CERTIFICATION TEST REPORT

Report Number. : 4790748041-E2V4

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-F946U, SM-F946U1
FCC ID	:	A3LSMF946U
EUT Description	:	GSM/WCDMA/LTE 5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC, WPT and UWB
Test Standard(s)	:	FCC CFR47 PART 22 SUBPART H FCC CFR47 PART 90 SUBPART R,S

Date Of Issue:
2023-05-26

Prepared by:
UL KOREA LTD.
26th floor, 152, Teheran-ro, Gangnam-gu Seoul, 06236, Korea

Suwon Test Site: UL KOREA LTD. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea
TEL: (031) 337-9902
FAX: (031) 213-5433

IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2023-05-15	Initial issue	Yeonhee Lim
V2	2023-05-23	Updated to address TCB's question	Yeonhee Lim
V3	2023-05-24	Updated to address TCB's question	Yeonhee Lim
V4	2023-05-26	Updated to address TCB's question	Yeonhee Lim

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

TABLE OF CONTENTS

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE 5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC, WPT and UWB.
MODEL NUMBER:	SM-F946U, SM-F946U1
SERIAL NUMBER:	R3CW20L0JZE, R3CW20NZSHN, R3CW20NZV7D (CONDUCTED); R3CW20P0BFD, R3CW20P0AXJ, R3CW20P0DT1, R3CW20P0BMZ, R3CW20P0AZT (RADIATED);
DATE TESTED:	2023-03-13 - 2023-05-26;

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 22H and 90R,S	Complies

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

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

Approved & Released For
UL KOREA LTD. By:

Seokhwan Hong
Suwon Lab Engineer
UL KOREA LTD.

Tested By:

Yeonhee Lim
Suwon Lab Engineer
UL KOREA LTD.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

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 90.
4. ANSI TIA-603-E, 2016
5. ANSI C63.26, 2015
6. 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:

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	2.80 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.92 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.06 dB
Radiated Disturbance, 18 GHz to 40 GHz	6.02 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 115:2021.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE 5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC, WPT and UWB. This test report addresses the WWAN operational mode.

Representative model	Difference	Derivative model
		SM-F946U1
SM-F946U	Hardware	Same as SM-F946U
	Software	Different UI

Thus, SM-F946U was set for final test.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum average radiated ERP output powers as follows:
Radiated samples were set to a higher power than conducted resulting in radiated ERP greater than conducted measurements.

GSM

FCC Part 22								
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated (ANT A+B)		Radiated (ANT A)	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
GSM850	824 ~ 849	GPRS	**31.78**	**1506.61**	**27.82**	605.34	**22.98**	**198.61**
		EGPRS	26.85	484.17	23.26	211.84	18.75	74.99

WCDMA

FCC Part 22								
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated (ANT A+B)		Radiated (ANT A)	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	824 ~ 849	Rel. 99	**24.83**	**304.09**	**20.71**	**117.76**	**17.40**	**54.95**
		HSDPA	23.80	239.88	19.85	96.61	16.67	46.45

LTE Band 5B (UL CA)

Part 22			
ERP Limit (dBm)	38.5	ANT Gain (dBi)_ANT A	-4.5
		ANT Gain (dBi)_ANT A+B	-5.8

Frequency Range (MHz)	Bandwidth (MHz)	Modulation	Output Power								
			Conducted Average Power	Antenna Gain ANT A	ERP Average Power (ANT A)		Margin	Antenna Gain ANT A+B	ERP Average Power (ANT A+B)		Margin
			(dBm)	dBi	dBm	mW		dBi	dBm	mW	
824 ~ 849	20MHz (10+10)	QPSK	24.67	-4.50	18.02	63.39	-20.48	-5.80	16.72	46.99	-21.78
		16QAM	23.95		17.30	53.70	-21.20		16.00	39.81	-22.50
	15MHz (10+5)	QPSK	24.60		17.95	62.37	-20.55		16.65	46.24	-21.85
		16QAM	23.89		17.24	52.97	-21.26		15.94	39.26	-22.56
	8MHz (5+3)	QPSK	**25.22**		**18.57**	**71.94**	**-19.93**		17.27	53.33	-21.23
		16QAM	25.14		18.49	70.63	-20.01		17.19	52.36	-21.31

LTE Band 14

FCC Part 90										
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated (ANT A+B)		Radiated (ANT A)	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 14	793	10	QPSK	23.83	241.55	17.73	59.29	19.15	82.22
			16QAM	23.27	212.32	16.64	46.13	18.07	64.12
			64QAM	22.01	158.85				
			256QAM	18.92	77.98				
	790.5 ~ 795.5	5	QPSK	**23.87**	**243.78**	**18.48**	**70.47**	**20.15**	**103.51**
			16QAM	23.16	207.01	17.41	55.08	19.20	83.18
			64QAM	22.06	160.69				
			256QAM	19.01	79.62				

LTE Band 26 (Part90)

FCC Part 90									
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated (ANT A+B)		Radiated (ANT A)	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	821.5	15	QPSK	24.07	255.27	18.43	69.66	16.76	47.42
			16QAM	23.32	214.78	17.41	55.08	15.74	37.50
			64QAM	22.25	167.88				
			256QAM	19.24	83.95				
	819	10	QPSK	**24.29**	**268.53**	18.67	73.62	16.66	46.34
			16QAM	23.41	219.28	17.73	59.29	15.75	37.58
			64QAM	22.44	175.39				
			256QAM	19.37	86.50				
	816.5 ~ 821.5	5	QPSK	24.22	264.24	18.94	78.34	16.98	49.89
			16QAM	23.48	222.84	18.04	63.68	15.75	37.58
			64QAM	22.48	177.01				
			256QAM	19.50	89.13				
	815.5 ~ 822.5	3	QPSK	24.27	267.30	**19.34**	**85.90**	16.81	47.97
			16QAM	23.43	220.29	18.22	66.37	15.72	37.33
			64QAM	22.46	176.20				
			256QAM	19.39	86.90				
	814.7 ~ 823.3	1.4	QPSK	24.24	265.46	19.23	83.75	**17.36**	**54.45**
			16QAM	23.39	218.27	17.99	62.95	16.26	42.27
			64QAM	22.36	172.19				
			256QAM	19.28	84.72				

LTE Band 26 (Straddle)

Straddle									
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated (ANT A+B)		Radiated (ANT A)	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	824	15	QPSK	24.42	276.69	18.73	74.64	16.94	49.43
			16QAM	23.75	237.14	17.94	62.23	15.99	39.72
			64QAM	22.43	174.98				
			256QAM	19.58	90.78				
		10	QPSK	24.55	285.10	19.41	87.30	17.09	51.17
			16QAM	23.89	244.91	18.23	66.53	16.12	40.93
			64QAM	22.73	187.50				
			256QAM	19.59	90.99				
		5	QPSK	24.56	285.76	19.52	89.54	**17.27**	**53.33**
			16QAM	23.91	246.04	18.35	68.39	16.09	40.64
			64QAM	22.70	186.21				
			256QAM	19.69	93.11				
		3	QPSK	24.48	280.54	**19.55**	**90.16**	16.97	49.77
			16QAM	23.92	246.60	18.48	70.47	16.00	39.81
			64QAM	22.69	185.78				
			256QAM	19.68	92.90				
		1.4	QPSK	**24.57**	**286.42**	19.24	83.95	17.03	50.47
			16QAM	23.73	236.05	18.17	65.61	16.03	40.09
			64QAM	22.63	183.23				
			256QAM	19.69	93.11				

LTE Band 26 (Part22)

FCC Part 22									
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated (ANT A+B)		Radiated (ANT A)	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	831.5 ~ 841.5	15	QPSK	24.08	255.86	19.53	89.74	18.51	70.96
			16QAM	23.34	215.77	18.56	71.78	17.42	55.21
			64QAM	22.23	167.11				
			256QAM	19.39	86.90				
	829 ~ 844	10	QPSK	24.30	269.15	19.75	94.41	**18.52**	**71.12**
			16QAM	23.44	220.80	18.85	76.74	17.43	55.34
			64QAM	22.38	172.98				
			256QAM	19.41	87.30				
	826.5 ~ 846.5	5	QPSK	**24.38**	**274.16**	19.71	93.54	18.42	69.50
			16QAM	23.46	221.82	18.59	72.28	17.53	56.62
			64QAM	22.52	178.65				
			256QAM	19.41	87.30				
	825.5 ~ 847.5	3	QPSK	24.35	272.27	**19.80**	**95.50**	18.41	69.34
			16QAM	23.59	228.56	18.72	74.47	17.50	56.23
			64QAM	22.54	179.47				
			256QAM	19.48	88.72				
	824.7 ~ 848.3	1.4	QPSK	24.30	269.15	19.77	94.84	18.11	64.71
			16QAM	23.52	224.91	18.80	75.86	16.98	49.89
			64QAM	22.55	179.89				
			256QAM	19.38	86.70				

NR Band n26 (Part90)

FCC Part 90										
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated (ANT A+B)		Radiated (ANT A)	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	821.5	15	DFT-s OFDM	π/2 BPSK	24.23	264.85				
				QPSK	**24.41**	**276.06**	19.71	93.54	15.91	38.99
				16QAM	23.26	211.84	18.67	73.62	14.92	31.05
				64QAM	21.88	154.17				
				256QAM	19.29	84.92				
			CP-OFDM	QPSK	22.73	187.50				
	819	10	DFT-s OFDM	π/2 BPSK	24.16	260.62				
				QPSK	24.18	261.82	19.60	91.20	15.85	38.46
				16QAM	23.15	206.54	18.52	71.12	14.91	30.97
				64QAM	21.81	151.71				
				256QAM	19.16	82.41				
			CP-OFDM	QPSK	22.76	188.80				
	816.5 ~ 821.5	5	DFT-s OFDM	π/2 BPSK	24.06	254.68				
				QPSK	24.29	268.53	**20.11**	**102.57**	**16.14**	**41.11**
				16QAM	23.14	206.06	19.16	82.41	15.13	32.58
				64QAM	21.86	153.46				
				256QAM	19.11	81.47				
			CP-OFDM	QPSK	22.60	181.97				

NR Band n26 (Straddle)

Straddle										
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated (ANT A+B)		Radiated (ANT A)	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	824.0	20	DFT-s OFDM	π/2 BPSK	24.37	273.53				
				QPSK	**24.46**	**279.25**	19.85	96.61	**16.95**	**49.55**
				16QAM	23.42	219.79	19.35	86.10	15.75	37.58
				64QAM	21.89	154.53				
				256QAM	19.23	83.75				
			CP-OFDM	QPSK	22.60	181.97				
		15	DFT-s OFDM	π/2 BPSK	24.32	270.40				
				QPSK	**24.46**	**279.25**	19.98	99.54	15.92	39.08
				16QAM	23.31	214.29	18.65	73.28	14.93	31.12
				64QAM	21.96	157.04				
				256QAM	19.54	89.95				
			CP-OFDM	QPSK	22.67	184.93				
		10	DFT-s OFDM	π/2 BPSK	24.25	266.07				
				QPSK	24.26	266.69	19.86	96.83	16.00	39.81
				16QAM	23.23	210.38	18.71	74.30	15.15	32.73
				64QAM	21.70	147.91				
				256QAM	19.01	79.62				
			CP-OFDM	QPSK	22.62	182.81				
		5	DFT-s OFDM	π/2 BPSK	24.06	254.68				
				QPSK	24.06	254.68	**20.22**	**105.20**	16.07	40.46
				16QAM	23.05	201.84	19.24	83.95	15.04	31.92
				64QAM	21.27	133.97				
				256QAM	19.20	83.18				
			CP-OFDM	QPSK	22.55	179.89				

NR Band n26 (Part22)

FCC Part 22										
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated (ANT A+B)		Radiated (ANT A)	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	834.0 ~ 839.0	20	DFT-s OFDM	π/2 BPSK	24.41	276.06				
				QPSK	**24.56**	**285.76**	20.12	102.80	17.02	50.35
				16QAM	23.59	228.56	18.90	77.62	16.12	40.93
				64QAM	22.15	164.06				
				256QAM	19.55	90.16				
			CP-OFDM	QPSK	22.94	196.79				
	831.5 ~ 841.5	15	DFT-s OFDM	π/2 BPSK	24.37	273.53				
				QPSK	24.46	279.25	**20.41**	**109.90**	17.51	56.36
				16QAM	23.48	222.84	19.43	87.70	16.75	47.32
				64QAM	22.15	164.06				
				256QAM	19.57	90.57				
			CP-OFDM	QPSK	22.91	195.43				
	829.0 ~ 844.0	10	DFT-s OFDM	π/2 BPSK	24.32	270.40				
				QPSK	24.32	270.40	20.32	107.65	**18.11**	**64.71**
				16QAM	23.24	210.86	19.23	83.75	17.08	51.05
				64QAM	21.93	155.96				
				256QAM	19.27	84.53				
			CP-OFDM	QPSK	22.69	185.78				
	826.5 ~ 846.5	5	DFT-s OFDM	π/2 BPSK	24.26	266.69				
				QPSK	24.33	**271.02**	20.37	108.89	18.01	63.24
				16QAM	23.21	209.41	19.35	86.10	16.97	49.77
				64QAM	21.93	155.96				
				256QAM	19.26	84.33				
			CP-OFDM	QPSK	22.69	185.78				

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 (dBd)
GSM850 / WCDMA Band 5 / LTE Band 5, 26 / NR Band n5, n26 814 - 849 MHz	-4.5 (ANT A) -5.8 (ANT A+B)
LTE Band 14 788 - 798 MHz	-5.0 (ANT A) -5.8 (ANT A+B)

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

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 LTE Bands the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM, 64QAM and 256QAM modulations. However, the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest power in QPSK.

For 5G NR Band n26 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 QPSK and 16QAM results were worst case as below.
SA modes was tested and worst case is reported. 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.

This device supports AFS (Adaptive Frame Switching) Mode for below 1GHz Bands.
The adaptive frame switching (AFS) mode of device operates only in the radiated state.
So both folded and open modes were tested and worst data is reported.

Condition	Antenna
Open, Half open, Full folded	A+B
Full folded (Grip)	A

LTE Band 5
LTE Band 5 (Frequency range: 824-849 MHz) is covered by LTE Band 26 (Frequency range: 814-849 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

NR Band n5
NR Band n5 (Frequency range: 824-849 MHz) is covered by NR Band n26 (Frequency range: 814-849 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

- Conducted Spurious Emission

Highest conducted output power setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
14	790.5	5	1	12
	793.0		1	12
	795.5		1	12
26 (Part 90)	819.0	10	1	0
26 (Straddle)	824.0	1.4	1	3
26 (Part 22)	826.5	5	1	12
	831.5		1	12
	846.5		1	12
NR Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
26 (Part 90)	821.5	15	1	77
26 (Straddle)	824.0	15	1	40
26 (Part 22)	834.0	20	1	53
	839.0		1	1

- Radiated Spurious Emission (ANT A+B)

Highest EIRP setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
14	790.5	5	1	12
	793.0		1	12
	795.5		1	12
26 (Part 90)	815.5	3	1	8
	822.5		1	8
26 (Straddle)	824.0	3	1	8
26 (Part 22)	825.5	3	1	8
	831.5		1	8
	847.5		1	8
NR Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
26 (Part 90)	816.5	5	1	13
	821.5		1	13
26 (Straddle)	824.0	5	1	23
26 (Part 22)	831.5	15	1	53
	841.5		1	1

- Radiated Spurious Emission (ANT A)

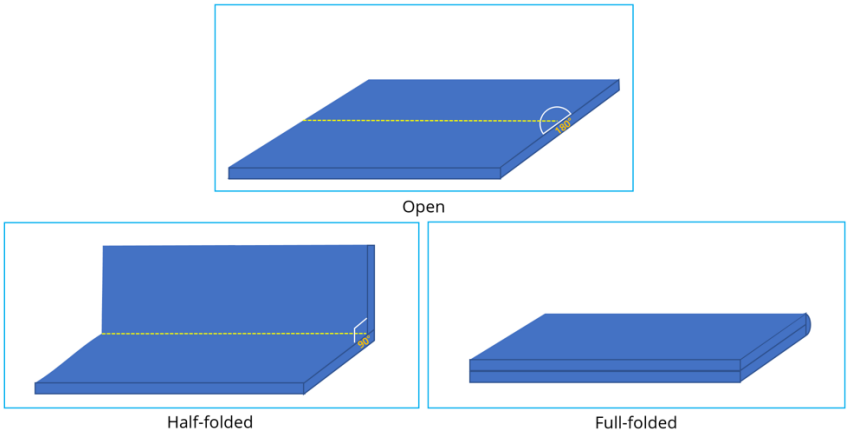
Highest EIRP setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
14	790.5	5	1	12
	793.0		1	12
	795.5		1	12
26 (Part 90)	814.7	1.4	1	3
	823.3		1	5
26 (Straddle)	824.0	5	1	0
26 (Part 22)	829.0	10	1	0
	831.5		1	25
	844.0		1	25
NR Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
26 (Part 90)	816.5	5	1	13
	821.5		1	13
26 (Straddle)	824.0	20	1	104
26 (Part 22)	829.0	10	1	26
	831.5		1	26
	841.5		1	26

- Uplink CA

Highest conducted output power setting for each bands					
LTE Band	**Component Carrier**	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
5B	PCC	826.5	5	1	24
	SCC	830.4	3	1	0
	PCC	835.0	5	1	24
	SCC	838.9	3	1	0
	PCC	843.6	5	1	24
	SCC	847.5	3	1	0

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

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



Band	ANT	ERP			RSE		
		X	Y	Z	X	Y	Z
GSM 850	A+B	Open	-	-	-	Half-folded	-
	A	-	-	Full-folded	Full-folded	-	-
WCDMA B5	A+B	Open	-	-	Half-folded	-	-
	A	-	-	Full-folded	-	Full-folded	
LTE B14	A+B	Open	-	-	Full-folded	-	-
	A	-	-	Full-folded	-	Full-folded	
LTE B26	A+B	Open	-	-	-	Half-folded	-
	A	-	-	Full-folded	-	-	Full-folded
NR n26	A+B	Open	-	-	-	Half-folded	-
	A	-	-	Full-folded	-	-	Full-folded
LTE 5B(UL CA)	A+B				Open	-	-
	A				-	-	Full-folded

Note : For ERP 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	**Manufacture**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37N9QP4SL9DK3	N/A
Data Cable	SAMSUNG	WBR0062M	GH39-02112A	N/A

I/O CABLE

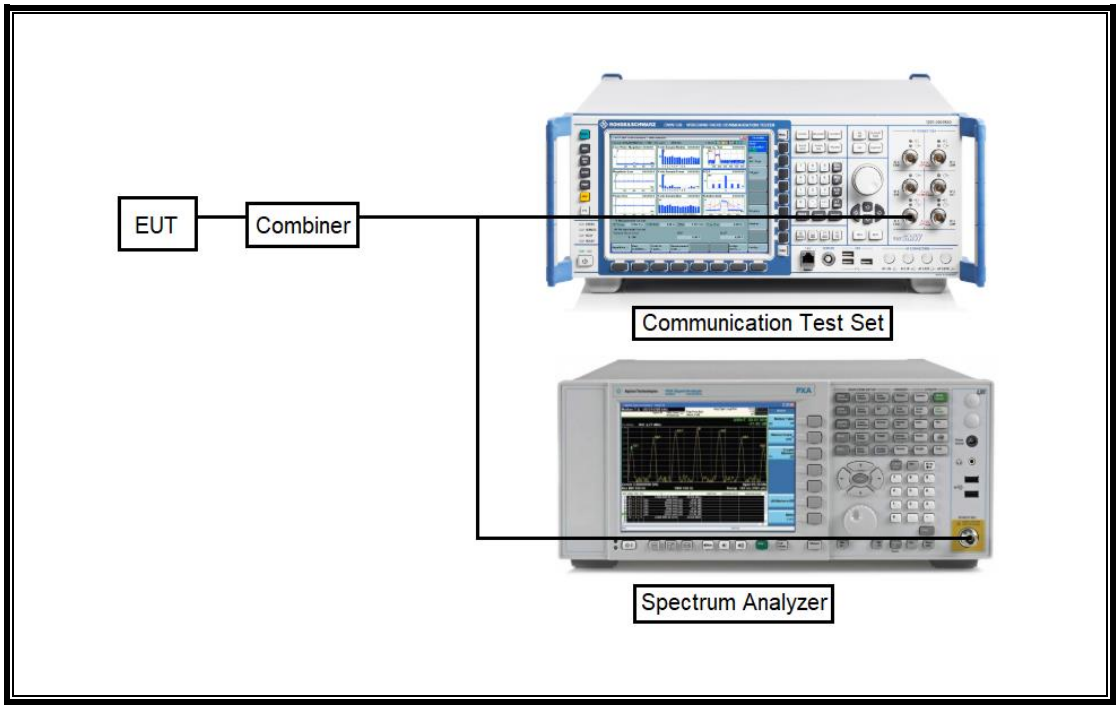
I/O Cable List						
Cable No.	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.0 m	N/A

TEST SETUP

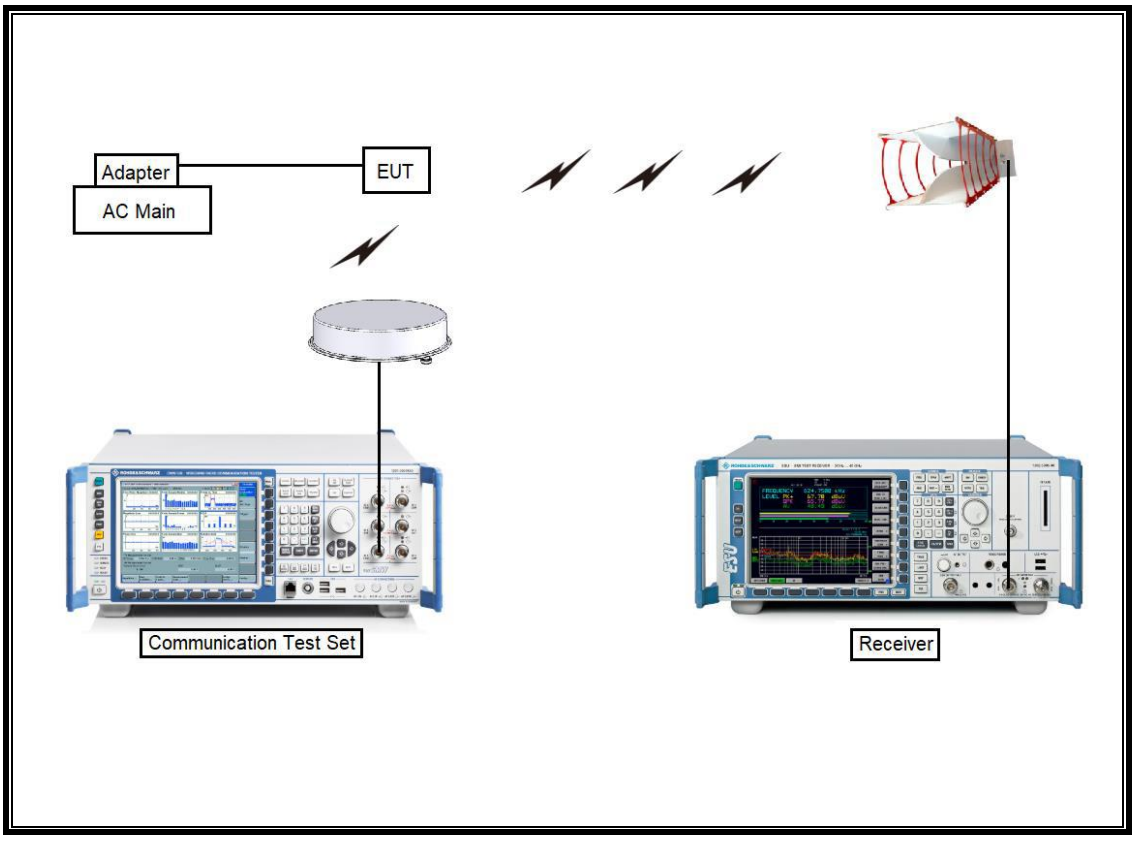
The EUT is continuously communicated with the call box during the tests.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

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	2025-01-17
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	00168645	2023-10-13
Preamplifier	ETS	3115-PA	00167475	2023-08-04
Preamplifier	ETS	3116C-PA	00168841	2023-08-04
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2024-08-15
Antenna, Horn, 18 GHz	ETS	3115	00161451	2024-08-21
Antenna, Horn, 18 GHz	ETS	3117	00168717	2024-08-21
Communications Test Set	R&S	CMW500	169796	2024-01-05
DC Power Supply	Agilent / HP	E3640A	MY54226395	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	341282	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	351741	2023-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	2023-08-01
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2023-08-01
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2023-08-03
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2023-08-01
Spectrum Analyzer, 44 GHz	KEYSIGHT	N9030B	MY60070693	2024-01-09
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2023-08-02
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2023-07-29
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	2023-08-01
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	2023-08-01
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	2023-08-01
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	2023-08-01
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	2023-08-01
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	2023-08-01
Attenuator	PASTERNACK	PE7087-10	A009	2023-08-03
Attenuator	PASTERNACK	PE7087-10	A001	2023-08-03
Attenuator	PASTERNACK	PE7087-10	A008	2023-08-03
Attenuator	PASTERNACK	PE7004-10	2	2023-08-01
Attenuator	PASTERNACK	PE7395-10	A011	2023-08-03
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2023-10-06
Temperature Chamber	ESPEC	SH-642	93001109	2023-08-01
Power Splitter	MINI-CIRCUITS	WA1534	UL003	2024-01-09
Power Splitter	MINI-CIRCUITS	WA1534	UL004	2024-01-09
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)	Band Edge / Conducted Spurious Emission	-13dBm		Pass
90.543(e)		-35 dBm		Pass
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 90.213	Frequency Stability	2.5PPM		Pass
22.913(a)(5)	Effective Radiated Power	38.5dBm	Radiated	Pass
90.542(a)(7) 90.635(b)		34.77dBm		Pass
22.917(a) 90.543(c) 90.691(a)	Radiated Spurious Emission	-13dBm		Pass

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

8. CONDUCTED RESULTS

8.1. CONDUCTED OUTPUT POWER

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to either CMW500 Test Set or E7515B Test set and configured to operate at maximum power.

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.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

8.1.1. CONDUCTED AVERAGE OUTPUT POWER

GSM

Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Maximum Average Power (dBm)			
					Measured		Tune-up Limit	
					Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr
GSM (Voice)	CS1	1	128	824.2	31.06	22.03	33.0	24.0
			190	836.6	31.57	22.54		
			251	848.8	31.78	22.75		
GPRS (GMSK)	CS1	1	128	824.2	31.10	22.07	33.0	24.0
			190	836.6	31.48	22.45		
			251	848.8	31.66	22.63		
		2	128	824.2	30.70	24.68	32.5	**26.5**
			190	836.6	30.60	24.58		
			251	848.8	30.83	24.81		
		3	128	824.2	28.85	24.59	30.5	26.2
			190	836.6	28.70	24.44		
			251	848.8	29.28	25.02		
		4	128	824.2	27.48	24.47	28.5	25.5
			190	836.6	27.18	24.17		
			251	848.8	27.42	24.41		
EGPRS (8PSK)	MCS5	1	128	824.2	26.19	17.16	28.0	19.0
			190	836.6	26.57	17.54		
			251	848.8	26.85	17.82		
		2	128	824.2	24.66	18.64	26.0	20.0
			190	836.6	24.45	18.43		
			251	848.8	24.74	18.72		
		3	128	824.2	22.84	18.58	24.0	19.7
			190	836.6	22.54	18.28		
			251	848.8	22.92	18.66		
		4	128	824.2	21.82	18.81	23.0	20.0
			190	836.6	21.74	18.73		
			251	848.8	22.03	19.02		

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

WCDMA B5

Mode		UL Ch No.	Freq. (MHz)	Maximum Average Power (dBm)		
				Measured Pwr	MPR	Tune-up Limit
Release 99	Rel 99 (RMC, 12.2 kbps)	4132	826.4	24.69	N/A	25.5
		4183	836.6	24.54		
		4233	846.6	24.83		
HSDPA	Subtest 1	4132	826.4	23.69	0	24.5
		4183	836.6	23.54		
		4233	846.6	23.80		
	Subtest 2	4132	826.4	23.68	0	24.5
		4183	836.6	23.50		
		4233	846.6	23.72		
	Subtest 3	4132	826.4	23.19	0.5	24.0
		4183	836.6	23.02		
		4233	846.6	23.30		
	Subtest 4	4132	826.4	23.20	0.5	24.0
		4183	836.6	23.04		
		4233	846.6	23.31		
HSUPA	Subtest 1	4132	826.4	23.69	0	24.5
		4183	836.6	23.50		
		4233	846.6	23.77		
	Subtest 2	4132	826.4	21.67	2	22.5
		4183	836.6	21.49		
		4233	846.6	21.76		
	Subtest 3	4132	826.4	22.68	1	23.5
		4183	836.6	22.46		
		4233	846.6	22.73		
	Subtest 4	4132	826.4	21.66	2	22.5
		4183	836.6	21.46		
		4233	846.6	21.76		
	Subtest 5	4132	826.4	23.27	0	24.5
		4183	836.6	23.07		
		4233	846.6	23.32		
DC-HSDPA	Subtest 1	4132	826.4	23.69	0	24.5
		4183	836.6	23.52		
		4233	846.6	23.78		
	Subtest 2	4132	826.4	23.67	0	24.5
		4183	836.6	23.51		
		4233	846.6	23.80		
	Subtest 3	4132	826.4	23.20	0.5	24.0
		4183	836.6	23.04		
		4233	846.6	23.32		
	Subtest 4	4132	826.4	23.21	0.5	24.0
		4183	836.6	23.03		
		4233	846.6	23.32		

LTE Band 5B (UL CA)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average Power (dBm)	
			Size	Offset	Size	Offset	QPSK	16QAM
20MHz (10MHz / 10MHz)	829.0	838.9	1	49	1	0	24.61	23.90
			1	0	1	49	14.38	14.66
			50	0	50	0	22.80	21.82
	831.5	841.4	1	49	1	0	24.54	23.70
			1	0	1	49	14.36	14.52
			50	0	50	0	22.75	21.75
	834.1	844.0	1	49	1	0	24.67	23.95
			1	0	1	49	14.31	14.56
			50	0	50	0	22.74	21.73

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average Power (dBm)	
			Size	Offset	Size	Offset	QPSK	16QAM
15MHz (10MHz / 5MHz)	829.0	836.2	1	49	1	0	24.60	23.84
			1	0	1	24	14.89	15.12
			50	0	25	0	22.83	21.84
	831.0	841.3	1	49	1	0	24.52	23.89
			1	0	1	24	14.88	15.11
			50	0	25	0	22.78	21.81
	839.3	846.5	1	49	1	0	24.60	23.86
			1	0	1	24	14.65	14.86
			50	0	25	0	22.72	21.69

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average Power (dBm)	
			Size	Offset	Size	Offset	QPSK	16QAM
8MHz (5MHz / 3MHz)	826.5	830.4	1	24	1	0	25.13	25.12
			1	0	1	14	15.01	15.24
			25	0	15	0	25.22	25.14
	835.0	838.9	1	24	1	0	24.74	25.09
			1	0	1	14	14.81	14.97
			25	0	15	0	24.85	24.86
	843.6	847.5	1	24	1	0	25.10	25.08
			1	0	1	14	14.84	14.94
			25	0	15	0	24.78	25.00

LTE Band 14

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)			MPR	Tune-up Limit
				Measured Pwr (dBm)				
					23330			
					793 MHz			
10 MHz	QPSK	1	0		23.69		0.0	25.5
		1	25		23.81		0.0	25.5
		1	49		23.83		0.0	25.5
		25	0		22.72		1.0	24.5
		25	12		22.84		1.0	24.5
		25	25		22.85		1.0	24.5
		50	0		22.89		1.0	24.5
	16QAM	1	0		23.12		1.0	24.5
		1	25		23.16		1.0	24.5
		1	49		23.27		1.0	24.5
		25	0		21.74		2.0	23.5
		25	12		21.83		2.0	23.5
		25	25		21.83		2.0	23.5
		50	0		21.83		2.0	23.5
	64QAM	1	0		21.88		2.0	23.5
		1	25		21.97		2.0	23.5
		1	49		22.01		2.0	23.5
		25	0		20.73		3.0	22.5
		25	12		20.81		3.0	22.5
		25	25		20.81		3.0	22.5
		50	0		20.81		3.0	22.5
	256QAM	1	0		18.78		5.0	20.5
		1	25		18.92		5.0	20.5
		1	49		18.90		5.0	20.5
		25	0		18.71		5.0	20.5
		25	12		18.79		5.0	20.5
		25	25		18.78		5.0	20.5
		50	0		18.79		5.0	20.5

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				23305	23330	23355		
				790.5 MHz	793 MHz	795.5 MHz		
5 MHz	QPSK	1	0	23.74	23.75	23.80	0.0	25.5
		1	12	23.79	23.85	23.87	0.0	25.5
		1	24	23.75	23.78	23.81	0.0	25.5
		12	0	22.73	22.73	22.80	1.0	24.5
		12	7	22.83	22.86	22.81	1.0	24.5
		12	13	22.82	22.82	22.88	1.0	24.5
		25	0	22.81	22.82	22.80	1.0	24.5
	16QAM	1	0	22.93	23.06	22.98	1.0	24.5
		1	12	23.06	23.16	23.11	1.0	24.5
		1	24	22.95	23.14	23.05	1.0	24.5
		12	0	21.72	21.89	21.82	2.0	23.5
		12	7	21.83	22.00	21.83	2.0	23.5
		12	13	21.81	21.96	21.89	2.0	23.5
		25	0	21.77	21.88	21.78	2.0	23.5
	64QAM	1	0	21.86	21.88	22.04	2.0	23.5
		1	12	21.93	22.00	22.06	2.0	23.5
		1	24	21.85	21.98	22.02	2.0	23.5
		12	0	20.70	20.72	20.81	3.0	22.5
		12	7	20.81	20.83	20.82	3.0	22.5
		12	13	20.80	20.80	20.88	3.0	22.5
		25	0	20.75	20.78	20.78	3.0	22.5
	256QAM	1	0	18.70	18.78	18.80	5.0	20.5
		1	12	18.89	19.01	18.93	5.0	20.5
		1	24	18.74	18.89	18.83	5.0	20.5
		12	0	18.70	18.68	18.74	5.0	20.5
		12	7	18.79	18.82	18.77	5.0	20.5
		12	13	18.74	18.75	18.79	5.0	20.5
		25	0	18.74	18.76	18.75	5.0	20.5

LTE Band 26

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm) Pmax				MPR	Tune-up Limit
				Measured Pwr (dBm)					
				26765	26865	26965	26790		
				821.5 MHz	831.5 MHz	841.5 MHz	824 MHz		
15 MHz	QPSK	1	0	24.07	23.91	23.98	24.42	0.0	25.5
		1	37	24.00	23.92	24.07	24.20	0.0	25.5
		1	74	23.92	23.86	24.08	24.25	0.0	25.5
		36	0	23.03	22.91	23.05	23.35	1.0	24.5
		36	20	23.06	22.98	23.04	23.38	1.0	24.5
		36	39	23.04	22.99	23.12	23.42	1.0	24.5
		75	0	23.08	22.99	23.06	23.43	1.0	24.5
	16QAM	1	0	23.32	23.34	23.16	23.66	1.0	24.5
		1	37	23.18	23.28	23.18	23.75	1.0	24.5
		1	74	23.05	23.23	23.19	23.53	1.0	24.5
		36	0	22.05	21.93	22.05	22.38	2.0	23.5
		36	20	22.09	21.99	22.04	22.41	2.0	23.5
		36	39	22.04	21.99	22.11	22.41	2.0	23.5
		75	0	22.09	22.01	22.07	22.46	2.0	23.5
	64QAM	1	0	22.25	22.03	22.17	22.43	2.0	23.5
		1	37	22.16	22.00	22.23	22.39	2.0	23.5
		1	74	22.02	22.01	22.23	22.36	2.0	23.5
		36	0	21.06	20.88	21.07	21.40	3.0	22.5
		36	20	21.09	20.93	21.06	21.49	3.0	22.5
		36	39	21.07	20.93	21.12	21.45	3.0	22.5
		75	0	21.10	20.94	21.07	21.48	3.0	22.5
	256QAM	1	0	19.24	19.05	19.18	19.38	5.0	20.5
		1	37	19.20	18.99	19.26	19.51	5.0	20.5
		1	74	19.20	19.17	19.39	19.58	5.0	20.5
		36	0	19.12	18.91	19.07	19.36	5.0	20.5
		36	20	19.10	18.97	19.06	19.43	5.0	20.5
		36	39	19.10	18.96	19.13	19.38	5.0	20.5
		75	0	19.12	18.97	19.09	19.39	5.0	20.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)				MPR	Tune-up Limit
				26740	26865	26990	26790		
				819 MHz	831.5 MHz	844 MHz	824 MHz		
10 MHz	QPSK	1	0	24.29	24.10	24.17	24.52	0.0	25.5
		1	25	24.23	24.14	24.30	24.55	0.0	25.5
		1	49	24.16	24.14	24.27	24.47	0.0	25.5
		25	0	23.17	23.04	23.18	23.53	1.0	24.5
		25	12	23.23	23.12	23.28	23.50	1.0	24.5
		25	25	23.19	23.11	23.24	23.47	1.0	24.5
		50	0	23.22	23.11	23.27	23.54	1.0	24.5
	16QAM	1	0	23.40	23.30	23.41	23.89	1.0	24.5
		1	25	23.41	23.31	23.44	23.87	1.0	24.5
		1	49	23.28	23.29	23.41	23.86	1.0	24.5
		25	0	22.17	22.04	22.18	22.57	2.0	23.5
		25	12	22.26	22.17	22.29	22.54	2.0	23.5
		25	25	22.21	22.15	22.28	22.54	2.0	23.5
		50	0	22.23	22.12	22.27	22.51	2.0	23.5
	64QAM	1	0	22.43	22.29	22.27	22.64	2.0	23.5
		1	25	22.44	22.29	22.38	22.73	2.0	23.5
		1	49	22.36	22.29	22.35	22.58	2.0	23.5
		25	0	21.19	21.05	21.20	21.54	3.0	22.5
		25	12	21.24	21.16	21.31	21.52	3.0	22.5
		25	25	21.23	21.11	21.30	21.51	3.0	22.5
		50	0	21.24	21.12	21.29	21.55	3.0	22.5
	256QAM	1	0	19.31	19.18	19.29	19.58	5.0	20.5
		1	25	19.37	19.27	19.41	19.55	5.0	20.5
		1	49	19.25	19.26	19.38	19.54	5.0	20.5
		25	0	19.18	19.05	19.21	19.54	5.0	20.5
		25	12	19.30	19.13	19.30	19.59	5.0	20.5
		25	25	19.22	19.13	19.28	19.50	5.0	20.5
		50	0	19.27	19.13	19.25	19.52	5.0	20.5

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)				MPR	Tune-up Limit
				26715	26865	27015	26790		
				816.5 MHz	831.5 MHz	846.5 MHz	824 MHz		
5 MHz	QPSK	1	0	24.21	24.08	24.26	24.42	0.0	25.5
		1	12	24.22	24.16	24.38	24.56	0.0	25.5
		1	24	24.15	24.08	24.28	24.41	0.0	25.5
		12	0	23.26	23.00	23.20	23.50	1.0	24.5
		12	7	23.26	23.11	23.20	23.50	1.0	24.5
		12	13	23.22	23.10	23.27	23.47	1.0	24.5
		25	0	23.22	23.10	23.20	23.56	1.0	24.5
	16QAM	1	0	23.39	23.26	23.37	23.80	1.0	24.5
		1	12	23.48	23.37	23.46	23.91	1.0	24.5
		1	24	23.34	23.28	23.40	23.75	1.0	24.5
		12	0	22.30	22.06	22.20	22.63	2.0	23.5
		12	7	22.31	22.17	22.23	22.70	2.0	23.5
		12	13	22.26	22.13	22.30	22.69	2.0	23.5
		25	0	22.23	22.09	22.21	22.48	2.0	23.5
	64QAM	1	0	22.35	22.09	22.46	22.69	2.0	23.5
		1	12	22.48	22.20	22.50	22.68	2.0	23.5
		1	24	22.34	22.11	22.52	22.70	2.0	23.5
		12	0	21.26	21.02	21.21	21.54	3.0	22.5
		12	7	21.28	21.12	21.26	21.57	3.0	22.5
		12	13	21.25	21.10	21.31	21.56	3.0	22.5
		25	0	21.25	21.11	21.23	21.54	3.0	22.5
	256QAM	1	0	19.41	19.07	19.26	19.49	5.0	20.5
		1	12	19.50	19.31	19.41	19.69	5.0	20.5
		1	24	19.41	19.19	19.37	19.59	5.0	20.5
		12	0	19.27	19.04	19.20	19.47	5.0	20.5
		12	7	19.30	19.16	19.25	19.53	5.0	20.5
		12	13	19.26	19.14	19.28	19.49	5.0	20.5
		25	0	19.23	19.14	19.20	19.54	5.0	20.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)				MPR	Tune-up Limit
				26705	26865	27025	26790		
				815.5 MHz	831.5 MHz	847.5 MHz	824 MHz		
3 MHz	QPSK	1	0	24.18	23.99	24.21	24.42	0.0	25.5
		1	8	24.27	24.11	24.35	24.48	0.0	25.5
		1	14	24.17	24.01	24.24	24.40	0.0	25.5
		8	0	23.21	23.00	23.18	23.51	1.0	24.5
		8	4	23.26	23.13	23.22	23.50	1.0	24.5
		8	7	23.23	23.13	23.30	23.49	1.0	24.5
		15	0	23.22	23.07	23.21	23.49	1.0	24.5
	16QAM	1	0	23.43	23.21	23.47	23.75	1.0	24.5
		1	8	23.42	23.26	23.59	23.92	1.0	24.5
		1	14	23.30	23.14	23.43	23.69	1.0	24.5
		8	0	22.24	22.07	22.19	22.58	2.0	23.5
		8	4	22.29	22.17	22.25	22.62	2.0	23.5
		8	7	22.26	22.15	22.34	22.64	2.0	23.5
		15	0	22.23	22.10	22.23	22.54	2.0	23.5
	64QAM	1	0	22.46	22.17	22.43	22.69	2.0	23.5
		1	8	22.44	22.29	22.54	22.65	2.0	23.5
		1	14	22.40	22.17	22.48	22.40	2.0	23.5
		8	0	21.28	21.02	21.25	21.53	3.0	22.5
		8	4	21.32	21.12	21.27	21.61	3.0	22.5
		8	7	21.30	21.10	21.37	21.56	3.0	22.5
		15	0	21.23	21.08	21.20	21.52	3.0	22.5
	256QAM	1	0	19.33	19.11	19.34	19.54	5.0	20.5
		1	8	19.39	19.29	19.48	19.63	5.0	20.5
		1	14	19.28	19.20	19.41	19.48	5.0	20.5
		8	0	19.25	19.05	19.24	19.47	5.0	20.5
		8	4	19.31	19.16	19.30	19.65	5.0	20.5
		8	7	19.30	19.14	19.35	19.68	5.0	20.5
		15	0	19.24	19.10	19.22	19.46	5.0	20.5

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)				MPR	Tune-up Limit
				26697	26865	27033	26790		
				814.7 MHz	831.5 MHz	848.3 MHz	824 MHz		
1.4 MHz	QPSK	1	0	24.18	24.06	24.28	24.48	0.0	25.5
		1	3	24.23	24.06	24.30	24.49	0.0	25.5
		1	5	24.19	24.06	24.25	24.39	0.0	25.5
		3	0	24.24	24.05	24.26	24.57	0.0	25.5
		3	1	24.22	24.06	24.24	24.45	0.0	25.5
		3	3	24.21	24.04	24.27	24.38	0.0	25.5
		6	0	22.73	22.52	22.70	22.94	1.0	24.5
	16QAM	1	0	23.38	23.27	23.41	23.69	1.0	24.5
		1	3	23.39	23.21	23.52	23.63	1.0	24.5
		1	5	23.35	23.16	23.43	23.56	1.0	24.5
		3	0	23.32	23.12	23.40	23.68	1.0	24.5
		3	1	23.32	23.07	23.42	23.73	1.0	24.5
		3	3	23.31	23.12	23.39	23.70	1.0	24.5
		6	0	22.21	22.14	22.17	22.53	2.0	23.5
	64QAM	1	0	22.35	22.29	22.50	22.63	2.0	23.5
		1	3	22.36	22.32	22.55	22.58	2.0	23.5
		1	5	22.27	22.26	22.48	22.54	2.0	23.5
		3	0	22.28	22.18	22.32	22.54	2.0	23.5
		3	1	22.31	22.21	22.29	22.54	2.0	23.5
		3	3	22.31	22.18	22.33	22.56	2.0	23.5
		6	0	21.18	21.04	21.23	21.42	3.0	22.5
	256QAM	1	0	19.28	19.21	19.38	19.62	5.0	20.5
		1	3	19.26	19.21	19.38	19.61	5.0	20.5
		1	5	19.25	19.18	19.32	19.53	5.0	20.5
		3	0	19.24	19.12	19.33	19.49	5.0	20.5
		3	1	19.23	19.15	19.32	19.46	5.0	20.5
		3	3	19.22	19.15	19.33	19.46	5.0	20.5
		6	0	19.13	19.14	19.27	19.69	5.0	20.5

NR Band n26

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)						
					Measured Pwr (dBm)					MPR	Tune-up Limit
						164800		166300	167800		
						824 MHz		834 MHz	839 MHz		
20 MHz	DFT-s-OFDM	π/2 BPSK	1	1		24.07		24.07	24.38	0.0	25.5
			1	53		24.20		24.38	24.27	0.0	25.5
			1	104		24.37		24.14	24.27	0.0	25.5
			50	0		23.19		23.38	23.44	0.5	25.0
			50	28		24.37		24.39	24.41	0.0	25.5
			50	56		23.50		23.31	23.47	0.5	25.0
			100	0		23.37		23.45	23.46	0.5	25.0
		QPSK	1	1		24.19		24.22	24.56	0.0	25.5
			1	53		24.34		24.46	24.41	0.0	25.5
			1	104		24.46		24.29	24.43	0.0	25.5
			50	0		23.25		23.39	23.49	1.0	24.5
			50	28		24.31		24.41	24.42	0.0	25.5
			50	56		23.48		23.36	23.47	1.0	24.5
			100	0		23.42		23.49	23.48	1.0	24.5
		16QAM	1	1		23.19		23.12	23.59	1.0	24.5
			1	53		23.27		23.48	23.34	1.0	24.5
			1	104		23.42		23.16	23.35	1.0	24.5
		64QAM	1	1		21.89		21.95	22.15	2.5	23.0
		256QAM	1	1		19.23		19.30	19.55	4.5	21.0
	CP-OFDM	QPSK	1	1		22.60		22.61	22.94	1.5	24.0

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)					MPR	Tune-up Limit
					164300	164800		166300	168300		
					821.5 MHz	824 MHz		831.5 MHz	841.5 MHz		
15 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.08	24.20		24.11	24.37	0.0	25.5
			1	40	24.15	24.32		24.30	24.24	0.0	25.5
			1	77	24.23	24.13		24.13	24.31	0.0	25.5
			36	0	23.17	23.23		23.35	23.40	0.5	25.0
			36	22	24.23	23.32		24.32	24.32	0.0	25.5
			36	43	23.30	23.41		23.28	23.37	0.5	25.0
			75	0	23.28	23.32		23.37	23.42	0.5	25.0
		QPSK	1	1	24.16	24.33		24.29	24.44	0.0	25.5
			1	40	24.29	24.46		24.38	24.38	0.0	25.5
			1	77	24.41	24.32		24.28	24.37	0.0	25.5
			36	0	23.21	23.13		23.89	23.44	1.0	24.5
			36	22	24.29	24.36		24.46	24.40	0.0	25.5
			36	43	23.33	23.50		23.83	23.44	1.0	24.5
			75	0	23.26	23.34		24.32	23.43	1.0	24.5
		16QAM	1	1	23.26	23.31		23.15	23.48	1.0	24.5
		64QAM	1	1	21.88	21.96		21.89	22.15	2.5	23.0
		256QAM	1	1	19.29	19.54		19.32	19.57	4.5	21.0
	CP-OFDM	QPSK	1	1	22.73	22.67		22.68	22.91	1.5	24.0

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)					MPR	Tune-up Limit
					163800	164800	165800	166300	168800		
					819 MHz	824 MHz	829 MHz	831.5 MHz	844 MHz		
10 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.01	24.12	24.06	24.03	24.16	0.0	25.5
			1	26	24.06	24.23	24.30	24.23	24.28	0.0	25.5
			1	50	24.03	24.25	24.21	24.13	24.23	0.0	25.5
			25	0	23.20	23.13	23.01	23.23	23.36	0.5	25.0
			25	14	24.16	23.23	23.32	24.31	24.32	0.0	25.5
			25	27	23.20	23.10	23.16	23.26	23.29	0.5	25.0
			50	0	23.19	23.31	23.24	23.28	23.32	0.5	25.0
		QPSK	1	1	24.11	24.12	24.13	24.11	24.24	0.0	25.5
			1	26	24.18	24.13	24.32	24.30	24.32	0.0	25.5
			1	50	24.14	24.26	24.26	24.24	24.29	0.0	25.5
			25	0	23.19	23.36	23.23	23.22	23.40	1.0	24.5
			25	14	24.16	24.22	24.10	24.30	24.30	0.0	25.5
			25	27	23.26	23.33	23.33	23.25	23.33	1.0	24.5
			50	0	23.19	23.26	23.16	23.33	23.36	1.0	24.5
		16QAM	1	1	23.15	23.23	23.23	23.07	23.24	1.0	24.5
		64QAM	1	1	21.81	21.70	21.68	21.83	21.93	2.5	23.0
		256QAM	1	1	19.16	19.01	19.13	19.20	19.27	4.5	21.0
	CP-OFDM	QPSK	1	1	22.76	22.62	22.52	22.55	22.69	1.5	24.0

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)					MPR	Tune-up Limit
					163300	164800	165300	166300	169300		
					816.5 MHz	824 MHz	826.5 MHz	831.5 MHz	846.5 MHz		
5 MHz	DFT-s-OFDM	π/2 BPSK	1	1	23.98	24.00	24.01	24.10	24.16	0.0	25.5
			1	13	24.06	24.06	24.03	24.23	24.13	0.0	25.5
			1	23	24.03	24.00	24.11	24.20	24.11	0.0	25.5
			12	0	23.13	23.09	23.09	23.23	23.26	0.5	25.0
			12	7	24.06	24.01	23.14	24.26	24.20	0.0	25.5
			12	13	23.15	23.02	23.24	23.30	23.20	0.5	25.0
			25	0	23.23	23.12	23.30	23.29	23.24	0.5	25.0
		QPSK	1	1	24.14	24.00	24.01	24.19	24.26	0.0	25.5
			1	13	24.29	24.06	24.22	24.31	24.24	0.0	25.5
			1	23	24.23	23.99	24.29	24.33	24.25	0.0	25.5
			12	0	23.15	23.11	23.10	23.23	23.26	1.0	24.5
			12	7	24.16	24.04	24.12	24.31	24.25	0.0	25.5
			12	13	23.22	23.06	23.20	23.27	23.23	1.0	24.5
			25	0	23.22	23.10	23.21	23.26	23.24	1.0	24.5
		16QAM	1	1	23.14	23.05	23.05	23.21	23.19	1.0	24.5
		64QAM	1	1	21.86	21.27	21.63	21.91	21.93	2.5	23.0
		256QAM	1	1	19.11	19.20	19.21	19.26	19.24	4.5	21.0
	CP-OFDM	QPSK	1	1	22.60	22.55	22.45	22.65	22.69	1.5	24.0

8.2. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to either CMW500 Test Set or E7515B Test set and configured to operate at maximum power. The PAR were measured on the Spectrum Analyzer.

Test Spec

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

NOTE

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

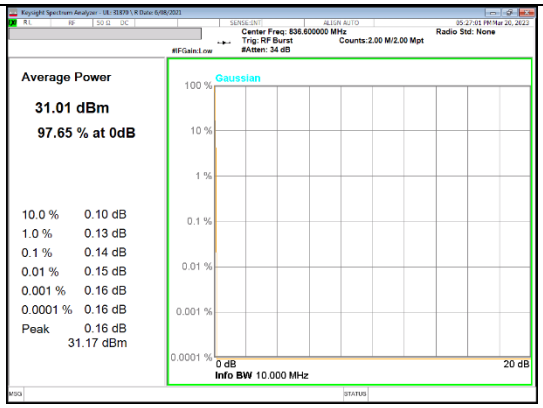
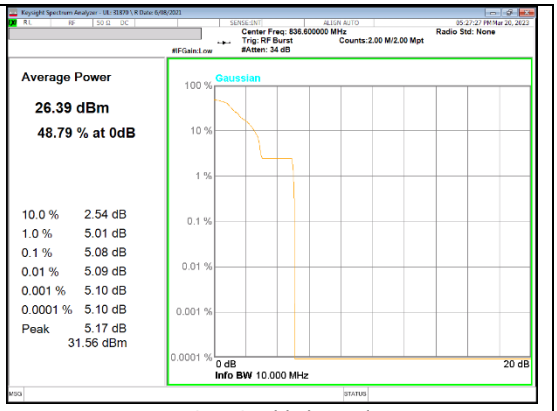
RESULTS

See the following pages.

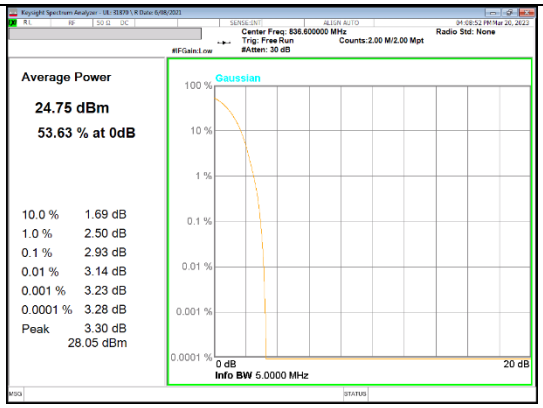
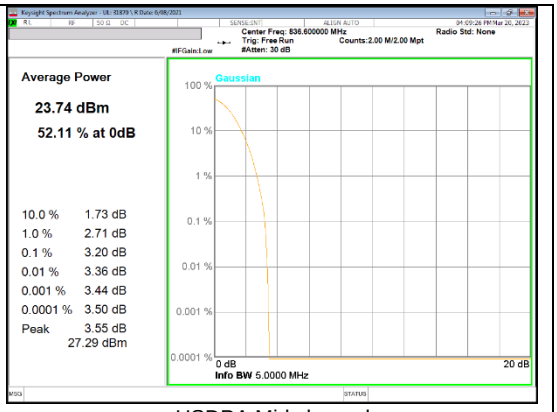
UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

8.2.1. CONDUCTED PEAK TO AVERAGE RESULT

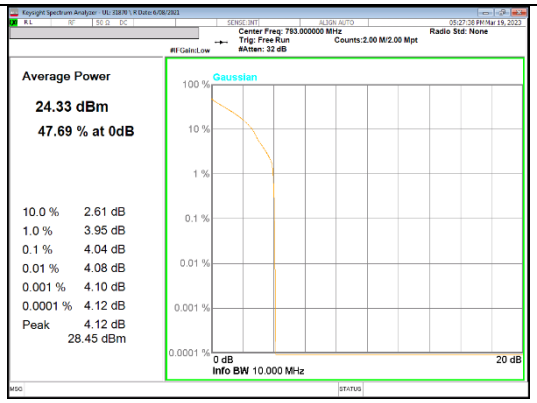
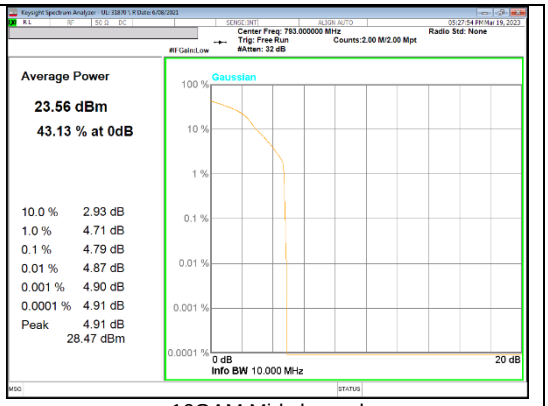
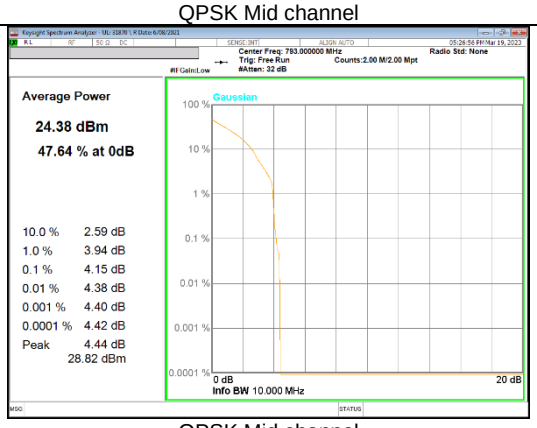
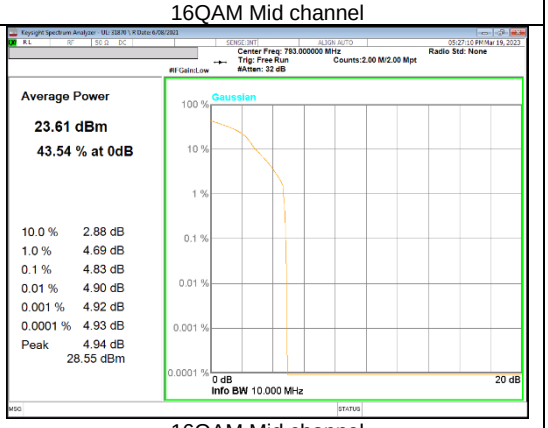
GSM

GSM 850	 GPRS Mid channel	 EGPRS Mid channel

WCDMA

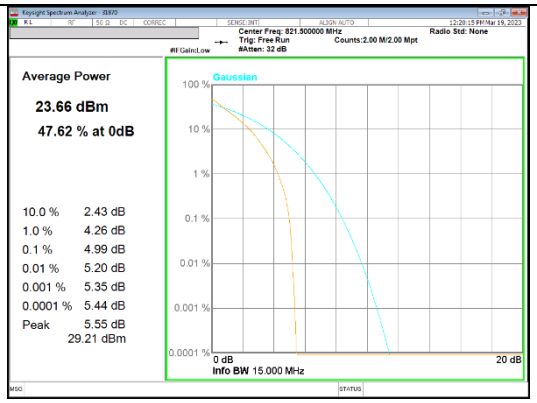
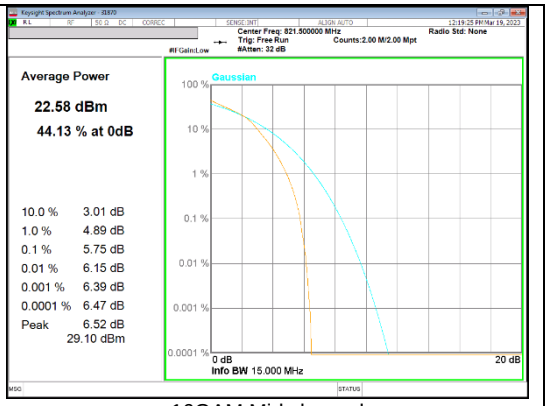
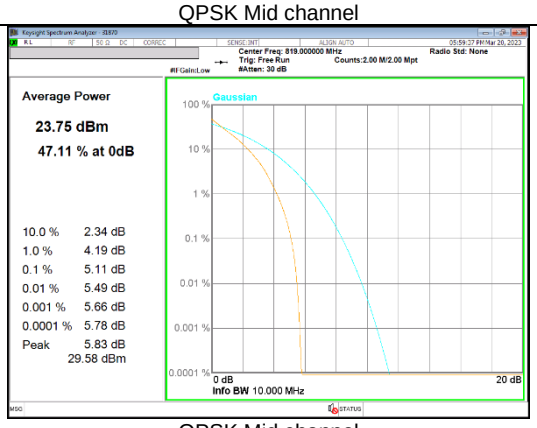
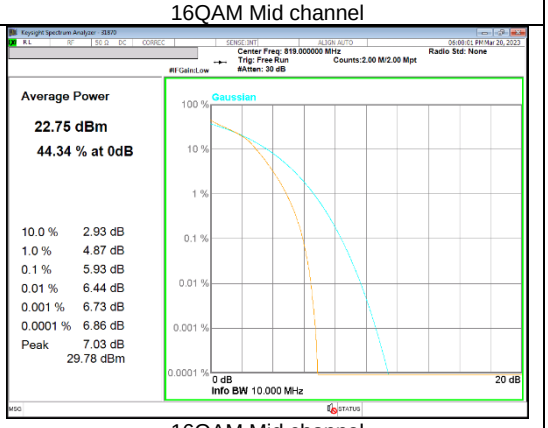
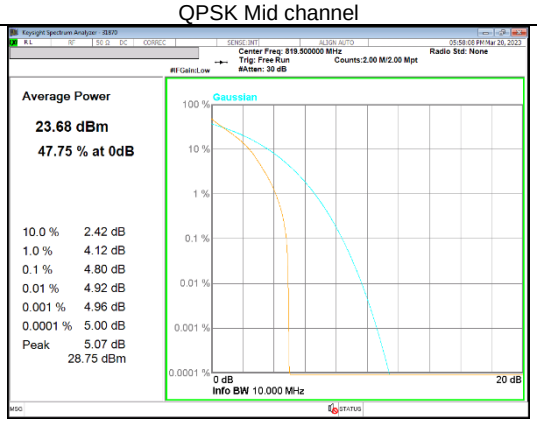
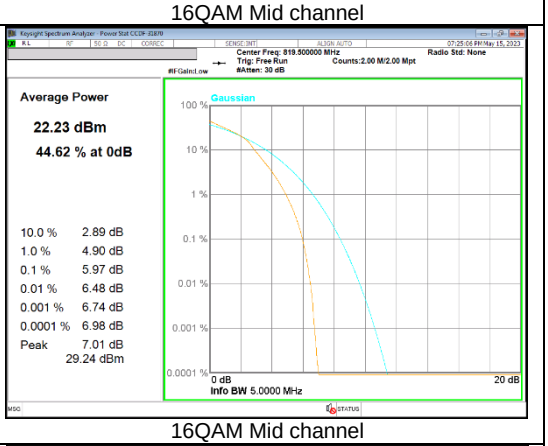
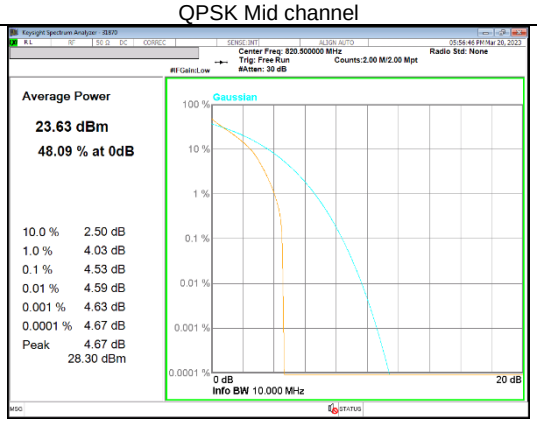
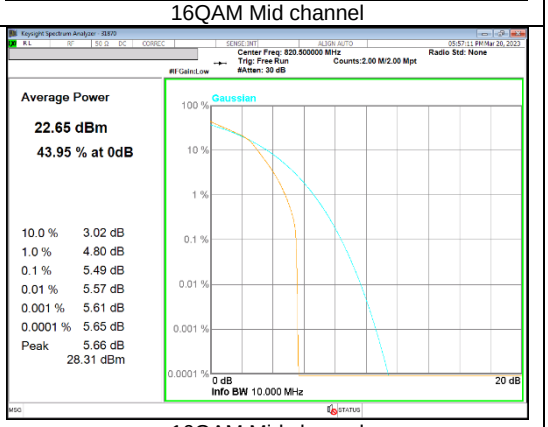
Band 5	 REL99 Mid channel	 HSDPA Mid channel

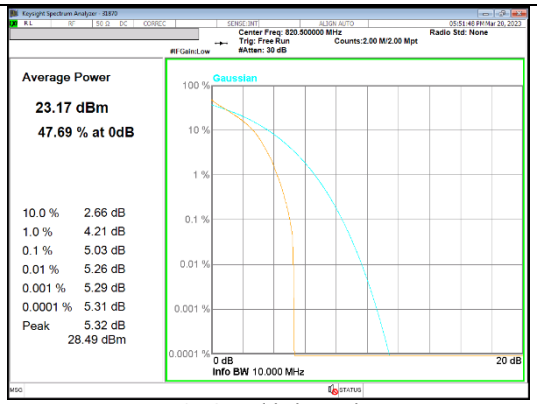
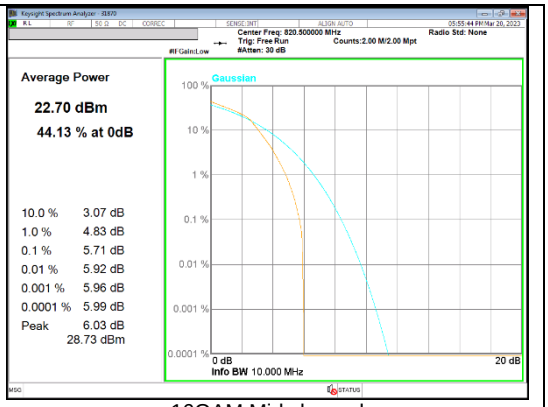
LTE Band 14

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

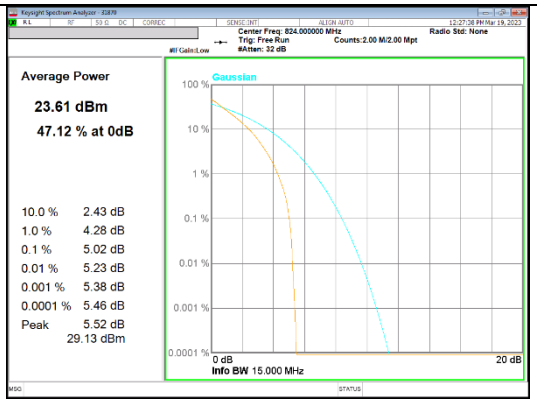
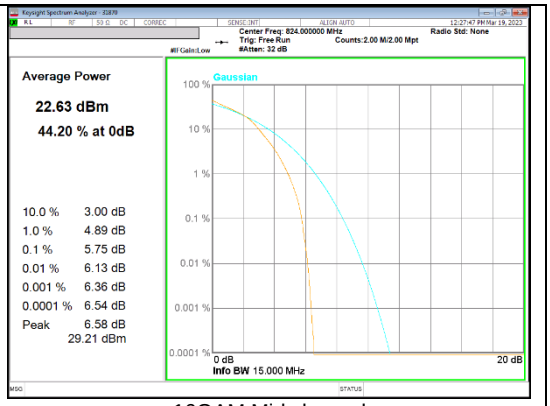
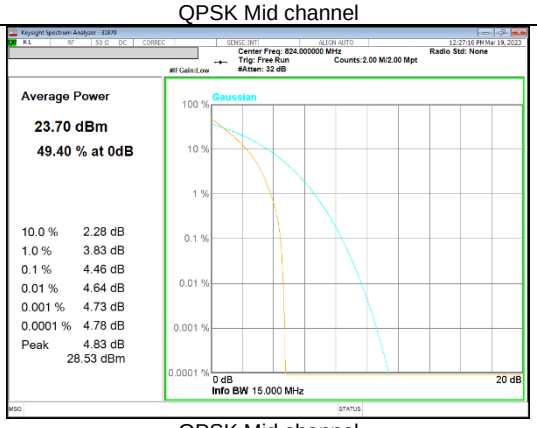
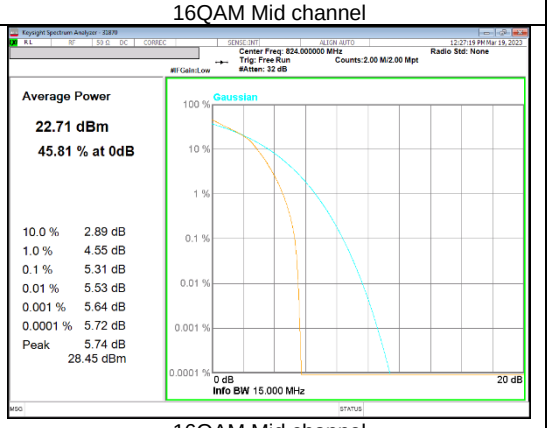
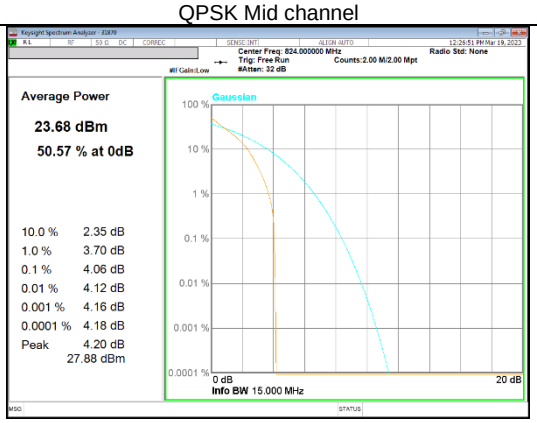
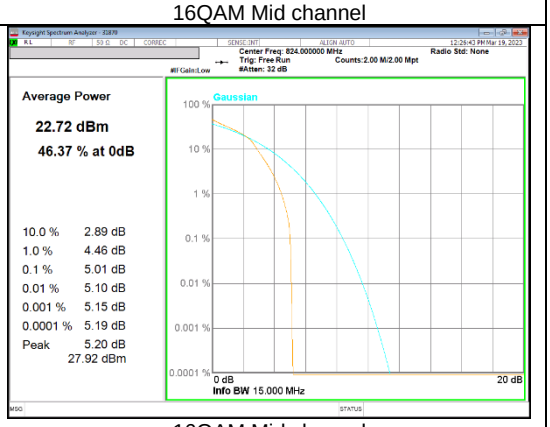
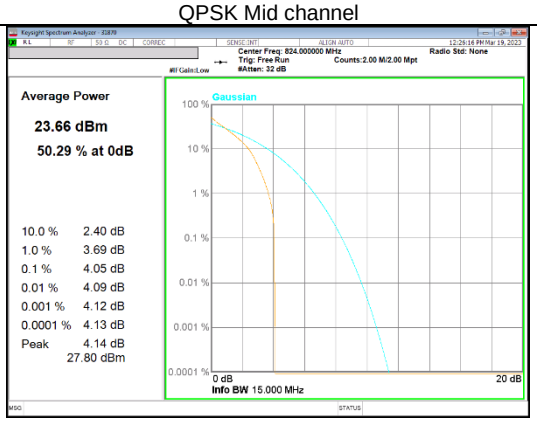
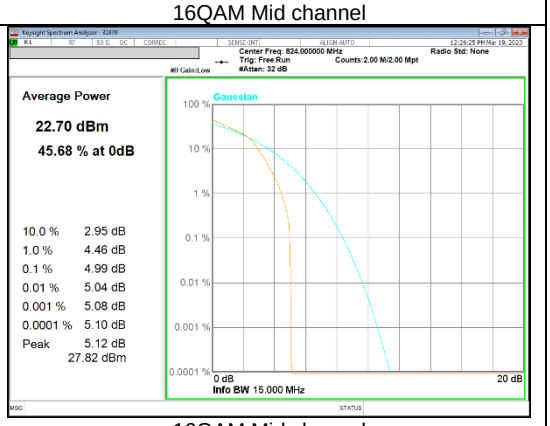
UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

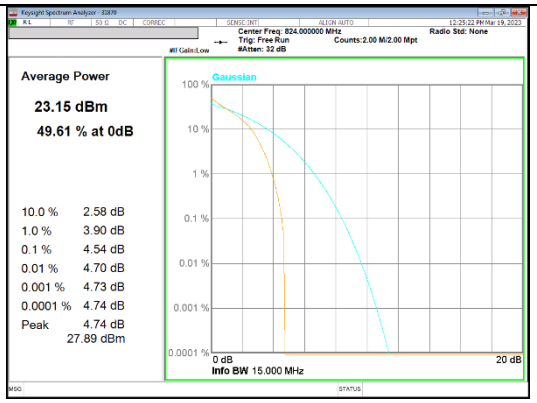
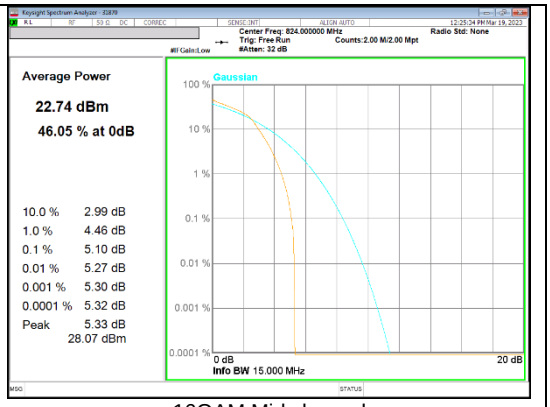
LTE Band 26 (Part 90)

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

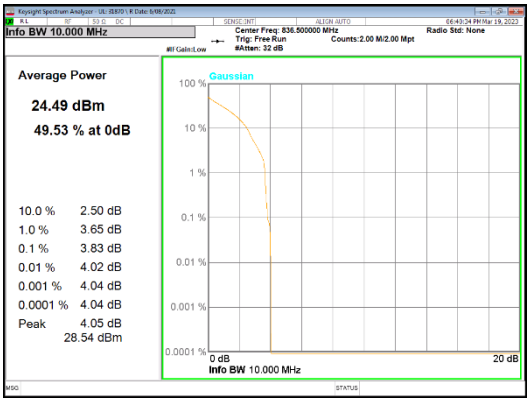
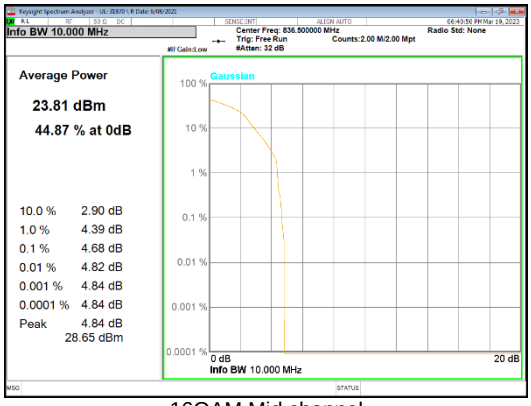
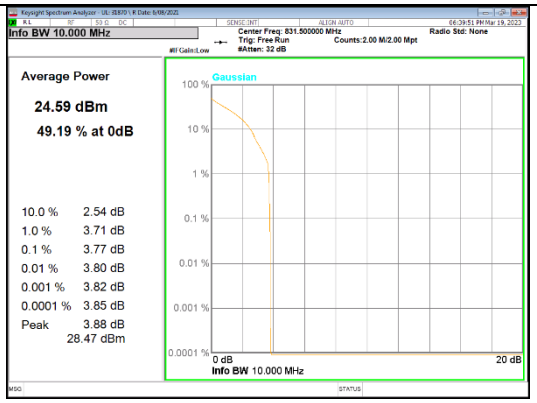
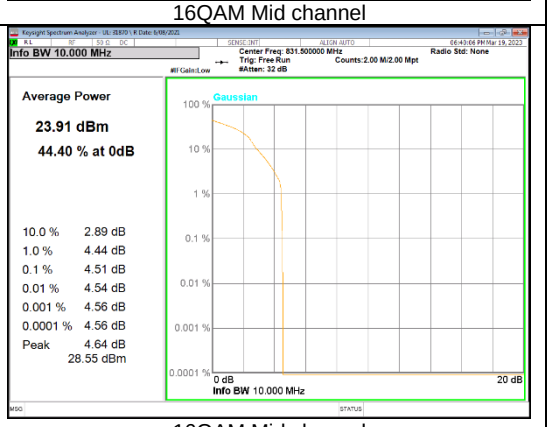
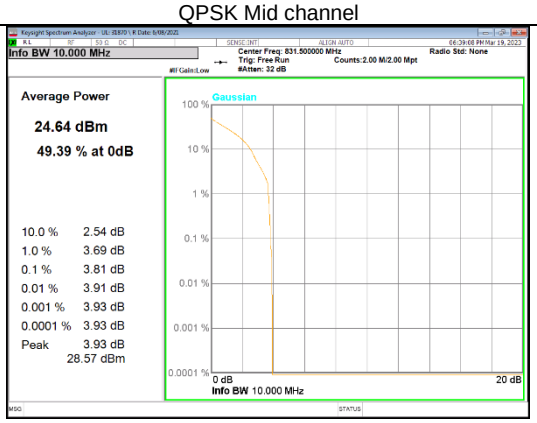
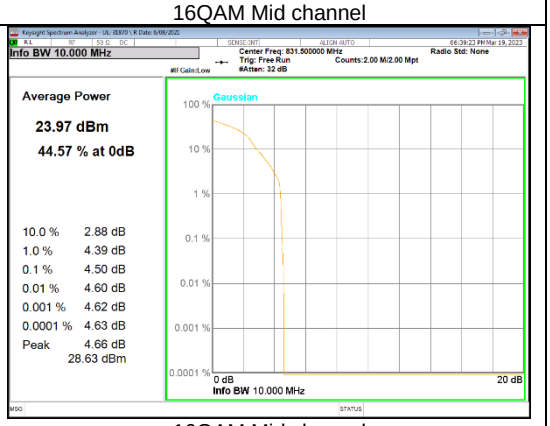
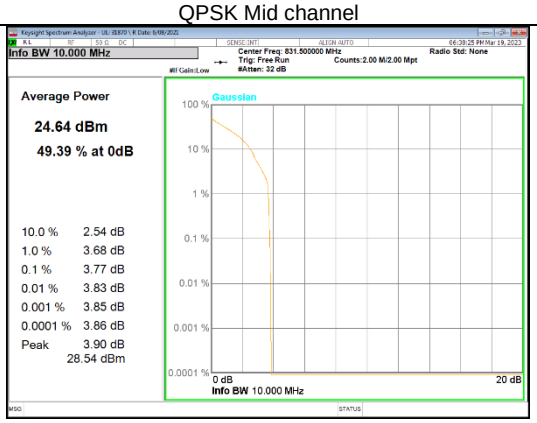
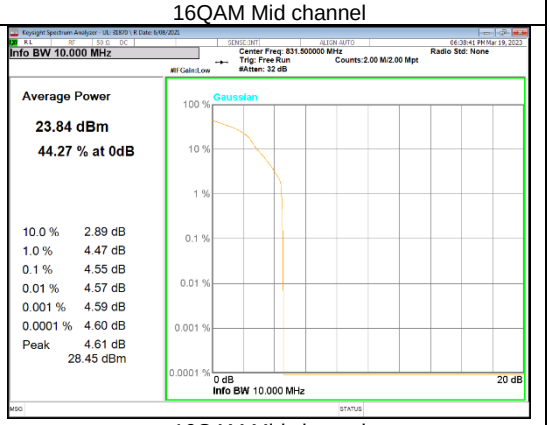
1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

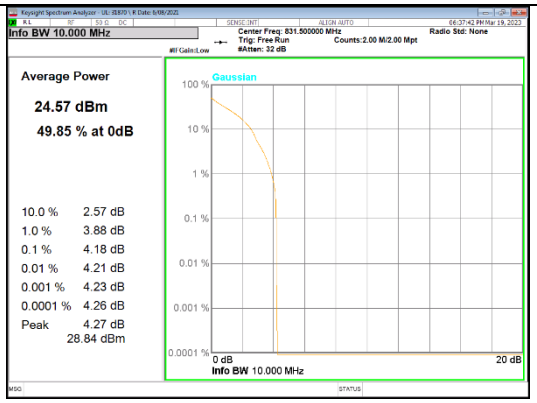
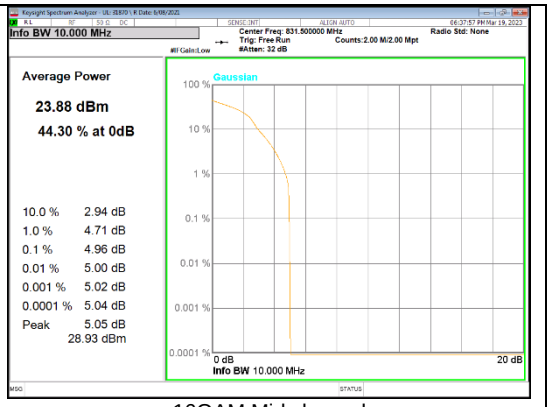
LTE Band 26 (Straddle)

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

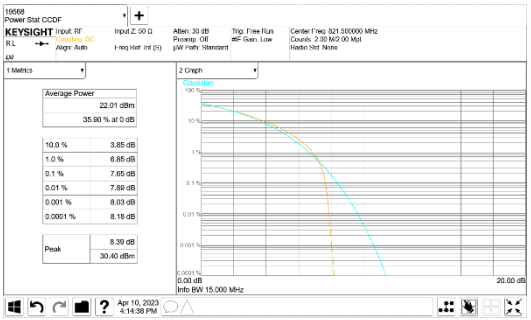
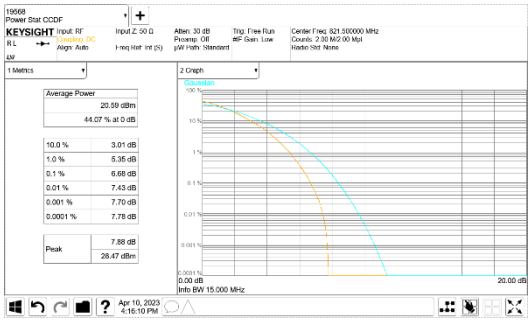
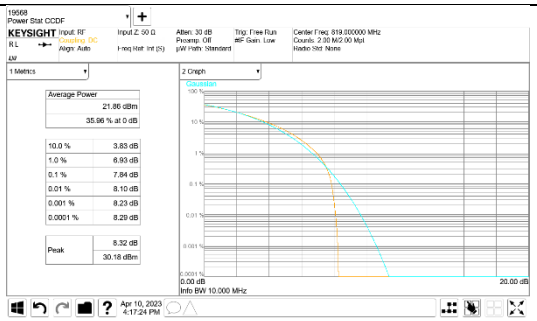
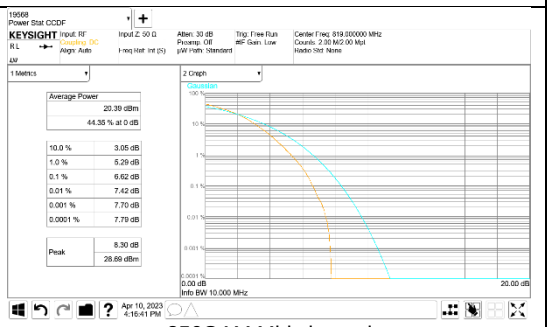
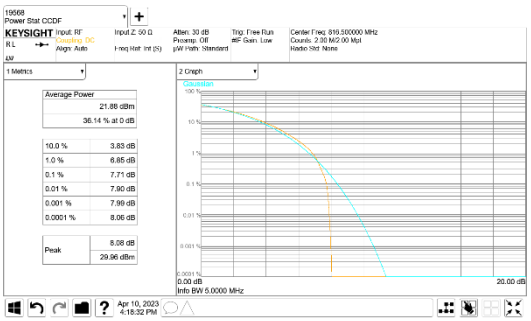
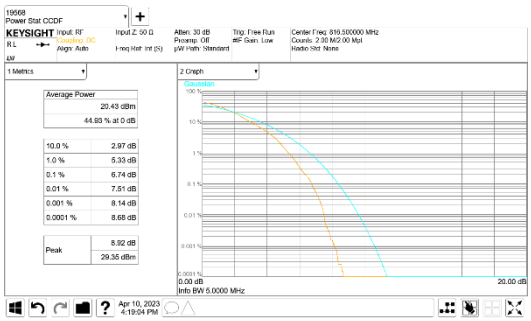
1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

LTE Band 26 (Part 22)

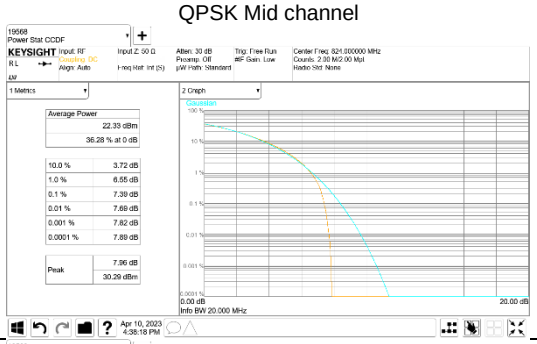
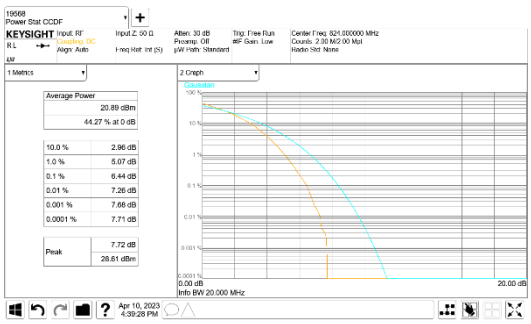
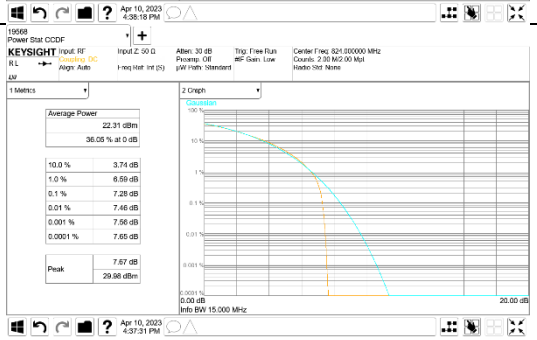
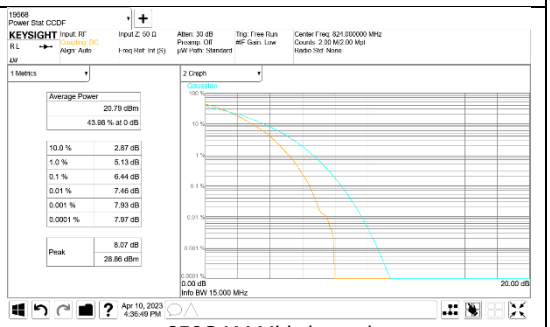
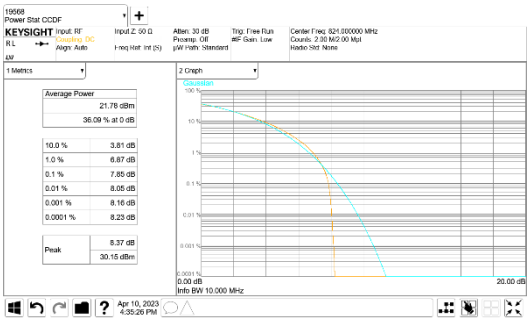
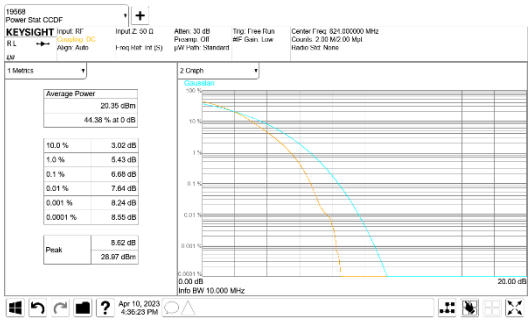
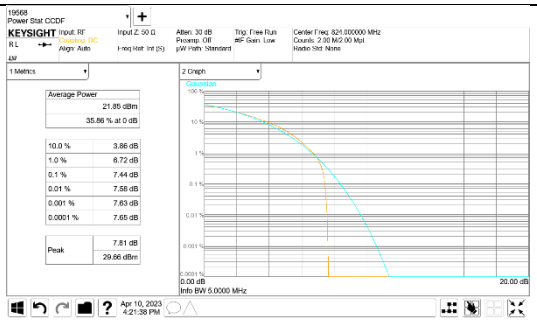
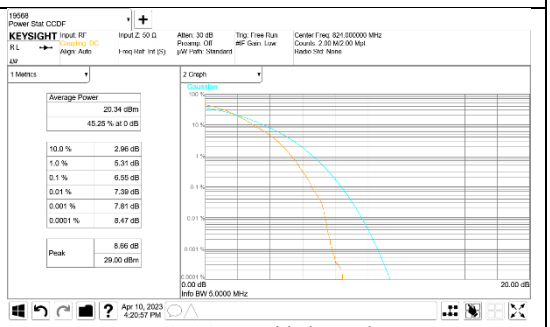
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel

1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

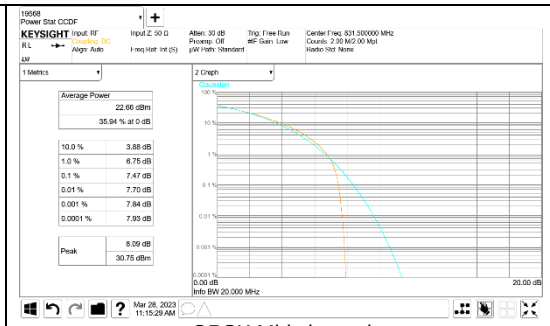
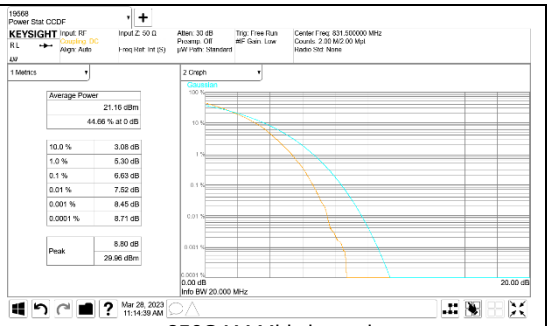
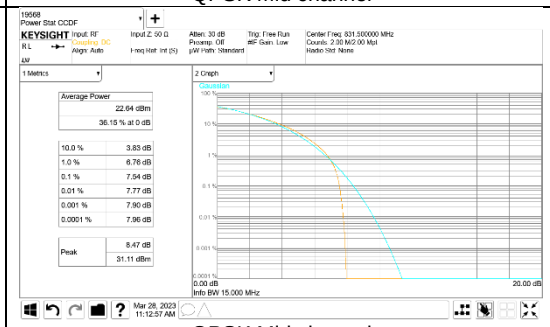
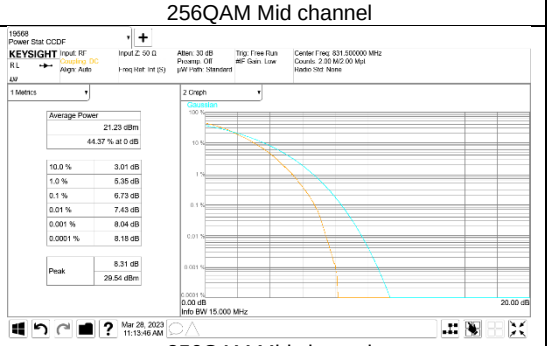
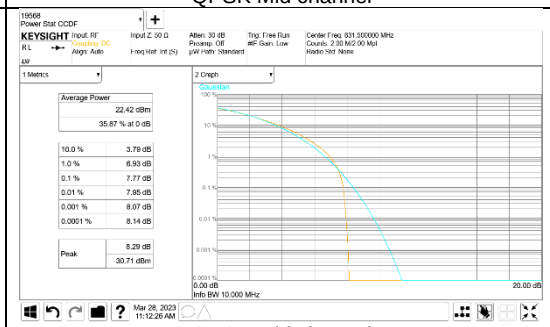
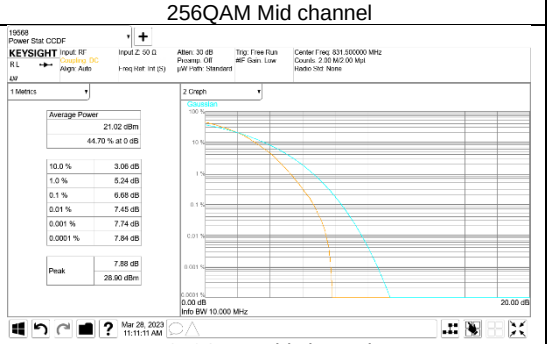
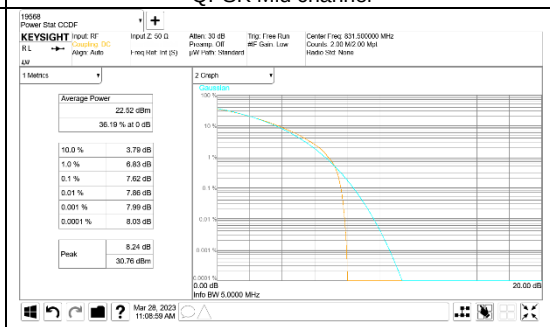
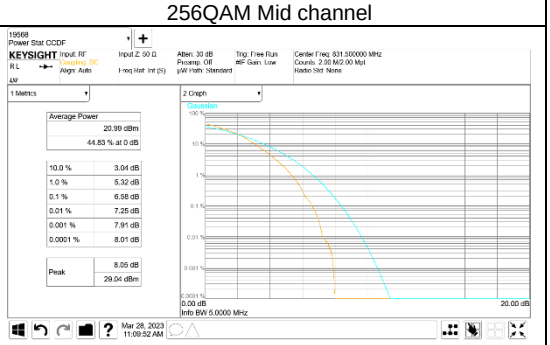
NR Band n26 (Part 90) CP-OFDM

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

NR Band n26 (Straddle) 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 n26 (Part 22) 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

8.3. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at middle channel in each band. The -26dB bandwidth was also measured and recorded.

(KDB 971168 D01 Power Meas License Digital Systems v03r01)

RESULTS

See the following pages.

- **GSM**

Band	Modulation	f [MHz]	99% BW (kHz)	-26dB BW (kHz)
850	GPRS	836.6	245.67	308.6
	EGPRS		237.55	295.0

- **WCDMA**

Band	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
B5	Rel.99	836.6	4.138	4.67
	HSDPA		4.145	4.66

- LTE Band 5B (UL CA)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
5B	20M	QPSK	836.5	18.106	19.63
		16QAM		18.012	19.63
	15M	QPSK	833.4	13.557	14.40
		16QAM		13.547	14.36
	8M	QPSK	836.5	7.529	7.86
		16QAM		7.284	7.92

- LTE Band 14

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B14	10M	QPSK	793.0	8.942	9.85
		16QAM		8.935	9.91
	5M	QPSK		4.491	5.04
		16QAM		4.502	5.12

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

- LTE Band 26 (Part 90)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	819.0	13.422	14.44
		16QAM		13.405	14.56
	10M	QPSK	819.0	8.981	9.68
		16QAM		8.943	9.72
	5M	QPSK	819.5	4.491	5.10
		16QAM		4.483	5.12
	3M	QPSK	820.5	2.684	3.04
		16QAM		2.686	2.99
	1.4M	QPSK	820.5	1.089	1.34
		16QAM		1.092	1.33

- LTE Band 26 (Straddle)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	824.0	13.385	14.59
		16QAM		13.382	14.64
	10M	QPSK		8.958	9.85
		16QAM		8.955	9.80
	5M	QPSK		4.486	5.03
		16QAM		4.483	5.08
	3M	QPSK		2.692	3.03
		16QAM		2.694	2.99
	1.4M	QPSK		1.087	1.34
		16QAM		1.090	1.35

- LTE Band 26 (Part 22)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	836.5	13.402	14.76
		16QAM		13.411	14.79
	10M	QPSK	831.5	8.973	9.89
		16QAM		8.972	9.86
	5M	QPSK	831.5	4.499	5.10
		16QAM		4.499	5.06
	3M	QPSK	831.5	2.697	3.03
		16QAM		2.700	3.01
	1.4M	QPSK	831.5	1.092	1.33
		16QAM		1.095	1.34

- NR Band n26 (Part 90)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n26	15M	QPSK	821.5	14.097	14.99
		16QAM		14.094	15.10
	10M	QPSK	819.0	9.280	10.11
		16QAM		9.285	10.05
	5M	QPSK	816.5	4.482	5.20
		16QAM		4.482	5.20

- NR Band n26 (Straddle)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n26	20M	QPSK	824.0	18.851	19.82
		16QAM		18.913	19.79
	15M	QPSK		14.086	15.03
		16QAM		14.048	14.97
	10M	QPSK		9.294	10.11
		16QAM		9.303	10.22
	5M	QPSK		4.475	5.20
		16QAM		4.481	5.14

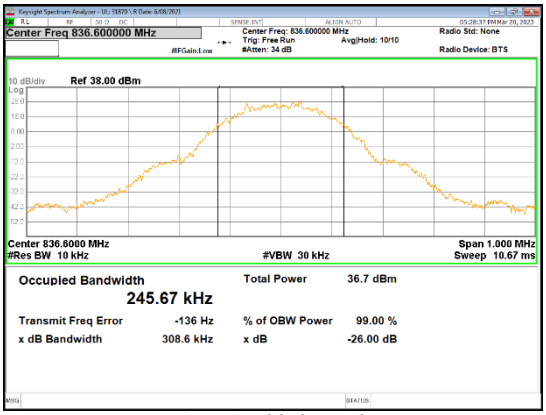
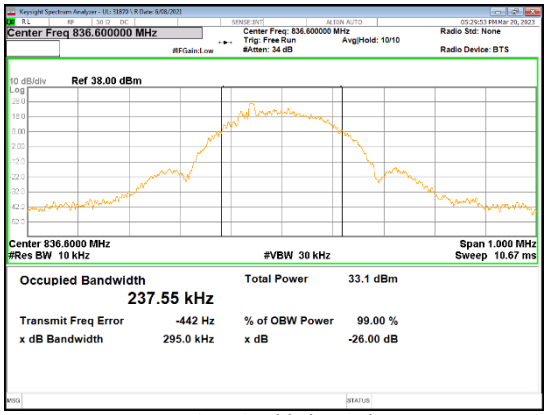
- NR Band n26 (Part 22)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n26	20M	QPSK	836.5	18.931	19.94
		16QAM		18.890	19.95
	15M	QPSK	836.5	14.104	14.93
		16QAM		14.130	15.10
	10M	QPSK	831.5	9.330	10.14
		16QAM		9.295	10.05
	5M	QPSK	831.5	4.475	5.21
		16QAM		4.496	5.17

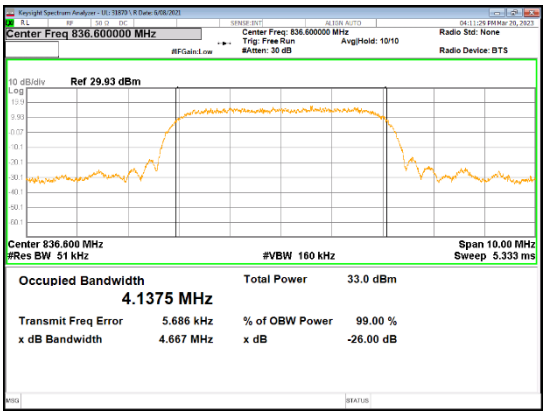
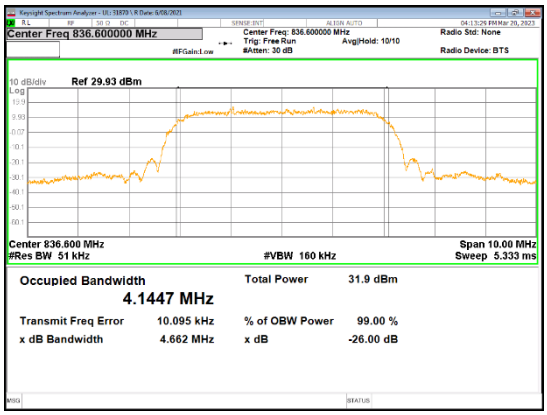
UL KOREA LTD. Suwon Laboratory FORM ID: FCC_22/90(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

8.3.1. OCCUPIED BANDWIDTH RESULTS

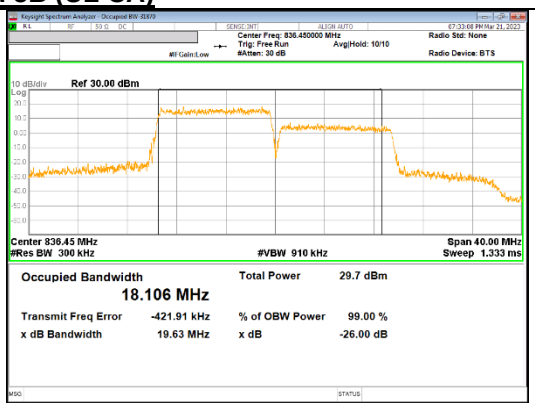
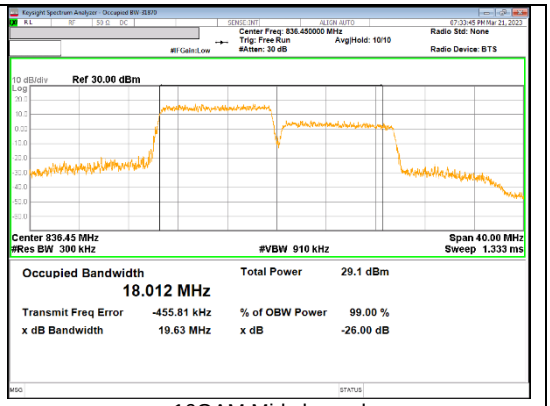
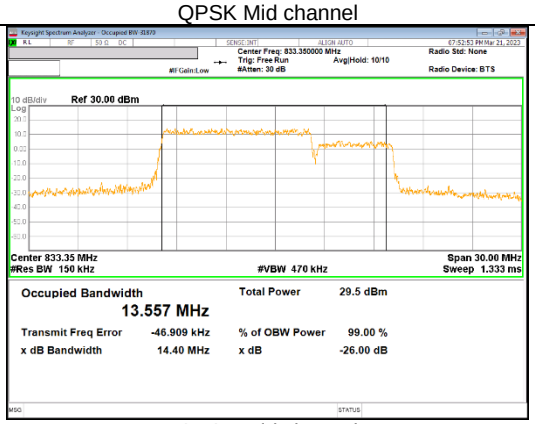
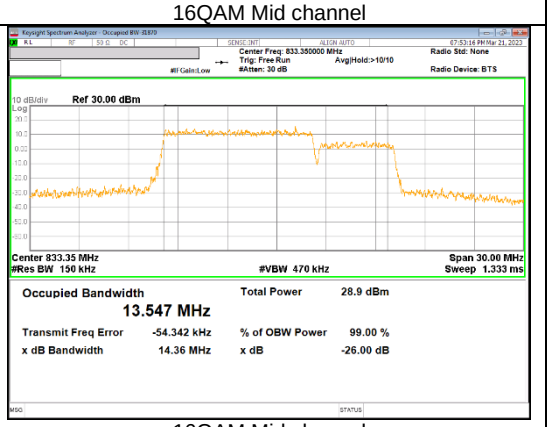
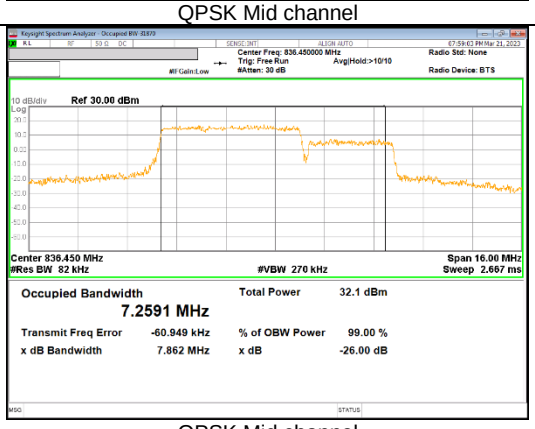
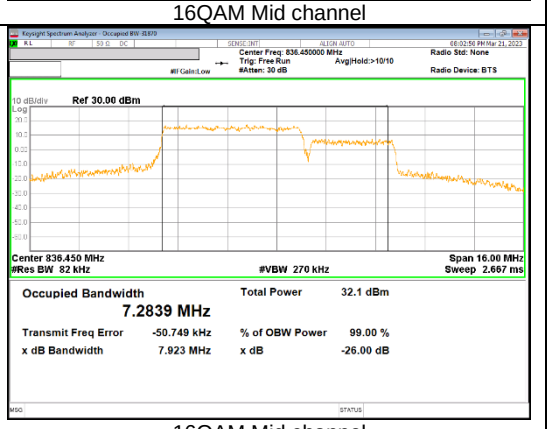
GSM 850

GSM 850	 GPRS Mid channel	 EGPRS Mid channel

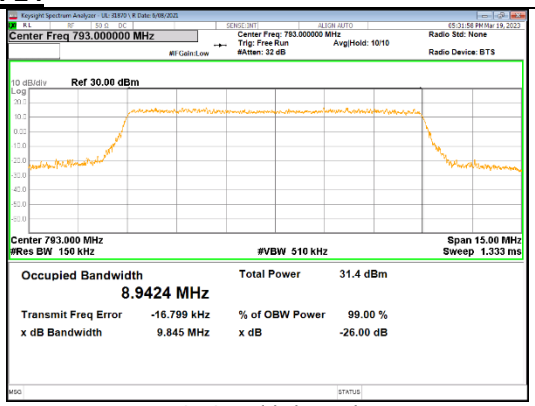
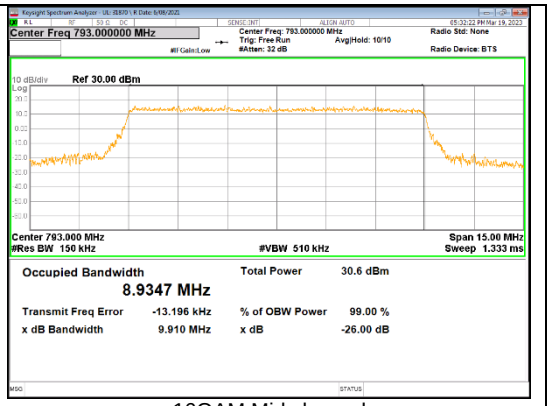
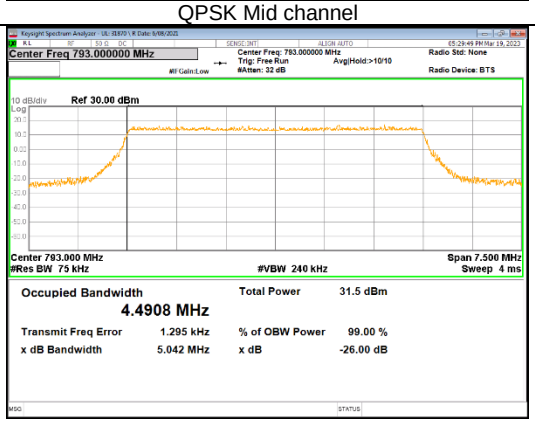
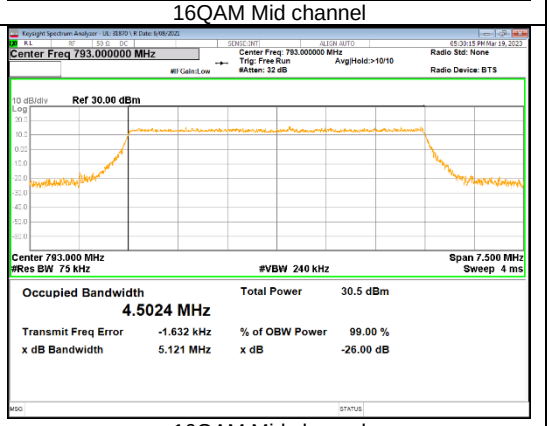
WCDMA Band 5

Band 5	 REL99 Mid channel	 HSDPA Mid channel

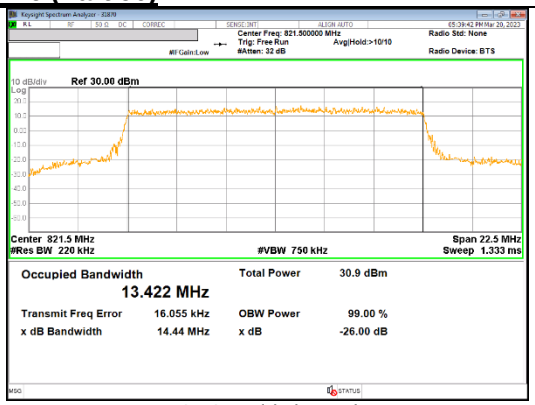
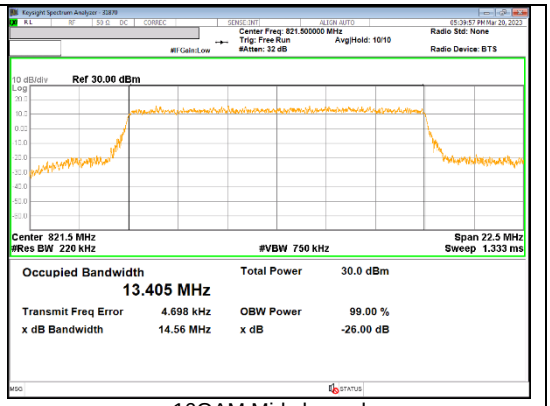
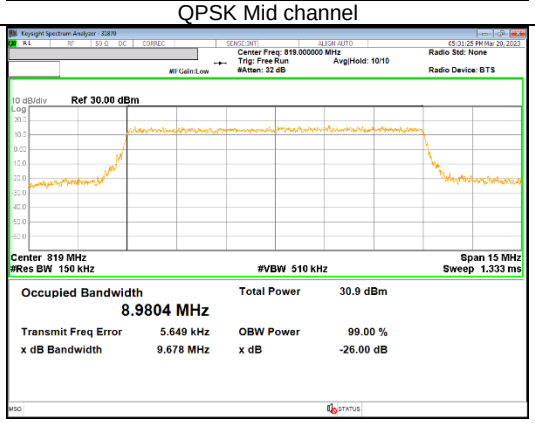
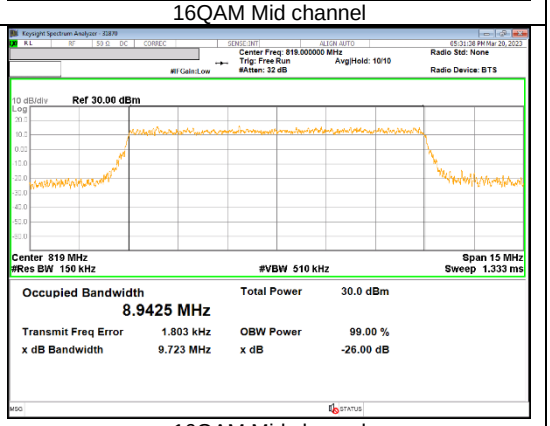
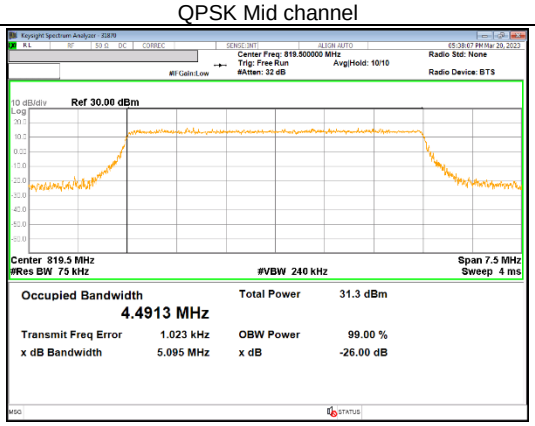
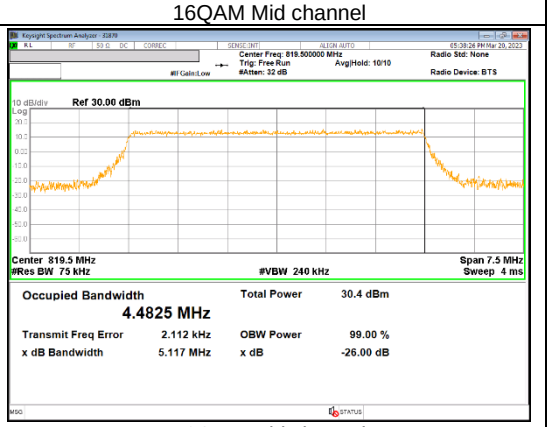
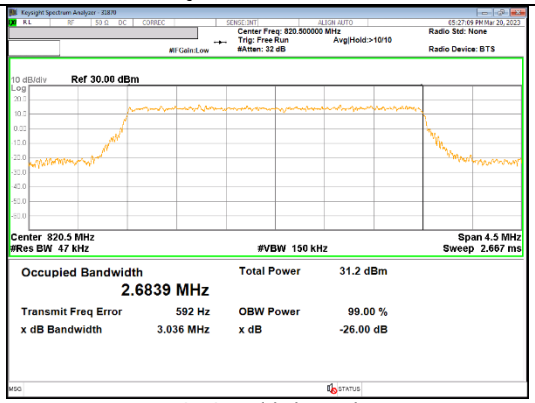
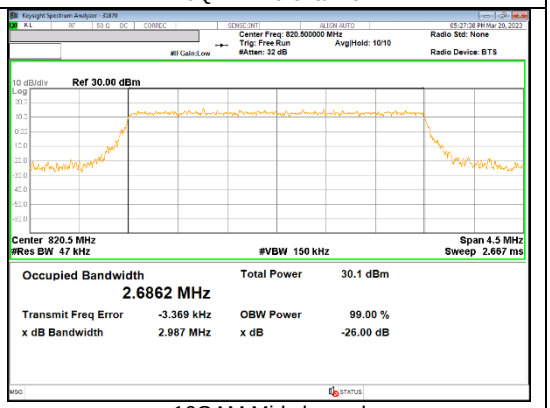
LTE Band 5B (UL CA)

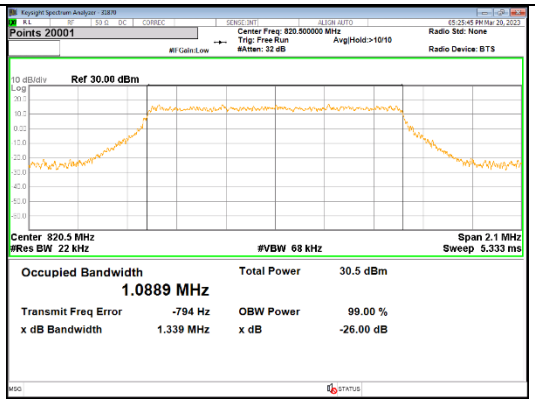
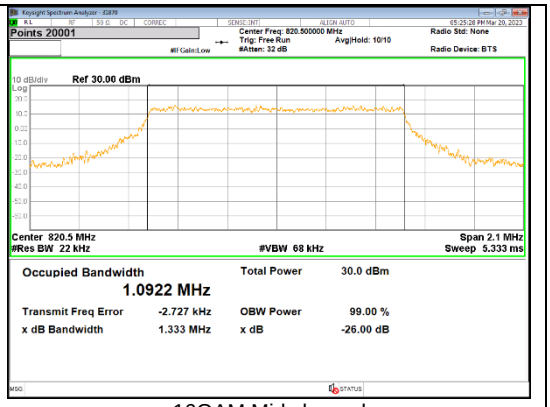
20MHz	 QPSK Mid channel	 16QAM Mid channel
15MHz	 QPSK Mid channel	 16QAM Mid channel
8MHz	 QPSK Mid channel	 16QAM Mid channel

LTE Band 14

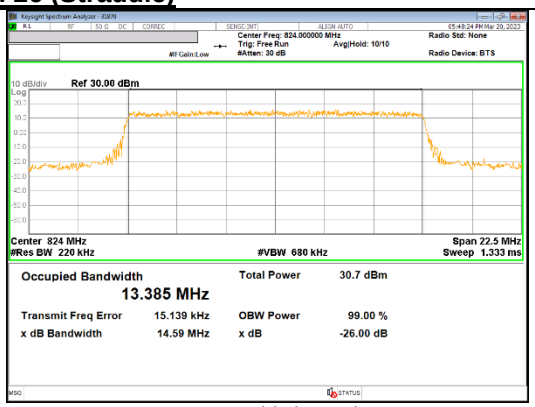
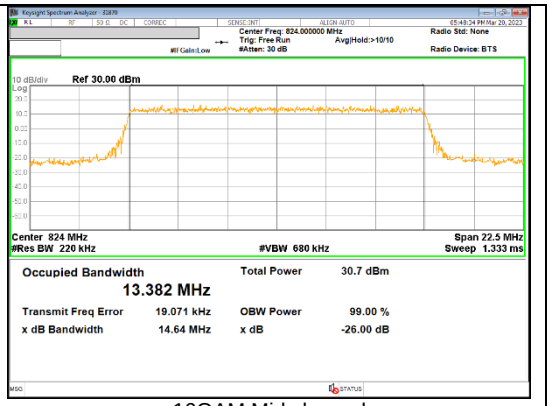
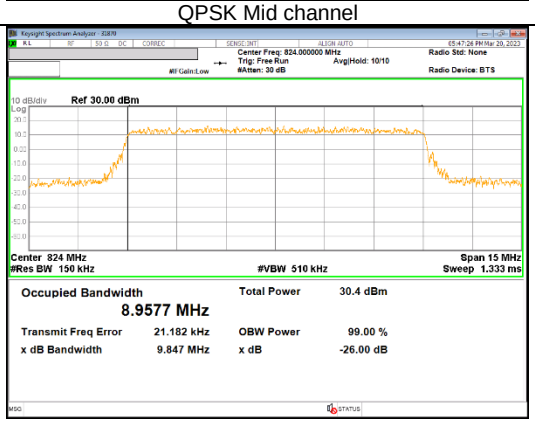
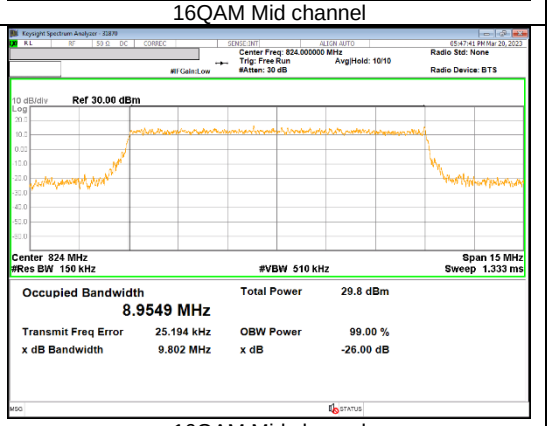
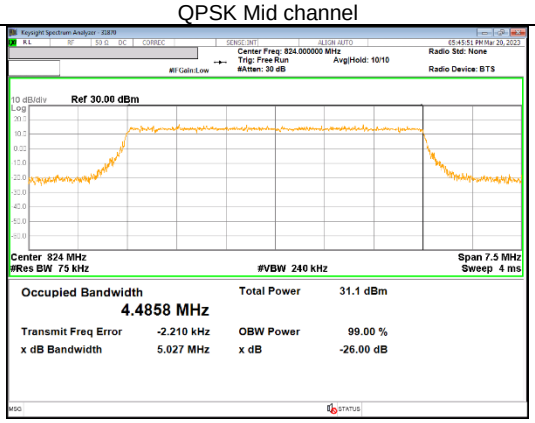
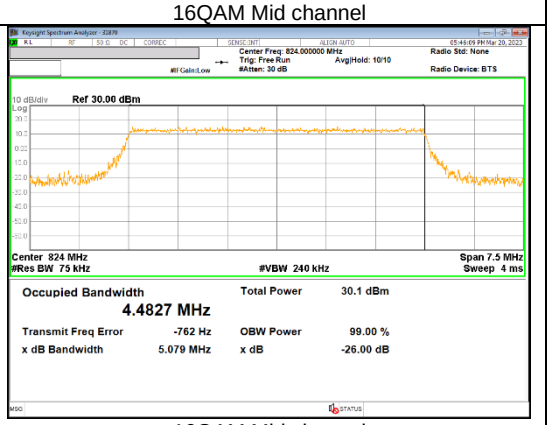
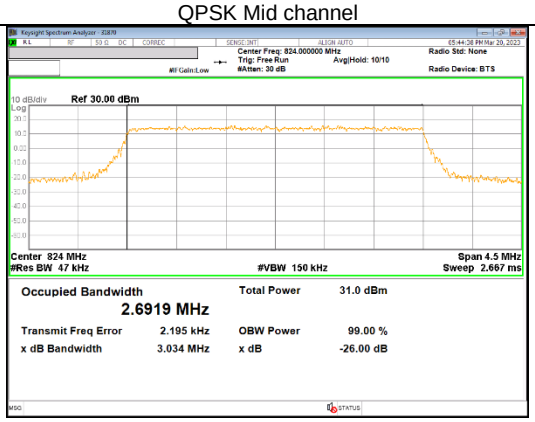
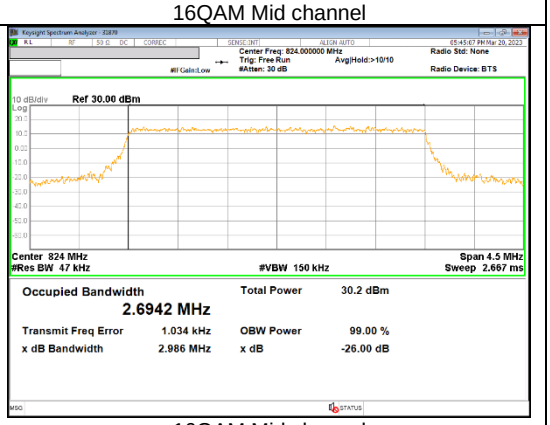
10MHz	 QPSK Mid channel	 16QAM Mid channel
5MHz	 QPSK Mid channel	 16QAM Mid channel

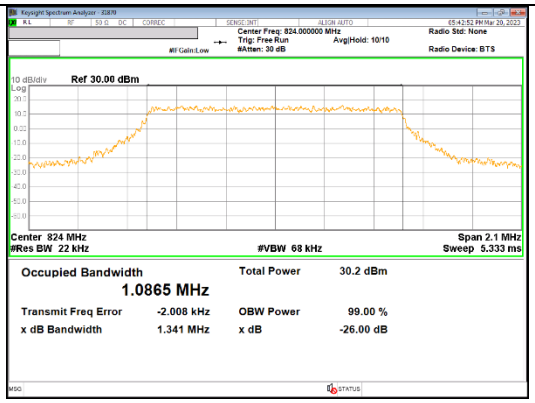
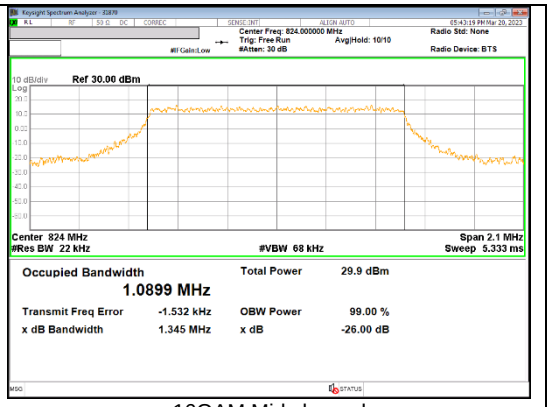
LTE Band 26 (Part 90)

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

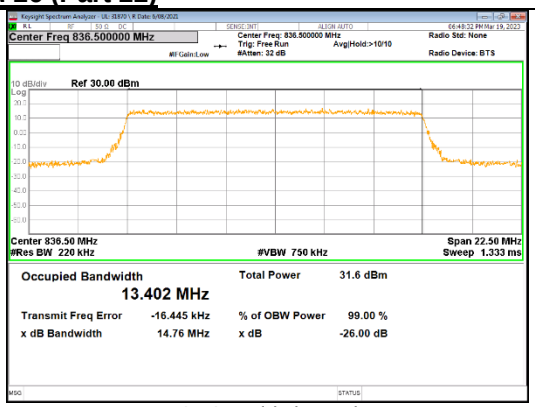
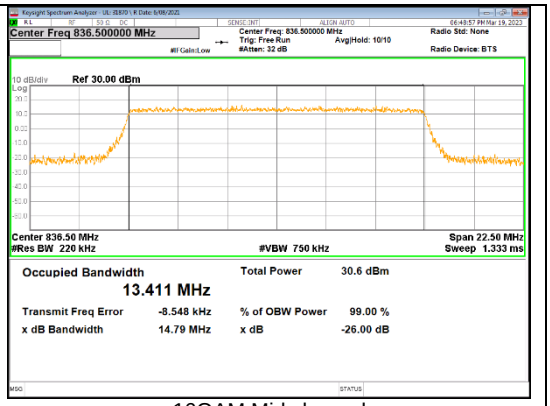
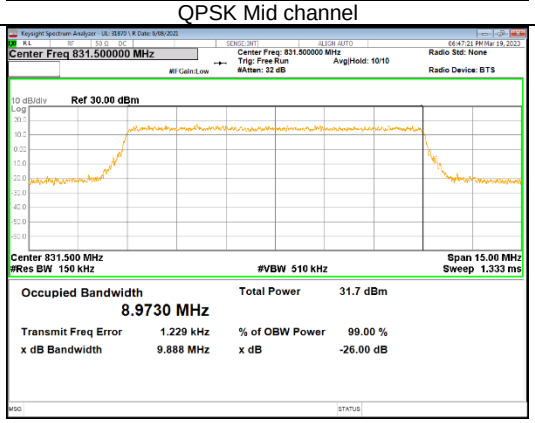
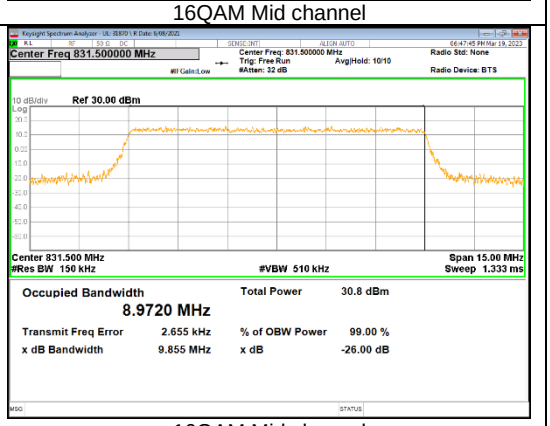
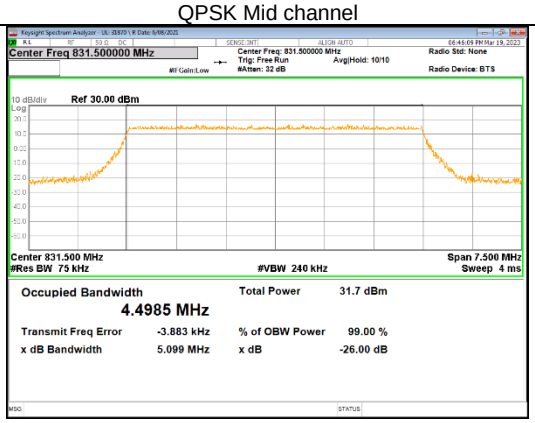
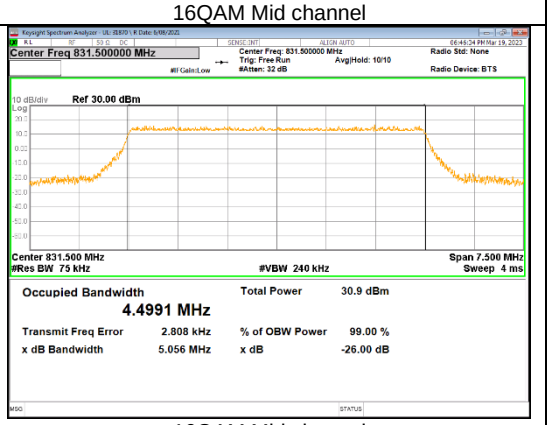
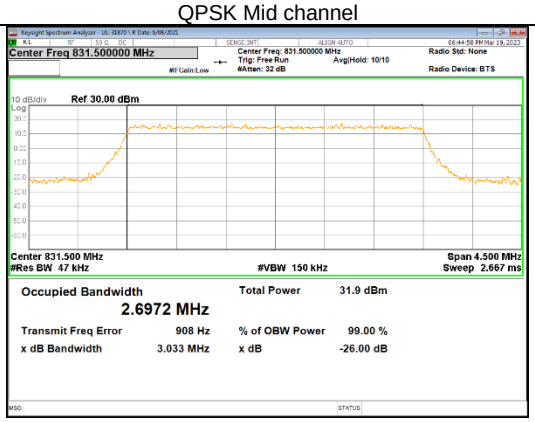
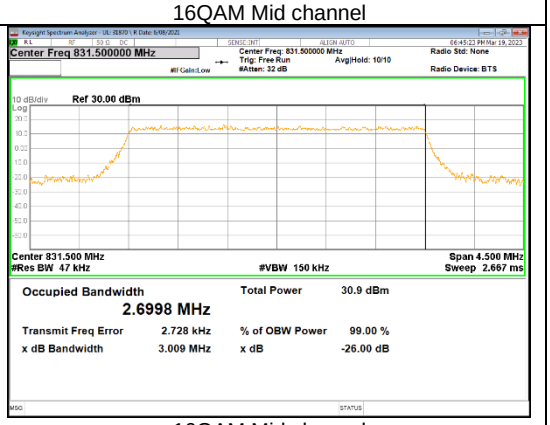
1.4MHz	 QPSK Mid channel	 16QAM Mid channel

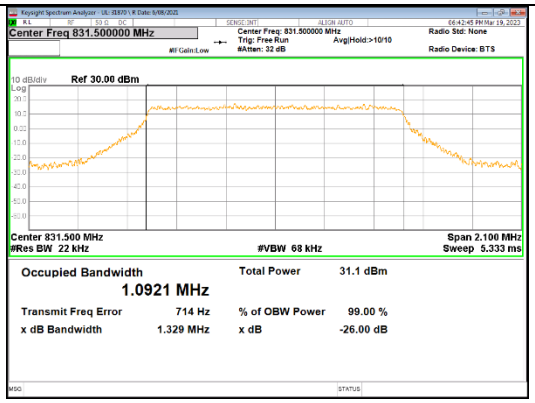
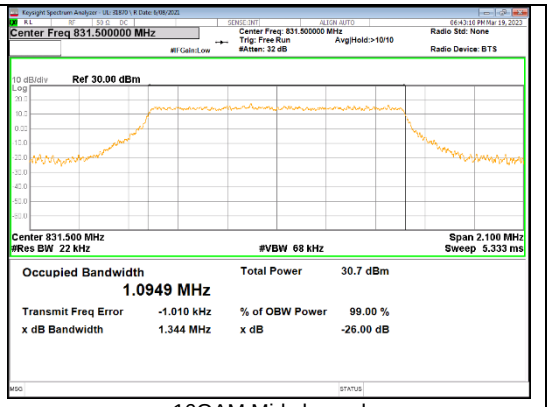
LTE Band 26 (Straddle)

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

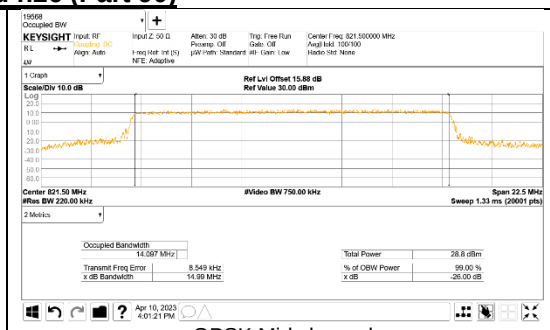
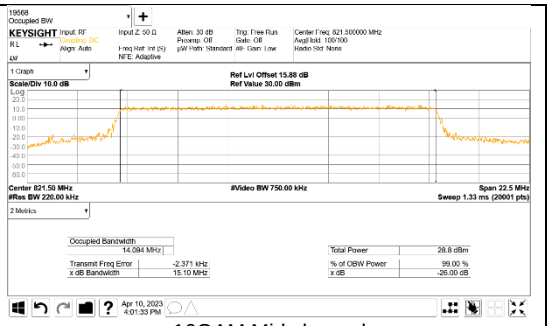
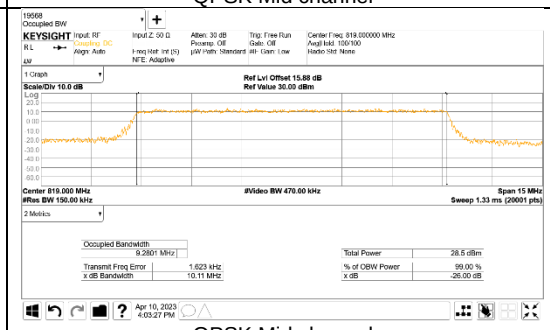
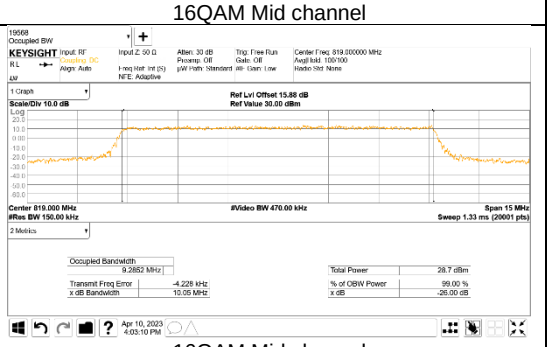
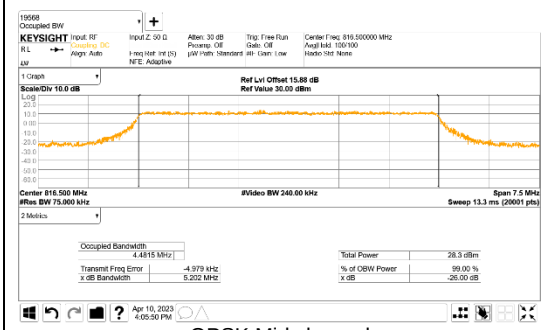
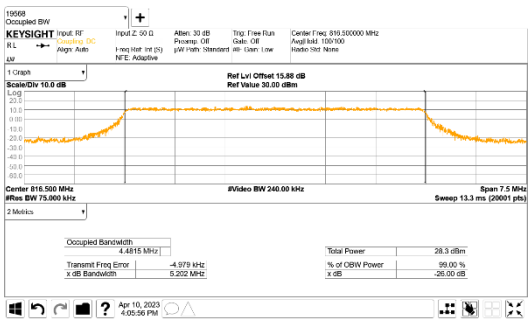
1.4MHz		
	QPSK Mid channel	16QAM Mid channel

LTE Band 26 (Part 22)

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

1.4MHz		
	QPSK Mid channel	16QAM Mid channel

NR Band n26 (Part 90)

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