB			Measurement:	DC level
Gain:	Minimum				
Channel switch:	See Table 2				
Group switch:	See Table 2				

Figure 5. UC1 Frequency Alignment Test Set-Up

1. Remove the antenna and connect the RF test cable, center conductor to W101, and shield to GND, as shown in Figure 5. (For Japan models, use J103 with the PT-1838-AF and the PT-1838-AJ test cable/adaptor.)
2. Measure the dc voltage at TP130 (tuning voltage line) and ground (GND).
3. Use the pink toney to adjust the VCO trimmer, C510, until the voltmeter reading equals that shown in Table 2, $\pm 0.125V$.
4. Connect the BNC cable end to the frequency counter, CH 2.
5. Use the blue toney to adjust the variable capacitor, C123, until the frequency counter measurement matches the desired frequency, within ± 1 kHz.
6. Disconnect the test cable from the frequency counter.
7. Use the test set-up and equipment settings in Figure 6 for the next test, the power output measurement.

Power Output Measurement

The output power measurement ensures that the output signal is strong enough for sufficient range when the system is in use. The output power measurement also verifies that the output power is not above the specified maximum level, to ensure compliance with regulatory agencies' standards.



UC1 Transmitter		Spectrum Analyzer		Audio Analyzer	
Power:	ON	Frequency:	See Table 2	Connect + :	TP130
Operating freq:	See Table 2	Span:	200 KHz	Connect - :	J202 (ground)
Input attenuator:	0dB	Reference voltage:	20 dBm	Measurement:	DC level
Gain:	Minimum	Peak search:	ON		
Channel switch:	See Table 2	Signal track:	ON		
Group switch:	See Table 2	Marker:	ON		

Figure 6. UC1 Power Output Measurement Test Set-Up

1. Remove the BNC cable end from the frequency counter and connect it to the 50 Ω input of the spectrum analyzer. Use the equipment settings shown in Figure 6.
2. Measure the output power. The output power should be:

UA, UB, MB, MC,MD frequencies:	$12 + 1 / - 2$ dBm
KK frequencies:	$12 + 1 / - 2$ dBm
JA, JB frequencies:	Adjust R144 to obtain 8.8 ± 0.5 dBm.
3. Turn the UC1 power OFF.
4. Remove the BNC end of the cable from the spectrum analyzer, but leave the bare end soldered to the printed circuit board (pcb). (For Japan models, leave the adapter cable connected to J103.)

Deviation

Deviation must be set to make sure the companding systems between the transmitter and receiver correctly track each other. The level coming out of the transmitter’s audio compressor must match the level going into the receiver’s audio expander. A fixed gain structure does not ensure an exact match, primarily because of variations in voltage-controlled oscillators (VCOs).

Two options for setting deviation are offered below.

Option 1: Using a UC4 or U4S Receiver

This test requires a UC4 or U4S receiver and is designed to tune the transmitter regardless of the accuracy of the receiver’s tuning. However, it is recommended that a properly-tuned receiver be used to perform the transmitter deviation adjustment.

Be sure to use a KK model receiver when tuning a KK model transmitter.

Reference Voltage

1. See Figure 7 for equipment test set-up and equipment settings.
2. Connect the rf signal generator output to the UC4 receiver antenna input (A or B).
3. Remove the UC4 cover and set the tone key switch (S501) to the OFF position to disable the tone key function.
4. Turn the UC4 receiver on.
5. Connect the audio voltmeter to the receiver’s unbalanced output.
6. Measure the output voltage (typically 1.525 V_{rms})
Record this voltage. This is the *deviation reference voltage*.
7. Turn OFF RF output

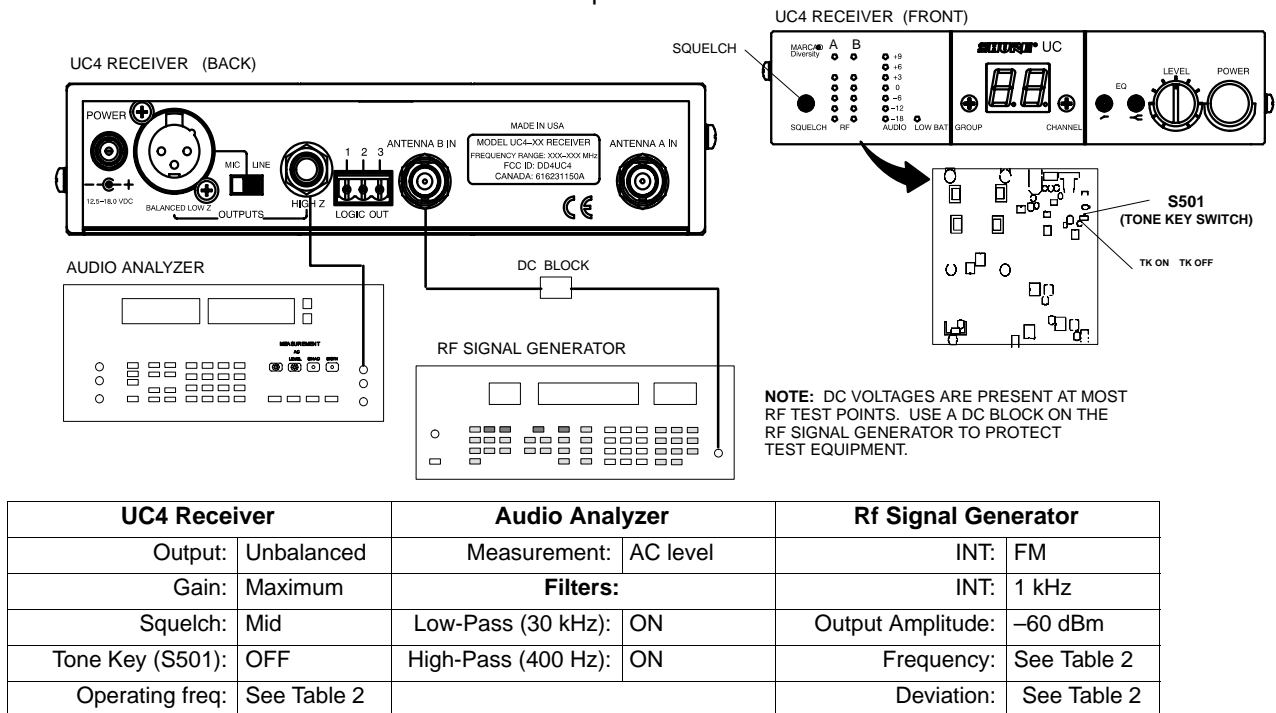


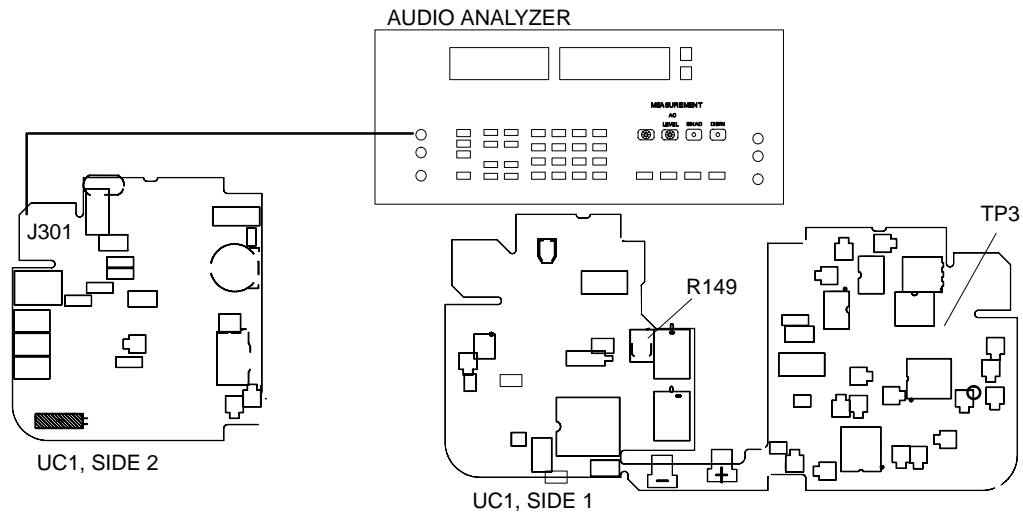
Figure 7. Deviation Reference Voltage Test Set-Up, Using a UC4 or U4S Receiver

Adjustment Voltage

1. Disconnect the rf signal generator from the UC4 receiver. Make sure the tone key switch (S501) is in the ON position.
2. Use the BNC to TINI QG cable to connect the audio analyzer output to the MIC input of the transmitter (J301).
3. Set the audio analyzer to 1 kHz.
4. Turn the UC1 power back ON.
5. Adjust the audio analyzer output level (typically = -2.2 dBu) to get the following readings at TP3, ± 0.02 dB:

Model:			
UA, UB	MB, MC,MD	JA, JB	KK
-6.8 dBu	- 16.3 dBu	- 23.47 dBu	- 15.3 dBu

6. See Figure 9 for equipment set-up and equipment settings for steps 7 through 8.

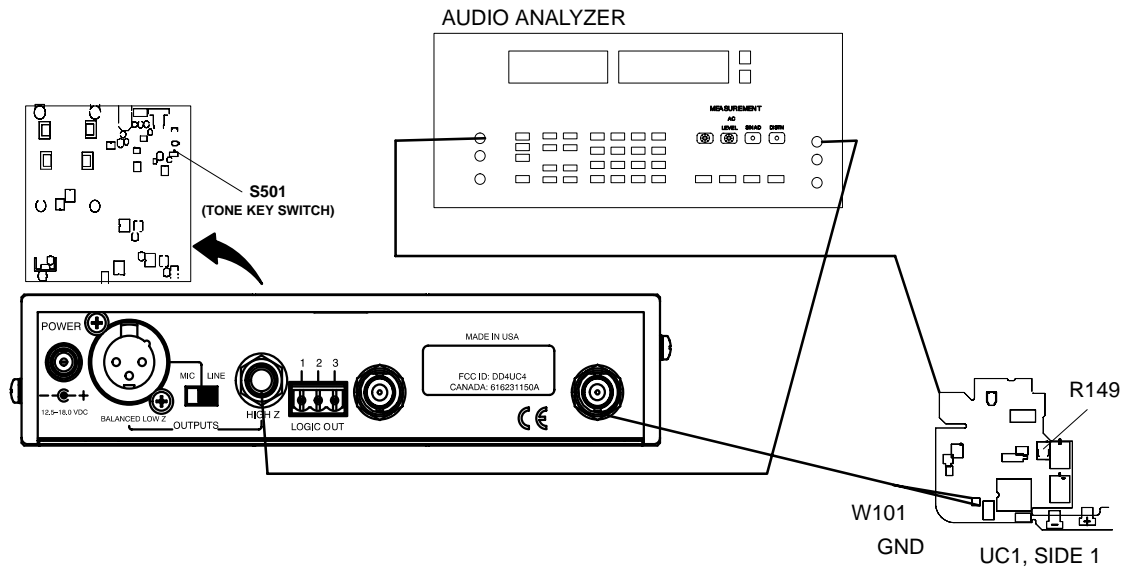


UC1 Transmitter		Audio Analyzer	
Power:	+9 Vdc	Measurement:	AC level
Gain:	Minimum	Output:	1 kHz
Input attenuator:	0dB	Filters:	
Channel switch:	See Table 2	Low-Pass (30 kHz):	ON
Group switch:	See Table 2	High-Pass (400 Hz):	ON

Figure 8. Deviation Adjustment Voltage Test Set-Up, Steps 1 through 4, Using a UC4 or U4S Receiver

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7. Connect the BNC end of the test cable that is soldered to W101 and GND to the antenna A or B inputs.
8. Turn ON the UC1 and adjust R149 until the audio volt-meter connected to the unbalanced output of the UC4 reads the same as the *deviation reference voltage*, measured above, ± 0.1 dB. R149 adjusts the deviation for 45 kHz, 100% modulation.



UC4 Receiver		UC1 Transmitter		Audio Analyzer	
Output:	Unbalanced	Power:	+ 9 Vdc	Measurement:	AC level
Gain:	Maximum	Gain:	Minimum	Output:	1 kHz
Squelch:	Mid	Input attenuator:	0dB	Filters:	
Tone key (S501):	ON	Channel switch:	See Table 2	Low-Pass (30 kHz):	ON
		Group switch:	See Table 2	High-Pass (400 Hz):	ON

Figure 9. Deviation Adjustment Voltage Test Set-Up, Steps 7 through 8, Using a UC4 or U4S Receiver

Option 2: Using a Modified SC4 IF Receiver

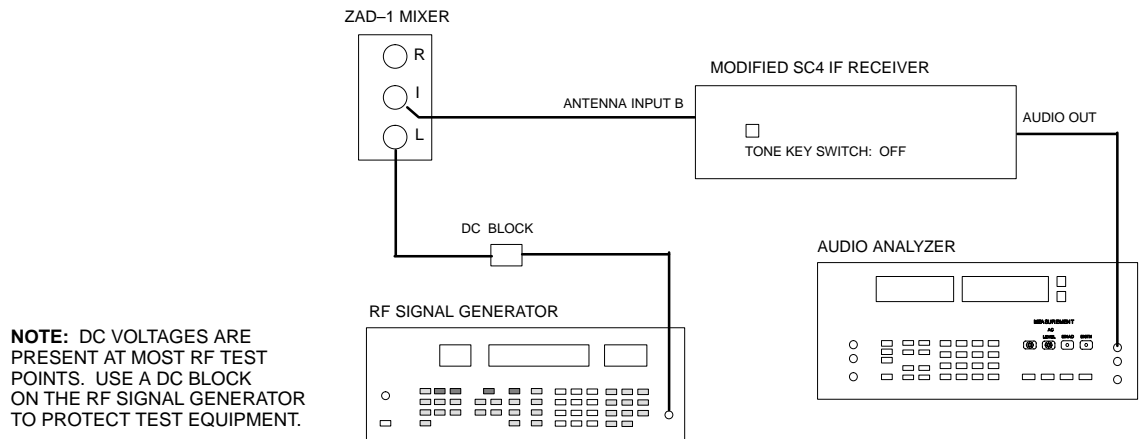
Deviation tests can also be performed using a modified SC4 IF receiver. For instructions on modifying an SC4 receiver, consult the *Shure Service Equipment* manual.

Reference Voltage

1. See Figure 10 for equipment test set-up and equipment settings.
2. Connect the rf signal generator output to the input port L (local oscillator) of a Zad-1 mixer
3. Connect the output port I (intermediate frequency) of the Zad-1 mixer to antenna input B of the SC4 IF receiver.
4. Turn the SC4 IF receiver ON and set the tone key switch on the front panel of the SC4 IF receiver to OFF.
5. Connect the audio voltmeter to the receiver's unbalanced output.
6. Measure the output voltage.

Record this voltage. This is the *deviation reference voltage*.

Use the same Zad-1 mixer connections for the next adjustment test.



SC4 IF Receiver		Audio Analyzer		Rf Signal Generator	
Output:	Unbalanced	Measurement:	AC level	INT:	FM
Gain:	Maximum	Filters:		INT:	1 kHz
Squelch:	Mid	Low-Pass (30 kHz):	ON	Output Amplitude:	+ 7 dBm
Tone Key switch:	OFF	High-Pass (400 Hz):	ON	Frequency:	10.7 MHz
Operating freq:	See Table 2			Deviation:	See Table 2

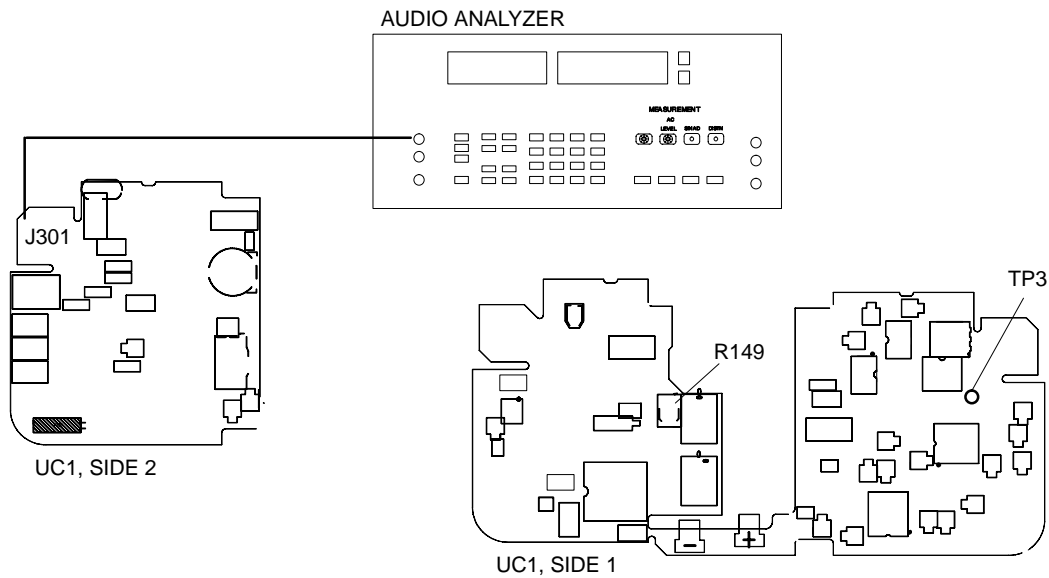
Figure 10. Deviation Reference Voltage Test Set-Up, Using a Modified SC4 IF Receiver

Adjustment Voltage

1. Disconnect the SC4 audio output from the audio analyzer input.
2. Use the BNC to TINI QG cable to connect the audio analyzer output to the MIC input of the transmitter (J301).
3. Set the audio analyzer frequency to 1 kHz.
4. Turn the UC1 power back ON.
5. Connect the shield probe test cable to the audio analyzer input.
6. Adjust the audio analyzer output level (typically = -2.2 dBu) until the following readings are read at TP3, ± 0.02 dB:

Model:			
UA, UB	MB,MC,MD	JA, JB	KK
-6.8 dBu	- 16.3 dBu	- 23.47 dBu	- 15.3 dBu

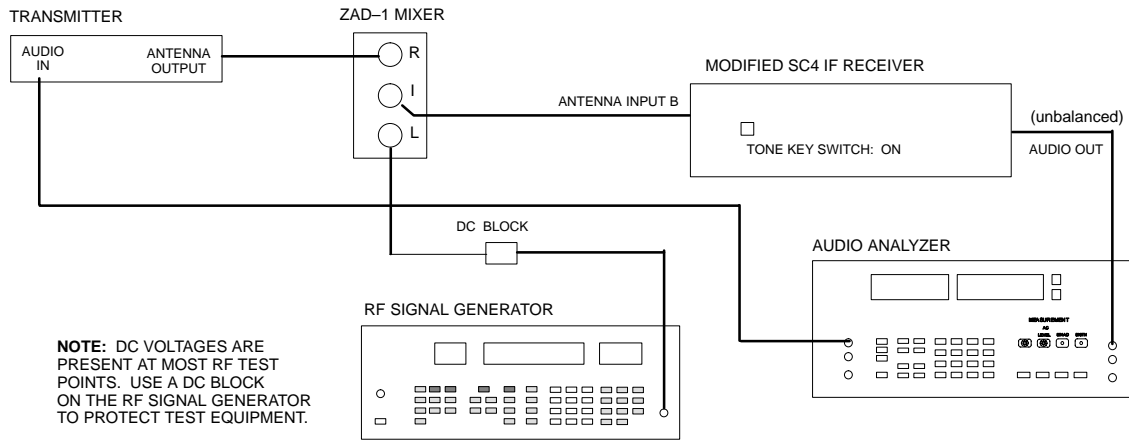
See Figure 12 for equipment set-up and settings for steps 7 through 9.



UC1 Transmitter		Audio Analyzer	
Power:	+9 Vdc	Measurement:	AC level
Gain:	Minimum	Output:	1 kHz
Input attenuator:	0	Filters:	
Channel switch:	See Table 2	Low-Pass (30 kHz):	ON
Group switch:	See Table 2	High-Pass (400 Hz):	ON

Figure 11. Deviation Adjustment Voltage Test Set-Up, Using a Modified SC4 IF Receiver

7. Connect the UC1 rf output test cable BNC end to the input port R (rf output) of the Zad-1 mixer.
8. Set the rf signal generator to the frequency given in Table 2, minus 10.7 MHz (Carrier Frequency (MHz) –10.7 MHz).
9. Set the SC4 tone key switch on the SC4 front panel to ON.
10. Connect the SC4 IF receiver's unbalanced output to the audio analyzer input, disconnecting the shield probe.
11. Turn ON the UC1 and adjust R149 until the audio analyzer connected to the unbalanced output of the UC4 reads the same as the *deviation reference voltage*, measured above, ± 0.1 dB.



SC4 IF Receiver		UC1 Transmitter		Audio Analyzer		Rf Signal Generator	
Output:	Unbalanced	Power:	+ 9 Vdc	Measurement:	AC level	INT:	FM
Gain:	Maximum	Gain:	Minimum	Output:	1 kHz	INT:	1 kHz
Squelch:	Mid	Input attenuator:	0dB	Filters:		Output amplitude:	+ 7 dBm
Tone Key switch:	ON	Change switch:	See Table 2	Low-Pass 30 kHz:	ON	Deviation:	See Table 2
		Group switch:	See Table 2	High-Pass 400 Hz:	ON	Frequency:	Oper. Freq. minus 10.7 MHz

Figure 12. Deviation Adjustment Voltage Test Set-Up, Steps 7 through 9, Using a Modified SC4 IF Receiver

Operating Specifications

After tuning, the unit should meet the following specifications.

*Table 3
Operating Specifications*

Specification	Minimum	Typical	Maximum
Current drain	50 mA	60 mA	70 mA
Frequency	-1.0 kHz	See Table 2	+1.0 kHz
Audio freq response @ 100 Hz wrt 1 k	-5.0 dB	-4.0 dB	-3.0 dB
Audio freq response @ 10 kHz wrt 1 k	+8.0 dB	+9.0 dB	+10.0 dB
UA, UB:			
System S/N @ 45 kHz, A weighted	95.0 dB	100.0 dB	-
Output power, UA, without C347	12.0 dBm	14.0 dBm	15.0 dBm
MB, MC, MD			
System S/N @ 1% THD, A weighted	80.0 dB	85.0 dB	-
Output power, without C347	12.0 dBm	14.0 dBm	15.0 dBm
KK:			
System S/N @ 1% THD, A weighted	80.0 dB	85.0 dB	-
Output power, without C347	12.0 dBm	14.0 dBm	15.0 dBm
JA, JB:			
System S/N @ 1% THD, A weighted	85.0 dB	90.0 dB	-
Output power, at J2, with C347 in place	8.3 dBm	8.8 dBm	9.3 dBm

Bench Checks

Dc Problems

Make all dc measurements with respect to the rf ground, unless otherwise specified.

- ✓ Verify that the battery voltage is between 6.0 Vdc and 9.5 Vdc.
- ✓ Check for +5 Vdc at labeled test points on the audio and rf boards.
- ✓ If incorrect voltage is present, check the biasing resistors' values.
- ✓ Trace the dc back to the battery and check the power switch.
- ✓ Look for open coils, cracked parts, reversed polarity capacitors, and solder shorts.
- ✓ If there is a short to ground from 5 Vdc, try to isolate different parts of the circuit.
- ✓ Verify that the rf OFF signal changes from +5 Vdc at power up and power down to 0 Vdc during normal operation. Trace the signal to the microprocessor. Q101 should be saturated during normal operation.
- ✓ Verify that the battery voltage appears at U205, pin 6, (TP +9 Vdc).

Rf Frequency Problems

- ✓ If the carrier is out of specification by less than 40 kHz and cannot be corrected by adjusting C123, check the values of C123, C124, and Y101. If these values are correct, replace Y101. As a last resort, replace the synthesizer, U104.
- ✓ If the carrier frequency is not 782 and 810 MHz, or is unstable, the loop is unlocked:

Check solder connections at the VCO, microprocessor (traces LE, D, and CK) and synthesizer, U104.

Check for 4 MHz oscillation at U104, pins 1 and 2. If there is not 4 MHz oscillation, replace the crystal, Y104.

Check the values and polarity of the loop filter: R121, R122, R123, C129, C130, C131, and C132. Check the bias voltage of U104, pins 3 and 4; and U106, pin 8. As a last resort, replace the synthesizer, U104.

The tuning voltage of the VCO at U104, pin 5, should be approximately 3 Vdc when the transmitter is programmed for 800 MHz operation.

Low Rf Output Power

- ✓ Check the polarity of the low-pass filters U107, U108, and U109. (Pin 1 is marked with a dash.)
- ✓ Check for missing ground connections.
- ✓ Verify the VCO output power at R128 and U104, pin 8.
- ✓ Check the dc level at the VCO Vcc pin.
- ✓ Isolate the VCO from the rest of the circuit by removing R127, R128, and C134. The carrier frequency will no longer be locked, but the output power from the VCO should be approximately 0 dBm.
- ✓ If the power out of the VCO is still low, the VCO is bad. Replace the rf board.
- ✓ Verify the dc bias of Q102 and Q104. Verify the rf mute signal changes from +5 Vdc at power up and power down, to 0 Vdc during normal operation. If Q103 and Q105 are not saturated during normal operation, the rf power at the antenna port will be attenuated by about 45 dB.
- ✓ Isolate components starting from the antenna port and working back to the rf power amp.
- ✓ Remove the low-pass filter and check the power OUT of the amplifier.
- ✓ Check the values of the output matching network for Q102 and Q104, C258, L206, and C256. Look for open coils.
- ✓ Check the values of the bypass capacitors.
- ✓ As a last resort, replace the transistors, Q102 and Q104.

Excessive Current Drain

- ✓ Isolate different sections of the circuit; rf, audio, and digital. Look for reversed polarity capacitors or wrong resistor values.

Deviation Problems

- ✓ If R149 cannot be adjusted to obtain the desired deviation, try to isolate the problem to the audio or rf section.
- ✓ Check the value of R149. To check the rf section, set the transmitter frequency to 800 MHz and verify that the tuning voltage of the VCO (U104, pin 5) is approximately 3 Vdc.

Audio Problems

No Tone Key

No tone key means that the 32 kHz tone key sidebands are not visible when the carrier is viewed on a spectrum analyzer. If tone key levels are there but are too low, the deviation is off and needs to be recalibrated.

- ✔ Apply a 1 kHz tone at a level of 0 dBu to the audio input with the audio gain pot at minimum.
- ✔ If the carrier on the spectrum analyzer does not show any deviation, check part integrity and audio path continuity between U201, pin 1, and the VCO.
- ✔ If the spectrum analyzer shows a deviated carrier, probe for a 32 kHz signal at TP4 and I246 and continue to the next step.
- ✔ If there is a signal at I246 but not at TP4, then the mute circuit through Q4 or Q211 is being activated. Verify that the logic signal at Q4 and Q211, pin 1, is logic low. If it is low, replace Q4 or Q211. If it is not low, check the line for a short to +5 V. If there is no short, the microprocessor is defective and must be replaced.
- ✔ If there is a 32 kHz signal at both I246 and TP4, replace R248.
- ✔ If there is not a 32 kHz signal at either I246 or TP4, there is something wrong with the tone key circuit or the tone key supply voltage. If the tone key supply voltage (U201, pin 7) is less than 2 V, there is a problem with one or more of the following components: R284, R287, R285, R286, C289, Q222, C222, R228, or R229..
- ✔ If the voltage at U201, pin 7, is greater than 2 V, the problem is in the tone key circuit itself. Check for shorts and opens. Replace parts in this circuit beginning with the crystal until the 32 kHz oscillation returns.

No Audio

- ✔ View the carrier on the spectrum analyzer. If there are not 32 kHz tone key sidebands around the carrier, follow the steps above for “No Tone Key.”
- ✔ If there are tone key sidebands around the carrier, verify that the signal generator is properly outputting signal.
- ✔ Verify +9 V, half-supply bias, and ground connections to U2.
- ✔ Verify +9 V, half-supply bias, and ground connections to U201.
- ✔ Follow the audio path from where audio is applied until the point of discontinuity is reached and replace the appropriate part.

Notes

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Replacement Parts and Drawings

Product Changes

Six versions of the UC1 and UC1L transmitters are available for use in various countries. Each version is identified below by country code, country designation, frequency range, and printed circuit board number.

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
UC1 / UC1L Model Frequency Variations
(in order by frequency)

Country Code	Country Designation	Frequency Range	UC1 Printed Circuit Board #	UC1L Printed Circuit Board #
UA	U.S.A. and Canada	782 – 806 MHz	90UA8790	90UA8791
UB	U.S.A.	692 – 716 MHz	90UB8790	90UB8791
MB	Europe	800 – 830 MHz	90MB8790	90MB8791
MC	Netherlands	774 – 782 MHz	90MC8790	90MC8791
MD	Scandinavia	800 – 820 MHz	90MD8790	90MD8791
JA	Japan	797 – 806 MHz	90JA8790	90JA8791
JB	Japan	806 – 810 MHz	90JB8790	90JB8791
KK	United Kingdom	838 – 862 MHz	90KK8790	90KK8791

Table 5
Replacement Parts

Reference Designation	Description	Shure Part Number
MP1	Antenna	70A8015
MP2	Belt clip	44A8013A
MP3	Bushing	66A308
MP4	Case back	65A8295A
MP5	Case front	65A8294A
MP6	Compression pad	36A8078
MP7	Door	65A8296
MP8	Foam pad	36A8073
MP9	Case screws and hardware	RPW622
MP10	QG mic connector/PCB assembly	RPW270
MP11	Lemo mic connector/PCB assembly	RPW274

Table 6
Printed Circuit Board Components

Reference Designation	Description	Shure Part Number
C123	Capacitor, trimmer, 5 – 40 pF	152F03
C510	Capacitor, trimmer, 0.65–2.5 pF	152A04
D101–104	Diode, dual switching, SOT-23	184A07
D105, 206	Diode, signal / switching, SOT-23	184A08
D201	LED, right angle, green	184F32
D202	LED, right angle, yellow	184E32
D203	LED, right angle, SMT, red	184D32
D501	Diode, rf tuning	184A36
J102	Jack, stereo, 35 mm	95A8774
J201	Connector, receptacle, 11 pin	170A08
J202,203	Battery contacts	56A8072A
J204	Connector, strip socket, 3 pin	170C15
J301	Receptacle, male, 4-pin, TINI QG	95A8413
J401	Connector, LEMO (UC1L)	95A8601
P301,305	Connector, interconnect strip	56D8074
Q1,4,211,215, 216,218	Transistor, SOT-23, FET, TMOS	183A30
Q101,213	Transistor, SOT-23, PNP	183A01
Q102,501,502	Transistor	183A48
Q103,105,217	Transistor, power, MOSFET	183A46
Q104	Transistor, SOT-23	183A49
Q201,202,204, 219,220,221, 222, 223	Transistor, SOT-23, NPN	183A02
R7	Potentiometer, gain	46H8014
R149	Audio Deviation Potentiometer, 1k	146B02
SW202	Power Switch, toggle, DPST	55A189
SW203	Attenuator Switch, slide	55A8087
Y101	Crystal, 4 MHz	40A8012
Y201	Crystal, 32.768 kHz	40A8010
U2	IC, dual op amp	188A18
U101	IC, microprocessor, programmed	188D238G
U103	IC, detector	188C210
U104	IC, PLL frequency synthesizer	188A265
U201	IC, quad op amp	188A49
U203	IC, compander	188A126
U205	IC, voltage regulator, 5 V	188A115
U208	IC, quad comparator	188A123
U501	Resonator, dielectric	140A14

Shure UC1 Body-Pack UHF Transmitter

Table 7
**U102 EEPROM Programed
Part Numbers**

Country Code	U102 Part Number
UA	188UCT131UA
UB	188UCT131UB
MB	188UCT131MB
MC	188UCT131MC
MD	188UCT131MD
JA	188UCT131JA
JB	188UCT131JB
KK	188UCT131KK

Table 8
**Frequency Dependent Components
(in order by frequency)**

CODE	COUNTRY	FREQ RANGE	R26	R27	R28	R29	R30	R31	R32	R33	R34	R35	R36
UA	US/ CANADA	782-806	145FF1 001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	145FF1 001	N/A	N/A
UB	US	692-716	N/A	N/A	N/A	N/A	N/A	145FF1 001	N/A	N/A	N/A	N/A	N/A
MB / MD	EUROPE SCANDA- NAVIA	800-830 800-820	N/A	145FF1 001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	145FF1 001	N/A
JA	JAPAN	797-806	N/A	N/A	145FF1 001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	145FF1 001
JB	JAPAN	806-810	N/A	N/A	N/A	145FF1 001	N/A	N/A	N/A	N/A	N/A	N/A	N/A
KK	EN- GLAND	838-862	N/A	N/A	N/A	N/A	145FF1 001	N/A	N/A	N/A	N/A	N/A	N/A
MC	NETHER- LANDS	774-782	N/A	N/A	N/A	N/A	N/A	N/A	145FF1 001	N/A	N/A	N/A	N/A

CODE	COUNTRY	FREQ RANGE	R37	R38	R39	R40	R1	R11	R12	R13	R14	R15	R16
UA	US/ CANADA	782-806	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
UB	US	692-716	N/A	N/A	145FF1 001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MB / MD	EUROPE SCANDA- NAVIA	800-830 800-820	N/A	N/A	N/A	N/A	145FF1 002	145FF4 021	145FF4 021	145FF4 022	145FF1 003	145FF1 002	145FF1 004
JA	JAPAN	797-806	N/A	N/A	N/A	N/A	145FF1 002	145FF4 021	145FF4 021	145FF4 021	145FF1 003	145FF1 002	145FF1 004
JB	JAPAN	806-810	145FF1 001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
KK	EN- GLAND	838-862	N/A	145FF1 001	N/A	N/A	145FF1 002	145FF4 021	145FF4 021	145FF4 022	145FF1 003	145FF1 002	145FF1 004
MC	NETHER- LANDS	774-782	N/A	N/A	N/A	145FF1 001	145FF1 002	145FF4 021	145FF4 021	145FF4 022	145FF1 003	145FF1 002	145FF1 004

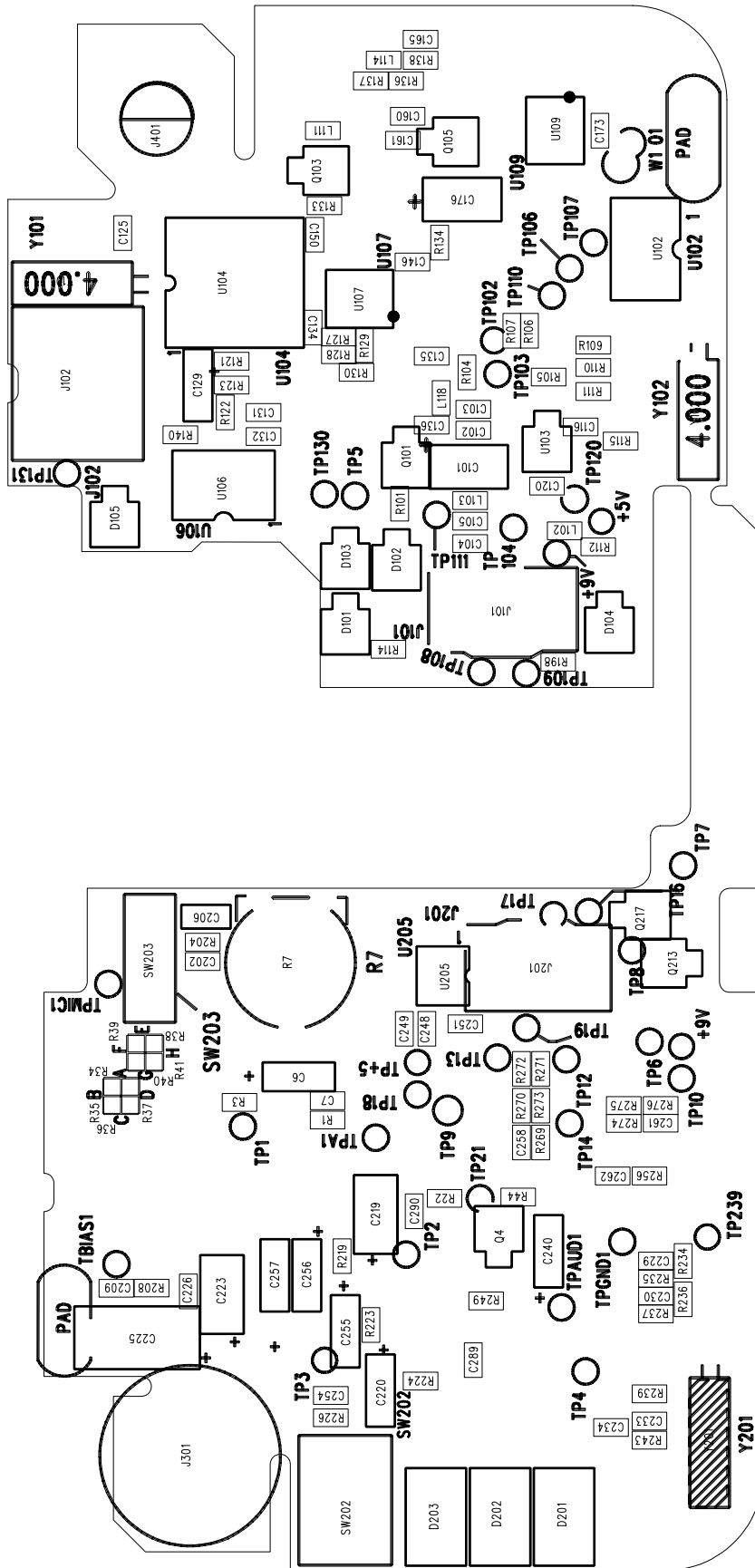
Shure UC1 Body-Pack UHF Transmitter

CODE	COUNTRY	FREQ RANGE	R17	R18	C7	C8	C12	C215	Q2	Q3	U1	R298	R25	R9
UA	US/ CANADA	782-806	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	145FF 4021	145FJ0 00	145FJ0 00
UB	US	692-716	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	145FF 4021	145FJ0 00	145FJ0 00
MB / MD	EUROPE SCANDANA- NAVIA	800-830 800-820	145FF 1004	145FF 22R1	150GC 473KB	150GC 104KB	150GB 101JA	151AB 225MA	183A0 1	183A0 2	188A1 36	N/A	N/A	N/A
JA	JAPAN	797-806	145FF 1004	145FF 22R1	150GC 473KB	150GC 104KB	150GB 101JA	151AB 225MA	183A0 1	183A0 2	188A1 36	N/A	N/A	N/A
JB	JAPAN	806-810	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	145FF 4021	145FJ0 00	145FJ0 00
KK	EN- GLAND	838-862	145FF 1004	145FF 22R1	150GC 473KB	150GC 104KB	150GB 101JA	151AB 225MA	183A0 1	183A0 2	188A1 36	N/A	N/A	N/A
MC	NETHER- LANDS	774-782	145FF 1004	145FF 22R1	150GC 473KB	150GC 104KB	150GB 101JA	151AB 225MA	183A0 1	183A0 2	188A1 36	N/A	N/A	N/A

CODE	COUNTRY	FREQ RANGE	C117	C118	C505	C506	C509	C148	Y102	Y103	J103	R144	R145	R133
UA	US/ CANADA	782-806	N/A	N/A	150GB4 78BA	150GB4 78BA	150GB1 88BA	N/A	N/A	140C15	N/A	N/A	N/A	145FF2 2R1
UB	US	692-716	N/A	N/A	150GB6 88BA	150GB6 88BA	150GB4 78BA	N/A	N/A	140C15	N/A	N/A	N/A	145FF2 2R1
MB / MD	EUROPE SCANDANA- NAVIA	800-830 800-820	N/A	N/A	150GB4 78BA	150GB4 78BA	150GB1 08BA	N/A	N/A	140C15	N/A	N/A	N/A	145FF2 2R1
JA	JAPAN	797-806	150GB2 70JA	150GB2 70JA	150GB4 78BA	150GB4 78BA	150GB1 88BA	N/A	40A801 2	N/A	170A14	146B02	145FF4 9R9	145FF4 020
JB	JAPAN	806-810	150GB2 70JA	150GB2 70JA	150GB4 78BA	150GB4 78BA	150GB1 88BA	N/A	40A801 2	N/A	170A14	146B02	145FF4 9R9	145FF4 020
KK	ENGLAND	838-862	N/A	N/A	150GB3 38BA	150GB3 38BA	N/A	N/A	N/A	140C15	N/A	N/A	N/A	145FF2 2R1
MC	NETHER- LANDS	774-782	N/A	N/A	150GB4 78BA	150GB4 78BA	150GB1 88BA	N/A	N/A	140C15	N/A	N/A	N/A	145FF2 2R1

CODE	COUNTRY	FREQ RANGE MHz	S101 GRP	S102 CH	C173	R156	R2	R3	C216	R150	R151	R152	R153	R154	R155
UA	US/CAN- ADA	782-806	155B11	155A11	150GB 270JA	N/A	145FJ0 00	145FF4 991	150GC 473KB	145FF1 001	N/A	N/A	N/A	N/A	N/A
UB	US	692-716	155B11	155A11	150GB 270JA	N/A	145FJ0 00	145FF4 991	150GC 473KB	N/A	N/A	N/A	N/A	N/A	145FF1 001
MB / MC	EUROPE SCANDANA- NAVIA	800-830 800-820	155B11	155A11	150GB 270JA	N/A	145FF1 002	145FF2 490	N/A	N/A	145FF1 001	N/A	N/A	N/A	N/A
JA	JAPAN	797-806	155A11	155B11	N/A	N/A	145FF1 002	145FF2 490	N/A	N/A	N/A	145FF1 001	N/A	N/A	N/A
JB	JAPAN	806-810	155B11	155A11	N/A	N/A	145FJ0 00	145FF4 991	150GC 473KB	N/A	N/A	N/A	145FF1 001	N/A	N/A
KK	ENGLAND	838-862	155B11	155A11	150GB 270JA	N/A	145FF1 002	145FF2 490	N/A	N/A	N/A	N/A	N/A	145FF1 001	N/A
MC	NETHER- LANDS	774-782	155B11	155A11	150GB 270JA	145FF1 001	145FF1 002	145FF2 490	N/A	N/A	N/A	N/A	N/A	N/A	N/A

CODE	COUNTRY	FREQ RANGE MHz	C507	C144	C157									
UA	US/CAN- ADA	782-806	150GB478 BA	150GB478 BA	150GB478 BA									
UB	US	692-716	150GB568 CA	150GB270 JA	150GB270 JA									
MB / MD	EUROPE SCANDANA- NAVIA	800-830 800-820	150GB478 BA	150GB478 BA	150GB478 BA									
JA	JAPAN	797-806	150GB478 BA	150GB478 BA	150GB478 BA									
JB	JAPAN	806-810	150GB478 BA	150GB478 BA	150GB478 BA									
KK	ENGLAND	838-862	150GB478 BA	150GB478 BA	150GB478 BA									
MC	NETHER- LANDS	774-782	150GB478 BA	150GB478 BA	150GB478 BA									



UC1 Body-Pack Transmitter
Audio-Rf Printed Circuit Board
Side 2