

Global Product Compliance Laboratory 600-700 Mountain Avenue Room 5B-108 Murray Hill, New Jersey 07974-0636 USA



Title 47 Code of Federal Regulations Test Report

Regulation: FCC Part 2 and 27

Client: Nokia Solutions and Networks US LLC

Product Evaluated: AirScale MAA 64T64R 192AE B41 320W AEHC Issue 2.0

> Report Number: TR-2020-0060-FCC2-27

> > Date Issued: June 8, 2020

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Table of Contents

1.	SYS	TEM INFORMATION AND REQUIREMENTS	4
1 1 1 1	.1 .2 .3 .4	INTRODUCTION PURPOSE AND SCOPE EUT DETAILS TEST REQUIREMENTS	5 5 5 7
1 1 1	.5 .6 .7	STANDARDS & PROCEDURES Executive Summary Test Configuration for all Antenna Port Measurements	7 9 9
2.	FCC	SECTION 2.1046 - RF POWER OUTPUT 1	0
2	.1	RF Power Output 1	0
3.	FCC	SECTION 2.1047 - MODULATION CHARACTERISTICS	30
3	.1	MODULATION CHARACTERISTICS	30
4.	FCC	SECTION 2.1049 – OCCUPIED BANDWIDTH/EDGE OF BAND EMISSIONS	37
4 4	.1 .2	Occupied Bandwidth	;7 ;8
5.	FCC	SECTION 2.1051 - SPURIOUS EMISSIONS AT TRANSMIT ANTENNA PORT	57
5	.1	MEASUREMENT OF SPURIOUS EMISSIONS AT TRANSMIT ANTENNA PORT	57
6.	FCC	SECTION 2.1053 - FIELD STRENGTH OF SPURIOUS RADIATION7	/8
6	.1 .2	SECTION 2.1053 FIELD STRENGTH OF SPURIOUS EMISSIONS	'8 '8
7.	FCC	SECTION 2.1055 - MEASUREMENT OF FREQUENCY STABILITY7	'9
8.	NVL	AP CERTIFICATE OF ACCREDITATION	39

Revisions

Date	Revision	Section	Change
6/3/20	0		Initial Release
6/4/20	1		Page 4: FCC ID Update
6/8/20	2		Section 1.3.2: Remove Incorrect EUT Photos

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1. System Information and Requirements

Report copies and other information not contained in this report are held by either the product engineer or in an identified file at the Global Product Compliance Laboratory in Murray-Hill, NJ.

Equipment Under Test (EUT):	i): AirScale MAA 64T64R 192AE B41 320W AEHC			
Serial Number:	L1201606511			
FCC ID:	VBNAEHC-01			
Hardware Version:	475124B.X32			
Software Version:	LTE: SBTS20A			
	5G: 5G19B			
Frequency Range:	2496-2690 MHz			
GPCL Project Number:	2020-0060			
Manufacturer:	NOKIA SOLUTIONS AND NETWORKS OY			
	KARAKAARI 7, FI-02610 ESPOO			
	FINLAND			
Test Requirement(s):	Title 47 CFR Parts 2 and 27			
Test Standards:	Title 47 CFR Parts 2 and 27			
	KDB 971168 D01 Power Measurement License Digital Systems			
	v03r01 April 9, 2018.			
	KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013			
	• ANSI C63.26 (2015)			
	• ANSI C63.4 (2014)			
Measurement Procedure(s):	FCC-IC-OB - GPCL Occupied Bandwidth and Power Measurement			
	Test Procedure 12-4-2017			
	FCC-IC-SE - GPCL Spurious Emissions Test Procedure 12-4-2017			
Test Date(s):	5/14/2020 - 5/28/2020			
Test Performed By:	Nokia			
	Global Product Compliance Laboratory			
	600-700 Mountain Ave.			
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	Murray Hill, NJ 07974-0636			
Product Engineer(s):	Ron Remy			
Lead Engineer:	Steve Gordon			
Test Engineer (s):	Jaideep Yadav			
Test Results: The EUT, as tested	met the above listed requirements. Report copies and other information			
not contained in this report are	held by either the product engineer or in an identified file at the Global			
Product Compliance Laboratory in New Providence, NJ.				

1.1 Introduction

This Conformity test report applies to the AirScale MAA 64T64R 192AE B41 320W AEHC, hereinafter referred to as the Equipment Under Test (EUT).

1.2 Purpose and Scope

The purpose of this document is to provide the testing data required for qualifying the EUT in compliance with FCC Parts 2 and 27 measured in accordance with the procedures set out in Section 2.1033 (c) (14) of the Rules.

Radio Access Technology	BW (MHz)	Power W/MHz	Total TRX Output power/Port (dBm)	Total TRX Output power/Port (Watts)	Total (64 ports) power (W)
5G-NR	100	3.2	37.0	5.0	320
5G-NR	60	4	35.7	3.8	243.2
5G-NR	40	4	34.0	2.5	160
LTE	20	5	31.9	1.6	102.4

This report covers the following configurations for AEHC FCC Filing:

1.3 EUT Details

1.3.1 Specifications

Specification Items	Description
Radio Access Technology	LTE & 5G NR
Duplex Mode	Time Division Duplex (TDD)
Modulation Type(s)	QPSK 16QAM 64QAM 256QAM
Operation Frequency Range	2496-2690 MHz
Channel Bandwidth	LTE 20MHz / 5G NR 40, 60, 100 MHz
Tx/Rx	64T64R
МІМО	Yes
Deployment Environment	Outdoor
Supply Voltage	-48.0 VDC
Max RF Output Power	320W (5W per TRX)

1.3.2 Photographs



1.4 Test Requirements

Each required measurement is listed below:

47 CFR FCC Sections	Description of Tests	Test Required
2.1046, 27.53	RF Power Output	Yes
2.1047, 27.53	Modulation Characteristics	Yes
2.1049, 27.53	(a) Occupied Bandwidth (b) Out-of-Band Emissions	Yes
2.1051, 27.53	Spurious Emissions at Antenna Terminals	Yes
2.1053, 27.53	Field Strength of Spurious Radiation	Yes
2.1055, 27.53	Frequency Stability	Yes

1.5 Standards & Procedures

1.5.1 Standards

- Title 47 Code of Federal Regulations, Federal Communications Commission Part 2.
- Title 47 Code of Federal Regulations, Federal Communications Commission Part 27.
- ANSI C63.26, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

1.5.2 Procedures

- 1. FCC-IC-0B and FCC-IC-SE
- ANSI C63.4 (2014) entitled: "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz", American National Standards Institute, Institute of Electrical and Electronic Engineers, Inc., New York, NY 10017-2394, USA.
- 3. FCC KDB 971168 D01 Power Measurement License Digital Systems v03r01 April 9, 2018. FCC KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013

1.5.3 MEASUREMENT UNCERTAINTY

The results of the calculations to estimate uncertainties for the several test methods and standards are shown in the Table below. These are the worst-case values.

	Worst Case Estimated Preasa ement oncer tainfies						
Standard, Method or Procedure		Condition	Frequency MHz	Expanded Uncertainty (k=2)			
a.	Classical Emissions, (<i>e.g.</i> , ANSI C63.4, CISPR 11, 14, 22, <i>etc.</i> , using ESHS 30,	Conducted Emissions	0.009 - 30	±3.5 dB			
		Radiated Emissions	30 MHz – 200MHz H	±5.1 dB			
		(AR-6 Semi-Anechoic	30 MHz – 200 MHz V	±5.1 dB			
		Chamber)	200 MHz – 1000 MHz H	±4.7 dB			
			200 MHz – 1000 MHz V	±4.7 dB			
			1 GHz - 18 GHz	±3.3 dB			

Worst-Case Estimated Measurement Uncertainties

Antenna Port Test	Signal Bandwidth	Frequency Range	Expanded Uncertainty (k=2), Amplitude
	10 Hz	9 kHz to 20 MHz	
Occupied Bandwidth, Edge of Band,	100 Hz	20 MHz to 1 GHz	1 70 dD
Conducted Spurious Emissions	10 kHz to 1 MHz	1 GHz to 10 GHz	1.70 UD
	1MHz	10 GHz to 40 GHz:	
RF Power	10 Hz to 20 MHz	50 MHz to 18 GHz	0.5 dB

1.6 Executive Summary

Requirement	Description	Result
47 CFR FCC Parts 2 and 27		
2.1046, 27.53	RF Power Output	
	Peak to Average Power Ratio	COMPLIES
2.1047, 27.53	Modulation Characteristics	COMPLIES
2.1049, 27.53	(a) Occupied Bandwidth	COMPLIES
	(b) Edge of Band Emissions	
2.1051, 27.53	Spurious Emissions at Antenna	COMPLIES
	Terminals	
2.1053, 27.53	Field Strength of Spurious Radiation	COMPLIES
2.1055, 27.53	Frequency Stability	COMPLIES

- 1. **COMPLIES -** Passed all applicable tests.
- 2. N/A Not Applicable.
- 3. **NT –** Not Tested.

1.7 Test Configuration for all Antenna Port Measurements.



2. FCC Section 2.1046 - RF Power Output

2.1 **RF Power Output**

This test is a measurement of the total RF power level transmitted at the antenna-transmitting terminal. The product was configured for test as shown in section above and allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26.

Power measurements were made with an MXA Signal Analyzer. TX Port 6 was the port with the highest power output.

Carrier	ТМ	TX Port	Channel Frequency MHz	Signal BW MHz	Modulation	Channel Power dBm
1	3.1a	6	2506	20	256 QAM	32.01
1	1.1	6	2593	20	QPSK	32.20
1	3.1	6	2680	20	64 QAM	31.57
2	3.1	6	2506+2526	20	64 QAM	34.760
2	1.1	6	2506+2680	20	QPSK	34.565
2	3.1a	6	2660+2680	20	256 QAM	34.852
3	3.1a	6	2506+2526+2546	20	256 QAM	36.545
3	3.1	6	2506+2593+2680	20	64 QAM	36.379
3	1.1	6	2640+2660+2680	20	QPSK	36.659

Tabular Data – LTE Channel RF Power

Tabular Data – 5G 40MHz Signal BW RF Power

ТМ	TX Port	Channel Frequency MHz	Signal BW MHz	Modulation	Channel Power dBm
3.1a	6	2516	40	256 QAM	34.307
3.1	6	2593	40	64 QAM	34.303
3.2	6	2670	40	QPSK/16QAM	34.408

Tabular Data – 5G 60MHz Signal BW RF Power

ТМ	TX Port	Channel Frequency MHz	Signal BW MHz	Modulation	Channel Power dBm
3.1	6	2526	60	64 QAM	35.905
3.2	6	2593	60	QPSK/16QAM	35.968
3.1a	6	2660	60	256 QAM	36.078

Tabular Data – 5G TUUMHZ Signal BW RF Powe	Tabular Data –	5G 100MHz Signal	BW RF Power
--	----------------	------------------	--------------------

		Channel Power	
		dBm	
	TM 3.1	TM 3.2	TM 3.1a
тх	64QAM Modulation	QPSK/16QAM Modulation	256QAM Modulation
Port	2546 MHz Channel Frequency	2593 MHz Channel Frequency	2640 MHz Channel Frequency
	100 MHz Signal BW	100 MHz Signal BW	100 MHz Signal BW
1	37.107	36.906	36.910
2	36.982	36.821	36.848
3	36.975	36.786	36.838
4	36.928	36.738	36.733
5	36.903	36.739	36.745
6	36.974	36.951	36.929
7	36.864	36.749	36.756
8	36.846	36.632	36.681
9	36.837	36.654	36.730
10	37.036	36.941	36.940
11	36.848	36.527	36.611
12	38.068	37.903	37.941
13	36.928	36.758	36.829
14	37.021	36.849	36.853
15	36.842	36.620	36.702
16	37.025	36.818	36.896
17	36.914	36.673	36.815
18	36.820	36.532	36.707
19	36.857	36.553	36.761
20	36.726	36.454	36.694
21	36.772	36.501	36.724
22	37.038	36.772	36.901
23	36.926	36.724	36.856
24	36.669	36.360	36.526
25	36.905	36.661	36.841
26	36.725	36.442	36.717
27	36.610	36.370	36.600
28	37.919	37.661	37.898
29	36.850	36.546	36.716
30	36.871	36.636	36.823
31	36.896	36.611	36.734
32	36.828	36.568	36.711
33	37.454	37.349	37.367
34	36.965	36.764	36.773
35	37.113	36.995	36.982
36	36.666	36.552	36.579
37	37.055	36.891	36.970
38	36.785	36.587	36.679
39	37.199	37.070	37.082

Global Product Compliance Laboratory Report No.: TR-2020-0060-FCC2-27 Product: AirScale MAA 64T64R 192AE B41 320W AEHC

40	36.931	36.821	36.900
41	37.465	37.388	37.434
42	37.250	37.162	37.229
43	37.004	36.932	36.946
44	38.131	38.071	38.107
45	37.136	36.950	36.986
46	37.014	36.818	36.869
47	37.002	36.815	36.787
48	36.818	36.730	36.776
49	37.187	36.963	37.149
50	37.221	36.869	36.991
51	37.192	36.920	37.050
52	36.746	36.388	36.562
53	37.060	36.898	36.927
54	37.095	36.691	36.886
55	37.016	36.704	36.837
56	36.937	36.901	36.925
57	37.234	37.057	37.165
58	37.185	37.005	37.123
59	36.986	36.806	36.660
60	34.474	34.345	34.373
61	36.938	36.700	36.881
62	36.991	36.868	36.918
63	37.230	37.047	37.075
64	36.984	36.822	36.898

NOTE: For 100MHz, only the maximum TX44 plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

2.1.1 Channel RF Power - Plots



LTE 1C Data Channel Frequency 2506 MHz, Modulation 256QAM, TX6

Channel Frequency 2593 MHz, Modulation QPSK, TX6









LTE 2C Data Channel Frequency 2506+2526 MHz, Modulation 64QAM, TX6

Channel Frequency 2506+2680 MHz, Modulation QPSK, TX6









LTE 3C Data Channel Frequency 2506+ 2526 + 2546 MHz, Modulation 256QAM, TX6

Channel Frequency 2506 + 2593 + 2680 MHz, Modulation 64QAM, TX6



Channel Frequency 2640 + 2660 + 2680 MHz, Modulation QPSK, TX6

Keysight Spectrum Analyzer - At	CP							
CM RF 50 Ω	2 AC	SE	NSE:INT			12:14:41 PM N	ay 22, 2020	Frequency
Center Freq 2.6600	00000 GHz	Center F	req: 2.660000	AvaiHold:	101/101	Radio Std: N	one	requerey
PASS Gate: LO	IFGain:	Low #Atten: 1	0 dB	Ext Gain:	-41.20 dB	Radio Devic	BTS	
10 dB/div Ref 45.0	00 dBm							
25.0								
33.0	32.1 dBr	m 32.0) dBm	31.5	dBm			Center Fred
25.0	attent and the second	and an and a state of the second state of the	a dumanta	al an thinks	and stand and the second stands			2.66000000 GHz
15.0	-provide the part of the		a la fan de la fan de		and subset			
5.00	1	¥	1	1	1			
5.00		1				l		
5.00								
-15.0								
-25.0								
OF O DEPENDENCE AND A DEPENDENCE						ma	BMS AVG	
-45.0								
Center 2 66 GHz						Snan 1	00 MHz	
#Pas RW 1 MHz		#\/	BM 3 MH			Sween 2	0.12 me	CF Step
			5WV 5 Millia			Oncep 2	0.12 1113	10.000000 MHz
Total Carrier Power	36.659 dBm/ 6	0.00 MHz	ACP-I	BW				Auto Man
				Lov	ver	Upper		
Carrier Power	Filter	Offset Freq	Integ BW	dBc	dBm (dBc dBm	Filter	Freg Offset
1 32 104 dBm / 204	00 MHz 3 dB			000		a di la		0.47
2 32.010 dBm / 20.0	00 MHz - 3 dB							0 Hz
3 31 530 dBm / 201	00 MHz -3 dB							
L Strado dbinn 20.								
100					C. CTATH			
Mou					STATUS			



5G 40MHz Channel Frequency 2516 MHz, Modulation 256QAM, TX6



Keysight Spe	ectrum Analyzer - ACL	R_EUTRA_TM3_1_2C_4	+0MBW_2593_0_TX6						0
20	RF 50 Ω	AC	S	ENSE:INT			(3:47:23 PM)	4ay 15, 2020	Frequency
Center F	req 2.59300	00000 GHz	Center F	req: 2.593000	0000 GHz		Radio Std: N	lone	riequency
PASS	Gate: LO		Trig: Ext	ternal1	Avg Hold: 1	01/101			
FA33		IFGain:Lo	w #Atten: 4	1 dB	Ext Gain: -4	1.20 dB	Radio Devic	e: BTS	
10 dB/div	Ref 45.0	0 dBm							
Log									
35.0			34.	3 dBm					Center Fre
25.0									2 593000000 GH
15.0		and interest and	minimum segurit	rist fight hand for	which we wanted	100			2.00000000000
15.0									
5.00						1			
5 m									
-5.00									
-15.0									
35.0									
-2010									
-35.0						100		FMS AVIS	
45.0								a contention of the state	
Contor 2	502 CH-						Cnan	90 MU-	
Center 2			-10.0				apan	80 WIHZ	CE Oto
#Res BW	1 MHZ		#V	SW 3 MHZ	4		Sweep 2	0.12 ms	Cr Sle
7.1.10		24 202 dDm/ 40	00 1411-	1.00	-				8.000000 MH
Total Car	mer Power	34.303 dBm/ 40	UU MHZ	ACP-	BW				Auto Ma
					Low	er	Upper		
Carrier P	ower	Filter	Offset Fred	Integ BW	dBc	dBm	dBc dBm	Eiltor	
Control 1			Childenney	integrom	dDC	ubiii	abc abin	1 mea	Freq Offse
1 34.	303 dBm / 40.0	0 MHz RRC							0 H
							_		
MSG 🤳 File	<aclr_eutr <="" td=""><td>_TM3_1_2C_40</td><td>+0MBW_2593_</td><td>0_TX6.state</td><td>> saved</td><td>STATU</td><td>IS</td><td></td><td></td></aclr_eutr>	_TM3_1_2C_40	+0MBW_2593_	0_TX6.state	> saved	STATU	IS		

Channel Frequency 2670 MHz, Modulation QPSK/16QAM, TX6





5G 60MHz Channel Frequency 2526 MHz, Modulation 64QAM, TX6

Channel Frequency 2593 MHz, Modulation QPSK/16QAM, TX6

Keysight Spectrum Analyzer - ACU	R_EUTRA_TM3_2_2C_60+0MB	W_2593_0_1X6			
CC RF 50 Ω	AC	SENSE:INT		12:25:21 PM May 18, 2020	Frequency
Center Freq 2.59300 PASS Gate: L0	IFGain:Low	Center Freq: 2.5930 Trig: External1 #Atten: 6 dB	Avg Hold: 101/101 Ext Gain: -41.20 dB	Radio Std: None Radio Device: BTS	requency
10 dB/div Ref 45.0	0 dBm				
25.0		36.0 dBm			Center Fre 2.593000000 GH
5.00			And the second		
5.00					
35.0				RMS AVG	
45.0				Onon 400 Mila	
Res BW 1 MHz		#VBW 3 MH	z	Sweep 20.12 ms	CF Ste 12.000000 MH
Total Carrier Power	35.968 dBm/ 60.00 N	Hz ACP	-IBW		<u>Auto</u> Ma
Carrier Power	Filter of	icat Erag Integ RW	Lower	Upper dBcdBmFiller	
1 35.968 dBm / 60.0	0 MHz RRC	ser rieg integ ow		ubc ubin Filler	Freq Offse 0 H
ISG JFile <aclr eutra<="" td=""><td>TM3 2 2C 60+0M</td><td>3W_2593_0_TX6.stat</td><td>e> saved 🛛 🖍 STATU</td><td>s</td><td></td></aclr>	TM3 2 2C 60+0M	3W_2593_0_TX6.stat	e> saved 🛛 🖍 STATU	s	







5G 100MHz Channel Frequency 2546 MHz, Modulation 64QAM, TX44

Channel Frequency 2593 MHz, Modulation QPSK/16QAM, TX44

Keysight Sp	ectrum Analyzer - ACLK_EU	TKA_TM3_2_2C_100+0MI	SW_2095_0_1X44			
Center	F 50 Ω A	00 GHz	Center Freq: 2.593	005000 GHz	12:46:22 PM May 12, Radio Std: None	Frequency
PASS	Gate: LO	-+	Trig: External1	Avg Hold: 101/101	Dadia Daviasi BT	
1,400		IFGain:Low	#Atten: 2 dB	Ext Gain46.90 dB	Radio Device. B I	<u> </u>
10 dB/div	Ref 45.00 d	Bm				
35.0			38.1.dBm			Center Freq
25.0			00.100			2 593005000 GHz
15.0			والمكارين والمتحدي والمحال والعود	and the second second second		E.OBOODOOD OTTE
5.00						
5.00						
15.0						
-25.0					5M	AVO
-35.0	and the second				and the state of the second	la an
-45.0						
Center :	2.593 GHz				Span 200 M	1Hz
#Res BV	1 MHz		#VBW 3 №	Hz	Sweep 20.12	ms CF Step
T-1-10-	-i D 20	071 dBm/ 100 00 1	1117 1.0	D IDW/		20.000000 MHz
I otal Ca	mer Power 36	.071 GBIIV 100.001	AC AC	P-IBW		Auto Man
Carrier	Power	Filter of	est Free Jotes Di	Lower	Upper	illes
Camerr	-0wei		set Freq Integrov		abc abiii F	Freq Offset
1 30	.071 dBm7 100.0 M	IZ RRC				0 Hz
MSG DEile	ACLE EUTRA T	M3 2 2C 100+0N	IBW 2593 0 TX44	state> saved	IS	
		10_2_20_100+0h				





2.1.2 Peak-to-Average Power Ratio (PAPR) – Plots

The Peak-to-Average Power Ratio (PAPR) was evaluated per KDB 971168 for 20MHz, 40MHz, 60 MHz and 100 MHz bandwidths. The PAPR values of all carriers measured are below 13dB.

LTE 1C Data



Channel Frequency 2680 MHz / Modulation 64QAM



Channel Frequency 2593 MHz / Modulation QPSK



LTE 2C Data



Channel Frequency 2660 MHz / Modulation 256QAM



Channel Frequency 2526 MHz / Modulation 64QAM



Channel Frequency 2680 MHz / Modulation QPSK





LTE 3C Data Channel Frequency 2506 MHz / Modulation 256QAM











LTE 3C Data Channel Frequency 2506 MHz / Modulation 64QAM











LTE 3C Data Channel Frequency 2640 MHz / Modulation QPSK











5G 40MHz Data Channel Frequency 2516 MHz / Modulation 256QAM











5G 60MHz Data Channel Frequency 2526 MHz / Modulation 64QAM

Channel Frequency 2593 MHz / Modulation QPSK/16QAM





5G 60MHz Data Channel Frequency 2660 MHz / Modulation 256QAM



5G 100MHz Data Channel Frequency 2546 MHz / Modulation 64QAM

Channel Frequency 2593 MHz / Modulation QPSK/16QAM





5G 100MHz Data Channel Frequency 2640 MHz / Modulation 256QAM

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Global Product Compliance Laboratory Report No.: TR-2020-0060-FCC2-27 Product: AirScale MAA 64T64R 192AE B41 320W AEHC

3. FCC Section 2.1047 - Modulation Characteristics

3.1 Modulation Characteristics

The RF signal at the antenna port was demodulated and verified for correctness of the modulation signal used before each test was performed.

LTE 1C Data

3.1.1 Modulation Characteristics – Plots

Channel Frequency 2506 MHz / Modulation 256QAM

Channel Frequency 2680 MHz / Modulation 64QAM



Channel Frequency 2593 MHz / Modulation QPSK





5G 40MHz Data Channel Frequency 2516 MHz / Modulation 256QAM

Channel Frequency 2593 MHz / Modulation 64QAM





5G 40MHz Data Channel Frequency 2670 MHz / Modulation QPSK/16QAM