CERTIFICATION TEST REPORT

Report Number. : 4790716492-E2V1

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-A145FB/DS
FCC ID	:	A3LSMA145F
EUT Description	:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac.
Test Standard(s)	:	FCC CFR47 PART 22 SUBPART H FCC CFR47 PART 24 SUBPART E FCC CFR47 PART 27 SUBPART M

Date Of Issue:
2023-02-10

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

ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2023-02-10	Initial issue	Yeonhee Lim

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

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS 4

2. TEST METHODOLOGY 5

3. FACILITIES AND ACCREDITATION 5

4. CALIBRATION AND UNCERTAINTY 6

4.1. MEASURING INSTRUMENT CALIBRATION 6
4.2. SAMPLE CALCULATION 6
4.3. MEASUREMENT UNCERTAINTY 6
4.4. DECISION RULE 6

5. EQUIPMENT UNDER TEST 7

5.1. DESCRIPTION OF EUT 7
5.2. MAXIMUM OUTPUT POWER 7
5.3. DESCRIPTION OF AVAILABLE ANTENNAS 9
5.4. WORST-CASE ORIENTATION 10
5.5. DESCRIPTION OF TEST SETUP 11

6. TEST AND MEASUREMENT EQUIPMENT 13

7. SUMMARY TABLE 14

8. LIMITS AND CONDUCTED RESULTS 15

8.1. CONDUCTED OUTPUT POWER 15
8.1.1. CONDUCTED AVERAGE OUTPUT POWER 16
8.2. PEAK TO AVERAGE RATIO 21
8.2.1. CONDUCTED PEAK TO AVERAGE RESULT 22

9. LIMITS AND CONDUCTED RESULTS 25

9.1. OCCUPIED BANDWIDTH 25
9.1.1. OCCUPIED BANDWIDTH RESULTS 27
9.2. BAND EDGE EMISSIONS 31
9.2.1. BAND EDGE RESULT 33
9.2.2. EMISSION MASK RESULT 40
9.3. OUT OF BAND EMISSIONS 52
9.3.1. OUT OF BAND EMISSIONS RESULT 53
9.4. FREQUENCY STABILITY 58
9.4.1. FREQUENCY STABILITY RESULTS 59
9.5. RADIATED POWER (ERP & EIRP) 62
9.5.1. ERP/EIRP Results 63
9.6. FIELD STRENGTH OF SPURIOUS RADIATION 65
9.6.1. SPURIOUS RADIATION PLOTS 66

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

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac.
MODEL NUMBER:	SM-A145FB/DS
SERIAL NUMBER:	R38TB002JMJ, R38TB0026XB, R38TB002LDK, R38T9006RQT (CONDUCTED); R38TB002DJX, R38TB002K9R, R38T90076XE, R38T90083KP (RADIATED);
DATE TESTED:	2022-12-13 – 2023-01-31;

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

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

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

Approved & Released For
UL Korea, Ltd. By:

Seokhwan Hong
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Yeonhee Lim
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

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

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

3. FACILITIES AND ACCREDITATION

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

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna)

(Path loss = Signal generator output – PSA reading with substitution antenna)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	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, Above 18 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.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac.
This test report addresses the WWAN operational mode.

5.2. MAXIMUM OUTPUT POWER

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

GSM

FCC Part 22/24						
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
GSM850	824~849	GPRS	**32.50**	**1778.28**	**30.09**	**1020.94**
		EGPRS	25.97	395.37	26.17	414.00
GSM1900	1850~1910	GPRS	**31.08**	**1282.33**	**32.00**	**1584.89**
		EGPRS	25.37	344.35	27.46	557.19

WCDMA

FCC Part 22						
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	824~849	Rel. 99	**24.59**	**287.74**	**22.69**	**185.78**
		HSDPA	22.46	176.20	20.62	115.35

LTE Band 5

FCC Part 22							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	829.0 - 844.0	10	QPSK	24.42	276.69	**23.44**	**220.80**
			16QAM	23.35	216.27	22.53	179.06
	826.5 - 846.5	5	QPSK	24.33	271.02	23.07	202.77
			16QAM	23.34	215.77	21.95	156.68
	825.5 - 847.5	3	QPSK	**24.44**	**277.97**	23.01	199.99
			16QAM	23.32	214.78	21.85	153.11
	824.7 - 848.3	1.4	QPSK	24.36	272.90	22.62	182.81
			16QAM	23.32	214.78	21.41	138.36

LTE Band 41

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 41	2506.0 - 2680.0	20	QPSK	21.66	146.55	24.38	274.16
			16QAM	20.97	125.03	23.46	221.82
	2503.5 - 2682.5	15	QPSK	21.68	147.23	**24.40**	**275.42**
			16QAM	21.18	131.22	23.40	218.78
	2501.0 - 2685.0	10	QPSK	21.69	147.57	24.39	274.79
			16QAM	21.13	129.72	23.44	220.80
	2498.5 - 2687.5	5	QPSK	**21.75**	**149.62**	24.26	266.69
			16QAM	20.79	119.95	23.47	222.33

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

Frequency (MHz)	Peak Gain (dBi)
GSM1900 1850 - 1910 MHz	-2.9
GSM850/WCDMA Band 5 / LTE Band 5 / 824 - 849 MHz	-6.0
LTE Band 41 2496 ~ 2690 MHz	-4.9

5.4. WORST-CASE ORIENTATION

Following modes should be considered as worst-case scenario for all other measurements.

- GSM GPRS/EGPRS
- UMTS REL 99/HSDPA

For all LTE Bands the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, and 16QAM 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.

Highest power setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
5	829.0	10	1	0
	836.5		1	0
	844.0		1	0
41	2503.5	15	1	37
	2593.0		1	0
	2682.5		1	74

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

Band	**ERP/EIRP**			**RSE**		
	X	**Y**	**Z**	**X**	**Y**	**Z**
GSM850	-	-	O	-	O	-
GSM1900	-	O	-	-	O	-
WCDMA B5	-	-	O	O	-	-
LTE B5	-	-	O	-	-	O
LTE B41	-	O	-	-	O	-

Note : For ERP/EIRP testing, the EUT didn't attached with travel adapter. But radiated spurious testing, the EUT attached with travel adapter for the worst case condition. The EUT is continuously communicated with the call box during the tests.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacture**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA200	R37NS8Q7J35DK3	N/A
Data Cable	SAMSUNG	EP-DR140AWE	GH39-02134A	N/A
Charger	SAMSUNG	EP-TA800	R37T2H82D29SEA	N/A
Data Cable	SAMSUNG	EP-DN980BWE	GH39-02115A	N/A
Earphone	SAMSUNG	EHS61ASFBE	GH59-15063A	N/A

I/O CABLE

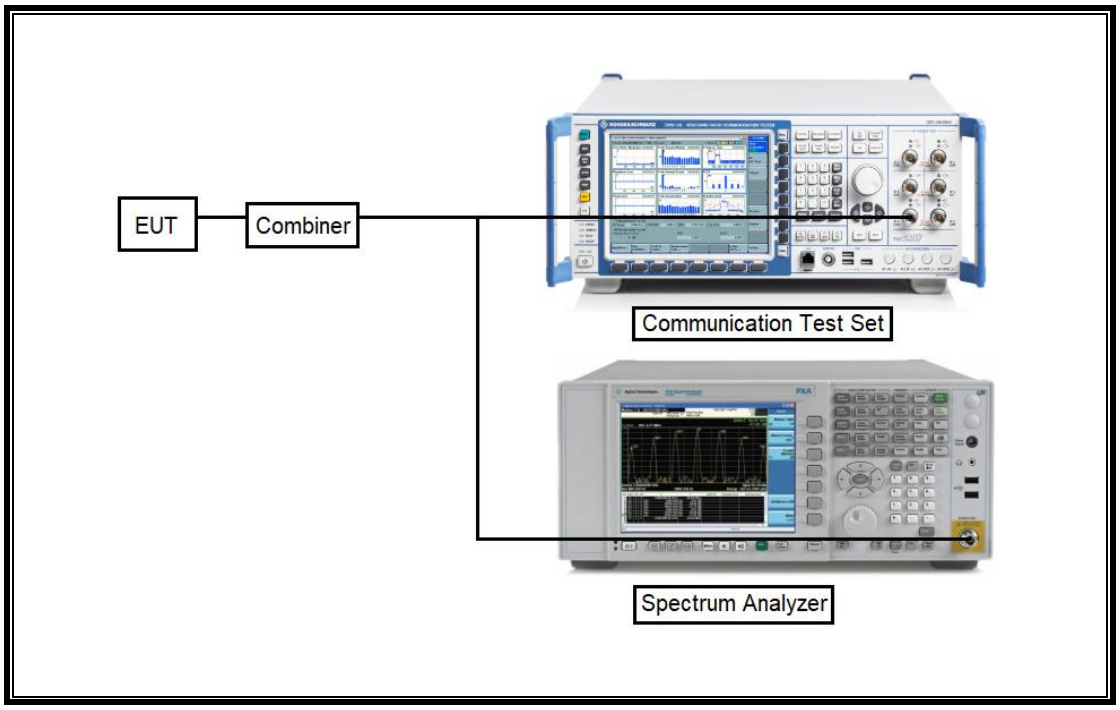
I/O Cable List						
Cable No.	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.0 m	N/A
2	Audio	2	Mini-jack	Unshielded	0.7 m	N/A

TEST SETUP

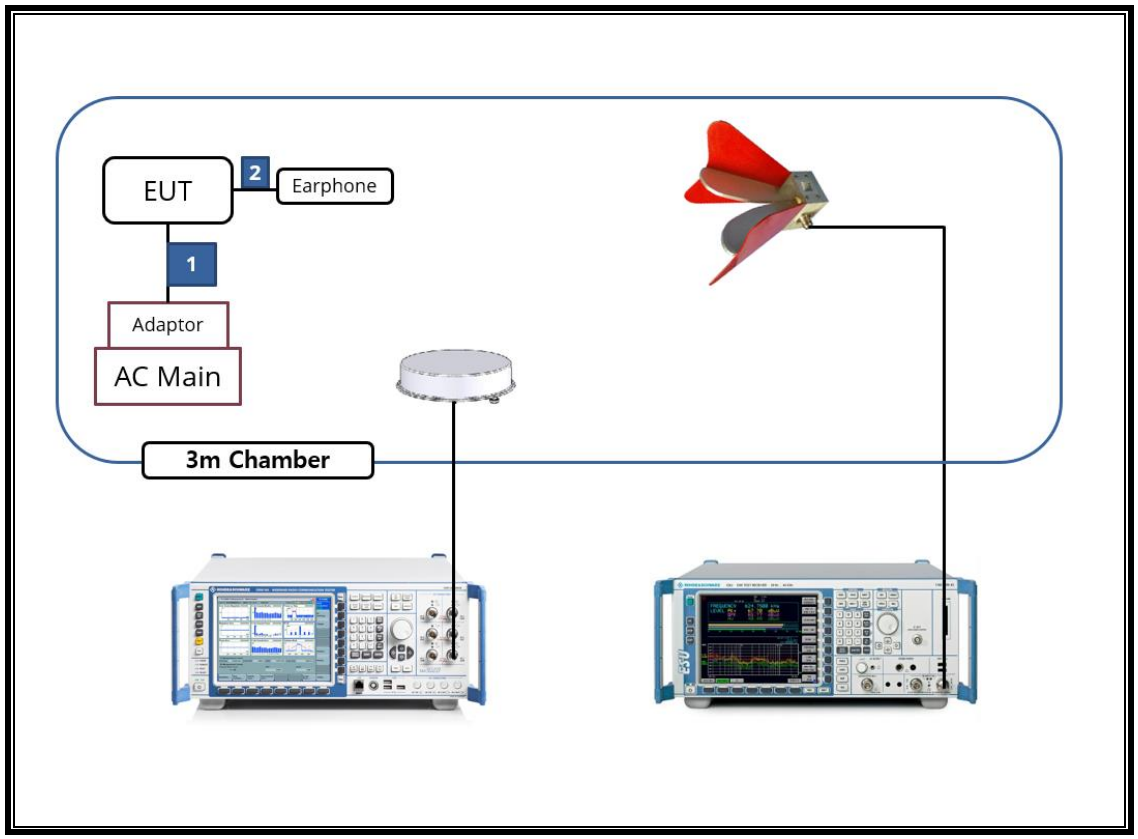
The EUT is continuously communicated with the call box during the tests.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_22/24/27(04)
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	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	1876511	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
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

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass
22.917(a) 24.238(a)	Band Edge / Conducted Spurious Emission	-13dBm		Pass
27.53(m)	Conducted Spurious Emission	-25dBm		Pass
27.53(m)	Emission mask	Section 9.2.2		Pass
2.1046	Conducted output power	N/A		Pass
22.355 24.235 27.54	Frequency Stability	2.5PPM		Pass
22.913(a)(5)	Effective Radiated Power	38.5dBm	Radiated	Pass
24.232(c) 27.50(h)(2)	Equivalent Isotropic Radiated Power	33dBm		Pass
22.917(a) 24.238(a)	Radiated Spurious Emission	-13dBm		Pass
27.53(m)		-25dBm		Pass

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

8. LIMITS AND 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 CMW500 Test Set configured to operate at maximum power.

RESULTS

See the following pages.

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

8.1.1. CONDUCTED AVERAGE OUTPUT POWER

GSM 850

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	32.29	23.26	34.0	25.0
			190	836.6	32.42	23.39		
			251	848.8	32.36	23.33		
GPRS (GMSK)	CS1	1	128	824.2	32.27	23.24	34.0	25.0
			190	836.6	32.50	23.47		
			251	848.8	32.42	23.39		
		2	128	824.2	30.52	24.50	32.0	26.0
			190	836.6	30.41	24.39		
			251	848.8	30.25	24.23		
		3	128	824.2	29.48	25.22	30.0	25.7
			190	836.6	29.30	25.04		
			251	848.8	29.12	24.86		
		4	128	824.2	28.41	25.40	29.5	**26.5**
			190	836.6	28.49	25.48		
			251	848.8	28.01	25.00		
EGPRS (8PSK)	MCS5	1	128	824.2	25.87	16.84	27.5	18.5
			190	836.6	25.97	16.94		
			251	848.8	25.79	16.76		
		2	128	824.2	23.93	17.91	25.5	19.5
			190	836.6	24.01	17.99		
			251	848.8	23.72	17.70		
		3	128	824.2	22.71	18.45	23.0	18.7
			190	836.6	22.57	18.31		
			251	848.8	22.37	18.11		
		4	128	824.2	21.62	18.61	22.0	19.0
			190	836.6	21.49	18.48		
			251	848.8	21.29	18.28		

GSM1900

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	512	1850.2	30.92	21.89	32.0	23.0
			661	1880.0	30.95	21.92		
			810	1909.8	31.02	21.99		
GPRS (GMSK)	CS1	1	512	1850.2	31.08	22.05	32.0	23.0
			661	1880.0	30.90	21.87		
			810	1909.8	30.84	21.81		
		2	512	1850.2	28.19	22.17	29.5	**23.5**
			661	1880.0	27.92	21.90		
			810	1909.8	28.09	22.07		
		3	512	1850.2	25.67	21.41	27.5	23.2
			661	1880.0	26.35	22.09		
			810	1909.8	27.17	22.91		
		4	512	1850.2	24.58	21.57	26.0	23.0
			661	1880.0	25.24	22.23		
			810	1909.8	25.78	22.77		
EGPRS (8PSK)	MCS5	1	512	1850.2	25.00	15.97	26.0	17.0
			661	1880.0	25.27	16.24		
			810	1909.8	25.37	16.34		
		2	512	1850.2	23.24	17.22	24.5	18.5
			661	1880.0	23.62	17.60		
			810	1909.8	23.71	17.69		
		3	512	1850.2	21.76	17.50	23.0	18.7
			661	1880.0	22.19	17.93		
			810	1909.8	22.33	18.07		
		4	512	1850.2	20.34	17.33	21.0	18.0
			661	1880.0	20.74	17.73		
			810	1909.8	20.85	17.84		

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

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	24.59	N/A	25.5
		4183	836.6	24.42		
		4233	846.6	24.34		
HSDPA	Subtest 1	4132	826.4	22.46	0	23.0
		4183	836.6	22.31		
		4233	846.6	22.14		
	Subtest 2	4132	826.4	22.42	0	23.0
		4183	836.6	22.31		
		4233	846.6	22.14		
	Subtest 3	4132	826.4	21.48	0.5	22.5
		4183	836.6	21.36		
		4233	846.6	21.21		
	Subtest 4	4132	826.4	21.79	0.5	22.5
		4183	836.6	21.73		
		4233	846.6	21.55		
HSUPA	Subtest 1	4132	826.4	22.05	0	23.0
		4183	836.6	21.95		
		4233	846.6	21.75		
	Subtest 2	4132	826.4	20.09	2	21.0
		4183	836.6	19.97		
		4233	846.6	19.82		
	Subtest 3	4132	826.4	20.98	1	22.0
		4183	836.6	20.86		
		4233	846.6	20.66		
	Subtest 4	4132	826.4	20.11	2	21.0
		4183	836.6	20.00		
		4233	846.6	19.78		
	Subtest 5	4132	826.4	22.02	0	23.0
		4183	836.6	21.85		
		4233	846.6	21.69		
DC-HSDPA	Subtest 1	4132	826.4	22.29	0	23.0
		4183	836.6	22.58		
		4233	846.6	22.41		
	Subtest 2	4132	826.4	22.31	0	23.0
		4183	836.6	22.58		
		4233	846.6	22.43		
	Subtest 3	4132	826.4	20.77	0.5	22.5
		4183	836.6	21.09		
		4233	846.6	20.92		
	Subtest 4	4132	826.4	21.65	0.5	22.5
		4183	836.6	21.93		
		4233	846.6	21.78		

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

LTE Band 5

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				Measured Pwr (dBm)			MPR	Tune-up Limit
				20450	20525	20600		
				829 MHz	836.5 MHz	844 MHz		
10 MHz	QPSK	1	0	24.30	24.42	24.34	0.0	25.5
		1	25	24.24	24.35	24.33	0.0	25.5
		1	49	24.20	24.29	24.27	0.0	25.5
		25	0	23.34	23.38	23.35	1.0	24.5
		25	12	23.31	23.32	23.31	1.0	24.5
		25	25	23.28	23.31	23.29	1.0	24.5
		50	0	23.32	23.35	23.33	1.0	24.5
	16QAM	1	0	23.28	23.35	23.19	1.0	24.5
		1	25	23.21	23.24	23.12	1.0	24.5
		1	49	23.17	23.20	23.11	1.0	24.5
		25	0	22.37	22.42	22.42	2.0	23.5
		25	12	22.34	22.37	22.39	2.0	23.5
		25	25	22.29	22.33	22.36	2.0	23.5
		50	0	22.38	22.34	22.38	2.0	23.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				20425	20525	20625		
				826.5 MHz	836.5 MHz	846.5 MHz		
5 MHz	QPSK	1	0	24.25	24.26	24.33	0.0	25.5
		1	12	24.24	24.21	24.30	0.0	25.5
		1	24	24.16	24.19	24.30	0.0	25.5
		12	0	23.32	23.32	23.37	1.0	24.5
		12	7	23.33	23.31	23.34	1.0	24.5
		12	13	23.31	23.33	23.36	1.0	24.5
		25	0	23.32	23.28	23.37	1.0	24.5
	16QAM	1	0	23.29	23.32	23.34	1.0	24.5
		1	12	23.25	23.27	23.34	1.0	24.5
		1	24	23.23	23.27	23.31	1.0	24.5
		12	0	22.42	22.39	22.40	2.0	23.5
		12	7	22.41	22.33	22.40	2.0	23.5
		12	13	22.39	22.35	22.37	2.0	23.5
		25	0	22.31	22.33	22.43	2.0	23.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				20415	20525	20635		
				825.5 MHz	836.5 MHz	847.5 MHz		
3 MHz	QPSK	1	0	24.35	24.30	24.44	0.0	25.5
		1	8	24.36	24.30	24.43	0.0	25.5
		1	14	24.32	24.30	24.41	0.0	25.5
		8	0	23.30	23.31	23.33	1.0	24.5
		8	4	23.30	23.29	23.32	1.0	24.5
		8	7	23.28	23.30	23.33	1.0	24.5
		15	0	23.30	23.34	23.33	1.0	24.5
	16QAM	1	0	23.19	23.16	23.32	1.0	24.5
		1	8	23.16	23.10	23.29	1.0	24.5
		1	14	23.11	23.13	23.29	1.0	24.5
		8	0	22.29	22.41	22.42	2.0	23.5
		8	4	22.32	22.41	22.37	2.0	23.5
		8	7	22.32	22.40	22.39	2.0	23.5
		15	0	22.35	22.35	22.30	2.0	23.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				20407	20525	20643		
				824.7 MHz	836.5 MHz	848.3 MHz		
1.4 MHz	QPSK	1	0	24.33	24.26	24.35	0.0	25.5
		1	3	24.32	24.26	24.34	0.0	25.5
		1	5	24.33	24.27	24.36	0.0	25.5
		3	0	24.27	24.30	24.26	0.0	25.5
		3	1	24.26	24.30	24.28	0.0	25.5
		3	3	24.25	24.30	24.29	0.0	25.5
		6	0	23.32	23.31	23.24	1.0	24.5
	16QAM	1	0	23.08	23.24	23.04	1.0	24.5
		1	3	23.05	23.22	23.03	1.0	24.5
		1	5	23.06	23.25	23.07	1.0	24.5
		3	0	23.27	23.32	23.29	1.0	24.5
		3	1	23.27	23.30	23.30	1.0	24.5
		3	3	23.30	23.29	23.30	1.0	24.5
		6	0	22.41	22.20	22.33	2.0	23.5

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

LTE Band 41

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)			MPR	Tune-up Limit
				Measured Pwr (dBm)				
				39750	40620	41490		
				2506 MHz	2593 MHz	2680 MHz		
20 MHz	QPSK	1	0	21.39	21.57	21.61	0.0	23.5
		1	49	21.37	21.50	21.60	0.0	23.5
		1	99	21.45	21.66	21.65	0.0	23.5
		50	0	20.74	20.89	20.98	1.0	22.5
		50	24	20.74	20.93	20.97	1.0	22.5
		50	50	20.77	20.99	20.98	1.0	22.5
		100	0	20.75	20.93	21.03	1.0	22.5
	16QAM	1	0	20.64	20.64	20.73	1.0	22.5
		1	49	20.82	20.97	20.94	1.0	22.5
		1	99	20.67	20.94	20.93	1.0	22.5
		50	0	19.71	19.94	20.05	2.0	21.5
		50	24	19.71	19.98	20.06	2.0	21.5
		50	50	19.77	20.01	20.06	2.0	21.5
		100	0	19.73	20.01	20.04	2.0	21.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				39725	40620	41515		
				2503.5 MHz	2593 MHz	2682.5 MHz		
15 MHz	QPSK	1	0	21.21	21.60	21.64	0.0	23.5
		1	37	21.29	21.56	21.64	0.0	23.5
		1	74	21.27	21.58	21.68	0.0	23.5
		36	0	20.69	20.96	21.03	1.0	22.5
		36	20	20.72	20.98	21.04	1.0	22.5
		36	39	20.72	20.98	21.04	1.0	22.5
		75	0	20.70	20.98	21.05	1.0	22.5
	16QAM	1	0	20.73	20.97	21.03	1.0	22.5
		1	37	20.41	20.99	20.90	1.0	22.5
		1	74	20.66	20.91	21.18	1.0	22.5
		36	0	19.73	20.02	20.06	2.0	21.5
		36	20	19.80	20.06	20.11	2.0	21.5
		36	39	19.77	20.06	20.11	2.0	21.5
		75	0	19.73	20.03	20.07	2.0	21.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				39700	40620	41540		
				2501 MHz	2593 MHz	2685 MHz		
10 MHz	QPSK	1	0	21.30	21.60	21.65	0.0	23.5
		1	25	21.32	21.63	21.69	0.0	23.5
		1	49	21.34	21.60	21.66	0.0	23.5
		25	0	20.70	20.98	21.02	1.0	22.5
		25	12	20.70	21.00	21.02	1.0	22.5
		25	25	20.72	21.01	21.01	1.0	22.5
		50	0	20.70	20.98	21.01	1.0	22.5
	16QAM	1	0	20.41	20.91	21.09	1.0	22.5
		1	25	20.45	20.93	21.13	1.0	22.5
		1	49	20.48	20.92	21.09	1.0	22.5
		25	0	19.73	20.02	20.05	2.0	21.5
		25	12	19.75	20.03	20.05	2.0	21.5
		25	25	19.77	20.06	20.07	2.0	21.5
		50	0	19.73	20.03	20.01	2.0	21.5
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				39675	40620	41565		
				2498.5 MHz	2593 MHz	2687.5 MHz		
5 MHz	QPSK	1	0	21.18	21.65	21.75	0.0	23.5
		1	12	21.19	21.65	21.74	0.0	23.5
		1	24	21.18	21.62	21.74	0.0	23.5
		12	0	20.62	21.04	21.05	1.0	22.5
		12	7	20.63	21.01	21.04	1.0	22.5
		12	13	20.63	21.00	21.04	1.0	22.5
		25	0	20.63	21.00	21.02	1.0	22.5
	16QAM	1	0	20.26	20.54	20.78	1.0	22.5
		1	12	20.27	20.57	20.79	1.0	22.5
		1	24	20.28	20.55	20.77	1.0	22.5
		12	0	19.59	19.97	20.13	2.0	21.5
		12	7	19.60	19.98	20.13	2.0	21.5
		12	13	19.60	19.98	20.12	2.0	21.5
		25	0	19.66	20.05	20.07	2.0	21.5

8.2. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

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

Test Spec

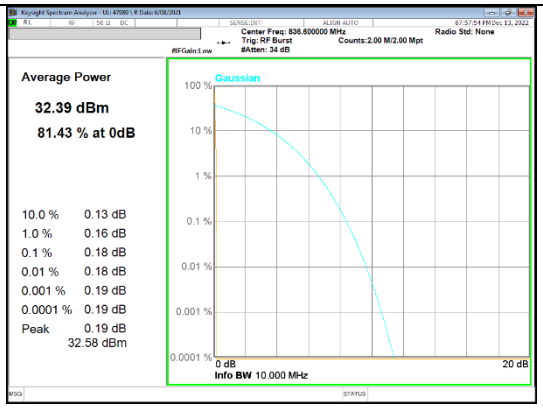
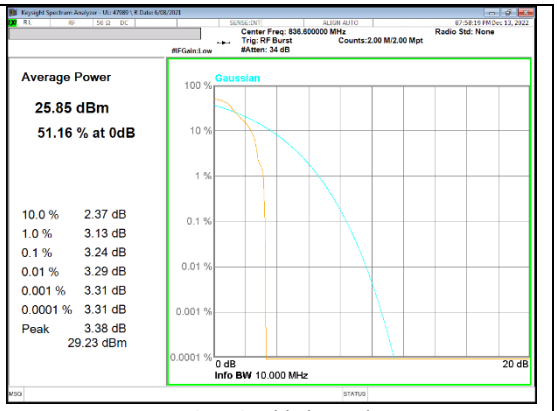
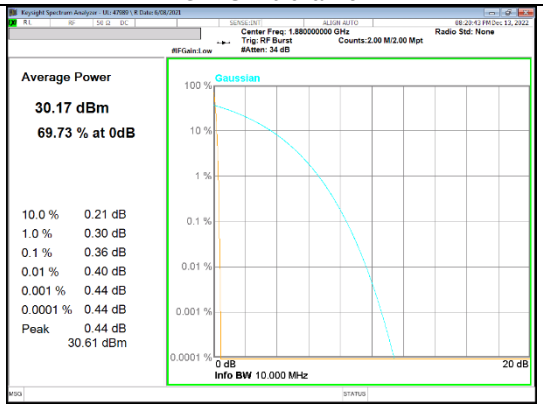
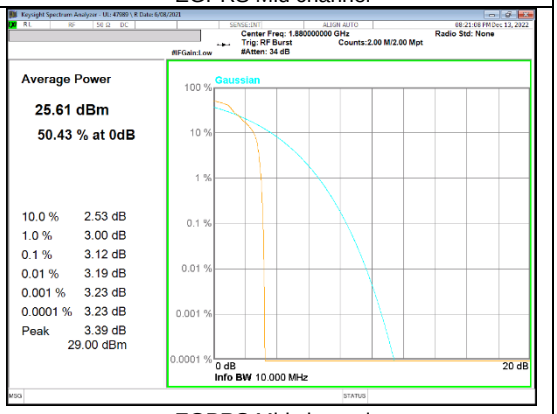
In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

RESULTS

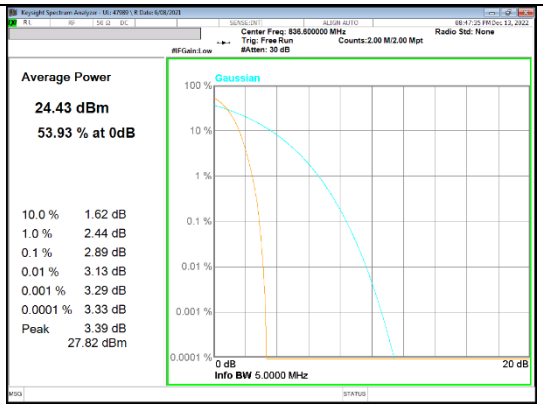
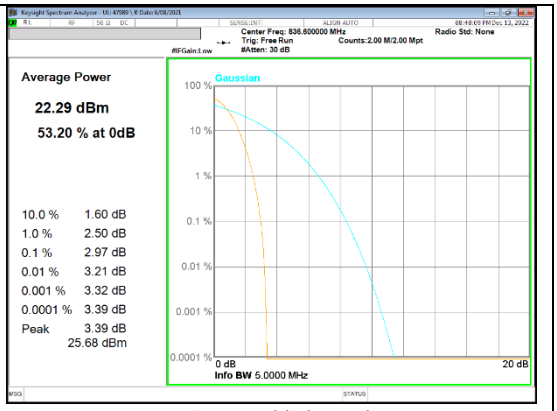
See the following pages.

8.2.1. CONDUCTED PEAK TO AVERAGE RESULT

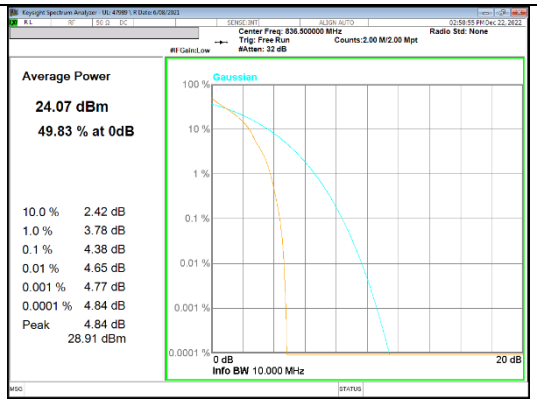
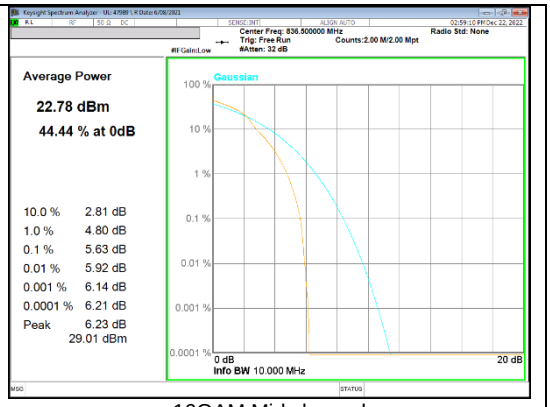
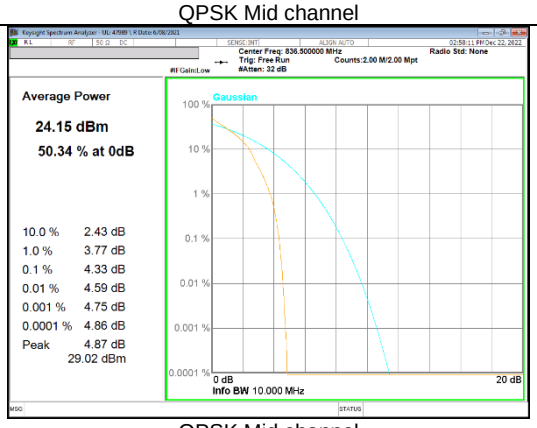
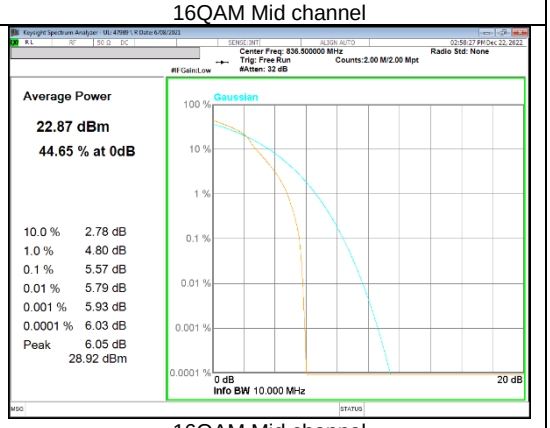
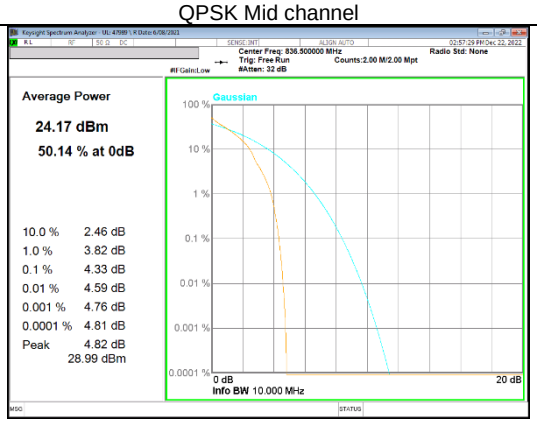
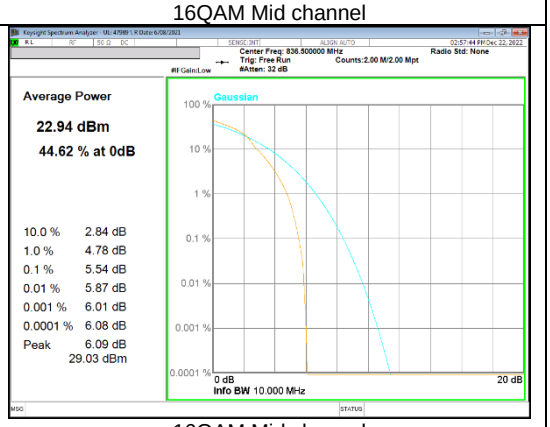
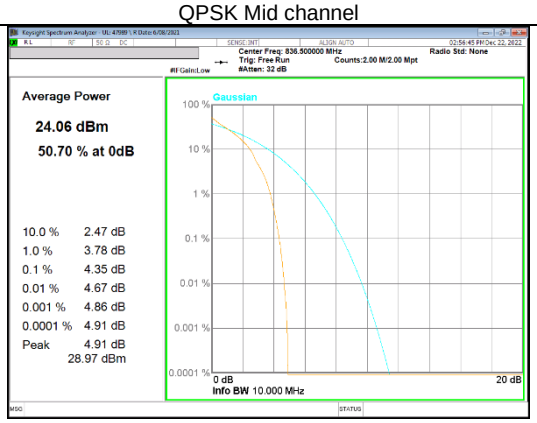
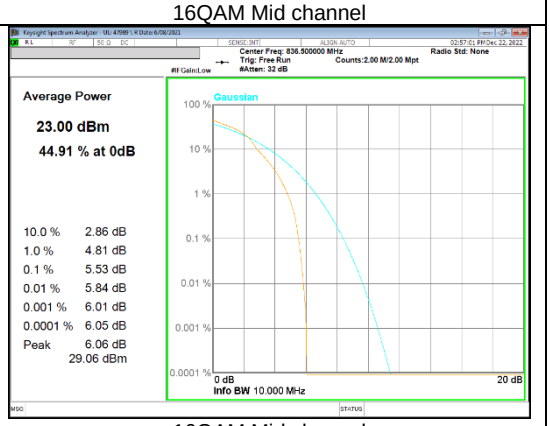
GSM

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

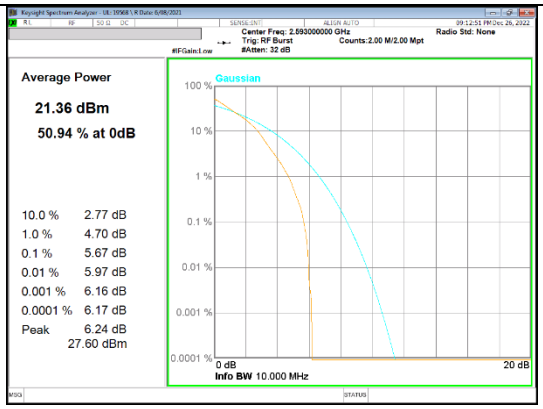
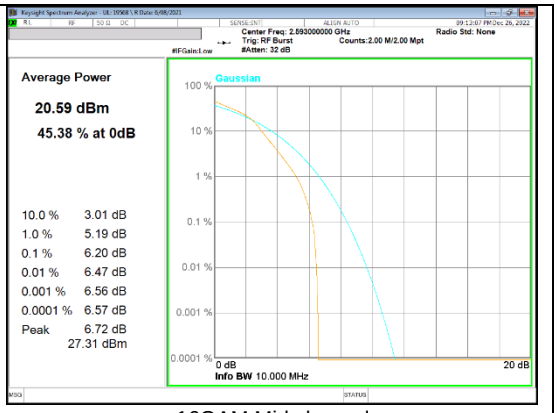
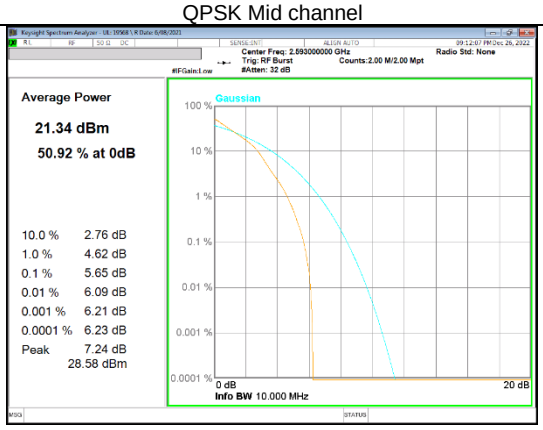
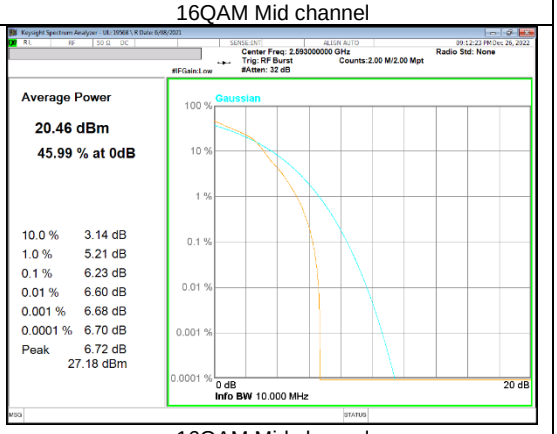
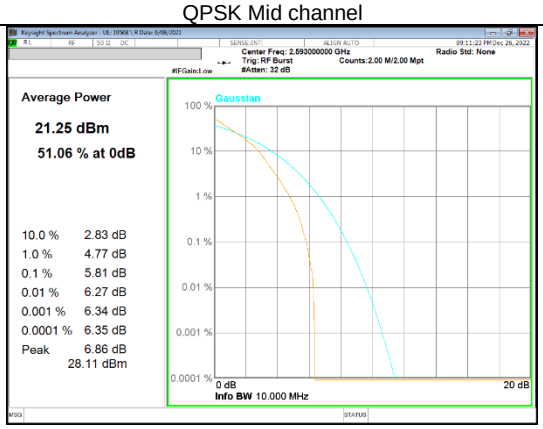
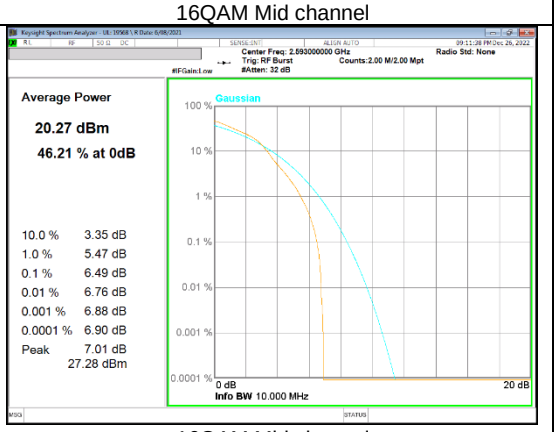
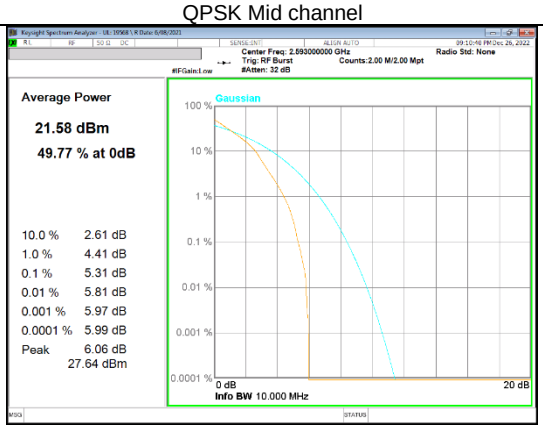
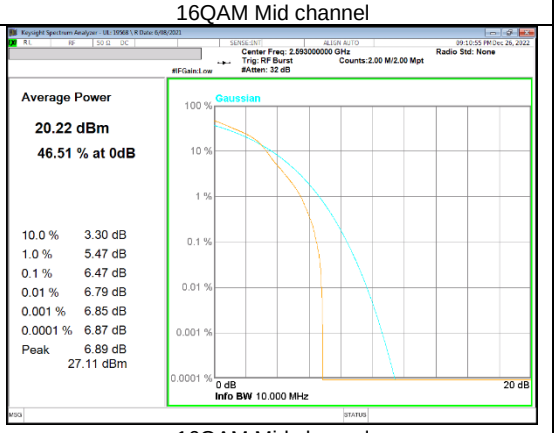
WCDMA

Band 5	 REL99 Mid channel	 HSDPA Mid channel

LTE Band 5

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

LTE Band 41

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

9. LIMITS AND CONDUCTED RESULTS

9.1. 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	243.69	314.0
	EGPRS		251.89	320.8
1900	GPRS	1880.0	245.02	315.6
	EGPRS		250.42	316.3

- **WCDMA**

Band	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
B5	Rel.99	836.6	4.140	4.695
	HSDPA		4.139	4.710

- LTE Band 5

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B5	10M	QPSK	836.5	8.965	10.280
		16QAM		8.969	10.170
	5M	QPSK		4.500	5.200
		16QAM		4.494	5.220
	3M	QPSK		2.708	3.110
		16QAM		2.692	3.090
	1.4M	QPSK		1.091	1.300
		16QAM		1.091	1.330

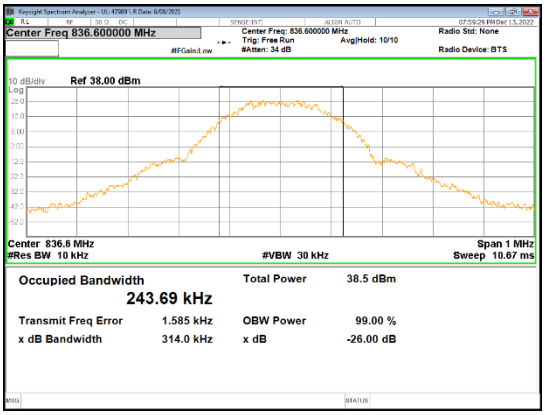
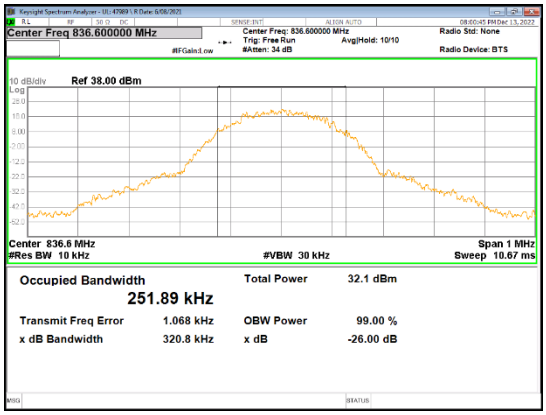
- LTE Band 41

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B41	20M	QPSK	2593.0	17.848	19.570
		16QAM		17.897	19.710
	15M	QPSK		13.420	15.010
		16QAM		13.436	14.970
	10M	QPSK		8.944	10.120
		16QAM		8.941	10.200
	5M	QPSK		4.435	5.190
		16QAM		4.472	4.980

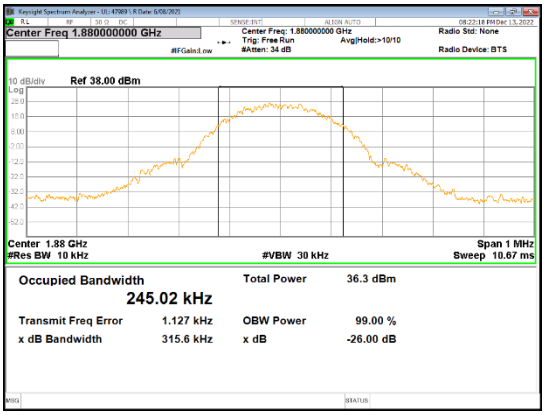
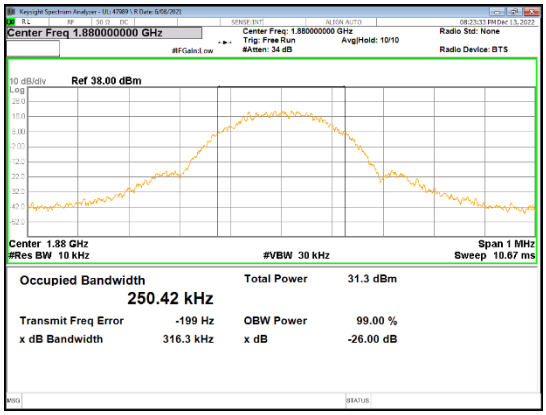
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_22/24/27(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

9.1.1. OCCUPIED BANDWIDTH RESULTS

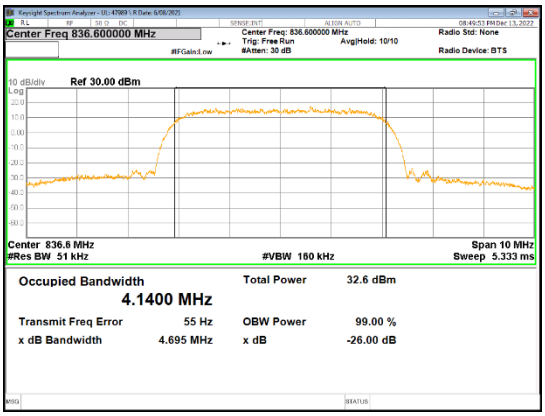
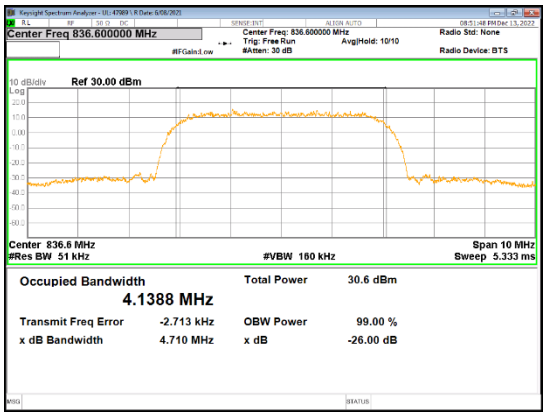
GSM 850

GSM 850	 GPRS Mid channel	 EGPRS Mid channel

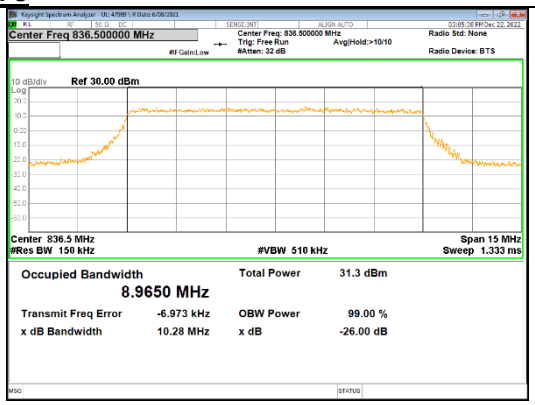
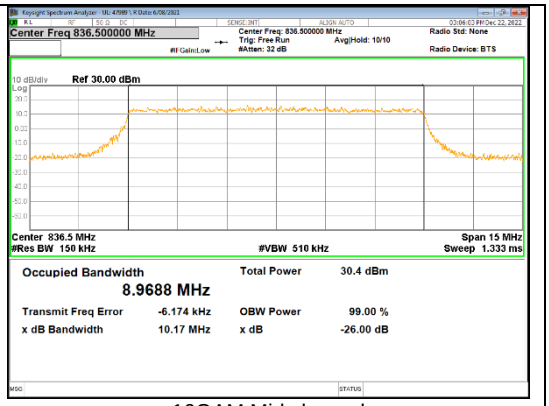
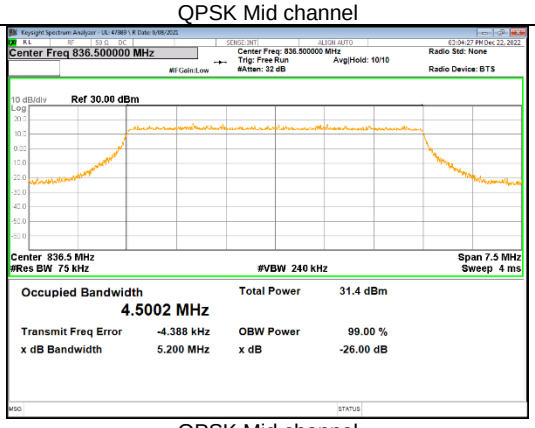
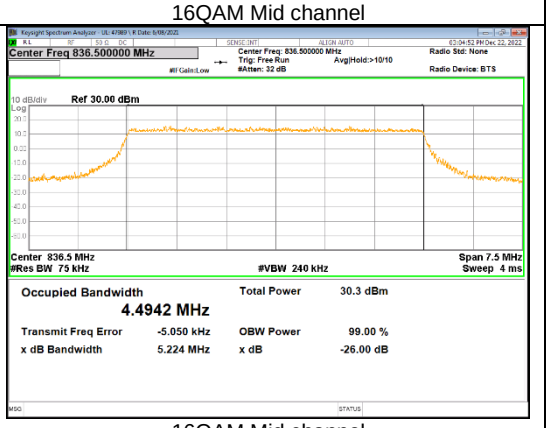
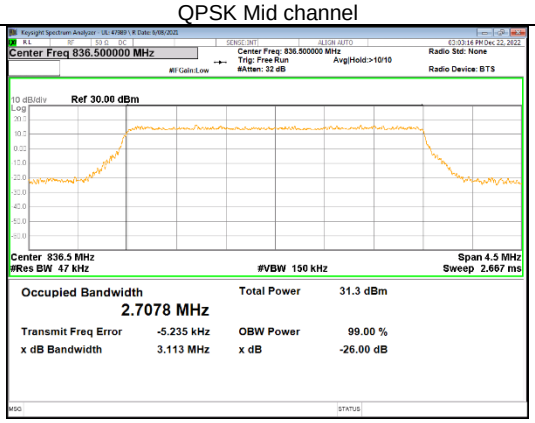
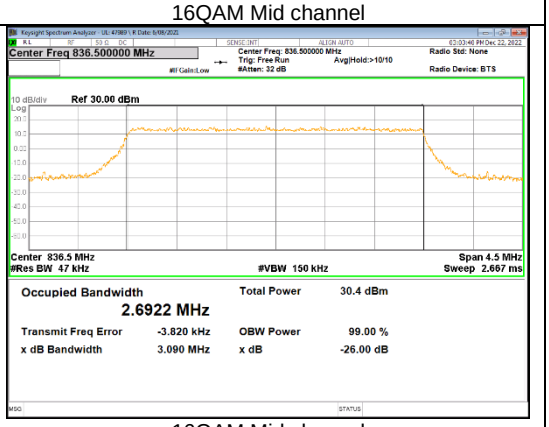
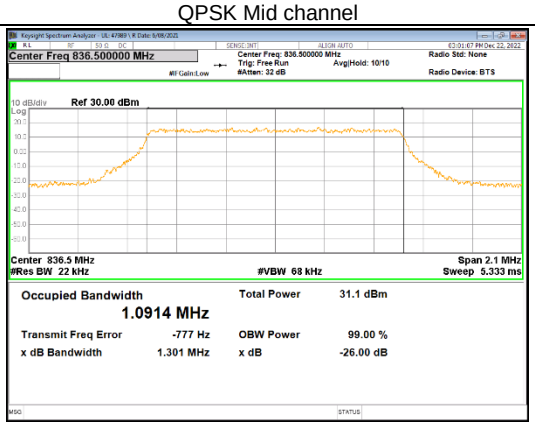
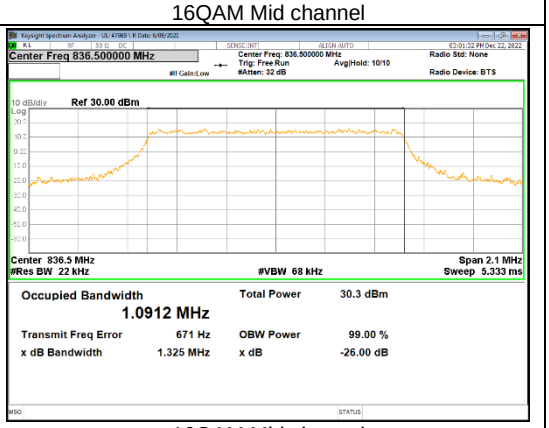
GSM 1900

GSM 1900	 GPRS Mid channel	 EGPRS Mid channel

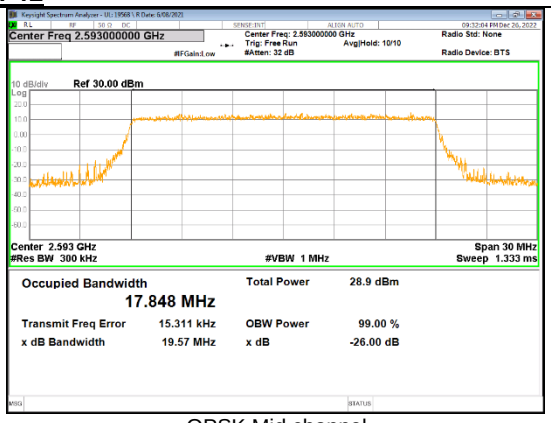
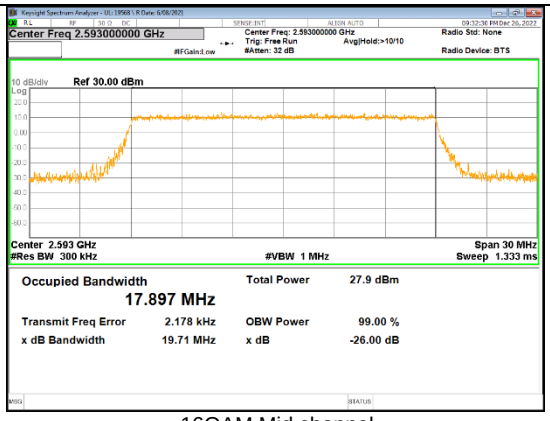
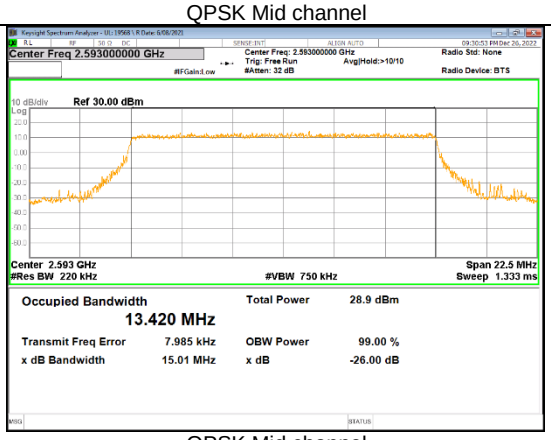
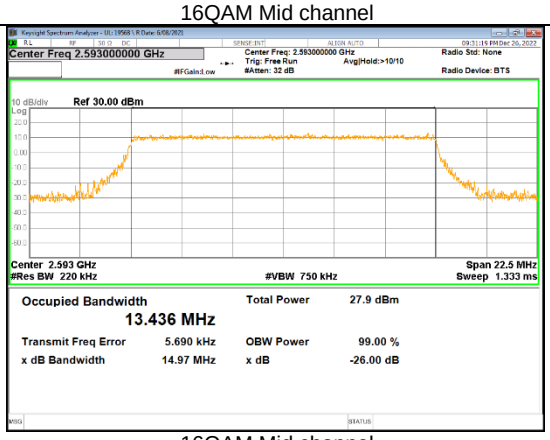
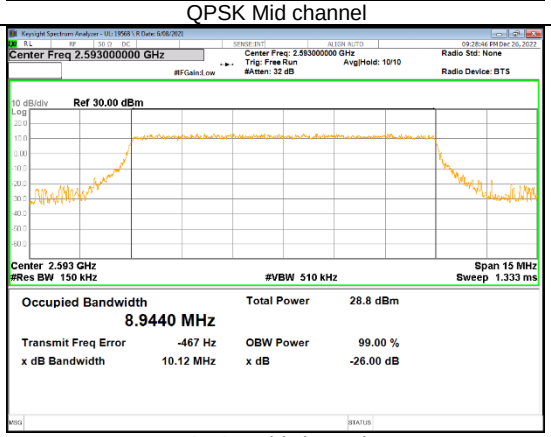
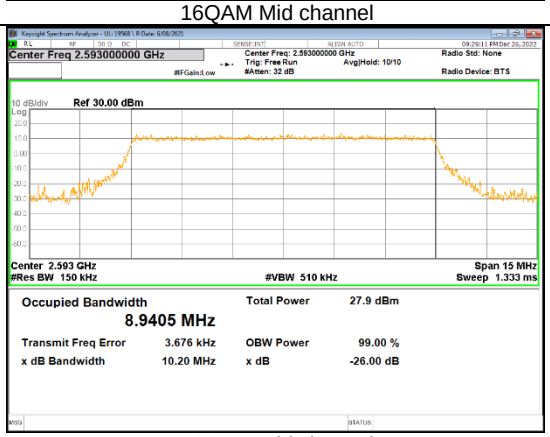
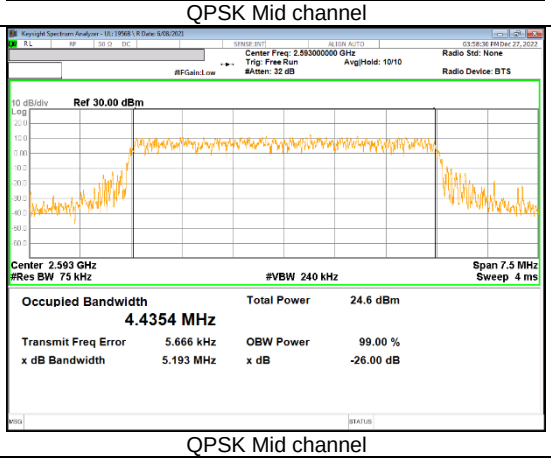
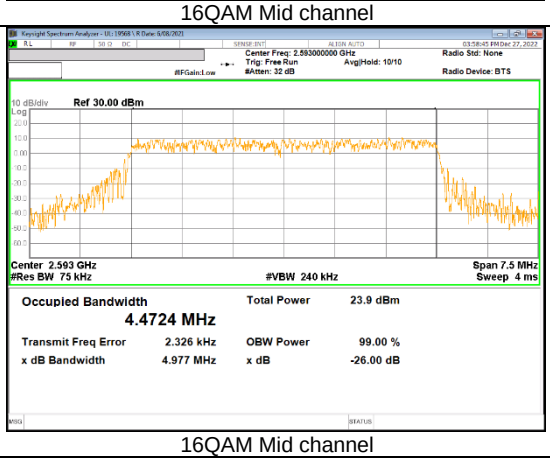
WCDMA Band 5

Band 5	 REL99 Mid channel	 HSDPA Mid channel

LTE Band 5

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 41

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

9.2. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §22.359, §22.917, §24.238 and §27. 53

LIMITS

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

Part 27.53:
(m) (4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01
The transmitter output was connected to 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.

GSM

a) Set the RBW = 1 ~ 5% of OBW(GSM850 – 8.2KHz, GSM1900 – 9.1KHz)
b) Set VBW ≥ 3 × RBW;
c) Set span ≥ 1.5 times the OBW;
d) Sweep time = 1S ;
e) Detector = RMS;
f) Ensure that the number of measurement points ≥ 2*Span/RBW;
g) Trace mode = Average(100);
h) Add duty cycle correction factor (9dB)

WCDMA/LTE

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

Note that the spurious emissions outside of the channel include narrowband signals. These signals are all below the -13dBm / -25dBm limits. Although the measurement bandwidth is less than the reference bandwidth of 1MHz no addental correction is applied as ANSI C63.26 section 4.2.3 only requires the correction to be applied when the OBW of the emission being measured is wider than the measurement bandwidth (Where the OBW of the signal under measurement is less than the RBW of the measuring instrument, no bandwidth correction or integration will be required.) Plots for low and high channels show the level of the emission measured with the reduced bandwidth and the level of the same emission measured using the integration method over the 1MHz reference bandwidth are very close, indicating the emissions are narrowband.

NOTE2

For Band-Edge extended:

CH BW (MHz)	RB Used (kHz)	CF for emissions more than 100kHz	CF for emissions more than 1MHz
1.4	15	+8.2 dB	+18.2 dB
3	30	+5.2 dB	+15.2 dB
5	51	+2.9 dB	+12.9 dB
10	100	N/A	+10.0 dB
15	150	N/A	+8.2 dB
20	200	N/A	+7.0 dB

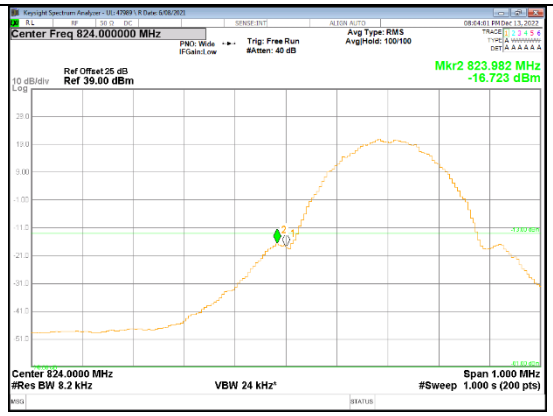
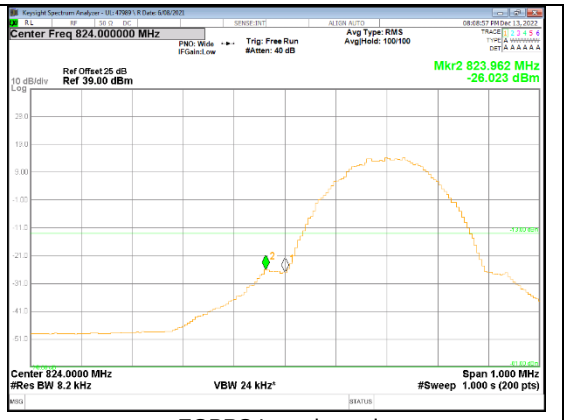
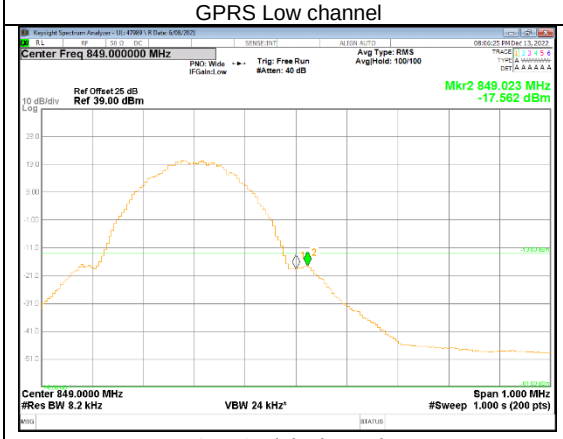
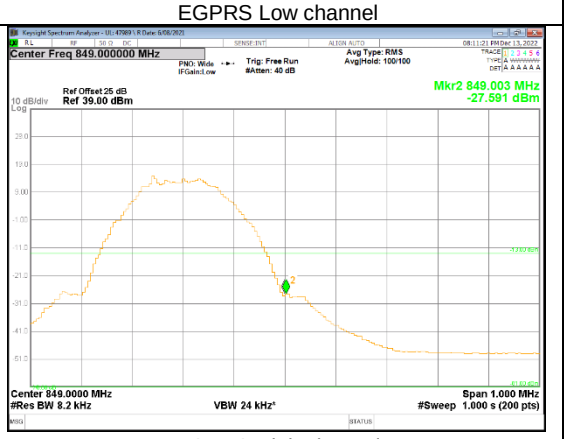
For the band edge value measured in [RB Used], even if [CF for emissions reference bandwidth 100kHz/1MHz] is applied, it is below -13dBm.

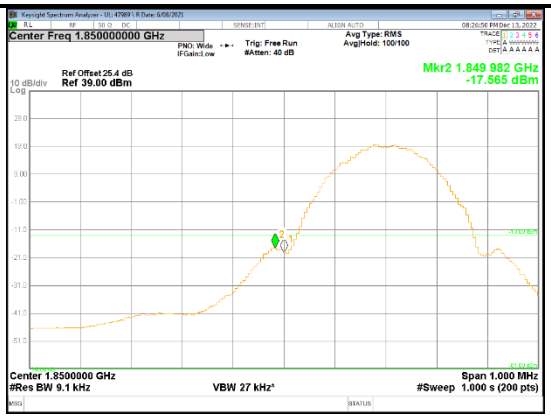
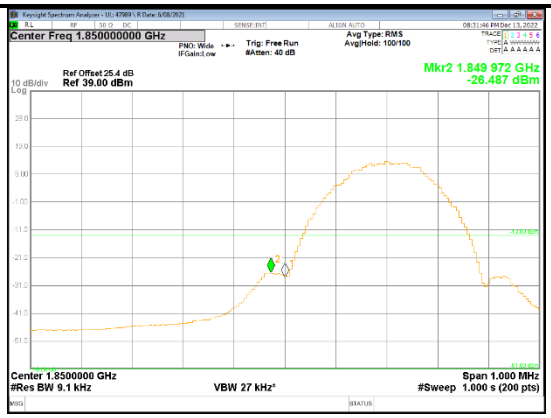
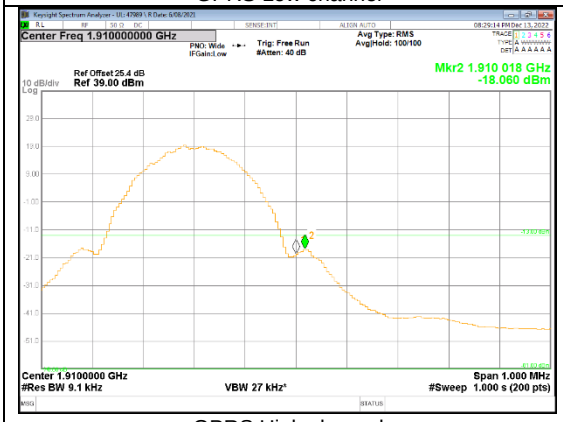
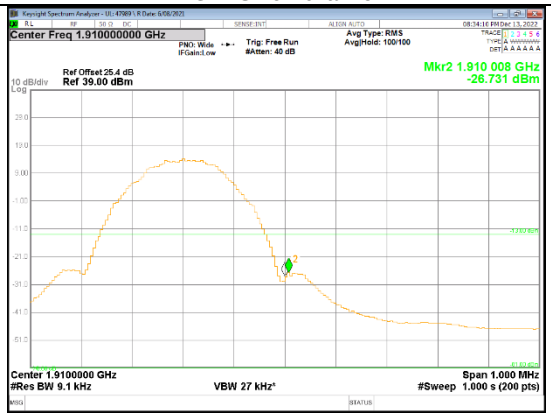
RESULTS

See the following pages.

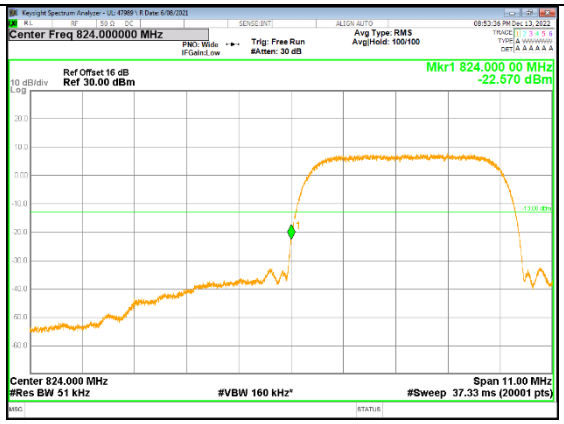
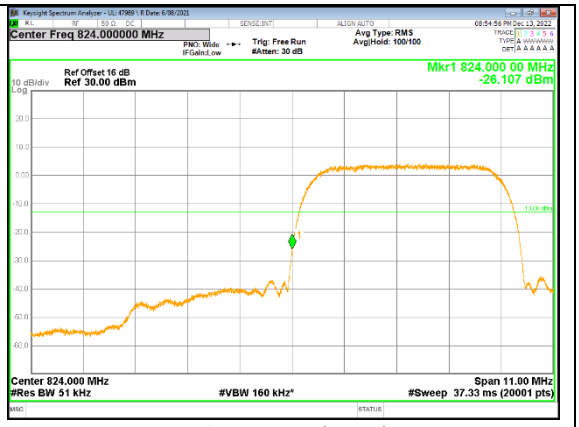
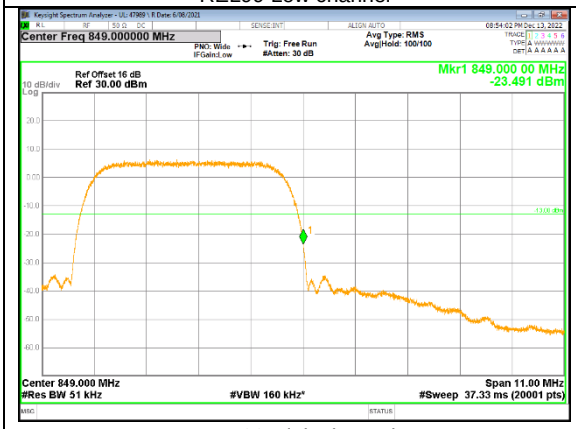
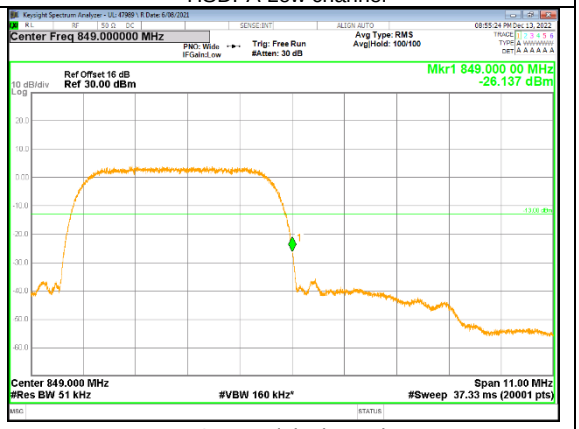
9.2.1. BAND EDGE RESULT

GSM

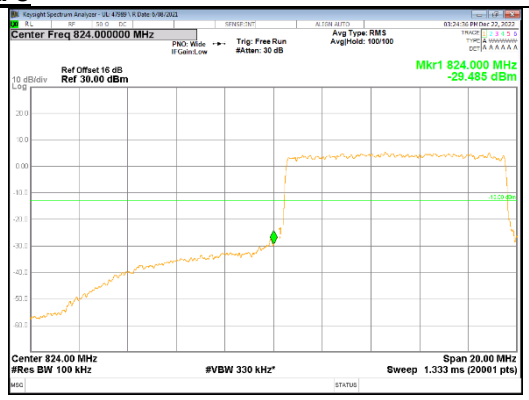
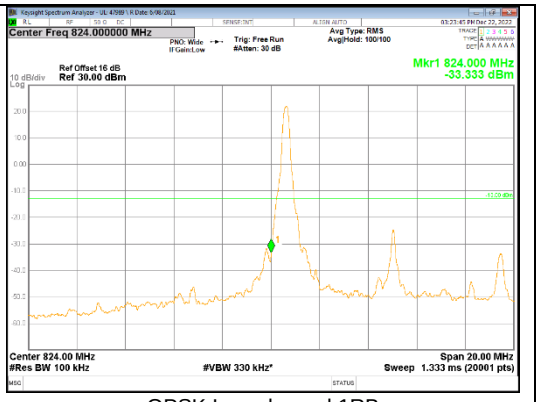
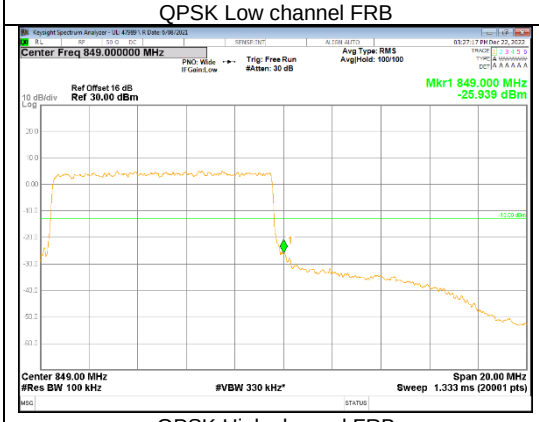
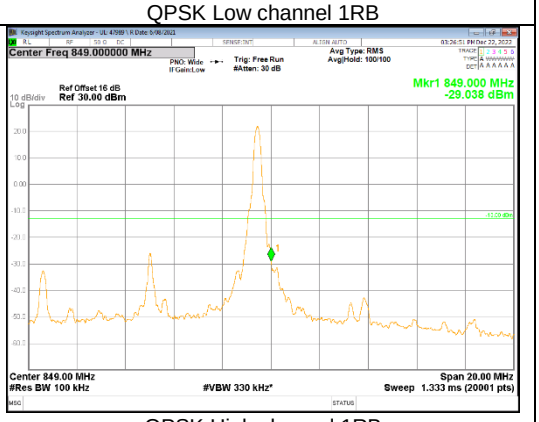
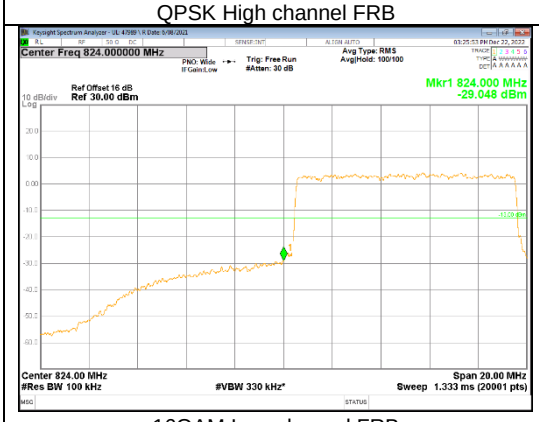
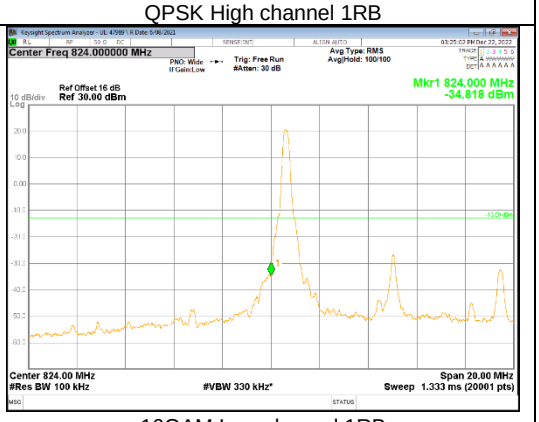
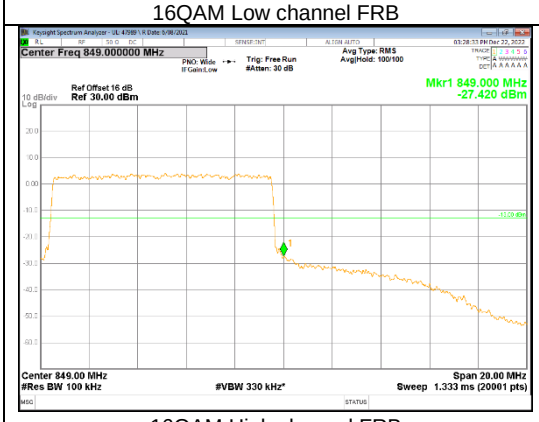
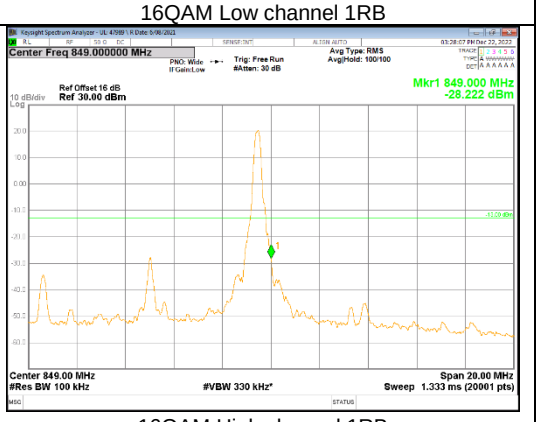
GSM 850	 GPRS Low channel	 EGPRS Low channel
	 GPRS High channel	 EGPRS High channel

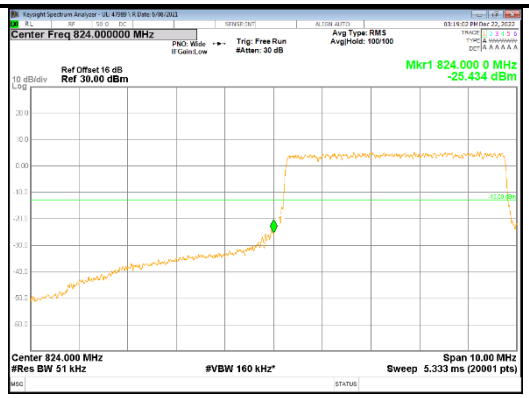
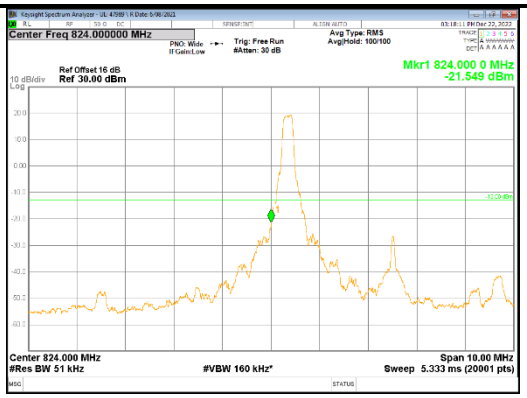
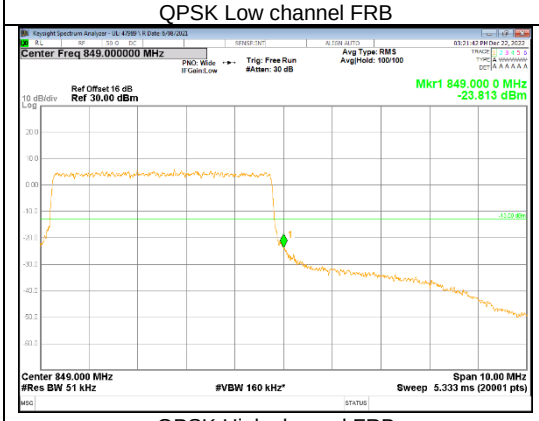
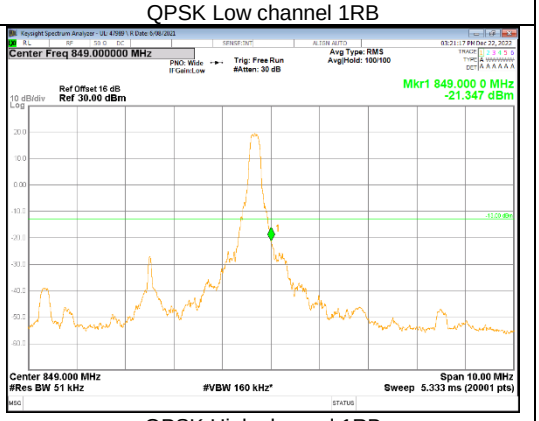
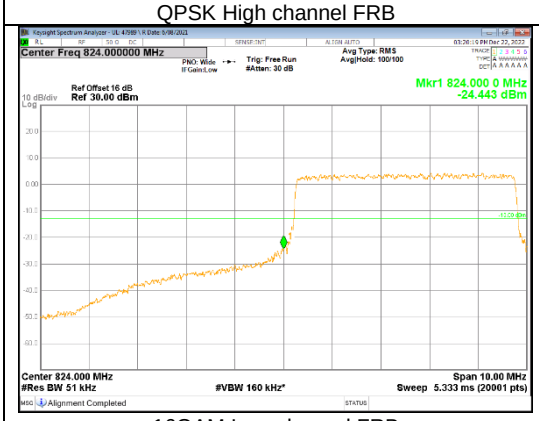
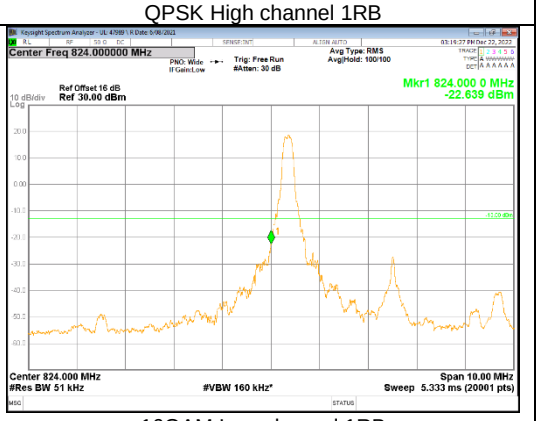
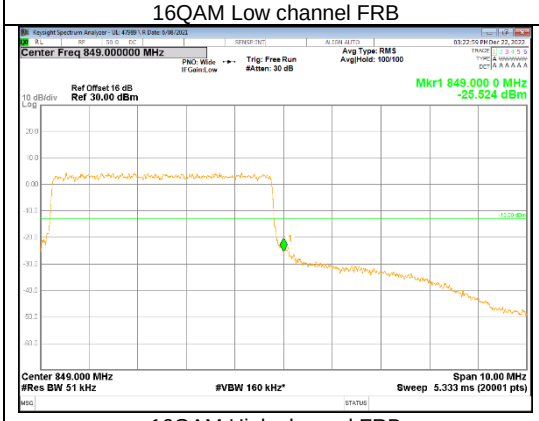
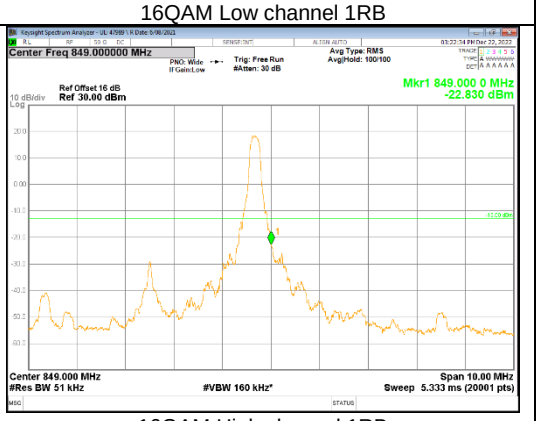
GSM 1900	 GPRS Low channel	 EGPRS Low channel
	 GPRS High channel	 EGPRS High channel

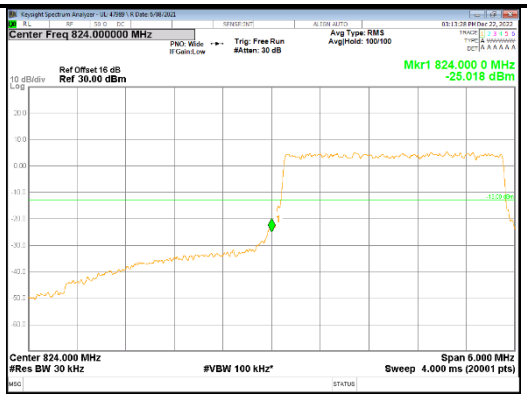
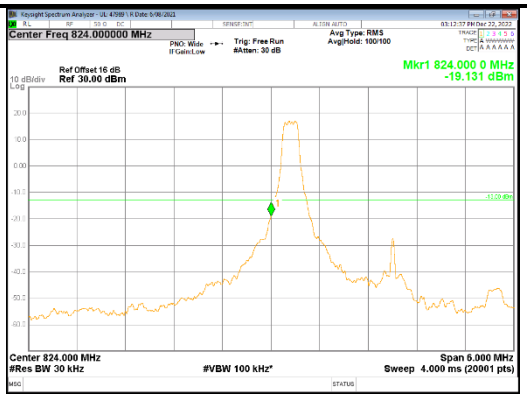
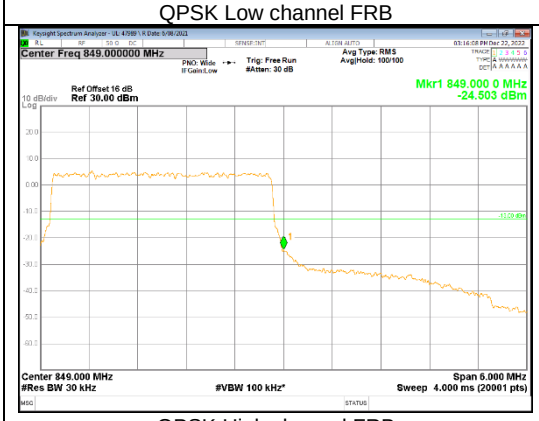
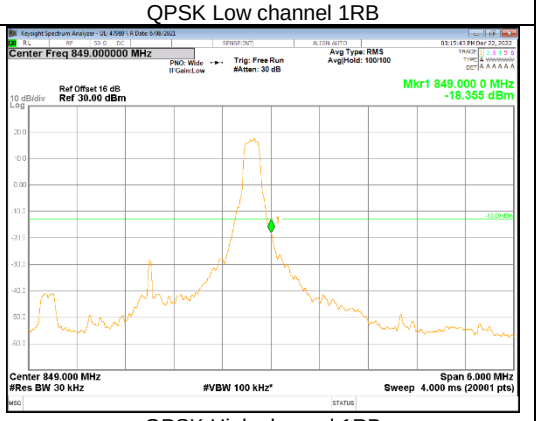
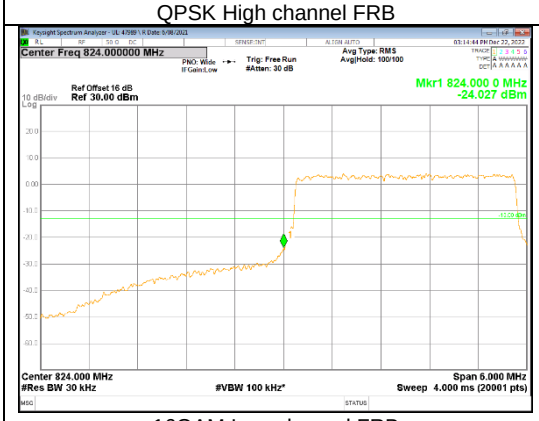
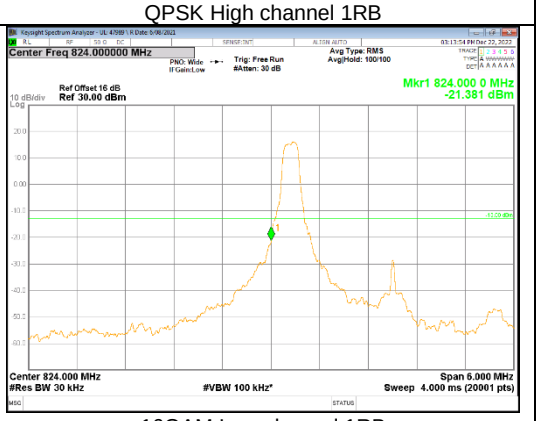
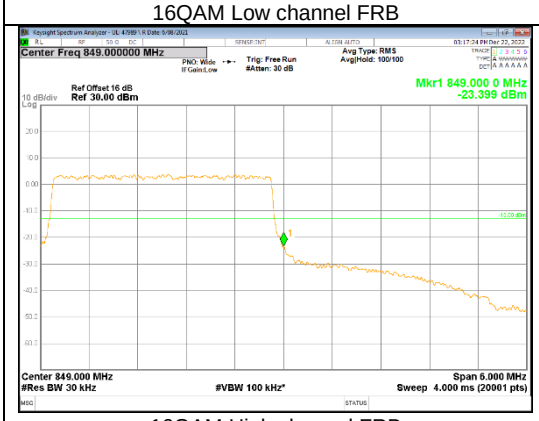
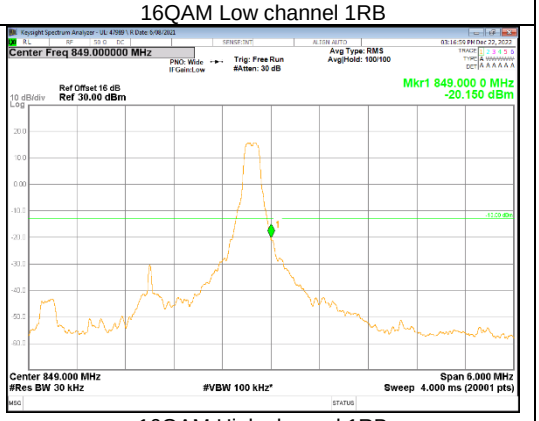
WCDMA

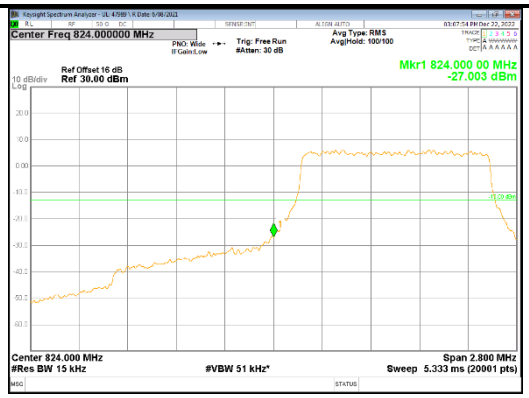
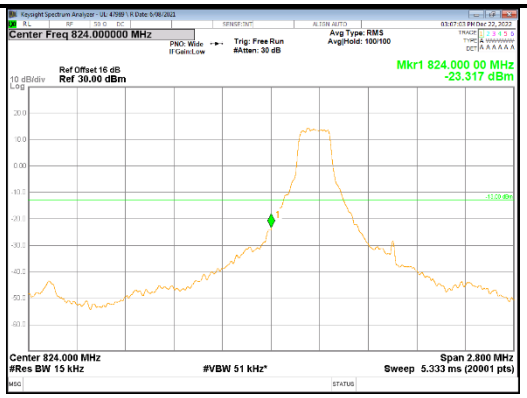
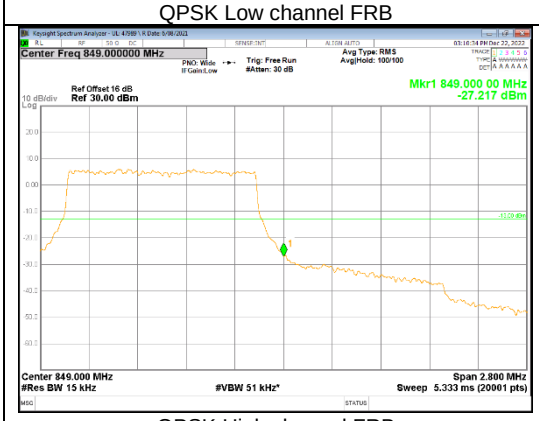
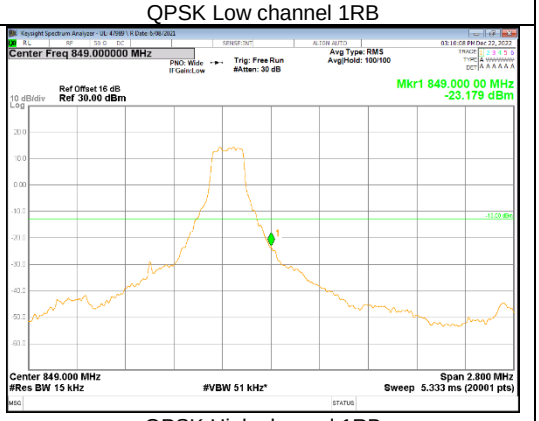
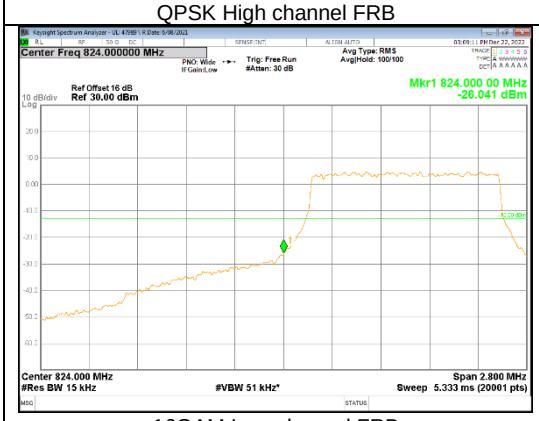
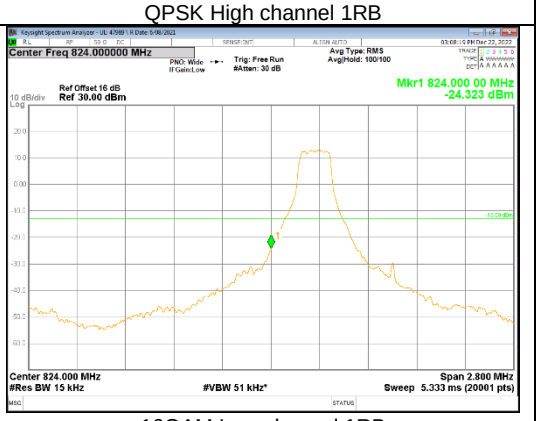
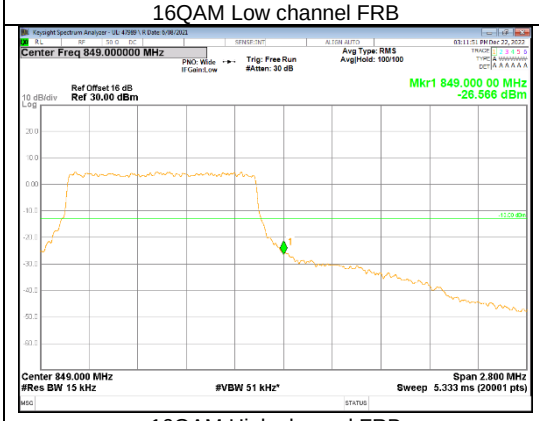
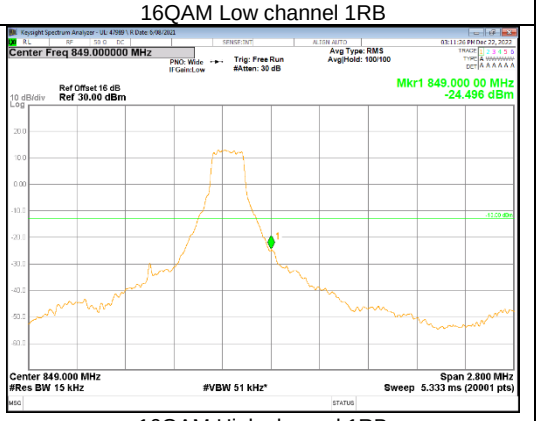
Band 5	 REL99 Low channel	 HSDPA Low channel
	 REL99 High channel	 HSDPA High channel

LTE Band 5

10MHz	 QPSK Low channel FRB	 QPSK Low channel 1RB
	 QPSK High channel FRB	 QPSK High channel 1RB
	 16QAM Low channel FRB	 16QAM Low channel 1RB
	 16QAM High channel FRB	 16QAM High channel 1RB

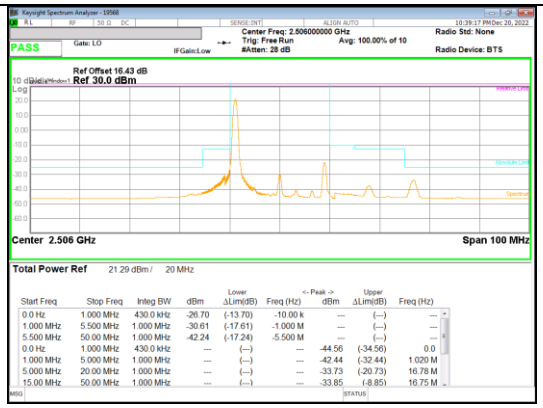
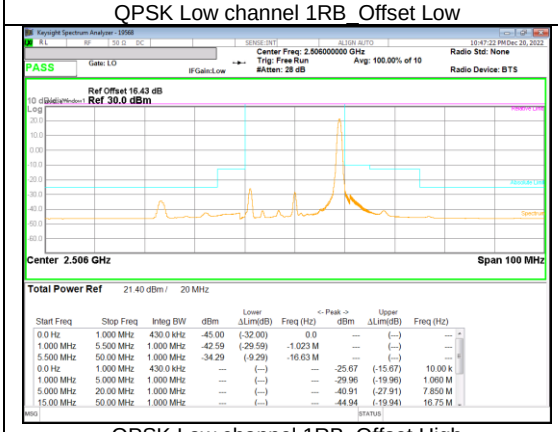
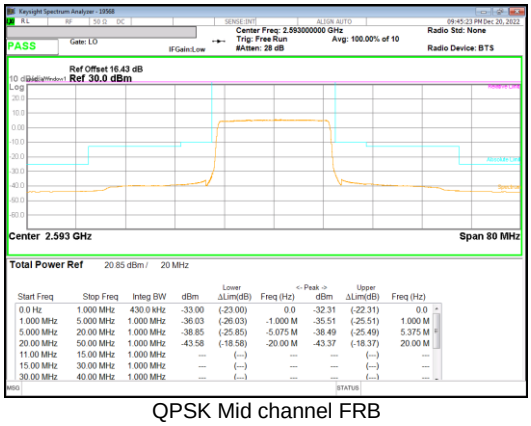
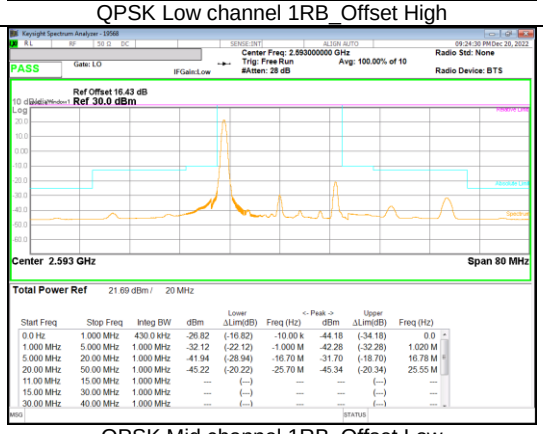
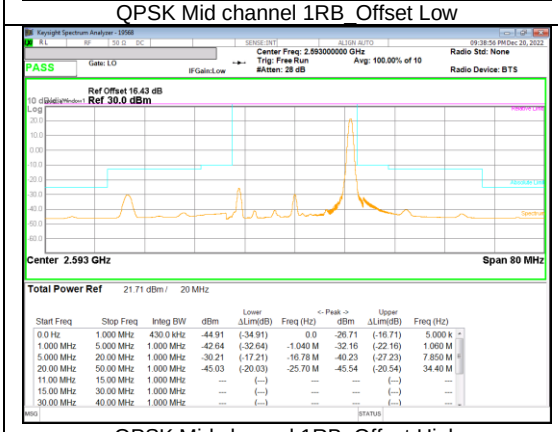
5MHz	 QPSK Low channel FRB	 QPSK Low channel 1RB
	 QPSK High channel FRB	 QPSK High channel 1RB
	 16QAM Low channel FRB	 16QAM Low channel 1RB
	 16QAM High channel FRB	 16QAM High channel 1RB

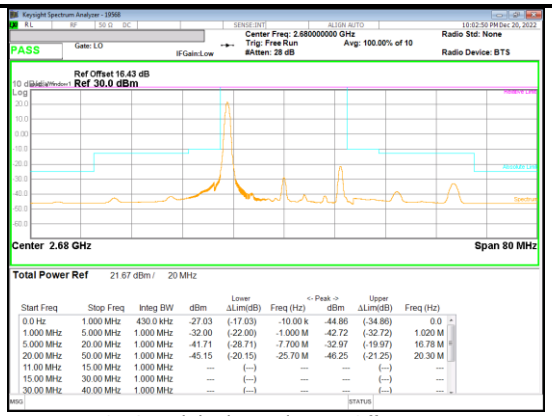
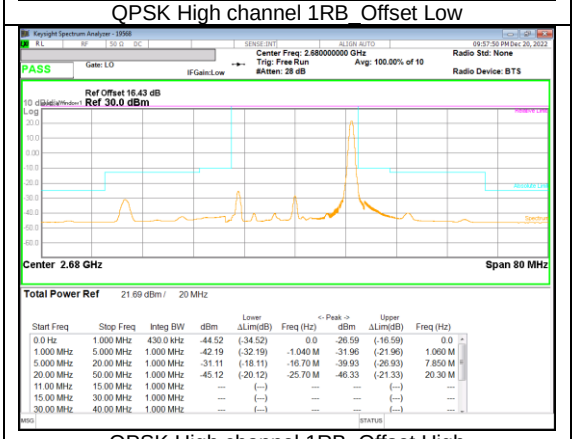
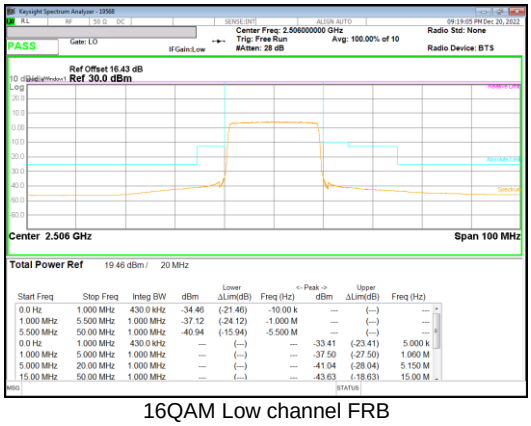
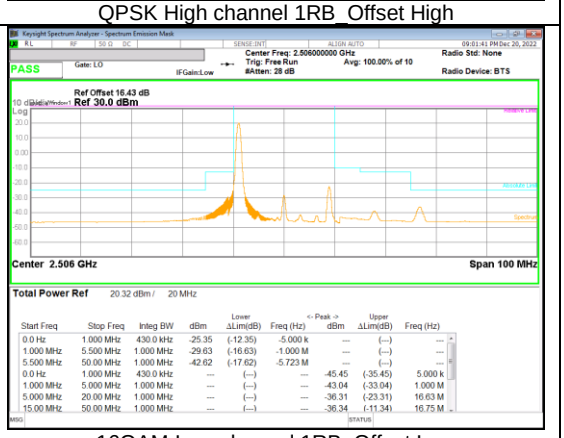
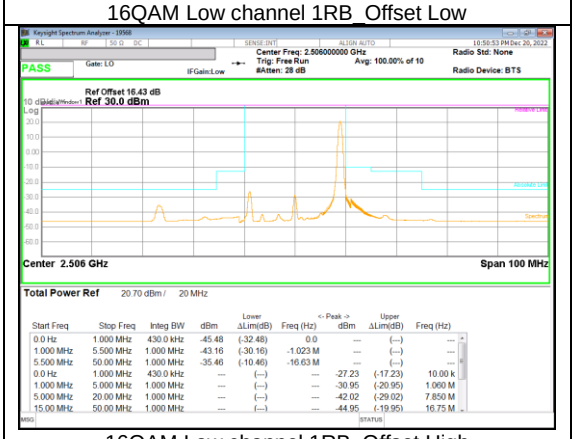
3MHz	 QPSK Low channel FRB	 QPSK Low channel 1RB
	 QPSK High channel FRB	 QPSK High channel 1RB
	 16QAM Low channel FRB	 16QAM Low channel 1RB
	 16QAM High channel FRB	 16QAM High channel 1RB

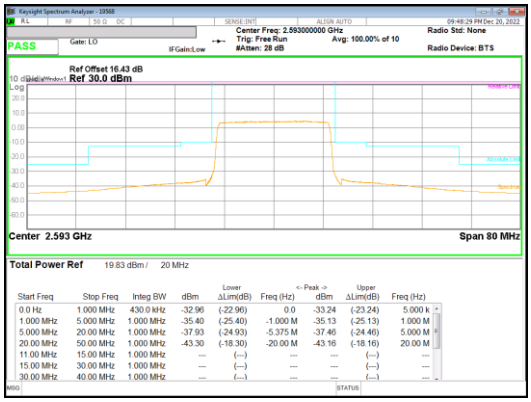
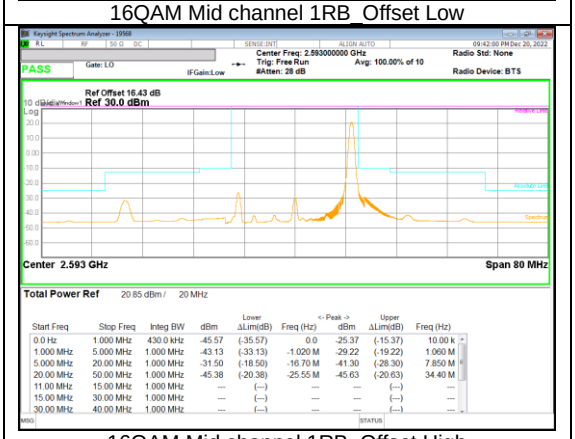
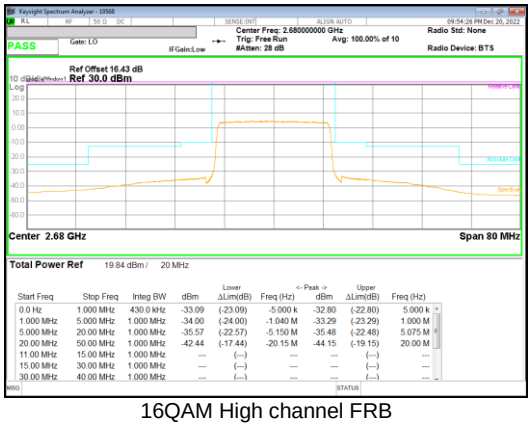
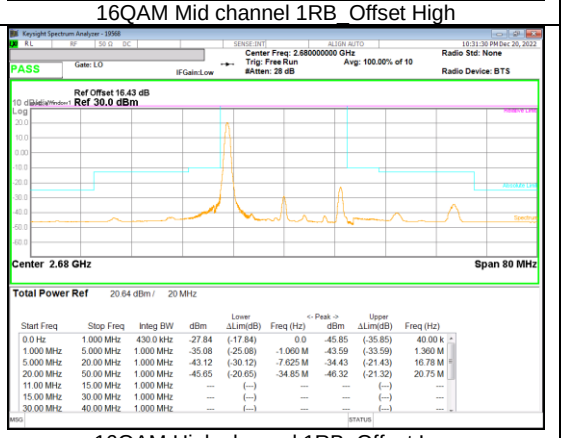
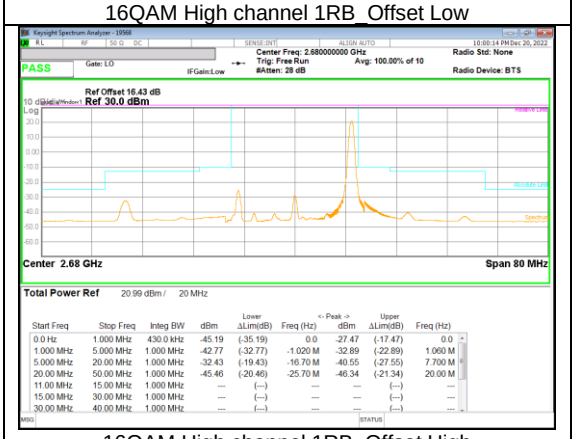
1.4MHz	 QPSK Low channel FRB	 QPSK Low channel 1RB
	 QPSK High channel FRB	 QPSK High channel 1RB
	 16QAM Low channel FRB	 16QAM Low channel 1RB
	 16QAM High channel FRB	 16QAM High channel 1RB

9.2.2. EMISSION MASK RESULT

LTE Band 41

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

20MHz 16QAM	 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