CERTIFICATION TEST REPORT

Report Number. : 4791196575-E5V3

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-F956U, SM-F956U1
FCC ID	:	A3LSMF956U
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 96

Date Of Issue:
2024-05-07

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	2024-04-29	Initial issue	Yeonghwan Hong
V2	2024-05-05	Updated to address TCB's question	Yeonghwan Hong
V3	2024-05-07	Updated to address TCB's question	Yeonghwan Hong

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(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_96(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-F956U, SM-F956U1
SERIAL NUMBER:	R3CX10W6A5R (CONDUTED); R3CX10W662L, R3CX10W66ZL, R3CX10W668D (RADIATED);
DATE TESTED:	2024-02-16 - 2024-04-29

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 96	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:

Yeonghwan Hong
Suwon Lab Engineer
UL KOREA LTD.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(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 47 CFR Part 2.
2. FCC 47 CFR Part 96.
3. ANSI TIA-603-E, 2016
4. ANSI C63.26, 2015
5. KDB 971168 D01 Power Meas License Digital Systems v03r01
6. KDB 412172 D01 Determining ERP and EIRP v01r01
7. KDB 940660 D01 Part 96 CBRS v03
8. WINNF-TS-0122-v1.0.2.
9. KDB 648474 D03 Wireless Chargers Battery Cover v01r04

3. FACILITIES AND ACCREDITATION

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

218 Maeyeong-ro
☒ Chamber 1(3m semi-anechoic chamber)
☒ Chamber 2(3m semi-anechoic chamber)
☐ Chamber 3(3m semi-anechoic chamber)
☒ Chamber 4(3m Full-anechoic chamber)
☐ Chamber 5(3m Full-anechoic chamber)

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

EIRP = SG reading with EUT worst orientation (dBm) - cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

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	2.79 dB
Radiated Disturbance, 9 kHz to 30 MHz	1.69 dB
Radiated Disturbance, 30 MHz to 1 GHz	4.07 dB
Radiated Disturbance, 1 GHz to 18 GHz	4.99 dB
Radiated Disturbance, Above 18 GHz	5.96 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 Clause 4.3.3 in IEC Guide 115:2023.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(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-F956U1
SM-F956U	Hardware	Same as SM-F956U
	Software	Different UI

The model SM-S956U was used for final testing and is representative of the test results in this report

The test utility software used during testing was WINNF-TS-0122 V1.0.2

5.2. MAXIMUM OUTPUT POWER

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

LTE Band 48

FCC Part 96							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted (ANT E)		Radiated (ANT E)	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 48	3560.00 ~ 3690.00	20	QPSK	21.81	151.71	21.14	130.02
			16QAM	21.29	134.59	20.54	113.24
			64QAM	20.12	102.80		
			256QAM	16.90	48.98		
	3557.50 -3692.50	15	QPSK	21.76	149.97	21.17	130.92
			16QAM	21.07	127.94	20.57	114.02
			64QAM	20.33	107.89		
			256QAM	16.81	47.97		
	3555.00 ~ 3695.00	10	QPSK	**21.90**	**154.88**	21.23	132.74
			16QAM	21.20	131.83	20.65	116.14
			64QAM	20.46	111.17		
			256QAM	16.91	49.09		
	3552.50 ~ 3697.50	5	QPSK	21.86	153.46	**21.62**	**145.21**
			16QAM	21.39	137.72	20.81	120.50
			64QAM	20.33	107.89		
			256QAM	16.99	50.00		

LTE Band 48C (UL CA)

FCC Part 96							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted (ANT E)		Radiated (ANT E)	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
48C	3560.00 ~ 3690.00	40MHz (20MHz / 20MHz)	QPSK	**23.16**	**207.01**	**20.98**	**125.31**
			16QAM	22.77	189.23	20.40	109.65
	3557.50 ~ 3690.00	35MHz (15MHz / 20MHz)	QPSK	23.15	206.54		
			16QAM	22.69	185.78		
	3555.00 ~ 3690.00	30MHz (10MHz / 20MHz)	QPSK	23.15	206.54		
			16QAM	22.41	174.18		
	3552.50 ~ 3690.00	25MHz (5MHz / 20MHz)	QPSK	22.40	173.78		
			16QAM	22.23	167.11		

NR Band n48

FCC Part 96								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted (ANT E)		Radiated (ANT E)	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n48	3570.00 ~ 3679.98	40	DFT-s OFDM	π/2 BPSK	21.64	145.88		
				QPSK	21.66	146.55	21.52	141.91
				16QAM	20.40	109.65	20.74	118.58
				64QAM	18.94	78.34		
				256QAM	16.74	47.21		
			CP-OFDM	QPSK	20.08	101.86		
	3565.02 ~ 3684.99	30	DFT-s OFDM	π/2 BPSK	21.76	149.97		
				QPSK	21.76	149.97	21.49	140.93
				16QAM	20.52	112.72	20.67	116.68
				64QAM	18.64	73.11		
				256QAM	16.57	45.39		
			CP-OFDM	QPSK	19.72	93.76		
	3624.99 ~ 3690.00	20	DFT-s OFDM	π/2 BPSK	21.66	146.55		
				QPSK	21.62	145.21	21.67	146.89
				16QAM	20.35	108.39	21.01	126.18
				64QAM	18.94	78.34		
				256QAM	16.80	47.86		
			CP-OFDM	QPSK	19.57	90.57		
	3557.52 ~ 3692.49	15	DFT-s OFDM	π/2 BPSK	21.75	149.62		
				QPSK	21.70	147.91	21.43	139.00
				16QAM	20.55	113.50	20.74	118.58
				64QAM	19.00	79.43		
				256QAM	16.95	49.55		
			CP-OFDM	QPSK	19.77	94.84		
	3555.00 ~ 3694.98	10	DFT-s OFDM	π/2 BPSK	21.81	151.71		
				QPSK	**21.82**	**152.05**	**21.78**	**150.66**
				16QAM	20.71	117.76	20.98	125.31
				64QAM	19.08	80.91		
				256QAM	17.04	50.58		
			CP-OFDM	QPSK	19.85	96.61		

NR Band n48(SRS1)

FCC Part 96						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted (ANT C)		Radiated (ANT C)	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n48	3570.00 ~ 3679.98	40	**18.21**	**66.22**	15.52	35.65
	3565.02 ~ 3684.99	30	18.14	65.16		
	3560.00 ~ 3690.00	20	17.98	62.81		
	3575.52 ~ 3692.49	15	18.05	63.83		
	3555.00 ~ 3694.98	10	18.19	65.92		

NR Band n48(SRS2)

FCC Part 96						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted (ANT F)		Radiated (ANT F)	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n48	3570.00 ~ 3679.98	40	22.64	183.65		
	3565.02 ~ 3684.99	30	22.63	183.23		
	3560.00 ~ 3690.00	20	**22.71**	**186.64**	20.10	102.33
	3575.52 ~ 3692.49	15	22.69	185.78		
	3555.00 ~ 3694.98	10	22.69	185.78		

NR Band n48(SRS3)

FCC Part 96						
Band	Frequency Range [MHz]	BandWidth [MHz]	Conducted (ANT A)		Radiated (ANT A)	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n48	3570.00 ~ 3679.98	40	20.21	104.95		
	3565.02 ~ 3684.99	30	20.27	106.41		
	3560.00 ~ 3690.00	20	20.17	103.99		
	3575.52 ~ 3692.49	15	**20.28**	**106.66**	16.69	46.67
	3555.00 ~ 3694.98	10	20.25	105.93		

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

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)	Antenna	Peak Gain (dBi)
LTE Band 48 / NR Band n48 3550 ~ 3700 MHz	E	-3.20
	C	-3.30
	F	-5.80
	A	-4.30

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(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.

For all LTE Band 48, 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. It was found QPSK and 16QAM results were worst case.

For all 5G NR Band n48, the worst-case scenario for all measurements is based on the Average conducted output power measurement investigation results. Output power measurements were measured on $\pi/2$ BPSK, QPSK, 16QAM, 64QAM and 256QAM modulations. It was found that QPSK and 16QAM results were worst case.

This device supports NSA and SA Mode and Antenna Switching Mode.
Worst case reported SA Mode Mode. So the test case is as below.

NR Band	NSA	SA	Antenna Switching
N48	N/A	**Stand Alone**	N/A

This device supports SRS (sounding reference signal) 1, 2, 3 Mode for NR TDD bands. For each SRS 1, 2 and 3, Conducted power and radiated measurement were performed through FTM Mode provide by the customer. The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. SRS1,2,3 the worstcase scenario was radiated tested and reported.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

- Conducted Spurious Emission

Highest output power setting for each bands					
LTE Band	**ANT**	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
48	E	3555.00	10	1	25
		3625.00		1	49
		3695.00		1	0
NR Band	**ANT**	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
48	E	3555.00	10	1	1
		3625.00		1	22
		3695.00		1	22

- Uplink CA Conducted Spurious Emission

Highest conducted output power setting for each bands						
LTE Band	**ANT**	**Component Carrier**	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
48C	E	PCC	3560.00	20	1	99
		SCC	3580.00	20	1	0

- Radiated Spurious Emission

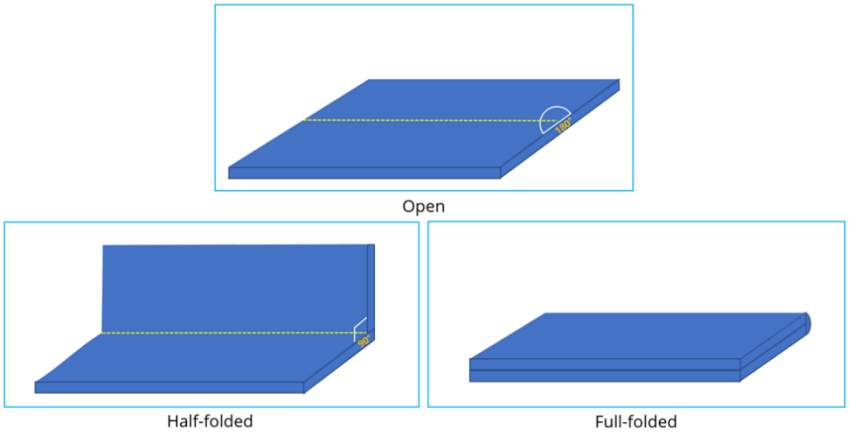
Highest output power setting for each bands					
LTE Band	**ANT**	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
48	E	3552.50	5	1	24
		3625.00		1	12
		3697.50		1	12
NR Band	**ANT**	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
48	E	3555.00	10	1	1
		3625.00		1	22
		3695.00		1	22

- Uplink CA Radiated Spurious Emission

Highest conducted output power setting for each bands						
LTE Band	**ANT**	**Component Carrier**	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
48C	E	PCC	3615.00	20	1	99
		SCC	3635.00	20	1	0

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(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
LTE B48	E	-	-	Half-folded	-	-	Half-folded
NR n48	E	-	-	Half-folded	-	-	Open
	C(SRS1)	Half-folded	-	-	Open	-	-
	F(SRS2)	Open	-	-	-	-	Full-folded
	A(SRS3)	Half-folded	-	-	-	Full-folded	-

Note : For the 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.

Note : The EUT supported wireless charging capability. For the radiated spurious testing were performed on wireless charging pad. The worst case is shown in this report.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacture**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37N9QP6H39DK3	N/A
Data Cable	SAMSUNG	EP-DN980	GH39-02111A	N/A
Wireless Charger	SAMSUNG	EP-N5200	RF7T20401XMCIS	A3LEPN5200
Wireless Charger	SAMSUNG	EP-P5400	RF7W800BH1CWSB	A3LEPP5400

I/O CABLE

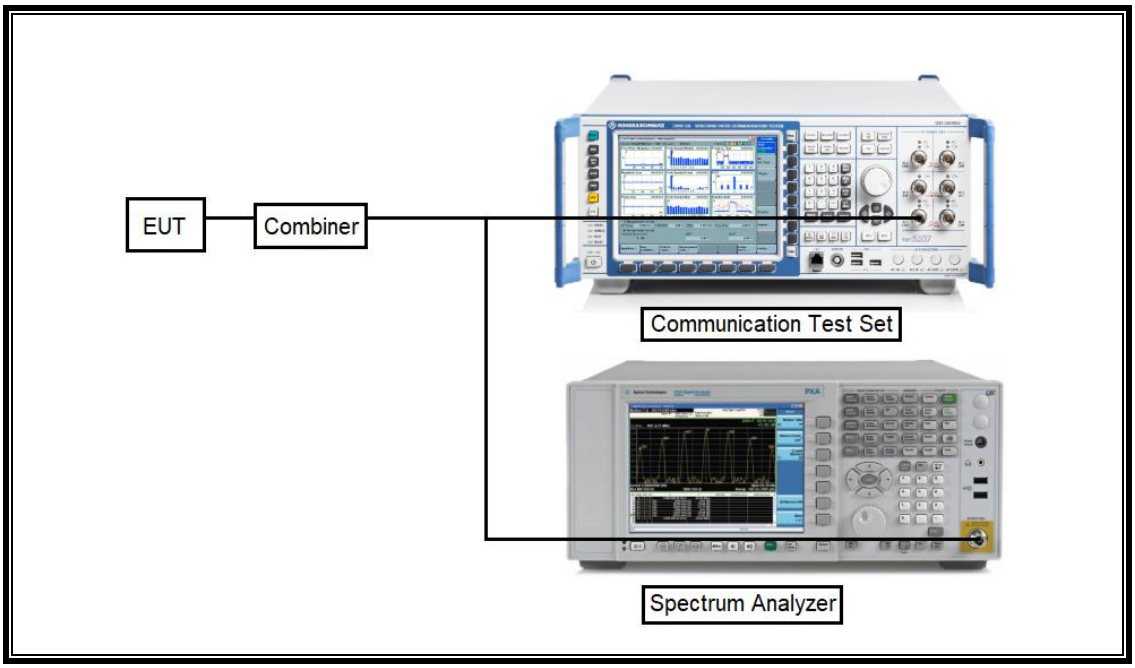
I/O Cable List						
Cable No.	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.0 m	N/A

TEST SETUP

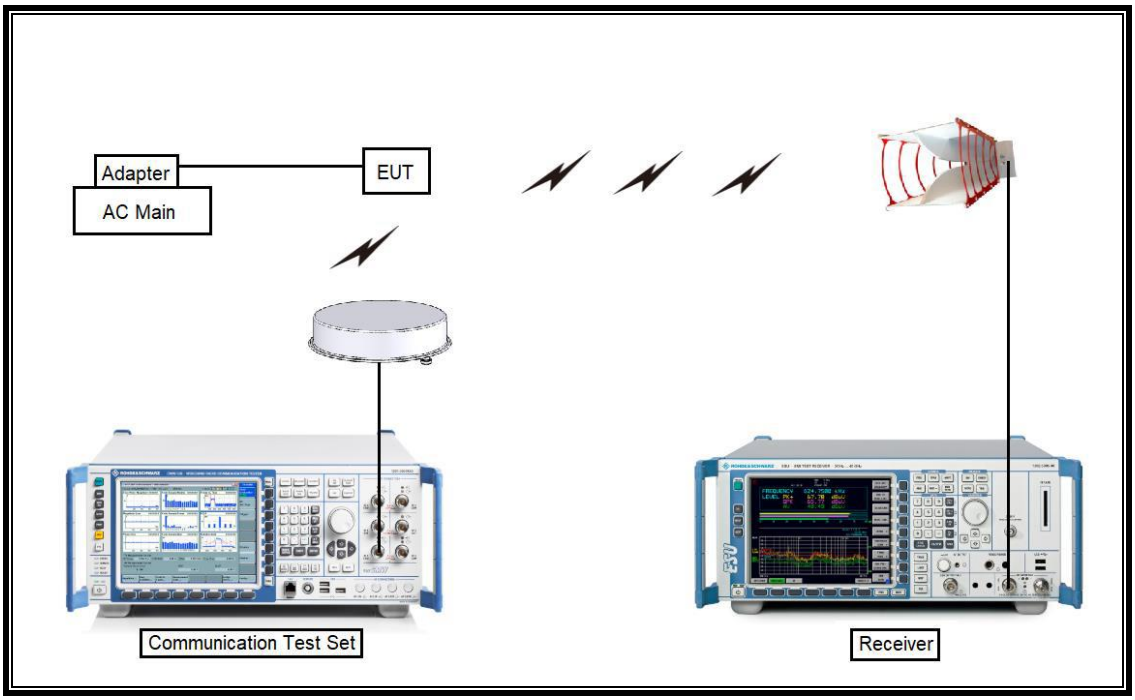
The EUT is continuously communicated with the call box during the tests.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

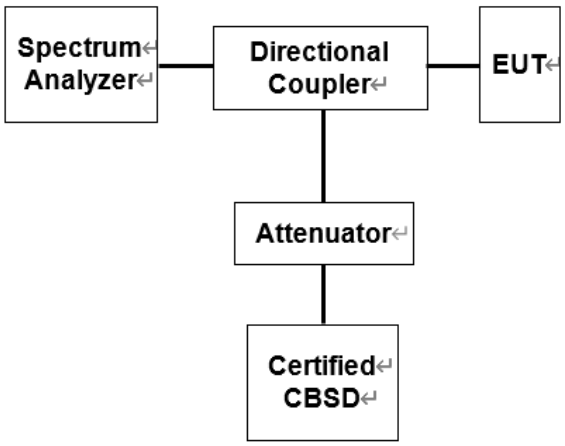
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)

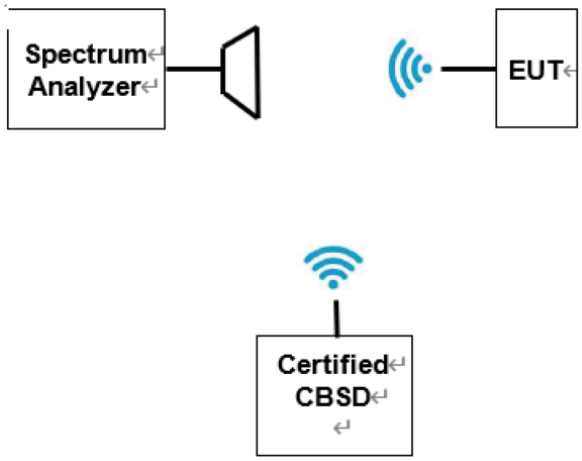


SETUP DIAGRAM FOR TESTS (LTE B48 CBSD TEST SETUP)



Remarks:
Certified CBSD – FCC ID: 2AS48SC-220
Connection between Certified CBSD and EUT is conducted method.
EUT is an End User Device (EUD)

SETUP DIAGRAM FOR TESTS (5G NR n48 CBSD TEST SETUP)



Remarks:
Certified CBSD – FCC ID: PIDAS2900
Connection between Certified CBSD and EUT is radiated method.
EUT is an End User Device (EUD)

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

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	00166155	2024-08-02
Antenna, Horn, 40 GHz	ETS	3116C	00168645	2025-10-05
Preamplifier	ETS	3115-PA	00167475	2024-07-25
Preamplifier	ETS	3116C-PA	00168841	2024-07-25
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	00167211	2024-08-04
Antenna, Horn, 18 GHz	ETS	3115	00161451	2024-08-21
Antenna, Horn, 18 GHz	ETS	3117	00168724	2024-08-04
Antenna, Horn, 18 GHz	ETS	3117	00168717	2024-08-21
Communications Test Set	R&S	CMW500	169797	2024-07-23
DC Power Supply	Agilent / HP	E3640A	MY54226395	2024-07-24
Preamplifier, 1000 MHz	Sonoma	310N	341282	2024-07-24
Preamplifier, 1000 MHz	Sonoma	310N	370599	2024-07-24
Preamplifier, 1000 MHz	Sonoma	310N	351741	2024-07-24
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	2024-07-24
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2024-07-25
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2024-07-25
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2024-07-24
Spectrum Analyzer, 44 GHz	KEYSIGHT	N9030B	MY57143717	2024-07-24
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2024-07-23
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2024-07-24
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	2024-07-23
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	2024-07-23
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	2024-07-24
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	2024-07-24
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	2024-07-24
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	2024-07-24
Attenuator	PASTERNACK	PE7087-10	A009	2024-07-24
Attenuator	PASTERNACK	PE7087-10	A001	2024-07-24
Attenuator	PASTERNACK	PE7087-10	A008	2024-07-27
Attenuator	PASTERNACK	PE7004-10	2	2024-07-23
Attenuator	PASTERNACK	PE7395-10	A011	2024-07-25
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2025-09-06
Temperature Chamber	ESPEC	SH-642	93001109	2024-07-24
Power Splitter	MINI-CIRCUITS	WA1534	UL003	2025-01-02
Power Splitter	MINI-CIRCUITS	WA1534	UL004	2025-01-02
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	MY57510655	2025-01-03

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

CBSD Test Equipment List				
Description	**Manufacturer**	**Model**	S/N	**Cal Due**
Spectrum Analyzer, EXA	Agilent (Keysight) Technologies	N9010A	MY54200580	2024-07-23
Step Attenuator	Keysight	8494B	MY42155321	2024-07-23
Directional Coupler	KRYTAR	1850	164429	2024-07-24

CBSD support software and equipment			
Description	**Manufacturer**	**Model**	**Version Number**
Laptop (SAS – WINNForum Test Harness)	SAMSUNG	NT550XDA-KC58G	2.0
Laptop for n48 CBSD connection	HP	HP EliteBook 830 G5	-
Laptop for n48 CBSD connection	DELL	Latitude 5520	

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Bandwidth(99%)	N/A	Conducted	Complies
2.1046	Conducted output power	N/A		Complies
2.1051 96.41(e)(ii)	Out of band emissions	Section 9.2 & 9.3		Complies
2.1055	Frequency Stability	Fundamental emissions stay within authorized frequency block		Complies
96.47	End user device additional requirements (CBSD Protocol)	Section 8.7		Complies
96.41(b)	Equivalent Isotropic Radiated Power	23 dBm/10 MHz	Radiated	Complies
2.1053 96.41(e)	Radiated Spurious Emission	-40 dBm/MHz		Complies

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

8. CONDUCTED RESULTES

8.1. CONDUCTED AND EIRP VERIFICATION

Test Procedurer

TIA-603-E Clause 2.2.17
KDB 971168 Section 5.6

$EIRP = P_{Meas} + G_T - L_C$
where:
EIRP = effective or equivalent radiated power, respectively (expressed in the same units as P_{Meas}, typically dBW or dBm);
P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;
G_T = gain of the transmitting antenna, in dBi (EIRP);
L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB.2

RESULTS

EUT includes different power levels for head use configuration and body use configuration and the below tables contain the highest of all configurations average conducted output powers as follows:

LTE Band 48 (ANT E)

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				Measured Pwr (dBm)			MPR	Tune-up Limit
				55340	55990	56640		
				3560 MHz	3625 MHz	3690 MHz		
20 MHz	QPSK	1	0	21.52	21.72	21.53	0.0	23.3
		1	49	21.54	21.81	21.54	0.0	23.3
		1	99	21.53	21.75	21.50	0.0	23.3
		50	0	20.50	20.72	20.54	1.0	22.3
		50	24	20.51	20.77	20.58	1.0	22.3
		50	50	20.53	20.77	20.57	1.0	22.3
		100	0	20.55	20.75	20.55	1.0	22.3
	16QAM	1	0	20.87	21.06	20.81	1.0	22.3
		1	49	20.92	21.29	20.97	1.0	22.3
		1	99	20.73	21.09	21.00	1.0	22.3
		50	0	19.52	19.77	19.50	2.0	21.3
		50	24	19.52	19.80	19.56	2.0	21.3
		50	50	19.52	19.79	19.57	2.0	21.3
		100	0	19.51	19.72	19.56	2.0	21.3
	64QAM	1	0	19.74	19.63	20.02	2.0	22.0
		1	49	19.82	19.72	20.12	2.0	22.0
		1	99	19.64	19.68	20.09	2.0	22.0
		50	0	19.75	18.66	19.05	3.0	21.0
		50	24	18.62	18.63	19.11	3.0	21.0
		50	50	18.63	18.54	19.13	3.0	21.0
		100	0	18.66	18.57	19.04	3.0	21.0
	256QAM	1	0	16.62	16.68	16.53	5.0	18.3
		1	49	16.58	16.90	16.53	5.0	18.3
		1	99	16.58	16.76	16.59	5.0	18.3
		50	0	16.50	16.74	16.55	5.0	18.3
		50	24	16.53	16.78	16.57	5.0	18.3
		50	50	16.55	16.76	16.59	5.0	18.3
		100	0	16.54	16.78	16.57	5.0	18.3
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				55315	55990	56665		
				3557.5 MHz	3625 MHz	3692.5 MHz		
15 MHz	QPSK	1	0	21.52	21.64	21.53	0.0	23.3
		1	37	21.55	21.76	21.53	0.0	23.3
		1	74	21.52	21.73	21.52	0.0	23.3
		36	0	20.52	20.69	20.53	1.0	22.3
		36	20	20.51	20.73	20.50	1.0	22.3
		36	39	20.56	20.73	20.51	1.0	22.3
		75	0	20.51	20.70	20.55	1.0	22.3
	16QAM	1	0	20.86	21.07	20.59	1.0	22.3
		1	37	20.86	20.96	20.73	1.0	22.3
		1	74	20.56	20.88	20.80	1.0	22.3
		36	0	19.59	19.75	19.53	2.0	21.3
		36	20	19.55	19.74	19.53	2.0	21.3
		36	39	19.57	19.77	19.55	2.0	21.3
		75	0	19.53	19.79	19.50	2.0	21.3
	64QAM	1	0	19.71	19.53	20.13	2.0	21.3
		1	37	19.63	19.75	20.21	2.0	21.3
		1	74	19.62	19.67	20.33	2.0	21.3
		36	0	18.55	18.52	19.13	3.0	20.3
		36	20	18.53	18.62	19.15	3.0	20.3
		36	39	18.51	18.53	19.11	3.0	20.3
		75	0	18.53	18.51	19.13	3.0	20.3
	256QAM	1	0	16.53	16.81	16.59	5.0	18.3
		1	37	16.71	16.77	16.63	5.0	18.3
		1	74	16.59	16.75	16.72	5.0	18.3
		36	0	16.51	16.73	16.52	5.0	18.3
		36	20	16.56	16.75	16.50	5.0	18.3
		36	39	16.52	16.81	16.52	5.0	18.3
		75	0	16.52	16.77	16.53	5.0	18.3

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				55290	55990	56690		
				3555 MHz	3625 MHz	3695 MHz		
10 MHz	QPSK	1	0	21.52	21.89	21.56	0.0	23.3
		1	25	21.51	21.90	21.56	0.0	23.3
		1	49	21.52	21.74	21.59	0.0	23.3
		25	0	20.54	20.76	20.54	1.0	22.3
		25	12	20.55	20.75	20.54	1.0	22.3
		25	25	20.51	20.80	20.56	1.0	22.3
		50	0	20.51	20.73	20.52	1.0	22.3
	16QAM	1	0	20.71	21.20	20.66	1.0	22.3
		1	25	20.90	21.18	20.84	1.0	22.3
		1	49	20.87	21.10	20.80	1.0	22.3
		25	0	19.52	19.80	19.51	2.0	21.3
		25	12	19.55	19.83	19.54	2.0	21.3
		25	25	19.50	19.82	19.56	2.0	21.3
		50	0	19.54	19.82	19.53	2.0	21.3
	64QAM	1	0	20.03	19.74	20.33	2.0	21.3
		1	25	19.98	19.63	20.46	2.0	21.3
		1	49	19.94	19.85	20.41	2.0	21.3
		25	0	18.60	18.63	19.08	3.0	20.3
		25	12	18.57	18.54	19.12	3.0	20.3
		25	25	18.61	18.53	19.11	3.0	20.3
		50	0	19.72	18.55	19.14	3.0	20.3
	256QAM	1	0	16.75	16.79	16.51	5.0	18.3
		1	25	16.62	16.91	16.55	5.0	18.3
		1	49	16.55	16.80	16.52	5.0	18.3
		25	0	16.52	16.80	16.54	5.0	18.3
		25	12	16.57	16.80	16.51	5.0	18.3
		25	25	16.55	16.76	16.55	5.0	18.3
		50	0	16.53	16.79	16.51	5.0	18.3

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				55265	55990	56715		
				3552.5 MHz	3625 MHz	3697.5 MHz		
5 MHz	QPSK	1	0	21.51	21.73	21.50	0.0	23.3
		1	12	21.51	21.86	21.52	0.0	23.3
		1	24	21.52	21.68	21.51	0.0	23.3
		12	0	20.50	20.80	20.55	1.0	22.3
		12	7	20.54	20.83	20.58	1.0	22.3
		12	13	20.52	20.77	20.52	1.0	22.3
		25	0	20.51	20.72	20.51	1.0	22.3
	16QAM	1	0	21.00	20.91	20.72	1.0	22.3
		1	12	20.88	21.39	20.79	1.0	22.3
		1	24	20.90	21.10	20.66	1.0	22.3
		12	0	19.55	19.84	19.56	2.0	21.3
		12	7	19.61	19.81	19.58	2.0	21.3
		12	13	19.55	19.84	19.55	2.0	21.3
		25	0	19.50	19.74	19.53	2.0	21.3
	64QAM	1	0	19.66	19.71	20.23	2.0	21.3
		1	12	19.76	19.82	20.33	2.0	21.3
		1	24	19.68	19.74	20.30	2.0	21.3
		12	0	18.74	18.56	19.05	3.0	20.3
		12	7	18.81	18.63	19.06	3.0	20.3
		12	13	18.73	18.58	19.05	3.0	20.3
		25	0	18.76	19.64	19.10	3.0	20.3
	256QAM	1	0	16.57	16.92	16.72	5.0	18.3
		1	12	16.91	16.99	16.58	5.0	18.3
		1	24	16.71	16.75	16.60	5.0	18.3
		12	0	16.53	16.81	16.52	5.0	18.3
		12	7	16.60	16.75	16.60	5.0	18.3
		12	13	16.53	16.63	16.50	5.0	18.3
		25	0	16.50	16.77	16.51	5.0	18.3

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

LTE Band 48C (UL CA) (ANT E)

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
40MHz (20MHz / 20MHz)	3560	3579.8	1	99	1	0	22.71	22.05
			1	0	1	99	14.26	14.63
			100	0	100	0	20.86	19.93
	3615.1	3634.9	1	99	1	0	22.78	22.24
			1	0	1	99	14.38	14.84
			100	0	100	0	21.02	20.02
	3670.2	3690	1	99	1	0	23.16	22.77
			1	0	1	99	14.69	15.30
			100	0	100	0	21.37	20.39

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
35MHz (15MHz / 20MHz)	3557.5	3574.6	1	74	1	0	22.59	22.25
			1	0	1	99	14.23	14.84
			75	0	100	0	20.76	19.89
	3615.2	3632.3	1	74	1	0	22.78	22.23
			1	0	1	99	14.55	14.94
			75	0	100	0	20.97	20.04
	3672.9	3690.0	1	74	1	0	23.15	22.69
			1	0	1	99	14.79	15.26
			75	0	100	0	21.34	20.41

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
30MHz (10MHz / 20MHz)	3555.0	3569.4	1	49	1	0	22.55	22.15
			1	0	1	99	14.19	14.83
			50	0	100	0	20.85	19.89
	3615.4	3629.8	1	49	1	0	22.67	22.12
			1	0	1	99	14.30	14.79
			50	0	100	0	20.98	20.02
	3675.6	3690.0	1	49	1	0	23.15	22.41
			1	0	1	99	14.82	14.94
			50	0	100	0	21.16	20.02

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
25MHz (5MHz / 20MHz)	3552.5	3564.2	1	24	1	0	22.03	21.77
			1	0	1	99	13.63	14.25
			25	0	100	0	20.34	19.34
	3615.6	3627.3	1	24	1	0	21.86	21.51
			1	0	1	99	13.66	14.33
			25	0	100	0	20.30	19.35
	3678.3	3690.0	1	24	1	0	22.40	22.23
			1	0	1	99	14.04	14.77
			25	0	100	0	20.68	19.59

NR Band n48 (ANT E)

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)			MPR	Tune-up Limit
					Measured Pwr (dBm)				
					638000	641666	645332		
					3570 MHz	3624.99 MHz	3679.98 MHz		
40 MHz	DFT-s-OFDM	π/2 BPSK	1	1	21.32	21.52	21.35	0.0	23.3
			1	53	21.21	21.47	21.21	0.0	23.3
			1	104	21.39	21.46	21.20	0.0	23.3
			50	0	20.33	20.49	20.35	0.5	22.8
			50	28	21.46	21.64	21.40	0.0	23.3
			50	56	20.31	20.57	20.42	0.5	22.8
			100	0	20.46	20.71	20.46	0.5	22.8
		QPSK	1	1	21.35	21.53	21.38	0.0	23.3
			1	53	21.20	21.48	21.14	0.0	23.3
			1	104	21.35	21.47	21.19	0.0	23.3
			50	0	20.29	20.53	20.38	1.0	22.3
			50	28	21.44	21.66	21.29	0.0	23.3
			50	56	20.40	20.56	20.21	1.0	22.3
			100	0	20.46	20.67	20.46	1.0	22.3
		16QAM	1	1	20.19	20.35	20.24	1.0	22.3
			1	53	20.15	20.40	20.14	1.0	22.3
			1	104	20.20	20.26	20.03	1.0	22.3
		64QAM	1	1	18.80	18.94	18.75	2.5	20.8
		256QAM	1	1	16.54	16.74	16.61	4.5	18.8
	CP-OFDM	QPSK	1	1	19.97	20.08	19.89	1.5	21.8
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					637668	641666	645666		
					3565.02 MHz	3624.99 MHz	3684.99 MHz		
30 MHz	DFT-s-OFDM	π/2 BPSK	1	1	21.45	21.51	21.59	0.0	23.3
			1	39	21.27	21.63	21.63	0.0	23.3
			1	76	21.42	21.73	21.76	0.0	23.3
			36	0	20.37	20.65	20.70	0.5	22.8
			36	21	21.40	21.73	21.74	0.0	23.3
			36	42	20.41	20.66	20.71	0.5	22.8
			75	0	20.36	20.66	20.67	0.5	22.8
		QPSK	1	1	21.45	21.47	21.58	0.0	23.3
			1	39	21.33	21.59	21.66	0.0	23.3
			1	76	21.43	21.68	21.75	0.0	23.3
			36	0	20.49	20.66	20.69	1.0	22.3
			36	21	21.42	21.66	21.76	0.0	23.3
			36	42	20.39	20.66	20.71	1.0	22.3
			75	0	20.35	20.67	20.69	1.0	22.3
		16QAM	1	1	20.32	20.46	20.52	1.0	22.3
		64QAM	1	1	18.36	18.53	18.64	2.5	20.8
		256QAM	1	1	16.57	16.39	16.37	4.5	18.8
	CP-OFDM	QPSK	1	1	19.53	19.63	19.72	1.5	21.8
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					637333	641666	646000		
					3560 MHz	3624.99 MHz	3690 MHz		
20 MHz	DFT-s-OFDM	π/2 BPSK	1	1	21.28	21.32	21.43	0.0	23.3
			1	26	21.27	21.33	21.66	0.0	23.3
			1	49	21.34	21.41	21.59	0.0	23.3
			25	0	20.49	20.46	20.54	0.5	22.8
			25	13	21.45	21.47	21.62	0.0	23.3
			25	26	20.39	20.50	20.56	0.5	22.8
			50	0	20.49	20.46	20.66	0.5	22.8
		QPSK	1	1	21.28	21.33	21.41	0.0	23.3
			1	26	21.25	21.33	21.53	0.0	23.3
			1	49	21.32	21.42	21.60	0.0	23.3
			25	0	20.29	20.46	20.56	1.0	22.3
			25	13	21.39	21.54	21.62	0.0	23.3
			25	26	20.38	20.49	20.57	1.0	22.3
			50	0	20.50	20.57	20.67	1.0	22.3
		16QAM	1	1	20.11	20.31	20.35	1.0	22.3
		64QAM	1	1	18.67	18.88	18.94	2.5	20.8
		256QAM	1	1	16.51	16.67	16.80	4.5	18.8
	CP-OFDM	QPSK	1	1	19.31	19.47	19.57	1.5	21.8

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					637168	641666	646166		
					3557.52 MHz	3624.99 MHz	3692.49 MHz		
15 MHz	DFT-s-OFDM	π/2 BPSK	1	1	21.38	21.41	21.51	0.0	23.3
			1	19	21.29	21.37	21.56	0.0	23.3
			1	36	21.44	21.46	21.73	0.0	23.3
			18	0	20.35	20.51	20.63	0.5	22.8
			18	10	21.47	21.55	21.75	0.0	23.3
			18	20	20.31	20.53	20.68	0.5	22.8
			36	0	20.34	20.52	20.71	0.5	22.8
		QPSK	1	1	21.37	21.43	21.62	0.0	23.3
			1	19	21.29	21.41	21.67	0.0	23.3
			1	36	21.36	21.46	21.66	0.0	23.3
			18	0	20.33	20.42	20.59	1.0	22.3
			18	10	21.47	21.55	21.70	0.0	23.3
			18	20	20.40	20.53	20.73	1.0	22.3
			36	0	20.35	20.50	20.69	1.0	22.3
		16QAM	1	1	20.21	20.41	20.55	1.0	22.3
		64QAM	1	1	18.77	18.97	19.00	2.5	20.8
		256QAM	1	1	16.58	16.80	16.95	4.5	18.8
	CP-OFDM	QPSK	1	1	19.39	19.55	19.77	1.5	21.8
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					637000	641666	646332		
					3555 MHz	3624.99 MHz	3694.98 MHz		
10 MHz	DFT-s-OFDM	π/2 BPSK	1	1	21.34	21.62	21.75	0.0	23.3
			1	12	21.30	21.58	21.74	0.0	23.3
			1	22	21.33	21.60	21.81	0.0	23.3
			12	0	20.34	20.51	20.71	0.5	22.8
			12	6	21.40	21.66	21.81	0.0	23.3
			12	12	20.31	20.60	20.72	0.5	22.8
			24	0	20.33	20.61	20.71	0.5	22.8
		QPSK	1	1	21.36	21.53	21.74	0.0	23.3
			1	12	21.28	21.59	21.72	0.0	23.3
			1	22	21.35	21.62	21.76	0.0	23.3
			12	0	20.36	20.61	20.73	1.0	22.3
			12	6	21.40	21.61	21.82	0.0	23.3
			12	12	20.32	20.60	20.75	1.0	22.3
			24	0	20.35	20.50	20.70	1.0	22.3
		16QAM	1	1	20.33	20.40	20.71	1.0	22.3
		64QAM	1	1	18.78	18.94	19.08	2.5	20.8
		256QAM	1	1	16.67	16.82	17.04	4.5	18.8
	CP-OFDM	QPSK	1	1	19.51	19.57	19.85	1.5	21.8

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

NR Band n48_SRS (ANT C, ANT F, ANT A)

Maximum Average Power (dBm) SRS1			Tune-up Limit	Maximum Average Power (dBm) SRS2			Tune-up Limit	Maximum Average Power (dBm) SRS3			Tune-up Limit
			18.5				23.0				20.5
BW (MHz)	RB Allocation	RB offset	MPR	BW (MHz)	RB Allocation	RB offset	MPR	BW (MHz)	RB Allocation	RB offset	MPR
	1	1	0.0		1	1	0.0		1	1	0.0
	Measured Pwr (dBm)				Measured Pwr (dBm)				Measured Pwr (dBm)		
40 MHz	638000	641666	645332	40 MHz	638000	641666	645332	40 MHz	638000	641666	645332
	3570 MHz	3624.99 MHz	3679.98 MHz		3570 MHz	3624.99 MHz	3679.98 MHz		3570 MHz	3624.99 MHz	3679.98 MHz
	18.21	17.63	17.13		22.64	22.61	22.48		20.21	20.13	20.09
30 MHz	637668	641666	645666	30 MHz	637668	641666	645666	30 MHz	637668	641666	645666
	3565.02 MHz	3624.99 MHz	3684.99 MHz		3565.02 MHz	3624.99 MHz	3684.99 MHz		3565.02 MHz	3624.99 MHz	3684.99 MHz
	18.14	17.71	17.05		22.61	22.57	22.63		20.27	20.21	20.13
20 MHz	641666	641666	646000	20 MHz	637333	641666	646000	20 MHz	641666	641666	646000
	3624.99 MHz	3624.99 MHz	3690 MHz		3559.99 MHz	3624.99 MHz	3690 MHz		3624.99 MHz	3624.99 MHz	3690 MHz
	17.98	17.82	16.66		22.58	22.71	22.63		20.17	20.08	20.03
15 MHz	637168	641666	646166	15 MHz	637168	641666	646166	15 MHz	637168	641666	646166
	3557.52 MHz	3624.99 MHz	3692.49 MHz		3557.52 MHz	3624.99 MHz	3692.49 MHz		3557.52 MHz	3624.99 MHz	3692.49 MHz
	18.05	17.73	16.59		22.64	22.68	22.69		20.28	20.09	19.71
10 MHz	637000	641666	646332	10 MHz	637000	641666	646332	10 MHz	637000	641666	646332
	3555 MHz	3624.99 MHz	3694.98 MHz		3555 MHz	3624.99 MHz	3694.98 MHz		3555 MHz	3624.99 MHz	3694.98 MHz
	18.19	17.71	16.61		22.63	22.66	22.69		20.25	20.11	19.76

8.2. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

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

Test Spec

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

NOTE

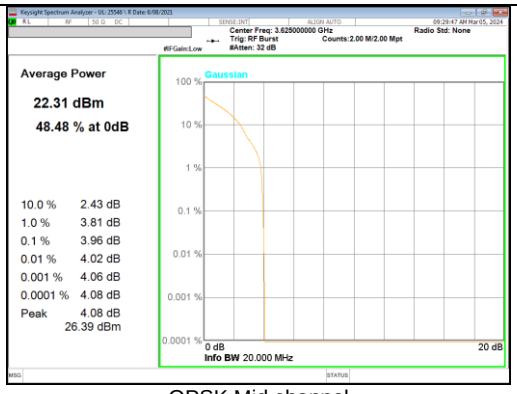
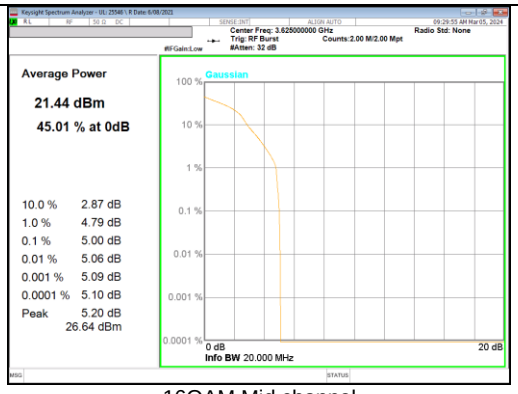
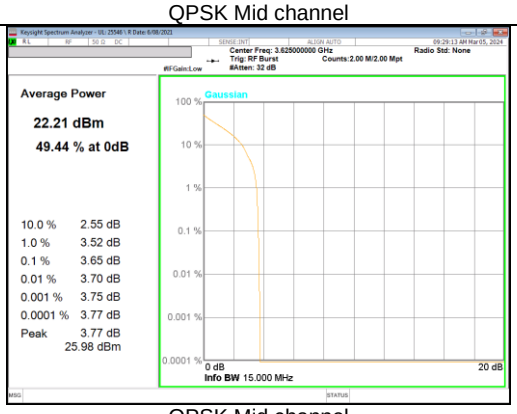
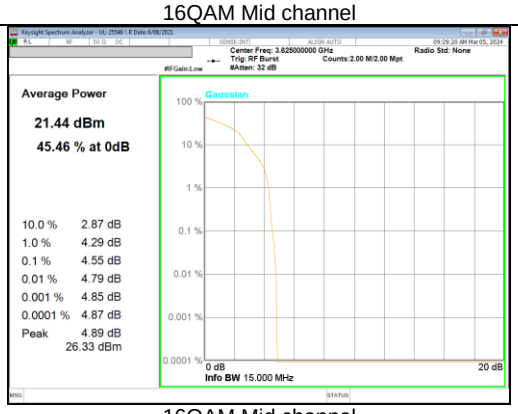
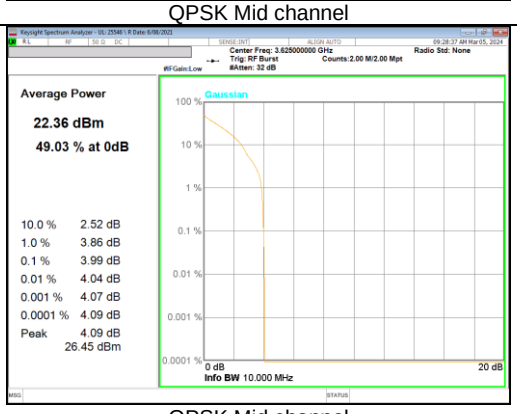
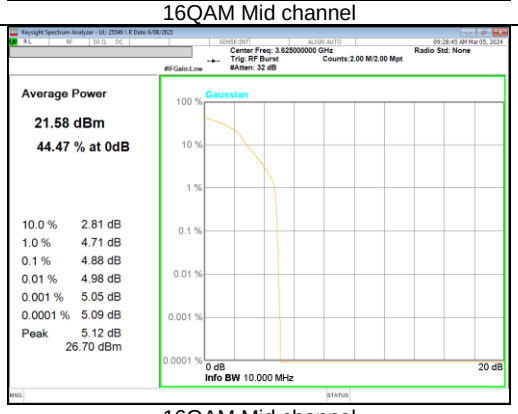
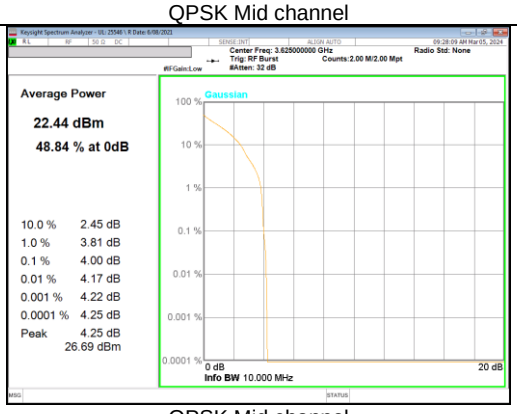
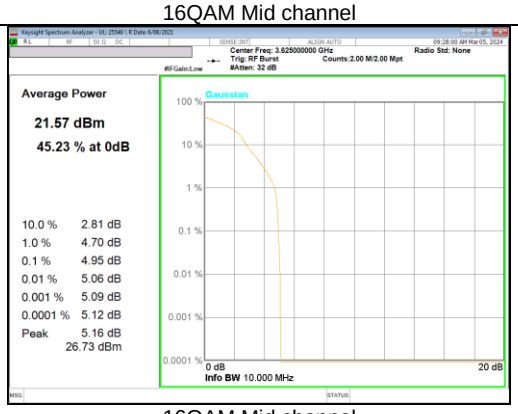
5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations (π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

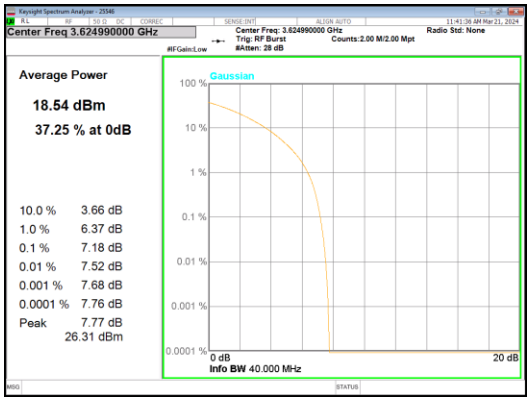
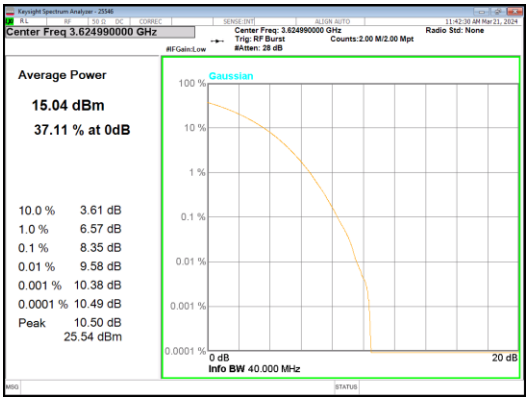
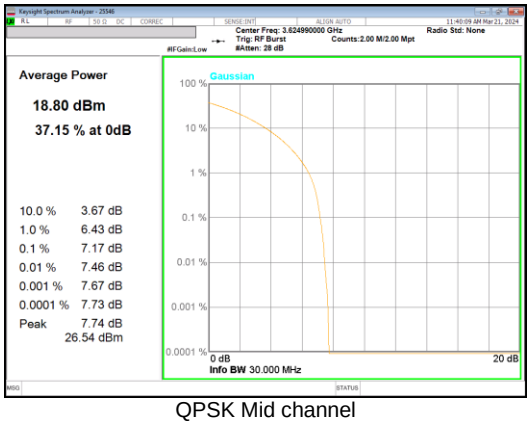
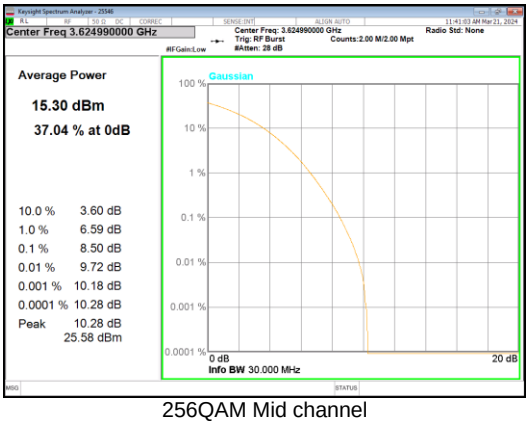
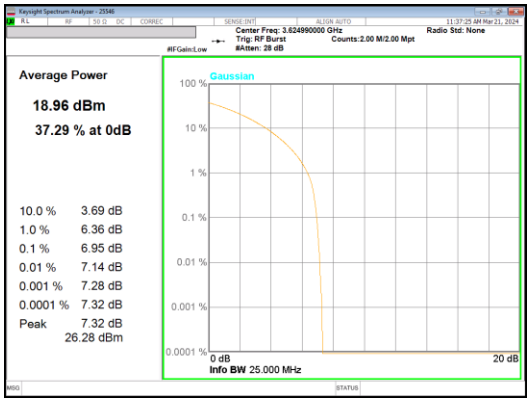
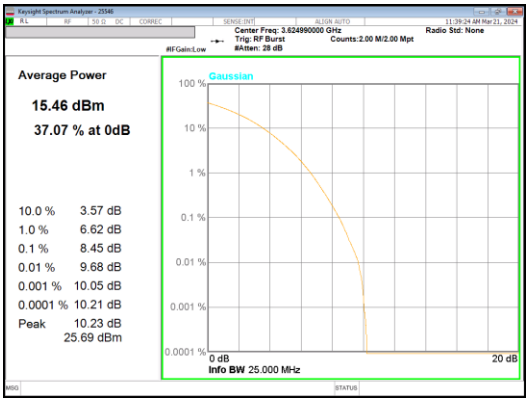
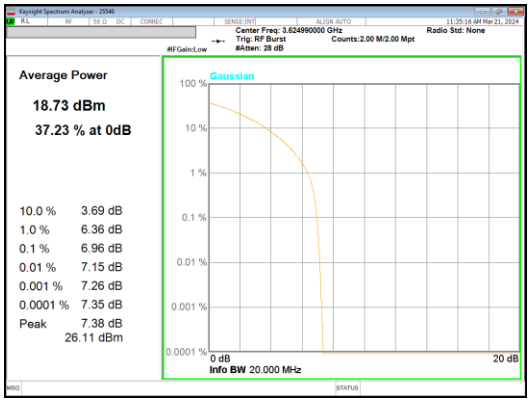
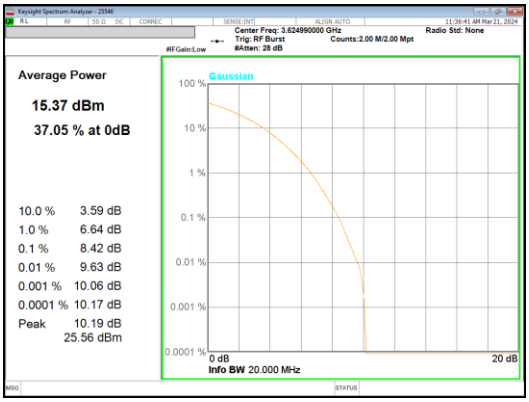
See the following pages.

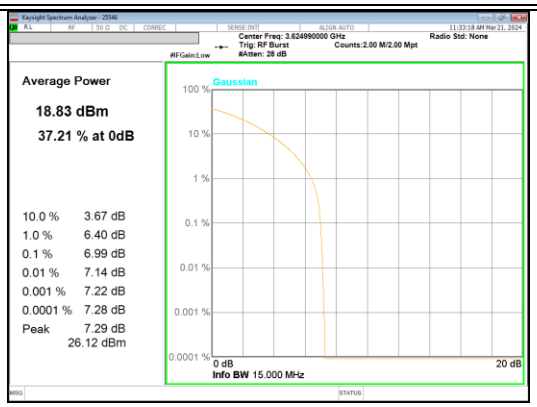
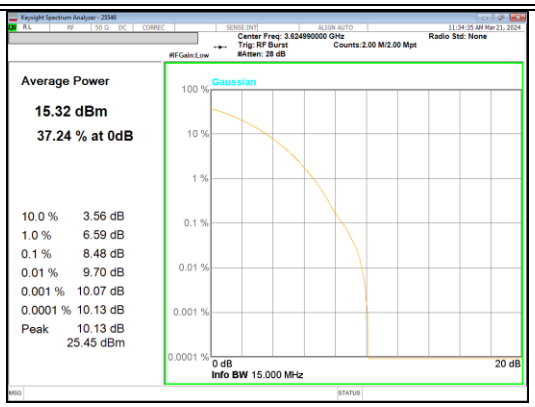
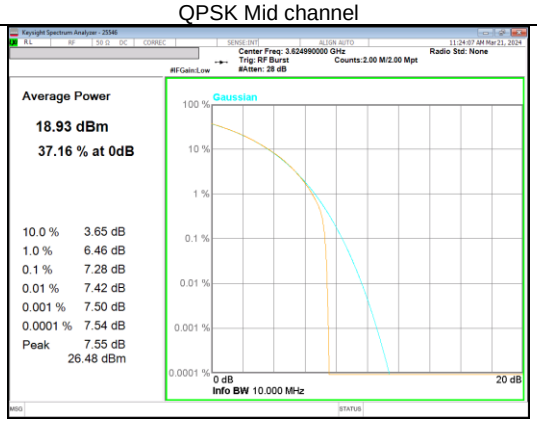
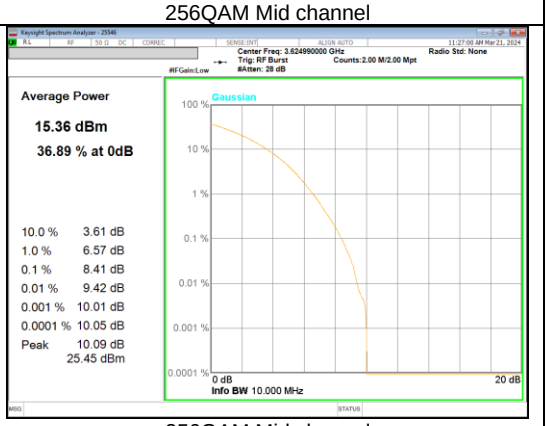
8.2.1. CONDUCTED PEAK TO AVERAGE RESULT

LTE Band 48

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

NR Band n48 CP-OFDM

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

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

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

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 the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

(KDB 971168 D01 Power Meas License Digital Systems v03r01)

OCCUPIED BANDWIDTH RESULTS

See the following pages.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_96(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

- LTE Band 48

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B48	20M	QPSK	3625.00	17.879	19.030
		16QAM		17.950	19.320
	15M	QPSK		13.436	14.300
		16QAM		13.432	14.340
	10M	QPSK		8.988	9.685
		16QAM		8.980	9.669
	5M	QPSK		4.486	4.986
		16QAM		4.485	5.120

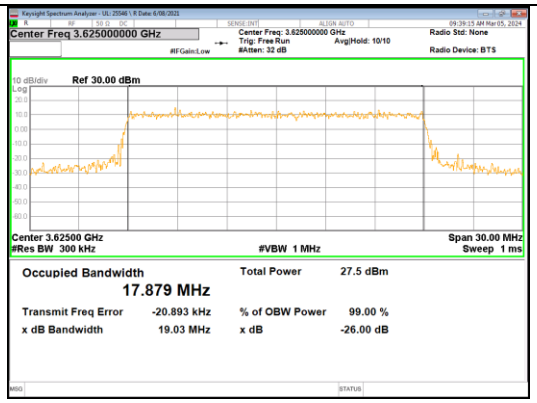
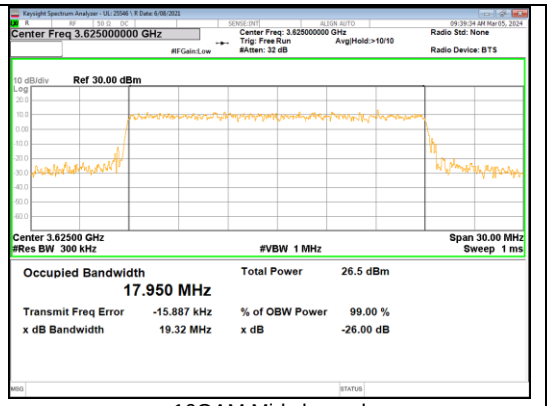
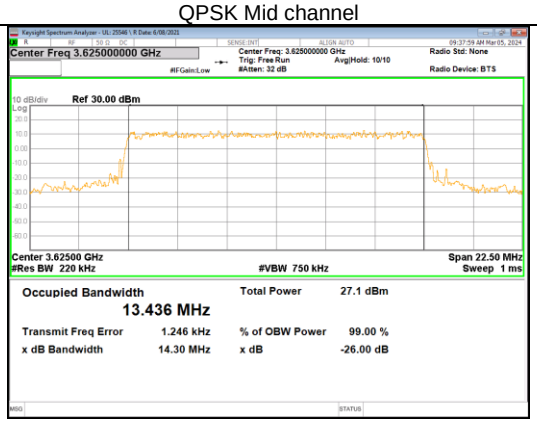
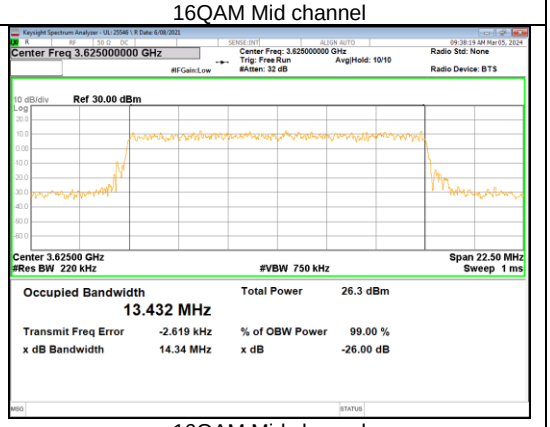
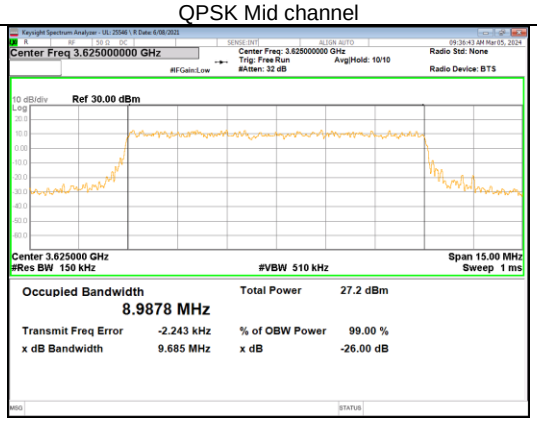
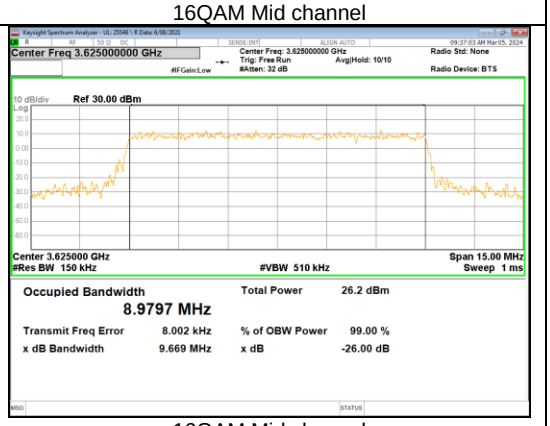
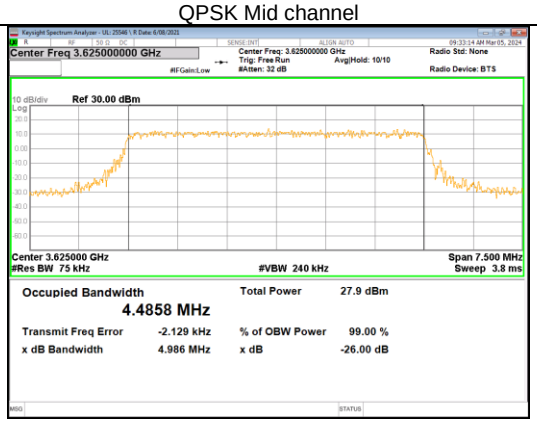
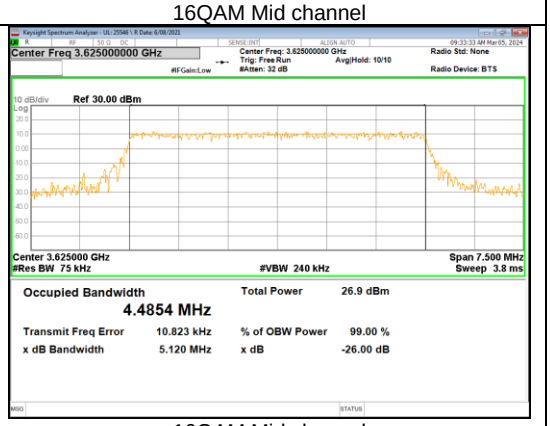
- LTE Band 48C

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B48 UL CA	20+20M	QPSK	3625.00	37.637	39.670
		16QAM		37.526	39.840
	15+20M	QPSK		32.643	34.460
		16QAM		32.716	34.370
	10+20M	QPSK		27.796	29.110
		16QAM		27.748	29.240
	5+20M	QPSK		22.827	23.830
		16QAM		22.833	23.910

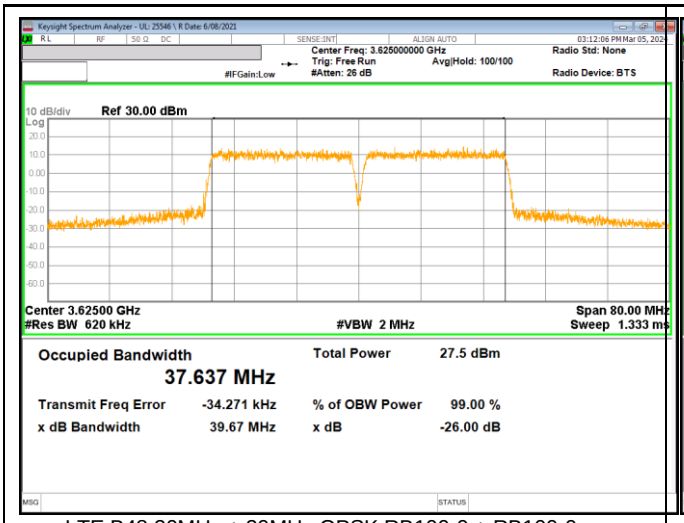
- NR Band n48

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n48	40M	QPSK	3624.99	38.024	39.740
		16QAM		38.027	39.530
	30M	QPSK		27.973	29.260
		16QAM		27.868	29.250
	20M	QPSK		18.227	19.790
		16QAM		18.245	19.670
	15M	QPSK		13.601	14.590
		16QAM		13.564	14.560
	10M	QPSK		8.611	9.814
		16QAM		8.612	9.722

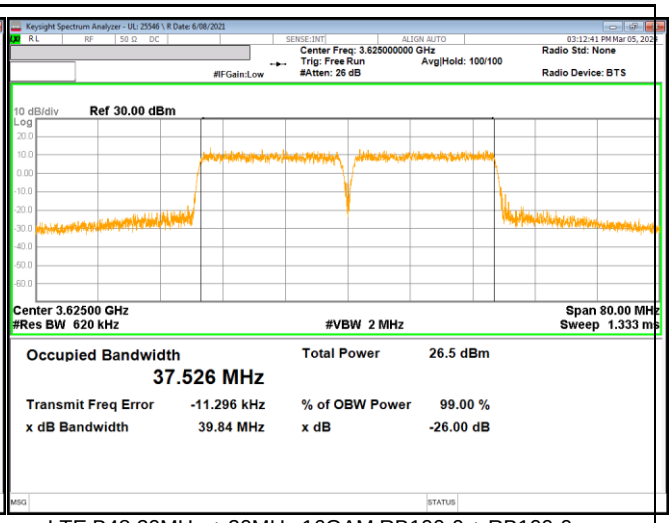
LTE Band 48

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

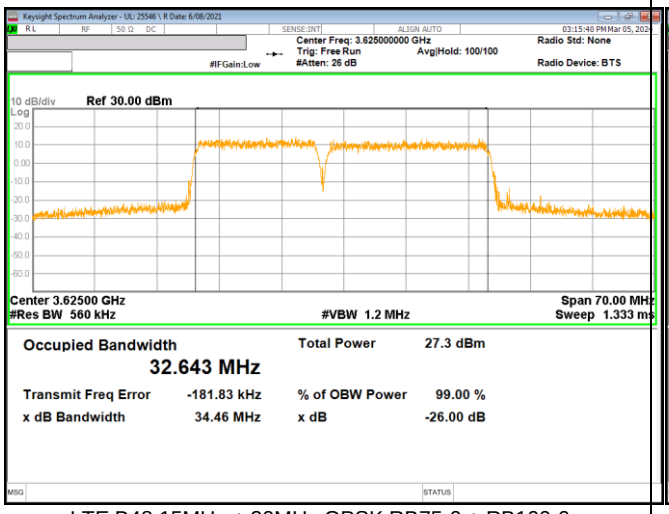
LTE Band 48C (UL CA)



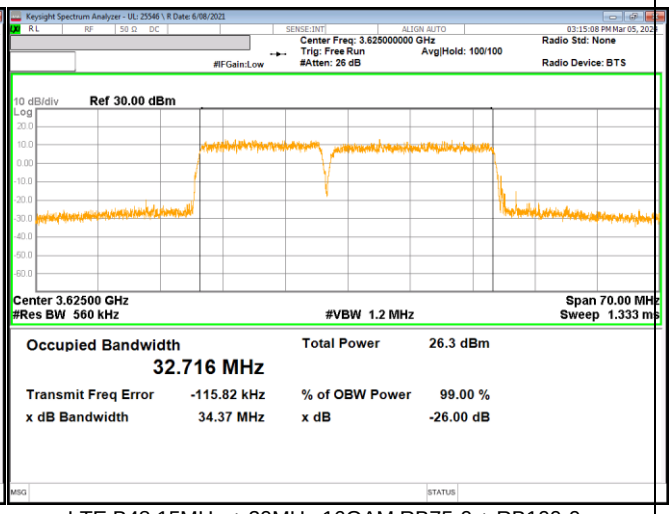
LTE B48 20MHz + 20MHz QPSK RB100-0 + RB100-0



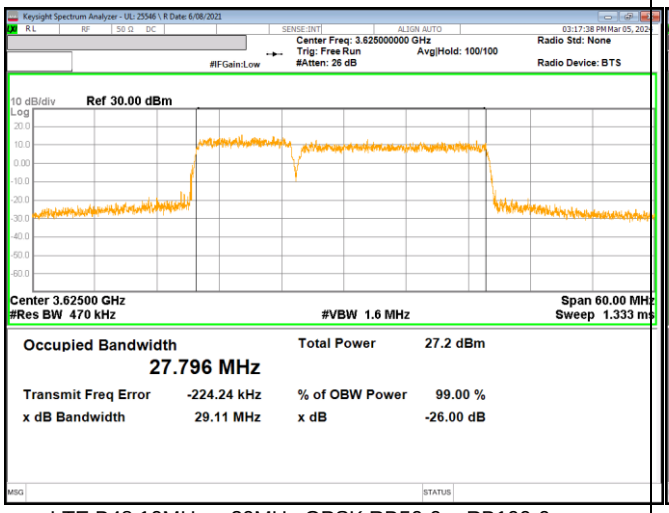
LTE B48 20MHz + 20MHz 16QAM RB100-0 + RB100-0



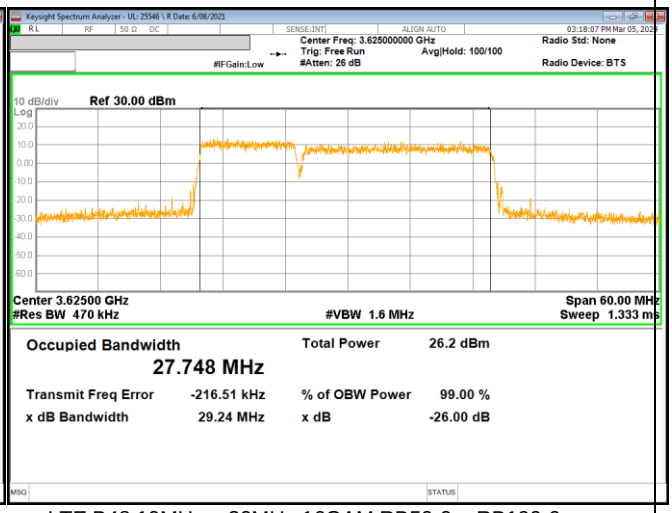
LTE B48 15MHz + 20MHz QPSK RB75-0 + RB100-0



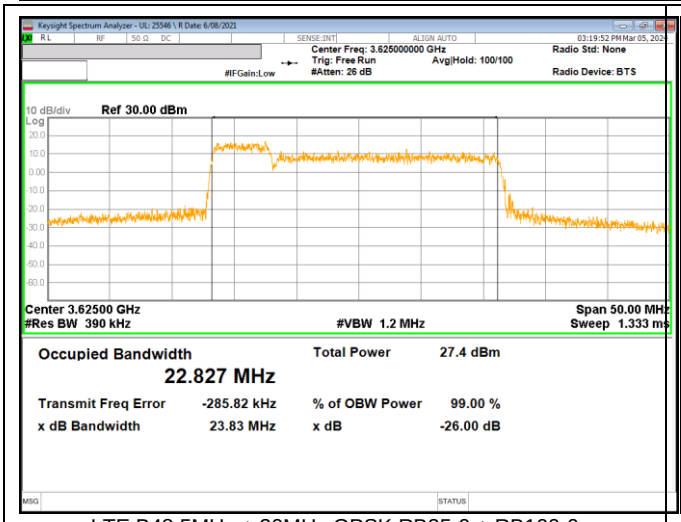
LTE B48 15MHz + 20MHz 16QAM RB75-0 + RB100-0



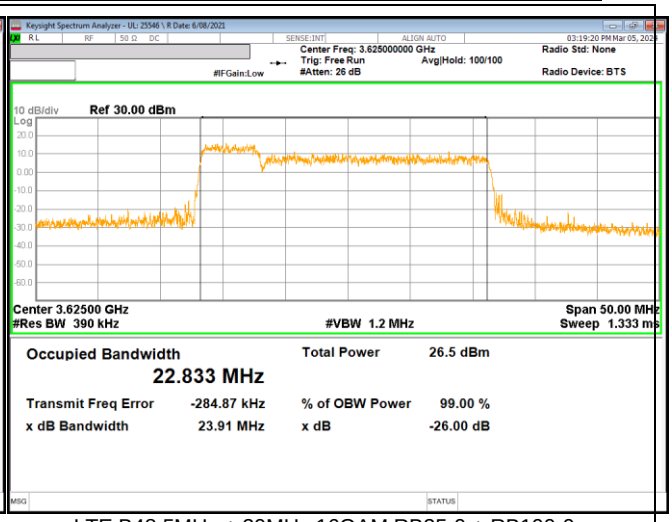
LTE B48 10MHz + 20MHz QPSK RB50-0 + RB100-0



LTE B48 10MHz + 20MHz 16QAM RB50-0 + RB100-0

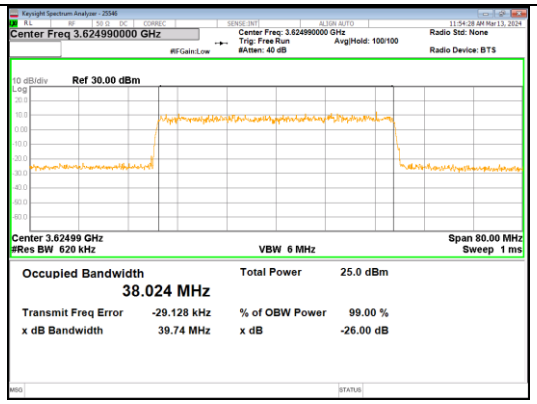
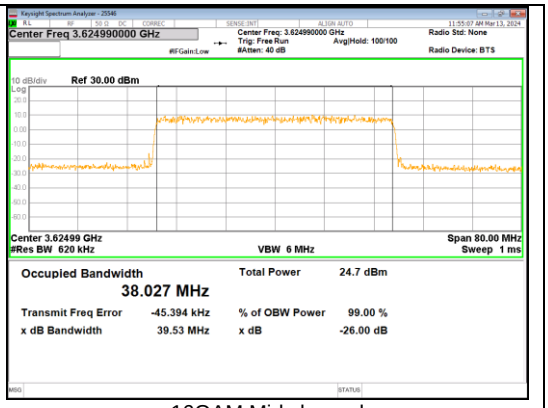
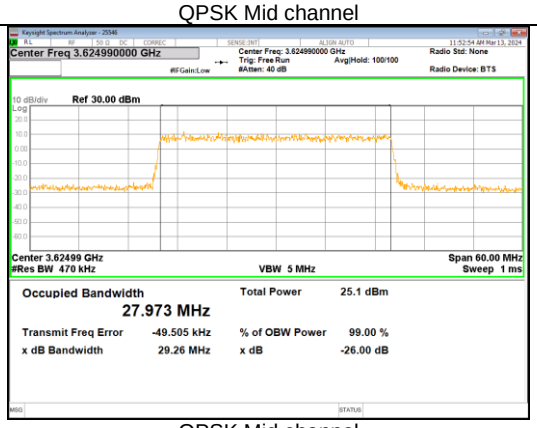
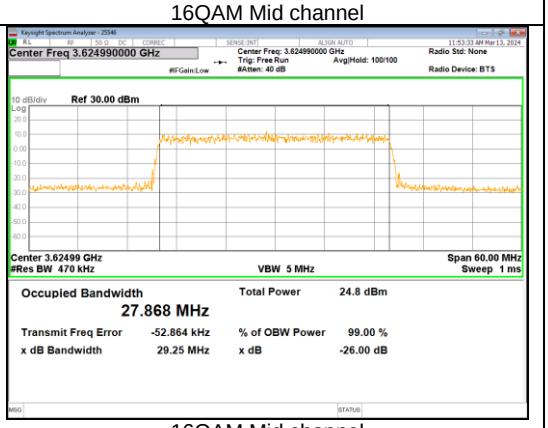
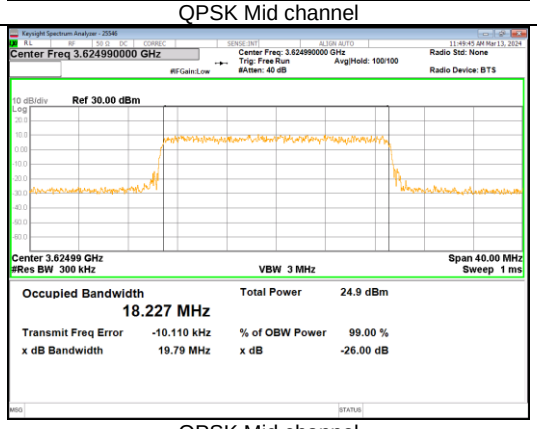
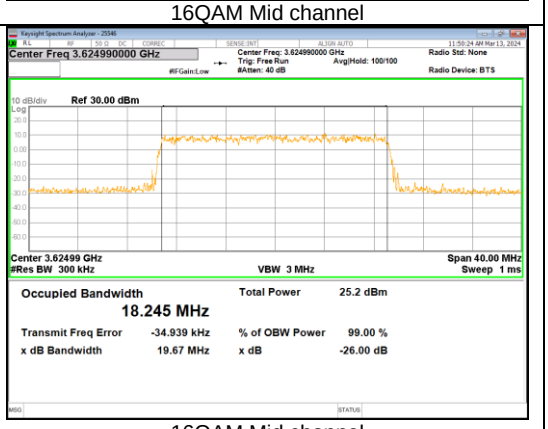
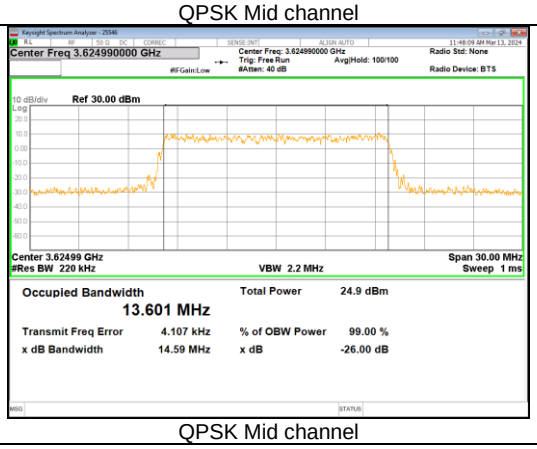
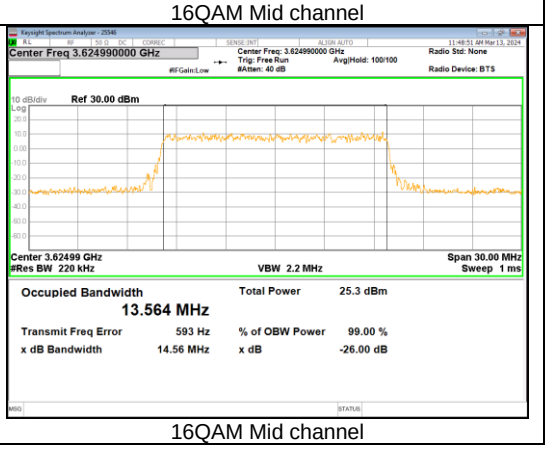


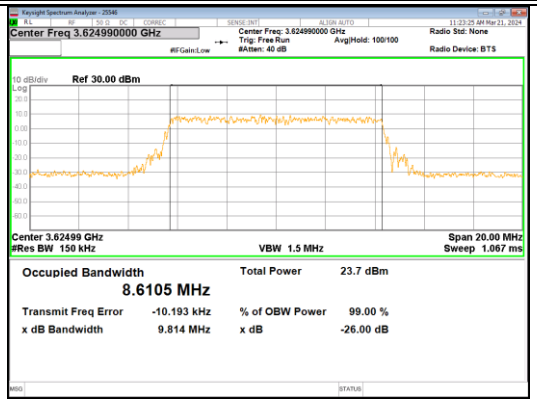
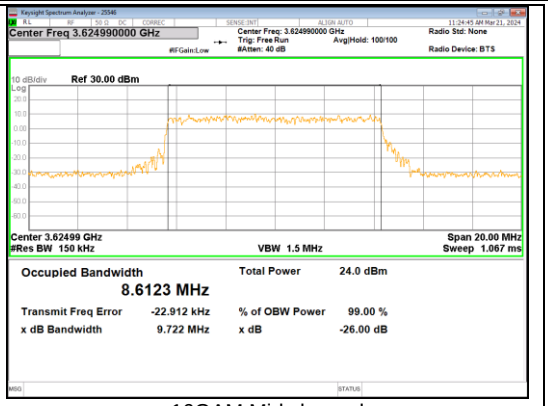
LTE B48 5MHz + 20MHz QPSK RB25-0 + RB100-0



LTE B48 5MHz + 20MHz 16QAM RB25-0 + RB100-0

NR Band n48 CP-OFDM

40 MHz	 QPSK Mid channel	 16QAM Mid channel
30 MHz	 QPSK Mid channel	 16QAM Mid channel
20 MHz	 QPSK Mid channel	 16QAM Mid channel
15 MHz	 QPSK Mid channel	 16QAM Mid channel

10 MHz		
	QPSK Mid channel	16QAM Mid channel

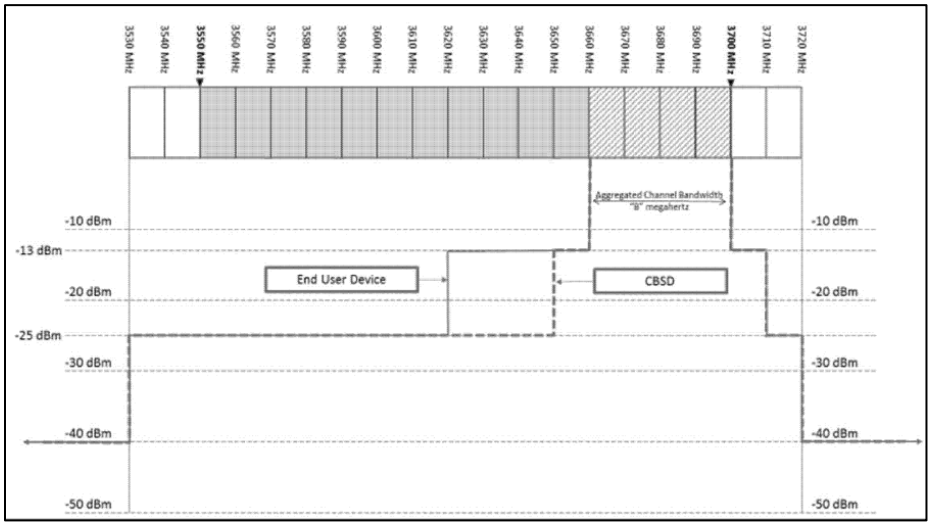
8.4. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §2.1051 and §96.41(e)(1) (ii) & (e)(2).

LIMITS

For channel and frequency assignments made by a CBSD to End User Devices, the conducted power of any End User Device emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed −13 dBm/MHz within 0 to B megahertz (where B is the bandwidth in megahertz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed −25 dBm/MHz. Notwithstanding the emission limits in this paragraph, the Adjacent Channel Leakage Ratio for End User Devices shall be at least 30 dB.
The conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/MHz.

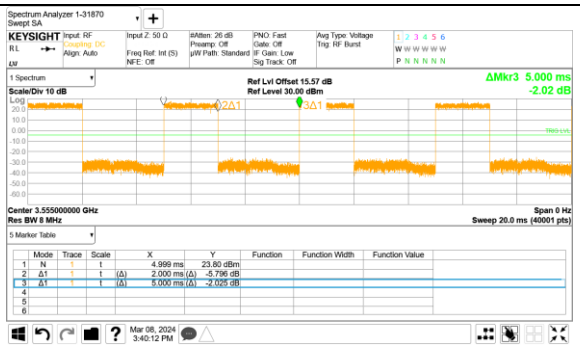
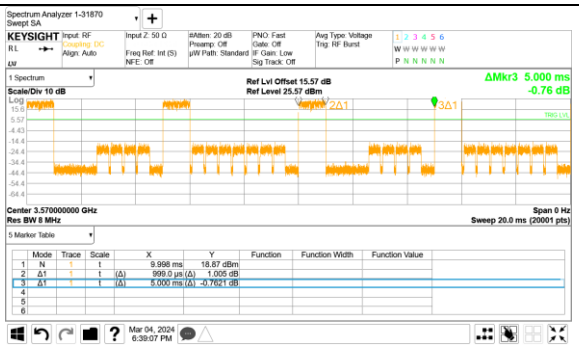


TEST PROCEDURE

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 band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

a) Set the RBW = 1 ~ 1.5 % of OBW(Typically limited to a minimum RBW of 1% of the OBW)
b) Set VBW ≥ 3 × RBW;
c) Set span ≥ 1.5 times the OBW;
d) Sweep time = Auto;
e) Detector = RMS;
f) Ensure that the number of measurement points ≥ 2*Span/RBW;
g) Trace mode = Average (100);

NOTE1

	
For LTE B48 (Gate trigger off): RF Path Loss: 15.57 dB & DCF 4 dB: 10log(2/5) Measure offset: 15.57 dB+4 dB = 19.57 dB	For NR n48 (Gate trigger off): RF Path Loss: 15.57 dB & DCF 7 dB: 10log(1/5) Measure offset: 15.57 dB+7 dB = 22.57 dB

NOTE2

Please refer to section 5.4 for bandwidth and RB setting about LTE, 5G NR bands.

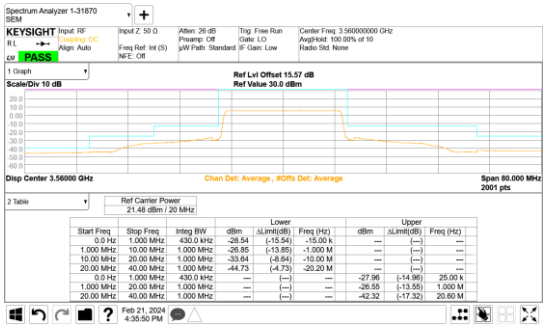
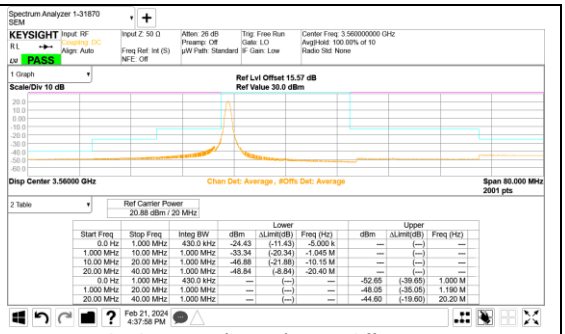
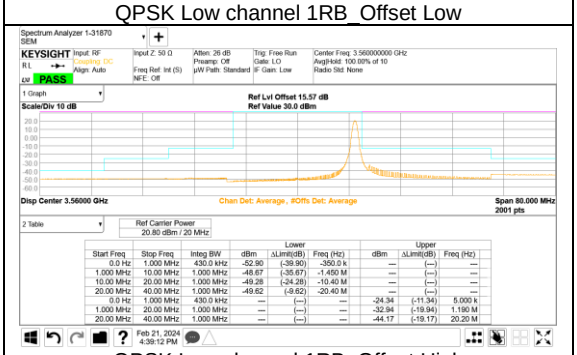
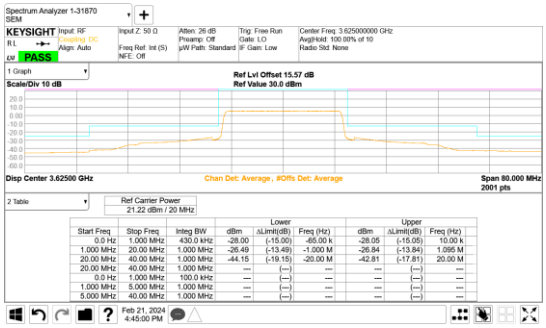
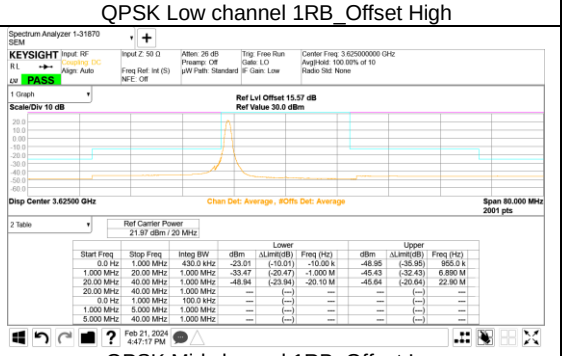
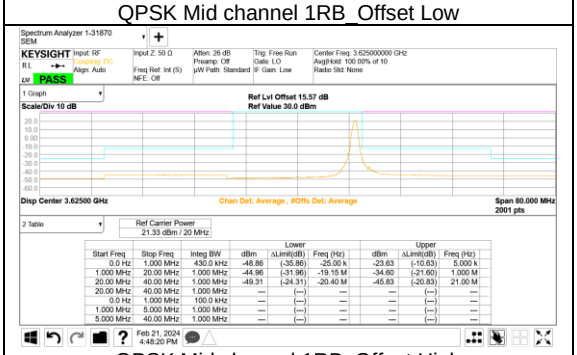
NOTE3

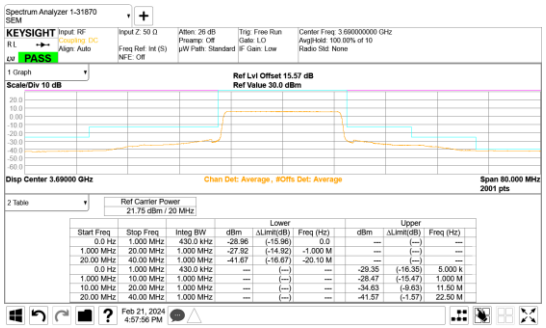
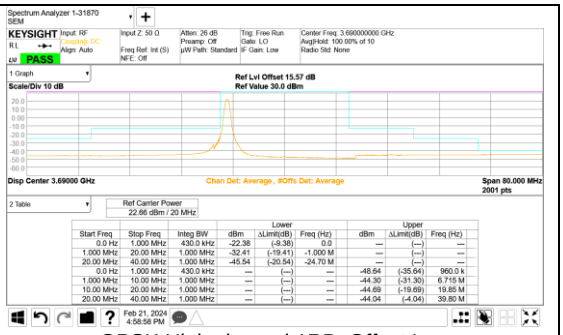
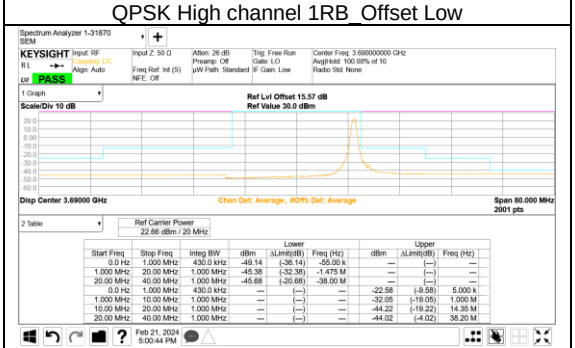
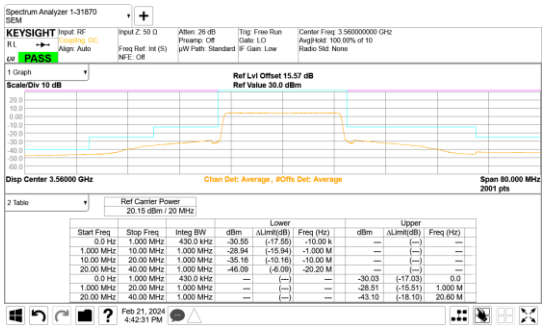
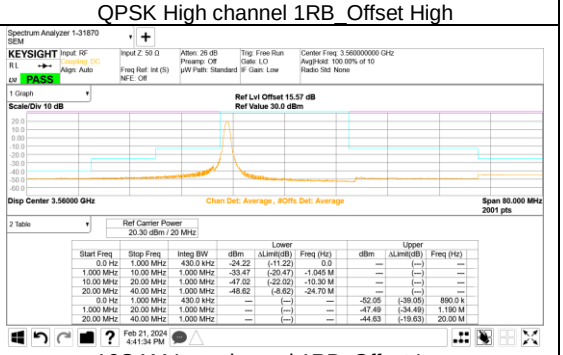
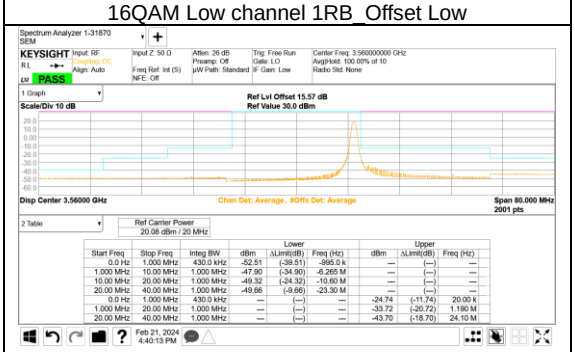
5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations (π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

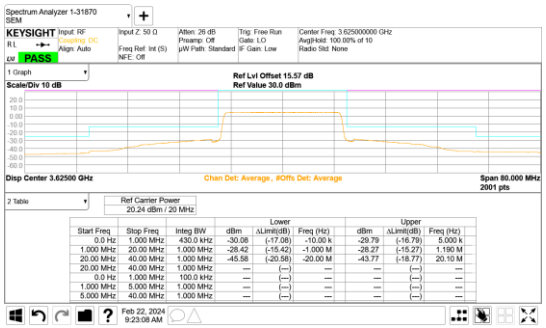
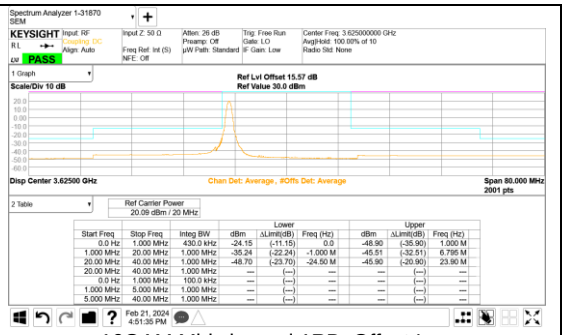
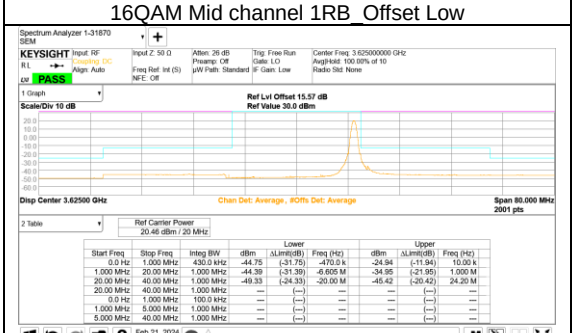
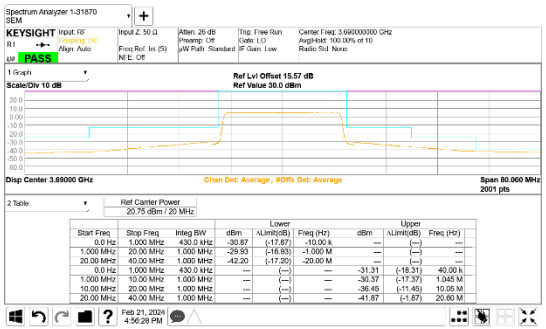
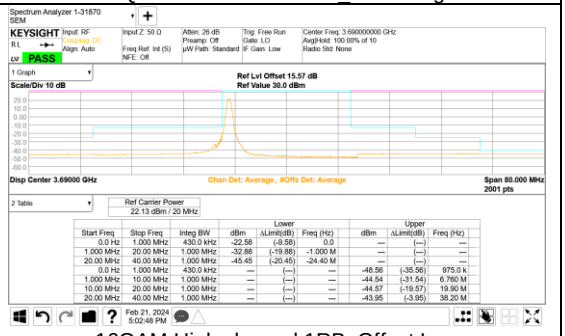
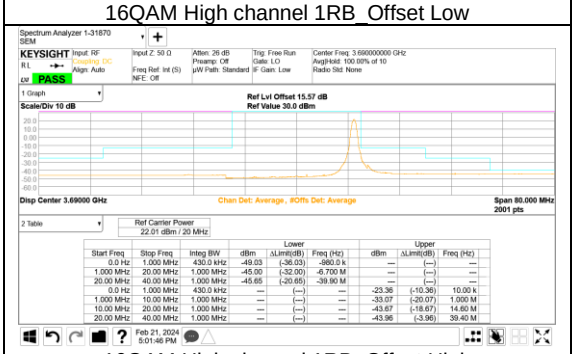
RESULTS

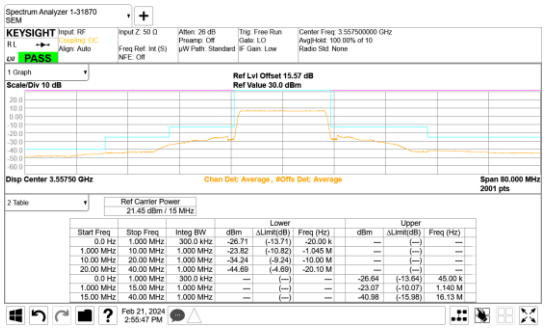
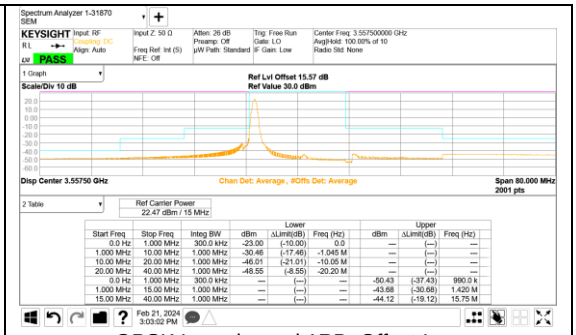
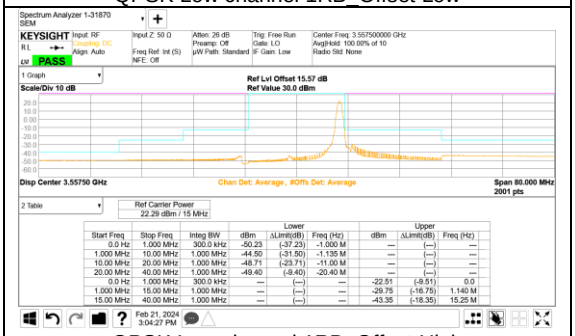
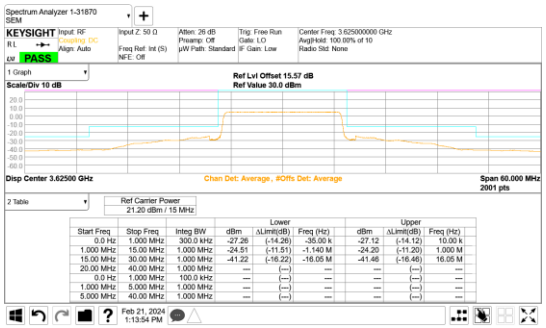
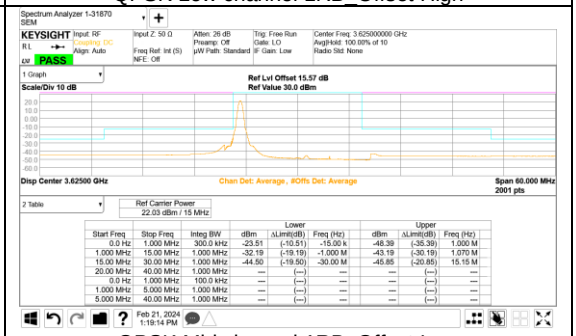
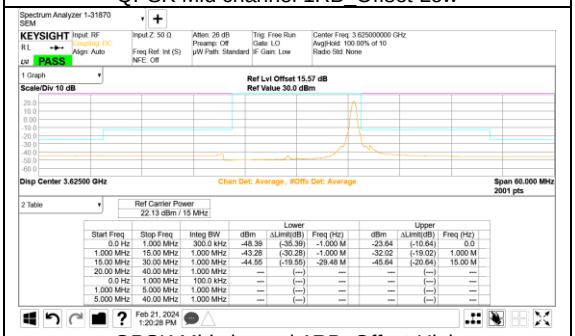
See the following pages.

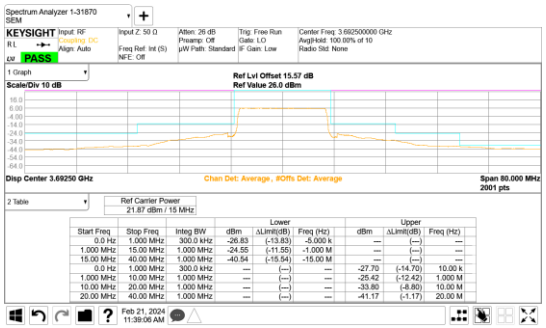
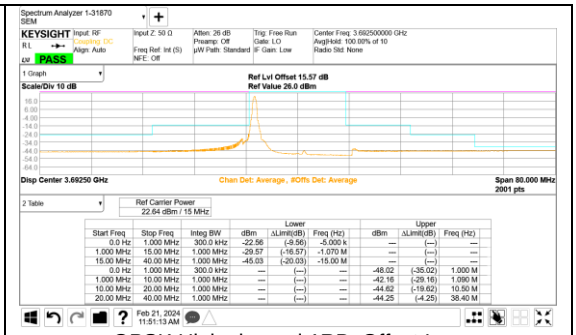
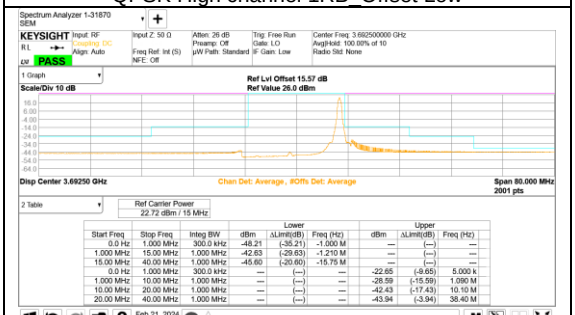
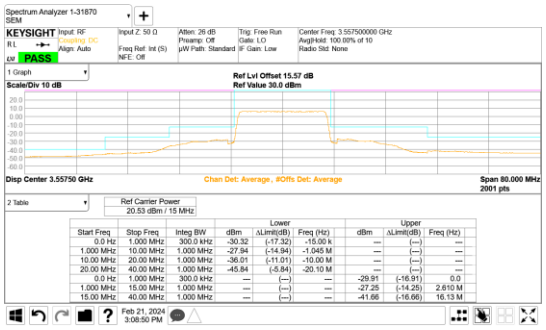
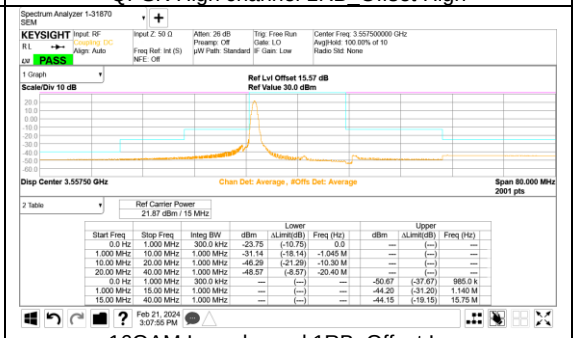
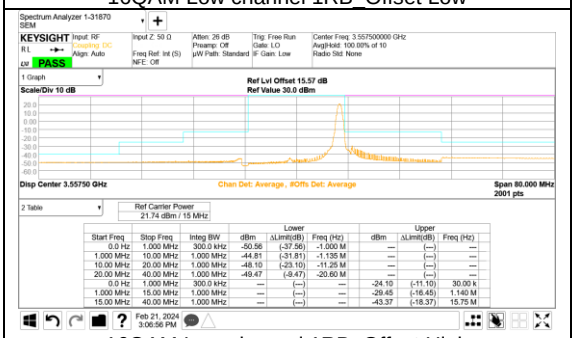
LTE Band 48

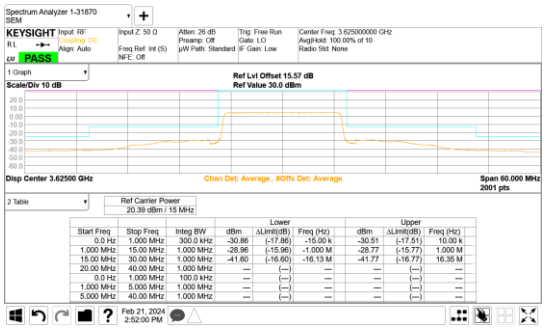
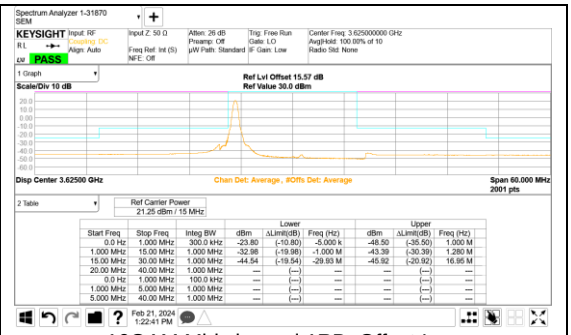
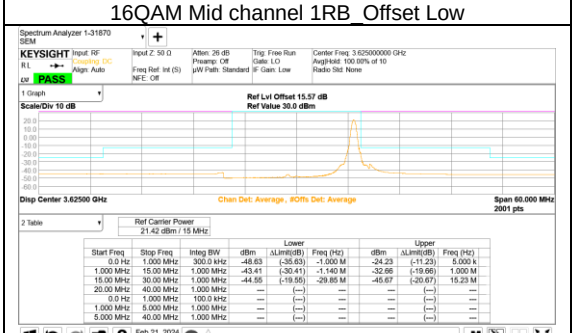
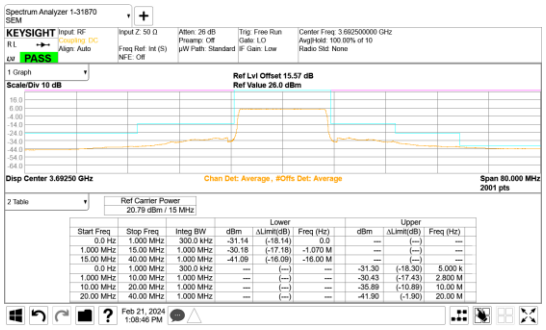
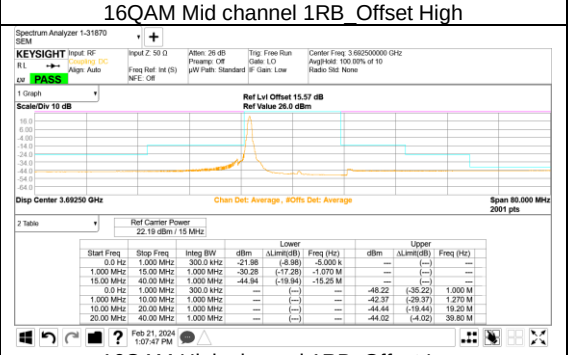
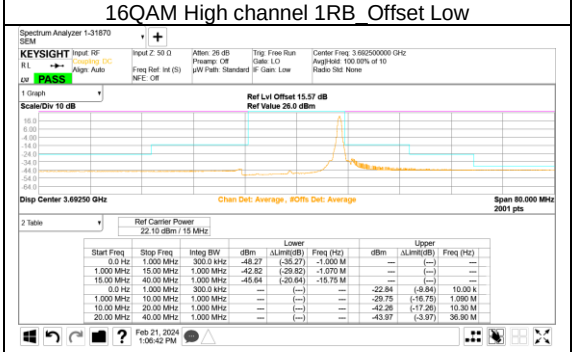
20MHz	 QPSK Low channel FRB	 QPSK Low channel 1RB_Offset Low
		 QPSK Low channel 1RB_Offset High
	 QPSK Mid channel FRB	 QPSK Mid channel 1RB_Offset Low
		 QPSK Mid channel 1RB_Offset High

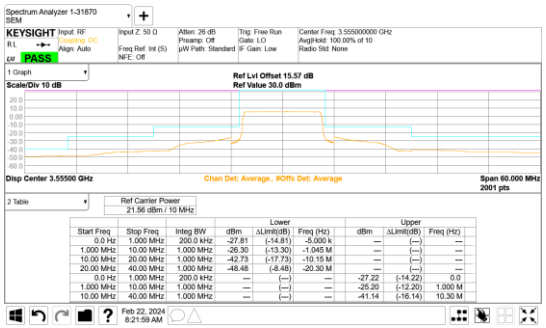
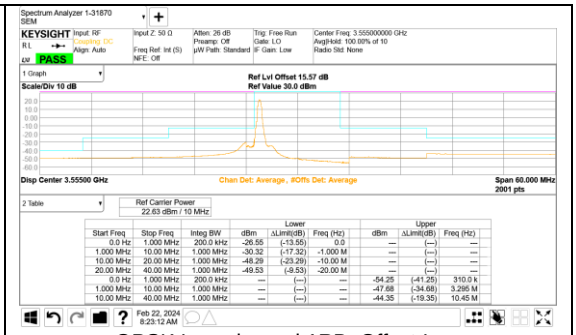
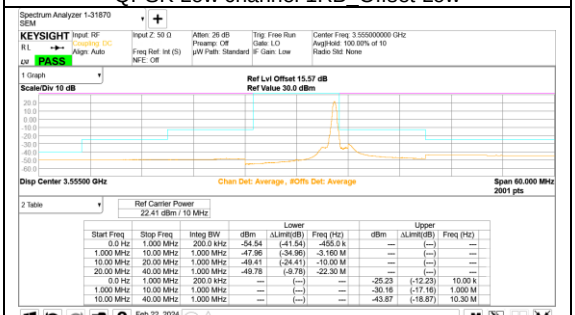
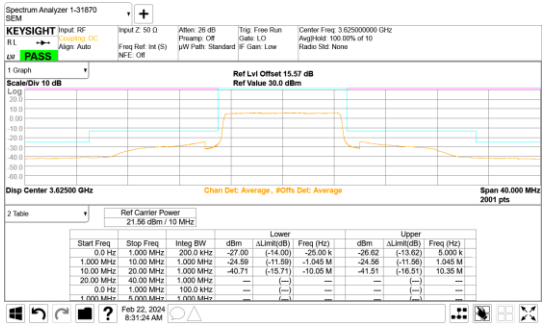
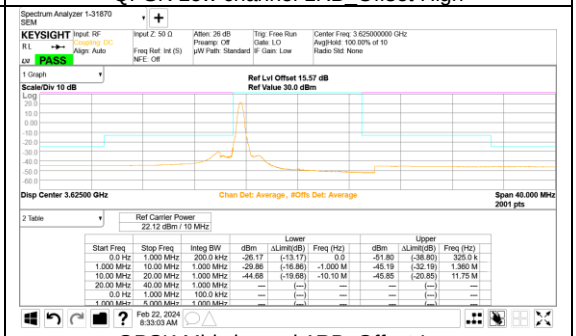
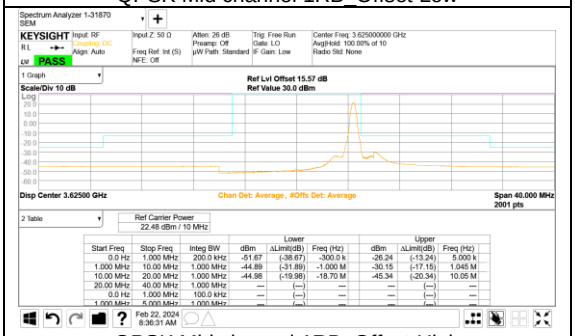
20MHz	 QPSK High channel FRB	 QPSK High channel 1RB_Offset Low
		 QPSK High channel 1RB_Offset High
20MHz	 16QAM Low channel FRB	 16QAM Low channel 1RB_Offset Low
		 16QAM Low channel 1RB_Offset High

20MHz	 16QAM Mid channel FRB	 16QAM Mid channel 1RB_Offset Low
		 16QAM Mid channel 1RB_Offset High
	 16QAM High channel FRB	 16QAM High channel 1RB_Offset Low
		 16QAM High channel 1RB_Offset High

15MHz	 QPSK Low channel FRB	 QPSK Low channel 1RB_Offset Low
		 QPSK Low channel 1RB_Offset High
	 QPSK Mid channel FRB	 QPSK Mid channel 1RB_Offset Low
		 QPSK Mid channel 1RB_Offset High

15MHz	 QPSK High channel FRB	 QPSK High channel 1RB_Offset Low
		 QPSK High channel 1RB_Offset High
	 16QAM Low channel FRB	 16QAM Low channel 1RB_Offset Low
		 16QAM Low channel 1RB_Offset High

15MHz	 16QAM Mid channel FRB	 16QAM Mid channel 1RB_Offset Low
		 16QAM Mid channel 1RB_Offset High
	 16QAM High channel FRB	 16QAM High channel 1RB_Offset Low
		 16QAM High channel 1RB_Offset High

10MHz	 QPSK Low channel FRB	 QPSK Low channel 1RB_Offset Low
		 QPSK Low channel 1RB_Offset High
	 QPSK Mid channel FRB	 QPSK Mid channel 1RB_Offset Low
		 QPSK Mid channel 1RB_Offset High