

Technical parameters

Radio parameters

Parameter	10 GHz		11 GHz		17 GHz		24 GHz	
Frequency range (approx.)	10.300 – 10.600 GHz		10.700 – 11.700 GHz		License-free band		License-free band	
	10.100 – 10.700 GHz				17.100 – 17.300 GHz		24.000 – 24.250 GHz	
Sub-band	Lower (GHz)	Upper (GHz)	Lower (GHz)	Upper (GHz)	no sub-bands		no sub-bands	
sub-band A	10.301-10.420	10.476-10.588	10.695-10.970	11.185-11.460	17.100 – 17.300		24.000 – 24.250	
sub-band B	10.125-10.325	10.475-10.675	10.935-11.195	11.425-11.695				
Channel spacing	1.75, 3.5, 7, 14, 20*, 28, 56 MHz		1.75, 3.5, 7, 14, 28, 30, 40, 56 MHz		3.5, 7, 14, 28, 40, 56 MHz		3.5, 7, 14, 28, 40, 56 MHz	
	(* band B only)							
Channel duplex spacing	selectable		490, 530 MHz		selectable		selectable	
	A: 56 – 258 MHz				60 – 192,5 MHz / CS 3.5 MHz		60 – 241,5 MHz / CS 3.5 MHz	
	B: 350 MHz				85 – 143,5 MHz / CS 56 MHz		85 – 192,5 MHz / CS 56 MHz	
Modulation	QPSK, 16, 32, 64, 128, 256 QAM, hitless ACM							
User data speed	2.5 – 360 Mbps		2.5 – 360 Mbps		4.9 – 360 Mbps		4.9 – 360 Mbps	
Forward Error Correction	LDPC							
Data sensitivity @BER 10e ⁻⁶	CS 1.75 MHz	CS 56 MHz	CS 1.75 MHz	CS 56 MHz	CS 3.5 MHz	CS 56 MHz	CS 3.5 MHz	CS 56 MHz
QPSK	-100	-86	-99	-87	-97	-87	-96	-86
16 QAM	-92	-79	-93	-80	-90	-80	-89	-79
32 QAM	-88	-75	-89	-76	-87	-76	-86	-75
64 QAM	-87	-72	-88	-73	-84	-73	-83	-72
128 QAM	-84	-68	-84	-69	-83	-69	-79	-68
256 QAM		-66		-67	-81	-66	-77	-65
Output power	-10 dBm to +13 dBm		-15 dBm to +24 dBm		-25 dBm to +5 dBm		-30 dBm to +10 dBm	
ATPC	YES		YES		YES		YES	
Latency (RFC 2544)	typ. 81µs (64 B/360 Mbps); 234 µs (1518 B/360 Mbps)							
User interface RJ45	1 Gb Eth. (10/100/1000) (IEEE 802.3ac 1000BASE-T), MTU 10240 B, recommended cable S/FTP CAT7							
User interface SFP	1000BASE-SX / 1000BASE-LX, MTU 10240 B, user exchangeable SFP							
Service interface	USB-A							
Power supply	PoE (40 - 60 VDC, IEEE 802.3at to 100m), 20 - 60 VDC, floating							
Power consumption	21 W		25 - 29 W		21 W		23 W	
Operating temperature range	- 30 to + 55°C (ETSI EN 300019-1-4, class 4.1.)							
Mechanical design	FOD (Full Outdoor)							
Size	245 × 245 × 150 mm							
Weight	2.8 kg		2.8 kg		2.5 kg		2.5 kg	

for complete specifications please see the user manual

Management

Configuration & management	HTTPS, SSH, Telnet
Real time monitoring	RSS, SNR, BER
Diagnostic tools	spectrum analyzer, pinger, constellation diagram
History charts	temperature, power supply, RSS, SNR, BER, data rate, output power
Statistics	RMON counters for all interfaces
Installation	RSS voltage output
Network management	SNMP ver.2c including configurable TRAPs

Antennas

Various suppliers	Class 2,3; Direct mounting to 30 – 120 cm parabolic antennas, mounting via flexible waveguide also possible
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Standards

Radio parameters	ETSI EN 302 217-2-2 V1.3.1. (2009-04), limits for ACCP/CCDP	ETSI EN 300 440-2 V 1.4.1
EMC	ETSI EN 301 489-1 V 1.8.1 (2008-04), ETSI EN 301 489-17 V1.3.2 (2008-04)	
Electrical safety	EN 60 950-1:2004	

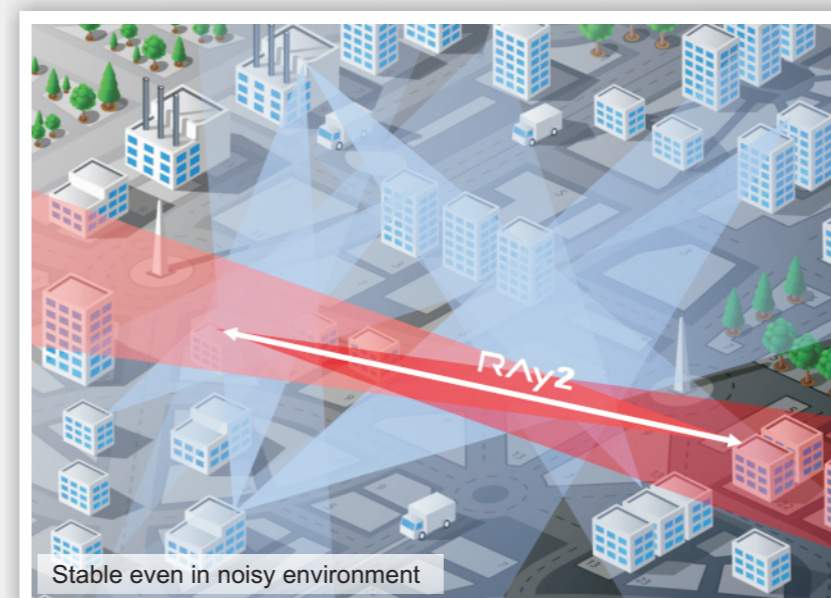


General

RAY2 is the latest **high-speed point-to-point microwave link** developed and manufactured in entirety by RACOM, a global leader in the development and production of high performance, industrial grade wireless equipment.

Benefitting from customer feedback, collected from thousands of units of its successful predecessor RAY – this proven concept has been further enhanced and improved. The concept of **RAY2** technology, based on excellent sensitivity and interference resistance, allows the user to build links with **high capacity over long distances**, while maintaining a **maximum link availability**.

Supporting a broad range of options and with an excellent reliability and price/performance ratio, **RAY2** is your perfect **product of choice** for every application.



RAY2

10 GHz | 11 GHz | 17 GHz | 24 GHz

Microwave link

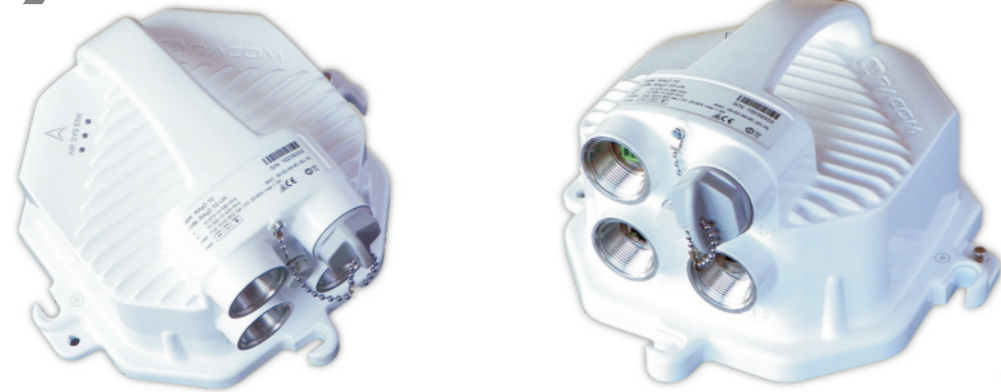
- **FREE & licensed bands**
- **Interference & obstacles tolerant**
- **Maximum distances & reliability**
- **Narrow channels from 1.75 MHz**
- **ACM, ATPC**
- **Optical + metallic Ethernet**
- **IPTV optimized**
- **PoE or DC (20 - 60V)**
- **Low power consumption**
- **Climate chamber tested**

Applications

- **LAN Extension**
- **Internet providers**
- **SCADA**

 **RACOM**
www.racom.eu

RAY2



Radio parameters

- High radio receiver **robustness** against unwanted interference
- Narrow channels (from **1.75 MHz**)
- SW selectable modulation: QPSK, 16, 32, 64, 128, 256 QAM
- Hitless ACM (Adaptive Coding and Modulation)
- ATPC (Automatic Transmit Power Control)

Reliability

- **Heavy-duty** industrial components
- Overvoltage and electrostatic protection
- Operating temperature range from **-30 to +55 °C** certified
- Every single unit is thoroughly **tested in a climatic chamber**
- Quality manufacturing results in **exceptional reliability**
- **Rugged** input filter without any adjustable components

Interfaces

- **Ethernet:** 1x optical, 1x metallic port configurable as:
2 independent user ports
1 user + 1 management port
- **Power:** PoE, DC (**20 – 60 V**)
- **USB:** Management via ETH/USB adapter
FW upgrade from flash disc

FREE & licensed bands

- Supports both **FREE & LICENSED** bands
- **17 & 24 GHz:** identical unit type for both ends of the line - directly results in **lower distribution and storage costs**
- Widely **configurable** channel **duplex spacing** eases free channel finding

Solution for any application

- High sensitivity altogether with wide channel width and modulation options allows to build link optimized both for **distance** and **performance**.
- MTU **10240 B**, MPLS transparent
- Packet buffer & QoS optimized for IPTV (multicasts, unicasts)

Installation in minutes

- Full outdoor unit with aluminium casing
- HW reset button for factory and customers settings
- Simple signal polarization change by unit's rotation
- RSS voltage output for antenna alignment
- Direct mounting to the parabolic antennas (same antennas for both RAY and RAY2)

Security & Standards

- Configuration via HTTPS, SSH
- All relevant international standards complied
- Key parameters measured and confirmed by certified laboratory

Advanced diagnostics

- Intuitive **web interface**
- Temperature, power supply, RSS, SNR, BER, data rate, output power status and history avail. as text or charts
- SNMP (Including generation of TRAPs)
- Built-in spectrum analyzer for free channel search
- Automatic detection of unit polarization
- Constellation diagram of the received signal

References



RACOM – solution of choice

RAY and **RAY2** are successfully installed in all types of environmental and climatic conditions within our ever expanding global market e.g. **Italy, Iraq, South Africa, United Arab Emirates, Philippines, Lebanon, Mexico, Jamaica** and others.

The excellent **reliability** of **RACOM's** microwave link is appreciated by numerous types of clients:

- global mobile operators e.g. **Vodafone**
- corporate networks operators **ha-vel internet** or **WIA**
- cable TV providers e.g. **UPC**
- government authorities such as **Czech National Customs Office**

Based on RACOM's experiences in the field of **SCADA and Telemetry**, RAY and **RAY2** are also used in SCADA networks, both as a backhaul solution or as a link for surveillance IP cameras.

Typical Applications

LAN extension

- Corporate clients
- Fiber line replacement
- Building to building interconnectivity

RAY2:

- Low and constant latency < 0.1 ms
- Two user ports available
- Ethernet, layer L2 transparent
- Excellent resistance to interference

Internet providers

- Backbone and hi-priority last-mile
- Heavy traffic with multiple TCP streams

RAY2:

- Free & licensed bands
- Both optical and metallic port
- IPTV proven solution
- Web interface including diagnostics
- Standard SNMP + SNMP traps, VLAN management

SCADA

- Maximise emphasis on reliability and response speed of the networks
- High speed backbone
- Small data packets have to be processed as fast as possible

RAY2:

- High reliability
- **24 VDC** powering
- Long range links, narrow channels
- Low OPEX costs

