



CERTIFICATION TEST REPORT

Report Number. : 4789893923-E2V2

Applicant : SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

Model : NP545XLA, NP545XLA-KA1TT, NP545XLA-KA1VZ

FCC ID : A3LNP545XLA

EUT Description : WCDMA/LTE/5G NR Laptop + BT/BLE, DTS/UNII a/b/g/n/ac/ax

Test Standard(s) : FCC CFR47 PART 22 SUBPART H
FCC CFR47 PART 24 SUBPART E
FCC CFR47 PART 27 SUBPART F,H,L,M,O,Q
FCC CFR47 PART 90 SUBPART R

Date Of Issue:

2021-06-22

Prepared by:

UL Korea, Ltd.

26th floor, 152, Teheran-ro, Gangnam-gu Seoul, 06236, Korea

Suwon Test Site: UL Korea, Ltd. Suwon Laboratory

218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea

TEL: (031) 337-9902

FAX: (031) 213-5433



ACCREDITED

Testing Laboratory

TL-637

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	2021-06-14	Initial issue	SunGeun Lee
V2	2021-06-22	Updated to address TCB's question	SunGeun Lee

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	6
4.1. <i>MEASURING INSTRUMENT CALIBRATION.....</i>	6
4.2. <i>SAMPLE CALCULATION.....</i>	6
4.3. <i>MEASUREMENT UNCERTAINTY</i>	6
4.4. <i>DECISION RULE</i>	6
5. EQUIPMENT UNDER TEST	7
5.1. <i>DESCRIPTION OF EUT.....</i>	7
5.2. <i>MAXIMUM OUTPUT POWER.....</i>	7
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	24
5.4. <i>WORST-CASE ORIENTATION.....</i>	25
5.5. <i>DESCRIPTION OF TEST SETUP</i>	27
6. TEST AND MEASUREMENT EQUIPMENT	29
7. SUMMARY TABLE.....	30
8. PEAK TO AVERAGE RATIO	31
8.1. <i>CONDUCTED PEAK TO AVERAGE RESULT</i>	32
9. LIMITS AND CONDUCTED RESULTS	49
9.1. <i>OCCUPIED BANDWIDTH.....</i>	49
9.1.1. <i>OCCUPIED BANDWIDTH RESULTS</i>	55
9.2. <i>BAND EDGE EMISSIONS</i>	72
9.2.1. <i>BAND EDGE RESULT.....</i>	75
9.2.2. <i>EMISSION MASK RESULT</i>	131
9.3. <i>OUT OF BAND EMISSIONS.....</i>	140
9.3.1. <i>OUT OF BAND EMISSIONS RESULT.....</i>	142
9.4. <i>FREQUENCY STABILITY.....</i>	157
9.4.1. <i>FREQUENCY STABILITY RESULTS</i>	158
9.5. <i>RADIATED POWER (ERP & EIRP)</i>	165
9.5.1. <i>ERP/EIRP Results.....</i>	167
9.5.2. <i>ERP/EIRP DATA</i>	178
9.6. <i>FIELD STRENGTH OF SPURIOUS RADIATION.....</i>	235
9.6.1. <i>SPURIOUS RADIATION PLOTS</i>	236

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: WCDMA/LTE/5G NR Tablet + BT/BLE, DTS/UNII a/b/g/n/ac/ax
MODEL NUMBER: NP545XLA, NP545XLA-KA1TT, NP545XLA-KA1VZ
SERIAL NUMBER: FLKR01R2S00504, FLKR01R2S00173 (CONDUCTED);
FLKJ930R400159L, FLKJ930R400156A, G0GE930R400415E,
G0GE930R400234R (RADIATED)
DATE TESTED: 2021-04-12 – 2021-06-14;

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22H, 24E, 27 F,H,L,M,O,Q and 90 R,S	Complies

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:



Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:



Sungeun Lee
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 22.
3. FCC CFR 47 Part 24.
4. FCC CFR 47 Part 27.
5. FCC CFR 47 Part 90.
6. ANSI TIA-603-E, 2016
7. ANSI C63.26, 2015
8. KDB 971168 D01 Power Meas License Digital Systems v03r01
9. KDB 412172 D01 Determining ERP and EIRP v01r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro	
<input checked="" type="checkbox"/>	Chamber 1
<input checked="" type="checkbox"/>	Chamber 2
<input type="checkbox"/>	Chamber 3

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$EIRP = \text{PSA reading with EUT worst orientation (dBm)} + \text{Path loss (dB)} - \text{cable loss (between the SG and substitution antenna)} + \text{Substitution Antenna Factor (dBi)}$

$ERP = \text{PSA reading with EUT worst orientation (dBm)} + \text{Path loss (dB)} - \text{cable loss (between the SG and substitution antenna)}$

(Path loss = Signal generator output – PSA reading with substitution antenna)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.01 dB
Radiated Disturbance, 30 MHz to 1 GHz	4.26 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.90 dB
Radiated Disturbance, Above 18 GHz	5.49 dB

Uncertainty figures are valid to a confidence level of 95%.

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2007.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a WCDMA/LTE/5G NR Laptop + BT/BLE, DTS/UNII a/b/g/n/ac/ax.
 This test report addresses the WWAN operational mode.

This report covers the Samsung models NP545XLA, NP545XLA-KA1TT and NP545XLA-KA1VZ. These models are identical in hardware except below.

NP545XLA-KA1TT: eSIM IC unmounted on PCB.

NP545XLA-KA1VZ: There is no difference in hardware(Supported RF band is different).

With some pre-scan, model NP545XLA was set for final test.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum average radiated ERP / EIRP output powers as follows:

Note : Conducted output power results were excerpted from RF exposure test report (4789893923-S1 FCC Report SAR).

- n77 Output power (P-limit): SAR Report

- n77 Output power (P-Max): RF report. Please refer to below sheet.

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)			
					Measured Pwr (dBm)		MPR	Tune-up Limit
					633332	3499.98MHz		
100 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.4		0.0	25.0
			1	137	24.5		0.0	25.0
			1	271	24.1		0.0	25.0
			135	0	24.0		0.5	24.5
			135	69	24.5		0.0	25.0
			135	138	23.9		0.5	24.5
		270	0	23.9		0.5	24.5	
		QPSK	1	1	24.4		0.0	25.0
			1	137	24.4		0.0	25.0
			1	271	24.1		0.0	25.0
			135	0	23.3		1.0	24.0
			135	69	24.5		0.0	25.0
	135		138	23.3		1.0	24.0	
	270	0	23.2		1.0	24.0		
	16QAM	1	1	23.3		1.0	24.0	
	64QAM	1	1	21.7		2.5	22.5	
256QAM	1	1	19.7		4.5	20.5		
CP-OFDM	QPSK	1	1	22.5		1.5	23.5	

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					633000	633332	633666		
					3495 MHz	3499.98 MHz	3504.99 MHz		
90 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	24.5	24.5	24.5	0.0	25.0
			1	123	24.5	24.4	24.4	0.0	25.0
			1	243	24.4	24.3	24.2	0.0	25.0
			120	0	23.9	23.9	23.9	0.5	24.5
			120	63	24.5	24.4	24.4	0.0	25.0
			120	125	23.9	23.9	23.9	0.5	24.5
			243	0	23.9	23.9	23.9	0.5	24.5
		QPSK	1	1	24.4	24.4	24.4	0.0	25.0
			1	123	24.4	24.4	24.4	0.0	25.0
			1	243	24.3	24.2	24.0	0.0	25.0
			120	0	23.2	23.3	23.2	1.0	24.0
			120	63	24.5	24.5	24.5	0.0	25.0
			120	125	23.3	23.3	23.3	1.0	24.0
			243	0	23.2	23.2	23.2	1.0	24.0
		16QAM	1	1	23.3	23.3	23.2	1.0	24.0
64QAM	1	1	21.7	21.7	21.8	2.5	22.5		
256QAM	1	1	19.7	19.6	19.7	4.5	20.5		
CP-OFDM	QPSK	1	1	22.6	22.6	22.6	1.5	23.5	
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					632668	633332	634000		
					3490.02 MHz	3499.98MHz	3510 MHz		
80 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	24.5	24.5	24.5	0.0	25.0
			1	109	24.5	24.4	24.4	0.0	25.0
			1	215	24.3	24.3	24.1	0.0	25.0
			108	0	23.9	23.9	23.9	0.5	24.5
			108	55	24.5	24.5	24.4	0.0	25.0
			108	109	24.0	24.0	23.8	0.5	24.5
			216	0	23.9	23.9	23.9	0.5	24.5
		QPSK	1	1	24.4	24.4	24.4	0.0	25.0
			1	109	24.4	24.4	24.3	0.0	25.0
			1	215	24.3	24.2	24.0	0.0	25.0
			108	0	23.3	23.2	23.2	1.0	24.0
			108	55	24.5	24.5	24.4	0.0	25.0
			108	109	23.3	23.3	23.2	1.0	24.0
			216	0	23.3	23.3	23.2	1.0	24.0
		16QAM	1	1	23.4	23.5	23.5	1.0	24.0
64QAM	1	1	21.7	21.7	21.8	2.5	22.5		
256QAM	1	1	19.6	19.6	19.7	4.5	20.5		
CP-OFDM	QPSK	1	1	22.6	22.6	22.7	1.5	23.5	

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					632000	633332	634666		
					3480 MHz	3499.98MHz	3519.99 MHz		
60 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.3	24.4	24.5	0.0	25.0
			1	81	24.4	24.5	24.4	0.0	25.0
			1	160	24.4	24.3	24.1	0.0	25.0
			81	0	23.9	23.9	23.9	0.5	24.5
			81	41	24.5	24.4	24.4	0.0	25.0
			81	81	24.0	23.9	23.8	0.5	24.5
			162	0	23.9	23.9	23.9	0.5	24.5
		QPSK	1	1	24.3	24.3	24.3	0.0	25.0
			1	81	24.4	24.4	24.3	0.0	25.0
			1	160	24.4	24.2	24.0	0.0	25.0
			81	0	23.2	23.2	23.2	1.0	24.0
			81	41	24.5	24.5	24.4	0.0	25.0
			81	81	23.3	23.3	23.2	1.0	24.0
			162	0	23.3	23.2	23.2	1.0	24.0
16QAM	1	1	23.4	23.2	23.4	1.0	24.0		
64QAM	1	1	21.6	21.8	21.7	2.5	22.5		
256QAM	1	1	19.5	19.7	19.6	4.5	20.5		
CP-OFDM	QPSK	1	1	22.5	22.5	22.6	1.5	23.5	
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					631668	633332	635000		
					3475.02 MHz	3499.98MHz	3525 MHz		
50 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.5	24.4	24.5	0.0	25.0
			1	67	24.4	24.4	24.4	0.0	25.0
			1	131	24.6	24.4	24.2	0.0	25.0
			64	0	23.9	23.9	23.9	0.5	24.5
			64	35	24.4	24.4	24.4	0.0	25.0
			64	69	24.0	23.9	23.8	0.5	24.5
			128	0	24.0	23.9	23.9	0.5	24.5
		QPSK	1	1	24.4	24.4	24.4	0.0	25.0
			1	67	24.4	24.3	24.2	0.0	25.0
			1	131	24.5	24.3	24.1	0.0	25.0
			64	0	23.2	23.2	23.2	1.0	24.0
			64	35	24.6	24.4	24.4	0.0	25.0
			64	69	23.3	23.3	23.2	1.0	24.0
			128	0	23.3	23.2	23.2	1.0	24.0
16QAM	1	1	23.3	23.4	23.2	1.0	24.0		
64QAM	1	1	21.8	21.8	21.8	2.5	22.5		
256QAM	1	1	19.6	19.7	19.7	4.5	20.5		
CP-OFDM	QPSK	1	1	22.6	22.6	22.7	1.5	23.5	

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					631334	633332	635332		
					3470.01 MHz	3499.98MHz	3529.98 MHz		
40 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	24.3	24.3	24.1	0.0	25.0
			1	53	24.2	24.2	24.0	0.0	25.0
			1	104	24.4	24.3	24.0	0.0	25.0
			50	0	23.5	23.6	23.4	0.5	24.5
			50	28	24.3	24.2	24.1	0.0	25.0
			50	56	23.6	23.6	23.5	0.5	24.5
			100	0	23.5	23.6	23.5	0.5	24.5
		QPSK	1	1	24.1	24.2	24.1	0.0	25.0
			1	53	24.2	24.1	23.9	0.0	25.0
			1	104	24.4	24.1	24.0	0.0	25.0
			50	0	23.0	23.1	23.0	1.0	24.0
			50	28	24.3	24.2	24.0	0.0	25.0
			50	56	23.1	23.1	23.0	1.0	24.0
			100	0	23.1	23.1	23.0	1.0	24.0
16QAM	1	1	23.2	23.3	23.1	1.0	24.0		
64QAM	1	1	21.6	21.6	21.7	2.5	22.5		
256QAM	1	1	19.5	19.5	19.4	4.5	20.5		
CP-OFDM	QPSK	1	1	22.5	22.5	22.4	1.5	23.5	
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					630668	633332	636000		
					3460.02 MHz	3499.98MHz	3540 MHz		
20 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	24.9	24.7	24.5	0.0	25.0
			1	26	24.8	24.5	24.3	0.0	25.0
			1	49	24.8	24.6	24.3	0.0	25.0
			25	0	24.2	24.0	23.9	0.5	24.5
			25	13	24.7	24.5	24.3	0.0	25.0
			25	26	24.2	24.1	23.8	0.5	24.5
			50	0	24.2	24.0	23.8	0.5	24.5
		QPSK	1	1	24.7	24.6	24.4	0.0	25.0
			1	26	24.6	24.4	24.2	0.0	25.0
			1	49	24.7	24.5	24.2	0.0	25.0
			25	0	23.7	23.5	23.3	1.0	24.0
			25	13	24.7	24.5	24.2	0.0	25.0
			25	26	23.8	23.5	23.2	1.0	24.0
			50	0	23.7	23.5	23.3	1.0	24.0
		16QAM	1	1	24.0	23.7	23.4	1.0	24.0
		64QAM	1	1	22.2	22.1	22.0	2.5	22.5
		256QAM	1	1	20.2	20.0	19.8	4.5	20.5
		CP-OFDM	QPSK	1	1	23.2	23.0	22.8	1.5

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
					Measured Pwr (dBm)			MPR	Tune-up Limit
					650000	656000	662000		
					3750 MHz	3840 MHz	3930 MHz		
100 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	23.3	23.3	23.6	0.0	25.0
			1	137	23.3	23.5	23.3	0.0	25.0
			1	271	23.1	23.6	23.4	0.0	25.0
			135	0	22.9	22.9	23.1	0.5	24.5
			135	69	23.4	23.6	23.4	0.0	25.0
			135	138	22.7	23.2	22.9	0.5	24.5
			270	0	22.9	23.0	23.0	0.5	24.5
		QPSK	1	1	23.4	23.4	23.7	0.0	25.0
			1	137	23.3	23.5	23.3	0.0	25.0
			1	271	23.1	23.7	23.4	0.0	25.0
			135	0	22.4	22.4	22.6	1.0	24.0
			135	69	23.4	23.6	23.4	0.0	25.0
			135	138	22.2	22.8	22.4	1.0	24.0
			270	0	22.4	22.5	22.4	1.0	24.0
	16QAM	1	1	22.5	22.6	22.6	1.0	24.0	
64QAM	1	1	21.0	20.6	21.1	2.5	22.5		
256QAM	1	1	18.7	18.6	19.0	4.5	20.5		
CP-OFDM	QPSK	1	1	21.8	21.9	22.2	1.5	23.5	
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					649668	656000	662332		
					3745.02 MHz	3840 MHz	3934.98 MHz		
90 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	23.5	23.4	23.6	0.0	25.0
			1	123	23.5	23.6	23.4	0.0	25.0
			1	243	23.1	23.7	23.4	0.0	25.0
			120	0	22.9	23.0	23.1	0.5	24.5
			120	63	23.5	23.6	23.5	0.0	25.0
			120	125	22.8	23.3	23.0	0.5	24.5
			243	0	23.0	23.2	22.9	0.5	24.5
		QPSK	1	1	23.6	23.4	23.7	0.0	25.0
			1	123	23.5	23.6	23.5	0.0	25.0
			1	243	23.2	23.7	23.5	0.0	25.0
			120	0	22.5	22.5	22.6	1.0	24.0
			120	63	23.6	23.7	23.6	0.0	25.0
			120	125	22.3	22.8	22.5	1.0	24.0
			243	0	22.4	22.7	22.5	1.0	24.0
	16QAM	1	1	22.6	22.5	22.8	1.0	24.0	
64QAM	1	1	21.0	20.6	21.1	2.5	22.5		
256QAM	1	1	19.0	18.9	19.1	4.5	20.5		
CP-OFDM	QPSK	1	1	21.9	21.9	22.2	1.5	23.5	

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					649334	656000	662666		
					3740.01 MHz	3840 MHz	3939.99 MHz		
80 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	23.5	23.3	23.6	0.0	25.0
			1	109	23.5	23.6	23.4	0.0	25.0
			1	215	23.2	23.6	23.4	0.0	25.0
			108	0	23.0	22.9	23.0	0.5	24.5
			108	55	23.6	23.7	23.5	0.0	25.0
			108	109	22.9	23.2	22.9	0.5	24.5
			216	0	23.0	23.1	23.0	0.5	24.5
		QPSK	1	1	23.6	23.4	23.6	0.0	25.0
			1	109	23.5	23.7	23.5	0.0	25.0
			1	215	23.2	23.7	23.4	0.0	25.0
			108	0	22.5	22.5	22.5	1.0	24.0
			108	55	23.6	23.7	23.5	0.0	25.0
			108	109	22.4	22.8	22.5	1.0	24.0
			216	0	22.5	22.7	22.5	1.0	24.0
16QAM	1	1	22.7	22.5	22.7	1.0	24.0		
64QAM	1	1	20.8	21.1	21.1	2.5	22.5		
256QAM	1	1	19.2	18.7	19.2	4.5	20.5		
CP-OFDM	QPSK	1	1	21.9	21.9	22.1	1.5	23.5	
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					648668	656000	663332		
					3730.02 MHz	3840 MHz	3949.98 MHz		
60 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	23.4	23.5	23.4	0.0	25.0
			1	81	23.5	23.4	23.4	0.0	25.0
			1	160	23.3	23.6	23.4	0.0	25.0
			81	0	23.0	22.9	23.0	0.5	24.5
			81	41	23.5	23.5	23.5	0.0	25.0
			81	81	23.1	23.0	23.0	0.5	24.5
			162	0	23.0	22.8	22.9	0.5	24.5
		QPSK	1	1	23.4	23.5	23.4	0.0	25.0
			1	81	23.5	23.6	23.4	0.0	25.0
			1	160	23.4	23.5	23.5	0.0	25.0
			81	0	22.6	22.5	22.5	1.0	24.0
			81	41	23.5	23.3	23.4	0.0	25.0
			81	81	22.5	22.5	22.5	1.0	24.0
			162	0	22.5	22.2	22.4	1.0	24.0
16QAM	1	1	22.6	22.6	22.5	1.0	24.0		
64QAM	1	1	20.6	20.7	20.8	2.5	22.5		
256QAM	1	1	18.8	19.3	19.1	4.5	20.5		
CP-OFDM	QPSK	1	1	21.8	21.8	21.9	1.5	23.5	

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit	
					648334	656000	663666			
					3725.01 MHz	3840 MHz	3954.99 MHz			
50 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	23.5	23.3	23.5	0.0	25.0	
			1	67	23.5	23.6	23.5	0.0	25.0	
			1	131	23.4	23.8	23.8	0.0	25.0	
			64	0	23.1	23.0	23.0	0.5	24.5	
			64	35	23.6	23.7	23.6	0.0	25.0	
			64	69	23.1	23.4	23.2	0.5	24.5	
			128	0	23.0	23.2	23.1	0.5	24.5	
		QPSK	1	1	23.5	23.4	23.6	0.0	25.0	
			1	67	23.5	23.6	23.5	0.0	25.0	
			1	131	23.5	23.8	23.8	0.0	25.0	
			64	0	22.6	22.5	22.5	1.0	24.0	
			64	35	23.6	23.7	23.6	0.0	25.0	
			64	69	22.6	22.9	22.7	1.0	24.0	
			128	0	22.5	22.7	22.6	1.0	24.0	
16QAM	1	1	22.7	22.6	22.8	1.0	24.0			
64QAM	1	1	20.9	20.8	20.9	2.5	22.5			
256QAM	1	1	19.2	18.9	19.2	4.5	20.5			
CP-OFDM	QPSK	1	1	22.0	21.9	22.1	1.5	23.5		
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit	
					648000	656000	664000			
					3720 MHz	3840 MHz	3960 MHz			
40 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	23.4	23.5	23.3	0.0	25.0	
			1	53	23.2	23.1	23.3	0.0	25.0	
			1	104	23.3	23.5	23.6	0.0	25.0	
			50	0	22.8	22.8	22.9	0.5	24.5	
			50	28	23.3	23.4	23.4	0.0	25.0	
			50	56	22.9	23.2	23.1	0.5	24.5	
			100	0	22.8	22.9	23.0	0.5	24.5	
		QPSK	1	1	23.4	23.6	23.4	0.0	25.0	
			1	53	23.3	23.4	23.4	0.0	25.0	
			1	104	23.4	23.5	23.7	0.0	25.0	
			50	0	22.2	22.6	22.4	1.0	24.0	
			50	28	23.3	23.5	23.4	0.0	25.0	
			50	56	22.3	22.6	22.6	1.0	24.0	
			100	0	22.2	22.7	22.5	1.0	24.0	
		16QAM	1	1	22.4	22.4	22.5	1.0	24.0	
		64QAM	1	1	20.5	20.8	20.6	2.5	22.5	
		256QAM	1	1	18.7	18.5	18.8	4.5	20.5	
		CP-OFDM	QPSK	1	1	21.7	21.8	21.9	1.5	23.5

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					647334	656000	664666		
					3710.01 MHz	3840 MHz	3969.99 MHz		
20 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	23.8	23.8	23.8	0.0	25.0
			1	26	23.6	23.5	23.8	0.0	25.0
			1	49	23.7	23.8	23.9	0.0	25.0
			25	0	23.3	23.2	23.3	0.5	24.5
			25	13	23.6	23.5	23.8	0.0	25.0
			25	26	23.2	23.3	23.4	0.5	24.5
			50	0	23.2	23.3	23.4	0.5	24.5
		QPSK	1	1	23.8	23.5	23.8	0.0	25.0
			1	26	23.6	23.7	23.8	0.0	25.0
			1	49	23.7	23.8	23.9	0.0	25.0
			25	0	22.8	22.7	22.8	1.0	24.0
			25	13	23.7	23.8	23.8	0.0	25.0
			25	26	22.7	22.9	22.9	1.0	24.0
		16QAM	50	0	22.6	22.8	22.8	1.0	24.0
			1	1	23.0	23.1	23.0	1.0	24.0
1	1		21.1	21.2	21.3	2.5	22.5		
64QAM	1	1	19.1	19.0	19.2	4.5	20.5		
	1	1	22.1	22.1	22.3	1.5	23.5		
CP-OFDM	QPSK	1	1	22.1	22.1	22.3	1.5	23.5	

WCDMA

FCC Part 22/24/27						
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	826.4~846.6	Rel. 99	23.98	250.17	23.17	207.49
		HSDPA	22.98	198.62	22.66	184.50
		HSUPA	23.01	199.76		
Band 4	1712.4~1752.6	Rel. 99	22.97	198.01	24.97	314.05
		HSDPA	21.97	157.31	24.02	252.35
		HSUPA	22.00	158.49		
Band 2	1852.4~1907.6	Rel. 99	22.98	198.54	23.65	231.74
		HSDPA	21.99	158.27	23.16	207.01
		HSUPA	22.04	159.96		

LTE Band 2

FCC Part 24							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 2	1860 ~ 1900	20	QPSK	23.70	234.33	24.36	272.90
			16QAM	23.30	213.58	24.36	272.90
			64QAM	22.39	173.30		
			256QAM	18.89	77.49		
	1857.5~1902.5	15	QPSK	23.72	235.53	24.54	284.45
			16QAM	23.19	208.41	23.96	248.89
			64QAM	22.29	169.35		
			256QAM	19.12	81.67		
	1855~1905	10	QPSK	23.77	238.19	24.25	266.07
			16QAM	23.15	206.53	23.74	236.59
			64QAM	22.14	163.49		
			256QAM	19.31	85.31		
	1852.5~1907.5	5	QPSK	23.84	242.24	24.42	276.69
			16QAM	23.33	215.06	23.86	243.22
			64QAM	22.23	166.95		
			256QAM	19.02	79.72		
	1851.5~1908.5	3	QPSK	23.83	241.71	24.62	289.73
			16QAM	23.21	209.59	24.03	252.93
			64QAM	22.23	166.95		
			256QAM	19.35	86.12		
	1850.7~1909.3	1.4	QPSK	23.72	235.43	24.48	280.54
			16QAM	23.33	215.10	23.68	233.35
			64QAM	22.31	170.20		
			256QAM	19.14	81.95		

LTE Band 5

FCC Part 22							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	829~844	10	QPSK	23.65	231.56	23.90	245.47
			16QAM	23.10	204.05	23.18	207.97
			64QAM	22.20	165.86		
			256QAM	19.20	83.08		
	826.5~846.5	5	QPSK	23.70	234.22	23.88	244.34
			16QAM	23.15	206.58	22.54	179.47
			64QAM	21.98	157.65		
			256QAM	18.86	76.87		
	825.5~847.5	3	QPSK	23.63	230.53	23.74	236.59
			16QAM	23.08	203.27	22.94	196.79
			64QAM	21.98	157.70		
			256QAM	19.17	82.61		
	824.7~848.3	1.4	QPSK	23.67	233.00	23.85	242.66
			16QAM	23.04	201.48	22.63	183.23
			64QAM	22.09	161.84		
			256QAM	18.89	77.41		

LTE Band 7

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 7	2510~2560	20	QPSK	23.42	220.00	25.12	325.09
			16QAM	22.99	199.19	24.23	264.85
			64QAM	21.99	158.15		
			256QAM	18.68	73.79		
	2507.5~2562.5	15	QPSK	23.41	219.48	25.51	355.63
			16QAM	22.86	193.30	24.52	283.14
			64QAM	21.96	157.06		
			256QAM	18.94	78.40		
	2505~2565	10	QPSK	23.43	220.28	25.37	344.35
			16QAM	22.77	189.37	24.43	277.33
			64QAM	21.85	153.24		
			256QAM	18.90	77.62		
	2502.5~2567.5	5	QPSK	23.52	224.70	24.82	303.39
			16QAM	22.81	190.80	24.44	277.97
			64QAM	21.85	153.23		
			256QAM	18.72	74.52		

LTE Band 12

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 12	704~711	10	QPSK	23.94	247.75	22.32	170.61
			16QAM	23.35	216.46	21.21	132.13
			64QAM	22.36	172.13		
			256QAM	19.38	86.60		
	701.5~713.5	5	QPSK	23.92	246.79	22.27	168.66
			16QAM	23.46	221.72	21.58	143.88
			64QAM	22.25	167.76		
			256QAM	19.14	82.11		
	700.5~714.5	3	QPSK	23.86	243.49	22.64	183.65
			16QAM	23.29	213.33	21.44	139.32
			64QAM	22.23	167.02		
			256QAM	19.41	87.30		
	699.7~715.3	1.4	QPSK	23.85	242.89	22.34	171.40
			16QAM	23.25	211.17	21.34	136.14
			64QAM	22.32	170.74		
			256QAM	19.08	80.88		

LTE Band 13

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 13	782	10	QPSK	23.61	229.55	23.40	218.78
			16QAM	23.04	201.41	21.96	157.04
			64QAM	21.75	149.54		
			256QAM	18.60	72.39		
	779.5~784.5	5	QPSK	23.64	231.12	23.29	213.30
			16QAM	23.16	206.85	22.46	176.20
			64QAM	21.95	156.57		
			256QAM	18.73	74.59		

LTE Band 14

FCC Part 90							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 14	793	10	QPSK	23.66	232.53	23.56	226.99
			16QAM	23.03	201.04	22.55	179.89
			64QAM	21.73	149.00		
			256QAM	18.61	72.66		
	790.5~795.5	5	QPSK	23.57	227.72	23.53	225.42
			16QAM	23.13	205.51	22.61	182.39
			64QAM	21.90	154.90		
			256QAM	18.72	74.48		

LTE Band 66

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 66	1720~1770	20	QPSK	23.82	241.12	26.82	480.84
			16QAM	23.44	220.71	25.98	396.28
			64QAM	22.44	175.39		
			256QAM	19.07	80.79		
	1717.5~1772.5	15	QPSK	23.81	240.22	26.76	474.24
			16QAM	23.21	209.54	25.96	394.46
			64QAM	22.44	175.39		
			256QAM	19.18	82.87		
	1715~1775	10	QPSK	23.87	244.05	26.64	461.32
			16QAM	23.25	211.29	25.71	372.39
			64QAM	22.16	164.58		
			256QAM	19.20	83.12		
	1712.5~1777.5	5	QPSK	23.93	247.14	26.59	456.04
			16QAM	23.44	220.55	26.08	405.51
			64QAM	22.30	169.74		
			256QAM	19.09	81.05		
	1711.5~1778.5	3	QPSK	23.96	248.70	26.88	487.53
			16QAM	23.40	218.81	26.10	407.38
			64QAM	22.33	171.13		
			256QAM	19.40	87.04		
1710.7~1779.3	1.4	QPSK	23.89	244.94	26.51	447.71	
		16QAM	23.31	214.05	25.31	339.63	
		64QAM	22.38	172.97			
		256QAM	19.19	82.90			

LTE Band 4

LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

NR Band n2

FCC Part 24								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n2	1860~1900	20	DFT-s OFDM	$\pi/2$ BPSK	23.67	232.80		
				QPSK	23.69	233.75	24.63	290.40
				16QAM	22.73	187.52	23.50	223.87
				64QAM	21.45	139.65		
				256QAM	18.96	78.66		
	CP-OFDM	QPSK	22.02	159.32				
	1857.5~1902.5	15	DFT-s OFDM	$\pi/2$ BPSK	23.62	230.14		
				QPSK	23.59	228.78	24.85	305.49
				16QAM	22.68	185.38	23.54	225.94
				64QAM	21.72	148.59		
				256QAM	18.96	78.76		
	CP-OFDM	QPSK	21.92	155.49				
	1855~1905	10	DFT-s OFDM	$\pi/2$ BPSK	23.50	224.06		
				QPSK	23.48	222.72	24.76	299.23
				16QAM	22.55	179.75	23.67	232.81
				64QAM	21.45	139.49		
				256QAM	18.92	78.05		
	CP-OFDM	QPSK	21.96	157.03				
	1852.5~1907.5	5	DFT-s OFDM	$\pi/2$ BPSK	23.54	226.10		
				QPSK	23.51	224.39	24.77	299.92
16QAM				22.54	179.46	23.44	220.80	
64QAM				21.57	143.56			
256QAM				18.86	76.98			
CP-OFDM	QPSK	21.89	154.62					

NR Band n5

FCC Part 22									
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated		
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	
n5	834~839	20	DFT-s OFDM	$\pi/2$ BPSK	23.66	232.13			
				QPSK	23.67	232.88	24.14	259.42	
				16QAM	22.75	188.22	23.06	202.30	
				64QAM	21.38	137.28			
				256QAM	19.42	87.49			
				CP-OFDM	QPSK	22.03	159.54		
	831.5~841.5	15	DFT-s OFDM	$\pi/2$ BPSK	23.65	231.77			
				QPSK	23.65	231.55	23.63	230.67	
				16QAM	22.79	190.30	22.51	178.24	
				64QAM	21.64	145.75			
				256QAM	19.12	81.71			
				CP-OFDM	QPSK	21.98	157.73		
	829~844	10	DFT-s OFDM	$\pi/2$ BPSK	23.65	231.84			
				QPSK	23.65	231.80	23.67	232.81	
				16QAM	22.65	184.28	22.61	182.39	
				64QAM	21.52	141.90			
				256QAM	18.99	79.29			
				CP-OFDM	QPSK	21.91	155.41		
	826.5~846.5	5	DFT-s OFDM	$\pi/2$ BPSK	23.69	233.92			
				QPSK	23.67	232.79	23.96	248.89	
16QAM				22.82	191.28	22.90	194.98		
64QAM				21.49	140.89				
256QAM				19.39	86.96				
			CP-OFDM	QPSK	22.12	162.97			

NR Band n66

FCC Part 27									
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated		
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	
n66	1720~1770	20	DFT-s OFDM	$\pi/2$ BPSK	23.54	225.75			
				QPSK	23.56	226.75	26.32	428.55	
				16QAM	22.71	186.76	25.19	330.37	
				64QAM	21.68	147.28			
				256QAM	19.04	80.19			
				CP-OFDM	QPSK	22.01	158.72		
	1717.5~1772.5	15	DFT-s OFDM	$\pi/2$ BPSK	23.66	232.05			
				QPSK	23.65	231.93	26.47	443.61	
				16QAM	22.81	191.18	25.29	338.06	
				64QAM	21.64	145.81			
				256QAM	19.12	81.73			
				CP-OFDM	QPSK	22.13	163.37		
	1715~1775	10	DFT-s OFDM	$\pi/2$ BPSK	23.42	219.66			
				QPSK	23.44	221.05	26.20	416.87	
				16QAM	22.55	179.94	24.89	308.32	
				64QAM	21.52	141.77			
				256QAM	18.90	77.69			
				CP-OFDM	QPSK	21.90	154.86		
	1712.5~1777.5	5	DFT-s OFDM	$\pi/2$ BPSK	23.47	222.22			
				QPSK	23.43	220.38	25.86	385.48	
16QAM				22.59	181.75	24.68	293.76		
64QAM				21.62	145.05				
256QAM				18.84	76.58				
			CP-OFDM	QPSK	21.88	154.19			

NR Band n77 (3450 – 3550 MHz)

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3499.98	100	DFT-s OFDM	$\pi/2$ BPSK	24.50	281.62		
				QPSK	24.46	279.29	25.94	392.64
				16QAM	23.31	214.34	24.92	310.46
				64QAM	21.65	146.26		
				256QAM	19.66	92.43		
	CP-OFDM	QPSK	22.54	179.32				
	3495~3504.99	90	DFT-s OFDM	$\pi/2$ BPSK	24.50	282.01		
				QPSK	24.50	281.89	26.08	405.51
				16QAM	23.29	213.41	25.09	322.85
				64QAM	21.84	152.77		
				256QAM	19.71	93.55		
	CP-OFDM	QPSK	22.64	183.84				
	3490.02~3510	80	DFT-s OFDM	$\pi/2$ BPSK	24.50	281.53		
				QPSK	24.48	280.65	26.08	405.51
				16QAM	23.46	222.07	25.18	329.61
				64QAM	21.80	151.38		
				256QAM	19.71	93.48		
	CP-OFDM	QPSK	22.71	186.44				
	3480~3519.99	60	DFT-s OFDM	$\pi/2$ BPSK	24.50	282.14		
				QPSK	24.50	281.89	26.22	418.79
				16QAM	23.40	218.61	25.34	341.98
				64QAM	21.84	152.79		
				256QAM	19.69	93.17		
	CP-OFDM	QPSK	22.60	181.93				
	3475.02~3525	50	DFT-s OFDM	$\pi/2$ BPSK	24.58	286.93		
				QPSK	24.56	285.48	26.01	399.02
				16QAM	23.41	219.45	25.13	325.84
				64QAM	21.83	152.36		
256QAM				19.68	92.99			
CP-OFDM	QPSK	22.72	186.96					
3470.01~3529.98	40	DFT-s OFDM	$\pi/2$ BPSK	24.41	276.23			
			QPSK	24.36	272.85	26.11	408.32	
			16QAM	23.31	214.05	25.37	344.35	
			64QAM	21.74	149.20			
			256QAM	19.53	89.83			
CP-OFDM	QPSK	22.52	178.58					
3460.02~3540	20	DFT-s OFDM	$\pi/2$ BPSK	24.86	306.50			
			QPSK	24.74	298.17	26.44	440.55	
			16QAM	23.99	250.67	25.65	367.28	
			64QAM	22.21	166.40			
			256QAM	20.25	105.90			
CP-OFDM	QPSK	23.17	207.54					

NR Band n77 (3700 – 3980 MHz)

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3750~3930	100	DFT-s OFDM	$\pi/2$ BPSK	23.63	230.59		
				QPSK	23.72	235.24	26.66	463.45
				16QAM	22.62	182.75	26.34	430.53
				64QAM	21.05	127.46		
				256QAM	19.04	80.22		
	CP-OFDM	QPSK	22.19	165.46				
	3745.02~3934.98	90	DFT-s OFDM	$\pi/2$ BPSK	23.68	233.19		
				QPSK	23.73	235.89	26.46	442.59
				16QAM	22.82	191.51	25.80	380.19
				64QAM	21.08	128.31		
				256QAM	19.10	81.35		
	CP-OFDM	QPSK	22.21	166.43				
	3740.01~3939.99	80	DFT-s OFDM	$\pi/2$ BPSK	23.68	233.52		
				QPSK	23.73	236.30	26.73	470.98
				16QAM	22.71	186.50	26.19	415.91
				64QAM	21.09	128.51		
				256QAM	19.21	83.29		
	CP-OFDM	QPSK	22.08	161.60				
	3730.02~3949.98	60	DFT-s OFDM	$\pi/2$ BPSK	23.60	229.09		
				QPSK	23.60	229.09	27.03	504.66
				16QAM	22.63	183.38	26.41	437.52
				64QAM	20.76	119.11		
				256QAM	19.30	85.11		
	CP-OFDM	QPSK	21.95	156.65				
	3725.01~3954.99	50	DFT-s OFDM	$\pi/2$ BPSK	23.82	241.01		
				QPSK	23.84	241.87	26.96	496.59
				16QAM	22.82	191.27	26.44	440.55
				64QAM	20.87	122.23		
256QAM				19.19	83.05			
CP-OFDM	QPSK	22.13	163.42					
3720~3960	40	DFT-s OFDM	$\pi/2$ BPSK	23.57	227.40			
			QPSK	23.66	232.48	27.00	501.19	
			16QAM	22.49	177.34	26.42	438.53	
			64QAM	20.80	120.23			
			256QAM	18.83	76.43			
CP-OFDM	QPSK	21.88	154.23					
3710.01~3969.99	20	DFT-s OFDM	$\pi/2$ BPSK	23.91	245.86			
			QPSK	23.93	247.26	27.15	518.80	
			16QAM	23.10	204.17	26.67	464.52	
			64QAM	21.33	135.70			
			256QAM	19.15	82.28			
CP-OFDM	QPSK	22.33	171.13					

5G NR Band 2

5G NR Band 2(Frequency range: 1850-1910 MHz) is covered by 5G NR Band 25 (Frequency range: 1850-1915 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a internal antenna for the [List the bands supported] with a maximum peak gain as follow:

Frequency (MHz)	Peak Gain (dBi)
WCDMA Band 5 / LTE Band 5 / NR Band n5 824 ~ 849 MHz	-0.01
WCDMA Band 4 / LTE Band 4 / LTE Band 66 / NR Band n66 1710 ~ 1780 MHz	1.80
WCDMA Band 2 / LTE Band 2 / NR Band n2 1850 ~ 1910 MHz	2.37
LTE Band 12 699 ~ 716 MHz	1.16
LTE Band 7 2500 ~ 2570 MHz	3.11
LTE Band 13 777 ~ 787 MHz	1.31
LTE Band 14 788 ~ 798 MHz	0.97
NR Band n77(Lower) 3450 ~ 3550 MHz	2.36
NR Band n77(Upper) 3700 ~ 3980 MHz	1.26

5.4. WORST-CASE ORIENTATION

Following modes should be considered as worst-case scenario for all other measurements.

- UMTS REL 99/HSDPA

For all LTE Bands, the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM, 64QAM and 256QAM modulations. It was found that QPSK and 16QAM results were worst case.

For all 5G NR Bands, the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM, 64QAM and 256QAM modulations. It was found that QPSK and 16QAM results were worst case. Both NSA and SA modes were tested and only NSA modes were reported. There is no difference between the two modes.

All testing was performed using QPSK and 16QAM modulations to represent the worst case. However, the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest conducted power in QPSK.

Highest power setting for each bands				
LTE Band	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
2	1852.5	5	1	12
	1880.0		1	12
	1907.5		1	12
5	826.5	5	1	0
	836.5		1	12
	846.5		1	0
7	2502.5	5	1	24
	2535.0		1	12
	2567.5		1	0
12	704.0	10	1	25
	707.5		1	0
	711.0		1	25
13	779.5	5	1	0
	782.0		1	0
	784.5		1	24
14	790.5	5	1	0
	793.0		1	12
	795.5		1	12
66	1711.5	3	1	0
	1745.0		1	0
	1778.5		1	0

NR Band	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
2	1860.0	20	1	104
	1880.0		1	1
	1900.0		1	53
5	834.0	20	1	53
	836.5		1	1
	839.0		1	53
66	1717.5	15	1	1
	1745.0		1	1
	1772.5		1	1
77 (Lower)	3460.02	20	1	1
	3499.98		1	1
	3540.00		1	1
77 (Upper)	3710.01	20	1	1
	3840.00		1	26
	3969.99		1	49

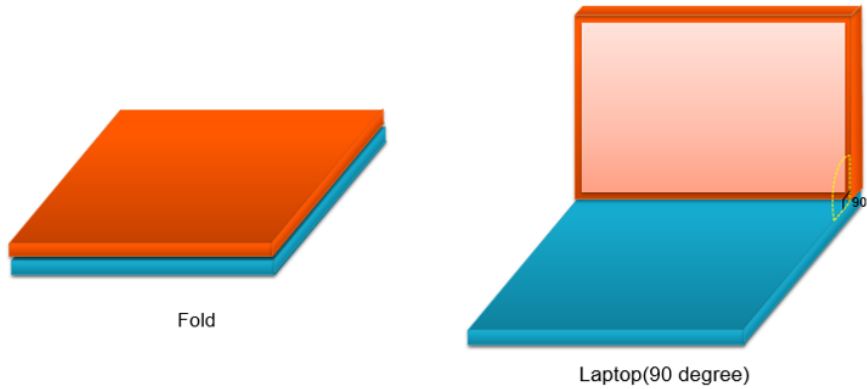
i. Worst Axis Condition

The fundamental and radiated spurious emission were investigated in three orthogonal orientations X and Y, it was determined that below orientation was worst-case orientation for each band.

Band	ERP/EIRP		RSE	
	X	Y	X	Y
WCDMA B5	Laptop	-	Laptop	-
WCDMA B4	Laptop	-	Laptop	-
WCDMA B2	Laptop	-	Laptop	-
LTE B2	Laptop	-	Laptop	-
LTE B5	Laptop	-	Laptop	-
LTE B7	Laptop	-	Laptop	-
LTE B12	Laptop	-	Laptop	-
LTE B13	Laptop	-	Laptop	-
LTE B14	-	Laptop	Laptop	-
LTE B66	Laptop	-	Laptop	-
NR n2	-	Laptop	-	Laptop
NR n5	Laptop	-	Laptop	-
NR n66	Laptop	-	Laptop	-
NR n77 (Lower)	-	Laptop	-	Laptop
NR n77 (Upper)	-	Laptop	-	Laptop

Note : For ERP/EIRP testing, the EUT didn't attached with travel adapter. But radiated spurious testing, the EUT attached with travel adapter for the worst case condition. The EUT is continuously communicated with the call box during the tests.

- ii. **Foldable Condition**
 The Fundamental of the EUT was investigated four foldable conditions(Fold, Laptop).



5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37R32A00XADK3	N/A
Data Cable	SAMSUNG	EP-DW767JWE	N/A	N/A

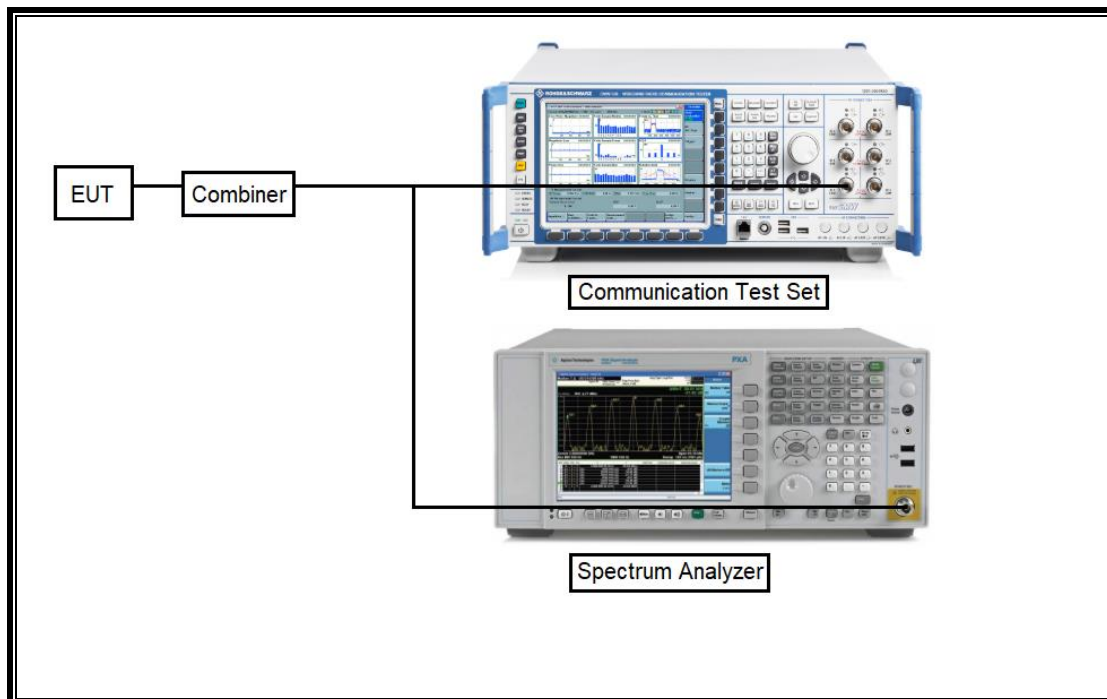
I/O CABLE

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	C Type	Shielded	1.0 m	N/A

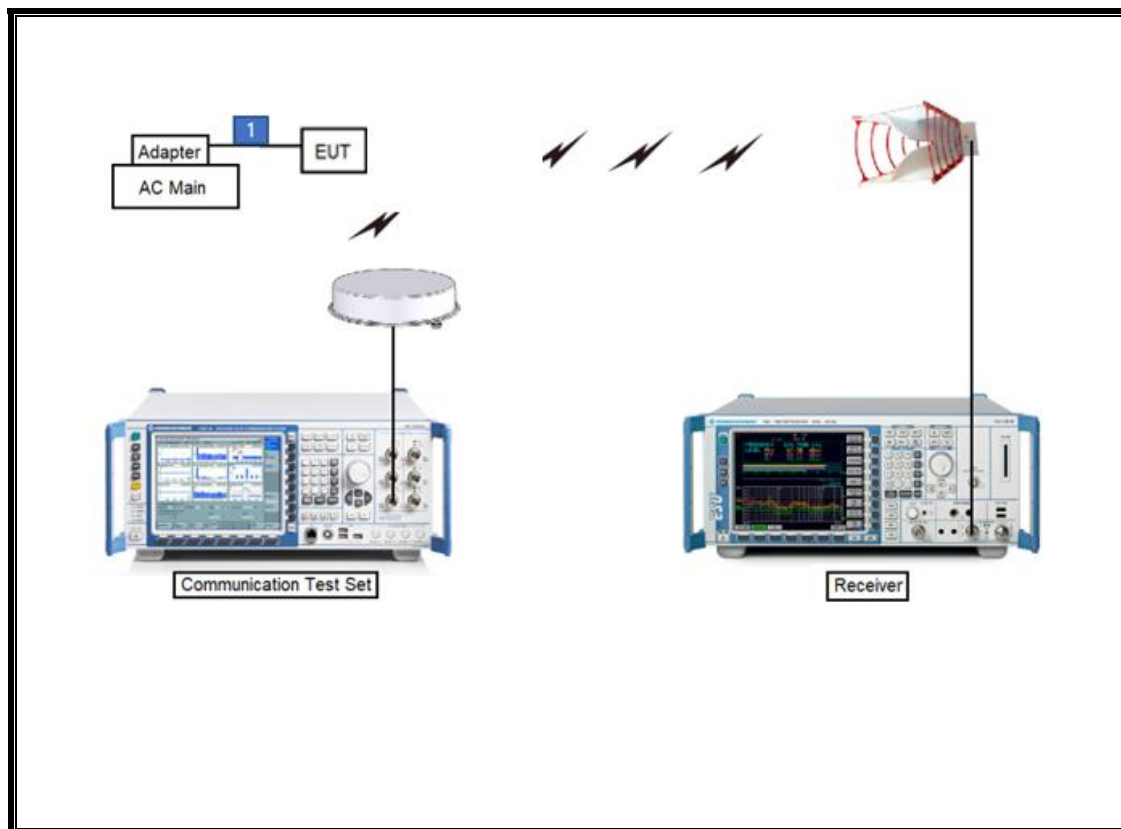
TEST SETUP

The EUT is continuously communicated with the call box during the tests.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121D DB4	00164753	2023-02-08
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	110367-0003	N/A
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	80108-0004	N/A
Antenna, Horn, 40 GHz	ETS	3116C	00166155	2022-08-04
Antenna, Horn, 40 GHz	ETS	3116C	00168645	2021-10-02
Preamplifier	ETS	3116C-PA	00168841	2021-08-06
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2022-08-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2022-08-13
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2022-08-13
Antenna, Horn, 18 GHz	ETS	3115	00167211	2022-07-27
Antenna, Horn, 18 GHz	ETS	3115	00161451	2022-08-15
Antenna, Horn, 18 GHz	ETS	3117	00168724	2022-07-27
Antenna, Horn, 18 GHz	ETS	3117	00168717	2022-08-15
Communications Test Set	R&S	CMW500	150314	2021-08-04
DC Power Supply	Agilent / HP	E3640A	MY54226395	2021-08-05
Preamplifier, 1000 MHz	Sonoma	310N	341282	2021-08-03
Preamplifier, 1000 MHz	Sonoma	310N	370599	2021-08-06
Preamplifier, 1000 MHz	Sonoma	310N	351741	2021-08-03
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	2021-08-03
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	2021-08-04
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2021-08-03
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2021-08-05
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2021-08-05
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2021-08-03
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2021-08-03
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	2021-08-05
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	2021-08-05
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	2021-08-05
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	2021-08-05
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	2021-08-05
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	2021-08-05
Attenuator	PASTERNAK	PE7087-10	A009	2021-08-05
Attenuator	PASTERNAK	PE7087-10	A001	2021-08-03
Attenuator	PASTERNAK	PE7087-10	A008	2021-08-03
Attenuator	PASTERNAK	PE7004-10	2	2021-08-04
Attenuator	PASTERNAK	PE7395-10	A011	2021-08-05
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2021-10-02
Temperature Chamber	ESPEC	SH-642	93001109	2021-08-04
Power Splitter	MINI-CIRCUITS	WA1534	UL001	2022-01-27
Power Splitter	MINI-CIRCUITS	WA1534	UL002	2022-01-27
UL Software				
Description	Manufacturer	Model	Version	
Antenna port test software	UL	CLT	Ver 2.5	
Radiated software	UL	UL EMC	Ver 9.5	
Antenna port test software (5G NR FR1)	UL	UL iM	Ver 1.04	

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Bandwidth(99%)	N/A	Conducted	Pass
22.917(a) 24.238(a) 27.53(c),(g),(h)	Band Edge / Conducted Spurious Emission	-13 dBm		Pass
90.543(e)		-35 dBm		Pass
27.53(m)	Conducted Spurious Emission	-25 dBm		Pass
27.53(m)	Emission mask	Section 9.2.2.		Pass
2.1046	Conducted output power	N/A		Pass
22.355 24.235	Frequency Stability	2.5ppm		Pass
22.913(a)(5)	Effective Radiated Power	38.5 dbm		Pass
27.50(b)(10) 27.50(c)(10) 90.542(a)(7)		34.77 dBm	Pass	
24.232(c) 27.50(h)(2)	Equivalent Isotropic Radiated Power	33 dBm	Pass	
27.50(d)(4)		30 dBm	Pass	
22.917(a) 24.238(a) 27.53(c),(g),(h)	Radiated Spurious Emission	-13 dBm	Radiated	Pass
27.53(m)		-25 dBm		Pass

8. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The PAR were measured on the Spectrum Analyzer.

Test Spec

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

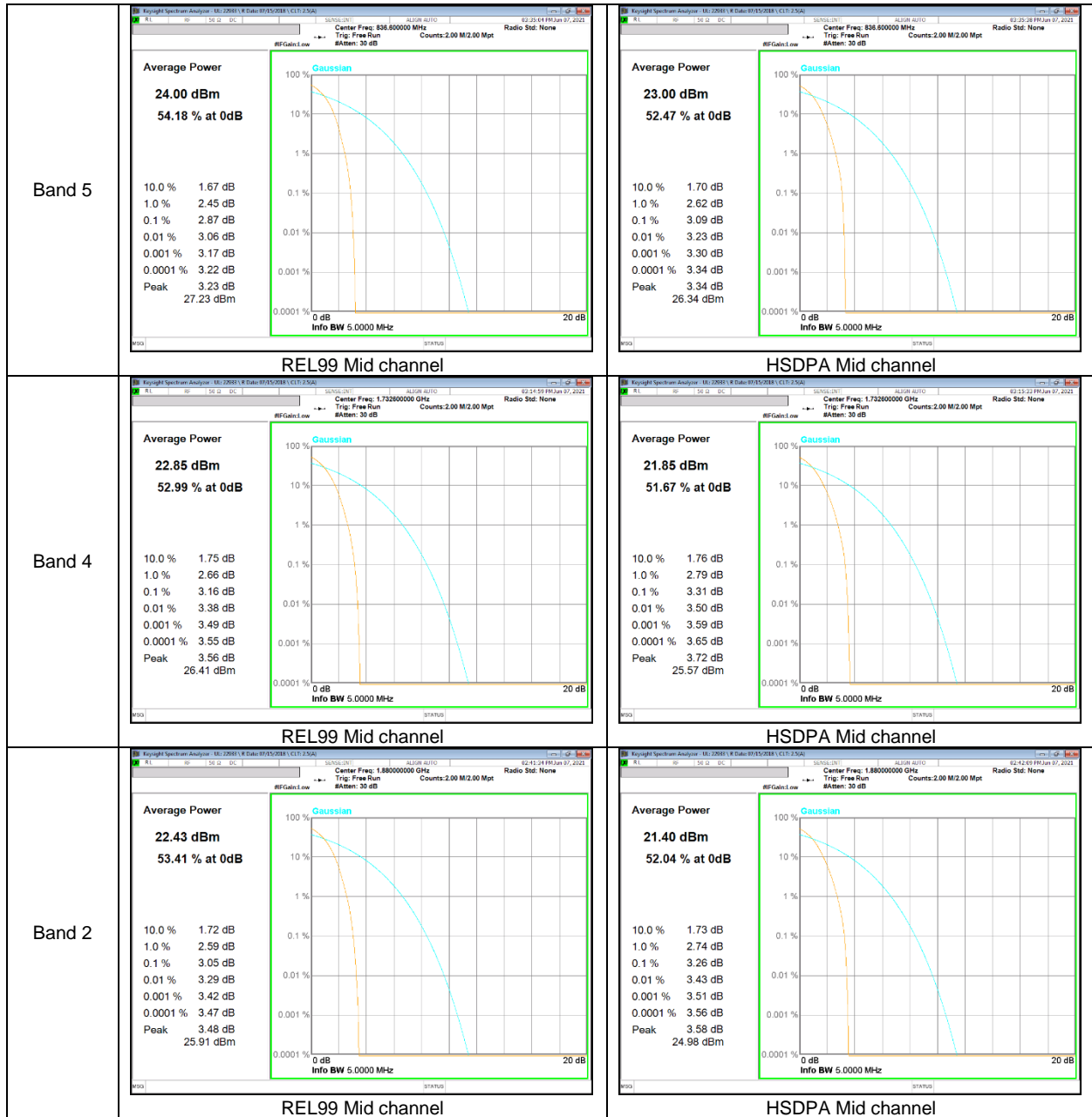
Note

5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) and modulations (QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

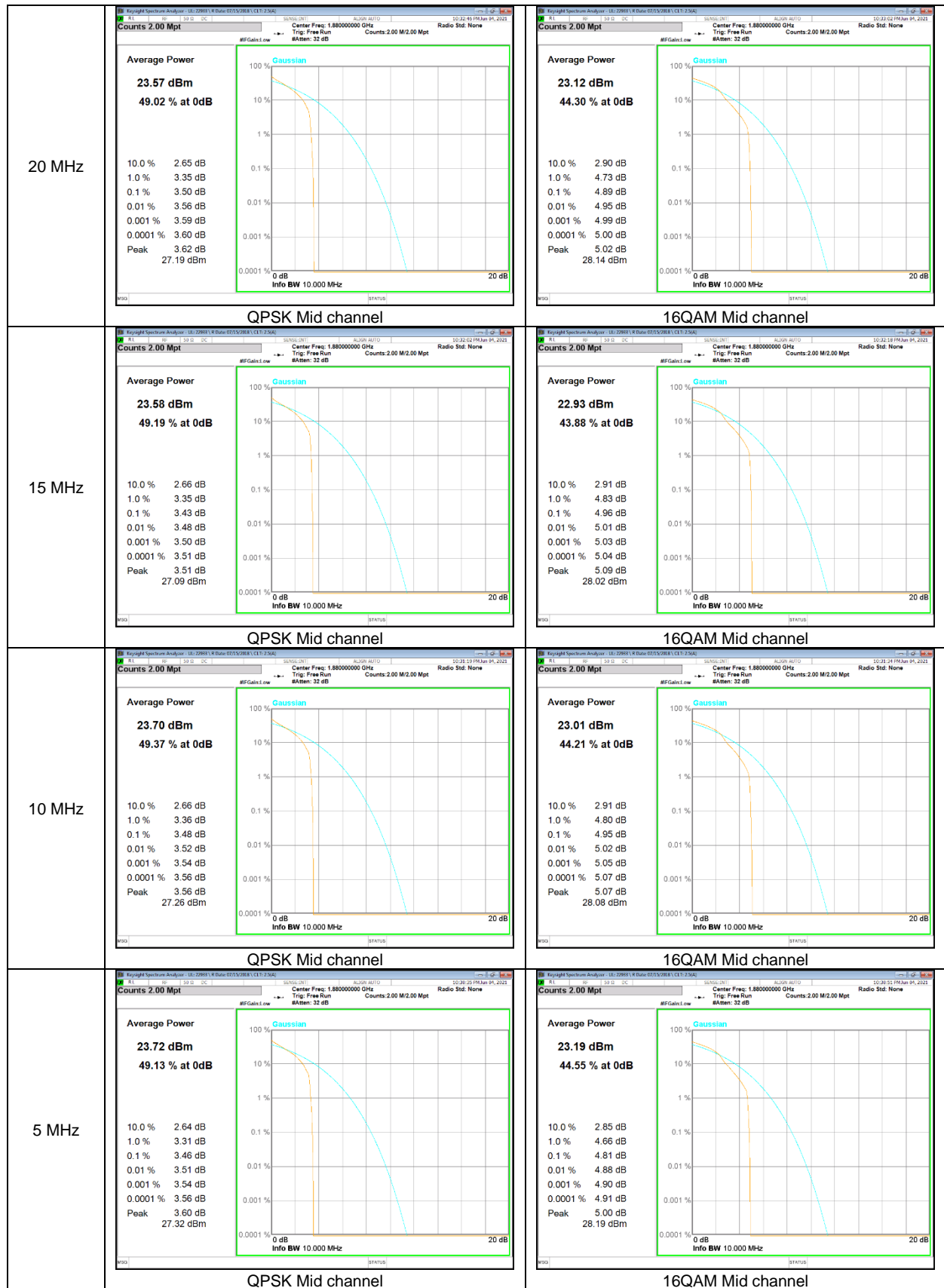
RESULTS

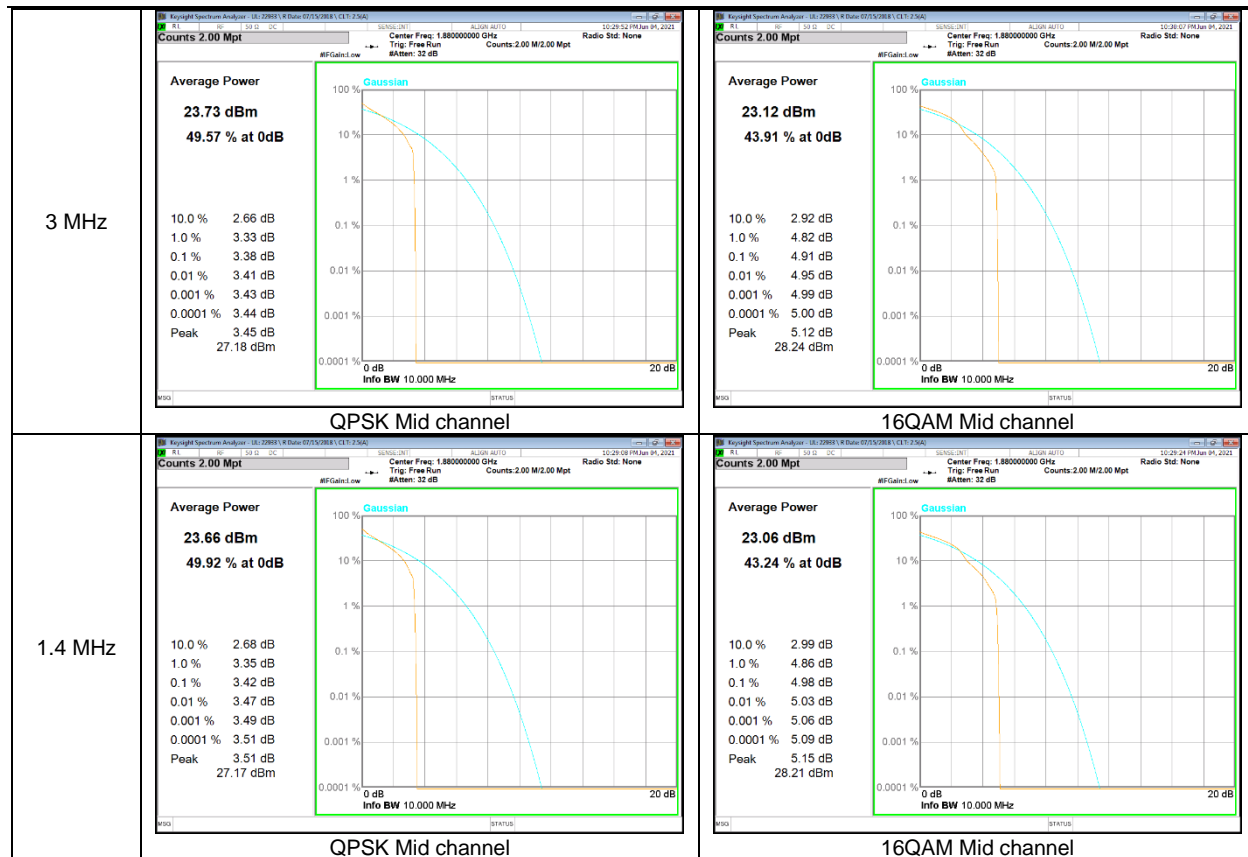
8.1. CONDUCTED PEAK TO AVERAGE RESULT

WCDMA

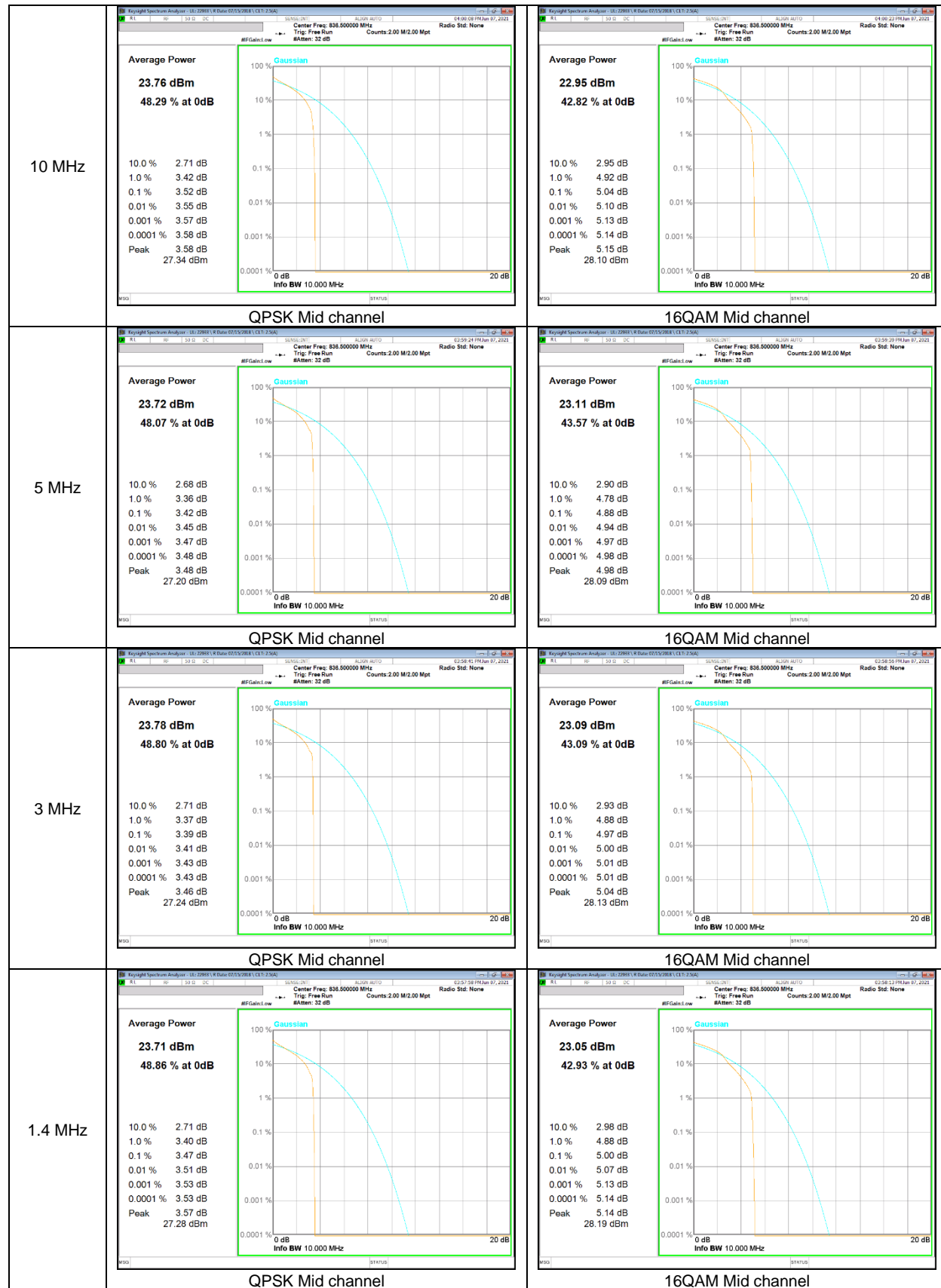


LTE Band 2

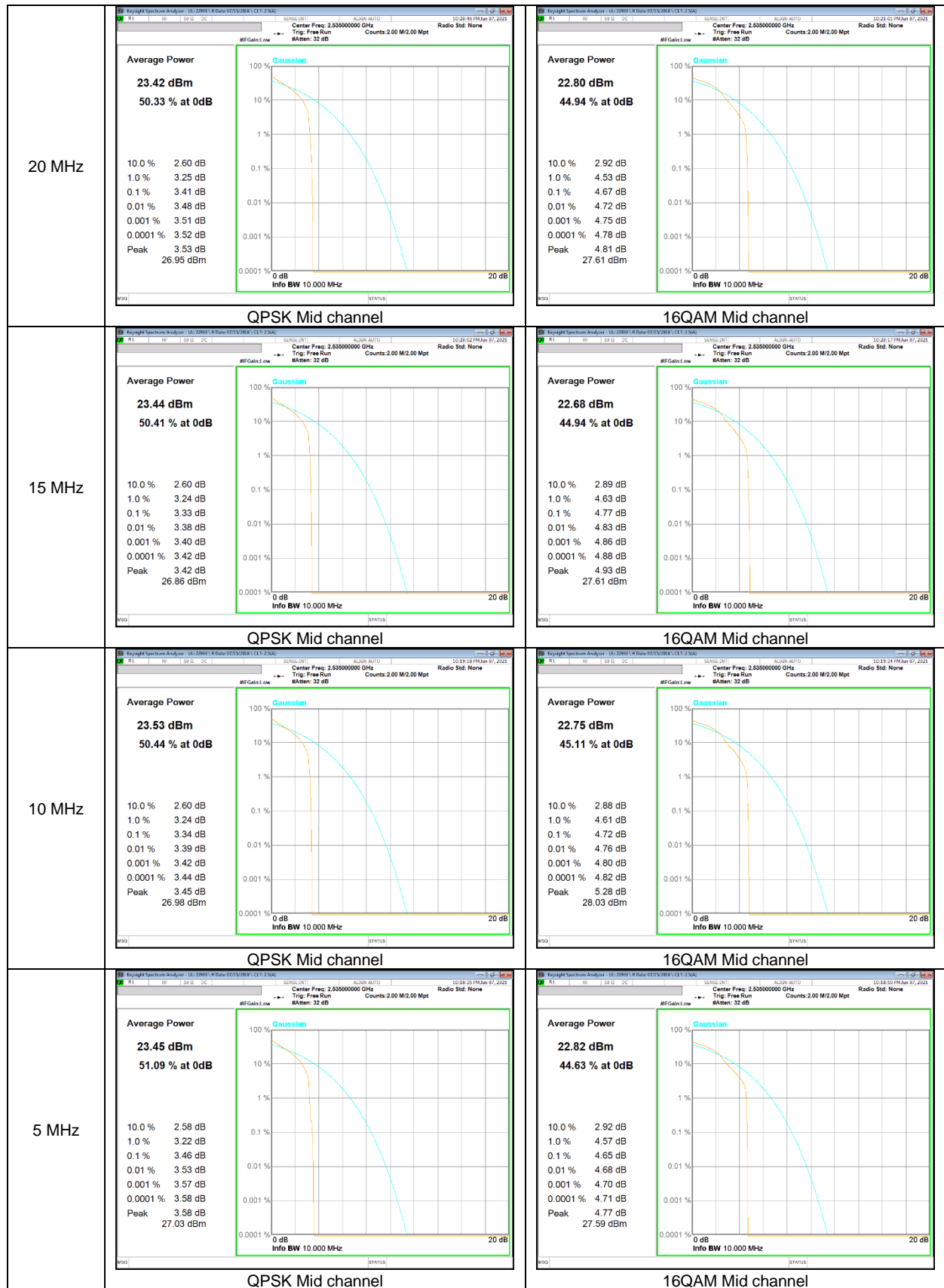




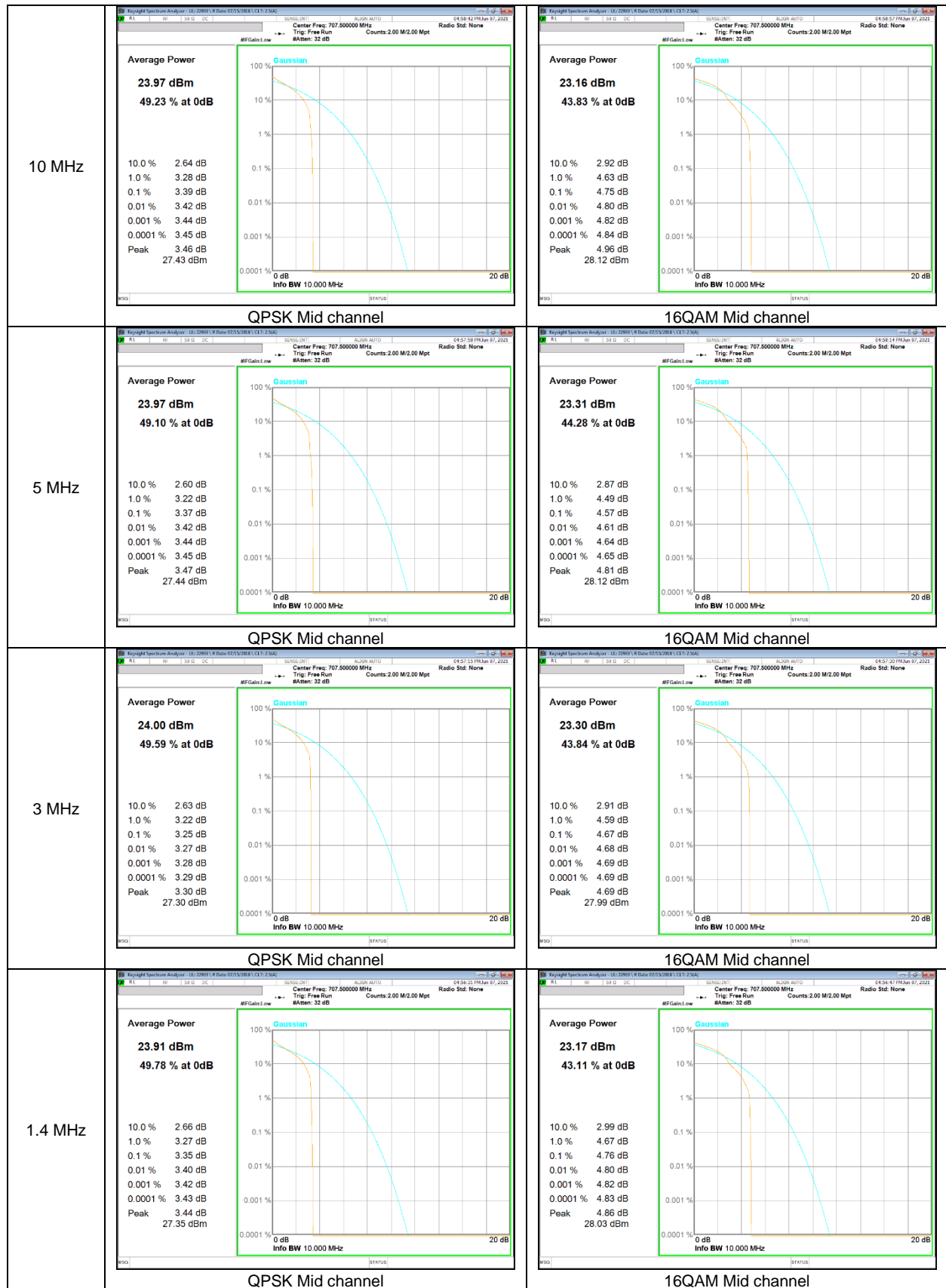
LTE Band 5



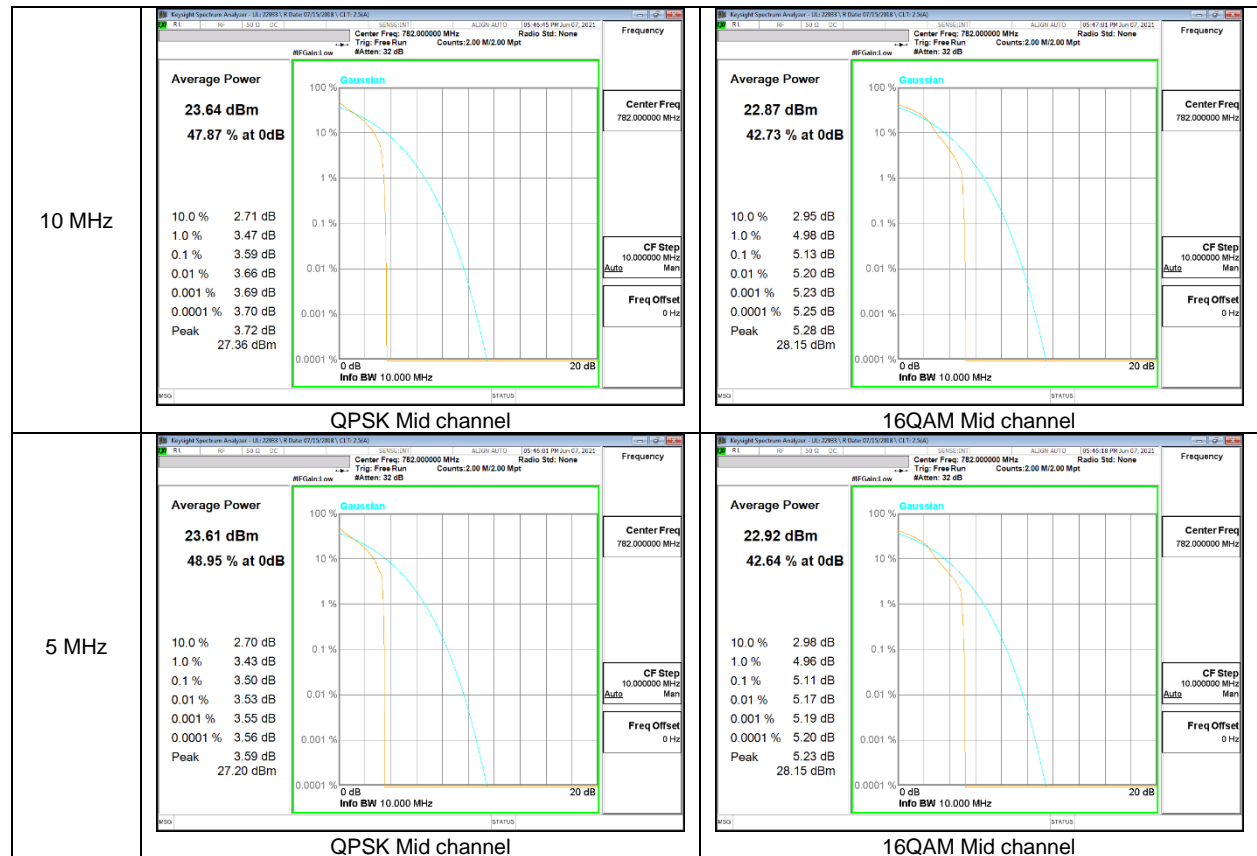
LTE Band 7



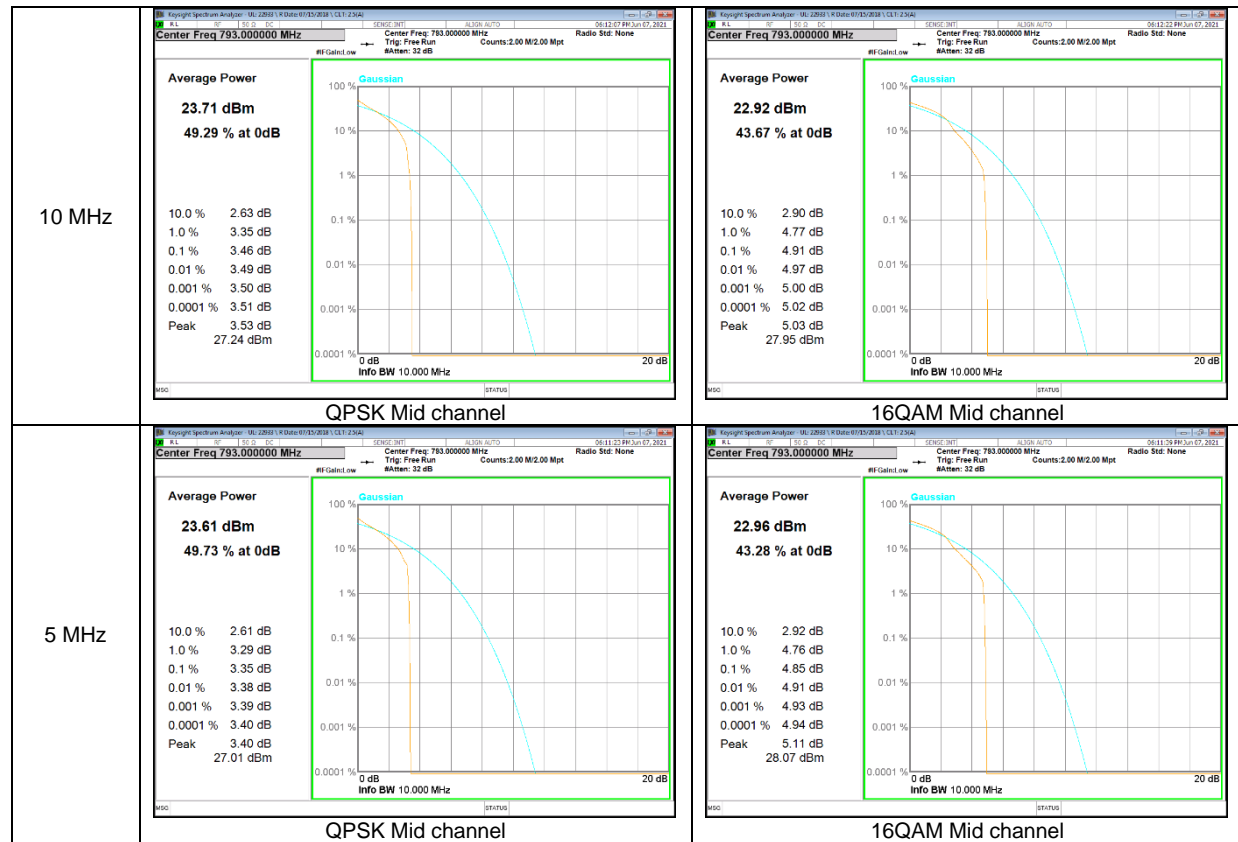
LTE Band 12



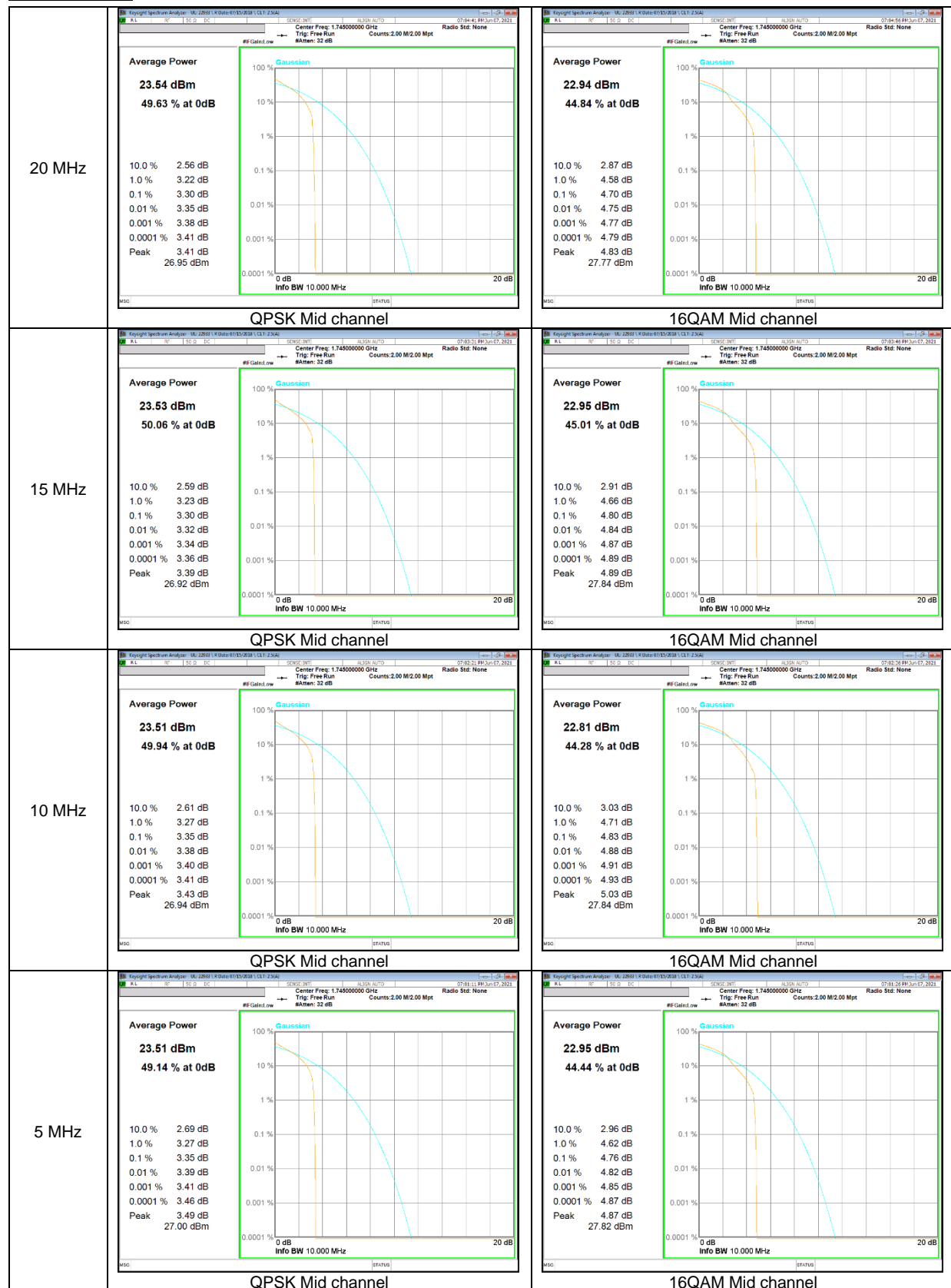
LTE Band 13

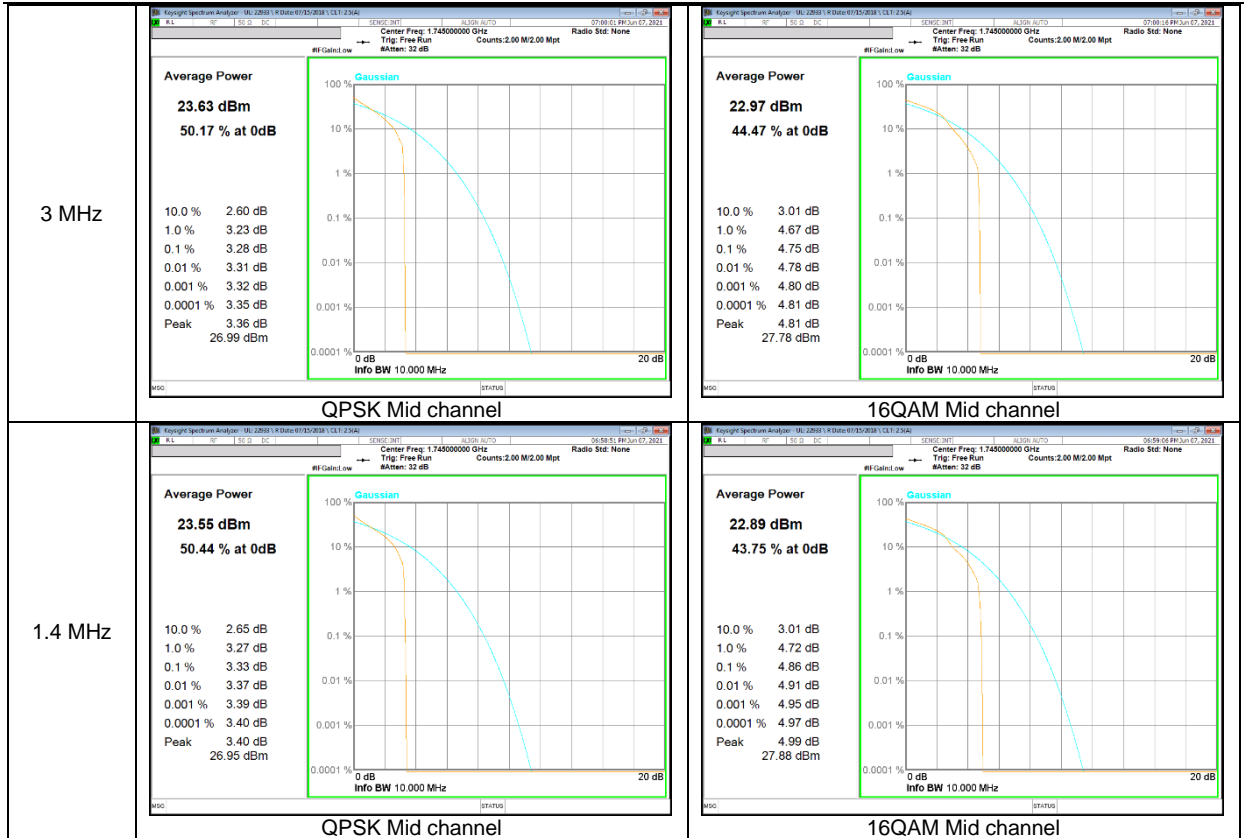


LTE Band 14



LTE Band 66

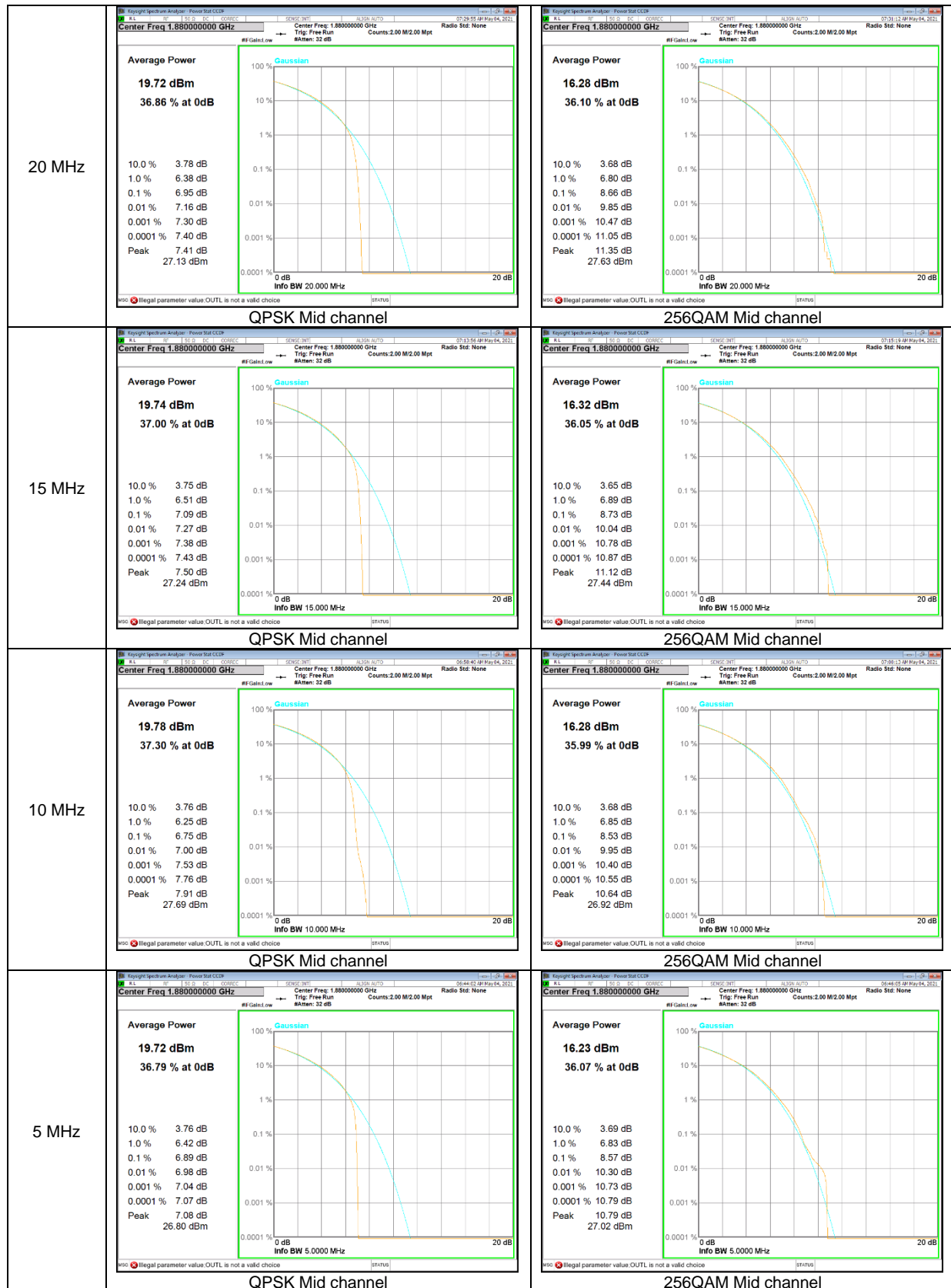




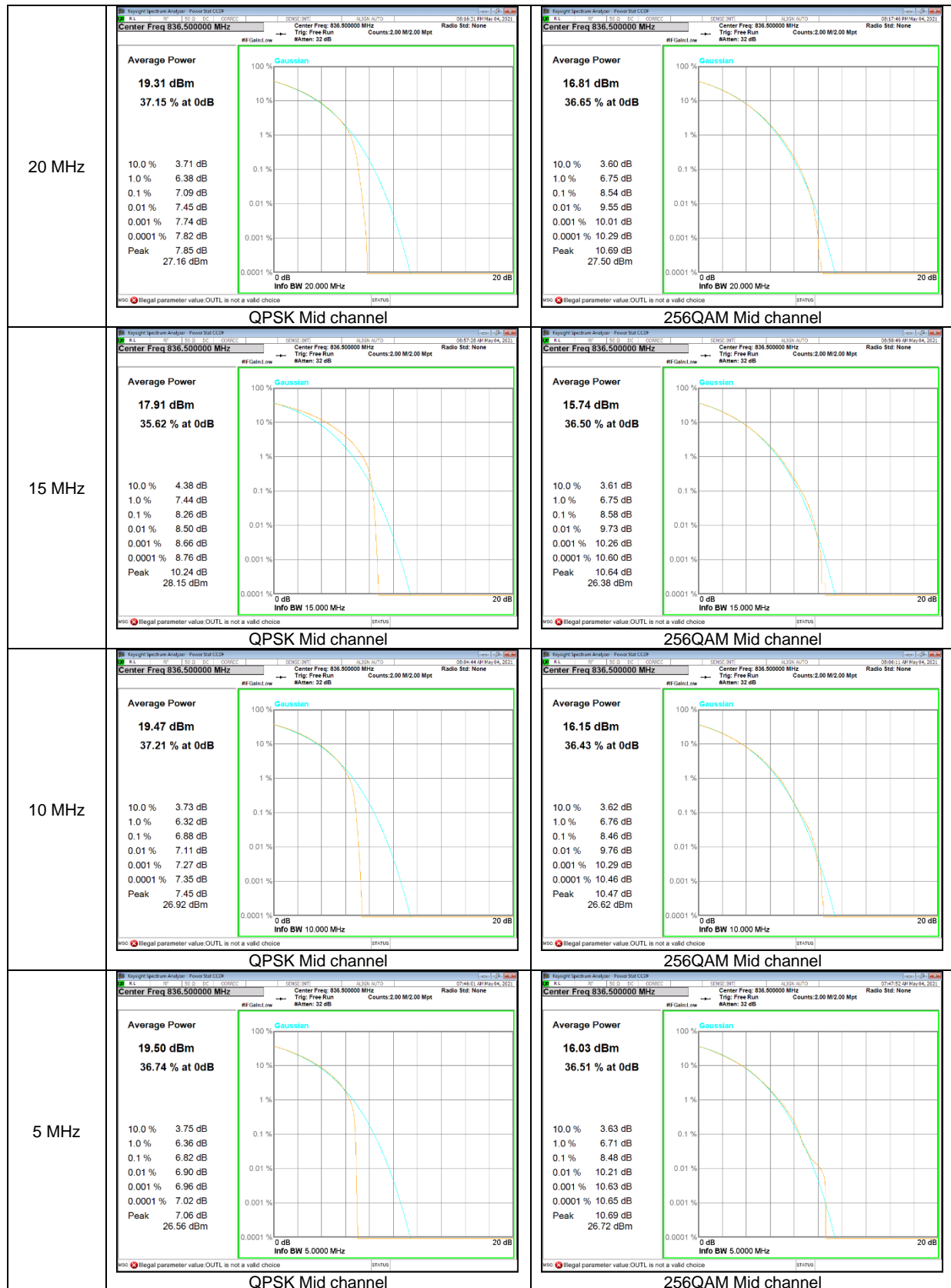
LTE Band 4

LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

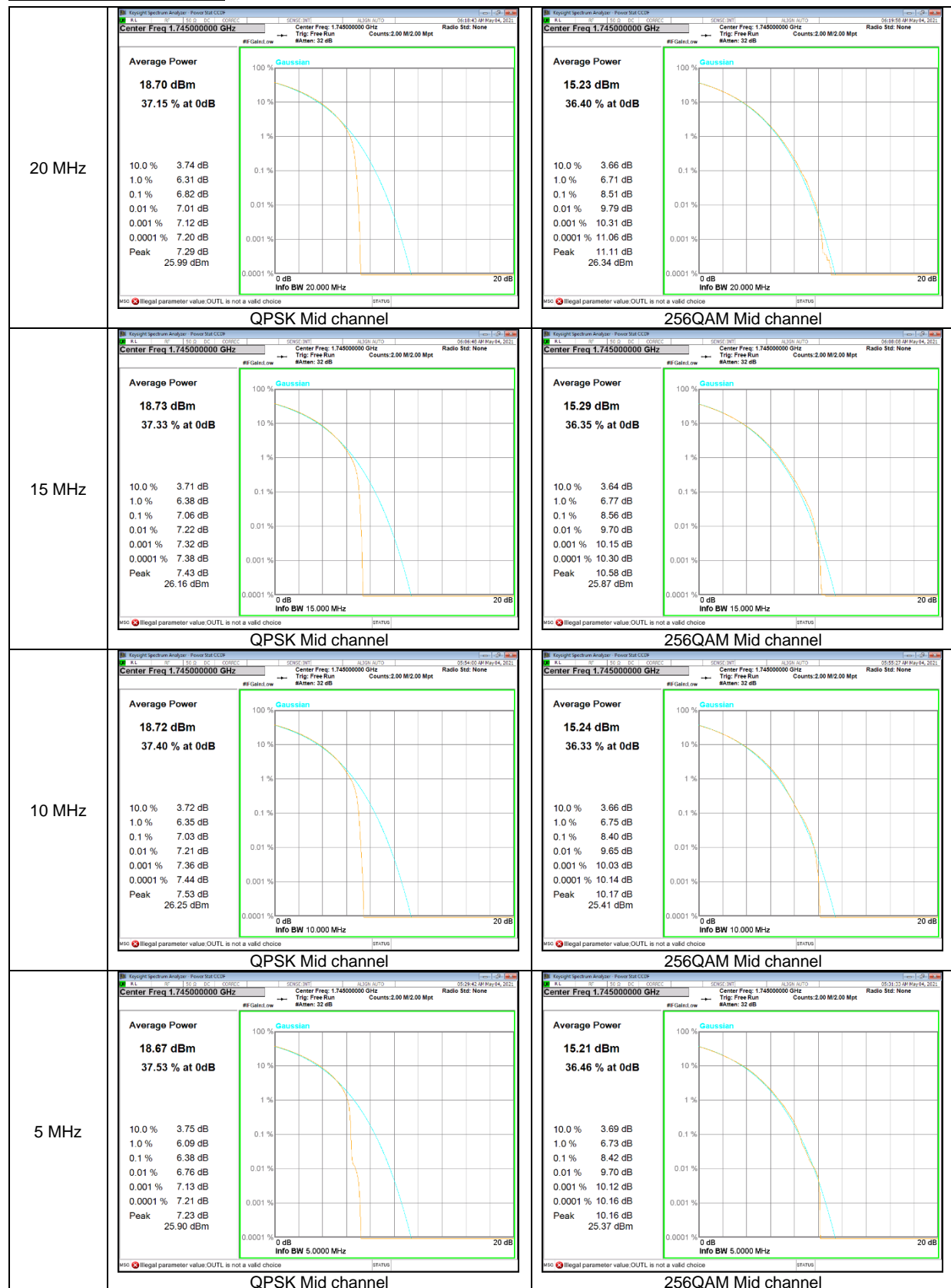
NR Band 2 CP-OFDM



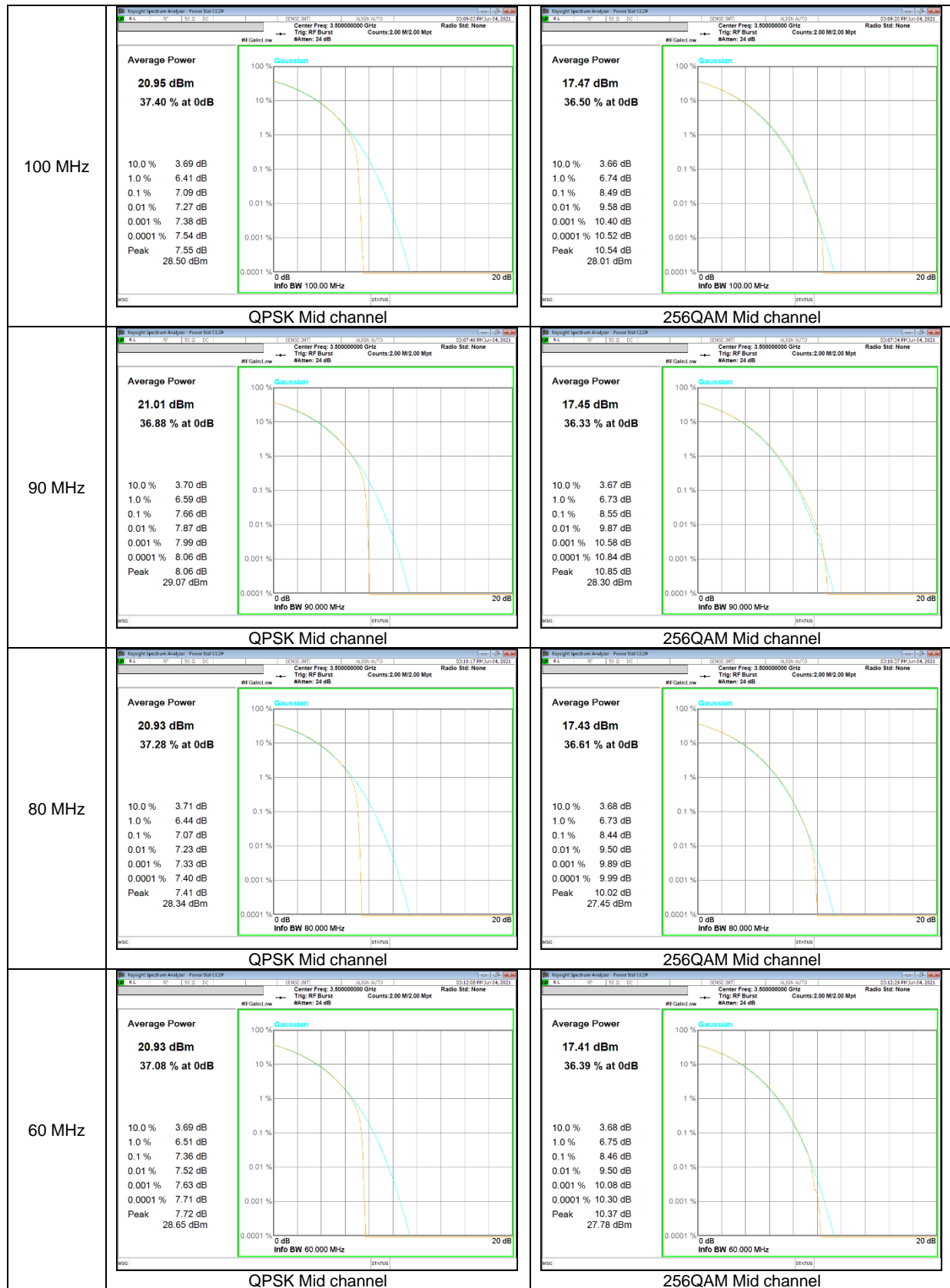
NR Band 5 CP-OFDM

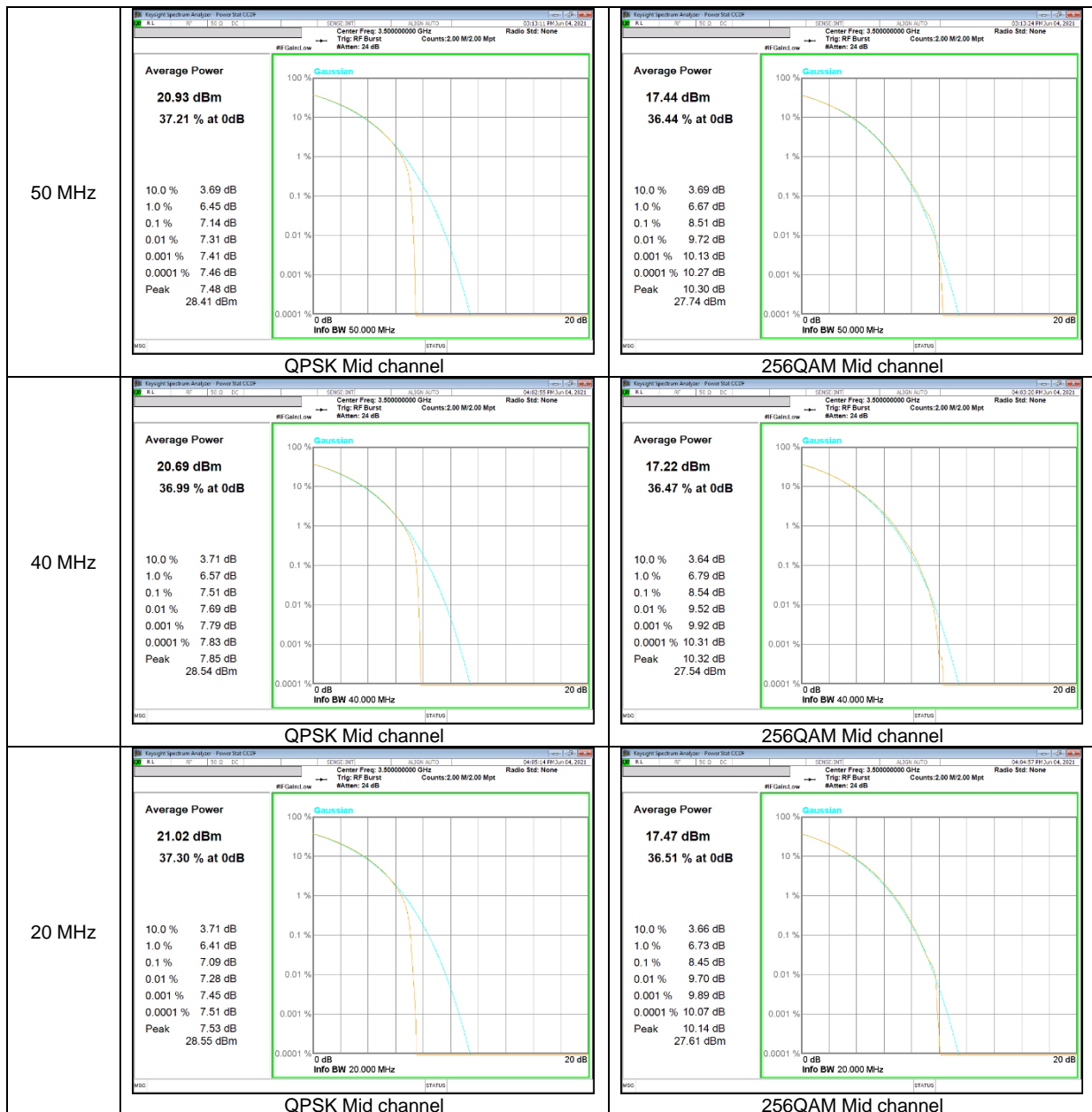


NR Band 66 CP-OFDM



NR Band 77 (Lower) CP-OFDM





NR Band 77 (Upper) CP-OFDM

