ARLINGTON COUNTY, VIRGINIA

AGREEMENT NO. 16-128-SS
AMENDMENT NUMBER 1

This Amendment Number 1 is made on the date of execution by the County and amends Agreement Number 16-128-SS dated December 31, 2015, ("Main Agreement") between Motorola Solutions, Inc. ("Contractor") and the County Board of Arlington County, Virginia ("County").

The County and the Contractor amend Exhibit A-1 section 1.10 called for under the Main Agreement as follows:

The Contractor shall provide an upgrade to replace the County's existing Microwave Radio System as outlined in the scope of work and pricing in Attachment A.

All other terms and conditions of the Main Agreement remain in effect.

WITNESS these signatures:

THE COUNTY BOARD OF ARLINGTON COUNTY, VIRGINIA	MOTOROLA SOLUTIONS, INC.
AUTHORIZED SIGNATURE: Cynthia Davis	AUTHORIZED SIGNATURE:
NAME: Cynthia Davis TITLE: Procurement Officer	NAME AND TITLE: David J. Dip Area Sales Manager
DATE: 10/2/2018	DATE: 10/1/18

Attachment A

MOTOROLA SOLUTIONS

Proposal

Arlington County, VA

Microwave Radio System Upgrade

January 16, 2018

Data Restrictions

This proposal is considered Motorola confidential and restricted. The proposal is submitted with the restriction that it is to be used for evaluation purposes only, and is not to be disclosed publicly or in any manner to anyone other than those employed by Arlington County, VA required to evaluate this proposal without the express permission of Motorola Solutions, Inc.

Contents

1 Digital Microwave Radio Design Overview

Motorola Solutions is partnering with Microwave Networks (MNI) to propose an upgrade to replace Arlington County's existing Proteus AMT microwave radio system, consisting of a 6 link ring configuration. The existing radios have only TDM capability, and no Ethernet capability. The Proteus AMT solution was installed in 2005. This radio is no longer manufactured.

The upgrade will provide the following:

- Six (6) links of the Proteus MX series Hybrid TDM and Ethernet radio
- 253 Mbps capacity
- 32 DS1 channels, with four (4) DS1's with Loop Protection built into the radios
- New microwave antenna systems
- New DC power systems
- Microwave Network Management system
- Network Health Mobile Application for mobile devices
- Full turnkey installation
- Two (2) year standard warranty

1.1 Path Engineering

1.1.1 Network Map

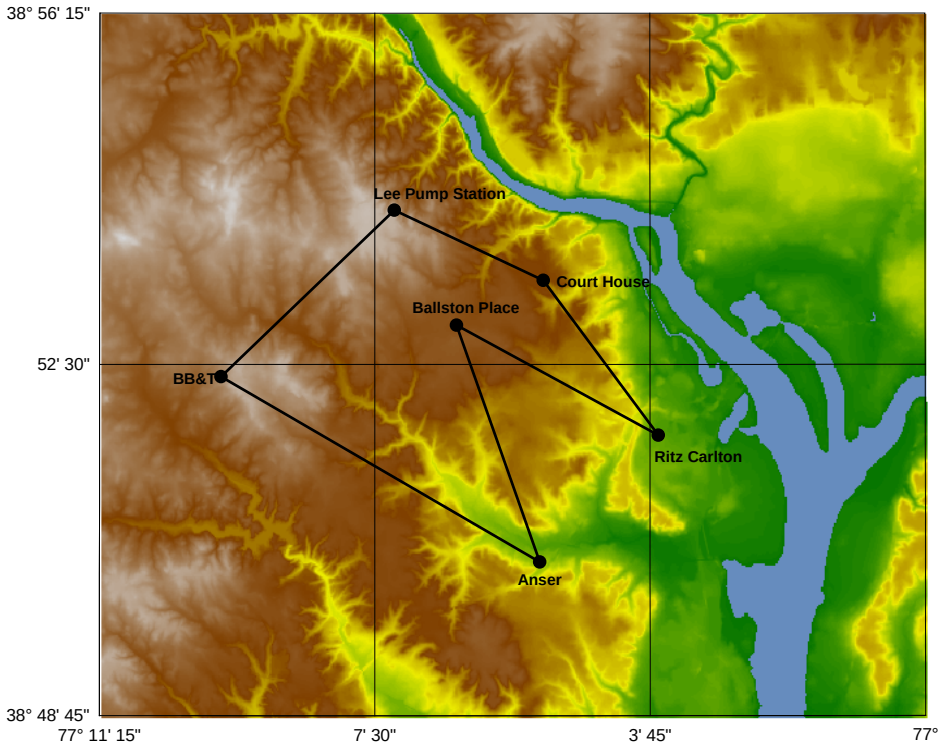

Figure 1: Microwave Network System Map

1.1.2 Path Analysis

Path analysis is attached.

1.1.3 Path Design Considerations

All paths are designed with 253 Mbps radio throughput. All paths are engineered to meet or exceed an annual two-way availability of 99.9995% at a BER of 10E-6 using the Vigants-Barnett model. The preliminary calculations for path performance are based on Microwave Networks published 10E-6 receiver threshold levels. Bellcore Standard transmission engineering practices, formulas and topographic data are the foundation of these calculations. Clearance criteria used to determine preliminary antenna centerlines are:

- K = 4/3 @ 100% F1
- 1/3" Arc USGS terrain data
- 30 meter NLCD 2001/2011 clutter data

Before system implementation a microwave path engineering survey will be conducted on all paths. The objective of this survey is "information verification" to confirm the information to be used for clearance and engineering performance objectives. This

confirmation includes site location (latitude/longitude coordinates), elevation above mean sea level (AMSL), accurate measurement of path obstructions along the path (i.e. trees and buildings, electrical transmission lines, cellular towers, the presence of reflective surfaces) and general compilation of local climate information.

At locations with existing towers, pre-determined azimuths and centerlines will be checked for availability/adaptability in terms of proposed antenna mounting.

2 Arlington County Microwave Equipment Solution

2.1 Proteus MX Available Features

The Proteus MX is a technically advanced, cost effective mission critical licensed band radio platform. As a hybrid radio, the MX supports native TDM (DS1, DS3, OC3) and native Ethernet IP traffic separately without converting traffic from one format to the other. This hybrid design has the advantage of preserving TDM timing and minimizing latency and jitter in the TDM traffic.

The Proteus MX was designed around Mission Critical Reliability; it was uniquely designed from the ground up to provide backhaul for critical applications such as, P-25, TETRA and LTE networks. In the 1+1 protected configuration every active component is duplicated with automatic switching between primary and standby at several different points in the traffic path. Individual modules can be removed for maintenance without disconnecting traffic cables or interrupting traffic in any way.

Setup and configuration is carried out using either a menu based Command Line Interface connection, or using the Proteus Element Manager 2 GUI application. Unlike many other radios on the market, both ends of a radio hop can be configured simultaneously from one site – there is no need to individually configure each site separately.

The Proteus MX is also available in various hardware and path protection configurations including '1+0' and '2+0', non-protected repeater, fully hot-standby protected (1+1), and protected transmit with space or frequency diversity receivers.

Key features include:

- Native Ethernet and Native TDM - Proteus MX offers risk-free migration from TDM to IP with the highest possible capacities at the lowest overall cost - addressing any deployment scenario.
- Data rates from 6 Mbps (2.5 MHz channel) to -350 Mbps (60 MHz channel)
- 6-38 GHz licensed frequency bands
- All Indoor or Split Mount with outdoor antenna mounted RF Units.
- QPSK to 256 QAM
- TDM Features
    - Up to 32xDS1 + 4DS3
    - SHARP – Self Healing Alternate Ring Protection- built-in T1 Loop Protection
    - M13 Multiplexer – DS1's inserted/dropped from a DS3
    - DACS – TDM Digital Cross Connection and Traffic Grooming
    - MicroBus – TDM single cable interface for co-located radios
- Carrier Ethernet Features:
    - Integrated L2 Ethernet switch with 4096 VLAN and QoS
    - Standard: 4 x10/100/1000Base-T interface (FE/GbE) – RJ45
    - Optional: 3x10/100/1000Base-T interfaces (FE/GbE) – RJ45 plus 1xGbE SFP 1000Base-X SFP
    - Optional: 12x10/100/1000Base-T interfaces (FE/GbE) – RJ45
    - Support up to 10k byte Jumbo Frame

- Encryption: AES 128/256 (optional)
- FIPS 140-2 Compliant (optional hardware version)

- Adaptive Coding & Modulation (ACM)
- Forward Error Correction for improved receiver threshold.
- System Identification Memory (SIM) – A front panel accessible Flash memory card (SD Flash) containing all configuration and history files. The SIM card can be transferred during maintenance to quickly and easily upload configuration to a replacement unit.
- Operating Temperature Range:
  - Indoor installed units: -5^{0}C to +55^{0}C
  - Outdoor installed units: -50°C to +55°C
- A powerful Transversal Equalizer to provide high tolerance to dispersive fades
- Transmitter pre-distortion for increased transmitter power
- RADIUS user authentication
- Element Manager 2 (EM2) application GUI for easy radio setup and configuration
- Available SPARCS Network Management System – An SNMP based NMS for managing Proteus radios as well as other SNMP based objects in the networks.

Figure 2: Proteus MX 1+1 Protected SPU

2.2 Proposed Proteus Radio Configuration

The proposed solution provides a Microwave ring topology with Native Ethernet and Native TDM Proteus MXD radios. We are proposing the Proteus MXD, which is configured as a 1+0 repeater at each site. The unique configuration of the MXD allows two radios to share a single Proteus Signal Processing Unit (SPU) chassis, providing an East/West configuration and saving rack space. The two Channel Units operate independently of each other. Each Channel Unit connects to its own RF Unit. The two Channel Units can be configured differently and connected to different kinds of frequencies or RF units, if necessary. In addition, the Proteus MXD can be configured as a 2 x 1+0 radio.

Sharing a common SPU chassis not only has a space saving advantage, but it also allows the two CU's to communicate with each other through the SPU's backplane, eliminating external cables in the repeater configuration. The MXD supports all modes of operation, including TDM DACCs, MicroBus TDM interconnection, SHARP DS1 loop protection and Ethernet Layer 2 switching

Figure 3: 1+0 Ring Configuration Signal Processing Unit

The Proteus MXD will provide both Ethernet Rapid Ring Protection and ring protected T1s on the radios.

All T1 circuits will run natively on the microwave radios. Running the T1 traffic directly on the microwave radios provides the lowest latency possible for all circuit level traffic, as well as a lower cost system. We equipped each radio terminal with Self-Healing Alternate Route Protection (SHARP) to provide built in T1 loop protection. See section 4.2.7 for more explanation of these features.

The Proteus MXD radio also has a built in feature to provide Ethernet Rapid Ring Protection. See section 4.2.6 for more explanation of this feature.

Figure 4 - Proteus MX Signal Processing Unit (Back)

The Outdoor RF Unit (ODU) is mounted on the tower and is designed for extreme environmental conditions while providing high performance and reliability. The ODU is mounted directly behind the antenna.

Figure 5 - ODU mounted on back of antenna

2.2.1 Proteus MX Ring Radio Details

- Equipment: Proteus MXD Repeater High Power Configuration
- Signal Processing Unit (SPU) – A rack mounted unit which accepts customer signal inputs, processes them, and provides an Intermediate Frequency (IF) signal to the Radio Frequency Unit. This unit consists of an Outer Chassis + 2 Channel Units (East/West)
- ODU Radio Frequency Unit Rack Mounted outdoors or indoors – Converts the IF signal from the SPU to the final radio frequency and amplifies the signal for transmission, and receives radio frequency signals from the far end of the radio hop, converts them to IF and sends them to the SPU.
- 11 GHz Band, Licensed for 253 Mbps in 40 MHz Channel
- Native IP, Native TDM
- 4x10/100/1000Base-T interfaces (FE/GbE)
- Ethernet Rapid Ring Protection
- 32 DS1s available
- SHARP – Self Healing Alternate Ring Protection- T1 Loop Protection
- SHARP loop protection for 4 DS1s
- Adaptive Coding & Modulation (ACM)
- CHAMP connector for DS1 interface to Telect panels, which provide RJ45 interface

2.2.2 Racks, Fuse Panels, and Cross Connect

The radios are mounted in 7'x19" racks equipped with a Trimm fuse/terminal block panel. The intra-rack DC power wiring will be connected to the Trimm fuse/terminal block panel and the DC circuit for each piece of rack mounted equipment will be separately fused. The racks will also be equipped with a ground bar system to meet R56 standards.

At all sites, our proposal also includes DSX-1 cross-connect panels. The cross-connect panels provide monitor and circuit interrupting access points for the testing, monitoring, and patching of the DS1 circuits, and provide an RJ-45 interface for each of them.

2.2.3 Antenna System

The antennas proposed for this system are 3ft RFS antennas in order to achieve the desired reliability. All the antennas are Category "A" per US FCC part 101. These antennas were

selected to provide direct connections to the ODUs so no flex waveguide would have to be used between ODU and antenna.

2.2.4 Power Systems

Our proposal includes Eltek Intrepid DC redundant rectifiers to provide 48 VDC to the microwave radios. The Eltek Intrepid rectifiers have an efficiency of up to 91%. This high efficiency translates into significant, ongoing AC power savings for the life of the system. The assembly will contain individual DC circuit breakers, distribution panel), voltage and current continuous metering capabilities, high/low DC voltage disconnect switching and all necessary maintenance and management alarm and control functions. Chargers will be provided in redundant arrangement with units of identical capacity and type working on a load-sharing basis during normal operation. Solid state monitoring by the power board will be continuous and automatic switchover employed in the event of failure of either unit. Upon switchover the surviving rectifier will be able to carry the entire site load plus growth and provide 24 hour recharge in the event of any loss of AC power.

Figure 6: Eltek Intrepid with redundant rectifiers

Battery Backup will be provided with NSB 40FT Red Batteries®, which are valve regulated batteries with an extended service life (10 years) in a compact configuration. The batteries will be rack mounted in EIA standard relay racks for floor space conservation and have been sized to provide eight hours of standby operation at full load plus 25% expansion. The DC distribution circuit breaker panels and the main -48 VDC ground (return) buss will be isolated in this rack as part of the Eltek power board assembly.

2.2.5 Spares

Spares are included for stock at the customer location. Spares include:

- 4 ODUs (2 low and 2 high band)
- Channel Unit
- SHARP Data Card
- Eltek Intrepid Rectifier module

2.2.6 Ethernet Ring Protection

The Proteus MX supports ring-based protection using Rapid Ring Protection (RRP), assuring path protection with fast restoration. In RRP, one node of the ring is designated as the Switch Node. It periodically sends polling to determine whether the ring is intact and to convey to the other nodes in the ring whether a topology change has occurred. With RRP, network engineers can configure several RRP parameters including the RRP behavior mode, poll timing intervals, broken ring timing thresholds, port forward delay timing, and ring identification. As an integral part of the hardware, RRP achieves switching times typically under 200 milliseconds, and well under the P-25 threshold of 800 milliseconds.

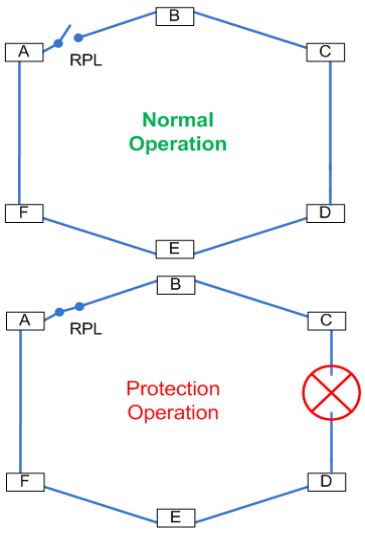

Figure 7 Ethernet RRP

2.2.7 DS1 Loop Protection

For the ring, we equipped each radio terminal with the Self-Healing Alternate Route Protection (SHARP) 32 DS1 Traffic Line Interface (TLI) modules for physical interface to legacy TDM traffic. This TLI can provide up to 32 DS1 drop/insert capability as well as providing loop switch functionality for the T1 traffic. Each radio is licensed for up to 4 DS1s. Each radio is equipped with MicroBus, which uses a proprietary high speed serial interface to digitally cross-connect pass-through TDM traffic of up to 190Mbps between co-located radios via a single cable using the DACS capability of the radio. This means that T1 circuits do not have to be physically dropped and reinserted to the network at each location. All adds, moves, and changes for T1 circuits will be done via software.

SHARP loop protection can be set on individual DS1s. Protection is provided on each tributary by splitting the signal and sending it in both directions around the loop. At each drop site the signals arriving from both directions are compared, and the better of the two is selected for use. The SHARP mechanism buffers and aligns the two DS1 inputs to ensure errorless switching on each DS1.

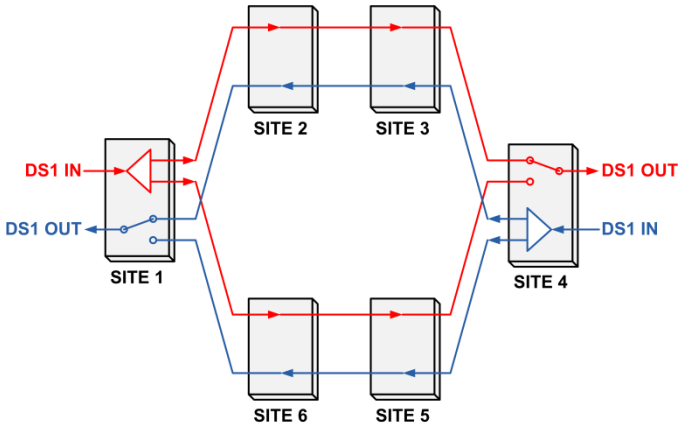

Figure 8: SHARP Ring Protection

2.2.8 Adaptive Coding and Modulation (ACM) in the Proteus MX

The Proteus MX allows the use of adaptive coding and modulation (ACM) which means that the modulation the amount of forward error correction (FEC) parity are automatically adjusted based on the quality of the received signal.

The quality of the received signal is measured by looking at the signal-to-noise ratio (SNR) of the received signal. When the SNR degrades, as may happen in the event of a path fade or interference, the ACM mechanism will automatically switch errorlessly to a more robust modulation to improve system gain. This change lowers the radio throughput, but maintains a working path. ACM will switch back to a higher modulation or use less FEC parity, whenever SNR improves.

When switching between two ACM levels, the SNR limit to switch down to a lower modulation is lower than the SNR limit to switch up allowing some hysteresis. For example, in the above table, the modem will switch from 64QAM to 32QAM when the current SNR drops below 25dB but it will switch from 32QAM to 64QAM when the current SNR exceeds 28.5dB.

Traffic Classes are used to ensure the most important Ethernet traffic is prioritized. The Proteus MX allows the user to classify traffic into one of 4 traffic classes, numbered TC0 to TC3. TC0 traffic has the highest priority and TC3 has the lowest. The radio can be set to allow all high priority traffic to be transmitted before lower classes, or it can be set for a 4,3,2,1 weighted priority. In the weighted priority scheme, for each 8 IP packets transmitted 4 will be TC0, 3 will be TC1, 2 will be TC2 and 1 will be TC3. Traffic class can be assigned in one of two ways: based on which Port the packet arrives on or based on which VLAN the packet belongs to.

2.3 Network Management

Several complementary products are included for Site Alarm and Network Management. These include the following:

- **Element Manager** (included), which provides direct local access or remote access over any IP network to provide configuration, link by link analysis, and alarms.
- **SPARCS** (included), which is an SNMP based open network monitoring and management system
- **Network Health Mobile Application** (NHMA) (Included at no additional cost), which is a mobile monitoring and alarm application that monitors a network of Microwave Networks radio links and reports the network's state to users on their mobile phones, tablets or PCs.

2.3.1 Element Manager

The Element Manager (EM) is the Proteus Series radio and link supervisory system that simplifies configuring, monitoring, and testing your radio or link. EM is a Microwave Networks proprietary software package, provided free of charge on a CD supplied with each

radio terminal. It has a graphical user interface. The EM gives radio installer, maintenance personnel, and operators a tool for management and control of individual radio links – on site or from remote locations – using a platform independent Java environment. A radio manager can use EM to configure a radio, test a radio or link, and monitor performance and alarms.

EM's graphical interface provides a clear display of radio information, alarms, status, configuration, and logs. The radio logs up to 200 items: 100 radio alarms and 100 events. Events include configuration changes and condition changes. EM has administrator and guest security levels. The following illustration shows the EM display of a protected radio configuration with LinkView enabled. LinkView summarizes performance graphically for both primary/secondary and near-end and far-end radios.

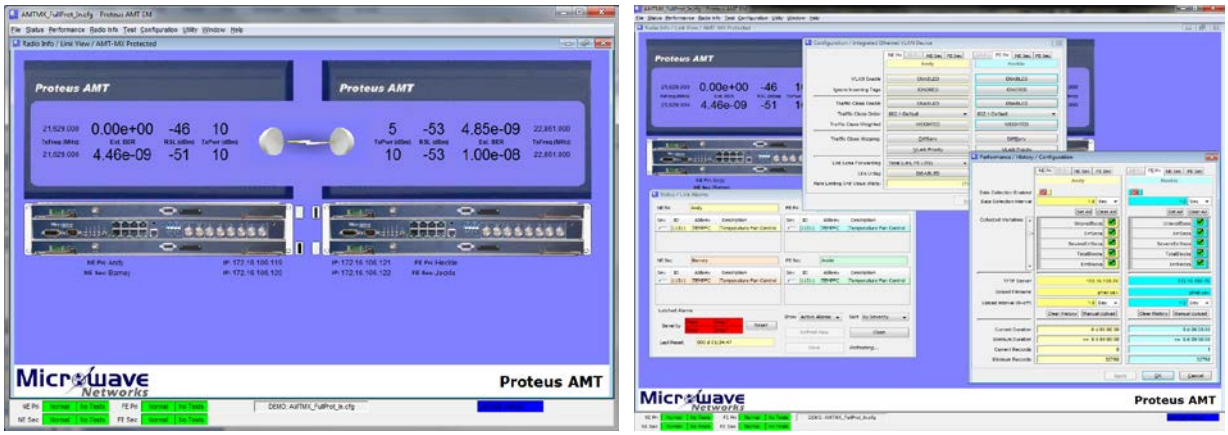

Figure 9: Element Manager Screens

The EM is for management of a single radio link, and management of multiple links and/or the entire network is achieved with SPARCS.

2.3.2 SPARCS Network Management System

The SPARCS Network Management System has been quoted to monitor and control the digital microwave system we are proposing. We will supply SPARCS already loaded on a PC/Server, and configure it to monitor your Microwave Network. SPARCS provides the following capabilities and features:

- Runs on Windows OS with modest hardware requirements. SPARCS is a completely open system allowing access to its data from external sources.
- SPARCS can be used to manage any SNMP enabled device.
- Supports a multi-level hierarchical map. Each hierarchy can represent cities, buildings, or sub-networks. Imported bitmaps of geographic maps or floor plans, along with manual or automatic network placement, lets you create a layout that closely matches the actual network.
- Automatically lay out each map network as a tree, ring, or bus topology. Each map object uses a device specific or user selected icon, and the object color indicates the device status.
- The Map Navigation Tool Window displays the map as a tree for direct selection of objects. The Navigation tree also displays the current alarm status of each subnet to quickly locate failing devices.

- The map window Full Zoom feature automatically moves and zooms the view so that all devices are always visible in the window. The Pan/Zoom feature lets you select a region to zoom into from the complete set of devices in a view.
- Automatic network discovery agents find new nodes on the network and automatically place them on the root Map. Operators can then move the newly discovered node to any sub-map and configure how SPARCS will interact with the node.
- Employs distributed polling agent architecture to provide a high performance solution capable of monitoring networks from several hundred devices to tens of thousands. Remote software and Web based consoles provide network information to everyone who needs it.
- Provides remote access consoles through Java or Windows based client software. Each remote user is assigned a security level and unique view of the network based on their user login.
- Security and accountability through support for user audit trails. Any user access to the management platform or configuration changes are tracked and written to a log file. Alerts are automatically generated if an intrusion attempt is detected.
- Alarm events can be configured to automatically Email and or page appropriate service personnel.
- With the Trend Reporting capability, Polling Agents monitor all user-defined report variables for a learning period and calculate a baseline for typical patterns. Thereafter, the Polling Agents compare the actual polled data to the baseline and generate alarms when variables deviate excessively from the baseline. Polling Agents automatically adjust baselines as traffic patterns change. You can also manually configure alarm thresholds for any polled variable.
- Changes the color of map objects and performs other actions based on received events. Event Action Filters select the action to take when an event occurs.
- Automatically export Map Topology, trend statistics and event log entries to industry standard databases for further processing. Use familiar tools such as Microsoft Access to generate customized trend reports.
- Automatically generates scheduled daily, weekly, and monthly statistic reports. Report formats include graph, bar chart, distribution, and summary. They can be exported to a variety of destinations, including printers, files, or a WEB server.
- User defined custom menus directly perform commands without having to select MIB objects. Custom menus can display a MIB table; edit, graph or chart any set of MIB variables; set an SNMP MIB variable; or run an application program.

SPARCS provides the most immediate real-time health indication of the network by the color of the icons representing the sub-networks, sites and individual radios in the network map: each icon's color represents the severity of the most serious problem that SPARCS knows of in the radio or radios that that icon represents. SPARCS determines the severity level of the radio by polling the radio's mnPrRadStatCurSeverity object, and also by tracking the setting and clearing SNMP traps that the radio can be configured to send to one or more SPARCS consoles.

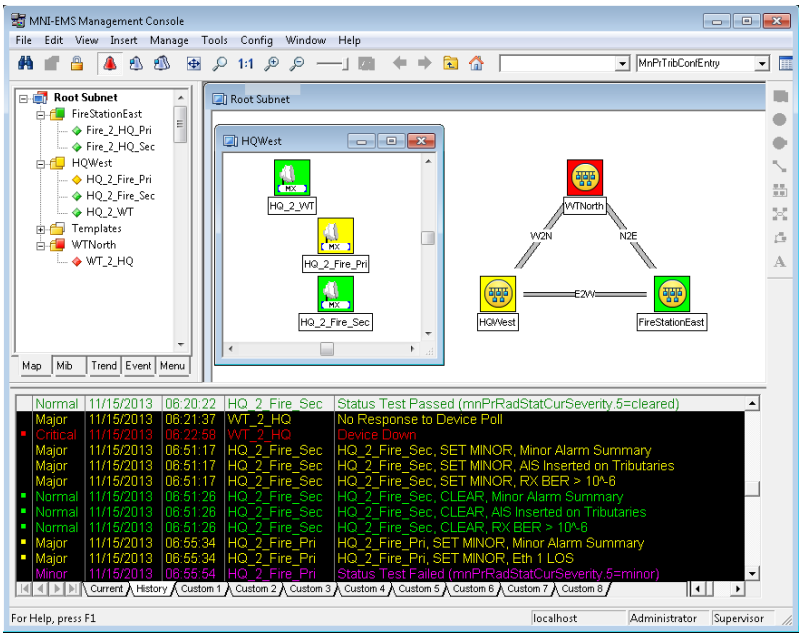

Figure 10: SPARCS Event Log, icon coloring, and hierarchical map

The Proteus MX radio's MIB contains dozens of status variables, and these can be viewed directly using SPARCS, or in a more formatted fashion using the Element Manager. In addition, any status variable can be polled by SPARCS or a SPARCS script, and SPARCS can trigger a notification event if the monitored variable exceeds specified thresholds.

2.3.3 Network Health Mobile Application

In addition, this proposal includes the Network Health Mobile Application. The Network Health Mobile Application (NHMA) is a web application that monitors a network of Microwave Networks radio links and reports the network's state to users on their mobile phones, tablets or PCs.

The NHMA server (customer provided) can be accessed by users on the County intranet, and can also be made available (through the County firewall) to employees over the public Internet. The NHMA is a pure web application that is accessed through the client devices' web browsers, so no client software installation is required. The NHMA runs in parallel with the existing Microwave Networks Element Manager and Microwave Networks Element Management System, supplementing but not replacing them.

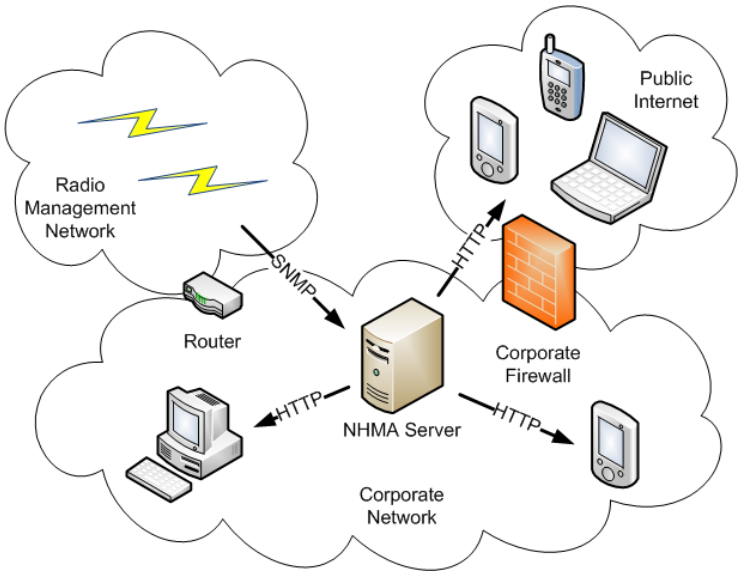

Figure 11: NHMA System Configuration

NHMA Features

Notifies mobile users when problems occur via email or SMS text

- Lists the radio links by the categories of problems, giving a quick overview of the overall network state.
- Gives a summary of the state of any particular link, including key performance statistics and a complete list of current alarms.
- Integrated access to street maps (showing radio terminal locations) and current National Weather radar maps.
- Provides a summary of performance of each link and the entire network over last 24 hours
- Flexible architecture: additional features will be added over time.
- The NHMA server based application will be added to the SPARCS server platform.
- The server needs to be accessible (via HTTP) to users on the corporate net and mobile users on the Internet (through a firewall configured to allow HTTP access over a configurable port number to the server.)
- NHMA will run on the following devices:
  - *Mobile Devices*: iPhone, iPad, iPod Touch, Android, Blackberry (OS 6 or greater), any mobile device that uses a WebKit-based or HTML5-capable browser.
  - *PC Browsers*: Chrome, Firefox, Safari, Internet Explorer (limited but improving), any WebKit-based or HTML5-capable browser.
  - *Email, SMS*: Devices that support email or SMS can receive alerts from the server that inform the user of changes in the state of the radio network.

Figure 12: NHMA Sample Screens

3 Implementation Plan

3.1 Microwave Networks Implementation Overview

Microwave Networks is providing the following services to support the Arlington County microwave network:

- Program Management
- Project Engineering
- Path Survey Engineering and Technical Report
- Customer Design Review
- FCC Frequency Coordination and Licensing
- Factory System Staging/Integration
- Factory System Acceptance Testing
- Installation & Optimization of Radio and DC Power Equipment Quoted
- Installation & Optimization of Antenna, Transmission Line and Pressurization Equipment Quoted
- Complete Cutover of all circuits
- Field Acceptance Testing
- Documentation
- Proteus MX Training at Customer Location (Up to 10 Students)
- Two (2) year Standard Factory Warranty
- 24/7 Telephone technical support
- Annual Preventive Maintenance

Below are the details of these services:

3.1.1 Program Management

Microwave Networks will provide Program Management services to proactively manage the flow of the project, keep customer up to date, and follow and track all aspects of the project, including documentation, scheduling, manufacturing, shipping and meetings. The Microwave Networks Program Manager will be responsible for all correspondence regarding the project and will be the primary point of contact throughout the project.

3.1.2 Path Survey Engineering and Technical Report

The initial step in the design of a microwave radio link or the planning of a microwave relocation project is the path survey. The purpose of the path survey is to accurately identify and locate all critical points and potential obstructions between the two sites and to determine the antenna centerlines that are required to meet the established path clearance criteria. Microwave Networks has an in-house staff of transmission engineers and survey crews to conduct path surveys.

Prior to beginning the physical path survey, computer analysis is conducted for the proposed path. Preliminary site coordinates are entered and preliminary path profiles are generated from USGS 1/3 arc second Digital Elevation Models (DEMs). This data is then used to calculate preliminary antenna centerlines and critical elevation points which require investigation and confirmation during the actual survey.

During the physical survey, the path is traversed and the horizontal and vertical positions of the proposed radio sites, critical elevation points, and potential obstructions are accurately identified using a differential global positioning system (DGPS) and a laser range finder. This information is digitally recorded on a path survey data collector.

To prepare the path survey report, the surveyed coordinates are scaled and plotted on USGS 7.5 minute (1:24,000) quadrangle maps. A line is drawn connecting the radio sites and all critical points or potential obstructions are indicated as determined by the survey. Based upon the as-surveyed path profile, antenna centerlines are selected to satisfy two sets of clearance criteria: F1 @ K=4/3 and 0.3F1 @ K=2/3. An analysis is also performed to determine if potential path reflections might interfere with path performance. Path reliability for a two-way link will be at least 99.999%.

All of the relevant information gathered during the survey, the path profiles, and the proposed antenna centerlines are compiled into a path survey report. The entire report includes each path for which a survey was conducted and will be delivered within 1 to 2 weeks after the completion of the survey.

In parallel with, or shortly after the path survey, Microwave Networks will conduct site surveys. The purpose of the site survey is to perform a visual inspection of the site and collect information that will be used to finalize the detailed site design and to accurately assess the scope and plan for installation. Within one week of the completion of the survey, Microwave Networks will deliver the site survey report which details the findings and recommendations.

3.1.3 Customer Design Review

Microwave Networks will attend and support the Customer Design Review held by Motorola at the customer's location.

3.1.4 FCC Frequency Coordination and Licensing

The Prior Coordination Notices will be modified to incorporate the new antennas on the links with new antennas, and the links that will reuse existing antennas. The new system is designed to have 99.999% per link availability with consideration for climatic and rain effects on propagation. New license applications will be filed on behalf of Arlington County as part of the proposal.

Microwave Networks will perform frequency coordination to find a frequency or block of frequencies that will operate without interfering with other microwave users in the area. This is an iterative process that requires computerized simulation of potential interference and an engineering analysis to eliminate interference cases and ultimately determine a usable set of frequencies.

The process begins with a tentative frequency selection consistent with existing frequency plans. Calculations are performed to determine the expected interference from and into the proposed system. These calculations include, as a minimum, co-channel and adjacent

channel interference as well as interference caused by inter-modulation products. The result is a list of potential interference cases that require further analysis and resolution.

If terrain blockage is a factor, then terrain profile studies are made and the interference levels are recalculated to account for the reduction caused by blockage. If interference cases remain, the engineer then evaluates system upgrade alternatives, starting with the simplest and least costly. This process continues until a workable system is found or until it is determined that no workable alternative exists in the proposed location and frequency band. In the latter case, alternate bands or locations will be recommended.

Prior Coordination Notice (PCN) is required by the FCC prior to obtaining a license to operate on specific frequencies. Microwave Networks will circulate, to other proposed and licensed common carriers, the required PCN indicating the frequency assignment and operating characteristics of your system. Microwave Networks will receive and respond to any objections to the proposed frequency and act as your technical liaison until all cases are resolved. Upon completion of the prior coordination, Microwave Networks will supply the supplemental showing which is required under FCC rules.

When requested and contracted to prepare FCC forms, Microwave Networks will complete the engineering sections of the Private Fixed Microwave Application Form 402. In addition, Microwave Networks will provide the exhibits of the functional system diagram which are required by FCC rules. This is the extent of the involvement by Microwave Networks in the completion of this form (Form 402). The end-user will be responsible to complete other sections of the form which relate to shared use of facilities, environmental impact, and other non-engineering aspects of the application.

3.1.5 Project Engineering

Given the results of the path survey, the site survey, and the frequency coordination, Microwave Networks, will perform the project engineering to develop a detailed equipment list which specifies, on a site-by-site basis, all of the individual items required to implement the new microwave radio system.

In addition to generating the detailed equipment list, the project engineering function also includes the preparation of all of the project specific documentation including rack elevation drawings and wire run lists. The Project Engineer will ensure proper interfacing of the new system to those portions of the existing system that will remain in-use by the new system.

3.1.6 Manufacturing

The Microwave Networks Program Manager will monitor all of the radio equipment through the manufacturing process from the material planning phase to the final test. By having real-time access to the status of the manufacturing process, the Program Manager can ensure the successful delivery of the equipment on-site with the start of the installation. Also, whenever situations occur on the project which require a modification to the manufacturing process the Program Manager can initiate the necessary changes quickly and establish the appropriate feedback channels to confirm that the changes are implemented.

3.1.7 Factory Staging and Factory Acceptance Testing

In the factory Systems Integration Facility, Microwave Networks can perform a complete factory integration and test of an entire system or sub-system. As part of the factory integration process, all of the equipment is configured exactly as it will be when installed. All radios are connected back-to-back with fixed attenuation while various radio and system-level tests are performed.

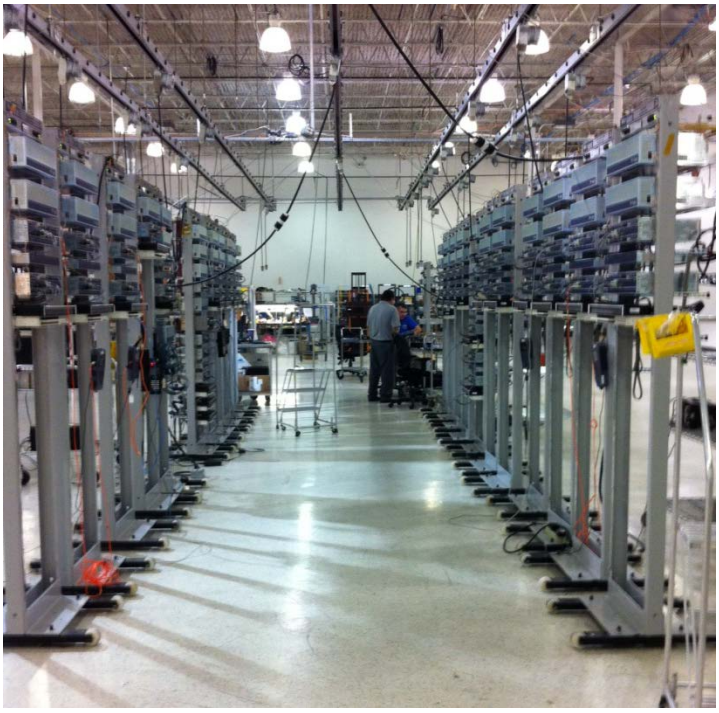

Figure 13:Factory Integration and Acceptance Testing at Microwave Networks

Upon completion of the factory system integration, Microwave Networks will conduct a functional test of the entire system, called the Factory Acceptance Test (FAT) at the Microwave Networks' factory, prior to shipment. With each system that involves factory integration, the Customer is given the option to visit the Microwave Networks facility (in Stafford, TX) and witness the final factory testing. The duration and extent of the factory witness testing is dependent on each Customer's specific requirements.

3.1.8 Equipment Delivery

All racked radio equipment, except for power systems and batteries will be delivered to the customer's local secure facility in racks, exactly as configured at the Microwave Networks factory. Power systems, batteries, antennas and waveguide and other mounting accessories will also be delivered to the local facility. Equipment will then be transferred directly to each site prior to installation of each site.

3.1.9 Installation of antenna systems, radio rack, DC Power System and Batteries

All antenna installation work is sub-contracted by Microwave Networks to one of our certified installation service providers who work under the direction of the Microwave Networks Program Manager. By acting as prime contractor for both the antenna installation and the other installation activities for the site, the Microwave Networks Program Manager coordinates all activities related to the antenna installation including the delivery of the equipment to the site and the assistance of the tower crew in the path alignment process.

As part of a turnkey installation, Microwave Networks will install the necessary lengths of waveguide to connect the radio to the antenna. Microwave Networks will adhere to established industry standards such as EIA Standard RS-222, Motorola R56, and manufacturers' recommendations when installing waveguide on towers.

Upon the completion of the installation of an antenna system, Microwave Networks conducts a sweep test on each section of waveguide. The purpose of the sweep test is to verify that the installed system conforms to VSWR specifications across the operating band.

Microwave Networks will also install and test the pressurization equipment. The pressurization equipment will be installed at a location designated in the site plan. Every effort is made to avoid installing the pressurization equipment in or very near the equipment rack. This will minimize any adverse effects that might be caused by vibration. Upon completion of the installation, Microwave Networks performs a pressure integrity test of the system.

At the heart of the installation of any microwave communication system is the radio itself. As manufacturer of the radio, Microwave Networks and their factory certified installation subcontractors are uniquely qualified to install and test the radio system. All MNI installations are performed by our certified subcontractors whose activities are directed and monitored by the Microwave Networks Program Manager.

The general scope of the installation includes uncrating, inspection, inventory, setting and securing in place, connection of DC power, connection to transmission system, and path alignment. When channel banks or multiplexing equipment is involved, the installation of these items is also included in the scope of the radio installation. While these general activities provide an overview of the scope of installation, the detailed installation plan will vary from site to site.

3.1.10 Acceptance Test Plan

Microwave Networks can conduct a wide range of on-site testing to meet your requirements. Attached is a routinely used set of standardized acceptance test procedures. These tests are a subset of the tests performed during the manufacturing process and the factory system test. In addition to reconfirming the results of the tests performed in the factory, all of the on-site test plans include a measurement of received signal level (RSL) to ensure the path is installed and aligned properly as well as an extended duration (typically 24 hr.) bit-error-

rate (BER) test to verify that the hop is functioning properly. Additional testing, to meet the Customer's specific requirements can be included upon request.

3.1.11 Integration and Cutover

Microwave Networks will develop a cutover plan to minimize the downtime of the public safety radio system. The team and the Customer will finalize a mutually agreed upon cutover plan based upon discussions held during the Customer Design Review. All will be on site during cutover to ensure the least amount of downtime possible. All user group(s) affected by the cutover will be notified.

3.1.12 Documentation

The following documentation will be provided:

- Detailed Implementation schedule
- Cutover Plan
- FCC licenses and coordination documentation
- Path Profiles and Path Link Analysis
- Formal Path and Site Survey Report
- One complete set of Microwave Networks Operation and Maintenance manuals with drawings for each rack.
- One complete set of vendor provided Operation and Maintenance literature with drawings for each location.
- Project completion notice upon completion of the activities detailed in the Scope of Work. The project completion notice may apply to the project on a per hop or per system basis, as mutually agreed upon by Microwave Networks and the Customer.
- Complete System functional diagram
- A complete documentation package of equipment as installed and accepted (As Builts), to the customer three (3) weeks after system acceptance, including wiring lists, calibration procedures, maintenance charts and tables.

3.2 Training Plan

Microwave Networks will provide training for up to 10 attendees at the Microwave Networks factory, at a time selected by the County, for the Proteus MX Series Microwave Radios. Training will be performed by a certified Microwave Networks instructor. At least a three week notice is required to schedule the training. The training syllabus follows.

3.2.1 Proteus MX Operations, Installation, and Maintenance Course

Overview

Technicians will receive Proteus MX operations theory and hands-on training. Training includes classroom, lectures, and practical exercises. During the course technicians will actually troubleshoot Proteus MX radios and links and provide corrective solutions.

Learning Objectives

Upon completion of the course, technicians will understand Proteus MX operations and work with the Element Manager to configure, provision, and troubleshoot Proteus MX radios.

Target Audience

The course is designed for technicians who are responsible for operations, installation, and maintenance of microwave radios and networks.

Prerequisites

Technicians should have an understanding the following topics:

- Basic microwave systems operations
- Basic RF knowledge: modulation, propagation, power and signal measurements
- Fundamentals of networking

Technicians must bring a modern Laptop PC – Windows OS – XP or better.

Logistics

Class Size:	8
Course Duration:	2 days
Location:	Stafford, TX or customer location
Certification:	yes
Materials Provided:	Digital and hardcopy manuals, Element Manager, and course presentations (USB)

Course Topics

Overview of the Proteus MX Radio

- Key Features
- Native TDM and native Ethernet
- Software Defined Radio -License Keys
- Element Manager

Hardware Configurations

- Architecture – Indoor and Split Mount
- Signal Processing Unit (SPU)

Standard Data Interfaces

- DS1
- DS3
- OC3
- 1000BaseT

Other External Connections

- Power
- IF (Intermediate Frequency)
- TLI (TDM Line Interface)
- Optical
- Network Management System
- Ethernet

Provisioning

- Data payload mapping
- Network Management System (NMS)
- Simple Network Management Protocol (SNMPc)

Troubleshooting and Repair

- Alarms
- CLI (Command Line Interface) versus Element Manager
- Firmware Download Process
- Configuration Backup and Restore
- Hands-on troubleshooting and correction

Protection and Diversity

- Hot Standby (1+1 versus 1+0 versus 1+n)
- SHARP (Self Healing Alternative Route Protection) - TDM
- Rapid Ring Protection – Ethernet
- Diversity: Space and Frequency

3.2.2 Network Management System Training

Overview

The Network Management System course provides theory and hand-on training about Microwave Networks' Network Management System (NMS). The course includes classroom lectures and practical exercises. During the course technicians will use the Element Manager to configure, monitor, and trouble shoot radios.

Learning Objectives

Upon completion of the course, technicians will understand the Network Management System and work with the Element Manager to configure, provision, and troubleshoot Proteus radios.

Target Audience

The Network Management System course is designed for technical staff responsible for configuring, monitoring, controlling, and troubleshooting Microwave Networks Proteus radios.

Prerequisites

Technical staff should have an understanding of basic microwave systems operations and telecommunications systems.

Technicians must bring a modern laptop PC with the following minimum specifications:

CPU	Intel 1 GHz
Memory	2 GB
Disk	5 GB
Operating Systems	Windows 7, 2008R2, Vista, 2003, XPsp2

Logistics

Class Size:	8
Course Duration:	1 day
Location:	Stafford, TX or customer location
Certification:	yes
Materials Provided:	Digital and hardcopy manuals, Element Manager, and course presentations (USB)

Course Topics

Network Management Overview

- Element Management System (EMS)
- Command Line Interface (CLI)
- Simple Network Management Protocol (SNMP)

Console Set Up and Displays

- PC Set Up And Configuration
- User Interface
- Graphical and Tabular Displays
- Network Mapping

Radio and Device Management

- Radio and Device Access and Settings
- TDM and Ethernet Services
- Proteus Configurations
- Backup

Network Performance Supervision

- Managing Tasks and Events
- Polling
- Baseline Variables

- Monitoring Radio and Device Status

Fault Detection & Management

- Threshold Alarms
- Alarm Alerts: E-Mail, Page, SMS

Reporting

- Event Logs
- Scheduling Network Reports

NMS User Administration

- Managing NMS Users
- Tablet and Smartphone Clients

Practical Exercises

- Configuring
- Troubleshooting

Microwave Networks Support Services

- NMS Support Services
- Network Operation Center (NOC) Service Levels

4 Warranty and Maintenance

Microwave Networks is providing the following Warranty and Maintenance Services for Arlington County:

- Two (2) year factory warranty
- Extended Warranty
- 24/7 Telephone technical support
- Product Return and Repair
- Preventive Maintenance

4.1 Two (2) Year Factory Warranty

Following is Microwave Network's standard warranty:

Products manufactured by Microwave Networks Incorporated ("MNI") are warranted to be free from defect in material and workmanship under normal use and service for a period of two (2) years from the date of shipment**.** In the event of a defect during the warranty period, Buyer will return the defective item to the MNI depot repair facility for repair or replacement. Repair at MNI's option may include the replacement of parts or equipment and all replaced parts or equipment shall be the property of MNI. Parts or equipment replaced during the warranty period are warranted for the remainder of the original applicable warranty period or ninety (90) days, whichever is greater. This expressed warranty is extended by MNI to the original Buyer for commercial, industrial or governmental use. Such action on the part of MNI shall be the full extent of MNI's liability and Buyer's exclusive remedy for breach of warranty. Expenses of Buyer such as travel expenses are not covered by this warranty.

This warranty extends only to products manufactured by MNI, and it is expressly conditioned upon the equipment having been installed in accordance with the installation practices accepted by the telecommunications industry, the standard installation and configuration practices recommended by MNI, and the equipment having been maintained in accordance with MNI recommended standard maintenance practices. Vendor products and other equipment not manufactured by MNI are excluded, but carry their own separate limited warranties.

This warranty shall automatically terminate if the product is used in other than its normal and customary use, has been subject to misuse, accident, neglect, or damage, is improperly disassembled, improper alterations or repairs, or if nonconforming parts are used in the product, unless done by a service facility authorized by MNI to perform warranty service. The warranty for Network Management Systems (NMS) shall automatically terminate if software is altered, added, or removed from the platform without the prior approval of MNI. NMS provided by MNI does not include virus protection software and this warranty does not cover damages caused by computer viruses.

Because each radio system is unique, MNI disclaims liability for range, coverage, or operation of a system as a whole under this warranty. This warranty shall not cover any

damages caused by Acts of God including, but not limited to, flood, lightning, seismic activity; and events of Force Majeure such as fire, explosion, war, civil disturbance et al.

THIS MNI WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EITHER EXPRMicrowave NetworksED OR IMPLIED, WHICH ARE SPECIFICALLY EXCLUDED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNMicrowave Networks FOR A PARTICULAR PURPOSE.

An authorization to return products under this warranty must be obtained from a MNI Customer Service Representative prior to making shipment to MNI's service location, and all returns shall be shipped freight pre-paid. MNI shall be responsible for return freight charges only on repaired and replaced products found to be defective.

In the event that MNI provides services only, MNI warrants the performance and specifications of such services but does not warrant that services performed will fulfill the total system requirement of the Buyer.

4.2 Extended Warranty

Pricing for extended product warranty is included for up to 5 years, but further years are available.

4.3 Microwave Networks Support and Repair Policies

24-Hour Technical Support by Phone:

Technical support is available 24 hours per day, seven days a week. Experienced Technical Support Engineers are available in the USA from 8:00am – 5:00pm (Central Time) Monday through Friday. At all other times, our Technical Support Engineers will return your call within 30 minutes whenever you have a traffic affecting emergency.

Technical Support is guaranteed for current products or products on Additions and Maintenance status. Engineers will provide remote technical support about:

- Microwave radio and signal operations
- Troubleshooting
- Installation
- Maintenance
- Equipment Upgrades
- Customized Weekly Reporting

Contact Information:

During Business Hours:		*After Business Hours:*	
U.S. and Canada		U.S. and Canada	
Toll Free:	1-888-225-4762 / 6429	Toll Free:	1-888-225-4762 / 6429
TEL:	281-263-6500	FAX:	281-263-6730

FAX: 281-263-6730

4.4 Product Return and Repair

Standard Repair:

MNI provides module repair service at no charge for items under warranty. Modules out of warranty are repaired on a fee basis. The standard repair turnaround for products currently being manufactured is typically 21working days from receipt of module.

Emergency Repair:

Emergency repair is available with a 24-hour turnaround on current manufactured products. Emergency repairs are invoiced at standard repair price plus $250.00/ $500.00 per unit.

Emergency Exchange:

Emergency exchange turnaround time is 24 hours for non-frequency sensitive products and 48 hours for frequency sensitive modules (subject to the availability). There is no charge for Warranty exchange. Note: To avoid billing for the full price of the unit, the failed item must be returned to MNI Repair within 30 days after shipment of the Emergency Exchange.

Please call, fax or email for a Return Material Authorization Number (RMA#) prior to shipment of any repair/return equipment. Modules should be returned in static protection material, and well packed for handling in shipment.

In Warranty Repairs:

Standard Repair:.....NO CHARGE

Emergency Exchange: .....NO CHARGE

Emergency Repair: .....NO CHARGE

5 Pricing

Motorola is pleased to provide the following equipment and services to Arlington County, VA to upgrade their current Microwave Radio System.

Total System List Price	$759,989.00
Total System Sale Price	**$650,000.00**

Year 3 Warranty for all quoted MNI Microwave Radio Products	$9,976.00
Year 4 Warranty for all quoted MNI Microwave Radio Products	$10,596.00
Year 5 Warranty for all quoted MNI Microwave Radio Products	$11,209.00