CERTIFICATION TEST REPORT

Report Number. : 4790302422-E3V1

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

Model : SM-A136M/DS, SM-A136M

FCC ID : A3LSMA136M

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

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:
2022-05-09

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IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2022-05-09	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.
MODEL NUMBER:	SM-A136M/DS, SM-A136M
SERIAL NUMBER:	R3CT20631HB (CONDUCTED, Original); R3CT206R5SN (CONDUCTED, Spot-Check); R3CT20635PA, R3CT206350J, R3CT206378T, R3CT209QMDZ, R3CT209QMGB (RADIATED, Original); R3CT206R5VJ (RADIATED, Spot-Check);
DATE TESTED:	2021-12-28 ~ 2022-03-23; (Original) 2022-04-01 ~ 2022-04-09; (Spot-Check)

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:

Seokhwan Hong
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Yeonhee Lim
Suwon Lab Engineer
UL Korea, Ltd.

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1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMA136M PCE WWAN(FCC CFR 47 Part 22,24,27,90). And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.2. DIFFERENCE

The FCC ID: A3LSMA136M shares the same enclosure and circuit board as FCC ID: A3LSMA136B. The WWAN antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMA136B remains representative of FCC ID: A3LSMA136M. The test data of FCC ID: A3LSMA136B being submitted for this application to cover WWAN features.

1.3. SPOT CHECK VERIFICATION DATA

(Worst case of the radiated band-edge and radiated spurious emissions)

Band	Test Item	Worst Mode	Frequency	Test Limit	Original model	Spot check model	Deviation	Remark
					SM-A136B/DSN Results	SM-A136M/DS Results		
					FCC ID : A3LSMA136B	FCC ID : A3LSMA136M		
GSM 850	ERP	GPRS	824.2 MHz	38.50 dBm	27.77 dBm	28.15 dBm	0.38 dB	
	RSE	GPRS	2546.4 MHz	-13.00 dBm	-40.70 dBm	-40.40 dBm	0.30 dB	
GSM 1900	EIRP	GPRS	1880.0 MHz	33.00 dBm	29.80 dBm	29.61 dBm	-0.19 dB	
	RSE	GPRS	3819.6 MHz	-13.00 dBm	-44.20 dBm	-47.60 dBm	-3.40 dB	
WCDMA Band 2	EIRP	REL99	1880.0 MHz	33.00 dBm	24.37 dBm	24.40 dBm	0.03 dB	
	RSE	REL99	7409.6 MHz	-13.00 dBm	-40.10 dBm	-48.00 dBm	-7.90 dB	
WCDMA Band 4	EIRP	REL99	1752.6 MHz	30.00 dBm	23.76 dBm	22.35 dBm	-1.41 dB	
	RSE	REL99	6849.6 MHz	-13.00 dBm	-39.30 dBm	-47.50 dBm	-8.20 dB	
WCDMA Band 5	ERP	REL99	826.4 MHz	38.50 dBm	19.72 dBm	19.69 dBm	-0.03 dB	
	RSE	REL99	2509.8 MHz	-13.00 dBm	-54.75 dBm	-57.10 dBm	-2.35 dB	
LTE Band 2	EIRP	20M QPSK	1900.0 MHz	33.00 dBm	23.63 dBm	23.15 dBm	-0.48 dB	
	RSE	20M QPSK	7440.0 MHz	-13.00 dBm	-29.50 dBm	-42.00 dBm	-12.50 dB	
LTE Band 12	ERP	5M QPSK	707.5 MHz	34.80 dBm	20.03 dBm	19.44 dBm	-0.59 dB	
	RSE	5M QPSK	2122.5 MHz	-13.00 dBm	-52.80 dBm	-57.30 dBm	-4.50 dB	
LTE Band 26(22)	ERP	5M QPSK	831.5 MHz	38.50 dBm	19.48 dBm	19.73 dBm	0.25 dB	
	RSE	5M QPSK	2539.5 MHz	-13.00 dBm	-54.30 dBm	-55.30 dBm	-1.00 dB	
LTE Band 26(90)	ERP	1.4M QPSK	823.3 MHz	50.00 dBm	18.74 dBm	18.97 dBm	0.23 dB	
	RSE	5M QPSK	1643.0 MHz	-13.00 dBm	-56.20 dBm	-58.70 dBm	-2.50 dB	
LTE Band 41	EIRP	5M QPSK	2498.5 MHz	33.00 dBm	23.84 dBm	24.56 dBm	0.72 dB	
	RSE	20M QPSK	12530.0 MHz	-25.00 dBm	-42.90 dBm	-45.50 dBm	-2.60 dB	
LTE Band 66	EIRP	5M QPSK	1712.5 MHz	30.00 dBm	23.19 dBm	23.23 dBm	0.04 dB	
	RSE	20M QPSK	6980.0 MHz	-13.00 dBm	-29.80 dBm	-46.10 dBm	-16.30 dB	
NR n5	ERP	15M BPSK	841.5 MHz	38.50 dBm	19.13 dBm	19.35 dBm	0.22 dB	
	RSE	5M BPSK	2539.5 MHz	-13.00 dBm	-54.80 dBm	-57.00 dBm	-2.20 dB	
NR n41	EIRP	60M BPSK	2526.0 MHz	33.00 dBm	22.80 dBm	22.72 dBm	-0.08 dB	
	RSE	100M BPSK	12965.0 MHz	-25.00 dBm	-44.30 dBm	-52.10 dBm	-7.80 dB	

Comparison of two models, upper deviation is within 3 dB range and all test results are under FCC Technical Limits.

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1.4. REFERENCE DETAIL

Reference application that contains the reused reference data in the individual test reports:

Equipment Class	Reference FCC ID (Parent)	Application Type	Reference Test report number	Exhibit Type	Variant Test Report Number	Data Re-used
PCE	A3LSMA136B	Original Grant	4790302419-E2	Test Report	4790302422-E2	All
DTS	A3LSMA136B	Original Grant	4790302419-E3 (802.11b/g/n)	Test Report	4790302422-E3 (802.11b/g/n)	All
			4790302419-E4 Bluetooth LE	Test Report	4790302422-E4 Bluetooth LE	All
DSS	A3LSMA136B	Original Grant	4790302419-E5 (Bluetooth)	Test Report	4790302422-E5 (Bluetooth)	All
NII	A3LSMA136B	Original Grant	4790302419-E6 (802.11a/n/ac)	Test Report	4790302422-E6 (802.11a/n/ac)	All

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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.
This test report addresses the WWAN operational mode.

This report covers the Samsung models SM-A136M/DS and SM-A136M.
These models are identical in hardware except SM-A136M has single SIM tray.
With some pre-scan, model SM-A136M/DS was set for final test.

5.2. MAXIMUM OUTPUT POWER

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

Note : Conducted output power results were excerpted from RF exposure test report.
(4790302422-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	**32.00**	**1583.94**	**27.77**	**598.07**
		EGPRS	25.51	355.67	20.94	124.21
GSM1900	1850~1910	GPRS	**29.76**	**946.52**	**29.80**	**955.23**
		EGPRS	25.17	328.63	29.53	897.65

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	**24.00**	**251.39**	**19.72**	**93.71**
		HSDPA	23.01	199.91	18.78	75.47
Band 4	1710~1755	Rel. 99	**23.99**	**250.88**	**23.76**	**237.60**
		HSDPA	22.96	197.70	22.84	192.25
Band 2	1850~1910	Rel. 99	**23.96**	**248.78**	23.14	205.93
		HSDPA	22.97	197.97	**24.37**	**273.35**

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LTE Band 2

FCC Part 24							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 2	1860 - 1900	20	QPSK	**23.92**	**246.60**	**23.63**	**230.51**
			16QAM	22.81	191.07	22.10	162.14
			64QAM	22.00	158.42		
	1857.5 - 1902.5	15	QPSK	23.31	214.33	23.37	217.32
			16QAM	22.78	189.60	22.78	189.70
			64QAM	21.62	145.35		
	1855 - 1905	10	QPSK	23.37	217.43	22.87	193.69
			16QAM	22.80	190.66	22.02	159.26
			64QAM	21.68	147.16		
	1852.5 - 1907.5	5	QPSK	23.55	226.68	22.57	180.76
			16QAM	22.98	198.80	21.87	153.85
			64QAM	21.84	152.87		
	1851.5 - 1908.5	3	QPSK	23.36	216.96	22.59	181.60
			16QAM	22.80	190.55	21.87	153.85
			64QAM	21.66	146.59		
	1850.7 - 1909.3	1.4	QPSK	23.80	239.82	22.83	191.76
			16QAM	23.13	205.69	22.02	159.13
			64QAM	22.23	167.00		

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	24.32	270.50	19.68	92.98
			16QAM	23.07	202.87	19.04	80.24
			64QAM	22.61	182.39		
	701.5 - 707.5	5	QPSK	**24.50**	**281.92**	**20.03**	**100.63**
			16QAM	23.95	248.31	18.53	71.35
			64QAM	22.99	198.99		
	700.5 - 714.5	3	QPSK	24.49	280.89	19.40	87.02
			16QAM	23.87	244.04	18.77	75.27
			64QAM	22.78	189.87		
	699.7 - 715.3	1.4	QPSK	24.45	278.92	19.55	90.10
			16QAM	23.83	241.82	18.02	63.35
			64QAM	22.89	194.59		

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LTE Band 13

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 13	782	10	QPSK	24.27	267.30	20.77	119.34
			16QAM	23.13	205.55	19.82	95.90
			64QAM	22.92	195.88		
	779.5 - 784.5	5	QPSK	**24.65**	**292.07**	**21.82**	**151.99**
			16QAM	23.83	241.33	20.28	106.61
			64QAM	22.99	199.07		

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	23.96	249.08	18.37	68.78
			16QAM	23.31	214.13	17.43	55.39
			64QAM	22.15	164.23		
	819	10	QPSK	23.99	250.36	18.51	70.91
			16QAM	23.01	200.09	17.23	52.81
			64QAM	22.19	165.68		
	816.5 - 821.5	5	QPSK	**24.11**	**257.72**	18.57	72.02
			16QAM	23.06	202.49	17.34	54.19
			64QAM	22.37	172.53		
	815.5 - 822.5	3	QPSK	24.01	251.51	18.30	67.59
			16QAM	23.08	203.13	17.49	56.15
			64QAM	22.21	166.42		
	814.7 - 823.3	1.4	QPSK	23.99	250.68	**18.74**	**74.86**
			16QAM	23.13	205.64	17.45	55.62
			64QAM	22.13	163.41		

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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	23.77	237.966	18.94	78.34
			16QAM	22.75	188.273	17.86	61.10
			64QAM	21.58	143.880		
	829 ~ 844	10	QPSK	23.87	243.980	19.17	82.60
			16QAM	22.92	196.096	17.92	61.94
			64QAM	22.07	161.224		
	826.5 ~ 846.5	5	QPSK	**24.06**	**254.586**	**19.48**	**88.72**
			16QAM	23.17	207.585	18.06	64.03
			64QAM	22.13	163.435		
	825.5 ~ 847.5	3	QPSK	23.83	241.547	19.04	80.21
			16QAM	22.89	194.590	18.01	63.25
			64QAM	22.03	159.595		
	824.7 ~ 848.3	1.4	QPSK	23.92	246.471	19.00	79.47
			16QAM	22.97	198.012	17.89	61.52
			64QAM	22.22	166.857		

LTE Band 26 (Straddle)

Straddle							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	824	15	QPSK	23.96	249.081	**18.98**	**79.02**
			16QAM	23.31	214.128	17.63	57.91
			64QAM	22.15	164.226		
		10	QPSK	23.96	249.149	18.61	72.58
			16QAM	23.35	216.033	17.54	56.73
			64QAM	22.21	166.398		
		5	QPSK	**24.05**	**254.034**	18.97	78.86
			16QAM	23.40	218.776	17.80	60.23
			64QAM	22.38	172.841		
		3	QPSK	23.98	249.781	18.58	72.08
			16QAM	23.31	214.315	17.40	54.93
			64QAM	22.16	164.552		
		1.4	QPSK	23.95	248.044	18.79	75.65
			16QAM	23.10	203.981	17.41	55.06
			64QAM	22.32	170.570		

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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	**23.71**	**234.77**	23.42	220.03
			16QAM	22.72	187.16	22.40	173.97
			64QAM	21.92	155.76		
	2503.5 - 2682.5	15	QPSK	23.60	229.09	23.52	23.52
			16QAM	22.48	176.82	22.40	173.84
			64QAM	21.76	150.09		
	2501 - 2685	10	QPSK	23.57	227.50	23.48	222.63
			16QAM	22.43	175.03	22.06	160.54
			64QAM	21.95	156.70		
	2498.5 - 2687.5	5	QPSK	23.45	221.18	**23.84**	**242.19**
			16QAM	22.34	171.26	22.10	162.24
			64QAM	21.98	157.63		

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LTE Band 66

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 66	1720 - 1770	20	QPSK	24.27	267.02	22.75	188.15
			16QAM	23.48	222.84	22.18	165.01
			64QAM	22.49	177.42		
	1717.5 - 1772.5	15	QPSK	23.81	240.26	22.99	199.28
			16QAM	23.09	203.83	21.98	157.93
			64QAM	22.44	175.39		
	1715 - 1775	10	QPSK	23.81	240.64	23.13	205.74
			16QAM	22.82	191.54	22.28	169.17
			64QAM	22.19	165.75		
	1712.5 - 1777.5	5	QPSK	23.97	249.50	**23.19**	**208.37**
			16QAM	23.29	213.07	22.34	171.33
			64QAM	22.12	163.10		
	1711.5 - 1778.5	3	QPSK	23.87	243.55	23.07	202.56
			16QAM	22.80	190.55	22.37	172.40
			64QAM	22.23	166.95		
	1710.7 - 1779.3	1.4	QPSK	**24.49**	**281.19**	22.31	170.13
			16QAM	23.49	223.44	21.45	139.56
			64QAM	22.48	177.15		

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	24.16	260.62	19.07	80.63
				QPSK	24.14	259.42		
				16QAM	23.13	205.59	17.66	58.28
				64QAM	22.01	158.85		
				256QAM	20.08	101.86		
			CP-OFDM	QPSK	22.78	189.67		
	831.5 - 841.5	15	DFT-s OFDM	π/2 BPSK	24.07	255.27	**19.13**	**81.84**
				QPSK	23.97	249.46		
				16QAM	23.07	202.77	17.98	79.23
				64QAM	21.74	149.28		
				256QAM	19.88	97.27		
			CP-OFDM	QPSK	22.44	175.39		
	829 - 844	10	DFT-s OFDM	π/2 BPSK	**23.83**	**241.55**	19.07	69.98
				QPSK	23.82	240.99		
				16QAM	23.27	212.32	17.73	80.73
				64QAM	21.71	148.25		
				256QAM	19.92	98.17		
			CP-OFDM	QPSK	22.32	170.61		
	826.5 - 846.5	5	DFT-s OFDM	π/2 BPSK	24.26	266.69	19.09	58.94
				QPSK	24.25	266.07		
				16QAM	23.40	218.78	17.70	80.70
				64QAM	22.07	161.06		
			CP-OFDM	QPSK	20.15	103.51		

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NR Band n41

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n41	2546.0~2640.0	100	DFT-s OFDM	π/2 BPSK	23.16	207.01	22.74	187.95
				QPSK	23.14	206.06		
				16QAM	21.06	127.64	21.03	126.78
				64QAM	19.62	91.62		
				256QAM	17.38	54.70		
			CP-OFDM	QPSK	20.23	105.44		
	2541.0~2645.0	90	DFT-s OFDM	π/2 BPSK	22.50	177.83	22.47	176.80
				QPSK	22.52	178.65		
				16QAM	21.01	126.18	20.96	124.88
				64QAM	19.70	93.33		
				256QAM	17.72	59.16		
			CP-OFDM	QPSK	20.57	114.02		
	2536.0~2650.0	80	DFT-s OFDM	π/2 BPSK	22.68	185.35	22.52	178.78
				QPSK	22.53	179.06		
				16QAM	21.76	149.97	21.66	146.72
				64QAM	21.34	136.14		
				256QAM	20.95	124.45		
			CP-OFDM	QPSK	20.95	124.45		
	2526.0~2660.0	60	DFT-s OFDM	π/2 BPSK	23.02	200.45	**22.80**	**190.76**
				QPSK	23.05	201.84		
				16QAM	21.55	142.89	21.46	140.12
				64QAM	20.02	100.46		
				256QAM	18.34	68.23		
			CP-OFDM	QPSK	21.79	151.01		
	2521.0~2665.0	50	DFT-s OFDM	π/2 BPSK	23.04	201.37	22.19	165.61
				QPSK	23.10	204.17		
				16QAM	21.87	153.82	21.55	142.92
				64QAM	20.22	105.20		
				256QAM	18.36	68.55		
			CP-OFDM	QPSK	21.32	135.52		
	2516.0~2670.0	40	DFT-s OFDM	π/2 BPSK	23.10	204.17	22.11	162.44
				QPSK	23.10	204.17		
				16QAM	21.41	138.36	21.36	136.68
				64QAM	19.97	99.31		
				256QAM	17.91	61.80		
			CP-OFDM	QPSK	20.83	121.06		
	2511.0~2675.0	30	DFT-s OFDM	π/2 BPSK	22.97	198.15	22.33	170.82
				QPSK	22.99	199.07		
				16QAM	21.67	146.89	21.69	147.42
				64QAM	20.34	108.14		
				256QAM	18.39	69.02		
			CP-OFDM	QPSK	21.21	132.13		
	2506.0~2680.0	20	DFT-s OFDM	π/2 BPSK	23.03	200.91	22.79	190.27
				QPSK	**23.21**	**209.41**		
				16QAM	21.89	154.53	21.78	150.79
				64QAM	20.39	109.40		
				256QAM	18.67	73.62		
			CP-OFDM	QPSK	21.41	138.36		
	2503.5~2683.5	15	DFT-s OFDM	π/2 BPSK	23.04	201.37	22.61	182.44
				QPSK	23.04	201.37		
				16QAM	21.97	157.40	21.43	139.03
				64QAM	20.38	109.14		
				256QAM	18.82	76.21		
			CP-OFDM	QPSK	21.42	138.68		
	2501.0~2685.0	10	DFT-s OFDM	π/2 BPSK	23.04	201.37	21.90	154.77
				QPSK	23.02	200.45		
				16QAM	21.96	157.04	21.50	141.15
				64QAM	20.42	110.15		
				256QAM	18.52	71.12		
			CP-OFDM	QPSK	21.46	139.96		

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NR Band n66

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n66	1720 - 1770	20	DFT-s OFDM	π/2 BPSK	22.97	198.15		
				QPSK	23.05	201.84	22.72	159.05
				16QAM	21.85	153.11	21.45	139.68
				64QAM	20.05	101.16		
				256QAM	18.63	72.95		
			CP-OFDM	QPSK	21.44	139.32		
	1717.5 - 1772.5	15	DFT-s OFDM	π/2 BPSK	22.96	197.70		
				QPSK	23.04	201.37	**23.45**	**169.75**
				16QAM	21.64	145.88	22.30	187.13
				64QAM	19.89	97.50		
				256QAM	18.65	73.28		
			CP-OFDM	QPSK	21.16	130.62		
	1715 - 1775	10	DFT-s OFDM	π/2 BPSK	**22.86**	**193.20**		
				QPSK	22.96	197.70	23.15	157.14
				16QAM	21.52	141.91	21.96	221.22
				64QAM	19.87	97.05		
				256QAM	18.57	71.94		
			CP-OFDM	QPSK	20.96	124.74		
	1712.5 - 1777.5	5	DFT-s OFDM	π/2 BPSK	23.06	202.30		
				QPSK	23.13	205.59	22.81	206.68
				16QAM	21.74	149.28	21.75	206.68
				64QAM	20.19	104.47		
			CP-OFDM	QPSK	18.74	74.82		

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5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

Frequency (MHz)	Peak Gain (dBi)
GSM1900 / WCDMA Band 2 / LTE Band 2 1850 ~ 1915 MHz	-0.06
WCDMA Band 4 / LTE Band 4 / LTE Band 66 / NR Band n66 1710 ~ 1780 MHz	-0.49
GSM850 / WCDMA Band 5 / LTE Band 5 / LTE Band 26 / NR Band n5 814 ~ 849 MHz	-3.77
LTE Band 12 / LTE Band 17 699 ~ 716 MHz	-4.56
LTE Band 13 777 ~ 787 MHz	-4.62
LTE Band 41 / NR Band n41 2496 ~ 2690 MHz	2.83

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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

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 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.

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.

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Highest power setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
2	1860.0	20	1	0
	1880.0		1	49
	1900.0		1	0
12	701.5	5	1	12
	707.5		1	0
	713.5		1	0
13	779.5	5	1	24
	782.0		1	12
	784.5		1	24
26 (Part 90)	816.5	5	1	24
	821.5		1	24
26 (Straddle)	824.0	5	1	0
26 (Part 22)	826.5	5	1	0
	831.5		1	0
	846.5		1	0
41	2506.0	20	1	49
	2593.0		1	49
	2680.0		1	99
66	1720.0	20	1	99
	1745.0		1	49
	1770.0		1	49

Highest power setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
5	826.5	5	1	1
	836.5		1	1
	846.5		1	1
41	2546.0	100	1	137
	2593.0		1	137
	2640.0		1	137
66	1712.5	5	1	23
	1745.0		1	1
	1777.5		1	13

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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**
41	**66**
66	5,12, **13**

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

Band	ERP/EIRP			RSE		
	X	Y	Z	X	Y	Z
GSM850	O	-	-	O	-	-
GSM1900	O	-	-	-	O	-
WCDMA B5	O	-	-	O	-	-
WCDMA B4	-	O	-	-	-	O
WCDMA B2	O	-	-	-	-	O
LTE B2	O	-	-	-	-	O
LTE B12	-	-	O	-	O	-
LTE B13	O	-	-	O	-	-
LTE B26	O	-	-	O	-	-
LTE B41	O	-	-	-	-	O
LTE B66	O	-	-	-	-	O
NR n5	O	-	-	-	O	-
NR n41	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.

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5.5. 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
Charger	SAMSUNG	EP-TA200	R37KC6F39T1SE3	N/A
Data Cable	SAMSUNG	EP-DR140AWE	GH39-01999A	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 to C Type	Shielded	1.0 m	N/A
2	DC Power	1	A to C Type	Shielded	1.0 m	N/A
3	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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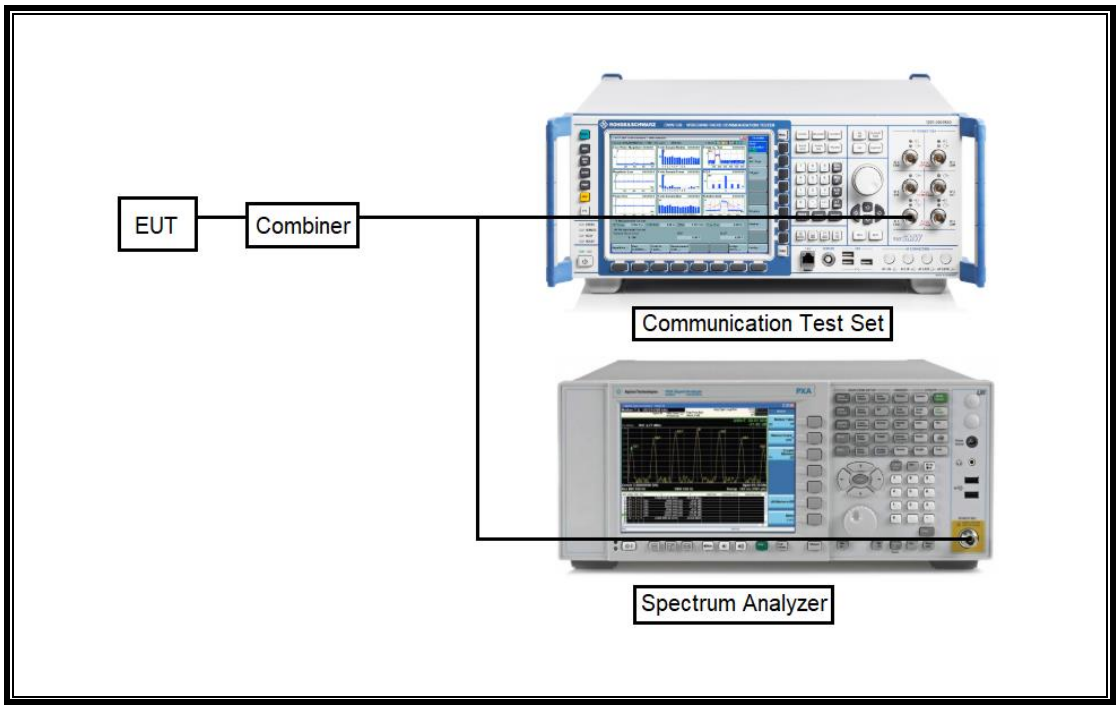
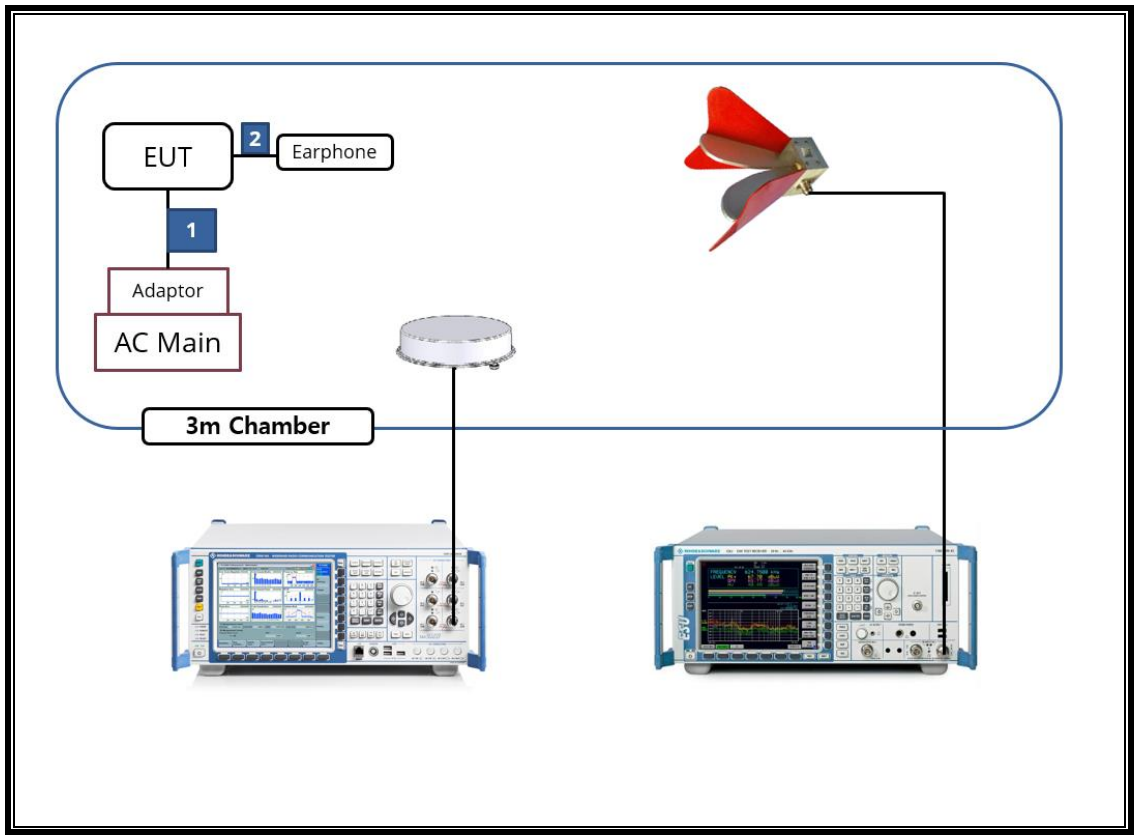
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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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 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 (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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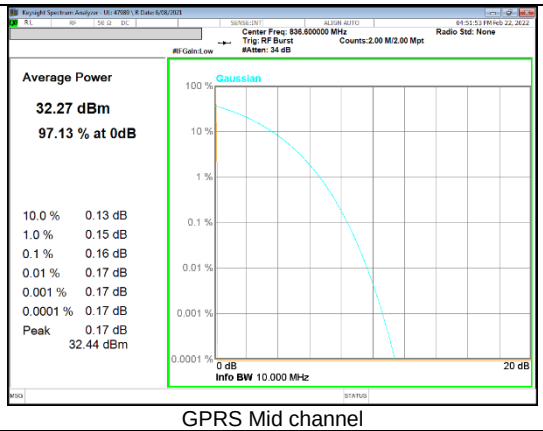
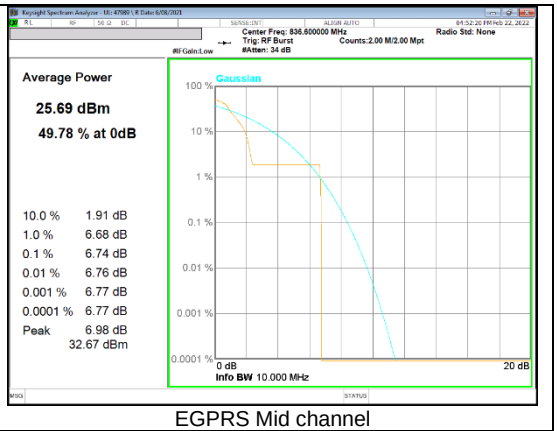
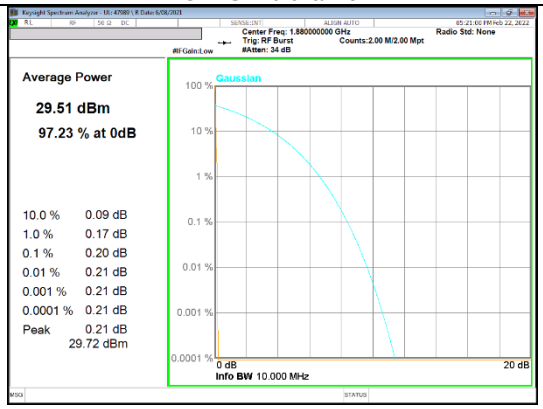
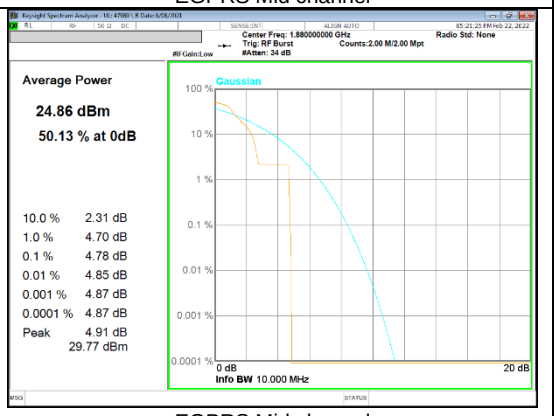
8.1. CONDUCTED PEAK TO AVERAGE RESULT

GSM

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

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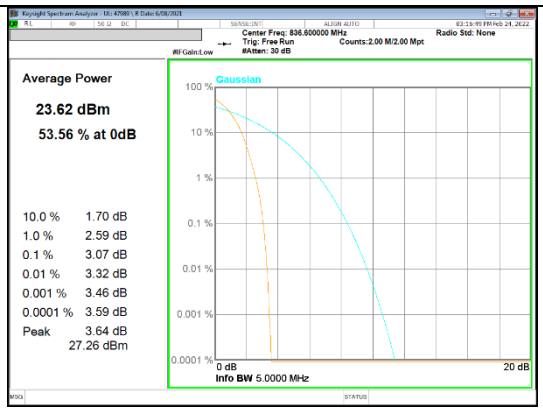
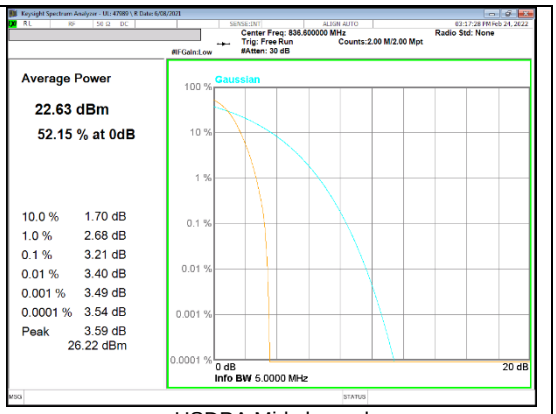
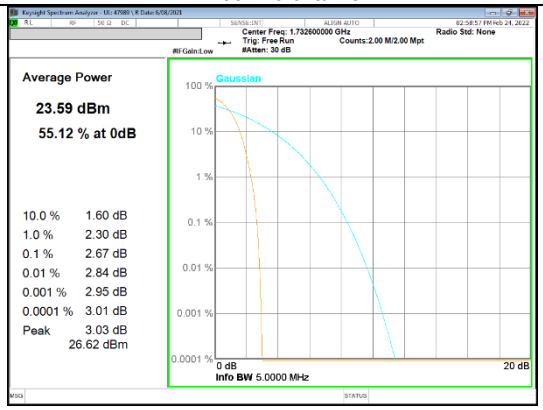
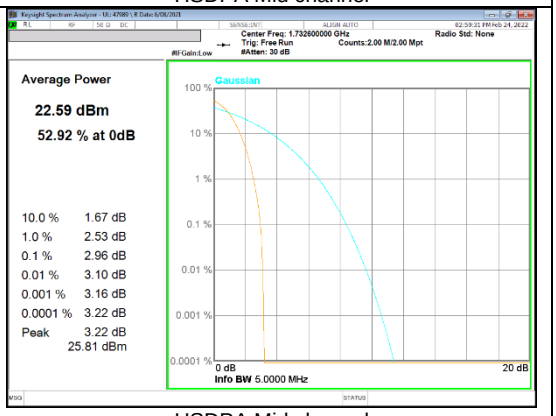
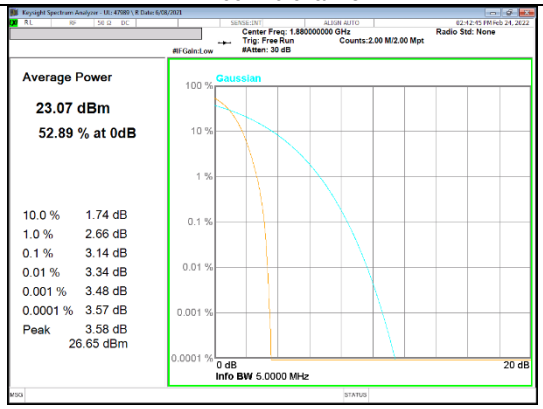
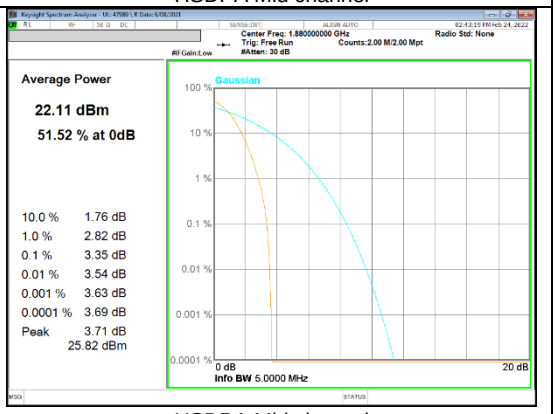
WCDMA

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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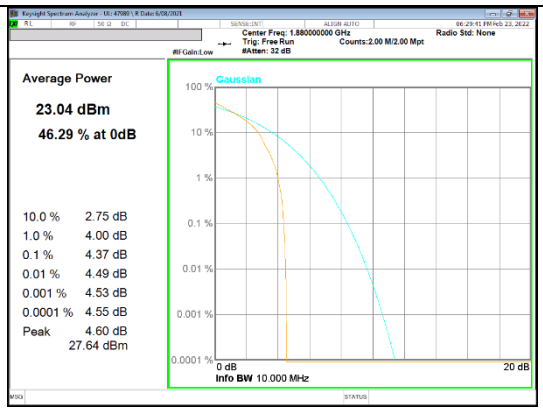
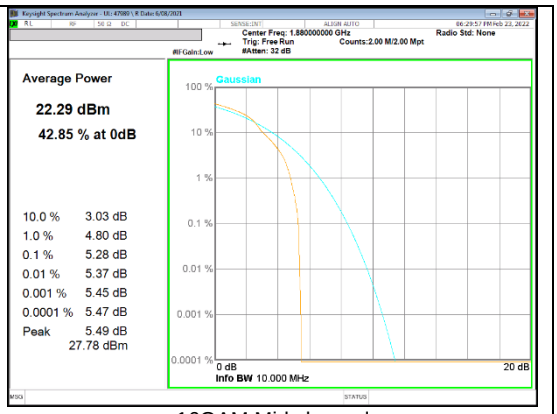
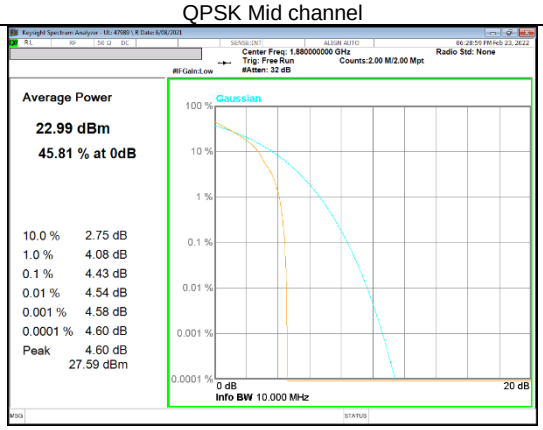
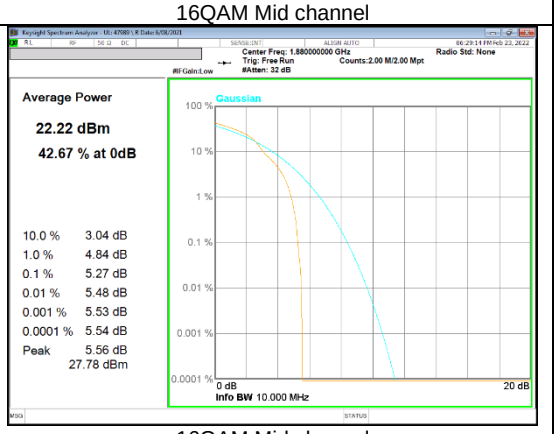
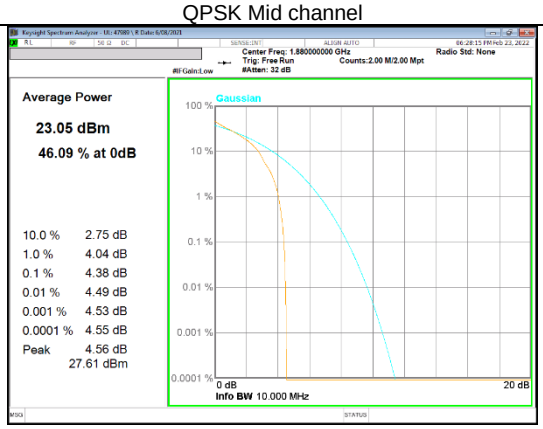
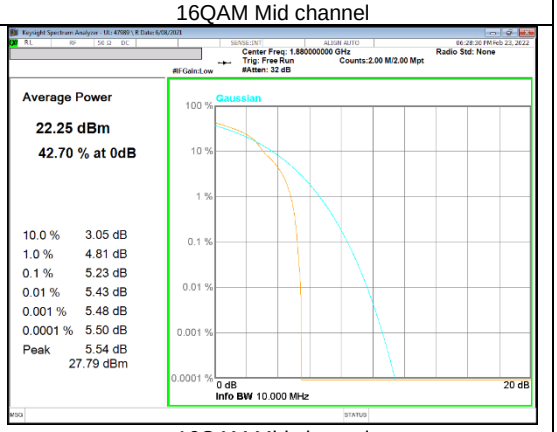
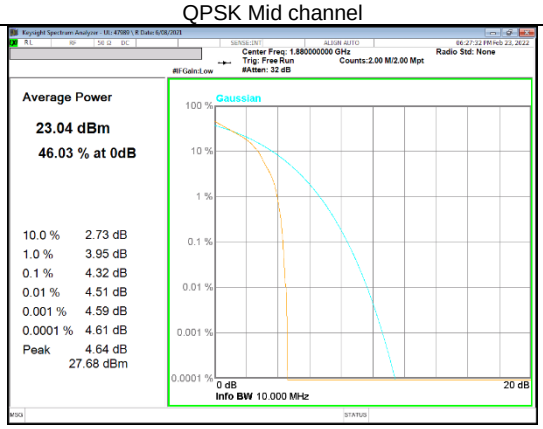
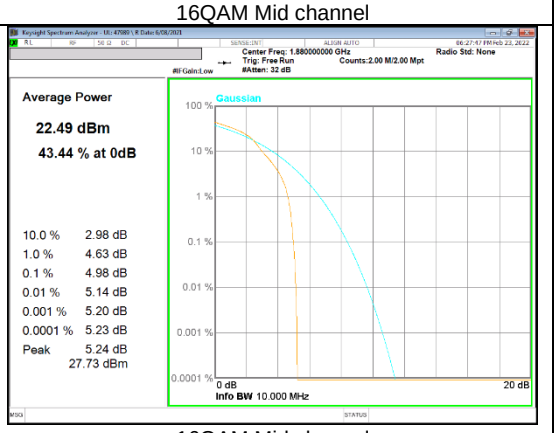
LTE Band 2

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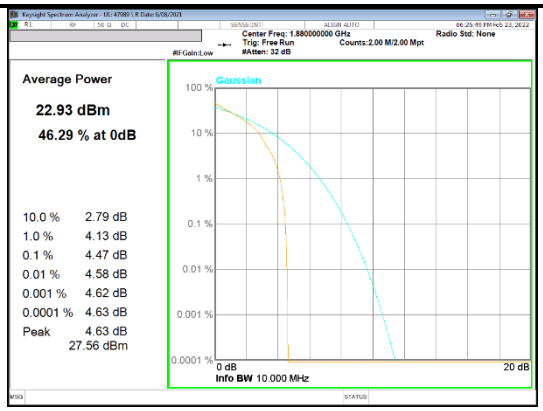
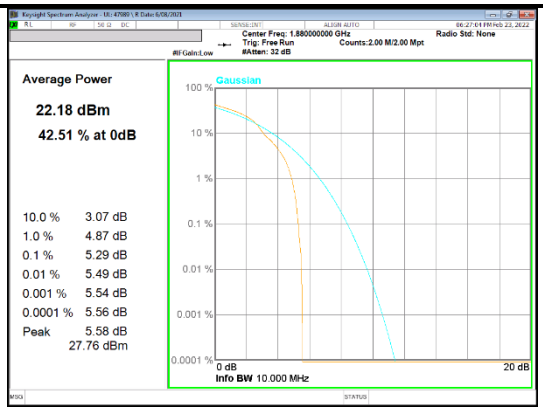
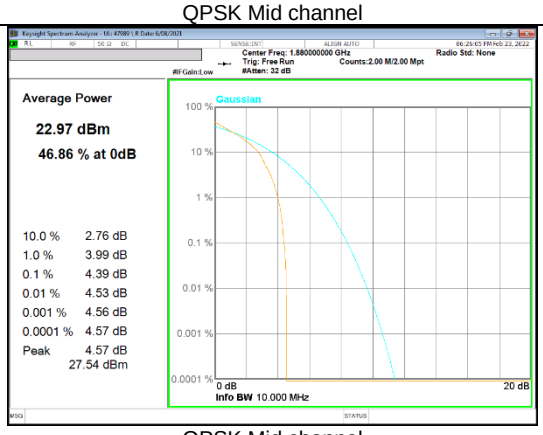
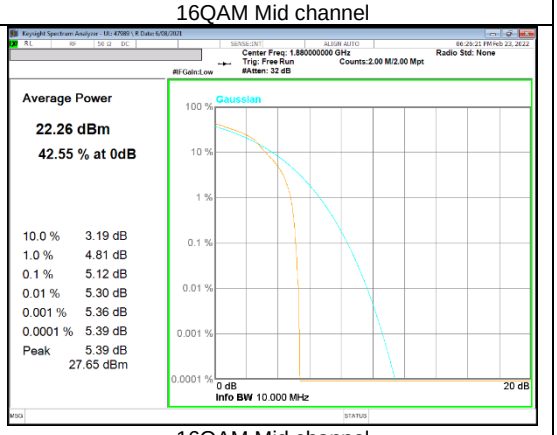
3 MHz		
	QPSK Mid channel	16QAM Mid channel
1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

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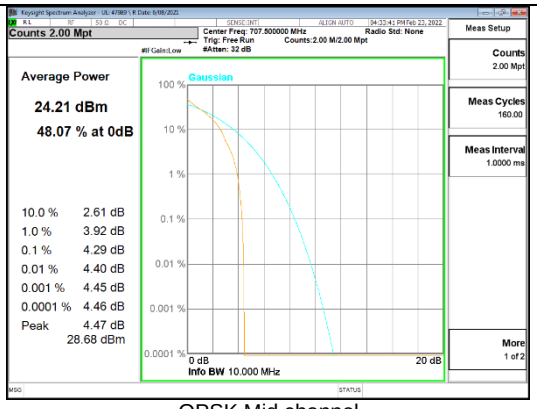
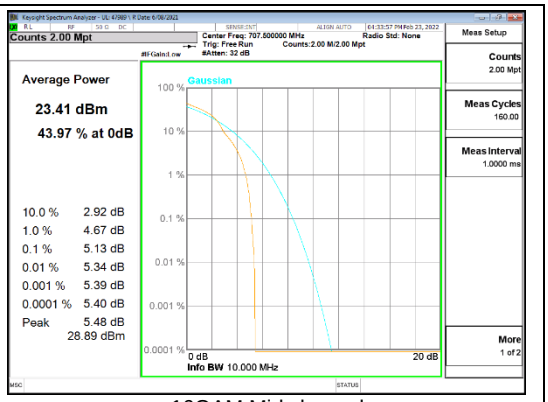
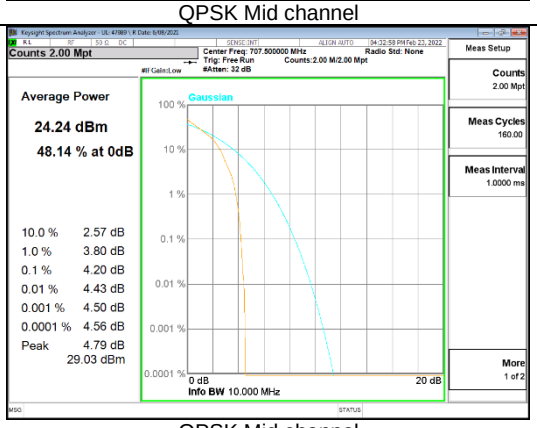
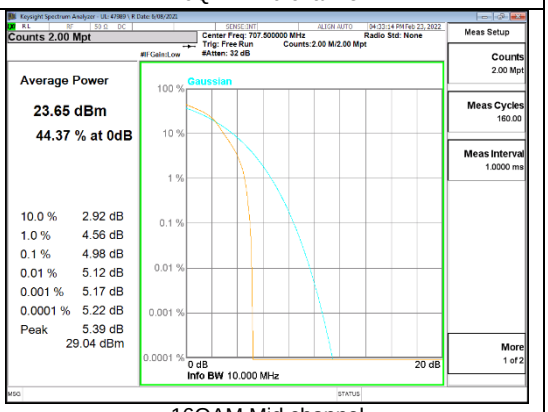
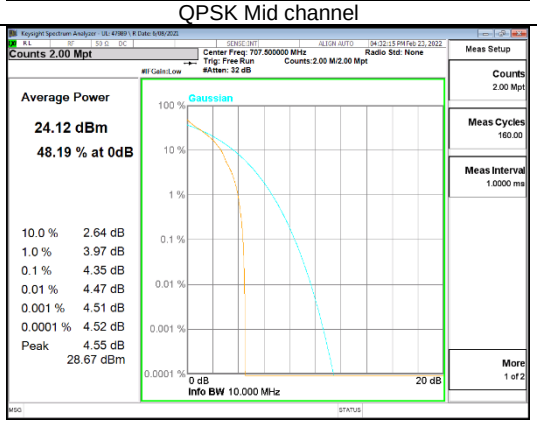
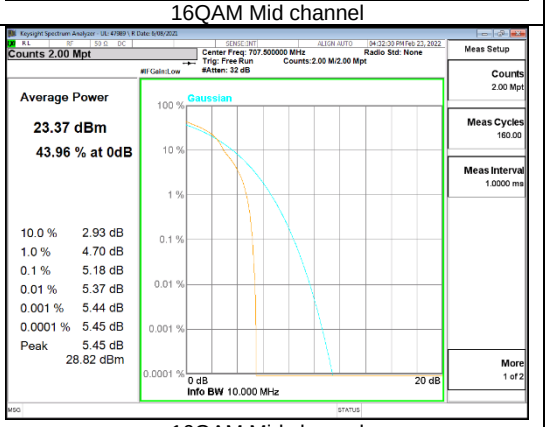
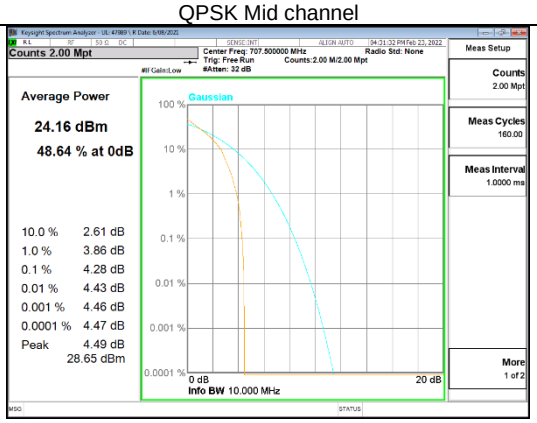
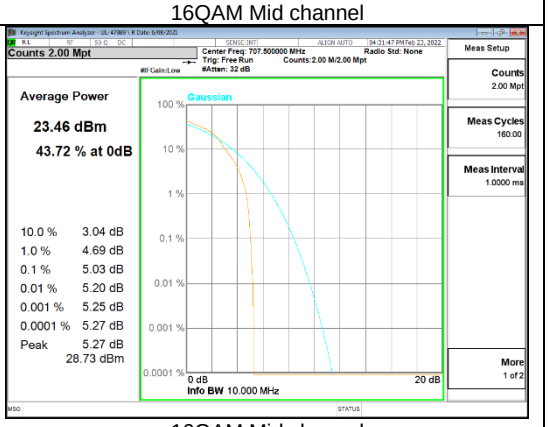
LTE Band 12

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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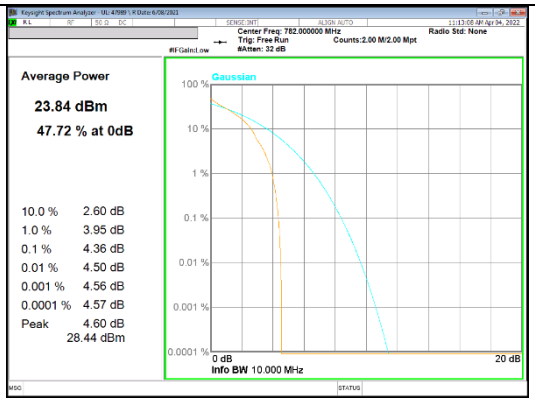
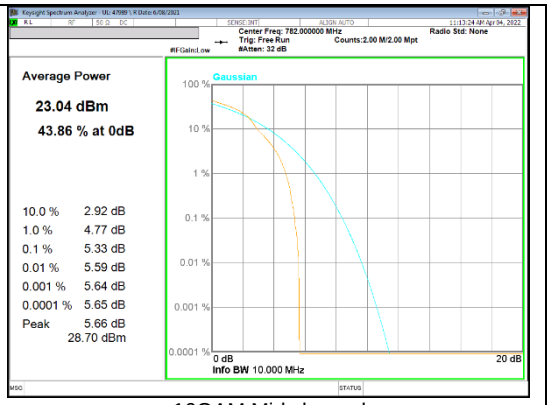
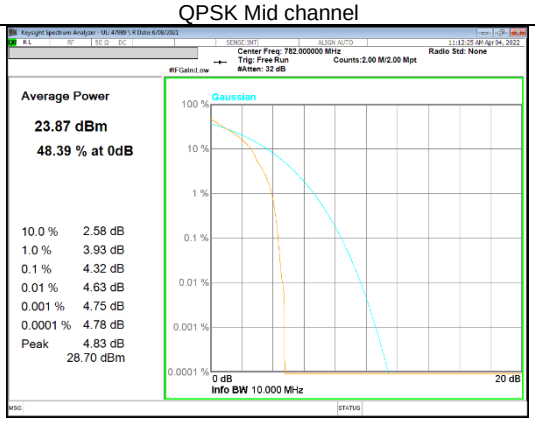
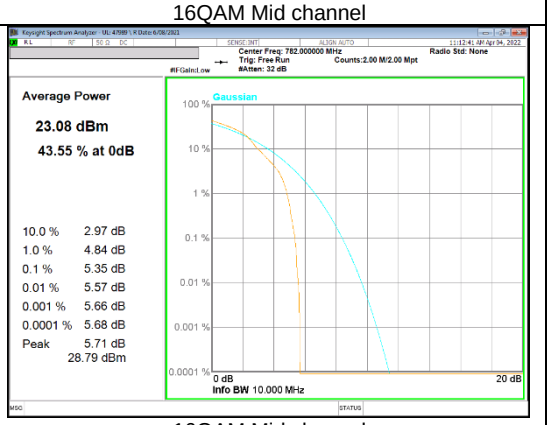
LTE Band 13

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

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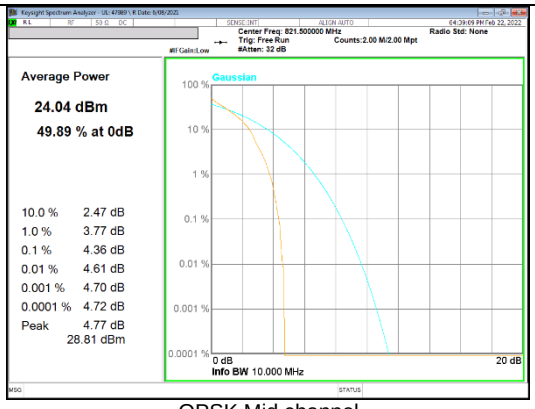
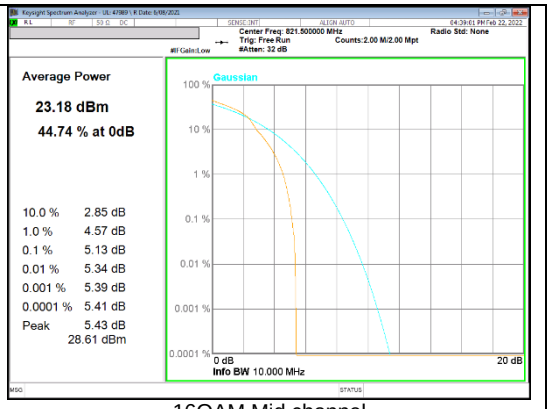
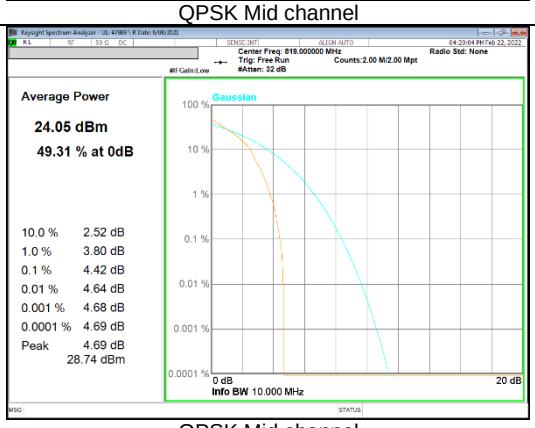
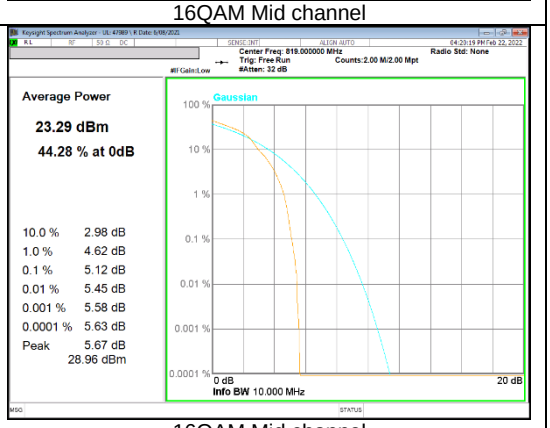
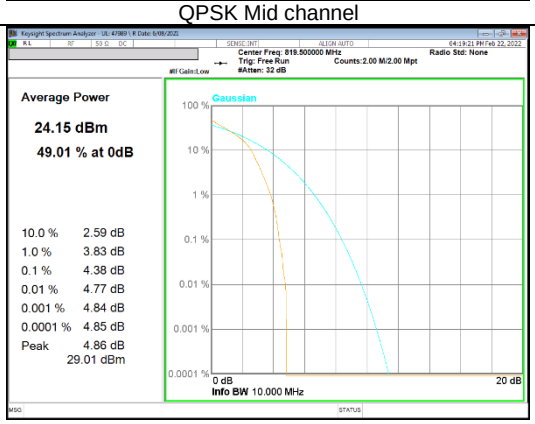
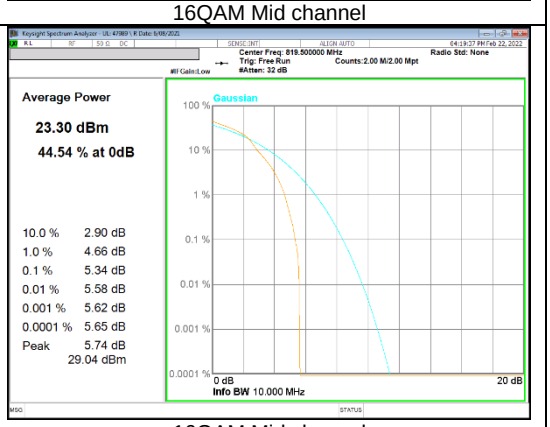
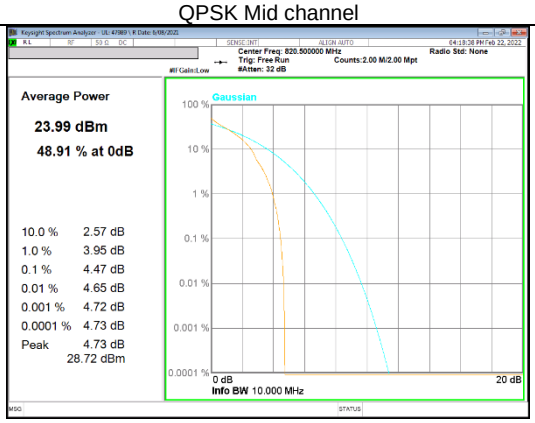
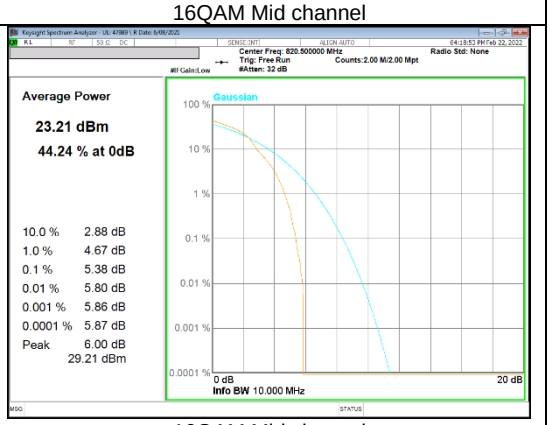
LTE Band 26 (Part 90)

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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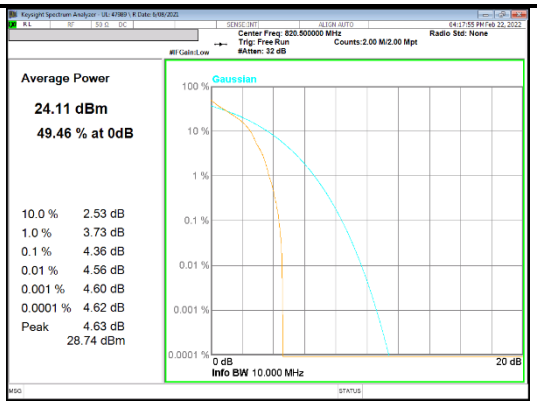
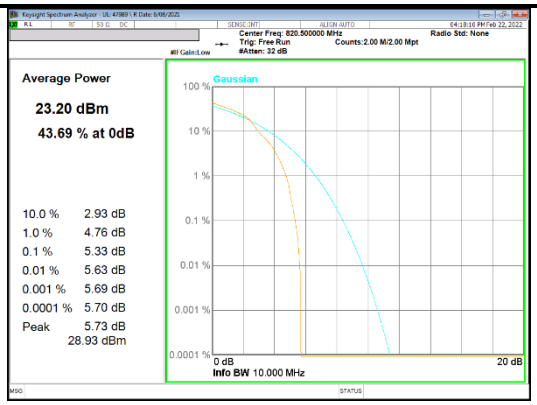
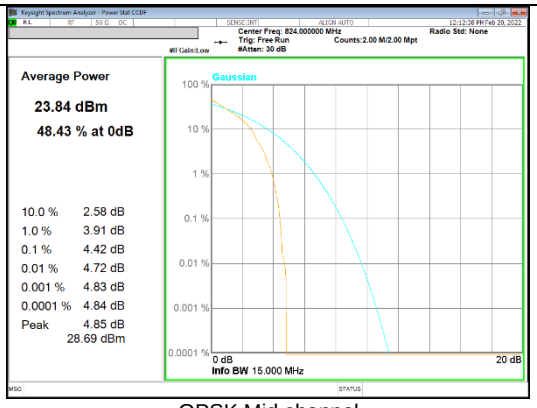
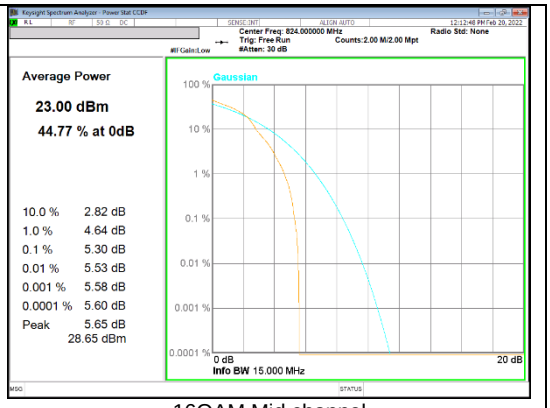
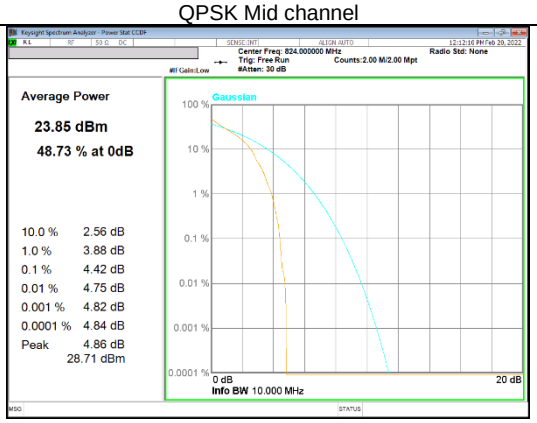
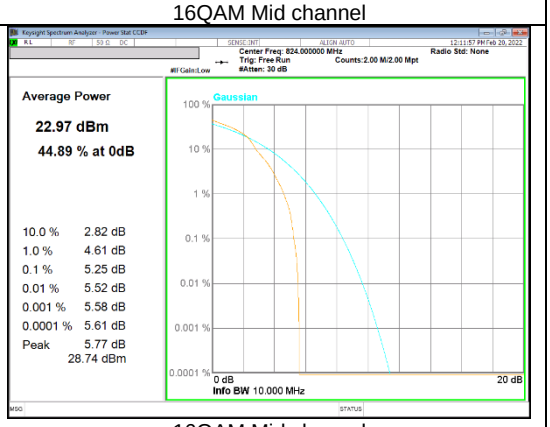
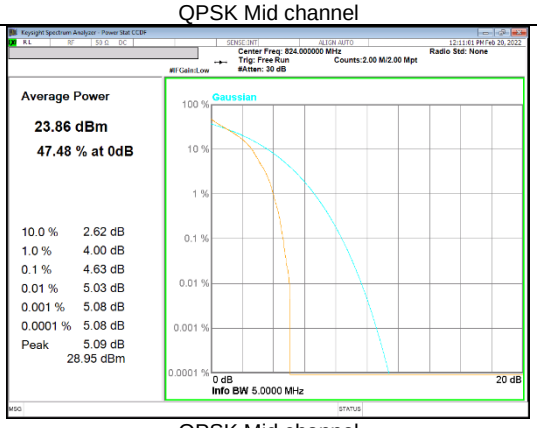
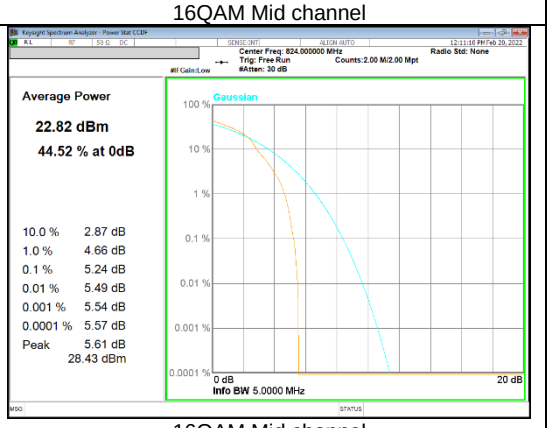
1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

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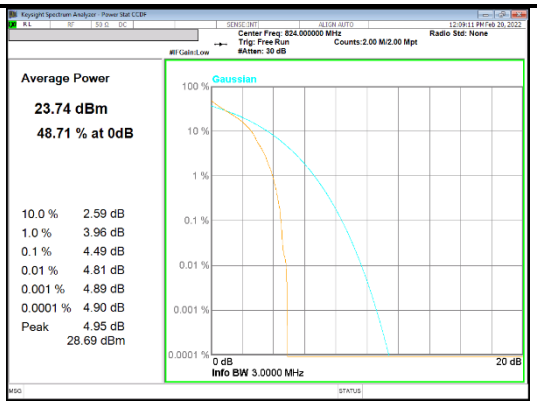
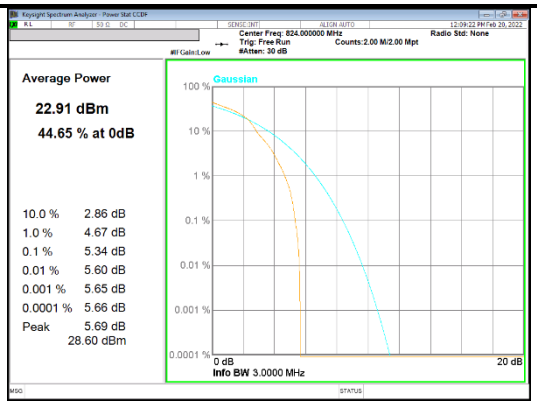
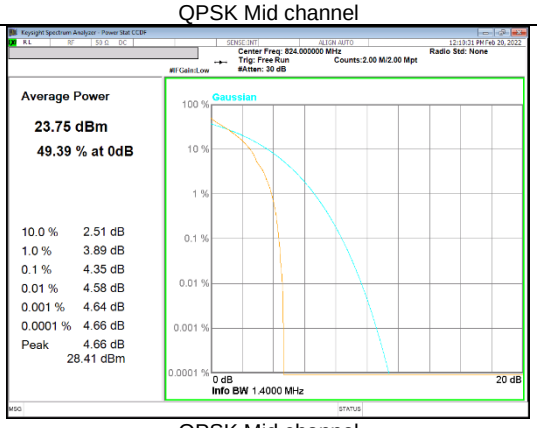
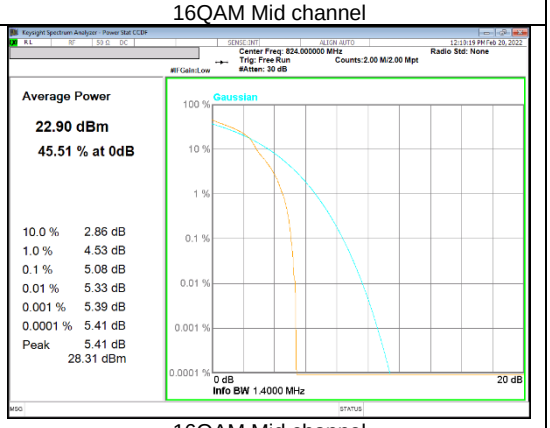
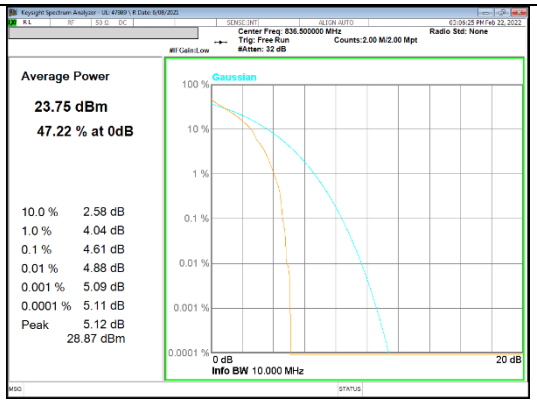
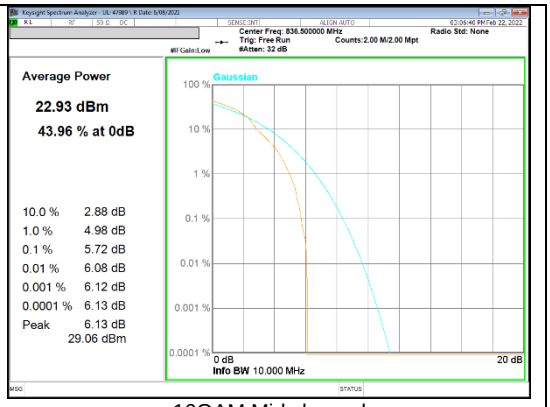
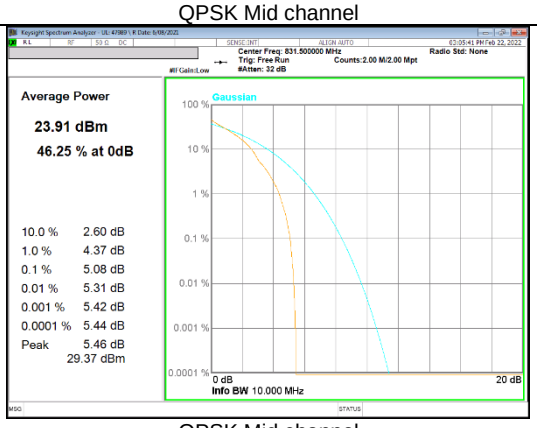
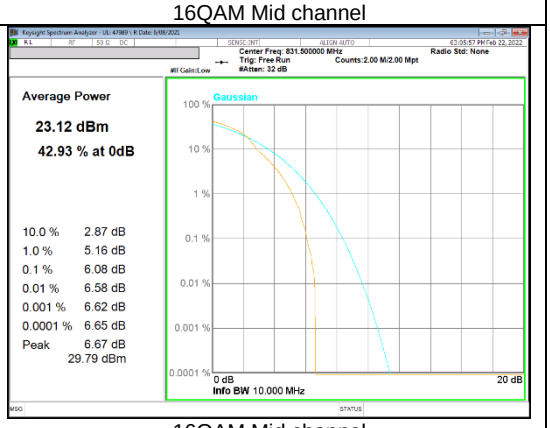
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

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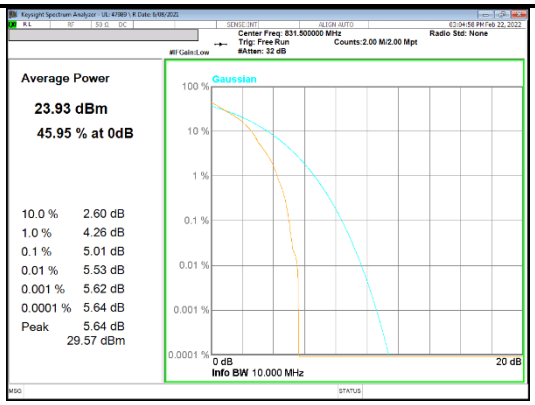
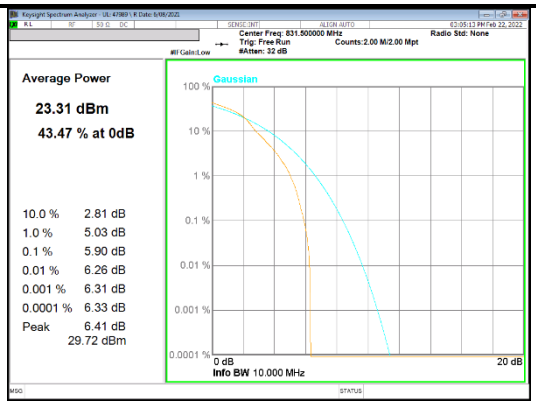
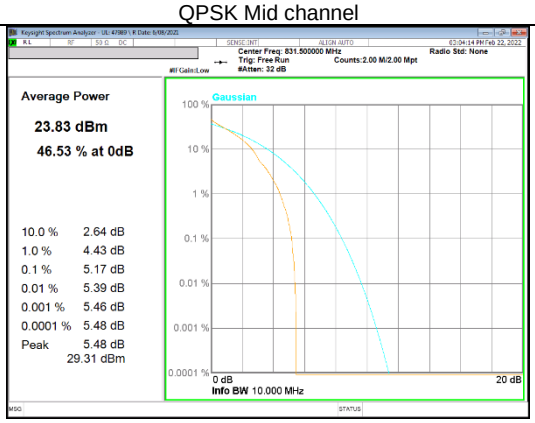
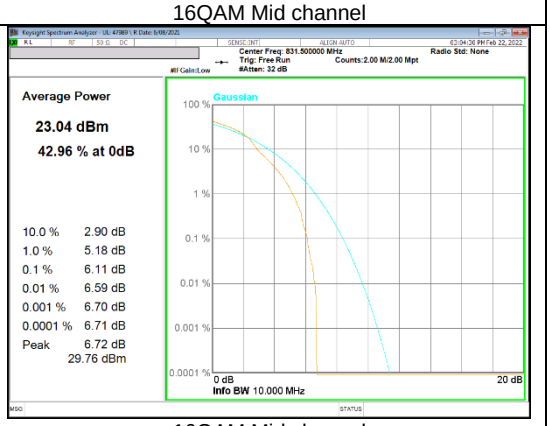
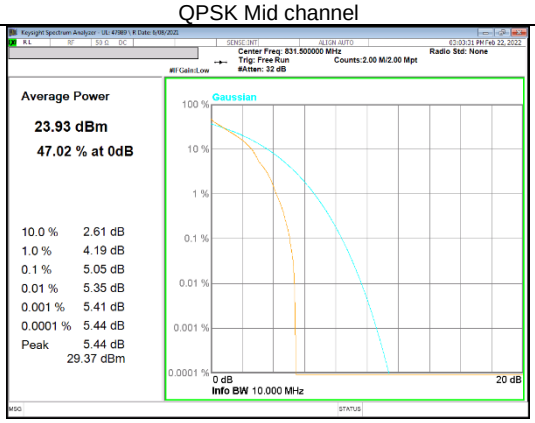
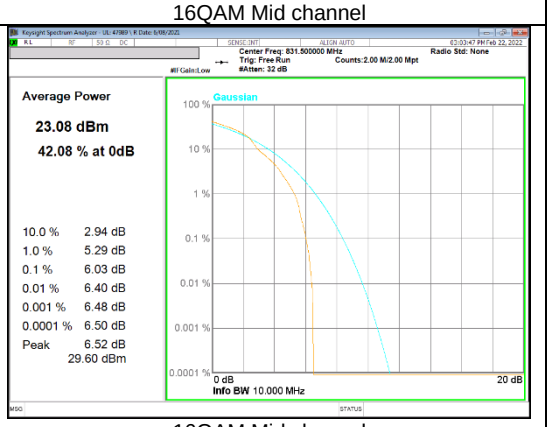
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

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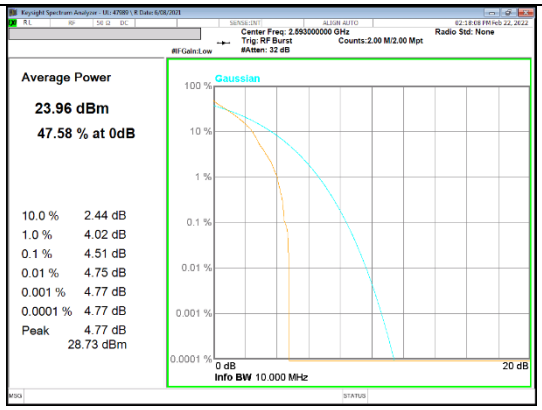
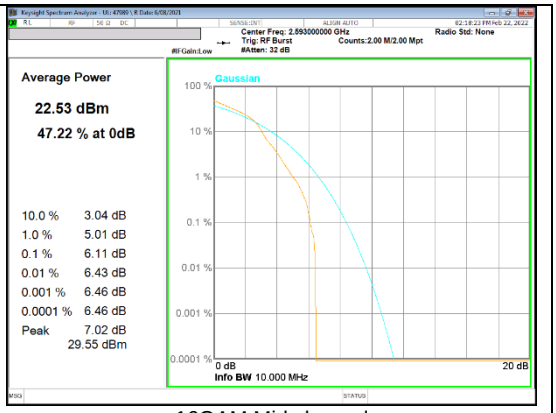
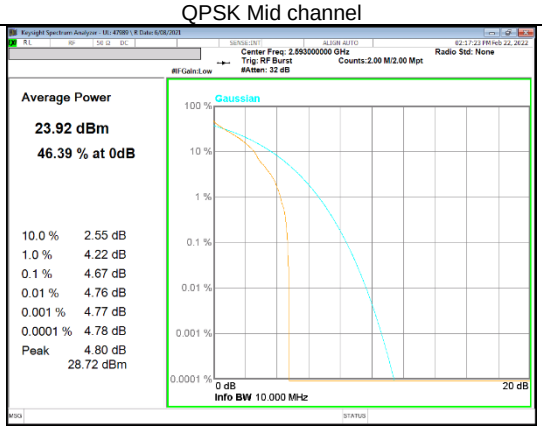
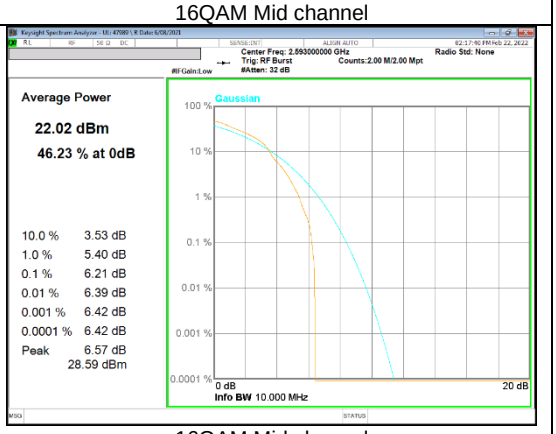
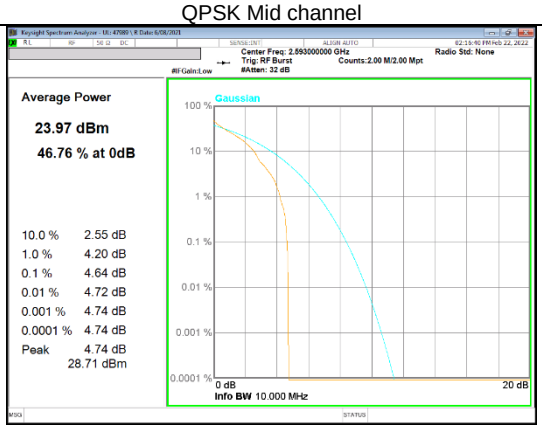
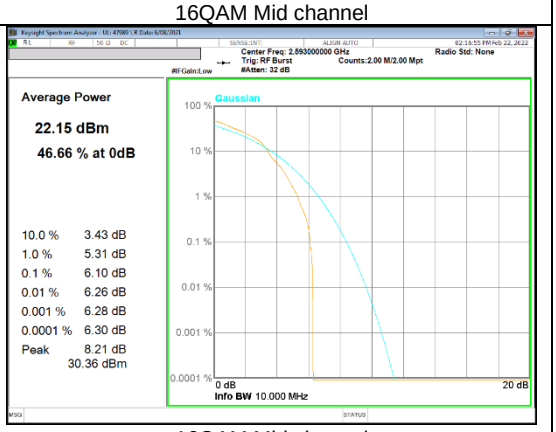
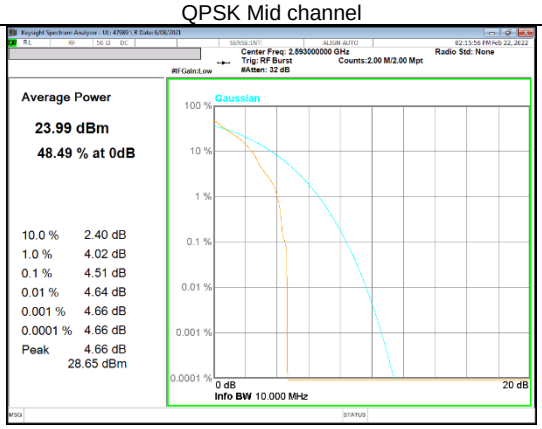
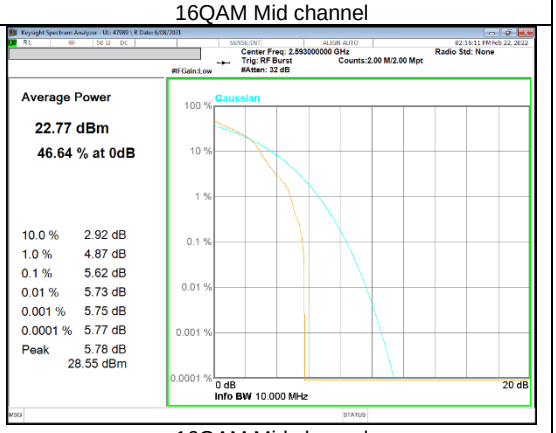
LTE Band 41

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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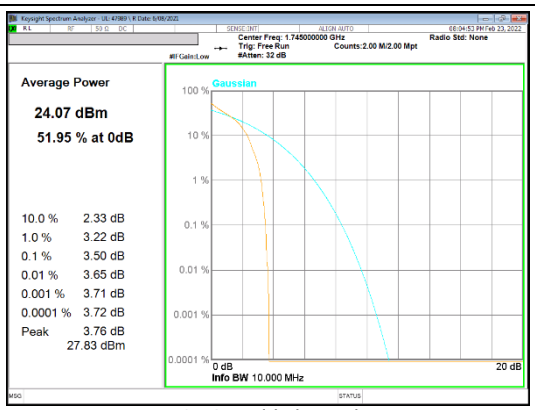
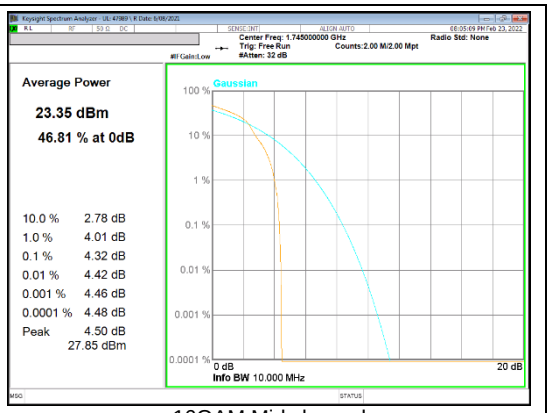
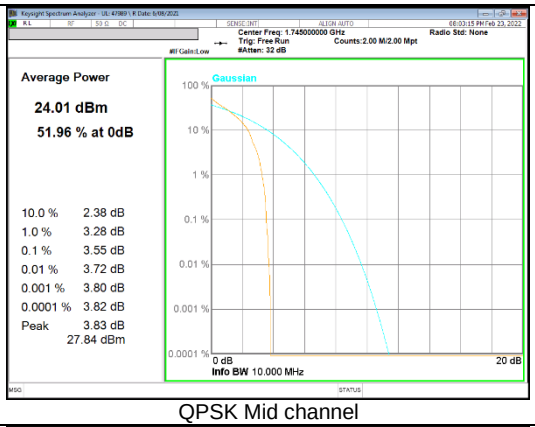
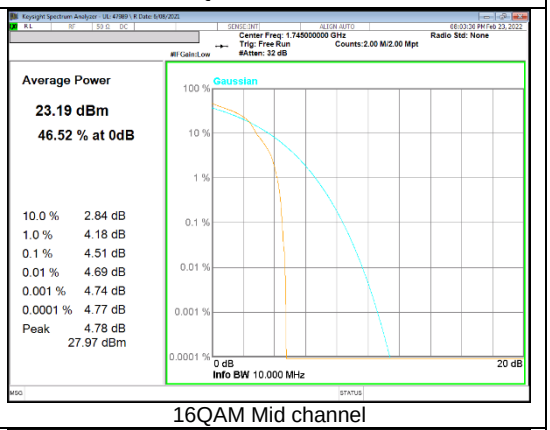
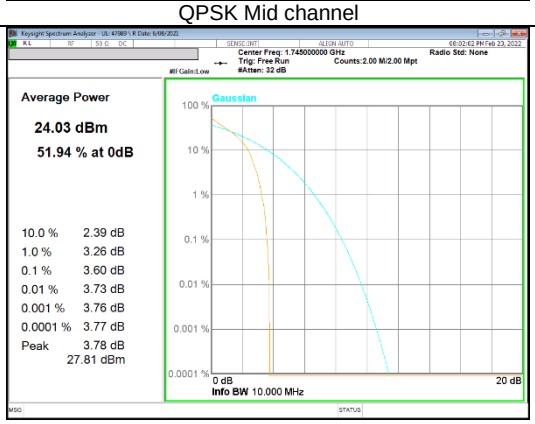
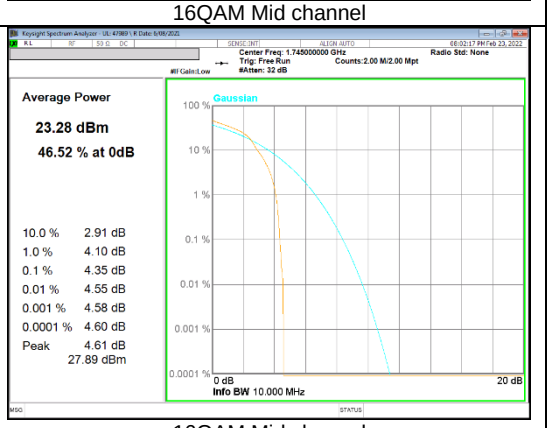
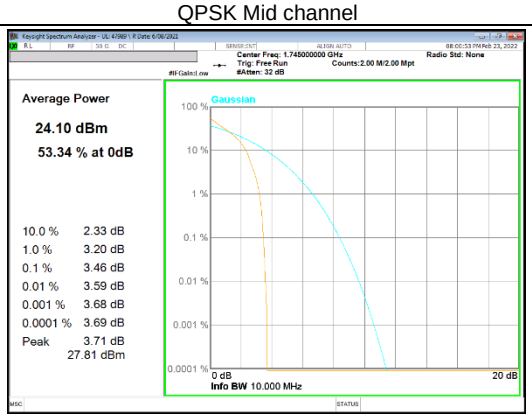
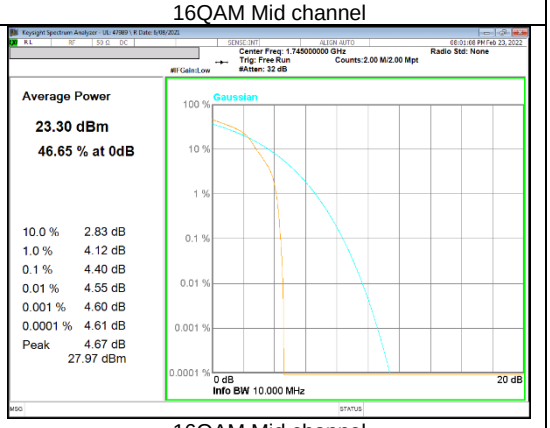
LTE Band 66

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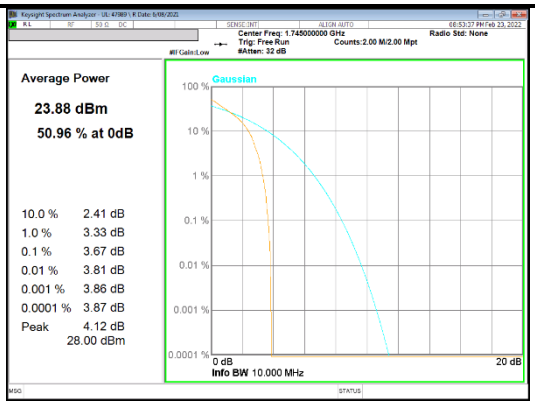
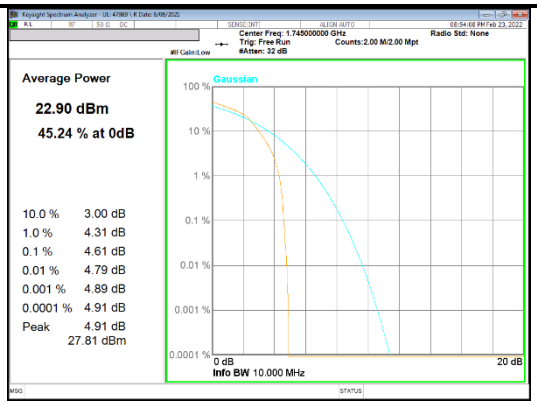
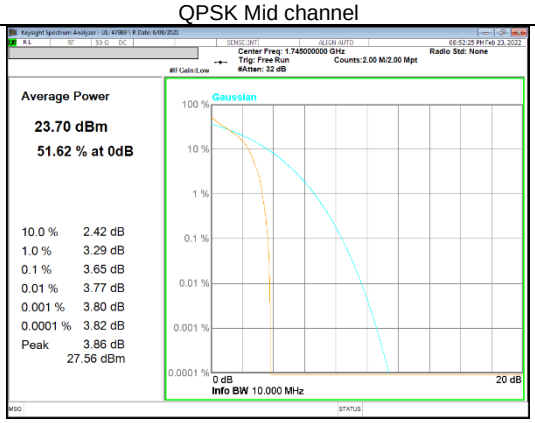
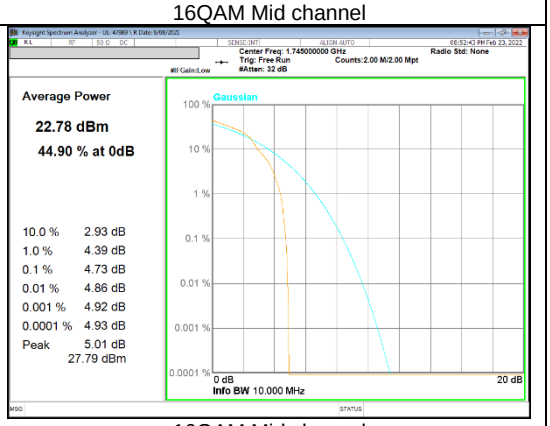
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

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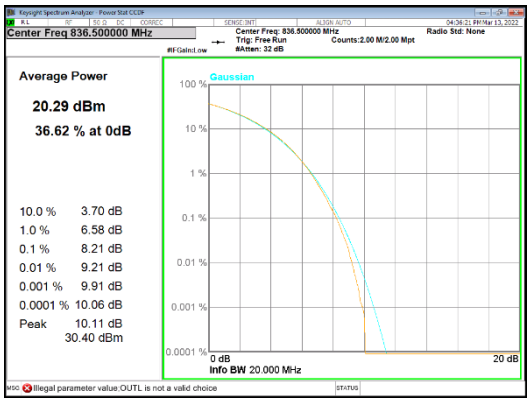
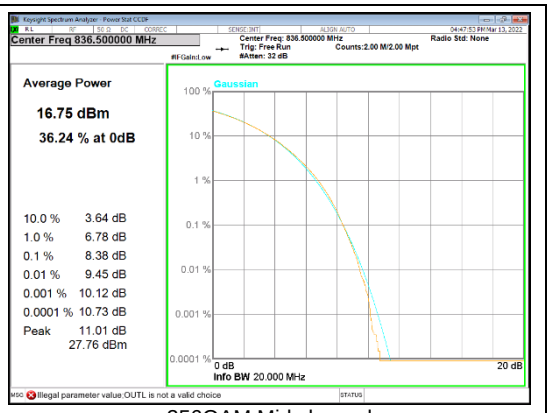
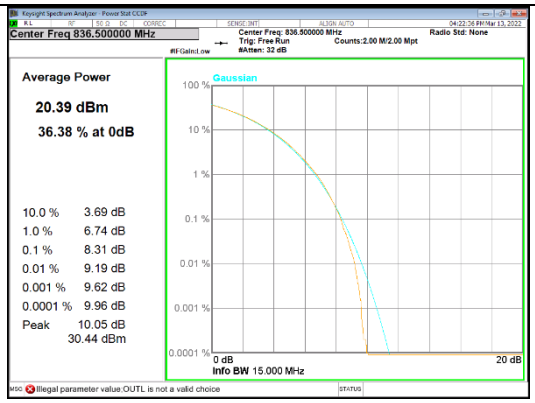
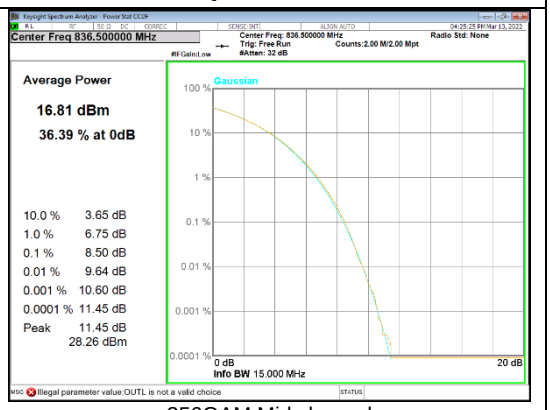
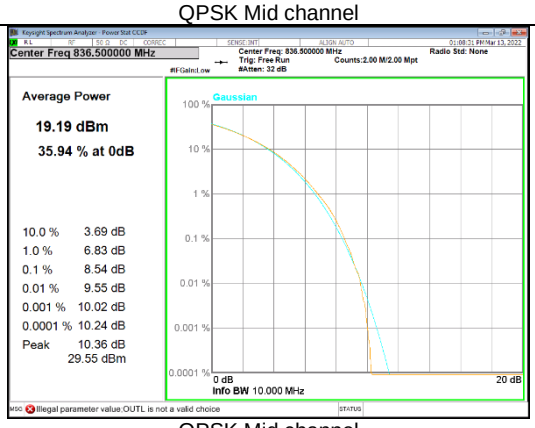
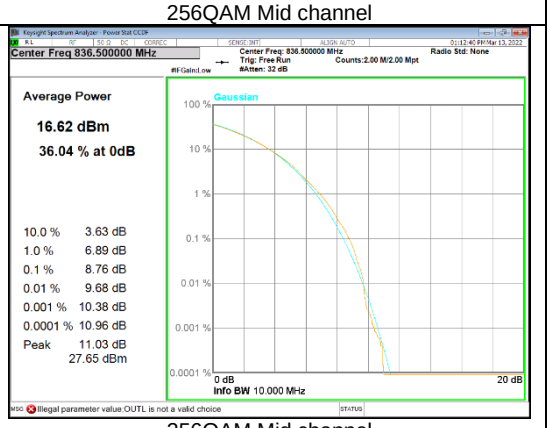
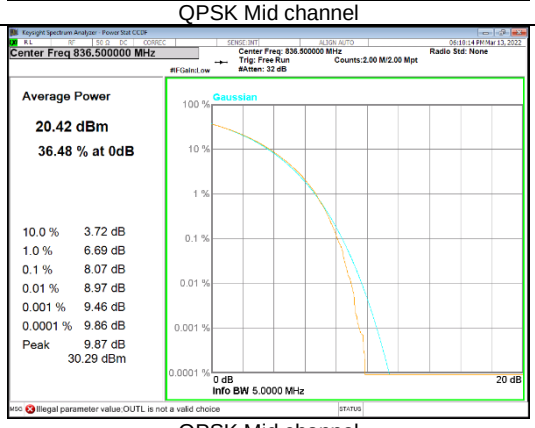
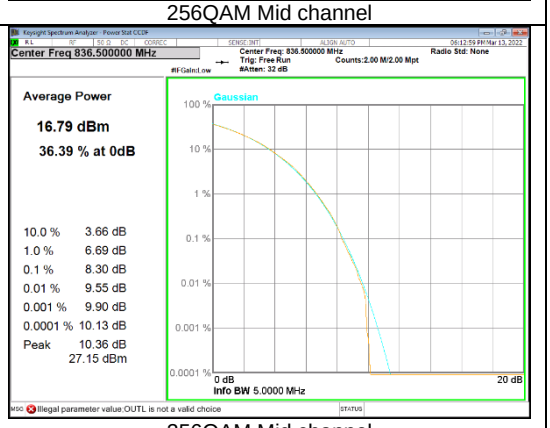
NR Band n5 CP-OFDM

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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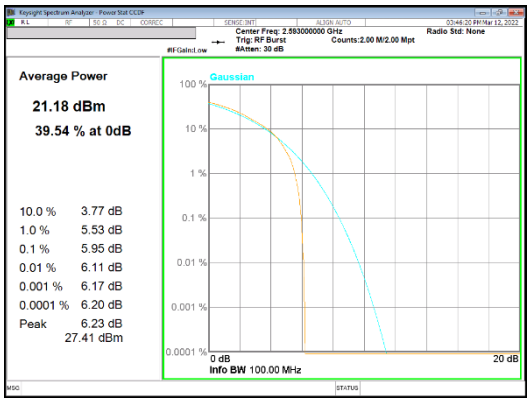
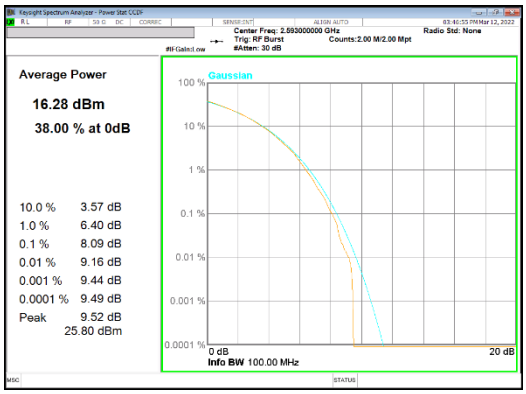
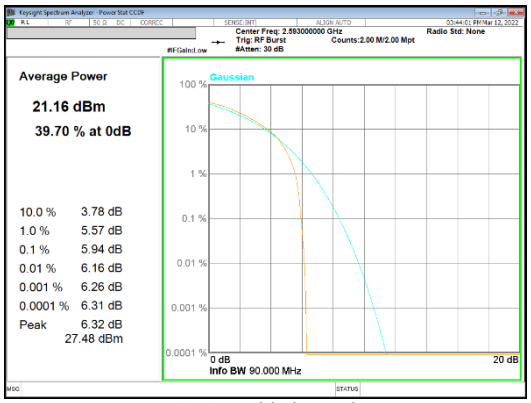
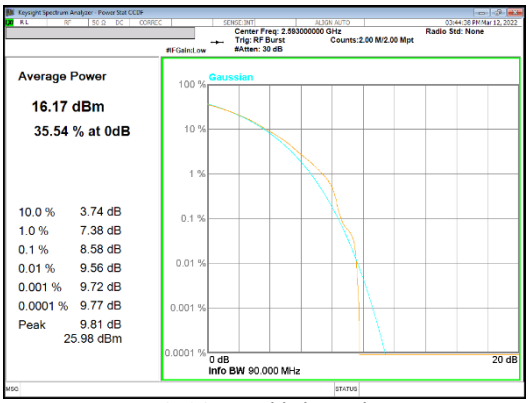
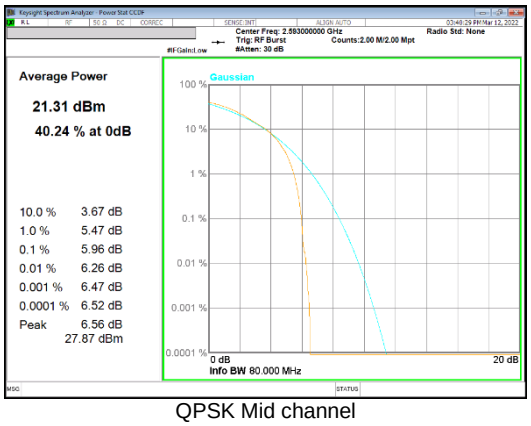
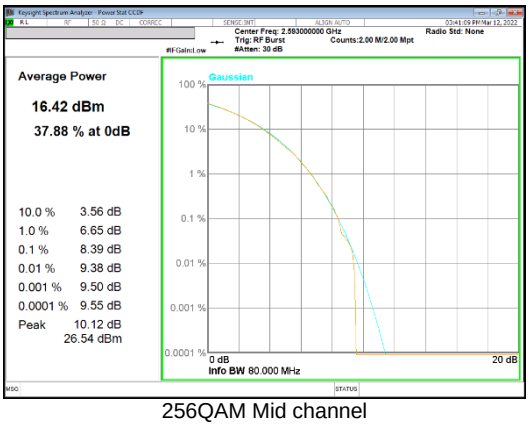
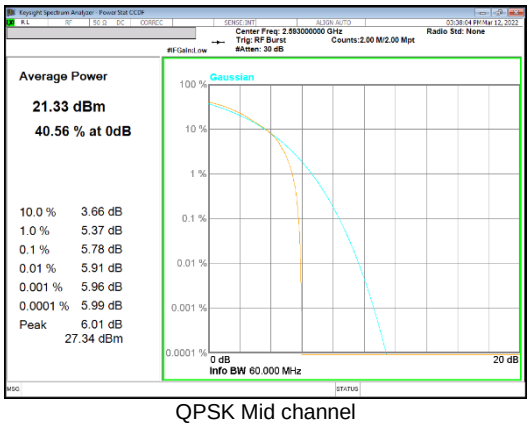
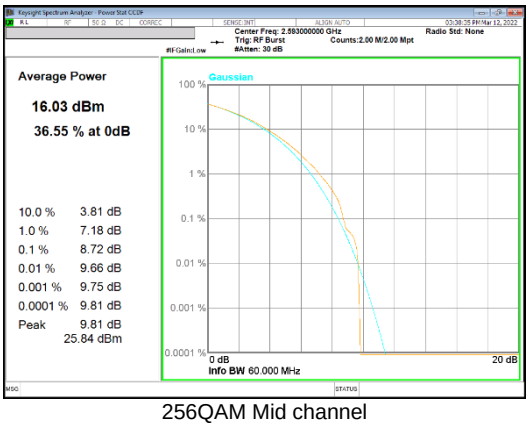
NR Band n41 CP-OFDM

100 MHz	 QPSK Mid channel	 256QAM Mid channel
90 MHz	 QPSK Mid channel	 256QAM Mid channel
80 MHz	 QPSK Mid channel	 256QAM Mid channel
60 MHz	 QPSK Mid channel	 256QAM Mid channel

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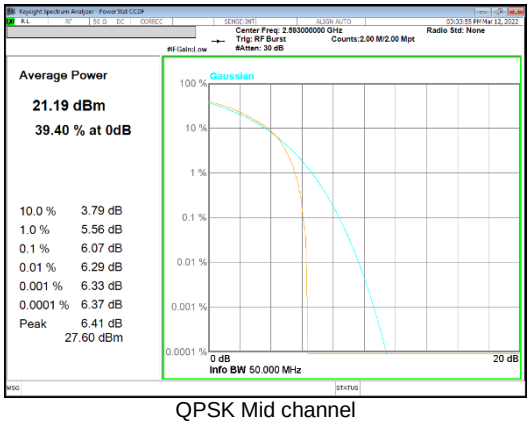
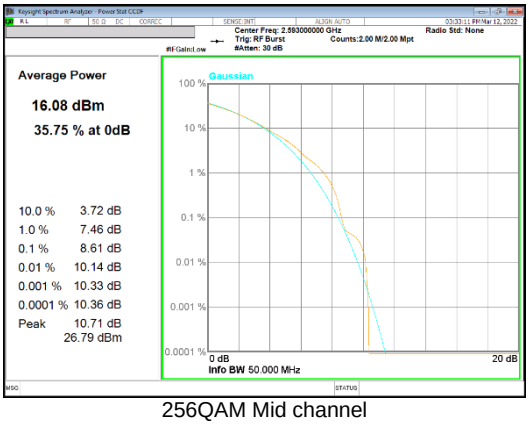
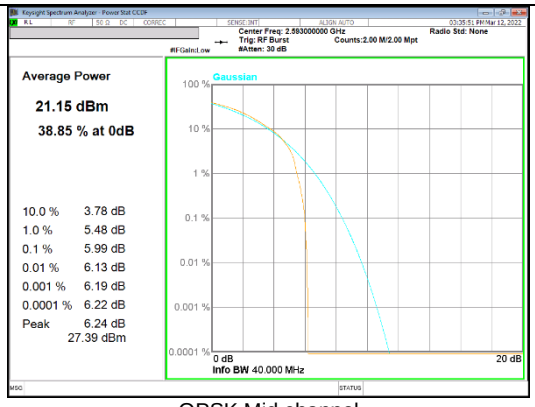
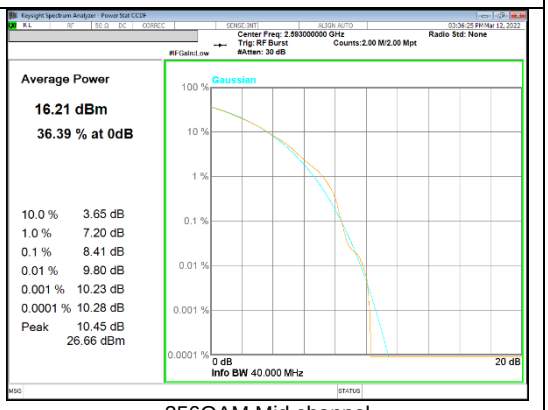
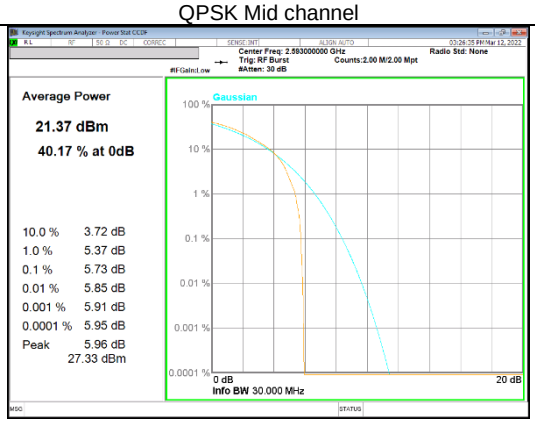
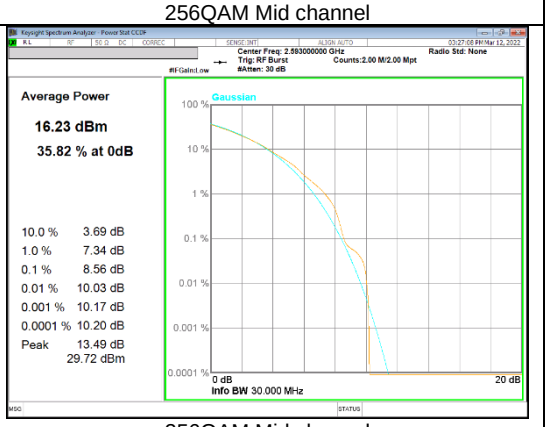
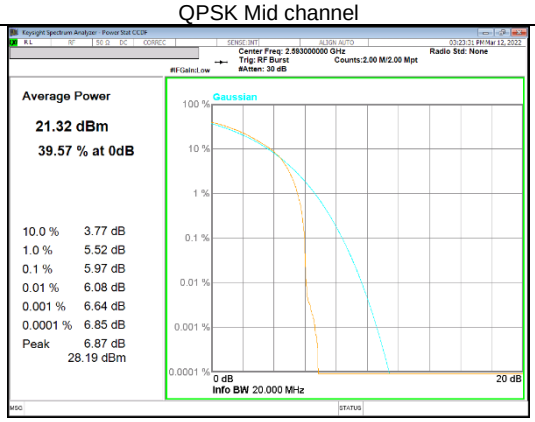
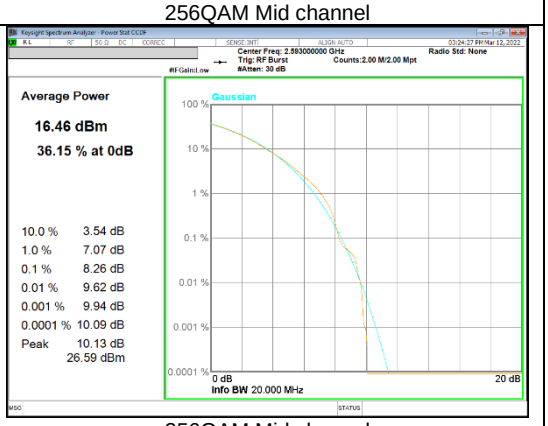
50 MHz	 QPSK Mid channel	 256QAM Mid channel
40 MHz	 QPSK Mid channel	 256QAM Mid channel
30 MHz	 QPSK Mid channel	 256QAM Mid channel
20 MHz	 QPSK Mid channel	 256QAM Mid channel

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