

TDFM 9200 TRANSCEIVER

P/N 121271-x

FINAL TEST PROCEDURE

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REVISION HISTORY
[136571]

REV	SECTION - PAGE -	DESCRIPTION	DATE	EDITED BY
A	ALL	Removed references to TDFM-9200 -3 and -4	01/03/2014	J R
B	UHF AM	Updating UHF AM	08/26/2014	A S
C	ALL	Added instruction to test with an RC-9000. C. R. 15674.	04/27/2015	J R
D	4, 7	Changed the Maximum RX audio from 6 V to 5 V rms.	07/02/2015	J R
E	5	Changed TX power tolerance to 5.7 to 6.0 watts in Table 2.	11/04/2015	J.R.
F	4	Changed test frequencies in Table 1.	16/12/2015	S.M.
G	3, 11, 12	Added instruction to record Front Panel and Main SW versions on TDS. Added Combined Audio, Keyloading and FPP Tests.	08/14/2017	J. R.
H	5, 6	Changed AF level from +10 to +6 dBm for max deviation alignment section.	04/30/2018	S.M.
J	3	Changed Max current draw spec. at power up to 800 ma.	07/27/2018	J. R.
K	3	Added instruction to use RF cable calibration before testing.	30/10/2018	J. R.
L	12	Added Mod 14 Tests.	30/06/2020	J. R
M	9	Added T6 to analog module tests.	03/15/2023	J. R.

TDFM-9200 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-9200 to radio test jig 13T209 or equivalent.
- 3) Connect the Module #1 antenna to the test set.

POWER UP TESTS:

- 1) Turn on the radio by pressing the knob.
- 2) The display should read "TECHNISONIC" and display software version numbers. Record the Main and Front Panel version numbers on the test data sheet (TDS).
- 3) The display should blank and then show what RF modules are installed, record the radio model on the TDS.
- 4) The display will then go into the normal mode. The unit should be drawing less than 800 mA and should not be making any strange squealing sounds. Record the current draw on the TDS.
- 5) Check that the fan is running during boot up and record on the TDS.

MODULES 1 & 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 1mV(-47dbm) with 1 kHz Audio tone and 1.5 kHz. The test frequency to use depends on the RF module installed in the #1 position.
- 4) Select a known conventional channel that is set to analog, FM with no PL/DPL tone/codes programmed. Any frequency within the band can be used. See table1.

BAND	FREQUENCY (MHz)
VHF	136 to 174
UHF LO	380 to 470
UHF HI	450 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 35. The distortion should be less than 5%. Record on the TDS.
- 7) Set the test set to 0.35 uV (-116 dbm). Measure the receive Sinad. Sinad should be > 12 db. Record on TDS
- 8) Confirm the Module 1 Green RX LED 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 MUP 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 Band selector moves up on the display. Toggle the "DOWN Switch". Confirm the Band 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. Set dimming to 31. Press and hold the BRT key. Confirm the display brightens to "Daylight Mode" release the BRT key. Confirm the dimming reverts to normal max brightness (31). 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 zone & channel. Verify the radio goes the desired channel. Push the Home key to 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 tester.
- 15) Confirm the Red TX LED lights on the selected band.
- 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 1kHz.
- 20) Measure 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). 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.
- 28) Perform the above tests again for Band 2 if installed. Record results on the TDS.

TRANSMIT FUNCTION TESTS FOR “T” MODULES:

- 1) Select module position 3 on the radio test panel.
- 2) Connect the test set to module 3 antenna connector.
- 3) Measure TX Power FM:
For T1 & T6 modules 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:
For T4 modules, program test frequencies: 118, 129 and 138 MHz. Set the test set to AM mode. Turn off or disconnect the AF generator. Transmit on each frequency, recording the HI power results on the TDS.
For T5 modules, program test frequencies of 225, 314 and 400 MHz. Set the test set to AM mode. Transmit on each frequency, recording HI the power results on the TDS.
For T6 modules, 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 T1 set to 50 MHz, T4 set to 138 MHz. T5 & 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:
For T1 & T6 modules, Set the test set to FM mode, generate an audio tone of 1000Hz, and level of -13dBm. 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:
For T1 & T6 modules, 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:
For T4 Modules, 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 and 138 MHz.
For T5 Modules, program a frequency of 225 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 314 and 400 MHz.
For T6 Modules, 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:
T1 & T6 modules 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:
T1 & T6 modules 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:
For T1 & T6 modules, program a frequency of 41 MHz FM with no Tone or DCS.
For T4, T5 modules, program a frequency of 129 or 314 MHz respectively.
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:
For T1 & T6 modules. Program a frequency of 41 MHz. PTT the module and measure and record the TX distortion.
- 17) Measure the module AM TX distortion:
For T4 Modules, program frequency 129 MHz.
For T5 & T6 program a frequency of 314 MHz. PTT the module and record the TX distortion.
- 18) Measure and record the FM TX Hum & Noise:
For T1 & T6 modules, 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:
For T4 Modules, program frequency 129 MHz.
For T5 & T6 program a frequency of 314 MHz. PTT the module and record the TX hum & noise.
- 20) Module #5 TX tests:
Switch to Module 5 on the test jig and select Module 5 on the radio. Repeat steps 3 – 19.

RECEIVE FUNCTION TESTS FOR “T” MODULES:

1) Measure the Module FM RX Sensitivity:

For T1 & T6 Modules, 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:

For T4 Modules, 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 129 & 138 MHz.

For T5 Modules, program a frequency of 225 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 314 & 400 MHz.

For T6 Modules, 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:

For T1 & T6 Modules, 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 1mV(-47dbm). 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:

For T4 Modules, program a frequency of 129 MHz, AM. Set the RF generator for the same with a tone of 1000 Hz at 30% AM modulation. Adjust the generator for 1mV(-47dbm). Turn the radio volume up all the way to 40. Measure the audio output and record on the TDS.

For T5 Modules, program a frequency of 314 MHz, AM. Set the RF generator for the same with a tone of 1000 Hz at 30% AM modulation. Adjust the generator for 1mV(-47dbm). Turn the radio volume up all the way to 40. Measure the audio output and record on the TDS.

For T6 Modules, 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 1mV(-47dbm). 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:

For T1 & T6 Modules, 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 1mV(-47dbm). Set the module volume to 35. Measure the RX Audio distortion and record on the TDS.

6) Measure AM RX Audio Distortion:

For T4 Modules, program a frequency of 129 MHz, AM. Set the RF generator for the same with a tone of 1000 Hz at 30% AM modulation. Adjust the generator for 1mV(-47dbm). Set the module volume to 35. Measure the RX Audio distortion and record on the TDS.

For T5 Modules, program a frequency of 314 MHz, AM. Set the RF generator for the same with a tone of 1000 Hz at 30% AM modulation. Adjust the generator for 1mV(-47dbm). Set the module volume to 35. Measure the RX Audio distortion and record on the TDS.

For T6 Modules, 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 1mV(-47dbm). 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:
For T1 & T6 Modules, 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 1mV(-47dbm). 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:
For T4 Modules, program a frequency of 129 MHz, AM. Set the RF generator for the same with a tone of 1000 Hz at 30% AM modulation. Adjust the generator for 1mV(-47dbm). Set the module signal to noise and record on the TDS.
For T5 Modules, program a frequency of 314 MHz, AM. Set the RF generator for the same with a tone of 1000 Hz at 30% AM modulation. Adjust the generator for 1mV(-47dbm). Set the module volume to 35. Measure the RX Audio signal to noise and record on the TDS.
For T6 Modules, 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 1mV(-47dbm). Set the module volume to 35. Measure the RX Audio signal to noise and record on the TDS.
- 10) Module #5 RX tests:
Switch to Module 5 on the test jig and select Module 5 on the radio. Repeat steps 1 – 9.

ANTENNA TUNER OUTPUT (T1 VLO Module only):

- 1) Connect the antenna tuner test jig cable (107469) and test Jig (99T082) to the VLOW Band 15 pin connector and connect power led to +28 Vdc. Tune the VLOW Module to 31 MHz. Verify on the TDS that the LEDs are lit correctly on the jig and match the truth table frequency range on the TDS. Repeat the test with the radio tuned to 35, 39, 41, 45 and 49 MHz.
- 2) Press and release the VLOW PTT monitoring the tune output on the test jig. Verify the tune LED is lit and the Tune indicator on the display of the radio shows a "TUNE" to the left of the frequency on the VLOW Band.
- 3) Record the results on the TDS. Record N/A if only VHF AM and UHF AM installed.

COMBINED OUTPUT TEST:

- 1) Select any band on the radio, connecting the appropriate antenna connector to the service monitor. Set Rx audio switch to "COMBINED 1" setting on the test panel. Select "User 1" with the MODE button. In TX mode – toggle the PTT COMB 1 switch. Verify the radio is transmitting on the band selected.
- 2) In Rx mode – type the selected frequency. Verify the radio is receiving that frequency in the combined mode. Press the current band selector button to toggle the combined mute. Verify with the "X" displayed that the audio is not muted. Move the band selector to another band. Verify that the audio on the "X tagged" band is now muted. Move the selector back to the muted band. Verify audio is heard on the original band. Press the band selector again to unmute and remove the "X".
- 3) Set the RX audio switch on the jig to "COMBINED 2", Select "User 2" with the MODE button. Repeat the above steps.

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 Band 1.
- 2) Verify the selected RF module displays "Keyloading".
- 3) Load an ADP key.
- 4) Switch to the other TYPE A RF module. Repeat loading an ADP key to the other module installed.
- 5) Disconnect the keyloader. Reboot the radio. Set both TYPE A RF modules to an encrypted channel – (Zone 1 Channel 6).
- 6) Toggle the ESW to the Encrypted mode. Verify the display shows the "Ⓢ" symbol and is not displaying "Key Fail" on either module.
- 7) Connect the keyloader. Zeroize all keys in both bands. Disconnect the keyloader. Reboot the radio.
- 8) Verify both TYPE A bands in encrypted mode show "Key Fail". Set each module to clear mode by toggling the ESW SW. Verify the "Ⓢ" symbol goes out.

MCP - MOD 14 TESTS:

- 1) Enable External Transceiver 1 and 2 in Configuration Menu.
- 2) Set S13 and S14 to Band 7. Also set S15 and S16 to Band 8. This switches audio and PTT lines on the Main radio test jig - Band 5 to Band 7 and Band 6 to Band 8.
- 3) Check if Band 7 and Band 8 PTT works.
- 4) On Mod 14 Test Jig (19T286) set all Switches to Band 7 and 8. Select position 5 on Main test jig. Key PTT switch on Main test jig to test Band 7 PTT. Set Main jig to position 6 to test Band 8 PTT.
- 5) When PTT 5 is keyed on the Main test Jig, the Band 7 LED on 19T286 should light up as well as TX indicator for External Transceiver #1 on the TDFM-9000 front display. When PTT 6 is keyed, Band 8 LED on 19T286 should light up as well as TX indicator for External Transceiver #2 on the TDFM-9000 front display.
- 6) Record on TDS.
- 7) Check if Band 7 RX Audio works:
 - A) Select External Transceiver 1 on Radio
 - B) Set Radio Test Jig to Band 5
 - C) Set Mod 14 Test Jig Switches: S9-UP, S10-DN, S13 & S14 to UP.
 - D) Set Audio generator to -7dBm
 - E) Turn volume level to 40 on radio
 - F) Verify audio level is 5 Vrms nominal, 4.8 to 5.2V.
 - G) Record on TDS
- 8) Check if Band 8 RX Audio works:
 - A) Select External Transceiver 2 on Radio
 - B) Set Radio Test Jig to Band 6
 - C) Set Mod 14 Test Jig Switches: S11-UP, S12-DN, S15 & S16 to UP.
 - D) Set Audio generator to -7dBm
 - E) Turn volume level to 40 on radio
 - F) Verify audio level is 5 Vrms nominal, 4.8 to 5.2V.
 - G) Record on TDS
- 9) Check if Band 7 Mic Audio works.
 - A) Select External Transceiver 1 on Radio
 - B) Set Radio Test jig to Band 5
 - C) Set Mod 14 Test Jig Switches: S9-DN, S10-UP, S13 & S14 to UP.
 - D) Set audio generator to -13dBm
 - E) Key Band 5 on Main test jig to key Band 7(Transceiver 1)
 - F) Verify TX audio level is 30 to 50mVrms.
 - G) Record on TDS
- 10) Check if Band 8 Mic Audio works.
 - A) Select External Transceiver 2 on Radio
 - B) Set Radio Test jig to Band 6
 - C) Set Mod 14 Test Jig Switches: S11-DN, S12-UP, S15 & S16 to UP.
 - D) Set audio generator to -13dBm
 - E) Key Band 6 on Main test jig to key Band 8(Transceiver 2)
 - F) Verify TX audio level is 30 to 50mVrms.
 - G) Record on TDS

- 11) Check if Band 7 Sidetone Audio works.
 - A) Select External Transceiver 1 on Radio
 - B) Set Main Radio Test jig to Band 5
 - C) Set Mod 14 Test jig Switches S9, 10, 13 & 14 to UP.
 - D) Key Transceiver 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 Band 8 Sidetone Audio works.
 - A) Select External Transceiver 2 on Radio
 - B) Set Main Radio Test jig to Band 6
 - C) Set Mod 14 Test jig Switches S11, 12, 15 & 16 to UP.
 - D) Key Transceiver 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 using S200 Simulator software. Record on TDS

FPP TESTS:

NOTE: This is a factory only requirement. Test the FPP option on TYPE A modules only if the radio is equipped. Test the FPP function on all analog modules.

- 1) Pick a TYPE 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) Pick a channel on any Analog Band. Edit the TX and RX frequency.
- 4) Verify the radio transmits and receives on the modified channels. Record on TDS.

RC-9000 TEST:

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

- 1) Connect a RC-9000 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.

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 and set Dual User to disabled. For MOD 14 radios, disable both External Transceivers.
- 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 35 and all modules to Zone 1 Channel 1.
- 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 and that all stickers and labels are properly installed. No missing or loose screws.
- 6) Shake the unit to confirm there is no loose hardware inside.