



CERTIFICATION TEST REPORT

Report Number. : 4790089631-E2V2

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

Model : SM-S908B/DS

FCC ID : A3LSMS908B

EUT Description : GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax,
NFC, WPT and UWB

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

Date Of Issue:

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TL-637

Revision History

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V1	2021-10-29	Initial issue	Yeonhee Lim
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC, WPT and UWB
MODEL NUMBER: SM-S908B/DS
SERIAL NUMBER: R3CR80AB3FD (CONDUCTED)
R3CR80AB39Y, R3CR06LSLL (RADIATED);
DATE TESTED: 2021-09-13 ~ 2021-10-28;

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22H, 24E, 27H, 27L, 27F, 27M and 90S	Pass

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:



Yeonhee Lim
Suwon Lab Technician
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

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	3.02 dB
Radiated Disturbance, 30 MHz to 1 GHz	4.05 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.78 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.58 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 GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC, WPT and UWB. This test report addresses the WWAN operational mode.

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.
 (4790089631-S1 FCC Report SAR)

GSM

FCC Part 22/24						
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
GSM850	824~849	GPRS	34.05	2540.50	30.08	1018.59
		EGPRS	27.19	523.16	23.73	236.05
GSM1900	1850~1910	GPRS	31.36	1366.64	30.57	1140.25
		EGPRS	26.95	495.93	26.40	436.52

WCDMA

FCC Part 22/24						
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	824~849	Rel. 99	24.27	267.39	19.98	99.54
		HSDPA	24.31	269.92	19.61	91.41
Band 4	1710~1755	Rel. 99	23.66	232.26	21.43	139.00
		HSDPA	23.58	227.89	21.21	132.13
Band 2	1850~1910	Rel. 99	23.27	212.29	23.30	213.80
		HSDPA	23.27	212.16	23.18	207.97

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	699 ~ 716	10	QPSK	23.94	247.52	17.72	59.16
			16QAM	22.10	162.19	15.67	36.90
			64QAM	20.78	119.63		
			256QAM	19.93	98.43		
		5	QPSK	23.77	238.29	17.76	59.70
			16QAM	22.16	164.35	15.68	36.98
			64QAM	21.06	127.52		
			256QAM	20.07	101.72		
		3	QPSK	23.93	247.03	17.64	58.08
			16QAM	22.19	165.60	15.82	38.19
			64QAM	20.87	122.04		
			256QAM	19.97	99.42		
		1.4	QPSK	23.83	241.78	17.76	59.70
			16QAM	22.13	163.33	15.80	38.02
			64QAM	21.00	125.88		
			256QAM	19.94	98.56		

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	777 ~ 787	10	QPSK	23.12	205.25	18.78	75.51
			16QAM	21.12	129.28	16.23	41.98
			64QAM	19.67	92.69		
			256QAM	18.88	77.25		
		5	QPSK	23.16	206.81	18.91	77.80
			16QAM	21.00	125.84	16.51	44.77
			64QAM	19.98	99.64		
			256QAM	18.89	77.50		

LTE Band 25

FCC Part 24							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 25	1850 ~ 1915	20	QPSK	23.22	209.66	23.04	201.37
			16QAM	21.53	142.30	20.78	119.67
			64QAM	20.47	111.36		
			256QAM	19.42	87.42		
		15	QPSK	22.85	192.85	23.10	204.17
			16QAM	21.45	139.67	21.27	133.97
			64QAM	20.20	104.79		
			256QAM	19.06	80.52		
		10	QPSK	22.90	194.85	23.49	223.36
			16QAM	21.15	130.40	21.03	126.77
			64QAM	20.04	100.94		
			256QAM	18.87	77.13		
		5	QPSK	22.85	192.62	23.65	231.74
			16QAM	21.18	131.16	21.87	153.82
			64QAM	20.34	108.08		
			256QAM	18.84	76.64		
		3	QPSK	22.83	191.70	23.47	222.33
			16QAM	21.22	132.46	21.59	144.21
			64QAM	20.08	101.90		
			256QAM	18.94	78.36		
		1.4	QPSK	22.89	194.58	23.79	239.33
			16QAM	20.97	125.00	21.92	155.60
			64QAM	20.06	101.41		
			256QAM	18.80	75.87		

LTE Band 26 (Part 90)

FCC Part 90							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	814 ~ 824	15	QPSK	23.67	233.06	18.33	68.08
			16QAM	22.09	161.65	16.49	44.57
			64QAM	20.69	117.27		
			256QAM	19.76	94.60		
		10	QPSK	23.08	203.41	18.49	70.63
			16QAM	21.25	133.50	16.26	42.27
			64QAM	20.21	105.04		
			256QAM	19.29	84.99		
		5	QPSK	23.08	203.01	18.49	70.63
			16QAM	21.43	139.13	16.48	44.46
			64QAM	20.24	105.67		
			256QAM	19.18	82.73		
		3	QPSK	23.18	208.03	18.46	70.15
			16QAM	21.15	130.32	16.67	46.45
			64QAM	20.07	101.67		
			256QAM	18.97	78.84		
		1.4	QPSK	23.10	204.11	18.47	70.31
			16QAM	21.23	132.76	16.45	44.16
			64QAM	20.17	103.93		
			256QAM	19.19	83.06		

LTE Band 26 (Part 22)

FCC Part 22							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	824 ~ 849	15	QPSK	23.67	233.06	19.57	90.57
			16QAM	22.09	161.65	17.59	57.41
			64QAM	20.69	117.27		
			256QAM	19.76	94.60		
		10	QPSK	23.19	208.35	19.54	89.95
			16QAM	21.38	137.36	17.53	56.62
			64QAM	20.10	102.24		
			256QAM	19.37	86.53		
		5	QPSK	23.19	208.50	19.35	86.10
			16QAM	21.37	137.12	17.87	61.24
			64QAM	20.06	101.46		
			256QAM	19.22	83.47		
		3	QPSK	23.08	203.21	19.40	87.10
			16QAM	21.38	137.51	17.42	55.21
			64QAM	20.08	101.78		
			256QAM	19.05	80.42		
		1.4	QPSK	23.18	208.15	19.54	89.95
			16QAM	21.27	134.04	17.58	57.28
			64QAM	20.31	107.29		
			256QAM	19.13	81.89		

LTE Band 26 (Straddle)

Straddle							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	824	15	QPSK	23.33	215.28	18.43	69.66
			16QAM	21.66	146.55	16.76	47.42
			64QAM				
			256QAM				
		10	QPSK	23.66	232.27	18.36	68.55
			16QAM	21.61	144.88	16.61	45.81
			64QAM				
			256QAM				
		5	QPSK	23.60	229.09	18.62	72.78
			16QAM	21.60	144.54	16.63	46.03
			64QAM				
			256QAM				
		3	QPSK	23.46	221.82	18.36	68.55
			16QAM	21.83	152.41	16.28	42.46
			64QAM				
			256QAM				
		1.4	QPSK	23.53	225.42	18.66	73.45
			16QAM	21.62	145.21	16.54	45.08
			64QAM				
			256QAM				

LTE Band 41 (PC2)

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 41	2496 ~ 2690	20	QPSK	25.83	383.10	23.11	204.64
			16QAM	24.95	312.63	22.45	175.79
			64QAM	23.70	234.48		
			256QAM	20.90	123.16		
		15	QPSK	25.38	344.96	23.92	246.60
			16QAM	24.60	288.18	23.35	216.27
			64QAM	23.43	220.31		
			256QAM	20.62	115.45		
		10	QPSK	25.55	358.59	23.64	231.21
			16QAM	24.95	312.60	23.02	200.45
			64QAM	23.43	220.31		
			256QAM	20.60	114.90		
		5	QPSK	25.42	348.13	23.71	234.96
			16QAM	24.36	272.75	22.93	196.34
			64QAM	23.34	216.01		
			256QAM	21.01	126.07		

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	1710 ~ 1780	20	QPSK	23.31	214.09	21.09	128.53
			16QAM	21.60	144.61	19.08	80.91
			64QAM	20.32	107.77		
			256QAM	19.15	82.19		
		15	QPSK	22.63	183.23	21.35	136.46
			16QAM	20.89	122.76	19.14	82.04
			64QAM	19.63	91.86		
			256QAM	18.74	74.81		
		10	QPSK	22.42	174.76	21.31	135.21
			16QAM	20.84	121.36	19.46	88.31
			64QAM	19.88	97.18		
			256QAM	18.51	71.04		
		5	QPSK	22.50	177.99	21.58	143.88
			16QAM	20.82	120.89	19.65	92.26
			64QAM	19.71	93.65		
			256QAM	18.71	74.33		
		3	QPSK	22.60	181.88	21.47	140.28
			16QAM	21.00	125.78	19.47	88.51
			64QAM	19.85	96.54		
			256QAM	18.77	75.37		
		1.4	QPSK	22.72	187.03	21.14	130.02
			16QAM	20.96	124.68	19.14	82.04
			64QAM	20.11	102.51		
			256QAM	18.73	74.60		

NR Band 5

FCC Part 22								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n5	834.0~839.0	20	DFT-s OFDM	$\pi/2$ BPSK	24.24	265.46		
				QPSK	24.36	272.90	16.10	40.74
				16QAM	23.21	209.41	14.85	30.55
				64QAM	21.64	145.88		
				256QAM	19.84	96.38		
	CP-OFDM	QPSK	22.80	190.55				
	831.5~841.5	15	DFT-s OFDM	$\pi/2$ BPSK	24.36	272.90		
				QPSK	24.35	272.27	17.16	52.00
				16QAM	23.61	229.61	15.75	37.58
				64QAM	22.01	158.85		
				256QAM	20.01	100.23		
	CP-OFDM	QPSK	22.81	190.99				
	829~844	10	DFT-s OFDM	$\pi/2$ BPSK	24.39	274.79		
				QPSK	24.38	274.16	17.31	53.83
				16QAM	23.46	221.82	16.17	41.40
				64QAM	21.91	155.24		
				256QAM	19.87	97.05		
	CP-OFDM	QPSK	22.83	191.87				
	826.5~846.5	5	DFT-s OFDM	$\pi/2$ BPSK	24.53	283.79		
				QPSK	24.43	277.33	17.12	51.52
16QAM				23.63	230.67	16.01	39.90	
64QAM				22.02	159.22			
256QAM				20.01	100.23			
CP-OFDM	QPSK	22.87	193.64					

NR Band 66

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n66	1720.0~1770.0	20	DFT-s OFDM	$\pi/2$ BPSK	23.21	209.41		
				QPSK	23.29	213.42	20.63	115.61
				16QAM	22.23	167.11	19.72	93.76
				64QAM	20.88	122.46		
				256QAM	18.77	75.34		
	CP-OFDM	QPSK	21.86	153.46				
	1717.5~1772.5	15	DFT-s OFDM	$\pi/2$ BPSK	23.22	209.68		
				QPSK	23.26	211.90	19.33	85.70
				16QAM	22.34	171.26	18.24	66.68
				64QAM	20.82	120.68		
				256QAM	18.82	76.17		
	CP-OFDM	QPSK	21.89	154.53				
	1715.0~1775.0	10	DFT-s OFDM	$\pi/2$ BPSK	23.25	211.29		
				QPSK	23.29	213.44	20.43	110.41
				16QAM	22.46	176.11	20.73	118.30
				64QAM	20.87	122.18		
				256QAM	18.80	75.89		
	CP-OFDM	QPSK	22.01	158.85				
	1712.5~1777.5	5	DFT-s OFDM	$\pi/2$ BPSK	23.27	212.49		
				QPSK	23.25	211.12	19.99	99.77
16QAM				22.32	170.67	19.24	83.95	
64QAM				21.01	126.24			
256QAM				18.95	78.52			
CP-OFDM	QPSK	21.89	154.53					

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)
GSM1900 / WCDMA Band 2 / LTE Band 2/ LTE Band 25 1850 ~ 1915 MHz	0.03
WCDMA Band 4 / LTE Band 4 / LTE Band 66 / NR Band 66 1710 ~ 1780 MHz	0.19
GSM850 / WCDMA Band 5 / LTE Band 5 / LTE Band 26 / NR Band 5 814 ~ 849 MHz	-0.52
LTE Band 12 / LTE Band 17 699 ~ 716 MHz	-2.08
LTE Band 13 777 ~ 787 MHz	-2.08
LTE Band 41 2496 ~ 2690 MHz	-1.90

5.4. WORST-CASE ORIENTATION

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

- GSM GPRS/EGPRS
- UMTS REL 99/HSDPA

A-MPR is implemented in this EUT when operating on HPUE per the A-MPR specification in 3GPP TS 36.101 (Table 6.2.4-4a). Conducted output power verification data are shown Appendix A. Also only Emission mask test item were performed A-MPR condition (Especially low channel side)

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, 256QAM modulations. It was found that QPSK and 16QAM results were worst case. 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 power in QPSK.

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 worst case is reported.

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
12	704.0	10	1	0
	707.5		1	25
	711.0		1	0
13	779.5	5	1	24
	782.0		1	12
	784.5		1	12
25	1860.0	20	1	99
	1882.5		1	49
	1905.0		1	0
26 (Part 90)	821.5	15	1	0
26 (Straddle)	824.0	10	1	0
26 (Part 22)	831.5	15	1	37
	841.5		1	37
41 (PC2)	2506.0	20	1	49
	2593.0		1	49
	2680.0		1	0
66	1720.0	20	1	49
	1745.0		1	49
	1770.0		1	49

NR Band	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	826.5	5	1	13
	836.5		1	1
	846.5		1	13
66	1715.0	10	1	1
	1745.0		1	1
	1775.0		1	50

For LTE anchor, the band with highest output power was chosen among the possible combinations with NR Bands.

NR Band	Anchor Band
5	<u>2</u> , 66
66	2, <u>5</u> , 12, 13

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

Band	ERP/EIRP			RSE		
	X	Y	Z	X	Y	Z
GSM850	-	-	O	O	-	-
GSM1900	O	-	-	-	-	O
WCDMA B5	-	-	O	-	-	O
WCDMA B4	-	-	O	O	-	-
WCDMA B2	O	-	-	O	-	-
LTE B12	-	O	-	-	O	-
LTE B13	O	-	-	-	O	-
LTE B25	O	-	-	O	-	-
LTE B26	-	-	O	-	-	O
LTE B41(PC2)	O	-	-	-	-	O
LTE B66	O	-	-	O	-	-
NR n5	-	-	O	-	-	O
NR n66	-	-	O	-	-	O

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.

LTE Band 2

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

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.

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.

LTE Band 17

LTE Band 17 (Frequency range: 704-716 MHz) is covered by LTE Band 12 (Frequency range: 699-716 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 41(PC3)

LTE Band 41(PC3, Frequency range : 2496-2690 MHz) is covered by LTE Band 41(PC2) (Frequency range: 2496-2690 MHz) due to same frequency range, same channel bandwidth and maximum tune-up limit is higher than LTE Band41(PC3).

NR Band 66(NSA)

NSA mode maximum tune-up is lower than SA mode, so SA mode is reported.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacture	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37N9BV0382HM3	N/A
Data Cable	SAMSUNG	EP- DN980BBE	N/A	N/A

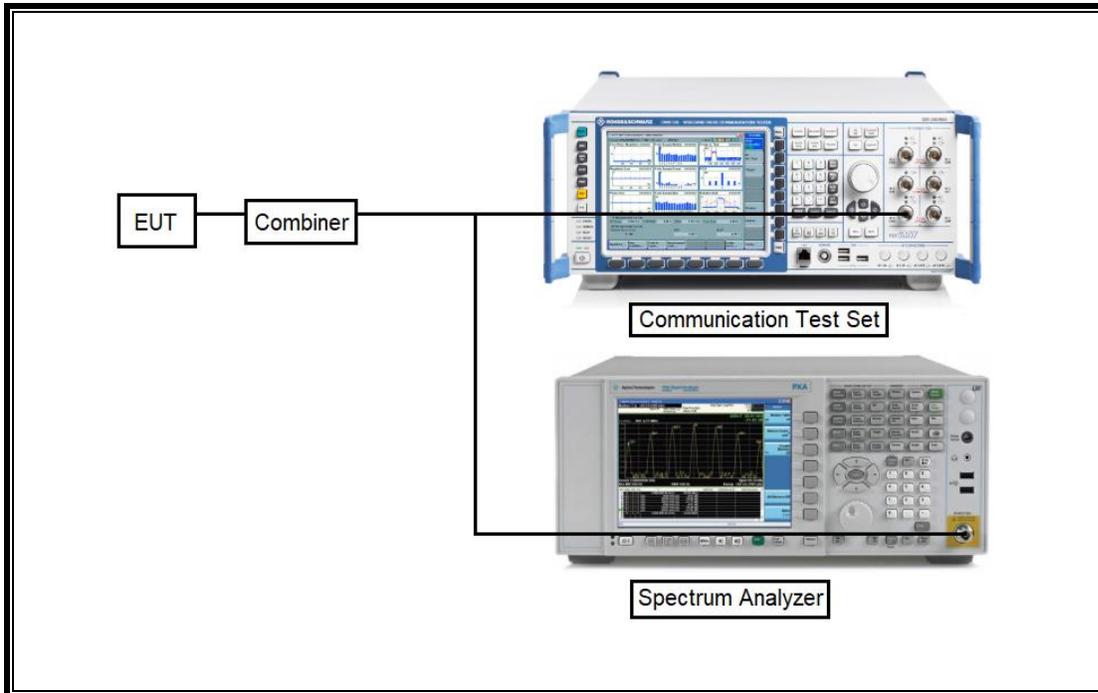
I/O CABLE

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

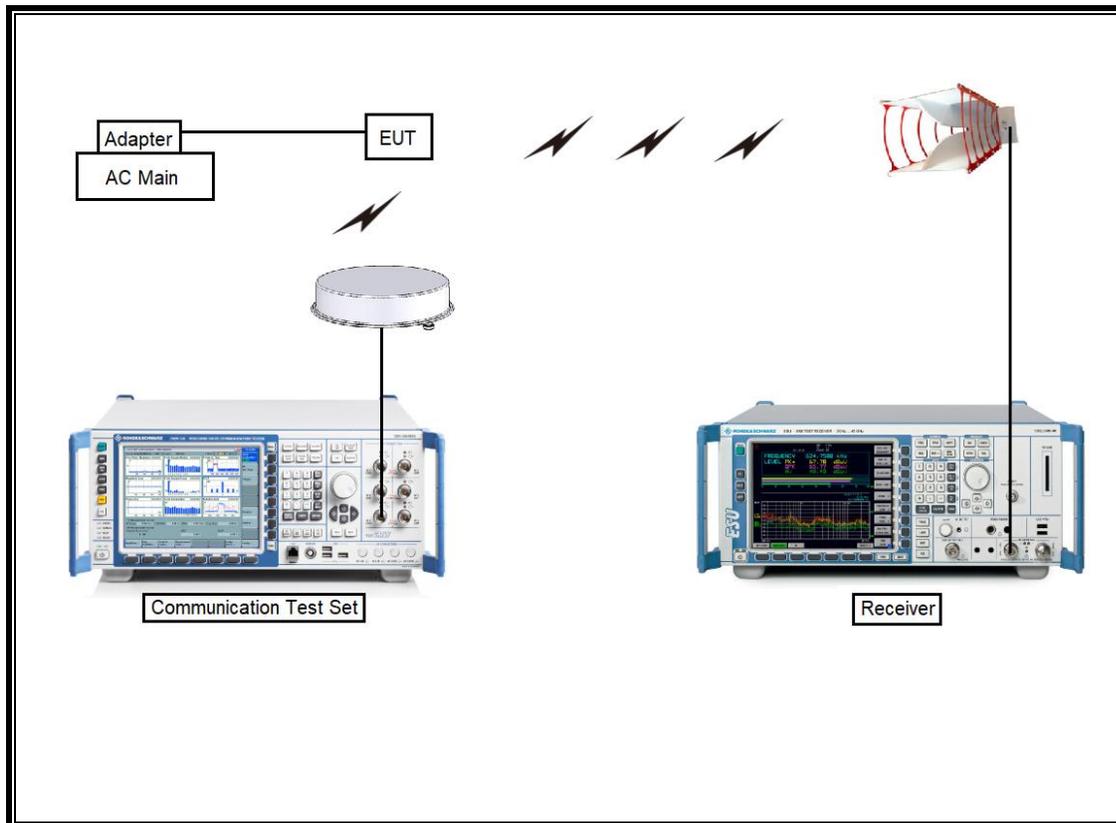
TEST SETUP

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	2023-10-13
Preamplifier	ETS	3116C-PA	00168841	2022-08-04
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	169796	2022-01-27
DC Power Supply	Agilent / HP	E3640A	MY54226395	2022-08-02
Preamplifier, 1000 MHz	Sonoma	310N	341282	2022-08-02
Preamplifier, 1000 MHz	Sonoma	310N	370599	2022-08-02
Preamplifier, 1000 MHz	Sonoma	310N	351741	2022-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	2022-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029168	2022-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2022-08-02
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2022-08-04
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2022-08-04
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2022-08-02
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2022-08-02
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	2022-08-03
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	2022-08-02
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	2022-08-03
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	2022-08-02
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	2022-08-03
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	2022-08-02
Attenuator	PASTERNAK	PE7087-10	A009	2022-08-03
Attenuator	PASTERNAK	PE7087-10	A001	2022-08-03
Attenuator	PASTERNAK	PE7087-10	A008	2022-08-03
Attenuator	PASTERNAK	PE7004-10	2	2022-08-02
Attenuator	PASTERNAK	PE7395-10	A011	2022-08-03
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2023-10-06
Temperature Chamber	ESPEC	SH-642	93001109	2022-08-02
Power Splitter	MINI-CIRCUITS	WA1534	UL001	2022-01-27
Power Splitter	MINI-CIRCUITS	WA1534	UL002	2022-01-27
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	MY58120110	2022-01-13
UL Software				
Description	Manufacturer	Model	Version	
Antenna port test software	UL	CLT	Ver 3.4	
Radiated software	UL	UL EMC	Ver 9.5	

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) 24.238(a) 27.53(c),(g),(h) 90.691	Band Edge / Conducted Spurious Emission	-13dBm		Pass
27.53(m)	Conducted Spurious Emission	-25dBm		Pass
27.53(m) 90.691	Emission mask	Section 9.2.2		Pass
2.1046	Conducted output power	N/A		Pass
22.355 24.235 27.54 90.213	Frequency Stability	2.5PPM		Pass
22.913(a)(5)	Effective Radiated Power	38.5dBm		Pass
90.635(b)		50 dBm	Pass	
27.50(c)(10) 27.50(b)(10)		34.77dBm	Pass	
24.232(c) 27.50(h)(2)	Equivalent Isotropic Radiated Power	33dBm	Pass	
27.50(d)(4)		30dBm	Pass	
22.917(a) 24.238(a) 27.53 (c),(g),(h) 90.691	Radiated Spurious Emission	-13dBm	Pass	
27.53 (m)		-25dBm	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

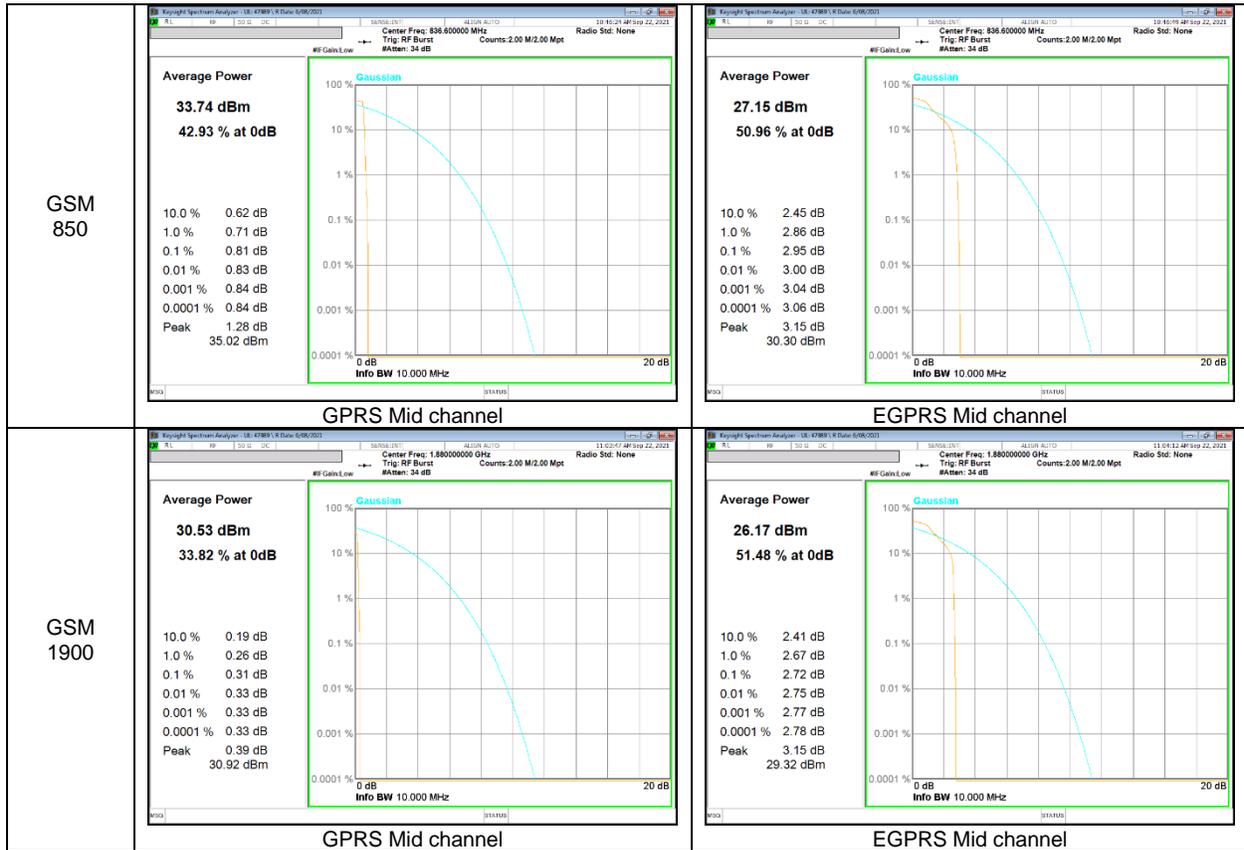
5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) and modulations (QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

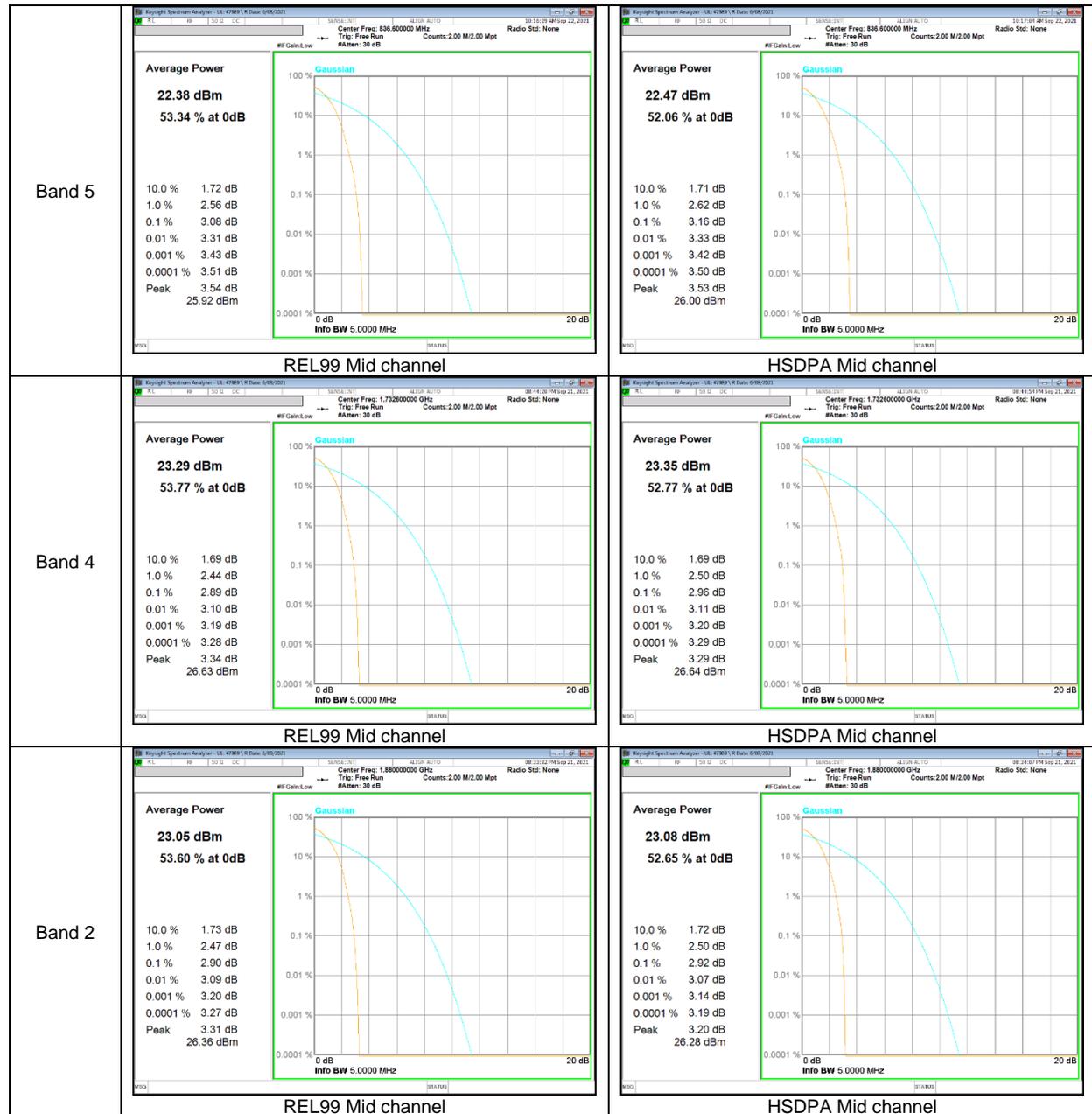
See the following pages.

8.1. CONDUCTED PEAK TO AVERAGE RESULT

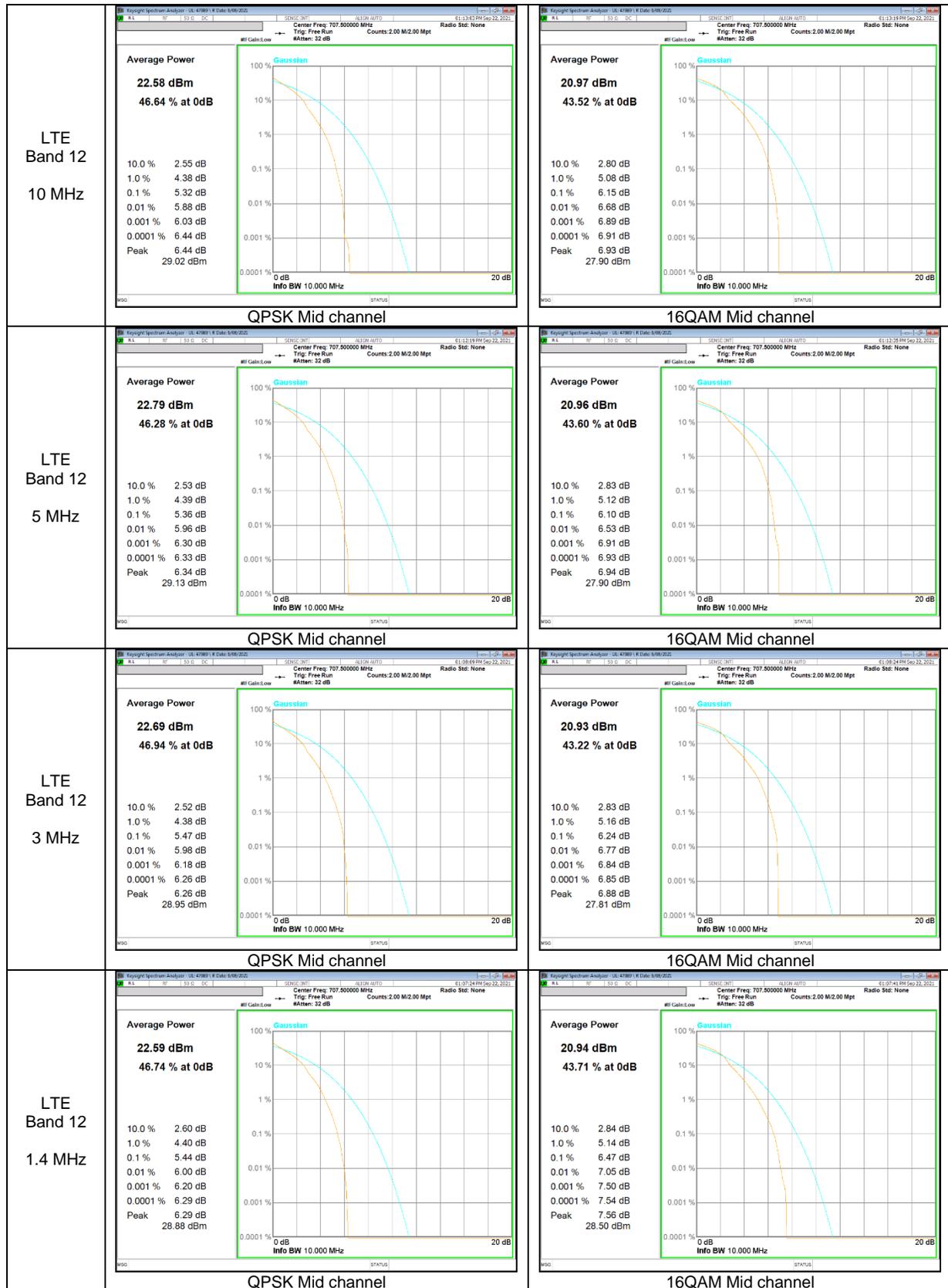
GSM



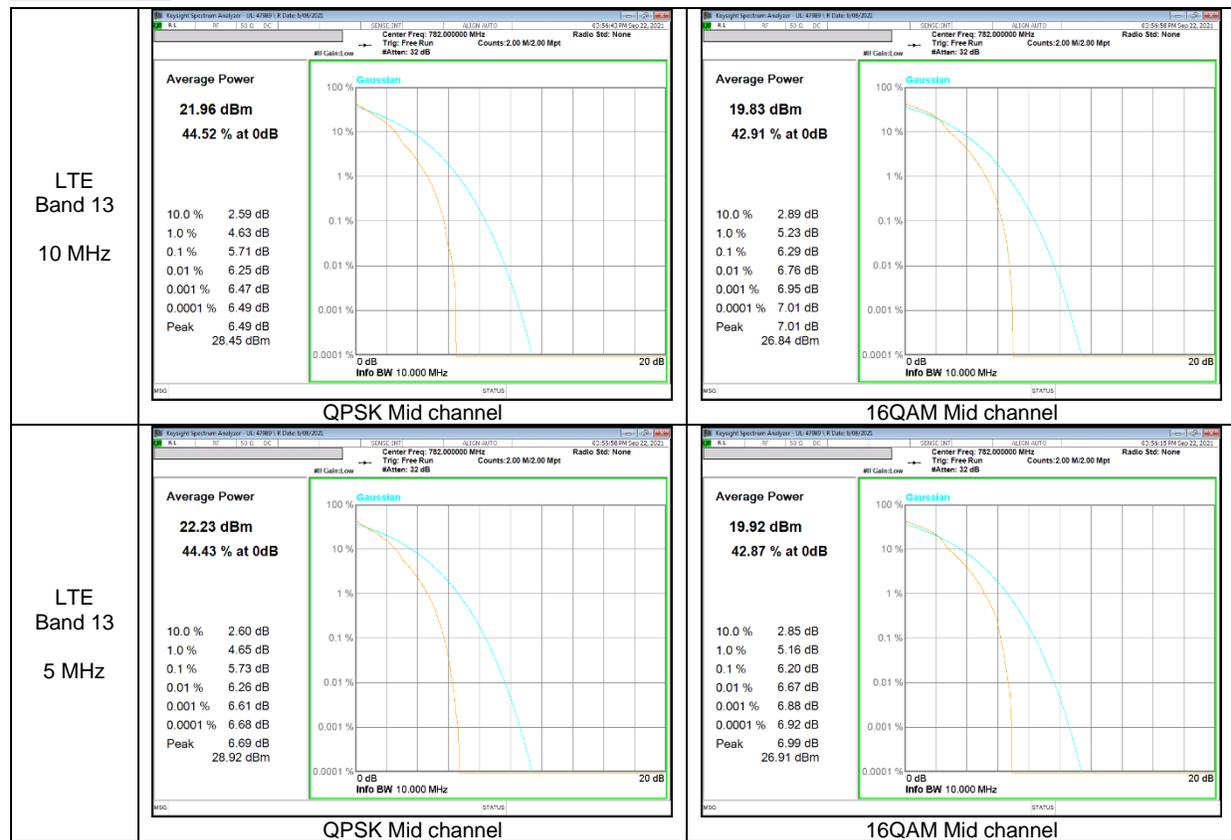
WCDMA



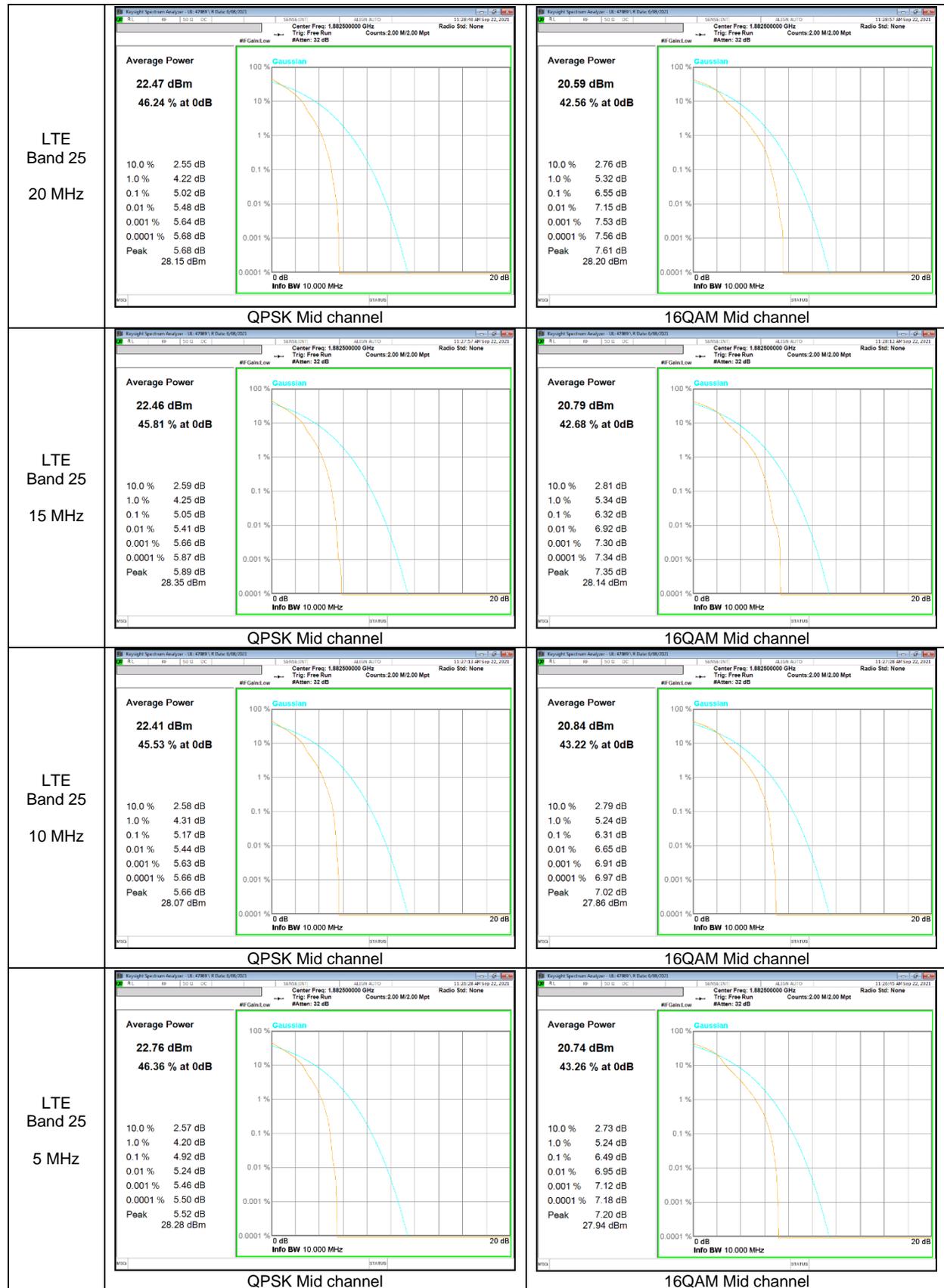
LTE Band 12

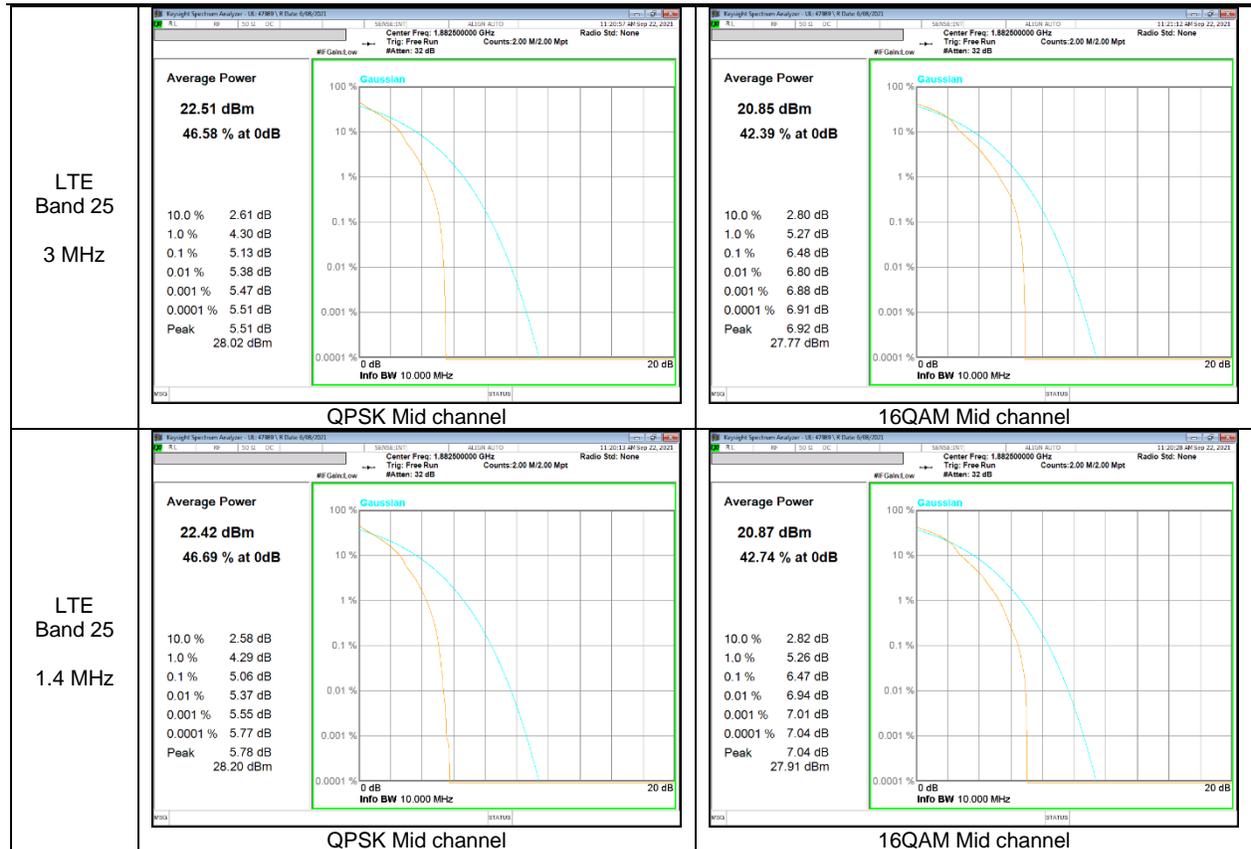


LTE Band 13

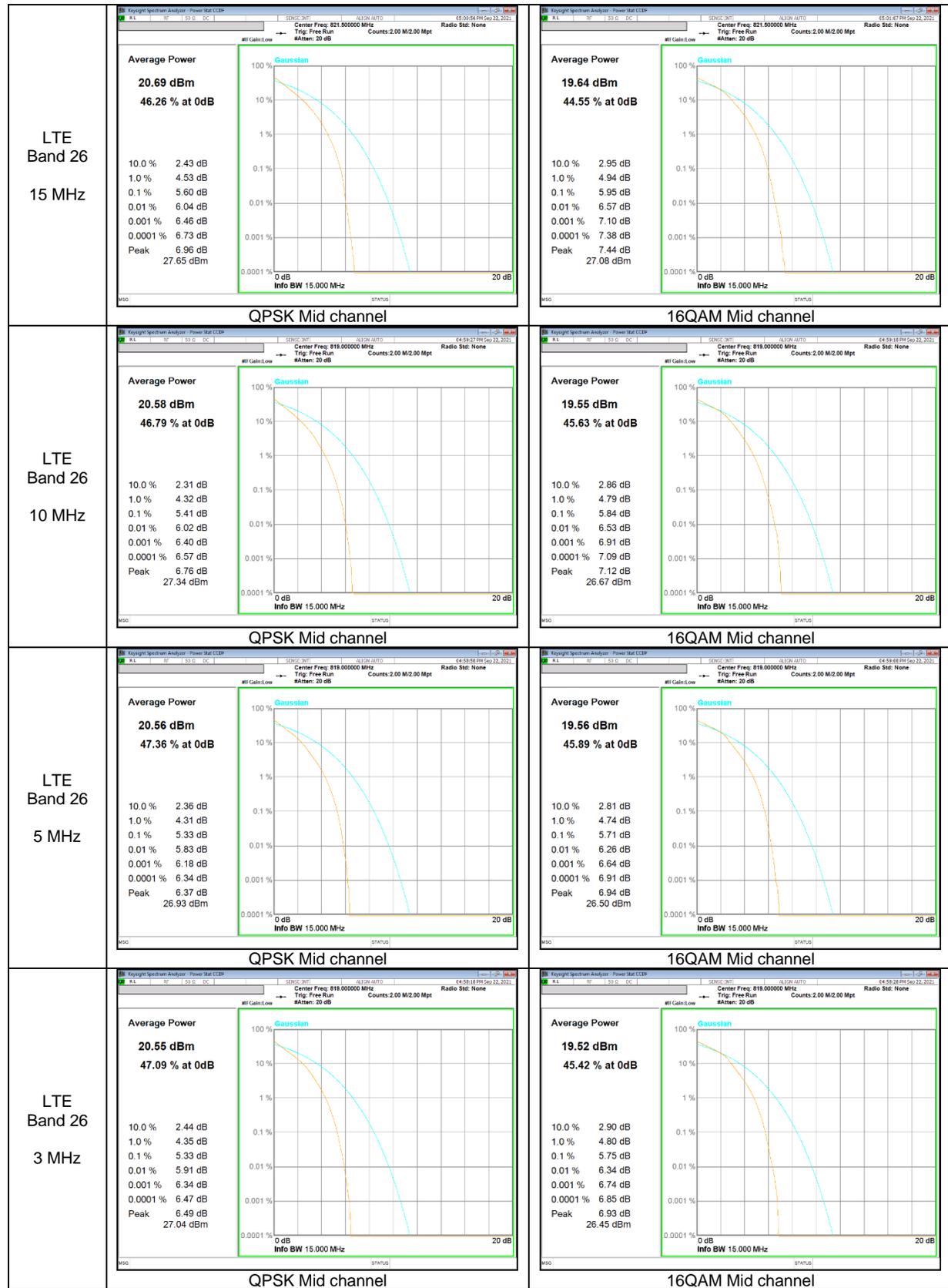


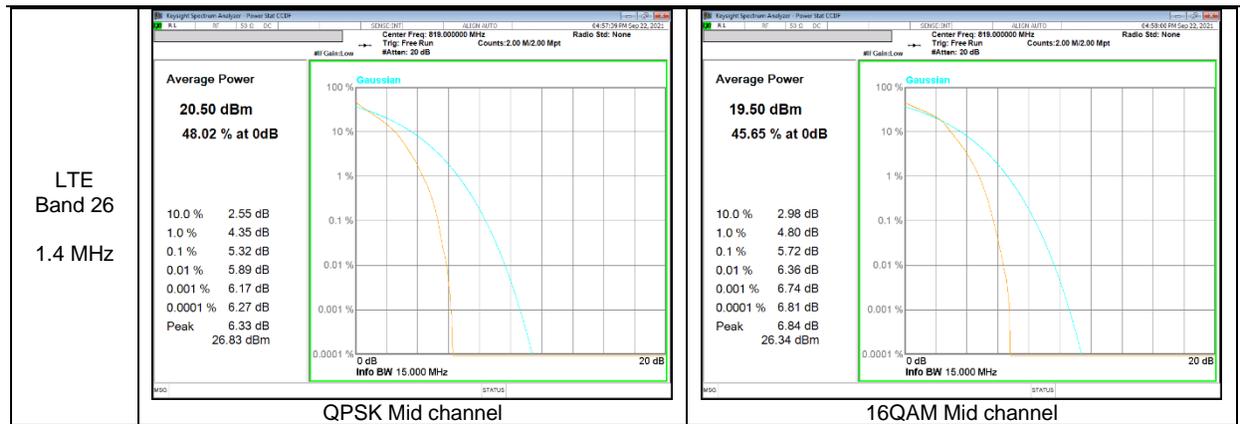
LTE Band 25



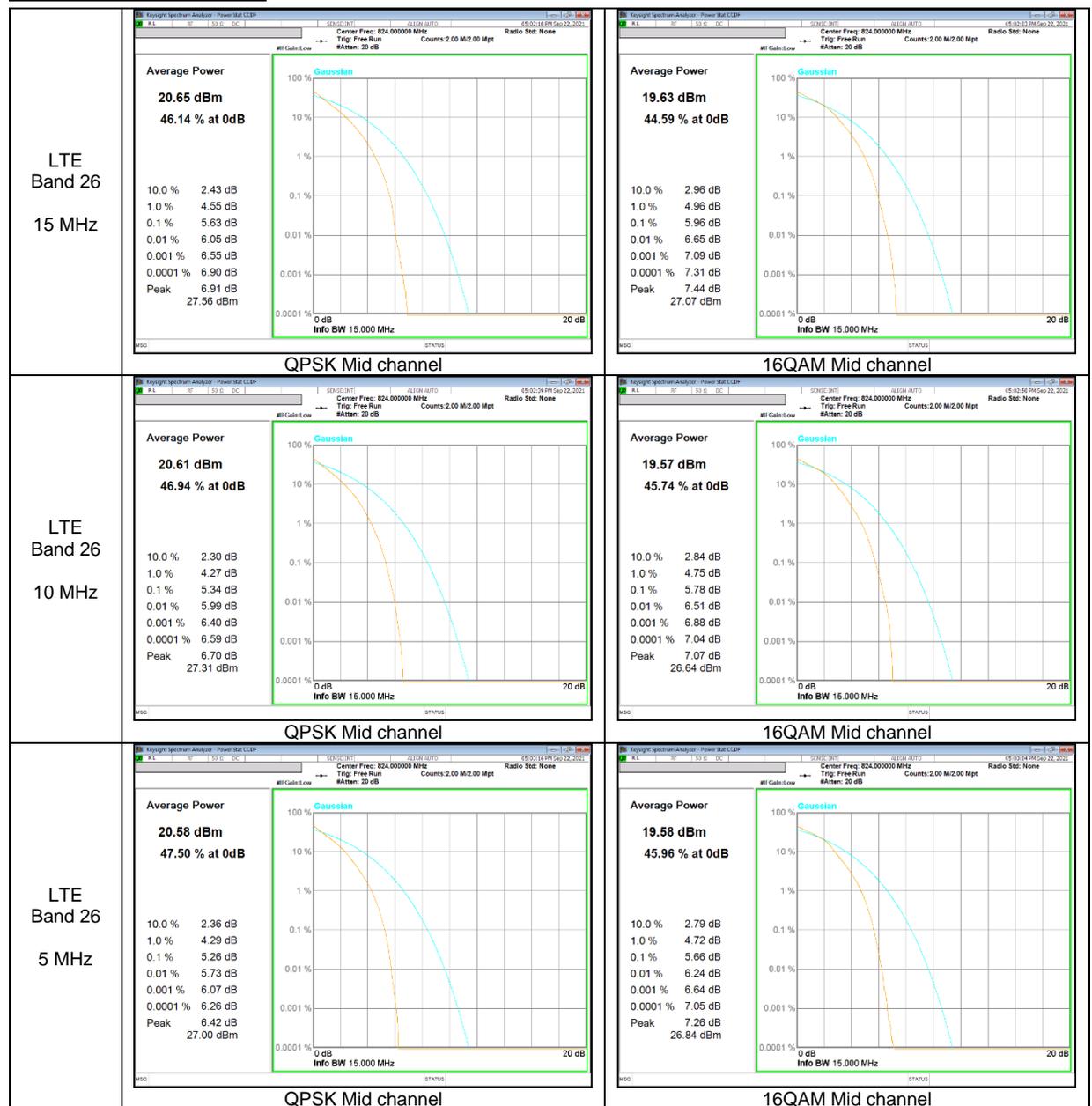


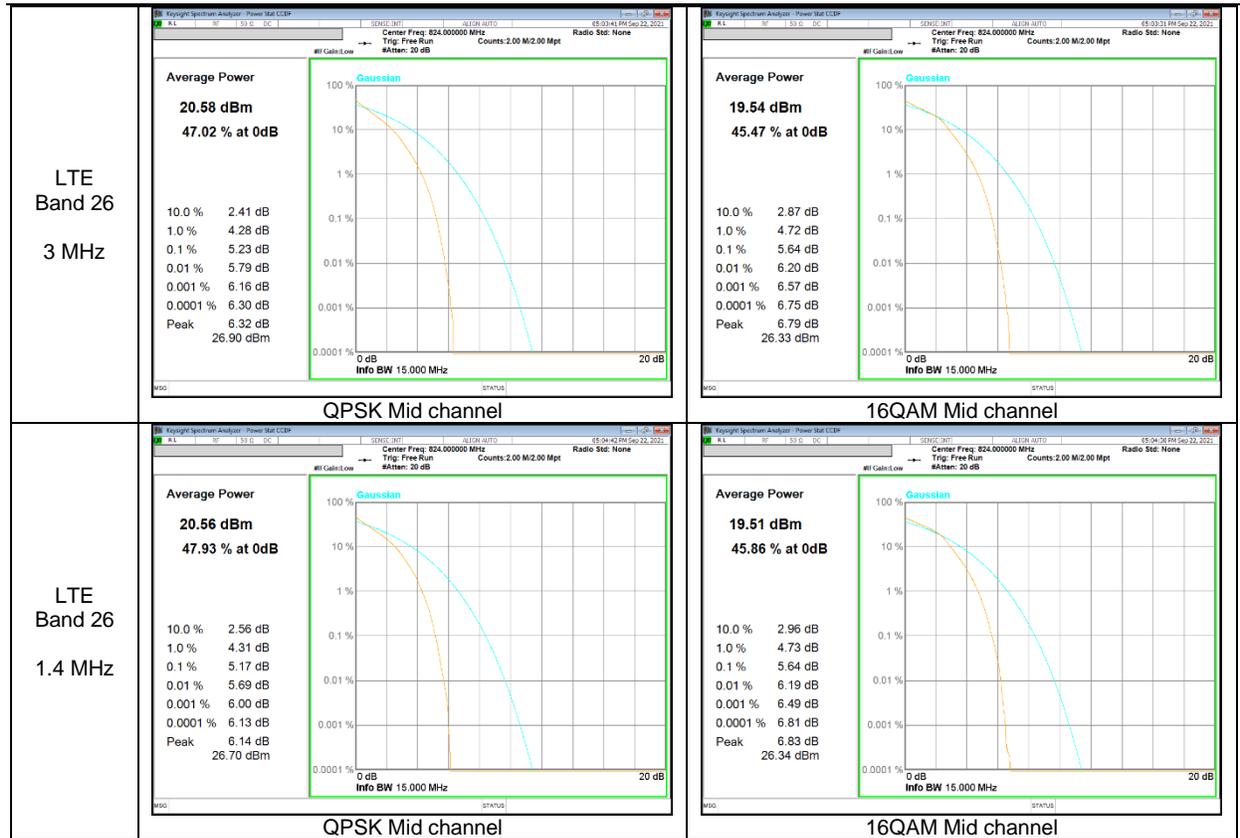
LTE Band 26 (Part 90)



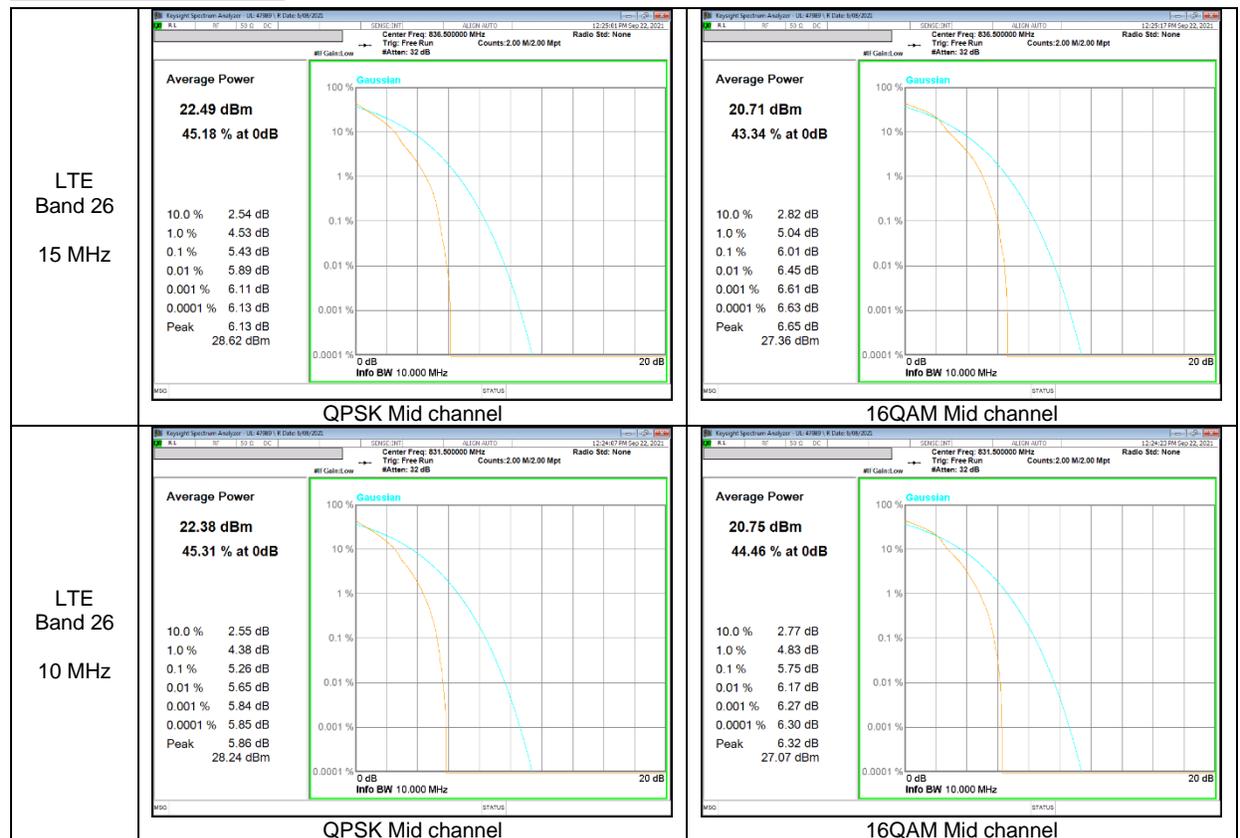


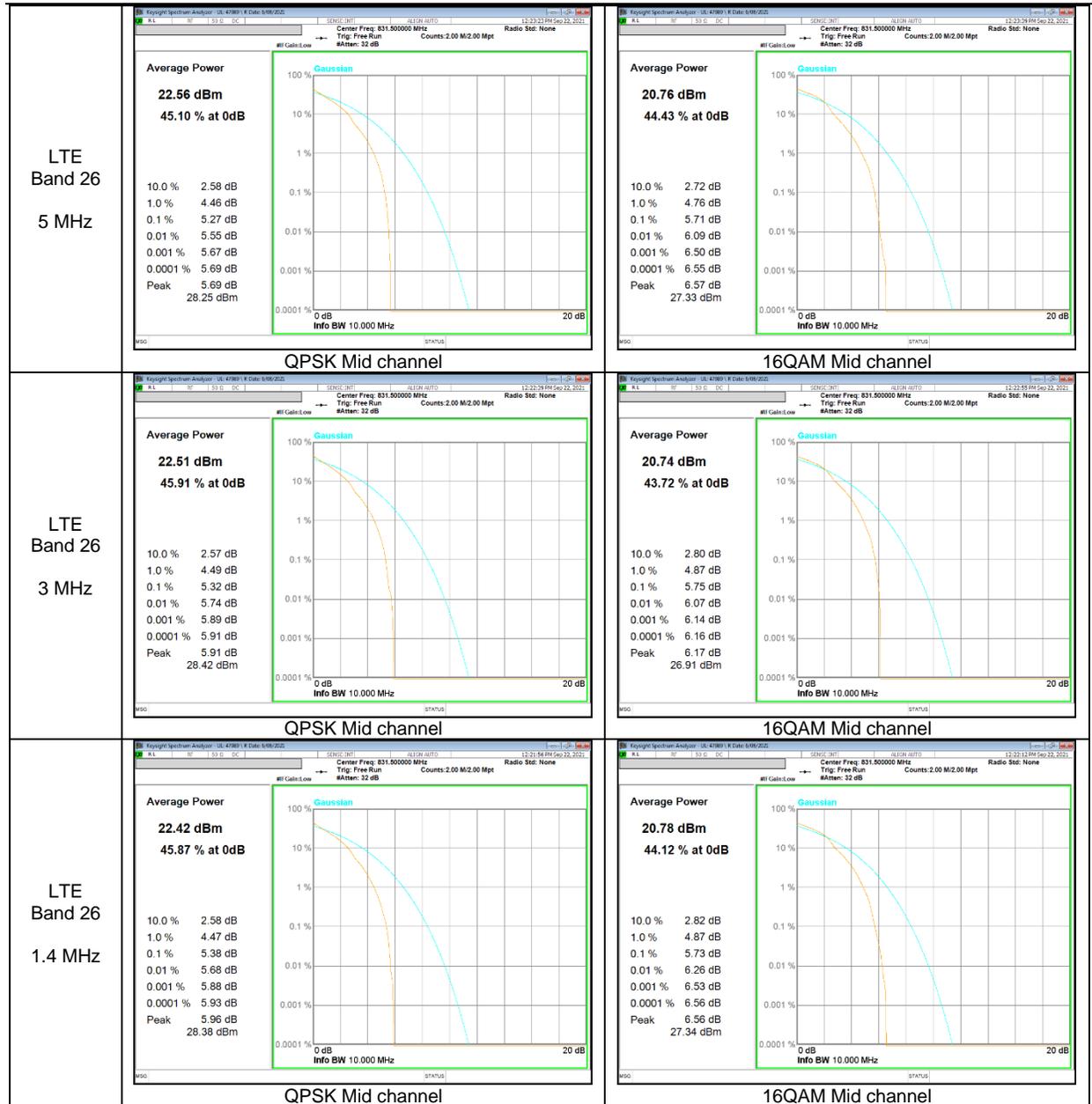
LTE Band 26 (Straddle)



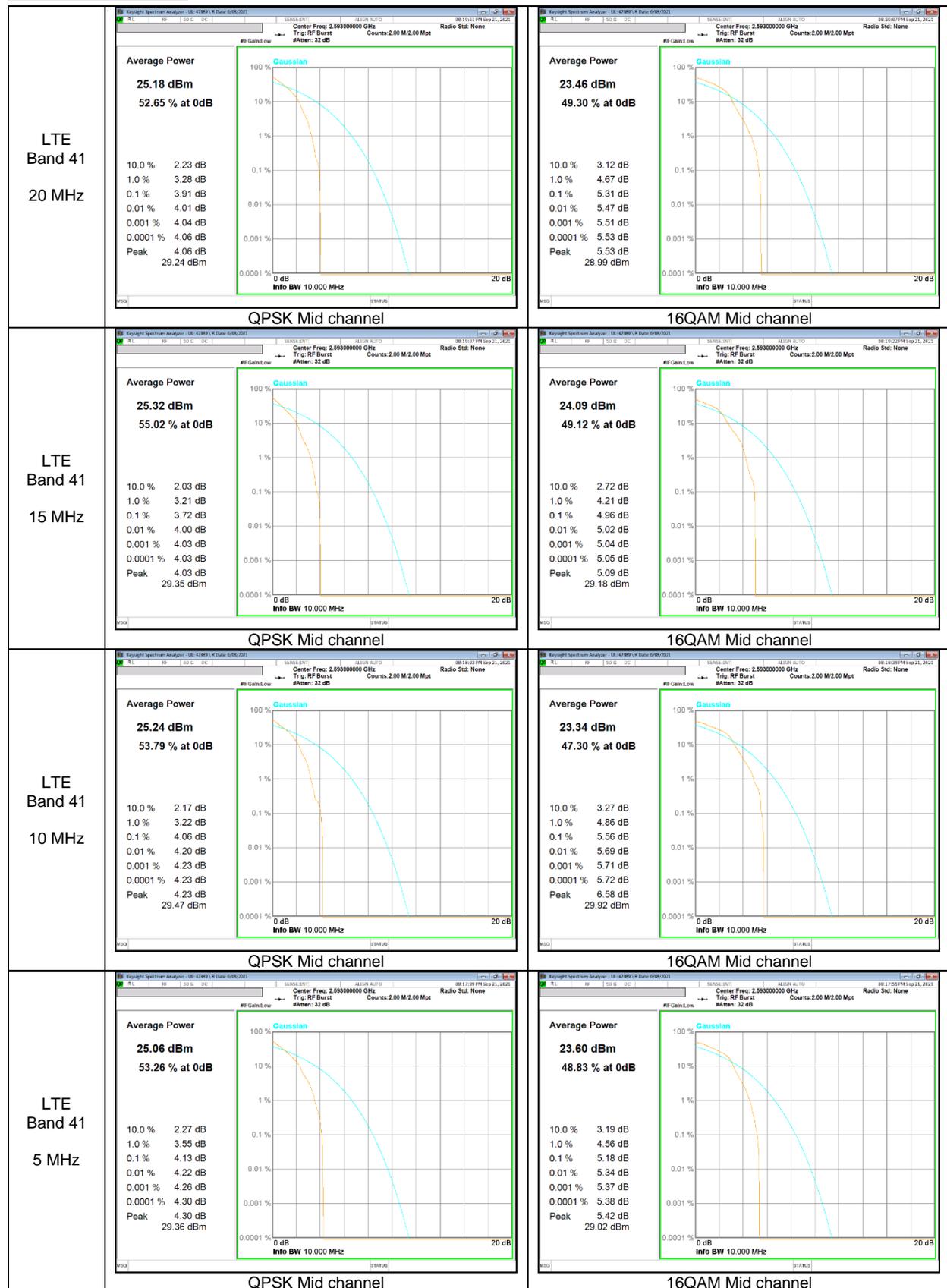


LTE Band 26 (Part 22)

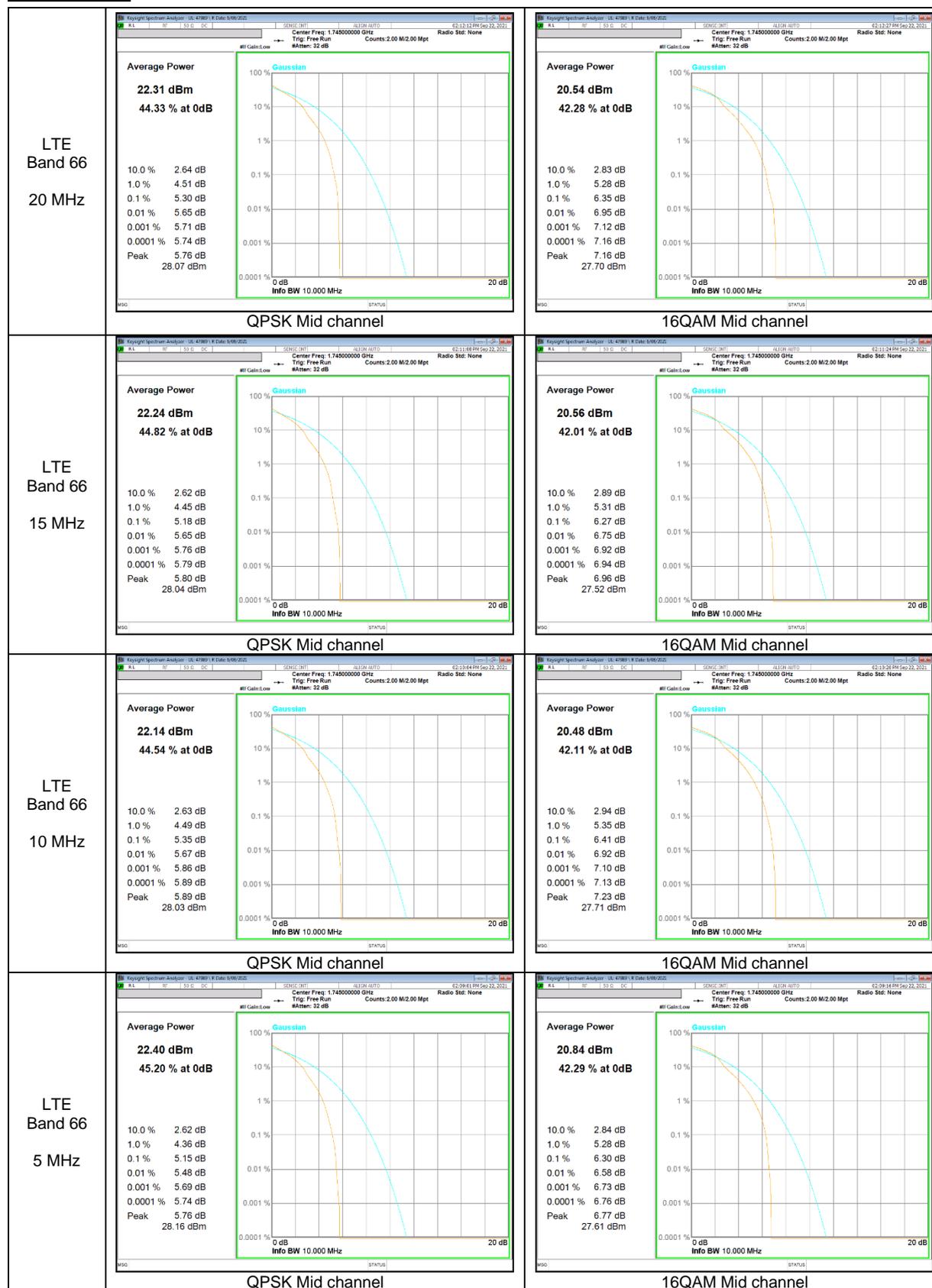


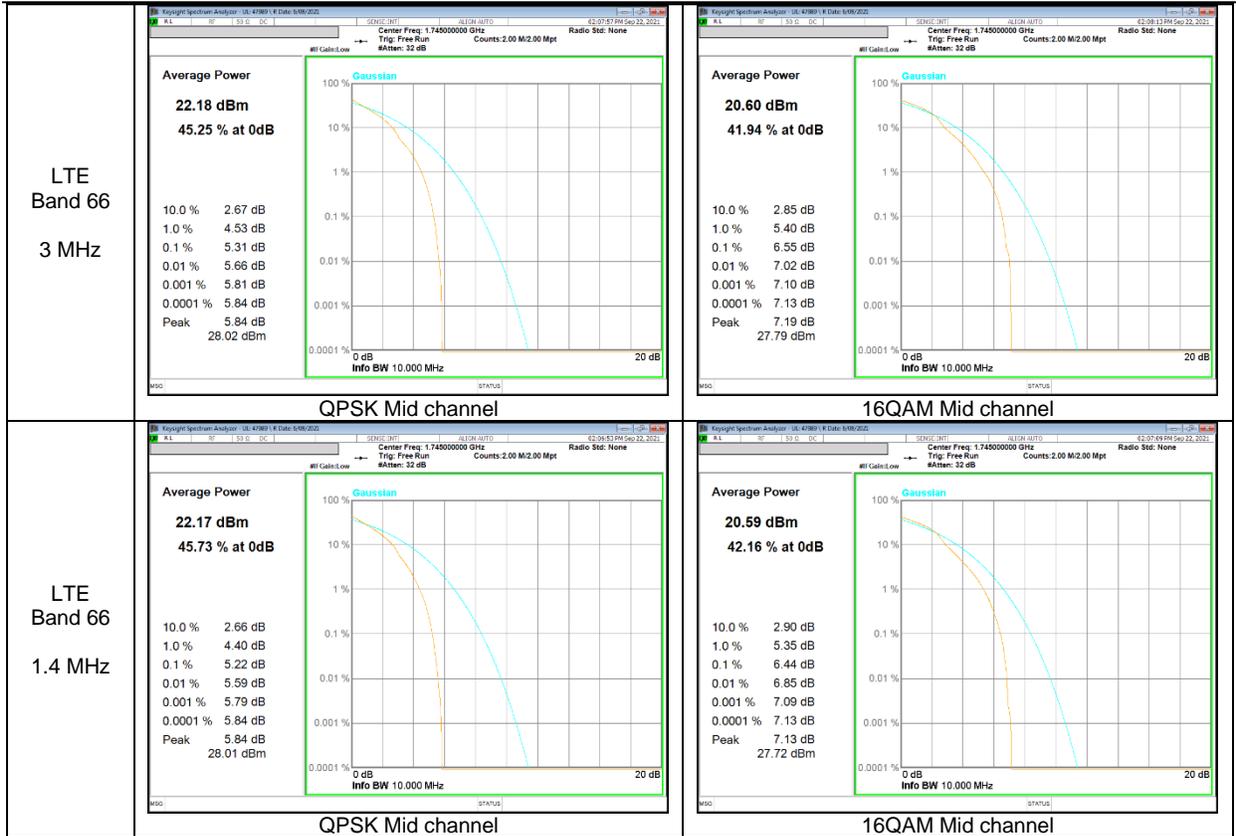


LTE Band 41 (PC2)

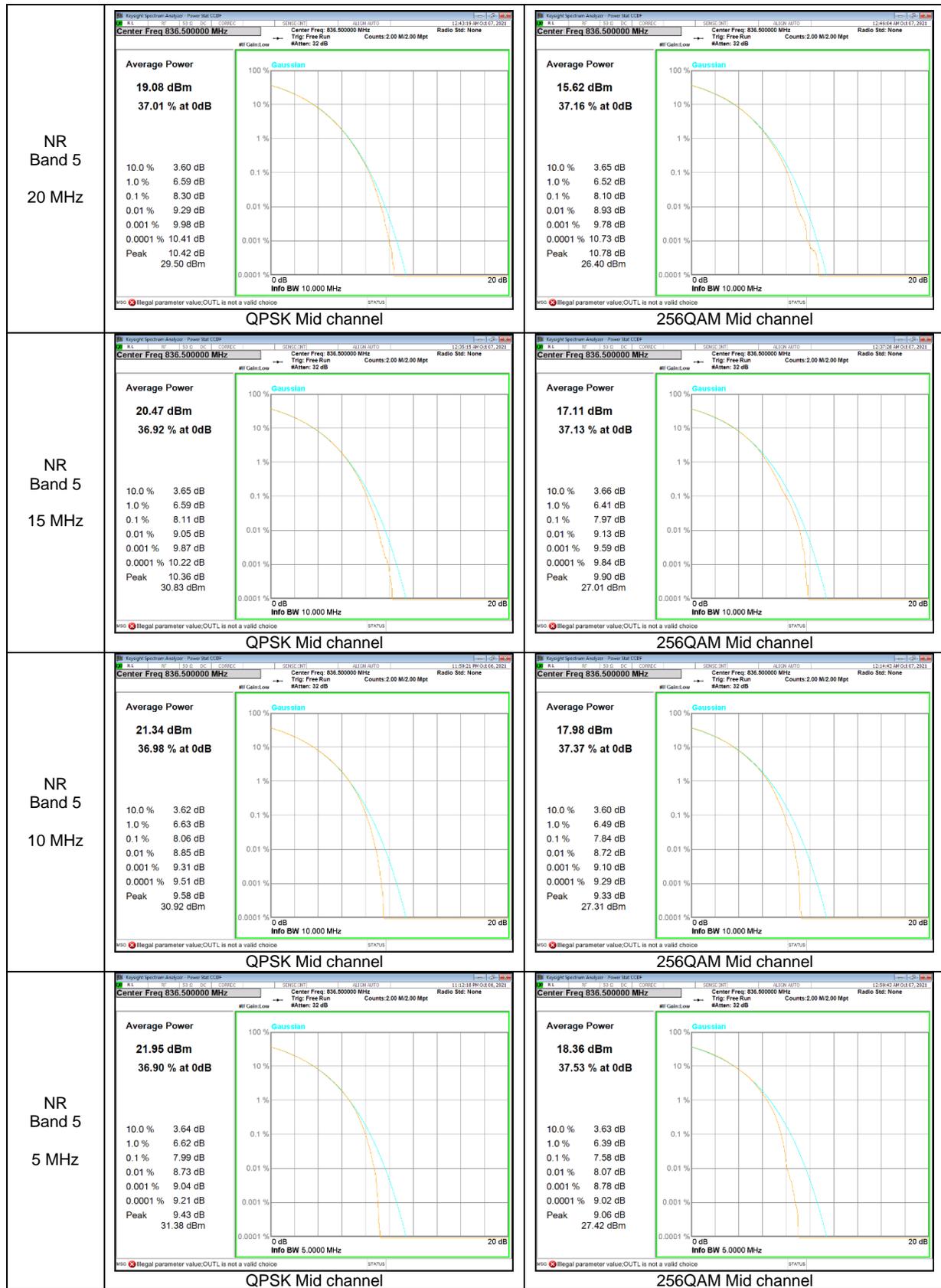


LTE Band 66

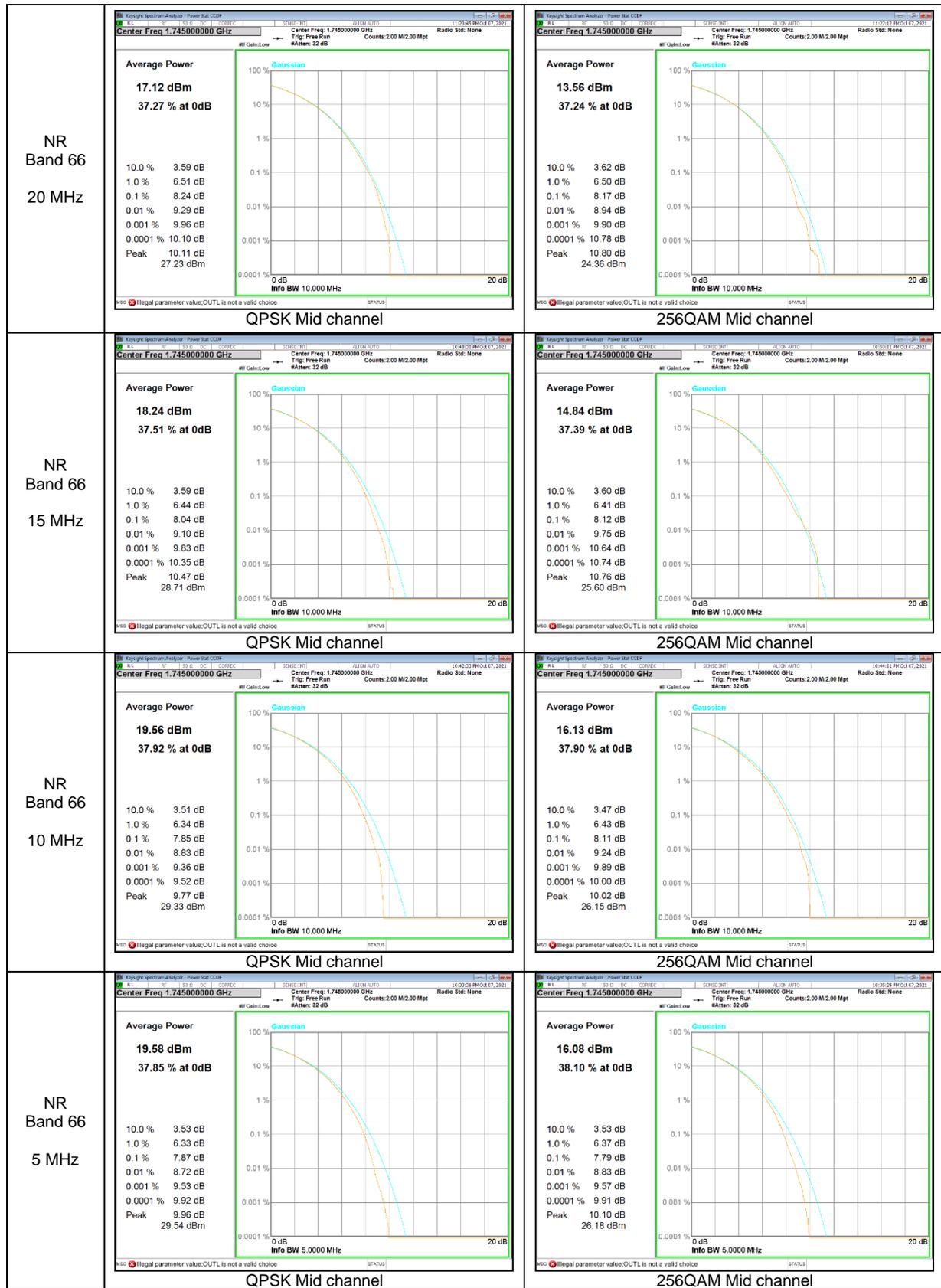




NR Band 5 CP-OFDM



NR Band 66 CP-OFDM



9. LIMITS AND CONDUCTED RESULTS

9.1. 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)

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

See the following pages.

- GSM

Band	Modulation	f [MHz]	99% BW (kHz)	-26dB BW (kHz)
850	GPRS	836.6	239.06	321.9
	EGPRS		250.91	315.8
1900	GPRS	1880.0	246.22	321.6
	EGPRS		244.64	312.7

- WCDMA

Band	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
B5	Rel.99	836.6	4.166	4.718
	HSDPA		4.215	4.689
B4	Rel.99	1732.6	4.171	4.740
	HSDPA		4.184	4.710
B2	Rel.99	1880.0	4.166	4.702
	HSDPA		4.191	4.713

- LTE Band 12

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B12	10M	QPSK	707.5	8.954	10.200
		16QAM		8.988	10.430
	5M	QPSK	707.5	4.499	5.260
		16QAM		4.490	5.210
	3M	QPSK	707.5	2.696	3.052
		16QAM		2.697	3.056
	1.4M	QPSK	707.5	1.083	1.296
		16QAM		1.088	1.301

- LTE Band 13

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B13	10M	QPSK	782.0	8.978	10.220
		16QAM		8.978	10.180
	5M	QPSK	782.0	4.503	5.266
		16QAM		4.503	5.273

- LTE Band 25

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B25	20M	QPSK	1882.5	17.921	19.780
		16QAM		17.923	19.610
	15M	QPSK	1882.5	13.426	15.080
		16QAM		13.415	15.400
	10M	QPSK	1882.5	8.996	10.330
		16QAM		8.974	10.210
	5M	QPSK	1882.5	4.506	5.256
		16QAM		4.497	5.169
	3M	QPSK	1882.5	2.699	3.084
		16QAM		2.702	3.088
	1.4M	QPSK	1882.5	1.087	1.291
		16QAM		1.092	1.319

- LTE Band 26 (Part 90)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26 Part(90)	15M	QPSK	821.5	13.419	14.930
		16QAM		13.428	15.030
	10M	QPSK	819.0	8.998	10.390
		16QAM		8.987	10.260
	5M	QPSK	819.0	4.499	5.221
		16QAM		4.512	5.261
	3M	QPSK	819.0	2.714	3.119
		16QAM		2.710	3.045
	1.4M	QPSK	819.0	1.087	1.322
		16QAM		1.085	1.291

- LTE Band 26 (Straddle)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26 (Straddle)	15M	QPSK	824.0	13.406	15.100
		16QAM		13.426	15.000
	10M	QPSK	824.0	8.980	10.370
		16QAM		8.971	10.270
	5M	QPSK	824.0	4.506	5.289
		16QAM		4.510	5.314
	3M	QPSK	824.0	2.702	3.074
		16QAM		2.700	3.111
	1.4M	QPSK	824.0	1.083	1.297
		16QAM		1.086	1.303

- LTE Band 26 (Part 22)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26 (Part 22)	15M	QPSK	831.5	13.386	14.960
		16QAM		13.409	15.220
	10M	QPSK	831.5	8.990	10.110
		16QAM		8.969	10.330
	5M	QPSK	831.5	4.499	5.176
		16QAM		4.496	5.208
	3M	QPSK	831.5	2.703	3.064
		16QAM		2.704	3.113
	1.4M	QPSK	831.5	1.087	1.292
		16QAM		1.089	1.326

- LTE Band 41

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B41	20M	QPSK	2593.0	17.918	19.710
		16QAM		17.894	19.440
	15M	QPSK	2593.0	13.388	15.090
		16QAM		13.414	15.170
	10M	QPSK	2593.0	8.968	10.430
		16QAM		8.976	10.450
	5M	QPSK	2593.0	4.496	5.202
		16QAM		4.475	5.117

- LTE Band 66

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B66	20M	QPSK	1745.0	17.936	19.720
		16QAM		17.894	20.090
	15M	QPSK	1745.0	13.428	14.940
		16QAM		13.432	15.070
	10M	QPSK	1745.0	8.977	10.160
		16QAM		8.977	10.090
	5M	QPSK	1745.0	4.504	5.264
		16QAM		4.516	5.285
	3M	QPSK	1745.0	2.702	3.041
		16QAM		2.698	3.022
	1.4M	QPSK	1745.0	1.092	1.297
		16QAM		1.085	1.290

- NR Band 5 CP-OFDM

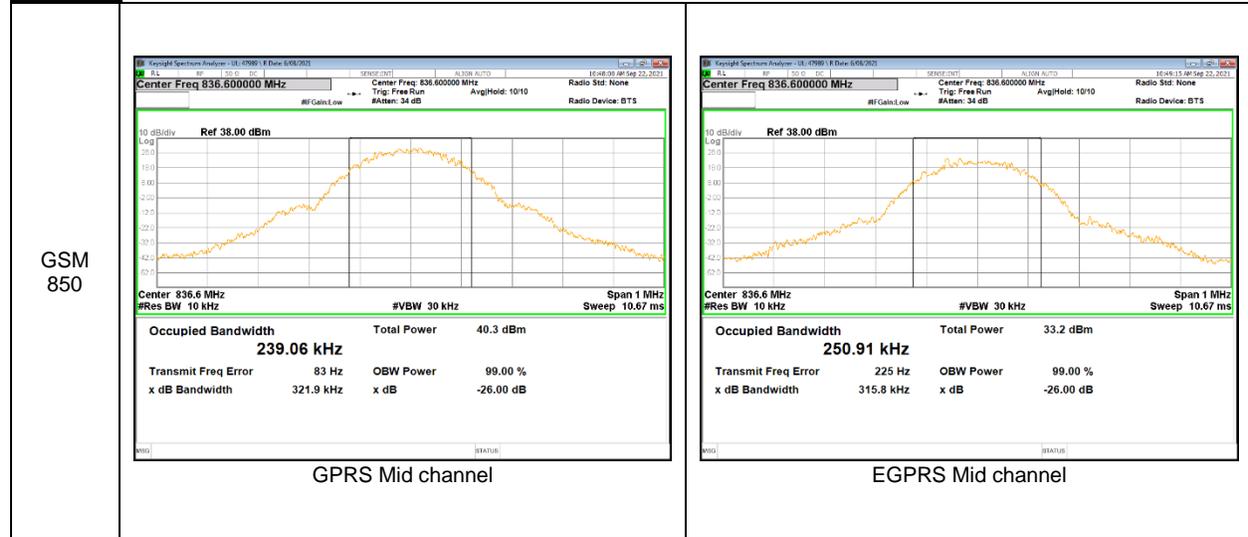
Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n5	20M	QPSK	836.5	18.984	20.610
		16QAM		18.953	20.540
	15M	QPSK	836.5	14.085	15.030
		16QAM		14.131	15.020
	10M	QPSK	836.5	9.297	10.200
		16QAM		9.282	10.270
	5M	QPSK	836.5	4.491	5.273
		16QAM		4.486	5.192

- NR Band 66 CP-OFDM

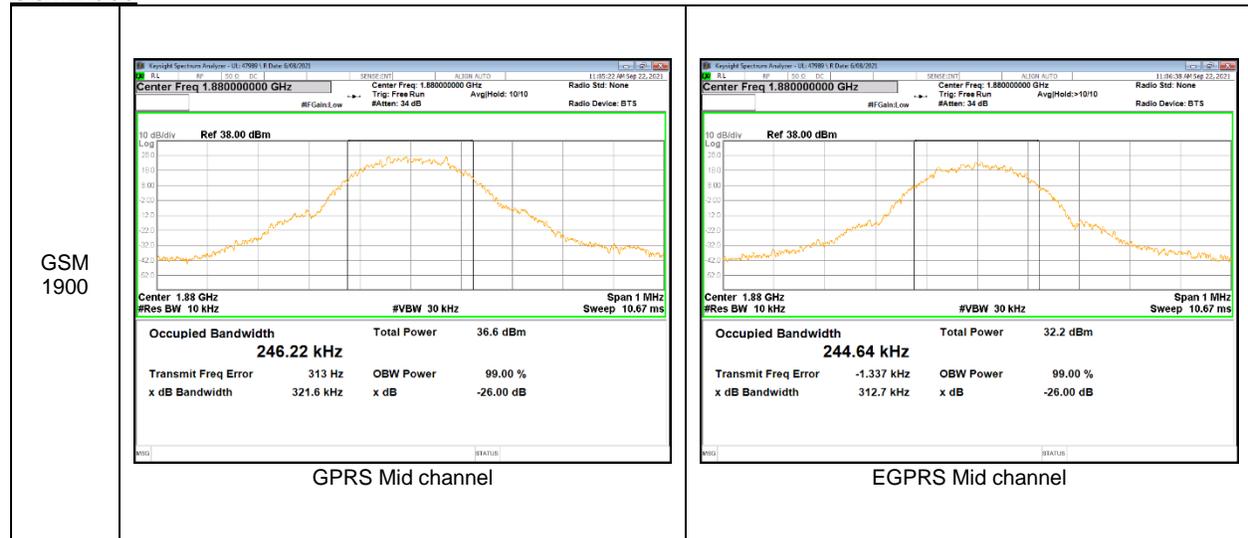
Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n66	20M	QPSK	1745.0	18.945	20.400
		16QAM		18.953	20.440
	15M	QPSK	1745.0	14.068	15.080
		16QAM		14.110	14.950
	10M	QPSK	1745.0	9.307	10.160
		16QAM		9.310	10.240
	5M	QPSK	1745.0	4.492	5.368
		16QAM		4.485	5.199

9.1.1. OCCUPIED BANDWIDTH RESULTS

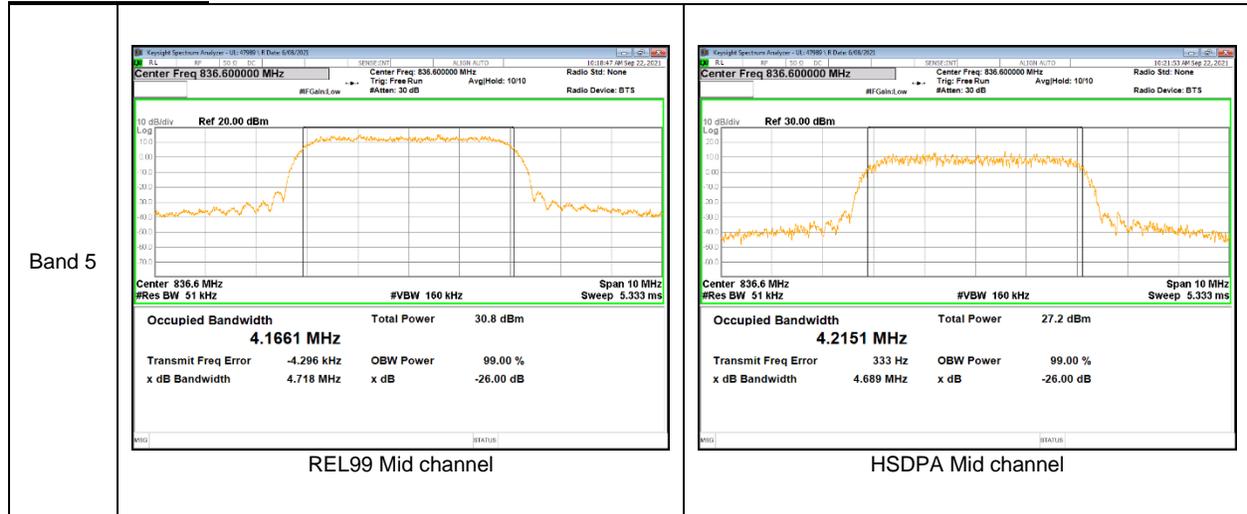
GSM 850



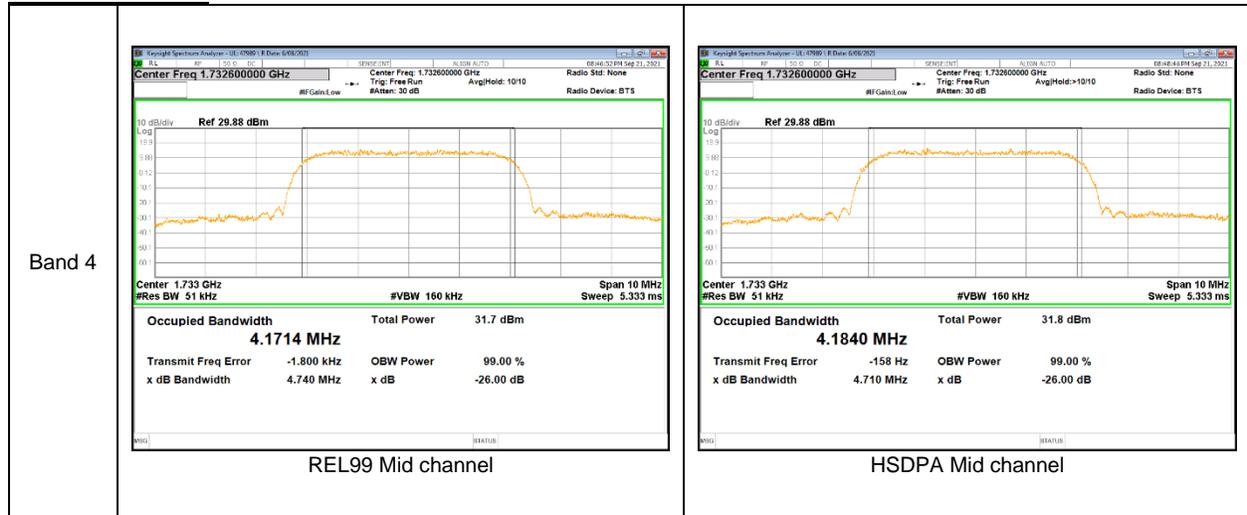
GSM 1900



WCDMA Band 5



WCDMA Band 4



WCDMA Band 2

