

## EX-s Series GigE ITU/ETSI



### Split-Mount, Carrier-Class, Upgradeable Licensed-Band Systems for Medium and High Capacity TDM and Ethernet Backhaul Applications

The EX-s Series GigE split-mount microwave radios are carrier-class, point-to-point systems for 6 to 40 GHz ITU/ETSI licensed spectrum. Featuring native TDM and native Gigabit Ethernet transport with over 360 Mbps full-duplex capacity per radio carrier, EX-s Series GigE systems are available with software configurable PDH or SDH interfaces up to 2xSTM-1 and up to 4x10/100/1000 BaseT ports available in the same 1RU IDU. The EX-s Series GigE systems are designed to support any mix of TDM and IP/Ethernet traffic, allowing risk-free network migration for both private and operator networks, including 3G to LTE evolution.

**The Native Difference.** The EX-s GigE systems deliver true carrier-class capability, made possible by running TDM and Ethernet natively. That means rock-solid TDM performance regardless of IP traffic behavior. It also means that when T1/E1 ports are added, TDM throughput is traded bit-for-bit for Ethernet throughput and vice versa, so there's never a question about available user throughput for either transport.

**Adaptive Modulation.** adaptive modulation technology allows links to simultaneously support different availability levels for TDM and Ethernet. This optimizes range and performance for the most sensitive TDM traffic while ensuring high performance for inherently resilient Ethernet traffic. Links can be engineered for longer distances and Ethernet transport will respond elastically to changing link conditions without affecting TDM availability.

**Capacity Aggregation.** The EX-s GigE radios can aggregate capacity across multiple licensed and license-exempt microwave links to deliver a single, high speed connection of up to 1 Gbps full-duplex across a single Gigabit Ethernet interface.

**Advanced Data Networking.** The EX-s GigE radios offer a rich set of advanced data networking features, including a built-in Gigabit Ethernet layer 2 switch with 802.1q VLAN (single and double tag) up to 4094 VLAN IDs plus multi-level QoS featuring 8 priority levels and 8 individual queues. Traffic can be prioritized based on 802.1p tags, VLAN ID, MAC source address or MAC destination address as required.

**High Security.** The EX-s GigE systems allow network managers to support the most stringent security requirements, with optional AES 128-bit and 256-bit encryption for data traffic protection and support for both encrypted SNMP v3 and SSL/SSH to ensure management security.

**Advanced Spectrum Diagnostics.** Radio offers built-in spectrum analysis in a licensed radio. The spectrum analyzer simplifies site survey analysis and aids in antenna alignment, installation and RSL optimization. Once the link is commissioned, the spectrum analyzer is a useful troubleshooting tool to ensure no interference issues exist and to verify that the link is performing at optimum.

Specifications	6 GHz	7 GHz	8 GHz	13 GHz	15 GHz	18 GHz	23 GHz	38 GHz
Maximum Capacity	TDM 1-2xSTM-1, 16xT1/E1, 8xT1/E1, and 4xT1/E1 in various configurations							
	Ethernet 187 Mbps				366 Mbps			
Frequency (GHz)	5.925-6.425	7.125-7.900	7.900-8.500	12.750-13.250	14.500-15.350	17.700-19700	21.200-23.610	38.595-40.100

## Specifications EX-s Series GigE ITU/ETSI

System	
<b>IDU Models<sup>1</sup></b>	
1000E	4xGbE
8-1000E	8xT1/E1 + 4xGbE
16-1000E	16xT1/E1 + 4xGbE
2STM1/4-1000E	2xSTM-1 + 4xT1/E1 + 4xGbE
<b>Power Control Step Size</b>	0.5 dB
<b>Maximum RSL</b>	
64QAM	-25 dBm error-free
128QAM	-27 dBm error-free
256QAM	-30 dBm error-free
<b>Error Floor</b>	10 <sup>-12</sup>
<b>Power Control Range</b>	20 dB
<b>ATPC</b>	Yes
<b>Adaptive Modulation</b>	QPSK - 256QAM; Selectable, fully configurable with prioritization
<b>TDM Latency</b>	250µs typical
<b>Ethernet Latency</b>	40–125µs (<100µs typical) at full throughput (GigE) with AES encryption enabled
<b>Data Security</b>	Optional NIST FIPS 197-compliant 128-bit AES and 256-bit AES2
<b>Link Security</b>	96-bit security key
<b>Equipment Configurations</b>	1+0, 1+1, 1+1 SD, 1+1 SD/FD N+0
<b>Path Protection</b>	Space diversity with errorless switching Frequency diversity
<b>Capacity aggregation</b>	Polarization aggregation with XPIC1 N+0 link aggregation
<b>T1/E1 Cross-connect</b>	Built-in, software controlled T1/E1 port cross-connection between endpoints
<b>T1/E1 Prioritization</b>	User configurable
<b>Spectrum management<sup>3</sup></b>	Built-in spectrum analyzer
<b>Installation and Management Manual</b>	Embedded in radio, accessible via HTTP GUI
<b>Management</b>	In-band and out-of-band management
<b>Security</b>	SSL/SSH and secure, encrypted SNMP v3
<b>Web GUI</b>	Embedded web server GUI (Internet Explorer, Firefox)
<b>CLI</b>	10/100/1000BaseT or serial craft port
<b>SNMP</b>	v1, v2c, and secure v3
<b>MIB</b>	MIB I, MIB II,
<b>XML</b>	XML configuration file
<b>SNMP Manager support</b>	Castlerock SNMPc, HP Openview or any SNMP EMS
<b>Compliance</b>	
<b>RF</b>	EN 302 217; ITU R-REC-F.383, 385, 386, 497, 595, 636, 637, 749
<b>EMI</b>	EN 301 489-4
<b>Safety</b>	EN 60950-1, IEC 60950-1
<b>Physical</b>	
<b>Dimensions (H x W x D)</b>	
<b>IDU</b>	1 RU: 1.7 x 17 x 11 in / 44 x 43 x 28 cm
<b>ODU</b>	10.9 x 9.4 x 3.6 in / 27.7 x 23.9 x 9 cm
<b>Weight</b>	IDU: 9 lbs / 4 kg ODU: ≤9.5 lbs / 4.3 kg
<b>Full Specification Temperature</b>	IDU: -5 to +50 °C / 23 to + 122 °F ODU: -33 to +50 °C / -27 to + 122 °F
<b>Operating Temperature</b>	IDU: -10 to +55 °C / 14 to +131 °F ODU: -40 to +55 °C / -40 to +131 °F
<b>Altitude</b>	15,000 ft/4.6 km
<b>Humidity</b>	IDU: 95% non-condensing ODU: 100% non-condensing

Interfaces			
<b>IDU to ODU</b>	N-type Female, impedance 50 ohm		
<b>TDM (Native)</b>	<b>STM-1</b>	<b>T1</b>	<b>E1</b>
<b>Connector</b>	SFP, Single Mode LC Transceiver	RJ48C/RJ45 Female (x16)	RJ48C/RJ45 Female (x16)
<b>Impedance</b>	-	100 ohms, balanced	120 ohms, balanced
<b>Line Code</b>	Binary Scrambled NRZ CMI	AMI, B8ZS, selectable per channel	HDB3
<b>Clocking Speed</b>	155.52MHz	1.544 MHz	2.048 MHz
<b>Compliance</b>	ITU-T G.957 G.703	ANSI T1.102-1987; ITU-T; G.823; GR-499-CORE	CEPT-1; G.703; ITU-T-G.703
<b>Loopback Modes</b>	Remote Internal; Remote External; Local Line		
<b>RX/TX</b>	1310nm single mode (2 km, 15 km) Rx: -31 to -8 dBm Tx: -15 to -8 dBm	-	-
	1310 nm multi-mode Rx: -30 to -14 dBm Tx: -19 to -14 dBm	-	-
<b>Ethernet (Native)</b>	<b>RJ45 Female (x2), auto-MDIX</b>	<b>SFP (x2)</b>	
<b>Interface Speed</b>	10/100/1000BaseT	1000BaseT/X	
<b>Duplex</b>	Half, Full, Auto	Half, Full, Auto	
<b>Compliance</b>	802.3	802.3	
<b>Maximum Packet Size</b>	9728 bytes	9728 bytes	
<b>VLAN</b>	802.1q, transparent, trunk, and management only; over 4,000 VLAN IDs		
<b>QoS</b>	8 priority levels, 8 queues 802.1p, 802.1q (VLAN ID), source MAC address, destination MAC address		
<b>Ethernet Rate Limiting</b>	Configurable per port via software, 1 Kbps resolution		
<b>1+1 Protection Port</b>	1x RJ48C/RJ45 Female, proprietary control		
<b>Expansion Port</b>	1x RJ48C/RJ45 Female, proprietary control		
<b>Console (Serial)</b>	9-pin Sub-D (F)		
<b>Speed</b>	9600 bps		
<b>Compliance</b>	EIA-574 (RS-232)		
<b>Alarm</b>	9-pin Sub-D (F) Inputs (2) TTL/Closure Outputs (2) Relay (Form C)		
<b>DC Power</b>	3-pin barrier strip		
<b>Input Voltage</b>	-48 VDC		
<b>Consumption</b>	<115 W (48 V: <2.5 A, 24 V: <5 A)		
<b>AC Power Adapter (optional accessory)</b>	EIC-to-NEMA 5-15		
<b>Input</b>	100-240 VAC, 2.5 A		
<b>Output</b>	48 VDC, 3 A, 150 W		
<b>Warranty</b>	Two years <sup>4</sup>		

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Frequency Bands <sup>1</sup>	6 GHz	7 GHz	8 GHz	13 GHz	15 GHz	18 GHz	23 GHz	38 GHz
Frequency Range (GHz)	5.925–6.425	7.125–7.900	7.900–8.500	12.750–13.250	14.500–15.350	17.700–19.700	21.200–23.610	38.595–40.100
TR Spacing (MHz)	252.04	154,161,168,196,245	119, 266, 311.32	266	315, 420, 490, 728	1010	1008, 1232	1260
Channel Spacing (MHz)	5, 10, 20, 30	7, 14, 28, 56	7, 14, 28, 56	7, 14, 28, 56	7, 14, 28, 56	7, 14, 28, 56	7, 14, 28, 56	7, 14, 28, 56
Antenna interface	-	WR-112	WR-112	WR-75	WR-62	WR-42	WR-42	0.219 dia
<b>Output Power (Standard/High; dBm)<sup>5</sup></b>								
QPSK	- / 30	25.5 / 30	25.5 / 30	24.5 / 26	24.5 / 26	22.5 / -	22.5 / -	22.5 / -
16QAM	- / 28	22 / 28.5	22 / 28.5	20.5 / 24.5	20.5 / 24.5	19.5 / -	19.5 / -	19.5 / -
32QAM	- / 28	21.5 / 28	21.5 / 28	20 / 24	20 / 24	19 / -	19 / -	19 / -
64QAM	- / 24	20.5 / 25.5	20.5 / 26.5	18.5 / 20.5	18.5 / 20.5	17.5 / -	16.5 / -	16.5 / -
128QAM	- / 24	20 / 25	20 / 25	18 / 20	18 / 20	17 / -	16 / -	16 / -
256QAM	- / 22	18.5 / 22.5	18.5 / 22.5	16.5 / 18.5	16.5 / 18.5	15.5 / -	14.5 / -	-
<b>Receiver Threshold (dBm) (guaranteed over temperature BER 10<sup>-6</sup>)</b>								
QPSK	5 MHz	-89	-	-	-	-	-	-
	7 MHz	-	-89	-88	-89	-89	-89	-87
16QAM	10 MHz	-86	-	-	-	-	-	-
	14 MHz	-	-86	-85	-86	-86	-86	-84
32QAM	20 MHz	-84	-	-	-	-	-	-
	28 MHz	-	-83	-82	-83	-83	-83	-81
64QAM	30 MHz	-83	-	-	-	-	-	-
	56 MHz	-	-80	-79	-80	-80	-80	-78
128QAM	5 MHz	-82	-	-	-	-	-	-
	7 MHz	-	-82	-82	-82	-82	-82	-81
256QAM	10 MHz	-81	-	-	-	-	-	-
	14 MHz	-	-79	-79	-79	-79	-79	-78
16QAM	20 MHz	-77	-	-	-	-	-	-
	28 MHz	-	-76	-76	-76	-76	-76	-75
32QAM	30 MHz	-76	-	-	-	-	-	-
	56 MHz	-	-73	-73	-73	-73	-73	-72
64QAM	5 MHz	-78	-	-	-	-	-	-
	7 MHz	-	-78	-78	-78	-78	-78	-77
128QAM	10 MHz	-78	-	-	-	-	-	-
	14 MHz	-	-76	-76	-76	-76	-76	-75
256QAM	20 MHz	-74	-	-	-	-	-	-
	28 MHz	-	-73	-73	-73	-73	-73	-72
16QAM	30 MHz	-73	-	-	-	-	-	-
	56 MHz	-	-70	-70	-70	-70	-70	-69
32QAM	5 MHz	-76	-	-	-	-	-	-
	7 MHz	-	-76	-76	-76	-76	-76	-75
64QAM	10 MHz	-75	-	-	-	-	-	-
	14 MHz	-	-73	-73	-73	-73	-73	-72
128QAM	20 MHz	-71	-	-	-	-	-	-
	28 MHz	-	-70	-70	-70	-70	-70	-69
256QAM	30 MHz	-70	-	-	-	-	-	-
	56 MHz	-	-67	-67	-67	-67	-67	-66
16QAM	5 MHz	-73	-	-	-	-	-	-
	7 MHz	-	-73	-73	-73	-73	-73	-72
32QAM	10 MHz	-72	-	-	-	-	-	-
	14 MHz	-	-70	-70	-70	-70	-70	-69
64QAM	20 MHz	-68	-	-	-	-	-	-
	28 MHz	-	-67	-67	-67	-67	-67	-66
128QAM	30 MHz	-67	-	-	-	-	-	-
	56 MHz	-	-64	-64	-64	-64	-64	-63
256QAM	5 MHz	-70	-	-	-	-	-	-
	7 MHz	-	-70	-70	-70	-70	-70	-69
16QAM	10 MHz	-68	-	-	-	-	-	-
	14 MHz	-	-67	-67	-67	-67	-67	-66
32QAM	20 MHz	-63	-	-	-	-	-	-
	28 MHz	-	-64	-64	-64	-64	-64	-63
64QAM	30 MHz	-64	-	-	-	-	-	-
	56 MHz	-	-61	-61	-61	-61	-61	-60

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Throughput (Mbps full-duplex) (Max system layer 1/Max Ethernet layer 2) <sup>6</sup>						
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
5 MHz	15 / 11	28 / 21	36 / 27	43 / 32	49 / 37	58 / 43
7 MHz	15 / 11	28 / 21	36 / 27	43 / 32	49 / 37	58 / 43
10 MHz	19 / 15	38 / 30	47 / 38	57 / 46	66 / 53	76 / 61
14 MHz	28 / 21	58 / 43	72 / 54	86 / 64	100 / 75	116 / 86
20 MHz	38 / 30	76 / 61	95 / 76	114 / 92	133 / 107	152 / 123
28 MHz	57 / 46	114 / 92	143 / 115	172 / 139	201 / 162	229 / 185
30 MHz	57 / 46	114 / 92	143 / 115	172 / 139	201 / 162	229 / 185
56 MHz	116 / 86	230 / 171	288 / 214	345 / 257	429 / 318	493 / 366

  

Dispersive Fade Margin (dB; Bellcore BER 10 <sup>-3</sup> )						
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
10 MHz	80	74	71	68	65	62
20 MHz	73	67	65	62	58	55
30 MHz	69	63	60	57	53	50
40 MHz	66	60	57	54	51	48
50 MHz	64	57	55	52	49	46

<sup>2</sup> Software license key option.

<sup>3</sup> Software upgrade required.

<sup>4</sup> Terms and conditions apply.

<sup>5</sup> ±1dB over temperature.

<sup>6</sup> Maximum layer 1 throughput as measured with 64-byte packets and maximum layer 2 Ethernet measured with 1522-byte packets.ases throughput includes source address, destination address and CRC overhead.