Town of Barrington NH

Specification for

Radio System Upgrade

October 21, 2021

The purpose of this document is to provide interested parties with information to enable them to prepare and submit a proposal to provide RF repeater system, subscriber units, and microwave radio

Submitted by:
Town of Barrington, NH
Conner McIver
Town Administrator
cmaciver@barrington.nh.gov

1 SOLICITATION PROCEDURE

The Town of Barrington has approved a project to replace the Barrington Fire Department VHF repeater, and to provide a new Public Works VHF repeater system with subscriber units. This document provides specifications for these upgrades. Contractors shall submit a system design and provide all of the necessary equipment and services required for a turnkey solution.

Due Date and Time – Responses are due on Monday, November 8, 2021 at 3:00 PM

One original and one electronic copy (stored on a portable memory device) of the completed proposal must be received at the Barrington Town Hall on the date and time specified.

Moreover, the Contractor may submit any questions via email to:

Conner McIver
Barrington Town Administrator
Barrington Town Hall
333 Calef Highway
(603) 664-7395
cmaciver@barrington.nh.gov

All questions must be submitted by Monday, November 1, 2021.

Contractor proposals shall be sent to the above address.

Pre-Bid Meeting – No

Site Tour – Upon Request

Performance Surety Bond Required – No

Recommended Manufacturer: None

Contractor Contact: Provide contractor contact name, address, phone number and email address

2 GENERAL INFORMATION AND EXISTING CONDITIONS

The following briefly describes existing Fire Department and Public Works systems in Barrington.

2.1 Public Works

The Barrington Public Works VHF simplex system is currently offline. There are approximately ten [10] mobiles and four [4] portable radios with a mobile base unit located at the Public Works garage.

The proposed DPW system upgrade includes converting to repeater operation, and to be co-located with the Fire Department repeater located at Ramsdell Road self-support tower.

Transmit Frequency:	155.820 MHz: this frequency to be re-licensed to new location by others
Receiver Frequency:	To be determined
Antenna Height:	Antenna tip at 120’ AGL
ERP:	Currently 200 watts ERP [may be reduced by the frequency coordinator]
Call Sign:	KNFS475, Town of Barrington

2.2 Fire Department

The Fire Department has a Motorola MTR3000 repeater, with a gain antenna on a 140' self-support tower located at Ramsdell Road in Barrington. This equipment is beyond end-of-life.

It is intended that the antenna and transmission lines and protection devices are to be replaced.

The repeater is wireline controlled by the UNH Dispatch Center in Durham via leased 4-wire circuit from Consolidated Communications.

The receiver is connected to a JPS voter located in Durham.

Transmit Frequency:	156.1050 MHz
Receive Frequency:	151.4300 MHz
Antenna Height:	Antenna base at 140' AGL [top]:
ERP:	25 watts
Call Sign:	KNJL459; Town of Madbury

3 SCOPE OF WORK

The Contractor will supply all supervision, labor, vehicles, tools, test equipment, transportation, inspection, unloading and inventory keeping. The installation must be fully tested and well documented with all cables and terminating hardware.

The equipment shall be the latest model of the equipment and procured according to the Town's procurement procedures.

The equipment and services to be supplied under this procurement include:

1. Provide and install two [2] VHF repeaters, transmission line, antennas, and protection devices at the Ramsdell Road tower
2. Public Works repeater shall be DMR capable, but will operate in the analog mode
3. Structural analysis of existing towers
4. Install one [1] control station [mobile with power supply, outside antennas, and external speaker] at Public Works garage
5. Reprogram Police Department subscriber units for new DPW frequency: nine [9] mobiles, twenty [20] portables, and one [1] control station
6. Provide the following DPW subscriber equipment
    a. 13 mobiles
    b. 4 portables
    c. 1 control station

3.1 RF Repeater Requirements

The repeater equipment and services to be supplied under this RFP shall be DMR or analog capable as follows:

Fire: Analog

Public Works: ETSI DMR Digital Capable; programmed for analog

- FCC Type Accepted for 12.5 KHz [6.25e] Bandwidth
- Duty Cycle – Continuous
- RF Power Output – 50 watts (minimum)
- Fully Shielded Chassis
- Remote Control – Tone / 4-wire [Fire repeater only]
- Broadcast FCC Call Sign ID
- In-Cabinet repeat
- Voting function [JPS]
- Cabinet with lock (2'wx2'dx48'h maximum)
- 120vac, 60Hz operation
- 12vdc battery revert, charger and battery to operate 4-hours on 50% Tx and 50% Rx duty cycle
- Local Control Panel with Microphone and Speaker
- Operate –30 to +60 degrees C

Antenna - The antenna system design shall be specified to reduce the potential for intermodulation or receiver desensitization, and to provide the required coverage within the restraints of the FCC license. The antenna systems, which include all antennas and transmission lines, shall have devices that protect the system from lightning and surge currents using Polyphaser type devices.

Duplexer - The repeater station shall be supplied with a duplexer. The repeater shall include an internal duplexer with sufficient isolation so as not to degrade the receiver by more than 1dB when the station is transmitting. The transmitter output shall be followed, at a minimum, by a single stage isolator. The isolator load shall be rated for the full output power of the transmitter.

Programming - The Contractor shall program the radio with the channels provided by the Town's Project Manager prior to installation.

Site Connectivity – For the Fire Dept repeater only; repeater to be controlled by UNH Dispatch utilizing existing leased 4-wire circuit from Consolidated Communications.

Fire repeater future requirement will be based on IP microwave hops; an IP gateway for Fire shall be proposed as an option including gateway for Zetron MAX console.

Equipment Cabinet Grounding – The Contractor shall supply and install a #6 green conductor between the equipment cabinet and the ground bar in the equipment room. Compression lugs, bolts, lock washers and nuts shall be used on all ground conductors. Ground conductors shall be routed with a minimum-bending radius of 8".

3.2 Subscriber Equipment

All user radios proposed [portables, mobiles, and control stations] shall fully support all features and functions available for user radios in the proposed DMR radio system. The pricing for user radios shall detail all options, programming and installation services required for operation.

Pricing shall include programming and installation.

All subscriber radios should be rugged, reliable, and provide the following minimum features.

Portable Radio

The number of units to be supplied: 4

Each portable shall be equipped with:

1. Battery
2. Single unit charger
3. Flexible ½ wavelength antenna whip
4. Remote speaker microphone [option]
5. Swivel leather carrying case with hold down strap [option]

The 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. IP67 Dust and Water Intrusion

Contractor shall specify the detailed performance specifications of the portable radio, at a minimum:

- Static Sensitivity (-117 dbm analog for 12 dB SINAD and 5 percent BER)
- Power Output 1 to 3 watts Selectable
- 155 MHZ LMR Bandwidth
- Frequency Stability +/-1.5 PPM
- Audio Power 0.5 watts

Mobile Radio

The number of units to be supplied: 13

For each mobile, including spares, shall be equipped with:

1. Plug-in type palm microphone with coiled cord
3. Permanent antenna mount assembly
4. Low profile roof/trunk mount antenna
5. Low loss coaxial cable
6. Plug-in type external speaker [option]

The proposed mobile radio units shall conform to applicable Mobile Military Standards 810C, 810D, and 810E.

Contractor shall provide detailed performance specifications of the mobile radio, at a minimum:

- Static Sensitivity (-117 dbm analog for 12 dB SINAD and 5 percent BER)
- Power Output 35 watts
- 155 MHZ LMR Bandwidth
- Frequency Stability +/-1.5 PPM
- Audio Power 0.5 watts
- Available Front Mount and Remote Mount [option]

3.3 IP Microwave System

As an option, this section defines the requirements for an IP backhaul microwave link between Barrington and the UNH Dispatch Center.

No sites have been selected for the microwave hop; the following assumptions shall be taken into consideration to establish labor and material cost: assume line-of-sight and Fresnel clearances; hops less than 8-miles; assume 100' antenna height on lattice towers; assume 10' between shelter and tower.

The Contractor shall provide the Town with simulated link verifications based on line-of-sight projections taking into consideration the terrain and obstructions detailing their effect on Fresnel interference as part of the proposal submission.

Tree Growth: The Contractor shall include a tree growth factor to be added to measured tree heights at critical points along all microwave paths. This tree growth factor shall be a minimum of 20-ft. Path profile data sheets included with final path engineering documents shall clearly denote the tree growth factor used at each critical point.

Path Outage: All paths in the system, including rings and spurs, shall be designed for a minimum two-way path reliability of 99.999% EFS (error free seconds) per year.

Fade Margin: minimum composite Fade Margin of 35dB.

Scalable QAM Reliability: All paths shall include calculations providing percent reliability based on throughput of higher and lower order QAMs.

Rain Outage Model: The Crane model shall be used to predict rain outage in all paths in the 11GHz band, or other bands where rain outage is a significant factor.

3.3.1 Microwave Radio Technical Requirements

- Frequency Band: 11 GHz FCC Licensed band
- Hot-Standby configuration
- Radio transmission must comply with FCC-47CFR Part 101
- Modulation: OFDM (BPSK)/QPSK: 16QAM/ 64QAM/ 128QAM/ 256QAM/ 512QAM/ 1024QAM/ 2048QAM/4096QAM
- Capacity: No less than 10-Mbps data rate (bi-directional) – software upgrade capable for future bandwidth increase
- Channel Bandwidth: As required for the proposed capacity
- Max TX Power: to meet FCC rules and provide the required availability specification
- Sensitivity: to meet FCC rules and provide the required availability specification
- Network interface is to be a 10/100/1000 Base-T Ethernet port(s)
- Ethernet POE switch: 8 Ports [min]]

3.3.2 General Requirements

The equipment shall be designed and manufactured for continuous duty operation in a fixed station application and have an expected operational service life of at least 15-years with proper maintenance and service.

The microwave radio shall utilize modulation schemes necessary to maintain overall system bandwidth performance and reliability.

The equipment proposed shall be a split unit [IDU / ODU].

Equipment shall be powered by 48volts DC [rectifier unit]; 4-hour backup capacity.

The contractor shall furnish and install all pipe mountings, as required, for support of the microwave antenna/radiohead. Stiff arms are required.

Microwave antennas shall be selected by the Contractor to meet the system reliability requirements defined within this specification. All antennas shall be single polarized, low VSWR, standard type antennas, unless path designs dictate otherwise.
All microwave antennas, including standard, high performance, and maximum or ultra-high performance types, shall be provided with protective radomes. Radomes shall be colored to minimize visual impact of the antenna system installation.

Furthermore, the microwave antenna design should be taken into consideration to minimize tower loading conditions, where applicable.

Proposed bandwidth is 10-Mbps minimum – Contractors shall discuss the merits of lower/higher bandwidths in their proposal.

Compatibility with Simulcast. Future requirement. Microwave radios, gateways, multiplexers, switches and routers provided shall reliably maintain low latency relative to simulcast delays at each site under normal conditions.

3.3.3 Path Design

NOTE: To be completed when sites have been identified.

- Path design calculations showing path reliability and fade margins
- Path profiles with trees/obstructions
- Path profile characteristics
  - ✓ K-factor(s) used
  - ✓ Path clearances at critical points along the path
  - ✓ Potential reflection points and natural/manmade shielding along the paths shall be identified /noted and discussed in detail
- Dish sizes, types, sizes, and tower loading requirements for each site
- Equipment rack profiles and floor space requirements for each site

3.3.4 Path Survey

Physical path surveys shall be performed upon contract execution.

The Contractor shall be responsible to provide all personnel, maps, proper instrumentation and any other equipment or material necessary to perform the physical path surveys based on a final statement of work. In executing the path surveys, the Contractor shall search for existing construction plans, permits, etc. for proposed structures along the projected path. If a particular location along the path is already developed with existing structures not likely to be re-built or extended/expanded, the Contractor shall state the pre-existence of these objects. If the new structure(s) are proposed, the contractor shall take the new construction into account in the microwave path calculations.

The Contractor shall be required to provide a report of the field path surveys on every site and path. These submittals shall provide, as a minimum, the following information and material:

- Verified site coordinates
- Verified site ground elevations
- Microwave system schematic drawings
- Sites plotted on maps

- Final path profiles
- Obstruction heights along microwave paths
- Reflection Analysis for all obstructions on all paths
- Antenna calculation sheets
- Path profile characteristics, path clearances at critical points along the path, potential reflection points

3.3.5 ***Technical Requirements***

The ODU shall be suitable for mounting on antenna tower structures, water tanks or building roof

The ODU shall be comprised of either a self-contained integral antenna or a separate antenna meeting these specifications.

- Specified path reliability specifications
- Operating Temperatures: -35°C to 60°C / -31°F to 140°F Humidity 95% non-condensing.

3.3.6 ***IP Performance Consideration***

This Section provides information regarding IP connectivity to all sites including the dispatch center.
The proposed transmitter simulcast radio system design as specified elsewhere in this specification shall utilize IP gateways. The contractor is required to provide connectivity to these devices as well as LAN switches and routers to be interfaced with the microwave system.

Latency: The IP performance for round-trip delay of packets across paths between redundant sub-site link pairs shall be measured and recorded; [Latency or IP Packet Transfer Delay is defined pursuant to RFC 2681].

Latency link budgets for IP voting and IP transmitter simulcast shall be designed to be fully functional for less than 10-ms to the remote RF sites.

Jitter: In an IP network system, the jitter shall be based upon 99th percentile (Y.1541), end-to-end jitter specifications shall be measured and recorded during peak activity daytime periods for the five longest anticipated routes and shall be demonstrated to be below the contractor's maximum jitter guarantee.

Jitter for IP voting and IP transmitter simulcast shall be designed to be fully functional for less than 10-ms.

Packet Loss: Packet loss can result from exceeding jitter budgets or actual packet loss in the network as "Type-P-One-Way-Packet-Loss" as defined pursuant to RFC 2680. Any packet loss will have an immediately effect on audio; end-to-end packet loss shall be tested and documented.

Packet Loss for IP voting and IP transmitter simulcast shall be designed to be fully functional for less than .01% packet loss

Packet Reordering. Packet reordering manifests itself as lost packets. The contractor shall design and implement the IP communications network to ensure that access times and audio quality will be acceptable.

4 SERVICES

Q*ualifications* - Designers and installers shall be experienced factory-authorized personnel to perform work on this system.

Safety - The Contractor is responsible for the safety of their workmen and all others while working on Town facilities. The Contractor shall ensure that their employees and agents comply with all applicable health and safety laws, OSHA rules and regulations without limitation.

Shipping – All items shall ship FOB Destination.

Programming and Labels – All necessary programming to provide the functions identified in this document. The Contractor will label all items, as required.

Each repeater shall be labeled identifying equipment owner department and frequencies.

FCC License Modifications – The Town is responsible for all necessary FCC and frequency coordination work required by the changes identified in this document.

4.1 Installation

Once the Town has chosen the selected contractor, a notice to proceed will be provided to begin project implementation according to the accepted plan.

The Contractor shall review the order prior to submitting it to the factory to ensure that all items are accurate. A revised proposal, if necessary, shall be supplied to the Town's Project Manager. No equipment shall be ordered until approval has been received from the Town's Project Manager.

The Contractor must coordinate all work with the Town's PM. It is the responsibility of the Contractor to notify the Town of any issues that must be addressed prior to commencing any work.

The Contractor shall attend project coordination meetings that directly impact the Contractor's work and/or schedule. The Contractor shall not receive compensation for any additional work required due to the lack of coordination with other Contractors.

Repeater Equipment

The Contractor shall perform a pre-installation visit to survey the locations for all equipment to be installed. If conditions not under the control of the Contractor require a change in the items and/or services proposed, a revised proposal shall be supplied to the Town's Project Manager.

No equipment shall be delivered, or work started, until approval has been received from the Town. Installation shall include all necessary wire/cables. Installation shall be performed by factory-trained staff. It is the Contractor's responsibility to ensure that all existing equipment to be interfaced is in proper working order. It is the responsibility of the Contractor to notify the Town of any issues that must be addressed prior to commencing any work.

Equipment and physical facilities shall be installed in a neat and professional manner, employing the highest standard of workmanship and in compliance with applicable standards.

All sites shall be left in a neat, presentable condition throughout the installation phase of the project. All rubbish, temporary structures, and equipment generated or used by the contractor shall be removed after completion of the work, and prior to acceptance.

Antenna Installation

All applicable OSHA rules and requirements shall be rigorously complied with, as well as applicable FCC and FAA requirements including RF exposure guidelines. For antenna installations, under no circumstances shall an individual be allowed to work alone. It is crucial and imperative that all current OSHA fall protection rules are followed. This includes but is not limited to "full body harness" and 100% "tie off", contractor employees found not following all OSHA rules and directives will be ordered from the job site by the Town.

The Contractor is responsible for providing and delivering the antennas, hardware, and transmission lines to the sites. Antennas shall be installed in the positions that orient the antenna in the azimuth benefiting coverage. For side mounted antennas, appropriate side arms shall be provided to minimize the effect of the tower on the antenna pattern

The contractor shall seal around wall/roof/ceiling penetrations to maintain building integrity and construction.

Antenna and equipment shall meet R56 for grounding and lightning protection.

Transmission line identification – each transmission line shall be color-coded with colored tape at three locations: at the cable entry inside the shelter; at the base of the tower at approximately 10-ft level; and at the top near the antenna.

Microwave Radio

The installation of the microwave equipment will be provided by the Contractor at the designated location within the equipment shelters at the sites. The contractor shall supply and install all required equipment, accessories, punchblocks, terminal strips or cables needed to interface to new or existing facilities.

Inspection of the completed microwave network equipment installation shall be performed to ensure compliance with standards set forth in final contract and the specifications.

Microwave Parabolic Antenna

Adjustments on horizontal and vertical azimuths shall be capable of a minimum extension of +/- 5-degrees. After completion of antenna panning, the side struts and stiff arms shall be cut to a suitable length past their mounting, not to exceed 3-feet.

Transmission line shall not exceed its bending radius or twisted. At antenna level, the t-line shall be terminated to the antenna via short jumper that will allow the antenna to be panned through +/- 2-degrees without creating any stress on the waveguide or its connector. Appropriate seals shall be used at the cable entry port of the shelter.

The antenna shall be capable of being panned +/- 2-degrees, and panned by noting the 3dB and 15dB points on both sides of the antenna pattern in both the horizontal and vertical planes.

All microwave antennas, regardless of size and frequency band, shall be provided with stiff arms for mounting and shall be attached to the tower in accordance with the requirements of the tower and microwave antenna manufacturers.

Subscriber Equipment

The Contractor shall coordinate all vehicle installations and removals with the Town's Project Manager.

Arrangements for scheduling this work shall be completed by the Contractor no less than 7-calendar days prior to the start of the work.

All mobile installations and removals shall be performed in such a way and to a time schedule that shall minimize down time and out of service time of the operational units.

Mounting locations of the mobile radio equipment shall be solely at the discretion of Public Works personnel and may vary from vehicle to vehicle dependent upon operational requirements.

A sample installation shall be performed by the Contractor for each type of vehicle/mobile antenna configuration, for the Town's acceptance, prior to continuing and completing the respective fleet installation.

Mobile equipment and radio accessories are to be mounted in a manner that shall permit safe operation of the vehicle and shall not interfere with proper operation of safety equipment.

The control unit and microphone shall be accessible from the driver's position or as otherwise specified by the Town.

Interconnecting cabling shall be properly designed and constructed [shielding, twisting, placement so as to preclude adverse effects from electrical interference, or physical damage, that may be present within the operating area of the vehicle.

Mobile radio installation pricing shall include disconnecting legacy equipment, removal, and transport to a storage/disposal location as directed by the Town.

4.2 Warranty and Maintenance

The Contractor shall warrant all equipment, software and installation work for a minimum of one [1] year after acceptance. Warranty shall include all parts, labor and travel necessary to return the equipment to its original working condition. The Contractor shall respond within 4-hours of notification of a problem during normal business hours. The Contractor is responsible to replace any spare parts used during the warranty period.

Subscriber radio warranty shall include on-site repair.

Depot Service - The Contractor shall explain the manufacturer's depot repair facility procedures, cost, turn-around time and typical system items returned.

5 PROPOSAL REQUIREMENTS

Provide a project narrative with sufficient detail to illustrate the proposed system, its performance, and equipment to be supplied

All work will be performed in accordance with all applicable local, state and federal laws. It is the Contractor's responsibility to obtain any permits etc. prior to commencing any work.

It is the responsibility of the Contractor to notify the Town of any issues that must be addressed prior to commencing any work.

The Contractor shall supply the number of proposal copies listed in the Submission Details, unless otherwise noted. The proposal shall contain the following information:

1. **Contact Info** - provide the name and telephone number of the individual who will be responsible for the coordination, installation, acceptance and warranty/service support.
2. **References** - The Contractor provide three [3] references to include a contact name and telephone number along with the type of work performed.
3. **Town Requirements** - list of any special requirements that need to be provided by the Town
4. **Equipment list** - of all items to be supplied, quantity, and cost
5. **Catalog "Cut" Sheets** - showing all the equipment to be supplied; brochure with information on all portable audio and carrying accessories
6. **Exception** - list any exceptions to the requirements stated in this document
7. **Certificate of Insurance -** Contractor is required to provide certificate indicating coverage limits as outlined by the Town prior to commencing any work.
8. **Project Schedule** – a summary schedule showing days after contract award for order review, equipment delivery, installation and acceptance.
9. **Cost Proposal** – submitted on the attached pricing sheet

6 PRICING

The Town of Barrington reserves the right to negotiate the price with bidders after proposals have been submitted.

Pricing should be submitted on the attached Pricing Sheet.

Barrington reserves the right, for any reason, to accept or reject in part or in its entirety any or all proposals; to postpone or cancel this RFP; to waive technical errors or any informalities in bids, or to negotiate with qualified Contractors if it is determined to be in the best interest of Barrington to do so. It is the discretion of Barrington to accept the lowest and most compliant response, which may or may not necessarily be the lowest cost response.

All proposals received will be evaluated by the Town, who reserve the right to award or not to award a contract. Barrington reserves the right to substantiate any or all bidder qualifications, capability to perform, availability, including past performance record.

P*ayment* - Payment will be processed with approved Contractor invoice. Payment terms includes:

- 50% of the cost at final equipment review and approval by the Town
- 25% after completion of installation
- 25% upon testing, final inspection, and acceptance of all work

7 ACCEPTANCE AND CLOSEOUT

Microwave Acceptance Test – For microwave, multiplexers, switches & routers**,** the following tests, in addition to other standard manufacturer's test procedures, shall be performed. Complete documentation of Field Acceptance Test results shall be provided to the Town upon completion of testing.

Path Alignment

- The Vendor shall be responsible to perform microwave dish alignments for all microwave paths
- Dishes shall be aligned for maximum RSL/BER
- The Vendor shall provide all material, equipment, and personnel required to perform path alignments
- Contractor shall provide screen shots of microwave radio configurations screens.

IP/Ethernet Testing

RFC-2544 and Y1564 tests is required all for all hops; Contractor shall provide printout of test results.

Radio & Microwave Acceptance Test - The Contractor shall demonstrate to the Town's Project Manager that all requirements stated in this document have been provided and are operating in accordance with manufacturer's specifications.

The system shall operate for 30-days without failure before the warranty period commences.

Other close out requirements:

1. The Town will inspect all installations
2. Provide Operation and Maintenance manuals
3. Provide Warranty information
4. Provide three copies of all installation, service and as-built documentation

8 PRICING SHEET

Tower Structural Analysis . . . . . .$_____

Fire Department Repeater, Duplexer
Antenna and Transmission Line; Installed . . . . . $_____

Public Works Repeater, Duplexer
Antenna and Transmission Line; Installed . . . . . $_____

Public Works Mobile Radio, Antenna; Installed . . . . . $_____

Unit Cost: $_____

Public Works Portable Radio, Antenna; Installed . . . . . .$_____

Unit Cost: $_____

Public Works Control Station, Antenna; Installed . . . . . $_____

Unit Cost: $_____

Police Subscriber Reprogramming . . . . . $_____

Mobile Unit Cost: $_____

Portable Unit Cost: $_____

Warranty . . . . . .$_____

Repeaters: $_____

Subscribers: $_____

Applicable Discounts . . . . . $_____

GRAND TOTAL . . . .$_____

OPTIONS

]

Option-1: Microwave Radio Single Hop; Installed . . . . . $_____

Microwave Warranty . . . . . .$_____

Option-2: IP Gateways; Installed . . . . . .$_____

Please identify per unit cost for the following subscriber radio function and features

ANALOG / DMR FEATURES	PORTABLE	MOBILE
High Capacity Li-ion battery [12-hours; 10/10/80]	_____	_____
Spare Antenna	_____	_____
Emergency button	_____	_____
12.5 kHz TDMA (6.25e) digital channel bandwidth	_____	_____
Alphanumeric display	_____	_____
Encryption	_____	_____
PTT ID	_____	_____
Private Call	_____	_____
All Call	_____	_____
Call Alert	_____	_____
Talk-around	_____	_____
Radio Check	_____	_____
Radio Disable/Enable Remote Monitor	_____	_____
16-position channel selector	_____	_____
Group scan	_____	_____
External microphone and speaker connections	_____	_____
Speaker/External Mic	_____	_____
Voice Annunciation	_____	_____
Integrated GPS	_____	_____
Remote Monitor	_____	_____
Auto Site Roaming	_____	_____
Lone Worker/Man Down Mode	_____	_____