



Avon Community School Corporation

**Radio
Communications
System Request for
Proposal
Plans & Specifications**

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General System Overview

The Motorola Capacity Plus Multi-Site trunking communications system shall provide reliable, efficient, radio functionality for Avon Community School Corporation's operational groups and shall accommodate Avon Community School Corporation's communications requirements between these operational groups. The radio system shall be upgradeable to a Capacity Max trunking communications system in the future. The radio system shall be provided with the features, functions, and capabilities as described herein.

Required Features and Functions

The proposed Radio System and protocol shall support the following features and functions:

1. The system and/or user equipment must support digital transmissions on a 6.25 kHz equivalent, 12.5 kHz TDMA channel using DMRIII trunking technology. The system and/or user equipment must also support analog transmissions on 12.5 kHz channels.
2. The repeater/base station equipment must be able to manage two independent time slots on a single 12.5 kHz frequency using TDMA (Time Division Multiple Access) technology transmissions.
3. All user portable radios must incorporate increased digital battery life over analog by operating in a TDMA digital mode.
4. All user portable radios must include battery technology for automatic maintenance and reconditioning.
5. All radio subscribers must have built in Wi-Fi capability.
6. All portable radio subscribers must support the Bluetooth low energy 4.0 protocol.
7. All portable radio subscribers must support man-down safety feature without using a 3rd party solution.
8. All radio equipment must support the use of radio subscriber accessories for automatic gain control and noise suppression.

9. The system and/or user equipment must include embedded digital forward error correction technology to increase clarity throughout range.
10. The system and/or user equipment must include embedded software-based privacy or scrambling to protect user privacy during communications. This embedded scrambling must support at least 40-bit protection with multiple keys.
11. All user radios must include Emergency Declaration capability with single button activation. The Emergency Declaration shall provide visual and audible status notification to specified radios. The Vendor's Proposal shall include a detailed description of the Emergency Declaration features and programming options.
12. The system and/or user equipment must include embedded GPS receivers in both the portable and mobile radios. Any additional external receivers or accessories shall not be required to receive or send GPS information. GPS shall be supported in a repeater and/or talk around mode.
13. The system and/or user equipment must include embedded text messaging capabilities. Any additional external receivers or accessories shall not be required to receive or send text message information. The user equipment must support unit-to-unit canned and user creatable text messaging capability. The user equipment must support at least 140 scrolling characters. Text messaging shall be supported in a repeater and/or talk around mode.
14. The system and/or user equipment must include embedded telemetry capabilities. Any additional external receivers or accessories shall not be required to receive or send telemetry information. Telemetry shall be supported in a repeater and/or talk around mode.
15. The system and/or user equipment must include intelligent channel steering capabilities to revert GPS traffic to alternate channels to control and manage data traffic more efficiently on the system.
16. Automatic Vehicle Location (AVL) information shall include vehicle identification, location, speed, and time of transmission.
17. Voice shall take priority over data transmissions on radios transmitting both

voice and data information.

18. The system user shall have the option of applying for licensure to detailed radio interface information. This information shall allow the radio user, if capable, to develop custom applications.
19. The system shall provide a software application that allows the system administrator the ability to monitor and control the radio repeaters within the system. The Repeater Diagnostics and Reporting system shall provide the following capabilities:
 - a. Repeater Diagnostics that include enabled-disabled station status, Transmitter power status, available channels and RSSI levels.
 - b. Repeater Controls that include changing channels, transmitter power, station reset and repeater knockdown.
 - c. Repeater Alarm Reporting including Receiver lock failure, transmit lock detect, station overheating, AC Power supply failure and detect and report of failure.
 - d. The application operates over the IP network or locally via USB or GPIO connection.
 - e. Repeater Alarms: RX (Receiver lock failure), TX (transmit lock detect), Temp (station overheating), Power (AC Power supply failure), Fan (fan failure), *PA Voltage Major, *PA Voltage Minor, *VSWR Major, *VSWR Minor, *TX Power Major, *TX Power Minor, *PA EEPROM Corruption, *Exciter EEPROM Corruption, *Receiver EEPROM Corruption, *Interoperability Between Exciter and PA, *Incorrect Carrier Frequency or Incorrect Codeplug for PA.
20. The system shall provide Basic Privacy using a 16-bit encryption key on all channels.

Trunking System Capabilities:

1. The system shall be a multi-site, multi-channel radio network capable of supporting multiple interconnected user groups/fleets. Various entities and work groups must be able to communicate without regard to geographic location.
2. The system design should allow connection of any site in the network to any site in the network over IP (Internet Protocol) to achieve the required network connectivity between sites. The network infrastructure should allow the system operator the flexibility of being able to configure the network in a linear, star or mesh type of network configuration.
3. System capability should allow expandability to support additional and/or future sites, radio channels, and users. The network shall support a minimum of 15 sites and support future expansion up to 250 sites.
4. The system design should allow seamless roaming between sites. The system shall provide for automatic radio switching between network sites without any action by the user to provide communications without any message interruption throughout the designated coverage area.
5. The system shall support the ability to trunk voice or data traffic to available system channels to maximize efficiency. The Trunking system shall automatically detect a Push-to-Talk as a request to talk, and automatically select and assign a voice path for the communications of the selected talk group. Various entities and work groups must be able to communicate without regard to channel selection, radio site selection or geographic location.
6. The system Trunking protocol shall not require the use of a dedicated control channel, allowing voice/data to simultaneously trunk on all system channels.
7. While in trunked mode, the subscriber access time, defined as PTT to system access, shall not exceed 900 milliseconds when a trunked voice path is available.

8. The system shall support 4 Sites with 2 repeaters at each site offering ACSC 4 simultaneous voice paths on the repeater system, using DMR III trunking technology amongst all talkgroups corporation wide. These sites include:
 - Transportation Center Tower
 - River Birch Elementary
 - Avon North Middle School
 - Avon High School

The above sites must include an integrated redundant backup power solution.

9. The system shall be capable of supporting data communications that include GPS location services, text messaging, and a data interface for other customer specific and supplied applications including telemetry, system performance management, VoIP dispatch, AVL, work-order management, and email connectivity.
10. In the event of a repeater failure, the system shall continue to maintain its trunked operation, regardless of which repeater fails.
11. In the event of frequency interference, the system shall continue to maintain its trunked operation, regardless of the channel interfered with.
12. The system shall allow the ability to designate whether a talk group is wide area or local, by which wide area talk groups are repeated across sites and local area talk groups are repeated only at the site in which they are transmitted.
13. The system shall support the ability to restrict communication access to certain sites.
14. The system shall support site roaming without user intervention.
15. The system shall have the ability to perform the following functions at a minimum:

- a. Site Wide / System Wide
 - b. Private Call
 - c. Remote Monitor
 - d. Text Message
 - e. GPS
 - f. Call Alert
 - g. Radio Check
 - h. Emergency Initiate
16. The system shall include expandable support to remotely disable and enable a radio from a central location, establish Priority Levels for individual users talkgroups, manage serial number-based user access groups, and support store/forward text messaging.
17. In the event of a wide area link failure, the system shall continue to maintain its local Trunked operation and shall continue to provide wide area communications where a wide area link is still available between sites.
18. With an upgrade to Capacity Max, through a central and remote IP connection, the system administrator shall be able to disable, remove, add, modify users and their permissions without any disruption to the network, repeaters, site controllers, roaming, calls in progress or registration.

1. User Equipment

1.1. General

All user radios proposed (portables, mobiles, and control stations) shall fully support all features and functions available for user radios in the proposed system. The pricing for user radios shall include all programming and installation services required for operation. At the appropriate time during the implementation process the Vendor will be expected to develop detailed programming personalities and talkgroup configurations with input and assistance from Avon Community School Corporation. User radio

programming shall not be performed until Avon Community School Corporation's Project Manager has approved the programming personalities and issued a written notice to proceed with radio programming.

All proposed portable, mobile, and control station radios shall conform to the minimum standards specified by TIA/EIA-603, Section 5 "Standards for Portables".

Responses shall include unit cost for mobile and portable radios. Unit price shall be locked in for a period of 1 year from contract signing. Trade in or buy back promo language should be included as well.

1.2. Portable Radios

The system proposal shall include 70 XPR 7550e Full Keypad GPS/Wi-Fi/GOB Enabled models and provide the following minimum features:

- Emergency button.
- 12.5 kHz analog channel bandwidth.
- 12.5 kHz TDMA (6.25e) digital channel bandwidth.
- Alphanumeric display.
- Support up to 1000 channels
- Digital Signaling - PTT ID, Private Call, All Call, Call Alert, Escalating Alerts, Emergency, Radio Check, Radio Disable/Enable and Remote Monitor
- Analog Signaling - MDC1200: PTT ID, Emergency and Call Alert
- 16-position channel selector.
- External microphone and speaker connections.
- Li-ion battery.
- Full line of optional accessories.
- Optional intrinsically safe model.
- 6 Programmable buttons (supporting both long and short press)
- Meets IP68 submersibility with or w/o accessory cover attached

The system proposal shall include 300 XPR 3500e 403-512 4W LKP WIFI Limited Keypad with Wi-Fi enabled models and provide the following minimum features:

- 12.5 kHz analog channel bandwidth.
- 12.5 kHz TDMA (6.25e) digital channel bandwidth.
- Alphanumeric display.
- Support up to 128
- 16-position channel selector.
- External microphone and speaker connections.
- Li-ion battery.
- Full line of optional accessories.
- 4 Programmable buttons (supporting both long and short press)
- Meets IP67 submersibility with or w/o accessory cover attached

The system proposal shall include 30 XPR 3300e 403-512 4W WIFI Enabled Limited Keypad and provide the following minimum features:

- 12.5 kHz analog channel bandwidth.
- 12.5 kHz TDMA (6.25e) digital channel bandwidth.
- Non display.
- Support up to 16 channels
- 16-position channel selector.
- External microphone and speaker connections.
- Li-ion battery.
- Full line of optional accessories.
- 2 Programmable buttons (supporting both long and short press)
- Meets IP67 submersibility with or w/o accessory cover attached

Proposed portable radio units shall conform to applicable Portable Military Standards 810C, 810D, and 810E. The portable transmitters and receivers must further meet or exceed the following specifications.

Portable Transmitter

Frequency Range	403-512 MHz
Frequency Stability	+/- 0.5ppm (GPS)
RF Power Output	1 – 4 watts
Channel Spacing	12.5 or 25 kHz
Adjacent Channel Power	60 dB @ 12.5 kHz

Portable Receiver

Frequency Range	403-512 MHz
Channel Spacing	12.5 or 25 kHz
Analog Sensitivity (12 dB SINAD)	0.16 uV
Digital Sensitivity	0.14 uV
Adjacent Channel Selectivity	60dB at 12.5 kHz
Spurious Rejection	70 dB
Audio Distortion	3%

1.3. Mobile Radios

The system proposal shall include 150 XPR 5550e GOB/BT/GPS/WI-FI Enabled models and provide the following minimum features:

- Emergency button.
- 12.5 kHz analog channel bandwidth.
- 12.5 kHz TDMA (6.25e) digital channel bandwidth.
- Alphanumeric display.
- Support up to 1000 channels
- Digital Signaling - PTT ID, Private Call, All Call, Call Alert, Escalating Alerts, Emergency, Radio Check, Radio Disable/Enable and Remote Monitor

- Analog Signaling - MDC1200: PTT ID, Emergency and Call Alert
- Full line of optional accessories, including desk top mics, external speakers, external PTT, ignition sense, and others.
- High Power Unit (at least 40 watts).
- 4 Programmable buttons (supporting both long and short press)

Mobile and control station transmitters and receivers must further meet or exceed the following specifications.

Mobile/Control Station Transmitter

Frequency Range	450-512 MHz
Frequency Stability	+/- 1.5ppm (Non-GPS) +/- 0.5ppm (GPS)
RF Power Output	1-40 watts
Channel Spacing	12.5 or 25 kHz
Adjacent Channel Power	60 dB @ 12.5 kHz

Mobile/Control Station Receiver

Frequency Range	450-512 MHz
Channel Spacing	12.5 or 25 kHz
Analog Sensitivity (12 dB SINAD)	0.30 uV / .22uV (typical]
Digital Sensitivity	5% BER: 0.3 uV
Adjacent Channel Selectivity	65dB at 12.5 kHz (w / TIA603) 50dB at 12.5 kHz (w / TIA603C)

Spurious Rejection	75 dB
Audio Distortion	3%

1.4. Desktop Control Station Radios

Desktop control stations may be installed at locations to be determined later. The following minimum features should be supported by the proposed control station radio:

- Emergency button.
- 12.5 kHz analog channel bandwidth.
- 12.5 kHz TDMA (6.25e) digital channel bandwidth.
- Alphanumeric display.
- Support up to 1000 channels.
- Digital Signaling - PTT ID, Private Call, All Call, Call Alert, Escalating Alerts, Emergency, Radio Check, Radio Disable/Enable and Remote Monitor
- Analog Signaling - MDC1200: PTT ID, Emergency, and Call Alert
- Full line of optional accessories.
- Support flexible 1-40-watt operation.
- 4 Programmable buttons (supporting both long and short press)

2. Infrastructure Equipment

2.1 Controller Equipment (for Control Channel Based Trunking)

Each site shall support future Control Channel based trunking system operation, including a central mechanism to control, manage, configure, and optimize system access and performance. The hardware for this mechanism must meet the following specifications:

General Specifications	
Performance	Celeron M, 1 GHz Microprocessor
Ethernet Connections	4-Auto sensing 10/100 Mbps Ports

Serial Connections	8- RS232 Ports
AC Input Power Requirements	100/240 VAC, 47 to 63 Hz , 30 Watts fully loaded.
Dimensions	17.32" X 9.96" X 3.54" (440 X 253 X 90 mm) (without mounting tabs)
Mounting	Standard 19" rack mounting
Weight	15.4 Lbs. (7 kg)

Environmental

Operating Temperature	-30 to +60°C (-22 to +142°F)
Humidity	5 to 95% RH
Storage Temperature	-40 to +85°C

Standards

FCC	Part 15 Subpart B, CISPR 22 Class A
UL/cUL	UL60950-1, CSA C 22.2 No. 60950-1-03, LVD EN60950-1

2.2 Base Station Equipment

There must be at least 2 options for repeater specifications to provide flexible options for repeater configurations. The system shall be capable of mixing the two types of repeaters within the same system and/or site. Repeater equipment must support an internal power supply. The 2 options must meet the following specifications:

Mid-Tier Repeater Option Specifications

Base Station Transmitter

The base station transmitters shall conform to the minimum standards specified by TIA/EIA-603, Section 4.2, and the Code of Federal Regulations 47, Part 90, Subpart I. The transmitters shall further meet or exceed the following specifications.

Frequency Range	403-470 MHz
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Frequency Stability	+ / - 0.5 ppm
RF Power Output	40+ watts (continuous)
Channel Spacing	12.5 kHz
Audio Distortion	3%

Base Station Receiver

The base station receivers shall conform to the minimum standards specified by TIA/EIA-603, Section 4.1. The base station receivers shall further meet or exceed the following specifications.

Frequency Range	403-470 MHz
Analog Sensitivity (12 dB SINAD)	0.30 uV / .22uV (typical]
Digital Sensitivity	5% BER: 0.3 uV
Adjacent Channel Selectivity	65dB at 12.5 kHz @ (TIA603) 50dB at 12.5 kHz @ (TIA603C)
Spurious Rejection	75 dB
Audio Distortion	3%

Higher Specification Repeater

Base Station Transmitter

The base station transmitters shall conform to the minimum standards specified by TIA/EIA-603, Section 4.2, and the Code of Federal Regulations 47, Part 90, Subpart I. The transmitters shall further meet or exceed the following specifications.

Frequency Range	400-470 MHz
Frequency Stability	UHF: 1.5 ppm
RF Power Output	UHF: 1-100 watts (continuous)
Channel Spacing Analog	12.5 kHz, 25 kHz
Channel Spacing Digital	12.5 kHz (6.25e compliant)
Audio Distortion	Less than 3% (1% typical) at 1000Hz; 60% RSD

Base Station Receiver

The base station receivers shall conform to the minimum standards specified by TIA/EIA-603, Section 4.1. The base station receivers shall further meet or exceed the following specifications.

Frequency Range	403-470, 470-524 MHz
Analog Sensitivity (12 dB SINAD)	0.30 uV (0.22 uV typical)
Digital Sensitivity	0.30 uV (0.20 V typical)
Adjacent Channel Selectivity (TIA603)	UHF @ 25kHz: 80 dB (86 dB typical) UHF @ 12.5kHz: 75 dB (78 dB typical)
Adjacent Channel Selectivity (TIA603D)	UHF @ 25kHz: 75 dB (85 dB typical) UHF @ 12.5kHz: 45 dB (60 dB typical)
Spurious Rejection	UHF: 85 dB
Audio Distortion	Less than 3% (1% typical) at 1000 Hz; 60% RSD

3. Site Assembled Rack Equipment

- It is expected that the Vendor will design, prepare, and assemble each system network site's equipment into a compact, industry rated, equipment rack.
- The system equipment rack may include all associated network components of base station repeaters, duplexer, transmitter combiners, receiver multicoupler, band pass/band reject filter and AC and lightning protection 19-inch rack mounted.
- System documentation shall include detailed drawings of these racks and the associated equipment and termination cabling.

4. Safety Reimagined Solution Support

The proposed communications system shall support:

- Integration with Avigilon camera and access control solutions and support associated Avigilon/MOTOTRBO Radio Alert notifications.
- WAVE iOS/Android smartphone/tablet system integration.
- Support integrated incident management solutions (i.e. Ally/Command Central solution integration).
- The chosen solution partner must have demonstrated Safe Schools integration experience and provide associated system implementation references.

5. Installation

- All Infrastructure/Site Components shall be installed to meet or exceed R56 Grounding
- Specifications where possible. All Infrastructure/Site Components shall be pre-assembled and mounted in a 19" E.I.A. Rack by the Equipment Manufacturer.
- The System including all Site Components shall be Staged (pre-installed) at the local Service Provider's Facility for calibration, testing, and training before delivery to final Site Locations.

- Avon Community School Corporation may inspect the system during system staging at Service Providers Facility.
- Installation shall be conducted by Factory Trained and ETA (Electronic Technician Association) Certified Technicians.
- Vendor shall prepare and submit all required F.C.C. License Applications, F.A.A. Applications, and any other legal requirements for the operation of proposed Radio System.

6. Additional Vendor Criteria

- Selected vendor must show past K-12 experience in installing multi-site, multi-repeater trunked systems and provide 5 references of such.
- Selected vendor must show experience in deploying the Safety Reimagined Portfolio of integrated solutions from Motorola, including TRBO, Avigilon ACC/ACM/ Ally Incident Management with references. Vendor shall provide Safety Reimagined Certification from Motorola showing proficiency in system deployment and familiarity with portfolio integration.
- Vendor must provide vendor financing not utilizing third party financing. ACSC financing plan will include:
 - o Down payment (50% due at signing, 50% due at customer acceptance of system)
 - o No payment in years 1-3
 - o Final payment split evenly made in years 4 and 5.
- Selected vendor shall provide separate multi-site trunked back up system for use should ACSC main system catastrophically fail. This system should be pre-programmed into ACSC radios.
- 5 Year maintenance plan in addition to warranty shall be included covering all radios and repeater sites excluding acts of God and physical damage/misuse by ACSC.
- Selected vendor must maintain service locations within 15 miles of ACSC Administration Building.

