DANIELS™
ELECTRONICS LTD.

Appendix A:
IFR 1200 Test Procedures

MAINTENANCE GUIDE

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Contents

Appendix A: IFR 1200 Test Procedures 1
MT-4E Testing with the IFR 1200 by Aeroflex 1
General Set-Up and Connections 2
Radio Service Software (RSS) 2
Control Cards 2
Turning OFF the MT-4E Receiver and Transmitter Modules 2
Adapters, Cables and Extender Cards 3
Audio Connections 3
Daniels MT-4E Radio System Test Sheet 3
System Regulator Testing 4
System Voltage Testing 4
Receiver Testing 5
Audio Distortion 6
Reference Sensitivity 6
Squelch 7
Audio Level 7
RF Preselector Alignment and Tuning 9
Reference Oscillator Adjustment 10
Transmitter Testing 13
Audio Distortion 14
RF Power 14
Reference Oscillator Adjustment 15
Deviation Level 15
CTCSS Testing 17
System Testing 19
Distortion 20
Deviation Level 21

APPENDIX A: IFR 1200 TEST PROCEDURES

MT-4E TESTING WITH THE IFR 1200 BY AEROFLEX

This Chapter contains instructions for Tuning, Testing, Maintaining and Servicing MT-4E Analog and P25 Digital Radio Systems with the IFR 1200 by Aeroflex.

This Chapter is intended as an aid to configuring and testing Daniels MT-4E radios using an IFR 1200 Service Monitor by Aeroflex. Neither Daniels Electronics Ltd. or Aeroflex Inc. assume responsibility for damage caused to either unit as a result of misinterpretation or misuse of this procedure. Daniels manufactured products are warranted against defective materials and workmanship. This warranty does not extend to damage due to misuse, neglect, accident, improper configuration or installation. Daniels and Aeroflex shall be released from all obligations under its respective warranty in the event the Products are subject to misuse, neglect, alteration, accident, improper installation or testing, or if unauthorized repairs are performed by the customer or others.

These procedures can be modified, changed and altered at any time to better suit your specific needs and requirements. Refer to Daniels Electronics Instruction Manuals for complete radio system specifications.

GENERAL SET-UP AND CONNECTIONS

Radio Service Software (RSS)

Start the RSS program on the computer and ensure you are connected to the receiver or transmitter via the type A to 5 pin mini-type B USB cable. Read the transmitter or receiver programming and familiarize yourself with the settings (RF frequency, wide / narrowband, digital / analog, CTCSS / NAC, etc.).

Control Cards

Some Daniels MT-4E radio systems may have an AC-3E Audio Control Card or CI-BC-4E Base Control Card for use in the radio system. The Control Cards connect to the receiver and transmitter balanced audio lines with an unbalanced load, which could cause some measurements to be in error. If the radio system includes an AC-3E Audio Control Card or CI-BC-4E Base Control Card, remove the control card from the rack for the individual receiver and transmitter tests unless otherwise noted.

Turning OFF the MT-4E Receiver and Transmitter Modules

Turning the switch on the front panel of the MT-4E receiver or transmitter modules to the OFF position can cause unwanted effects on other MT-4E receiver and transmitter modules.

When the MT-4E receiver and transmitter are connected directly together with the LVDS serial data RJ45 cable, turning the MT-4E transmitter front panel switch to the OFF position will cause the MT-4E receiver module to turn off. The MT-4E receiver modules A and D LEDs on the front panel will blink on and off when this occurs. Turning the MT-4E receiver modules front panel switch to the OFF position will not cause any adverse effects on the MT-4E transmitter. When turning the MT-4E receiver modules front panel switch from the OFF to NORM position (or vice versa), it will cause the MT-4E transmitter to reboot. Remove the RJ45 cable to stop this interaction from occurring. When connecting the LVDS serial data RJ45 cables to the CI-RC-4L repeater control card or CI-RC-4M multiple link controller, the MT-4E receiver and transmitter modules are isolated from each other and the modules can be turned on or off independently of each other.

When the MT-4E receiver and transmitter channel and bank select lines are connected together in parallel, turning the MT-4E receiver or transmitter front panel switch to the OFF position will cause the channel and bank select lines to be grounded. This will cause the other MT-4E module to operate on Bank B, Channel 1 regardless of how the channel and bank select lines are set. If the bank select lines are not connected in parallel, only the channel will be affected. The channel select lines are independent of the LVDS serial data RJ45 cables (the cables will have no impact on the channel select).

When the MT-4E receiver and transmitter are connected to the antenna relay in the System Regulator module, turning the MT-4E transmitter front panel switch to the OFF position will cause the MT-4E transmitter PTT OUT line to be grounded, activating the antenna relay and causing it to be switched so that the transmitter is connected to the antenna. This makes it impossible to test the MT-4E receiver through the antenna relay when the MT-4E transmitter is turned off.

When performing maintenance on the Daniels MT-4E radio system it is best to simply remove the MT-4E receiver or transmitter, that is not being tested, from the subrack and disconnect all RJ45 cables, rather than turning the front panel switch to the OFF position. All Daniels modules are hot swappable. There is no need to disconnect the power supply when inserting or removing the modules from the subrack.

Adapters, Cables and Extender Cards

Various adapters, cables and extender cards are required for the different radio tests. Extender cards and adapters are available from Daniels Electronics. The receiver reference oscillator and RF preselector filter tests require an SMB - BNC adapter and a small SMB - SMB cable is required for the reference oscillator test as well. The SMB adapters and cables are included in the A-TK-04 Tool Kit.

Audio Connections

The Receiver, Transmitter and Auxiliary Balanced audio lines are available for connection on Daniels extender cards or by connecting to the optional back panel A-PNL-AUX96-3 screw-type terminal connector. The extender cards have solder points available on each signal line that can have a small test point, (5059-TP110300) that is supplied with the extender card, soldered to them for easy connection with clip-on type clips. Recommended Test Points are:

Audio Control Card and Base Control Card Extender Card pins (EC-96D1 and EC-96K-1.22):
Auxiliary 1 Audio Output = B11 and A11
Auxiliary 2 Audio Output = C1 and C3 (Audio Control Card); C2 and C4 (Base Control Card)
Auxiliary 1 Audio Input = C19 and C20
Auxiliary 2 Audio Input = B14 and A14

Receiver and Transmitter Extender Card pins (EC-48RD and EC-48RK-1.22):
Rx Balanced Audio Output = B26 and Z26
Tx Balanced Audio Input = B18 and Z18
Tx Subtone Input = B22 and Ground (B32)

The test points can be soldered into the extender cards as shown in Figure A-1.

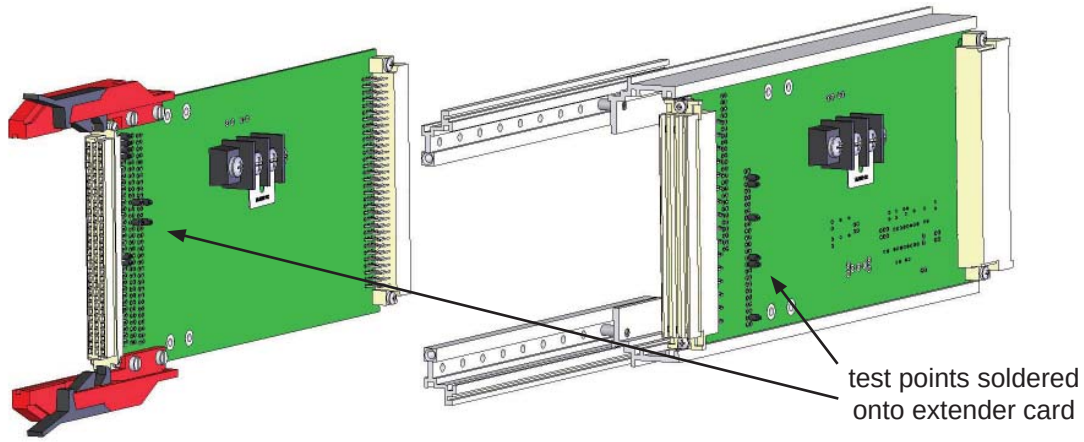

Figure A-1: EC-96D1 and EC-48RD Direct Connect Extender Cards with Test Points Added

Daniels MT-4E Radio System Test Sheet

A Daniels MT-4E Radio System Test Sheet is included in Chapter 7 of the Maintenance Guide. It is recommended that this test sheet be filled out each time the radio system is tested. If two or more pairs of transceivers are tested, use a second test sheet to record the results. The test sheet will record settings for a single Tx and Rx frequency, however other frequencies can be tested and recorded if desired.

SYSTEM REGULATOR TESTING

System Voltage Testing

The first stage of testing a Daniels MT-4E radio system is to perform a basic system check on the supply and regulated voltages. The System Regulator module is designed with a convenient and easy test point built into the front panel. This test point allows a technician access to the DC supply and regulated voltages. Simply connect a standard Digital Volt Meter (DVM) to the METER jacks on the front panel of the System Regulator as shown in Figure A-2.

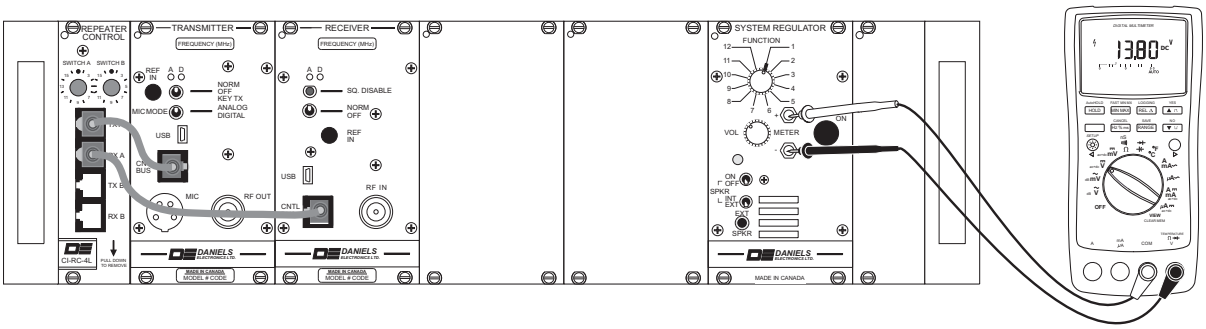

Figure A-2: System Regulator Voltage Testing

The FUNCTION rotary switch on the front panel of the System Regulator will allow you to test various points in the radio system. Following is a list of System Regulator rotary switch positions, the functions they measure and the parameters measured:

1	Supply Voltage	+10 Vdc to +17 Vdc (+13.8 Vdc nominal)
2	+9.5 Volts Regulated	+9.5 Vdc (± 0.1 Vdc)
3	Rx A Audio	Receiver A Audio (NOT Rx Balanced Output)
4	Rx A Carrier Strength	0 Vdc to +5.0 Vdc based on received signal strength (0 Vdc is a low RF signal level, +5.0 Vdc is high)
5	Rx B Audio	Receiver B Audio (NOT Rx Balanced Output)
6	Rx B Carrier Strength	0 Vdc to +5.0 Vdc based on received signal strength (0 Vdc is a low RF signal level, +5.0 Vdc is high)

Enter the Supply Voltage and +9.5 Volts Regulated values on the MT-4E Test Sheet and inject a -100 dBm carrier signal into the Receiver and record the RSSI Voltage on the MT-4E Test Sheet. Enter the Date, Firmware Versions and Serial numbers of the Receivers and Transmitters on the MT-4E Test Sheet. The Firmware Version and Serial Number can be found by connecting the RSS and clicking on Rx ID or Tx ID. The Serial Numbers can also be found on the side of the modules.

The standby current draw of the radio system should be measured for battery / solar powered systems. Connect an ammeter to the power input line and measure the standby current draw and transmit current draw of the system. Enter the Standby Current Draw and Transmit Current Draw readings on the MT-4E Test Sheet. The maximum standby and transmit current draw is dependent on the radio system (number and class of receivers, transmitter output power, amplifiers, auxiliary equipment, etc.).

RECEIVER TESTING

Connect the IFR 1200 and Daniels Radio as shown in Figure A-3:

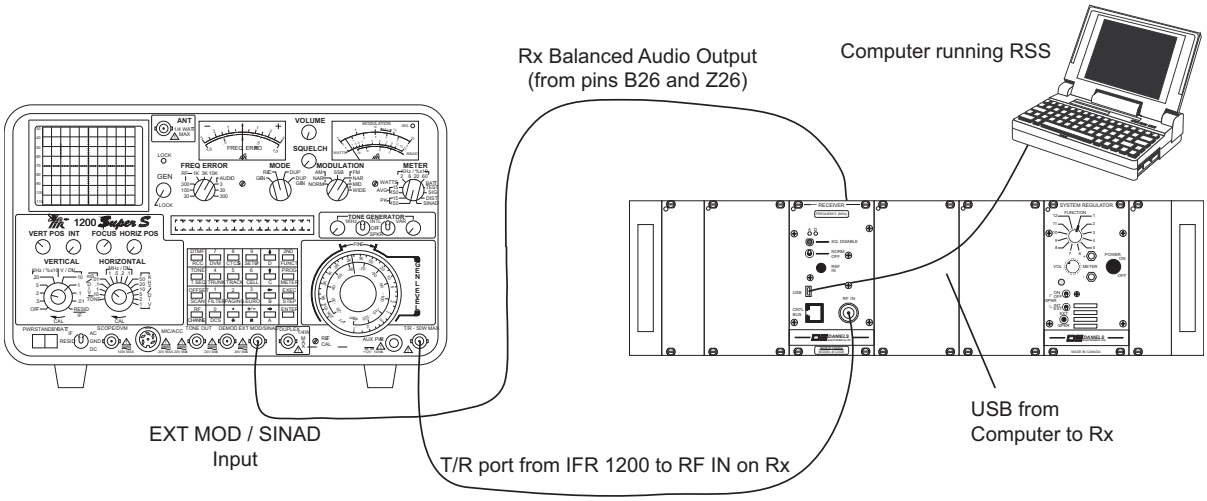

Figure A-3: Receiver Testing

Set up the IFR 1200 as follows:

1. Temporarily unplug the EXT MOD / SINAD input.
2. Set the MODE switch to GEN.
3. Set the MODULATION switch to FM NAR.
4. Set the METER switch to 6 (Khz/%x10).
5. Set the GEN LEVEL dial to -70 dBm.
6. Push the RF button on the keypad and input the Receiver RF frequency.
7. Push 2ND FUNCT then METER (PROG) on the keypad.
8. On the TONE GENERATOR area turn the 1 KHz tone ON (up).
9. Adjust the 1 KHz variable level knob until the meter reads +/- 60% maximum deviation (+/- 1.5 KHz (narrowband) or +/- 3.0 KHz (wideband)).

Enter the correct CTCSS tone (if used) and deviation level for the tone.

10. On the TONE GENERATOR area turn the 1 KHz tone OFF (down) and turn the VAR tone ON (up).
11. Push TONE and enter the CTCSS decode tone, then ENTER on the keypad.
12. Push 2ND FUNCT then METER (PROG) on the keypad.
13. Adjust the VAR variable level knob until the meter reads a deviation of +/- 0.35 KHz (narrowband) or +/- 0.50 KHz (wideband).
14. On the TONE GENERATOR area turn the 1 KHz tone ON (up).

On the Daniels Radio system, ensure the receiver is turned on and turn the System Regulator Speaker switch to ON and INT. Set the FUNCTION rotary switch to position 3 for Rx A or position 5 for Rx B (depending on the receiver being tested), then turn the volume up until the 1 KHz tone is audible.

In the Jumper Settings area of the Service section on the RSS, ensure that the “Subtones on audio path” selection is set to “Don’t pass” as shown in Figure A-4. The IFR 1200 will conduct all tests with CTCSS tones on the audio, giving erroneous measurements, if the Subtones are set to “Pass”.

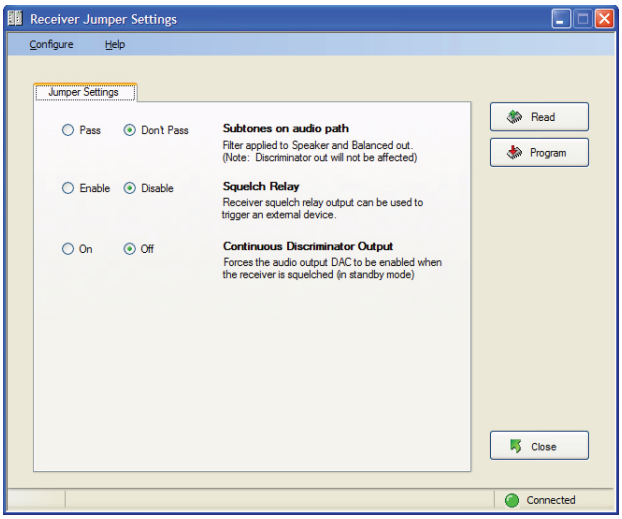

Figure A-4: RSS Subtone Settings

Audio Distortion

To check the receiver distortion, set the METER switch to DIST. Plug the EXT MOD / SINAD input back into the IFR1200. Receiver audio distortion is typically less than 2.0 %. Please note that the IFR 1200 does not have the proper bandpass filter for a true Audio Distortion measurement according to TIA-603-C. The distortion reading will be slightly higher than normal when read using an IFR 1200.

Enter the Audio Distortion reading on the MT-4E Test Sheet.

Reference Sensitivity

To check the receiver sensitivity, set the METER switch to SINAD. If not done already, plug the EXT MOD / SINAD input back into the IFR1200. Slowly turn the GEN LEVEL dial down to lower RF generator levels while monitoring the SINAD meter. The 12 dB SINAD point should be at an RF carrier level less than the specified Analog Sensitivity point of the receiver.

Enter the Reference Sensitivity (12 dB SINAD) reading on the MT-4E Test Sheet.

If the distortion or reference sensitivity measurements are not within Daniels published specifications, the RF Preselector may need re-alignment. Refer to the Receiver RF Preselector Alignment and Tuning section.

Squelch

Adjust the RF carrier level up and down until the receiver squelches and unsquelches. There should be approximately 6.0 dBm of hysteresis between the squelch and unsquelch points. The squelch point can be adjusted in the Squelch Levels area of the Service section on the RSS.

The Receiver operates on a Noise based squelch (default) or a Received Signal Strength based squelch (optional). The squelch can be set globally for all channels, or on a per channel basis. To set the squelch Open and Close points, inject an RF signal at the desired Open or Close level and click the Set button.

Enter the Squelch and Unsquelch readings on the MT-4E Test Sheet.

Audio Level

The audio level adjustment is not required when connecting the receiver in a repeater configuration using LVDS Serial Data. The audio level adjustment can be done on both the Rx Balanced Audio Output and the Auxiliary Balanced Output (1 and 2). The Auxiliary Balanced Output is only available on the AC-3E Control Card or CI-BC-4E Base Control Card. The Receiver and Auxiliary Balanced Audio Outputs are 600 ohm balanced audio outputs and will require an external 600 ohm matching load before an accurate measurement of the audio level can be performed by the IFR 1200.

Set up the IFR 1200 as follows:

1. Set the GEN LEVEL dial to -70 dBm.
2. Set the METER switch to 6 (Khz/%x10).
3. Push 2ND FUNCT then METER (PROG) on the keypad.
4. On the TONE GENERATOR area turn the 1 KHz tone ON (up).
5. Adjust the 1 KHz variable level knob until the meter reads +/- 60% maximum deviation (+/- 1.5 KHz (narrowband) or +/- 3.0 KHz (wideband)).

Enter the correct CTCSS tone (if used) and deviation level for the tone.

9. On the TONE GENERATOR area turn the 1 KHz tone OFF (down) and turn the VAR tone ON (up).
10. Push TONE and enter the CTCSS decode tone, then ENTER on the keypad.
11. Push 2ND FUNCT then METER (PROG) on the keypad.
12. Adjust the VAR variable level knob until the meter reads a deviation of +/- 0.35 KHz (narrowband) or +/- 0.50 KHz (wideband).
13. On the TONE GENERATOR area turn the 1 KHz tone ON (up).

Receiver Balanced Audio Output:

1. Ensure the receiver is turned on and the AC-3E Control Card or CI-BC-4E Base Control Card is NOT plugged into the subrack.

2. Disconnect the Rx Balanced Audio Output from the EXT MOD/SINAD connector and connect it to the SCOPE/DVM input on the IFR 1200.

3. Push 2ND FUNCT then DVM (7) on the IFR 1200 keypad.

4. If the DVM meter is reading a DC voltage, push +/- on the keypad to toggle between DC and AC Voltmeter.

5. In the Audio Levels area of the Service section on the RSS, adjust the Rx Balanced Audio Output level adjustment as shown in Figure A-5 until -8.0 dBm audio level (0.308 Vrms @ 600 ohms) is measured on the DVM meter of the IFR 1200. If no external 600 ohm load is available, the audio level could be adjusted for approximately 0.585 Vrms in the IFR 1200.

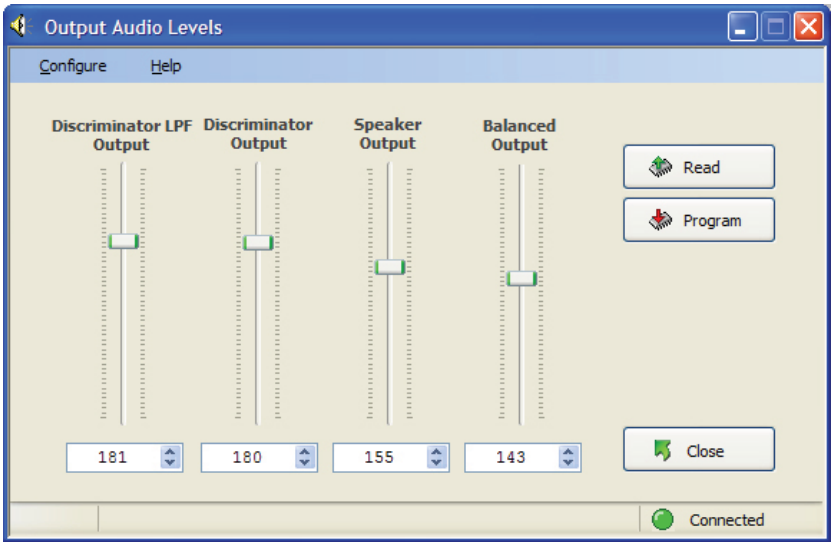

Figure A-5: RSS Receiver Audio Level Adjustment

Auxiliary Balanced Audio Output (1 or 2):

1. Ensure the receiver is turned on and the AC-3E Control Card or CI-BC-4E Base Control Card IS plugged into the subrack using an extender card. Ensure that NO external devices (eg. tone remote adapter or IP router) are connected to the auxiliary audio output.

2. Connect the Auxiliary Balanced Audio Output to the SCOPE/DVM input on the IFR 1200. Auxiliary 1 audio output is available on pins B11 and A11, and Auxiliary 2 audio output is available on pins C1 and C3 for the AC-3E Control Card and pins C2 and C4 for the CI-BC-4E Base Control Card.

3. Push 2ND FUNCT then DVM (7) on the IFR 1200 keypad.

4. If the DVM meter is reading a DC voltage, push +/- on the keypad to toggle between DC and AC Voltmeter.

5. Adjust the Auxiliary Balanced Audio Output Level adjustment (R13 for Aux Out 1, R56 for Aux Out 2) for 0.0 dBm audio level (0.775 Vrms @ 600 ohms). If no external 600 ohm load is available, the audio level could be adjusted for approximately 2.500 Vrms in the IFR 1200.

Enter the Balanced Audio Output Level and Auxiliary Audio Output Level (if used) readings on the MT-4E Test Sheet.

RF Preselector Alignment and Tuning

Tuning of the RF Preselector filter is typically only required when the Sensitivity or Distortion do not meet published specifications, or when the receiver RF frequency is changed beyond the band pass of the filter (typically 5 - 7 MHz in a VHF or UHF 400 MHz receiver). The UHF 800 MHz receiver RF Preselector is Full Band and does not require any tuning. Some IFR 1200 models may not have the required tracking generator option installed. Push 2ND FUNCT then TRACK (5) on the keypad. Push the UP ARROW key until TRACK LOW appears on the display, then push the ENTER key. If TRACK LOW does not appear on the display, then the IFR 1200 does not have tracking generator capability.

Connect the IFR 1200 and Daniels Radio as shown in Figure A-6.

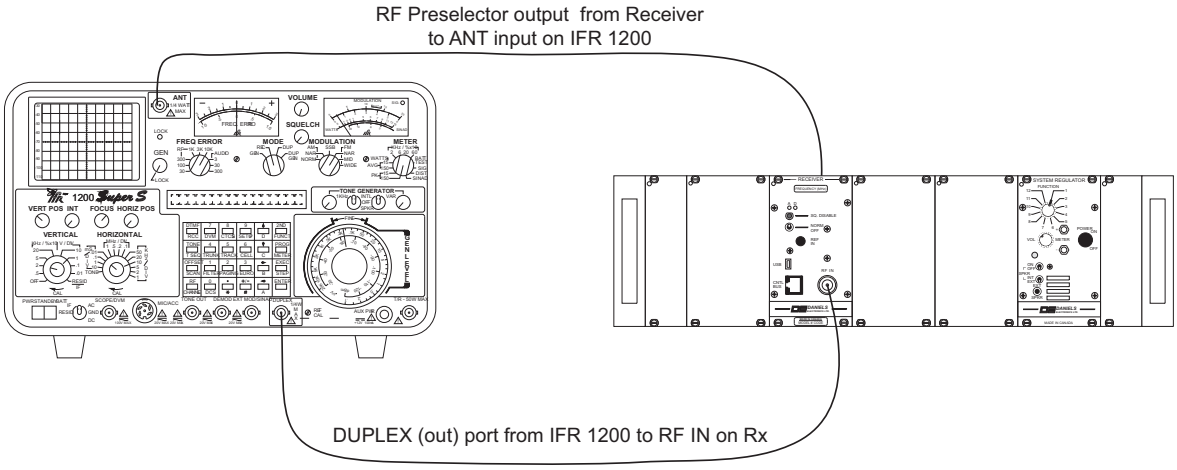

Figure A-6: Receiver RF Preselector Tuning

The RF Preselector output is a small RF cable internal in the receiver that terminates in an SMB connector. The SMB plugs into J3 on the Receiver Mainboard. Disconnect the SMB cable from J3 and use the SMB-BNC adapter to connect this point to the ANT input on the IFR 1200 as shown in Figure A-7.

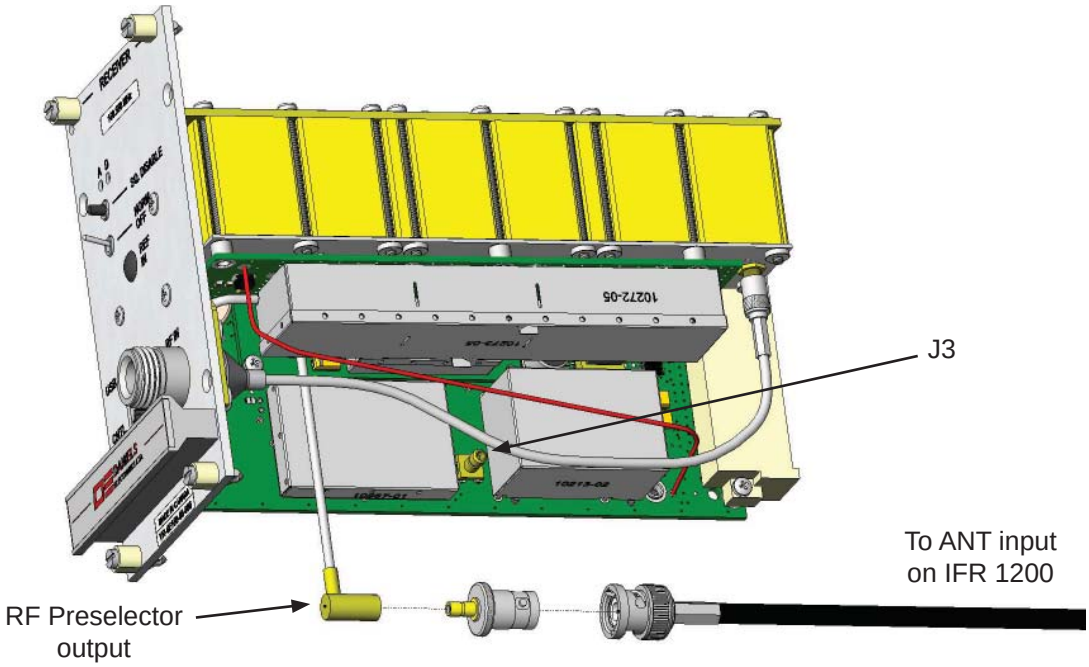

Figure A-7: Receiver RF Preselector Connection

Set up the IFR 1200 as follows:

1. Set the IFR 1200 in TRACK LOW as described previously.
2. Set the MODE switch to DUP.
3. Set the VERTICAL to .5 (Khz/%x10).
4. Set the HORIZONTAL to 1 (MHz/DIV).
5. Push the RF button on the keypad and input the Receiver RF frequency.

Ensure the receiver is turned on. The filter waveform will appear on the scope display. To tune the RF Preselector filter, remove the dust caps on the variable capacitors and, starting from the capacitor closest to the front panel of the receiver and moving back, tune the filter to its new frequency.

Reference Oscillator Adjustment

Connect the IFR 1200 and Daniels Radio as shown in Figure A-8.

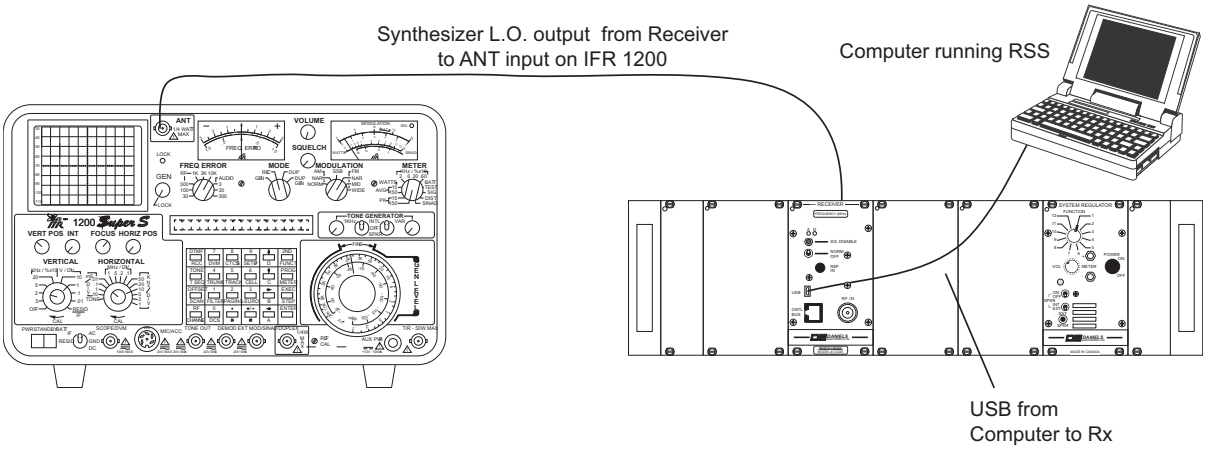

Figure A-8: Receiver Reference Oscillator Testing

The reference oscillator test on the receiver requires a connection directly into the Synthesizer, which uses an SMB connector. Disconnect the SMB cable from the LO output of the synthesizer and connect the small SMB-SMB cable to the SMB jack that is mounted on the Synthesizer (beneath the RF Preselector). The SMB-BNC adapter is required to connect this point to the ANT input on the IFR 1200 as shown in Figure A-9 (VHF and UHF 400 MHz Receiver) and A-10 (UHF 800 MHz Receiver).

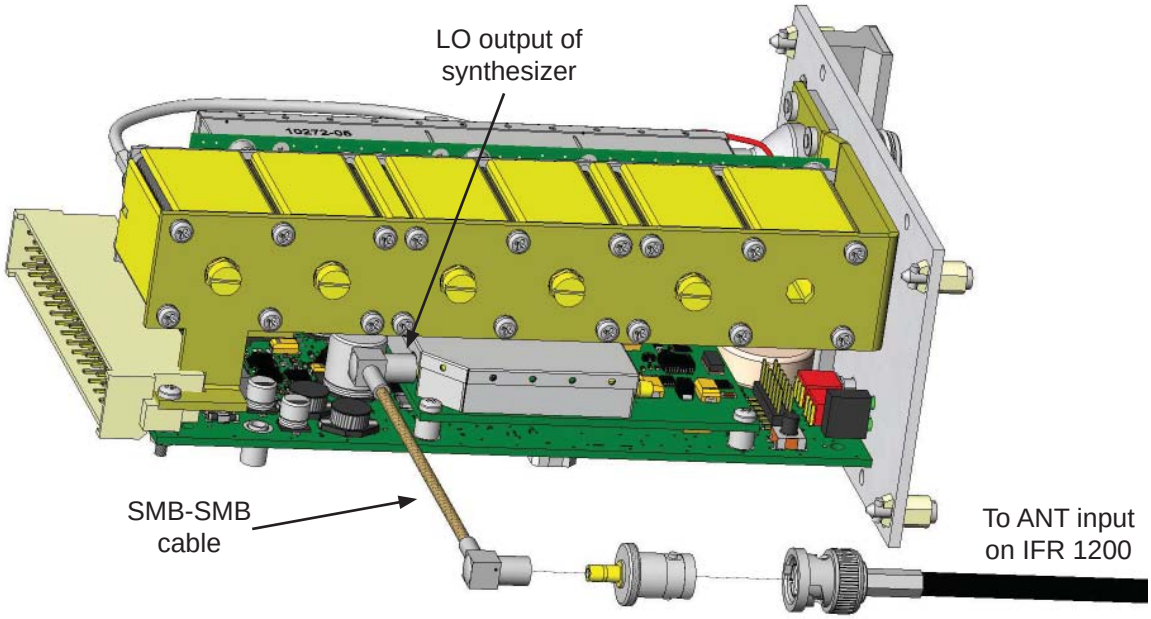

Figure A-9: VHF and UHF 400 MHz Receiver Reference Oscillator Connection

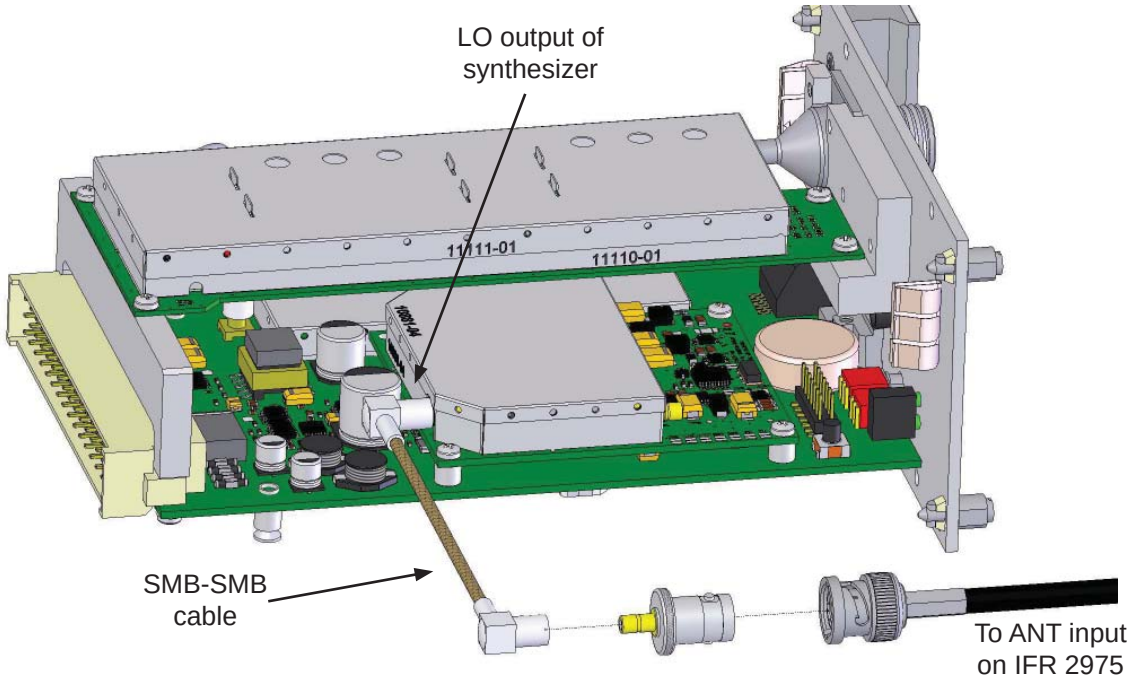

Figure A-10: UHF 800 MHz Receiver Reference Oscillator Connection

Set up the IFR 1200 as follows:

1. Set the MODE switch to REC.
2. Push the RF button on the keypad and input the reference oscillator frequency (See Below).
3. Push 2ND FUNCT then METER (PROG) on the keypad.
4. Set the FREQ ERROR switch to RF 1 KHz

In the receiver RSS, enter the Service section and click on “Ref Oscillator”. The reference oscillator frequency is shown as the “Target Synthesizer RF OUT”. Enter this RF frequency into the IFR 1200. The receiver generates this frequency out of the Synthesizer into the IFR 1200.

Monitor the RF Frequency Error on the IFR 1200. To change the reference frequency, adjust the softpot slider in the RSS as shown in Figure A-11. Adjust until the RF error is as close to 0 Hz as possible. Click on the “Program” button to program in the new Reference Oscillator softpot value.

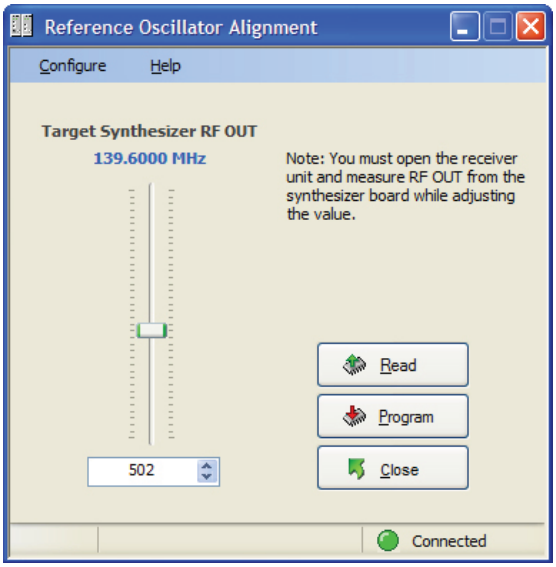

Figure A-11: RSS Receiver Reference Oscillator Alignment

Enter the L.O. Reference Oscillator Offset reading on the MT-4E Test Sheet.

TRANSMITTER TESTING

Connect the IFR 1200 and Daniels Radio as shown in Figure A-12.

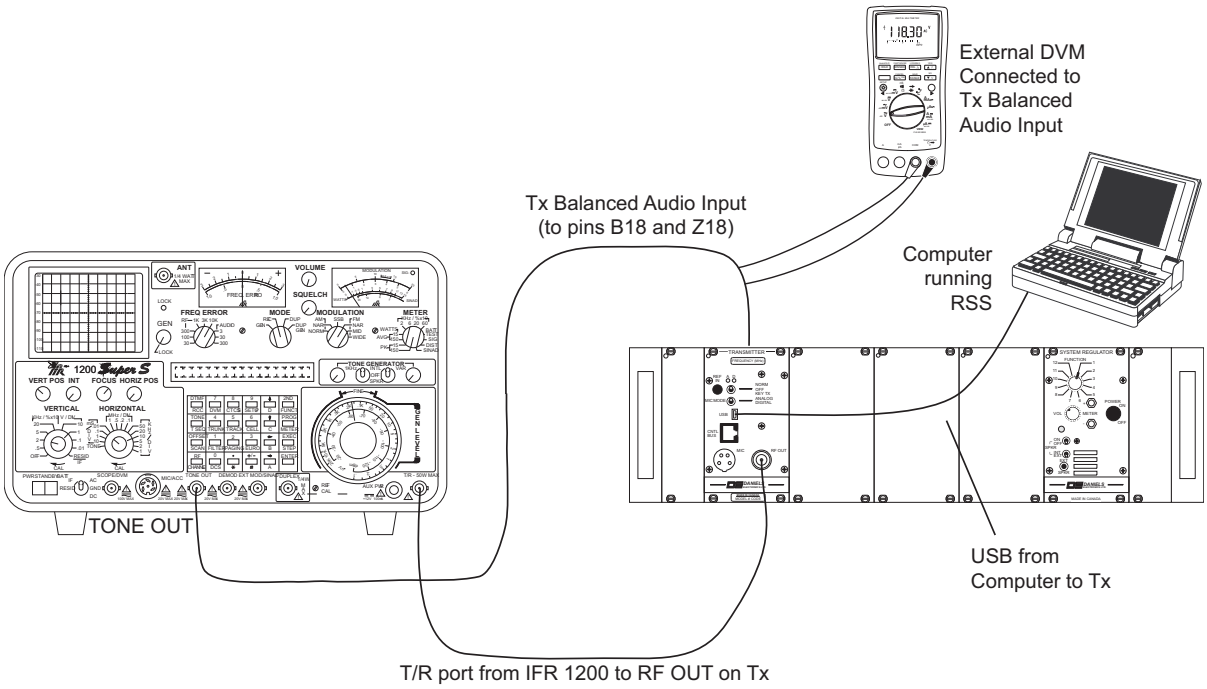

Figure A-12: Transmitter Testing

Set up the IFR 1200 as follows:

1. Set the MODE switch to REC.
2. Set the MODULATION switch to FM NAR.
3. Set the VERTICAL to 2 (Khz/%x10).
4. Set the HORIZONTAL to 1 (ms/DIV).
5. Push the RF button on the keypad and input the Transmitter RF frequency.
6. Push 2ND FUNCT then METER (PROG) on the keypad.
7. On the TONE GENERATOR area turn the 1 KHz tone ON (up).
8. Adjust the 1 KHz variable level knob until the external DVM meter reads -8.0 dBm (308 mVrms).

Set the MIC MODE switch on the front panel of the transmitter to Analog, and flip the other switch to KEY TX (or set the switch to NORM and key the transmitter through the RSS).

Audio Distortion

If the transmitter has CTCSS encode (internal or external), temporarily reprogram the transmitter for no tone. Connect a jumper cable from DEMOD (out) to EXT MOD / SINAD (in).

To check the transmitter distortion, set the METER switch to DIST.

If the IFR 1200 reads a much higher distortion than normal (eg. 20%), the internal demod level in the IFR 1200 may not be high enough for the distortion meter (this is more likely to occur in a narrowband transmitter). Increase the 1 KHz variable level knob slightly until the distortion meter becomes active.

Enter the Audio Distortion reading on the MT-4E Test Sheet.

If the CTCSS tone was temporarily programmed for no tone, reprogram the internal or external setting. Disconnect the jumper cable from DEMOD (out) to EXT MOD / SINAD (in).

RF Power

To check the RF power output, set the METER switch to 15 WATTS AVG. In the Power Level area of the Service section on the RSS, click on the “Key Tx” button and adjust the Transmitter Output Power adjustment as shown in Figure A-13 to change the RF output power. Transmitter RF power output will vary slightly with the +10 - +17 Vdc input.

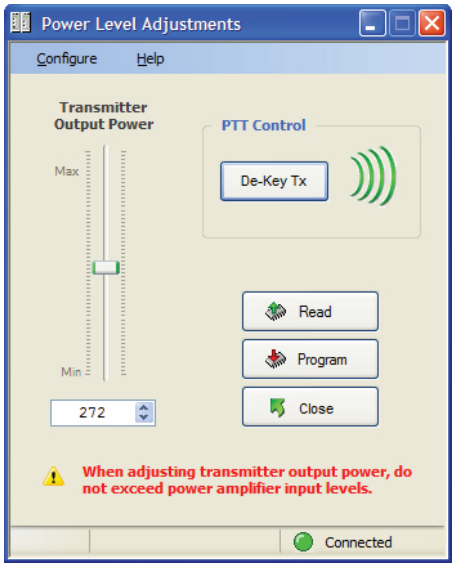

Figure A-13: RSS Transmitter Power Level Adjustment

Enter the RF Power Output reading on the MT-4E Test Sheet.

Connect the transmitter to the power amplifier (if used) and measure the RF power output of the amplifier. Daniels 30 Watt Amplifier’s RF power output can be changed by adjusting the transmitter (exciter) RF power output. Do not exceed power amplifier input levels. Higher power amplifiers typically have a fixed RF power input level and RF power output level.

Enter the Amplifier RF Power Output reading on the MT-4E Test Sheet.

Reference Oscillator Adjustment

To check the transmitter reference oscillator (frequency stability), set the FREQ ERROR switch to RF 1 KHz. In the transmitter RSS, enter the Service section and click on “Ref Oscillator”. The reference oscillator frequency is shown as the “Target Frequency”. Enter this RF frequency into the IFR 1200. Click on the “Key Tx” button and the transmitter will generate the reference frequency out of the RF output into the IFR 1200.

Monitor the RF Frequency Error on the IFR 1200. To change the reference frequency, click on the “Key Tx” button and adjust the softpot slider in the RSS as shown in Figure A-14. Adjust until the RF error is as close to 0 Hz as possible. Click on the “Program” button to program in the new Reference Oscillator softpot value.

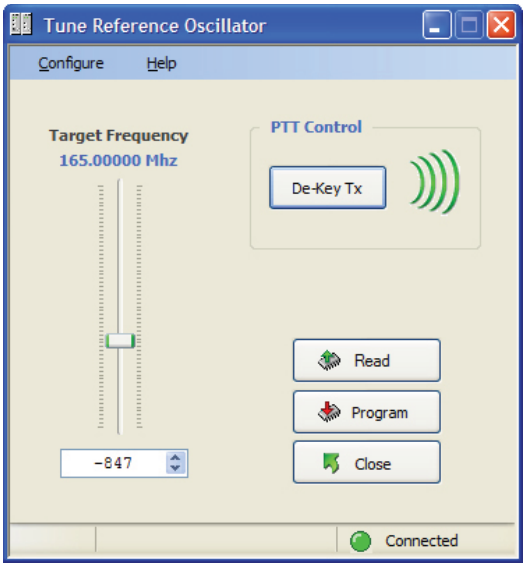

Figure A-14: RSS Transmitter Reference Oscillator Alignment

Enter the Carrier Reference Oscillator Offset reading on the MT-4E Test Sheet.

Deviation Level

The deviation level adjustment is not required when connecting the transmitter in a repeater configuration using LVDS Serial Data. The audio level / deviation level adjustment can be done on both the Tx Balanced Audio Input and the Auxiliary Balanced Input (1 and 2). The Auxiliary Balanced Input is only available on the AC-3E Control Card or CI-BC-4E Base Control Card.

Transmitter Balanced Audio Input:

Set up the IFR 1200 as follows:

1. Set the METER switch to 6 (Khz/%x10).
2. Push 2ND FUNCT then METER (PROG) on the keypad.
3. On the TONE GENERATOR area turn the 1 KHz tone ON (up).
4. Adjust the 1 KHz variable level knob until the external DVM meter reads -8.0 dBm (308 mVrms).

If the transmitter has CTCSS encode (internal or external), temporarily reprogram the transmitter for no tone.

Ensure that the AC-3E or CI-BC-4E Control Card is NOT plugged into the subrack.In the Audio Levels area of the Service section on the RSS, click on the “Key Tx” button and adjust the Tx Balanced Audio Input level adjustment as shown in Figure A-15 until a deviation of +/- 1.5 KHz (narrowband) or +/-3.0 KHz (wideband) is measured on the IFR 1200.

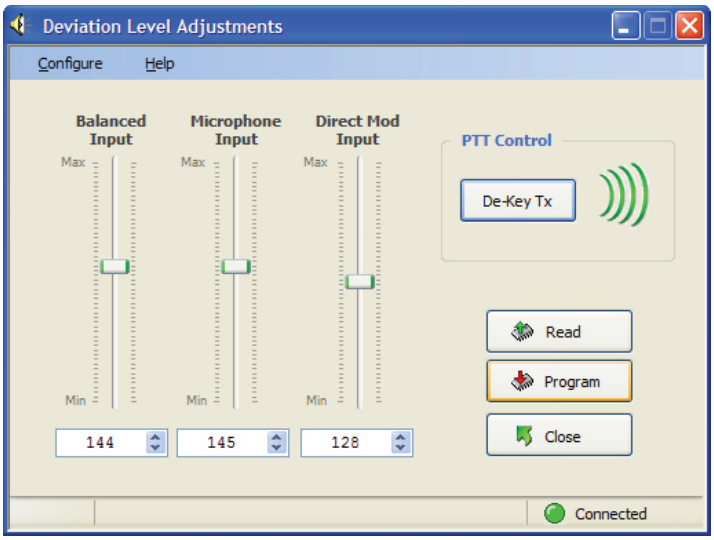

Figure A-15: RSS Transmitter Audio Level Adjustment

Enter the Transmitter Deviation Level reading on the MT-4E Test Sheet.

On the TONE GENERATOR area turn the 1 KHz tone OFF (down) and turn the VAR tone ON (up). Push TONE and enter 300.0 then ENTER on the keypad. Adjust the VAR variable level knob until the external DVM meter reads +10.0 dBm (2.500 Vrms) Adjust the audio frequency from 300 Hz to 3400 Hz in increments of 100 Hz using the keypad (push TONE and the RIGHT arrow key until the 100 position is flashing, then use the UP arrow key) and check that the transmitter deviation does not rise above +/- 2.5 KHz (narrowband) or +/-5.0 KHz (wideband). The MT-4E Transmitter will transmit a maximum deviation at an audio frequency of approximately 1300 Hz.

Enter the Transmitter Maximum Deviation Level reading on the MT-4E Test Sheet.

Auxiliary Balanced Audio Input:

To adjust the auxiliary balanced audio input, plug the AC-3E Control Card or CI-BC-4E Base Control Card into the subrack using an extender card, and connect the TONE OUT on the IFR 1200 to the Auxiliary Balanced audio input (1 or 2). Auxiliary 1 audio input is available on pins C19 and C20, and Auxiliary 2 audio input is available on pins B14 and A14. Ensure that NO external devices (eg. tone remote adapter or IP router) are connected to the auxiliary audio input. On the TONE GENERATOR area turn the 1 KHz tone ON (up) and turn the VAR tone OFF (down). Adjust the 1 KHz variable level knob until the external DVM meter reads 0.0 dBm (0.775 Vrms). Adjust the Auxiliary Balanced Audio Input level adjustment (R120 for Aux In 1, R123 for Aux In 2) for deviation of +/- 1.5 KHz (narrowband) or +/-3.0 KHz (wideband).

Enter the Auxiliary Deviation Level (if used) reading on the MT-4E Test Sheet.

If the CTCSS tone was temporarily programmed for no tone, reprogram the internal or external setting.

CTCSS Testing

MT-4E Transmitters can be programmed, per channel, to generate CTCSS tones internally, or to allow for External Input of the CTCSS tones from another device (such as a tone-remote adapter).

Connect the IFR 1200 and Daniels Radio as shown in Figure A-16. The Tx Subtone input connection is only required when testing the External Input. If the internal programming is used to generate the CTCSS tone, disconnect the Tx Subtone input from the IFR 1200.

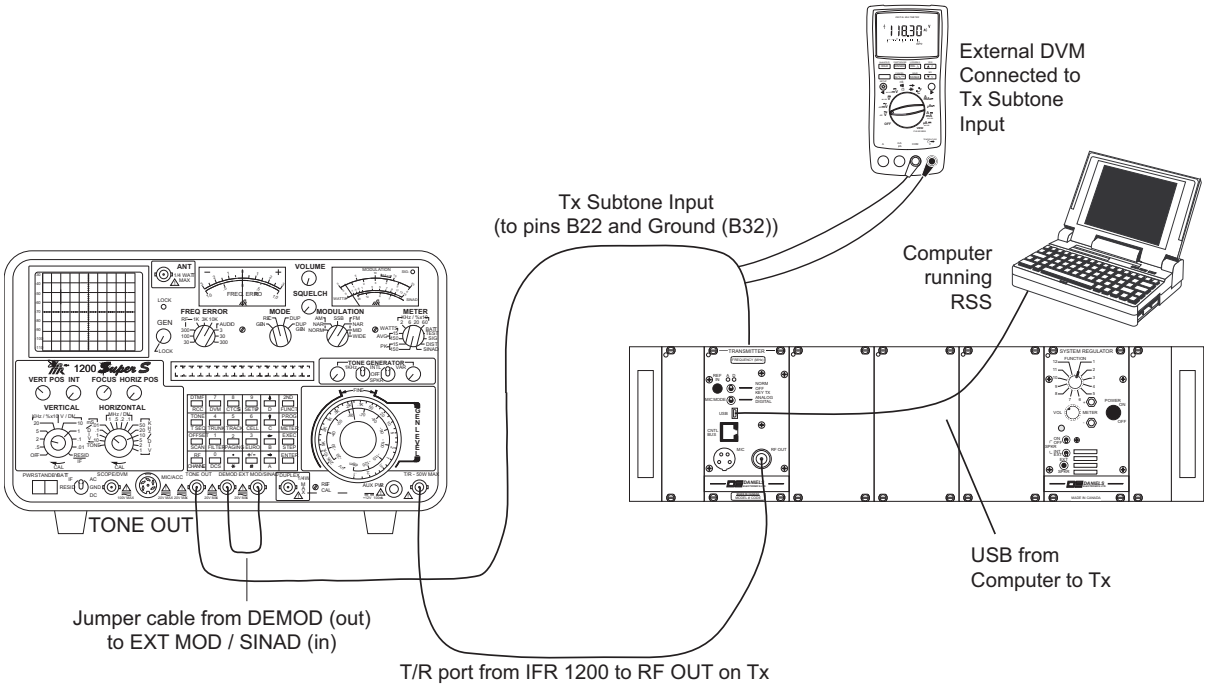

Figure A-16: Transmitter CTCSS Testing

Set the MIC MODE switch on the front panel of the transmitter to Analog, and flip the other switch to KEY TX (or set the switch to NORM and key the transmitter through the RSS).

Set up the IFR 1200 as follows:

1. Set the METER switch to 2 (Khz/%x10).
2. Set the VERTICAL to 2 (Khz/%x10).
3. Set the HORIZONTAL to TONE.
4. On the TONE GENERATOR area turn the 1 KHz tone OFF (down) and turn the VAR tone ON (up).
5. Push TONE and enter the CTCSS encode tone, then ENTER on the keypad.
6. Adjust the VAR variable level knob until the external DVM meter reads -18.0 dBm (0.098 Vrms).
7. Push 2ND FUNCTNthen METER (PROG) on the keypad.

In the Subtone Levels area of the Service section on the RSS, click on the “Key Tx” button and adjust the Narrow and/or Wide Internal and/or External Subtone Deviation level adjustment as shown in Figure A-17 until a deviation of +/- 0.35 KHz (narrowband) or +/-0.5 KHz (wideband) is measured on the IFR 1200.

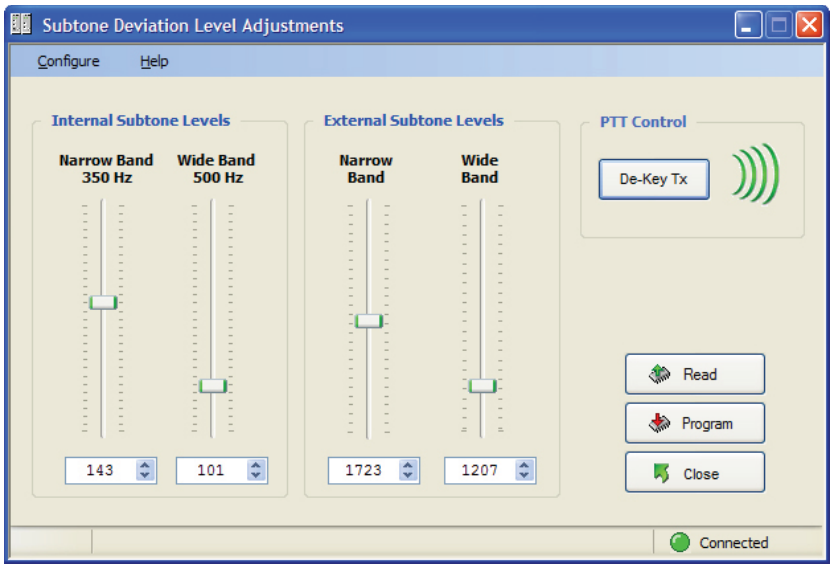

Figure A-17: RSS Transmitter Subtone Deviation Level Adjustment

If the CTCSS tone entered in the IFR 1200 is the same as the internally programmed CTCSS encode tone in the transmitter, a small stable oval shape will appear on the IFR 1200 scope (the oval shape may sometimes look like a straight line, simply re-enter the tone until a more oval shape appears). If a different tone was entered than the internally programmed CTCSS encode tone, the oval shape will fluctuate or become distorted.

Enter the CTCSS Encode Deviation level reading on the MT-4E Test Sheet.

SYSTEM TESTING

Some IFR 1200 models may not have the required duplex option installed. Push 2ND FUNCT then TRACK (5) on the keypad. Push the UP ARROW key until DUPLEX LOW appears on the display, then push the ENTER key. If DUPLEX LOW does not appear on the display, then the IFR 1200 does not have duplex capability.

Connect the IFR 1200 and Daniels Radio as shown in Figure A-18:

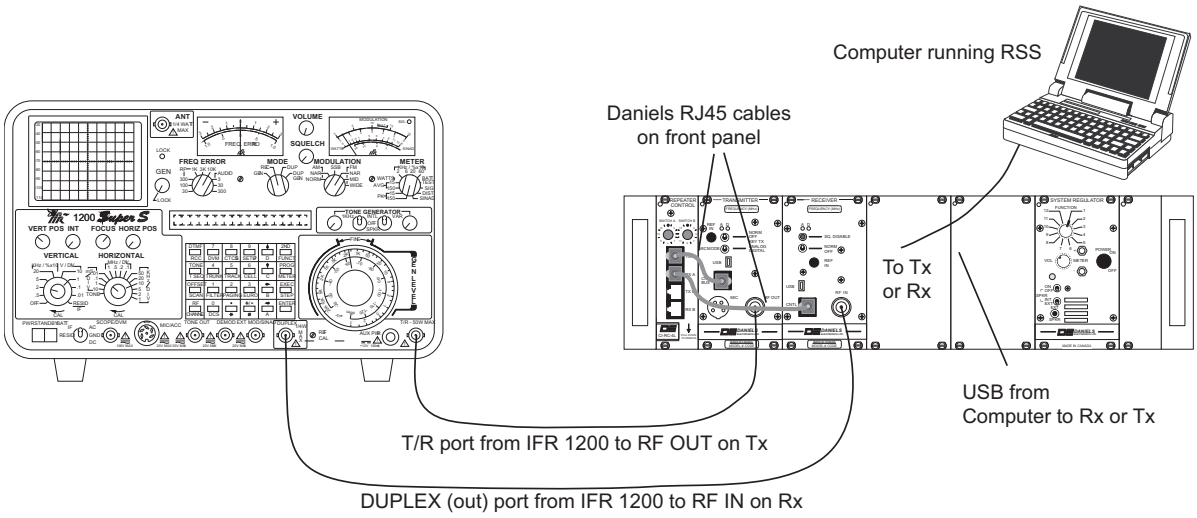

Figure A-18: System Duplex Testing

Set up the IFR 1200 as follows:

1. Set the IFR 1200 in DUPLEX LOW as described previously.
2. Set the MODULATION switch to FM NAR.
3. Set the METER switch to 6 (Khz/%x10).
4. Push the RF button on the keypad and input the Transmitter RF frequency.
5. Push the OFFSET button on the keypad and input the difference between the Receiver and Transmitter RF frequencies. If the Rx frequency is higher than the Tx frequency, the + sign should be shown, and the - sign if the Rx frequency is lower than the Tx frequency.
6. Push 2ND FUNCT then METER (PROG) on the keypad.
7. Set the MODE switch to DUP GEN.
8. On the TONE GENERATOR area turn the 1 KHz tone ON (up).
9. Adjust the 1 KHz variable level knob until the meter reads +/- 60% maximum deviation (+/- 1.5 KHz (narrowband) or +/- 3.0 KHz (wideband)).

Enter the correct CTCSS tone (if used) and deviation level for the tone.

10. On the TONE GENERATOR area turn the 1 KHz tone OFF (down) and turn the VAR tone ON (up).

11. Push TONE and enter the CTCSS decode tone, then ENTER on the keypad.

12. Push 2ND FUNCT then METER (PROG) on the keypad.

13. Adjust the VAR variable level knob until the meter reads a deviation of +/- 0.35 KHz (narrowband) or +/- 0.50 KHz (wideband).

14. On the TONE GENERATOR area turn the 1 KHz tone ON (up).

15. Set the MODE switch to DUP.

Set the receiver and transmitter front panel switch to NORM. The MIC MODE switch on the transmitter front panel can be set to either Digital or Analog (this test does not make use of the front panel switch).

Ensure that the receiver and transmitter are connected to the repeater controller via the RJ45 cables on the front panel (In some systems, the Rx and Tx may be connected directly together using the RJ45 cables).

Distortion

If the transmitter has CTCSS encode (internal or external), temporarily reprogram the transmitter for no tone. Connect a jumper cable from DEMOD (out) to EXT MOD / SINAD (in).

To check the repeater system distortion, set the METER switch to DIST.

If the IFR 1200 reads a much higher distortion than normal (eg. 20%), the internal demod level in the IFR 1200 may not be high enough for the distortion meter (this is more likely to occur in a narrowband transmitter). Increase the 1 KHz variable level knob slightly until the distortion meter becomes active.

Enter the System Distortion reading on the MT-4E Test Sheet.

If the CTCSS tone was temporarily programmed for no tone, reprogram the internal or external setting. Disconnect the jumper cable from DEMOD (out) to EXT MOD / SINAD (in).

Deviation Level

If the transmitter has CTCSS encode (internal or external), temporarily reprogram the transmitter for no tone.

To check the repeater deviation level, set the METER switch to 6 (Khz/%x10). Ideally the deviation level out of the transmitter should match the input to the receiver. The repeater deviation level matching is adjusted by the analog LVDS level adjustment that is available in both the receiver and transmitter (only one needs to be adjusted).

In the receiver or transmitter RSS, enter the Service section and click on “LVDS Level”. A default value of 100 on the softpot slider should be close to matching receiver and transmitter deviation levels, however minor adjustments can be made. Adjust the softpot slider in the RSS as shown in Figure A-19 until a deviation of +/- 1.5 KHz (narrowband) or +/- 3.0 KHz (wideband) is measured on the IFR 1200.

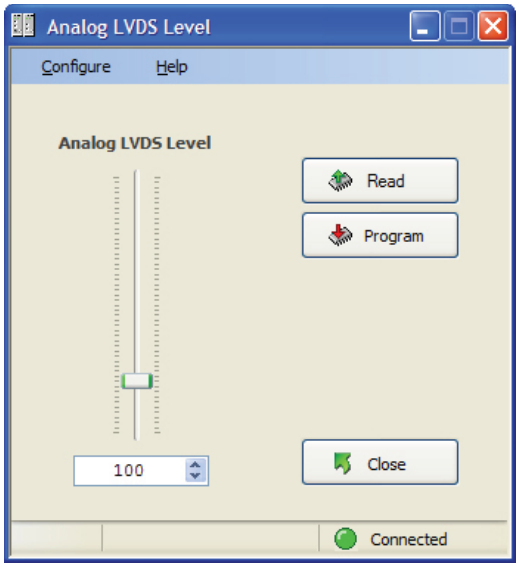

Figure A-19: RSS Receiver or Transmitter Analog LVDS Level Adjustment

Enter the Repeat Deviation Level reading on the MT-4E Test Sheet.

If the CTCSS tone was temporarily programmed for no tone, reprogram the internal or external setting.

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