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Quad

Full-outdoor Quad-carrier Packet Radio



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Quad in a nutshell

Our Quad, a unique quad-carrier microwave radio transceiver, is a potent full-outdoor, zero-footprint carrier-grade packet radio solution. With its whopping 4.2 Gbps capacity potential, it represents the perfect back-up or alternative for optical fibre cable and Free Space Optics (FSO). Compared to fibre, it can tremendously improve time-to-service and greatly decrease cost of implementation. Compared to FSO, it can greatly increase capacity, range and service availability at a comparable or lower cost.

The robust and durable Quad single-box structure is built to withstand harsh weather conditions and exposure to the elements. It can readily be mounted on towers, rooftops, lamp posts, traffic light poles and mobile cell-sites. The Quad boasts very high spectral efficiency through 4096 QAM modulation and packet header compression, warranting the most effective use of scarce spectrum resources.

Being a high-capacity frequency-division duplex (FDD) solution, it's ideally suited for demanding low-latency applications. Its support of both frequency and phase synchronization makes it an ideal companion for mobile backhaul. In good DragonWave tradition, the Quad features a user-friendly GUI.

Applications

4G and 5G Mobile Backhaul

Quad is a perfect fit for 3G, 4G and 5G base station site backhaul, serving as an alternative or backup for optical fibre circuits and FSO. It's a perfect fit for modern all-packet base stations because it packs a lot of capacity in a single unit, which, coupled to low latency and jitter, frequency & phase network synchronization and very high link availability with properly engineered links.



Internet Service Provider Access & Transport Network

Our Quad allows ISPs, who own no land lines, to quickly establish a fat data pipeline without quality compromises. ISPs can grow their profits by delivering services with guaranteed SLAs or reach out to remote clients using dependable, licensed-band radios.

Enterprise Networks

Quad is an affordable high-capacity radio solution for enterprises that need ultra-fast, high-availability private lines for their broadband Ethernet traffic. It offers a good alternative to optical fibre, FSO, DOCSIS and xDSL-based access. With an external circuit-emulating switch, or with a so-called smart SFP interface unit, it can even support legacy TDM or PDH circuits requiring 1 to 16 E1 or T1 interfaces.

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Channel Configurations



Quad supports the following channel configurations:

1. Quad-carrier in two channels using dual-polarization and XPIC on both channels: 4+0 XPIC
2. Quad-carrier in four different channels using the same or dual-polarization: 4+0
3. Dual channel east / west in four different channels: 2 x (2+0)

By adding a coupler even larger configurations like 8+0 can be attached to a single antenna, boasting an impressive 8.4 Gbps of maximum throughput, across distances that cannot be matched by E-band links.

Configurations 1 and 2 deliver up to 4.2 Gbps of full-duplex capacity in a single link. Configuration 3 delivers up to 2.1 Gbps in two directions on two links.

Feature Highlights & Specifications

Carrier-grade, zero footprint, fully outdoor, cost-effective solution with up to 4.2 Gbps full-duplex capacity.

Radio & Modem

- 4+0 and 4+0 XPIC native configurations
- Supported licensed bands: L6 GHz, U6 GHz, 7 GHz, 8 GHz, 11 GHz, 13 GHz, 15 GHz, 18 GHz, 23 GHz, 26 GHz, 28 GHz, 32 GHz, 38 GHz and 42 GHz
- Supported unlicensed bands: 10.5 GHz, 17 GHz and 24 GHz
- Supported channels:
  - ETSI / ITU: between 28 MHz and 112 MHz
  - ANSI: between 30 MHz and 80 MHz
- Modulation between QPSK and 4,096 QAM
- Hitless Adaptive Coding and Modulation (ACM)
- Advanced multilevel LDPC and RS FEC
- Adaptive Digital Pre-Distortion (DPD)

Baseband Interfaces

- 2 x 10 Gbps SFP+ cages / receptacles
- 2 x FE/GE electrical RJ45 interface
- - 48 V_{DC} power supply with 2-wire or coaxial cable
- RSSI I/F for antenna alignment: mini-BNC

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Switching

- Embedded Layer-2 switch
- Auto MDI/MDXI (802.3ab)
- Flow control (802.3x)
- Buffer: 8 Mbit non-blocking store & forward
- Jumbo frames up to 10,240 bytes
- 16k MAC table entries with auto learning & aging
- QoS (802.1p) with Rate-Limiting and Shaping (RLS) based on port, VLAN ID / Priority, and DSCP for traffic prioritization
- VLAN (802.1Q), QinQ (802.1ad)
- STP/RSTP (802.1D) and MSTP path protection mechanisms
- LACP (802.1AX) link aggregation / load balancing
- Header Compression (HC) for enhanced L2 throughput

Network Synchronization

- Synchronous Ethernet (SyncE)
- IEEE1588v2 (PTP) TC & BC

Network Security

- AES256 payload encryption
- HTTPS / SSH / SFTP / SNMPv3

Diagnostics & Monitoring

- Embedded spectrum scan
- Bit Error Rate (BER) monitoring
- Local and Remote loopback for line checking
- System Log for alarms, events, configuration

NMS & Local Management

- Local management though secure (https) Web GUI
- In-band or out of band (remote) management through SNMPv1/v2c/v3
- SNMP traps, MIB
- In-band & out-of band management
- Radio performance monitor
- PMON & RMON stats

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Capacity Table

Modulation & Throughput (Mbps)										
Channel BW (MHz)	**QPSK**	**16QAM**	**32QAM**	**64QAM**	**128QAM**	**256QAM**	**512QAM**	**1024QAM**	**2048QAM**	**4096QAM**
28	184,0	367,6	452,0	552,4	644,4	736,0	830,8	921,2	1012,0	1079,6
29,65	192,0	384,0	472,0	576,8	673,2	768,8	867,6	962,0	1057,2	1127,6
40	260,8	520,8	640,0	782,0	912,8	1042,4	1176,4	1304,4	1433,2	1528,8
56	368,0	735,2	904,0	1104,8	1289,2	1472,4	1661,6	1842,4	2024,4	2159,6
60	391,2	781,2	960,4	1173,2	1369,2	1563,6	1764,8	1956,4	2150,0	2293,6
80	514,8	1028,0	1284,0	1544,4	1802,4	2058,0	2322,8	2575,6	2830,0	3018,8
112	715,2	1428,4	1753,6	2142,4	2499,6	2865,6	3210,4	3570,8	3952,8	4255,6

Transmit Power Table

	Frequency	**6L GHz**	**6U-11 GHz**	**13-15 GHz**	**18 GHz**	**23-26 GHz**	**≥32 GHz**
Maximum RF Output Power per channel (dBm)	4096QAM	20	19	18	17	18	13
	2048QAM	20	19	18	19	18	13
	1024QAM	21	20	19	20	19	13
	512QAM	21	20	19	20	21	14
	256QAM	21	20	19	20	21	15
	128QAM	21	20	19	20	21	15
	64QAM	22	21	20	21	21	16
	32QAM	22	21	20	21	21	17
	16QAM	22	21	20	21	21	18
	QPSK	22	21	20	21	21	19
Minimum RF Output Power (dBm)		0					
Power tuning Increment (dB)		1					
Power accuracy (dB)		±2					



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Receiver Sensitivity Table

Frequency			6L GHz	6U GHz	8GHz	11-15GHz	18 GHz	23 GHz	>32GHz
Rx at BER=10^{-6} (dBm)	112MHz	4096QAM	-49.1	-49.1	-49.1	-48.6	-48.1	-48.1	-48.1
		2048QAM	-53.0	-53.0	-53.0	-52.5	-52.0	-52.0	-52.0
		1024QAM	-56.1	-56.1	-56.1	-55.6	-55.1	-55.1	-55.1
		512QAM	-59.3	-59.3	-59.3	-58.8	-58.3	-58.3	-58.3
		256QAM	-62.3	-62.3	-62.3	-61.8	-61.3	-61.3	-61.3
		128QAM	-65.4	-65.4	-65.4	-64.9	-64.4	-64.4	-64.4
		64QAM	-68.3	-68.3	-68.3	-67.8	-67.3	-67.3	-67.3
		32QAM	-70.6	-70.6	-70.6	-70.1	-69.6	-69.6	-69.6
		16QAM	-73.7	-73.7	-73.7	-73.2	-72.7	-72.7	-72.7
		QPSK	-80.1	-80.1	-80.1	-79.6	-79.1	-79.1	-79.1
	80MHz	4096QAM	-50.5	-50.5	-50.5	-50.0	-49.5	-49.5	-49.5
		2048QAM	-54.4	-54.4	-54.4	-53.9	-53.4	-53.4	-53.4
		1024QAM	-57.6	-57.6	-57.6	-57.1	-56.6	-56.6	-56.6
		512QAM	-60.7	-60.7	-60.7	-60.2	-59.7	-59.7	-59.7
		256QAM	-63.8	-63.8	-63.8	-63.3	-62.8	-62.8	-62.8
		128QAM	-66.9	-66.9	-66.9	-66.4	-65.9	-65.9	-65.9
		64QAM	-69.7	-69.7	-69.7	-69.2	-68.7	-68.7	-68.7
		32QAM	-72.1	-72.1	-72.1	-71.6	-71.1	-71.1	-71.1
		16QAM	-75.2	-75.2	-75.2	-74.7	-74.2	-74.2	-74.2
		QPSK	-81.7	-81.7	-81.7	-81.2	-80.2	-80.2	-80.2
	56MHz	4096QAM	-51.9	-51.9	-51.9	-51.4	-50.9	-50.9	-50.9
		2048QAM	-55.8	-55.8	-55.8	-55.3	-54.8	-54.8	-54.8
		1024QAM	-59.1	-59.1	-59.1	-58.6	-58.1	-58.1	-58.1
		512QAM	-62.3	-62.3	-62.3	-61.8	-61.3	-61.3	-61.3
		256QAM	-65.4	-65.4	-65.4	-64.9	-64.4	-64.4	-64.4
		128QAM	-68.4	-68.4	-68.4	-67.9	-67.4	-67.4	-67.4
		64QAM	-71.2	-71.2	-71.2	-70.7	-70.3	-70.3	-70.3
		32QAM	-73.7	-73.7	-73.7	-73.2	-72.7	-72.7	-72.7
		16QAM	-76.8	-76.8	-76.8	-76.3	-75.8	-75.8	-75.8
		QPSK	-83.2	-83.2	-83.2	-82.7	-82.2	-82.2	-82.2
	40MHz	4096QAM	-53.3	-53.3	-53.3	-52.8	-52.3	-52.3	-52.3
		2048QAM	-57.2	-57.2	-57.2	-56.7	-56.2	-56.2	-56.2
		1024QAM	-60.6	-60.6	-60.6	-60.1	-59.6	-59.6	-59.6
		512QAM	-63.8	-63.8	-63.8	-63.3	-62.8	-62.8	-62.8
		256QAM	-67.0	-67.0	-67.0	-66.5	-66.0	-66.0	-66.0
		128QAM	-69.8	-69.8	-69.8	-69.3	-68.8	-68.8	-68.8
		64QAM	-72.6	-72.6	-72.6	-72.1	-71.6	-71.6	-71.6
		32QAM	-75.2	-75.2	-75.2	-74.7	-74.2	-74.2	-74.2
		16QAM	-78.4	-78.4	-78.4	-77.9	-77.4	-77.4	-77.4
		QPSK	-84.7	-84.7	-84.7	-84.2	-83.7	-83.7	-83.7
	28MHz	4096QAM	-54.6	-54.6	-54.6	-54.1	-53.6	-53.6	-53.6
		2048QAM	-58.6	-58.6	-58.6	-58.1	-57.6	-57.6	-57.6
		1024QAM	-62.1	-62.1	-62.1	-61.6	-61.1	-61.1	-61.1
		512QAM	-65.4	-65.4	-65.4	-64.9	-64.4	-64.4	-64.4
		256QAM	-68.5	-68.5	-68.5	-68.0	-67.5	-67.5	-67.5
		128QAM	-71.3	-71.3	-71.3	-70.8	-70.3	-70.3	-70.3
		64QAM	-74.1	-74.1	-74.1	-73.6	-73.1	-73.1	-73.1
		32QAM	-76.8	-76.8	-76.8	-76.3	-75.8	-75.8	-75.8
		16QAM	-79.9	-79.9	-79.9	-79.4	-78.9	-78.9	-78.9
		QPSK	-86.2	-86.2	-86.2	-85.7	-85.2	-85.2	-85.2
Flange			N-Type	UBR84	UBR84	UBR140	UBR220	UBR220	UBR225
RSSI			Output voltage vs. RSL: 0 ~ 1.4V vs. -90 ~ -20dBm (10dB / 200 mV)						
RSL Accuracy			±2 dB@-80~-30 dBm, ±3 dB@-90~-80 dBm or -30~-20 dBm						
Frequency Stability			±5 ppm						
Frequency Source			Synthesizer						
Max Input Level Without Damage			0 dBm						

Electromechanical & Environmental Specification

Dimensions:	390 x 300 x 150mm (outdoor unit without OMT)
Weight:	7.1 kg (outdoor unit without OMT or accessories)
Power supply voltage:	-48VDC ±20%
Power consumption:	< 150W
Ingress protection rating:	IP67
Ambient temperature range:	-40 to +55 ˚C (-35 ˚C cold start, +60 ˚C peak)
Humidity:	0-100% RH, condensing
Maximum deployment altitude:	4572 m (15,000 ft)

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