

# CERTIFICATION TEST REPORT

**Report Number.** : 4790841154-E2V2

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

**Model** : SM-X518U

**FCC ID** : A3LSMX518U

**EUT Description** : WCDMA/LTE 5G NR Tablet+ BT/BLE, DTS/UNII a/b/g/n/ac/ax,  
and Digitizer.

**Test Standard(s)** : FCC CFR47 PART 22 SUBPART H  
FCC CFR47 PART 90 SUBPART R,S

**Date Of Issue:**  
2023-07-24

**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

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	2023-07-17	Initial issue	Yujin Kim
V2	2023-07-28	Updated to address TCB's question	Yujin Kim

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>4</b>
<b>2. TEST METHODOLOGY .....</b>	<b>5</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>5</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>6</b>
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
<b>5. EQUIPMENT UNDER TEST.....</b>	<b>7</b>
5.1. <i>DESCRIPTION OF EUT.....</i>	7
5.2. <i>MAXIMUM OUTPUT POWER.....</i>	7
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS .....</i>	10
5.4. <i>WORST-CASE ORIENTATION.....</i>	11
5.5. <i>DESCRIPTION OF TEST SETUP.....</i>	14
<b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>16</b>
<b>7. SUMMARY TABLE.....</b>	<b>17</b>
<b>8. CONDUCTED RESULTS.....</b>	<b>18</b>
8.1. <i>CONDUCTED OUTPUT POWER .....</i>	18
8.1.1. <i>CONDUCTED AVERAGE OUTPUT POWER.....</i>	19
8.2. <i>PEAK TO AVERAGE RATIO.....</i>	27
8.2.1. <i>CONDUCTED PEAK TO AVERAGE RESULT .....</i>	28
8.3. <i>OCCUPIED BANDWIDTH.....</i>	37
8.3.1. <i>OCCUPIED BANDWIDTH RESULTS.....</i>	41
8.4. <i>BAND EDGE EMISSIONS .....</i>	52
8.4.1. <i>BAND EDGE RESULT.....</i>	54
8.4.2. <i>EMISSION MASK RESULT .....</i>	70
8.5. <i>CONDUCTED SPURIOUS EMISSIONS .....</i>	83
8.5.1. <i>OUT OF BAND EMISSIONS RESULT.....</i>	84
8.6. <i>FREQUENCY STABILITY.....</i>	89
8.6.1. <i>FREQUENCY STABILITY RESULTS .....</i>	90
<b>9. RADIATED RESULTS.....</b>	<b>92</b>
9.1. <i>RADIATED POWER (ERP).....</i>	92
9.1.1. <i>ERP Results .....</i>	93
9.2. <i>RADIATED SPURIOUS EMISSION .....</i>	96
9.2.1. <i>SPURIOUS RADIATION PLOTS .....</i>	98

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SAMSUNG ELECTRONICS CO., LTD.

**EUT DESCRIPTION:** WCDMA/LTE 5G Tablet + BT/BLE, DTS/UNII a/b/g/n/ac/ax, and Digitizer.

**MODEL NUMBER:** SM-X518U

**SERIAL NUMBER:** R32W500QLJV, R32W500QM6Y (CONDUCTED);  
R32W500QQVJ, R32W500QT0P, R32W500QSXX (RADIATED);

**DATE TESTED:** 2023-05-24 - 2023-07-21;

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22H and 90R,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:

Tested By:



Seokhwan Hong  
Suwon Lab Engineer  
UL KOREA LTD.

Yujin Kim  
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 90.
4. ANSI TIA-603-E, 2016
5. ANSI C63.26, 2015
6. KDB 971168 D01 Power Meas License Digital Systems v03r01

## 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(3m semi-anechoic chamber)
<input checked="" type="checkbox"/>	Chamber 2(3m semi-anechoic chamber)
<input type="checkbox"/>	Chamber 3(3m semi-anechoic chamber)
<input type="checkbox"/>	Chamber 4(3m Full-anechoic chamber)
<input type="checkbox"/>	Chamber 5(3m Full-anechoic chamber)

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:

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

(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	2.80 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.92 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.06 dB
Radiated Disturbance, 18 GHz to 40 GHz	6.02 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 115:2021.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

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

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum average radiated ERP output powers as follows:  
 Radiated samples were set to a higher power than conducted resulting in radiated ERP greater than conducted measurements.

#### WCDMA

FCC Part 22						
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	824.00 ~ 849.00	Rel. 99	<b>24.26</b>	<b>266.69</b>	<b>24.04</b>	<b>253.71</b>
		HSDPA	23.66	232.27	23.23	210.54

#### LTE Band 5B (UL CA)

Part 22			
ERP Limit (dBm)	38.5	ANT Gain (dBi)	-1.8

Frequency Range (MHz)	Bandwidth (MHz)	Modulation	Output Power				Margin
			Conducted Average Power	Antenna Gain	ERP Average Power		
			(dBm)	dBi	dBm	mW	
824 ~ 849	20MHz (10+10)	QPSK	<b>24.67</b>	-1.80	<b>20.72</b>	<b>118.03</b>	-17.78
		16QAM	23.74		19.79	95.28	-18.71
	15MHz (10+5)	QPSK	24.58		20.63	115.61	-17.87
		16QAM	23.60		19.65	92.26	-18.85
	8MHz (5+3)	QPSK	24.65		20.70	117.49	-17.80
		16QAM	24.60		20.65	116.14	-17.85

**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	793.00	10	QPSK	<b>24.15</b>	<b>260.02</b>	<b>24.41</b>	<b>276.06</b>
			16QAM	23.44	220.80	23.16	207.01
			64QAM	22.27	168.66		
			256QAM	19.51	89.33		
	790.50 – 795.50	5	QPSK	23.41	219.28	24.26	266.69
			16QAM	22.85	192.75	23.11	204.64
256QAM			18.77	75.34			

**LTE Band 26 (Part90)**

FCC Part 90							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	821.50	15	QPSK	24.11	257.63	24.18	261.82
			16QAM	23.36	216.77	23.12	205.12
			64QAM	22.32	170.61		
			256QAM	19.31	85.31		
	819.00	10	QPSK	24.36	272.90	23.87	243.78
			16QAM	23.69	233.88	22.86	193.20
			64QAM	22.30	169.82		
			256QAM	19.24	83.95		
	816.50 – 821.50	5	QPSK	24.37	273.53	24.34	271.64
			16QAM	23.75	237.14	23.37	217.27
			64QAM	22.38	172.98		
			256QAM	19.39	86.90		
	815.50 – 822.50	3	QPSK	<b>24.46</b>	<b>279.25</b>	24.48	280.54
			16QAM	23.50	223.87	23.40	218.78
			64QAM	22.39	173.38		
			256QAM	19.58	90.78		
814.70 – 823.30	1.4	QPSK	24.33	271.02	<b>24.64</b>	<b>291.07</b>	
		16QAM	23.56	226.99	23.42	219.79	
		64QAM	22.43	174.98			
		256QAM	19.15	82.22			

**LTE Band 26 (Straddle)**

Straddle							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated (ANT A+B)	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	824.00	15	QPSK	<b>24.20</b>	<b>263.03</b>	24.75	298.54
			16QAM	23.53	225.42	23.60	229.09
			64QAM	22.20	165.96		
			256QAM	19.30	85.11		
		10	QPSK	24.11	257.63	24.65	291.74
			16QAM	23.51	224.39	23.58	228.03
			64QAM	22.23	167.11		
			256QAM	19.21	83.37		
		5	QPSK	24.08	255.86	<b>24.83</b>	<b>304.09</b>
			16QAM	23.60	229.09	23.81	240.44
			64QAM	22.13	163.31		
			256QAM	19.24	83.95		
		3	QPSK	23.99	250.61	24.52	283.14
			16QAM	23.33	215.28	23.48	222.84
			64QAM	22.16	164.44		
			256QAM	19.33	85.70		
1.4	QPSK	24.16	260.62	24.75	298.54		
	16QAM	23.29	213.30	23.50	223.87		
	64QAM	22.53	179.06				
	256QAM	19.38	86.70				



**LTE Band 26 (Part22)**

FCC Part 22							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated (ANT A+B)	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	831.50 ~ 841.50	15	QPSK	24.37	273.53	<b>25.84</b>	<b>383.71</b>
			16QAM	23.62	230.14	24.74	297.85
			64QAM	22.66	184.50		
			256QAM	19.68	92.90		
	829.00 ~ 844.00	10	QPSK	24.47	279.90	25.48	353.18
			16QAM	23.69	233.88	24.44	277.97
			64QAM	22.54	179.47		
			256QAM	19.61	91.41		
	826.50 ~ 846.50	5	QPSK	24.56	285.76	25.58	361.41
			16QAM	23.80	239.88	24.59	287.74
			64QAM	22.47	176.60		
			256QAM	19.53	89.74		
	825.50 ~ 847.50	3	QPSK	24.46	279.25	25.60	363.08
			16QAM	23.75	237.14	24.46	279.25
			64QAM	22.28	169.04		
			256QAM	19.43	87.70		
	824.70 ~ 848.30	1.4	QPSK	<b>24.58</b>	<b>287.08</b>	25.42	348.34
			16QAM	23.62	230.14	24.34	271.64
			64QAM	22.55	179.89		
			256QAM	19.56	90.36		

**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	834.00 - 839.00	20	DFT-s OFDM	$\pi/2$ BPSK	23.57	227.51			
				QPSK	23.60	229.09	<b>25.86</b>	<b>385.48</b>	
				16QAM	22.70	186.21	24.85	305.49	
				64QAM	21.13	129.72			
				256QAM	19.03	79.98			
	831.50 - 841.50	15	DFT-s OFDM	CP-OFDM	QPSK	22.13	163.31		
					$\pi/2$ BPSK	24.22	264.24		
					QPSK	24.22	264.24	25.72	373.25
					16QAM	23.38	217.77	24.69	294.44
					64QAM	21.69	147.57		
	829.00 - 844.00	10	DFT-s OFDM	CP-OFDM	256QAM	19.71	93.54		
					$\pi/2$ BPSK	24.30	269.15		
					QPSK	<b>24.32</b>	<b>270.40</b>	25.71	372.39
					16QAM	23.36	216.77	24.72	296.48
					64QAM	21.83	152.41		
	826.50 - 846.50	5	DFT-s OFDM	CP-OFDM	256QAM	19.72	93.76		
					QPSK	22.76	188.80		
					$\pi/2$ BPSK	24.04	253.51		
					QPSK	24.12	258.23	25.51	355.63
					16QAM	23.08	203.24	24.58	287.08
				64QAM	21.66	146.55			
				256QAM	19.62	91.62			
				CP-OFDM	QPSK	22.60	181.97		

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

Frequency (MHz)	Peak Gain (dBd)
WCDMA Band 5 / LTE Band 5, 26 / NR Band n5 814 - 849 MHz	-1.8
LTE Band 14 788 - 798 MHz	-2.0

## 5.4. WORST-CASE ORIENTATION

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

- UMTS REL 99/HSDPA

For 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. However, the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest power in QPSK.

For 5G NR Band n5 the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on  $\pi/2$  BPSK, QPSK, 16QAM, 64QAM and 256QAM modulations. It was found QPSK and 16QAM results were worst case as below.

Both NSA and SA modes were tested and worst case is reported. 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

### **LTE Band 5**

LTE Band 5 (Frequency range: 824-849 MHz) is covered by LTE Band 26 (Frequency range: 814-849 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

NR Worst case

BAND	NSA or SA	Antenna
n5	SA	Main 1

● Conducted Spurious Emission

Highest conducted output power setting for each bands				
LTE Band	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
14	793.00	10	1	0
26 (Part 90)	815.50	3	1	14
	822.50		1	0
26 (Straddle)	824.00	15	1	37
26 (Part 22)	824.70	1.4	1	0
	831.50		1	3
	848.30		1	5
NR Band	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	829.00	10	1	26
	836.50		1	1
	844.00		1	26

● Radiated Spurious Emission

Highest ERP setting for each bands				
LTE Band	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
14	793.00	10	1	0
26 (Part 90)	814.70	1.4	1	5
	823.30		1	0
26 (Straddle)	824.00	5	1	0
26 (Part 22)	831.50	15	1	0
	836.50		1	0
	841.50		1	0
NR Band	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	834.00	20	1	53
	836.50		1	1
	839.00		1	1

● Uplink CA

Highest conducted output power setting for each bands					
LTE Band	Component Carrier	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	PCC	834.10	10	1	49
	SCC	844.00	10	1	0

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

Band	ERP			RSE		
	X	Y	Z	X	Y	Z
WCDMA B5	-	O	-	-	O	-
LTE B14	-	O	-	-	O	-
LTE B26	-	O	-	-	O	-
NR n5	-	O	-	-	O	-
LTE 5B(UL CA)	-	-	-	O	-	-

Note : For ERP 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.

## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacture	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37N9QP4SL9DK3	N/A
Data Cable	SAMSUNG	EP-DN980	GH39-02115A	N/A

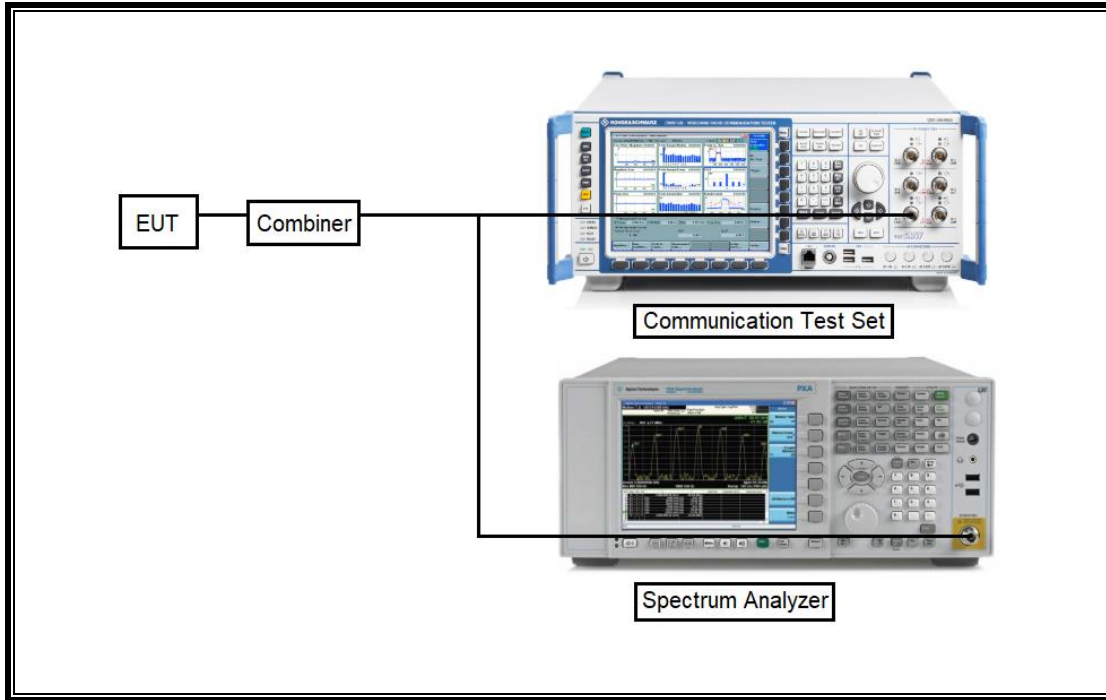
### I/O CABLE

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

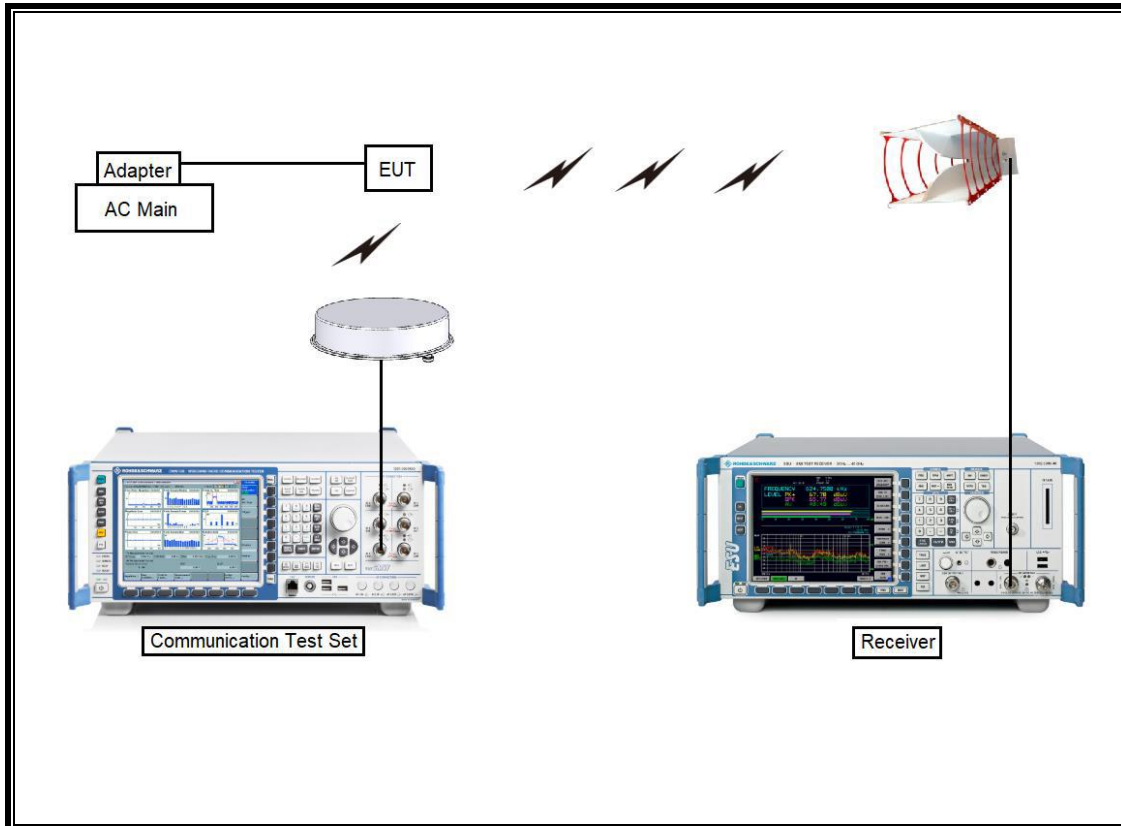
### TEST SETUP

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	2025-01-17
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	00168645	2023-10-13
Preamplifier	ETS	3115-PA	00167475	2023-08-04
Preamplifier	ETS	3116C-PA	00168841	2023-08-04
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2024-08-15
Antenna, Horn, 18 GHz	ETS	3115	00161451	2024-08-21
Antenna, Horn, 18 GHz	ETS	3117	00168717	2024-08-21
Communications Test Set	R&S	CMW500	169796	2024-01-05
DC Power Supply	Agilent / HP	E3640A	MY54226395	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	341282	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	351741	2023-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	2023-08-01
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2023-08-01
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2023-08-03
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2023-08-01
Spectrum Analyzer, 44 GHz	KEYSIGHT	N9030B	MY60070693	2024-01-09
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2023-08-02
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2023-07-29
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	2023-08-01
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	2023-08-01
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	2023-08-01
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	2023-08-01
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	2023-08-01
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	2023-08-01
Attenuator	PASTERNAK	PE7087-10	A009	2023-08-03
Attenuator	PASTERNAK	PE7087-10	A001	2023-08-03
Attenuator	PASTERNAK	PE7087-10	A008	2023-08-03
Attenuator	PASTERNAK	PE7004-10	2	2023-08-01
Attenuator	PASTERNAK	PE7395-10	A011	2023-08-03
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2023-10-06
Temperature Chamber	ESPEC	SH-642	93001109	2023-08-01
Power Splitter	MINI-CIRCUITS	WA1534	UL003	2024-01-09
Power Splitter	MINI-CIRCUITS	WA1534	UL004	2024-01-09
UL Software				
Description	Manufacturer	Model	Version	
Antenna port test software	UL	CLT	Ver 3.4	
Radiated software	UL	UL EMC	Ver 9.5	
Antenna port test software (5G NR FR1)	UL	UL iM	Ver 1.06	



## 7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass
22.917(a)	Band Edge / Conducted Spurious Emission	-13dBm		Pass
90.543(e)		-35 dBm		Pass
90.691	Emission mask	Section 9.2.2		Pass
2.1046	Conducted output power	N/A		Pass
90.635(b)		50 dBm		Pass
22.355 90.213	Frequency Stability	2.5PPM		Pass
22.913(a)(5)	Effective Radiated Power	38.5dBm	Radiated	Pass
90.542(a)(7) 90.635(b)		34.77dBm		Pass
22.917(a) 90.543(c) 90.691(a)	Radiated Spurious Emission	-13dBm		Pass

## 8. CONDUCTED RESULTS

### 8.1. CONDUCTED OUTPUT POWER

#### Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to either CMW500 Test Set or E7515B Test set and configured to operate at maximum power.

#### NOTE

5G NR: All Waveforms (CP-OFDM vs DFT-s\_OFDM) and modulations ( $\pi/2$  BPSK, 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

See the following pages.

### 8.1.1. CONDUCTED AVERAGE OUTPUT POWER

#### WCDMA B5

Mode		UL Ch No.	Freq. (MHz)	Maximum Average Power (dBm)		
				Measured Pwr	MPR	Tune-up Limit
Release 99	Rel 99 (RMC, 12.2 kbps)	4132	826.40	24.26	N/A	24.5
		4183	836.60	23.95		
		4233	846.60	24.06		
HSDPA	Subtest 1	4132	826.40	23.63	0	24.0
		4183	836.60	23.54		
		4233	846.60	23.66		
	Subtest 2	4132	826.40	23.25	0	24.0
		4183	836.60	23.11		
		4233	846.60	23.20		
	Subtest 3	4132	826.40	22.75	0.5	23.5
		4183	836.60	22.62		
		4233	846.60	22.73		
	Subtest 4	4132	826.40	22.21	0.5	23.5
		4183	836.60	22.07		
		4233	846.60	22.20		
HSUPA	Subtest 1	4132	826.40	22.75	0	24.0
		4183	836.60	22.52		
		4233	846.60	22.62		
	Subtest 2	4132	826.40	20.61	2	22.0
		4183	836.60	20.41		
		4233	846.60	20.50		
	Subtest 3	4132	826.40	21.62	1	23.0
		4183	836.60	21.43		
		4233	846.60	21.52		
	Subtest 4	4132	826.40	20.61	2	22.0
		4183	836.60	20.41		
		4233	846.60	20.51		
	Subtest 5	4132	826.40	23.79	0	24.0
		4183	836.60	23.59		
		4233	846.60	23.68		
DC-HSDPA	Subtest 1	4132	826.40	23.79	0	24.0
		4183	836.60	23.64		
		4233	846.60	23.56		
	Subtest 2	4132	826.40	23.25	0	24.0
		4183	836.60	23.19		
		4233	846.60	23.12		
	Subtest 3	4132	826.40	21.69	0.5	23.5
		4183	836.60	21.63		
		4233	846.60	21.55		
	Subtest 4	4132	826.40	22.21	0.5	23.5
		4183	836.60	22.19		
		4233	846.60	22.10		

**LTE Band 5B (UL CA)**

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average Power (dBm)	
			Size	Offset	Size	Offset	QPSK	16QAM
20MHz (10MHz / 10MHz)	829.0	838.9	1	49	1	0	24.62	23.66
			1	0	1	49	16.03	16.11
			50	0	50	0	22.12	21.06
	831.5	841.4	1	49	1	0	24.58	23.51
			1	0	1	49	16.00	16.15
			50	0	50	0	22.06	20.99
	834.1	844.0	1	49	1	0	24.67	23.74
			1	0	1	49	15.91	16.91
			50	0	50	0	22.04	20.94

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average Power (dBm)	
			Size	Offset	Size	Offset	QPSK	16QAM
15MHz (10MHz / 5MHz)	829.0	836.2	1	49	1	0	23.94	22.96
			1	0	1	24	14.31	14.60
			50	0	25	0	21.96	20.89
	834.2	841.3	1	49	1	0	24.58	23.60
			1	0	1	24	14.40	14.47
			50	0	25	0	22.53	21.52
	839.3	846.5	1	49	1	0	24.42	23.51
			1	0	1	24	14.35	14.45
			50	0	25	0	22.77	21.69

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average Power (dBm)	
			Size	Offset	Size	Offset	QPSK	16QAM
8MHz (5MHz / 3MHz)	826.5	830.4	1	24	1	0	24.48	24.42
			1	0	1	14	14.96	15.21
			25	0	15	0	24.51	24.45
	835.1	838.9	1	24	1	0	24.65	24.60
			1	0	1	14	14.92	15.22
			25	0	15	0	24.50	24.42
	843.6	847.5	1	24	1	0	24.52	24.47
			1	0	1	14	15.25	15.36
			25	0	15	0	24.63	24.60

**LTE Band 14**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				Measured Pwr (dBm)			MPR	Tune-up Limit
				23330	793.00 MHz	23330		
10 MHz	QPSK	1	0	24.15			0.0	25.0
		1	25	24.14			0.0	25.0
		1	49	24.01			0.0	25.0
		25	0	23.15			1.0	24.0
		25	12	23.13			1.0	24.0
		25	25	23.08			1.0	24.0
	16QAM	50	0	23.14			1.0	24.0
		1	0	23.39			1.0	24.0
		1	25	23.44			1.0	24.0
		1	49	23.27			1.0	24.0
		25	0	22.14			2.0	23.0
		25	12	22.13			2.0	23.0
	64QAM	25	25	22.11			2.0	23.0
		50	0	22.12			2.0	23.0
		1	0	22.27			2.0	23.0
		1	25	22.27			2.0	23.0
		1	49	22.22			2.0	23.0
		25	0	21.12			3.0	22.0
	256QAM	25	12	21.08			3.0	22.0
		25	25	21.07			3.0	22.0
50		0	21.11			3.0	22.0	
1		0	19.51			5.0	20.0	
1		25	19.43			5.0	20.0	
1		49	19.36			5.0	20.0	
5 MHz	QPSK	25	0	19.17			5.0	20.0
		25	12	19.14			5.0	20.0
		25	25	19.10			5.0	20.0
		50	0	19.13			5.0	20.0
		1	0	23.33	23.36	23.33	0.0	25.0
		1	12	23.36	23.32	23.41	0.0	25.0
	16QAM	1	24	23.36	23.33	23.29	0.0	25.0
		12	0	22.41	22.38	22.42	1.0	24.0
		12	7	22.42	22.35	22.42	1.0	24.0
		12	13	22.39	22.34	22.37	1.0	24.0
		25	0	22.43	22.36	22.41	1.0	24.0
		1	0	22.85	22.61	22.68	1.0	24.0
	64QAM	1	12	22.74	22.50	22.73	1.0	24.0
		1	24	22.66	22.56	22.57	1.0	24.0
		12	0	21.43	21.38	21.41	2.0	23.0
		12	7	21.37	21.36	21.37	2.0	23.0
		12	13	21.38	21.38	21.35	2.0	23.0
		25	0	21.36	21.34	21.43	2.0	23.0
	256QAM	1	0	21.70	21.64	21.63	2.0	23.0
		1	12	21.45	21.49	21.42	2.0	23.0
1		24	21.68	21.58	21.39	2.0	23.0	
12		0	19.56	20.33	19.68	3.0	22.0	
12		7	20.34	20.31	20.27	3.0	22.0	
12		13	19.63	20.29	19.66	3.0	22.0	
256QAM	25	0	20.33	20.33	20.28	3.0	22.0	
	1	0	18.60	18.77	18.53	5.0	20.0	
	1	12	18.16	18.61	18.35	5.0	20.0	
	1	24	18.36	18.70	18.40	5.0	20.0	
	12	0	18.46	18.39	18.31	5.0	20.0	
	12	7	18.46	18.38	18.29	5.0	20.0	
	12	13	18.40	18.33	18.35	5.0	20.0	
	25	0	18.37	18.33	18.33	5.0	20.0	

**LTE Band 26**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)							MPR	Tune-up Limit
				Measured Pwr (dBm)								
				26765	26790	26865	26915	26965				
				821.50 MHz	824.00 MHz	831.50 MHz	836.50 MHz	841.50 MHz				
15 MHz	QPSK	1	0	24.11	24.08	24.17	23.87	24.37	0.0	25.0		
		1	37	23.96	24.20	23.96	23.78	24.17	0.0	25.0		
		1	74	24.00	24.02	24.04	23.74	24.26	0.0	25.0		
		36	0	23.22	23.12	23.30	22.95	23.50	1.0	24.0		
		36	20	23.17	23.22	23.26	22.91	23.45	1.0	24.0		
		36	39	23.16	23.05	23.23	22.85	23.43	1.0	24.0		
	16QAM	75	0	23.22	23.14	23.26	22.86	23.49	1.0	24.0		
		1	0	23.36	23.41	23.50	22.79	23.62	1.0	24.0		
		1	37	23.35	23.53	23.32	22.76	23.44	1.0	24.0		
		1	74	23.20	23.26	23.33	22.64	23.49	1.0	24.0		
		36	0	22.23	22.12	22.24	21.93	22.48	2.0	23.0		
		36	20	22.20	22.18	22.19	21.85	22.44	2.0	23.0		
	64QAM	36	39	22.17	22.06	22.13	21.81	22.40	2.0	23.0		
		75	0	22.19	22.15	22.22	21.83	22.44	2.0	23.0		
		1	0	22.32	22.20	22.22	21.90	22.66	2.0	23.0		
		1	37	22.21	21.90	21.94	21.94	22.49	2.0	23.0		
		1	74	22.18	21.99	22.08	21.85	22.54	2.0	23.0		
		36	0	21.22	21.16	21.28	20.82	21.51	3.0	22.0		
	256QAM	36	20	21.19	21.12	21.23	20.77	21.47	3.0	22.0		
		36	39	21.14	21.15	21.20	20.84	21.45	3.0	22.0		
		75	0	21.14	21.13	21.19	20.76	21.42	3.0	22.0		
1		0	19.31	19.30	19.50	19.00	19.68	5.0	20.0			
1		37	19.14	19.15	19.25	19.07	19.51	5.0	20.0			
1		74	19.15	19.10	19.31	18.91	19.54	5.0	20.0			
10 MHz	QPSK	36	0	19.17	19.13	19.22	18.75	19.48	5.0	20.0		
		36	20	19.13	19.11	19.17	18.75	19.45	5.0	20.0		
		36	39	19.07	19.05	19.14	18.73	19.38	5.0	20.0		
		75	0	19.12	19.15	19.19	18.74	19.43	5.0	20.0		
		1	0	24.36	24.11	24.15	24.45	24.09	0.0	25.0		
		1	25	24.32	23.95	23.96	24.47	24.01	0.0	25.0		
16QAM	QPSK	1	49	24.29	24.05	23.09	24.36	24.04	0.0	25.0		
		25	0	23.39	23.12	23.32	23.43	23.09	1.0	24.0		
		25	12	23.36	23.11	23.29	23.41	23.06	1.0	24.0		
		25	25	23.32	23.25	23.30	23.38	23.04	1.0	24.0		
		50	0	23.36	23.28	23.32	23.42	23.07	1.0	24.0		
		1	0	23.57	23.51	23.53	23.64	23.41	1.0	24.0		
	16QAM	1	25	23.69	23.40	23.43	23.69	23.40	1.0	24.0		
		1	49	23.46	23.45	23.47	23.61	23.33	1.0	24.0		
		25	0	22.36	22.28	22.45	22.41	22.10	2.0	23.0		
		25	12	22.36	22.25	22.38	22.39	22.06	2.0	23.0		
64QAM	QPSK	25	25	22.34	22.36	22.32	22.38	22.04	2.0	23.0		
		50	0	22.33	22.30	22.35	22.37	22.02	2.0	23.0		
		1	0	22.22	22.16	22.32	22.51	22.04	2.0	23.0		
		1	25	22.30	22.23	22.34	22.54	21.95	2.0	23.0		
		1	49	22.23	22.21	22.45	22.51	21.92	2.0	23.0		
		25	0	21.26	21.20	21.23	21.27	21.01	3.0	22.0		
	64QAM	25	12	21.26	21.23	21.22	21.25	20.97	3.0	22.0		
		25	25	21.22	21.15	21.15	21.22	20.95	3.0	22.0		
		50	0	21.23	21.21	21.23	21.25	20.96	3.0	22.0		
		1	0	19.24	19.21	19.45	19.61	19.10	5.0	20.0		
256QAM	1	25	19.07	19.11	19.32	19.35	19.12	5.0	20.0			
	1	49	19.15	19.16	19.41	19.50	19.01	5.0	20.0			
	25	0	19.21	19.13	19.21	19.29	19.01	5.0	20.0			
	25	12	19.19	19.15	19.16	19.28	19.00	5.0	20.0			
	25	25	19.15	19.11	19.20	19.24	18.94	5.0	20.0			
	50	0	19.17	19.12	19.21	19.24	18.92	5.0	20.0			

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)						MPR	Tune-up Limit
				26715	26765	26790	26815	26865	27015		
				816.50 MHz	821.5 MHz	824.00 MHz	824.7 MHz	831.50 MHz	846.50 MHz		
5 MHz	QPSK	1	0	24.35	24.05	24.08	24.09	24.54	24.07	0.0	25.0
		1	12	24.37	24.14	24.06	24.04	24.56	23.96	0.0	25.0
		1	24	24.35	24.09	24.07	24.06	24.53	24.03	0.0	25.0
		12	0	23.43	23.17	23.20	23.15	23.54	23.12	1.0	24.0
		12	7	23.43	23.15	23.16	23.22	23.52	23.11	1.0	24.0
		12	13	23.39	23.16	23.14	23.35	23.50	23.08	1.0	24.0
	16QAM	25	0	23.40	23.14	23.15	23.38	23.52	23.10	1.0	24.0
		1	0	23.72	23.46	23.60	23.41	23.80	23.44	1.0	24.0
		1	12	23.71	23.51	23.56	23.37	23.74	23.28	1.0	24.0
		1	24	23.75	23.45	23.51	23.36	23.75	23.43	1.0	24.0
		12	0	22.43	22.16	22.19	22.47	22.58	22.17	2.0	23.0
		12	7	22.41	22.13	22.18	22.34	22.56	22.17	2.0	23.0
	64QAM	12	13	22.39	22.09	22.17	22.45	22.57	22.17	2.0	23.0
		25	0	22.36	22.14	22.16	22.34	22.50	22.06	2.0	23.0
		1	0	22.34	22.12	22.13	22.23	22.47	21.92	2.0	23.0
		1	12	22.33	22.10	22.11	22.21	22.37	21.87	2.0	23.0
		1	24	22.38	22.11	22.13	22.24	22.41	21.98	2.0	23.0
		12	0	21.15	21.06	21.13	21.16	21.21	20.90	3.0	22.0
	256QAM	12	7	21.12	21.03	21.10	21.13	21.19	20.88	3.0	22.0
		12	13	21.14	21.04	21.11	21.12	21.19	20.88	3.0	22.0
		25	0	21.11	21.01	21.10	21.19	21.25	20.89	3.0	22.0
		1	0	19.17	19.14	19.24	19.43	19.53	18.82	5.0	20.0
		1	12	19.12	19.39	19.22	19.40	19.45	18.62	5.0	20.0
		1	24	19.16	19.24	19.23	19.45	19.52	18.79	5.0	20.0
	3 MHz	QPSK	12	0	19.12	19.04	19.09	19.12	19.28	18.84	5.0
12			7	19.11	19.05	19.14	19.23	19.29	18.84	5.0	20.0
12			13	19.11	19.07	19.10	19.20	19.25	18.81	5.0	20.0
25			0	19.10	19.09	19.10	19.14	19.20	18.88	5.0	20.0
1			0	24.39	24.16	23.96	24.22	24.46	24.18	0.0	25.0
1			8	24.17	24.06	23.93	24.12	24.42	24.13	0.0	25.0
16QAM		1	14	24.46	24.13	23.99	24.20	24.41	24.21	0.0	25.0
		8	0	23.37	23.13	23.15	23.06	23.55	23.18	1.0	24.0
		8	4	23.39	23.07	23.13	23.09	23.52	23.15	1.0	24.0
		8	7	23.37	23.09	23.13	23.06	23.50	23.19	1.0	24.0
		15	0	23.39	23.09	23.14	23.08	23.54	23.14	1.0	24.0
		1	0	23.45	23.50	23.30	23.16	23.71	23.40	1.0	24.0
		1	8	23.45	23.40	23.20	23.02	23.69	23.42	1.0	24.0
		1	14	23.37	23.35	23.33	23.03	23.75	23.36	1.0	24.0
		8	0	22.34	22.29	22.21	22.25	22.60	22.21	2.0	23.0
64QAM	8	4	22.35	22.22	22.23	22.20	22.57	22.17	2.0	23.0	
	8	7	22.35	22.24	22.17	22.18	22.58	22.17	2.0	23.0	
	15	0	22.29	22.14	22.17	22.10	22.44	22.14	2.0	23.0	
	1	0	22.33	22.23	22.15	22.25	22.28	21.98	2.0	23.0	
	1	8	22.18	22.16	22.13	22.20	22.25	21.90	2.0	23.0	
	1	14	22.39	22.27	22.16	22.16	22.21	22.08	2.0	23.0	
256QAM	8	0	21.21	21.15	21.05	21.30	21.32	20.94	3.0	22.0	
	8	4	21.18	21.20	21.10	21.26	21.30	20.94	3.0	22.0	
	8	7	21.21	21.24	21.17	21.31	21.30	20.95	3.0	22.0	
	15	0	21.06	21.12	21.01	21.24	21.28	20.97	3.0	22.0	
	1	0	19.58	19.28	19.33	19.27	19.35	19.09	5.0	20.0	
	1	8	19.35	19.19	19.16	19.16	19.29	18.99	5.0	20.0	
256QAM	1	14	19.46	19.33	19.29	19.43	19.33	19.03	5.0	20.0	
	8	0	19.23	19.15	19.26	19.12	19.34	19.02	5.0	20.0	
	8	4	19.16	19.14	19.17	19.14	19.33	18.95	5.0	20.0	
	8	7	19.18	19.08	19.16	19.12	19.25	19.00	5.0	20.0	
	15	0	19.15	19.08	19.06	19.07	19.31	18.99	5.0	20.0	

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)						MPR	Tune-up Limit
				26697	26783	26790	26797	26865	27033		
				814.70 MHz	823.3 MHz	824.00 MHz	824.7 MHz	831.50 MHz	848.30 MHz		
1.4 MHz	QPSK	1	0	24.30	24.04	24.11	24.15	24.52	24.17	0.0	25.0
		1	3	24.15	23.91	23.94	23.96	24.58	23.98	0.0	25.0
		1	5	24.31	24.02	23.14	24.11	24.51	24.17	0.0	25.0
		3	0	24.33	24.10	24.16	24.11	24.54	24.25	0.0	25.0
		3	1	24.30	24.03	24.08	24.09	24.55	24.20	0.0	25.0
		3	3	24.30	24.03	24.06	24.08	24.47	24.06	0.0	25.0
		6	0	23.33	23.06	23.11	23.06	23.50	23.17	1.0	24.0
	16QAM	1	0	23.36	23.18	23.07	23.15	23.58	23.52	1.0	24.0
		1	3	23.56	23.16	23.05	23.07	23.56	23.56	1.0	24.0
		1	5	23.42	23.11	23.00	23.02	23.62	23.57	1.0	24.0
		3	0	23.48	23.29	23.29	23.27	23.60	23.31	1.0	24.0
		3	1	23.33	23.16	23.20	23.15	23.45	23.39	1.0	24.0
		3	3	23.35	23.22	23.01	23.18	23.54	23.32	1.0	24.0
		6	0	22.46	22.14	22.17	22.15	22.66	22.17	2.0	23.0
	64QAM	1	0	22.15	21.95	22.53	22.46	22.51	22.12	2.0	23.0
		1	3	22.10	22.00	22.46	22.50	22.55	22.27	2.0	23.0
		1	5	22.11	22.43	22.14	22.32	22.45	22.19	2.0	23.0
		3	0	22.24	22.03	22.13	22.21	22.48	21.96	2.0	23.0
		3	1	22.25	22.00	21.97	22.36	22.44	21.94	2.0	23.0
		3	3	22.21	22.18	22.33	22.30	22.37	21.89	2.0	23.0
		6	0	21.29	20.99	21.06	21.21	21.39	21.01	3.0	22.0
	256QAM	1	0	19.15	18.92	18.98	19.25	19.45	18.96	5.0	20.0
		1	3	19.05	18.94	19.38	19.41	19.56	19.12	5.0	20.0
		1	5	19.13	18.82	18.96	19.35	19.39	18.91	5.0	20.0
		3	0	19.05	19.07	19.15	19.26	19.34	19.09	5.0	20.0
		3	1	18.99	19.00	19.04	19.11	19.25	19.04	5.0	20.0
		3	3	19.00	18.97	18.99	19.10	19.20	18.98	5.0	20.0
		6	0	19.11	19.07	18.98	19.23	19.34	18.91	5.0	20.0



**NR Band n5**

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					166800	167300	167800		
					834.00 MHz	836.50 MHz	839.00 MHz		
20 MHz	DFT-s-OFDM	π/2 BPSK	1	1	23.50	23.57	23.47	0.0	25.0
			1	53	23.54	23.54	23.32	0.0	25.0
			1	104	23.24	23.21	23.07	0.0	25.0
			50	0	22.59	22.61	22.46	0.5	24.5
			50	28	23.50	23.50	23.35	0.0	25.0
			50	56	22.39	22.37	22.26	0.5	24.5
		100	0	22.53	22.52	22.40	0.5	24.5	
		QPSK	1	1	23.55	23.60	23.56	0.0	25.0
			1	53	23.55	23.52	23.42	0.0	25.0
			1	104	23.31	23.25	23.15	0.0	25.0
			50	0	22.62	22.63	22.52	1.0	24.0
			50	28	23.54	23.51	23.37	0.0	25.0
			50	56	22.40	22.37	22.28	1.0	24.0
		100	0	22.54	22.52	22.41	1.0	24.0	
16QAM	1	1	22.60	22.62	22.70	1.0	24.0		
64QAM	1	1	21.06	21.13	21.06	2.5	22.5		
256QAM	1	1	19.03	18.99	19.01	4.5	20.5		
CP-OFDM	QPSK	1	1	22.08	22.08	22.13	1.5	23.5	
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					166300	167300	168300		
					831.50 MHz	836.50 MHz	841.50 MHz		
15 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.16	24.18	24.04	0.0	25.0
			1	40	24.09	23.94	23.80	0.0	25.0
			1	77	23.97	23.87	23.75	0.0	25.0
			36	0	23.23	23.21	23.03	0.5	24.5
			36	22	24.22	24.08	23.92	0.0	25.0
			36	43	23.11	22.98	22.89	0.5	24.5
		75	0	23.22	23.09	22.93	0.5	24.5	
		QPSK	1	1	24.21	24.22	24.12	0.0	25.0
			1	40	24.13	23.99	23.86	0.0	25.0
			1	77	24.00	23.89	23.81	0.0	25.0
			36	0	23.24	23.22	23.03	1.0	24.0
			36	22	24.20	24.08	23.93	0.0	25.0
			36	43	23.08	22.98	22.89	1.0	24.0
		75	0	23.22	23.11	22.95	1.0	24.0	
16QAM	1	1	23.28	23.38	23.07	1.0	24.0		
64QAM	1	1	21.69	21.66	21.61	2.5	22.5		
256QAM	1	1	19.55	19.71	19.58	4.5	20.5		
CP-OFDM	QPSK	1	1	22.72	22.73	22.59	1.5	23.5	
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					165800	167300	168800		
					829.00 MHz	836.50 MHz	844.00 MHz		
10 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.20	24.14	23.82	0.0	25.0
			1	26	24.30	24.08	23.75	0.0	25.0
			1	50	24.15	23.90	23.71	0.0	25.0
			25	0	23.27	23.15	22.84	0.5	24.5
			25	14	24.25	24.04	23.81	0.0	25.0
			25	27	23.24	23.00	22.78	0.5	24.5
		50	0	23.27	23.07	22.85	0.5	24.5	
		QPSK	1	1	24.25	24.20	23.91	0.0	25.0
			1	26	24.32	24.05	23.96	0.0	25.0
			1	50	24.18	23.93	23.78	0.0	25.0
			25	0	23.27	23.17	22.88	1.0	24.0
			25	14	24.26	24.08	23.84	0.0	25.0
			25	27	23.24	23.01	22.81	1.0	24.0
		50	0	23.27	23.10	22.86	1.0	24.0	
16QAM	1	1	23.32	23.36	22.84	1.0	24.0		
64QAM	1	1	21.80	21.83	21.35	2.5	22.5		
256QAM	1	1	19.72	19.67	19.36	4.5	20.5		
CP-OFDM	QPSK	1	1	22.76	22.72	22.42	1.5	23.5	

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit	
					165300	167300	169300			
					826.50 MHz	836.50 MHz	846.50 MHz			
5 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	24.04	23.86	23.82	0.0	25.0	
			1	13	23.91	23.74	23.75	0.0	25.0	
			1	23	23.94	23.80	23.03	0.0	25.0	
			12	0	23.05	22.90	23.92	0.5	24.5	
			12	7	24.03	23.85	22.89	0.0	25.0	
			12	13	23.00	22.83	24.03	0.5	24.5	
		25	0	23.04	22.88	22.88	0.5	24.5		
		1	1	24.12	23.91	23.91	0.0	25.0		
		1	13	23.98	23.77	23.77	0.0	25.0		
		1	23	24.01	23.83	23.83	0.0	25.0		
		12	0	23.10	22.91	23.02	1.0	24.0		
		12	7	24.04	23.86	23.08	0.0	25.0		
		12	13	23.02	22.86	23.10	1.0	24.0		
		25	0	23.08	22.88	23.36	1.0	24.0		
		16QAM	1	1	23.08	22.92	22.32	1.0	24.0	
		64QAM	1	1	21.66	21.44	20.32	2.5	22.5	
		256QAM	1	1	19.62	19.37	18.99	4.5	20.5	
		CP-OFDM	QPSK	1	1	22.60	22.37	21.78	1.5	23.5

## 8.2. PEAK TO AVERAGE RATIO

### Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to either CMW500 Test Set or E7515B 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

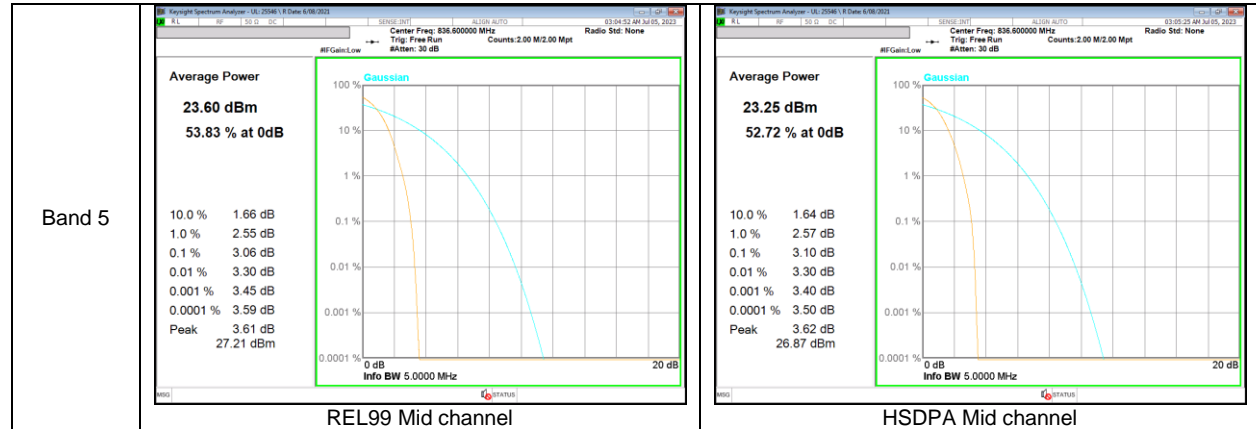
5G NR: All Waveforms (CP-OFDM vs DFT-s\_OFDM) and modulations ( $\pi/2$  BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

### RESULTS

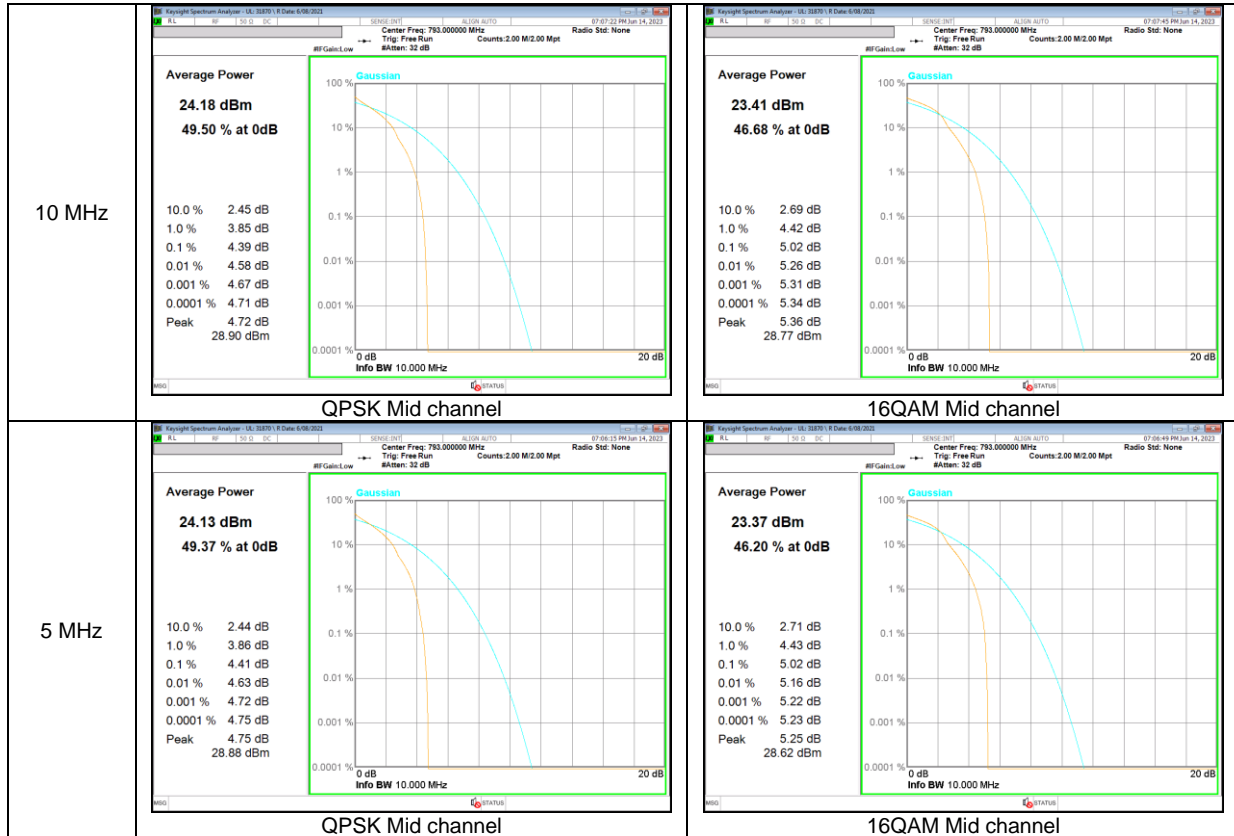
See the following pages.

### 8.2.1. CONDUCTED PEAK TO AVERAGE RESULT

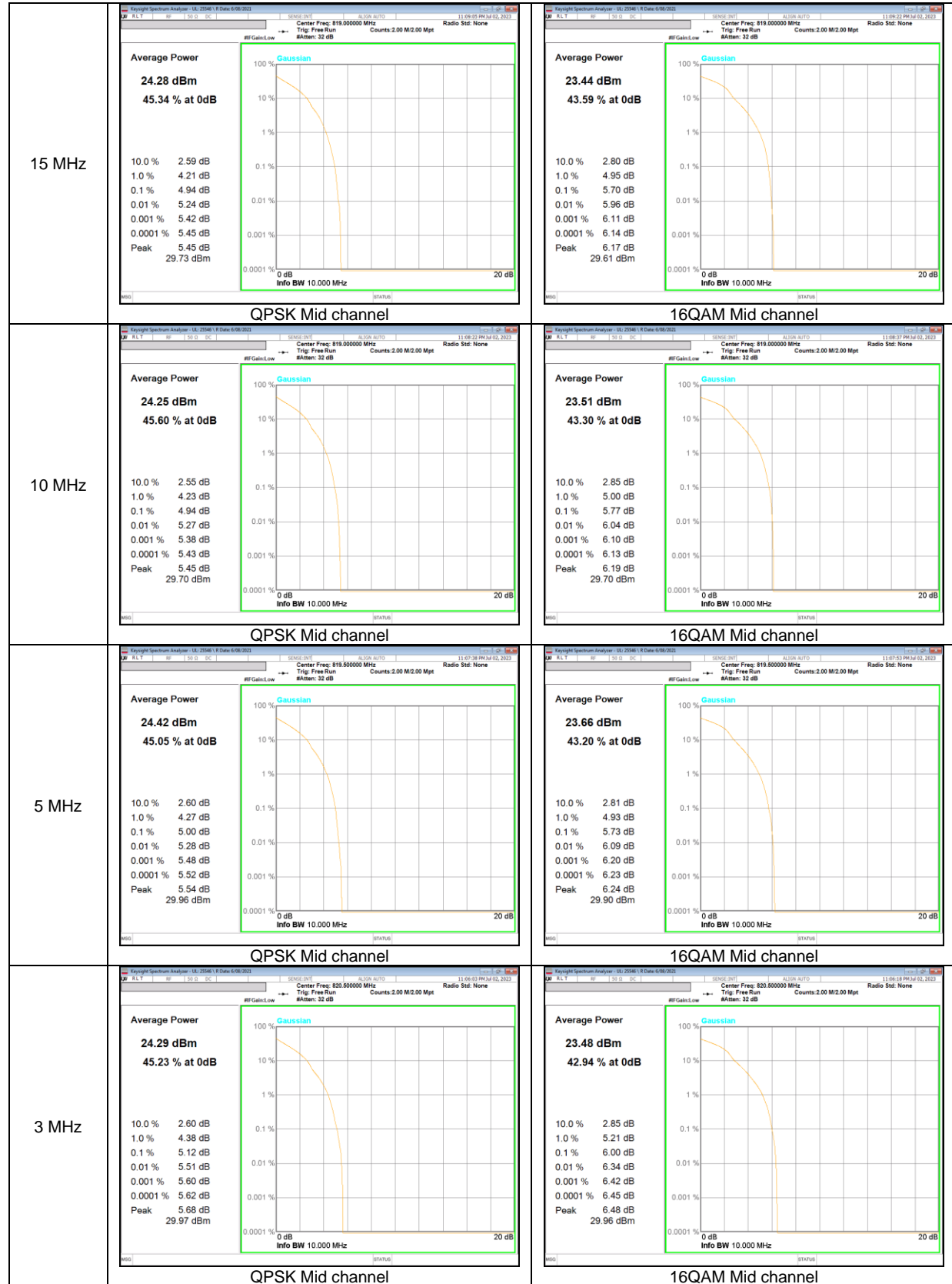
#### WCDMA

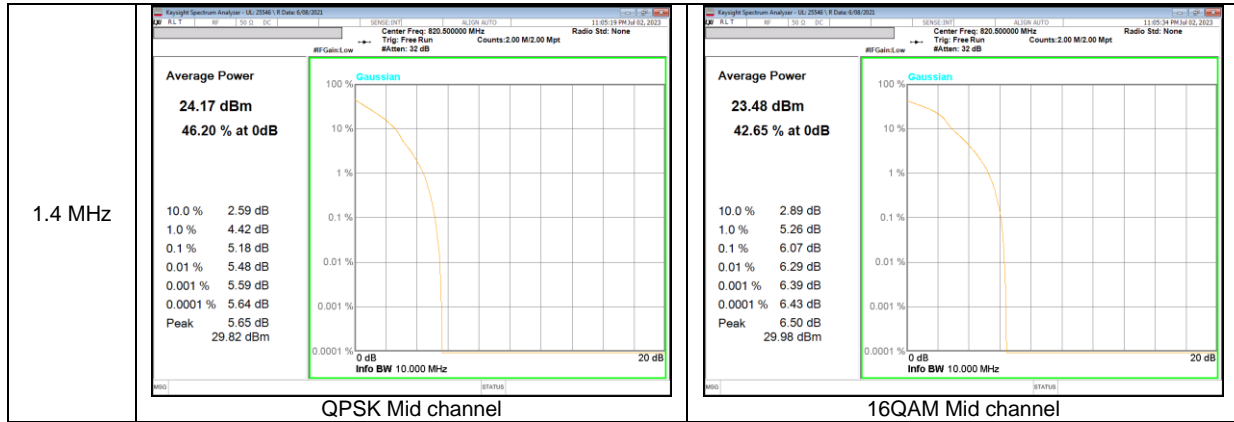


**LTE Band 14**



**LTE Band 26 (Part 90)**

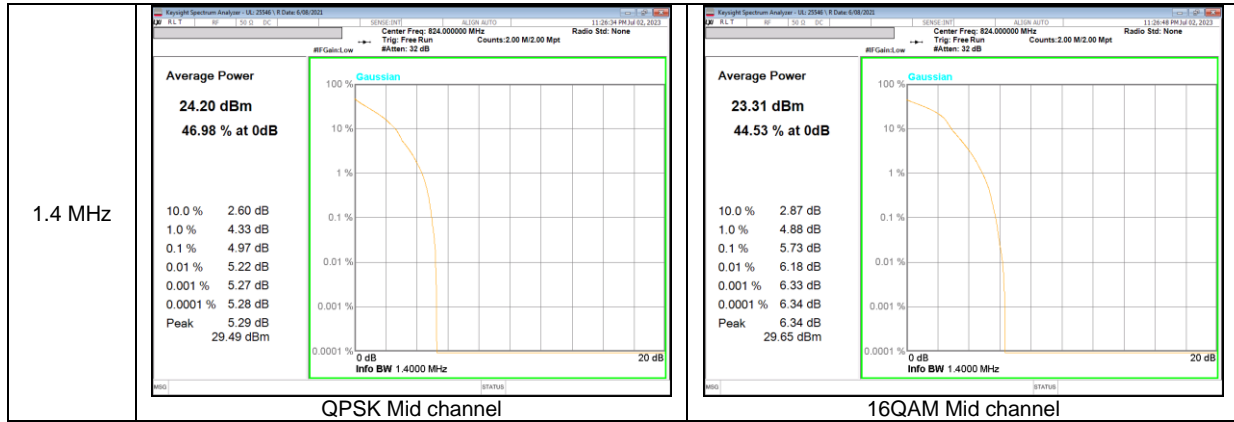




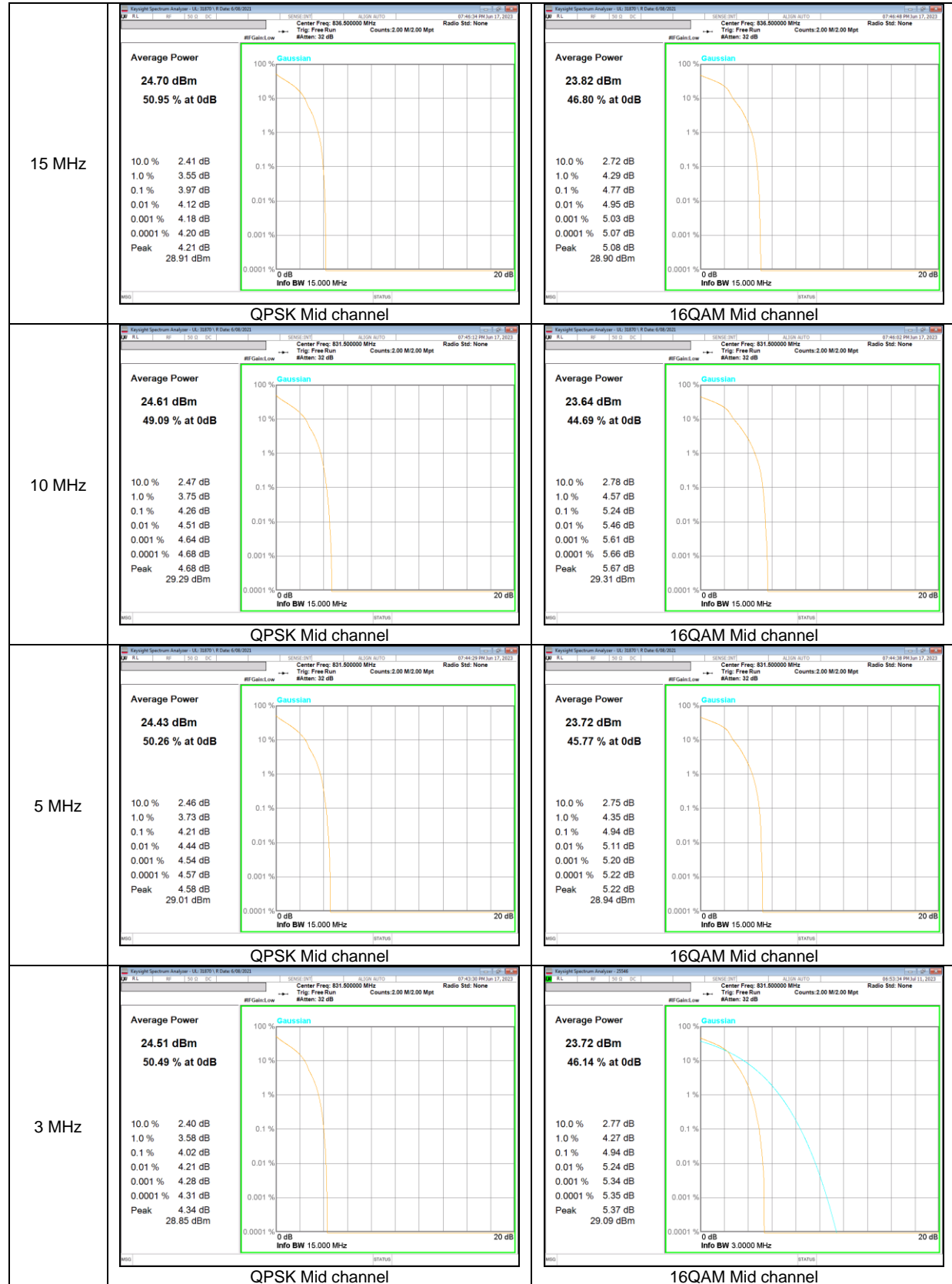
**LTE Band 26 (Straddle)**

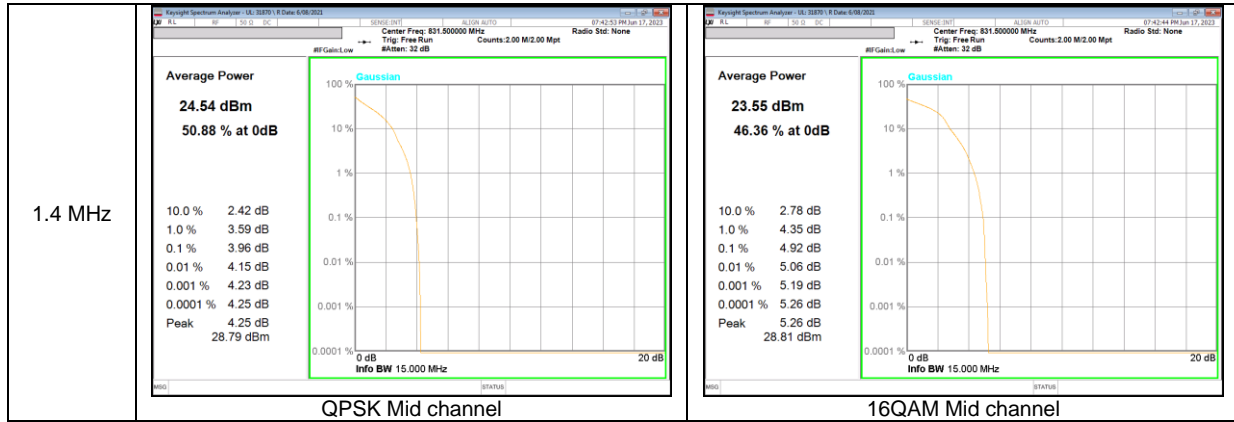




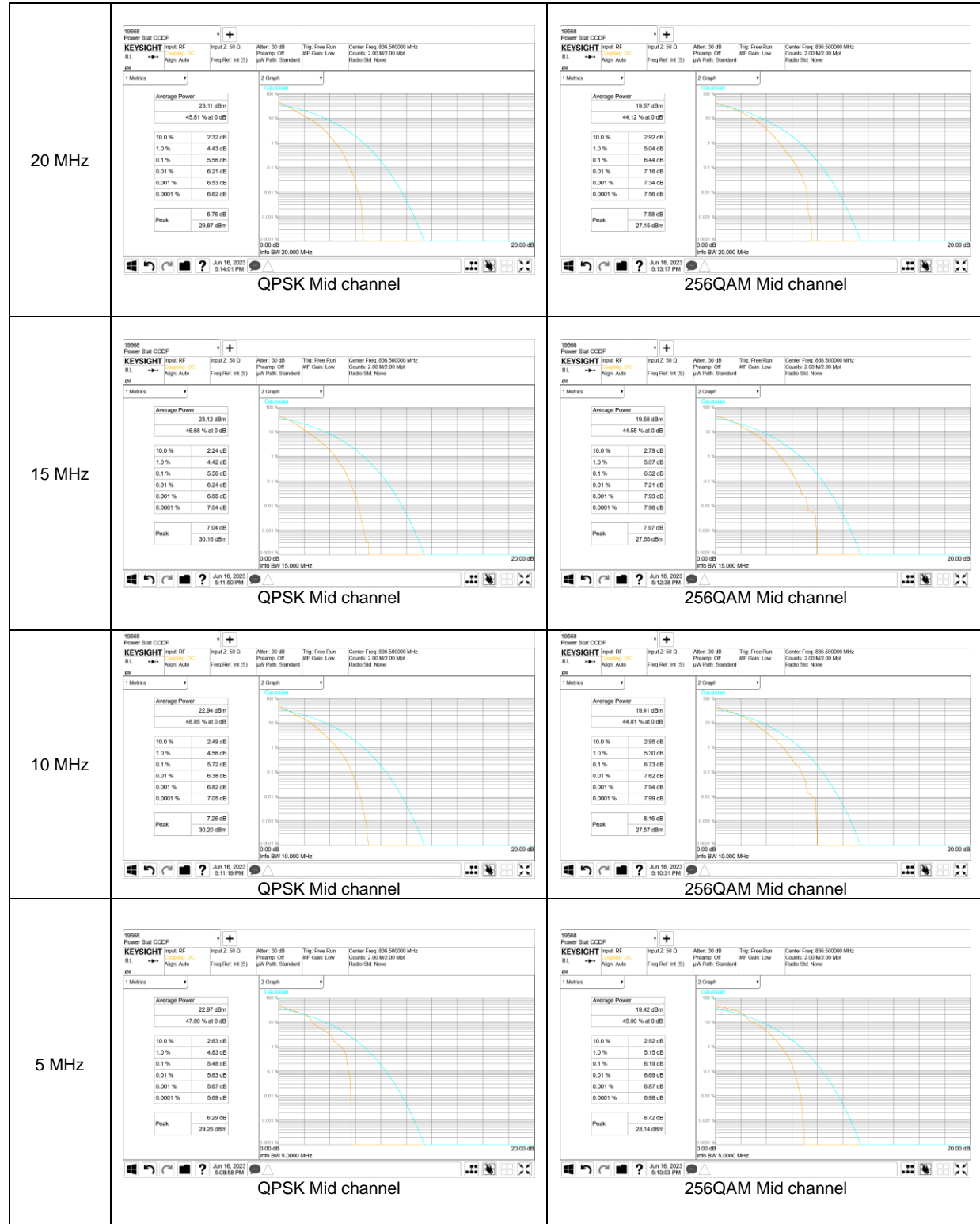


**LTE Band 26 (Part 22)**





**NR Band n5 CP-OFDM**



### **8.3. OCCUPIED BANDWIDTH**

#### **RULE PART(S)**

FCC: §2.1049

#### **LIMITS**

For reporting purposes only

#### **TEST PROCEDURE**

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at middle channel in each band. The -26dB bandwidth was also measured and recorded.

(KDB 971168 D01 Power Meas License Digital Systems v03r01)

#### **RESULTS**

See the following pages.

**- WCDMA**

Band	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
B5	Rel.99	836.6	4.149	4.699
	HSDPA		4.147	4.685

**- LTE Band 5B (UL CA)**

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
5B	20M	QPSK	836.5	18.744	20.160
		16QAM		18.664	20.110
	15M	QPSK		13.840	15.130
		16QAM		13.883	15.110
	8M	QPSK		7.462	8.080
		16QAM		7.484	8.096

**- LTE Band 14**

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B14	10M	QPSK	793.0	8.962	10.130
		16QAM		8.956	10.110
	5M	QPSK		4.503	5.386
		16QAM		4.492	5.230

**- LTE Band 26 (Part 90)**

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	819.0	13.424	14.990
		16QAM		13.443	15.020
	10M	QPSK	819.0	8.978	10.310
		16QAM		8.986	10.320
	5M	QPSK	819.5	4.502	5.226
		16QAM		4.504	5.322
	3M	QPSK	820.5	2.705	3.079
		16QAM		2.694	3.045
	1.4M	QPSK	820.5	1.084	1.300
		16QAM		1.084	1.278

**- LTE Band 26 (Straddle)**

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	824.0	13.402	14.820
		16QAM		13.410	14.820
	10M	QPSK		8.952	10.030
		16QAM		8.986	10.110
	5M	QPSK		4.485	5.186
		16QAM		4.500	5.174
	3M	QPSK		2.692	3.055
		16QAM		2.699	3.068
	1.4M	QPSK		1.084	1.306
		16QAM		1.083	1.285

**- LTE Band 26 (Part 22)**

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	836.5	13.438	14.950
		16QAM		13.425	15.160
	10M	QPSK	831.5	8.969	10.320
		16QAM		8.973	10.330
	5M	QPSK	831.5	4.493	5.243
		16QAM		4.493	5.360
	3M	QPSK	831.5	2.700	3.070
		16QAM		2.703	3.085
	1.4M	QPSK	831.5	1.084	1.288
		16QAM		1.087	1.302

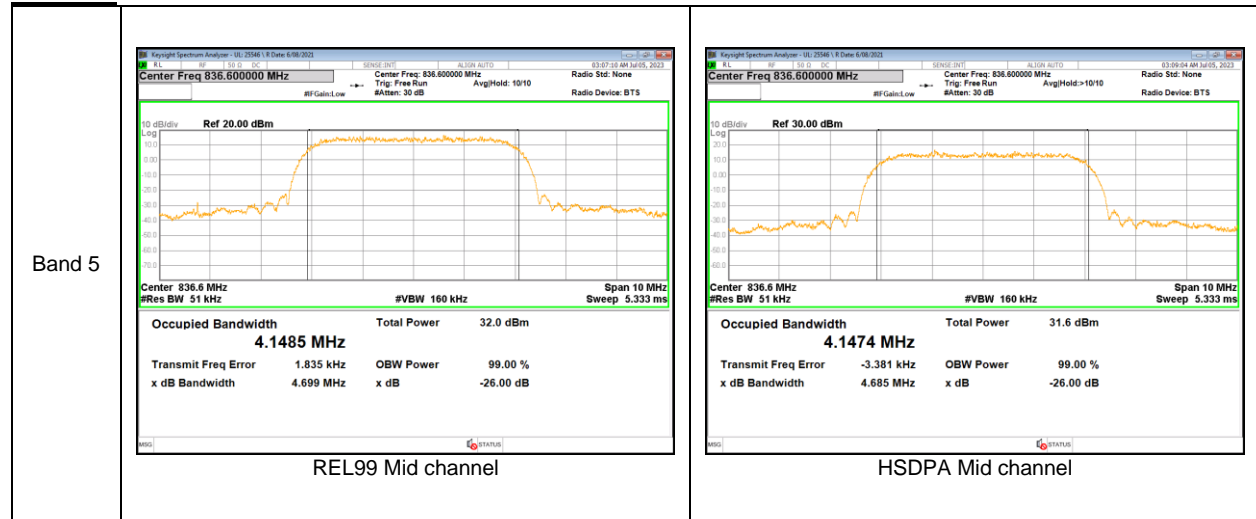
**- NR Band n5**

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n5	20M	QPSK	836.5	18.900	20.530
		16QAM		18.885	20.500
	15M	QPSK		14.117	15.020
		16QAM		14.085	14.880
	10M	QPSK		9.291	10.210
		16QAM		9.282	10.010
	5M	QPSK		4.472	5.160
		16QAM		4.478	5.210

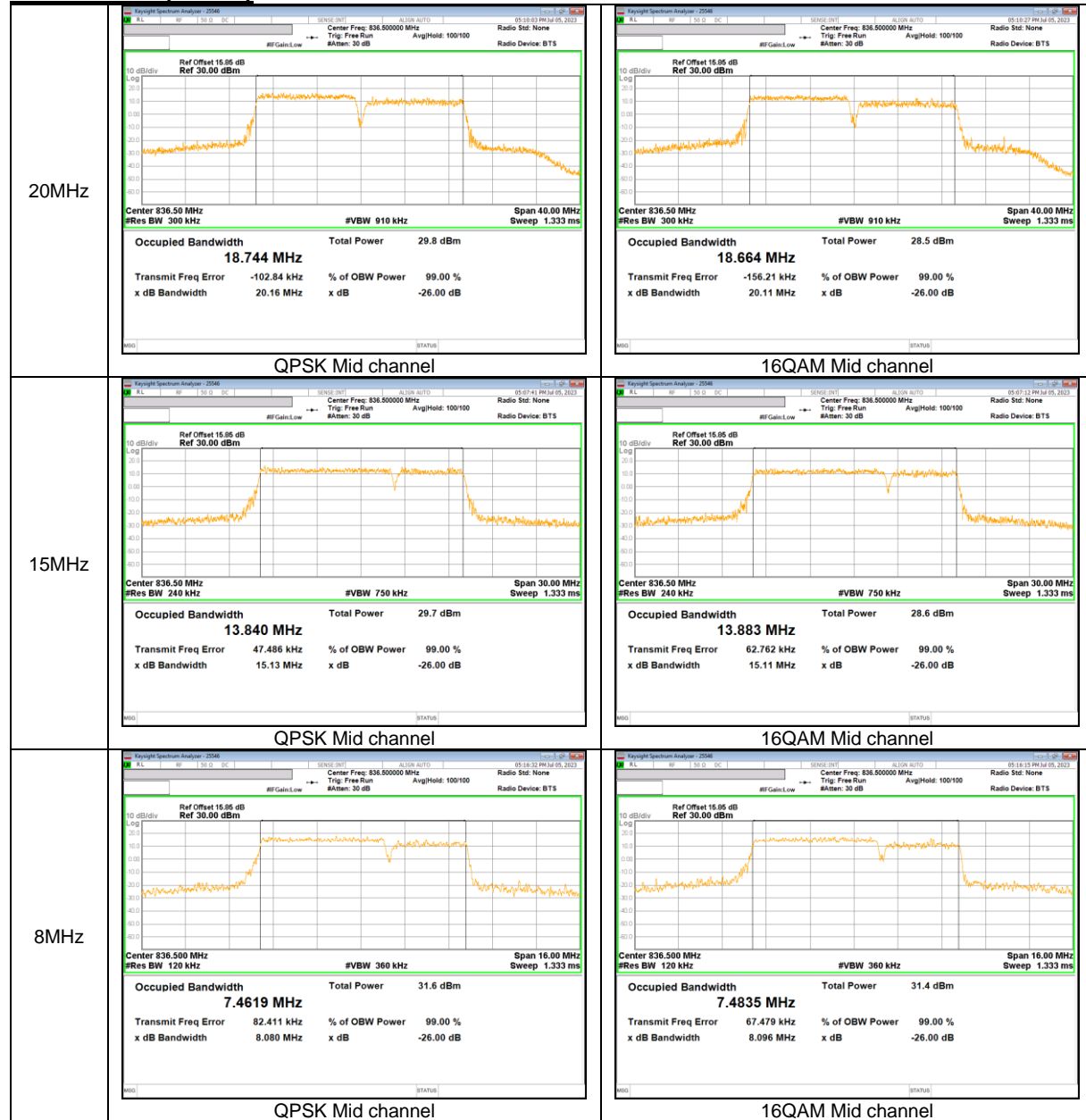


### 8.3.1. OCCUPIED BANDWIDTH RESULTS

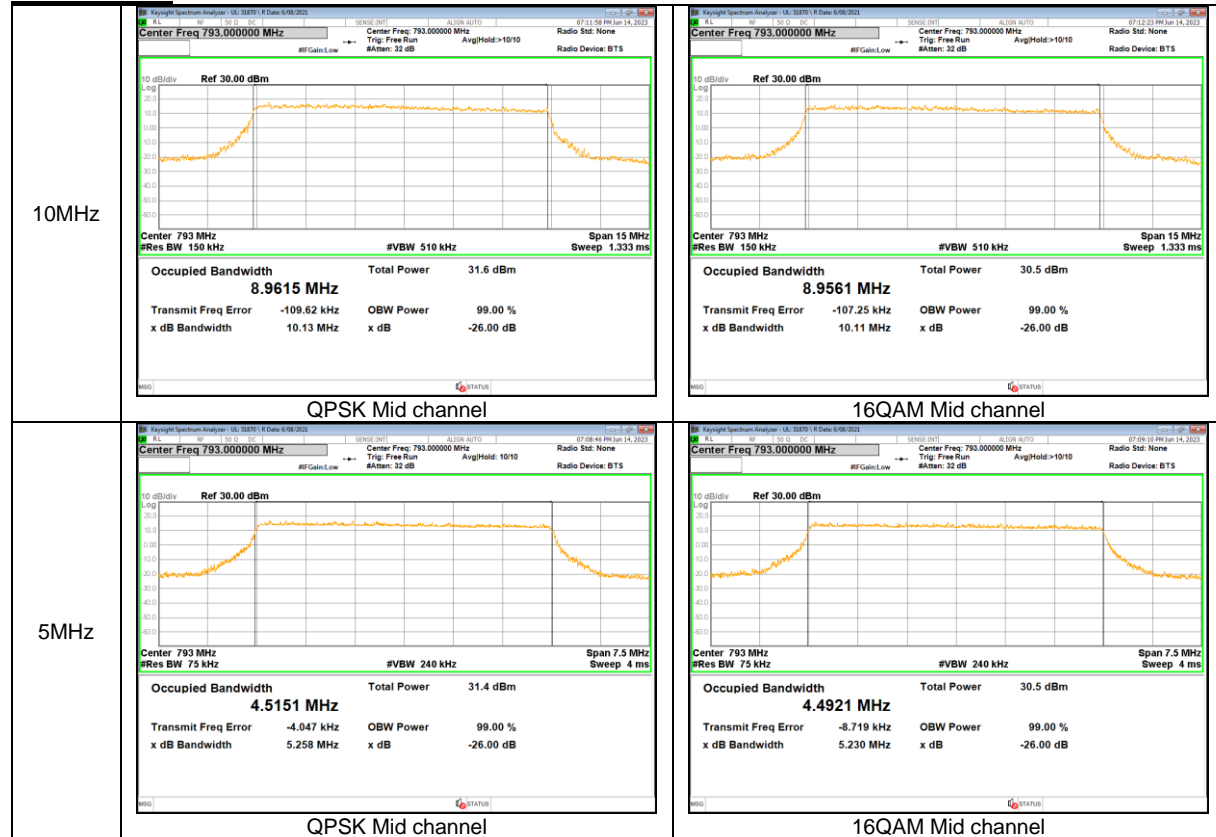
#### WCDMA



**LTE Band 5B (UL CA)**

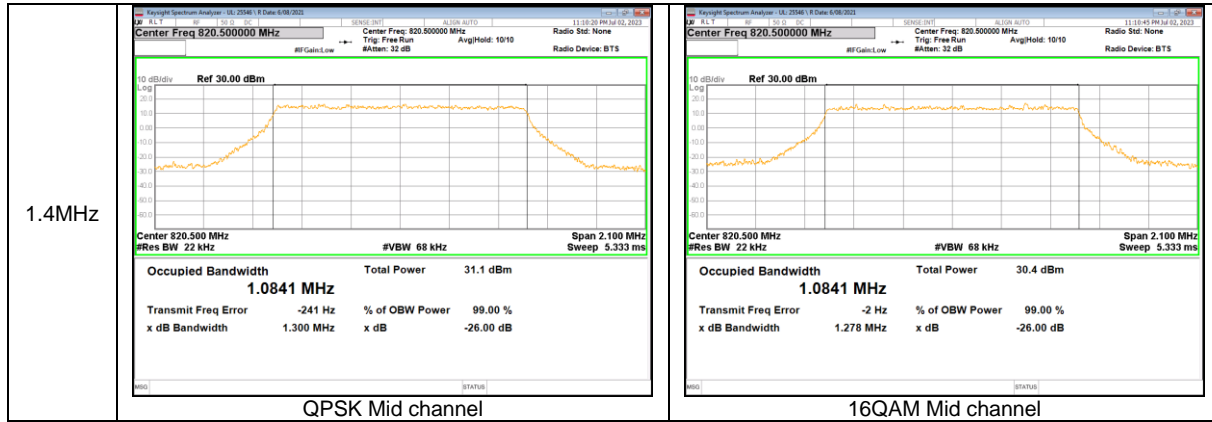


**LTE Band 14**



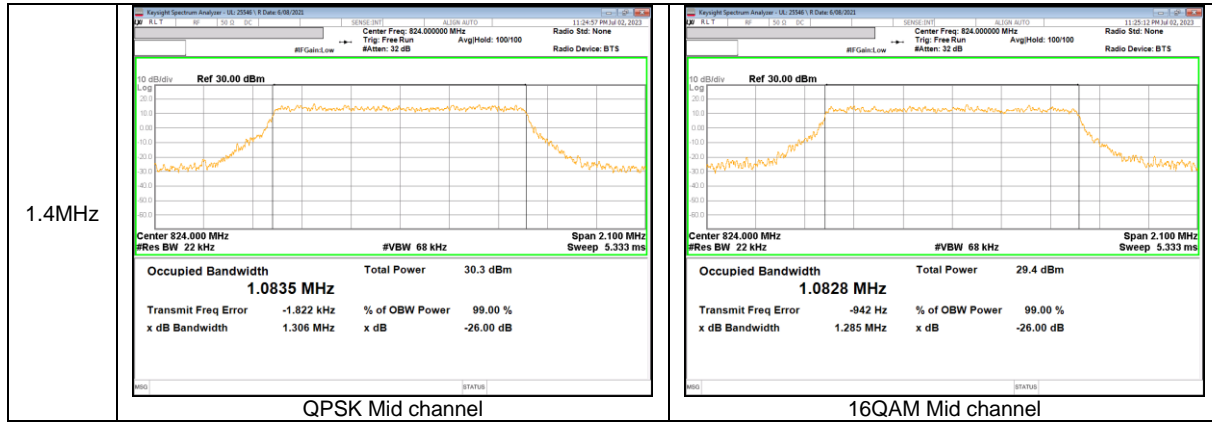
**LTE Band 26 (Part 90)**





**LTE Band 26 (Straddle)**

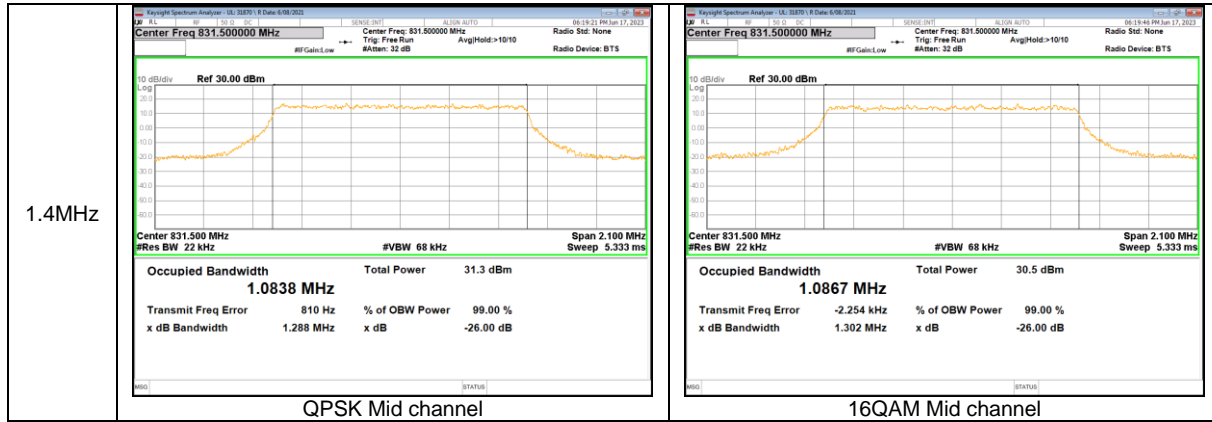




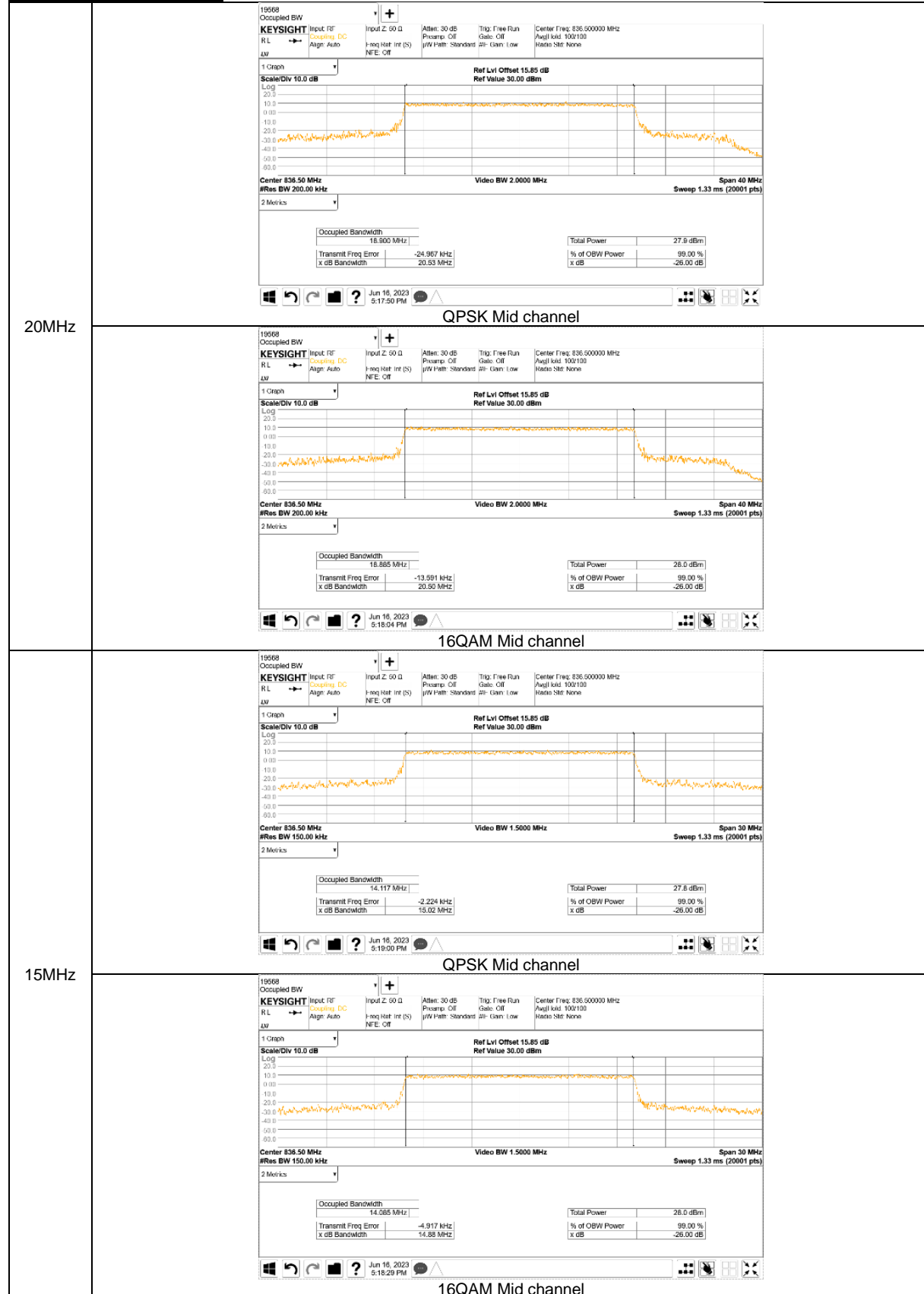
**LTE Band 26 (Part 22)**

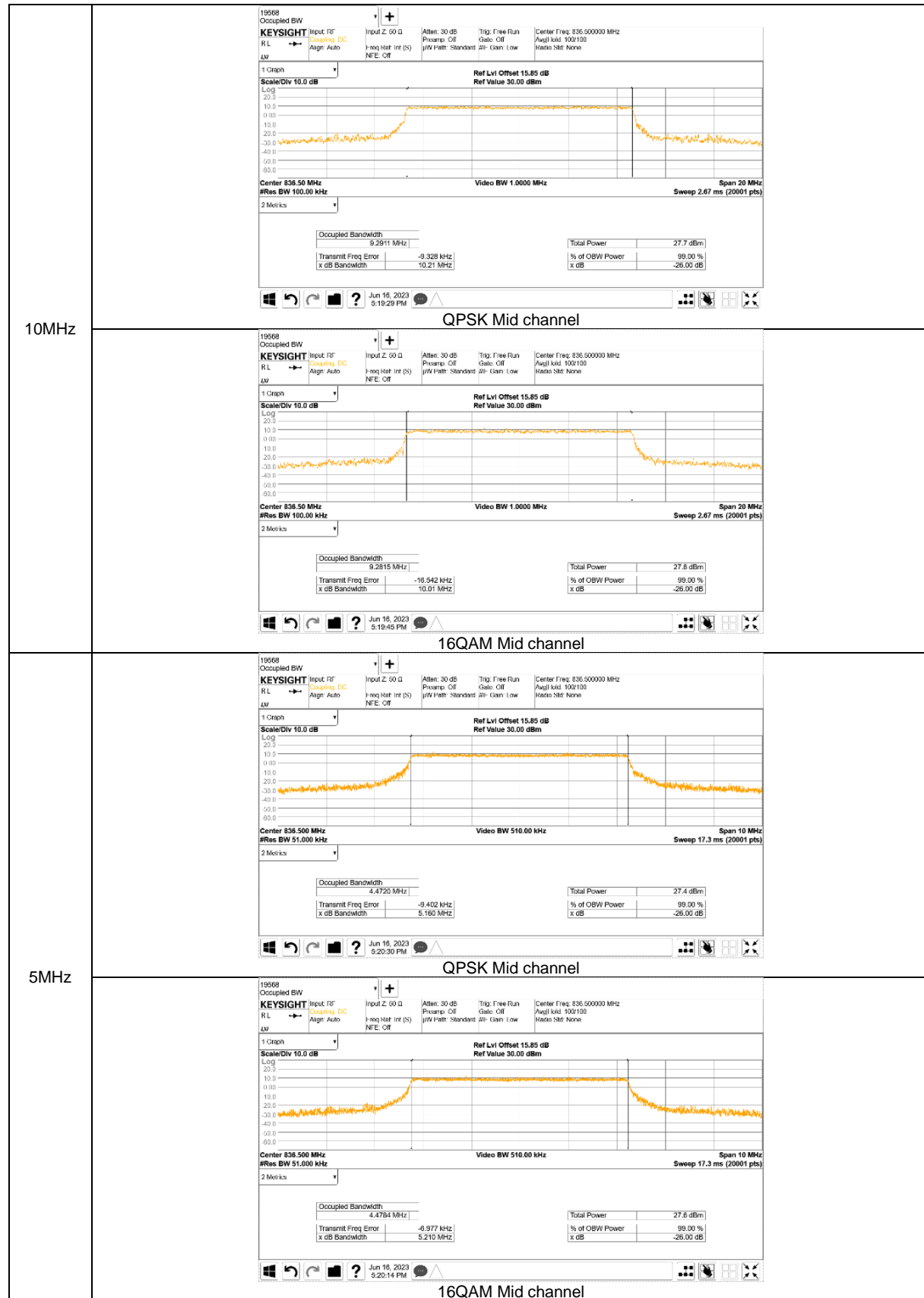






NR Band n5 CP-OFDM





## 8.4. BAND EDGE EMISSIONS

### RULE PART(S)

FCC: §22.359, §22.917, §90.543 and 90.691

### LIMITS

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

Part 90.543:

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $76 + 10 \log (P)$  dB in a 6.25 kHz band segment, for base and fixed stations.
- (2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations.
- (3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10 \log (P)$  dB.
- (4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

Part 90.691:

(a) Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

- (1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least  $116 \text{Log}_{10}(f/6.1)$  decibels or  $50 + 10 \text{Log}_{10}(P)$  decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.
- (2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \text{Log}_{10}(P)$  decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

**TEST PROCEDURE**

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

The transmitter output was connected to either CMW500 Test Set or E7515B Test set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

**WCDMA/LTE/5G NR**

- a) Set the RBW = 1 - 1.5 % of OBW(Typically limited to a minimum RBW of 1% of the OBW)
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 1.5$  times the OBW;
- d) Sweep time = Auto;
- e) Detector = RMS;
- f) Ensure that the number of measurement points  $\geq 2 \times$  Span/RBW;
- g) Trace mode = Average (100);

**NOTE1**

Note that the spurious emissions outside of the channel include narrowband signals. These signals are all below the -13dBm / -25dBm limits. Although the measurement bandwidth is less than the reference bandwidth of 1MHz no addtional correction is applied as ANSI C63.26 section 4.2.3 only requires the correction to be applied when the OBW of the emission being measured is wider than the measurement bandwidth (Where the OBW of the signal under measurement is less than the RBW of the measuring instrument, no bandwidth correction or integration will be required.) Plots for low and high channels show the level of the emission measured with the reduced bandwidth and the level of the same emission measured using the integration method over the 1MHz reference bandwidth are very close, indicating the emissions are narrowband.

**NOTE2**

For Band-Edge extended:

CH BW (MHz)	RB Used (kHz)	CF for emissions more than 100kHz
1.4	15	+8.2 dB
3	30	+5.2 dB
5	51	+2.9 dB
10	100	N/A
15	150	N/A
20	200	N/A

For the band edge value measured in [RB Used], even if [CF for emissions reference bandwidth 100kHz] is applied, it is below -13dBm.

**NOTE3**

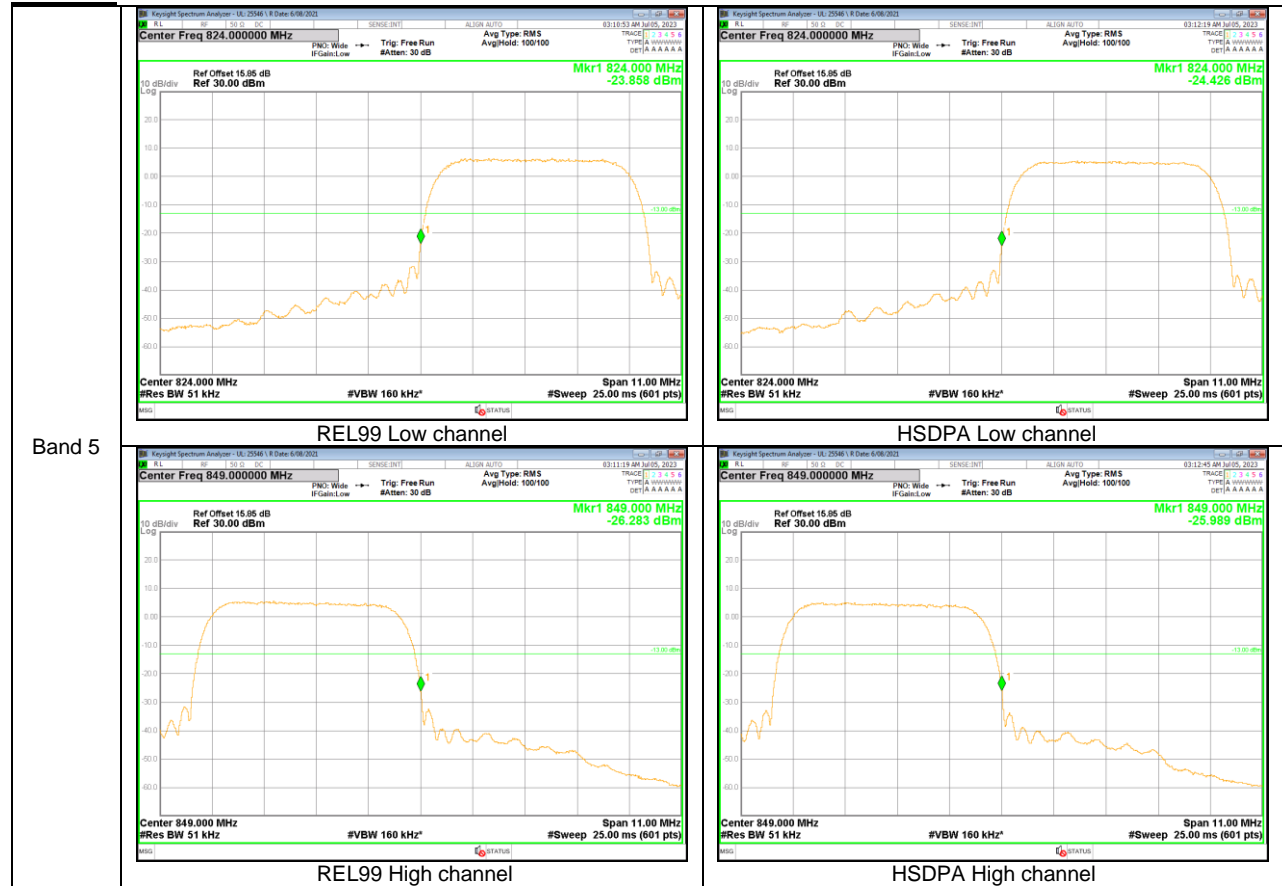
5G NR: All Waveforms (CP-OFDM vs DFT-s\_OFDM) and modulations ( $\pi/2$  BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

**RESULTS**

See the following pages.

### 8.4.1. BAND EDGE RESULT

WCDMA



**LTE Band 5B (UL CA)**

