

FlexiPacket System Main Technical Specifications

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1 FlexiPacket MultiRadio Technical Specifications

WARNING

Please, skip this chapter and jump to the chapter 2 if the course is about the FlexiPacket Radio



WARNING

For the complete list about the Technical Specifications, please refer yourself to the Customer Documentation Product Description



1.1 FlexiPacket MultiRadio Radio Ethernet Throughput without overhead Compression



Ethernet throughput depends on the Ethernet frame size and on the configured R channel size. Following data refer to minimum R-channel (64kb/s).



WARNING

Layer 1 includes Ethernet preambles and IFG (Inter-Frame Gap)

1.1.1 3.5 MHz channel bandwidth




Modulation	Packet Size 64			Packet Size 128			Packet Size 256		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	5,7	4,4	8540	5,1	4,4	4336	4,8	4,5	2185
16QAM	11,6	8,8	17199	10,3	8,9	8732	9,7	9,0	4400

Modulation	Packet Size 512			Packet Size 1024			Packet Size 1518		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	4,7	4,5	1097	4,6	4,5	550	4,6	4,5	371
16QAM	9,4	9,0	2209	9,2	9,1	1107	9,2	9,1	747


Fig. 1 3.5MHz channel bandwidth

1.1.2 7 MHz channel bandwidth



Modulation	Packet Size 64			Packet Size 128			Packet Size 256		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	11,5	8,7	17079	10,3	8,9	8671	9,7	9,0	4369
16QAM	23,1	17,6	34398	20,7	17,9	17464	19,4	18,0	8799
32QAM	29,9	22,8	44501	26,8	23,1	22593	25,1	23,3	11384
64QAM	36,7	28,0	54604	32,8	28,4	27722	30,8	28,6	13968
128QAM	43,5	33,1	64707	38,9	33,6	32851	36,6	33,9	16553
256QAM	50,3	38,3	74809	45,0	38,9	37980	42,3	39,2	19137

Fig. 2 7 MHz channel bandwidth (1)



Modulation	Packet Size 512			Packet Size 1024			Packet Size 1518		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	9,3	9,0	2193	9,2	9,0	1099	9,1	9,0	742
16QAM	18,8	18,1	4417	18,5	18,1	2213	18,4	18,1	1494
32QAM	24,3	23,4	5714	23,9	23,5	2863	23,8	23,5	1932
64QAM	29,8	28,7	7011	29,3	28,8	3513	29,2	28,8	2371
128QAM	35,4	34,0	8309	34,8	34,1	4162	34,6	34,1	2810
256QAM	40,9	39,4	9606	40,2	39,4	4812	40,0	39,5	3248

Fig. 3 7 MHz channel bandwidth (2)

1.1.3 14 MHz channel bandwidth



Modulation	Packet Size 64			Packet Size 128			Packet Size 256		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	23,1	17,6	34398	20,7	17,9	17464	19,4	18,0	8799
16QAM	46,4	35,4	69036	41,5	35,9	35049	39,0	36,2	17660
32QAM	60,0	45,7	89242	53,6	46,4	45308	50,4	46,8	22829
64QAM	73,6	56,0	109448	65,8	56,9	55566	61,8	57,3	27998
128QAM	87,1	66,4	129654	77,9	67,4	65824	73,2	67,9	33167
256QAM	100,7	76,7	149860	90,1	77,9	76083	84,7	78,5	38336


Fig. 4 14 MHz channel bandwidth (1)



Modulation	Packet Size 512			Packet Size 1024			Packet Size 1518		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	18,8	18,1	4417	18,5	18,1	2213	18,4	18,1	1494
16QAM	37,7	36,3	8865	37,1	36,4	4441	36,9	36,4	2998
32QAM	48,8	46,9	11459	48,0	47,0	5741	47,7	47,1	3875
64QAM	59,8	57,6	14054	58,8	57,7	7041	58,5	57,7	4752
128QAM	70,9	68,2	16648	69,7	68,3	8340	69,3	68,4	5630
256QAM	81,9	78,8	19243	80,5	79,0	9640	80,1	79,0	6507


Fig. 5 14 MHz channel bandwidth (2)

1.1.4 28 MHz channel bandwidth



Modulation	Packet Size 64			Packet Size 128			Packet Size 256		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	51,1	38,9	75977	45,7	39,5	38573	42,9	39,8	19436
16QAM	102,3	77,9	152190	91,5	79,1	77267	86,0	79,7	38930
32QAM	132,2	100,7	196716	118,2	102,3	99872	111,1	103,1	50323
64QAM	162,0	123,5	241141	145,0	125,4	122425	136,2	126,3	61685
128QAM	191,9	146,2	285565	171,7	148,5	144978	161,3	149,6	73052
256QAM	221,8	169,0	330087	198,4	171,6	167583	186,4	172,9	84440

Fig. 6 28 MHz channel bandwidth (1)



Modulation	Packet Size 512			Packet Size 1024			Packet Size 1518		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	41,5	40,0	9756	40,8	40,1	4889	40,6	40,1	3301
16QAM	83,2	80,0	19542	81,8	80,2	9791	81,3	80,3	6610
32QAM	107,5	103,5	25259	105,7	103,7	12656	105,1	103,7	8540
64QAM	131,8	126,8	30962	129,6	127,1	15514	128,8	127,2	10471
128QAM	156,1	150,2	36669	153,4	150,5	18368	152,6	150,6	12401
256QAM	180,4	173,6	42385	177,3	173,9	21232	176,3	174,0	14331

Fig. 7 28 MHz channel bandwidth (2)

1.1.5 40 MHz channel bandwidth



Modulation	Packet Size 64			Packet Size 128			Packet Size 256		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	72,2	55,0	107375	64,5	55,8	54515	60,6	56,3	27468
16QAM	144,5	110,1	214982	129,2	111,8	109148	121,4	112,6	54992
32QAM	186,7	142,3	277851	167,0	144,4	141064	156,9	145,6	71078
64QAM	228,9	174,4	340575	204,7	177,1	172907	192,4	178,4	87121
128QAM	271,0	206,5	403300	242,4	209,7	204751	227,8	211,3	103170
256QAM	313,3	238,7	466161	280,2	242,3	236667	263,3	244,2	119249


Fig. 8 40 MHz channel bandwidth (1)



Modulation	Packet Size 512			Packet Size 1024			Packet Size 1518		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	58,7	56,5	13787	57,7	56,6	6910	57,4	56,7	4665
16QAM	117,5	113,1	27606	115,5	113,3	13831	114,9	113,4	9337
32QAM	151,8	146,1	35677	149,3	146,4	17876	148,4	146,5	12063
64QAM	186,1	179,1	43729	183,0	179,5	21911	182,0	179,6	14788
128QAM	220,4	212,1	51787	216,7	212,5	25941	215,5	212,7	17514
256QAM	254,8	245,2	59859	250,4	245,6	29985	249,0	245,8	20239


Fig. 9 40 MHz channel bandwidth (2)

1.1.6 56 MHz channel bandwidth



Modulation	Packet Size 64			Packet Size 128			Packet Size 256		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	101,6	77,4	151233	90,9	78,6	76781	85,4	79,2	38687
16QAM	203,5	155,0	302792	182,0	157,4	153729	171,0	158,6	77454
32QAM	263,0	200,4	391339	235,2	203,4	198681	221,0	205,0	100110
64QAM	322,3	245,6	479683	288,3	249,4	243531	270,9	251,3	122706
128QAM	381,7	290,8	568028	341,4	295,3	288381	320,8	297,6	145310
256QAM	441,2	336,2	656565	394,7	341,3	333334	370,8	344,0	167957

Fig. 10 56 MHz channel bandwidth (1)



Modulation	Packet Size 512			Packet Size 1024			Packet Size 1518		
	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Layer 1 (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
QPSK	82,6	79,5	19419	81,3	79,7	9732	80,8	79,8	6570
16QAM	165,5	159,3	38881	162,7	159,6	19480	161,8	159,7	13151
32QAM	213,9	205,8	50249	210,3	206,2	25177	209,0	206,3	16990
64QAM	262,1	252,3	61590	257,8	252,8	30861	256,3	252,9	20829
128QAM	310,4	298,8	72940	305,1	299,3	36536	303,5	299,6	24667
256QAM	358,8	345,3	84308	352,7	346,0	42233	350,7	346,2	28506

Fig. 11 56 MHz channel bandwidth (2)

1.1.7 155 Mbps profile



Modulation	Packet Size 64			Packet Size 128			Packet Size 256		
	Ethernet (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Ethernet (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Ethernet (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
128QAM	197,8	150,7	294299	176,9	153,0	149413	166,2	154,2	75286

Fig. 12 155 Mbps profile (1)



WARNING

This profile provides a capacity equivalent to 1xSTM-1 in 28 MHz, @128 QAM. Adaptive Modulation is disabled



Modulation	Packet Size 512			Packet Size 1024			Packet Size 1518		
	Ethernet (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Ethernet (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)	Ethernet (Mbit/s)	Layer 2 (Mbit/s)	Packet (pkt/sec)
128QAM	160,8	154,8	37789	158,1	155,1	18932	157,2	155,2	12779

Fig. 13 155 Mbps profile (2)



WARNING

This profile provides a capacity equivalent to 1xSTM-1 in 28 MHz, @128 QAM. Adaptive Modulation is disabled.

1.2 Environmental standards and conditions



Storage (FlexiPacket Radio and Antennas)	
Ambient temperature	-40 to +70°C (Class 1.2 is guaranteed, which requires from -25 up to +55°C. Moreover both the lower and the higher temperature values are proprietary extended from -40°C up to +70°C: compliance with Class 1.3 requirements)
EN 300 019-1-1	Class 1.2
EN 300 019-2-1	Class 1.2
Transportation (FlexiPacket Radio and Antennas)	
Ambient temperature	-40 to +70°C
EN 300 019-1-2	Class 2.3
EN 300 019-2-2	Class 2.3
Operation and tightness (FlexiPacket Radio)	
Operating temperature	-40°C to +55°C
Wind	< 55 m/s
Relative humidity	8 to 100%
Low air pressure	70 kPa (represents a limit value for open air use, normally at about 3000 m)
IEC 60529	Class IP 65
EN 300 019-1-4	Class 4.1
EN 300 019-2-4	Class 4.1
Operation (Antennas)	
Operating temperature	-45°C to +55°C (operational)
Wind load, survival	55 m/s with radial ice load of 25 mm, density 7 kN/m ³
Relative humidity	8 to 100%
IEC 60529	Class IP 55

Fig. 14 FlexiPacket Radio environmental standards and conditions

1.3 Dimensions without antenna and alignment units



Height	Width	Depth	Weight
237.8 mm	237.8 mm	168.46 mm	5 kg

Fig. 15 FlexiPacket Radio dimensions without antenna and alignment units

1.4 Consumption



DC supply voltage		-26 Vdc to -63 Vdc	

FlexiPacket MultiRadio power supply voltage

6 GHz	7-8 GHz	11 GHz	13 GHz	15 GHz	18 GHz	23 GHz	26 GHz	28 GHz	32 GHz	38 GHz
36 W	35 W	35 W	35 W	35 W	35 W	35 W	38 W	35 W	40 W	38 W

FlexiPacket MultiRadio power consumption

Fig. 16 Consumption

1.5 Frequency bands

- 6 GHz (6L)
- 6 GHz (6U)
- 7 GHz
- 8 GHz
- 11 GHz
- 13 GHz
- 15 GHz
- 18 GHz
- 23 GHz
- 26 GHz
- 28 GHz
- 32 GHz
- 38 GHz



1.5.1 Frequency Adjustment

Frequency adjustment step	250 kHz



Fig. 17 Frequency adjustment

1.6 Typical transmit power at antenna connector



Frequency band	Channel band	Transmitted power (typical values) (dBm)					
		4QAM	16QAM	32QAM	64QAM	128QAM	256QAM
6 GHz	3.5 MHz	25	25	-	-	-	-
	7 MHz	25	25	25	23	23	23
	14 MHz	25	25	25	23	23	23
	28 MHz	25	25	25	23	23	23
	40 MHz	25	25	25	23	23	23
	56 MHz	25	25	25	23	23	23
7 GHz	3.5 MHz	23	23	-	-	-	-
	7 MHz	23	23	23	21	21	21
	14 MHz	23	23	23	21	21	21
	28 MHz	23	23	23	21	21	21
	56 MHz	23	21	21	19	19	17
8 GHz	3.5 MHz	23	23	-	-	-	-
	7 MHz	23	23	23	21	21	21
	14 MHz	23	23	23	21	21	21
	28 MHz	23	23	23	21	21	21
	56 MHz	23	21	21	19	19	17
11 GHz	3.5 MHz	24	24	-	-	-	-
	7 MHz	24	24	24	22	22	22
	14 MHz	24	24	24	22	22	22
	28 MHz	24	24	24	22	22	22
	40 MHz	24	24	24	22	22	22
	56 MHz	24	24	24	22	22	22
13 GHz	3.5 MHz	23	23	-	-	-	-
	7 MHz	23	23	23	21	21	21
	14 MHz	23	23	23	21	21	21
	28 MHz	23	23	23	21	21	21
	56 MHz	23	21	21	19	19	17
15 GHz	3.5 MHz	23	23	-	-	-	-
	7 MHz	23	23	23	21	21	21
	14 MHz	23	23	23	21	21	21
	28 MHz	23	23	23	21	21	21
	56 MHz	23	21	21	19	19	17

Fig. 18 Typical transmit power at antenna connector



Frequency band	Channel band	Transmitted power (typical values) (dBm)					
		4QAM	16QAM	32QAM	64QAM	128QAM	256QAM
18 GHz	3.5 MHz	23	23	-	-	-	-
	7 MHz	23	23	23	21	21	21
	14 MHz	23	23	23	21	21	21
	28/40 MHz	23	23	23	21	21	21
	56/50 MHz	23	21	21	19	19	17
23 GHz	3.5 MHz	20	20	-	-	-	-
	7 MHz	20	20	20	18	18	18
	14 MHz	20	20	20	18	18	18
	28/40 MHz	20	20	20	18	18	18
	56 MHz	20	18	18	16	16	15
26 GHz	3.5 MHz	19	19	-	-	-	-
	7 MHz	19	19	19	17	17	17
	14 MHz	19	19	19	17	17	17
	28 MHz	19	19	19	17	17	17
	56 MHz	19	17	17	15	15	14
28 GHz	3.5 MHz	17	17	-	-	-	-
	7 MHz	17	17	17	15	15	15
	14 MHz	17	17	17	15	15	15
	28 MHz	17	17	17	15	15	15
	56 MHz	17	17	17	15	15	14
32 GHz	3.5 MHz	18	18	-	-	-	-
	7 MHz	18	18	18	16	16	16
	14 MHz	18	18	18	16	16	16
	28 MHz	18	18	18	16	16	16
	56 MHz	18	16	16	14	14	13
38 GHz	3.5 MHz	14	14	-	-	-	-
	7 MHz	14	14	14	12	12	12
	14 MHz	14	14	14	12	12	12
	28 MHz	14	14	14	12	12	12
	56 MHz	14	12	12	10	10	9

Fig. 19 Typical transmit power at antenna connector (Cont.)

WARNING

Guaranteed values (in full temperature range and frequency range) are 1 dB worse.



1.7 Maximum receiver power level at antenna connector



Frequency band	Maximum input power at BER level		No damage
6 GHz	-20 dBm	10 ⁻³	< 0 dBm
7 GHz			
8 GHz			
11 GHz			
13 GHz			
15 GHz			
18 GHz			
23 GHz			
26 GHz			
28 GHz			
32 GHz			
38 GHz			

Fig. 20 Maximum receiver power level at antenna connector

1.8 Noise Figure



Frequency band	Noise Figure (dB)
6 GHz	6.5
7 GHz	6.5
8 GHz	6.5
11 GHz	6.5
13 GHz	6.5
15 GHz	7
18 GHz	7
23 GHz	7.5
26 GHz	8.5
28 GHz	8.5
32 GHz	8.5
38 GHz	9.5

Fig. 21 Noise Figure

1.9 System gain

The system gain is defined as the attenuation value between the transmitter and receiver antenna ports, which causes BER 10⁻⁶.

Guaranteed values (in full temperature range and frequency range) are 2 dB worse.



Frequency band	Channel band	System gain (dB), typical values					
		4QAM	16QAM	32QAM	64QAM	128QAM	256QAM
6 GHz	3.5 MHz	121.5	115.5	n.a.	n.a.	n.a.	n.a.
	7 MHz	118.5	112.5	108.5	103.5	100.5	97.5
	14 MHz	115.5	109.5	105.5	100.5	97.5	94.5
	28 MHz	115.5	109.5	105.5	100.5	97.5	94.5
	40 MHz	111.5	104.5	100.5	96.5	93.5	89.5
	56 MHz	109.5	103.5	99.5	94.5	91.5	88.5
7 GHz	3.5 MHz	119.0	113.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	116.0	110.0	106.0	101.0	98.0	95.0
	14 MHz	113.0	107.0	103.0	98.0	95.0	92.0
	28 MHz	110.0	104.0	100.0	95.0	92.0	89.0
	56 MHz	107.0	99.0	95.0	90.0	87.0	82.0
8 GHz	3.5 MHz	119.0	113.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	116.0	110.0	106.0	101.0	98.0	95.0
	14 MHz	113.0	107.0	103.0	98.0	95.0	92.0
	28 MHz	110.0	104.0	100.0	95.0	92.0	89.0
	56 MHz	107.0	99.0	95.0	90.0	87.0	82.0
11 GHz	3.5 MHz	120.0	114.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	117.0	111.0	107.0	102.0	99.0	96.0
	14 MHz	114.0	108.0	104.0	99.0	96.0	93.0
	28 MHz	111.0	105.0	101.0	96.0	93.0	90.0
	40 MHz	110.0	103.0	99.0	95.0	92.0	88.0
	56 MHz	108.0	102.0	98.0	93.0	90.0	87.0
13 GHz	3.5 MHz	119.0	113.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	116.0	110.0	106.0	101.0	98.0	95.0
	14 MHz	113.0	107.0	103.0	98.0	95.0	92.0
	28 MHz	110.0	104.0	100.0	95.0	92.0	89.0
	56 MHz	107.0	99.0	95.0	90.0	87.0	82.0

Fig. 22 System gain (BER 10⁻⁶) (Typical values)



Frequency band	Channel band	System gain (dB), typical values					
		4QAM	16QAM	32QAM	64QAM	128QAM	256QAM
15 GHz	3.5 MHz	118.0	112.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	115.0	109.0	105.0	101.0	98.0	94.0
	14 MHz	113.0	106.0	102.0	98.0	95.0	92.0
	28 MHz	110.0	103.0	99.0	95.0	92.0	88.0
	56 MHz	107.0	98.0	94.0	90.0	87.0	82.0
18 GHz	3.5 MHz	118.0	112.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	115.0	109.0	105.0	101.0	98.0	94.0
	14 MHz	113.0	106.0	102.0	98.0	95.0	92.0
	28 MHz	110.0	103.0	99.0	95.0	92.0	88.0
	56 MHz	107.0	98.0	94.0	90.0	87.0	82.0
23 GHz	3.5 MHz	115.0	109.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	112.0	106.0	102.0	98.0	95.0	91.0
	14 MHz	110.0	103.0	99.0	95.0	92.0	89.0
	28 MHz	107.0	100.0	96.0	92.0	89.0	85.0
	56 MHz	104.0	95.0	91.0	87.0	84.0	80.0
26 GHz	3.5 MHz	113.0	107.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	110.0	104.0	100.0	95.0	92.0	89.0
	14 MHz	107.0	101.0	97.0	92.0	89.0	86.0
	28 MHz	104.0	98.0	94.0	89.0	86.0	83.0
	56 MHz	101.0	93.0	89.0	84.0	81.0	77.0
28 GHz	3.5 MHz	111.0	105.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	108.0	102.0	98.0	93.0	90.0	87.0
	14 MHz	105.0	99.0	95.0	90.0	87.0	84.0
	28 MHz	102.0	96.0	92.0	87.0	84.0	81.0
	56 MHz	99.0	93.0	89.0	84.0	81.0	77.0
32 GHz	3.5 MHz	112.0	106.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	109.0	103.0	99.0	94.0	91.0	88.0
	14 MHz	106.0	100.0	96.0	91.0	88.0	85.0
	28 MHz	103.0	97.0	93.0	88.0	85.0	82.0
	56 MHz	100.0	92.0	88.0	83.0	80.0	76.0

Fig. 23 System gain (BER 10⁻⁶) (Typical values) (Cont.)



Frequency band	Channel band	System gain (dB), typical values					
		4QAM	16QAM	32QAM	64QAM	128QAM	256QAM
38 GHz	3.5 MHz	107.0	101.0	n.a.	n.a.	n.a.	n.a.
	7 MHz	104.0	98.0	94.0	89.0	86.0	83.0
	14 MHz	101.0	95.0	91.0	86.0	83.0	80.0
	28 MHz	98.0	92.0	88.0	83.0	80.0	77.0
	56 MHz	95.0	87.0	83.0	78.0	75.0	71.0

Fig. 24 System gain (BER 10-6) (Typical values) (Cont.)

1.10 Residual Bit Ratio (RBER)



RBER	≤ 10 ⁻¹¹

Fig. 25 Residual bit error ratio (RBER)

2 FlexiPacket Radio Technical Specifications

WARNING

Please, skip this chapter if the course is about the FlexiPacket MultiRadio



WARNING

For the complete list about the Technical Specifications, please refer yourself to the Customer Documentation Product Description



2.1 Some Definitions



Layer 2 throughput

Layer 2 throughput includes only the Ethernet frame, consisting of the payload and MAC addresses, and excludes the pre-amble and IFG as reported in Fig. 26

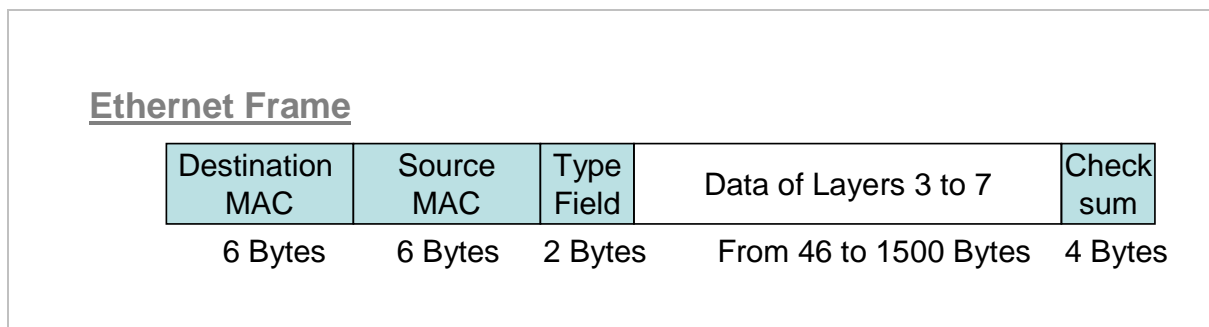


Fig. 26 Ethernet Frame



The smaller is the size of the frame the lower is the effective data throughput.

More frames means the addition of the pre-amble and the IFG bytes, which do not count as data.

Each Ethernet frame consists of additional information besides the actual data payload. Between consecutive frames there are Preamble, and the inter-frame, or inter-packet gap (IFG). The minimum IFG is 12 bytes.

Layer 1 throughput

Each Ethernet frame consists of additional information besides the actual data payload. Between consecutive frames there are Preamble, and the inter-frame, or inter-packet gap (IFG). The minimum IFG is 12 bytes.

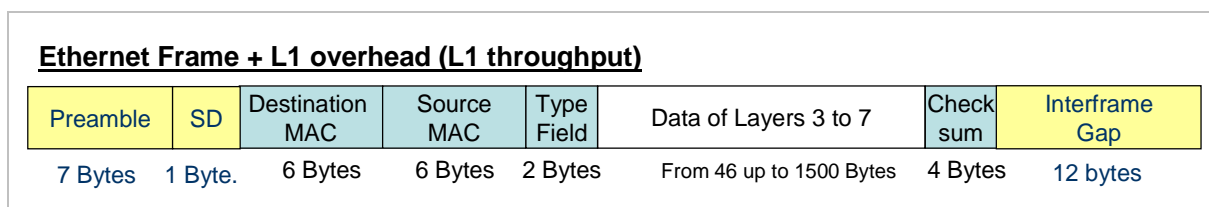


Fig. 27 Ethernet Frame and L1 overhead



Radio throughput

On the radio side, preamble and IFG data are stripped from the incoming data stream and are not transmitted over the radio link.

A small negligible overhead is transmitted on air

At the far end network interface, the "radio overhead" will be processed and removed while preamble and IFG data bytes will be then re-inserted into the data stream by the radio equipment.

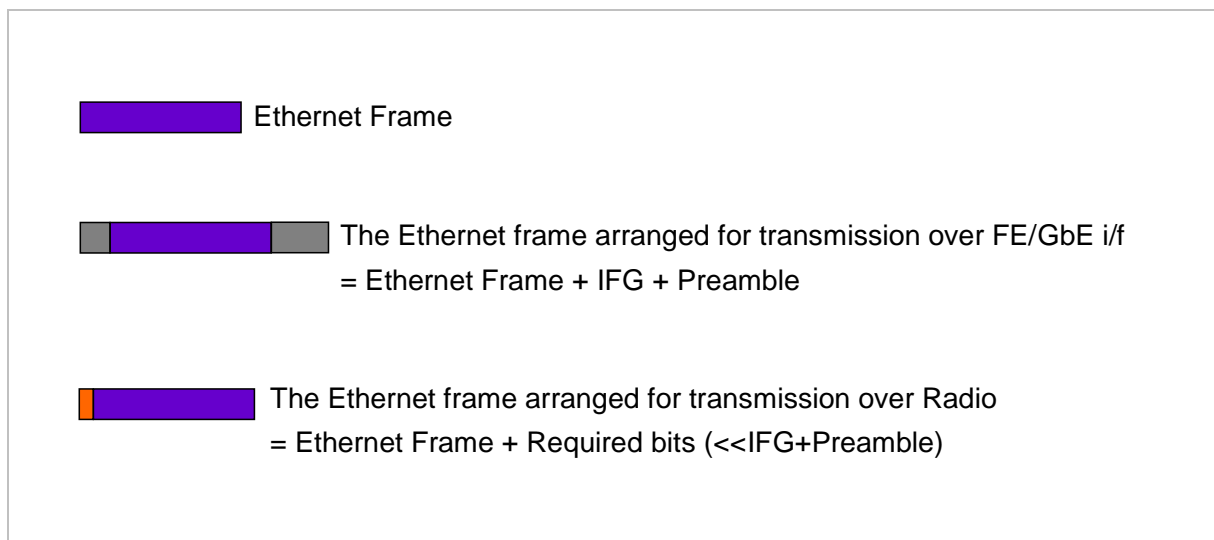


Fig. 28 Radio throughput

2.2 FlexiPacket Radio Layer 2 Ethernet Throughput



Ethernet throughput depends on the Ethernet frame size and on the configured R channel size.

Fig. 29 refers to minimum R-channel (64kb/s) and 64 bytes Ethernet Frames input traffic.



	4 QAM	16 QAM	64 QAM	128 QAM	256 QAM
3.5 MHz	4.2 Mbit/s	8.5 Mbit/s	-	-	-
7 MHz	8.1 Mbit/s	16.4 Mbit/s	26.6 Mbit/s	31.7 Mbit/s	36.8 Mbit/s
13.75/14 MHz	17.1 Mbit/s	34.4 Mbit/s	56.2 Mbit/s	67.2 Mbit/s	78.1 Mbit/s
27.5/28 MHz	42.2 Mbit/s	84.7 Mbit/s	130.2 Mbit/s	153.0 Mbit/s	175.9 Mbit/s
27.5/28 MHz HP ¹⁾	38.3 Mbit/s	76.7 Mbit/s	122.3 Mbit/s	145.1 Mbit/s	168.0 Mbit/s
55/56 MHz	83.0 Mbit/s	166.3 Mbit/s	255.7 Mbit/s	300.4 Mbit/s	345.1 Mbit/s
55/56 MHz HP ¹⁾	75.2 Mbit/s	150.6 Mbit/s	240.0 Mbit/s	284.7 Mbit/s	329.5 Mbit/s

1) The HP (High Performance) profile uses a different coding.

Fig. 29 Throughput (1)



Throughput - 512 bytes Ethernet Frames input traffic - minimum R-channel (64 kbit/s)



	4 QAM	16 QAM	64 QAM	128 QAM	256 QAM
3.5 MHz	4.2 Mbit/s	8.6 Mbit/s	-	-	-
7 MHz	8.2 Mbit/s	16.6 Mbit/s	27.0 Mbit/s	32.1 Mbit/s	37.3 Mbit/s
13.75/14 MHz	17.3 Mbit/s	34.8 Mbit/s	57.0 Mbit/s	68.1 Mbit/s	79.2 Mbit/s
27.5/28 MHz	42.8 Mbit/s	85.8 Mbit/s	132.0 Mbit/s	155.1 Mbit/s	178.3 Mbit/s
27.5/28 MHz HP ¹⁾	38.8 Mbit/s	77.8 Mbit/s	124.0 Mbit/s	147.1 Mbit/s	170.3 Mbit/s
55/56 MHz	84.2 Mbit/s	168.6 Mbit/s	259.2 Mbit/s	304.5 Mbit/s	349.8 Mbit/s
55/56 MHz HP ¹⁾	76.2 Mbit/s	152.6 Mbit/s	243.3 Mbit/s	288.6 Mbit/s	334.0 Mbit/s

1) The HP (High Performance) profile uses a different coding.

Fig. 30 Throughput (2)

Throughput with 1632 bytes Ethernet Frames input traffic and R-channel (64 kbit/s)



	4 QAM	16 QAM	64 QAM	128 QAM	256 QAM
3.5 MHz	4.2 Mbit/s	8.6 Mbit/s	-	-	-
7 MHz	8.2 Mbit/s	16.6 Mbit/s	27.0 Mbit/s	32.1 Mbit/s	37.4 Mbit/s
13.75/14 MHz	17.3 Mbit/s	34.9 Mbit/s	57.1 Mbit/s	68.2 Mbit/s	79.3 Mbit/s
27.5/28 MHz	42.9 Mbit/s	85.9 Mbit/s	132.2 Mbit/s	155.3 Mbit/s	178.6 Mbit/s
27.5/28 MHz HP ¹⁾	38.8 Mbit/s	77.9 Mbit/s	124.2 Mbit/s	147.3 Mbit/s	170.5 Mbit/s
55/56 MHz	84.3 Mbit/s	168.8 Mbit/s	259.5 Mbit/s	304.9 Mbit/s	350.3 Mbit/s
55/56 MHz HP ¹⁾	76.3 Mbit/s	152.8 Mbit/s	243.6 Mbit/s	289.0 Mbit/s	334.4 Mbit/s

1) The HP (High Performance) profile uses a different coding.

Fig. 31 Throughput (3)

2.3 FlexiPacket Radio Layer 1 Ethernet Throughput



Ethernet throughput depends on the Ethernet frame size and on the configured R channel size. Following data refer to minimum R-channel (64kb/s).



	4 QAM	16 QAM	64 QAM	128 QAM	256 QAM
3.5 MHz	5.4 Mbit/s	11.2 Mbit/s	-	-	-
7 MHz	10.6 Mbit/s	21.5 Mbit/s	34.9 Mbit/s	41.6 Mbit/s	48.3 Mbit/s
13.75/14 MHz	22.6 Mbit/s	45.1 Mbit/s	73.8 Mbit/s	88.2 Mbit/s	102.6 Mbit/s
27.5/28 MHz	55.4 Mbit/s	111.1 Mbit/s	170.9 Mbit/s	200.8 Mbit/s	230.9 Mbit/s
27.5/28 MHz HP ¹⁾	50.24 Mbit/s	100.73 Mbit/s	160.57 Mbit/s	190.49 Mbit/s	220.54 Mbit/s
55/56 MHz	109.0 Mbit/s	218.3 Mbit/s	335.6 Mbit/s	394.3 Mbit/s	453.0 Mbit/s
55/56 MHz HP ¹⁾	98.71 Mbit/s	197.66 Mbit/s	315.06 Mbit/s	373.69 Mbit/s	432.46 Mbit/s

1) The HP (High Performance) profile uses a different coding.

Fig. 32 Throughput (4)



Throughput with 512 bytes input traffic and minimum R-channel (64 kbit/s)



	4 QAM	16 QAM	64 QAM	128 QAM	256 QAM
3.5 MHz	4.4 Mbit/s	9.0 Mbit/s	-	-	-
7 MHz	8.5 Mbit/s	17.2 Mbit/s	28.0 Mbit/s	33.4 Mbit/s	38.8 Mbit/s
13.75/14 MHz	18.0 Mbit/s	36.2 Mbit/s	59.2 Mbit/s	70.7 Mbit/s	82.3 Mbit/s
27.5/28 MHz	44.5 Mbit/s	89.2 Mbit/s	137.2 Mbit/s	161.2 Mbit/s	185.3 Mbit/s
27.5/28 MHz HP ¹⁾	50.92 Mbit/s	102.09 Mbit/s	162.76 Mbit/s	193.09 Mbit/s	223.56 Mbit/s
55/56 MHz	87.5 Mbit/s	175.1 Mbit/s	269.3 Mbit/s	316.4 Mbit/s	363.5 Mbit/s
55/56 MHz HP ¹⁾	100.05 Mbit/s	200.35 Mbit/s	319.36 Mbit/s	378.81 Mbit/s	438.37 Mbit/s

1) The HP (High Performance) profile uses a different coding.

Fig. 33 Throughput (5)

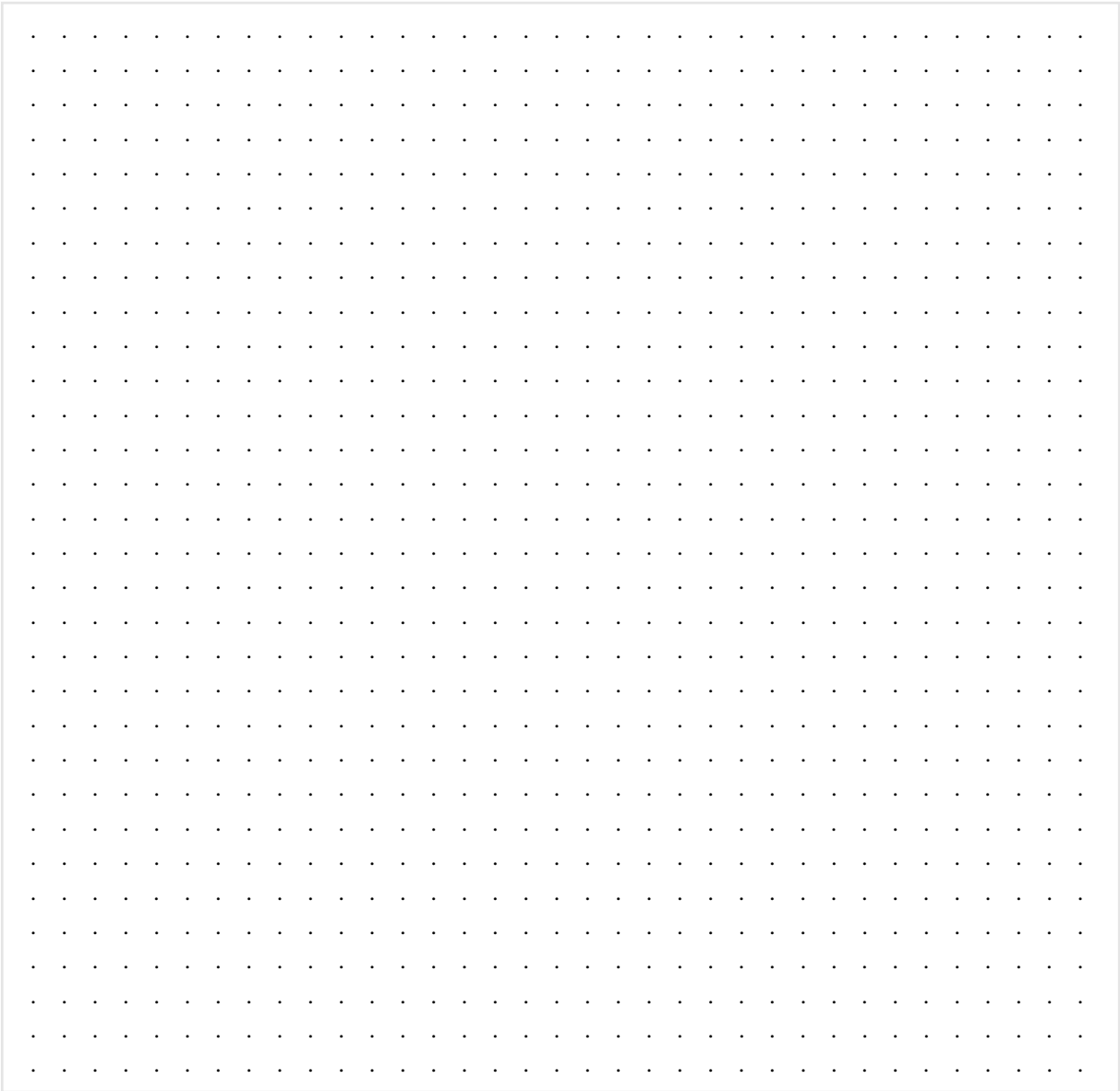
Throughput with 1632 bytes input traffic and minimum R-channel (64 kbit/s)



	4 QAM	16 QAM	64 QAM	128 QAM	256 QAM
3.5 MHz	4.3 Mbit/s	8.7 Mbit/s	-	-	-
7 MHz	8.3 Mbit/s	16.8 Mbit/s	27.3 Mbit/s	32.5 Mbit/s	37.8 Mbit/s
13.75/14 MHz	17.6 Mbit/s	35.3 Mbit/s	57.8 Mbit/s	69.0 Mbit/s	80.3 Mbit/s
27.5/28 MHz	43.4 Mbit/s	87.0 Mbit/s	133.8 Mbit/s	157.2 Mbit/s	180.8 Mbit/s
27.5/28 MHz HP ¹⁾	50.99 Mbit/s	102.25 Mbit/s	162.97 Mbit/s	193.34 Mbit/s	223.85 Mbit/s
55/56 MHz	85.3 Mbit/s	170.9 Mbit/s	262.7 Mbit/s	308.7 Mbit/s	354.6 Mbit/s
55/56 MHz HP ¹⁾	100.18 Mbit/s	200.63 Mbit/s	319.79 Mbit/s	379.31 Mbit/s	438.95 Mbit/s

1) The HP (High Performance) profile uses a different coding.

Fig. 34 Throughput (6)



2.4 FlexiPacket Radio Net Capacity



The Radio Net Capacity is shown in Fig. 35.



	4 QAM	16 QAM	64 QAM	128 QAM	256 QAM
3.5 MHz	4.4 Mbit/s	8.8 Mbit/s	-	-	-
7 MHz	8.4 Mbit/s	16.8 Mbit/s	27.2 Mbit/s	32.4 Mbit/s	37.6 Mbit/s
13.75/14 MHz	17.6 Mbit/s	35.1 Mbit/s	57.3 Mbit/s	68.4 Mbit/s	79.6 Mbit/s
27.5/28 MHz	43.1 Mbit/s	86.2 Mbit/s	132.5 Mbit/s	155.6 Mbit/s	178.9 Mbit/s
27.5/28 MHz HP ¹⁾	39.1 Mbit/s	78.1 Mbit/s	124.4 Mbit/s	147.6 Mbit/s	170.9 Mbit/s
55/56 MHz	84.6 Mbit/s	169.1 Mbit/s	259.9 Mbit/s	305.3 Mbit/s	350.7 Mbit/s
55/56 MHz HP ¹⁾	76.6 Mbit/s	153.1 Mbit/s	244.0 Mbit/s	289.4 Mbit/s	334.9 Mbit/s

1) The HP (High Performance) profile uses a different coding.

Fig. 35 Radio Net Capacity

2.5 Environmental standards and conditions



Storage (FlexiPacket Radio and Antennas)	
Ambient temperature	-40 to +70°C (Class 1.2 is guaranteed, which requires from -25 up to +55°C. Moreover both the lower and the higher temperature values are proprietary extended from -40°C up to +70°C: compliance with Class 1.3 requirements)
EN 300 019-1-1	Class 1.2
EN 300 019-2-1	Class 1.2
Transportation (FlexiPacket Radio and Antennas)	
Ambient temperature	-40 to +70°C
EN 300 019-1-2	Class 2.3
EN 300 019-2-2	Class 2.3
Operation and tightness (FlexiPacket Radio)	
Operating temperature	-40°C to +55°C
Wind	< 55 m/s
Relative humidity	8 to 100%
Low air pressure	70 kPa (represents a limit value for open air use, normally at about 3000 m)
IEC 60529	Class IP 65
EN 300 019-1-4	Class 4.1
EN 300 019-2-4	Class 4.1
Operation (Antennas)	
Operating temperature	-45°C to +55°C (operational)
Wind load, survival	55 m/s with radial ice load of 25 mm, density 7 kN/m ³
Relative humidity	8 to 100%
IEC 60529	Class IP 55

Fig. 36 FlexiPacket Radio environmental standards and conditions

2.6 Dimensions without antenna and alignment units



Height	Width	Depth	Weight
237.8 mm	237.8 mm	168.46 mm	5 kg

Fig. 37 FlexiPacket Radio dimensions without antenna and alignment units

2.7 Consumption



DC supply voltage	-34 Vdc to -54 Vdc
Typical power consumption	35 W

Fig. 38 Consumption



2.8 Frequency bands

- 7 GHz
- 8 GHz
- 13 GHz
- 15 GHz
- 18 GHz
- 23 GHz
- 26 GHz
- 28 GHz
- 38 GHz

2.9 RF parameters

Guaranteed values are in full temperature range and frequency range.



Frequency band	Transmit power, typical values				
	4QAM	16QAM	64QAM	128QAM	256QAM
7 GHz	+23 dBm	+21 dBm	+19 dBm	+19 dBm	+17 dBm
8 GHz					
13 GHz	+23 dBm	+21 dBm	+19 dBm	+19 dBm	+17 dBm
15 GHz					
18 GHz					
23 GHz	+20 dBm	+18 dBm	+16 dBm	+16 dBm	+15 dBm
26 GHz	+19 dBm	+17 dBm	+15 dBm	+15 dBm	+14 dBm
28 GHz	+19 dBm	+17 dBm	+15 dBm	+15 dBm	+14 dBm
38 GHz	+14 dBm	+12 dBm	+10 dBm	+10 dBm	+9 dBm

Fig. 39 Nominal transmit power at antenna connector



Frequency band	Transmit power, guaranteed values				
	4QAM	16QAM	64QAM	128QAM	256QAM
7 GHz	+22 dBm	+20 dBm	+18 dBm	+18 dBm	+16 dBm
8 GHz					
13 GHz	+22 dBm	+20 dBm	+18 dBm	+18 dBm	+16 dBm
15 GHz					
18 GHz					
23 GHz	+19 dBm	+17 dBm	+15 dBm	+15 dBm	+14 dBm
26 GHz	+18 dBm	+16 dBm	+14 dBm	+14 dBm	+13 dBm
28 GHz	+18 dBm	+16 dBm	+14 dBm	+14 dBm	+13 dBm
38 GHz	+13 dBm	+11 dBm	+9 dBm	+9 dBm	+8 dBm

Fig. 40 Guaranteed Transmit power at antenna connector



WARNING

Guaranteed values are in full temperature range and frequency range.



Frequency band	Transmit power stability	Transmit power regulation	
		Range from nominal 4 QAM Tx power	Adjustment step
7 GHz	<±2 dB	20 dB, RTPC	1 dB
8 GHz		25 dB, ATPC	
13 GHz			
15 GHz			
18 GHz			
23 GHz			
26 GHz			
28 GHz			
38 GHz			
Note: The PTx_min values follow the maximum ones considering the ATPC range or RTPC range.			

Fig. 41 Transmit power stability and adjustment



Frequency band	Maximum input power at BER level		No damage
7 GHz	-20 dBm	10 ⁻³	< 0 dBm
8 GHz			
13 GHz			
15 GHz			
18 GHz			
23 GHz			
26 GHz			
28 GHz			
38 GHz			

Fig. 42 Maximum receiver power level at antenna connector



Frequency band	Noise Figure (dB)
7 GHz	6.5
8 GHz	6.5
13 GHz	6.5
15 GHz	7

Frequency band	Noise Figure (dB)
18 GHz	7
23 GHz	7.5
26 GHz	8.5
28 GHz	8
38 GHz	9.5

Fig. 43 Noise Figure

2.10 System gain



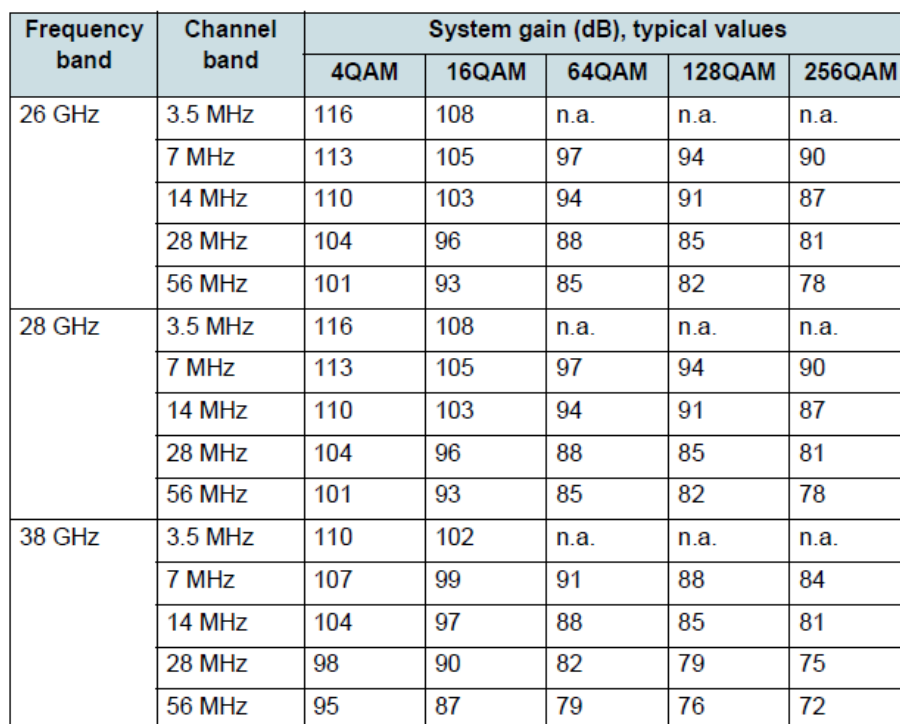
The system gain is defined as the attenuation value between the transmitter and receiver antenna ports, which causes BER 10⁻⁶.

Guaranteed values are in full temperature range and frequency range.



Frequency band	Channel band	System gain (dB), typical values				
		4QAM	16QAM	64QAM	128QAM	256QAM
7 GHz	3.5 MHz	121	113	n.a.	n.a.	n.a.
	7 MHz	118	110	102	99	94
	14 MHz	115	108	99	96	91
	28 MHz	109	101	93	90	85
	56 MHz	106	98	90	87	82
8 GHz	3.5 MHz	121	113	n.a.	n.a.	n.a.
	7 MHz	118	110	102	99	94
	14 MHz	115	108	99	96	91
	28 MHz	109	101	93	90	85
	56 MHz	106	98	90	87	82
13 GHz	3.5 MHz	121	113	n.a.	n.a.	n.a.
	7 MHz	118	110	102	99	94
	14 MHz	115	108	99	96	91
	28 MHz	109	101	93	90	85
	56 MHz	106	98	90	87	82
15 GHz	3.5 MHz	121	113	n.a.	n.a.	n.a.
	7 MHz	118	110	102	99	94
	14 MHz	115	108	99	96	91
	28 MHz	109	101	93	90	85
	56 MHz	106	98	90	87	82
18 GHz	3.5 MHz	121	113	n.a.	n.a.	n.a.
	7 MHz	118	110	102	99	94
	14 MHz	115	108	99	96	91
	28 MHz	109	101	93	90	85
	56 MHz	106	98	90	87	82
23 GHz	3.5 MHz	118	110	n.a.	n.a.	n.a.
	7 MHz	115	107	99	96	92
	14 MHz	112	105	96	93	89
	28 MHz	106	98	90	87	83
	56 MHz	103	95	87	84	80

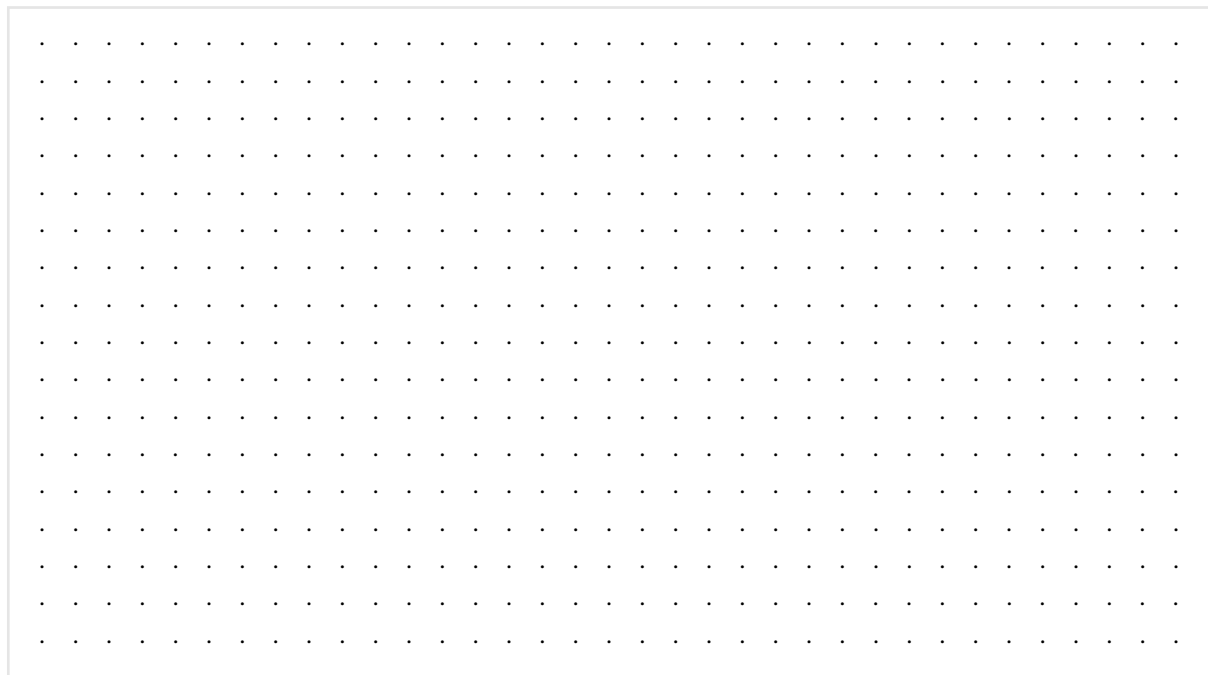
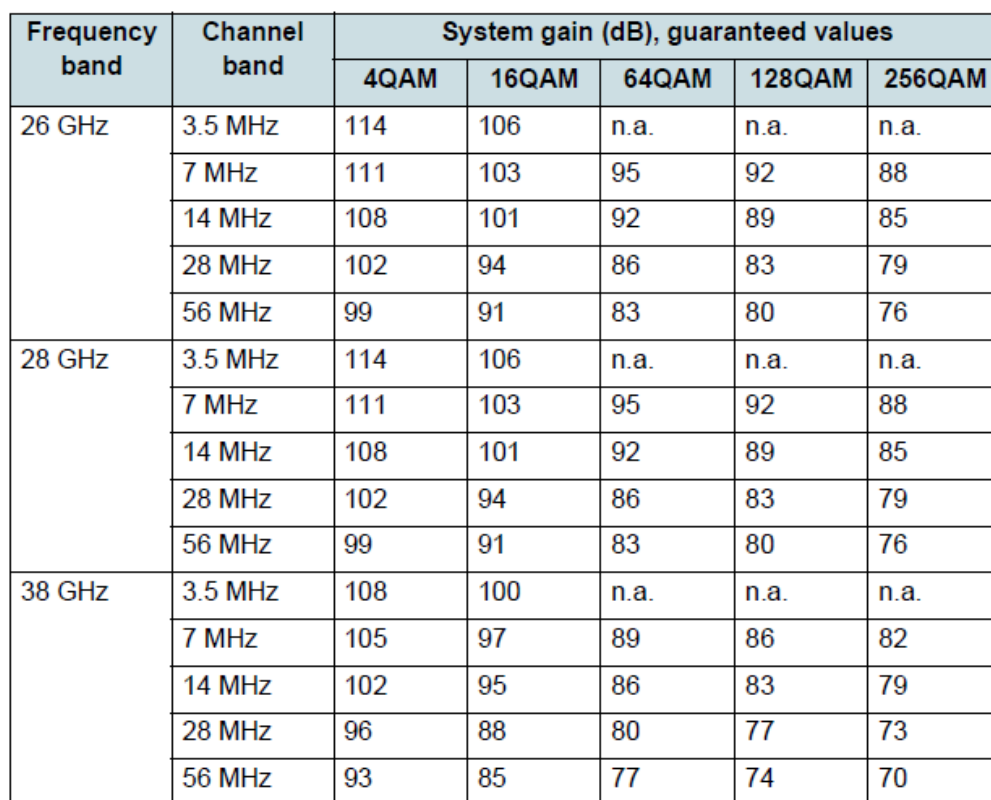
Fig. 44 System gain (BER 10⁻⁶) (Typical values)





Frequency band	Channel band	System gain (dB), guaranteed values				
		4QAM	16QAM	64QAM	128QAM	256QAM
7 GHz	3.5 MHz	119	111	n.a.	n.a.	n.a.
	7 MHz	116	108	100	97	92
	14 MHz	113	106	97	94	89
	28 MHz	107	99	91	88	83
	56 MHz	104	96	88	85	80
8 GHz	3.5 MHz	119	111	n.a.	n.a.	n.a.
	7 MHz	116	108	100	97	92
	14 MHz	113	106	97	94	89
	28 MHz	107	99	91	88	83
	56 MHz	104	96	88	85	80
13 GHz	3.5 MHz	119	111	n.a.	n.a.	n.a.
	7 MHz	116	108	100	97	92
	14 MHz	113	106	97	94	89
	28 MHz	107	99	91	88	83
	56 MHz	104	96	88	85	80
15 GHz	3.5 MHz	119	111	n.a.	n.a.	n.a.
	7 MHz	116	108	100	97	92
	14 MHz	113	106	97	94	89
	28 MHz	107	99	91	88	83
	56 MHz	104	96	88	85	80
18 GHz	3.5 MHz	119	111	n.a.	n.a.	n.a.
	7 MHz	116	108	100	97	92
	14 MHz	113	106	97	94	89
	28 MHz	107	99	91	88	83
	56 MHz	104	96	88	85	80
23 GHz	3.5 MHz	116	108	n.a.	n.a.	n.a.
	7 MHz	113	105	97	94	90
	14 MHz	110	103	94	91	87
	28 MHz	104	96	88	85	81
	56 MHz	101	93	85	82	78

Fig. 46 System gain (BER 10⁻⁶) (Guaranteed values)



2.11 ACM thresholds



BW [MHz]	Mod. [QAM]	From lower to upper modulation - S/MSE (dB)	From upper to lower modulation - S/MSE (dB)
3.5	4	20	-
	16	-	17
7	4	19	-
	16	26	16
	64	29	23
	128	33	26
	256	-	30
14	4	18	-
	16	25	15
	64	28	22
	128	31	25
	256	-	28
28	4	20	-
	16	27	17
	64	30	24
	128	34	27
	256	-	31
56	4	20	-
	16	27	17
	64	30	24
	128	34	27
	256	-	31

Fig. 48 ACM Thresholds

2.12 Residual Bit Ratio (RBER)



RBER	$\leq 10^{-11}$
------	-----------------

Fig. 49 Residual bit error ratio (RBER)

3 FlexiPacket FirstMile and HUB 800 Performance Specifications

WARNING

For the complete list about the Technical Specifications, please refer yourself to the Customer Documentation Product Description



3.1 FirstMile200 Performance specifications



Max. number of Services on UNI

- 256

Max. number of Eth services (E-LAN + E-line)

- 256

Max number of E-Line services

- 256

Max number of E-LAN services

- 128

3.2 HUB 800 Performance specifications

Max. number of Services on UNI

- 256

Max. number of Eth services (E-LAN + E-line)

- 256

Max number of E-Line services

- 256

Max number of E-LAN services

- 256

Max number of E-Line/E-LAN used for CESoP (in addition)

- 111