NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

March 6, 2017

Handheld Radio

Specialist's Factual Report
By Joseph A. Gregor

1. EVENT SUMMARY

Location:	Chester, Pennsylvania
Date:	April 3, 2016
Operator:	National Railroad Passenger Corporation (AMTRAK)
Locomotive:	89
NTSB Number:	DCA16FR007
Summary:	Refer to the Accident Summary report, within this docket.

2. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following devices:

Device #1 Manufacturer/Model:	Icom IC-F3161DT
Serial Number:	6614063
Operator Marking:	AMTRAK R3506
Device #2 Manufacturer/Model:	Icom IC-F3161DT
Serial Number:	6106860
Operator Marking:	AMTRAK R0144
Device #3 Manufacturer/Model:	Icom IC-F3161DT
Serial Number:	6615624
Operator Marking:	AMTRAK R4449
Device #4 Manufacturer/Model:	Icom IC-F3161DT
Serial Number:	6612035
Operator Marking:	AMTRAK R3343

1.1. Icom IC-F3161DT Device Description

The Icom IC-F3161DT is a battery-powered handheld digital trunk radio transceiver operating on the VHF[1] band. The radio supports 2-Tone, 5-Tone, CTCSS,[2] DTCS,[3] and MDC[4] signaling capabilities are built-in for group communication or selective calling. Both LTR trunking[5] and conventional channels are programmable on a radio. While the radio is designed to operate primarily as a subscriber on a trunk radio system for enhanced range and to support channelized talk-group features, it is capable of operating in simplex – direct radio to radio – mode when the programmed trunk radio system is not available.

1.1.1. Icom IC-F3161DT Device Testing

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed that the radios had sustained no overt damage. All 4 units appeared to power up normally. All four radios were switched to channel 1, which corresponded with a direct radio-to-radio simplex frequency. The radios were tested in pairs with the radios operating in separate adjacent rooms to avoid overdriving the receiver section of the non-transmitting radio. A voice quality test was performed on these radios using the Telecommunications Industry Association (TIA) Delivered Audio Quality (DAQ)[6] rating system as shown in Table 1.

Table 1. DAQ criterion.

Delivered Audio Quality (DAQ)	
DAQ 1:	Unusable. Speech present but not understandable.
DAQ 2:	Understandable with considerable effort. Frequent repetition required due to noise and/or distortion.
DAQ 3:	Understandable with slight effort. Occasional repetition required.
DAQ 3.4:	Understandable with little or no repetition required. Some noise or distortion may be present.
DAQ 4:	Easily understandable. Little noise or distortion.
DAQ 4.5:	Easily understandable. Rare occasions of noise or distortion.
DAQ 5:	Perfect reproduction. No discernible noise or distortion.

[1] 136–174MHz.
[2] Continuous Tone-Coded Squelch System; a system used to inhibit reception of communications from radios operating on the same frequency that are not a part of the desired communication group.
[3] Distributed Tactical Communications System; a satellite-based networking capability.
[4] Motorola Data Communications; a low data rate signaling capability; typically used to provide information to the radio network silently (in the background) including: unit ID, status buttons, emergency button, selective inhibit, radio check, and selective calling.
[5] Logic Trunked Radio; a system developed in the late 1970s that does not employ a dedicated system-wide control channel. Instead, each repeater has its own controller and coordinates activates with each other repeater controller subscribed to the network.
[6] The DAQ criterion attempts to obtain a quantitative measure of received voice audio quality based on the qualitative impression radio users.

A DAQ of 3.4 or higher is generally required for a ‘Pass’ under the this testing protocol. The radios were tested using the following schedule:

- Radio #1 to #2
- Radio #2 to #1
- Radio #3 to #4
- Radio #4 to #3
- Radio #2 to #3
- Radio #3 to #2

This schedule ensured that each radio could communicate with its partner as they were paired upon receipt in the lab; and that each pair could communicate with a radio from the other pair. All communications resulted in a voice quality rating of DAQ 5.