CERTIFICATION TEST REPORT

Report Number. : 4789424849-E2V2

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-A716V
FCC ID	:	A3LSMA716V
EUT Description	:	GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac, ANT+ and NFC
Test Standard(s)	:	FCC CFR47 PART 22 SUBPART H FCC CFR47 PART 24 SUBPART E FCC CFR47 PART 27 SUBPART H,L,M,F

Date Of Issue:
June 02, 2020

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IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	05/20/20	Initial issue	Sungeun Lee
V2	06/02/20	Updated to address TCB's question	Sungeun Lee

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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, ANT+ and NFC
MODEL NUMBER:	SM-A716V
SERIAL NUMBER:	R3CN20P1BVT (CONDUCTED); R3CN20P1GLN, R3CN20P1ELA, R3CN20P1HMY (RADIATED)
DATE TESTED:	MAR 26, 2020 – JUN 02, 2020;

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

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Sungeun Lee
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 22.
3. FCC CFR 47 Part 24.
4. FCC CFR 47 Part 27.
5. ANSI TIA-603-E, 2016
6. ANSI C63.26, 2015
7. KDB 971168 D01 Power Meas License Digital Systems v03r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro
☒ Chamber 1
☒ Chamber 2
☐ Chamber 3

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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	2.35 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.49 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.82 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.49 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 1, Clause 4.4.2 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, ANT+ and NFC. This test report addresses the WWAN operational mode.

5.2. MAXIMUM OUTPUT POWER

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

Note : Conducted output power results were excerpted from RF exposure test report (4789424849-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	**31.99**	**1580.12**	**28.95**	**785.24**
		EGPRS	26.89	489.04	23.74	236.59
GSM1900	1850~1910	GPRS	28.92	780.00	26.95	495.45
		EGPRS	25.49	353.93	24.20	263.03

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	22.96	197.82	20.11	102.57
		HSDPA	21.94	156.45	19.12	81.66
Band 2	1850~1910	Rel. 99	**22.96**	**197.89**	**20.49**	**111.94**
		HSDPA	22.00	158.40	19.61	91.41

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	1850 ~ 1910	20	QPSK	23.77	238.02	21.91	155.24
			16QAM	23.38	217.77	21.16	130.62
			64QAM	22.43	175.17		
		15	QPSK	23.83	241.32	**22.00**	**158.49**
			16QAM	23.22	209.98	20.87	122.18
			64QAM	21.92	155.51		
		10	QPSK	23.66	232.26	21.82	152.05
			16QAM	23.03	200.91	20.82	120.78
			64QAM	21.88	154.04		
		5	QPSK	23.82	240.81	**22.00**	**158.49**
			16QAM	23.08	203.27	21.42	138.68
			64QAM	22.01	158.79		
		3	QPSK	**23.86**	**243.06**	21.91	155.24
			16QAM	22.96	197.59	20.77	119.40
			64QAM	22.12	162.76		
		1.4	QPSK	23.67	233.03	21.49	140.93
			16QAM	22.91	195.62	20.50	112.20
			64QAM	22.16	164.31		

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	824 ~ 849	10	QPSK	**23.68**	**233.35**	**21.24**	**133.05**
			16QAM	22.75	188.45	20.39	109.40
			64QAM	21.95	156.59		
		5	QPSK	23.65	231.49	21.03	126.77
			16QAM	23.17	207.54	20.40	109.65
			64QAM	21.92	155.56		
		3	QPSK	23.57	227.74	21.07	127.94
			16QAM	22.92	195.87	19.80	95.50
			64QAM	21.72	148.62		
		1.4	QPSK	23.60	229.28	20.77	119.40
			16QAM	22.85	192.56	19.84	96.38
			64QAM	21.96	157.01		

LTE Band 7

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 7	2500 ~ 2570	20	QPSK	**22.47**	**176.51**	18.36	68.55
			16QAM	21.94	156.48	17.52	56.49
			64QAM	21.07	127.94		
		15	QPSK	22.44	175.27	20.66	116.41
			16QAM	21.86	153.57	19.56	90.36
			64QAM	21.05	127.31		
		10	QPSK	22.30	169.92	20.74	118.58
			16QAM	21.46	140.11	19.82	95.94
			64QAM	20.61	115.11		
		5	QPSK	22.39	173.25	**20.87**	**122.18**
			16QAM	21.93	155.99	19.77	94.84
			64QAM	20.71	117.76		

LTE Band 12

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 12	699 ~ 716	10	QPSK	23.91	246.14	17.93	62.09
			16QAM	23.21	209.51	16.73	47.10
			64QAM	22.21	166.32		
		5	QPSK	24.02	252.15	18.02	63.39
			16QAM	23.45	221.28	17.39	54.83
			64QAM	22.31	170.41		
		3	QPSK	**24.08**	**255.86**	**18.31**	**67.76**
			16QAM	23.42	219.88	17.12	51.52
			64QAM	22.29	169.30		
		1.4	QPSK	24.06	254.87	17.72	59.16
			16QAM	23.27	212.30	16.62	45.92
			64QAM	22.12	163.11		

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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	777 ~ 787	10	QPSK	23.62	229.94	21.46	139.96
			16QAM	22.72	187.20	20.84	121.34
			64QAM	22.09	161.94		
		5	QPSK	**23.95**	**248.44**	**21.65**	**146.22**
			16QAM	23.22	209.79	21.22	132.43
			64QAM	22.10	162.05		

LTE Band 66

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 66	1710 ~ 1780	20	QPSK	**23.76**	**237.91**	**24.39**	**274.79**
			16QAM	23.35	216.02	23.30	213.80
			64QAM	22.23	167.11		
		15	QPSK	23.76	237.87	24.04	253.51
			16QAM	23.19	208.55	23.23	210.38
			64QAM	22.10	162.36		
		10	QPSK	23.39	218.46	23.09	203.70
			16QAM	22.87	193.48	22.14	163.68
			64QAM	21.09	128.67		
		5	QPSK	23.64	230.98	23.01	199.99
			16QAM	22.94	196.63	22.50	177.83
			64QAM	21.81	151.85		
		3	QPSK	23.52	225.07	23.16	207.01
			16QAM	22.90	194.88	22.28	169.04
			64QAM	21.89	154.49		
		1.4	QPSK	23.66	232.04	22.77	189.23
			16QAM	23.00	199.60	21.82	152.05
			64QAM	21.78	150.70		

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.

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NR Band n2

FCC Part 24								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n2	1850 ~ 1910	20	DFT-s OFDM	QPSK	23.68	233.35	18.62	72.78
				16QAM	23.07	202.77	18.65	73.28
				64QAM	21.63	145.55		
				256QAM	19.52	89.54		
			CP-OFDM	QPSK	22.20	165.96		
				16QAM	21.55	142.89		
				64QAM	20.53	112.98		
				256QAM	17.75	59.57		
		15	DFT-s OFDM	QPSK	23.65	231.74	19.60	91.20
				16QAM	23.10	204.17	19.09	81.10
				64QAM	21.60	144.54		
				256QAM	19.43	87.70		
			CP-OFDM	QPSK	22.08	161.44		
				16QAM	21.60	144.54		
				64QAM	20.45	110.92		
				256QAM	17.74	59.43		
		10	DFT-s OFDM	QPSK	**23.71**	**234.96**	**22.05**	**160.32**
				16QAM	23.03	200.91	21.17	130.92
				64QAM	21.47	140.28		
				256QAM	19.43	87.70		
			CP-OFDM	QPSK	22.39	173.38		
				16QAM	21.87	153.82		
				64QAM	20.74	118.58		
				256QAM	17.68	58.61		
		5	DFT-s OFDM	QPSK	23.54	225.94	20.13	103.04
				16QAM	23.09	203.70	19.87	97.05
				64QAM	21.48	140.60		
				256QAM	19.36	86.30		
			CP-OFDM	QPSK	22.07	161.06		
				16QAM	21.83	152.41		
				64QAM	20.41	109.90		
				256QAM	17.84	60.81		

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	824-849	20	DFT-s OFDM	QPSK	23.27	212.32	18.77	75.34
				16QAM	22.53	179.06	18.25	66.83
				64QAM	21.07	127.94		
				256QAM	19.38	86.70		
			CP-OFDM	QPSK	21.83	152.41		
				16QAM	21.39	137.72		
				64QAM	20.14	103.28		
				256QAM	17.57	57.15		
		15	DFT-s OFDM	QPSK	23.35	216.27	**18.80**	**75.86**
				16QAM	22.61	182.39	17.93	62.09
				64QAM	21.17	130.92		
				256QAM	19.28	84.72		
			CP-OFDM	QPSK	21.90	154.88		
				16QAM	21.51	141.58		
				64QAM	20.18	104.23		
				256QAM	17.59	57.41		
		10	DFT-s OFDM	QPSK	**23.42**	**219.79**	18.06	63.97
				16QAM	22.51	178.24	18.46	70.15
				64QAM	21.06	127.64		
				256QAM	19.28	84.72		
			CP-OFDM	QPSK	21.91	155.24		
				16QAM	21.51	141.58		
				64QAM	20.19	104.47		
				256QAM	17.33	54.08		
		5	DFT-s OFDM	QPSK	23.25	211.35	17.63	57.94
				16QAM	22.54	179.47	17.29	53.58
				64QAM	21.03	126.77		
				256QAM	19.18	82.79		
			CP-OFDM	QPSK	21.95	156.68		
				16QAM	21.37	137.09		
				64QAM	20.16	103.75		
				256QAM	17.44	55.46		

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	1710 ~ 1780	20	DFT-s OFDM	QPSK	**23.78**	**238.78**	22.67	184.93
				16QAM	23.00	199.53	21.08	128.23
				64QAM	21.60	144.54		
				256QAM	19.40	87.10		
			CP-OFDM	QPSK	22.42	174.58		
				16QAM	21.88	154.17		
				64QAM	20.57	114.02		
				256QAM	17.88	61.38		
		15	DFT-s OFDM	QPSK	23.76	237.68	**23.73**	**236.05**
				16QAM	22.95	197.24	21.57	143.55
				64QAM	21.52	141.91		
				256QAM	19.68	92.90		
			CP-OFDM	QPSK	22.37	172.58		
				16QAM	21.90	154.88		
				64QAM	20.83	121.06		
				256QAM	17.83	60.67		
		10	DFT-s OFDM	QPSK	23.74	236.59	20.17	103.99
				16QAM	23.28	212.81	19.32	85.51
				64QAM	21.69	147.57		
				256QAM	19.68	92.90		
			CP-OFDM	QPSK	22.30	169.82		
				16QAM	21.78	150.66		
				64QAM	20.49	111.94		
				256QAM	17.74	59.43		
		5	DFT-s OFDM	QPSK	23.74	236.59	21.51	141.58
				16QAM	23.19	208.45	21.44	139.32
				64QAM	21.43	139.00		
				256QAM	19.55	90.16		
			CP-OFDM	QPSK	22.42	174.58		
				16QAM	21.88	154.17		
				64QAM	20.50	112.20		
				256QAM	17.78	59.98		

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

Frequency (MHz)	Peak Gain (dBi)
GSM 850 824 ~ 849 MHz	-4.46
GSM 1900 1850 ~ 1910 MHz	-1.46
LTE Band 4 / LTE Band 66 / NR Band n66 1710 ~ 1780 MHz	-0.03
WCDMA Band 5 / LTE Band 5 / NR Band n5 814 ~ 849 MHz	-4.46
WCDMA Band 2/ LTE Band 2 / NR Band n2 1850 ~ 1910 MHz	-1.46
LTE Band 12 699 ~ 716 MHz	-4.61
LTE Band 7 2500 ~ 2570 MHz	-1.42
LTE Band 13 777 ~ 787 MHz	-3.56

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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/5G NR Bands, the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM and 64QAM modulations. It was found that QPSK and 16QAM results were worst case. All testing was performed using QPSK and 16QAM modulations to represent the worst case. However, the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest conducted power in QPSK.

Highest power setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
2	1851.5	3	1	0
	1880		1	0
	1908.5		1	8
5	829	10	1	25
	836.5		1	25
	844		1	25
7	2510	20	1	49
	2535		1	49
	2560		1	49
12	700.5	3	1	0
	707.5		1	0
	714.5		1	0
13	779.5	5	1	24
	782		1	24
	784.5		1	24
66	1720	20	1	49
	1745		1	0
	1770		1	49
NR Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
2	1855	10	1	26
	1880		1	26
	1905		1	1
5	834	20	1	1
	836.5		1	1
	839		1	1
66	1720	20	1	1
	1745		1	53
	1770		1	53

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 B2	O	-	-	O	-	-
LTE B2	O	-	-	O	-	-
LTE B5	-	-	O	-	-	O
LTE B7	O	-	-	-	O	-
LTE B12	-	-	O	-	O	-
LTE B13	-	-	O	-	-	O
LTE B66	-	-	O	-	-	O
NR Band n2	-	O	-	-	-	O
NR Band n5	-	-	O	O	-	-
NR Band 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.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37KAT21494SE3	N/A
Data Cable	SAMSUNG	EP-DA705BBE	N/A	N/A

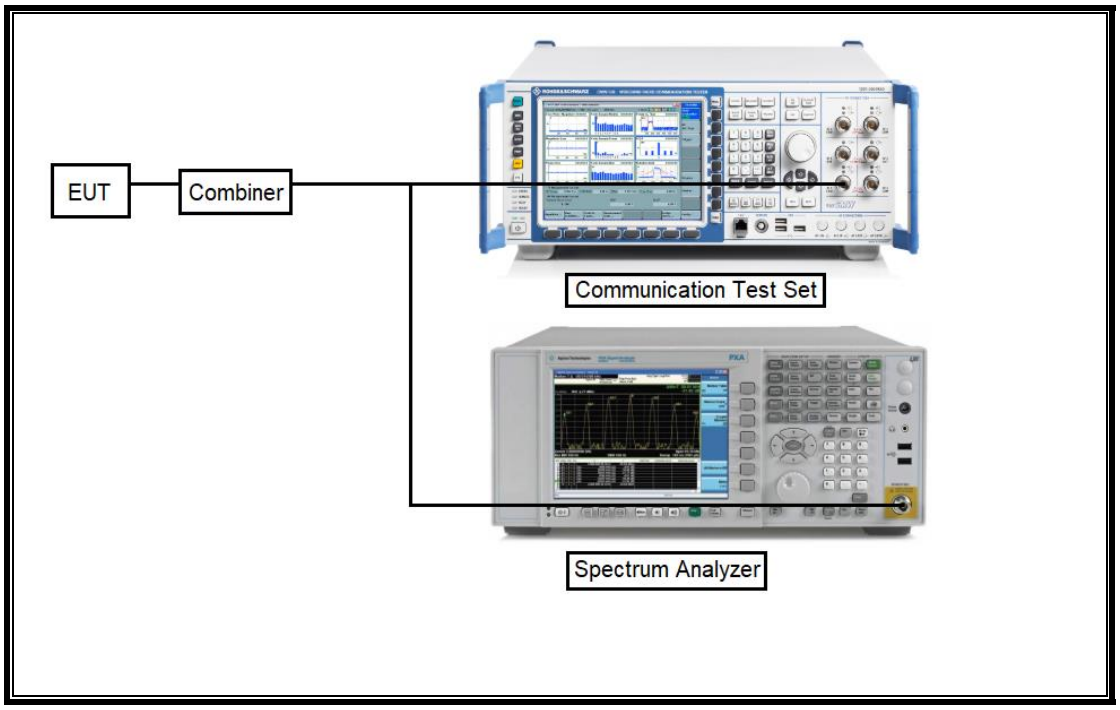
I/O CABLE

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

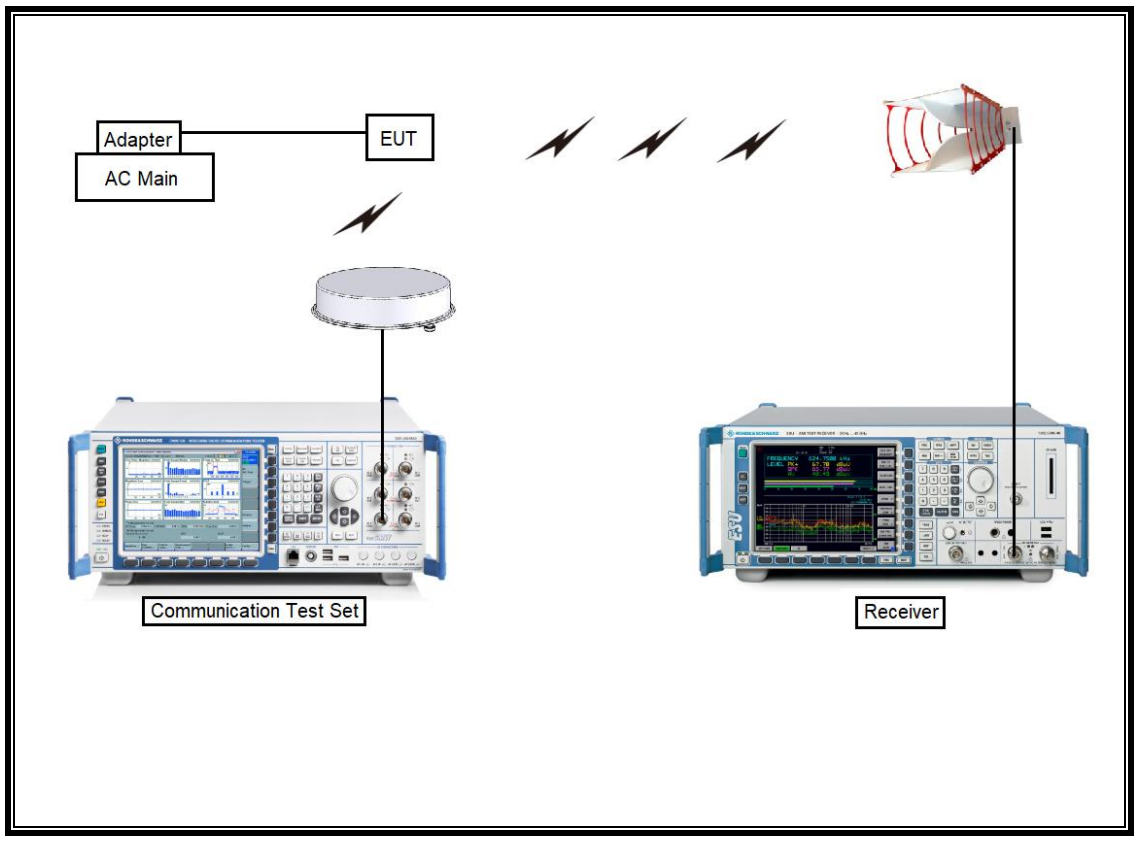
TEST SETUP

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

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121D DB4	00164753	01-31-21
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-13-20
Preamplifier	ETS	3116C-PA	00168841	08-08-20
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Power Splitter	WEINSCHEL	WA1534	UL001	02-05-21
Power Splitter	WEINSCHEL	WA1535	UL002	02-05-21
Combiner	WEINSCHEL	1575	2150	08-08-20
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	MY57510655	02-06-21
Communications Test Set	R&S	CMW500	115331	08-05-20
DC Power Supply	Agilent / HP	E3640A	MY54226395	08-06-20
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-20
Spectrum Analyzer	KEYSIGHT	N9030B	MY57143717	01-20-21
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-20
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-20
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	08-05-20
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	08-05-20
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	08-05-20
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	08-05-20
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	08-05-20
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	08-05-20
Attenuator	PASTERNACK	PE7087-10	A009	08-08-20
Attenuator	PASTERNACK	PE7087-10	A001	08-08-20
Attenuator	PASTERNACK	PE7087-10	A008	08-08-20
Attenuator	PASTERNACK	PE7087-10	2	08-08-20
Attenuator	PASTERNACK	PE7395-10	A011	08-08-20
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-02-21
Temperature Chamber	ESPEC	SH-642	93001109	08-05-20
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Antenna port test software	UL	CLT	Ver 2.5	

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass
22.917(a) 24.238(a) 27.53(g),(h)	Band Edge / Conducted Spurious Emission	-13dBm		Pass
27.53(m)	Conducted Spurious Emission	-25 dBm		Pass
27.53(m)	Emission mask	Section 9.2.2		Pass
2.1046	Conducted output power	N/A		Pass
22.355 24.235 27.54	Frequency Stability	2.5PPM		Pass
22.913(a)(5)	Effective Radiated Power	38.5 dBm	Radiated	Pass
27.50(b)(10) 27.50(c)(10)		34.77 dBm		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)	Radiated Spurious Emission	-13dBm		Pass
27.53 (m)		-25dBm		Pass

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_22/24/27(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

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

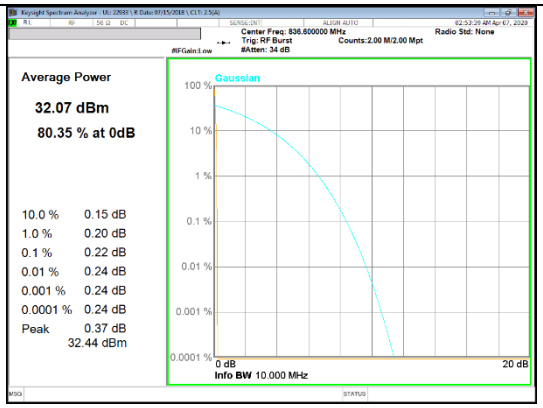
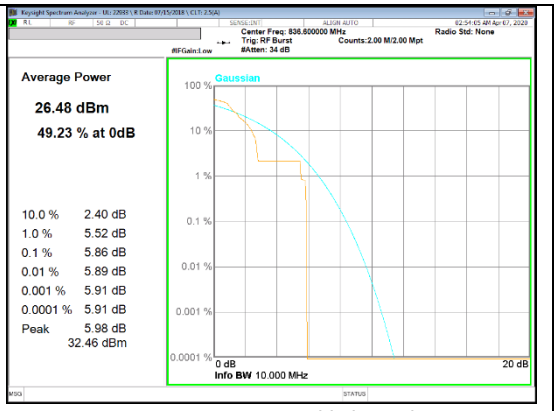
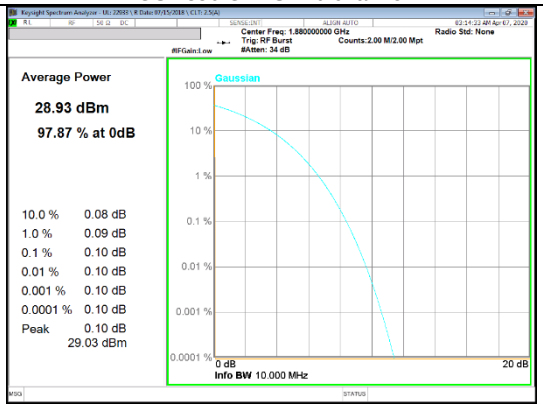
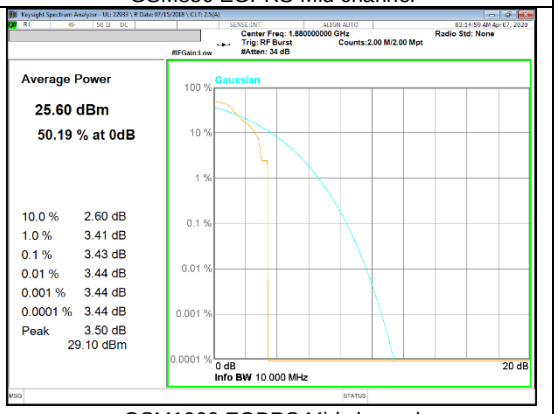
5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

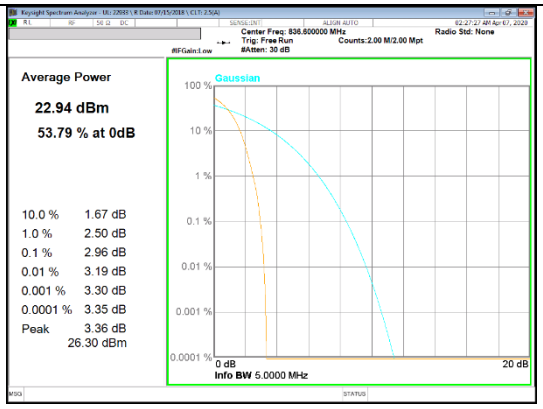
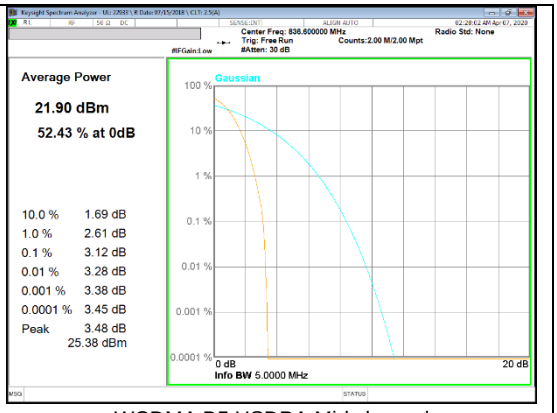
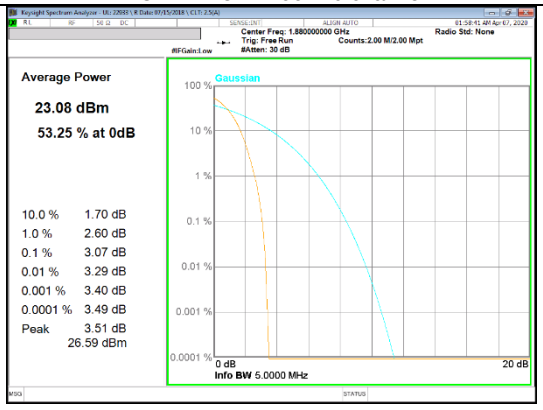
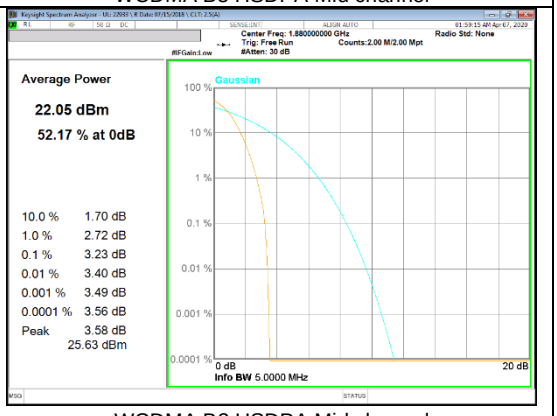
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_22/24/27(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

8.1. CONDUCTED PEAK TO AVERAGE RESULT

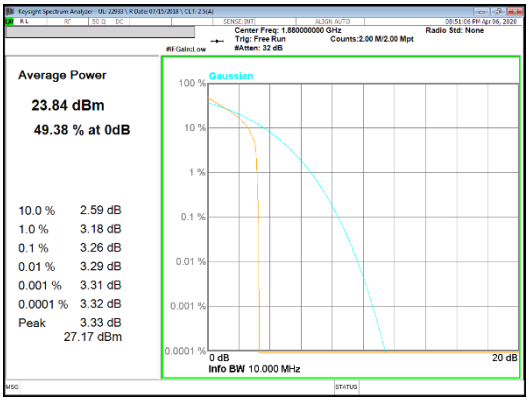
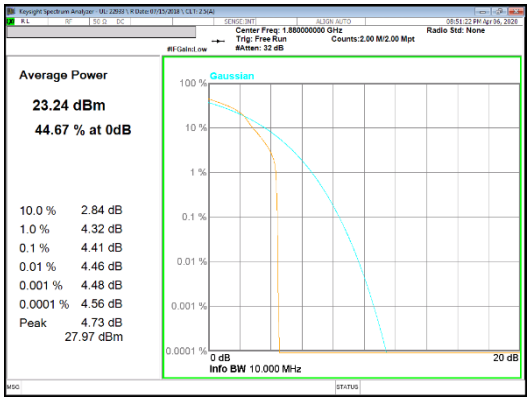
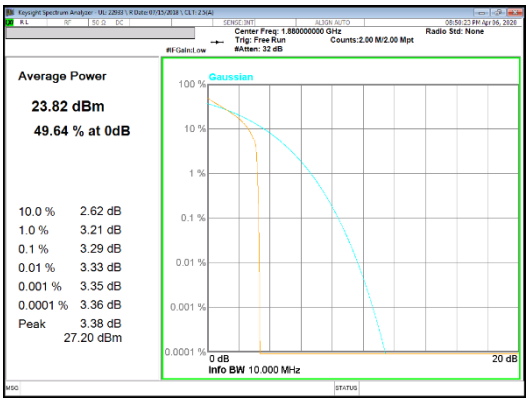
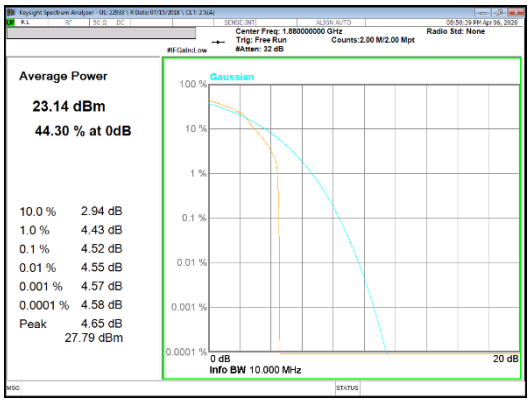
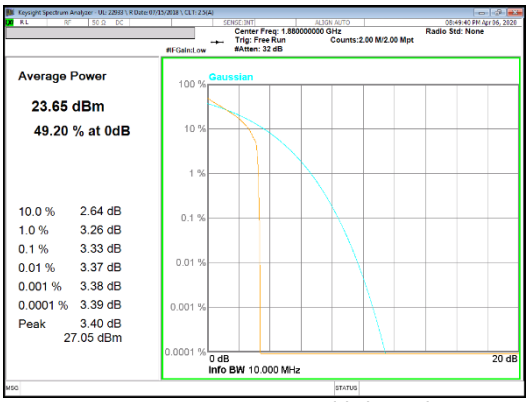
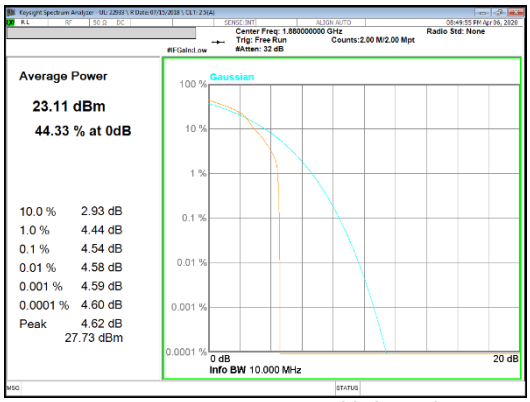
GSM

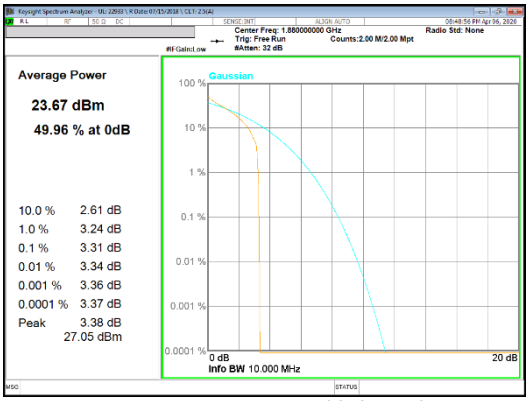
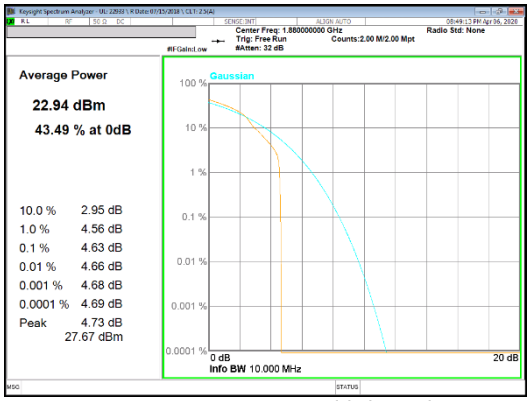
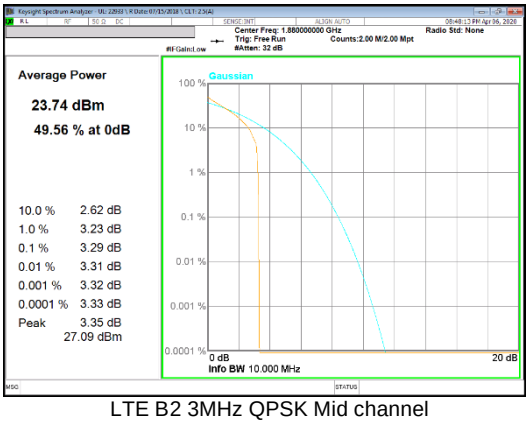
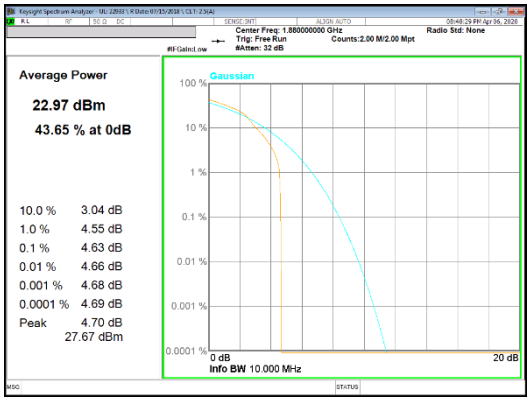
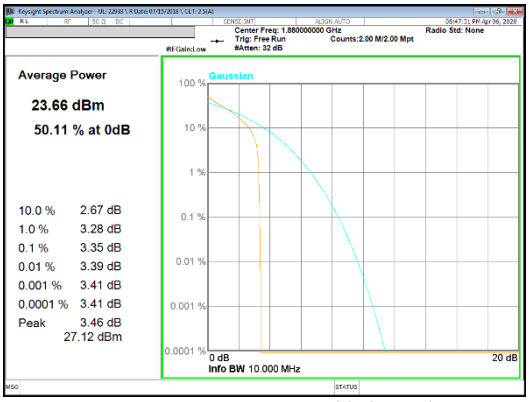
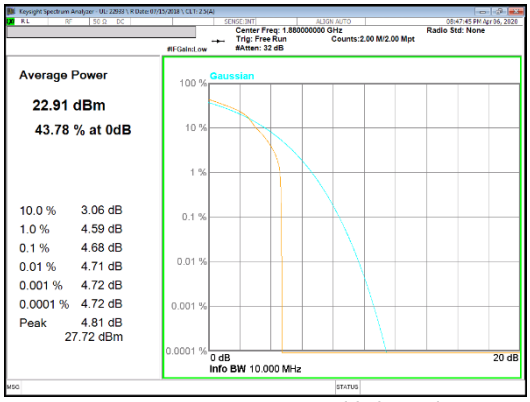
GSM 850	 GSM850 GPRS Mid channel	 GSM850 EGPRS Mid channel
GSM 1900	 GSM1900 GPRS Mid channel	 GSM1900 EGPRS Mid channel

WCDMA

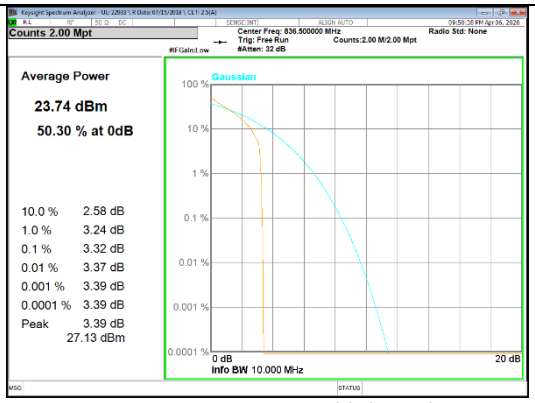
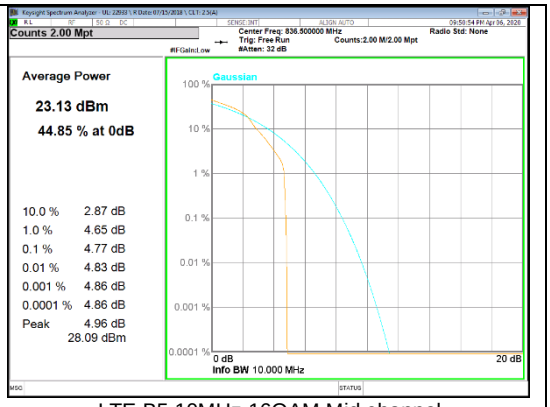
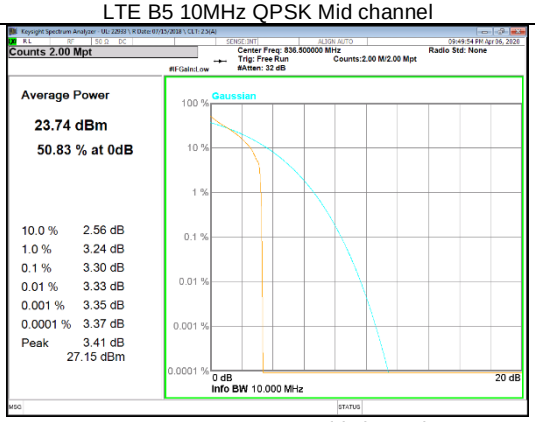
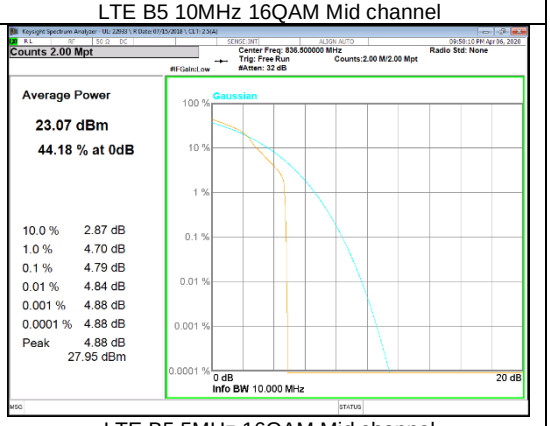
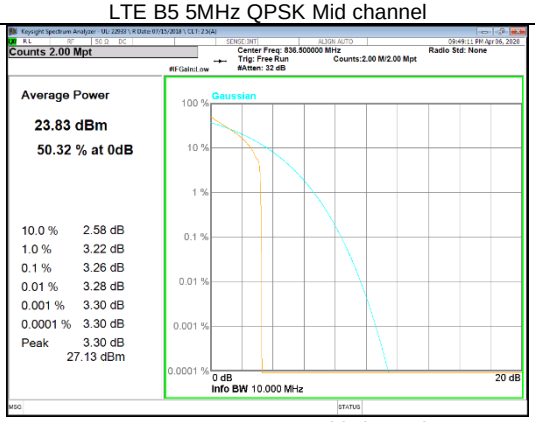
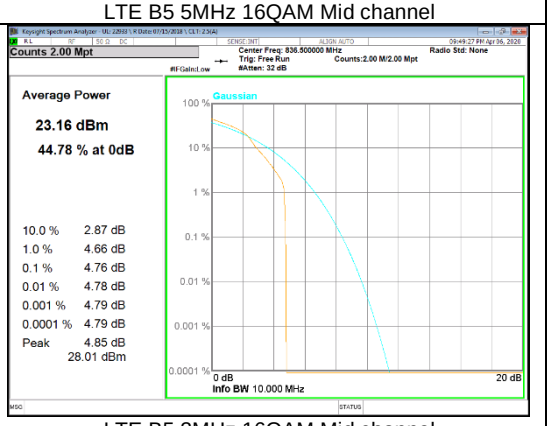
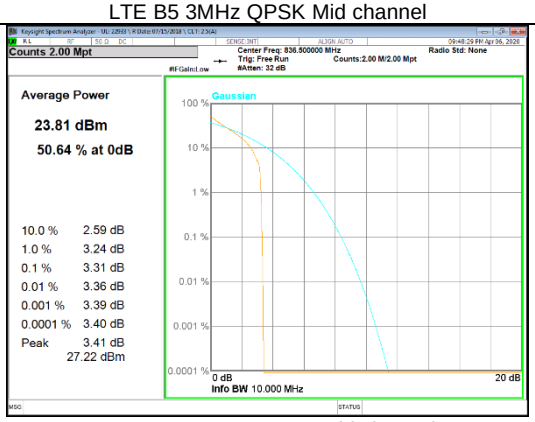
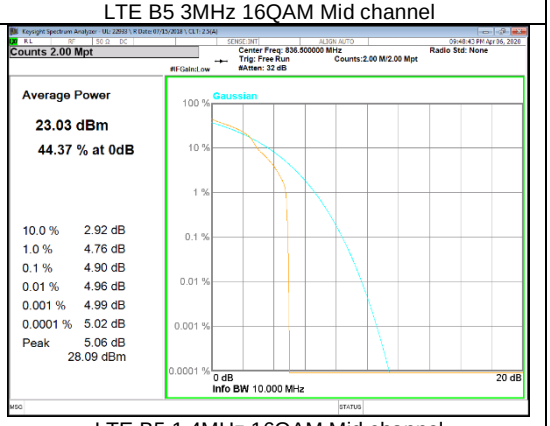
WCDMA Band 5	 WCDMA B5 REL99 Mid channel	 WCDMA B5 HSDPA Mid channel
WCDMA Band 2	 WCDMA B2 REL99 Mid channel	 WCDMA B2 HSDPA Mid channel

LTE Band 2

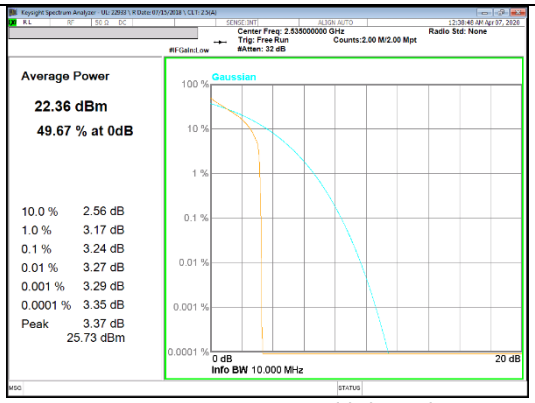
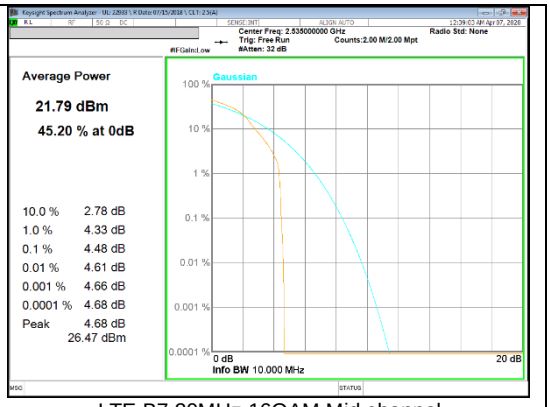
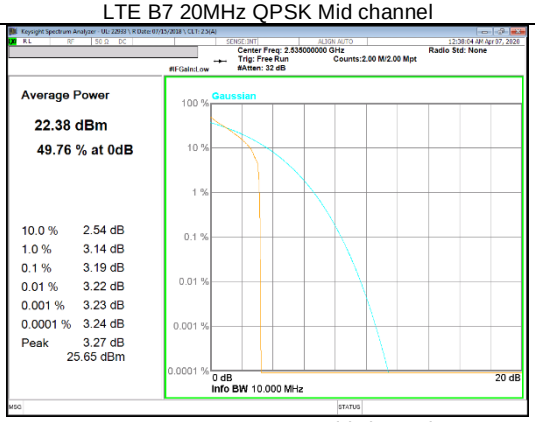
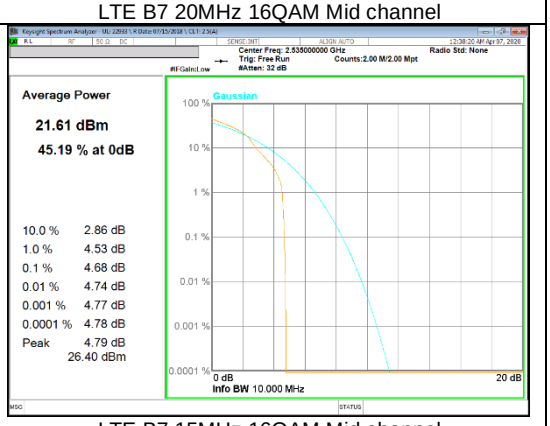
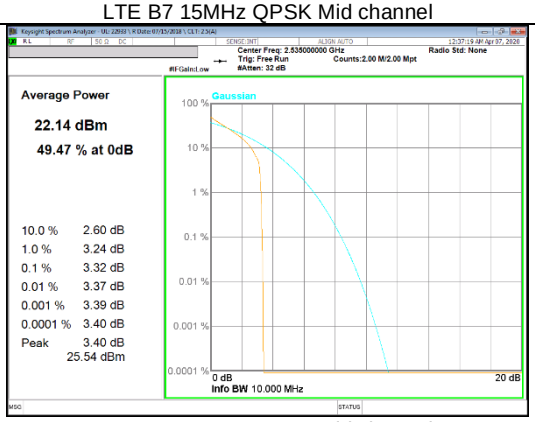
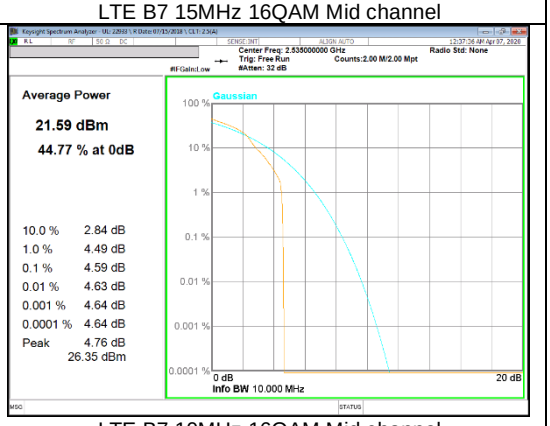
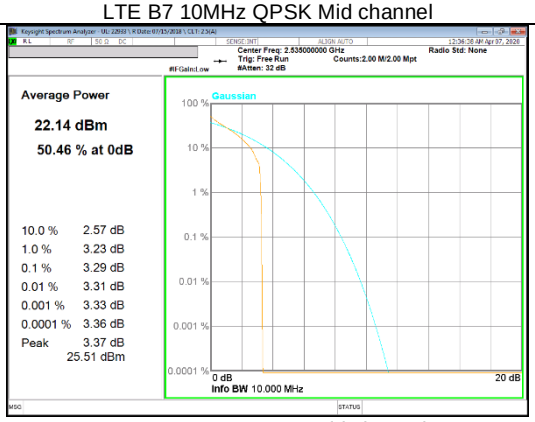
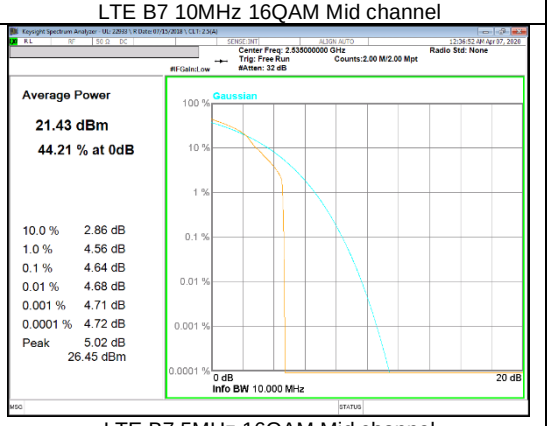
LTE Band 2 20 MHz	 LTE B2 20MHz QPSK Mid channel	 LTE B2 20MHz 16QAM Mid channel
LTE Band 2 15 MHz	 LTE B2 15MHz QPSK Mid channel	 LTE B2 15MHz 16QAM Mid channel
LTE Band 2 10 MHz	 LTE B2 10MHz QPSK Mid channel	 LTE B2 10MHz 16QAM Mid channel

LTE Band 2 5 MHz	 LTE B2 5MHz QPSK Mid channel	 LTE B2 5MHz 16QAM Mid channel
LTE Band 2 3 MHz	 LTE B2 3MHz QPSK Mid channel	 LTE B2 3MHz 16QAM Mid channel
LTE Band 2 1.4 MHz	 LTE B2 1.4MHz QPSK Mid channel	 LTE B2 1.4MHz 16QAM Mid channel

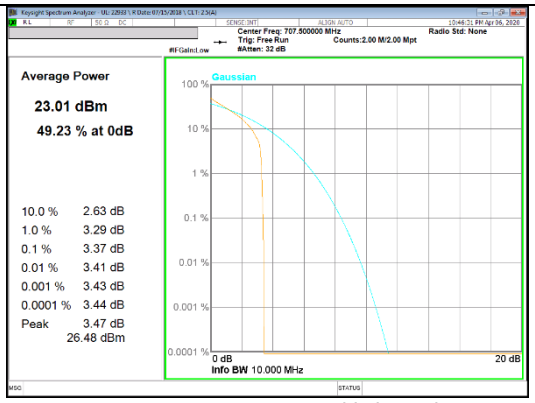
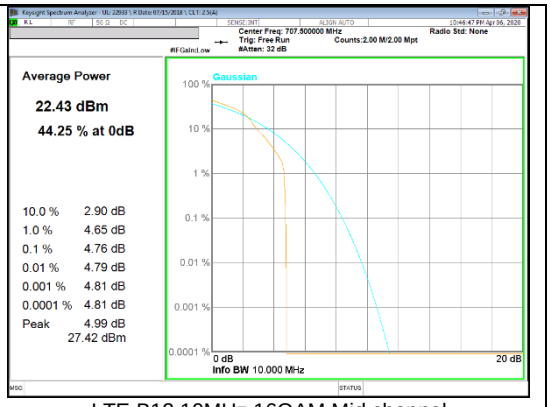
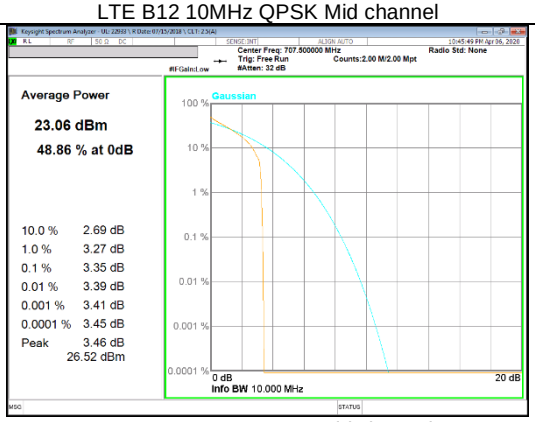
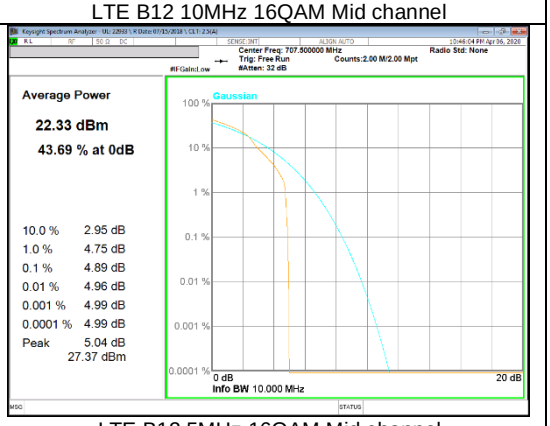
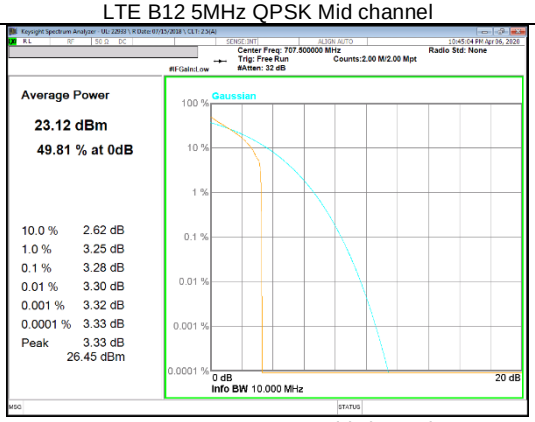
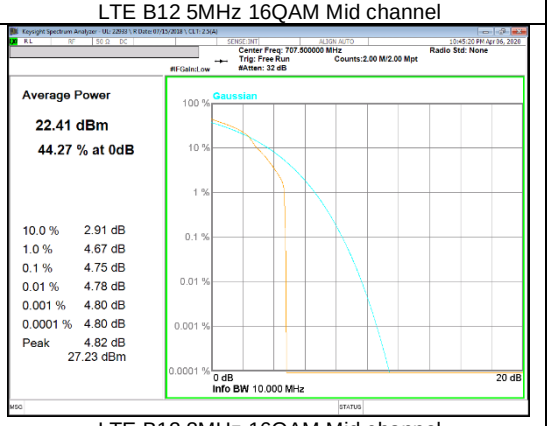
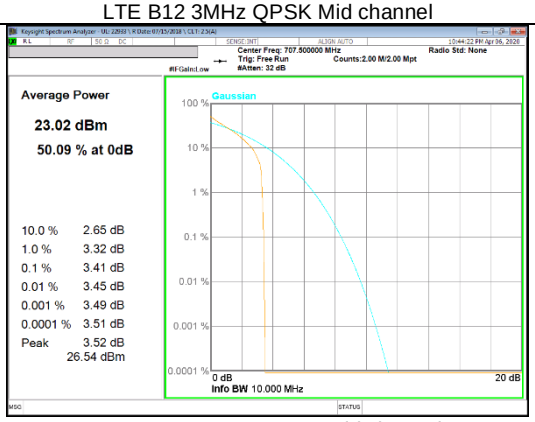
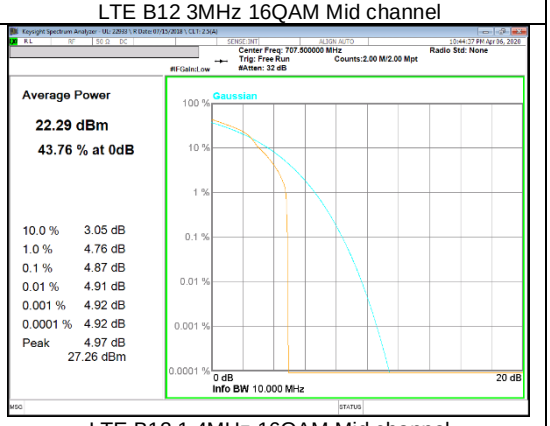
LTE Band 5

LTE Band 5 10 MHz	 LTE B5 10MHz QPSK Mid channel	 LTE B5 10MHz 16QAM Mid channel
LTE Band 5 5 MHz	 LTE B5 5MHz QPSK Mid channel	 LTE B5 5MHz 16QAM Mid channel
LTE Band 5 3 MHz	 LTE B5 3MHz QPSK Mid channel	 LTE B5 3MHz 16QAM Mid channel
LTE Band 5 1.4 MHz	 LTE B5 1.4MHz QPSK Mid channel	 LTE B5 1.4MHz 16QAM Mid channel

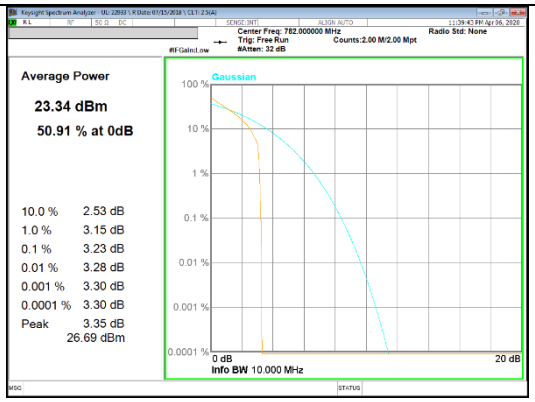
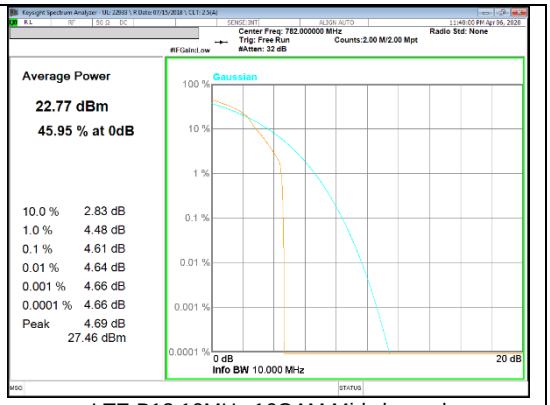
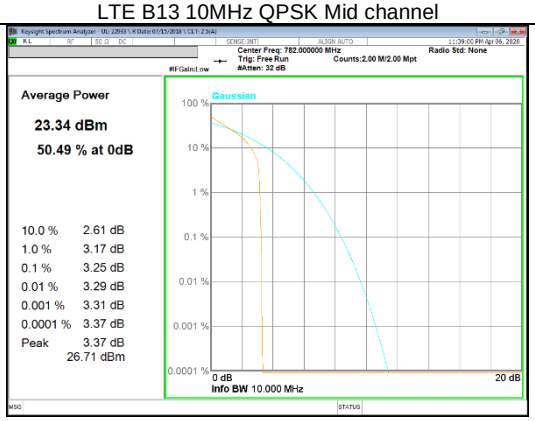
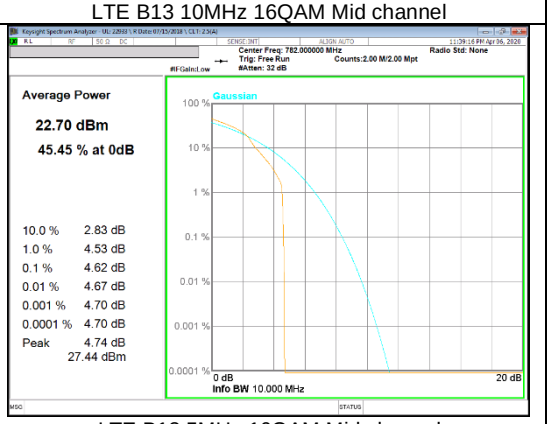
LTE Band 7

LTE Band 7 20 MHz	 LTE B7 20MHz QPSK Mid channel	 LTE B7 20MHz 16QAM Mid channel
LTE Band 7 15 MHz	 LTE B7 15MHz QPSK Mid channel	 LTE B7 15MHz 16QAM Mid channel
LTE Band 7 10 MHz	 LTE B7 10MHz QPSK Mid channel	 LTE B7 10MHz 16QAM Mid channel
LTE Band 7 5 MHz	 LTE B7 5MHz QPSK Mid channel	 LTE B7 5MHz 16QAM Mid channel

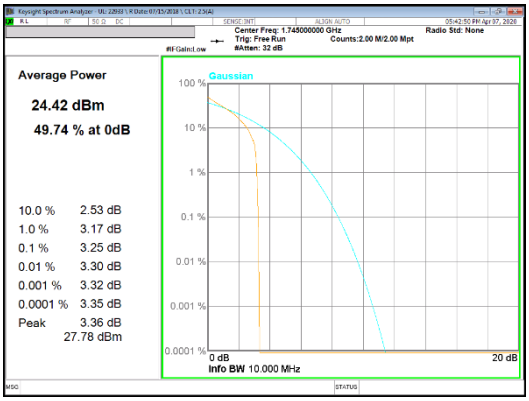
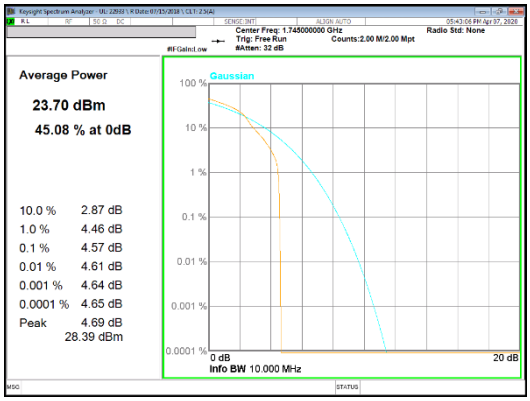
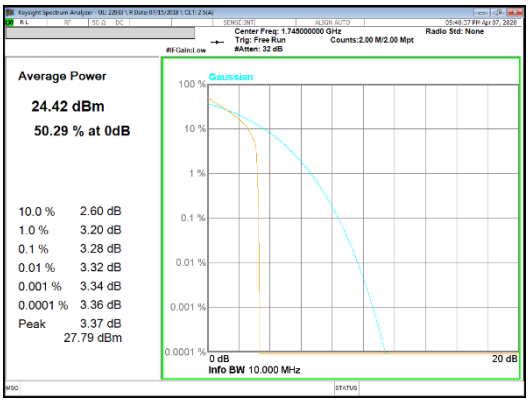
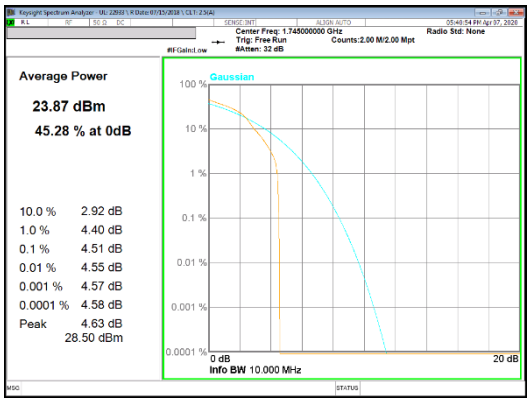
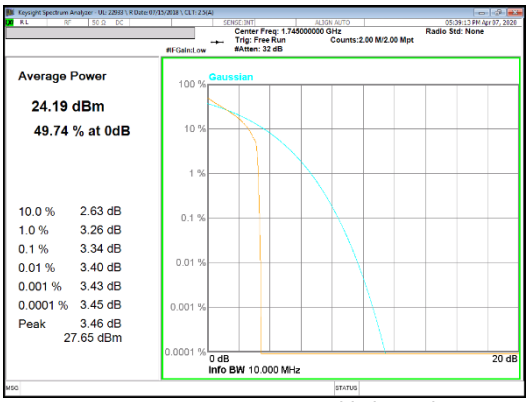
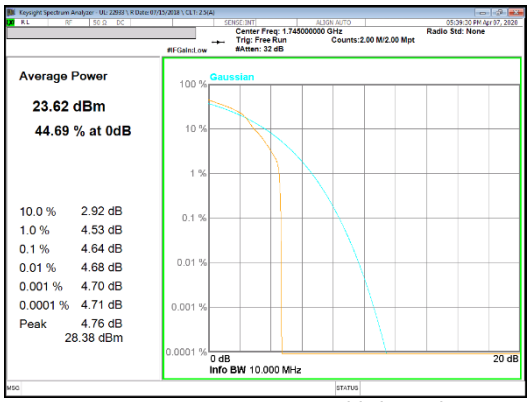
LTE Band 12

LTE Band 12 10 MHz	 LTE B12 10MHz QPSK Mid channel	 LTE B12 10MHz 16QAM Mid channel
LTE Band 12 5 MHz	 LTE B12 5MHz QPSK Mid channel	 LTE B12 5MHz 16QAM Mid channel
LTE Band 12 3 MHz	 LTE B12 3MHz QPSK Mid channel	 LTE B12 3MHz 16QAM Mid channel
LTE Band 12 1.4 MHz	 LTE B12 1.4MHz QPSK Mid channel	 LTE B12 1.4MHz 16QAM Mid channel

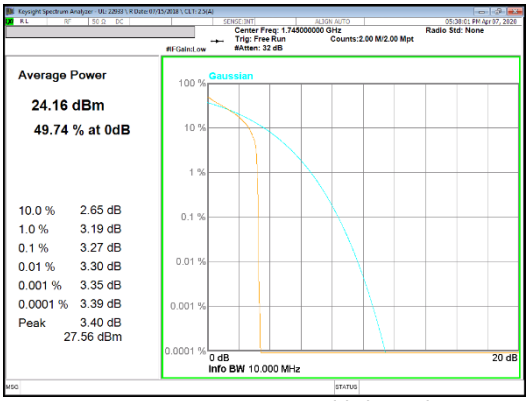
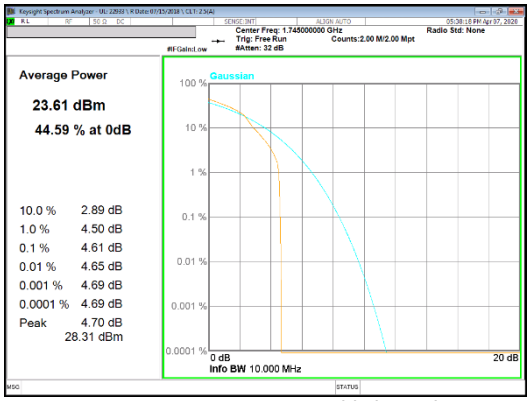
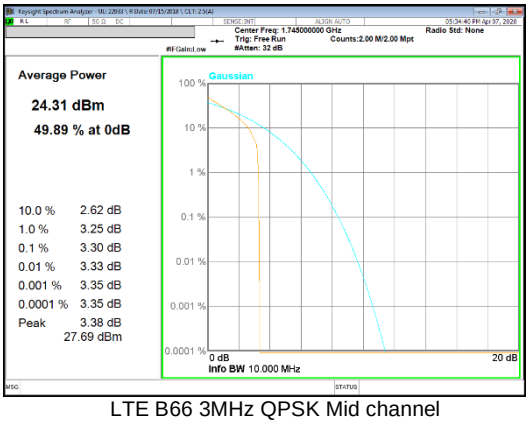
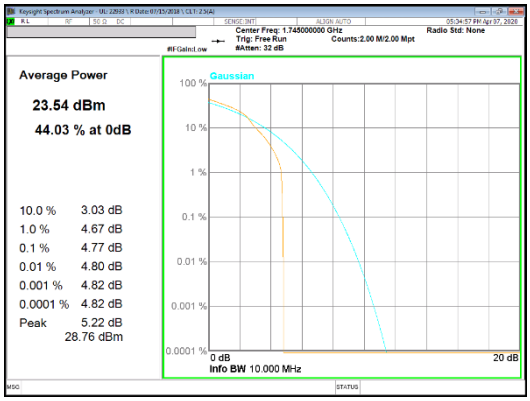
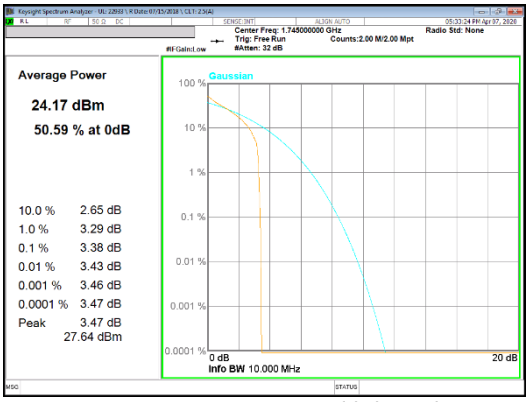
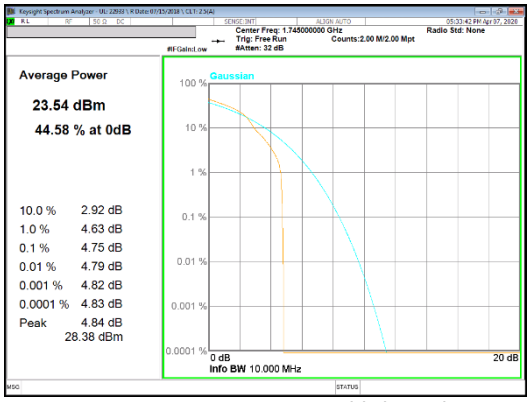
LTE Band 13

LTE Band 13 10 MHz	 LTE B13 10MHz QPSK Mid channel	 LTE B13 10MHz 16QAM Mid channel
LTE Band 13 5 MHz	 LTE B13 5MHz QPSK Mid channel	 LTE B13 5MHz 16QAM Mid channel

LTE Band 66

LTE Band 66 20 MHz	 LTE B66 20MHz QPSK Mid channel	 LTE B66 20MHz 16QAM Mid channel
LTE Band 66 15 MHz	 LTE B66 15MHz QPSK Mid channel	 LTE B66 15MHz 16QAM Mid channel
LTE Band 66 10 MHz	 LTE B66 10MHz QPSK Mid channel	 LTE B66 10MHz 16QAM Mid channel

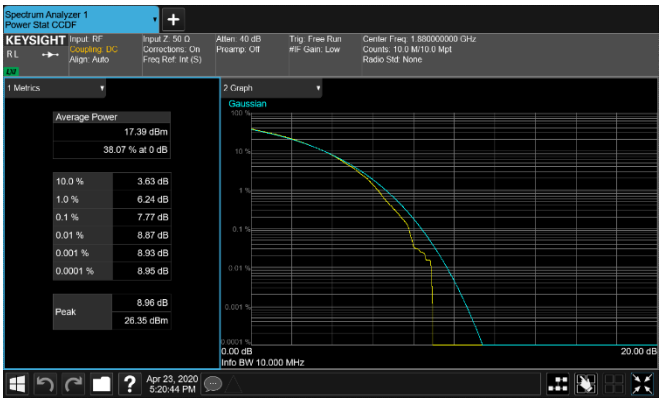
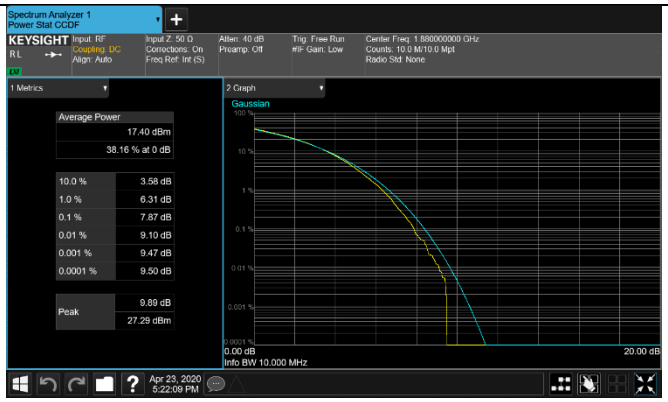
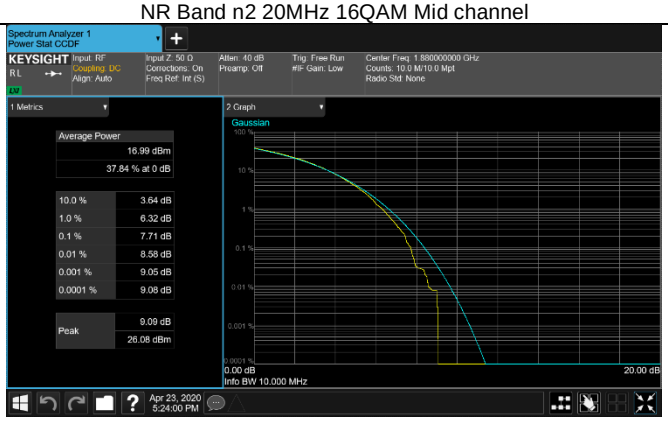
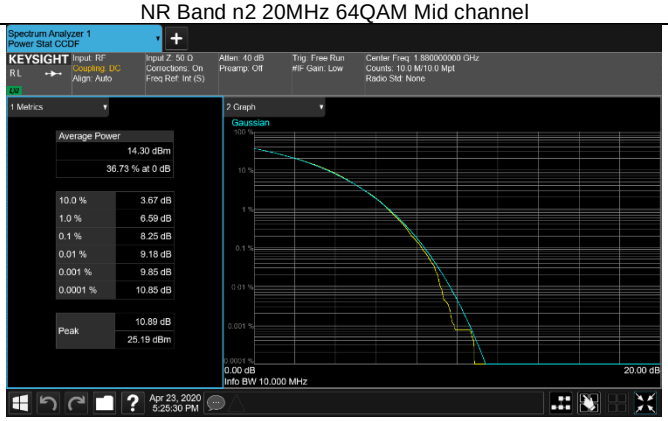
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_22/24/27(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

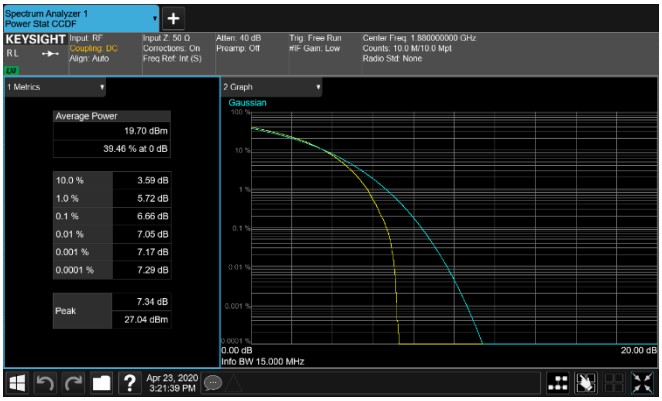
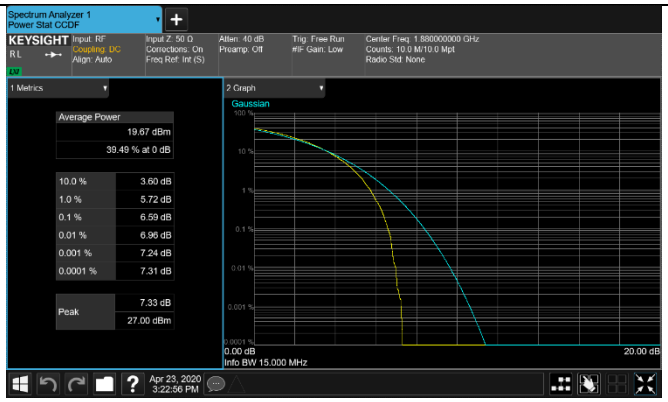
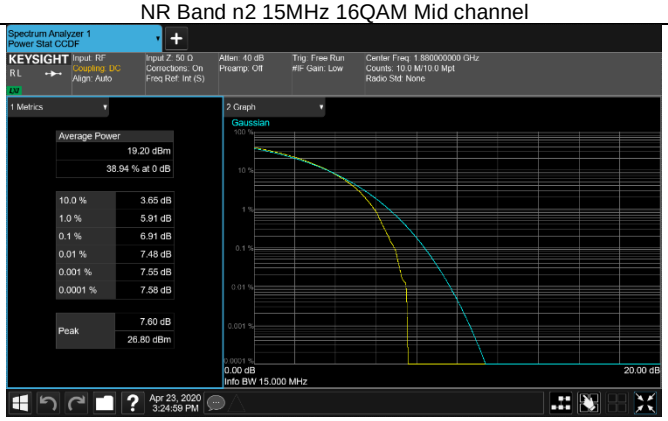
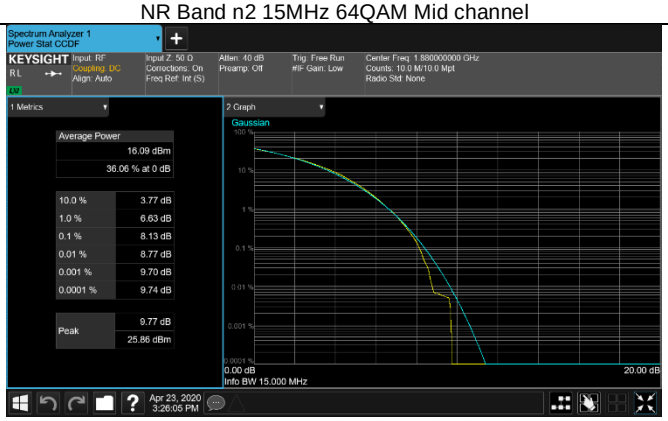
LTE Band 66 5 MHz	 LTE B66 5MHz QPSK Mid channel	 LTE B66 5MHz 16QAM Mid channel
LTE Band 66 3 MHz	 LTE B66 3MHz QPSK Mid channel	 LTE B66 3MHz 16QAM Mid channel
LTE Band 66 1.4 MHz	 LTE B66 1.4MHz QPSK Mid channel	 LTE B66 1.4MHz 16QAM Mid channel

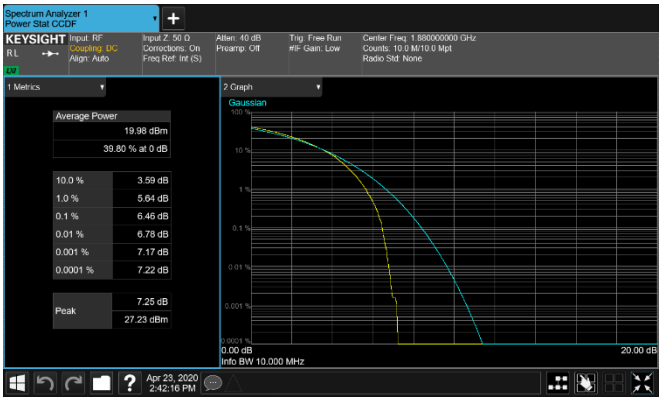
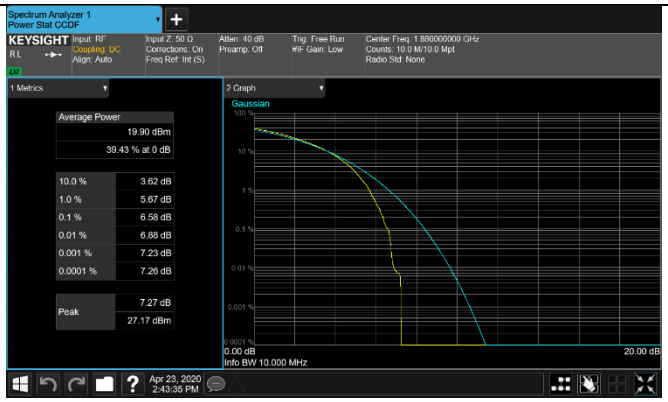
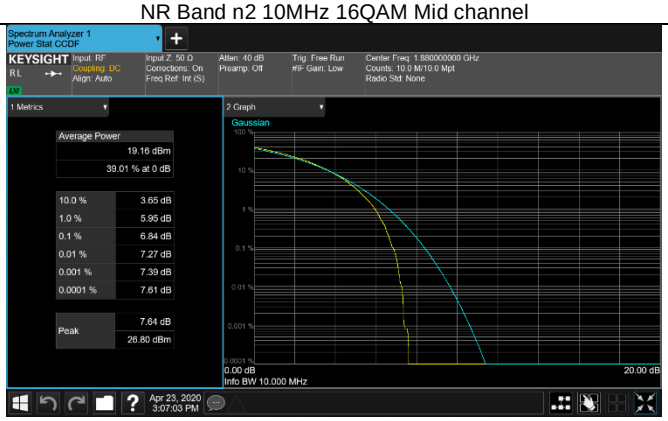
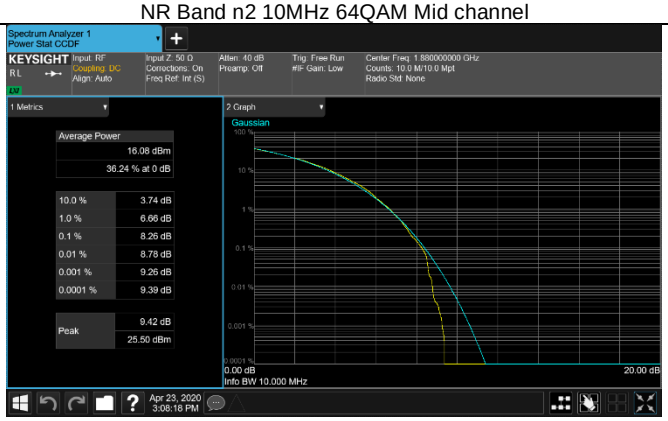
LTE Band 4

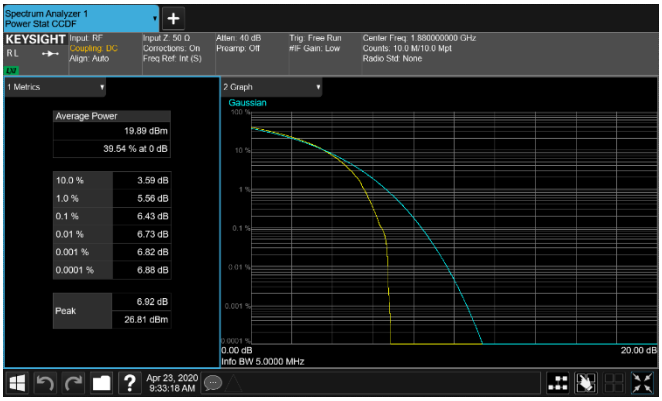
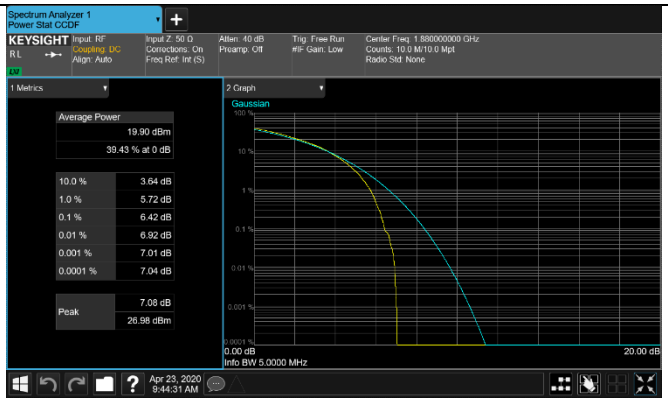
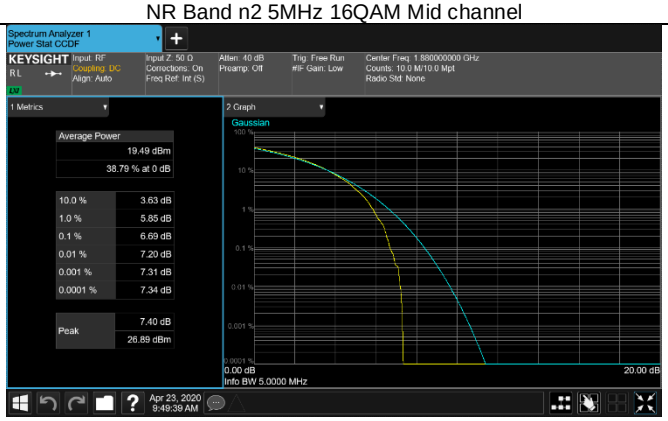
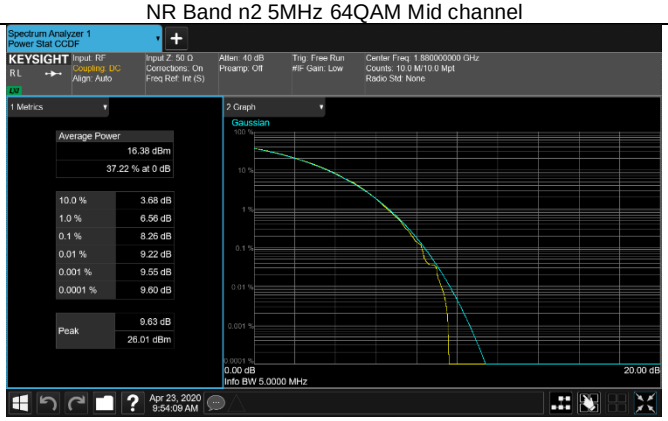
LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

NR Band n2

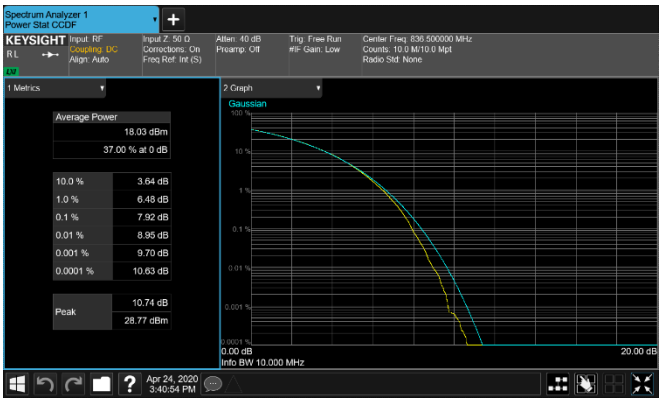
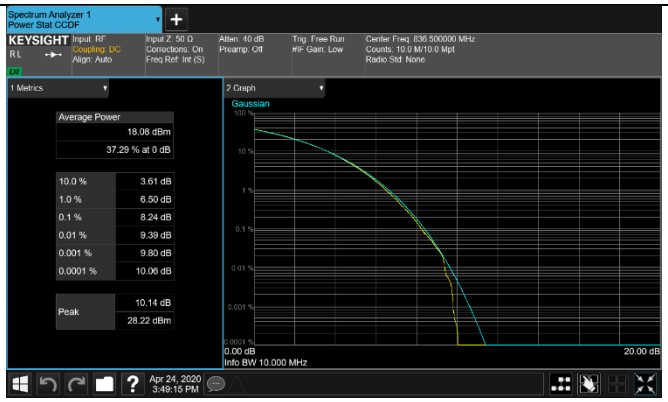
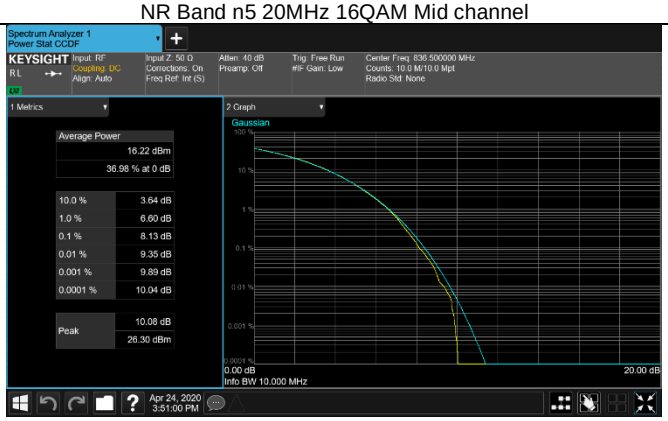
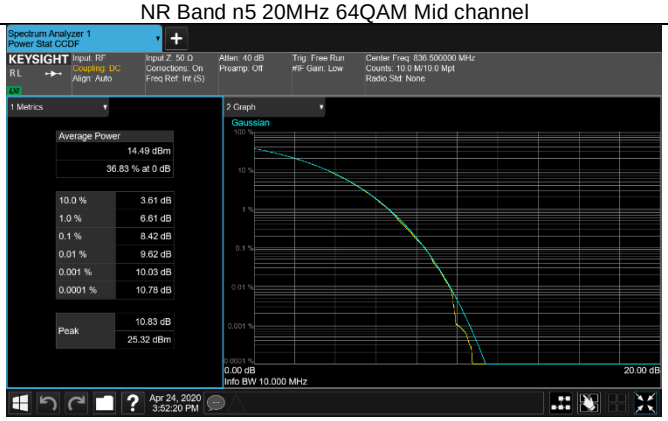
NR Band n2 20 MHz CP-OFDM	 NR Band n2 20MHz QPSK Mid channel
	 NR Band n2 20MHz 16QAM Mid channel
	 NR Band n2 20MHz 64QAM Mid channel
	 NR Band n2 20MHz 256QAM Mid channel

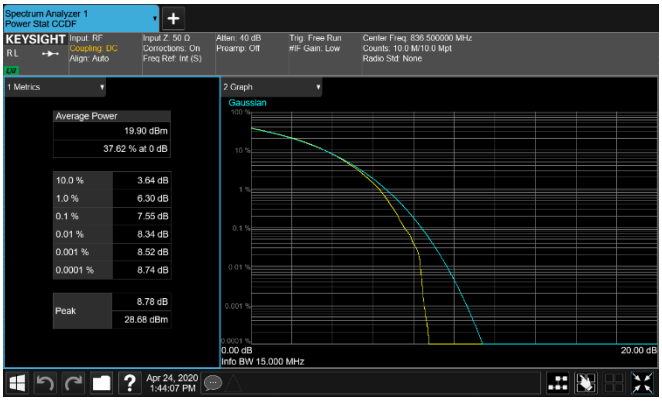
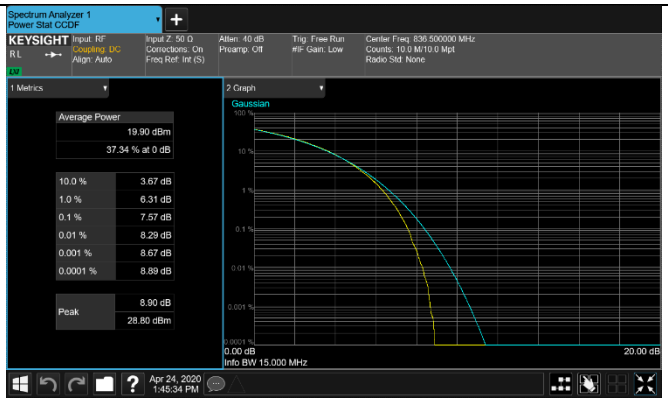
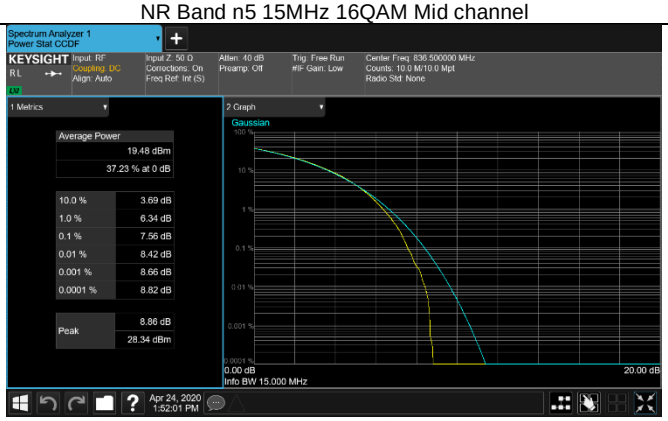
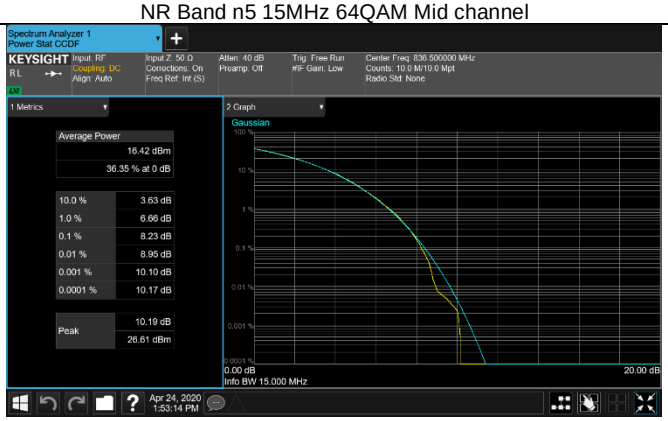
NR Band n2 15 MHz CP-OFDM	 NR Band n2 15MHz QPSK Mid channel
	 NR Band n2 15MHz 16QAM Mid channel
	 NR Band n2 15MHz 64QAM Mid channel
	 NR Band n2 15MHz 256QAM Mid channel

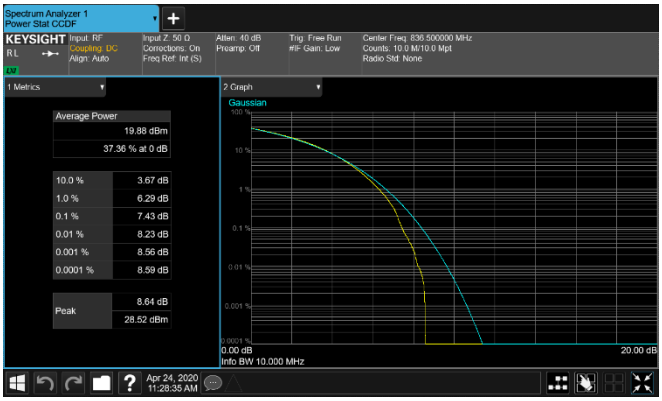
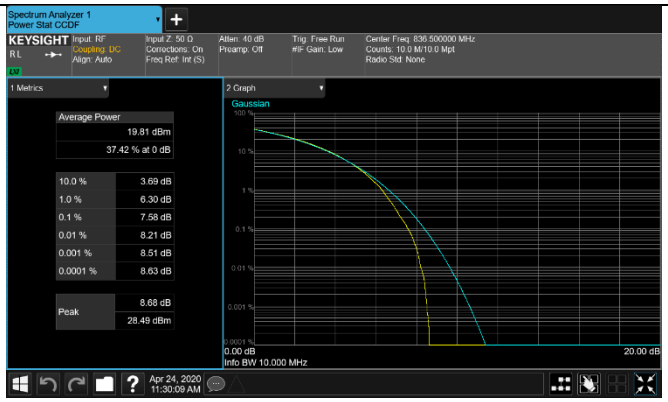
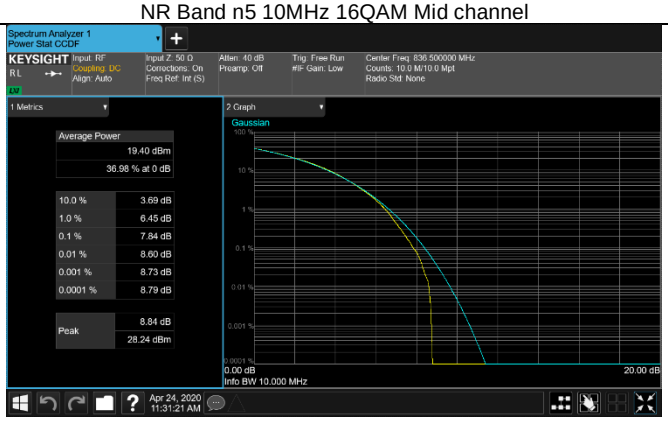
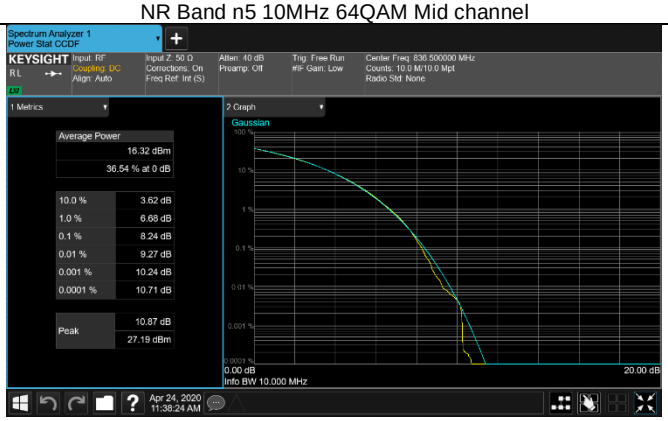
NR Band n2 10 MHz CP-OFDM	 NR Band n2 10MHz QPSK Mid channel
	 NR Band n2 10MHz 16QAM Mid channel
	 NR Band n2 10MHz 64QAM Mid channel
	 NR Band n2 10MHz 256QAM Mid channel

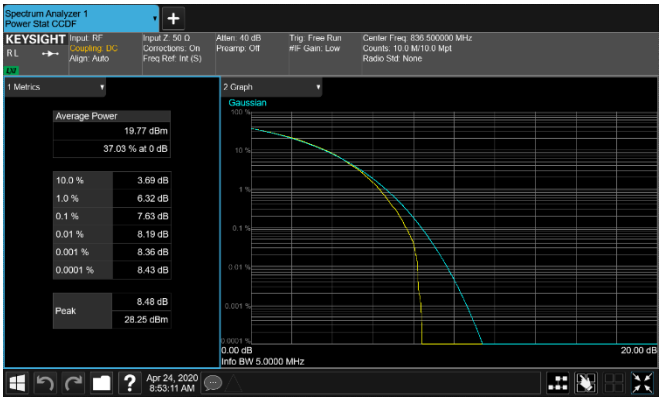
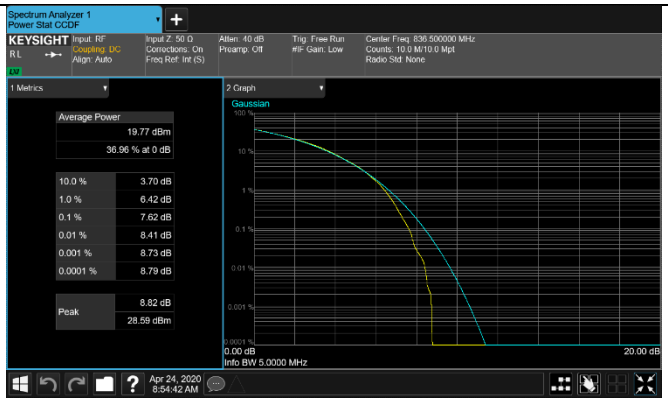
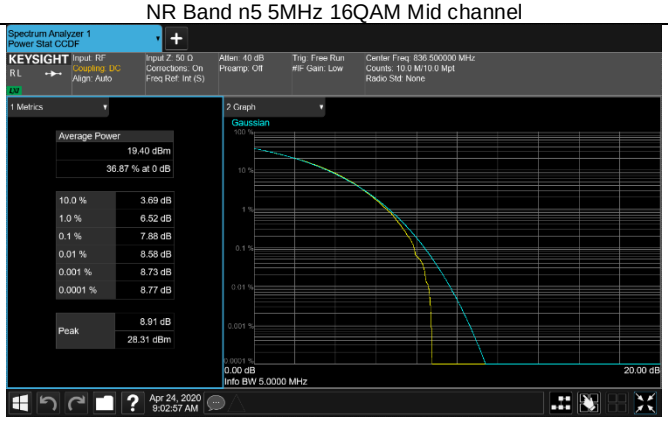
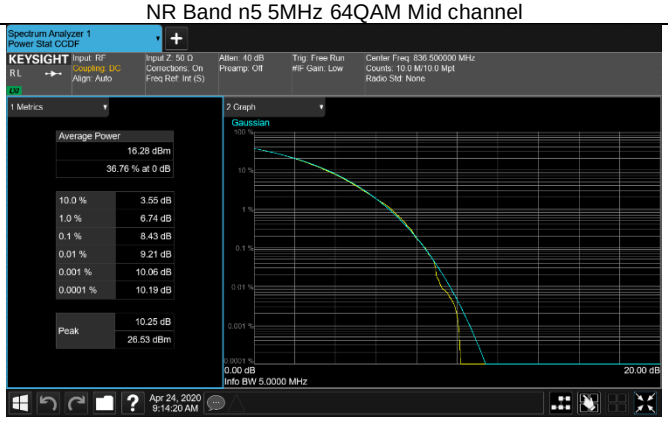
NR Band n2 5 MHz CP-OFDM	 NR Band n2 5MHz QPSK Mid channel
	 NR Band n2 5MHz 16QAM Mid channel
	 NR Band n2 5MHz 64QAM Mid channel
	 NR Band n2 5MHz 256QAM Mid channel

NR Band n5

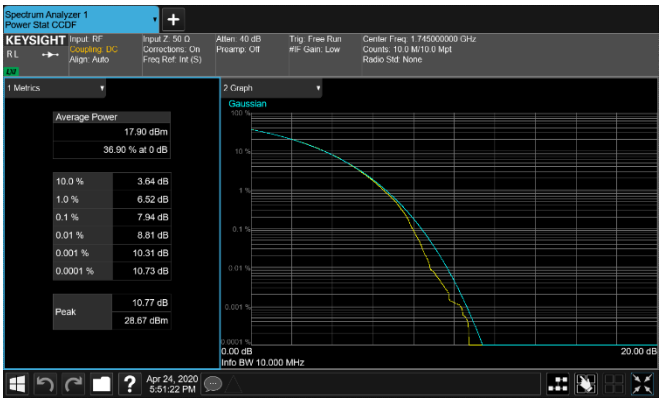
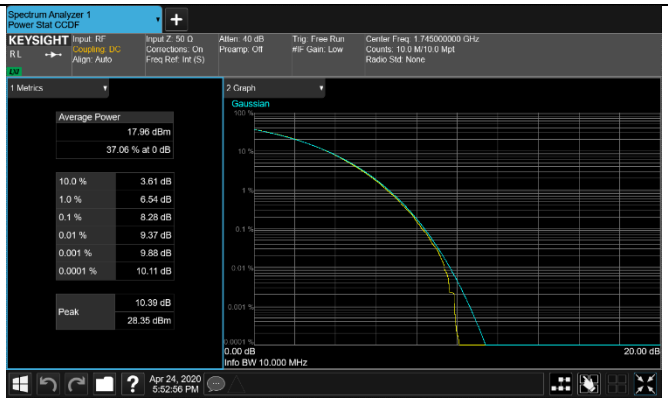
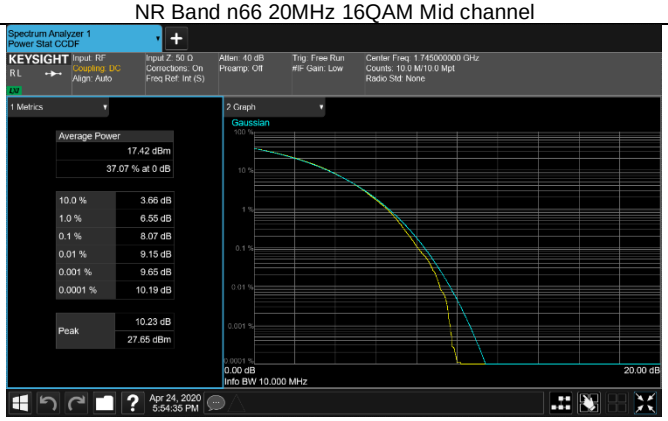
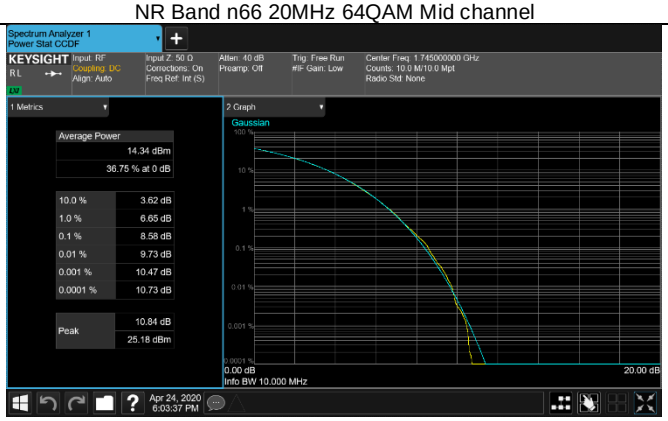
NR Band n5 20 MHz CP-OFDM	 NR Band n5 20MHz QPSK Mid channel
	 NR Band n5 20MHz 16QAM Mid channel
	 NR Band n5 20MHz 64QAM Mid channel
	 NR Band n5 20MHz 256QAM Mid channel

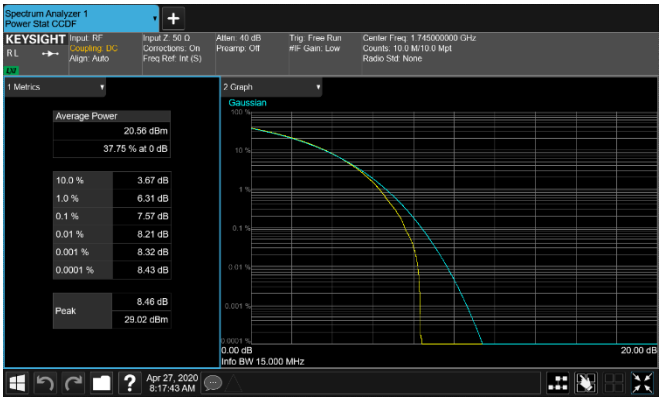
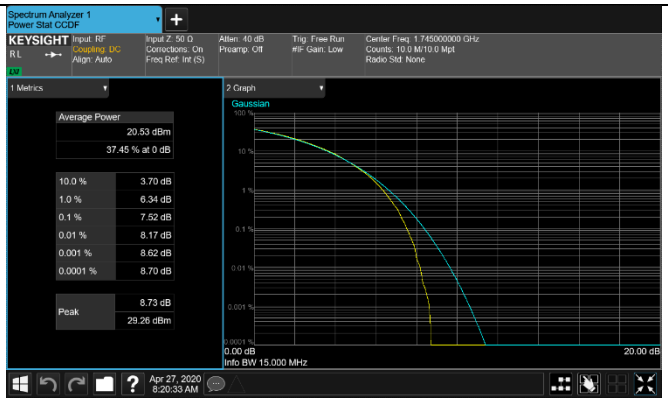
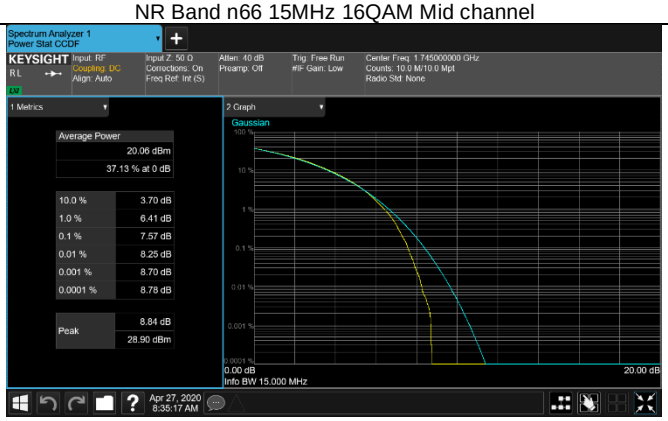
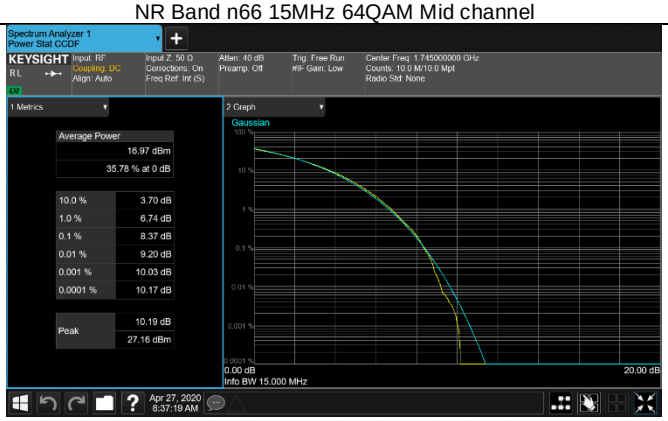
NR Band n5 15 MHz CP-OFDM	 NR Band n5 15MHz QPSK Mid channel
	 NR Band n5 15MHz 16QAM Mid channel
	 NR Band n5 15MHz 64QAM Mid channel
	 NR Band n5 15MHz 256QAM Mid channel

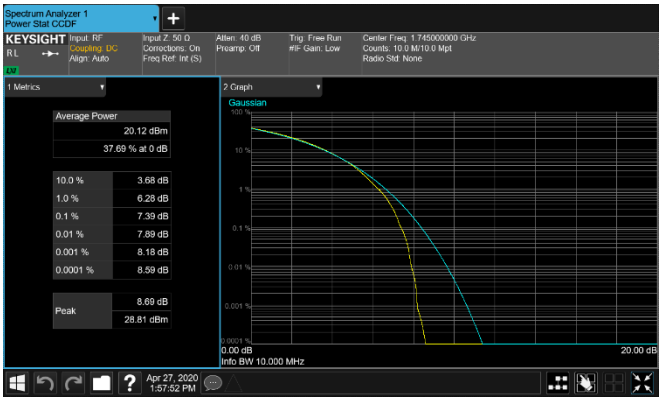
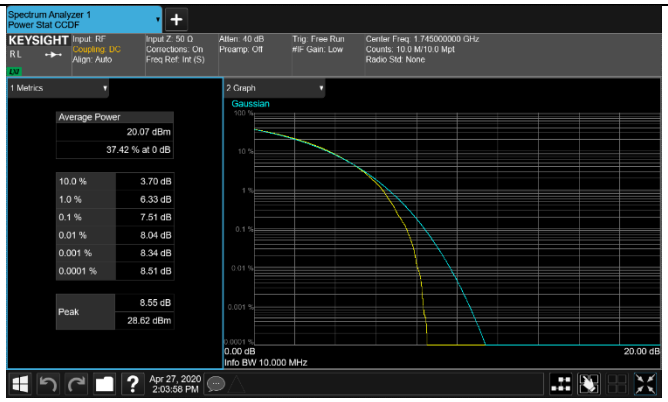
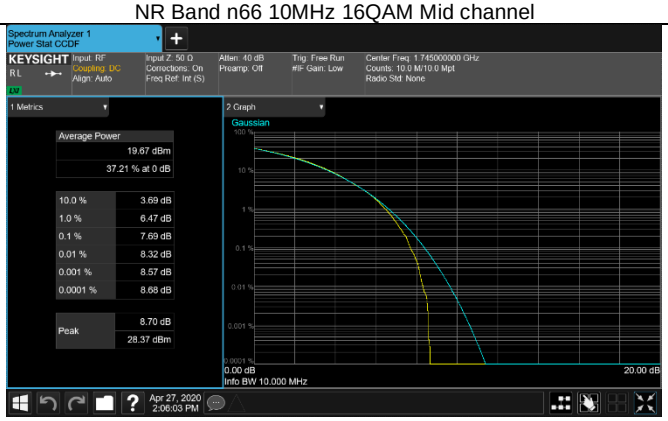
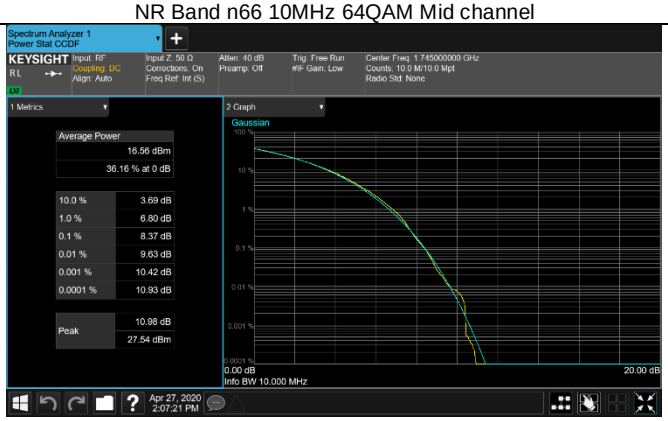
NR Band n5 10 MHz CP-OFDM	 NR Band n5 10MHz QPSK Mid channel
	 NR Band n5 10MHz 16QAM Mid channel
	 NR Band n5 10MHz 64QAM Mid channel
	 NR Band n5 10MHz 256QAM Mid channel

NR Band n5 5 MHz CP-OFDM	 NR Band n5 5MHz QPSK Mid channel
	 NR Band n5 5MHz 16QAM Mid channel
	 NR Band n5 5MHz 64QAM Mid channel
	 NR Band n5 5MHz 256QAM Mid channel

NR Band n66

NR Band n66 20 MHz CP-OFDM	 NR Band n66 20MHz QPSK Mid channel
	 NR Band n66 20MHz 16QAM Mid channel
	 NR Band n66 20MHz 64QAM Mid channel
	 NR Band n66 20MHz 256QAM Mid channel

NR Band n66 15 MHz CP-OFDM	 NR Band n66 15MHz QPSK Mid channel
	 NR Band n66 15MHz 16QAM Mid channel
	 NR Band n66 15MHz 64QAM Mid channel
	 NR Band n66 15MHz 256QAM Mid channel

NR Band n66 10 MHz CP-OFDM	 NR Band n66 10MHz QPSK Mid channel
	 NR Band n66 10MHz 16QAM Mid channel
	 NR Band n66 10MHz 64QAM Mid channel
	 NR Band n66 10MHz 256QAM Mid channel