



**FCC CFR47 PART 22 SUBPART H
FCC CFR47 PART 24 SUBPART E**

WWAN

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER : SM-J810F/DS, SM-J810F

FCC ID: A3LSMJ810F

REPORT NUMBER: 4788458975-E5V2

ISSUE DATE: MAY 25, 2018

Prepared for
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ACCREDITED*

Testing
Laboratory

TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	05/14/18	Initial issue	Hoonpyo Lee
V2	05/25/18	Updated to address TCB's question	Hoonpyo Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: GSM/WCDMA/LTE Phone + BT/BLE , ANT+ and DTS b/g/n

MODEL NUMBER: SM-J810F/DS, SM-J810F

SERIAL NUMBER: R38K30RGB8V (RADIATED);
R38K30RGFGK (CONDUCTED)

DATE TESTED: APR 30, 2018 - MAY 10, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22H, 24E	Pass

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

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

Approved & Released For
UL Korea, Ltd. By:



SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:



Hoonpyo Lee
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

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

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

3. FACILITIES AND ACCREDITATION

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

218 Maeyeong-ro	
☒	Chamber 1
☒	Chamber 2
☐	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:

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

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

(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	2.32 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 , ANT+ and DTS b/g/n.
This test report addresses the WWAN operational mode.

5.2. MAXIMUM OUTPUT POWER

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

GSM

FCC Part 22/24				
Band	Frequency Range	Modulation	Radiated	
	[MHz]		Avg [dBm]	Avg [mW]
GSM850	824~849	GMSK		
		GPRS	27.48	559.76
		EGPRS	20.80	120.23
GSM1900	1850~1910	GMSK		
		GPRS	26.16	413.05
		EGPRS	21.19	131.52

WCDMA

FCC Part 22/24				
Band	Frequency Range	Modulation	Radiated	
	[MHz]		Avg [dBm]	Avg [mW]
Band 5	824~849	REL99	17.90	61.66
		HSDPA	16.54	45.08
Band 2	1850~1910	REL99	19.36	86.30
		HSDPA	18.47	70.31

LTE Band 5

FCC Part 22					
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation Peak	Radiated	
				Avg [dBm]	Avg [mW]
Band 5	824 ~ 849	10	QPSK	19.12	81.66
			16QAM	18.01	63.24
		5	QPSK	18.35	68.39
			16QAM	17.91	61.80
		3	QPSK	18.40	69.18
			16QAM	17.71	59.02
		1.4	QPSK	18.43	69.66
			16QAM	17.56	57.02

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)
WCDMA Band 5 / LTE Band 5 824 ~ 849 MHz	-5.62
GSM1900 / WCDMA Band 2 1850 ~ 1910 MHz	-3.83

5.4. WORST-CASE ORIENTATION

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

For GSM1900 / WCDMA Band 2, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X 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	EP-TA50EWE	1565617	N/A
Data Cable	SAMSUNG	ECB-DU68WE	N/A	N/A
Earphone	SAMSUNG	EHS64AVFWE	N/A	N/A

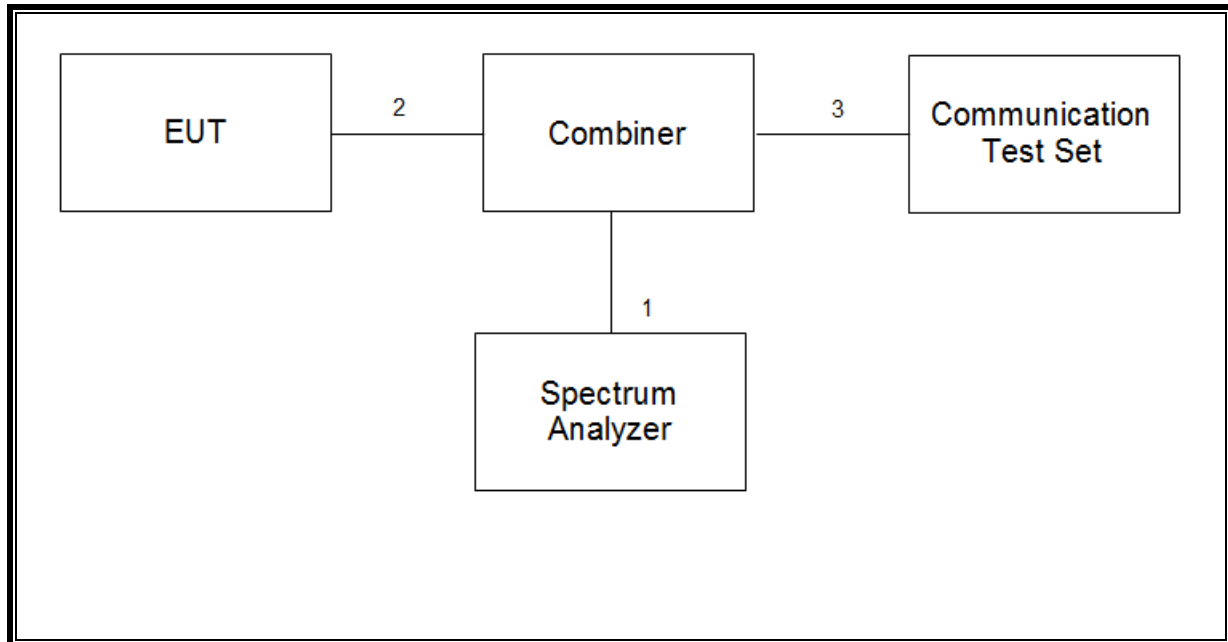
I/O CABLES

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	0.8m	N/A
2	Audio	2	Mini-Jack	Unshielded	1.2m	N/A

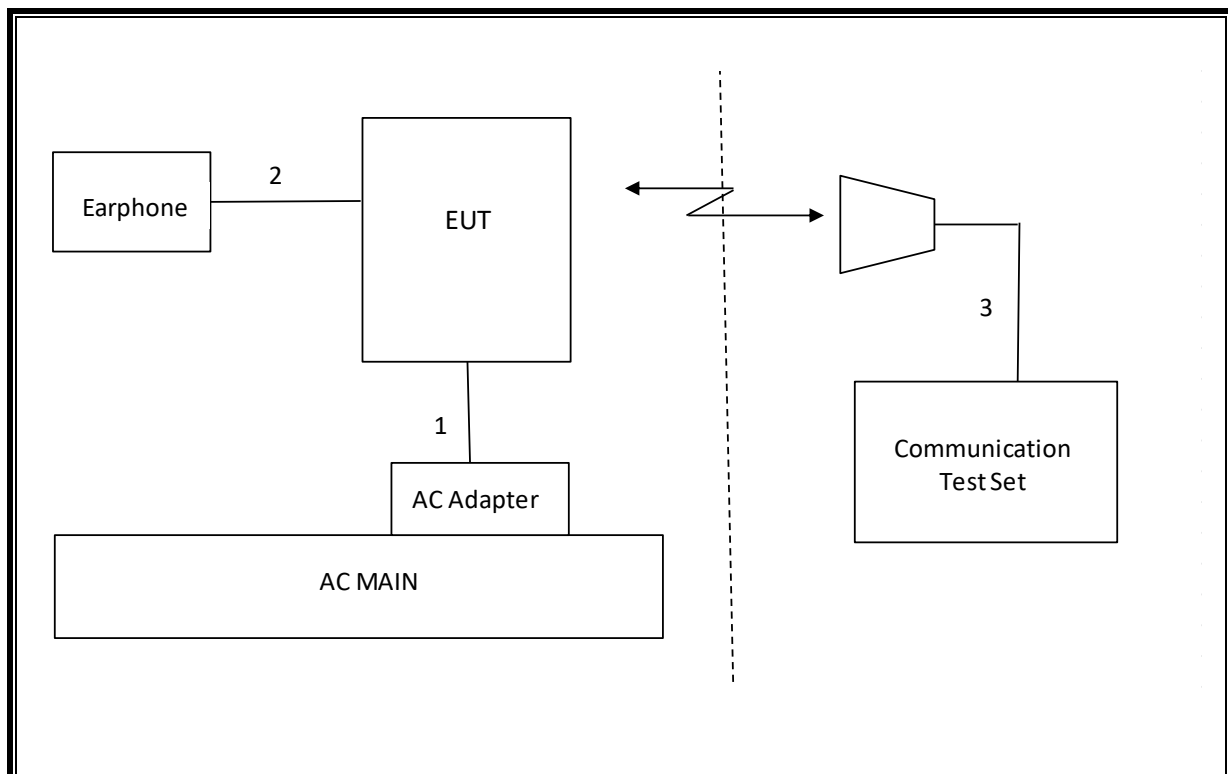
TEST SETUP

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	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
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, 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
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
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	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) 24.238(a)	Band Edge / Conducted Spurious Emission	-13dBm		Pass
22.355 24.235	Frequency Stability	2.5PPM		Pass
22.913(a)(2)	Effective Radiated Power	38.5 dBm	Radiated	Pass
24.232(c)	Equivalent Isotropic Radiated Power	33dBm		Pass
22.917(a) 24.238(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	0.560	2.5 ppm	247KGXW		GSM850
22H	824.2 - 848.8	0.120	2.5 ppm	253KG7W		EDGE850
24E	1850.2 - 1909.8	0.413	2.5 ppm	247KGXW		GSM1900
24E	1850.2 - 1909.8	0.132	2.5 ppm	248KG7W		EDGE1900
WCDMA						
22H	826.4 - 846.6	0.062	2.5 ppm	4M14F9W		WCDMA B5
24E	1852.4 - 1907.6	0.086	2.5 ppm	4M16F9W		WCDMA B2
LTE Band 5						
22H	829.0 - 844.0	0.082	2.5 ppm	8M96G7W	10	QPSK
22H	829.0 - 844.0	0.063	2.5 ppm	8M97D7W	10	16QAM

8. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

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	0.46	13.00
			EGPRS	3.40	
GSM1900	661	1880.0	GPRS	0.35	
			EGPRS	3.48	

WCDMA

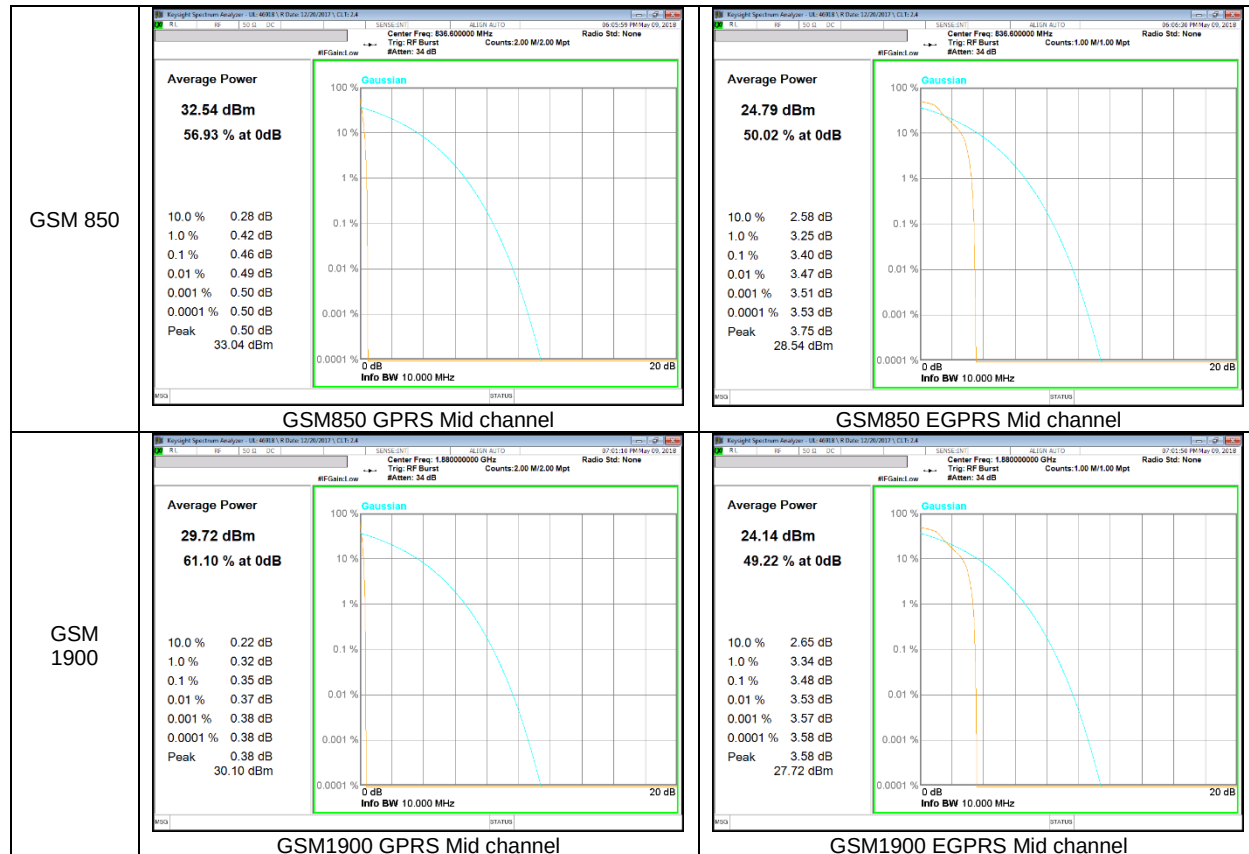
Band	Channel	f [MHz]	Mode	Ratio [dB]	Limit [dB]
Band 5	4183	836.6	REL99	2.93	13.00
			HSDPA	3.09	
Band 2	9400	1880.0	REL99	2.83	
			HSDPA	2.97	

LTE Band 5

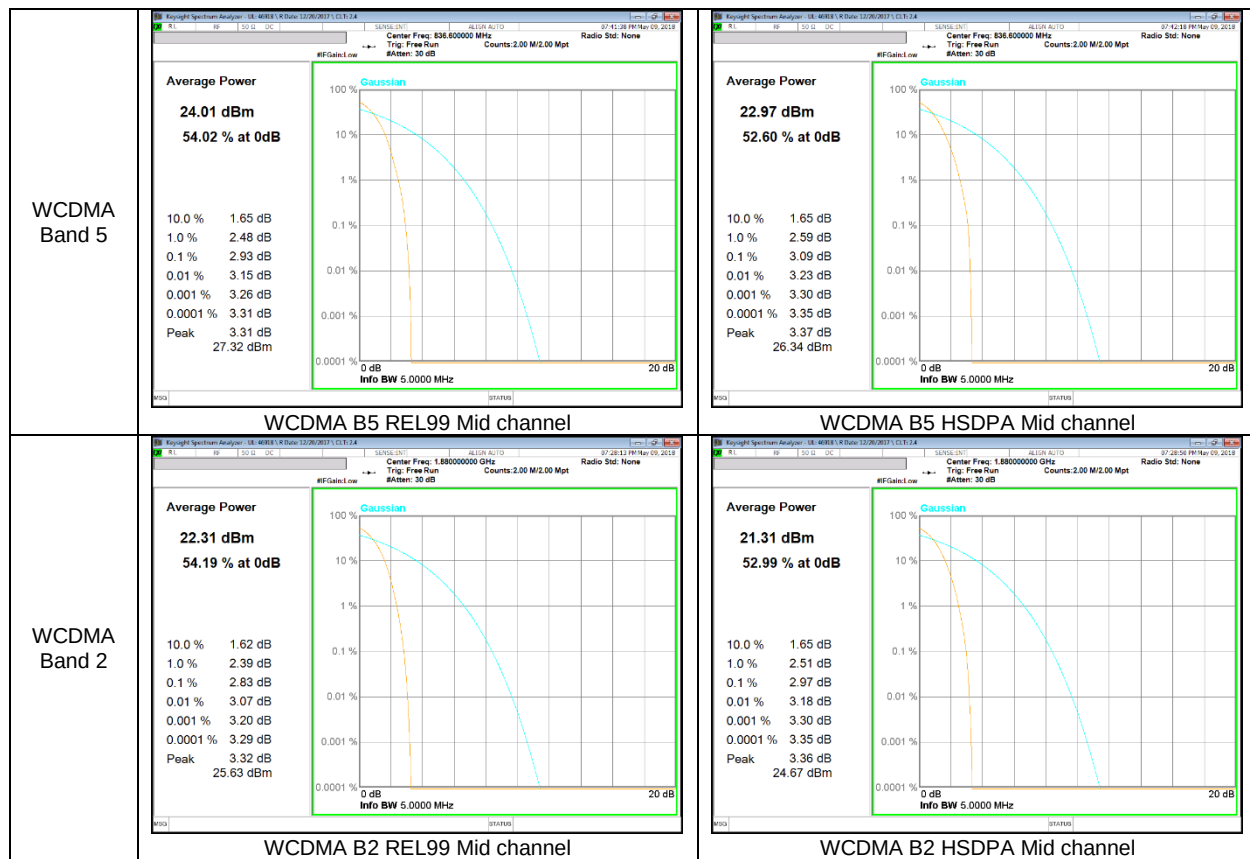
Band	BW [MHz]	Channel	f [MHz]	Mode	Ratio [dB]	Limit [dB]
Band 5	10	20525	836.5	QPSK	3.42	13.00
				16QAM	4.21	
	5			QPSK	3.42	
				16QAM	4.17	
	3			QPSK	3.44	
				16QAM	4.23	
	1.4			QPSK	3.46	
				16QAM	4.24	

8.2. CONDUCTED PEAK TO AVERAGE PLOTS

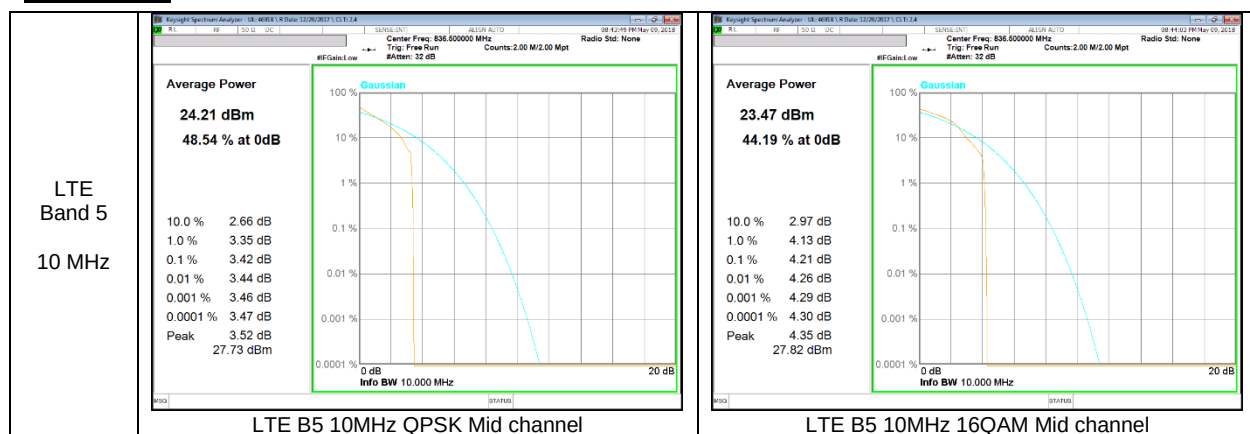
GSM

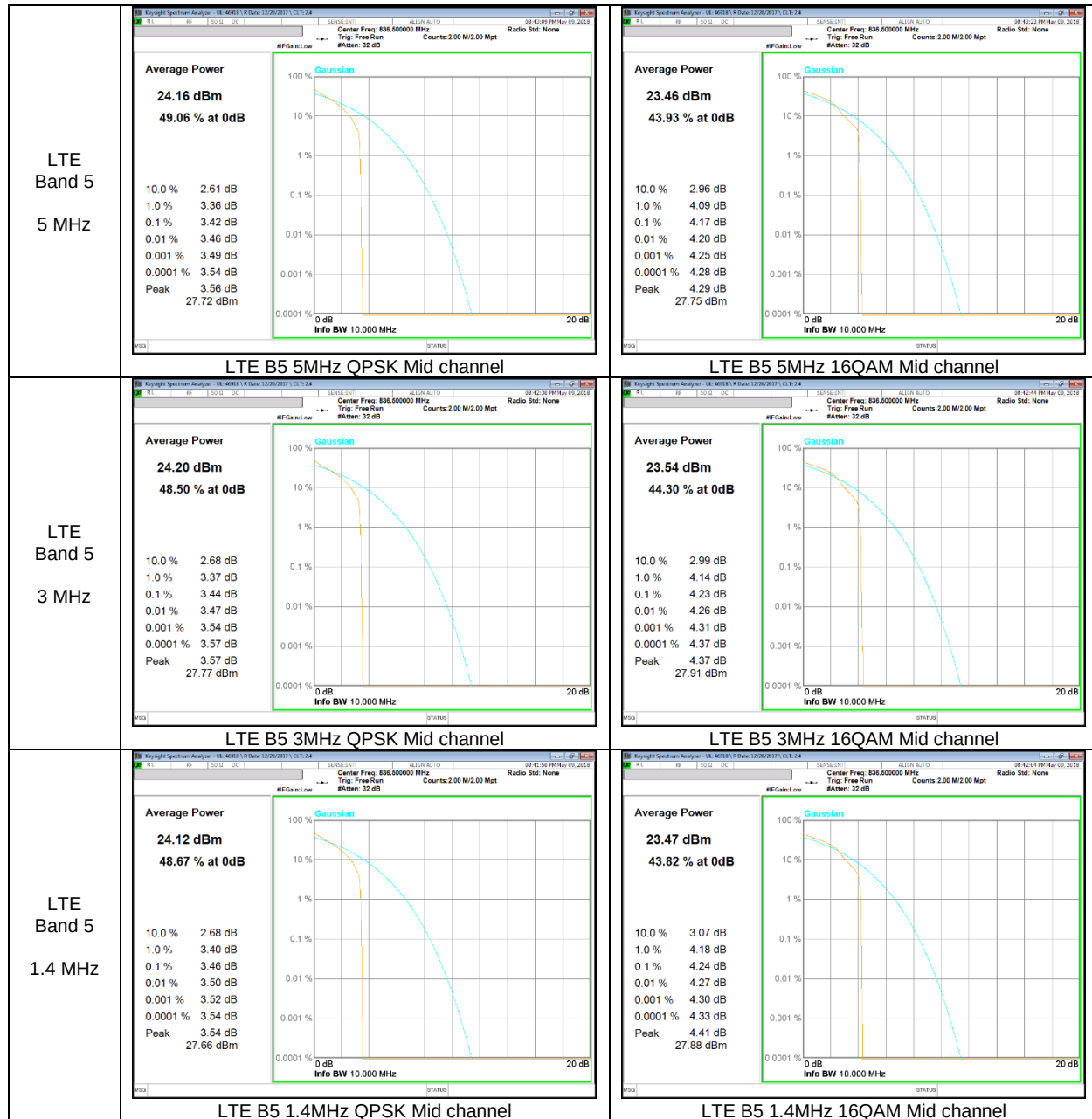


WCDMA



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 v03r01)

9.1.1. OCCUPIED BANDWIDTH RESULTS

GSM

Band	Mode	Channel	f [MHz]	99% BW [KHz]	26dB BW [KHz]
GSM850	GPRS	128	824.2	246.89	321.6
		190	836.6	244.07	307.4
		251	848.8	247.27	313.2
	EGPRS	128	1850.2	253.01	318.7
		190	1880.0	251.36	314.3
		251	1909.8	233.67	290.2
GSM1900	GPRS	512	1850.2	243.41	321.1
		661	1880.0	242.62	319.9
		810	1909.8	246.91	319.7
	EGPRS	512	1850.2	247.78	310.9
		661	1880.0	241.26	310.3
		810	1909.8	229.61	293.3

WCDMA

Band	Mode	Channel	f [MHz]	99% BW [MHz]	26dB BW [MHz]
Band 5	REL99	4132	826.4	4.1325	4.681
		4183	836.6	4.1367	4.674
		4233	846.6	4.1326	4.691
	HSDPA	4132	826.4	4.1225	4.689
		4183	836.6	4.1369	4.671
		4233	846.6	4.1267	4.657
Band 2	REL99	9262	1852.4	4.1366	4.709
		9400	1880.0	4.1411	4.707
		9538	1907.6	4.1558	4.701
	HSDPA	9262	1852.4	4.1353	4.681
		9400	1880.0	4.1492	4.673
		9538	1907.6	4.1524	4.697

LTE Band 5

Band	BW [MHz]	Channel	f [MHz]	Mode	99% BW [MHz]	26dB BW [MHz]
Band 5	10	20450	829.0	QPSK	8.9365	9.859
				16QAM	8.9279	9.836
		20524	836.5	QPSK	8.9568	9.822
				16QAM	8.9537	9.798
		20599	844.0	QPSK	8.9431	9.818
				16QAM	8.9668	9.814
	5	20425	826.5	QPSK	4.5044	4.958
				16QAM	4.4874	4.950
		20524	836.5	QPSK	4.4890	4.948
				16QAM	4.4902	4.948
		20624	846.5	QPSK	4.4869	4.926
				16QAM	4.4795	4.920
	3	20415	825.5	QPSK	2.6889	2.976
				16QAM	2.6917	2.958
		20524	836.5	QPSK	2.6940	2.976
				16QAM	2.6938	2.978
		20634	847.5	QPSK	2.6928	2.958
				16QAM	2.6849	2.974
	1.4	20407	824.7	QPSK	1.0947	1.299
				16QAM	1.0847	1.273
		20524	836.5	QPSK	1.0839	1.278
				16QAM	1.0841	1.273
		20624	848.3	QPSK	1.0897	1.311
				16QAM	1.0949	1.299

9.1.2. OCCUPIED BANDWIDTH PLOTS

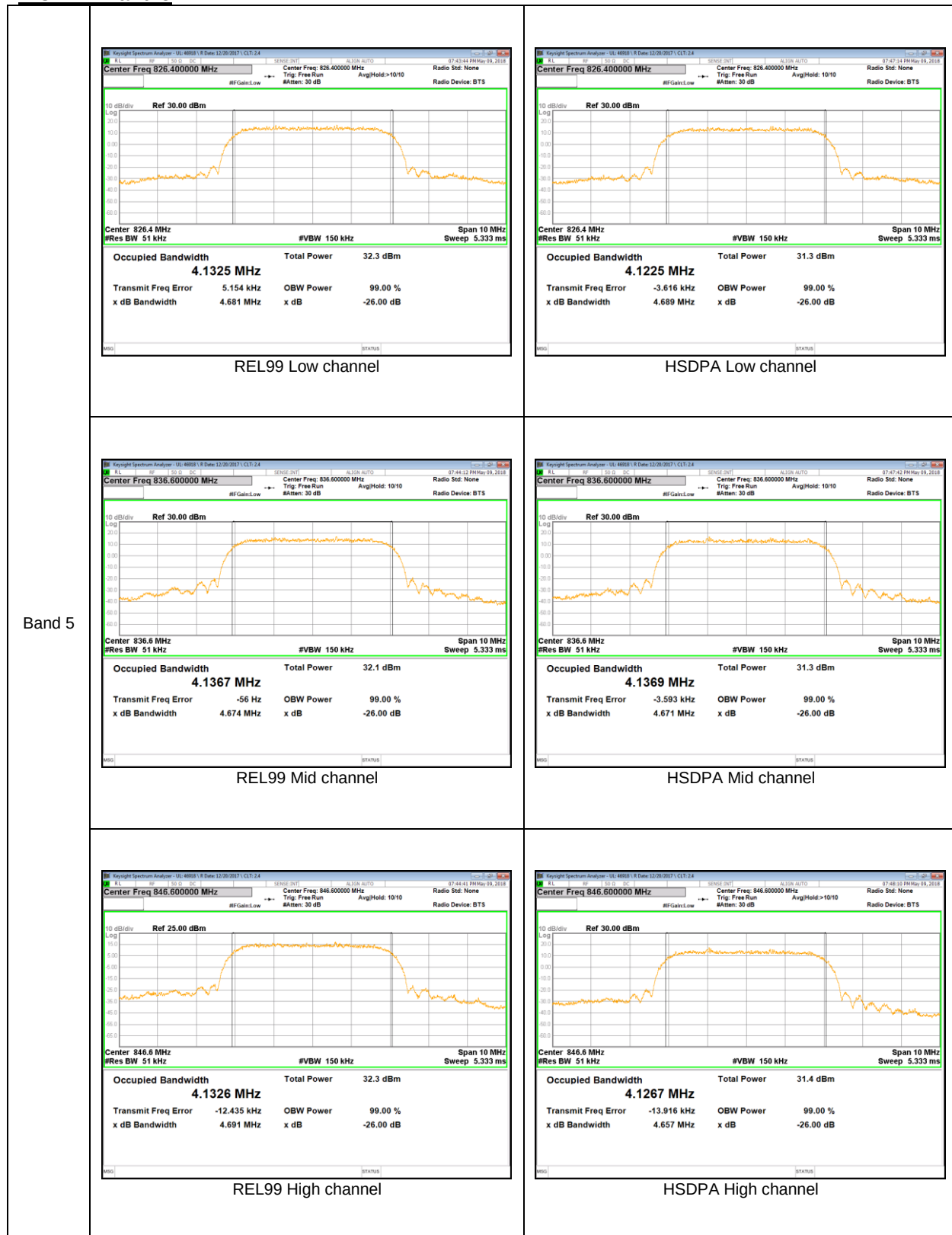
GSM 850



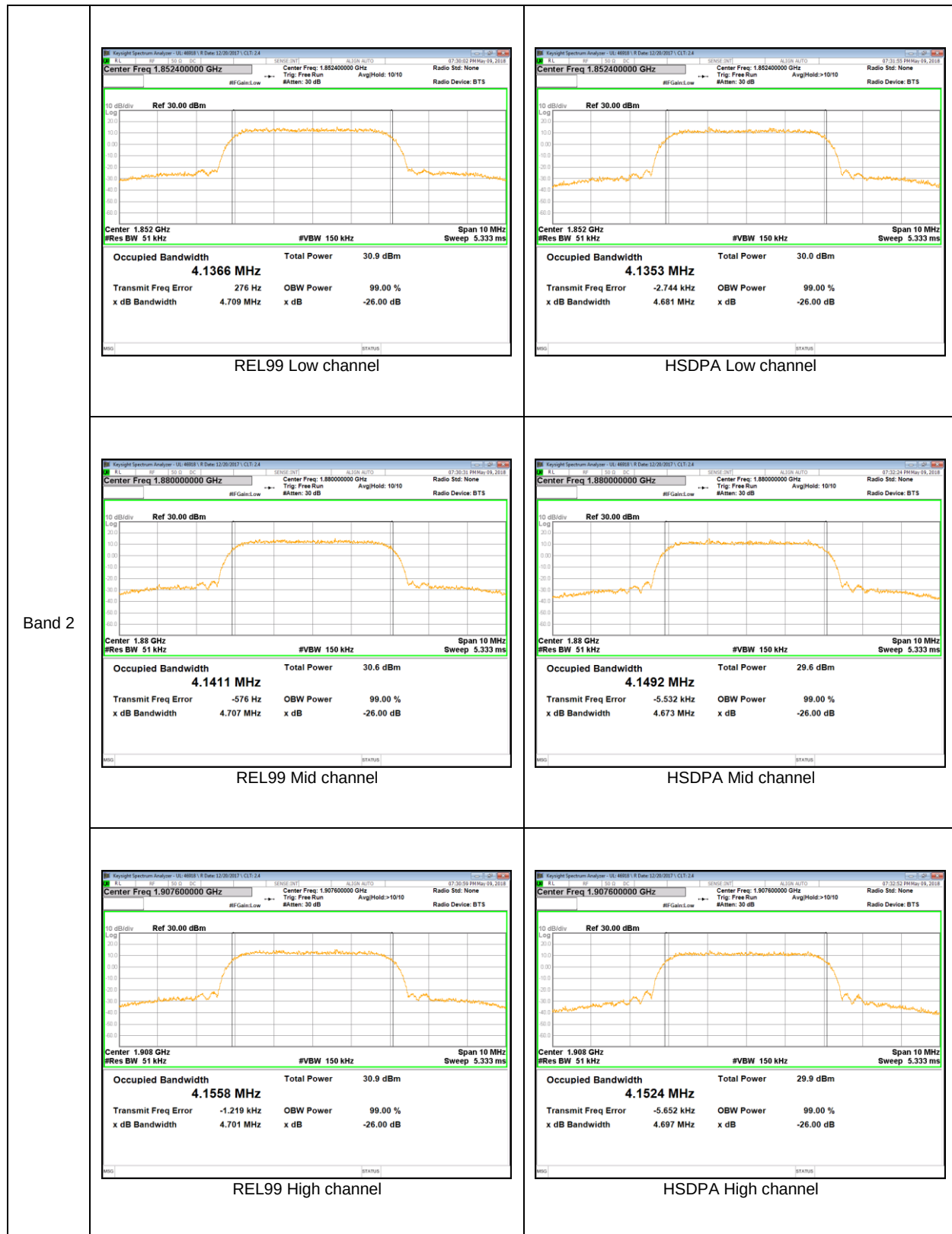
GSM 1900



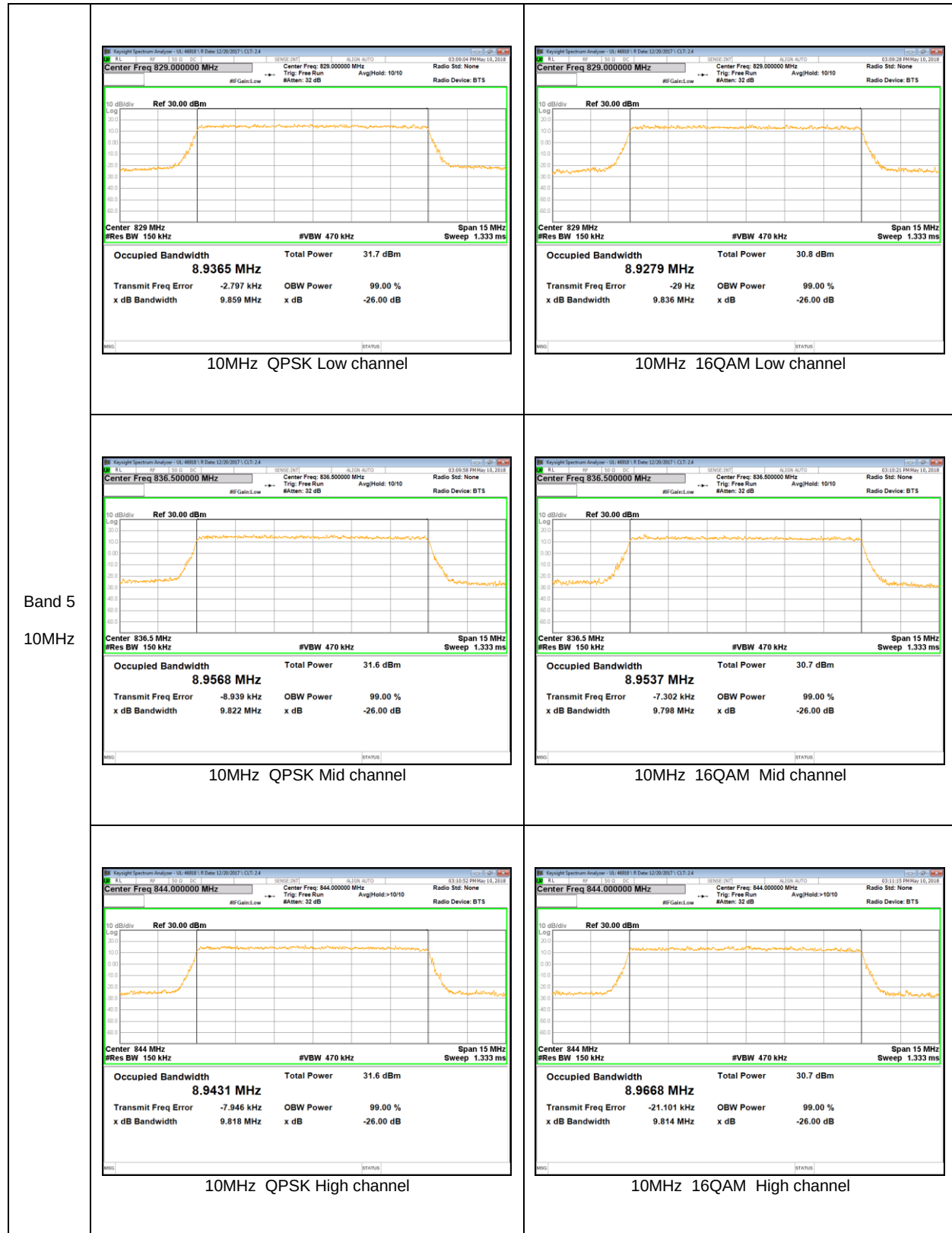
WCDMA Band 5

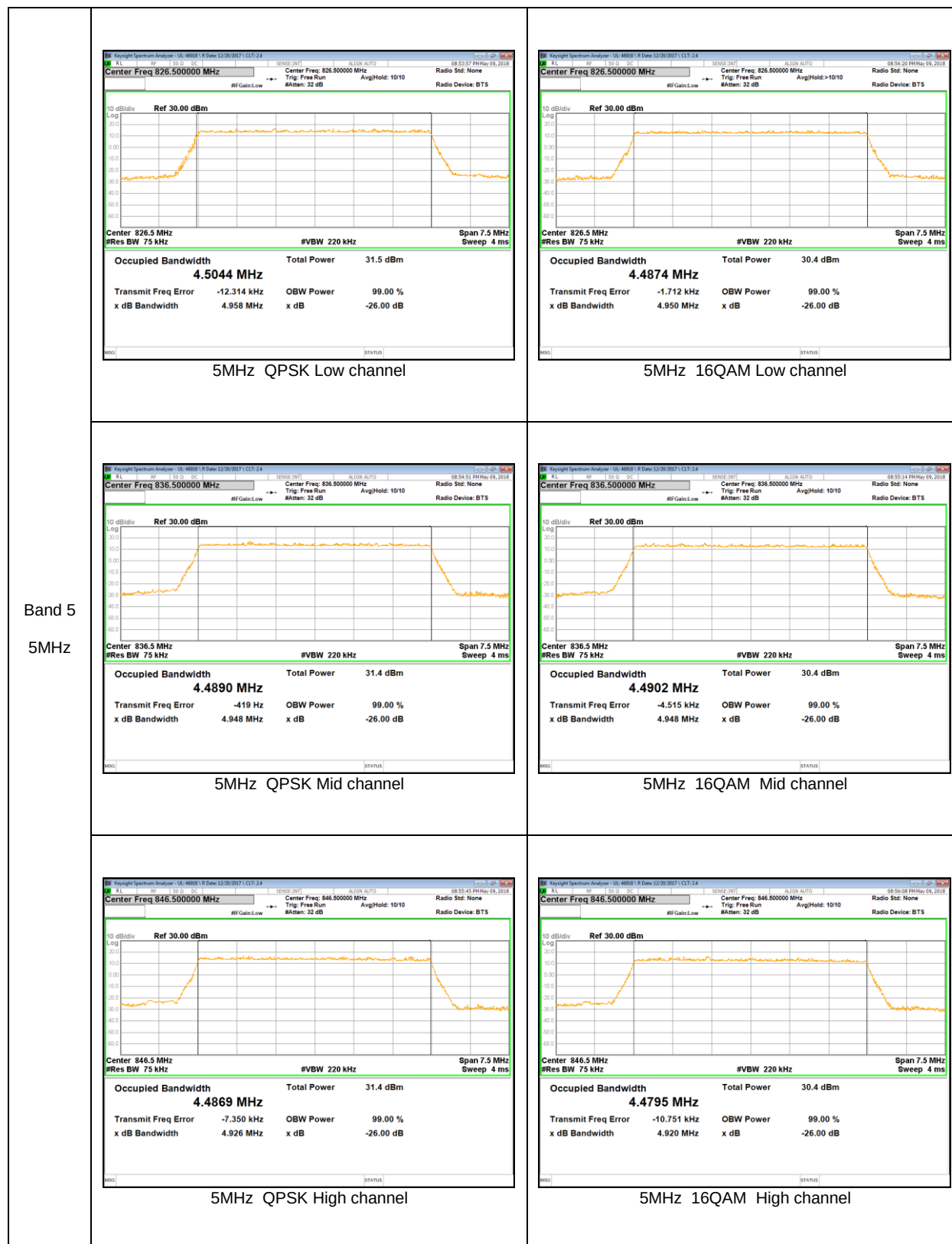


WCDMA Band 2



LTE Band 5









9.2. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §22.359, §24.238

LIMITS

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

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

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

The transmitter output was connected to 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	-15.632	-13.00
		Upper	849.023	-15.530	
	EGPRS	Lower	823.987	-25.065	
		Upper	849.023	-22.054	
GSM1900	GPRS	Lower	1849.982	-19.127	
		Upper	1910.023	-18.140	
	EGPRS	Lower	1849.992	-24.347	
		Upper	1910.008	-22.989	

WCDMA

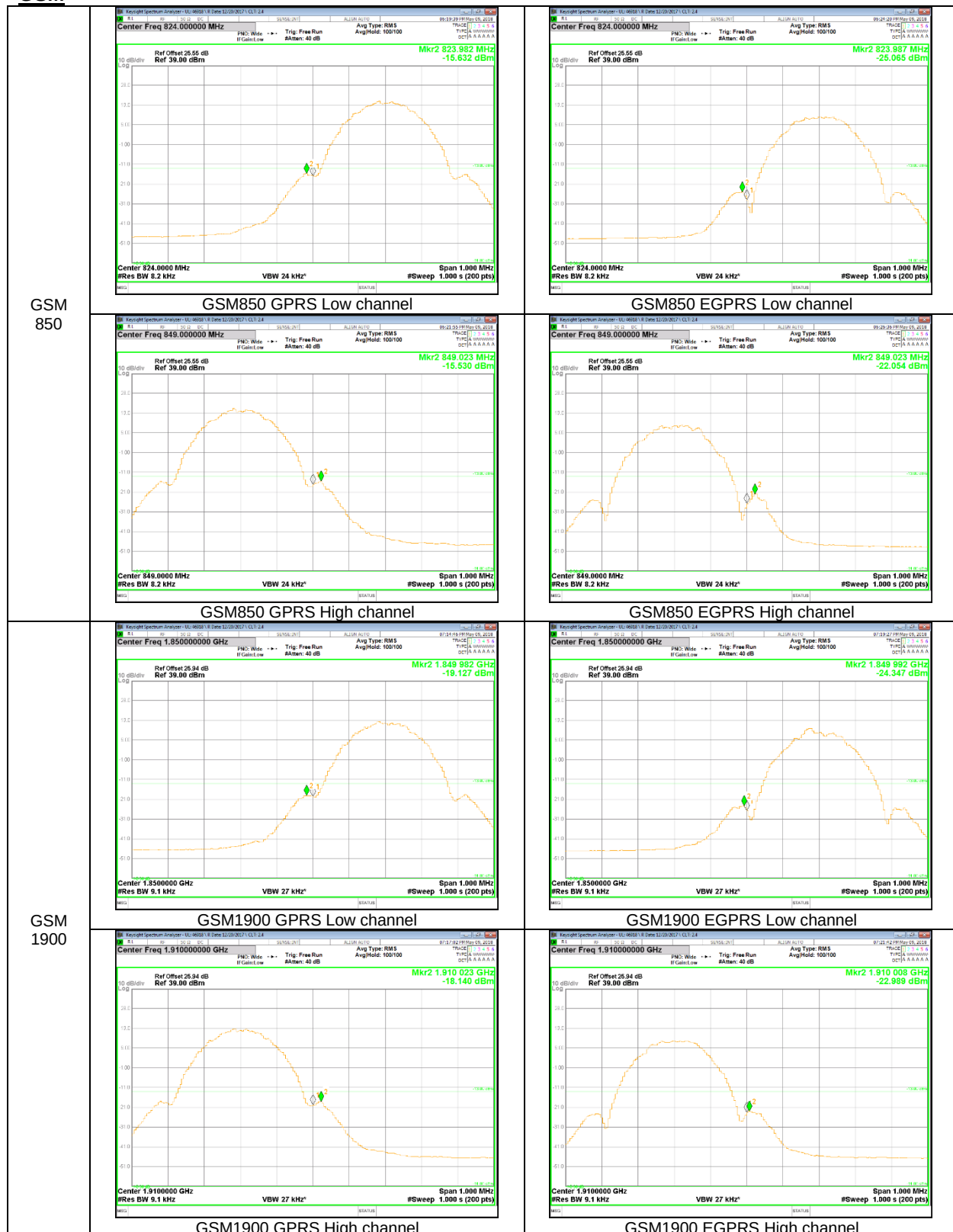
Band	Mode	Side	f [MHz]	Level [dBm]	Limit [dBm]
Band 5	REL99	Lower	824.000	-25.296	-13.00
		Upper	849.000	-26.813	
	HSDPA	Lower	824.000	-29.230	
		Upper	849.000	-28.916	
Band 2	REL99	Lower	1850.000	-24.951	
		Upper	1910.000	-26.284	
	HSDPA	Lower	1850.000	-28.974	
		Upper	1910.000	-28.190	

LTE 5

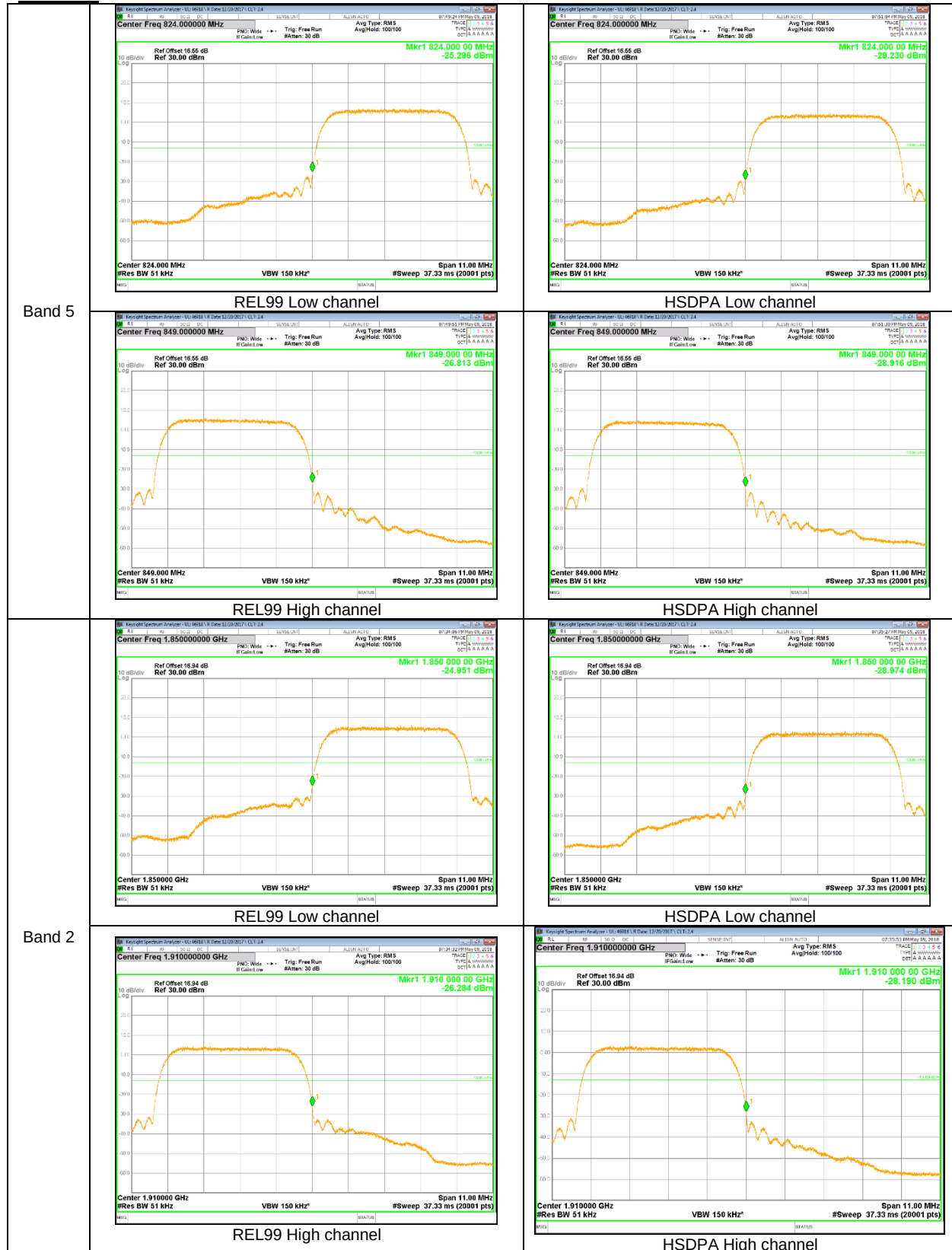
Bandwidth	Mode	Side	RB Status	f [MHz]	Level [dBm]	Limit [dBm]
10 MHz	QPSK	Lower	1RB	824.000	-33.420	-13.00
			FRB	824.000	-28.969	
		Upper	1RB	849.000	-29.234	
			FRB	849.000	-32.337	
	16QAM	Lower	1RB	824.000	-33.556	
			FRB	824.000	-31.558	
		Upper	1RB	849.000	-28.631	
			FRB	849.000	-33.291	
5 MHz	QPSK	Lower	1RB	824.000	-20.251	
			FRB	824.000	-29.145	
		Upper	1RB	849.000	-20.180	
			FRB	849.000	-28.932	
	16QAM	Lower	1RB	824.000	-22.590	
			FRB	824.000	-29.514	
		Upper	1RB	849.000	-19.060	
			FRB	849.000	-30.573	
3 MHz	QPSK	Lower	1RB	824.000	-19.643	
			FRB	824.000	-28.837	
		Upper	1RB	849.000	-19.136	
			FRB	849.000	-27.972	
	16QAM	Lower	1RB	824.000	-20.532	
			FRB	824.000	-29.060	
		Upper	1RB	849.000	-19.598	
			FRB	849.000	-29.491	
1.4 MHz	QPSK	Lower	1RB	824.000	-21.584	
			FRB	824.000	-29.643	
		Upper	1RB	849.000	-21.243	
			FRB	849.000	-29.853	
	16QAM	Lower	1RB	824.000	-23.248	
			FRB	824.000	-30.896	
		Upper	1RB	849.000	-23.964	
			FRB	849.000	-31.294	

9.2.1. BAND EDGE PLOTS

GSM



WCDMA



LTE Band 5

