



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-R805F, SM-R805N

FCC ID: A3LSMR805F

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TL-637

Revision History

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

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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-R805F, SM-R805N

SERIAL NUMBER: R3AK400934Z, R3AK400936H, R3AK400935X, R3AK40096WD
(RADIATED);
R3AK400931D (CONDUCTED);

DATE TESTED: JUN 26, 2018 - JUN 27, 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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SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:



Hoonpyo Lee
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UL Korea, Ltd.

1.1. 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

2. 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>.

3. CALIBRATION AND UNCERTAINTY

3.1. 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.

3.2. 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)

3.3. 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%.

4. EQUIPMENT UNDER TEST

4.1. 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-R805F" was used for the test.

4.2. MAXIMUM OUTPUT POWER

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

WCDMA

FCC Part 22/24				
Band	Frequency Range	Modulation	Radiated	
	[MHz]		Avg [dBm]	Avg [mW]
Band 5	824~849	REL99	2.68	1.85
		HSDPA	2.90	1.95

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	8.58	7.21
			16QAM	6.92	4.92
		5	QPSK	8.16	6.55
			16QAM	6.89	4.89
		3	QPSK	7.94	6.22
			16QAM	6.76	4.74
		1.4	QPSK	8.32	6.79
			16QAM	6.87	4.86

4.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

Band	Peak Gain (dBi)
WCDMA Band 5 / LTE Band 5	-6.65

4.4. WORST-CASE ORIENTATION

For 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 erp/eirp tests, these bands were performed connected with wireless charger for evaluation of worst case mode.

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

4.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

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

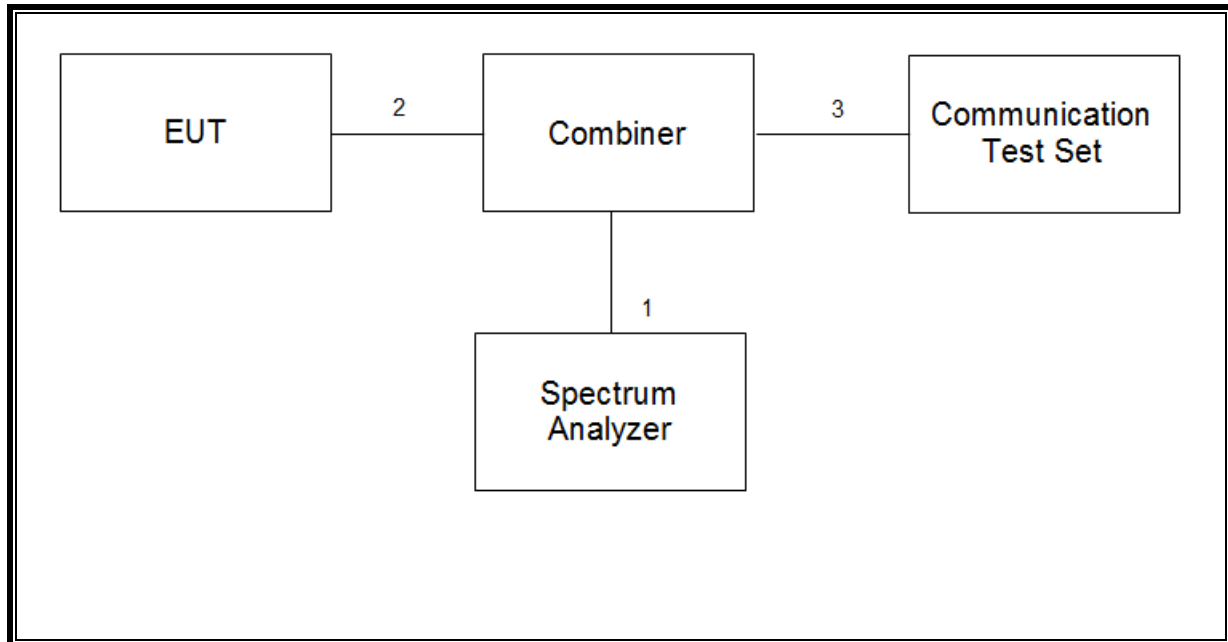
I/O CABLES

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

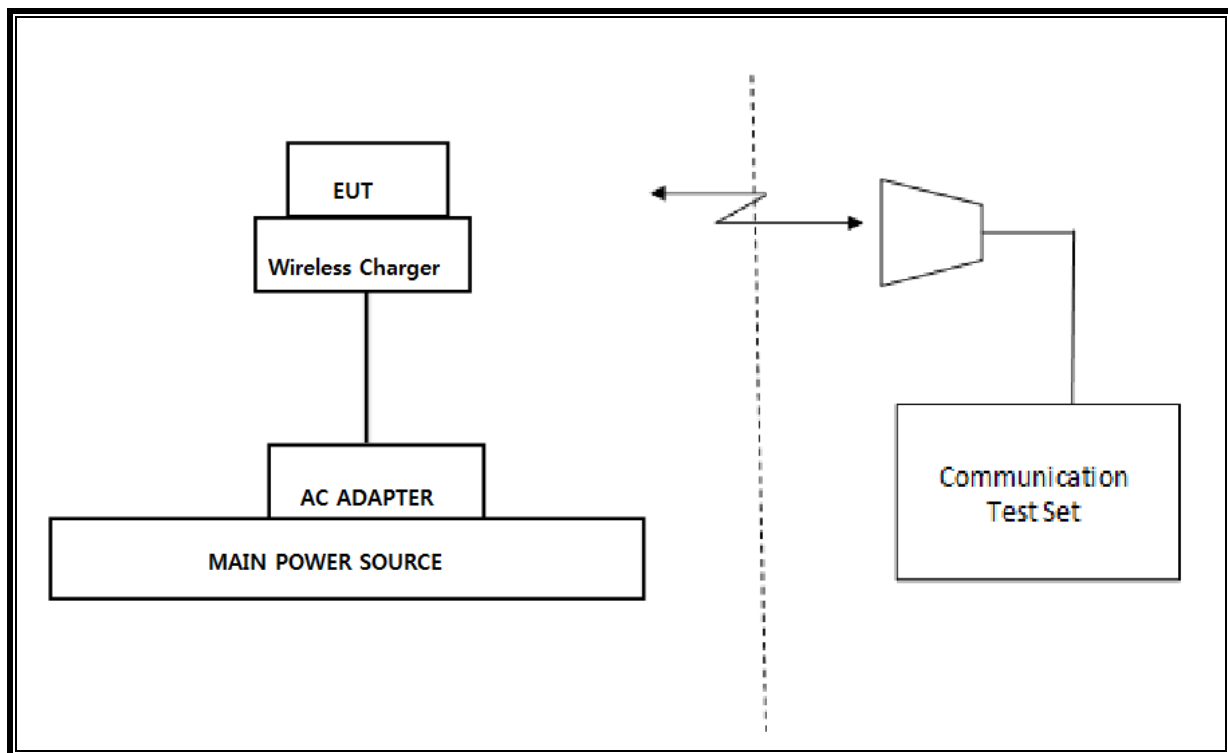
TEST SETUP

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)



5. 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	

6. 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		See the RF exposure test report. (4788494710-S1 FCC Report SAR)
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
WCDMA						
22H	826.4 - 846.6	0.002	2.5 ppm	4M15F9W		WCDMA B5
LTE Band 5						
22H	829.0 - 844.0	0.007	2.5 ppm	8M96G7W	10	QPSK
22H	829.0 - 844.0	0.005	2.5 ppm	8M98D7W	10	16QAM

7. 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

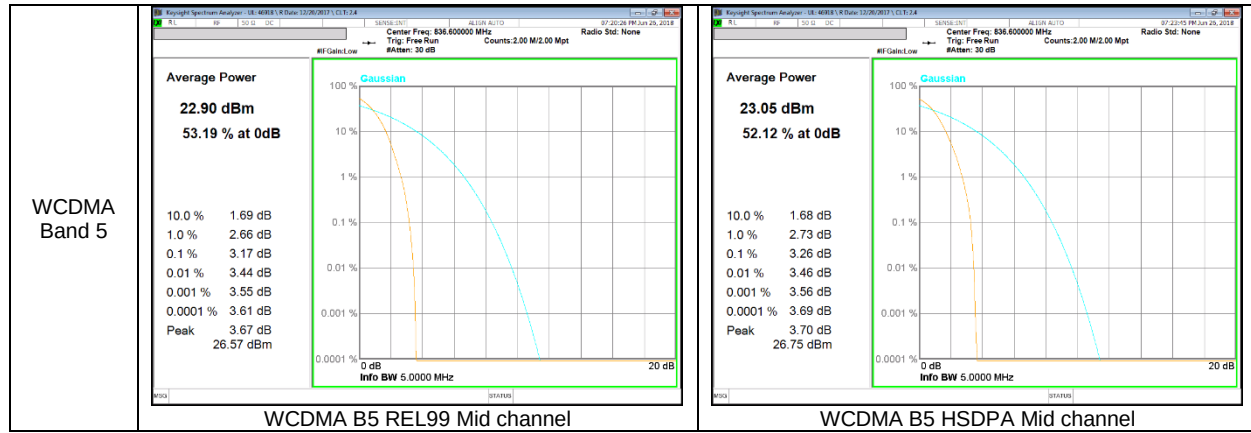
In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

RESULTS

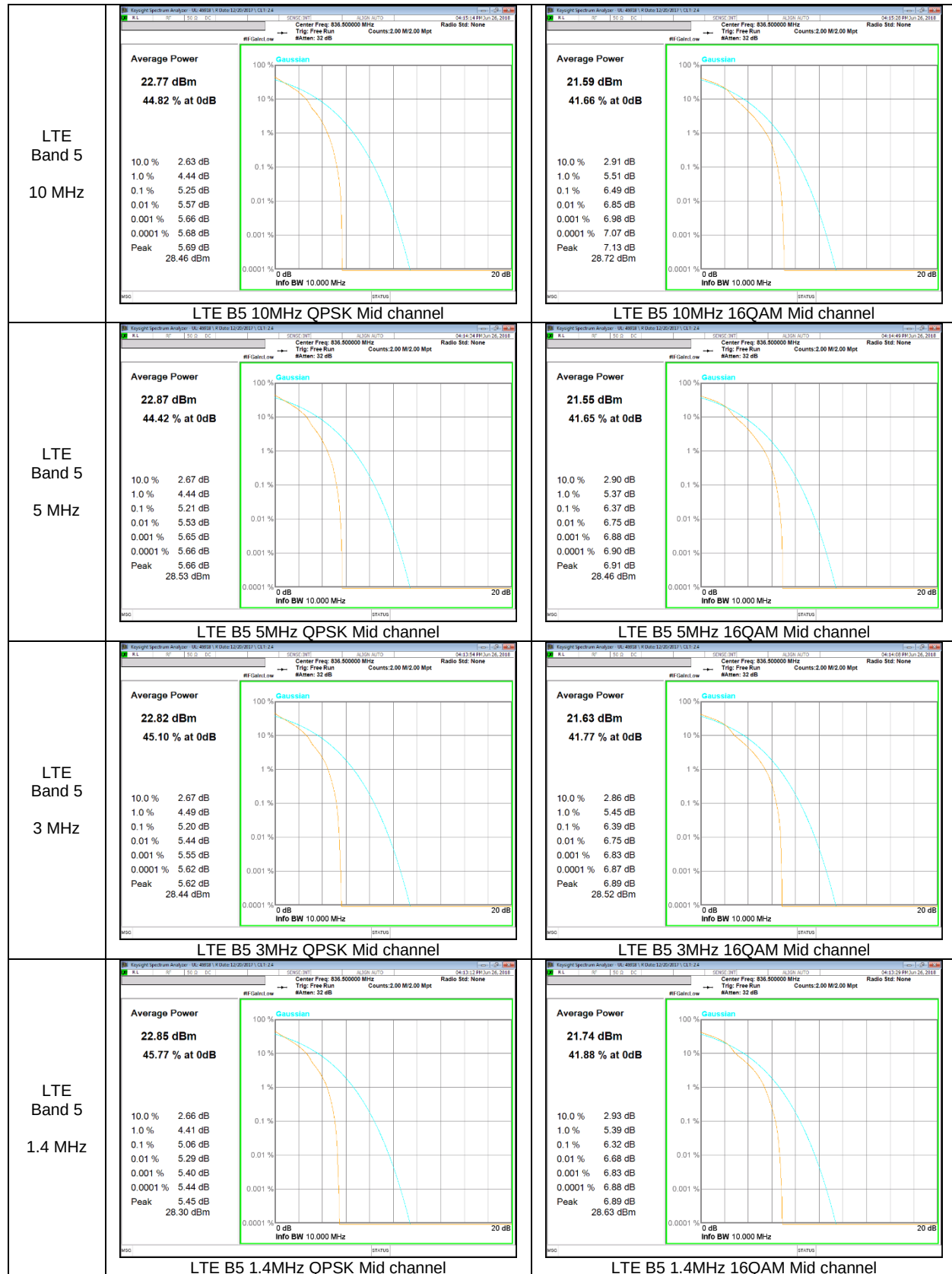
See the following pages.

7.1. CONDUCTED PEAK TO AVERAGE RESULTS

WCDMA



LTE Band 5



8. LIMITS AND CONDUCTED RESULTS

8.1. 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.

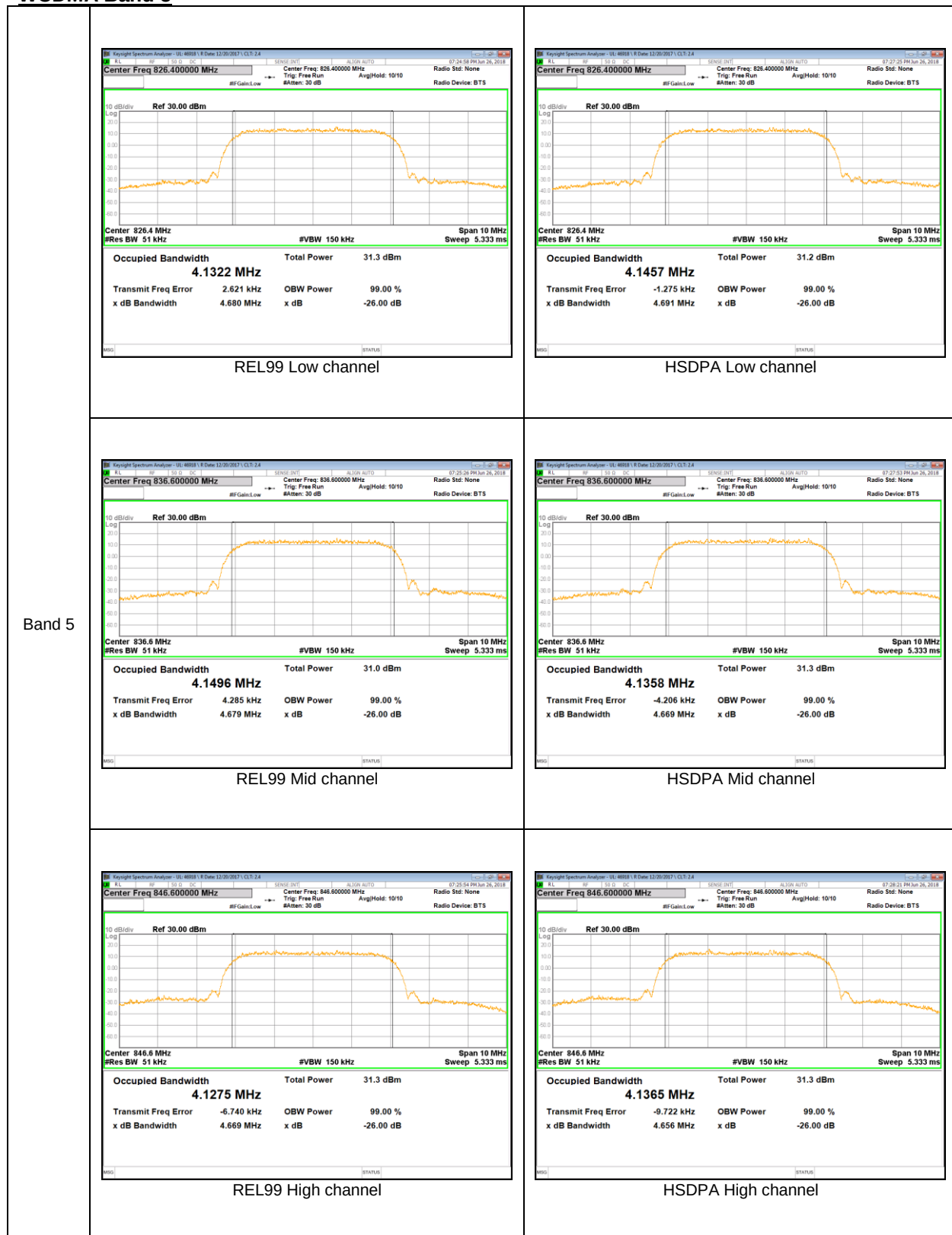
(KDB 971168 D01 Power Meas License Digital Systems v03r01)

RESULTS

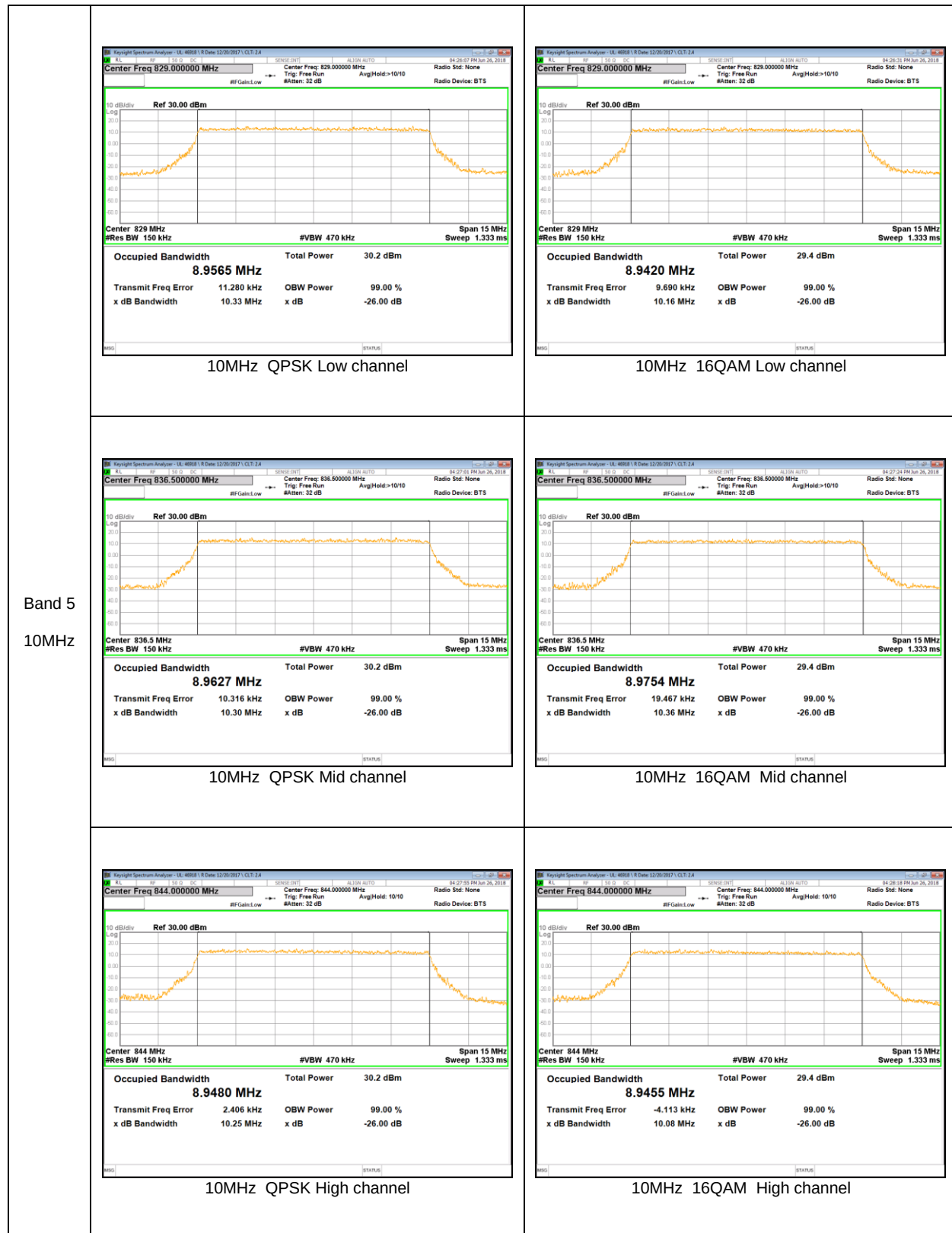
See the following pages.

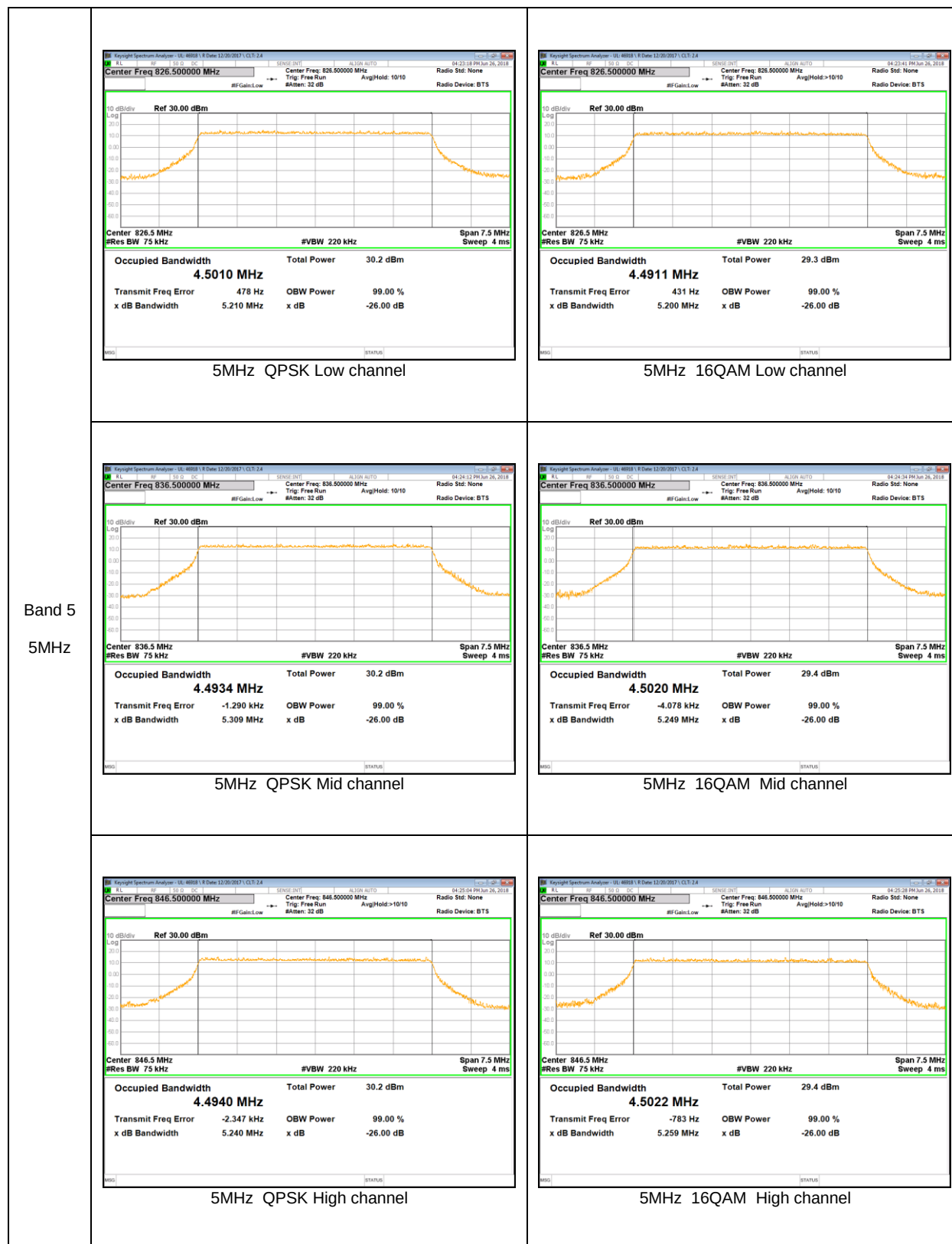
8.1.1. OCCUPIED BANDWIDTH RESULTS

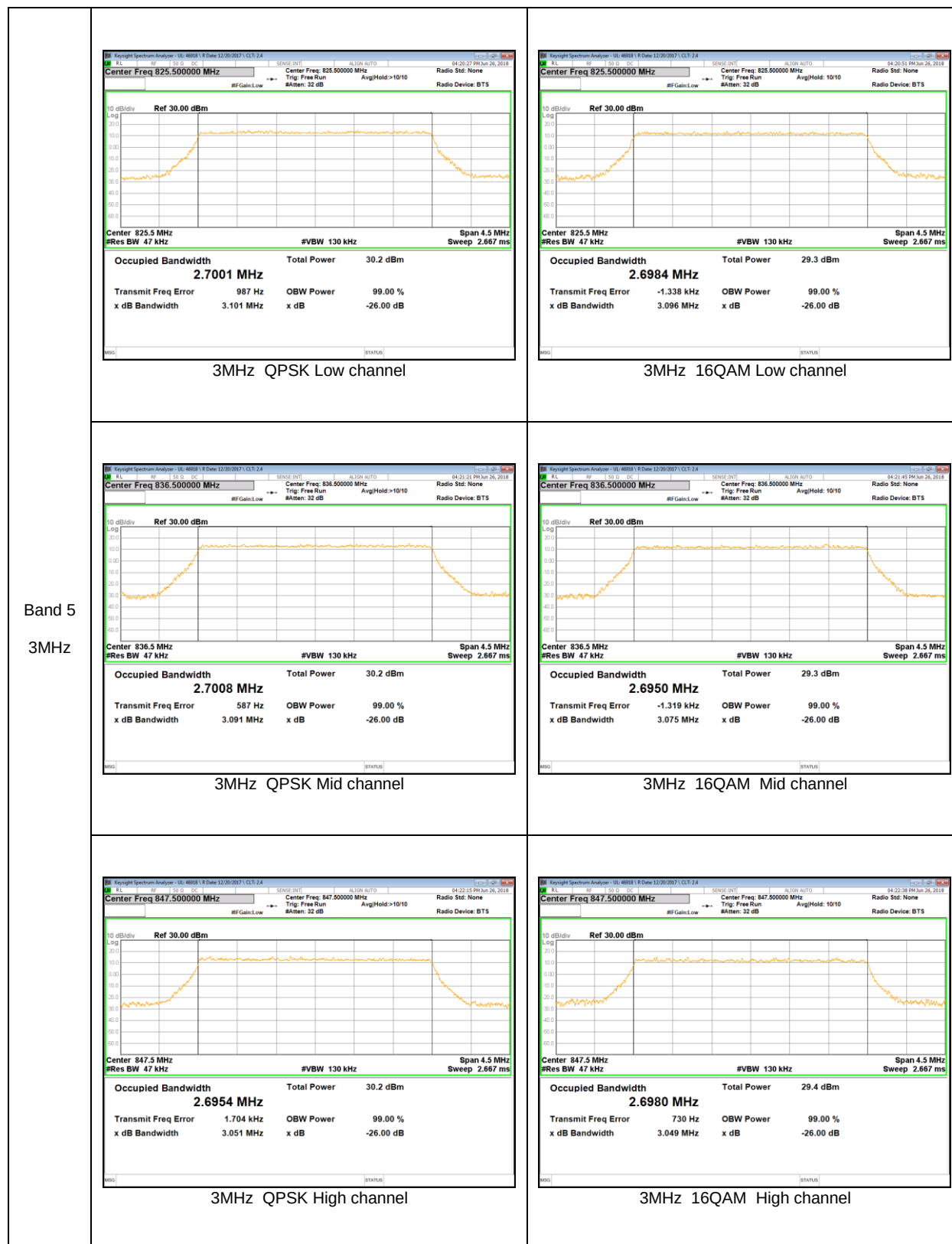
WCDMA Band 5

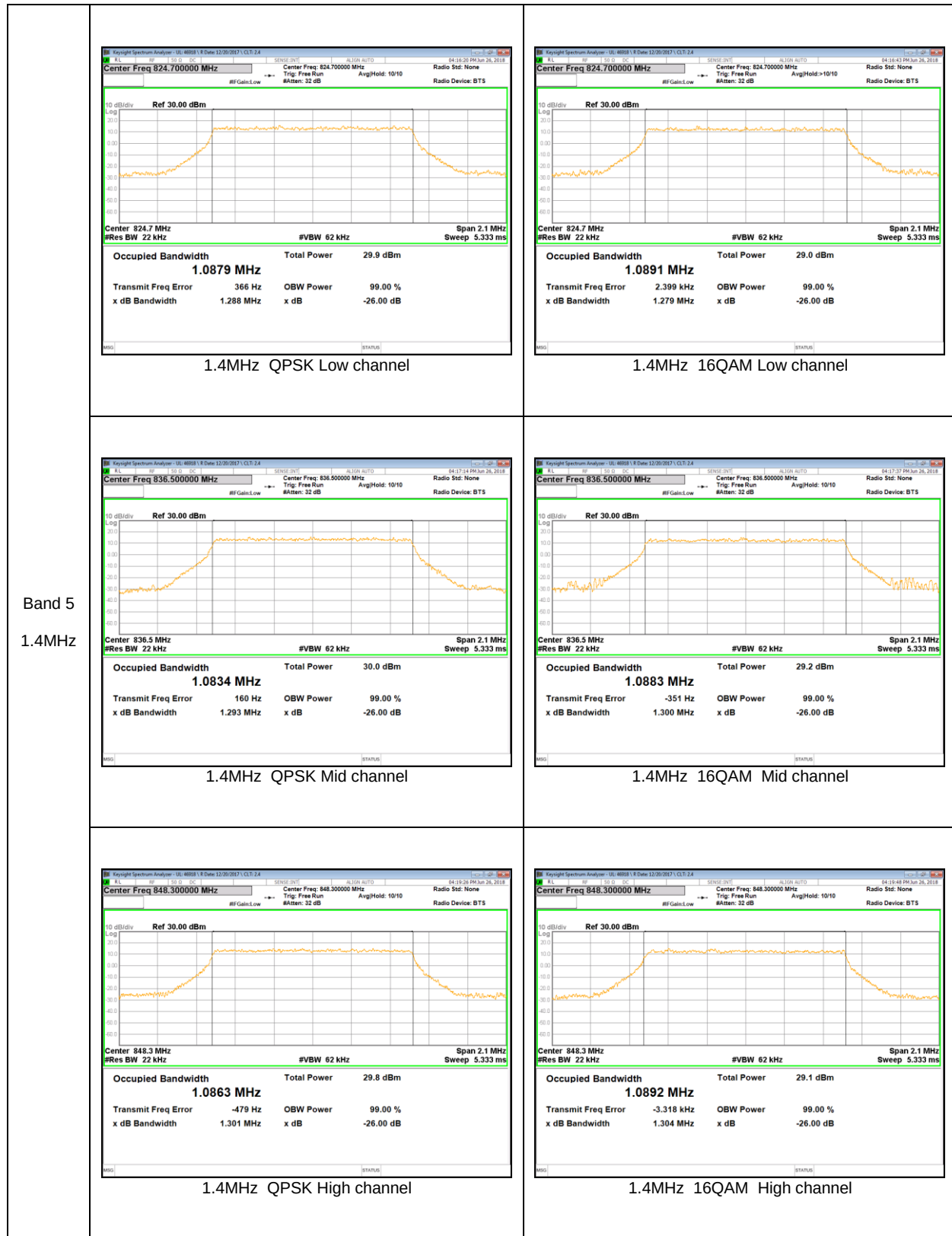


LTE Band 5









8.2. 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.

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB.

(h) The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ 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

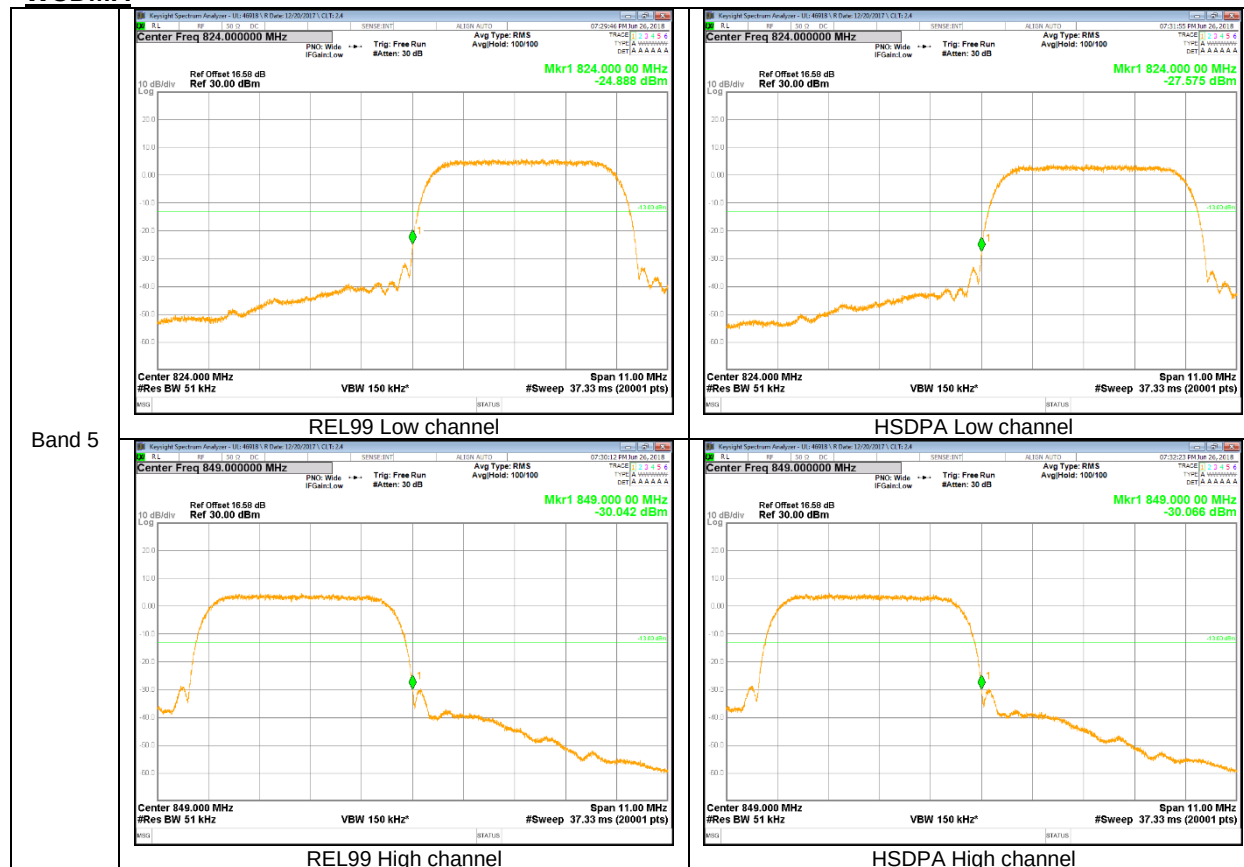
- a) Set the RBW = 1 ~ 1.5 % of OBW(Typically limited to a minimum RBW of 1% of the OBW)
- b) Set VBW $\geq 3 \times$ RBW;
- c) Set span ≥ 1.5 times the OBW;
- d) Sweep time = Auto;
- e) Detector = RMS;
- f) Ensure that the number of measurement points $\geq 2 \times$ Span/RBW;
- g) Trace mode = Average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

RESULTS

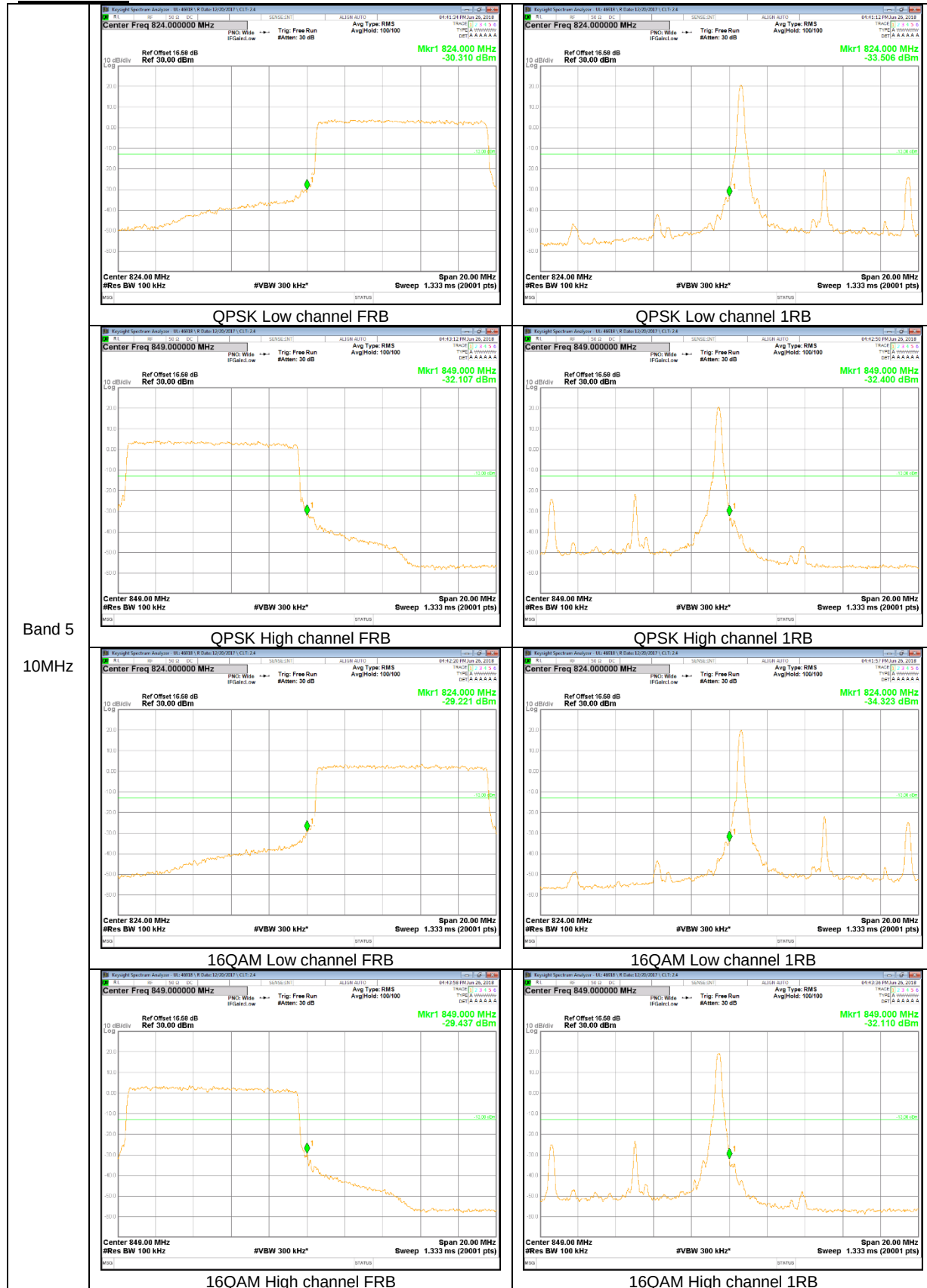
See the following pages.

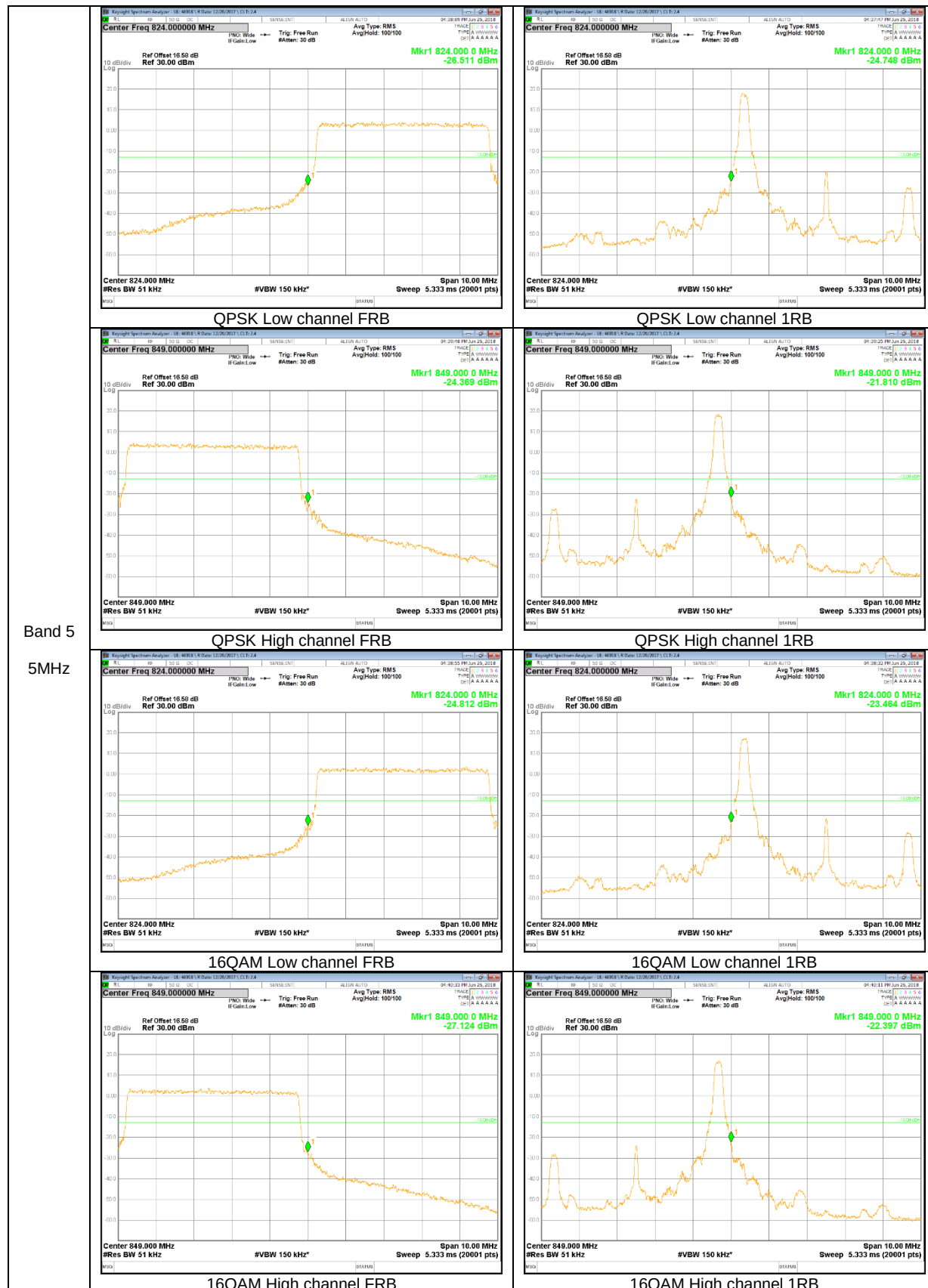
8.2.1. BAND EDGE RESULTS

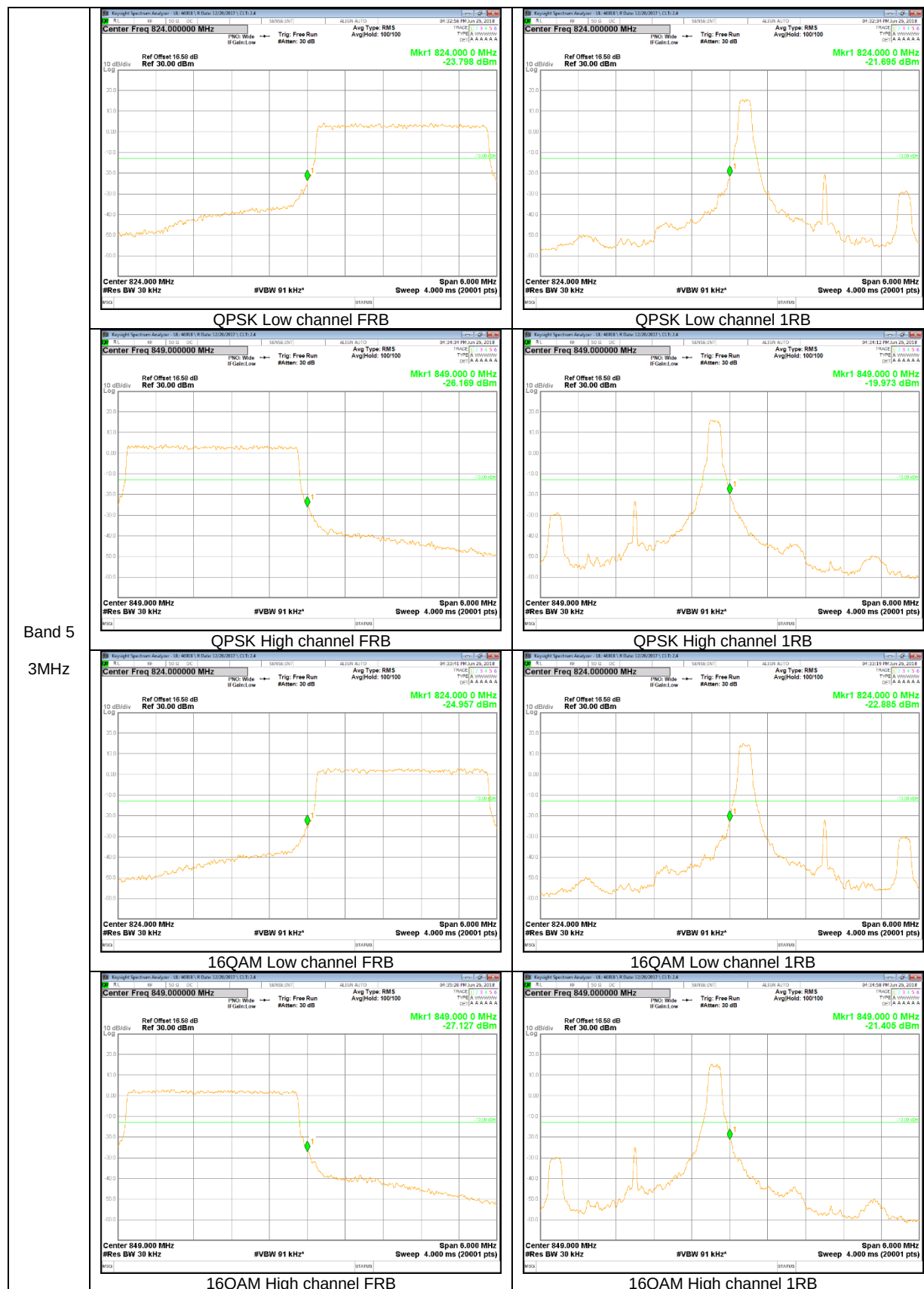
WCDMA

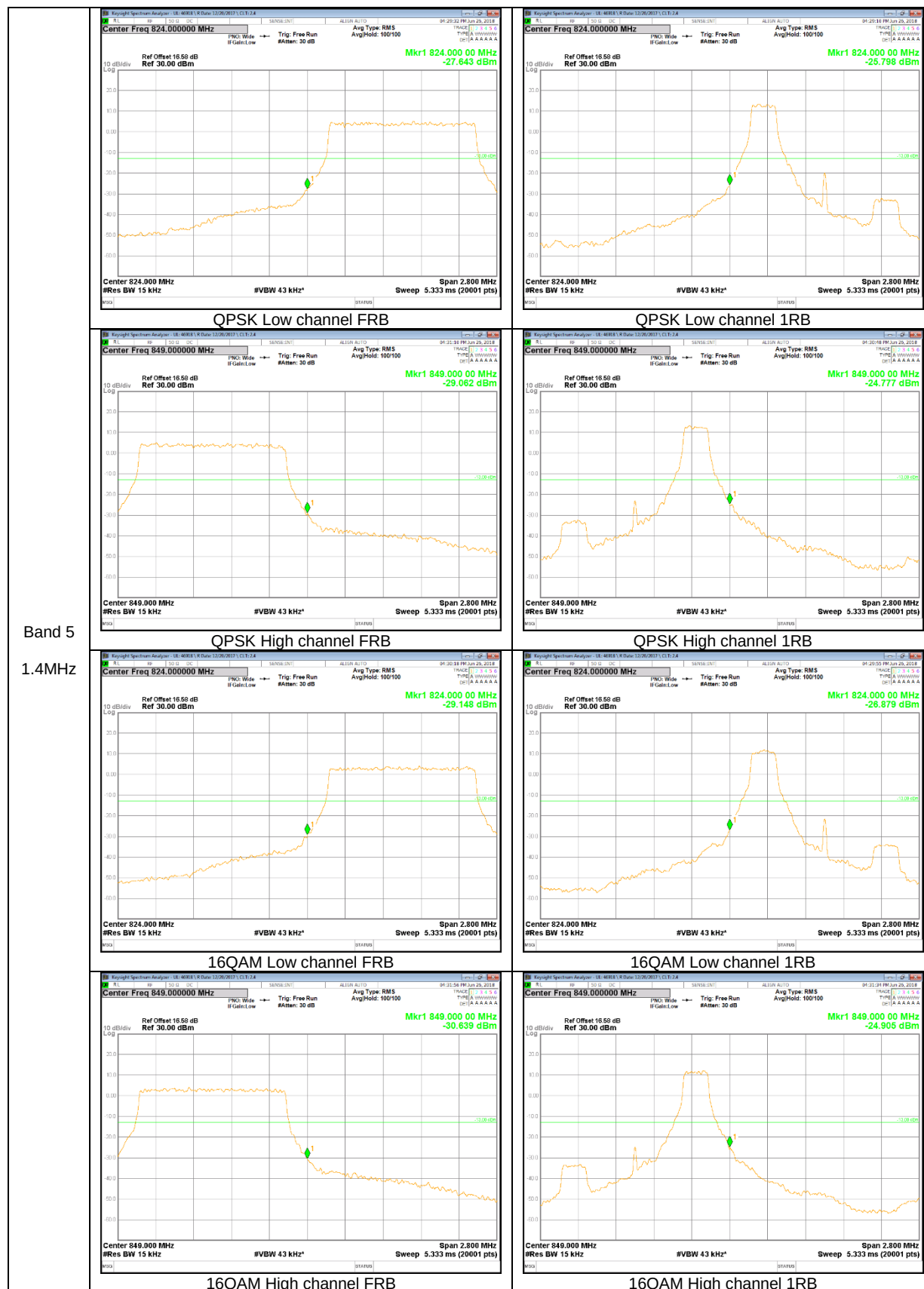


LTE Band 5









8.3. 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 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(WCDMA, LTE);

RESULTS

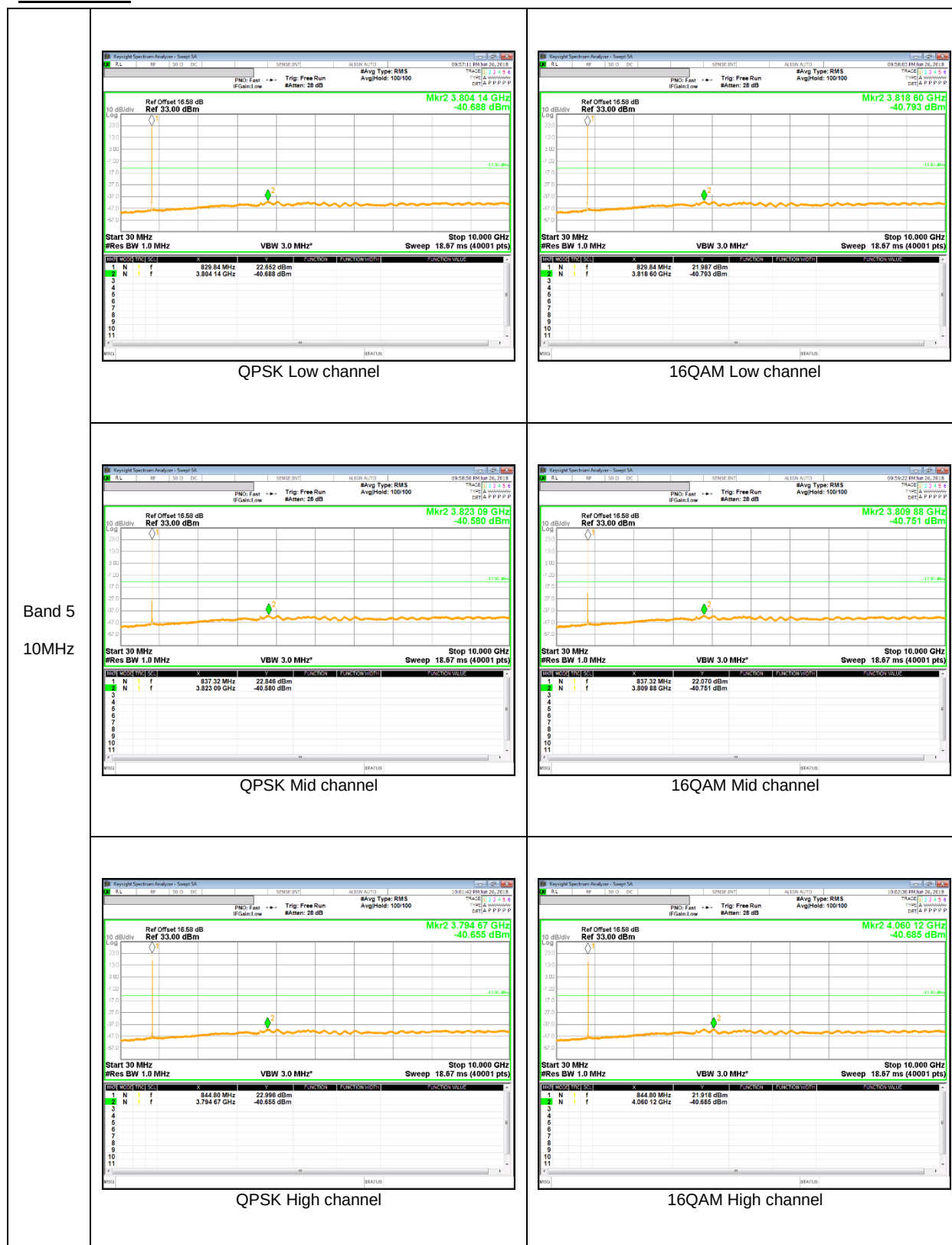
See the following pages.

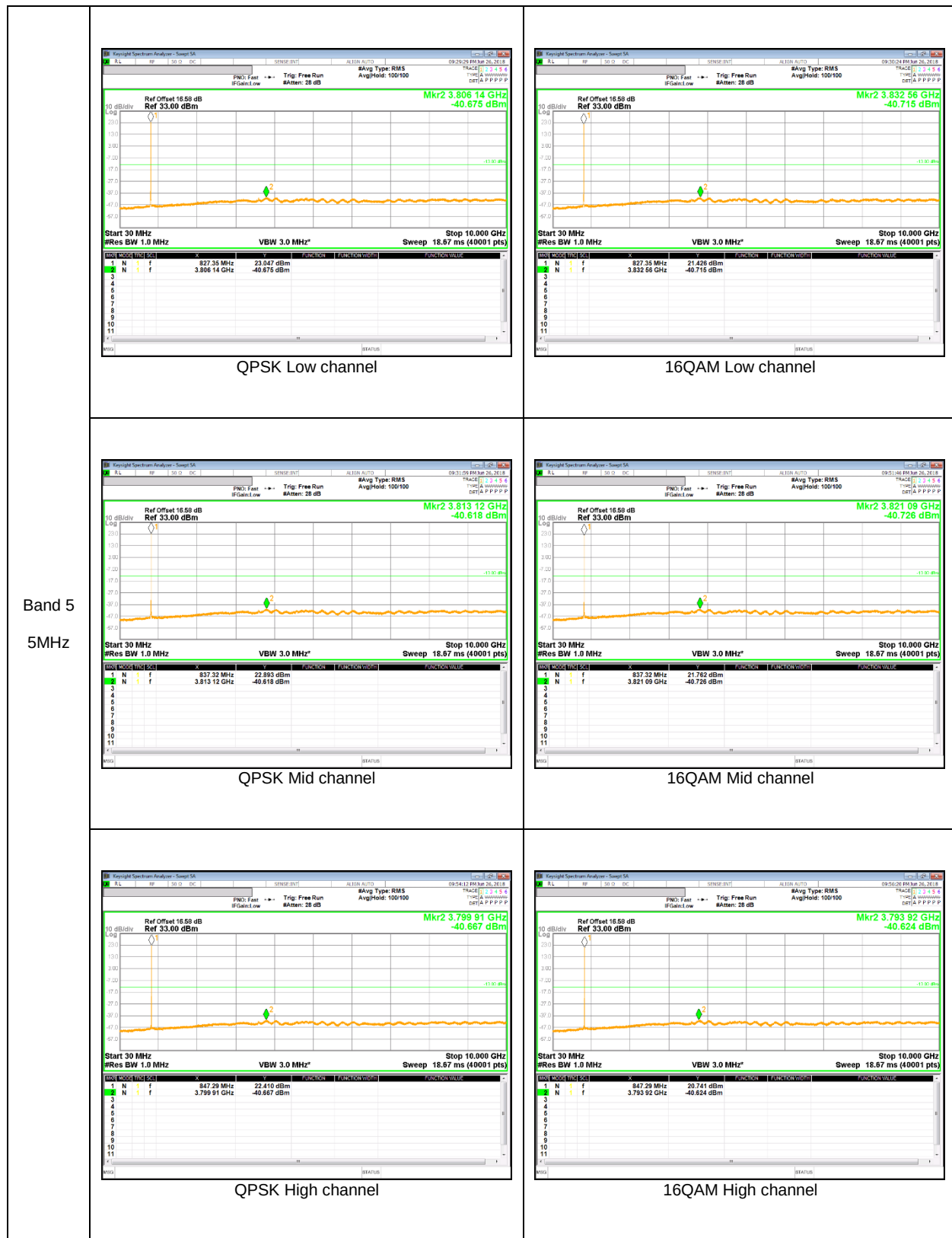
8.3.1. OUT OF BAND EMISSIONS RESULTS

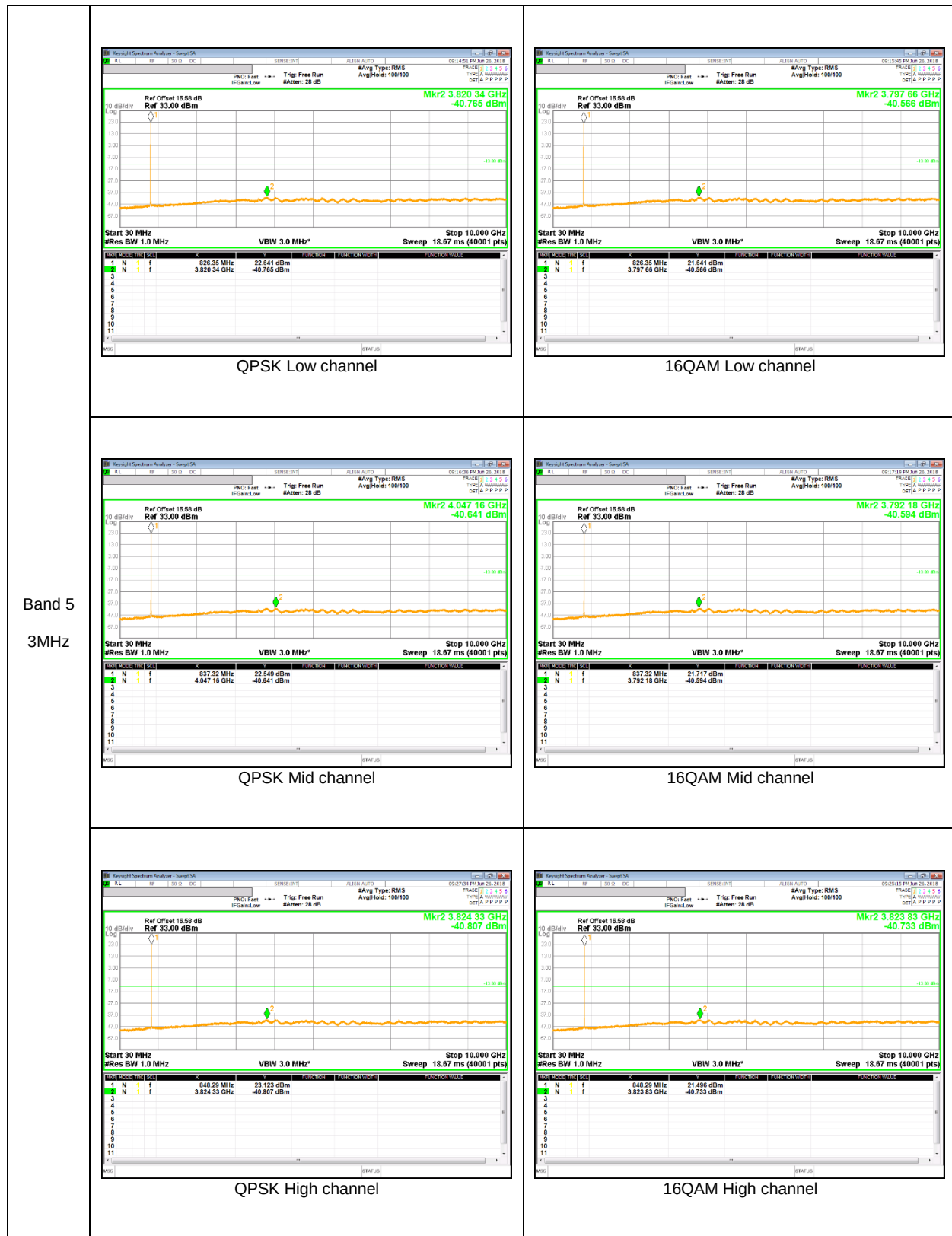
WCDMA Band 5



LTE Band 5









8.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355

LIMITS

§22.355 - The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

RESULTS

See the following pages.

8.4.1. FREQUENCY STABILITY RESULTS

CDMA Band 5 (Rel 99)

Reference Frequency : WCDMA Band 5 Low Channel 826.4 MHz / High Channel 846.6 MHz @ 20°C						
Limit: +- 2.5 ppm =	Low Channel	2066.000	Hz	High Channel	2116.500	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.85	50	826.39998252	-0.002	846.59998806	-0.004	2.5
3.85	40	826.39998603	-0.006	846.59998593	-0.002	2.5
3.85	30	826.39998027	0.001	846.59998131	0.004	2.5
3.85	20	826.39998099	0.000	846.59998455	0.000	2.5
3.85	10	826.39998933	-0.010	846.59998778	-0.004	2.5
3.85	0	826.39998393	-0.004	846.59998261	0.002	2.5
3.85	-10	826.39998210	-0.001	846.59998295	0.002	2.5
3.85	-20	826.39998028	0.001	846.59998094	0.004	2.5
3.85	-30	826.39998470	-0.004	846.59998470	0.000	2.5
Reference Frequency : WCDMA Band 5 Low Channel 826.4 MHz / High Channel 846.6 MHz @ 20°C						
Limit: +- 2.5 ppm =	Low Channel	2066.000	Hz	High Channel	2116.500	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.85	20	826.39998099	0	846.59998455	0	2.5
4.40	20	826.39998543	-0.005	846.59998827	-0.004	2.5
3.60	20	826.39998834	-0.009	846.59998161	0.003	2.5

LTE Band 5 (QPSK)

Reference Frequency : LTE Band 5 Low Channel 824.7 MHz / High Channel 848.3 MHz @ 20°C						
Limit: +- 2.5 ppm =	Low Channel	2061.750	Hz	High Channel	2120.750	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.85	50	824.69998323	-0.003	848.29998559	0.001	2.5
3.85	40	824.69998923	-0.010	848.29998012	0.008	2.5
3.85	30	824.69998135	0.000	848.29998932	-0.003	2.5
3.85	20	824.69998112	0.000	848.29998649	0.000	2.5
3.85	10	824.69998331	-0.003	848.29998647	0.000	2.5
3.85	0	824.69998746	-0.008	848.29998652	0.000	2.5
3.85	-10	824.69998893	-0.009	848.29998261	0.005	2.5
3.85	-20	824.69998576	-0.006	848.29998056	0.007	2.5
3.85	-30	824.69998750	-0.008	848.29998655	0.000	2.5
Reference Frequency : LTE Band 5 Low Channel 824.7 MHz / High Channel 848.3 MHz @ 20°C						
Limit: +- 2.5 ppm =	Low Channel	2061.750	Hz	High Channel	2120.750	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.85	20	824.69998112	0	848.29998649	0	2.5
4.40	20	824.69998803	-0.008	848.29998378	0.003	2.5
3.60	20	824.69998938	-0.010	848.29999031	-0.005	2.5

9. RADIATED TEST RESULTS

9.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §22.913

LIMITS

22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

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

TEST PROCEDURE

ANSI / TIA / EIA 603 E Clause 2.2.17; ESU40 setting reference to 971168 D01 v03r01

For radiated output power measurement with a ESU40:

a) Set the RBW $\geq$ OBW; b) Set VBW $\geq 3 \times$ RBW; c) Set span $\geq 2 \times$ RBW; d) Sweep time = auto couple; e) Detector = rms; f) Ensure that the number of measurement points $\geq$ span/RBW; g) Trace mode = max hold(WCDMA), average(LTE);

TEST RESULTS

9.1.1. ERP/EIRP Results

WCDMA

Band	Mode	Channel	f [MHz]	ERP / EIRP	
				[dBm]	[mW]
Band 5	REL99	4132	826.4	2.51	1.78
		4183	836.6	1.90	1.55
		4233	846.6	2.68	1.85
	HSDPA	4132	826.4	2.72	1.87
		4183	836.6	2.37	1.73
		4233	846.6	2.90	1.95

LTE Band 5

Band	BW	Mode	RB Size/	f [MHz]	ERP / EIRP	
	[MHz]		RB Offset		[dBm]	[mW]
Band 5	10	QPSK	1/0	829.0	7.91	6.18
			1/0	836.5	8.58	7.21
			1/0	844.0	7.95	6.24
		16QAM	1/0	829.0	6.44	4.41
			1/0	836.5	6.87	4.86
			1/0	844.0	6.92	4.92
	5	QPSK	1/0	826.5	7.99	6.30
			1/12	836.5	7.97	6.27
			1/0	846.5	8.16	6.55
		16QAM	1/12	826.5	6.58	4.55
			1/12	836.5	6.57	4.54
			1/0	846.5	6.89	4.89
	3	QPSK	1/8	825.5	7.59	5.74
			1/14	836.5	7.62	5.78
			1/8	847.5	7.94	6.22
		16QAM	1/0	825.5	6.76	4.74
			1/14	836.5	6.11	4.08
			1/14	847.5	6.52	4.49
	1.4	QPSK	1/0	824.7	7.65	5.82
			1/5	836.5	8.00	6.31
			1/0	848.3	8.32	6.79
		16QAM	1/3	824.7	6.37	4.34
			3/3	836.5	6.84	4.83
			3/0	848.3	6.87	4.86

9.1.2. ERP/EIRP DATA

WCDMA Band 5

WCDMA

Band 5

REL99

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788494710
Date: 2018-06-26
Test Engineer: 47989
Configuration: EUT / Z-Position
Location: Chamber 2
Mode: Rel99 Band 5 Fundamentals

Test Equipment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 3m N-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.40	4.93	V	1.0	-1.5	2.51	38.5	-36.0	
826.40	0.99	H	1.0	-1.5	-1.43	38.5	-39.9	
Mid Ch								
836.60	4.28	V	1.0	-1.4	1.90	38.5	-36.6	
836.60	1.02	H	1.0	-1.4	-1.36	38.5	-39.9	
High Ch								
846.60	5.03	V	1.0	-1.4	2.68	38.5	-35.8	
846.60	1.70	H	1.0	-1.4	-0.65	38.5	-39.1	

WCDMA

Band 5

HSDPA

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788494710
Date: 2018-07-16
Test Engineer: 47989
Configuration: EUT, Cradle, Adapter / Z-Position
Location: Chamber 2
Mode: LTE_16QAM Band 5 Fundamentals, 1.4MHz Bandwidth

Test Equipment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 3m N-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
824.70	7.70	V	1.0	-1.5	5.27	38.5	-33.2	
824.70	8.80	H	1.0	-1.5	6.37	38.5	-32.1	
Mid Ch								
836.50	7.93	V	1.0	-1.4	5.55	38.5	-33.0	
836.50	9.22	H	1.0	-1.4	6.84	38.5	-31.7	
High Ch								
848.30	7.61	V	1.0	-1.4	5.26	38.5	-33.2	
848.30	9.22	H	1.0	-1.4	6.87	38.5	-31.6	

LTE Band 5

LTE Band 5 10MHz QPSK	UL Verification Services, Inc. High Frequency Substitution Measurement Company: Samsung Project #: 4788494710 Date: 2018-07-16 Test Engineer: 47989 Configuration: EUT, Cradle, Adapter / Z-Position Location: Chamber 2 Mode: LTE_QPSK Band 5 Fundamentals, 10MHz Bandwidth Test Equipment: Receiving: VULB9163-749, and Chamber 2 SMA Cables Substitution: Dipole 3121_DB4, 3m N-type Cable <table><tr><th>f MHz</th><th>SG reading (dBm)</th><th>Ant. Pol. (H/V)</th><th>Cable Loss (dB)</th><th>Antenna Gain (dBd)</th><th>ERP (dBm)</th><th>Limit (dBm)</th><th>Delta (dB)</th><th>Notes</th></tr><tr><td colspan="9">Low Ch</td></tr><tr><td>829.00</td><td>9.19</td><td>V</td><td>1.0</td><td>-1.5</td><td>6.78</td><td>38.5</td><td>-31.7</td><td></td></tr><tr><td>829.00</td><td>10.32</td><td>H</td><td>1.0</td><td>-1.5</td><td>7.91</td><td>38.5</td><td>-30.6</td><td></td></tr><tr><td colspan="9">Mid Ch</td></tr><tr><td>836.50</td><td>8.92</td><td>V</td><td>1.0</td><td>-1.4</td><td>6.54</td><td>38.5</td><td>-32.0</td><td></td></tr><tr><td>836.50</td><td>10.96</td><td>H</td><td>1.0</td><td>-1.4</td><td>8.58</td><td>38.5</td><td>-29.9</td><td></td></tr><tr><td colspan="9">High Ch</td></tr><tr><td>844.00</td><td>8.50</td><td>V</td><td>1.0</td><td>-1.4</td><td>6.15</td><td>38.5</td><td>-32.4</td><td></td></tr><tr><td>844.00</td><td>10.31</td><td>H</td><td>1.0</td><td>-1.4</td><td>7.95</td><td>38.5</td><td>-30.5</td><td></td></tr></table>									f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes	Low Ch									829.00	9.19	V	1.0	-1.5	6.78	38.5	-31.7		829.00	10.32	H	1.0	-1.5	7.91	38.5	-30.6		Mid Ch									836.50	8.92	V	1.0	-1.4	6.54	38.5	-32.0		836.50	10.96	H	1.0	-1.4	8.58	38.5	-29.9		High Ch									844.00	8.50	V	1.0	-1.4	6.15	38.5	-32.4		844.00	10.31	H	1.0	-1.4	7.95	38.5	-30.5	
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes																																																																																										
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	829.00	9.19	V	1.0	-1.5	6.78	38.5	-31.7																																																																																											
	829.00	10.32	H	1.0	-1.5	7.91	38.5	-30.6																																																																																											
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	836.50	8.92	V	1.0	-1.4	6.54	38.5	-32.0																																																																																											
	836.50	10.96	H	1.0	-1.4	8.58	38.5	-29.9																																																																																											
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	844.00	8.50	V	1.0	-1.4	6.15	38.5	-32.4																																																																																											
844.00	10.31	H	1.0	-1.4	7.95	38.5	-30.5																																																																																												
LTE Band 5 10MHz 16QAM	UL Verification Services, Inc. High Frequency Substitution Measurement Company: Samsung Project #: 4788494710 Date: 2018-07-16 Test Engineer: 47989 Configuration: EUT, Cradle, Adapter / Z-Position Location: Chamber 2 Mode: LTE_16QAM Band 5 Fundamentals, 10MHz Bandwidth Test Equipment: Receiving: VULB9163-749, and Chamber 2 SMA Cables Substitution: Dipole 3121_DB4, 3m N-type Cable <table><tr><th>f MHz</th><th>SG reading (dBm)</th><th>Ant. Pol. (H/V)</th><th>Cable Loss (dB)</th><th>Antenna Gain (dBd)</th><th>ERP (dBm)</th><th>Limit (dBm)</th><th>Delta (dB)</th><th>Notes</th></tr><tr><td colspan="9">Low Ch</td></tr><tr><td>829.00</td><td>7.72</td><td>V</td><td>1.0</td><td>-1.5</td><td>5.31</td><td>38.5</td><td>-33.2</td><td></td></tr><tr><td>829.00</td><td>8.85</td><td>H</td><td>1.0</td><td>-1.5</td><td>6.44</td><td>38.5</td><td>-32.1</td><td></td></tr><tr><td colspan="9">Mid Ch</td></tr><tr><td>836.50</td><td>7.46</td><td>V</td><td>1.0</td><td>-1.4</td><td>5.08</td><td>38.5</td><td>-33.4</td><td></td></tr><tr><td>836.50</td><td>9.25</td><td>H</td><td>1.0</td><td>-1.4</td><td>6.87</td><td>38.5</td><td>-31.6</td><td></td></tr><tr><td colspan="9">High Ch</td></tr><tr><td>844.00</td><td>7.15</td><td>V</td><td>1.0</td><td>-1.4</td><td>4.80</td><td>38.5</td><td>-33.7</td><td></td></tr><tr><td>844.00</td><td>9.28</td><td>H</td><td>1.0</td><td>-1.4</td><td>6.92</td><td>38.5</td><td>-31.6</td><td></td></tr></table>									f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes	Low Ch									829.00	7.72	V	1.0	-1.5	5.31	38.5	-33.2		829.00	8.85	H	1.0	-1.5	6.44	38.5	-32.1		Mid Ch									836.50	7.46	V	1.0	-1.4	5.08	38.5	-33.4		836.50	9.25	H	1.0	-1.4	6.87	38.5	-31.6		High Ch									844.00	7.15	V	1.0	-1.4	4.80	38.5	-33.7		844.00	9.28	H	1.0	-1.4	6.92	38.5	-31.6	
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes																																																																																										
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	829.00	7.72	V	1.0	-1.5	5.31	38.5	-33.2																																																																																											
	829.00	8.85	H	1.0	-1.5	6.44	38.5	-32.1																																																																																											
	Mid Ch																																																																																																		
	836.50	7.46	V	1.0	-1.4	5.08	38.5	-33.4																																																																																											
	836.50	9.25	H	1.0	-1.4	6.87	38.5	-31.6																																																																																											
	High Ch																																																																																																		
	844.00	7.15	V	1.0	-1.4	4.80	38.5	-33.7																																																																																											
844.00	9.28	H	1.0	-1.4	6.92	38.5	-31.6																																																																																												

LTE

Band 5

5MHz

QPSK

UL Verification Services, Inc.

High Frequency Substitution Measurement

Company: Samsung

Project #: 4788494710

Date: 2018-07-16

Test Engineer: 47989

Configuration: EUT, Cradle, Adapter / Z-Position

Location: Chamber 2

Mode: LTE_QPSK Band 5 Fundamentals, 5MHz Bandwidth

Test Equipment:

Receiving: VULB9163-749, and Chamber 2 SMA Cables

Substitution: Dipole 3121_DB4, 3m N-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.50	9.32	V	1.0	-1.5	6.90	38.5	-31.6	
826.50	10.41	H	1.0	-1.5	7.99	38.5	-30.5	
Mid Ch								
836.50	8.87	V	1.0	-1.4	6.49	38.5	-32.0	
836.50	10.35	H	1.0	-1.4	7.97	38.5	-30.5	
High Ch								
846.50	8.46	V	1.0	-1.4	6.11	38.5	-32.4	
846.50	10.51	H	1.0	-1.4	8.16	38.5	-30.3	

LTE

Band 5

5MHz

16QAM

UL Verification Services, Inc.

High Frequency Substitution Measurement

Company: Samsung

Project #: 4788494710

Date: 2018-07-16

Test Engineer: 47989

Configuration: EUT, Cradle, Adapter / Z-Position

Location: Chamber 2

Mode: LTE_16QAM Band 5 Fundamentals, 5MHz Bandwidth

Test Equipment:

Receiving: VULB9163-749, and Chamber 2 SMA Cables

Substitution: Dipole 3121_DB4, 3m N-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.50	8.00	V	1.0	-1.5	5.58	38.5	-32.9	
826.50	9.00	H	1.0	-1.5	6.58	38.5	-31.9	
Mid Ch								
836.50	7.61	V	1.0	-1.4	5.23	38.5	-33.3	
836.50	8.95	H	1.0	-1.4	6.57	38.5	-31.9	
High Ch								
846.50	7.09	V	1.0	-1.4	4.74	38.5	-33.8	
846.50	9.24	H	1.0	-1.4	6.89	38.5	-31.6	

LTE Band 5 3MHz QPSK	UL Verification Services, Inc. High Frequency Substitution Measurement Company: Samsung Project #: 4788494710 Date: 2018-07-16 Test Engineer: 47989 Configuration: EUT, Cradle, Adapter / Z-Position Location: Chamber 2 Mode: LTE_QPSK Band 5 Fundamentals, 3MHz Bandwidth Test Equipment: Receiving: VULB9163-749, and Chamber 2 SMA Cables Substitution: Dipole 3121_DB4, 3m N-type Cable								
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
	Low Ch								
	825.50	9.27	V	1.0	-1.5	6.85	38.5	-31.6	
	825.50	10.01	H	1.0	-1.5	7.59	38.5	-30.9	
	Mid Ch								
	836.50	9.10	V	1.0	-1.4	6.72	38.5	-31.8	
	836.50	10.00	H	1.0	-1.4	7.62	38.5	-30.9	
	High Ch								
	847.50	8.34	V	1.0	-1.4	6.00	38.5	-32.5	
847.50	10.29	H	1.0	-1.4	7.94	38.5	-30.6		
LTE Band 5 3MHz 16QAM	UL Verification Services, Inc. High Frequency Substitution Measurement Company: Samsung Project #: 4788494710 Date: 2018-07-16 Test Engineer: 47989 Configuration: EUT, Cradle, Adapter / Z-Position Location: Chamber 2 Mode: LTE_16QAM Band 5 Fundamentals, 3MHz Bandwidth Test Equipment: Receiving: VULB9163-749, and Chamber 2 SMA Cables Substitution: Dipole 3121_DB4, 3m N-type Cable								
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
	Low Ch								
	825.50	7.92	V	1.0	-1.5	5.50	38.5	-33.0	
	825.50	9.18	H	1.0	-1.5	6.76	38.5	-31.7	
	Mid Ch								
	836.50	7.61	V	1.0	-1.4	5.23	38.5	-33.3	
	836.50	8.49	H	1.0	-1.4	6.11	38.5	-32.4	
	High Ch								
	847.50	7.19	V	1.0	-1.4	4.85	38.5	-33.7	
847.50	8.87	H	1.0	-1.4	6.52	38.5	-32.0		

LTE Band 5 1.4MHz QPSK	UL Verification Services, Inc. High Frequency Substitution Measurement Company: Samsung Project #: 4788494710 Date: 2018-07-16 Test Engineer: 47989 Configuration: EUT, Cradle, Adapter / Z-Position Location: Chamber 2 Mode: LTE_QPSK Band 5 Fundamentals, 1.4MHz Bandwidth Test Equipment: Receiving: VULB9163-749, and Chamber 2 SMA Cables Substitution: Dipole 3121_DB4, 3m N-type Cable <table><tr><th>f MHz</th><th>SG reading (dBm)</th><th>Ant. Pol. (H/V)</th><th>Cable Loss (dB)</th><th>Antenna Gain (dBd)</th><th>ERP (dBm)</th><th>Limit (dBm)</th><th>Delta (dB)</th><th>Notes</th></tr><tr><td>Low Ch</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>824.70</td><td>9.12</td><td>V</td><td>1.0</td><td>-1.5</td><td>6.69</td><td>38.5</td><td>-31.8</td><td></td></tr><tr><td>824.70</td><td>10.08</td><td>H</td><td>1.0</td><td>-1.5</td><td>7.65</td><td>38.5</td><td>-30.8</td><td></td></tr><tr><td>Mid Ch</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>836.50</td><td>8.94</td><td>V</td><td>1.0</td><td>-1.4</td><td>6.56</td><td>38.5</td><td>-31.9</td><td></td></tr><tr><td>836.50</td><td>10.38</td><td>H</td><td>1.0</td><td>-1.4</td><td>8.00</td><td>38.5</td><td>-30.5</td><td></td></tr><tr><td>High Ch</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>848.30</td><td>8.60</td><td>V</td><td>1.0</td><td>-1.4</td><td>6.25</td><td>38.5</td><td>-32.2</td><td></td></tr><tr><td>848.30</td><td>10.67</td><td>H</td><td>1.0</td><td>-1.4</td><td>8.32</td><td>38.5</td><td>-30.2</td><td></td></tr></table>									f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes	Low Ch								824.70	9.12	V	1.0	-1.5	6.69	38.5	-31.8		824.70	10.08	H	1.0	-1.5	7.65	38.5	-30.8		Mid Ch									836.50	8.94	V	1.0	-1.4	6.56	38.5	-31.9		836.50	10.38	H	1.0	-1.4	8.00	38.5	-30.5		High Ch									848.30	8.60	V	1.0	-1.4	6.25	38.5	-32.2		848.30	10.67	H	1.0	-1.4	8.32	38.5	-30.2		
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes																																																																																										
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	824.70	10.08	H	1.0	-1.5	7.65	38.5	-30.8																																																																																											
	Mid Ch																																																																																																		
	836.50	8.94	V	1.0	-1.4	6.56	38.5	-31.9																																																																																											
	836.50	10.38	H	1.0	-1.4	8.00	38.5	-30.5																																																																																											
	High Ch																																																																																																		
	848.30	8.60	V	1.0	-1.4	6.25	38.5	-32.2																																																																																											
848.30	10.67	H	1.0	-1.4	8.32	38.5	-30.2																																																																																												
LTE Band 5 1.4MHz 16QAM	UL Verification Services, Inc. High Frequency Substitution Measurement Company: Samsung Project #: 4788494710 Date: 2018-07-16 Test Engineer: 47989 Configuration: EUT, Cradle, Adapter / Z-Position Location: Chamber 2 Mode: LTE_16QAM Band 5 Fundamentals, 1.4MHz Bandwidth Test Equipment: Receiving: VULB9163-749, and Chamber 2 SMA Cables Substitution: Dipole 3121_DB4, 3m N-type Cable <table><tr><th>f MHz</th><th>SG reading (dBm)</th><th>Ant. Pol. (H/V)</th><th>Cable Loss (dB)</th><th>Antenna Gain (dBd)</th><th>ERP (dBm)</th><th>Limit (dBm)</th><th>Delta (dB)</th><th>Notes</th></tr><tr><td>Low Ch</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>824.70</td><td>7.70</td><td>V</td><td>1.0</td><td>-1.5</td><td>5.27</td><td>38.5</td><td>-33.2</td><td></td></tr><tr><td>824.70</td><td>8.80</td><td>H</td><td>1.0</td><td>-1.5</td><td>6.37</td><td>38.5</td><td>-32.1</td><td></td></tr><tr><td>Mid Ch</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>836.50</td><td>7.93</td><td>V</td><td>1.0</td><td>-1.4</td><td>5.55</td><td>38.5</td><td>-33.0</td><td></td></tr><tr><td>836.50</td><td>9.22</td><td>H</td><td>1.0</td><td>-1.4</td><td>6.84</td><td>38.5</td><td>-31.7</td><td></td></tr><tr><td>High Ch</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>848.30</td><td>7.61</td><td>V</td><td>1.0</td><td>-1.4</td><td>5.26</td><td>38.5</td><td>-33.2</td><td></td></tr><tr><td>848.30</td><td>9.22</td><td>H</td><td>1.0</td><td>-1.4</td><td>6.87</td><td>38.5</td><td>-31.6</td><td></td></tr></table>									f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes	Low Ch									824.70	7.70	V	1.0	-1.5	5.27	38.5	-33.2		824.70	8.80	H	1.0	-1.5	6.37	38.5	-32.1		Mid Ch									836.50	7.93	V	1.0	-1.4	5.55	38.5	-33.0		836.50	9.22	H	1.0	-1.4	6.84	38.5	-31.7		High Ch									848.30	7.61	V	1.0	-1.4	5.26	38.5	-33.2		848.30	9.22	H	1.0	-1.4	6.87	38.5	-31.6	
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes																																																																																										
	Low Ch																																																																																																		
	824.70	7.70	V	1.0	-1.5	5.27	38.5	-33.2																																																																																											
	824.70	8.80	H	1.0	-1.5	6.37	38.5	-32.1																																																																																											
	Mid Ch																																																																																																		
	836.50	7.93	V	1.0	-1.4	5.55	38.5	-33.0																																																																																											
	836.50	9.22	H	1.0	-1.4	6.84	38.5	-31.7																																																																																											
	High Ch																																																																																																		
	848.30	7.61	V	1.0	-1.4	5.26	38.5	-33.2																																																																																											
848.30	9.22	H	1.0	-1.4	6.87	38.5	-31.6																																																																																												

9.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §22.917

LIMIT

Part 22.917(a)

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

ANSI / TIA / EIA 603 E Clause 2.2.12; ESU40 setting reference to 971168 D01 v03r01

For peak power measurement with a ESU40:

- a) Set the RBW = 100 KHz for emission below 1GHz and 1MHz for emissions above 1GHz
- 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 $\geq$ span/RBW;
- g) Trace mode = average(WCDMA, LTE);

NOTE : Radiated spurious emissions were investigated below 30MHz, 30MHz – 1GHz and above 1GHz. There were no emissions found on below 30MHz and 30MHz – 1GHz.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field based on KDB 414788.

RESULTS

See the following pages.

WCDMA Band 5

WCDMA

Band 5

REL99

UL Verification Services, Inc.

Above 1GHz High Frequency Substitution Measurement

Company:

Project #:

Date:

Test Engineer:

Configuration:

Location:

Mode:

Samsung

4788494710

2018-06-28

47989

EUT / Adapter / Cradke , Z-position

Chamber 2

Rel99 Band 5 Harmonics

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 826.4MHz									
1652.80	-29.3	V	3.0	38.2	1.0	-66.6	-13.0	-53.6	
2479.20	-28.0	V	3.0	38.8	1.0	-65.8	-13.0	-52.8	
3305.60	-26.7	V	3.0	39.4	1.0	-65.2	-13.0	-52.2	
1652.80	-28.4	H	3.0	38.2	1.0	-65.6	-13.0	-52.6	
2479.20	-28.7	H	3.0	38.8	1.0	-66.5	-13.0	-53.5	
3305.60	-27.0	H	3.0	39.4	1.0	-65.5	-13.0	-52.5	
Mid Ch, 836.6MHz									
1673.20	-28.3	V	3.0	38.2	1.0	-65.5	-13.0	-52.5	
2509.80	-28.1	V	3.0	38.8	1.0	-65.9	-13.0	-52.9	
3346.40	-26.8	V	3.0	39.5	1.0	-65.3	-13.0	-52.3	
1673.20	-25.9	H	3.0	38.2	1.0	-63.1	-13.0	-50.1	
2509.80	-28.5	H	3.0	38.8	1.0	-66.4	-13.0	-53.4	
3346.40	-26.7	H	3.0	39.5	1.0	-65.1	-13.0	-52.1	
High Ch, 846.6MHz									
1693.20	-27.6	V	3.0	38.2	1.0	-64.8	-13.0	-51.8	
2539.80	-27.4	V	3.0	38.9	1.0	-65.3	-13.0	-52.3	
3386.40	-26.4	V	3.0	39.5	1.0	-64.9	-13.0	-51.9	
1693.20	-29.5	H	3.0	38.2	1.0	-66.8	-13.0	-53.8	
2539.80	-28.3	H	3.0	38.9	1.0	-66.2	-13.0	-53.2	
3386.40	-26.5	H	3.0	39.5	1.0	-65.0	-13.0	-52.0	

WCDMA

Band 5

HSDPA

UL Verification Services, Inc.

Above 1GHz High Frequency Substitution Measurement

Company:

Project #:

Date:

Test Engineer:

Configuration:

Location:

Mode:

Samsung

4788494710

2018-06-28

47989

EUT / Adapter / Cradke , Z-position

Chamber 2

HSDPA Band 5 Harmonics

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 826.4MHz									
1652.80	-29.8	V	3.0	38.2	1.0	-67.0	-13.0	-54.0	
2479.20	-28.1	V	3.0	38.8	1.0	-65.9	-13.0	-52.9	
3305.60	-26.7	V	3.0	39.4	1.0	-65.2	-13.0	-52.2	
1652.80	-26.5	H	3.0	38.2	1.0	-63.7	-13.0	-50.7	
2479.20	-28.7	H	3.0	38.8	1.0	-66.5	-13.0	-53.5	
3305.60	-26.6	H	3.0	39.4	1.0	-65.1	-13.0	-52.1	
Mid Ch, 836.6MHz									
1673.20	-28.0	V	3.0	38.2	1.0	-65.2	-13.0	-52.2	
2509.80	-28.1	V	3.0	38.8	1.0	-65.9	-13.0	-52.9	
3346.40	-26.8	V	3.0	39.5	1.0	-65.3	-13.0	-52.3	
1673.20	-31.4	H	3.0	38.2	1.0	-68.6	-13.0	-55.6	
2509.80	-28.5	H	3.0	38.8	1.0	-66.3	-13.0	-53.3	
3346.40	-26.9	H	3.0	39.5	1.0	-65.4	-13.0	-52.4	
High Ch, 846.6MHz									
1693.20	-28.5	V	3.0	38.2	1.0	-65.7	-13.0	-52.7	
2539.80	-27.9	V	3.0	38.9	1.0	-65.8	-13.0	-52.8	
3386.40	-26.3	V	3.0	39.5	1.0	-64.8	-13.0	-51.8	
1693.20	-29.8	H	3.0	38.2	1.0	-67.0	-13.0	-54.0	
2539.80	-28.4	H	3.0	38.9	1.0	-66.3	-13.0	-53.3	
3386.40	-26.4	H	3.0	39.5	1.0	-64.9	-13.0	-51.9	

LTE Band 5

LTE Band 5 10MHz QPSK	UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement Company: Samsung Project #: 4788494710 Date: 2018-06-27 Test Engineer: 47989 Configuration: EUT / Adapter / Cradle , Z-position Location: Chamber 2 Mode: LTE_QPSK Band 5 Harmonics, 10MHz Bandwidth									
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
	Low Ch, 829MHz									
	1658.00	-27.6	V	3.0	38.2	1.0	-64.8	-13.0	-51.8	
	2487.00	-28.8	V	3.0	38.8	1.0	-66.6	-13.0	-53.6	
	3316.00	-27.4	V	3.0	39.4	1.0	-65.9	-13.0	-52.9	
	1658.00	-22.8	H	3.0	38.2	1.0	-60.0	-13.0	-47.0	
	2487.00	-29.3	H	3.0	38.8	1.0	-67.1	-13.0	-54.1	
	3316.00	-27.3	H	3.0	39.4	1.0	-65.7	-13.0	-52.7	
	Mid Ch, 836.5MHz									
	1673.00	-24.2	V	3.0	38.2	1.0	-61.4	-13.0	-48.4	
	2509.50	-28.8	V	3.0	38.8	1.0	-66.6	-13.0	-53.6	
	3346.00	-27.2	V	3.0	39.5	1.0	-65.7	-13.0	-52.7	
	1673.00	-25.3	H	3.0	38.2	1.0	-62.5	-13.0	-49.5	
	2509.50	-29.3	H	3.0	38.8	1.0	-67.2	-13.0	-54.2	
	3346.00	-27.6	H	3.0	39.5	1.0	-66.1	-13.0	-53.1	
	High Ch, 844MHz									
	1688.00	-26.0	V	3.0	38.2	1.0	-63.3	-13.0	-50.3	
	2532.00	-28.6	V	3.0	38.9	1.0	-66.5	-13.0	-53.5	
	3376.00	-27.7	V	3.0	39.5	1.0	-66.2	-13.0	-53.2	
	1688.00	-23.6	H	3.0	38.2	1.0	-60.9	-13.0	-47.9	
	2532.00	-29.1	H	3.0	38.9	1.0	-67.0	-13.0	-54.0	
	3376.00	-27.8	H	3.0	39.5	1.0	-66.3	-13.0	-53.3	
LTE Band 5 10MHz 16QAM	UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement Company: Samsung Project #: 4788494710 Date: 2018-06-27 Test Engineer: 47989 Configuration: EUT / Adapter / Cradle , Z-position Location: Chamber 2 Mode: LTE_16QAM Band 5 Harmonics, 10MHz Bandwidth									
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
	Low Ch, 829MHz									
	1658.00	-28.6	V	3.0	38.2	1.0	-65.8	-13.0	-52.8	
	2487.00	-28.2	V	3.0	38.8	1.0	-66.0	-13.0	-53.0	
	3316.00	-27.5	V	3.0	39.4	1.0	-65.9	-13.0	-52.9	
	1658.00	-23.7	H	3.0	38.2	1.0	-60.9	-13.0	-47.9	
	2487.00	-29.1	H	3.0	38.8	1.0	-66.9	-13.0	-53.9	
	3316.00	-27.2	H	3.0	39.4	1.0	-65.6	-13.0	-52.6	
	Mid Ch, 836.5MHz									
	1673.00	-25.5	V	3.0	38.2	1.0	-62.8	-13.0	-49.8	
	2509.50	-28.7	V	3.0	38.8	1.0	-66.5	-13.0	-53.5	
	3346.00	-27.2	V	3.0	39.5	1.0	-65.7	-13.0	-52.7	
	1673.00	-25.7	H	3.0	38.2	1.0	-63.0	-13.0	-50.0	
	2509.50	-29.1	H	3.0	38.8	1.0	-66.9	-13.0	-53.9	
	3346.00	-27.4	H	3.0	39.5	1.0	-65.9	-13.0	-52.9	
	High Ch, 844MHz									
	1688.00	-26.6	V	3.0	38.2	1.0	-63.9	-13.0	-50.9	
	2532.00	-28.8	V	3.0	38.9	1.0	-66.6	-13.0	-53.6	
	3376.00	-27.2	V	3.0	39.5	1.0	-65.7	-13.0	-52.7	
	1688.00	-25.0	H	3.0	38.2	1.0	-62.3	-13.0	-49.3	
	2532.00	-29.3	H	3.0	38.9	1.0	-67.2	-13.0	-54.2	
	3376.00	-27.1	H	3.0	39.5	1.0	-65.6	-13.0	-52.6	

LTE Band 5 5MHz QPSK	UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement									
	Company: Samsung									
	Project #: 4788494710									
	Date: 2018-06-27									
	Test Engineer: 47989									
	Configuration: EUT / Adapter / Cradle , Z-position									
	Location: Chamber 2									
	Mode: LTE_QPSK Band 5 Harmonics, 5MHz Bandwidth									
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
	Low Ch, 826.5MHz									
	1653.00	-29.4	V	3.0	38.2	1.0	-66.7	-13.0	-53.7	
	2479.50	-28.6	V	3.0	38.8	1.0	-66.4	-13.0	-53.4	
	3306.00	-27.7	V	3.0	39.4	1.0	-66.1	-13.0	-53.1	
	1653.00	-29.7	H	3.0	38.2	1.0	-66.9	-13.0	-53.9	
	2479.50	-28.8	H	3.0	38.8	1.0	-66.6	-13.0	-53.6	
	3306.00	-27.7	H	3.0	39.4	1.0	-66.2	-13.0	-53.2	
	Mid Ch, 836.5MHz									
	1673.00	-27.5	V	3.0	38.2	1.0	-64.8	-13.0	-51.8	
	2509.50	-28.5	V	3.0	38.8	1.0	-66.3	-13.0	-53.3	
3346.00	-27.6	V	3.0	39.5	1.0	-66.0	-13.0	-53.0		
1673.00	-25.9	H	3.0	38.2	1.0	-63.2	-13.0	-50.2		
2509.50	-29.3	H	3.0	38.8	1.0	-67.1	-13.0	-54.1		
3346.00	-27.3	H	3.0	39.5	1.0	-65.7	-13.0	-52.7		
High Ch, 846.5MHz										
1693.00	-23.7	V	3.0	38.2	1.0	-60.9	-13.0	-47.9		
2539.50	-28.1	V	3.0	38.9	1.0	-66.0	-13.0	-53.0		
3386.00	-27.6	V	3.0	39.5	1.0	-66.0	-13.0	-53.0		
1693.00	-24.8	H	3.0	38.2	1.0	-62.0	-13.0	-49.0		
2539.50	-29.2	H	3.0	38.9	1.0	-67.0	-13.0	-54.0		
3386.00	-27.6	H	3.0	39.5	1.0	-66.0	-13.0	-53.0		
LTE Band 5 5MHz 16QAM	UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement									
	Company: Samsung									
	Project #: 4788494710									
	Date: 2018-06-27									
	Test Engineer: 47989									
	Configuration: EUT / Adapter / Cradle , Z-position									
	Location: Chamber 2									
	Mode: LTE_16QAM Band 5 Harmonics, 5MHz Bandwidth									
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
	Low Ch, 826.5MHz									
	1653.00	-30.0	V	3.0	38.2	1.0	-67.2	-13.0	-54.2	
	2479.50	-28.9	V	3.0	38.8	1.0	-66.8	-13.0	-53.8	
	3306.00	-27.4	V	3.0	39.4	1.0	-65.9	-13.0	-52.9	
	1653.00	-29.5	H	3.0	38.2	1.0	-66.8	-13.0	-53.8	
	2479.50	-29.5	H	3.0	38.8	1.0	-67.3	-13.0	-54.3	
	3306.00	-27.7	H	3.0	39.4	1.0	-66.1	-13.0	-53.1	
	Mid Ch, 836.5MHz									
	1673.00	-28.4	V	3.0	38.2	1.0	-65.6	-13.0	-52.6	
	2509.50	-28.4	V	3.0	38.8	1.0	-66.3	-13.0	-53.3	
3346.00	-26.9	V	3.0	39.5	1.0	-65.4	-13.0	-52.4		
1673.00	-27.3	H	3.0	38.2	1.0	-64.5	-13.0	-51.5		
2509.50	-29.1	H	3.0	38.8	1.0	-66.9	-13.0	-53.9		
3346.00	-27.5	H	3.0	39.5	1.0	-66.0	-13.0	-53.0		
High Ch, 846.5MHz										
1693.00	-24.8	V	3.0	38.2	1.0	-62.1	-13.0	-49.1		
2539.50	-28.2	V	3.0	38.9	1.0	-66.1	-13.0	-53.1		
3386.00	-27.6	V	3.0	39.5	1.0	-66.0	-13.0	-53.0		
1693.00	-26.0	H	3.0	38.2	1.0	-63.2	-13.0	-50.2		
2539.50	-28.8	H	3.0	38.9	1.0	-66.6	-13.0	-53.6		
3386.00	-27.4	H	3.0	39.5	1.0	-65.9	-13.0	-52.9		

	UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement									
	Company: Samsung Project #: 4788494710 Date: 2018-06-27 Test Engineer: 47989 Configuration: EUT / Adapter / Cradle , Z-position Location: Chamber 2 Mode: LTE_QPSK Band 5 Harmonics, 3MHz Bandwidth									
LTE Band 5 3MHz QPSK	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
	Low Ch, 825.5MHz									
	1651.00	-27.3	V	3.0	38.2	1.0	-64.5	-13.0	-51.5	
	2476.50	-28.2	V	3.0	38.8	1.0	-66.0	-13.0	-53.0	
	3302.00	-27.1	V	3.0	39.4	1.0	-65.5	-13.0	-52.5	
	1651.00	-29.0	H	3.0	38.2	1.0	-66.2	-13.0	-53.2	
	2476.50	-28.9	H	3.0	38.8	1.0	-66.7	-13.0	-53.7	
	3302.00	-26.7	H	3.0	39.4	1.0	-65.1	-13.0	-52.1	
	Mid Ch, 836.5MHz									
	1673.00	-27.3	V	3.0	38.2	1.0	-64.6	-13.0	-51.6	
	2509.50	-28.6	V	3.0	38.8	1.0	-66.5	-13.0	-53.5	
	3346.00	-27.3	V	3.0	39.5	1.0	-65.7	-13.0	-52.7	
	1673.00	-29.6	H	3.0	38.2	1.0	-66.8	-13.0	-53.8	
	2509.50	-28.7	H	3.0	38.8	1.0	-66.5	-13.0	-53.5	
	3346.00	-27.0	H	3.0	39.5	1.0	-65.4	-13.0	-52.4	
	High Ch, 847.5MHz									
	1695.00	-27.2	V	3.0	38.2	1.0	-64.4	-13.0	-51.4	
	2542.50	-27.6	V	3.0	38.9	1.0	-65.5	-13.0	-52.5	
	3390.00	-27.2	V	3.0	39.5	1.0	-65.7	-13.0	-52.7	
	1695.00	-27.8	H	3.0	38.2	1.0	-65.1	-13.0	-52.1	
	2542.50	-28.8	H	3.0	38.9	1.0	-66.7	-13.0	-53.7	
	3390.00	-26.6	H	3.0	39.5	1.0	-65.1	-13.0	-52.1	

	UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement									
	Company: Samsung Project #: 4788494710 Date: 2018-06-27 Test Engineer: 47989 Configuration: EUT / Adapter / Cradle , Z-position Location: Chamber 2 Mode: LTE_16QAM Band 5 Harmonics, 3MHz Bandwidth									
LTE Band 5 3MHz 16QAM	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
	Low Ch, 825.5MHz									
	1651.00	-29.8	V	3.0	38.2	1.0	-67.1	-13.0	-54.1	
	2476.50	-28.7	V	3.0	38.8	1.0	-66.5	-13.0	-53.5	
	3302.00	-27.2	V	3.0	39.4	1.0	-65.6	-13.0	-52.6	
	1651.00	-30.1	H	3.0	38.2	1.0	-67.4	-13.0	-54.4	
	2476.50	-29.2	H	3.0	38.8	1.0	-67.0	-13.0	-54.0	
	3302.00	-27.8	H	3.0	39.4	1.0	-66.2	-13.0	-53.2	
	Mid Ch, 836.5MHz									
	1673.00	-28.2	V	3.0	38.2	1.0	-65.4	-13.0	-52.4	
	2509.50	-28.5	V	3.0	38.8	1.0	-66.3	-13.0	-53.3	
	3346.00	-27.5	V	3.0	39.5	1.0	-66.0	-13.0	-53.0	
	1673.00	-30.8	H	3.0	38.2	1.0	-68.0	-13.0	-55.0	
	2509.50	-28.8	H	3.0	38.8	1.0	-66.7	-13.0	-53.7	
	3346.00	-27.0	H	3.0	39.5	1.0	-65.4	-13.0	-52.4	
	High Ch, 847.5MHz									
	1695.00	-28.9	V	3.0	38.2	1.0	-66.2	-13.0	-53.2	
	2542.50	-28.6	V	3.0	38.9	1.0	-66.5	-13.0	-53.5	
	3390.00	-27.3	V	3.0	39.5	1.0	-65.8	-13.0	-52.8	
	1695.00	-27.1	H	3.0	38.2	1.0	-64.3	-13.0	-51.3	
	2542.50	-28.8	H	3.0	38.9	1.0	-66.7	-13.0	-53.7	
	3390.00	-27.3	H	3.0	39.5	1.0	-65.8	-13.0	-52.8	

LTE Band 5 1.4MHz QPSK	UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement									
	Company: Samsung Project #: 4788494710 Date: 2018-06-27 Test Engineer: 47989 Configuration: EUT / Adapter / Cradle , Z-position Location: Chamber 2 Mode: LTE_QPSK Band 5 Harmonics, 1.4MHz Bandwidth									
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
	Low Ch, 824.7MHz									
	1649.40	-29.4	V	3.0	38.2	1.0	-66.7	-13.0	-53.7	
	2474.10	-28.2	V	3.0	38.8	1.0	-66.0	-13.0	-53.0	
	3298.80	-27.8	V	3.0	39.4	1.0	-66.2	-13.0	-53.2	
	1649.40	-30.4	H	3.0	38.2	1.0	-67.7	-13.0	-54.7	
	2474.10	-29.4	H	3.0	38.8	1.0	-67.2	-13.0	-54.2	
	3298.80	-27.8	H	3.0	39.4	1.0	-66.3	-13.0	-53.3	
	Mid Ch, 836.5MHz									
	1673.00	-27.5	V	3.0	38.2	1.0	-64.7	-13.0	-51.7	
	2509.50	-28.8	V	3.0	38.8	1.0	-66.6	-13.0	-53.6	
	3346.00	-26.9	V	3.0	39.5	1.0	-65.3	-13.0	-52.3	
	1673.00	-25.4	H	3.0	38.2	1.0	-62.6	-13.0	-49.6	
	2509.50	-29.0	H	3.0	38.8	1.0	-66.9	-13.0	-53.9	
	3346.00	0.0	H	3.0	39.5	1.0	-38.5	-13.0	-25.5	
	High Ch, 848.3MHz									
	1696.60	-25.6	V	3.0	38.2	1.0	-62.8	-13.0	-49.8	
	2544.90	-27.8	V	3.0	38.9	1.0	-65.7	-13.0	-52.7	
	3393.20	-27.2	V	3.0	39.5	1.0	-65.7	-13.0	-52.7	
	1696.60	-24.3	H	3.0	38.2	1.0	-61.6	-13.0	-48.6	
	2544.90	-28.3	H	3.0	38.9	1.0	-66.2	-13.0	-53.2	
	3393.20	-27.2	H	3.0	39.5	1.0	-65.7	-13.0	-52.7	
LTE Band 5 1.4MHz 16QAM	UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement									
	Company: Samsung Project #: 4788494710 Date: 2018-06-27 Test Engineer: 47989 Configuration: EUT / Adapter / Cradle , Z-position Location: Chamber 2 Mode: LTE_16QAM Band 5 Harmonics, 1.4MHz Bandwidth									
	f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
	Low Ch, 824.7MHz									
	1649.40	-29.6	V	3.0	38.2	1.0	-66.9	-13.0	-53.9	
	2474.10	-28.5	V	3.0	38.8	1.0	-66.3	-13.0	-53.3	
	3298.80	-27.9	V	3.0	39.4	1.0	-66.3	-13.0	-53.3	
	1649.40	-30.6	H	3.0	38.2	1.0	-67.8	-13.0	-54.8	
	2474.10	-29.2	H	3.0	38.8	1.0	-67.0	-13.0	-54.0	
	3298.80	-27.2	H	3.0	39.4	1.0	-65.7	-13.0	-52.7	
	Mid Ch, 836.5MHz									
	1673.00	-28.5	V	3.0	38.2	1.0	-65.8	-13.0	-52.8	
	2509.50	-28.2	V	3.0	38.8	1.0	-66.0	-13.0	-53.0	
	3346.00	-27.1	V	3.0	39.5	1.0	-65.5	-13.0	-52.5	
	1673.00	-26.4	H	3.0	38.2	1.0	-63.7	-13.0	-50.7	
	2509.50	-29.2	H	3.0	38.8	1.0	-67.1	-13.0	-54.1	
	3346.00	-27.5	H	3.0	39.5	1.0	-65.9	-13.0	-52.9	
	High Ch, 848.3MHz									
	1696.60	-27.3	V	3.0	38.2	1.0	-64.5	-13.0	-51.5	
	2544.90	-27.6	V	3.0	38.9	1.0	-65.5	-13.0	-52.5	
	3393.20	-26.7	V	3.0	39.5	1.0	-65.1	-13.0	-52.1	
	1696.60	-25.1	H	3.0	38.2	1.0	-62.4	-13.0	-49.4	
	2544.90	-28.1	H	3.0	38.9	1.0	-65.9	-13.0	-52.9	
	3393.20	-26.6	H	3.0	39.5	1.0	-65.1	-13.0	-52.1	