

Lectrosonics Standard Test & Alignment Procedure

Part number(s):	WM	Hardware version(s):	17419B (radio) & 17420B (audio)	Firmware version(s):	2.0
Part number(s):	WM/E01	Hardware version(s):	17419B (radio) & 17420B (audio)	Firmware version(s):	2.0
Part number(s):	WM/E02	Hardware version(s):	17419B (radio) & 17420B (audio)	Firmware version(s):	2.0
Common name:	WM transmitters	Author(s):	Cruz Garcia & Rodney Wildhagen	Test procedure version:	01.00
Date:	09 Apr 2012				

Test segment #10 of 40

NOTE: This need only be performed it is powered up, when μ C IC is replaced, or when a firmware update is desired and confirmed to be appropriate. Only audio boards are required for this segment.

Initial setup:

- Audio board with PIC18F67J11 μ C IC

Step	<u>Measurement name & description</u>	Measurement result	(Typ)
10.10	<u>Program μC IC and measure audio board current draw</u>		
10.10.10	+3.3 VDC, 200 mA current limit in at audio board J8-10 (J8-1 is circuit common)		
10.10.20	Measure current draw		(?)
10.10.30	Program μ C IC via ICSP port (J6)		
10.10.40	Remove ICSP cable from DUT		
10.10.50	Measure current draw		(76)
Note	The goal here is to be sure the audio board is powered up, the μ C IC is running, and the audio board is not burning up with fever. A tighter tolerance current draw measurement will be made later		
10.10.60	Remove DC power from audio board		

Test segment #20 of 40

NOTE: This segment may be performed using one audio board to test multiple radio boards

Initial setup:

- Known good, pre-tested audio board connected to the radio board.
- Test key pad connected to audio board J3.
- All voltage measurements referenced to DUT circuit common
- All audio signal amplitude measurements taken with a <10 Hz HPF and 80 kHz LPF (use filter on audio signal analyzer, not modulation meter)
- All audio signal noise and distortion measurements taken with a 22Hz HPF and 22kHz LPF (use filter on audio signal analyzer, not on modulation meter)
- All demodulated carrier and carrier deviation measurements taken with a Hewlett Packard 8901A modulation analyzer with no 8901A filters selected. Use of other instruments may yield different results particularly measurements pertaining to noise and phase and measurements where noise is a significant factor
- This font indicates use the Alternate Method to manual testing using the LectroLink apparatus and LecNet2 Command Terminal Utility. Sub-steps bearing the same number indicate alternate method(s). Use of the LectroLink apparatus creates an additional opportunity for ground loop currents which commonly disrupt LectroLink communications so use of an optically isolated USB hub (B and B Electronics model UIISOHUB4 or equivalent) is recommended. The LectroLink method is the only method to adjust carrier power, no menu equivalent exists.

Step	<u>Measurement name & description</u>	Measurement result	(Typ)
20.10	<u>Audio board frequency block assignment</u>		
20.10.10	+1.5 VDC, 2.5 A current limit in at radio board P4-1 (P7-1 is circuit common).		
20.10.20.10	Hold Audio and Frequency buttons simultaneously on test panel key pad for 3 seconds while shorting audio board TP5 (TEST) to J6-4 (circuit common). This powers DUT up in factory mode.		
20.10.20.20	Press test panel keypad AUD switch repeatedly until LCD displays frequency block number		
20.10.20.30	Press test panel keypad UP or DOWN switch repeatedly to assign appropriate block number		
20.10.20.10	block= (acceptable values are 470, 19-33, 944, 400-999)		
20.10.20.20	Cycle DUT power		

20.20	<u>Power supply voltage measurements</u>			
Note	On 06 Mar 2012 I requested of Dave Bundy that the next board rev set contain test points for all supply rail voltages not available at a header.			
20.20.+3.3V	Measure DC voltage at audio board:	J8-10 (+3.3V)	+3.135 to +3.465VDC	(+3.3)
20.20.BAT+		J8-12 (BAT+)	+1.485 to +1.515VDC	(+1.5)
20.20.+6V		J8-13 (+6V)	+5.65 to +6.25VDC	(+5.95)
20.20.-3V		J8-14 (-3V)	-2.73 to -2.47VDC	(-2.6)
20.20.+6V_SLEEP		J2-4 (+6V_SLEEP)	+5.65 to +6.25VDC	(+5.95)
20.20.-3V_SLEEP		J2-3 (-3V_SLEEP)	-2.73 to -2.47VDC	(-2.6)
20.20.+3.3V_SLEEP		J2-2 (+3.3V_SLEEP)	+3.135 to +3.465VDC	(+3.3)
20.20.+3V	Measure DC voltage at radio board:	C48, U6 jct (+3V)		(?)
20.20.+4V_VAR		TP3 (+4V_VAR)	+2.82 to +3.15VDC	(+3)
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20.30	<u>VCO adjustment & VCO start-up test</u>			
20.30.10	Install VCO shield tuning cover. If possible it should make good electrical connection to the resonator and the shield fence. DO NOT SOLDER IT IN PLACE!			
20.30.20	Navigate menu so LCD reads Aud			
20.30.30	Press test panel key pad FREQ button twice, LCD reads "CH--"			
20.30.40	Press test panel key pad FREQ and UP or DWN button to select highest carrier frequency			
20.30.50	channel=	assign highest carrier freq.		
20.30.60	Adjust radio board C23 for 2.5 VDC at radio board TP1 (VCO_CONT)		+2.45 to +2.55 VDC	(+2.5)
20.30.70	Remove DC power from DUT			
20.30.80	Wait 3 sec.			
20.30.90	Restore DC power to DUT			
20.30.100	Measure DC voltage at radio board TP1 (VCO_CONT) as an indicator that the VCO starts on power up at selected carrier frequency		+2.45 to +2.55 VDC	(+2.5)
20.30.110	Press test panel key pad FREQ and UP or DWN button to select lowest carrier frequency			
20.30.110	channel=	assign lowest carrier freq.		
20.30.120	Measure DC voltage at radio board TP1 (VCO_CONT)		+0.6 to +1.2 VDC	
20.30.130	Remove DC power from DUT			
20.30.140	Wait 3 sec.			
20.30.150	Restore DC power to DUT			
20.30.160	Measure DC voltage at radio board TP1 (VCO_CONT) as an indicator that the VCO starts on power up at selected carrier frequency		+0.6 to +1.2 VDC	
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20.40	<u>Carrier signal power adjustments & spectral purity measurements</u>			
Note	If the LectroLink tool is used to perform all DUT manipulations, it is not necessary for the DUT to be in Factory mode to perform this step.			
20.40.10	Press test panel keypad AUD switch until LCD displays P_XXX (carrier power menu, 250mW, lowest carrier freq.)			
Note	This sets the DUT to 250mW carrier power at the lowest carrier frequency, from here pressing the FREQ switch once will move to the middle carrier freq. pressing it again moves to the highest freq. Once more moves to 100mW at the lowest freq and the pattern continues until 250mW, high freq is achieved then the pattern repeats. At each power/freq setting the UP /DOWN switches adjust carrier power.			
20.40.20	Repeatedly press UP or DOWN switch to achieve target carrier power at radio board P1-1 (P1-2 is common) and manipulate menu to set carrier signal power for all power settings (50mW, 100mW, & 250mW) at lo, mid, and high carrier freq. (9 positions)			
20.40.30	Measure spectral purity (spurs) 5MHz to 1450MHz at radio board P1-1 (P1-2 is common) and current draw at all 3 carrier power settings at low, mid, & high carrier freq (9 positions).		≤ -70 dBC	
	Neither second nor third harmonics should be considered spurs.			
20.40.40	Measure spectral purity (spurs) carrier freq. +/- 20 MHz at radio board P1-1 (P1-2 is common) and current draw at all 3 carrier power settings at low, mid, & high carrier freq (9 positions)		≤ -70 dBC	
20.40.50	Measure current draw			(?)
20.40.60	Repeat this process until all 9 carrier signal power points have been adjusted and double checked after the last adjustment has been made			

Current draw tolerances for test procedure segment #20			Carrier signal power tolerances for test procedure segment #20			
50mW	100mW	250mW		50mW	100mW	250mW
300 to 500 mA (400)	400 to 600 mA (500)	600 to 900 mA (750)	WM	+15 to +19dBm	+18 to +22dBm	≥ +23.7dBm
			WM/E01	+14.8 to -18.8dBm	+18 to +22dBm	≥ +23.7dBm

Note Carrier power may alternatively be adjusted by first querying the powercal value "powercal(50,0)?" and subsequently incrementing or decrementing carrier power using "p=+2" syntax.

20.50	<u>Modulation level and distortion adjust</u>		
Prerequisite(s):	Unit in factory test mode (power unit up with audio board TP5 or TP8 (TEST) connected to circuit common) DUT to 100 mW carrier power		
20.50.10	Press AUD button on the test panel key pad until LCD reads "d80 " ("dAb" for BL779)		
20.50.20	Adjust radio board R19 for minimum modulation distortion at demodulated carrier at radio board P1-1 (beware the possibility of two "sweet spots", one better than the other)	≤1.0 % THD+N	(0.7)
20.50.30	Adjust radio board R47 for 100kHz deviation at radio board P1-1	99 to 101 kHz dev	(100)
20.50.40	Repeat steps #20.50.20 and #20.50.30 until no further adjustments are required		
20.50.50	Press FREQ button on the test panel key panel until LCD reads "d00 00 "		
20.50.60	Measure distortion at demodulated carrier, fine adjusting radio board R19 if required	≤1.2 % THD+N	(0.7)
20.50.70	Press UP or DWN button on the test panel key pad for 100 kHz peak carrier deviation at radio board P1-1	99 to 101 kHz dev	(100)
20.50.80	Press FREQ button on the test panel key pad until LCD reads "dFF 00 " ("dAb" for BL779)		
20.50.90	Measure distortion at demodulated carrier, fine adjusting radio board R19 if required	≤1.2 % THD+N	(0.7)
20.50.100	Press UP or DWN button on the test panel key pad for 100 kHz peak carrier deviation at radio board P1-1	99 to 101 kHz dev	(100)
20.50.110	Repeat step #20.50.10 to #20.50.100 until no further adjustment is necessary (maximum of three times)		
20.50.120	Press AUD button on the test panel key pad until LCD reads "AUD 0"		
20.50.130	Remove VCO shield tuning cover		

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30.60	<u>Install VCO shield cover</u>		
30.60.10	No DC power in at radio board		
30.60.20	Disconnect radio board from audio board		
30.60.30	Install VCO shield assembly. Verify that the shield top is completely seated all around the fence perimeter		
30.60.40	Solder VCO shield top to resonator on top and all around the VCO shield fence. Verify that there are no spots where the solder stands proud of the shield top and that the solder point to the resonator appears to be properly flowed.		
30.60.50	Allow to cool for a minimum of 10 minutes before proceeding		

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NOTE: This segment must be performed using the audio/radio board pairs that will remain paired up

Initial setup:

- Audio board running firmware version appropriate & current for part number connected to the radio board it shall cohabitate with until death do they part.
- Test key pad connected to audio board J3.
- All voltage measurements referenced to circuit common
- All audio stimulus signals applied to audio input rig defined at foot of this document, see ~ below
- All demodulated carrier and carrier deviation measurements taken with a Hewlett Packard 8901A modulation analyzer with no 8901A filters selected. Use of other instruments may yield different results particularly measurements pertaining to noise and phase and measurements where noise is a significant factor
- This font indicates use the Alternate Method to manual testing using the LectroLink apparatus and LecNet2 Command Terminal Utility. Sub-steps bearing the same number indicate alternate method(s). Use of the LectroLink apparatus creates an additional opportunity for ground loop currents which commonly disrupt LectroLink communications so use of an optically isolated USB hub (B and B Electronics model UIISOHUB4 or equivalent) is recommended. The LectroLink method is the only method to adjust carrier power, no menu equivalent exists.

Step	<u>Measurement name & description</u>		Measurement result	(Typ)
40.10	<u>Power up sequence, current draw measurement, & push switch circuit test</u>			
40.10.10	+1.5 VDC, 2.5 A current limit in at radio board P4-1 (P7-1 is circuit common).			
40.10.20	Hold Audio and Frequency buttons simultaneously on test panel key pad for 3 seconds while shorting audio board TP5 (TEST) to J6-4 (circuit common). This powers DUT up in factory mode.			
Note	"Factory Mode" gives extended menu options for test & alignment.			
40.10.30.10	Observe behavior of audio board LCD and keypad LED's	All LED's	Flash red once	
40.10.30.20		All LED's	Flash green once	
40.10.30.30		LCD	"On1, On2, On3"	
40.10.30.40			"LECTro"	
40.10.30.50		LED's	Audio off, PWR green	
40.10.30.60		LCD	(block & firmware version ID)	
40.10.30.70		LCD	"CP - -"	
40.10.30.80		LCD	Audio gain setting (usually "Aud 0")	
Note	LCD occasionally may flash "PLL" to indicate PLL not locked (audio board block number assignment may not be set up at this point)			
40.10.40	Measure current draw		30 to 1000 mA	
Note	The goal here is to be sure the transmitter is powered up and is not burning up with fever. A tighter tolerance current draw measurement will be made later			
40.10.50.10	Press and hold the UP switch			
40.10.50.20	buttons?		" 1 "	(1)
40.10.50.30	Release the UP switch			
40.10.60.10	Press and hold the DOWN switch			
40.10.60.20	buttons?		" 2 "	(2)
40.10.60.30	Release the DOWN switch			
40.10.70.10	Press and hold the FREQ switch			
40.10.70.20	buttons?		" 4 "	(4)
40.10.70.30	Release the FREQ switch			
40.10.80.10	Press and hold the AUDIO switch			
40.10.80.20	buttons?		" 8 "	(8)
40.10.80.30	Release the AUDIO switch			
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40.20	<u>DC voltage measurements</u>			
40.20.10.1.8VC	Measure DC voltage at audio board:	TP17 (1.8VC)	+1.7 to +1.9 VDC	(+1.8)
40.20.10.+3.3V_PIC		L4, C58 jet (+3.3V_PIC)	+3.1 to+3.5 VDC	(+3.32)
40.20.10.+3.3V_DSP		TP14 (+3.3V_DSP)	+3.1 to+3.5 VDC	(+3.32)
40.20.10.LGB		TP6 (low gain branch)	+1.39 to +1.59 VDC	(+1.49)
40.20.10.HGB		TP15 (high gain branch)	TP6 value +/- 50 mVDC	(+10mV)
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40.30	<u>Phantom power DC voltage measurements</u>			
40.30.10	Audio input rig (see ~ below) connected to audio board J1			
40.30.20.4V	Measure DC voltage at audio input rig TP1 with:	4V phantom selected (phantom=2)	+4.3 to +4.5 VDC	(+4.4)
40.30.20.2V		2V phantom selected (phantom=1)	+1.9 to +2.1 VDC	(+2.0)
40.30.20.0V		OFF phantom selected (phantom=0)	-0.1 to +0.1 VDC	(0)
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40.40	<u>Audio board frequency block assignment</u>			
Prerequisite(s):	Unit in factory test mode (power unit up with audio board TP5 or TP8 (TEST) connected to circuit common) if menu is used, not required if LectroLink is used			
Note	If the appropriate frequency block number is not found in the menu, the alternate (Lectrolink) method must be used			
40.40.10	Press test panel key pad AUD button until LCD reads block number (usually "b 470 ")			
40.40.20	Press test panel key pad UP or DWN button to assign appropriate frequency block			

Note	If the Lectrolink apparatus is used to assign the block number, DUT power must be cycled thereafter or the PLL/VCO loop will not function as prescribed.	
40.40.10	block=	Legal values are: 470, 19-33, 944, 400-999
40.40.20	Cycle DUT power	

40.50	<u>VCO adjustment & VCO start-up test</u>	
40.50.10	Navigate menu so LCD reads Aud	
40.50.20.10	Press test panel key pad FREQ button twice, LCD reads "CH--"	
40.50.20.20	Press test panel key pad FREQ and UP or DWN button to select highest carrier frequency	
40.50.20	channel=	assign highest carrier freq.
40.50.30	Adjust radio board C23 for 2.5 VDC at radio board TP1 (VCO_CONT)	+2.45 to +2.55 VDC (+2.5)
40.50.40(HF/LF)	Remove DC power from DUT	
40.50.50(HF/LF)	Wait 3 sec.	
40.50.60(HF/LF)	Restore DC power to DUT	
40.50.70(HF/LF)	Measure carrier signal power to be sure the VCO starts on power up at selected carrier frequency	≥ +10 dBm
40.50.80	Press test panel key pad FREQ and UP or DWN button to select lowest carrier frequency	
40.50.80	channel=	assign lowest carrier freq.
40.50.90	Measure DC voltage at radio board TP1 (VCO_CONT)	+0.6 to +1.2 VDC
40.50.100	Repeat test sub-steps #40.50.40 through #40.50.70 (VCO start-up) then proceed	

40.60	<u>Carrier signal power adjustments</u>	
Note	If the LectroLink tool is used to perform all DUT manipulations, it is not necessary for the DUT to be in Factory mode to perform this step.	
40.60.10	Press test panel keypad AUD switch until LCD displays P_XXX (carrier power menu, 50mW, lowest carrier freq.)	
Note	This sets the DUT to 50mW carrier power at the lowest carrier frequency, from here pressing the FREQ switch once will move to the middle carrier freq. pressing it again moves to the highest freq. Once more moves to 100mW at the lowest freq and the pattern continues until 250mW, high freq is achieved then the pattern repeats. At each power/freq setting the UP /DOWN switches adjust carrier power.	
40.60.20	Repeatedly press UP or DOWN switch to achieve target carrier power at radio board P1-1 (P1-2 is common)	Target +/- 0.3dB
Note	Later firmware packages support "press and hold" functionality, not sure at what firmware version this became available	
40.60.30	Measure spectral purity (spurs) carrier freq. +/- 350 MHz	≤ -70 dBm
40.60.40	Measure current draw	
40.60.50	Repeat this process until all 9 carrier signal power points have been adjusted and double checked after the last adjustment has been made	

Current draw tolerances for test procedure segment #30			Carrier signal power targets for test procedure segment #30			
50mW	100mW	250mW		50mW	100mW	250mW
300 to 500 mA (400)	395 to 535 mA (465)	600 to 900 mA (750)	WM	+17dBm	+20dBm	+24dBm
			WM/E01	+16.8dBm	+20dBm	+24dBm

Note	Carrier power may alternatively be adjusted by first querrying the powercal value "powercal(50,0)?" and subsequently incrementing or decrementing carrier power using "p=+2" syntax.	
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40.70	<u>Modulation level and distortion adjust</u>	
Prerequisite(s):	Unit in factory test mode (power unit up with audio board TP5 or TP8 (TEST) connected to circuit common) DUT to 100 mW carrier power	
40.70.10	Press AUD button on the test panel key pad until LCD reads"d80 " ("dAb" for B1779)	
40.70.20	Adjust radio board R19 for minimum modulation distortion at demodulated carrier at radio board P1-1 (P2-1 is circuit common) (beware the possibility of two "sweet spots", one better than the other)	≤ 1.0 % THD+N (0.7)
40.70.30	Adjust radio board R47 for 100kHz deviation at radio board P1-1 (P2-1 is circuit common)	99 to 101 kHz dev (100)
40.70.40	Repeat steps #40.70.20 and #40.70.30 until no further adjustments are required	
40.70.50	Press FREQ button on the test panel key panel until LCD reads "d00 00 "	
40.70.60	Measure distortion at demodulated carrier, fine adjusting radio board R19 if required	≤ 1.2 % THD+N (0.7)
40.70.70	Press UP or DWN button on the test panel key pad for 100 kHz peak carrier deviation at radio board P1-1 (P2-1 is circuit common)	98 to 102 kHz dev (100)

40.70.80	Press FREQ button on the test panel key pad until LCD reads "dFF 00 " ("dAb" for BL779)		
40.70.90	Measure distortion at demodulated carrier, fine adjusting radio board R19 if required	≤ 1.2 % THD+N	(0.7)
40.70.100	Press UP or DWN button on the test panel key pad for 100 kHz peak carrier deviation at radio board P1-1 (P2-1 is circuit common)	98 to 102 kHz dev	(100)
40.70.110	Repeat steps #40.70.10 through #40.70.100 until no further adjustment is necessary (maximum of three times)		
40.70.120	Press AUD button on the test panel key pad until LCD reads "AUD 0"		
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40.80	<u>High pass filter set / and Frequency adjust</u>		
Prerequisite(s):	Unit in factory test mode (power unit up with audio board TP5 or TP8 (TEST) connected to circuit common) DUT to 100 mW carrier power		
40.80.10	Press AUD button on the test panel key pad until LCD reads "LF 35" If LCD reads anything other than "LF 35" simultaneously press the DWN and AUD button on the test panel key pad to change it to "LF 35".		
40.80.20	Press AUD button on the test panel key pad until carrier frequency selection menu (F xx) is arrived at		
40.80.30	Press FREQ button on the test panel key pad until LCD indicated lowest carrier frequency is selected		
40.80.40	Press UP or DWN button on the test panel key pad to fine adjust carrier signal frequency at the low end of the frequency block	Target +/- 2kHz	
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40.90	<u>Pilot signal deviation & frequency measurements</u>		
Prerequisite(s):	Unit in factory test mode (power unit up with audio board TP5 or TP8 (TEST) connected to circuit common) DUT to 100 mW carrier power, lowest carrier frequency Lowest carrier frequency selected		
40.90.10	No audio signal in at audio input rig		
40.90.20	Press AUD button on the test panel key pad until LCD reads "CP - - -"		
40.90.30	Press UP button on the test panel key pad until LCD reads "CP400"		
40.90.40	AUD set to "Aud 0"		
40.90.50	Measure peak carrier deviation at radio board P1-1	4.5 to 6.5 kHz	(5.5)
40.90.60	Measure pilot signal frequency at demodulated carrier at radio board P1-1	31.999 to 32.001 kHz	(32000)
Note	Step #40.90.60 checks out the DSP clock signal frequency which in this case is common with the µC IC clock		
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40.100	<u>Noise measurements (low gain branch)</u>		
Prerequisite(s):	Unit in factory test mode (power unit up with audio board TP5 or TP8 (TEST) connected to circuit common) DUT to 100 mW carrier power No audio signal in at audio input rig		
40.100.10	Press AUD button on the test panel key pad until LCD reads "CP 400"		
40.100.20	Press UP button on the test panel key pad until LCD reads "CP--"		
40.100.30	Press AUD button on the test panel key pad twice then FREQ button twice		
40.100.40	Press FREQ and DWN button simultaneously to change frequency to "CH -- " (top of band)		
40.100.50.OFF_PHANTOM	Measure noise signal amplitude at audio board TP6 with:	OFF phantom selected (phantom=0)	-90 dBu max. (-95)
40.100.50.4V_PHANTOM		4V phantom selected (phantom=2)	-90 dBu max. (-95)
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40.110	<u>Noise & microphonics measurements (high gain branch)</u>		
Prerequisite(s):	Unit in factory test mode (power unit up with audio board TP5 or TP8 (TEST) connected to circuit common) DUT to 100 mW carrier power No audio signal in at audio input rig CP---		
40.110.10	FREQ set to "CH -- " (top of band)		
40.110.20	AUD set to "Aud 0"		
40.110.30	Measure and note noise signal amplitude of demodulated carrier at radio board P1-1	≤-58.5 dBu	(-62)
40.110.40	Repeatedly & gently tap side of radio board farthest from the VCO and watch for disturbances in noise signal	Noise to Noise + 18dB	(+12)
40.110.50	Press AUD and UP button simultaneously to change audio level to "Aud 44"		
40.110.60	Measure noise signal amplitude of demodulated carrier at radio board P1-1	≤-55.5 dBu	(-59)
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40.120	<u>Mic gain pot taper test</u>		

Prerequisite(s):	Unit in factory mode DUT to 100 mW carrier power CP---		
	FREQ set to "CH -- " (top of band) Audio set to "Aud 44"		
40.120.10	-50 dBu, 1kHz, low distortion, sinusoidal signal in at audio input rig		
Note	Neither audio board LED (D5 nor D6) are red (limiter not activated)		
40.120.20.AUD44	Measure audio signal level at demodulated carrier at radio board P1-1	Audio set to "Aud 44"	reference for remainder of step
40.120.20.AUD22		Audio set to "Aud 22 "	Ref - 20 to Ref - 24dB (-22)
40.120.20.AUD0		Audio set to "Aud 0"	Ref - 41.5 to Ref - 45.5 dB (-43.5)

40.130	<u>Modulation distortion measurement</u>		
Prerequisite(s):	Unit in factory test mode (power unit up with audio board TP5 or TP8 (TEST) connected to circuit common) DUT to 100 mW carrier power Lowest carrier frequency selected CP---		
	Audio Level set to "Aud 00"		
40.130.10	-10 dBu, 1kHz, low distortion, sinusoidal signal in at audio input rig		
40.130.20	Neither keypad audio LED are red (limiter not activated)		
40.130.30.HF	Measure audio signal distortion of the demodulated carrier radio board RF P1-1 at carrier frequency:	"CH -- " (top of band)	≤ 0.7% THD+N (0.25)
40.130.30.LF		"CH -- " (bottom of band)	≤ 0.7% THD+N (0.25)
40.130.30.MF		"CH -- " (middle of band)	≤ 0.7% THD+N (0.25)

40.140	<u>Limiting range adjust / and -10 Limiter light adjust</u>		
Prerequisite(s):	Unit in factory test mode (power unit up with audio board TP5 or TP8 (TEST) connected to circuit common) DUT to 100 mW carrier power CP---		
	Frequency set to "CH -- " (middle of band)		
40.140.10	-30 dBu, 1kHz, low distortion, sinusoidal signal in at audio input rig		
40.140.20	Press AUD button on the test panel key pad until LCD screen reads "Aud 0"		
40.140.30	Press AUD and UP button simultaneously to change audio level to "Aud 22 "		
40.140.40	Neither keypad audio LED are red (limiter not activated)		
40.140.50	Press AUD button on the test panel key pad until LCD screen reads "Lr "		
40.140.60	Measure and record audio signal amplitude at demodulated carrier RF P1-1		Reference for remainder of step
40.140.70	Press FRQ button on the test panel key pad until LCD screen reads "LS 00"		
40.140.80	Press UP or DWN button for 5 dB below reference amplitude		Reference value - (3.5 to 6.5) dB (-5)
40.140.90	Press FRQ button on the test panel key pad until LCD screen reads "L 10"		
40.140.100	Increase stimulus signal amplitude in 1dB increments until ? changes from green to red		
40.140.110	? typically switches from green to red with about -27 dBu +/- 1 dB applied to audio input rig		
40.140.120	Increase audio signal at DUT input amplitude by 10 dB		
40.140.130	Press the UP button on the test panel key pad to set -10 LED		
40.140.140	If keypad ? is red decrease 1kHz signal at input rig by 2 dB and verify that audio board ? switches to green, if so skip to next step		
40.140.150	If keypad ? is green increase 1kHz signal at input rig by 2 dB and verify that audio board ? switches to red, if so skip to next step		
40.140.160	If neither test sub-steps #40.140.140 nor #10.140.150 are true repeat this step (maximum of three times)		
40.140.170	Press AUD button on the test panel key pad until LCD screen reads "Aud 22 "		

40.150	<u>Frequency response measurement (low gain branch) & LF rolloff pot taper</u>		
Prerequisite(s):	Unit in factory test mode (power unit up with audio board TP5 or TP8 (TEST) connected to circuit common) DUT to 100 mW carrier power		

	CP---			
	Frequency set to "CH -- " (middle of band)			
	4V phantom selected (menu)			
	LF filter set to "LF 35"			
	Audio level set to "AUD 22"			
40.150.10	-50 dBu, 1kHz, low distortion, sinusoidal signal in at audio input rig			
Note	Neither audio board LED (D5 nor D6) are red (limiter not activated)			
40.150.20.20kHz	Measure frequency response of demodulated carrier (1kHz ref) at 20 kHz RF J3		-3.9 to +0.1 dB	(-1.9)
40.150.20.10kHz		10 kHz	-1.7 to +0.3 dB	(-0.3)
40.150.20.100Hz		100 Hz	-1.1 to +0.9 dB	(-0.1)
40.150.20.50Hz		50 Hz	-1.7 to +1.3 dB	(-0.2)
40.150.20.31.5Hz		31.5Hz	-5.5 to -1.5 db	(-3.5)
40.150.60	Press AUD button on the test panel key pad until LCD screen reads "LF 35"			
40.150.70	Press AUD and UP button simultaneously to change HPF to "LF 150"			
40.150.80		31.5 Hz	-18 to -14 dB	(-16)
40.150.90	Press AUD and DWN button simultaneously to change HPF to "LF 70 "			
40.150.100		31.5 Hz	-13 to -9 dB	(-11)
40.150.110	Press AUD and DWN button simultaneously to change HPF to "LF 35 "			
40.150.120	OFF phantom selected (menu)	31.5 Hz	-3.3 to +0.7 dB	(-1.3)
<hr/>				
40.160	<u>Frequency response measurement (High gain branch)</u>			
Prerequisite(s)	Unit in Factory Mode DUT to 100 mW carrier power CP---			
	Frequency set to "CH -- " (middle of band)			
	LF filter set to "LF 35"			
	Audio level set to "AUD 22"			
	OFF phantom selected			
Note	Neither keypad audio LED are on.			
40.160.20	-65 dBu, 1kHz, low distortion, sinusoidal signal in at audio input rig			
40.160.30.20kHz	Measure frequency response TP15 (1kHz ref)	20 kHz	-3 to +0.1 dB	(-1)
40.160.30.10kHz		10 kHz	-1.7 to +0.3 dB	(-0.3)
40.160.30.100Hz		100 Hz	-1.1 to +0.9 dB	(-0.1)
40.160.30.50.31.5Hz		31.5 Hz	-4.7 to -0.7 dB	(-2.7)
<hr/>				
40.170	<u>Audio signal level and distortion measurements (high gain)</u>			
Prerequisite(s)	Unit in Factory Mode DUT to 100 mW carrier power CP---			
	Frequency set to "CH -- " (middle of band)			
	0V phantom selected (menu)			
	LF filter set to "LF 35"			
	Audio level set to "AUD 22"			
Note	Neither audio board LED (D5 nor D6) are on -65 dBu, 1kHz, low distortion, sinusoidal signal in at audio input rig			
Note	Neither LED (D5 nor D6) are red (limiter not activated)			
40.170.10	Measure audio signal amplitude at TP15		-27 to -23 dBu	(-25)
40.170.20	Measure audio signal distortion TP15		≤1.0% THD+N	(0.7)
40.170.30	Measure audio signal amplitude at TP6		TP15 value - 18 dB+/- 0.25dB	(-17.97)
<hr/>				
40.180	<u>Audio signal phase response measurement</u>			
Prerequisite(s)	Unit in Factory Mode DUT to 100 mW carrier power			

	CP---			
	Frequency set to "CH -- " (middle of band)			
	OFF phantom selected			
	LF filter set to "LF 35"			
	Audio level set to "AUD 22"			
40.180.10	-20 dBu, 1kHz, low distortion, sinusoidal signal in at audio input rig			
Note	Only one audio LED red (limiter activated)			
40.180.20	Measure phase of the demodulated carrier at the output of	20kHz	?	(-18)
	Hewlett Packard 8901A modulation analyzer relative to the signal source (DUT input Rig) at:			
		1kHz	?	(-168)
		31.5Hz	?	(-174)
<hr/>				
40.190	<u>Battery status telemetry adjustment, battery status indicator test, power down & low voltage power up test</u>			
Prerequisite(s)	Unit in Factory Mode			
	DUT to 100 mW carrier power			
	CP---			
	Frequency set to "CH -- " (middle of band)			
40.190.10	No audio signal at DUT input			
40.190.20	+1.00 VDC, 2.5 A current limit in at radio board P4-1 (P7-1 is circuit common).			
40.190.25	Verify battery status indicator LED is flashing red/off		Red/Off	
Note	The battery status indicator LED will cease flashing when the DUT enters the battery status telemetering setup menu			
40.190.30	Press AUD button on the test panel key pad until LCD screen reads "bs_XX"			
40.190.40	Press FRQ button on the test panel key pad to shift from High (bs_XX) to low (bs_XX) Frequency on until LCD screen			
40.190.50	Press UP or DWN button on the test panel key pad to adjust for 3.5 KHz freq. shift	3.5 kHz +/- 0.1		(3.5)
40.190.70	Press AUD and FRQ button simultaneously to turn unit off			
40.190.80	Watch LCD display read "OFF ...3" and count down to 1 then go BLANK before releasing button.			
40.190.90	Measure current draw		0 to 4 mA	(?)
40.190.100	Press AUD and FREQ buttons and hold for 3 seconds before releasing buttons to turn unit ON.			
40.190.110	Measure current draw		765 to 935 mA	(850)
<hr/>				
40.200	<u>Carrier deviation, limiter distortion measurements (low gain)</u>			
Prerequisite(s)	Unit in Factory Mode			
	DUT to 100 mW carrier power			
	CP---			
	Frequency set to "CH -- " (middle of band)			
	0V phantom selected			
	LF filter set to "LF 35"			
	Audio level set to "AUD 22"			
40.200.10	+1.5 VDC, 2.5 A current limit in at radio board P4-1 (P7-1 is circuit common).			
40.200.20	-20 dBu, 1kHz, low distortion, sinusoidal signal in at audio input rig			
Note	Only one audio LED red (limiter activated)			
40.200.30	Measure peak carrier deviation at RF P1-1 with:	middle freq. selected	70 to 80 kHz	(74)
40.200.40	Measure audio signal distortion at demodulated carrier at RF P1-1 output		≤ 1% THD+N	(0.3)
<hr/>				
40.210	<u>Current draw measurement, power down test, & carrier deviation measurement (pilot and compressor on)</u>			
Prerequisite(s)	DUT to 100 mW carrier power			
	Frequency set to "CH -- " (middle of band)			
	0V phantom selected (menu)			
	Audio level set to "AUD 22"			
	LF filter set to "LF 35"			
	-20 dBu, 1kHz, low distortion, sinusoidal signal in at audio input rig			
40.210.10	Press AUD button on the test panel key pad until LCD reads "CP - - -"			
40.210.20	Press UP button on the test panel key pad until LCD reads "CP400"			
WARNING!	DO NOT SWITCH OFF THE TRANSMITTER USING THE KEYPAD, THIS IS LIKELY TO RESULT IN REMOVING 400 MODE FROM THE MENU!			

40.210.30	Measure current draw	504 to 616 mA	(560)
40.210.40	Remove DC power from DUT		
40.210.50	Press AUD and FREQ buttons and hold for 3 seconds before releasing buttons to turn unit ON.		
40.210.60	Adjust audio input at input Rig so -20 LED just switches from GREEN to RED, (-10 LED is GREEN)		
40.210.70	Measure peak carrier deviation at RF P1-1	42 to 48 KHz	(45)
40.210.80	-10 dBu, 1kHz, low distortion, sinusoidal signal in at audio input rig		
40.210.90	Measure peak carrier deviation at RF P1-1 with:	middle freq. selected	47 to 53 KHz (50)
40.220.SM(D)B/E01	Set DUT to 50mW carrier power setting		
40.230.SM(D)B/E01	Set DUT to hybrid 'Hbr' compatibility mode		

40.220 Set up carrier power & compatibility mode menus

Note It is not yet know to the author if/how this step may be performed other than by the LectroLink method

40.220.10.WM/E01	Set DUT to 50mW carrier power setting		
40.230.20.WM/E01	Set DUT to hybrid 'Hbr' compatibility mode		
40.220.30.WM	enablep=		7
40.220.30.WM/E01			1
40.220.40.WM	enablec=		126
40.220.40.WM/E01			3072
40.220.50.WM	enablep?		7
40.220.50.WM/E01			1
40.220.60.WM	enablec?		126 (7E)
40.220.60.WM/E01			3072 (C00)

WARNING! If the transmitter is in a menu that permits menu configuration, pressing buttons may result in unintended menu reconfiguration. It is best not to press any buttons at this time. Power the transmitter down by removing the power supply connection.

Audio input rig

