CERTIFICATION TEST REPORT

Report Number. : 4790357232-E2V2

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-F721B
FCC ID	:	A3LSMF721B
EUT Description	:	GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC and WPT.
Test Standard(s)	:	FCC CFR47 PART 22 SUBPART H FCC CFR47 PART 24 SUBPART E FCC CFR47 PART 27 SUBPART F,H,L,M,O,Q FCC CFR47 PART 90 SUBPART S

Date Of Issue:
2022-06-22

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IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2022-06-15	Initial issue	Yeonhee Lim
V2	2022-06-22	Updated to address TCB's question	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/ax, NFC and WPT.
MODEL NUMBER:	SM-F721B
SERIAL NUMBER:	R3CT40DGDLT, R3CT40DGDKJ, R3CT504VPRP (CONDUCTED); R3CT40DGEFV, R3CT40DGE6E, R3CT40SSA9P, R3CT40SS7ET, R3CT504WD3Y, R3CT504WDHP (RADIATED);
DATE TESTED:	2022-04-22 ~ 2022-06-15;

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

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/ax, NFC and WPT. 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. (4790357232-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	**32.22**	**1667.97**	**27.58**	**572.80**
		EGPRS	26.77	475.87	23.62	230.14
GSM1900	1850~1910	GPRS	**29.76**	**946.73**	**31.66**	**1465.55**
		EGPRS	25.94	393.02	27.84	608.14

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	**24.17**	**261.03**	**20.94**	**124.17**
		HSDPA	23.22	210.01	19.75	94.41
Band 4	1710~1755	Rel. 99	**23.19**	**208.45**	**23.55**	**226.46**
		HSDPA	22.17	164.82	22.72	192.25
Band 2	1850~1910	Rel. 99	**24.46**	**279.25**	**26.87**	**486.41**
		HSDPA	23.70	234.55	25.94	392.64

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LTE Band 5

FCC Part 22							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	829.0 - 844.0	10	QPSK	24.50	282.03	20.56	113.67
			16QAM	23.84	241.92	19.55	90.08
			64QAM	22.72	187.07		
			256QAM	19.61	91.41		
	826.5 - 846.5	5	QPSK	24.59	287.51	20.58	114.27
			16QAM	23.99	250.61	19.52	89.52
			64QAM	22.75	188.36		
			256QAM	19.64	92.04		
	825.5 - 847.5	3	QPSK	**24.65**	**291.80**	20.49	111.83
			16QAM	24.00	250.92	19.59	90.90
			64QAM	22.70	186.24		
			256QAM	19.64	92.04		
	824.7 - 848.3	1.4	QPSK	24.64	291.24	**20.62**	115.27
			16QAM	23.95	248.57	19.40	87.04
			64QAM	22.74	187.93		
			256QAM	19.92	98.17		

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	23.82	241.16	**21.18**	**131.22**
			16QAM	23.35	216.22	20.08	101.86
			64QAM	22.05	160.15		
			256QAM	18.88	77.23		
	701.5 - 707.5	5	QPSK	**24.01**	**251.86**	20.75	118.85
			16QAM	23.38	217.90	19.68	92.90
			64QAM	22.04	159.99		
			256QAM	18.96	78.63		
	700.5 - 714.5	3	QPSK	24.01	251.55	20.78	119.67
			16QAM	23.33	215.08	19.83	96.16
			64QAM	22.08	161.60		
			256QAM	19.08	80.93		
	699.7 - 715.3	1.4	QPSK	23.94	247.89	20.81	120.50
			16QAM	23.31	214.40	19.68	92.90
			64QAM	22.10	162.14		
			256QAM	19.04	80.17		

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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	**23.93**	**247.29**	18.59	72.28
			16QAM	23.22	209.89	17.73	59.29
			64QAM	21.95	156.68		
			256QAM	19.18	82.81		
	779.5 - 784.5	5	QPSK	23.91	245.85	**19.06**	**80.54**
			16QAM	23.31	214.18	17.81	60.39
			64QAM	22.08	161.49		
			256QAM	19.00	79.41		

LTE Band 25

FCC Part 24							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 25	1860 - 1905	20	QPSK	23.92	246.72	23.54	225.94
			16QAM	23.45	221.10	22.84	192.31
			64QAM	22.21	166.34		
			256QAM	19.14	82.06		
	1857.5 - 1907.5	15	QPSK	23.77	238.37	**24.13**	**258.82**
			16QAM	23.16	206.95	23.22	209.89
			64QAM	22.15	164.20		
			256QAM	18.73	74.57		
	1855 - 1910	10	QPSK	23.83	241.43	22.72	187.07
			16QAM	23.14	206.03	22.11	162.55
			64QAM	22.34	171.52		
			256QAM	18.74	74.79		
	1852.5 - 1912.5	5	QPSK	23.90	245.48	23.66	232.27
			16QAM	23.26	211.69	22.86	193.20
			64QAM	22.10	162.18		
			256QAM	18.89	77.48		
	1851.5 - 1913.5	3	QPSK	23.86	243.01	23.26	211.84
			16QAM	23.32	214.65	22.63	183.23
			64QAM	21.95	156.68		
			256QAM	18.94	78.32		
	1850.7 - 1914.3	1.4	QPSK	**23.93**	**247.04**	23.47	222.33
			16QAM	23.16	207.13	22.89	194.54
			64QAM	22.50	177.63		
			256QAM	18.83	76.38		

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	23.58	227.867	18.48	70.47
			16QAM	22.83	192.026	19.36	86.30
			64QAM	21.92	155.597		
			256QAM	18.72	74.450		
	819	10	QPSK	23.91	245.846	20.02	100.46
			16QAM	23.21	209.271	19.00	79.43
			64QAM	21.85	153.109		
			256QAM	18.90	77.585		
	816.5 - 821.5	5	QPSK	23.91	246.085	20.92	123.59
			16QAM	23.33	215.095	19.93	98.40
			64QAM	21.98	157.761		
			256QAM	19.13	81.763		
	815.5 - 822.5	3	QPSK	**23.98**	**249.948**	**20.96**	**124.74**
			16QAM	23.26	211.732	19.83	96.16
			64QAM	21.93	155.955		
			256QAM	18.93	78.241		
	814.7 - 823.3	1.4	QPSK	23.92	246.402	20.90	123.03
			16QAM	23.31	214.256	20.05	101.16
			64QAM	22.18	165.196		
			256QAM	19.03	80.010		

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	23.74	236.83	20.94	124.17
			16QAM	23.04	201.20	19.18	82.79
			64QAM	21.93	155.96		
			256QAM	18.81	76.03		
	829 ~ 844	10	QPSK	23.88	244.43	**21.12**	**129.42**
			16QAM	23.34	215.72	20.04	100.93
			64QAM	21.98	157.76		
			256QAM	18.97	78.92		
	826.5 ~ 846.5	5	QPSK	**23.92**	**246.51**	21.08	128.23
			16QAM	23.21	209.24	19.96	99.08
			64QAM	22.04	159.96		
			256QAM	19.02	79.75		
	825.5 ~ 847.5	3	QPSK	23.87	244.02	19.86	96.83
			16QAM	23.29	213.18	18.98	79.07
			64QAM	22.03	159.48		
			256QAM	18.94	78.29		
	824.7 ~ 848.3	1.4	QPSK	23.86	242.96	20.98	125.31
			16QAM	23.12	205.24	19.79	95.28
			64QAM	22.12	163.00		
			256QAM	18.96	78.62		

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	23.58	227.867	20.24	105.68
			16QAM	22.83	192.026	19.00	79.43
			64QAM	21.92	155.597		
			256QAM	18.72	74.450		
		10	QPSK	**23.73**	**236.120**	20.72	118.03
			16QAM	23.06	202.279	19.64	92.04
			64QAM	21.86	153.462		
			256QAM	18.81	76.067		
		5	QPSK	23.69	233.861	**20.97**	**125.03**
			16QAM	23.14	206.194	19.78	95.06
			64QAM	21.94	156.315		
			256QAM	18.97	78.944		
		3	QPSK	23.71	235.075	19.98	99.54
			16QAM	23.09	203.709	18.87	77.09
			64QAM	21.90	154.882		
			256QAM	18.89	77.373		
		1.4	QPSK	23.64	231.454	20.79	119.95
			16QAM	22.83	191.989	19.73	93.97
			64QAM	21.83	152.405		
			256QAM	18.80	75.891		

LTE Band 41(PC2)

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 41	2506 - 2680	20	QPSK	25.34	341.98	23.24	210.86
			16QAM	24.89	308.32	22.64	183.65
			64QAM	23.88	244.34		
			256QAM	20.87	122.18		
	2503.5 - 2682.5	15	QPSK	25.69	370.68	23.37	217.27
			16QAM	24.99	315.50	22.51	178.24
			64QAM	23.41	219.28		
			256QAM	20.31	107.40		
	2501 - 2685	10	QPSK	**25.83**	**382.82**	**23.42**	**219.79**
			16QAM	25.21	331.89	22.68	185.35
			64QAM	23.55	226.46		
			256QAM	20.53	112.98		
	2498.5 - 2687.5	5	QPSK	25.29	338.06	23.28	212.81
			16QAM	24.86	306.20	22.35	171.79
			64QAM	23.16	207.01		
			256QAM	19.97	99.31		

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	23.03	200.91	20.64	115.88
			16QAM	22.53	179.06	21.73	148.94
			64QAM	21.28	134.28		
			256QAM	18.20	66.07		
	1717.5 - 1772.5	15	QPSK	23.03	200.91	**22.51**	**178.24**
			16QAM	22.35	171.79	21.57	143.55
			64QAM	21.22	132.43		
			256QAM	18.21	66.22		
	1715 - 1775	10	QPSK	23.15	206.54	21.87	153.82
			16QAM	22.50	177.83	20.97	125.03
			64QAM	21.31	135.21		
			256QAM	18.29	67.45		
	1712.5 - 1777.5	5	QPSK	**23.20**	**208.93**	21.79	151.01
			16QAM	22.57	180.72	21.25	133.35
			64QAM	21.36	136.77		
			256QAM	18.39	69.02		
	1711.5 - 1778.5	3	QPSK	23.14	206.06	21.89	154.53
			16QAM	22.54	179.47	21.16	130.62
			64QAM	21.32	135.52		
			256QAM	18.29	67.45		
	1710.7 - 1779.3	1.4	QPSK	23.02	200.45	21.66	146.55
			16QAM	22.41	174.18	21.20	131.83
			64QAM	21.40	138.04		
			256QAM	18.30	67.61		

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	**24.14**	**259.42**	**18.73**	**74.64**
				QPSK	24.11	257.63		
				16QAM	23.12	205.12	17.64	58.08
				64QAM	22.11	162.55		
				256QAM	19.44	87.90		
			CP-OFDM	QPSK	22.59	181.55		
	831.5 - 841.5	15	DFT-s OFDM	π/2 BPSK	23.84	242.10	**18.73**	**74.64**
				QPSK	23.89	244.91		
				16QAM	22.83	191.87	17.90	61.66
				64QAM	21.47	140.28		
				256QAM	18.86	76.91		
			CP-OFDM	QPSK	22.45	175.79		
	829 - 844	10	DFT-s OFDM	π/2 BPSK	23.77	238.23	18.36	68.55
				QPSK	23.74	236.59		
				16QAM	22.70	186.21	17.09	51.17
				64QAM	21.45	139.64		
				256QAM	18.70	74.13		
			CP-OFDM	QPSK	22.25	167.88		
	826.5 - 846.5	5	DFT-s OFDM	π/2 BPSK	23.92	246.60	18.71	74.30
				QPSK	23.94	247.74		
				16QAM	22.89	194.54	17.04	50.58
				64QAM	21.61	144.88		
				256QAM	18.90	77.62		
			CP-OFDM	QPSK	22.39	173.38		

NR Band n12

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n12	706.5 - 708.5	15	DFT-s OFDM	π/2 BPSK	**24.57**	**286.42**		
				QPSK	24.56	285.76	**19.87**	**97.05**
				16QAM	23.57	227.51	19.22	83.56
				64QAM	22.37	172.58		
				256QAM	19.68	92.90		
			CP-OFDM	QPSK	21.79	151.01		
	704 - 711	10	DFT-s OFDM	π/2 BPSK	24.38	274.16		
				QPSK	24.39	274.79	19.74	94.19
				16QAM	23.30	213.80	19.30	85.11
				64QAM	22.09	161.81		
				256QAM	19.26	84.33		
			CP-OFDM	QPSK	22.82	191.43		
	701.5 - 713.5	5	DFT-s OFDM	π/2 BPSK	24.41	276.06		
				QPSK	24.45	278.61	19.61	91.41
				16QAM	23.39	218.27	19.12	81.66
				64QAM	22.14	163.68		
				256QAM	19.43	87.70		
			CP-OFDM	QPSK	22.86	193.20		

NR Band n25

FCC Part 24										
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated (Main Ant)		Radiated (Sub Ant)	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n25	1860 - 1905	20	DFT-s OFDM	π/2 BPSK	23.71	234.96				
				QPSK	23.80	239.88	**26.84**	**483.27**		
				16QAM	22.84	192.31	25.47	352.52		
				64QAM	21.56	143.22				
				256QAM	19.06	80.54				
			CP-OFDM	QPSK	22.13	163.31				
	1857.5 - 1907.5	15	DFT-s OFDM	π/2 BPSK	23.88	244.34				
				QPSK	**23.92**	**246.60**	25.07	321.50	**23.95**	**248.31**
				16QAM	22.88	194.09	23.49	223.45	23.11	204.64
				64QAM	21.56	143.22				
				256QAM	18.81	76.03				
			CP-OFDM	QPSK	22.17	164.82				
	1855 - 1910	10	DFT-s OFDM	π/2 BPSK	23.78	238.78				
				QPSK	23.79	239.33	24.80	301.92		
				16QAM	22.81	190.99	23.35	216.28		
				64QAM	21.54	142.56				
				256QAM	18.75	74.99				
			CP-OFDM	QPSK	21.85	153.11				
	1852.5 - 1912.5	5	DFT-s OFDM	π/2 BPSK	23.83	241.55				
				QPSK	23.89	244.91	25.31	339.83		
				16QAM	22.91	195.43	24.86	306.38		
				64QAM	21.62	145.21				
				256QAM	18.87	77.09				
			CP-OFDM	QPSK	21.99	158.12				

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	24.59	287.74	23.90	245.47
				QPSK	24.53	283.79		
				16QAM	23.45	221.31	22.95	197.24
				64QAM	21.20	131.83		
				256QAM	19.08	80.91		
			CP-OFDM	QPSK	22.28	169.04		
	2541.0~2645.0	90	DFT-s OFDM	π/2 BPSK	24.58	287.08	24.12	258.23
				QPSK	24.45	278.61		
				16QAM	23.41	219.28	23.08	203.24
				64QAM	21.30	134.90		
				256QAM	19.09	81.10		
			CP-OFDM	QPSK	22.32	170.61		
	2536.0~2650.0	80	DFT-s OFDM	π/2 BPSK	24.46	279.25	24.25	266.07
				QPSK	24.43	277.33		
				16QAM	23.34	215.77	23.29	213.30
				64QAM	23.21	209.41		
				256QAM	23.38	217.77		
			CP-OFDM	QPSK	23.38	217.77		
	2526.0~2660.0	60	DFT-s OFDM	π/2 BPSK	24.50	281.84	24.42	276.69
				QPSK	24.43	277.33		
				16QAM	23.42	219.79	23.42	219.79
				64QAM	21.68	147.23		
				256QAM	19.47	88.51		
			CP-OFDM	QPSK	22.74	187.93		
	2521.0~2665.0	50	DFT-s OFDM	π/2 BPSK	**24.84**	**304.79**	24.39	274.79
				QPSK	24.83	304.09		
				16QAM	23.76	237.68	23.46	221.82
				64QAM	21.94	156.31		
				256QAM	19.73	93.97		
			CP-OFDM	QPSK	22.94	196.79		
	2516.0~2670.0	40	DFT-s OFDM	π/2 BPSK	24.67	293.09	**24.62**	**289.73**
				QPSK	24.61	289.07		
				16QAM	23.54	225.94	23.69	233.88
				64QAM	21.83	152.41		
				256QAM	19.65	92.26		
			CP-OFDM	QPSK	22.85	192.75		
	2511.0~2675.0	30	DFT-s OFDM	π/2 BPSK	24.58	287.08	24.52	283.14
				QPSK	24.48	280.54		
				16QAM	23.47	222.33	23.50	223.87
				64QAM	21.82	152.05		
				256QAM	19.64	92.04		
			CP-OFDM	QPSK	22.82	191.43		
	2506.0~2680.0	20	DFT-s OFDM	π/2 BPSK	24.33	271.02	24.61	289.07
				QPSK	24.30	269.15		
				16QAM	23.29	213.30	23.74	236.59
				64QAM	21.77	150.31		
				256QAM	19.59	90.99		
			CP-OFDM	QPSK	22.78	189.67		

NR Band n41(SRS1)

FCC Part 27						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n41	2546.0~2640.0	100	19.00	79.43		
	2541.0~2645.0	90	19.80	95.50		
	2536.0~2650.0	80	19.79	95.28		
	2526.0~2660.0	60	19.55	90.16		
	2521.0~2665.0	50	19.50	89.13		
	2516.0~2670.0	40	19.60	91.20		
	2511.0~2675.0	30	**19.90**	**97.72**	**18.17**	**65.61**
	2506.0~2680.0	20	19.29	84.92		

NR Band n41(SRS2)

FCC Part 27						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n41	2546.0~2640.0	100	16.33	42.95		
	2541.0~2645.0	90	16.39	43.55		
	2536.0~2650.0	80	16.20	41.69		
	2526.0~2660.0	60	16.00	39.81		
	2521.0~2665.0	50	15.50	35.48		
	2516.0~2670.0	40	**16.49**	**44.57**	**14.87**	**30.69**
	2511.0~2675.0	30	16.48	44.46		
	2506.0~2680.0	20	15.80	38.02		

NR Band n41(SRS3)

FCC Part 27						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n41	2546.0~2640.0	100	16.40	43.65		
	2541.0~2645.0	90	16.48	44.46		
	2536.0~2650.0	80	16.43	43.95		
	2526.0~2660.0	60	16.35	43.15		
	2521.0~2665.0	50	16.37	43.35		
	2516.0~2670.0	40	**16.48**	**44.46**	**13.63**	**23.07**
	2511.0~2675.0	30	15.90	38.90		
	2506.0~2680.0	20	16.46	44.26		

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	23.65	231.74		
				QPSK	**23.74**	**236.59**	20.15	103.50
				16QAM	22.62	182.81	19.37	86.49
				64QAM	21.28	134.28		
				256QAM	18.56	71.78		
			CP-OFDM	QPSK	20.61	115.08		
	1717.5 - 1772.5	15	DFT-s OFDM	π/2 BPSK	23.64	231.21		
				QPSK	23.65	231.74	20.37	109.01
				16QAM	22.57	180.72	19.66	92.57
				64QAM	21.21	132.13		
				256QAM	18.50	70.79		
			CP-OFDM	QPSK	21.29	134.59		
	1715.0 - 1775.0	10	DFT-s OFDM	π/2 BPSK	23.46	221.82		
				QPSK	23.63	230.67	20.12	102.73
				16QAM	22.44	175.39	19.36	86.24
				64QAM	21.11	129.12		
				256QAM	18.41	69.34		
			CP-OFDM	QPSK	21.39	137.72		
	1712.5 - 1777.5	5	DFT-s OFDM	π/2 BPSK	23.46	221.82		
				QPSK	23.63	230.67	**20.72**	**117.95**
				16QAM	22.44	175.39	19.85	96.54
				64QAM	21.11	129.12		
				256QAM	18.41	69.34		
			CP-OFDM	QPSK	21.39	137.72		

NR Band n66(Sub Ant)

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated (Main Ant)	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n66	1720.0 - 1770.0	20	DFT-s OFDM	π/2 BPSK	23.81	240.44		
				QPSK	23.89	244.91		
				16QAM	22.88	194.09		
				64QAM	21.50	141.25		
				256QAM	18.83	76.38		
			CP-OFDM	QPSK	22.35	171.79		
	1717.5 - 1772.5	15	DFT-s OFDM	π/2 BPSK	23.89	244.91		
				QPSK	24.03	252.93		
				16QAM	22.86	193.20		
				64QAM	21.58	143.88		
				256QAM	18.86	76.91		
			CP-OFDM	QPSK	22.40	173.78		
	1715.0 - 1775.0	10	DFT-s OFDM	π/2 BPSK	24.36	272.90		
				QPSK	24.36	272.90		
				16QAM	22.79	190.11		
				64QAM	21.61	144.88		
				256QAM	18.82	76.21		
			CP-OFDM	QPSK	22.32	170.61		
	1712.5 - 1777.5	5	DFT-s OFDM	π/2 BPSK	24.36	272.90		
				QPSK	**24.37**	**273.53**	**23.15**	**206.40**
				16QAM	23.28	212.81	22.36	172.07
				64QAM	21.90	154.88		
				256QAM	19.28	84.72		
			CP-OFDM	QPSK	22.83	191.87		

NR Band n77(3450 ~ 3550 MHz)

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3499.98	100	DFT-s OFDM	π/2 BPSK	24.26	266.69	25.55	358.92
				QPSK	24.26	266.69		
				16QAM	22.98	198.61	24.60	288.40
				64QAM	21.83	152.41		
				256QAM	19.62	91.62		
			CP-OFDM	QPSK	21.80	151.36		
	3495.0 - 3504.99	90	DFT-s OFDM	π/2 BPSK	24.43	277.33	25.31	339.63
				QPSK	24.45	278.61		
				16QAM	23.36	216.77	24.37	273.53
				64QAM	21.94	156.31		
				256QAM	19.75	94.41		
			CP-OFDM	QPSK	22.91	195.43		
	3490.02 - 3510.0	80	DFT-s OFDM	π/2 BPSK	24.41	276.06	25.28	337.29
				QPSK	24.32	270.40		
				16QAM	23.10	204.17	24.28	267.92
				64QAM	23.29	213.30		
				256QAM	23.25	211.35		
			CP-OFDM	QPSK	23.25	211.35		
	3485.01 - 3514.98	70	DFT-s OFDM	π/2 BPSK	24.38	274.16	25.28	337.29
				QPSK	24.30	269.15		
				16QAM	23.33	215.28	24.55	285.10
				64QAM	21.88	154.17		
				256QAM	19.68	92.90		
			CP-OFDM	QPSK	22.85	192.75		
	3480 - 3519.99	60	DFT-s OFDM	π/2 BPSK	24.50	281.84	25.49	354.00
				QPSK	24.45	278.61		
				16QAM	23.43	220.29	24.38	274.16
				64QAM	21.99	158.12		
				256QAM	19.79	95.28		
			CP-OFDM	QPSK	23.02	200.45		
	3475.02 - 3525	50	DFT-s OFDM	π/2 BPSK	24.51	282.49	25.52	356.45
				QPSK	24.51	282.49		
				16QAM	23.44	220.80	24.65	291.74
				64QAM	21.98	157.76		
				256QAM	19.80	95.50		
			CP-OFDM	QPSK	23.01	199.99		
	3470.01 - 3529.98	40	DFT-s OFDM	π/2 BPSK	**24.75**	**298.54**	25.11	324.34
				QPSK	24.69	294.44		
				16QAM	23.61	229.61	23.94	247.74
				64QAM	22.20	165.96		
				256QAM	19.99	99.77		
			CP-OFDM	QPSK	23.24	210.86		
	3465.0 - 3535.02	30	DFT-s OFDM	π/2 BPSK	24.67	293.09	**25.92**	**390.84**
				QPSK	24.69	294.44		
				16QAM	23.62	230.14	24.96	313.33
				64QAM	22.19	165.58		
				256QAM	19.97	99.31		
			CP-OFDM	QPSK	23.18	207.97		

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3460.02 - 3540.0	20	DFT-s OFDM	π/2 BPSK	24.66	292.42	25.45	350.75
				QPSK	24.64	291.07		
				16QAM	23.54	225.94	24.67	293.09
				64QAM	22.16	164.44		
				256QAM	19.95	98.86		
			CP-OFDM	QPSK	23.16	207.01		
	3457.5 - 3542.49	15	DFT-s OFDM	π/2 BPSK	24.46	279.25	25.43	349.14
				QPSK	24.49	281.19		
				16QAM	23.50	223.87	24.53	283.79
				64QAM	22.03	159.59		
				256QAM	19.81	95.72		
			CP-OFDM	QPSK	23.05	201.84		
	3455.01 - 3549.99	10	DFT-s OFDM	π/2 BPSK	24.31	269.77	25.17	328.85
				QPSK	24.31	269.77		
				16QAM	23.17	207.49	23.83	241.55
				64QAM	21.79	151.01		
				256QAM	19.65	92.26		
			CP-OFDM	QPSK	22.81	190.99		

NR Band n77(3450 ~ 3550 MHz, SRS1)

FCC Part 27						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3499.98	100	21.00	125.89		
	3495.0 - 3504.99	90	21.10	128.82		
	3490.02 - 3510.0	80	21.00	125.89		
	3485.01 - 3514.98	70	21.20	131.83		
	3480 - 3519.99	60	21.00	125.89		
	3475.02 - 3525	50	21.65	146.22		
	3470.01 - 3529.98	40	21.40	138.04		
	3465.0 - 3535.02	30	**21.69**	**147.57**	**16.39**	**43.55**
	3460.02 - 3540.0	20	21.40	138.04		
	3457.5 - 3542.49	15	21.60	144.54		
	3455.01 - 3549.99	10	21.55	142.89		

NR Band n77(3450 ~ 3550 MHz, SRS2)

FCC Part 27						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3499.98	100	22.86	193.20		
	3495.0 - 3504.99	90	22.90	194.98		
	3490.02 - 3510.0	80	22.92	195.88		
	3485.01 - 3514.98	70	23.00	199.53		
	3480 - 3519.99	60	23.16	207.01		
	3475.02 - 3525	50	23.24	210.86		
	3470.01 - 3529.98	40	**23.50**	**223.87**	**19.62**	**91.62**
	3465.0 - 3535.02	30	23.46	221.82		
	3460.02 - 3540.0	20	23.46	221.82		
	3457.5 - 3542.49	15	23.42	219.79		
	3455.01 - 3549.99	10	23.20	208.93		

NR Band n77(3450 ~ 3550 MHz, SRS3)

FCC Part 27						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3499.98	100	**17.92**	**61.94**	**14.00**	**25.12**
	3495.0 - 3504.99	90	17.53	56.62		
	3490.02 - 3510.0	80	17.73	59.29		
	3485.01 - 3514.98	70	17.72	59.16		
	3480 - 3519.99	60	17.60	57.54		
	3475.02 - 3525	50	17.00	50.12		
	3470.01 - 3529.98	40	17.20	52.48		
	3465.0 - 3535.02	30	17.38	54.70		
	3460.02 - 3540.0	20	17.28	53.46		
	3457.5 - 3542.49	15	17.80	60.26		
	3455.01 - 3549.99	10	17.42	55.21		

NR Band n77(3700 ~ 3980 MHz)

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3750.0 - 3930.0	100	DFT-s OFDM	π/2 BPSK	24.38	274.16	25.01	316.96
				QPSK	24.36	272.90		
				16QAM	23.33	215.28	23.15	206.54
				64QAM	21.93	155.96		
				256QAM	19.75	94.41		
			CP-OFDM	QPSK	22.93	196.34		
	3745.02 - 3934.98	90	DFT-s OFDM	π/2 BPSK	24.47	279.90	26.33	429.54
				QPSK	24.43	277.33		
				16QAM	23.33	215.28	25.84	383.71
				64QAM	21.94	156.31		
				256QAM	19.76	94.62		
			CP-OFDM	QPSK	22.93	196.34		
	3740.01 - 3939.99	80	DFT-s OFDM	π/2 BPSK	24.44	277.97	25.90	389.05
				QPSK	24.39	274.79		
				16QAM	23.28	212.81	25.86	385.48
				64QAM	23.30	213.80		
				256QAM	23.33	215.28		
			CP-OFDM	QPSK	23.33	215.28		
	3735.02 - 3944.98	70	DFT-s OFDM	π/2 BPSK	24.45	278.61	26.32	428.55
				QPSK	24.42	276.69		
				16QAM	23.38	217.77	25.75	375.84
				64QAM	21.91	155.24		
				256QAM	19.72	93.76		
			CP-OFDM	QPSK	22.96	197.70		
	3730.02 - 3949.98	60	DFT-s OFDM	π/2 BPSK	24.47	279.90	26.33	429.54
				QPSK	24.45	278.61		
				16QAM	23.34	215.77	25.84	383.71
				64QAM	21.92	155.60		
				256QAM	19.67	92.68		
			CP-OFDM	QPSK	22.89	194.54		
	3725.01 - 3954.99	50	DFT-s OFDM	π/2 BPSK	24.42	276.69	26.44	440.55
				QPSK	24.43	277.33		
				16QAM	23.30	213.80	26.02	399.94
				64QAM	21.85	153.11		
				256QAM	19.68	92.90		
			CP-OFDM	QPSK	22.89	194.54		
	3720.02 - 3960.0	40	DFT-s OFDM	π/2 BPSK	**24.63**	**290.40**	**26.48**	**444.63**
				QPSK	24.59	287.74		
				16QAM	23.54	225.94	26.22	418.79
				64QAM	22.09	161.81		
				256QAM	19.91	97.95		
			CP-OFDM	QPSK	23.13	205.59		
	3715.02 - 3964.98	30	DFT-s OFDM	π/2 BPSK	24.57	286.42	26.01	399.02
				QPSK	**24.50**	**281.84**		
				16QAM	23.54	225.94	25.10	323.59
				64QAM	22.00	158.49		
				256QAM	19.83	96.16		
			CP-OFDM	QPSK	23.06	202.30		

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3710.01 - 3969.99	20	DFT-s OFDM	π/2 BPSK	24.59	287.74	25.80	380.19
				QPSK	24.53	283.79		
				16QAM	23.48	222.84	24.89	308.32
				64QAM	22.02	159.22		
				256QAM	19.82	95.94		
			CP-OFDM	QPSK	23.03	200.91		
	3707.52 - 3972.48	15	DFT-s OFDM	π/2 BPSK	24.53	283.79	25.98	396.28
				QPSK	24.53	283.79		
				16QAM	23.47	222.33	24.97	314.05
				64QAM	22.00	158.49		
				256QAM	19.78	95.06		
			CP-OFDM	QPSK	22.98	198.61		
	3705.0 - 3975.0	10	DFT-s OFDM	π/2 BPSK	24.52	283.14	26.19	415.91
				QPSK	**24.53**	**283.79**		
				16QAM	23.35	216.27	24.93	311.17
				64QAM	21.93	155.96		
				256QAM	19.74	94.19		
			CP-OFDM	QPSK	22.95	197.24		

NR Band n77(3700 ~ 3980 MHz, SRS1)

FCC Part 27						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3750.0 - 3930.0	100	**21.42**	**138.68**	**15.24**	**33.42**
	3745.02 - 3934.98	90	20.83	121.06		
	3740.01 - 3939.99	80	20.91	123.31		
	3735.02 - 3944.98	70	20.73	118.30		
	3730.02 - 3949.98	60	20.52	112.72		
	3725.01 - 3954.99	50	20.90	123.03		
	3720.02 - 3960.0	40	20.81	120.50		
	3715.02 - 3964.98	30	21.34	136.14		
	3710.01 - 3969.99	20	21.23	132.74		
	3707.52 - 3972.48	15	21.19	131.52		
	3705.0 - 3975.0	10	21.16	130.62		

NR Band n77(3700 ~ 3980 MHz, SRS2)

FCC Part 27						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3750.0 - 3930.0	100	**23.16**	**207.01**	**22.26**	**168.27**
	3745.02 - 3934.98	90	22.70	186.21		
	3740.01 - 3939.99	80	22.66	184.50		
	3735.02 - 3944.98	70	22.41	174.18		
	3730.02 - 3949.98	60	22.46	176.20		
	3725.01 - 3954.99	50	22.65	184.08		
	3720.02 - 3960.0	40	23.06	202.30		
	3715.02 - 3964.98	30	23.06	202.30		
	3710.01 - 3969.99	20	22.90	194.98		
	3707.52 - 3972.48	15	23.01	199.99		
	3705.0 - 3975.0	10	22.90	194.98		

NR Band n77(3700 ~ 3980 MHz, SRS3)

FCC Part 27						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n77	3750.0 - 3930.0	100	**16.98**	**49.89**	**14.58**	**28.71**
	3745.02 - 3934.98	90	16.21	41.78		
	3740.01 - 3939.99	80	15.77	37.76		
	3735.02 - 3944.98	70	15.91	38.99		
	3730.02 - 3949.98	60	16.00	39.81		
	3725.01 - 3954.99	50	16.99	50.00		
	3720.02 - 3960.0	40	16.85	48.42		
	3715.02 - 3964.98	30	15.90	38.90		
	3710.01 - 3969.99	20	16.17	41.40		
	3707.52 - 3972.48	15	16.06	40.36		
	3705.0 - 3975.0	10	16.12	40.93		

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 25 1850 ~ 1915 MHz	-1.9 (Main ANT) -3.7 (Sub ANT)
WCDMA Band 4 / LTE Band 4 / LTE Band 66 / NR Band n66 1710 ~ 1780 MHz	-2.4 (Main ANT) -3.5 (Sub ANT)
GSM850 / WCDMA Band 5 / LTE Band 5 / LTE Band 26 / NR Band n5 814 ~ 849 MHz	-3.3
LTE Band 12 / NR Band n12 699 ~ 716 MHz	-3.0
LTE Band 13 777 ~ 787 MHz	-3.5
LTE Band 41(PC2) / NR Band n41 2496 ~ 2690 MHz	-3.7
NR Band n41(SRS1) 2496 ~ 2690 MHz	-3.2
NR Band n41(SRS2) 2496 ~ 2690 MHz	-4.5
NR Band n41(SRS3) 2496 ~ 2690 MHz	-4.2
NR Band n77(Lower) 3450 ~ 3550 MHz	-3.2
NR Band n77(Lower, SRS1) 3450 ~ 3550 MHz	-4.6
NR Band n77(Lower, SRS2) 3450 ~ 3550 MHz	-4.4
NR Band n77(Lower, SRS3) 3450 ~ 3550 MHz	-2.5
NR Band n77(Upper) 3700 ~ 3980 MHz	-2.9
NR Band n77(Upper, SRS1) 3700 ~ 3980 MHz	-7.5
NR Band n77(Upper, SRS2) 3700 ~ 3980 MHz	-3.4
NR Band n77(Upper, SRS3) 3700 ~ 3980 MHz	-3.8

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 Band, the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on π/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

This device supports SRS (sounding reference signal) 1, 2, 3 mode for NR TDD bands. For each SRS 1, 2 and 3, Conducted power and radiated measurement were performed through FTM mode provide by the customer.

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

LTE Band 4
LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

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

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

NR Band n2
NR Band n2 (Frequency range: 1850-1910 MHz) is covered by NR Band n25 (Frequency range: 1850-1915 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

NR Band n25 (Sub Antenna)
Sub Antenna of NR Band n25 (Frequency range: 1850-1915 MHz) is covered by Main Antenna of NR Band n25 (Frequency range: 1850-1915 MHz) due to overlapping frequency range, lower maximum tune-up limit and same channel bandwidth.

NR Band n66 (Sub Antenna)
Sub Antenna of NR Band n66 (Frequency range: 1710-1780 MHz) is covered by Main Antenna of NR Band n66 (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**
5	825.5	3	1	8
	836.5		1	8
	847.5		1	8
12	701.5	5	1	12
	707.5		1	12
	713.5		1	12
13	782	10	1	0
25	1850.7	1.4	1	3
	1882.5		1	3
	1914.3		1	0
26 (Part 90)	815.5	3	1	8
	822.5		1	8
26 (Straddle)	824.0	3	1	8
26 (Part 22)	826.5	5	1	12
	831.5		1	12
	846.5		1	12
41(PC2)	2501.0	10	1	49
	2593.0		1	25
	2685.0		1	25
66	1712.5	5	1	24
	1745.0		1	12
	1777.5		1	12

Highest power setting for each bands				
NR Band n	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
5	834.0	20	1	1
	836.5		1	1
	839.0		1	104
12	706.5	15	1	40
	707.5		1	1
	708.5		1	1
25 (Main ANT)	1852.5	5	1	1
	1882.5		1	1
	1912.5		1	13
25 (Sub ANT)	1852.5	5	1	1
	1882.5		1	1
	1912.5		1	13
41	2516.01	40	1	104
	2592.99		1	104
	2670.00		1	104
66 (Main ANT)	1712.5	5	1	13
	1745.0		1	13
	1777.5		1	23
66 (Sub ANT)	1720.0	20	1	1
	1745.0		1	104
	1770.0		1	1
77 (3450-3550 MHz)	3470.01	40	1	1
	3499.98		1	1
	3529.98		1	1
77 (3700-3980 MHz)	3720.00	40	1	1
	3840.00		1	104
	3960.00		1	1

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

NR Band	LTE Band
5	**2**, 66
25	**12**, 13
41	4, **12**, 66
66	2, **5**, 12, 13
77 (3450-3550 MHz)	2, **5**, 12, 13, 25, 66
77 (3700-3980 MHz)	2, **5**, 12, 13, 25, 66

i. Worst Axis Condition

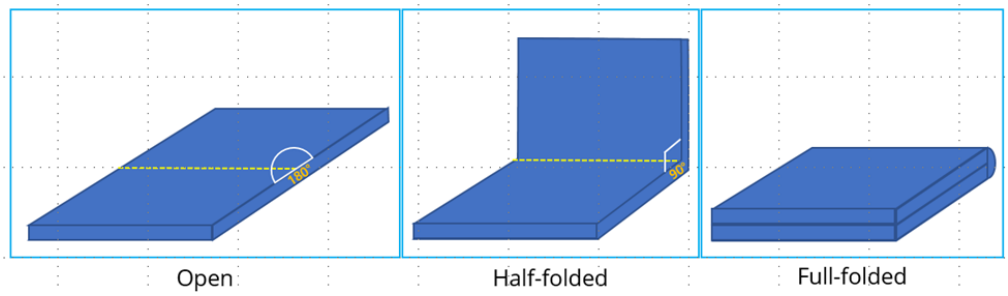
The fundamental and radiated spurious emission were investigated in three orthogonal orientations X, Y and Z, it was determined that below orientation was worst-case orientation for each band.

Band	ERP/EIRP			RSE		
	X	Y	Z	X	Y	Z
GSM850	-	-	Half-folded	-	-	Half-folded
GSM1900	-	Half-folded	-	-	Open	-
WCDMA B5	-	-	Open	-	-	Open
WCDMA B4	-	Half-folded	-	-	Half-folded	-
WCDMA B2	-	Half-folded	-	-	Half-folded	-
LTE B5	-	-	Open	-	-	Open
LTE B12	-	Half-folded	-	-	-	Open
LTE B13	-	-	Open	-	-	Open
LTE B25	Open	-	-	Open	-	-
LTE B26	-	-	Open	-	-	Open
LTE B41	Open	-	-	-	Open	-
LTE B66	Half-folded	-	-	Half-folded	-	-
NR n5	Open	-	-	Open	-	-
NR n12	Open	-	-	Open	-	-
NR n25 (Main ANT)	Open	-	-	Open	-	-
NR n25 (Sub ANT)	Open	-	-	Open	-	-
NR n41	Open	-	-	Open	-	-
NR n41(SRS1)	-	Open	-	-	Open	-
NR n41(SRS2)	Open	-	-	-	-	Open
NR n41(SRS3)	-	Open	-	-	-	Open
NR n66 (Main ANT)	Open	-	-	Open	-	-
NR n66 (Sub ANT)	Half-folded	-	-	Half-folded	-	-
NR n77 (3450 ~ 3550 MHz)	-	-	Half-folded	-	-	Half-folded
NR n77 (SRS1) (3450 ~ 3550 MHz)	Open	-	-	Open	-	-
NR n77 (SRS2) (3450 ~ 3550 MHz)	-	-	Half-folded	-	-	Half-folded
NR n77 (SRS3) (3450 ~ 3550 MHz)	Open	-	-	Open	-	-
NR n77 (3700 ~ 3980 MHz)	-	-	Half-folded	-	-	Half-folded
NR n77 (SRS1) (3700 ~ 3980 MHz)	Open	-	-	Open	-	-
NR n77 (SRS2) (3700 ~ 3980 MHz)	-	Open	-	-	Open	-
NR n77 (SRS3) (3700 ~ 3980 MHz)	Open	-	-	Open	-	-

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.

ii. Fordable Condition

The Fudamental of the EUT was investigated three foldarble conditions(Open, Halrf-folded, Full-folded).



5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacture**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37R38J49R8SE3	N/A
Data Cable	SAMSUNG	EP-DN980	GH39-02111ABBE	N/A

I/O CABLE

I/O Cable List						
Cable No.	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.0 m	N/A

TEST SETUP

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

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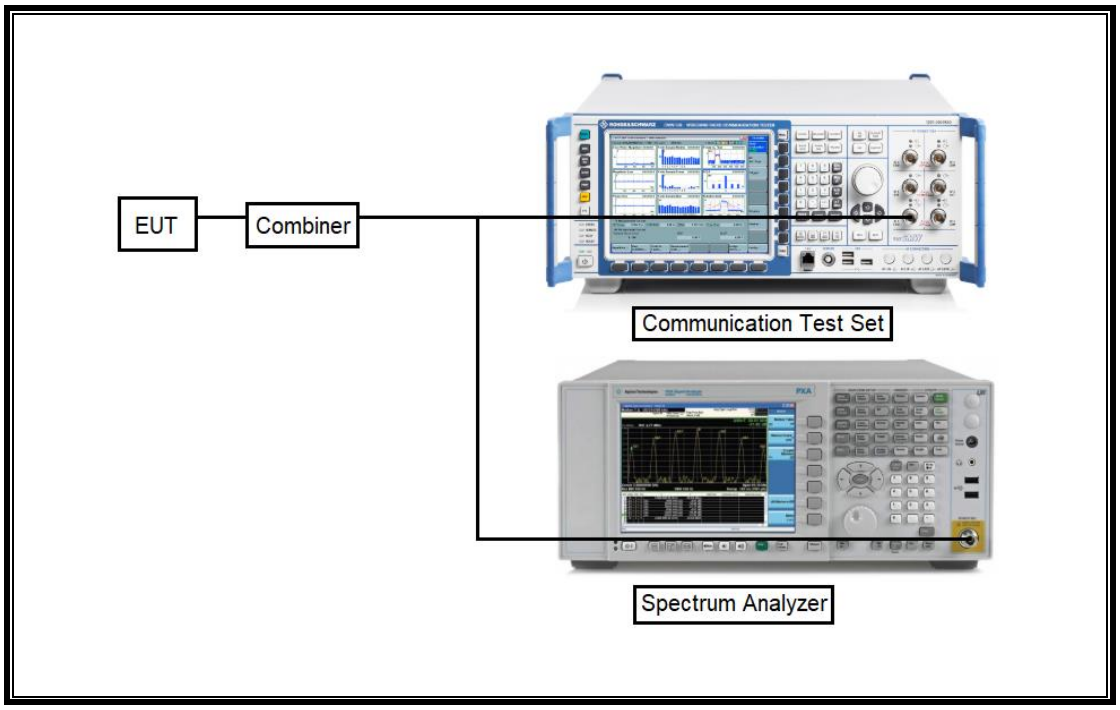
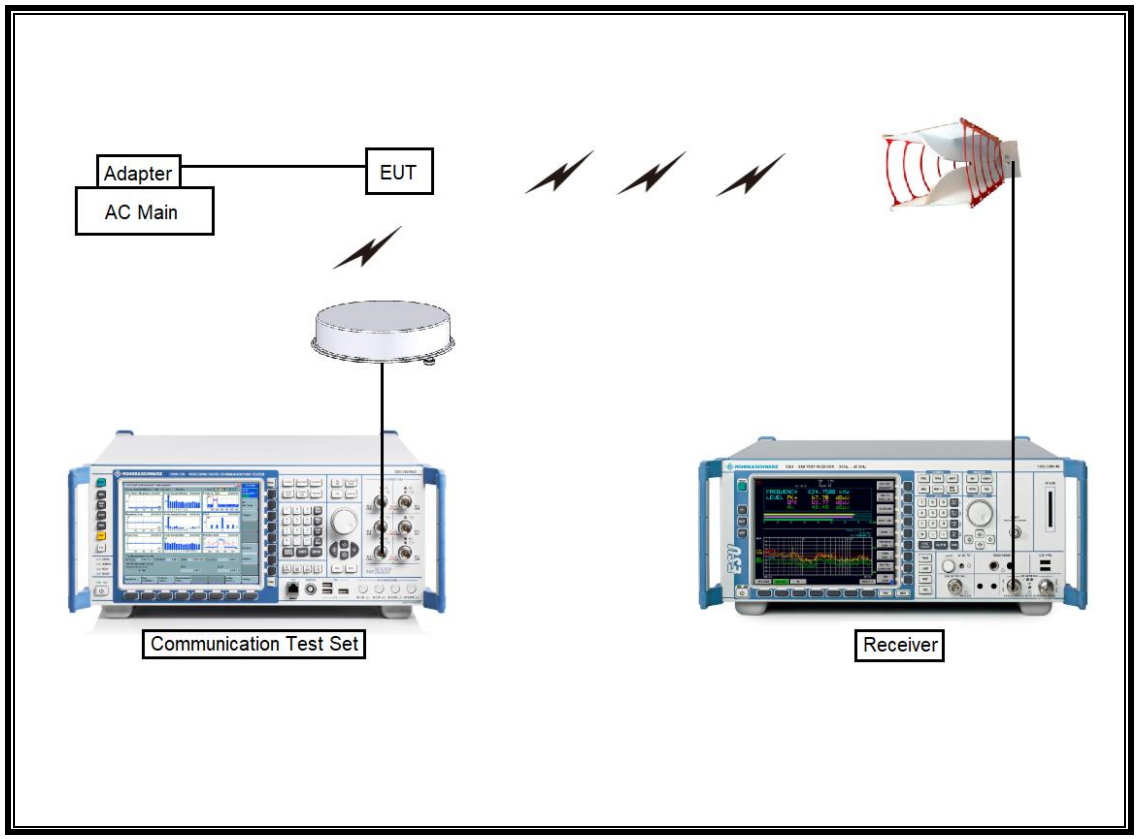
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121D DB4	00164753	2023-02-08
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	110367-0003	N/A
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	80108-0004	N/A
Antenna, Horn, 40 GHz	ETS	3116C	00166155	2022-08-04
Antenna, Horn, 40 GHz	ETS	3116C	00168645	2023-10-13
Preamplifier	ETS	3116C-PA	00168841	2022-08-04
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2022-08-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2022-08-13
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2022-08-13
Antenna, Horn, 18 GHz	ETS	3115	00167211	2022-07-27
Antenna, Horn, 18 GHz	ETS	3115	00161451	2022-08-15
Antenna, Horn, 18 GHz	ETS	3117	00168724	2022-07-27
Antenna, Horn, 18 GHz	ETS	3117	00168717	2022-08-15
Communications Test Set	R&S	CMW500	169796	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	

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), 27.53(l)(2) 27.53(n)(2) 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) 27.50(j)(3) 27.50(k)(3)	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) 27.53(l)(2) 27.53(n)(2)		-25dBm		Pass

8. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to 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

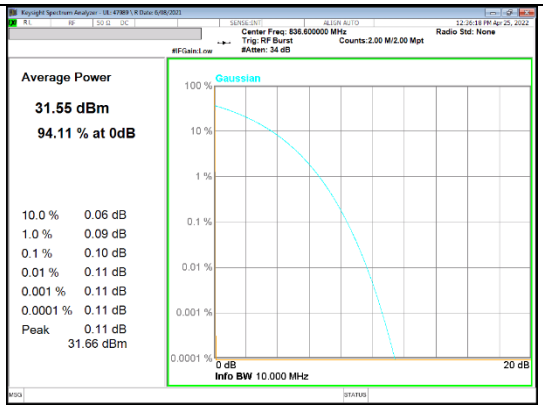
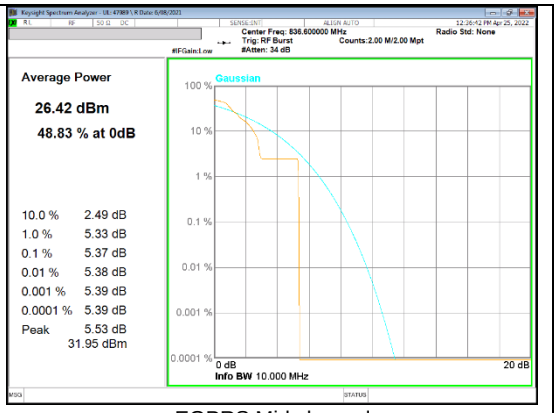
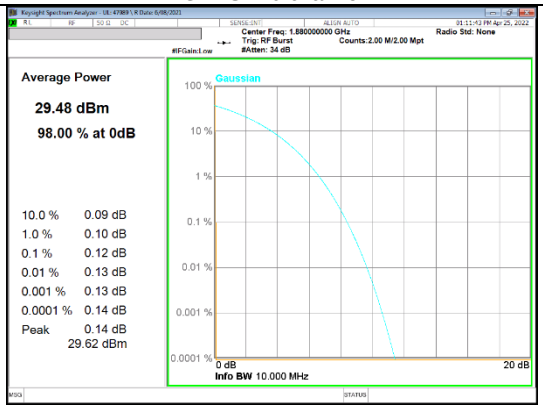
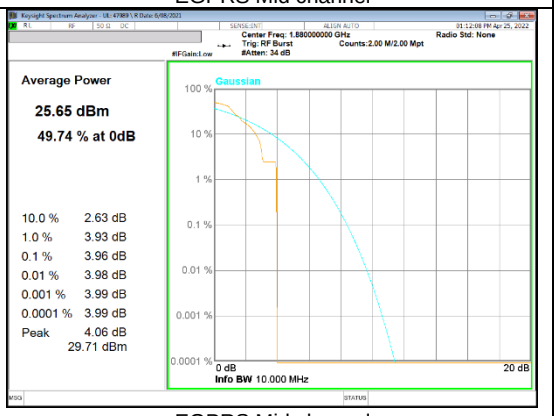
5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) and modulations (π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

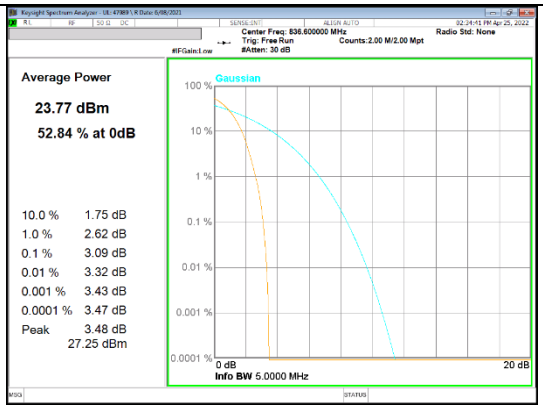
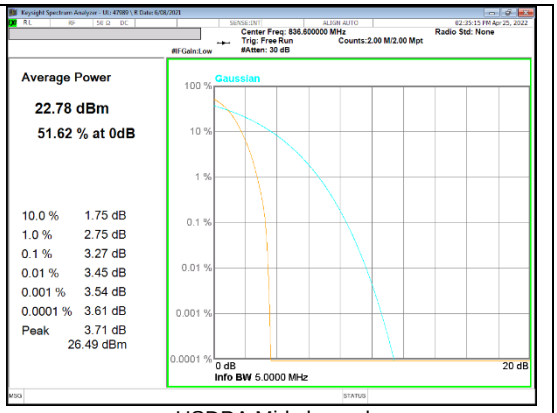
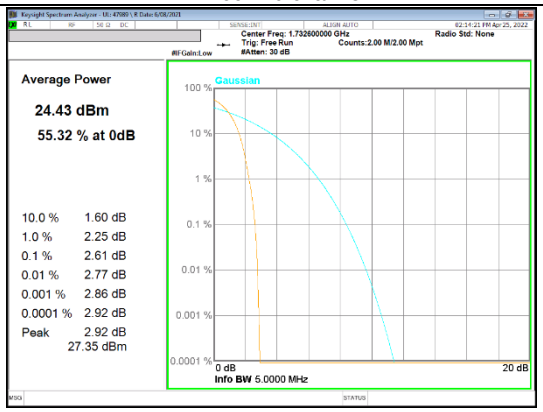
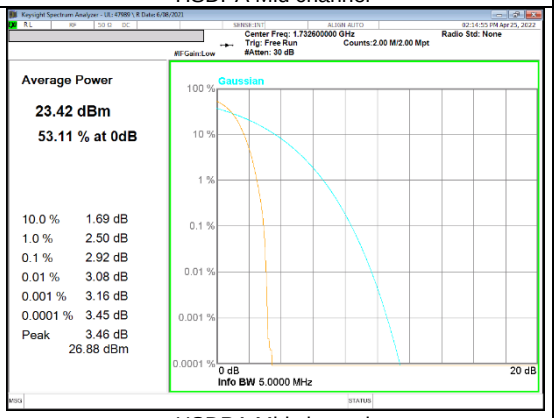
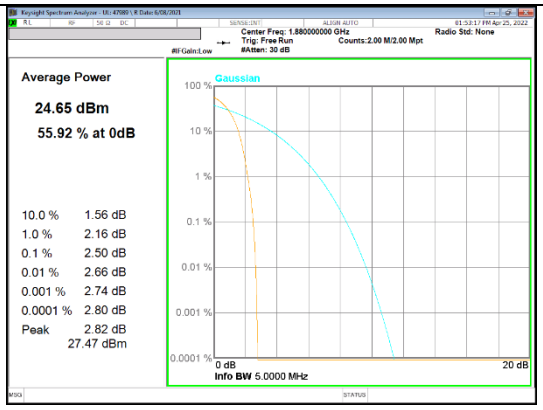
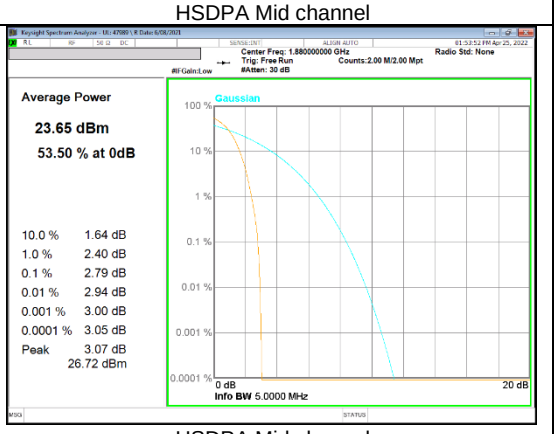
See the following pages.

8.1. CONDUCTED PEAK TO AVERAGE RESULT

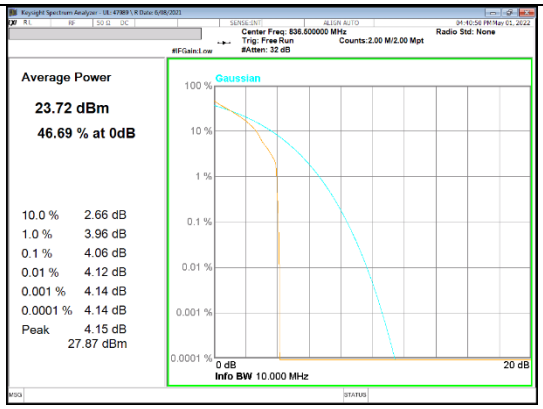
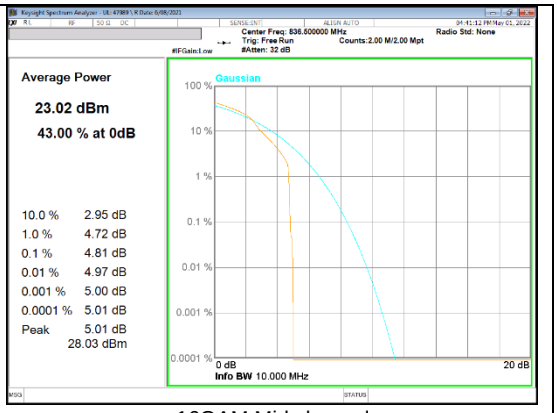
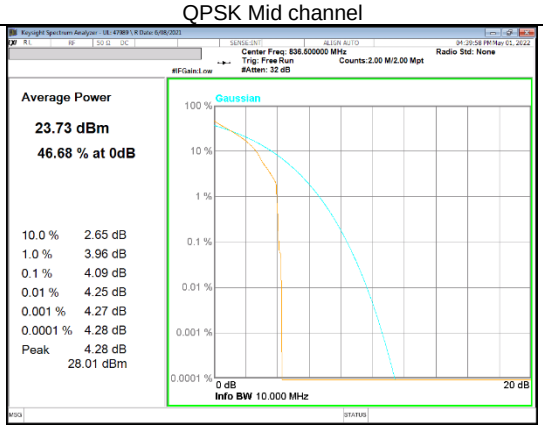
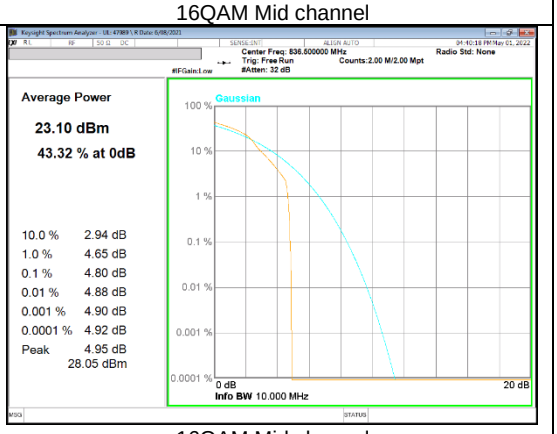
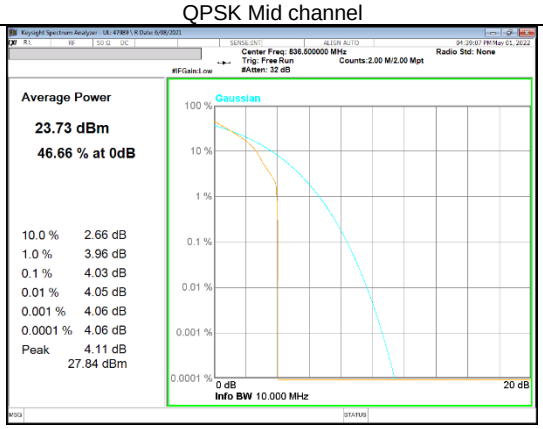
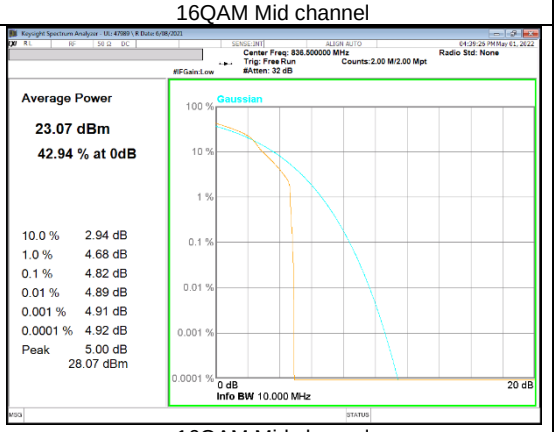
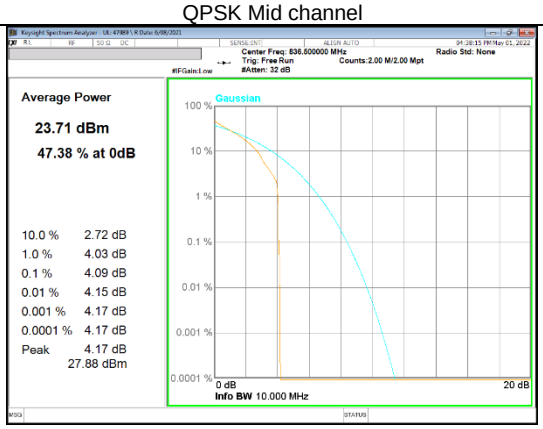
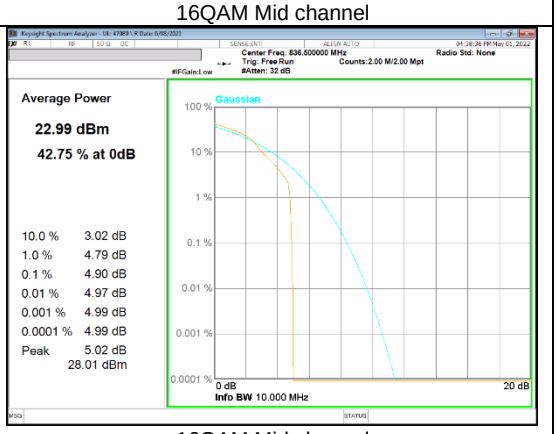
GSM

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

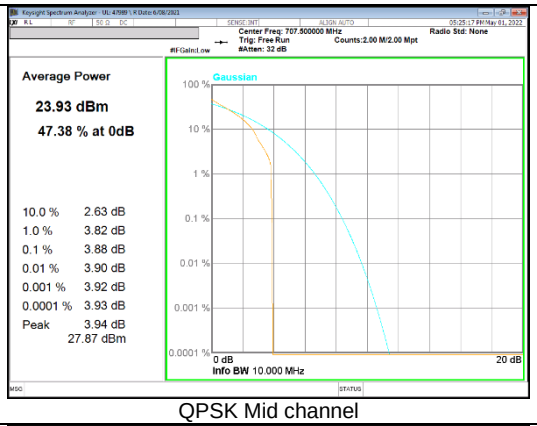
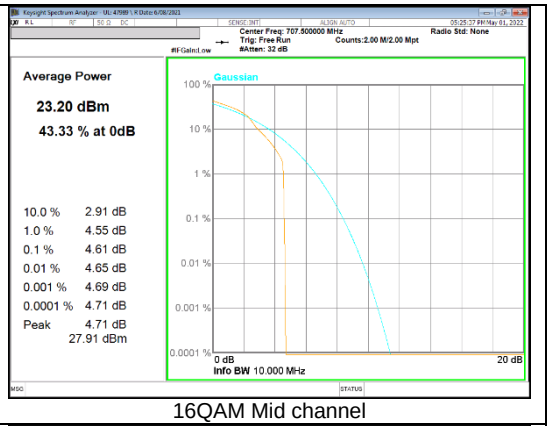
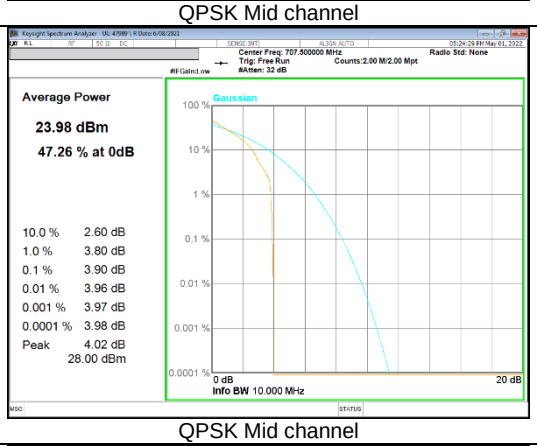
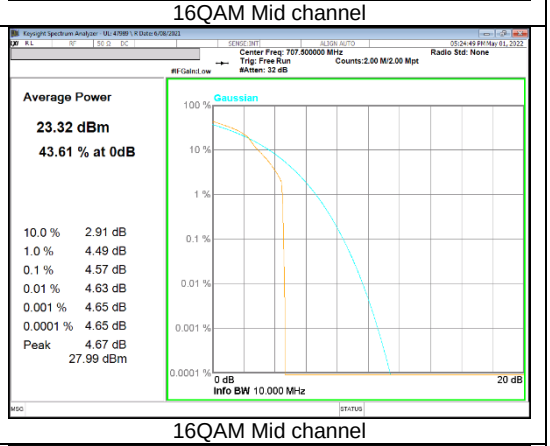
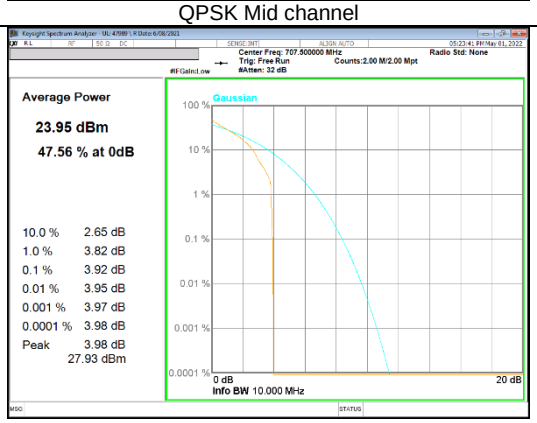
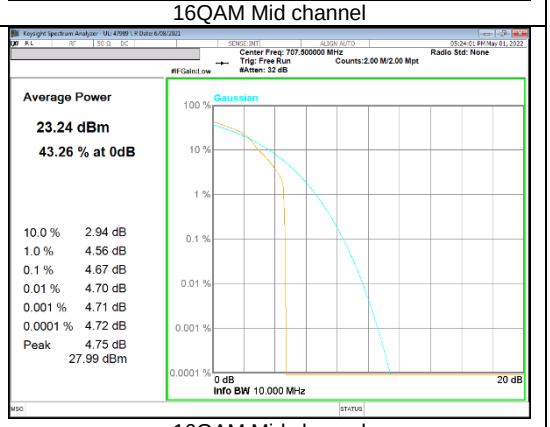
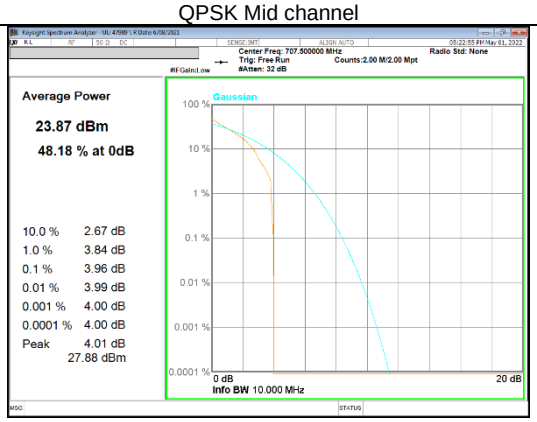
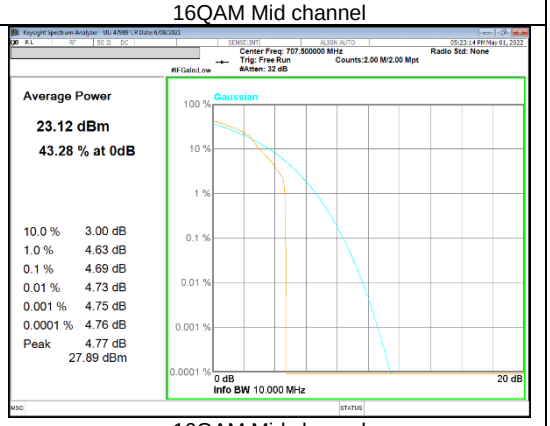
WCDMA

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

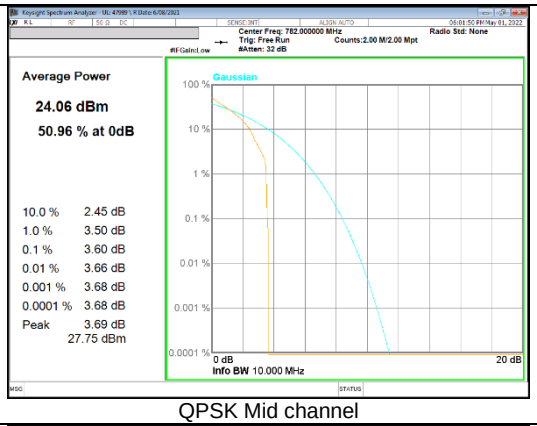
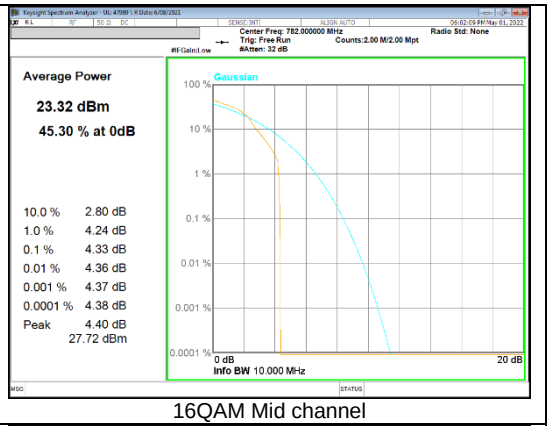
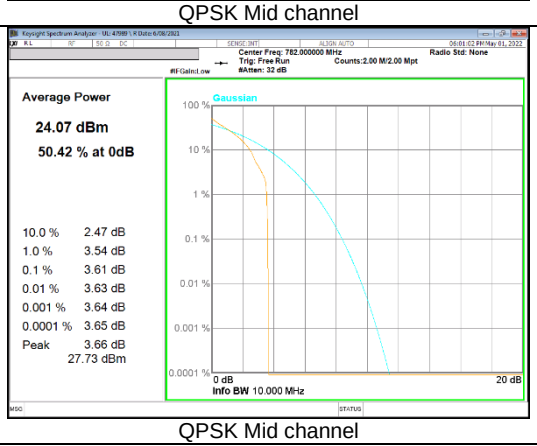
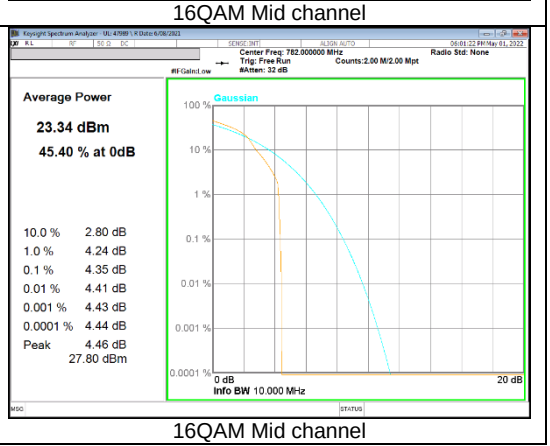
LTE Band 5

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

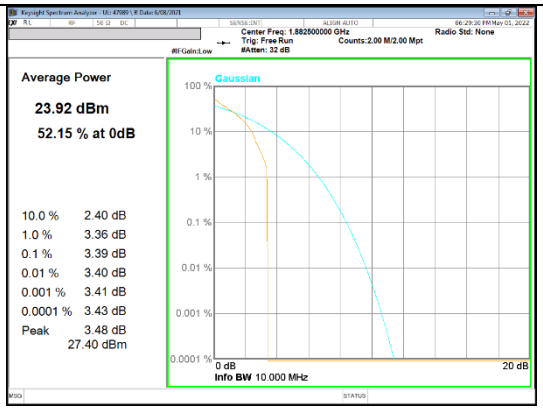
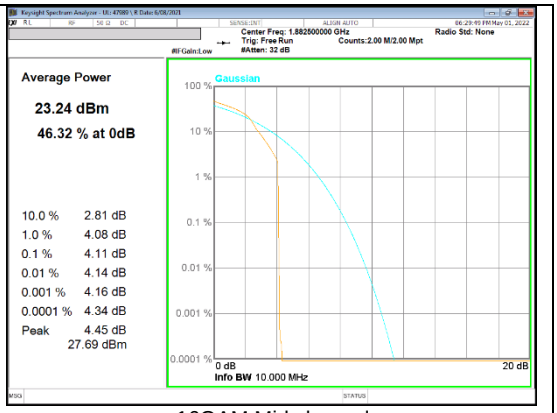
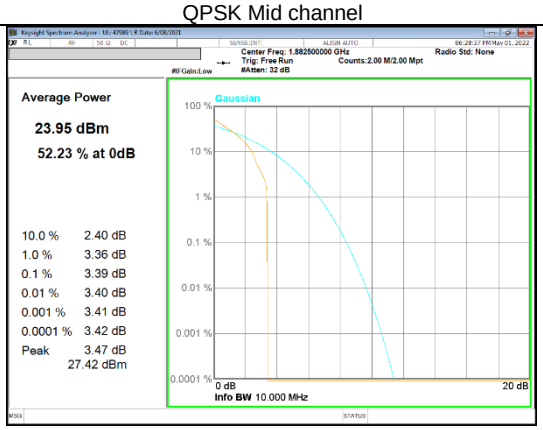
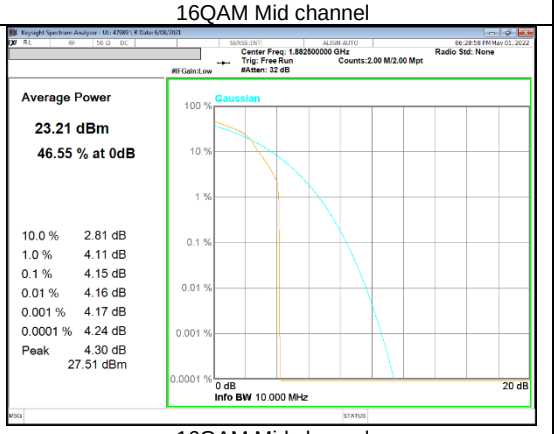
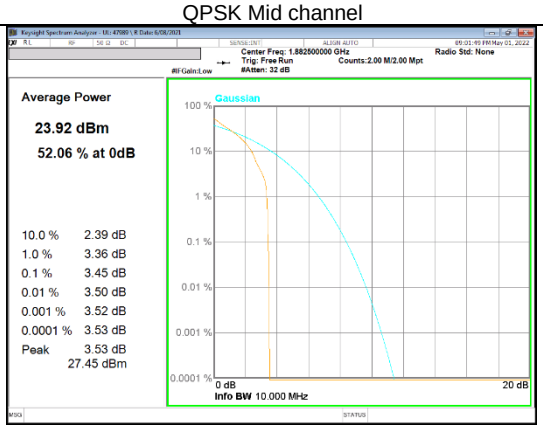
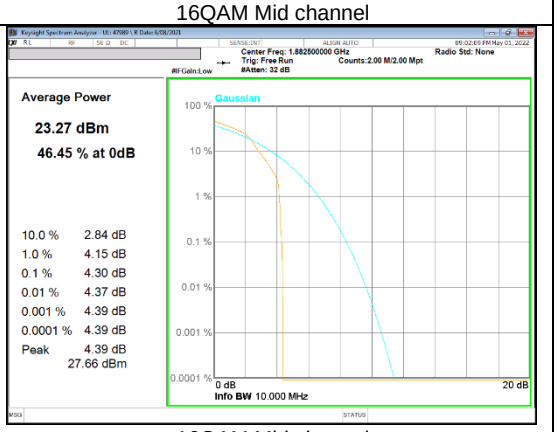
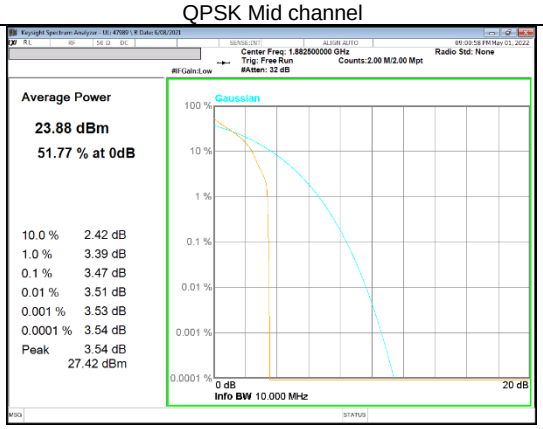
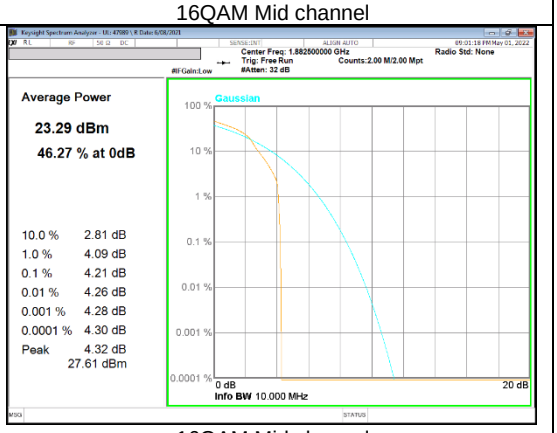
LTE Band 12

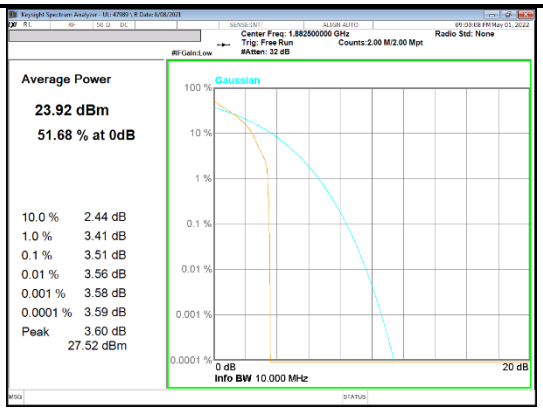
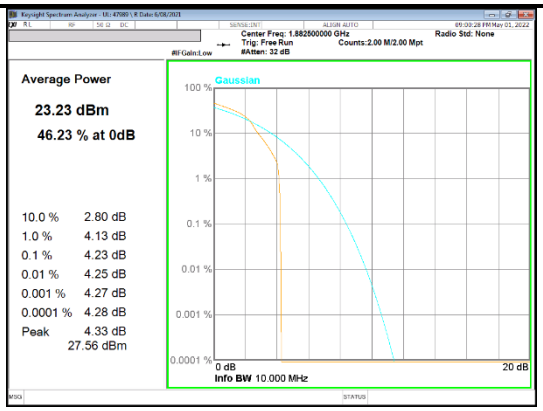
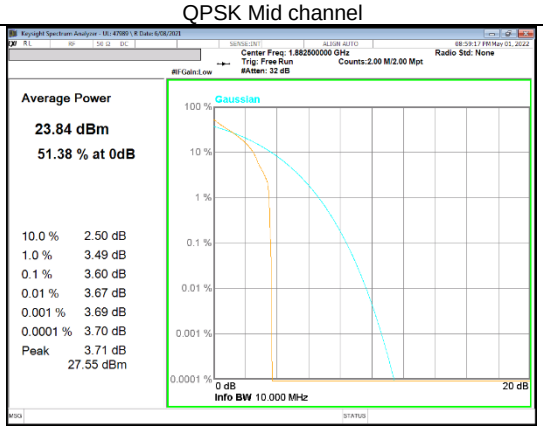
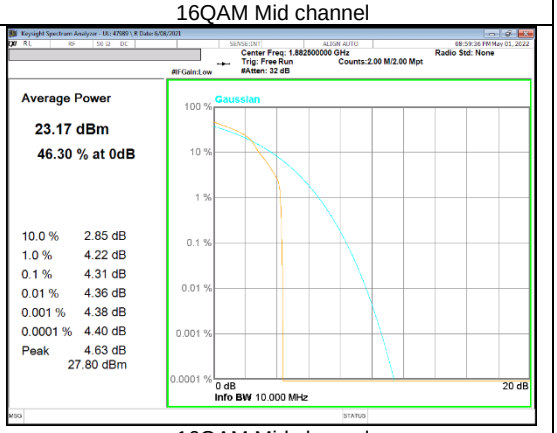
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

LTE Band 13

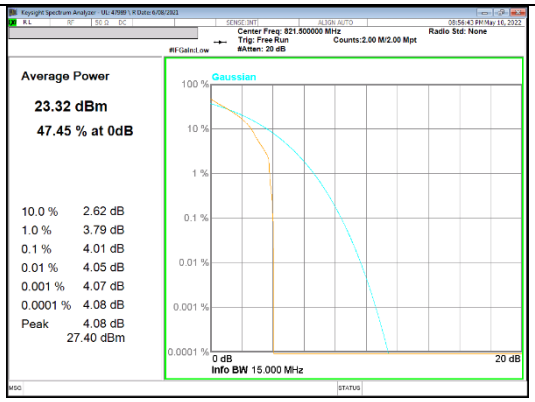
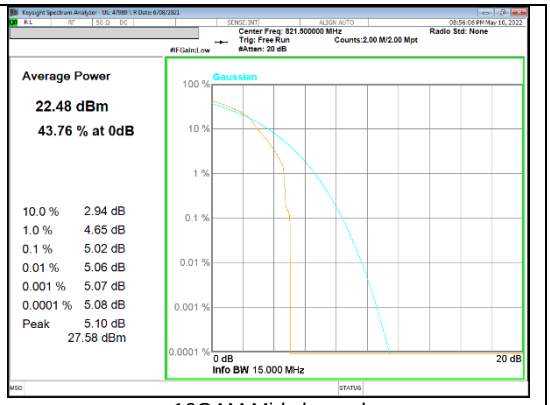
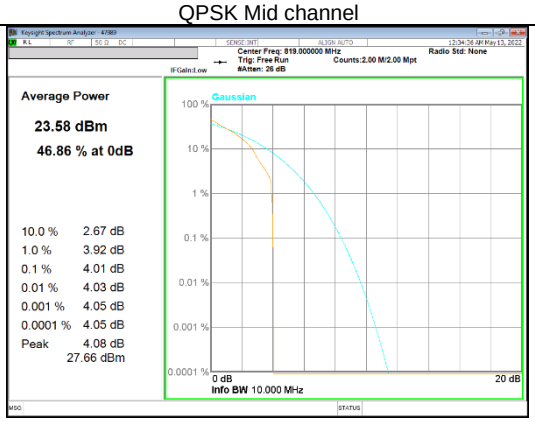
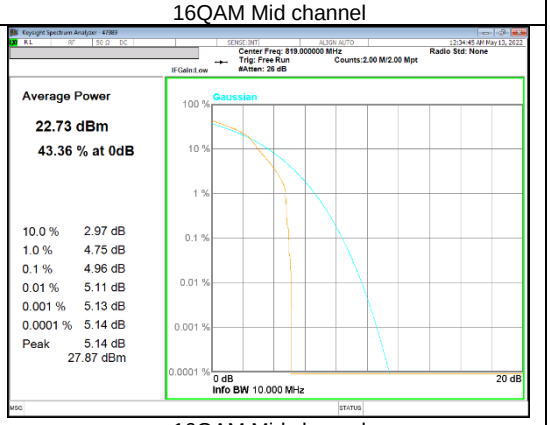
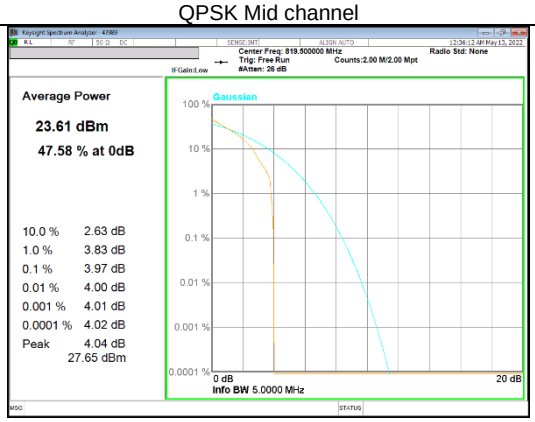
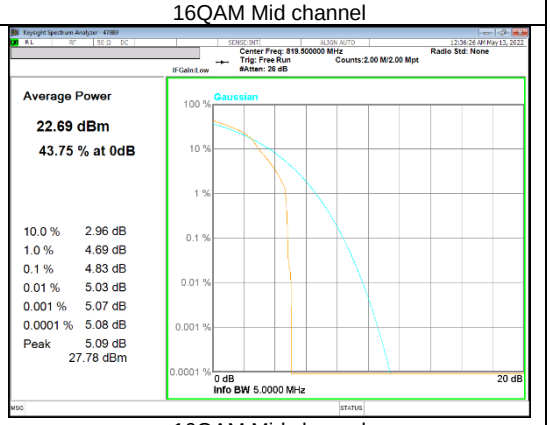
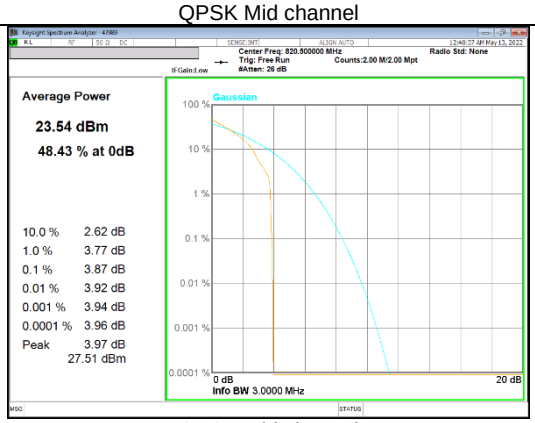
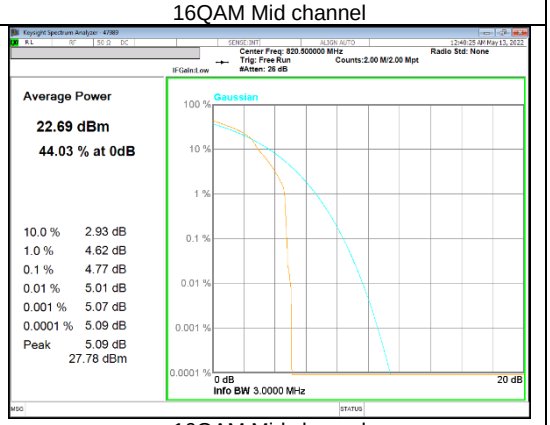
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel

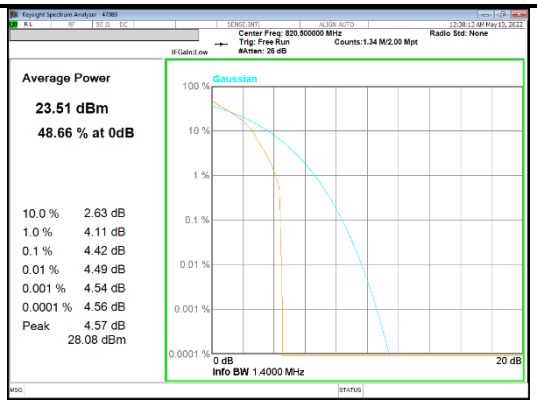
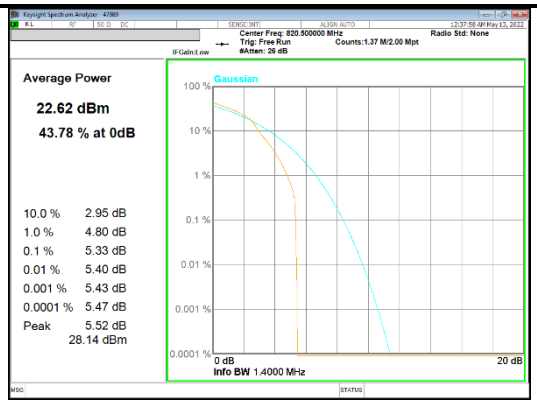
LTE Band 25

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

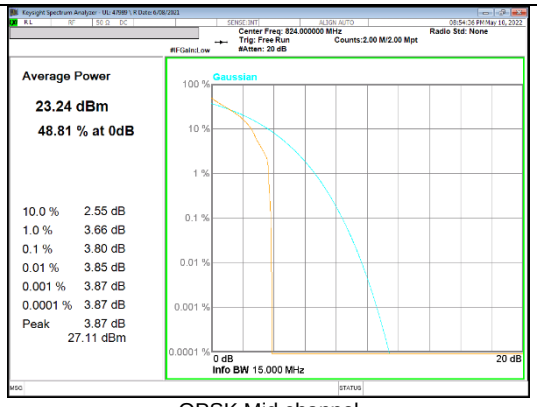
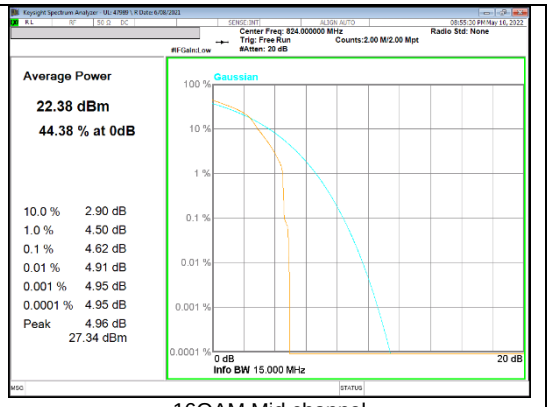
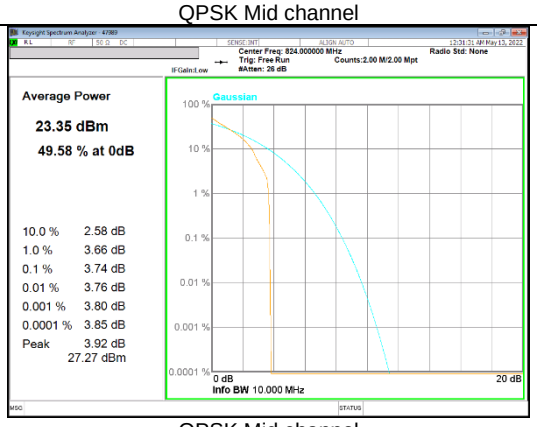
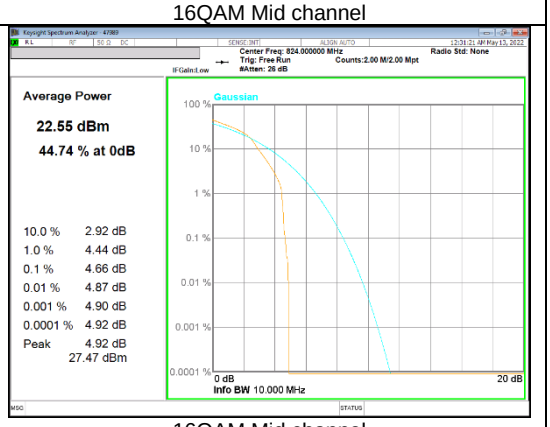
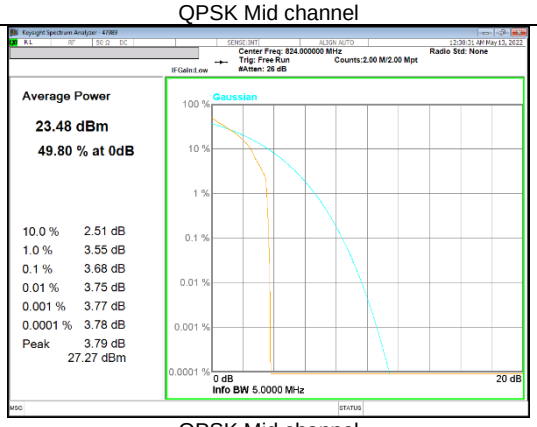
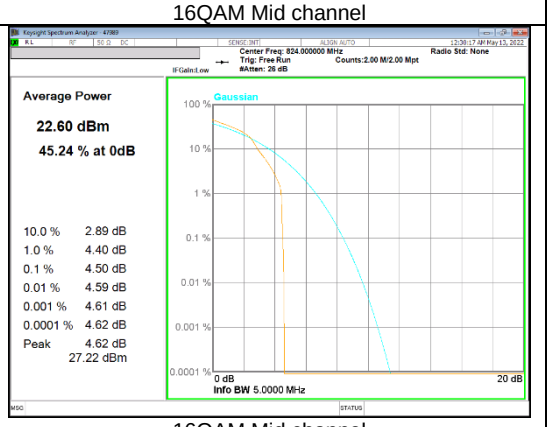
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

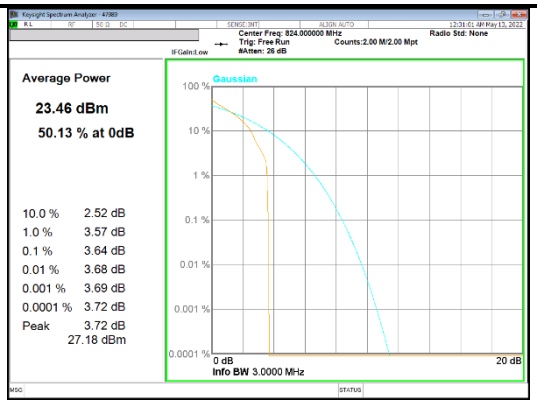
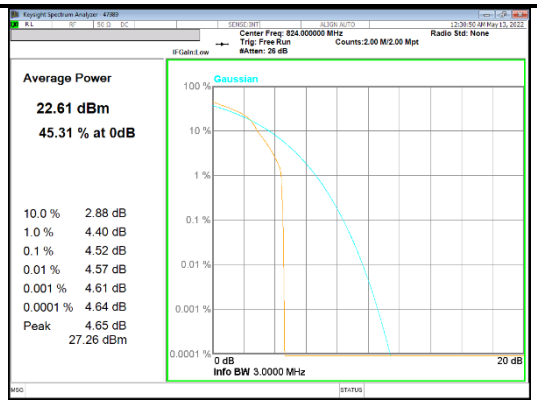
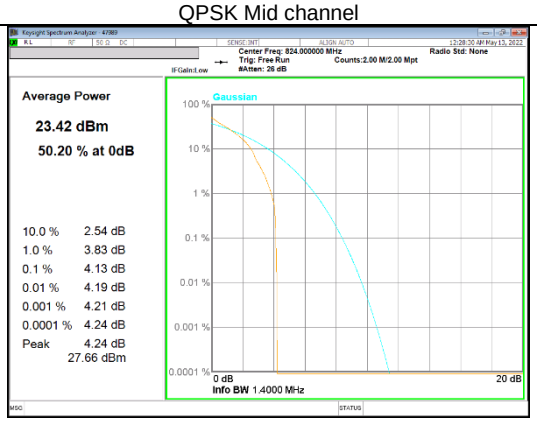
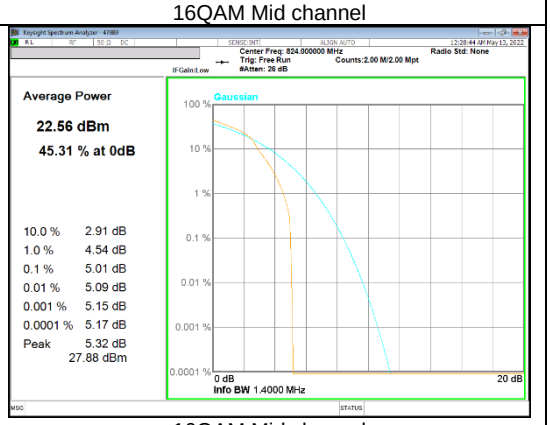
LTE Band 26 (Part 90)

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

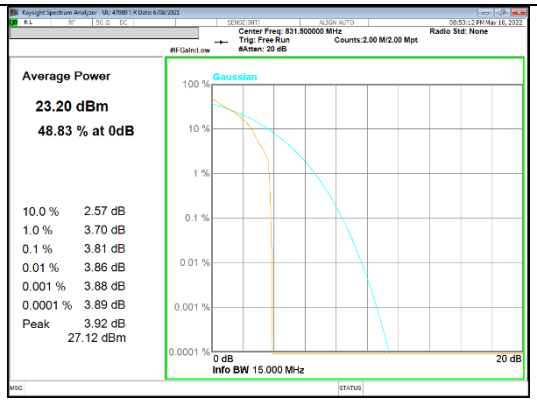
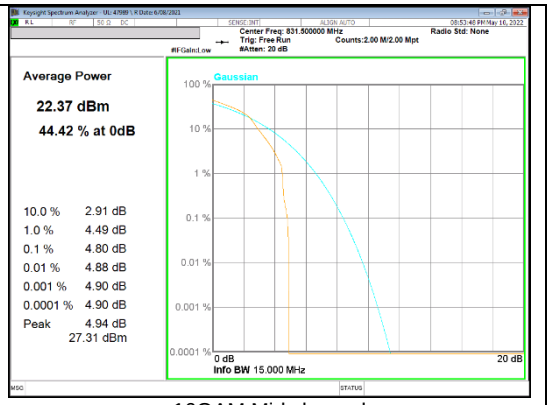
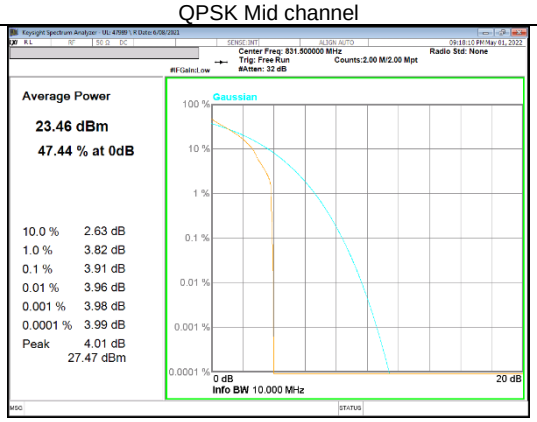
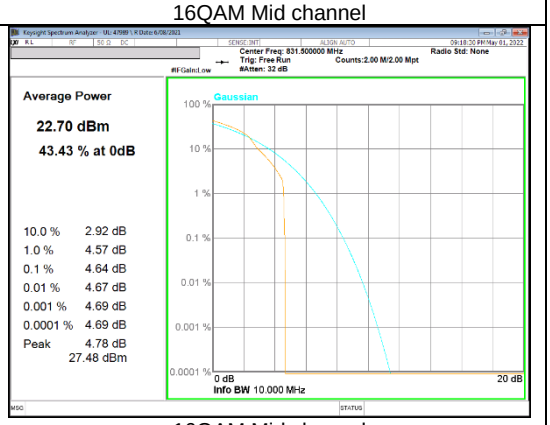
1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

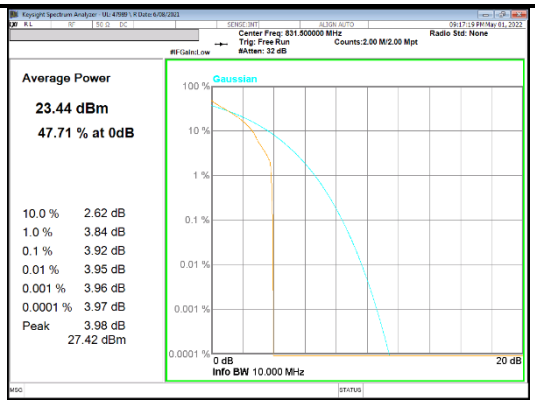
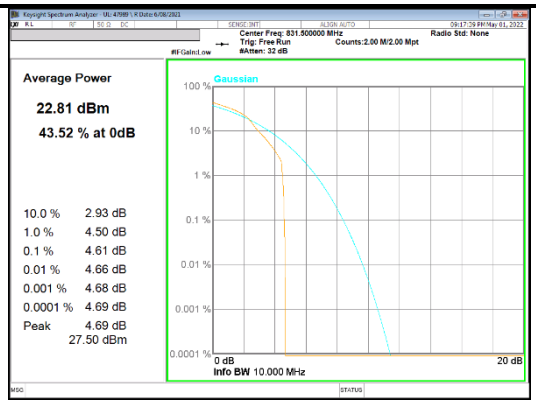
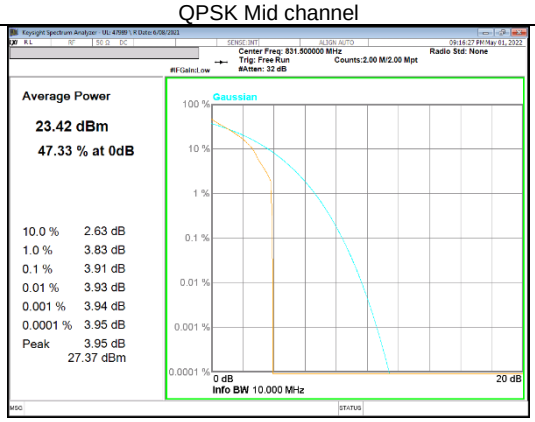
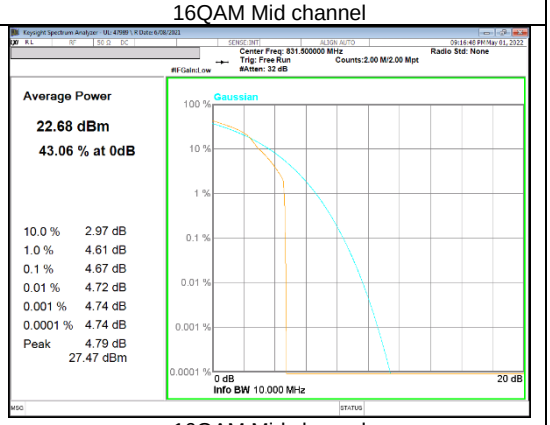
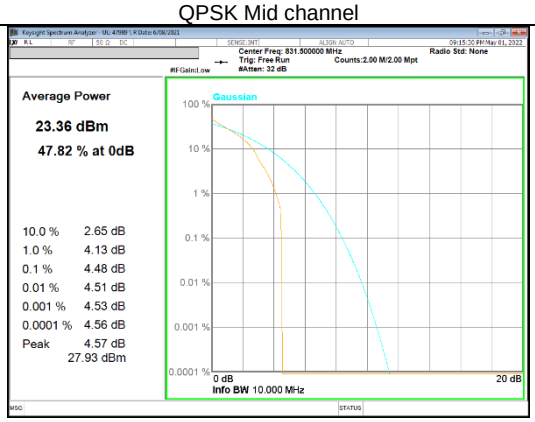
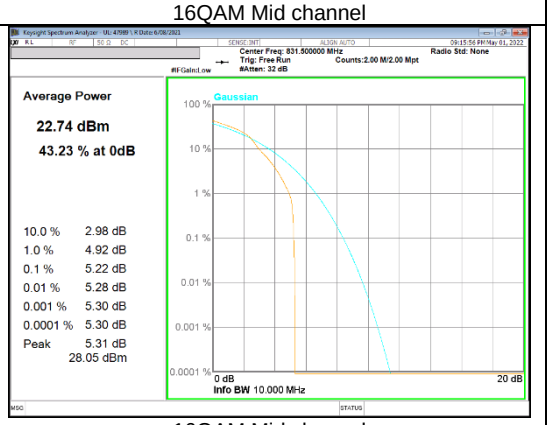
LTE Band 26 (Straddle)

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

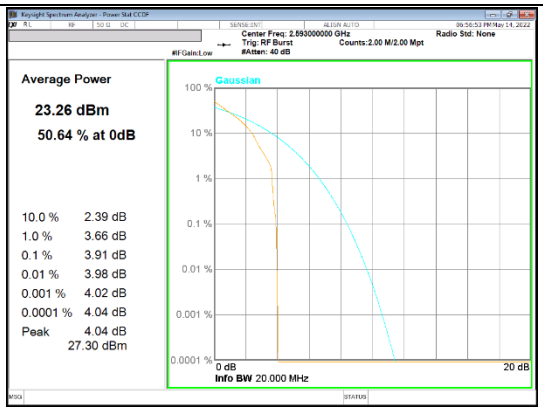
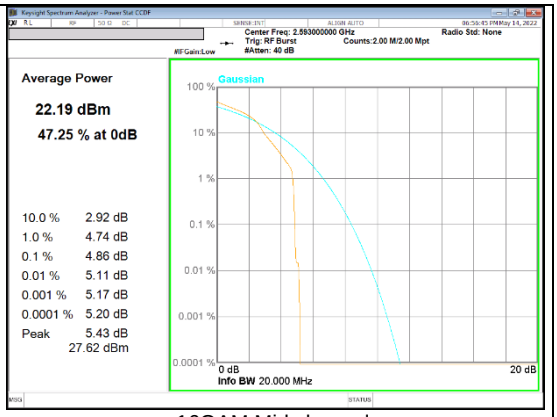
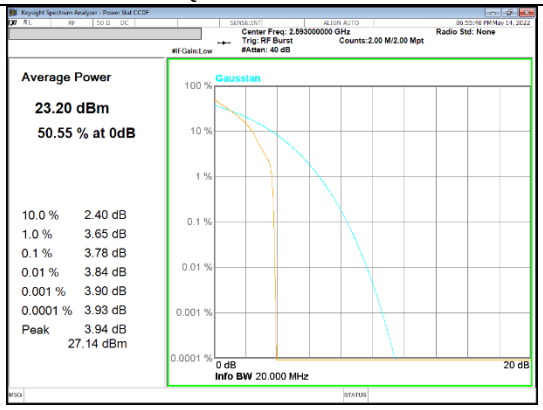
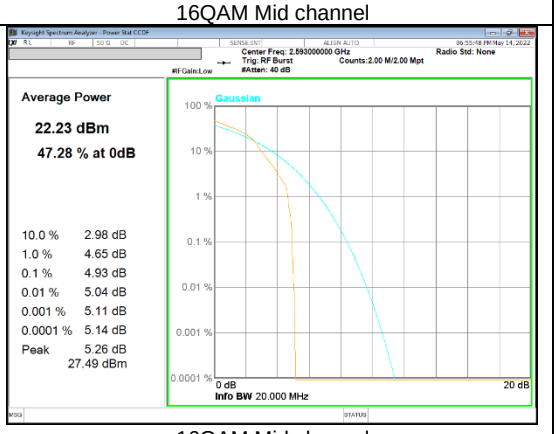
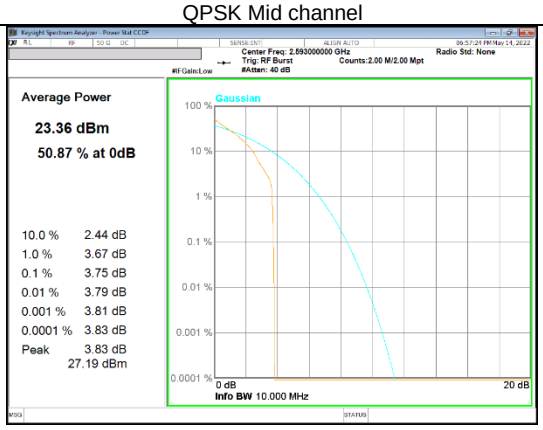
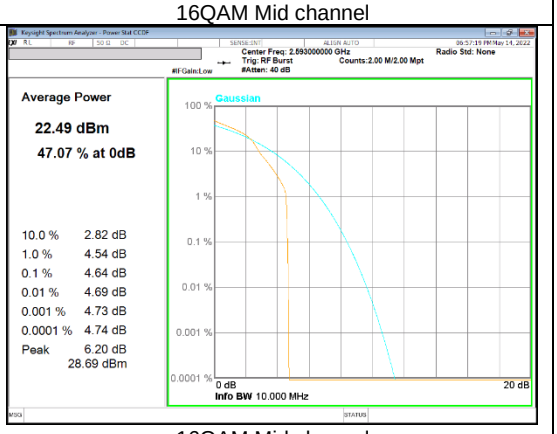
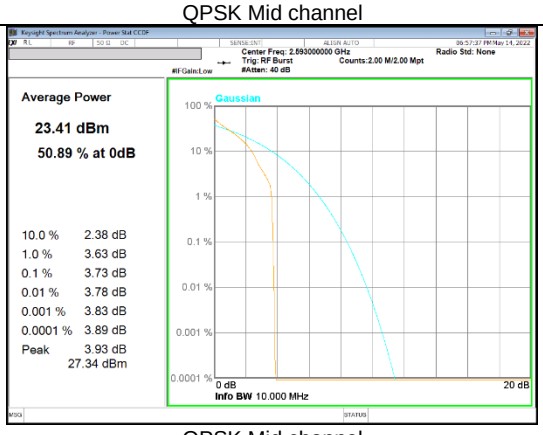
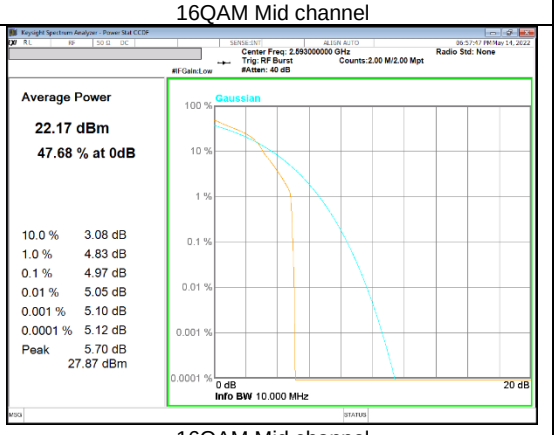
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

LTE Band 26 (Part 22)

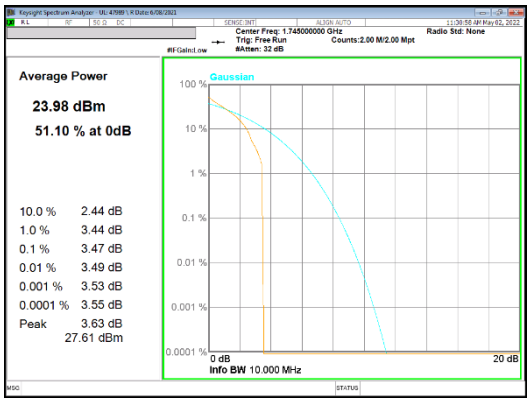
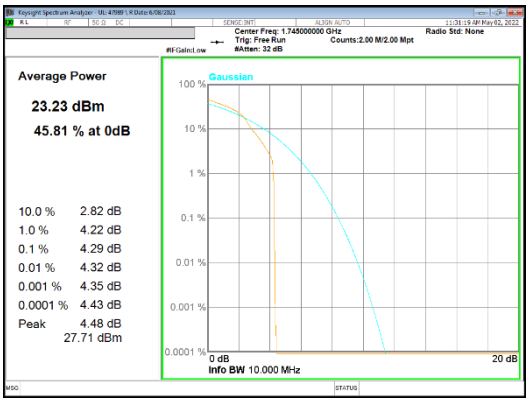
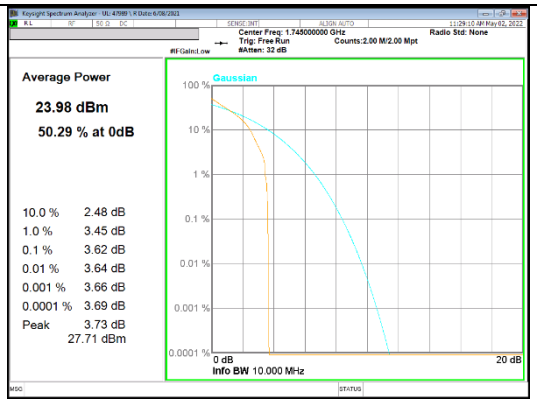
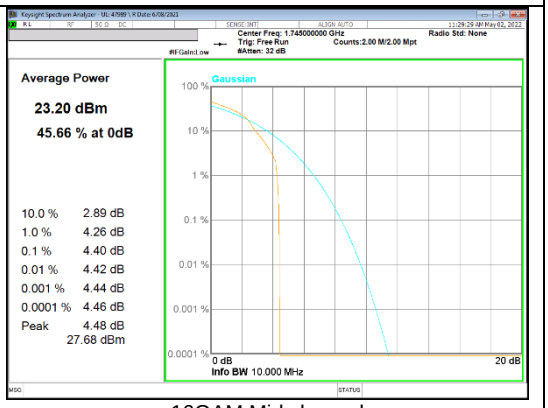
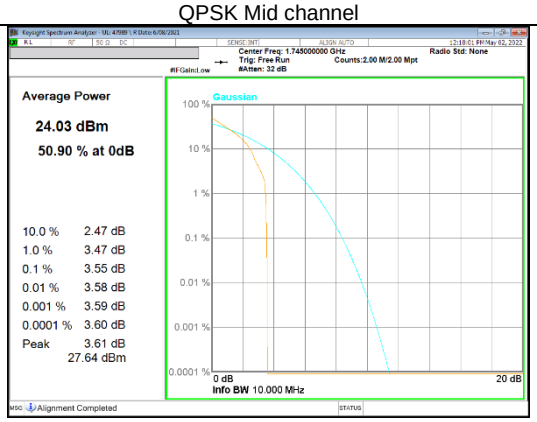
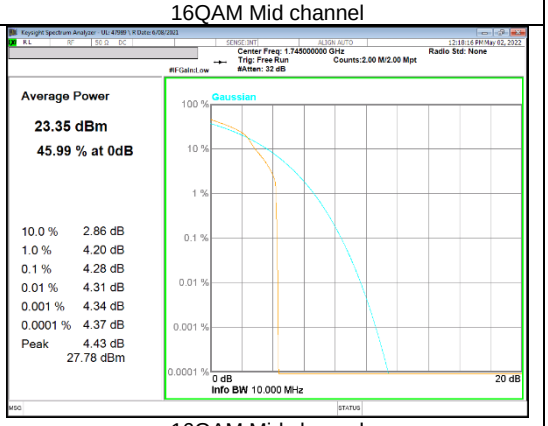
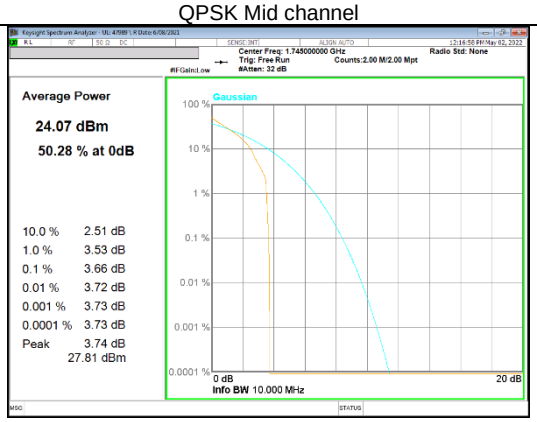
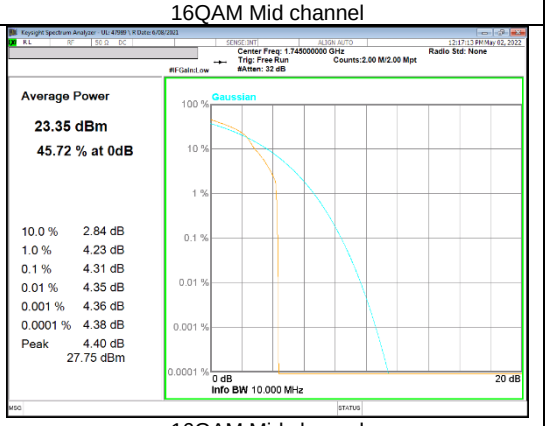
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel

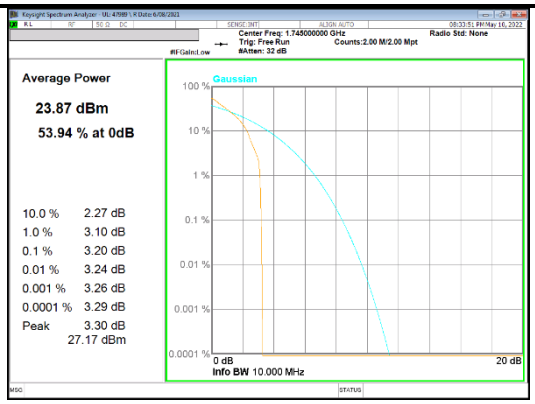
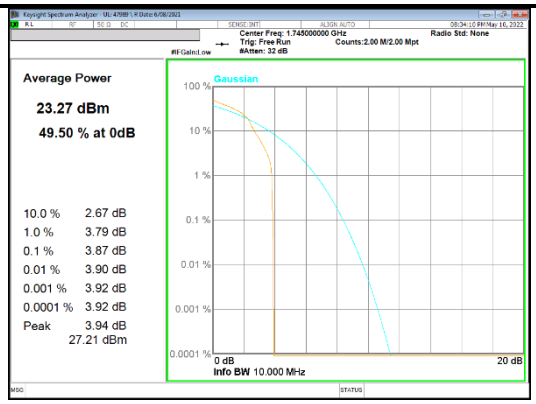
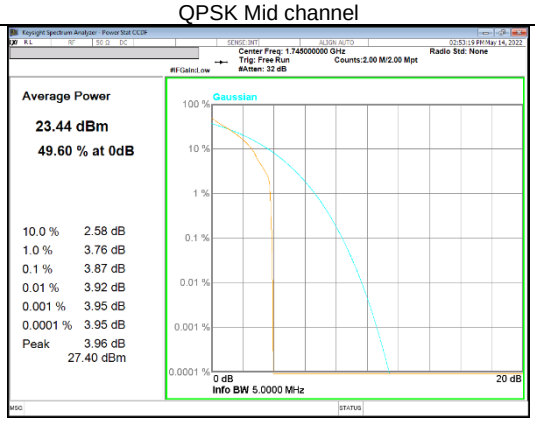
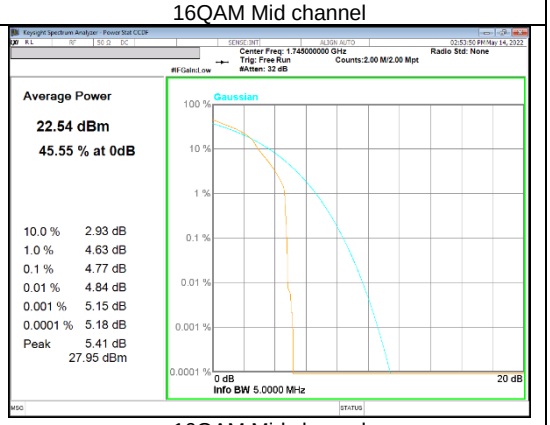
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

LTE Band 41(PC2)

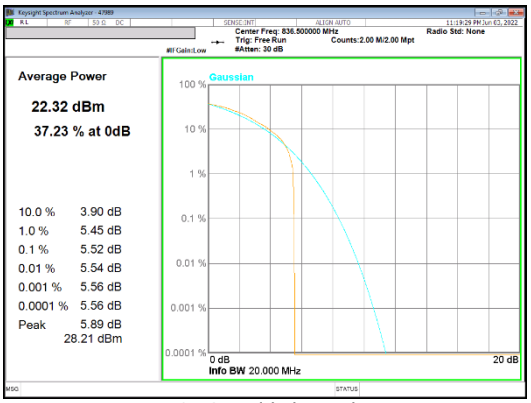
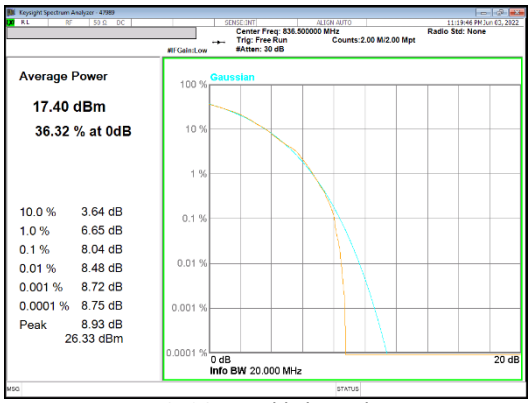
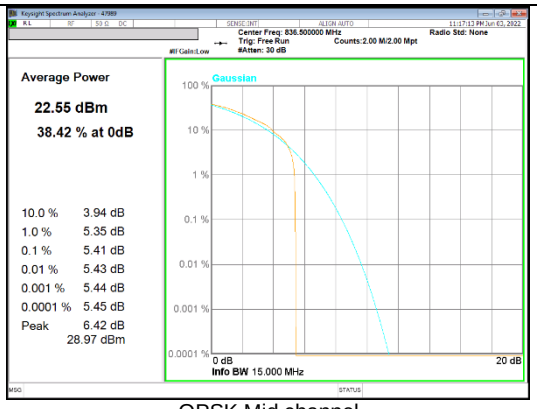
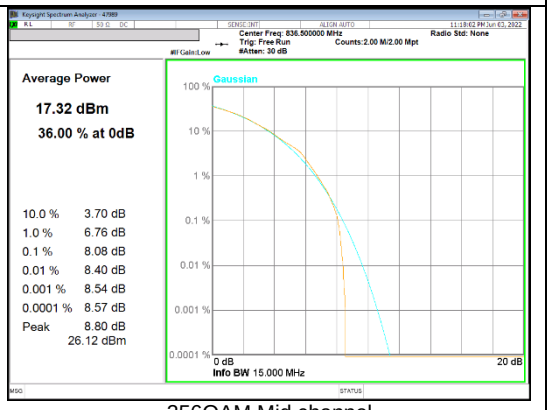
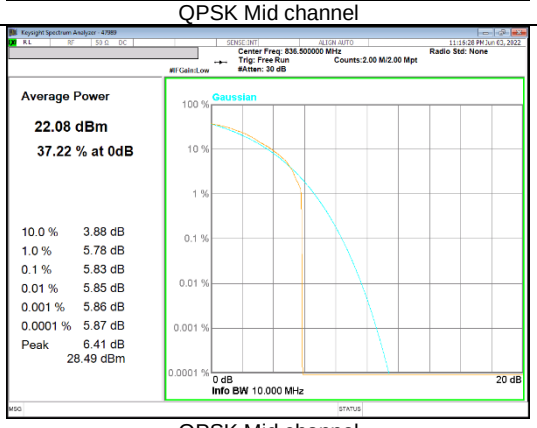
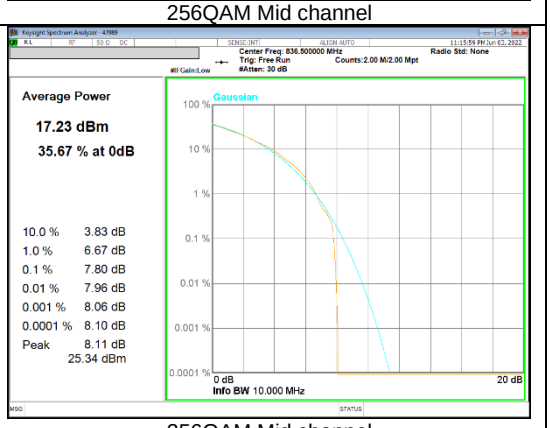
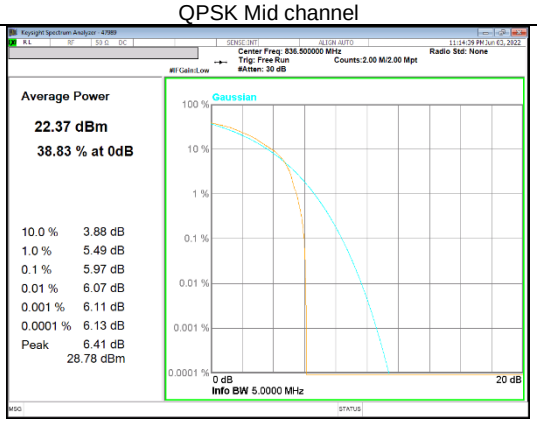
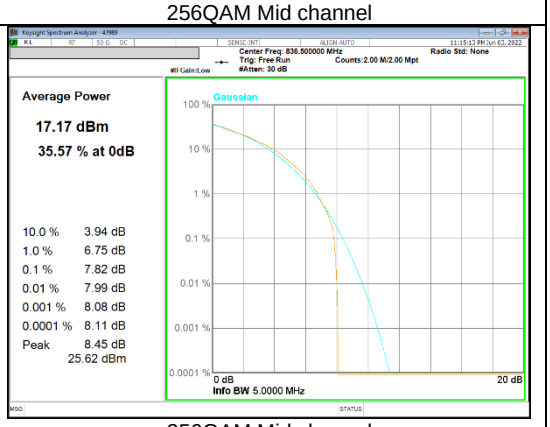
20 MHz	 QPSK Mid channel	 16QAM Mid channel
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel

LTE Band 66

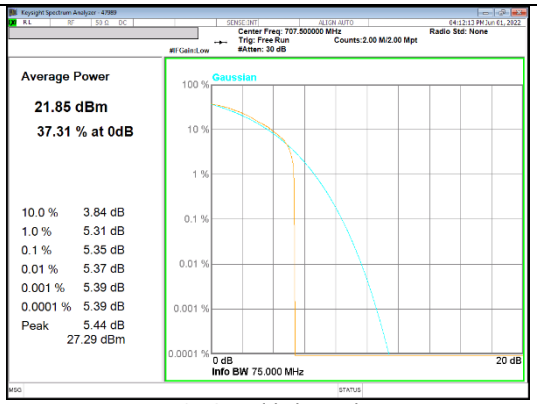
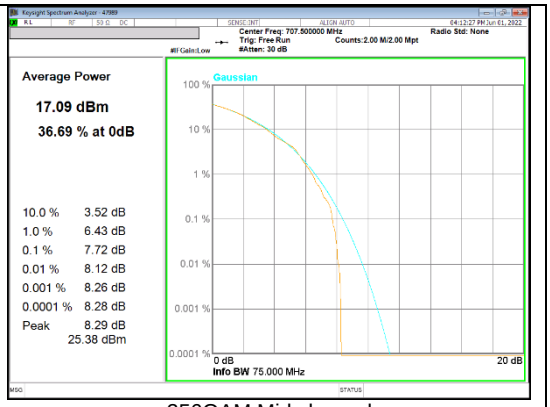
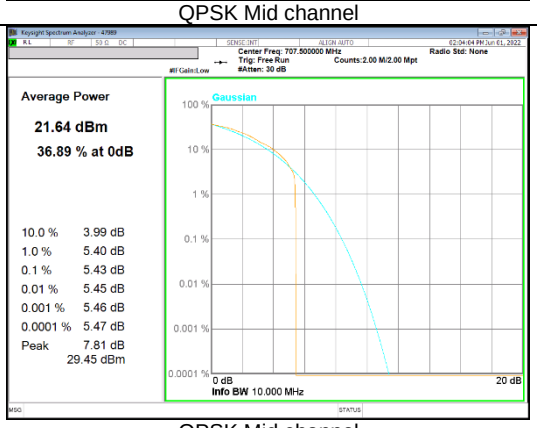
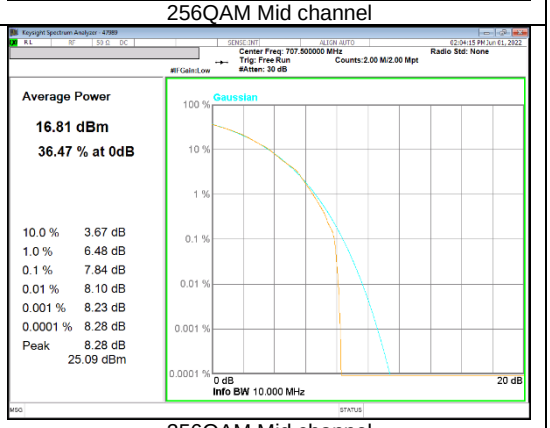
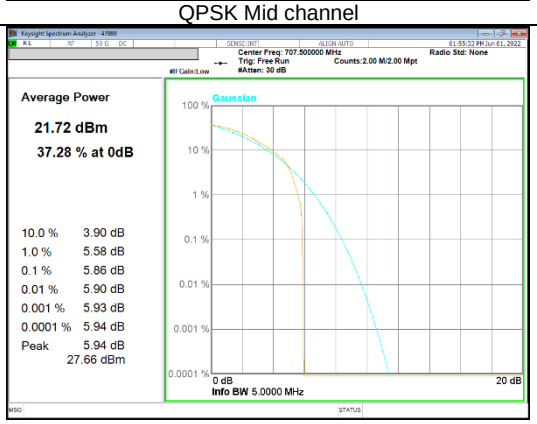
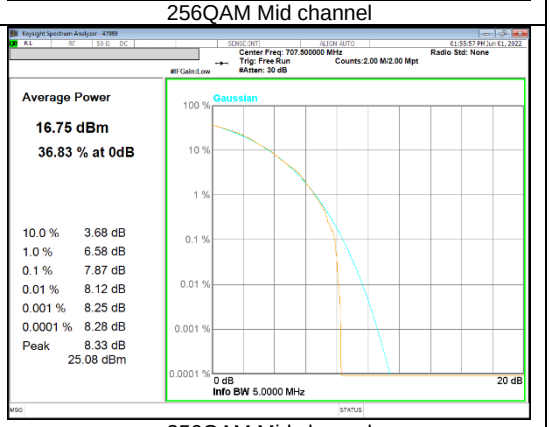
20 MHz	 QPSK Mid channel	 16QAM Mid channel
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel

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

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

NR Band n12 CP-OFDM

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