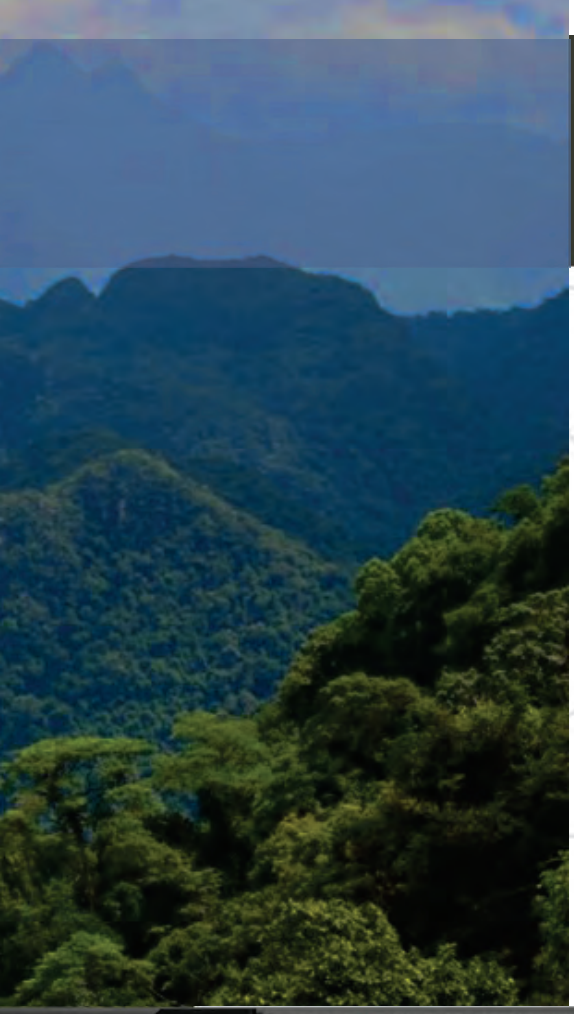

RAPTOR XR®

EXtended **R**ange

HIGH-SPEED UHF
PEER-TO-PEER & MESH
NETWORKING

A COMPLETE BROADBAND NETWORKING BACKHAUL AND MESH INFRASTRUCTURE SOLUTION PROVIDING SUPERIOR RANGE, COVERAGE, AND RELIABILITY FOR WILDERNESS, RURAL, AND URBAN OPERATIONS

Single-Link 2W Full-Duplex
Peer-to-Peer Configuration

MAJOR CAPABILITIES

- **UHF operating band for extended range and coverage**
- **Scalable point-to-point to wide-area mesh**
- **Robust suite of physical security and data encryption services**
- **End-to-end redundancy and fault tolerance configurations**
- **Up to 30 Mbps full-duplex links**

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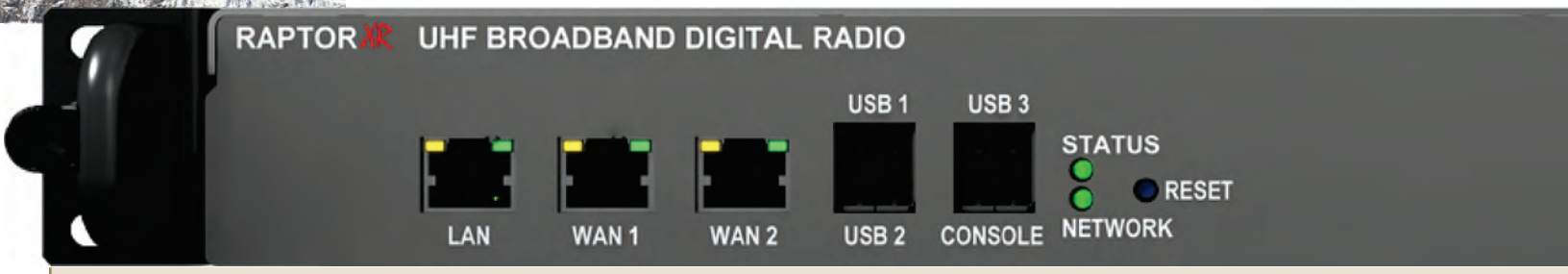
RAPTOR XR SYSTEM OVERVIEW

THE RAPTOR XR IS AN INDUSTRIAL-GRADE WIRELESS NETWORKING SYSTEM DESIGNED TO MEET THE RIGORS AND CONNECTIVITY REQUIREMENTS OF CRITICAL BACKHAUL AND INFRASTRUCTURE OPERATIONS.

RAPTOR XR FEATURES A MODULAR HARDWARE AND FIRMWARE SYSTEM CONCEPT THAT KEEPS PACE WITH EVER INCREASING TRANSPORT AND SECURITY REQUIREMENTS.



RAPTOR XR STANDARD CONFIGURATIONS AND APPLICATIONS

STANDARD AND OPTIONAL CONFIGURATIONS

BROAD SPECTRUM OPERATING SUPPORT

- Dual UHF operation:
  470-602, 620-698 MHz
- Power output:
  Standard: 2W (33 dBm)
- Dynamic link performance engine continuously maintains end-to-end signal integrity
- Spectrum Management System works to avoid interference and sustain connectivity

NETWORK ARCHITECTURE

- Pre or field-configurable architectures: point-to-point, broadcast, and ad hoc peer-to-peer mesh topologies
- Compatible with all IP-based routers, hosts, and clients
- Bonded channel aggregation capability increases system reliability, payload capacity, and interference resistance

ANTENNA OPTIONS

- Standard: Common (Tx/Rx) antenna (with integrated diplexer)
- Option: Independent Tx/Rx antenna options provide range and coverage flexibility

SECURITY

- Robust suite of physical, firmware, and software tools to defend against wireline and wireless threats.

APPLICATIONS

TELECOMMUNICATIONS

- LTE/4G/GSM Range Extension
- Remote WiFi/WiMax Off-load
- Rural Internet infrastructure
- Superior infrastructure RF penetration and coverage
- Maritime ship-to-shore and ship-to-ship

NATIONAL INFRASTRUCTURE

- Border networks to support VoIP, video, data, and ISR systems
- Oil and gas production and distribution
- Water and waste water infrastructure
- Electric power transmission and distribution grid
- Chemical and pharmaceutical processing facilities

TRANSPORTATION SYSTEMS

- Public and safety backhaul
- Highway infrastructure networks
- Rail monitoring and control systems
- Harbor and waterways network

OPTIONS

- Mobile and explosion resistant packaging
- Interfaces for legacy (non-IP) devices
- DC input support from 12 to –48 VDC

RAPTOR XR NETWORK DESIGN

RAPTOR XR WIRELESS NETWORK TECHNOLOGY OFFERS THE NETWORK DESIGNER, OPERATOR AND SERVICE PROVIDER MAJOR PERFORMANCE ADVANTAGES OVER CONVENTIONAL LTE/4G, MICROWAVE, AND SATELLITE SYSTEMS.

Spectrum Advantage

- Up to 5 times the range and coverage than WiMax and WiFi in urban and rural settings (see Table 1)
- Superior RF reach and coverage within structures, canopied, and vegetative areas
- Spectrum Agility and Frequency Diversity to increase throughput, and avoid or by-pass on-air interference

TABLE 1. RAPTOR XR RANGE AND COVERAGE ADVANTAGE

FREQUENCY MHz	BAND/ TECHNOLOGY	NOMINAL RANGE (km)	
		IN-CITY	RURAL
470–698	UHF	7	25
903–928	UHF	4	10
2400	802.11g/n WiFi	2.5	7
5800	802.11a WiFi	1	4

Table 1 Analysis Parameters
- Tx and Rx antenna height: 20 meters; Rx sensitivity: -80 dBm at 6 MHz bandwidth
- UHF power out: 27.8 dBm; Single link full-duplex payload rate: 10 Mbps
- 0.9, 2.4, 5.8 GHz systems at 27 dBm output.

Network Advantage

Raptor XR's embedded physical and network level peer-to-peer and ad hoc unified mesh routing engine supports all network architectures—point-to-point, mesh, star and tree network configurations. With these configurations nearly any real-world connectivity challenge can be solved.

Network Management Advantage

SafariView, RAPTOR XR's embedded Operations, Administration and Maintenance (OAM) tool provides total secure administration and control of each RAPTOR XR node and the network.

Cyber Advantage

RAPTOR XR's suite of security-focused hardware, firmware, and software assists in defending critical operations and information from internal and external wireless and network threats.

Application Versatility Advantage

RAPTOR XR's network of scalability and versatility allows system planners to meet specific range, coverage, security, and mission requirements at minimum life cycle cost and system interruption.

Capital Advantage

RAPTOR XR is the economic solution of choice. Its broad operating spectrum capability and longer reach mean quicker deployment with less equipment and required infrastructure. Raptor XR offers a real alternative to VSAT and microwave in challenging environments.

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NETWORKING

RAPTOR XR TOPOLOGY EXAMPLES

Flexibility and scalability are essential elements in successfully meeting today's backhaul infrastructure requirements. The figures below illustrate Raptor XR's ability to meet virtually any topology challenge.

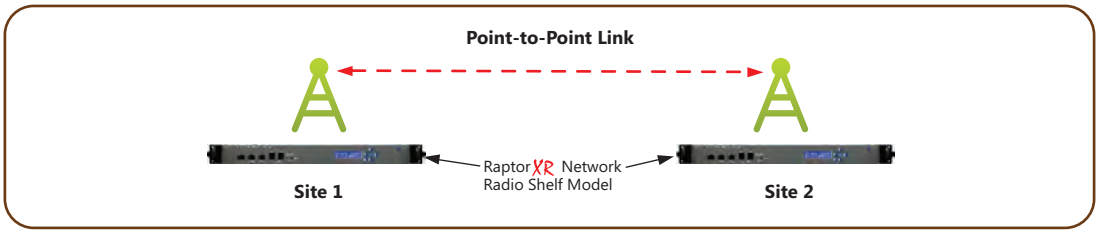

Figure 1. Point-to-point link using a dual VHF or UHF channels.

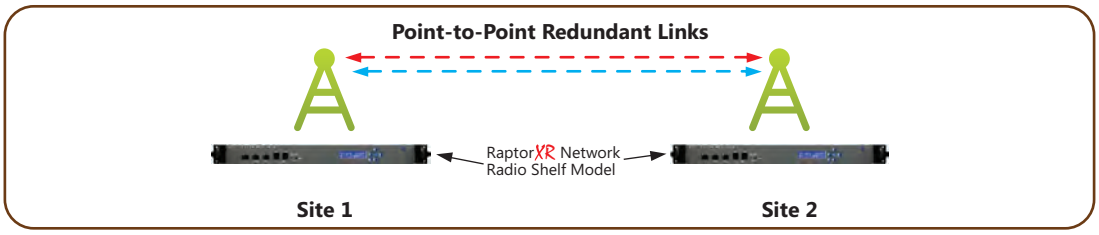

Figure 2. Aggregating multiple channels increases throughput by doubling RF bandwidth and enhancing system reliability through spare diversity (antenna separation) and frequency diversity via a secondary UHF link.

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NETWORK SECURITY AND MAINTENANCE TOOLS

RAPTORXR DUAL CPU CORE, CRYPTO-ACCELERATED NETWORK PROCESSOR SUPPORTS DEPLOYMENT IN NEARLY ANY CRITICAL INFRASTRUCTURE APPLICATION.

Standard network architecture and security capabilities include:

FIREWALL/DMZ

- Robust firewall rule construction
- Secure download of firewall rule sets

AUTHENTICATION

- Multi-factor authentication
- Remote access token-based authentication

MALICIOUS CODE DETECTION

- Deep packet inspection

EVENT/STATUS MONITORING AND LOGGING

- SNMPV3 enhanced security and remote configuration
- Maintenance logs
- Authentication
- Traffic monitoring and analysis
- Intrusion detection

WIRELESS MAINTENANCE SUPPORT

- Secure password support for remote management and configuration of wireless and network elements

FAULT TOLERANT AND REDUNDANCY SUPPORT

- Power Shelf provides 100% backup for all RF functions
- Dual channel operation supports frequency and space diversity providing high reliability data transfer over long and NLOS paths

VLAN SUPPORT

- Multiple independent VLANs
- VLAN trunking

CYBER DEFENSE TOOLS:

- Static Coding of ARP Tables
- Embedded encryption along with strong authentication provides resilience to Man-in-the-Middle attacks
- Embedded ARPWatch tool monitors and logs Ethernet traffic activity e.g. changing IP and MAC addresses. RaptorXR will notify and react if non-approved Ethernet/IP pairings occur.

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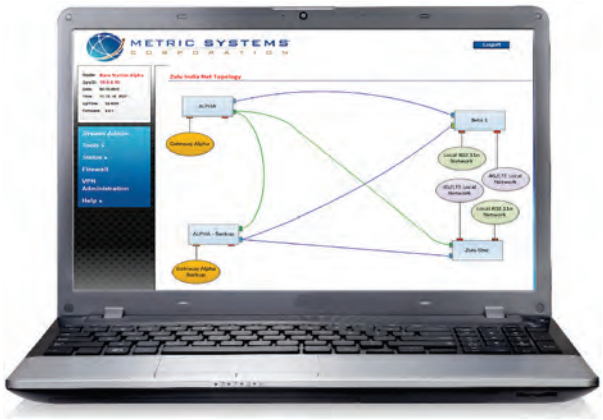

SafariView Network Graph UI provides a visual monitor of all levels of connectivity and key statistics

INTERFACING WITH RAPTOR XR

RaptorXR Network Radio Shelves are bundled with SafariView, an embedded web-based UI that performs standard Operations, Administration, and Maintenance (OA&M) activities.

SafariView | RaptorXR Operations, Administration, and Maintenance (OAM) Tool

Embedded in each RaptorXR is a robust suite of network tools and applications to configure, monitor, administer, and control each RaptorXR within the network. Capabilities under password and secure control include:

- Ability to configure any RaptorXR within a network locally or remotely
- Robust firewall defense at each RaptorXR WAN and LAN gateway
- Support for multiple secure VPN circuits
- Redundant and alternative fault-tolerant network scenario support
- Manual or automatic control of radio link services for each RaptorXR site
- Embedded wireless controller support for secure WiFi and third party wireless systems
- Factory support for non-IP devices and wireless voice and data systems
- Deployment Aids:
  - Over-the-air antenna aiming tools
  - Link quality measurement system

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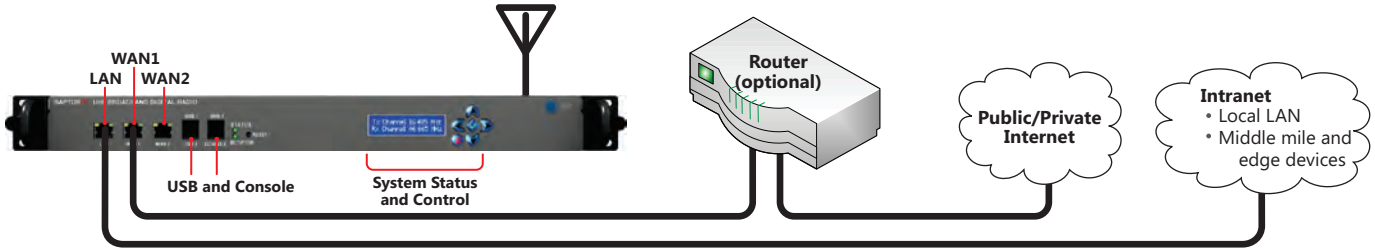
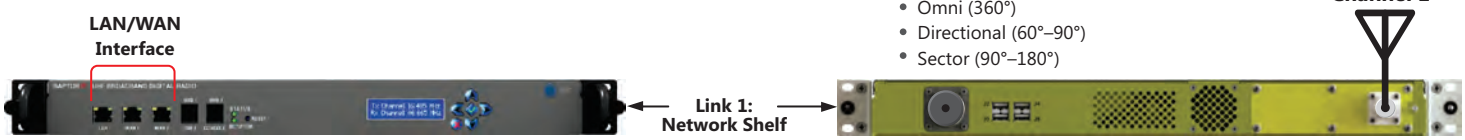
TYPICAL NETWORK AND RF SITE CONFIGURATIONS

Basic Site Configuration



Single Link Full-Duplex/Common Tx/Rx Antenna Configuration



Use this configuration for point-to-point and multi-point applications.
(See Topolgies Example page)

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Raptor XR Standard Singlel Link Configuration

Primary Wireless Link and Network Processor.....

OPERATING AND TECHNICAL SPECIFICATIONS

GENERAL	
Standard Frequency Range	
UHF Low-Band	470–602 MHz
UHF High-Band	620–698 MHz
Dynamic Frequency Agility (DFA) option	Provides active broad spectrum operation to avoid fading and interference
Frequency tuning steps	1 kHz
Weight	
Primary link	9.5 lbs (4.31 kg)
Power supply	9.4 lbs (4.26 kg)
Dimensions	
Primary link	14 in. D x 19 in. W x 1.75 in, H (355.6 mm x 482.6 mm x 44.45 mm)
Power supply	14 in. D x 19 in. W x 1.75 in, H (355.6 mm x 482.6 mm x 44.45 mm)
Operating temperature	Standard: -10° to +65°C Optional: -35° to +65°C

RECEIVER/TRANSMITTER MINIMUM SPECIFICATIONS			
Modulation Mode	Minimum Signal Level dBm	Minimum Required SNR (dB)	Full-Duplex Link Rate (Mbps)
QPSK (4 QAM)	-85	8	8.28
16 QAM - OFDM	-80	12	12.4
64 QAM - OFDM	-75	18	18.66
Adjacent channel rejection (6 MHz channel VHF/UHF)	> 70 dB (100 kHz off-channel)		
Image rejection	> 70 dB		
Average conductive RF power output per VHF/UHF 6 MHz channel	27.8 dBm		

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POWER	
AC Input	110/240 VAC 50/60 Hz
Power consumption:	70 Watts
SECURITY	
Encryption	128/256-bit Advanced Encryption Standard (AES)
Authorization and Accounting	Protects against unauthorized administration/ maintenance and over-the-air access
System access/authentication capabilities	Multi-factor authentication. Remote access token-based authentication
System access/authentication capabilities	Integrated firewall and Information Assurance tools
NETWORK ARCHITECTURE	
VLAN	Supports multiple laws; static and dynamic
	System integrity logs
Firewall	Robust rule support and encrypted download
Dynamic ad hoc network	Adaptive, self-forming, self-healing network
Network size	Limited only by available RF channels
Network capabilities/single channel	Point-to-point, point-to-multipoint, and mesh
Network capabilities/dual channel	Point-to-point, multipoint, and mesh
Maintenance/diagnostics	Over-the-air programming, integrated web-based administration, monitoring, and reconfiguration
System logs	System. security, authentication, information flow, traffic monitoring, and intrusion detection
Network timing	Multiple network timing protocol options (NTP)
STANDARD ANTENNA INTERFACES	
Standard	Common Tx/Rx antenna (with diplexer)
Optional	Separate Tx and Rx antennas
FREQUENCY STABILITY	
Internal (standard)	±2.5 ppm, ±25 Hz
External GPS (optional)	High stability reference, ±0.25 Hz
SUPPORT ACCESSORIES	
Antennas	Directional, omni or sector
External GPS Geo Location module	Provides NEMA 0183 format latitude and longitude output
Precision Frequency Synchronization Module	GPS time-base precision frequency source (<±.1 ppm), ±1 Hz

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Q/A

CHANNEL SELECTION

How do I choose what channel to use?

Operating channels should match your application. For example, in long range and wide coverage scenarios, a lower operating frequency or channel should be used. Operating over a relatively flat 20 km range, a UHF channel will perform well with adequate signal margin to survive 10 to 20 dB fades. Over the same range in a forested area, high-band VHF 170 to 216 MHz provides a higher Rx signal and increased fade tolerance.

How do I determine what channels are available?

In LOS applications, both VHF and UHF bands offer comparable service, although when possible, the lower frequency provides additional margin. For outside to inside operation, UHF is recommended. In high vegetative and beyond-line-of-sight applications, VHF is superior. In all cases, Raptor XR's spectrum evaluation tool will assist in this process. Whenever possible, over-the-air (OTA) evaluation should be performed in both VHF and UHF bands if channels are available.

INTERFERENCE

What happens if there is interference on a channel I am using?

When communication is degraded by interference, the Raptor XR can be configured to manually, or automatically do the following:

a) Switch to an alternate authorized clear channel using Raptor XR's embedded SafariView Spectrum Management tools.

b) Automatically or manually change modulation format to maintain data flow.

c) Increase power to legal maximum to overcome the interference.

d) Automatically switch to a pre-programmed channel to continue operation.

SPECIALIZED SOLUTIONS

Can Metric Systems provide specialized Raptor XR solutions to fit ship-to-shore, ship-to-ship, ground-to-ground, or ground-to-air requirements?

Yes, Metric Systems sales representatives welcome the opportunity to work with your organization to deliver application-specific solutions to meet your specific needs.

NETWORK CAPABILITIES

Can I use multiple VHF/UHF channels to increase transport speed and reliability?

Yes. Independent adjacent or non-adjacent channels in the same or different VHF/UHF bands can be bonded to increase data speeds and to provide frequency and spatial diversity to increase system reliability in the event of channel degradation by noise or fading.

Note: Channel bonding requires at least one Raptor XR Link Expansion Shelf.

Can I change channels remotely?

Yes. Raptor XR network access is fully controlled by a secure pre-configuration, or over-the-air via an encrypted channel.

Can a Raptor XR network integrate into an existing RF data network or microwave infrastructure network?

Yes. The Raptor XR is an Internet Protocol (IP) device using Ethernet interconnect technology which is compatible with all other network devices including WiFi and LTE/4G systems. Raptor XR's internal routing engine allows you to integrate with any network based communication system.

ANTENNAS

How do I determine what antenna to use?

Antenna choice is based primarily on two factors:

a) In a point-to-point application, directional gain antennas are recommended. Raptor XR offers an independent receive antenna option that allows the use of high gain Rx antennas to increase Rx signal level for extended reach applications.

b) For point-to-multipoint operations, recommended antennas range from 360° omnidirectional coverage to 90 to 180° sector antennas provide defined geographical coverage.

LICENSING

Is an export license required?

An export license for the Raptor XR is only required if it is used for military applications or optimized to operate in the 225 to 400 MHz band.

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