

Aeronautical P25 Digital VHF-FM Radio Transceivers

FS/OAS A-19, Revision F

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This document specifies the minimum performance specifications for all Fire Approved aeronautical P25 digital VHF-FM radio transceivers used in USFS and DOI fire operations.

1. Specifications

- a. All transceivers will be specifically designed for aviation use and meet all applicable RTCA and FAA requirements for transceivers operated in aircraft.
- b. The transceiver must be retested to FCC requirements if the transceiver is modified using untested third party RF modules. This will ensure the transceiver continues to meet FCC requirements after being modified.
- c. Transceiver Characteristics
 - i. All transceivers will be frequency synthesized, operate on any channel from 136.0000 MHz to 173.9875 MHz VHF-FM, have at least one main transceiver, have at least one guard receiver and be TIA TSB-102 APCO Project 25 (P25) digital compliant. Guard receivers will meet the same specifications as the receivers in transceivers.
 - ii. Meet the operational characteristics in the National Telecommunications and Information Administration (NTIA) and FCC basic channeling plans for the VHF-FM 136.0000 MHz to 173.9875 MHz frequency band.
 - iii. All standard CTCSS tones will be available in flight on analog channels.
 - iv. The audio required to fully modulate the transmitter will not exceed that normally produced by the aircraft's audio system and/or microphone. Audio impedance will be designed for a 600 ohm civilian aircraft audio system.
 - v. The guard receiver will be simultaneously monitored with the main transceiver. Scanning of the guard receiver is not acceptable. The guard receiver requirement may be met with a stand-alone receiver having a transmit frequency paired with it or a separate transceiver. Examples of how a multi-band transceiver can meet this requirement are by having a conventional VHF-FM P25 digital receiver dedicated for guard use or a VHF-FM trunked transceiver with a channel preset to conventional simplex Rx/Tx 168.6250 MHz with a Tx CTCSS tone of 110.9 Hz.
- d. Channel and Frequency Selection
 - i. Preset channel selection and programming will be available to the operator by channel while in flight utilizing front panel controls (FPP). The same information will also be programmable from a laptop operating Windows 10. Programming via a laptop while in flight will be a rare exception. VHF-FM trunked guard receivers/transceivers need not be programmable in flight.
 - ii. Receivers will not be disabled during programming.

- iii. FPP programming will not require transceiver power to be cycled to update radio information.
 - iv. The main transceiver will be capable of a minimum of 200 channel presets and the guard will have at least one preset channel.
 - v. Preset channels will contain band settings (analog or P25 digital), receive and transmit frequencies (simplex/duplex), receive and transmit CTCSS tones/NAC & talkgroup codes, and a minimum of an eight character alphanumeric channel designator.
- e. Transmitters
- i. Single band VHF-FM transceivers will be capable of 10 watts power out (HI power). Multi-band transceivers will be capable of 6 watts power out (HI power). Transceivers will not transmit more than 10 watts. A 20% variation is permitted (10 watts = 8.0 to 10 watts and 6 watts = 4.8 to 6 watts). Transmitters will also be capable of transmitting 1 watt (LO power).
 - ii. A selectable 90 second time-out-timer (on/off) will be available.
 - iii. Transmitter sidetone audio will be provided for the main and guard transmitters. Sidetone level adjustment will be externally accessible or via front panel settings.
- f. Receivers
- i. The guard receiver will be simultaneously monitored with the main transceiver.
 - ii. Scanning of the guard receiver is not acceptable.
 - iii. The guard receiver requirement may be met with a stand-alone receiver having a transmit frequency paired with it or a separate transceiver. Examples of how a multi-band transceiver can meet this requirement are by having a conventional VHF-FM P25 digital receiver dedicated for guard use or a VHF-FM trunked transceiver with a channel preset to conventional simplex Rx/Tx 168.6250 MHz with a Tx CTCSS tone of 110.9 Hz.
 - iv. Guard receivers will commonly be preset to narrowband, Rx/Tx 168.6250 MHz, Tx CTCSS tone of 110.9 Hz and labeled "Guard" or similar. When multiple transceivers are operated in the same aircraft local operational requirements may dictate different channel information.
- g. CTCSS Operation
- i. CTCSS tones will meet ANSI/TIA-603 (as revised) for all standard CTCSS code frequencies.
 - ii. Any standard CTCSS tone, or the lack of a tone, will be FPP operator programmable by channel and by frequency.
- h. NAC/Talkgroup Operation
- i. NAC and talkgroup codes will meet TIA TSB-102 APCO Project 25 specifications.
 - ii. Any valid NAC and talkgroup will be FPP operator programmable by channel and by frequency.

i. Display

- i. The transceiver will simultaneously display the channel number in use, bandwidth in use (narrow/P25), CTCSS tone/P25 code in use (i.e. Rx, Rt, or Rg) and either the seven digit frequency in use (i.e. 166.6750) or an operator programmable eight character alpha numeric channel designator (i.e. Air 47).

Display examples:

Desired	001	Air 47	n166.6750Rx
Desired	022	Blue Mtn	D171.5250Rg
Acceptable	058	n166.6750	Rt

- ii. A means to view programmed CTCSS tones, NAC codes and talkgroup codes in each channel.
- iii. The display will have a minimum viewing angle of $\pm 80^\circ$.
- iv. The display will be easily visible in direct sunlight from a distance of 36 inches.
- v. Indicators will provide indication of transmitter activation and signal reception for all transceivers and channels in use.

j. Controls

- i. Single band VHF-FM transceivers will have separate volume controls for the main and guard receivers. Audio outputs will be combined into a single output.
- ii. Multi-band transceivers may utilize a common volume control and combined or separate audio outputs.
- iii. A squelch override/defeat switch will be available to provide audio level adjustment. A single switch is acceptable when the switch activates both main and guard receivers simultaneously. Multiple switches or a switch that steps through the receivers is acceptable when a single switch cannot be used.
- iv. A keypad will be available for DTMF operation. It is desired that the DTMF keypad also be used for FPP manual radio programming.
- v. A transmitter HI/LO power selection switch will be available.
- vi. A means of quickly selecting the guard preset channel will be available (i.e. a main/guard transmit toggle switch).
- vii. A primary power ON/OFF switch will be available.

k. Scanning (when provided)

- i. Scanning will be enabled/disabled by the operator on a per channel basis.
- ii. Channel sampling intervals will be of sufficient duration as to monitor the channel being scanned but no more than 2 seconds before sampling the next channel.
- iii. Scanned channels having activity will briefly pause 3 to 5 seconds allowing the operator time to view the channel and allow the operator an opportunity to respond to that channel (talkback). Paused channels will display the channel number and alphanumeric designator or receive frequency.

- iv. A talkback feature will allow the operator to respond to scanned communications. If the receiver detects no further incoming activity, or the operator discontinues transmissions, the receiver will automatically resume scanning.

2. Leading Particulars

- a. The front panel will be standard avionics non-reflective flat black.
- b. The transceiver's primary power will be +28.0 VDC. The transceiver's case will be ground.
- c. The front panel, controls and display will be backlit when the aircraft's avionics dimming bus is activated. Backlighting will be capable of operating with +28 VDC.
- d. Standard Dzus mounting will be used for all panel mounted transceivers and control heads.
- e. All controls will be clearly and permanently labeled. Labeling will be easily viewable when the front panel and controls are backlit.
- f. An identification tag containing all required markings will be permanently affixed to the exterior of each unit.

3. Environmental Conditions and Test Procedures for Airborne Equipment

Minimum RTCA DO-160G approvals for all transceivers:

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|----|------------|---|----|
| a. | Section 4 | Temperature and Altitude | A2 |
| b. | Section 5 | Temperature and Variation | B |
| c. | Section 6 | Humidity | A |
| d. | Section 7 | Operational Shocks and Crash Safety | B |
| e. | Section 8 | Vibration | |
| | | 1. Fixed Wing | S |
| | | 2. Helicopter | U |
| f. | Section 9 | Explosive Atmosphere | |
| | | 1. Standard USFS requirement | X |
| | | 2. Requirement for use in military aircraft | E |
| g. | Section 15 | Magnetic Effect | A |
| h. | Section 16 | Power Input | B |
| i. | Section 17 | Voltage Spike | B |
| j. | Section 18 | Audio Frequency Conducted Susceptibility | B |
| k. | Section 19 | Induced Signal Susceptibility | AC |
| l. | Section 20 | Radio Frequency Susceptibility (Radiated and Conducted) | S |
| m. | Section 21 | Emission of Radio Frequency Energy | M |
| n. | Section 25 | Electrostatic Discharge (ESD) | A |
| o. | Section 26 | Fire, Flammability | C |

In lieu of meeting Section 26, Category C, the following may be used:

14 CFR § 25.853.a Compartment Interiors

Previously approved transceivers having significant upgrades must have the appropriate DO-160G tests re-accomplished.

4. List of Abbreviations

ANSI	American National Standards Institute
APCO	Association of Public-Safety Communications Officials
CTCSS	Continuous Tone Controlled Squelch System
D	Digital operating mode
DOI	Department of the Interior
DTMF	Dual-Tone Multi-Frequency signaling
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FPP	Front Panel Programming
HI	High transmitter power (maximum default output)
Hz	Hertz
LO	Low transmitter power (typically 1 watt)
MHz	Megahertz
n	Narrowband operating mode
NAC	Network Access Code
NTIA	National Telecommunications and Information Administration
P25	Project 25
Rg	Receiving in the P25 digital mode with NAC + TalkGroup
Rt	Receiving in the analog mode with a CTCSS tone required
RTCA	Radio Technical Commission for Aeronautics
Rx	Receiving in the analog mode with no CTCSS tone required (noise squelch)
TalkGroup	A sub-code of a NAC code
TIA	Telecommunications Industry Association
Tx	Transmitting in the analog mode with no CTCSS tone required
VDC	Volts Direct Current
VHF-FM	Very High Frequency – Frequency Modulation
USFS	United States Forest Service