



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

WWAN

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER : SM-A605FN/DS, SM-A605FN, SM-A605X

FCC ID: A3LSMA605FN

REPORT NUMBER: 4788372835-E7V2

ISSUE DATE: MAR 26, 2018

Prepared for
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TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	03/20/18	Initial issue	Junwhan Lee
V2	03/26/18	Updated to address TCB's question	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, DTS/UNII a/b/g/n, ANT+ and NFC

MODEL NUMBER: SM-A605FN/DS, SM-A605FN, SM-A605X

SERIAL NUMBER: R38K108QG5F, R38K104R4WF(RADIATED);
R38K104QAPL (CONDUCTED);

DATE TESTED: FEB 22, 2018 - MAR 19, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22H and 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
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Suwon Lab Engineer
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Tested By:



Junwhan 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 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	
☒	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, DTS/UNII a/b/g/n, ANT+ and NFC.
This test report addresses the WWAN operational mode.

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.(4788372835-S1V1 FCC Report SAR)

GSM

FCC Part 22/24						
Band	Frequency Range	Modulation	Conducted		Radiated	
	[MHz]	Peak	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
GSM850	824~849	GMSK	33.9	2454.71		
		GPRS	33.8	2398.83	27.04	505.82
		EGPRS	27.0	501.19	20.78	119.67
GSM1900	1850~1910	GMSK	30.5	1122.02		
		GPRS	30.3	1071.52	29.66	924.70
		EGPRS	25.7	371.54	26.30	426.58

WCDMA

FCC Part 22/24						
Band	Frequency Range	Modulation	Conducted		Radiated	
	[MHz]	Peak	Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	824~849	REL99	24.1	257.04	17.93	62.09
		HSDPA	23.1	204.17	17.43	55.34
		HSUPA	23.1	204.17		
		DC-HSDPA	23.1	204.17		
Band 2	1850~1910	REL99	23.6	229.09	21.40	138.04
		HSDPA	22.6	181.97	20.43	110.41
		HSUPA	22.6	181.97		
		DC-HSDPA	22.6	181.97		

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	24.7	295.12	16.32	42.85
			16QAM	23.8	239.88	15.50	35.48
		5	QPSK	24.4	275.42	16.08	40.55
			16QAM	23.9	245.47	15.07	32.14
		3	QPSK	24.4	275.42	16.45	44.16
			16QAM	23.9	245.47	15.42	34.83
		1.4	QPSK	24.4	275.42	13.98	25.00
			16QAM	23.7	234.42	13.14	20.61

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	-4.45
GSM1900 / WCDMA Band 2 1850 ~ 1910 MHz	-2.78

5.4. WORST-CASE 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 Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z 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 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	DW3J719AS/A- E	N/A
Data Cable	SAMSUNG	ECB-DU68WE	N/A	N/A
Earphone	SAMSUNG	EHS61ASFWE	N/A	N/A

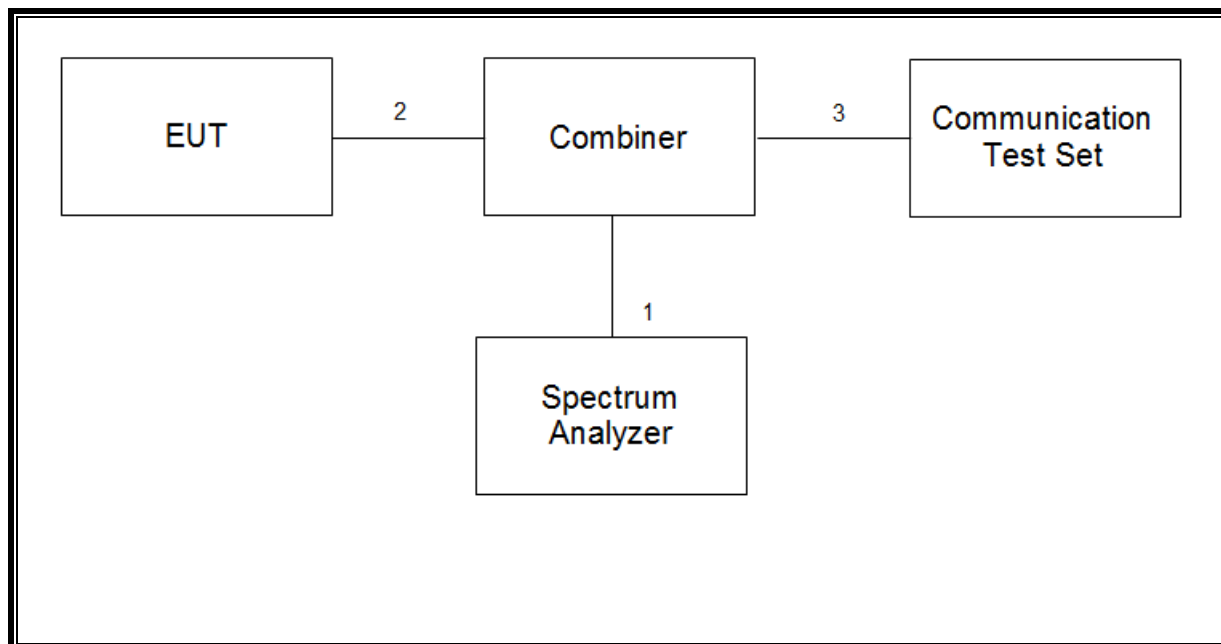
I/O CABLES

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

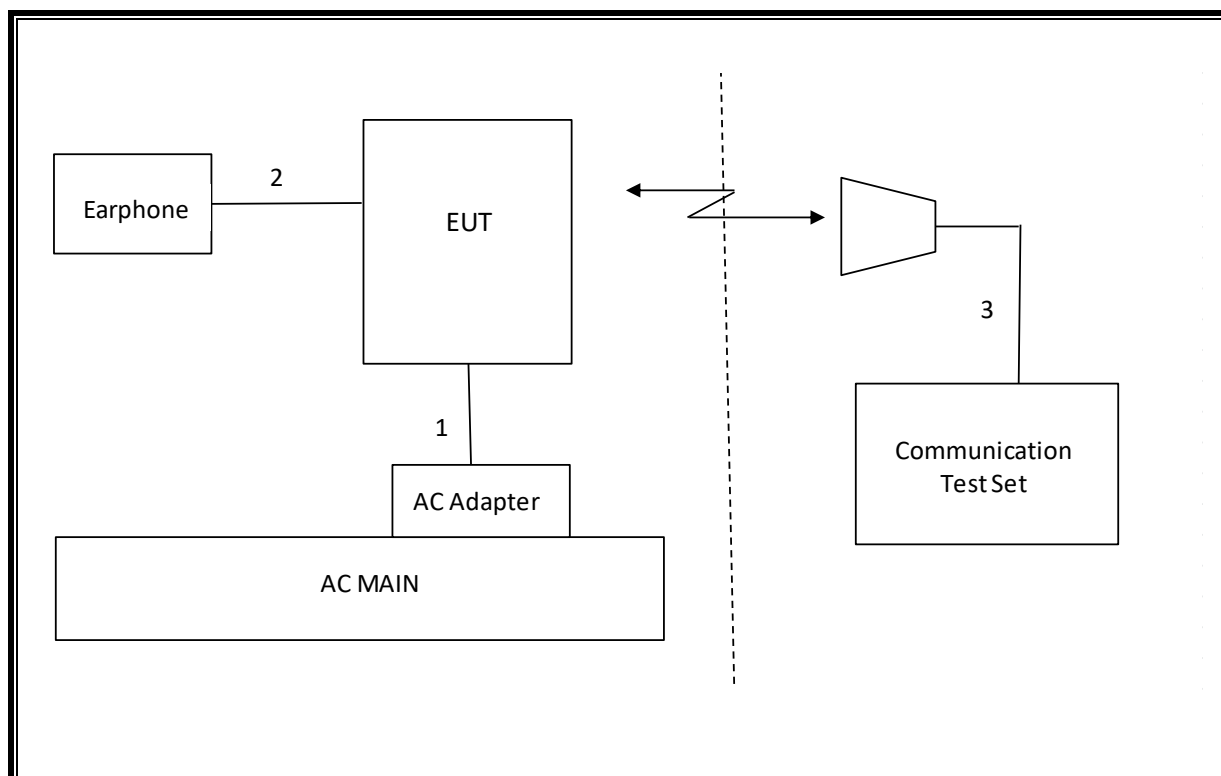
TEST SETUP

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) 24.238(a)	Band Edge / Conducted Spurious Emission	-13dBm		Pass
2.1046	Conducted output power	N/A		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	0.506	2.5 ppm	246KGXW		GSM850
22H	824.2 - 848.8	0.120	2.5 ppm	255KG7W		EDGE850
24E	1850.2 - 1909.8	0.925	2.5 ppm	248KGXW		GSM1900
24E	1850.2 - 1909.8	0.427	2.5 ppm	246KG7W		EDGE1900
WCDMA						
22H	826.4 - 846.6	0.062	2.5 ppm	4M13F9W		WCDMA B5
24E	1852.4 - 1907.6	0.138	2.5 ppm	4M16F9W		WCDMA B2
LTE Band 5						
22H	829.0 - 844.0	0.043	2.5 ppm	8M97G7W	10	QPSK
22H	829.0 - 844.0	0.035	2.5 ppm	8M97D7W	10	16QAM
22H	825.5 - 847.5	0.044	2.5 ppm	2M69G7W	3	QPSK

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	0.38	13.00
			EGPRS	3.45	
GSM1900	661	1880.0	GPRS	0.41	
			EGPRS	3.52	

WCDMA

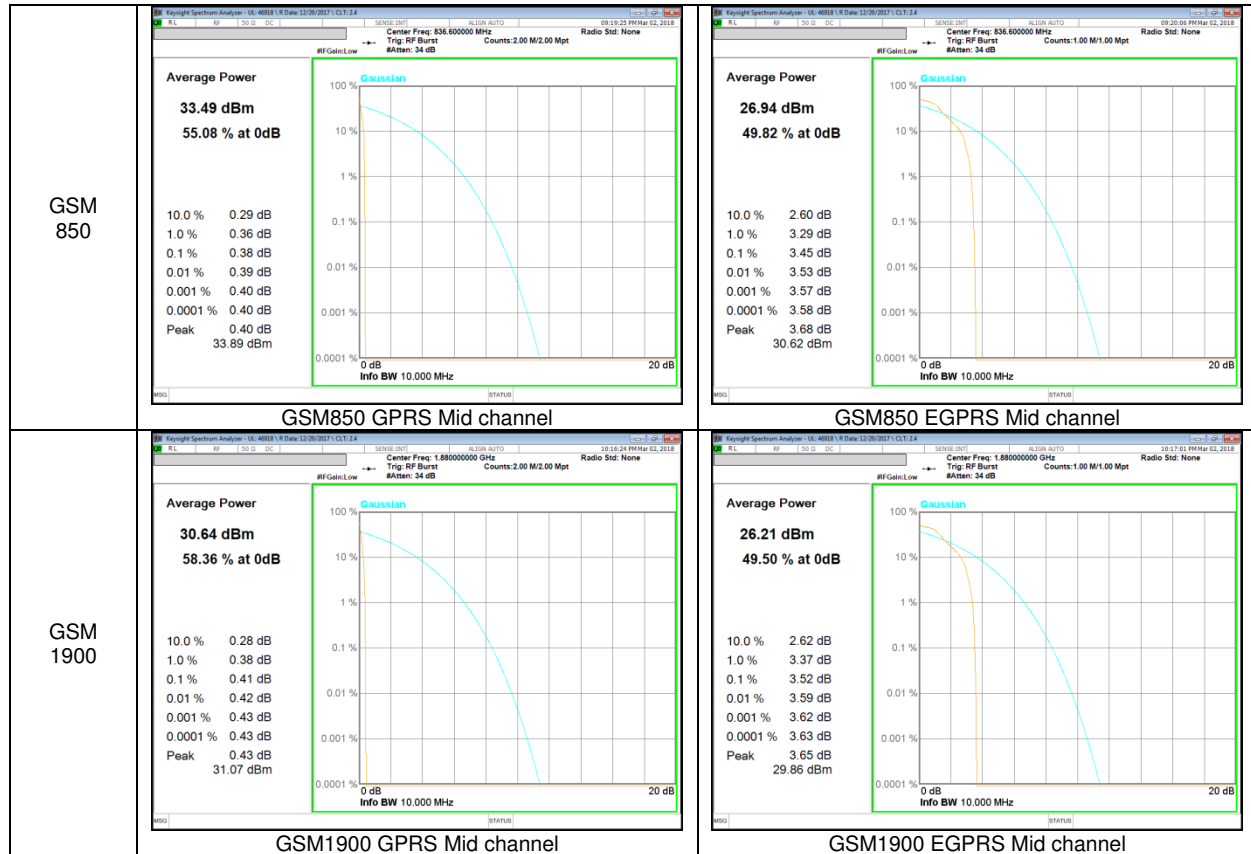
Band	Channel	f [MHz]	Mode	Ratio [dB]	Limit [dB]
Band 5	4183	836.6	REL99	2.93	13.00
			HSDPA	3.08	
Band 2	9400	1880.0	REL99	2.89	
			HSDPA	3.04	

LTE Band 5

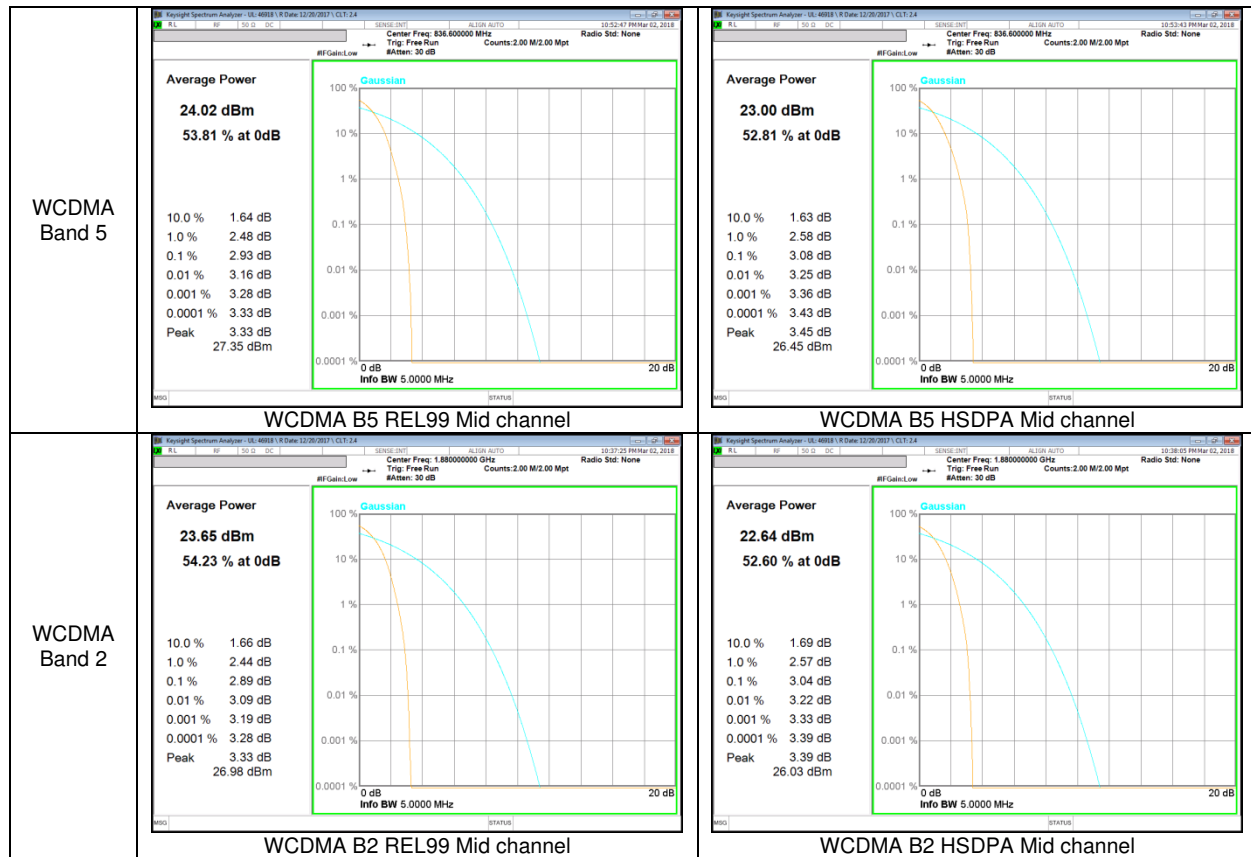
Band	BW [MHz]	Channel	f [MHz]	Mode	Ratio [dB]	Limit [dB]
Band 5	10	20525	836.5	QPSK	3.54	13.00
				16QAM	4.29	
	5			QPSK	3.51	
				16QAM	4.27	
	3			QPSK	3.49	
				16QAM	4.32	
	1.4			QPSK	3.48	
				16QAM	4.34	

8.2. CONDUCTED PEAK TO AVERAGE PLOTS

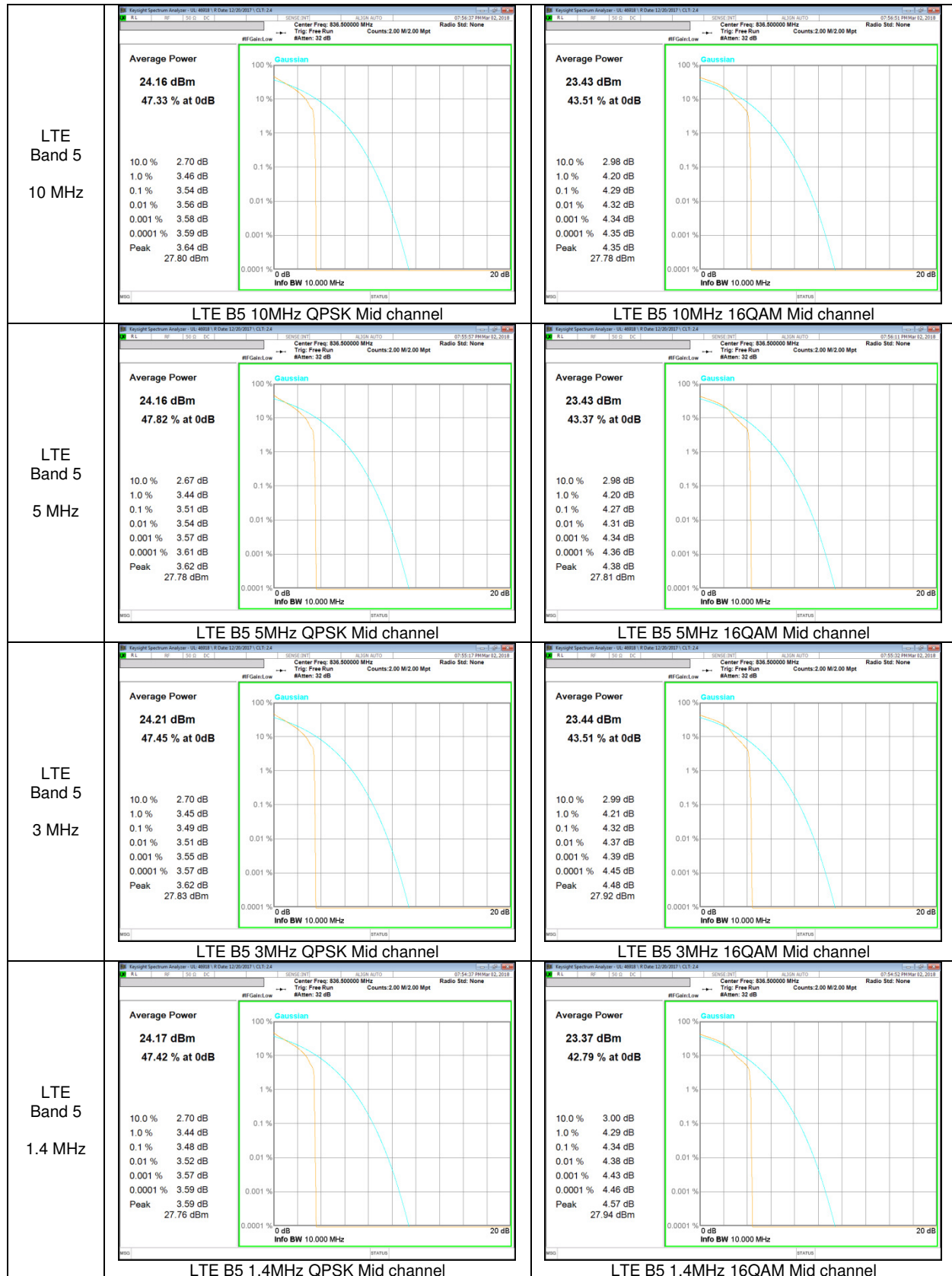
GSM



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	244.47	315.1
		190	836.6	245.59	326.2
		251	848.8	241.08	316.9
	EGPRS	128	824.2	255.07	319.0
		190	836.6	238.34	302.6
		251	848.8	245.21	296.3
GSM1900	GPRS	512	1850.2	242.43	315.3
		661	1880.0	248.32	313.6
		810	1909.8	247.01	320.2
	EGPRS	512	1850.2	245.93	303.4
		661	1880.0	234.08	301.2
		810	1909.8	241.77	309.4

WCDMA

Band	Mode	Channel	f [MHz]	99% BW [MHz]	26dB BW [MHz]
Band 5	REL99	4132	826.4	4.1265	4.657
		4183	836.6	4.1261	4.695
		4233	846.6	4.1333	4.680
	HSDPA	4132	826.4	4.1294	4.666
		4183	836.6	4.1271	4.696
		4233	846.6	4.1328	4.679
Band 2	REL99	9262	1852.4	4.1481	4.696
		9400	1880.0	4.1353	4.682
		9538	1907.6	4.1463	4.704
	HSDPA	9262	1852.4	4.1531	4.667
		9400	1880.0	4.1562	4.684
		9538	1907.6	4.1522	4.670

LTE Band 5

Band	BW [MHz]	Channel	f [MHz]	Mode	99% BW [MHz]	26dB BW [MHz]
Band 5	10	20450	829.0	QPSK	8.9549	9.768
				16QAM	8.9694	9.814
		20524	836.5	QPSK	8.9428	9.812
				16QAM	8.9557	9.780
		20599	844.0	QPSK	8.9689	9.749
				16QAM	8.9419	9.729
	5	20425	826.5	QPSK	4.4985	4.970
				16QAM	4.4927	4.985
		20524	836.5	QPSK	4.4889	4.952
				16QAM	4.4881	4.952
		20624	846.5	QPSK	4.4950	4.945
				16QAM	4.4826	4.928
	3	20415	825.5	QPSK	2.6919	2.975
				16QAM	2.6949	2.948
		20524	836.5	QPSK	2.6909	2.970
				16QAM	2.6908	2.969
		20634	847.5	QPSK	2.6931	2.979
				16QAM	2.6898	2.980
	1.4	20407	824.7	QPSK	1.0952	1.296
				16QAM	1.0834	1.283
		20524	836.5	QPSK	1.0830	1.269
				16QAM	1.0842	1.283
		20624	848.3	QPSK	1.0873	1.311
				16QAM	1.0930	1.287

9.1.2. OCCUPIED BANDWIDTH PLOTS

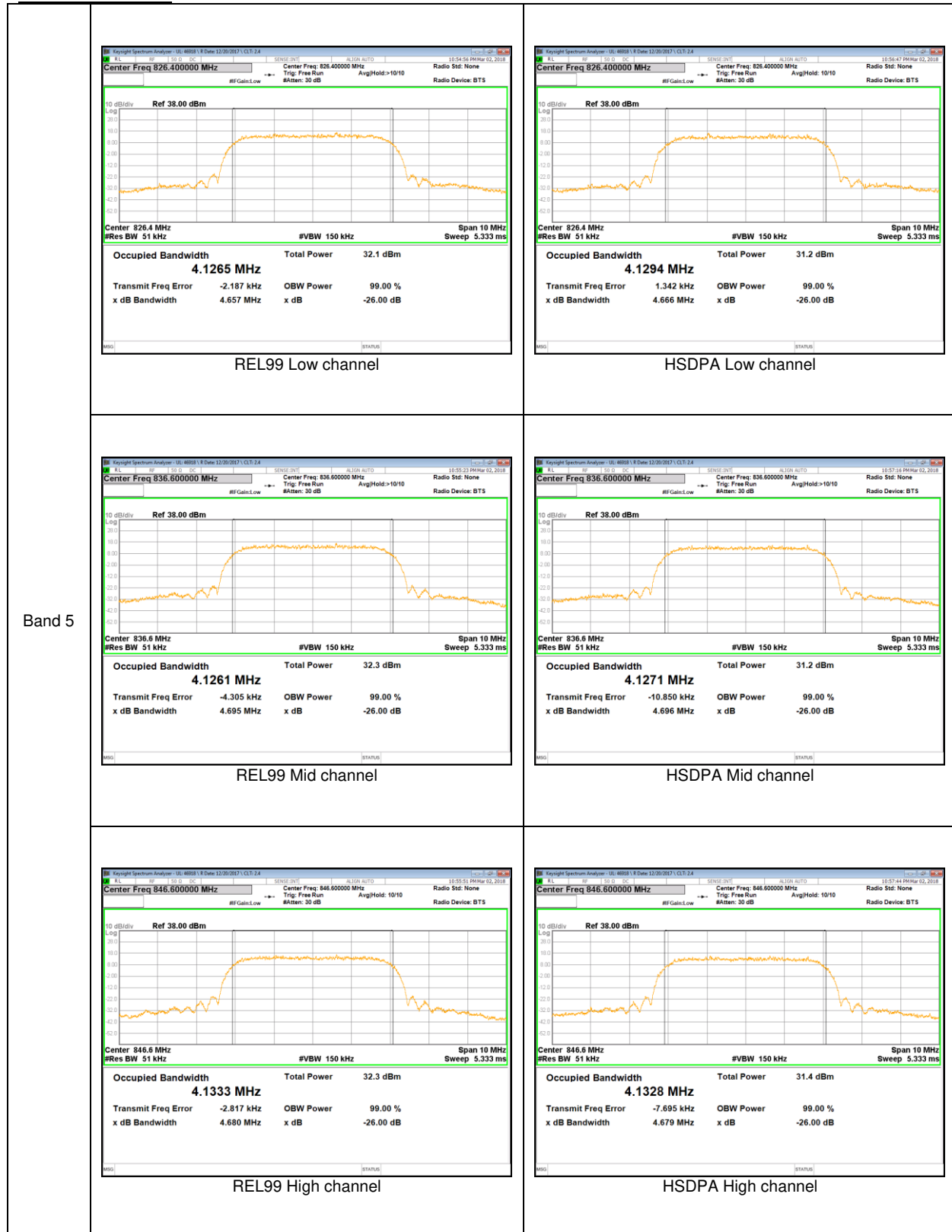
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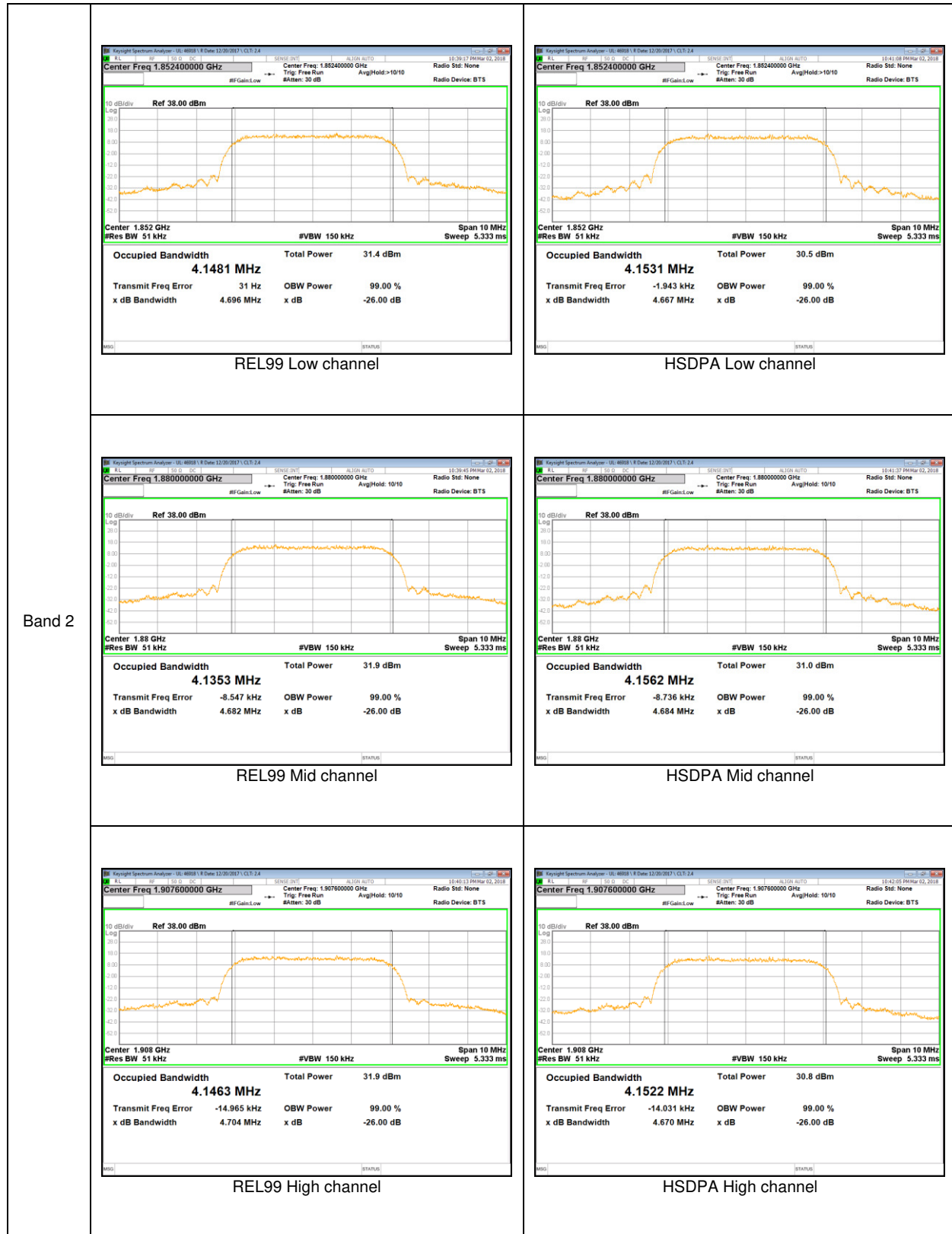
GSM 1900



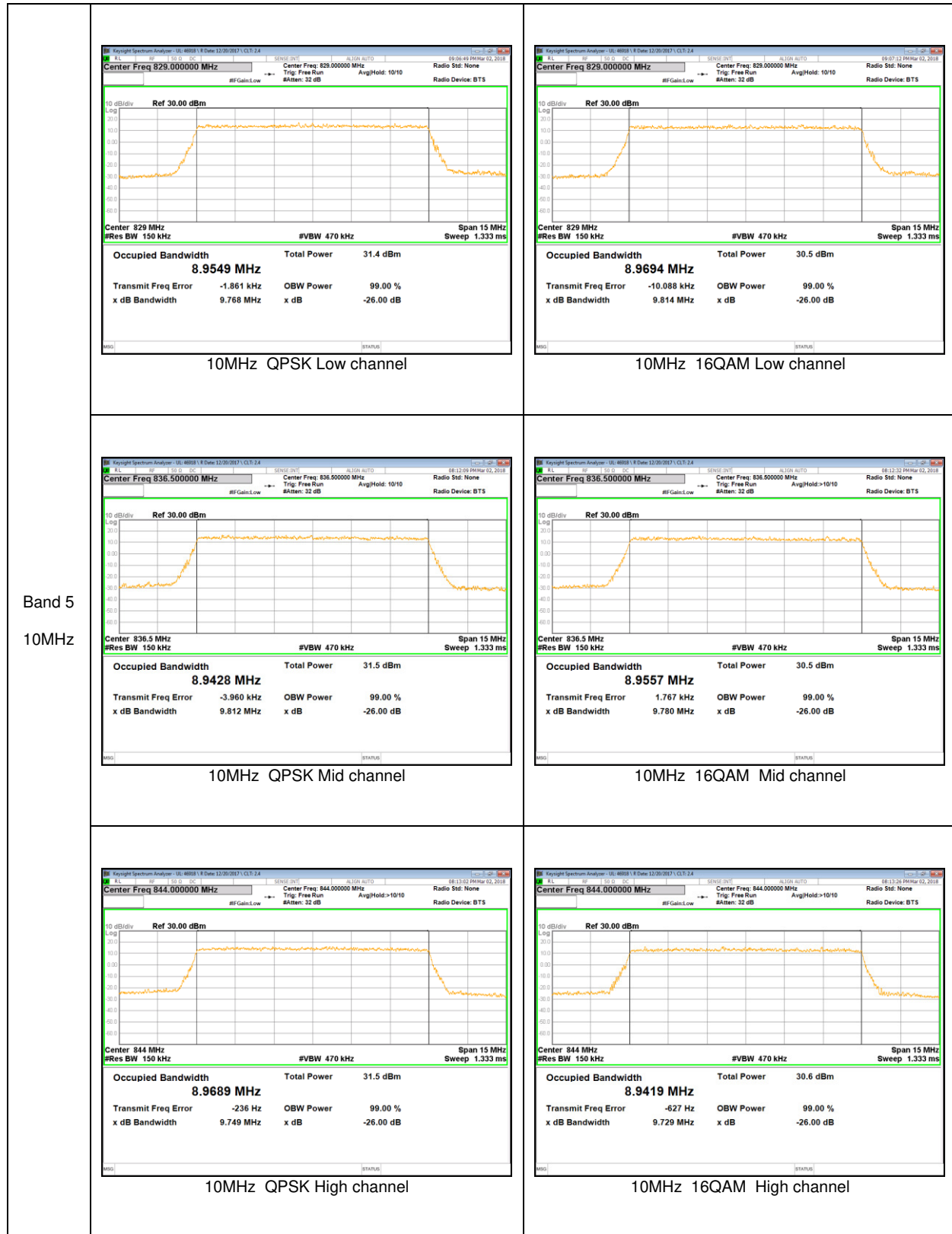
WCDMA Band 5

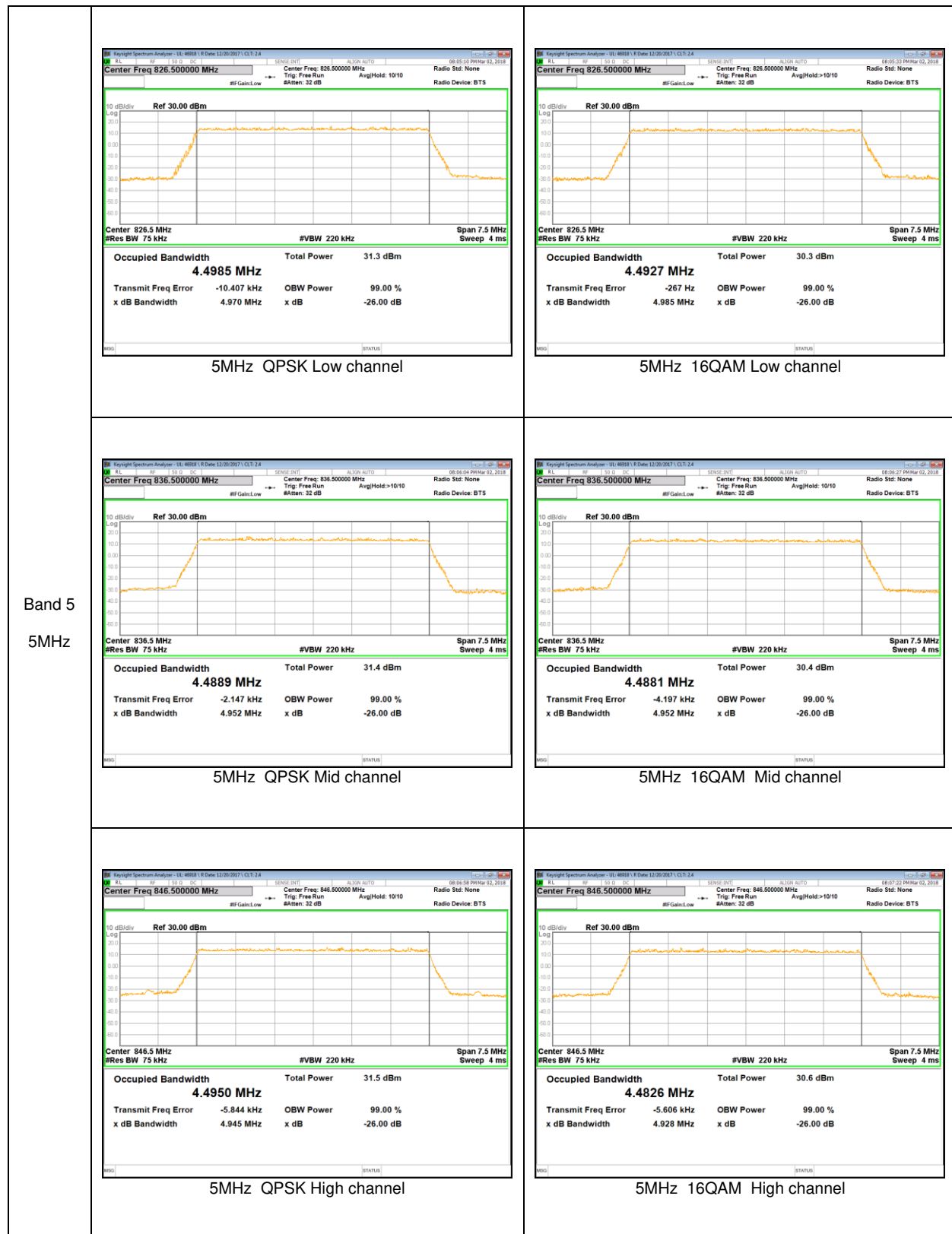


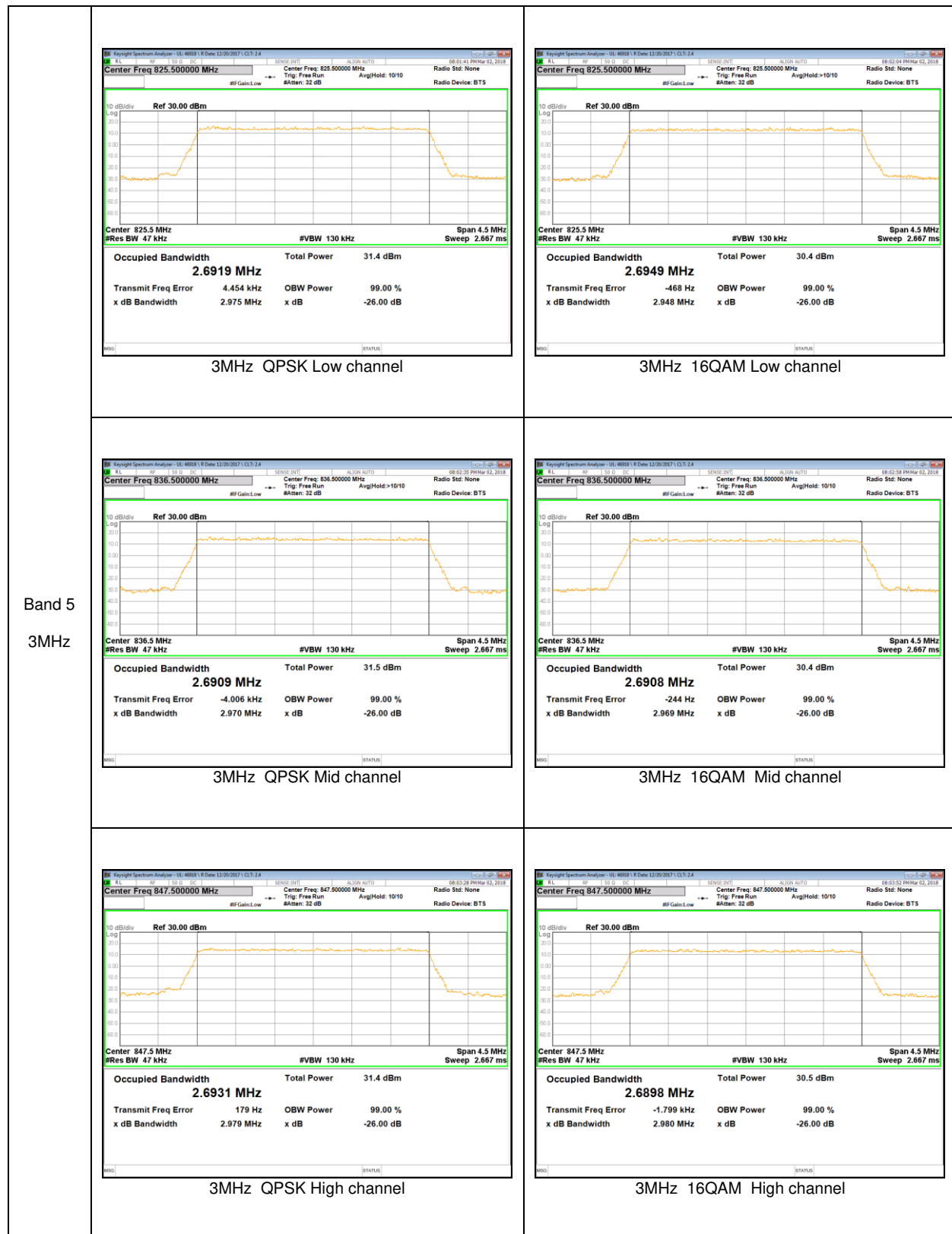
WCDMA Band 2

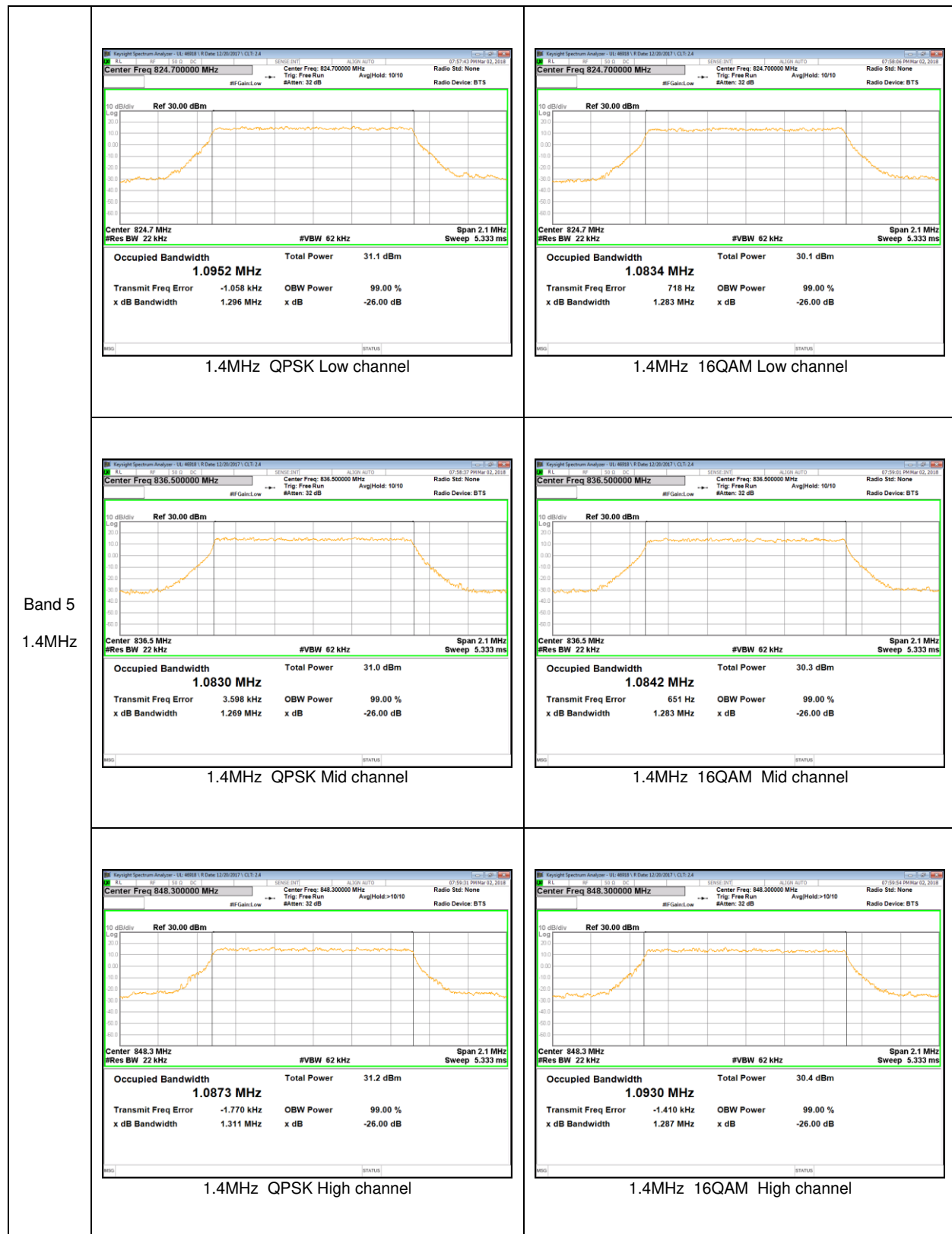


LTE Band 5









9.2. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §22.359, §24.238 and §27. 53(m)

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 $\geq 2 \times \text{Span} / \text{RBW}$;
- 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 $\geq 2 \times \text{Span} / \text{RBW}$;
- g) Trace mode = Average (100);

RESULTS

GSM

Band	Mode	Side	f [MHz]	Level [dBm]	Limit [dBm]
GSM850	GPRS	Lower	823.982	-15.471	-13.00
		Upper	849.018	-14.954	
	EGPRS	Lower	823.982	-23.419	
		Upper	849.018	-23.359	
GSM1900	GPRS	Lower	1849.982	-17.461	
		Upper	1910.018	-17.545	
	EGPRS	Lower	1849.987	-23.139	
		Upper	1910.018	-23.665	

WCDMA

Band	Mode	Side	f [MHz]	Level [dBm]	Limit [dBm]
Band 5	REL99	Lower	824.000	-26.128	-13.00
		Upper	849.000	-26.874	
	HSDPA	Lower	824.000	-28.785	
		Upper	849.000	-28.024	
Band 2	REL99	Lower	1850.000	-26.296	
		Upper	1910.000	-25.995	
	HSDPA	Lower	1850.000	-29.987	
		Upper	1910.000	-29.345	

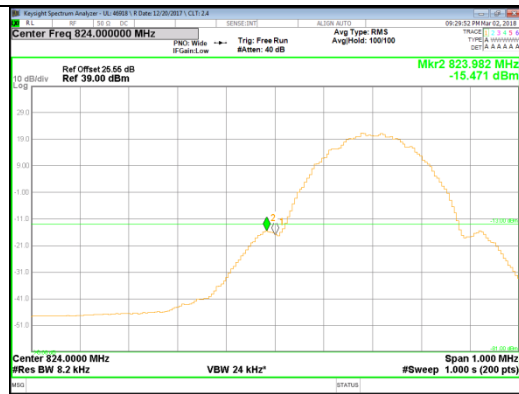
LTE 5

Bandwidth	Mode	Side	RB Status	f [MHz]	Level [dBm]	Limit [dBm]
10 MHz	QPSK	Lower	1RB	824.000	-29.666	-13.00
			FRB	824.000	-32.007	
		Upper	1RB	849.000	-29.025	
			FRB	849.000	-30.974	
	16QAM	Lower	1RB	824.000	-30.350	
			FRB	824.000	-32.407	
		Upper	1RB	849.000	-31.135	
			FRB	849.000	-33.119	
5 MHz	QPSK	Lower	1RB	824.000	-21.725	
			FRB	824.000	-28.711	
		Upper	1RB	849.000	-20.575	
			FRB	849.000	-28.470	
	16QAM	Lower	1RB	824.000	-22.361	
			FRB	824.000	-32.811	
		Upper	1RB	849.000	-21.221	
			FRB	849.000	-31.134	
3 MHz	QPSK	Lower	1RB	824.000	-19.697	
			FRB	824.000	-30.350	
		Upper	1RB	849.000	-17.273	
			FRB	849.000	-27.037	
	16QAM	Lower	1RB	824.000	-20.239	
			FRB	824.000	-29.691	
		Upper	1RB	849.000	-19.249	
			FRB	849.000	-29.690	
1.4 MHz	QPSK	Lower	1RB	824.000	-24.205	
			FRB	824.000	-29.799	
		Upper	1RB	849.000	-21.675	
			FRB	849.000	-29.891	
	16QAM	Lower	1RB	824.000	-23.640	
			FRB	824.000	-32.251	
		Upper	1RB	849.000	-22.246	
			FRB	849.000	-30.375	

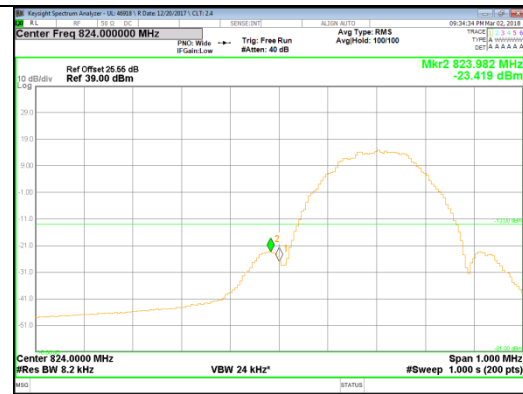
9.2.1. BAND EDGE PLOTS

GSM

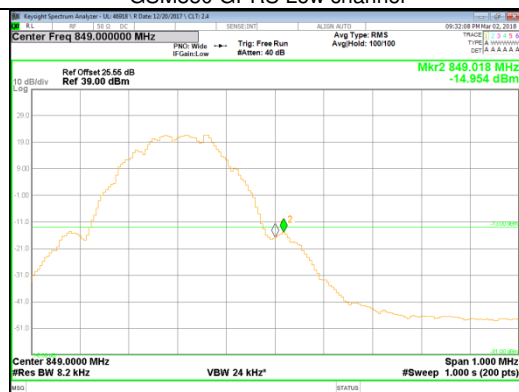
GSM
850



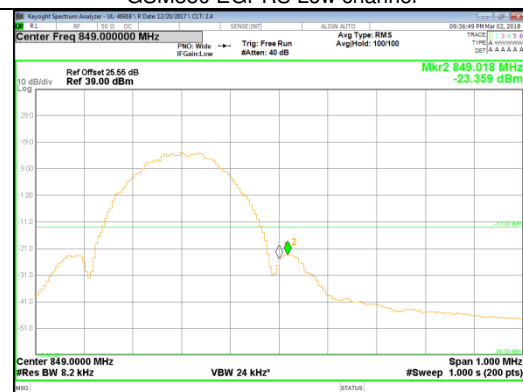
GSM850 GPRS Low channel



GSM850 EGPRS Low channel

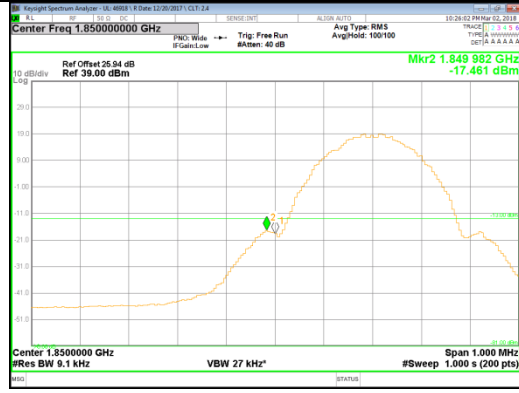


GSM850 GPRS High channel

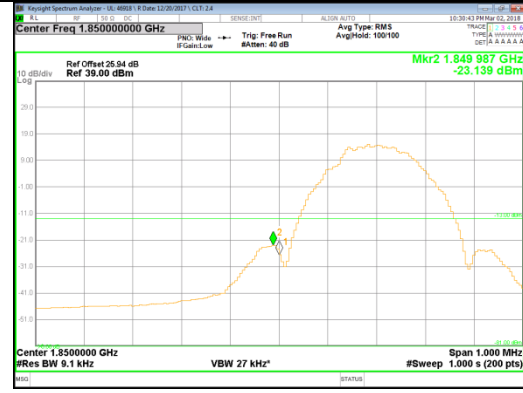


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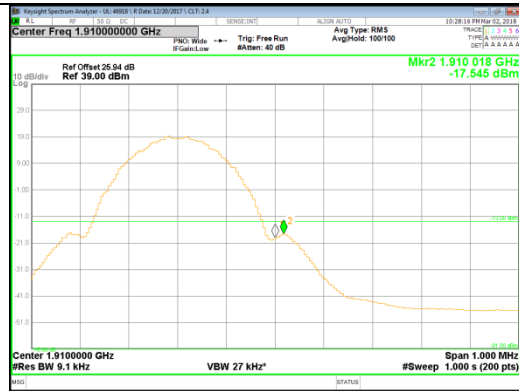
GSM
1900



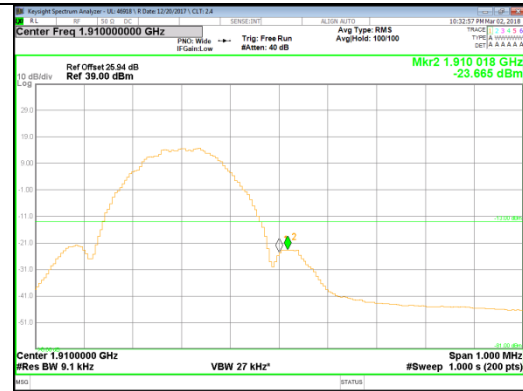
GSM1900 GPRS Low channel



GSM1900 EGPRS Low channel

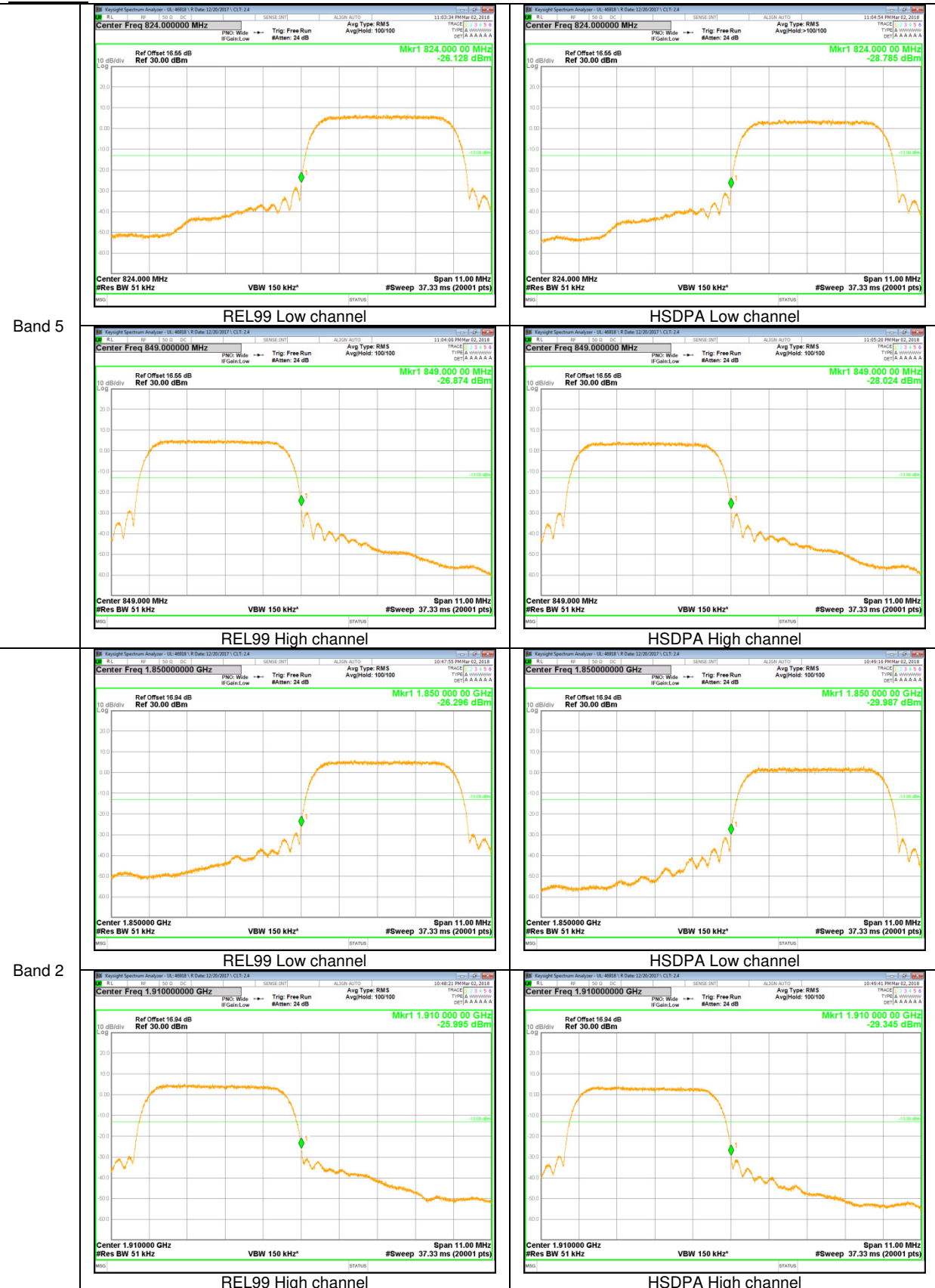


GSM1900 GPRS High channel

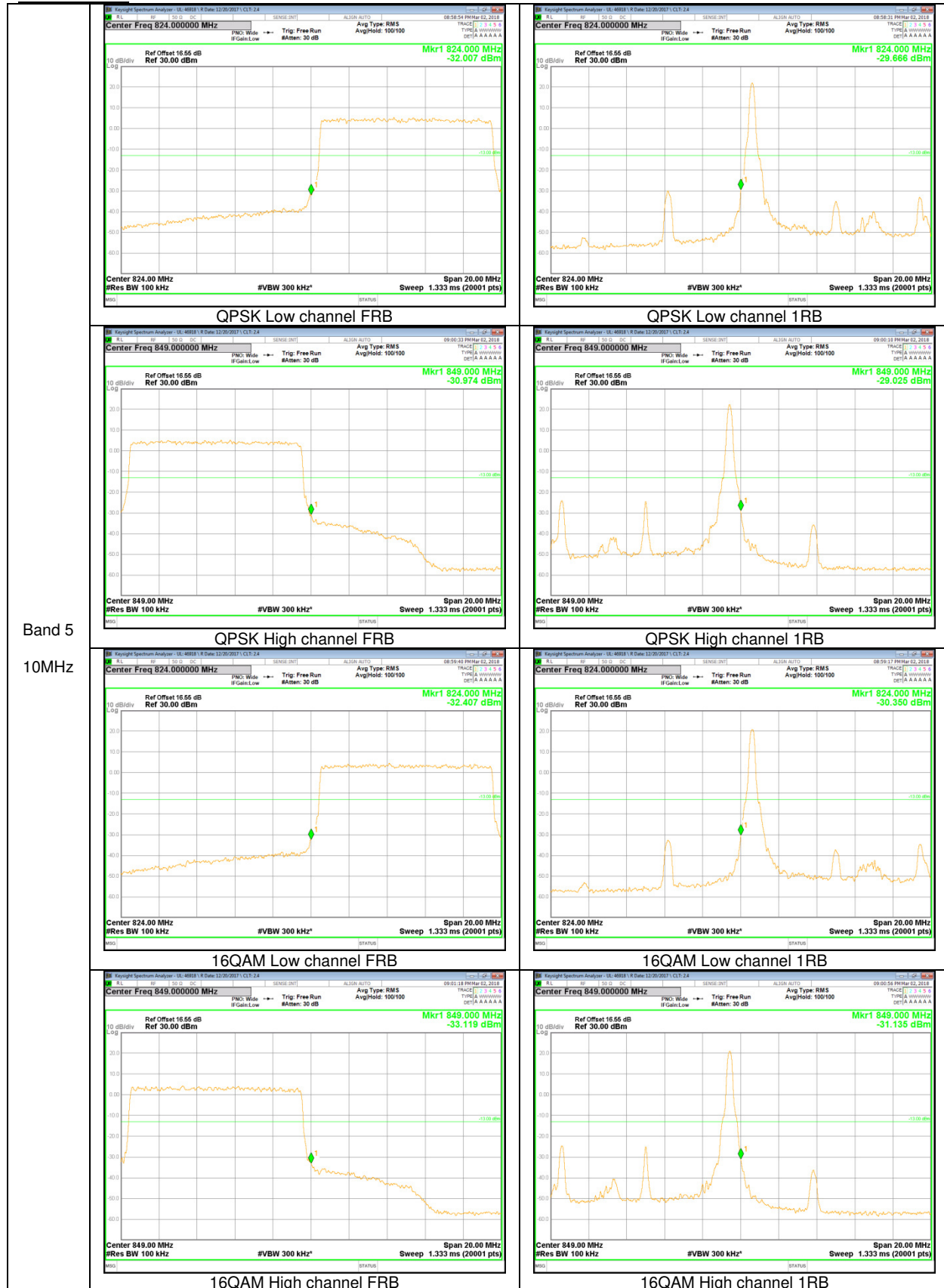


GSM1900 EGPRS High channel

WCDMA



LTE Band 5



Band 5
10MHz