



FCC CFR47 PART 22 SUBPART H

WWAN

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone + BT/BLE and DTS b/g/n

MODEL NUMBER : SM-J400F/DS, SM-J400F

FCC ID: A3LSMJ400F

REPORT NUMBER: 4788404029-E4V1

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ACCREDITED*

Testing
Laboratory

TL-637

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	04/09/18	Initial issue	Junwhan Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: GSM/WCDMA/LTE Phone + BT/BLE and DTS b/g/n
MODEL NUMBER: SM-J400F/DS, SM-J400F
SERIAL NUMBER: R38K30FQM6A (RADIATED);
R38K30FQL8T (CONDUCTED)
DATE TESTED: MAR 28, 2018 - APR 09, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22H	Pass

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

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

Approved & Released For
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Suwon Lab Engineer
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Tested By:



Junwhan Lee
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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. KDB 971168 D01 Power Meas License Digital Systems v03

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 type="checkbox"/>	Chamber 1
<input checked="" type="checkbox"/>	Chamber 2
<input checked="" type="checkbox"/>	Chamber 3

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.pdf>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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

(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	2.32 dB
Radiated Disturbance, Below 1GHz	3.86 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

SM-J400F/DS and SM-J400F are same hardware, but for different number of SIM card slot. SM-J400F has one slot and SM-J400F/DS is dual SIM version.
 SM-J400F/DS used for the tests.

5.2. MAXIMUM OUTPUT POWER

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

Note : Conducted output power results were excerpted from RF exposure test report.(4788404029-S1 FCC Report SAR)

GSM

FCC Part 22/24						
Band	Frequency Range	Modulation	Conducted		Radiated	
	[MHz]		Peak	Avg [dBm]	Avg [mW]	Avg [dBm]
GSM850	824~849	GMSK	32.9	1949.84		
		GPRS	33.0	1995.26	28.87	770.90
		EGPRS	27.4	549.54	23.86	243.22

WCDMA

FCC Part 22/24						
Band	Frequency Range	Modulation	Conducted		Radiated	
	[MHz]		Peak	Avg [dBm]	Avg [mW]	Avg [dBm]
Band 5	824~849	REL99	23.7	234.42	18.30	67.61
		HSDPA	23.5	223.87	18.32	67.92
		HSUPA	22.2	165.96		
		DC-HSDPA	23.7	234.42		

LTE Band 5

FCC Part 22							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation Peak	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	824 ~ 849	10	QPSK	23.8	239.88	16.98	49.89
			16QAM	23.3	213.80	15.92	39.08
		5	QPSK	23.7	234.42	16.47	44.36
			16QAM	22.4	173.78	15.43	34.91
		3	QPSK	23.7	234.42	16.71	46.88
			16QAM	22.6	181.97	15.68	36.98
		1.4	QPSK	23.6	229.09	14.37	27.35
			16QAM	22.7	186.21	13.36	21.68

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

Frequency (MHz)	Peak Gain (dBi)
GSM850 / WCDMA Band 5 / LTE Band 5 824 ~ 849 MHz	-3.65

5.4. WORST-CASE ORIENTATION

For GSM850/WCDMA Band 5 / LTE Band 5, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

Note : All radiated spurious tests were performed connected with earphone and charger for evaluation of worst case mode.(For ERP/EIRP tests, the EUT didn't connected with earphone and charger)

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	ETA0U83EWE	DK1FB06TS/A- E	N/A
Data Cable	SAMSUNG	ECB-DU68WE	N/A	N/A
Earphone	SAMSUNG	EHS61ASFWE	N/A	N/A

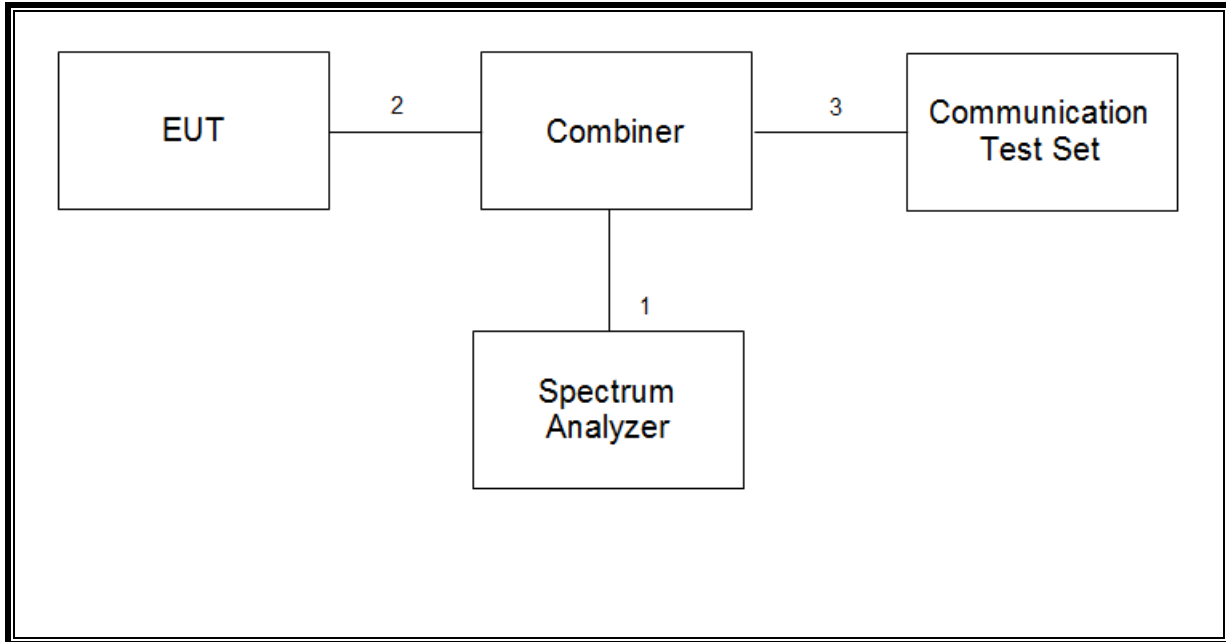
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Mini-USB	Shielded	1.2m	N/A
2	Audio	2	Mini-Jack	Unshielded	1.2m	N/A

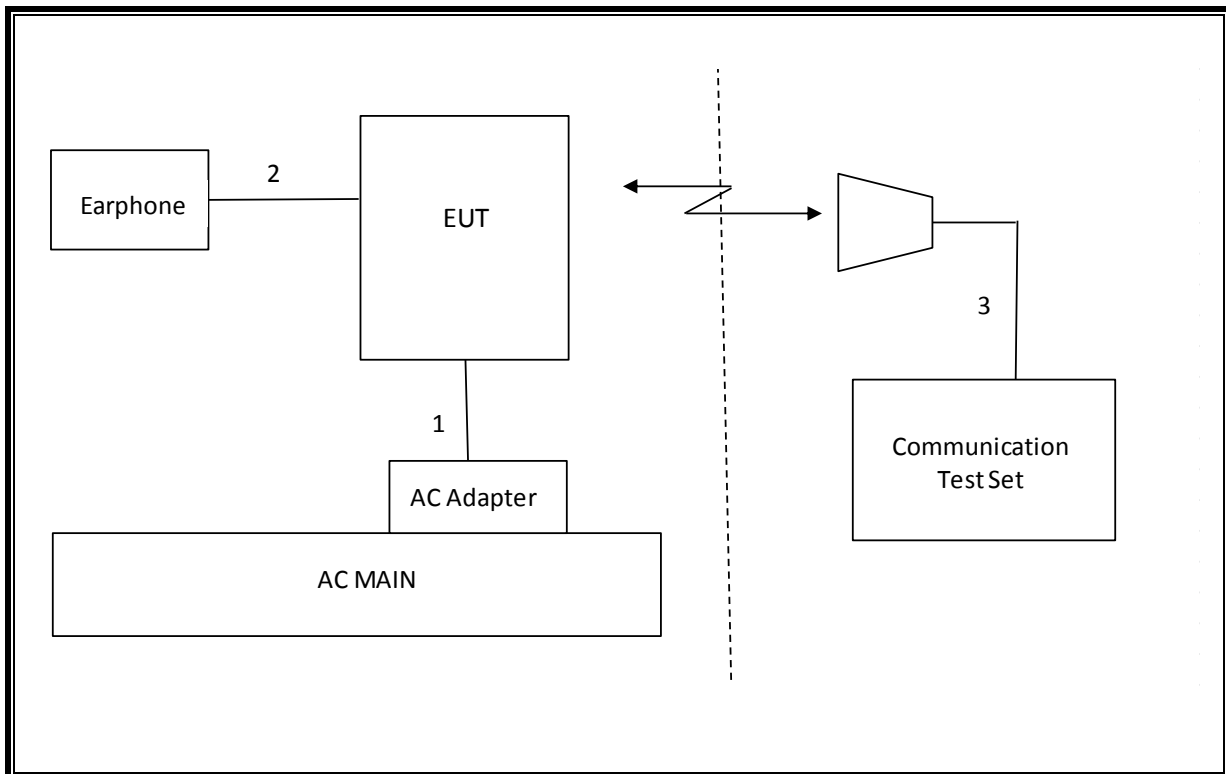
TEST SETUP

The EUT is continuously communicated to 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	06-30-19
Antenna, Horn, 40 GHz	ETS	3116C	00166155	12-04-19
Preamplifier	ETS	3116C-PA	00168841	11-13-19
Antenna, Horn, 40 GHz	ETS	3116C	00168645	12-04-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-31-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-31-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	09-14-19
Antenna, Horn, 18 GHz	ETS	3115	00167211	10-14-18
Antenna, Horn, 18 GHz	ETS	3115	00161451	03-10-19
Antenna, Horn, 18 GHz	ETS	3117	00168724	05-31-19
Antenna, Horn, 18 GHz	ETS	3117	00205959	11-29-18
Antenna, Horn, 18 GHz	ETS	3117	00168717	05-31-19
Combiner	WEINSCHTEL	1575	2152	08-08-18
Communications Test Set	R&S	CMW500	115331	08-07-18
DC Power Supply	Agilent / HP	E3640A	MY54226395	08-07-18
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-09-18
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-10-18
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-07-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-08-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-11-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-08-18
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-08-18
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-08-18
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-08-18
EMI Test Receive, 44 GHz	R&S	ESW40	101590	08-09-18
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	08-09-18
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	08-08-18
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	08-09-18
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	08-08-18
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	08-09-18
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	08-08-18
Attenuator	PASTERNAK	PE7087-10	A009	08-08-18
Attenuator	PASTERNAK	PE7087-10	A001	08-08-18
Attenuator	PASTERNAK	PE7087-10	A008	08-08-18
Attenuator	PASTERNAK	PE7087-10	2	08-10-18
Attenuator	PASTERNAK	PE7395-10	A011	02-12-19
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-26-19
Temperature Chamber	ESPEC	SH-642	93001109	08-08-18
UL Software				
Description	Manufacturer	Model	Version	
Antenna port test software	UL	CLT	Ver 2.4	

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
2.1046	Conducted output power	N/A		Pass
22.355	Frequency Stability	2.5PPM		Pass
22.913(a)(2)	Effective Radiated Power	38.5 dBm	Radiated	Pass
22.917(a)	Radiated Spurious Emission	-13dBm		Pass

FCC Rule Part	Frequency Range [MHz]	Output Power [W]	Frequency Tolerance	Emission Designator	Emission Bandwidth [MHz]	Communication Type
GSM						
22H	824.2 - 848.8	0.771	2.5 ppm	244KGXW		GSM850
22H	824.2 - 848.8	0.243	2.5 ppm	244KG7W		EDGE850
WCDMA						
22H	826.4 - 846.6	0.068	2.5 ppm	4M14F9W		WCDMA B5
LTE Band 5						
22H	829.0 - 844.0	0.050	2.5 ppm	8M97G7W	10	QPSK
22H	829.0 - 844.0	0.039	2.5 ppm	8M98D7W	10	16QAM

8. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03;

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

Test Spec

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

8.1. CONDUCTED PEAK TO AVERAGE RESULT

GSM

Band	Channel	f [MHz]	Mode	Ratio [dB]	Limit [dB]
GSM850	190	836.6	GPRS	0.31	13.00
			EGPRS	3.37	

WCDMA

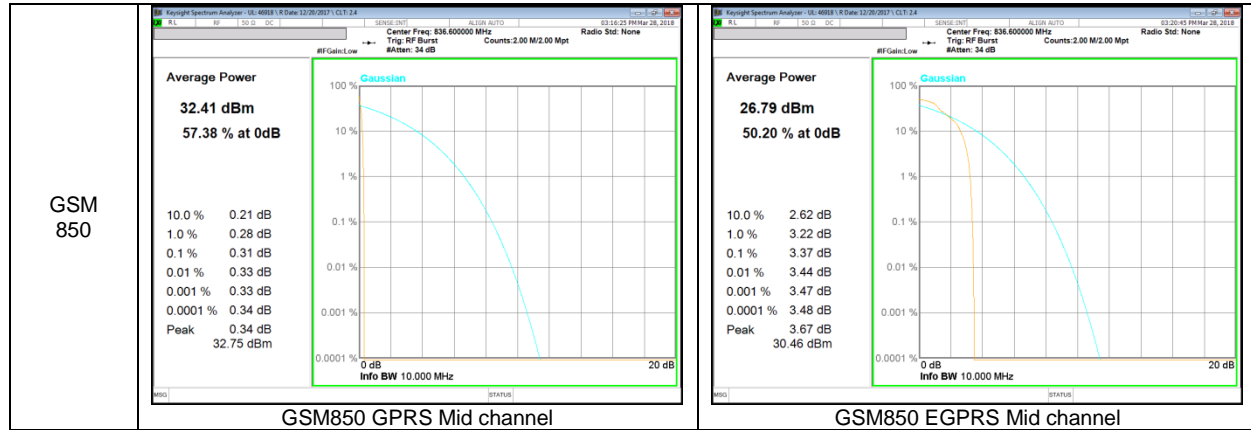
Band	Channel	f [MHz]	Mode	Ratio [dB]	Limit [dB]
Band 5	4183	836.6	REL99	3.01	13.00
			HSDPA	3.01	

LTE Band 5

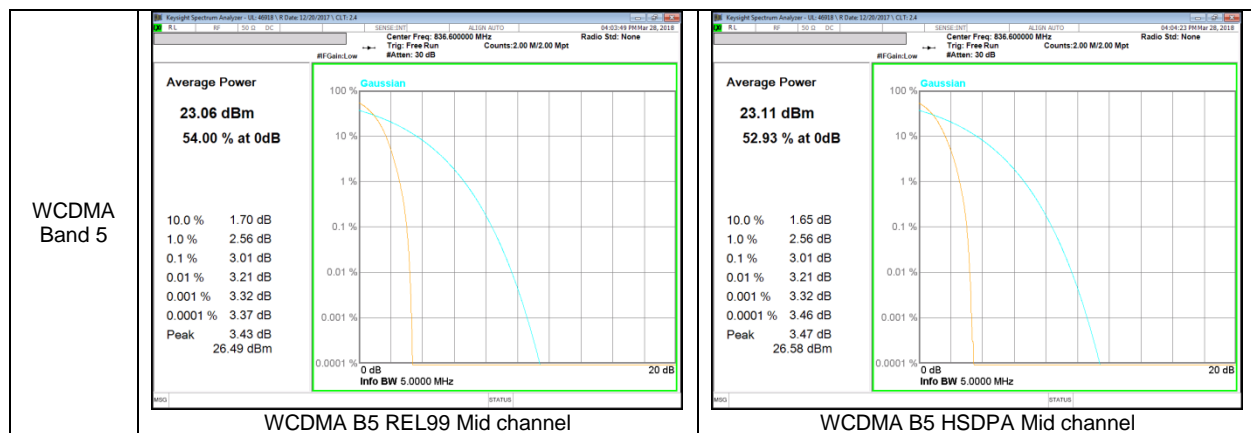
Band	BW [MHz]	Channel	f [MHz]	Mode	Ratio [dB]	Limit [dB]
Band 5	10	20525	836.5	QPSK	4.14	13.00
				16QAM	5.66	
	5			QPSK	4.26	
				16QAM	5.48	
	3			QPSK	4.21	
				16QAM	5.57	
	1.4			QPSK	4.14	
				16QAM	5.10	

8.2. CONDUCTED PEAK TO AVERAGE PLOTS

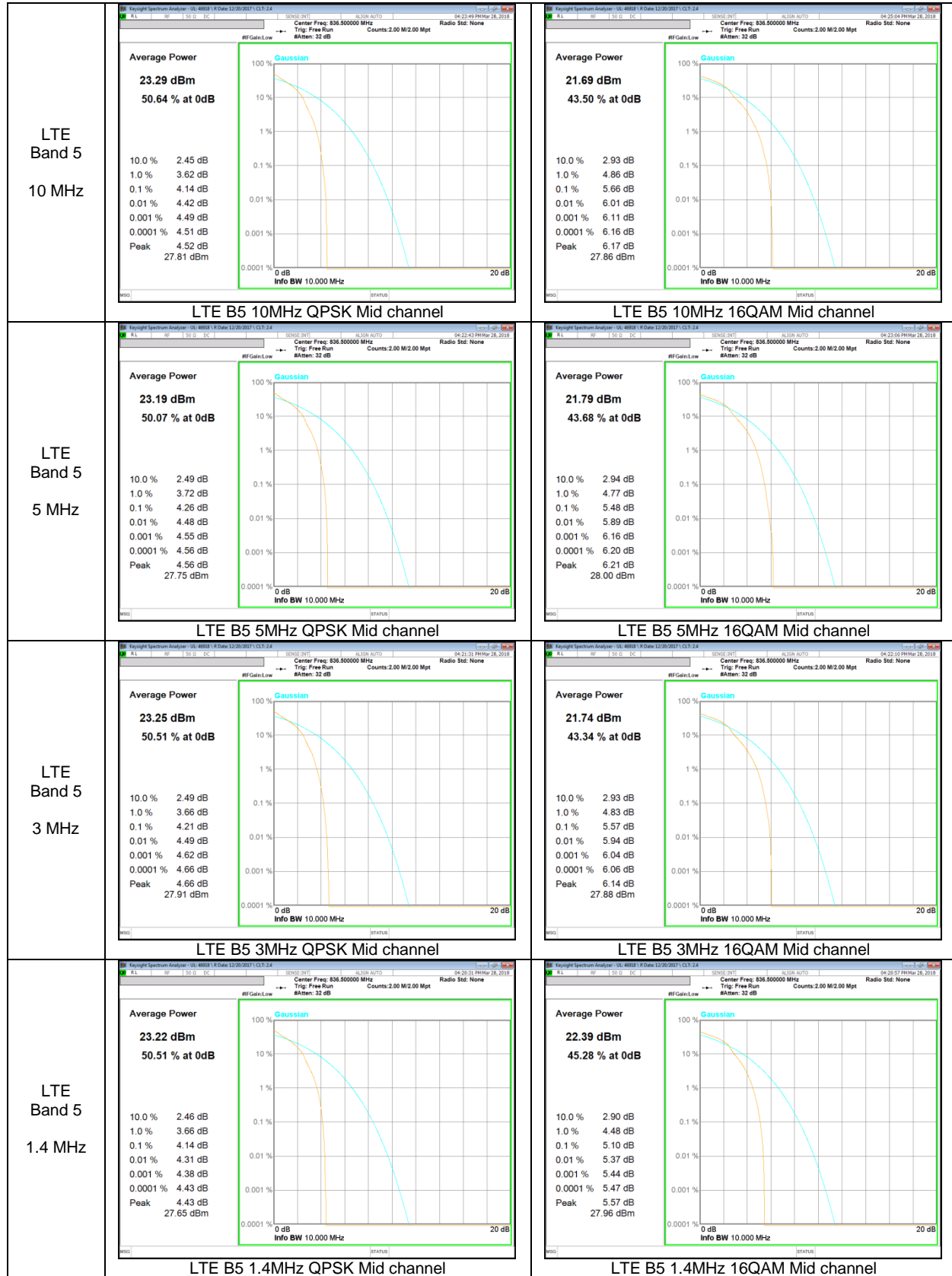
GSM



WCDMA



LTE Band 5



9. LIMITS AND CONDUCTED RESULTS

9.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

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

(KDB 971168 D01 Power Meas License Digital Systems v03)

9.1.1. OCCUPIED BANDWIDTH RESULTS

GSM

Band	Mode	Channel	f [MHz]	99% BW [KHz]	26dB BW [KHz]
GSM850	GPRS	128	824.2	244.28	315.5
		190	836.6	242.25	309.6
		251	848.8	243.12	306.8
	EGPRS	128	824.2	244.48	311.3
		190	836.6	240.39	309.7
		251	848.8	235.79	301.0

WCDMA

Band	Mode	Channel	f [MHz]	99% BW [MHz]	26dB BW [MHz]
Band 5	REL99	4132	826.4	4.1205	4.698
		4183	836.6	4.1266	4.687
		4233	846.6	4.1347	4.684
	HSDPA	4132	826.4	4.1278	4.719
		4183	836.6	4.1372	4.679
		4233	846.6	4.1395	4.694

LTE Band 5

Band	BW [MHz]	Channel	f [MHz]	Mode	99% BW [MHz]	26dB BW [MHz]
Band 5	10	20450	829.0	QPSK	8.9537	10.26
				16QAM	8.9545	10.04
		20524	836.5	QPSK	8.9656	10.35
				16QAM	8.9803	10.16
		20599	844.0	QPSK	8.9436	9.960
				16QAM	8.9419	10.21
	5	20425	826.5	QPSK	4.4914	5.120
				16QAM	4.4913	5.318
		20524	836.5	QPSK	4.4995	5.215
				16QAM	4.5061	5.208
		20624	846.5	QPSK	4.4984	5.206
				16QAM	4.5038	5.275
	3	20415	825.5	QPSK	2.6970	3.080
				16QAM	2.6993	3.069
		20524	836.5	QPSK	2.7067	3.059
				16QAM	2.7033	3.095
		20634	847.5	QPSK	2.7021	3.080
				16QAM	2.6932	3.062
	1.4	20407	824.7	QPSK	1.0969	1.338
				16QAM	1.0913	1.420
		20524	836.5	QPSK	1.0919	1.398
				16QAM	1.0911	1.399
		20624	848.3	QPSK	1.0951	1.421
				16QAM	1.0935	1.397

9.1.2. OCCUPIED BANDWIDTH PLOTS

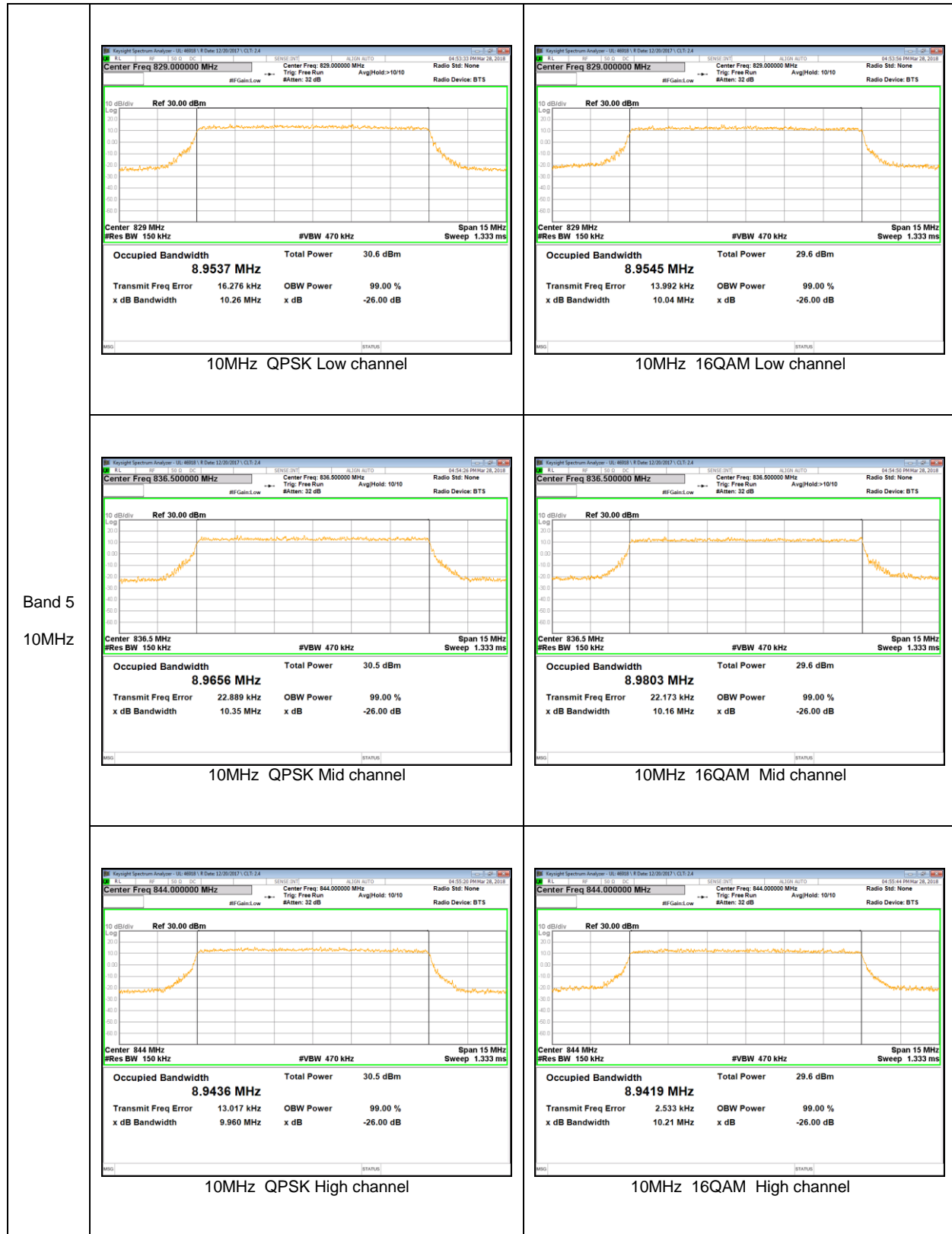
GSM 850

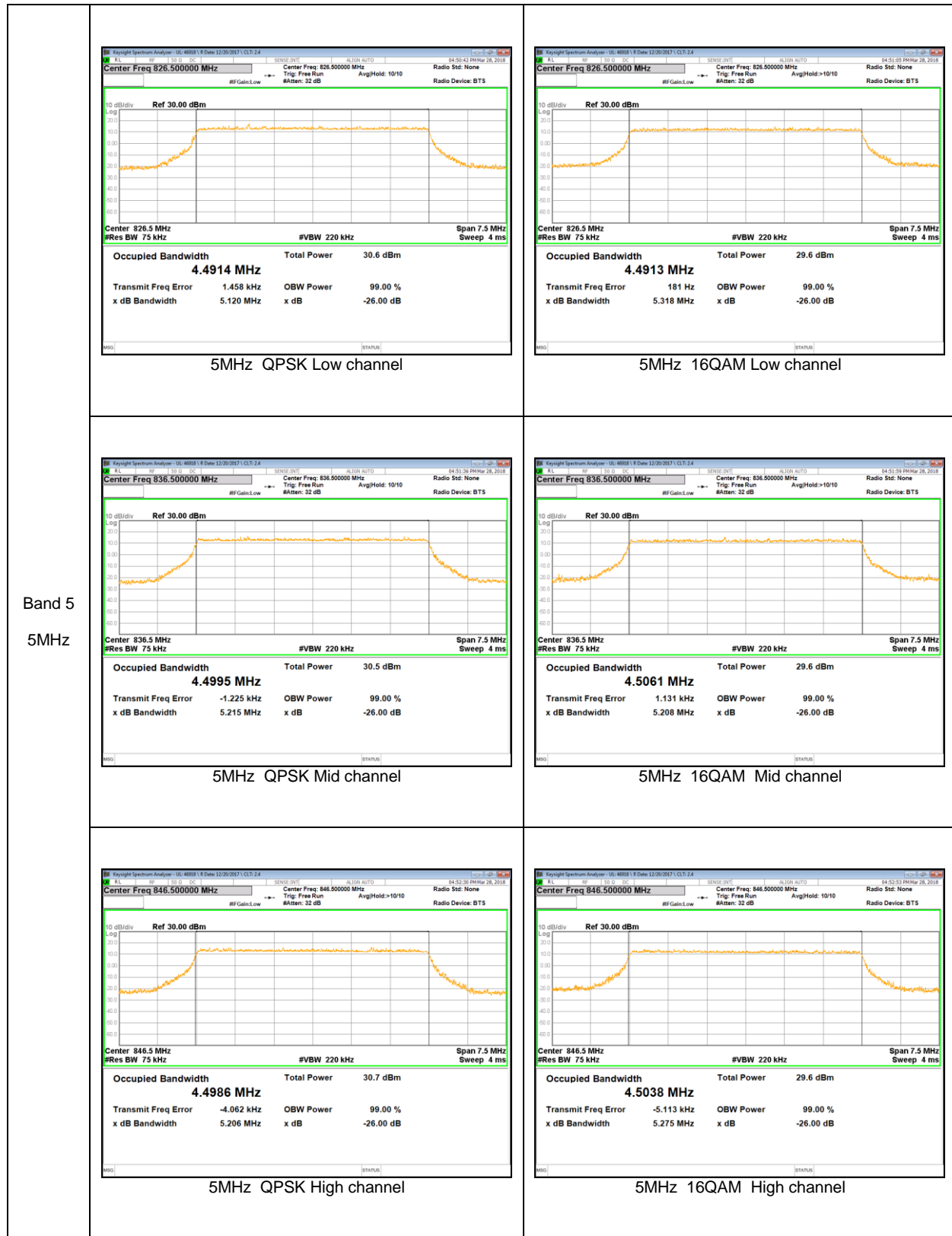


WCDMA Band 5

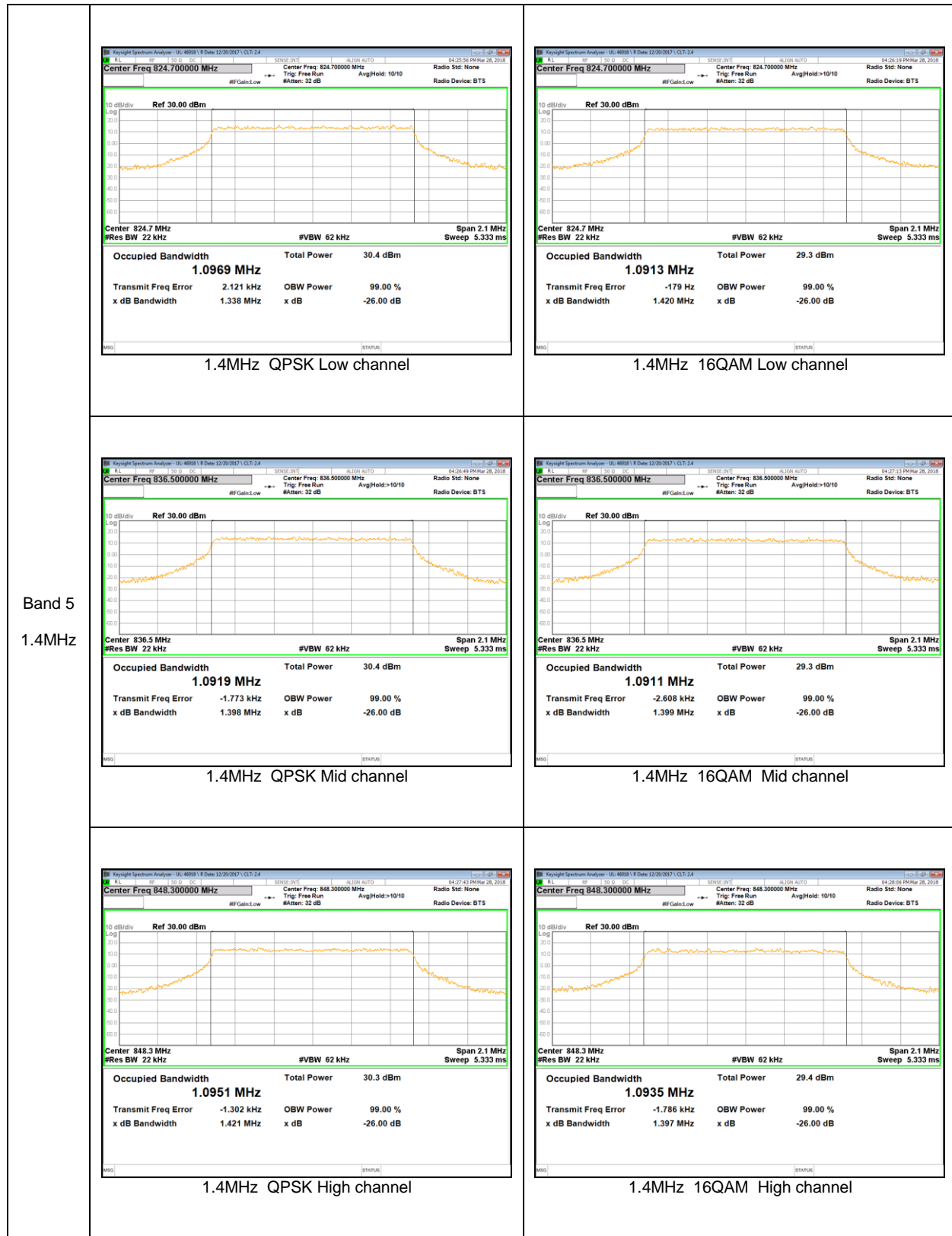


LTE Band 5









9.2. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §22.359

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 v03

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

GSM

- a) Set the RBW = 1 ~ 5% of OBW(GSM850 – 8.2KHz, GSM1900 – 9.1KHz)
- 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

- b) 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);

RESULTS

GSM

Band	Mode	Side	f [MHz]	Level [dBm]	Limit [dBm]
GSM850	GPRS	Lower	823.982	-16.783	-13.00
		Upper	849.023	-16.551	
	EGPRS	Lower	823.987	-22.750	
		Upper	849.018	-22.596	

WCDMA

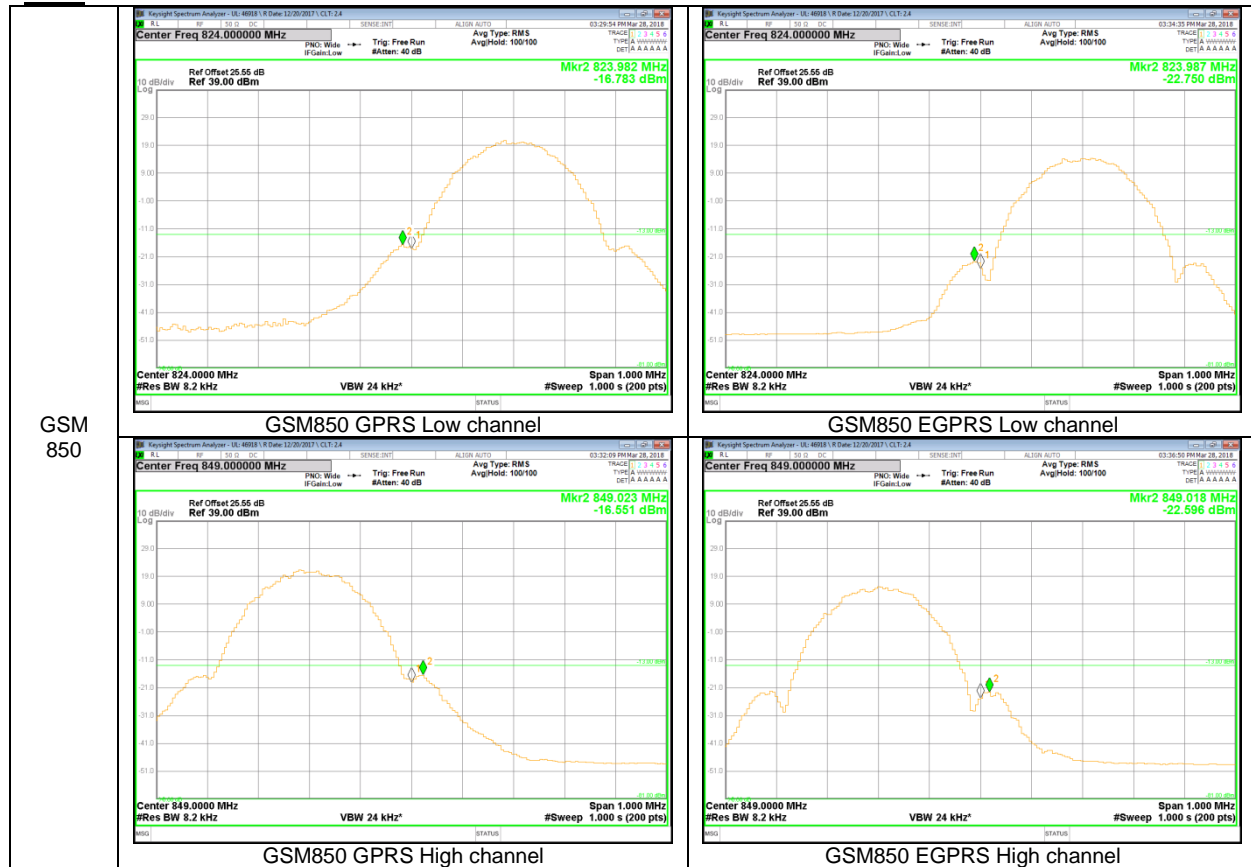
Band	Mode	Side	f [MHz]	Level [dBm]	Limit [dBm]
Band 5	REL99	Lower	824.000	-25.107	-13.00
		Upper	849.000	-27.679	
	HSDPA	Lower	824.000	-27.279	
		Upper	849.000	-27.491	

LTE 5

Bandwidth	Mode	Side	RB Status	f [MHz]	Level [dBm]	Limit [dBm]
10 MHz	QPSK	Lower	1RB	824.000	-31.350	-13.00
			FRB	824.000	-30.371	
		Upper	1RB	849.000	-31.678	
			FRB	849.000	-31.360	
	16QAM	Lower	1RB	824.000	-35.933	
			FRB	824.000	-27.169	
		Upper	1RB	849.000	-28.591	
			FRB	849.000	-30.979	
5 MHz	QPSK	Lower	1RB	824.000	-20.418	-13.00
			FRB	824.000	-22.839	
		Upper	1RB	849.000	-20.752	
			FRB	849.000	-25.056	
	16QAM	Lower	1RB	824.000	-23.228	
			FRB	824.000	-24.421	
		Upper	1RB	849.000	-22.896	
			FRB	849.000	-24.360	
3 MHz	QPSK	Lower	1RB	824.000	-18.283	-13.00
			FRB	824.000	-24.343	
		Upper	1RB	849.000	-18.138	
			FRB	849.000	-24.237	
	16QAM	Lower	1RB	824.000	-20.877	
			FRB	824.000	-26.556	
		Upper	1RB	849.000	-20.041	
			FRB	849.000	-25.384	
1.4 MHz	QPSK	Lower	1RB	824.000	-22.444	-13.00
			FRB	824.000	-23.008	
		Upper	1RB	849.000	-22.175	
			FRB	849.000	-25.293	
	16QAM	Lower	1RB	824.000	-24.538	
			FRB	824.000	-24.144	
		Upper	1RB	849.000	-24.317	
			FRB	849.000	-25.571	

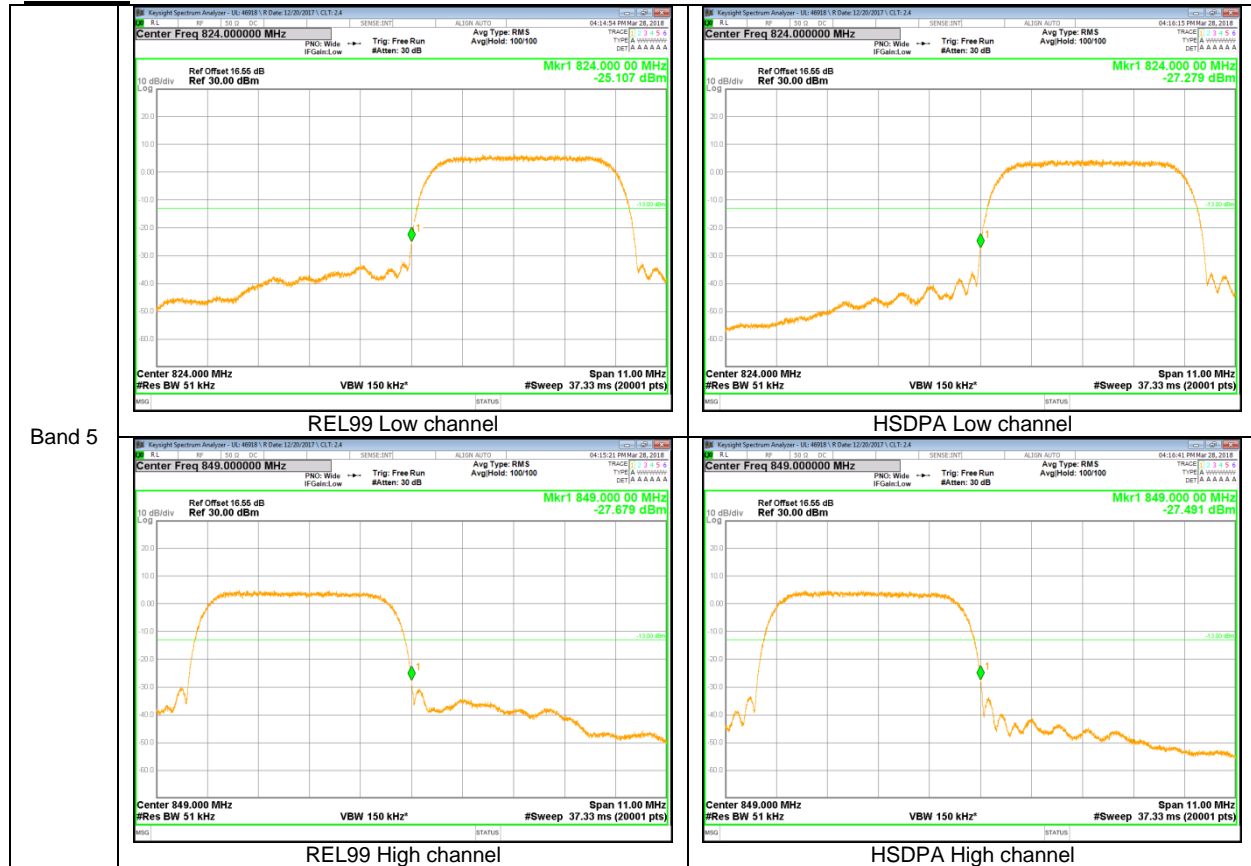
9.2.1. BAND EDGE PLOTS

GSM

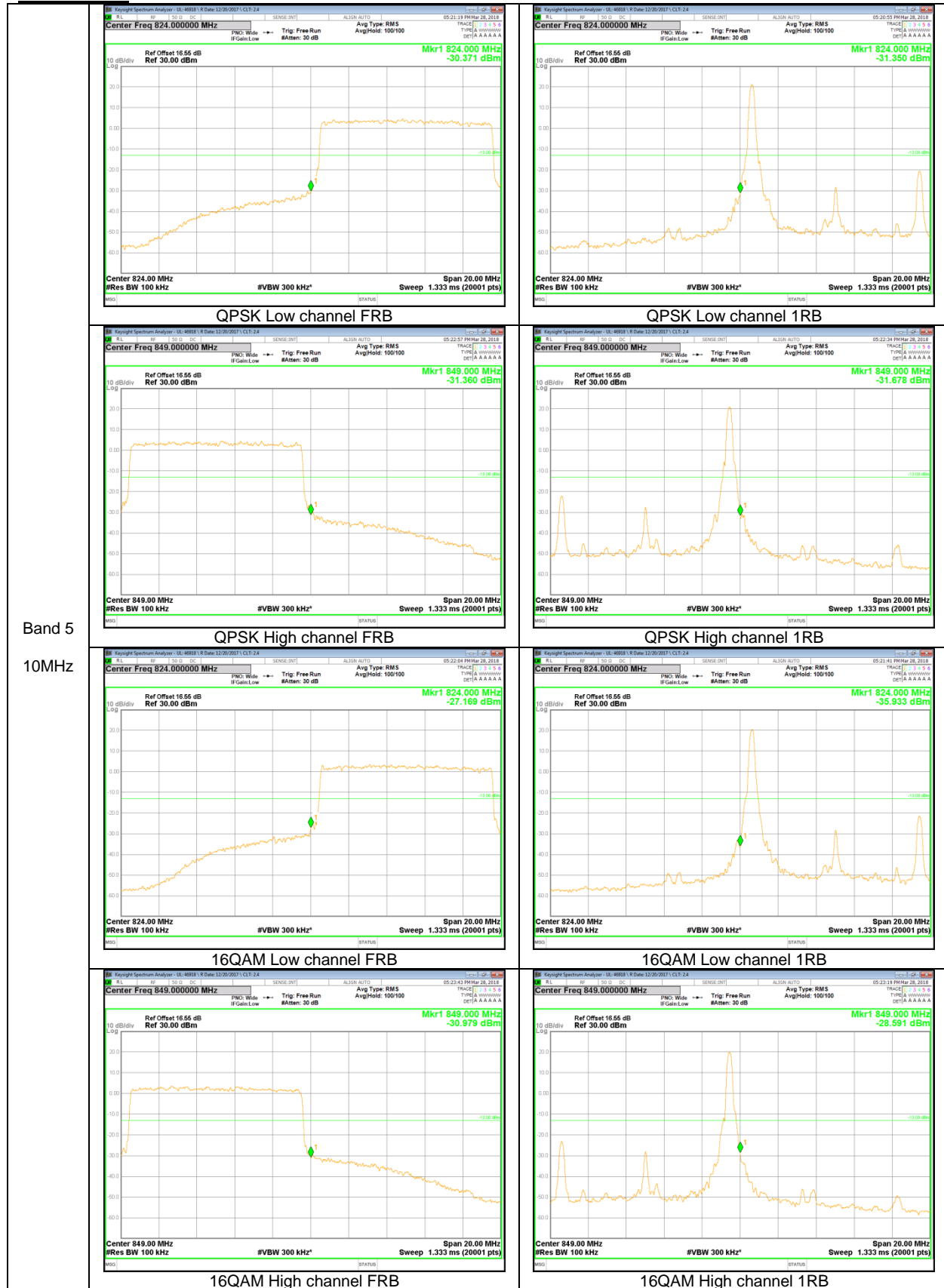


GSM
850

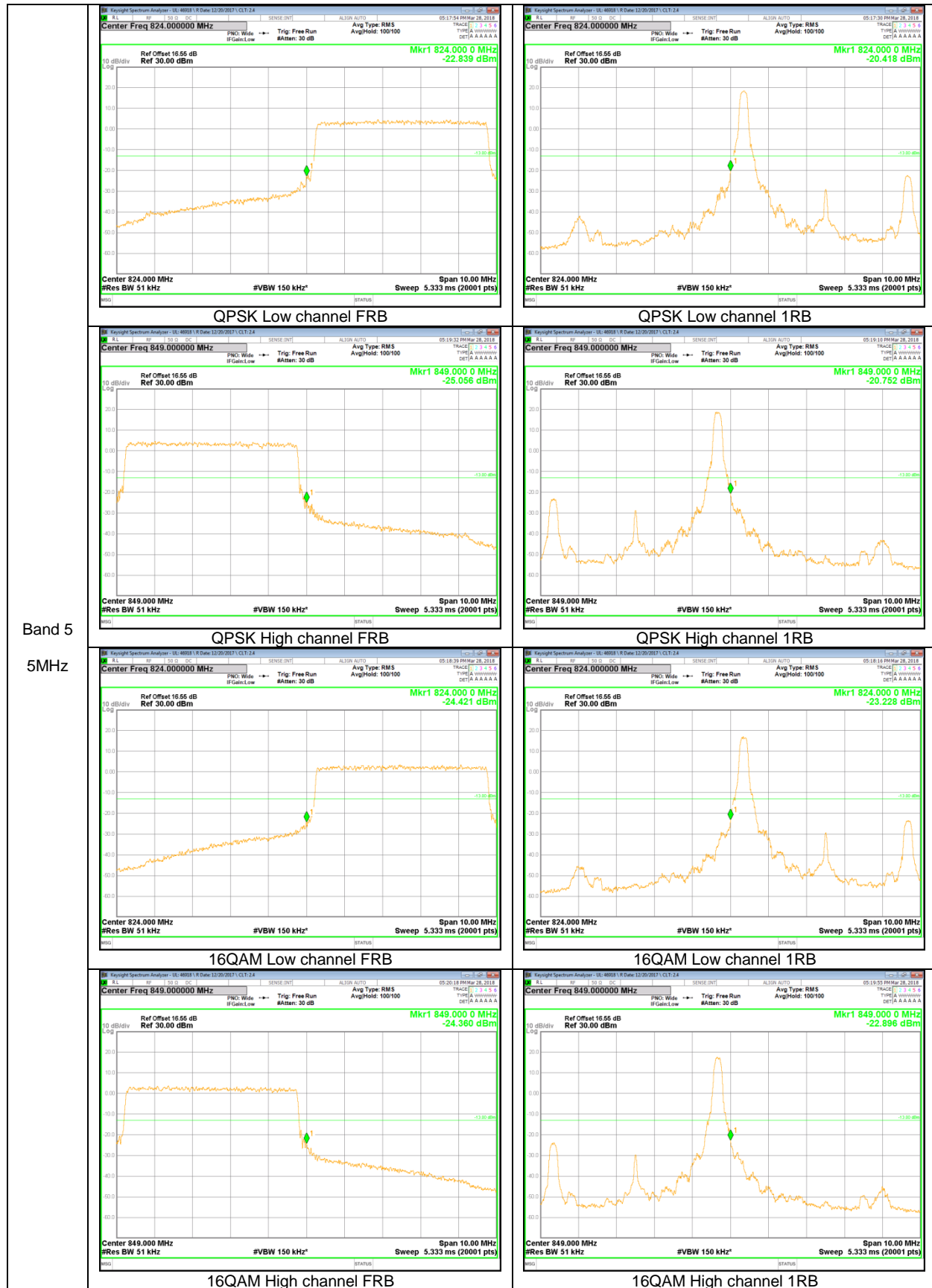
WCDMA

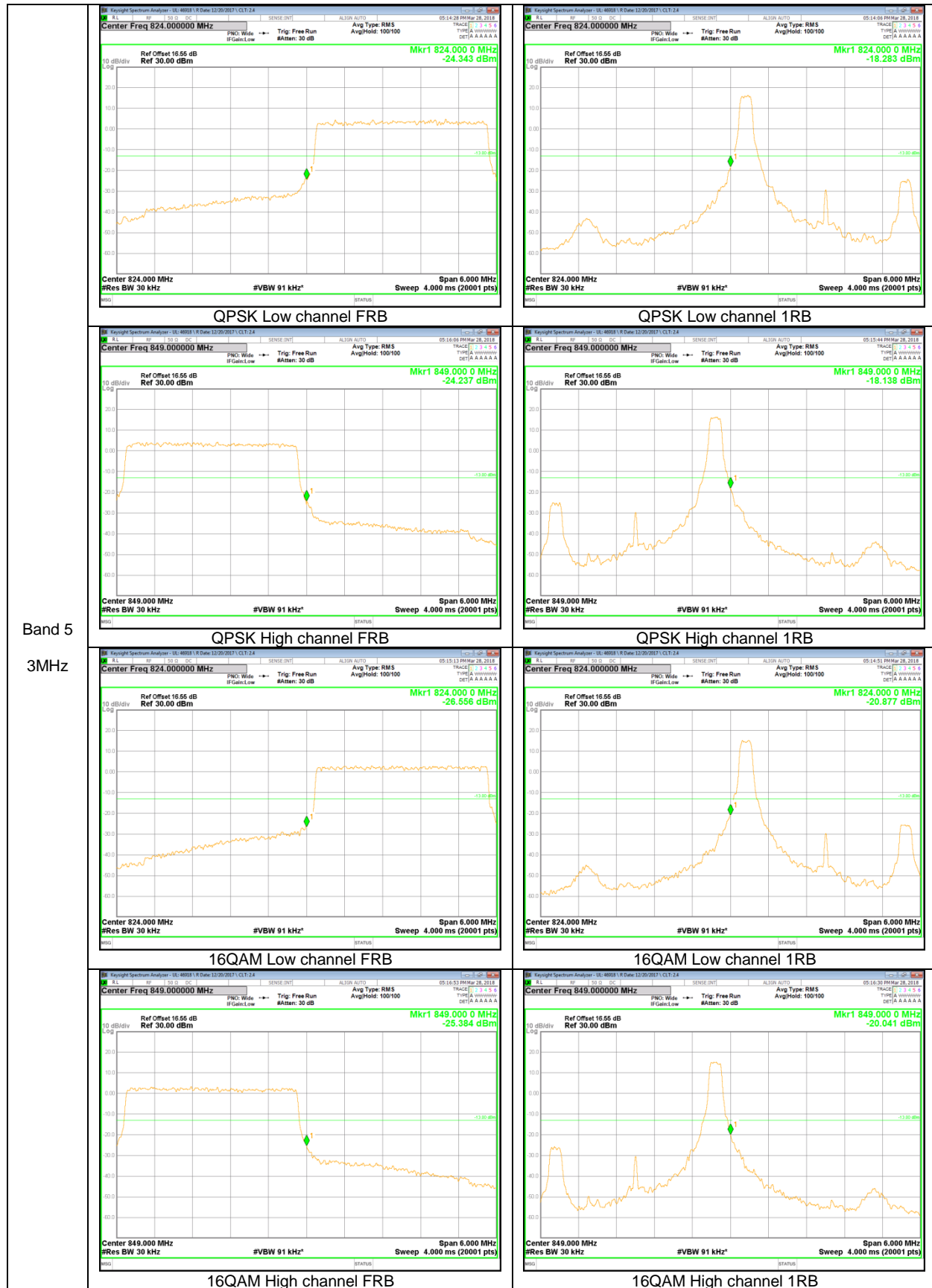


LTE Band 5

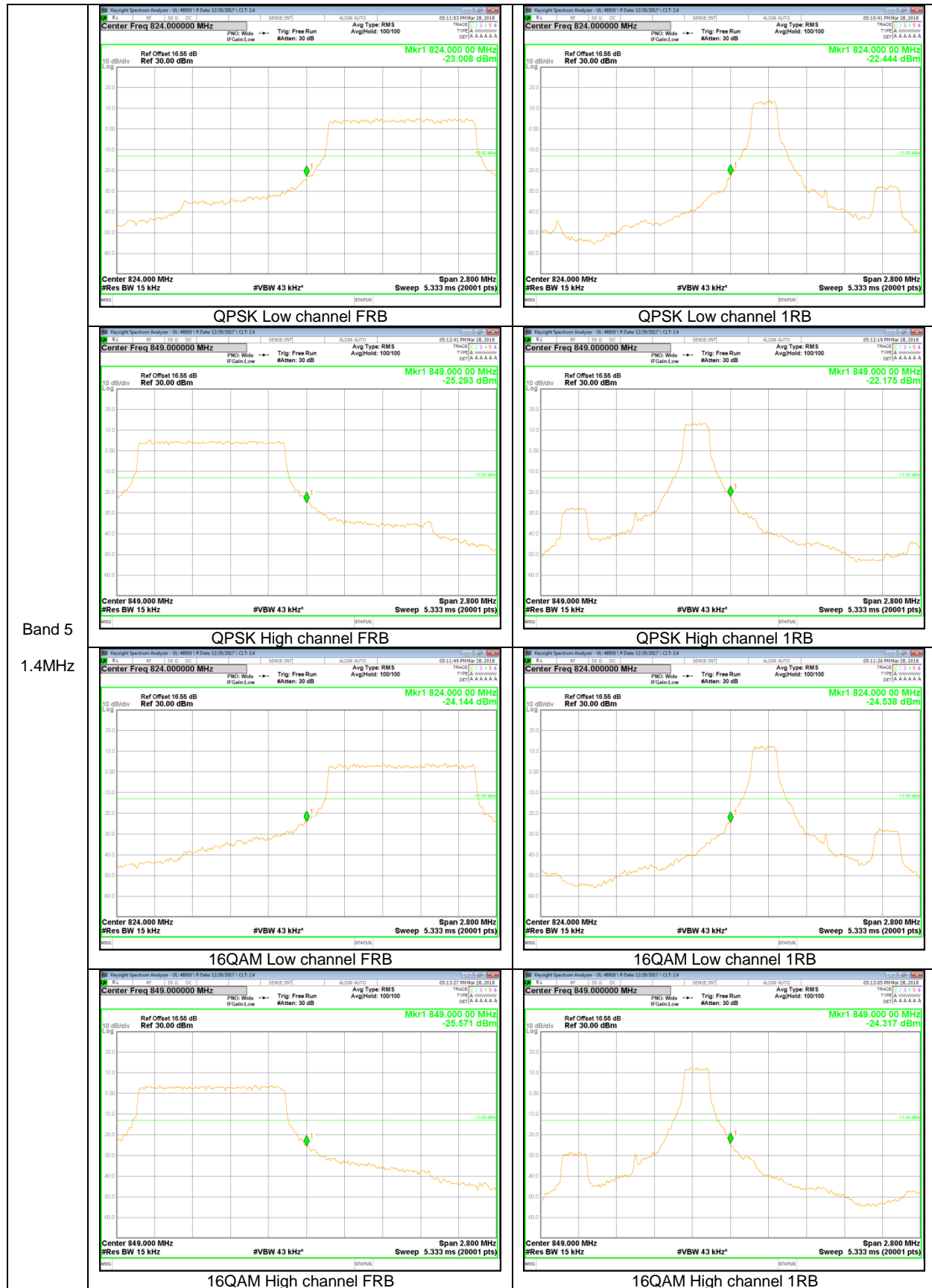


Band 5
10MHz





Band 5
 3MHz



Band 5
 1.4MHz

9.3. OUT OF BAND 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 v03

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 = 100KHz for emission below 1GHz and 1MHz for emissions above 1GHz
(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 = peak;
- f) Ensure that the number of measurement points = Max (40001);
- g) Trace mode = max hold;

RESULTS

GSM

Band	Mode	f [MHz]	Spurious [dBm]	Limit [dBm]
GSM850	GPRS	824.2	-21.96	-13.00
		836.6	-22.61	
		848.8	-21.68	
	EGPRS	824.2	-22.80	
		836.6	-22.38	
		848.8	-22.09	

WCDMA

Band	Mode	f [MHz]	Spurious [dBm]	Limit [dBm]
Band 5	REL99	826.4	-26.50	-13.00
		836.6	-26.75	
		846.6	-26.50	
	HSDPA	826.4	-26.05	
		836.6	-26.78	
		846.6	-26.72	

LTE 5

Bandwidth	Mode	f [MHz]	Spurious [dBm]	Limit [dBm]
10 MHz	QPSK	829.0	-30.94	-13.00
		836.5	-30.03	
		844.0	-31.16	
	16QAM	829.0	-31.38	
		836.5	-31.43	
		844.0	-30.06	
5 MHz	QPSK	826.5	-31.47	
		836.5	-30.90	
		846.5	-31.33	
	16QAM	826.5	-31.38	
		836.5	-31.43	
		846.5	-31.26	
3 MHz	QPSK	825.5	-30.53	
		836.5	-31.48	
		847.5	-31.54	
	16QAM	825.5	-31.00	
		836.5	-31.26	
		847.5	-30.97	
1.4 MHz	QPSK	824.7	-30.53	
		836.5	-30.65	
		848.3	-30.86	
	16QAM	824.7	-30.64	
		836.5	-31.10	
		848.3	-30.43	

9.3.1. OUT OF BAND EMISSIONS PLOTS

GSM 850

