CERTIFICATION TEST REPORT

Report Number. : 4790406778-E2V3

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

Model : SM-A236B/DSN

FCC ID : A3LSMA236BN

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

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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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

IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

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V1	2022-06-29	Initial issue	Yeonhee Lim
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac and NFC.
MODEL NUMBER:	SM-A236B/DSN
SERIAL NUMBER:	R3CT506P9TT (CONDUCTED); R3CT506PDCD, R3CT506PCLJ, R3CT506PDAY (RADIATED);
DATE TESTED:	2022-06-15 ~ 2022-06-30;

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 22H, 24E, 27H,L,F,M 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:

Seokhwan Hong
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Yeonhee Lim
Suwon Lab Engineer
UL Korea, Ltd.

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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(3m semi-anechoic chamber)
☒ Chamber 2(3m semi-anechoic chamber)
☐ Chamber 3(3m semi-anechoic chamber)
☒ Chamber 4(3m Full-anechoic chamber)
☐ 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.

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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 = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – 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.

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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 and NFC.
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.
(4790406778-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	**32.09**	**1618.08**	**28.79**	**756.83**
		EGPRS	27.40	549.54	25.92	390.84
GSM1900	1850~1910	GPRS	**30.02**	**1004.62**	**30.79**	**1199.50**
		EGPRS	26.00	398.11	28.93	781.63

WCDMA

FCC Part 22/24/27						
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	824~849	Rel. 99	**24.40**	**275.42**	**19.33**	**85.70**
		HSDPA	23.41	219.28	18.36	68.55
Band 4	1710~1755	Rel. 99	**23.69**	**233.88**	**23.66**	**232.27**
		HSDPA	22.70	186.21	22.74	187.93
Band 2	1850~1910	Rel. 99	**23.43**	**220.29**	**24.33**	**270.99**
		HSDPA	22.42	174.58	23.05	201.81

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LTE Band 2(Main Ant)

FCC Part 24							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 2	1860.0 -1900.0	20	QPSK	24.18	261.82	24.30	269.15
			16QAM	23.74	236.59	23.16	207.01
			64QAM	22.48	177.01		
			256QAM	19.37	86.50		
	1857.5 - 1902.5	15	QPSK	24.55	285.10	24.22	264.24
			16QAM	23.91	246.04	23.35	216.27
			64QAM	23.07	202.77		
			256QAM	20.01	100.23		
	1855.0 - 1905.0	10	QPSK	24.64	291.07	24.16	260.62
			16QAM	23.70	234.42	23.61	229.61
			64QAM	22.93	196.34		
			256QAM	20.16	103.75		
	1852.5 - 1907.5	5	QPSK	24.64	291.07	**24.39**	**274.79**
			16QAM	23.85	242.66	23.73	236.05
			64QAM	22.97	198.15		
			256QAM	19.81	95.72		
	1851.5 - 1908.5	3	QPSK	**24.67**	**293.09**	24.35	272.27
			16QAM	23.73	236.05	23.53	225.42
			64QAM	23.06	202.30		
			256QAM	20.01	100.23		
	1850.7 - 1909.3	1.4	QPSK	24.57	286.42	24.19	262.42
			16QAM	24.06	254.68	23.61	229.61
			64QAM	23.00	199.53		
			256QAM	19.84	96.38		

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LTE Band 2(Sub Ant)

FCC Part 24							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 2	1860.0 -1900.0	20	QPSK	**19.63**	**91.83**	**19.43**	**87.70**
			16QAM	19.19	82.99	18.45	69.98
			64QAM	18.04	63.68		
			256QAM	14.86	30.62		
	1857.5 - 1902.5	15	QPSK	19.51	89.33		
			16QAM	18.99	79.25		
			64QAM	17.92	61.94		
			256QAM	14.74	29.79		
	1855.0 - 1905.0	10	QPSK	19.53	89.74		
			16QAM	18.98	79.07		
			64QAM	17.96	62.52		
			256QAM	14.81	30.27		
	1852.5 - 1907.5	5	QPSK	19.62	91.62		
			16QAM	18.99	79.25		
			64QAM	18.00	63.10		
			256QAM	14.84	30.48		
	1851.5 - 1908.5	3	QPSK	19.43	87.70		
			16QAM	18.91	77.80		
			64QAM	17.85	60.95		
			256QAM	14.70	29.51		
	1850.7 - 1909.3	1.4	QPSK	19.53	89.74		
			16QAM	18.99	79.25		
			64QAM	17.94	62.23		
			256QAM	14.79	30.13		

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LTE Band 12

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 12	704 - 711	10	QPSK	24.72	296.48	**20.60**	**114.82**
			16QAM	24.13	258.82	19.29	84.92
			64QAM	22.96	197.70		
			256QAM	19.84	96.38		
	701.5 - 707.5	5	QPSK	**24.73**	**297.17**	20.56	113.76
			16QAM	23.90	245.47	19.46	88.31
			64QAM	23.16	207.01		
			256QAM	19.92	98.17		
	700.5 - 714.5	3	QPSK	24.69	294.44	20.44	110.66
			16QAM	23.81	240.44	19.41	87.30
			64QAM	23.67	232.81		
			256QAM	20.00	100.00		
	699.7 - 715.3	1.4	QPSK	24.70	295.12	20.29	106.91
			16QAM	24.07	255.27	19.28	84.72
			64QAM	24.68	293.76		
			256QAM	19.87	97.05		

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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	821.5	15	QPSK	24.01	251.77	20.40	109.65
			16QAM	23.37	217.27	20.05	101.16
			64QAM	22.56	180.30		
			256QAM	19.42	87.50		
	819	10	QPSK	24.20	263.03	20.35	108.39
			16QAM	23.31	214.29	20.34	108.14
			64QAM	22.64	183.65		
			256QAM	19.48	88.72		
	816.5 - 821.5	5	QPSK	**24.32**	**270.40**	21.27	133.97
			16QAM	23.41	219.28	20.29	106.91
			64QAM	22.59	181.55		
			256QAM	19.48	88.72		
	815.5 - 822.5	3	QPSK	24.27	267.30	21.44	139.38
			16QAM	23.37	217.27	20.36	108.64
			64QAM	22.67	184.93		
			256QAM	19.53	89.74		
	814.7 - 823.3	1.4	QPSK	24.23	264.85	**21.83**	**152.41**
			16QAM	23.56	226.99	20.78	119.67
			64QAM	22.52	178.65		
			256QAM	19.51	89.33		

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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	831.5 ~ 841.5	15	QPSK	24.28	267.92	21.27	133.97
			16QAM	23.30	213.80	20.41	109.90
			64QAM	22.56	180.30		
			256QAM	19.42	87.50		
	829 ~ 844	10	QPSK	24.57	286.42	21.34	136.14
			16QAM	23.96	248.89	20.26	106.17
			64QAM	22.87	193.64		
			256QAM	19.62	91.62		
	826.5 ~ 846.5	5	QPSK	**24.64**	**291.07**	21.27	133.97
			16QAM	24.00	251.19	20.88	122.46
			64QAM	22.93	196.34		
			256QAM	19.78	95.06		
	825.5 ~ 847.5	3	QPSK	24.51	282.49	**21.70**	**147.91**
			16QAM	23.86	243.22	20.57	114.02
			64QAM	22.60	181.97		
			256QAM	19.58	90.78		
	824.7 ~ 848.3	1.4	QPSK	24.48	280.54	21.52	141.91
			16QAM	23.87	243.78	20.27	106.41
			64QAM	22.99	199.07		
			256QAM	19.97	99.31		

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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	24.25	266.07	20.70	117.49
			16QAM	23.61	229.61	19.66	92.47
			64QAM	22.61	182.39		
			256QAM	19.81	95.72		
		10	QPSK	24.29	268.53	20.27	106.41
			16QAM	23.30	213.80	19.39	86.90
			64QAM	22.74	187.93		
			256QAM	19.90	97.72		
		5	QPSK	**24.30**	**269.15**	20.94	124.17
			16QAM	23.39	218.27	19.76	94.62
			64QAM	22.38	172.98		
			256QAM	19.47	88.51		
		3	QPSK	**24.30**	**269.15**	21.06	127.64
			16QAM	23.33	215.28	20.16	103.75
			64QAM	22.81	190.99		
			256QAM	19.72	93.76		
		1.4	QPSK	24.25	266.07	**21.09**	**128.53**
			16QAM	23.69	233.88	20.14	103.28
			64QAM	22.47	176.60		
			256QAM	19.36	86.30		

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LTE Band 41

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 41	2506 - 2680	20	QPSK	23.79	239.33	**25.24**	**334.20**
			16QAM	22.85	192.75	24.46	279.25
			64QAM	21.96	157.04		
			256QAM	19.01	79.62		
	2503.5 - 2682.5	15	QPSK	23.67	232.81	24.90	309.03
			16QAM	22.70	186.21	24.05	254.10
			64QAM	21.88	154.17		
			256QAM	19.09	81.10		
	2501 - 2685	10	QPSK	**23.88**	**244.34**	25.16	328.10
			16QAM	23.01	199.99	24.18	261.82
			64QAM	22.29	169.43		
			256QAM	19.26	84.33		
	2498.5 - 2687.5	5	QPSK	23.78	238.78	25.13	325.84
			16QAM	22.99	199.07	24.76	299.23
			64QAM	22.20	165.96		
			256QAM	19.25	84.14		

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LTE Band 66(Main Ant)

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 66	1720 - 1770	20	QPSK	24.12	258.23	**23.75**	**237.14**
			16QAM	23.73	236.05	22.80	190.55
			64QAM	22.90	194.98		
			256QAM	19.36	86.30		
	1717.5 - 1772.5	15	QPSK	24.32	270.40	23.48	222.84
			16QAM	23.69	233.88	22.68	185.35
			64QAM	23.05	201.84		
			256QAM	19.74	94.19		
	1715 - 1775	10	QPSK	24.52	283.14	23.50	223.87
			16QAM	23.76	237.68	22.88	194.09
			64QAM	22.81	190.99		
			256QAM	20.02	100.46		
	1712.5 - 1777.5	5	QPSK	**24.55**	**285.10**	23.13	205.59
			16QAM	23.99	250.61	22.55	179.89
			64QAM	22.80	190.55		
			256QAM	19.63	91.83		
	1711.5 - 1778.5	3	QPSK	24.52	283.14	22.99	199.07
			16QAM	23.80	239.88	22.02	159.22
			64QAM	23.08	203.24		
			256QAM	19.99	99.77		
	1710.7 - 1779.3	1.4	QPSK	24.41	276.06	22.48	177.01
			16QAM	23.66	232.27	21.81	151.71
			64QAM	22.99	199.07		
			256QAM	19.75	94.41		

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LTE Band 66(Sub Ant)

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 66	1720 - 1770	20	QPSK	**18.14**	**65.16**	**19.37**	**86.50**
			16QAM	17.38	54.70	18.77	75.34
			64QAM	16.39	43.55		
			256QAM	13.19	20.84		
	1717.5 - 1772.5	15	QPSK	18.10	64.57		
			16QAM	17.16	52.00		
			64QAM	16.36	43.25		
			256QAM	13.22	20.99		
	1715 - 1775	10	QPSK	17.85	60.95		
			16QAM	17.05	50.70		
			64QAM	16.14	41.11		
			256QAM	13.05	20.18		
	1712.5 - 1777.5	5	QPSK	18.03	63.53		
			16QAM	17.09	51.17		
			64QAM	16.30	42.66		
			256QAM	13.16	20.70		
	1711.5 - 1778.5	3	QPSK	18.03	63.53		
			16QAM	17.25	53.09		
			64QAM	16.34	43.05		
			256QAM	13.11	20.46		
	1710.7 - 1779.3	1.4	QPSK	18.12	64.86		
			16QAM	17.36	54.45		
			64QAM	16.34	43.05		
			256QAM	13.18	20.80		

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NR Band n5

FCC Part 22								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n5	834 - 839	20	DFT-s OFDM	π/2 BPSK	23.67	232.81		
				QPSK	23.68	233.35	**21.93**	**155.96**
				16QAM	22.86	193.20	20.76	119.12
				64QAM	21.44	139.32		
				256QAM	18.99	79.25		
			CP-OFDM	QPSK	22.47	176.60		
	831.5 - 841.5	15	DFT-s OFDM	π/2 BPSK	23.66	232.27		
				QPSK	23.65	231.74	21.41	138.36
				16QAM	22.41	174.18	20.48	111.69
				64QAM	21.24	133.05		
				256QAM	18.76	75.16		
			CP-OFDM	QPSK	21.84	152.76		
	829 - 844	10	DFT-s OFDM	π/2 BPSK	23.72	235.50		
				QPSK	**23.76**	**237.68**	21.33	135.83
				16QAM	22.43	174.98	20.41	109.90
				64QAM	21.28	134.28		
				256QAM	18.77	75.34		
			CP-OFDM	QPSK	21.87	153.82		
	826.5 - 846.5	5	DFT-s OFDM	π/2 BPSK	23.68	233.35		
				QPSK	23.64	231.21	20.63	115.61
				16QAM	22.76	188.80	19.57	90.57
				64QAM	21.44	139.32		
				256QAM	18.85	76.74		
			CP-OFDM	QPSK	22.06	160.69		

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NR Band n66(Main Ant)

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	23.99	250.61		
				QPSK	**24.12**	**258.23**	23.17	207.49
				16QAM	22.96	197.70	22.30	169.82
				64QAM	21.67	146.89		
				256QAM	19.12	81.66		
			CP-OFDM	QPSK	22.37	172.58		
	1717.5 - 1772.5	15	DFT-s OFDM	π/2 BPSK	23.86	243.22		
				QPSK	24.01	251.77	22.97	198.15
				16QAM	22.85	192.75	21.62	145.21
				64QAM	21.68	147.23		
				256QAM	19.05	80.35		
			CP-OFDM	QPSK	22.34	171.40		
	1715.0 - 1775.0	10	DFT-s OFDM	π/2 BPSK	23.99	250.61		
				QPSK	24.02	252.35	**23.21**	**209.41**
				16QAM	23.00	199.53	22.16	164.44
				64QAM	21.54	142.56		
				256QAM	19.11	81.47		
			CP-OFDM	QPSK	22.21	166.34		
	1712.5 - 1777.5	5	DFT-s OFDM	π/2 BPSK	23.92	246.60		
				QPSK	24.07	255.27	23.18	207.97
				16QAM	23.02	200.45	21.92	155.60
				64QAM	21.85	153.11		
				256QAM	19.17	82.60		
			CP-OFDM	QPSK	22.25	167.88		

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NR Band n66(Sub Ant)

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	23.60	229.09		
				QPSK	**23.61**	**229.61**	**21.62**	**145.13**
				16QAM	22.64	183.65	20.39	109.33
				64QAM	21.26	133.66		
				256QAM	18.93	78.16		
			CP-OFDM	QPSK	21.47	140.28		
	1717.5 - 1772.5	15	DFT-s OFDM	π/2 BPSK	23.58	228.03		
				QPSK	23.59	228.56		
				16QAM	22.12	162.93		
				64QAM	21.23	132.74		
				256QAM	18.91	77.80		
			CP-OFDM	QPSK	21.44	139.32		
	1715.0 - 1775.0	10	DFT-s OFDM	π/2 BPSK	23.59	228.56		
				QPSK	23.60	229.09		
				16QAM	22.05	160.32		
				64QAM	21.22	132.43		
				256QAM	18.92	77.98		
			CP-OFDM	QPSK	21.29	134.59		
	1712.5 - 1777.5	5	DFT-s OFDM	π/2 BPSK	23.59	228.56		
				QPSK	23.60	229.09		
				16QAM	22.10	162.18		
				64QAM	21.22	132.43		
				256QAM	18.92	77.98		
			CP-OFDM	QPSK	21.43	139.00		

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5.3. WORST-CASE ORIENTATION

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

- GSM GPRS/EGPRS
- UMTS REL 99/HSDPA

For all LTE Bands, the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM, 64QAM and 256QAM modulations. 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 $\pi/2$ BPSK, 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

Both ‘Main ANT’ and ‘Sub ANT’ were tested and the worst case of either ‘Main ANT’ or ‘Sub ANT’ is reported.

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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, lower than 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 2 (Sub Antenna)
Sub Antenna of LTE Band 2 (Frequency range: 1850-1915 MHz) is covered by Main Antenna of LTE Band 2 (Frequency range: 1850-1915 MHz) due to overlapping frequency range, lower maximum tune-up limit and same channel bandwidth.

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

NR Band 66 (Sub Antenna)
Sub Antenna of NR Band 66 (Frequency range: 1710-1780 MHz) is covered by Main Antenna of NR Band 66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, lower maximum tune-up limit and same channel bandwidth.

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Highest power setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
2 (Main ANT)	1851.5	3	1	0
	1880.0		1	0
	1908.5		1	0
2 (Sub ANT)	1860.0	20	1	0
	1880.0		1	99
	1900.0		1	0
12	701.5	5	1	24
	707.5		1	24
	714.5		1	0
26 (Part 90)	816.5	5	1	0
	821.5		1	12
26 (Straddle)	824.0	5	1	24
26 (Part 22)	826.5	5	1	12
	831.5		1	24
	846.5		1	0
41	2501.0	10	1	25
	2593.0		1	25
	2685.0		1	49
66 (Main ANT)	1712.5	5	1	0
	1745.0		1	0
	1777.5		1	0
66 (Sub ANT)	1720.0	20	1	99
	1745.0		1	99
	1770.0		1	0

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Highest power setting for each bands				
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 (Main ANT)	1720.0	20	1	104
	1745.0		1	104
	1777.0		1	1
66 (Sub ANT)	1720.0	20	1	104
	1745.0		1	53
	1777.0		1	53

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

NR Band	LTE Band
5	**2**, 66
66	2, **5**

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i. Worst Axis Condition

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 B2 (Main ANT)	-	O	-	-	-	O
LTE B2 (Sub ANT)	-	O	-	O	-	-
LTE B12	-	-	O	O	-	-
LTE B26	-	-	O	-	O	-
LTE B41	O	-	-	O	-	-
LTE B66 (Main ANT)	O	-	-	-	-	O
LTE B66 (Sub ANT)	O	-	-	-	-	O
NR n5	-	-	O	-	O	-
NR n66 (Main ANT)	-	O	-	-	-	O
NR n66 (Sub ANT)	-	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.

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5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacture**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37MANQ1E72SE3	N/A
Data Cable	SAMSUNG	EP-DN980	GH39-02115A BWE	N/A
Earphone	SAMSUNG	GH59-15055A	EHS64AVFWE	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
2	Audio	2	Mini-jack	Unshielded	0.7 m	N/A

TEST SETUP

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

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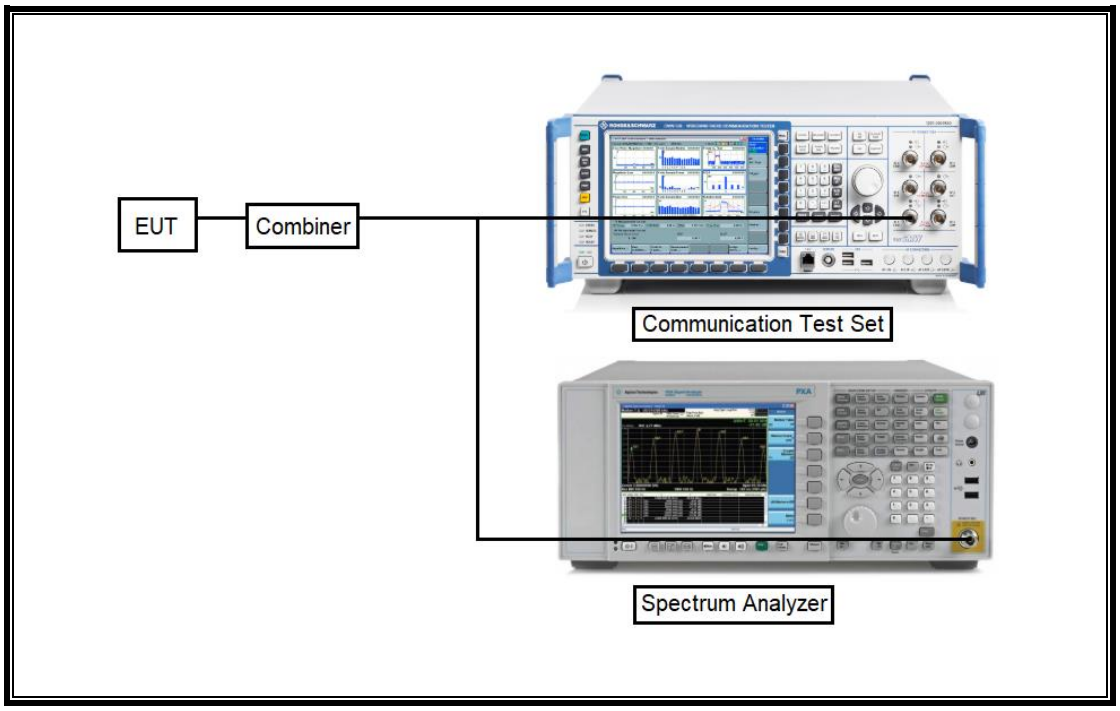
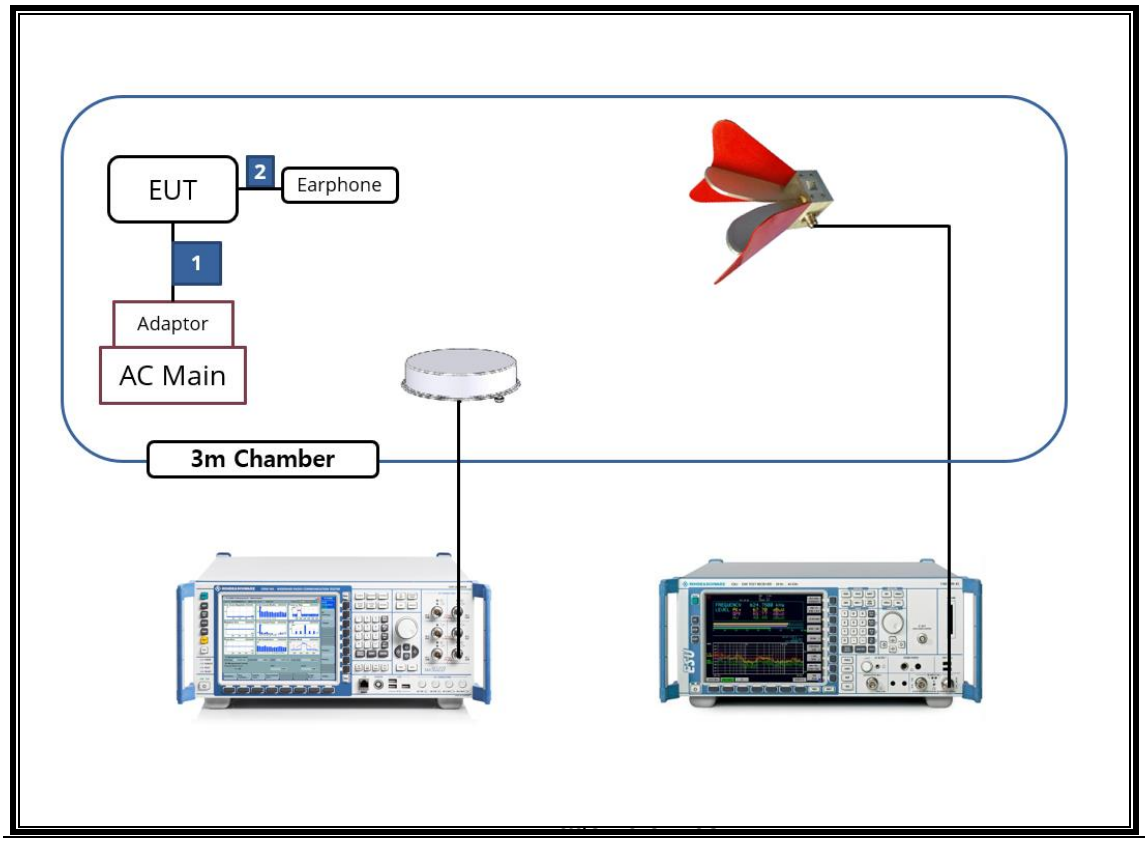
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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5.5. 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 (dBi)
GSM1900 / WCDMA Band 2 / LTE Band 2 1850 ~ 1915 MHz	0.55 (Main Ant) -2.11 (Sub Ant)
WCDMA Band 4 / LTE Band 4 / LTE Band 66 / NR Band n66 1710 ~ 1780 MHz	-0.55 (Main Ant) 0.09 (Sub Ant)
GSM850 / WCDMA Band 5 / LTE Band 5 / LTE Band 26 / NR Band n5 814 ~ 849 MHz	-4.05 (Main Ant) -5.34 (Sub Ant)
LTE Band 12 / LTE Band 17 699 ~ 716 MHz	-3.98
LTE Band 41 2496 ~ 2690 MHz	0.12

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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	2023-01-07
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	PASTERNACK	PE7087-10	A009	2022-08-03
Attenuator	PASTERNACK	PE7087-10	A001	2022-08-03
Attenuator	PASTERNACK	PE7087-10	A008	2022-08-03
Attenuator	PASTERNACK	PE7004-10	2	2022-08-02
Attenuator	PASTERNACK	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	UL003	2023-01-11
Power Splitter	MINI-CIRCUITS	WA1534	UL004	2023-01-11
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	MY58120110	2023-01-07

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

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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(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
90.635(b)		50 dBm		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
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 (g),(h) 90.691	Radiated Spurious Emission	-13dBm		Pass
27.53(m)		-25dBm		Pass

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8. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to both CMW500 Test Set and E7515B Test set 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 (π/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.

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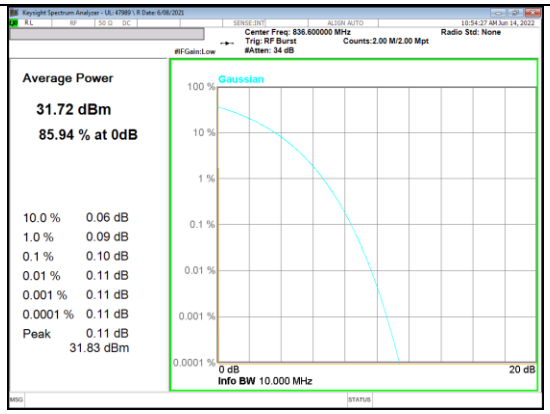
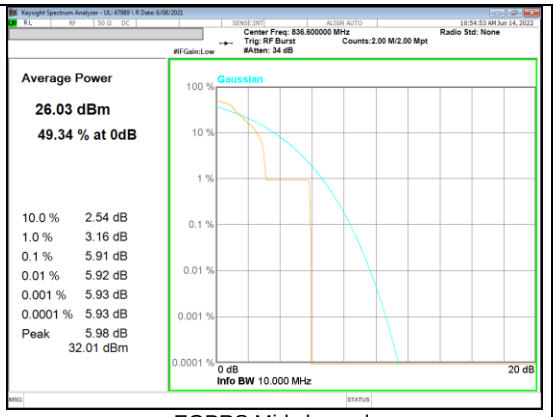
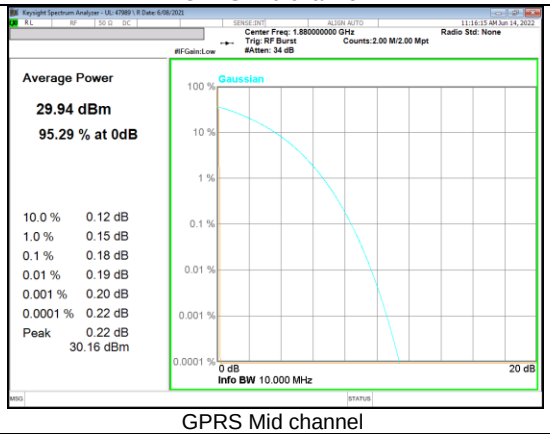
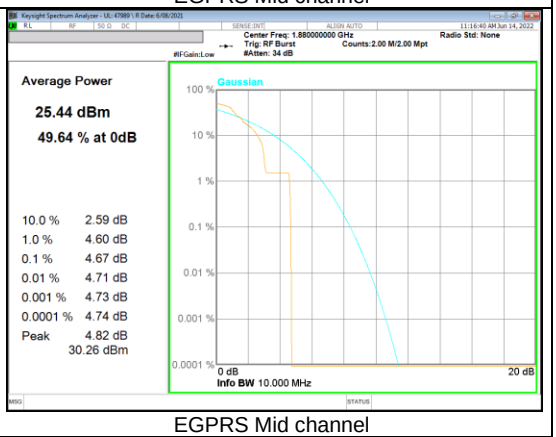
8.1. CONDUCTED PEAK TO AVERAGE RESULT

GSM

GSM 850	 GPRS Mid channel	 EGPRS Mid channel
GSM 1900	 GPRS Mid channel	 EGPRS Mid channel

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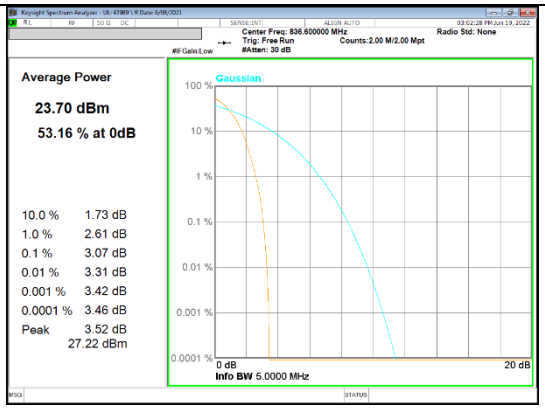
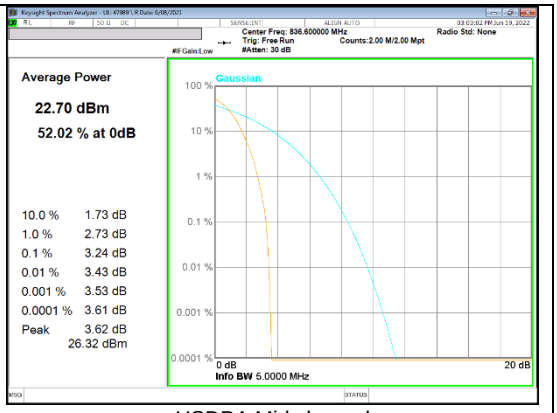
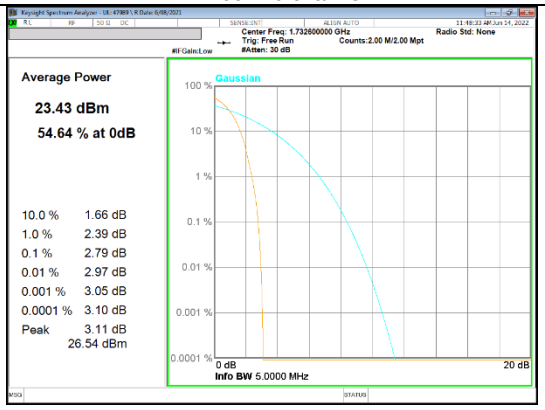
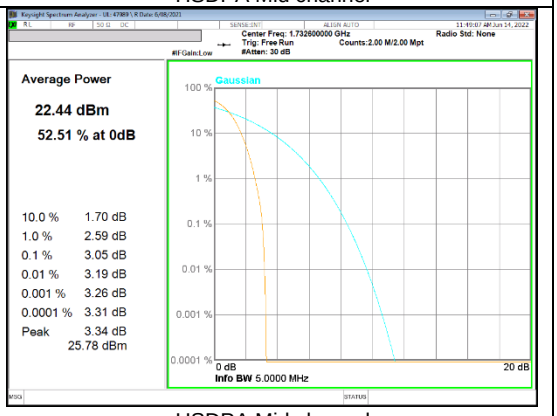
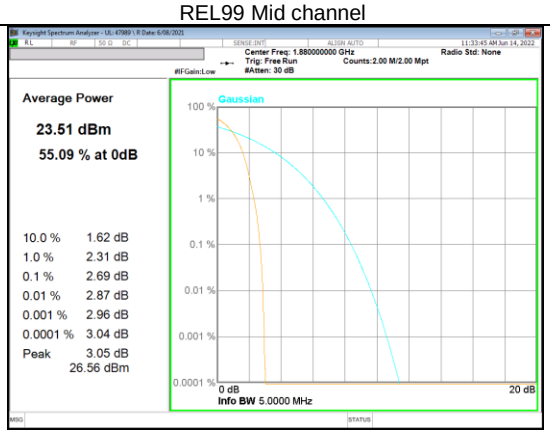
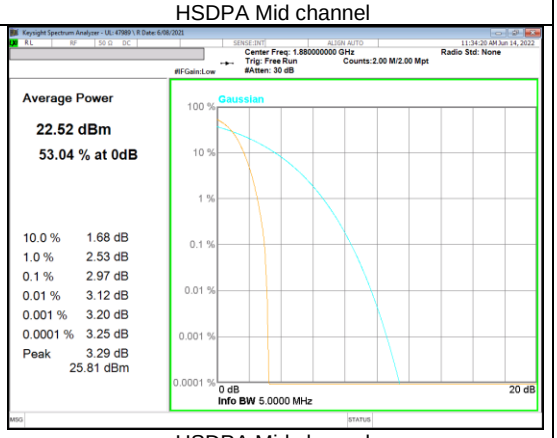
WCDMA

Band 5	 REL99 Mid channel	 HSDPA Mid channel
Band 4	 REL99 Mid channel	 HSDPA Mid channel
Band 2	 REL99 Mid channel	 HSDPA Mid channel

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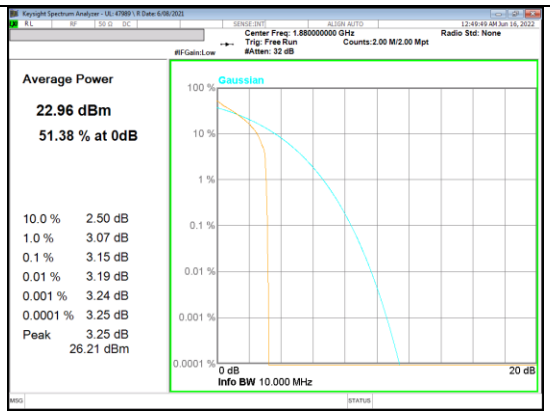
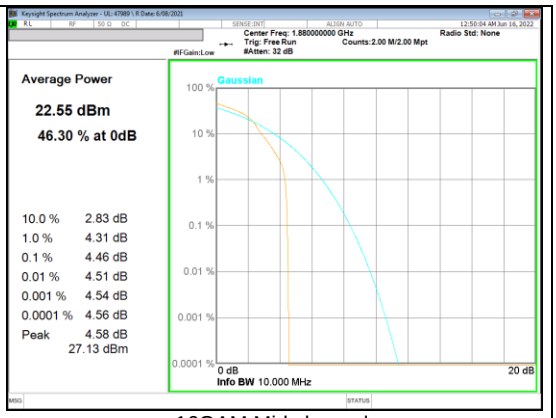
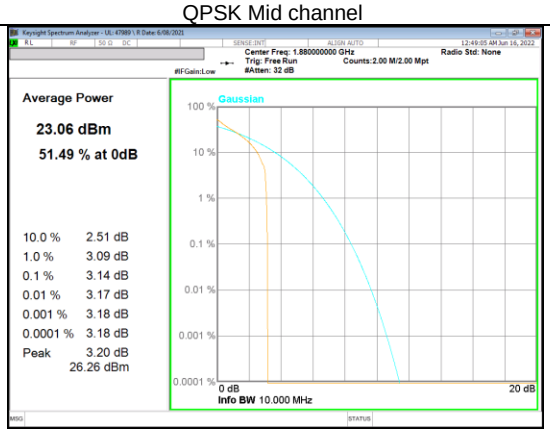
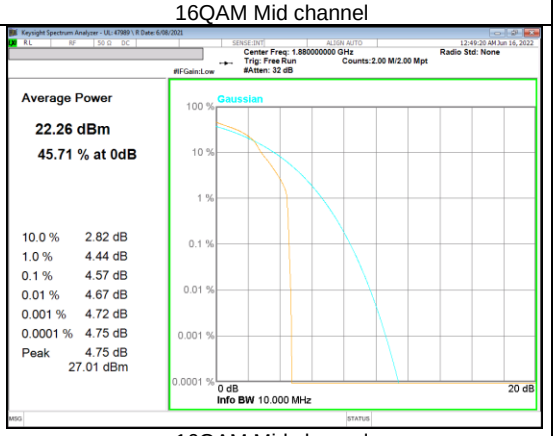
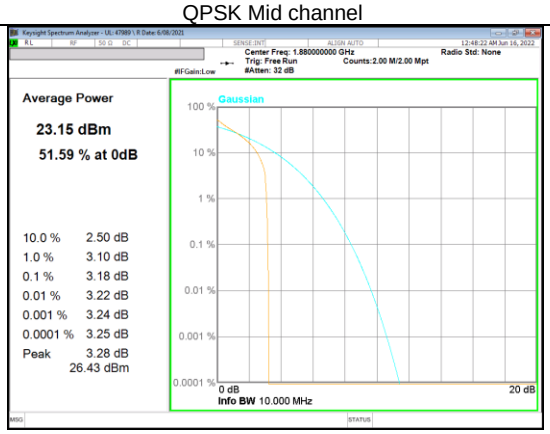
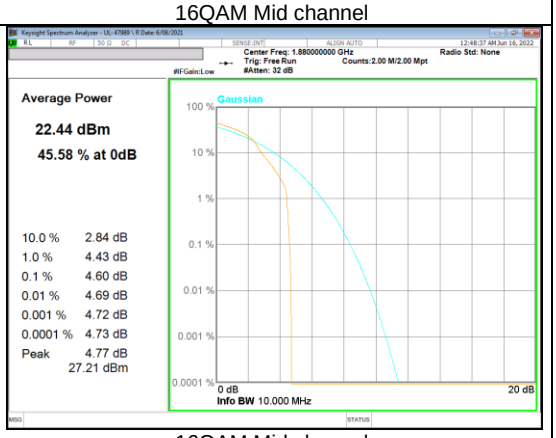
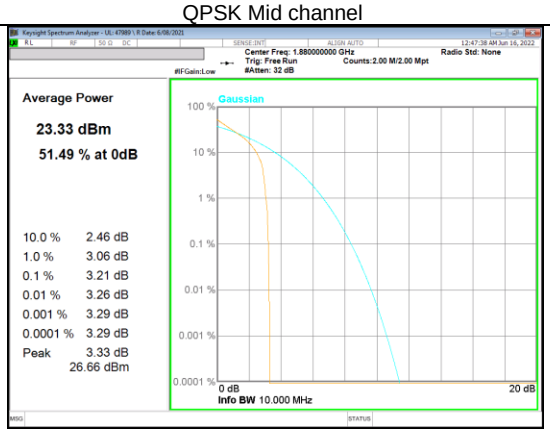
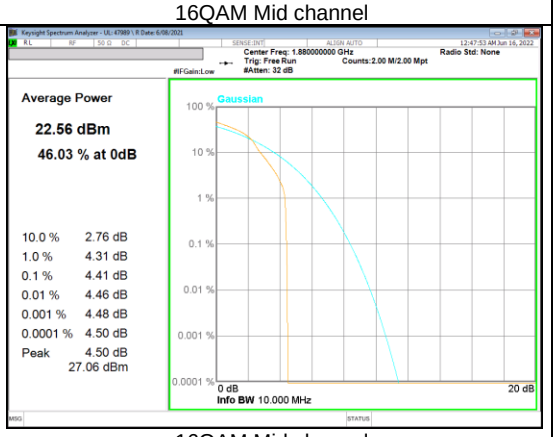
LTE Band 2

20 MHz	 QPSK Mid channel	 16QAM Mid channel
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel

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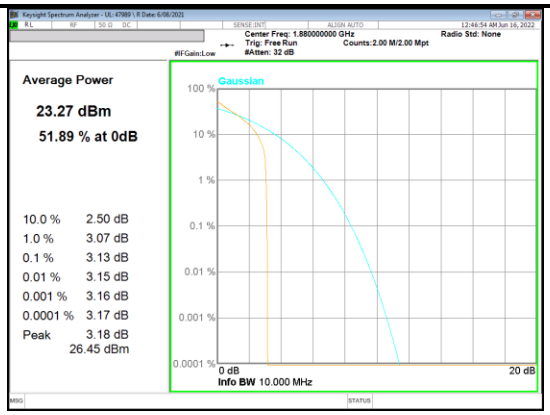
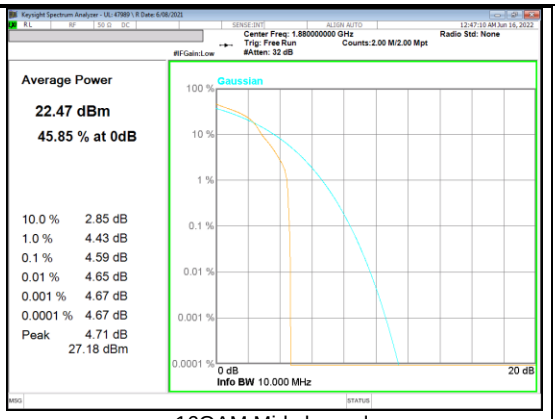
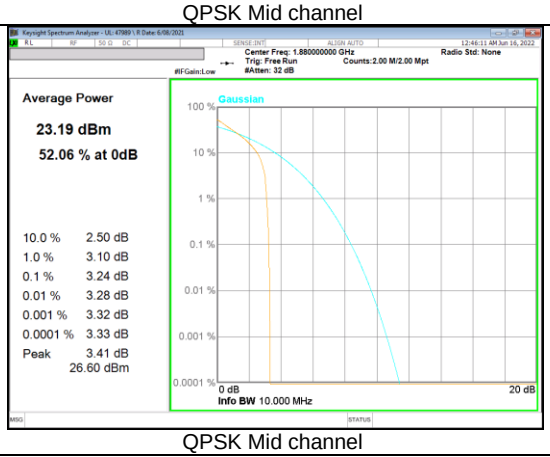
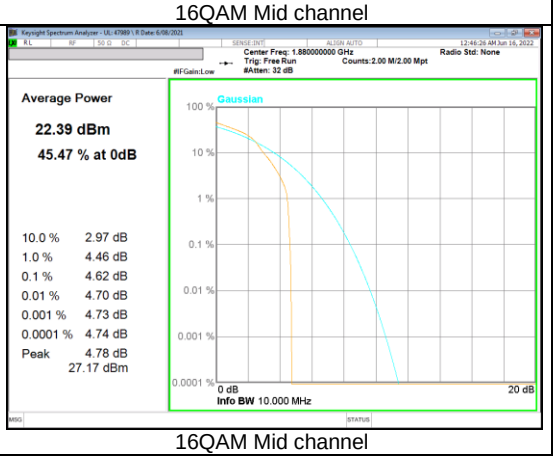
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

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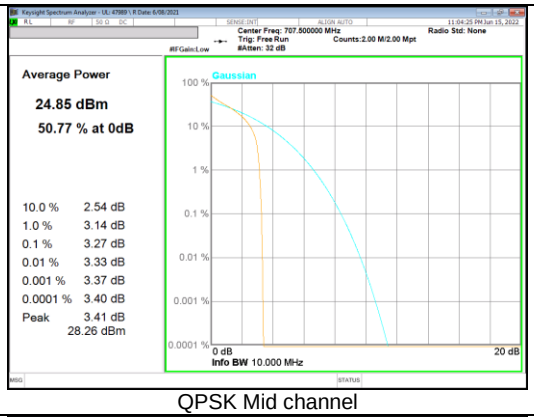
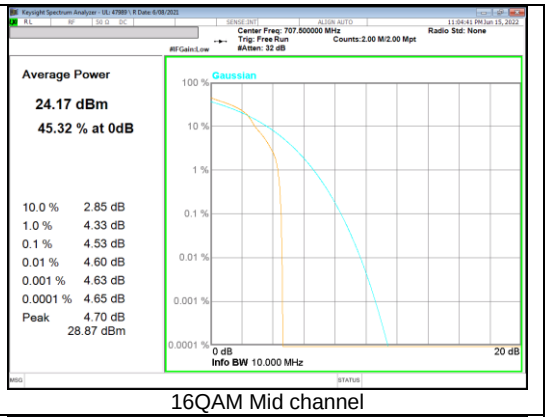
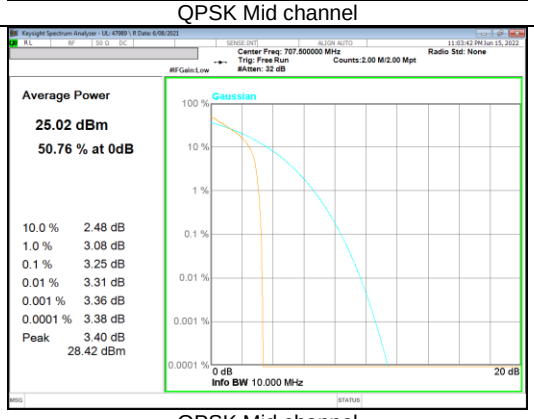
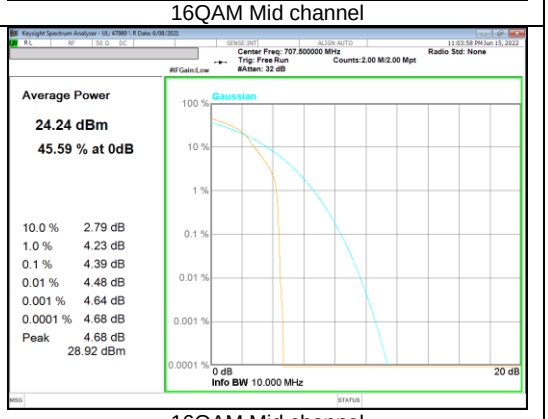
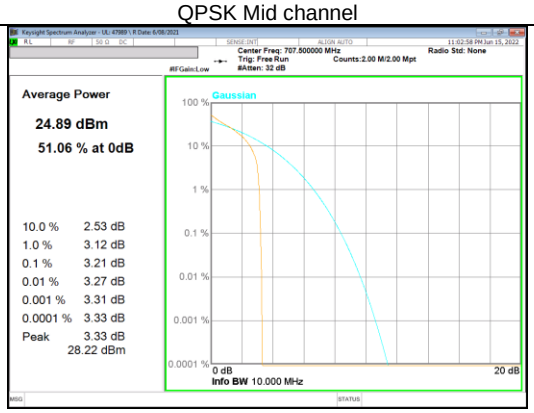
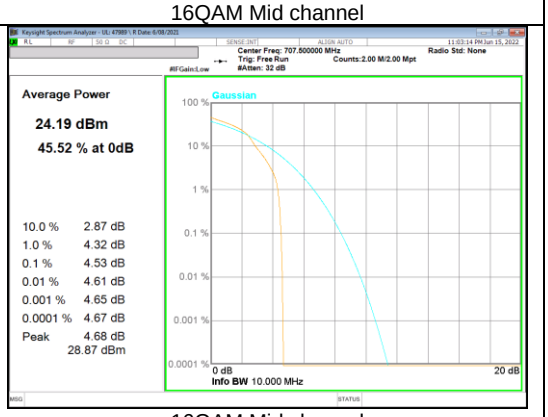
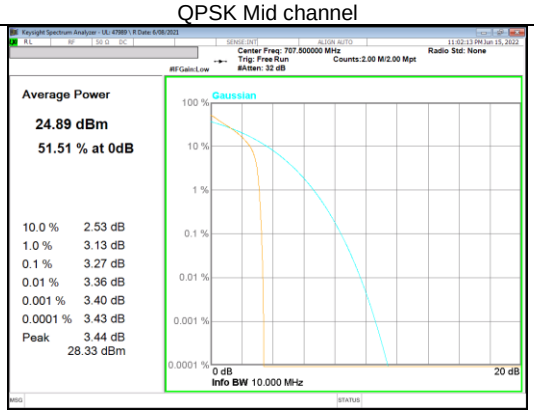
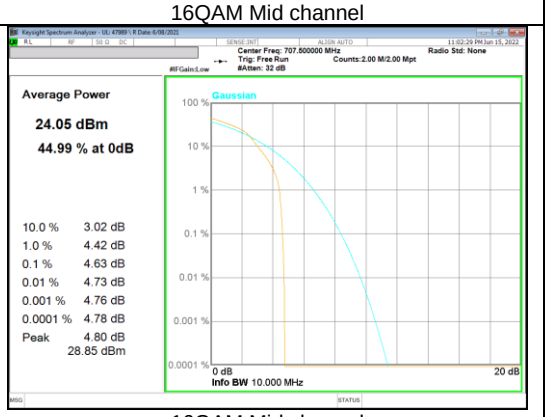
LTE Band 12

10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

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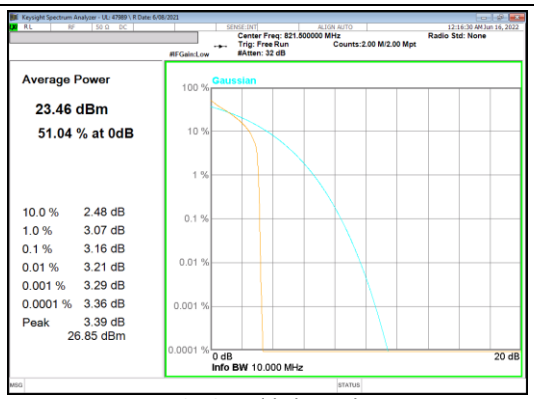
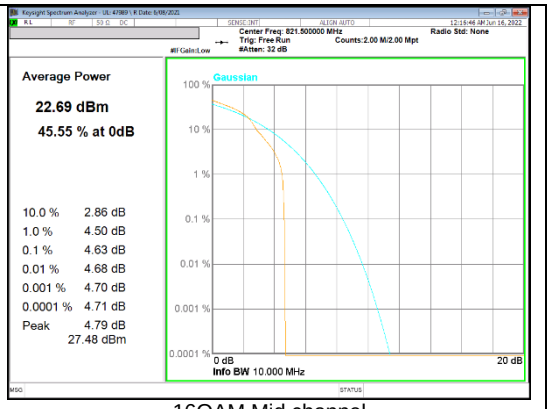
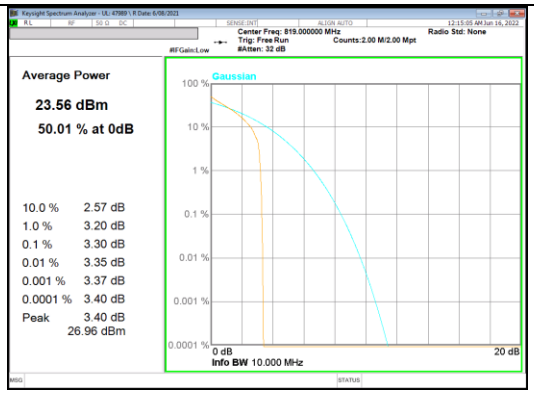
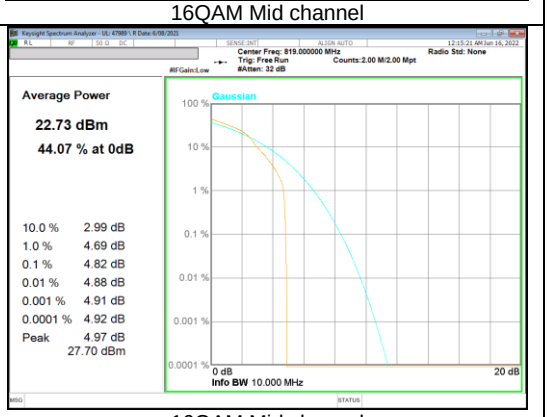
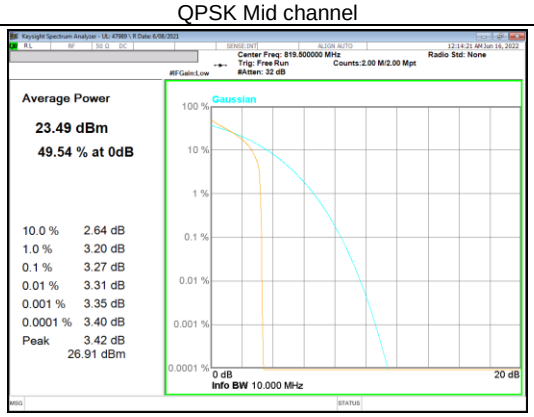
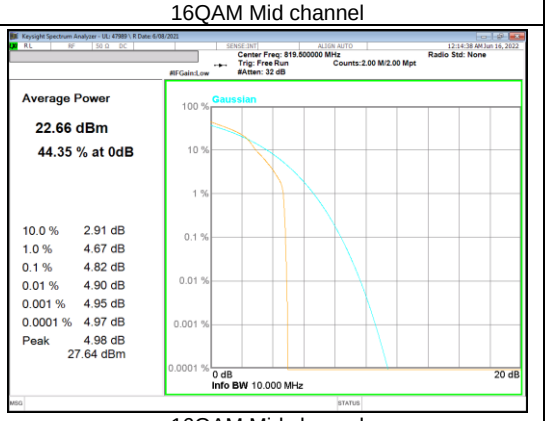
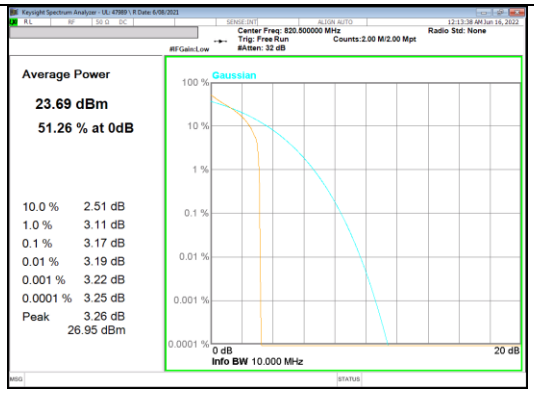
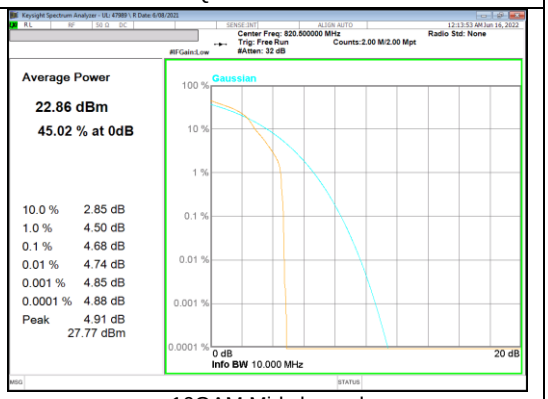
LTE Band 26 (Part 90)

15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel

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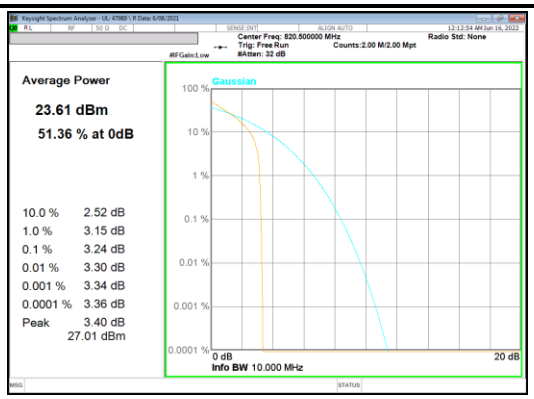
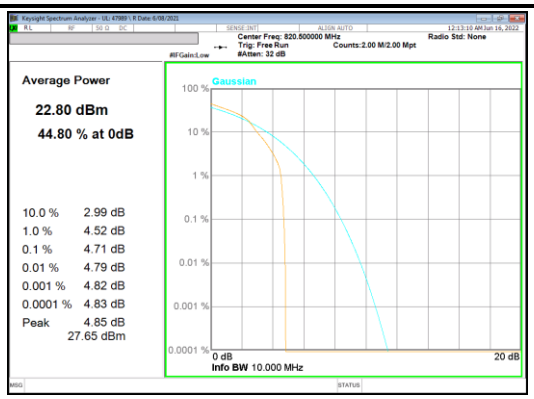
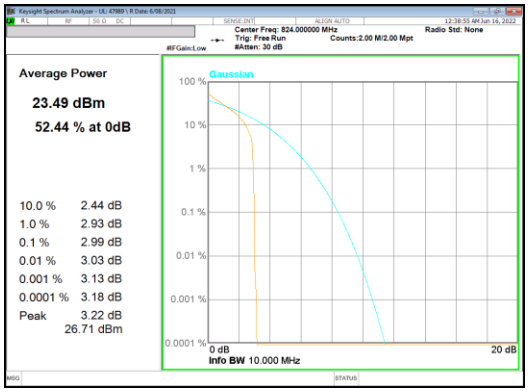
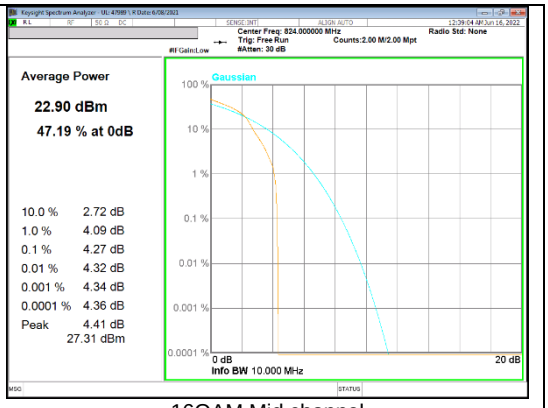
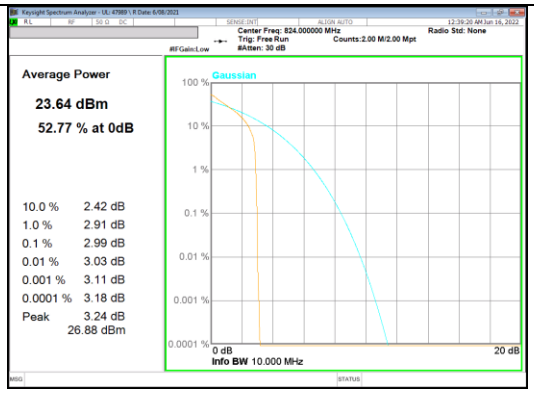
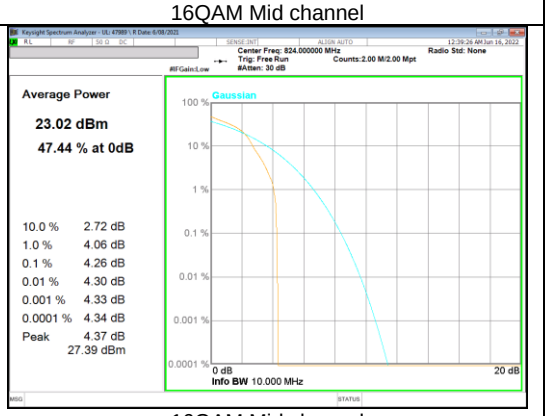
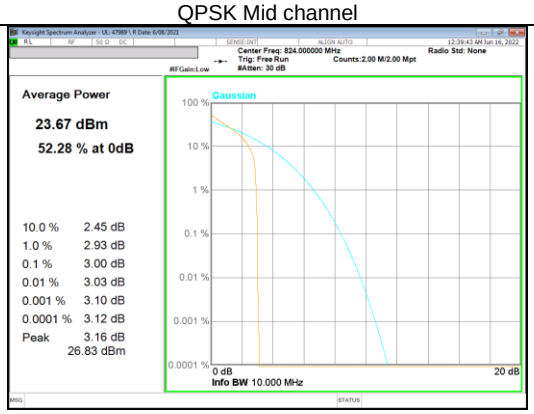
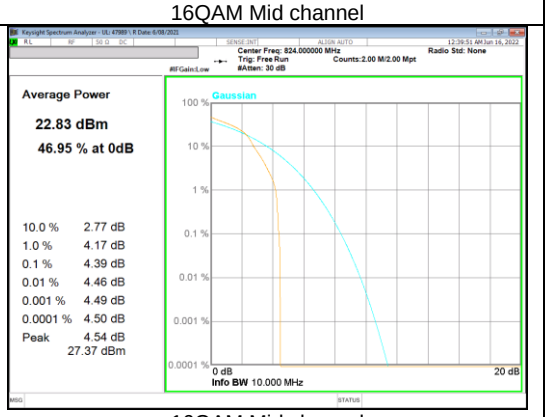
1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

LTE Band 26 (Straddle)

15 MHz		
	QPSK Mid channel	16QAM Mid channel
10 MHz		
	QPSK Mid channel	16QAM Mid channel
5 MHz		
	QPSK Mid channel	16QAM Mid channel

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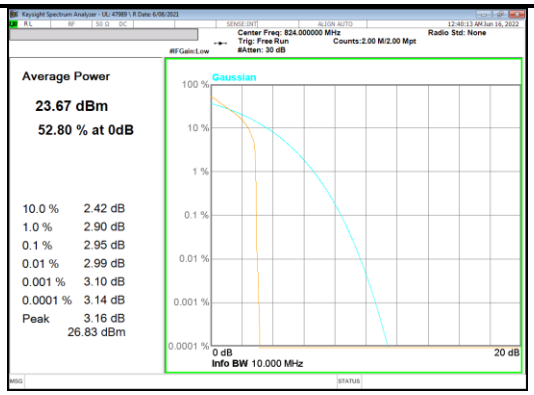
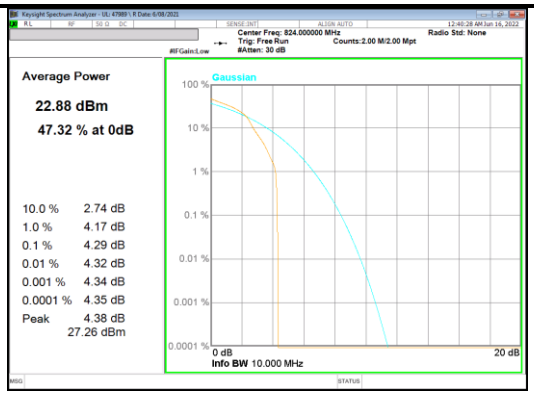
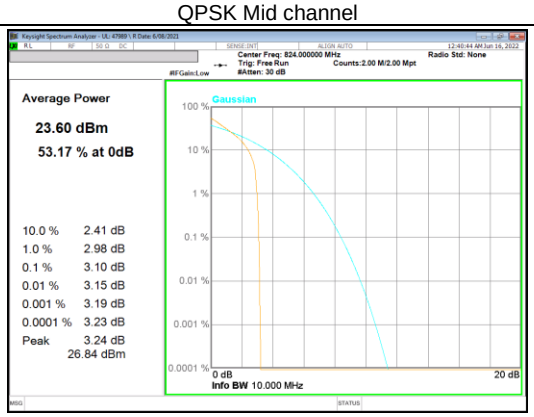
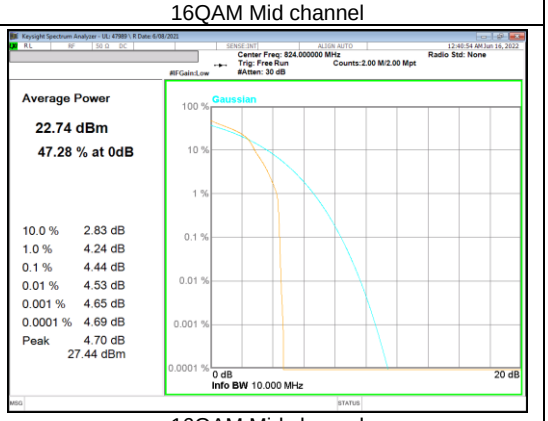
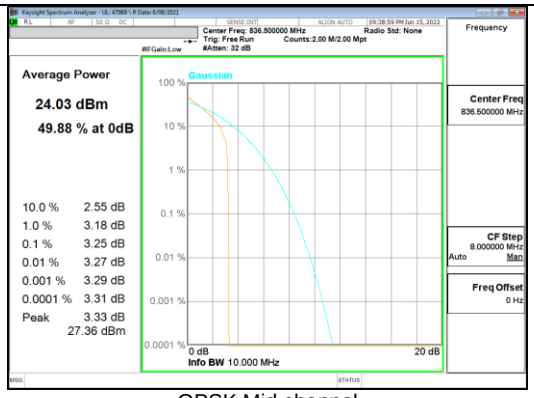
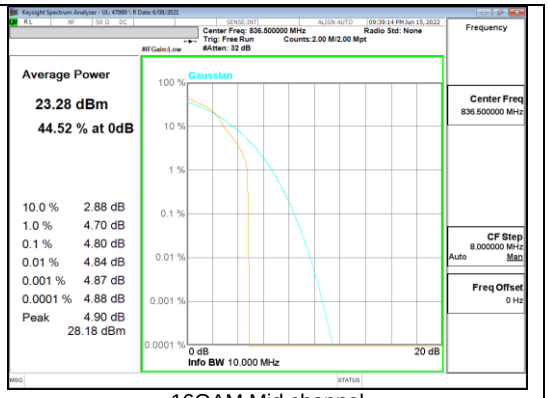
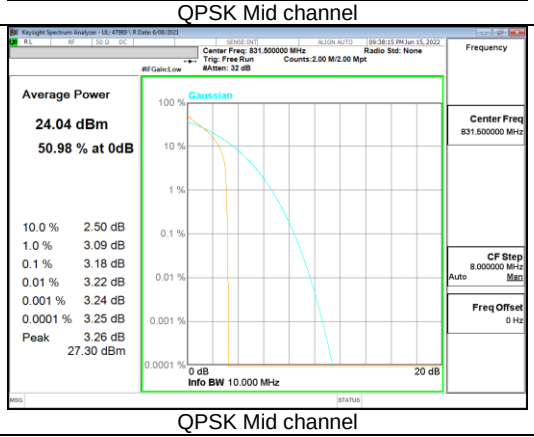
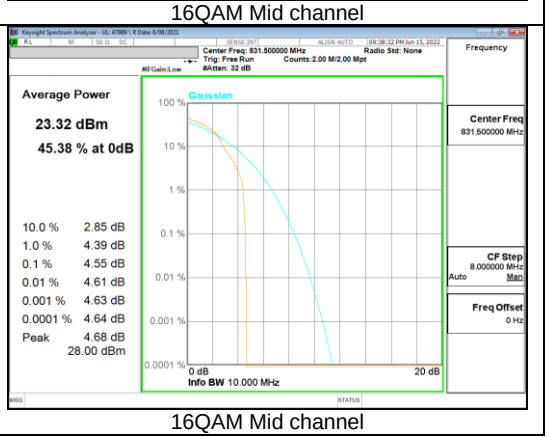
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

LTE Band 26 (Part 22)

15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel

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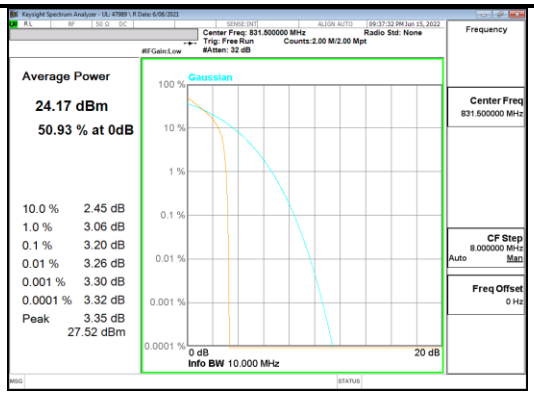
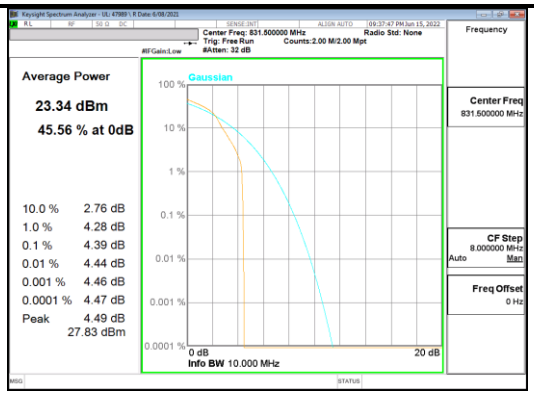
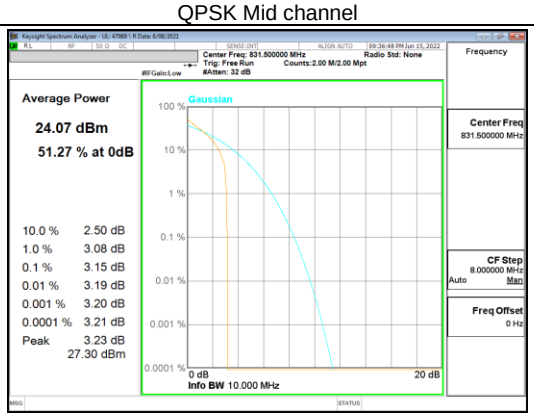
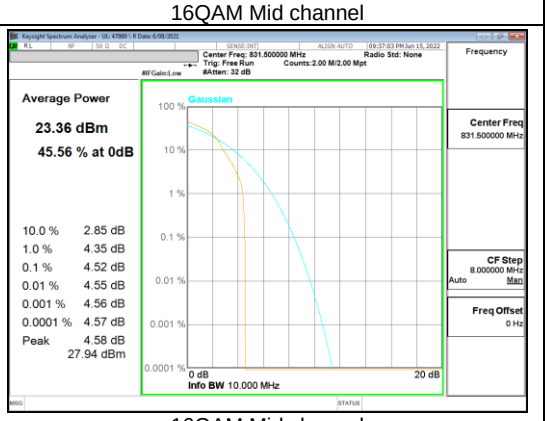
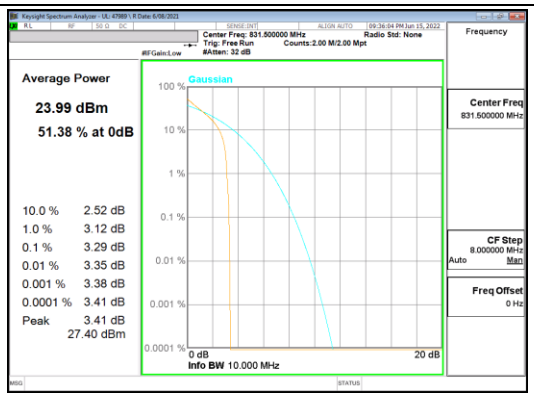
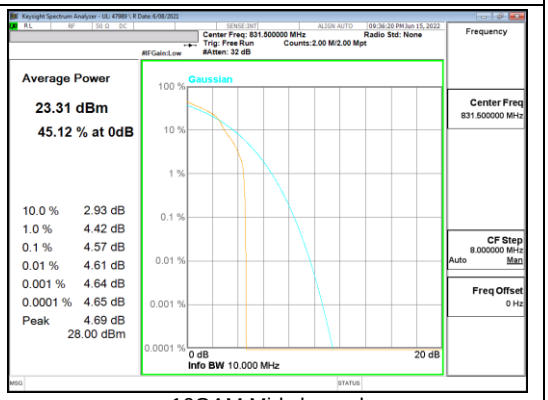
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

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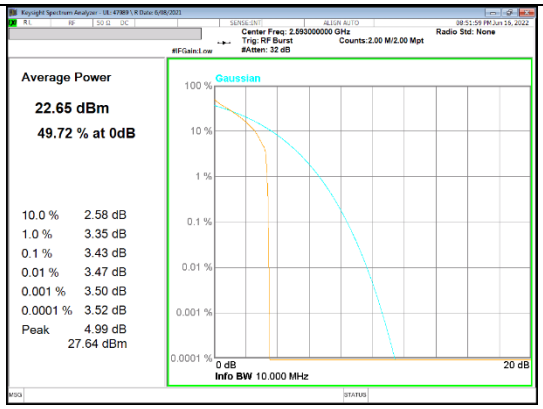
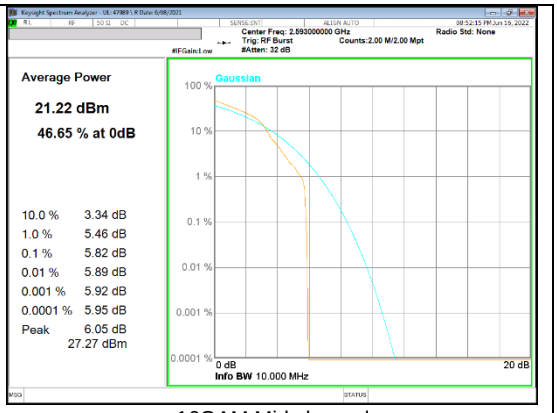
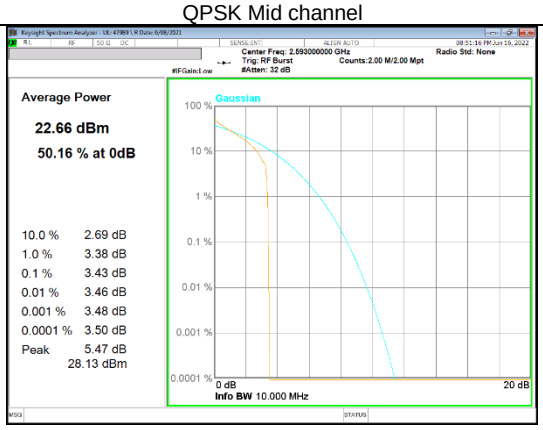
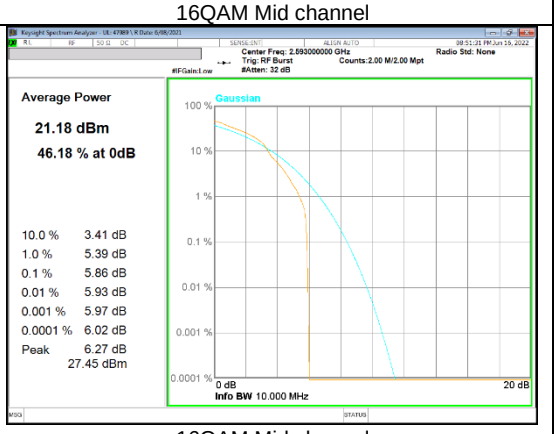
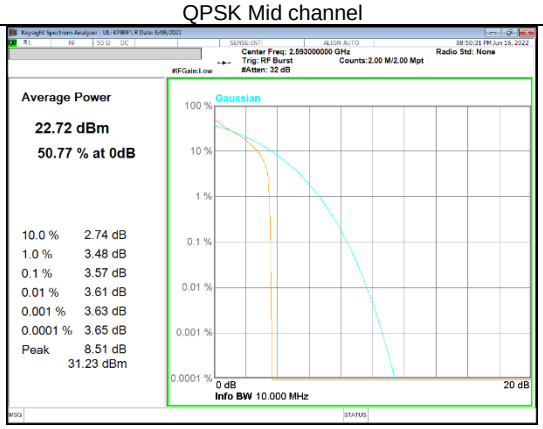
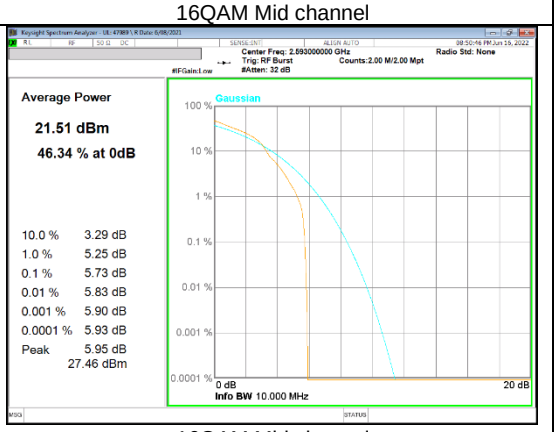
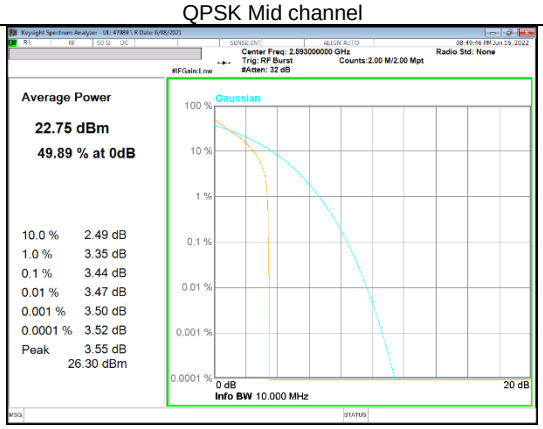
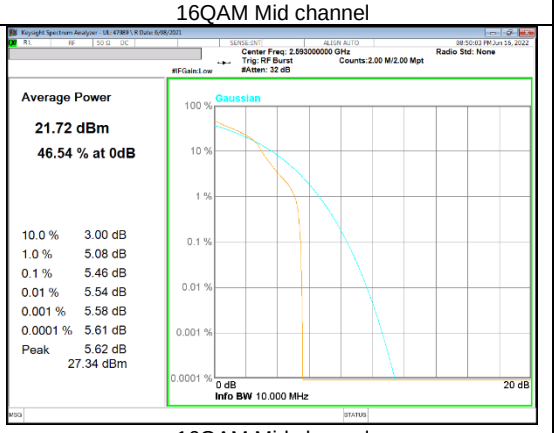
LTE Band 41

20 MHz	 QPSK Mid channel	 16QAM Mid channel
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel

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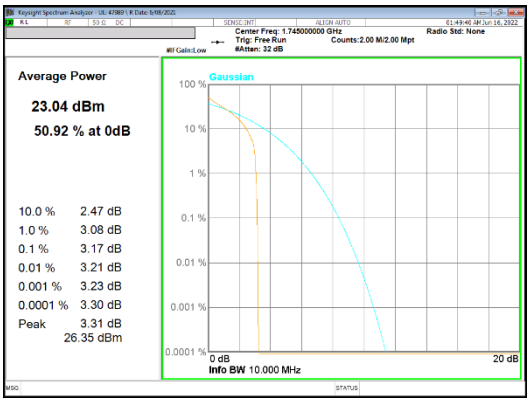
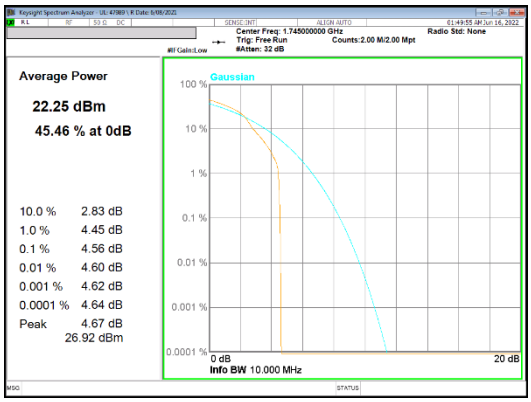
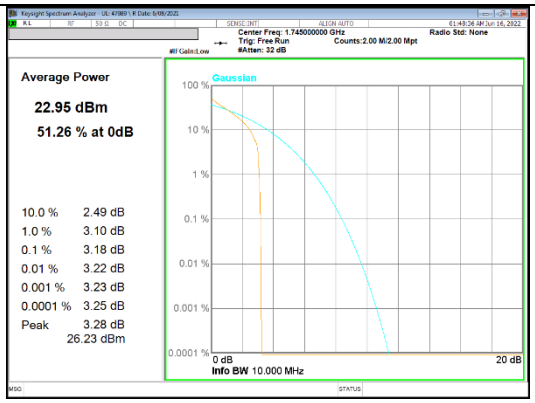
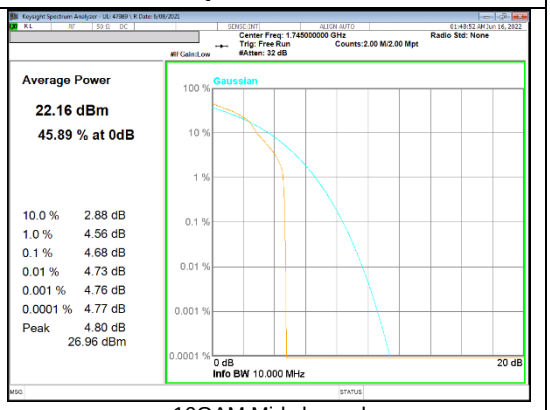
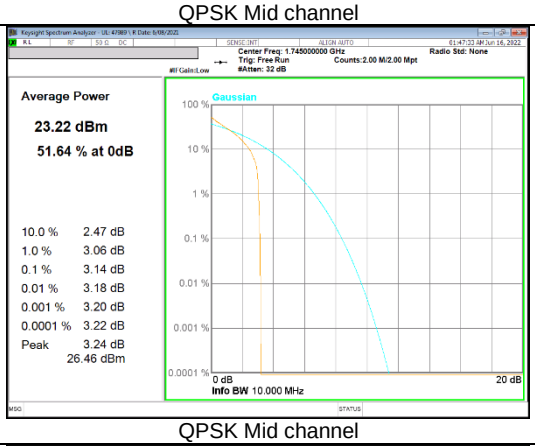
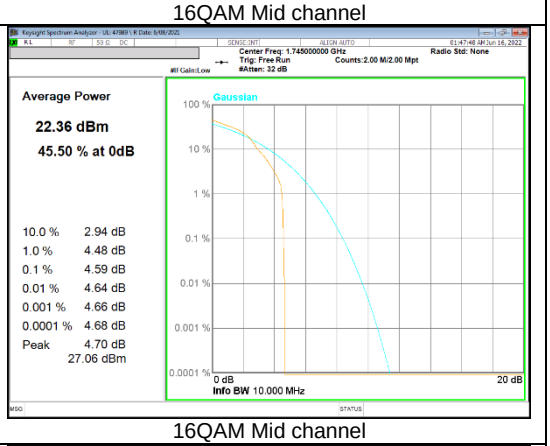
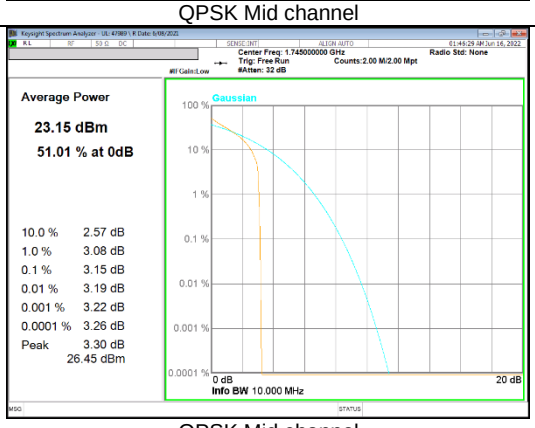
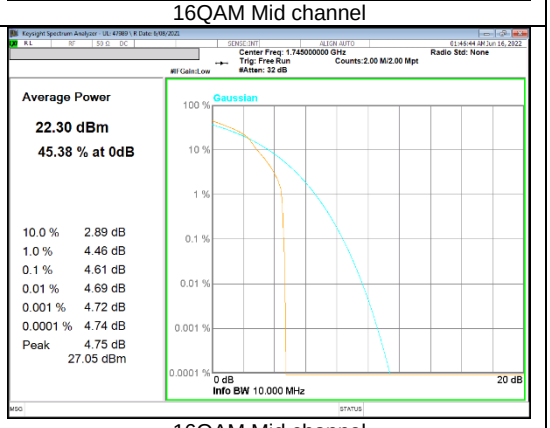
LTE Band 66

20 MHz	 QPSK Mid channel	 16QAM Mid channel
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel

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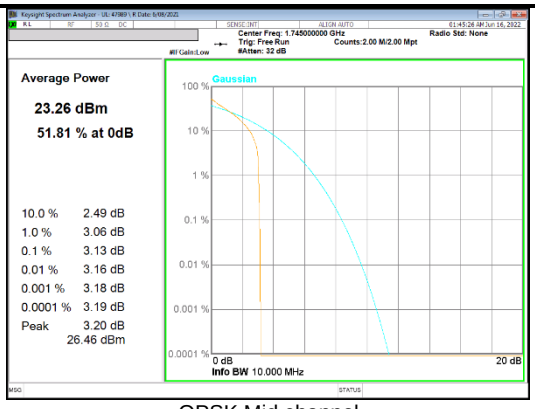
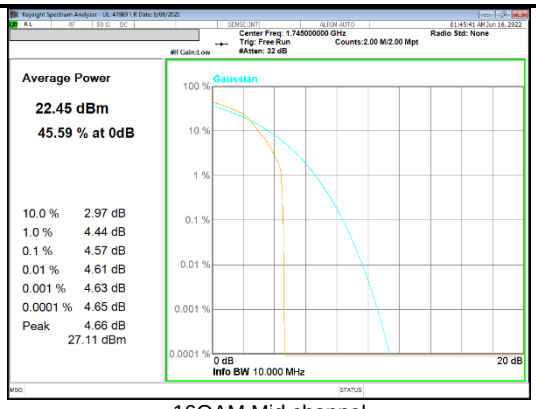
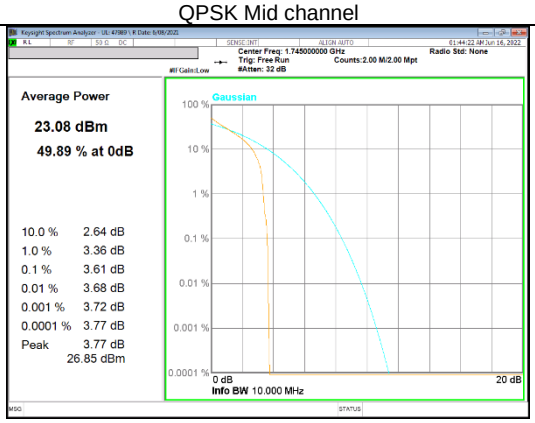
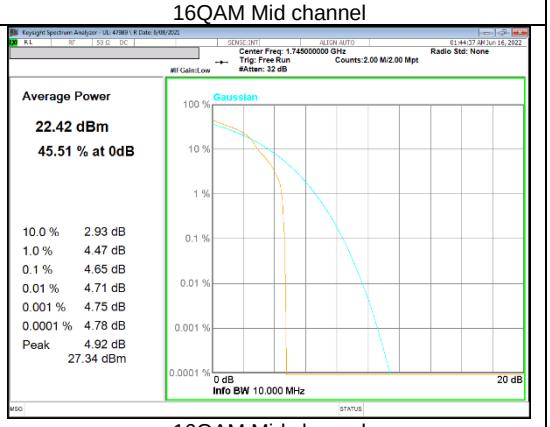
3 MHz		
	QPSK Mid channel	16QAM Mid channel
1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

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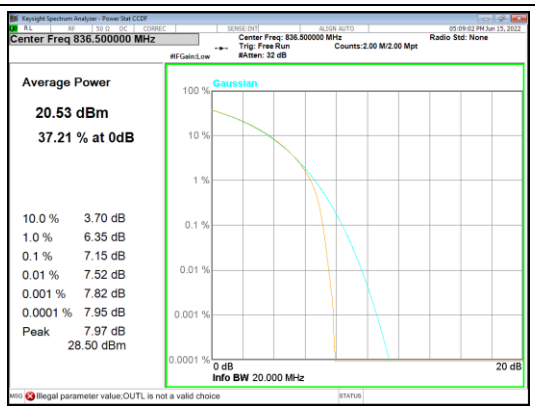
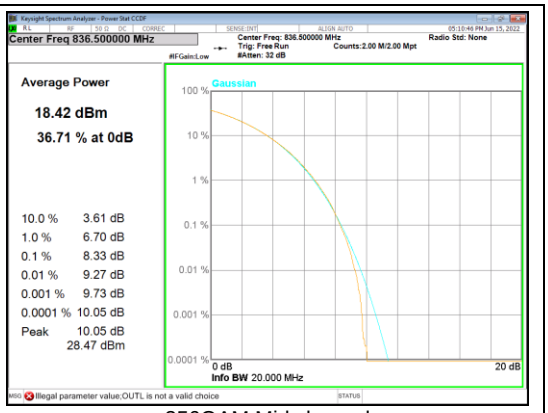
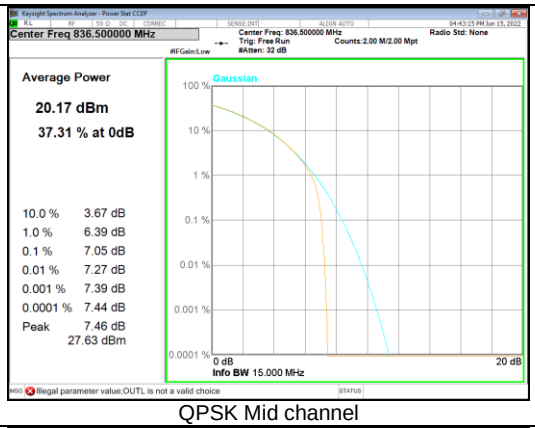
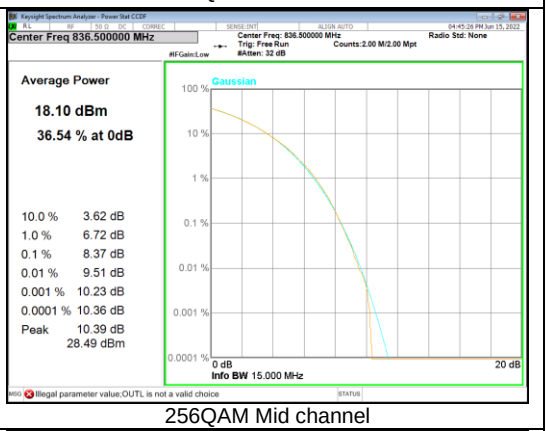
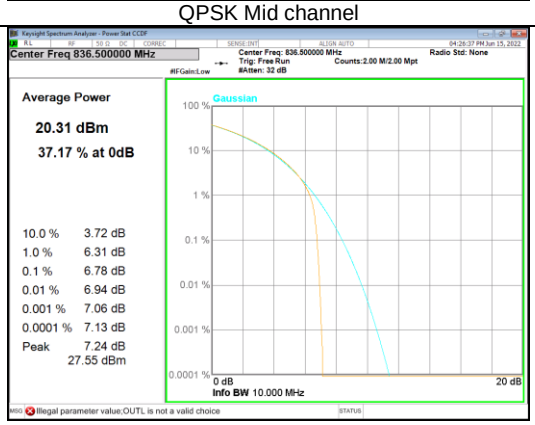
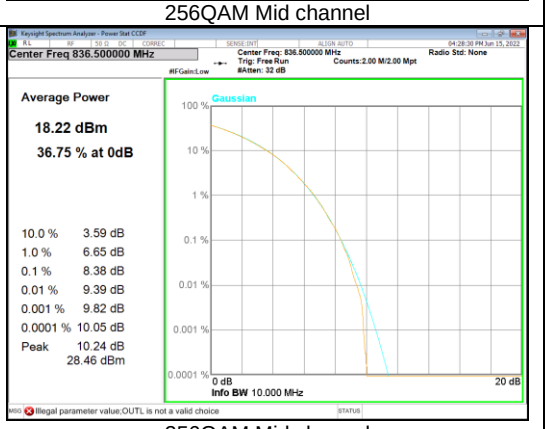
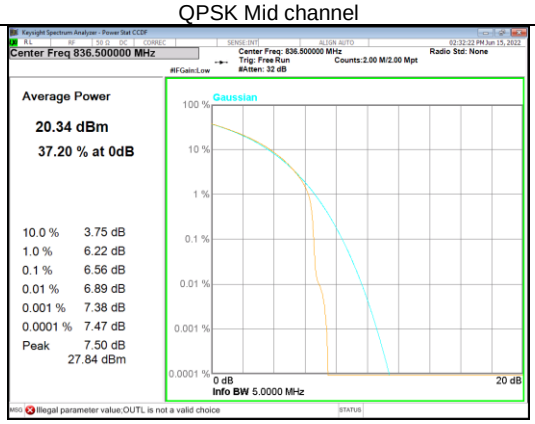
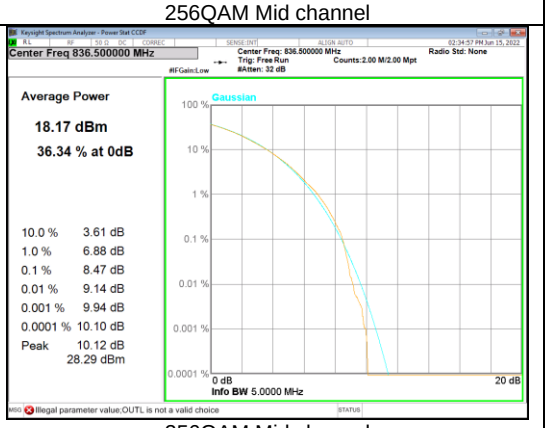
NR Band n5 CP-OFDM

20 MHz	 QPSK Mid channel	 256QAM Mid channel
15 MHz	 QPSK Mid channel	 256QAM Mid channel
10 MHz	 QPSK Mid channel	 256QAM Mid channel
5 MHz	 QPSK Mid channel	 256QAM Mid channel

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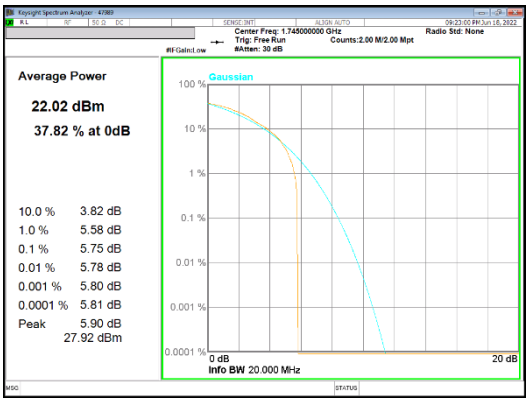
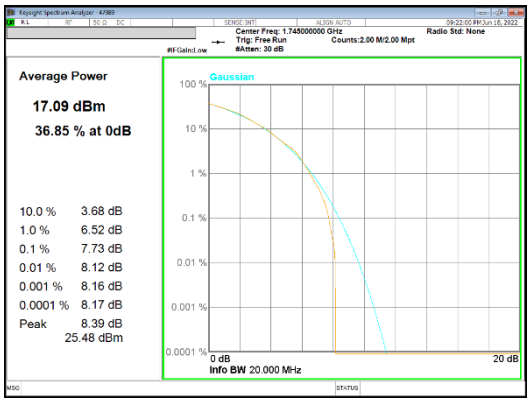
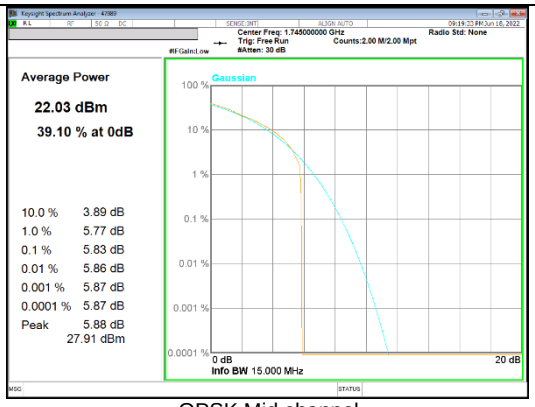
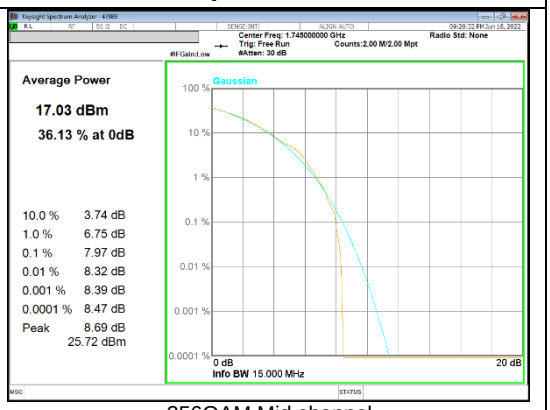
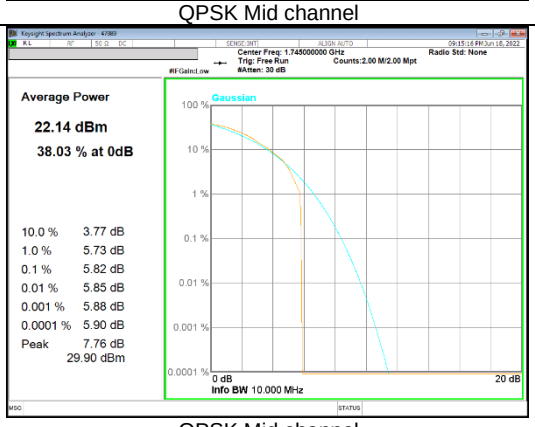
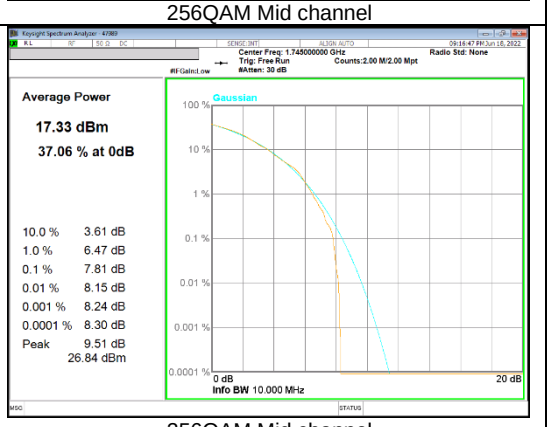
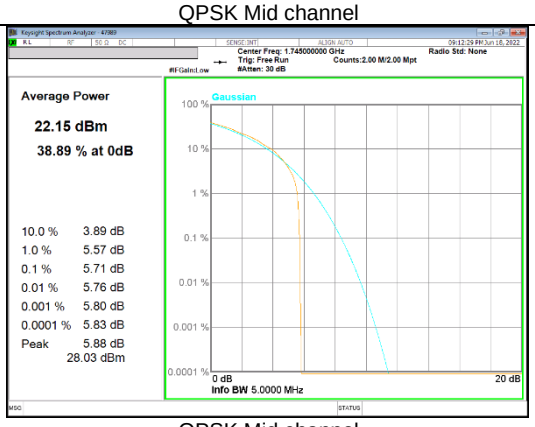
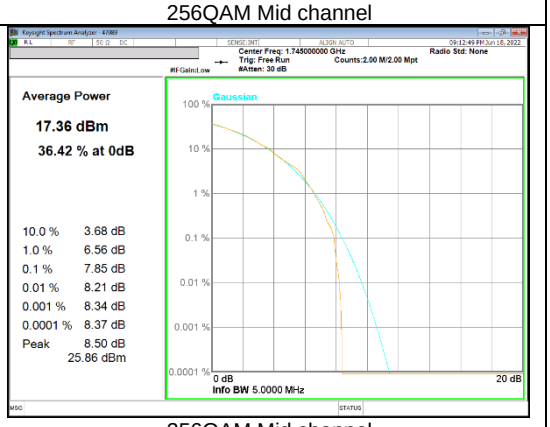
NR Band n66 CP-OFDM

20 MHz	 QPSK Mid channel	 256QAM Mid channel
15 MHz	 QPSK Mid channel	 256QAM Mid channel
10 MHz	 QPSK Mid channel	 256QAM Mid channel
5 MHz	 QPSK Mid channel	 256QAM Mid channel

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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)

RESULTS

See the following pages.

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- **GSM**

Band	Modulation	f [MHz]	99% BW (kHz)	-26dB BW (kHz)
850	GPRS	836.6	247.67	325.00
	EGPRS		233.98	296.10
1900	GPRS	1880.0	247.83	303.80
	EGPRS		245.74	295.60

- **WCDMA**

Band	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
B5	Rel.99	836.6	4.128	4.660
	HSDPA		4.142	4.668
B4	Rel.99	1732.6	4.156	4.691
	HSDPA		4.152	4.675
B2	Rel.99	1880.0	4.152	4.709
	HSDPA		4.156	4.679

- LTE Band 2

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B2	20M	QPSK	1880.0	17.896	19.200
		16QAM		17.866	19.280
	15M	QPSK		13.422	14.520
		16QAM		13.425	14.460
	10M	QPSK		8.963	9.790
		16QAM		8.945	9.757
	5M	QPSK		4.490	4.910
		16QAM		4.487	4.915
	3M	QPSK		2.692	2.968
		16QAM		2.689	3.005
	1.4M	QPSK		1.080	1.225
		16QAM		1.084	1.222

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- LTE Band 12

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B12	10M	QPSK	707.5	8.946	9.759
		16QAM		8.929	9.778
	5M	QPSK		4.484	4.918
		16QAM		4.484	4.904
	3M	QPSK		2.689	2.986
		16QAM		2.688	2.994
	1.4M	QPSK		1.086	1.227
		16QAM		1.086	1.232

- LTE Band 26 (Part 90)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	821.5	13.372	14.530
		16QAM		13.385	14.440
	10M	QPSK	819.0	8.970	9.665
		16QAM		8.934	9.704
	5M	QPSK	819.5	4.496	4.899
		16QAM		4.478	4.884
	3M	QPSK	820.5	2.694	3.004
		16QAM		2.693	2.983
	1.4M	QPSK	820.5	1.091	1.232
		16QAM		1.081	1.219

- LTE Band 26 (Straddle)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	824.0	13.402	14.490
		16QAM		13.402	14.400
	10M	QPSK		8.932	9.729
		16QAM		8.957	9.735
	5M	QPSK		4.483	4.917
		16QAM		4.485	4.963
	3M	QPSK		2.689	3.003
		16QAM		2.691	2.992
	1.4M	QPSK		1.087	1.237
		16QAM		1.086	1.234

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- LTE Band 26 (Part 22)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	831.5	13.410	14.630
		16QAM		13.416	14.540
	10M	QPSK		8.944	9.790
		16QAM		8.950	9.714
	5M	QPSK		4.488	4.902
		16QAM		4.492	4.911
	3M	QPSK		2.696	2.988
		16QAM		2.691	2.994
	1.4M	QPSK		1.086	1.227
		16QAM		1.092	1.231

- LTE Band 41

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B41	20M	QPSK	2593.0	17.911	19.200
		16QAM		17.908	20.000
	15M	QPSK		13.413	14.430
		16QAM		13.430	14.470
	10M	QPSK		9.001	9.962
		16QAM		8.950	10.090
	5M	QPSK		4.502	5.132
		16QAM		4.482	4.946

- LTE Band 66

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B66	20M	QPSK	1745.0	17.884	19.320
		16QAM		17.904	19.370
	15M	QPSK		13.425	14.550
		16QAM		13.406	14.540
	10M	QPSK		8.989	9.735
		16QAM		8.987	9.815
	5M	QPSK		4.494	4.899
		16QAM		4.481	4.908
	3M	QPSK		2.695	2.975
		16QAM		2.688	2.997
	1.4M	QPSK		1.080	1.223
		16QAM		1.083	1.225

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- NR Band n5 CP-OFDM

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n5	20M	QPSK	836.5	18.885	19.880
		16QAM		18.882	19.770
	15M	QPSK		14.112	14.860
		16QAM		14.132	14.930
	10M	QPSK		9.295	9.930
		16QAM		9.295	9.878
	5M	QPSK		4.475	4.937
		16QAM		4.481	4.894

- NR Band n66 CP-OFDM

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n66	20M	QPSK	1745.0	18.922	19.800
		16QAM		18.944	19.940
	15M	QPSK		14.068	14.870
		16QAM		14.130	14.800
	10M	QPSK		9.284	9.842
		16QAM		9.269	9.987
	5M	QPSK		4.470	4.936
		16QAM		4.490	4.832

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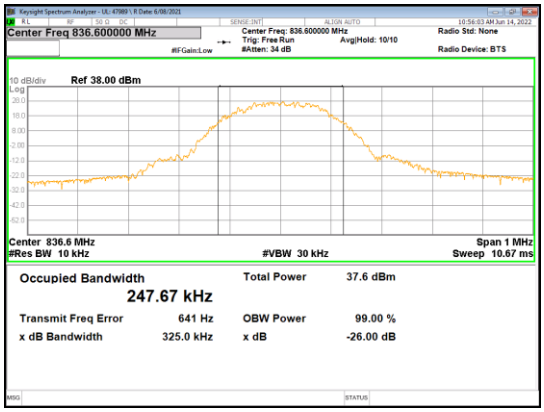
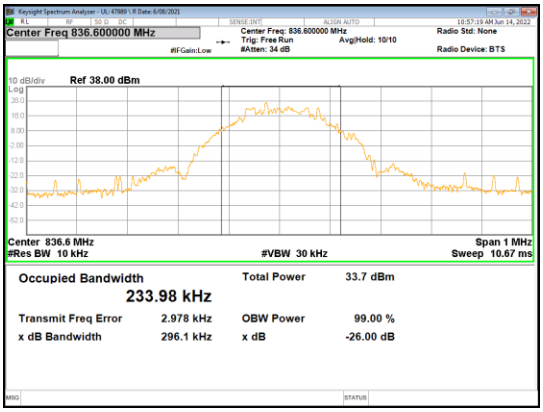
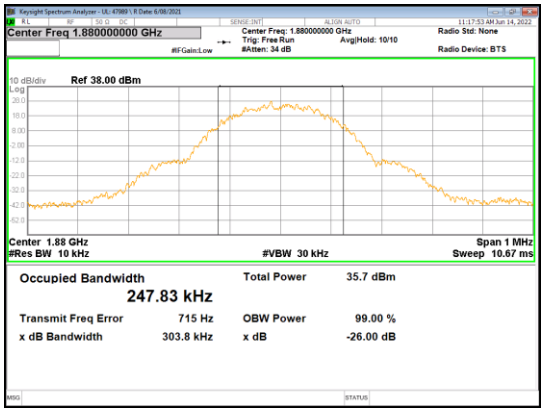
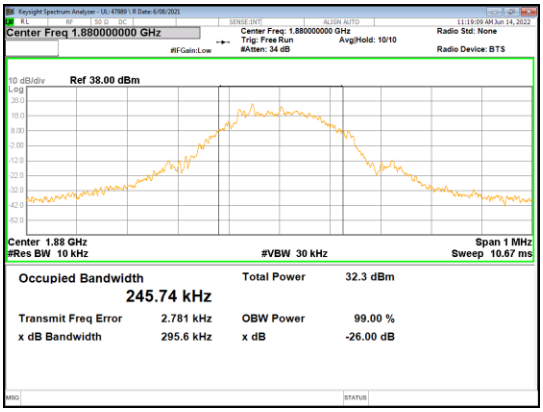
9.1.1. OCCUPIED BANDWIDTH RESULTS

GSM 850

GSM 850	 GPRS Mid channel	 EGPRS Mid channel

GSM 1900

GSM 1900	 GPRS Mid channel	 EGPRS Mid channel

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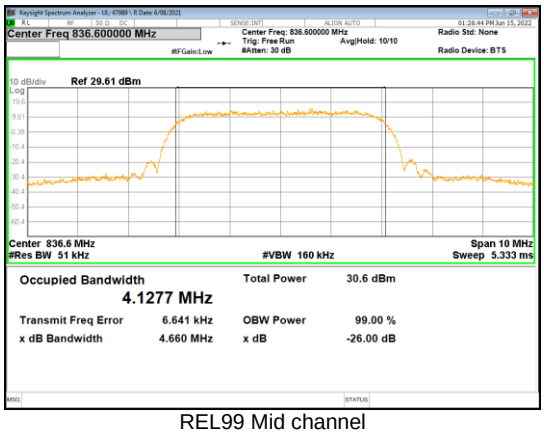
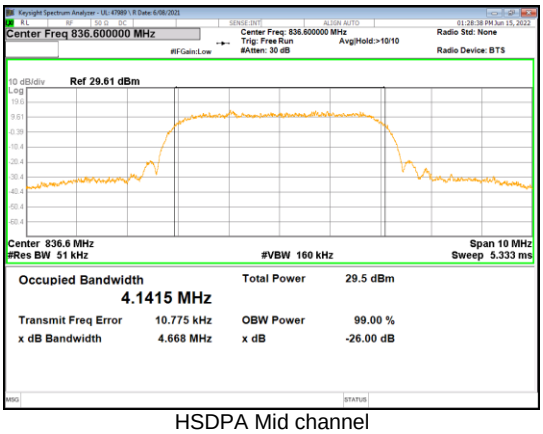
WCDMA Band 5

Band 5



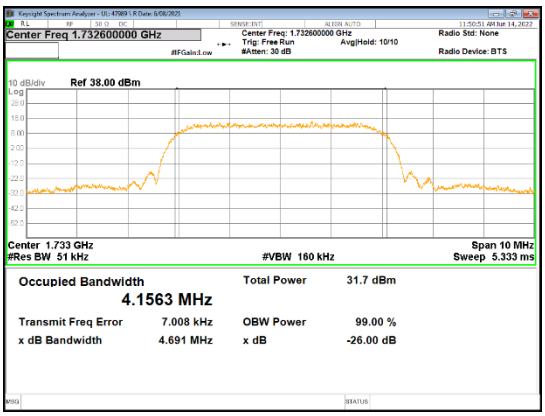
REL99 Mid channel



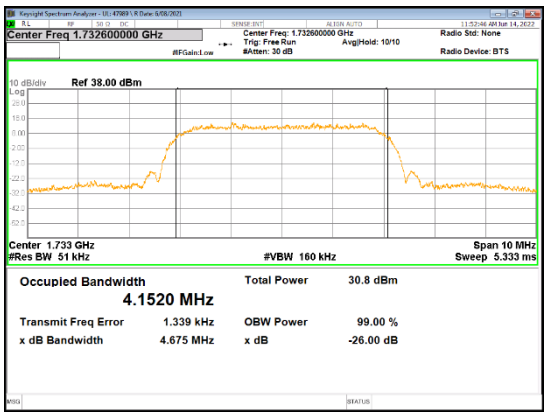
HSDPA Mid channel

WCDMA Band 4

Band 4



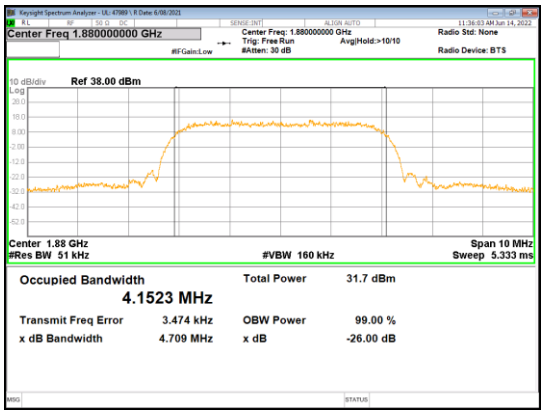
REL99 Mid channel



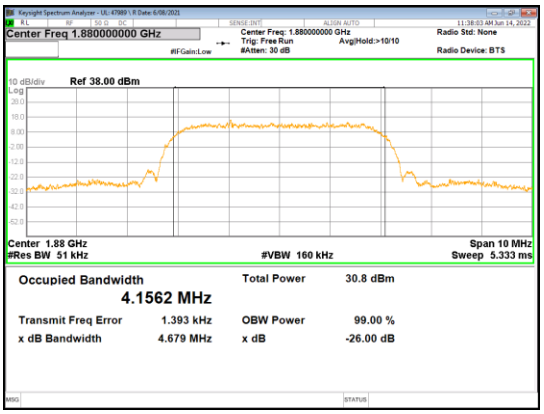
HSDPA Mid channel

WCDMA Band 2

Band 2



REL99 Mid channel



HSDPA Mid channel

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