

CERTIFICATION TEST REPORT

Report Number. : 4791082054-E2V3

Applicant : SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

Model : SM-A556E, SM-A556E/DS

FCC ID : A3LSMA556E

EUT Description : GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax,
and NFC.

Test Standard(s) : FCC 47 CFR PART 22 SUBPART H
FCC 47 CFR PART 90 SUBPART S

Date Of Issue:
2024-01-18

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

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V2	2024-01-12	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 Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, and NFC.

MODEL NUMBER: SM-A556E, SM-A556E/DS

SERIAL NUMBER: R3CWA0H7NHA, R3CWB0FCVGV, R3CWB0A1AKR (CONDUCTED); R3CWB0A1A3B, R3CWB0A1DBF, R3CWB0A1AYP, R3CWB0A1B4K (RADIATED);

DATE TESTED: 2023-11-30 - 2024-01-18;

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 47 CFR Part 2.
2. FCC 47 CFR Part 22.
3. FCC 47 CFR Part 90.
4. ANSI TIA-603-E, 2016
5. ANSI C63.26, 2015
6. KDB 971168 D01 Power Meas License Digital Systems v03r01
7. KDB 971168 D02 Misc Rev Approv License Devices v02r02
8. KDB 412172 D01 Determining ERP and EIRP v01r01

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	
<input checked="" type="checkbox"/>	Chamber 1(3m semi-anechoic chamber)
<input checked="" type="checkbox"/>	Chamber 2(3m semi-anechoic chamber)
<input type="checkbox"/>	Chamber 3(3m semi-anechoic chamber)
<input type="checkbox"/>	Chamber 4(3m Full-anechoic chamber)
<input type="checkbox"/>	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:

$$\text{ERP} = \text{PSA reading with EUT worst orientation (dBm)} + \text{Path loss (dB)} - \text{cable loss (between the SG and substitution antenna)}$$

(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.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

Representative model	Difference	Derivative model
		SM-A556E/DS
SM-A556E	Hardware	Different SIM tray SM-A556E/DS has dual sim tray
	Software	Same as SM-A556E

Thus, SM-A556E was set for final test.

5.2. MAXIMUM OUTPUT POWER

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

GSM

FCC Part 22							
Band	ANT	Frequency Range [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
GSM 850	Antenna A Main 1	824.20 ~ 848.80	GPRS	32.86	1931.97	29.66	924.70
			EGPRS	26.99	500.03	24.09	256.45

WCDMA

FCC Part 22							
Band	ANT	Frequency Range [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	Antenna A Main 1	826.40 ~ 846.60	Rel. 99	24.64	291.07	19.91	97.95
			HSDPA	23.00	199.53	18.39	69.02

LTE Band 26 (Part90)

FCC Part 90								
Band	ANT	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	Antenna A Main 1	821.50	15	QPSK	23.78	238.78	17.85	60.95
				16QAM	22.91	195.43	16.91	49.09
				64QAM	21.75	149.62		
				256QAM	18.90	77.62		
		819.00	10	QPSK	23.79	239.33	17.65	58.21
				16QAM	23.07	202.77	16.86	48.53
				64QAM	22.00	158.49		
		816.50 ~ 821.50	5	256QAM	18.92	77.98		
				QPSK	23.60	229.09	17.35	54.33
				16QAM	23.02	200.45	16.70	46.77
		815.50 ~ 822.50	3	64QAM	21.68	147.23		
				256QAM	18.67	73.62		
				QPSK	23.68	233.35	17.41	55.08
		814.70 ~ 823.30	1.4	16QAM	22.75	188.36	16.84	48.31
				64QAM	22.02	159.22		
				256QAM	18.82	76.21		
QPSK	23.70			234.42	17.42	55.21		
				16QAM	22.83	191.87	16.61	45.81
				64QAM	21.81	151.71		
				256QAM	18.78	75.51		

LTE Band 26 (Straddle)

Straddle								
Band	ANT	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	Antenna A Main 1	824.00	15	QPSK	22.96	197.70	18.00	63.10
				16QAM	22.31	170.22	16.98	49.89
				64QAM	21.26	133.66		
				256QAM	18.31	67.76		
			10	QPSK	22.97	198.15	18.01	63.24
				16QAM	22.30	169.82	16.97	49.77
				64QAM	21.33	135.83		
			5	256QAM	18.33	68.08		
				QPSK	23.33	215.28	18.37	68.71
				16QAM	22.50	177.83	17.17	52.12
			3	64QAM	21.16	130.62		
				256QAM	18.20	66.07		
				QPSK	23.24	210.86	18.28	67.30
			1.4	16QAM	22.60	181.97	17.27	53.33
				64QAM	21.33	135.83		
				256QAM	18.44	69.82		
QPSK	23.06	202.30		18.10	64.57			
				16QAM	22.60	181.97	16.93	49.32
				64QAM	21.33	135.83		
				256QAM	18.25	66.83		

LTE Band 26 (Part22)

FCC Part 22								
Band	ANT	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	Antenna A Main 1	831.50 ~ 841.50	15	QPSK	23.93	247.17	19.02	79.80
				16QAM	23.10	204.17	18.29	67.45
				64QAM	21.89	154.53		
				256QAM	19.03	79.98		
		829.00 ~ 844.00	10	QPSK	23.66	232.27	19.37	86.50
				16QAM	22.93	196.34	18.22	66.37
				64QAM	21.79	151.01		
		826.50 ~ 846.50	5	256QAM	19.02	79.80		
				QPSK	23.61	229.61	19.34	85.90
				16QAM	23.00	199.53	18.30	67.61
		825.50 ~ 847.50	3	64QAM	21.68	147.23		
				256QAM	18.81	76.03		
				QPSK	23.72	235.50	19.45	88.10
		824.70 ~ 848.30	1.4	16QAM	22.91	195.43	18.21	66.22
				64QAM	21.94	156.31		
				256QAM	19.01	79.62		
QPSK	23.73			236.05	19.46	88.31		
				16QAM	22.91	195.43	18.17	65.61
				64QAM	21.94	156.31		
				256QAM	19.09	81.10		

NR Band n5

FCC Part 22									
Band	ANT	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
						Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n5	Antenna A Main 1	834.00 - 839.00	20	DFT-s OFDM	$\pi/2$ BPSK	24.16	260.62		
					QPSK	24.18	261.82	19.37	86.50
					16QAM	23.25	211.35	18.40	69.18
					64QAM	21.62	145.21		
				256QAM	19.60	91.20			
		CP-OFDM	QPSK	22.64	183.65				
		831.50 - 841.50	15	DFT-s OFDM	$\pi/2$ BPSK	24.11	257.63		
					QPSK	24.13	258.82	19.26	84.33
					16QAM	23.18	207.97	18.33	68.08
					64QAM	21.66	146.55		
		256QAM	19.57	90.57					
		CP-OFDM	QPSK	22.66	184.50				
		829.00 - 844.00	10	DFT-s OFDM	$\pi/2$ BPSK	24.10	257.04		
					QPSK	24.13	258.82	19.24	83.95
					16QAM	23.25	211.35	18.40	69.18
					64QAM	21.64	145.88		
256QAM	19.58			90.78					
CP-OFDM	QPSK	22.60	181.97						
826.50 - 846.50	5	DFT-s OFDM	$\pi/2$ BPSK	24.08	255.86				
			QPSK	24.10	257.04	19.19	82.99		
			16QAM	23.19	208.45	18.34	68.23		
			64QAM	21.70	147.91				
		256QAM	19.61	91.41					
CP-OFDM	QPSK	22.62	182.81						

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)	ANT	Peak Gain (dBi)
GSM850 / WCDMA Band 5 / LTE Band 5, 26 / NR Band n5 814 - 849 MHz	Antenna A Main 1	-5.5

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. It was found QPSK and 16QAM results were worst case.

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

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

NR Band	LTE Band
N5	2, <u>66</u>

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.

● Conducted Spurious Emission

Highest conducted output power setting for each bands					
LTE Band	ANT	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
26 (Part 90)	Antenna A Main 1	819.00	10	1	25
26 (Straddle)		824.00	5	1	14
26 (Part 22)		831.50	15	1	0
		836.50		1	0
		841.50		1	0
NR Band	ANT	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	Antenna A Main 1	834.00	20	1	53
		836.50		1	53
		839.00		1	53

● Radiated Spurious Emission

Highest ERP setting for each bands					
LTE Band	ANT	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
26 (Part 90)	Antenna A Main 1	821.50	15	1	0
26 (Straddle)		824.00	5	1	14
26 (Part 22)		824.70	1.4	1	0
		831.50		1	5
		848.30		1	3
NR Band	ANT	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	Antenna A Main 1	834.00	20	1	53
		836.50		1	53
		839.00		1	53

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

Band	ANT	ERP			RSE		
		X	Y	Z	X	Y	Z
GSM 850	Antenna A Main 1	-	-	O	-	-	O
WCDMA B5	Antenna A Main 1	-	-	O	-	-	O
LTE B26	Antenna A Main 1	-	-	O	-	-	O
NR n5	Antenna A Main 1	-	-	O	-	-	O

Note : For the radiated spurious testing, the EUT attached with travel adapter for the worst case condition. The EUT is continuously communicated with the call box during the tests.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacture	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37W61WENTASEA	N/A
Data Cable	SAMSUNG	EP-DN980	GH39-02117A	N/A

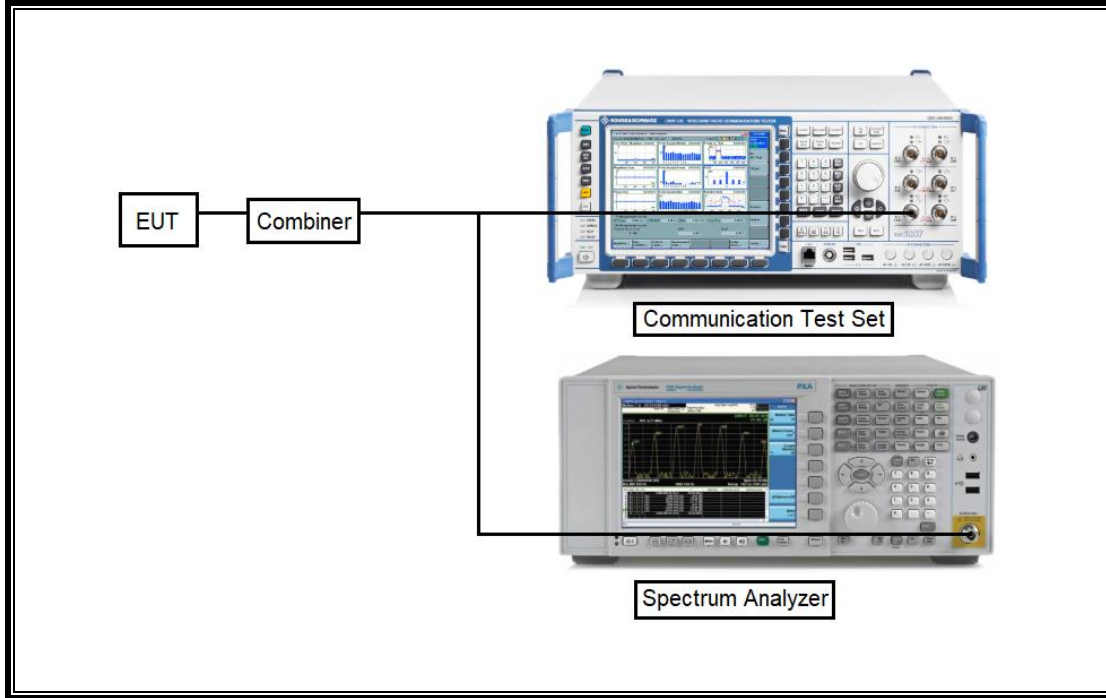
I/O CABLE

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

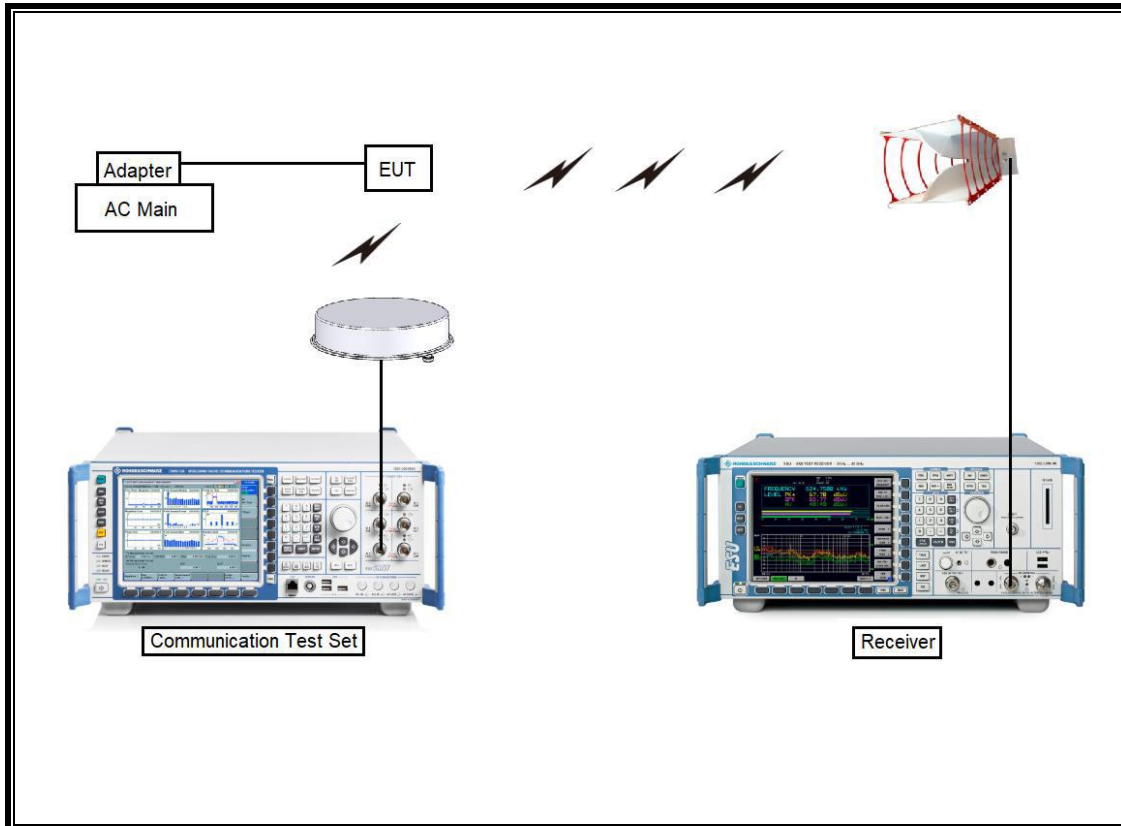
TEST SETUP

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

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	00166155	2024-08-02
Antenna, Horn, 40 GHz	ETS	3116C	00168645	2025-10-05
Preamplifier	ETS	3115-PA	00167475	2024-07-25
Preamplifier	ETS	3116C-PA	00168841	2024-07-25
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2024-08-15
Antenna, Horn, 18 GHz	ETS	3115	00167211	2024-08-04
Antenna, Horn, 18 GHz	ETS	3115	00161451	2024-08-21
Antenna, Horn, 18 GHz	ETS	3117	00168724	2024-08-04
Antenna, Horn, 18 GHz	ETS	3117	00168717	2024-08-21
Communications Test Set	R&S	CMW500	169797	2024-07-23
DC Power Supply	Agilent / HP	E3640A	MY54226395	2024-07-24
Preamplifier, 1000 MHz	Sonoma	310N	341282	2024-07-24
Preamplifier, 1000 MHz	Sonoma	310N	370599	2024-07-24
Preamplifier, 1000 MHz	Sonoma	310N	351741	2024-07-24
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	2024-07-24
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2024-07-25
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2024-07-25
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2024-07-24
Spectrum Analyzer, 44 GHz	KEYSIGHT	N9030B	MY57143717	2024-07-24
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2024-07-23
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2024-07-24
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	2024-07-23
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	2024-07-23
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	2024-07-24
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	2024-07-24
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	2024-07-24
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	2024-07-24
Attenuator	PASTERNAK	PE7087-10	A009	2024-07-24
Attenuator	PASTERNAK	PE7087-10	A001	2024-07-24
Attenuator	PASTERNAK	PE7087-10	A008	2024-07-27
Attenuator	PASTERNAK	PE7004-10	2	2024-07-23
Attenuator	PASTERNAK	PE7395-10	A011	2024-07-25
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2025-09-06
Temperature Chamber	ESPEC	SH-642	93001109	2024-07-24
Power Splitter	MINI-CIRCUITS	WA1534	UL003	2025-01-02
Power Splitter	MINI-CIRCUITS	WA1534	UL004	2025-01-02
UXM5G Wireless Test Platform	KEYSIGHT	E7515B	MY58010202	2024-01-27
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 Results	
2.1046	Conducted Output Power	N/A	Conducted	Pass	
90.635(b)		50 dBm			
2.1049	Occupied Bandwidth (99%)	N/A		Pass	
22.917(a)	Conducted Band Edge / Conducted Spurious Emission	-13 dBm		Pass	
90.543(e)		-35 dBm		Pass	
90.691	Emission Mask	Section 9.2.2		Pass	
22.355 90.213	Frequency Stability	2.5 ppm		Pass	
22.913(a)(5)	Effective Radiated Power	38.5 dBm		Radiated	Pass
90.635(b)		50 dBm			
22.917(a), 90.691(a)	Radiated Spurious Emission	-13 dBm	Pass		

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 ($\pi/2$ 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.

8.1.1. CONDUCTED AVERAGE OUTPUT POWER

GSM (Antenna A, Main 1)

Mode	Coding Scheme	Time Slots	Maximum Average Power (dBm)			
			Measured		Tune-up Limit	
			Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr
GSM (Voice)	CS1	1	32.62	23.59	34.0	25.0
			32.71	23.68		
			32.86	23.83		
GPRS (GMSK)	CS1	1	32.53	23.50	34.0	25.0
			32.72	23.69		
			32.84	23.81		
		2	30.88	24.86	32.0	26.0
			30.90	24.88		
			30.11	24.09		
		3	29.42	25.16	29.5	25.2
			29.46	25.20		
			28.81	24.55		
		4	27.77	24.76	28.5	25.5
			27.61	24.60		
			27.89	24.88		
EGPRS (8PSK)	MCS5	1	26.97	17.94	27.0	18.0
			26.99	17.96		
			26.98	17.95		
		2	25.11	19.09	25.5	19.5
			25.12	19.10		
			25.16	19.14		
		3	23.69	19.43	24.0	19.7
			23.75	19.49		
			23.73	19.47		
		4	22.51	19.50	23.0	20.0
			22.53	19.52		
			22.61	19.60		

WCDMA (Antenna A, Main 1)

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	24.64	N/A	25.0
		4183	836.6	24.45		
		4233	846.6	24.54		
HSDPA	Subtest 1	4132	826.4	22.98	0	23.0
		4183	836.6	23.00		
		4233	846.6	22.99		
	Subtest 2	4132	826.4	22.09	0	23.0
		4183	836.6	21.91		
		4233	846.6	21.96		
	Subtest 3	4132	826.4	21.04	0.5	22.5
		4183	836.6	20.87		
		4233	846.6	20.95		
	Subtest 4	4132	826.4	21.05	0.5	22.5
		4183	836.6	20.86		
		4233	846.6	20.98		
HSUPA	Subtest 1	4132	826.4	22.06	0	24.0
		4183	836.6	21.86		
		4233	846.6	21.93		
	Subtest 2	4132	826.4	20.12	2	22.0
		4183	836.6	19.91		
		4233	846.6	20.00		
	Subtest 3	4132	826.4	21.06	1	23.0
		4183	836.6	20.83		
		4233	846.6	20.93		
	Subtest 4	4132	826.4	20.11	2	22.0
		4183	836.6	19.90		
		4233	846.6	19.98		
	Subtest 5	4132	826.4	23.25	0	24.0
		4183	836.6	23.04		
		4233	846.6	23.08		
DC-HSDPA	Subtest 1	4132	826.4	23.06	0	23.5
		4183	836.6	23.20		
		4233	846.6	23.04		
	Subtest 2	4132	826.4	22.09	0	23.5
		4183	836.6	22.10		
		4233	846.6	21.99		
	Subtest 3	4132	826.4	20.97	0.5	23.0
		4183	836.6	21.09		
		4233	846.6	20.95		
	Subtest 4	4132	826.4	21.10	0.5	23.0
		4183	836.6	21.10		
		4233	846.6	20.99		

LTE Band 26 (Antenna A, Main 1)

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)					MPR	Tune-up Limit
				Measured Pwr (dBm)						
				26765	26790	26865	26915	26965		
15 MHz	QPSK	1	0	23.78	22.96	23.77	23.09	23.90	0.0	25.0
		1	37	23.73	22.78	23.82	22.70	23.93	0.0	25.0
		1	74	23.58	22.83	23.63	22.91	23.55	0.0	25.0
		36	0	22.92	22.05	22.89	22.15	22.98	1.0	24.0
		36	20	22.86	22.05	22.83	22.12	22.95	1.0	24.0
		36	39	22.81	22.01	22.77	22.05	22.91	1.0	24.0
		75	0	22.89	22.10	22.82	22.11	22.98	1.0	24.0
	16QAM	1	0	22.89	22.31	23.10	22.42	23.02	1.0	24.0
		1	37	22.91	22.22	23.09	22.11	23.08	1.0	24.0
		1	74	22.69	22.19	22.94	22.17	22.84	1.0	24.0
		36	0	21.87	21.09	21.82	21.15	22.00	2.0	23.0
		36	20	21.81	21.02	21.76	21.08	21.93	2.0	23.0
		36	39	21.77	20.99	21.73	21.05	21.88	2.0	23.0
		75	0	21.81	21.06	21.81	21.06	21.91	2.0	23.0
	64QAM	1	0	21.75	21.23	21.74	21.35	21.89	2.0	23.0
		1	37	21.75	21.26	21.73	21.26	21.85	2.0	23.0
		1	74	21.63	21.25	21.57	21.30	21.70	2.0	23.0
		36	0	20.80	21.24	20.83	21.23	20.80	3.0	22.0
		36	20	20.75	20.11	20.79	20.15	20.76	3.0	22.0
		36	39	20.68	20.06	20.74	20.11	20.70	3.0	22.0
		75	0	20.80	20.16	20.74	20.16	20.77	3.0	22.0
	256QAM	1	0	18.89	18.31	18.80	18.41	19.03	5.0	20.0
		1	37	18.90	18.03	18.68	18.27	18.85	5.0	20.0
		1	74	18.71	18.02	18.66	18.32	18.84	5.0	20.0
		36	0	18.80	18.14	18.73	18.17	18.82	5.0	20.0
		36	20	18.75	18.13	18.67	18.10	18.76	5.0	20.0
		36	39	18.69	18.06	18.63	18.03	18.69	5.0	20.0
		75	0	18.77	18.14	18.71	18.11	18.78	5.0	20.0
10 MHz	QPSK	1	0	23.78	22.97	23.08	23.64	23.66	0.0	25.0
		1	25	23.79	22.92	23.15	23.57	23.52	0.0	25.0
		1	49	23.60	22.96	22.98	23.57	23.60	0.0	25.0
		25	0	22.72	22.09	22.08	22.66	22.71	1.0	24.0
		25	12	22.69	22.03	22.05	22.65	22.68	1.0	24.0
		25	25	22.65	21.99	22.03	22.59	22.64	1.0	24.0
		50	0	22.71	22.02	22.03	22.66	22.69	1.0	24.0
	16QAM	1	0	22.98	22.30	22.41	22.85	22.93	1.0	24.0
		1	25	23.07	22.30	22.34	22.92	22.84	1.0	24.0
		1	49	22.91	21.93	22.32	22.70	22.74	1.0	24.0
		25	0	21.80	21.10	21.22	21.67	21.72	2.0	23.0
		25	12	21.76	21.08	21.12	21.65	21.66	2.0	23.0
		25	25	21.71	21.00	21.11	21.60	21.63	2.0	23.0
		50	0	21.68	21.02	21.11	21.64	21.71	2.0	23.0
	64QAM	1	0	21.91	21.23	21.15	21.69	21.79	2.0	23.0
		1	25	22.00	21.33	21.16	21.67	21.72	2.0	23.0
		1	49	21.85	21.24	21.11	21.54	21.72	2.0	23.0
		25	0	20.77	20.16	20.15	20.69	20.77	3.0	22.0
		25	12	20.74	20.20	20.15	20.68	20.72	3.0	22.0
		25	25	20.71	20.16	20.11	20.64	20.69	3.0	22.0
		50	0	20.73	20.18	20.07	20.65	20.70	3.0	22.0
	256QAM	1	0	18.88	18.23	18.19	18.72	19.02	5.0	20.0
		1	25	18.92	18.11	18.29	18.65	18.96	5.0	20.0
		1	49	18.77	18.09	18.07	18.63	18.84	5.0	20.0
		25	0	18.77	18.33	18.13	18.70	18.77	5.0	20.0
		25	12	18.73	18.27	18.08	18.67	18.71	5.0	20.0
		25	25	18.69	18.22	18.05	18.63	18.68	5.0	20.0
		50	0	18.68	18.22	18.04	18.61	18.67	5.0	20.0

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)						MPR	Tune-up Limit
				26715	26765	26790	26815	26865	27015		
				816.50 MHz	821.50 MHz	824.00 MHz	826.50 MHz	831.50 MHz	846.50 MHz		
5 MHz	QPSK	1	0	23.58	23.15	23.33	23.10	23.61	23.55	0.0	25.0
		1	12	23.60	23.16	23.10	23.11	23.59	23.58	0.0	25.0
		1	24	23.58	23.11	23.11	23.13	23.60	23.58	0.0	25.0
		12	0	22.67	22.16	22.17	22.20	22.67	22.69	1.0	24.0
		12	7	22.65	22.15	22.17	22.18	22.66	22.68	1.0	24.0
		12	13	22.66	22.17	22.14	22.13	22.66	22.67	1.0	24.0
		25	0	22.64	22.15	22.17	22.18	22.65	22.66	1.0	24.0
	16QAM	1	0	22.99	22.44	22.50	22.40	22.97	22.90	1.0	24.0
		1	12	22.97	22.27	22.44	22.47	22.97	22.90	1.0	24.0
		1	24	23.02	22.29	22.48	22.51	23.00	22.95	1.0	24.0
		12	0	21.76	21.27	21.25	21.20	21.70	21.70	2.0	23.0
		12	7	21.74	21.26	21.15	21.22	21.67	21.66	2.0	23.0
		12	13	21.72	21.22	21.14	21.18	21.66	21.68	2.0	23.0
		25	0	21.65	21.18	21.13	21.18	21.65	21.65	2.0	23.0
	64QAM	1	0	21.65	21.11	21.16	21.15	21.64	21.55	2.0	23.0
		1	12	21.57	21.05	21.13	21.13	21.65	21.48	2.0	23.0
		1	24	21.68	21.16	21.15	21.14	21.68	21.59	2.0	23.0
		12	0	20.72	20.23	20.13	20.15	20.66	20.69	3.0	22.0
		12	7	20.70	20.21	20.11	20.11	20.65	20.67	3.0	22.0
		12	13	20.67	20.16	20.15	20.13	20.63	20.67	3.0	22.0
		25	0	20.64	20.19	20.06	20.09	20.61	20.66	3.0	22.0
	256QAM	1	0	18.67	18.02	18.02	18.12	18.59	18.81	5.0	20.0
		1	12	18.52	18.04	17.80	18.02	18.39	18.73	5.0	20.0
		1	24	18.58	17.99	17.95	18.09	18.49	18.80	5.0	20.0
		12	0	18.64	18.17	18.09	18.15	18.59	18.62	5.0	20.0
12		7	18.64	18.17	18.11	18.14	18.59	18.61	5.0	20.0	
12		13	18.62	18.14	18.07	18.11	18.57	18.62	5.0	20.0	
25		0	18.65	18.18	18.20	18.19	18.61	18.66	5.0	20.0	
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)						MPR	Tune-up Limit
				26705	26775	26790	26805	26865	27025		
				815.50 MHz	822.50 MHz	824.00 MHz	825.50 MHz	831.50 MHz	847.50 MHz		
3 MHz	QPSK	1	0	23.66	23.14	23.20	23.10	23.61	23.62	0.0	25.0
		1	8	23.41	23.10	23.10	23.09	23.61	23.62	0.0	25.0
		1	14	23.68	23.07	23.24	23.04	23.61	23.61	0.0	25.0
		8	0	22.67	22.23	22.19	22.17	23.71	23.70	1.0	24.0
		8	4	22.62	22.16	22.17	22.17	23.71	23.72	1.0	24.0
		8	7	22.64	22.16	22.21	22.19	23.72	23.71	1.0	24.0
		15	0	22.63	22.18	22.15	22.13	23.71	23.72	1.0	24.0
	16QAM	1	0	22.74	22.67	22.50	22.57	22.91	22.84	1.0	24.0
		1	8	22.67	22.75	22.60	22.54	22.88	22.79	1.0	24.0
		1	14	22.62	22.73	22.57	22.59	22.87	22.77	1.0	24.0
		8	0	21.71	21.33	21.27	21.25	22.73	22.76	2.0	23.0
		8	4	21.71	21.34	21.25	21.26	22.76	22.78	2.0	23.0
		8	7	21.69	21.38	21.21	21.24	22.75	22.77	2.0	23.0
		15	0	21.68	21.19	21.19	21.15	22.74	22.74	2.0	23.0
	64QAM	1	0	22.02	21.35	21.33	21.33	21.88	21.94	2.0	23.0
		1	8	21.71	21.16	21.26	21.29	21.85	21.89	2.0	23.0
		1	14	21.70	21.26	21.27	21.32	21.85	21.88	2.0	23.0
		8	0	21.67	21.20	21.16	21.16	21.75	21.75	3.0	22.0
		8	4	21.65	21.16	21.12	21.21	21.74	21.75	3.0	22.0
		8	7	21.67	21.11	21.06	21.19	21.75	21.73	3.0	22.0
		15	0	21.66	21.08	21.03	21.16	21.70	21.66	3.0	22.0
	256QAM	1	0	18.82	18.43	18.30	18.35	18.99	19.01	5.0	20.0
		1	8	18.80	18.38	18.29	18.20	18.95	18.98	5.0	20.0
		1	14	18.76	18.28	18.44	18.38	18.95	18.96	5.0	20.0
		8	0	18.70	18.23	18.20	18.22	18.73	18.76	5.0	20.0
8		4	18.70	18.24	18.22	18.20	18.73	18.74	5.0	20.0	
8		7	18.71	18.23	18.25	18.24	18.72	18.75	5.0	20.0	
15		0	18.66	18.24	18.17	18.20	18.73	18.72	5.0	20.0	

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)						MPR	Tune-up Limit
				26697	26783	26790	26797	26865	27033		
				814.70 MHz	823.30 MHz	824.00 MHz	824.70 MHz	831.50 MHz	848.30 MHz		
1.4 MHz	QPSK	1	0	23.62	22.99	23.05	22.97	23.52	23.56	0.0	25.0
		1	3	23.53	22.95	22.98	22.93	23.59	23.60	0.0	25.0
		1	5	23.59	22.95	22.99	22.95	23.60	23.59	0.0	25.0
		3	0	23.69	23.12	23.06	23.10	23.73	23.71	1.0	24.0
		3	1	23.70	23.02	23.05	23.04	23.72	23.71	1.0	24.0
		3	3	23.60	22.98	23.00	23.03	23.73	23.72	1.0	24.0
	16QAM	6	0	22.61	21.95	21.98	22.02	23.66	23.64	1.0	24.0
		1	0	22.62	22.33	22.06	22.05	22.82	23.04	1.0	24.0
		1	3	22.63	22.44	22.26	22.10	22.78	22.99	1.0	24.0
		1	5	22.69	22.32	21.99	22.09	22.79	23.00	1.0	24.0
		3	0	22.83	22.16	22.13	22.14	22.86	22.83	2.0	23.0
		3	1	22.71	22.23	21.93	22.01	22.86	22.81	2.0	23.0
	64QAM	3	3	22.78	22.19	22.08	22.06	22.87	22.83	2.0	23.0
		6	0	21.67	21.03	21.08	21.05	22.75	22.64	2.0	23.0
		1	0	21.81	21.26	21.10	21.13	21.67	21.66	2.0	23.0
		1	3	21.55	21.12	21.03	21.26	21.80	21.68	2.0	23.0
		1	5	21.71	21.13	21.28	21.35	21.82	21.66	2.0	23.0
		3	0	21.81	21.22	21.30	21.21	21.85	21.72	3.0	22.0
	256QAM	3	1	21.77	21.15	21.29	21.30	21.84	21.71	3.0	22.0
		3	3	21.76	21.20	21.16	21.33	21.82	21.71	3.0	22.0
		6	0	20.64	20.26	20.18	21.24	21.67	21.58	3.0	22.0
		1	0	18.74	18.15	18.03	18.24	19.09	18.79	5.0	20.0
		1	3	18.70	18.15	18.22	18.11	19.08	18.75	5.0	20.0
		1	5	18.78	18.16	18.14	18.23	19.07	18.76	5.0	20.0
		3	0	18.65	18.29	18.25	18.36	18.80	18.73	5.0	20.0
		3	1	18.61	18.18	18.23	18.35	18.81	18.71	5.0	20.0
		3	3	18.68	18.22	18.23	18.25	18.81	18.70	5.0	20.0
		6	0	18.65	18.19	18.11	18.04	18.62	18.63	5.0	20.0

NR Band n5 (Antenna A, Main 1)

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)			MPR	Tune-up Limit
					Measured Pwr (dBm)				
					166800	167300	167900		
20 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.01	24.10	24.07	0.0	25.0
			1	52	24.09	24.16	24.13	0.0	25.0
			1	104	23.96	24.04	23.98	0.0	25.0
			50	0	23.04	23.15	23.12	0.5	24.5
			50	28	24.04	24.11	24.09	0.0	25.0
			50	56	23.01	23.09	23.09	0.5	24.5
		100	0	23.06	23.13	23.11	0.5	24.5	
		QPSK	1	1	24.05	24.11	24.10	0.0	25.0
			1	52	24.10	24.18	24.12	0.0	25.0
			1	104	23.99	24.03	24.01	0.0	25.0
	50		0	23.05	23.14	23.14	1.0	24.0	
	16QAM	50	28	24.06	24.12	24.09	0.0	25.0	
		50	56	23.02	23.09	23.12	1.0	24.0	
		100	0	23.06	23.13	23.12	1.0	24.0	
		1	1	23.17	23.21	23.17	1.0	24.0	
	64QAM	1	52	23.18	23.25	23.21	1.0	24.0	
		1	104	23.03	23.06	23.09	1.0	24.0	
	256QAM	1	1	21.54	21.59	21.62	2.5	22.5	
		1	1	19.55	19.51	19.60	4.5	20.5	
	CP-OFDM	QPSK	1	1	22.57	22.60	22.64	1.5	23.5
15 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.06	24.11	24.06	0.0	25.0
			1	39	23.98	24.01	24.00	0.0	25.0
			1	77	24.00	24.08	23.99	0.0	25.0
			36	0	23.10	23.12	23.09	0.5	24.5
			36	21	24.08	24.11	24.08	0.0	25.0
			36	43	23.08	23.10	23.08	0.5	24.5
			75	0	23.10	23.13	22.95	0.5	24.5
		QPSK	1	1	24.07	24.13	24.08	0.0	25.0
			1	39	23.96	24.04	24.01	0.0	25.0
			1	77	23.99	24.06	24.01	0.0	25.0
			36	0	23.09	23.14	23.09	1.0	24.0
			36	21	24.09	24.10	24.09	0.0	25.0
			36	43	23.08	23.11	23.08	1.0	24.0
			75	0	23.10	23.12	23.09	1.0	24.0
			1	1	23.08	23.17	23.16	1.0	24.0
	16QAM	1	39	23.02	23.12	23.06	1.0	24.0	
		1	77	23.02	23.18	23.06	1.0	24.0	
		1	1	21.66	21.62	21.59	2.5	22.5	
		1	1	19.49	19.55	19.57	4.5	20.5	
	CP-OFDM	QPSK	1	1	22.62	22.66	22.61	1.5	23.5

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					165900	167300	168800		
					829.00 MHz	836.50 MHz	844.00 MHz		
10 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.08	24.09	24.06	0.0	25.0
			1	25	24.10	24.09	24.10	0.0	25.0
			1	50	24.07	24.06	24.02	0.0	25.0
			25	0	23.09	23.12	23.08	0.5	24.5
			25	13	24.09	24.09	24.06	0.0	25.0
			25	27	23.10	23.09	23.03	0.5	24.5
		50	0	23.11	23.13	23.07	0.5	24.5	
		QPSK	1	1	24.09	24.13	24.06	0.0	25.0
			1	25	24.13	24.10	24.09	0.0	25.0
			1	50	24.07	24.08	24.03	0.0	25.0
			25	0	23.10	23.13	23.08	1.0	24.0
			25	13	24.10	24.09	24.06	0.0	25.0
			25	27	23.09	23.09	23.05	1.0	24.0
		16QAM	50	0	23.10	23.12	23.06	1.0	24.0
			1	1	23.11	23.06	23.14	1.0	24.0
			1	25	23.22	23.25	23.18	1.0	24.0
		64QAM	1	50	23.11	23.12	23.02	1.0	24.0
			1	1	21.58	21.64	21.59	2.5	22.5
1	1		19.57	19.58	19.50	4.5	20.5		
256QAM	1	1	19.57	19.58	19.50	4.5	20.5		
CP-OFDM	QPSK	1	1	22.60	22.60	22.55	1.5	23.5	
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					165300	167300	169300		
					826.50 MHz	836.50 MHz	846.50 MHz		
5 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.05	24.06	24.08	0.0	25.0
			1	12	23.97	23.99	23.97	0.0	25.0
			1	23	24.06	24.05	23.99	0.0	25.0
			12	0	23.07	23.08	23.08	0.5	24.5
			12	6	24.05	24.07	24.05	0.0	25.0
			12	13	23.08	23.08	23.04	0.5	24.5
		25	0	23.09	23.10	23.07	0.5	24.5	
		QPSK	1	1	24.10	24.07	24.09	0.0	25.0
			1	12	23.99	24.01	23.97	0.0	25.0
			1	23	24.08	24.06	24.00	0.0	25.0
			12	0	23.11	23.10	23.10	1.0	24.0
			12	6	24.07	24.08	24.04	0.0	25.0
			12	13	23.08	23.08	23.04	1.0	24.0
		16QAM	25	0	23.10	23.10	23.08	1.0	24.0
			1	1	23.08	23.19	23.08	1.0	24.0
			1	12	23.04	23.06	22.95	1.0	24.0
		64QAM	1	23	23.10	23.12	22.90	1.0	24.0
			1	1	21.70	21.51	21.53	2.5	22.5
1	1		19.56	19.55	19.61	4.5	20.5		
256QAM	1	1	19.56	19.55	19.61	4.5	20.5		
CP-OFDM	QPSK	1	1	22.61	22.60	22.62	1.5	23.5	

8.2. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to 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

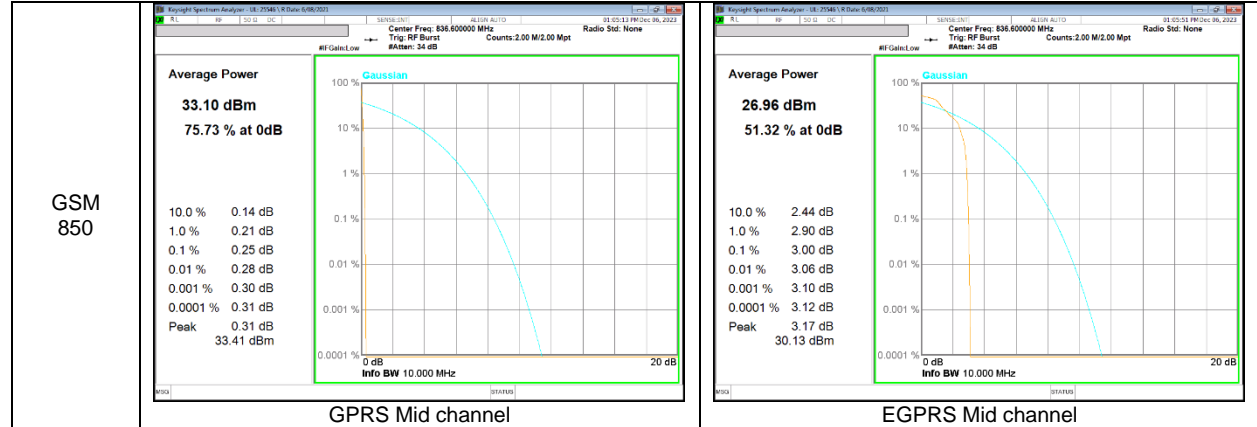
5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations ($\pi/2$ BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

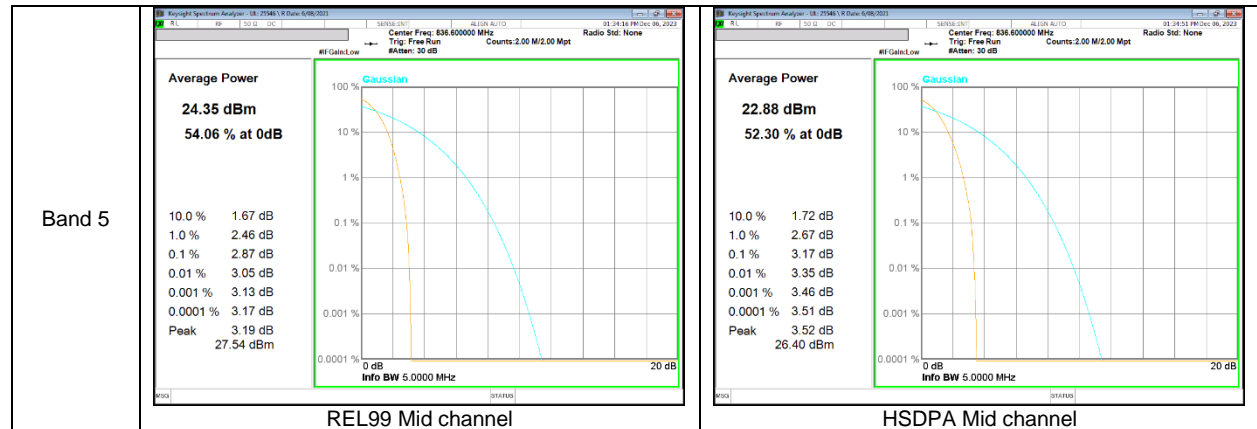
See the following pages.

8.2.1. CONDUCTED PEAK TO AVERAGE RESULTS

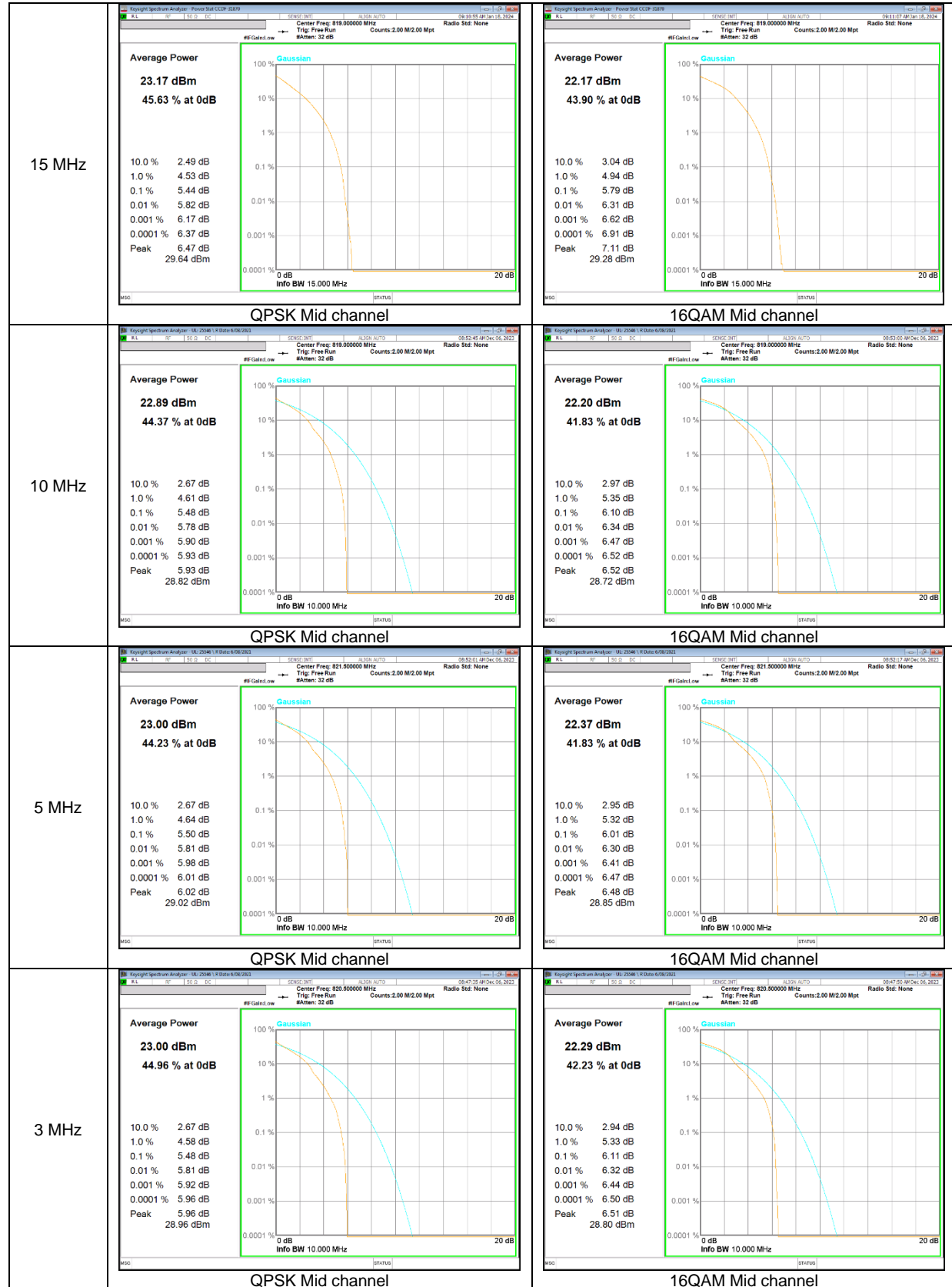
GSM

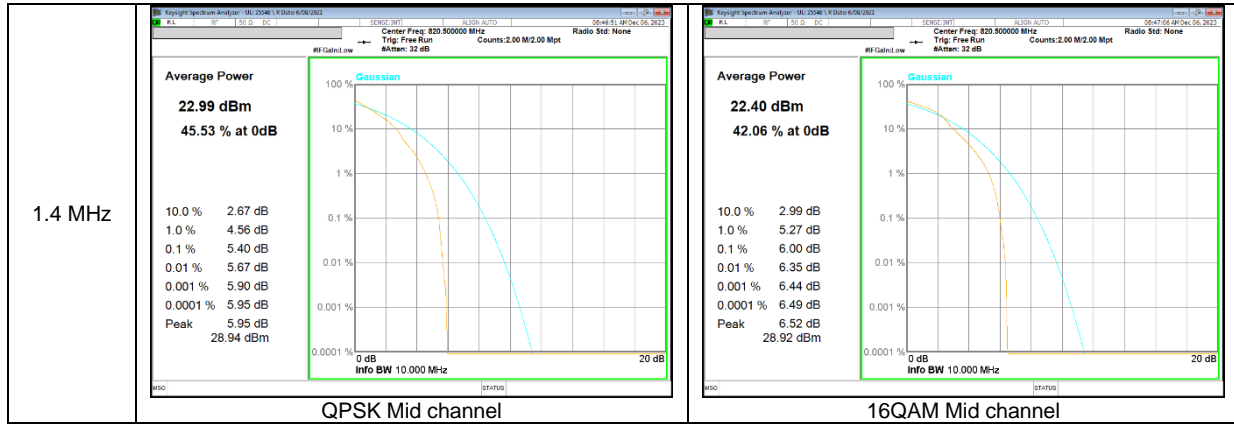


WCDMA

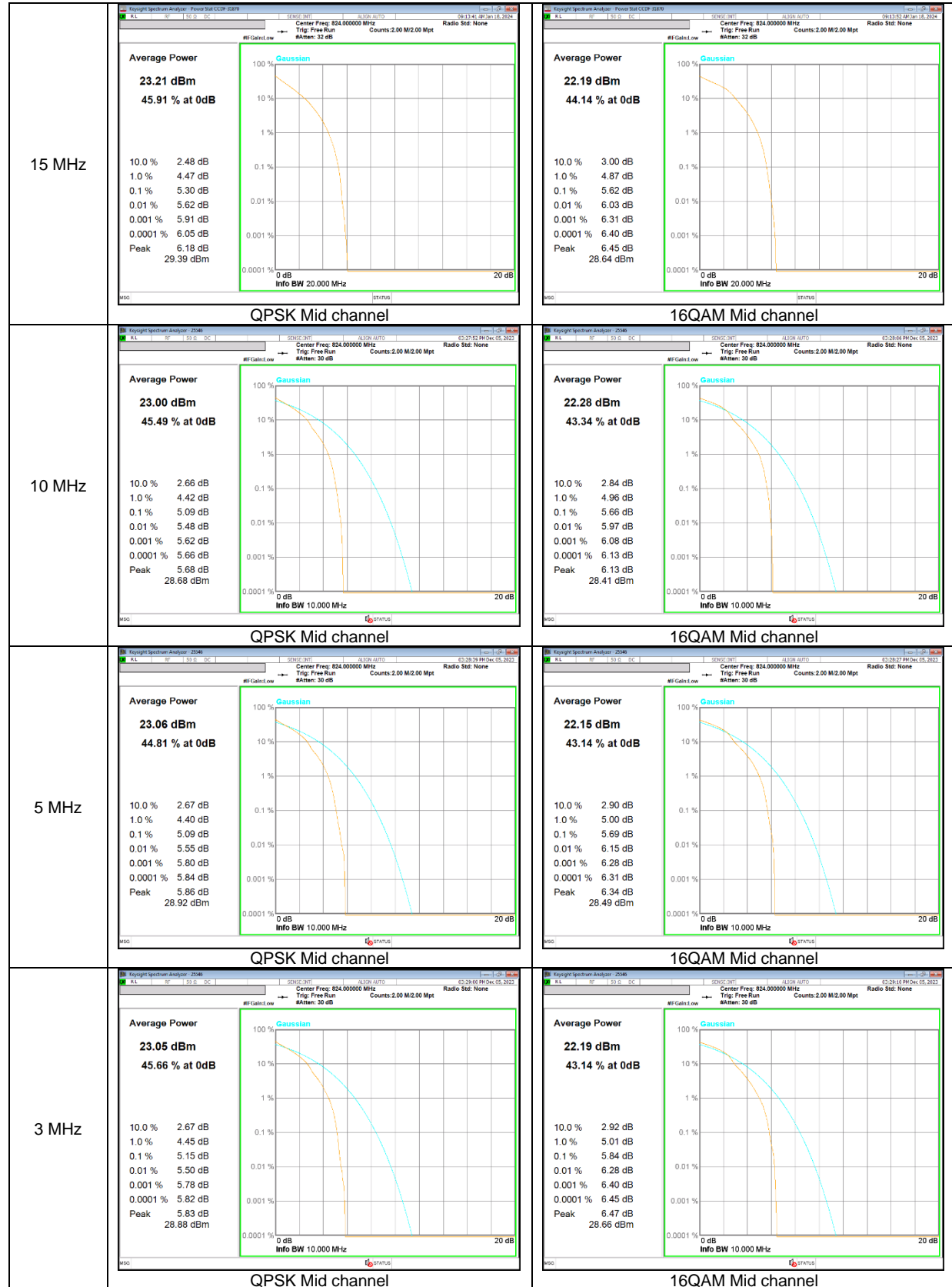


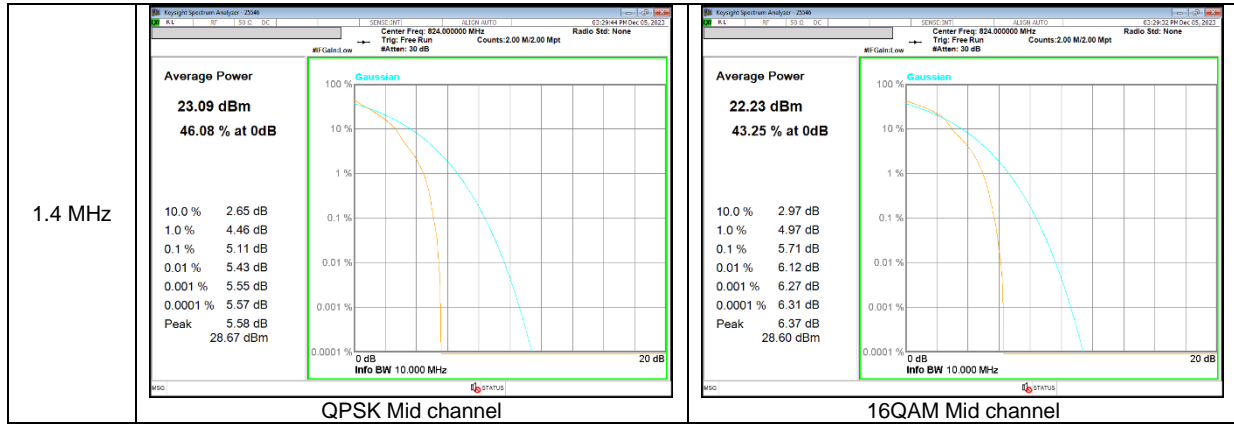
LTE Band 26 (Part 90)



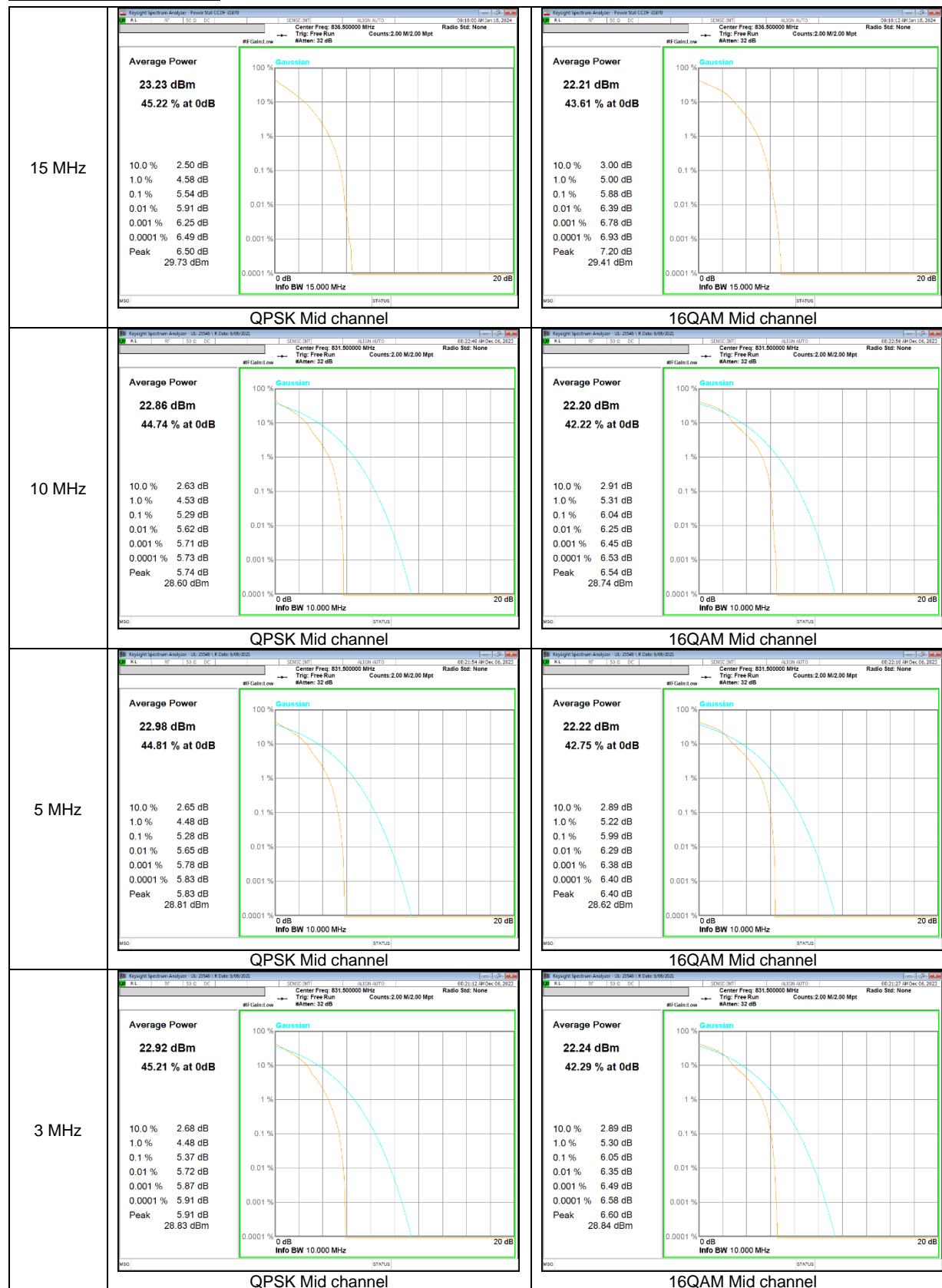


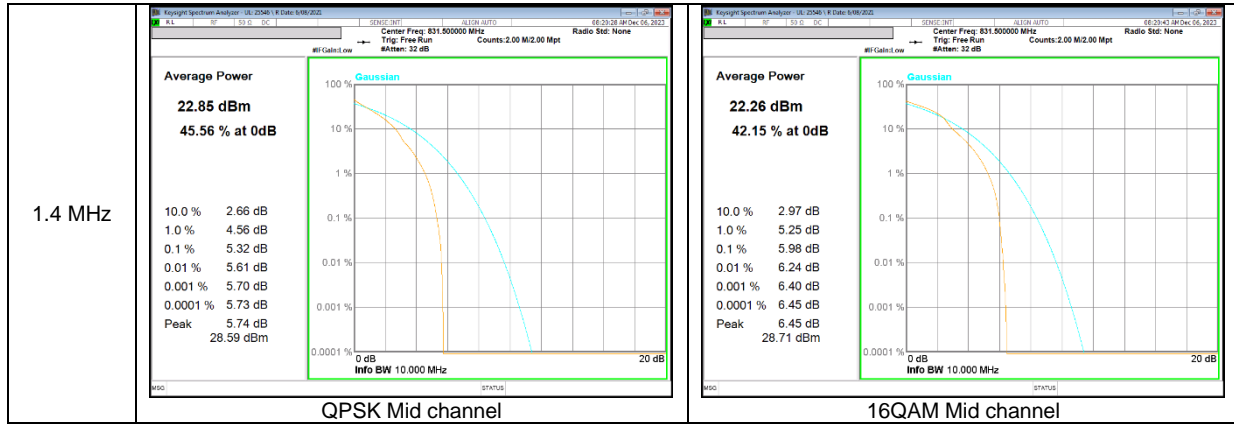
LTE Band 26 (Straddle)



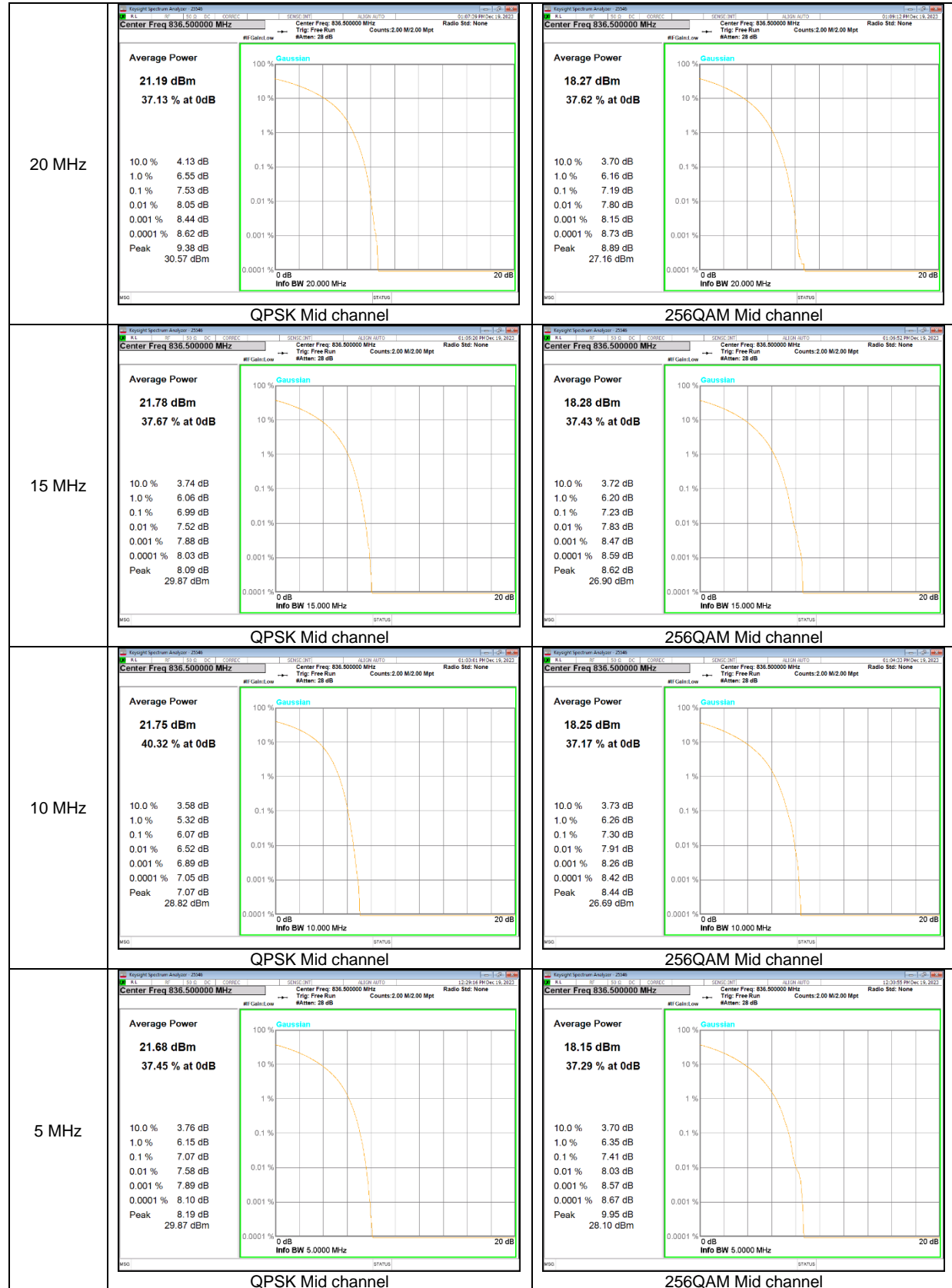


LTE Band 26 (Part 22)





NR Band n5 CP-OFDM



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	242.62	312.0
	EGPRS		247.89	310.6

- WCDMA

Band	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
B5	Rel.99	836.6	4.144	4.709
	HSDPA		4.153	4.697

- LTE Band 26 (Part 90)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	819.0	13.410	14.910
		16QAM		13.406	14.960
	10M	QPSK	819.0	8.969	10.270
		16QAM		8.978	10.000
	5M	QPSK	821.5	4.505	5.253
		16QAM		4.500	5.230
	3M	QPSK	820.5	2.701	3.076
		16QAM		2.701	3.084
	1.4M	QPSK	820.5	1.089	1.324
		16QAM		1.088	1.290

- LTE Band 26 (Straddle)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	824.0	13.427	14.960
		16QAM		13.401	14.660
	10M	QPSK		8.939	9.995
		16QAM		8.938	9.836
	5M	QPSK		4.493	5.276
		16QAM		4.483	5.199
	3M	QPSK		2.693	3.022
		16QAM		2.693	3.004
	1.4M	QPSK		1.085	1.248
		16QAM		1.086	1.303

- LTE Band 26 (Part 22)

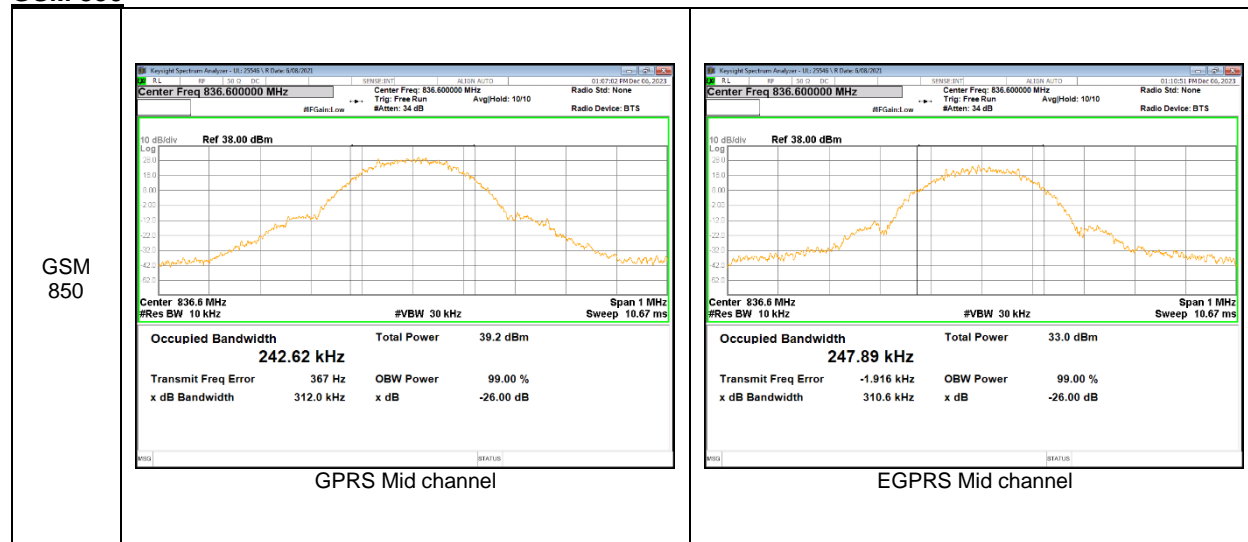
Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26	15M	QPSK	836.5	13.446	15.120
		16QAM		13.446	15.290
	10M	QPSK	831.5	8.983	10.280
		16QAM		8.974	10.100
	5M	QPSK		4.503	5.212
		16QAM		4.499	5.249
	3M	QPSK		2.697	3.066
		16QAM		2.702	3.087
	1.4M	QPSK		1.083	1.234
		16QAM		1.087	1.296

- NR Band n5

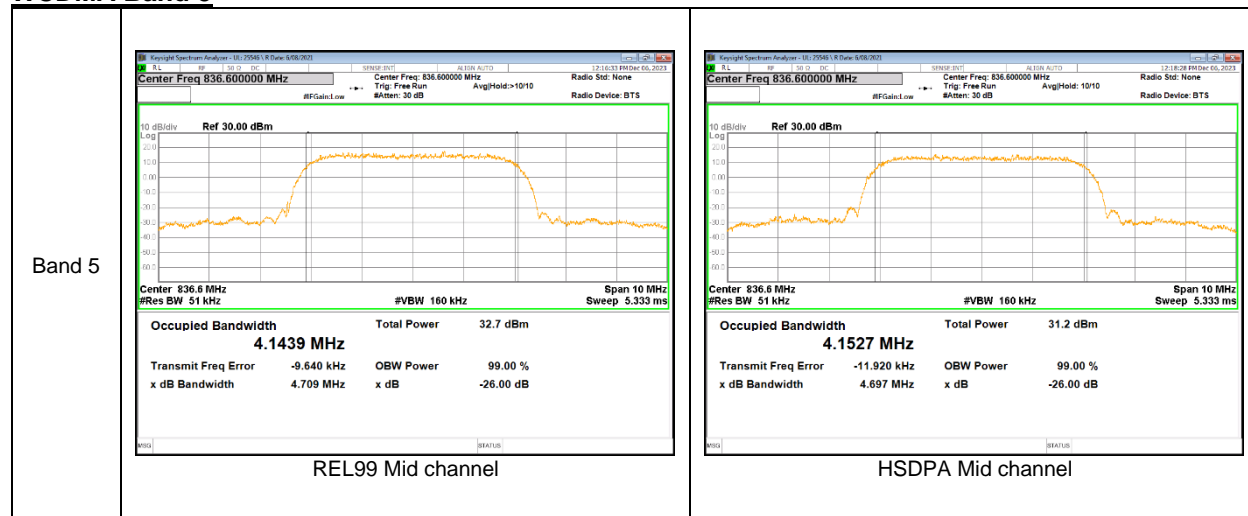
Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n5	20M	QPSK	836.5	18.957	20.440
		16QAM		19.024	20.690
	15M	QPSK		14.103	17.280
		16QAM		14.147	15.130
	10M	QPSK		9.315	10.350
		16QAM		9.319	10.350
	5M	QPSK		4.480	5.325
		16QAM		4.497	5.517

8.3.1. OCCUPIED BANDWIDTH RESULTS

GSM 850

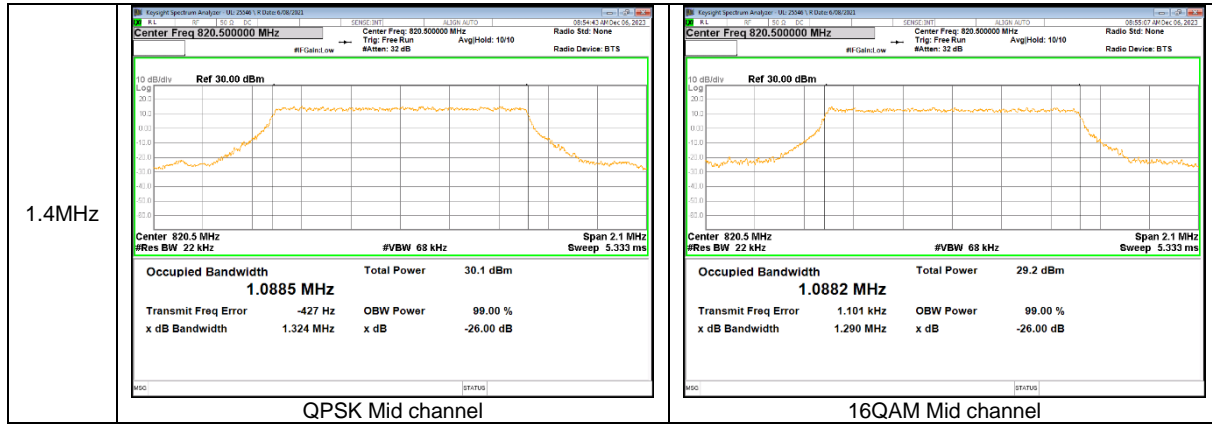


WCDMA Band 5

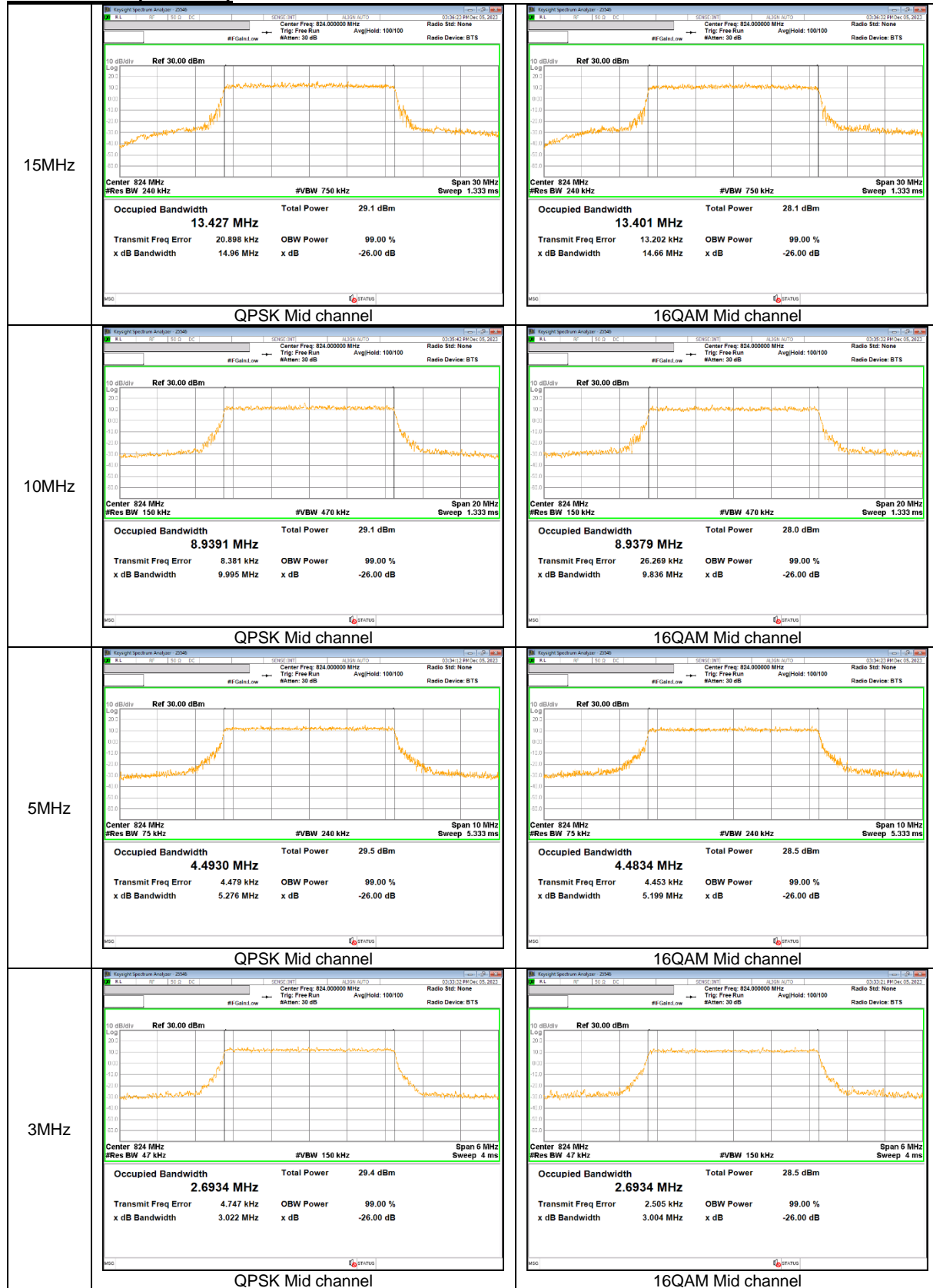


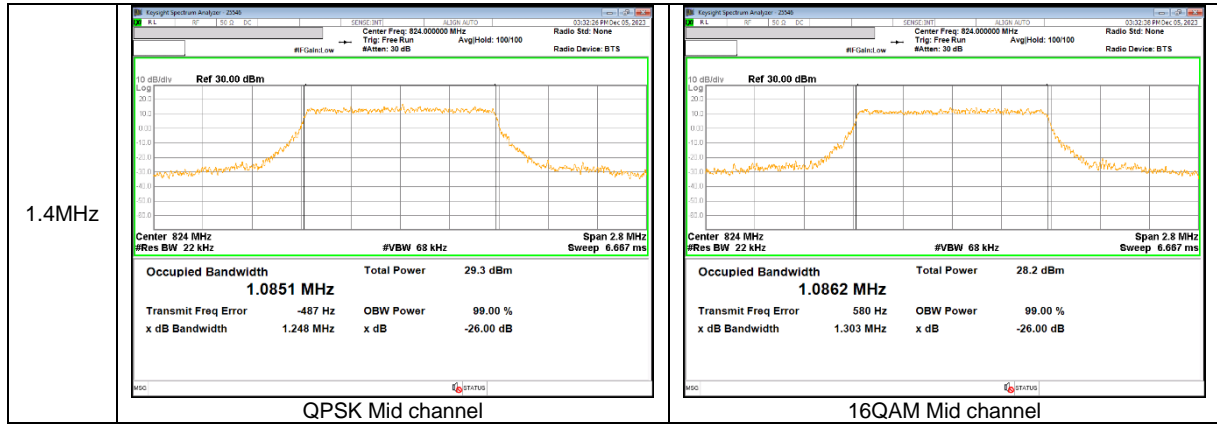
LTE Band 26 (Part 90)





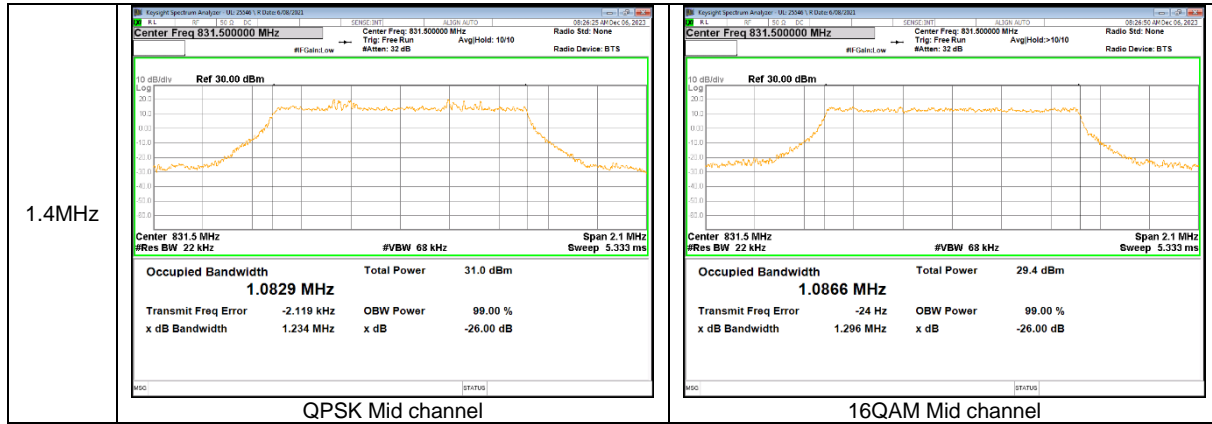
LTE Band 26 (Straddle)





LTE Band 26 (Part 22)





NR Band n5



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 $116 \text{ Log}_{10}(f/6.1)$ decibels or $50 + 10 \text{ Log}_{10}(P)$ 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 $43 + 10 \text{ Log}_{10}(P)$ 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.

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 $\geq 3 \times$ RBW;
- c) Set span ≥ 1.5 times the OBW;
- d) Sweep time = 1S ;
- e) Detector = RMS;
- f) Ensure that the number of measurement points $\geq 2 \times$ 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 $\geq 3 \times$ RBW;
- c) Set span ≥ 1.5 times the OBW;
- d) Sweep time = Auto;
- e) Detector = RMS;
- f) Ensure that the number of measurement points $\geq 2 \times$ 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 limits. Although the measurement bandwidth is less than the reference bandwidth of 1MHz no addtional 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

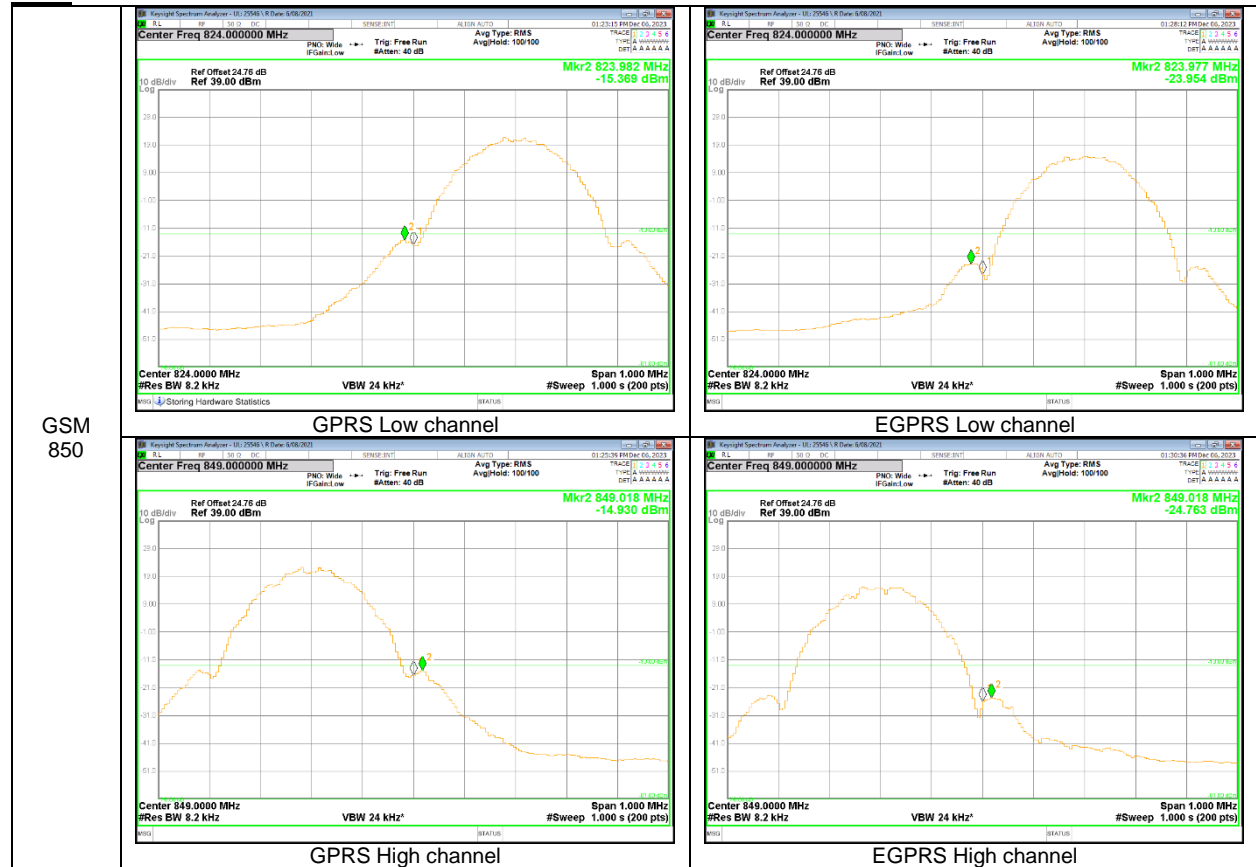
5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations ($\pi/2$ BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

See the following pages.

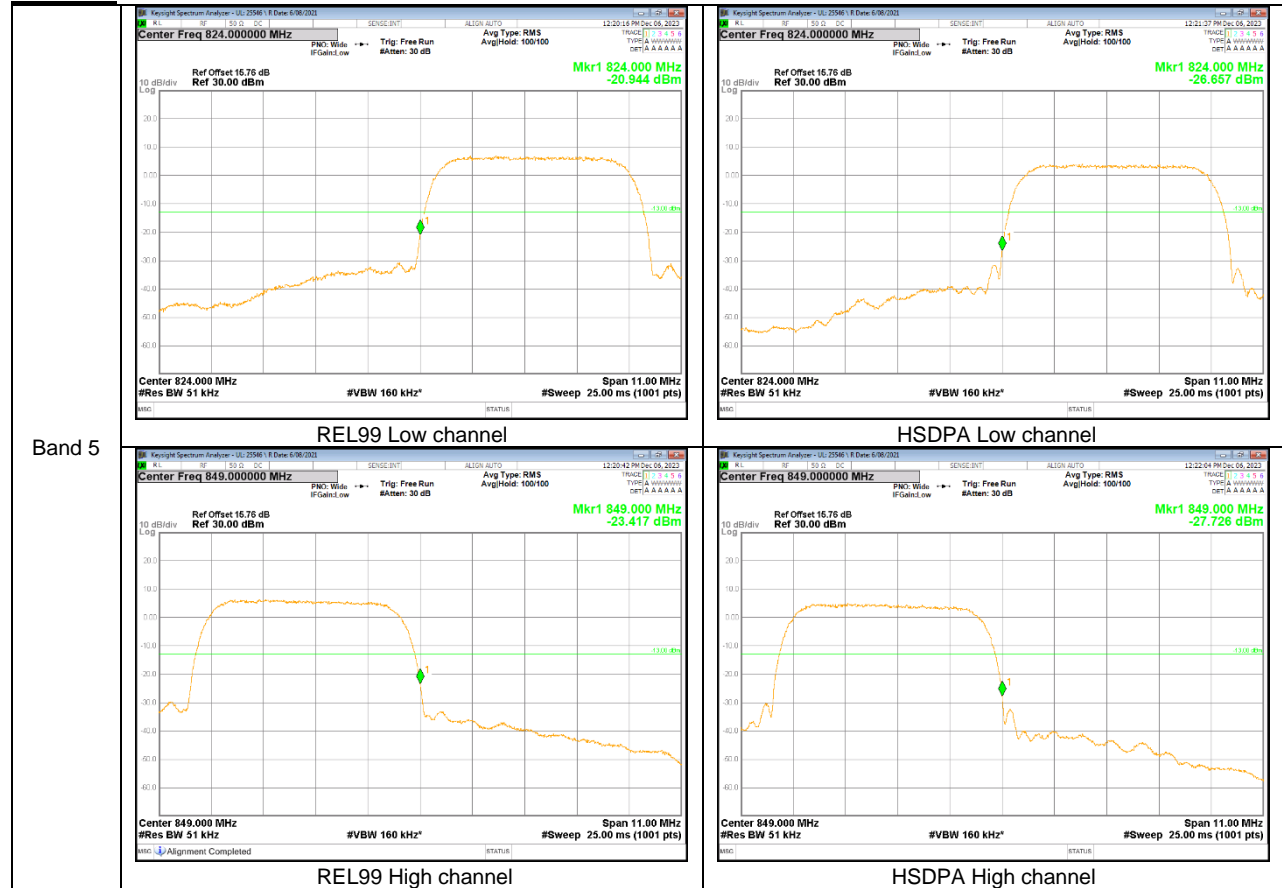
8.4.1. BAND EDGE RESULTS

GSM



GSM
850

WCDMA



LTE Band 26 (Part 22)

