CERTIFICATION TEST REPORT

Report Number. : 4790841155-E2V2

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-X516B
FCC ID	:	A3LSMX516B
EUT Description	:	GSM/WCDMA/LTE 5G NR Tablet + BT/BLE, DTS/UNII a/b/g/n/ac/ax, and Digitizer
Test Standard(s)	:	FCC CFR47 PART 22 SUBPART H FCC CFR47 PART 90 SUBPART S

Date Of Issue:
2023-07-21

Prepared by:
UL KOREA LTD.
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Suwon Test Site: UL KOREA LTD. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu,
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IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2023-07-14	Initial issue	Yeonhee Lim
V2	2023-07-21	Updated to address TCB's question	Yeonhee Lim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE 5G NR Tablet + BT/BLE, DTS/UNII a/b/g/n/ac/ax, and Digitizer.
MODEL NUMBER:	SM-X516B
SERIAL NUMBER:	R32W400Y96X, R32W400Y98L, R32W400YF3V (CONDUCTED); R32W400YGJB, R32W400YACY, R32W400YF3V (RADIATED);
DATE TESTED:	2023-06-12 - 2023-07-21;

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

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

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

Approved & Released For
UL KOREA LTD. By:

Seokhwan Hong
Suwon Lab Engineer
UL KOREA LTD.

Tested By:

Yeonhee Lim
Suwon Lab Engineer
UL KOREA LTD.

2. TEST METHODOLOGY

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

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 22.
3. FCC CFR 47 Part 90.
4. ANSI TIA-603-E, 2016
5. ANSI C63.26, 2015
6. KDB 971168 D01 Power Meas License Digital Systems v03r01

3. FACILITIES AND ACCREDITATION

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

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.80 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.92 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.06 dB
Radiated Disturbance, 18 GHz to 40 GHz	6.02 dB

Uncertainty figures are valid to a confidence level of 95%.

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2021.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

5.2. MAXIMUM OUTPUT POWER

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

GSM

FCC Part 22						
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
GSM850	824 ~ 849	GPRS	**32.41**	1741.81	**34.66**	**2924.15**
		EGPRS	26.07	404.58	28.20	660.69

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	**23.63**	**230.67**	**24.76**	**299.23**
		HSDPA	23.32	214.78	24.29	268.53

LTE Band 26 (Part90)

FCC Part 90							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	821.5	15	QPSK	**23.76**	**237.68**	23.43	220.29
			16QAM	22.97	198.15	22.26	168.27
			64QAM	21.88	154.17		
			256QAM	18.86	76.91		
	819	10	QPSK	23.68	233.35	23.18	207.97
			16QAM	22.96	197.70	21.78	150.66
			64QAM	21.79	151.01		
			256QAM	18.72	74.47		
	816.5 ~ 821.5	5	QPSK	23.56	226.99	23.63	230.67
			16QAM	22.68	185.35	22.60	181.97
			64QAM	21.72	148.59		
			256QAM	18.72	74.47		
	815.5 ~ 822.5	3	QPSK	23.73	236.05	**24.20**	**263.03**
			16QAM	22.84	192.31	22.99	199.07
			64QAM	22.14	163.68		
			256QAM	18.95	78.52		
	814.7 ~ 823.3	1.4	QPSK	23.66	232.27	24.02	252.35
			16QAM	22.75	188.36	22.76	188.80
			64QAM	21.87	153.82		
			256QAM	18.74	74.82		

LTE Band 26 (Straddle)

Straddle							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	824	15	QPSK	23.74	236.59	23.84	242.10
			16QAM	22.94	196.79	22.62	182.81
			64QAM	21.80	151.36		
			256QAM	18.74	74.82		
		10	QPSK	23.79	239.33	24.08	255.86
			16QAM	23.10	204.17	23.19	208.45
			64QAM	21.70	147.91		
			256QAM	18.85	76.74		
		5	QPSK	23.73	236.05	24.14	259.42
			16QAM	23.03	200.91	23.14	206.06
			64QAM	21.78	150.66		
			256QAM	18.86	76.91		
		3	QPSK	23.65	231.74	24.09	256.45
			16QAM	23.03	200.91	22.96	197.70
			64QAM	21.96	157.04		
			256QAM	18.97	78.89		
		1.4	QPSK	**23.81**	**240.44**	**24.22**	**264.24**
			16QAM	22.81	190.99	22.90	194.98
			64QAM	21.73	148.94		
			256QAM	18.84	76.56		

LTE Band 26 (Part22)

FCC Part 22							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	831.5 ~ 841.5	15	QPSK	**23.87**	**243.78**	24.81	302.69
			16QAM	23.11	204.64	23.62	230.14
			64QAM	22.01	158.85		
			256QAM	18.99	79.25		
	829 ~ 844	10	QPSK	23.77	238.23	**25.15**	**327.34**
			16QAM	22.91	195.43	23.85	242.66
			64QAM	22.04	159.96		
			256QAM	19.20	83.18		
	826.5 ~ 846.5	5	QPSK	23.66	232.27	25.04	319.15
			16QAM	22.97	198.15	23.84	242.10
			64QAM	22.00	158.49		
			256QAM	19.05	80.35		
	825.5 ~ 847.5	3	QPSK	23.75	237.14	24.89	308.32
			16QAM	22.90	194.98	23.88	244.34
			64QAM	21.90	154.88		
			256QAM	18.81	76.03		
	824.7 ~ 848.3	1.4	QPSK	23.74	236.59	25.02	317.69
			16QAM	22.82	191.43	23.96	248.89
			64QAM	21.86	153.46		
			256QAM	19.01	79.62		

NR Band n5

FCC Part 22								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n5	834 ~ 839	20	DFT-s OFDM	π/2 BPSK	23.52	224.91		
				QPSK	24.00	251.19	**25.00**	**316.23**
				16QAM	22.81	190.99	24.01	251.77
				64QAM	21.36	136.77		
				256QAM	18.99	79.25		
			CP-OFDM	QPSK	22.06	160.69		
	831.5 ~ 841.5	15	DFT-s OFDM	π/2 BPSK	23.58	228.03		
				QPSK	23.62	230.14	24.94	311.89
				16QAM	22.72	187.07	23.83	241.55
				64QAM	21.16	130.62		
				256QAM	19.08	80.91		
			CP-OFDM	QPSK	22.13	163.31		
	829 ~ 844	10	DFT-s OFDM	π/2 BPSK	23.75	237.14		
				QPSK	23.60	229.09	24.82	303.39
				16QAM	22.66	184.50	23.82	240.99
				64QAM	21.11	129.12		
				256QAM	19.03	79.98		
			CP-OFDM	QPSK	22.13	163.31		
	826.5 ~ 846.5	5	DFT-s OFDM	π/2 BPSK	24.07	255.27		
				QPSK	**24.08**	**255.86**	24.63	290.40
				16QAM	23.07	202.77	23.67	232.81
				64QAM	21.47	140.28		
				256QAM	19.47	88.51		
			CP-OFDM	QPSK	22.55	179.89		

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

Frequency (MHz)	Peak Gain (dBd)
GSM850 / WCDMA Band 5 / LTE Band 5, 26 / NR Band n5 814 - 849 MHz	-1.8

5.4. WORST-CASE ORIENTATION

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

- GSM GPRS/EGPRS
- UMTS REL 99/HSDPA

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

For 5G NR Band n5 the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on π/2 BPSK, QPSK, 16QAM, 64QAM and 256QAM modulations. It was found QPSK and 16QAM results were worst case as below.

Both NSA and SA modes was tested and worst case(SA mode) is reported. the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest conducted power.

LTE Band 5

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

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- Conducted Spurious Emission

Highest conducted output power setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
26 (Part 90)	821.5	15	1	0
26 (Straddle)	824.0	1.4	1	3
26 (Part 22)	831.5	15	1	0
	836.5		1	0
	841.5		1	0
NR Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
5	826.5	5	1	1
	836.5		1	1
	846.5		1	1

- Radiated Spurious Emission

Highest ERP power setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
26 (Part 90)	815.5	3	1	14
	822.5		1	14
26 (Straddle)	824.0	1.4	1	3
26 (Part 22)	829.0	10	1	0
	831.5		1	25
	844.0		1	0
NR Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
5	834.0	20	1	53
	836.5		1	1
	839.0		1	1

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

NR Band	LTE Band
5	**2**, 66

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	ERP			RSE		
	X	**Y**	**Z**	**X**	**Y**	**Z**
GSM 850	-	O	-	O	-	-
WCDMA B5	-	O	-	-	O	-
LTE B26	-	O	-	-	O	-
NR n5	-	O	-	-	O	-

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

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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacture**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37M9KML7D2DK3	N/A
Data Cable	SAMSUNG	EP-DN980	GH39-02115A	N/A

I/O CABLE

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

TEST SETUP

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

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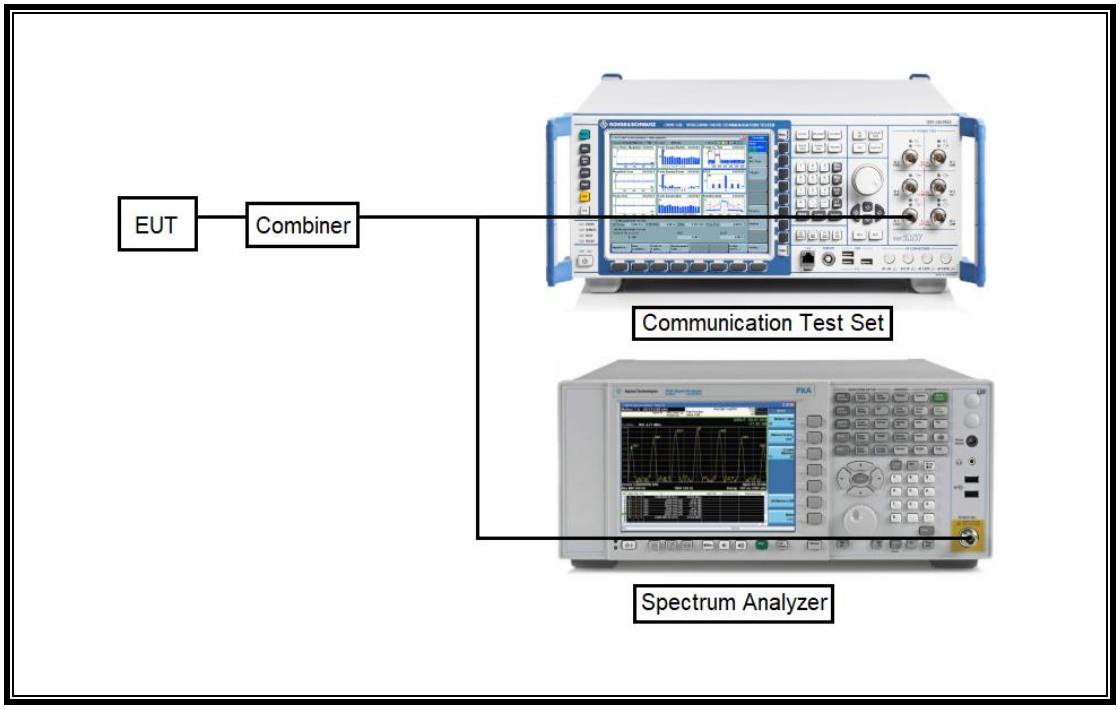
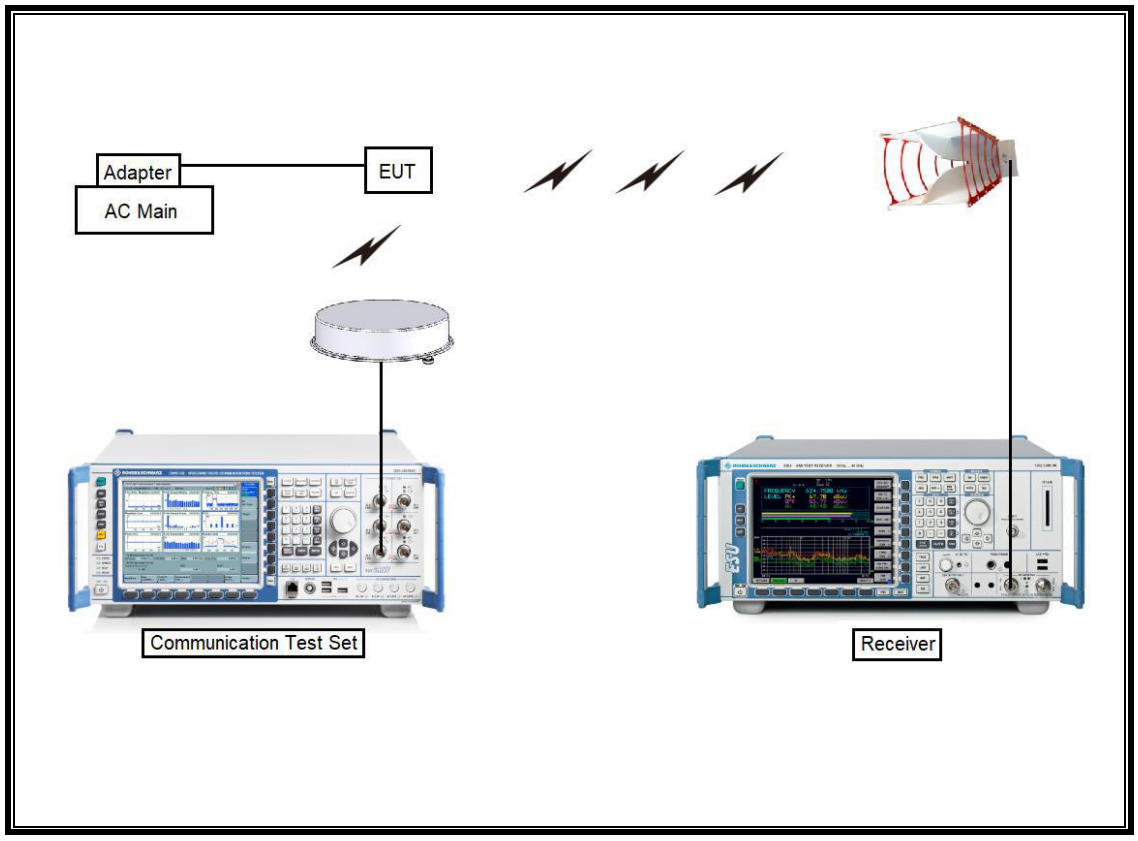
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121D DB4	00164753	2025-01-17
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	110367-0003	N/A
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	80108-0004	N/A
Antenna, Horn, 40 GHz	ETS	3116C	00168645	2023-10-13
Preamplifier	ETS	3115-PA	00167475	2023-08-04
Preamplifier	ETS	3116C-PA	00168841	2023-08-04
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2024-08-15
Antenna, Horn, 18 GHz	ETS	3115	00161451	2024-08-21
Antenna, Horn, 18 GHz	ETS	3117	00168717	2024-08-21
Communications Test Set	R&S	CMW500	169796	2024-01-05
DC Power Supply	Agilent / HP	E3640A	MY54226395	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	341282	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	351741	2023-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	2023-08-01
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2023-08-01
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2023-08-03
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2023-08-01
Spectrum Analyzer, 44 GHz	KEYSIGHT	N9030B	MY60070693	2024-01-09
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2023-08-02
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2023-07-29
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	2023-08-01
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	2023-08-01
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	2023-08-01
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	2023-08-01
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	2023-08-01
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	2023-08-01
Attenuator	PASTERNACK	PE7087-10	A009	2023-08-03
Attenuator	PASTERNACK	PE7087-10	A001	2023-08-03
Attenuator	PASTERNACK	PE7087-10	A008	2023-08-03
Attenuator	PASTERNACK	PE7004-10	2	2023-08-01
Attenuator	PASTERNACK	PE7395-10	A011	2023-08-03
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2023-10-06
Temperature Chamber	ESPEC	SH-642	93001109	2023-08-01
Power Splitter	MINI-CIRCUITS	WA1534	UL003	2024-01-09
Power Splitter	MINI-CIRCUITS	WA1534	UL004	2024-01-09
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Antenna port test software	UL	CLT	Ver 3.4	
Radiated software	UL	UL EMC	Ver 9.5	
Antenna port test software (5G NR FR1)	UL	UL iM	Ver 1.06	

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass
22.917(a)	Band Edge / Conducted Spurious Emission	-13dBm		Pass
90.691	Emission mask	Section 9.2.2		Pass
2.1046	Conducted output power	N/A		Pass
22.355 90.213	Frequency Stability	2.5PPM		Pass
22.913(a)(5)	Effective Radiated Power	38.5dBm	Radiated	Pass
90.635(b)		50 dBm		Pass
22.917(a) 90.691(a)	Radiated Spurious Emission	-13dBm		Pass

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8. CONDUCTED RESULTS

8.1. CONDUCTED OUTPUT POWER

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

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

NOTE

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

RESULTS

See the following pages.

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8.1.1. CONDUCTED AVERAGE OUTPUT POWER

GSM

Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Maximum Average Power (dBm)			
					Measured		Tune-up Limit	
					Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr
GSM (Voice)	CS1	1	128	824.2	32.29	23.26	33.5	24.5
			190	836.6	32.22	23.19		
			251	848.8	32.41	23.38		
GPRS (GMSK)	CS1	1	128	824.2	32.34	23.31	33.5	24.5
			190	836.6	32.27	23.24		
			251	848.8	32.39	23.36		
		2	128	824.2	30.08	24.06	31.5	25.5
			190	836.6	29.91	23.89		
			251	848.8	30.38	24.36		
		3	128	824.2	28.81	24.55	30.0	**25.7**
			190	836.6	28.59	24.33		
			251	848.8	29.02	24.76		
		4	128	824.2	27.18	24.17	28.0	25.0
			190	836.6	27.06	24.05		
			251	848.8	27.35	24.34		
EGPRS (8PSK)	MCS5	1	128	824.2	25.97	16.94	27.5	18.5
			190	836.6	25.79	16.76		
			251	848.8	26.07	17.04		
		2	128	824.2	24.21	18.19	25.0	19.0
			190	836.6	23.99	17.97		
			251	848.8	24.36	18.34		
		3	128	824.2	22.64	18.38	24.0	19.7
			190	836.6	22.49	18.23		
			251	848.8	22.99	18.73		
		4	128	824.2	21.11	18.10	23.0	20.0
			190	836.6	21.00	17.99		
			251	848.8	21.32	18.31		

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	23.58	N/A	24.5
		4183	836.6	23.63		
		4233	846.6	23.63		
HSDPA	Subtest 1	4132	826.4	23.32	0	23.5
		4183	836.6	23.26		
		4233	846.6	23.28		
	Subtest 2	4132	826.4	22.80	0	23.5
		4183	836.6	22.74		
		4233	846.6	22.77		
	Subtest 3	4132	826.4	22.27	0.5	23.0
		4183	836.6	22.21		
		4233	846.6	22.22		
	Subtest 4	4132	826.4	21.77	0.5	23.0
		4183	836.6	21.73		
		4233	846.6	21.72		
HSUPA	Subtest 1	4132	826.4	22.25	0	23.5
		4183	836.6	22.15		
		4233	846.6	22.15		
	Subtest 2	4132	826.4	20.31	2	21.5
		4183	836.6	20.22		
		4233	846.6	20.22		
	Subtest 3	4132	826.4	21.25	1	22.5
		4183	836.6	21.16		
		4233	846.6	21.17		
	Subtest 4	4132	826.4	20.32	2	21.5
		4183	836.6	20.23		
		4233	846.6	20.21		
	Subtest 5	4132	826.4	23.47	0	23.5
		4183	836.6	23.39		
		4233	846.6	23.36		
DC-HSDPA	Subtest 1	4132	826.4	23.31	0	23.5
		4183	836.6	23.19		
		4233	846.6	23.10		
	Subtest 2	4132	826.4	22.83	0	23.5
		4183	836.6	22.64		
		4233	846.6	22.57		
	Subtest 3	4132	826.4	21.26	0.5	23.0
		4183	836.6	21.09		
		4233	846.6	21.01		
	Subtest 4	4132	826.4	21.78	0.5	23.0
		4183	836.6	21.67		
		4233	846.6	21.56		

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LTE Band 26

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)						
				Measured Pwr (dBm)					MPR	Tune-up Limit
				26765	26865	26915	26965	26790		
				821.5 MHz	831.5 MHz	836.5 MHz	841.5 MHz	824 MHz		
15 MHz	QPSK	1	0	23.76	23.87	23.84	23.73	23.74	0.0	25.0
		1	37	23.59	23.64	23.83	23.61	23.49	0.0	25.0
		1	74	23.67	23.72	23.71	23.68	23.59	0.0	25.0
		36	0	22.84	22.93	22.92	22.83	22.79	1.0	24.0
		36	20	22.81	22.89	22.91	22.81	22.74	1.0	24.0
		36	39	22.78	22.85	22.85	22.80	22.72	1.0	24.0
		75	0	22.82	22.90	22.83	22.83	22.74	1.0	24.0
	16QAM	1	0	22.97	23.01	23.11	23.00	22.94	1.0	24.0
		1	37	22.93	22.86	23.08	22.87	22.78	1.0	24.0
		1	74	22.84	22.88	23.06	22.90	22.76	1.0	24.0
		36	0	21.77	21.84	21.94	21.79	21.75	2.0	23.0
		36	20	21.74	21.81	21.87	21.75	21.68	2.0	23.0
		36	39	21.71	21.77	21.84	21.72	21.63	2.0	23.0
		75	0	21.78	21.79	21.84	21.82	21.73	2.0	23.0
	64QAM	1	0	21.88	21.80	21.99	21.92	21.80	2.0	23.0
		1	37	21.87	21.64	22.01	21.85	21.55	2.0	23.0
		1	74	21.82	21.72	21.97	21.81	21.66	2.0	23.0
		36	0	20.76	20.80	20.85	20.87	20.63	3.0	22.0
		36	20	20.72	20.76	20.84	20.83	20.63	3.0	22.0
		36	39	20.68	20.74	20.81	20.79	20.57	3.0	22.0
		75	0	20.74	20.80	20.73	20.77	20.62	3.0	22.0
	256QAM	1	0	18.86	18.97	18.89	18.75	18.74	5.0	20.0
		1	37	18.77	18.79	18.99	18.67	18.68	5.0	20.0
		1	74	18.71	18.86	18.93	18.66	18.53	5.0	20.0
		36	0	18.76	18.81	18.81	18.76	18.64	5.0	20.0
		36	20	18.71	18.75	18.81	18.71	18.61	5.0	20.0
		36	39	18.67	18.74	18.77	18.68	18.58	5.0	20.0
		75	0	18.72	18.76	18.76	18.74	18.62	5.0	20.0

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BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)				MPR	Tune-up Limit
				26740	26865	26990	26790		
				819 MHz	831.5 MHz	844 MHz	824 MHz		
10 MHz	QPSK	1	0	23.68	23.73	23.67	23.72	0.0	25.0
		1	25	23.62	23.77	23.49	23.79	0.0	25.0
		1	49	23.65	23.63	23.63	23.68	0.0	25.0
		25	0	22.68	22.70	22.69	22.75	1.0	24.0
		25	12	22.64	22.67	22.67	22.75	1.0	24.0
		25	25	22.61	22.66	22.65	22.66	1.0	24.0
		50	0	22.65	22.69	22.69	22.71	1.0	24.0
	16QAM	1	0	22.96	22.89	22.91	23.02	1.0	24.0
		1	25	22.84	22.87	22.81	23.10	1.0	24.0
		1	49	22.86	22.85	22.78	22.84	1.0	24.0
		25	0	21.67	21.71	21.73	21.74	2.0	23.0
		25	12	21.64	21.66	21.68	21.71	2.0	23.0
		25	25	21.64	21.65	21.67	21.65	2.0	23.0
		50	0	21.64	21.66	21.65	21.73	2.0	23.0
	64QAM	1	0	21.78	22.04	21.62	21.61	2.0	23.0
		1	25	21.62	21.97	21.54	21.70	2.0	23.0
		1	49	21.79	22.03	21.50	21.58	2.0	23.0
		25	0	20.74	20.73	20.75	20.69	3.0	22.0
		25	12	20.73	20.71	20.71	20.70	3.0	22.0
		25	25	20.70	20.70	20.70	20.63	3.0	22.0
		50	0	20.69	20.70	20.70	20.66	3.0	22.0
	256QAM	1	0	18.57	19.20	18.83	18.84	5.0	20.0
		1	25	18.44	19.18	18.78	18.85	5.0	20.0
		1	49	18.49	19.09	18.76	18.76	5.0	20.0
		25	0	18.72	18.76	18.77	18.71	5.0	20.0
		25	12	18.69	18.73	18.74	18.68	5.0	20.0
		25	25	18.67	18.71	18.71	18.63	5.0	20.0
		50	0	18.65	18.71	18.69	18.65	5.0	20.0

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)				MPR	Tune-up Limit
				26715	26865	27015	26790		
				816.5 MHz	831.5 MHz	846.5 MHz	824 MHz		
5 MHz	QPSK	1	0	23.55	23.66	23.62	23.65	0.0	25.0
		1	12	23.51	23.64	23.45	23.73	0.0	25.0
		1	24	23.56	23.65	23.63	23.68	0.0	25.0
		12	0	22.63	22.68	22.68	22.71	1.0	24.0
		12	7	22.61	22.68	22.67	22.71	1.0	24.0
		12	13	22.60	22.65	22.68	22.70	1.0	24.0
		25	0	22.61	22.66	22.69	22.72	1.0	24.0
	16QAM	1	0	22.68	22.77	22.97	22.96	1.0	24.0
		1	12	22.60	22.60	22.81	23.03	1.0	24.0
		1	24	22.68	22.70	22.91	22.97	1.0	24.0
		12	0	21.59	21.62	21.67	21.72	2.0	23.0
		12	7	21.56	21.59	21.65	21.71	2.0	23.0
		12	13	21.56	21.60	21.66	21.68	2.0	23.0
		25	0	21.61	21.63	21.64	21.73	2.0	23.0
	64QAM	1	0	21.69	22.00	21.91	21.78	2.0	23.0
		1	12	21.67	21.88	21.91	21.77	2.0	23.0
		1	24	21.72	21.94	21.98	21.77	2.0	23.0
		12	0	20.69	20.72	20.72	20.69	3.0	22.0
		12	7	20.66	20.70	20.69	20.64	3.0	22.0
		12	13	20.68	20.69	20.67	20.64	3.0	22.0
		25	0	20.65	20.73	20.75	20.64	3.0	22.0
	256QAM	1	0	18.72	19.05	18.69	18.86	5.0	20.0
		1	12	18.66	18.97	18.44	18.76	5.0	20.0
		1	24	18.68	19.02	18.67	18.77	5.0	20.0
		12	0	18.67	18.75	18.74	18.65	5.0	20.0
		12	7	18.66	18.75	18.74	18.66	5.0	20.0
		12	13	18.66	18.71	18.69	18.59	5.0	20.0
		25	0	18.67	18.67	18.74	18.69	5.0	20.0

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BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)				MPR	Tune-up Limit
				26705	26865	27025	26790		
				815.5 MHz	831.5 MHz	847.5 MHz	824 MHz		
3 MHz	QPSK	1	0	23.72	23.62	23.72	23.65	0.0	25.0
		1	8	23.46	23.55	23.67	23.61	0.0	25.0
		1	14	23.73	23.57	23.75	23.59	0.0	25.0
		8	0	22.64	22.66	22.69	22.73	1.0	24.0
		8	4	22.62	22.72	22.69	22.70	1.0	24.0
		8	7	22.61	22.67	22.69	22.71	1.0	24.0
		15	0	22.63	22.69	22.63	22.71	1.0	24.0
	16QAM	1	0	22.84	22.88	22.73	23.03	1.0	24.0
		1	8	22.78	22.80	22.65	22.96	1.0	24.0
		1	14	22.73	22.90	22.66	23.01	1.0	24.0
		8	0	21.61	21.79	21.68	21.77	2.0	23.0
		8	4	21.60	21.77	21.65	21.75	2.0	23.0
		8	7	21.57	21.77	21.62	21.71	2.0	23.0
		15	0	21.59	21.67	21.68	21.68	2.0	23.0
	64QAM	1	0	22.12	21.57	21.83	21.92	2.0	23.0
		1	8	21.97	21.51	21.75	21.84	2.0	23.0
		1	14	22.14	21.49	21.90	21.96	2.0	23.0
		8	0	20.71	20.74	20.73	20.82	3.0	22.0
		8	4	20.68	20.71	20.71	20.74	3.0	22.0
		8	7	20.72	20.75	20.76	20.78	3.0	22.0
		15	0	20.62	20.74	20.76	20.61	3.0	22.0
	256QAM	1	0	18.95	18.73	18.76	18.97	5.0	20.0
		1	8	18.79	18.69	18.71	18.83	5.0	20.0
		1	14	18.92	18.67	18.71	18.86	5.0	20.0
		8	0	18.79	18.77	18.79	18.81	5.0	20.0
		8	4	18.75	18.79	18.74	18.76	5.0	20.0
		8	7	18.75	18.72	18.77	18.76	5.0	20.0
		15	0	18.68	18.81	18.79	18.73	5.0	20.0
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)				MPR	Tune-up Limit
				26697	26865	27033	26790		
				814.7 MHz	831.5 MHz	848.3 MHz	824 MHz		
1.4 MHz	QPSK	1	0	23.63	23.68	23.66	23.63	0.0	25.0
		1	3	23.55	23.64	23.42	23.81	0.0	25.0
		1	5	23.64	23.70	23.67	23.67	0.0	25.0
		3	0	23.66	23.74	23.73	23.67	0.0	25.0
		3	1	23.58	23.73	23.73	23.68	0.0	25.0
		3	3	23.59	23.69	23.57	23.61	0.0	25.0
		6	0	22.59	22.71	22.70	22.70	1.0	24.0
	16QAM	1	0	22.63	22.55	22.71	22.80	1.0	24.0
		1	3	22.65	22.64	22.82	22.62	1.0	24.0
		1	5	22.65	22.57	22.78	22.81	1.0	24.0
		3	0	22.75	22.78	22.55	22.78	1.0	24.0
		3	1	22.69	22.71	22.67	22.65	1.0	24.0
		3	3	22.64	22.74	22.65	22.73	1.0	24.0
		6	0	21.55	21.62	21.65	21.78	2.0	23.0
	64QAM	1	0	21.87	21.50	21.86	21.73	2.0	23.0
		1	3	21.77	21.56	21.68	21.73	2.0	23.0
		1	5	21.80	21.56	21.82	21.73	2.0	23.0
		3	0	21.68	21.50	21.68	21.69	2.0	23.0
		3	1	21.57	21.44	21.59	21.65	2.0	23.0
		3	3	21.56	21.47	21.62	21.67	2.0	23.0
		6	0	20.66	20.60	20.67	20.77	3.0	22.0
	256QAM	1	0	18.62	18.56	18.87	18.82	5.0	20.0
		1	3	18.74	18.64	19.01	18.84	5.0	20.0
		1	5	18.59	18.57	18.81	18.77	5.0	20.0
		3	0	18.51	18.76	18.66	18.59	5.0	20.0
		3	1	18.43	18.73	18.54	18.57	5.0	20.0
		3	3	18.40	18.68	18.46	18.53	5.0	20.0
		6	0	18.59	18.69	18.61	18.70	5.0	20.0

NR Band n5

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
					Measured Pwr (dBm)			MPR	Tune-up Limit
					166800	167300	167800		
					834 MHz	836.5 MHz	839 MHz		
20 MHz	DFT-s-OFDM	π/2 BPSK	1	1	23.47	23.48	23.46	0.0	25.0
			1	53	23.48	23.37	23.52	0.0	25.0
			1	104	23.15	23.07	23.13	0.0	25.0
			50	0	22.52	22.47	23.01	0.5	24.5
			50	28	23.45	23.36	23.37	0.0	25.0
			50	56	22.28	22.21	22.82	0.5	24.5
			100	0	22.45	22.39	22.91	0.5	24.5
		QPSK	1	1	23.51	23.52	24.00	0.0	25.0
			1	53	23.54	23.43	23.43	0.0	25.0
			1	104	23.19	23.14	23.20	0.0	25.0
			50	0	22.52	22.53	22.64	1.0	24.0
			50	28	23.47	23.40	23.41	0.0	25.0
			50	56	22.30	22.26	22.40	1.0	24.0
			100	0	22.45	22.44	22.47	1.0	24.0
		16QAM	1	1	22.48	22.56	22.77	1.0	24.0
			1	53	22.57	22.55	22.81	1.0	24.0
			1	104	22.18	22.20	22.46	1.0	24.0
		64QAM	1	1	21.09	21.01	21.36	2.5	22.5
		256QAM	1	1	18.99	18.93	18.96	4.5	20.5
	CP-OFDM	QPSK	1	1	22.00	22.03	22.06	1.5	23.5
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					166300	167300	168300		
					831.5 MHz	836.5 MHz	841.5 MHz		
15 MHz	DFT-s-OFDM	π/2 BPSK	1	1	23.53	23.58	23.49	0.0	25.0
			1	40	23.43	23.36	23.20	0.0	25.0
			1	77	23.36	23.28	23.21	0.0	25.0
			36	0	23.07	23.09	22.94	0.5	24.5
			36	22	23.55	23.49	23.33	0.0	25.0
			36	43	22.99	22.85	22.79	0.5	24.5
			75	0	23.06	23.01	22.85	0.5	24.5
		QPSK	1	1	23.58	23.62	23.59	0.0	25.0
			1	40	23.48	23.40	23.29	0.0	25.0
			1	77	23.38	23.29	23.27	0.0	25.0
			36	0	22.61	22.62	22.48	1.0	24.0
			36	22	23.57	23.51	23.36	0.0	25.0
			36	43	22.53	22.40	22.29	1.0	24.0
			75	0	22.58	22.53	22.38	1.0	24.0
		16QAM	1	1	22.64	22.72	22.64	1.0	24.0
		64QAM	1	1	21.13	21.16	20.86	2.5	22.5
		256QAM	1	1	19.08	19.08	19.02	4.5	20.5
	CP-OFDM	QPSK	1	1	22.13	22.09	22.12	1.5	23.5

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BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					165800	167300	168800		
					829 MHz	836.5 MHz	844 MHz		
10 MHz	DFT-s-OFDM	π/2 BPSK	1	1	23.54	23.51	23.30	0.0	25.0
			1	26	23.75	23.51	23.29	0.0	25.0
			1	50	23.49	23.27	23.19	0.0	25.0
			25	0	23.09	23.02	22.81	0.5	24.5
			25	14	23.56	23.45	23.25	0.0	25.0
			25	27	23.07	22.87	22.74	0.5	24.5
			50	0	23.08	22.96	22.78	0.5	24.5
		QPSK	1	1	23.60	23.59	23.35	0.0	25.0
			1	26	23.59	23.55	23.32	0.0	25.0
			1	50	23.54	23.31	23.23	0.0	25.0
			25	0	22.62	22.55	22.33	1.0	24.0
			25	14	23.60	23.48	23.28	0.0	25.0
			25	27	22.59	22.38	22.25	1.0	24.0
			50	0	22.62	22.50	22.28	1.0	24.0
		16QAM	1	1	22.66	22.54	22.34	1.0	24.0
		64QAM	1	1	21.04	21.11	20.81	2.5	22.5
		256QAM	1	1	19.03	18.99	18.84	4.5	20.5
	CP-OFDM	QPSK	1	1	22.13	22.07	21.88	1.5	23.5
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					165300	167300	169300		
					826.5 MHz	836.5 MHz	846.5 MHz		
5 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.07	23.86	23.57	0.0	25.0
			1	13	23.99	23.72	23.5	0.0	25.0
			1	23	24.05	23.76	23.57	0.0	25.0
			12	0	23.07	22.9	22.61	0.5	24.5
			12	7	24.06	23.84	23.6	0.0	25.0
			12	13	23.07	22.81	22.6	0.5	24.5
			25	0	23.08	22.87	22.61	0.5	24.5
		QPSK	1	1	24.08	23.93	23.64	0.0	25.0
			1	13	23.99	23.78	23.54	0.0	25.0
			1	23	24.08	23.78	23.61	0.0	25.0
			12	0	23.09	22.92	22.65	1.0	24.0
			12	7	24.06	23.87	23.63	0.0	25.0
			12	13	23.07	22.85	22.64	1.0	24.0
			25	0	23.06	22.87	22.64	1.0	24.0
		16QAM	1	1	23.07	23.01	22.65	1.0	24.0
		64QAM	1	1	21.42	21.47	21.11	2.5	22.5
		256QAM	1	1	19.44	19.47	19.1	4.5	20.5
	CP-OFDM	QPSK	1	1	22.55	22.37	22.13	1.5	23.5

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8.2. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

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

Test Spec

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

NOTE

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

RESULTS

See the following pages.

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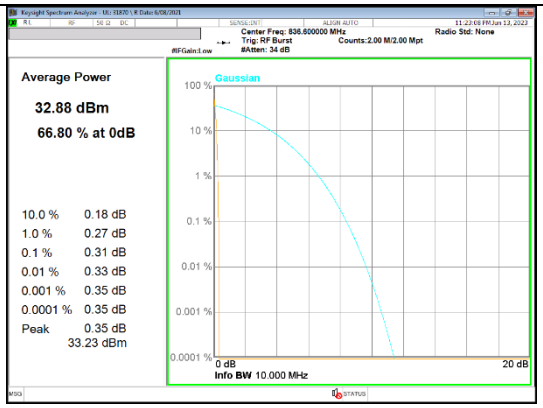
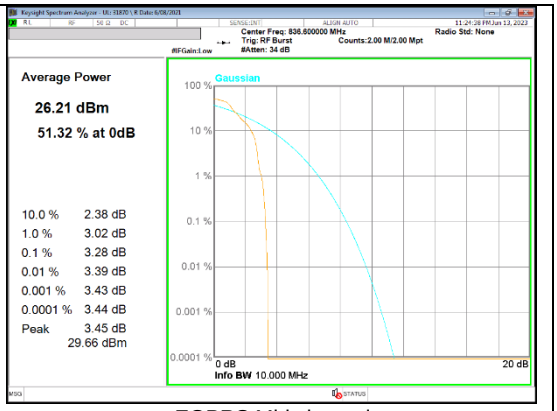
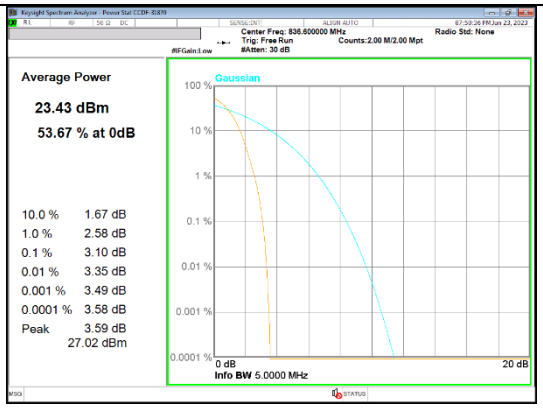
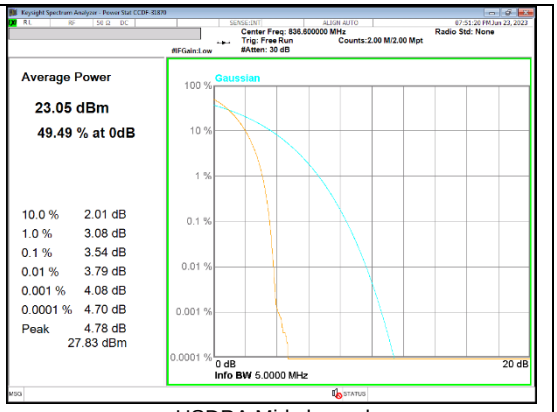
8.2.1. CONDUCTED PEAK TO AVERAGE RESULT

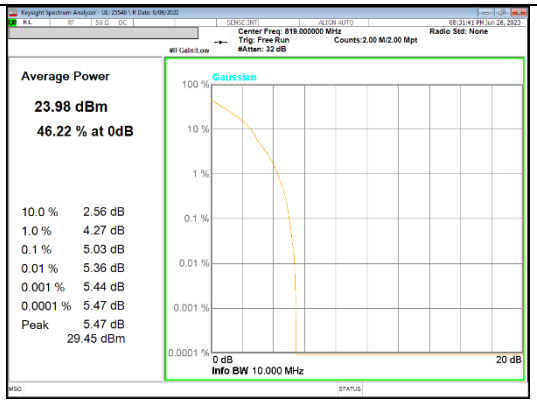
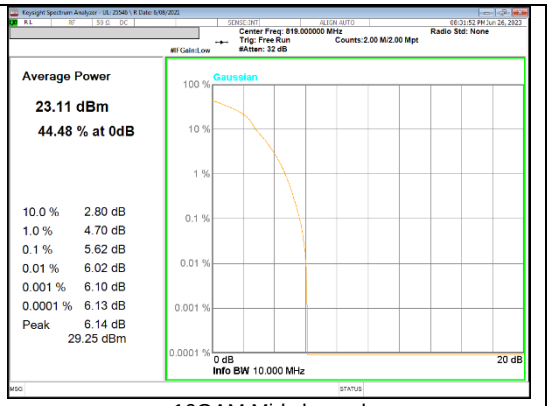
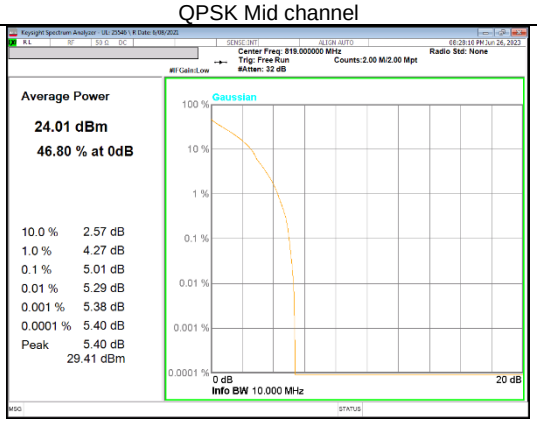
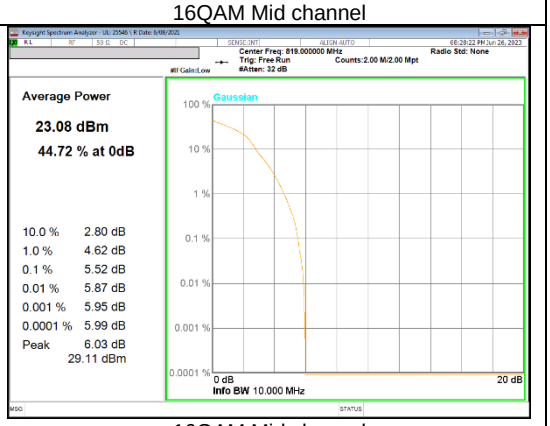
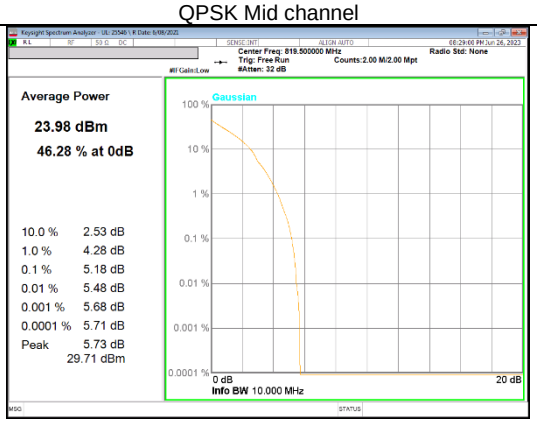
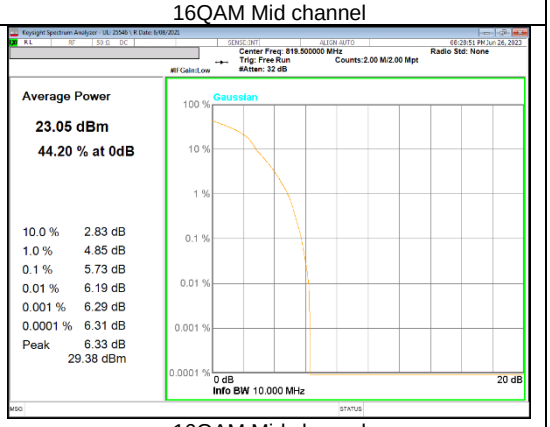
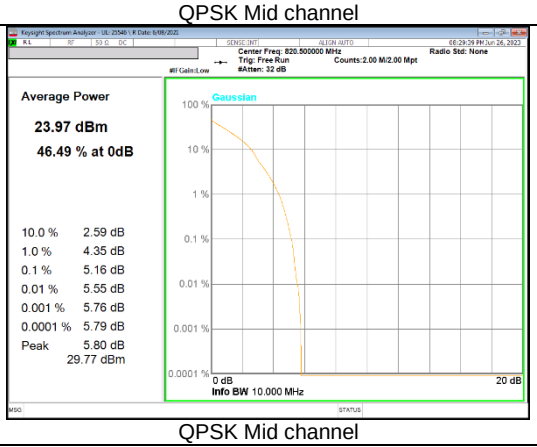
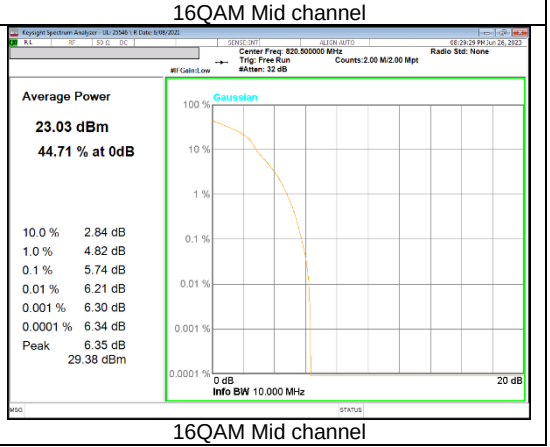
GSM

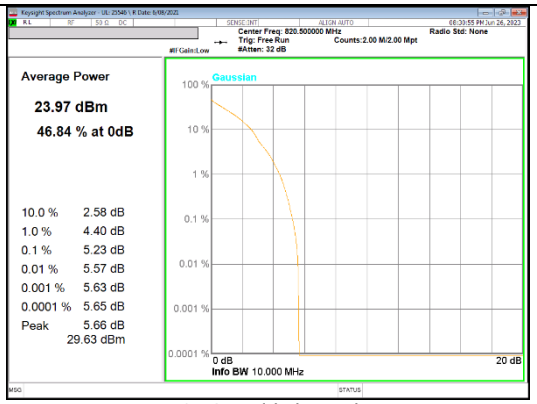
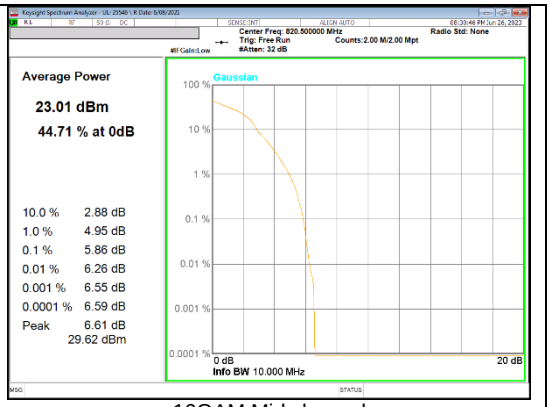
GSM 850	 GPRS Mid channel	 EGPRS Mid channel

WCDMA

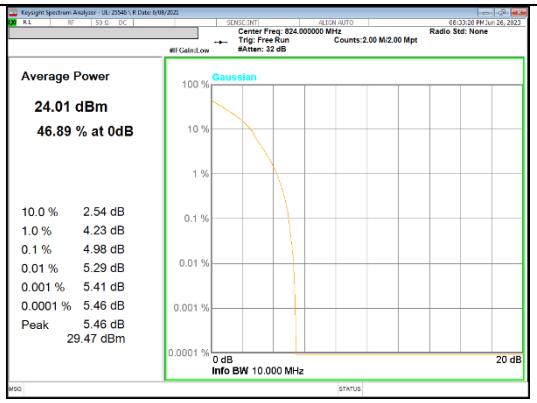
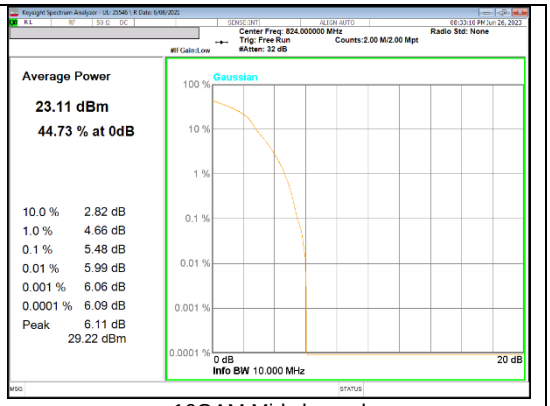
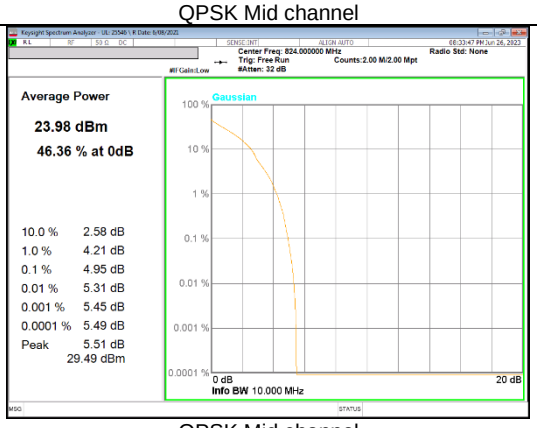
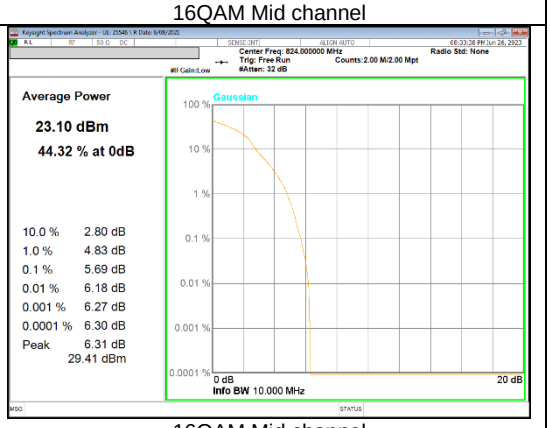
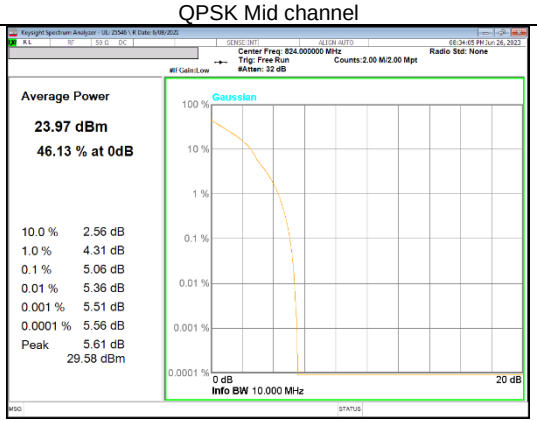
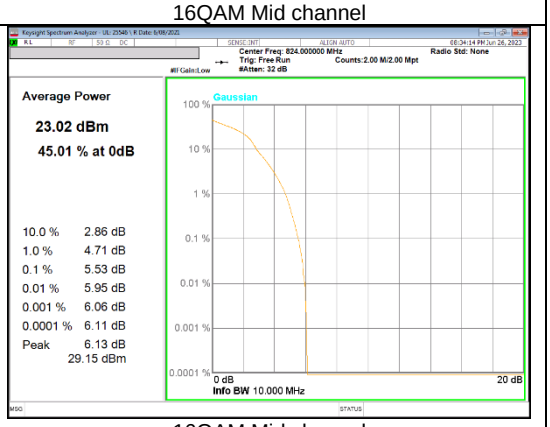
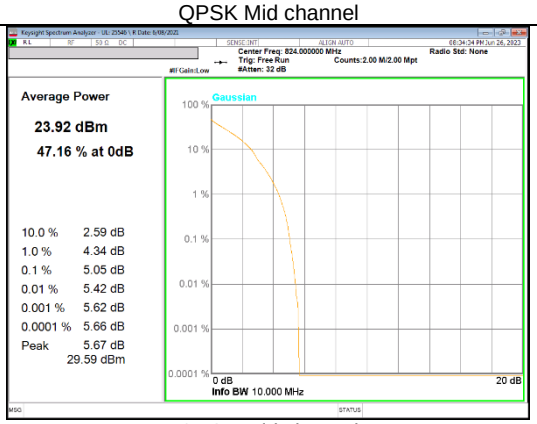
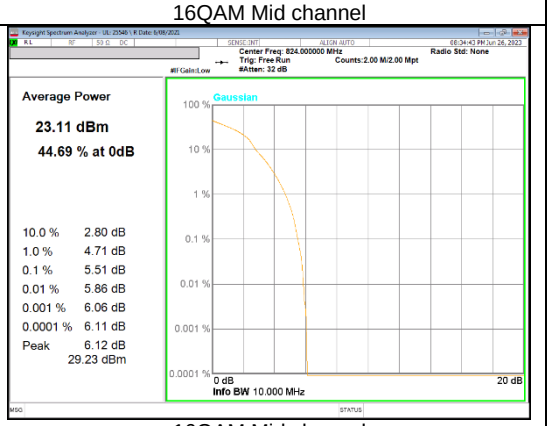
Band 5	 REL99 Mid channel	 HSDPA Mid channel

LTE Band 26 (Part 90)

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

1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

LTE Band 26 (Straddle)

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

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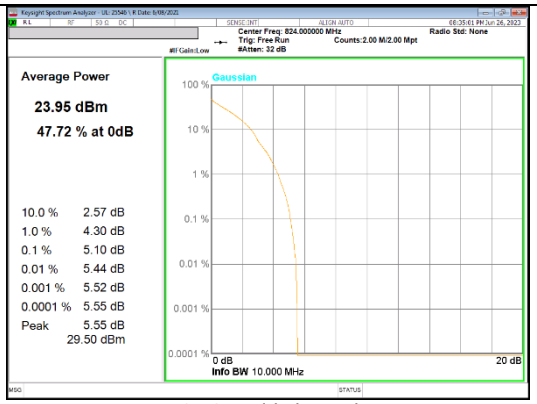
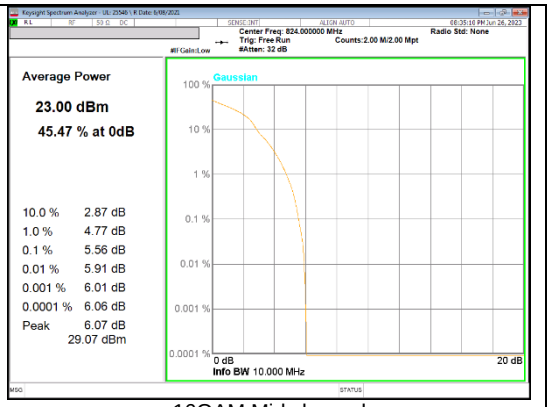
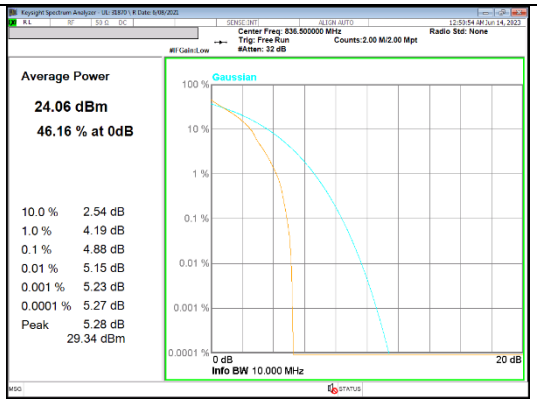
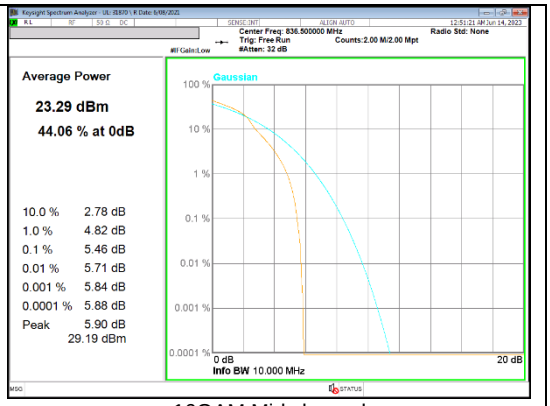
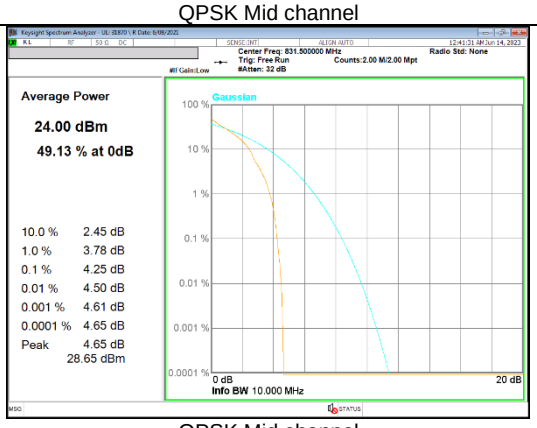
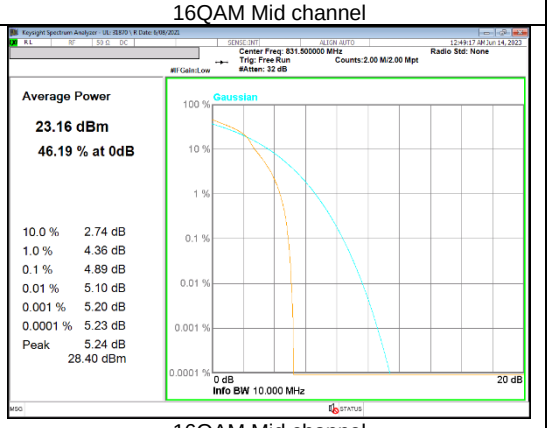
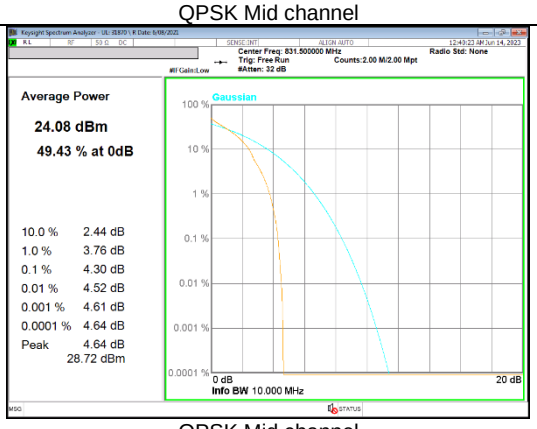
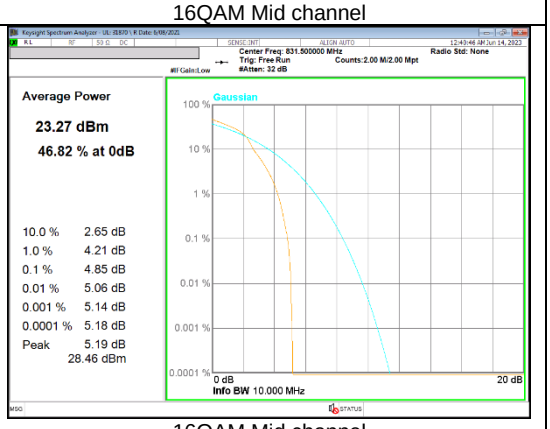
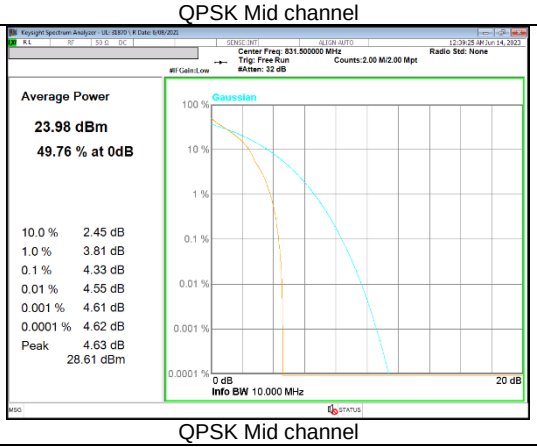
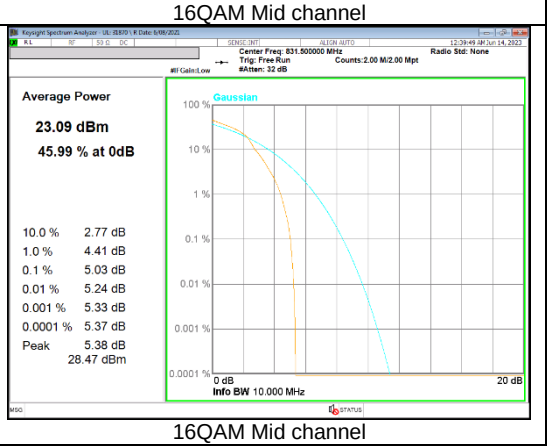
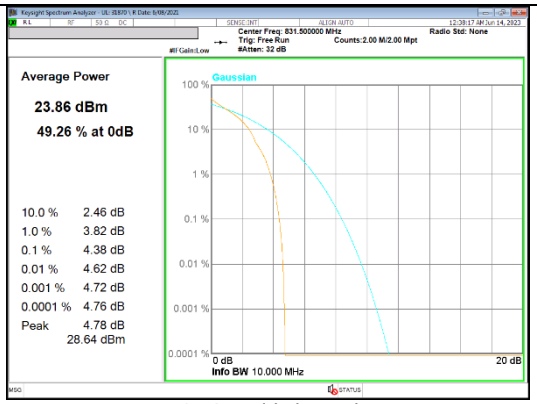
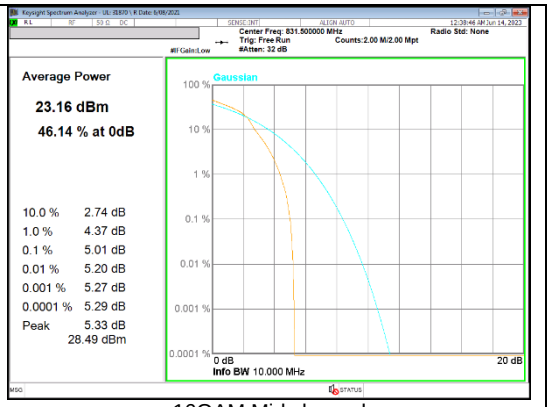
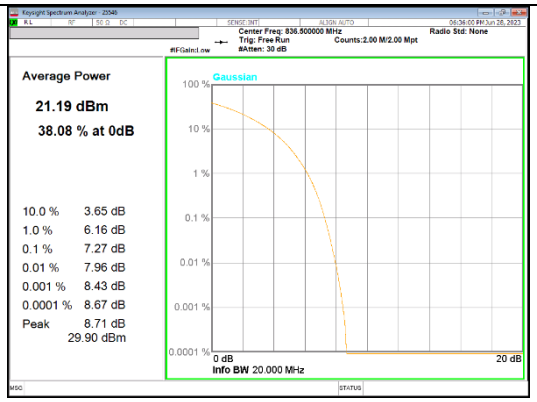
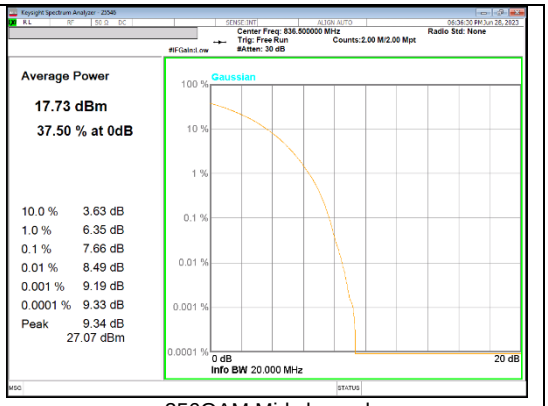
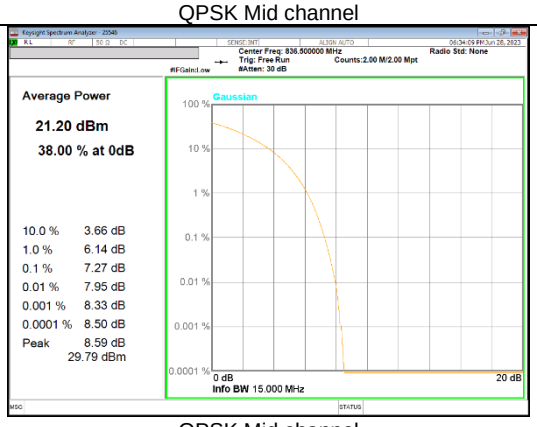
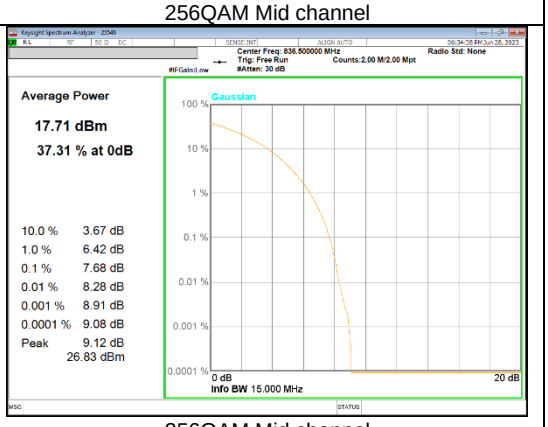
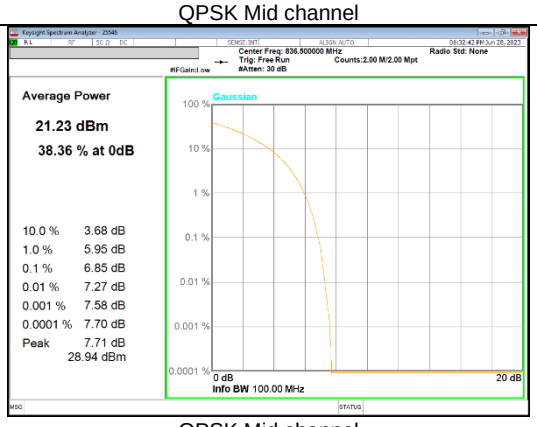
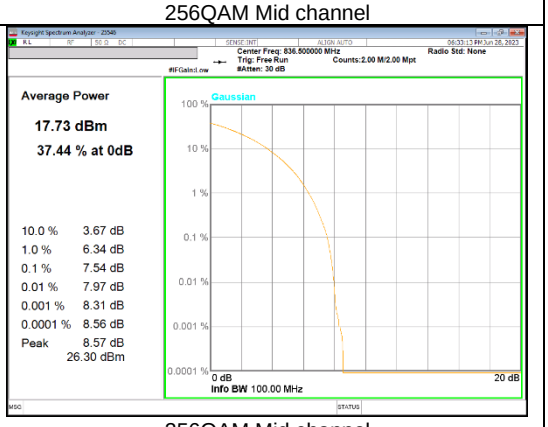
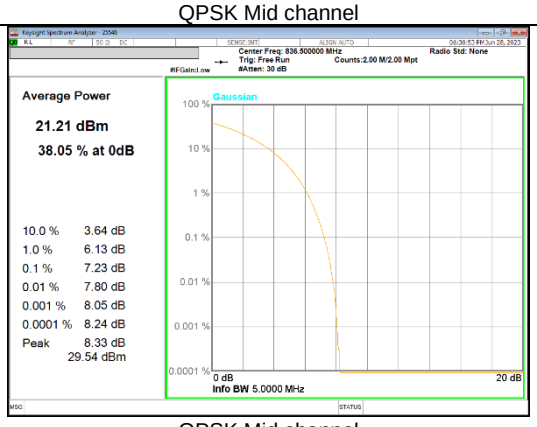
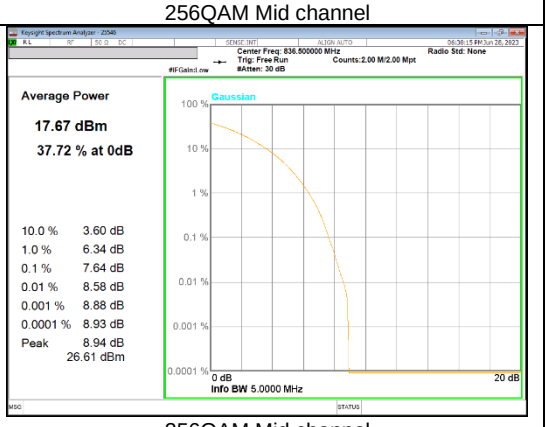
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

LTE Band 26 (Part 22)

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

1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

NR Band n5 CP-OFDM

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

8.3. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

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

(KDB 971168 D01 Power Meas License Digital Systems v03r01)

RESULTS

See the following pages.

- **GSM**

Band	Modulation	f [MHz]	99% BW (kHz)	-26dB BW (kHz)
850	GPRS	836.6	249.430	317.300
	EGPRS		248.540	316.400

- **WCDMA**

Band	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
B5	Rel.99	836.6	4.146	4.703
	HSDPA		4.162	4.659

- LTE Band 26 (Part 90)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	819.0	13.391	15.120
		16QAM		13.428	14.690
	10M	QPSK	819.0	8.976	10.050
		16QAM		8.970	10.120
	5M	QPSK	819.5	4.486	5.248
		16QAM		4.499	5.254
	3M	QPSK	820.5	2.691	3.061
		16QAM		2.690	3.077
	1.4M	QPSK	820.5	1.087	1.289
		16QAM		1.082	1.304

- LTE Band 26 (Straddle)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	824.0	13.377	14.720
		16QAM		13.398	14.790
	10M	QPSK		8.964	9.989
		16QAM		8.944	10.080
	5M	QPSK		4.488	5.218
		16QAM		4.496	5.136
	3M	QPSK		2.702	3.047
		16QAM		2.691	3.020
	1.4M	QPSK		1.085	1.251
		16QAM		1.082	1.285

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- LTE Band 26 (Part 22)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	836.5	13.411	14.880
		16QAM		13.446	15.030
	10M	QPSK	831.5	8.972	10.420
		16QAM		8.972	10.380
	5M	QPSK	831.5	4.500	5.273
		16QAM		4.508	5.251
	3M	QPSK	831.5	2.696	3.078
		16QAM		2.701	3.099
	1.4M	QPSK	831.5	1.083	1.309
		16QAM		1.087	1.313

- NR Band n5

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n5	20M	QPSK	836.5	18.976	20.580
		16QAM		18.956	20.760
	15M	QPSK		14.129	15.050
		16QAM		14.128	15.210
	10M	QPSK		9.293	10.200
		16QAM		9.310	10.120
	5M	QPSK		4.494	5.372
		16QAM		4.502	5.262

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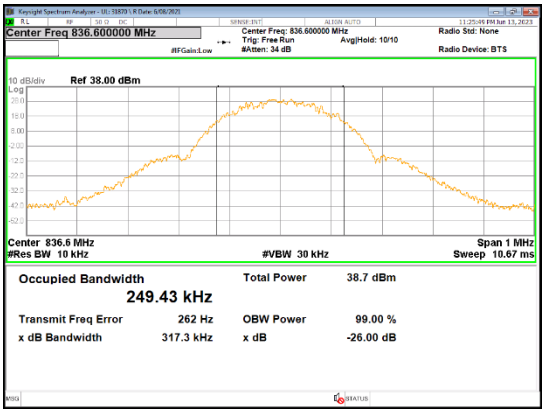
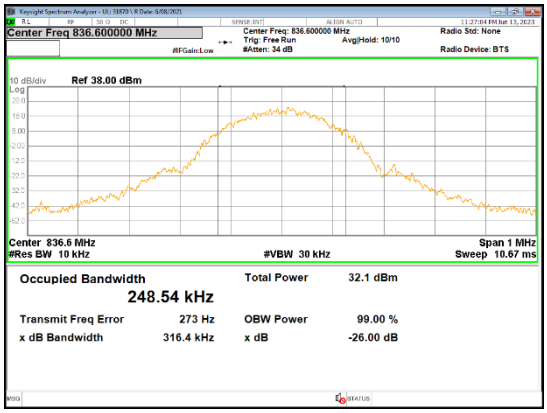
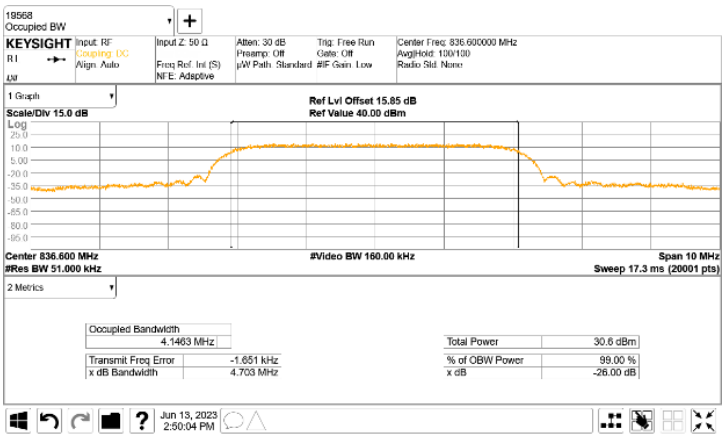
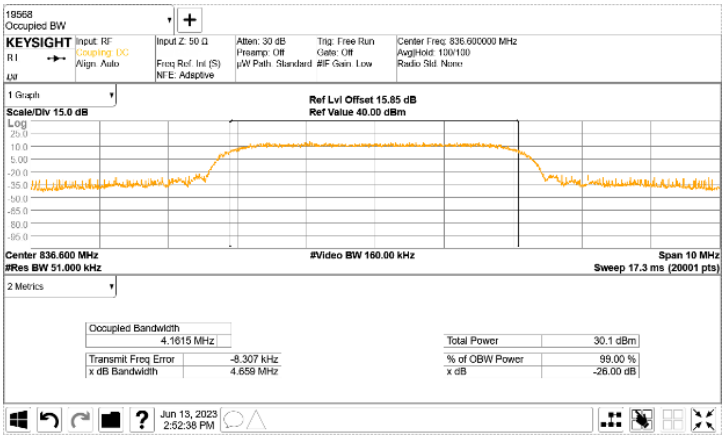
8.3.1. OCCUPIED BANDWIDTH RESULTS

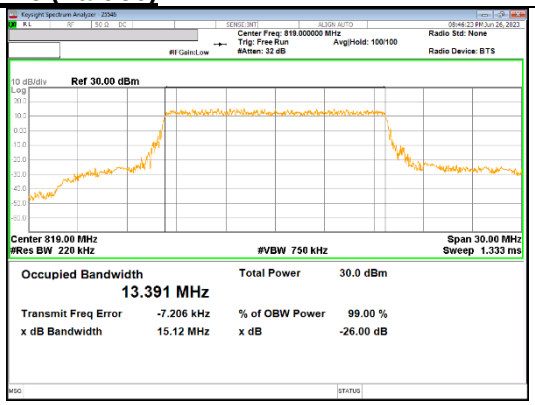
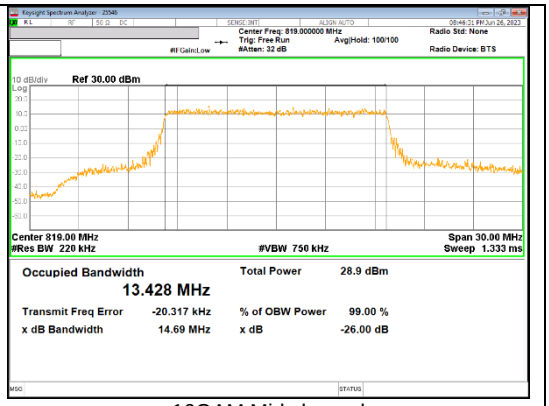
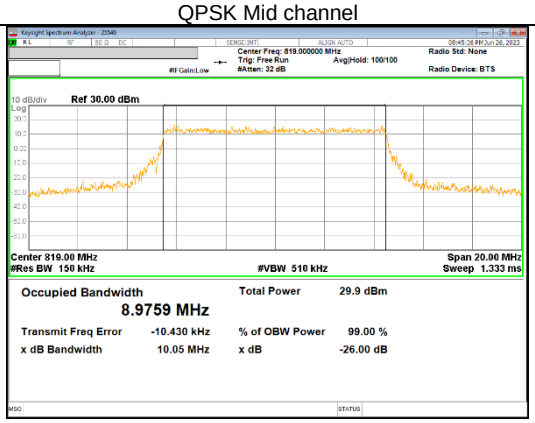
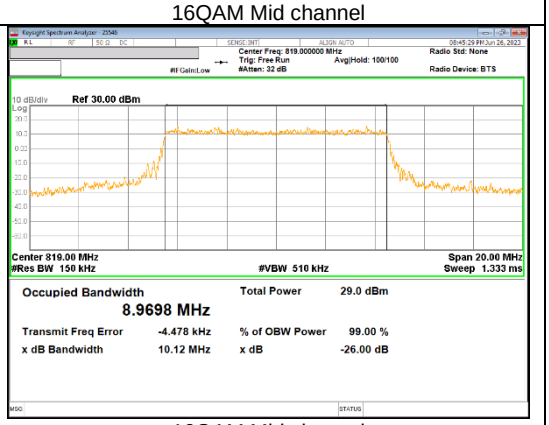
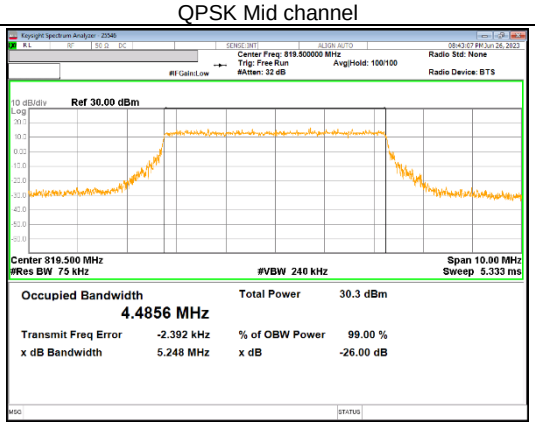
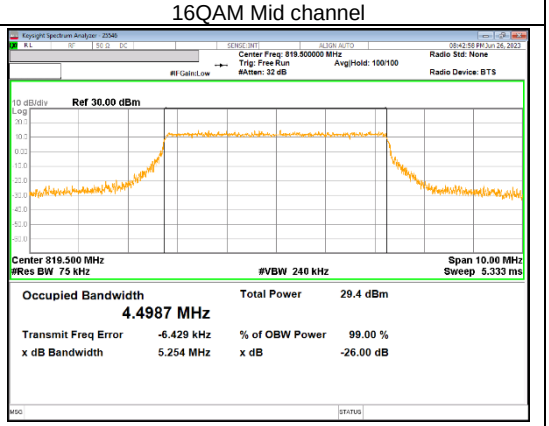
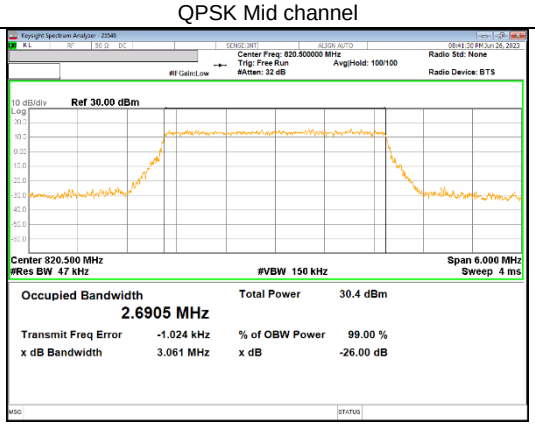
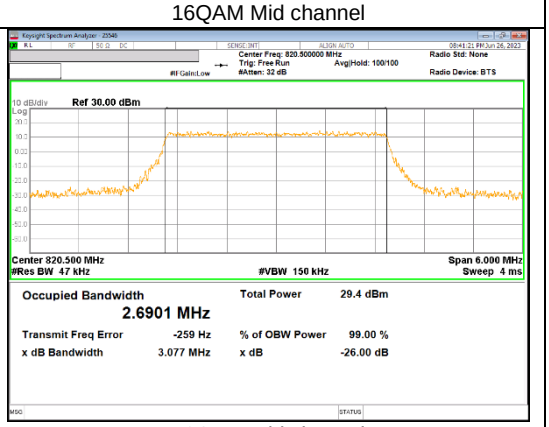
GSM 850

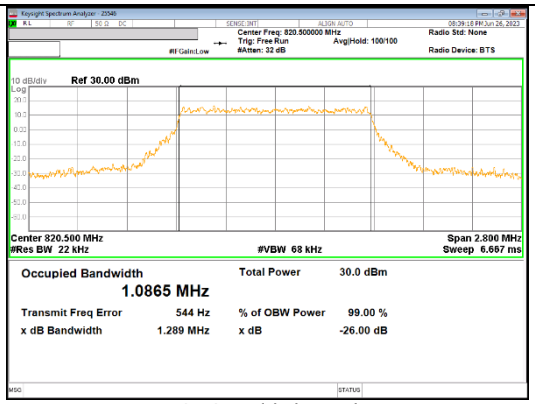
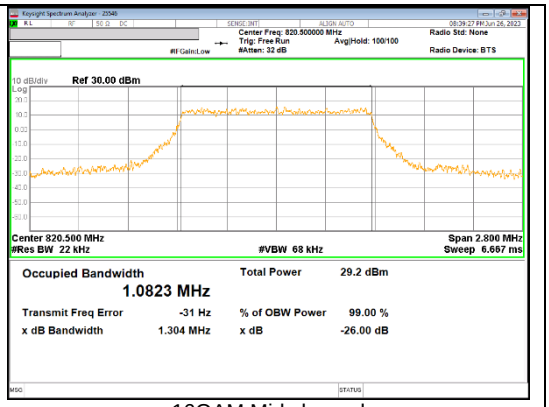
GSM 850	 GPRS Mid channel	 EGPRS Mid channel

WCDMA Band 5

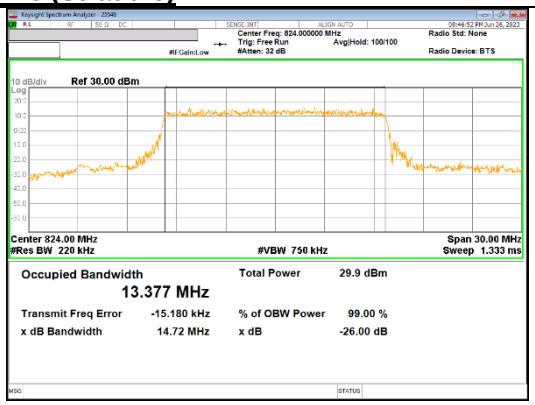
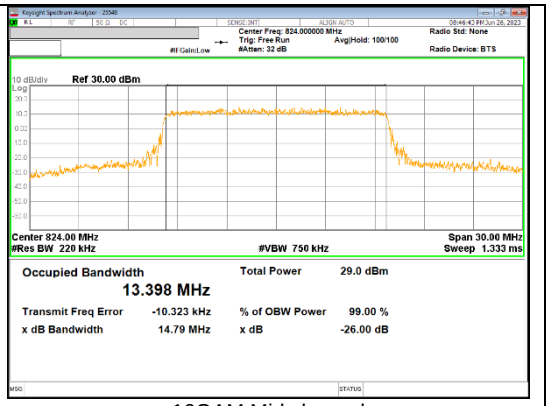
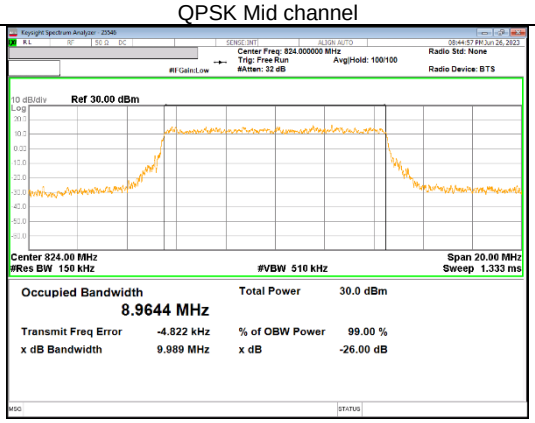
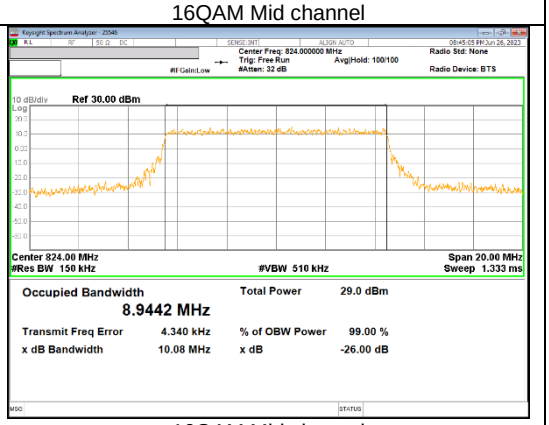
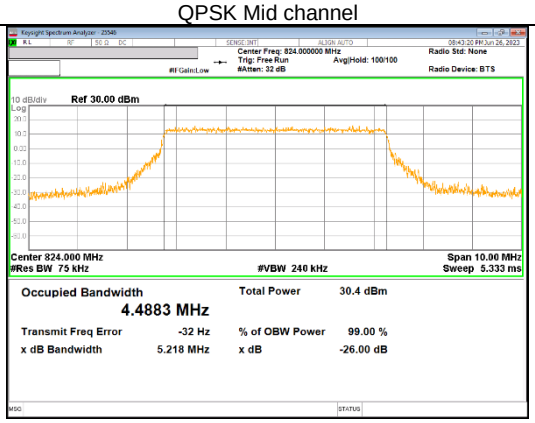
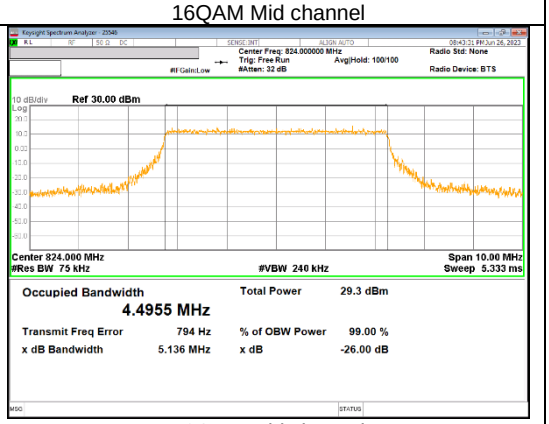
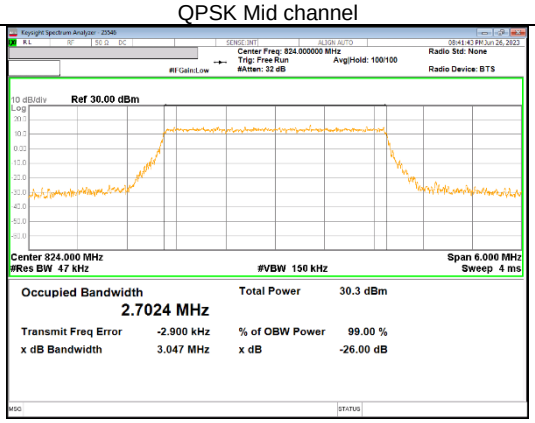
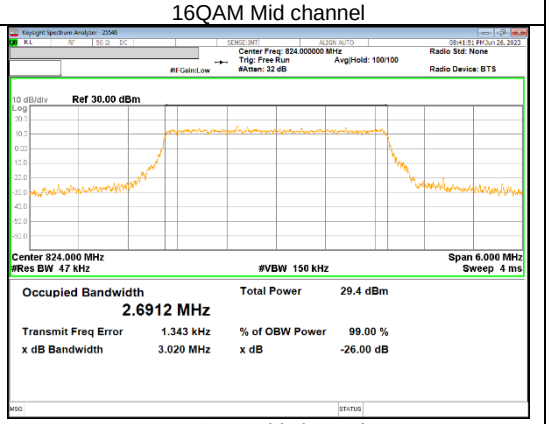
Band 5	 REL99 Mid channel
	 HSDPA Mid channel

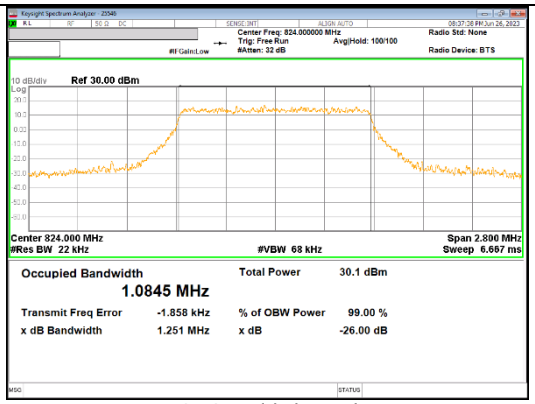
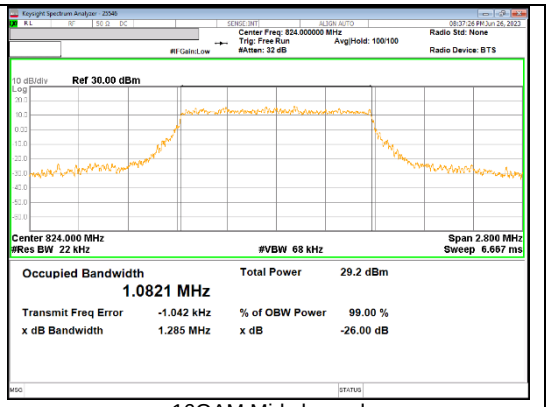
LTE Band 26 (Part 90)

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

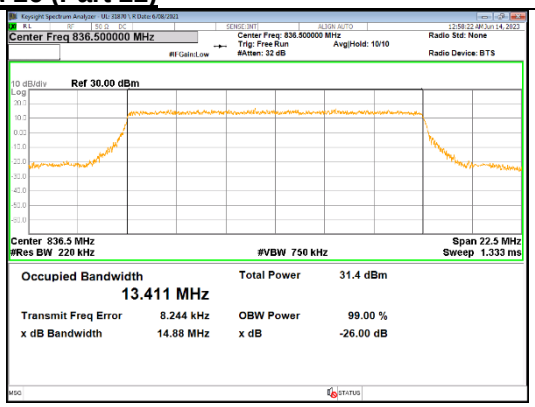
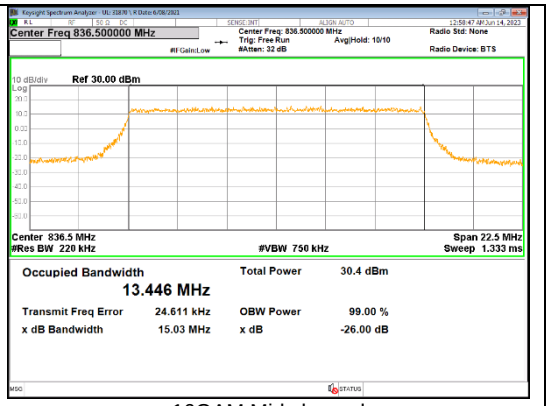
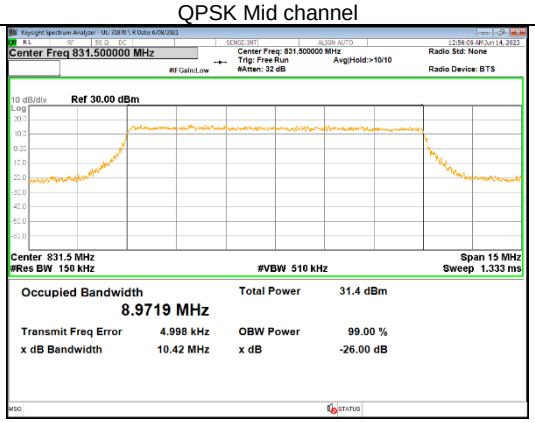
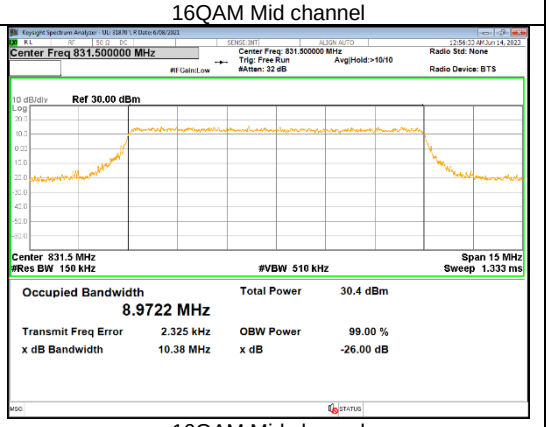
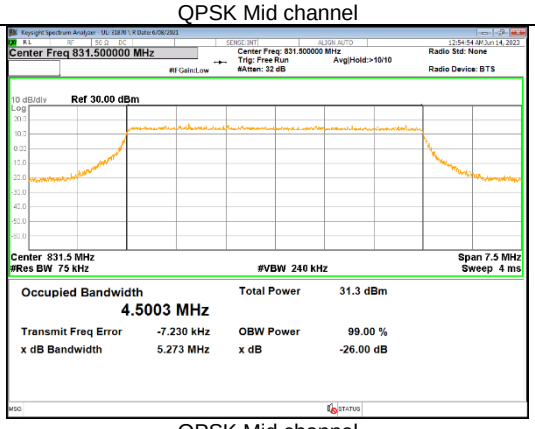
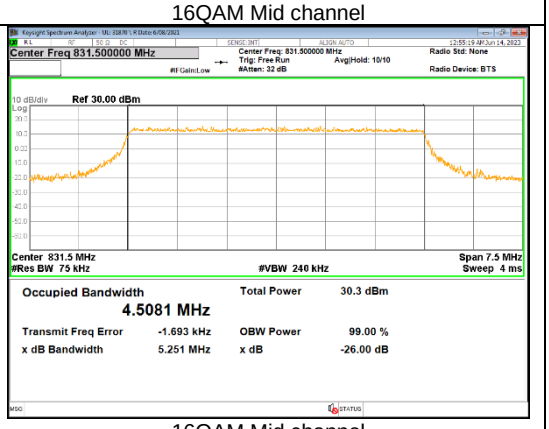
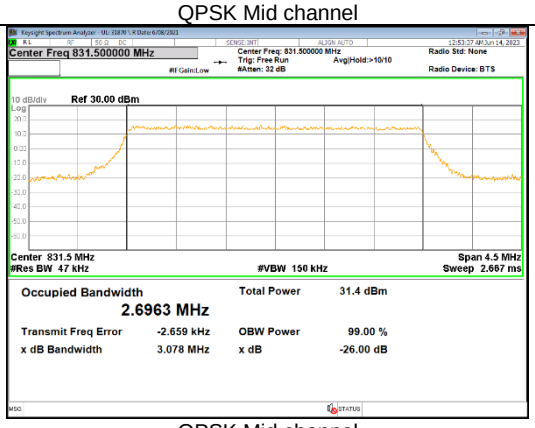
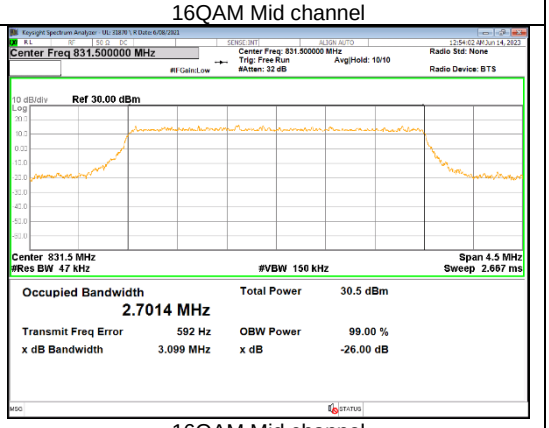
1.4MHz	 QPSK Mid channel	 16QAM Mid channel

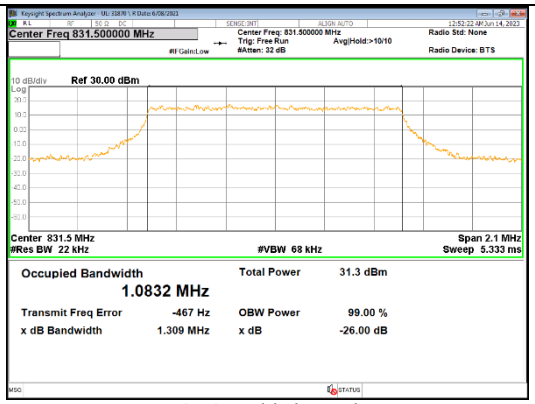
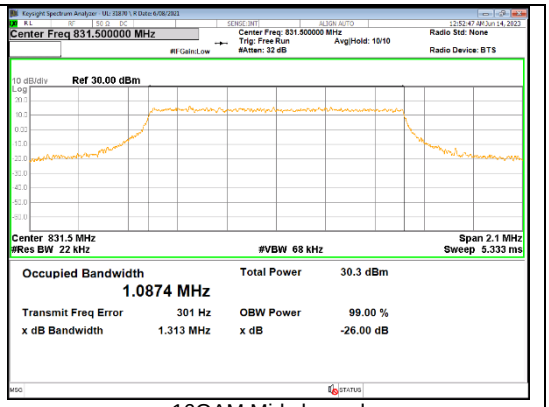
LTE Band 26 (Straddle)

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

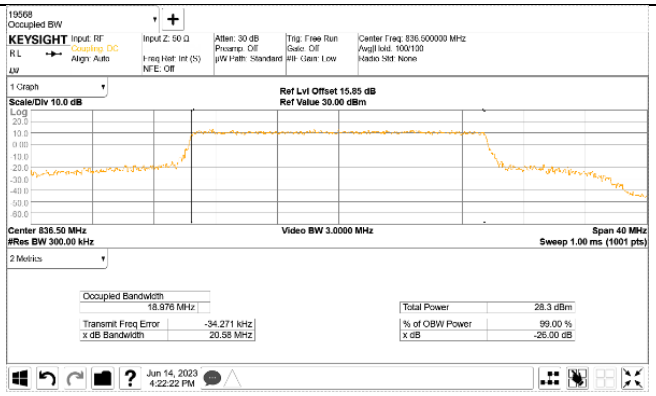
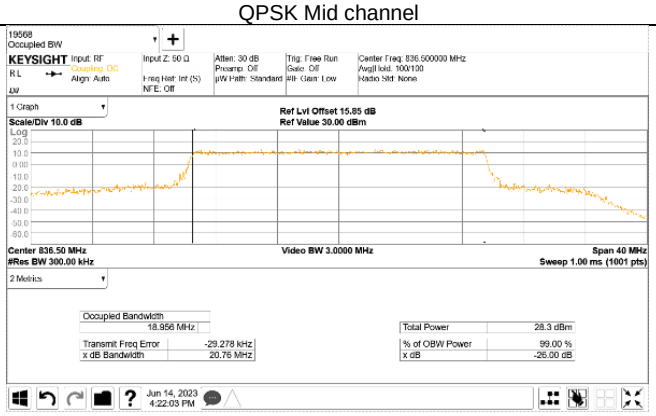
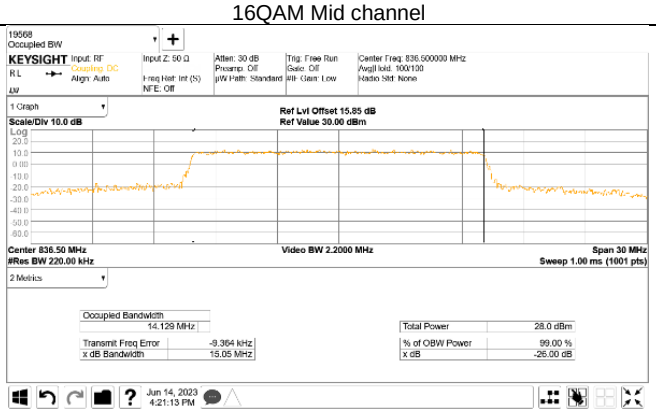
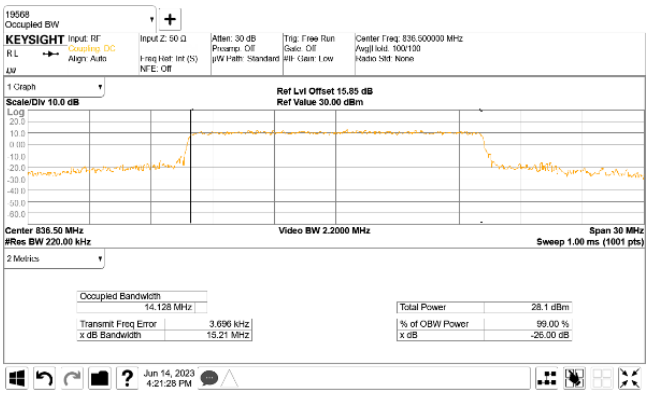
1.4MHz		
	QPSK Mid channel	16QAM Mid channel

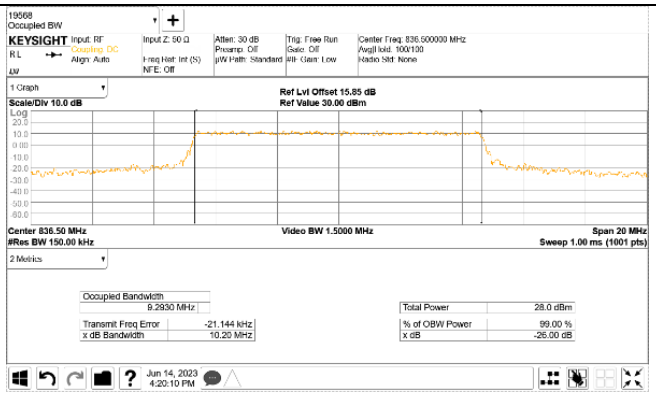
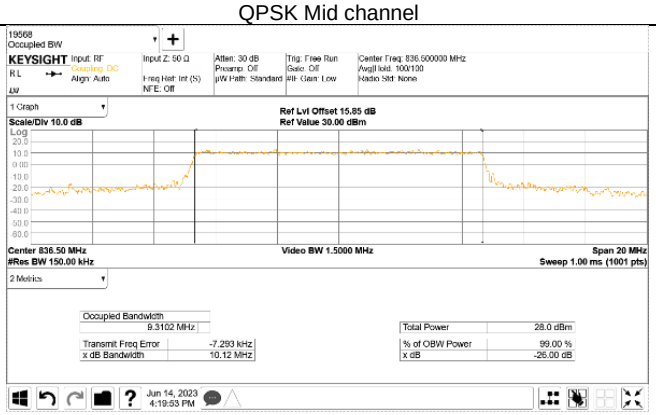
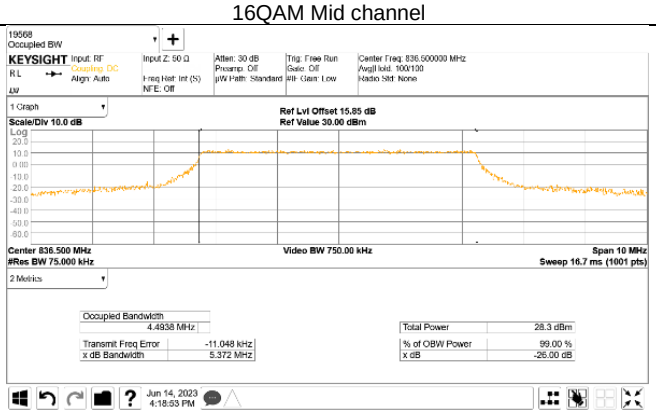
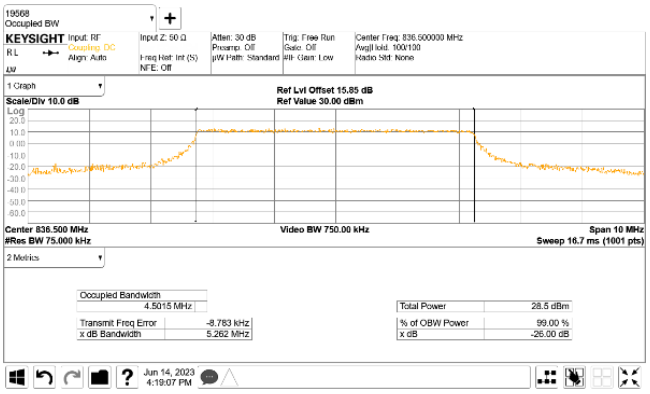
LTE Band 26 (Part 22)

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

1.4MHz	 QPSK Mid channel	 16QAM Mid channel

NR Band n5 CP-OFDM

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

8.4. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §22.359, §22.917 and 90.691

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 90.691:
(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

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TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01
The transmitter output was connected to either CMW500 Test Set or E7515B Test set and configured to operate at maximum power. The 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)
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/5G NR

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);

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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.

NOTE3

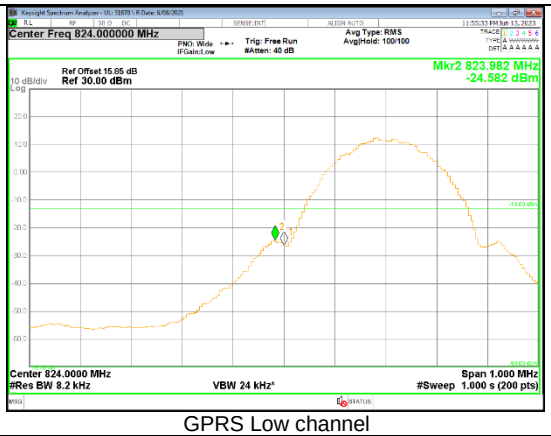
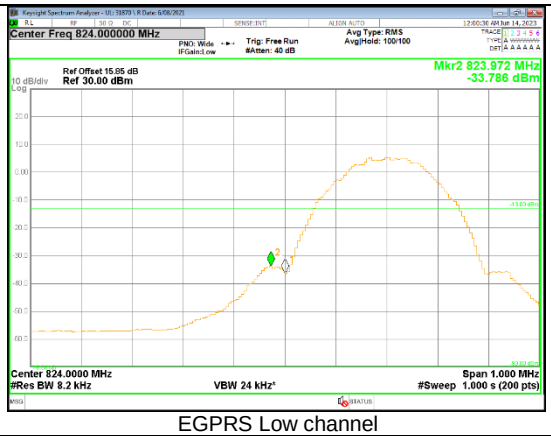
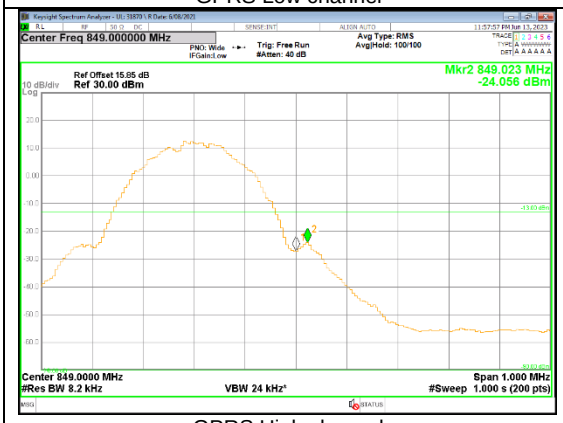
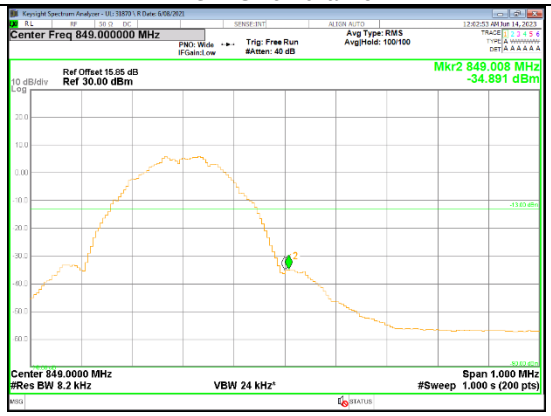
5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations (π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

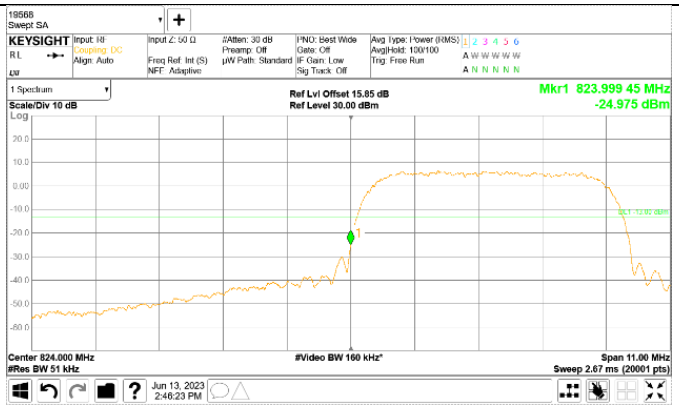
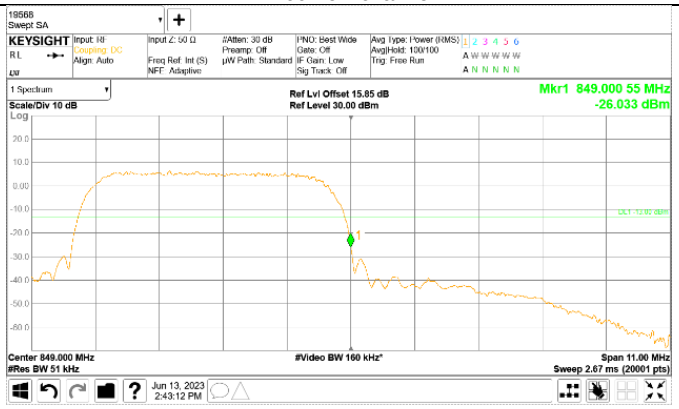
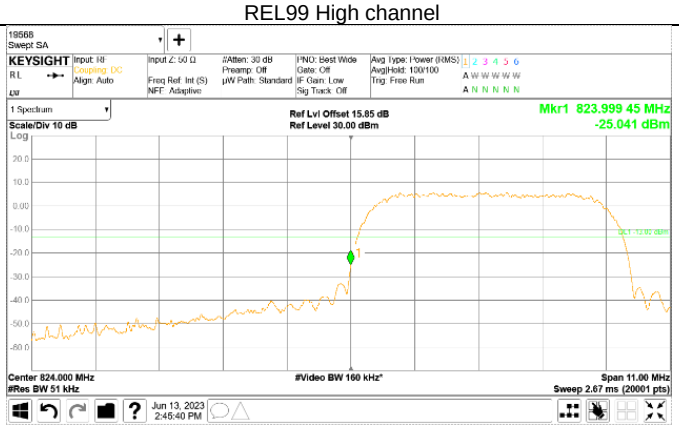
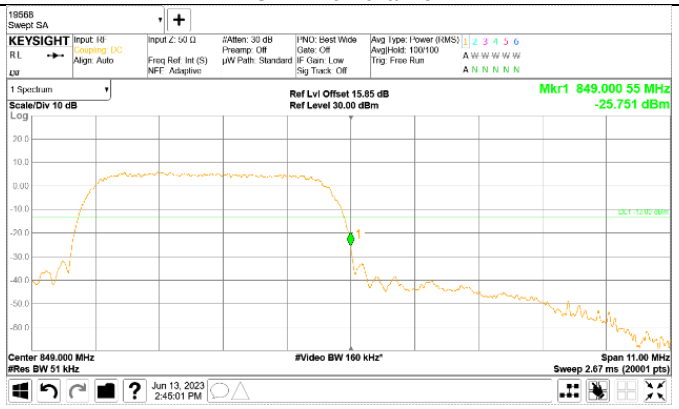
See the following pages.

8.4.1. BAND EDGE RESULT

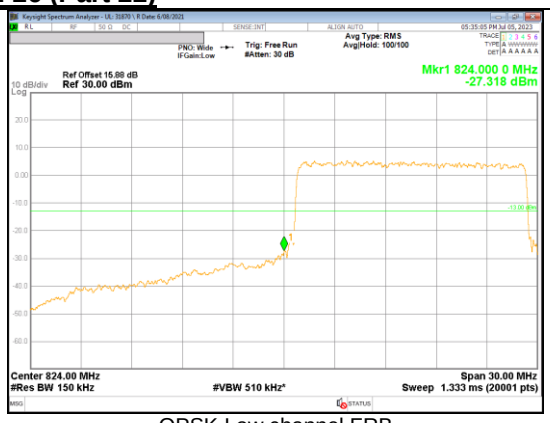
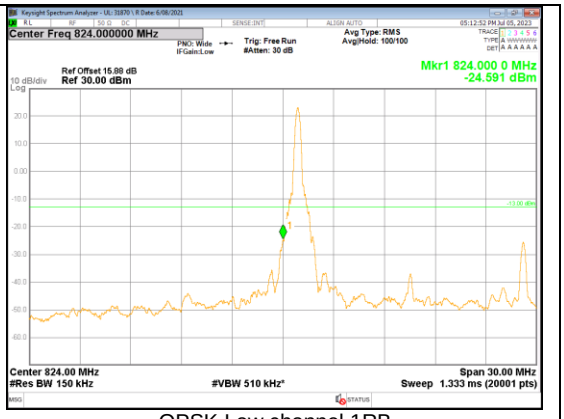
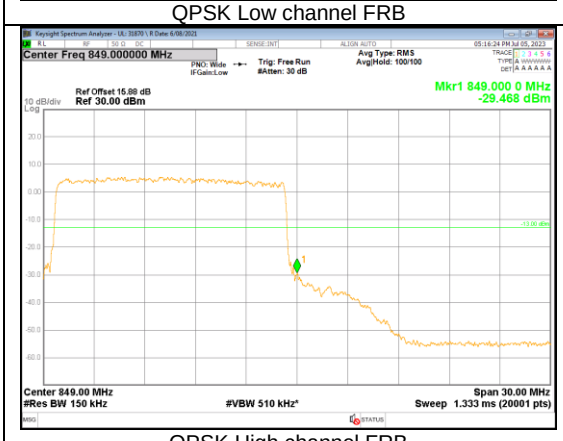
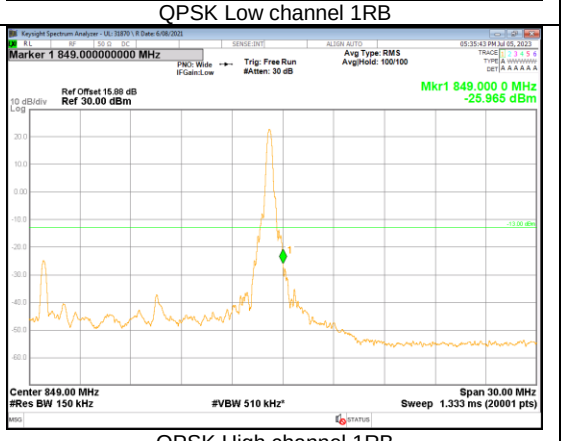
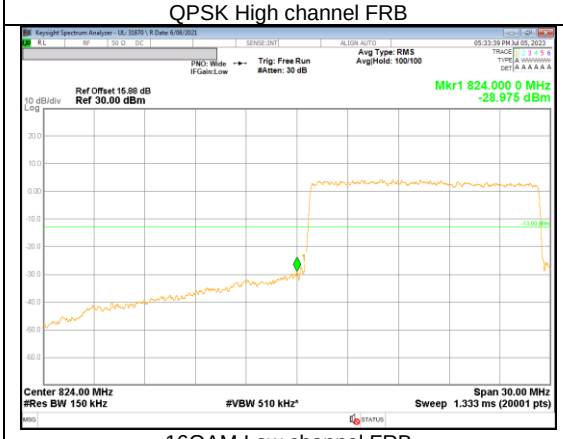
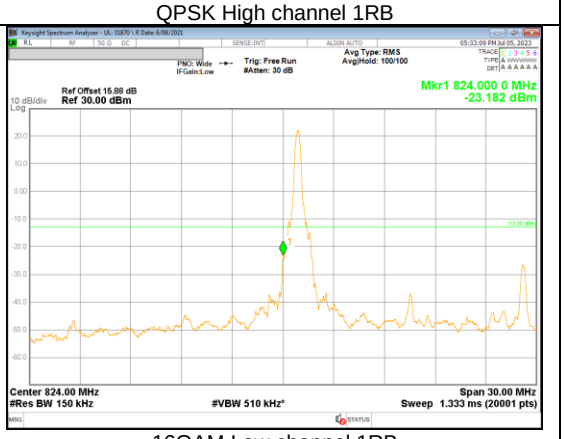
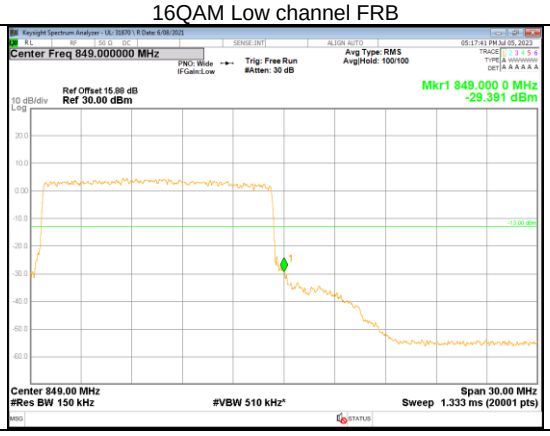
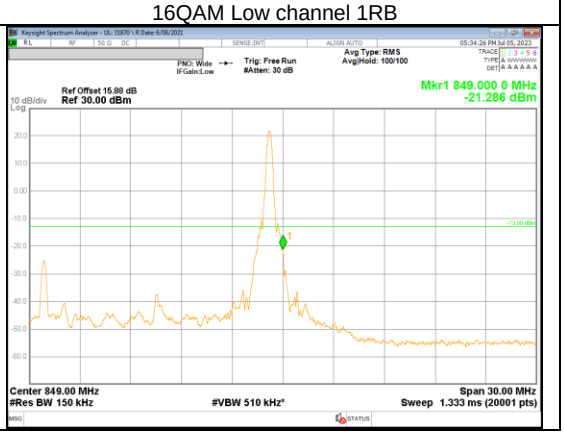
GSM

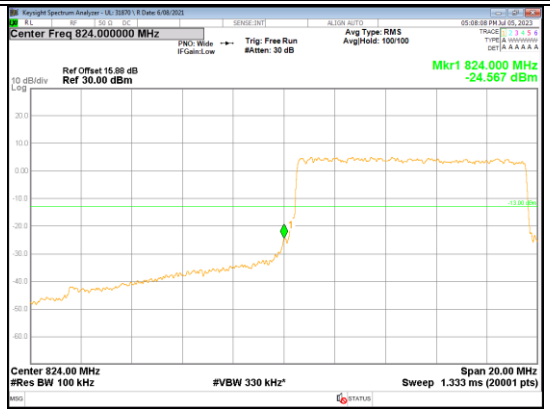
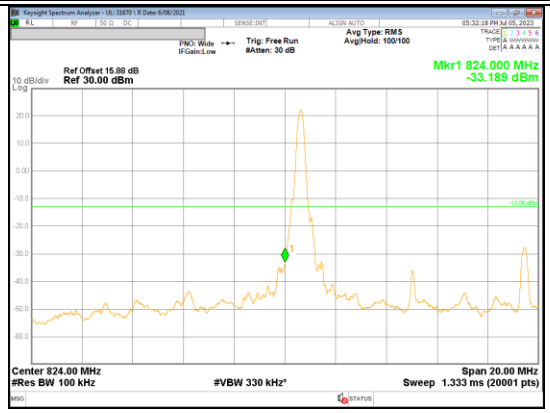
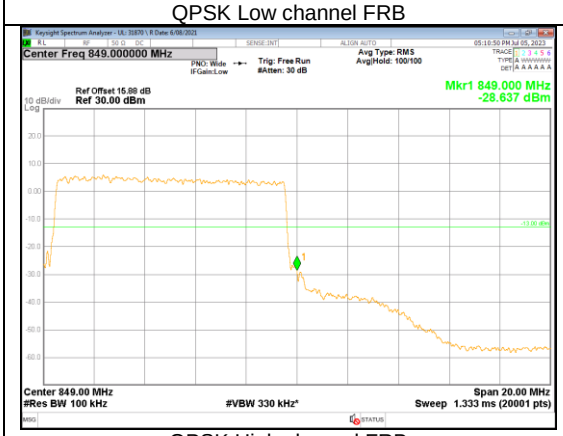
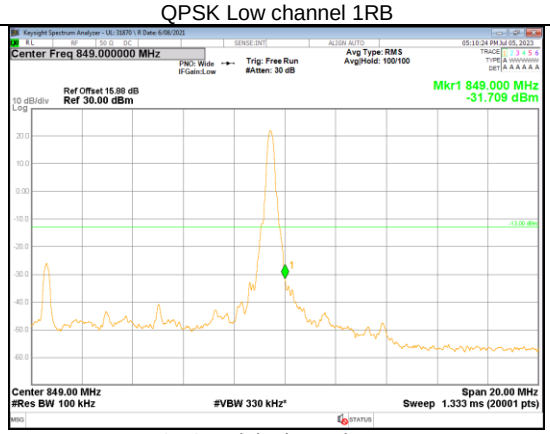
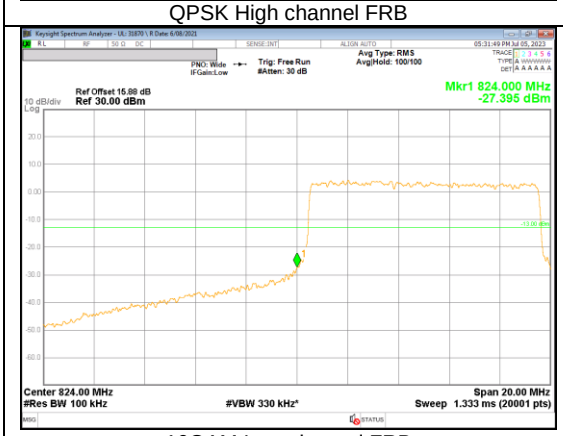
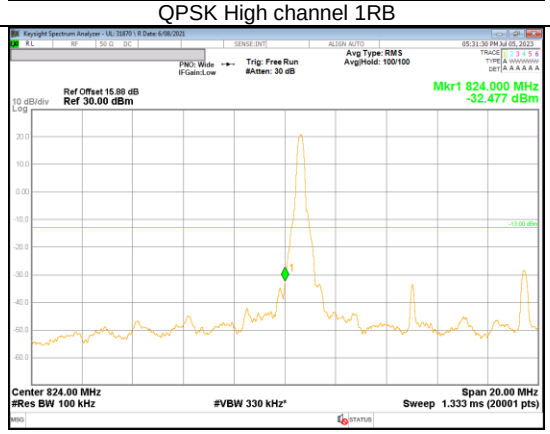
GSM 850	 GPRS Low channel	 EGPRS Low channel
	 GPRS High channel	 EGPRS High channel

WCDMA

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

LTE Band 26 (Part 22)

15MHz	 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
		
	QPSK Low channel FRB	QPSK Low channel 1RB
		
10MHz	QPSK High channel FRB	QPSK High channel 1RB
		
	16QAM Low channel FRB	16QAM Low channel 1RB