

MINI-LINK 6600 and MINI-LINK 6366

Release 1.13

Product Specification



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1 Introduction

MINI-LINK 6600 and MINI-LINK 6366 product family covers microwave nodes tailor made for different site needs spanning from simplest outdoor tail site to advanced split mounted aggregation site.

The following products are available:

- MINI-LINK 6651
- MINI-LINK 6691 with NPU 1002 or NPU1003 or NPU 1005
- MINI-LINK 6692 with NPU 1002 or NPU 1005
- MINI-LINK 6693 with NPU 1002 or NPU 1003 or NPU 1005
- MINI-LINK 6694 with NPU 1002 or NPU 1003 or NPU 1005
- MINI-LINK 6654 with PNM 1001 or PNM 1002
- MINI-LINK 6655 with PNM 1002
- MINI-LINK 6366

All the listed product above are hop-compatible and supports radio links with modulation up to 4096 QAM and channel separation up to 112 MHz.

MINI-LINK 6651 is a compact 1RU node for tail sites.

MINI-LINK 6651/1 has a switch capacity of 14.5 Gbps and can connect one or two split mount radio links in one direction. It has 1 Gbps and 2.5 Gbps Ethernet interfaces on the front. It has forced cooling (fan unit).

MINI-LINK 6651/2 has a switch capacity of 14.5 Gbps and can connect one or two split mount radio links in two directions. It has 1 Gbps and 2.5 Gbps Ethernet interfaces on the front. It has forced cooling (fan unit).

MINI-LINK 6651/3 has a switch capacity of 14.5 Gbps and can connect one split mount radio link in one direction. It has 1 Gbps and 2.5 Gbps Ethernet interfaces on the front. It has convectional cooling (no fan).

MINI-LINK 6651/4 has a switch capacity of 47 Gbps and can connect one or two split mount radio links in two directions. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front. Hierarchical Radio Link Bonding is supported. It has forced cooling (fan unit).

In this document, the notation MINI LINK 6651 will be used for generic specifications and parameters. The explicit notation MINI-LINK 6651/1, MINI-



LINK 6651/2, MINI-LINK 6651/3 and MINI-LINK 6651/4 will be used where there are differences in the product versions.

MINI-LINK 6691 with NPU 1002 is a small flexible 1RU node for small aggregation hubs up to 4 radio links in a maximum of 4 radio directions. It has a switch capacity of 88 Gbps, where 38 Gbps can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front.

MINI-LINK 6691 with NPU 1003 is a small flexible 1RU node for small aggregation hubs up to 4 radio links in a maximum of 4 radio directions. It has a switch capacity of 45.5 Gbps, where 38 Gbps can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front.

MINI-LINK 6691 with NPU 1005 is a small flexible 1RU node for small aggregation hubs up to 4 radio links in a maximum of 4 radio directions. It has a switch capacity of 65.5 Gbps, where 43 Gbps can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front. Hierarchical Radio Link Bonding is supported.

MINI-LINK 6692 with NPU 1002 is a flexible 3RU node for large aggregation hubs up to 16 radio links in a maximum of 15 radio directions. It has a switch capacity of 88 Gbps, where 7.5 Gbps is reserved for future use. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front. MINI-LINK 6692 supports redundant NPUs and PFUs.

MINI-LINK 6692 with NPU 1005 is a flexible 3RU node for large aggregation hubs up to 16 radio links in a maximum of 11 radio directions. It has a switch capacity of 65.5 Gbps, where the full capacity can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front. MINI-LINK 6692 supports redundant NPUs and PFUs. Hierarchical Radio Link Bonding is supported.

MINI-LINK 6693 with NPU 1002 is a flexible 1.5RU node for medium aggregation hubs up to 8 radio links in a maximum of 8 radio directions. It has a switch capacity of 88 Gbps, where 46.5 Gbps can be used in this enclosure and has 1 Gbps and 10 Gbps Ethernet interfaces on the front.

MINI-LINK 6693 with NPU 1003 is a flexible 1.5RU node for medium aggregation hubs up to 8 radio links in a maximum of 7 radio directions. It has a switch capacity of 45.5 Gbps, and the full capacity can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front.

MINI-LINK 6693 with NPU 1005 is a flexible 1.5RU node for medium aggregation hubs up to 8 radio links in a maximum of 7 radio directions. It has a switch capacity of 65.5 Gbps, where 55.5 Gbps can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front. Hierarchical Radio Link Bonding is supported.

MINI-LINK 6694 with NPU 1002 is a flexible 2RU node for medium aggregation hubs up to 8 radio links in a maximum of 8 radio directions. It has a switch capacity of 88 Gbps where 59.5 Gbps can be used in this enclosure. It has 1 Gbps



and 10 Gbps Ethernet interfaces on the front. MINI-LINK 6694 supports redundant NPUs and PFUs.

MINI-LINK 6694 with NPU 1003 is a flexible 2RU node for medium aggregation hubs up to 8 radio links in a maximum of 7 radio directions. It has a switch capacity of 45.5 Gbps and the full capacity can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front. MINI-LINK 6694 supports redundant PFUs. Redundant NPU with NPU 1003 is not possible.

MINI-LINK 6694 with NPU 1005 is a flexible 2RU node for medium aggregation hubs up to 8 radio links in a maximum of 7 radio directions. It has a switch capacity of 65.5 Gbps where 55.5 can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front. MINI-LINK 6694 supports redundant NPUs and PFUs. Hierarchical Radio Link Bonding is supported.

MINI-LINK 6654 with PNM 1001 is a small flexible 1RU node for medium aggregation hubs up to 5 radio links in a maximum of 5 radio directions. It has a switch capacity of 36.5 Gbps, and the full capacity can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front.

MINI-LINK 6654 with PNM 1002 is a small flexible 1RU node for medium aggregation hubs up to 6 radio links in a maximum of 6 radio directions. It has a switch capacity of 39 Gbps, and the full capacity can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front.

MINI-LINK 6655 with PNM 1002 is a small flexible 1.5RU node for medium aggregation hubs up to 10 radio links in a maximum of 8 radio directions. It has a switch capacity of 44 Gbps, and the full capacity can be used in this enclosure. It has 1 Gbps and 10 Gbps Ethernet interfaces on the front.

MINI-LINK 6366 is an all-outdoor equipment. It has a switch capacity of 9.5 Gbps and can connect one or two MINI-LINK 6363 radios. It has 1 Gbps and 2.5 Gbps Ethernet interfaces on the front.

1.1 Scope

This product specification defines the basic conditions, characteristics and performance of the MINI-LINK 6600 and MINI-LINK 6366 Network Elements.

It applies to MINI-LINK 6600 and MINI-LINK 6366 release 1.13 and later maintenance releases.

For more information about supported features please see

47/221 02-HRA 901 20/11 Technical Description MINI-LINK 6600 and
49/221 02-HRA 901 20/13 Technical Description MINI-LINK 6366.



2 Ethernet Characteristics

For more information about supported features please see

47/221 02-HRA 901 20/11 Technical Description MINI-LINK 6600 and 49/221 02-HRA 901 20/13 Technical Description MINI-LINK 6366.

For relations between Frame ID and corresponding Channel Separation support, see also chapter 5.2

2.1 Traffic Capacity

Capacity characteristics for Ethernet depend on hardware configuration, selected physical mode and assigned Ethernet traffic capacity. Measured values are typical, not guaranteed.

Measurements are done according to RFC 2544.

2.1.1 Layer 1 Line Interface Capacity for ETSI

Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz] (Frame ID)	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
7 (256 356)	4QAM S	8	10.8	9.8	8.9	8.8	8.8	8.8	8.8	8.8
	4QAM	10	12.7	11.5	10.1	10.3	10.4	10.3	10.3	10.3
	16QAM S	18	22.6	19.9	18.4	18.2	17.9	17.6	17.6	17.7
	16QAM	21	26.4	23.2	20.4	21.3	21	21	20.9	20.7
	32QAM	26	33.1	29.6	27.8	26.9	26.4	26.3	26.2	26.1
	64QAM	33	41.6	37.1	34.9	33.7	33.1	33	33	32.7
	128QAM	39	49.2	44	41.3	40.0	39.2	39.1	39	38.7
	256QAM	45	56.8	50.8	47.6	46.1	45.3	45.1	45	44.7
	512QAM	48	60.6	54.2	50.8	49.2	48.3	48.1	48	47.6
	512QAM L	51	64.4	57.5	54	52.3	51.3	51.2	51	50.6
	1024QAM	53	67.4	60.3	56.7	54.7	53.8	53.6	53.5	53.1
1024QAM L	56	71.2	63.7	59.8	57.8	56.8	56.6	56.5	56	



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz] (Frame ID)	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
13.75 14 (257 357)	4QAM S	19	23.3	20.8	19.5	18.9	18.6	18.5	18.4	18.3
	4QAM	22	27.2	24.3	22.9	22.1	2.7	21.6	21.6	21.4
	16QAM S	37	47	42	39.4	38.1	37.5	37.3	37.2	37
	16QAM	43	54.3	49.1	46.1	44.6	43.8	43.6	43.5	43.2
	32QAM	54	69	61.7	58	56	55	54.8	54.7	54.3
	64QAM	68	86.4	77.3	72.7	70.2	69	68.7	68.6	68
	128QAM	81	102.3	91.5	86	83	81.6	81.3	81.1	80.5
	256QAM	93	118.1	105.6	99.2	95.9	94.2	93.9	93.7	92.9
	512QAM	99	126	112.7	105.9	102.3	100.5	100.1	99.9	99.1
	512QAM L	105	133.8	119.7	112.5	108.7	106.8	106.4	106.2	105.3
	1024QAM	110	140.3	125.5	117.9	113.9	111.9	111.5	111.3	110.4
	1024QAM L	117	148.2	132.5	124.5	120.3	118.2	117.8	117.5	116.6
	2048QAM	121	154	137.8	129.5	125.3	123	122.6	122.4	121.2
	2048QAM L	127	161.9	144.8	136.1	131.5	129.2	128.7	128.5	127.4



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz] (Frame ID)	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
27.5 28 (258 358)	4QAM S	37	47.1	42.1	39.5	38.3	37.6	37.5	37.4	37.1
	4QAM	44	55	49.2	46.2	44.7	43.9	43.7	43.7	43.3
	16QAM S	75	94.6	84.7	79.4	76.8	75.5	75.2	75.1	74.5
	16QAM	87	110.4	98.8	92.9	89.7	88.1	87.8	87.6	86.9
	32QAM	109	138.7	124.1	116.6	112.8	110.8	110.4	110.2	109.1
	64QAM	137	173.8	155.5	146.1	141.2	138.6	138.2	137.9	136.8
	128QAM	162	205.4	183.8	172.8	167.1	164	163.4	163	161.7
	256QAM	186	237.2	212.2	199.4	192.9	189.5	188.8	188.4	186.7
	512QAM	199	253	226.4	212.7	205.8	202.1	201.4	201	199.1
	512QAM L	211	268.9	240.5	226	218.6	214.8	214.1	213.6	211.6
	1024QAM	221	281.7	252	236.8	229.1	225	224.3	223.8	221.7
	1024QAM L	234	297.5	266.2	250.1	242	237.6	236.9	236.4	234.2
	2048QAM	243	309.4	276.7	260	251.6	247.1	246.3	245.8	243.5
	2048QAM L	256	325.2	290.9	273.4	264.5	259.7	258.9	258.4	255.9
	4096QAM	264	336	300.6	282.4	273.3	268.4	267.5	267	264.3
4096QAM L	276	351.9	314.8	295.8	286.1	281	280.1	279.5	276.9	



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz] (Frame ID)	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
40 (259 359)	4QAM S	53	67.5	60.4	56.7	54.9	53.9	53.7	53.6	53.1
	4QAM	62	78.8	70.5	66.2	64.1	62.9	62.7	62.6	62
	16QAM S	107	135.4	121.1	113.8	110.1	108.1	107.8	107.6	106.5
	16QAM	124	158	141.4	132.8	128.5	126.2	125.8	125.5	124.4
	32QAM	156	198.3	177.4	166.7	161.3	158.4	157.9	157.5	156.1
	64QAM	196	248.6	222.4	208.9	202.1	198.5	197.9	197.5	195.6
	128QAM	231	293.8	262.9	247	239	234.7	233.9	233.5	231.3
	256QAM	267	339.1	303.4	285.1	275.8	270.9	270	269.4	266.9
	512QAM	285	361.8	323.5	304.1	294.2	288.9	288	287.4	284.7
	512QAM L	302	384.4	343.9	323.1	312.6	307	306	305.4	302.5
	1024QAM	317	402.7	360.3	338.5	327.4	321.7	320.6	320	316.9
	1024QAM L	335	425.4	380.4	357.6	345.9	339.8	338.6	338	334.8
	2048QAM	348	441.8	395.2	371.3	359.3	352.9	351.7	351	347.7
	2048QAM L	366	464.9	415.9	390.8	378.1	371.3	370.1	369.4	365.9
	4096QAM	378	480.3	429.7	403.7	390.6	383.7	382.4	381.6	378
4096QAM L	395	499.9	450	422.8	409	401.7	400.4	399.6	395.8	



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz] (Frame ID)	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
55 56 62.5 (260 360)	4QAM S	75	95.7	85.6	80.4	77.8	76.4	76.2	76.0	75.3
	4QAM	88	111.7	99.9	93.9	90.8	89.2	88.9	88.7	87.9
	16QAM S	151	191.8	171.6	161.2	156	153.2	152.7	152.1	150.9
	16QAM	176	223.8	199.7	188.1	182	178.6	177.9	177.6	176.1
	32QAM	221	280.8	251.2	236	228.3	224.3	223.5	223.1	221
	64QAM	277	351.9	314.8	295.8	286.2	281.1	280.2	279.6	277
	128QAM	327	416	372.1	349.7	338.3	332.3	331.2	330.5	327.4
	256QAM	377	480	429.4	403.5	390.4	383.4	382.2	381.4	377.8
	512QAM	402	512	458	430.4	416.4	409	407.6	406.8	403
	512QAM L	427	544	486.6	457.3	442.4	434.5	433.1	432.2	428.1
	1024QAM	448	569.9	509.8	479	463.5	455.2	453.7	452.8	448.5
	1024QAM L	473	601.8	538.4	505.9	489.5	480.7	479.2	478.2	473.7
	2048QAM	492	625.7	559.8	526	508.9	499.8	498.2	497.2	492.5
	2048QAM L	517	657.7	588.4	552.9	534.9	525.3	523.6	522.6	517.6
	4096QAM	534	679.5	607.9	571.2	552.6	542.8	541	539.9	534.8
4096QAM L	559	711.5	636.5	598.1	578.7	568.3	566.5	565.3	560	



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz] (Frame ID)	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
80 (303 403)	4QAM S	108	137.5	123	115.6	111.8	109.8	109.5	109.2	108.2
	4QAM	126	160.5	143.6	134.9	130.5	128.2	127.8	127.5	126.3
	16QAM S	217	275.4	246.4	231.5	224	220	219.3	218.8	216.7
	16QAM	253	321.4	287.5	270.2	261.4	256.7	255.9	255.3	252.9
	32QAM	317	403.1	360.7	338.9	327.9	322	321	320.3	317.3
	64QAM	397	504.4	451.2	423.9	410.1	402.8	401.5	400.7	396.9
	128QAM	469	597.2	534.3	502	485.7	477	475.5	474.5	470.1
	256QAM	542	689.2	616.5	579.4	560.5	550.5	548.7	547.6	542.4
	512QAM	578	735	657.7	618	597.9	587.2	585.3	584.1	578.6
	512QAM L	614	781.1	698.8	656.7	635.3	623.9	621.9	620.6	614.8
	1024QAM	643	818.4	732.1	687.9	665.5	653.7	651.6	650.2	644.1
	1024QAM L	679	863.4	772.2	725.8	702.1	689.6	687.3	685.9	679.5
	2048QAM	706	898.6	803.6	755.4	730.8	717.8	715.5	714	707.2
	2048QAM L	742	943.2	843.8	792.9	767.1	753.4	750.9	749.4	742.3
4096QAM	767	973.5	870.8	818.3	791.6	777.5	774.9	773.4	766.1	



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz] (Frame ID)	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
110 112 125 (261 361)	4QAM S	151	191.6	171.4	161	155.8	153	152.5	152.2	150.8
	4QAM	176	223.6	200	187.9	181.8	178.6	178	177.6	175.9
	16QAM S	302	383.5	343.1	322.4	311.9	306.4	305.4	304.7	301.8
	16QAM	352	447.5	400.4	376.2	364	357.5	356.3	355.6	352.2
	32QAM	441	561.3	502.2	471.9	456.5	448.4	446.9	446	441.8
	64QAM	553	703.5	629.4	591.4	572.1	561.9	560.1	559	553.7
	128QAM	654	831.5	743.8	699	676.2	664.2	662	660.7	654.4
	256QAM	754	956.7	855.9	804.3	778	764.2	761.7	760	753
	512QAM	804	1021	913.8	858.7	830.8	816	813.3	811.6	804
	512QAM L	855	1085	966.5	908.2	878.7	862.9	860	858.5	850.3
	1024QAM	895	1136	1011	955.3	924.3	907.9	902.8	902.9	894.5
	1024QAM L	946	1201	1068	1009	974.8	957.7	945.9	945.3	943.3
	2048QAM	983	1248	1110	1048	1012	994.8	990.8	990.1	980.2
	2048QAM L	1033	1311	1167	1102	1063	1043	1041	1040	1030
4096QAM	1068	1356	1206	1139	1100	1078	1076	1075	1065	



2.1.2 Layer 1 Line Interface Capacity ANSI

Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz]	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
10 (262 362)	4QAM S	13	16	14.1	13.2	12.8	12.6	12.5	12.5	12.4
	4QAM	15	18.4	16.5	15.5	15	14.7	14.7	14.6	14.5
	16QAM S	25	31.8	28.4	26.7	25.8	25.4	25.3	25.2	25
	16QAM	29	37.1	33.2	31.2	30.2	29.7	29.6	29.5	29.2
	32QAM	37	46.7	41.7	39.2	37.9	37.3	37.1	37.1	36.7
	64QAM	46	58.5	52.4	49.2	47.6	46.7	46.6	46.5	46.1
	128QAM	55	69.2	61.9	58.2	56.3	55.3	55.1	55	54.5
	256QAM	63	79.9	71.5	67.2	65	63.8	63.6	63.5	62.9
	512QAM	67	85.3	76.3	71.7	69.4	68.1	67.9	67.8	67.1
	512QAM L	71	90.6	81.1	76.2	73.7	72.4	72.2	72	71.3
	1024QAM	75	95	85	79.8	77.2	75.8	75.6	75.4	74.7
1024QAM L	79	110.3	89.7	84.3	81.6	80.1	79.9	79.7	78.9	
20 (263 363)	4QAM S	26	33.1	29.6	27.8	26.9	26.4	26.4	26.3	26.1
	4QAM	31	38.7	34.6	32.5	31.5	30.9	30.8	30.7	30.4
	16QAM S	53	66.6	59.6	56	54.2	53.2	53	52.9	52.4
	16QAM	61	77.8	69.6	65.4	63.3	62.1	61.9	61.8	61.2
	32QAM	77	97.7	87.4	82.1	79.4	78	77.8	77.6	76.9
	64QAM	97	122.5	109.6	103	99.6	97.8	97.5	97.3	96.4
	128QAM	114	144.8	129.6	121.7	117.8	115.7	115.3	115.1	114
	256QAM	132	176.2	149.6	140.5	136	133.5	133.1	132.8	131.6
	512QAM	140	178.4	159.5	149.9	145	142.5	142	141.7	140.4
	512QAM L	149	189.5	169.5	159.3	154.1	151.4	150.9	150.6	149.2
	1024QAM	156	198.6	177.6	166.9	161.5	158.6	158.1	157.8	156.3
	1024QAM L	165	209.7	187.6	176.3	170.6	167.5	167	166.6	165.1
	2048QAM	172	218.1	195.1	183.3	177.3	174.2	173.6	173.3	171.6
2048QAM L	180	229.3	205.1	192.7	186.4	183.1	182.5	182.1	180.4	



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz]	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
30 (264 364)	4QAM S	40	50.4	45.1	42.4	41	40.3	40.1	40.1	39.7
	4QAM	47	58.9	52.7	49.5	47.9	47	46.9	46.8	46.4
	16QAM S	80	101.3	90.6	85.1	82.4	80.9	80.6	80.5	79.7
	16QAM	93	118.3	105.8	99.4	96.2	94.4	94.1	94	93.1
	32QAM	117	148.4	132.8	124.8	120.7	118.6	118.2	117.9	116.8
	64QAM	147	186.1	166.5	156.4	151.3	148.6	148.1	147.8	146.4
	128QAM	173	220	196.8	184.9	178.9	175.7	175.1	174.8	173.1
	256QAM	200	251	224.6	211	204.1	200.5	199.8	199.4	197.6
	512QAM	213	270.9	242.3	227.7	220.3	216.3	215.6	215.2	213.2
	512QAM L	226	287.8	257.5	241.9	234.1	229.9	229.1	228.7	226.5
	1024QAM	237	301.6	269.8	253.5	245.2	240.9	240	239.6	237.3
	1024QAM L	251	318.5	284.9	267.7	259	254.4	253.6	253.1	250.7
	2048QAM	261	331.2	296.2	278.4	269.3	264.5	263.6	263.1	260.6
	2048QAM L	274	348.1	311.4	292.6	283.1	278.1	277.1	276.6	274
	4096QAM	283	359.7	321.8	302.4	292.5	287.3	286.4	285.8	283.1
4096QAM L	296	376.6	336.9	316.6	306.3	300.8	299.9	299.3	296.4	



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz]	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
40 (265 365)	4QAM S	54	68	60.9	57.2	55.3	54.3	54.2	54	53.5
	4QAM	63	79.4	71.1	66.8	64.6	63.4	63.2	63.1	62.5
	16QAM S	108	136.5	122.1	114.7	111	109	108.7	108.4	107.4
	16QAM	126	159.3	142.5	133.9	129.6	127.3	126.8	126.6	125.4
	32QAM	157	199.9	178.8	168.1	162.5	159.7	159.2	158.8	157.3
	64QAM	197	250.6	224.2	210.7	203.8	200.2	199.5	199.1	197.2
	128QAM	233	296.2	265	249	240.9	236.6	235.9	235.4	233.2
	256QAM	269	341.9	305.9	287.4	278.1	273.1	272.2	271.6	269.1
	512QAM	287	364.7	326.3	306.6	296.6	291.3	290.4	289.8	287
	512QAM L	305	387.6	346.7	325.8	315.2	309.6	308.5	307.9	305
	1024QAM	319	406	363.2	341.3	330.1	324.3	323.3	322.6	319.6
	1024QAM L	337	428.9	383.6	360.5	348.8	342.5	341.4	340.7	337.5
	2048QAM	351	445.9	398.9	374.8	362.6	356.1	355	354.3	350.9
	2048QAM L	369	468.7	419.3	394	381.2	374.4	373.2	372.4	368.9
	4096QAM	381	484.3	433.2	407.1	393.8	386.8	385.6	384.8	381.1
4096QAM L	399	504.4	451.2	423.9	410.1	402.8	401.5	400.7	396.9	



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz]	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
50 (266 366)	4QAM S	68	85.5	76.5	71.8	69.6	68.3	68.1	68	67.3
	4QAM	79	99.9	89.3	83.9	81.2	79.8	79.5	79.3	78.6
	16QAM S	135	171.5	153.4	144.1	139.4	137	136.5	136.2	134.9
	16QAM	158	200	179	168.2	162.7	159.8	159.3	159	157.5
	32QAM	198	251	224.6	211	204.1	200.5	199.8	199.4	197.6
	64QAM	248	314.7	281.5	264.5	255.9	251.3	250.5	250	247.7
	128QAM	293	372	332.8	312.7	302.5	297.1	296.1	295.5	292.7
	256QAM	338	429.2	384	360.8	349.1	342.9	341.7	341	337.8
	512QAM	360	457.9	409.6	384.9	372.4	365.7	364.5	363.7	360.4
	512QAM L	383	486.5	435.2	409	395.7	388.6	387.3	386.6	382.9
	1024QAM	401	509.7	456	428.5	414.5	407.1	405.8	405	401.2
	1024QAM L	423	538.4	481.6	452.6	437.8	430	428.6	427.6	423.7
	2048QAM	440	559.7	500.7	470.5	455.2	447.1	445.6	444.7	440.5
	2048QAM L	463	588.4	526.3	494.6	478.5	470	468.4	467.5	463.1
	4096QAM	478	607.9	543.8	511	494.4	485.6	484	483	478.4
4096QAM L	500	636.4	569.5	535.1	517.7	508.5	506.8	505.8	501	



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz]	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
60 (267 367)	4QAM S	81	102.8	92	86.4	83.6	82.1	81.8	81.7	80.9
	4QAM	95	120	107.4	100.9	97.6	95.9	95.5	95.4	94.5
	16QAM S	162	206.1	184.4	173.2	167.6	164.6	164.1	163.7	162.2
	16QAM	189	240.5	215.1	202.2	195.6	192.1	191.5	191.1	189.3
	32QAM	237	301.7	269.9	253.6	245.4	241	240.2	239.7	237.5
	64QAM	297	378.2	338.3	317.9	307.6	302.1	301.1	300.5	297.6
	128QAM	352	447	399.9	375.8	363.5	357.1	355.9	355.2	351.8
	256QAM	406	515.8	461.5	433.6	419.5	412	410.7	409.9	406
	512QAM	433	550.3	492.3	462.6	447.5	439.5	438.1	437.2	433.1
	512QAM L	460	584.7	523.1	491.5	475.5	467	465.5	464.6	460.2
	1024QAM	481	612.6	548	514.9	498.2	489.3	487.6	486.7	482.1
	1024QAM L	509	647	578.8	543.9	526.2	516.8	515.1	514	509.2
	2048QAM	529	672.7	601.8	565.4	547	537.3	535.5	534.5	529.4
	2048QAM L	556	707.1	632.1	594.4	575	564.8	562.9	561.8	556.5
	4096QAM	574	730.6	653.6	614.1	594.1	583.5	581.6	580.5	575
4096QAM L	601	759.2	679.1	638.1	617.4	606.4	604.4	603.2	597.5	



Physical mode			Layer 1 Line Interface Capacity [Mbps]							
CS [MHz]	Modulation	Frame size [bytes]	64	128	256	512	1024	1280	1518	9216
		Air Interface Capacity [Mbps]								
80 (268 368)	4QAM S	108	137.5	123	115.6	111.8	109.8	109.5	109.2	108.2
	4QAM	126	160.5	143.6	134.9	130.5	128.2	127.8	127.5	126.3
	16QAM S	217	275.4	246.4	231.5	224	220	219.3	218.8	216.7
	16QAM	253	321.4	287.5	270.2	261.4	256.7	255.9	255.3	252.9
	32QAM	317	403.1	360.7	338.9	327.9	322	321	320.3	317.3
	64QAM	397	504.4	451.2	423.9	410.1	402.8	401.5	400.7	396.9
	128QAM	469	597.2	534.3	502	485.7	477	475.5	474.5	470.1
	256QAM	542	689.2	616.5	579.4	560.5	550.5	548.7	547.6	542.4
	512QAM	578	735	657.7	618	597.9	587.2	585.3	584.1	578.6
	512QAM L	614	781.1	698.8	656.7	635.3	623.9	621.9	620.6	614.8
	1024QAM	643	818.4	732.1	687.9	665.5	653.7	651.6	650.2	644.1
	1024QAM L	679	863.4	772.2	725.8	702.1	689.6	687.3	685.9	679.5
	2048QAM	706	898.6	803.6	755.4	730.8	717.8	715.5	714	707.2
	2048QAM L	742	943.2	843.8	792.9	767.1	753.4	750.9	749.4	742.3
4096QAM	767	973.5	870.8	818.3	791.6	777.5	774.9	773.4	766.1	

2.1.3 Layer 2 Line Interface Capacity

$$L2 = L1 \times (\text{packet size}) / (\text{packet size} + 20)$$



2.2 Traffic Latency

Latency characteristics for Ethernet depend on hardware configuration, selected physical mode and assigned Ethernet traffic capacity. Measured values are typical, not guaranteed.

Measurements are done according to RFC 2544.

2.2.1 Traffic Latency for ETSI

In the table below **LL** denotes values for low latency Frame ID's (356, 357, 358, 359, 360, 361 and 403) and **STD** denotes values for standard Frame ID's (256, 257, 258, 259, 260, 261 and 303).

Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
7 (256 356)	4QAM S	64	766	1657	750	1635	840	1679
		128	825	1707	810	1706	860	1709
		256	946	1847	930	1846	980	1848
		512	1204	2098	1170	2079	1210	2118
		1024	1639	2552	1630	2551	1670	2553
		1280	1896	2834	1860	2803	1900	2865
		1518	2115	3035	2080	3034	2120	3037
		9216	9185	10257	9160	10245	9200	10269
7 (256 356)	4QAM	64	752	1621	730	1621	920	1621
		128	799	1687	780	1681	840	1693
		256	896	1804	880	1803	930	1804
		512	1101	2015	1090	2007	1120	2022
		1024	1510	2431	1480	2422	1520	2440
		1280	1716	2627	1680	2614	1720	2640
		1518	1904	2808	1880	2806	1910	2811
		9216	7917	9033	7910	9031	7940	9035



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
7 (256 356)	16QAM S	64	709	1580	698	1580	725	1581
		128	736	1618	728	1615	754	1621
		256	795	1694	788	1694	816	1694
		512	917	1832	900	1830	980	1835
		1024	1152	2062	1140	2055	1170	2069
		1280	1272	2184	1260	2177	1290	2191
		1518	1388	2302	1370	2295	1390	2309
		9216	4914	5974	4900	5972	4980	5977
7 (256 356)	16QAM	64	698	1575	690	1573	713	1577
		128	722	1616	716	1609	738	1623
		256	776	1675	770	1675	790	1675
		512	875	1778	870	1777	890	1779
		1024	1081	1993	1070	1987	1090	2000
		1280	1180	2092	1170	2091	1190	2092
		1518	1279	2199	1273	2190	1290	2207
		9216	4314	5370	4290	5366	4360	5373
7 (256 356)	32QAM	64	686	1566	681	1564	700	1567
		128	707	1592	702	1589	720	1595
		256	751	1644	745	1643	762	1645
		512	832	1728	827	1726	840	1730
		1024	994	1896	990	1895	1002	1897
		1280	1076	1988	1070	1983	1080	1993
		1518	1157	2064	1148	2062	1163	2065
		9216	3580	4638	3570	4634	3630	4642



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
7 (256 356)	64QAM	64	680	1556	673	1556	688	1557
		128	694	1578	690	1576	705	1580
		256	730	1621	720	1621	740	1622
		512	796	1690	793	1689	803	1691
		1024	924	1832	922	1830	933	1834
		1280	992	1898	980	1897	1000	1899
		1518	1054	1963	1051	1961	1062	1965
		9216	3013	4052	3000	4047	3030	4058
7 (256 356)	128QAM	64	673	1552	669	1552	682	1552
		128	686	1574	683	1573	696	1575
		256	716	1606	713	1605	724	1606
		512	773	1665	770	1664	780	1666
		1024	886	1787	881	1784	891	1789
		1280	941	1843	939	1842	949	1844
		1518	995	1900	992	1899	1001	1902
		9216	2652	3696	2640	3695	2680	3696
7 (256 356)	256QAM	64	669	1550	665	1549	676	1551
		128	681	1566	678	1564	689	1568
		256	707	1597	700	1597	720	1598
		512	757	1653	750	1652	760	1653
		1024	853	1756	852	1753	859	1758
		1280	902	1809	900	1807	920	1812
		1518	951	1856	947	1855	956	1858
		9216	2395	3442	2380	3442	2420	3443



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
7 (256 356)	512QAM	64	665	1548	662	1547	672	1549
		128	678	1563	674	1563	684	1564
		256	696	1593	690	1593	701	1593
		512	745	1643	740	1642	750	1645
		1024	829	1743	828	1743	836	1743
		1280	874	1794	872	1791	880	1797
		1518	917	1840	915	1840	922	1841
		9216	2198	3336	2190	3334	2220	3338
7 (256 356)	512QAM L	64	N/A	1548	N/A	1546	N/A	1550
		128	N/A	1563	N/A	1563	N/A	1563
		256	N/A	1589	N/A	1588	N/A	1590
		512	N/A	1639	N/A	1638	N/A	1641
		1024	N/A	1731	N/A	1729	N/A	1733
		1280	N/A	1779	N/A	1777	N/A	1780
		1518	N/A	1823	N/A	1822	N/A	1823
		9216	N/A	3240	N/A	3237	N/A	3243
7 (256 356)	1024QAM	64	664	1547	661	1546	670	1548
		128	674	1562	671	1561	680	1563
		256	695	1595	692	1586	701	1603
		512	737	1634	735	1634	741	1635
		1024	815	1725	813	1722	820	1727
		1280	854	1768	852	1768	859	1768
		1518	891	1812	889	1811	896	1813
		9216	2056	3173	2051	3171	2059	3175



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
7 (256 356)	1024QAM L	64	N/A	1547	N/A	1545	N/A	1548
		128	N/A	1560	N/A	1560	N/A	1561
		256	N/A	1591	N/A	1583	N/A	1598
		512	N/A	1629	N/A	1629	N/A	1630
		1024	N/A	1717	N/A	1716	N/A	1717
		1280	N/A	1759	N/A	1759	N/A	1759
		1518	N/A	1798	N/A	1797	N/A	1798
13.75 14 (257 357)	4QAM S	64	391	808	384	799	413	817
		128	423	839	410	833	480	846
		256	482	921	470	920	550	921
		512	597	1038	580	1033	660	1044
		1024	821	1265	810	1250	890	1280
		1280	940	1390	920	1383	1000	1397
		1518	1043	1504	1030	1496	1050	1512
13.75 14 (257 357)	4QAM	64	391	797	370	787	460	808
		128	411	827	400	815	429	839
		256	460	894	450	885	510	902
		512	559	988	550	981	610	995
		1024	752	1191	740	1186	800	1196
		1280	848	1294	840	1290	910	1298
		1518	943	1386	930	1379	950	1393
	9216	3869	4470	3860	4456	3930	4484	



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
13.75 14 (257 357)	16QAM S	64	366	781	350	770	410	791
		128	379	794	373	786	402	802
		256	407	828	400	821	440	836
		512	466	896	460	888	500	904
		1024	581	1018	570	1011	610	1025
		1280	642	1084	630	1078	670	1089
		1518	699	1143	690	1136	704	1150
13.75 14 (257 357)	16QAM	64	358	771	353	763	382	780
		128	371	790	367	783	396	797
		256	398	820	390	813	420	827
		512	448	878	440	869	470	887
		1024	548	986	540	971	570	1000
		1280	600	1037	590	1032	620	1042
		1518	648	1086	642	1076	655	1096
13.75 14 (257 357)	32QAM	64	353	768	349	758	378	778
		128	364	781	360	774	386	788
		256	384	825	380	816	400	834
		512	426	853	420	845	450	862
		1024	506	940	505	933	515	948
		1280	549	986	547	978	554	994
		1518	588	1026	585	1018	593	1035
	9216	1791	2364	1780	2354	1810	2373	



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
13.75 14 (257 357)	64QAM	64	349	763	345	755	374	771
		128	357	772	354	764	373	781
		256	376	794	374	785	380	802
		512	409	834	407	826	424	842
		1024	475	907	472	903	493	912
		1280	508	942	506	934	528	949
		1518	539	979	536	967	544	991
13.75 14 (257 357)	128QAM	64	346	759	343	752	367	767
		128	354	771	350	763	370	779
		256	369	790	368	781	374	799
		512	398	821	397	812	414	830
		1024	454	887	452	879	467	896
		1280	485	918	482	908	490	928
		1518	510	948	508	940	515	957
13.75 14 (257 357)	256QAM	64	355	759	340	750	370	767
		128	353	767	349	760	358	774
		256	365	784	360	775	370	793
		512	391	816	389	806	393	825
		1024	440	872	439	862	443	881
		1280	467	899	464	890	469	908
		1518	490	928	488	919	492	937
		9216	1218	1791	1214	1781	1230	1801



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
13.75 14 (257 357)	512QAM	64	354	757	346	748	357	766
		128	349	767	347	758	355	775
		256	362	782	360	774	392	789
		512	385	810	384	801	388	818
		1024	428	865	427	857	431	873
		1280	454	893	451	883	455	904
		1518	473	917	471	909	475	926
13.75 14 (257 357)	512QAM L	64	N/A	757	N/A	749	N/A	766
		128	N/A	765	N/A	756	N/A	775
		256	N/A	791	N/A	773	N/A	810
		512	N/A	809	N/A	800	N/A	818
		1024	N/A	860	N/A	850	N/A	870
		1280	N/A	885	N/A	877	N/A	894
		1518	N/A	912	N/A	903	N/A	921
13.75 14 (257 357)	1024QAM	64	352	763	346	757	357	769
		128	347	766	345	758	355	774
		256	363	780	362	772	380	788
		512	381	807	379	798	383	816
		1024	420	858	419	848	423	867
		1280	443	882	442	874	445	889
		1518	459	906	458	895	461	917
9216	1054	1664	1052	1655	1065	1673		



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
13.75 14 (257 357)	1024QAM L	64	N/A	759	N/A	753	N/A	766
		128	N/A	764	N/A	756	N/A	772
		256	N/A	785	N/A	769	N/A	801
		512	N/A	804	N/A	794	N/A	814
		1024	N/A	853	N/A	845	N/A	861
		1280	N/A	878	N/A	869	N/A	886
		1518	N/A	900	N/A	892	N/A	907
13.75 14 (257 357)	2048QAM	64	350	760	345	753	354	768
		128	348	764	345	756	354	772
		256	361	780	360	772	378	789
		512	379	801	377	792	383	810
		1024	418	848	417	840	420	856
		1280	439	873	437	864	441	882
		1518	457	896	456	887	460	904
13.75 14 (257 357)	2048QAM L	64	349	761	344	750	359	773
		128	346	767	344	761	351	773
		256	358	785	356	785	360	785
		512	378	801	376	794	380	809
		1024	415	844	413	835	417	853
		1280	435	867	433	860	437	875
		1518	452	889	450	879	454	899
		9216	1000	1571	998	1562	1010	1580



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
27.5 28 (258 358)	4QAM S	64	211	419	207	413	217	424
		128	226	437	220	432	232	443
		256	258	484	250	469	260	498
		512	316	545	310	541	320	549
		1024	429	665	420	662	430	667
		1280	491	728	480	724	500	732
		1518	545	784	546	780	548	787
		9216	2273	2650	2270	2648	2278	2652
27.5 28 (258 358)	4QAM	64	209	419	205	419	213	420
		128	222	434	218	428	226	441
		256	248	466	240	461	260	471
		512	297	522	290	522	300	523
		1024	396	630	390	627	420	634
		1280	452	681	449	672	454	689
		1518	495	733	492	729	497	738
		9216	1978	2356	1976	2353	1982	2358
27.5 28 (258 358)	16QAM S	64	209	404	198	399	221	408
		128	222	419	200	416	210	422
		256	248	437	221	430	226	443
		512	297	473	252	467	264	479
		1024	396	539	312	535	322	543
		1280	452	573	344	568	353	578
		1518	495	607	372	603	377	610
		9216	1978	1635	1265	1631	1274	1639



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
27.5 28 (258 358)	16QAM	64	196	403	194	399	216	407
		128	206	412	203	408	209	417
		256	218	431	217	425	221	437
		512	245	463	243	458	258	468
		1024	298	524	296	520	311	529
		1280	325	552	323	548	339	556
		1518	350	581	348	577	353	585
27.5 28 (258 358)	32QAM	64	203	402	196	397	224	407
		128	199	410	197	408	210	413
		256	214	436	212	431	216	441
		512	235	454	233	449	245	459
		1024	276	502	275	499	287	505
		1280	301	528	298	525	310	532
		1518	320	552	318	549	328	556
27.5 28 (258 358)	64QAM	64	200	410	194	408	216	411
		128	196	411	195	411	205	412
		256	207	422	205	421	228	424
		512	226	446	225	446	233	446
		1024	261	488	259	488	269	489
		1280	280	510	278	509	288	511
		1518	296	532	295	530	298	534
		9216	811	1178	809	1174	813	1183



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
27.5 28 (258 358)	128QAM	64	206	408	198	406	214	410
		128	197	411	195	411	211	411
		256	211	428	205	422	209	434
		512	223	440	222	439	224	442
		1024	253	488	252	486	254	490
		1280	270	499	268	498	271	500
		1518	284	516	283	516	285	517
		9216	729	1093	727	1089	730	1096
27.5 28 (258 358)	256QAM	64	202	407	195	406	212	408
		128	200	410	196	409	214	410
		256	210	431	200	431	214	431
		512	217	438	216	437	222	438
		1024	244	473	242	472	249	474
		1280	259	491	257	491	264	491
		1518	272	538	270	507	276	568
		9216	665	1032	664	1028	672	1036
27.5 28 (258 358)	512QAM	64	200	408	194	407	209	408
		128	200	409	195	407	211	411
		256	207	419	198	418	214	419
		512	214	436	212	435	218	436
		1024	238	471	237	471	243	471
		1280	252	486	251	486	257	487
		1518	263	503	262	502	264	504
		9216	618	1007	617	1004	624	1010



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
27.5 28 (258 358)	512QAM L	64	N/A	409	N/A	407	N/A	412
		128	N/A	409	N/A	408	N/A	409
		256	N/A	424	N/A	421	N/A	428
		512	N/A	435	N/A	435	N/A	436
		1024	N/A	468	N/A	468	N/A	469
		1280	N/A	484	N/A	483	N/A	484
		1518	N/A	500	N/A	499	N/A	501
27.5 28 (258 358)	1024QAM	64	198	413	194	412	207	413
		128	199	410	194	410	209	410
		256	207	418	198	417	211	419
		512	212	434	211	433	223	435
		1024	235	466	233	466	239	467
		1280	247	481	246	481	252	481
		1518	258	496	256	496	260	497
27.5 28 (258 358)	1024QAM L	64	N/A	411	N/A	409	N/A	413
		128	N/A	408	N/A	408	N/A	408
		256	N/A	418	N/A	418	N/A	419
		512	N/A	438	N/A	433	N/A	443
		1024	N/A	464	N/A	463	N/A	465
		1280	N/A	480	N/A	480	N/A	480
		1518	N/A	493	N/A	493	N/A	493
		9216	N/A	952	N/A	949	N/A	955



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
27.5 28 (258 358)	2048QAM	64	198	411	193	411	206	412
		128	199	410	194	409	208	410
		256	207	418	197	417	209	418
		512	211	442	210	442	214	442
		1024	233	463	231	463	237	464
		1280	245	480	244	479	249	480
		1518	256	493	255	493	259	494
		9216	572	939	571	934	577	944
27.5 28 (258 358)	2048QAM L	64	197	412	193	412	205	412
		128	199	410	193	410	206	410
		256	205	420	196	416	209	425
		512	210	432	208	432	213	433
		1024	231	464	230	463	235	465
		1280	243	478	242	478	247	478
		1518	253	491	252	491	256	491
		9216	558	927	556	921	563	933
27.5 28 (258 358)	4096QAM	64	197	412	193	410	205	414
		128	200	413	193	410	206	415
		256	205	423	197	423	209	423
		512	210	432	209	432	213	432
		1024	230	461	229	460	234	461
		1280	242	476	241	474	246	477
		1518	252	490	250	490	255	490
		9216	548	917	546	915	553	920



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
27.5 28 (258 358)	4096QAM L	64	196	412	193	412	204	412
		128	196	414	192	413	205	415
		256	205	423	196	423	207	424
		512	209	431	207	431	212	432
		1024	228	461	227	460	231	462
		1280	240	474	239	474	244	474
		1518	250	487	248	486	252	489
		9216	536	906	534	901	540	910
40 (259 359)	4QAM S	64	158	310	154	309	183	311
		128	168	325	160	325	200	325
		256	190	351	180	351	210	351
		512	234	395	230	395	250	395
		1024	314	487	312	484	317	491
		1280	358	531	354	530	368	531
		1518	397	575	394	574	399	576
		9216	1623	1933	1621	1933	1626	1933
40 (259 359)	4QAM	64	155	306	151	306	180	306
		128	164	318	161	316	182	319
		256	184	342	181	342	186	343
		512	220	381	218	381	223	382
		1024	291	460	288	460	309	460
		1280	327	499	324	499	346	500
		1518	361	538	357	537	364	539
		9216	1417	1733	1416	1733	1435	1734



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
40 (259 359)	16QAM S	64	158	298	151	297	179	299
		128	153	307	151	307	165	307
		256	169	323	167	323	174	323
		512	190	350	189	350	199	351
		1024	232	400	231	399	243	401
		1280	256	428	254	427	266	429
		1518	276	451	274	450	285	452
		9216	919	1228	918	1227	924	1229
40 (259 359)	16QAM	64	155	303	149	300	172	306
		128	150	305	149	304	168	305
		256	165	327	163	318	173	336
		512	183	340	181	339	191	340
		1024	221	388	219	387	229	389
		1280	241	411	239	410	250	411
		1518	259	433	257	432	266	435
		9216	819	1128	817	1128	829	1128
40 (259 359)	32QAM	64	158	301	150	300	166	302
		128	149	303	147	303	154	304
		256	166	321	156	314	173	328
		512	175	335	174	334	176	335
		1024	206	375	205	374	207	375
		1280	224	394	222	394	225	395
		1518	238	411	237	411	239	412
		9216	697	1006	696	1005	705	1007



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
40 (259 359)	64QAM	64	154	303	148	303	161	303
		128	153	306	149	305	160	306
		256	164	323	153	323	169	323
		512	169	328	168	328	170	329
		1024	195	363	194	362	196	364
		1280	210	379	208	379	211	379
		1518	222	396	220	395	223	397
		9216	601	909	600	909	607	909
40 (259 359)	128QAM	64	153	303	147	301	161	304
		128	153	304	148	303	162	304
		256	159	319	151	319	165	320
		512	166	325	164	325	170	325
		1024	188	357	187	356	192	358
		1280	201	373	200	373	205	373
		1518	212	387	210	387	216	387
		9216	543	853	541	853	547	853
40 (259 359)	256QAM	64	152	303	148	303	159	304
		128	152	302	147	302	160	302
		256	158	315	151	315	163	315
		512	164	325	162	325	167	325
		1024	184	354	183	353	188	355
		1280	196	369	195	369	199	370
		1518	205	382	204	381	208	383
		9216	501	811	499	810	506	812



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
40 (259 359)	512QAM	64	152	304	147	304	156	304
		128	151	307	147	307	158	307
		256	157	315	150	314	161	315
		512	162	332	160	331	171	333
		1024	180	351	179	351	183	352
		1280	191	365	190	365	194	366
		1518	200	380	198	380	202	380
		9216	468	794	466	793	472	794
40 (259 359)	512QAM L	64	N/A	304	N/A	303	N/A	306
		128	N/A	305	N/A	305	N/A	305
		256	N/A	315	N/A	315	N/A	316
		512	N/A	324	N/A	323	N/A	325
		1024	N/A	350	N/A	350	N/A	350
		1280	N/A	365	N/A	364	N/A	365
		1518	N/A	378	N/A	377	N/A	378
		9216	N/A	779	N/A	778	N/A	779
40 (259 359)	1024QAM	64	151	304	146	304	155	304
		128	152	305	146	303	155	307
		256	155	314	149	314	160	314
		512	160	323	159	322	163	323
		1024	178	349	176	349	180	349
		1280	188	362	187	362	190	363
		1518	196	376	194	376	198	376
		9216	445	768	443	768	448	769



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
40 (259 359)	1024QAM L	64	N/A	305	N/A	304	N/A	306
		128	N/A	305	N/A	303	N/A	306
		256	N/A	313	N/A	313	N/A	314
		512	N/A	328	N/A	328	N/A	328
		1024	N/A	349	N/A	348	N/A	349
		1280	N/A	361	N/A	361	N/A	361
		1518	N/A	373	N/A	373	N/A	374
		9216	N/A	757	N/A	757	N/A	757
40 (259 359)	2048QAM	64	151	305	146	304	155	306
		128	151	307	146	306	155	308
		256	155	312	149	311	160	312
		512	160	324	158	320	162	328
		1024	178	351	176	347	180	355
		1280	187	360	185	359	189	361
		1518	195	372	193	372	196	373
		9216	435	749	434	748	439	750
40 (259 359)	2048QAM L	64	150	304	146	303	154	306
		128	152	309	146	309	155	309
		256	154	315	149	315	159	315
		512	159	328	158	327	166	329
		1024	175	347	174	346	178	348
		1280	185	360	184	360	188	360
		1518	192	370	191	370	193	371
		9216	425	738	423	737	428	738



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
40 (259 359)	4096QAM	64	149	303	146	300	153	305
		128	153	306	148	303	155	309
		256	155	311	149	309	158	313
		512	159	324	158	321	161	327
		1024	175	344	174	341	177	347
		1280	184	356	183	355	186	358
		1518	191	368	190	365	193	371
		9216	418	730	417	728	422	731
40 (259 359)	4096QAM L	64	150	304	146	302	153	305
		128	151	304	145	302	154	306
		256	154	311	149	308	158	314
		512	158	326	157	324	164	328
		1024	174	346	172	341	175	351
		1280	183	357	182	355	185	358
		1518	190	368	189	366	191	369
		9216	410	721	408	719	413	723
55 56 62.5 (260 360)	4QAM S	64	122	226	119	224	144	228
		128	130	238	127	237	144	239
		256	146	287	144	285	149	290
		512	177	294	175	293	187	295
		1024	236	361	234	360	251	361
		1280	269	394	266	390	283	397
		1518	296	426	294	423	299	428
		9216	1185	1443	1181	1440	1189	1445



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
55 56 62.5 (260 360)	4QAM	64	120	225	117	222	146	228
		128	127	235	124	232	140	237
		256	141	277	139	275	153	279
		512	168	283	166	281	181	285
		1024	219	343	217	341	232	345
		1280	247	373	244	371	260	375
		1518	272	403	269	401	274	406
55 56 62.5 (260 360)	16QAM S	64	130	225	120	222	142	228
		128	119	228	117	227	127	230
		256	131	247	127	244	147	251
		512	146	259	145	257	153	261
		1024	178	300	177	297	186	303
		1280	196	321	195	319	203	323
		1518	211	338	210	336	217	340
55 56 62.5 (260 360)	16QAM	64	126	226	119	224	138	228
		128	118	226	116	222	125	229
		256	131	250	124	247	143	253
		512	142	255	140	252	147	258
		1024	170	292	169	289	176	295
		1280	187	310	185	309	192	312
		1518	199	328	198	325	204	331
	9216	613	876	612	874	617	879	



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
55 56 62.5 (260 360)	32QAM	64	123	228	118	226	131	229
		128	124	228	118	226	133	230
		256	132	235	122	232	136	238
		512	136	252	135	248	141	255
		1024	160	283	159	281	164	285
		1280	174	299	172	295	178	302
		1518	185	315	183	312	188	317
55 56 62.5 (260 360)	64QAM	64	119	227	116	224	127	230
		128	122	230	116	224	128	235
		256	128	240	119	238	129	243
		512	132	249	131	246	136	251
		1024	152	278	151	275	175	280
		1280	164	292	162	290	167	294
		1518	173	305	172	303	176	306
55 56 62.5 (260 360)	128QAM	64		229		226		232
		128	121	230	116	230	124	230
		256	121	239	115	236	125	242
		512	125	250	118	244	129	257
		1024	130	275	128	271	133	278
		1280	147	286	146	285	150	287
		1518	158	299	156	296	160	302
	9216	166	686	164	685	168	687	



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
55 56 62.5 (260 360)	256QAM	64	119	229	115	226	122	232
		128	120	231	114	227	123	236
		256	124	236	118	236	128	237
		512	128	251	126	249	135	254
		1024	144	272	142	269	146	275
		1280	153	285	152	283	155	288
		1518	161	296	159	293	162	300
55 56 62.5 (260 360)	512QAM	64	119	232	114	231	122	233
		128	120	230	114	229	122	231
		256	123	241	118	240	126	241
		512	127	249	126	245	129	253
		1024	141	270	140	267	143	273
		1280	150	280	149	276	152	285
		1518	156	292	155	288	158	296
55 56 62.5 (260 360)	512QAM L	64	N/A	231	N/A	227	N/A	234
		128	N/A	232	N/A	229	N/A	235
		256	N/A	238	N/A	236	N/A	241
		512	N/A	249	N/A	248	N/A	249
		1024	N/A	271	N/A	269	N/A	273
		1280	N/A	281	N/A	278	N/A	285
		1518	N/A	293	N/A	290	N/A	295
		9216	N/A	637	N/A	635	N/A	640



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
55 56 62.5 (260 360)	1024QAM	64	117	232	114	229	120	235
		128	118	233	114	232	121	234
		256	121	239	117	237	125	241
		512	129	248	124	247	131	249
		1024	139	269	138	266	141	271
		1280	148	280	146	278	149	283
		1518	154	291	152	289	155	293
55 56 62.5 (260 360)	1024QAM L	64	N/A	230	N/A	229	N/A	230
		128	N/A	232	N/A	231	N/A	233
		256	N/A	238	N/A	236	N/A	240
		512	N/A	248	N/A	248	N/A	248
		1024	N/A	268	N/A	266	N/A	270
		1280	N/A	280	N/A	278	N/A	283
		1518	N/A	291	N/A	288	N/A	293
55 56 62.5 (260 360)	2048QAM	64	117	233	114	231	120	235
		128	118	234	114	232	121	235
		256	121	240	117	237	124	242
		512	127	247	123	247	130	248
		1024	138	273	137	271	140	275
		1280	147	279	146	276	148	281
		1518	153	290	151	287	154	292
9216	342	617	341	614	345	619		



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
55 56 62.5 (260 360)	2048QAM L	64	116	233	113	231	119	236
		128	117	234	113	233	120	236
		256	120	240	117	238	124	241
		512	128	247	123	247	129	248
		1024	138	267	136	265	139	270
		1280	146	280	145	275	147	285
		1518	152	289	150	287	153	290
55 56 62.5 (260 360)	4096QAM	64	116	233	113	231	119	236
		128	117	235	113	232	120	237
		256	121	238	117	236	124	241
		512	125	250	123	249	129	252
		1024	137	270	136	269	138	270
		1280	145	278	144	276	146	279
		1518	151	288	149	285	152	291
55 56 62.5 (260 360)	4096QAM L	64	117	233	114	231	119	236
		128	117	235	114	233	120	236
		256	120	241	117	238	123	243
		512	128	251	123	248	129	253
		1024	137	268	136	265	138	270
		1280	145	277	143	275	146	280
		1518	150	287	149	285	151	289
	9216	325	602	323	601	327	604	



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
80 (303 403)	4QAM S	64	103	171	97	171	107	171
		128	100	179	98	179	103	179
		256	113	206	111	196	134	215
		512	136	221	134	220	137	223
		1024	179	273	177	272	180	273
		1280	201	296	199	296	203	297
		1518	222	323	220	323	223	323
		9216	858	1092	856	1091	859	1092
80 (303 403)	4QAM	64	101	175	96	172	104	178
		128	98	177	96	176	104	178
		256	109	191	107	191	110	191
		512	129	214	128	214	130	214
		1024	167	260	165	260	168	260
		1280	186	281	185	281	188	282
		1518	204	303	202	302	205	304
		9216	755	992	754	990	757	993
80 (303 403)	16QAM S	64	99	175	95	172	101	177
		128	102	173	95	172	108	173
		256	106	188	99	185	111	192
		512	114	200	113	200	115	200
		1024	138	232	136	232	139	233
		1280	151	248	150	247	152	248
		1518	162	263	161	262	163	263
		9216	511	746	510	745	512	747



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
80 (303 403)	16QAM	64	98	177	93	177	103	177
		128	97	174	94	174	105	175
		256	107	190	97	190	108	190
		512	111	203	110	198	112	207
		1024	132	228	131	227	133	228
		1280	144	242	143	242	145	242
		1518	154	256	153	256	155	257
		9216	461	698	460	698	462	699
80 (303 403)	32QAM	64	97	176	93	175	101	177
		128	99	177	93	174	101	180
		256	103	187	97	187	106	187
		512	107	202	106	201	109	202
		1024	125	221	124	221	127	222
		1280	135	235	134	234	136	235
		1518	144	248	143	247	145	249
		9216	402	640	401	640	403	640
80 (303 403)	64QAM	64	96	178	92	177	98	178
		128	96	179	92	176	98	181
		256	100	185	95	184	103	185
		512	104	199	103	197	110	200
		1024	119	220	118	216	120	224
		1280	129	230	128	229	130	231
		1518	136	242	135	242	137	243
		9216	355	596	354	596	357	596



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
80 (303 403)	128QAM	64	94	180	91	180	96	180
		128	95	180	91	180	97	181
		256	98	186	94	185	101	186
		512	104	197	101	197	107	197
		1024	116	215	115	215	117	215
		1280	125	228	123	227	126	228
		1518	131	240	130	239	132	240
		9216	326	571	325	570	328	571
80 (303 403)	256QAM	64	93	181	90	181	94	181
		128	93	182	90	182	95	182
		256	97	186	94	186	100	186
		512	104	198	100	197	105	198
		1024	113	215	112	214	114	216
		1280	121	226	120	225	122	226
		1518	127	235	126	235	128	236
		9216	305	551	304	550	307	552
80 (303 403)	512QAM	64	92	180	90	180	93	181
		128	93	180	90	180	94	181
		256	96	186	94	185	98	186
		512	102	197	99	196	104	197
		1024	111	218	110	217	112	219
		1280	119	224	118	222	120	225
		1518	124	234	123	234	125	234
		9216	289	544	288	544	290	544



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
80 (303 403)	512QAM L	64	N/A	182	N/A	182	N/A	182
		128	N/A	184	N/A	183	N/A	184
		256	N/A	188	N/A	187	N/A	189
		512	N/A	199	N/A	199	N/A	200
		1024	N/A	218	N/A	216	N/A	220
		1280	N/A	226	N/A	224	N/A	229
		1518	N/A	234	N/A	234	N/A	235
80 (303 403)	1024QAM	64	91	182	89	182	92	182
		128	92	183	89	183	93	183
		256	95	188	93	187	97	188
		512	103	198	99	197	103	198
		1024	110	217	109	215	111	219
		1280	117	224	116	223	118	224
		1518	122	233	121	233	123	233
80 (303 403)	1024QAM L	64	N/A	182	N/A	182	N/A	182
		128	N/A	183	N/A	182	N/A	183
		256	N/A	187	N/A	187	N/A	187
		512	N/A	196	N/A	196	N/A	196
		1024	N/A	217	N/A	217	N/A	218
		1280	N/A	225	N/A	223	N/A	228
		1518	N/A	232	N/A	232	N/A	232
		9216	N/A	528	N/A	528	N/A	528



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
80 (303 403)	2048QAM	64	91	184	89	183	92	184
		128	92	184	90	184	93	185
		256	95	186	93	183	97	188
		512	101	199	98	199	102	199
		1024	110	218	109	218	111	218
		1280	117	225	116	225	118	225
		1518	122	234	121	234	123	234
		9216	273	524	272	523	274	526
80 (303 403)	2048QAM L	64	91	183	89	183	92	183
		128	91	184	89	184	92	185
		256	94	189	92	188	96	189
		512	101	198	99	198	102	199
		1024	109	217	109	217	110	217
		1280	116	225	115	223	117	227
		1518	120	233	120	232	121	234
		9216	268	519	267	518	269	520
80 (303 403)	4096QAM	64	90	183	89	182	91	183
		128	91	184	89	184	92	184
		256	94	188	92	188	96	189
		512	101	197	98	197	102	198
		1024	109	216	108	215	112	216
		1280	115	224	114	223	116	226
		1518	120	230	119	228	121	232
		9216	265	518	264	518	266	518



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
110 112 125 (261 361)	4QAM S	64	92	140	80	139	105	141
		128	82	141	80	140	96	141
		256	96	167	89	167	111	167
		512	109	174	107	174	116	175
		1024	141	213	139	213	149	214
		1280	159	234	157	234	166	234
		1518	174	252	172	252	180	253
110 112 125 (261 361)	4QAM	64	88	138	81	137	101	139
		128	88	139	83	138	102	140
		256	98	156	87	151	105	161
		512	105	169	103	168	110	169
		1024	133	205	131	204	138	205
		1280	149	224	147	223	154	224
		1518	162	241	160	240	167	242
110 112 125 (261 361)	16QAM S	64	83	142	78	140	89	144
		128	83	144	78	143	89	145
		256	90	153	81	153	93	153
		512	93	161	92	161	96	162
		1024	112	188	111	188	115	188
		1280	123	202	122	201	126	203
		1518	132	213	130	213	134	213
	9216	400	618	399	618	404	619	



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
110 112 125 (261 361)	16QAM	64	82	142	78	142	86	142
		128	82	144	78	143	87	145
		256	87	152	80	151	90	152
		512	92	159	90	158	94	159
		1024	108	187	107	186	110	187
		1280	118	198	117	197	120	199
		1518	126	209	125	208	128	209
110 112 125 (261 361)	32QAM	64	80	144	77	144	83	144
		128	81	146	77	145	84	147
		256	84	150	80	150	88	150
		512	90	163	87	163	95	163
		1024	103	183	102	180	105	187
		1280	112	196	111	193	114	199
		1518	118	205	117	205	120	205
110 112 125 (261 361)	64QAM	64	78	145	75	145	81	146
		128	80	148	76	147	82	148
		256	82	151	79	151	85	151
		512	89	160	85	158	91	162
		1024	99	184	98	184	100	185
		1280	107	191	106	190	108	191
		1518	112	199	111	199	114	200
		9216	288	515	287	514	290	515



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
110 112 125 (261 361)	128QAM	64	77	145	75	145	79	145
		128	78	147	75	146	80	148
		256	81	152	78	151	83	154
		512	88	162	84	160	89	163
		1024	97	181	96	177	100	184
		1280	104	190	103	187	105	193
		1518	109	196	108	195	110	198
110 112 125 (261 361)	256QAM	64	76	147	75	146	78	148
		128	77	148	75	147	78	149
		256	80	152	78	150	82	154
		512	86	162	83	161	88	163
		1024	95	180	94	179	98	181
		1280	102	189	100	188	103	190
		1518	106	198	105	197	107	199
110 112 125 (261 361)	512QAM	64	76	150	74	149	77	150
		128	76	150	75	149	78	152
		256	79	153	77	152	81	155
		512	86	162	84	160	87	164
		1024	93	181	92	178	96	185
		1280	100	188	99	187	103	189
		1518	104	197	103	196	105	199
		9216	241	479	240	475	242	483



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
110 112 125 (261 361)	512QAM L	64	N/A	149	N/A	148	N/A	151
		128	N/A	150	N/A	149	N/A	151
		256	N/A	153	N/A	152	N/A	154
		512	N/A	163	N/A	162	N/A	164
		1024	N/A	182	N/A	180	N/A	183
		1280	N/A	190	N/A	188	N/A	192
		1518	N/A	197	N/A	195	N/A	198
110 112 125 (261 361)	1024QAM	64	75	149	74	148	77	151
		128	76	149	74	148	77	151
		256	78	153	77	152	80	154
		512	85	162	82	161	86	163
		1024	92	179	91	176	95	183
		1280	99	188	98	187	102	190
		1518	103	197	102	196	104	198
110 112 125 (261 361)	1024QAM L	64	N/A	151	N/A	150	N/A	153
		128	N/A	151	N/A	151	N/A	152
		256	N/A	154	N/A	153	N/A	156
		512	N/A	164	N/A	163	N/A	165
		1024	N/A	181	N/A	181	N/A	182
		1280	N/A	190	N/A	188	N/A	193
		1518	N/A	198	N/A	196	N/A	199
		9216	N/A	466	N/A	465	N/A	467



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
110 112 125 (261 361)	2048QAM	64	75	152	74	150	76	153
		128	76	151	74	150	77	153
		256	79	154	77	153	80	156
		512	85	164	83	162	86	165
		1024	92	183	91	182	95	184
		1280	98	189	97	187	101	191
		1518	103	198	101	196	103	199
110 112 125 (261 361)	2048QAM L	64	75	154	74	149	76	162
		128	76	153	74	149	77	159
		256	78	157	77	154	80	169
		512	85	168	83	164	85	179
		1024	92	189	91	185	94	201
		1280	98	201	97	195	100	212
		1518	102	208	101	205	102	221
110 112 125 (261 361)	4096QAM	64	75	153	74	149	76	161
		128	75	153	74	151	76	163
		256	78	157	77	154	80	168
		512	84	168	82	164	85	179
		1024	91	189	90	180	94	202
		1280	97	201	96	195	98	212
		1518	101	209	100	203	102	221
	9216	224	533	222	529	225	545	



2.2.2 Traffic Latency for ANSI

In the table below LL denotes values for low latency Frame ID's (362, 363, 364, 365, 366, 367 and 368) and STD denotes values for standard Frame ID's (262, 263, 264, 265, 266, 267 and 268).

Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
10 (262 362)	4QAM S	64	567	1177	540	1171	730	1183
		128	609	1232	580	1222	730	1243
		256	730	1325	700	1323	830	1328
		512	936	1500	900	1489	1030	1510
		1024	1341	1842	1260	1837	1380	1847
		1280	1512	2024	1440	2022	1560	2025
		1518	1532	2178	1490	2178	1570	2178
		9216	6665	7336	6640	7335	6700	7337
10 (262 362)	4QAM	64	556	1161	530	1153	670	1169
		128	584	1211	570	1206	690	1215
		256	684	1302	650	1293	770	1312
		512	859	1439	830	1438	930	1439
		1024	1202	1750	1170	1748	1240	1752
		1280	1363	1883	1340	1873	1400	1893
		1518	1367	2024	1340	2017	1410	2031
		9216	5757	6462	5730	6461	5790	6462
10 (262 362)	16QAM S	64	521	1138	500	1135	540	1140
		128	541	1158	520	1157	590	1158
		256	590	1220	570	1215	610	1226
		512	687	1303	672	1302	701	1303
		1024	876	1476	840	1476	920	1476
		1280	967	1567	930	1564	990	1570
		1518	1002	1658	992	1657	1020	1658
		9216	3590	4317	3570	4314	3600	4319
10 (262 362)	16QAM	64	514	1130	500	1130	580	1130
		128	532	1150	521	1150	550	1150
		256	570	1196	558	1195	587	1196
		512	651	1274	630	1274	700	1275
		1024	818	1422	790	1421	850	1424
		1280	894	1499	860	1499	930	1500
		1518	930	1573	920	1573	980	1573
		9216	3148	3880	3136	3873	3163	3887



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
10 (262 362)	32QAM	64	504	1121	496	1120	525	1121
		128	519	1141	511	1140	540	1142
		256	547	1175	542	1173	571	1177
		512	613	1245	600	1242	650	1248
		1024	728	1371	717	1370	746	1371
		1280	791	1429	776	1424	805	1434
		1518	840	1489	830	1485	870	1492
10 (262 362)	64QAM	64	496	1117	491	1117	520	1117
		128	509	1134	503	1132	532	1135
		256	536	1186	520	1161	560	1210
		512	585	1214	570	1213	610	1214
		1024	682	1315	670	1314	710	1317
		1280	737	1364	720	1364	760	1364
		1518	769	1412	760	1411	790	1414
10 (262 362)	128QAM	64	493	1112	487	1111	516	1112
		128	506	1126	498	1123	526	1130
		256	524	1174	510	1154	570	1195
		512	567	1200	560	1200	590	1200
		1024	651	1286	640	1284	670	1288
		1280	695	1329	680	1328	720	1330
		1518	725	1371	721	1370	741	1372
10 (262 362)	256QAM	64	490	1110	485	1110	514	1110
		128	498	1120	490	1118	530	1122
		256	517	1142	510	1142	560	1143
		512	554	1182	540	1182	570	1183
		1024	628	1260	622	1260	642	1260
		1280	667	1299	660	1297	680	1301
		1518	693	1336	691	1335	707	1337
10 (262 362)	512QAM	64	488	1110	483	1109	512	1110
		128	497	1117	490	1116	520	1117
		256	514	1143	500	1142	550	1143
		512	547	1177	542	1176	553	1177
		1024	611	1252	604	1250	615	1253
		1280	645	1289	642	1288	654	1291
		1518	669	1323	667	1323	681	1323
10 (262 362)	512QAM	64	488	1110	483	1109	512	1110
		128	497	1117	490	1116	520	1117
		256	514	1143	500	1142	550	1143
		512	547	1177	542	1176	553	1177
		1024	611	1252	604	1250	615	1253
		1280	645	1289	642	1288	654	1291
		1518	669	1323	667	1323	681	1323
10 (262 362)	512QAM	64	488	1110	483	1109	512	1110
		128	497	1117	490	1116	520	1117
		256	514	1143	500	1142	550	1143
		512	547	1177	542	1176	553	1177
		1024	611	1252	604	1250	615	1253
		1280	645	1289	642	1288	654	1291
		1518	669	1323	667	1323	681	1323



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
10 (262 362)	512QAM L	64	N/A	1104	N/A	1102	N/A	1106
		128	N/A	1116	N/A	1115	N/A	1118
		256	N/A	1139	N/A	1138	N/A	1139
		512	N/A	1174	N/A	1172	N/A	1176
		1024	N/A	1243	N/A	1243	N/A	1244
		1280	N/A	1281	N/A	1278	N/A	1285
		1518	N/A	1315	N/A	1313	N/A	1316
10 (262 362)	1024QAM	64	487	1105	482	1105	511	1106
		128	494	1116	480	1115	520	1116
		256	509	1151	495	1136	530	1165
		512	537	1171	532	1170	552	1171
		1024	598	1238	592	1238	613	1238
		1280	629	1274	623	1274	642	1275
		1518	653	1306	650	1306	663	1307
10 (262 362)	1024QAM L	64	N/A	1104	N/A	1104	N/A	1104
		128	N/A	1115	N/A	1115	N/A	1115
		256	N/A	1136	N/A	1135	N/A	1137
		512	N/A	1167	N/A	1166	N/A	1167
		1024	N/A	1231	N/A	1231	N/A	1231
		1280	N/A	1265	N/A	1264	N/A	1267
		1518	N/A	1297	N/A	1294	N/A	1300
20 (263 363)	4QAM S	64	287	590	279	588	308	593
		128	315	612	300	611	360	613
		256	356	660	340	660	410	661
		512	452	747	420	746	500	748
		1024	626	919	590	916	670	922
		1280	720	996	680	996	760	997
		1518	764	1083	740	1082	810	1083
20 (263 363)	4QAM	64	283	576	274	570	303	582
		128	300	596	292	589	321	603
		256	339	641	327	634	356	649
		512	415	713	400	708	460	718
		1024	571	867	550	866	600	868
		1280	647	935	620	927	660	943
		1518	684	1007	670	1001	730	1013
20 (263 363)	4QAM	64	283	576	274	570	303	582
		128	300	596	292	589	321	603
		256	339	641	327	634	356	649
		512	415	713	400	708	460	718
		1024	571	867	550	866	600	868
		1280	647	935	620	927	660	943
		1518	684	1007	670	1001	730	1013



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
20 (263 363)	16QAM S	64	267	561	261	556	279	566
		128	279	575	270	568	320	581
		256	299	602	290	596	350	609
		512	346	646	330	639	370	653
		1024	433	739	423	733	442	746
		1280	480	787	460	779	500	795
		1518	508	828	503	821	524	834
		9216	1775	2202	1771	2197	1784	2206
20 (263 363)	16QAM	64	263	558	259	553	288	563
		128	272	568	268	565	293	571
		256	290	593	287	586	300	600
		512	330	633	325	627	338	639
		1024	405	712	398	705	415	719
		1280	447	750	439	743	454	757
		1518	474	789	469	783	485	796
		9216	1568	1993	1563	1990	1574	1997
20 (263 363)	32QAM	64	258	553	256	547	284	558
		128	267	562	260	558	290	567
		256	283	598	280	590	300	606
		512	315	616	310	609	321	622
		1024	371	683	368	677	378	688
		1280	404	715	399	711	411	719
		1518	430	747	427	741	436	753
		9216	1315	1749	1312	1740	1321	1758
20 (263 363)	64QAM	64	266	557	258	548	287	566
		128	262	559	260	552	287	565
		256	276	599	270	592	300	605
		512	302	604	298	598	316	610
		1024	351	660	346	655	365	664
		1280	376	689	371	683	390	695
		1518	397	715	394	709	401	721
		9216	1115	1552	1113	1547	1120	1557
20 (263 363)	128QAM	64	265	555	257	552	285	557
		128	259	557	257	550	281	563
		256	271	591	269	583	283	599
		512	294	597	291	592	305	601
		1024	337	645	332	638	348	651
		1280	358	671	354	665	369	676
		1518	376	693	373	688	379	697
		9216	994	1435	991	1430	997	1440



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
20 (263 363)	256QAM	64	262	553	255	549	272	558
		128	258	555	256	550	276	560
		256	269	576	266	563	278	590
		512	288	590	286	583	298	598
		1024	325	633	322	628	335	638
		1280	344	657	341	652	355	662
		1518	361	677	359	672	364	681
20 (263 363)	512QAM	64	266	558	258	554	282	561
		128	259	559	256	559	275	559
		256	269	580	266	572	284	587
		512	286	592	283	592	295	593
		1024	319	636	316	634	322	637
		1280	337	656	334	656	341	656
		1518	351	678	349	677	357	678
20 (263 363)	512QAM L	64	N/A	564	N/A	561	N/A	568
		128	N/A	567	N/A	564	N/A	570
		256	N/A	583	N/A	577	N/A	588
		512	N/A	597	N/A	595	N/A	598
		1024	N/A	630	N/A	625	N/A	635
		1280	N/A	649	N/A	644	N/A	655
		1518	N/A	671	N/A	664	N/A	678
20 (263 363)	1024QAM	64	267	553	258	548	280	558
		128	258	557	255	552	277	562
		256	271	569	264	562	285	575
		512	283	588	281	580	291	595
		1024	313	627	311	622	321	632
		1280	329	648	327	642	338	654
		1518	343	665	341	661	347	670
20 (263 363)	1024QAM L	64	N/A	555	N/A	550	N/A	559
		128	N/A	557	N/A	550	N/A	563
		256	N/A	574	N/A	562	N/A	586
		512	N/A	585	N/A	579	N/A	591
		1024	N/A	624	N/A	618	N/A	631
		1280	N/A	644	N/A	638	N/A	651
		1518	N/A	661	N/A	654	N/A	668
20 (263 363)	1024QAM L	64	N/A	555	N/A	550	N/A	559
		128	N/A	557	N/A	550	N/A	563
		256	N/A	574	N/A	562	N/A	586
		512	N/A	585	N/A	579	N/A	591
		1024	N/A	624	N/A	618	N/A	631
		1280	N/A	644	N/A	638	N/A	651
		1518	N/A	661	N/A	654	N/A	668



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
20 (263 363)	2048QAM	64	266	554	258	549	279	559
		128	260	555	255	550	277	560
		256	266	579	264	572	283	585
		512	281	584	279	578	289	590
		1024	311	622	309	617	318	628
		1280	327	641	325	635	335	646
		1518	340	657	338	651	344	664
20 (263 363)	2048QAM L	64	265	552	257	546	277	558
		128	262	555	259	549	278	562
		256	267	577	263	571	282	583
		512	280	583	279	579	287	588
		1024	309	618	307	613	316	624
		1280	324	637	322	632	331	643
		1518	337	655	335	648	339	662
30 (264 364)	4QAM S	64	202	396	190	391	230	402
		128	216	410	209	405	238	416
		256	242	448	230	445	270	451
		512	304	505	209	499	330	510
		1024	421	623	400	617	450	629
		1280	480	678	470	677	510	680
		1518	514	735	500	730	540	740
30 (264 364)	4QAM	64	196	393	191	390	220	396
		128	212	411	203	409	224	414
		256	234	460	228	433	245	487
		512	286	489	276	486	291	492
		1024	381	592	370	588	410	595
		1280	433	641	423	635	441	647
		1518	466	690	463	684	490	695
30 (264 364)	16QAM S	64	187	380	180	375	210	386
		128	193	393	190	388	202	398
		256	210	410	206	406	215	414
		512	240	446	235	443	257	448
		1024	298	507	292	503	301	510
		1280	329	539	322	534	344	543
		1518	352	571	349	566	361	575
		9216	1207	1544	1205	1540	1212	1548



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
30 (264 364)	16QAM	64	195	387	186	386	215	389
		128	191	387	185	382	204	391
		256	205	418	200	402	230	435
		512	231	436	228	431	241	440
		1024	280	492	276	486	295	497
		1280	307	521	302	516	321	526
		1518	329	550	326	544	337	556
30 (264 364)	32QAM	64	193	379	183	376	212	383
		128	187	387	184	382	207	391
		256	198	399	190	396	210	401
		512	220	425	210	422	230	427
		1024	260	474	258	470	272	478
		1280	283	498	279	493	294	502
		1518	300	521	298	518	305	523
30 (264 364)	64QAM	64	188	386	182	384	204	389
		128	184	383	182	379	201	388
		256	194	409	192	404	215	414
		512	212	423	210	411	221	435
		1024	245	456	243	451	254	461
		1280	264	477	261	473	273	482
		1518	279	497	276	492	281	501
30 (264 364)	128QAM	64	191	380	183	373	204	386
		128	182	380	181	377	197	383
		256	195	398	189	396	209	399
		512	207	409	205	405	214	414
		1024	236	448	234	444	244	453
		1280	252	465	250	461	260	469
		1518	265	484	263	480	271	488
30 (264 364)	256QAM	64	189	386	182	378	199	393
		128	186	392	183	386	200	398
		256	195	401	188	397	205	405
		512	203	413	202	404	210	422
		1024	229	440	227	438	236	443
		1280	243	458	241	454	250	461
		1518	255	476	253	472	257	480
30 (264 364)	256QAM	64	189	386	182	378	199	393
		128	186	392	183	386	200	398
		256	195	401	188	397	205	405
		512	203	413	202	404	210	422
		1024	229	440	227	438	236	443
		1280	243	458	241	454	250	461
		1518	255	476	253	472	257	480
30 (264 364)	256QAM	64	189	386	182	378	199	393
		128	186	392	183	386	200	398
		256	195	401	188	397	205	405
		512	203	413	202	404	210	422
		1024	229	440	227	438	236	443
		1280	243	458	241	454	250	461
		1518	255	476	253	472	257	480



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
30 (264 364)	512QAM	64	187	380	182	376	196	384
		128	187	379	182	375	197	383
		256	195	390	186	385	201	395
		512	200	407	199	402	207	412
		1024	224	439	222	434	230	443
		1280	237	455	235	452	243	458
		1518	248	471	246	468	250	474
30 (264 364)	512QAM L	64	N/A	380	N/A	376	N/A	384
		128	N/A	385	N/A	377	N/A	392
		256	N/A	394	N/A	394	N/A	394
		512	N/A	406	N/A	402	N/A	410
		1024	N/A	437	N/A	433	N/A	442
		1280	N/A	452	N/A	450	N/A	455
		1518	N/A	467	N/A	463	N/A	470
30 (264 364)	1024QAM	64	186	383	181	380	195	387
		128	187	383	181	379	195	386
		256	190	397	185	394	198	401
		512	198	410	197	408	203	411
		1024	220	436	218	432	225	440
		1280	232	451	231	448	237	454
		1518	242	465	240	460	246	469
30 (264 364)	1024QAM L	64	N/A	382	N/A	379	N/A	385
		128	N/A	382	N/A	378	N/A	386
		256	N/A	390	N/A	386	N/A	393
		512	N/A	405	N/A	401	N/A	408
		1024	N/A	436	N/A	431	N/A	440
		1280	N/A	450	N/A	448	N/A	453
		1518	N/A	465	N/A	460	N/A	469
30 (264 364)	2048QAM	64	185	384	181	379	193	388
		128	186	382	181	378	194	386
		256	191	397	184	393	198	401
		512	198	405	196	401	203	408
		1024	219	435	217	431	223	438
		1280	230	449	229	445	235	453
		1518	240	463	239	459	245	466
		9216	544	897	543	893	547	901



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
30 (264 364)	2048QAM L	64	185	383	181	378	193	388
		128	186	382	181	379	193	386
		256	191	396	184	392	197	399
		512	197	408	196	407	202	409
		1024	217	433	215	431	222	435
		1280	229	447	227	442	234	451
		1518	238	461	236	458	241	465
30 (264 364)	4096QAM	64	185	384	180	380	192	387
		128	185	385	180	379	192	391
		256	192	396	184	392	196	399
		512	196	407	195	406	201	407
		1024	216	433	215	429	220	437
		1280	227	447	226	443	232	451
		1518	237	460	235	457	240	463
30 (264 364)	4096QAM L	64	187	383	181	381	191	386
		128	186	388	181	384	192	393
		256	191	394	184	390	195	399
		512	196	407	194	406	205	407
		1024	215	430	213	427	219	433
		1280	226	444	224	440	230	448
		1518	235	458	233	455	238	461
40 (265 365)	4QAM S	64	157	306	153	302	182	309
		128	169	320	164	314	193	326
		256	191	347	180	342	210	351
		512	236	391	220	389	260	392
		1024	322	480	310	478	340	482
		1280	364	525	350	522	390	529
		1518	396	568	390	564	400	572
40 (265 365)	4QAM	64	156	303	151	299	180	306
		128	165	312	160	309	185	314
		256	187	337	170	334	200	340
		512	219	375	215	371	243	379
		1024	295	453	288	452	301	454
		1280	334	494	327	489	340	499
		1518	360	533	356	530	371	536
		9216	1430	1716	1426	1715	1437	1716



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
40 (265 365)	16QAM S	64	157	293	149	289	178	296
		128	153	303	150	300	175	306
		256	165	338	160	335	190	341
		512	188	343	186	339	201	348
		1024	233	395	229	391	245	398
		1280	256	421	252	417	258	426
		1518	275	446	272	443	278	450
40 (265 365)	16QAM	64	155	298	147	292	165	305
		128	151	299	148	296	157	302
		256	162	313	157	310	172	316
		512	182	336	180	332	190	340
		1024	220	382	218	379	231	384
		1280	241	404	238	401	252	408
		1518	258	426	256	423	261	429
40 (265 365)	32QAM	64	157	298	148	295	171	301
		128	148	297	146	293	156	300
		256	159	310	155	307	176	313
		512	174	329	172	324	182	334
		1024	206	369	203	365	214	373
		1280	223	388	221	386	231	390
		1518	237	407	235	404	239	409
40 (265 365)	64QAM	64	155	299	147	295	164	304
		128	151	302	148	302	165	302
		256	157	316	152	313	169	318
		512	168	323	166	319	174	327
		1024	194	358	192	354	200	361
		1280	209	373	207	369	216	377
		1518	221	391	219	389	224	393
40 (265 365)	128QAM	64	151	297	147	295	160	300
		128	152	300	147	299	161	300
		256	159	305	151	302	165	308
		512	165	321	163	318	170	325
		1024	188	352	186	348	193	356
		1280	200	367	199	364	206	370
		1518	211	382	209	378	213	385
40 (265 365)	128QAM	64	151	297	147	295	160	300
		128	152	300	147	299	161	300
		256	159	305	151	302	165	308
		512	165	321	163	318	170	325
		1024	188	352	186	348	193	356
		1280	200	367	199	364	206	370
		1518	211	382	209	378	213	385



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
40 (265 365)	256QAM	64	150	298	145	297	157	299
		128	150	297	145	293	158	301
		256	157	307	149	307	162	307
		512	162	319	161	316	166	322
		1024	183	348	181	346	187	351
		1280	194	363	193	359	199	367
		1518	203	375	202	372	206	379
		9216	501	805	498	801	503	808
40 (265 365)	512QAM	64	149	297	145	294	155	300
		128	150	305	144	301	155	308
		256	156	309	148	306	159	312
		512	160	328	159	324	169	331
		1024	179	346	177	344	183	348
		1280	189	360	188	358	193	363
		1518	198	373	197	370	200	376
		9216	466	785	464	783	469	787
40 (265 365)	512QAM L	64	N/A	300	N/A	298	N/A	303
		128	N/A	300	N/A	293	N/A	307
		256	N/A	310	N/A	307	N/A	312
		512	N/A	318	N/A	315	N/A	321
		1024	N/A	345	N/A	342	N/A	348
		1280	N/A	360	N/A	356	N/A	363
		1518	N/A	371	N/A	368	N/A	374
		9216	N/A	774	N/A	771	N/A	777
40 (265 365)	1024QAM	64	149	299	145	296	154	301
		128	150	298	144	295	154	301
		256	154	310	147	306	158	313
		512	159	318	157	314	166	321
		1024	176	344	174	342	179	347
		1280	186	357	185	355	189	360
		1518	194	369	192	366	195	373
		9216	442	762	440	758	446	766
40 (265 365)	1024QAM L	64	N/A	300	N/A	297	N/A	302
		128	N/A	300	N/A	295	N/A	305
		256	N/A	308	N/A	306	N/A	311
		512	N/A	319	N/A	319	N/A	320
		1024	N/A	347	N/A	341	N/A	353
		1280	N/A	356	N/A	351	N/A	360
		1518	N/A	368	N/A	364	N/A	371
		9216	N/A	750	N/A	748	N/A	753



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
40 (265 365)	2048QAM	64	149	300	145	297	153	303
		128	149	302	144	295	153	308
		256	154	306	147	306	158	307
		512	158	319	157	312	167	326
		1024	175	342	174	339	178	346
		1280	185	355	184	353	188	357
		1518	193	368	191	366	194	371
40 (265 365)	2048QAM L	64	149	299	145	296	152	302
		128	150	303	145	300	153	306
		256	154	309	148	306	158	312
		512	159	318	158	318	167	318
		1024	174	343	173	339	177	347
		1280	184	355	183	351	187	358
		1518	191	365	190	362	193	369
40 (265 365)	4096QAM	64	149	301	145	299	151	302
		128	149	304	145	301	152	307
		256	153	308	148	306	157	311
		512	158	323	156	319	164	326
		1024	173	344	172	338	176	351
		1280	183	352	182	349	186	356
		1518	190	366	189	362	191	369
40 (265 365)	4096QAM L	64	147	300	144	297	151	303
		128	149	301	144	295	152	307
		256	153	307	148	304	156	311
		512	157	321	155	318	163	324
		1024	172	340	171	337	175	343
		1280	181	352	180	348	184	356
		1518	188	364	187	360	190	368
50 (266 366)	4QAM S	64	133	250	129	248	158	252
		128	142	262	138	261	161	263
		256	160	285	150	282	200	287
		512	195	320	190	318	215	322
		1024	264	396	256	392	281	399
		1280	300	432	292	429	315	435
		1518	327	466	322	466	336	467
		9216	1331	1583	1327	1582	1337	1585



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
50 (266 366)	4QAM	64	131	247	127	244	156	250
		128	138	258	130	256	160	260
		256	153	278	140	275	175	281
		512	184	310	180	306	201	314
		1024	242	376	237	374	252	377
		1280	272	408	267	405	283	411
		1518	298	440	294	439	305	442
50 (266 366)	16QAM S	64	133	246	127	245	150	246
		128	129	248	127	246	147	251
		256	139	271	137	266	142	276
		512	158	284	156	281	168	287
		1024	194	328	192	325	204	331
		1280	215	349	211	347	224	350
		1518	230	370	227	369	232	372
50 (266 366)	16QAM	64	136	248	127	243	143	252
		128	128	249	125	247	148	251
		256	139	260	137	258	156	263
		512	153	278	151	276	161	281
		1024	185	319	183	316	187	322
		1280	203	340	200	338	210	342
		1518	216	356	214	354	218	358
50 (266 366)	32QAM	64	133	249	126	247	144	251
		128	130	254	127	253	142	254
		256	139	268	131	267	145	270
		512	147	272	146	270	149	275
		1024	173	309	171	306	176	311
		1280	188	325	186	322	195	329
		1518	200	340	198	338	202	343
50 (266 366)	64QAM	64	130	250	125	249	138	250
		128	131	251	125	246	139	255
		256	137	259	129	252	140	265
		512	142	270	141	267	144	273
		1024	164	300	163	298	166	302
		1280	177	315	175	313	182	318
		1518	187	330	185	328	189	331
50 (266 366)	64QAM	64	130	250	125	249	138	250
		128	131	251	125	246	139	255
		256	137	259	129	252	140	265
		512	142	270	141	267	144	273
		1024	164	300	163	298	166	302
		1280	177	315	175	313	182	318
		1518	187	330	185	328	189	331



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
50 (266 366)	1024QAM L	64	N/A	251	N/A	249	N/A	253
		128	N/A	253	N/A	250	N/A	256
		256	N/A	257	N/A	257	N/A	258
		512	N/A	271	N/A	269	N/A	274
		1024	N/A	289	N/A	287	N/A	292
		1280	N/A	302	N/A	299	N/A	305
		1518	N/A	314	N/A	310	N/A	317
50 (266 366)	2048QAM	64	126	252	123	249	129	254
		128	127	252	122	250	130	254
		256	130	258	126	256	134	260
		512	135	270	133	268	141	272
		1024	149	295	148	293	151	297
		1280	158	300	156	297	160	303
		1518	164	313	163	309	165	316
50 (266 366)	2048QAM L	64	126	253	123	251	128	256
		128	127	254	122	250	130	258
		256	130	257	126	253	133	261
		512	137	268	133	267	140	268
		1024	148	288	147	286	150	291
		1280	157	300	155	298	159	302
		1518	163	312	161	310	164	315
50 (266 366)	4096QAM	64	125	252	122	249	128	254
		128	126	253	122	250	129	257
		256	130	258	126	256	133	260
		512	136	270	132	267	139	273
		1024	147	290	146	289	149	291
		1280	156	299	155	297	158	301
		1518	162	310	161	308	163	312
50 (266 366)	4096QAM L	64	125	252	122	250	127	255
		128	126	253	122	250	129	256
		256	129	260	125	258	132	262
		512	136	271	132	269	138	273
		1024	147	289	145	286	149	291
		1280	155	300	154	297	157	303
		1518	161	310	159	307	162	312
50 (266 366)	4096QAM L	64	125	252	122	250	127	255
		128	126	253	122	250	129	256
		256	129	260	125	258	132	262
		512	136	271	132	269	138	273
		1024	147	289	145	286	149	291
		1280	155	300	154	297	157	303
		1518	161	310	159	307	162	312
50 (266 366)	4096QAM L	64	125	252	122	250	127	255
		128	126	253	122	250	129	256
		256	129	260	125	258	132	262
		512	136	271	132	269	138	273
		1024	147	289	145	286	149	291
		1280	155	300	154	297	157	303
		1518	161	310	159	307	162	312



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
60 (267 367)	4QAM S	64	115	213	112	211	140	215
		128	125	225	120	224	150	226
		256	139	245	130	243	159	247
		512	169	275	164	272	180	278
		1024	225	340	220	339	242	342
		1280	257	372	252	367	271	376
		1518	281	402	276	400	288	405
60 (267 367)	4QAM	64	123	216	116	213	144	218
		128	120	221	117	219	145	223
		256	134	263	130	262	160	264
		512	160	266	156	264	174	268
		1024	209	324	204	322	223	326
		1280	236	350	230	348	248	352
		1518	256	380	253	376	264	383
60 (267 367)	16QAM S	64	123	214	113	213	132	215
		128	114	215	111	212	127	217
		256	124	233	120	225	130	242
		512	139	245	137	242	147	248
		1024	169	285	167	282	177	287
		1280	186	303	184	299	194	306
		1518	200	322	198	319	202	325
60 (267 367)	16QAM	64	120	219	112	217	129	222
		128	118	216	114	214	132	219
		256	126	235	118	231	133	238
		512	135	247	133	238	141	255
		1024	161	276	159	274	168	278
		1280	176	295	174	292	183	298
		1518	188	310	187	309	190	311
60 (267 367)	32QAM	64	115	216	111	213	125	219
		128	117	219	112	218	126	219
		256	119	226	115	225	130	228
		512	129	242	128	234	141	249
		1024	152	268	150	267	157	269
		1280	164	283	163	283	170	284
		1518	175	297	173	296	180	298
60 (267 367)	32QAM	64	115	216	111	213	125	219
		128	117	219	112	218	126	219
		256	119	226	115	225	130	228
		512	129	242	128	234	141	249
		1024	152	268	150	267	157	269
		1280	164	283	163	283	170	284
		1518	175	297	173	296	180	298



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
60 (267 367)	64QAM	64	114	217	110	212	121	222
		128	116	220	110	215	122	225
		256	120	226	113	225	125	228
		512	125	239	124	233	129	245
		1024	144	262	143	261	148	264
		1280	155	281	144	273	160	288
		1518	164	290	162	286	168	293
60 (267 367)	128QAM	64	113	218	109	217	118	218
		128	114	219	109	217	118	221
		256	119	226	113	223	123	229
		512	123	237	122	236	131	237
		1024	139	260	138	258	143	262
		1280	150	272	148	270	153	275
		1518	157	285	156	283	160	287
60 (267 367)	256QAM	64	113	217	109	216	116	219
		128	114	220	109	219	117	220
		256	117	226	112	224	121	228
		512	123	239	120	236	128	241
		1024	137	257	135	254	140	260
		1280	146	270	144	268	148	273
		1518	153	282	151	279	155	284
60 (267 367)	512QAM	64	112	217	108	214	115	220
		128	113	220	108	218	116	223
		256	116	225	112	223	119	227
		512	122	234	119	234	126	235
		1024	134	259	133	253	137	264
		1280	142	271	141	265	145	277
		1518	149	280	147	277	151	284
60 (267 367)	512QAM L	64	N/A	219	N/A	217	N/A	220
		128	N/A	220	N/A	217	N/A	223
		256	N/A	225	N/A	223	N/A	227
		512	N/A	234	N/A	230	N/A	239
		1024	N/A	254	N/A	251	N/A	258
		1280	N/A	270	N/A	270	N/A	270
		1518	N/A	278	N/A	276	N/A	281
9216	N/A	612	N/A	610	N/A	614		



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
60 (267 367)	1024QAM	64	111	218	108	216	113	220
		128	112	221	108	218	114	223
		256	115	225	111	223	118	228
		512	120	236	118	234	124	239
		1024	132	256	131	251	134	261
		1280	140	268	139	268	142	269
		1518	146	277	145	275	148	279
60 (267 367)	1024QAM L	64	N/A	220	N/A	217	N/A	223
		128	N/A	222	N/A	220	N/A	225
		256	N/A	227	N/A	225	N/A	229
		512	N/A	236	N/A	230	N/A	241
		1024	N/A	255	N/A	252	N/A	257
		1280	N/A	265	N/A	263	N/A	268
		1518	N/A	277	N/A	275	N/A	279
60 (267 367)	2048QAM	64	111	220	108	218	113	222
		128	111	221	108	218	114	225
		256	114	226	111	225	118	228
		512	120	238	117	236	124	241
		1024	131	255	130	253	133	257
		1280	139	265	138	263	141	267
		1518	145	277	144	274	147	279
60 (267 367)	2048QAM L	64	110	220	107	217	113	223
		128	111	221	107	219	113	223
		256	114	226	111	223	117	229
		512	121	234	117	231	123	238
		1024	131	254	129	253	135	255
		1280	139	264	137	261	141	266
		1518	144	275	143	273	145	277
60 (267 367)	4096QAM	64	110	219	108	217	112	222
		128	111	221	107	218	113	224
		256	114	225	111	222	117	228
		512	119	234	117	233	123	235
		1024	130	259	129	256	132	262
		1280	138	265	137	262	140	267
		1518	143	274	142	271	144	276
	9216	315	585	314	583	318	588	



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
60 (267 367)	4096QAM L	64	110	219	107	216	112	222
		128	110	221	107	218	113	224
		256	113	225	110	222	116	228
		512	119	235	116	234	122	236
		1024	130	255	128	250	134	260
		1280	137	264	136	259	139	269
		1518	142	273	141	271	143	275
80 (268 368)	4QAM S	64	105	171	96	171	125	171
		128	101	179	98	179	123	179
		256	113	206	110	196	122	215
		512	136	221	133	220	149	223
		1024	180	273	176	272	192	273
		1280	203	296	199	296	211	297
		1518	223	323	219	323	231	323
80 (268 368)	4QAM	64	103	175	95	172	121	178
		128	98	177	96	176	118	178
		256	109	191	100	191	120	191
		512	130	214	127	214	140	214
		1024	168	260	164	260	178	260
		1280	188	281	184	281	199	282
		1518	205	303	204	302	213	304
80 (268 368)	16QAM S	64	100	175	95	172	110	177
		128	101	173	95	172	111	173
		256	109	188	99	185	115	192
		512	114	200	112	200	120	200
		1024	138	232	136	232	144	233
		1280	151	248	150	247	158	248
		1518	163	263	161	262	168	263
80 (268 368)	16QAM	64	98	177	94	177	107	177
		128	100	174	93	174	107	175
		256	106	190	97	190	111	190
		512	111	203	109	198	116	207
		1024	132	228	131	227	137	228
		1280	144	242	143	242	149	242
		1518	154	256	153	256	157	257
		9216	466	698	464	698	469	699



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
80 (268 368)	32QAM	64	98	176	93	175	103	177
		128	99	177	92	174	103	180
		256	102	187	95	187	106	187
		512	107	202	106	201	116	202
		1024	125	221	124	221	129	222
		1280	136	235	134	234	139	235
		1518	144	248	142	247	147	249
80 (268 368)	64QAM	64	98	178	94	177	100	178
		128	99	179	94	176	102	181
		256	103	185	98	184	106	185
		512	107	199	105	197	113	200
		1024	122	220	121	216	123	224
		1280	132	230	130	229	134	231
		1518	138	242	137	242	139	243
80 (268 368)	128QAM	64	94	180	91	180	97	180
		128	95	180	91	180	98	181
		256	98	186	94	185	101	186
		512	103	197	101	197	108	197
		1024	116	215	115	215	119	215
		1280	125	228	123	227	126	228
		1518	131	240	130	239	133	240
80 (268 368)	256QAM	64	95	181	93	181	97	181
		128	96	182	93	182	98	182
		256	99	186	96	186	103	186
		512	105	198	102	197	108	198
		1024	116	215	115	214	118	216
		1280	124	226	123	225	126	226
		1518	130	235	129	235	131	236
80 (268 368)	512QAM	64	95	180	92	180	96	181
		128	95	180	93	180	98	181
		256	98	186	96	185	101	186
		512	105	197	102	196	107	197
		1024	115	218	113	217	116	219
		1280	122	224	121	222	123	225
		1518	127	234	126	234	128	234
		9216	292	544	291	544	294	544



Physical mode		Frame size [bytes]	Latency [μ s]					
CS [MHz] (Frame ID)	Modulation		Average		Minimum		Maximum	
			LL	STD	LL	STD	LL	STD
80 (268 368)	512QAM L	64	N/A	182	N/A	182	N/A	182
		128	N/A	184	N/A	183	N/A	184
		256	N/A	188	N/A	187	N/A	189
		512	N/A	199	N/A	199	N/A	200
		1024	N/A	218	N/A	216	N/A	220
		1280	N/A	226	N/A	224	N/A	229
		1518	N/A	234	N/A	234	N/A	235
80 (268 368)	1024QAM	64	94	182	92	182	95	182
		128	95	183	92	183	96	183
		256	98	188	95	187	100	188
		512	105	198	101	197	106	198
		1024	113	217	112	215	117	219
		1280	120	224	119	223	122	224
		1518	125	233	124	233	126	233
80 (268 368)	1024QAM L	64	N/A	182	N/A	182	N/A	182
		128	N/A	183	N/A	182	N/A	183
		256	N/A	187	N/A	187	N/A	187
		512	N/A	196	N/A	196	N/A	196
		1024	N/A	217	N/A	217	N/A	218
		1280	N/A	225	N/A	223	N/A	228
		1518	N/A	232	N/A	232	N/A	232
80 (268 368)	2048QAM	64	94	184	92	183	95	184
		128	94	184	93	184	96	185
		256	98	186	95	183	100	188
		512	104	199	101	199	105	199
		1024	113	218	111	218	116	218
		1280	120	225	119	225	121	225
		1518	124	234	123	234	125	234
80 (268 368)	2048QAM L	64	91	183	89	183	92	183
		128	91	184	89	184	93	185
		256	94	189	92	188	96	189
		512	101	198	98	198	103	199
		1024	110	217	108	217	113	217
		1280	116	225	115	223	117	227
		1518	121	233	120	232	122	234
		9216	269	519	267	518	270	520



Physical mode		Frame size [bytes]	Latency [μs]					
CS [MHz]	Modulation		Average		Minimum		Maximum	
(Frame ID)			LL	STD	LL	STD	LL	STD
80 (268 368)	4096QAM	64	93	183	92	182	94	183
		128	94	184	92	184	95	184
		256	97	188	95	188	99	189
		512	104	197	100	197	105	198
		1024	112	216	110	215	115	216
		1280	119	224	118	223	120	226
		1518	123	230	122	228	124	232
		9216	268	518	267	518	270	518



2.3 Ethernet Switch Functionality

Switch capabilities	NPU 1002	NPU 1003
Switch capacity	88 [in Gbps] ¹	45.5 [in Gbps]
Number of supported switch interfaces	25 in total 2x10GE front LAN ports 3x1GE front LAN ports 17x2,5GE backplane ports 2x1GE backplane ports	14 in total 2x10GE front LAN ports 3x1 GE front LAN ports 9x2,5 GE backplane ports

Switch capabilities	NPU 1005	MINI-LINK 6366
Switch capacity	65.5 [in Gbps]	9.5 [in Gbps]
Number of supported switch interfaces	22 in total 2x10GE front LAN ports 3x1 GE front LAN ports 17x2,5 GE backplane ports	5 in total 2x2.5 GE front LAN ports 2x1 GE front LAN ports 1x2.5 GE radio link ports

Switch capabilities	MINI-LINK 6651/1	MINI-LINK 6651/2	MINI-LINK 6651/3
Switch capacity	14.5 [in Gbps]	14.5 [in Gbps]	14.5 [in Gbps]
Number of supported switch interfaces	7 in total - 4x 2.5GE front LAN port - 2x 1GE front LAN port - 1x 2.5GE radio link port	7 in total - 3x 2.5GE front LAN port - 2x 1GE front LAN port - 2x 2.5GE radio link port	7 in total - 4x 2.5GE front LAN port - 2x 1GE front LAN port - 1x 2.5GE radio link port

¹ 7,5 Gbps is reserved for future use



Switch capabilities	MINI-LINK 6651/4
Switch capacity	47 [in Gbps]
Number of supported switch interfaces	8 in total - 4x 10GE front LAN port - 2x 1GE front LAN port - 2x 2.5GE radio link port

Switch capabilities	PNM 1001	PNM 1002
Switch capacity	36,5 [in Gbps]	44 [in Gbps]
Number of supported switch interfaces	11 in total: 2x10GE front LAN port 4x1GE front LAN port 4x2,5GE backplane port 1x2,5GE to internal MMU	14 in total: 2x10GE front LAN port 4x1 GE front LAN port 6x2,5GE backplane port 2x2,5GE to internal MMU

MAC Learning	NPU 1002 / NPU 1003 / NPU 1005 / PNM 1001 / PNM 1002 MINI-LINK 6651 / MINI-LINK 6366
Max nr of MAC tables entries	32k
Aging time	10 – 10 000 s
VLAN	
VLAN range	1 – 4094



VLAN support	Single tagged and double tagged VLAN handling via QinQ with and Provider Bridge	
Max nr of VLAN	1000	
Supported Frame sizes		
Min	64 byte	
Max	9216 byte	(Note! See chapter 6.4)

2.4 QoS

MINI-LINK 6600 and 6366 support Policing and Priority Mapping in the ingress direction and Queuing, Scheduling and Shaping in the egress direction.

	NPU 1002 / NPU 1005	NPU 1003 / PNM 1001 / PNM 1002	MINI-LINK 6651/1-3, MINI-LINK 6366	MINI-LINK 6651/4
Priority queues	8 queues per egress interface			
Priority mapping	Mapping 802.1 p priority bits			
Hierarchical priority queues (HQoS)	Nx8 queues per egress interface 4-level hierarchy (queue–node–node–interface) with hierarchical scheduling and VLAN shaping			
Scheduling	Strict priority and weighted queuing			
Frames discard	Aging, tail drop, color drop and WRED			
Buffer sizes				
Ports with deep buffering	720 MB (shared memory)	180 MB (shared memory)		512 MB (shared memory)
Ports without deep buffering	2 MB (shared memory)			



	NPU 1002 / NPU 1005	NPU 1003 / PNM 1001 / PNM 1002	MINI-LINK 6651/1-3, MINI-LINK 6366	MINI-LINK 6651/4
Ingress Policing				
CIR/EIR	0.064 – 10000 Mbps in steps of 64 kbps			
CBS	0, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192 & 16384 kB			
EBS	0,16, 32, 64, 128, 256, 512 & 1024 kB			
Supported bandwidth profile associations	<ul style="list-style-type: none"> - per UNI - per EVC (VLAN) per Class of Service 			
Egress Traffic Shaping				
CIR	0.064 – 10000 Mbps in steps of 64 kbps			
CBS	0 ² , 16, 32, 64, 128, 256, 512, 1024 & 2048 kB			
Classification				
Supported priority fields used for classification on UNI ports	Either: <ul style="list-style-type: none"> - PCP bits in the VLAN tag - DSCP bits in the IPv4/IPv6 header - TC (former EXP) bits in the MPLS tag - Both the TC bits in the MPLS tag and the DSCP bits in the IPv4/IPv6 header 			
Queue management				
WRED	Compliant with RFC 2309			
- T _{Buff_min}	Preset to 15x 64 KB			
- T _{buff_max}	Preset to 48x 64 KB			
- P _{mark}	Preset to 0.1 that is 10%.			
- Gain (W _q)	Preset to 9 (0.002). Gain variable in steps of 1, range 1-13 $W_q = 2^{-Gain}$, Gain = $-\log(W)/\log(2) = \log(0.002)/\log(2) = 9$			
Buffer Aging	24, 36, 48, 60, 72, 84 ms			



2.5 Ethernet Protection

LAG/LACP (Link Aggregation Group/Link Aggregation Control Protocol)	NPU 1002 / NPU 1003 / NPU 1005 / PNM 1001 / PNM 1002	MINI-LINK 6651/1-3	MINI-LINK 6651/4	MINI-LINK 6366
Maximum number of supported interfaces	8 per LAG/LACP Static or dynamic 2 per LAG/LACP 1+1	2 per LAG/LACP 2+0, 1+1	2 per LAG/LACP 2+0, 1+1	2 per LAG/LACP 2+0, 1+1
Maximum throughput	20 Gbit/s	5 Gbit/s	20 Gbit/s	5 Gbit/s
Maximum single stream throughput	10 Gbit/s	2.5 Gbit/s	10 Gbit/s	2.5 Gbit/s

LAG hashing algorithms ²
MAC Source Address + VLAN ID + Ethertype + source bridge port ID
MAC Destination Address + VLAN ID + Ethertype + source bridge port ID
MAC Source Address + MAC Destination Address + VLAN ID + Ethertype + source bridge port ID
Source IP address + TCP/UDP Source Port
Destination IP address + TCP/UDP Destination Port
Source IP address + TCP/UDP Source Port + Destination IP address + TCP/UDP Destination Port

² Configurable per each LAG group



RSTP	
Up to four hops in a ring topology with RSTP have the following characteristics ³ :	
Disruption times when a connection is broken	70-105 ms (typical average 90 ms)
Disruption time when a connection is restored	10-40 ms (typical average 20 ms)
MSTP	
Number of MSTP instances	Up to 16
Up to four hops in a ring topology with MSTP have the following characteristics ³ :	
Disruption times are when a connection is broken	70-105 ms (typical average 90 ms)
Disruption times when a connection is restored	10-40 ms (typical average 20 ms)

ERP	
Number of supported interfaces	See chapter 2.3
Disruption time when a link is broken with 1 ring configured (with 3.3 ms CCM)	Under 50 ms (typical average 25 ms)
Disruption time when a link is restored broken with 1 ring configured (with 3.3 ms CCM)	Under 50 ms (typical average 25 ms)
Number of ERP instances	Up to 254
Number of VLANs per ERP instance	Up to 1000
Supported CCM intervals	3.3 ms, 10 ms
Subrings are supported	

³ Tests with up to 20 nodes in a ring topology have also been performed. The result is consistent to the test with less number of nodes. This indicates that the number of nodes has no major impact on the disruption times.



2.6 Ethernet Service OAM

Service OAM – FM	
Feature support	CC, Loopback, Linktrace, RDI
CC interval support	3.3ms, 10ms, 100ms, 1s, 10s, 1min, 10min
Max number of MEP	150
Max number of MIP	150
Service OAM – PM	
Feature support	Delay, Delay variation (2-way)
	Single ended Frame Loss (ETH-LM) supported between MINI-LINK 6600 nodes and MINI-LINK 6366 nodes only
CC interval support	3.3ms, 10ms, 100ms, 1s, 10s, 1min, 10min
Frame Loss interval Support	100ms, 1s, 10s, 1min, 10min
Max number of MEP	128
Max number of MIP	NA

2.7 Ethernet Bandwidth Notification

Ethernet Bandwidth Notification is a standard protocol that enables microwave nodes to send notification messages on the actual capacity of microwave links. Connecting routers can use these notifications to implement various traffic management solutions.

Ethernet BN	
Feature support	G.8013/Y.1731 and Cisco proprietary message formats
BNM interval support	1s, 10s, 1min
Max number of Ethernet BN instances	16



2.8 Link Layer Discovery Protocol

Link Layer Discovery Protocol (LLDP) is used by network elements for advertising their identity, capabilities and neighbors. LLDP is specified in IEEE 802.1 AB.

Supported TLVs

- ChassisID
- PortID
- Time To Live
- System Name
- Management Address

2.9 Two-Way Active Measurement Protocol

Two-way Active Measurement protocol (TWAMP) enables two-way or round-trip measurement capabilities of packet loss and delay. TWAMP is specified in RFC 5357.

- TWAMP Reflector Light is supported
- Configuration via CLI only
- Software timestamp used for ingress/egress packets

2.10 Ethernet Back Plane Capacity

MINI-LINK 66xx provides Ethernet capacity between NPU and application boards such as MMUs and ETUs.

NPUs and PNMs have the maximum Ethernet traffic between the NPU/PNM and the application per the below tables depending on the slot. In most situations, the application board cannot use the full traffic capacity.

For ETU 1001 and ETU1002, this means that all four ports can be used in APU slot 3 in MINI-LINK 6691, and in APU slot 2 in MINI-LINK 6692, 6693 and 6694. If the ETU 1001 or ETU1002 is set in another slot, the number of usable ports is reduced according to the tables below. Please note: max capacity for an ETU 1001 or ETU1002 port is 1Gbps, except for the 10G port on ETU1002. This 10G port will just work if the slot support "1 x 10G (4 lanes)".

NPU 1002 inserted in MINI-LINK 6691:

APU Slot	Eth capacity	APU slot	Eth capacity
1	2 x 2,5G	3	1 x 10G (4 lanes) or 4 x 2,5G



NPU 1003 inserted in MINI-LINK 6691:

APU Slot	Eth capacity	APU slot	Eth capacity
1	2 x 2,5G	3	1 x 10G (4 lanes) or 4 x 2,5G

NPU 1005 inserted in MINI-LINK 6691:

APU Slot	Eth capacity	APU slot	Eth capacity
1	1 x 10G (4 lanes) or 4 x 2,5G	3	1 x 10G (4 lanes) or 4 x 2,5G

NPU 1002 inserted in MINI-LINK 6692:

APU Slot	Eth capacity	APU slot	Eth capacity
6	1 x 2,5G + 1 x 1G	12	1 x 2,5G + 1 x 1G
5	2 x 2,5G	11	2 x 2,5G
2	1 x 10G (4 lanes) or 4 x 2,5G	8	1 x 10G (4 lanes) or 4 x 2,5G
1	2 x 2,5G	7	1 x 2,5G

NPU 1005 inserted in MINI-LINK 6692:

APU Slot	Eth capacity	APU slot	Eth capacity
6	1 x 2,5G	12	1 x 2,5G
5	1 x 10G (4 lanes) or 4 x 2,5G	11	1 x 2,5G
2	1 x 10G (4 lanes) or 4 x 2,5G	8	1 x 2,5G
1	1 x 10G (4 lanes) or 4 x 2,5G	7	1 x 2,5G



NPU 1002 inserted in MINI-LINK 6693:

APU Slot	Eth capacity	APU slot	Eth capacity
2	1 x 10G (4 lanes) or 4 x 2,5G	5	1 x 2,5G + 1 x 1G
1	2 x 2,5G	4	2 x 2,5G

NPU 1003 inserted in MINI-LINK 6693:

APU Slot	Eth capacity	APU slot	Eth capacity
2	1 x 10G (4 lanes) or 4 x 2,5G	5	2 x 2,5G
1	2 x 2,5G	4	1 x 2,5G

NPU 1005 inserted in MINI-LINK 6693:

APU Slot	Eth capacity	APU slot	Eth capacity
2	1 x 10G (4 lanes) or 4 x 2,5G	5	1 x 2,5G
1	1 x 10G (4 lanes) or 4 x 2,5G	4	1 x 10G (4 lanes) or 4 x 2,5G

NPU 1002 inserted in MINI-LINK 6694:

APU Slot	Eth capacity	APU slot	Eth capacity
2	1 x 10G (4 lanes) or 4 x 2,5G	6	1 x 2,5G + 1 x 1G
1	2 x 2,5G	5	2 x 2,5G



NPU 1003 inserted in MINI-LINK 6694:

APU Slot	Eth capacity	APU slot	Eth capacity
2	1 x 10G (4 lanes) or 4 x 2,5G	6	2 x 2,5G
1	2 x 2,5G	5	1 x 2,5G

NPU 1005 inserted in MINI-LINK 6694:

APU Slot	Eth capacity	APU slot	Eth capacity
2	1 x 10G (4 lanes) or 4 x 2,5G	6	1 x 2,5G
1	1 x 10G (4 lanes) or 4 x 2,5G	5	1 x 10G (4 lanes) or 4 x 2,5G

PNM 1001 or PNM 1002 inserted in MINI-LINK 6654:

APU Slot	Eth capacity	APU slot	Eth capacity
1	2 x 2,5G	3	2 x 2,5G

PNM 1002 inserted in MINI-LINK 6655:

APU Slot	Eth capacity	APU slot	Eth capacity
2	2 x 2,5G	5	1 x 2,5G
1	2 x 2,5G	4	1 x 2,5G



2.11 Radio Link Bonding

Radio Link Bonding enables transparent transport of Ethernet frames over a number of parallel Packet Links.

Radio Link bonding	MMU 1002 MMU 1104	MMU 1001	MINI-LINK 6651 ⁴	MINI-LINK 6366	PNM 1002
Max number of bonded links	4	2	2	2	2
Max capacity for bonded links	2,5 Gbit/s	2,5 Gbit/s	2,5 Gbit/s	2,5 Gbit/s	2,5 Gbit/s

Protection and bonding do not add additional overhead, nor any latency compared to a 1+0 configuration.

The latency for a bonded hop will be determined by the slowest member in the bonding group.

2.12 Hierarchical Radio Link Bonding

With Hierarchical Radio Link Bonding (hRLB) there is a possibility to increase both the number of bonded links and the aggregated capacity for bonded links. hRLB is supported with NPU 1005 and MMU 1002 or MMU 1004. MINI-LINK 6651/4 also support hRLB.

	NPU 1005	MINI-LINK 6651/4
hRLB capacity in total	10 Gbps	10 Gbps
Maximum hRLB group capacity	10 Gbps	10 Gbps
Maximum number of hRLB groups	2	2
Maximum number of hRLB members in total, per group	4	2
Maximum number of carriers in total	16	4

For supported hRLB use cases see chapter 5.11.9.

⁴ Not applicable for MINI-LINK 6651/1



2.12.1 Link efficiency and capacity

The hRLB capacity is 4.5Mpps which makes it possible for frames with 300Bytes or more to utilize the 10Gbps bandwidth. Considering RFC2544 throughput test with 64, 128, 256 bytes frames the 10Gbps capacity should not be expected.

The utilization of an hRLB link compared to an ordinary link depends on the Ethernet frame size. In a typical mobile backhaul or Internet traffic (IMIX 7/4/1) the link efficiency is 99%, but with 1518 Bytes standard Ethernet frames the utilization is over 99.7%.

2.12.2 Latency

The latency on an hRLB link depends on the latency of all its members, that is the latency of the configured Radio Links. In a steady state the hRLB algorithm ensures that traffic flows are distributed among the hRLB members in a way to optimize the average latency of the traffic flows. This means that the link with highest latency will not determine the latency of all flows. However, it is recommended to plan latency with the value for the link with highest latency.

2.13 Multi-Layer Header compression

MMU 1004, MMU 1002, MMU 1001, PNM 1001, PNM 1002, MINI-LINK 6651/1, MINI-LINK 6651/2, MINI-LINK 6651/4 and MINI-LINK 6366 support the possibility to enable and use Multi-Layer Header Compression (MLHC). The MLHC function does not add any latency. The header types for which this is supported are listed in the table below.

Header types
Ethernet double tagged + 3xMPLS
L2 VPN – Ethernet PW over MPLS over Ethernet
L2 VPN – Ethernet over MPLS over Ethernet
L3 VPN – Ipv4 over MPLS over Ethernet
L3 VPN – Ipv6 over MPLS over Ethernet



2.14 NPU board protection

NPU board protection can be configured by installing a second NPU 1002 and NPU 1005 in a MINI-LINK 6692 or MINI-LINK 6694 node. The failover function of the secondary NPU board protects both management and traffic plane in case of equipment failure, software failure and board removal.

The protection covers

- NPU front LAN and SFP interfaces
- Network synchronization and NPU front synchronization interfaces
- DCN and management access
- NPU user I/O interfaces
- TDM traffic

Typical traffic disturbance interval in case of failover is less than 20 seconds. When using hRLB on NPU1005 the interval is between 25 and 40 seconds.

2.15 NPU board port extension

Port extension of a second NPU board can be configured by installing a second NPU 1002 in a MINI-LINK 6692 or MINI-LINK 6694 node and enabling NPU board protection. Extension is done per Ethernet interface by switching off the protection for an interface and adding it to the available configurable interfaces. This enables the active use of the front ports of the extended slave NPU. Configuration of an extended interface is done similarly to any other Ethernet interface.

The board is still protected, but traffic on an extended port on the slave NPU and the same port number on the master NPU is no longer protected by mirrored configuration. To have protection of the traffic link-level (for example: LAG, LACP) or network level (for example: RSTP, MSTP, ERP) protection must be configured.

Port extension covers:

- L2 and L3 user traffic and features on extended ports
- The first four Ethernet interfaces extendable (number 4 through 7)
- 10 Gbps speed capability when the 7th port is extended on the slave NPU



2.16 Performance Monitoring

The following Ethernet performance counters are available:

Counter type
Per interface on SNMP: octets, unicast, multicast, broadcast, discarded and error
Per interface in XML at 15 minutes /24 hours granularity: octets, unicast, multicast, broadcast, discarded and error, bandwidth utilization (min, max, average, histogram)
Per traffic class in XML at 15 minutes /24 hours granularity: octets, packets, discarded and error, bandwidth utilization (min, max, average, histogram)
Per VLAN in XML at 15 minutes /24 hours granularity: bandwidth utilization (min, max, average, histogram)

2.17 MAC swap loopback

MAC swap loopback feature is used for troubleshooting and testing.

Specified Ethernet frames are looped back in the selected ingress port in line rate. Frames can be specified by VLAN ID, destination and optionally source MAC address.

As an extension ingress loopback with egress lookup can be configured. In case of egress-lookup configuration, traffic is checked on the ingress port and if it should be egressed on the port which has MAC Swap Loopback configured, then it's looped back on the ingress port.



3 Network Synchronization

Network synchronization is an important supporting function in telecommunication networks, since proper operation of different transport and radio technologies requires certain type and level of synchronization of the network equipment.

Frequency synchronization is required by TDM-based transport networks (PDH, SDH/SONET) and FDD-based radio technologies (GSM, WCDMA, LTE-FDD, etc.), while time synchronization is required by some advanced radio technologies (LTE-TDD, eMBMS, etc.).

3.1 Frequency Synchronizations Technologies

In MINI-LINK frequency synchronization is handled by the Netsync function, that contains a SETG (Synchronous Equipment Timing Generator) device. The SETG device can be frequency synchronized to any physical interface that can carry synchronization, or to the clock signal that is recovered by the PTP protocol in G.8265.1 mode. Out of all potential synchronization reference interfaces four interfaces can be selected to be connected.

The frequency sync function follows performance requirements in ITU-T G.813, G.823, G.8261, G.8262, and the main functional requirements in ITU-T G.781 and G.8264 with the following main deviations:

- QL forwarding (SSM) on PDH and 2Mhz outgoing interfaces is not supported
- Wait to restore is configurable to 0 or 10 s only
- Clear of wait timer is not included
- Manual switch is not included
- Hold off time is 300 to 2500 ms

Frequency Synchronization function can operate in the following modes:

Mode	Netsync disabled	Netsync enabled
Free Running	Yes (internal clock)	Yes
Locked	No	Yes
Holdover	No	Yes

Sync source selection can be configured in the following ways:

- Normal Operation, sync source interface is selected automatically based on the following settings
 - Both QL (Quality Level) and Priority is used in the selection logic
 - Only Priority is used in the selection logic
- Forced to specific interface, sync source is manually selected by the operator
- Forced to Holdover



Frequency synchronization is supported over the following interfaces:

	E1 ⁵	2MHz	Synchronous Ethernet	Sync over Radio	STM-1	G.8265.1
NPU 1002	N/A	Yes	Yes	N/A	No	Yes
NPU 1003	Yes	Yes	Yes	N/A	No	Yes
NPU 1005	N/A	Yes	Yes	N/A	No	Yes
ETU 1001	N/A	N/A	Yes	N/A	N/A	Yes
ETU 1002	N/A	N/A	Yes	N/A	N/A	Yes
PNM 1001	Yes	Yes	Yes	Yes	No	Yes
PNM 1002	Yes	Yes	Yes	Yes	No	Yes
MINI-LINK 6651	Yes	N/A	Yes	Yes	No	Yes
MINI-LINK 6366	N/A	N/A	Yes	Yes	No	Yes
LTU 1001	Yes	N/A	N/A	N/A	No	N/A
LTU 1002⁶	Yes	N/A	N/A	N/A	Yes	N/A
MMU 1004	No	N/A	N/A	Yes	No	No
MMU 1002	No	N/A	N/A	Yes	No	No
MMU 1001	No	N/A	N/A	Yes	No	No

When Netsync mode is enabled, all terminated protocol layers' interfaces, for example STM-1, will follow the reference frequency.

In the event of failure of all synchronization source nominees, the SETG enters holdover mode using its own internal clock as source. If any of the nominees become valid again, SETG will synchronize to it automatically.

QL forwarding (SSM/ESMC) on outgoing interfaces is supported (except for PDH and 2 MHz)

Squelch (AIS) selectable on PDH and 2 MHz outgoing interfaces.

⁵ Input only. Output transparent, not synchronized to equipment clock. SSM not supported, Squelch (AIS) supported

⁶ ETSI only



The following interfaces are supported for Synchronous Ethernet:

Interface Board	RJ45 1Gbps	RJ45 100Mbps	RJ45 10Mbps	SFPo 1Gbps	SFPo 2.5Gbps	SFPo 10Gbps	SFPe
NPU 1002	Yes	Yes	No	Yes	No	Yes	No
NPU 1003	Yes	Yes	No	Yes	No	Yes	No
NPU 1005	Yes	Yes	No	Yes	No	Yes	No
ETU 1001	Yes	Yes	No	N/A	N/A	N/A	N/A
ETU 1002	N/A	N/A	N/A	Yes	N/A	Yes	No
PNM 1001	Yes	Yes	No	Yes	No	Yes	No
PNM 1002	Yes	Yes	No	Yes	No	Yes	No
MINI-LINK 6651/1-3	Yes	Yes	No	Yes	No	N/A	No
MINI-LINK 6651/4	Yes	Yes	No	Yes	N/A	Yes	No
MINI-LINK 6366	Yes	Yes	No	Yes	No	N/A	No

Sync over PTP (G8265.1 mode):

- Only IPv4 is supported
- Ordinary Clock (OC) is supported
- Slave mode consists of a Single Slave-Only OC (SOOC) instance



3.2 Time Synchronization Technologies

IEEE1588-2008 standard provides the general framework for packet-based time synchronization, including Boundary Clock (BC), Ordinary Clock (OC), and Transparent Clock (TC). However, in order to meet the functional and performance requirements of a certain application, further requirements defined in a so called "profile" need to be supported as well. Applicable performance requirements are defined in ITU-T G.8273.2 for telecom devices, and in G.8271.1 for end-to-end network limits.

The following profiles are supported:

Function	PTP Profile (IEEE1588-2008)	G.8275.1 Profile
Delay request response	Two-way message	Two-way message
Event msg send	One step mode	One step mode
Event msg receive	One step mode, two step message	One step mode, two step message
Encapsulation	Multicast (Default) Unicast	Multicast
Supported VLAN taggings	No VLAN tag Single VLAN tag Double VLAN tag	No VLAN tag Single VLAN tag Double VLAN tag
Supported Bridge modes	Customer bridge, Provider bridge	Customer bridge, Provider bridge
Supported Clock Types	Boundary Clock (BC) Transparent Clock (TC)	Telecom Boundary Clock (T-BC) Telecom Transparent Clock (T-TC)

For accurate time synchronization a PRC-traceable frequency from the Frequency Synchronization function that is recovered from an L1 (non-PTP) source is mandatory in both profiles.



In MINI-LINK 6600, all radio interfaces and all LAN ports in 1Gbps, 2.5Gbps and 10Gbps speeds support G.8275.1 Telecom profile packet-based synchronization.

	1PPS/ToD input	1PPS/ToD output ⁷
NPU 1005	HW prepared	Yes
NPU 1003	HW prepared	Yes
NPU 1002	HW prepared	Yes
PNM 1001	HW prepared	Yes
PNM 1002	HW prepared	Yes
MINI-LINK 6651	HW prepared	Yes
MINI-LINK 6366	No	No

Timing characteristics requirements are defined in G.8273.2. Performance categories of the recovered clock is listed in the table below.

<i>[ns]</i>	Class B (G.8273.2)	1G LAN⁸	10G LAN⁸	RL
max TE 	70	70	70	70
Range of cTE	±20	±20	±20	±20
dTE	40	40	40	40

⁷ For the 1PPS/ToD RJ45 front port, 1PPS is only for measurement purposes

⁸ - Timestamping on ethernet interfaces is only supported in GE mode. Timestamping in FE mode is not supported.

- SFP interfaces are validated only with officially supported SFP types. Performance is not guaranteed with 3rd party SFP types that is not on the official Ericsson list.

- While 1588 timestamping is supported on any type of SFPs, Synchronous Ethernet – which is prerequisite for phase synchronization – is not supported on electrical SFPs. However, 1588 phase synchronization in general can work, in case network synchronization is provided to the node over any other interface.



4

Layer 3 Virtual Private Networks

MINI-LINK product family supports Layer 3 Virtual Private Networks (L3VPN) according to RFC 4364. L3VPN is available on the following hardware configurations:

- MINI-LINK 6651
- MINI-LINK 6691 with NPU 1002, NPU 1003 or with NPU 1005
- MINI-LINK 6692 with NPU 1002 or with NPU 1005
- MINI-LINK 6693 with NPU 1002, NPU 1003 or with NPU 1005
- MINI-LINK 6694 with NPU 1002, NPU 1003 or with NPU 1005
- MINI-LINK 6654 with PNM 1001 or PNM 1002
- MINI-LINK 6655 with PNM 1002
- MINI-LINK 6366

MINI-LINK nodes provide the following Layer 3 services and solutions:

- End-to-end unicast IPv4 Layer 3 connection over an IP/(Multiprotocol Label Switching) MPLS core network
- Business Virtual Private Networks (VPNs), such as Border Gateway Protocol (BGP)/MPLS L3VPNs on PE nodes
- Core routing solutions, such as P router, in an IP/MPLS core network
- Multiple virtual routing instances via VRF (Virtual Routing Forwarding)
- The NE can provide Layer 2 Ethernet transport services and Layer 3 unicast routing on the same NE without separate Layer 2 and Layer 3 devices.
- RSVP-TE Fast Reroute (FRR) with one-to-one local protection, enabling traffic failover times below 50 ms.
- BGP Alternate Path Routing (APR) to enable multi-homing to multiple PE routers, with fast switchover.
- RSVP-TE Path Protection (interim solution) enables establishing primary and backup LSPs with sub-second switchover time.
- RSVP-TE Path Protection with BFD over LSP enables establishing primary and backup LSPs with switchover time below 50 ms.
- Seamless MPLS (with BGP-LU) enables the interconnection of separate MPLS domains into a single MPLS domain.



- IPv4 Access Control Lists (ACLs) enable filtering IP packets on the interfaces.

L3VPN	
Protocol support	IPv4, ARP, OSPFv2, LDP, MP-BGP, BFD, IS-IS Level 1 and Level 2, eBGP, BGP-LU, MPLS OAM, RSVP-TE, RSVP-TE Fast Reroute extensions, BFD over LSP
Node roles	P, PE, CE
Maximum number of IP interfaces per node	512
Maximum number of VPNs per PE	127 on NPU 1003, PNM 1001, PNM 1002, MINI-LINK 6651, and MINI-LINK 6366 251 on NPU 1002 and NPU 1005
Maximum IP forwarding table size (IPv4 unicast)	4000 prefixes on NPU 1003, PNM 1001, PNM 1002, MINI-LINK 6651, and MINI-LINK 6366 28000 prefixes on NPU 1002 and NPU 1005
Maximum number of MPLS labels in MPLS forwarding table	4000
Network scalability	~1000 nodes flat MPLS network
Network failover time	Below 1 second with protocol re-convergence Below 50 ms with RSVP-TE Fast Reroute and RSVP-TE Path Protection



5 Radio Link

For relations between Frame ID and corresponding Channel Separation support, see chapter 5.2.

5.1 Supported Modem and Radio Unit combinations

	MINI-LINK 6363 (max 33W)	MINI-LINK 6363/2 (max 20W)	MINI-LINK 6365 (max 33W)	RAU2 X (max 42W)
MMU 1001	✓	✓	✓	✓
MMU 1002	✓	✓	✓	✓
MMU 1004	✓	✓	✓	✓
PNM 1001	✓	✓	✓	✓
PNM 1002	✓	✓	✓	✓
MINI-LINK 6651	✓	✓	✓	✓
MINI-LINK 6366	✓	✓	✓	✓ ⁹

5.2 Channel Separation to Frame ID relation

The tables below show the relationship between Channel Separation and corresponding Frame ID.

ETSI Channel Separation	Frame ID Single Carrier	Frame ID XPIC	Frame ID 2x2 MIMO	Frame ID 4x4 MIMO
7 MHz	256, 356	1256, 1356		
13.75 MHz	257, 357	1257, 1357		
14 MHz	257, 357	1257, 1357		

⁹ MINI-LINK 6366 supports RAU2 X but not all configurations are possible for mechanical reasons.

- Config 1: Integrated mount: Not supported
- Config 2: Separate mount: Supported
- Config 3: Rail Mount: Supported



27.5 MHz	258, 358	1258, 1358	2358	2358
28 MHz	258, 358	1258, 1358	2358	2358
40 MHz	259, 359	1259, 1359		
55 MHz	260, 360	1260, 1360	2360	2360
56 MHz	260, 360	1260, 1360	2360	2360
62,5 MHz	260, 360	1260, 1360		
80 MHz	303, 403	1303, 1403		
110 MHz	261, 361	1261, 1361		
112 MHz	261, 361	1261, 1361		
125 MHz	261, 361	1261, 1361		

ANSI Channel Separation	Frame ID Single Carrier	Frame ID XPIC	Frame ID 2x2 MIMO	Frame ID 4x4 MIMO
10 MHz	262, 362	1262, 1362		
20 MHz	263, 363	1263, 1363		
30 MHz	264, 364	1264, 1364	2364	2364
40 MHz	265, 365	1265, 1365	2365	2365
50 MHz	266, 366	1266, 1366		
60 MHz	267, 367	1267, 1367		
80 MHz	268, 368	1268, 1368		

5.3 Radio Frequencies

5.3.1 Radio Frequencies

Within the restrictions of channel arrangement and sub-band ranging imposed by the different Radio Unit the channel frequency can be selected from the O&M system.

Frequency band and sub range, as well as lowest, highest and selected center frequency is readable from the O&M system.



The operating center frequency can be set in steps of 0.025 or 0.25 MHz depending on sub-band, frequency band and Radio Unit.

For Radio Units with SW configurable duplex distance, the distance between transmitter and receiver shall always comply with regulatory requirements. The most common duplex distances can be found after each sub-band table.

The Radio Units are produced for frequency bands, sub ranges and channel plans according to the tables in the following chapters.

5.3.2 CS Dependence

Lower and upper frequencies in below tables state the edges for respective sub-bands (indexes). The given frequency edge shall therefore be compensated for actual CS according below. (CS= 7, 14, 28, 40, 56, 80 & 112 MHz for ETSI and 5, 10, 20, 30, 40, 50, 60 & 80 MHz for ANSI)

Lowest user frequency = Tx or Rx Lower edge + CS/2

Highest user frequency = Tx or Rx Higher edge – CS/2

5.3.3 5 GHz Band

RAU2 X 5 HP

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11 300	4400.00	4570.00	170.00	4700.00	4870.00	170.00	ETSI
15 300	4700.00	4870.00	170.00	4400.00	4570.00	170.00	ETSI
12 300	4530.00	4700.00	170.00	4830.00	5000.00	170.00	ETSI
16 300	4830.00	5000.00	170.00	4530.00	4700.00	170.00	ETSI
A11	4400.00	4570.00	170.00	4700.00	4870.00	170.00	ETSI
A15	4700.00	4870.00	170.00	4400.00	4570.00	170.00	ETSI
A12	4530.00	4700.00	170.00	4830.00	5000.00	170.00	ETSI
A16	4830.00	5000.00	170.00	4530.00	4700.00	170.00	ETSI

Sub-band 1x is valid for CS 7, 14, 28, 40 & 56 MHz.

Sub-band A1x (Duplex 300 & 312 MHz) is valid for CS 7, 14, 28, 40 & 56 MHz.

5.3.4 6 GHz Lower Band

RAU2 X 6L [HP]

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11 252.04	5925.000	6020.250	95.25	6177.050	6272.300	95.25	ETSI/ANSI
15 252.04	6177.050	6272.300	95.25	5925.000	6020.250	95.25	ETSI/ANSI
12 252.04	6018.000	6110.250	92.25	6270.050	6362.300	92.25	ETSI/ANSI
16 252.04	6270.050	6362.300	92.25	6018.000	6110.250	92.25	ETSI/ANSI
13 252.04	6078.500	6173.250	94.75	6330.550	6425.300	94.75	ETSI/ANSI
17 252.04	6330.550	6425.300	94.75	6078.500	6173.250	94.75	ETSI/ANSI
14 252.04	5989.675	6048.975	59.30	6241.725	6301.025	59.30	ETSI/ANSI



Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
18 252.04	6241.725	6301.025	59.30	5989.675	6048.975	59.30	ETSI/ANSI
A11	5925.000	6020.250	95.250	6177.050	6272.300	95.250	ETSI/ANSI
A15	6177.050	6272.300	95.250	5925.000	6020.250	95.250	ETSI/ANSI
A12	6018.000	6110.250	92.250	6270.050	6362.300	92.250	ETSI/ANSI
A16	6270.050	6362.300	92.250	6018.000	6110.250	92.250	ETSI/ANSI
A13	6078.500	6173.250	94.750	6330.550	6425.300	94.750	ETSI/ANSI
A17	6330.550	6425.300	94.750	6078.500	6173.250	94.750	ETSI/ANSI
A14	5989.675	6048.975	59.300	6241.725	6301.025	59.300	ETSI/ANSI
A18	6241.725	6301.025	59.300	5989.675	6048.975	59.300	ETSI/ANSI
A51	5925.000	6020.250	95.250	6177.050	6277.000	99.950	ANSI
A55	6177.050	6277.000	99.950	5925.000	6020.250	95.250	ANSI
A52	6011.000	6110.250	99.250	6270.050	6362.300	92.250	ANSI
A56	6270.050	6362.300	92.250	6011.000	6110.250	99.250	ANSI
A53	6078.500	6173.250	94.750	6330.550	6425.300	94.750	ANSI
A57	6330.550	6425.300	94.750	6078.500	6173.250	94.750	ANSI
A54	5989.675	6048.975	59.300	6241.725	6301.025	59.300	ANSI
A58	6241.725	6301.025	59.300	5989.675	6048.975	59.300	ANSI

Sub-band 1x is valid for CS 7, 14, 28/29.65 & 56/59.3 MHz.

Sub-band 1x is valid for CS 9.88/10, 20, 29.65/30, 40, 50 & 59.3/60 MHz.

Sub-band A1x (Duplex 240, 252.04, 260 & 266 MHz) is valid for CS 7, 14, 28/29.65 & 56/59.3 MHz.

Sub-band A1x (Duplex 252.04 MHz) are valid for CS 9.88/10, 20, 29.65/30, 40, 50 & 59.3/60 MHz.

Sub-band A5x (Duplex 252.04 MHz) are valid for CS 9.88/10, 20, 29.65/30, 40, 50 & 59.3/60 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11L	5925.000	6020.250	95.250	6177.050	6277.000	99.950	ETSI/ANSI
11H	6177.050	6277.000	99.950	5925.000	6020.250	95.250	ETSI/ANSI
12L	6011.000	6110.250	99.250	6270.050	6362.300	92.250	ETSI/ANSI
12H	6270.050	6362.300	92.250	6011.000	6110.250	99.250	ETSI/ANSI
13L	6078.500	6173.250	94.750	6330.550	6425.300	94.750	ETSI/ANSI
13H	6330.550	6425.300	94.750	6078.500	6173.250	94.750	ETSI/ANSI
14L	5989.325	6049.350	60.025	6241.350	6301.375	60.025	ETSI/ANSI
14H	6241.350	6301.375	60.025	5989.325	6049.350	60.025	ETSI/ANSI
51L	5925.000	6020.250	95.250	6177.050	6277.000	99.950	ANSI
51H	6177.050	6277.000	99.950	5925.000	6020.250	95.250	ANSI
52L	6011.000	6110.250	99.250	6270.050	6362.300	92.250	ANSI
52H	6270.050	6362.300	92.250	6011.000	6110.250	99.250	ANSI
53L	6078.500	6173.250	94.750	6330.550	6425.300	94.750	ANSI
53H	6330.550	6425.300	94.750	6078.500	6173.250	94.750	ANSI
54L	5989.330	6049.330	60.000	6241.370	6301.370	60.000	ANSI
54H	6241.370	6301.370	60.000	5989.330	6049.330	60.000	ANSI

Sub-band 1xL/H (Duplex 240, 252.04, 260 & 266 MHz) is valid for CS 7, 14, 28/29.65 & 56/59.3 MHz.

Sub-band 1xL/H (Duplex 252.04 MHz) are valid for CS 9.88/10, 20, 29.65/30, 40, 50 & 59.3/60 MHz.

Sub-band 5xL/H (Duplex 252.04 MHz) are valid for CS 9.88/10, 20, 29.65/30, 40, 50 & 59.3/60 MHz.



5.3.5 6 GHz Upper Band

RAU2 X 6U [HP]

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
21 340	6430.00	6565.00	135.00	6770.00	6905.00	135.00	ETSI/ANSI
25 340	6770.00	6905.00	135.00	6430.00	6565.00	135.00	ETSI/ANSI
22 340	6550.00	6685.00	135.00	6890.00	7025.00	135.00	ETSI/ANSI
26 340	6890.00	7025.00	135.00	6550.00	6685.00	135.00	ETSI/ANSI
23 340	6635.00	6765.00	130.00	6975.00	7105.00	130.00	ETSI/ANSI
27 340	6975.00	7105.00	130.00	6635.00	6765.00	130.00	ETSI/ANSI
24 340	6520.00	6600.00	80.00	6860.00	6940.00	80.00	ETSI/ANSI
28 340	6860.00	6940.00	80.00	6520.00	6600.00	80.00	ETSI/ANSI
A21	6430.000	6565.000	135.000	6770.000	6905.000	135.000	ETSI/ANSI
A25	6770.000	6905.000	135.000	6430.000	6565.000	135.000	ETSI/ANSI
A22	6550.000	6685.000	135.000	6890.000	7025.000	135.000	ETSI/ANSI
A26	6890.000	7025.000	135.000	6550.000	6685.000	135.000	ETSI/ANSI
A23	6635.000	6765.000	130.000	6975.000	7105.000	130.000	ETSI/ANSI
A27	6975.000	7105.000	130.000	6635.000	6765.000	130.000	ETSI/ANSI
A24	6520.000	6600.000	80.000	6860.000	6940.000	80.000	ETSI/ANSI
A28	6860.000	6940.000	80.000	6520.000	6600.000	80.000	ETSI/ANSI
31 160	6540.00	6602.50	62.50	6700.00	6762.50	62.50	ANSI
35 160	6700.00	6762.50	62.50	6540.00	6602.50	62.50	ANSI
32 160	6597.50	6657.50	60.00	6757.50	6817.50	60.00	ANSI
36 160	6757.50	6817.50	60.00	6597.50	6657.50	60.00	ANSI
33 160	6650.00	6710.00	60.00	6810.00	6870.00	60.00	ANSI
37 160	6810.00	6870.00	60.00	6650.00	6710.00	60.00	ANSI
A31	6540.000	6610.000	70.000	6700.000	6770.000	70.000	ANSI
A35	6700.000	6770.000	70.000	6540.000	6610.000	70.000	ANSI
A32	6597.500	6657.500	60.000	6757.500	6817.500	60.000	ANSI
A36	6757.500	6817.500	60.000	6597.500	6657.500	60.000	ANSI
A33	6640.000	6710.000	70.000	6800.000	6870.000	70.000	ANSI
A37	6800.000	6870.000	70.000	6640.000	6710.000	70.000	ANSI
A41	6523.750	6626.250	102.500	6773.750	6876.250	102.500	ANSI
A45	6773.750	6876.250	102.500	6523.750	6626.250	102.500	ANSI

Sub-band 2x is valid for 7, 14, 28/30, 40 & 56/60 MHz.

Sub-band 2x is valid for CS 10, 20, 30, 40 & 50 MHz

Sub-band A2x (Duplex 340 MHz) is valid for CS 7, 14, 28/30, 40 & 56/60 MHz.

Sub-band A2x (Duplex 340 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

Sub-band 3x is valid for CS 10, 20, 30, 40 & 50 MHz

Sub-band A3x (Duplex 160 & 170 MHz) are valid for CS 10, 20, 30, 40 & 50 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
21L	6430.000	6565.000	135.000	6770.000	6905.000	135.000	ETSI/ANSI
21H	6770.000	6905.000	135.000	6430.000	6565.000	135.000	ETSI/ANSI
22L	6550.000	6685.000	135.000	6890.000	7025.000	135.000	ETSI/ANSI
22H	6890.000	7025.000	135.000	6550.000	6685.000	135.000	ETSI/ANSI
23L	6635.000	6765.000	130.000	6975.000	7105.000	130.000	ETSI/ANSI
23H	6975.000	7105.000	130.000	6635.000	6765.000	130.000	ETSI/ANSI
24L	6520.000	6600.000	80.000	6860.000	6940.000	80.000	ETSI/ANSI
24H	6860.000	6940.000	80.000	6520.000	6600.000	80.000	ETSI/ANSI



Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
31L	6540.000	6610.000	70.000	6700.000	6770.000	70.000	ANSI
31H	6700.000	6770.000	70.000	6540.000	6610.000	70.000	ANSI
32L	6597.500	6657.500	60.000	6757.500	6817.500	60.000	ANSI
32H	6757.500	6817.500	60.000	6597.500	6657.500	60.000	ANSI
33L	6640.000	6710.000	70.000	6800.000	6870.000	70.000	ANSI
33H	6800.000	6870.000	70.000	6640.000	6710.000	70.000	ANSI

Sub-band 2xL/H (Duplex 340 MHz) is valid for CS 7, 14, 28/30, 40 & 56/60 MHz.

Sub-band 2xL/H (Duplex 340 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

Sub-band 3xL/H (Duplex 160 & 170 MHz) are valid for CS 10, 20, 30, 40 & 50 MHz.

5.3.6 7 GHz Band

RAU2 X 7 [HP]

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01 196	7107.00	7163.00	56.00	7303.00	7359.00	56.00	ETSI
05 196	7303.00	7359.00	56.00	7107.00	7163.00	56.00	ETSI
02 196	7163.00	7219.00	56.00	7359.00	7415.00	56.00	ETSI
06 196	7359.00	7415.00	56.00	7163.00	7219.00	56.00	ETSI
03 196	7191.00	7247.00	56.00	7387.00	7443.00	56.00	ETSI
07 196	7387.00	7443.00	56.00	7191.00	7247.00	56.00	ETSI
11 154	7428.00	7484.00	56.00	7582.00	7638.00	56.00	ETSI
15 154	7582.00	7638.00	56.00	7428.00	7484.00	56.00	ETSI
12 154	7456.00	7512.00	56.00	7610.00	7666.00	56.00	ETSI
16 154	7610.00	7666.00	56.00	7456.00	7512.00	56.00	ETSI
13 154	7484.00	7540.00	56.00	7638.00	7694.00	56.00	ETSI
17 154	7638.00	7694.00	56.00	7484.00	7540.00	56.00	ETSI
14 154	7512.00	7568.00	56.00	7666.00	7722.00	56.00	ETSI
18 154	7666.00	7722.00	56.00	7512.00	7568.00	56.00	ETSI
21 245	7426.50	7513.75	87.25	7671.50	7758.75	87.25	ETSI
25 245	7671.50	7758.75	87.25	7426.50	7513.75	87.25	ETSI
22 245	7482.25	7569.75	87.50	7727.25	7814.75	87.50	ETSI
26 245	7727.25	7814.75	87.50	7482.25	7569.75	87.50	ETSI
23 245	7510.25	7597.75	87.50	7755.25	7842.75	87.50	ETSI
27 245	7755.25	7842.75	87.50	7510.25	7597.75	87.50	ETSI
24 245	7566.25	7653.75	87.50	7755.25	7842.75	87.50	ETSI
28 245	7811.25	7898.75	87.50	7566.25	7653.75	87.50	ETSI
31 161	7124.50	7184.00	59.50	7285.50	7345.00	59.50	ETSI
35 161	7285.50	7345.00	59.50	7124.50	7184.00	59.50	ETSI
32 161	7152.50	7212.00	59.50	7313.50	7373.00	59.50	ETSI
36 161	7313.50	7373.00	59.50	7152.50	7212.00	59.50	ETSI
33 161	7180.50	7240.00	59.50	7341.50	7401.00	59.50	ETSI
37 161	7341.50	7401.00	59.50	7180.50	7240.00	59.50	ETSI
34 161	7208.50	7268.00	59.50	7369.50	7429.00	59.50	ETSI
38 161	7369.50	7429.00	59.50	7208.50	7268.00	59.50	ETSI



Index / Duplex (MHz)		Transmitter frequency information			Receiver frequency information			Telecom Standard
		Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
41	161	7424.50	7484.00	59.50	7585.50	7645.00	59.50	ETSI
45	161	7585.50	7645.00	59.50	7424.50	7484.00	59.50	ETSI
42	161	7449.50	7512.00	62.50	7610.50	7673.00	62.50	ETSI
46	161	7610.50	7673.00	62.50	7449.50	7512.00	62.50	ETSI
43	161	7477.50	7540.00	62.50	7638.50	7701.00	62.50	ETSI
47	161	7638.50	7701.00	62.50	7477.50	7540.00	62.50	ETSI
44	161	7505.50	7568.00	62.50	7666.50	7729.00	62.50	ETSI
48	161	7666.50	7729.00	62.50	7505.50	7568.00	62.50	ETSI
51	168	7107.00	7163.00	56.00	7275.00	7331.00	56.00	ETSI
55	168	7275.00	7331.00	56.00	7107.00	7163.00	56.00	ETSI
52	168	7135.00	7191.00	56.00	7303.00	7359.00	56.00	ETSI
56	168	7303.00	7359.00	56.00	7135.00	7191.00	56.00	ETSI
53	168	7163.00	7219.00	56.00	7331.00	7387.00	56.00	ETSI
57	168	7331.00	7387.00	56.00	7163.00	7219.00	56.00	ETSI
54	168	7191.00	7247.00	56.00	7359.00	7415.00	56.00	ETSI
58	168	7359.00	7415.00	56.00	7191.00	7247.00	56.00	ETSI
61	168	7414.00	7470.00	56.00	7582.00	7638.00	56.00	ETSI
65	168	7582.00	7638.00	56.00	7414.00	7470.00	56.00	ETSI
62	168	7442.00	7498.00	56.00	7610.00	7666.00	56.00	ETSI
66	168	7610.00	7666.00	56.00	7442.00	7498.00	56.00	ETSI
63	168	7470.00	7526.00	56.00	7638.00	7694.00	56.00	ETSI
67	168	7638.00	7694.00	56.00	7470.00	7526.00	56.00	ETSI
64	168	7498.00	7554.00	56.00	7666.00	7722.00	56.00	ETSI
68	168	7666.00	7722.00	56.00	7498.00	7554.00	56.00	ETSI
71	154	7128.00	7184.00	56.00	7282.00	7338.00	56.00	ETSI
75	154	7282.00	7338.00	56.00	7128.00	7184.00	56.00	ETSI
72	154	7156.00	7212.00	56.00	7310.00	7366.00	56.00	ETSI
76	154	7310.00	7366.00	56.00	7156.00	7212.00	56.00	ETSI
73	154	7184.00	7240.00	56.00	7338.00	7394.00	56.00	ETSI
77	154	7338.00	7394.00	56.00	7184.00	7240.00	56.00	ETSI
74	154	7212.00	7268.00	56.00	7366.00	7422.00	56.00	ETSI
78	154	7366.00	7422.00	56.00	7212.00	7268.00	56.00	ETSI
81	161	7249.50	7309.00	59.50	7410.50	7470.00	59.50	ETSI
85	161	7410.50	7470.00	59.50	7249.50	7309.00	59.50	ETSI
82	161	7277.50	7337.00	59.50	7438.50	7498.00	59.50	ETSI
86	161	7438.50	7498.00	59.50	7277.50	7337.00	59.50	ETSI
83	161	7305.50	7365.00	59.50	7466.50	7526.00	59.50	ETSI
87	161	7466.50	7526.00	59.50	7305.50	7365.00	59.50	ETSI
84	161	7333.50	7393.00	59.50	7494.50	7554.00	59.50	ETSI
88	161	7494.50	7554.00	59.50	7333.50	7393.00	59.50	ETSI
91	168	7443.00	7499.00	56.00	7611.00	7667.00	56.00	ETSI
95	168	7611.00	7667.00	56.00	7443.00	7499.00	56.00	ETSI
92	168	7471.00	7527.00	56.00	7639.00	7695.00	56.00	ETSI
96	168	7639.00	7695.00	56.00	7471.00	7527.00	56.00	ETSI
93	168	7499.00	7555.00	56.00	7667.00	7723.00	56.00	ETSI
97	168	7667.00	7723.00	56.00	7499.00	7555.00	56.00	ETSI
94	168	7527.00	7583.00	56.00	7695.00	7751.00	56.00	ETSI
98	168	7695.00	7751.00	56.00	7527.00	7583.00	56.00	ETSI
101	175	7125.00	7170.00	45.00	7300.00	7345.00	45.00	ANSI
105	175	7300.00	7345.00	45.00	7125.00	7170.00	45.00	ANSI
102	175	7155.00	7195.00	40.00	7330.00	7370.00	40.00	ANSI
106	175	7330.00	7370.00	40.00	7155.00	7195.00	40.00	ANSI
103	175	7180.00	7225.00	45.00	7355.00	7400.00	45.00	ANSI
107	175	7355.00	7400.00	45.00	7180.00	7225.00	45.00	ANSI
104	175	7210.00	7250.00	40.00	7385.00	7425.00	40.00	ANSI
108	175	7385.00	7425.00	40.00	7210.00	7250.00	40.00	ANSI



Index / Duplex (MHz)		Transmitter frequency information			Receiver frequency information			Telecom Standard
		Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
111	150	7425.00	7480.00	55.00	7575.00	7630.00	55.00	ANSI
115	150	7575.00	7630.00	55.00	7425.00	7480.00	55.00	ANSI
112	150	7460.00	7515.00	55.00	7610.00	7665.00	55.00	ANSI
116	150	7610.00	7665.00	55.00	7460.00	7515.00	55.00	ANSI
113	150	7515.00	7555.00	40.00	7665.00	7705.00	40.00	ANSI
117	150	7665.00	7705.00	40.00	7515.00	7555.00	40.00	ANSI
114	150	7545.00	7575.00	30.00	7695.00	7725.00	30.00	ANSI
118	150	7695.00	7725.00	30.00	7545.00	7575.00	30.00	ANSI
132	269	7505.00	7533.00	28.00	7774.00	7802.00	28.00	ETSI
136	269	7774.00	7802.00	28.00	7505.00	7533.00	28.00	ETSI
A01		7107.000	7163.000	56.00	7303.000	7359.000	56.00	ETSI
A05		7303.000	7359.000	56.00	7107.000	7163.000	56.00	ETSI
A02		7163.000	7219.000	56.00	7359.000	7415.000	56.00	ETSI
A06		7359.000	7415.000	56.00	7163.000	7219.000	56.00	ETSI
A03		7191.000	7247.000	56.00	7387.000	7443.000	56.00	ETSI
A07		7387.000	7443.000	56.00	7191.000	7247.000	56.00	ETSI
A11		7414.000	7485.000	71.00	7575.000	7645.000	70.00	ETSI/ANSI
A15		7575.000	7645.000	70.00	7414.000	7485.000	71.00	ETSI/ANSI
A12		7442.000	7515.000	73.00	7610.000	7673.000	63.00	ETSI/ANSI
A16		7610.000	7673.000	63.00	7442.000	7515.000	73.00	ETSI/ANSI
A13		7470.000	7540.000	70.00	7638.000	7701.000	63.00	ETSI/ANSI
A17		7638.000	7701.000	63.00	7470.000	7540.000	70.00	ETSI/ANSI
A14		7498.000	7568.000	70.00	7665.000	7729.000	64.00	ETSI/ANSI
A18		7665.000	7729.000	64.00	7498.000	7568.000	70.00	ETSI/ANSI
A21		7426.500	7513.750	87.250	7671.500	7758.750	87.250	ETSI
A25		7671.500	7758.750	87.250	7426.500	7513.750	87.250	ETSI
A22		7482.250	7569.750	87.500	7727.250	7814.750	87.500	ETSI
A26		7727.250	7814.750	87.500	7482.250	7569.750	87.500	ETSI
A23		7510.250	7597.750	87.500	7755.250	7842.750	87.500	ETSI
A27		7755.250	7842.750	87.500	7510.250	7597.750	87.500	ETSI
A24		7566.250	7653.750	87.500	7811.250	7898.750	87.500	ETSI
A28		7811.250	7898.750	87.500	7566.250	7653.750	87.500	ETSI
A31		7107.000	7184.000	77.00	7275.000	7345.000	70.00	ETSI/ANSI
A35		7275.000	7345.000	70.00	7107.000	7184.000	77.00	ETSI/ANSI
A32		7135.000	7212.000	77.00	7303.000	7373.000	70.00	ETSI/ANSI
A36		7303.000	7373.000	70.00	7135.000	7212.000	77.00	ETSI/ANSI
A33		7163.000	7240.000	77.00	7331.000	7401.000	70.00	ETSI/ANSI
A37		7331.000	7401.000	70.00	7163.000	7240.000	77.00	ETSI/ANSI
A34		7191.000	7268.000	77.00	7359.000	7429.000	70.00	ETSI/ANSI
A38		7359.000	7429.000	70.00	7191.000	7268.000	77.00	ETSI/ANSI
A81		7249.500	7309.000	59.50	7410.500	7470.000	59.50	ETSI
A85		7410.500	7470.000	59.50	7249.500	7309.000	59.50	ETSI
A82		7277.500	7337.000	59.50	7438.500	7498.000	59.50	ETSI
A86		7438.500	7498.000	59.50	7277.500	7337.000	59.50	ETSI
A83		7305.500	7365.000	59.50	7466.500	7526.000	59.50	ETSI
A87		7466.500	7526.000	59.50	7305.500	7365.000	59.50	ETSI
A84		7333.500	7393.000	59.50	7494.500	7554.000	59.50	ETSI
A88		7494.500	7554.000	59.50	7333.500	7393.000	59.50	ETSI
A94		7527.000	7583.000	56.00	7695.000	7751.000	56.00	ETSI/ANSI
A98		7695.000	7751.000	56.00	7527.000	7583.000	56.00	ETSI/ANSI

Sub-band 0x, 1x, 2x, 3x, 4x, 5x, 6x, 7x, 8x, 9x & 13x are valid for CS 7, 14, 28 & 56 MHz.

Sub-band 10x is valid for CS 10, 20, 30 & 40 MHz.

Sub-band 111, 112, 115 & 116 are valid for CS 10, 20, 30, 40 & 50 MHz.

Sub-band 114 & 118 are valid for CS 10, 20 & 30 MHz.



Sub-band A0x (Duplex 196 MHz), A2x (Duplex 245 & 269 MHz), A8x (Duplex 161 MHz) are valid for CS 7, 14, 28 & 56 MHz.

Sub-band A1x (Duplex 154, 161 & 168 MHz), A3x (Duplex 154, 161 & 168 MHz), A9x (Duplex 168 MHz) are valid for CS 7, 14, 28 & 56 MHz.

Sub-band A1x (Duplex 150 MHz), A3x (Duplex 175 MHz) & A9x (Duplex 150 MHz) are valid for CS 10, 20, 30, 40 & 50 MHz.



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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	7107.000	7163.000	56.00	7303.000	7359.000	56.00	ETSI
01H	7303.000	7359.000	56.00	7107.000	7163.000	56.00	ETSI
02L	7163.000	7219.000	56.00	7359.000	7415.000	56.00	ETSI
02H	7359.000	7415.000	56.00	7163.000	7219.000	56.00	ETSI
03L	7191.000	7247.000	56.00	7387.000	7443.000	56.00	ETSI
03H	7387.000	7443.000	56.00	7191.000	7247.000	56.00	ETSI
11L	7414.000	7485.000	71.00	7575.000	7645.000	70.00	ETSI/ANSI
11H	7575.000	7645.000	70.00	7414.000	7485.000	71.00	ETSI/ANSI
12L	7442.000	7515.000	73.00	7610.000	7673.000	63.00	ETSI/ANSI
12H	7610.000	7673.000	63.00	7442.000	7515.000	73.00	ETSI/ANSI
13L	7470.000	7540.000	70.00	7638.000	7701.000	63.00	ETSI/ANSI
13H	7638.000	7701.000	63.00	7470.000	7540.000	70.00	ETSI/ANSI
14L	7498.000	7568.000	70.00	7665.000	7729.000	64.00	ETSI/ANSI
14H	7665.000	7729.000	64.00	7498.000	7568.000	70.00	ETSI/ANSI
21L	7426.500	7513.750	87.250	7671.500	7758.750	87.250	ETSI
21H	7671.500	7758.750	87.250	7426.500	7513.750	87.250	ETSI
22L	7482.250	7569.750	87.500	7727.250	7814.750	87.500	ETSI
22H	7727.250	7814.750	87.500	7482.250	7569.750	87.500	ETSI
23L	7510.250	7597.750	87.500	7755.250	7842.750	87.500	ETSI
23H	7755.250	7842.750	87.500	7510.250	7597.750	87.500	ETSI
24L	7566.250	7653.750	87.500	7811.250	7898.750	87.500	ETSI
24H	7811.250	7898.750	87.500	7566.250	7653.750	87.500	ETSI
31L	7107.000	7184.000	77.00	7275.000	7345.000	70.00	ETSI/ANSI
31H	7275.000	7345.000	70.00	7107.000	7184.000	77.00	ETSI/ANSI
32L	7135.000	7212.000	77.00	7303.000	7373.000	70.00	ETSI/ANSI
32H	7303.000	7373.000	70.00	7135.000	7212.000	77.00	ETSI/ANSI
33L	7163.000	7240.000	77.00	7331.000	7401.000	70.00	ETSI/ANSI
33H	7331.000	7401.000	70.00	7163.000	7240.000	77.00	ETSI/ANSI
34L	7191.000	7268.000	77.00	7359.000	7429.000	70.00	ETSI/ANSI
34H	7359.000	7429.000	70.00	7191.000	7268.000	77.00	ETSI/ANSI
81L	7249.500	7309.000	59.50	7410.500	7470.000	59.50	ETSI
81H	7410.500	7470.000	59.50	7249.500	7309.000	59.50	ETSI
82L	7277.500	7337.000	59.50	7438.500	7498.000	59.50	ETSI
82H	7438.500	7498.000	59.50	7277.500	7337.000	59.50	ETSI
83L	7305.500	7365.000	59.50	7466.500	7526.000	59.50	ETSI
83H	7466.500	7526.000	59.50	7305.500	7365.000	59.50	ETSI
84L	7333.500	7393.000	59.50	7494.500	7554.000	59.50	ETSI
84H	7494.500	7554.000	59.50	7333.500	7393.000	59.50	ETSI
94L	7527.000	7583.000	56.00	7695.000	7751.000	56.00	ETSI/ANSI
94H	7695.000	7751.000	56.00	7527.000	7583.000	56.00	ETSI/ANSI

Sub-band 0xL/H (Duplex 196 MHz), 2xL/H (Duplex 245 & 269 MHz), 8xL/H (Duplex 161 MHz) are valid for CS 7, 14, 28 & 56 MHz.

Sub-band 1xL/H (Duplex 154, 161 & 168 MHz), 3xL/H (Duplex 154, 161 & 168 MHz), 9xL/H (Duplex 168 MHz) are valid for CS 7, 14, 28 & 56 MHz.

Sub-band 1xL/H (Duplex 150 MHz), 3xL/H (Duplex 175 MHz) & 9xL/H (Duplex 150 MHz) are valid for CS 10, 20, 30, 40 & 50 MHz.



5.3.7

7/8 GHz Band

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
A01L	7107.000	7219.000	112.000	7303.000	7415.000	112.000	ETSI
A01H	7303.000	7415.000	112.000	7107.000	7219.000	112.000	ETSI
A03L	7163.000	7247.000	84.000	7359.000	7443.000	84.000	ETSI
A03H	7359.000	7443.000	84.000	7163.000	7247.000	84.000	ETSI
A11L	7414.000	7515.000	101.00	7575.000	7673.000	98.00	ETSI/ANSI
A11H	7575.000	7673.000	98.00	7414.000	7515.000	101.00	ETSI/ANSI
A13L	7470.000	7568.000	98.00	7635.000	7729.000	94.00	ETSI/ANSI
A13H	7635.000	7729.000	94.00	7470.000	7568.000	98.00	ETSI/ANSI
A21L	7426.500	7569.750	143.250	7671.500	7814.750	143.250	ETSI
A21H	7671.500	7814.750	143.250	7426.500	7569.750	143.250	ETSI
A23L	7510.250	7653.750	143.500	7755.250	7898.750	143.500	ETSI
A23H	7755.250	7898.750	143.500	7510.250	7653.750	143.500	ETSI
A31L	7107.000	7212.000	105.00	7275.000	7373.000	98.00	ETSI/ANSI
A31H	7275.000	7373.000	98.00	7107.000	7212.000	105.00	ETSI/ANSI
A33L	7163.000	7268.000	105.00	7331.000	7429.000	98.00	ETSI/ANSI
A33H	7331.000	7429.000	98.00	7163.000	7268.000	105.00	ETSI/ANSI
A81L	7249.50	7337.00	87.50	7410.50	7498.00	87.50	ETSI
A81H	7410.50	7498.00	87.50	7249.50	7337.00	87.50	ETSI
A83L	7305.50	7393.00	87.50	7466.50	7554.00	87.50	ETSI
A83H	7466.50	7554.00	87.50	7305.50	7393.00	87.50	ETSI
A94L	7527.000	7583.000	56.00	7695.000	7751.000	56.00	ETSI/ANSI
A94H	7695.000	7751.000	56.00	7527.000	7583.000	56.00	ETSI/ANSI
B01L	7744.750	7793.750	49.000	7893.000	7942.250	49.250	ETSI
B01H	7893.000	7942.250	49.250	7744.750	7793.750	49.000	ETSI
B02L	7779.750	7828.750	49.000	7928.000	7977.250	49.250	ETSI
B02H	7928.000	7977.250	49.250	7779.750	7828.750	49.000	ETSI
B11L	7718.050	7851.500	133.450	8016.500	8162.800	146.300	ETSI/ANSI
B11H	8016.500	8162.800	146.300	7718.050	7851.500	133.450	ETSI/ANSI
B12L	7777.000	7911.000	134.000	8073.000	8222.250	149.250	ETSI/ANSI
B12H	8073.000	8222.250	149.250	7777.000	7911.000	134.000	ETSI/ANSI
B14L	7835.000	7985.000	150.000	8128.500	8281.500	153.000	ETSI/ANSI
B14H	8128.500	8281.500	153.000	7835.000	7985.000	150.000	ETSI/ANSI
B21L	8279.000	8328.000	49.000	8398.000	8450.500	52.500	ETSI
B21H	8398.000	8450.500	52.500	8279.000	8328.000	49.000	ETSI
B23L	8324.500	8377.000	52.500	8447.000	8496.000	49.000	ETSI
B23H	8447.000	8496.000	49.000	8324.500	8377.000	52.500	ETSI
B42L	8307.000	8349.000	42.000	8426.000	8475.000	49.000	ETSI
B42H	8426.000	8475.000	49.000	8307.000	8349.000	42.000	ETSI
B61L	7905.000	8024.000	119.000	8171.000	8327.000	156.000	ETSI
B61H	8171.000	8327.000	156.000	7905.000	8024.000	119.000	ETSI
B62L	7961.000	8073.000	112.000	8234.000	8383.000	149.000	ETSI
B62H	8234.000	8383.000	149.000	7961.000	8073.000	112.000	ETSI
B63L	7989.000	8136.000	147.000	8290.000	8439.000	149.000	ETSI
B63H	8290.000	8439.000	149.000	7989.000	8136.000	147.000	ETSI
B64L	8073.000	8185.000	112.000	8383.000	8495.000	112.000	ETSI
B64H	8383.000	8495.000	112.000	8073.000	8185.000	112.000	ETSI



Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
B91L	8050.000	8134.000	84.000	8258.000	8342.000	84.000	ETSI
B91H	8258.000	8342.000	84.000	8050.000	8134.000	84.000	ETSI
B92L	8106.000	8190.000	84.000	8314.000	8398.000	84.000	ETSI
B92H	8314.000	8398.000	84.000	8106.000	8190.000	84.000	ETSI
B93L	8162.000	8246.000	84.000	8370.000	8454.000	84.000	ETSI
B93H	8370.000	8454.000	84.000	8162.000	8246.000	84.000	ETSI

Sub-band A0xL/H (Duplex 196MHz), A2xL/H (Duplex 245MHz) & A8xL/H (Duplex 161MHz) are valid for CS 7, 14, 28 & 56MHz.

Sub-band A1xL/H (Duplex 154MHz), A3xL/H (Duplex 154MHz), A1xL/H (Duplex 150MHz), A3xL/H (Duplex 175MHz) & A9xL/H (Duplex 150MHz) are valid for CS 10, 20, 30, 40 & 50MHz.

Sub-band B2xL/H & B4xL/H (Duplex 119MHz) are valid for CS 7, 14 & 28/29.65MHz.

Sub-band B1xL/H (Duplex 283.5, 310 & 311.32MHz), B6xL/H (Duplex 266 & 310MHz) & B9xL/H (Duplex 208MHz) are valid for CS 7, 14, 28/29.65 & 56/59.3MHz.

Sub-band: B1xL/H (Duplex 300MHz) is valid for CS 10, 20, 30, 40 & 50 MHz



5.3.8 8 GHz Band

RAU2 X 8 [HP]

Index / Duplex (MHz)		Transmitter frequency information			Receiver frequency information			Telecom Standard
		Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11	311.32	7718.050	7807.000	88.950	8029.375	8118.325	88.950	ETSI
15	311.32	8029.375	8118.325	88.950	7718.050	7807.000	88.950	ETSI
12	311.32	7777.350	7866.300	88.950	8088.675	8177.625	88.950	ETSI
16	311.32	8088.675	8177.625	88.950	7777.350	7866.300	88.950	ETSI
13	311.32	7821.825	7910.775	88.950	8133.150	8222.100	88.950	ETSI
17	311.32	8133.150	8222.100	88.950	7821.825	7910.775	88.950	ETSI
14	311.32	7881.125	7970.075	88.950	8192.450	8281.400	88.950	ETSI
18	311.32	8192.450	8281.400	88.950	7881.125	7970.075	88.950	ETSI
21	126	8282.50	8324.50	42.00	8408.50	8450.50	42.00	ETSI
25	126	8408.50	8450.50	42.00	8282.50	8324.50	42.00	ETSI
23	126	8324.50	8366.50	42.00	8450.50	8492.50	42.00	ETSI
27	126	8450.50	8492.50	42.00	8324.50	8366.50	42.00	ETSI
31	119	8286.00	8328.00	42.00	8405.00	8447.00	42.00	ETSI
35	119	8405.00	8447.00	42.00	8286.00	8328.00	42.00	ETSI
33	119	8328.00	8370.00	42.00	8447.00	8489.00	42.00	ETSI
37	119	8447.00	8489.00	42.00	8328.00	8370.00	42.00	ETSI
41	119	8279.00	8321.00	42.00	8398.00	8440.00	42.00	ETSI
45	119	8398.00	8440.00	42.00	8279.00	8321.00	42.00	ETSI
42	119	8307.00	8349.00	42.00	8426.00	8468.00	42.00	ETSI
46	119	8426.00	8468.00	42.00	8307.00	8349.00	42.00	ETSI
43	119	8335.00	8377.00	42.00	8454.00	8496.00	42.00	ETSI
47	119	8454.00	8496.00	42.00	8335.00	8377.00	42.00	ETSI
51	126	8279.00	8321.00	42.00	8405.00	8447.00	42.00	ETSI
55	126	8405.00	8447.00	42.00	8279.00	8321.00	42.00	ETSI
52	126	8307.00	8349.00	42.00	8433.00	8475.00	42.00	ETSI
56	126	8433.00	8475.00	42.00	8307.00	8349.00	42.00	ETSI
53	126	8328.00	8370.00	42.00	8454.00	8496.00	42.00	ETSI
57	126	8454.00	8496.00	42.00	8328.00	8370.00	42.00	ETSI
61	266	7905.00	8010.00	105.00	8171.00	8276.00	105.00	ETSI
65	266	8171.00	8276.00	105.00	7905.00	8010.00	105.00	ETSI
62	266	7968.00	8073.00	105.00	8234.00	8339.00	105.00	ETSI
66	266	8234.00	8339.00	105.00	7968.00	8073.00	105.00	ETSI
63	266	8031.00	8136.00	105.00	8297.00	8402.00	105.00	ETSI
67	266	8297.00	8402.00	105.00	8031.00	8136.00	105.00	ETSI
71	311.32	7718.050	7836.650	118.600	8029.375	8147.975	118.600	ETSI
75	311.32	8029.375	8147.975	118.600	7718.050	7836.650	118.600	ETSI
72	311.32	7777.350	7881.125	103.775	8088.675	8192.450	103.775	ETSI
76	311.32	8088.675	8192.450	103.775	7777.350	7881.125	103.775	ETSI
73	311.32	7851.475	7970.075	118.600	8162.800	8281.400	118.600	ETSI
77	311.32	8162.800	8281.400	118.600	7851.475	7970.075	118.600	ETSI
81	300	7725.00	7805.00	80.00	8025.00	8105.00	80.00	ANSI
85	300	8025.00	8105.00	80.00	7725.00	7805.00	80.00	ANSI
82	300	7785.00	7865.00	80.00	8085.00	8165.00	80.00	ANSI
86	300	8085.00	8165.00	80.00	7785.00	7865.00	80.00	ANSI
83	300	7835.00	7910.00	75.00	8135.00	8210.00	75.00	ANSI
87	300	8135.00	8210.00	75.00	7835.00	7910.00	75.00	ANSI
84	300	7895.00	7965.00	70.00	8195.00	8265.00	70.00	ANSI
88	300	8195.00	8265.00	70.00	7895.00	7965.00	70.00	ANSI



Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard	
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)		
91	208	8050.00	8134.00	84.00	8258.00	8342.00	84.00	ETSI
95	208	8258.00	8342.00	84.00	8050.00	8134.00	84.00	ETSI
92	208	8106.00	8190.00	84.00	8314.00	8398.00	84.00	ETSI
96	208	8314.00	8398.00	84.00	8106.00	8190.00	84.00	ETSI
93	208	8162.00	8246.00	84.00	8370.00	8454.00	84.00	ETSI
97	208	8370.00	8454.00	84.00	8162.00	8246.00	84.00	ETSI
101	310	7905.00	8017.00	112.00	8215.00	8327.00	112.00	ETSI
105	310	8215.00	8327.00	112.00	7905.00	8017.00	112.00	ETSI
102	310	7989.00	8101.00	112.00	8299.00	8411.00	112.00	ETSI
106	310	8299.00	8411.00	112.00	7989.00	8101.00	112.00	ETSI
103	310	8073.00	8185.00	112.00	8383.00	8495.00	112.00	ETSI
107	310	8383.00	8495.00	112.00	8073.00	8185.00	112.00	ETSI
111	310	7725.00	7837.00	112.00	8035.00	8147.00	112.00	ETSI
115	310	8035.00	8147.00	112.00	7725.00	7837.00	112.00	ETSI
112	310	7777.00	7881.00	104.00	8087.00	8191.00	104.00	ETSI
116	310	8087.00	8191.00	104.00	7777.00	7881.00	104.00	ETSI
113	310	7851.00	7965.00	114.00	8161.00	8275.00	114.00	ETSI
117	310	8161.00	8275.00	114.00	7851.00	7965.00	114.00	ETSI
121	148.5	7744.75	7793.75	49.00	7893.25	7942.25	49.00	ETSI
125	148.5	7893.25	7942.25	49.00	7744.75	7793.75	49.00	ETSI
122	148.5	7779.75	7828.75	49.00	7928.25	7977.25	49.00	ETSI
126	148.5	7928.25	7977.25	49.00	7779.75	7828.75	49.00	ETSI
131	148.25	7744.75	7793.75	49.00	7893.00	7942.00	49.00	ETSI
135	148.25	7893.00	7942.00	49.00	7744.75	7793.75	49.00	ETSI
132	148.25	7779.75	7828.75	49.00	7928.00	7977.00	49.00	ETSI
136	148.25	7928.00	7977.00	49.00	7779.75	7828.75	49.00	ETSI
A01		7744.750	7793.750	49.000	7893.000	7942.250	49.250	ETSI
A05		7893.000	7942.250	49.250	7744.750	7793.750	49.000	ETSI
A02		7779.750	7828.750	49.000	7928.000	7977.250	49.250	ETSI
A06		7928.000	7977.250	49.250	7779.750	7828.750	49.000	ETSI
A11		7718.050	7837.000	118.950	8025.000	8147.975	122.975	ETSI/ANSI
A15		8025.000	8147.975	122.975	7718.050	7837.000	118.950	ETSI/ANSI
A12		7777.000	7910.775	133.775	8085.000	8222.100	137.100	ETSI/ANSI
A16		8085.000	8222.100	137.100	7777.000	7910.775	133.775	ETSI/ANSI
A14		7835.000	7970.075	135.075	8135.000	8281.400	146.400	ETSI/ANSI
A18		8135.000	8281.400	146.400	7835.000	7970.075	135.075	ETSI/ANSI
A21		8279.000	8328.000	49.000	8405.000	8450.500	45.500	ETSI
A25		8405.000	8450.500	45.500	8279.000	8328.000	49.000	ETSI
A23		8324.500	8370.000	45.500	8447.000	8492.500	45.500	ETSI
A27		8447.000	8492.500	45.500	8324.500	8370.000	45.500	ETSI
A41		8279.000	8321.000	42.000	8398.000	8440.000	42.000	ETSI
A45		8398.000	8440.000	42.000	8279.000	8321.000	42.000	ETSI
A42		8307.000	8349.000	42.000	8426.000	8475.000	49.000	ETSI
A46		8426.000	8475.000	49.000	8307.000	8349.000	42.000	ETSI
A43		8328.000	8377.000	49.000	8454.000	8496.000	42.000	ETSI
A47		8454.000	8496.000	42.000	8328.000	8377.000	49.000	ETSI
A61		7905.000	8017.000	112.000	8171.000	8327.000	156.000	ETSI
A65		8171.000	8327.000	156.000	7905.000	8017.000	112.000	ETSI
A62		7968.000	8073.000	105.000	8234.000	8339.000	105.000	ETSI
A66		8234.000	8339.000	105.000	7968.000	8073.000	105.000	ETSI
A63		7989.000	8136.000	147.000	8297.000	8411.000	114.000	ETSI
A67		8297.000	8411.000	114.000	7989.000	8136.000	147.000	ETSI
A64		8073.000	8185.000	112.000	8383.000	8495.000	112.000	ETSI
A68		8383.000	8495.000	112.000	8073.000	8185.000	112.000	ETSI



Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
A91	8050.000	8134.000	84.000	8258.000	8342.000	84.000	ETSI
A95	8258.000	8342.000	84.000	8050.000	8134.000	84.000	ETSI
A92	8106.000	8190.000	84.000	8314.000	8398.000	84.000	ETSI
A96	8314.000	8398.000	84.000	8106.000	8190.000	84.000	ETSI
A93	8162.000	8246.000	84.000	8370.000	8454.000	84.000	ETSI
A97	8370.000	8454.000	84.000	8162.000	8246.000	84.000	ETSI

Sub-band 1x is valid for CS 7, 14, 28/29.65 & 56/59.3 MHz..

Sub-band 2x, 3x, 12x & 13x are valid for 7, 14 & 28/29.65 MHz.

Sub-band 4x & 5x, are valid for CS 7, 14 & 28/29.65 MHz.

Sub-band 6x, 7x, 9x, 10x & 11x are valid for CS 7, 14, 28/29.65 & 56/59.3 MHz.

Sub-band 8x is valid for CS 10, 20, 30, 40 & 50 MHz.

Sub-band A0x (Duplex 148.25 & 148.5 MHz), A2x & A4x (Duplex 119 & 126 MHz) are valid for CS 7, 14 & 28/29.65 MHz.

Sub-band A1x (Duplex 283.5, 310 & 311.32 MHz), A6x (Duplex 266 & 310 MHz) & A9x (Duplex 208 MHz) are valid for CS 7, 14, 28/29.65 & 56/59.3 MHz.

Sub-band A1x (Duplex 300 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	7744.750	7793.750	49.000	7893.000	7942.250	49.250	ETSI
01H	7893.000	7942.250	49.250	7744.750	7793.750	49.000	ETSI
02L	7779.750	7828.750	49.000	7928.000	7977.250	49.250	ETSI
02H	7928.000	7977.250	49.250	7779.750	7828.750	49.000	ETSI
11L	7718.050	7837.000	118.950	8025.000	8147.975	122.975	ETSI/ANSI
11H	8025.000	8147.975	122.975	7718.050	7837.000	118.950	ETSI/ANSI
12L	7777.000	7910.775	133.775	8085.000	8222.100	137.100	ETSI/ANSI
12H	8085.000	8222.100	137.100	7777.000	7910.775	133.775	ETSI/ANSI
14L	7835.000	7970.075	135.075	8135.000	8281.400	146.400	ETSI/ANSI
14H	8135.000	8281.400	146.400	7835.000	7970.075	135.075	ETSI/ANSI
21L	8279.000	8328.000	49.000	8405.000	8450.500	45.500	ETSI
21H	8405.000	8450.500	45.500	8279.000	8328.000	49.000	ETSI
23L	8324.500	8370.000	45.500	8447.000	8492.500	45.500	ETSI
23H	8447.000	8492.500	45.500	8324.500	8370.000	45.500	ETSI
41L	8279.000	8321.000	42.000	8398.000	8440.000	42.000	ETSI
41H	8398.000	8440.000	42.000	8279.000	8321.000	42.000	ETSI
42L	8307.000	8349.000	42.000	8426.000	8475.000	49.000	ETSI
42H	8426.000	8475.000	49.000	8307.000	8349.000	42.000	ETSI
43L	8328.000	8377.000	49.000	8454.000	8496.000	42.000	ETSI
43H	8454.000	8496.000	42.000	8328.000	8377.000	49.000	ETSI
61L	7905.000	8017.000	112.000	8171.000	8327.000	156.000	ETSI
61H	8171.000	8327.000	156.000	7905.000	8017.000	112.000	ETSI
62L	7968.000	8073.000	105.000	8234.000	8339.000	105.000	ETSI
62H	8234.000	8339.000	105.000	7968.000	8073.000	105.000	ETSI
63L	7989.000	8136.000	147.000	8290.000	8411.000	121.000	ETSI
63H	8290.000	8411.000	121.000	7989.000	8136.000	147.000	ETSI
64L	8073.000	8185.000	112.000	8383.000	8495.000	112.000	ETSI
64H	8383.000	8495.000	112.000	8073.000	8185.000	112.000	ETSI



Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
91L	8050.000	8134.000	84.000	8258.000	8342.000	84.000	ETSI
91H	8258.000	8342.000	84.000	8050.000	8134.000	84.000	ETSI
92L	8106.000	8190.000	84.000	8314.000	8398.000	84.000	ETSI
92H	8314.000	8398.000	84.000	8106.000	8190.000	84.000	ETSI
93L	8162.000	8246.000	84.000	8370.000	8454.000	84.000	ETSI
93H	8370.000	8454.000	84.000	8162.000	8246.000	84.000	ETSI

Sub-band 0xL/H (Duplex 148.25 & 148.5 MHz), 2xL/H & 4xL/H (Duplex 119 & 126 MHz) are valid for CS 7, 14 & 28/29.65 MHz.

Sub-band 1xL/H (Duplex 283.5, 310 & 311.32 MHz), 6xL/H (Duplex 266 & 310 MHz) & 9xL/H (Duplex 208 MHz) are valid for CS 7, 14, 28/29.65 & 56/59.3 MHz.

Sub-band 1xL/H (Duplex 300 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

5.3.9 10 GHz Band

RAU2 X 10 [HP]

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard	
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)		
11	65	10550.00	10570.00	20.00	10615.00	10635.00	20.00	ANSI
15	65	10615.00	10635.00	20.00	10550.00	10570.00	20.00	ANSI
12	65	10565.00	10585.00	20.00	10630.00	10650.00	20.00	ANSI
16	65	10630.00	10650.00	20.00	10565.00	10585.00	20.00	ANSI
13	65	10580.00	10600.00	20.00	10645.00	10665.00	20.00	ANSI
17	65	10645.00	10665.00	20.00	10580.00	10600.00	20.00	ANSI
14	65	10595.00	10615.00	20.00	10660.00	10680.00	20.00	ANSI
18	65	10660.00	10680.00	20.00	10595.00	10615.00	20.00	ANSI
21	91	10500.50	10528.50	28.00	10591.50	10619.50	28.00	ETSI
25	91	10591.50	10619.50	28.00	10500.50	10528.50	28.00	ETSI
22	91	10528.50	10556.50	28.00	10619.50	10647.50	28.00	ETSI
26	91	10619.50	10647.50	28.00	10528.50	10556.50	28.00	ETSI
23	91	10556.50	10584.50	28.00	10647.50	10675.50	28.00	ETSI
27	91	10647.50	10675.50	28.00	10556.50	10584.50	28.00	ETSI
31	350	10125.00	10300.00	175.00	10475.00	10650.00	175.00	ETSI
35	350	10475.00	10650.00	175.00	10125.00	10300.00	175.00	ETSI
41	168	10308.00	10420.00	112.00	10476.00	10588.00	112.00	ETSI
45	168	10476.00	10588.00	112.00	10308.00	10420.00	112.00	ETSI
51	350	10130.00	10186.00	56.00	10480.00	10536.00	56.00	ETSI
55	350	10480.00	10536.00	56.00	10130.00	10186.00	56.00	ETSI
52	350	10144.00	10200.00	56.00	10494.00	10550.00	56.00	ETSI
56	350	10494.00	10550.00	56.00	10144.00	10200.00	56.00	ETSI
71	350	10000.00	10189.00	189.00	10350.00	10539.00	189.00	ETSI
75	350	10350.00	10539.00	189.00	10000.00	10189.00	189.00	ETSI
72	350	10125.00	10330.00	205.00	10475.00	10680.00	205.00	ETSI
76	350	10475.00	10680.00	205.00	10125.00	10330.00	205.00	ETSI
A11		10550.00	10570.00	20.00	10615.00	10635.00	20.00	ANSI
A15		10615.00	10635.00	20.00	10550.00	10570.00	20.00	ANSI
A12		10565.00	10585.00	20.00	10630.00	10650.00	20.00	ANSI
A16		10630.00	10650.00	20.00	10565.00	10585.00	20.00	ANSI
A13		10580.00	10600.00	20.00	10645.00	10665.00	20.00	ANSI
A17		10645.00	10665.00	20.00	10580.00	10600.00	20.00	ANSI
A14		10595.00	10615.00	20.00	10660.00	10680.00	20.00	ANSI
A18		10660.00	10680.00	20.00	10595.00	10615.00	20.00	ANSI



Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
A21	10500.50	10528.50	28.00	10591.50	10619.50	28.00	ETSI
A25	10591.50	10619.50	28.00	10500.50	10528.50	28.00	ETSI
A22	10528.50	10556.50	28.00	10619.50	10647.50	28.00	ETSI
A26	10619.50	10647.50	28.00	10528.50	10556.50	28.00	ETSI
A23	10556.50	10584.50	28.00	10647.50	10675.50	28.00	ETSI
A27	10647.50	10675.50	28.00	10556.50	10584.50	28.00	ETSI
A41	10308.00	10420.00	112.00	10476.00	10588.00	112.00	ETSI
A45	10476.00	10588.00	112.00	10308.00	10420.00	112.00	ETSI
A51	10130.00	10186.00	56.00	10480.00	10536.00	56.00	ETSI
A55	10480.00	10536.00	56.00	10130.00	10186.00	56.00	ETSI
A52	10144.00	10200.00	56.00	10494.00	10550.00	56.00	ETSI
A56	10494.00	10550.00	56.00	10144.00	10200.00	56.00	ETSI
A71	10000.00	10189.00	189.00	10350.00	10539.00	189.00	ETSI
A75	10350.00	10539.00	189.00	10000.00	10189.00	189.00	ETSI
A72	10125.00	10330.00	205.00	10475.00	10680.00	205.00	ETSI
A76	10475.00	10680.00	205.00	10125.00	10330.00	205.00	ETSI

Sub-band 1x is valid for CS 10 & 20 MHz

Sub-band 2x is valid for 7, 14 & 28 MHz.

Sub-band 3x, 4x & 5x are valid for 7, 14, 28 & 56 MHz.

Sub-band A1x (Duplex 65 MHz) is valid for CS 10 & 20 MHz.

Sub-band A2x (Duplex 91 MHz) is valid for CS 7, 14 & 28 MHz.

Sub-band A4x (Duplex 168 MHz), A5x & A7x (Duplex 350 MHz) are valid for CS 7, 14, 28 & 56 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
21L	10500.50	10528.50	28.00	10591.50	10619.50	28.00	ETSI
21H	10591.50	10619.50	28.00	10500.50	10528.50	28.00	ETSI
22L	10528.50	10556.50	28.00	10619.50	10647.50	28.00	ETSI
22H	10619.50	10647.50	28.00	10528.50	10556.50	28.00	ETSI
23L	10556.50	10584.50	28.00	10647.50	10675.50	28.00	ETSI
23H	10647.50	10675.50	28.00	10556.50	10584.50	28.00	ETSI
41L	10308.00	10420.00	112.00	10476.00	10588.00	112.00	ETSI
41H	10476.00	10588.00	112.00	10308.00	10420.00	112.00	ETSI
71L	10000.00	10189.00	189.00	10350.00	10539.00	189.00	ETSI
71H	10350.00	10539.00	189.00	10000.00	10189.00	189.00	ETSI
72L	10125.00	10330.00	205.00	10475.00	10680.00	205.00	ETSI
72H	10475.00	10680.00	205.00	10125.00	10330.00	205.00	ETSI

Sub-band 2xL/H (Duplex 91 MHz) is valid for CS 7, 14 & 28 MHz.

Sub-band 4xL/H (Duplex 168 MHz) & 7xL/H (Duplex 350 MHz) are valid for CS 7, 14, 28 & 56 MHz.



5.3.10 11 GHz Band

RAU2 X 11 [HP]

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11 530	10695.00	10855.00	160.00	11225.00	11385.00	160.00	ETSI
15 530	11225.00	11385.00	160.00	10695.00	10855.00	160.00	ETSI
12 530	10835.00	11035.00	200.00	11365.00	11565.00	200.00	ETSI
16 530	11365.00	11565.00	200.00	10835.00	11035.00	200.00	ETSI
13 530	11015.00	11175.00	160.00	11545.00	11705.00	160.00	ETSI
17 530	11545.00	11705.00	160.00	11015.00	11175.00	160.00	ETSI
21 490	10695.00	10875.00	180.00	11185.00	11365.00	180.00	ETSI/ANSI
25 490	11185.00	11365.00	180.00	10695.00	10875.00	180.00	ETSI/ANSI
22 490	10855.00	11055.00	200.00	11345.00	11545.00	200.00	ETSI/ANSI
26 490	11345.00	11545.00	200.00	10855.00	11055.00	200.00	ETSI/ANSI
23 490	11035.00	11195.00	160.00	11525.00	11685.00	160.00	ETSI/ANSI
27 490	11525.00	11685.00	160.00	11035.00	11195.00	160.00	ETSI/ANSI
A01	10695.00	10875.00	180.00	11185.00	11385.00	200.00	ETSI/ANSI
A05	11185.00	11385.00	200.00	10695.00	10875.00	180.00	ETSI/ANSI
A02	10835.00	11055.00	220.00	11345.00	11565.00	220.00	ETSI/ANSI
A06	11345.00	11565.00	220.00	10835.00	11055.00	220.00	ETSI/ANSI
A03	11015.00	11200.00	185.00	11525.00	11705.00	180.00	ETSI/ANSI
A07	11525.00	11705.00	180.00	11015.00	11200.00	185.00	ETSI/ANSI

Sub-band 1x and 2x are valid for 7, 14, 28, 40 & 56 MHz.

Sub-band 2x is valid for CS 10, 20, 30, 40 & 50 MHz.

Sub-band A0x (Duplex 490 & 530 MHz) is valid for CS 7, 14, 28, 40 & 56 MHz.

Sub-band A0x (Duplex 490 & 500 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	10695.00	10877.00	182.00	11185.00	11385.00	200.00	ETSI/ANSI
01H	11185.00	11385.00	200.00	10695.00	10877.00	182.00	ETSI/ANSI
02L	10835.00	11055.00	220.00	11345.00	11565.00	220.00	ETSI/ANSI
02H	11345.00	11565.00	220.00	10835.00	11055.00	220.00	ETSI/ANSI
03L	11015.00	11200.00	185.00	11525.00	11705.00	180.00	ETSI/ANSI
03H	11525.00	11705.00	180.00	11015.00	11200.00	185.00	ETSI/ANSI

Sub-band 0xL/H (Duplex 490 & 530 MHz) is valid for CS 7, 14, 28, 40 & 56 MHz.

Sub-band 0xL/H (Duplex 490 & 500 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
51L	10715.00	10755.00	40.00	11245.00	11285.00	40.00	Japan
51H	11245.00	11285.00	40.00	10715.00	10755.00	40.00	Japan
52L	10755.00	10795.00	40.00	11285.00	11325.00	40.00	Japan
52H	11285.00	11325.00	40.00	10755.00	10795.00	40.00	Japan
53L	10795.00	10835.00	40.00	11325.00	11365.00	40.00	Japan
53H	11325.00	11365.00	40.00	10795.00	10835.00	40.00	Japan



Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
54L	10835.00	10875.00	40.00	11365.00	11405.00	40.00	Japan
54H	11365.00	11405.00	40.00	10835.00	10875.00	40.00	Japan
55L	10875.00	10915.00	40.00	11405.00	11445.00	40.00	Japan
55H	11405.00	11445.00	40.00	10875.00	10915.00	40.00	Japan
56L	10915.00	10955.00	40.00	11445.00	11485.00	40.00	Japan
56H	11445.00	11485.00	40.00	10915.00	10955.00	40.00	Japan

Sub-band 5xL/H (Duplex 530 MHz) is valid for CS 40MHz.



5.3.11 13 GHz Band

RAU2 X 13 [HP]

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11 266	12751.00	12835.00	84.00	13017.00	13101.00	84.00	ETSI/ANSI
15 266	13017.00	13101.00	84.00	12751.00	12835.00	84.00	ETSI/ANSI
12 266	12821.00	12905.00	84.00	13087.00	13171.00	84.00	ETSI/ANSI
16 266	13087.00	13171.00	84.00	12821.00	12905.00	84.00	ETSI/ANSI
13 266	12891.00	12975.00	84.00	13157.00	13241.00	84.00	ETSI/ANSI
17 266	13157.00	13241.00	84.00	12891.00	12975.00	84.00	ETSI/ANSI
14 266	12863.00	12919.00	56.00	13129.00	13185.00	56.00	ETSI/ANSI
18 266	13129.00	13185.00	56.00	12863.00	12919.00	56.00	ETSI/ANSI
42 266	12807.00	12891.00	84.00	13073.000	13157.000	84.00	ETSI/ANSI
46 266	13073.00	13157.00	84.00	12807.000	12891.000	84.00	ETSI/ANSI
A01	12751.00	12863.00	112.00	13017.00	13129.00	112.00	ETSI/ANSI
A05	13017.00	13129.00	112.00	12751.00	12863.00	112.00	ETSI/ANSI
A02	12807.00	12905.00	98.00	13073.00	13171.00	98.00	ETSI/ANSI
A06	13073.00	13171.00	98.00	12807.00	12905.00	98.00	ETSI/ANSI
A03	12863.00	12975.00	112.00	13129.00	13241.00	112.00	ETSI/ANSI
A07	13129.00	13241.00	112.00	12863.00	12975.00	112.00	ETSI/ANSI

Note: FCC part 101.147(p)(2) frequency range begins at 12700.00 MHz.
 Sub-band 1x & 4x are valid for 7, 14, 28 & 56 MHz.
 Sub-band 1x & 4x are valid for CS 10, 20, 30, 40 & 50 MHz.
 Sub-band A0x (Duplex 266 MHz) is valid for 7, 14, 28 & 56 MHz.
 Sub-band A0x (Duplex 225 & 266 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.
 For RAU2 X/Xu 13 [HP] CS=12.5 MHz and 25 MHz (10 MHz in a 12.5 MHz CS and 20 MHz in a 25 MHz CS) are supported.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	12751.00	12900.00	149.00	13017.00	13157.00	140.00	ETSI/ANSI
01H	13017.00	13157.00	140.00	12751.00	12900.00	149.00	ETSI/ANSI
03L	12863.00	12975.00	112.00	13129.00	13241.00	112.00	ETSI/ANSI
03H	13129.00	13241.00	112.00	12863.00	12975.00	112.00	ETSI/ANSI

Note: FCC part 101.147(p)(2) frequency range begins at 12700.00 MHz.
 Sub-band 0xL/H (Duplex 266 MHz) is valid for 7, 14, 28 & 56 MHz.
 Sub-band 0xL/H (Duplex 225 & 266 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
A01L	12751.00	12919.00	168.00	13017.00	13185.00	168.00	ETSI/ANSI
A01H	13017.00	13185.00	168.00	12751.00	12919.00	168.00	ETSI/ANSI
A03L	12863.00	12975.00	112.00	13125.00	13241.00	116.00	ETSI/ANSI
A03H	13125.00	13241.00	116.00	12863.00	12975.00	112.00	ETSI/ANSI

Note: FCC part 101.147(p)(2) frequency range begins at 12700.00 MHz.
 Sub-band A0xL/H (Duplex 266 MHz) is valid for 7, 14, 28 & 56 MHz.
 Sub-band A0xL/H (Duplex 225 & 266 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.



5.3.12 15 GHz Band

RAU2 X 15 [HP]

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard	
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)		
11	735	14499.25	14613.00	113.75	15234.25	15348.00	113.75	ETSI
18	735	15234.25	15348.00	113.75	14499.25	14613.00	113.75	ETSI
12	315	14604.25	14732.00	127.75	14919.25	15047.00	127.75	ETSI
15	315	14919.25	15047.00	127.75	14604.25	14732.00	127.75	ETSI
13	315	14709.25	14828.50	119.25	15024.25	15143.50	119.25	ETSI
16	315	15024.25	15143.50	119.25	14709.25	14828.50	119.25	ETSI
14	315	14814.25	14933.50	119.25	15129.25	15248.50	119.25	ETSI
17	315	15129.25	15248.50	119.25	14814.25	14933.50	119.25	ETSI
21	420	14495.75	14620.00	124.25	14915.75	15040.00	124.25	ETSI
25	420	14915.75	15040.00	124.25	14495.75	14620.00	124.25	ETSI
22	420	14607.75	14732.00	124.25	15027.75	15152.00	124.25	ETSI
26	420	15027.75	15152.00	124.25	14607.75	14732.00	124.25	ETSI
23	420	14719.75	14837.00	117.25	15139.75	15257.00	117.25	ETSI
27	420	15139.75	15257.00	117.25	14719.75	14837.00	117.25	ETSI
24	420	14817.75	14928.00	110.25	15237.75	15348.00	110.25	ETSI
28	420	15237.75	15348.00	110.25	14817.75	14928.00	110.25	ETSI
43	644	14495.75	14700.50	204.75	15139.75	15344.50	204.75	ETSI
49	644	15139.75	15344.50	204.75	14495.75	14700.50	204.75	ETSI
51	475	14700.00	14800.00	100.00	15175.00	15275.00	100.00	ANSI
53	475	15175.00	15275.00	100.00	14700.00	14800.00	100.00	ANSI
52	475	14775.00	14875.00	100.00	15250.00	15350.00	100.00	ANSI
54	475	15250.00	15350.00	100.00	14775.00	14875.00	100.00	ANSI
55	475	14500.00	14620.00	120.00	14975.00	15095.00	120.00	ANSI
57	475	14975.00	15095.00	120.00	14500.00	14620.00	120.00	ANSI
56	475	14600.00	14720.00	120.00	15075.00	15195.00	120.00	ANSI
58	475	15075.00	15195.00	120.00	14600.00	14720.00	120.00	ANSI
61	728	14495.75	14620.00	124.25	15223.75	15348.00	124.25	ETSI
68	728	15223.75	15348.00	124.25	14495.75	14620.00	124.25	ETSI
62	308	14614.75	14735.50	120.75	14922.75	15043.50	120.75	ETSI
65	308	14922.75	15043.50	120.75	14614.75	14735.50	120.75	ETSI
63	308	14698.75	14819.50	120.75	15006.75	15127.50	120.75	ETSI
66	308	15006.75	15127.50	120.75	14698.75	14819.50	120.75	ETSI
64	308	14810.75	14931.50	120.75	15118.75	15239.50	120.75	ETSI
67	308	15118.75	15239.50	120.75	14810.75	14931.50	120.75	ETSI
80	490	14397.75	14522.00	124.25	14887.75	15012.00	124.25	ETSI
85	490	14887.75	15012.00	124.25	14397.75	14522.00	124.25	ETSI
81	490	14481.75	14606.00	124.25	14971.75	15096.00	124.25	ETSI
86	490	14971.75	15096.00	124.25	14481.75	14606.00	124.25	ETSI
82	490	14565.75	14690.00	124.25	15055.75	15180.00	124.25	ETSI
87	490	15055.75	15180.00	124.25	14565.75	14690.00	124.25	ETSI
83	490	14649.75	14774.00	124.25	15139.75	15264.00	124.25	ETSI
88	490	15139.75	15264.00	124.25	14649.75	14774.00	124.25	ETSI
84	490	14733.75	14858.00	124.25	15223.75	15348.00	124.25	ETSI
89	490	15223.75	15348.00	124.25	14733.75	14858.00	124.25	ETSI
92	322	14627.00	14739.00	112.00	14949.00	15061.00	112.00	ETSI
95	322	14949.00	15061.00	112.00	14627.00	14739.00	112.00	ETSI
93	322	14711.00	14823.00	112.00	15033.00	15145.00	112.00	ETSI
96	322	15033.00	15145.00	112.00	14711.00	14823.00	112.00	ETSI
94	322	14795.00	14907.00	112.00	15117.00	15229.00	112.00	ETSI
97	322	15117.00	15229.00	112.00	14795.00	14907.00	112.00	ETSI



Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
A01	14495.75	14774.00	278.25	15055.75	15348.00	292.25	ETSI
A05	15055.75	15348.00	292.25	14495.75	14774.00	278.25	ETSI
A02	14604.25	14739.00	134.75	14919.25	15061.00	141.75	ETSI
A06	14919.25	15061.00	141.75	14604.25	14739.00	134.75	ETSI
A03	14698.75	14828.50	129.75	15006.75	15145.00	138.25	ETSI
A07	15006.75	15145.00	138.25	14698.75	14828.50	129.75	ETSI
A04	14795.00	14933.50	138.50	15117.00	15248.50	131.50	ETSI
A08	15117.00	15248.50	131.50	14795.00	14933.50	138.50	ETSI
A11	14397.75	14660.00	262.25	14887.75	15130.00	242.25	ETSI/ANSI
A15	14887.75	15130.00	242.25	14397.75	14660.00	262.25	ETSI/ANSI
A12	14600.00	14732.00	132.00	15027.75	15195.00	167.25	ETSI/ANSI
A16	15027.75	15195.00	167.25	14600.00	14732.00	132.00	ETSI/ANSI
A13	14700.00	14928.00	228.00	15139.75	15350.00	210.25	ETSI/ANSI
A17	15139.75	15350.00	210.25	14700.00	14928.00	228.00	ETSI/ANSI

Sub-band 1x, 2x, 6x, 8 & 9x are valid for CS 7, 14, 28 & 56 MHz.

Sub-band 5x are valid for CS 10, 20, 30, 40 & 50 MHz.

Sub-band A0x (Duplex 308, 315, 322, 490, 644, 728 & 735 MHz) & A1x (Duplex 420, 470 & 490 MHz) are valid for CS 7, 14, 28 & 56 MHz.

Sub-band A1x (Duplex 420, 470 & 490 MHz) are valid for CS 7, 14, 28 & 56 MHz.

Sub-band A1x (Duplex 475 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	14495.75	14774.00	278.25	15055.75	15348.00	292.25	ETSI
01H	15055.75	15348.00	292.25	14495.75	14774.00	278.25	ETSI
02L	14604.25	14739.00	134.75	14919.25	15061.00	141.75	ETSI
02H	14919.25	15061.00	141.75	14604.25	14739.00	134.75	ETSI
03L	14698.75	14828.50	129.75	15006.75	15145.00	138.25	ETSI
03H	15006.75	15145.00	138.25	14698.75	14828.50	129.75	ETSI
04L	14795.00	14933.50	138.50	15117.00	15248.50	131.50	ETSI
04H	15117.00	15248.50	131.50	14795.00	14933.50	138.50	ETSI
11L	14397.75	14660.00	262.25	14887.75	15130.00	242.25	ETSI/ANSI
11H	14887.75	15130.00	242.25	14397.75	14660.00	262.25	ETSI/ANSI
12L	14501.00	14732.00	231.00	14921.00	15195.00	274.00	ETSI/ANSI
12H	14921.00	15195.00	274.00	14501.00	14732.00	231.00	ETSI/ANSI
13L	14700.00	14928.00	228.00	15139.75	15350.00	210.25	ETSI/ANSI
13H	15139.75	15350.00	210.25	14700.00	14928.00	228.00	ETSI/ANSI

Sub-band 0xL/H (Duplex 308, 315, 322, 490, 644, 728 & 735 MHz) is valid for CS 7, 14, 28 & 56 MHz.

Sub-band 1xL/H (Duplex 420, 470 & 490 MHz) is valid for CS 7, 14, 28 & 56 MHz.

Sub-band 1xL/H (Duplex 475 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.



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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	14495.75	14774.00	278.25	15055.75	15348.00	292.25	ETSI
01H	15055.75	15348.00	292.25	14495.75	14774.00	278.25	ETSI
02L	14604.25	14739.00	134.75	14919.25	15061.00	141.75	ETSI
02H	14919.25	15061.00	141.75	14604.25	14739.00	134.75	ETSI
03L	14698.75	14828.50	129.75	15006.75	15145.00	138.25	ETSI
03H	15006.75	15145.00	138.25	14698.75	14828.50	129.75	ETSI
04L	14795.00	14933.50	138.50	15117.00	15248.50	131.50	ETSI
04H	15117.00	15248.50	131.50	14795.00	14933.50	138.50	ETSI
11L	14397.75	14660.00	262.25	14887.75	15130.00	242.25	ETSI/ANSI
11H	14887.75	15130.00	242.25	14397.75	14660.00	262.25	ETSI/ANSI
12L	14600.00	14732.00	132.00	15027.75	15195.00	167.25	ETSI/ANSI
12H	15027.75	15195.00	167.25	14600.00	14732.00	132.00	ETSI/ANSI
13L	14700.00	14928.00	228.00	15139.75	15350.00	210.25	ETSI/ANSI
13H	15139.75	15350.00	210.25	14700.00	14928.00	228.00	ETSI/ANSI

Sub-band 0xL/H (Duplex 308, 315, 322, 490, 644, 728 & 735 MHz) is valid for CS 7, 14, 28 & 56 MHz.

Sub-band 1xL/H (Duplex 420, 470 & 490 MHz) is valid for CS 7, 14, 28 & 56 MHz.

Sub-band 1xL/H (Duplex 475 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.



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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
51L	14500.00	14540.00	40.00	14970.00	15010.00	40.00	Japan
51H	14970.00	15010.00	40.00	14500.00	14540.00	40.00	Japan
52L	14540.00	14580.00	40.00	15010.00	15050.00	40.00	Japan
52H	15010.00	15050.00	40.00	14540.00	14580.00	40.00	Japan
53L	14580.00	14620.00	40.00	15050.00	15090.00	40.00	Japan
53H	15050.00	15090.00	40.00	14580.00	14620.00	40.00	Japan
54L	14620.00	14660.00	40.00	15090.00	15130.00	40.00	Japan
54H	15090.00	15130.00	40.00	14620.00	14660.00	40.00	Japan

Sub-band 5xL/H (Duplex 470 MHz) is valid for CS 40 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
A01L	14495.75	14781.00	285.25	15055.75	15348.00	292.25	ETSI
A01H	15055.75	15348.00	292.25	14495.75	14781.00	285.25	ETSI
A11L	14397.75	14669.00	271.25	14865.00	15135.00	270.00	ETSI/ANSI
A11H	14865.00	15135.00	270.00	14397.75	14669.00	271.25	ETSI/ANSI
A12L	14501.00	14739.00	238.00	14919.25	15229.00	309.75	ETSI/ANSI
A12H	14919.25	15229.00	309.75	14501.00	14739.00	238.00	ETSI/ANSI
A13L	14700.00	14933.50	233.50	15117.00	15350.00	233.00	ETSI/ANSI
A13H	15117.00	15350.00	233.00	14700.00	14933.50	233.50	ETSI/ANSI
A21L	14698.75	14828.50	129.75	15006.75	15145.00	138.25	ETSI
A21H	15006.75	15145.00	138.25	14698.75	14828.50	129.75	ETSI

Sub-band A0xL/H (Duplex 490 & 735 MHz) is valid for CS 7, 14, 28, 56 & 112MHz.

Sub-band A1xL/H (Duplex 420, 470 & 490 MHz) is valid for CS 7, 14, 28, 56 & 112MHz.

Sub-band A1xL/H (Duplex 475 MHz) is valid for CS 10, 20, 30, 40, 50, 60 & 80MHz.

5.3.13 18 GHz Band

RAU2 X 18 [HP]

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard	
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)		
11	1010	17706.50	18009.50	303.00	18716.50	19019.50	303.00	ETSI
15	1010	18716.50	19019.50	303.00	17706.50	18009.50	303.00	ETSI
12	1010	17933.50	18236.50	303.00	18943.50	19246.50	303.00	ETSI
16	1010	18943.50	19246.50	303.00	17933.50	18236.50	303.00	ETSI
13	1010	18153.50	18456.50	303.00	19163.50	19466.50	303.00	ETSI
17	1010	19163.50	19466.50	303.00	18153.50	18456.50	303.00	ETSI
14	1010	18373.50	18676.50	303.00	19383.50	19686.50	303.00	ETSI
18	1010	19383.50	19686.50	303.00	18373.50	18676.50	303.00	ETSI
21	340	18580.00	18670.00	90.00	18920.00	19010.00	90.00	ANSI
25	340	18920.00	19010.00	90.00	18580.00	18670.00	90.00	ANSI
22	340	18655.00	18745.00	90.00	18995.00	19085.00	90.00	ANSI
26	340	18995.00	19085.00	90.00	18655.00	18745.00	90.00	ANSI
23	340	18730.00	18830.00	100.00	19070.00	19170.00	100.00	ANSI
27	340	19070.00	19170.00	100.00	18730.00	18830.00	100.00	ANSI
24	340	18820.00	18920.00	100.00	19160.00	19260.00	100.00	ANSI
28	340	19160.00	19260.00	100.00	18820.00	18920.00	100.00	ANSI



Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard	
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)		
31	1560	17700.00	18003.00	303.00	19260.00	19563.00	303.00	ANSI
35	1560	19260.00	19563.00	303.00	17700.00	18003.00	303.00	ANSI
32	1560	17837.00	18140.00	303.00	19397.00	19700.00	303.00	ANSI
36	1560	19397.00	19700.00	303.00	17837.00	18140.00	303.00	ANSI
41	1008	17720.50	18009.50	289.00	18728.50	19017.50	289.00	ETSI
45	1008	18728.50	19017.50	289.00	17720.50	18009.50	289.00	ETSI
42	1008	17935.50	18236.50	301.00	18943.50	19244.50	301.00	ETSI
46	1008	18943.50	19244.50	301.00	17935.50	18236.50	301.00	ETSI
43	1008	18155.50	18456.50	301.00	19163.50	19464.50	301.00	ETSI
47	1008	19163.50	19464.50	301.00	18155.50	18456.50	301.00	ETSI
44	1008	18375.50	18672.50	297.00	19383.50	19680.50	297.00	ETSI
48	1008	19383.50	19680.50	297.00	18375.50	18672.50	297.00	ETSI
71	1010	17706.50	18009.50	303.00	18716.50	19019.50	303.00	ETSI
75	1010	18716.50	19019.50	303.00	17706.50	18009.50	303.00	ETSI
72	1010	17933.50	18236.50	303.00	18943.50	19246.50	303.00	ETSI
76	1010	18943.50	19246.50	303.00	17933.50	18236.50	303.00	ETSI
73	1010	18153.50	18456.50	303.00	19163.50	19466.50	303.00	ETSI
77	1010	19163.50	19466.50	303.00	18153.50	18456.50	303.00	ETSI
74	1010	18373.50	18676.50	303.00	19383.50	19686.50	303.00	ETSI
78	1010	19383.50	19686.50	303.00	18373.50	18676.50	303.00	ETSI
A11		17706.50	18236.50	530.00	18600.00	19246.50	646.50	ANSI
A15		18600.00	19246.50	646.50	17706.50	18236.50	530.00	ANSI
A13		18002.25	18676.50	674.25	19094.75	19686.50	591.75	ANSI
A17		19094.75	19686.50	591.75	18002.25	18676.50	674.25	ANSI
A21		18580.00	18670.00	90.00	18920.00	19010.00	90.00	ANSI
A25		18920.00	19010.00	90.00	18580.00	18670.00	90.00	ANSI
A22		18655.00	18745.00	90.00	18995.00	19085.00	90.00	ANSI
A26		18995.00	19085.00	90.00	18655.00	18745.00	90.00	ANSI
A23		18730.00	18830.00	100.00	19070.00	19170.00	100.00	ANSI
A27		19070.00	19170.00	100.00	18730.00	18830.00	100.00	ANSI
A24		18820.00	18920.00	100.00	19160.00	19260.00	100.00	ANSI
A28		19160.00	19260.00	100.00	18820.00	18920.00	100.00	ANSI
A31		17700.00	18140.00	440.00	19260.00	19700.00	440.00	ANSI
A35		19260.00	19700.00	440.00	17700.00	18140.00	440.00	ANSI

Sub-band 1x, 4x & 7x are valid for CS 7, 13.75/14, 27.5/28 & 55/56 MHz.

Sub-band 2x, 3x are valid for CS 7, 13.75/14, 27.5/28 & 55/56 MHz.

Sub-band 2x & 3x are valid for CS 10, 20, 30, 40 & 50 MHz.

Sub-band A1x (Duplex 1008 & 1010 MHz), A2x (Duplex 340 MHz) & A3x (Duplex 1560 MHz) are valid for CS 7, 13.75/14, 27.5/28 & 55/56 MHz.

Sub-band A1x (Duplex 1160 MHz), A2x (Duplex 340 MHz) & A3x (Duplex 1560 MHz) are valid for CS 10, 20, 30, 40 & 50 MHz.



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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11L	17706.50	18236.50	530.00	18600.00	19246.50	646.50	ETSI/ANSI
11H	18600.00	19246.50	646.50	17706.50	18236.50	530.00	ETSI/ANSI
13L	18002.25	18676.50	674.25	19094.75	19686.50	591.75	ETSI/ANSI
13H	19094.75	19686.50	591.75	18002.25	18676.50	674.25	ETSI/ANSI
21L	18580.00	18670.00	90.00	18920.00	19010.00	90.00	ETSI/ANSI
21H	18920.00	19010.00	90.00	18580.00	18670.00	90.00	ETSI/ANSI
22L	18655.00	18745.00	90.00	18995.00	19085.00	90.00	ETSI/ANSI
22H	18995.00	19085.00	90.00	18655.00	18745.00	90.00	ETSI/ANSI
23L	18730.00	18830.00	100.00	19070.00	19170.00	100.00	ETSI/ANSI
23H	19070.00	19170.00	100.00	18730.00	18830.00	100.00	ETSI/ANSI
24L	18820.00	18920.00	100.00	19160.00	19260.00	100.00	ETSI/ANSI
24H	19160.00	19260.00	100.00	18820.00	18920.00	100.00	ETSI/ANSI
31L	17700.00	18140.00	440.00	19260.00	19700.00	440.00	ETSI/ANSI
31H	19260.00	19700.00	440.00	17700.00	18140.00	440.00	ETSI/ANSI

Sub-band 1xL/H (Duplex 1008 & 1010 MHz), 2xL/H (Duplex 340 MHz) & 3xL/H (Duplex 1560 MHz) are valid for CS 7, 13.75/14, 27.5/28, 55/56 & 110/112MHz.

Sub-band 1xL/H (Duplex 1160 MHz), 2xL/H (Duplex 340 MHz) & 3xL/H (Duplex 1560 MHz) are valid for CS 10, 20, 30, 40, 50, 60 & 80 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
51L	17850.00	17890.00	40.00	18600.00	18640.00	40.00	Japan
51H	18600.00	18640.00	40.00	17850.00	17890.00	40.00	Japan
52L	17890.00	17930.00	40.00	18640.00	18680.00	40.00	Japan
52H	18640.00	18680.00	40.00	17890.00	17930.00	40.00	Japan
53L	17930.00	17970.00	40.00	18680.00	18720.00	40.00	Japan
53H	18680.00	18720.00	40.00	17930.00	17970.00	40.00	Japan

Sub-band 5xL/H (Duplex 750 MHz) are valid for CS 40 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
A11L	17700.00	18236.50	536.50	18590.00	19260.00	670.00	ETSI/ANSI
A11H	18590.00	19260.00	670.00	17700.00	18236.50	536.50	ETSI/ANSI
A13L	18002.25	18690.00	687.75	19081.25	19700.00	618.75	ETSI/ANSI
A13H	19081.25	19700.00	618.75	18002.25	18690.00	687.75	ETSI/ANSI
A21L	18580.00	18745.00	165.00	18920.00	19085.00	165.00	ETSI/ANSI
A21H	18920.00	19085.00	165.00	18580.00	18745.00	165.00	ETSI/ANSI
A23L	18730.00	18920.00	190.00	19070.00	19260.00	190.00	ETSI/ANSI
A23H	19070.00	19260.00	190.00	18730.00	18920.00	190.00	ETSI/ANSI
A31L	17700.00	18140.00	440.00	19260.00	19700.00	440.00	ETSI/ANSI
A31H	19260.00	19700.00	440.00	17700.00	18140.00	440.00	ETSI/ANSI

Sub-band A1xL/H (Duplex 1010 MHz) & A3xL/H (Duplex 1560 MHz) are valid for CS 7, 13.75/14, 27.5/28, 55/56 & 110/112MHz.

Sub-band A1xL/H (Duplex 1160 MHz) & A3xL/H (Duplex 1560MHz) are valid for CS 10, 20, 30, 40, 50, 60 & 80MHz.



5.3.14 23 GHz Band

RAU2 X 23 [HP]

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard	
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)		
72	1008	22100.00	22400.00	300.00	23108.00	23408.00	300.00	ETSI
73	1008	23108.00	23408.00	300.00	22100.00	22400.00	300.00	ETSI
74	1008	22217.75	22540.25	322.50	23225.75	23548.25	322.50	ETSI
75	1008	23225.75	23548.25	322.50	22217.75	22540.25	322.50	ETSI
76	1008	22002.75	22316.25	313.50	23010.75	23324.25	313.50	ETSI
78	1008	23010.75	23324.25	313.50	22002.75	22316.25	313.50	ETSI
77	1008	22274.00	22590.75	316.75	23282.00	23598.75	316.75	ETSI
79	1008	23282.00	23598.75	316.75	22274.00	22590.75	316.75	ETSI
81	1200	21218.25	21523.25	305.00	22418.25	22723.25	305.00	ETSI/ANSI
85	1200	22418.25	22723.25	305.00	21218.25	21523.25	305.00	ETSI/ANSI
82	1200	21494.75	21824.75	330.00	22694.75	23024.75	330.00	ETSI/ANSI
86	1200	22694.75	23024.75	330.00	21494.75	21824.75	330.00	ETSI/ANSI
83	1200	21796.25	22145.25	349.00	22996.25	23345.25	349.00	ETSI/ANSI
87	1200	22996.25	23345.25	349.00	21796.25	22145.25	349.00	ETSI/ANSI
84	1200	22094.75	22400.00	305.25	23294.75	23600.00	305.25	ETSI/ANSI
88	1200	23294.75	23600.00	305.25	22094.75	22400.00	305.25	ETSI/ANSI
91	1232	21224.00	21532.25	308.25	22456.00	22764.25	308.25	ETSI/ANSI
95	1232	22456.00	22764.25	308.25	21224.00	21532.25	308.25	ETSI/ANSI
92	1232	21503.75	21812.25	308.50	22735.75	23044.25	308.50	ETSI/ANSI
96	1232	22735.75	23044.25	308.50	21503.75	21812.25	308.50	ETSI/ANSI
93	1232	21784.00	22092.25	308.25	23016.00	23324.25	308.25	ETSI/ANSI
97	1232	23016.00	23324.25	308.25	21784.00	22092.25	308.25	ETSI/ANSI
94	1232	22049.75	22363.25	313.50	23281.75	23595.25	313.50	ETSI/ANSI
98	1232	23281.75	23595.25	313.50	22049.75	22363.25	313.50	ETSI/ANSI
101	1050	21950.25	22263.75	313.50	23000.25	23313.75	313.50	ETSI
103	1050	23000.25	23313.75	313.50	21950.25	22263.75	313.50	ETSI
102	1050	22235.25	22538.25	303.00	23285.25	23588.25	303.00	ETSI
104	1050	23285.25	23588.25	303.00	22235.25	22538.25	303.00	ETSI
111	1200	21200.00	21523.25	323.25	22400.00	22723.25	323.25	ETSI
115	1200	22400.00	22723.25	323.25	21200.00	21523.25	323.25	ETSI
A01		21200.00	21824.75	624.75	22400.00	23044.25	644.25	ETSI/ANSI
A05		22400.00	23044.25	644.25	21200.00	21824.75	624.75	ETSI/ANSI
A02		21784.00	22600.00	816.00	22996.25	23600.00	603.75	ETSI/ANSI
A06		22996.25	23600.00	603.75	21784.00	22600.00	816.00	ETSI/ANSI

Sub-band 7x, 8x, 9x, 10x & 11x are valid for CS 7, 14, 28 & 56 MHz.

Sub-band 8x & 9x are valid for CS 10, 20, 30, 40 & 50 MHz.

Sub-band A0x (Duplex 1008, 1050, 1200 & 1232 MHz) is valid for CS 7, 14, 28 & 56 MHz.

Sub-band A0x (Duplex 1200 & 1232 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.



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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	21200.00	21824.75	624.75	22400.00	23044.25	644.25	ETSI/ANSI
01H	22400.00	23044.25	644.25	21200.00	21824.75	624.75	ETSI/ANSI
02L	21784.00	22600.00	816.00	22996.25	23600.00	603.75	ETSI/ANSI
02H	22996.25	23600.00	603.75	21784.00	22600.00	816.00	ETSI/ANSI

Sub-band 0xL/H (Duplex 1008, 1050, 1200 & 1232 MHz) is valid for CS 7, 14, 28, 56 & 112 MHz.

Sub-band 0xL/H (Duplex 1200 & 1232 MHz) is valid for CS 10, 20, 30, 40, 50, 60 & 80 MHz.

5.3.15 24 GHz Band

RAU2 X 24

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
41 800	24250.00	24450.00	200.00	25050.00	25250.00	200.00	ANSI
45 800	25050.00	25250.00	200.00	24250.00	24450.00	200.00	ANSI
A41	24250.00	24450.00	200.00	25050.00	25250.00	200.00	ANSI
A45	25050.00	25250.00	200.00	24250.00	24450.00	200.00	ANSI

Sub-band 4x is valid for CS 10, 20, 30, 40 & 50 MHz.

Sub-band A4x (Duplex 800 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
41L	24250.00	24450.00	200.00	25050.00	25250.00	200.00	ANSI
41H	25050.00	25250.00	200.00	24250.00	24450.00	200.00	ANSI

Sub-band 4xL/H (Duplex 800 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

5.3.16 26 GHz Band

RAU2 X 26

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
51 1008	24549.00	24885.00	336.00	25557.00	25893.00	336.00	ETSI
55 1008	25557.00	25893.00	336.00	24549.00	24885.00	336.00	ETSI
52 1008	24829.00	25165.00	336.00	25837.00	26173.00	336.00	ETSI
56 1008	25837.00	26173.00	336.00	24829.00	25165.00	336.00	ETSI
53 1008	25109.00	25445.00	336.00	26117.00	26453.00	336.00	ETSI
57 1008	26117.00	26453.00	336.00	25109.00	25445.00	336.00	ETSI
A01	24549.00	25165.00	616.00	25557.00	26173.00	616.00	ETSI
A05	25557.00	26173.00	616.00	24549.00	25165.00	616.00	ETSI
A02	24883.25	25469.00	585.75	25891.25	26477.00	585.75	ETSI
A06	25891.25	26477.00	585.75	24883.25	25469.00	585.75	ETSI

Sub-band 5x is valid for CS 7, 14, 28 & 56 MHz.

Sub-band A0x (Duplex 1008 MHz) is valid for CS 7, 14, 28 & 56 MHz



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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	24549.00	25165.00	616.00	25557.00	26173.00	616.00	ETSI
01H	25557.00	26173.00	616.00	24549.00	25165.00	616.00	ETSI
02L	24883.25	25469.00	585.75	25891.25	26477.00	585.75	ETSI
02H	25891.25	26477.00	585.75	24883.25	25469.00	585.75	ETSI

Sub-band 0xL/H (Duplex 1008 MHz) is valid for CS 7, 14, 28, 56 and 112MHz.

5.3.17 28 GHz Band

RAU2 X 28

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
31 420	27505.00	27701.00	196.00	27925.00	28121.00	196.00	ANSI
33 420	27925.00	28121.00	196.00	27505.00	27701.00	196.00	ANSI
32 420	27701.00	27925.00	224.00	28121.00	28345.00	224.00	ANSI
34 420	28121.00	28345.00	224.00	27701.00	27925.00	224.00	ANSI
41 1008	27548.50	27884.50	336.00	28556.50	28892.50	336.00	ETSI
45 1008	28556.50	28892.50	336.00	27548.50	27884.50	336.00	ETSI
42 1008	27828.50	28164.50	336.00	28836.50	29172.50	336.00	ETSI
46 1008	28836.50	29172.50	336.00	27828.50	28164.50	336.00	ETSI
43 1008	28108.50	28444.50	336.00	29116.50	29452.50	336.00	ETSI
47 1008	29116.50	29452.50	336.00	28108.50	28444.50	336.00	ETSI
51 450	27500.00	27700.00	200.00	27950.00	28150.00	200.00	ANSI
53 450	27950.00	28150.00	200.00	27500.00	27700.00	200.00	ANSI
52 450	27700.00	27900.00	200.00	28150.00	28350.00	200.00	ANSI
54 450	28150.00	28350.00	200.00	27700.00	27900.00	200.00	ANSI
A01	27548.50	27996.50	448.00	28556.50	29004.50	448.00	ETSI
A05	28556.50	29004.50	448.00	27548.50	27996.50	448.00	ETSI
A02	27996.50	28444.50	448.00	29004.50	29452.50	448.00	ETSI
A06	29004.50	29452.50	448.00	27996.50	28444.50	448.00	ETSI
A03	27828.50	28276.50	448.00	28836.50	29284.50	448.00	ETSI
A07	28836.50	29284.50	448.00	27828.50	28276.50	448.00	ETSI
A11	27500.00	27701.00	201.00	27925.00	28150.00	225.00	ANSI
A15	27925.00	28150.00	225.00	27500.00	27701.00	201.00	ANSI
A12	27700.00	27925.00	225.00	28121.00	28350.00	229.00	ANSI
A16	28121.00	28350.00	229.00	27700.00	27925.00	225.00	ANSI

Sub-band 3x & 5x are valid for CS 10, 20, 30, 40 & 50 MHz.

Sub-band 4x is valid for CS 7, 14, 28 & 56 MHz.

Sub-band A0x (Duplex 1008 MHz) is valid for CS 7, 14, 28 & 56 MHz.

Sub-band A1x (Duplex 420 & 450 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.



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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	27548.50	27996.50	448.00	28556.50	29004.50	448.00	ETSI
01H	28556.50	29004.50	448.00	27548.50	27996.50	448.00	ETSI
02L	27996.50	28444.50	448.00	29004.50	29452.50	448.00	ETSI
02H	29004.50	29452.50	448.00	27996.50	28444.50	448.00	ETSI
11L	27500.00	27701.00	201.00	27925.00	28150.00	225.00	ANSI
11H	27925.00	28150.00	225.00	27500.00	27701.00	201.00	ANSI
12L	27700.00	27925.00	225.00	28121.00	28350.00	229.00	ANSI
12H	28121.00	28350.00	229.00	27700.00	27925.00	225.00	ANSI

Sub-band 0xL/H (Duplex 1008 MHz) is valid for CS 7, 14, 28, 56 and 112MHz.

Sub-band 1xL/H (Duplex 420 & 450 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

5.3.18 32 GHz Band

RAU2 X 32

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11 812	31815.00	32095.00	280.00	32627.00	32907.00	280.00	ETSI
15 812	32627.00	32907.00	280.00	31815.00	32095.00	280.00	ETSI
12 812	32053.00	32333.00	280.00	32865.00	33145.00	280.00	ETSI
16 812	32865.00	33145.00	280.00	32053.00	32333.00	280.00	ETSI
13 812	32291.00	32599.00	308.00	33103.00	33411.00	308.00	ETSI
17 812	33103.00	33411.00	308.00	32291.00	32599.00	308.00	ETSI
A11	31815.00	32207.00	392.00	32627.00	33019.00	392.00	ETSI
A15	32627.00	33019.00	392.00	31815.00	32207.00	392.00	ETSI
A12	32053.00	32333.00	280.00	32865.00	33145.00	280.00	ETSI
A16	32865.00	33145.00	280.00	32053.00	32333.00	280.00	ETSI
A13	32207.00	32599.00	392.00	33019.00	33411.00	392.00	ETSI
A17	33019.00	33411.00	392.00	32207.00	32599.00	392.00	ETSI

Sub-band 1x is valid for CS 7, 14, 28 & 56 MHz.

Sub-band A1x (Duplex 812 MHz) is valid for CS 7, 14, 28 & 56 MHz.

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Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11L	31815.00	32207.00	392.00	32627.00	33019.00	392.00	ETSI
11H	32627.00	33019.00	392.00	31815.00	32207.00	392.00	ETSI
13L	32207.00	32599.00	392.00	33019.00	33411.00	392.00	ETSI
13H	33019.00	33411.00	392.00	32207.00	32599.00	392.00	ETSI

Sub-band 1xL/H (Duplex 812 MHz) is valid for CS 7, 14, 28, 56 and 112MHz.



5.3.19 38 GHz Band

RAU2 X 38

Index / Duplex (MHz)		Transmitter frequency information			Receiver frequency information			Telecom Standard
		Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11	1260	37058.00	37339.75	281.75	38318.00	38599.75	281.75	ETSI
15	1260	38318.00	38599.75	281.75	37058.00	37339.75	281.75	ETSI
12	1260	37338.00	37619.75	281.75	38598.00	38879.75	281.75	ETSI
16	1260	38598.00	38879.75	281.75	37338.00	37619.75	281.75	ETSI
13	1260	37618.00	37899.75	281.75	38878.00	39159.75	281.75	ETSI
17	1260	38878.00	39159.75	281.75	37618.00	37899.75	281.75	ETSI
14	1260	37898.00	38179.75	281.75	39158.00	39439.75	281.75	ETSI
18	1260	39158.00	39439.75	281.75	37898.00	38179.75	281.75	ETSI
23	1260	37758.00	38039.75	281.75	39018.00	39299.75	281.75	ETSI
27	1260	39018.00	39299.75	281.75	37758.00	38039.75	281.75	ETSI
31	700	38600.00	38800.00	200.00	39300.00	39500.00	200.00	ANSI
35	700	39300.00	39500.00	200.00	38600.00	38800.00	200.00	ANSI
32	700	38770.00	38970.00	200.00	39470.00	39670.00	200.00	ANSI
36	700	39470.00	39670.00	200.00	38770.00	38970.00	200.00	ANSI
33	700	38930.00	39130.00	200.00	39630.00	39830.00	200.00	ANSI
37	700	39630.00	39830.00	200.00	38930.00	39130.00	200.00	ANSI
34	700	39100.00	39300.00	200.00	39800.00	40000.00	200.00	ANSI
38	700	39800.00	40000.00	200.00	39100.00	39300.00	200.00	ANSI
A11		37058.00	37619.75	561.75	38318.00	38879.75	561.75	ETSI
A15		38318.00	38879.75	561.75	37058.00	37619.75	561.75	ETSI
A12		37618.00	38179.75	561.75	38878.00	39439.75	561.75	ETSI
A16		38878.00	39439.75	561.75	37618.00	38179.75	561.75	ETSI
A31		38600.00	38800.00	200.00	39300.00	39500.00	200.00	ANSI
A35		39300.00	39500.00	200.00	38600.00	38800.00	200.00	ANSI
A32		38770.00	38970.00	200.00	39470.00	39670.00	200.00	ANSI
A36		39470.00	39670.00	200.00	38770.00	38970.00	200.00	ANSI
A33		38930.00	39130.00	200.00	39630.00	39830.00	200.00	ANSI
A37		39630.00	39830.00	200.00	38930.00	39130.00	200.00	ANSI
A34		39100.00	39300.00	200.00	39800.00	40000.00	200.00	ANSI
A38		39800.00	40000.00	200.00	39100.00	39300.00	200.00	ANSI

Sub-band 1x & 2x are valid for CS 7, 14, 28 & 56 MHz.

Sub-band 3x is valid for CS 10, 20, 30, 40 & 50 MHz for ANSI.

Sub-band A1x (Duplex 1260 MHz) is valid for CS 7, 14, 28 & 56 MHz.

Sub-band A3x (Duplex 700 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.



MINI-LINK 6363 38; MINI-LINK 6363/2 38

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11L	37058.00	37619.75	561.75	38318.00	38879.75	561.75	ETSI
11H	38318.00	38879.75	561.75	37058.00	37619.75	561.75	ETSI
12L	37618.00	38179.75	561.75	38878.00	39439.75	561.75	ETSI
12H	38878.00	39439.75	561.75	37618.00	38179.75	561.75	ETSI
31L	38600.00	38800.00	200.00	39300.00	39500.00	200.00	ANSI
31H	39300.00	39500.00	200.00	38600.00	38800.00	200.00	ANSI
32L	38770.00	38970.00	200.00	39470.00	39670.00	200.00	ANSI
32H	39470.00	39670.00	200.00	38770.00	38970.00	200.00	ANSI
33L	38930.00	39130.00	200.00	39630.00	39830.00	200.00	ANSI
33H	39630.00	39830.00	200.00	38930.00	39130.00	200.00	ANSI
34L	39100.00	39300.00	200.00	39800.00	40000.00	200.00	ANSI
34H	39800.00	40000.00	200.00	39100.00	39300.00	200.00	ANSI

Sub-band 1xL/H (Duplex 1260 MHz) is valid for CS 7, 14, 28, 56 & 112 MHz.

Sub-band 3xL/H (Duplex 700 MHz) is valid for CS 10, 20, 30, 40 & 50 MHz.

5.3.20 42 GHz Band

RAU2 X 42

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
11 1500	40522.00	40830.00	308.00	42022.00	42330.00	308.00	ETSI
15 1500	42022.00	42330.00	308.00	40522.00	40830.00	308.00	ETSI
12 1500	40774.00	41054.00	280.00	42274.00	42554.00	280.00	ETSI
16 1500	42274.00	42554.00	280.00	40774.00	41054.00	280.00	ETSI
21 1500	40998.00	41278.00	280.00	42498.00	42778.00	280.00	ETSI
25 1500	42498.00	42778.00	280.00	40998.00	41278.00	280.00	ETSI
22 1500	41222.00	41502.00	280.00	42722.00	43002.00	280.00	ETSI
26 1500	42722.00	43002.00	280.00	41222.00	41502.00	280.00	ETSI
31 1500	41446.00	41726.00	280.00	42946.00	43226.00	280.00	ETSI
35 1500	42946.00	43226.00	280.00	41446.00	41726.00	280.00	ETSI
32 1500	41670.00	41964.00	294.00	43170.00	43464.00	294.00	ETSI
36 1500	43170.00	43464.00	294.00	41670.00	41964.00	294.00	ETSI
A01	40522.00	41054.00	532.00	42022.00	42554.00	532.00	ETSI
A05	42022.00	42554.00	532.00	40522.00	41054.00	532.00	ETSI
A02	40998.00	41502.00	504.00	42498.00	43002.00	504.00	ETSI
A06	42498.00	43002.00	504.00	40998.00	41502.00	504.00	ETSI
A03	41446.00	41964.00	518.00	42946.00	43464.00	518.00	ETSI
A07	42946.00	43464.00	518.00	41446.00	41964.00	518.00	ETSI

Sub-band 1x, 2x & 3x are valid for CS 7, 14, 28 & 56 MHz.

Sub-band A0x (Duplex 1500 MHz) is valid for CS 7, 14, 28 & 56 MHz.



MINI-LINK 6363 42

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	40522.00	41054.00	532.00	42022.00	42554.00	532.00	ETSI
05H	42022.00	42554.00	532.00	40522.00	41054.00	532.00	ETSI
02L	40998.00	41502.00	504.00	42498.00	43002.00	504.00	ETSI
02H	42498.00	43002.00	504.00	40998.00	41502.00	504.00	ETSI
03L	41446.00	41964.00	518.00	42946.00	43464.00	518.00	ETSI
03H	42946.00	43464.00	518.00	41446.00	41964.00	518.00	ETSI

Sub-band 0xL/H (Duplex 1500 MHz) is valid for CS 7, 14, 28, 56 and 112MHz.

5.3.21 80 GHz Band

MINI-LINK 6363 80

Index / Duplex (MHz)	Transmitter frequency information			Receiver frequency information			Telecom Standard
	Tx Lower edge	Tx Upper edge	Tx Bw (MHz)	Rx Lower edge	Rx Upper edge	Rx Bw (MHz)	
01L	71125.00	72250.00	1125.00	81125.00	82250.00	1125.00	ETSI/ANSI
01H	81125.00	82250.00	1125.00	71125.00	72250.00	1125.00	ETSI/ANSI
02L	72250.00	73500.00	1250.00	82250.00	83500.00	1250.00	ETSI/ANSI
02H	82250.00	83500.00	1250.00	72250.00	73500.00	1250.00	ETSI/ANSI
03L	73500.00	74750.00	1250.00	83500.00	84750.00	1250.00	ETSI/ANSI
03H	83500.00	84750.00	1250.00	73500.00	74750.00	1250.00	ETSI/ANSI
04L	74750.00	75875.00	1125.00	84750.00	85875.00	1125.00	ETSI/ANSI
04H	84750.00	85875.00	1125.00	74750.00	75875.00	1125.00	ETSI/ANSI

Sub-band 0xL/H is valid for CS 62.5 and 125 MHz (with CS 56, 60, 80 and 112 MHz physical modes).

5.4 Carrier Aggregation

Specific radio requirements associated with Carrier Aggregation (CA) will be included in conjunction with radio link feature support.

5.5 Transmitter Performance

See Chapter 5.10 for supported physical modes and traffic capacity.

5.5.1 Frequency Tolerance

The transmitter carrier frequency does not deviate more than ± 10 ppm from nominal frequency. During the first year of operation the deviation is less than ± 3 ppm.



5.5.2 Output Power for QAM, Static Modulation

MINI-LINK 6363 and MINI-LINK 6365 Output power including high power license (+4 dB).

RAU2 X, MINI-LINK 6363 and MINI-LINK 6365 has an output power tolerance of -1/+2 dB applicable for maximum output power. Otherwise the tolerance is ± 2 dB.

MINI-LINK 6363 80 and MINI-LINK 6363/2 has an output power tolerance of ± 2 dB applicable for maximum output power. Otherwise the tolerance is ± 2.5 dB.

The output power is set in 1 dB steps in ranges:

Radio Type	P _{max} (dBm) versus Modulation (QAM)										P _{min} (dBm)
	4	16	32	64	128	256	512	1024	2048	4096	
RAU2 X 5 HP	30	30	30	30	30	29	29	28	27 ¹⁰	26 ¹⁰	-10
RAU2 X 6L	29	27	27	26	26	25	25	24	23 ¹⁰	22 ¹⁰	-10
RAU2 X 6L HP	30	30	30	30	30	29	29	28	27 ¹⁰	26 ¹⁰	-10
MINI-LINK 6363 6L	30	30	30	30	30	29	29	28	28	27	-10
RAU2 X 6U	29	27	27	26	26	25	25	24	23 ¹⁰	22 ¹⁰	-10
RAU2 X 6U HP	30	30	30	30	30	29	29	28	27 ¹⁰	26 ¹⁰	-10
MINI-LINK 6363 6U	30	30	30	30	30	29	29	28	28	27	-10
RAU2 X 7	29	27	27	26	26	25	25	24	23 ¹⁰	22 ¹⁰	-10
RAU2 X 7 HP	30	30	30	30	30	29	29	28	27 ¹⁰	26 ¹⁰	-10
MINI-LINK 6363 7	30	30	30	30	30	29	29	28	28	27	-10
MINI-LINK 6365 7/8 ¹¹	30	30	30	30	30	29	29	28	28	27	-10
RAU2 X 8	29	27	27	26	26	25	25	24	23 ¹⁰	22 ¹⁰	-10
RAU2 X 8 HP	30	30	30	30	30	29	29	28	27 ¹⁰	26 ¹⁰	-10
MINI-LINK 6363 8	30	30	30	30	30	29	29	28	28	27	-10
RAU2 X 10 ¹²	28	26	26	25	25	24	24	23	22 ¹⁰	21 ¹⁰	-10
RAU2 X 10 HP ¹²	30	30	30	29	29	28	28	27	26 ¹⁰	25 ¹⁰	-10
MINI-LINK 6363 10	30	30	30	29	29	28	28	27	27	26	-10
RAU2 X 11	28	26	26	25	25	24	24	23	22 ¹⁰	21 ¹⁰	-10
RAU2 X 11 HP	30	30	30	29	29	28	28	27	26 ¹⁰	25 ¹⁰	-10
MINI-LINK 6363 11	30	30	30	29	29	28	28	27	27	26	-10
MINI-LINK 6363/4 11	30	30	30	30	29	28	28	27	27	26	-10
RAU2 X 13	24	22	22	21	21	20	20	19	18 ¹⁰	17 ¹⁰	-10
RAU2 X 13 HP	28	26	26	25	25	24	24	23	22 ¹⁰	21 ¹⁰	-10
MINI-LINK 6363 13	27	26	26	25	25	24	24	23	23	22	-10
MINI-LINK 6363/2 13	19	18	18	17	17	16	16	15	15	14	-10
MINI-LINK 6365 13 ¹¹	27	26	26	25	25	24	24	23	23	22	-10
RAU2 X 15	24	22	22	21	21	20	20	19	18 ¹⁰	17 ¹⁰	-10
RAU2 X 15 HP	28	26	26	25	25	24	24	23	22 ¹⁰	21 ¹⁰	-10
MINI-LINK 6363 15	27	26	26	25	25	24	24	23	23	22	-10
MINI-LINK 6363/2 15	19	18	18	17	17	16	16	15	15	14	-10

¹⁰ With RAU2 X R-state \geq R6A

¹¹ Transmitter output power in Carrier aggregation -6dB compared to Single Carrier

¹² With duplex \leq 168 MHz; Pmax 1 dB lower



Radio Type	P _{max} (dBm) versus Modulation (QAM)										P _{min} (dBm)
	4	16	32	64	128	256	512	1024	2048	4096	
MINI-LINK 6363/4 15	26	26	26	26	25	24	24	23	23	22	-10
MINI-LINK 6365 15 ¹¹	27	26	26	25	25	24	24	23	23	22	-10
RAU2 X 18	21	19	19	18	18	17	17	16	15 ¹⁰	14 ¹⁰	-10
RAU2 X 18 HP	26	24	24	23	23	22	22	21	20 ¹⁰	19 ¹⁰	-10
MINI-LINK 6363 18	25	24	24	23	23	22	22	21	21	20	-10
MINI-LINK 6363/2 18	17	16	16	15	15	14	14	13	13	12	-10
MINI-LINK 6363/4 18	20	20	20	20	20	20	20	20	20	20	-10
MINI-LINK 6365 18 ¹¹	26	25	25	24	24	23	23	22	22	21	-10
RAU2 X 23	21	19	19	18	18	17	17	16	15 ¹⁰	14 ¹⁰	-10
RAU2 X 23 HP	25	23	23	22	22	21	21	20	19 ¹⁰	18 ¹⁰	-10
MINI-LINK 6363 23	24	23	23	22	22	21	21	20	20	19	-10
MINI-LINK 6363/2 23	16	15	15	14	14	13	13	12	12	11	-10
RAU2 X 24	23	21	21	20	20	19	19	18	17 ¹⁰	16 ¹⁰	-10
MINI-LINK 6363 24	25	24	24	23	23	22	22	21	21	20	-10
RAU2 X 26	23	21	21	20	20	19	19	18	17 ¹⁰	16 ¹⁰	-10
MINI-LINK 6363 26	25	24	24	23	23	22	22	21	21	20	-10
RAU2 X 28	22	20	20	19	19	18	18	17	16 ¹⁰	15 ¹⁰	-10
MINI-LINK 6363 28	23	22	22	21	21	20	20	19	19	18	-10
RAU2 X 32	20	18	18	17	17	16	16	15	14 ¹⁰	13 ¹⁰	-10
MINI-LINK 6363 32	22	21	21	20	20	19	19	18	18	17	-10
RAU2 X 38	20	18	18	17	17	16	16	15	14 ¹⁰	13 ¹⁰	-10
MINI-LINK 6363 38	22	21	21	20	20	19	19	18	18	17	-10
MINI-LINK 6363/2 38	14	13	13	12	12	11	11	10	10	9	-10
RAU2 X 42	18	16	16	15	15	14	14	13	12 ¹⁰	11 ¹⁰	-10
MINI-LINK 6363 42	18	17	17	16	16	15	15	14	14	13	-10
MINI-LINK 6363 80	17	16	16	15	15	14	14	13	13 ¹³	12 ¹³	-10

¹³ Modulations ≥ 2048 QAM is not supported. Specified values shall be used as Pmax reference in Admod



5.6 Output Power for QAM, Adaptive Modulation

5.6.1 ETSI

Maximum output power values (P_{max}) are according to chapter 5.5.2 with the following limitations:

MINI-LINK 6363, MINI-LINK 6365, MINI-LINK 6363/2 and RAU2 X
Max output power relative to P_{max} at 4096QAM (dB):

RSEC	2	4L 4H	5LB/5HB 6LB/6HB 7B
Modulation			
4096QAM	0	0	0
2048QAM	0	0	0
1024QAM	1	1	1
512QAM	1	1	1
256QAM	2	2	2
128QAM	3	3	3
64QAM	3	3	3
32QAM	4	4	3
16QAM	4	4	3
4QAM	5	4	3

5.6.2 ANSI

Maximum output power values (P_{max}) are according to chapter 5.5.2 with the following limitations:

MINI-LINK 6363, MINI-LINK 6365, MINI-LINK 6363/2 and RAU2 X/Xu
Max output power relative to P_{max} at 4096QAM (dB):

Modulation	P_{max} relative
4096QAM	0
2048QAM	0
1024QAM	1
512QAM	1
256QAM	2
128QAM	3
64QAM	3
32QAM	4
16QAM	4
4QAM	5



5.7 Emission Designator

5.7.1 Adaptive Modulation

ETSI

Channel separation (MHz)	Emission Designator
7	6M30D7W
14/13.75	12M8D7W
28/27.5	25M6D7W
40	36M0D7W
56/55/62.5	51M5D7W
80	74M0D7W
112/110/125	103MD7W

ANSI

Channel separation (MHz)	Emission Designator
10	8M75D7W
20	18M1D7W
30	27M4D7W
40	36M8D7W
50	46M1D7W
60	55M4D7W
80	74MD7W

5.7.2 Transmitter off

RF output power in Tx off mode < -50 dBm

5.7.3 Transmitter Spurious Levels for QAM

Transmitter spurious levels are below:

- -50 dBm in the band 30 MHz-21.2 GHz
 - -50 dBm in any 100 kHz band from 30 MHz to 1 GHz
 - -50 dBm in any 1 MHz band from 1 GHz to 21.2 GHz
- -30 dBm in the band 21.2 – 110 GHz
 - -30 dBm in any 100 kHz band for channel separation ≤ 7 MHz, and in the range from ± 2.5 times of channel separation to ± 56 MHz
 - -30 dBm in any 1 MHz band in all other cases

The above excludes a frequency band ± 2.5 times the channel separation from the nominal transmitter frequency.



5.8 Receiver Performance

See chapter 5.10 for supported physical modes, traffic capacity & XPIC or MIMO support.

5.8.1 Threshold Definition

Guarantee: Guaranteed value for all temperatures.

Planning: Ericsson recommendation for path planning
Planning threshold = 1 dB below guarantee threshold.
 Planning threshold is used by path planning programs.

Typical: Average value in room temperature.

5.8.2 Detection Performance for QAM, Adaptive Modulation

5.8.2.1 Detection Performance, ETSI

The receiver complies with detection performance listed below:

Radio Type	Frame ID	Modulation	BER 10 ⁻⁶ threshold (dBm)		BER 10 ⁻⁹ threshold (dBm)	
			Typ.	Guar.	Typ.	Guar.
RAU2 X 5		4QAM S	-95,5	-93,5	-93,5	-91,5
RAU2 X 6L		4QAM	-94	-92	-92	-90
RAU2 X 6U		16QAM S	-89	-87	-87	-85
RAU2 X 7		16QAM	-87,5	-85,5	-85,5	-83,5
RAU2 X 8		16QAM	-87,5	-85,5	-85,5	-83,5
RAU2 X 10		32QAM	-84	-82	-82	-80
(Dupl. > 168MHz)	256	32QAM	-84	-82	-82	-80
RAU2 X 11	356	64QAM	-81,5	-79,5	-79,5	-77,5
RAU2 X 13	1256	128QAM	-78,5	-76,5	-76,5	-74,5
RAU2 X 15	1356	256QAM	-75,5	-73,5	-73,5	-71,5
MINI-LINK 6363 6L		512QAM	-72,5	-70,5	-70,5	-68,5
MINI-LINK 6363 6U		512QAM L ¹⁴	-71	-69	-69	-67
MINI-LINK 6363 7		1024QAM	-69,5	-67,5	-67,5	-65,5
MINI-LINK 6363 8		1024QAM L ¹⁵	-68	-66	-66	-64
MINI-LINK 6363 10		1024QAM L ¹⁵	-68	-66	-66	-64
(Dupl. > 168MHz)		4QAM S	-92,5	-90,5	-90,5	-88,5
MINI-LINK 6363 11	257	4QAM	-91	-89	-89	-87
MINI-LINK 6363 13	357	16QAM S	-86	-84	-84	-82
MINI-LINK 6363 15	1257	16 QAM	-84,5	-82,5	-82,5	-80,5
MINI-LINK 6363/2 13	1357	16 QAM	-84,5	-82,5	-82,5	-80,5
MINI-LINK 6363/2 15		32QAM	-81	-79	-79	-77

¹⁴ For Frame ID 356,357,358,359,360,361 and 403 this value shall be used for ACM 512 QAM

¹⁵ For Frame ID 356,357,358,359,360,361 and 403 this value shall be used for ACM 1024 QAM



Radio Type	Frame ID	Modulation	BER 10 ⁻⁶ threshold (dBm)		BER 10 ⁻⁹ threshold (dBm)	
			Typ.	Guar.	Typ.	Guar.
MINI-LINK 6365 7/8 MINI-LINK 6365 13 MINI-LINK 6365 15		64QAM	-78,5	-76,5	-76,5	-74,5
		128QAM	-75,5	-73,5	-73,5	-71,5
		256QAM	-72,5	-70,5	-70,5	-68,5
		512QAM	-69,5	-67,5	-67,5	-65,5
		512QAM L ¹⁴	-68	-66	-66	-64
		1024QAM	-66,5	-64,5	-64,5	-62,5
		1024QAM L ¹⁵	-65	-63	-63	-61
		2048 QAM	-63	-61	-61	-59
		2048 QAM L	-61,5	-59,5	-59,5	-57,5
	258 358 1258 1358 2358 ¹⁶	4QAM S	-89,5	-87,5	-87,5	-85,5
		4QAM	-88	-86	-86	-84
		16QAM S	-83	-81	-81	-79
		16 QAM	-81,5	-79,5	-79,5	-77,5
		32QAM	-78	-76	-76	-74
		64QAM	-75,5	-73,5	-73,5	-71,5
		128QAM	-72,5	-70,5	-70,5	-68,5
		256QAM	-69,5	-67,5	-67,5	-65,5
		512QAM	-66,5	-64,5	-64,5	-62,5
		512QAM L ¹⁴	-65	-63	-63	-61
		1024QAM	-63,5	-61,5	-61,5	-59,5
		1024QAM L ¹⁵	-62	-60	-60	-58
		2048 QAM	-60	-58	-58	-56
		2048 QAM L	-58,5	-56,5	-56,5	-54,5
	4096 QAM	-56,5	-54,5	-54,5	-52,5	
	4096 QAM L	-55	-53	-53	-51	
	259 359 1259 1359	4QAM S	-88	-86	-86	-84
		4QAM	-86,5	-84,5	-84,5	-82,5
		16QAM S	-81,5	-79,5	-79,5	-77,5
		16 QAM	-80	-78	-78	-76
		32QAM	-76,5	-74,5	-74,5	-72,5
64QAM		-74	-72	-72	-70	
128QAM		-71	-69	-69	-67	
256QAM		-68	-66	-66	-64	
512QAM		-65	-63	-63	-61	
512QAM L ¹⁴		-63,5	-61,5	-61,5	-59,5	
1024QAM		-62	-60	-60	-58	
1024QAM L ¹⁵	-60,5	-58,5	-58,5	-56,5		
2048 QAM	-58,5	-56,5	-56,5	-54,5		
2048 QAM L	-57	-55	-55	-53		

¹⁶ For Frame ID 2358 and 2360 the 10⁻⁶ thresholds should be increased with +0.5 dB and the 10⁻⁹ thresholds should be increased with +1.0 dB.



Radio Type	Frame ID	Modulation	BER 10 ⁻⁶ threshold (dBm)		BER 10 ⁻⁹ threshold (dBm)	
			Typ.	Guar.	Typ.	Guar.
		4096 QAM	-55	-53	-53	-51
		4096 QAM L	-53,5	-51,5	-51,5	-49,5
	260 360 1260 1360 2360 ¹⁶	4QAM S	-86,5	-84,5	-84,5	-82,5
		4QAM	-85	-83	-83	-81
		16QAM S	-80	-78	-78	-76
		16 QAM	-78,5	-76,5	-76,5	-74,5
		32QAM	-75	-73	-73	-71
		64QAM	-72,5	-70,5	-70,5	-68,5
		128QAM	-69,5	-67,5	-67,5	-65,5
		256QAM	-66,5	-64,5	-64,5	-62,5
		512QAM	-63,5	-61,5	-61,5	-59,5
		512QAM L ¹⁴	-62	-60	-60	-58
		1024QAM	-60,5	-58,5	-58,5	-56,5
		1024QAM L ¹⁵	-59	-57	-57	-55
		2048 QAM	-57	-55	-55	-53
		2048 QAM L	-55,5	-53,5	-53,5	-51,5
		4096 QAM	-53,5	-51,5	-51,5	-49,5
		4096 QAM L	-52	-50	-50	-48
	303 403 1303 1403	4QAM S	-85	-83	-83	-81
		4QAM	-83,5	-81,5	-81,5	-79,5
		16QAM S	-78,5	-76,5	-76,5	-74,5
		16 QAM	-77	-75	-75	-73
		32QAM	-73,5	-71,5	-71,5	-69,5
		64QAM	-71	-69	-69	-67
		128QAM	-68	-66	-66	-64
		256QAM	-65	-63	-63	-61
		512QAM	-62	-60	-60	-58
		512QAM L ¹⁴	-60,5	-58,5	-58,5	-56,5
		1024QAM	-59	-57	-57	-55
		1024QAM L ¹⁵	-57,5	-55,5	-55,5	-53,5
	2048 QAM	-55,5	-53,5	-53,5	-51,5	
	2048 QAM L	-54	-52	-52	-50	
	4096 QAM	-52	-50	-50	-48	
	261 361 1261 1361	4QAM S	-83,5	-81,5	-81,5	-79,5
		4QAM	-82	-80	-80	-78
		16QAM S	-77	-75	-75	-73
		16 QAM	-75,5	-73,5	-73,5	-71,5
		32QAM	-72	-70	-70	-68
		64QAM	-69,5	-67,5	-67,5	-65,5
		128QAM	-66,5	-64,5	-64,5	-62,5
		256QAM	-63,5	-61,5	-61,5	-59,5
	512QAM	-60,5	-58,5	-58,5	-56,5	



Radio Type	Frame ID	Modulation	BER 10 ⁻⁶ threshold (dBm)		BER 10 ⁻⁹ threshold (dBm)	
			Typ.	Guar.	Typ.	Guar.
		512QAM L ¹⁴	-59	-57	-57	-55
		1024QAM	-57,5	-55,5	-55,5	-53,5
		1024QAM L ¹⁵	-56	-54	-54	-52
		2048 QAM	-54	-52	-52	-50
		2048 QAM L	-52,5	-50,5	-50,5	-48,5
		4096 QAM	-50,5	-48,5	-48,5	-46,5
RAU2 X 10 ¹⁷ (Dupl. ≤ 168 MHz) RAU2 X 18 RAU2 X 23 RAU2 X 26 MINI-LINK 6363 10 ¹⁷ (Dupl. ≤ 168 MHz) MINI-LINK 6363 18 MINI-LINK 6363 23 MINI-LINK 6363 26 MINI-LINK 6363/2 18 MINI-LINK 6363/2 23 MINI-LINK 6365 18	All	All	Add 1 dB to figures above.			
RAU2 X 28 RAU2 X 32 RAU2 X 38 MINI-LINK 6363 28 MINI-LINK 6363 32 MINI-LINK 6363 38 MINI-LINK 6363/2 38	All	All	Add 2 dB to figures above.			
RAU2 X 42 MINI-LINK 6363 42	All	All	Add 3 dB to figures above.			
MINI-LINK 6363 80	260,1260 261,1261 360,1360 361,1361	All	Add 7 dB to figures above			

5.8.2.2 Detection Performance, ANSI

The receiver complies with detection performance listed below:

Radio Type	Frame ID	Modulation	BER 10 ⁻⁶ threshold (dBm)		BER 10 ⁻⁹ threshold (dBm)	
			Typ.	Guar.	Typ.	Guar.
RAU2 X 5	262	4QAM S	-94	-92	-92	-90
RAU2 X 6L	362	4QAM	-92,5	-90,5	-90,5	-88,5
RAU2 X 6U	1262	16QAM S	-87,5	-85,5	-85,5	-83,5

¹⁷ Max CS = 28 MHz



Radio Type	Frame ID	Modulation	BER 10 ⁻⁶ threshold (dBm)		BER 10 ⁻⁹ threshold (dBm)		
			Typ.	Guar.	Typ.	Guar.	
RAU2 X 7 RAU2 X 8 RAU2 X 10 (Dupl. > 168MHz) RAU2 X 11 RAU2 X 13 RAU2 X 15 MINI-LINK 6363 6L MINI-LINK 6363 6U MINI-LINK 6363 7 MINI-LINK 6363 8 MINI-LINK 6363 10 (Dupl. > 168MHz) MINI-LINK 6363 11 MINI-LINK 6363 13 MINI-LINK 6363 15 MINI-LINK 6363/2 13 MINI-LINK 6363/2 15 MINI-LINK 6365 7/8 MINI-LINK 6365 13 MINI-LINK 6365 15	1362	16QAM	-86	-84	-84	-82	
		32QAM	-82,5	-80,5	-80,5	-78,5	
		64QAM	-80	-78	-78	-76	
		128QAM	-77	-75	-75	-73	
		256QAM	-74	-72	-72	-70	
		512QAM	-71	-69	-69	-67	
		512QAM L ¹⁸	-69,5	-67,5	-67,5	-65,5	
		1024QAM	-68	-66	-66	-64	
		1024QAM L ¹⁹	-66,5	-64,5	-64,5	-62,5	
		263 363 1263 1363	4QAM S	-91	-89	-89	-87
			4QAM	-89,5	-87,5	-87,5	-85,5
			16QAM S	-84,5	-82,5	-82,5	-80,5
			16 QAM	-83	-81	-81	-79
			32QAM	-79,5	-77,5	-77,5	-75,5
			64QAM	-77	-75	-75	-73
			128QAM	-74	-72	-72	-70
			256QAM	-71	-69	-69	-67
			512QAM	-68	-66	-66	-64
			512QAM L ¹⁸	-66,5	-64,5	-64,5	-62,5
			1024QAM	-65	-63	-63	-61
			1024QAM L ¹⁹	-63,5	-61,5	-61,5	-59,5
			2048 QAM	-61,5	-59,5	-59,5	-57,5
			2048 QAM L	-60	-58	-58	-56
		264 364 1264 1364 2364 ²⁰	4QAM S	-89,5	-87,5	-87,5	-85,5
			4QAM	-88	-86	-86	-84
			16QAM S	-83	-81	-81	-79
			16 QAM	-81,5	-79,5	-79,5	-77,5
			32QAM	-78	-76	-76	-74
			64QAM	-75,5	-73,5	-73,5	-71,5
			128QAM	-72,5	-70,5	-70,5	-68,5
	256QAM		-69,5	-67,5	-67,5	-65,5	
	512QAM		-66,5	-64,5	-64,5	-62,5	
	512QAM L ¹⁸		-65	-63	-63	-61	
	1024QAM	-63,5	-61,5	-61,5	-59,5		
	1024QAM L ¹⁹	-62	-60	-60	-58		
	2048 QAM	-60	-58	-58	-56		

¹⁸ For Frame ID 362,363,364,365,366,367 and 368 this value shall be used for ACM 512 QAM

¹⁹ For Frame ID 362,363,364,365,366,368 and 403 this value shall be used for ACM 1024 QAM

²⁰ For Frame ID 2364 and 2365 the 10⁻⁶ thresholds should be increased with +0.5 dB and the 10⁻⁹ thresholds should be increased with +1.0 dB.



Radio Type	Frame ID	Modulation	BER 10 ⁻⁶ threshold (dBm)		BER 10 ⁻⁹ threshold (dBm)	
			Typ.	Guar.	Typ.	Guar.
					2048 QAM L	-58,5
		4096 QAM	-56,5	-54,5	-54,5	-52,5
		4096 QAM L	-55	-53	-53	-51
	265 365 1265 1365 2365 ²⁰	4QAM S	-88	-86	-86	-84
		4QAM	-86,5	-84,5	-84,5	-82,5
		16QAM S	-81,5	-79,5	-79,5	-77,5
		16 QAM	-80	-78	-78	-76
		32QAM	-76,5	-74,5	-74,5	-72,5
		64QAM	-74	-72	-72	-70
		128QAM	-71	-69	-69	-67
		256QAM	-68	-66	-66	-64
		512QAM	-65	-63	-63	-61
		512QAM L ¹⁸	-63,5	-61,5	-61,5	-59,5
		1024QAM	-62	-60	-60	-58
		1024QAM L ¹⁹	-60,5	-58,5	-58,5	-56,5
		2048 QAM	-58,5	-56,5	-56,5	-54,5
		2048 QAM L	-57	-55	-55	-53
		4096 QAM	-55	-53	-53	-51
	4096 QAM L	-53,5	-51,5	-51,5	-49,5	
	266 366 1266 1366	4QAM S	-87	-85	-85	-83
		4QAM	-85,5	-83,5	-83,5	-81,5
		16QAM S	-80,5	-78,5	-78,5	-76,5
		16 QAM	-79	-77	-77	-75
		32QAM	-75,5	-73,5	-73,5	-71,5
		64QAM	-73	-71	-71	-69
		128QAM	-70	-68	-68	-66
		256QAM	-67	-65	-65	-63
		512QAM	-64	-62	-62	-60
		512QAM L ¹⁸	-62,5	-60,5	-60,5	-58,5
		1024QAM	-61	-59	-59	-57
		1024QAM L ¹⁹	-59,5	-57,5	-57,5	-55,5
		2048 QAM	-57,5	-55,5	-55,5	-53,5
	2048 QAM L	-56	-54	-54	-52	
	4096 QAM	-54	-52	-52	-50	
	4096 QAM L	-52,5	-50,5	-50,5	-48,5	
	267 367 1276 1367	4QAM S	-86	-84	-84	-82
		4QAM	-84,5	-82,5	-82,5	-80,5
		16QAM S	-79,5	-77,5	-77,5	-75,5
		16 QAM	-78	-76	-76	-74
		32QAM	-74,5	-72,5	-72,5	-70,5
		64QAM	-72	-70	-70	-68
	128QAM	-69	-67	-67	-65	



Radio Type	Frame ID	Modulation	BER 10 ⁻⁶ threshold (dBm)		BER 10 ⁻⁹ threshold (dBm)			
			Typ.	Guar.	Typ.	Guar.		
		256QAM	-66	-64	-64	-62		
		512QAM	-63	-61	-61	-59		
		512QAM L ¹⁸	-61,5	-59,5	-59,5	-57,5		
		1024QAM	-60	-58	-58	-56		
		1024QAM L ¹⁹	-58,5	-56,5	-56,5	-54,5		
		2048 QAM	-56,5	-54,5	-54,5	-52,5		
		2048 QAM L	-55	-53	-53	-51		
		4096 QAM	-53	-51	-51	-49		
		4096 QAM L	-51,5	-49,5	-49,5	-47,5		
	268 368 1268 1368	4QAM S	-85	-83	-83	-81		
		4QAM	-83,5	-81,5	-81,5	-79,5		
		16QAM S	-78,5	-76,5	-76,5	-74,5		
		16 QAM	-77	-75	-75	-73		
		32QAM	-73,5	-71,5	-71,5	-69,5		
		64QAM	-71	-69	-69	-67		
		128QAM	-68	-66	-66	-64		
		256QAM	-65	-63	-63	-61		
		512QAM	-62	-60	-60	-58		
		512QAM L ¹⁸	-60,5	-58,5	-58,5	-56,5		
		1024QAM	-59	-57	-57	-55		
		1024QAM L ¹⁹	-57,5	-55,5	-55,5	-53,5		
		2048 QAM	-55,5	-53,5	-53,5	-51,5		
		2048 QAM L	-54	-52	-52	-50		
		4096 QAM	-52	-50	-50	-48		
		RAU2 X 10 ²¹ (Dupl. ≤ 168 MHz) RAU2 X 18 RAU2 X 23 RAU2 X 24 MINI-LINK 10 ²¹ (Dupl. ≤ 168 MHz) MINI-LINK 6363 18 MINI-LINK 6363 23 MINI-LINK 6363 26 MINI-LINK 6363/2 18 MINI-LINK 6363/2 23 MINI-LINK 6365 18	All	All	Add 1 dB to figures above			

²¹ Max CS=20 MHz



Radio Type	Frame ID	Modulation	BER 10^{-6} threshold (dBm)		BER 10^{-9} threshold (dBm)	
			Typ.	Guar.	Typ.	Guar.
RAU2 X 28 RAU2 X 32 RAU2 X 38 MINI-LINK 6363 28 MINI-LINK 6363 32 MINI-LINK 6363 38 MINI-LINK 6363/2 38	All	All	Add 2 dB to figures above.			
RAU2 X 42 MINI-LINK 6363 42	All	All	Add 3 dB to figures above.			
MINI-LINK 6363 80	267 367 268 368	All	Add 7 dB to figures above			

5.8.3 Switching Level, Adaptive Modulation

Typical switching levels between different physical modes are at Residual BER thresholds and are based on a measurement of the SNIR in the received signal.

For path planning usage this RBER level for down switching can be approximated to 4 dB above the typical 10^{-6} BER threshold for the currently used modulation scheme and CS.

For Frame ID 2358, 2360, 2364 and 2365 the RBER level for down switching can be approximated to 6 dB above the typical 10^{-6} BER threshold for the currently used modulation scheme and CS.

5.8.4 Co-channel Interference for QAM

The limits of co-channel interference are as given in table below, giving C/I values for 1 dB and 3 dB increase of the 10^{-6} BER thresholds, specified in chapter 5.8.2.



Co-channel	C/I values for 1 dB & 3 dB	
Modulation	1dB	3dB
4QAM S	13	9
4QAM	14	10
16QAM S	19	15
16QAM	21	17
32QAM	24	20
64QAM	27	23
128QAM	30	26
256QAM	34	30
512QAM	35	31
512QAM L ²²	36.5	32.5
1024QAM	38.5	34.5
1024QAM L ²³	40	36
2048QAM	42	38
2048QAM L	43	39
4096QAM	45	41
4096QAM L	48	44

5.8.5 Adjacent Channel Interference for QAM

5.8.5.1 ETSI

The limits of first adjacent-channel interference are as given in table below, giving C/I values for 1 dB and 3 dB increase of the 10^{-6} BER thresholds, specified in ch.5.8.2.1.

²² For Frame ID 356,357,358,359,360,361 and 403 this value shall be used for ACM 512 QAM

²³ For Frame ID 356,357,358,359,360,361 and 403 this value shall be used for ACM 1024 QAM



Modulation	RSEC	C/I values for 1 dB and 3 dB	
		1 dB	3dB
4QAM	2	-16	-20
	4L/4H	-20	-24
	5B/6B	-23	-27
16QAM	2/4L/4H	-20	-24
	5B/6B	-23	-27
32QAM	2/4L/4H	-20	-24
	5B/6B	-23	-27
64QAM	2/4L/4H	-20	-24
	5B/6B	-22	-26
128QAM	All	-19	-23
256QAM	All	-16	-20
512QAM	All	-14	-14
1024QAM	All	-10 ²⁴	-10
2048QAM	All	-7	-7
4096QAM	All	1	1

5.8.5.2 ANSI

The limits of first adjacent-channel interference are as given in table below, giving C/I values for 1 dB and 3 dB increase of the 10^{-6} BER thresholds, specified in ch.5.8.2.2

Modulation	C/I values for 1 dB and 3 dB	
	1 dB	3dB
4QAM	-23	-27
16QAM	-23	-27
32QAM	-23	-27
64QAM	-23	-27
128QAM	-19	-23
256QAM	-16	-20
512QAM	-14	-14
1024QAM	-10	-10
2048QAM	-7	-7
4096QAM	1	1

5.8.6 CW Interference

For a receiver operating at the specified 10^{-6} threshold, the introduction of a CW interferer with C/I of -30 dB at any frequency up to 80 GHz, excluding a frequency 2.5 times the channel separation on either side of the wanted frequency, does not result in a BER greater than 10^{-5} .

²⁴ Add 4 dB for MINI-LINK 6363 80GHz



5.8.7 Residual BER

5.8.7.1 Adaptive Modulation, ETSI

10^{-6} thresholds specified in ch. 5.8.2.1

Modulation	Residual BER guarantee thresholds		Residual BER		
	Lower (dB relative BER = 10^{-6})	Upper (dBm)	Typical	Guarantee	
4QAM	+5	-20	< 10^{-12}	< 10^{-11} (<100 Mbps)	< 10^{-12} (>100 Mbps)
16QAM		-21			
32QAM		-22			
64QAM		-23			
128QAM		-24			
256QAM		-25			
512QAM		-25			
1024QAM		-25			
2048QAM		-25			
4096QAM		-25			

5.8.7.2 Adaptive Modulation, ANSI

10^{-6} thresholds specified in ch.5.8.2.2

Modulation	Residual BER guarantee thresholds		Residual BER		
	Lower (dB relative BER = 10^{-6})	Upper (dBm)	Typical	Guarantee	
4QAM	+5	-20	< 10^{-12}	< 10^{-11} (<100 Mbps)	< 10^{-12} (>100 Mbps)
16QAM		-21			
32QAM		-22			
64QAM		-23			
128QAM		-24			
256QAM		-25			
512QAM		-25			
1024QAM		-25			
2048QAM		-25			
4096QAM		-25			

5.8.8 Signature for QAM

Reference delay: 6.3 ns.

Minimum phase and non-minimum phase

The table below states the Notch depth (dB) at BER 10^{-6} , as specified in ch 5.8.2.
The Notch depth of BER 10^{-3} is 1 dB higher than the BER 10^{-6} value.



ETSI/ANSI

BER 10^{-6} Notch depth (dB)												
Modulation	Signature width (MHz)											
	7.5	11	15	22	31	33	44	55	61	66	88	123
	Channel Separation (MHz)											
	7	10	14	20	28	30	40	50	56	60	80	112
4QAM	40	40	40	40	40	40	40	40	40	40	40	40
16QAM	40	40	40	40	40	40	38	36	35	34	32	29
32QAM	40	40	40	38	36	34	32	30	29	28	26	23
64QAM	40	40	39	36	34	32	30	28	27	26	24	20
128QAM	40	40	37	34	31	30	28	26	25	24	22	18
256QAM	40	38	35	32	30	28	26	24	23	22	20	17
512QAM	40	37	34	31	29	27	25	23	22	21	19	16
1024QAM	39	36	33	30	27	26	24	22	21	20	18	15
2048QAM			32	29	26	25	23	21	20	19	17	14
4096QAM					25	23	21	19	18	17	15	13

When the notch frequency is swept across the defined bandwidth with a rate up to 100 MHz/s, the notch depth for BER= 10^{-6} will not degrade by more than 1 dB with respect to the values listed in the table above.

5.8.9 Receiver Overload

Maximum input level where normal operation is guaranteed: - 20 dBm

5.8.10 Receiver Resistibility

Maximum tolerable input power without permanent degradation is 0 dBm.

5.8.11 Received Signal Indication

5.8.11.1 For Path Acceptance

When measured in steady state condition, an RF-input level measure is given with an accuracy of,

- for RF-input levels -30 dBm to -60 dBm: ± 2 dB
- for RF-input levels -60 dBm to -80 dBm: ± 3 dB



5.8.11.2 For Antenna Alignment

This detector presents on an external standard voltmeter a voltage corresponding to RF-input level.

The RF input level referred to the antenna port in dBm can be calculated from the measured voltage using the following formula:

$$R_{fin}(\text{dBm}) = 40 * \text{measured_voltage}(V) - 120$$

When measured at the Antenna Alignment Port, the accuracy of the measured voltage converted to RF-input level using the formula above shall be

- for RF-input levels -30 dBm to -60 dBm: ± 2.5 dB
- for RF-input levels -60 dBm to -80 dBm: ± 3 dB

5.9 Cross-Polar Interference Canceller (XPIC)

An XPIC is used to enhance the CCDP operation by cancelling the interference from the cross polar signal. The improvement factor offered by the XPIC enables the fulfillment of the defined RSL degradation at BER 10^{-6} to meet the corresponding co-channel "internal" interference sensitivity under flat fading conditions (C/I) and the fulfillment of the signature width and depth requirements for co-channel "internal" interference under dispersive fading conditions in agreement with ETSI EN 302 217-2-1.

See chapter 5.10 for HW & physical modes supporting XPIC.

5.9.1 Co-channel "Internal" Interference Sensitivity Under Dispersive Fading Conditions, Static Modulation

Limits of the co-channel interference sensitivity measured according to ETSI EN 302 217-2-1 under worst phase conditions.

Reference BER		10^{-6}	10^{-6}
RSL Degradation (dB)		<1	<3
XPI (dB)	4QAM	12	8
	16QAM	12	8
	32QAM	12	8
	64QAM	13	9
	128QAM	13	9
	256QAM	14	10
	512QAM	14	10
	1024QAM	15	11
	2048QAM	16	12
	4096QAM	17	13



5.10 Supported Physical Modes

5.10.1 Radio Units

5.10.1.1 MINI-LINK RAU2 X HW

MINI-LINK RAU2 X HW supports physical modes according to the tables below. The physical modes supported are denoted by an X, those that are shaded also support XPIC. See chapter 5.3 for supported frequencies and channel separation for a specific RAU2 X.

Telecom Standard: ETSI

Products	Telecom Standard: ETSI					
	CS	7 MHz	14/13.75 MHz	28/27.5 MHz	40 MHz	56/55/62,5 MHz
RAU2 X 5-42 ≥ R6A	Mod.					
	4QAM	X	X	X	X	X
	8QAM	X	X	X	X	X
	16QAM	X	X	X	X	X
	32QAM	X	X	X	X	X
	64QAM	X	X	X	X	X
	128QAM	X	X	X	X	X
	256QAM	X	X	X	X	X
	512QAM	X	X	X	X	X
	1024QAM	X	X	X	X	X
	2048QAM		X ²⁵	X ²⁵	X ²⁵	X ²⁵
	4096QAM			X ²⁵	X ²⁵	X ²⁵

Telecom Standard: ETSI

Products	Telecom Standard: ETSI					
	CS	7 MHz	14/13.75 MHz	28/27.5 MHz	40 MHz	56/55/62,5 MHz
RAU2 X 5-11 < R6A RAU2 X 13&15 ≥ R3A & < R6A RAU2 X 18&23 ≥ R5A & < R6A	Mod.					
	4QAM	X	X	X	X	X
	8QAM	X	X	X	X	X
	16QAM	X	X	X	X	X
	32QAM	X	X	X	X	X
	64QAM	X	X	X	X	X
	128QAM	X	X	X	X	X
	256QAM	X	X	X	X	X
	512QAM	X	X	X	X	X
	1024QAM		X ²⁶	X ²⁶	X ²⁶	X ²⁶

²⁵ Requires RAU SW CXP 901 2878 R5A or later

²⁶ Requires RAU SW CXP 901 2878 R-state R4D or later (RAU2 X/Xu 10/11/18/23 R-state R1A use RAU SW CXC 113 500 and hence cannot support 1024 QAM.)



Telecom Standard: ETSI

Products
RAU2 X 13&15 < R3A
RAU2 X 18&23 < R5A
RAU2 X 26-42 < R6A

CS	7 MHz	14/13.75 MHz	28/27.5 MHz	40 MHz	56/55/62,5 MHz
Mod.					
4QAM	X	X	X	X	X
8QAM	X	X	X	X	X
16QAM	X	X	X	X	X
32QAM	X	X	X	X	X
64QAM	X	X	X	X	X
128QAM	X	X	X	X	X
256QAM	X	X	X	X	X
512QAM	X	X	X	X	X
1024QAM		X ²⁷	X ²⁷	X ²⁷	X ²⁷

Telecom Standard: ANSI

Products
RAU2 X 5-42 ≥ R6A

CS	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz	60 MHz
Mod.						
4QAM	X	X	X	X	X	X
8QAM	X	X	X	X	X	X
16QAM	X	X	X	X	X	X
32QAM	X	X	X	X	X	X
64QAM	X	X	X	X	X	X
128QAM	X	X	X	X	X	X
256QAM	X	X	X	X	X	X
512QAM	X	X	X	X	X	X
1024QAM	X	X	X	X	X	X
2048QAM		X ²⁸				
4096QAM			X ²⁸	X ²⁸	X ²⁸	X ²⁸

¹⁾Requires RAU SW CXP 901 2878 R5A or later

Telecom Standard: ANSI

Products
RAU2 X 6L-11 < R6A
RAU2 X 13&15 ≥ R3A & < R6A
RAU2 X 18&23 ≥ R5A & < R6A

CS	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz	60 MHz
Mod.						
4QAM	X	X	X	X	X	X
8QAM	X	X	X	X	X	X
16QAM	X	X	X	X	X	X
32QAM	X	X	X	X	X	X
64QAM	X	X	X	X	X	X
128QAM	X	X	X	X	X	X
256QAM	X	X	X	X	X	X
512QAM	X	X	X	X	X	X
1024QAM		X ²⁷				

²⁷ Requires RAU SW CXP 901 2878 R-state R4D or later (RAU2 X/Xu 10/11/18/23 R-state R1A use RAU SW CXC 113 500 and hence cannot support 1024 QAM.)

²⁸ Requires RAU SW CXP 901 2878 R5A or later



Telecom Standard: ANSI

Products	CS	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz	60 MHz
	Mod.						
RAU2 X 13 & 15 < R3A	4QAM	X	X	X	X	X	X
RAU2 X 18 & 23 < R5A	8QAM	X	X	X	X	X	X
RAU2 X 24 – 38 < R6A	16QAM	X	X	X	X	X	X
	32QAM	X	X	X	X	X	X
	64QAM	X	X	X	X	X	X
	128QAM	X	X	X	X	X	X
	256QAM	X	X	X	X	X	X
	512QAM	X	X	X	X	X	X
	1024QAM		X ²⁹				

²⁹ Requires RAU SW CXP 901 2878 R-state R4D or later (RAU2 X/Xu 10/11/18/23 R-state R1A use RAU SW CXC 113 500 and hence cannot support 1024 QAM.)



5.10.1.2 MINI-LINK 6363, MINI-LINK 6363/2 and MINI-LINK 6365 HW

MINI-LINK 6363, MINI-LINK 6363/2 and MINI-LINK 6365 HW supports physical modes according to the tables below. The physical modes supported are denoted by an X, those that are shaded also support XPIC and those that have an asterisk support MIMO. See chapter 5.3 for supported frequencies and channel separations for a specific frequency band.

Telecom Standard: ETSI

Products
MINI-LINK 6363 6L- 42 ≥ R1A
MINI-LINK 6363/2 13 - 38 ≥ R1A
MINI-LINK 6365 7/8 ≥ R1A
MINI-LINK 6365 13 – 18 ≥ R1A

CS Mod.	7 MHz	14/ 13.75 MHz	28/ 27.5 MHz	40 MHz	56/ 55/ 62,5 MHz	80 MHz	112/ 110/ 125 MHz
4QAM	X	X	X*	X	X*	X	X
8QAM	X	X	X*	X	X*	X	X
16QAM	X	X	X*	X	X*	X	X
32QAM	X	X	X*	X	X*	X	X
64QAM	X	X	X*	X	X*	X	X
128QAM	X	X	X*	X	X*	X	X
256QAM	X	X	X*	X	X*	X	X
512QAM	X	X	X*	X	X*	X	X
1024QAM	X	X	X	X	X*	X	X
2048QAM		X	X	X	X	X	X
4096QAM			X	X	X	X	X

Products
MINI-LINK 6363 80 ≥ R1A

CS Mod.	7 MHz	14/ 13.75 MHz	28/ 27.5 MHz	40 MHz	56/ 55/ 62,5 MHz	80 MHz	112/ 110/ 125 MHz
4QAM					X	X	X
8QAM					X	X	X
16QAM					X	X	X
32QAM					X	X	X
64QAM					X	X	X
128QAM					X	X	X
256QAM					X	X	X
512QAM					X	X	X
1024QAM					X	X	X
2048QAM							
4096QAM							



Telecom Standard: ANSI

Products
MINI-LINK 6363 6L – 42 ≥ R1A
MINI-LINK 6363/2 13 – 38 ≥ R1A
MINI-LINK 6365 7/8 ≥ R1A
MINI-LINK 6365 13 – 18 ≥ R1A

CS	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz
Mod.							
4QAM	X	X	X*	X*	X	X	X
8QAM	X	X	X*	X*	X	X	X
16QAM	X	X	X*	X*	X	X	X
32QAM	X	X	X*	X*	X	X	X
64QAM	X	X	X*	X*	X	X	X
128QAM	X	X	X*	X*	X	X	X
256QAM	X	X	X*	X*	X	X	X
512QAM	X	X	X*	X*	X	X	X
1024QAM	X	X	X	X	X	X	X
2048QAM		X	X	X	X	X	X
4096QAM			X	X	X	X	X

Products
MINI-LINK 6363 80 ≥ R1A

CS	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz
Mod.							
4QAM						X	X
8QAM						X	X
16QAM						X	X
32QAM						X	X
64QAM						X	X
128QAM						X	X
256QAM						X	X
512QAM						X	X
1024QAM						X	X
2048QAM							
4096QAM							

5.10.2 MMU

This chapter describes the traffic capacities of each MMU per carrier, depending on channel separation & modulation. Note that the support may require a certain SW.

- It is possible to configure all Adaptive Coding and Modulation (ACM) physical modes as static modes, by setting Max Capacity–Modulation equal to Min Capacity–Modulation.
- Physical modes that are shaded in the tables support XPIC.
- Physical modes that that have an asterisk in the tables support MIMO.
- S= Strong coding and L= Light coding
- The figures in the tables related to maximum E1/DS1 are valid when TDM is used in a single direction. When TDM in 2 directions is enabled, the maximum number of E1/DS1 is limited to 40 per direction.



ETSI:

MMU 1004, MMU 1002, MMU 1001, PNM 1001, PNM 1002, MINI-LINK 6651 and MINI-LINK 6366

(note: Not for E1 for MINI-LINK 6366)

Modulation	Frame ID 256 356	Frame ID 257 357	Frame ID 258 358	Frame ID 259 359	Frame ID 260 360	Frame ID 303 403	Frame ID 261 361
4QAM S	8 Mbps 2xE1	19 Mbps 6xE1	37 Mbps 15xE1*	53 Mbps 23xE1	75 Mbps 34xE1*	108 Mbps 49xE1	151 Mbps 70xE1
4QAM	10 Mbps 3xE1	22 Mbps 8xE1	44 Mbps 18xE1*	62 Mbps 28xE1	88 Mbps 40xE1*	126 Mbps 58xE1	176 Mbps 80xE1
16QAM S	18 Mbps 6xE1	37 Mbps 15xE1	75 Mbps 34xE1*	107 Mbps 49xE1	151 Mbps 70xE1*	217 Mbps 80xE1	302 Mbps 80xE1
16QAM	21 Mbps 7xE1	43 Mbps 18xE1	87 Mbps 33xE1*	124 Mbps 57xE1	176 Mbps 71xE1*	253 Mbps 80xE1	352 Mbps 80xE1
32QAM	26 Mbps 10xE1	54 Mbps 24xE1	109 Mbps 50xE1*	156 Mbps 73xE1	221 Mbps 80xE1*	317 Mbps 80xE1	441 Mbps 80xE1
64QAM	33 Mbps 13xE1	68 Mbps 30xE1	137 Mbps 63xE1*	196 Mbps 80xE1	277 Mbps 80xE1*	397 Mbps 80xE1	553 Mbps 80xE1
128QAM	39 Mbps 16xE1	81 Mbps 36xE1	162 Mbps 75xE1*	231 Mbps 80xE1	327 Mbps 80xE1*	470 Mbps 80xE1	654 Mbps 80xE1
256QAM	45 Mbps 19xE1	93 Mbps 42xE1	186 Mbps 80xE1*	267 Mbps 80xE1	377 Mbps 80xE1*	542 Mbps 80xE1	754 Mbps 80xE1
512QAM	48 Mbps 21xE1	99 Mbps 45xE1	199 Mbps 80xE1*	285 Mbps 80xE1	402 Mbps 80xE1*	578 Mbps 80xE1	804 Mbps 80xE1
512QAM L	51 Mbps 22xE1	105 Mbps 48xE1	211 Mbps 80xE1*	302 Mbps 80xE1	427 Mbps 80xE1*	614 Mbps 80xE1	855 Mbps 80xE1
1024QAM	53 Mbps 23xE1	110 Mbps 51xE1	221 Mbps 80xE1	317 Mbps 80xE1	448 Mbps 80xE1	643 Mbps 80xE1	895 Mbps 80xE1
1024QAM L	56 Mbps 25xE1	117 Mbps 54xE1	234 Mbps 80xE1*	335 Mbps 80xE1	473 Mbps 80xE1	679 Mbps 80xE1	946 Mbps 80xE1
2048QAM	-	121 Mbps 56xE1	243 Mbps 80xE1	348 Mbps 80xE1	492 Mbps 80xE1	706 Mbps 80xE1	983 Mbps 80xE1
2048QAM L	-	127 Mbps 59xE1	256 Mbps 80xE1	366 Mbps 80xE1	517 Mbps 80xE1	742 Mbps 80xE1	1033 Mbps 80xE1
4096QAM	-	-	264 Mbps 80xE1	378 Mbps 80xE1	534 Mbps 80xE1	767 Mbps 80xE1	1068 Mbps 80xE1
4096QAM L	-	-	276 Mbps 80xE1	395 Mbps 80xE1	559 Mbps 80xE1	-	-



MMU 1004, MMU 1002

Modulation	Frame ID 2358	Frame ID 2360
4QAM S	36 Mbps 15xE1	73 Mbps 33xE1
4QAM	42 Mbps 18xE1	86 Mbps 39xE1
16QAM S	72 Mbps 33xE1	146 Mbps 68xE1
16QAM	85 Mbps 38xE1	171 Mbps 80xE1
32QAM	109 Mbps 50xE1	219 Mbps 80xE1
64QAM	133 Mbps 62xE1	268 Mbps 80xE1
128QAM	157 Mbps 74xE1	317 Mbps 80xE1
256QAM	182 Mbps 80xE1	366 Mbps 80xE1
512QAM	194 Mbps 80xE1	390 Mbps 80xE1
512QAM L	206 Mbps 80xE1	415 Mbps 80xE1
1024QAM		435 Mbps 80xE1
1024QAM L		459 Mbps 80xE1



ANSI:

MMU 1004, MMU 1002, MMU 1001, PNM 1001, PNM 1002, MINI-LINK 6651 and MINI-LINK 6366

(note: Not for DS1 for MINI-LINK 6366)

Modulation	Frame ID 262 362	Frame ID 263 363	Frame ID 264 364	Frame ID 265 365	Frame ID 266 366	Frame ID 267 367	Frame ID 268 368
4QAM S	13 Mbps 5xDS1	26 Mbps 14xDS1	40 Mbps 23xDS1*	54 Mbps 32xDS1*	68 Mbps 40xDS1	81 Mbps 49xDS1	108 Mbps 66xDS1
4QAM	15 Mbps 7xDS1	31 Mbps 17xDS1	47 Mbps 27xDS1*	63 Mbps 37xDS1*	79 Mbps 47xDS1	95 Mbps 58xDS1	126 Mbps 78xDS1
16QAM S	25 Mbps 13xDS1	53 Mbps 31xDS1	80 Mbps 48xDS1*	108 Mbps 66xDS1*	135 Mbps 80xDS1	162 Mbps 80xDS1	217 Mbps 80xDS1
16QAM	29 Mbps 16xDS1	61 Mbps 36xDS1	93 Mbps 57xDS1*	126 Mbps 77xDS1*	158 Mbps 80xDS1	189 Mbps 80xDS1	253 Mbps 80xDS1
32QAM	37 Mbps 21xDS1	77 Mbps 46xDS1	117 Mbps 72xDS1*	157 Mbps 80xDS1*	198 Mbps 80xDS1	237 Mbps 80xDS1	317 Mbps 80xDS1
64QAM	46 Mbps 27xDS1	97 Mbps 59xDS1	147 Mbps 80xDS1*	197 Mbps 80xDS1*	248 Mbps 80xDS1	297 Mbps 80xDS1	397 Mbps 80xDS1
128QAM	55 Mbps 32xDS1	114 Mbps 70xDS1	173 Mbps 80xDS1*	233 Mbps 80xDS1*	293 Mbps 80xDS1	352 Mbps 80xDS1	470 Mbps 80xDS1
256QAM	63 Mbps 37xDS1	132 Mbps 80xDS1	200 Mbps 80xDS1*	269 Mbps 80xDS1*	338 Mbps 80xDS1	406 Mbps 80xDS1	542 Mbps 80xDS1
512QAM	67 Mbps 40xDS1	140 Mbps 80xDS1	213 Mbps 80xDS1*	287 Mbps 80xDS1*	360 Mbps 80xDS1	433 Mbps 80xDS1	578 Mbps 80xDS1
512QAM L	71 Mbps 43xDS1	149 Mbps 80xDS1	226 Mbps 80xDS1*	305 Mbps 80xDS1*	383 Mbps 80xDS1	460 Mbps 80xDS1	614 Mbps 80xDS1
1024QAM	75 Mbps 45xDS1	156 Mbps 80xDS1	237 Mbps 80xDS1	319 Mbps 80xDS1	401 Mbps 80xDS1	482 Mbps 80xDS1	643 Mbps 80xDS1
1024QAM L	79 Mbps 48xDS1	165 Mbps 80xDS1	251 Mbps 80xDS1	337 Mbps 80xDS1	423 Mbps 80xDS1	509 Mbps 80xDS1	679 Mbps 80xDS1
2048QAM	-	172 Mbps 80xDS1	260 Mbps 80xDS1	351 Mbps 80xDS1	440 Mbps 80xDS1	529 Mbps 80xDS1	706 Mbps 80xDS1
2048QAM L	-	180 Mbps 80xDS1	274 Mbps 80xDS1	369 Mbps 80xDS1	463 Mbps 80xDS1	556 Mbps 80xDS1	742 Mbps 80xDS1
4096QAM	-	-	283 Mbps 80xDS1	381 Mbps 80xDS1	478 Mbps 80xDS1	574 Mbps 80xDS1	767 Mbps 80xDS1
4096QAM L	-	-	296 Mbps 80xDS1	399 Mbps 80xDS1	500 Mbps 80xDS1	601 Mbps 80xDS1	-



MMU 1004, MMU 1002

Modulation	Frame ID 2364	Frame ID 2365
4QAM S	39 Mbps 22xDS1	52 Mbps 31xDS1
4QAM	46 Mbps 26xDS1	61 Mbps 36xDS1
16QAM S	78 Mbps 47xDS1	105 Mbps 64xDS1
16QAM	91 Mbps 55xDS1	122 Mbps 75xDS1
32QAM	117 Mbps 72xDS1	157 Mbps 80xDS1
64QAM	143 Mbps 80xDS1	192 Mbps 80xDS1
128QAM	169 Mbps 80xDS1	227 Mbps 80xDS1
256QAM	195 Mbps 80xDS1	262 Mbps 80xDS1
512QAM	208 Mbps 80xDS1	279 Mbps 80xDS1
512QAM L	221 Mbps 80xDS1	297 Mbps 80xDS1



5.11 Protection and Bonding

5.11.1 Configurations

All configurations giving radio protection and/or equipment protection are based on the same RAUs and MMUs as used for unprotected terminals.

5.11.2 1+1 RLP

Configuration based on one dual carrier MMU 1002 or MMU 1004.

- Both transmitters are tuned to same frequency.
- One transmitter is active and the other is in standby mode (HSB).
- Both receivers are active and tuned to the same radio frequency.
- At reception, the receiver with best quality measure is active.
- 1+1 RLP provides hitless switching at fading conditions.
- Switching due to RAU hardware failures is non-hitless.
- One antenna with IPS or two antennas may be used.
- Two antennas with spatial separation are required for space diversity.

5.11.2.1 1+1 RLP EQP

Configuration based on two MMU 1002, two MMU 1004 or two MMU 1001.

In addition to 1+1 RLP:

- Equipment protection of MMUs
- Switching due to MMU hardware failures is non-hitless.

5.11.3 2+0 RLB

Configuration based on one dual carrier MMU 1002 or MMU 1004.

NB! In CCDP mode XPIC configuration is always recommended.

- In ACCP or ACAP mode transmitters are tuned to different frequencies.
- In CCDP mode both transmitters are tuned to same frequency.
- Both transmitters are active (WSB).
- Both receivers are active and tuned respectively to the corresponding transmitted frequencies.
- 2+0 RLB provides double capacity during normal operation.
- 2+0 RLB provides graceful degradation at fading conditions.
- Switching due to RAU hardware failures is non-hitless.
- One antenna with IPS or two antennas may be used (ACAP or ACCP).
- One antenna with OMT must be used for CCDP mode.

5.11.3.1 2+0 RLB EQP

Configuration based on two MMU 1002, two MMU 1004 or two MMU 1001.



In addition to 2+0 RLB:

- Equipment protection of MMUs
- Switching due to MMU hardware failures is non-hitless.

5.11.3.2 Dual 2+0 RLB EQP

Configuration based on two MMU 1002 or MMU 1004.

In addition to 2+0 RLB EQP:

- A second 2+0 RLB EQP can be configured, using the same two MMU 1002 or MMU 1004.
- The second remaining RLT is used for this additional configuration.

5.11.4 2+2 RLP EQP

Configuration based on two MMU 1002 or MMU 1004.

NB! In CCDP mode XPIC configurations per MMU are pre-defined.

- In ACCP or ACAP mode the two active transmitters on same MMU are tuned to different frequencies.
- In CCDP mode the two active transmitters on same MMU are tuned to same frequency.
- Two transmitters are active and two transmitters are in standby mode (HSB).
- All receivers are active and tuned respectively to the corresponding transmitted frequencies.
- At reception the two receivers with the best quality measure are active.
- 2+2 RLP EQP provides hitless switching at fading conditions.
- 2+2 RLP EQP provides double capacity during normal operation.
- Switching due to RAU hardware failures is non-hitless.
- Equipment protection of MMUs
- Switching due to MMU hardware failures is non-hitless.
- One antenna with three IPS may be used (ACAP or ACCP).
- One antenna with two IPS and one OMT may be used (CCDP).
- Two antennas and two IPS may be used (ACAP or ACCP).
- Two antennas and two OMT may be used for (CCDP).
- Two antennas with spatial separation are required for space diversity.

5.11.5 4+0 RLB EQP

Configuration based on two MMU 1002 or MMU 1004.

NB! In CCDP mode XPIC configurations per MMU are pre-defined.

- In ACCP or ACAP mode all transmitters are tuned to different frequencies.
- In CCDP mode both transmitters on same MMU are tuned to same frequency but differs between MMUs.



- In MIMO configuration all transmitters on both MMUs are tuned to same frequency.
- All transmitters are active (WSB).
- All receivers are active and tuned respectively to the corresponding transmitted frequencies.
- 4+0 RLB EQP provides quadruple capacity during normal operation.
- 4+0 RLB EQP provides graceful degradation at fading conditions.
- Switching due to RAU hardware failures is non-hitless.
- Equipment protection of MMUs
- Switching due to MMU hardware failures is non-hitless.
- One antenna with three IPS may be used (ACAP or ACCP).
- Two antennas and two IPS may be used (ACAP or ACCP).
- One antenna with two IPS and one OMT may be used for CCDP.
- Two antennas and two OMT may be used for CCDP.
- Two antennas and two OMT must be used for MIMO.

5.11.6 Receiver Switching

5.11.6.1 Radio Path and Propagation Protection

Receiver switching due to flat fading is hitless, with fading rate up to 50 dB/s, for RF input levels at least 5 dB above BER 10^{-6} threshold.

5.11.7 1+1 RLP Transmitter Selection

Two modes of operation are available:

- Automatic mode, with transmitter selection controlled by locally generated transmitter alarms and status signals or by request from remote end receivers.
- Manual mode, with transmitter selection controlled manually through the O&M system (locally and remotely).

Automatic mode is default mode of operation. In the event of automatic mode operation, transmitter switching due to fading is not hitless.

5.11.8 Multi-Band Booster with Policy Based Forwarding

Policy Based Forwarding offers the possibility to bond together two different bands through different types of equipment in an L1 bonding group and forward user traffic based on priority fields. The user can configure high priority traffic to go through the trusted higher availability band with lower capacity. The low priority traffic with much higher bandwidth needs can be kept on the link with lower availability but higher capacity. In case of link failure all traffic is forwarded on the remaining link.

The following forwarding decisions are supported:

- VLAN PCP priority bits



- IP DSCP priority bits
- MPLS TC (EXP) priority bits
- VLAN ID (forced and protected)
- Dynamic VLAN handling
- Dynamic PCP priority handling

The following functionality is supported:

- User traffic
- DCN over VLAN
- Routed DCN with separate cables to external devices
- All L2 and L3 node features

L1 bonding group characteristics:

- 2 interfaces bonded together of any Ethernet link type (WAN and LAN)
- Up to 4 instances are configurable
- 3.3 ms Service OAM Continuity Check Message subscription for remote link failure detection and faster than 15 ms switching time



5.11.9 Hierarchical Radio Link Bonding (hRLB)

Bonded Radio Links can be configured as members in an hRLB group to increase capacity. In a Multi Band Booster scenario, MINI LINK 6352 is connected using a LAN interface that also can be included in the hRLB group.

Supported configuration for traditional bands are listed below. These configurations are supported with NPU 1005 and MMU 1002 or MMU 1004.

hRLB Mode	hRLB Configuration	Max hRLB Capacity*	Comment
4+0 hRLB	2x(2+0 RLB) hRLB	5 Gbps	Supported in two directions
8+0 hRLB	2x(4+0 RLB EQP) hRLB	5 Gbps	Supported in one direction
16+0 hRLB	4x(4+0 RLB EQP) hRLB	10 Gbps	
4+4 hRLB	2x(2+2 RLP EQP) hRLB	5 Gbps	HSB, SD, Supported in one direction

*Note: The Max capacity for the connection will be limited by both the hRLB Max capacity and the Radio Link Max Capacity

Supported configurations using All Outdoor (AOD) node for Multi Band Booster are listed below. These configurations are supported with MINI.LINK 6352 as AOD, NPU 1005 and MMU 1002 or MMU 1004.

hRLB Mode	hRLB Configuration	Max hRLB Capacity*	Comment
(1+0) + AOD hRLB	(1+0) + AOD (1+0) hRLB	10 Gbps	AOD via NPU 1005 or ETU 1002
(2+0) + AOD hRLB	(2+0 RLB) + AOD (1+0) hRLB	10 Gbps	AOD via NPU 1005 or ETU 1002

*Note: The Max capacity for the connection will be limited by both the hRLB Max capacity and the Radio Link Max Capacity

Supported configuration using All Outdoor (AOD) node for Multi Band Booster with MINI-LINK 6651/4

hRLB Mode	hRLB Configuration	Max hRLB Capacity*	Comment
(1+0) + AOD hRLB	(1+0) + AOD (1+0) hRLB	10 Gbps	In two directions
(2+0) + AOD hRLB	(2+0 RLB) + AOD (1+0) hRLB	10 Gbps	In one direction

*Note: The Max capacity for the connection will be limited by both the hRLB Max capacity and the Radio Link Max Capacity

5.12 AES Encryption Over-the-Hop (OTH)

AES encryption over-the-hop (OTH) is a radio link integrity feature. The encryption is compliant to AES-256-CTR.

The encryption does not add any latency and the additional overhead is less than 1.5%.



6 TDM Characteristics

6.1 PDH Characteristics

6.1.1 E1 Traffic Performance

6.1.1.1 Tolerable Input Jitter and Wander

Input jitter and tolerance according to G.823, 02/00.

6.1.1.2 Output Jitter at Max Input Jitter

Maximum output jitter for E1 complies with G.742-88 for intrinsic jitter and with G.742-88 for jitter attenuation.

6.1.2 DS1 Traffic Performance

6.1.2.1 Tolerable Input Jitter and Wander

Input jitter and tolerance according to T1.403-1999 § 6.3.1.1.

6.1.2.2 Output Jitter at Max Input Jitter

Maximum output jitter for DS1 complies with T1.403-1999 § 6.3.2.1 source for intrinsic jitter and with Bellcore GR 499 § 7.3.3 for jitter attenuation.

6.1.3 1+1 E1/DS1 SNCP Performance

The switching time for the 1+1 E1/DS1 SNCP mechanism is:

Less than 50 ms loss of traffic due to signal failure detection

6.1.4 E1/DS1 Cross-connect Performance

The capacity of the internal TDM bus is stated in Table 1 E1/DS1 cross-connect capacity.

To facilitate future software functional upgrades, it is not recommended to route traffic that exceeds the "Recommended maximum usage".



Table 1 E1/DS1 cross-connect capacity

Model	E1/DS1 unidirectional capacity	E1/DS1 cross-connect capacity
MINI-LINK 6692	392 E1s / 504 DS1s	196 E1 / 252 DS1 cross-connections
MINI-LINK 6691, 6693 and 6694	196 E1s / 252 DS1s	98 E1 / 126 DS1 cross-connections
MINI-LINK 6654 and 6655	196 E1s / 252 DS1s	98 E1 / 126 DS1 cross-connections

The traffic connections are asynchronous and with independent timing.

The free running frequency of 2048 kbit/s is ± 50 ppm, taken 10 years aging into consideration.

The free running frequency of 1544 kbit/s is ± 32 ppm.

6.1.5 E1/DS1 Overhead calculation

Allocating tributaries (E1/DS1) to a radio link will reduce available bandwidth for the normal packet traffic. How much the bandwidth is reduced can be calculated as "required air rate" using the formula below:

$$rate = MAX(minrate, m + k * n)$$

That is, required air rate is either *minrate* or a calculation of $m + k * n$ whichever is the largest.

- Rate = Required air rate (kbps)
- minrate = Minimum air rate (kbps)
- m = Constant air rate offset (kbps)
- k = Rate dependency for each configured tributary (kbps)
- n = Number of tributaries

The values for each telecom standard are specified in the table below:

	m (kbps)	k (kbps)	minrate (kbps)
ETSI	1606	2055	4239
ANSI	1616	1551	4266



6.2 SDH Characteristics

6.2.1 STM-1 Traffic Performance

6.2.1.1 Input Jitter Tolerance

The tolerable jitter of the STM-1 interface is according to ITU-T G.825 03/00.

6.2.1.2 Maximum Output Jitter

Maximum output jitter in the absence of input jitter is according to ITU-T G.783 02/04.

6.2.2 MSP 1+1

The switching time for the MSP mechanisms is less than 50 ms loss of traffic due to signal failure or degradation.

6.3 Circuit Emulation Services

MINI-LINK 6600 supports CES according to the standards:

- RFC 4553
- MEF 8

6.3.1 Characteristics

CES is supported on the LTU 1002 board with the following characteristics:

- Up to 32 Pseudo wires per board, each emulating a single E1/DS1. Every emulated E1/DS1 is available from the backplane over a TDM cross-connection,
- Structure-agnostic emulation of full E1/DS1 – SAToP (RFC 4553) and MEF 8.

CES is supported by MINI-LINK 6651/4 with the following characteristics:

- Structure-agnostic emulation of full E1 – SAToP (RFC 4553) and MEF 8.

6.3.2 Packet Transport Capability

CES over Ethernet (MEF8) packet transport:

- ECID Range 0..1048575 ($2^{20} - 1$)
- C-VLAN tagging (optional).
- C-VLAN priority marking is configurable.
- All the PWs on an LTU 1002 share the same MAC address



In Provider Bridge configuration:

- S-VLAN added through C-VLAN registration table on the NPU switch.
- S-VLAN priority marking is derived for C-VLAN p-bits through internal UNI.

Jitter buffer:

- Jitter buffer size is configurable. Maximum depth is 512 frames.
- Packet re-ordering is supported.

6.3.3 Synchronization

Synchronization options for E1/DS1 interface:

- Loop timing
- Recover timing from incoming PW packet stream (ACR)

The sync performance of the CES function on the E1/DS1 traffic interface is compliant to ITU-T G.8261 and ITU-T G.823/G.824.

6.4 TDM relationship with Ethernet

The TDM traffic is transmitted together with Ethernet packets.

Using TDM traffic with Ethernet packet size above 1522 bytes may result in bit errors on TDM.

6.5 TDM Latency

The TDM traffic is transmitted together with Ethernet packets. The TDM latency is fixed once configuration is done and is set based on the minimum configured ACM in the current Channel Spacing. The higher minimum configured ACM and the wider Channel Spacing the lower latency.



6.5.1 TDM Latency ETSI

Mod / Frame Id (CS)	256 (7 MHz)	257 (14 MHz)	258 (28 MHz)	259 (40 MHz)	260 (56 MHz)	303 (80 MHz)	261 (125 MHz)
4QAM S	6089	3255	1853	1476	1205	1008	872
4QAM	5575	3010	1740	1399	1148	964	833
16QAM S	4121	2279	1388	1154	964	816	706
16QAM	3851	2134	1314	1100	919	778	675
32QAM	3550	1975	1234	1035	866	731	640
64QAM	3287	1855	1176	982	820	695	614
128QAM	3089	1772	1134	942	788	672	598
256QAM	2942	1704	1094	906	761	655	587
512QAM	2898	1678	1075	891	749	649	582
512QAM L	2867	1660	1058	877	740	642	578
1024QAM	2840	1650	1046	868	734	638	575
1024QAM L	2782	1638	1033	859	728	633	572
2048QAM	NA	1628	1025	854	724	631	570
2048QAM L	NA	1602	1015	846	720	626	567
4096QAM	NA	NA	1009	841	717	624	565
4096QAM L	NA	NA	997	829	710	618	NA

Latency in μ s

6.5.2 TDM Latency ETSI LL

Mod / Frame Id (CS)	356 (7 MHz)	357 (14 MHz)	358 (28 MHz)	359 (40 MHz)	360 (56 MHz)	403 (80 MHz)	361 (125 MHz)
4QAM S	5175	2795	1661	1317	1101	926	821
4QAM	4667	2542	1545	1237	1043	880	779
16QAM S	3208	1821	1194	998	862	736	652
16QAM	2906	1675	1118	944	818	702	622
32QAM	2568	1515	1032	880	761	662	588
64QAM	2311	1396	971	825	712	633	563
128QAM	2138	1313	929	784	676	616	547
256QAM	2003	1244	889	747	649	601	535
512QAM	1908	1199	854	718	628	588	526
512QAM L	NA	NA	NA	NA	NA	NA	NA
1024QAM	1822	1176	827	701	618	577	520
1024QAM L	NA	NA	NA	NA	NA	NA	NA
2048QAM	NA	1167	820	696	615	574	519
2048QAM L	NA	1146	810	690	612	570	516
4096QAM	NA	NA	805	684	608	568	514
4096QAM L	NA	NA	795	673	601	566	NA

Latency in μ s



6.5.3 TDM Latency ANSI

Mod / Frame Id (CS)	262 (10 MHz)	263 (20 MHz)	264 (30 MHz)	265 (40 MHz)	266 (50 MHz)	267 (60 MHz)	268 (80 MHz)
4QAM S	4640	2480	1820	1510	1320	1180	1020
4QAM	4270	2320	1710	1430	1250	1130	980
16QAM S	3170	1810	1380	1180	1050	940	840
16QAM	2940	1700	1320	1110	990	890	810
32QAM	2700	1590	1230	1040	920	830	760
64QAM	2500	1500	1170	980	860	790	740
128QAM	2380	1440	1110	940	830	770	710
256QAM	2300	1390	1070	900	810	740	700
512QAM	2260	1370	1040	890	800	740	690
512QAM L	2220	1350	1030	880	790	720	680
1024QAM	2210	1340	1020	870	780	720	680
1024QAM L	2180	1320	1020	860	780	710	680
2048QAM	NA	1310	1010	860	780	720	680
2048QAM L	NA	1290	1000	860	770	710	680
4096QAM	NA	NA	990	850	760	710	670
4096QAM L	NA	NA	980	830	760	700	NA

Latency in μ s

6.5.4 TDM Latency ANSI LL

Mod / Frame Id (CS)	362 (10 MHz)	363 (20 MHz)	364 (30 MHz)	365 (40 MHz)	366 (50 MHz)	367 (60 MHz)	368 (80 MHz)
4QAM S	3940	2170	1620	1340	1190	1090	960
4QAM	3580	1980	1510	1270	1130	1020	910
16QAM S	2500	1470	1170	1020	920	840	750
16QAM	2280	1370	1100	960	870	790	710
32QAM	2020	1260	1020	890	800	730	670
64QAM	1830	1180	950	820	750	700	640
128QAM	1690	1110	900	780	710	670	620
256QAM	1600	1060	850	760	680	650	610
512QAM	1550	1030	810	720	680	630	590
512QAM L	NA						
1024QAM	1490	1000	800	700	650	620	590
1024QAM L	NA						
2048QAM	NA	980	800	700	650	620	580
2048QAM L	NA	960	800	700	650	610	580
4096QAM	NA	NA	780	690	640	610	590
4096QAM L	NA	NA	770	690	640	600	NA

Latency in μ s



7 Security

To protect the confidentiality and data integrity of the OAM traffic the following secure protocols and features are supported.

7.1 Secure Protocols

SSHv2 (server) protocol for secure remote login as a secure alternative to the usage of Telnet connection.

Secure File Transfer Protocol, SFTP, (also known as the SSH File Transfer network protocol) is supported.

SNMPv3 protocol with privacy (encryption) for the secure transfer of alarms and other management data from a node to an NMS.

Within the A.A.A. (Authentication, Authorization, and Accounting) services, two protocols are implemented in accordance with the following standards:

- RADIUS: IETF RFC 2865 for Authentication Authorization.
- TACACS+: draft-grant-tacacs-02.txt, (draft version 1.78) for Authentication Authorization

7.2 Security Features

- Local access control: 4 Local Users (System Admin, Network Admin, Operator, Guest) with different set of privileges, for both local and remote connection. Password rules for Local Users: Passwords are not included in log file, never displayed in plain text, encrypted and shadowed. Password strength indicator is implemented
- SNMPv3 Centralized Authentication, possibility to disable Local Users, Ipv4/Ipv6 support
- Centralized Access Control: 4 Centralized User Roles (System Admin, Network Admin, Operator, Guest) with same set of privileges as Local users. Centralized authentication in place with unique UserId and passwords. Audit log can trace individual logins. Password management and User management must be managed in the external RADIUS or TACACS+ server
- Hardening: a number of protections and countermeasures from DoS attacks, a firewall is implemented for packet filtering
- Audit log capability is available: sequence number, timestamp, Ipaddr of the source, operation performed and UserId are traced. The System Admin is the only user that can manage the file. The file can be transferred in secure way via SFTP. CPU/Mem/Flash usage/load of O&M management related resources are recorded in AuditLog file. The audit log can contain up to 500 entries. The log is uploaded continuously, hence the size can in practice be considered as unlimited
- Password brute force protection mechanism is triggered upon subsequent authentication error events. Feature is enabled/disabled via CLI or SNMP
- NTP authentication



- Information about previous login added for Radius/TACACS when logging on to the NE via CLI or SNMP
- Inactivity timeout for Local users, possibility to set the timeout value for all Local users to close unused management sessions
- Local access disabling option: the local access to the node is available via USB or Site LAN port. The central user can disable the ports independently in case of malicious actions.
- Alarms and notifications regarding Security are implemented.
- File Integrity Monitoring: Alarms are generated if the Integrity Check discovers a Security violation
- TACACS+/RADIUS session accounting are supported.
- TACACS+ command accounting is supported.
- Brute-force lockout time can be configured, banned user-address pairs can be enabled.
- Enhanced SNMPv3 security options are introduced
 - SHA1 and SHA2-512 SNMPv3 authentication protocols are supported
 - AES128 and AES256 SNMPv3 privacy protocols are supported
 - Node default settings may be overwritten by TACACS+/RADIUS individual user-specific attributes
 - That is Proposed to use the new algorithms in conjunction with TACACS+/RADIUS authentication



8 DCN

8.1 DCN over VLAN

The node supports building a L2 switched DCN using either wired/optical Ethernet links or Ethernet over packet links. In this case nodes are configured as end hosts on the L2 network. In case of DCN over VLAN, both Ipv4 and Ipv6 is supported, with static routes.

8.1.1 DCN over VLAN on L1 ports

If a node is configured with an L1 ethernet connection (Ethernet Private Line, EPL), to connect the node to the DCN network, the L1 ports can be inserted into the DCN VLAN. This way, the node can be part of the DCN over VLAN network. The L1 connection will remain fully transparent to ethernet traffic, except for the DCN VLAN, which will be connected to the node DCN function.

8.1.2 DCN over VLAN Configuration

DCN over VLAN is configurable via MINI-LINK Node GUI or CLI or MIBs.

8.2 Routed DCN

The node supports building an Ipv4 Routed DCN using either wired/optical Ethernet links, Ethernet over packet links or PPP over TDM links.

Routed DCN is available on the following hardware configurations:

- MINI-LINK 6651
- MINI-LINK 6691 with NPU 1002, NPU 1003 or with NPU 1005
- MINI-LINK 6692 with NPU 1002 or with NPU 1005
- MINI-LINK 6693 with NPU 1002, NPU 1003 or with NPU 1005
- MINI-LINK 6694 with NPU 1002, NPU 1003 or with NPU 1005
- MINI-LINK 6654 with PNM 1001 or with PNM 1002
- MINI-LINK 6655 with PNM 1002
- MINI-LINK 6366



Routed DCN	
Protocol support	Ipv4, ARP, OSPFv2, IS-IS Level 1 and Level 2, eBGP
Network scalability	50-100 nodes/ospf area is recommended. ABR function and virtual links are supported to build multi-area DCN.

8.2.1 L3 Interfaces

8.2.1.1 L3 VLAN subinterfaces

L3 VLAN sub interfaces can be defined on ethernet ports and can use VLAN tagging. L2 switching is not available for L3 VLAN subinterfaces.

8.2.1.2 L3 VLAN interfaces (Bridge Virtual Interfaces, BVIs)

L3 VLAN (BVI) interfaces can be defined on VLANs. L2 switching will operate on the VLAN ports while L3 traffic is handled by the L3 interface. This enables building a L2 DCN with dynamic routing (e.g. OSPF).

8.2.1.3 PPP interfaces

PPP interfaces can be used on LTU1002 boards, to create a DCN link over the STM-1 link.

8.2.1.4 Unnumbered L3 Interfaces

Unnumbered L3 interfaces are supported in order to simplify DCN configuration, as well as to facilitate savings on the Ipv4 address space. Unnumbered IP interfaces are available both for PPP over TDM and L3 VLAN subinterfaces over wired/optical/microwave packet links (according to RFC 5309).

8.2.1.5 Ipv4 ACLs

Ipv4 Access Control Lists (ACLs) enable filtering IP packets on the interfaces.

8.2.2 Routed DCN Configuration

Routed DCN is configurable via CLI and Node GUI.



9 Physical Interfaces

9.1 Ethernet Traffic Interfaces

9.1.1 Interface Types

10BASE-T	IEEE802.3i 173incl.. In 802.3-2005
100BASE-TX	IEEE802.3u 173incl.. In 802.3-2005
1000BASE-T	IEEE802.3ab incl. In 802.3-2005
1000BASE-SX	IEEE 802.3z incl. In 802.3-2005
1000BASE-LX	IEEE 802.3z incl. In 802.3-2005
1000BASE-ZX	IEEE 802.3z incl. In 802.3-2005
1000BASE-BX10	IEEE 802.3(58) incl. In 802.3-2005
1000BASE-X	CWDM (1470-1610 nm)
10GBASE-LR	IEEE 802.3ae (49)
10GBASE-ER	IEEE 802.3ae (49)
10GBASE-ZR	Single Mode 1550 nm



9.1.2 Interfaces per Application

Application	Connector type	Rate (Mbit/s)	# of ports
NPU 1002	Shielded RJ45 jack	10/100/1000	2
	SFP/SFP+	See ch. 9.1.3	3 (max 2 SFP+)
NPU 1003	Shielded RJ45 jack	10/100/1000	2
	SFP/SFP+	See ch. 9.1.3	3 (max 2 SFP+)
NPU 1005	Shielded RJ45 jack	10/100/1000	2
	SFP/SFP+	See ch. 9.1.3	3 (max 2 SFP+)
ETU 1001	Shielded RJ45 jack	10/100/1000	Up to 4 ³⁰
ETU 1002	SFP	1000	Up to 4 ³¹
	SFP+	10G	1 ³²
PNM 1001	Shielded RJ45 jack	10/100/1000	2
	SFP/SFP+ (≤ 2.5G)	See ch. 9.1.3	4 (max 2 SFP+)
PNM 1002	Shielded RJ45 jack	10/100/1000	2
	SFP/SFP+ (≤ 2.5G)	See ch. 9.1.3	4 (max 2 SFP+)
MINI-LINK 6651/1	Shielded RJ45 jack	10/100/1000	2
	SFP/SFP+ (≤ 2.5G)	See ch. 9.1.3	4
MINI-LINK 6651/2	Shielded RJ45 jack	10/100/1000	2
	SFP/SFP+ (≤ 2.5G)	See ch. 9.1.3	3
MINI-LINK 6651/3	Shielded RJ45 jack	10/100/1000	2
	SFP/SFP+ (≤ 2.5G)	See ch. 9.1.3	4
MINI-LINK 6651/4	Shielded RJ45 jack	10/100/1000	2
	SFP/SFP+	See ch. 9.1.3	4 (max 4 SFP+)
MINI-LINK 6366	Shielded RJ45 jack	10/100/1000	2
	SFP/SFP+ (≤ 2.5G)	See ch. 9.1.3	2

All interfaces support Auto negotiation & Set-up.

³⁰ Number of usable ports depends on the slot used, and the NPU type. See ch. 2.10.

³¹ The ports can be configured for up to 4×1G or 1×10G Base-X, but not at the same time.

³² 10G only available when the ETU 1002 is installed in specific slots. See ch. 2.10.



9.1.3 Ethernet SFP

The "SFP" (Small Form-factor Pluggable) enables the customer to choose between optical and electrical interfaces. The SFPs are not locked to a certain brand. Non-Ericsson SFPs will be activated by the node if it is possible, but Ericsson can then not guarantee interoperability between the node and the SFP.

Interface	Capability
Electrical, shielded RJ45 jack	10/100/1000BASE-T
Optical, LC connector	1000BASE-SX Multi mode 850 nm
Optical, LC connector	1000BASE-LX Single mode 1310 nm
Optical, LC connector	1000BASE-LX Single/Multi mode 1310 nm
Optical, LC connector	1000BASE-ZX Single mode 1550 nm
Optical, LC connector	1000BASE-BX10-U Single mode Tx 1310 Rx 1490 nm
Optical, LC connector	1000BASE-BX10-D Single mode Tx 1490 Rx 1310 nm
Optical, LC connector	1000BASE-BX40-U Single mode Tx 1310 Rx 1490 nm
Optical, LC connector	1000BASE-BX40-D Single mode Tx 1490 Rx 1310 nm
Optical, LC connector	10GBASE-LR Single mode 1310nm
Optical, LC connector	1000BASE-X CWDM Single mode 1470-1610 nm
Optical, LC connector	10GBASE-ER Single Mode 1550 nm
Optical, LC connector	10GBASE-ZR Single Mode 1550 nm
Optical, LC connector	10GBASE-X DWDM Single mode 1528-1566 nm

9.1.3.1 Ethernet DAC cable

The DAC (Direct Attach Copper) cable enables the customer to connect two collocated nodes at 10Gbps rate. DAC is a cost-effective alternative for Ethernet SFP+ modules and cables. The DACs are not locked to a certain brand. Non-Ericsson DACs will be activated by the node if it is possible but Ericsson can then not guarantee interoperability between the nodes.

Connector type	Rate
SFP+	10Gbps



9.2 PDH interfaces

9.2.1 ETSI

E1 electrical interface is according to G.703 for 75 Ω and 120 Ω .
(See chapter 9.4.1)

Output pulse mask in resistive load is according to ITU-T Rec. G.703.

9.2.2 ANSI

DS1 electrical interface is according to T1.403-1999 with line build out for 0-655 ft.

Output mask complies with T1.403-1999 Figure 2.

Line code is AMI/B8Z5.

9.3 SDH Interfaces

9.3.1 SDH SFP

The SFP (Small Form-factor Pluggable) enables the customer to choose between optical and electrical interfaces. The SFPs are not locked to a certain brand. Non-Ericsson SFPs will be activated by the node if it is possible, but Ericsson can then not guarantee interoperability between the node and the SFP.

The SDH SFP will be used as STM-1

Interface	Capability
Electrical, DIN 1.0/2.3 75 Ohm, female	S-1.E
Optical, LC connector	S-1.1 1310nm
Optical, LC connector	L-1.1 1310nm
Optical, LC connector	L-1.2 1550nm
Optical, LC connector	BiDi 1310/1550nm
Optical, LC connector	BiDi 1550/1310nm
Optical, LC connector	L-1/4/16.2C CWDM 1470-1610nm



9.4 PDH Traffic Connectors

9.4.1 ETSI

For NPU 1003, PNM 1001, PNM 1002, LTU 1001 and LTU 1002, the E1 connector is a male SOFIX 24 pin connector with 4xE1 120 Ω balanced and 75 Ω unbalanced short haul (6 dB) terminations. The impedance is selectable between 75 Ω and 120 Ω .

For MINI-LINK 6651, the E1 connector on is an RJ45 connector. Only 120 Ω impedance is supported.

9.4.2 ANSI

For NPU 1003, PNM 1001, PNM 1002, LTU 1001 and LTU 1002, the DS1 connector is a male SOFIX 24-pin connector, with 4xDS1 terminations.

9.5 Local O&M

9.5.1 Site LAN Port

One of the fixed Ethernet ports on NPU 1002 / NPU 1003 / NPU 1005 / PNM 1001 / PNM 1002 / MINI-LINK 6651 / MINI-LINK 6366 can be configured as a site LAN port.

- The Ethernet connection is a shielded 8 pin RJ45 modular jack (DTE).
- The interface supports 10/100/1000 Mbit/s full duplex Ethernet with auto-negotiate
- The green LED on NPUs shows "Link up" connectivity.

9.5.2 USB Interface

There is a mini USB device port on NPU 1002 / NPU 1003 / NPU 1005 / PNM 1001 / PNM 1002 / MINI-LINK 6651 / MINI-LINK 6366.

- The interface is a 5 pin USB2 connector. (Mini-B USB connector)
- The bit rate is up to 480 Mbit

9.5.3 User I/O Interface

The User I/O interface includes a number of output and input signals.

- The output signals can be used to export alarms from the MINI-LINK 6600 to other equipment's supervision systems.
- The input signals can be used to transfer alarm and status information from on-site equipment to central management systems.



Plug-in units with User I/O interface

Board Type	# of input signals	# of output signals	Connector Type
NPU 1002	6	3	Male 24 pin SOFIX connector
NPU 1003	2	1	Male 24 pin SOFIX connector
NPU 1005	6	3	Male 24 pin SOFIX connector
PNM 1001	2	1	Male 24 pin SOFIX connector
PNM 1002	2	1	Male 24 pin SOFIX connector

9.5.3.1 Input Signals

The input signals are opto-coupled and have a reference that is floating with respect to each other and station ground. All signals are positive to the reference and shall read

- logical "0" when the Voltage < 1.0 V DC
- logical "1" when the Voltage > 2.4 V DC

These signals can be connected directly to a "Normally Open" (NO) or Normally Closed (NC) equipment like a relay or a mechanical switch, since they have weak internal drivers (2,5 Volt driver with ~4 Kohm serial resistors).

An input Voltage less than 15 V DC will not damage the equipment.

9.5.3.2 Output Signals

The output signals are performed with relay settings.

The output signals consist of three pins:

- NCL (Normally Closed)
- RTN (ReTurN)
- NOP (Normally Open).

At start-up the default position is:

- NCL-RTN is "normally closed" (impedance < 1 Ω)
- NOP-RTN is "normally open" (impedance > 1 M Ω)

The relays used to switch the settings have the contact rating:

- 100 V DC, 1 A
- 125 V AC, 1 A



The outputs are reset to default temporarily upon cold restart but are not affected by a warm restart of the board.

9.5.3.3 LED Indications

For Information about functionality and behavior please see CPI document, 35/1551-HRA 901 20/11 LED Descriptions.

9.6 Antenna Interface

Frequency band	Waveguide interface, flange types
5 GHz band	154 IEC-UDR 48
6 GHz Lower band	154 IEC-UDR 70
6 GHz Upper band	154 IEC-UDR 70
7 GHz band	154 IEC-UBR 84
8 GHz band	154 IEC-UBR 84
10 GHz band	154 IEC-UBR 120
11 GHz band	154 IEC-UBR 120
13 GHz band	154 IEC-UBR 120
15 GHz band	154 IEC-UBR 140
18 GHz band	154 IEC-UBR 220
23 GHz band	154 IEC-UBR 220
26 GHz band	154 IEC-UBR 260
28 GHz band	154 IEC-UBR 260
32 GHz band	154 IEC-UBR 320
38 GHz band	154 IEC-UBR 320
42 GHz band	Ericsson proprietary flange (waveguide R500)
80 GHz band	IEC R740 (WR-12)

9.7 Indoor-Outdoor Interconnection

RAU connector type: N

MMU connector type: TNC

ETSI

Maximum cable length for performance as specified above:

- 100 m (CS 112 MHz 85 m) With cable type TZA 500 97
- 200 m (CS 112 MHz 160 m) With cable type TZA 500 32
- 400 m (CS 112 MHz 300 m) With cable type TZA 501 26

ANSI

Maximum cable length for performance as specified above:

- 220 yd (CS 80 MHz 175 yd) With cable type TZA 500 95
- 440 yd (CS 80 MHz 330 yd) With cable type TZA 500 80



10 Power

10.1 Power Supply

MINI-LINK 6691 has two DC inputs located on the PFU 1101.

MINI-LINK 6692 has one DC input located on each PFU 1201.

MINI-LINK 6693 has two DC inputs located on the PFU 1301.

MINI-LINK 6694 has one DC input located on each PFU 1601.

MINI-LINK 6654 has two DC inputs located on PNM 1001/1002

MINI-LINK 6655 has two DC inputs located on PNM 1002

MINI-LINK 6651 has two DC inputs.

MINI-LINK 6366 has one DC input.

10.1.1 DC Supply Interface

- The power is floating, i.e. not connected to station ground.
- The PFU provides surge protection.

10.1.2 DC Supply Voltage

Normal service voltage range

The system is able to run at full operation in this range.

Abnormal service voltage range

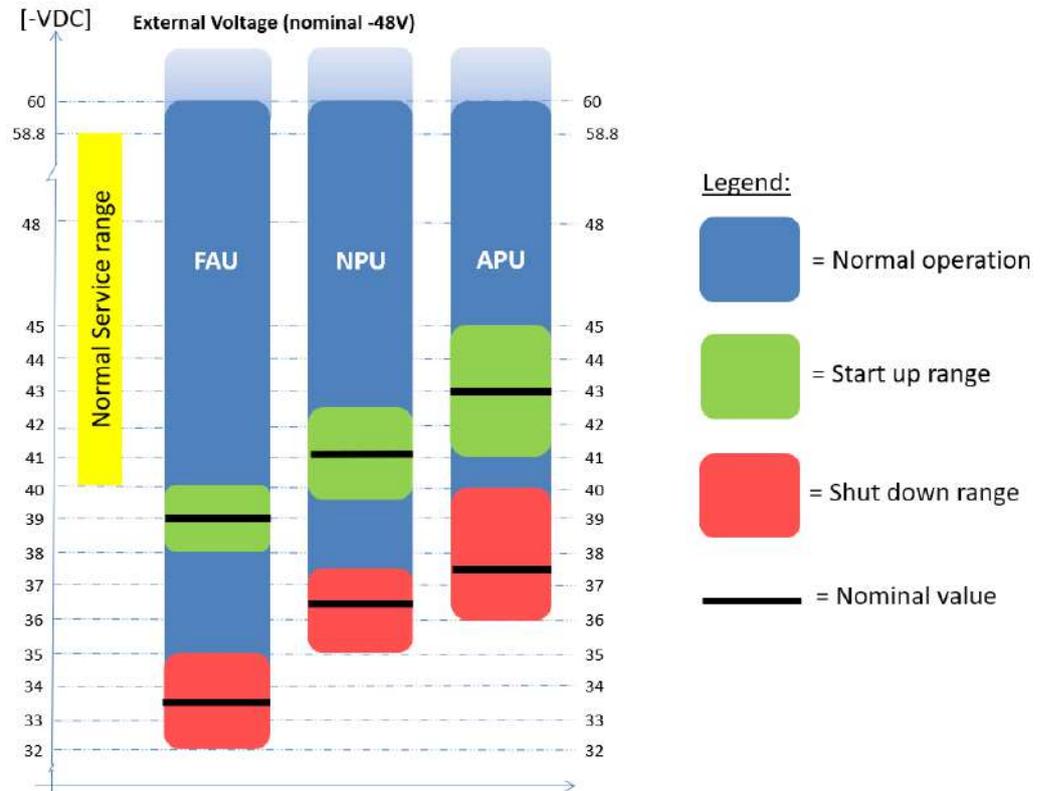
No function is guaranteed, but it will not result in any permanent damage, when operated in this range.

The system will restore to full operation when returning to normal service voltage range.

Nominal voltage	-48 VDC			
Product	6691, 6692, 6693 and 6694	6654 and 6655	6651	6366
Normal service voltage range	-58.8 V to -40 V	58.8 V to -40 V	-58.8 V to -40 V	-58.8 V to -38 V
Abnormal service voltage range	-60 V to -58.8 V -40 V to 0 V	-60 V to -58.8 V -40 V to 0 V	-60 V to -58.8 V -40 V to 0 V	-60 V to -58.8 V -38 V to 0 V
Typical startup voltage	-39 V to -43 V	-41 V to -43 V	-44 V to -46 V	-44 V to -46 V
Typical shutdown voltage	-33.5 V to -37.5 V	-33.5 V to -37.5 V	-37.5 V to -39.5 V	-35.5 V to -37.5 V



10.1.2.1 Clarification of input voltage behavior for MINI-LINK 6691, 6692, 6693 and 6694

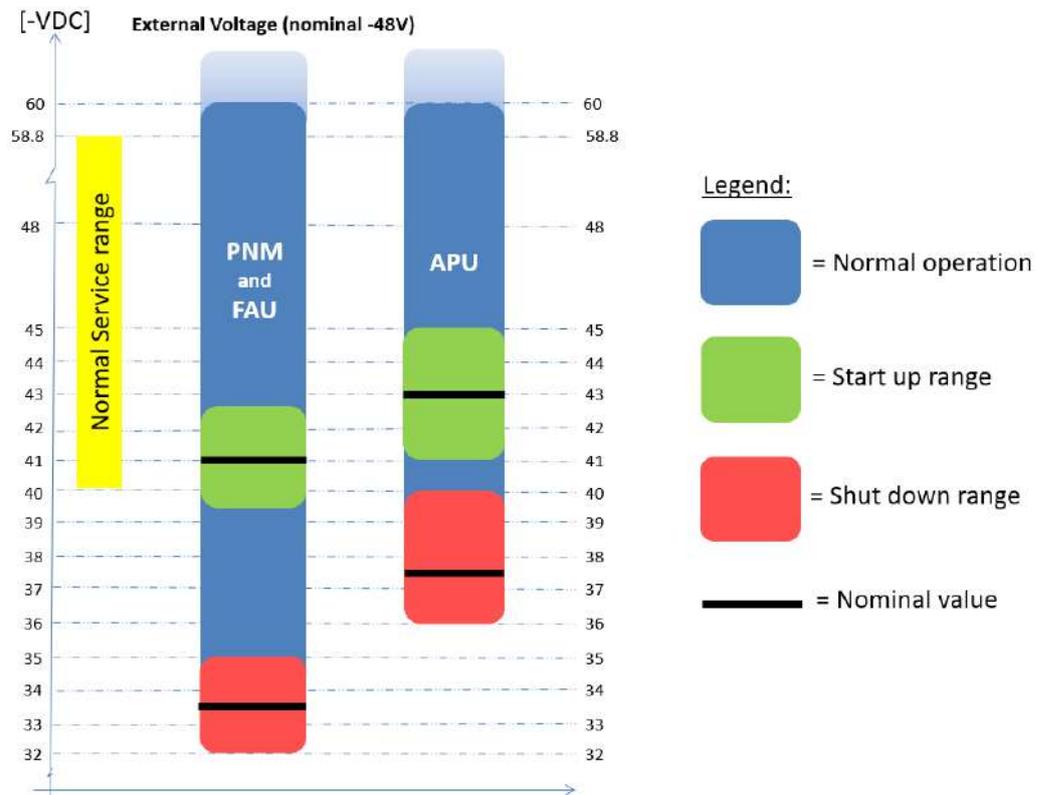


The picture above shows the Input voltage behavior for MINI-LINK 6691, 6692, 6693 and 6694. The different units within MINI-LINK 6691, 6692, 6693 and 6694 will be turned on and off at different voltages.

There is a hysteresis for all units to prevent power flapping (turning on/off repeatedly around a threshold).



10.1.2.2 Clarification of input voltage behavior for MINI-LINK 6654 and 6655



The picture above shows the Input voltage behavior for MINI-LINK 6654 and 6655. PNM and APU's will be turned on and off at different voltages.

There is a hysteresis for all units to prevent power flapping (turning on/off repeatedly around a threshold).

10.1.3 Power Supply Protection

PFU 1101, PFU 1301, PNM 1001, PNM 1002, and MINI-LINK 6651 have an external redundant power supply.

The same is applicable for PFU 1201 and PFU 1601 but these PFUs also support a redundant PFU solution.

If the input voltages to the PFU are lost, an alarm is sent.

MINI-LINK 6366 does not support redundant power supply.

10.1.4 Soft Start (all Plug-in Units)

The soft start function limits inrush current at start up or in case of a short circuit accordingly to EN 300 132-2.



10.1.5 Power Connector

PFU 1101:	Male 2-pin bus bar
PFU 1201:	Male 3-pin bus bar
PFU 1301:	Male 2-pin bus bar
PFU 1601:	Male 2-pin bus bar
PNM 1001:	Male 2-pin bus bar
PNM 1002:	Male 2-pin bus bar
MINI-LINK 6651:	Male 2-pin bus bar
MINI-LINK 6366/1:	2-pole power terminal with connection for shield
MINI-LINK 6366/4:	Male 2-pin with shield, Octis type

10.2 Power Line Disturbance

MINI-LINK 6691, 6692, 6693, 6694, PNM 1001, and PNM 1002 support Power Line Disturbance according to ATIS-0600315.2007 §5.5 (10 ms Fuse Blowing Transient) without restart.

APU, Application Plug-in Units are dimensioned to handle up to 0.1 ms transients.

10.3 Power Consumption

Power consumptions to be used for dimensioning of site power supply are 33% higher than the typical values. For OPEX calculation regarding power consumption the typical values give the best estimate.

10.3.1 Maximum Power Level for Fuse and Power Dimensioning

The supply voltage is specified in chapter 10.1.2.

The figures below are to be used for fuse and power dimensioning only.

Fuse type requirements: DC voltage of minimum 80 V, a breaking capacity of 5000 A or more, and one of the following types:

- Thermo-electromagnetic over-current release certified according to IEC 60947-2, according to curve C (IEC 60898).
- Hydraulic-magnetic over-current release according to Eaton/Heinemann curve 3 or equivalent.



Product	Fuse Type	
	Thermo-electromagnetic	Hydraulic-magnetic
MINI-LINK 6691	10 A	10 A
MINI-LINK 6692	40 A	40 A
MINI-LINK 6693	16 A	16 A
MINI-LINK 6694	25 A	25 A
MINI-LINK 6654	16 A	16 A
MINI-LINK 6655	25 A	25 A
MINI-LINK 6651	10 A	10 A
MINI-LINK 6366	4 A	6 A

For MINI-LINK 6200 installations other fuse values might be applicable. See reference [1].



10.3.2 Power Consumption & Heat Dissipation

Preconditions: 25 °C ambient temperature, -48V DC supply

Unit	Typical power consumption & dissipation
NPU 1002 ^{33,34}	30W
NPU 1003 ^{33,34}	23W
NPU 1005 ^{33,34}	41W
PNM 1001 ^{33,34,35}	44W
PNM 1002 ^{33,34,35}	48W
PFU 1101 ^{35,36}	2W (4W)
PFU 1201 ^{35,37}	2W (8 W)
PFU 1301 ^{35,38}	2W (5 W)
PFU 1601 ^{35,38}	2W (5 W)
FAU 1101 ³⁹	6W (20W)
FAU 1201 ³⁹	8 W (15W)
FAU 1301 ³⁹	2.5 W (10.5W)
FAU 1401 ³⁹	1.7W (12W)
FAU 1501 ³⁹	2.5 W (10.5W)
FAU 1601 ³⁹	2.5 W (10.5W)
LTU 1001	5W
LTU 1002 ³³	20W
ETU 1001	7W
ETU 1002 ³³	18W
MINI-LINK 6651/1 ^{33,34, 39}	40W (57W)
MINI-LINK 6651/2 ^{33,34, 39}	40W (57W)
MINI-LINK 6651/3 ^{33, 34}	27W
MINI-LINK 6651/4 ^{33,34,39}	58W(75W)
MINI-LINK 6366 ^{33, 34}	37W

³³ Each SFP adds 1 W and each SFP+ adds 1.5 W to the consumption value

³⁴ Additional power consumption per connected radio unit. See chapter 10.3.3.1. The specified value is applicable when no radio units are connected

³⁵ FAU DC loss included

³⁶ Enclosure equipped with 1 MMU 1002 or MMU 1004 and 2 radio units consuming 42 W each. Number within brackets represents PFU power consumption for enclosure equipped with 2 MMU 1002 or MMU 1004 and 4 radio units consuming 42 W each. Value within brackets includes fan-unit (FAU) running at full speed.

³⁷ Enclosure equipped with 2 MMU 1002 or MMU 1004 and 4 radio units consuming 42W each. Number within brackets represents PFU power consumption for enclosure equipped with 8 MMU 1002 or MMU 1004 and 16 radio units consuming 42 W each. Value within brackets includes fan-unit (FAU) running at full speed.

³⁸ Enclosure equipped with 2 MMU 1002 or MMU 1004 and 4 radio units consuming 42W each. Number within brackets represents PFU power consumption for enclosure equipped with 4 MMU 1002 or MMU 1004 and 8 radio units consuming 42 W each. Value within brackets includes fan-unit (FAU) running at full speed.

³⁹ Nominal value at room temperature. Value within brackets is when the fan-unit (FAU) is running at full speed (high temperature).



10.3.3 Radio Terminal Power Consumption

10.3.3.1 MMU Power Consumption and Indoor Heat Dissipation, typical

Preconditions: 25 °C ambient temperature, -48V DC supply

Unit	Typical power consumption & dissipation
MMU 1001 ⁴⁰	21 W
MMU 1002 ⁴⁰	25 W
MMU 1004 ⁴⁰	25 W
Additional power consumption in MMU 1001, MMU 1002, MMU 1004, PNM 1001, PNM 1002, MINI-LINK 6651 or MINI-LINK 6366 per connected radio unit	10% of the radio unit's power consumption

⁴⁰ Applicable when no radio units are connected



10.3.3.2 MINI-LINK 6363 Power Consumption and Outdoor Heat Dissipation

Typical power consumption & heat dissipation (W) at P_{max} (Including HP License), P_{max}-10dB and P_{min}.

Radio Type	P _{max}	P _{max} -10dB	P _{min}
MINI-LINK 6363 6L	33	27	17
MINI-LINK 6363 6U	33	27	17
MINI-LINK 6363 7	32	26	16
MINI-LINK 6363 8	32	26	16
MINI-LINK 6363 10	30	24	16
MINI-LINK 6363 11	30	24	16
MINI-LINK 6363 13	23	18	15
MINI-LINK 6363 15	25	20	16
MINI-LINK 6363 18	23	21	19
MINI-LINK 6363 23	23	21	19
MINI-LINK 6363 24	24	21	19
MINI-LINK 6363 26	24	21	19
MINI-LINK 6363 28	23	20	19
MINI-LINK 6363 32	23	20	19
MINI-LINK 6363 38	23	22	20
MINI-LINK 6363 42	23	22	20
MINI-LINK 6363 80	24	23	19

10.3.3.3 MINI-LINK 6363/2 Power Consumption and Outdoor Heat Dissipation

Typical power consumption & heat dissipation (W) at P_{max}, P_{max}-10dB and P_{min}.

Radio Type	P _{max}	P _{max} -10dB	P _{min}
MINI-LINK 6363/2 13	16	15	14
MINI-LINK 6363/2 15	16	15	14
MINI-LINK 6363/2 18	14	13	12
MINI-LINK 6363/2 23	14	13	12
MINI-LINK 6363/2 38	20	20	19

10.3.3.4 MINI-LINK 6365 Power Consumption and Outdoor Heat Dissipation

Typical power consumption & heat dissipation (W) at P_{max}, P_{max}-10dB and P_{min}.

Radio Type	P _{max}	P _{max} -10dB	P _{min}
MINI-LINK 6365 7/8	35	29	19
MINI-LINK 6365 13	26	22	18
MINI-LINK 6365 15	26	22	18
MINI-LINK 6365 18	24	22	20



10.3.3.5 RAU2 X Power Consumption and Outdoor Heat Dissipation

Typical power consumption & heat dissipation (W) at different RAU output power levels.

RAU Type	Nominal cons.	Eco Mode		
		P _{max} ⁴¹	P _{max-10dB}	P _{min}
RAU2 X 5 HP	42	37	23	15
RAU2 X 6L	30	27	24	17
RAU2 X 6L HP	42	37	28	15
RAU2 X 6U	28	25	22	15
RAU2 X 6U HP	42	37	28	15
RAU2 X 7	29	26	23	16
RAU2 X 7 HP	42	37	28	15
RAU2 X 8	30	27	24	16
RAU2 X 8 HP	42	42	26	16
RAU2 X 10	32	32	24	17
RAU2 X 10 HP	38	38	28	18
RAU2 X 11	27	27	20	16
RAU2 X 11 HP	39	39	28	17
RAU2 X 13	23	20	19	15
RAU2 X 13 HP	26	22	20	15
RAU2 X 15	24	19	19	15
RAU2 X 15 HP	26	21	20	15
RAU2 X 18	22	20	19	16
RAU2 X 18 HP	27	24	24	16
RAU2 X 23	22	20	19	16
RAU2 X 23 HP	28	25	24	16
RAU2 X 24	25	22	18	16
RAU2 X 26	25	22	18	16
RAU2 X 28	26	23	19	17
RAU2 X 32	24	22	22	15
RAU2 X 38	27	24	24	20
RAU2 X 42	25	23	21	19

⁴¹ Requires RAU2 X HW ≥ R6A.



10.3.4 Power consumption for pre-defined configurations

In the table below the power consumption of orderable pre-defined configurations are stated.

The stated power consumption only includes the power consumption for the indoor unit. As the power consumption for the indoor parts has a small dependency to the power consumption of the outdoor units, the following has been assumed:

- All radio connectors are connected to an outdoor unit
- All connected outdoor units have a power consumption of 30W

Also,

- The power consumption of SFPs are not included



Product Number	Name	Content	Typical Power (room temp.)	Typical Power (full speed fans)
BFZ 601 36/1	ML 6651/1	MINI-LINK 6651/1, Fan Unit	46	63
BFZ 601 36/2	ML 6651/2	MINI-LINK 6651/2, Fan Unit	46	63
BFZ 601 36/3	ML 6651/3	MINI-LINK 6651/3	30	30
BFZ 601 36/4	ML 6651/4	MINI-LINK 6651/4	64	81
BFZ 601 46/1	ML 6654 Config 1	Magazine set with PNM 1001, FAU 1401	49	59
BFZ 601 46/2	ML 6654 Config 2	Magazine set with PNM 1002, FAU 1401	56	66
BFZ 601 48/1	ML 6655 Config 1	Magazine set with PNM 1002, FAU 1501	57	65
BFZ 601 25/4	ML 6691 Config 4	Magazine set with NPU 1002, PFU 1101, FAU 1101	37	51
BFZ 601 25/5	ML 6691 Config 5	Magazine set with NPU 1002, PFU 1101, FAU 1101, one MMU 1002	68	82
BFZ 601 25/6	ML 6691 Config 6	Magazine set with NPU 1002, PFU 1101, FAU 1101, two MMU 1002	100	114
BFZ 601 25/7	ML 6691 Config 7	Magazine set with NPU 1003, PFU 1101, FAU 1101	30	44
BFZ 601 25/8	ML 6691 Config 8	Magazine set with NPU 1003, PFU 1101, FAU 1101, one MMU 1002	61	75
BFZ 601 25/9	ML 6691 Config 9	Magazine set with NPU 1003, PFU 1101, FAU 1101, two MMU 1002	93	107
BFZ 601 25/10	ML 6691 Config 10	Magazine set with NPU 1003, PFU 1101, FAU 1101, one MMU 1001	54	68
BFZ 601 25/11	ML 6691 Config 11	Magazine set with NPU 1005, PFU 1101, FAU 1101	48	62
BFZ 601 25/12	ML 6691 Config 12	Magazine set with NPU 1005, PFU 1101, FAU 1101, one MMU 1002	79	93
BFZ 601 25/13	ML 6691 Config 13	Magazine set with NPU 1005, PFU 1101, FAU 1101, two MMU 1002	111	125
BFZ 601 25/14	ML 6691 Config 14	Magazine set with NPU 1005, PFU 1101, FAU 1101, one MMU 1001	65	79
BFZ 601 25/15	ML 6691 Config 15	Magazine set with NPU 1002, PFU 1101, FAU 1101, one MMU 1004	68	82



BFZ 601 25/16	ML 6691 Config 16	Magazine set with NPU 1002, PFU 1101, FAU 1101, two MMU 1004	100	114
BFZ 601 25/17	ML 6691 Config 17	Magazine set with NPU 1003, PFU 1101, FAU 1101, one MMU 1004	61	75
BFZ 601 25/18	ML 6691 Config 18	Magazine set with NPU 1003, PFU 1101, FAU 1101, two MMU 1004	93	107
BFZ 601 25/19	ML 6691 Config 19	Magazine set with NPU 1005, PFU 1101, FAU 1101, one MMU 1004	79	93
BFZ 601 25/20	ML 6691 Config 20	Magazine set with NPU 1005, PFU 1101, FAU 1101, two MMU 1004	111	125
BFZ 601 31/1	ML 6692 Config 1	Magazine set with NPU 1002, PFU 1201, FAU 1201	40	47
BFZ 601 31/2	ML 6692 Config 2	Magazine set with NPU 1002, PFU 1201, FAU 1201, one MMU 1002	71	78
BFZ 601 31/3	ML 6692 Config 3	Magazine set with NPU 1002, PFU 1201, FAU 1201, two MMU 1002	102	109
BFZ 601 31/4	ML 6692 Config 4	Magazine set with NPU 1002, PFU 1201, FAU 1201, three MMU 1002	133	140
BFZ 601 31/5	ML 6692 Config 5	Magazine set with NPU 1002, PFU 1201, FAU 1201, four MMU 1002	185	192
BFZ 601 31/6	ML 6692 Config 6	Magazine set with NPU 1002, PFU 1201, FAU 1201, one MMU 1001	64	71
BFZ 601 31/7	ML 6692 Config 7	Magazine set with NPU 1005, PFU 1201, FAU 1201	51	58
BFZ 601 31/8	ML 6692 Config 8	Magazine set with NPU 1005, PFU 1201, FAU 1201, one MMU 1002	82	89
BFZ 601 31/9	ML 6692 Config 9	Magazine set with NPU 1005, PFU 1201, FAU 1201, two MMU 1002	113	120
BFZ 601 31/10	ML 6692 Config 10	Magazine set with NPU 1005, PFU 1201, FAU 1201, three MMU 1002	144	151
BFZ 601 31/11	ML 6692 Config 11	Magazine set with NPU 1005, PFU 1201, FAU 1201, four MMU 1002	196	203
BFZ 601 31/12	ML 6692 Config 12	Magazine set with NPU 1005, PFU 1201, FAU 1201, one MMU 1001	75	82



BFZ 601 31/13	ML 6692 Config 13	Magazine set with NPU 1002, PFU 1201, FAU 1201, one MMU 1004	71	78
BFZ 601 31/14	ML 6692 Config 14	Magazine set with NPU 1002, PFU 1201, FAU 1201, two MMU 1004	102	109
BFZ 601 31/15	ML 6692 Config 15	Magazine set with NPU 1002, PFU 1201, FAU 1201, three MMU 1004	133	140
BFZ 601 31/16	ML 6692 Config 16	Magazine set with NPU 1002, PFU 1201, FAU 1201, four MMU 1004	185	192
BFZ 601 31/17	ML 6692 Config 17	Magazine set with NPU 1005, PFU 1201, FAU 1201, one MMU 1004	82	89
BFZ 601 31/18	ML 6692 Config 18	Magazine set with NPU 1005, PFU 1201, FAU 1201, two MMU 1004	113	120
BFZ 601 31/19	ML 6692 Config 19	Magazine set with NPU 1005, PFU 1201, FAU 1201, three MMU 1004	144	151
BFZ 601 31/20	ML 6692 Config 20	Magazine set with NPU 1005, PFU 1201, FAU 1201, four MMU 1004	196	203
BFZ 601 39/1	ML 6693 Config 1	Magazine set with NPU 1002, PFU 1301, FAU 1301	35	43
BFZ 601 39/2	ML 6693 Config 2	Magazine set with NPU 1002, PFU 1301, FAU 1301, one MMU 1002	66	74
BFZ 601 39/3	ML 6693 Config 3	Magazine set with NPU 1002, PFU 1301, FAU 1301, two MMU 1002	97	105
BFZ 601 39/4	ML 6693 Config 4	Magazine set with NPU 1003, PFU 1301, FAU 1301	28	36
BFZ 601 39/5	ML 6693 Config 5	Magazine set with NPU 1003, PFU 1301, FAU 1301, one MMU 1002	59	67
BFZ 601 39/6	ML 6693 Config 6	Magazine set with NPU 1003, PFU 1301, FAU 1301, two MMU 1002	90	98
BFZ 601 39/7	ML 6693 Config 7	Magazine set with NPU 1003, PFU 1301, FAU 1301, one MMU 1001	52	60
BFZ 601 39/8	ML 6693 Config 8	Magazine set with NPU 1005, PFU 1301, FAU 1301	35	43
BFZ 601 39/9	ML 6693 Config 9	Magazine set with NPU 1005, PFU 1301, FAU 1301, one MMU 1002	77	85



BFZ 601 39/10	ML 6693 Config 10	Magazine set with NPU 1005, PFU 1301, FAU 1301, two MMU 1002	108	116
BFZ 601 39/11	ML 6693 Config 11	Magazine set with NPU 1005, PFU 1301, FAU 1301, one MMU 1001	70	78
BFZ 601 39/12	ML 6693 Config 12	Magazine set with NPU 1002, PFU 1301, FAU 1301, one MMU 1004	66	74
BFZ 601 39/13	ML 6693 Config 13	Magazine set with NPU 1002, PFU 1301, FAU 1301, two MMU 1004	97	105
BFZ 601 39/14	ML 6693 Config 14	Magazine set with NPU 1003, PFU 1301, FAU 1301, one MMU 1004	59	67
BFZ 601 39/15	ML 6693 Config 15	Magazine set with NPU 1003, PFU 1301, FAU 1301, two MMU 1004	90	98
BFZ 601 39/16	ML 6693 Config 16	Magazine set with NPU 1005, PFU 1301, FAU 1301, one MMU 1004	77	85
BFZ 601 39/17	ML 6693 Config 17	Magazine set with NPU 1005, PFU 1301, FAU 1301, two MMU 1004	108	116
BFZ 601 49/1	ML 6694 Config 1	Magazine set with NPU 1002, PFU 1601, FAU 1601	35	43
BFZ 601 49/2	ML 6694 Config 2	Magazine set with NPU 1002, PFU 1601, FAU 1601, one MMU 1002	66	74
BFZ 601 49/3	ML 6694 Config 3	Magazine set with NPU 1002, PFU 1601, FAU 1601, two MMU 1002	97	105
BFZ 601 49/4	ML 6694 Config 4	Magazine set with NPU 1002, PFU 1601, FAU 1601, one MMU 1001	59	67
BFZ 601 49/5	ML 6694 Config 5	Magazine set with NPU 1005, PFU 1601, FAU 1601	46	54
BFZ 601 49/6	ML 6694 Config 6	Magazine set with NPU 1005, PFU 1601, FAU 1601, one MMU 1002	77	85
BFZ 601 49/7	ML 6694 Config 7	Magazine set with NPU 1005, PFU 1601, FAU 1601, two MMU 1002	108	116
BFZ 601 49/8	ML 6694 Config 8	Magazine set with NPU 1005, PFU 1601, FAU 1601, one MMU 1001	70	78
BFZ 601 49/9	ML 6694 Config 9	Magazine set with NPU 1003, PFU 1601, FAU 1601	28	36



BFZ 601 49/10	ML 6694 Config 10	Magazine set with NPU 1002, PFU 1601, FAU 1601, one MMU 1004	66	74
BFZ 601 49/11	ML 6694 Config 11	Magazine set with NPU 1002, PFU 1601, FAU 1601, two MMU 1004	97	105
BFZ 601 49/12	ML 6694 Config 12	Magazine set with NPU 1005, PFU 1601, FAU 1601, one MMU 1004	77	85
BFZ 601 49/13	ML 6694 Config 13	Magazine set with NPU 1005, PFU 1601, FAU 1601, two MMU 1004	108	116



11 Environment

11.1 Environmental Conditions

Continuous Conditions (Normal Operation)

Environmental conditions in which all units are able to function as specified.

Exceptional Conditions (Safe Function)

Environmental stress outside the limits for normal operation in which all units continue to function, but performance or capacity may be reduced, e.g. slightly increased bit error rates.

11.1.1 Indoor Equipment

Ambient temperature range

Continuous Conditions: -5 to +60° C (+23 to +131° F)
(Normal Operation)

Exceptional Conditions: -25 to +65° C (-13 to +140° F)
(Safe Function – except for MINI-LINK 6651/3)

Exceptional Conditions: -25 to +60° C (-13 to +131° F)
(Safe Function – for MINI-LINK 6651/3)

Relative humidity range: 5-95 %

11.1.2 Outdoor Equipment

Ambient temperature range

Continuous Conditions: -33 to +55° C (-27 to +131° F)⁴²
(Normal Operation)

Exceptional Conditions: -45 to +60° C (-49 to +140° F)⁴²
(Safe Function)

Relative humidity range: 8-100 %

⁴² Outdoor temperature is measured in an open unshielded area preferably close to the radio. Sensor has to be protected from the sun. Minimum distance to other objects is 50 cm.



11.2 Altitude

Supported altitude over sea level is:

-100 meters to 5500 meters (-328 feet to 18045 feet)

11.3 Acoustic noise

MINI-LINK 6600 is compliant to acoustic level to ETSI 300 753, V1.3.1 <7.2 bels.

The fan speed and the acoustic level increase with increasing ambient temperature.

(MINI-LINK 6366 is fan-less = no noise)

11.4 EM Conditions

To conform with all EMC requirements shielded cables shall be used as specified in Ericsson product catalog.

11.4.1 Operating Conditions

When applicable the RF input signal is supposed to be set to a value 15 dB above the receiver input level for BER=10⁻⁵.

11.4.2 Performance Criteria

11.4.2.1 Performance Criterion for Continuous Phenomena (CT)

The communication link shall be maintained during and after the test.

During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data.

Ethernet and packet-data interfaces (LAN 10/100/1000 Mbit/s):
No more than 5 % additional errored frames above the quiescent level shall be permitted during the exposure.

Digital signal ports (E1/DS1, 60V Radio port):

The number of bit errors at each individual exposure shall not exceed the maximum number of errors stated by the manufacturer for intended operation.



11.4.2.2 Performance Criterion for Transient Phenomena (TT)

The communication link shall be maintained after the test.

After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed.

Ethernet and packet-data interfaces (LAN 10/100/1000 Mbit/s):

The data link connection shall be maintained.

Digital signal ports (E1/DS1, 60V Radio port):

Loss of frame alignment or loss of synchronization is not allowed during each individual exposure. No alarms shall be generated as a result of the electromagnetic stress.

The above does not apply to surge testing where some loss of frame alignment may be expected. For this test, the EUT shall operate as intended following the cessation of the exposure.

11.4.3 Radiated Immunity

11.4.3.1 ETSI

Performance Criterion for Continuous Phenomena (CT) applies for the Network Element when subjected to electrical fields up to the following level:

- For the frequency range 80 – 690 MHz the level is 3 V/m, and for frequency range 690 – 6000 MHz the test level is 10 V/m.

11.4.3.2 ANSI

Performance Criterion for Continuous Phenomena (CT) applies for the Network Element when subjected to electrical fields up to the following level:

- AM 1 kHz, 80% and level 8.5 V/m in the band 0.01–1000 MHz
- PM, 1 kHz, 1 μ s and level 8.5 V/m in the band 1000–10000 MHz



11.4.4 Conducted Immunity Radio Frequency, DC Power Ports, Signal Ports & Ground

11.4.4.1 ETSI

Performance Criterion for Continuous Phenomena (CT) applies for the Network Element when the DC power leads, signal leads and ground are subjected to interference injection up to the following level:

- 3 V_{RMS}, AM 1 kHz, 80% in the frequency range 0.15-80 MHz

11.4.5 Conducted Immunity Radio Frequency, DC Power Ports & Telecom Ports

11.4.5.1 ANSI

Performance Criterion for Continuous Phenomena (CT) applies for the Network Element when the DC power ports & Telecom ports (signal & telecom leads) are subjected to interference injection up to the following level:

- 89–80.5 dB μ Arms, AM 1 kHz, 80% in the frequency range 0.01–0.15 MHz.
- 80.5 dB μ Arms, AM 1 kHz, 80% in the frequency range 0.15–30 MHz.

11.4.6 Conducted Immunity Burst, DC Power Ports

Performance Criterion for Transient Phenomena (TT) applies for the Network Element when the DC power cable is subject to interference injection of fast transients (bursts) (direct connection) up to the following level:

- 1 kV open circuit voltage

11.4.7 Conducted Immunity Burst, Signal Ports

Performance Criterion for Transient Phenomena (TT) applies for the Network Element when the signal leads are subjected to interference injection of fast transients (bursts) (capacitive coupling) up to the following level:

- 0.5 kV open circuit voltage



11.4.8 Conducted Immunity Surge, Signal Ports – Indoor

Performance Criterion for Transient Phenomena (TT) applies for the Network Element when the indoor signal leads are subjected to injection of surge (1.2/50 μ s) up to the following level:

- 0.5 kV True Common Mode (Lines – ground – 40 or 42 Ω)
- 0.5 kV True Common Mode (Shield – ground – 2 Ω)

11.4.9 Intra-Building Lightning, Telecom Ports

11.4.9.1 ANSI

The Network Element shall not be damaged and shall continue to operate properly after the test when the Telecom ports are subjected to injection of lightning (1.2/50 μ s) up to the following level:

- Intra-Building Lightning Surge Shielded Cables:
1.5 kV Common Mode (Lines & Shield – ground – 1.2/50 μ s – 2+2 Ω)

11.4.10 Conducted Immunity Surge, Signal Ports – Outdoor

Performance Criterion for Transient Phenomena (TT) applies for the Network Element when the outdoor signal leads are subjected to injection of surge (1.2/50 μ s and 10/700 μ s) up to the following level:

- 1 kV True Common Mode (Shield – ground – 1.2/50 μ s – 2 Ω)
- 1 kV True Common Mode (Lines – ground – 1.2/50 μ s – 40 or 42 Ω)
- 1 kV True Common Mode (Lines – ground – 10/700 μ s – 40 Ω)

11.4.11 First Level & Intra-Building Lightning, Radio Ports

11.4.11.1 ANSI

The Network Element shall not be damaged and shall continue to operate properly after the test when the Radio ports are subjected to injection of lightning (1.2/50 μ s) up to the following level:

- Intra-Building Lightning Surge Shielded Cables:
1.5 kV Common Mode (Line & Shield – ground – 1.2/50 μ s – 2+2 Ω)
- First-Level Lightning Criteria for Antenna Ports:
600 V Common Mode (Line – ground – 1.2/50 μ s – 2 Ω)
- DC Power to Antenna Lightning Criteria:
6 kV Common Mode (Line – ground – 1.2/50 μ s – 2 Ω)



11.4.12 Electrostatic Discharge

11.4.12.1 ETSI

Performance Criterion for Transient Phenomena (TT) applies for the Network Element when it is subjected to electrostatic discharge up to the following levels:

- Air discharge: ± 8 kV
- Contact discharge: ± 4 kV

11.4.12.2 ANSI

Performance Criterion for Transient Phenomena (TT) applies for the Network Element when it is subjected to electrostatic discharge up to the following levels:

- Air discharge: ± 15 kV
- Contact discharge: ± 8 kV

11.4.13 Overvoltage Transient DC Power Ports

11.4.13.1 ANSI

The Network Element shall not be damaged and shall continue to operate properly after the test when the DC power ports are subjected to an overvoltage transient up to the following level:

- -75 V Overvoltage Transient, 10 ms + ≤ 2 μ s rise time & 2.5 ms fall time, Slope 10 V/ms.

11.4.14 Protection Device Operation Transient DC Power Ports

11.4.14.1 ANSI

The Network Element shall not be damaged and shall continue to operate properly after the test when the DC power ports are subjected to a transient up to the following level:

- -90/+100/+50%: -5V Undervoltage Transient Level & -100V/-75V Overvoltage Transient Level.
 - Under Voltage Dip: 10 ms + ≤ 12 μ s fall time & ≤ 5 μ s rise time.
 - Over Voltage Dip: 10 ms + ≤ 2 μ s rise time & 2.5 ms fall time.



11.5 EM Performance

To conform with all EMC requirements shielded cables shall be used as specified in Ericsson product catalog.

11.5.1 Radiated Emission Electric Field

The value of the radiated electric field from the Network Element and the cables measured at 3 m:

Frequency range	Limit, quasi-peak (dB μ V/m)
30 – 230 MHz	40
230 – 1000 MHz	47

Frequency range	Limit, average (dB μ V/m)	Limit, peak (dB μ V/m)
1 – 3 GHz	50	70
3 – 6 GHz	54	74

11.5.2 Conducted Emission, DC Power Ports

The quasi-peak and average value of the interference voltage on the DC power ports is less than:

Frequency range	Limit, quasi-peak (dB μ V)	Limit, average (dB μ V)
>150 kHz – 500 kHz	79	66
>500 kHz – 30 MHz	66	60

11.5.3 Conducted Emission, Telecommunication Ports

The quasi-peak and average value of the interference voltage or current on the Telecommunication Ports is less than:

Frequency range (MHz)	Voltage Limit, dB μ V		Current Limit, dB μ A	
	Quasi-peak	Average	Quasi-peak	Average
0.15 – 0.5	84 – 74	74 – 64	40 – 30	30 – 20
0.5 – 30	74	64	30	20

11.6 CE Mark

The equipment fulfills the requirements for CE mark according to the Radio and Telecommunications Terminal directive and the RoHS directive.



11.7 Grounding

11.7.1 Indoor Unit

MINI-LINK 6600 has a separate grounding connection to station ground.

For -48 VDC there are three independent power connections;

- Battery + (0 V)
- Battery – (-48 V)
- Station ground

The shield of the radio cables shall be connected to the radio connectors of the equipment, which in turn has galvanic contact with the enclosure.

11.7.2 Outdoor Unit (Radio Unit)

The chassis of the Radio Unit is connected to the mast, which is grounded.

The Radio Unit is provided with a separate grounding screw.

The shield of the coaxial cable is connected to the Radio Unit's chassis.



12 Mechanical Data

12.1 Outdoor Units

12.1.1 Weight (antennas not included)

RAU2 X:

Frequency	Typical	Max ⁴³
5–8 GHz	4.8 kg (10.6 lbs.)	5.5 kg (12.1 lbs.)
10–23 GHz	4.0 kg (8.8 lbs.)	4.5 kg (9.9 lbs.)
24–42 GHz	3.7 kg (8.2 lbs.)	4.0 kg (8.8 lbs.)

MINI-LINK 6363, MINI-LINK 6363/2 and MINI-LINK 6365:

Frequency	Typical	Max ⁴³
6 – 15 GHz	2.7 kg (6.0 lbs.)	3.2 kg (7.1 lbs.)
18 – 80 GHz	2.3 kg (5.1 lbs.)	2,7 kg (6.0 lbs.)

MINI-LINK 6366/1:

- 4.0 kg without mounting bracket
- 5.2 kg with mounting bracket for integrated mount
- 4.2 kg with two brackets for split-mount

MINI-LINK 6366/4:

- 4.0 kg without mounting bracket
- 5.2 kg with mounting bracket for integrated mount
- 4.2 kg with two brackets for split-mount

⁴³ Maximum weight varies due to different sub-bands' diplexers.



12.1.2 Nominal Dimensions

Product	Dimensions (DxWxH)	
	mm	inch
RAU2 X	97 x 260 x 321	3 ³ / ₄ " x 10 ¹ / ₄ " x 12 ¹ / ₂ "
MINI-LINK 6363, MINI-LINK 6363/2 and MINI-LINK 6365	79 x 197 x 179	3 ⁷ / ₆₄ " x 7 ³ / ₄ " x 7 ³ / ₆₄ "
MINI-LINK 6366/1 without mounting bracket	43 x 462 x 303	1 ¹¹ / ₁₆ x 20 ¹⁷ / ₆₄ x 11 ⁵⁹ / ₆₄)
MINI-LINK 6366/1 with mounting bracket for integrated mount	158 x 462 x 303	6 ⁷ / ₃₂ x 20 ¹⁷ / ₆₄ x 11 ⁵⁹ / ₆₄
MINI-LINK 6366/4 without mounting bracket	70 x 310 x 291	2 ³ / ₄ x 12 ¹ / ₅ x 11 ⁵ / ₁₁
MINI-LINK 6366/4 with mounting bracket for integrated mount	188 x 335 x 291	7 ² / ₅ x 13 ¹ / ₅ x 11 ⁵ / ₁₁

12.2 Indoor Units

12.2.1 Weight

Enclosure 1101:	2.9 kg
Enclosure 1201:	6.2 kg
Enclosure 1301:	3.6 kg
Enclosure 1401:	2.9 kg
Enclosure 1501:	3.5 kg
Enclosure 1601:	4.8 kg
PFU 1101:	0.2 kg
PFU 1201:	0.2 kg
PFU 1301:	0.2 kg
PFU 1601:	0.2 kg
FAU 1101:	0.3 kg
FAU 1201:	0.6 kg
FAU 1301:	0.3 kg



FAU 1401:	0.2 kg
FAU 1501:	0.3 kg
FAU 1601:	0.4 kg
NPU 1002:	0.9 kg
NPU 1003:	0.7 kg
NPU 1005:	0.9 kg
PNM 1001:	1.0 kg
PNM 1002:	1.2 kg
LTU 1001:	0.4 kg
LTU 1002:	0.4 kg
ETU 1001:	0.4 kg
ETU 1002:	0,4 kg
MMU 1001:	0.6 kg
MMU 1002:	0.7 kg
MMU 1004:	0.7 kg
APU Dummy unit:	0.4 kg
NPU Dummy unit:	0.5 kg
PFU Dummy unit:	0.05 kg
MINI-LINK 6651/1, /2 and /4 (incl. fan)	3.7 kg
MINI-LINK 6651/3	3.0 kg

12.2.1.1 Full configurations:

<u>MINI-LINK 6691:</u> (Incl. NPU 1002, PFU 1101, FAU 1101, 2 x MMU 1002)	5.6 kg
<u>MINI-LINK 6692:</u> (Incl. NPU 1002, PFU 1201, FAU 1201, 8 x MMU 1002)	13.5 kg
<u>MINI-LINK 6693:</u> (Incl. NPU 1003, PFU 1301, FAU 1301, 4 x MMU 1002)	7.3 kg
<u>MINI-LINK 6694:</u> (Incl. NPU 1002, PFU 1601, FAU 1601, 4 x MMU 1002)	9,5 kg
<u>MINI-LINK 6654:</u> (Incl. PNM 1001, FAU 1401, 2 x MMU 1002)	5,5 kg
<u>MINI-LINK 6655:</u> (Incl. PNM 1002, FAU 1501, 4 x MMU 1002)	7.7 kg



12.2.2 Nominal Dimensions

The sub-racks fit into standard IEC 297-3 19" cabinets or into cabinets following metric standard IEC 917-2-2.

MINI-LINK 6691 and MINI-LINK 6654

Depth (total; with connectors):	259 mm
Depth (behind mounting brackets):	240 mm
Width (total):	483 mm
Width (without mounting brackets):	446 mm
Height:	44 mm

MINI-LINK 6692

Depth (total; with connectors):	259 mm
Depth (behind mounting brackets):	240 mm
Width (total):	483 mm
Width (without mounting brackets):	446 mm
Height:	132.7 mm

MINI-LINK 6693 and MINI-LINK 6655

Depth (total; with connectors):	259 mm
Depth (behind mounting brackets):	240 mm
Width (total):	483 mm
Width (without mounting brackets):	446 mm
Height:	66 mm

MINI-LINK 6694

Depth (total; with connectors):	259 mm
Depth (behind mounting brackets):	240 mm
Width (total):	483 mm
Width (without mounting brackets):	446 mm
Height:	89 mm

MINI-LINK 6651/1, /2 and /4

Depth (total; with connectors):	261 mm
Depth (behind mounting brackets):	240 mm
Width (total):	483 mm
Width (without mounting brackets):	444 mm
Height:	44 mm

MINI-LINK 6651/3

Depth (total; with connectors):	194 mm
Depth (behind mounting brackets):	171 mm
Width (total):	483 mm
Width (without mounting brackets):	444 mm
Height:	44 mm



13 Standards

Compliance with relevant parts of the listed standards.

13.1 R&TTE Directive

Directive 1999/5/EC (Annex IV - CE E0682 - RAU/MMU & Annex II - CE - Other)	Of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity
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13.2 RoHS Directive

Directive 2011/65/EU CE	Of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment
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13.3 Council Recommendation

Council Recommendation 1999/519/EC (10 W/m ² – Public)	Of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz)
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13.4 RoHS

EN 50581	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
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13.5 Normative References

Code of Federal Regulations Title 21 Volume 8	Food and Drugs Chapter 1 – Food and Drugs Administration Department of Health and Human Services Subchapter J – Radiological Health
Code of Federal Regulations Title 47 Volume 1 & 5	Telecommunication Chapter I – Federal Communications Commission Chapter I
Interference-Causing Equipment Standards (ICES)	Spectrum Management and Telecommunication Official Publications, Standards, Interference-Causing Equipment Standards (ICES)
Radio Standards Specification (RSS)	Spectrum Management and Telecommunication Official Publications, Standards, Radio Equipment Standards, Radio Standards Specifications (RSS)
Spectrum Utilization Policy (SP)	Spectrum Management and Telecommunication Official Publications, Policies, Spectrum Utilization Policies (SP)
Standard Radio System Plan (SRSP)	Spectrum Management and Telecommunication Official Publications, Standards, Standard Radio System Plan (SRSP)
Telecommunications Regulation Circulars (TRC)	Spectrum Management and Telecommunication Official Publications, Information, Telecommunications Regulation Circulars (TRC)

13.6 Mechanics

IEC 60297-3-100	Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482.6 mm (19 in) series Part 3-100: Basic dimensions of front panels, sub racks, chassis, racks and cabinets
IEC 60297-3-101	Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482.6 mm (19 in) series Part 3-101: Sub-racks and associated plug-in units
IEC 60297-3-105	Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482.6 mm (19 in) series Part 3-105: Dimensions and design aspects for 1U high chassis
ETSI EN 300 119-3	Environmental Engineering: European telecommunication standard for equipment practice; Part 3: Engineering requirements for miscellaneous racks and cabinets
ETSI EN 300 119-4	Environmental Engineering: European telecommunication standard for equipment practice; Part 4: Engineering requirements for sub racks in miscellaneous racks and cabinets
IEC 60917-2-2	Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Section 2:



	Detail specification – Dimensions for sub racks, chassis, back planes, front panels and plug-in units
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13.7 Power

EN 300 132-2	Environment Engineering (EE); Power supply interface at the input to telecommunications equipment and 209atacom (ICT); Part 2: Operated by -48 V direct current (dc)
ATIS-0600315	Voltage Levels for DC-powered Equipment Used in the Telecommunications Environment

13.8 EMC

ETSI EN 301 489-4 (CE DC – Table 6)	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electro-Magnetic Compatibility (EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links and ancillary equipment
ETSI EN 301 489-1 (Emission – Class B Immunity – Level 2)	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electro-Magnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
FCC 47 CFR part 15	Code of Federal Regulations Title 47: Telecommunication Part 15 – Radio frequency devices
ICES-003	Information Technology Equipment (ITE) – Limits and methods of measurement
GR-1089-CORE	Telcordia Technologies Generic Requirements Electromagnetic Compatibility (EMC) and Electrical Safety – Generic Criteria for Network Telecommunications Equipment

13.9 Safety/Health

IEC/EN 60215 (100 W/m ²)	Safety requirements for radio transmitting equipment
IEC/EN 60 950-1 (Class III Equipment)	Information technology equipment – Safety, Part1: General requirements
IEC/EN 60 950-22	Information technology equipment – Safety – Part 22: Equipment installed outdoors
IEC/EN 60 825-1 (Class 1 Laser)	Safety of laser products – Part 1: Equipment classification, requirements and user's guide
IEC/EN 60529 (IP 66 – Outdoor MINI-LINK 6363) (IP 55 – Outdoor RAU2 with Ingress Protection Cover), (IP 20 – Indoor)	Degrees of protection provided by enclosures (IP Code)



IEC/EN 62311 (10 W/m ² – Public)	Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz-300 GHz)
EN 50385 (10 W/m ² – Public)	Product standard to demonstrate the compliance of radio base stations and fixed terminal stations for wireless telecommunication systems with the basic restrictions or the reference levels related to human exposure to radio frequency electromagnetic fields (110 MHz – 40 GHz) – General public
ETSI TR 102 457 (10 W/m ² – Public; 50 W/m ² – Workers)	Transmission and Multiplexing I; Study on the electromagnetic radiated field in fixed radio systems for environmental issues
ICNIRP Health Physics (Table 7) (10 W/m ² – Public; 50 W/m ² – Workers)	Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (Up to 300 GHz)
ANSI/UL 60950-1 (Listed/Recognized)	Information Technology Equipment – Safety – Part 1: General Requirements
CSA-C22.2 No. 60950-1 (Listed/Recognized)	Information Technology Equipment – Safety – Part 1: General Requirements (Bi-National standard, with UL 60950-1)
ANSI/UL 60950-22 (RAU2)	Information Technology Equipment – Safety – Part 22: Equipment to be Installed Outdoors
CSA-C22.2 No. 60950-22 (RAU2)	Information Technology Equipment – Safety – Part 22: Equipment to be Installed Outdoors (Bi-National standard, with UL 60950-22)
UL 50E (Type 3R Enclosure)	Enclosures for Electrical Equipment, Environmental Considerations
CSA-C22.2 No.94 (Type 3R Enclosure)	Enclosures for Electrical Equipment, Environmental Considerations (Tri-National Standard, with NMX-J-235/2-ANCE-2007 and UL 50E)
FCC 21 CFR part 1040, § Sec. 1040.10 (Class 1 Laser)	Code of Federal Regulations Title 21 Volume 8 – Food and Drugs Chapter 1 – Food and Drugs Administration Department of Health and Human Services Subchapter J – Radiological Health – Performance Standards for Light-Emitting Products – Laser Products
REDR C1370	Radiation Emitting Devices Regulations
FCC OET Bulletin 65 (10 W/m² – Public; 100 W/m² – Workers)	Evaluating Compliance with FCC Guidelines Human Exposure to Radiofrequency Electromagnetic Fields
IEEE Std C95.1 (10 W/m² – Public; 100 W/m² – Workers)	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
Safety Code 6 (10 W/m² – Public; 50 W/m² – Workers)	Limits of Human Exposure to radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz



13.10

Environmental & climatic

ETSI EN 300 132-2	Environment Engineering (EE); Power supply interface at the input to telecommunications equipment and 211atacom (ICT); Part 2: Operated by -48 V direct current (dc)
ETSI EN 300 019-1-1 (Class 1.2)	Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-1: Classification of environmental conditions; Storage
ETSI EN 300 019-1-2 (Class 2.3)	Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-2: Classification of environmental conditions; Transportation
ETSI EN 300 019-1-3 (Class 3.1E – Normal Operation, Class 3.3 – Safe Function)	Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weather protected locations
ETSI EN 300 019-1-4 (Class 4.1 & 4.2H – Normal Operation, Class 4.1E & 4.2H – Safe Function)	Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weather protected locations
ETSI EN 300 019-2-1	Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-1: Specification of environmental tests; Storage
ETSI EN 300 019-2-2	Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-2: Specification of environmental tests; Transportation
ETSI EN 300 019-2-3	Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-3: Specification of environmental tests; Stationary use at weather protected locations
ETSI EN 300 019-2-4	Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-4: Specification of environmental tests; Stationary use at non-weather protected locations
GR-63-CORE	Telcordia Technologies Generic Requirements NEBS™ Requirements: Physical Protection
FCC 47 CFR part 2	Code of Federal Regulations Title 47: Telecommunication Part 2 – Frequency allocations and radio treaty matters; general rules and regulations.
CENELEC EN 60079-0:2012 (MINI-LINK 6363)	Explosive atmospheres – Part 0: Equipment – General requirements



CENELEC EN 60079-15:2012 (MINI-LINK 6363)	Explosive atmospheres – Part 15: Equipment protection by type of protection “n”
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13.11 PDH

ITU-T O.151 10/92	Error performance measuring equipment operating at the primary rate and above
ITU-T G.703 10/98	Physical/electrical characteristics of hierarchical digital interfaces
ITU-T G.823 03/00	The control of jitter and wander within digital networks which are based on the 2048 Kbit/s hierarchy; Jitter and wander
ITU-T G.826 12/02	Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate. (Definition of parameters)
ITU-T G.921	Digital sections based on the 2048 kbit/s hierarchy
ITU-T G.775 10/98	Loss of Signal (LOS), Alarm Indication Signal (AIS) and Remote Defect Indication (RDI) defect detection and clearance criteria for PDH signals
G.742-88	Second order digital multiplex operating at 8.448 Mbit/s.
G.751-88	Third order digital multiplex operating at 34.368 Mbit/s.
ANSI T1.403-1999	Network to customer installation interface-DS1 electrical interface.
ANSI T1.102-1993	Digital Hierarchy, electrical interfaces
ANSI T1.231-1997	Digital Hierarchy-Layer 1 in-Service Digital Transmission Performance Monitoring.
ANSI T1.404-1994	DS3 and Metallic Interface Specification
Bellcore GR-499 –CORE	Transport Systems Generic Requirements (TSGR).

13.12 SDH

ITU-T G.703 10/98	Physical/electrical characteristics of hierarchical digital interfaces
ITU-T G.707 12/03	Network Element interface for the synchronous digital hierarchy (SDH)
ITU-T G.783 02/04	Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks
ITU-T G.826 12/02	Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate.
ITU-T G.828 02/00	Error performance parameters and objectives for international, constant bit rate synchronous digital paths



ITU-T G.841 10/98	Types and characteristics of SDH network protection architecture
ITU-T G.957 07/99	Optical interfaces for equipments and systems relating to the synchronous digital hierarchy
ITU-T M.2120 02/00	PDH path, section and transmission system and SDH path and multiplex section fault detection and localization procedures
ITU-T G.664	Optical safety procedures and requirements for optical transport systems
SFF-8472	Diagnostic Monitoring Interface for Optical Xcvrs
ETSI 301 167	Transmission and MultiplexII;Management of Synchronous Digital Hierarchy (SDH) transmission equipment; Fault management and performance monitoring; Functional description

13.13 Ethernet

IEEE 802.3/802.3u/802.3ab (Ethernet Interface)	CSMA/CD Access Method and Physical Layer Specifications
IEEE 802.3ac	Frame Extensions for Virtual Bridged Local Area Network (VLAN) Tagging on IEEE 802.3 Networks
IEEE 802.1ad	IEEE Standard for Local and metropolitan area networks Virtual Bridged Local Area Networks Amendment 4: Provider Bridges
IEEE 802.3ah	Media Access Control Parameters, Physical layers, and Management Parameters for Subscriber Access Networks
IEEE 802.3as-2006 (Frame size)	Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
IEEE 802.1	Working group for 802 LAN/MAN architecture, internetworking among 802 LANs, MANs and other wide area networks, 802 Security, 802 overall network management, and protocol layers above the MAC & LLC layers.
IEEE 802.1p (Priority)	Traffic Class Expediting and Dynamic Multicast Filtering (published in 802.1D-1998)
IEEE 802.1D	IEEE Standard for Local and metropolitan area networks: Media Access Control (MAC) Bridges
IEEE 802.1Q	IEEE Standard for Local and Metropolitan Area Networks--- Virtual Bridged Local Area Networks
IEEE 802.3x (Flow control)	IEEE Standards for Local and Metropolitan Area Networks: Specification for 802.3 Full Duplex Operation



IEEE 802.1AX	IEEE Standard for Local and metropolitan area networks— Link Aggregation
IETF RFC 1242	Benchmarking Terminology for Network Interconnection Devices: Performance measurements
RFC 2309	Recommendations on Queue Management and Congestion Avoidance in the Internet
IETF RFC 2544	Benchmarking Methodology for Network Interconnect Devices: Measurement of latency for SDH
RFC 4188	Definitions of Managed Objects for Bridges
MEF 2	Requirements and Framework for Ethernet Service Protection in Metro Ethernet Networks
MEF 9	Abstract Test Suite for Ethernet Services at the UNI
MEF 10	Ethernet Services Attributes Phase I
MEF 14	Abstract Test Suite for Ethernet Services at the UNI
IEEE 802.1ag/ ITU-T Y.1731	Ethernet Service OAM CFM
ITU-T Y.1731	Ethernet Service OAM PM

13.14 Synchronization

ITU-T G.781 07/99	Synchronization layer functions
ITU-T G.813 03/03	Timing characteristics of SDH equipment slave clocks (SEC)
ITU-T G.823 03/00	The control of jitter and wander within digital networks which are based on the 2048 Kbit/s hierarchy; Jitter and wander
ITU-T G.8261/Y.1361	Timing and synchronization aspects in packet network
ITU-T G.8262/Y.1362	Timing characteristics of a synchronous Ethernet equipment slave clock
ITU-T G.8264/Y.1364	Distribution of timing information through packet networks
G.8265.1	Precision time protocol telecom profile for frequency synchronization
ITU-T G.8273.2	Timing characteristics of telecom boundary clocks and telecom time slave clocks
ITU-T G.8271.1	Network limits for time synchronization in packet networks
ITU-T G.8275.1	Precision time protocol telecom profile for phase/time synchronization with full timing support from the network



IEEE 1588-2008	Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems
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13.15 Digital Radio Transmission

ETSI EN 302 217-2-2 (Radio equipment Class II)	Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-2: Digital systems operating in frequency bands where frequency co-ordination is applied; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
ETSI EN 302 217-2-1	Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-1: System-dependent requirements for digital systems operating in frequency bands where frequency coordination is applied
ETSI EN 302 217-1	Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 1: Overview and system independent common characteristics
ETSI EN 301 126-1	Fixed Radio Systems; Conformance testing; Part 1: Point-to-Point equipment – Definitions, general requirements and test procedures
ETSI EN 301 390	Fixed Radio Systems; Point-to-point and Multipoint Systems; Unwanted emissions in the spurious domain and receiver immunity limits at equipment/antenna port of Digital Fixed Radio Systems
CEPT ERC/DEC/(00) 07	Shared use of the band 17.7-19.7 GHz by the fixed service and Earth stations of the fixed-satellite service.
CEPT/ERC/REC 74-01E	Unwanted Emissions in the Spurious Domain
Rec. ITU-R F.1099	Radio-frequency channel arrangements for high- and medium-capacity digital fixed wireless systems in the upper 4 GHz (4 400-5 000 MHz) band
Rec. ITU-R F.383	Radio-frequency channel arrangements for high-capacity fixed wireless systems operating in the lower 6 GHz (5 925 to 6 425 MHz) band
Rec. ITU-R F.384	Radio-frequency channel arrangements for medium- and high-capacity digital fixed wireless systems operating in the 6 425-7 125 MHz band
Rec. ITU-R F.385	Radio-frequency channel arrangements for fixed wireless systems operating in the 7 110-7 900 MHz band
Rec. ITU-R F.386	Radio-frequency channel arrangements for fixed wireless systems operating in the 8 GHz (7 725 to 8 500 MHz) band



Rec. ITU-R F.747	Radio-frequency channel arrangements for fixed wireless systems operating in the 10.0-10.68 GHz band
Rec. ITU-R F.1568	Radio-frequency block arrangements for fixed wireless access systems in the range 10.15-10.3/10.5-10.65 GHz
Rec. ITU-R F.387	Radio-frequency channel arrangements for fixed wireless systems operating in the 10.7-11.7 GHz band
Rec. ITU-R F.497	Radio-frequency channel arrangements for fixed wireless systems operating in the 13 GHz (12.75-13.25 GHz) frequency band
Rec. ITU-R F.636	Radio-frequency channel arrangements for fixed wireless systems operating in the 14.4-15.35 GHz band
Rec. ITU-R F.595	Radio-frequency channel arrangements for fixed wireless systems operating in the 17.7-19.7 GHz frequency band
Rec. ITU-R F.637	Radio-frequency channel arrangements for fixed wireless systems operating in the 21.2-23.6 GHz band
Rec. ITU-R F.748	Radio-frequency arrangements for systems of the fixed service operating in the 25, 26 and 28 GHz bands
Rec. ITU-R F.1520	Radio-frequency arrangements for systems in the fixed service operating in the band 31.8-33.4 GHz
Rec. ITU-R F.749	Radio-frequency arrangements for systems of the fixed service operating in the 36-40.5 GHz band
Rec. ITU-R F.2005	Radio-frequency channel and block arrangements for fixed wireless systems operating in the 42 GHz (40.5 to 43.5 GHz) band
CEPT/ERC/REC 14-01 E	Radio-frequency channel arrangements for high capacity analogue and digital radio-relay systems operating in the band 5925 MHz – 6425 MHz
CEPT/ERC/REC 14-02 E	Radio-frequency channel arrangements for medium and high capacity analogue or high capacity digital radio-relay systems operating in the band 6425 MHz-7125 MHz
ECC/REC/(02)06	Preferred channel arrangements for digital Fixed Service Systems operating in the frequency range 7125-8500 MHz
CEPT/ERC/REC 12-05 E	Harmonized radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 10.0 – 10.68 GHz
CEPT/ERC/REC 12-06 E	Preferred channel arrangements for fixed service systems operating in the frequency band 10.7 – 11.7 GHz
CEPT/ERC/REC 12-02 E	Harmonized radio frequency channel arrangements for analogue and digital terrestrial fixed systems operating in the bands 12.75 GHz to 13.25 GHz
CEPT/ERC/REC 12-07 E	Harmonized radio frequency channel arrangements for analogue and digital terrestrial fixed systems operating in the bands 14.5 – 14.62 GHz paired with 15.23 -15.35 GHz
CEPT/ERC/REC 12-03 E	Harmonized radio frequency channel arrangements for analogue and digital terrestrial fixed systems operating in the bands 17.7 GHz to 19.7 GHz
T/R 13-02	Preferred channel arrangements for fixed services in the range 22.0-29.5 GHz



ERC/REC/(01)02	Preferred channel arrangements for digital fixed service systems operating in the frequency band 31.8 – 33.4 GHz
T/R 12-01 E	Harmonized radio frequency channel arrangements for analogue and digital terrestrial fixed systems operating in the bands 37-39.5 GHz
ECC/REC/(01)04	Recommended guidelines for the accommodation and assignment of multimedia wireless systems (MWS) and point-to-point (P-P) fixed wireless systems in the frequency band 40.5 – 43.5 GHz
FCC 47 CFR part 2 (§ 2.902 Verification)	Code of Federal Regulations Title 47: Telecommunication Part 2 – Frequency allocations and radio treaty matters; general rules and regulations.
FCC 47 CFR part 101	Code of Federal Regulations Title 47: Telecommunication Part 101 – Fixed microwave services
RSS-191	Local Multipoint Communication Systems in the Band 25.35-28.35 GHz; Point-to-Point and Point-to-Multipoint Broadband Communication Systems in the Bands 24.25-24.45 GHz and 25.05-25.25 GHz; and Point-to-Multipoint Broadband Communications in the Band 38.6-40.0 GHz
SP Gen	General Information Related to Spectrum Utilization and Radio Systems Policies
SP 1-20 GHz	Revisions to Microwave Spectrum Utilization Policies in the Range of 1-20 GHz
SP 3-30 GHz	Revisions to Spectrum Utilization Policies in the 3-30 GHz Frequency Range and Further Consultation
SRSP-305.9	Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 5925 – 6425 MHz
SRSP-306.4	Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 6425 – 6930 MHz
SRSP-306.5	Technical Requirements for Radio Systems Operating in the Fixed Service and Providing Television Auxiliary Services in the Bands 6590 – 6770 MHz and 6930 – 7125 MHz
SRSP-307.1	Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 7125 – 7725 MHz
SRSP-307.7	Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 7725 – 8275 MHz
SRSP-310.5	Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 10.55-10.68 GHz
SRSP-310.7	Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 10.7 – 11.7 GHz



SRSP-314.5	Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 14.5 – 15.35 GHz
SRSP-317.8	Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Bands 17.8-18.3 GHz and 19.3-19.7 GHz
SRSP-321.8	Technical Requirements for the Fixed Line-of-Sight Radio Systems Operating in the Bands 21.8 – 22.4 GHz and 23.0 – 23.6 GHz
SRSP-324.25	Technical requirements for Fixed Radio Systems Operating in the Bands 24.25 – 24.45 GHz and 25.05 – 25.25 GHz
SRSP-325.25	Technical Requirements for Fixed Radio Systems Operating in the Bands 25.25-26.5 GHz and 27.5-28.35 GHz
SRSP-338.6	Technical Requirements for Fixed Radio Systems Operating in the Band 38.6 – 40.0 GHz
TRC-43	Designation of Emissions (Including Necessary Bandwidth and Classification), Class of Station and Nature of Service

13.16 Operation & Maintenance Interfaces

13.16.1 DCN

IEEE 802.3	10 BASE-T Ethernet
IEEE 802.2	Local and metropolitan area networks-Specific requirements; Part 2: Logical Link Control
IETF RFC 768	User Datagram Protocol
IETF RFC 791	Internet protocol DARPA internet program protocol specification
IETF RFC 792	Internet control message protocol DARPA internet program protocol specification
IETF RFC 793	Transmission control protocol DARPA internet program protocol specification
IETF RFC 826	Address Resolution Protocol for SiteLAN and local access port
IETF RFC 854	Telnet protocol specification
IETF RFC 894	Transmission of IP datagrams over Ethernet Networks on SiteLAN Access and the local access port.
IETF RFC 951	Bootstrap protocol (bootp)
IETF RFC 959	File transfer protocol (ftp)
IETF RFC 1035	Domain names – implementation and specification
IETF RFC 1042	Transmission of IP Datagrams over IEEE 802 Networks on SiteLAN Access and the local access port.
IETF RFC 1144	PPP TCP/IP header compression
IETF RFC 1305	Network Time Protocol (Version 3) Specification, Implementation and Analysis



IETF RFC 1519	Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy
IETF RFC 1542	Clarifications and Extensions for the Bootstrap Protocol
IETF RFC 1631	The IP Network Address Translator (NAT) for the local access port.
IETF RFC 1700	Assigned Numbers (Telnet)
IETF RFC 1812	Requirements for IP Version 4 Routers
IETF RFC 2096	IP Forwarding Table MIB
IETF RFC 2131	Dynamic Host Configuration Protocol for the Local Access Port.
IETF RFC 2328	OSPF Version 2
IETF RFC 2474	Definition of the Differentiated Services Field (DS Field) in the Ipv4 and Ipv6 Headers
IETF RFC 2508	Compressing IP/UDP/RTP Headers for Low-Speed Serial Links
IETF RFC 2509	IP Header Compression over PPP
IETF RFC 2780	IANA Allocation Guidelines for values in the Internet Protocol and Related Headers
IETF RFC 4251	The Secure Shell (SSH) Protocol Architecture
IETF RFC 5426	Transmission of Syslog Messages over UDP

13.16.2 SNMP

The list below shows all IETF RFCs, which the MINI-LINK 6600 and MINI-LINK 6366 complies with in applicable parts. None of the IETF specified notification types are supported.

IETF RFC 1157	A Simple Network Management Protocol (SNMP)
IETF RFC 1212	Concise MIB Definitions
IETF RFC 1213	Management Information Base for Network Management of TCP/IP-based internets: MIB-II
IETF RFC 1850	OSPF Version 2 Management Information Base
IETF RFC 1901	Introduction to Community-Based SNMPv2
IETF RFC 2011	SNMPv2 Management Information Base for the Internet Protocol using SMIPv2
IETF RFC 2012	SNMPv2 Management Information Base for the Transmission Control Protocol using SMIPv2
IETF RFC 2013	SNMPv2 Management Information Base for the User Datagram Protocol using SMIPv2
IETF RFC 2558	Definitions of Managed Objects for the SONET/SDH Interface Type
IETF RFC 2571	An Architecture for Describing SNMP Management Frameworks
IETF RFC 2578/STD58	Structure of Management Information Version 2 (SMIPv2)
IETF RFC 2579/STD58	Textual Conventions for SMIPv2
IETF RFC 2580/STD58	Conformance Statements for SMIPv2



IETF RFC 2737	Entity MIB
IETF RFC 2863	The Interfaces Group MIB for SiteLAN
IETF RFC 2864	The Inverted Stack Table Extension to the Interfaces Group MIB
IETF RFC 3410	Introduction and Applicability Statements for Internet-standard Network Management Framework
IETF RFC 3411/STD62	An architecture for Describing SNMP Management Frameworks
IETF RFC 3412/STD62	Message Processing and Dispatching for the SNMP
IETF RFC 3413/STD62	SNMP Applications
IETF RFC 3414/STD62	User-based Security Model (USM) for SNMPv3
IETF RFC 3415/STD62	View-based Access Control Model (VACM) for SNMP
IETF RFC 3416/STD62	Version 2 of the Protocol Operations for SNMP
IETF RFC 3417/STD62	Transport Mappings for SNMP
IETF RFC 3418/STD62	Management Information Base for SNMP
IETF RFC 3584	Co-existence Between Version 1, Version 2, and Version 3 of the Internet-Standard Network Management Framework
IETF RFC 3593	Textual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals
IETF RFC 4133	Entity MIB (Version 3)
IETF RFC 4188	Definition of Managed Objects for Bridges
IETF RFC 4001	Textual conventions for Internet network addresses
IETF RFC 4805	Definitions of Managed Objects for the DS1, J1, E1, DS2, and E2 Interface Types

13.17 Security

ITU-T X.800	Security Architecture for open system interconnection for CCIT applications
ITU-T X.805	Security Architecture for systems providing end-to-end communications
IETF RFC2865	RADIUS
IETF draft-grant-tacacs-02.txt	TACACS+ v 1.78
IETF 4251, 4252, 4253	SSH
IETF RFC 3414/STD62	User-based Security Model (USM) for SNMPv3
IETF RFC 3826	The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model



Definitions/Abbreviations

ACAP	Adjacent Channel Alternate Polarization
ACCP	Adjacent Channel Co-Polarization
AIS	Alarm Indicating Signal
APU	Application Plug-in Unit
ATPC	Automatic Transmit Power Control
AU-n	Administrative Unit-n
BER	Bit Error Rate
BERT	Bit error Ratio Test
CBS	Committed Burst Size
CCDP	Co-Channel Dual-Polarization
CCS	Common Channel Signaling
CESoPSN	Structure-aware TDM Circuit Emulation Service over Packet Switched Network
CIR	Committed Information Rate
CW	Continuous Wave
DCN	Data Communication Network
DTE	Data Terminal Equipment
EBS	Excess Burst Size
ECID	Emulated Circuit Identifier
EIR	Excess Information Rate
EM	Electro Magnetic
EMC	Electro Magnetic Compatibility
ETU	Ethernet Termination Unit
FAU	Fan unit
FTP	File Transfer Protocol
IEC	International Electro technical Commission
IETF	Internet Engineering Task Force
IME	Inverse Multiplexing
LAG	Link Aggregation Group
LAN	Local Area Network
LED	Light Emitting Diode
LTU	Line Termination Unit
MEF	Metro Ethernet Forum
MIB	Management Information Base
MMU	Modem Unit
MSP	Multiplexer Section Protection
NNI	Network-Network Interface
NPU	Node Processor Unit
OSPF	Open Shortest Path First
PEP	Provider Edge Port
PFU	Power Filtering Unit



PL	Packet Link
PPP	Point to Point Protocol
PRT	Product Ready for Tender
PSU	Power Supply Unit
PTP	Precision Timing Protocol
PW	Pseudowire
QAM	Quadrature Amplitude Modulation
QL	Quality Level
RADIUS	Remote Authentication Dial In User Service
RAU	Radio Unit
RBER	Residual Bit Error Rate
RFC	Request For Comments
RLB	Radio Link Bonding
RLP	Radio Link Protection
RSEC	Reference Spectral Efficiency Class
RTPC	Remote Transmit Power Control
SAToP	Structure-Agnostic TDM over Packet
SFP	Small Form-factor Pluggable
SFPe	SFP electrical
SFPo	SFP optical
SI	Single Interface
SMI	Structure of Management Information
SNCP	Sub-Network Connection Protection
SNMP	Simple Network Management Protocol
SPQ	Strict Priority Queuing
SSM	Synchronization Status Message
STM-n	Synchronous Transport Module-n
TACACS+	Terminal Access Control, Access Control Server
TBD	To Be Determined
TC	Traffic Class
TCP/IP	Transmission Control Protocol/Internet Protocol
TDM	Time Division Multiplexing
TOS	Type Of Service
TUG	Tributary Unit Group
U	Measure used in mechanical constructions (1U = 44.45 mm)
UDP	User Datagram Protocol
UNI	User-Network Interface
USM	User-based Security Model
VACM	View-based Access Model
VCAT	Virtual Concatenation
VC-n	Virtual Container
VCC	Virtual Channel Connection
VID	VLAN ID
VPC	Virtual Path Connection
WAN	Wide Area Network
WDRR	Weighted Deficit Round Robin
WFQ	Weighted Fair Queuing
WRED	Weighted Random Early Detection
XPIC	Cross-Polarization Interference Canceller



15

References

- [1] 1/1301-HRA 901 20/14 MINI-LINK 6200 Product Specification



16 Revision History

Rev.	Date	Changes
A	2015-12-18	Applicable for MINI-LINK 6600 1.0
B	2016-04-22	Rework of document structure Added/updated information in chapter: 1, 2.1, 2.2, 2.3, 2.6, 3, 4.2.3, 6 (new), 9.1.2, 9.2, 9.3.3.1, 13
C	2016-05-26	Added MINI-LINK 6363 7, 13, 15 and 38 in document - Clarified IP classification for MINI-LINK 6363
D	2016-08-19	Applicable for MINI-LINK 6600 1.1 - Introduced for ANSI
E	2016-10-04	Moved chapter 2.8 DCN to chapter 7 DCN Added chapter 2.8 MLHC and updated chapter 2.1.1, 4.3.1, 4.5.1 and 4.5.2
F	2016-10-19	Added data for MINI-LINK 6363 6L, 6U, 8, 10, 11, 24, 26 and 80 in document.
G	2016-11-28	Chapter 4.3.4, 4.3.5 & 4.3.8 has been updated Chapter 4.3.9 has been added
J	2017-01-30	Updated for MINI-LINK 6600 1.2 Added MINI-LINK 6692, NPU 1002, PFU 1201, FAU 1201, LTU 1001 & MINI-LINK 6651 Updated Mechanical and Power data for Indoor Updated latency values for 112 MHz CS Updated Eth cap for 112 MHz 128QAM and 64kb packet Updated chapter 10.1
K	2017-02-01	Removed a watermark
L	2017-02-06	Correction made in Chapter 1
M	2017-02-21	Updated Chapter 2.7
N	2017-02-22	Updated Chapter 2.3 & 2.7
S	2017-04-26	Added MINI-LINK 6693 -updated chapters 1, 2.7, 9 and 11
T	2017-07-06	Added data for MINI-LINK 6363 28, 32 and 42 Output power tolerance information and Pmax for 2048/4096QAM added as reference for MINI-LINK 6363 80. Supported Physical modes MINI-LINK 6363 80 updated Power consumption table updated Updated Adjacent channel table for 4096 QAM and 1024QAM for MINI-LINK 6363 80GHz Added MINI-LINK 6366



U	2017-07-07	Correction of Supported release
V	2017-07-13	Correction for MINI-LINK 6366
X	2017-09-06	NPU 1003 added, minor corrections
Y	2017-10-09	Added content: New SFP+ HW Routed DCN (Unnumbered Ethernet interfaces) LAN DCN Ipv6 ERP BNM 1588 phase & time L3 VPN RLP RLB MMU 1001 MINI-LINK 6651/2 LTU 1002
Z	2017-10-24	Added information for MINI-LINK 6363/2 13 and 15
AA	2017-11-23	SNMPv3 Security features were added to 7 th and 13 th chapter
AB	2017-12-01	Updated number of supported tributaries and limitation of 40 tributaries in each direction for TDM in two directions. Added ch 5.1.
AC	2018-01-19	NPU 1001 is removed as it is no longer supported. The following chapters have been updated: 1, 2.1.1, 2.4, 2.5, 2.6, 2.9, 2.10, 3.1, 3.2, 5.1, 5.6.3, 5.9, 9.1.2, 9.4.1, 9.4.2, 9.5.1, 9.5.2, 9.5.3, 10.3.2, 12.2.1,
AD	2018-03-09	Ch. 2.4 QoS is updated. Ch. 2.5 Ethernet Protection updated Ch. 3.2 Time Synchronization Technologies is updated Updated Adjacent Channel values, added 80 MHz FF for ETSI. Added Capacity and Latency for 80 MHz ETSI. Ch. 9.5.3 User I/O interface is updated.
AE	2018-04-06	Introduced PNM 1001, PNM 1002, MINI-LINK 6654, and MINI-LINK 6366/4 The following chapters have been updated: 2.4, 2.8, 3.1, 4, 5.9.1, 5.9.2, 5.9.3, 5.9.4, 8.2, 9.1.2, 9.5.1, 9.5.2, 9.5.3, 10.1, 10.2, 10.3.1, 10.3.2, 10.3.3, 12.2.1, 14
AF	2018-05-04	Updated output power for ML6363 28 Re-introduced chapter 12.2.2 Nominal Dimensions. This chapter was missing in revision AE.



AG	2018-06-27	Frequency information updated with CS112MHz support Increased freq. bandwidth for ML6363 13 sub-band 01L/H Updated Pcon table for ML6363 Included ML6363/2 18 and 23GHz in document Added LLDP Added TWAMP Updated Radio Link Bonding information Added info that MINI-LINK 6651 and MINI-LINK 6366 support MLHC Protection and Bonding information updated Latency values for new FF's updated Additional updates due to low latency FF's ETU 1002 introduced Physical Interfaces information updated Ethernet DAC cable introduced Local O&M information updated MINI-LINK 6655 introduced Ethernet Traffic Interfaces updated: 10 Mbps rate added; half duplex support removed DC Supply Voltage figure updated with PNM Indoor Units information updated
AH	2018-09-20	Increased freq. bandwidth for ML6363 6L sub-band 14L/H and 54L/H Included reference for ATEX in environmental and climatic standards Added Multi-Band Booster with Policy Based Forwarding Updated with ANSI LL FF information Updated reference for ATEX Updated Chapters 2.5, 2.12, and 4 with PNM 1001 and PNM 1002 information Updated Chapter 2.11: Added PNM 1002, changed NPUs to MMUs. Updated chapter 5.4.2 Information regarding maximum output power including HP license.
AJ	2018-09-27	NPU board port extension added Multi-Band Booster with Policy Based Forwarding IP DSCP option added HqoS added
AK	2018-10-09	NPU board port extension removed
AL	2018-12-20	Input voltage ranges for ML6654 and 6655 clarified (separate sub-chapter added) ML6651/3 introduced Updated Multi-Band Booster with PBF Power consumption for pre-defined configurations (BFZs) added ML6694 added NPU 1002 – ML6692 update related to "Port limitation removal": Chapter 2.3, 2.10 and the Introduction. Updated chapter 3.1: added Synchronous Ethernet support for ETU 1002.



AM	2019-03-05	Chapter 11.6.1 Grounding (Indoor). Text has been corrected to a more general text. (minor change) Chapter 13.6 Mechanics. IEC 60297-3-101 added. (minor change) Chapter 5.1 Supported Modem and Radio Unit combinations. Clarification of: Supported Modem and Radio Unit combinations Chapter 9.1.2 Interfaces per Application. Updated ETU 1002 information. Chapter 2.14 NPU board port extension added. Chapter 10.3.3 Radio Terminal Power Consumption. Power values corrected for BFZ 601 31/6 (ML6692 config 6). Included MINI-LINK 6363/2 38 in document Chapter 6.3 Circuit Emulation Services added.
AN	2019-03-26	Chapter 3.1, Table 1 is updated. Chapter 3.2, paragraph after Table 3 is updated. Chapter 3, A sentence about G.8265.1 is added. Chapter 3.1, Table 2, A new column with G.8265.1 content is added. Chapter 2.13, 2.14 MINI-LINK 6694 node is added to NPU board protection. Chapter 2.14, 2.15 and 5.10.7 are updated/added (Port extension, Ethernet Performance Monitoring and Multiband Booster PBF).
AS	2019-06-27	Chapter 1 and 2.3: Corrected switch capacity for NPU 1002 and NPU 1003 related to Port Extension. Chapter 2.15 updated Chapter 3.1: Table 2 updated Chapter 3.2: Tables 3 and 4 updated Chapter 4: Seamless MPLS and BGP-LU added Chapter 5.3.10: Increased fTx High edge 13GHz sub-band 01L from 12891 to 12900MHz. (Support for FCC CS50 (n4)). Chapter 5.7, 5.9.1, 5.9.2 and 5.10.4: MIMO added Chapter 5.10.7: Minor corrections in Multi-Band Booster PBF Chapter 10.3: BFZ 601 49/9 added for ML6694 (with NPU 1003)
AT	2019-07-11	Chapter 2.4: QoS: Added supported BW profile association Chapter 4: Maximum number of VPNs per PE corrected. Chapter 10.3.1: Fuse value for MINI-LINK 6694 changed from 20A to 25A, and fuse value for MINI-LINK 6655 changed from 20A to 25A
AU	2019-08-29	Chapter 4: Maximum IP forwarding table size (Ipv4 unicast) set to 4000 Chapter 9.2.1 and 9.4.1 updated. Clarification added about E1 impedance.
AV	2019-09-04	Chapter 10.3.1: Table updated: MINI-LINK 6691 fuse value changed from 12A to 10A MINI-LINK 6693 fuse value changed from 20A to 16A



AX	2019-10-02	Chapter 2.15: Correction in counters on TC Chapter 2.16: MAC Swap Loopback added Chapter 3: Support for SyncE and ieee1588v2 capabilities on ETU 1001 Chapter 4: Updated with RSVP-TE Path Protection Chapter 5.3.8: Radio frequencies 10GHz removed sub-band 1xL/H Chapter 5.3.9: Radio frequencies 11GHz updated sub-band 01L/H Chapter 5.3.11: Radio frequencies 15GHz updated sub-band 12L/H Chapter 5.10.7: Correction in Policy based forwarding description Chapter 10.3.1: Fuse requirements added Chapter 11.3: New chapter for Acoustic noise NPU 1005 added. The following chapters has been updated: 1, 2.3, 3.1, 3.2, 4, 8.2, 9.1, 9.5, 10.3, 12.2
AY	2019-10-15	Document moved to new template for external communication Chapter 1: Corrected information about number of radio link and number of directions.
AZ	2019-12-17	General: Channel Separation reference removed from applicable tables. Only Frame ID is used Chapter 4: Maximum number of MPLS labels in MPLS forwarding table corrected Chapter 5.1 ML6366 now officially supports RAU2 X for some configs Chapter 5.2: Channel Separation to Frame ID relation table updated with XPIC and MIMO Frame IDs Chapter 5.4.1: RSEC updated in ETSI table Chapter 5.5.1: Channel Separation updated in ETSI table Chapter 5.6.7: Residual BER tables updated Chapter 5.8.1.1 and 5.8.1.2: Channel Separation added in tables Chapter 6.1.5: Added E1/DS1 overhead calculation formula. Chapter 6.4 & 6.5 Added (TDM relationship with Ethernet & TDM latency) Chapter 12.2: Some weights corrected
BA	2020-01-29	Converted to Templafy TRX3 removed (LH specific) MIMO for ANSI added MIMO capacities added Support for ITU-T G8275.1 Transparent clock added MINI-LINK 6365 7/8, 13, 15 and 18 GHz added Frequency data for MINI-LINK 6365 added Support for IS-IS Level 2 added Support for Hierarchical Radio Link Bonding (hRLB) added



BB	2020-04-07	<p>Ch 2.6: SOAM Frame Loss measurements added Ch 2.10: Corrected slot positions for NPU 1003 in MINI-LINK 6694 Ch 2.11, Ch 2.13, Ch 5.12: Clarification that no Latency is added Ch 2.14: Failover time for NPU protection is changed to “less than 20 sec”. Failover time 25-40 seconds in case of hRLB added. Ch 3: Synchronization chapter restructured. Tables updated. Ch 5.3 and Ch 5.5.2. Included Frequency data and Maximum output power data for ML6363/4 11, 15 and 18. Ch 5.8.2.1: Updated with Frame ID for XPIC and MIMO + footnotes Ch 5.8.2.2: Updated with Frame ID for XPIC and MIMO + footnotes Ch 5.8.3: Updated with switch down threshold for MIMO Ch.5.10.1: Supported Physical Modes, corrected matrix for MINI-LINK 6363, ML6363/2 and ML6365 (XPIC support for 2048QAM in CS13.75/14MHz and 2048QAM in CS20MHz) Ch 5.11: 2+2 RLP EQP as RLT mode added. 4+0 RLB EQP corrected. Ch 10.3: Power consumption for NPU 1002 changed from 50W to 30W Ch 13: Standards, Synchronization standards put in own standards table. (ch 13.14) Ch 15: Reference to MINI-LINK 6200 Product Specification added. Referenced from Chapter 10.3.1</p>
BC	2020-05-19	<p>MINI-LINK 6651/4 added MMU 1004 added Ch 2.1, 2.2: CS added in tables Ch 2.2.1: Low Latency Max figures for FramID 258/358 – 1024 QAM corrected Ch 2.17: MAC swap loopback - ingress with egress MAC lookup added Ch 5.5.2: Updated table for maximum output power for ML6363 80 R4A Ch 5.11: 16+0 hRLB added Ch 5.11.8: Dynamic PCP priority handling added Ch 6: CES and TDM info updated in connection with LTU1002 support in ANSI Ch 6.3: Updated with DS1 Ch 6.5: TDM latency figures added Ch 9.1.4: Board list is updated both in ETSI and ANSI. Ch 10.3.2: Power consumption for NPU 1005 added Ch 10.3.2: Power consumption for PFU 1101 corrected Ch 10.3.3.2: ML6363 Pcon table updated Ch 10.3.4: Configurations with NPU 1005 and MMU 1004 added. Power consumption with full fan speed are updated.</p>