



FCC CFR47 PART 22 SUBPART H

WWAN

CERTIFICATION TEST REPORT

FOR

WCDMA/LTE Wrist device + BT/BLE and DTS b/g/n

MODEL NUMBER : SM-R815F, SM-R815N

FCC ID: A3LSMR815F

REPORT NUMBER: 4788542024-E4V3

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Prepared for

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ACCREDITED*

Testing
Laboratory

TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	07/17/18	Initial issue	Hoonpyo Lee
V2	07/18/18	Updated to address TCB's question	Hoonpyo Lee
V2	07/19/18	Updated to address TCB's question	Hoonpyo Lee

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	6
4.1. MEASURING INSTRUMENT CALIBRATION	6
4.2. SAMPLE CALCULATION	6
4.3. MEASUREMENT UNCERTAINTY.....	7
5. EQUIPMENT UNDER TEST	8
5.1. DESCRIPTION OF EUT	8
5.2. MAXIMUM OUTPUT POWER.....	8
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	9
5.4. WORST-CASE ORIENTATION	9
5.5. DESCRIPTION OF TEST SETUP.....	9
6. TEST AND MEASUREMENT EQUIPMENT	11
7. Summary Table	12
8. PEAK TO AVERAGE RATIO	13
8.1. CONDUCTED PEAK TO AVERAGE RESULT.....	13
8.2. CONDUCTED PEAK TO AVERAGE PLOTS.....	14
9. LIMITS AND CONDUCTED RESULTS	16
9.1. OCCUPIED BANDWIDTH	16
9.1.1. OCCUPIED BANDWIDTH RESULTS	16
9.1.2. OCCUPIED BANDWIDTH PLOTS.....	18
9.2. BAND EDGE EMISSIONS	23
WCDMA/LTE.....	23
9.2.1. BAND EDGE PLOTS	26
9.3. OUT OF BAND EMISSIONS.....	31
9.3.1. OUT OF BAND EMISSIONS PLOTS	34
9.4. FREQUENCY STABILITY.....	39
9.4.1. FREQUENCY STABILITY RESULTS	40
10. RADIATED TEST RESULTS	41
10.1. RADIATED POWER (ERP & EIRP).....	41
10.1.1. ERP/EIRP Results.....	42

10.1.2.	ERP/EIRP DATA.....	43
10.2.	<i>FIELD STRENGTH OF SPURIOUS RADIATION</i>	48
10.2.1.	SPURIOUS RADIATION PLOTS.....	49
11.	SETUP PHOTOS	54

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: WCDMA/LTE Wrist device + BT/BLE and DTS b/g/n

MODEL NUMBER: SM-R815F, SM-R815N

SERIAL NUMBER: R3AK5006LTE, R3AK5006MDH, R3AK4009TLX
R3AK4009TMH, R3AK5006LET (RADIATED);
R3AK5006M0Z (CONDUCTED);

DATE TESTED: JUN 27, 2018 – JUL 17, 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
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. ANSI TIA-603-E, 2016
4. 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:

EIRP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – 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 WCDMA/LTE Wrist device + BT/BLE and DTS b/g/n.
This test report addresses the WWAN operational mode.

Model number "SM-R815F" was used for the test.

5.2. MAXIMUM OUTPUT POWER

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

WCDMA

FCC Part 22				
Band	Frequency Range	Modulation	Radiated	
	[MHz]		Avg [dBm]	Avg [mW]
Band 5	824~849	REL99	2.50	1.78
		HSDPA	2.37	1.73

LTE Band 5

FCC Part 22					
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Radiated	
			Peak	Avg [dBm]	Avg [mW]
Band 5	824 ~ 849	10	QPSK	6.70	4.68
			16QAM	5.71	3.72
		5	QPSK	5.99	3.97
			16QAM	4.55	2.85
		3	QPSK	7.08	5.11
			16QAM	4.92	3.10
		1.4	QPSK	6.66	4.63
			16QAM	4.51	2.82

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a front metal 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	-5.41

5.4. WORST-CASE ORIENTATION

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 LTE band 5 ERP test was performed connected with wireless charger for evaluation of worst case mode but WCDMA band 5 test was performed stand-alone condition for evaluation of worst case mode.(didn't connected with wireless charger)

All radiated spurious tests were performed connected with wireless charger for evaluation of worst case mode.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Adapter	SAMSUNG	EP-TA60EBE	R37K4Q17VG3RT3	N/A
Wireless Charger	SAMSUNG	EP-YO805	N/A	A3LEPYO805
Data cable	SAMSUNG	ECB-DU2EBE	N/A	N/A

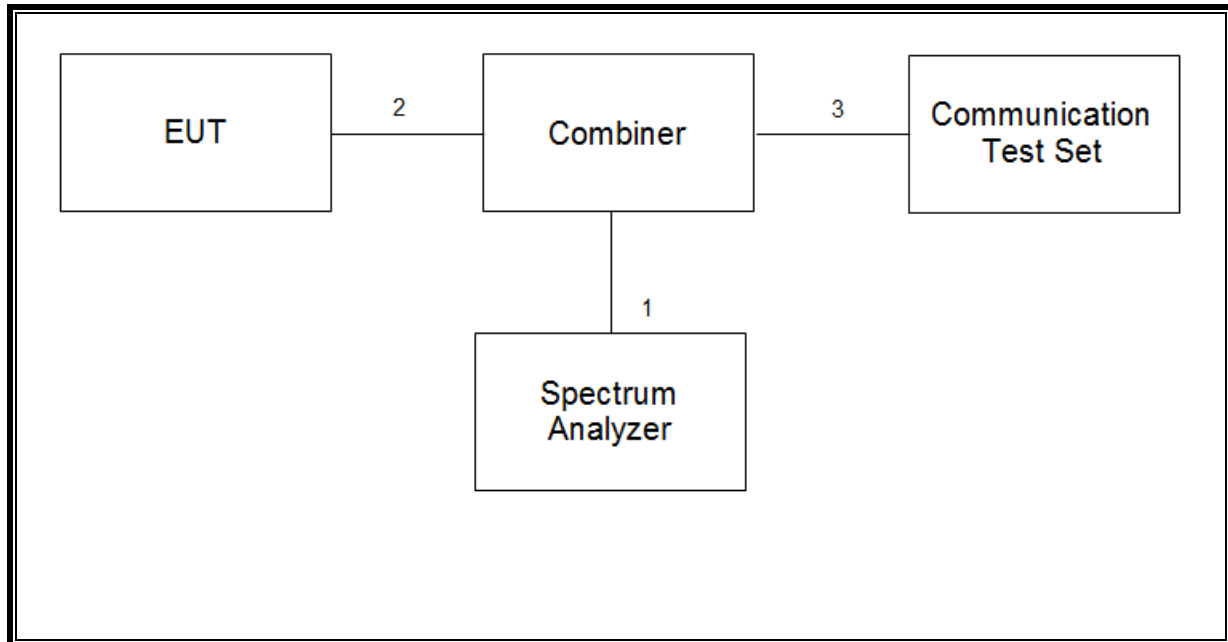
I/O CABLES

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

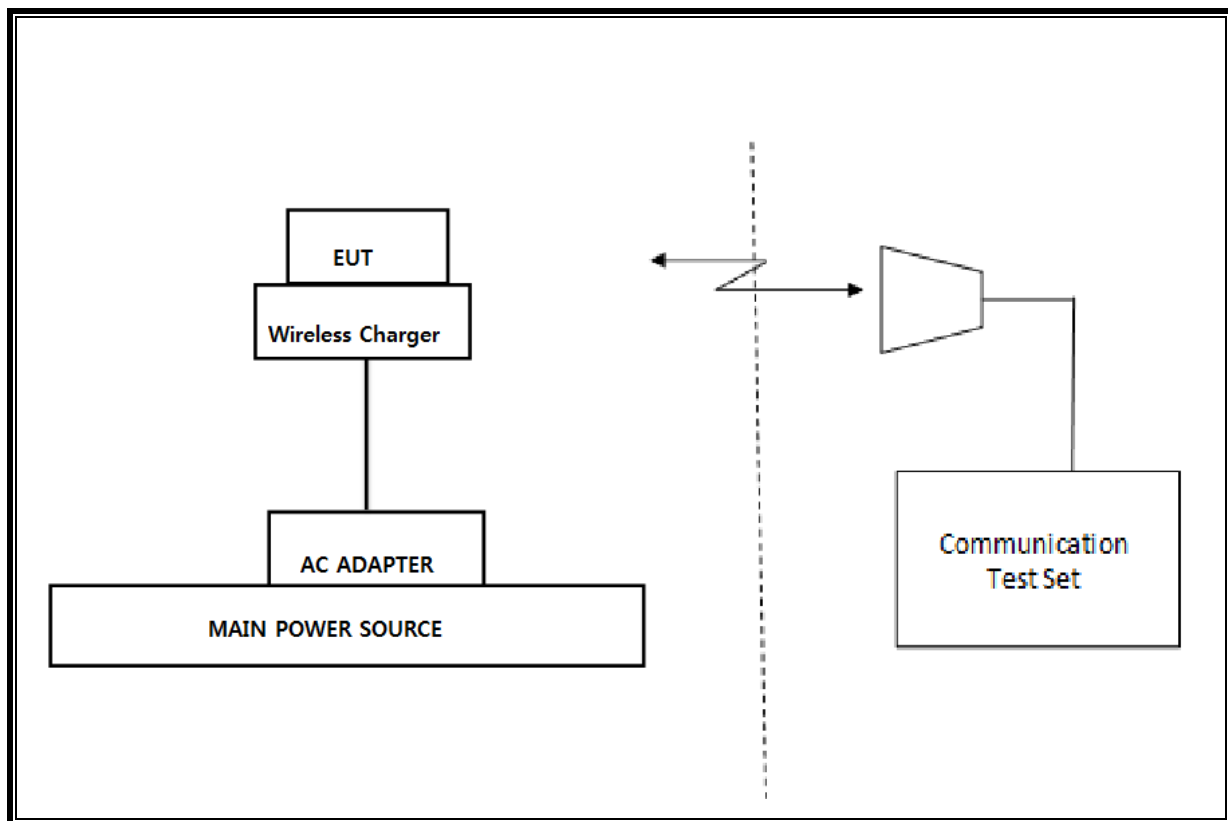
TEST SETUP

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
22.359(a)	Band Edge / Conducted Spurious Emission	-13dBm		Pass
22.355	Frequency Stability	2.5PPM		Pass
22.913(a)(5)	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
WCDMA						
22H	826.4 - 846.6	0.00178	2.5 ppm	4M14F9W		WCDMA B5
LTE Band 5						
22H	829.0 - 844.0	0.00468	2.5 ppm	8M97G7W	10	QPSK
22H	829.0 - 844.0	0.00372	2.5 ppm	8M98D7W	10	16QAM
22H	825.5 - 847.5	0.00511	2.5 ppm	2M71G7W	3	QPSK

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

WCDMA

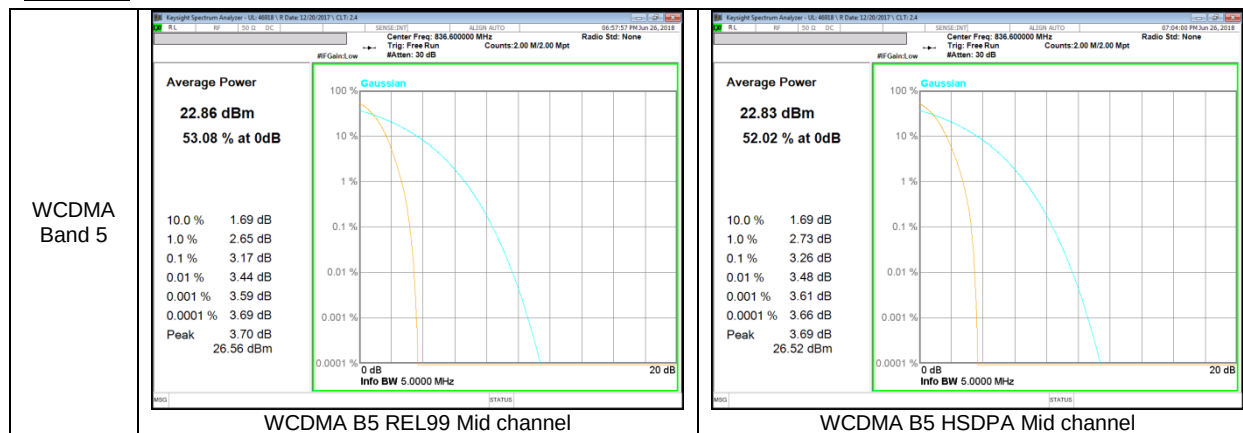
Band	Channel	f [MHz]	Mode	Ratio [dB]	Limit [dB]
Band 5	4183	836.6	REL99	3.17	13.00
			HSDPA	3.26	

LTE Band 5

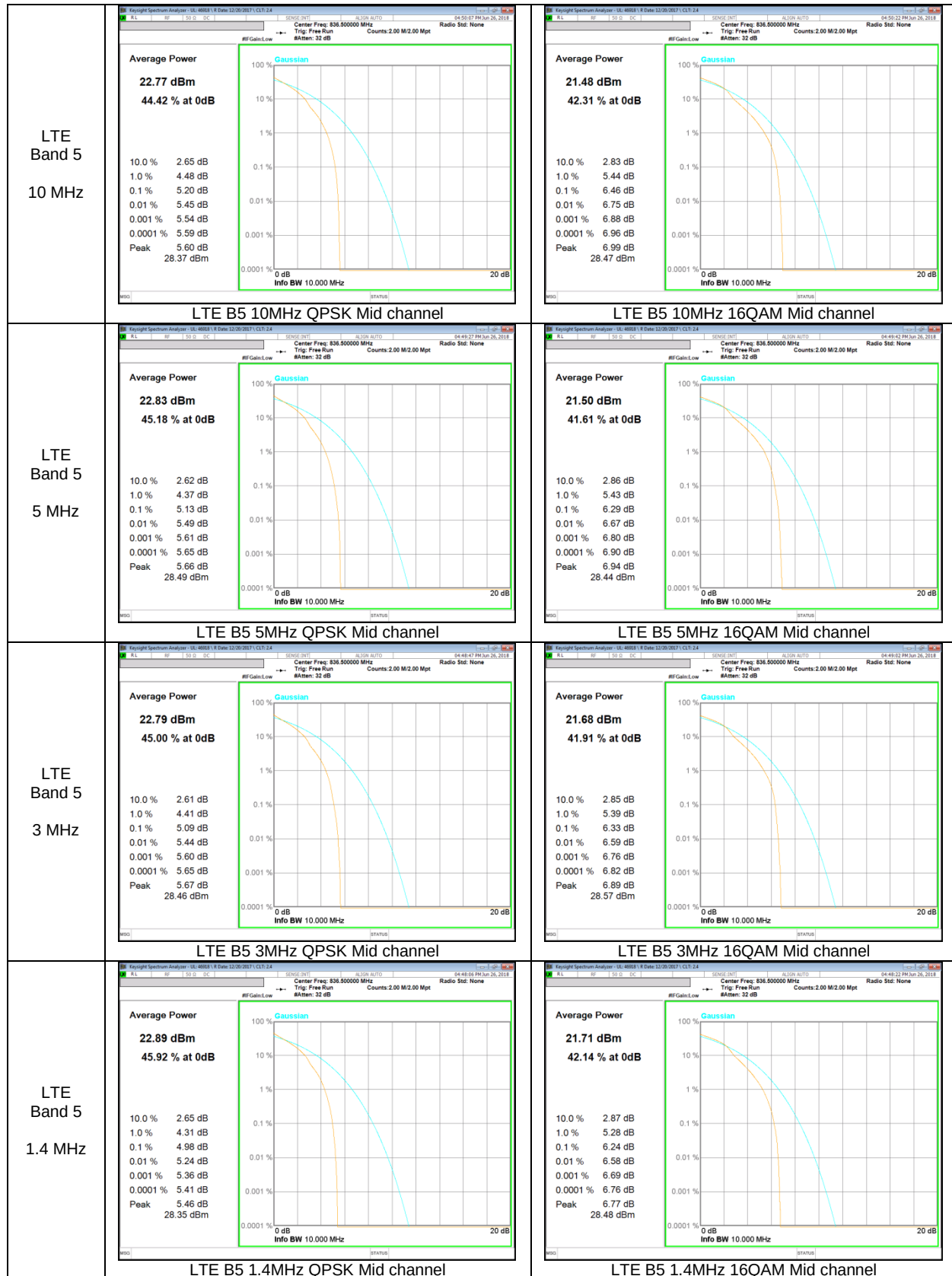
Band	BW [MHz]	Channel	f [MHz]	Mode	Ratio [dB]	Limit [dB]
Band 5	10	20525	836.5	QPSK	5.20	13.00
				16QAM	6.46	
	5			QPSK	5.13	
				16QAM	6.29	
	3			QPSK	5.09	
				16QAM	6.33	
	1.4			QPSK	4.98	
				16QAM	6.24	

8.2. CONDUCTED PEAK TO AVERAGE PLOTS

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

WCDMA

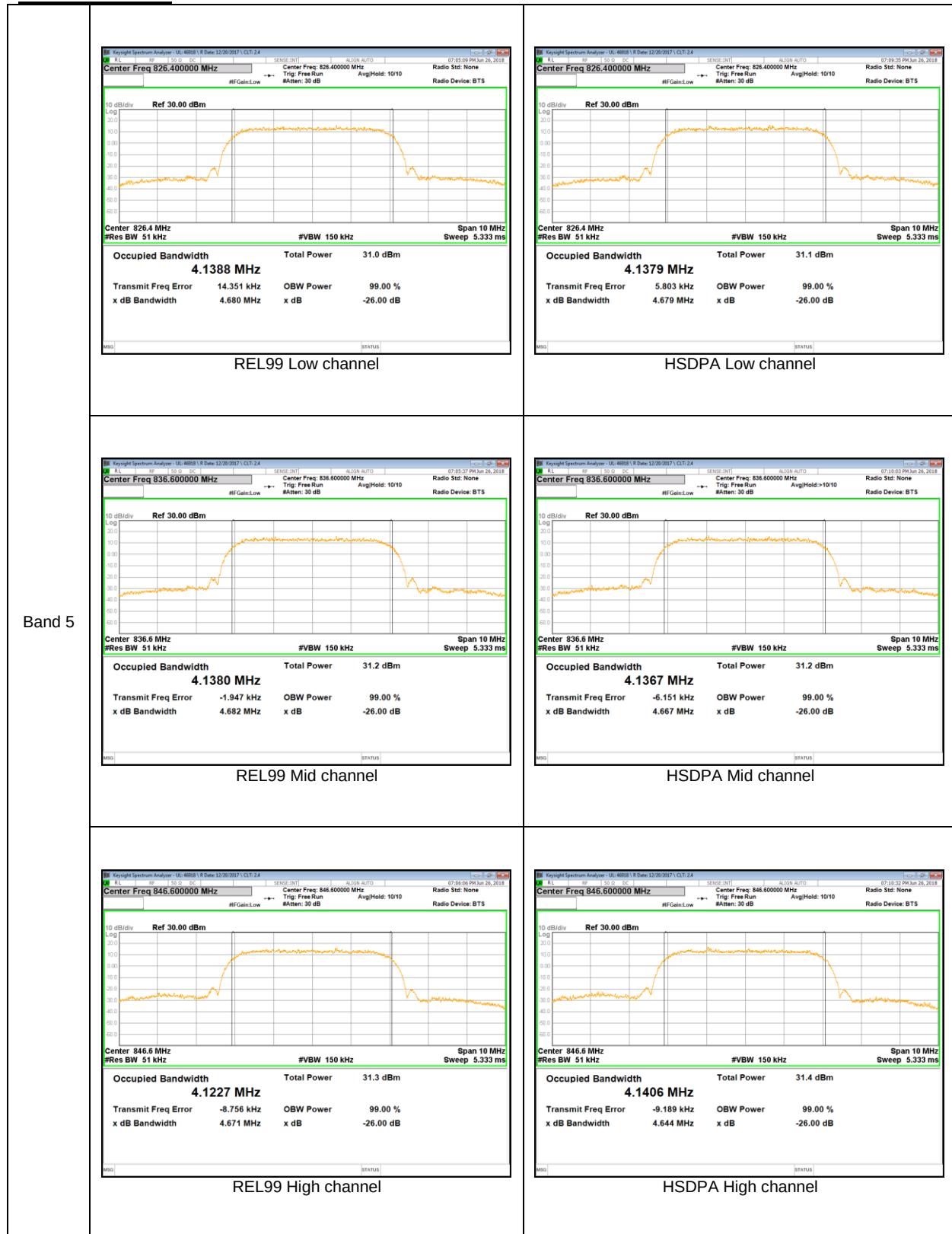
Band	Mode	Channel	f [MHz]	99% BW [MHz]	26dB BW [MHz]
Band 5	REL99	4132	826.4	4.1388	4.680
		4183	836.6	4.1380	4.682
		4233	846.6	4.1227	4.671
	HSDPA	4132	826.4	4.1379	4.679
		4183	836.6	4.1367	4.667
		4233	846.6	4.1406	4.644

LTE Band 5

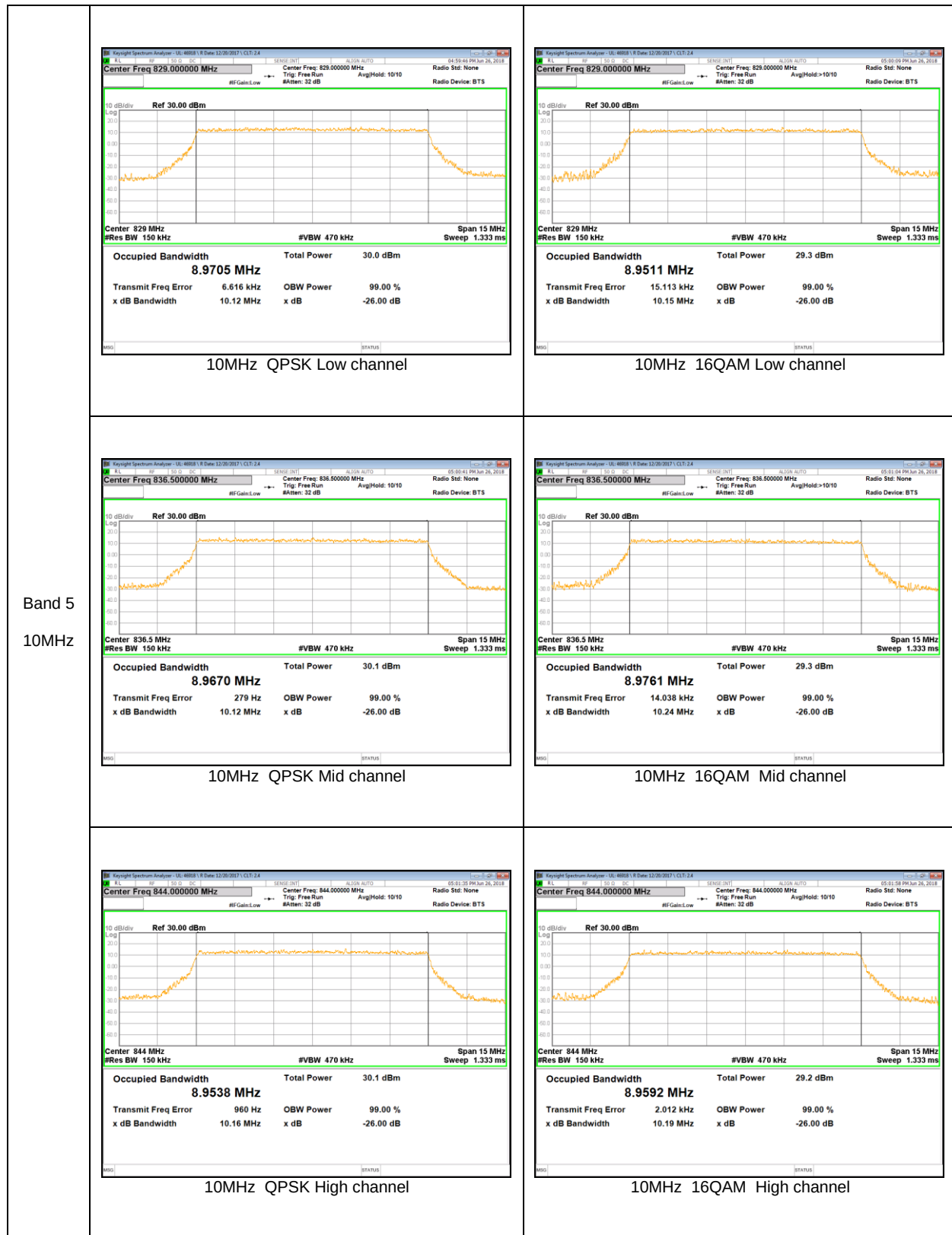
Band	BW [MHz]	Channel	f [MHz]	Mode	99% BW [MHz]	26dB BW [MHz]
Band 5	10	20450	829.0	QPSK	8.9705	10.12
				16QAM	8.9511	10.15
		20524	836.5	QPSK	8.9670	10.12
				16QAM	8.9761	10.24
		20599	844.0	QPSK	8.9538	10.16
				16QAM	8.9592	10.19
	5	20425	826.5	QPSK	4.4944	5.260
				16QAM	4.4956	5.197
		20524	836.5	QPSK	4.4968	5.220
				16QAM	4.4932	5.060
		20624	846.5	QPSK	4.4962	5.240
				16QAM	4.4995	5.257
	3	20415	825.5	QPSK	2.7006	3.108
				16QAM	2.6981	3.037
		20524	836.5	QPSK	2.7112	3.108
				16QAM	2.7032	3.061
		20634	847.5	QPSK	2.7002	3.067
				16QAM	2.6993	3.069
	1.4	20407	824.7	QPSK	1.0848	1.267
				16QAM	1.0850	1.293
		20524	836.5	QPSK	1.0880	1.276
				16QAM	1.0928	1.297
		20624	848.3	QPSK	1.0870	1.287
				16QAM	1.0859	1.297

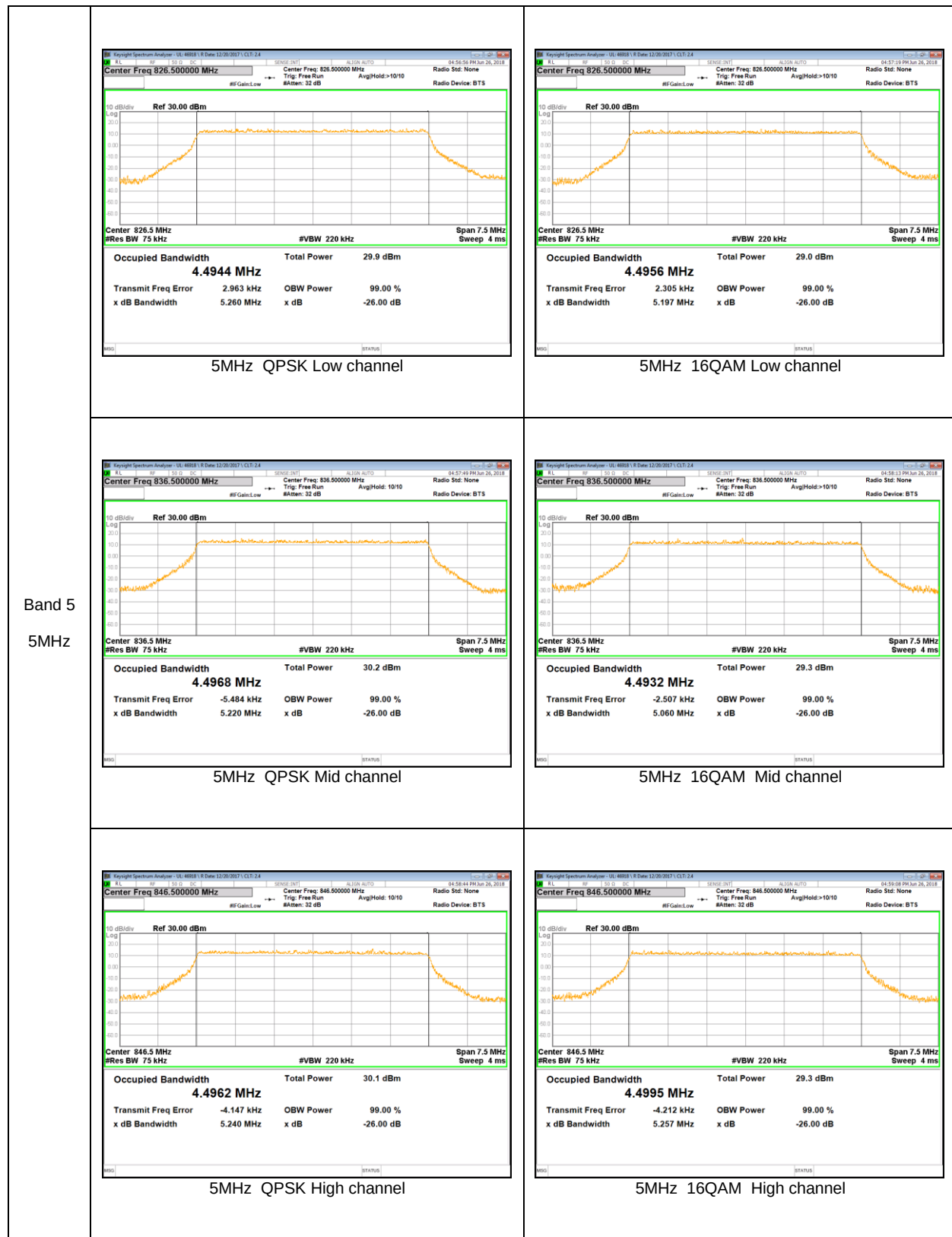
9.1.2. OCCUPIED BANDWIDTH PLOTS

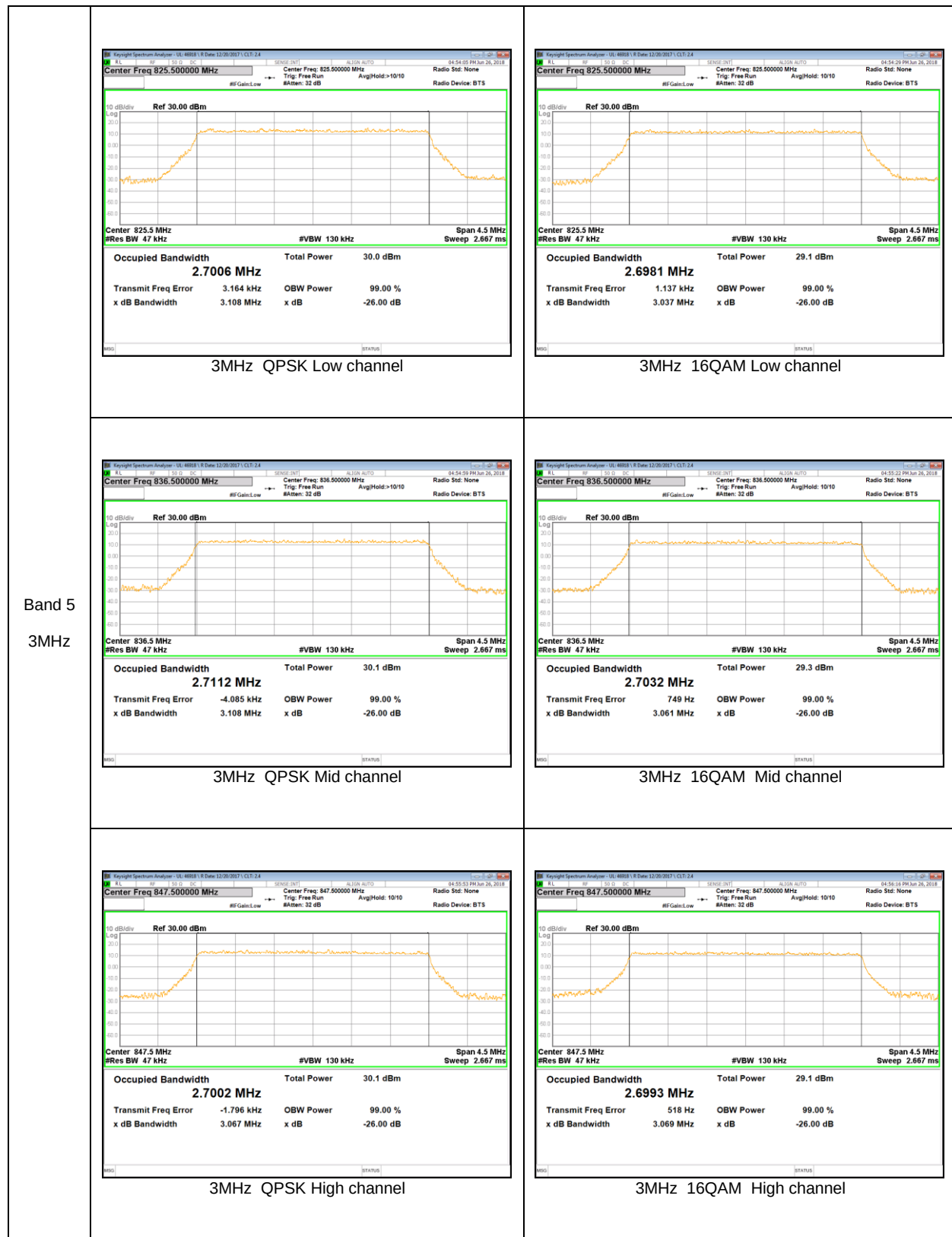
WCDMA Band 5

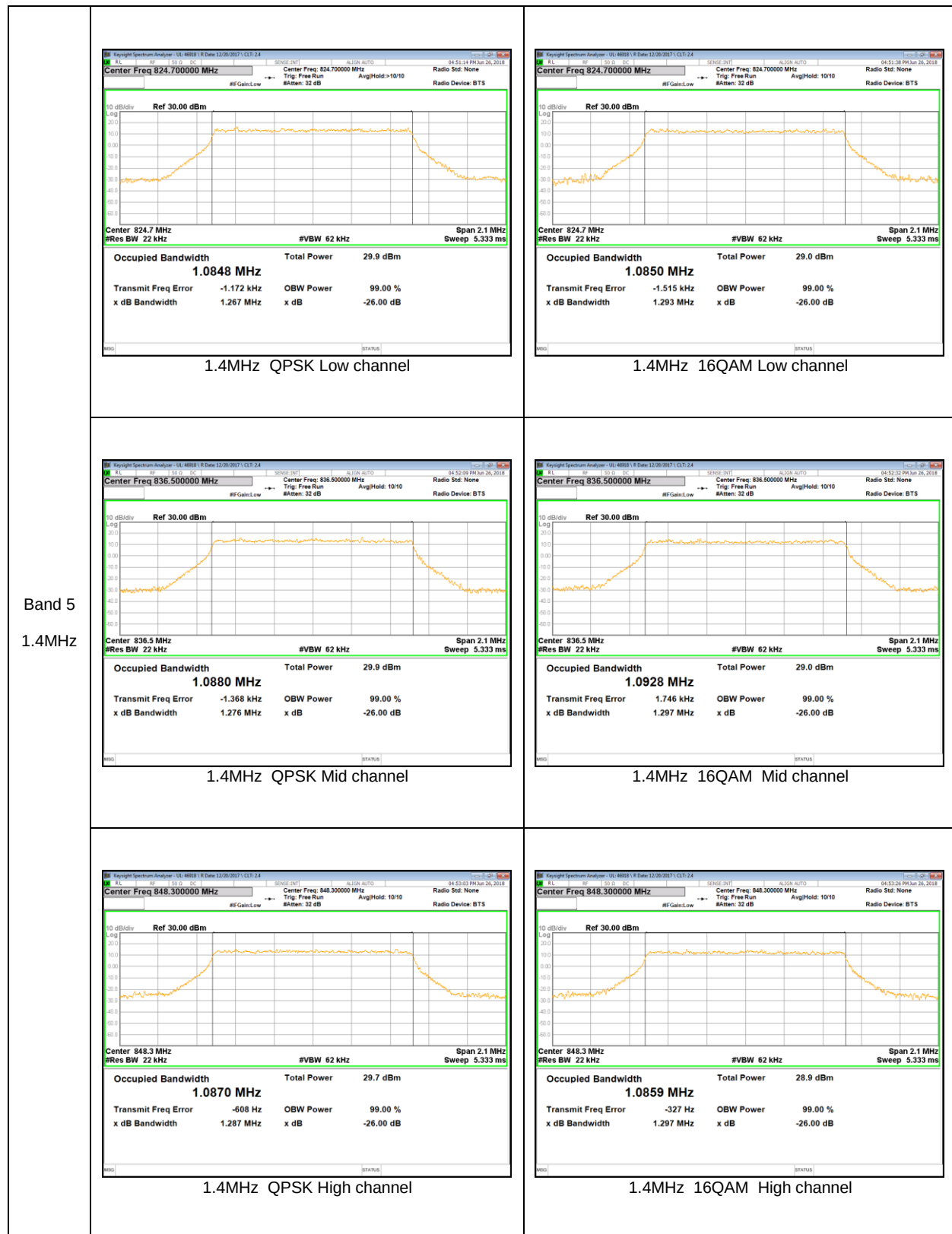


LTE Band 5









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 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.

WCDMA/LTE

- a) Set the RBW = 1 ~ 1.5 % of OBW(Typically limited to a minimum RBW of 1% of the OBW)
- b) Set VBW $\geq 3 \times$ RBW;
- c) Set span ≥ 1.5 times the OBW;
- d) Sweep time = Auto;
- e) Detector = RMS;
- f) Ensure that the number of measurement points $\geq 2 \times$ Span/RBW;
- g) Trace mode = Average (100);

RESULTS

WCDMA

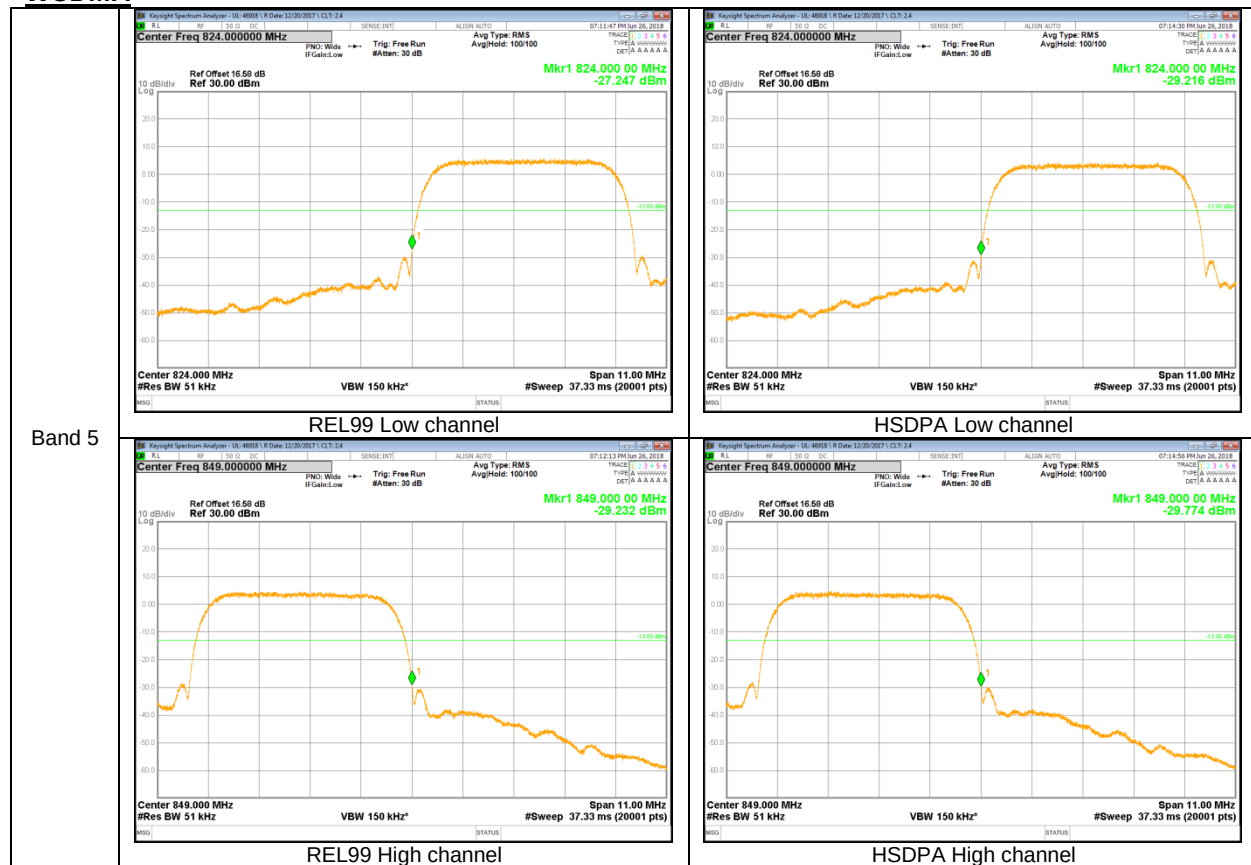
Band	Mode	Side	f [MHz]	Level [dBm]	Limit [dBm]
Band 5	REL99	Lower	824.000	-27.247	-13.00
		Upper	849.000	-29.232	
	HSDPA	Lower	824.000	-29.216	
		Upper	849.000	-29.774	

LTE 5

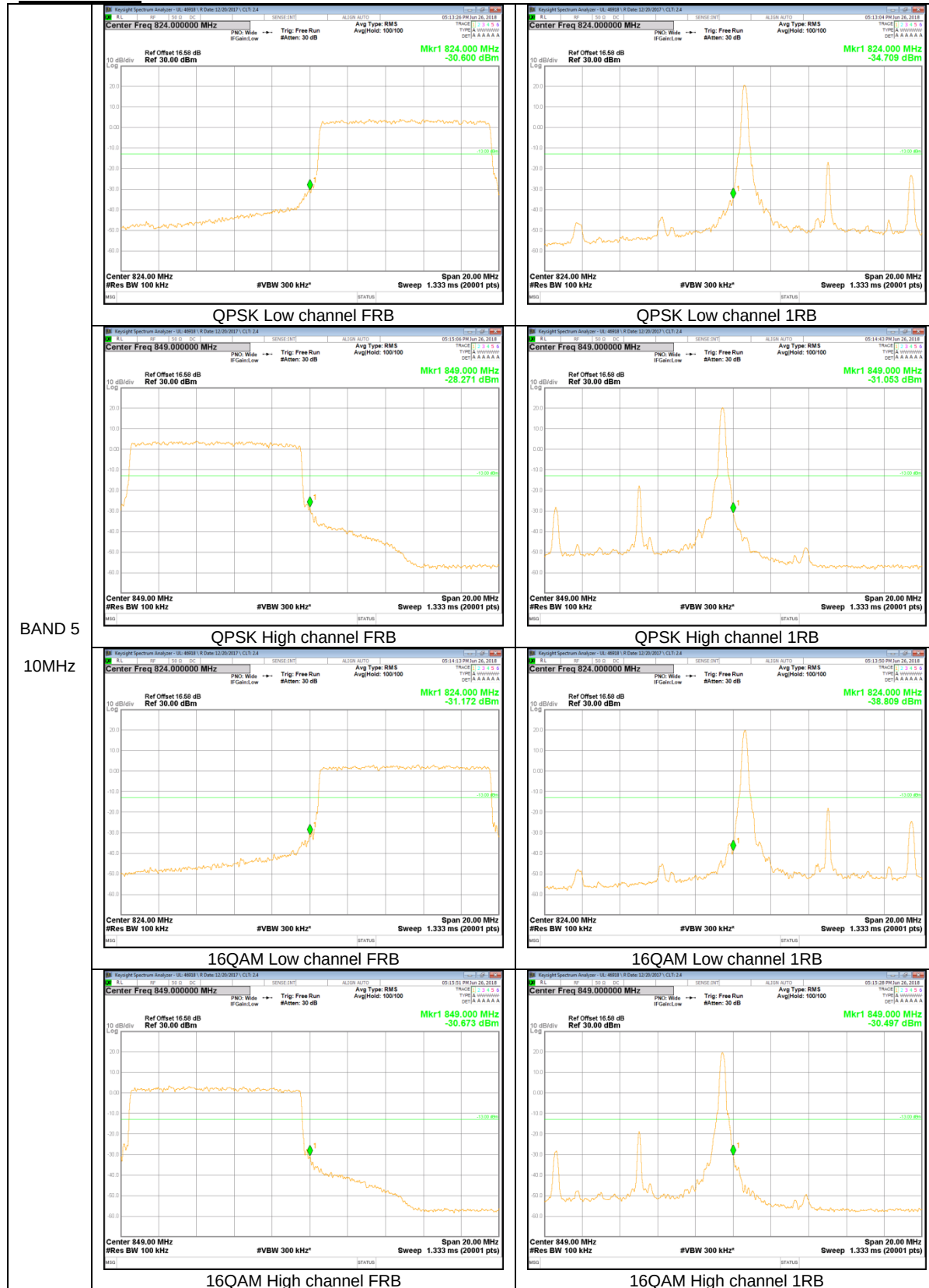
Bandwidth	Mode	Side	RB Status	f [MHz]	Level [dBm]	Limit [dBm]
10 MHz	QPSK	Lower	1RB	824.000	-34.709	-13.00
			FRB	824.000	-30.600	
		Upper	1RB	849.000	-31.053	
			FRB	849.000	-28.271	
	16QAM	Lower	1RB	824.000	-38.809	
			FRB	824.000	-31.172	
		Upper	1RB	849.000	-30.497	
			FRB	849.000	-30.673	
5 MHz	QPSK	Lower	1RB	824.000	-22.089	
			FRB	824.000	-26.954	
		Upper	1RB	849.000	-20.641	
			FRB	849.000	-24.592	
	16QAM	Lower	1RB	824.000	-24.006	
			FRB	824.000	-24.934	
		Upper	1RB	849.000	-25.628	
			FRB	849.000	-27.641	
3 MHz	QPSK	Lower	1RB	824.000	-21.018	
			FRB	824.000	-25.045	
		Upper	1RB	849.000	-18.012	
			FRB	849.000	-25.731	
	16QAM	Lower	1RB	824.000	-23.247	
			FRB	824.000	-25.283	
		Upper	1RB	849.000	-18.720	
			FRB	849.000	-26.552	
1.4 MHz	QPSK	Lower	1RB	824.000	-26.791	
			FRB	824.000	-29.459	
		Upper	1RB	849.000	-23.612	
			FRB	849.000	-28.074	
	16QAM	Lower	1RB	824.000	-26.808	
			FRB	824.000	-31.769	
		Upper	1RB	849.000	-27.327	
			FRB	849.000	-29.435	

9.2.1. BAND EDGE PLOTS

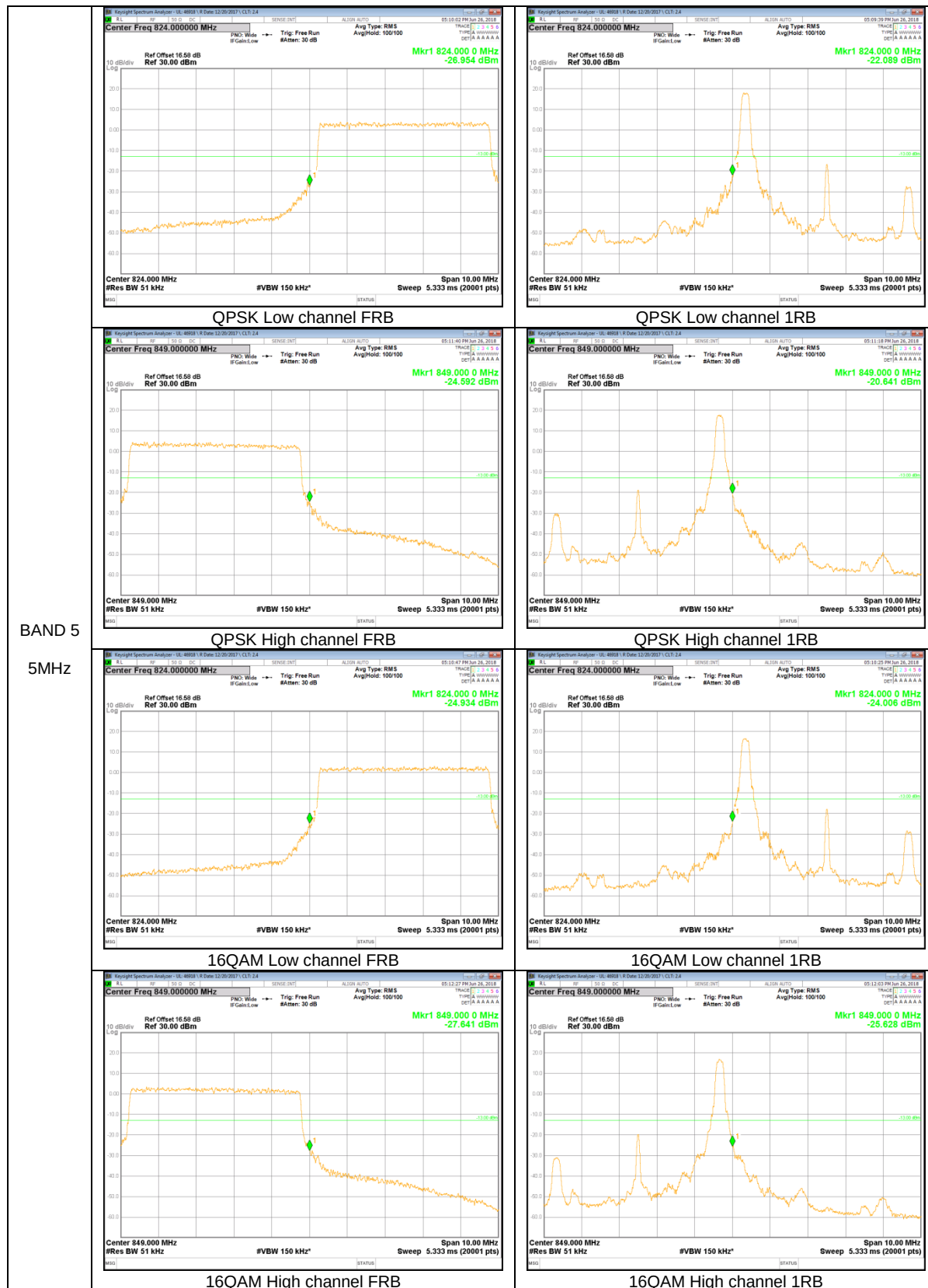
WCDMA

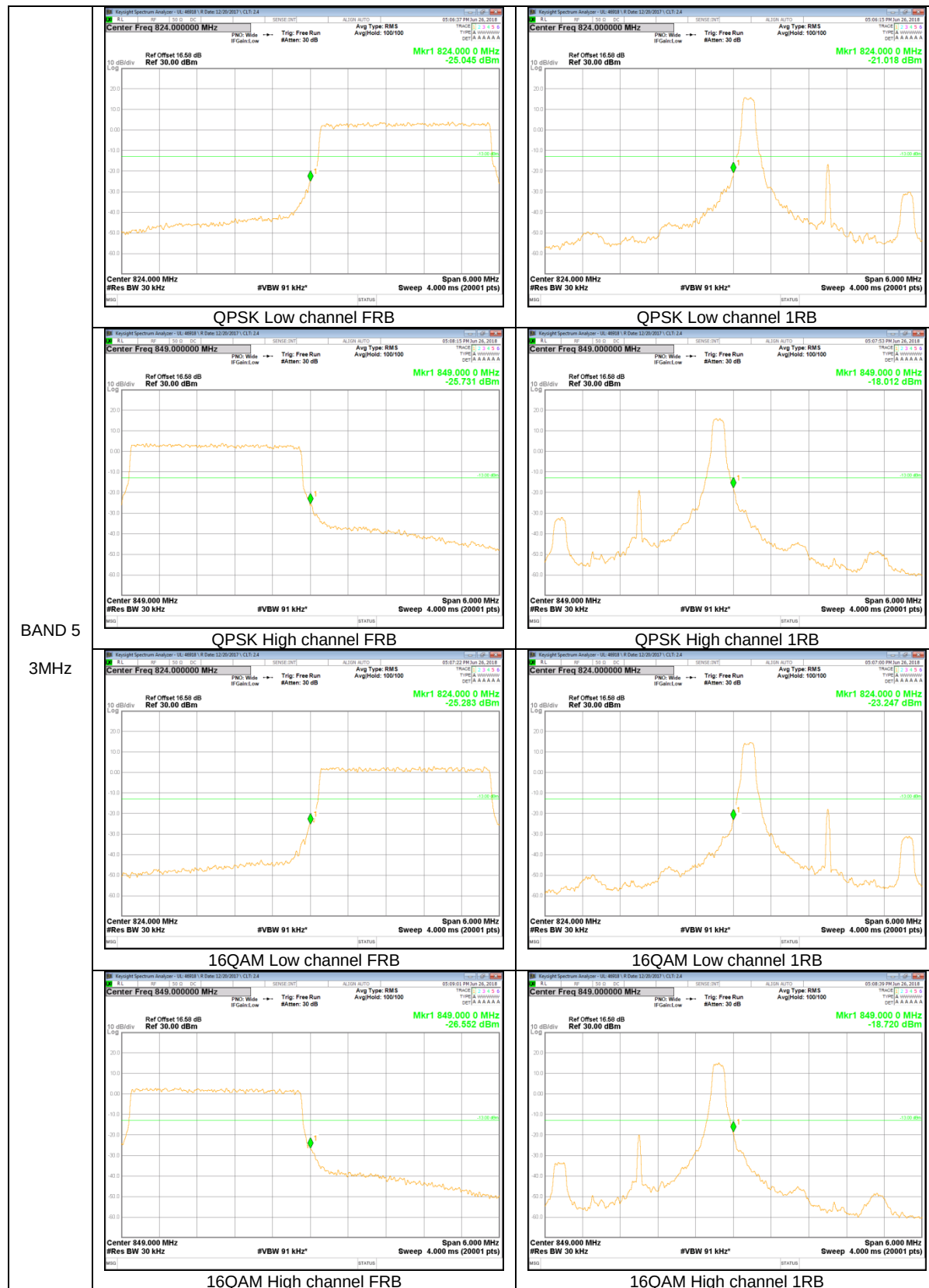


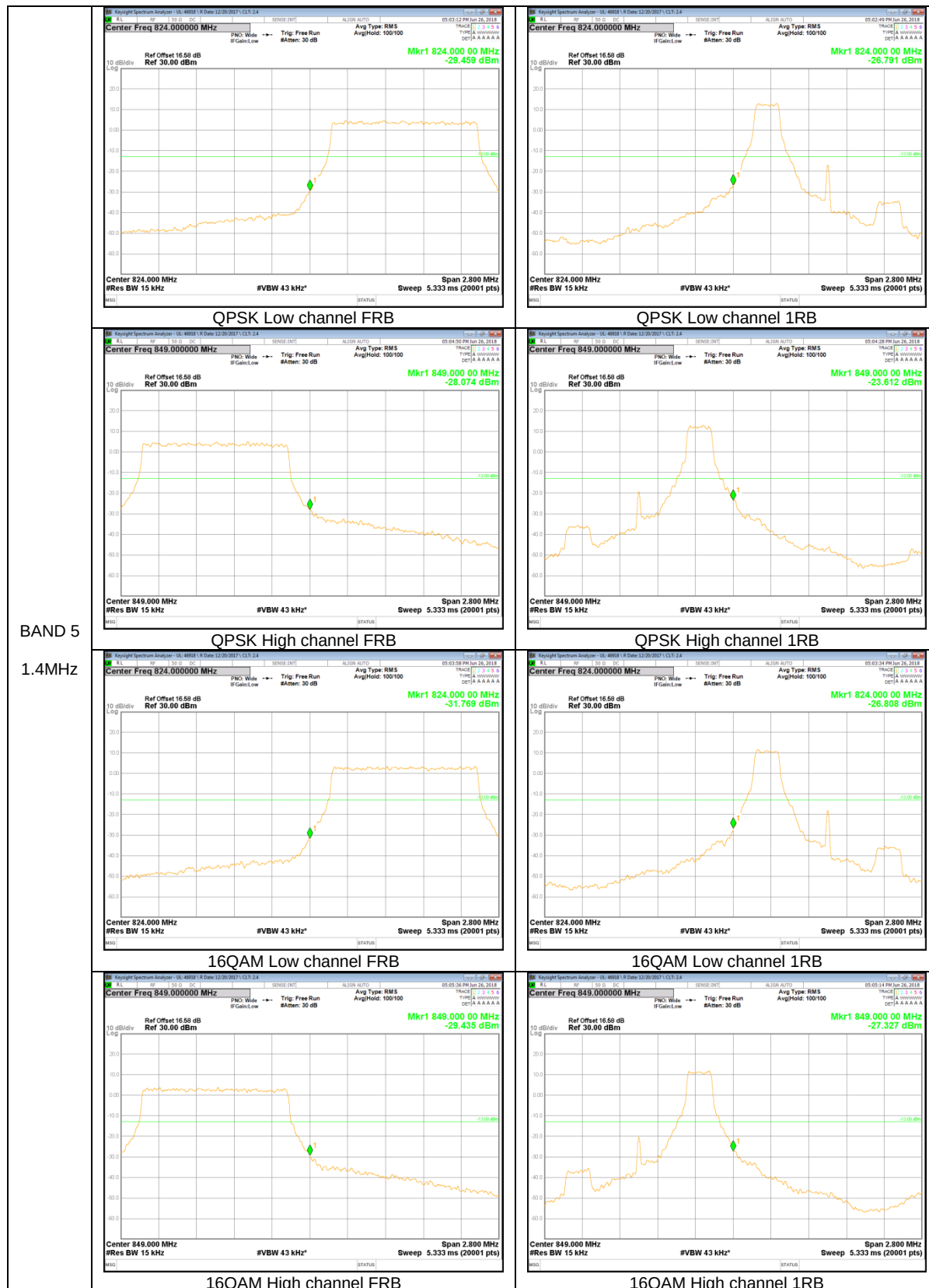
LTE BAND 5



BAND 5
10MHz







9.3. OUT OF BAND 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 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 = 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 = rms;
- f) Ensure that the number of measurement points = Max (40001);
- g) Trace mode = average

RESULTS

WCDMA

Band	Mode	f [MHz]	Spurious [dBm]	Limit [dBm]
Band 5	REL99	826.4	-42.462	-13.00
		836.6	-42.682	
		846.6	-42.526	
	HSDPA	826.4	-42.310	
		836.6	-42.607	
		846.6	-42.669	

LTE 5

Bandwidth	Mode	f [MHz]	Spurious [dBm]	Limit [dBm]
10 MHz	QPSK	829.0	-40.833	-13.00
		836.5	-40.718	
		844.0	-40.480	
	16QAM	829.0	-40.584	
		836.5	-40.428	
		844.0	-40.750	
5 MHz	QPSK	826.5	-40.722	
		836.5	-40.453	
		846.5	-40.816	
	16QAM	826.5	-40.852	
		836.5	-40.601	
		846.5	-40.549	
3 MHz	QPSK	825.5	-40.886	
		836.5	-40.536	
		847.5	-40.703	
	16QAM	825.5	-40.638	
		836.5	-40.811	
		847.5	-40.741	
1.4 MHz	QPSK	824.7	-40.639	
		836.5	-40.556	
		848.3	-40.590	
	16QAM	824.7	-40.589	
		836.5	-40.474	
		848.3	-40.656	

9.3.1. OUT OF BAND EMISSIONS PLOTS

WCDMA Band 5



LTE BAND 5

