

# Unikátní mikrovlnné spoje

# RAY

10 GHz

11 GHz

17 GHz

18 GHz

24 GHz

RAY je vysokorychlostní point-to-point mikrovlnný spoj vhodný i pro nejnáročnější podmínky. Využívají jej poskytovatelé internetových služeb i globální telekomunikační operátoři pro páteřní sítě a vysokorychlostní last-mile spoje.



## Market leader

- Výjimečná spolehlivost na extrémní vzdálenosti
- Maximální využití spektra
- Minimální spotřeba energie
- Wifi management, mobilní aplikace

## Výkon

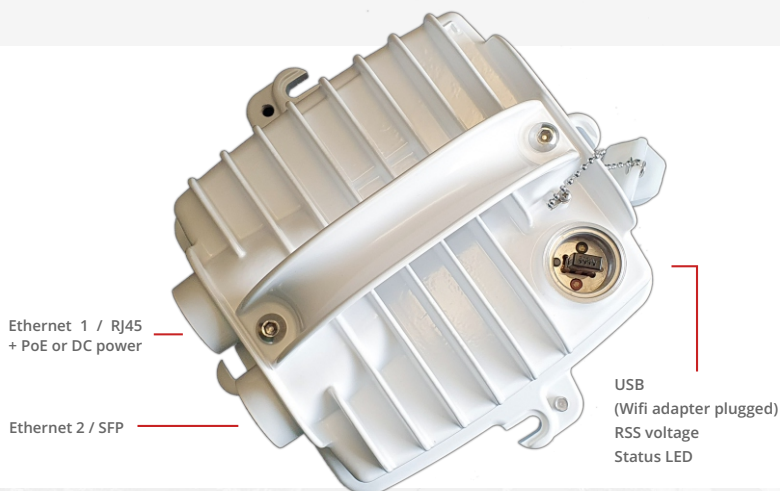
- 1 Gb/s FDD, (2 Gb/s 11 GHz)
- 3.5 – 112 MHz kanály
- QPSK – 4096 QAM
- 10, 11, 17, 18, 24 GHz

## Efektivní využití spektra

- Každá část spektra efektivně využita
- Vestavěný analyzátor spektra
- Vhodný i pro silně zarušené lokality
- Úzké i asymetrické kanály

## Spolehlivost

- Vysoká citlivost, Hitless ACM a ATPC
- Ochrana proti přepětí 4 kV, ESD 8 kV
- Každá jednotka testována v klimatické komoře
- MTBF > 100 let, vyrobeno v ČR



RACOM

www.racom.eu

# Technick parametry

Radio parameters	10 GHz		17 GHz / 24 GHz		11 GHz / 18 GHz	
	Lower	Upper	The same HW for L/U		Lower	Upper
Sub-band A	10.301 – 10.420	10.476 – 10.588	no sub-bands		11 GHz: 10.695 – 10.989 18 GHz: 17.700 – 18.209	11 GHz: 11.199 – 11.491 18 GHz: 18.710 – 19.219
Sub-band B	10.125 – 10.325	10.475 – 10.675	17.10 – 17.30		11 GHz: 10.905 – 11.195 18 GHz: 18.167 – 18.690	11 GHz: 11.395 – 11.699 18 GHz: 19.177 – 19.700
Sub-band C	–	–	24.00 – 24.25		18 GHz: 17.700 – 18.300	18 GHz: 19.300 – 19.700
Channels	3.5; 7; 14; 20; 28; 40; 56; 80; 84; 112 MHz		3.5; 5; 7; 10; 14; 20; 28; 40; 56; 80; 100; 112 MHz		11 GHz: 5; 7; 10; 14; 20; 28; 30; 40; 56; 60; 80; 112 MHz Dual channel: 2x60; 2x80; 2x112 MHz 18 GHz: 5; 7; 7.5; 10; 13.75; 20; 27.5; 30; 40; 50; 55; 60; 80; 100; 110 MHz	
Duplex spacing	Sub-band A: Flexible 58 - 285 MHz; location adj. by SW Sub-band B: 350 MHz		Flexible min.18 MHz between channel edges; location adjusted by SW		11 GHz: 490 MHz (ETSI) or 530 MHz @ Sub-band A, B 18 GHz: 1008, 1010 MHz @ Sub-band A, B 1560 MHz @ Sub-band C	
Gross data rate	2.9 – 1010 Mb/s		2.7 – 1002 Mb/s		11 GHz: 2.9 – 2026 Mb/s 18 GHz: 4.2 – 1010 Mb/s	
FEC	LDPC		LDPC, RS		LDPC	
<b>Speed / Sensitivity</b>						
<b>Modulation</b>	<b>5 MHz</b>	<b>112 MHz</b>	<b>3.5 MHz</b>	<b>112 MHz</b>	<b>5 MHz</b>	<b>110/112 MHz</b>
QPSK_S	4.2 Mb/s @ -105.5 dBm	96 Mb/s @ -86.0 dBm	2.7 Mb/s @ -100.5 dBm	97 Mb/s @ -86.5 dBm	4.2 Mb/s @ -100.5 dBm	96 Mb/s @ -86.5 dBm
QPSK	7.2 Mb/s @ -96.5 dBm	166 Mb/s @ -82.0 dBm	5.0 Mb/s @ -96.0 dBm	161 Mb/s @ -83.0 dBm	7.2 Mb/s @ -96.5 dBm	166 Mb/s @ -82.5 dBm
16QAM	12 Mb/s @ -92.0 dBm	287 Mb/s @ -77.0 dBm	9.5 Mb/s @ -90.0 dBm	334 Mb/s @ -76.0 dBm	12 Mb/s @ -92.0 dBm	287 Mb/s @ -77.5 dBm
32QAM	17 Mb/s @ -87.0 dBm	400 Mb/s @ -72.0 dBm	11 Mb/s @ -86.5 dBm	426 Mb/s @ -72.0 dBm	17 Mb/s @ -87.0 dBm	400 Mb/s @ -72.5 dBm
64QAM	22 Mb/s @ -84.0 dBm	513 Mb/s @ -69.5 dBm	15 Mb/s @ -83.5 dBm	536 Mb/s @ -69.0 dBm	22 Mb/s @ -84.0 dBm	513 Mb/s @ -70.0 dBm
128QAM	26 Mb/s @ -81.5 dBm	604 Mb/s @ -66.5 dBm	17 Mb/s @ -80.5 dBm	636 Mb/s @ -66.0 dBm	26 Mb/s @ -81.5 dBm	604 Mb/s @ -67.0 dBm
256QAM	30 Mb/s @ -78.5 dBm	698 Mb/s @ -63.5 dBm	19 Mb/s @ -77.5 dBm	730 Mb/s @ -63.0 dBm	30 Mb/s @ -78.5 dBm	698 Mb/s @ -64.0 dBm
512QAM	34 Mb/s @ -75.5 dBm	791 Mb/s @ -60.5 dBm	22 Mb/s @ -74.5 dBm	823 Mb/s @ -60.0 dBm	34 Mb/s @ -75.5 dBm	791 Mb/s @ -61.0 dBm
1024QAM	38 Mb/s @ -72.0 dBm	881 Mb/s @ -57.5 dBm	23 Mb/s @ -71.0 dBm	918 Mb/s @ -57.0 dBm	38 Mb/s @ -72.0 dBm	881 Mb/s @ -57.5 dBm
2048QAM	42 Mb/s @ -68.5 dBm	958 Mb/s @ -54.5 dBm	-	1002 Mb/s @ -54.0 dBm	42 Mb/s @ -68.5 dBm	958 Mb/s @ -53.5 dBm
4096QAM	-	1010 Mb/s @ -50.5 dBm	540 Mb/s @ -54.0 dBm @ 56 MHz		-	1010 Mb/s @ -49.5 dBm
ACM	Hitless					
RF Output power	Sub-band A: -15 to +10 dBm (+13 dBm for QPSK) Sub-band B: -15 to +10 dBm		-30 to +10 dBm (all modulations and channels)		-1 to +23 dBm (all modulations and channels) -3 to +18 dBm (Dual channel)	
ATPC	Yes					
MTU	10240 B					
Latency (RFC 2544)	<150 µs (66 B, 352 Mb/s); <200 µs (1518 B, 352 Mb/s) <100 µs (66 B, 1010 Mb/s); <150 µs (1518 B, 1010 Mb/s)		268 µs (64B/366 Mb/s); 313 µs (1518 B/366 Mb/s) 173 µs (64B/1002 Mb/s); 198 µs (1518 B/1002 Mb/s)		<150 µs (66 B, 352 Mb/s); <200 µs (1518 B, 352 Mb/s) <100 µs (66 B, 1010 Mb/s); <150 µs (1518 B, 1010 Mb/s)	
Synchronization	Synchronous Ethernet; PTP (transparent for IEEE-1588v2)					
<b>Electrical</b>						
Primary power	PoE active, IEEE 802.3 bt (PoE++); PoE passive 20 – 60 VDC; DC 20 – 60 VDC; floating		PoE active, IEEE 802.3 at (PoE+); PoE passive 20 – 60 VDC; DC 20 – 60 VDC; floating		PoE active, IEEE 802.3 bt (PoE++); PoE passive 37 – 60 VDC; DC 37 – 60 VDC; floating	
Power consumption	Typ. 26.5 W (w/o SFP)		Typ. 22.5 W (w/o SFP)		Typ. 30 W for Tx < +17 dBm (w/o SFP); 33 W for Tx >= +17 dBm (w/o SFP)	
<b>Interfaces</b>						
Ethernet	1x 10/100/1000 Base-T Auto MDI/MDIX / RJ45					
SFP	1x 10/100/1000/2500 Base-T; 1000Base-SX; 1000Base-LX (power max. 1.25 W)					
USB	USB 2.0 / Host A					
RSS voltage	Two contact sockets					
Indication LED	System status (multicolor)					
<b>Environmental</b>						
IP Code (Ingress Protection)	IP66					
MTBF (Mean Time Between Failure)	> 1 000 000 hours (> 114 years)					
Operating temperature	- 30 to + 55°C (ETSI EN 300019-1-4, class 4.1.)					
Operating humidity	5 to 95% non-condensing					
Surge immunity	4 kV acc. EN 61000-4-5					
ESD resistance	8 kV acc. EN 61000-4-2					
<b>Mechanical</b>						
Casing	Rugged die-cast aluminium					
Size	160 H x 245 W x 245 D mm (6.3 x 9.6 x 9.6 in)					
Weight	2.8 kg (6.2 lbs)		2.6 kg (5.7 lbs)		2.9 kg (6.4 lbs)	
Mounting	FOD, direct mounting to antenna					
<b>Diagnostic</b>						
Real time monitoring	RSS, MSE, BER					
Diagnostic tools	Spectrum analyzer, Pinger		Spectrum analyzer, Pinger, Radio loopback		Spectrum analyzer, Pinger	
History charts	Temperature, Power voltage, RSS, MSE, BER, Data rate, RF Output power					
Statistics	RMON counters for all interfaces					
Antenna alignment	RSS voltage, Mobile App (RAYTools), Web					
SNMP	v2c including configurable TRAPs					
<b>Security</b>						
Management	Web (HTTP, HTTPS), SSH, Telnet, Mobile App (RAYTools)					
Access accounts	3 levels (Guest, Admin, Super)					
Encryption	AES256, 192, 128					
<b>Standards</b>						
Approvals	CE (RED), RoHS		17 GHz CE (RED), RoHS 24 GHz CE (RED), FCC, RoHS		CE (RED), RoHS	

Technical parameters are subject to change without prior notification. For more details see [User manuals](#).

