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Edward J. Tolan
Chief of Police

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Lieutenant

February 1, 2017

Request for Proposal (RFP) ----- *Digital Two Way Radio System*

Dear Vendor,

You are invited to submit a proposal for our *Digital Two Way Radio* project in accordance with the requirements set forth in the attached request for proposal (RFP).

The Falmouth Police Department serves a population of 12,000 covering approximately 34 square miles. The current radio analog system operates in a four season environment under extreme weather conditions covering the ocean and high elevation climate.

The original copies, and electronic version of your proposal must be received not later than **March 10, 2017** or your proposal will otherwise be disqualified.

The provider whose proposal is the best solution for our project will be selected after the closing date in a timely manner and we will notify all providers, whether they are disqualified, rejected or unsuccessful in the selection process. Any questions need to be received by email (etolan@falmouthme.org) .I will be the single point of contact for all inquires and correspondences.

I thank you for your time, effort and interest.

Respectfully,

Edward J. Tolan
Chief of Police

REQUEST for PROPOSAL

DIGITAL TWO WAY RADIO SYSTEM

Technical Requirements

February 1, 2017

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1.0 Project Overview

Town of Falmouth is seeking proposals from interested suppliers for a trunked, digital land mobile radio system. The selected supplier shall engineer, furnish, configure, install, and commission the digital land mobile radio system for the Town. The proposed system shall comply with the DMR Tier II open standard as part of this initial system installation and be fully capable of DMR Tier III included. System shall also be capable of upgrade to P25 phase 1 should this option be chosen in the future.

1.1 Demographic Overview

Town of Falmouth is a Government Agency with principal offices in Falmouth, Maine, USA who provides police and public safety services for 12000 resident and approximately 35 field employees who provide police and marine services to the Town of Falmouth

1.2 Existing Two-Way Radio System

Presently the Town of Falmouth operates on a VHF Legacy analog system. The system has reached end-of-life as our coverage has been diminished with the advent of narrow banding. The system operates on 1 – 155.790 MHz frequencies; 12.5 kHz channel. There are approximately 16 mobiles and 30 portables deployed. The system supports Zetron MAX dispatch operator consoles located 2 Marshall Drive in Falmouth.

1.3 New VHF Radio System

The new radio system will replace the legacy system with new digital system. The new system will improve reliability and operational costs by replacing the aging technology at the end of its life cycle. The advanced digital technology will be capable of providing new communication functions and features and will operate at greater spectral efficiency. The build-out of the new digital land mobile radio system will utilize existing infrastructure including existing buildings and tower sites. The system will be interconnected using microwave, and fiber communication systems. System shall use IP for its backhaul and to the greatest extent possible, commercial off the shelf computers, switches, and servers (COTS) for system management and control.

1.4 Goals and Scope of the Project

The goals of this RFP are to procure a DMR Tier II 5 site simulcast radio system. The new simulcast radio system is to:

- Provide the overall most cost effective solution including both capital and ongoing operating and maintenance costs.
- Provide an open standards based system to lower capital and operations costs with true, multi-vendor interoperability
- Provide the equal or improved radio coverage of the territory w/ 95% service territory coverage at 95% expected availability for portable radios, on the street, with portable on the hip with a speaker mic.
- Provide a modern digital radio system with twice the spectral efficiency of the legacy system
- Increase reliability, radio system availability while improving maintenance efficiency.
- Leverage software defined radio technology to reduce operational costs

- Support required system and user features/applications/use cases and interfaces as further delineated subsequently herein
- Complete successful installation, deployment, commissioning, system tests, and migration to the new radio system

The scope of the system entails:

- Upgrading as required land mobile infrastructure at the radio tower on Blackstrap Mountain and 3 Town owned buildings, and one State of Maine owned building.
- Upgrades as required to site back-haul linking
- Provisioning of new digital land mobile radio infrastructure
- Provide new antenna transmission feed lines to the Blackstrap Mountain site as well as the 3 other repeater sites
- Provide Combiner antenna systems to 4 sites. Due to space requirements at all of our sites we need to use antenna combining systems to use one antenna at each site. Combiners will be configured for Police and Fire frequencies. Fire will not be upgrading their system at this time. The intent it to allow Fire to "Plug and Play" when their system is upgraded.
- Provisioning of new digital mobiles, portables and interface to Zetron MAX System
- Provide a Carrier grade Licensed Microwave link from Blackstrap Mountain to 2 Marshall Dr.
See attachment 1.

2.0 Customer Responsibilities

Town of Falmouth intends to provide installation support and technical services for this project. Town of Falmouth will provide Fiber circuits for four sites.

Site 1- 271 Falmouth Rd

Site 2- 6 Bucknam Rd

Site 3- Mackworth Island

Site 4- 287 Foreside Rd

2.1 Supplier Responsibilities

Supplier shall engineer, furnish, configure, install, and commission the digital land mobile system. This includes providing of all site radio system equipment, antenna system equipment, and new antenna transmission feed lines and new mobiles, portables and connect to current Zetron consoles. Falmouth will provide Fiber Circuits to four sites. IP Hardware to interconnect radio equipment with console will be provided by the successful bidder.

2.2 Project Management

Vendor shall provide a qualified project manager for the project. This person will have project management and telecommunication skill sets and provide comprehensive project management and coordination. Town of Falmouth will also provide a project manager. Supplier shall anticipate that common project management tools, including the use of on-site meetings, scheduled conference calls, and meeting minutes.

3.0 System Description

This is a request for proposal to engineer, furnish, configure, install, and commission a multi-site, wide-area Tier II DMR simulcast/voter radio system.

The radio system shall operate within a 12.5 KHz bandwidth in the 150 MHz frequency band and be designed to support voice, automatic vehicle location (AVL), and low speed data services. The Town has licensed several VHF MHz frequencies under FCC Part 90 rules. This spectrum will be used to support the new system.

3.1 DMR Open Standards

The system shall be DMR Tier II Conventional. The radio system shall be fully compliant with the European Telecommunications Standards Institute (ETSI) Digital Mobile Radio Standard TS-102 361-1, 2, 3, 4. This is a two-slot TDMA 6.25 "equivalent" technology. The system shall have an IP based interface capable of supporting interoperability with other digital Land Mobile and commercial PTT radio applications. The Town strongly supports the DMR open standards and the evaluation of the proposed system will hinge on the ability of the system to support third party subscriber mobile/portable units and console systems. Suppliers shall in their response state which if any portion of their proposed system is proprietary or limits the number of third party suppliers.

The backbone of the system shall consist of multiple repeater sites connected to a wide area controller(s), or switch(s), to provide reliable wide area voice communications to and from mobile and portable units and central console systems throughout Falmouth's service areas. To enhance system reliability, avoiding single points of failure, distributed control architecture, is strongly recommended. It is Falmouth's intent to use a new licensed microwave (from Blackstrap Mountain to 2 Marshall Dr.) and fiber optic communications infrastructure (including towers, buildings, power systems, IP network, and interconnected digital channels) be used to support this new system.

For the new system, emphasis will be placed on a system design that provides fault tolerant, highly reliable, high quality, minimum latency 2-way communications throughout the service area. If multiple wide area controllers are necessary to provide the required network coverage and reliability they must be capable of being linked for extended system wide communications.

As described in later sections, all controllers or system switches, if present in the design, will have redundant backup units. The network communications architecture shall provide the radio user transparent radio communications across the entire area of coverage. The proposed simulcast radio system shall permit the radio user to travel across the entire area of coverage without requiring manual switching or changing of sites.

In order to reach the requested degree of radio coverage without adding more frequency pairs, especially in areas where the amount of calls to be managed is low, the proposed Simulcast/voter system shall be simulcast capable without adding any optional hardware. Preferred solutions are those where no external GPS or external synchronization sources are used.

Another key element is the successful installation and conversion of the proposed new system and related project management and communications. The transition from the present conventional radio systems and analog voted system to the proposed DMR system shall be seamless. The Supplier shall work with the project team on a continuous basis to complete final design, support the schedule, and coordinate testing, installation, proof of performance, and cutover.

3.2 System Block Diagram

Supplier will provide a complete high level block diagram for the entire proposed system showing the repeater sites, wide area controller(s) or local controllers as applicable, dispatch consoles, and any other major system components (system management computer, AVL interface, etc.).

3.3 System Configurations

For maximum reliability, the proposed system shall be capable of being configured in a fully decentralized mode without the necessity for a centralized switch. This shall provide for local area communications without the requirement of providing back-haul to a centralized switch. All communications traffic shall be peer-to-peer/site-to-site. Loss of a site(s) or connectivity to a site(s) shall not degrade wide area communications amongst the remaining sites operating in decentralized configuration. Supplier shall specify any limitations to the number of sites/channels/groups/users which can be combined into a fully decentralized configuration.

To accommodate legacy back-haul networks, the system shall also be capable of being configured in a fully centralized mode of operations using a centralized switch. All inter-site traffic is routed through the centralized switch. Loss of a site(s) or connectivity to a site(s) shall not degrade wide area communications amongst the remaining sites operating in centralized configuration.

For the highest degree of reliability, the proposed system shall have the flexibility to be configured in smaller, decentralized Regions operating in peer-to-peer mode. A region shall consist of a sub-set of the total number of networked sites and will correspond to Falmouth's local operating areas/Districts. Decentralized Regions shall be networked to a centralized switch for inter-region communications traffic and connectivity to major sub-systems. Major sub-systems include the Town's corporate PABX, the dispatch system. This shall provide maximum reliability in design with local area communications and a centralized switch.

3.4 Network Call Control Controller Location

Supplier shall provide a block diagram of the space required and rack layouts for each network level wide area (multisite) controller location in Visio format. These diagrams shall show all major components and the quantity and type of communication circuits required to connect the wide area controller to repeater sites, regions, remote consoles, conventional repeaters, etc.

If one network level wide area controller is recommended by a Supplier, The Town prefers that the main controller be located at their dispatch center at 2 Marshall Dr. If redundant controllers are available, the Town desires one controller located in Town Hall and a hot-standby controller be located at their Backup Control Center. Supplier shall provide a list of all power and HVAC requirements for the wide area controller equipment. Supplier shall also provide the same information for a redundant, hot-standby wide area controller in Visio format.

Supplier shall state additional network level redundancy features available and recommended such as the ability to operate the main network controller in Falmouth in a cluster – two servers back-to-back. Any other features that provide additional layers or redundancy and reliability shall be clearly stated in the supplier's response.

3.5 Call Management Devices

Site level and region level call control management are required for user registration, access, working time slot assignments, and tracking users as they roam – intra & inter-region or inter-site. Supplier shall specify what additional devices are required at the site and region level for call management e.g. a "site controller" or "region controller". The Town of Falmouth prefers a compact design where extra devices requiring space, power, wiring, maintenance ARE NOT required.

3.6 Repeater Site Locations

Site 1: 271 Falmouth Rd 43-44-01.3 N, 070-16-46.2 W

Site 2: 4 Bucknam Rd 43-43-33.1 N, 070-13-55.9 W

Site 3: 2 Macworth Island 43-41-17.6 N, 070-13-56.1 W

Site 4: Blackstrap Mountain 43-45-33.0 N, 070-19-13.0 W

Site 5: 287 Foreside Rd 43° 44' 10.8" N, 70° 12' 23.8" W

Refer to attached copies of FCC Licenses for antenna heights and location information.

Supplier shall provide a block diagram of the space required and rack layouts for each repeater site configuration, showing all major components at the site and the quantity and type of communication circuits required to connect the site to the wide area controller in Visio format. A block diagram and rack layout for each site IS NOT required. But, each site representative "configuration" e.g. 2 carrier, 3 carrier, 4 carrier, etc... shall be included in suppliers response.

Supplier shall use the proposed sites delineated herein for their coverage study. If to achieve the 95% Coverage/95% Reliability, supplier shall recommend the deployment of additional sites and should leverage Falmouth owned facilities before looking at sites owned by others and/or new property. The Supplier will list the number of antennas and antenna models proposed and the recommended transmit and receive antenna locations on the tower.

3.7 Site Back-Haul Circuits

All Falmouth's radio sites will have IP network via fiber connectivity provided by Falmouth between sites, offices, and dispatch locations. The circuits used will be Fiber except for the "hop" between Blackstrap Mountain and 2 Marshall Dr. Proposed microwave back-haul from Blackstrap Mountain to 2 Marshall Dr. shall be carrier grade and be a minimum of 50Mbps bandwidth using an FCC licensed frequency spectrum (not 4.9GHz) with a reliability of 99.9990% minimum. Vendor will be responsible for hardware at the radio site to interconnect the radio system to the fiber network.

Suppliers must include all path engineering design and link budget documentation in their response.

3.8 DMR Tier II

Falmouth anticipates there may be discrete parts of its operations, for example the generating stations, disaster recovery, interoperability, etc. where they will want to continue to operate in conventional mode, but take advantage of digital technology innovations.

Supplier shall state if the proposed system is capable of operating in DMR Tier II Digital simulcast and Conventional simulcast modes. Supplier shall describe their digital conventional system operations and any additional equipment or software required.

Falmouth prefers analog communications can occur on the same Tier II hardware. If not, supplier shall state any limitations on the system.

To assist with system cutover, Falmouth would like to first upgrade the user and site equipment with Tier II capable equipment and allow users to operate as they always have, but in analog mode. Then Falmouth will cutover to digital mode. Supplier will explain if this option is available and how the transition/cutover would occur. Falmouth prefers a smooth cutover with as little change to end user "radio experience" as possible.

Part of the bid proposal will include removing the existing Harris Master III analog repeater from Blackstrap Mountain and re-installing it at 2 Marshall Drive. The frequencies for this station shall be: TX-153.940 RX-159.0075 PL Tone 100.0. The existing duplexer will be re-tuned to these frequencies. This repeater shall be "hard patched" with the new DMR system to re-broadcast Slot 1 traffic.

3.9 Simulcast

Falmouth prefers a simulcast option where control points are "soft" - defined by software versus hard points defined by hardware. The simulcast/voter system should not have a single point of failure that would result in an inoperable system. Supplier shall describe redundant features for synchronization and equalization of the sand for the voting process. The simulcast/voter system should have a small footprint and fit within a standard EIA 19" rack.

Provide a description of how the proposed simulcast/voter system operates, unique features, etc.

3.10 Additional RF System Options and Features

Falmouth has outlined the requirements for the Digital Two Way Radio System herein. There may be additional software and hardware options and/or features the Supplier system incorporates that would provide additional value to help boost system performance, reduce the cost of ownership, and extend the useable life of the proposed system. For example areas of interest are software defined radios that can

support additional RF and system configurations without the requirement of additional hardware to support interoperability, system and coverage enhancements. Supplier shall state whether such options and/or features are included, available as options, and provide a description of how the option would be enabled and associated costs.

4.0 Radio Coverage Requirements and Testing

4.1 Mobile Radio Coverage

The system shall be designed for reliable communications with the use of portable radio units as defined herein.

4.2 Coverage Guidance

Coverage predictions must be conducted in accordance with TIA TSB-88 latest version, to the greatest extent possible and the following TSB-88 definitions shall be used. All coverage testing will be performed in both analog and digital modes.

The Service Area is the Town of Falmouth service territory included on Attachment 1

- The target device for two-way communications shall be mobile radios with a quarter wave whip antenna mounted in the center of the roof
- Basic network coverage shall be designed to accommodate vehicles traveling at speeds up to 70 MPH.
- Channel Performance Criteria (CPC), the minimum design performance in a faded channel, shall be a Delivered Audio Quality (DAQ) of DAQ3.0.
- Reliability Design Goal should be a service area probability of 95%
- Required Service Area Reliability CPC target shall be 95% of the Service Area
- Mobile radio talk-in and talk-out balance shall be designed to be within two dB.

4.3 Coverage Maps

Supplier shall include with their response coverage maps for their proposed system. Radio coverage shall be predicted through the use of the "Okamura-Hata" radio propagation model which was developed on the basis of theoretical and empirical data and takes into account terrain irregularity, foliage, urban clutter, noise and long and short term signal variations. The use of other radio propagation models must be approved by Falmouth. If the respondent requests to use a different model it shall be clearly identified and the rationale for system losses (e.g. power, gain, etc.) and performance shall be provided. Coverage maps will meet the following guidelines:

- Supplier shall provide their coverage maps using a "tiling" style output with a resolution of at least 0.05 miles per tile both vertically and horizontally. Simple contour maps are not acceptable for system planning and design. The Town of Falmouth's service area boundary and appropriate highway, city and county boundaries shall be included in all coverage plots. An electronic shape file (.shp, .dbf and .shx) with the service area is available upon request.

- Supplier will provide detailed RF propagation coverage maps for both the individual sites and a composite system map for both mobile talk-in and talk-out.
- Included with coverage maps Supplier will include a spreadsheet(s) with all input link budget data used to develop the coverage plots and a spreadsheet(s) with all output data resulting from the map calculations. These will include but not be limited to, for each site, transmitter power output, combiner losses, effective radiated power, antenna pattern used, antenna height and field strength(s) required to meet coverage requirements. Supplier will supply any reasonable additional information requested by Falmouth not included on spread sheets to validate the coverage predictions.
- Coverage maps will include (either on them or on a related spread sheet) the following:
 - Name of Site
 - RF Power Output and ERP
 - Repeater antenna height, gain and orientation (if applicable)
 - Effective receiver sensitivity
 - Mobile antenna type and height above ground
 - Mobile RF power output (Falmouth anticipates using 50 watt mobiles)
 - Portable RF Power output 6 watts

4.4 RF Coverage Testing

RF coverage testing may be required at the Town's discretion if the installed system is suspected of not meeting coverage requirements. An optional price for this coverage testing must be included as a separate line item in the bid submission. If after testing it is determined that the system does not meet coverage requirements, the successful bidder will be responsible for the cost of the testing plus upgrades to the system to meet requirements.

See attachment 2.

- The supplier shall include a draft Coverage Verification Test Plan (CVTP) with their proposal meeting the requirements of this document. Both Falmouth and the successful supplier will agree upon the final CVTP and method to be used no later than 90 days after award of contract.
- All costs for testing (except for Falmouth personnel and vehicles involved in witnessing and participating in tests) shall be borne by the vendor and as needed included in vendor's proposed costs.
- Falmouth's and vendor personnel talking over the radios to verify that DAQ 3.0 intelligibility is attained. Delivered Audio Quality 3.0 is defined as "speech understandable with slight effort – occasional repetition required due to noise/distortion". The human intelligibility tests shall incorporate both talk-out and talk-in test formats.

4.5 Voice Quality

Coverage is defined as the minimum signal required providing Delivered Audio Quality of 3.0 (DAQ 3.0). DAQ 3.0 is defined as "speech understandable with slight effort with occasional repetition required due to noise/distortion". It is Falmouth's expectation that most areas will have a DAQ better than this, typically DAQ 3.4. Supplier shall relate the voice quality ratings to a signal level, BER, and Frame Error Rate for digital system acceptance testing purposes, as applicable.

- Conformance Test Confidence Level (TSB-88) of 99 percent shall be attained. Respondent shall describe their proposed automated field test and validation procedures including how representative tiles will be selected, sampled, the number sampled and test parameters used to validate system performance.

5.0 Radio Spectrum and Channel Assignments

Falmouth has several VHF Frequencies under FCC Part 90 rules. This spectrum will be used to support this new system.

5.1 Repeater Channel Assignments

All Five Repeater sites shall use the following frequencies:

155.790 Repeater Transmit

155.790 Repeater Receive

5.2 FCC Waivers

It will be Falmouth's responsibility, if required, to make necessary filings with the FCC regarding spectrum compatibility and RF power level issues. It will be the Suppliers' responsibility to work with Falmouth and resolve any system/antenna changes resulting from these findings.

6.0 Core Functional Requirements

The minimum basic operational mode of the system will be DMR Tier II Simulcast/voter system, with field units monitoring DMR and analog channels. Most of the communications will use this mode with communications taking place through repeater sites located throughout the served territory.

Wide area calls over multiple sites will take place in a similar manner, except calls will be routed to the applicable repeater sites by a wide area call control management system and switch(s). The mobile and portable radios will also enable users to manually select communication modes such as the use of conventional channels or talk-around mode when out of range of the repeater site. Repeaters shall work in dual mode, meaning analog and DMR, without reprogramming.

For interoperability reasons a strong conformance to the ETSI DMR Tier II standard is preferred. The radios shall scan DMR Tier II, P-25 conventional, and Analog channels

6.1 Wide Area Communications

The system shall provide the ability to place and receive calls to and from any point in the network covered by the DMR repeater sites. All sites shall be linked to the wide area radio network by means of a microwave link from Blackstrap Mountain and 2 Marshall Dr, Falmouth's fiber optic cable system, leased circuits, or a combination thereof. Supplier shall state the backhaul requirements for each site/repeater i.e. DS-0, DS-1, 3 KHz analog channel, IP, latency, jitter etc.

6.2 Voice and Data Traffic (for future needs)

The system shall be able to equally support both voice and data traffic. Supplier shall fully explain the types of data available on the system e.g. GPS updates, text, SMS, etc... Supplier shall indicate if the data is carried on the control time slot, the working time slot, or both. The GPS will not be enabled at the present time.

6.3 Channelization

The system shall be designed to operate within 12.5 KHz frequency channels in the 150 MHz spectrum and with 6.25 KHz "equivalency".

6.4 Interoperability

The Supplier shall describe industry standards related to "over the air" interfaces and operation. Solutions that utilize open standards are preferred. Supplier shall state what Tier level the system has been certified by the DMR Association. The Supplier shall also include, with the proposal, copies of each Tier level certification. If the proposed system is not certified at a Tier III level the Supplier shall state when the proposed system is expected to be certified and explain why it is not certified Tier III level at the time of the RFP submittal.

Automatic is defined as operating without operator (user or dispatcher) intervention. It is acceptable for an operator to be required to set up the initial connection. However, all subsequent inter-system communications should occur without any human intervention. Supplier shall explain how this is accomplished.

6.5 Caller Identification and Alias

The radio ID shall be included in each transmission. The system shall display this ID on its associated group module in the console at the dispatch center. Mobile and portable radios shall be able to display the calling unit ID for both individual and group calls. Each mobile radio, portable radio, control station, and dispatch console shall be capable of displaying an alphanumeric alias corresponding to the unit ID, if so programmed into the system.

6.6 Dispatcher Override

This feature ensures that calls originating from a dispatch console (Design A or B) cannot be blocked by normal members of the same voice group. The system shall permit a call originating from a dispatch console to interrupt a call by a normal member of the same voice group, overriding the call so that other members of the voice group only hear the dispatcher.

6.7 Emergency Alert and Emergency Call

The system shall support emergency call for the mobile and portable radios. When the emergency button is pressed on a mobile or portable radio, the radio shall transmit an emergency alert message to the central dispatch locations and all other radios within

that talk group. The emergency button must be held down for pre-programmable time duration before an emergency alert can be activated (to prevent false activation). At a minimum this programmable function shall be from 0 to 3 seconds.

The emergency alert message should include the radio ID, alphanumeric alias (if available), and the location of the radio (if available through AVL). Upon receipt of an emergency alert message the system shall immediately establish an emergency voice call.

6.8 Conventional Systems

The system shall provide automatic interoperability with existing conventional radio channels. This is where a voice group on the new system is connected through the wide area controller to a conventional radio channel, or alternatively to a CTCSS defined voice group on a conventional radio channel.

Automatic is defined as operating without operator (user or dispatcher) intervention. It is acceptable for an operator to be required to set up the initial connection. However, all subsequent inter-system communications should occur without any human intervention. Supplier shall explain how this is accomplished. Falmouth anticipates using this function for the cutover process.

6.9 System Reliability and Fault Tolerance

System reliability and fault tolerance shall be major objectives in the design of the system. Supplier shall describe in detail all measures taken to ensure reliable operation of the system. This includes, as a minimum; the repeaters and system management computer.

- Wide Area Control

The system shall be designed such that there are no situations where a single failure in equipment will disable wide area operation. No single point of failure within the wide area controller(s) shall prevent any unit from normal operation. Falmouth desires a system configuration whereby wide area controllers are configured in a cluster such that if one controller fails the second controller assumes call control management. Falmouth also desires a system whereby wide area controllers incorporate geo-diversity. Supplier shall describe how the same is realized if a distributed approach is proposed.

The wide area controllers will be supplied as a cluster in a hot-standby redundant configuration. A second set of hot-standby wide area controller equipment shall be capable of being located in a remote backup emergency operations center interconnected by an appropriate communication media such as Falmouth's microwave, fiber, or leased circuits.

The backup site will be several miles from the primary operations center. Supplier shall state the number of circuits, type, and communication bandwidth required to the remote backup control connectivity for the hot-standby wide area controller functions.

If one or more site elements or site links fail, the rest of the system shall continue wide area communication, and the isolated sites shall continue standalone trunked operation. Supplier shall indicate the impact on system operation of each of the

following system element failures. Supplier shall detail how the system responds and what features, if any, are lost:

- wide area controller(s) failure, as applicable
 - region site controller(s), as applicable
 - local site controller(s), as applicable
 - system management computer failure
 - backhaul link failure
- **Failover**
A hot-standby wide area controller shall take full control within 15.0 seconds after sensing that the primary unit has failed. Any loss of voice or data communications shall be limited to the interval from the failure of the primary unit to the time the standby unit takes full control. Supplier shall describe the performances and pros and cons if a distributed approach is proposed.
 - **System Management Computer**
The network architecture shall include redundant system management. Redundant and primary system databases should be synchronized automatically.

It shall be possible to access the redundant system management computer remotely from the primary system management computer. The redundant computer shall be capable of being located at a remote back-up emergency operations center interconnected by an appropriate communication media (microwave or fiber through a digital duplexer, lease circuit, etc.).

The remote site is several miles from the primary operations center. Supplier shall state the number of circuits, type, and communication bandwidth required to remote the redundant computer.

If the proposed architecture consists of distributed system management computers, failure of one system management computer shall be automatically sensed by the remaining system management computers which shall then take over the work of the failed unit.

7.0 Repeater Site Requirements

Equipment provided at each site shall consist of repeaters and all other associated hardware and software for the proposed system.

7.1 Duty Cycle

All transmitting and receiving equipment (all repeater channels) shall be capable of 100% continuous duty cycle operation limiting the use of fans or blowers.

7.2 Transmitter ID

All repeaters shall be able to transmit automatic call sign identification that meets the FCC requirements for identifying trunked repeater sites.

7.3 Programming Software

All required programming software will be included. The programming software application shall run on the Windows 7 (or newer Microsoft operating system) operating systems.

The system shall provide the ability to reprogram individual repeaters through the network backhaul interface. The Supplier shall indicate the extent to which repeater parameters can be configured remotely and whether this programming is restricted to repeater parameters or also includes repeater software.

See Attachment 3

7.4 Control and Alarms

The repeater station shall be controlled and managed through the system management computer which shall be capable of remotely controlling the following functions:

- placing a hot-standby repeater on-line
- taking a repeater off-line
- commanding local repeater controls on/off
- retrieving and setting repeater operating parameters
- retrieving and setting repeater transmit/receive frequencies

Supplier shall explain in detail if the above functions can be performed and what additional functions can be performed. The repeater station shall permit the system management computer to monitor the status of the following conditions, at a minimum, and provide an automatic alarm to the system management computer if they are out of specification:

- high power amplifier temperature
- high power amplifier RF output power level
- high power amplifier RF output failure
- station controller failure
- receiver failure
- transmitter exciter failure

Supplier shall list any additional features that may be monitored. Supplier should also state whether a hot-standby repeater is an option and, if so, can its control and alarms be managed by the system management computer.

7.5 Physical Environment

The repeater stations, including repeater and station controller, shall be housed in standard 19 inch width EIA aluminum relay racks of various heights depending on which sites the equipment will be installed. All hardware and software necessary for the stations to perform the functions and to meet the system requirements shall be provided and housed in this same rack.

7.6 Maintainability

Falmouth closely manages operating expenses and seeks a new digital system that minimizes operating expenses. Therefore, high reliability and ease of maintenance are of high priorities for the new system.

Supplier shall state reliability/failure rates for the repeater stations.

Falmouth prefers a system that is modular and easily maintained. Supplier shall state if and how repeater stations may be accessed remotely and what information and functions may be performed without having to travel to a site. At a site, supplier shall explain what and how repeater stations are accessed by a trained technician. Ease of access to technician lap tops or simple Man Machine Interface not requiring a lap top are preferred options.

Supplier shall explain the degree with which modularity is built into their repeater stations. Supplier shall describe the procedure for changing modules, if possible, at the repeater station site.

7.7 Antenna Systems

The Supplier shall develop complete antenna systems that achieve the required coverage, and are most advantageous to Falmouth from cost and performance aspects. The antenna system design shall include antennas, antenna mounts, transmission line, lightning suppression, coaxial entrances boot(s), cable hangers, connectors, weatherproofing, ground kits, filters, transmitter combiners, a receiver multi-coupler, tower-top amp, etc... as appropriate.

Combiners shall be installed in each repeater site. These combiners shall be designed to accommodate two frequency pairs.

TX Channels: 155.790 and 154.980

RX: Channels: 159.735 and 151.43

All antennas should be designed for mounting at the top of the tower/building (unless otherwise specified by Falmouth) if they do not extend the overall tower height beyond the ASR (if applicable) height or over 200 feet where there is not an ASR issued.

If the existing radio system antennas are causing a problem with the installation of the new radio system antennas they can be relocated to a temporary lower location on the tower while they are still in use.

7.8 Repeater Antennas

All repeater antenna configurations shall be designed to provide the specified coverage. All antennas shall be supplied with all necessary heavy duty, corrosion resistant, mounting brackets and mounting hardware for both top and side mounting on a mast or tower. All brackets, masts, clamps, and other hardware shall be made of galvanized or stainless steel. The antennas shall survive undamaged during wind gusts up to 125 mph. The Supplier shall state the mechanical specifications for rated wind speeds.

- Repeater Antennas (Recommended)
Supplier shall submit antenna design with required antenna types.

Omni-directional antennas shall provide consistent patterns to ensure that no nulls occur in coverage due to the antenna pattern or mounting. Antenna shall be BF

type with at least 5.25 of dB gain.

Where offset pattern omni-directional antennas or semi-directional antennas are required, they shall be RFS 440-1 dipole arrays or equivalent.

All antennas will need to be pre-approved by Falmouth. Antenna down tilt, where required, shall be generated by means of electrical down tilt (antenna design). Obtaining pattern down tilt through mechanical mounting methods is not acceptable.

The Town reserves the right to use existing antennas if they will operate according to coverage specs.

- **Transmitter Combiner/Duplexer**
Although this system is initially installed for Police Department communications only, the antenna and combiner systems shall be designed and installed to accommodate both the Police and Fire repeater pairs to allow for cost affective Fire System upgrades in the future.

The transmitter combiner shall be the expandable type and initially supplied to accommodate Police and Fire channels.

Blackstrap site

Will be a (2) antenna system using (2) separate duplexers TX/RX model # 28-37-02A or equivalent. Only the Police antenna and duplexer at this site will be replaced at this time.

(4) Other sites

These sites will include a TX/RX T-Pass combiner or equivalent antenna combining/receiver system. ***Due to antenna mounting space limitations these sites will use a single antenna type design.***

- **Transmission Line Couplers**
Transmission lines shall be constructed from one continuous length of low-loss dielectric coaxial cables. Depending on the length of the transmission line required at a site, the following types of line may be used for transmitting or receiving:

Blackstrap Site

7/8 cable and jumpers recently replaced Dec. 2016

(4) Other sites

1/2" hardline cable is acceptable, with 1/2" super-flexible jumpers at the radio equipment end.

The Contractor shall determine the transmission line lengths required for each site during site inspections. Appropriate grounding kits shall be provided at the top and bottom of the run, and in the middle for any run over 100 feet in length. Cable hoisting grips shall be used at the top of each tower run to support the vertical coaxial cable weight. Additional cable hoisting grips shall be used in the middle of

any vertical run over 100' or any increment thereof.

Cable hangers shall be provided that are appropriate to the type of structure and cable ladder system on which the transmission line is mounted (Valmont/Microflex or equivalent). Cable hanging hardware shall be corrosion protected (galvanized) or made of stainless steel.

- Interconnection RF Cable and Connectors
Super-flexible 1/2" coaxial cable shall be utilized for interconnecting transmitters, combiners, receivers, multi-couplers, and antenna system transmission lines inside of the equipment building. Type N connectors or better suitable for the 150 MHz band with Teflon insulation and gold or silver-plated mating surfaces shall be used throughout the RF system. Adapters shall not be used.

8.0 System & Network Management

Base station and associated equipment shall be capable of secure remote network diagnostics, management, and control, including remote firmware/software upgrades/patches, and user access lists, using the Supplier-supplied Network- or Element Management System. Secure local access shall also be provided. Supplier shall provide details of his proposed Network- or Element Management system, including system capabilities, instruction, and use.

The system management device shall be a UNIX or Windows 7 (or newer Microsoft operating system) based computer with a client/server architecture and single-point database for all system management functions. The system shall include at least one system management console which provides system management of the entire system. Vendor shall describe what type of computer, with pricing, that is proposed.

The system shall be capable of supporting multiple system management operator consoles operating concurrently at different locations within the wide area network. The system management computer and consoles shall be powered from 115 VAC 60 Hz. Supplier shall specify power requirements.

In addition to the features outlined below, Supplier shall provide details of his proposed Network- or Element Management system, including system capabilities, instruction, and use.

8.1 Network Management Features

- Polling & Alarms: The system management computer shall support polling and alarms. System devices which detect that they have changed status or are operating below specification shall automatically transmit an alarm to the system management computer.

In some cases device failure will prevent the transmission of an alarm. These situations will be detected through polling. The system management computer shall automatically and routinely poll system devices to determine status.

- Network Topology Map: The system management computer shall provide a hierarchical network topology map, showing all managed devices using color coding to represent device status. Through the network topology map it shall be possible for the operator to determine the current detailed status of a managed object, by double clicking on the object.
- Fault Browser: The system management computer shall provide a scrollable, time sorted list of alarm messages sent by managed objects.
- Alarm Notification: The system management computer console will be mostly unattended. The system management computer shall provide a programmable audible and visible alert to notify the operator of changes in the system status. The system management shall have the option to phone/page/text/e-mail an alarm notification. List all viable notification options in Supplier's response.
- Remote Access: System Manager shall be accessible through the internet. Falmouth will be responsible for external security access to the System Manager.
- System Administration: The system administration computer shall support establishing and updating repeater site parameters, remotely enabling and disabling radios, etc. Supplier shall detail what parameters can be programmed over the air.

The system administration computer shall support the registration of new voice users in the system, assigning voice group membership, and assigning of user privileges. Supplier shall list all functions and controls available.

The system administration computer shall connect to the proposed radio system via an IP connection. The system administration computer shall run on Windows 7 or newer Microsoft operating systems.

It is desired that the system administration computer shall have different levels of access. This includes full access (make all levels of changes available) to just system monitoring. Only one or two people would have the highest access and would be able to assign an access level to other system administration computers connected to the system either directly or by system log on ID. It would be acceptable for only one system administration computer be equipped with remote access and the other could log on at different access levels. Supplier to detail how secured access is attained and levels of access available.

In the System Pricing .XLS, list the cost for a computer with system administration software and the cost for the software only. Also, state whether there is a charge for each copy of the system administration software.

- Statistics: The system management computer shall collect and save performance statistics for later analysis. Supplier shall describe the type and frequency of statistics collected and stored by the system management computer.

9.0 Dispatch Equipment

The equipment proposed shall connect to the existing Zetron MAX consoles at the Falmouth Dispatch Center. Falmouth prefers a direct connection to the DMR network without the use of control station radios.

Connectivity between the DMR Network and Zetron MAX should be:

- 1) Via microwave/MUX connection using standard tone or E&M format
Or
- 2) Via IP connection directly connecting the console to the proposed DMR system.
PREFERRED
- 3) Falmouth does not wish to use "control stations" as primary connection to the system. Connection to the Zetron MAX console will be a direct connection.

Programming Software

All required programming software will be included. The programming software application shall run on the Windows 7 and newer Microsoft operating systems. Supplier shall provide pricing for any additional programming accessories, cables, etc. that may be required.

The list below represents the approximate quantity of fully featured radios required by Falmouth. The exact quantity and type of equipment will be identified after contract award by Falmouth. The equipment quantities contained in this RFP are approximations and are for use in providing Supplier with an indication as to the potential magnitude of the requirement.

9.1 Mobile Radios

Number of mobile radios estimated at: 19

If there are different levels of mobile radios available, Supplier shall describe in detail each type of mobile with a list of features and its cost. For bidding purposes, the Supplier will use the highest priced radio in their bid response in System Pricing.XLS.

For interoperability reasons a strong conformance to the ETSI DMR Tier II standard is preferred. The radios shall scan both DMR Tier II and Analog channels

One of the mobile radios shall have a dual control head.

See attachment 4

9.2 Portable Radios

Number of portable radios estimated at: 30

Battery
Desk Charge
Speaker microphone
Leather case with swivel (only #20)

If there are different levels of portable radios available, Supplier shall describe in detail each type of portable with a list of features and its price. For bidding purposes the Supplier will use the highest priced radio in their bid response in the price sheet in main section of RFP.

See attachment 4

9.3 Fire Police Portable Radios

Number of Portables estimate at: 7

Battery
Desk Charger
Speaker microphone
Belt Clip

The Fire Police Portable shall be included in this bid. The Fire Police Portables do not need P-25 features. The Fire Police Portables shall be capable of both DMR and analog operation and have the minimum standards listed below. Portables will be supplied with a rapid rate charger as well as speaker microphones and belt clips.

See attachment 5

10.0 Project management

Supplier will provide a project manager for the project will be determined by the Chief of Police. This person will have project management and telecommunication skill sets and provide comprehensive project management and coordination. Supplier shall anticipate that common project management tools, including the use of on-site meetings, scheduled conference calls and meeting minutes.

11.0 Project System Engineering

Project engineering services shall be provided from the initial system design through the completion of system acceptance and the warranty period. At a minimum the services shall include:

- final system design and review
- coverage prediction and acceptance testing
- system configuration
- implementation & testing support
- final system documentation
- resolution of technical problems

12.0 Training

The Supplier shall provide a description and optional cost break down for training on the operation of all equipment provided with the radio system. In general, the Supplier shall support training as follows:

- Overview training of Tier II Simulcast technology and setting user expectations for non-technical personnel.
- Management training for administrative and management personnel who will be responsible for defining and maintaining the system's configurable parameters.
- User equipment operator training for designated purchaser trainers on the operation of portable radios, mobile radios, and control stations. The training will be conducted using a train-the-trainer format at up to four locations throughout Falmouth's service territory.
- Console equipment operator training for dispatchers. This training will be conducted at locations throughout Falmouth's service territory.

The Supplier shall provide a description of each course including the material to be covered, number of hours or days of training per course, limits on number of attendees per class, and prerequisites. The Supplier shall also list any additional recommended training and the cost for each additional training session.

The Town requires the following, not to exceed response and repair times during the warranty period: For all fixed infrastructure equipment 24-hour x7-day coverage. One (1) hour OSR (on-site response) 8 hour repair from time of OSR.

The proposer shall identify in the response the local organization or organizations that will be responsible for warranty during the first year. If more than one (1) organization is offered, a breakout shall be provided which identifies the items that each organization will be responsible for.

The response shall include the following information on the offered warranty organization or organizations only if different from the bidder organization: Business name, address and telephone, number of years in service under this or any other name, name of General Manager and Technical Manager

Total number of technicians

Brief overview of the relevant experience of the business

State whether the organization has any pending litigation and state whether the organizations has had any litigation in the last 5 years.

If the Vendor's warranty and maintenance staff are not the same organization(s) offered to perform the system and equipment installations, the above information shall be stated in the response for the offered installation organization. WARRANTY AND MAINTENANCE.

Costs associated with this warranty period shall be clearly and individually identified in the pricing section of the response.

13 VENDOR RFP RESPONSE FORMAT

Brief executive overview(no more than 4 pages) Introduction of the prime vendors company including history, qualifications, experience, main line of business, how business is organized (corporation, LLC, partnership, public, private, etc) □ Introduction of the subcontractor(s) including history, qualifications, experience, main line of business, how business is organized (corporation, partnership, private, public, etc). Identify all subcontractor(s) by listing name, address, phone and contact person. State whether the prime vendor has worked with the subcontractor(s) in the past. If so, provide brief descriptions on: the project(s) (no more than 3); the system elements; the scope of each subcontractor's responsibility; the approximate start date and duration of the project.

13.1 Statement Of Work

Describe the work to be performed by the prime vendor by identifying all major project tasks and milestones. Describe the work to be performed by each subcontractor by identifying all major project tasks and milestones. Group all project tasks by their associated subcontractor. Identify the anticipated responsibilities of the County. Provide a proposed project organizational chart.

13.2 Point by Point Response

Unless indicated otherwise a point-by point response shall be presented in this section Note that some of the specifications sections may not need or require a response. Any specification section that is not included in this point-by-point response will be deemed to have been accepted and agreed to by the vendor. Every point-by-point response shall be identified by its corresponding specification section number. All responses shall follow the same numeric sequence of the specification. □ Reiteration of the specification section text in the point-by-point response is not necessary. If there are nay exceptions, clarifications and/or substitutions (E/C/S); identify each item clearly as an exception, clarification or substitution. E/C/S items shall only be presented in this section of the response.

For clarifications or substitutions, provide an explanation of the difference between what the specification requested and what will be supplied by the vendor. Vendors shall explain why they believe their method of accomplishing the requested functionality will be equal or better. For exceptions, provide the reason.

13.3 Technical System Information

Description of the system(s) being offered. Include a detailed itemized list and quantities, in matrix form, of all equipment supplied and their intended installed location. Do not include costs. Intended locations shall appear as columns on the matrix. Include equipment catalog or specification sheets. Include simple block system diagrams illustrating all major system components of each of the systems offered. These diagrams shall be provided on a per site basis.

13.4 Radio Coverage Contours

This section shall contain a statement that the vendor clearly understands the propagation maps provided in this RFP and that the system will be built to provide that coverage.

13.5 Migration Plans – N/A

13.6 Project Schedule – Estimated timeline

13.7 Vendor's Project Manager Information

13.8 Warranty and Maintenance

13.9 List of References

Provide a list of three (3) references with radio systems having similar requirements of this solicitation. Include a brief description of the system, approximate date of acceptance, contact name and telephone number. FOR EACH SUBVENDOR – Provide a list of three (3) references with radio systems having the similar requirements of this solicitation. Include a brief description of the system, approximate date of acceptance, contact name and telephone number.

13.10 Costs

Cost sheets shall be in spreadsheet form to the greatest extent possible. The costs shall cover all the items to be supplied by the successful vendor. Costs shall be shown on a per unit and extended basis. Identify all cost sheet items, at a minimum, in the following order; quantity, model number, description, unit cost and extended cost. Sections should be broken out by location or site. Cost for major services such as installation, licensing, systems engineering, program management, training, etc., shall be clearly identified. Costs for these services shall not be lumped. List all sub-items associated with each major item. Clearly identify each cost sheet with an appropriate header which includes the costs associated with allowances. Any costs for optional items or offering shall be presented on a separate cost sheet.

The Supplier shall provide a description of each course including the material to be covered, number of hours or days of training per course, limits on the number of attendees per class, and prerequisites. The Supplier will indicate the price of each item listed above for both on-site training and training at the Supplier's facilities. The Supplier will state where the Supplier's training facilities are located. Falmouth will bear all travel and living costs for any training at the Supplier's or manufacturer's facility.

Acceptance testing will consist of Operational Performance Tests and RF Coverage Performance Tests. Supplier will be required to develop an acceptance test plan for each step in the implementation plan and a final system acceptance plan that meets

Falmouth's approval. The final system acceptance and all related documentation shall be completed no later than 60 days after contract signing.

13.11 Operational Performance Tests

The Operational Performance Tests will include the following basic test procedures:

- Verify that all equipment is delivered and installed in a workmanship like manner in accordance with the Contract.
- Demonstrate that all equipment performs as specified by examination of test data and the re-running of specific tests, if deemed appropriate.

Supplier shall detail the offered standard warranty for all equipment and software. The basic system pricing will be based the suppliers' standard warranty from date of system acceptance. Falmouth would like to consider options to extend the warranty in one year increments up to a three year total warranty period. The warranty will also cover all software updates for the same period of time. The warranty period will commence upon successful completion of the final Operational Performance Test and the RF Coverage Performance Test.

13.12 Spare Parts

Suppliers shall quote, as an option, a complete recommended spare parts package which will support maintenance following the warranty period. Spare parts for user equipment and fixed equipment to be quoted on the basis of supporting anticipated fail points. The supplier shall quote the cost of having one of each system components in stock.

13.13 Repair and Return

Supplier shall detail their Repair and Return policy and costs including both "in warranty" and "out of warranty" scenarios.

13.14 Subcontractors and Radio Maintenance Facilities

Suppliers will provide information on subcontractors and factory authorized radio maintenance facilities near Falmouth that are available to supplement Falmouth maintenance and warranty services. Information provided will include qualifications and locations in terms of years in business, experience, size of facilities and number of technicians, and average years of experience in maintenance of the specific communications equipment and system being proposed to Falmouth.

13.15 VRS Vehicle Repeaters

Part of this bid will include the winning bidder to re-program and retune 7 vehicular repeaters from a 150 channel to a 173 channel.

13.16 Remove Old Equipment and Install New Equipment

The bid shall state the cost to remove old mobile radio equipment and install new equipment. Successful bidder will connect new mobiles to existing VRS systems.

DEADLINE FOR SUBMISSION

All responses to this Request for Proposals must be received by the Falmouth Police Department no later than March 10, 2017. Proposals should be sent to: Edward J. Tolan, Chief of Police, 2 Marshall Drive, Falmouth, Maine 04105.

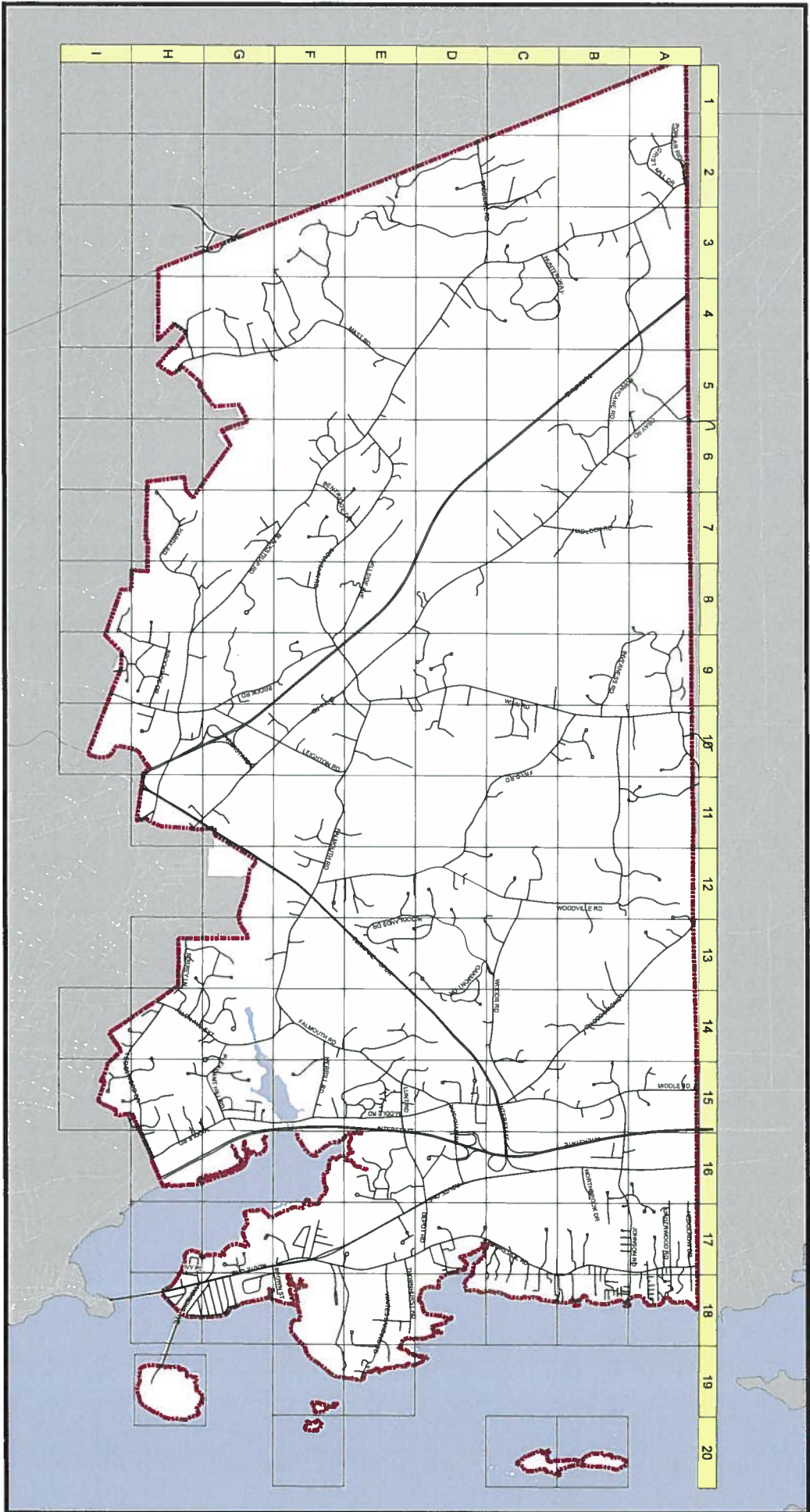
RIGHT TO REJECT PROPOSALS

The Town of Falmouth reserves the right to reject any or all submissions received, for any reason, and to negotiate proposal terms in order to best serve the interest of the Town.

Attachment 1

Microwave System Minimum Specifications

- FCC Licensed Link (no unlicensed or 4.9Ghz)
- 50 Mbps full duplex minimum
- Software upgradable as an add-on future option to 1000 Mbps
- Integrated 256-bit AES encryption
- Latency- 120 μ s @ 256QAM. 50 MHz
- Modulations- QPSK to 2048QAM
- All outdoor radio/modem
- Antenna external to radio
- -48V, Power on Ethernet
- Supports QoS
- Web based management
- Carrier Grade
- Minimum design of 99.9990% reliability



Data Sources:
Town of Falmouth
Maine Office of GIS
Map Prepared by:
SPACIAL
SPACIAL CONSULTANTS
1000 W. Main St., Suite 200
Portland, ME 04101
Map Produced: November 2018

**Town of Falmouth
1/2 Mile Grid
Maine**



~ Road Centerlines
- - - - - Town Boundary

Attachment 3

Mobile and portable radio minimum requirements:

General Mobile and portable requirements

- 136-174 MHz
- Analog narrowband
- DMR Tier II (**Included feature**)
- P25 Conventional (**included feature**)
- P25 Trunking (Phase 1 & 2) Protocol (**available as a future software upgrade if needed**)
- Mixed Digital & FM Analog Operation
- 6.25 & 12.5 kHz Channels
- Emergency Call
- Remote Check
- GPS Location
- MDC-1200
- Two-Tone paging
- Built-in Voice Inversion Scrambler
- P25 Conventional Trunking (Phase 1 & 2) Protocol (Capable)
- AMBE+2™ Enhanced Vocoder
- Talk Group ID Lists
- Individual ID Lists
- Caller ID Display
- Built-in 56-bit DES Encryption
- Optional 256-bit AES Encryption
- Built-In GPS Receiver/Antenna
- Built-in Bluetooth® Module
- microSD/microSDHC Memory Card Slot for increased memory capacity for “Voice & Data”
- Maximum of 4,000 CH/Radio capacity, 512 CH/Zone, 128 Zones

Portable specific features

- 6 W (136-174 MHz)
- 1 W Loud Speaker Audio
- Built-in Motion Sensor for life-critical mandown detection
- IP67/68 and MIL-STD-810 C/D/E/F/G
- Active Noise Reduction (ANR) utilizing built-in DSP with two microphones for suppression of ambient noise

Mobile specific features

- 5 W – 50 W
- Volume Knob (required)
- Channel select Knob (required)
- Single remote head configuration (required)
- Dual Remote Control Head Option and Multi-Band (Multi RF Deck) Control available as an Option
- Active Noise Reduction (ANR) utilizing built-in DSP for suppression of ambient noise
- IP54/55 and MIL-STD-810 C/D/E/F/G
- 4 W Speaker Audio

Attachment 4

Fire Police Portables Minimum Standards

Fire police portables shall be capable of scanning DMR Tier II and Analog

General data

Frequency range	VHF: 136 - 174 MHz UHF: 400 - 527 MHz
Channel capacity	1024
Zone capacity	64
Channel spacing	25/20/12.5 kHz (analog) 12.5 kHz (digital)
Operating voltage	7.4 V
Battery	1500 mAh (Li-Ion)
Battery service life (5/5/90)	approx. 11 h (analog) approx. 16 h (digital)
Frequency stability	±0.5 ppm
Antenna impedance	50 Ω
Dimensions (HxWxD)	4.8 x 2.17 x 1.1 inches
Weight	10.23oz

Transmitter

RF Power Output	HF: High 5W - Low 1W UHF: High 4W - Low 1W
FM Modulation (Analog Emissions Designator)	11K f3E @ 4Kf3E @ 20KHz ; 16Kf3E @ 25KHz
4FSK Digital Modulation (Digital Emissions Designator)	2.5KHz Data Only: 7K6fXD 2.5KHz Data & Voice: 7KfXW
Conducted/Radiated Emission	-36 dBm < 1 GHz -30 dBm > 1 GHz
Modulation limiting	±2.5 kHz at 12.5 kHz ±4.0 kHz at 20 kHz ±5.0 kHz at 25 kHz
FM Hum & Noise	40 dB at 12.5 kHz 43 dB at 20 kHz 45 dB at 25 kHz
Adjacent Channel Power	60 dB at 12.5 kHz 70 dB at 20/25 kHz
Audio Response	+1 dB to -3 dB
Audio Distortion	≤ 3%
Digital vocoder type	AMBE++ or SELP
Digital Protocol	ETSI-TS102 361-1, 2&3

Receiver

Sensitivity (analogue)	0.22 μV (12 dB SINAD) 0.22 μV (typical) (12 dB SINAD)
------------------------	--

Sensitivity (digital)	0.4 μ V (20 dB SINAD)
Adjacent channel selectivity	0.22 μ V / BER 5%
TIA-603	60 dB at 12.5 kHz / 70 dB at 20 and 25 kHz
ETSI	60 dB at 12.5 kHz / 70 dB at 20 and 25 kHz
Intermodulation	
TIA-603	70 dB at 12.5/20/25 kHz
ETSI	70 dB at 12.5/20/25 kHz
Spurious response rejection	
TIA-603	70 dB at 12,5/20/25 kHz
ETSI	70 dB at 12.5/20/25 kHz
Spurious response rejection	
	40 dB at 12.5 kHz
	43 dB at 20 kHz
	45 dB at 25 kHz
Nominal audio power output	0.5 W
Nominal audio distortion	\leq 3 %
Audio sensitivity	+1 dB to -3 dB
Conducted spurious emission	< -57 dBm

Ambient Specs

Operating temperature range	-30 °C to +60 °C
Storage temperature range	-40 °C to +85 °C
ESD	IEC 61000-4-2 (level 4) \pm 8 kV (contact discharge) \pm 15 kV (air discharge)
Protection against dust and moisture	IP67
Shock and vibration resistance	MIL-STD-810 C/D/E/F/G
Relative humidity	MIL-STD-810 C/D/E/F/G

GPS (nur PD605G)

TTF (cold start)	< 1 minute
TTF (warm start)	< 10 seconds
Horizontal Accuracy	< 10 meter

Attachment 5

Repeater/System Minimum Specifications

General

- Compliant with the Telecommunications Industry Association (TIA) Project 25 Common Air Interface
- Compliant with the European Telecommunications Standards Institute (ETSI) Digital Mobile Radio (DMR) Standard TS-102 361-1, 2, 3, 4

Standard Operating Modes

1. Analog FM
2. DMR II Digital Conventional
3. Analog FM/DMR II Digital Conventional hybrid system
4. DMR III Digitally Trunked

Software Upgradable Operating Modes

1. P25 Phase 1 simulcast systems

Standard Features and Hardware

- TX and RX frequency range 136-174MHz
- Output Power Programmable from 10W up to 110W
- Analog Sensitivity PM modulation: < -119 dBm @ 12 dB SINAD
- Digital sensitivity C4FM: < -120 dBm @ BER = 5×10^{-2} 4FSK: < -120 dBm @ BER = 5×10^{-2}
- 4 wire audio line interface (tone and E&M)
- Embedded Tier III Trunking Controller
- Capable of operating in "dual mode" and switch automatically from digital DMR II (or P25) to Analog FM on the same channel and vice versa
- GPS receiver is integral to the repeater
- All modules are tuned and configured completely via software
- The 110W PA is self-contained within the repeater, no external power amplifiers
- The synchronization, equalization, voting are all contained within repeater.
- Completely "auto-tuning". Synchronization is maintained. Equalization is automatically adjusted. Voting is automatic and continuous. There is no requirement for periodic alignment and tuning.
- Front mounted numerical key-pad and display for configuration and maintenance
- Supports multicast as well as hybrid multicast and simulcast networks using the same hardware/firmware
- Simulcast Master, Sub-Master, Slave mode within the same device. Each repeater can be configured as a control point master, submaster or slave and each repeater can be configured as a master in the event of a failure.
- Voting is integral to the repeater

- Reliable fall-back mode: Slave in-cabinet repeating and Backup Master automatic reconfiguration
- Embedded AMBE+2 vocoder
- I/O ports- LAN, RS232, 4 digital inputs, 4 digital outputs, 2 analog inputs
- CTCSS (TX/RX split-tones)
- DCSS (TX/RX split-tones)
- OCXO (Oven Controlled Crystal Oscillator) 50 ppb temperature stability with programmable zero-offset compensation

Optional items:

- Diversity Receiver
- Redundant internal GPS

Attachment 6

AGREEMENT

I. PARTIES

This contract (hereinafter referred to as "Agreement") is made and entered into on this _____ day of _____, 20____, by and between the Inhabitants of the Town of Falmouth with a mailing address of 271 Falmouth Road, Falmouth, Maine 04105 (hereinafter referred to as "Town"); and _____, with a mailing address of _____(hereinafter referred to as "Consultant"). In consideration of the mutual promises contained herein, Consultant agrees to perform the following services for the Town.

II. SCOPE OF WORK

In consideration of the compensation set forth herein, the Consultant shall perform the services as outlined in a request for proposal dated _____ and attached hereto as Exhibit A and the response attached hereto as Exhibit B.

III. COMMENCEMENT AND COMPLETION

The Consultant will commence work on or before _____, 200____ and will complete work on or before _____, 200____.

IV. PAYMENT TERMS

The Consultant shall submit an invoice on or about the first of each month reflecting services performed at the Consultant's normal professional billing rates, attached hereto as Exhibit C. The Consultant understands that the payment for completion of the services outlined in Section II shall not exceed _____ Dollars (\$____), and the Consultant agrees to perform the services on that basis. Invoices shall list separately all out of pocket expenses being billed.

V. TERMINATION

Either party may terminate this Agreement for cause after giving the other party written notice and a reasonable opportunity to cure. The Town may terminate without cause by giving the Consultant fourteen (14) days notice, and compensating the Consultant equitably to the termination date.

VI. DISPUTE RESOLUTION

Any controversy or claim arising out of or related to this Agreement, which cannot be resolved between the parties shall be submitted to the Maine Superior Court (Cumberland County). This agreement shall be governed by Maine law.

VII. QUALIFICATIONS

The Consultant represents it holds, and will continue to hold during the term hereof any and all qualifications, licenses and certifications required to perform its services in Maine. The consultant shall perform all services in accordance with professional standards.

VIII. SUBCONTRACTORS

The Consultant shall be fully responsible to the Town for the acts and omissions of any subcontractors, and of persons either directly or indirectly employed by it, and shall hold subcontractors to the same terms and conditions as Consultant is held under this Agreement. No subcontractors shall be retained on this Agreement without the specific prior written approval of the Town.

IX. INSURANCE

The Consultant shall purchase and maintain Workers' Compensation Insurance, General Public Liability and Property Damage Insurance including vehicle coverage and professional liability insurance, all with limits and terms satisfactory to the Town. The Town shall be named as an additional insured on the liability policy.

X. INDEMNIFICATION

The Consultant will indemnify and hold harmless the Town, its officers, agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the Agreement by the Consultant, its officials, employees, agents and subcontractors.

XI. ENTIRE AGREEMENT

This Agreement and its attachments represent and contain the entire agreement between the parties. Prior discussions or verbal representations by the parties that are not contained in this Agreement and its attachments are not a part of this Agreement. Where there is any conflict between the provisions of this Agreement and the provisions of any attachment, the provisions of this Agreement shall control.

Date: _____

By: _____

Title: _____

Date: _____

INHABITANTS OF THE
TOWN OF FALMOUTH, MAINE

By: _____
Nathan A. Poore, Town Manager

REFERENCE COPY

This is not an official FCC license. It is a record of public information contained in the FCC's licensing database on the date that this reference copy was generated. In cases where FCC rules require the presentation, posting, or display of an FCC license, this document may not be used in place of an official FCC license.



Federal Communications Commission
Public Safety and Homeland Security Bureau

RADIO STATION AUTHORIZATION

LICENSEE: FALMOUTH, TOWN OF

ATTN: COMMUNICATIONS SUPERVISOR
FALMOUTH, TOWN OF
2 MARSHALL DRIVE
FALMOUTH, ME 04105

Call Sign KNIE500	File Number
Radio Service PW - Public Safety Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number	

FCC Registration Number (FRN): 0003672185

Grant Date 06-04-2013	Effective Date 01-12-2016	Expiration Date 07-01-2023	Print Date
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STATION TECHNICAL SPECIFICATIONS

Fixed Location Address or Mobile Area of Operation

- Loc. 1** Address: 2 MARSHALL DR
City: FALMOUTH County: CUMBERLAND State: ME
Lat (NAD83): 43-44-22.0 N Long (NAD83): 070-15-04.9 W ASR No.: Ground Elev: 43.0
- Loc. 2** Address: .2 MI OFF BLACKSTRAP RD
City: PORTLAND County: CUMBERLAND State: ME
Lat (NAD83): 43-45-33.0 N Long (NAD83): 070-19-13.0 W ASR No.: 1014068 Ground Elev: 152.4
- Loc. 3** Address: 271 FALMOUTH RD
City: FALMOUTH County: CUMBERLAND State: ME
Lat (NAD83): 43-44-01.9 N Long (NAD83): 070-16-45.7 W ASR No.: Ground Elev: 36.5
- Loc. 4** Area of operation
Operating within a 32.0 km radius around fixed location 1
- Loc. 5** Area of operation
Operating within a 32.0 km radius around fixed location 3
- Loc. 6** Address: 287 FORESIDE RD
City: FALMOUTH County: CUMBERLAND State: ME
Lat (NAD83): 43-44-10.8 N Long (NAD83): 070-12-23.8 W ASR No.: Ground Elev: 33.0
- Loc. 7** Address: 6 BUCKNAM RD
City: FALMOUTH County: CUMBERLAND State: ME
Lat (NAD83): 43-43-34.0 N Long (NAD83): 070-13-56.6 W ASR No.: Ground Elev: 14.0

Conditions:

Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

Licensee Name: FALMOUTH, TOWN OF

Call Sign: KNIE500

File Number:

Print Date:

Antennas

Loc No.	Ant No.	Frequencies (MHz)	Sta. Cls.	No. Units	No. Pagers	Emission Designator	Output Power (watts)	ERP (watts)	Ant. Ht./Tp meters	Ant. AAT meters	Construct Deadline Date
1	1	000156.17250000	FB	1		11K0F3E	100.000	75.000	25.0	34.1	
2	1	000156.17250000	FB2	1		11K0F3E	110.000	75.000	30.0	129.9	
2	1	000155.79000000	FB2	1		7K60FXE	100.000	90.000	30.0	129.9	01-12-2017
3	1	000156.17250000	FB	1		11K0F3E	100.000	50.000	25.0	22.9	
3	1	000155.79000000	FB2	1		7K60FXE	100.000	50.000	25.0	22.9	01-12-2017
4	1	000156.17250000	MO	100		11K0F3E	40.000	40.000			
5	1	000156.17250000	MO	100		11K0F3E	40.000	40.000			09-04-2008
5	1	000153.74000000	MO	100		11K0F3E 7K60FXE	40.000	25.000			01-12-2017
6	1	000155.79000000	FB2	1		7K60FXE	100.000	50.000	20.0	28.0	01-12-2017
7	1	000155.79000000	FB2	1		7K60FXE	50.000	50.000	20.0	6.8	01-12-2017

Control Points

Control Pt. No. 1

Address: 271 FALMOUTH ROAD

City: FALMOUTH County: CUMBERLAND State: ME Telephone Number: (207)781-2300

Control Pt. No. 2

Address: 2 MARSHALL DR

City: FALMOUTH County: CUMBERLAND State: ME Telephone Number: (207)781-4242

Associated Call Signs

KCF437, WNNY384

<NA>

Waivers/Conditions:

NONE

REFERENCE COPY

This is not an official FCC license. It is a record of public information contained in the FCC's licensing database on the date that this reference copy was generated. In cases where FCC rules require the presentation, posting, or display of an FCC license, this document may not be used in place of an official FCC license.



**Federal Communications Commission
Public Safety and Homeland Security Bureau**

RADIO STATION AUTHORIZATION

LICENSEE: FALMOUTH, TOWN OF

ATTN: CHIEF OF POLICE
FALMOUTH, TOWN OF
271 FALMOUTH RD
FALMOUTH, ME 04105

Call Sign KCF437	File Number
Radio Service PW - Public Safety Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number	

FCC Registration Number (FRN): 0003672185

Grant Date 04-17-2013	Effective Date 09-30-2016	Expiration Date 07-01-2023	Print Date
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STATION TECHNICAL SPECIFICATIONS

Fixed Location Address or Mobile Area of Operation

- Loc. 2** Address: 271 FALMOUTH RD
City: FALMOUTH County: CUMBERLAND State: ME
Lat (NAD83): 43-44-01.3 N Long (NAD83): 070-16-46.2 W ASR No.: N/A Ground Elev: 30.0
- Loc. 4** Area of operation
Operating within a 16.0 km radius around 43-44-35.3 N, 070-19-22.2 W,
FALMOUTH, CUMBERLAND county, ME
- Loc. 5** Address: .3KM FROM BLACKSTRAP RD
City: PORTLAND County: CUMBERLAND State: ME
Lat (NAD83): 43-45-33.0 N Long (NAD83): 070-19-13.0 W ASR No.: 1014068 Ground Elev: 152.4
- Loc. 6** Area of operation
Operating within a 40.0 km radius around fixed location 5
- Loc. 7** Address: 4 BUCKMAN ROAD
City: FALMOUTH County: CUMBERLAND State: ME
Lat (NAD83): 43-43-33.1 N Long (NAD83): 070-13-55.9 W ASR No.: Ground Elev: 12.0
- Loc. 8** Address: 2 MARSHALL DR
City: FALMOUTH County: CUMBERLAND State: ME
Lat (NAD83): 43-44-22.9 N Long (NAD83): 070-15-04.9 W ASR No.: Ground Elev: 43.0
- Loc. 9** Area of operation
Operating within a 40.0 km radius around fixed location 8
- Loc. 10** Area of operation
Operating within a 15.0 km radius around fixed location 8

Conditions:
Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

Licensee Name: FALMOUTH, TOWN OF

Call Sign: KCF437

File Number:

Print Date:

Fixed Location Address or Mobile Area of Operation

Loc. Address: 2 MACKWORTH ISLAND
11 City: FALMOUTH County: CUMBERLAND State: ME
Lat (NAD83): 43-41-17.6 N Long (NAD83): 070-13-56.1 W ASR No.: Ground Elev: 22.5

Antennas

Loc No.	Ant No.	Frequencies (MHz)	Sta. Cls.	No. Units	No. Pagers	Emission Designator	Output Power (watts)	ERP (watts)	Ant. Ht./Tp meters	Ant. AAT meters	Construct Deadline Date
2	1	000453.47500000	FB2	1		11K0F3E	100.000	200.000	21.0	17.0	
4	1	000155.52000000	MO	30		11K0F3E	100.000	100.000			
4	1	000155.79000000	MO	30		11K0F3E	90.000	90.000			
4	1	000159.73500000	MO	30		11K0F3E	75.000	75.000			
4	1	000453.47500000	MO	250		11K0F3E	100.000	100.000			
4	1	000458.47500000	MO	250		11K0F3E	100.000	100.000			
4	1	000150.99500000	MO	50		11K0F3E	5.000	5.000			06-25-2014
5	1	000155.79000000	FB2	1		11K0F3E 11K2F3E	100.000	100.000	30.0	152.1	05-23-2004
5	1	000453.47500000	FB2	1		11K0F3E 11K2F1D 11K2F3E	100.000	200.000	30.0	152.1	10-18-2006
6	1	000155.79000000	MO	50		11K0F3E 11K2F3E	50.000	50.000			05-23-2004
6	1	000153.74000000	MO	50		11K0F3E 11K2F1D	40.000	40.000			10-08-2010
7	1	000453.81250000	FXO	1		11K0F3E 11K2F3E	10.000	15.000	7.0	-5.3	09-11-2007
7	1	000458.78750000	FXO	1		11K0F3E 11K2F3E	10.000	15.000	7.0	-5.3	09-11-2007
8	1	000155.79000000	FB	1		11K0F3E	100.000	125.000	25.0	28.4	10-18-2008
8	1	000159.73500000	FX1	3		11K0F3E	50.000	50.000	25.0	28.4	10-18-2008

Frequency 000159.73500000 Special Condition
Authorized by waiver of Rule 90.20(c) granted 10/18/07.

Licensee Name: FALMOUTH, TOWN OF

Call Sign: KCF437

File Number:

Print Date:

Antennas

Loc No.	Ant No.	Frequencies (MHz)	Sta. Cls.	No. Units	No. Pagers	Emission Designator	Output Power (watts)	ERP (watts)	Ant. Ht./Tp meters	Ant. AAT meters	Construct Deadline Date
8	1	000154.06250000	FX1	3		11K0F3E 11K2F3E	50.000	50.000	25.0	28.4	10-18-2008
8	1	000159.00750000	FX1	1		11K0F3E	45.000	25.000	25.0	28.4	12-30-2016
8	1	000153.74000000	FB2	1		11K0F3E 11K2F3E	100.000	50.000	25.0	28.4	12-30-2016
Frequency 000153.74000000 Special Condition Authorization on a secondary basis.											
9	1	000155.79000000	MO	30		11K0F3E	90.000	90.000			10-18-2008
10	1	000159.00750000	MO	100		11K0F3E	45.000	45.000			12-30-2016
10	1	000173.31250000	MO3	50		11K0F3E	5.000	2.000			09-30-2017
10	1	000173.31250000	MO	50		11K0F3E	4.000	4.000			09-30-2017
11	1	000155.79000000	FB2	1		11K0F3E 7K60FXE	40.000	40.000	15.0	16.9	09-30-2017

Control Points

Control Pt. No. 1

Address: 271 FALMOUTH RD

City: FALMOUTH County: CUMBERLAND State: ME Telephone Number: (207)781-2300

Control Pt. No. 2

Address: 2 MARSHALL DR

City: FALMOUTH County: CUMBERLAND State: ME Telephone Number: (207)781-4242

Associated Call Signs

KNIE500, WQKT39I

<NA>

Waivers/Conditions:

NONE

REFERENCE COPY

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**Federal Communications Commission
Wireless Telecommunications Bureau**

RADIO STATION AUTHORIZATION

LICENSEE: FALMOUTH, TOWN OF

ATTN: COMMUNICATIONS SUPERVISOR
FALMOUTH, TOWN OF
2 MARSHALL DR
FALMOUTH, ME 04105

Call Sign WQKT391	File Number
Radio Service 1G - Industrial/Business Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number	

FCC Registration Number (FRN): 0003672185

Grant Date 09-05-2009	Effective Date 09-05-2009	Expiration Date 09-05-2019	Print Date
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STATION TECHNICAL SPECIFICATIONS

Fixed Location Address or Mobile Area of Operation

Loc. 1 Address: 2 MARSHALL DR
City: FALMOUTH County: CUMBERLAND State: ME
Lat (NAD83): 43-44-22.9 N Long (NAD83): 070-15-04.9 W ASR No.: Ground Elev: 43.0

Loc. 2 Area of operation
Operating within a 40.0 km radius around fixed location 1

Antennas

Loc No.	Ant No.	Frequencies (MHz)	Sta. Cls.	No. Units	No. Pagers	Emission Designator	Output Power (watts)	ERP (watts)	Ant. Ht./Tp meters	Ant. AAT meter	Construct Deadline Date
1	1	000159.73500000	FB	1		11K0F3E	100.000	100.000	20.0	543.0	09-05-2010
2	1	000159.73500000	MO	15		11K0F3E	100.000	100.000			09-05-2010

Conditions:

Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

Licensee Name: FALMOUTH, TOWN OF

Call Sign: WQKT391

File Number:

Print Date:

Control Points

Control Pt. No. 1

Address: 2 MARSHALL DR

City: FALMOUTH County: CUMBERLAND State: ME Telephone Number: (207)781-4242

Associated Call Signs

Waivers/Conditions:

NONE