



Parameter	10 GHz		11 GHz		17 GHz / 24 GHz		18 GHz	
Frequency range (approx.)	10.300 – 10.600 GHz		10.700 – 11.700 GHz		License-free band		17.700 – 19.700 GHz	
	10.100 – 10.700 GHz				17.1 – 17.3 / 24.0 – 24.25 GHz			
Sub-band	Lower (GHz)	Upper (GHz)	Lower (GHz)	Upper (GHz)	no sub-bands		Lower (GHz)	Upper (GHz)
sub-band A	10.300-10.420	10.476-10.588	10.695-10.970	11.185-11.460	17.1 – 17.3 / 24.0 – 24.25		17.700-18.209	18.710-19.219
sub-band B	10.125-10.325	10.475-10.675	10.935-11.195	11.425-11.695			18.167-18.690	19.177-19.700
sub-band C							17.700-18.300	19.300-19.700
Channel spacing	1.75 – 56 MHz		1.75 – 56 MHz		3.5 – 56 MHz		1.75 – 55 MHz	
Channel duplex spacing	min. 56 MHz		490, 530 MHz		min. 60 Mhz		1008, 1010, 1560 MHz	
Modulation	QPSK, 16, 32, 64, 128, 256 QAM, hitless ACM							
User data speed	1.4 – 360 Mbps		1.4 – 360 Mbps		4.9 – 360 Mbps		2.5 – 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 1.75 MHz	CS 55 MHz
QPSK	-103	-86	-102	-87	-97 / -96	-87 / -86	-97	-84
16 QAM	-97	-79	-97	-80	-90 / -89	-80 / -79	-91	-75
32 QAM	-94	-75	-94	-76	-87 / -86	-76 / -75	-88	-72.5
64 QAM	-91	-72	-91	-73	-84 / -83	-73 / -72	-85	-70
128 QAM	-88	-68	-88	-69	-83 / -79	-69 / -68	-82.5	-67
256 QAM	-66		-67		-81 / -77		-66 / -65	
Output power	-10 to +13 dBm		-15 to +24 dBm		-25 to +5 dBm / -30 to +10 dBm		-10 to +24 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 exchangable SFP, power consumption max. 1.25 W							
Service interface	USB-A: USB / ETH a USB / WiFi							
Power supply	PoE (40 - 60 VDC, IEEE 802.3at to 100m. max. 25 W), 20 - 60 VDC, floating							
Power consumption	21 W		21 - 29 W		21 W / 23 W		21 - 28 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		2.7 kg	

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 V2.1.1	ETSI EN 300 440-2 V 1.4.1	ETSI EN 302 217-2-2 V2.1.1
	limits for ACCP/CCDP		limits for ACCP/CCDP
EMC	ETSI EN 301 489-4 V 2.1.1, ETSI EN 301 489-1 V1.9.2		
Safety	EN 60 950-1:2006		
FCC		CFR 47 part 101	RAY2-24: CFR 47 part 15
			CFR 47 part 101

Technical parameters are subject to change without prior notification.



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

General

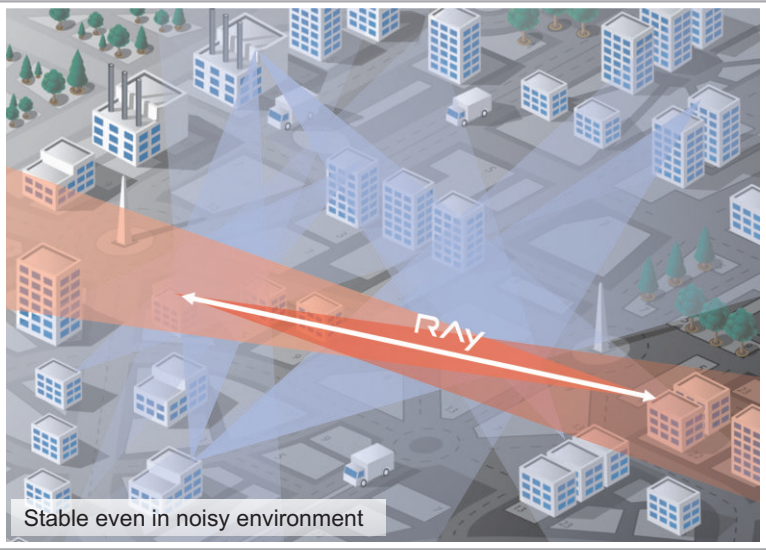
RAy is the **high-speed point-to-point microwave link** developed and completely manufactured by RACOM, a global leader in the development and production of high performance, industrial grade wireless equipment. Benefiting from customer feedback, collected from thousands of units sold, **RAy** is continually being enhanced and further improved.

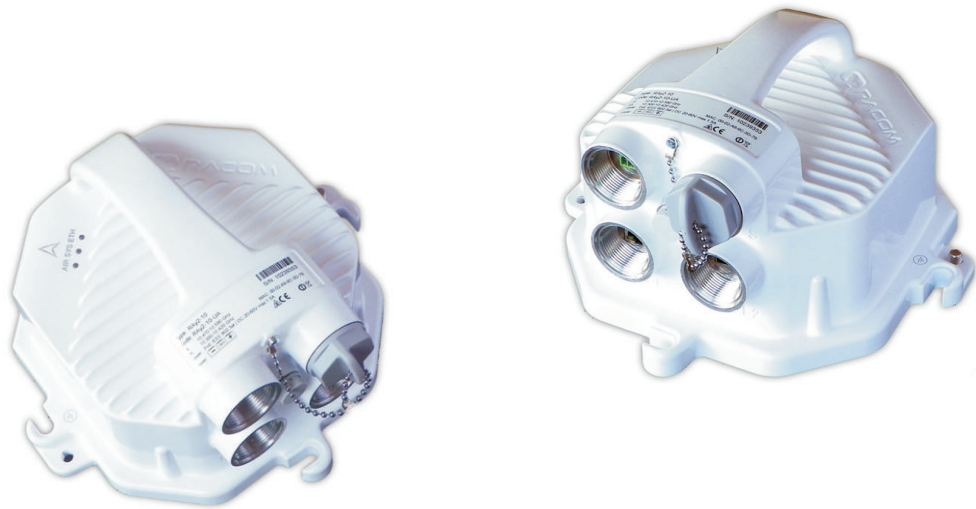
The concept of **RAy** technology, based on excellent sensitivity and interference resistance, allows the user to build links with **high capacity over long distances**, whilst maintaining **maximum link availability**.

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

Applications

- **High speed last miles**
- **Internet providers backhails**
- **Corporate LAN extensions**
- **SCADA network backbones**





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)

Interfaces

- **Ethernet:** 1x optical, 1x metallic port configurable as: 2 independent user ports, in-band management 1 user + 1 management port
- **Power:** PoE, DC (**20 – 60 V**)
- **USB:** Management via USB / ETH or USB / WiFi

Solution for any application

- High sensitivity together with wide channel width and modulation enables optimized links for **distance** and **performance**.
- MTU **10240 B**, MPLS transparent
- Packet buffer & QoS optimized for IPTV (multicasts, unicasts)

Security & Standards

- Configuration via HTTPS and SSH for secured access
- Compliance to all relevant international standards
- Key parameters measured and confirmed by certified laboratory
- SFP modules, NMS and power supplies have no proprietary restrictions

Reliability

- **Heavy-duty** industrial components
- Built-in surge 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** with no adjustable components

FREE & licensed bands

- Supports both **FREE & LICENSED** bands
- **17 & 24 GHz: Fulfilling SRD standards.** Identical unit type at both ends of link offers **lower distribution and storage costs**
- Widely **configurable** channel **duplex spacing** eases sourcing of available channels

Instalation 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 parabolic antennas

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 microwave links are successfully installed in all types of environmental and climatic conditions in **dozens of countries** from Europe through Middle East to Tropical areas.

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

- global mobile operators: **Vodafone, O2**
- corporate networks operators
- cable TV providers: **UPC**
- government authorities: **Czech National Customs Office**

Based on RACOM's experience in the field of **SCADA and Telemetry**, RAY microwave links 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

RAy:

- 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

RAy:

- 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 time requirements
- High speed backbone
- Small data packets have to be processed as fast as possible

RAy:

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

