



CERTIFICATION TEST REPORT

Report Number. : 4790089626-E2V1

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

Model : SM-S906B/DS

FCC ID : A3LSMS906B

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

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ACCREDITED

Testing Laboratory

TL-637

Revision History

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

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

MODEL NUMBER: SM-S906B/DS

SERIAL NUMBER: R3CR80TBD6T, R3CR80TBV5M (CONDUCTED);
R3CR80TBVEE, R3CR80TBVBL (RADIATED);

DATE TESTED: 2021-09-17 ~ 2021-10-29;

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	
☒	Chamber 1
☒	Chamber 2
☐	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:

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

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

(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	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/5G NR 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.(4790089626-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	33.14	2060.63	29.57	905.73
		EGPRS	25.91	389.94	23.46	221.82
GSM1900	1850~1910	GPRS	30.79	1199.50	30.64	1158.78
		EGPRS	25.59	362.24	27.26	532.11

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	24.65	291.78	19.60	91.20
		HSDPA	24.49	281.19	16.79	47.75
Band 4	1710~1755	Rel. 99	23.27	212.41	22.05	160.32
		HSDPA	21.91	155.24	20.64	115.88
Band 2	1850~1910	Rel. 99	23.54	226.05	23.12	205.12
		HSDPA	22.12	162.79	21.92	155.60

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	24.30	269.40	17.81	60.39
			16QAM	22.49	177.41	15.12	32.51
			64QAM	21.67	146.94		
			256QAM	20.46	111.17		
		5	QPSK	24.88	307.53	17.42	55.21
			16QAM	23.27	212.18	15.34	34.20
			64QAM	21.93	155.90		
			256QAM	20.49	111.94		
		3	QPSK	24.95	312.34	21.14	130.02
			16QAM	23.25	211.35	18.58	72.11
			64QAM	22.83	191.76		
			256QAM	20.44	110.66		
		1.4	QPSK	24.94	311.54	17.36	54.45
			16QAM	23.28	212.65	15.42	34.83
			64QAM	22.11	162.53		
			256QAM	20.48	111.69		

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	24.51	282.49	19.79	95.28
			16QAM	22.25	167.96	16.52	44.87
			64QAM	22.28	169.04		
			256QAM	20.26	106.28		
		5	QPSK	24.61	288.76	19.74	94.19
			16QAM	22.32	170.43	17.87	61.24
			64QAM	21.19	131.54		
			256QAM	19.79	95.18		

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	23.79	239.33	23.41	219.28
			16QAM	22.63	183.24	21.69	147.57
			64QAM	21.41	138.36		
			256QAM	20.24	105.57		
		15	QPSK	23.81	240.65	23.36	216.77
			16QAM	22.25	167.89	21.43	139.00
			64QAM	21.08	128.37		
			256QAM	20.49	111.94		
		10	QPSK	23.35	216.47	23.64	231.21
			16QAM	21.91	155.27	21.84	152.76
			64QAM	20.98	125.43		
			256QAM	20.32	107.54		
		5	QPSK	23.40	218.81	24.05	254.10
			16QAM	21.89	154.35	22.19	165.58
			64QAM	20.93	123.91		
			256QAM	20.08	101.82		
		3	QPSK	23.99	250.44	23.89	244.91
			16QAM	22.33	170.92	22.07	161.06
			64QAM	20.58	114.25		
			256QAM	19.97	99.30		
		1.4	QPSK	23.78	238.64	24.15	260.02
			16QAM	22.19	165.60	21.95	156.68
			64QAM	20.79	119.95		
			256QAM	20.22	105.11		

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	24.55	285.13	17.11	51.40
			16QAM	22.66	184.40	14.98	31.48
			64QAM	21.65	146.06		
			256QAM	20.49	112.04		
		10	QPSK	24.61	288.74	16.76	47.42
			16QAM	23.10	204.37	15.02	31.77
			64QAM	22.68	185.44		
			256QAM	20.30	107.15		
		5	QPSK	24.59	287.60	17.26	53.21
			16QAM	23.14	206.13	15.21	33.19
			64QAM	22.19	165.52		
			256QAM	19.88	97.22		
		3	QPSK	24.58	287.15	17.08	51.05
			16QAM	22.80	190.34	15.10	32.36
			64QAM	22.01	158.70		
			256QAM	19.78	94.99		
		1.4	QPSK	24.76	299.40	16.93	49.32
			16QAM	23.04	201.37	15.23	33.34
			64QAM	22.33	171.18		
			256QAM	20.44	110.66		

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	24.55	285.13	16.96	49.66
			16QAM	22.66	184.40	14.65	29.17
			64QAM	21.65	146.06		
			256QAM	20.49	112.04		
		10	QPSK	24.84	304.64	17.01	50.23
			16QAM	22.98	198.80	15.30	33.88
			64QAM	22.08	161.39		
			256QAM	20.47	111.43		
		5	QPSK	24.88	307.36	16.83	48.19
			16QAM	23.34	215.86	15.03	31.84
			64QAM	22.24	167.48		
			256QAM	20.42	110.20		
		3	QPSK	24.81	302.61	17.26	53.21
			16QAM	23.32	214.91	15.09	32.28
			64QAM	22.07	160.99		
			256QAM	20.46	111.11		
		1.4	QPSK	24.98	315.05	17.08	51.05
			16QAM	23.30	213.94	15.04	31.92
			64QAM	23.24	210.96		
			256QAM	20.50	112.20		

LTE Band 26 (Straddle)

Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Straddle			
				Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	824	15	QPSK	23.14	206.06	17.27	53.33
			16QAM	22.54	179.47	15.01	31.70
			64QAM				
			256QAM				
		10	QPSK	23.10	204.17	17.50	56.23
			16QAM	22.29	169.43	15.11	32.43
			64QAM				
			256QAM				
		5	QPSK	23.13	205.59	17.08	51.05
			16QAM	22.38	172.98	15.12	32.51
			64QAM				
			256QAM				
		3	QPSK	22.92	195.88	17.14	51.76
			16QAM	22.19	165.58	14.90	30.90
			64QAM				
			256QAM				
		1.4	QPSK	23.13	205.59	17.01	50.23
			16QAM	22.58	181.13	15.14	32.66
			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	25.14	326.40	22.81	190.99
			16QAM	24.85	305.39	22.51	178.24
			64QAM	23.89	244.92		
			256QAM	21.34	136.12		
		15	QPSK	25.00	316.47	22.49	177.42
			16QAM	24.52	283.29	23.03	200.91
			64QAM	23.51	224.44		
			256QAM	20.56	113.74		
		10	QPSK	25.08	322.29	23.10	204.17
			16QAM	24.74	297.81	22.63	183.23
			64QAM	23.51	224.44		
			256QAM	20.44	110.73		
		5	QPSK	25.44	349.93	23.14	206.06
			16QAM	24.57	286.40	22.37	172.58
			64QAM	23.59	228.71		
			256QAM	20.60	114.71		

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	24.06	254.64	23.18	207.97
			16QAM	22.26	168.17	21.43	139.00
			64QAM	21.20	131.69		
			256QAM	19.98	99.48		
		15	QPSK	23.92	246.72	23.16	207.01
			16QAM	22.35	171.79	21.08	128.23
			64QAM	21.34	136.17		
			256QAM	19.79	95.22		
		10	QPSK	23.93	247.32	22.78	189.67
			16QAM	22.43	175.01	21.09	128.53
			64QAM	21.45	139.66		
			256QAM	19.99	99.77		
		5	QPSK	23.78	239.01	22.97	198.15
			16QAM	22.45	175.99	20.85	121.62
			64QAM	21.31	135.17		
			256QAM	19.93	98.35		
		3	QPSK	24.02	252.13	22.94	196.79
			16QAM	22.30	169.91	20.78	119.67
			64QAM	21.39	137.74		
			256QAM	19.88	97.27		
		1.4	QPSK	24.07	254.98	23.01	199.99
			16QAM	22.48	177.05	20.93	123.88
			64QAM	21.66	146.72		
			256QAM	20.00	99.89		

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	24.70	294.87		
				QPSK	24.62	289.90	18.52	71.12
				16QAM	23.43	220.42	17.36	54.45
				64QAM	21.90	154.95		
				256QAM	19.95	98.76		
	831.5~841.5	15	DFT-s OFDM	QPSK	22.92	196.09		
				$\pi/2$ BPSK	24.56	285.91		
				QPSK	24.55	284.87	19.02	79.80
				16QAM	23.47	222.24	18.04	63.68
				64QAM	21.88	154.21		
				256QAM	19.89	97.53		
	829~844	10	DFT-s OFDM	QPSK	22.93	196.12		
				$\pi/2$ BPSK	24.73	297.45		
				QPSK	24.63	290.13	19.07	80.72
				16QAM	23.50	223.74	18.05	63.83
				64QAM	21.96	157.18		
	826.5~846.5	5	DFT-s OFDM	256QAM	20.01	100.23		
				QPSK	22.99	198.93		
				$\pi/2$ BPSK	24.58	287.11		
				QPSK	24.58	287.32	18.95	78.52
				16QAM	23.58	227.89	17.54	56.75
				64QAM	22.08	161.61		
				256QAM	20.10	102.36		
			CP-OFDM	QPSK	23.09	203.53		

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	π/2 BPSK	24.14	259.42		
				QPSK	24.10	257.04	24.09	256.45
				16QAM	23.04	201.37	22.85	192.75
				64QAM	21.92	155.60		
				256QAM	19.81	95.72		
			CP-OFDM	QPSK	22.61	182.39		
	1717.5~1772.5	15	DFT-s OFDM	π/2 BPSK	24.01	251.87		
				QPSK	23.99	250.83	24.02	252.35
				16QAM	23.17	207.49	22.74	187.93
				64QAM	21.58	143.88		
				256QAM	19.52	89.54		
			CP-OFDM	QPSK	22.43	174.98		
	1715.0~1775.0	10	DFT-s OFDM	π/2 BPSK	24.11	257.67		
				QPSK	24.15	260.15	24.21	263.63
				16QAM	22.86	193.20	22.90	194.98
				64QAM	21.59	144.21		
				256QAM	19.73	93.97		
			CP-OFDM	QPSK	22.61	182.39		
	1712.5~1777.5	5	DFT-s OFDM	π/2 BPSK	23.98	249.76		
				QPSK	24.03	253.16	24.13	258.82
				16QAM	22.95	197.24	22.86	193.20
				64QAM	21.81	151.71		
				256QAM	19.72	93.76		
			CP-OFDM	QPSK	22.56	180.30		

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	-2.3
WCDMA Band 4 / LTE Band 4 / LTE Band 66 / NR Band 66 1710 ~ 1780 MHz	-2.0
GSM850 / WCDMA Band 5 / LTE Band 5 / LTE Band 26 / NR Band 5 814 ~ 849 MHz	-3.5
LTE Band 12 / LTE Band 17 699 ~ 716 MHz	-3.8
LTE Band 13 777 ~ 787 MHz	-3.3
LTE Band 41 2496 ~ 2690 MHz	-3.3

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

LTE Band 41 FCC were tested on HPUE mode since it is high power.(Power class 2)

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	700.5	3	1	0
	707.5		1	14
	714.5		1	8
13	779.5	5	1	24
	782		1	12
	784.5		1	24
25	1851.5	3	1	0
	1882.5		1	0
	1913.5		1	0
26 (Part 90)	814.7	1.4	1	5
	823.3		1	5
26 (Straddle)	824	1.4	1	0
26 (Part 22)	824.7	1.4	1	0
	831.5		1	0
	848.3		1	0
41 (PC2)	2498.5	5	1	0
	2593		1	12
	2687.5		1	0
66	1720	20	1	0
	1745		1	0
	1770		1	0

NR Band	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	829.0	10	1	26
	836.5		1	26
	844.0		1	26
66	1715.0	10	1	50
	1745.0		1	1
	1775.0		1	1

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

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

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

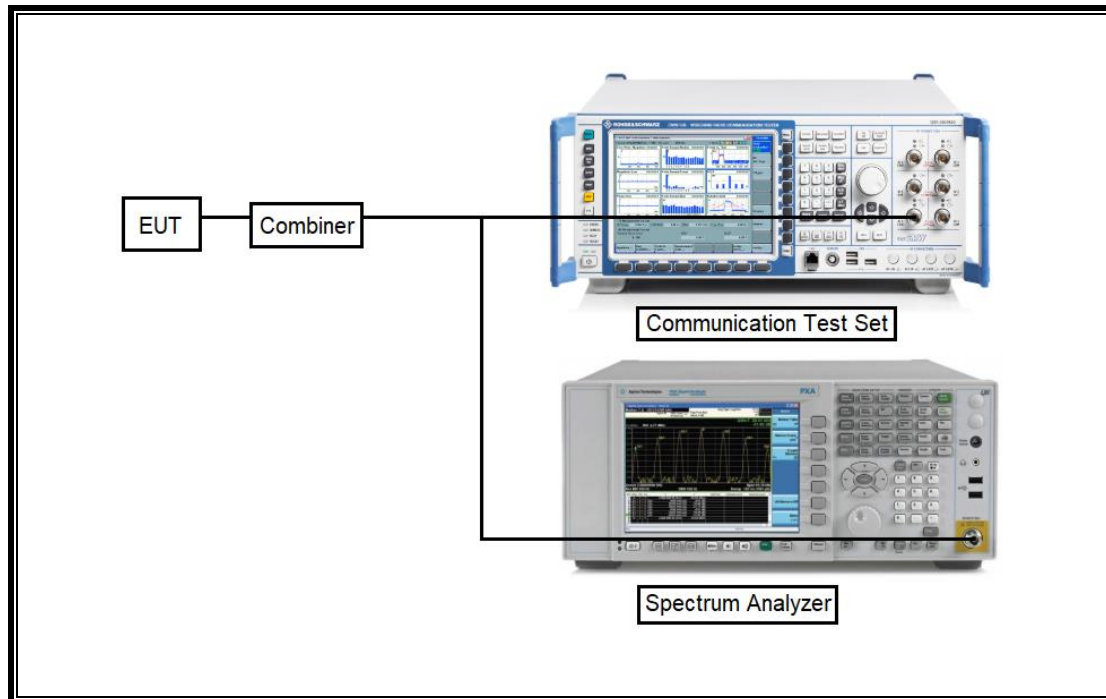
I/O CABLE

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

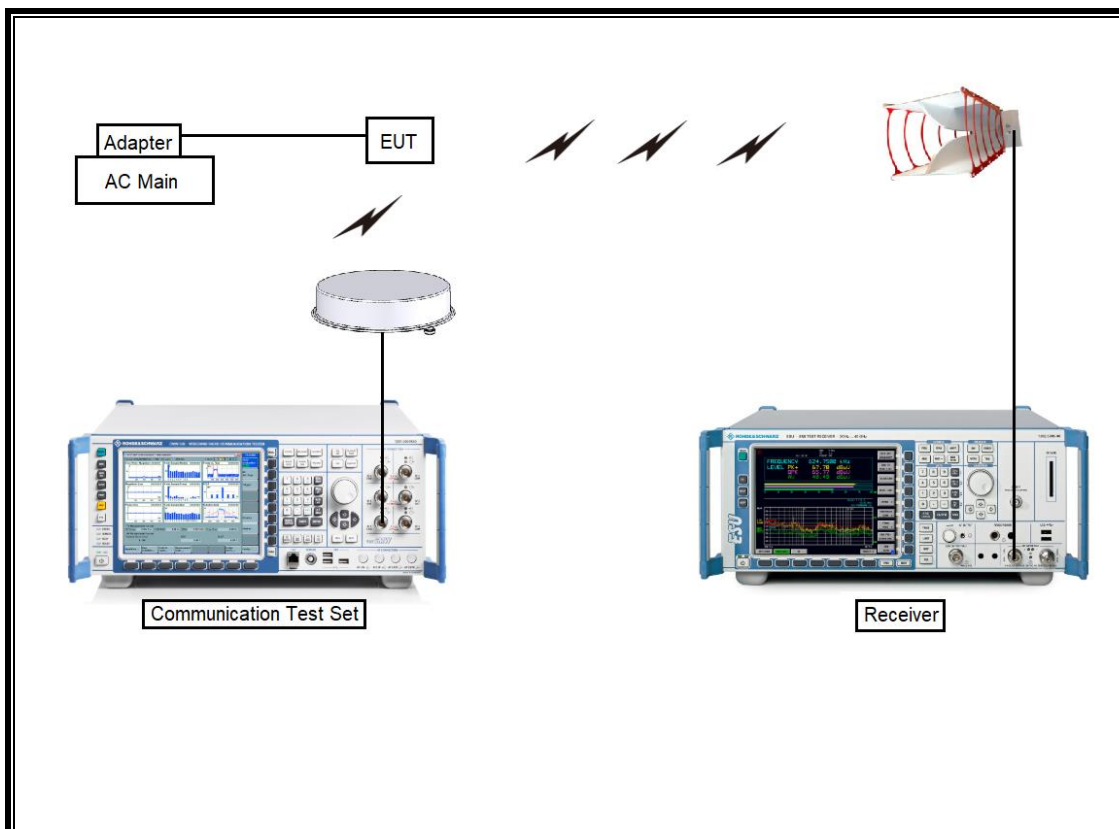
TEST SETUP

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	Radiated	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

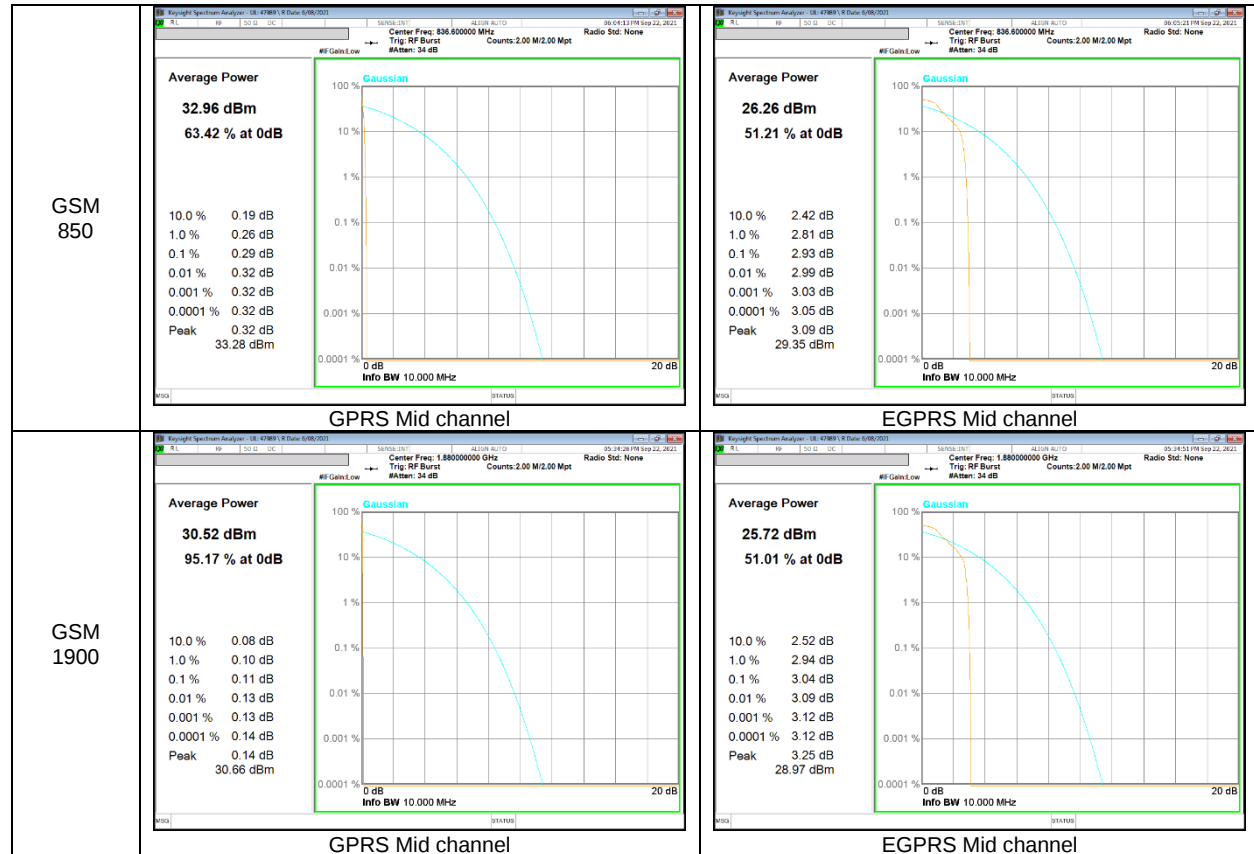
5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) and modulations (QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

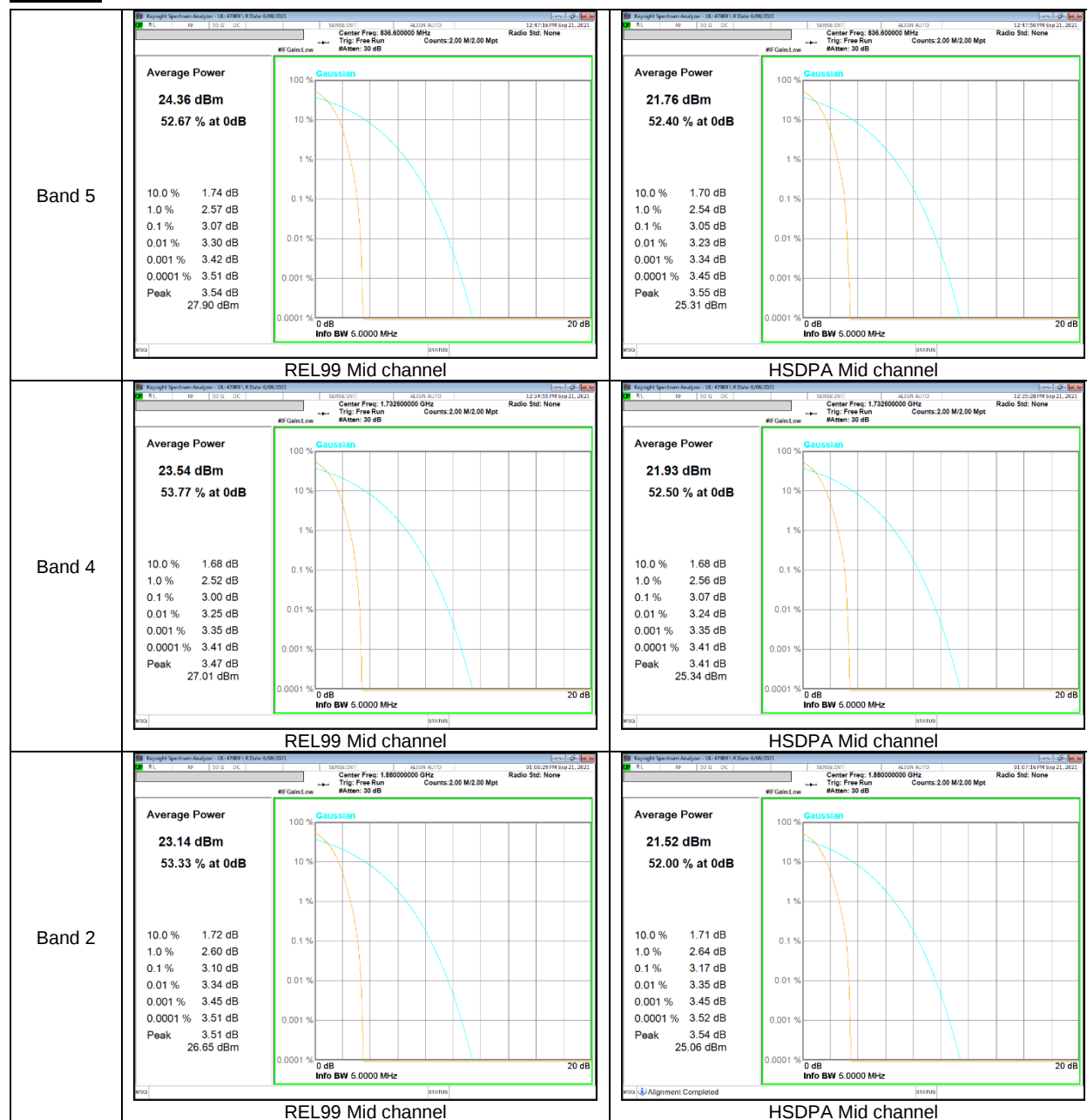
See the following pages.

8.1. CONDUCTED PEAK TO AVERAGE RESULT

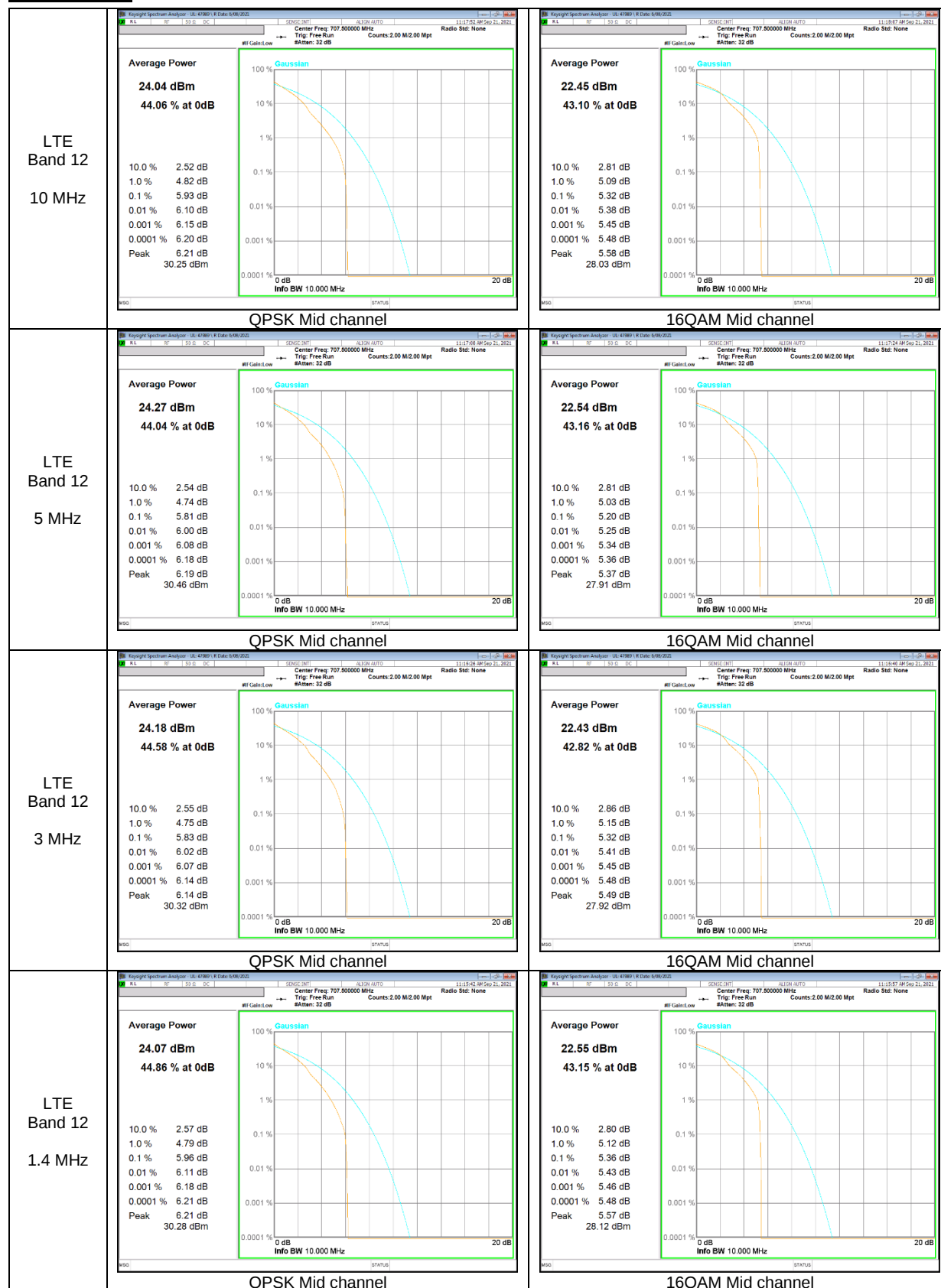
GSM



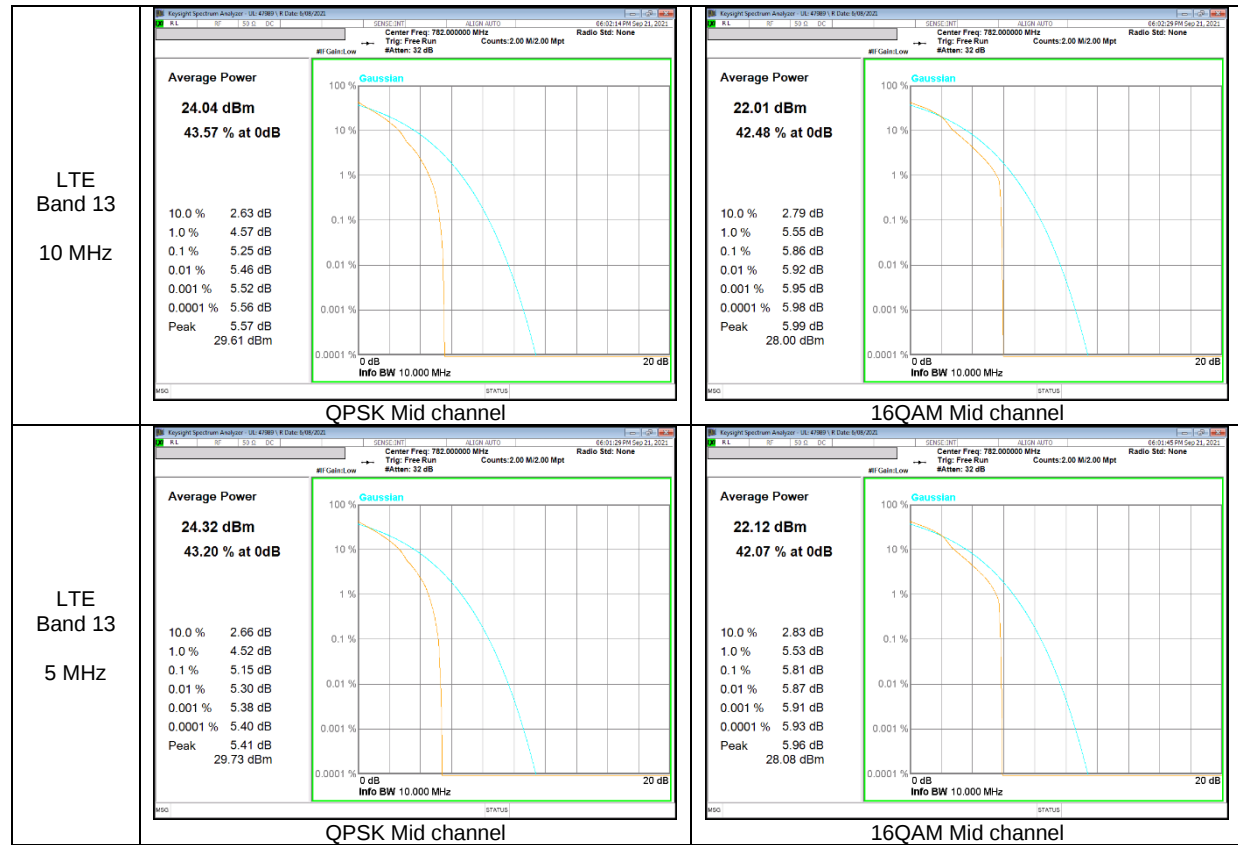
WCDMA



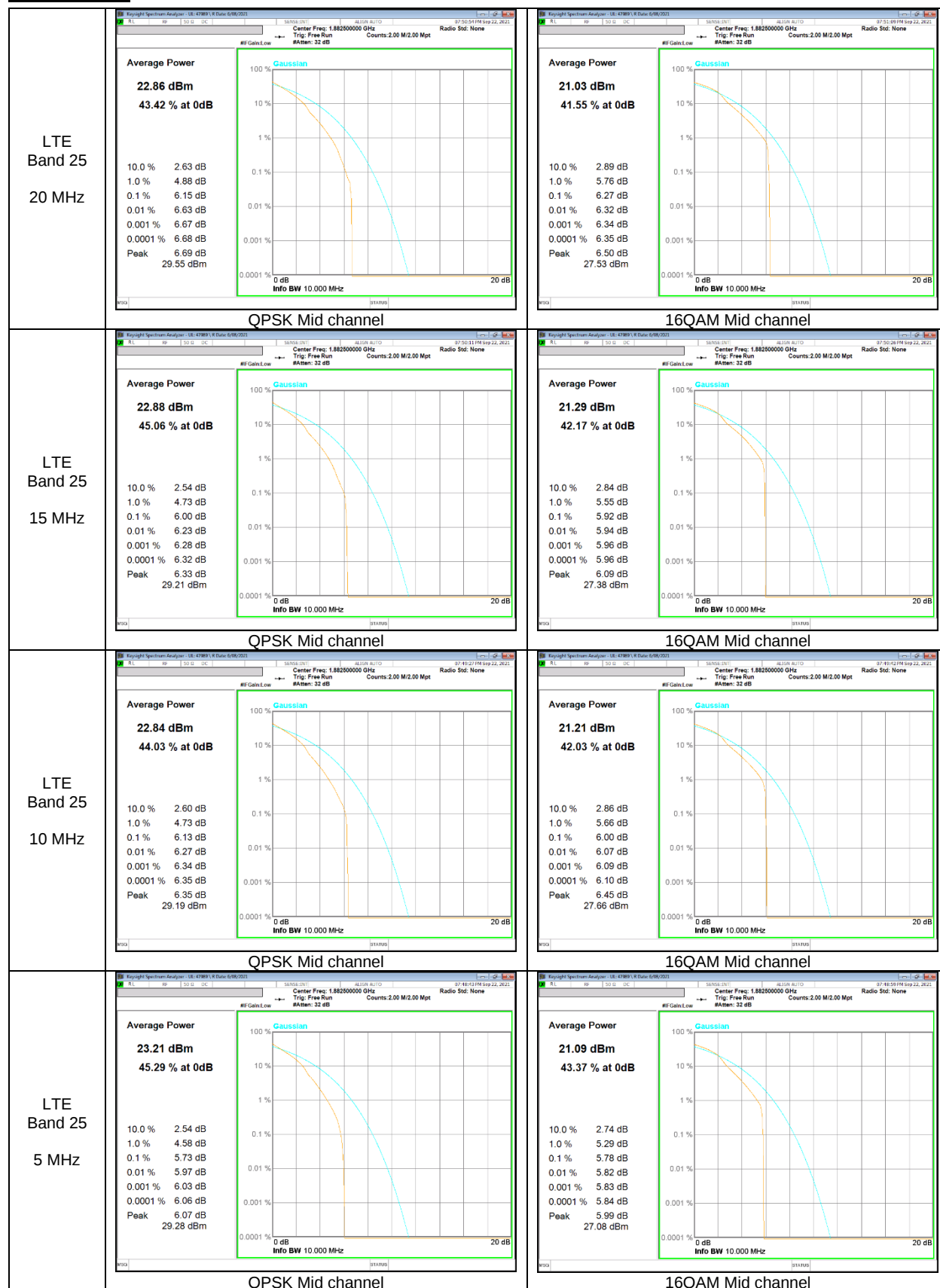
LTE Band 12

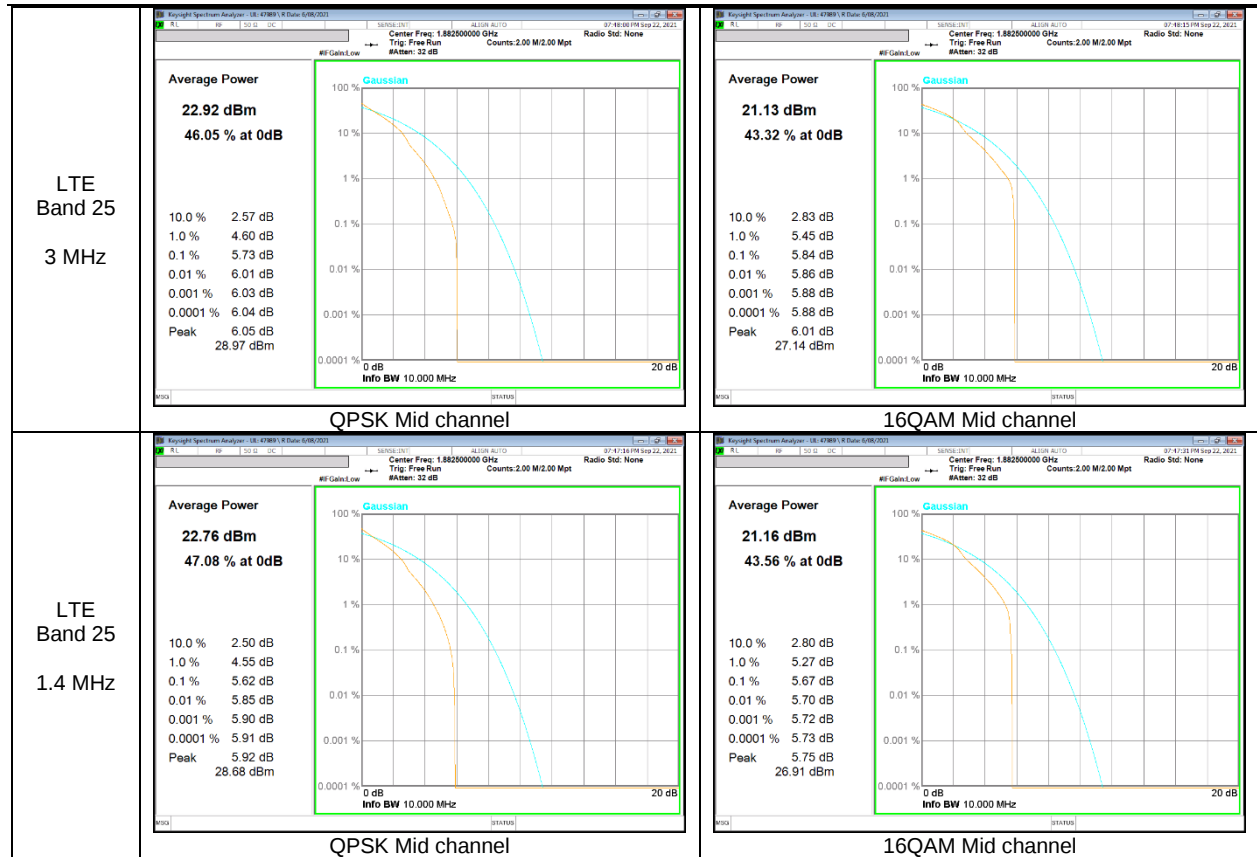


LTE Band 13

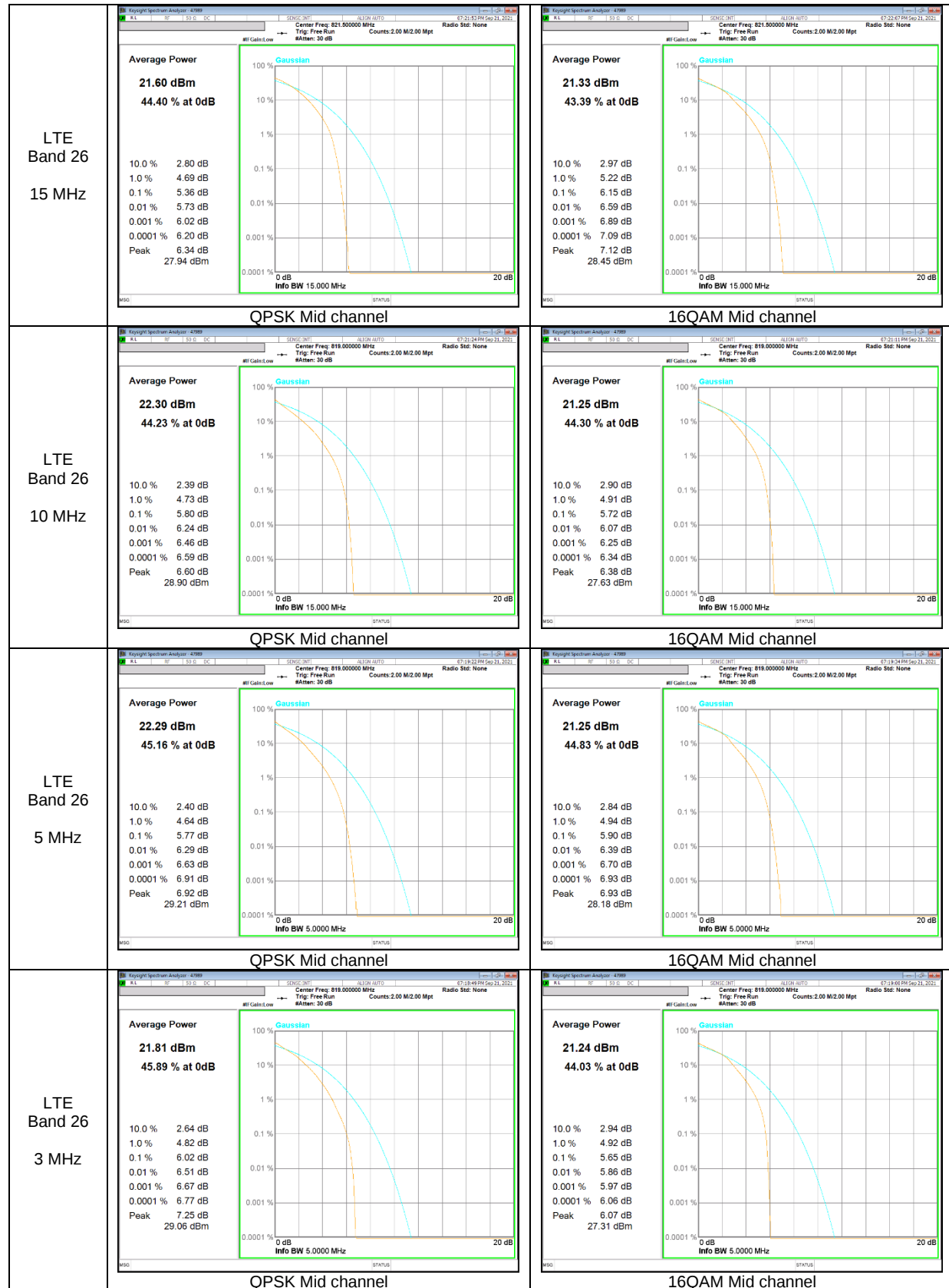


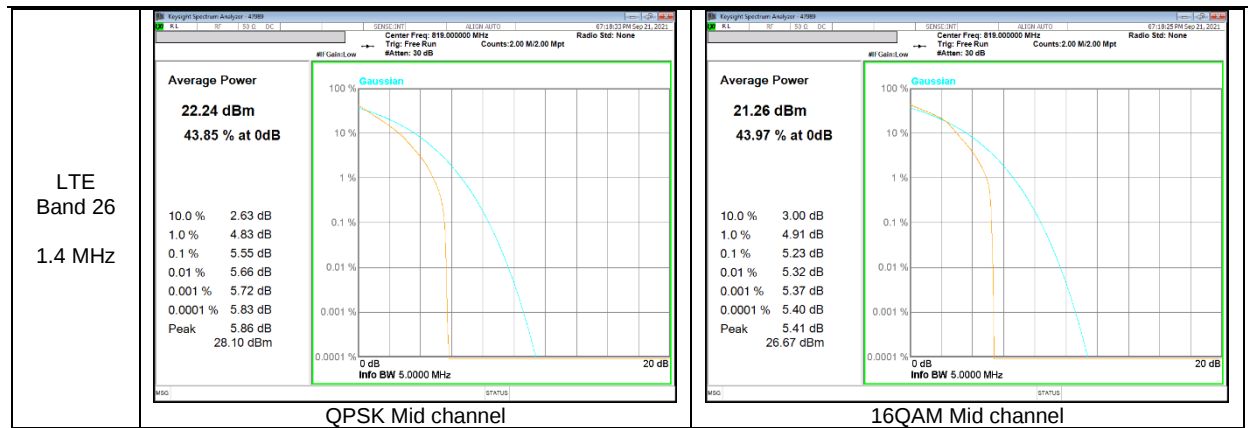
LTE Band 25



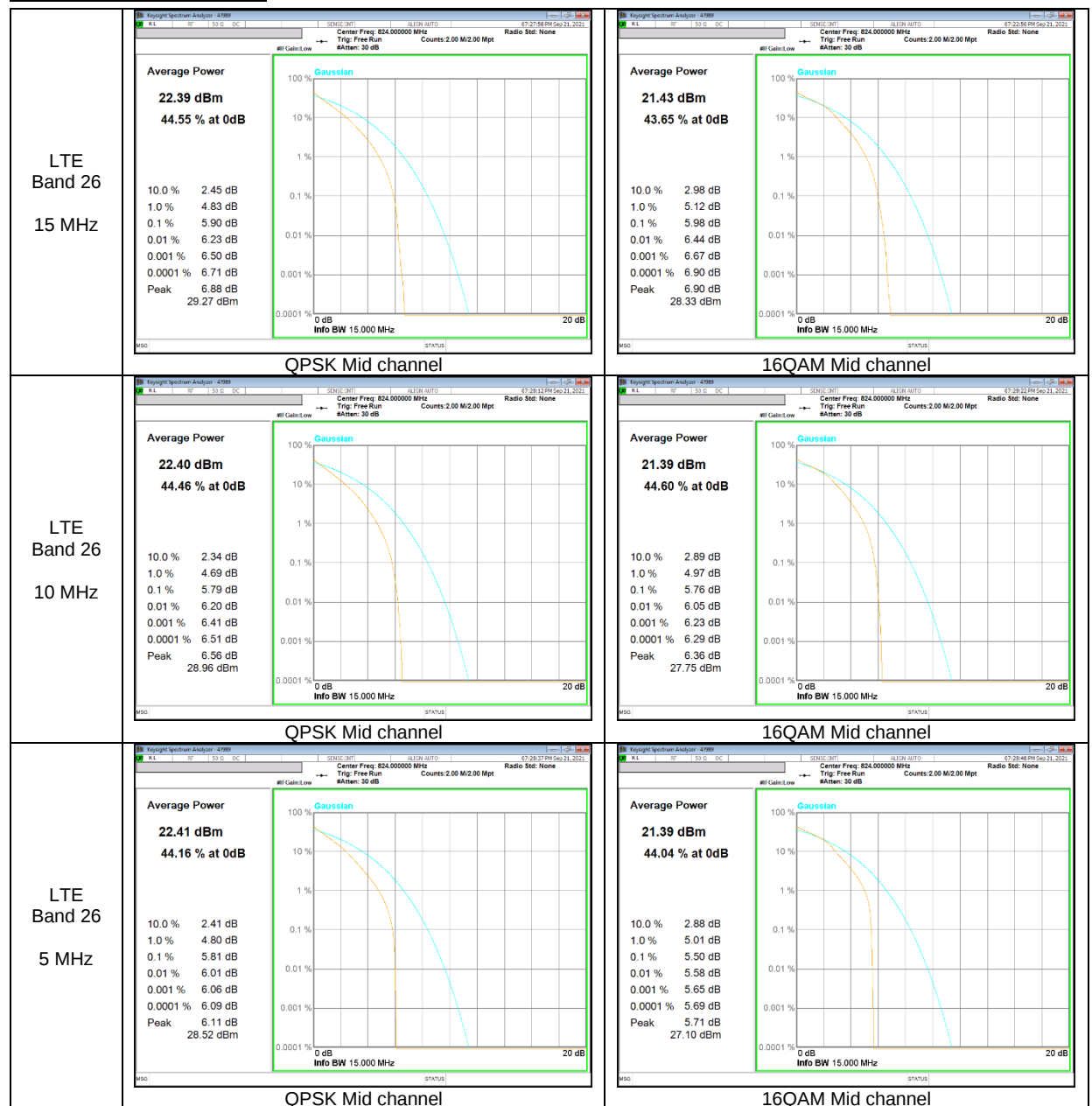


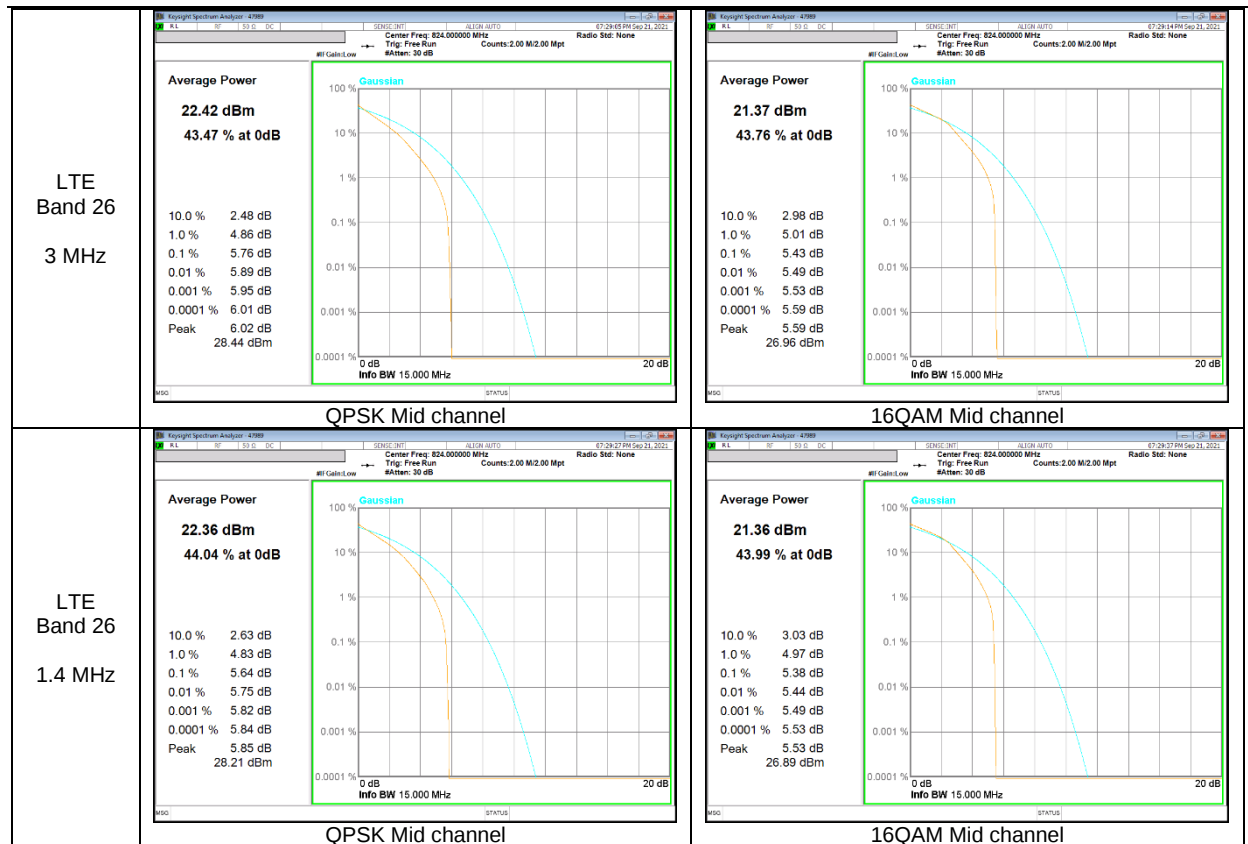
LTE Band 26 (Part 90)



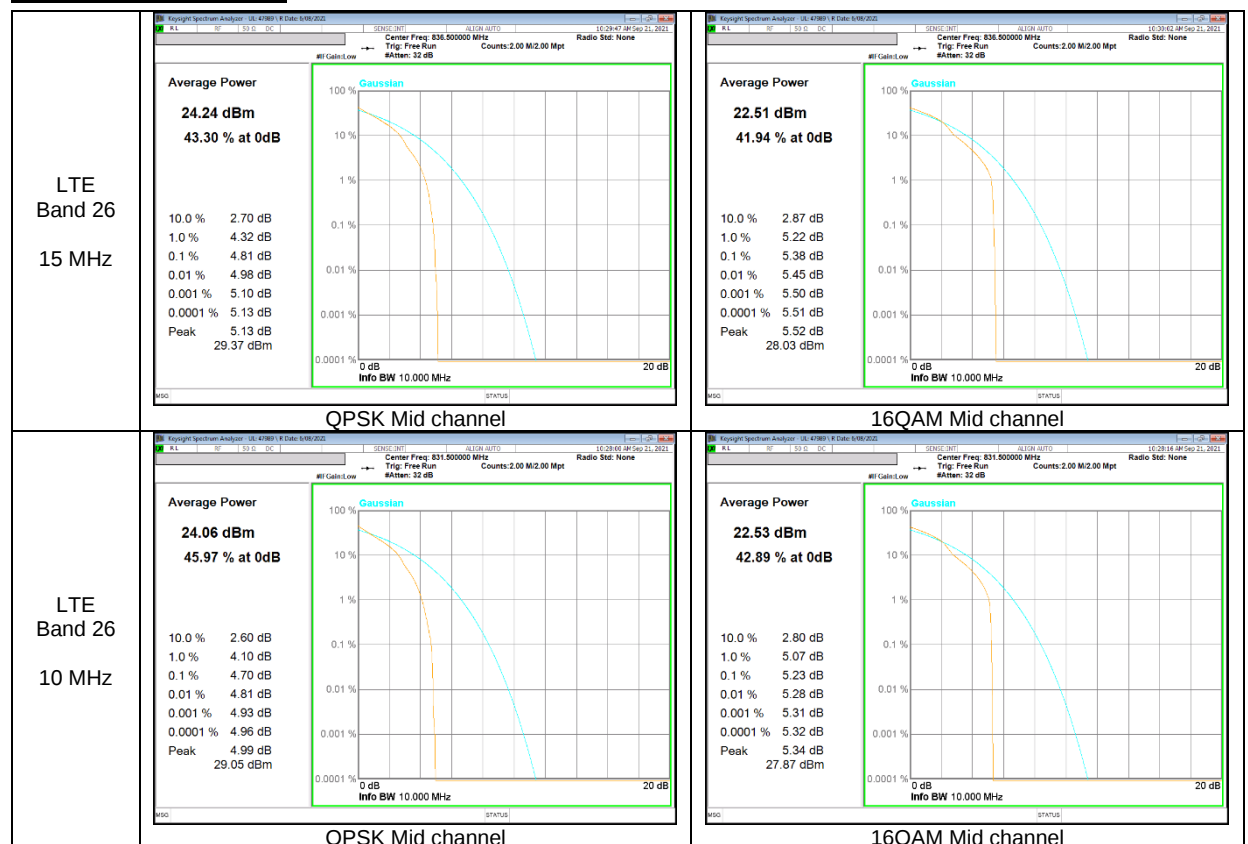


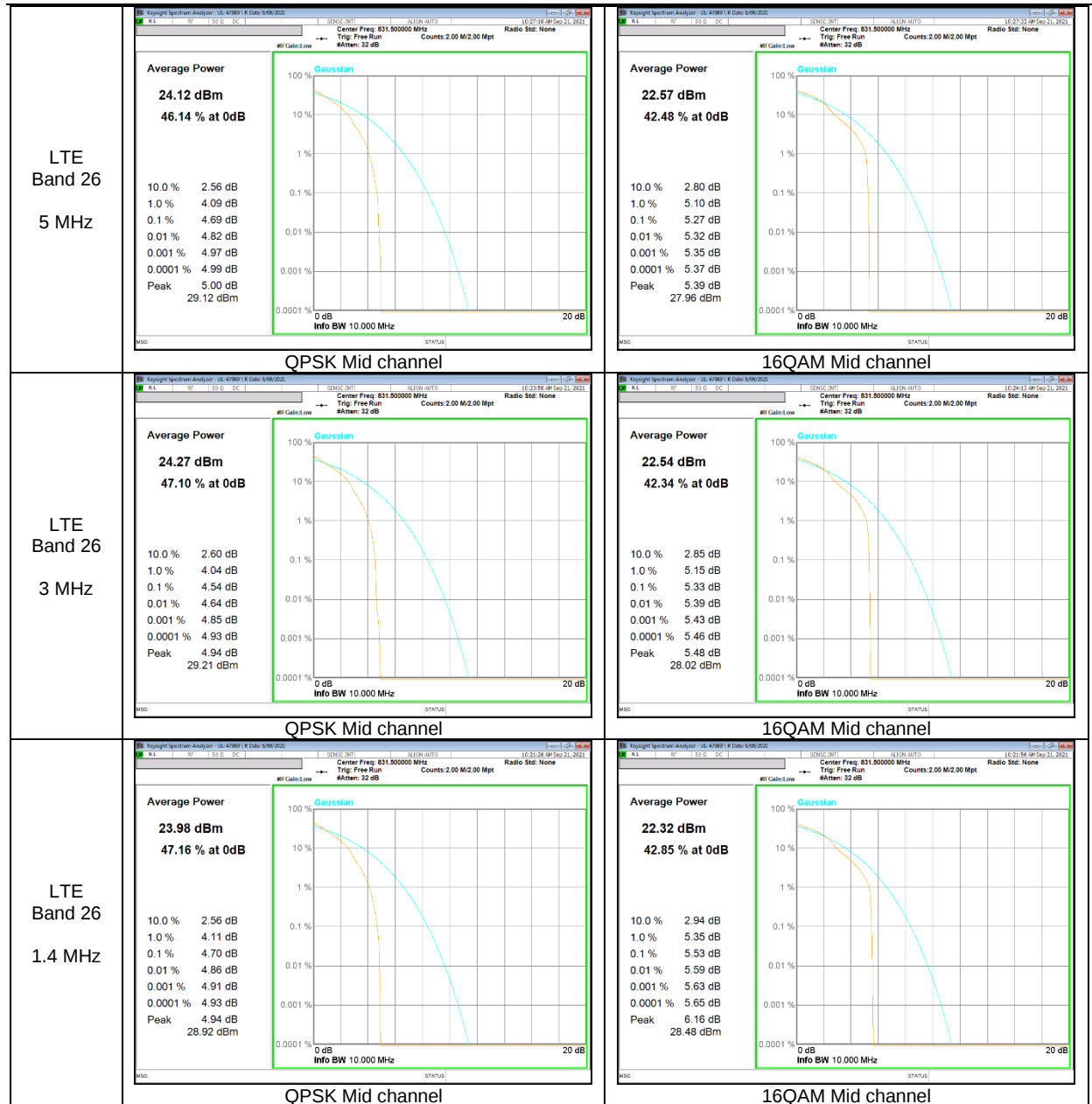
LTE Band 26 (Straddle)

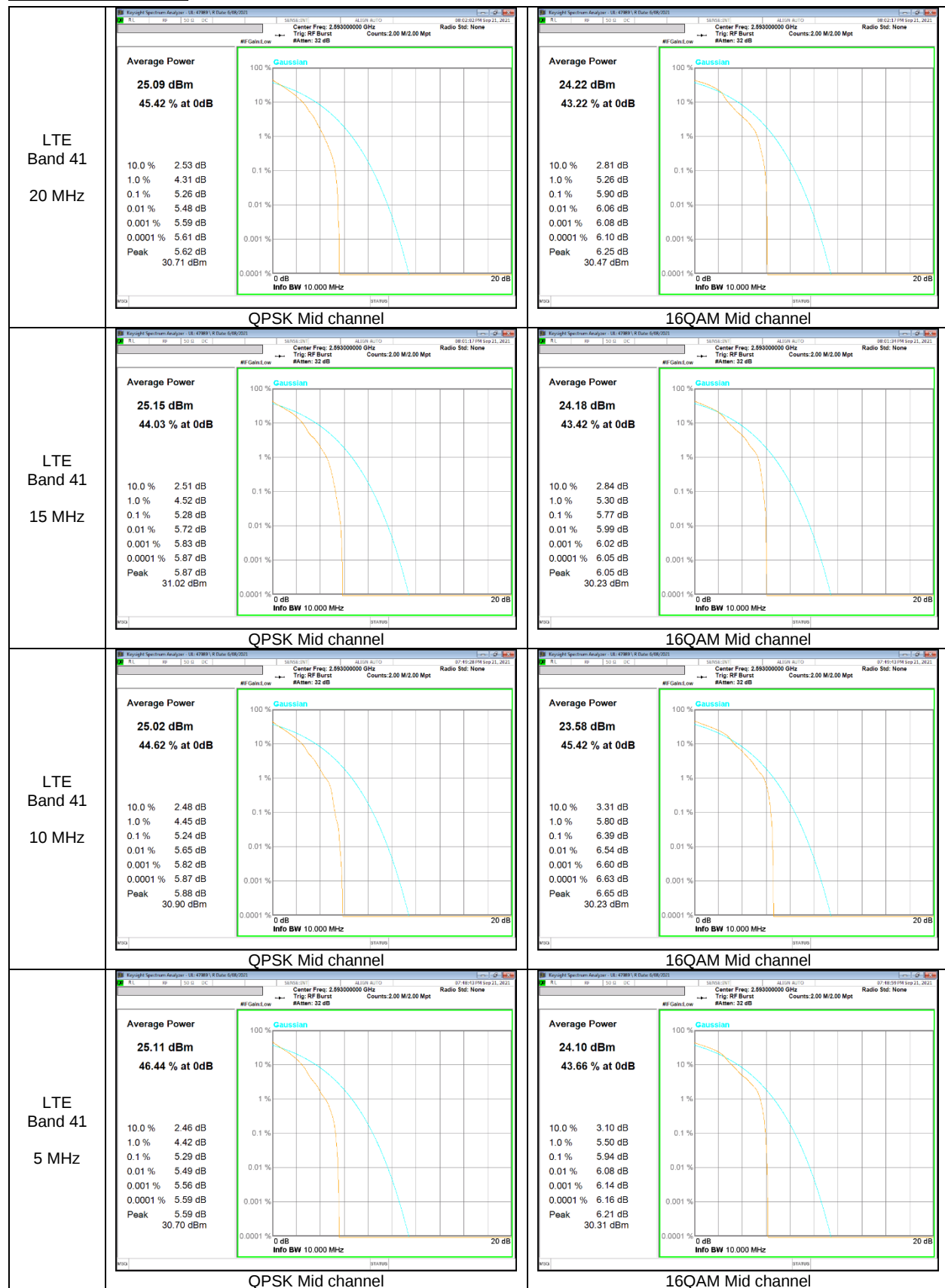




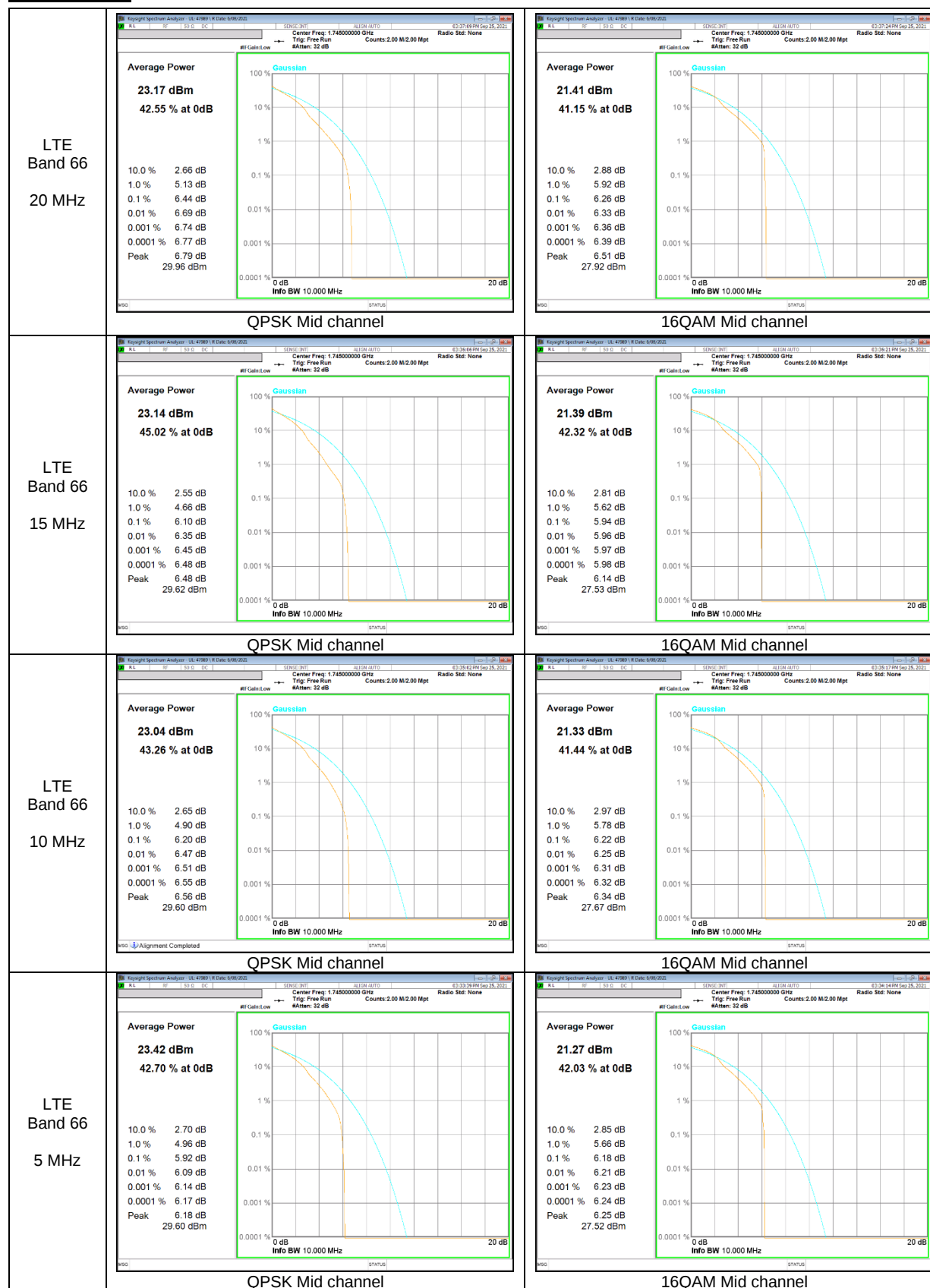
LTE Band 26 (Part 22)

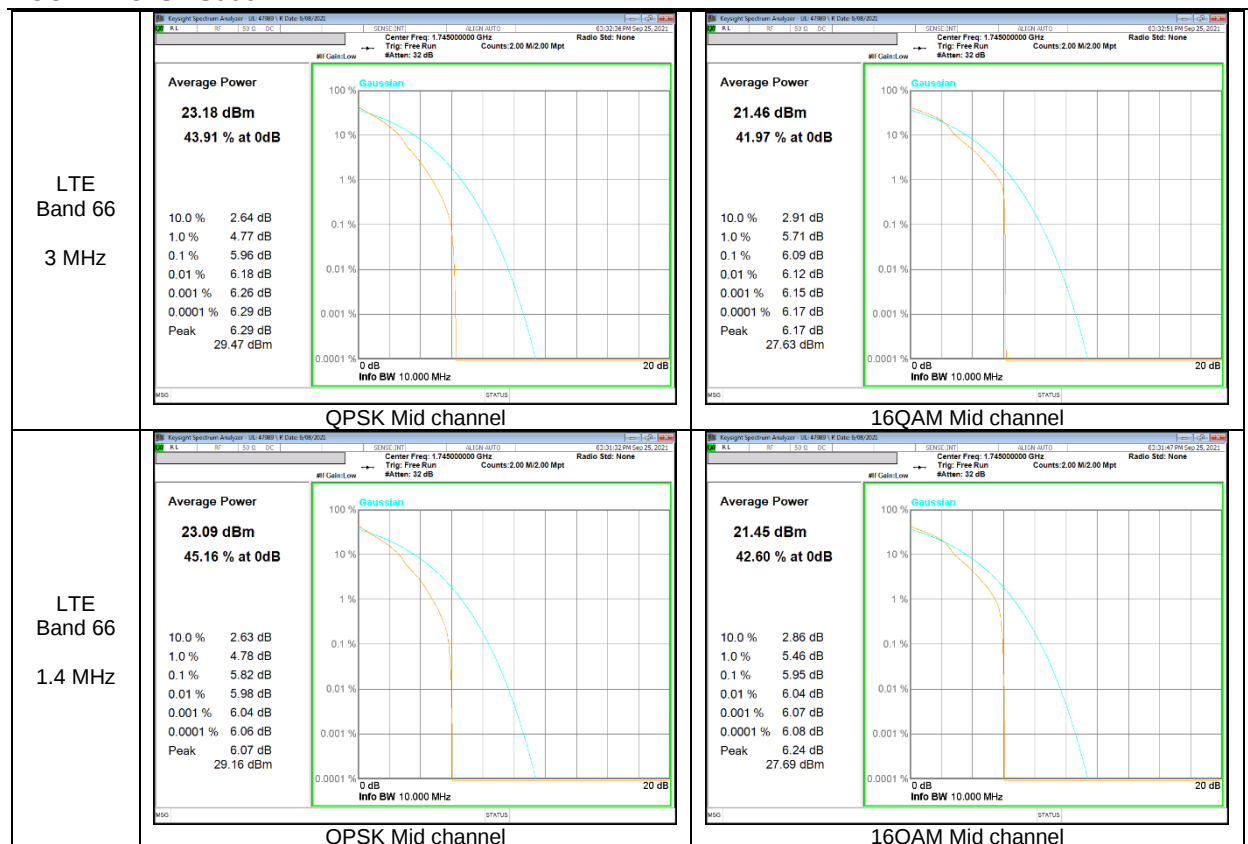




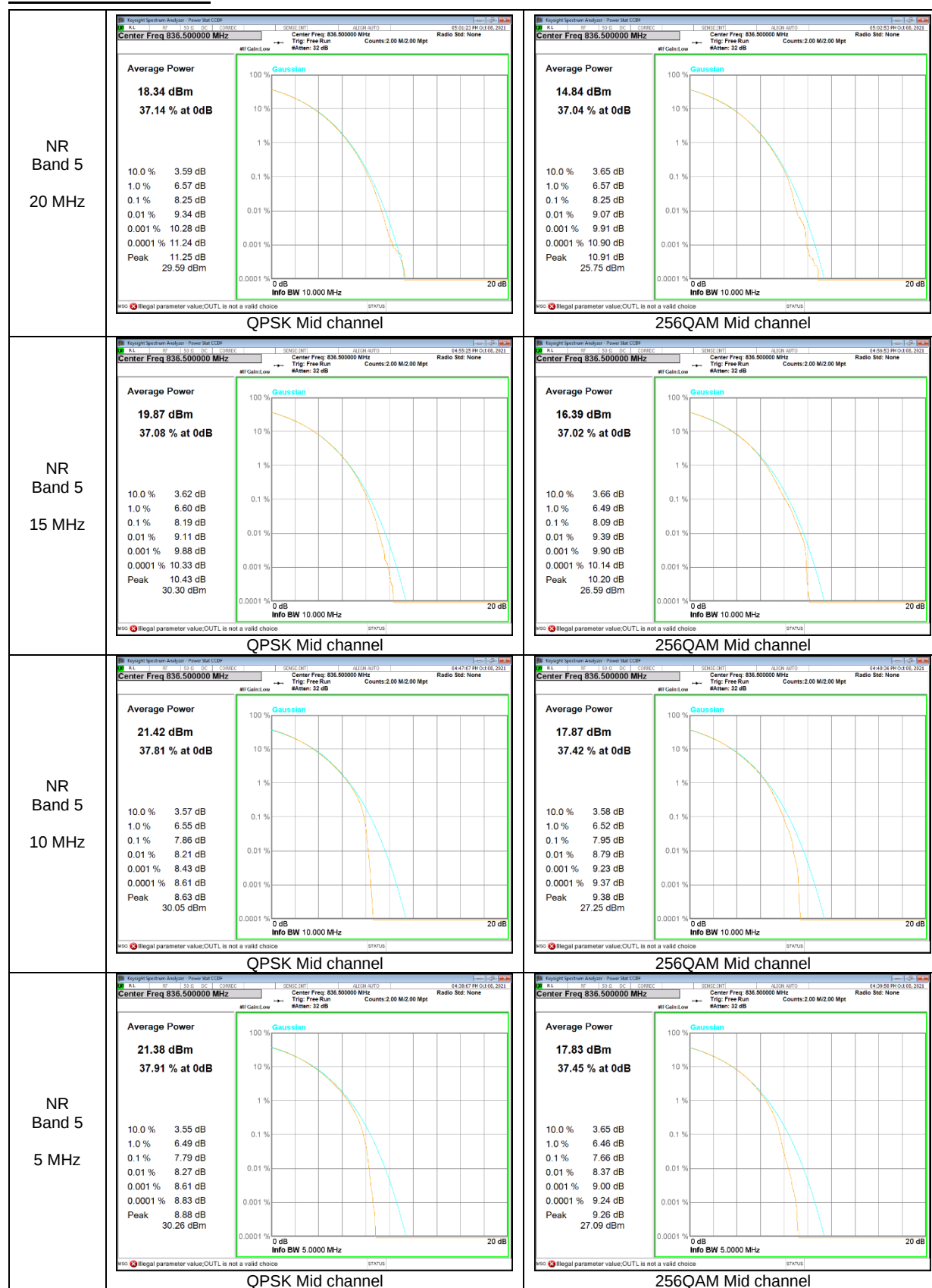
LTE Band 41 (PC2)

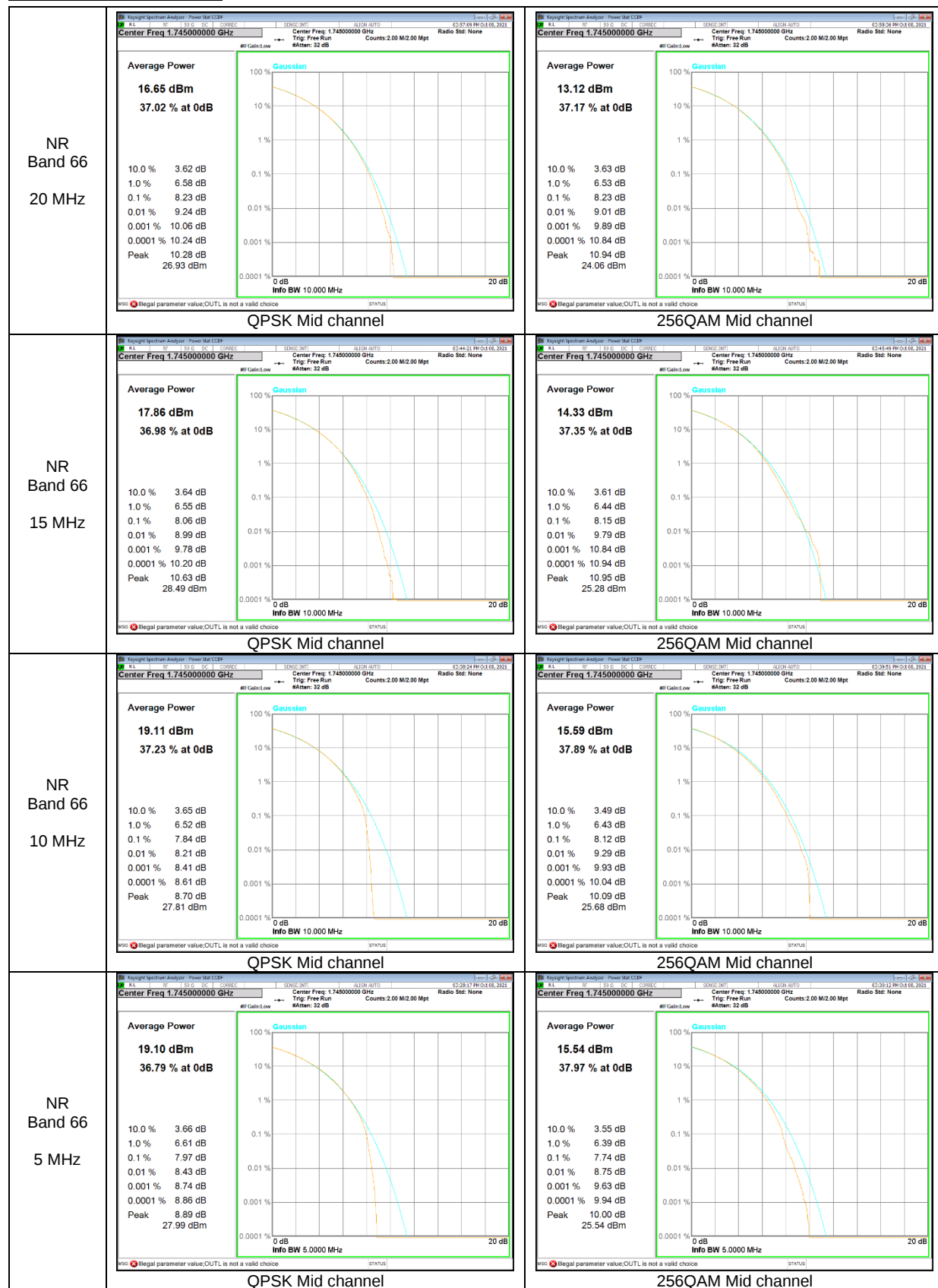
LTE Band 66





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	240.98	318.6
	EGPRS		253.39	324.4
1900	GPRS	1880.0	241.46	316.9
	EGPRS		248.68	313.1

- WCDMA

Band	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
B5	Rel.99	836.6	4.176	4.704
	HSDPA		4.182	4.704
B4	Rel.99	1732.6	4.164	4.702
	HSDPA		4.172	4.702
B2	Rel.99	1880.0	4.173	4.690
	HSDPA		4.172	5.412

- LTE Band 12

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B12	10M	QPSK	707.5	8.981	10.170
		16QAM		8.986	10.320
	5M	QPSK	707.5	4.505	5.276
		16QAM		4.498	5.221
	3M	QPSK	707.5	2.706	3.128
		16QAM		2.699	3.055
	1.4M	QPSK	707.5	1.087	1.288
		16QAM		1.091	1.362

- LTE Band 13

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B13	10M	QPSK	782.0	8.971	10.180
		16QAM		8.956	10.010
	5M	QPSK	782.0	4.499	5.302
		16QAM		4.499	5.205

- LTE Band 25

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B25	20M	QPSK	1882.5	17.916	19.820
		16QAM		17.916	19.590
	15M	QPSK	1882.5	13.431	15.010
		16QAM		13.407	15.140
	10M	QPSK	1882.5	8.995	10.380
		16QAM		8.964	10.460
	5M	QPSK	1882.5	4.501	5.252
		16QAM		4.489	5.216
	3M	QPSK	1882.5	2.696	3.054
		16QAM		2.699	3.094
	1.4M	QPSK	1882.5	1.083	1.302
		16QAM		1.086	1.295

- LTE Band 26 (Part 90)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26 Part(90)	15M	QPSK	821.5	13.421	15.110
		16QAM		13.445	15.160
	10M	QPSK	819.0	8.991	10.100
		16QAM		8.991	10.270
	5M	QPSK	819.0	4.493	5.216
		16QAM		4.502	5.171
	3M	QPSK	819.0	2.703	3.112
		16QAM		2.692	3.033
	1.4M	QPSK	819.0	1.091	1.286
		16QAM		1.086	1.291

- LTE Band 26 (Straddle)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26 (Straddle)	15M	QPSK	824.0	13.429	15.070
		16QAM		13.418	15.080
	10M	QPSK	824.0	8.954	10.420
		16QAM		8.959	10.260
	5M	QPSK	824.0	4.504	5.244
		16QAM		4.499	5.329
	3M	QPSK	824.0	2.700	3.074
		16QAM		2.701	3.074
	1.4M	QPSK	824.0	1.091	1.307
		16QAM		1.084	1.298

- LTE Band 26 (Part 22)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26 (Part 22)	15M	QPSK	836.5	13.445	15.100
		16QAM		13.446	14.980
	10M	QPSK	831.5	8.982	10.210
		16QAM		8.967	10.330
	5M	QPSK	831.5	4.498	5.358
		16QAM		4.505	5.261
	3M	QPSK	831.5	2.706	3.113
		16QAM		2.700	3.088
	1.4M	QPSK	831.5	1.086	1.283
		16QAM		1.080	1.199

- LTE Band 41

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B41	20M	QPSK	2593.0	17.922	19.610
		16QAM		17.895	19.740
	15M	QPSK	2593.0	13.407	14.990
		16QAM		13.414	14.830
	10M	QPSK	2593.0	8.962	10.210
		16QAM		8.974	10.110
	5M	QPSK	2593.0	4.497	5.316
		16QAM		4.476	5.220

- LTE Band 66

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B66	20M	QPSK	1745.0	17.920	19.760
		16QAM		17.921	19.740
	15M	QPSK	1745.0	13.414	15.150
		16QAM		13.440	15.290
	10M	QPSK	1745.0	8.963	10.210
		16QAM		8.989	10.290
	5M	QPSK	1745.0	4.506	5.258
		16QAM		4.502	5.187
	3M	QPSK	1745.0	2.705	3.078
		16QAM		2.700	3.101
	1.4M	QPSK	1745.0	1.090	1.312
		16QAM		1.090	1.302

- NR Band 5 CP-OFDM

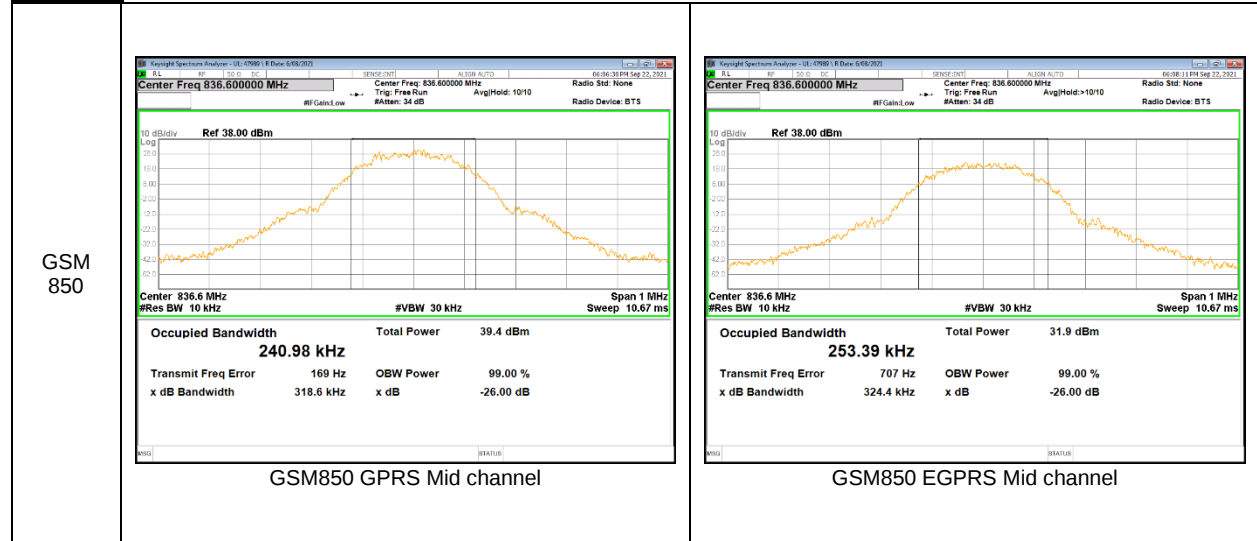
Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n5	20M	QPSK	836.5	18.930	20.640
		16QAM		18.978	20.390
	15M	QPSK	836.5	14.128	15.230
		16QAM		14.147	15.060
	10M	QPSK	836.5	9.349	10.230
		16QAM		9.316	10.240
	5M	QPSK	836.5	4.493	5.346
		16QAM		4.494	5.294

- NR Band 66 CP-OFDM

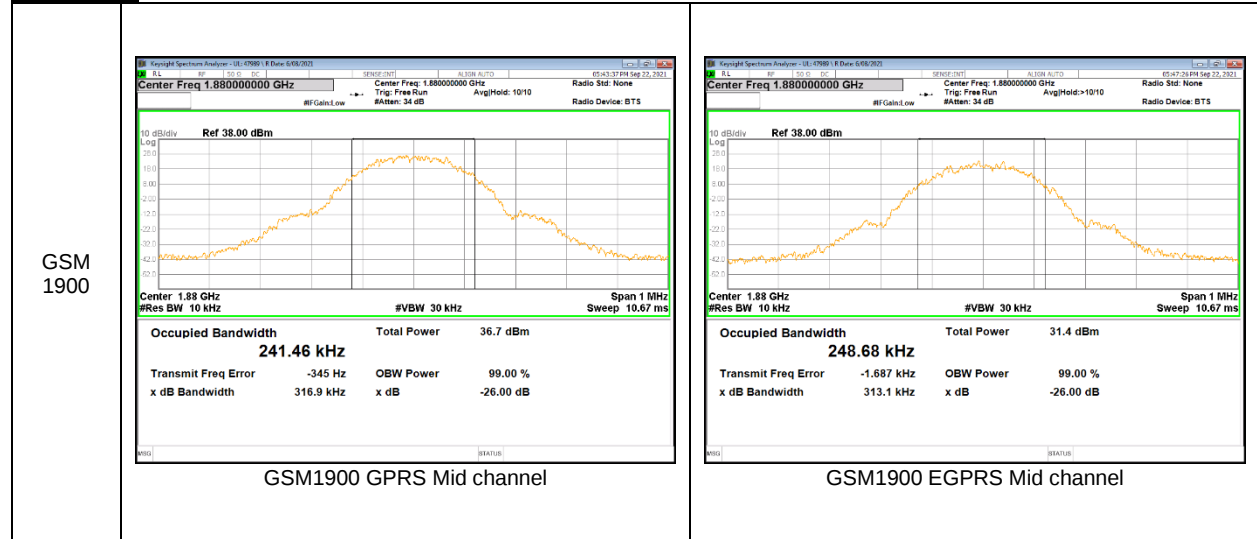
Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n66	20M	QPSK	1745.0	18.900	20.130
		16QAM		18.875	19.900
	15M	QPSK	1745.0	14.101	15.080
		16QAM		14.073	14.900
	10M	QPSK	1745.0	9.310	10.220
		16QAM		9.325	10.150
	5M	QPSK	1745.0	4.491	5.359
		16QAM		4.479	5.226

9.1.1. OCCUPIED BANDWIDTH RESULTS

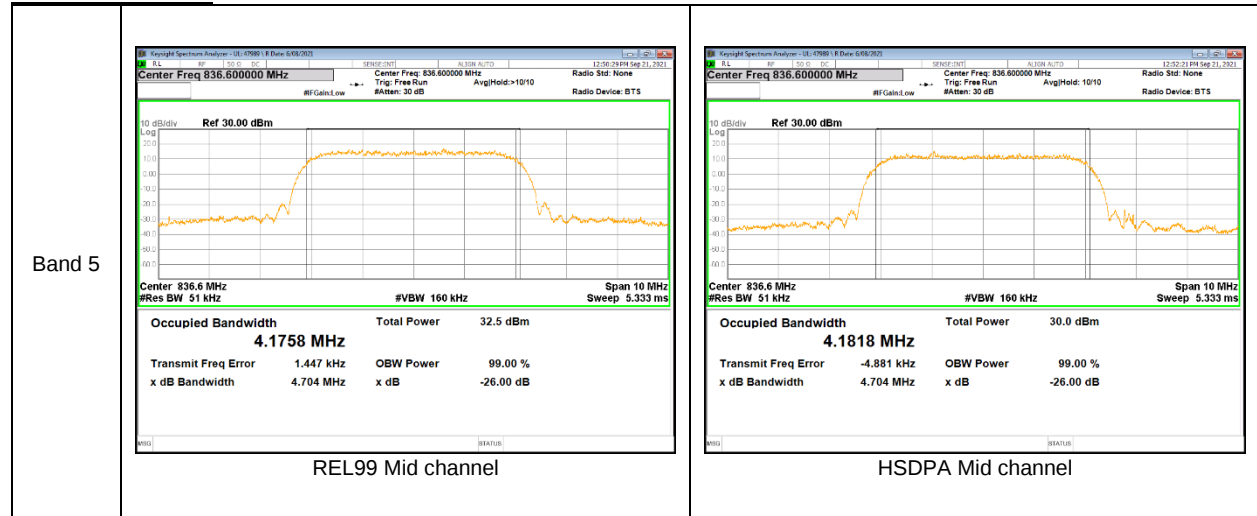
GSM 850



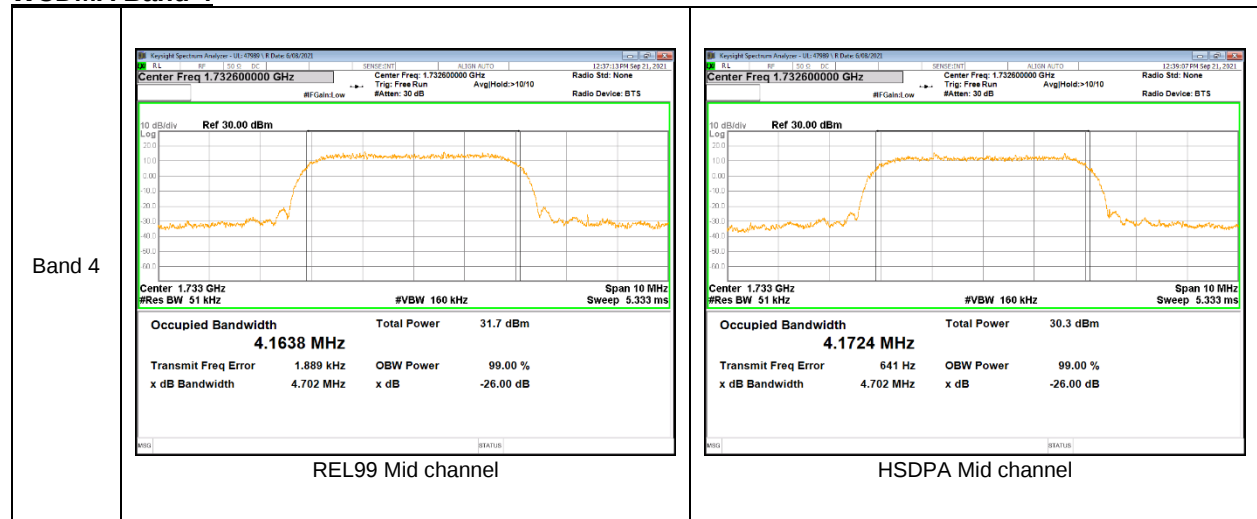
GSM 1900



WCDMA Band 5



WCDMA Band 4



WCDMA Band 2

