

CERTIFICATION TEST REPORT

Report Number. : 4791196642-E2V2

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

Model : SC-55E, SCG28

FCC ID : A3LSMF956JPN

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

Test Standard(s) : FCC CFR47 PART 22 SUBPART H

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Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2024-05-31	Initial issue	Yeonhee Lim
V2	2024-06-10	Updated dated test.	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, NFC, WPT and UWB.

MODEL NUMBER: SC-55E, SCG28

SERIAL NUMBER: R3CX30KWQAL, R3CX30KWV3L (CONDUCTED);
R3CX30KWTZA, R3CX30KWQJE (RADIATED);

DATE TESTED: 2024-04-23 – 2024-05-31;

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22H	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
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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. ANSI TIA-603-E, 2016
4. ANSI C63.26, 2015
5. KDB 971168 D01 Power Meas License Digital Systems v03r01
6. KDB 971168 D02 Misc Rev Approv License Devices v02r02
7. 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	
☒	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 = SG reading with EUT worst orientation (dBm) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBd)

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.79 dB
Radiated Disturbance, 9 kHz to 30 MHz	1.69 dB
Radiated Disturbance, 30 MHz to 1 GHz	4.07 dB
Radiated Disturbance, 1 GHz to 18 GHz	4.99 dB

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

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Clause 4.3.3 in IEC Guide 115:2023.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

Representative model	Difference	Derivative model
		SCG28
SC-55E	Hardware	Same as SC-55E
	Software	Different UI

The model SC-55E was used for final testing and is representative of the test results in this report.

5.2. MAXIMUM OUTPUT POWER

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

GSM

FCC Part 22								
Band	Frequency Range [MHz]	Modulation	Conducted (ANT A)		Radiated (ANT A+B)		Radiated (ANT A)	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
GSM 850	824.20 ~ 848.80	GPRS	32.39	1733.80	29.98	995.41	23.05	201.84
		EGPRS	26.33	429.54	25.30	338.84	18.72	74.47

WCDMA

FCC Part 22								
Band	Frequency Range [MHz]	Modulation	Conducted (ANT A)		Radiated (ANT A+B)		Radiated (ANT A)	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	826.40 ~ 846.60	Rel. 99	24.46	279.25	22.17	164.82	18.17	65.61
		HSDPA	23.49	223.36	21.03	126.77	17.12	51.52

LTE Band 5

FCC Part 22									
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted (ANT A)		Radiated (ANT A+B)		Radiated (ANT A)	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	829.00 ~ 844.00	10	QPSK	24.49	281.19	22.16	164.44	18.37	68.71
			16QAM	23.75	237.14	21.25	133.35	17.54	56.75
			64QAM	22.81	190.99				
			256QAM	19.83	96.16				
	826.50 ~ 846.50	5	QPSK	24.39	274.79	22.14	163.68	19.12	81.66
			16QAM	24.01	251.77	21.36	136.77	18.20	66.07
			64QAM	23.03	200.91				
			256QAM	19.70	93.33				
	825.50 ~ 847.50	3	QPSK	24.43	277.33	21.89	154.53	18.87	77.09
			16QAM	23.87	243.78	20.99	125.60	17.98	62.81
			64QAM	22.81	190.99				
			256QAM	19.69	93.11				
	824.70 ~ 848.30	1.4	QPSK	24.34	271.64	22.05	160.32	18.80	75.86
			16QAM	23.70	234.42	21.13	129.72	17.82	60.53
			64QAM	22.81	190.99				
			256QAM	19.68	92.90				

NR Band n5

FCC Part 22												
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted (ANT A)		Radiated (ANT A+B)		Radiated (ANT A)			
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]		
n5	834.00 - 839.00	20	DFT-s OFDM	π/2 BPSK	24.23	264.85						
				QPSK	24.25	266.07	21.56	143.22	17.13	51.64		
				16QAM	23.10	204.17	20.60	114.82	16.14	41.11		
				64QAM	21.88	154.17						
				256QAM	19.17	82.60						
			CP-OFDM	QPSK	22.83	191.87						
			831.50 - 841.50	15	DFT-s OFDM	π/2 BPSK	24.45	278.61				
						QPSK	24.45	278.61	21.45	139.64	17.26	53.21
	16QAM	23.32				214.78	20.96	124.74	16.45	44.16		
	64QAM	22.10				162.18						
	256QAM	19.38				86.70						
	CP-OFDM	QPSK			23.03	200.91						
	829.00 - 844.00	10			DFT-s OFDM	π/2 BPSK	24.50	281.84				
			QPSK	24.50		281.84	21.33	135.83	16.94	49.43		
			16QAM	23.33		215.28	20.57	114.02	16.30	42.66		
			64QAM	22.14		163.68						
			256QAM	19.38		86.70						
			CP-OFDM	QPSK	23.03	200.91						
			826.50 - 846.50	5	DFT-s OFDM	π/2 BPSK	24.47	279.90				
	QPSK	24.40				275.42	21.43	139.00	17.29	53.58		
	16QAM	23.28				212.81	20.58	114.29	16.33	42.95		
	64QAM	22.08				161.44						
	256QAM	19.42				87.50						
	CP-OFDM	QPSK			23.03	200.91						

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 / NR Band n5 824 - 849 MHz	A+B	-3.9
	A	-4.7

5.4. WORST-CASE ORIENTATION

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

- **GSM GPRS/EGPRS**
The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on GPRS and EGPRS modulations. It was found GPRS results were worst case.
- **UMTS REL 99/HSDPA**
The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on REL 99 and HSDPA modulations. It was found REL 99 results were worst case.
- **LTE Band 5**
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.

This device supports Antenna Switching. So the test case is as below

Band	Antenna Switching
GSM 850	AFS (Adaptive Frame Switching)
WCDMA B5	
LTE B5	

- **NR 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 $\pi/2$ BPSK, QPSK, 16QAM, 64QAM and 256QAM modulations. It was found QPSK and 16QAM results were worst case.

This device supports NSA and SA and Antenna Switching Mode.

Worst case reported both SA and Antenna Switching. So the test case is as below.

NR Band	NSA	SA	Antenna Switching
n5	LTE B2, B66	Stand Alone	AFS

- The AFS mode of device operates only in radiated state.
So both folded and open modes were tested and worst data is reported.

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

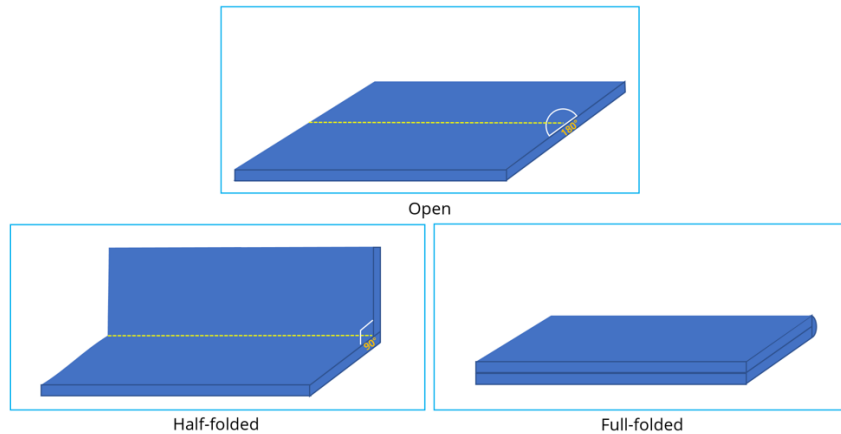
● Conducted Spurious Emission

Highest conducted output power setting for each bands					
LTE Band	ANT	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	A	829.00	10	1	25
		836.50		1	0
		844.00		1	49
NR Band	ANT	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	A	829.00	10	1	1
		836.50		1	1
		844.00		1	1

● Radiated Spurious Emission

Highest ERP setting for each bands					
LTE Band	ANT	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	A+B	829.00	10	1	25
		836.50		1	0
		844.00		1	49
	A	826.50	5	1	0
		836.50		1	0
		846.50		1	12
NR Band	ANT	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
5	A+B	834.00	20	1	1
		836.50		1	1
		839.00		1	1
	A	826.50	5	1	1
		836.50		1	1
		846.50		1	13

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



Band	ANT	ERP			RSE		
		X	Y	Z	X	Y	Z
GSM 850	A+B	Open	-	-	-	-	Open
	A	-	-	Full-folded	-	Full-folded	-
WCDMA B5	A+B	Open	-	-	Half-folded	-	-
	A	-	-	Full-folded	-	Full-folded	-
LTE B5	A+B	Open	-	-	-	Half-folded	-
	A	-	-	Full-folded	-	-	Full-folded
NR n5	A+B	Open	-	-	-	Open	-
	A	-	-	Full-folded	-	Full-folded	-

Note1 : 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.

Note2 : The EUT supported wireless charging capability. For the radiated spurious testing were performed on wireless charging pad. The worst case is shown in this report.

Note3 : Antenna switching-related actions according to foldable conditions were force operated and tested in factory mode.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacture	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37N9QP4R69DK3	N/A
Data Cable	SAMSUNG	EP-DN980	GH39-02117A	N/A
Wireless Charger	SAMSUNG	EP-N5200	RF7T20401XMCIS	A3LEPN5200
Wireless Charger	SAMSUNG	EP-P5400	RF7W800BH1CWSB	A3LEPP5400

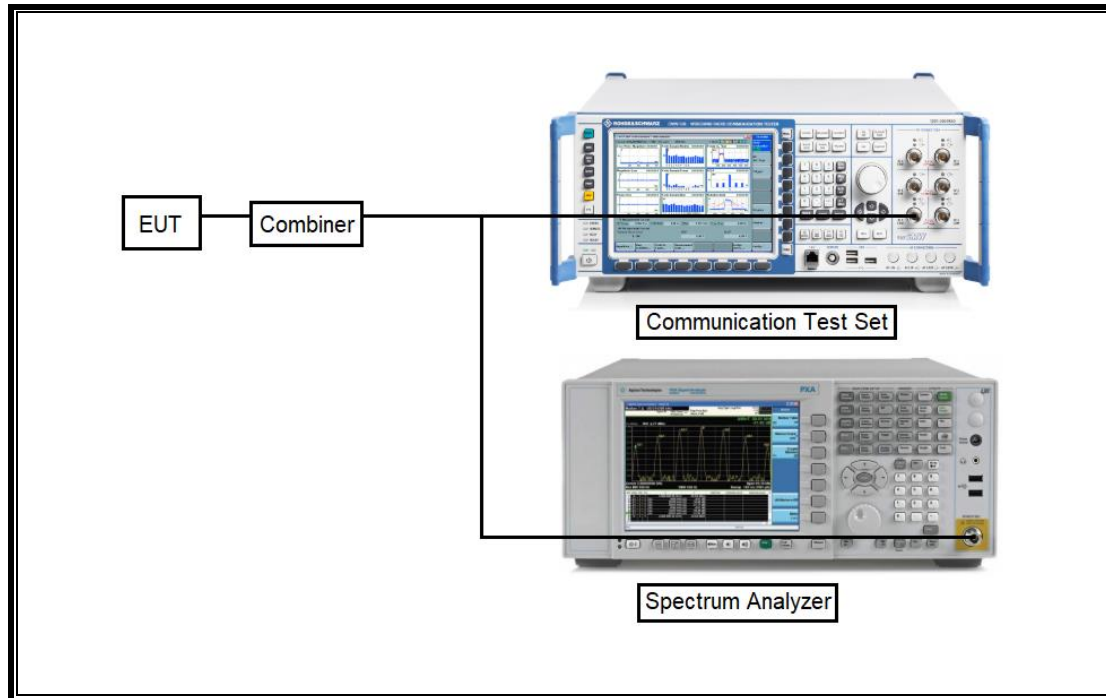
I/O CABLE

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

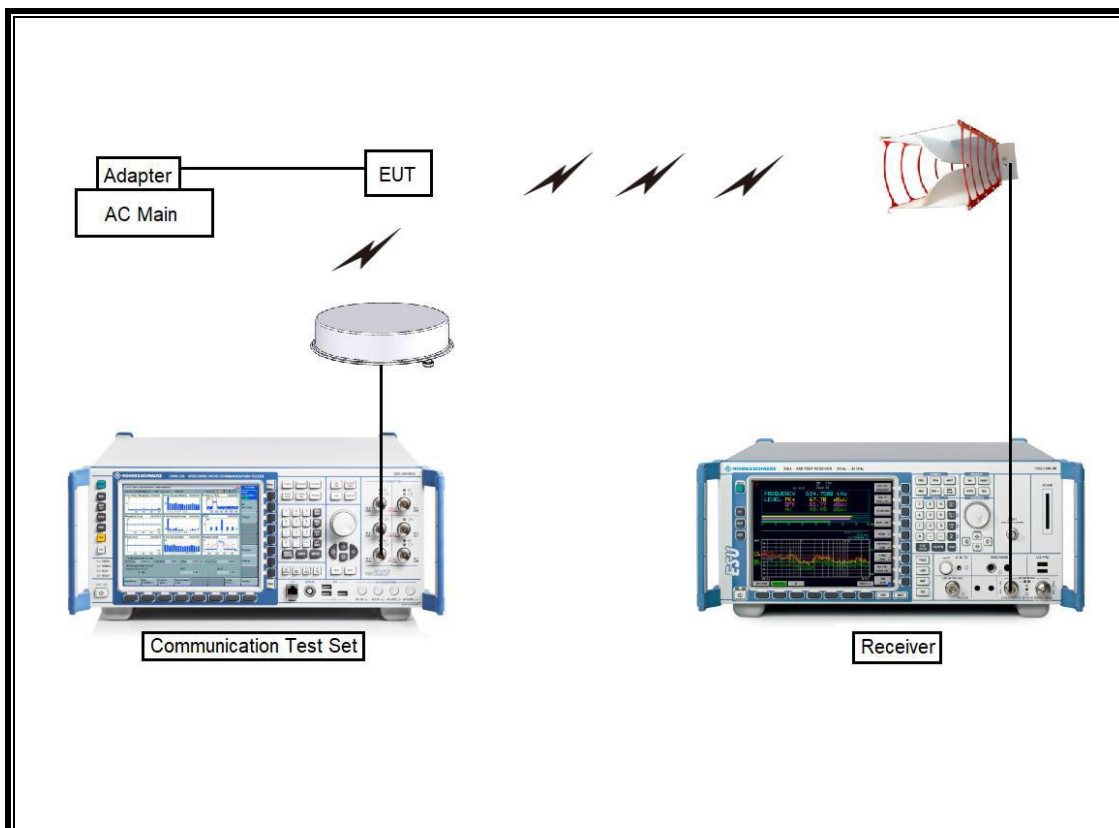
TEST SETUP

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

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
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	MY57510655	2025-01-03
UL Software				
Description	Manufacturer	Model	Version	
Antenna port test software	UL	CLT	Ver 3.4	
Radiated software	UL	UL EMC	Ver 9.5	
Antenna port test software (5G NR FR1)	UL	UL iM	Ver 1.06	

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Results
2.1046	Conducted Output Power	N/A	Conducted	Pass
2.1049	Occupied Bandwidth (99%)	N/A		Pass
22.917(a)	Conducted Band Edge / Conducted Spurious Emission	-13 dBm		Pass
22.355	Frequency Stability	2.5 ppm		Pass
22.913(a)(5)	Effective Radiated Power	38.5 dBm	Radiated	Pass
22.917(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 (ANT A)

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	32.22	23.03	33.3	24.3
			32.37	23.18		
			32.39	23.20		
GPRS (GMSK)	CS1	1	32.21	23.02	33.3	24.3
			32.28	23.09		
			32.28	23.09		
		2	30.59	24.41	32.5	26.5
			31.18	25.00		
			30.92	24.74		
		3	28.79	24.37	30.5	26.2
			29.05	24.63		
			28.84	24.42		
		4	26.86	23.69	28.5	25.5
			27.16	23.99		
			26.77	23.60		
EGPRS (8PSK)	MCS5	1	25.92	16.73	28.0	19.0
			26.20	17.01		
			26.33	17.14		
		2	24.61	18.43	26.0	20.0
			24.96	18.78		
			25.08	18.90		
		3	22.60	18.18	24.0	19.7
			22.75	18.33		
			22.71	18.29		
		4	21.61	18.44	23.0	20.0
			21.74	18.57		
			22.03	18.86		

WCDMA B5 (ANT A)

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	24.46	N/A	25.3
		4183	836.6	24.43		
		4233	846.6	24.46		
HSDPA	Subtest 1	4132	826.4	23.48	0	24.3
		4183	836.6	23.40		
		4233	846.6	23.49		
	Subtest 2	4132	826.4	23.49	0	24.3
		4183	836.6	23.45		
		4233	846.6	23.24		
	Subtest 3	4132	826.4	23.01	0.5	23.8
		4183	836.6	22.91		
		4233	846.6	22.99		
	Subtest 4	4132	826.4	22.99	0.5	23.8
		4183	836.6	22.91		
		4233	846.6	22.99		
HSUPA	Subtest 1	4132	826.4	23.26	0	24.3
		4183	836.6	23.03		
		4233	846.6	23.22		
	Subtest 2	4132	826.4	21.25	2	22.3
		4183	836.6	21.23		
		4233	846.6	21.36		
	Subtest 3	4132	826.4	22.39	1	23.3
		4183	836.6	22.31		
		4233	846.6	22.37		
	Subtest 4	4132	826.4	21.38	2	22.3
		4183	836.6	21.33		
		4233	846.6	21.34		
	Subtest 5	4132	826.4	22.92	0	24.3
		4183	836.6	22.90		
		4233	846.6	22.97		
DC-HSDPA	Subtest 1	4132	826.4	23.47	0	24.3
		4183	836.6	23.43		
		4233	846.6	23.44		
	Subtest 2	4132	826.4	23.50	0	24.3
		4183	836.6	23.42		
		4233	846.6	23.47		
	Subtest 3	4132	826.4	23.00	0.5	23.8
		4183	836.6	22.90		
		4233	846.6	22.95		
	Subtest 4	4132	826.4	23.00	0.5	23.8
		4183	836.6	22.89		
		4233	846.6	22.69		

LTE Band 5 (ANT A)

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				Measured Pwr (dBm)			MPR	Tune-up Limit
				20450	20525	20600		
				829.00 MHz	836.50 MHz	844.00 MHz		
10 MHz	QPSK	1	0	24.47	24.31	24.18	0.0	25.5
		1	25	24.49	24.26	24.25	0.0	25.5
		1	49	24.21	24.30	24.35	0.0	25.5
		25	0	23.36	23.31	23.25	1.0	24.5
		25	12	23.33	23.34	23.26	1.0	24.5
		25	25	23.26	23.30	23.32	1.0	24.5
	16QAM	50	0	23.27	23.28	23.32	1.0	24.5
		1	0	23.75	23.39	23.64	1.0	24.5
		1	25	23.64	23.46	23.69	1.0	24.5
		1	49	23.47	23.44	23.54	1.0	24.5
		25	0	22.45	22.37	22.29	2.0	23.5
		25	12	22.32	22.37	22.28	2.0	23.5
	64QAM	25	25	22.31	22.32	22.29	2.0	23.5
		50	0	22.28	22.30	22.36	2.0	23.5
		1	0	22.56	22.56	22.81	2.0	23.5
		1	25	22.52	22.42	22.67	2.0	23.5
		1	49	22.45	22.58	22.55	2.0	23.5
		25	0	21.57	21.38	21.49	3.0	22.5
5 MHz	QPSK	25	12	21.53	21.41	21.49	3.0	22.5
		25	25	21.46	21.32	21.56	3.0	22.5
		50	0	21.43	21.39	21.49	3.0	22.5
	16QAM	1	0	19.51	19.36	19.40	5.0	20.5
		1	25	19.83	19.51	19.43	5.0	20.5
		1	49	19.38	19.59	19.30	5.0	20.5
	64QAM	25	0	19.45	19.42	19.36	5.0	20.5
		25	12	19.45	19.42	19.51	5.0	20.5
		25	25	19.45	19.41	19.42	5.0	20.5
	256QAM	50	0	19.43	19.41	19.39	5.0	20.5
		1	0	24.39	24.30	24.22	0.0	25.5
	QPSK	1	12	24.34	24.17	24.32	0.0	25.5
		1	24	24.30	24.18	24.30	0.0	25.5
		12	0	23.40	23.25	23.25	1.0	24.5
		12	7	23.40	23.30	23.31	1.0	24.5
		12	13	23.36	23.25	23.30	1.0	24.5
	16QAM	25	0	23.37	23.28	23.32	1.0	24.5
		1	0	24.01	23.70	23.66	1.0	24.5
		1	12	23.90	23.62	23.80	1.0	24.5
		1	24	23.72	23.62	23.66	1.0	24.5
		12	0	22.51	22.34	22.35	2.0	23.5
		12	7	22.51	22.31	22.40	2.0	23.5
	64QAM	12	13	22.45	22.27	22.42	2.0	23.5
		25	0	22.44	22.29	22.36	2.0	23.5
		1	0	23.03	22.87	22.69	2.0	23.5
		1	12	22.74	22.69	22.85	2.0	23.5
		1	24	22.64	22.48	22.80	2.0	23.5
		12	0	21.49	21.47	21.48	3.0	22.5
	256QAM	12	7	21.61	21.36	21.47	3.0	22.5
		12	13	21.49	21.41	21.51	3.0	22.5
		25	0	21.50	21.40	21.40	3.0	22.5
		1	0	19.57	19.39	19.56	5.0	20.5
		1	12	19.64	19.63	19.70	5.0	20.5
		1	24	19.43	19.26	19.53	5.0	20.5
	256QAM	12	0	19.53	19.39	19.46	5.0	20.5
		12	7	19.49	19.44	19.41	5.0	20.5
		12	13	19.47	19.35	19.54	5.0	20.5
		25	0	19.51	19.37	19.40	5.0	20.5

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				20415	20525	20635		
				825.50 MHz	836.50 MHz	847.50 MHz		
3 MHz	QPSK	1	0	24.39	24.30	24.23	0.0	25.5
		1	8	24.43	24.25	24.26	0.0	25.5
		1	14	24.26	24.17	24.14	0.0	25.5
		8	0	23.35	23.21	23.19	1.0	24.5
		8	4	23.35	23.23	23.26	1.0	24.5
		8	7	23.35	23.20	23.27	1.0	24.5
	15	0	23.38	23.27	23.20	1.0	24.5	
	16QAM	1	0	23.78	23.53	23.54	1.0	24.5
		1	8	23.70	23.61	23.87	1.0	24.5
		1	14	23.66	23.50	23.74	1.0	24.5
		8	0	22.56	22.35	22.32	2.0	23.5
		8	4	22.49	22.28	22.31	2.0	23.5
		8	7	22.46	22.27	22.37	2.0	23.5
	15	0	22.46	22.28	22.23	2.0	23.5	
	64QAM	1	0	22.81	22.53	22.73	2.0	23.5
		1	8	22.68	22.54	22.75	2.0	23.5
		1	14	22.54	22.47	22.73	2.0	23.5
		8	0	21.51	21.45	21.48	3.0	22.5
		8	4	21.57	21.48	21.41	3.0	22.5
		8	7	21.53	21.49	21.60	3.0	22.5
	15	0	21.48	21.41	21.36	3.0	22.5	
	256QAM	1	0	19.51	19.58	19.48	5.0	20.5
		1	8	19.67	19.57	19.38	5.0	20.5
		1	14	19.69	19.32	19.36	5.0	20.5
8		0	19.45	19.45	19.49	5.0	20.5	
8		4	19.52	19.32	19.45	5.0	20.5	
8		7	19.54	19.34	19.44	5.0	20.5	
15	0	19.50	19.32	19.40	5.0	20.5		
BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				20407	20525	20643		
				824.70 MHz	836.50 MHz	848.30 MHz		
1.4 MHz	QPSK	1	0	24.34	24.16	24.24	0.0	25.5
		1	3	24.30	24.18	24.16	0.0	25.5
		1	5	24.33	24.17	24.15	0.0	25.5
		3	0	24.32	24.14	24.17	0.0	25.5
		3	1	24.22	24.15	24.15	0.0	25.5
		3	3	24.34	24.12	24.15	0.0	25.5
	6	0	23.33	23.16	23.20	1.0	24.5	
	16QAM	1	0	23.70	23.39	23.41	1.0	24.5
		1	3	23.63	23.44	23.43	1.0	24.5
		1	5	23.64	23.37	23.46	1.0	24.5
		3	0	23.55	23.26	23.33	1.0	24.5
		3	1	23.39	23.28	23.29	1.0	24.5
		3	3	23.43	23.28	23.27	1.0	24.5
	6	0	22.38	22.24	22.31	2.0	23.5	
	64QAM	1	0	22.76	22.56	22.42	2.0	23.5
		1	3	22.81	22.73	22.57	2.0	23.5
		1	5	22.74	22.52	22.51	2.0	23.5
		3	0	22.54	22.43	22.51	2.0	23.5
		3	1	22.56	22.47	22.43	2.0	23.5
		3	3	22.57	22.51	22.52	2.0	23.5
	6	0	21.50	21.44	21.49	3.0	22.5	
	256QAM	1	0	19.54	19.41	19.54	5.0	20.5
		1	3	19.68	19.46	19.57	5.0	20.5
		1	5	19.59	19.39	19.56	5.0	20.5
3		0	19.49	19.41	19.41	5.0	20.5	
3		1	19.50	19.32	19.50	5.0	20.5	
3		3	19.67	19.27	19.44	5.0	20.5	
6	0	19.57	19.28	19.41	5.0	20.5		

NR Band n5 (ANT A)

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
					Measured Pwr (dBm)			MPR	Tune-up Limit
					166800	167300	167800		
					834.00 MHz	836.50 MHz	839.00 MHz		
20 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	24.20	24.23	24.16	0.0	25.0
			1	52	24.09	24.06	24.06	0.0	25.0
			1	104	24.06	24.00	24.03	0.0	25.0
			50	0	23.09	23.04	23.07	1.0	24.0
			50	28	24.04	24.03	24.00	0.0	25.0
			50	56	22.93	23.02	23.00	0.0	25.0
			100	0	23.09	23.12	23.10	1.0	24.0
		QPSK	1	1	24.24	24.25	24.18	0.0	25.0
			1	52	24.08	24.07	24.06	0.0	25.0
			1	104	23.99	23.94	24.01	0.0	25.0
			50	0	23.06	23.04	23.04	1.0	24.0
			50	28	24.02	24.05	23.99	0.0	25.0
			50	56	22.93	22.95	23.00	0.0	25.0
			100	0	23.10	23.10	23.09	1.0	24.0
		16QAM	1	1	23.10	23.00	23.02	1.0	24.0
			1	52	22.90	22.94	22.85	1.0	24.0
			1	104	22.88	22.85	22.83	1.0	24.0
		64QAM	1	1	21.88	21.81	21.78	2.5	22.5
		256QAM	1	1	19.17	19.11	19.06	4.5	20.5
	CP-OFDM	QPSK	1	1	22.83	22.71	22.67	1.5	23.5
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					166300	167300	168300		
					831.50 MHz	836.50 MHz	841.50 MHz		
15 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	24.41	24.45	24.26	0.0	25.0
			1	39	24.39	24.29	24.21	0.0	25.0
			1	77	24.32	24.26	24.22	0.0	25.0
			36	0	23.38	23.36	23.17	1.0	24.0
			36	21	24.35	24.24	24.24	0.0	25.0
			36	43	24.19	24.24	23.17	0.0	25.0
			75	0	23.28	23.33	23.27	1.0	24.0
		QPSK	1	1	24.45	24.43	24.26	0.0	25.0
			1	39	24.35	24.21	24.17	0.0	25.0
			1	77	24.27	24.27	24.15	0.0	25.0
			36	0	23.41	23.37	23.24	1.0	24.0
			36	21	24.27	24.26	24.21	0.0	25.0
			36	43	23.22	23.19	23.18	0.0	25.0
			75	0	23.30	23.30	23.17	1.0	24.0
		16QAM	1	1	23.32	23.32	23.17	1.0	24.0
			1	39	23.17	23.17	23.10	1.0	24.0
			1	77	23.20	23.19	23.04	1.0	24.0
		64QAM	1	1	22.10	22.10	21.91	2.5	22.5
		256QAM	1	1	19.38	19.36	19.25	4.5	20.5
	CP-OFDM	QPSK	1	1	23.03	23.00	22.87	1.5	23.5
BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					165800	167300	168800		
					829.00 MHz	836.50 MHz	844.00 MHz		
10 MHz	DFT-s-OFDM	$\pi/2$ BPSK	1	1	24.42	24.40	24.44	0.0	25.0
			1	25	24.48	24.43	24.50	0.0	25.0
			1	50	24.21	24.38	24.18	0.0	25.0
			25	0	23.35	23.37	23.25	1.0	24.0
			25	13	23.40	24.42	24.36	0.0	25.0
			25	27	24.26	24.37	24.31	0.0	25.0
			50	0	23.23	23.37	23.28	1.0	24.0
		QPSK	1	1	24.50	24.47	24.37	0.0	25.0
			1	25	24.40	24.47	24.36	0.0	25.0
			1	50	24.22	24.28	24.26	0.0	25.0
			25	0	23.37	23.35	23.41	1.0	24.0
			25	13	24.26	24.33	24.35	0.0	25.0
			25	27	24.26	24.26	24.23	0.0	25.0
			50	0	23.33	23.27	23.27	1.0	24.0
		16QAM	1	1	23.24	23.33	23.21	1.0	24.0
			1	25	23.29	23.25	23.28	1.0	24.0
			1	50	23.09	23.16	23.10	1.0	24.0
		64QAM	1	1	22.14	22.14	22.07	2.5	22.5
		256QAM	1	1	19.36	19.38	19.31	4.5	20.5
	CP-OFDM	QPSK	1	1	23.01	23.03	23.03	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	$\pi/2$ BPSK	1	1	24.47	24.27	24.15	0.0	25.0
			1	12	24.37	24.27	24.15	0.0	25.0
			1	23	24.28	24.23	24.23	0.0	25.0
			12	0	23.34	23.27	23.19	1.0	24.0
			12	6	24.32	24.21	24.19	0.0	25.0
			12	13	23.32	23.18	23.17	0.0	25.0
		QPSK	25	0	23.34	23.23	23.27	1.0	24.0
			1	1	24.40	24.28	24.19	0.0	25.0
			1	12	24.40	24.24	24.27	0.0	25.0
			1	23	24.32	24.21	24.20	0.0	25.0
			12	0	23.33	23.25	23.13	1.0	24.0
			12	6	24.34	24.23	24.24	0.0	25.0
			12	13	23.29	23.18	23.23	0.0	25.0
			25	0	23.31	23.24	23.23	1.0	24.0
		16QAM	1	1	23.28	23.22	23.12	1.0	24.0
			1	12	23.21	23.08	23.08	1.0	24.0
			1	23	23.23	23.08	23.11	1.0	24.0
		64QAM	1	1	22.08	21.94	21.85	2.5	22.5
		256QAM	1	1	19.42	19.30	19.21	4.5	20.5
	CP-OFDM	QPSK	1	1	23.03	22.83	22.85	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

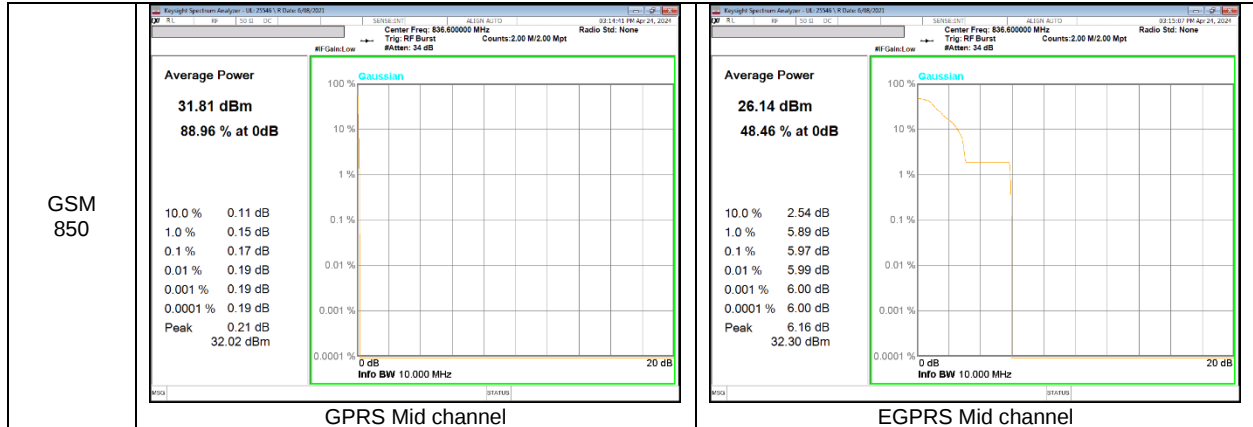
5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations ($\pi/2$ BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

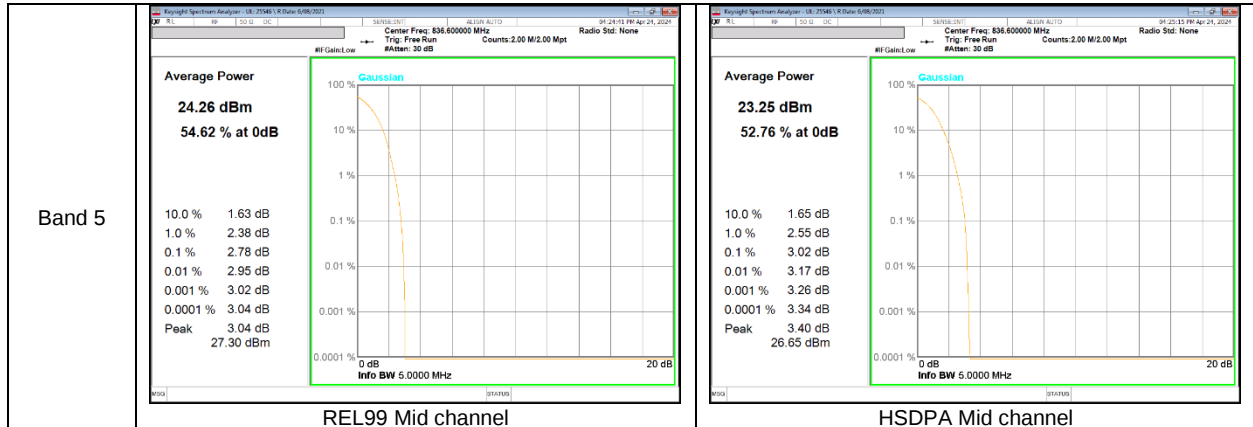
See the following pages.

8.2.1. CONDUCTED PEAK TO AVERAGE RESULT

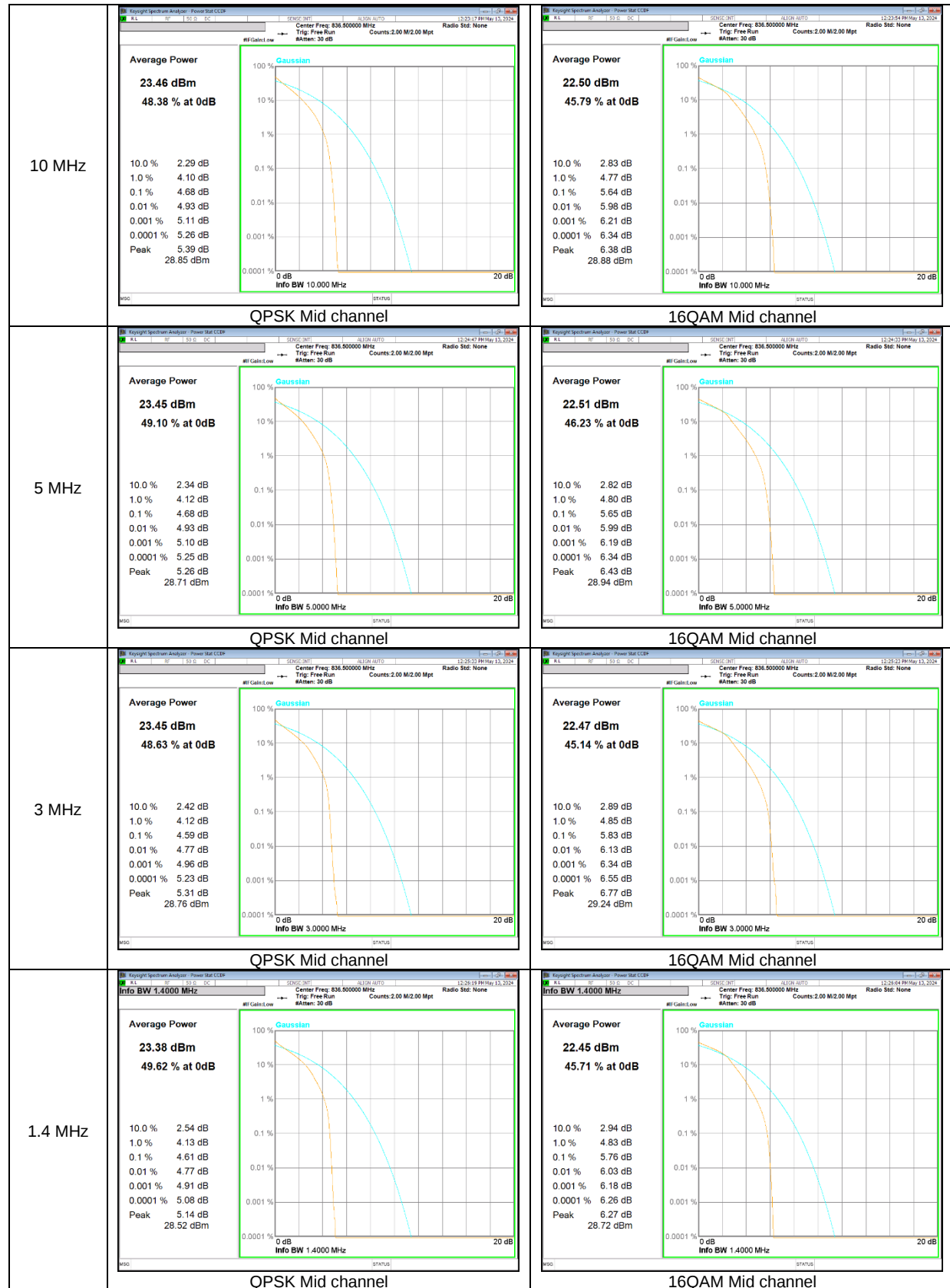
GSM



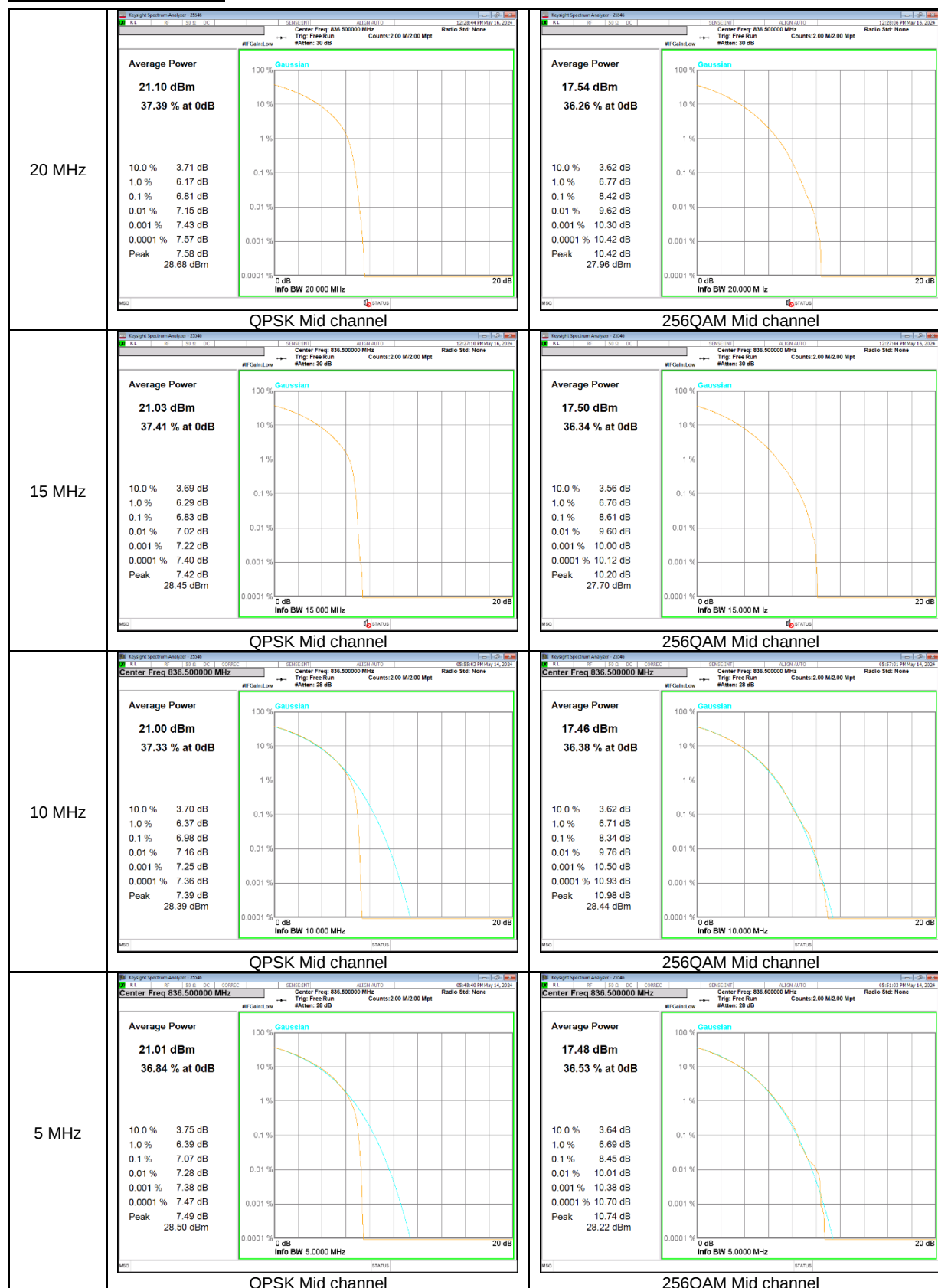
WCDMA



LTE Band 5



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	836.60	245.68	312.6
	EGPRS		236.06	294.1

- WCDMA

Band	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
B5	Rel.99	836.60	4.143	4.698
	HSDPA		4.134	4.715

- LTE Band 5

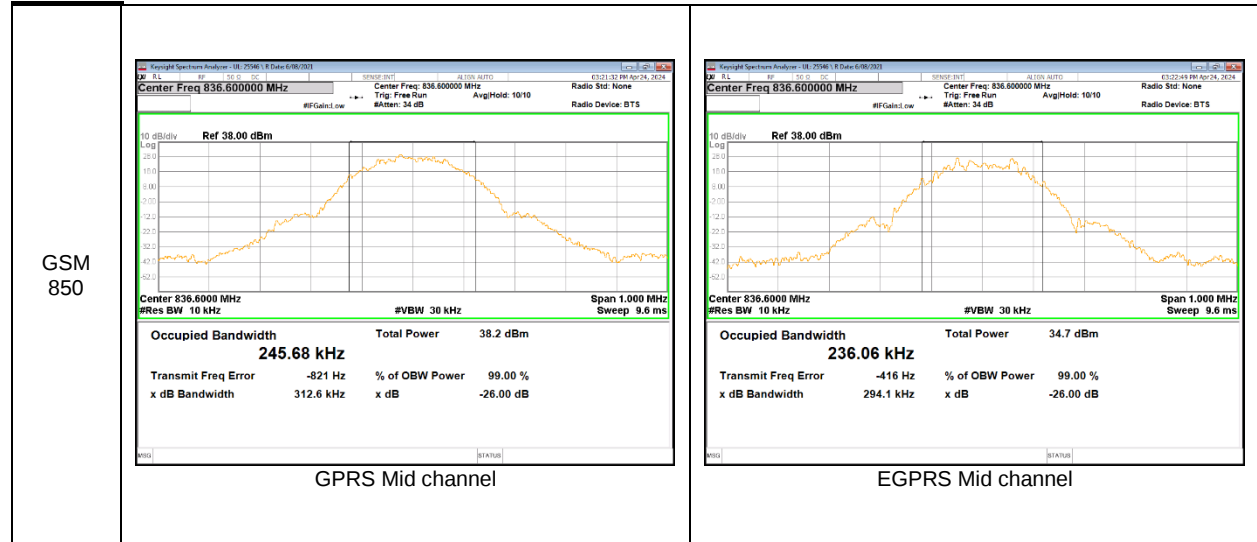
Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B5	10M	QPSK	836.50	8.996	9.976
		16QAM		8.994	9.970
	5M	QPSK		4.498	5.119
		16QAM		4.513	5.128
	3M	QPSK		2.705	3.062
		16QAM		2.702	3.055
	1.4M	QPSK		1.092	1.360
		16QAM		1.094	1.369

- NR Band n5

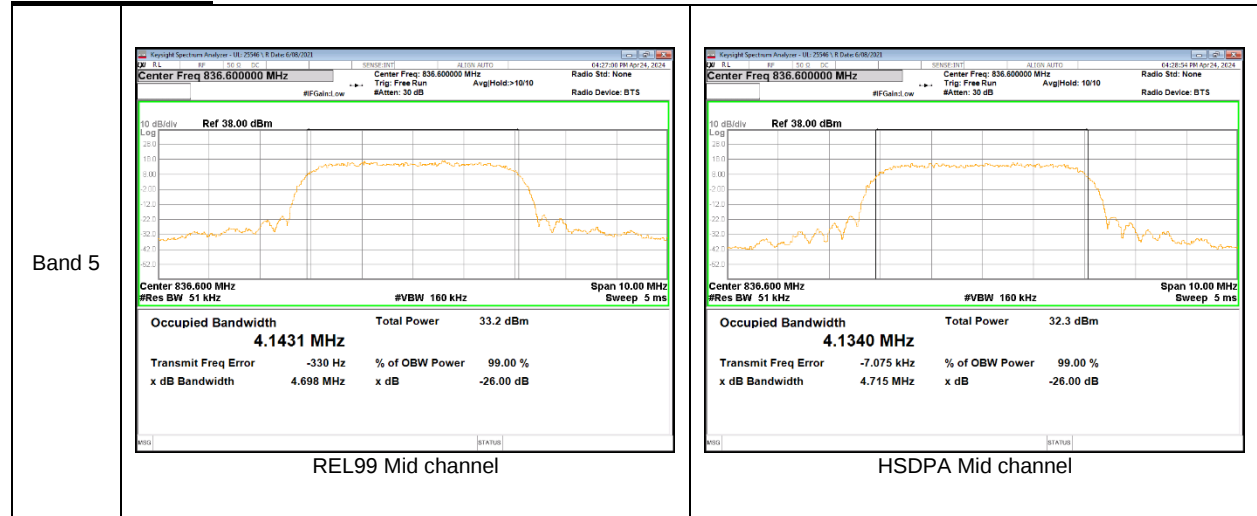
Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n5	20M	QPSK	836.50	18.959	20.000
		16QAM		18.920	19.890
	15M	QPSK		14.132	15.080
		16QAM		14.120	14.970
	10M	QPSK		9.305	10.130
		16QAM		9.316	10.230
	5M	QPSK		4.484	5.264
		16QAM		4.473	5.148

8.3.1. OCCUPIED BANDWIDTH RESULT

GSM 850



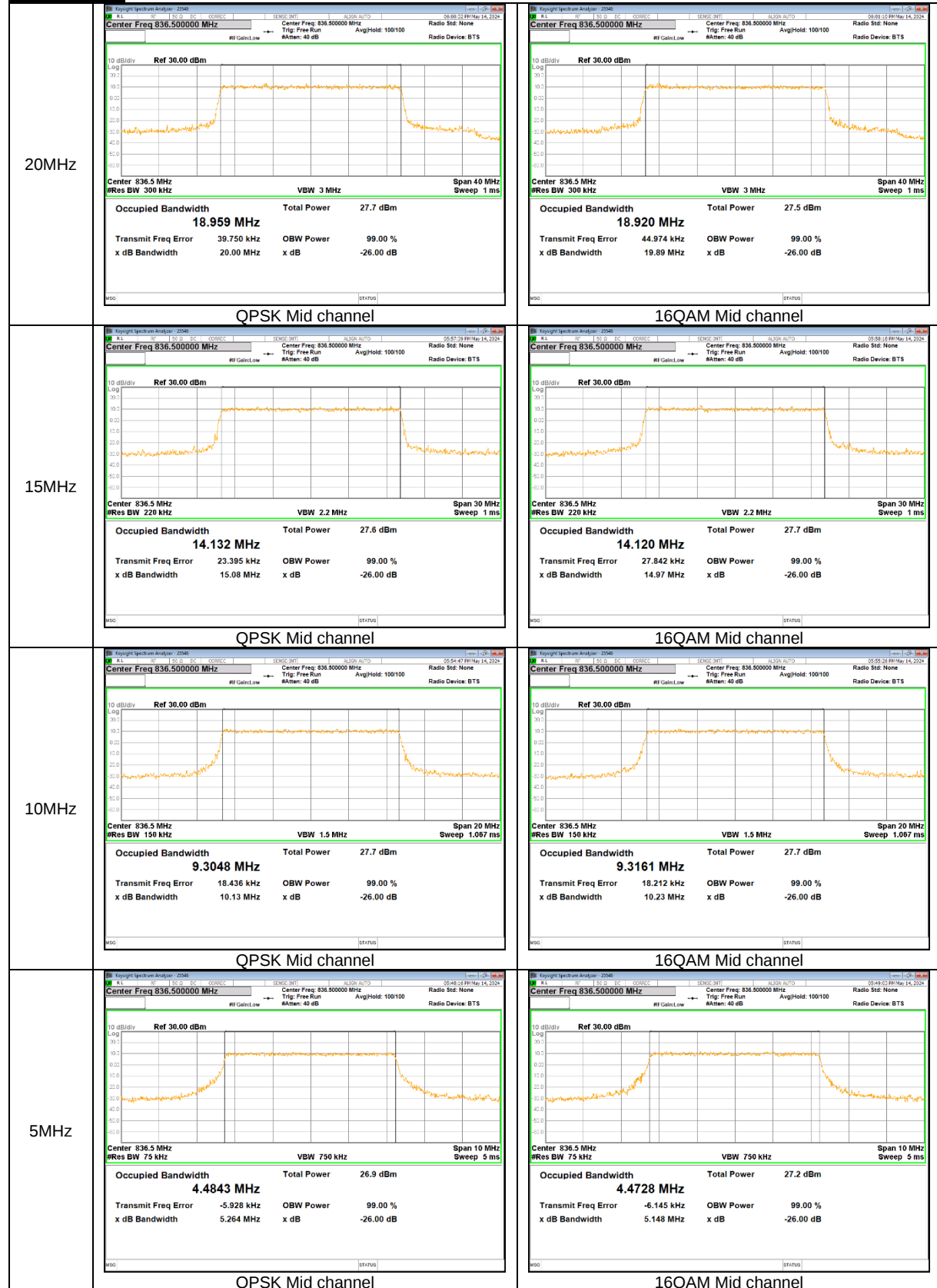
WCDMA Band 5



LTE Band 5



NR Band n5



8.4. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §22.359, §22.917

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.

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 $\geq 2 \times \text{Span} / \text{RBW}$;
- 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 $\geq 2 \times \text{Span} / \text{RBW}$;
- 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.

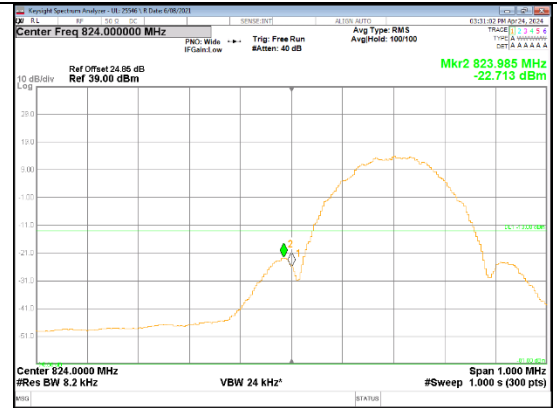
8.4.1. BAND EDGE RESULT

GSM

GSM
850



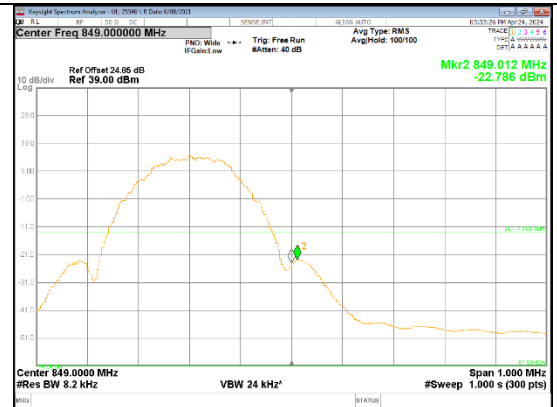
GPRS Low channel



EGPRS Low channel

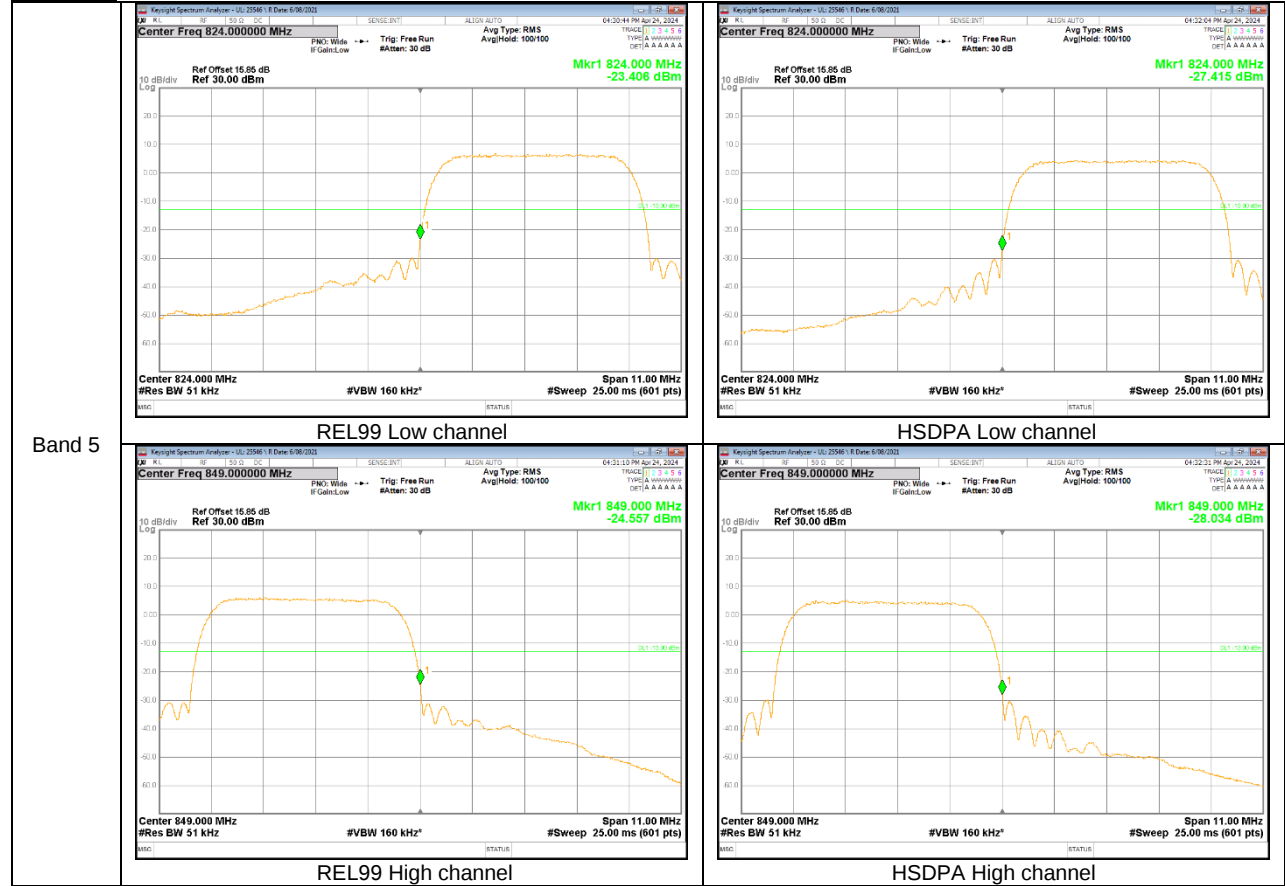


GPRS High channel

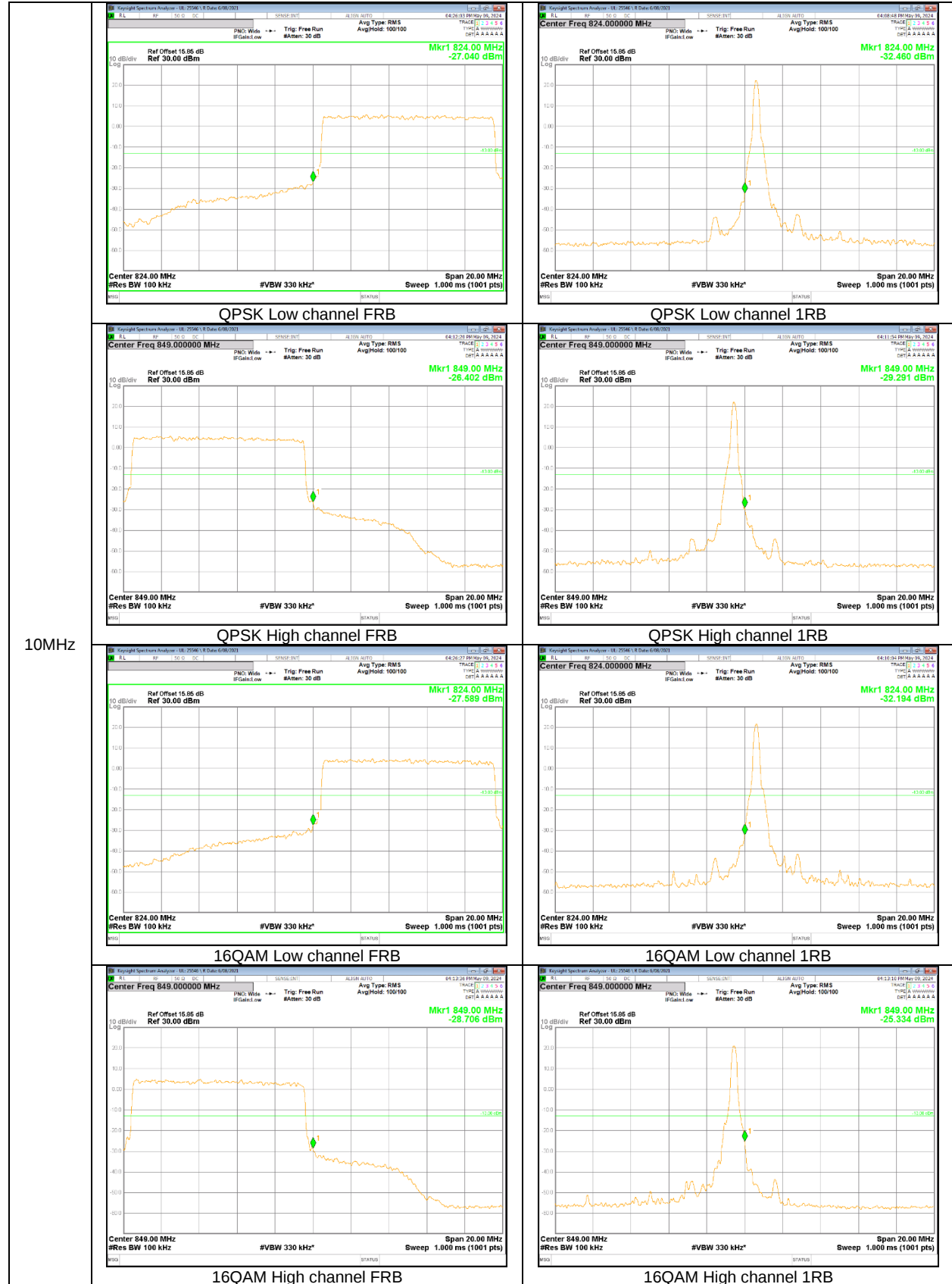


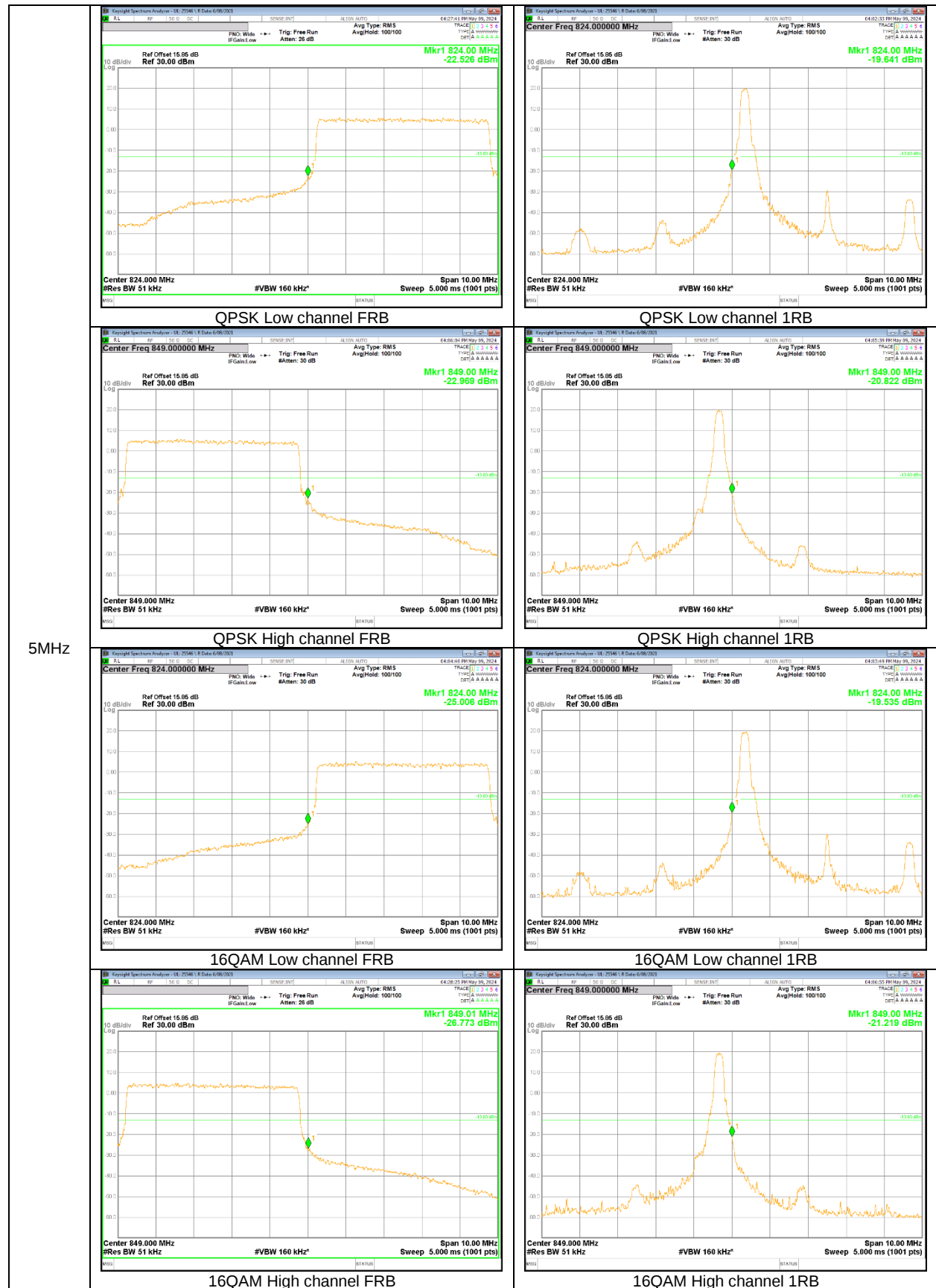
EGPRS High channel

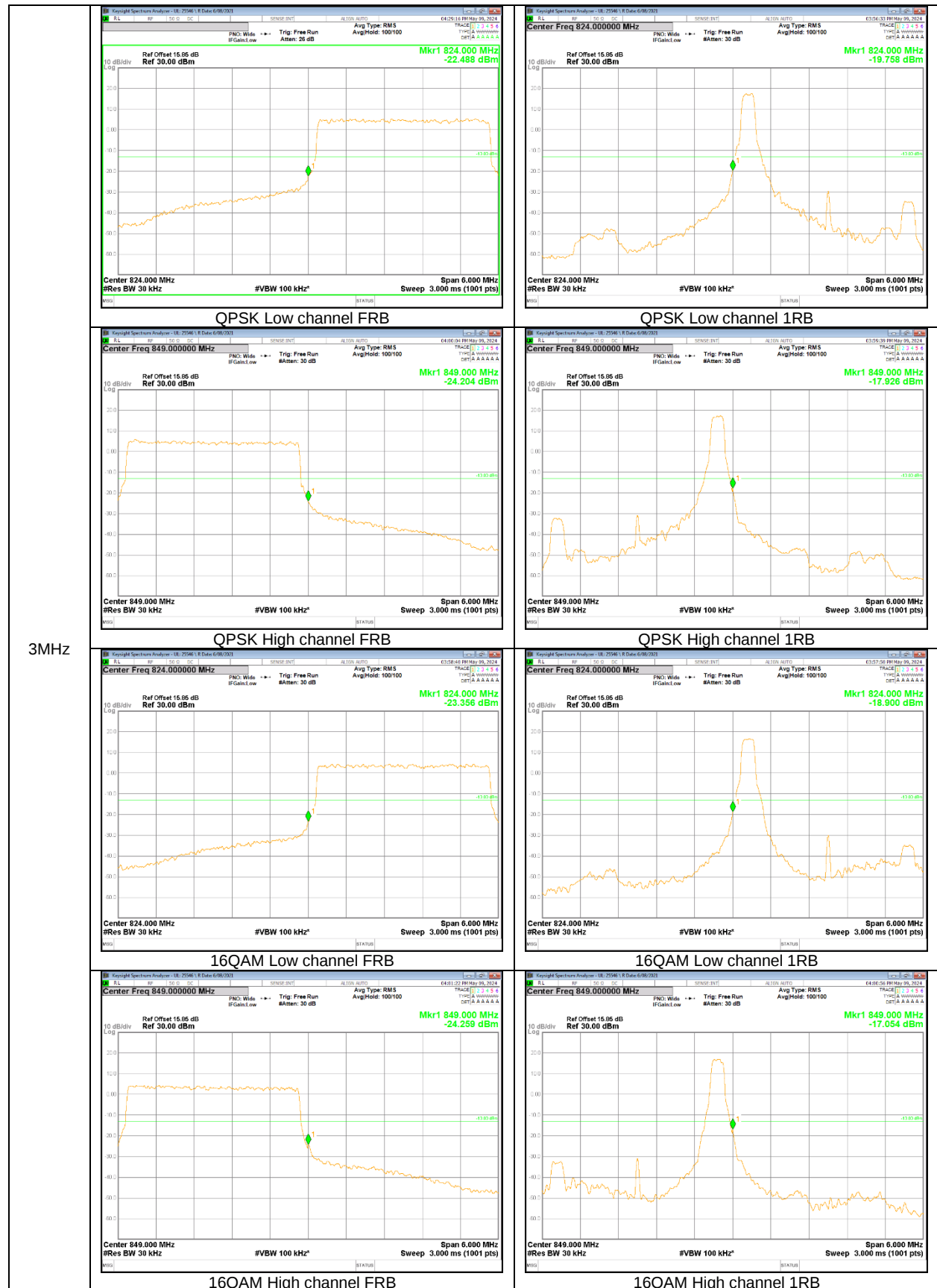
WCDMA

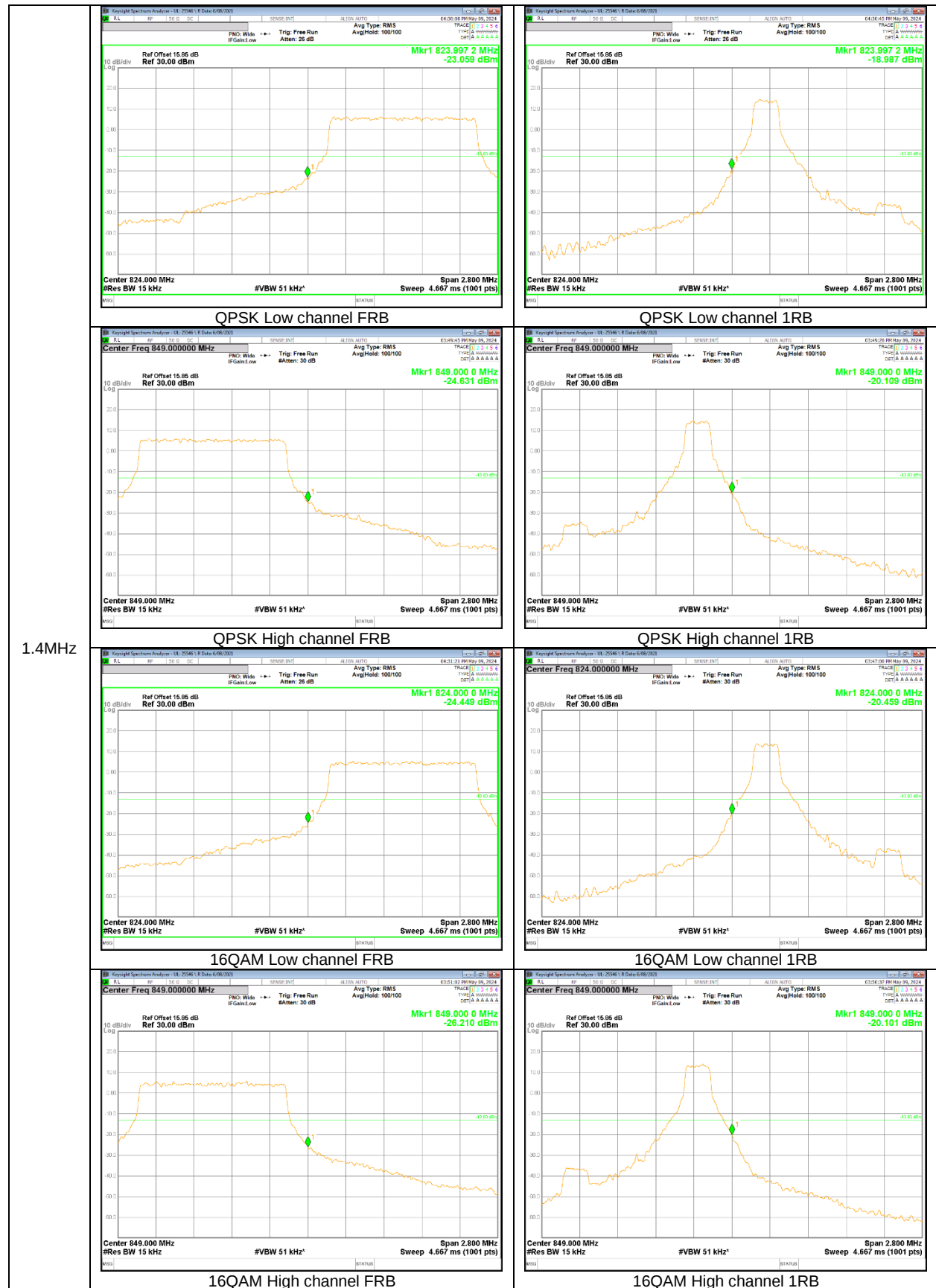


LTE Band 5

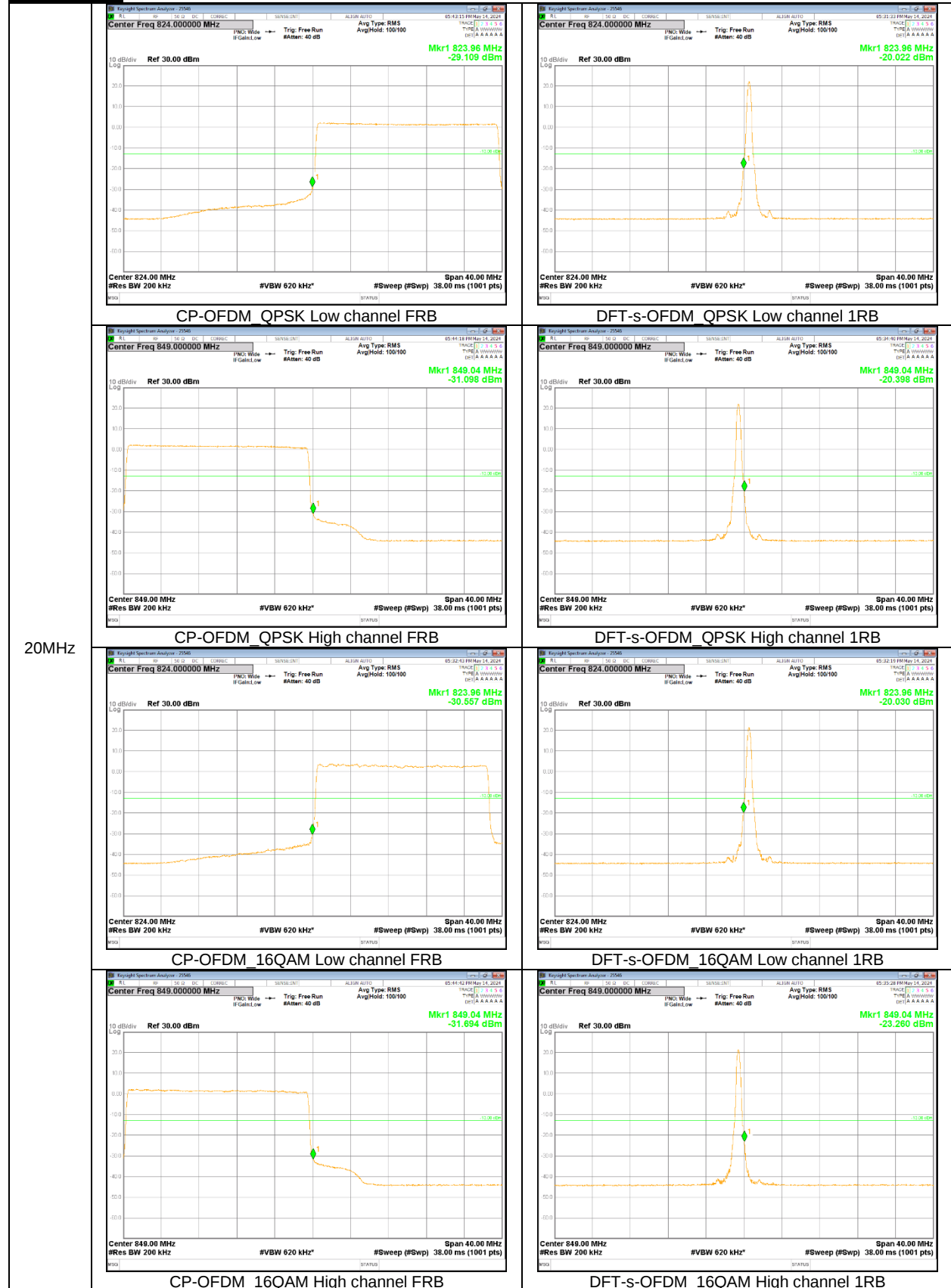


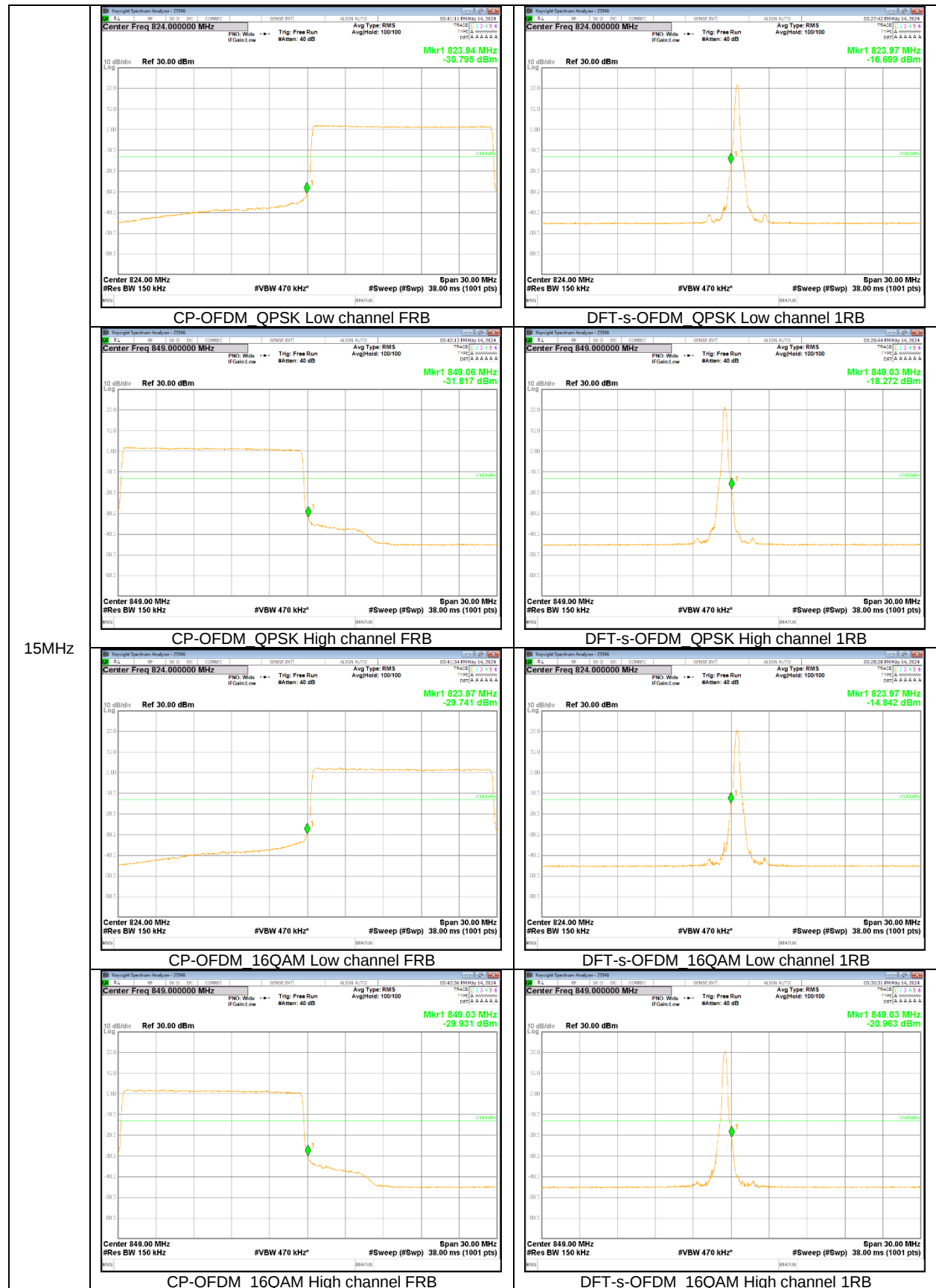


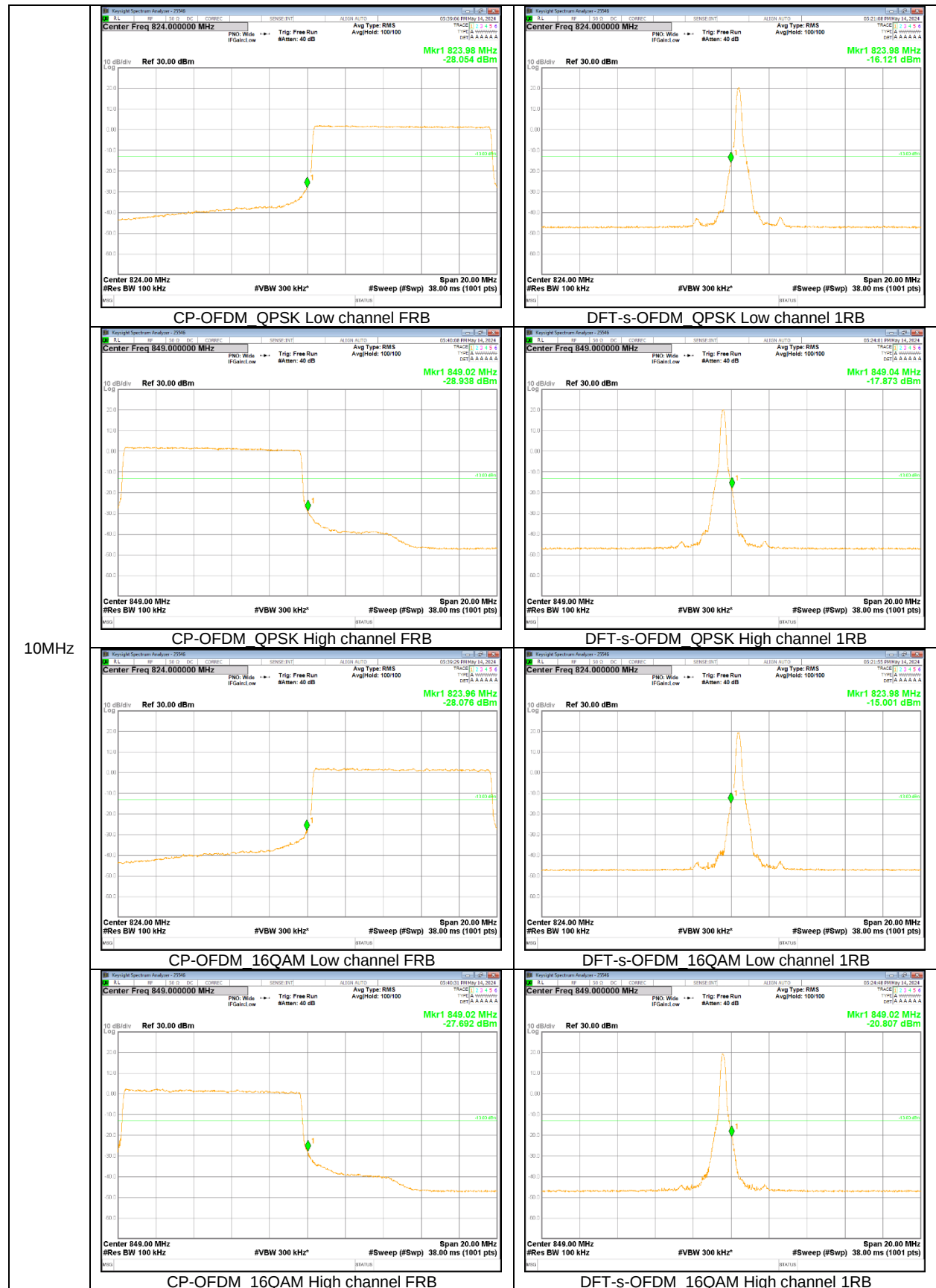


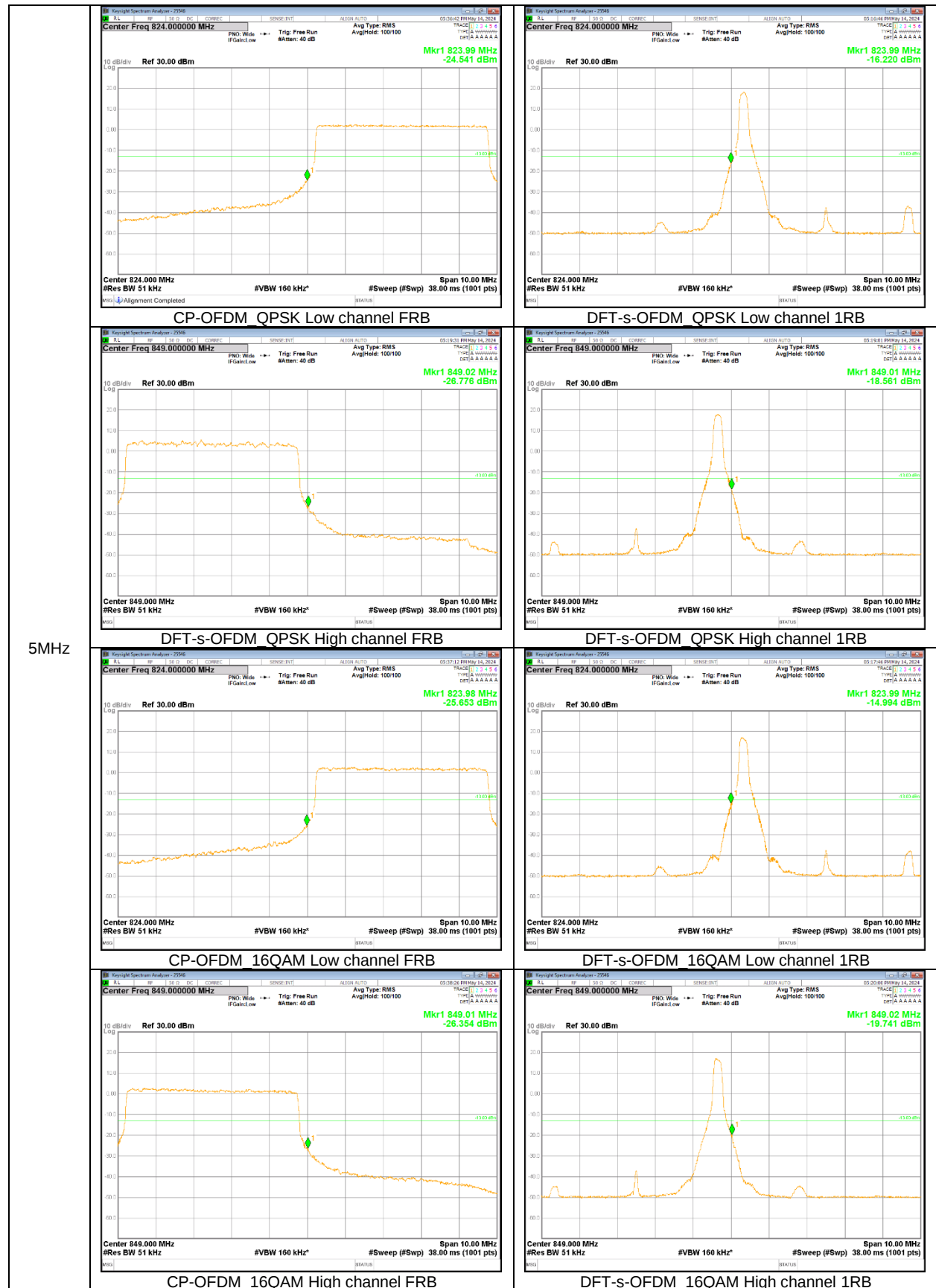


NR Band n5









8.5. CONDUCTED SPURIOUS EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.901, §22.917

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.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

- a) Set the RBW = 100 kHz for emission below 1 GHz
(Tests were performed 1MHz [Worst case], to sweep 1 time for all frequency range)
- b) Set VBW $\geq 3 \times$ RBW;
- c) Set span ≥ 1.5 times the OBW;
- d) Sweep time = auto couple;
- e) Detector = rms;
- f) Ensure that the number of measurement points = Max (40001);
- g) Trace mode = average(WCDMA, LTE, 5G NR), Max hold(GSM);

NOTE1

GSM : It was tested at GPRS as worst case (the highest output power and density).

UMTS: It was tested at REL 99 as worst case (the highest output power and density).

LTE: It was tested at 1RB QPSK as worst case (the highest output power and density).

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.

NOTE2

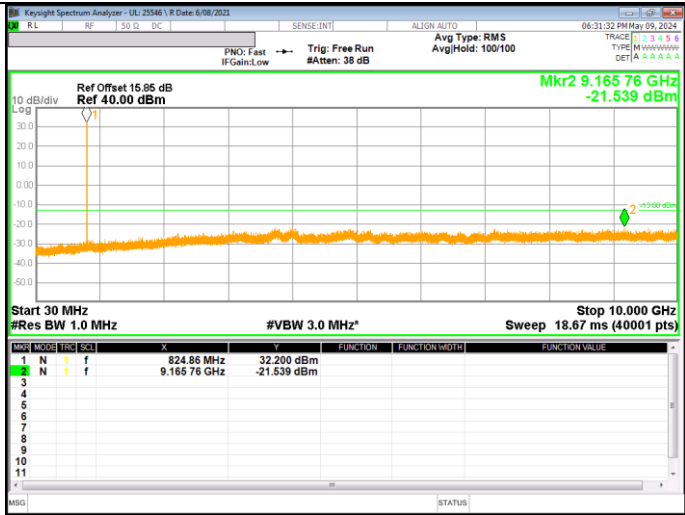
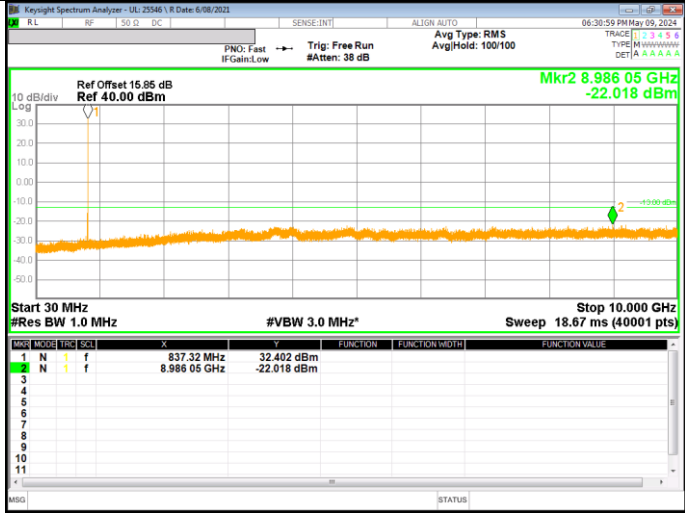
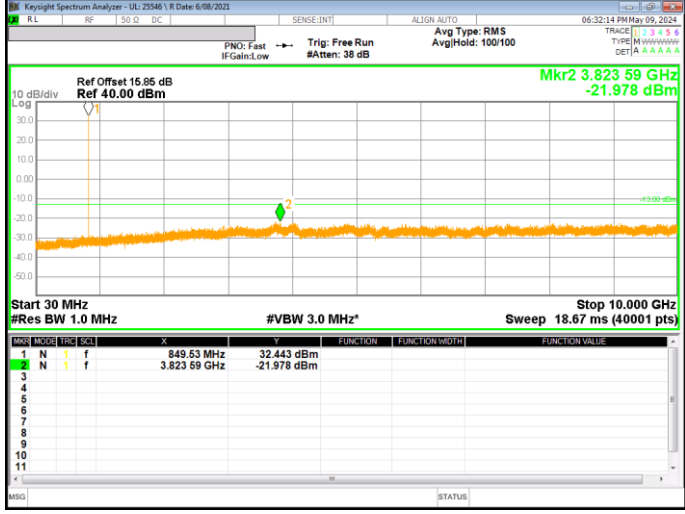
Please refer to section 5.4 for bandwidth and RB setting about LTE, 5G NR bands.

RESULTS

See the following pages.

8.5.1. OUT OF BAND EMISSIONS RESULT

GSM 850

GPRS	 Low channel
	 Mid channel
	 High channel