

TDFM-9100 TRANSCEIVER

P/N 121270-x

FINAL ACCEPTANCE TEST PROCEDURE

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REVISION HISTORY [146606]				
REV	SECTION - PAGE -	DESCRIPTION	DATE	EDITED BY
N/C		Original Release	05/14/2014	J.R.
A	5	Added test for RC port.	06/29/2015	J.R.
B	5	Changed TX power tolerance to 5.7 to 6.0 watts in Table 2.	11/04/2015	J.R.
C	3	Changed test frequencies in Table 1.	12/16/2015	S.M.
D	5, 6	Added combined audio, keyloading and FPP tests.	09/01/2017	J.R.
E	4	Changed Max signal level for deviation test to +6 dBm.	09/27/2018	J.R.
F	3	Added instruction to use RF cable calibration before testing.	30/10/2018	J.R.
G	6, 7	Added MOD 14 test instructions.	06/10/2021	J.R.
H	ALL	Added T6 Module 3 tests section.	29/07/2022	A.S
J	ALL	Streamlined T6 Module 3 tests.	26/03/2024	J.R.

TDFM-9100 FINAL ACCEPTANCE TEST PROCEDURE

NOTE: The radio should be fully assembled with all RF modules installed, lids and screws. This test procedure assumes that the factory codeplugs and test frequencies are programmed into the radio prior to testing. If factory codeplugs are not available, then tune the radio to known analog FM non-trunked Channels. For accurate measurement, ensure that the test set has the RF cable calibrations applied before testing.

GENERAL:

- 1) Set bench power supply to 28 volts and current limit to 5A.
- 2) Connect the TDFM-9100 J1 & P1 to radio test jig (#13T209) or an equivalent fixture.
- 3) Connect Module one antenna of the TDFM-9100 under test to the service monitor.
- 4) Record all test results on Test Data Sheet #146607

POWER UP TESTS:

- 1) Turn on the radio by pressing the knob.
- 2) Verify the display reads TECHNISONIC and all 6 LED indicators are illuminated.
- 3) Verify the next screen shows TDFM-9100 and the software version number. Record the version number on the test data sheet. (TDS)
- 4) The display should blank and then show what RF modules are installed. The display will then go into the normal mode. Verify the unit draws less than 400 mA and is not making any strange squealing sounds. Record the current draw on the TDS.

MODULES 1 AND 2 FUNCTION TESTS:

- 1) Switch to Module #1 on the test fixture.
- 2) Select Module 1 on the radio.
- 3) Set the test set to generate an RF signal of 1 mV(-47 dBm) with 1 KHz Audio tone and 1.5 KHz deviation. The test frequency to use depends on the RF module installed in #1 slot.
- 4) Select a known conventional channel that is set to analog, FM with no PL/DPL tone/codes programmed. Any frequency within the Module selected may be used. See table 1.

BAND	FREQUENCY (MHz)
VHF	136 to 174
UHF LO	380 to 470
UHF HI	450 to 520
UHF	380 to 520
700/800	764 to 870

TABLE 1: Test Frequencies by Band

- 5) Turn the volume all the way up. The audio output level should be above 4.5 Vrms. Record on the TDS.
- 6) Turn the volume to a setting of 20. The distortion should be less than 5%. Record on the TDS.
- 7) Set the test set to 0.28 uV (−116 dBm). Measure the receive Sinad. The Sinad should be > 12 db. Record on TDS.
- 8) Confirm the Module 1 RX LED on the left side is lit, indicating open squelch. Remove the signal to the receiver. Confirm the RX led goes out or flashes for a second then goes out. Record on TDS.
- 9) Press the rotary knob several times until the lower right hand display shows "Chan". Turn the knob to select another channel. Confirm the module changes to the channel dialed. Rotate the knob back to select the first channel. Verify the module follows.

Press the MUP key momentarily to increment the selected channel. Confirm the radio changes to the desired channel. Press and hold the MUP key and verify the channel number scrolls up. Release the key. Verify the module is now on the selected channel dialed.

Press the MDN key momentarily to decrement the selected channel. Confirm the radio changes to the desired channel. Press and hold the MDN key and verify the channel number scrolls down. Release the key. Verify the module is now on the selected channel dialed.

Set the Chan/Band SW to Channel position on the test Jig. Toggle the "UP Switch" on the radio test jig. Confirm the radio increments the channel. Toggle the "DOWN Switch". Confirm radio decrements the channel Put the Chan/Band switch into Band mode on the test jig.

Toggle the "UP Switch" on the radio test jig. Confirm the Module selector moves up on the display. Toggle the "DOWN Switch". Confirm the Module selector moves down on the display.

Record on TDS that channel selector works.
- 10) Press and hold the DIM and BRT buttons. Confirm the display dims and brightens. Record on TDS.
- 11) Press the knob a few more times to get back into volume mode.
- 12) Go through some of the soft menus to confirm the soft keys and the home key function. Change zones. Verify the zone and channel has changed. Toggle the function keys F1-F4 ESW and TSW switches.

Press the knob several times to put the radio into Recall Mode. Enter a channel number. Verify the radio goes to the desired channel. Set the Knob menu back to default "VOL" mode.

Press the knob to put the radio into Zone Mode. Enter a Zone. Verify the radio goes to the desired Zone and channel. Set the Knob menu back to default "VOL" mode. Record on TDS.
- 13) Disconnect the TX audio cable from the test set.
- 14) Press PTT on the test jig.
- 15) Confirm the TX LED on the right lights on the selected module.
- 16) Record the transmit frequency on the TDS. It should be the frequency previously selected.
- 17) Press each of the number keys (0-9) and the # and * keys to check for DTMF and number key operation. Verify and record on the TDS the DTMF pad works.
- 18) Connect the TX audio cable to the test set audio generator.
- 19) Set the audio generator to +6 dBm at 1 KHz.
- 20) Check the deviation level and record on the TDS. It should not be more than +/-2.5 KHz.
- 21) Set the audio generator to -13 dBm.
- 22) Check the deviation to be between 1.25 and 2 KHz (NARROW FM). Record on the TDS.

- 23) Check the TX distortion and record on the TDS. It should be less than 5%.
- 24) Set the Module to low power. Key up and measure the TX power. Check the RF power output (all bands) to be between 0.8 – 1.2 watts. Record on TDS.
- 25) Set the Module to HI power. Key up and measure the TX power. Check that the Hi power is within the specs as shown in Table 2. Record power of test frequency from Table 1 on the TDS.

BAND	FREQUENCY	NOMINAL (W)	RANGE (W)
VHF	136.0 - 174.0	6	5.7 - 6.0
UHF LO	380.0 - 470.0	5	4.8 - 5.2
UHF HI	450.0 - 520.0	5	4.8 - 5.2
700 MHz	764.0 - 794.0	2.5	2.4 - 2.6
800 MHz	795.0 - 870.0	3	2.9 - 3.1

TABLE 2: Transmit HI Power Settings

- 26) Connect the test set to the Module 2 antenna connector.
- 27) Switch to position #2 on the test panel and select module 2 on the radio. Perform the above tests again for module 2 if installed.

MODULE 3 TRANSMIT FUNCTION TESTS:

NOTE: This procedure to be done on MOD 14 radios with the "T6 Multiband RF Module" installed.

- 1) Connect the "J6" Test cable to P1 connector on the 9100. Select module **Position 4** on the test Jig panel. Select **Module # 3** on the 9100.
- 2) Connect the test set to module 3 antenna connector.
- 3) Measure TX Power FM:
Program test frequencies: 30, 41 and 50 MHz. Set the test set to FM mode. Set output power to LOW with the soft menu. Turn off or disconnect the AF generator.
Transmit on each frequency, recording the power results on the TDS.
Set TX power to HI and test each frequency again. Record on the TDS.
- 4) Measure TX Power AM:
Program test frequencies: 118, 129, 138, 225, 314 and 400 MHz. Set the test set to AM mode. Set output power to LOW with the soft menu. Transmit on each frequency, recording the power results on the TDS. Set TX power to HI and test each frequency again. Record on the TDS.
- 5) Frequency Check:
Tune the module to the highest frequency supported: For T6 set to 400 MHz. Transmit and record the actual frequency on the TDS.
- 6) Verify that the module TX LED indicator is lit when keyed. Mark on TDS.
- 7) Testing DTMF Keys:
Turn off or disconnect the AF generator. Set the test set to the frequency and mode of the module. Key the module, press each of the number keys and the # and * keys to check for DTMF and number key operation. Verify and record on the TDS the DTMF pad works.
- 8) FM Nominal Deviation:
Set the test set to FM mode, generate an audio tone of 1000Hz, and level of -13 dBm. Set the module to 41 MHz, FM WIDE deviation with no CTCSS tone or DCS code.
Key the radio and measure the Normal Deviation. Record the deviation on the TDS.
- 9) FM Max Deviation:
Set the test set to FM mode, generate an audio tone of 2500Hz, and level of +6 dBm. Set the module for 30 MHz, WIDE deviation, and program a CTCSS TX tone of 103.5 Hz. Press PTT and record the deviation. Repeat test on 41 and 50 MHz. Record the levels on the TDS.
- 10) AM Modulation Depth:
Program a frequency of 118 MHz, AM. Set the test set to AM mode, and set generator to 1000Hz, and level of 100mV. Press PTT to measure the modulation depth. Record on the TDS. Repeat for 129, 138, 225, 314 and 400 MHz.
- 11) Test CTCSS Tone:
Program 41 MHz with a CTCSS tone of 103.5 Hz. Turn off or disconnect the AF generator. Press PTT and check if the Tone is 103.5 Hz.
- 12) Press PTT and record the deviation of the CTCSS Tone on the TDS.
- 13) Test DCS Code:
Program 41 MHz with a DCS code of 152. Turn off or disconnect the AF generator. Press PTT and check if the test set decodes 152.
- 14) Press PTT and record the deviation of the DCS code on the TDS.

- 15) Measure the Module Side Tone Level:
Program a frequency of 41 MHz FM with no Tone or DCS.
Set the Test set to generate a tone of 1000 Hz with a level of -13 dBm. Press PTT and measure the side tone, recording the result on the TDS.
- 16) Measure the module FM TX distortion:
Program a frequency of 41 MHz. PTT the module and measure and record the TX distortion.
- 17) Measure the module AM TX distortion:
Program a frequency of 314 MHz. PTT the module and record the TX distortion.
- 18) Measure and record the FM TX Hum & Noise:
Program a frequency of 41 MHz. PTT the module and measure and record the TX hum & noise.
- 19) Measure and record the AM TX Hum & Noise:
Program a frequency of 314 MHz. PTT the module and record the TX hum & noise.

MODULE 3 RECEIVE FUNCTION TESTS:

- 1) Measure the Module FM RX Sensitivity:
Program a frequency of 30 MHz, FM wide. Set the RF generator for the same with a tone of 1000 Hz at 3 KHz deviation. Press and hold the F1 Key to open the SQ on the radio. Adjust the generator to measure 12 dB Sinad.
Record the sensitivity on the TDS. Repeat for 40 and 50 MHz.
- 2) Measure the Module AM RX Sensitivity:
Program a frequency of 118 MHz, AM. Set the RF generator for the same with a tone of 1000 Hz at 30% AM modulation. Press and hold the F1 Key to open the SQ on the radio. Adjust the generator to measure 12 db Sinad. Record the sensitivity on the TDS. Repeat for the following frequencies: 129, 138, 225, 314 & 400 MHz.
- 3) Measure Maximum FM RX Audio Level:
Program a frequency of 41 MHz, FM wide. Set the RF generator for the same with a tone of 1000 Hz at 3 KHz deviation. Adjust the RF generator for 1 mV(-47 dBm). Turn the module volume up all the way to 40. Measure the audio output and record on the TDS.
- 4) Measure Maximum AM RX Audio Level:
Program a frequency of 129 or 314 MHz, AM. Set the RF generator for the same with a tone of 1000 Hz at 30% AM modulation. Adjust the generator for 1 mV(-47 dBm). Turn the radio volume up all the way to 40. Measure the audio output and record on the TDS.
- 5) Measure FM RX Audio Distortion:
Program a frequency of 41 MHz, FM wide. Set the RF generator for the same with a tone of 1000 Hz at 3 KHz deviation. Adjust the RF generator for 1 mV(-47 dBm). Set the module volume to 35. Measure the RX Audio distortion and record on the TDS.
- 6) Measure AM RX Audio Distortion:
Program a frequency of 129 or 314 MHz, AM. Set the RF generator for the same with a tone of 1000 Hz at 30% AM modulation. Adjust the generator for 1 mV(-47 dBm). Set the module volume to 35. Measure the RX Audio distortion and record on the TDS.
- 7) Confirm the module RX LED is lit, indicating open squelch. Remove the signal to the receiver. Confirm the RX led goes out. Record on TDS.
- 8) Measure FM RX Audio Signal to Noise:
Program a frequency of 41 MHz, FM wide. Set the RF generator for the same with a tone of 1000 Hz at 3 KHz deviation. Adjust the RF generator for 1 mV(-47 dBm). Set the module volume to 35. Measure the RX Audio signal to noise and record on the TDS.
- 9) Measure AM RX Signal to Noise:
Program a frequency of 129 or 314 MHz, AM. Set the RF generator for the same with a tone of 1000 Hz at 30% AM modulation. Adjust the generator for 1 mV(-47 dBm). Set the module volume to 35. Measure the RX Audio signal to noise and record on the TDS.

MCP MOD 14 TESTS:

NOTE: This procedure to be done on MOD 14 equipped radios only. Ensure the TDFM - 9100 is connected to the Test Jig 19T286, or similar, with the TDFM-9100 harness and then connected to the Main Radio test jig.

- 1) Enable Bands 4 & 5 in the Maintenance Menu. This will enable "External Transceivers" 1 & 2 or "EXT 1" & "EXT 2" on the 9100.
- 2) On Mod 14 Test Jig (19T286) Set S13 and S14 to EXT 1. Also set S15 and S16 to EXT 2. This switches audio and PTT lines on the Main radio test jig - Module 5 to EXT 1 and Module 6 to EXT 2 on the 9100.
- 3) Check if EXT 1 and EXT 2 PTT works.
- 4) On Mod 14 Test Jig (19T286) set all switches to EXT 1 and EXT 2. Select position 5 on Main test jig. Key PTT switch on Main test jig to test EXT 1 PTT. Set Main jig to position 6 to test EXT 2 PTT.
- 5) Toggle the 9100 Module selector to show the External Radio # 1. When PTT 5 is keyed on the Main test Jig, the EXT 1 LED on 19T286 should light up as well as right side TX indicator for External Radio #1 on the TDFM-9100 display. Toggle the Module selector on the 9100 to show External Radio # 2. When PTT 6 is keyed, EXT 2 LED on 19T286 should light up as well as right side TX indicator for External Radio #2 on the TDFM-9100 display.
- 6) Record on TDS.
- 7) Check if EXT 1 RX Audio works:
 - A) Select External Radio 1 on 9100.
 - B) Set Radio Test Jig to Module 5.
 - C) Set Mod 14 Test Jig Switches: S9-RXA OUT, S10-RXA IN, S13 & S14 to EXT 1.
 - D) Set Audio generator to -10 dBm.
 - E) Turn volume level to 20 on radio.
 - F) Verify audio level is 5 Vrms nominal, 4.8 to 5.2V.
 - G) Set Audio generator to -7 dBm.
 - H) Verify the EXT 1 RX led lights.
 - I) Record on TDS.
- 8) Check if EXT 2 RX Audio works:
 - A) Select External Radio 2 on 9100
 - B) Set Radio Test Jig to Module 6
 - C) Set Mod 14 Test Jig Switches: S11- RXA OUT, S12- RXA IN, S15 & S16 to EXT 2.
 - D) Set Audio generator to -10 dBm
 - E) Turn volume level to 20 on radio
 - F) Verify audio level is 5 Vrms nominal, 4.8 to 5.2V.
 - G) Set Audio generator to -7 dBm.
 - H) Verify the EXT 1 RX led lights.
 - I) Record on TDS

- 9) Check if EXT 1 Mic Audio works.
 - A) Select External Radio 1 on 9100
 - B) Set Radio Test jig to Module 5
 - C) Set Mod 14 Test Jig Switches: S9-TXA OUT, S10-TXA IN, S13 & S14 to EXT 1.
 - D) Set audio generator to -13 dBm
 - E) Key Module 5 on Main test jig to key External Radio 1
 - F) Verify TX audio level is 20 to 50 mVrms.
 - G) Record on TDS
- 10) Check if EXT 2 Mic Audio works.
 - A) Select External Radio 2 on 9100
 - B) Set Radio Test jig to Module 6
 - C) Set Mod 14 Test Jig Switches: S11-TXA OUT, S12-TXA IN, S15 & S16 to EXT 2.
 - D) Set audio generator to -13 dBm
 - E) Key Module 6 on Main test jig to key External Radio 2
 - F) Verify TX audio level is 20 to 50 mVrms.
 - G) Record on TDS
- 11) Check if EXT 1 Sidetone Audio works.
 - A) Select External Radio 1 on 9100
 - B) Set Main Radio Test jig to Module 5
 - C) Set Mod 14 Test jig Switches S9, 10, 13 & 14 to UP.
 - D) Key External Radio 1
 - E) Verify Side tone level is 1 V nominal, 0.8 to 1.2 Vrms with 600 ohm load.
 - F) Record on TDS
- 12) Check if EXT 2 Sidetone Audio works.
 - A) Select External Radio 2 on 9100
 - B) Set Main Radio Test jig to Module 6
 - C) Set Mod 14 Test jig Switches S11, 12, 15 & 16 to UP.
 - D) Key External Radio 2
 - E) Verify Side tone level is 1 V nominal, 0.8 to 1.2 Vrms with 600 ohm load.
 - F) Record on TDS
- 13) Check if Remote RXD/TXD is working.
 - A) Select External Radio 2 on 9100.
 - B) Connected the S200 simulator to the serial port on the Mod 14 Test Jig (19T286).
 - C) Send heartbeat to the 9100 from the simulator. Verify the display changed to S 200 mode.
 - D) Key EXT 2. Verify a PTT was received on the S200 simulator.
 - E) Record the S200 TX/RX port works on TDS.

COMBINED OUTPUT TEST:

- 1) Select either module on the radio, connecting the appropriate antenna connector to the service monitor. On the test Jig set Module Selector switch to Position #3 to key the 9100 on its "Combined Port". Set the service monitor to TX mode – toggle the PTT 3 switch. Verify the radio is transmitting on the module selected.
- 2) Set the service monitor to RX mode – generate a signal on the selected frequency. Verify the radio is receiving that frequency in the combined mode.

KEYLOADING TEST:

NOTE: *This is a factory only requirement. Test Keyloading only if a keyloader is available.*

- 1) Connect a KVL 3000+ or KVL 4000 keyloader to the programming connector. Select Module 1.
- 2) Verify the selected RF module displays "Keyloading".
- 3) Load an ADP key.
- 4) Switch to the next RF module. Repeat loading an ADP key to each module installed.
- 5) Disconnect the keyloader. Reboot the radio. Set both modules to an encrypted channel: (Zone 1 Channel 6).
- 6) Toggle the ESW to the Encrypted mode. Verify the display shows the "S" symbol and is not displaying "Key Fail" on either module.
- 7) Connect the keyloader. Zeroize all keys in each module. Disconnect the keyloader. Reboot the radio.
- 8) Verify all modules in encrypted mode show "Key Fail". Set each module to clear mode by toggling the ESW SW. Verify the "S" symbol goes out.

FPP TEST:

NOTE: *This is a factory only requirement. Test the FPP option only if the radio is equipped.*

- 1) Pick a module with the FPP option and select an FPP enabled Zone.
- 2) Edit a channel. Program an RX and TX frequency, RX & TX PL tone and change the channel name.
- 3) Verify the radio transmits and receive on the modified channel. Record on TDS.

RC-9100 TEST:

NOTE: *This is a factory only requirement. Test with an RC unit if one is available.*

- 1) Connect a RC-9100 to the radio.
- 2) Confirm the RC display shows the same as the radio's display.
- 3) Press buttons on the RC unit and confirm that the functions are working on the radio. Record on TDS that the RC port works.

FINAL CHECKS:

- 1) Go into the configuration menu and set the knob default to VOL. Make sure the recall mode is turned ON. Set the "always on" mode to disabled.
- 2) Test backlighting at 28 volts and 5V. The back lighting brightness and profile should be similar to the TDFM-6000. Set all the volumes to 15. Set both modules to Zone 1, Channel 001.
- 3) Turn off radio and confirm it really shuts off. (Wait 30 seconds to be sure.)
- 4) Disconnect from test equipment.
- 5) Check for good appearance of radio. Check that all labels are properly installed. No screws missing or loose.
- 6) Shake the unit to confirm there is no loose hardware inside.