HyperBridge Integral series

We are excited to take a step forward in the evolution of full outdoor packet microwave radio systems. Integral is an unbelievably light, energy efficient, carrier-grade system that exemplifies an outstanding return on smart engineering - the synergy of high competence in radio electronics and materials science. Integration of the next generation microwave radio with high and super high-performance antennas into a single unit translates into a lower total cost of ownership, as well as less time spent on the installation site, and better reliability of the link even in densely served areas.

Perfect for small-cell, RAN, and HetNet backhaul where aesthetics in a metropolitan area is key concern, Integral delivers ambitious performance in a compact package never before available in licensed microwave backhaul. Integral's embedded software takes full advantage of its cutting-edge network processor providing SyncE support for LTE network, builds Layer 2 header compression and 256-bit AES encryption for public, government, and enterprise networks. Thanks to a convenient design and its solid functionality Integral is an industry-unique microwave system with a superior radiation pattern and payload capacity of up to 1 Gbps.

Integral – by its form and specification – is a proper building block for a variety of modern wireless networking applications. To stay advanced and competitive in the telecom world increasingly depends on seamless Integration and interoperability of synchronization-sensitive systems. It is smart to invest in technology that takes the right direction: the concept of Integral is on that path.

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Technical specification

		Integral-G, Integral-GS		Integral-W, Integral-WS	
General					
Concept / form factor		FODU with antenna or FODU Slip-fit			
Frequency bands		6GHz, 7GHz, *8GHz**, 11GHz, 13GHz, 15GHz, 17GHz UL, 18GHz, 23GHz, 24GHz UL, 25GHz, 26GHz, 28GHz, 38GHz, *and more**			
Frequency stability		± 10 ppm			
Capacity		up to 1Gbps* with HC at 1+0 or 2+0		883 Mbps at 112 MHz 1024QAM 643 Mbps at 80 MHz 1024QAM (for Integral-WS 17GHz and 24GHz)	
		474 Mbps at 60 MHz 1024QAM (legacy version**)	491 Mbps at 60 MHz 2048QAM		
Max modulation		1024QAM (legacy)	2048QAM	1024QAM	
Configurations		1+0, 2+0 link bonding, 1+1 HSB		1+0	
ACM and ATPC		Yes		Yes	
Channel bandwidth		ETSI: from 3.5 MHz, up to 56 MHz FCC: from 5 MHz, up to 60 MHz		ETSI: from 56 MHz, up to 112 MHz FCC: from 40 MHz, up to 80 MHz	
Ports					
Gigabit Ethernet	1x RJ-45	Electrical with built-in PoE splitter and surge arrestor		2x RJ-45	Electrical with built-in PoE splitter and surge arrestor
	2x SFP	Fiber Optics		1x SFP	Alternative to 1xRJ-45
Service ports	3.5mm	Audible alignment and RSSI			
	USB B	RS232 serial over USB B-Type			
	LED	Power On, Link Synchronization, RSL, Polarization accuracy*			
Ethernet					
Ethernet		Built-in Carrier Ethernet Gigabit Network Processor		Unmanaged Gigabit Ethernet	
Gigabit Switch functionality		802.1Q VLANs with QoS/CoS incl. *WRED**, shaping, DWRR and on MPLS-TP exp bit; Spanning Tree Protocol, Jumbo frames *and more**		Transparent	
Synchronization		SyncE, *IEEE 1588v2 PTP**		-	
Carrier Ethernet functionality		Provider Bridging, MEF9&14, High Efficiency Header Compression,*OAM**		Transparent	
Jumbo frames		Yes, 9600 bytes		Yes, 9600 bytes	
Encryption		AES 256-bit, licensed feature		-	
Management		SNMP v1/2c/3, SSH, Telnet, HTTPS, Serial, RADIUS, Network Time Protocol			
		In-band MNG over same ETH port		Both In-band and Out-of-band MNG	
Perf. monitoring		Performance graphs, constellation diagram, alarms, detailed counters			
Electrical					
Power consumption		31...74 W depending on model and frequency band. See table below.			
Voltage range	Integral	36…57 V DC			
	PoE Injector[1]	36…60 V DC all Integral models; 22...60 V DC models with ≤50 W consumption			
Temperature range		-33...+55 °C / -28…+130 °F			

** Inquire HYPERCABLE representative for more information*

*** Legacy models are Integral and Integral-S, same as Integral-G (-GS) but without 2048QAM support*

	Integral-G, Integral-GS	Integral-W, Integral-WS

[1] *Voltage range using I0ATPI24 Power over Ethernet Injector*

Mechanical & environmental specification

Integral Model		Integral-G, Integral-W		Integral-GS, Integral-WS
Antenna type		0.3m / 1ft	0.6m / 2ft	External antenna
Ant. performance		High Performance and *Super High Performance**		
Stationary use		Conforms to ETSI EN 300 019 Class 4.1, IP67 (IP66 6…13GHz), NEMA 4X		
Size, 15GHz and higher, w/o mount		378 x 378 x 227 mm / 14.9” x 14.9” x 9”	669 x 669 x 289 mm / 26.3” x 26.3” x 11.4”	235 x 250 x 72 mm / 9.26” x 9.85” x 2.84”
Size, Integral -WS 17/24 GHz UL		N/A***	N/A***	235 x 250 x 111 mm / 9.26” x 9.85” x 4.37”
Size, 6…13* GHz		N/A	N/A	280 x 437 x 100 mm / 11.02” x 17.2” x 3.9”
Weight, w/o mount		5 kg / 11 lbs	5 kg / 11 lbs	2.9 kg / 6.4 lbs
Weight, Integral -WS 17/24 GHz UL		N/A***	N/A***	4.9 kg / 10.8 lbs
Weight, 6…13* GHz		N/A	N/A	6.5 kg / 14.3 lbs
Mount	Mount size	292 x 176 x 250 mm / 11.5” x 7” x 10” max		Mount on antenna
	Pole size	Ø 40 – 120 mm / Ø 1.6” – 4.7”		
	Weight	2.55 kg / 5.6 lbs		

** Inquire HYPERCABLE representative for more information*

**** Among Integral-W family, only Integral-WS model with external antenna is currently available for 17/24 GHz unlicensed bands.*

Power consumption at 48V DC[2]

Model	L6 GHz	U6, 7 GHz	11, 13 GHz	15 GHz	17 GHz	18 GHz	23 GHz	24 GHz	25, 26, 28 GHz	38 GHz
Integral-G, Integral-GS	74W	69W	65W	40W	35W	45W[3]	41W	38W	45W	47W
Integral-W, Integral-WS	70W	64W	51W	31W	28W	35W	35W	30W	36W	38W

[2] *Power consumption of Integral radio shown only. For power consumption of complete system add up to 8% (at 48V DC input) for PoE in DC/DC mode, around 4W for 100m cable (depends on cable) and approx. 1W for SFP transceiver, if used.*

[3] *Both Standard and HP product versions*

Exterior design of Integral models

Integral-G, Integral-W	Integral-GS, Integral-WS	
	 **General design, 15GHz and higher** 	

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Available for 15GHz band and higher	Integral-WS 17GHz, 24GHz UL version	6GHz …13GHz models

Maximum Tx Power [dBm] for Integral-G and Integral-GS

1) For all ETSI channels, and FCC 60 MHz channel in fixed Tx power mode:

Modulation	L6, U6, 7, 8[3] GHz	11 GHz	13 GHz	15 GHz, 18 GHz HP[4]	18, 23, 25, 26, 28 GHz	17 GHz[5], 24 GHz[5]	38 GHz
4 QAM	+31	+26	+28	+23	+20	-26 … +5	+15
16 QAM	+30	+25	+27	+22	+19	-26 … +5	+14
32 QAM	+29	+24	+26	+21	+18	-26 … +5	+14
64 QAM	+28	+23	+25	+20	+17	-26 … +5	+13
128 QAM	+28	+23	+25	+20	+17	-26 … +5	+13
256 QAM	+27	+22	+24	+19	+16	-26 … +5	+12
512 QAM	+26	+21	+23	+18	+15	-26 … +5	+11
1024 QAM	+23	+18	+20	+15	+12	-26 … +5	+10
2048 QAM[6]	+22	+17	+19	+14	+11	-26 … +5	+9

2) For FCC 5 to 50 MHz channels in fixed Tx power mode:

Frequency band	L6, U6, 7, 8[3] GHz				11 GHz				13 GHz				15 GHz, 18 GHz HP[4]				18, 23, 25, 26, 28 GHz				17 GHz[5], 24 GHz[5]	38 GHz
BW, MHz / Modulation	50 40 30		25 20	10 5	50 40 30		25 20	10 5	50 40 30		25 20	10 5	50 40 30		25 20	10 5	50 40 30		25 20	10 5	5 … 60	5 … 60
4 QAM	+30	**+29**	+27		+25	+24	+22		+27	+26	+24		+22	+21	+19		+19	+18	+16		-26 … +5	+15
16 QAM	+30	**+29**	+27		+25	+24	+22		+27	+26	+24		+22	+21	+19		+19	+18	+16		-26 … +5	+14
32 QAM	+29	**+29**	+27		+24	+24	+22		+26	+26	+24		+21	+21	+19		+18	+18	+16		-26 … +5	+14
64 QAM	+28	**+28**	+27		+23	+23	+22		+25	+25	+24		+20	+20	+19		+17	+17	+16		-26 … +5	+13
128 QAM	+28	**+28**	+27		+23	+23	+22		+25	+25	+24		+20	+20	+19		+17	+17	+16		-26 … +5	+13
256 QAM	+27	**+27**	+27 -		+22	+22	+22 -		+24	+24	+24 -		+19	+19	+19 -		+16	+16	+16 -		-26 … +5	+12
512 QAM	+26	**+26**	-		+21	+21	-		+23	+23	-		+18	+18	-		+15	+15	-		-26 … +5	+11
1024 QAM	+23	**+23**	-		+18	+18	-		+20	+20	-		+15	+15	-		+12	+12	-		-26 … +5	+10
2048 QAM[6]	+22	-	-		+17	-	-		+19	-	-		+14	-	-		+11	-	-		-26 … +5	+9

3) For FCC 5 to 60 MHz channels in variable Tx power mode:

Frequency band	L6, U6, 7, 8[3] GHz					11 GHz				13 GHz				15 GHz, 18 GHz HP[4]					18, 23, 25, 26, 28 GHz				38 GHz			
BW, MHz / Modulation	60	50 40 30		25 20	10 5	60	50 40 30		25 20	10 5	60	50 40 30		25 20	10 5	60	50 40 30		25 20	10 5	60	50 40 30		25 20	10 5	60	50 40 30		25 20	10 5
4 QAM	+31	+30	+29	+27		+26	+25	+24	+22		+28	+27	+26	+24		+23	+22	+21	+19		+20	+19	+18	+16		+15	+14	+13	+11	
16 QAM	+30	+30	+29	+27		+25	+25	+24	+22		+27	+27	+26	+24		+22	+22	+21	+19		+19	+19	+18	+16		+14	+14	+13	+11	
32 QAM	+29	+29	+29	+27		+24	+24	+24	+22		+26	+26	+26	+24		+21	+21	+21	+19		+18	+18	+18	+16		+13	+13	+13	+11	
64 QAM	+28	+28	+28	+27		+23	+23	+23	+22		+25	+25	+25	+24		+20	+20	+20	+19		+17	+17	+17	+16		+12	+12	+12	+11	
128 QAM	+27	+27	+27	+27		+22	+22	+22	+22		+24	+24	+24	+24		+19	+19	+19	+19		+16	+16	+16	+16		+11	+11	+11	+11	
256 QAM	+25	+25	+25	+27 -		+20	+20	+20	+22 -		+22	+22	+22	+24 -		+17	+17	+17	+19 -		+14	+14	+14	+16 -		+9	+9	+9	+11 -	
512 QAM	+24	+24	+24	-		+19	+19	+19	-		+21	+21	+21	-		+16	+16	+16	-		+13	+13	+13	-		+8	+8	+8	-	
1024 QAM	+23	+23	+23	-		+18	+18	+18	-		+20	+20	+20	-		+15	+15	+15	-		+12	+12	+12	-		+7	+7	+7	-	
2048 QAM[6]	+22	+22	-	-		+17	+17	-	-		+19	+19	-	-		+14	+14	-	-		+11	+11	-	-		+6	+6	-	-	

[3] *Preliminary data*

[4] *Integral-G (-GS) 18 GHz HP version has 3dB higher Tx power than standard version*

[5] *Max Tx power settings depend on EIRP allowed by national regulatory and antenna size.*

[6] *2048QAM modulation is available only for Integral-G and Integral-GS, not supported by legacy models*

Maximum Tx Power [dBm] for Integral-W and Integral-WS

Tx Power, dBm						
Modulation	L6 GHz	U6 GHz	11 GHz	15, 18, 23, 25, 26, 28 GHz	17 GHz[5], 24 GHz[5]	38 GHz
4 QAM	+33	+31	+28	+22	-26 … +5	+17
8 QAM	+33	+31	+28	+22	-26 … +5	+17
16 QAM	+32	+30	+27	+21	-26 … +5	+16
32 QAM	+31	+29	+26	+21	-26 … +5	+16
64 QAM	+30	+28	+25	+20	-26 … +5	+15
128 QAM	+30	+28	+25	+20	-26 … +5	+15
256 QAM	+30	+28	+25	+19	-26 … +5	+14
512 QAM	+30	+28	+25	+19	-26 … +5	+14
1024 QAM	+28	+26	+23	+17	-26 … +5	+12

[5] *Max Tx power settings depend on EIRP allowed by national regulatory and antenna size.*

Integral-G,-GS RSL Thresholds and Capacity for ETSI channels [3, 6, 7]

Bandwidth, MHz	Modulation	6GHz	7GHz	11GHz	13GHz	15GHz	17GHz	18GHz	23GHz	24GHz	26GHz	28GHz	38 GHz	Capacity, Mbps	
		Guaranteed RSL Threshold, dBm												-G, -GS modes	Legacy modes
3.5	4QAM StrongFEC	-97	-96	-96	- 96.5	-95.5	-94	-96	-96	-96.5	-95.5	-95	-92		4
	16QAM StrongFEC	-90	-90.5	-89	-90	-88.5	-87,5	-89.5	-89	-89.5	-89.5	-89	-86		8
	32QAM StrongFEC	-86	-86.5	-85	-86	-84	-83	-85.5	-84.5	-85.5	-84.5	-84	-82		10
	64QAM StrongFEC	-83.5	-83.5	-82.5	-83	-81.5	-80.5	-82.5	-81.5	-83	-82	-82	-79		13
	128QAM StrongFEC	-80	-80.5	-79	-80	-77.5	-76.5	-78.5	-77	-79.5	-78.5	-79	-76		16
	128QAM WeakFEC	-77.5	-78	-76	-78	-73.5	-75	-76.5	-75	-77.5	-76.5	-76	-74		17
7	4QAM StrongFEC	-94	-94.5	-93	-94	-93	-91	-94	-93	-93.5	-92.5	-93	-90.5		8
	16QAM StrongFEC	-87	-87.5	-86.5	-88	-86	-84.5	-87.5	-86	-87	-86	-86	-84		16
	32QAM StrongFEC	-84	-84.5	-83.5	-84	-82.5	-80.5	-83.5	-82	-83.5	-82.5	-83	-80		20
	64QAM StrongFEC	-80.5	-81.5	-80.5	-81	-80	-78	-80.5	-80	-80.5	-79	-80	-77.5		27
	128QAM StrongFEC	-77	-78	-76.5	-77	-76	-75	-77.5	-77	-77.5	-76	-76.5	-74		33
	256QAM StrongFEC	-74	-74.5	-73.5	-74.5	-73	-71	-74.5	-72	-73.5	-72.5	-73	-71		39
	256QAM WeakFEC	-72	-73	-71.5	-72	-70	-69	-72.5	-71	-71.5	-69	-71	-69		41
14	4QAM StrongFEC	-91	-91	-90.5	-91	-90	-88	-91	-87.5	-91	-90	-90	-87		17
	16QAM StrongFEC	-85	-85	-84	-85	-83.5	-81.5	-84.5	-82	-84	-83.5	-84	-81		33
	32QAM StrongFEC	-80	-81	-80	-80.5	-79	-77	-80.5	-78	-80	-79	-79	-77		44
	64QAM StrongFEC	-78	-78.5	-77	-78.5	-77	-75	-78.5	-76	-78	-77	-77	-74		56
	128QAM StrongFEC	-75	-75.5	-74	-71	-74	-72	-75.5	-73	-74.5	-73.5	-74	-71		67
	256QAM StrongFEC	-71.5	-72	-71	-67	-71	-68.5	-71.5	-69.5	-71	-70.5	-70.5	-69		79
	512QAM StrongFEC	-68.5	-68	-67	-63	-67	-65	-68.5	-67	-67.5	-67.5	-67	-65		90
	512QAM WeakFEC	-65.5	-66	-64.5	-61	-64	-61.5	-65.5	-63	-65	-64	-64	-62		97
20	4QAM StrongFEC	-89	-90	-88,5	-88.5	-88.5	-87	-89.5	-86	-89	-89.5	-89	-86		25
	16QAM StrongFEC	-83	-84	-83	-81	-82.5	-80	-83.5	-81	-83	-82.5	-82.5	-79.5		51
	32QAM StrongFEC	-80	-80	-79	-78	-78	-76.5	-79.5	-77	-79	-78.5	-79	-75.5		64
	64QAM StrongFEC	-77	-77	-76,5	-74.5	-76	-74	-77	-75	-77	-75.5	-76	-73		85
	128QAM StrongFEC	-74	-74	-73	-71.5	-73	-70.5	-74	-72	-73	-72.5	-73	-70		102
	256QAM StrongFEC	-70,5	-71	-69,5	-67.5	-69.5	-68	-70.5	-68.5	-70	-70.5	-71	-67		119
	512QAM StrongFEC	-67,5	-68	-67	-65	-66	-64.5	-67.5	-65.5	-67	-66	-66	-63.5		136
	1024QAM StrongFEC	-64	-64	-62,5	-61	-63	-60.5	-64.5	-62	-63	-62.5	-62	-60		153
	1024QAM WeakFEC	-62	-62	-61	-58	-60	-58	-62.5	-59.5	-61	-60.5	-60	-58		163
28	4QAM StrongFEC	-88	-89	-88	-87	-87	-85	-88	-84	-88	-86.5	-87	-85	34	35
	16QAM StrongFEC	-82	-83	-81.5	-79.5	-81	-79	-82.5	-79.5	-82	-81.5	-81	-78	69	69
	32QAM StrongFEC	-79	-79	-77.5	-77	-77	-75	-78.5	-75.5	-78	-77.5	-77	-74	87	88
	64QAM StrongFEC	-76	-76	-75.5	-74	-75	-72	-75.5	-73.5	-75	-74.5	-74.5	-72	114	115
	128QAM StrongFEC	-73	-73	-71.5	-70.5	-72	-69	-72.5	-70.5	-72	-71.5	-71	-69	137	138
	256QAM StrongFEC	-70	-70	-68.5	-66.5	-68	-66	-69.5	-67.5	-69	-68	-68	-65	160	161
	512QAM StrongFEC	-66.5	-66	-65	-63.5	-65	-62.5	-66.5	-64	-65	-64.5	-64	-62	183	184
	1024QAM StrongFEC	-63	-63	-62	-59.5	-61.5	-59	-63.5	-61	-62	-61.5	-61	-58	206	207
	1024QAM WeakFEC	-61		-59.5		-59	-57	-60.5	-59.5	-60	-58.5	-59	-56		220

Bandwidth, MHz	Modulation	6GHz	7GHz	11GHz	13GHz	15GHz	17GHz	18GHz	23GHz	24GHz	26GHz	28GHz	38 GHz	Capacity, Mbps	
		Guaranteed RSL Threshold, dBm												-G, -GS modes	Legacy modes
40	2048QAM StrongFEC	-59	-60	-58	-56	-58	-54.5	-59	-57	-59	-58	-57	-54	226	
	4QAM StrongFEC	-86.5	-87	-85	-86	-85.5	-83	-86.5	-83	-85.5	-85	-85.5	-83	50	50
	16QAM StrongFEC	-81	-81	-79.5	-78.5	-79.5	-77	-81	-78.5	-80	-79.5	-79	-76.5	98	98
	32QAM StrongFEC	-77	-77	-76.5	-75.5	-75.5	-73	-77	-74.5	-76	-75.5	-75.5	-73	125	125
	64QAM StrongFEC	-74	-74	-73.5	-71	-73	-71	-74	-72	-73	-73.5	-73.5	-70.5	165	165
	128QAM StrongFEC	-71	-71	-70.5	-70	-70.5	-67	-71	-69	-70	-69.5	-70	-67	198	198
	256QAM StrongFEC	-68	-68	-67	-65	-66.5	-64	-68	-66	-67	-66.5	-65	-63.5	231	231
	512QAM StrongFEC	-65	-65	-64	-62	-63.5	-61	-65	-63	-63.5	-63.5	-63	-60.5	264	264
	1024QAM StrongFEC	-61	-61	-60.5	-59	-60	-57	-61.5	-59.5	-60.5	-59.5	-59	-56.5	298	298
	1024QAM WeakFEC	-59		-59		-57	-55	-59	-57.5	-58.5	-58	-57.5	-55		314
	2048QAM StrongFEC	-58	-58	-56.5	-54	-56	-54	-57.5	-55.5	-56.5	-56	-56	-52.5	336	
56	4QAM StrongFEC	-85	-85	-84	-84.5	-84	-81	-85	-82	-84	-83.5	-84	-81	71	72
	16QAM StrongFEC	-79	-79.5	-78.5	-78	-78	-75	-79	-77	-78.5	-78	-78	-75	144	145
	32QAM StrongFEC	-75	-75.5	-74.5	-74	-74	-71.5	-75	-73	-74.5	-73.5	-74	-72	183	183
	64QAM StrongFEC	-72	-73	-72	-71	-71	-69	-72	-70	-72.5	-71	-71	-69	238	241
	128QAM StrongFEC	-70	-69.5	-68.5	-68	-69	-66	-69	-67.5	-69.5	-68	-68	-65	286	289
	256QAM StrongFEC	-67	-66	-65.5	-64	-65	-62	-66	-64.5	-65.5	-64.5	-65	-62	334	337
	512QAM StrongFEC	-63	-63.5	-62	-61	-62	-59	-63	-61.5	-62.5	-61	-62	-59	382	385
	1024QAM StrongFEC	-60	-60	-58.5	-58	-58	-56	-59	-57.5	-59.5	-57.5	-58	-55	430	433
	1024QAM WeakFEC	-58		-57		-55	-54	-57.5	-55.5		-55.5	-55.5	-54		456
	2048QAM StrongFEC	-56	-57	-54.5	--55	-54	-52.5	-55	-53.5	-55.5	-54	-54.5	-52	472	

[3] *Preliminary data*

[6] *2048QAM modulation is available only for Integral-G and Integral-GS, not supported by legacy models*

[7] *1024QAM modulation with Weak FEC setting is available for legacy models or in legacy modes only*

Integral-G,-GS RSL Thresholds and Capacity for FCC channels [3, 6, 7]

BW, MHz	Modulation	6GHz	7GHz	11GHz	13GHz	15GHz	17GHz	18GHz	23GHz	24GHz	26GHz	28GHz	38 GHz	Capacity, Mbps	
		Guaranteed RSL Threshold, dBm												-G, -GS modes	Legacy modes
5	4QAM StrongFEC	-96	-96	-95	-95.5	-94	-92.5	-95	-94	-95.5	-94.5	-95	-91		5
	16QAM StrongFEC	-89	-89.5	-88	-89	-87	-86.5	-88.5	-88	-89	-87.5	-88	-85		10
	32QAM StrongFEC	-85	-85.5	-84	-85	-83.5	-82.5	-84.5	-84	-85	-83.5	-84	-81		12
	64QAM StrongFEC	-82.5	-82.5	-81,5	-82	-80.5	-79.5	-81.5	-81	-82	-81	-81	-79		17
	128QAM StrongFEC	-79	-79.5	-78.5	-79	-77.5	-76.5	-78.5	-77.5	-79	-78	-78	-75		20
	128QAM WeakFEC	-77	-77	-76.5	-77	-74	-73.5	-76.5	-75.5	-76.5	-75.5	-75.5	-73		22
10	4QAM StrongFEC	-92	-92.5	-91	-92.5	-91	-89	-92	-90	-92	-91.5	-91.5	-89		12
	16QAM StrongFEC	-86	-86.5	-85	-86	-84.5	-82.5	-85.5	-84	-85.5	-84.5	-85	-82		24
	32QAM StrongFEC	-82	-82.5	-81.5	-82	-81	-79	-82.5	-80	-82	-81	-81	-78		30
	64QAM StrongFEC	-79.5	-80	-79	-79.5	-78	-76	-79.5	-78	-79	-78	-78	-76		40
	128QAM StrongFEC	-76	-76.5	-75.5	-76	-75	-73	-76.5	-75	-76	-75	-75	-73		48
	256QAM StrongFEC	-73	-73.5	-72	-73	-72	-69	-72.5	-71	-72.5	-71.5	-71	-70		56
	256QAM WeakFEC	-70	-70.5	-69	-70	-69	-66.5	-70.5	-68	-69.5	-68.5	-68.5	-66		60
20	4QAM StrongFEC	-89	-90	-88.5	-88.5	-88.5	-86	-89	-86.5	-89	-88.5	-88	-86		24
	16QAM StrongFEC	-83	-84	-83	-81	-83	-80	-83.5	-81	-83	-82.5	-82.5	-80		49
	32QAM StrongFEC	-80	-80	-79	-78	-79	-76.5	-79.5	-77	-79	-78.5	-79	-77		62
	64QAM StrongFEC	-77	-77	-76.5	-74.5	-76	-74	-76.5	-74.5	-77	-75.5	-76	-73		82
	128QAM StrongFEC	-74	-74	-73	-71.5	-73	-70.5	-73.5	-71.5	-73	-72.5	-73	-71		99
	256QAM StrongFEC	-70.5	-71	-69.5	-67.5	-70	-67	-70.5	-68.5	-70	-69.5	-70	-67.5		115
	512QAM StrongFEC	-67.5	-68	-67	-65	-66	-64.5	-67.5	-65.5	-67	-66	-66	-64		132
	1024QAM StrongFEC	-64	-64	-62.5	-61	-63	-60.5	-64.5	-62.5	-63	-62.5	-62	-61		148
	1024QAM WeakFEC	-62	-62	-61	-58	-60	-58	-62.5	-59.5	-61	-60.5	-60	-58		157
25	4QAM StrongFEC	-88	-88.5	-88	-88	-88	-85	-88	-85	-88	-87.5	-87	-85		31
	16QAM StrongFEC	-82	-83	-82.5	-81	-82	-79	-82.5	-80	-82	-81.5	-81.5	-79		62
	32QAM StrongFEC	-79	-79	-78.5	-76.5	-78	-75.5	-78.5	-77	-78.5	-77.5	-78	-75		78
	64QAM StrongFEC	-76	-76	-75.5	-74	-75	-73	-76.5	-73.5	-75.5	-74.5	-75	-72		104
	128QAM StrongFEC	-73	-73	-72.5	-70.5	-72	-70	-72.5	-70.5	-72.5	-71.5	-72	-69		124
	256QAM StrongFEC	-70	-70	-69.5	-65.5	-69	-66	-69.5	-68	-69	-68.5	-68	-66		145
	512QAM StrongFEC	-66.5	-67	-65.5	-63	-66	-63	-66.5	-65	-66	-65.5	-64.5	-63		166
	1024QAM StrongFEC	-63	-63	-61.5	-59	-62	-59	-63.5	-61.5	-62.5	-61.5	-61	-60		187

BW, MHz	Modulation	6GHz	7GHz	11GHz	13GHz	15GHz	17GHz	18GHz	23GHz	24GHz	26GHz	28GHz	38 GHz	Capacity, Mbps	
		Guaranteed RSL Threshold, dBm												-G, -GS modes	Legacy modes
	1024QAM WeakFEC	-61	-61	-59.5	-58	-58	-57	-60.5	-59.5	-60	-59.5	-59	-57		198
30	4QAM StrongFEC	-88	-88	-87	-87	-87	-85	-88	-84.5	-87	-86.5	-86.5	-84		37
	16QAM StrongFEC	-82	-82	-81.5	-79.5	-81	-78.5	-81.5	-79	-81.5	-80.5	-81	-78		73
	32QAM StrongFEC	-78	-79	-77.5	-76.5	-77	-75	-78.5	-75	-77.5	-76.5	-77	-74		93
	64QAM StrongFEC	-76	-76	-74.5	-74	-74	-72	-75.5	-73	-75	-74.5	-74	-71.5		123
	128QAM StrongFEC	-72	-73	-71.5	-70	-71	-69	-72.5	-70	-71.5	-71.5	-71	-69		148
	256QAM StrongFEC	-69	-69	-68.5	-67	-68	-66	-69	-67.5	-68.5	-67.5	-68	-65		173
	512QAM StrongFEC	-66	-66	-65.5	-62.5	-65	-62	-66.5	-64.5	-65	-64.5	-64	-62		197
	1024QAM StrongFEC	-63	-62	-61.5	-60	-61	-59	-62.5	-61.5	-61.5	-61	-60	-58		222
	1024QAM WeakFEC	-61		-60		-58	-57	-60.5	-59.5	-60.5	-59	-58.5	-56		235
	2048QAM StrongFEC	-59	-60	-58	-56.5	-56	-54.5	-58	-57	-58.5	-57	-57.5	-54	244	
40	4QAM StrongFEC	-86.5	-87	-85	-86	-85.5	-83	-86	-83	-85.5	-85	-85.5	-82		51
	16QAM StrongFEC	-81	-81	-79.5	-78.5	-79	-77	-80.5	-78	-80	-79.5	-79	-77		101
	32QAM StrongFEC	-77	-77	-76.5	-75.5	-76	-73	-77	-74	-76	-75.5	-75.5	-73		129
	64QAM StrongFEC	-74	-74	-73.5	-71	-73	-70	-74	-72	-73	-72.5	-72.5	-70		170
	128QAM StrongFEC	-71	-71	-70.5	-70	-70	-67	-71	-69	-70	-69.5	-70	-67		204
	256QAM StrongFEC	-68	-68	-67	-65	-66.5	-64.5	-67	-66	-67	-66.5	-65.5	-64		238
	512QAM StrongFEC	-65	-65	-64	-62	-64	-61	-64.5	-63	-63.5	-63.5	-63	-61		272
	1024QAM StrongFEC	-61	-61	-60.5	-59	-58	-57.5	-61.5	-59	-60.5	-59.5	-59.5	-56.5		306
	1024QAM WeakFEC	-60		-59		-55	-55	-59.5	-57.5	-58.5	-58	-57.5	-55.5		323
	2048QAM StrongFEC	-58	-58	-57	-54	-53	-54	-57.5	-55	-56.5	-55.5	-56	-53	336	
50	4QAM StrongFEC	-85	-86	-84.5	-85.5	-85	-82	-85	-82.5	-85.5	-84	-84	-81.5	63	63
	16QAM StrongFEC	-80	-80	-78.5	-78	-78	-76	-79.5	-77	-79.5	-78	-78	-76	128	130
	32QAM StrongFEC	-76	-76	-74.5	-74.5	-75	-72	-75.5	-73	-75.5	-74.5	-74.5	-72.5	163	163
	64QAM StrongFEC	-73	-73.5	-72.5	-71	-72	-69	-72	-71	-72.5	-71.5	-72	-69.5	212	216
	128QAM StrongFEC	-70	-70	-69	-68	-69	-66	-70	-68	-69.5	-68	-69	-66.5	254	258
	256QAM StrongFEC	-67	-67	-65.5	-64	-66	-63	-66	-64.5	-66.5	-65	-65	-63	297	301
	512QAM StrongFEC	-64	-63.5	-63	-61	-63	-59	-63.5	-62	-63	-62	-62	-60	339	344
	1024QAM StrongFEC	-61	-61	-60	-57	-58	-56	-60	-58.5	-59.5	-58.5	-58	-56	382	385
	1024QAM WeakFEC	-59		-57		-55	-54	-57.5	-55.5	-57.5	-56	-56	-54		410
	2048QAM StrongFEC	-57	-57	-56	-55	-53	-52.5	-56	-54	-56.5	-55.5	-55	-52	420	
60	4QAM StrongFEC	-84	-85	-83.5	-84.5	-84	-81	-85	-82	-84	-83.5	-83.5	-81	74	74
	16QAM StrongFEC	-79	-79.5	-78	-77	-78	-75	-78.5	-76	-78.5	-77	-77.5	-75	149	151
	32QAM StrongFEC	-75	-75.5	-74.5	-73	-74	-71	-75	-73	-74.5	-73.5	-74	-71	190	190
	64QAM StrongFEC	-72	-73	-71.5	-71	-71	-69	-72	-70	-71.5	-71	-71	-69	247	251
	128QAM StrongFEC	-70	-69.5	-68.5	-68	-68	-66	-69	-67	-69	-67.5	-68	-65	297	301
	256QAM StrongFEC	-66	-66	-65	-64	-65	-62	-66	-64.5	-65.5	-64.5	-65	-62	347	351
	512QAM StrongFEC	-63	-63	-62.5	-61	-62	-59	-62.5	-61.5	-62.5	-61	-61	-59	397	401
	1024QAM StrongFEC	-60	-59	-58.5	-58	-58	-55	-59	-57.5	-58.5	-57.5	-57	-54.5	447	451
	1024QAM WeakFEC	-58		-57		-55	-53	-57	-55.5	-56.5	-55.5	-55.5	-53		474
	2048QAM StrongFEC	-56	-56	-54	-54	-54	-52	-55	-53	-55.5	-54.5	-54	-51.5	491	

[3] *Preliminary data*

[6] *2048QAM modulation is available only for Integral-G and Integral-GS, not supported by legacy models*

[7] *1024QAM modulation with Weak FEC setting is available for legacy models or in legacy modes only*

Integral-W /-WS RSL Threshold (dBm) and Link Capacity (Mbps)

BW, MHz	Modulation, Strong FEC	6L GHz	6U GHz	11GHz	15GHz	17GHz	18GHz	23GHz	24GHz	26GHz	28GHz	38 GHz	Capacity, Mbps
		Guaranteed RSL Threshold, dBm											-W, -WS
40 FCC	4QAM	-82.5	-82.5	-82.5	-82	-79	-83.5	-80.5	-80	-82	-82.5	-79	63
	8QAM	-79	-79	-78	-77.5	-76	-80.5	-76.5	-75.5	-78	-78.5	-75	94
	16QAM	-76	-76	-75.5	-75	-73	-76.5	-74.5	-72.5	-75	-74.5	-72.5	126
	32QAM	-73	-73	-73	-72.5	-70	-74	-71.5	-70	-72	-72	-69.5	157
	64QAM	-70	-70	-70	-69.5	-67.5	-71.5	-69.5	-66.5	-69	-69	-66.5	189
	128QAM	-67	-67	-67	-66.5	-64.5	-68	-65.5	-64	-66	-66.5	-63.5	220
	256QAM	-64	-64	-64	-63.5	-61	-63.5	-62.5	-60.5	-63	-61.5	-60.5	252
	512QAM	-61	-61	-60	-59.5	-58	-59.5	-59.5	-57.5	-60	-59.5	-57.5	284
	1024QAM	-57	-57	-56.5	-56	-55	-55.5	-57	-54	-56	-55.5	-53	315
50	4QAM	-82	-82	-82	-81.5	-79	-82.5	-79.5	-79	-81	-81	-78.5	78

		6L GHz	6U GHz	11GHz	15GHz	17GHz	18GHz	23GHz	24GHz	26GHz	28GHz	38 GHz	Capacity, Mbps
BW, MHz	Modulation, Strong FEC	Guaranteed RSL Threshold, dBm											-W, -WS
FCC	8QAM	-78	-78	-77	-76.5	-75	-79	-75.5	-75	-77	-77	-74.5	118
	16QAM	-75	-75	-75	-74.5	-72	-76.5	-74.5	-72	-74	-74	-72	157
	32QAM	-72	-72	-72	-71.5	-69.5	-73.5	-71.5	-69	-71	-71	-69	197
	64QAM	-69	-69	-69	-68.5	-66.5	-70.5	-68.5	-66	-68	-68.5	-66	236
	128QAM	-66	-66	-66	-65.5	-63.5	-65.5	-65.5	-62.5	-65.5	-66.5	-64	276
	256QAM	-63	-63	-63	-62.5	-60	-62.5	-61.5	-60	-62	-62	-60	315
	512QAM	-60	-60	-60	-59.5	-57.5	-58.5	-58.5	-57	-59	-59	-57	355
	1024QAM	-56	-56	-56	-55.5	-54	-55.5	-55.5	-53	-55	-54.5	-52.5	394
56 ETSI	4QAM	-81.5	-81.5	-81	-80.5	-78.5	-82.5	-80	-78	-80	-80.5	-77.5	89
	8QAM	-77	-77	-76	-75.5	-74.5	-78	-75.5	-73	-76	-76.5	-73.5	134
	16QAM	-74.5	-74.5	-74	-73.5	-72	-75.5	-74	-71	-74	-74	-71	178
	32QAM	-71.5	-71.5	-71	-70.5	-69	-72.5	-70.5	-68.5	-71	-71.5	-69.5	224
	64QAM	-68.5	-68.5	-68.5	-68	-66	-68.5	-67.5	-65	-68	-68	-66	269
	128QAM	-65	-65	-65	-64.5	-63	-65.5	-65	-62	-65	-65	-62	314
	256QAM	-62.5	-62.5	-62.5	-62	-60	-61.5	-61.5	-59	-62	-62.5	-59.5	359
	512QAM	-59.5	-59.5	-59	-58.5	-57	-58.5	-58.5	-56	-58	-59	-56	404
	1024QAM	-55	-55	-55.5	-55	-53	-54.5	-55	-52.5	-55	-55.5	-52.5	449
60 FCC	4QAM	-81	-81	-81	-80.5	-78.5	-81.5	-80.5	-78	-80	-80	-77.5	96
	8QAM	-76.5	-76.5	-76	-75.5	-74	-78	-75.5	-74	-76	-76	-73.5	144
	16QAM	-74.5	-74.5	-74	-73.5	-71.5	-75.5	-73.5	-71	-74	-74.5	-72	192
	32QAM	-71.5	-71.5	-71	-70.5	-68.5	-72.5	-70.5	-68	-71	-71.5	-68.5	240
	64QAM	-68.5	-68.5	-67.5	-67	-64.5	-67.5	-67.5	-65	-67	-67	-65	288
	128QAM	-65	-65	-65	-64.5	-62.5	-65.5	-64.5	-62	-65	-65.5	-62.5	336
	256QAM	-62.5	-62.5	-62	-61.5	-59.5	-61.5	-61.5	-59	-61	-61.5	-58.5	385
	512QAM	-59	-59	-58	-57.5	-56.5	-58.5	-58.5	-55.5	-58	-58	-56	433
	1024QAM	-55	-55	-55	-54.5	-53	-54.5	-55	-52	-55	-54.5	-52	481
80 FCC	4QAM	-79.5	-79.5	-79.5	-79	-77.5	-81	-78.5	-76	-79	-79	-76.5	128
	8QAM	-75.5	-75.5	-74	-73.5	-72.5	-77	-75	-73	-75	-75	-72.5	192
	16QAM	-72.5	-72.5	-72	-71.5	-70	-74.5	-71.5	-70	-72	-72	-69.5	257
	32QAM	-69.5	-69.5	-69	-68.5	-67.5	-71.5	-68.5	-67	-69	-69	-66.5	321
	64QAM	-66.5	-66.5	-66.5	-66	-64.5	-67.5	-65.5	-64	-66	-66	-63.5	385
	128QAM	-63.5	-63.5	-63.5	-63	-61	-64	-62.5	-61	-63	-63	-60.5	450
	256QAM	-60.5	-60.5	-60.5	-60	-58	-60.5	-59.5	-58	-60	-60	-57.5	514
	512QAM	-57.5	-57.5	-57	-56.5	-55	-57	-56.5	-54	-56.5	-56.5	-54	578
	1024QAM	-53.5	-53.5	-53.5	-53	-51.5	-53.5	-53	-51	-53.5	-53.5	-51	643
100[8] FCC	4QAM	-78.5	-78.5	-79	-78.5	-	-80	-77.5	-	-78.5	-78.5	-76	168
	8QAM	-74.5	-74.5	-74	-73.5	-	-76	-73.5	-	-73.5	-73.5	-71	252
	16QAM	-71.5	-71.5	-71	-70.5	-	-73	-70.5	-	-71.5	-71.5	-69	336
	32QAM	-68.5	-68.5	-69	-68.5	-	-70	-67.5	-	-68.5	-68.5	-66	420
	64QAM	-65.5	-65.5	-65.5	-65	-	-66	-64.5	-	-65.5	-65.5	-63	504
	128QAM	-63	-63	-63	-62.5	-	-63	-61.5	-	-62.5	-62.5	-60	588
	256QAM	-59.5	-59.5	-59.5	-59	-	-60	-58.5	-	-58.5	-58.5	-56	672
	512QAM	-56	-56	-56	-55.5	-	-56	-55.5	-	-56.5	-56.5	-54	756
	1024QAM	-52	-52	-51	-50.5	-	-51.5	-52	-	-51.5	-51.5	-49	840
112[8] ETSI	4QAM	-78.5	-78.5	-77.5	-77	-	-79.5	-77.5	-	-77.5	-77.5	-75	176
	8QAM	-73.5	-73.5	-73.5	-73	-	-76	-73	-	-73	-73	-70.5	265
	16QAM	-71.5	-71.5	-71	-70.5	-	-73	-70.5	-	-70.5	-70.5	-68	359
	32QAM	-68.5	-68.5	-68	-67.5	-	-70	-67.5	-	-67.5	-67.5	-65	441
	64QAM	-65	-65	-65	-64.5	-	-66	-64.5	-	-64.5	-64.5	-62	530
	128QAM	-62.5	-62.5	-62	-61.5	-	-63	-61.5	-	-61.5	-61.5	-59	618
	256QAM	-59.5	-59.5	-59	-58.5	-	-59	-58.5	-	-58.5	-58.5	-56	707
	512QAM	-54.5	-54.5	-56	-55.5	-	-56	-54.5	-	-54.5	-54.5	-52	795
	1024QAM	-52	-52	-51.5	-51	-	-51.5	-51	-	-51.5	-51.5	-49	883

[8] *100 MHz and 112 MHz channel bandwidths are available for all Integral-W /-WS models except 17GHz and 24GHz UL.*

High Performance Integrated antenna specification

Size	Frequency, GHz	Gain, dBi	Half power beamwidth	XPD dB	F/B ratio, dB	Compliance	
						ETSI	FCC
0.3m	**15**	32.1	4.3°	30	58	Class 3	N/A
	17	33.4	3.5°	30	60	Class 3	B2
	18	34.2	3.3°	30	61	Class 3	B2
	23	35.3	3.0°	30	62	Class 3	A
	24	36.1	2.6°	30	62	Class 3	N/A
	26	36.6	2.5°	30	63	Class 3	N/A
	38	40.1	1.6°	30	61	Class 3B	A
	42	40.8	1.5°	30	60	Class 3	A
0.6m	**15**	37.5	2.4°	30	62.5	Class 3	N/A
	17	38.2	2.3°	30	65	Class 3	A
	18	39.1	1.9°	30	64.5	Class 3	A
	23	41.4	1.6°	30	66.5	Class 3	A
	24	41.1	1.4°	30	66	Class 3	N/A
	26	41.6	1.5°	30	68	Class 3	A
	38	45.2	0.9°	30	64	Class 3B	A
	42	46	0.8°	30	65	Class 3	A