



UPSHUR COUNTY

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DEPUTY

P25 CONVENTIONAL RECEIVE VOTING SYSTEM

NOVEMBER 2, 2018

TRAN

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November 2, 2018

Sheriff Larry Webb
Upshur County
405 Titus St
Gilmer, TX 75644

Subject: Project 25 Conventional Receive Voting System

Dear Sheriff Webb,

Motorola Solutions, Inc. ("Motorola Solutions") is pleased to have the opportunity to provide Upshur County, TX with quality communications equipment and services. The Motorola Solutions project team has taken great care to propose a solution that will address your needs and provide exceptional value.

To best meet the functional and operational specifications of this solicitation, our solution includes a combination of hardware, software, and services. Specifically, this solution is for a VHF P25 Conventional Receive Voting System and provides:

- G-Series voting repeater equipment and antenna system at the Barnwell site.
- G-Series receiver and antenna system at the Big Sandy Etex site.
- G-Series receiver and antenna system at the Ore City Etex site.
- APX4500 control station at the Upshur County Sheriff's Office dispatch site.

This proposal is subject to the enclosed HGAC System Purchase Agreement and remains valid for a period of 90 days from the date of this cover letter. Upshur County may accept the proposal by returning to Motorola a signed copy of the aforementioned agreement. Alternatively, Motorola Solutions would be pleased to address any concerns you may have regarding the proposal. Any questions can be directed to your Motorola Account Executive, Casey Moore, our Sr. Account Manager, at [817-368-8683](tel:817-368-8683).

We thank you for the opportunity to furnish Upshur County with "best in class" solutions and we hope to strengthen our relationship by implementing this project. Our goal is to provide you with the best products and services available in the communications industry.

Sincerely,

Motorola Solutions, Inc.



Brad Rice
Area Sales Manager

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SECTION 1

SOLUTION OVERVIEW

1.1 INTRODUCTION

Motorola Solutions is proposing a solution for the Upshur County Sheriff's Office that consists of a VHF P25 voting conventional public safety radio system comprised of three sites.

A description of the features, benefits, system architecture, and hardware components are provided in this system description.

Motorola Solutions has taken great care to propose an offering that will provide Upshur County with a radio solution that meets their needs.

1.2 CONVENTIONAL VOTING SYSTEM

Receiver voting system topologies are used when a single transmitter provides sufficient outbound coverage, but a single receiver does not provide sufficient inbound coverage for subscriber transmissions. To provide balanced coverage, multiple satellite receivers are added to cover "dead spots" created by buildings, foliage, valleys, or hills.

Since the receivers operate on the same frequency, it is possible that a field radio may simultaneously hit multiple sites when transmitting. To ensure that the best audio from these satellite receivers is processed, a voting comparator compares and selects the best signal. This signal is then forwarded to the transmitter for rebroadcast to the subscriber units, as well as the console for dispatcher monitoring.

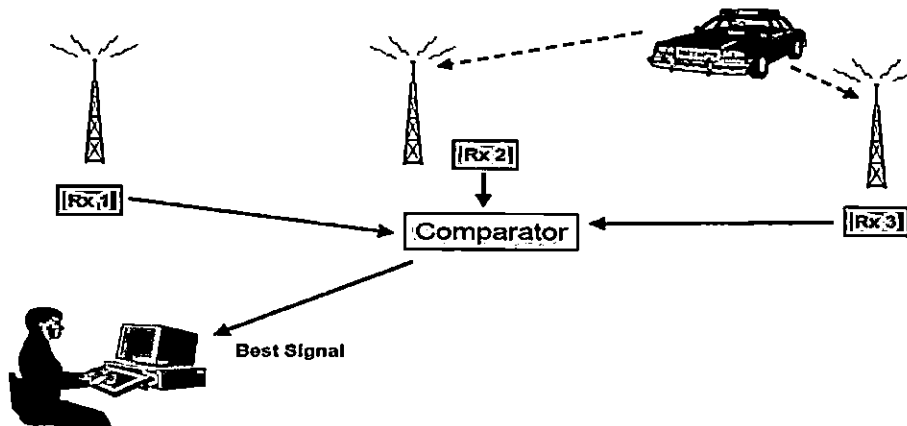


Figure 1-1: Typical Voting System

The conventional system proposed for Upshur County is a 3-site voting system.

SECTION 2

SYSTEM DESCRIPTION

2.1 CONVENTIONAL VOTING SYSTEM

The proposed design consists of a single channel VHF P25 conventional system containing G-Series equipment. The Barnwell site will be setup as a voting repeater site. It will house a GTR8000 repeater, GRV8000 conventional comparator along with networking equipment and antenna and lines. The Big Sandy and Ore City tower sites will be setup as receive only RF sites. It will house a GPW8000 receiver along with networking equipment and antenna and lines. Motorola Solutions has used the following parameters to model coverage for the proposed design.

Sites	Barnwell	Big Sandy Tower Site	Ore City Tower Site
Latitude	32°47'27.2" N	32°36'2.72" N	32°47'43" N
Longitude	94°52'3.4" W	95°6'39.05" W	94°44'30" W
Tower Height (ft)	465	180	250
Transmit/Receive Antenna Height (ft)	445	160	200
Azimuth (Degrees)	0	0	0
ERP (watts)	177.82	NA	NA
Antenna Model	BA80-41-DIN-T3	BA80-41-DIN	BA40-41-DIN
Antenna Gain (dBd)	6	6	3
Transmission Line Type	7/8" AVA	7/8" AVA	7/8" AVA

- Portable – APX4000, 5 W, 1/2 wave Flex Whip Antenna, Tx/Rx at Hip in Swivel case with RSM.
- Mobile – APX6500, 50 W, 1/4 wave Antenna, Center Roof-Mount.

2.2 SYSTEM ARCHITECTURE

2.2.1 System Components

The system designed for Upshur County consists of the following major components:

- GTR 8000 Base Station/Repeater.
- GPW 8000 Receiver.
- GRV8000 Comparator.
- GGM 8000 Site Gateway.

2.2.1.1 GTR 8000 Base Radio

The GTR 8000 base radio supports Motorola Solutions' single, multisite, and high performance data systems. The modular software design coupled with the Software Download Manager enhances the ability for future upgrades.

The GTR 8000 Base Radio consists of a transceiver module, power amplifier module, fan module, and power supply. The transceiver module includes the functionality for the exciter, receiver, and station control. The base radio software, configuration, and network management, as well as inbound/outbound traffic handling, are performed through this transceiver module. On-board serial and Ethernet ports are located on this module for local servicing via Configuration/Service Software (CSS).

The power amplifier module amplifies the low-level modulated RF signal from the transceiver module and delivers the amplified signal on the path to the transmit antenna. The power supply module supports the transceiver and power amplifier modules, and can also provide auxiliary power to a connected site controller or Receive Multicoupler/Low Noise Amplifier (RMC/LNA).

One GTR8000 base radio is needed per channel at each site. The stand alone base radio only occupies 3 rack units of space allowing for efficient use of expensive site space.

The proposed system includes a total of one VHF P25 conventional GTR 8000 Repeater at Barnwell Site.

2.2.1.2 GPW 8000 Receiver

The GPW 8000 Receiver supports Motorola Solutions' conventional voting and simulcast/voting system topologies. The receiver is used to increase in-bound signal coverage for infrastructure systems so that mobile or portable coverage can be improved without deploying a full-size transmit and receive site.

The conventional GPW 8000 Receiver is based on the same hardware platform as the Conventional GTR 8000 Base Radio. It only occupies 3 rack units of space allowing for efficient use of expensive site space.

The GPW 8000 Receiver supports the 700 MHz, 800 MHz, UHF, and VHF frequency bands and receive Compatible 4-level Frequency Modulation (C4FM) for traffic channel communications.

The GPW 8000 Receiver supports both an IP interface for ASTRO 25 7.x conventional systems, a V.24 interface for existing ASTRO 25 3.1 conventional systems, and an analog 4-wire interface for analog conventional systems.

The proposed system includes a total of one VHF P25 conventional GPW 8000 Receiver at Big Sandy and Ore City Site.

2.2.1.3 GRV 8000 Comparator

The GRV 8000 Comparator is used in Project 25 (P25) conventional or P25 Trunking voting and simulcast network topologies to increase the talk-in coverage of a radio in the field. The comparator works by picking up the audio from multiple sites and performing a frame-by-frame analysis to identify and combine the highest quality audio package for transmission. The GRV 8000 supports analog conventional and P25 digital conventional systems.

The proposed system includes a total of one VHF P25 conventional GPW 8000 Comparator at Barnwell Site.



2.2.1.4 GGM 8000 Site Gateway

The proposed G-Series gateway provide(s) the network interface to transport voice and management traffic for the RF site. This equipment also provides IP traffic prioritization for all packets departing the site if IP links are utilized.

Designed to provide Conventional System interface modularity and improve system availability, the Motorola Solutions GGM 8000 is a specialized network appliance that helps ensure system predictability and performance by converging mission critical data and voice applications into a single platform. GGM 8000s are versatile, secure capable network devices that can ensure timely delivery of delay-sensitive traffic. The GGM 8000 supports secure integrated voice and data applications as well as high-speed site-to-site connections—including compression and data prioritization—without compromising their ability to accomplish additional packet-handling functions as needed.

At the proposed receive-only site and comparator site, the GGM 8000 site gateway performs three functions: provide WAN connectivity to the site; prioritize packets which are leaving the site; and they fragment large IP packets according to industry standards.

The proposed system includes a total of three GGM 8000 site gateways, one for each at Barnwell Voting and RF and Big Sandy and Ore City receive only RF Sites.

2.3 SUMMARY

Motorola Solutions is providing a VHF P25 voting conventional system for Upshur County, TX. Motorola Solutions has designed this system to enhance voice communications for Upshur County, providing users with effective and reliable communication.

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SECTION 3

EQUIPMENT LIST

This section lists the equipment necessary for the proposed solution.

SUB SYS	BLOCK	QTY	NOMENCLATURE	DESCRIPTION
Barnwell	SWITCH	1	CLN1856	2620-24 ETHERNET SWITCH
Barnwell	SWITCH	1	CLN1856	2620-24 ETHERNET SWITCH
Barnwell	ROUTER	1	SQM01SUM0205	GGM 8000 GATEWAY
Barnwell	ROUTER	1	CA01616AA	ADD: AC POWER
Barnwell	GTR8000	1	T7039	GTR 8000 Base Radio
Barnwell	GTR8000	1	CA00717AA	ADD: ASTRO SYSTEM RELEASE 7.17
Barnwell	GTR8000	1	X530BG	ADD: VHF (136-174 MHZ)
Barnwell	GTR8000	1	CA01948AA	ADD: CONVENTIONAL SOFTWARE
Barnwell	GTR8000	1	CA01505AA	ADD: ASTRO 25 CONVENTIONAL VOTING SOFT
Barnwell	GTR8000	1	X182CC	ADD: DUPLEXER, 136-146 MHZ), THEN TX AND RX MUST BE 136-146
Barnwell	GTR8000	1	X153AW	ADD: RACK MOUNT HARDWARE
Barnwell	GRV8000	1	T8341	GRV 8000 COMPARATOR
Barnwell	GRV8000	1	CA03084AA	ADD: COMPARATOR
Barnwell	GRV8000	1	CA03320AA	ADD: ASTRO 25 CONVENTIONAL SOFTWARE
Barnwell	GRV8000	1	CA03316AA	ADD: DIGITAL CONV VOTING SOFTWARE
Barnwell	GRV8000	1	X153AW	ADD: RACK MOUNT HARDWARE
Barnwell	POWER	1	DSTSJADP	RACK MOUNT GROUND BAR, 19 IN FOR TSJ AND WPH SERIES DATA SPDS
Barnwell	POWER	1	DSRMP615A	SPD, TYPE 3, 120V RACK MOUNT, 15A PLUG-IN W/ (6) 15A NEMA 5-15 OUTLETS
Barnwell	UPS	1	DSGXTR1350N006	UPS, GXT RACKMOUNT 1500VA/1350W, 6 MIN RUNTIME, 120V
Barnwell	RACK	1	TRN7343	SEVEN AND A HALF FOOT RACK
Barnwell	ANTENNA	1	DSBA8041DIN	OMNI, EXPOSED DIPOLE ARRAY, 6 DBD, 136-174 MHZ, PIM RATED
Barnwell	UPPERJUMPR	15	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POLY JKT PER FOOT
Barnwell	UPPERJUMPR	2	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2 IN CABLE
Barnwell	JUMPER	2	TDN9289	221213 CABLE WRAP WEATHERPROOFING
Barnwell	MAINLINE	495	DSAVA550	AVA5-50, COAXIAL CABLE, CORRUGATED COPPER, 7/8 IN, BLACK PE JACKET
Barnwell	MAINLINE	2	DSA5DFD	D-CLASS 7-16 DIN FEMALE FOR AVA5-50 CABLE
Barnwell	MAINLINE	15	DSSG7812B2U	SG78-12B2U SUREGROUND GROUNDING KIT FOR 7/8 IN COAXIAL CABLE

SUB SYS	BLOCK	QTY	NOMENCLATURE	DESCRIPTION
Barnwell	MAINLINE	1	DSL5SGRIP	L5SGRIP 7/8" SUPPORT HOIST GRIP
Barnwell	ANTACC	7	MDN6817	42396A-5 7/8" CABLE HANGER STAINLESS, 10 PK
Barnwell	SURGE	1	DSVHF50DMAPGR	RF SPD, 100-512MHZ, DC BLOCK HIGH POWER DIN MALE ANT, DIN FEMALE EQUIP
Barnwell	LOWERJUMPR	25	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POLY JKT PER FOOT
Barnwell	LOWERJUMPR	1	DDN1088	L4TNM-PSA TYPE N MALE PS FOR 1/2 IN CABLE
Barnwell	LOWERJUMPR	1	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2 IN CABLE
Big Sandy	SWITCH	1	CLN1856	2620-24 ETHERNET SWITCH
Big Sandy	ROUTER	1	SQM01SUM0205	GGM 8000 GATEWAY
Big Sandy	ROUTER	1	CA01616AA	ADD: AC POWER
Big Sandy	GPW8000	1	T7540	GPW 8000 RECEIVER
Big Sandy	GPW8000	1	X301AR	ADD: QTY 1 GPW 8000 RECEIVER
Big Sandy	GPW8000	1	CA00717AA	ADD: ASTRO SYSTEM RELEASE 7.17
Big Sandy	GPW8000	1	X530BH	ADD: VHF (136-174 MHZ)
Big Sandy	GPW8000	1	CA01193AB	ADD: IP BASED MULTISITE (SIMULCAST/VOTING) RCVR SW
Big Sandy	GPW8000	1	X265AN	ADD: NARROW PRESECTOR, 136-154 MHZ
Big Sandy	GPW8000	1	X153AW	ADD: RACK MOUNT HARDWARE
Big Sandy	POWER	1	DSTSJADP	RACK MOUNT GROUND BAR, 19 IN FOR TSJ AND WPH SERIES DATA SPDS
Big Sandy	POWER	1	DSRMP615A	SPD, TYPE 3, 120V RACK MOUNT, 15A PLUG-IN W/ (6) 15A NEMA 5-15 OUTLETS
Big Sandy	UPS	1	DSGXTR1350N006	UPS, GXT RACKMOUNT 1500VA/1350W, 6 MIN RUNTIME, 120V
Big Sandy	ANTENNA	1	DSBA8041DIN	OMNI, EXPOSED DIPOLE ARRAY, 6 DBD, 136-174 MHZ, PIM RATED
Big Sandy	UPPERJUMPR	15	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POLY JKT PER FOOT
Big Sandy	UPPERJUMPR	2	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2 IN CABLE
Big Sandy	JUMPER	2	TDN9289	221213 CABLE WRAP WEATHERPROOFING
Big Sandy	MAINLINE	175	DSAVA550	AVA5-50, COAXIAL CABLE, CORRUGATED COPPER, 7/8 IN, BLACK PE JACKET
Big Sandy	MAINLINE	2	DSA5DFD	D-CLASS 7-16 DIN FEMALE FOR AVA5-50 CABLE
Big Sandy	MAINLINE	6	DSSG7812B2U	SG78-12B2U SUREGROUND GROUNDING KIT FOR 7/8 IN COAXIAL CABLE
Big Sandy	MAINLINE	1	DSL5SGRIP	L5SGRIP 7/8" SUPPORT HOIST GRIP
Big Sandy	ANTACC	7	MDN6817	42396A-5 7/8" CABLE HANGER STAINLESS, 10 PK
Big Sandy	SURGE	1	DSVHF50DMAPGR	RF SPD, 100-512MHZ, DC BLOCK HIGH POWER DIN MALE ANT, DIN FEMALE EQUIP
Big Sandy	LOWERJUMPR	25	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POLY JKT PER FOOT



SUB SYS	BLOCK	QTY	NOMENCLATURE	DESCRIPTION
Big Sandy	LOWERJUMPR	1	DDN1088	L4TNM-PSA TYPE N MALE PS FOR 1/2 IN CABLE
Sheriff Office Dispatch	APX4500	1	DDN9682	F4PNMV2-HC 1/2" TYPE N MALE PLATED CONNECTOR
Sheriff Office Dispatch	APX4500	100	L3570	FSJ4RK-50B CABLE: 1/2" SUPERFLEX FOAM COAX BLK FIRE RETARDANT JCKT,
Sheriff Office Dispatch	APX4500	1	DDN9682	F4PNMV2-HC 1/2" TYPE N MALE PLATED CONNECTOR
Sheriff Office Dispatch	APX4500	1	DSVHF50DMPGR	RF SPD, 100-512MHZ, DC BLOCK HIGH POWER DIN MALE ANT, DIN FEMALE EQUIP
Sheriff Office Dispatch	APX4500	1	DDN1089	L4TNF-PSA TYPE N FEMALE PS FOR 1/2 IN CABLE
Sheriff Office Dispatch	APX4500	100	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POLY JKT PER FOOT
Sheriff Office Dispatch	APX4500	1	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2 IN CABLE
Sheriff Office Dispatch	APX4500	1	DSCOL53140	OMNI, MEANDER COLLINEAR, 4 DBD, 130-140 MHZ, PIM RATED
Sheriff Office Dispatch	APX4500	3	DSSG1212B2U	SG12-12B2U, SUREGROUND 1/2", 48"
Sheriff Office Dispatch	APX4500	1	HKN6184C	CABLE CH, PROGRAMMING,USB
Sheriff Office Dispatch	APX4500	1	HKN6243A	APX CONSOLETTA WALL MOUNT BRACKET KIT
Sheriff Office Dispatch	APX4500	1	M22KSS9PW1 N	APX4500 VHF
Sheriff Office Dispatch	APX4500	1	Q811	ADD: SOFTWARE P25 CONVENTIONAL
Sheriff Office Dispatch	APX4500	1	QA01648	ADD: ADVANCED SYSTEM KEY - HARDWARE KEY
Sheriff Office Dispatch	APX4500	1	GA00804	ADD: APX O2 CONTROL HEAD (Green)

SUB SYS	BLOCK	QTY	NOMENCLATURE	DESCRIPTION
Sheriff Office Dispatch	APX4500	1	G444	ADD: APX CONTROL HEAD SOFTWARE
Sheriff Office Dispatch	APX4500	1	G66	ADD: DASH MOUNT O2 WWM
Sheriff Office Dispatch	APX4500	1	G89	ADD: NO RF ANTENNA NEEDED
Sheriff Office Dispatch	APX4500	1	W382	ADD: CONTROL STATION DESK GCAI MIC
Sheriff Office Dispatch	APX4500	1	B18	ADD: AUXILARY SPKR 7.5 WATT
Sheriff Office Dispatch	APX4500	1	GA00318	ADD: 5Y ESSENTIAL SERVICE
Sheriff Office Dispatch	APX4500	1	G91	ADD: CONTROL STATION POWER SUPPLY
Sheriff Office Dispatch	APX4500	1	W665	ADD: CONTROL STATION OPERATION
Ore City	SWITCH	1	CLN1856	2620-24 ETHERNET SWITCH
Ore City	ROUTER	1	SQM01SUM0205	GGM 8000 GATEWAY
Ore City	ROUTER	1	CA01616AA	ADD: AC POWER
Ore City	GPW8000	1	T7540	GPW 8000 RECEIVER
Ore City	GPW8000	1	X301AR	ADD: QTY 1 GPW 8000 RECEIVER
Ore City	GPW8000	1	CA00717AA	ADD: ASTRO SYSTEM RELEASE 7.17
Ore City	GPW8000	1	X530BH	ADD: VHF (136-174 MHZ)
Ore City	GPW8000	1	CA01193AB	ADD: IP BASED MULTISITE (SIMULCAST/VOTING) RCVR SW
Ore City	GPW8000	1	X265AN	ADD: NARROW PRESELCTOR, 136-154 MHZ
Ore City	GPW8000	1	X153AW	ADD: RACK MOUNT HARDWARE
Ore City	POWER	1	DSTSJADP	RACK MOUNT GROUND BAR, 19 IN FOR TSJ AND WPH SERIES DATA SPDS
Ore City	POWER	1	DSRMP615A	SPD, TYPE 3, 120V RACK MOUNT, 15A PLUG-IN W/ (6) 15A NEMA 5-15 OUTLETS
Ore City	UPS	1	DSGXTR1350N006	UPS, GXT RACKMOUNT 1500VA/1350W, 6 MIN RUNTIME, 120V
Ore City	ANTENNA	1	DSBA4041DIN	OMNI, EXPOSED DIPOLE ARRAY, 3 DBD, 136-174 MHZ, PIM RATED
Ore City	UPPERJUMPR	15	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POLY JKT PER FOOT



SUB SYS	BLOCK	QTY	NOMENCLATURE	DESCRIPTION
Ore City	UPPERJUMPR	2	DDN1090	L4TDM-PSA 7-16 DIN MALE PS FOR 1/2 IN CABLE
Ore City	JUMPER	2	TDN9289	221213 CABLE WRAP WEATHERPROOFING
Ore City	MAINLINE	17 5	DSAVA550	AVA5-50, COAXIAL CABLE, CORRUGATED COPPER, 7/8 IN, BLACK PE JACKET
Ore City	MAINLINE	2	DSA5DFD	D-CLASS 7-16 DIN FEMALE FOR AVA5-50 CABLE
Ore City	MAINLINE	6	DSSG7812B2U	SG78-12B2U SUREGROUND GROUNDING KIT FOR 7/8 IN COAXIAL CABLE
Ore City	MAINLINE	1	DSL5SGRIP	L5SGRIP 7/8" SUPPORT HOIST GRIP
Ore City	ANTACC	7	MDN6817	42396A-5 7/8" CABLE HANGER STAINLESS, 10 PK
Ore City	SURGE	1	DSVHF50DMPGR	RF SPD, 100-512MHZ, DC BLOCK HIGH POWER DIN MALE ANT, DIN FEMALE EQUIP
Ore City	LOWERJUMPR	25	L1705	LDF4-50A CABLE: 1/2" LDF HELIAX POLY JKT PER FOOT
Ore City	LOWERJUMPR	1	DDN1088	L4TNM-PSA TYPE N MALE PS FOR 1/2 IN CABLE
SPARES	SPARES	1	CLN1856	2620-24 ETHERNET SWITCH
SPARES	SPARES	1	SQM01SUM0205	GGM 8000 GATEWAY
SPARES	SPARES	1	CA01616AA	ADD: AC POWER
SPARES	SPARES	1	DLN6781	FRU: POWER SUPPLY
SPARES	SPARES	1	DLN6898	FRU: FAN MODULE
SPARES	SPARES	1	DLN6892	FRU: XCVR VHF V2
SPARES	SPARES	1	DLN6455	CONFIGURATION/SERVICE SOFTWARE

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SECTION 4

POWER AND HVAC (BTU) REQUIREMENTS

Please refer to the following table for Power and BTU requirements for the proposed design.

Sites	Barnwell	Big Sandy Tower Site	Ore City Tower Site	Upshur County Sheriff Office (County to provide UPS if necessary)
AC Circuits on UPS	4	3	3	1
AC Amps on UPS	10.18	5.76	5.76	2
KBTUs	4.2	2.36	2.36	0.75

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SECTION 5

STATEMENT OF WORK

Motorola Solutions is proposing to Upshur County, TX the installation and configuration of the following equipment at the specified locations.

Site Name	Major Equipment
Upshur County Sheriff Office/Dispatch Site	APX4500 Control Station x Qty 1 Antenna and lines x Qty 1 FRU Spares for Router, LAN Switch, GTR Repeater, GRV Comparator, and GPW Receiver
Barnwell Site – Repeater/Voter site	GGM8000 Router x Qty 1 HP LAN Switch x Qty 1 GTR8000 Repeater x Qty 1 GRV8000 Comparator x Qty 1 Antenna and lines x Qty 1 Rack Mount UPS x Qty 1
Big Sandy Site – Receive Only site	GGM8000 Router x Qty 1 HP LAN Switch x Qty 1 GPW8000 Receiver x Qty 1 Antenna and lines x Qty 1 Rack Mount UPS x Qty 1
Ore City Site – Receive Only site	GGM8000 Router x Qty 1 HP LAN Switch x Qty 1 GPW8000 Receiver x Qty 1 Antenna and lines x Qty 1 Rack Mount UPS x Qty 1

Motorola Solutions understands that the County’s Telex ADHB-4 console system supports a total of six audio channels and that there are six audio channels (control stations) currently configured on the console system today. This proposal is based on the audio channel (control station) labeled Ore City PD and associated CDM control station being removed and replaced with the proposed APX 4500 control station for P25 conventional operation.

The document delineates the general responsibilities between Motorola Solutions and Upshur County as agreed to by contract.

5.1 MOTOROLA SOLUTIONS RESPONSIBILITIES

Motorola Solutions’ general responsibilities include the following:

- Perform the installation of the Motorola Solutions supplied equipment described above.
- Schedule the implementation in agreement with Upshur County.
- Coordinate the activities of all Motorola Solutions subcontractors.
- Administer safe work procedures for installation.
- Program 109 radios consisting of 50 mobile radios and 59 portable radios.

- Develop 12 templates (between Portables and Mobiles) – Basic APX Template Includes: 2 Systems, 4 Personalities, and 4 Zones.
- Assist the County with filling out 601 forms for frequency licensing.
- Perform tower site mapping and loading analysis.
- Perform County witnessed system acceptance test.
- Provide final system documentation.

5.2 UPSHUR COUNTY RESPONSIBILITIES

Upshur County will assume responsibility for the installation and performance of all other equipment and work necessary for completion of this project that is not provided by Motorola Solutions. General responsibilities for Upshur County include the following:

- Provide all buildings, equipment shelters, and towers required for system installation.
- Insure communications sites meet space, grounding, power, and connectivity requirements for the installation of all equipment.
- Obtain frequencies for project as required if included spectrum identification services do not yield usable frequencies.
- Customer will provide a dedicated delivery point, such as a warehouse, for receipt, inventory and storage of equipment prior to delivery to the site(s).
- Obtain all licensing, site access, or permitting required for project implementation.
- Coordinate the activities of all Upshur County's vendors or other contractors.
- County will secure rack space, power, and tower mounting space for each site location.
- County will provide electrical services to install quad box and necessary circuits at Barnwell and Big Sandy sites to power the UPS and proposed equipment.
- Ensure one port is available on the County's Telex console system for the proposed APX4500 control station.
- Ensure all portable and mobile radios to be programmed are enabled for Project 25 conventional operation.
- County will provide 2Mbps Ethernet connectivity between the Barnwell site and Big Sandy site that meets the minimum specifications required for acceptable system performance.
- County to provide Ethernet demark within 10ft of the proposed fan-out switch at the Barnwell site.
- Provide licensed VHF frequencies for the proposed VHF voting system. Frequencies must support spacing required by the proposed duplexer.
- Pay for the FCC coordination fees and sign the paperwork for the FCC license application.
- Provide a Crane, Gin Pole or any required equipment to install the antennas on the tower if required.

Motorola Solutions has made several assumptions in preparing this proposal, which are noted below. In order to provide a firm quote, Motorola Solutions will need to verify all assumptions or seek alternate solutions in the case of invalid assumptions.

- All existing sites or equipment locations will have adequate electrical power in the proper phase and voltage and site grounding to support the requirements of the system described.
- Motorola Solutions will use existing rack space for the proposed equipment at the Big Sandy site.
- All existing towers will have adequate space and size to support the antenna network requirements of the system described.



- Any required system interconnections not specifically outlined here will be provided by Upshur County. These may include dedicated phone circuits, microwave links or other types of connectivity.
- There is no staging or training included in this design.
- Motorola Solutions assumes that existing towers have sufficient space available for the proposed RF antenna and lines.
- Any structural and site improvements will be responsibility of the County.
- Motorola Solutions assumed that no prevailing wages are required for this project.
- Motorola Solutions assumes that the estimated ERPs are available at proposed sites.
- Motorola Solutions assumes that there are no critical in-building requirements for this design.
- Motorola Solutions will use proposed UPS units' output receptacles to power the equipment.
- All civil work activities will fit within the existing compounds and will not require compound expansions.
- The sites have adequate utility service to support the proposed equipment loading. Utility transformer upgrades or step-up or down transformers will not be required.
- No new logging recorder has been included in this proposal.
- No coverage guarantee or testing is included in this proposal.
- There is no spectrum fingerprinting or noise floor measurement services included in the proposal.
- No R56 upgrades are included in this proposal.
- Any work that is required to complete this project not described in this statement of work will be considered above the scope of this proposal and subject to re-quotation.
- Motorola Solutions is not responsible for interference caused or received by the Motorola Solutions provided equipment except for interference that is directly caused by the Motorola Solutions provided transmitter(s) to the Motorola Solutions provided receiver(s). Should the Customer's system experience interference, Motorola Solutions can be contracted to investigate the source and recommend solutions to mitigate the issue.
- Motorola Solutions assumed that each site has sufficient space and power required for the equipment needed for spectrum fingerprinting and the digital noise floor measurements. If Motorola Solutions cannot use the shelter at each site to house and power the test equipment, then Motorola Solutions would need to transport a self contained test equipment trailer and the price for transporting the trailer will be billed to the County.

SECTION 6

SITE DEVELOPMENT STATEMENT OF WORK

6.1 BARNWELL

- Existing 465' Guyed Tower and Shelter.

6.1.1 Site Scope Summary

- Engineering services for site drawings and regulatory approvals.
- Existing tower and shelter to be used for antennas and equipment.
- Assumes existing generator has sufficient capacity for proposed equipment.
- Site Acquisition Services including application, coordination, and negotiation are by others.

6.1.2 Motorola Solutions Responsibilities:

6.1.2.1 Site Engineering

- Prepare site construction drawings, showing the layout of various new and existing site components.
- Conduct site walks to collect pertinent information from the sites (e.g., location of Telco, power, existing facilities, etc.).
- Provide limited NEPA review of customer provided documentation.
- Perform 4-point soil resistivity test.
- Conduct tower mapping for structural analysis (limited to tower steel above grade).
- Provide a structural engineering analysis for antenna support structure, if necessary, to support the proposed antenna system. If the tower structure fails the analysis, the cost of any site relocation or modifications to the tower required to support the antenna system will be the responsibility of Customer. (Note: It is assumed that the tower owner will have the tower, foundation, and Geotech information to analyse the tower).
- Preparation, submission and tracking of application for local permit fees (zoning, electrical, building etc.) and procurement of information necessary for filing.
- City permitting fees up to \$500.

6.1.2.2 Site Preparation

- Provide one-time mobilization costs for the construction crews. Any remobilization due to interruptions/delays that are out of Motorola Solutions' control will result in additional costs.

6.1.2.3 Antenna and Transmission Line Installation

- Install antenna(s) for the RF system. Assume antennas can be installed 20' below the top of tower to allow for head room.

- Supply and install mount(s) for antennas.
- Supply and install 6-foot side arm(s) for antenna mount(s).
- Perform sweep tests on transmission line(s).
- Provide and install attachment hardware for supporting transmission lines on the antenna support structure every three feet.

6.2 BIG SANDY

- Existing 180' Self-Support Tower and Shelter.

6.2.1 Site Scope Summary

- Engineering services for site drawings and regulatory approvals.
- Existing tower and shelter to be used for antennas and equipment.
- Assumes existing generator has sufficient capacity for proposed equipment.
- Site Acquisition Services including application, coordination, and negotiation are by others.

6.2.2 Motorola Solutions Responsibilities:

6.2.2.1 Site Engineering

- Prepare site construction drawings, showing the layout of various new and existing site components.
- Conduct site walks to collect pertinent information from the sites (e.g., location of Telco, power, existing facilities, etc.).
- Provide limited NEPA review of customer provided documentation.
- Perform 4-point soil resistivity test.
- Conduct tower mapping for structural analysis (limited to tower steel above grade).
- Provide a structural engineering analysis for antenna support structure, if necessary, to support the proposed antenna system. If the tower structure fails the analysis, the cost of any site relocation or modifications to the tower required to support the antenna system will be the responsibility of Customer. (Note: It is assumed that the tower owner will have the tower, foundation, and Geotech information to analyse the tower).
- Preparation, submission and tracking of application for local permit fees (zoning, electrical, building etc.) and procurement of information necessary for filing.
- City permitting fees up to \$500.

6.2.2.2 Site Preparation

- Provide one-time mobilization costs for the construction crews. Any remobilization due to interruptions/delays that are out of Motorola Solutions' control will result in additional costs.

6.2.2.3 Antenna and Transmission Line Installation

- Install antenna(s) for the RF system. Assume antennas can be installed 20' below the top of tower to allow for head room.
- Supply and install mount(s) for antennas.
- Supply and install 6-foot side arm(s) for antenna mount(s).



- Perform sweep tests on transmission line(s).
- Provide and install attachment hardware for supporting transmission lines on the antenna support structure every three feet.

6.3 ORE CITY

- Existing 250' Self-Support Tower and Shelter.

6.3.1 Site Scope Summary

- Engineering services for site drawings and regulatory approvals.
- Existing tower and shelter to be used for antennas and equipment.
- Assumes existing generator has sufficient capacity for proposed equipment.
- Site Acquisition Services including application, coordination, and negotiation are by others.

6.3.2 Motorola Solutions Responsibilities:

6.3.2.1 Site Engineering

- Prepare site construction drawings, showing the layout of various new and existing site components.
- Conduct site walks to collect pertinent information from the sites (e.g., location of Telco, power, existing facilities, etc.).
- Provide limited NEPA review of customer provided documentation.
- Perform 4-point soil resistivity test.
- Conduct tower mapping for structural analysis (limited to tower steel above grade).
- Provide a structural engineering analysis for antenna support structure, if necessary, to support the proposed antenna system. If the tower structure fails the analysis, the cost of any site relocation or modifications to the tower required to support the antenna system will be the responsibility of Customer. (Note: It is assumed that the tower owner will have the tower, foundation, and Geotech information to analyse the tower).
- Preparation, submission and tracking of application for local permit fees (zoning, electrical, building etc.) and procurement of information necessary for filing.
- City permitting fees up to \$500.

6.3.2.2 Site Preparation

- Provide one-time mobilization costs for the construction crews. Any remobilization due to interruptions/delays that are out of Motorola Solutions' control will result in additional costs.

6.3.2.3 Antenna and Transmission Line Installation

- Install antenna(s) for the RF system. Assume antennas can be installed 20' below the top of tower to allow for head room.
- Supply and install mount(s) for antennas.
- Supply and install 6-foot side arm(s) for antenna mount(s).
- Perform sweep tests on transmission line(s).

- Provide and install attachment hardware for supporting transmission lines on the antenna support structure every three feet.

6.4 CUSTOMER RESPONSIBILITIES

- If required, prepare and submit Electromagnetic Energy (EME) plans for the site (as a licensee) to demonstrate compliance with FCC RF Exposure guidelines.
- As applicable, coordinate, prepare, submit, and pay for all required permits and inspections for the work that is the Customer's responsibility.
- Pay for all utility connection, pole or line extensions, and any easement or usage fees.
- Review and approve site design drawings within 7 calendar days of submission by Motorola Solutions or its subcontractor(s). Should a re-submission be required, the Customer shall review and approve the re-submitted plans within 7 calendar days from the date of submittal.
- Pay for the usage costs of power, leased lines and generator fuelling both during the construction/installation effort and on an on-going basis.
- Pay for application fees, taxes and recurring payments for lease/ownership of the property.
- Provide personnel to observe construction progress and testing of site equipment according to the schedule provided by Motorola Solutions.
- As applicable (based on local jurisdictional authority), the Customer will be responsible for any installation or up-grades of the electrical system in order to comply with NFPA 70, Article 708
- Secure proper leasing, approvals and pay any associated costs for new construction and/or modifications to existing equipment with site owners where applicable.
- Secure proper leasing, approvals and pay any associated costs for new construction and/or modifications to existing equipment with site owners where applicable.

6.5 ASSUMPTIONS

- Existing cable ladder is sufficient for new coax lines.
- Existing waveguide bridge is sufficient for new coax lines.
- All work is assumed to be done during normal business hours as dictated by time zone (Monday thru Friday, 7:30 a.m. to 5:00 p.m.).
- All utility installations shall be coordinated and paid for by the site owner and located at jointly agreed to location within or around the new communications shelter or equipment room.
- Pricing has been based on National codes such IBC or BOCA. Local codes or jurisdictional requirements have not been considered in this proposal.
- Hazardous materials are not present at the work location. Testing and removal of hazardous materials, found during site investigations, construction or equipment installation will be the responsibility of the customer.
- A maximum of 30 days will be required for obtaining approved building permits from time of submission, and a maximum of 60 days will be required for zoning approvals from time of submittal.
- If extremely harsh or difficult weather conditions delay the site work for more than a week, Motorola Solutions will seek excusable delays rather than risk job site safety.
- The existing ground system and soil resistivity at the site is sufficient to achieve resistance of 10 ohms or less. Communication site grounding will be designed and installed per Motorola's R56 standards.
- AM detuning or electromagnetic emission studies will not be required.



- Structural and foundation drawings of the antenna support structure will be made available to preclude the need for ultrasonic testing, geotechnical borings or mapping of existing tower structural members.
- Lead paint testing of existing painted towers has not been included.
- On the existing tower, the antenna locations for the proposed antenna system design will be available at the time of installation.
- The site has adequate utility service to support the proposed equipment loading. Utility transformer upgrades or step-up or down transformers will not be required.
- Underground utilities are not present in the construction area and as such no relocation will be required.
- The existing antenna support structure is structurally capable of supporting the new antenna, cables, and ancillary equipment proposed and will not need to be removed or rebuilt at the existing site. The tower or supporting structure meets all applicable EIA/TIA-222 structural, foundation, ice, wind, and twist and sway requirements. Motorola Solutions has not included any cost for structural or foundation upgrades to the antenna support structure.
- The existing cable support facilities from the antenna to the cable entry port can be used for supporting the new antenna cables.
- Structural analyses for towers or other structures that have not been performed by Motorola Solutions will relinquish Motorola Solutions from any responsibility for the analysis report contents and/or recommendation therein.
- All civil work activities will fit within the existing compounds and will not require compound expansions.

6.6 COMPLETION CRITERIA

- Site development completed per issued for construction (IFC) construction drawings, project requirements, contractual obligations (including any customer/Motorola Solutions approved changes), and approved by Upshur County, TX.
- This shall be confirmed by contractor and reviewed with Motorola Solutions construction manager and project manager before inspections occur.
- All jurisdictional and contractual required testing and inspections to be performed by the contractor. (Contractual testing and inspections defined and agreed to with project team and customer prior to project kick off; vendor solely responsible for conducting, coordinating and paying for all jurisdictional testing and inspections).
- Motorola Solutions site development checklist shall be completed and signed off by contractor prior to customer inspection. (Review with project team and customer and amend checklist as required at project kick off or before work begins).
- Site turn-over package completed and turned over to Motorola Solutions (As defined and agreed to with project team and customer).
- All punch list and deficiencies shall be completed prior to customer and Motorola Solutions inspections.

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SECTION 7

ACCEPTANCE TEST PLAN

System Acceptance of the proposed solution will occur upon successful completion of a Functional Acceptance Test Plan (FATP), which will test the features, functions, and failure modes for the installed equipment in order to verify that the solution operates according to its design. This plan will validate that Upshur County's solution will operate according to its design, and increase the efficiency and accuracy of the final installation activities. A detailed FATP will be developed and finalized during the Design Review.



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SECTION 8

PRICING

Motorola Solutions is pleased to provide the following equipment and services to Upshur County:

Item	Pricing
P25 Equipment	\$108,207
Implementation Services	\$229,288
Total	\$337,495

Pricing is based on HGAC contract RA05-18.

SECTION 9

APPENDICES

The following appendices provide additional detailed information regarding our proposed solution.

9.1 COVERAGE MAPS

Please see the coverage maps, included below.

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Tx Upshur County
 P25 3-Site Conventional Voting System
 Shaded Area Represents 95% Covered Area Reliability at DAQ 3.4
 Barnwell - Tx/Rx; Big Sandy Tower - Rx Only, New Ore City - Rx Only

This map is a coverage estimate based upon the information provided and should be used for informational purposes only




© OpenStreetMap contributors.

Portable Config: APX4000, 5 W, 1/2 wave Flex Whip Antenna
 Tx/Rx at Hip in Swivel case with RSM

Scale 1 : 343918

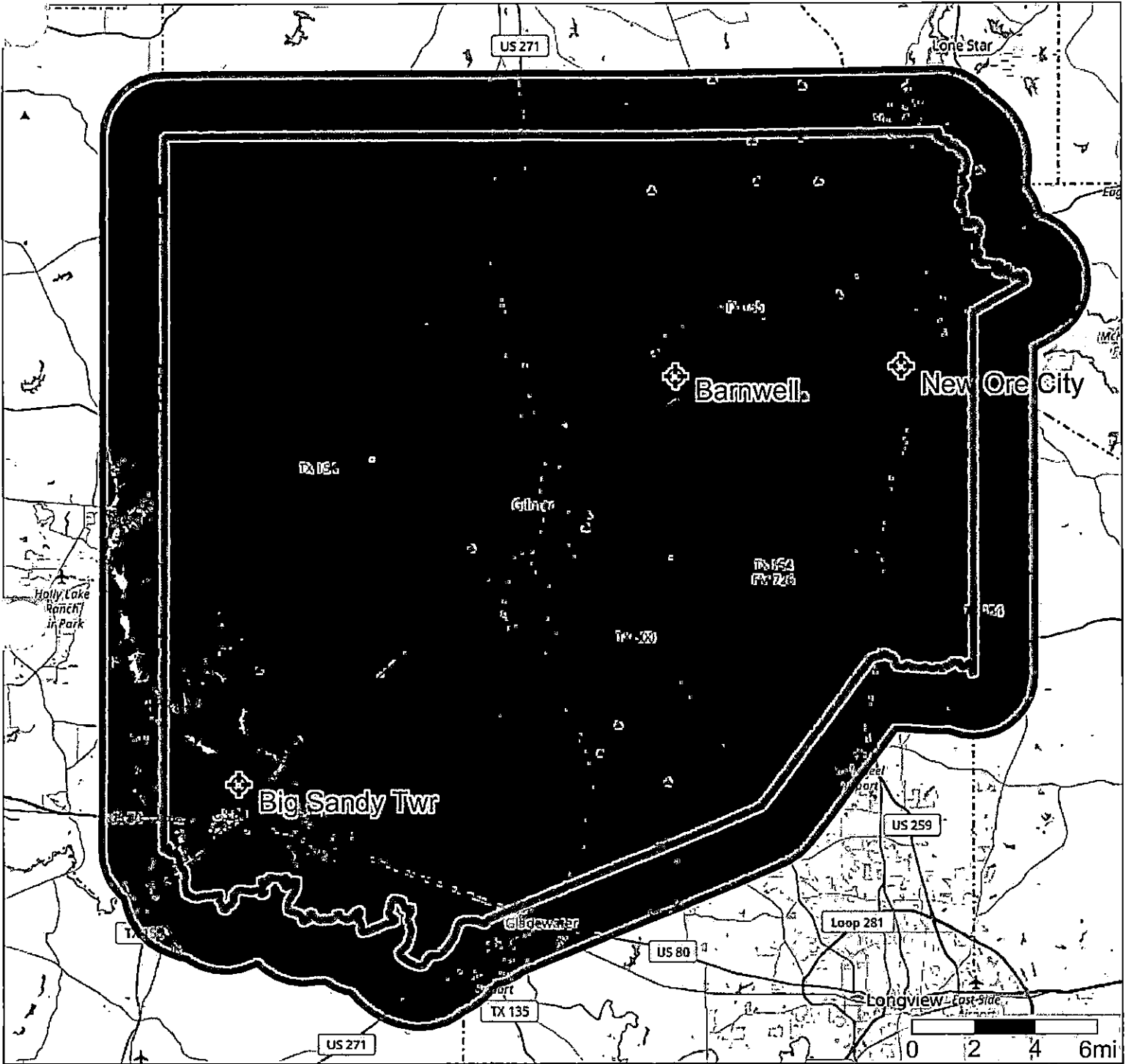
Legend

 95% Area inbound APX4000



TX_Upshur County
 P25 3-Site Conventional Voting System
 Shaded Area Represents 95% Covered Area Reliability at DAQ 3.4
 Barnwell - Tx/Rx; Big Sandy Tower - Rx Only, New Ore City - Rx Only

This map is a coverage estimate based upon the information provided and should be used for informational purposes only




© OpenStreetMap contributors.

Portable Config: APX4000, 5 W, 1/2 wave Flex Whip Antenna
 Tx/Rx at Hip in Swivel case with RSM

Scale 1 : 343918

Legend

 95% Area outbound APX4000



Tx_Upshur County
 P25 3-Site Conventional Voting System
 Shaded Area Represents 95% Covered Area Reliability at DAQ 3.4
 Barnwell - Tx/Rx; Big Sandy Tower - Rx Only, New Ore City - Rx Only

This map is a coverage estimate based upon the information provided and should be used for informational purposes only





© OpenStreetMap contributors.

Portable Config: APX4000, 5 W, 1/2 wave Flex Whip Antenna
 Tx/Rx at Hip in Swivel case with RSM

Scale 1 : 337619

Legend

-  95% Area round_trip APX4000 - 3 site (Old Ore City)
-  95% Area round_trip APX4000 - 3 site (New Ore City)



Tx Upshur County
 P25 3-Site Conventional Voting System
 Shaded Area Represents 95% Covered Area Reliability at DAQ 3.4
 Barnwell - Tx/Rx; Big Sandy Tower - Rx Only, New Ore City - Rx Only

This map is a coverage estimate based upon the information provided and should be used for informational purposes only



© OpenStreetMap contributors.

Portable Config: APX4000, 5 W, 1/2 wave Flex Whip Antenna
 Tx/Rx at Hip in Swivel case with RSM

Scale 1 : 337619

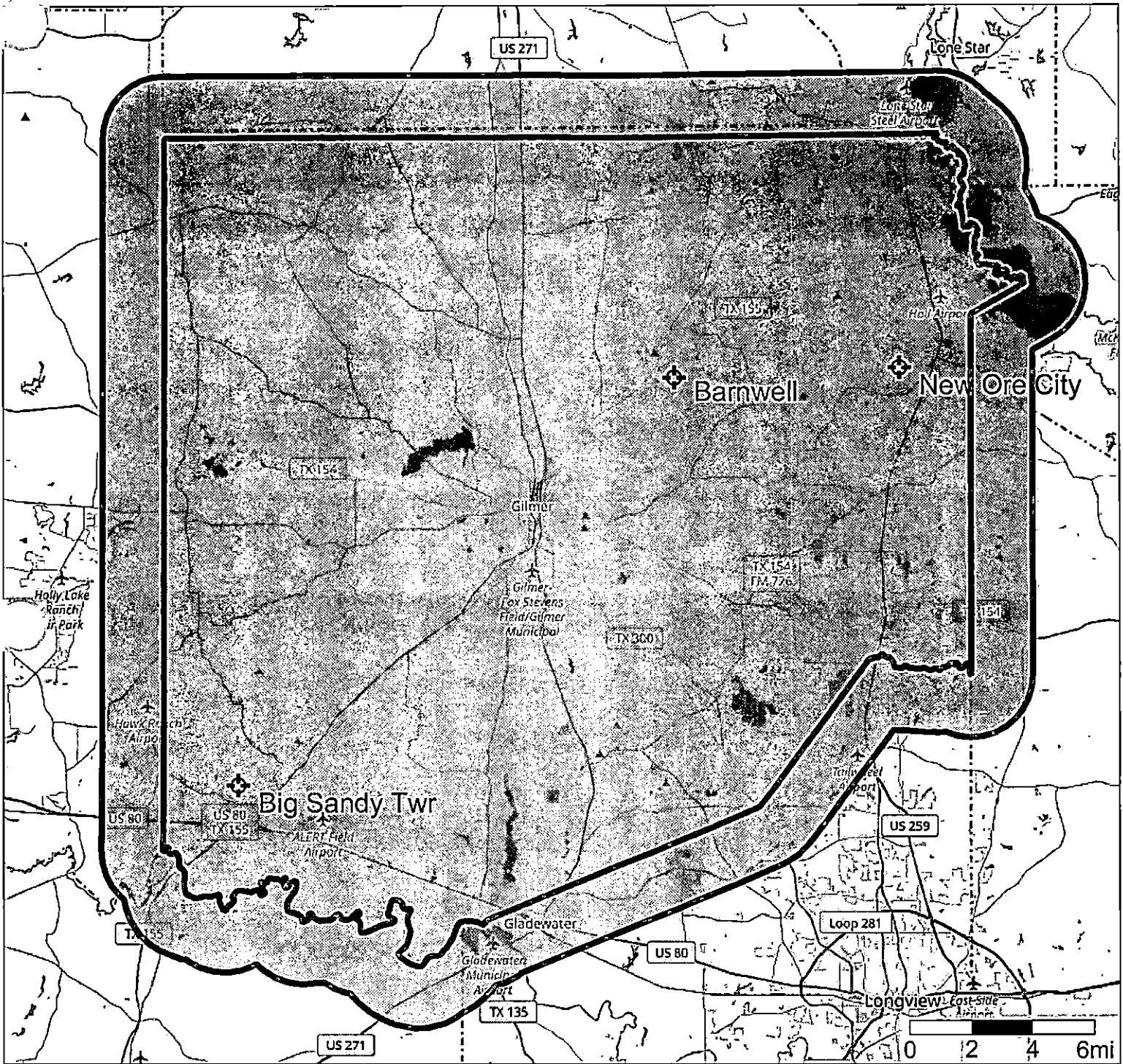
Legend

■ 95% Area round_trip APX4000



Tx_Upshur County
 P25 3-Site Conventional Voting System
 Shaded Area Represents 95% Covered Area Reliability at DAQ 3.4
 Barnwell - Tx/Rx; Big Sandy Tower - Rx Only, New Ore City - Rx Only

This map is a coverage estimate based upon the information provided and should be used for informational purposes only



© OpenStreetMap contributors.

Mobile Config: APX6500, 50 W,
 1/4 wave Antenna, Center Roof-Mount

Scale 1 : 343918

Legend

 95% Area round_trip APX6500



9.2 BLOCK DRAWINGS

Please see detailed block drawings for each site, included below.



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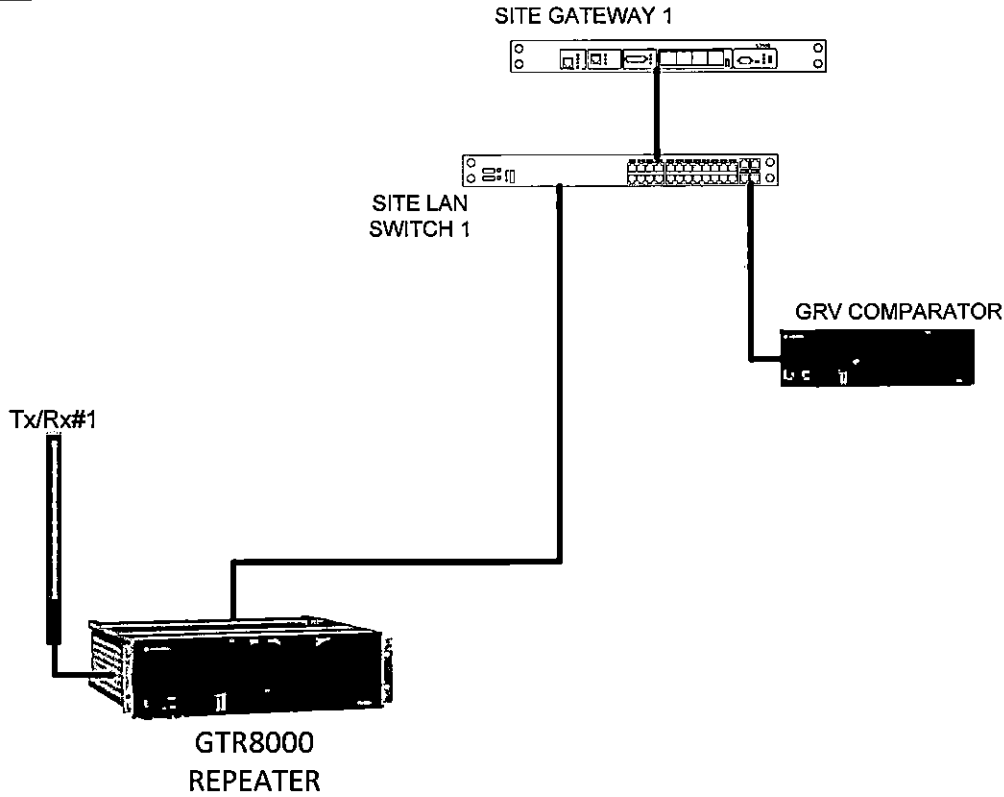
Barnwell

Over the Air to
Upshur County
Sheriff Office Dispatch

LEGEND

— 10/100 BaseT

— Other



PROJECT: UPSHUR COUNTY, TX

TITLE: BARNWELL - VOTING & RF SITE
BLOCK DIAGRAM

DESIGNED BY: VISHAL SHAH DATE: 10/08/2018

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ORIGINAL DOCUMENT SIZE IS 8.5X11, CORRECT SCALE
IS NOT GUARANTEED IF REDUCED OR ENLARGED

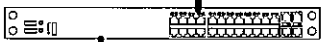
Big Sandy

County Provided Ethernet Link
to Barnwell

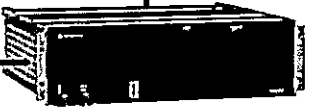
SITE GATEWAY 1



SITE LAN
SWITCH 1



Tx/Rx#1




GPW8000
Receiver

LEGEND

— 10/100 BaseT

— Other

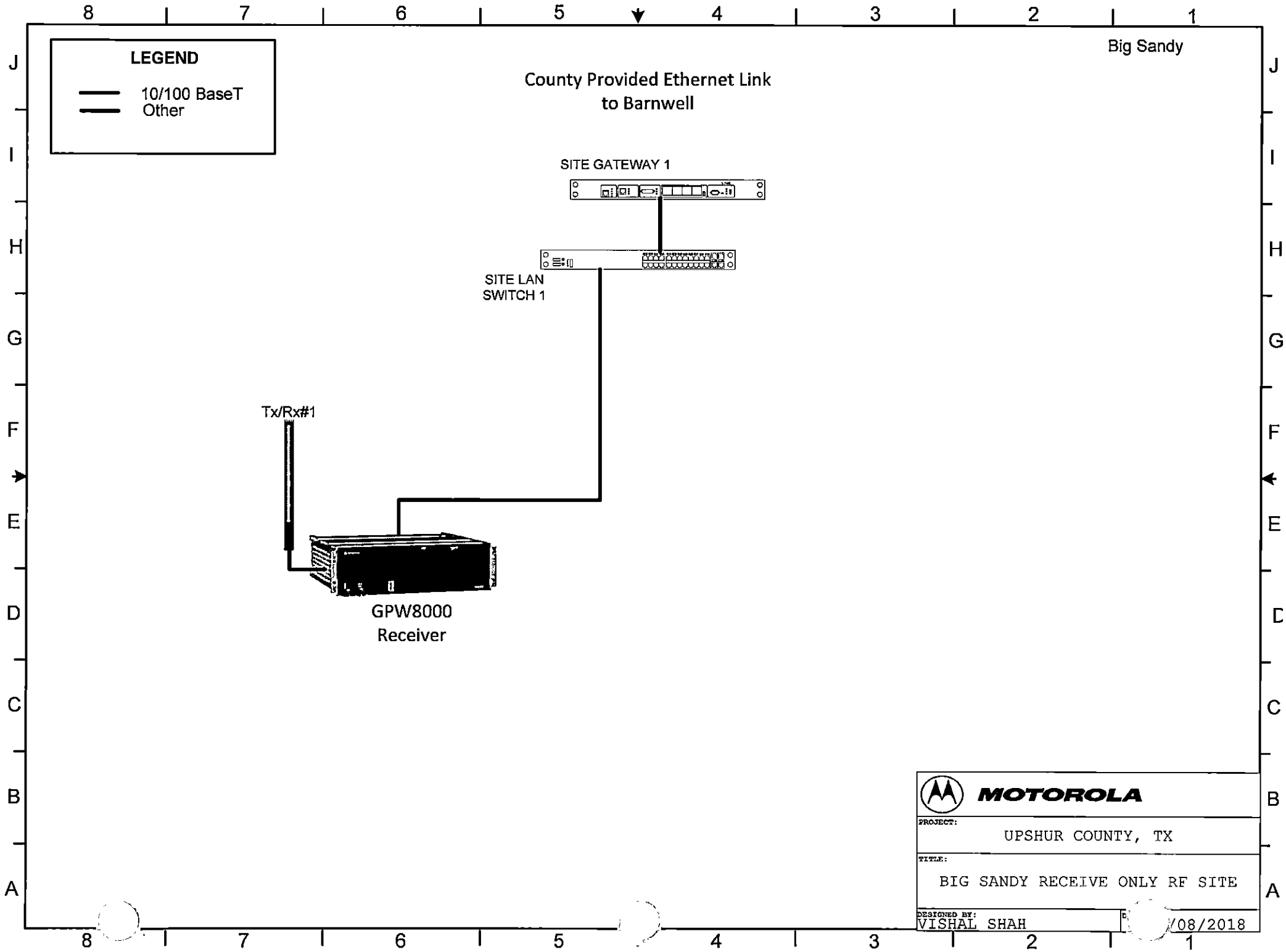
 **MOTOROLA**

PROJECT: UPSHUR COUNTY, TX




TITLE: BIG SANDY RECEIVE ONLY RF SITE

DESIGNED BY: VISHAL SHAH

08/2018



LEGEND

-  T1
-  10/100 BaseT
-  Other/Fiber



Existing Telex Console

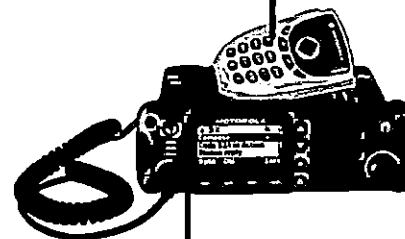
2-wire Connection

Tx/Rx#1



Over the Air to
Conventional
Voting Receive System

APX4500
CONTROL STATION
ORE CITY PD



MOTOROLA

PROJECT:

UPSHUR COUNTY, TX

TITLE:

UPSHUR COUNTY
SHERIFF OFFICE DISPATCH SITE

DESIGNED BY:

VISHAL SHAH

DATE:

10/08/2018



9.3 RACK DRAWINGS

Please see detailed rack drawings for each site, included below.



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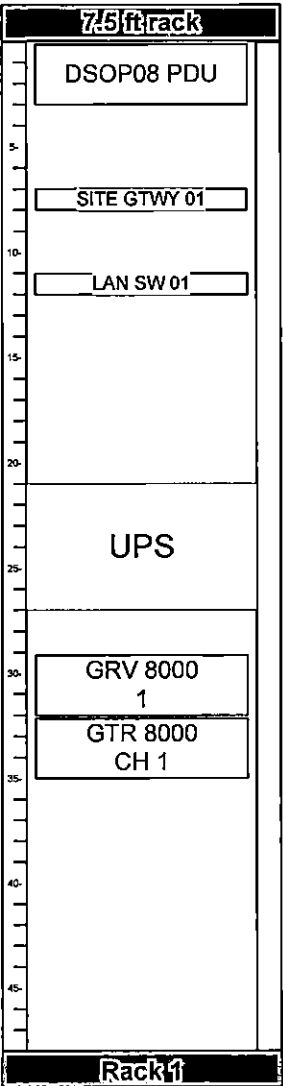
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A



MOTOROLA

PROJECT:	UPSHUR COUNTY, TX
TITLE:	BARNWELL VOTING & RF SITE
DESIGNED BY:	VISHAL SHAH
DATE:	10/08/2018

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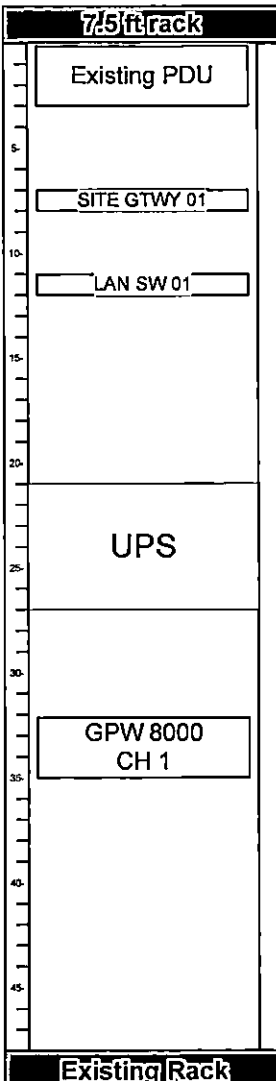
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 MOTOROLA	
PROJECT: UPSHUR COUNTY, TX	
TITLE: BIG SANDY AND ORE CITY RECEIVE ONLY RF SITE	
DESIGNED BY: VISHAL SHAH	DATE: 10/08/2018

ORIGINAL DOCUMENT SIZE IS 8.5X11, CORRECT SCALE IS NOT GUARANTEED IF REDUCED OR ENLARGED





9.4 PRODUCT BROCHURES AND SPECIFICATION SHEETS

Please see product literature, included below.



P25 Conventional Receive Voting System

Use or disclosure of this proposal is subject
to the restrictions on the cover page.



Motorola Solutions Confidential Restricted

Appendices 9-7

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BA Series

VHF OMNIDIRECTIONAL DIPOLE ARRAYS

136-174 MHz



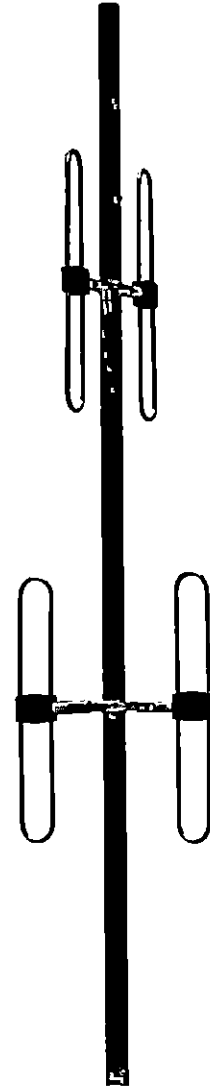
These high performance VHF dipole omnidirectional arrays are for use in highly populated radio sites requiring long haul omnidirectional coverage. The arrays feature high gain, low noise performance and enhanced null fill coverage with omnidirectional coverage characteristics.

These antennas offer industry leading PIM ratings, essential for the latest digital radio systems. With all welded construction and superior internal harness construction, these antennas provide not only excellent pattern characteristics but also defined, high levels of intermodulation and noise suppression. The entire array rests at ground potential and offers the ultimate in lightning resistant antennas.

Each of the dipoles are fed via an internal phasing harness with stable, PTFE based double-shielded coaxial cable with PE jacket for optimum weatherproofing. These omnidirectional arrays incorporate extensive side lobe suppression and null fill, and the binary phasing arrangement ensures consistent omnidirectional coverage and vertical pattern control.

These arrays provide unparalleled bandwidth, covering the entire 136-174 MHz band with a VSWR of better than 1.5:1. Available in 3dBd, dual 3dBd and 6dBd gain configurations and power rated to 750 watts. The antennas are suitable for high power paging sites or high density, multichannel installations requiring maximum performance and service life.

- High gain omnidirectional patterns
- Full band 136 – 174 MHz operation without tuning or adjustment
- BA4040-41-DIN dual 3 dBd version offers typical 25dB isolation between antennas
- Industry leading PIM ratings providing low PIM and low noise characteristics for optimum performance



RFI
2023 Case Parkway North
Twinsburg, OH 44087
Phone: 330 486 0706
Fax: 330 486 0705

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BA Series

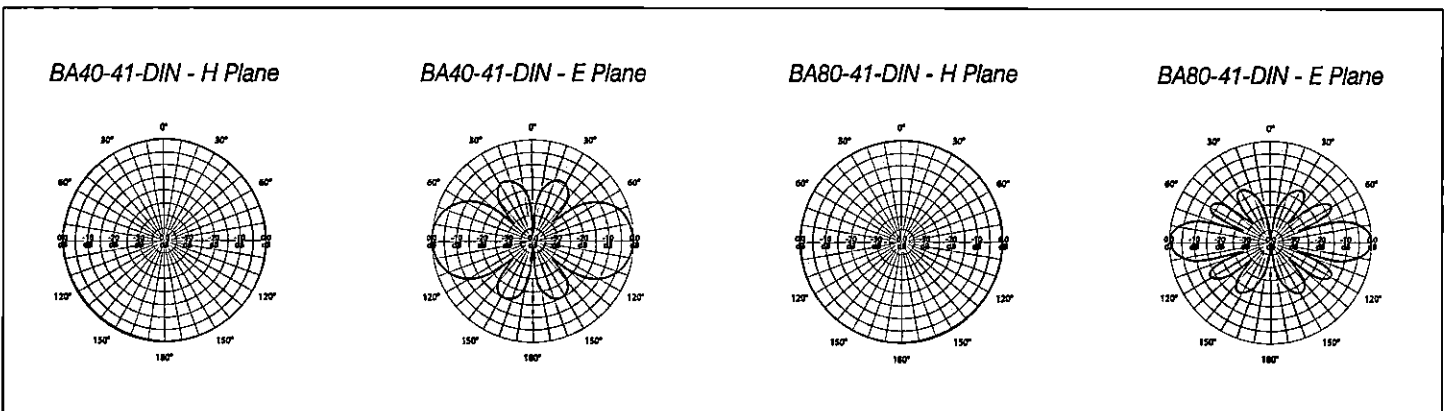
VHF OMNIDIRECTIONAL DIPOLE ARRAYS

136-174 MHz



Electrical Specifications			
Model Number	BA40-41-DIN	BA4040-41-DIN	BA80-41-DIN
Nominal Gain <i>dBd</i>	3	2 x 3	6
Frequency <i>MHz</i>	136 - 174		
Tuned Bandwidth <i>MHz</i>	Entire band		
VSWR	>1.5 :1 (14 dB)		
Nominal Impedance Ω	50		
Downtilt	Not offered.	Not offered	0° Std, -3°. See note (2)
Vertical Beamwidth*	35	2 x 35	18
Horizontal Beamwidth*	Omni +/- 0.5dB		
Input Power <i>Watts</i>	750		
Passive IM 3rd order (2x20W) <i>dBc</i>	-150	-140	-140

Mechanical Specifications			
Model Number	BA40-41-DIN	BA4040-41-DIN	BA80-41-DIN
Construction & Configuration	4 dipoles (2 bays) Turnstile stacked Single section support	2 x 4 dipoles (2 bays) Turnstile stacked Dual section support	8 dipoles (4 bays) Turnstile stacked Dual section support
Length <i>inches</i>	138	248	248
Weight <i>lbs</i>	32	68	68
Shipping Weight <i>lbs</i>	192	288	288
Shipping Dimensions <i>inches</i>	H	26	26
	W	26	32
	L	146	146
Termination	7/16 DIN female with 20° 9142 cable tail		
Mounting Area <i>inches</i>	20" x 2.5" diam. aluminum	20" x 3.0" diam. aluminum	20" x 3.0" diam. aluminum
Suggested Clamps (not included)	UC12	UC1142	UC1142
Projected area <i>ft²</i>	No ice	4.5	8.9
	with ice	7.7	14.3
Lateral (Thrust) @ 100mph <i>lbs</i>	111	221	221
Wind Gust Rating <i>mph</i>	No ice	149	114
	with ice	115	89
Torque @ 100mph <i>ft-lbs.</i>	455	1921	1921



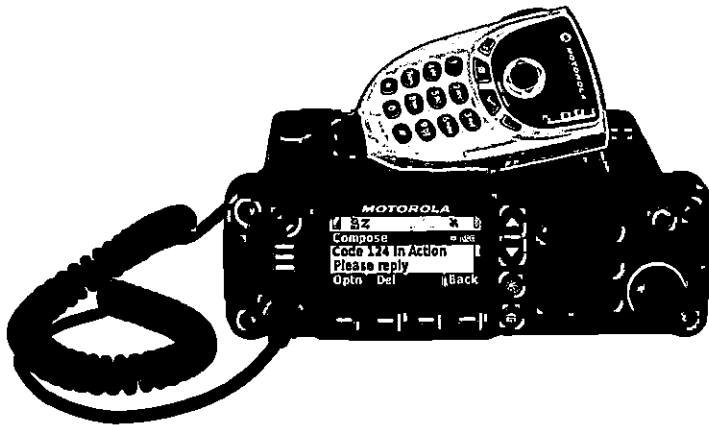
(1) Single section arrays are rated to -150dBc PIM rating. Dual section arrays are rated at -140dBc.

(2) Factory pre-set downtilt of 3° may be specified on BA80-41-DIN antennas by adding -T3 to the part number ordered e.g. BA80-41-DIN-T3

RoHS Compliant

RFI
2023 Case Parkway North
Twinsburg, OH 44087
Phone: 330 486 0706
Fax: 330 486 0705

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BE BETTER EQUIPPED TO BE MISSION READY

APX™ 4500 PROJECT 25 MOBILE RADIO

A downed power line or the city transit system coming to a halt during rush hour, when the unexpected strikes, you must interoperate seamlessly and securely with other agencies and responders – often across multiple Project 25 (P25) systems. You need to instantly connect and be informed to make better decisions and respond effectively. While the advanced technology of APX™ radios expertly equips you for the unexpected, your organization may be challenged to improve operating expenses.

That's where the APX 4500 P25 mobile radio fits the bill perfectly. It delivers all the benefits of TDMA technology in a compact P25 capable mobile. The APX 4500 brings together powerful technology in an easy-to-use radio that's easy on your budget. It seamlessly unifies public works, utility, rural public safety and transportation users to first responders so they can communicate effectively in the moments that matter.

CONVENIENTLY SMALL, EASY TO INSTALL

The APX 4500 is designed to get the job done without getting in the way. A simplified dash mount design makes installation quick and easy, fitting into the existing XTL™ footprint so you can reuse mounting holes and cables.

Count on the APX 4500 to withstand wet, dusty and hazardous conditions, too. Its IP56 durability rating is the highest level of certification for uncompromising durability and world class quality in a mobile performer you can hose down.

KEEPS CREWS IN TOUCH, AND UP TO THE MINUTE

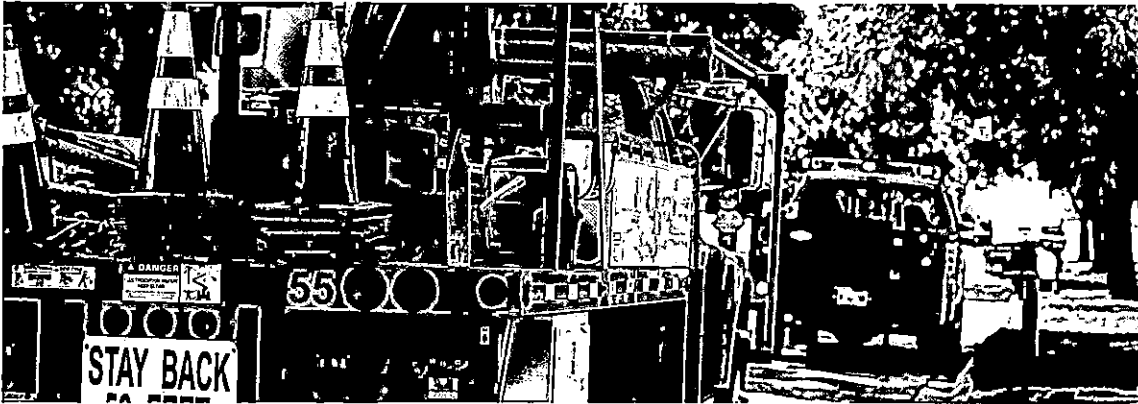
Safety runs in the APX family and the APX 4500 mobile is no exception. Like all our APX P25 radios trusted by responders worldwide, the APX 4500 mobile redefines safety. Your crews can count on quick, seamless interoperability and extended range – whether they are talking from the top of a pole or the bottom of a trench. You can depend on AES encryption for secure, tamperproof voice and data communications every time they connect.

With integrated GPS in the APX 4500, you can keep an eye on workers and assets you can't see, tracking their locations continuously. The O2 control head with color display is easy to read and operate in all lighting conditions, from bright sunlight to dark streets. The intelligent lighting on the O2 control head notifies your workers when a call is received, an emergency arises, or when they are out of range. Plus, an enlarged multifunction knob makes it easy to use talk-group and volume settings when they're wearing gloves.

Over-the-air programming on the APX 4500 keeps your crews current in the field. You can update the latest mobile without interrupting voice communications while they work.

SIZED RIGHT FOR YOUR BUDGET

The APX 4500 lets you reuse many accessories which utilize the O5 and O3 control heads on XTL radios, so you can maximize your investment while you benefit from the latest technology. Since the APX 4500 is P25 Phase 2 capable for twice the voice capacity, you can add more users without adding more frequencies or infrastructure. It is backwards and forwards compatible with all Motorola mission critical radio systems, so you can interoperate with confidence while you improve operating expenses.



APX™ 4500 SPECIFICATIONS

FEATURES AND BENEFITS:

Available in 700/800 MHz, VHF, UHF1, UHF2, and 900 MHz.
Supports NPCS band (901-902 MHz and 940-941 MHz)

512 Channels

Trunking Standards supported:

- Clear or digital encrypted Trunked Operation
- Capable of SmartZone®, SmartZone Omnilink, SmartNet®

Analog MDC-1200 and Digital APCO P25 Conventional System Configurations

Narrow and wide bandwidth digital receiver
(6.25/12.5/25/30 kHz)

Embedded digital signaling (ASTRO and ASTRO 25)

Intelligent Priority Scan

Integrated Encryption Hardware

Integrated GPS/GLONASS for outdoor location tracking

Intelligent lighting

Radio profiles

Unified Call List

Meets applicable MIL-STD 810C, D, E, F, G

Ships standard IP56

Tactical Inhibit

Instant Recall

Customer Programming Software (CPS) supported on
Windows XP, Vista, 7 and 8

(Windows 7 or 8 required for CPS R12.00.00 [June 2014] and later)

- Supports USB Communications
- Built in FLASHport™ support

Re-uses XTL™ accessories, plus new
IMPRES accessories

OPTIONAL FEATURES:

AES Encryption

Programming over Project 25 (POP25)

Text Messaging

12 character RF ID asset tracking

Tactical OTAR

APX 4500 CONTROL HEAD PORTFOLIO



02 RUGGED CONTROL HEAD

- Large color display with intelligent lighting
- 3 lines of text 14 characters max / 1 line of icons / 1 line of menus
- Built in 7.5 W speaker
- Multifunction volume/channel knob
- Night/day mode button

TRANSMITTER - TYPICAL PERFORMANCE SPECIFICATIONS

	700 MHz	800 MHz	VHF	UHF Range 1	UHF Range 2	900 MHz		
Frequency Range/Bandsplits	764-776 MHz 794-806 MHz	806-824 MHz 851-870 MHz	136-174 MHz	380-470 MHz	450-520 MHz	896-902 MHz 935-941 MHz		
Channel Spacing	25/12.5 kHz	25/12.5 kHz	30/25/12.5 kHz	25/12.5 kHz	25/12.5 kHz	12.5 kHz		
Maximum Frequency Separation	Full Bandsplit	Full Bandsplit	Full Bandsplit	Full Bandsplit	Full Bandsplit	Full Bandsplit		
Rated RF Output Power (Adjustable)*	10-30 W	10-35 W	10-50 W	10-40 W	10-45 W (450-485 MHz) 10-40 W (485-512 MHz) 10-25 W (512-520 MHz)	1-30 W (896-901 MHz) (935-940 MHz) 1-3 W (901-902 MHz) (940-941 MHz)		
Frequency Stability* (-30°C to +60°C; +25°C Ref.)	0.8 PPM	±0.8 PPM	±0.8 PPM	±0.8 PPM	±0.8 PPM	±0.8 PPM		
Modulation Limiting*	±5/±2.5 kHz	±5/±4 (NPSAPC) /±2.5 kHz	±5/±2.5 kHz	±5/±2.5 kHz	±5/±2.5 kHz	±2.5 kHz		
Modulation Fidelity (C4FM) 12.5 kHz Digital Channel	1.5%	1.5%	2.5%	1.1%	1.1%	1.5%		
Emissions*	Conducted* -75/-85 dBc	Radiated* -20/-40 dBm	Conducted -75 dBc	Radiated -20 dBm	Conducted -85 dBc	Radiated -20 dBm	Conducted* -70 dBc	Radiated* -20 dBm
Audio Response*	+1, -3 dB (EIA)		+1, -3 dB (EIA)		+1, -3 dB (EIA)		+1, -3 dB (EIA)	
FM Hum & Noise	25 & 20 kHz 12.5 kHz	-50 dB -48 dB	-50 dB -48 dB	-53 dB -52 dB	-53 dB -50 dB	-53 dB -50 dB	-45 dB	
Audio Distortion*	25 & 20 kHz 12.5 kHz	0.50% 0.50%	0.50% 0.50%	0.50% 0.50%	0.50% 0.50%	0.50% 0.50%	0.80%	

RECEIVER - TYPICAL PERFORMANCE SPECIFICATIONS

	700 MHz	800 MHz	VHF	UHF Range 1	UHF Range 2	900 MHz				
Frequency Range/Bandsplits	764-776 MHz	851-870 MHz	136-174 MHz	380-470 MHz	450-520 MHz	935-941 MHz				
Channel Spacing	25/12.5 kHz	25/12.5 kHz	30/25/12.5 kHz	25/12.5 kHz	25/12.5 kHz	12.5 kHz				
Maximum Frequency Separation	Full Bandsplit	Full Bandsplit	Full Bandsplit	Full Bandsplit	Full Bandsplit	Full Bandsplit				
Audio Output Power 3% distortion, 8/3.2 Ohm speakers	7.5/15 W	7.5/15 W	7.5/15 W	7.5/15 W	7.5/15 W	7.5/15 W				
Frequency Stability* (-30°C to +60°C; +25°C Ref.)	±0.8 PPM	±0.8 PPM	±0.8 PPM	±0.8 PPM	±0.8 PPM	±0.8 PPM				
Analog Sensitivity*	12 dB SINAD	-121 dBm (0.199 µV)	-121 dBm (0.199 µV)	Pre-Amp -123 dBm (0.158 µV)	Standard -119 dBm (0.251 µV)	Pre-Amp -123 dBm (0.158 µV)	Standard -119 dBm (0.251 µV)	Pre-Amp -123 dBm (0.158 µV)	Standard -120 dBm (0.224 µV)	
Digital Sensitivity	5% BER	-121.5 dBm (0.210 µV)	-121.5 dBm (0.210 µV)	-123 dBm (0.158 µV)	-119 dBm (0.251 µV)	-123 dBm (0.158 µV)	-119 dBm (0.251 µV)	-123 dBm (0.158 µV)	-121 dBm (0.200 µV)	
Intermodulation	25 kHz 12.5 kHz	82 dB 82 dB	82 dB 82 dB	84 dB 85 dB	86 dB 86 dB	82 dB 83 dB	86 dB 85 dB	82 dB 83 dB	86 dB 82 dB	
Spurious Rejection	91 dB	91 dB	95 dB	93 dB	93 dB	93 dB	93 dB	93 dB	91 dB	
Audio Distortion at rated*	2%	2%	2%	2%	2%	2%	2%	2%	2%	
Selectivity*	25 kHz 12.5 kHz 30 kHz	85 dB 75 dB —	85 dB 75 dB —	89 dB 77 dB 90 dB	83 dB 72 dB —	83 dB 72 dB —	83 dB 72 dB —	83 dB 72 dB —	83 dB 72 dB —	74 dB — —

DIMENSIONS

	Inches	Millimeters
Mid Power Radio Transceiver	2 x 7 x 6.4	50.8 x 178 x 163
O2 Control Head	2.7 x 8.1 x 2.1	69 x 207 x 53
Mid Power Radio Transceiver and O2 Control Head - Dash Mount	2.7 x 8.1 x 8.8	69 x 207 x 223
Mid Power Radio Transceiver and O2 Control Head Weight	5.28 lbs	2.45 kg

SIGNALING (ASTRO MODE)

Signaling Rate	9.6 kbps
Digital ID Capacity	10,000,000 Conventional / 48,000 Trunking
Digital Network Access Codes	4,096 network site addresses
ASTRO® Digital User Group Addresses	4,096 network site addresses
Project 25 - CAI Digital User Group Addresses	65,000 Conventional / 4,094 Trunking
Error Correction Techniques	Golay, BCH, Reed-Solomon codes
Data Access Control	Slotted CSMA: Utilizes infrastructure-sourced data status bits embedded in both voice and data transmissions.

RADIO MODELS

700/800 (763-870 MHz)	M22URS9PW1AN
VHF (136-174 MHz)	M22KSS9PW1AN
UHF Range 1 (380-470 MHz)	M22QSS9PW1AN
UHF Range 2 (450-520 MHz)	M22SSS9PW1AN

GPS SPECIFICATIONS

Channels	12
Tracking Sensitivity	-153 dBm
Accuracy**	<10 meters (95%)
Cold Start	<60 seconds (95%)
Hot Start	<10 seconds (95%)
Mode of Operation	Autonomous (Non-Assisted) GPS

POWER AND BATTERY DRAIN

Model Type	136-174 MHz, 380-470 MHz, 450-520 MHz, 764-870 MHz, 896-941 MHz				
Minimum RF Power Output	2-30 W (764-776 MHz), 2-30 W (794-806 MHz), 2-35 W (806-824 MHz), 2-35 W (851-870 MHz), 1-50 W (136-174 MHz), 1-40 W (380-470 MHz), 1-45 W (450-485 MHz), 1-40 W (485-512 MHz), 1-25 W (512-520 MHz), 1-30 W (896-901 MHz), 1-3 W (901-902 MHz), 1-30 W (935-940 MHz), 1-3 W (940-941 MHz)				
Operation	13.8V DC ±20% Negative Ground				
Standby at 13.8V	0.85A (764-870 MHz), 0.85A (136-174 MHz), 0.85A (380-470 MHz), 0.85A (450-520 MHz)				
Receive Current at Rated Audio at 13.8V	3.2A (764-870 MHz), 3.2A (136-174 MHz), 3.2A (380-470 MHz), 3.2A (450-520 MHz)				
Transmit Current (A) at Rated Power	136-174 MHz (10-50 W)	13A (50 W)	8A (15 W)	764-870 MHz (2-35 W)	12A (35 W) 8A (15 W)
	380-470 MHz (10-40 W)	11A (40 W)	8A (15 W)	896-901 MHz (1-30 W)	10A (30 W) 7A(15 W)
	380-470 MHz (10-40 W)	11A (45 W)	8A (15 W)	935-940 MHz(1-30 W)	10A (30 W) 7A(15 W)
				901-902 MHz(1-3 W)	5A (3 W)
				940-941 MHz(1-3 W)	5A (3 W)

MOBILE MILITARY STANDARDS 810 C, D, E, F, G

	MIL-STD 810C		MIL-STD 810D		MIL-STD 810E		MIL-STD 810F		MIL-STD 810G	
	Method	Proc./Cat.	Method	Proc./Cat.	Method	Proc./Cat.	Method	Proc./Cat.	Method	Proc./Cat.
Low Pressure	500.1	I	500.2	II	500.3	II	500.4	II	500.5	II
High Temperature Storage	501.1	I	501.2	I/A1	501.3	I/A1	501.4	I/Hot	501.5	I/A1
High Temperature Operation	501.1	II	501.2	II/A1	501.3	II/A1	501.4	II/Hot	501.5	II
Low Temperature Storage	502.1	I	502.2	I/C3	502.3	I/C3	502.4	I/C3	502.5	I/C3
Low Temperature Operation	502.1	I	502.2	II/C1	502.3	II/C1	502.4	II/C1	502.5	II
Temperature Shock	503.1	-	503.2	I/A1-C3	503.3	I/A1-C3	503.4	I/Hot-C3	503.5	I/C
Solar Radiation	505.1	II	505.2	I	505.3	I	505.4	I	505.5	I/A1
Rain Blowing	506.1	I	506.2	I	506.3	I	506.4	I	506.5	I
Rain Steady	506.1	II	506.2	II	506.3	II	506.4	III	506.5	III
Humidity	507.1	II	507.2	II	507.3	II	507.4	-	507.5	II-Aggravated
Salt Fog	509.1	-	509.2	-	509.3	-	509.4	-	509.5	1 Proc
Blowing Dust	510.1	I	510.2	I	510.3	I	510.4	I	510.5	I
Blowing Sand	-	-	510.2	II	510.3	II	510.4	II	510.5	II
Vibration Min. Integrity	514.2	VIII/F, Curve-W	514.3	I/10	514.4	I/10	514.5	I/24	514.6	I-Cat.24
Vibration Loose Cargo	514.2	XI	514.3	II/3	514.4	II/3	514.5	II/5	514.6	-
Shock Functional	516.2	I	516.3	I	516.4	I	516.5	I	516.6	I, V, VI

ENCRYPTION

Supported Encryption Algorithms	AES and ADP
Encryption Algorithm Capacity	Single
Encryption Keys per Radio	Module capable of storing 1024 keys. Programmable for 64 Common Key Reference (CKR) or 16 Physical Identifier (PID)
Encryption Frame Re-sync Interval	P25 CA1 300 mSec
Encryption Keying	Key Loader
Synchronization	XL – Counter Addressing, OFB – Output Feedback
Vector Generator	National Institute of Standards and Technology(NIST) approved random number generator
Encryption Type	Digital
Key Storage	Tamper protected volatile or non-volatile memory
Key Erasure	Keyboard command and tamper detection
Standards	FIPS 140-2 Level 3 FIPS 197

* Measured in the analog mode per TIA/EIA 603 under nominal conditions

** Accuracy specs are for long-term tracking (95th percentile values >5 satellites visible at a nominal -130 dBm signal strength)

† Specs includes performance for the non-GNSS/GNSS bands

Specifications subject to change without notice. All specifications shown are typical. Radio meets applicable regulatory requirements.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	-30°C/+60°C
Storage Temperature	-40°C/+85°C
Humidity	Per MIL-STD
ESD	IEC 801-2 KV
Water and Dust Intrusion	IP56, MIL-STD

TRANSMITTER CERTIFICATION

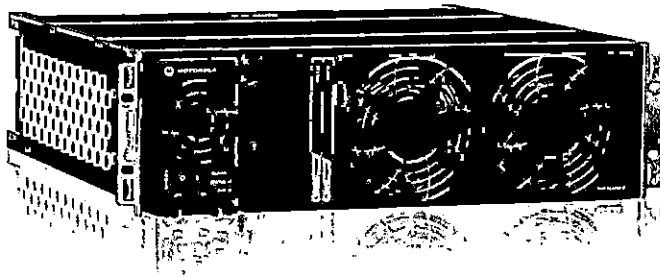
700/800 (764-775, 793-805, 806-824, 851-869 MHz)	AZ492FT7055
VHF (136-174 MHz)	AZ492FT3826
UHF R1 (380-470 MHz)	AZ492FT4915
UHF R2 (450-520 MHz)	AZ492FT4916
900 MHz (896-901, 901-902, 935-940, 940-941 MHz)	AZ492FT5865

FCC EMISSIONS DESIGNATORS

FCC Emissions Designators	8K10F1D, 8K10F1E, 8K10F1W, 11K0F3E, 16K0F3E, 20K0F1E, 10K0F3E (for AZ492FT5865 only)
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FLEXIBLE DESIGN – SOFTWARE CONFIGURABLE

G-SERIES SITE EQUIPMENT FOR ASTRO® 25 SYSTEMS

Motorola's ASTRO 25 networks are designed to meet the current and future requirements for Project 25 (P25) solutions. Our G-series portfolio of RF stations, receivers, site controllers and comparators is designed to maximize channel up-time, simplify system technology refresh, enable smaller, more efficient site design and minimize the cost of ownership.

Our G-series equipment is designed so that many upgrades, migrations, and conversions can be completed with only software installations, allowing new features to be quickly added to your existing system with a simple download. You can easily add P25 TDMA and Dynamic Channel Assignment; Information Assurance, Network Security and system release updates. Furthermore, you can migrate from conventional to trunking, 3600 to P25 trunking and from 12.5 kHz P25 FDMA to 6.25e kHz P25 TDMA.

Designed to carry your needs into the future, the G-series hardware platform has built-in functionality and flexibility with an AC/DC - 48VDC power supply and two-branch receive diversity capacity, as well as a linear power amplifier for improved coverage in P25 FDMA Simulcast systems.



GTR 8000 Expandable Site Subsystem

SIMULCAST

Motorola is an industry leader in simulcast system solutions with more mission critical systems fully operational in the field than any other LMR systems provider. The G-series site equipment is designed with simulcast system design and functionality in mind. GTR 8000 Base Radios feature a linear modulation (LSM) that provides industry-leading P25 coverage in VHF, UHF, 700/800 MHz and 900 MHz. LSM enables simulcast systems to be deployed with greater site spacing without sacrificing coverage or capability, resulting in fewer sites to build and maintain. It also allows current systems to deploy IP-based simulcast without the need to add fill-in sites.

SERVICING MADE EASY

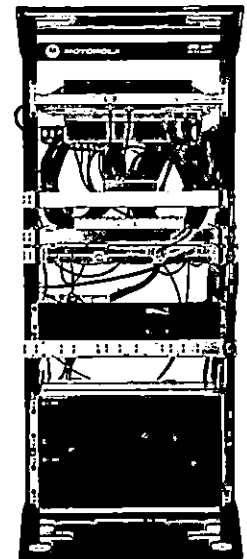
G-series site equipment has many features built in to support ease of service. Six basic modules create the entire G-series platform resulting in reduced spare parts inventory. Modules have front access to improve serviceability with hot-swap support to ensure channels are back on the air in minimum possible time. Standard Battery Revert and Charging capability is built into every G-series power supply. Integrating these capability eliminates the need for a large uninterrupted power supply and saves valuable site space.

A built-in GPS with frequency reference distribution is optionally available on the GTR 8000 Expandable Site Subsystem, which can significantly reduce or eliminate site visits.

Software upgrades are more stable and performed with less downtime in the GTR 8000 base radio. One version of software can run actively while another version is downloading. Using a remote IP connection, the user can decide when to switch between the two versions of software allowing the system manager to prepare for software downloads.

OPTIMIZED NETWORK SECURITY

Information Assurance capabilities are standard with G-series equipment and can be configured or disabled depending on your specific system maintenance and security requirements. G-series products provide the necessary boundary defense capabilities required in mission critical infrastructure today including local user accounts and password controls, user privilege model support (two levels), local and remote access services controls, secure shell services support, SNMPv3, central authentication, general operating system and network services hardening, and device test services controls.



GTR 8000 Site Subsystem

SYSTEM CONFIGURATIONS

ASTRO 25 TRUNKING

GTR 8000 Base Radios, GPW 8000 Receivers, GCP 8000 Site Controllers, and GCM 8000 Comparators are the building blocks of an ASTRO® 25 trunking system. Site repeater and simulcast system architectures in P25 FDMA and P25 TDMA offer the flexibility to deliver communications that fit user requirements.

G-series equipment is capable of both Project 25 FDMA and Project 25 TDMA in ASTRO 25 trunking systems. Dynamic Channel Assignment is optional for GTR 8000 Base Radios as part of the ASTRO 25 Dynamic Dual Mode system option, and offers seamless interoperability between P25 FDMA and P25 TDMA users, dynamically allocating a call based on available resources without any user intervention or awareness. The P25 TDMA trunking features are offered across the complete trunking portfolio to address the needs of users ranging from single site to statewide radio systems.

ASTRO 25 trunking is a fully scalable solution from as small as a single trunking site to large statewide systems that include a mix of site repeater and simulcast operation as well as additional data and mutual aid overlays. G-series equipment configured for trunking supports both V.24 circuit-based architectures as well as state-of-the-art IP-based system designs. GPW 8000 Receivers and GCM 8000 Comparators improve the in-bound subscriber signal coverage and re-broadcast a quality improved composite signal respectively in simulcast or receiver voting systems.

Motorola offers industry-leading channel resiliency in trunking systems with the GTR 8000 Expandable Site Subsystem. The architecture ensures that no single point of failure can remove more than one channel from service at the RF sites. Plus, the sites are simultaneously simplified through the integration of base station frequency references, Ethernet LAN switches and network gateways.

Motorola also offers a turn-key P25 trunking site with the ASTRO 25 Express system, a GTR 8000 Expandable Site Subsystem designed to operate as a single-site solution. Stations, site controllers, Ethernet switches, RF combiners and multicouplers are all integrated into a single rack or cabinet. If more capacity is required, additional cabinets can be added to the site.

ASTRO 25 CONVENTIONAL

ASTRO® 25 Conventional is a feature-rich conventional system solution on the common-hardware G-series platform. The GTR 8000 Base Radios, GPW 8000 Receivers, and GCM 8000 Comparators can be used together or separately to build everything from a small, single repeater site to a large, countywide or statewide receiver-voting or simulcast conventional system.

The hardware will support IP-only circuit system design while connectivity with consoles can be either IP-based or 4-wire depending on migration plans and system specific operational requirements. GTR 8000 can be configured for either base station or standalone repeater operation. GPW

8000 Receivers and GCM 8000 Comparators improve the inbound subscriber signal coverage and re-broadcast a quality improved composite signal respectively in simulcast or receiver voting systems.

Sixteen configurable channel personalities enable the station to change channel bandwidth and frequency setting via IP or v.24 commands. General purpose I/O offers 12 logic inputs and 12 logic outputs that can be programmed via the user-friendly GTR 8000 Configuration Service Software (Windows® application) for a highly customized alarm reporting solution and station operation.

ASTRO 25 Conventional can also be deployed as a system overlay with ASTRO 25 Trunking systems by adding a GTR 8000 Base Radio configured for conventional operation to an existing trunking GTR 8000 Expandable Site Subsystem and sharing the common wide-area network connections as well as RF cavity combiners and receiver multicouplers.

ANALOG CONVENTIONAL

The GTR 8000 and GPW 8000 products support analog conventional operation in 800 MHz, UHF 380-524 MHz and VHF 136-174 MHz. Analog standalone repeater, receiver voting and simulcast capabilities are available and include a 100 ppb/2 year internal frequency reference for optimal audio performance on 12.5 KHz analog channels.

The G-series equipment provides full support for analog 4-wire circuit connectivity. Over an IP network, technicians can remotely adjust line level settings and tone remote operational modes. 16 configurable analog personalities enable the station to change channel bandwidth and frequency settings via TRC (tone remote control) or WildCard general purpose I/O. The general purpose I/O offers 12 logic inputs and 12 logic outputs, which can be programmed via the user friendly Configuration Service Software (Windows® application) for a highly customized alarm-reporting solution and station operation.

MIXED ANALOG/DIGITAL CONVENTIONAL

G-Series site equipment can be configured to simultaneously support both analog and digital communication. This mixed mode form of operation allows the system to support a

mixed fleet of analog and digital subscribers as a flexible long term solution, or as part of a gradual migration path from analog to digital. Mixed mode operation is supported on conventional standalone repeaters, receiver voting and simulcast systems.

ASTRO 25 DATA

ASTRO 25 trunking and conventional systems can be enabled with P25 Integrated Data functionality so users can leverage their investment in voice infrastructure for basic data needs. Enhanced Data is a software feature in systems with Integrated Data. Enhanced Data optimizes the data channels in an ASTRO 25 system for data applications that require short inbound data messages like location, telemetry and biometrics, and can improve data efficiency by 12x. For example, with Enhanced Data, customers can set quicker location polling rates for a larger number of users on their system, therefore providing better real-time view to resource locations. Based on customer requirements, ASTRO 25 Enhanced Data allows for data to be prioritized over voice, protecting channels for data use and enabling agency shared data channels. If higher data throughput is a requirement, Motorola offers HPD as an overlay on ASTRO 25 trunking systems to provide the same coverage footprint for both systems.

3600 TRUNKING

The GTR 8000 base radio supports 3600 trunking operation, enabling new future-ready base radios to be added to existing SmartZone systems with SmartX. The GTR 8000 is software upgradeable to P25 trunking when the time is right to migrate to P25. 3600 trunking operation is available on both simulcast and intellirepeater systems, in either analog or digital mode.

The GTR 8000 supports WildCard general purpose I/O with 12 logic inputs and 12 logic outputs, which can be programmed via the user friendly Configuration Service Software (Windows application) for a highly customized alarm-reporting solution and station operation.

Using an IP connection, the GTR 8000 can be monitored, configured and software updated from a convenient, remote location.

G-SERIES SITE EQUIPMENT PRODUCTS

GTR 8000 EXPANDABLE SITE SUBSYSTEM

A space-efficient, single rack design, the GTR 8000 Expandable Site Subsystem (ESS) integrates up to six GTR 8000 Base Radios, redundant GCP 8000 Site Controllers or GPB 8000 Reference Distribution Modules, redundant Ethernet LAN switches, redundant network gateways, transmit combiners, and receiver multicouplers. This enables

a highly resilient architecture that provides industry-leading protection against single points of failure at the RF sites while providing a turn-key site solution that minimizes site cabling connections and installation effort.

It supports ASTRO 25 simulcast and site repeater trunking operation, 3600 simulcast and intellirepeater trunking operation with SmartX, HPD, and P25 digital and analog conventional operation. When ordered as an ASTRO 25

Express System, the GTR 8000 Expandable Site Subsystem is the industry's only turn-key, single-site Project 25 trunking solution.

GTR 8000 BASE RADIO

Designed to support ASTRO 25 trunking simulcast, 3600 trunking simulcast with SmartX, HPD, and P25 and analog conventional operation, GTR 8000 Base Radios offer additional design flexibility for infrastructure sites where equipment may have to be interchanged individually during a technology refresh or when used as a station replacement for QUANTAR™ or STR 3000 stations.

GPW 8000 RECEIVER

In conventional and trunking voting or simulcast voting applications, the GPW 8000 Receiver increases in-bound signal coverage for subscribers. Physical space is optimized at receive-only sites with the GPW 8000 space efficient dual receive module design.

GTR 8000 SITE SUBSYSTEM

This configuration supports HPD with the redundant site controllers and GTR 8000 Base Radio configured for data operation. The specially designed low-loss RF system ensures that HPD signal coverage equals the coverage available from the integrated voice and data

solution allowing complete data coverage in an ASTRO® 25 system without the inconvenience of fill-in sites for coverage holes.

GCP 8000 SITE CONTROLLER

The GCP 8000 Site Controller is used at an ASTRO 25 trunking site to assign voice and data channels, manage and report alarms on site resources, provide Ethernet switching capability, and provide a frequency reference to GTR 8000 Base Radios. The frequency reference is provided either via a GPS receiver or an ultra high stability oscillator. The nature of these frequency references eliminates or minimizes site visits for frequency tuning servicing.

GCM 8000 AND GRV 8000 COMPARATORS

Used in voting and simulcast networks, G-Series Comparators increase the talk-in coverage of a radio in the field. The comparators pick up audio from multiple sites and perform a frame-by-frame analysis to build a high quality composite audio package for transmission. The GCM 8000 supports P25 digital conventional and P25 trunking systems. The GRV 8000 supports analog conventional and P25 digital conventional systems.

GTR 8000 EXPANDABLE SITE SUBSYSTEM (SQM01SUM7054A)

GENERAL PERFORMANCE

	HPD	INTEGRATED VOICE & DATA				
	700/800 MHz	900 MHz	700/800 MHz	UHF: 380-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Number of Channels	1-5	1-6	1-6	1-6	1-6	2-6
Height with 7.5 ft Rack	90.4 in (230 cm)	90.4 in (230 cm)	90.4 in (230 cm)	90.4 in (230 cm)	90.4 in (230 cm)	90.4 in (230 cm)
Footprint (W x D) with 7.5 ft Rack	20.5 x 23.5 in (52 x 60 cm)	20.5 x 23.5 in (52 x 60 cm)	20.5 x 23.5 in (52 x 60 cm)	20.5 x 23.5 in (52 x 60 cm)	20.5 x 23.5 in (52 x 60 cm)	20.5 x 23.5 in (52 x 60 cm)
Weight (fully configured) with 7.5 ft Rack	520 lbs (235 kg)	575 lbs (260 kg)	520 lbs (235 kg)	UHF 380-435 MHz: 475 lbs (215 kg) UHF 450-512 MHz: 565 lbs (260 kg)	475 lbs (215 kg)	538 lbs (246 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption (fully configured)						
Power Efficiency Package	2200 W	C4FM: 3700 W LSM, H-DPOSK: 4100 W C4FM: 3700 W LSM, H-DPOSK: 4100 W	C4FM, FM: 2755 W LSM, H-DPOSK: 2900 W C4FM, FM: 2900 W LSM, H-DPOSK: 3100 W	C4FM, FM: 2325 W LSM, H-DPOSK: 2500 W C4FM, FM: 2500 W LSM, H-DPOSK: 2700 W	C4FM, FM: 2500 W LSM, H-DPOSK: 2100 W C4FM, FM: 2650 W LSM, H-DPOSK: 2200 W	C4FM, FM: 4310 W
Standard	2400 W					C4FM, FM: 4580 W
Antenna Connectors	TX: 7/16 Female RX: N Female	TX: 7/16 or N Female RX: N Female	TX: 7/16 Female RX: N Female	TX: 7/16 Female RX: N Female	TX: N Female RX: BNC Female	TX: N Female RX: N Female
Channel Spacing	25 kHz	12.5 kHz	12.5/25 kHz	12.5/25 kHz	12.5/15/25/30 KHz	12.5/25 kHz
Transmit Combiner Spacing	150 kHz	12.5 kHz (Hybrid) 150 kHz (Cavity)	150 kHz	150 kHz (450 - 512 MHz) N/A (380-450, 512-524 MHz)	N/A	N/A
Modulation	TX: 64QAM, 16QAM, QPSK RX: 64QAM, 16QAM, QPSK	TX: C4FM, LSM, H-DPOSK RX: C4FM, H-CPM	TX: C4FM, LSM, H-DPOSK, FM RX: C4FM, H-CPM, FM	TX: C4FM, LSM, H-DPOSK, FM RX: C4FM, H-CPM, FM	TX: C4FM, LSM, H-DPOSK, FM RX: C4FM, H-CPM, FM	TX: FM, C4FM RX: C4FM, H-CPM, FM
Frequency Stability	GPS synchronized	Repeater Site: 100 ppb/2 yr Simulcast (Multisite): GPS synchronized	Repeater Site: 100 ppb/2 yr Simulcast (Multisite): GPS synchronized	Repeater Site: 100 ppb/2 yr Simulcast (Multisite): GPS synchronized	Repeater Site: 100 ppb/2 yr Simulcast (Multisite): GPS synchronized	Repeater Site: 100 ppb/2 yr Simulcast (Multisite): GPS synchronized

Specifications subject to change without notice.

GTR 8000 EXPANDABLE SITE SUBSYSTEM (SQM01SUM7054A) CONTINUED

TRANSMITTER (CABINET OUTPUT)*

	HPD	INTEGRATED VOICE & DATA				
	700/800 MHz	900 MHz	700/800 MHz	UHF: 380-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Frequency Range	764-776, 851-870 MHz	935-941 MHz	764-776, 851-870 MHz	380-435, 435-524 MHz	136-174 MHz	851-870 MHz
Average Power output per channel	1-20 W	2-way Hybrid: 1-37 W 3-way Hybrid: 1-22 W 4-way Hybrid: 1-17 W 5-way Hybrid: 1-12 W 6-way Hybrid: 1-10 W	1-40 W	C4FM, FM: 2-110 W (380-450, 512-524 MHz) LSM, H-DQPSK: 2-100 W (380-450, 512-524 MHz) C4FM, FM: 1-33 W (450-512 MHz) LSM, H-DQPSK: 1-30 W (450-512 MHz)	C4FM, FM: 2-100 W LSM, H-DQPSK: 2-60 W	13-134 W
Modulation Fidelity	N/A	5%	5%	5%	5%	5%
EVM	10%	N/A	N/A	N/A	N/A	N/A
Intermodulation Attenuation	80 dB	80 dB	80 dB	80 dB (450-512 MHz) 65 dB (380-450, 512-524 MHz)	55 dB	55 dB
Spurious and Harmonic Emissions Attenuation	90 dB	90 dB	90 dB	90 dB	90 dB	90 dB
Analog FM Hum and Noise						
12.5 kHz	N/A	N/A	45 dB	45 dB	45 dB	
25 kHz	N/A	N/A	50 dB	50 dB	50 dB	
Analog Audio Distortion	N/A	N/A	Less than 2% at 1000 Hz	Less than 2% (1% typical) at 1000 Hz	Less than 2% (1% typical) at 1000 Hz	Less than 2% at 1000 Hz
Emissions Designators	17K7D7D	8K70D1E, 8K70D1D 8K70D1W, 8K10F1E 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D 9K80D7W, 10K0F1D 11K0F3E, 16K0F1D 16K0F3E	8K70D1E, 8K70D1D 8K70D1W, 8K10F1E 8K10F1D, 8K10F1W 10K0F1E, 10K0F1D 10K0F1W, 9K80D7E 9K80D7D, 9K80D7W 17K7D7D, 16K0F1D 16K0F3E, 11K0F3E 14K0F1D, 14K0F3E 21K7D7E, 21K7D7D 21K7D7W	8K70D1E, 8K70D1D 8K70D1W, 8K10F1E 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D 9K80D7W, 10K0F1D 11K0F3E, 16K0F1D 16K0F3E	8K70D1E, 8K70D1D 8K70D1W, 8K10F1E 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D 9K80D7W, 10K0F1D 11K0F3E, 16K0F1D 16K0F3E	8K10F1E, 8K10F1D, 8K10F1W, 10K0F1E, 10K0F1D, 10K0F1W, 16K0F1D, 16K0F3E, 11K0F3E, 14K0F1D, 14K0F3E

RECEIVER (TOP OF CABINET)

	HPD	INTEGRATED VOICE & DATA				
	700/800 MHz	900 MHz	700/800 MHz	UHF: 380-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Frequency Range	792-825 MHz	896-902 MHz	792-825 MHz	380-435, 435-524 MHz	136-174 MHz	806-825 MHz
Analog Sensitivity 12 dB SINAD	N/A	N/A	12.5 kHz: -123 dBm 25 kHz: -122 dBm	12.5 kHz: -117 dBm (380-450, 512-524 MHz) 12.5 kHz: -121.5 dBm (450-512 MHz) 25 kHz: -116 dBm (380-450, 512-524 MHz) 25 kHz: -120.5 dBm (450-512 MHz)	12.5/15 kHz: -118 dBm 25/30 kHz: -117 dBm	12.5 kHz: -123 dBm 25 kHz: -122 dBm
Digital Sensitivity 1% Bit Error Rate Static (BER)						
64 QAM	-101 dBm	N/A	N/A	N/A	N/A	N/A
16 QAM	-108 dBm	N/A	N/A	N/A	N/A	N/A
QPSK	-115 dBm	N/A	N/A	N/A	N/A	N/A
Digital Sensitivity 5% Bit Error Rate Static (BER)						
C4FM	N/A	-123 dBm	-123 dBm	-117 dBm (380-450, 512-524 MHz) -121.5 dBm (450-512 MHz)	-118 dBm	
H-CPM	N/A	-118.5 dBm	-121 dBm	-115 dBm (380-450, 512-524 MHz) -119.5 dBm (450-512 MHz)	-116 dBm	-123 dBm N/A
Intermodulation Rejection	75 dB**	80 dB	80 dB	80 dB	80 dB	80 dB
Digital Adjacent Channel Rejection	50 dB**	60 dB	60 dB	60 dB	60 dB	60 dB

* Includes Transmitter RF Distribution System for 900 MHz, 700/800 MHz, and UHF 450-512 MHz. Does not include Transmitter RF Distribution System for VHF, UHF 380-450, 512-524 MHz and High Power 800 MHz. Reference signal is QPSK

** Specifications subject to change without notice.

GTR 800 EXPANDABLE SITE SUBSYSTEM (SQM01SUM7054A) CONTINUED

RECEIVER (TOP OF CABINET)

HPD		INTEGRATED VOICE & DATA				
700/800 MHz		900 MHz	700/800 MHz	UHF: 380-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Analog Adjacent Channel Rejection (EIA603)						
Analog 12.5 kHz	N/A	N/A	75 dB	75 dB	75 dB	75 dB
Analog Adjacent Channel Rejection (TIA603D)						
Analog 12.5 kHz	N/A	N/A	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)
Analog 25 kHz	N/A	N/A	80 dB	80 dB	80 dB	80 dB
Spurious and Image Response Rejection	90 dB**	100 dB	100 dB	65 dB (380-435 MHz) 100 dB (450-512 MHz)	90 dB	100 dB
Analog Audio Response	N/A	N/A	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output
Analog Audio Distortion	N/A	N/A	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)
Analog FM Hum and Noise						
12.5 kHz	N/A	N/A	45 dB	45 dB	45 dB	45 dB
25 kHz	N/A	N/A	50 dB	50 dB	50 dB	50 dB
Intermediate Frequency	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 44.85 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz

TRANSMITTER RF DISTRIBUTION SYSTEM

	700/800 MHz Cavity	900 MHz Hybrid	UHF: 450-512 MHz Cavity
Frequency Range	764-776, 851-870 MHz	935-941 MHz	450-512 MHz
Insertion Loss (150 kHz spacing)	3.1 dB typ	2-way loss: 4.4 dB typ 3-way loss: 6.3 dB typ 4-way loss: 7.6 dB typ 5-way loss: 8.8 dB typ 6-way loss: 9.7 dB typ	4.5 dB typ
Tx-Tx Isolation (150 kHz spacing)	32 dB	20 dB	32 dB

RECEIVER RF DISTRIBUTION SYSTEM

	700/800/900 MHz		UHF: 450-512 MHz	
Frequency Range	792-825 MHz or 896-902 MHz		450-512 MHz	
	Typical	Limit	Typical	Limit
Noise Figure	3.8 dB	5 dB	4.6 dB	5.5 dB
Gain	13 dB	-16 to 24 dB adjustable	10 dB	-16 to 24 dB adjustable
3rd Order Output Intercept	21 dBm		19 dBm	
Amplifier Intercept	35 dBm		40 dBm	
Preselector Bandwidth	792-825 MHz or 896-902 MHz		2 or 3.5 MHz	
RF Input Connector Type	N		N	
RF Output Connector Type	BNC		BNC	

* Includes Transmitter RF Distribution System for 900 MHz, 700/800 MHz, and UHF 450-512 MHz. Does not include Transmitter RF Distribution System for VHF, UHF 380-450, 512-524 MHz and High Power: 800 MHz.
** Reference signal is QPSK

Specifications subject to change without notice.

GCP 8000 SITE CONTROLLER (T7038A)

GENERAL PERFORMANCE

HPD		INTEGRATED VOICE & DATA
Channel Capacity	5	Repeater Site: 28 Simulcast (Multicast): 30
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	5.25 x 19 x 18 in (133 x 483 x 457 mm)
Weight	40 lbs (18 kg)	40 lbs (18 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)
Rack Option	19 in standard rack mountable	19 in standard rack mountable
Frequency Stability	GPS Synchronized	Simulcast (Multisite): External
ELECTRICAL		
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption	AC: 160 W DC: 80 W	AC: 130 W DC: 60 W

GCM 8000 COMPARATOR (T7321A)

GENERAL PERFORMANCE

INTEGRATED VOICE & DATA	
Channel Capacity	1 or 2
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)
Weight	40 lbs (18 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)
Rack Option	19 in standard rack mountable
Time Stability	External Reference
ELECTRICAL	
Power Requirements	AC: 90-264 VAC 47-63Hz DC: 43.2-60 VDC
Power Consumption	AC: 1 module 130 W AC: 2 modules 160 W DC: 1 module 60 W DC: 2 modules 80 W

G-SERIES COMPACT SITE

GENERAL PERFORMANCE

Frequency Band	700 MHz, 800 MHz
Channel Capacity	3
Size (HxWxD)	51.2 x 27.2 x 36.5 in (Pole Mount) 59.5 x 27.2 x 36.5 in (Pad Mount) 55.3 x 27.2 x 36.5 in (Wall Mount)
Weight	230 lbs (empty), 460 lbs (fully loaded)
Temperature Range	-30 to 50°C (External to Cabinet)
Rack Option	Pole, Pad, or Wall Mountable

GRV 8000 COMPARATOR (T8341A)

GENERAL PERFORMANCE

OPERATION	ANALOG CONVENTIONAL DIGITAL CONVENTIONAL
Channel Capacity	1 or 2
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)
Weight	36 lbs (16 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)
Rack Option	19 in standard rack mountable
Frequency Stability	External Reference
ELECTRICAL	
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption	AC: 1 module 80 W AC: 2 modules 105 W DC: 1 module 50 W DC: 2 modules 75 W

Specifications subject to change without notice.

GTR 8000 BASE RADIO (T7039A)

GENERAL PERFORMANCE

	HPD	INTEGRATED VOICE & DATA			
	700/800 MHz	700/800 MHz	UHF: 380-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	5.25 x 19 x 18 in (133 x 483 x 457 mm)
Weight	46 lbs (21 kg)	46 lbs (21 kg)	46 lbs (21 kg)	46 lbs (21 kg)	48 lbs (22 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)	-22 to 140°F (-30 to 60°C)
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption	325 W	C4FM, FM: 405 W LSM, H-DQPSK: 425 W	C4FM, FM: 410 W LSM, H-DQPSK: 445 W	C4FM, FM: 405 W LSM, H-DQPSK: 315 W	C4FM, FM: 700 W
Power Efficiency Package	325 W	C4FM, FM: 430W LSM, H-DQPSK: 470 W	C4FM, FM: 435 W LSM, H-DQPSK: 455 W	C4FM, FM: 435 W LSM, H-DQPSK: 345 W	C4FM, FM: 725 W
Standard	325 W				
Antenna Connectors TX	N female	N female	N female	N female	N female
Antenna Connectors RX	BNC female	BNC female N female **	BNC female N female **	BNC female N female **	BNC female N female **
Channel Spacing	25 kHz	12.5/25 kHz	12.5/25 kHz	12.5/15/25/30 kHz	12.5/25 kHz
Modulation	TX: 64QAM, 16QAM, QPSK RX: 64QAM, 16QAM, QPSK	TX: C4FM, LSM, H-DQPSK, FM RX: C4FM, H-CPM, FM	TX: C4FM, LSM, H-DQPSK, FM RX: C4FM, H-CPM, FM	TX: C4FM, LSM, H-DQPSK, FM RX: C4FM, H-CPM, FM	TX: FM, C4FM RX: C4FM, H-CPM, FM
Frequency Stability	External Reference	100 ppb/2 yr or External Reference	100 ppb/2 yr or External Reference	100 ppb/2 yr or External Reference	100 ppb/2 yr or External Reference

TRANSMITTER

	700/800 MHz	700/800 MHz	UHF: 380-435 MHz UHF: 435-524 MHz	VHF: 136-174 MHz	800 MHz: High Power & Low Power unless indicated
Frequency Range	764-776, 851-870 MHz	764-776, 851-870 MHz	380-435, 435-524 MHz	136-174 MHz	851-870 MHz
Power Output	2-50 W	2-100 W	C4FM, FM: 2-110 W H-DQPSK, LSM: 2-100 W	C4FM, FM: 2-100 W H-DQPSK, LSM: 2-60 W	High Power: 15-150 W Low Power: 2-30 W
Electronic Bandwidth	Full Bandwidth	Full Bandwidth	Full Bandwidth	Full Bandwidth	Full Bandwidth
Modulation Fidelity	N/A	5%	5%	5%	5%
EVM	10%	N/A	N/A	N/A	N/A
Intermodulation Attenuation	80 dB	80 dB	65 dB	55 dB	55 dB
Spurious and Harmonic Emissions Attenuation	90 dB	90 dB	90 dB	90 dB	90 dB
Analog FM Hum and Noise	N/A	45 dB	45 dB	45 dB	45 dB
12.5 kHz	N/A	50 dB	50 dB	50 dB	50 dB
25 kHz	N/A				
Analog Audio Distortion	N/A	Less than 2% at 1000 Hz	Less than 2% (1% typical) at 1000 Hz	Less than 2% (1% typical) at 1000 Hz	Less than 2% at 1000 Hz
Emissions Designators	17K7D7D	8K70D1E, 8K70D1D, 8K70D1W 8K10F1E, 8K10F1D, 8K10F1W 10K0F1E, 10K0F1D, 10K0F1W 9K80D7E, 9K80D7D, 9K80D7W 17K7D7D, 16K0F1D, 16K0F3E 11K0F3E, 14K0F1D, 14K0F3E 21K7D7E, 21K7D7D, 21K7D7W	8K70D1E, 8K70D1D, 8K70D1W 8K10F1E, 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D, 9K80D7W 10K0F1D, 11K0F3E, 16K0F1D 16K0F3E	8K70D1E, 8K70D1D, 8K70D1W 8K10F1E, 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D, 9K80D7W 10K0F1D, 11K0F3E, 16K0F1D 16K0F3E	High Power: 8K10F1E, 8K10F1D, 8K10F1W 16K0F1D, 16K0F3E, 11K0F3E 14K0F1D, 14K0F3E Low Power: 8K10F1D, 8K10F1E, 8K10F7W 8K70D1W, 8K70D7W, 9K80D7W 10K0F1D, 11K0F3E, 16K0F3E 16K0F1D

RECEIVER

	700/800 MHz	700/800 MHz	UHF: 380-435 MHz UHF: 435-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Frequency Range	792-825 MHz	792-825 MHz	380-435, 435-524 MHz	136-174 MHz	806-825 MHz
Analog Sensitivity (12 dB SINAD)	N/A	12.5 kHz: -118 dBm 25 kHz: -117 dBm	12.5 kHz: -118 dBm 25 kHz: -117 dBm	12.5 kHz: -119 dBm 25/30 kHz: -118 dBm	12.5 kHz: -118 dBm 25 kHz: -117 dBm
Digital Sensitivity 1% Bit Error Rate Static (BER)					
64 QAM	-98 dBm	N/A	N/A	N/A	N/A
16 QAM	-104 dBm	N/A	N/A	N/A	N/A
QPSK	-111 dBm	N/A	N/A	N/A	N/A
Digital Sensitivity 5% Bit Error Rate Static (BER)					
C4FM	N/A	-118 dBm	-118 dBm	-119 dBm	-118 dBm
H-CPM	N/A	-116 dBm	-116 dBm	-117 dBm	-116 dBm

* Reference signal is QPSK ** Optional Preselector
Specifications subject to change without notice.

GTR 8000 BASE RADIO (T7039A) CONTINUED

RECEIVER

HPD		INTEGRATED VOICE & DATA			
700/800 MHz		700/800 MHz	UHF: 380-435 MHz UHF: 435-524 MHz	VHF: 136-174 MHz	High Power 800 MHz
Intermodulation Rejection	75 dB*	85 dB	85 dB	85 dB	85 dB
Digital Adjacent Channel Rejection	50 dB*	60 dB	60 dB	60 dB	60 dB
Analog Adjacent Channel Rejection (EIA603) Analog 12.5 kHz	N/A	75 dB	75 dB	75 dB	75 dB
Analog Adjacent Channel Rejection (TIA603D) Analog 12.5 kHz	N/A	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)
Analog 25 kHz	N/A	80 dB	80 dB	80 dB	80 dB
Spurious and Image Response Rejection	85 dB*	85 dB 100 dB**	85 dB 100 dB**	90 dB 95 dB**	85 dB 100 dB**
Analog Audio Response	N/A	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output
Analog Audio Distortion	N/A	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)
Analog FM Hum and Noise 12.5 kHz	N/A	45 dB	45 dB	45 dB	45 dB
25 kHz	N/A	50 dB	50 dB	50 dB	50 dB
Intermediate Frequency	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 44.85 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz

GPW 8000 RECEIVER (T7540A)

GENERAL PERFORMANCE

INTEGRATED VOICE & DATA						
700/800 MHz		UHF: 380-435 MHz UHF: 435-524 MHz		VHF: 136-174 MHz		
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)		5.25 x 19 x 18 in (133 x 483 x 457 mm)		5.25 x 19 x 18 in (133 x 483 x 457 mm)	
Weight	36 lbs (16 kg)		36 lbs (16 kg)		36 lbs (16 kg)	
Temperature Range	-22 to 140°F (-30 to 60°C)		-22 to 140°F (-30 to 60°C)		-22 to 140°F (-30 to 60°C)	
Power Requirements						
AC	90-264 VAC, 47-63 Hz		90-264 VAC, 47-63 Hz		90-264 VAC, 47-63 Hz	
DC	43.2-60 VDC		43.2-60 VDC		43.2-60 VDC	
Power Consumption	1 Module	2 Module	1 Module	2 Module	1 Module	2 Module
AC – Power Efficiency Package	40 W	65 W	40 W	65 W	40 W	65 W
DC – Power Efficiency Package	30 W	50 W	30 W	50 W	30 W	50 W
AC	80 W	105 W	80 W	105 W	80 W	105 W
DC	50 W	75 W	50 W	75 W	50 W	75 W
Antenna Connectors RX	BNC female N female **		BNC female N female **		BNC female N female **	
Channel Spacing	12.5/25 kHz		12.5/25 kHz		12.5/15/25/30 kHz	
Modulation	C4FM, FM		C4FM, FM		C4FM, FM	
Frequency Stability	Conventional: 100 ppb/2 yr		Conventional: 100 ppb/2 yr		Conventional: 100 ppb/2 yr	

Reference signal is OPSK ** Optional Preselector
Specifications subject to change without notice.

GPW 8000 RECEIVER (T7540A) CONTINUED

RECEIVER

INTEGRATED VOICE & DATA - CONVENTIONAL			
	700/800 MHz	UHF: 380-435 MHz UHF: 435-524 MHz	VHF: 136-174 MHz
Frequency Range	792-825 MHz	380-435 MHz, 435-524 MHz	136-174 MHz
Analog Sensitivity 12 dB SINAD	12.5 kHz: -118 dBm 25 kHz: -117 dBm	12.5 kHz: -118 dBm 25 kHz: -117 dBm	12.5/15 kHz: -119 dBm 25/30 kHz: -118 dBm
Digital Sensitivity 5% Bit Error Rate Static (BER)			
C4FM	-118 dBm	-118 dBm	-119 dBm
H-CPM	-116 dBm	-116 dBm	-117 dBm
Intermodulation Rejection	85 dB	85 dB	85 dB
Digital Adjacent Channel Rejection	60 dB	60 dB	60 dB
Analog Adjacent Channel Rejection (EIA603)			
Analog 12.5 kHz	75 dB	75 dB	75 dB
Analog 25 kHz			
Analog Adjacent Channel Rejection (TIA603D)			
Analog 12.5 kHz	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)
Analog 25 kHz	80 dB	80 dB	80 dB
Spurious and Image Response Rejection	85 dB 100 dB*	85 dB 100 dB*	90 dB 95 dB*
Analog Audio Response	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output	+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output
Analog Audio Distortion	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)
Analog FM Hum and Noise			
Analog 12.5 kHz	45 dB	45 dB	45 dB
Analog 25 kHz	50 dB	50 dB	50 dB
Intermediate Frequency	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 73.35 MHz 2nd: 2.16 MHz	1st: 44.85 MHz 2nd: 2.16 MHz

* Optional Preselector.

Specifications subject to change without notice.

GTR 8000 SITE SUBSYSTEM (T7133A)

GENERAL PERFORMANCE

HPD	
700/800 MHz	
Number of Channels	1
Height	27 RU, 50.4 in (128 cm)
Footprint (W x D)	20.9 x 25.4 in (53 x 64.5 cm)
Weight	225 lbs (102 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption (fully configured)	AC: 615 W DC: 495 W
Antenna Connectors TX	N Female
Antenna Connectors RX	N Female
Channel Spacing	25 kHz
Modulation	TX: 64QAM, 16QAM, QPSK RX: 64QAM, 16QAM, QPSK
Frequency Stability	GPS synchronized

TRANSMITTER INCLUDING RFDS

HPD	
700/800 MHz	
Frequency Range	764-776, 851-870 MHz
Average Power output per channel	1-27 W
Electronic Bandwidth	Full Bandwidth
Error Vector Magnitude	10%
Spurious and Harmonic Emissions Attenuation	90 dB
Emissions Designators	17K7D7D

RECEIVER INCLUDING RFDS

HPD	
700/800 MHz	
Frequency Range	792-825 MHz
Sensitivity 1% Bit Error Rate Static (BER)	
64 QAM	-101 dBm
16 QAM	-108 dBm
QPSK	-115 dBm
Intermodulation Rejection	75 dB*
Adjacent Channel Rejection	50 dB*
Spurious and Image Response Rejection	90 dB*
Intermediate Frequency	
1st	73.35 MHz
2nd	2.16 MHz
Preselector Bandwidth	792-825 MHz

* Reference signal is QPSK.
Specifications subject to change without notice.

FCC TYPE ACCEPTANCE

FCC DESIGNATION

Frequency Range	Type	Power Output	Type Acceptance Number
136-174 MHz	Transmitter	2-100 W	ABZ89FC3790B, ABZ89FC3799B
136-174 MHz	Receiver	N/A	ABZ89FR3791B
406-435 MHz	Transmitter	2-110 W	ABZ89FC4821B
406-435 MHz	Receiver	N/A	ABZ89FR4822B
435-512 MHz	Transmitter	2-110 W	ABZ89FC4819B
435-512 MHz	Receiver	N/A	ABZ89FR4820B
764-776 MHz	Transmitter	2-100 W 2-50 W (HPD)	ABZ89FC5812B
851-870 MHz	Transmitter	2-100 W 2-50 W (HPD)	ABZ89FC5810B
792-825 MHz	Receiver	N/A	ABZ89FR5811B
935-941 MHz	Transmitter	2-120 W	ABZ89FC5823B
896-902 MHz	Receiver	N/A	ABZ89FR5824B
851-870 MHz	Transmitter	15-150W	ABZ89FC5825B

EU REGULATORY COMPLIANCE

CE mark is available on the GTR 8000 Base Radio (T7039A) and GPW 8000 Receiver (T7540A) in the following frequency ranges: UHF 380-525 MHz and VHF 136-174 MHz. Specifications subject to change without notice.



Motorola Solutions, Inc. 500 West Monroe Street, Chicago, IL 60661 U.S.A. motorolasolutions.com

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Liebert® GXT4™ UPS, 500VA -3000VA

Intelligent, Reliable UPS Protection

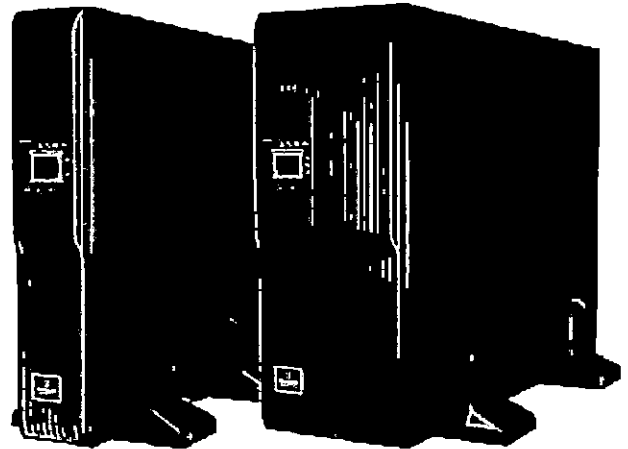
Liebert GXT4 is a true on-line UPS that delivers continuous, high-quality AC power to connected equipment with no interruption when transferring to battery. It provides protection from blackouts, brownouts, sags, surges or noise interference.

For robust UPS protection up to 3kVA, the Liebert GXT4 UPS provides industry leading features in a compact design:

- On-line design means zero transfer time. When utility power fails, your critical load remains supported by a seamless flow of power.
- Highest level of protection available in this capacity range.
- Selectable Eco-Mode allows improved energy efficiency.
- Easy serviceability with replaceable, hot-swappable batteries.
- Controllable power to multiple devices via two independently programmable pairs of outlets.
- ENERGY STAR® qualified models available.
- Intelligent-ready networking.

Ideally suited for:

- Mission critical applications and systems
- Network workstations
- Servers
- Network closets
- Large network peripherals
- VoIP
- PCs



The Liebert GXT4 UPS package includes everything you need for a fast and easy installation:

- UPS
- Tower stands
- Rackmount rails
- Hardware
- CD with software and manuals
- Convenient lifting straps
- Cables and ties



Liebert GXT4 UPS Flexible, Reliable and Low Total Cost Features

The Proven Reliability Of True On-Line Operation With The Features You Need Most

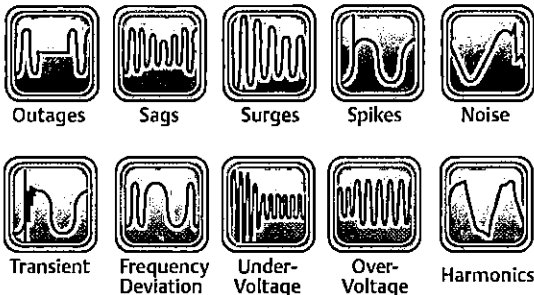
The Liebert® GXT4™ UPS requires just a slim 2U of rack space, but provides the capabilities often found only in larger systems. Get up to 3kVA of capacity and battery backup. External battery cabinets may be added for extended run time.

Liebert GXT4 UPS is a true on-line power source, which means power is always being conditioned and supplied to the connected device(s), whatever the quality of power coming in, a pure sinewave output results to ensure equipment is protected.

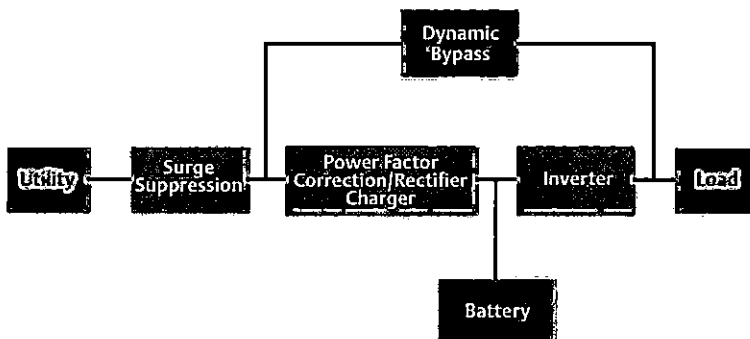
Liebert GXT4 UPS includes:

- Power factor correction
- Internal batteries
- Frequency conversion
- Internal automatic bypass to protect against adverse conditions
- Manual bypass capability
- Support for up to six external battery cabinets

Full Protection from Damaging Power Problems.



On-Line, Double Conversion UPS Protection for Critical Applications



Flexibility:

Two Controllable Outlet Groups

Can be programmed for load shedding and sequential restart if the UPS is in overload or when selected backup time remains.

Rotatable Display Panel

The color LCD display panel rotates 90° to make the readout easy to see in rack or tower installations.

Automatic Frequency Sensing

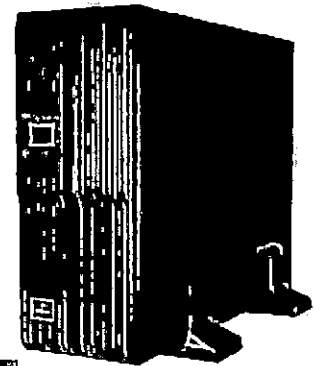
The UPS automatically adjusts to the input frequency, 50Hz or 60Hz, and can also be programmed to convert from one to the other.

Mounting Flexibility

Rack rails and tower supports included.

Intelligent Communications

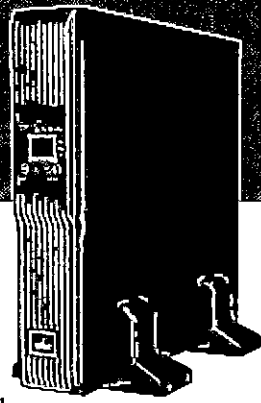
DCIM and BMS ready.



ENERGY STAR®-qualified
UPS models

Power Assurance Package Provides Comprehensive On-site services

- **Five-year protection plan** with 100% parts coverage and 7x24 emergency service.
- **On-Site installation and start-up** to provide pain-free multi-site rollout management and free you from hazardous material disposal in your existing UPS, when applicable.
- **On-site service support** to free up time-strapped IT resources.
- **Preventative Maintenance** to reduce the worry of downtime and ensure rapid recovery.



Liebert® GXT4™ UPS contains internal batteries, and is also able to support up to six external battery cabinets – also 2U size.

High Availability:

Advance Early Warning of UPS System Status
Multiple audible and visual alarms immediately alert you to critical issues.

3-17 minutes of Battery Backup Time at Full load
Provides ample time for an orderly shutdown. Optional matching external battery cabinets offer additional backup time.

Overload Capability
Designed to handle output overload conditions.

Periodic Battery Testing
Provides automatic and manual self-diagnostic battery testing for peace of mind to indicate if the battery is healthy.

Replaceable Hot Swappable Batteries
Easy to replace batteries to protect your investment by extending the product life.

Power-Factor Correction
Prevents noise, harmonics and distortion from being passed on to connected loads or from being fed back to the utility.

Internal Automatic and Manual Bypass Capability
Assures continuity of power to critical loads at all times. Convenient for times of battery maintenance.

Intelligent Battery Management
Includes efficient three-stage charging technique and comprehensive discharging protection that extends battery life.

Input Circuit Breaker
Provides increased protection to ease recovery from overloads.

Lightning and Surge Protection
The transient voltage surge suppression (TVSS) circuitry inside Liebert GXT4 UPS provides additional protection for the connected equipment.

Low Total Cost Of Ownership:

High Output Power Factor
Liebert GXT4 UPS rated output power factor up to 0.9 better matches switch-mode power supplies used in today's IT equipment, providing more efficient utilization of the UPS.

Selectable ECO-Mode
Connected equipment can be powered through the bypass while the inverter remains idle, reducing electricity consumption.

Wide Input Voltage Window
Prolongs battery life by allowing the UPS to maximize the use of utility power before transferring to battery when input voltage exceeds specified limits.

Intelligent Fan Operation
Automatically changes rotation speed depending on system requirements to decrease power consumption and noise.

Warranty Protection
The industry's best warranty – No-hassle two-year warranty with advanced UPS replacement in the event of problems. Shipping is free for both original UPS return and the replacement unit. Optional one-year and three-year extensions also available.

Multiple Choices For Communication, Shutdown And Reporting:

SNMP And Web-Based Communication Options

Liebert IntelliSlot® Web Card provides SNMP (including SNMPv3) and IPv6 and web-based management to your Liebert GXT4 UPS. Provides ability to monitor and control your UPS from your network management system or any PC running Microsoft Internet Explorer.



- Sends both SNMP traps and emails for event notification, and automatically emails a daily UPS history

- Auto-senses 10M/100M Ethernet

The Liebert GXT4 UPS is also fully compatible with:

- Liebert MultiLink™ shutdown software –included with the Liebert GXT4 UPS

- Liebert Nform™ monitoring software

- Liebert Multiport multiplexing unit

- Liebert Intellislot Relay Interface Card

- Liebert SiteScan®

- Trellis™ Platform

- USB Communications

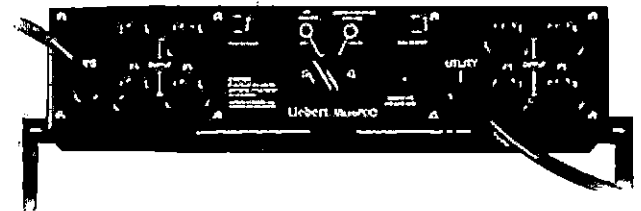
Optional Liebert MicroPOD™ Output Distribution And Maintenance Bypass Module

When your computer system can't be without power, even for scheduled UPS maintenance, the Liebert MicroPOD Maintenance Bypass and Output Distribution Unit ensures continuous uptime. It allows you to manually transfer connected equipment to utility power via a maintenance bypass switch, permitting scheduled service or UPS replacement without the need to shut down connected equipment. Features include:

- 2U height minimizes rack space requirements

- Installs with plug-and-play ease

- Two-year, no-hassle replacement warranty



Liebert MicroPOD

Specifications

Parameters	GXT4-500RT120 (500VA/450W)	GXT4-700RT120 (700VA/630W)	GXT4-1000RT120 (1000VA/900W)
Dimensions, D x W x H, in. (mm)	16.2 x 16.9 x 3.4 (408 x 430 x 85)		
Weight, lb (kg)	40 (18.2)		
Input AC			
Voltage Range (typical)	120VAC nominal; variable based on output load		
Frequency	40Hz ~ 70Hz; Auto Sensing		
Input Power Cord	10 ft. attached w/ NEMA 5-15P plug		
Output AC			
NEMA Output Receptacles	5-15R x 6		
Voltage	110/115/120VAC (user-configurable); ±3%		
Waveform	Sine wave		
Battery			
Type	Valve-regulated, nonspillable, lead acid		
Qty x V x Rating	4 x 12V x 5.0Ah		
Battery Part #	GXT4-5A48BATKIT		
Agency			
Safety	UL 1778, cUL Listed		
RFI/EMI	FCC Class A		
Surge Immunity	IEC 62040-2 2nd Ed		
Transportation	ISTA Procedure 1A		
ENERGY STAR® qualified	No	Yes	Yes

Parameters	GXT4-1500RT120 (1500VA/1350W)	GXT4-2000RT120 (2000VA/1800W)	GXT4-3000RT120 (3000VA/2700W)	GXT4-3000RT208 (3000VA/2700W)
Dimensions, D x W x H, in. (mm)	19.7 x 16.9 x 3.4 (497 x 430 x 85)		23.7 x 16.9 x 3.4 (602 x 430 x 85)	
Weight, lb (kg)	54.6 (24.8)	56.1 (25.5)	71.4 (32.4)	
Input AC				
Voltage Range (typical)	120VAC nominal; variable based on output load			115-280VAC
Frequency	40 - 70Hz; Auto Sensing			
Input Power Cord	10 ft. attached w/ NEMA 5-15P plug	10 ft. attached w/ NEMA 5-20P plug	10 ft. attached w/ NEMA L5-30P plug	10 ft. attached w/ NEMA L6-20P plug
Output AC				
NEMA Output Receptacles	5-15R x 6	5-15/20R x 6	L5-30R x 1 +5-20R x 6	L6-20R x 1 +L6-15R x 2
Voltage	110/115/120VAC (user-configurable); ±3%			208/220/230/240 VAC (user-configurable); ±3%
Waveform	Sine wave			
Battery				
Type	Valve-regulated, nonspillable, lead acid			
Qty x V x Rating	4 x 12V x 9.0Ah		6 x 12V x 9.0Ah	
Battery Part #	GXT4-9A48BATKIT		GXT4-9A72BATKIT	
Agency				
Safety	UL 1778, c-UL Listed			
RFI/EMI	FCC Class A			
Surge Immunity	IEC 62040-2 2nd Ed			
Transportation	ISTA Procedure 1A			
ENERGY STAR® qualified	Yes	Yes	Yes	Yes

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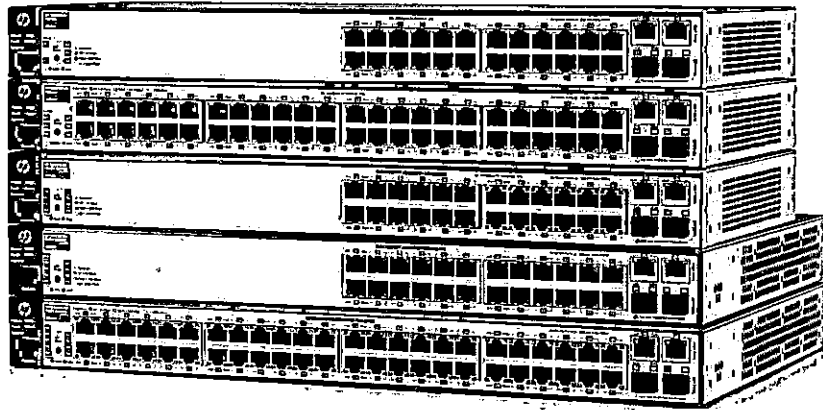
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HPE 2620 Switch Series



Product overview

The HPE 2620 Switch Series consists of five switches with 10/100 connectivity. The HPE 2620-24 Switch has a fan-less design for quiet operation, making it suitable for deployments in open spaces. The models 2620-24-PPoE+, 2620-24-PoE+ models, and 2620-48-PoE+ are IEEE 802.3af- and IEEE 802.3at-compliant switches that provide up to 30 W per powered port. The 2620-48 model has variable-speed fans for quiet operation.

All 2620 switches include two 10/100/1000BASE-T ports and two SFP slots for Gigabit Ethernet uplink connectivity. An optional redundant external power supply is also available to provide redundancy in the event of a power supply failure.

With IPv4/IPv6 static and RIP routing, robust security and management features, as well as a Limited Lifetime Warranty and included software updates, the 2620 Switch Series is a cost-effective solution for those building converged enterprise-edge networks.

A summary of the highlights of the 2620 Switch Series

- Cost-effective access layer switches
- Lite L3 IPv4/IPv6 static and RIP routing
- 30 W PoE+ support on PoE models
- Gigabit fiber uplinks
- Enterprise-class features

Features and benefits

Unified Wired and Wireless

- **New** ClearPass Policy Manager
Supports unified wired and wireless policies using Aruba ClearPass Policy Manager
- Switch auto-configuration
Automatically configures switch for different settings such as VLAN, CoS, PoE max power, and PoE priority when Aruba AP is detected
- **New** User Role
A set of switch-based policies in areas such as security, authentication, and QoS. A User Role can be assigned to a group of users or devices, using switch configuration or ClearPass

Quality of service (QoS)

- L4 prioritization
Enables prioritization based on TCP/UDP port numbers
- Traffic prioritization (IEEE 802.1p)
Allows real-time traffic classification into eight priority levels that are mapped to eight queues
- Class of service (CoS)
Sets the IEEE 802.1p priority tag based on the IP address, IP type of service (ToS), L3 protocol, TCP/UDP port number, source port, and DiffServ
- Rate limiting
Establishes per-port ingress-enforced maximums and per-port, per-queue minimums

Connectivity

- Auto-MDIX
Provides automatic adjustments for straight-through or crossover cables on all 10/100 and 10/100/1000 ports
- IPv6
 - IPv6 host
Allows the switches to be managed and deployed at the edge of an IPv6 network
 - Dual stack (IPv4/IPv6)
Provides a transition mechanism from IPv4 to IPv6; and supports connectivity for both protocols
 - MLD snooping
Forwards IPv6 multicast traffic to the appropriate interface; and helps prevent IPv6 multicast traffic from flooding the network
 - Security
RA Guard, DHCPv6 Protection, Dynamic IPv6 Lockdown
- IEEE 802.3af power over Ethernet (PoE)
Provides up to 15.4 W per port to IEEE 802.3af-compliant PoE-powered devices such as IP phones, wireless access points, and security cameras
- IEEE 802.3at PoE+
Provides up to 30 W per port to IEEE 802.3 for PoE-/PoE+-powered devices such as video IP phones, IEEE 802.11n wireless access points, and advanced pan/tilt/zoom security cameras
- Pre-standard PoE support
Detects and provides power to pre-standard PoE devices (refer to the list of supported devices in the product FAQs, which can be accessed at hpe.com/networking/support)
- Single-IP-address management
Provides single-IP-address management for a virtual stack of up to 16 switches

Resiliency and high availability

- External redundant power supply
Provides high reliability
- IEEE 802.3ad link-aggregation-control protocol (LACP) and HPE port trunking
Support up to 24 trunks, each with up to eight links (ports) per trunk
- Multiple spanning tree protocol (STP) and IEEE 802.1s
Offers high link availability in multiple VLAN environments by allowing multiple spanning trees; and provides legacy support for IEEE 802.1d and IEEE 802.1w
- SmartLink
Provides easy-to-configure link redundancy of active and standby links

Management

- **New** Zero-Touch Provisioning (ZTP)
Uses settings in DHCP to enable ZTP with Aruba AirWave Network Management
- Dual flash images
Provides independent primary and secondary operating system files for backup while upgrading
- Friendly port names
Allows assignment of descriptive names to ports
- Multiple configuration files
Are easily stored with a flash image
- Port mirroring
Enables traffic on a port to be simultaneously sent to a network analyzer for monitoring
- sFlow® (RFC 3176)
Delivers wirespeed traffic accounting and monitoring, configured by the SNMP and CLI with three terminal encrypted receivers
- Remote monitoring (RMON)
Provides advanced monitoring and reporting capabilities for statistics, history, alarms, and events
- Find, fix, and inform
Finds and fixes common network problems automatically, and then informs the administrator
- Comware CLI
 - Comware-compatible CLI
Bridges the experience of HPE Comware CLI users who use the HPE ProVision software CLI
 - Display and fundamental Comware CLI commands
Are embedded in the switch CLI as native commands; display output is formatted as on Comware-based switches and fundamental commands provide a Comware-familiar initial switch setup
 - Configuration Comware CLI commands
Elicit CLI help to formulate the correct ProVision software CLI command
- TR-069 support
Enables zero-touch configuration for switches

L2 switching

- VLANs
Provide support for 512 VLANs and 4,094 VLAN IDs
- Jumbo packet support
Improves the performance of large data transfers; and supports frame sizes up to 9,220 bytes
- IEEE 802.1v protocol VLANs
Isolate select non-IPv4 protocols automatically into their own VLANs
- Per-VLAN spanning tree plus (PVST+)
Allows each VLAN to build a separate spanning tree, improving link bandwidth usage in network environments with multiple VLANs

L3 routing

- Static IP routing
Provides manually configured routing; and includes the ECMP capability
- Routing information protocol (RIP)
Provides RIPv1 and RIPv2 routing

Security

- Access control lists (ACLs)
Provide IP L3 filtering, based on the source/destination IP address/subnet and source/destination TCP/UDP port number
- Source-port filtering
Allows only specified ports to communicate with each other
- RADIUS/TACACS+
Eases switch management security administration by using a password authentication server
- Secure shell
Encrypts all transmitted data for secure remote CLI access over IP networks
- Secure sockets layer (SSL)
Encrypts all HTTP traffic, enabling secure access to the browser-based management GUI in the switch
- Port security
Allows access only to specified MAC addresses, which can be learned or specified by the administrator
- MAC address lockout
Helps prevent certain configured MAC addresses from connecting to the network
- Secure FTP
Allows secure file transfer to and from the switch; and protects against unwanted file downloads or unauthorized copying of a switch configuration file
- Custom banner
Displays the security policy when users log in to the switch
- Identity-driven ACL
Enables implementation of a highly granular and flexible access security policy and VLAN assignment—specific to each authenticated network user

- STP BPDU port protection
Blocks bridge protocol data units (BPDUs) on ports that do not require BPDUs, mitigating forged BPDU attacks
- STP root guard
Protects the root bridge from malicious attacks or configuration mistakes
- DHCP protection
Blocks DHCP packets from unauthorized DHCP servers, mitigating denial-of-service attacks
- Dynamic ARP protection
Blocks ARP broadcasts from unauthorized hosts, helping prevent eavesdropping or theft of network data
- Multiple user authentication methods
 - IEEE 802.1X
Uses an IEEE 802.1X supplicant on the client, in conjunction with a RADIUS server, to authenticate in accordance with industry standards
 - Web-based authentication
Provides a browser-based environment, similar to IEEE 802.1X, to authenticate clients that do not support the IEEE 802.1X supplicant
 - MAC-based authentication
Authenticates the client with the RADIUS server, based on the client's MAC address
- Authentication flexibility
 - Multiple IEEE 802.1X users per port
Enables authentication of multiple IEEE 802.1X users per port; and helps prevent a user from “piggybacking” on another user's IEEE 802.1X authentication
 - Concurrent IEEE 802.1X, Web, and MAC authentication schemes per port
Allows a switch port to accept up to 32 sessions of IEEE 802.1X, Web, and MAC authentications
- Port mirroring for network threats
Provides sampled port traffic, using sFlow technology, to the HPE Network Immunity Manager application for network behavior anomaly detection analysis—to detect and mitigate threats at the ports where the threats originate
- Per-port broadcast throttling
Selectively configures broadcast control on heavy traffic port uplinks

Convergence

- IP multicast snooping (data-driven IGMP)
Mitigates flooding of IP multicast traffic automatically
- Media endpoint discovery (MED) enabled by the link-layer discovery protocol (LLDP)
Defines a standard extension of LLDP that stores values for parameters such as QoS and VLAN to automatically configure network devices such as IP phones
- IEEE 802.1ab LLDP
Facilitates easy mapping, using network management applications with the LLDP automated device discovery protocol

- PoE and PoE+ allocations
Support multiple methods—automatic, IEEE 802.3at dynamic, LLDP-MED fine grain, IEEE 802.3af device class, or user specified—to allocate and manage PoE/PoE+ power for more efficient energy use
- LLDP-CDP compatibility
Receives and recognizes CDP packets from Cisco's IP phones for seamless interoperation
- Local MAC Authentication
Assigns attributes such as VLAN and QoS using locally configured profile that can be a list of MAC prefixes Unified Wired and Wireless
- HTTP redirect function
Supports HPE Intelligent Management Center (IMC) bring your own device (BYOD) solution

Monitor and diagnostics

- Port mirroring
Enables traffic on a port to be simultaneously sent to a network analyzer for monitoring
- Software updates
Are offered as free downloads from the Web

Flexibility

- Quiet operation
 - Fan-less design (2620-24 switch)
Enables quiet operation for deployment in open spaces
 - Variable-speed fans (2620-24-PPoE+, 2620-24-PoE+, 2620-48, and 2620-48-PoE+ switches)
Improve fan speed for the operating environment, while keeping noise and energy consumption levels to a minimum
- Flexible mounting
 - Rack mountable
Allows the switch to be mounted on a standard 19-inch rack, with the hardware included
 - Surface mountable
Allows the switch to be mounted above or below a surface (such as a desk or table), using the hardware included

Warranty and support

- Limited Lifetime Warranty:
See hpe.com/networking/warrantysummary for warranty and support information included with your product purchase
- Software releases
To find software for your product, visit hpe.com/networking/support; for details on the software releases available with your product purchase, visit hpe.com/networking/warrantysummary

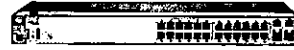


HPE 2620 Switch Series

Specifications



HPE 2620-24 Switch (J9623A)



HPE 2620-24-PPoE+ Switch (J9624A)



HPE 2620-24-PoE+ Switch (J9625A)

	HPE 2620-24 Switch (J9623A)	HPE 2620-24-PPoE+ Switch (J9624A)	HPE 2620-24-PoE+ Switch (J9625A)
Ports	<p>24 autosensing 10/100 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX); Media Type: Auto-MDIX; Duplex: half or full</p> <p>1 RJ-45 serial console port</p> <p>2 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only</p> <p>2 open mini-GBIC (SFP) slots</p>	<p>12 RJ-45 autosensing 10/100 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX); Media Type: Auto-MDIX; Duplex: half or full</p> <p>12 RJ-45 autosensing 10/100 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3at PoE+); Duplex: half or full</p> <p>1 RJ-45 serial console port</p> <p>2 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only</p> <p>2 open mini-GBIC (SFP) slots</p>	<p>24 RJ-45 autosensing 10/100 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3at PoE+); Media Type: Auto-MDIX; Duplex: half or full</p> <p>1 RJ-45 serial console port</p> <p>2 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only</p> <p>2 open mini-GBIC (SFP) slots</p>
Physical characteristics			
Dimensions	17.44(w) x 10(d) x 1.73(h) in (44.3 x 25.4 x 4.39 cm) (1U height)	17.44(w) x 10(d) x 1.73(h) in (44.3 x 25.4 x 4.39 cm) (1U height)	17.44(w) x 14.5(d) x 1.73(h) in (44.3 x 36.83 x 4.39 cm) (1U height)
Weight	5.71 lb (2.59 kg), Fully loaded	7.03 lb (3.19 kg)	10.67 lb (4.84 kg), Fully loaded
Memory and processor			
Processor	Power PC FreeScale 8313 @ 400 MHz, 512 MB flash, 512 MB SDRAM, 4 MB flash ROM; packet buffer size: 1 MB	Power PC FreeScale 8313 @ 400 MHz, 512 MB flash, 512 MB SDRAM, 4 MB flash ROM; packet buffer size: 1 MB	Power PC FreeScale 8313 @ 400 MHz, 512 MB flash, 512 MB SDRAM, 4 MB flash ROM; packet buffer size: 1 MB
Mounting	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); horizontal surface mounting only	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); horizontal surface mounting only	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); horizontal surface mounting only
Performance			
100 Mb Latency	IPv6 Ready Certified < 8.3 μs (LIFO 64-byte packets)	IPv6 Ready Certified < 8.3 μs (LIFO 64-byte packets)	IPv6 Ready Certified < 8.3 μs (LIFO)
1000 Mb Latency	< 2.9 μs (LIFO 64-byte packets)	< 2.9 μs (LIFO 64-byte packets)	< 2.9 μs (LIFO)
Throughput	up to 9.5 million pps	up to 9.5 million pps	up to 9.5 million pps
Routing/Switching capacity	12.8 Gbps	12.8 Gbps	12.8 Gbps
MAC address table size	16000 entries	16000 entries	16000 entries
Environment			
Operating temperature	32°F to 131°F (0°C to 55°C)	32°F to 131°F (0°C to 55°C)	32°F to 131°F (0°C to 55°C)
Operating relative humidity	15% to 95%, noncondensing	15% to 95%, noncondensing	15% to 95%, noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 90%, noncondensing	15% to 90%, noncondensing	15% to 90%, noncondensing
Altitude	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)
Acoustic	Power: 0 dB, Pressure: 0 dB No Fan	Power: 37.1 dB, Pressure: 25.9 dB	Power: 34.0 dB, Pressure: 29.7 dB

HPE 2620 Switch Series

Specifications (Continued)

	HPE 2620-24 Switch (J9623A)	HPE 2620-24-PPoE+ Switch (J9624A)	HPE 2620-24-PoE+ Switch (J9625A)
Electrical characteristics			
Frequency	Achieved Miercom Certified Green Award 50/60 Hz	Achieved Miercom Certified Green Award 50/60 Hz	Achieved Miercom Certified Green Award 50/60 Hz
Maximum heat dissipation	95 BTU/hr (100.23 kJ/hr)	177 BTU/hr (186.74 kJ/hr), (switch only: 177 BTU/hr; combined switch + max. PoE devices: 679 BTU/hr)	270 BTU/hr (284.85 kJ/hr), (switch only: 270 BTU/hr; combined switch + max. PoE devices: 1751 BTU/hr)
Voltage	100-127/200-240 VAC	100-127/200-240 VAC	100-127/200-240 VAC
Current	0.43 A/0.27 A	1.8 A/0.97 A	4.9 A/2.5 A
Maximum power rating	28 W	38.5 W	39.5 W
Idle power	13.3 W	22.0 W	22.8 W
PoE power	0 W	128 W	382 W
Notes	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated. PoE power is the power supplied by the internal power supply. It is dependent on the type and quantity of power supplies and may be supplemented with the use of an external power supply (EPS)	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated. PoE power is the power supplied by the internal power supply. It is dependent on the type and quantity of power supplies and may be supplemented with the use of an external power supply (EPS)	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated. PoE power is the power supplied by the internal power supply. It is dependent on the type and quantity of power supplies and may be supplemented with the use of an external power supply (EPS)
Safety	EN 60950/IEC 60950; CAN/CSA 22.2 No. 60950; EN 60825; UL 60950	EN 60950/IEC 60950; CAN/CSA 22.2 No. 60950; EN 60825; UL 60950	EN 60950/IEC 60950; CAN/CSA 22.2 No. 60950; EN 60825; UL 60950
Processor	Power PC FreeScale 8313 @ 400 MHz, 512 MB flash, 512 MB SDRAM, 4 MB flash ROM; packet buffer size: 1 MB	Power PC FreeScale 8313 @ 400 MHz, 512 MB flash, 512 MB SDRAM, 4 MB flash ROM; packet buffer size: 1 MB	Power PC FreeScale 8313 @ 400 MHz, 512 MB flash, 512 MB SDRAM, 4 MB flash ROM; packet buffer size: 1 MB
Emissions	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A
Immunity	EN 55024, CISPR 24	EN 55024, CISPR 24	EN 55024, CISPR 24
EN	IEC 61000-4-2	IEC 61000-4-2	IEC 61000-4-2
ESD	IEC 61000-4-3	IEC 61000-4-3	IEC 61000-4-3
Radiated	IEC 61000-4-4	IEC 61000-4-4	IEC 61000-4-4
EFT/Burst	IEC 61000-4-5	IEC 61000-4-5	IEC 61000-4-5
Surge	IEC 61000-4-6	IEC 61000-4-6	IEC 61000-4-6
Conducted	IEC 61000-4-8	IEC 61000-4-8	IEC 61000-4-8
Power frequency magnetic field	IEC 61000-4-11	IEC 61000-4-11	IEC 61000-4-11
Voltage dips and interruptions	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Harmonics	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Flicker			
Management	Command-line interface; Web browser; AirWave Network Management	Command-line interface; Web browser; AirWave Network Management	Command-line interface; Web browser; AirWave Network Management
Services	Refer to the Hewlett Packard Enterprise website at hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.


HPE 2620 Switch Series
Specifications (Continued)**HPE 2620-48 Switch (J9626A)****HPE 2620-48-POE+ Switch (J9627A)**

Ports	<p>48 autosensing 10/100 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX); Media Type: Auto-MDIX; Duplex: half or full</p> <p>1 RJ-45 serial console port 2 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only 2 open mini-GBIC (SFP) slots</p>	<p>48 RJ-45 autosensing 10/100 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3at PoE+); Media Type: Auto-MDIX; Duplex: half or full 1 RJ-45 serial console port 2 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only 2 open mini-GBIC (SFP) slots</p>
Physical characteristics		
Dimensions	17.44(w) x 10(d) x 1.73(h) in (44.3 x 25.4 x 4.39 cm) (1U height)	17.44(w) x 14.5(d) x 1.73(h) in (44.3 x 36.83 x 4.39 cm) (1U height)
Weight	6.48 lb (2.94 kg), Fully loaded	11.53 lb (5.23 kg), Fully loaded
Memory and processor		
Processor	Power PC FreeScale 8313 @ 400 MHz, 512 MB flash, 512 MB SDRAM, 4 MB flash ROM; packet buffer size: 2 MB	Power PC FreeScale 8313 @ 400 MHz, 512 MB flash, 512 MB SDRAM, 4 MB flash ROM; packet buffer size: 2 MB
Mounting		
	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); horizontal surface mounting only	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); horizontal surface mounting only
Performance		
100 Mb Latency	IPv6 Ready Certified < 8.3 μs (LIFO)	IPv6 Ready Certified < 8.3 μs (LIFO)
1000 Mb Latency	< 2.9 μs (LIFO)	< 2.9 μs (LIFO)
Throughput	up to 13.0 million pps	up to 13.0 million pps
Routing/Switching capacity	17.6 Gbps	17.6 Gbps
MAC address table size	16000 entries	16000 entries
Environment		
Operating temperature	32°F to 131°F (0°C to 55°C)	32°F to 131°F (0°C to 55°C)
Operating relative humidity	15% to 95%, noncondensing	15% to 95%, noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 90%, noncondensing	15% to 90%, noncondensing
Altitude	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)
Acoustic	Power: 36.5 dB, Pressure: 24.5 dB	Power: 34.0 dB, Pressure: 25.3 dB

HPE 2620 Switch Series

Specifications (Continued)

	HPE 2620-48 Switch (J9626A)	HPE 2620-48-POE+ Switch (J9627A)
Electrical characteristics		
Frequency	Achieved Miercom Certified Green Award 50/60 Hz	Achieved Miercom Certified Green Award 50/60 Hz
Maximum heat dissipation	148 BTU/hr (156.14 kJ/hr)	325 BTU/hr (342.88 kJ/hr), (switch only: 325 BTU/hr; combined switch + max. PoE devices: 1833 BTU/hr)
Voltage	100-127/200-240 VAC	100-127/200-240 VAC
Current	0.68 A/0.39 A	5.6 A/2.8 A
Maximum power rating	43.5 W	54.9 W
Idle power	19.4 W	29.6 W
PoE power		382 W
Notes	Idle power is the actual power consumption of the device with no ports connected Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated	Idle power is the actual power consumption of the device with no ports connected Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated PoE power is the power supplied by the internal power supply. It is dependent on the type and quantity of power supplies and may be supplemented with the use of an external power supply (EPS)
Safety	EN 60950/IEC 60950; CAN/CSA 22.2 No. 60950; EN 60825; UL 60950	EN 60950/IEC 60950; CAN/CSA 22.2 No. 60950; EN 60825; UL 60950
Emissions	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A
Immunity		
EN	EN 55024, CISPR 24	EN 55024, CISPR 24
ESD	IEC 61000-4-2	IEC 61000-4-2
Radiated	IEC 61000-4-3	IEC 61000-4-3
EFT/Burst	IEC 61000-4-4	IEC 61000-4-4
Surge	IEC 61000-4-5	IEC 61000-4-5
Conducted	IEC 61000-4-6	IEC 61000-4-6
Power frequency magnetic field	IEC 61000-4-8	IEC 61000-4-8
Voltage dips and interruptions	IEC 61000-4-11	IEC 61000-4-11
Harmonics	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Management	Command-line interface; Web browser; AirWave Network Management	Command-line interface; Web browser; AirWave Network Management
Services	Refer to the Hewlett Packard Enterprise website at hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office	Refer to the Hewlett Packard Enterprise website at hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office

HPE 2620 Switch Series

Specifications (Continued)

	HPE 2620-48 Switch (J9626A)		HPE 2620-48-PoE+ Switch (J9627A)
Standards and Protocols (applies to all products in series)	<p>Device management</p> <p>RFC 1591 DNS (client)</p> <p>HTML and telnet management</p> <p>RFC 2576 (Coexistence between SNMP V1, V2, V3)</p> <p>RFC 2579 (SMIPv2 Text Conventions)</p> <p>RFC 2580 (SMIPv2 Conformance)</p> <p>RFC 3416 (SNMP Protocol Operations v2)</p> <p>RFC 3417 (SNMP Transport Mappings)</p> <p>General protocols</p> <p>IEEE 802.1D MAC Bridges</p> <p>IEEE 802.1p Priority</p> <p>IEEE 802.1Q VLANs</p> <p>IEEE 802.1s Multiple Spanning Trees</p> <p>IEEE 802.1v VLAN classification by Protocol and Port</p> <p>IEEE 802.1w Rapid Reconfiguration of Spanning Tree</p> <p>IEEE 802.3ad LACP</p> <p>IEEE 802.3x Flow Control</p> <p>RFC 768 UDP</p> <p>RFC 783 TFTP Protocol (revision 2)</p> <p>RFC 792 ICMP</p> <p>RFC 793 TCP</p> <p>RFC 826 ARP</p> <p>RFC 854 TELNET</p> <p>RFC 868 Time Protocol</p> <p>RFC 951 BOOTP</p> <p>RFC 1058 RIPv1</p> <p>RFC 1350 TFTP Protocol (revision 2)</p> <p>RFC 1542 BOOTP Extensions</p> <p>RFC 1918 Address Allocation for Private Internet</p> <p>RFC 2030 Simple Network Time Protocol (SNTP) v4</p> <p>RFC 2131 DHCP</p> <p>RFC 2453 RIPv2</p> <p>RFC 3046 DHCP Relay Agent Information Option</p> <p>RFC 3575 IANA Considerations for RADIUS</p> <p>RFC 5905 NTP Client</p> <p>IP multicast</p> <p>RFC 3376 IGMPv3</p>	<p>IPv6</p> <p>RFC 1981 IPv6 Path MTU Discovery</p> <p>RFC 2460 IPv6 Specification</p> <p>RFC 2464 Transmission of IPv6 over Ethernet Networks</p> <p>RFC 2710 Multicast Listener Discovery (MLD) for IPv6</p> <p>RFC 2925 Remote Operations MIB (Ping only)</p> <p>RFC 3019 MLDv1 MIB</p> <p>RFC 3315 DHCPv6 (client only)</p> <p>RFC 3484 Default Address Selection for IPv6</p> <p>RFC 3513 IPv6 Addressing Architecture</p> <p>RFC 3596 DNS Extension for IPv6</p> <p>RFC 3810 Multicast Listener Discovery Version 2 (MLDv2) for IPv6</p> <p>RFC 4022 MIB for TCP</p> <p>RFC 4113 MIB for UDP</p> <p>RFC 4251 SSHv6 Architecture</p> <p>RFC 4252 SSHv6 Authentication</p> <p>RFC 4253 SSHv6 Transport Layer</p> <p>RFC 4254 SSHv6 Connection</p> <p>RFC 4291 IP Version 6 Addressing Architecture</p> <p>RFC 4293 MIB for IP</p> <p>RFC 4419 Key Exchange for SSH</p> <p>RFC 4443 ICMPv6</p> <p>RFC 4541 IGMP & MLD Snooping Switch</p> <p>RFC 4861 IPv6 Neighbor Discovery</p> <p>RFC 4862 IPv6 Stateless Address Auto-configuration</p> <p>MIBs</p> <p>RFC 1155 Structure & ID of Mgmt Info for TCP/IP Internet</p> <p>RFC 1213 MIB II</p> <p>RFC 1493 Bridge MIB</p> <p>RFC 1724 RIPv2 MIB</p> <p>RFC 2021 RMONv2 MIB</p> <p>RFC 2096 IP Forwarding Table MIB</p> <p>RFC 2578 Structure of Management Information Version 2 (SMIPv2)</p> <p>RFC 2613 SMON MIB</p> <p>RFC 2618 RADIUS Client MIB</p> <p>RFC 2620 RADIUS Accounting MIB</p> <p>RFC 2665 Ethernet-Like-MIB</p> <p>RFC 2668 802.3 MAU MIB</p> <p>RFC 2674 802.1p and IEEE 802.1Q Bridge MIB</p> <p>RFC 2737 Entity MIB (Version 2)</p> <p>RFC 2863 The Interfaces Group MIB</p> <p>RFC 2925 Ping MIB</p> <p>RFC 4836 Managed Objects for 802.3 Medium Attachment Units (MAU)</p>	<p>Network management</p> <p>IEEE 802.1AB LLDP</p> <p>RFC 2819 Four groups of RMON: 1 (statistics), 2 (history), 3 (alarm), and 9 (events)</p> <p>RFC 3176 sFlow</p> <p>RFC 5424 Syslog Protocol</p> <p>ANSI/TIA-1057 LLDP-MED</p> <p>SNMPv1/v2c/v3</p> <p>XRMON</p> <p>QoS/CoS</p> <p>RFC 2474 DiffServ Precedence, including 8 queues/port</p> <p>RFC 2597 DiffServ Assured Forwarding (AF)</p> <p>RFC 2598 DiffServ Expedited Forwarding (EF)</p> <p>Ingress Rate Limiting</p> <p>Security</p> <p>IEEE 802.1X Port Based Network Access Control</p> <p>RFC 1492 TACACS+</p> <p>RFC 2138 RADIUS Authentication</p> <p>RFC 2866 RADIUS Accounting</p> <p>SSL</p> <p>Network management</p> <p>IEEE 802.1AB LLDP</p> <p>RFC 2819 Four groups of RMON: 1 (statistics), 2 (history), 3 (alarm), and 9 (events)</p> <p>RFC 3176 sFlow</p> <p>RFC 3411 SNMP Management Frameworks</p> <p>RFC 3412 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)</p> <p>RFC 3413 Simple Network Management Protocol (SNMP) Applications</p> <p>RFC 3414 User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)</p> <p>RFC 3415 View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)</p> <p>RFC 3418 Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)</p> <p>RFC 5424 Syslog Protocol</p> <p>ANSI/TIA-1057 LLDP-MED</p> <p>SNMPv1/v2c/v3</p> <p>XRMON</p> <p>QoS/CoS</p> <p>RFC 2474 DiffServ Precedence, including 8 queues/port</p> <p>RFC 2475 DiffServ Architecture</p> <p>RFC 2597 DiffServ Assured Forwarding (AF)</p> <p>RFC 2598 DiffServ Expedited Forwarding (EF)</p> <p>Ingress Rate Limiting</p> <p>Security</p> <p>IEEE 802.1X Port Based Network Access Control</p> <p>RFC 1492 TACACS+</p> <p>RFC 2138 RADIUS Authentication</p> <p>RFC 2866 RADIUS Accounting</p> <p>SSL</p>

HPE 2620 Switch Series accessories

Transceivers	<p>HPE X121 1G SFP LC SX Transceiver (J4858C) HPE X121 1G SFP LC LX Transceiver (J4859C) HPE X121 1G SFP LC LH Transceiver (J4860C) HPE X121 1G SFP RJ45 T Transceiver (J8177C) HPE X111 100M SFP LC FX Transceiver (J9054C) HPE X122 1G SFP LC BX-D Transceiver (J9142B) HPE X122 1G SFP LC BX-U Transceiver (J9143B)</p>
Cables	<p>HPE 0.5 m Multimode OM3 LC/LC Optical Cable (AJ833A) HPE 1 m Multimode OM3 LC/LC Optical Cable (AJ834A) HPE 2 m Multimode OM3 LC/LC Optical Cable (AJ835A) HPE 5 m Multimode OM3 LC/LC Optical Cable (AJ836A) HPE 15 m Multimode OM3 LC/LC Optical Cable (AJ837A) HPE 30 m Multimode OM3 LC/LC Optical Cable (AJ838A) HPE 50 m Multimode OM3 LC/LC Optical Cable (AJ839A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 1m Cable (QK732A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 2m Cable (QK733A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 5m Cable (QK734A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 15m Cable (QK735A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 30m Cable (QK736A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 50m Cable (QK737A)</p>
Mounting Kit	HPE X410 1U Universal 4-post Rack Mounting Kit (J9583A)
HPE 2620-24 Switch (J9623A)	HPE 600 Redundant and External Power Supply (J8168A)
HPE 2620-24-PPoE+ Switch (J9624A)	HPE 600 Redundant and External Power Supply (J8168A)
HPE 2620-24-PoE+ Switch (J9625A)	<p>HPE 620 Redundant/External Power Supply (J8696A) HPE 630 Redundant and/or External Power Supply (J9443A)</p>
HPE 2620-48 Switch (J9626A)	HPE 600 Redundant and External Power Supply (J8168A)
HPE 2620-48-PoE+ Switch (J9627A)	<p>HPE 630 Redundant and/or External Power Supply (J9443A) HPE 620 Redundant/External Power Supply (J8696A)</p>



Products within this series have achieved sufficient scores in each of the rated criteria to achieve the Miercom Certified Green distinction Award. See the Specifications section of this series for more information.

Products within this series are IPv6 Ready certified. See the Specifications section of this series for more information.



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4AA3-7117ENW, June 2016, Rev. 4

SECTION 10

CONTRACTUAL DOCUMENTATION

Contractual Documentation is included on the following pages.



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SYSTEM PURCHASE AGREEMENT (Radio Systems)

THIS AGREEMENT ("Agreement") is made and entered into this 15TH day of NOVEMBER, by and between Motorola Solutions, Inc., a Delaware corporation duly authorized to conduct business in the State of Texas ("Motorola" or "Seller") and _____, a body corporate and politic ("Purchaser").
UPSHUR COUNTY TEXAS

WITNESSETH:

WHEREAS, the Purchaser desires to purchase a Communications System; and

WHEREAS, Motorola desires to sell a Communications System to Purchaser; and

WHEREAS, Houston-Galveston Area Council ("H-GAC"), acting as the agent for various local governmental entities who are "End Users" under interlocal agreements (including the Purchaser) has solicited proposals for radio communications equipment and conducted discussions with Motorola concerning its proposal and, where applicable, in accordance with the competitive procurement procedures of Texas law; and

WHEREAS, H-GAC and Motorola entered into that certain Contract dated as of May 1, 2018 (the "Contract"), which provided that End Users may purchase radio communications equipment from Motorola pursuant to certain terms contained therein; and

WHEREAS, pursuant to Article 6 of the Contract, Motorola and Purchaser now wish to enter into this System Purchase Agreement to delineate the specific terms of the purchase of radio communications equipment from Motorola by the Purchaser.

THEREFORE, the parties hereby enter into an agreement pursuant to which Motorola shall perform the work and furnish the equipment and services as more fully set forth herein and in the following exhibits, which are either attached hereto or incorporated by reference and hereby made a part of this Agreement:

- Exhibit A General Provisions.
- Exhibit B Motorola Software License Agreement.
- Exhibit C Technical and Implementation Documents, consisting of: _____
all dated _____.
- Exhibit D Motorola/H-GAC Contract dated May 1, 2018.
- Exhibit E Warranty and Maintenance Plan and Service Terms and Conditions (if applicable).

NOW, THEREFORE, for and in consideration of the mutual promises and covenants contained herein, the parties agree as follows:

Section 1 SCOPE OF WORK

A. Motorola shall furnish all of the equipment and software as outlined in Exhibit C and provide the tools, supplies, labor and supervision necessary for the installation of the items purchased in accordance with Exhibit C.

B. In addition to responsibilities described in the Statement of Work, Purchaser shall perform the following coincident with the performance of this Agreement:

- (1) Provide a designated Project Director.
- (2) Provide ingress and egress to Purchaser's facilities and/or sites as requested by Motorola and have such facilities available for installation of the equipment to be installed.
- (3) Provide adequate telephone or other communications lines (including modem access and adequate interfacing networking capabilities) for the installation, operation and support of the equipment.
- (4) Provide adequate space, air conditioning and other environmental conditions, and adequate and appropriate electrical power outlets, distribution, equipment and connections for the installation, operation and support of the equipment.
- (5) Provide a designated work area with adequate heat and light, and a secure storage area for equipment delivered to the Purchaser. The Purchaser shall be solely liable for loss or damage to equipment prior to, during and following installation when such equipment is on or within Purchaser's facilities and/or vehicles.

Section 2 SITES

This Agreement is predicated on the utilization of sites and site configurations, which have been selected either by the Purchaser or by Motorola and set forth in Exhibit C. In either situation, should it be determined by either Motorola or Purchaser during the course of performance on this Agreement that the sites or configuration selected are no longer available or desired, new or replacement sites or configuration will be selected and approved by both Motorola and the Purchaser. If any price or schedule adjustments are necessary as a result of these new or replacement sites, such adjustments will be added to this Agreement by change order in accordance with Section 4 of the General Provisions.

Section 3 SUBSURFACE/STRUCTURAL CONDITIONS

This Agreement is predicated upon normal soil conditions defined by E.I.A. standard RS-222 (latest revision). Should Motorola encounter subsurface, structural, adverse environmental and/or latent conditions at any site differing from those indicated on the specifications, or as used in the preparation of the bid price, the Purchaser will be given immediate notice of such conditions before they are further disturbed. Thereupon, Motorola and the Purchaser shall

promptly investigate the conditions and, if found to be different, will adjust the plans and/or specifications as may be necessary. Any changes that cause an adjustment in the contract price or in time required for the performance of any part of the contract shall result in a contract modification in accordance with Section 4 of the General Provisions.

Section 4 PERIOD OF PERFORMANCE

A. Motorola projects that it will be able to obtain final acceptance and completion of the Acceptance Test Plan within the time interval specified in Exhibit C (if applicable). A more detailed timeline shall be provided to Purchaser after the design review and customer kick-off meeting.

B. Whenever a party knows or reasonably should know that any actual or potential condition due to circumstances beyond its control is delaying or threatens to delay the timely performance of the work, the party shall within thirty (30) days give the other party notice thereof and may request an extension of time to perform the work.

C. In order to successfully integrate and implement this project, shipments will be made F.O.B. Destination to Purchaser facilities, local Motorola staging facilities, warehousing facilities, or any combination thereof. It is agreed that this plan is acceptable to Purchaser and that Motorola will advise prior to shipment of actual destination and that Purchaser will accept shipment, and make payment as required by this Agreement.

D. It is also agreed that equipment shipping dates reflected in this Agreement are estimates only, and that shipment may be made at any time prior to, or subsequent to these estimated shipping dates.

Section 5 ACCEPTANCE CRITERIA

A. Motorola will test the Communications System in accordance with the Acceptance Test Plan. System acceptance will occur upon the successful completion of such testing ("System Acceptance") at which time both parties shall promptly execute a certificate of system acceptance. If the Acceptance Test Plan includes separate tests for individual subsystems or phases of the System, both parties shall promptly execute certificates of subsystem acceptance upon the successful completion of testing of such subsystems or phases. Minor omissions or variances in performance which do not materially affect the operation of the Communications System as a whole will not postpone System Acceptance. Purchaser and Motorola will jointly prepare a list of such omissions and variances which Motorola will correct according to an agreed upon schedule.

B. Motorola agrees to notify Purchaser when the Communications System is ready for acceptance testing. Motorola and Purchaser agree to commence acceptance testing within ten (10) business days after receiving such notification. If testing is delayed for reasons within the control of Purchaser or its employees, contractors, agents or consultants for more than ten (10) business days after notification, final payment will be due within thirty (30) days after such notification and the Warranty Period will commence immediately.

C. Motorola may, but is not obligated to, issue written authorization for Purchaser to use the Communications System or its subsystem(s) for limited training or testing purposes, prior to the completion of testing by Motorola. Any use of the Communications System without prior written authorization by Motorola shall constitute System Acceptance.

Section 6 PAYMENT SCHEDULE

A. Motorola agrees to sell all of the equipment and perform the services as outlined in the Scope of Work, and Purchaser agrees to buy the aforementioned equipment and services for the sum of _____ (\$ 337,495.00), which includes the H-GAC administration fee. The final price may be adjusted by change orders approved pursuant to Statement of Work attached hereto as Exhibit "C".

B. Payments to Motorola shall be made according to the following milestones:

1. 20% of the total contract price is due when Purchaser executes this Agreement;
2. 60% of the total contract price will be invoiced immediately after the Equipment is shipped from Motorola's facilities;
3. 10% of the total contract price will be invoiced immediately after the Equipment is installed at the sites specified in the Exhibits; and
4. 10% of the total contract price will be invoiced immediately after System Acceptance.

Motorola reserves the right to make partial shipments of equipment and to request payment upon shipment of such equipment. In addition, Motorola reserves the right to invoice for installations or civil work completed on a site-by-site basis, when applicable.

C. In the event of failure or delay by the Purchaser in providing sites, space, approvals, licenses, or any other Purchaser obligations required preceding delivery of Motorola equipment, it is agreed that Motorola, at its sole discretion, may ship equipment as planned and that the Purchaser will accept the equipment and make payment in accordance with the terms of this Agreement. Any additional costs incurred by Motorola for storage of equipment will be invoiced and paid by Purchaser.

D. Payments to Motorola shall be made as follows:

- (i) Motorola shall immediately forward an invoice for the payment requested in Section 6(B) above to Purchaser.
- (ii) Purchaser shall pay the Motorola invoice within thirty (30) calendar days of receipt.

E. Motorola will pay H-GAC's administrative fee in accordance with the payment terms of Motorola/H-GAC Contract dated May 1, 2018.

F. TERM. Unless terminated in accordance with other provisions of this Agreement or extended by mutual agreement of the Parties, the term of this Agreement begins on the date as set forth above and continues until the date of Final Project Acceptance or expiration of the Warranty Period, whichever occurs last.

Section 7 PROJECT MANAGEMENT

A. If the size or complexity of the project warrants, Motorola will assign a Project Manager, who is authorized to exercise technical direction of this project. Motorola, at any time, may designate a new or alternate Project Manager with written notice to Purchaser and H-GAC.

B. All matters affecting the terms of this Agreement or the administration thereof shall be referred to Motorola's cognizant Contract Administrator who shall have authority to negotiate changes in or amendments to this Agreement.

Section 8 NOTICE ADDRESSES

A. Motorola Solutions, Inc.
500 W. Monroe Street, 43rd Floor
Chicago, IL 60661
Attn.: Law Department

B.

C. Houston-Galveston Area Council
3555 Timmons Lane, Suite 120
Houston, Texas 77027
Attn.: Public Services Manager

Section 9 ORDER OF PRECEDENCE

In the event of an inconsistency in this Agreement, the inconsistency shall be resolved in the following order:

The main body of this Agreement.

Exhibit A General Provisions.

Exhibit B Motorola Software License.

- Exhibit C Technical and Implementation Documents, consisting of: _____.
- Exhibit E Warranty and Maintenance Plan and Service Terms and Conditions (if applicable)
- Exhibit D Motorola/H-GAC Contract dated May 1, 2018.

Section 10 DISPUTES

Motorola and the Purchaser will attempt to settle any claim or controversy arising out of this Agreement through consultation and negotiation in good faith and a spirit of mutual cooperation. If those attempts fail, then the dispute will be mediated by a mutually acceptable mediator to be chosen by Motorola and the Purchaser within thirty (30) days after written notice by one of the parties demanding non-binding mediation. Neither party may unreasonably withhold consent to the selection of a mediator. Motorola and the Purchaser will bear their own costs but will share the cost of the mediator equally. By mutual agreement, however, Motorola and Purchaser may postpone mediation until both parties have completed some specified but limited discovery about the dispute. The parties may also agree to replace mediation with some other form of non-binding alternate dispute resolution procedure (“ADR”).

Any dispute which cannot be resolved between the parties through negotiation or mediation within two (2) months of the date of the initial demand for it by one of the parties may then be submitted to a court of competent jurisdiction in Texas. Both Motorola and Purchaser consent to jurisdiction over it by such a court. All communications pursuant to the negotiation and mediation will be treated as compromise and settlement negotiations for purposes of applicable rules of evidence and any additional confidentiality protections provided by applicable law. The use of any ADR procedures will not be considered under the doctrine of laches, waiver or estoppel to affect adversely the rights of either party. Nothing shall prevent either of the parties from resorting to the judicial proceedings mentioned in this paragraph if (a) good faith efforts to attempt resolution of the dispute under these procedures have been unsuccessful or (b) interim relief from the court is necessary to prevent serious and irreparable injury to one of the parties or others.

Section 11 SEVERABILITY

If any portion of this Agreement or any exhibits hereto is held to be invalid, such provision or portion of such provision shall be considered severable, and the remainder of this Agreement shall not be affected.

Section 12 HEADINGS AND SECTION REFERENCES

The headings given to the paragraphs are inserted for convenience only and are in no way to be construed as part of this Agreement or as a limitation of the scope of the particular paragraph to which the heading refers.

Section 13 SURVIVAL OF TERMS

The following provisions will survive the expiration or termination of this Agreement for any reason: Section 6 (Payment Schedule) if any payment obligations exist; Section 9 (Order of Precedence); Section 10 (Disputes); Section 11 (Severability); Section 12 (Headings and Section References); Section 13 (Survival of Terms) and Section 14 (Full Agreement).

Section 14 FULL AGREEMENT

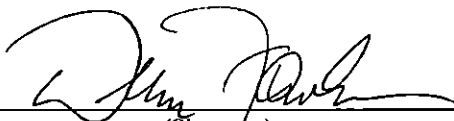
This Agreement and its Exhibits constitute the final expression of the agreement of the parties and supersedes all previous agreements and understandings, whether written or oral, relating to the work. This Agreement may be executed in multiple counterparts, each of which shall be an original and all of which shall constitute one and the same instrument. A facsimile copy or computer image, such as a PDF or tiff image, or a signature shall be treated as and shall have the same effect as an original signature. In addition, a true and correct facsimile copy or computer image of this Agreement shall be treated as and shall have the same effect as an original signed copy of this document. This Agreement may not be altered, amended, or modified except by written instrument signed by duly authorized representatives of the parties. The preprinted terms and conditions found on any Purchaser purchase order, acknowledgment or other form will not be considered an amendment or modification of this Agreement, even if a representative of each party signs that document.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their duly authorized representatives as of the last day and year written below.

MOTOROLA SOLUTIONS, INC.

PURCHASER

By: _____
(Signature)

By: 
(Signature)

Name: _____
(Print - Block Letters)

Name: DEAN FOWLER
(Print - Block Letters)

Title: _____
(Print - Block Letters)

Title: UPSHUR COUNTY JUDGE
(Print - Block Letters)

Date: _____

Date: NOVEMBER 15, 2018

**EXHIBIT A
GENERAL PROVISIONS
MOTOROLA SOLUTIONS, INC.**

Section 1 STANDARDS OF WORK

Motorola agrees that the performance of work described in this Agreement and pursuant to this Agreement shall be done in a professional manner and shall conform to professional standards. All packaging and packing shall be in accordance with good commercial practice.

Section 2 TAXES

The prices set forth in the Agreement are exclusive of any amount for Federal, State or Local excise, sales, lease, gross income service, rental, use, property, occupation or similar taxes. If any taxes are determined applicable to this transaction or Motorola is required to pay or bear the burden thereof, the Purchaser agrees to pay to Motorola the amount of such taxes and any interest or penalty thereon no later than thirty (30) days after receipt of an invoice therefor.

Section 3 SHIPPING, TITLE AND RISK OF LOSS

All sales and deliveries are F.O.B. Destination. Motorola reserves the right to make deliveries in installments and the Agreement shall be severable as to such installments. Title to the equipment shall pass to the Purchaser upon receipt at the F.O.B. Destination. After delivery to the F.O.B. Destination, risk of loss and damage to the articles shall be borne by the Purchaser. The above notwithstanding, title to software and any third party supplied software shall not pass upon payment of the license fee therefor or under any circumstances.

Section 4 CHANGES IN THE WORK

A. The Purchaser may, at any time, by written order, make changes within the general scope of the work, including but not limited to revisions of, or additions to, portions of the work, or changes in method of shipment or packaging and place of delivery.

B. If any order under this Section 4 causes an increase or decrease in the cost of or time required for the performance of any part of the work under this Agreement, an equitable adjustment shall be made in the Agreement price or delivery schedule, or both, and the Agreement shall be modified in writing accordingly. Motorola is not obligated to comply with any order hereunder unless and until the parties reach agreement as to the aforementioned equitable adjustment and same is reflected as an addendum to this Agreement.

Section 5 LIMITATION OF LIABILITY

Except for personal injury or death, Motorola's total liability whether for breach of contract, warranty, negligence, indemnification, strict liability in tort or otherwise, is limited to the price of the particular products or services sold hereunder with respect to which losses or damages are claimed. IN NO EVENT WILL MOTOROLA BE LIABLE FOR ANY LOSS OF USE, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS OR OTHER INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW. This limitation of liability provision survives the expiration or termination of the Agreement and applies notwithstanding any contrary provision. No action shall be brought for any breach of this contract more than two (2) years after the accrual of such cause of action except for money due upon an open account.

Section 6 EXCUSABLE DELAYS

A. Neither Motorola nor the Purchaser shall be responsible for delays or lack of performance resulting from acts beyond the reasonable control of the party or parties. Such acts shall include, but are not be limited to, acts of God; fire; strikes; material shortages; compliance with laws or regulations; riots; acts of war; or any other conditions beyond the reasonable control of the party or parties.

B. Delays as identified herein may cause an impact on the Period of Performance stated in the Agreement. Such delays will be subject to an Agreement addendum as described in Section 4.

Section 7 DEFAULT

A. If either party fails to perform a material obligation under this Agreement, the other party may consider the non-performing party to be in default (unless such failure has been caused by the conditions set forth in Section 6 of these General Provisions) and may assert a default claim by giving the non-performing party a written and detailed notice of default. Except for a default by Purchaser for failing to pay any amount when due under this Agreement which must be cured immediately, the defaulting party will have thirty (30) days after receipt of the notice of default to either cure the default or, if the default is not curable within thirty (30) days, provide a written cure plan. The defaulting party will begin implementing the cure plan immediately after receipt of notice by the other party that it approves the plan. If Purchaser is the defaulting party, Motorola may stop work on the project until it approves the Purchaser's cure plan.

B. If a defaulting party fails to cure the default as provided above in Section 7.A, unless otherwise agreed in writing, the non-defaulting party may terminate any unfulfilled portion of this Agreement. In the event of termination for default, the defaulting party will promptly return to the non-defaulting party any of its confidential information. If Purchaser is the non-defaulting party, terminates this Agreement as

permitted by this Section, and completes the System through a third party, Purchaser may as its exclusive remedy recover from Motorola reasonable costs incurred to complete the System to a capability not exceeding that specified in this Agreement less the unpaid portion of the contract price. Purchaser will mitigate damages and provide Motorola with detailed invoices substantiating the charges. IN THE EVENT OF DEFAULT, MOTOROLA SHALL NOT BE LIABLE FOR ANY INCIDENTAL, LIQUIDATED, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES.

Section 8 DELAYS BY PURCHASER

If the Purchaser is responsible for delays in the schedule set forth in the Agreement, the Purchaser shall be liable for actual costs incurred by Motorola resulting from these delays if Motorola requests compensation. Such charges may include, but are not limited to, additional Engineering; rescheduling charges; storage charges; maintenance charges; and transportation charges. The Purchaser shall have the option to attempt to minimize actual costs incurred by storing and transporting equipment at its own expense. Such delays will be subject to an Agreement addendum as described in Section 4.

Section 9 LICENSES/AUTHORIZATION

The Purchaser is solely responsible for obtaining any licenses or other authorizations required by the Federal Communications Commission and for complying with FCC rules. Neither Motorola nor any of its employees is an agent or representative of the Purchaser in FCC matters or otherwise. Motorola, however, may assist in the preparation of the license application at no charge to the Purchaser. Purchaser acknowledges that project implementation is predicated on receipt of proper FCC licensing.

Section 10 INDEMNIFICATION

Motorola agrees to and hereby indemnifies and saves Purchaser harmless from all liabilities, judgments, costs, damages and expenses which may accrue against, be charged to, or recovered from the Purchaser by reason of or on account of damage to the tangible property of the Purchaser or the property of, injury to, or death of any person, to the extent and in the proportion that such damage or injury is caused by Motorola's negligent acts or omissions or that of its employees, subcontractors, or agents while on the premises of the Purchaser during the delivery and installation of the communications equipment. IN NO EVENT WILL MOTOROLA BE LIABLE FOR INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES.

Section 11 WARRANTIES

A. **WARRANTY PERIOD.** Upon System Acceptance, the System Functionality representation described below is fulfilled. The Equipment and Motorola Software is warranted for a period of one (1) year after System Acceptance ("Warranty Period") in accordance with the applicable limited warranties shown below. In no event will the warranty period last longer than eighteen (18) months after the Equipment and Software

is shipped from Motorola. Purchaser must notify Motorola in writing if Equipment or Motorola Software does not conform to these warranties no later than one month after the expiration of the Warranty Period.

B. **SYSTEM FUNCTIONALITY.** Motorola represents that the Communications System will satisfy the functional requirements in Exhibit C. Upon System Acceptance, this System Functionality representation is fulfilled. After System Acceptance, the Equipment Warranty set forth below and the Software Warranty set forth in the Software License Agreement will apply.

Motorola will not be responsible for performance deficiencies of the System caused by ancillary equipment not furnished by Motorola which is attached to or used in connection with the System provided hereunder. Additionally, Motorola will not be responsible for System performance when the functionality is reduced for reasons beyond Motorola's control including, but not limited to, i) an earthquake, adverse atmospheric conditions or other natural causes; ii) the construction of a building that adversely affects the microwave path reliability or RF coverage; iii) the addition of additional frequencies at System sites that cause RF interference or intermodulation; iv) Purchaser changes to load usage and/or configuration outside the parameters specified in Exhibit C; v) any other act of parties who are beyond Motorola's control, including Purchaser or its employees, contractors, consultants or agents.

C. **EQUIPMENT WARRANTY.** Motorola warrants the Equipment against material defects in material and workmanship under normal use and service during the Warranty Period. Unless otherwise specified in writing, the Warranty Period for non-Motorola manufactured Equipment will be as stated in this Section. At no additional charge and at its option, Motorola will either repair the defective Equipment, replace it with the same or equivalent Equipment, or refund the purchase price of the defective Equipment, and such action on the part of Motorola will be the full extent of Motorola's liability hereunder. Repaired or replaced Equipment is warranted for the balance of the original applicable warranty period. All replaced parts of the Equipment shall become the property of Motorola.

THIS WARRANTY DOES NOT APPLY TO

- a) Defects or damage resulting from use of the Equipment in other than its normal and customary manner.
- b) Defects or damage occurring from misuse, accident, liquids, neglect or acts of God.
- c) Defects or damage occurring from testing, maintenance, installation, alteration, modification, or adjustment not provided by Motorola pursuant to this System Purchase Agreement.

- d) Breakage of or damage to antennas unless caused directly by defects in material or workmanship.
- e) Equipment that has been subjected to unauthorized modifications, disassembly or repairs (including the addition to the Equipment of non-Motorola supplied equipment if not authorized by Motorola) which adversely affect performance of the Equipment or interfere with Motorola's normal warranty inspection and testing of the Equipment to verify any warranty claim.
- f) Equipment that has had the serial number removed or made illegible.
- g) Batteries (because they carry their own separate limited warranty).
- h) Freight costs to the repair depot.
- i) Equipment that has been subject to illegal or unauthorized alteration of the software/firmware in the Equipment.
- j) Scratches or other cosmetic damage to Equipment surfaces that does not affect the operation of the Equipment.
- k) Software.
- l) Normal or customary wear and tear.

D. Motorola Software Warranty. Motorola Software is warranted in accordance with the terms of the Software License Agreement attached as Exhibit B.

E. These express limited warranties as set forth in this Section are extended by Motorola to the original end user purchasing or leasing the System for commercial, industrial, or governmental use only, and are not assignable or transferable. These are the complete warranties for the Equipment and Software provided pursuant to this Agreement.

F. THESE WARRANTIES ARE GIVEN IN LIEU OF ALL OTHER WARRANTIES. MOTOROLA DISCLAIMS ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT WILL MOTOROLA BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE EQUIPMENT. IN NO EVENT WILL MOTOROLA BE LIABLE FOR ANY LOSS OF USE, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS OR OTHER INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE EQUIPMENT, TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

Section 12 CONFIDENTIAL INFORMATION

Motorola proprietary computer programs will be released in accordance with the Software License provisions set forth elsewhere, if applicable. All other material and information of confidential nature marked Motorola PROPRIETARY and/or CONFIDENTIAL will be released as necessary under the following conditions:

- (1) Purchaser shall exercise reasonable and prudent measures to keep these items in confidence.
- (2) Purchaser shall not disclose these items to third parties without prior written permission, unless Motorola makes them public or Purchaser learns them rightfully from sources independent of Motorola, or it is required by law to be disclosed.
- (3) Motorola, where necessary, retains the right to prescribe specific security measures for the Purchaser to follow to maintain the confidentiality.

In the event disclosure of such information is necessary, a separate Non-Disclosure Agreement will be required.

Section 13 SOFTWARE LICENSE

A. Motorola Software. Any Motorola Software furnished will be licensed to Purchaser solely according to the terms and restrictions of the Software License Agreement attached as Exhibit B. Purchaser hereby accepts all of the terms and restrictions of the Software License Agreement.

B. Non-Motorola Software. Any Non-Motorola Software furnished by Motorola will be subject to the terms and restrictions of its copyright owner unless such copyright owner has granted to Motorola the right to sublicense such Non-Motorola Software pursuant to the Software License Agreement, in which case the Software License Agreement (including any addendum to satisfy such copyright owner's requirements) shall apply and the copyright owner will have all of Motorola's rights and protections under the Software License Agreement.

Section 14 PATENT INDEMNIFICATION

A. Motorola will defend at its expense any suit brought against Purchaser to the extent it is based on a third-party claim alleging that the Equipment manufactured by Motorola or the Motorola Software ("Motorola Product") directly infringes a United States patent or copyright ("Infringement Claim"). Motorola's duties to defend and indemnify are conditioned upon: Purchaser promptly notifying Motorola in writing of the Infringement Claim; Motorola having sole control of the defense of the suit and all negotiations for its settlement or compromise; and Purchaser providing to Motorola cooperation and, if requested by Motorola, reasonable assistance in the defense of the Infringement Claim. In addition to Motorola's obligation to defend, and subject to the

same conditions, Motorola will pay all damages finally awarded against Purchaser by a court of competent jurisdiction for an Infringement Claim or agreed to, in writing, by Motorola in settlement of an Infringement Claim.

B. If an Infringement Claim occurs, or in Motorola's opinion is likely to occur, Motorola may at its option and expense: (a) procure for Purchaser the right to continue using the Motorola Product; (b) replace or modify the Motorola Product so that it becomes non-infringing while providing functionally equivalent performance; or (c) accept the return of the Motorola Product and grant Purchaser a credit for the Motorola Product, less a reasonable charge for depreciation. The depreciation amount will be calculated based upon generally accepted accounting standards.

C. Motorola will have no duty to defend or indemnify for any Infringement Claim that is based upon: (a) the combination of the Motorola Product with any software, apparatus or device not furnished by Motorola; (b) the use of ancillary equipment or software not furnished by Motorola and that is attached to or used in connection with the Motorola Product; (c) Motorola Product designed or manufactured in accordance with Purchaser's designs, specifications, guidelines or instructions, if the alleged infringement would not have occurred without such designs, specifications, guidelines or instructions; (d) a modification of the Motorola Product by a party other than Motorola; (e) use of the Motorola Product in a manner for which the Motorola Product was not designed or that is inconsistent with the terms of this Agreement; or (f) the failure by Purchaser to install an enhancement release to the Motorola Software that is intended to correct the claimed infringement. In no event will Motorola's liability resulting from its indemnity obligation to Purchaser extend in any way to royalties payable on a per use basis or the Purchaser's revenues, or any royalty basis other than a reasonable royalty based upon revenue derived by Motorola from Purchaser from sales or license of the infringing Motorola Product.

D. This Section 14 provides Purchaser's sole and exclusive remedies and Motorola's entire liability in the event of an Infringement Claim. Purchaser has no right to recover and Motorola has no obligation to provide any other or further remedies, whether under another provision of this Agreement or any other legal theory or principle, in connection with an Infringement Claim. In addition, the rights and remedies provided in this Section 14 are subject to and limited by the restrictions set forth in Section 5.

Section 15 DISCLAIMER OF PATENT LICENSE

Nothing contained in this Agreement shall be deemed to grant, either directly or by implication, estoppel, or otherwise, any license under any patents or patent applications of Motorola, except that Purchaser shall have the normal non-exclusive royalty-free license to use that is implied, or otherwise arises by operation of law, in the sale of a product.

Section 16 WAIVER

Failure or delay on the part of Motorola or Purchaser to exercise a right or power hereunder shall not operate as a waiver of the right or power. For a waiver of a right or power to be effective, it must be in a writing signed by the waiving party. An effective waiver of a right or power will not be construed as either a future or continuing waiver of that same right or power, or the waiver of any other right or power.

Section 17 GOVERNING LAW

This Agreement shall be governed by and construed in accordance with the laws of the State of Texas.

Section 18 ASSIGNABILITY

Except as provided herein, neither party may assign this Agreement or any of its rights or obligations hereunder without the prior written consent of the other party, which consent will not be unreasonably withheld. Any attempted assignment, delegation, or transfer without the necessary consent will be void. Notwithstanding the foregoing, Motorola may assign this Agreement to any of its affiliates or its right to receive payment without the prior consent of Purchaser. In addition, in the event Motorola separates one or more of its businesses (each a "Separated Business"), whether by way of a sale, establishment of a joint venture, spin-off or otherwise (each a "Separation Event"), Motorola may, without the prior written consent of the other party and at no additional cost to Motorola, assign this Agreement such that it will continue to benefit the Separated Business and its affiliates (and Motorola and its affiliates, to the extent applicable) following the Separation Event. Motorola may subcontract any of the work, but subcontracting will not relieve Motorola of its duties under this Agreement..

Section 19 SURVIVAL OF TERMS

The following provisions will survive the expiration or termination of this Agreement for any reason: Section 2 (Taxes); Section 5 (Limitation of Liability); Section 7 (Default); Subsection 11.F (Disclaimer of Implied Warranties); Section 12 (Confidential Information); Section 13 (Software License); and Section 16 (Waiver); Section 17 (Governing Law) and Section 19 (Survival of Terms).

Section 20 ADMINISTRATOR LEVEL ACCOUNT ACCESS

Motorola will provide Purchaser with Administrative User Credentials. Purchaser agrees to only grant Administrative User Credentials to those personnel with the training or experience to correctly use the access. Purchaser is responsible for protecting Administrative User Credentials from disclosure and maintaining Credential validity by, among other things, updating passwords when required. Purchaser may be asked to provide valid Administrative User Credentials when in contact with Motorola System support. Purchaser understands that changes made as the Administrative User can significantly impact the performance of the System. Purchaser agrees that it will be solely responsible for any negative impact on the System or its users by any such changes. System issues occurring as a result of changes made by an Administrative User

may impact Motorola's ability to perform its obligations under the Agreement or its Maintenance and Support Agreement. In such cases, a revision to the appropriate provisions of the Agreement, including the Statement of Work, may be necessary. To the extent Motorola provides assistance to correct any issues caused by or arising out of the use of or failure to maintain Administrative User Credentials, Motorola will be entitled to bill Purchaser and Purchaser will pay Motorola on a time and materials basis for resolving the issue.

Section 21 MAINTENANCE SERVICE

If this Agreement contains a Warranty and Maintenance Plan, then, during the Warranty Period, in addition to warranty services, Motorola will provide maintenance services for the Equipment and support for the Motorola Software pursuant to the terms of this Agreement, including the Warranty and Maintenance Plan and Service Terms and Conditions. Such services and support are included in the Contract Price. If Customer wishes to purchase additional maintenance and support services during the Warranty Period, or any maintenance and support services after the Warranty Period, the description of and pricing for such services will be set forth in a separate document. Unless otherwise agreed by the Parties in writing, the terms and conditions applicable to such maintenance and support will be Motorola's standard Service Terms and Conditions, together with the appropriate statements of work.

Exhibit B

Software License Agreement

This Exhibit B, Software License Agreement ("Agreement") is between Motorola Solutions, Inc., ("Motorola"), and _____ ("Licensee").

For good and valuable consideration, the parties agree as follows:

Section 1 DEFINITIONS

1.1 "Designated Products" means products provided by Motorola to Licensee with which or for which the Software and Documentation is licensed for use.

1.2 "Documentation" means product and software documentation that specifies technical and performance features and capabilities, and the user, operation and training manuals for the Software (including all physical or electronic media upon which such information is provided).

1.3 "Open Source Software" means software with either freely obtainable source code, license for modification, or permission for free distribution.

1.4 "Open Source Software License" means the terms or conditions under which the Open Source Software is licensed.

1.5 "Primary Agreement" means the agreement to which this exhibit is attached.

1.6 "Security Vulnerability" means a flaw or weakness in system security procedures, design, implementation, or internal controls that could be exercised (accidentally triggered or intentionally exploited) and result in a security breach such that data is compromised, manipulated or stolen or the system damaged.

1.7 "Software" (i) means proprietary software in object code format, and adaptations, translations, de-compilations, disassemblies, emulations, or derivative works of such software; (ii) means any modifications, enhancements, new versions and new releases of the software provided by Motorola; and (iii) may contain one or more items of software owned by a third party supplier. The term "Software" does not include any third party software provided under separate license or third party software not licensable under the terms of this Agreement.

Section 2 SCOPE

Motorola and Licensee enter into this Agreement in connection with Motorola's delivery of certain proprietary Software or products containing embedded or pre-loaded proprietary Software, or both. This Agreement contains the terms and conditions of the license Motorola is providing to Licensee, and Licensee's use of the Software and Documentation.

Section 3 GRANT OF LICENSE

3.1. Subject to the provisions of this Agreement and the payment of applicable license fees, Motorola grants to Licensee a personal, limited, non-transferable (except as permitted in Section 7) and non-exclusive license under Motorola's copyrights and Confidential Information (as defined in the Primary Agreement) embodied in the Software to use the Software, in object code form, and the Documentation solely in connection with Licensee's use of the Designated Products. This Agreement does not grant any rights to source code.

3.2. If the Software licensed under this Agreement contains or is derived from Open Source Software, the terms and conditions governing the use of such Open Source Software are in the Open Source Software Licenses of the copyright owner and not this Agreement. If there is a conflict between the terms and conditions of this Agreement and the terms and conditions of the Open Source Software Licenses governing Licensee's use of the Open Source Software, the terms and conditions of the license grant of the applicable Open Source Software Licenses will take precedence over the license grants in this Agreement. If requested by Licensee, Motorola will use commercially reasonable efforts to: (i) determine whether any Open Source Software is provided under this Agreement; (ii) identify the Open Source Software and provide Licensee a copy of the applicable Open Source Software License (or specify where that license may be found); and, (iii) provide Licensee a copy of the Open Source Software source code, without charge, if it is publicly available (although distribution fees may be applicable).

Section 4 LIMITATIONS ON USE

4.1. Licensee may use the Software only for Licensee's internal business purposes and only in accordance with the Documentation. Any other use of the Software is strictly prohibited. Without limiting the general nature of these restrictions, Licensee will not make the Software available for use by third parties on a "time sharing," "application service provider," or "service bureau" basis or for any other similar commercial rental or sharing arrangement.

4.2. Licensee will not, and will not allow or enable any third party to: (i) reverse engineer, disassemble, peel components, decompile, reprogram or otherwise reduce the Software or any portion to a human perceptible form or otherwise attempt to recreate the source code; (ii) modify, adapt, create derivative works of, or merge the Software; (iii) copy, reproduce, distribute, lend, or lease the Software or Documentation to any third party, grant any sublicense or other rights in the Software or Documentation to any third party, or take any action that would cause the Software or Documentation to be placed in the public domain; (iv) remove, or in any way alter or obscure, any copyright notice or other notice of Motorola's proprietary rights; (v) provide, copy, transmit, disclose, divulge or make the Software or Documentation available to, or permit the use of the Software by any third party or on any machine except as expressly authorized by this Agreement; or (vi) use, or permit the use of, the Software in a manner that would result in the production of a copy of the Software solely by activating a machine containing the Software. Licensee may make one copy of Software to be used solely for archival, back-up, or disaster recovery purposes; *provided* that Licensee may not operate that copy of the Software at the same time as the original Software is being operated. Licensee may make as many copies of the Documentation as it may reasonably require for the internal use of the Software.

4.3. Unless otherwise authorized by Motorola in writing, Licensee will not, and will not enable or allow any third party to: (i) install a licensed copy of the Software on more than one unit of a Designated Product; or (ii) copy onto or transfer Software installed in one unit of a Designated Product onto one other device. Licensee may temporarily transfer Software installed on a Designated Product to another device if the Designated Product is inoperable or malfunctioning, if Licensee provides written notice to Motorola of the temporary transfer and identifies the device on which the Software is transferred. Temporary transfer of the Software to another device must be discontinued when the original Designated Product is returned to operation and the Software must be removed from the other device. Licensee must provide prompt written notice to Motorola at the time temporary transfer is discontinued.

4.4. When using Motorola's Radio Service Software ("RSS"), Licensee must purchase a separate license for each location at which Licensee uses RSS. Licensee's use of RSS at a licensed location does not entitle Licensee to use or access RSS remotely. Licensee may make one copy of RSS for each licensed location. Licensee shall provide Motorola with a list of all locations at which Licensee uses or intends to use RSS upon Motorola's request.

4.5. Licensee will maintain, during the term of this Agreement and for a period of two years thereafter, accurate records relating to this license grant to verify compliance with this Agreement. Motorola or an independent third party ("Auditor") may inspect Licensee's premises, books and records, upon reasonable

prior notice to Licensee, during Licensee's normal business hours and subject to Licensee's facility and security regulations. Motorola is responsible for the payment of all expenses and costs of the Auditor. Any information obtained by Motorola and the Auditor will be kept in strict confidence by Motorola and the Auditor and used solely for the purpose of verifying Licensee's compliance with the terms of this Agreement.

Section 5 OWNERSHIP AND TITLE

Motorola, its licensors, and its suppliers retain all of their proprietary rights in any form in and to the Software and Documentation, including, but not limited to, all rights in patents, patent applications, inventions, copyrights, trademarks, trade secrets, trade names, and other proprietary rights in or relating to the Software and Documentation (including any corrections, bug fixes, enhancements, updates, modifications, adaptations, translations, de-compilations, disassemblies, emulations to or derivative works from the Software or Documentation, whether made by Motorola or another party, or any improvements that result from Motorola's processes or, provision of information services). No rights are granted to Licensee under this Agreement by implication, estoppel or otherwise, except for those rights which are expressly granted to Licensee in this Agreement. All intellectual property developed, originated, or prepared by Motorola in connection with providing the Software, Designated Products, Documentation or related services, remains vested exclusively in Motorola, and Licensee will not have any shared development or other intellectual property rights.

Section 6 LIMITED WARRANTY; DISCLAIMER OF WARRANTY

6.1. The commencement date and the term of the Software warranty will be a period of ninety (90) days from Motorola's shipment of the Software (the "Warranty Period"). If Licensee is not in breach of any of its obligations under this Agreement, Motorola warrants that the unmodified Software, when used properly and in accordance with the Documentation and this Agreement, will be free from a reproducible defect that eliminates the functionality or successful operation of a feature critical to the primary functionality or successful operation of the Software. Whether a defect occurs will be determined by Motorola solely with reference to the Documentation. Motorola does not warrant that Licensee's use of the Software or the Designated Products will be uninterrupted, error-free, completely free of Security Vulnerabilities, or that the Software or the Designated Products will meet Licensee's particular requirements. Motorola makes no representations or warranties with respect to any third party software included in the Software.

6.2 Motorola's sole obligation to Licensee and Licensee's exclusive remedy under this warranty is to use reasonable efforts to remedy any material Software defect covered by this warranty. These efforts will involve either replacing the media or attempting to correct significant, demonstrable program or documentation errors or Security Vulnerabilities. If Motorola cannot correct the defect within a reasonable time, then at Motorola's option, Motorola will replace the defective Software with functionally-equivalent Software, license to Licensee substitute Software which will accomplish the same objective, or terminate the license and refund the Licensee's paid license fee.

6.3. Warranty claims are described in the Primary Agreement.

6.4. The express warranties set forth in this Section 6 are in lieu of, and Motorola disclaims, any and all other warranties (express or implied, oral or written) with respect to the Software or Documentation, including, without limitation, any and all implied warranties of condition, title, non-infringement, merchantability, or fitness for a particular purpose or use by Licensee (whether or not Motorola knows, has reason to know, has been advised, or is otherwise aware of any such purpose or use), whether arising by law, by reason of custom or usage of trade, or by course of dealing. In addition, Motorola disclaims any warranty to any person other than Licensee with respect to the Software or Documentation.

Section 7 TRANSFERS

Licensee will not transfer the Software or Documentation to any third party without Motorola's prior written consent. Motorola's consent may be withheld at its discretion and may be conditioned upon transferee paying all applicable license fees and agreeing to be bound by this Agreement. If the Designated Products are Motorola's radio products and Licensee transfers ownership of the Motorola radio products to a third party, Licensee may assign its right to use the Software (other than RSS and Motorola's FLASHport® software) which is embedded in or furnished for use with the radio products and the related Documentation; *provided* that Licensee transfers all copies of the Software and Documentation to the transferee, and Licensee and the transferee sign a transfer form to be provided by Motorola upon request, obligating the transferee to be bound by this Agreement.

Section 8 TERM AND TERMINATION

8.1 Licensee's right to use the Software and Documentation will begin when the Primary Agreement is signed by both parties and will continue for the life of the Designated Products with which or for which the Software and Documentation have been provided by Motorola, unless Licensee breaches this Agreement, in which case this Agreement and Licensee's right to use the Software and Documentation may be terminated immediately upon notice by Motorola.

8.2 Within thirty (30) days after termination of this Agreement, Licensee must certify in writing to Motorola that all copies of the Software have been removed or deleted from the Designated Products and that all copies of the Software and Documentation have been returned to Motorola or destroyed by Licensee and are no longer in use by Licensee.

8.3 Licensee acknowledges that Motorola made a considerable investment of resources in the development, marketing, and distribution of the Software and Documentation and that Licensee's breach of this Agreement will result in irreparable harm to Motorola for which monetary damages would be inadequate. If Licensee breaches this Agreement, Motorola may terminate this Agreement and be entitled to all available remedies at law or in equity (including immediate injunctive relief and repossession of all non-embedded Software and associated Documentation unless Licensee is a Federal agency of the United States Government).

Section 9 UNITED STATES GOVERNMENT LICENSING PROVISIONS

This Section applies if Licensee is the United States Government or a United States Government agency. Licensee's use, duplication or disclosure of the Software and Documentation under Motorola's copyrights or trade secret rights is subject to the restrictions set forth in subparagraphs (c)(1) and (2) of the Commercial Computer Software-Restricted Rights clause at FAR 52.227-19 (JUNE 1987), if applicable, unless they are being provided to the Department of Defense. If the Software and Documentation are being provided to the Department of Defense, Licensee's use, duplication, or disclosure of the Software and Documentation is subject to the restricted rights set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 (OCT 1988), if applicable. The Software and Documentation may or may not include a Restricted Rights notice, or other notice referring to this Agreement. The provisions of this Agreement will continue to apply, but only to the extent that they are consistent with the rights provided to the Licensee under the provisions of the FAR or DFARS mentioned above, as applicable to the particular procuring agency and procurement transaction.

Section 10 CONFIDENTIALITY

Licensee acknowledges that the Software and Documentation contain Motorola's valuable proprietary and confidential information and are Motorola's trade secrets. Licensee will not disclose the Software and Documentation to any third party except as permitted by this Agreement or expressly in writing by Motorola. Licensee will take necessary and appropriate precautions to maintain the confidentiality and guard against the unauthorized disclosure of the Software and Documentation. Licensee will limit access

to the Software and Documentation only to Licensee's employees who "need to know" and are authorized to use the Software and Documentation as permitted by this Agreement.

Section 11 LIMITATION OF LIABILITY

The Limitation of Liability provision is described in the Primary Agreement.

Section 12 NOTICES

Notices are described in the Primary Agreement.

Section 13 GENERAL

13.1. **COPYRIGHT NOTICES.** The existence of a copyright notice on the Software will not be construed as an admission or presumption of publication of the Software or public disclosure of any trade secrets associated with the Software.

13.2. **COMPLIANCE WITH LAWS.** Licensee acknowledges that the Software is subject to the laws and regulations of the United States and Licensee will comply with all applicable laws and regulations, including export laws and regulations of the United States. Licensee will not, without the prior authorization of Motorola and the appropriate governmental authority of the United States, in any form export or re-export, sell or resell, ship or reship, or divert, through direct or indirect means, any item or technical data or direct or indirect products sold or otherwise furnished to any person within any territory for which the United States Government or any of its agencies at the time of the action, requires an export license or other governmental approval. Violation of this provision is a material breach of this Agreement.

13.3. **ASSIGNMENTS AND SUBCONTRACTING.** Motorola may assign its rights or subcontract its obligations under this Agreement, or encumber or sell its rights in any Software, without prior notice to or consent of Licensee.

13.4. **GOVERNING LAW.** This Agreement is governed by the laws of the United States to the extent that they apply and otherwise by the internal substantive laws of the State to which the Software is shipped if Licensee is a sovereign government entity, or the internal substantive laws of the State of Illinois if Licensee is not a sovereign government entity. The terms of the U.N. Convention on Contracts for the International Sale of Goods do not apply. In the event that the Uniform Computer Information Transaction Act, any version of this Act, or a substantially similar law (collectively "UCITA") becomes applicable to a party's performance under this Agreement, UCITA does not govern any aspect of this Agreement or any license granted under this Agreement, or any of the parties' rights or obligations under this Agreement. The governing law will be that in effect prior to the applicability of UCITA.

13.5. **THIRD PARTY BENEFICIARIES.** This Agreement is entered into solely for the benefit of Motorola and Licensee. No third party has the right to make any claim or assert any right under this Agreement, and no third party is deemed a beneficiary of this Agreement. Notwithstanding the foregoing, any licensor or supplier of third party software included in the Software will be a direct and intended third party beneficiary of this Agreement.

13.6. **SURVIVAL.** Sections 4, 5, 6.4, 7, 8, 9, 10, 11 and 13 survive the termination of this Agreement.

13.7. **ORDER OF PRECEDENCE.** In the event of inconsistencies between this Exhibit and the Primary Agreement, the parties agree that this Exhibit prevails, only with respect to the specific subject matter of this Exhibit, and not the Primary Agreement or any other exhibit as it applies to any other subject matter.

13.8. **SECURITY.** Motorola uses reasonable means in the design and writing of its own Software and the acquisition of third party Software to limit Security Vulnerabilities. While no software can be

guaranteed to be free from Security Vulnerabilities, if a Security Vulnerability is discovered, Motorola will take the steps set forth in Section 6 of this Agreement.



Exhibit C

Technical and Implementation Documents

SEE MOTOROLA'S PROPOSAL DATED _____

Exhibit D

Motorola/H-GAC Contract dated May 1, 2018.

Exhibit E

Service Terms and Conditions

Motorola Solutions, Inc. ("Motorola") and the customer named in this Agreement ("Customer") hereby agree as follows:

Section 1 APPLICABILITY

These Service Terms and Conditions apply to service contracts whereby Motorola will provide to Customer either (1) maintenance, support and/or other services under a Motorola Service Agreement, or (2) installation services under a Motorola Installation Agreement.

Section 2 DEFINITIONS AND INTERPRETATION

2.1 "Agreement" means these Service Terms and Conditions; the cover page for the Service Agreement or the Installation Agreement, as applicable; and any other attachments, all of which are incorporated herein by this reference. In interpreting this Agreement and resolving any ambiguities, these Service Terms and Conditions take precedence over any cover page, and the cover page takes precedence over any attachments, unless the cover page or attachment states otherwise.

2.2 "Equipment" means the equipment that is specified in the attachments or is subsequently added to this Agreement.

2.3 "Services" means those installation, maintenance, support, training, and other services described in this Agreement.

Section 3 ACCEPTANCE

Customer accepts these Service Terms and Conditions and agrees to pay the prices set forth in the Agreement. This Agreement becomes binding only when accepted in writing by Motorola. The term of this Agreement begins on the "Start Date" indicated in this Agreement.

Section 4 SCOPE OF SERVICES

4.1. Motorola will provide the Services described in this Agreement or in a more detailed statement of work or other document attached to this Agreement. At Customer's request, Motorola may also provide additional services at Motorola's then-applicable rates for the services.

4.2. If Motorola is providing Services for Equipment, Motorola parts or parts of equal quality will be used; the Equipment will be serviced at levels set forth in the manufacturer's product manuals; and routine service procedures that are prescribed by Motorola will be followed.

4.3. If Customer purchases from Motorola additional equipment that becomes part of the same system as the initial Equipment, the additional equipment may be added to this Agreement and will be billed at the applicable rates after the warranty for the additional equipment expires.

4.4. All Equipment must be in good working order on the Start Date or when additional equipment is added to the Agreement. Upon reasonable request by Motorola, Customer will provide a complete serial and model number list of the Equipment. Customer must promptly notify Motorola in writing when any Equipment is lost, damaged, stolen or taken out of service. Customer's obligation to pay Service fees for such Equipment will terminate at the end of the month in which Motorola receives the written notice.

4.5. Customer must specifically identify any Equipment that is labeled intrinsically safe for use in hazardous environments.

4.6. If Equipment cannot, in Motorola's reasonable opinion, be properly or economically serviced for any reason, Motorola may modify the scope of Services related to such Equipment; remove that Equipment from the Agreement; or increase the price to Service such Equipment.

4.7. Customer must promptly notify Motorola of any Equipment failure. Motorola will respond to Customer's notification in a manner consistent with the level of Service purchased as indicated in this Agreement.

Section 5 EXCLUDED SERVICES

5.1. Service excludes the repair or replacement of Equipment that has become defective or damaged from use in other than the normal, customary, intended, and authorized manner; use not in compliance with applicable industry standards; excessive wear and tear; or accident, liquids, power surges, neglect, acts of God or other force majeure events.

5.2. Unless specifically included in this Agreement, Service excludes items that are consumed in the normal operation of the Equipment, such as batteries or magnetic tapes.; upgrading or reprogramming Equipment; accessories, belt clips, battery chargers, custom or special products, modified units, or software; and repair or maintenance of any transmission line, antenna, microwave equipment, tower or tower lighting, duplexer, combiner, or multicoupler. Motorola has no obligations for any transmission medium, such as telephone lines, computer networks, the internet or the worldwide web, or for Equipment malfunction caused by such transmission medium.

Section 6 TIME AND PLACE OF SERVICE

Service will be provided at the location specified in this Agreement. When Motorola performs service at Customer's location, Customer will provide Motorola, at no charge, a non-hazardous work environment with adequate shelter, heat, light, and power and with full and free access to the Equipment. Waivers of liability from Motorola or its subcontractors will not be imposed as a site access requirement. Customer will provide all information pertaining to the hardware and software elements of any system with which the Equipment is interfacing so that Motorola may perform its Services. Unless otherwise stated in this Agreement, the hours of Service will be 8:30 a.m. to 4:30 p.m., local time, excluding weekends and holidays. Unless otherwise stated in this Agreement, the price for the Services exclude any charges or expenses associated with helicopter or other unusual access requirements; if these charges or expenses are reasonably incurred by Motorola in rendering the Services, Customer agrees to reimburse Motorola for those charges and expenses.

Section 7 CUSTOMER Contact

Customer will provide Motorola with designated points of contact (list of names and phone numbers) that will be available twenty-four (24) hours per day, seven (7) days per week, and an escalation procedure to enable Customer's personnel to maintain contact, as needed, with Motorola.

Section 8 PAYMENT

Unless alternative payment terms are stated in this Agreement, Motorola will invoice Customer in advance for each payment period. All other charges will be billed monthly, and Customer must pay each invoice in U.S. dollars within thirty (30) days of the invoice date. Customer will reimburse Motorola for all property taxes, sales and use taxes, excise taxes, and other taxes or assessments that are levied as a result of Services rendered under this Agreement (except income, profit, and franchise taxes of Motorola) by any governmental entity.

Section 9 WARRANTY

Motorola warrants that its Services under this Agreement will be free of defects in materials and workmanship for a period of ninety (90) days from the date the performance of the Services are completed. In the event of a breach of this warranty, Customer's sole remedy is to require Motorola to re-perform the non-conforming Service or to refund, on a pro-rata basis, the fees paid for the non-conforming Service. MOTOROLA DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Section 10 DEFAULT/TERMINATION

10.1. If either party defaults in the performance of this Agreement, the other party will give to the non-performing party a written and detailed notice of the default. The non-performing party will have thirty (30) days thereafter to provide a written plan to cure the default that is acceptable to the other party and begin implementing the cure plan immediately after plan approval. If the non-performing party fails to provide or implement the cure plan, then the injured party, in addition to any other rights available to it

under law, may immediately terminate this Agreement effective upon giving a written notice of termination to the defaulting party.

10.2. Any termination of this Agreement will not relieve either party of obligations previously incurred pursuant to this Agreement, including payments which may be due and owing at the time of termination. All sums owed by Customer to Motorola will become due and payable immediately upon termination of this Agreement. Upon the effective date of termination, Motorola will have no further obligation to provide Services.

Section 11 LIMITATION OF LIABILITY

Except for personal injury or death, Motorola's total liability, whether for breach of contract, warranty, negligence, strict liability in tort, or otherwise, will be limited to the direct damages recoverable under law, but not to exceed the price of twelve (12) months of Service provided under this Agreement. ALTHOUGH THE PARTIES ACKNOWLEDGE THE POSSIBILITY OF SUCH LOSSES OR DAMAGES, THEY AGREE THAT MOTOROLA WILL NOT BE LIABLE FOR ANY COMMERCIAL LOSS; INCONVENIENCE; LOSS OF USE, TIME, DATA, GOOD WILL, REVENUES, PROFITS OR SAVINGS; OR OTHER SPECIAL, INCIDENTAL, INDIRECT, OR CONSEQUENTIAL DAMAGES IN ANY WAY RELATED TO OR ARISING FROM THIS AGREEMENT OR THE PERFORMANCE OF SERVICES BY MOTOROLA PURSUANT TO THIS AGREEMENT. No action for contract breach or otherwise relating to the transactions contemplated by this Agreement may be brought more than two (2) years after the accrual of such cause of action, except for money due upon an open account. This limitation of liability will survive the expiration or termination of this Agreement and applies notwithstanding any contrary provision.

Section 12 EXCLUSIVE TERMS AND CONDITIONS

12.1. This Agreement supersedes all prior and concurrent agreements and understandings between the parties, whether written or oral, related to the Services, and there are no agreements or representations concerning the subject matter of this Agreement except for those expressed herein. The Agreement may not be amended or modified except by a written agreement signed by authorized representatives of both parties.

12.2. Customer agrees to reference this Agreement on any purchase order issued in furtherance of this Agreement, however, an omission of the reference to this Agreement will not affect its applicability. In no event will either party be bound by any terms contained in a Customer purchase order, acknowledgement, or other writing unless: the purchase order, acknowledgement, or other writing specifically refers to this Agreement; clearly indicate the intention of both parties to override and modify this Agreement; and the purchase order, acknowledgement, or other writing is signed by authorized representatives of both parties.

Section 13 PROPRIETARY INFORMATION; CONFIDENTIALITY; INTELLECTUAL PROPERTY RIGHTS

13.1. Any information or data in the form of specifications, drawings, reprints, technical information or otherwise furnished to Customer under this Agreement will remain Motorola's property, will be deemed proprietary, will be kept confidential, and will be promptly returned at Motorola's request. Customer may not disclose, without Motorola's written permission or as required by law, any confidential information or data to any person, or use confidential information or data for any purpose other than performing its obligations under this Agreement. The obligations set forth in this Section survive the expiration or termination of this Agreement.

13.2. Unless otherwise agreed in writing, no commercial, financial or technical information disclosed in any manner or at any time by Customer to Motorola will be deemed secret or confidential. Motorola will have no obligation to provide Customer with access to its confidential and proprietary information, including cost and pricing data.

13.3. This Agreement does not grant directly or by implication, estoppel, or otherwise, any ownership right or license under any Motorola patent, copyright, trade secret, or other intellectual property including any intellectual property created as a result of or related to the Equipment sold or Services performed under this Agreement.

Section 14 FCC LICENSES AND OTHER AUTHORIZATIONS

Customer is solely responsible for obtaining licenses or other authorizations required by the Federal Communications Commission or any other federal, state, or local government agency and for complying with all rules and regulations required by such agencies. Neither Motorola nor any of its employees is an agent or representative of Customer in any governmental matters.

Section 15 COVENANT NOT TO EMPLOY

During the term of this Agreement and continuing for a period of two (2) years thereafter, Customer will not hire, engage on contract, solicit the employment of, or recommend employment to any third party of any employee of Motorola or its subcontractors without the prior written authorization of Motorola. This provision applies only to those employees of Motorola or its subcontractors who are responsible for rendering services under this Agreement. If this provision is found to be overly broad under applicable law, it shall be modified as necessary to conform to such law.

Section 16 MATERIALS, TOOLS AND EQUIPMENT

All tools, equipment, dies, gauges, models, drawings or other materials paid for or furnished by Motorola for the purpose of this Agreement will be and remain the sole property of Motorola. Customer will safeguard all such property while it is in Customer's custody or control, be liable for any loss or damage to this property, and return it to Motorola upon request. This property will be held by Customer for Motorola's use without charge and may be removed from Customer's premises by Motorola at any time without restriction.

Section 17 GENERAL TERMS

17.1. If any court renders any portion of this Agreement unenforceable, the remaining terms will continue in full force and effect.

17.2. This Agreement and the rights and duties of the parties will be governed and interpreted in accordance with the laws of the State of Texas.

17.3. Failure to exercise any right will not operate as a waiver of that right, power, or privilege.

17.4. Neither party is liable for delays or lack of performance resulting from any causes that are beyond that party's reasonable control, such as strikes, material shortages, or acts of God.

17.5. Motorola may assign its rights and obligations, and may subcontract any portion of its performance, under this Agreement.

17.6. If Motorola provides Services after the termination or expiration of this Agreement, the terms and conditions in effect at the time of the termination or expiration will apply to those Services and Customer agrees to pay for those services on a time and materials basis at Motorola's then effective hourly rates.

SECTION 11

OUR COMMITMENT

Motorola Solutions creates innovative, mission-critical communication solutions and services that help public safety and commercial customers build safer cities and thriving communities. You can find our products at work in a variety of industries including law enforcement, fire, emergency medical services, national government security, utilities, mining, energy, manufacturing, hospitality, retail, transportation and logistics, education, and public services.

Founded in 1928, Motorola Solutions has a history of innovation that has revolutionized communications. From pioneering mobile communications in the 1930s and making equipment that carried the first words from the moon in 1969, to supporting modern-day emergency response equipment for disaster relief efforts around the world, Motorola Solutions has a global footprint with products that demonstrate its thought leadership.

Throughout its history, Motorola Solutions has transformed innovative ideas into products that connect people to each other and the world around them. Moving forward, the company strives to keep its commitment of make things better and life easier, to make sound recommendations that will guide you in linking your current and future communication needs and objectives with technology's ever-evolving promise.

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