CERTIFICATION TEST REPORT

Report Number. : 11692709-E1V2

Applicant : QUALCOMM TECHNOLOGIES, INC.
5770 MOREHOUSE DRIVE,
SAN DIEGO, CA 92121, USA

FCC ID : J9C2NET2LTE
IC: 2723A-2NET2LTE

Model Number : QCL-HUB-2.0-US

EUT Description : WIRELESS DATA HUB

Test Standard(s) : FCC CFR47 PART 22 SUBPART H
FCC CFR47 PART 24 SUBPART E
FCC CFR47 PART 27 SUBPART F, H, L
INDUSTRY CANADA RSS-130 ISSUE 1
INDUSTRY CANADA RSS-132 ISSUE 3
INDUSTRY CANADA RSS-133 ISSUE 6
INDUSTRY CANADA RSS-139 ISSUE 3

Date Of Issue:
September 15, 2017

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	08/10/17	Initial Issue	--
V2	09/15/17	Added conducted test results	Tina Chu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: QUALCOMM TECHNOLOGIES, INC.
5770 MOREHOUSE DRIVE,
SAN DIEGO, CA 92121 USA

EUT DESCRIPTION: WIRELESS DATA HUB

SERIAL NUMBER: QUALC001TN10M1RP74, QUALC001TN10M1RN3C

DATE TESTED: APRIL 12, 2017 to SEPTEMBER 14, 2017

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 22H, 24E, 27F, 27H, 27L	PASS
INDUSTRY CANADA RSS-130,132,133, 139	PASS

UL Verification Services Inc. 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 Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.26:2015, FCC CFR 47 Part 2, Part 22, Part 24, Part 27, FCC KDB 971168 D01 v02r02/ D02 v01, IC RSS-130, RSS-132, RSS-133, RSS-139.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. 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.

47173 Benicia Street	47266 Benicia Street
☒ Chamber A(IC: 2324B-1)	☐ Chamber D(IC: 22541-1)
☒ Chamber B(IC: 2324B-2)	☐ Chamber E(IC: 22541-2)
☐ Chamber C(IC: 2324B-3)	☐ Chamber F(IC: 22541-3)
	☐ Chamber G(IC: 22541-4)
	☐ Chamber H(IC: 22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.
UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

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

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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, 9KHz to 0.15 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Radiated Disturbance,1000 to 18000 MHz	4.32 dB
Radiated Disturbance,18000 to 26000 MHz	4.45 dB
Radiated Disturbance,26000 to 40000 MHz	5.24 dB
Occupied Channel Bandwidth	±0.39 %
Temperature	±0.9 °C
Supply voltages	±0.45 %
Time	±0.02 %

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

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

This EUT is a 2net2 device (LTE North American Version AT&T) that has the following radio modules:

- Wistron WWAN module, M14Q2FG.
- Qualcomm Unlicensed Module, QCA WCN 3660.

5.2. MAXIMUM OUTPUT POWER

ERP/EIRP LIMIT

FCC: §2.1046, §22.913, §24.232, §27.50
RSS130§4.4, RSS132§5.4; RSS133§6.4, RSS139§6.5

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015
KDB 971168 Section 5.6

ERP/EIRP = PMeas + GT − LC
where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);
PMeas = measured transmitter output power or PSD, in dBm or dBW;
GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.2

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

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

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WCDMA MODE

RSS 132 Band 5							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
824- 849	REL 99	24.40	-0.90	23.50	223.9	40.6	-17.1
	HSDPA	23.20	-0.90	22.30	169.8	40.6	-18.3
Part 22 Band 5							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	ERP		Limit (dBm)	Margin (dB)
				dBm	mW		
824- 849	REL 99	24.40	-0.90	21.35	136.5	38.5	-17.1
	HSDPA	23.20	-0.90	20.15	103.5	38.5	-18.3
Part 24 / RSS 133 Band 2							
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	EIRP		Limit (dBm)	Margin (dB)
				dBm	mW		
1850-1910	REL 99	24.10	2.50	26.60	457.1	33.0	-6.4
	HSDPA	23.20	2.50	25.70	371.5	33.0	-7.3

LTE BAND 2

Part 24 / RSS 133	
EIRP Limit (dBm)	33.00
Antenna Gain (dBi)	2.50

Bandwidth (MHz)	Frequency Range (MHz)	Modulation	Conducted Average (dBm)	EIRP Average		Margin (dB)
				dBm	mW	
5.0	1850-1910	QPSK	23.0	**25.5**	**354.8**	-7.5
		16QAM	21.8	**24.3**	**269.2**	-8.7

LTE BAND 4

Part 27 / RSS 139	
EIRP Limit (dBm)	30.00
Antenna Gain (dBi)	0.50

Bandwidth (MHz)	Frequency Range (MHz)	Modulation	Conducted Average (dBm)	EIRP Average		Margin (dB)
				dBm	mW	
5.0	1710-1755	QPSK	23.7	**24.2**	**263.0**	-5.8
		16QAM	22.5	**23.0**	**199.5**	-7.0

LTE BAND 5 (FCC)

Part 22	
ERP Limit (dBm)	38.45
Antenna Gain (dBi)	-0.90

Bandwidth (MHz)	Frequency Range (MHz)	Modulation	Conducted Average (dBm)	ERP Average		Margin (dB)
				dBm	mW	
5.0	824-849	QPSK	23.4	**20.35**	**108.4**	-18.1
		16QAM	22.4	**19.35**	**86.1**	-19.1

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LTE BAND 5 (IC)

RSS 132						
EIRP Limit (dBm)		40.60				
Antenna Gain (dBi)		-0.90				
Bandwidth (MHz)	Frequency Range (MHz)	Modulation	Conducted Average (dBm)	EIRP Average		Margin (dB)
				dBm	mW	
5.0	824-849	QPSK	23.4	**22.5**	**177.8**	-18.1
		16QAM	22.4	**21.5**	**141.3**	-19.1

LTE BAND 12 (FCC)

Part 27						
ERP Limit (dBm)		34.77				
Antenna Gain (dBi)		-2.80				
Bandwidth (MHz)	Frequency Range (MHz)	Modulation	Conducted Average (dBm)	ERP Average		Margin (dB)
				dBm	mW	
5.0	699-716	QPSK	23.5	**18.55**	**71.6**	-16.2
		16QAM	22.6	**17.65**	**58.2**	-17.1

LTE BAND 12 (IC)

RSS 130						
EIRP Limit (dBm)		37.0				
Antenna Gain (dBi)		-2.80				
Bandwidth (MHz)	Frequency Range (MHz)	Modulation	Conducted Average (dBm)	EIRP Average		Margin (dB)
				dBm	mW	
5.0	699-716	QPSK	23.5	**20.7**	**117.5**	-16.3
		16QAM	22.6	**19.8**	**95.5**	-17.2

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5.3. SOFTWARE AND FIRMWARE

The test utility software used during testing was adb Ver.1.0.26, QRCT Ver.3.0.84.0.

5.4. MAXIMUM ANTENNA GAIN

Please see table below:

LTE Bands	Antenna Gain (dBi)
WCDMA Band 2 and LTE Band 2, 1850 – 1910 MHz	2.5
LTE Band 4, 1710 – 1755 MHz	0.5
WCDMA Band 5 and LTE Band 5, 824 – 849 MHz	-0.9
LTE Band 12, 699 – 716 MHz	-2.8

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT supports:
WCDMA: Band 5 and band 2.
LTE Bands: Band 2, Band 4, Band 5, Band 12. All bands only support 5MHz bandwidth.

The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results.

The EUT was investigated in three orthogonal orientations X/Y/Z, it was determined that Z (Portrait) orientation was worst-case orientation for cell bands; X (Flatbed) orientation was worst-case orientation for PCS/AWS bands.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	**Manufacturer**	**Model**	**Serial Number**
N/A	N/A	N/A	N/A

I/O CABLES (RF Conducted Test)

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	US 115V	Un-shielded	2.0m	N/A
2	RF In/Out	1	EUT	Un-shielded	0.6m	N/A
3	RF In/Out	1	Communication Test Set	Un-shielded	1.2m	N/A
4	RF In/Out	1	Barrel	N/A	N/A	N/A

I/O CABLES (RF Radiated Test)

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	RF In/Out	1	Antenna	Un-shielded	5.0m	N/A

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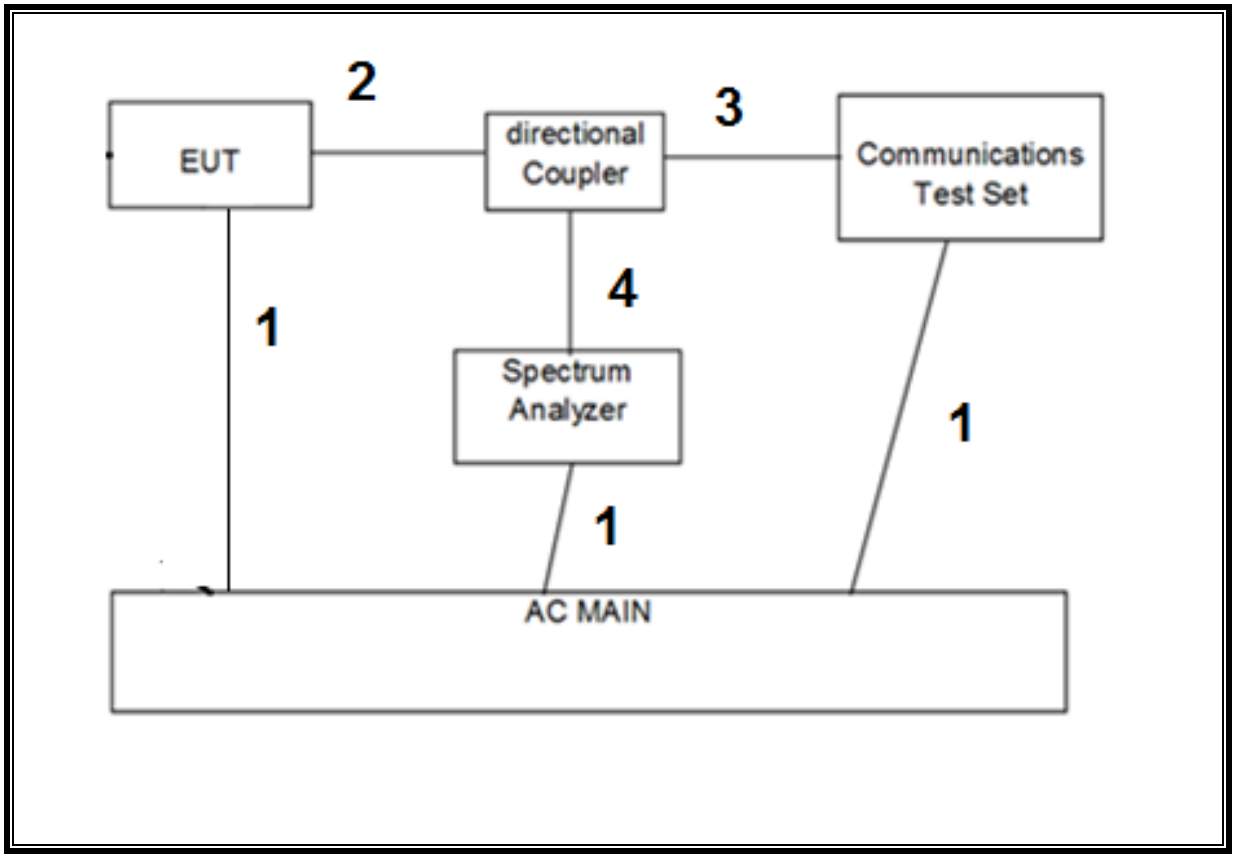
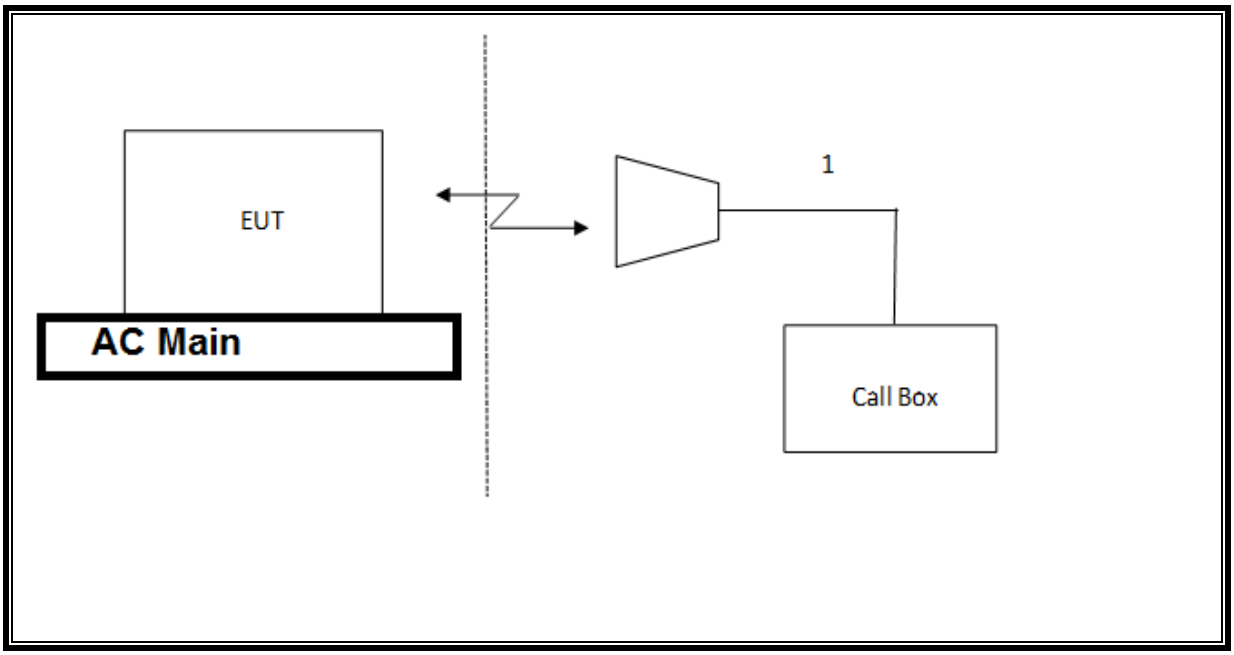
CONDUCTED SETUP



RADIATED SETUP



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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**	**T Number**	**Cal Date**	**Cal Due**
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	971	8/10/2017	8/10/2018
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight	E4446A	146	7/18/2017	7/18/2018
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	754	9/8/2017	3/8/2018
Amplifier, 1 to 18 GHz	Miteq	AFS43-00101800-25-S-42	493	02/15/17	02/15/18
Amplifier, 1 to 8 GHz	Miteq	AMF-4D-01000800-30-29P	1156	02/15/17	02/15/18
Amplifier, 10KHz to 1GHz, 32dB	Keysight	8447D	10	02/15/17	02/15/18
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	477	06/22/16	06/22/17
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	907	01/23/17	01/23/18
Amplifier, 10KHz to 1GHz, 32dB	Keysight	8447D	10	02/15/17	02/15/18
Highpass Filter, 2.7 GHz	Micro-Circuits	H2G518G6	772	07/05/16	07/05/18
Highpass Filter, 1 GHz	Micro-Tronics	HPM18129	T889	02/21/17	02/21/18
Amplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	931	08/26/16	08/26/17
Amplifier, 1 to 8GHz	Miteq	AMF-4D-01000800-30-29P	1170	04/28/16	04/28/17
Amplifier, 10KHz to 1GHz, 32dB	Keysight	8447D	15	08/26/16	08/26/17
Antenna, Broadband Hybrid 30MHz to 2000MHz	Sunol Sciences	JB3	408	11/10/16	11/10/17
Antenna, Horn 1-18GHz	ETS Lindgren	3117	712	01/30/17	01/30/18
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	905	01/11/17	01/11/18
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121C DB4	273	05/16/16	05/16/17
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	711	01/30/17	01/30/18
Communication Test set	Rhode & Shcwarz	CMW500	703	03/20/17	03/20/18

NOTES:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

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7. RF OUTPUT POWER

7.1. WCDMA

TEST PROCEDURE

The transmitter output was connected to the input terminal of Directional Coupler via calibrated coaxial cable. The output coupling terminal of the Directional Coupler was directly connected to a spectrum analyzer while the output through terminal connected to the communication test set via calibrated coaxial cable.

The output power was measured with the spectrum analyzer at the low, middle and high channel in each band.

- Set the spectrum analyzer span wide enough or greater than the modulated signal BW.
- Set a spectrum analyzer at peak detection mode with VBW ≥ RBW.≥ 26dB BW, typically 5MHz.
- Set a marker to point the corresponding peak value.

REL 99

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc/βd	8/15

HSDPA REL 5

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	11/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs=βhs/βc	30/15			

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HSPA REL 6 (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSPA				
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2 kbps RMC				
	HSDPA FRC	H-Set 1				
	HSUPA Test	HSPA				
	Power Control Algorithm	Algorithm 2				Algorithm 1
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/βd	11/15	6/15	15/9	2/15	15/1
	βhs	22/15	12/15	30/15	4/15	5/15
	βed	1309/225	94/75	47/15	56/75	47/15
	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	E-DPDCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E-TFCIs	5	5	2	5	1
	Reference E-TFCI	11	11	11	11	67
	Reference E-TFCI PO	4	4	4	4	18
	Reference E-TFCI	67	67	92	67	67
	Reference E-TFCI PO	18	18	18	18	18
	Reference E-TFCI	71	71	71	71	71
	Reference E-TFCI PO	23	23	23	23	23
	Reference E-TFCI	75	75	75	75	75
	Reference E-TFCI PO	26	26	26	26	26
	Reference E-TFCI	81	81	81	81	81
	Reference E-TFCI PO	27	27	27	27	27
	Maximum Channelization Codes	2xSF2				SF4

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DUAL CARRIER HSDPA (DC-HSDPA (REL 8, CAT 24)

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH _Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table.		
Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

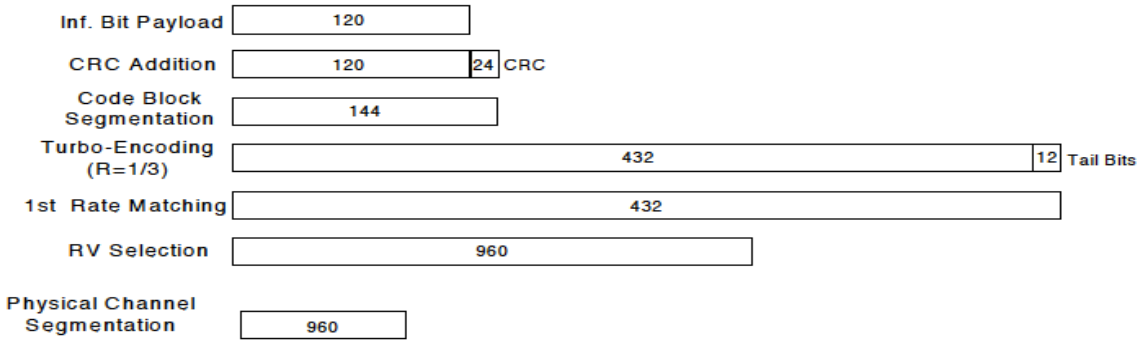

Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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The following 4 Sub-tests for HSDPA were completed according to Release 8 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm2			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	βd (SF)	64			
	βc/βd	2/15	11/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs = βhs/ βc	30/15			

RESULT

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7.1.1. WCDMA BAND 5

ID:	29439	Date:	9/13/17

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Average Power (dBm)
W-CDMA Band 5 (850MHz)	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	**24.4**
			4183	836.6	N/A	24.2
			4233	846.6	N/A	23.9
	HSDPA	Subtest 1	4132	826.4	0	**23.2**
			4183	836.6	0	23.0
			4233	846.6	0	22.7
		Subtest 2	4132	826.4	0	22.7
			4183	836.6	0	22.7
			4233	846.6	0	22.5
		Subtest 3	4132	826.4	0.5	22.3
			4183	836.6	0.5	22.2
			4233	846.6	0.5	21.8
		Subtest 4	4132	826.4	0.5	22.3
			4183	836.6	0.5	22.1
			4233	846.6	0.5	21.9
	HSPA (HSDPA & HSUPA)	Subtest 1	4132	826.4	0	22.8
			4183	836.6	0	22.4
			4233	846.6	0	22.2
		Subtest 2	4132	826.4	2	21.0
			4183	836.6	2	21.3
			4233	846.6	2	20.9
		Subtest 3	4132	826.4	1	21.6
			4183	836.6	1	21.7
			4233	846.6	1	21.4
		Subtest 4	4132	826.4	2	22.4
			4183	836.6	2	22.1
			4233	846.6	2	21.6
		Subtest 5	4132	826.4	0	22.6
			4183	836.6	0	22.4
			4233	846.6	0	22.2
	DC-HSDPA	Subtest 1	4132	826.4	0	23.0
			4183	836.6	0	22.8
			4233	846.6	0	22.6
		Subtest 2	4132	826.4	0	22.9
			4183	836.6	0	22.8
			4233	846.6	0	22.7
		Subtest 3	4132	826.4	0.5	22.6
			4183	836.6	0.5	22.2
			4233	846.6	0.5	22.1
		Subtest 4	4132	826.4	0.5	22.5
			4183	836.6	0.5	22.2
			4233	846.6	0.5	22.0

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7.1.2. WCDMA BAND 2

ID:	29439	Date:	9/13/17

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Average Power (dBm)
W-CDMA Band 2 (1900MHz)	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	**24.1**
			9400	1880.0	N/A	23.8
			9538	1907.6	N/A	24.0
	HSDPA	Subtest 1	9262	1852.4	0	22.6
			9400	1880.0	0	**23.2**
			9538	1907.6	0	22.6
		Subtest 2	9262	1852.4	0	22.2
			9400	1880.0	0	22.9
			9538	1907.6	0	22.5
		Subtest 3	9262	1852.4	0.5	21.5
			9400	1880.0	0.5	22.4
			9538	1907.6	0.5	21.9
		Subtest 4	9262	1852.4	0.5	21.7
			9400	1880.0	0.5	22.4
			9538	1907.6	0.5	21.8
	HSPA (HSDPA & HSUPA)	Subtest 1	9262	1852.4	0	22.0
			9400	1880.0	0	22.6
			9538	1907.6	0	22.4
		Subtest 2	9262	1852.4	2	20.3
			9400	1880.0	2	21.7
			9538	1907.6	2	20.4
		Subtest 3	9262	1852.4	1	21.1
			9400	1880.0	1	22.1
			9538	1907.6	1	21.9
		Subtest 4	9262	1852.4	2	21.6
			9400	1880.0	2	22.5
			9538	1907.6	2	21.7
		Subtest 5	9262	1852.4	0	22.3
			9400	1880.0	0	22.9
			9538	1907.6	0	22.6
	DC-HSDPA	Subtest 1	9262	1852.4	0	22.3
			9400	1880.0	0	23.0
			9538	1907.6	0	22.7
		Subtest 2	9262	1852.4	0	22.3
			9400	1880.0	0	23.1
			9538	1907.6	0	22.6
		Subtest 3	9262	1852.4	0.5	21.7
			9400	1880.0	0.5	22.6
			9538	1907.6	0.5	22.1
		Subtest 4	9262	1852.4	0.5	21.7
			9400	1880.0	0.5	22.6
			9538	1907.6	0.5	22.1

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7.2. LTE

CONDUCTED OUTPUT POWER MEASUREMENT PROCEDURE

All LTE bands conducted average power is obtained from the CMW500 telecommunication test set.

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS_01".3

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23[1]	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-
Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.					

RESULTS

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7.2.1. LTE BAND 2

ID:	29439	Date:	9/14/17

OUTPUT POWER FOR LTE BAND 2 (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Conducted Average (dBm)		
				18625	18900	19175
				1852.5 MHz	1880.0 MHz	1907.5 MHz
5.0	QPSK	1	0	22.2	22.8	22.6
		1	12	22.3	**23.0**	22.4
		1	24	22.2	22.8	22.3
		12	0	21.2	21.8	21.7
		12	6	21.3	21.9	21.6
		12	11	21.2	21.9	21.7
		25	0	21.3	21.9	21.6
	16QAM	1	0	21.1	21.5	21.4
		1	12	21.2	**21.8**	21.2
		1	24	21.2	21.6	21.3
		12	0	20.3	20.8	20.5
		12	6	20.3	20.8	20.6
		12	11	20.2	20.9	20.5
		25	0	20.5	20.7	20.6

7.2.2. LTE BAND 4

ID:	29439	Date:	9/14/17

OUTPUT POWER FOR LTE BAND 4 (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Conducted Average (dBm)		
				19975	20175	20375
				1712.5 MHz	1732.5 MHz	1752.5 MHz
5.0	QPSK	1	0	23.4	23.4	23.5
		1	12	23.5	23.4	23.5
		1	24	23.4	23.3	**23.7**
		12	0	22.4	22.5	22.7
		12	6	22.6	22.6	22.8
		12	11	22.6	22.7	22.8
		25	0	22.5	22.6	22.7
	16QAM	1	0	22.3	22.4	22.4
		1	12	22.4	**22.5**	22.4
		1	24	22.3	22.3	22.3
		12	0	21.3	21.5	21.5
		12	6	21.5	21.4	21.4
		12	11	21.5	21.5	21.4
		25	0	21.5	21.6	21.4

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7.2.3. LTE BAND 5

ID:	29439	Date:	9/14/17

OUTPUT POWER FOR LTE BAND 5 (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Conducted Average (dBm)		
				20425	20525	20625
				826.5 MHz	836.5 MHz	846.5 MHz
5.0	QPSK	1	0	23.2	23.4	23.4
		1	12	23.4	**23.4**	23.4
		1	24	23.2	23.3	23.2
		12	0	22.7	22.4	22.3
		12	6	22.5	22.4	22.3
		12	11	22.5	22.5	22.2
		25	0	22.5	22.4	22.4
	16QAM	1	0	**22.4**	22.1	22.0
		1	12	22.2	22.2	22.0
		1	24	22.0	22.1	22.1
		12	0	21.7	21.4	21.4
		12	6	21.6	21.4	21.3
		12	11	21.4	21.4	21.2
		25	0	21.7	21.6	21.4

7.2.4. LTE BAND 12

ID:	29439	Date:	9/14/17

OUTPUT POWER FOR LTE BAND 12 (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Conducted Average (dBm)		
				23035	23095	23155
				701.5 MHz	707.5 MHz	713.5 MHz
5.0	QPSK	1	0	23.3	23.2	23.2
		1	12	**23.5**	23.2	23.5
		1	24	23.3	23.1	23.2
		12	0	22.3	22.4	22.4
		12	6	22.5	22.4	22.5
		12	11	22.3	22.3	22.4
		25	0	22.3	22.3	22.4
	16QAM	1	0	22.0	22.0	22.4
		1	12	22.1	22.4	**22.6**
		1	24	22.2	22.4	22.3
		12	0	21.1	21.4	21.3
		12	6	21.4	21.5	21.4
		12	11	21.2	21.3	21.4
		25	0	21.4	21.3	21.5

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8. CONDUCTED TEST RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

IC: RSS130, RSS132; RSS133 §2.3, RSS139

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 middle channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

RESULTS

There is no limit required and power is the same for low, middle and high channel; therefore, only middle channel was tested.

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WCDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BAND 5	REL 99	4408	836.6	4.1197	4.671
	HSDPA			4.1522	4.676
BAND 2	REL 99	9800	1880.0	4.1163	4.677
	HSDPA			4.1168	4.689

LTE BAND 2

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 2	5 MHz, QPSK	25/0	1880.0	4.5005	4.932
	5 MHz, 16QAM			4.5058	4.991

LTE BAND 4

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 4	5 MHz, QPSK	25/0	1732.5	4.5095	4.963
	5 MHz, 16QAM			4.4954	4.913

LTE BAND 5

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 5	5 MHz, QPSK	25/0	836.5	4.5324	4.975
	5 MHz, 16QAM			4.4949	4.927

LTE BAND 12

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 12	5 MHz, QPSK	25/0	707.5	4.5094	5.003
	5 MHz, 16QAM			4.5139	4.961

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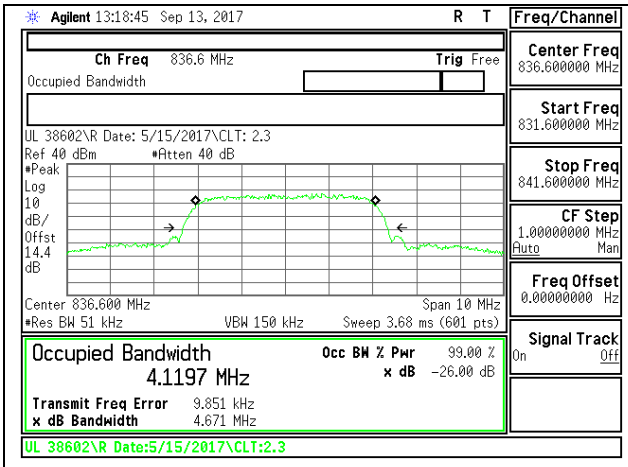
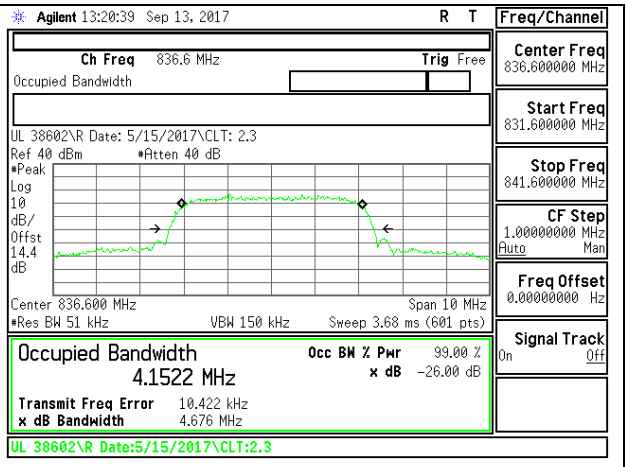
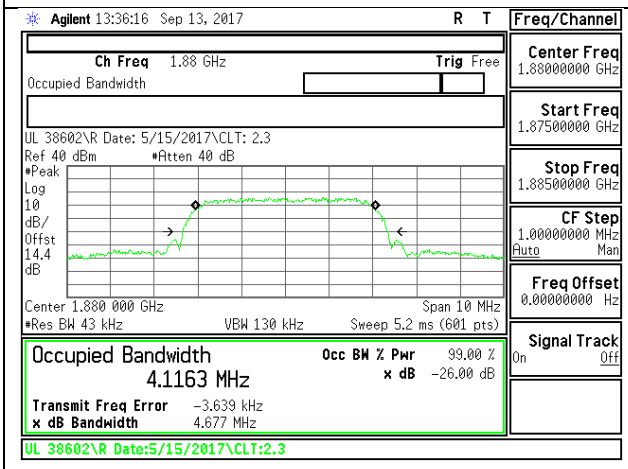
8.1.1. WCDMA



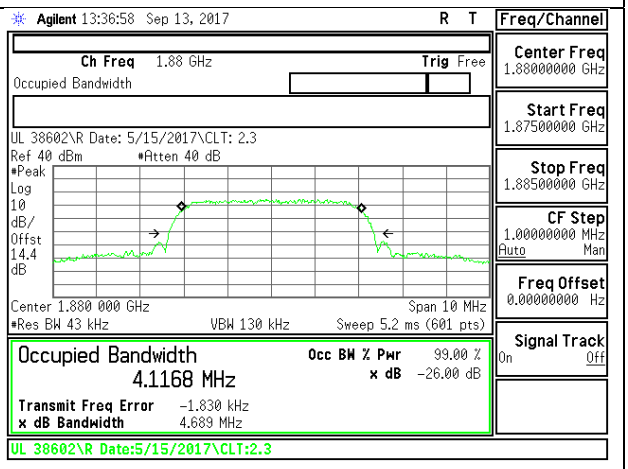
WCDMA Band 5 Rel 99 Middle Channel



WCDMA Band 5 HSDPA Middle Channel



WCDMA Band 2 Rel 99 Middle Channel



WCDMA Band 2 HSDPA Middle Channel

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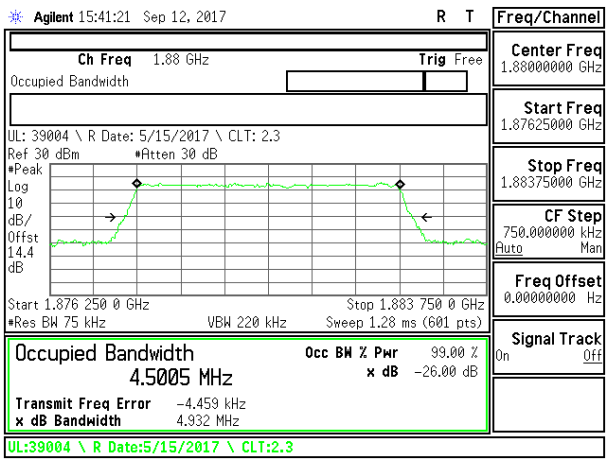
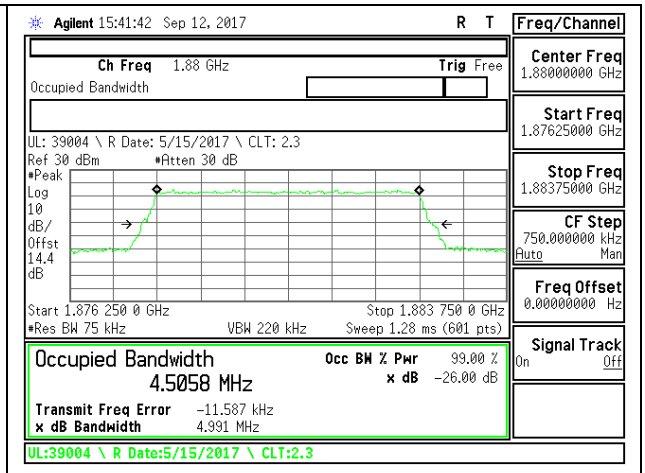
8.1.2. LTE BAND 2

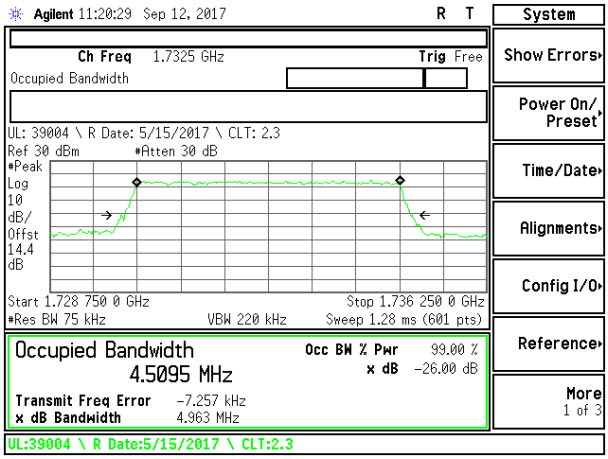


LTE B2 5MHz QPSK Middle Channel RB25-0

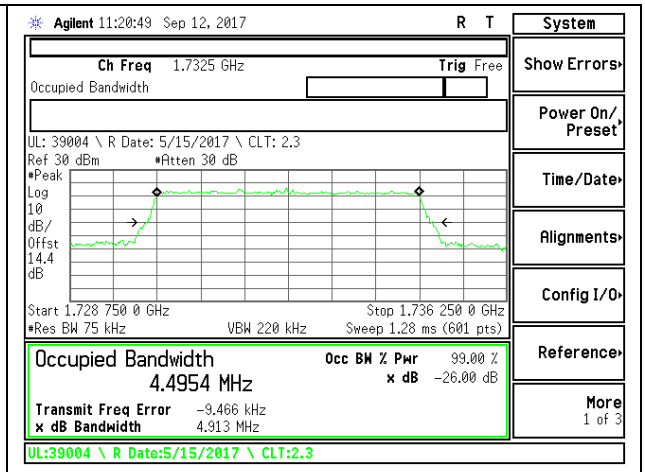


LTE B2 5MHz 16QAM Middle Channel RB25-0

8.1.3. LTE BAND 4



LTE B4 5MHz QPSK Middle Channel RB25-0



LTE B4 5MHz 16QAM Middle Channel RB25-0

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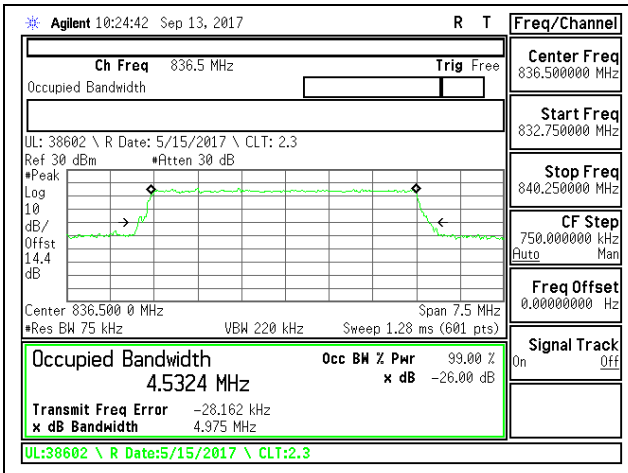
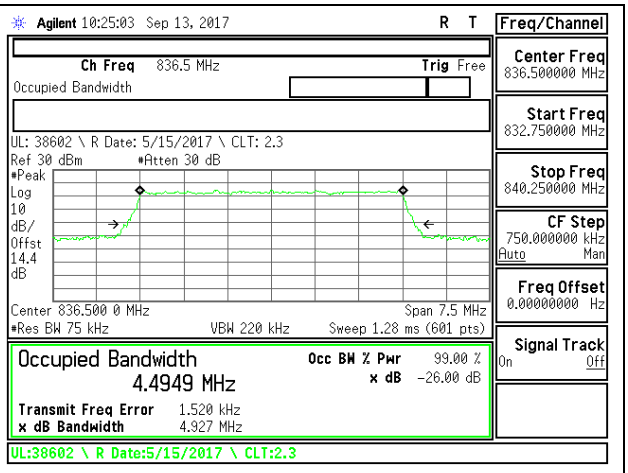
8.1.4. LTE BAND 5

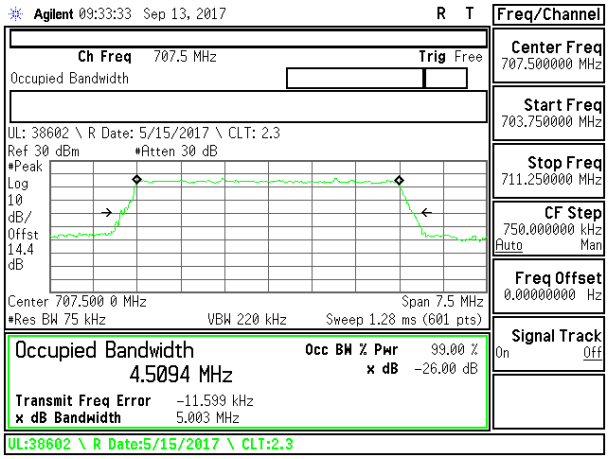


LTE B5 5MHz QPSK Middle Channel RB25-0

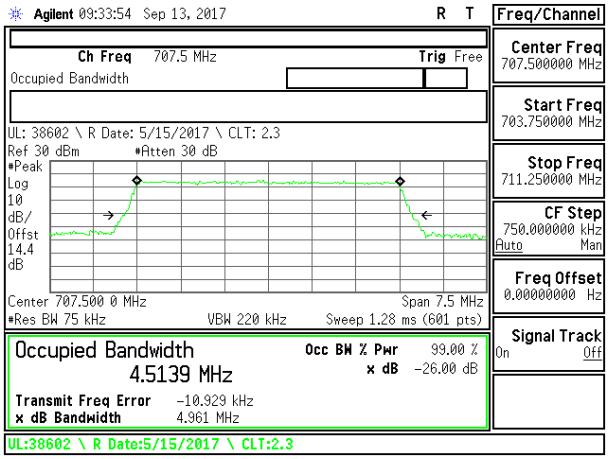


LTE B5 5MHz 16QAM Middle Channel RB25-0

8.1.5. LTE BAND 12



LTE B12 5MHz QPSK Middle Channel RB25-0



LTE B12 5MHz 16QAM Middle Channel RB25-0

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8.2. BAND EDGE

RULE PART(S)

FCC: §2.1051, §22.917, §24.238, §27.53

IC: RSS130§4.6, RSS132§5.5; RSS133§6.5, RSS139§6.6

LIMITS

FCC: §22.917, §24.238, §27.53(h)

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.

FCC: §27.53 (Band 12)

(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. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS130§4.6

4.6.1 The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

4.6.2 In addition to the limit outlined in Section 4.6.1 above, equipment operating in the frequency bands 746-756 MHzand 777-787 MHz shall also comply with the following restrictions:

(a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHzand 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

(i) 76 + 10 log10 p (watts), dB, for base and fixed equipment, and

(ii) 65 + 10 log10 p (watts), dB, for mobile and portable equipment.

RSS132§5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

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RSS133§6.5

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts).

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS139§6.6

(i) (i)In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block,Footnote2 which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least43 + 10 log10 p (watts) dB.

(ii) (ii)After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

TEST PROCEDURE

The transmitter output was connected to a CMW500Test 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.

For each band edge measurement:

1. Set the spectrum analyzer span to include the block edge frequency.
2. Set a marker to point the corresponding band edge frequency in each test case.
3. Set display line at -13 dBm
4. Set resolution bandwidth to at least 1% of emission bandwidth.

RESULTS

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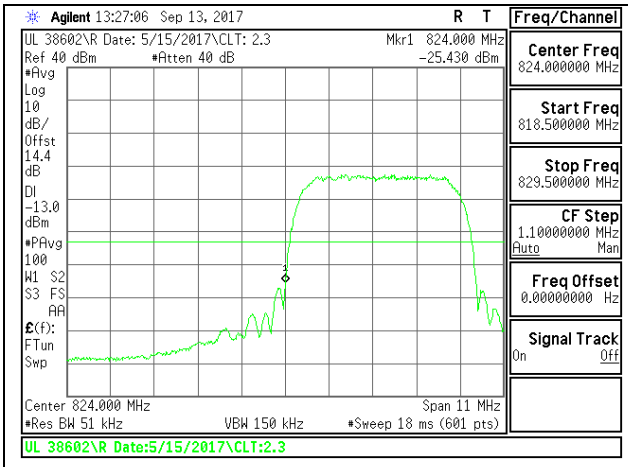
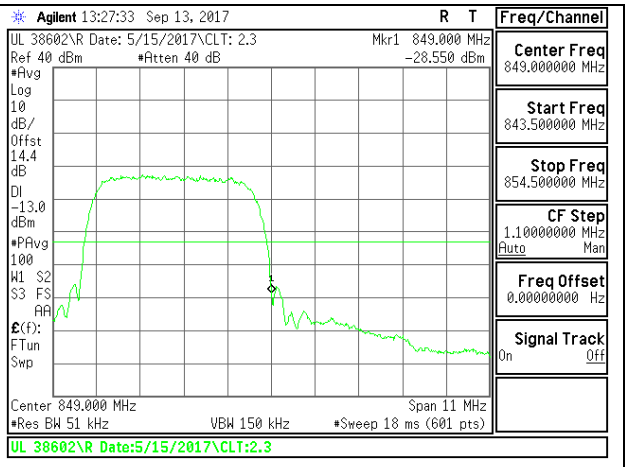
8.2.1. WCDMA BAND 5



WCDMA Band 5 Rel 99 Low Channel



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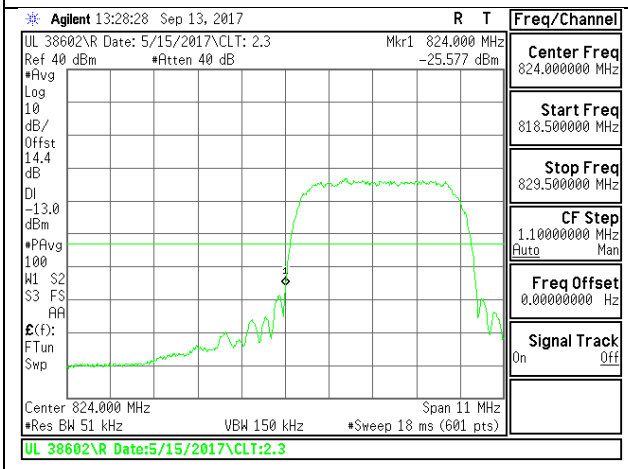
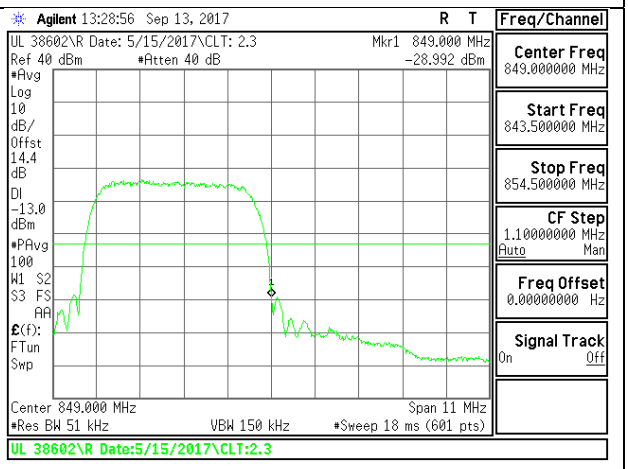


WCDMA Band 5 HSDPA Low Channel



WCDMA Band 5 HSDPA High Channel

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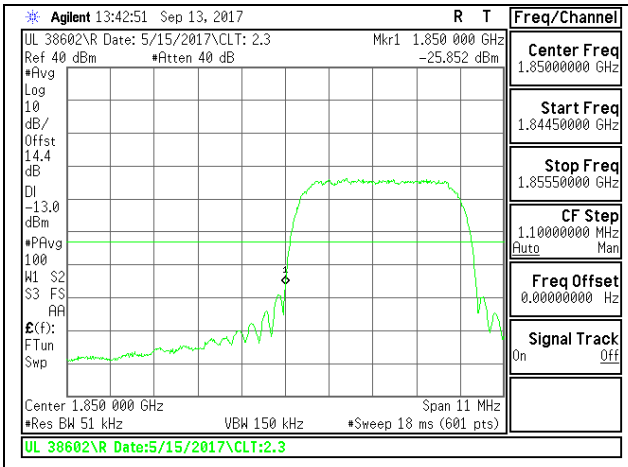
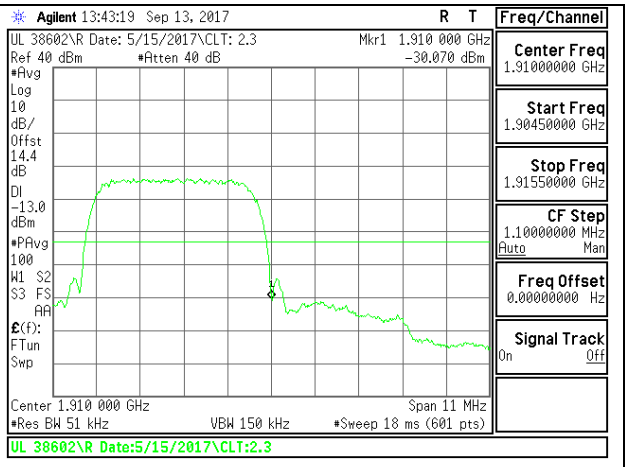
8.2.2. WCDMA BAND 2



WCDMA Band 2 Rel 99 Low Channel



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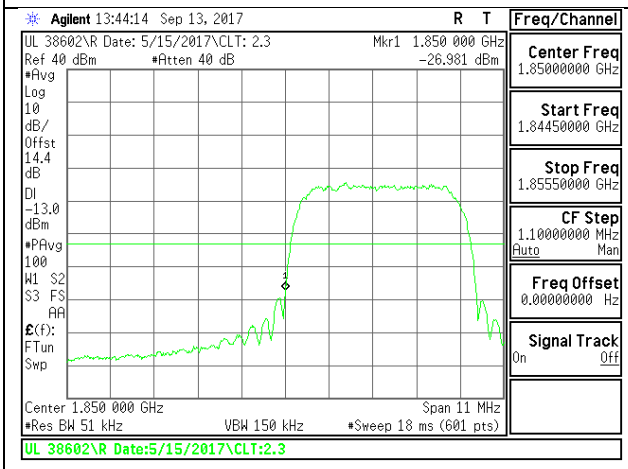

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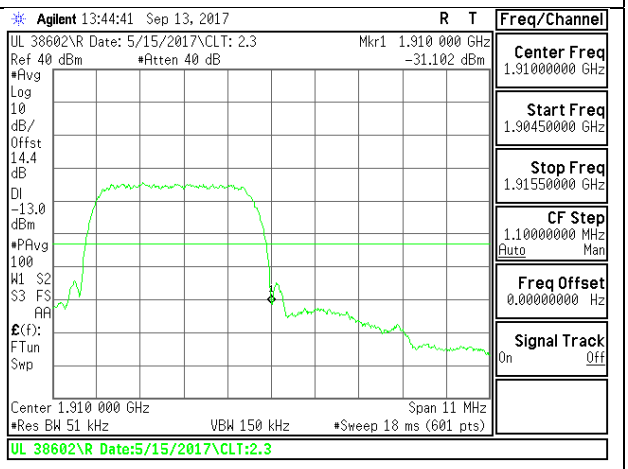

WCDMA Band 2 HSDPA High Channel

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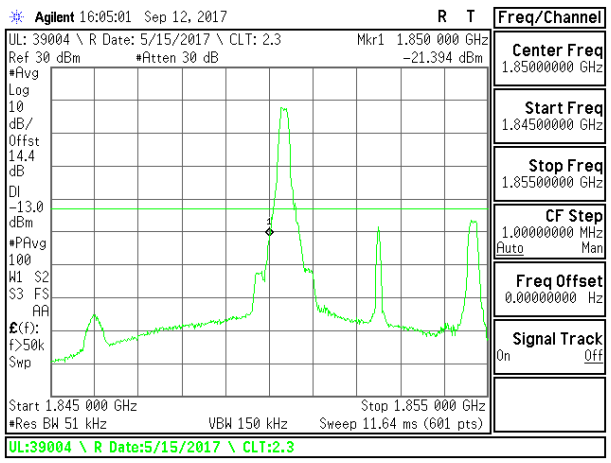
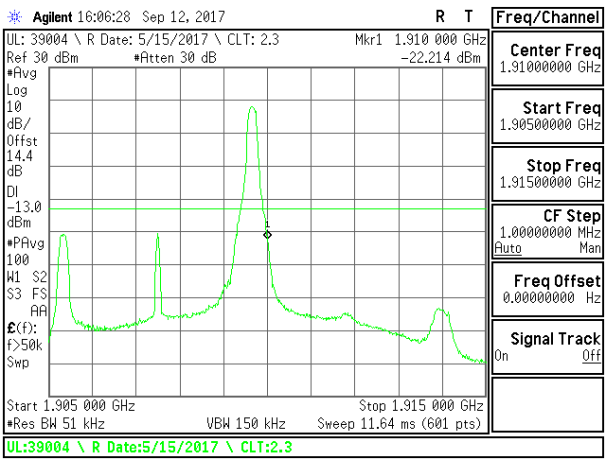
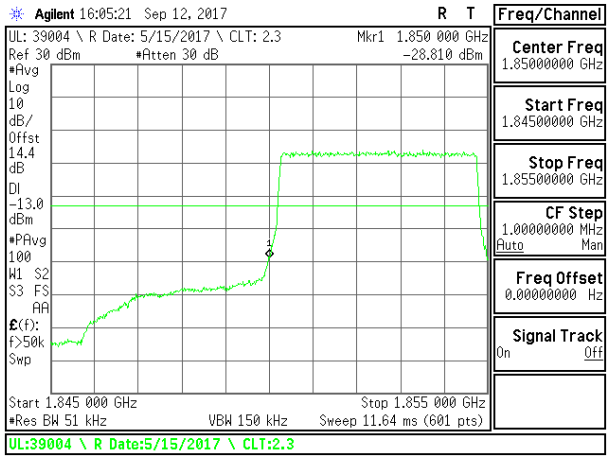
8.2.3. LTE BAND 2



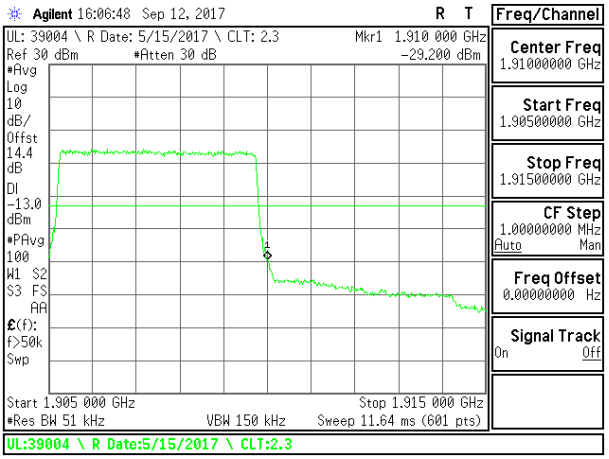
LTE B2 5MHz QPSK Low Channel RB1-0



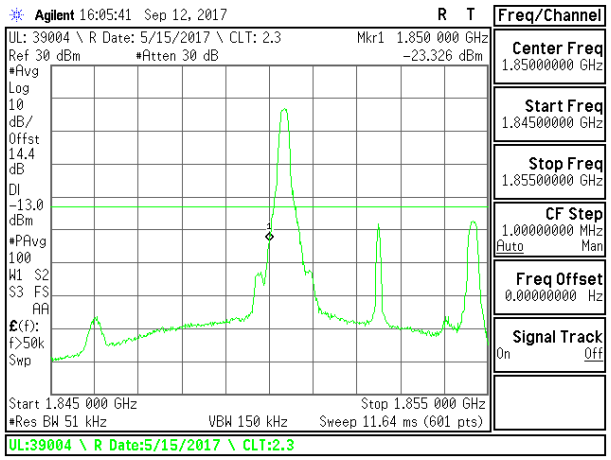
LTE B2 5MHz QPSK High Channel RB1-24



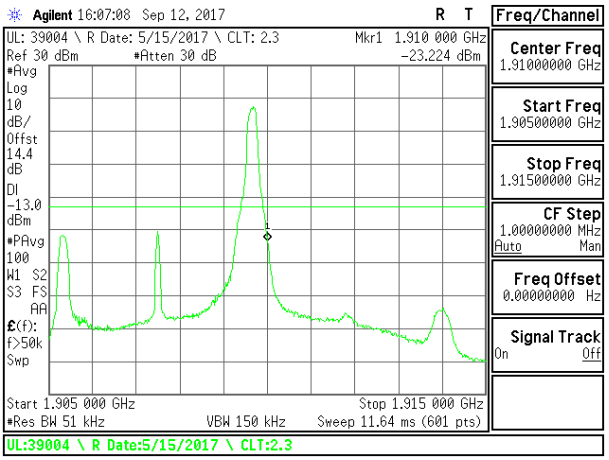
LTE B2 5MHz QPSK Low Channel RB25-0



LTE B2 5MHz QPSK High Channel RB25-0



LTE B2 5MHz 16QAM Low Channel RB1-0



LTE B2 5MHz 16QAM High Channel RB1-24

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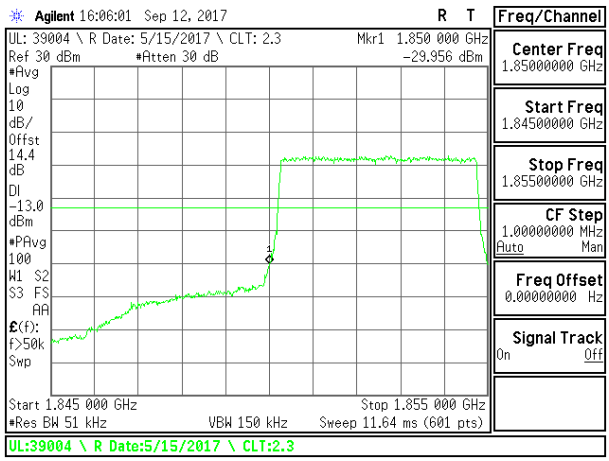
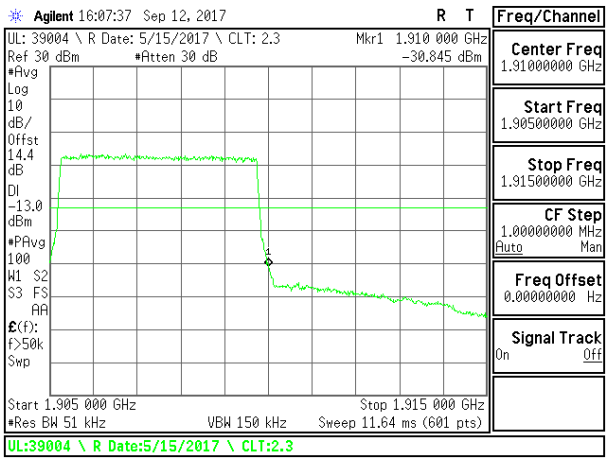


LTE B2 5MHz 16QAM Low Channel RB25-0



LTE B2 5MHz 16QAM High Channel RB25-0

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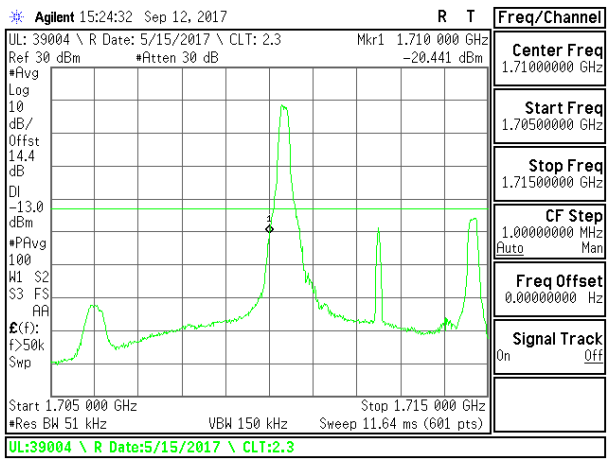
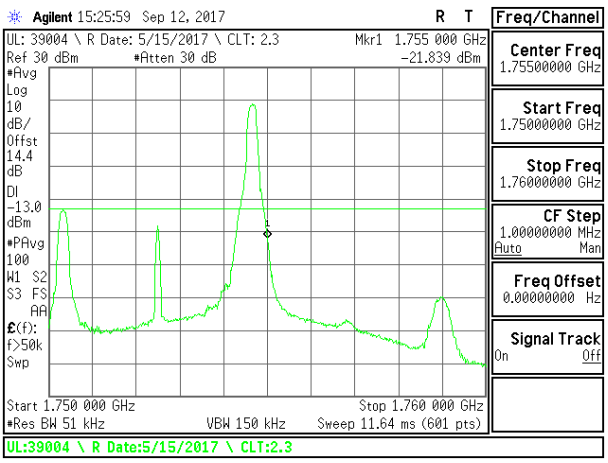
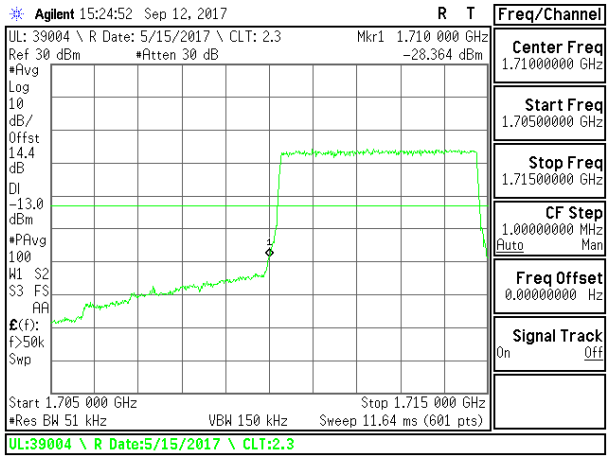
8.2.4. LTE BAND 4



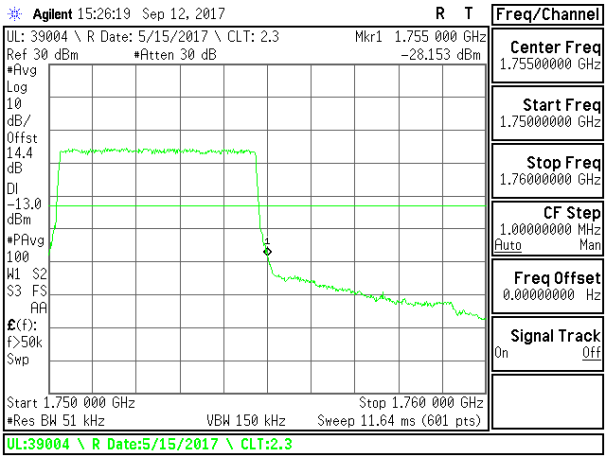
LTE B4 5MHz QPSK Low Channel RB1-0



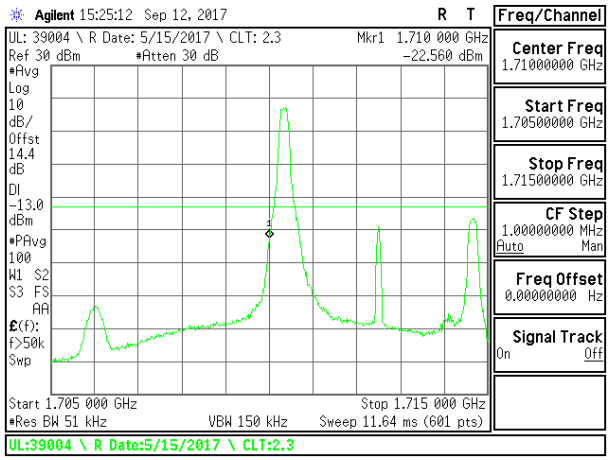
LTE B4 5MHz QPSK High Channel RB1-24



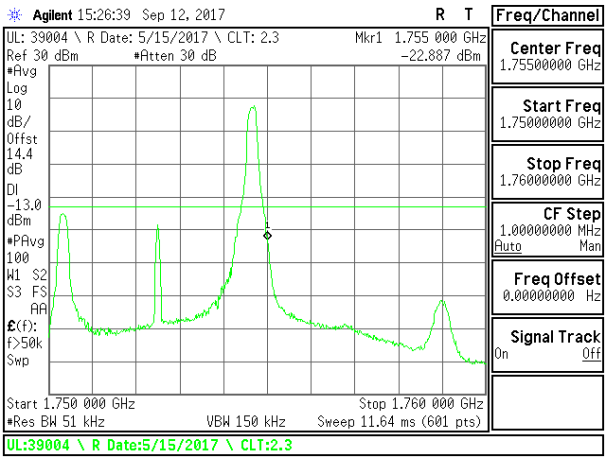
LTE B4 5MHz QPSK Low Channel RB25-0



LTE B4 5MHz QPSK High Channel RB25-0



LTE B4 5MHz 16QAM Low Channel RB1-0



LTE B4 5MHz 16QAM High Channel RB1-24

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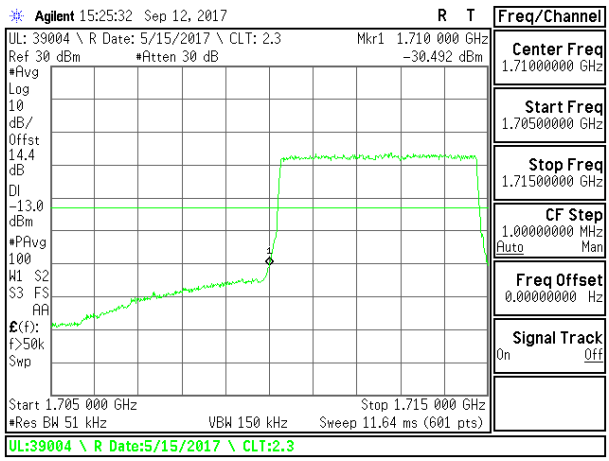
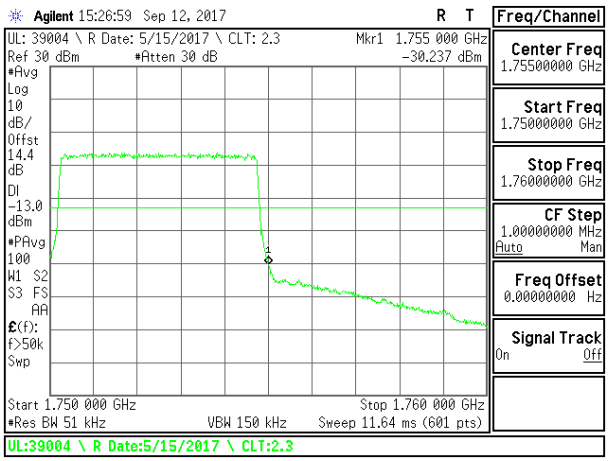


LTE B4 5MHz 16QAM Low Channel RB25-0



LTE B4 5MHz 16QAM High Channel RB25-0

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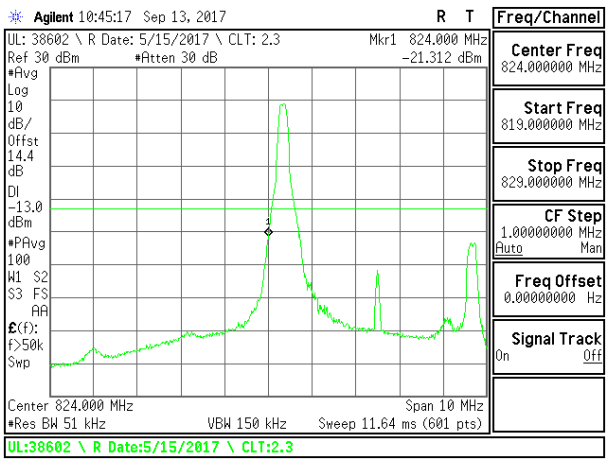
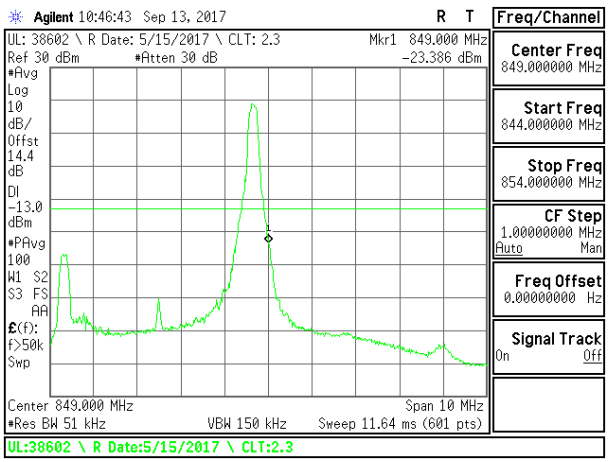
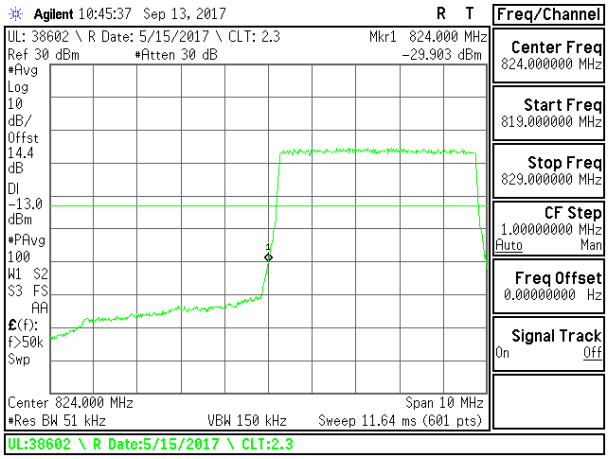
8.2.5. LTE BAND 5



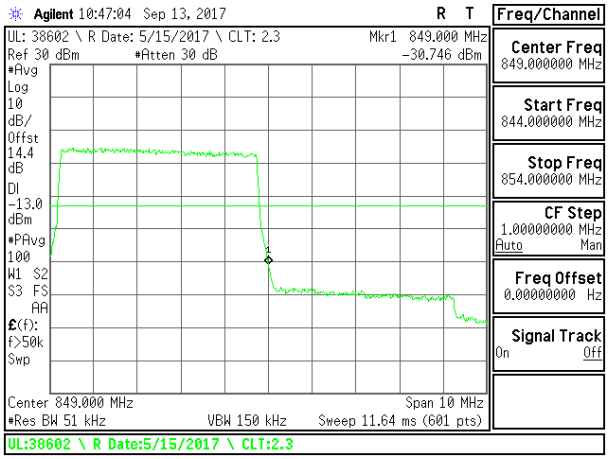
LTE B5 5MHz QPSK Low Channel RB1-0



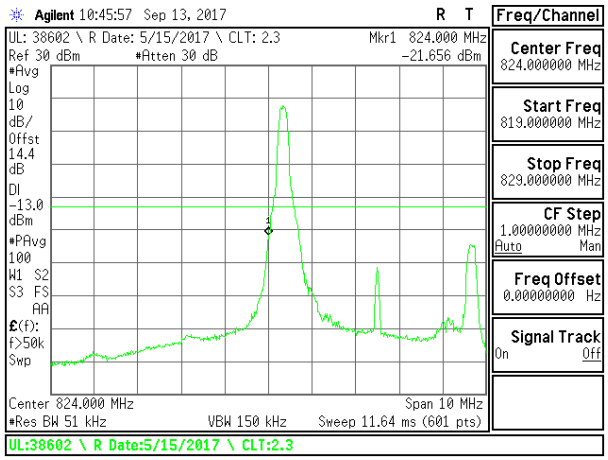
LTE B5 5MHz QPSK High Channel RB1-24



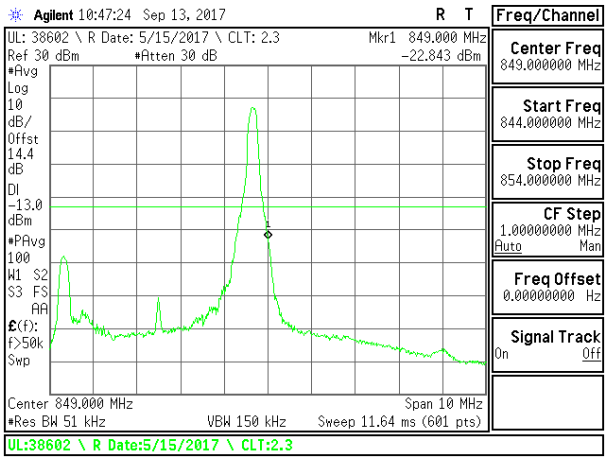
LTE B5 5MHz QPSK Low Channel RB25-0



LTE B5 5MHz QPSK High Channel RB25-0



LTE B5 5MHz 16QAM Low Channel RB1-0



LTE B5 5MHz 16QAM High Channel RB1-24

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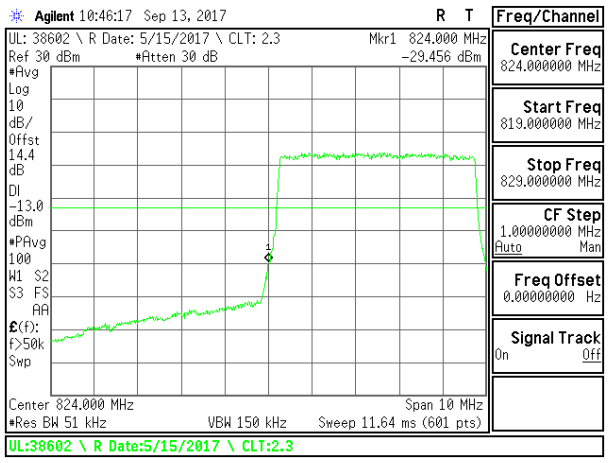
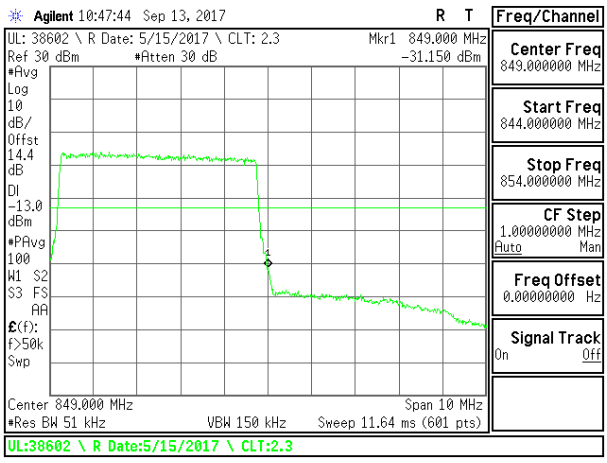


LTE B5 5MHz 16QAM Low Channel RB25-0



LTE B5 5MHz 16QAM High Channel RB25-0

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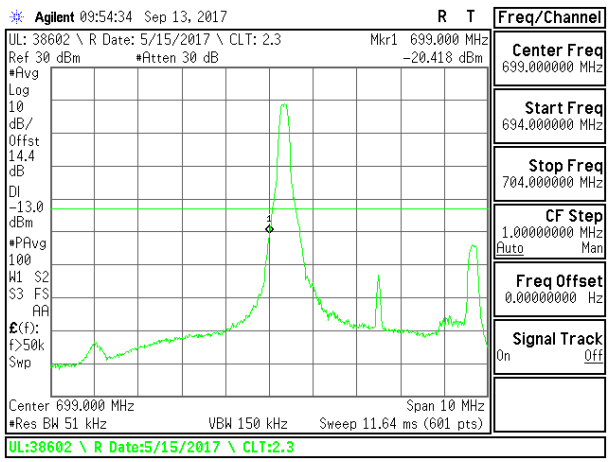
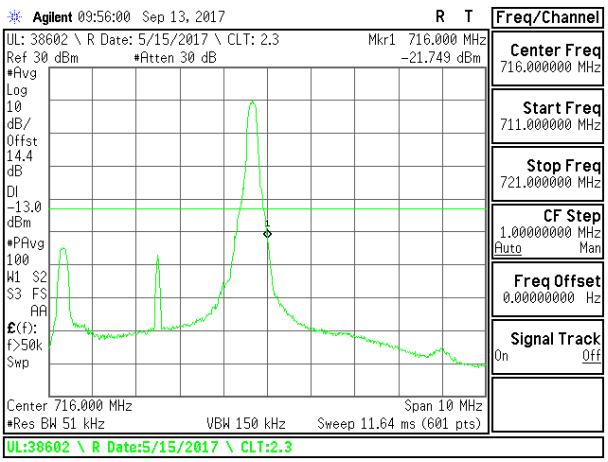
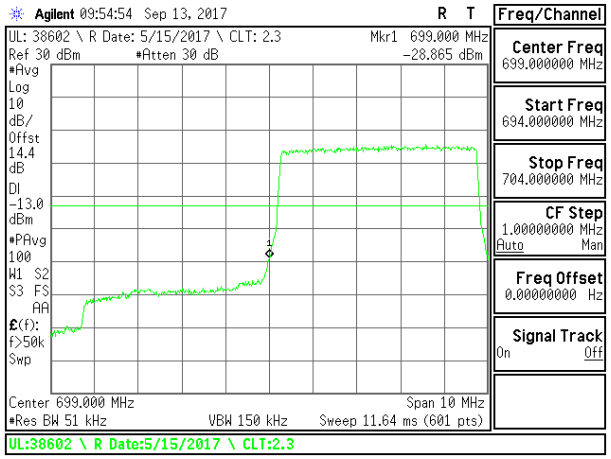
8.2.6. LTE BAND 12



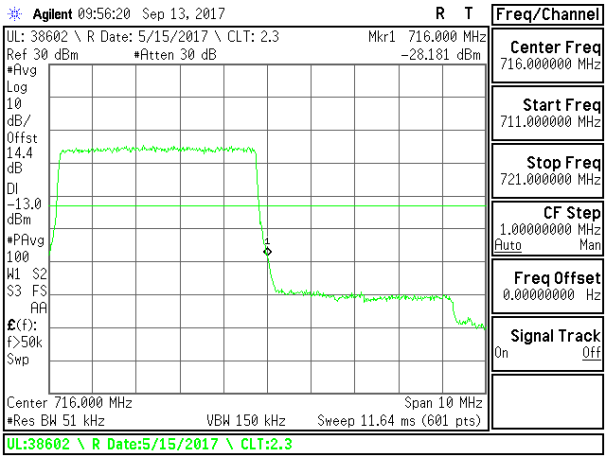
LTE B12 5MHz QPSK Low Channel RB1-0



LTE B12 5MHz QPSK High Channel RB1-24



LTE B12 5MHz QPSK Low Channel RB25-0



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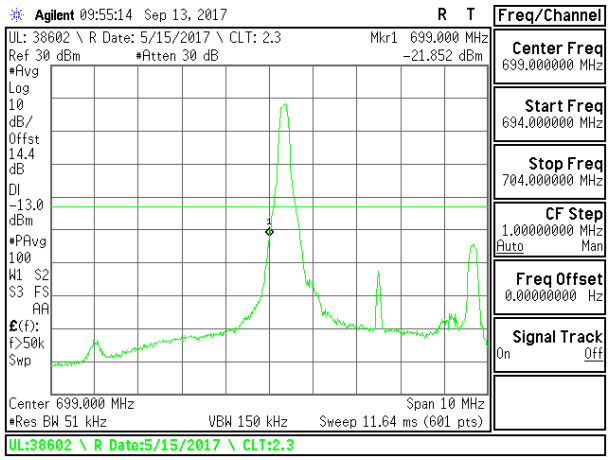
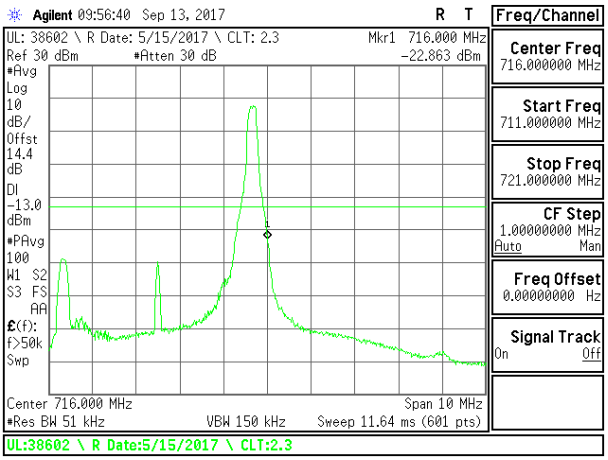


LTE B12 5MHz 16QAM Low Channel RB1-0



LTE B12 5MHz 16QAM High Channel RB1-24

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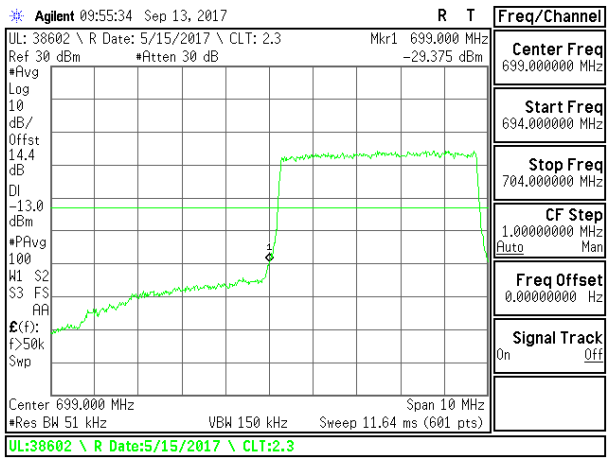
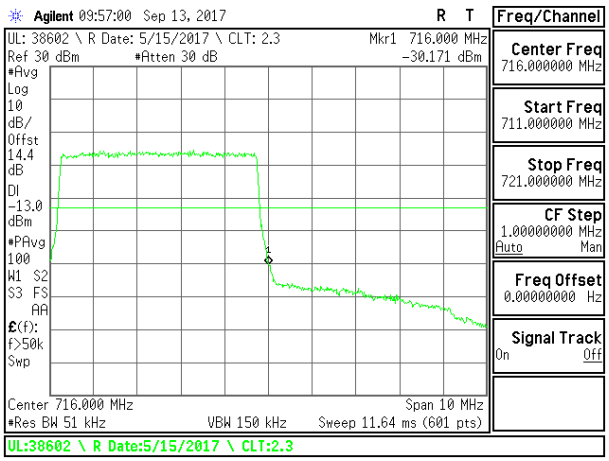


LTE B12 5MHz 16QAM Low Channel RB25-0



LTE B12 5MHz 16QAM High Channel RB25-0

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8.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238, §27.53
IC:RSS130§4.6, RSS132§5.5; RSS133§6.5, RSS139§6.6

LIMITS

FCC: §22.917, §24.238, §27.53 (g), (h)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

RSS130§4.6, RSS132§5.5, RSS133§6.5, RSS139§6.6
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

TEST PROCEDURE

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.

For each out of band emissions measurement:

- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

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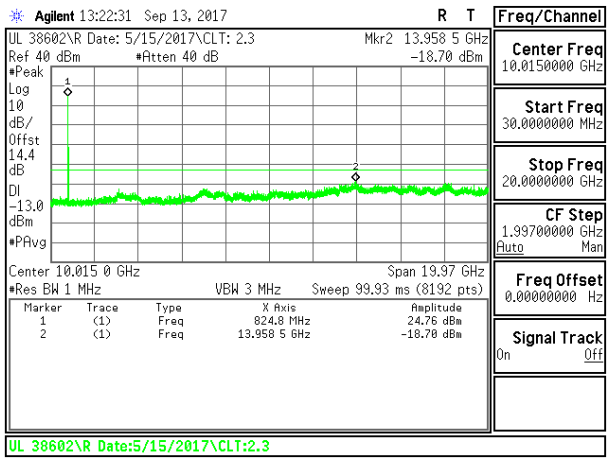
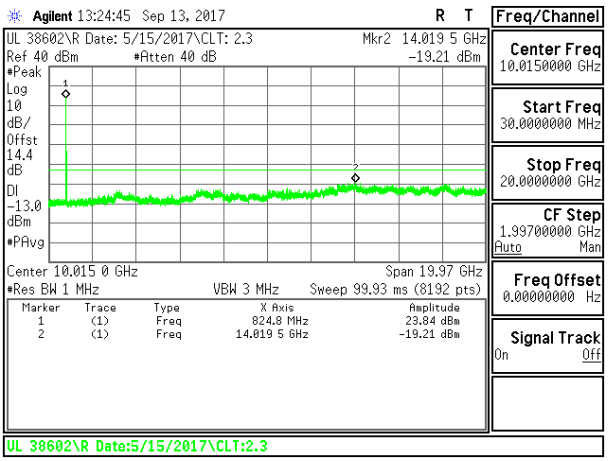
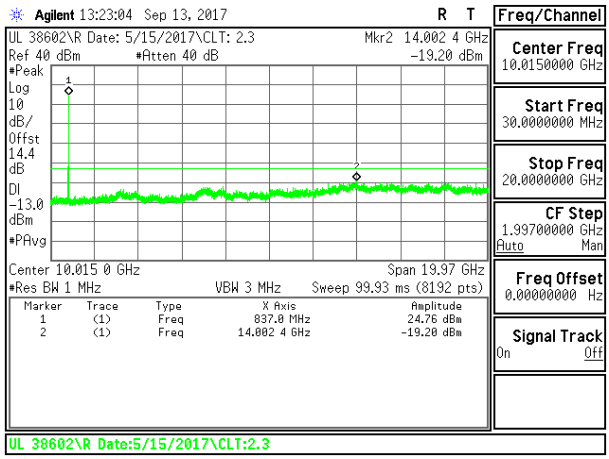
8.3.1. WCDMA BAND 5



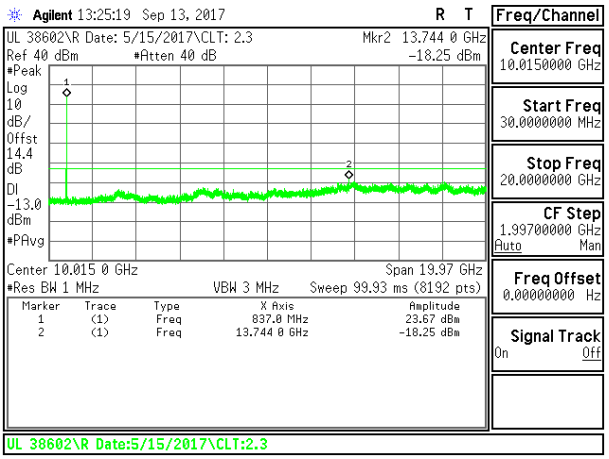
WCDMA Band 5 Rel 99 Low Channel



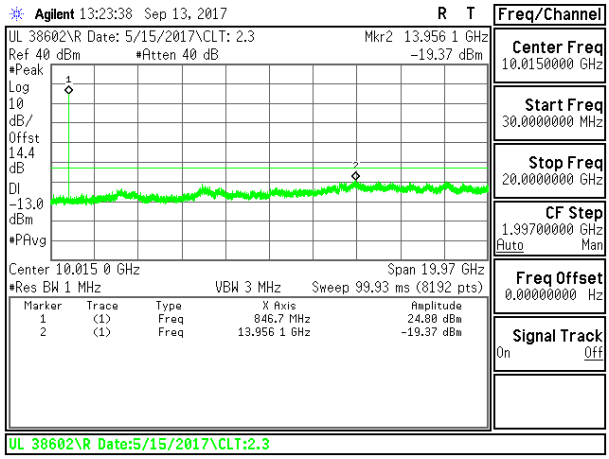
WCDMA Band 5 HSDPA Low Channel



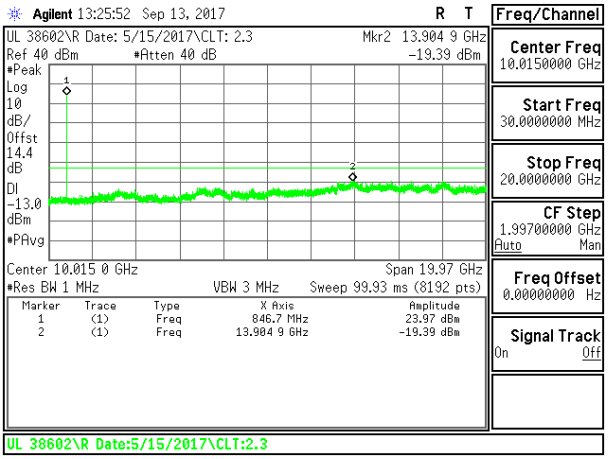
WCDMA Band 5 Rel 99 Middle Channel



WCDMA Band 5 HSDPA Middle Channel



WCDMA Band 5 Rel 99 High Channel



WCDMA Band 5 HSDPA High Channel

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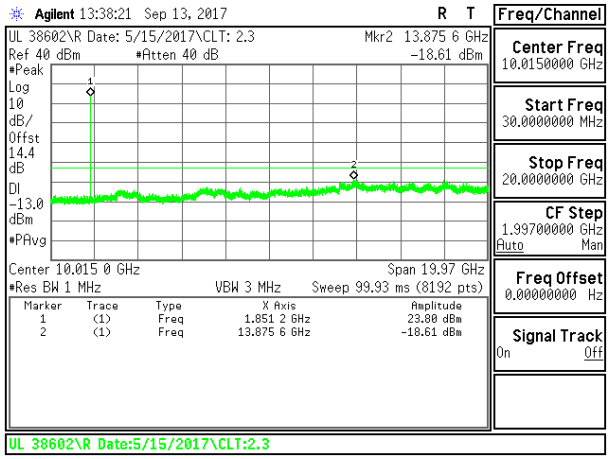
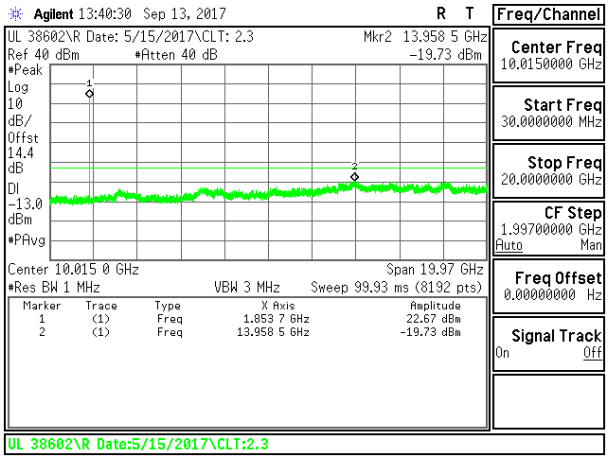
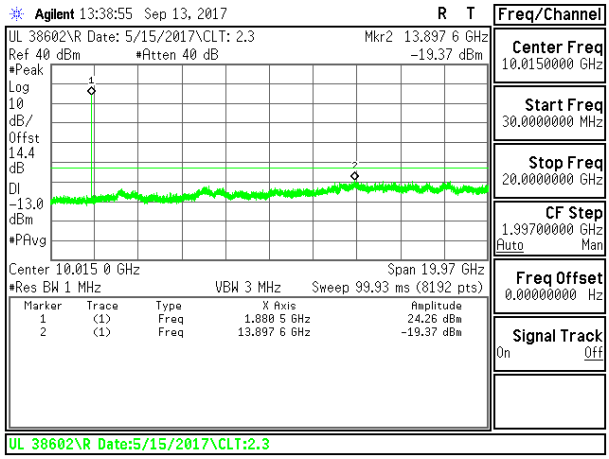
8.3.2. WCDMA BAND 2



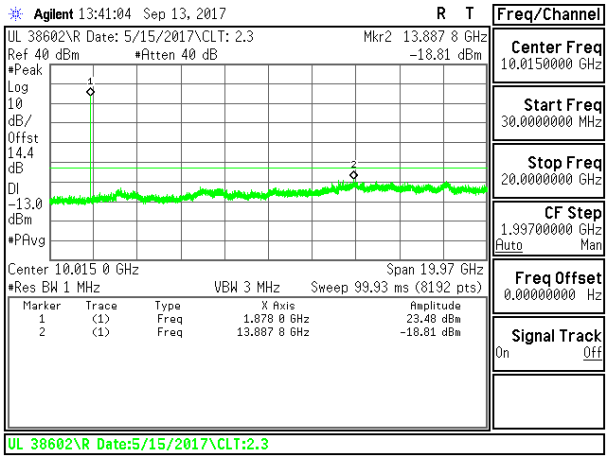
WCDMA Band 2 Rel 99 Low Channel



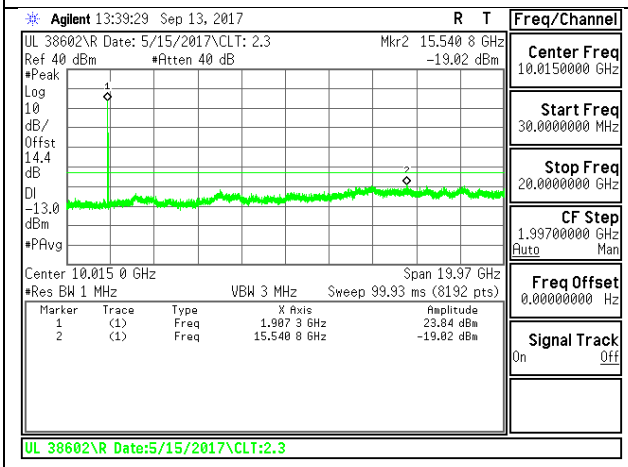
WCDMA Band 2 HSDPA Low Channel



WCDMA Band 2 Rel 99 Middle Channel



WCDMA Band 2 HSDPA Middle Channel



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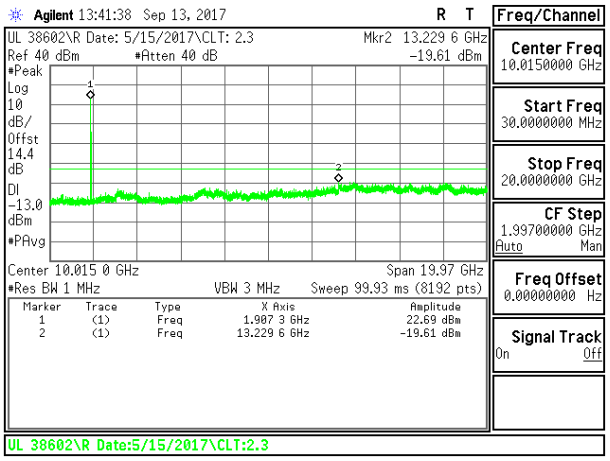

WCDMA Band 2 HSDPA High Channel

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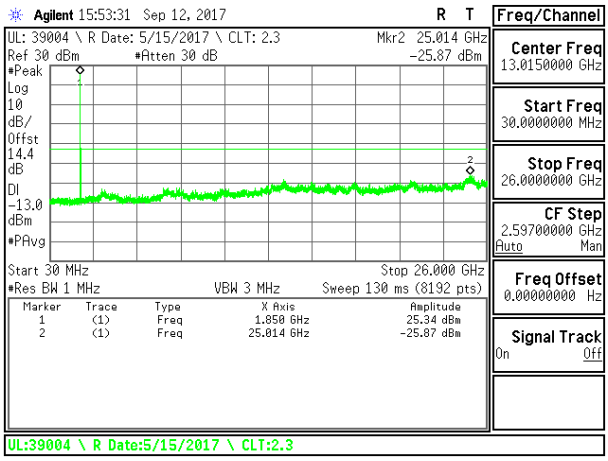
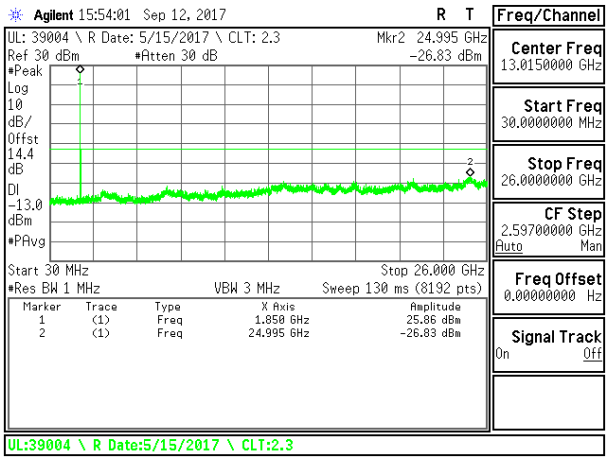
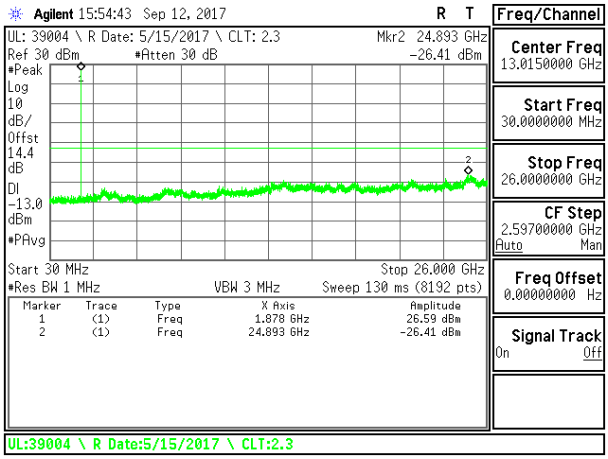
8.3.3. LTE BAND 2



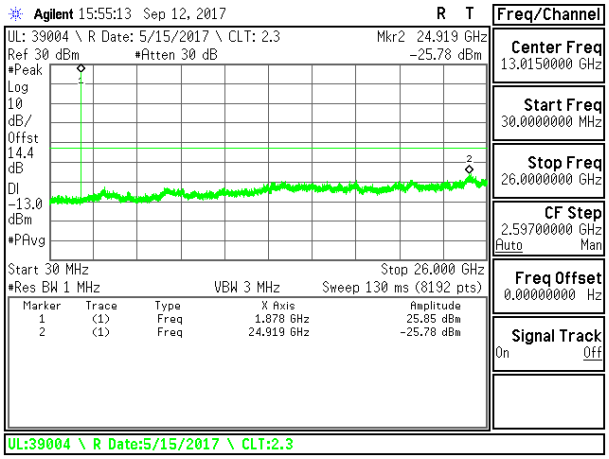
LTE B2 5MHz QPSK Low Channel RB1-0



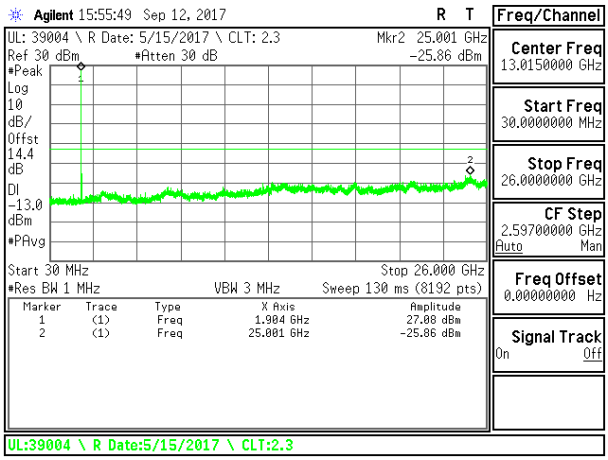
LTE B2 5MHz 16QAM Low Channel RB1-0



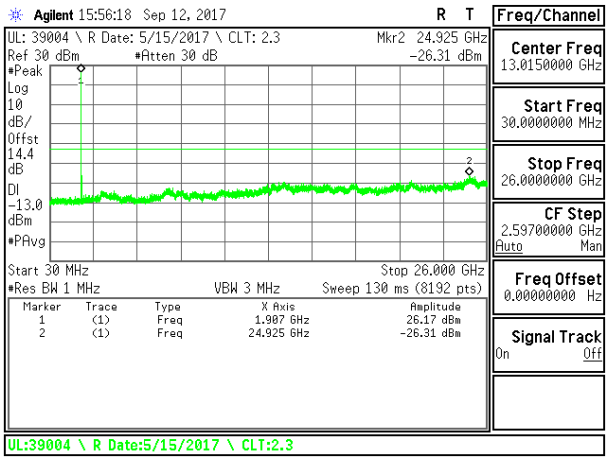
LTE B2 5MHz QPSK Middle Channel RB1-0



LTE B2 5MHz 16QAM Middle Channel RB1-0



LTE B2 5MHz QPSK High Channel RB1-0



LTE B2 5MHz 16QAM High Channel RB1-0

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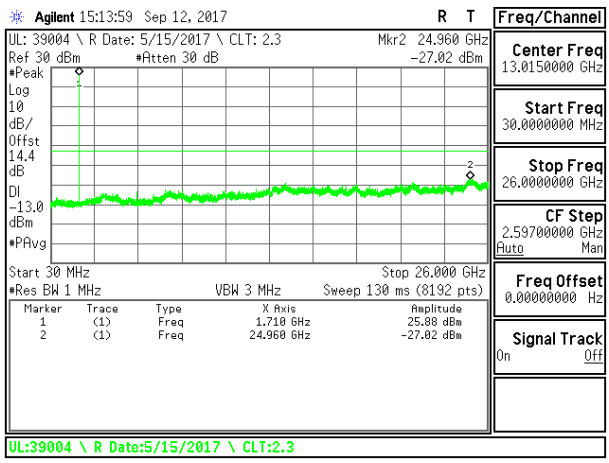
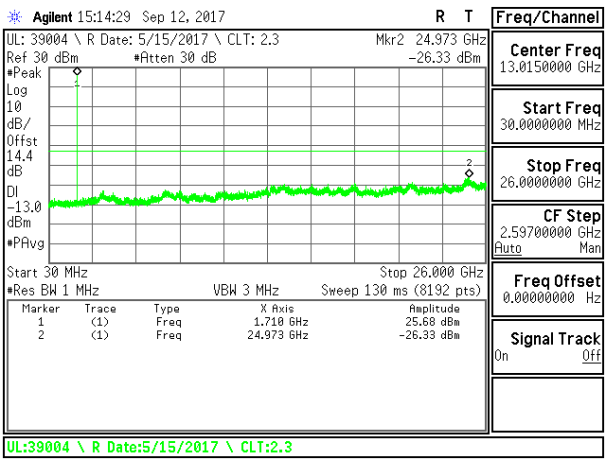
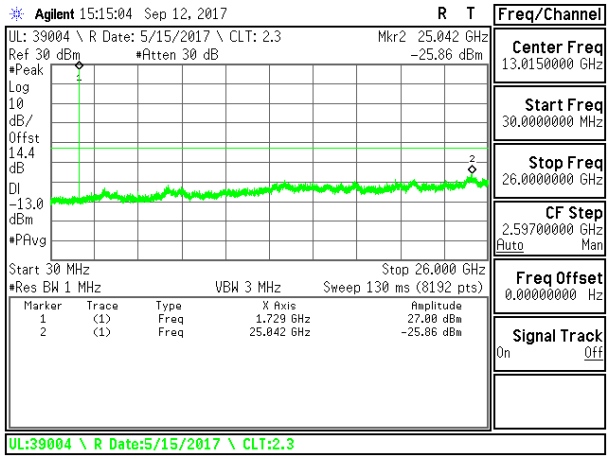
8.3.4. LTE BAND 4



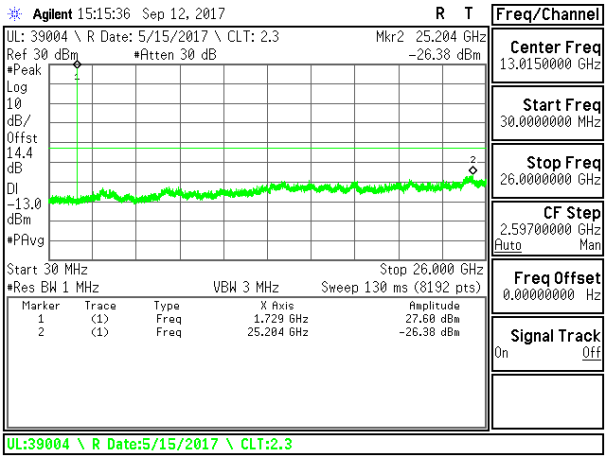
LTE B4 5MHz QPSK Low Channel RB1-0



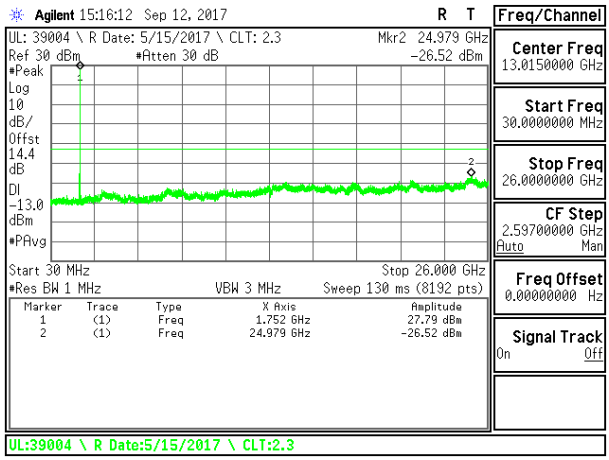
LTE B4 5MHz 16QAM Low Channel RB1-0



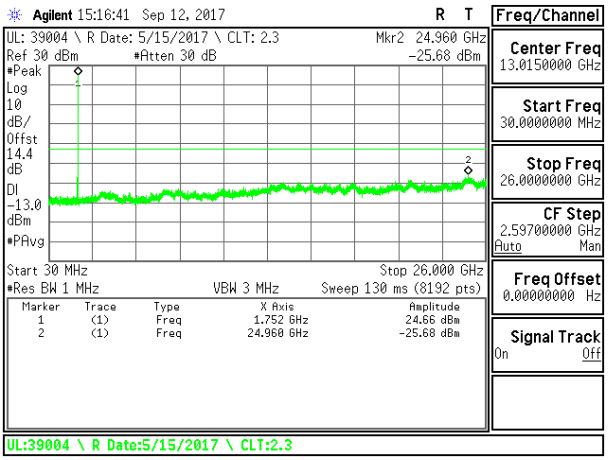
LTE B4 5MHz QPSK Middle Channel RB1-0



LTE B4 5MHz 16QAM Middle Channel RB1-0



LTE B4 5MHz QPSK High Channel RB1-0



LTE B4 5MHz 16QAM High Channel RB1-0

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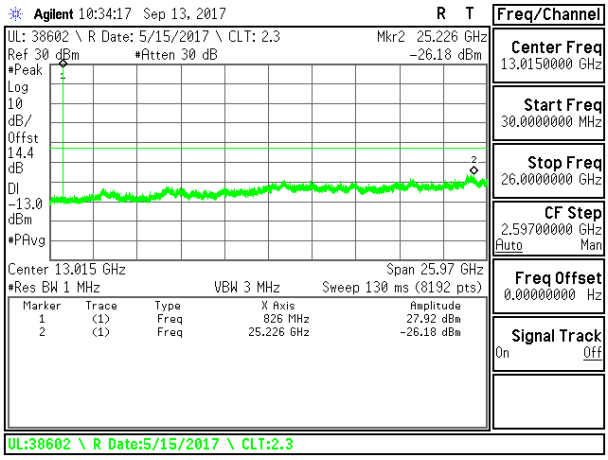
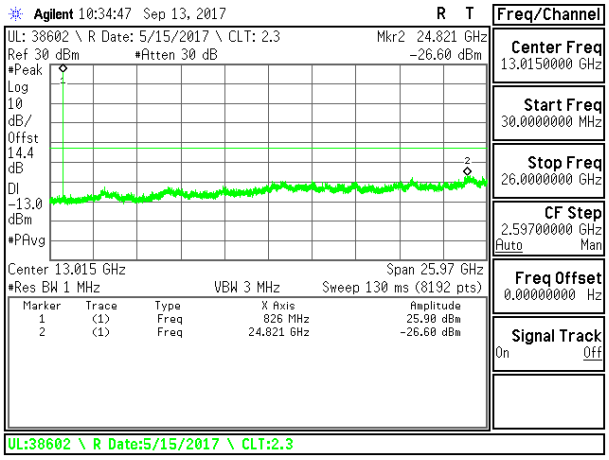
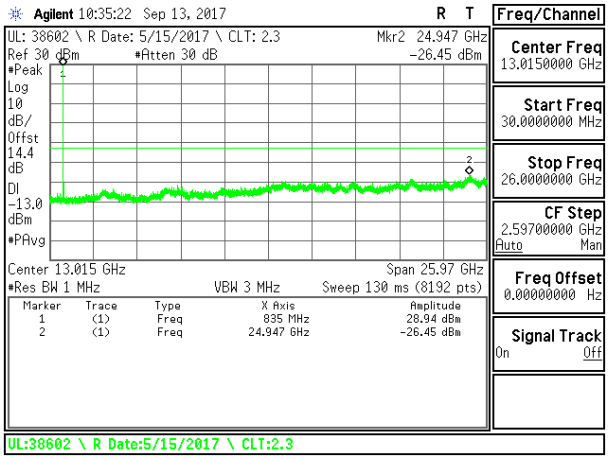
8.3.5. LTE BAND 5



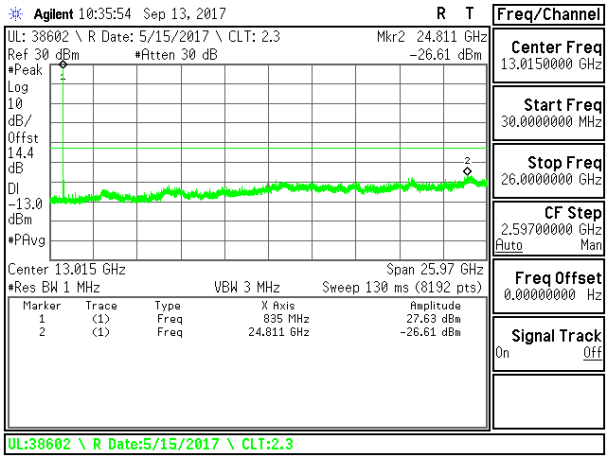
LTE B5 5MHz QPSK Low Channel RB1-0



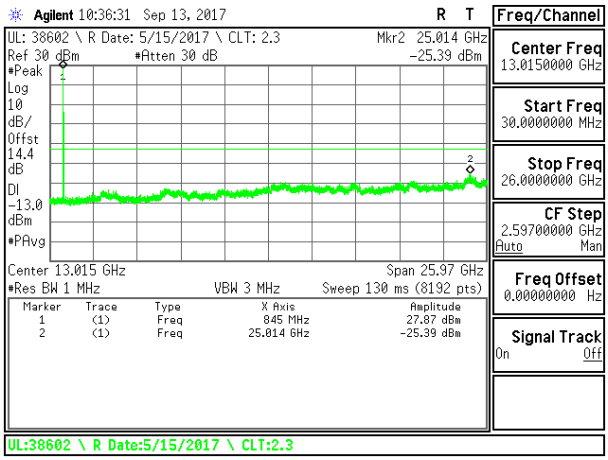
LTE B5 5MHz 16QAM Low Channel RB1-0



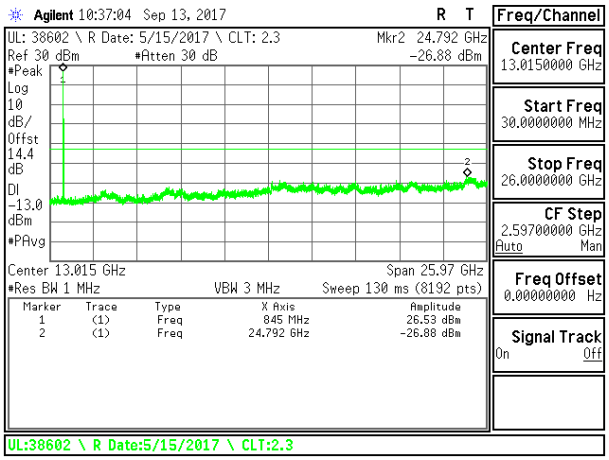
LTE B5 5MHz QPSK Middle Channel RB1-0



LTE B5 5MHz 16QAM Middle Channel RB1-0



LTE B5 5MHz QPSK High Channel RB1-0



LTE B5 5MHz 16QAM High Channel RB1-0

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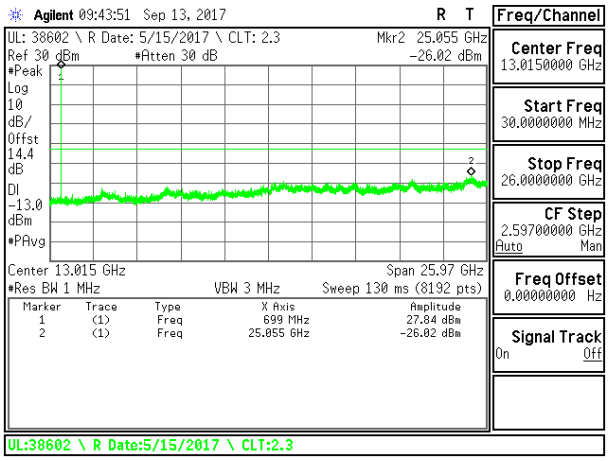
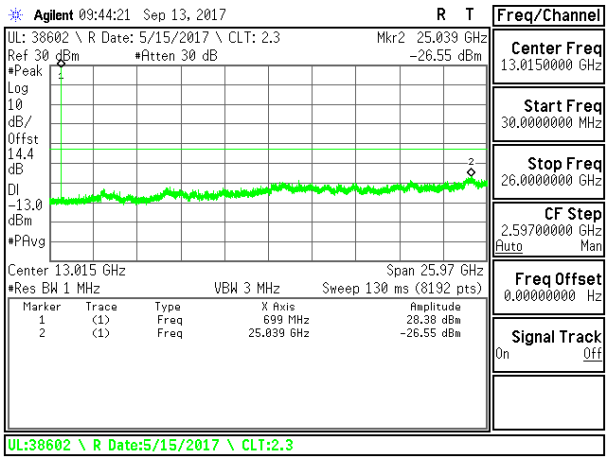
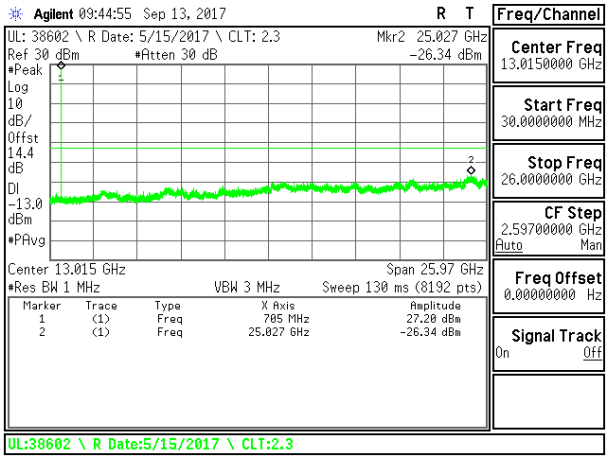
8.3.6. LTE BAND 12



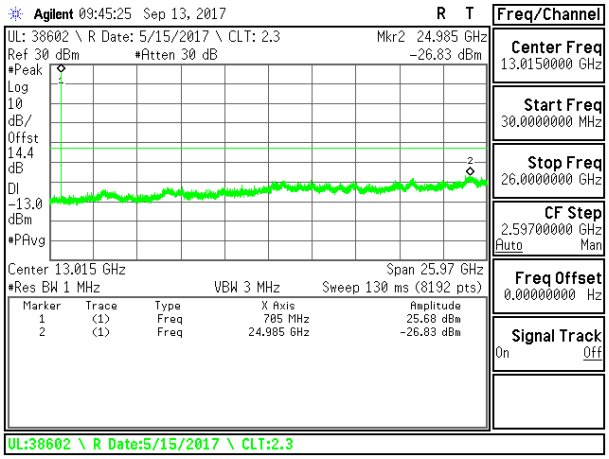
LTE B12 5MHz QPSK Low Channel RB1-0



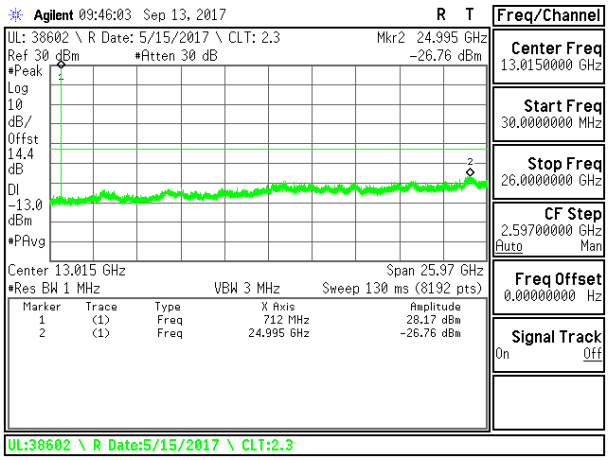
LTE B12 5MHz 16QAM Low Channel RB1-0



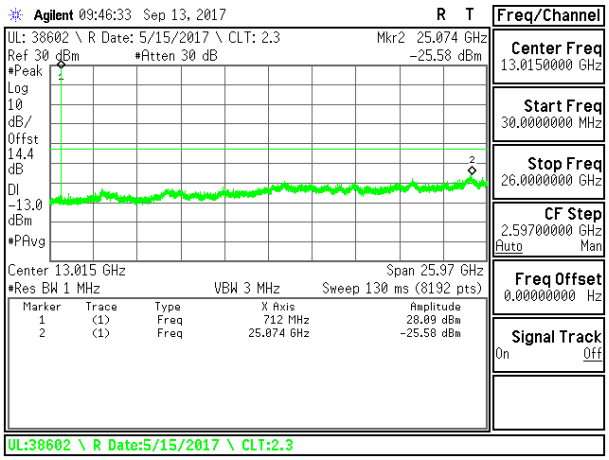
LTE B12 5MHz QPSK Middle Channel RB1-0



LTE B12 5MHz 16QAM Middle Channel RB1-0



LTE B12 5MHz QPSK High Channel RB1-0



LTE B12 5MHz 16QAM High Channel RB1-0

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8.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235, §27.54
RSS130§4.3, RSS132§5.3; RSS133§6.3, RSS139§6.4

LIMITS

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

FCC: §24.235 & §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS130§4.3
The transmitter frequency stability limit shall be determined as follows:

a. The frequency offset shall be measured according to the procedure described in RSS-Gen and recorded;
b. Using a resolution bandwidth of 1% of the occupied bandwidth, a reference point at the unwanted emission level which complies with the attenuation of 43 + 10 log10 p (watts) on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as fL and fH respectively.

The applicant shall ensure frequency stability by showing that fL minus the frequency offset and fH plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

RSS132§5.3
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 SRSP for mobile stations and±1.5 ppm for base stations.
In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the occupied bandwidth stays within each of the sub-bands (see Section 5.1) when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS133§6.3
The carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and ±1.0 ppm for base stations.
In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS139§6.4
The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

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TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- Temp. = −30°C to +50°C
- Voltage = (85% - 115%)

  Low voltage, 102VAC, Normal, 120VAC and High voltage, 138VAC.
  End Voltage, 101VAC.

Frequency Stability vs Temperature:

The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

RESULTS

See the following pages.

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8.4.1. WCDMA

ID:	38602	Date:	9/14/17

WCDMA REL 99 BAND 5

Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	824.1112	848.8693		
Extreme (50C)		824.1112	848.8693	2.94	0.004
Extreme (40C)		824.1112	848.8693	2.46	0.003
Extreme (30C)		824.1112	848.8693	-3.09	-0.004
Extreme (10C)		824.1112	848.8693	2.78	0.003
Extreme (0C)		824.1112	848.8693	3.13	0.004
Extreme (-10C)		824.1112	848.8693	3.50	0.004
Extreme (-20C)		824.1112	848.8693	-2.79	-0.003
Extreme (-30C)		824.1112	848.8693	-2.90	-0.003
20C	15%	824.1112	848.8693	-3.06	-0.004
	-15%	824.1112	848.8693	-2.26	-0.003
	End Point	824.1112	848.8693	-2.72	-0.003

WCDMA REL 99 BAND 2

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	1850.1267	1909.8675		
Extreme (50C)		1850.1267	1909.8675	-6.03	-0.003
Extreme (40C)		1850.1267	1909.8675	-6.00	-0.003
Extreme (30C)		1850.1267	1909.8675	-4.95	-0.003
Extreme (10C)		1850.1267	1909.8675	-6.33	-0.003
Extreme (0C)		1850.1267	1909.8675	-6.44	-0.003
Extreme (-10C)		1850.1267	1909.8675	-5.62	-0.003
Extreme (-20C)		1850.1267	1909.8675	-5.11	-0.003
Extreme (-30C)		1850.1267	1909.8675	-4.60	-0.002
20C	15%	1850.1267	1909.8675	-5.32	-0.003
	-15%	1850.1267	1909.8675	-6.15	-0.003
	End Point	1850.1267	1909.8675	-6.48	-0.003

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8.4.2. LTE BAND 2

ID:	38602	Date:	9/14/17

QPSK, (5.0MHz BANDWIDTH)

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1850.2455	1909.7556		
Extreme (50C)		1850.2455	1909.7556	-10.95	-0.006
Extreme (40C)		1850.2455	1909.7556	-10.49	-0.006
Extreme (30C)		1850.2455	1909.7556	-10.24	-0.005
Extreme (10C)		1850.2455	1909.7556	-10.37	-0.006
Extreme (0C)		1850.2455	1909.7556	-10.36	-0.006
Extreme (-10C)		1850.2455	1909.7556	-9.58	-0.005
Extreme (-20C)		1850.2455	1909.7556	-9.02	-0.005
Extreme (-30C)		1850.2455	1909.7556	-10.96	-0.006
20C	15%	1850.2455	1909.7556	-10.60	-0.006
	-15%	1850.2455	1909.7556	-9.34	-0.005
	End Point	1850.2455	1909.7556	-11.27	-0.006

8.4.3. LTE BAND 4

ID:	38602	Date:	9/14/17

QPSK, (5.0MHz BANDWIDTH)

Limit		1710	1755	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1710.2490	1754.7549		
Extreme (50C)		1710.2490	1754.7549	-7.31	-0.004
Extreme (40C)		1710.2490	1754.7549	-7.12	-0.004
Extreme (30C)		1710.2490	1754.7549	-6.78	-0.004
Extreme (10C)		1710.2490	1754.7549	7.50	0.004
Extreme (0C)		1710.2490	1754.7549	6.65	0.004
Extreme (-10C)		1710.2490	1754.7549	8.04	0.005
Extreme (-20C)		1710.2490	1754.7549	9.91	0.006
Extreme (-30C)		1710.2490	1754.7549	7.87	0.005
20C	15%	1710.2490	1754.7549	7.71	0.004
	-15%	1710.2490	1754.7549	6.77	0.004
	End Point	1710.2490	1754.7549	7.25	0.004

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8.4.4. LTE BAND 5

ID:	38602	Date:	9/14/17

QPSK, (5.0MHz BANDWIDTH)

Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	824.2492	848.7512		
Extreme (50C)		824.2492	848.7512	-5.75	-0.007
Extreme (40C)		824.2492	848.7512	-4.94	-0.006
Extreme (30C)		824.2492	848.7512	-5.05	-0.006
Extreme (10C)		824.2492	848.7512	-4.26	-0.005
Extreme (0C)		824.2492	848.7512	-3.89	-0.005
Extreme (-10C)		824.2492	848.7512	-4.47	-0.005
Extreme (-20C)		824.2492	848.7512	-3.88	-0.005
Extreme (-30C)		824.2492	848.7512	-4.21	-0.005
20C	15%	824.2492	848.7512	-4.45	-0.005
	-15%	824.2492	848.7512	-3.84	-0.005
	End Point	824.2492	848.7512	-4.12	-0.005

8.4.5. LTE BAND 12

ID:	38602	Date:	9/14/17

QPSK, (5.0MHz BANDWIDTH)

Limit		699	716	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	699.2494	715.7546		
Extreme (50C)		699.2494	715.7545	-5.01	-0.007
Extreme (40C)		699.2494	715.7545	-3.74	-0.005
Extreme (30C)		699.2494	715.7545	-4.05	-0.006
Extreme (10C)		699.2494	715.7545	-3.62	-0.005
Extreme (0C)		699.2494	715.7545	-3.85	-0.005
Extreme (-10C)		699.2494	715.7546	4.49	0.006
Extreme (-20C)		699.2494	715.7546	5.08	0.007
Extreme (-30C)		699.2494	715.7546	4.81	0.007
20C	15%	699.2494	715.7545	-4.39	-0.006
	-15%	699.2494	715.7545	-4.03	-0.006
	End Point	699.2494	715.7545	-3.97	-0.006

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8.5. PEAK-TO-AVERAGE POWER RATIO

LIMIT

In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

RESULT

The results from all CCDF plots are passed with 13dB peak-to-average power ratio criteria. LTE bands PAPR was performed by using full resource blocks (FRB) as the worse case scenario.

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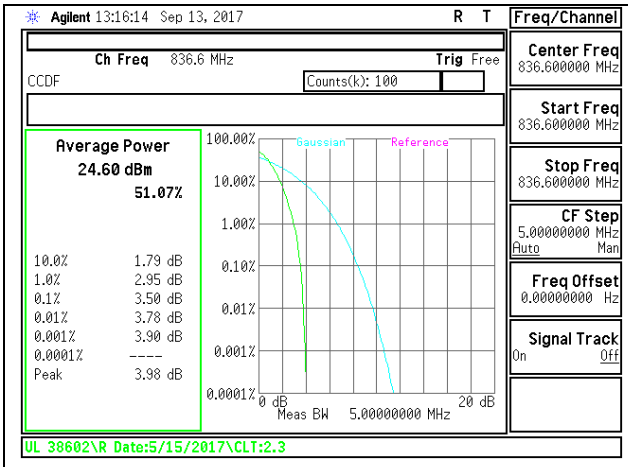
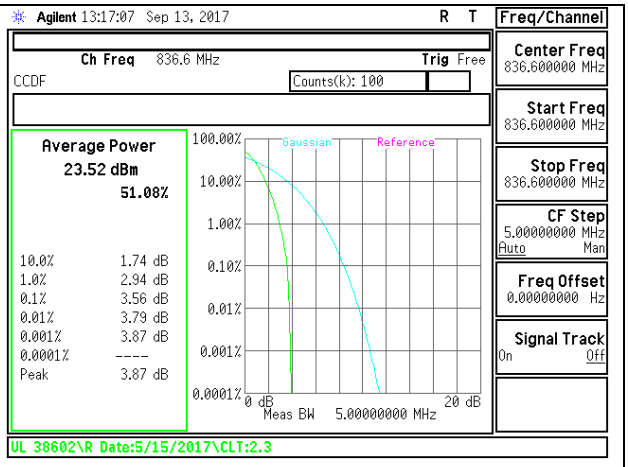
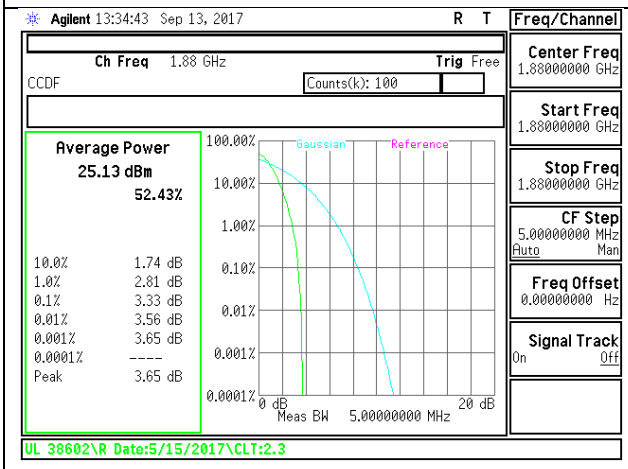
8.5.1. WCDMA



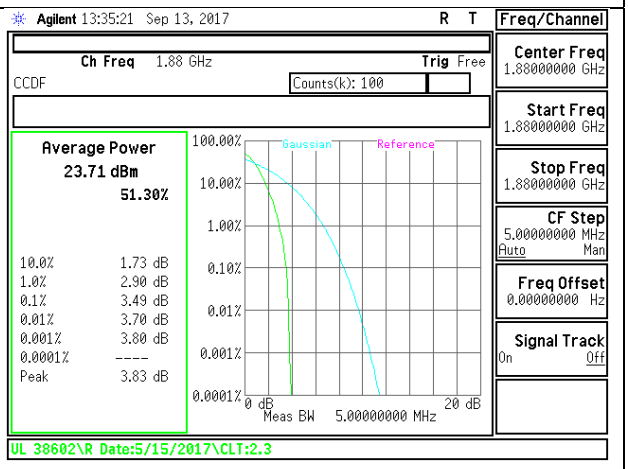
WCDMA Band 5 Rel 99 Middle Channel



WCDMA Band 5 HSDPA Middle Channel



WCDMA Band 2 Rel 99 Middle Channel



WCDMA Band 2 HSDPA Middle Channel

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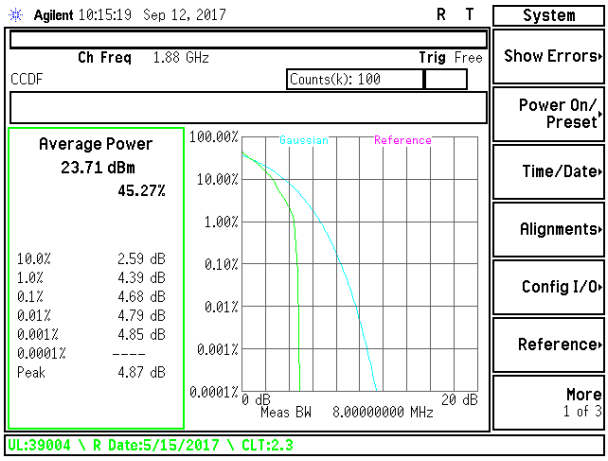
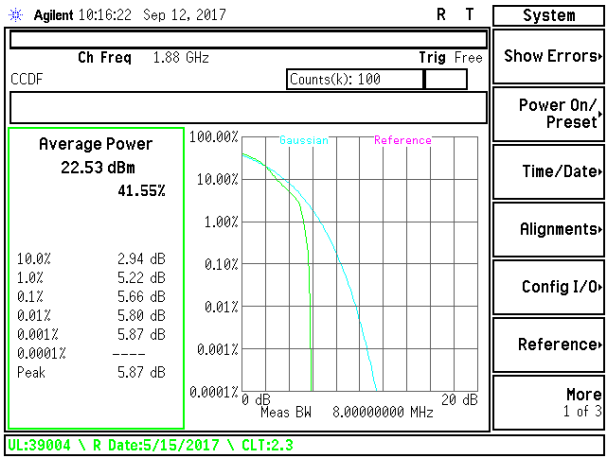
8.5.2. LTE BAND 2

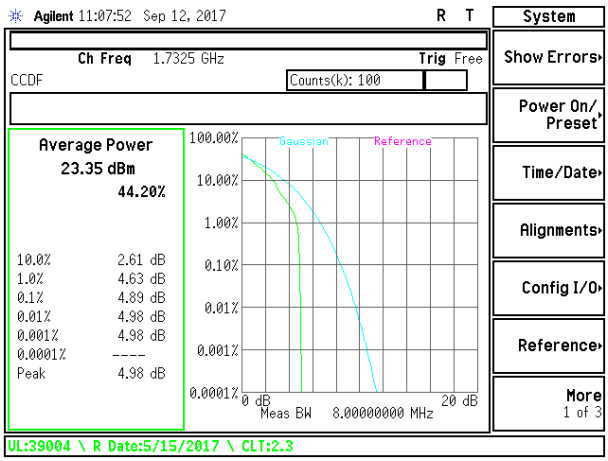


LTE B2 5MHz QPSK Middle Channel

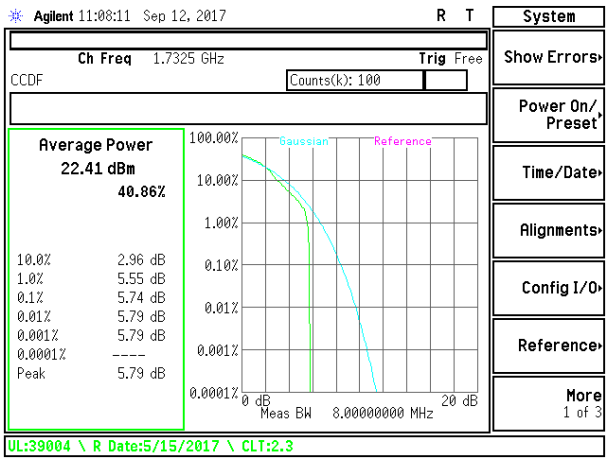


LTE B2 5MHz 16QAM Middle Channel

8.5.3. LTE BAND 4



LTE B4 5MHz QPSK Middle Channel



LTE B4 5MHz 16QAM Middle Channel

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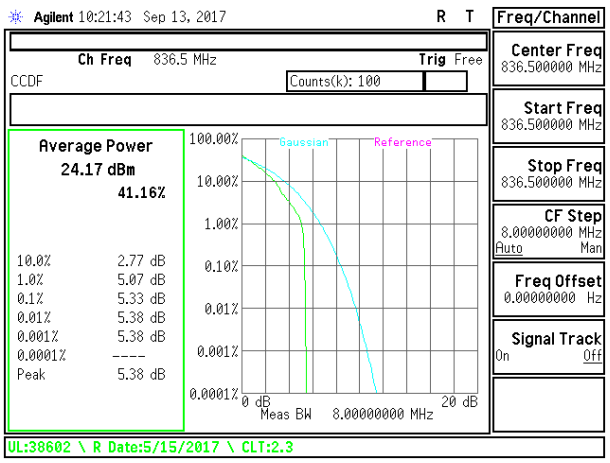
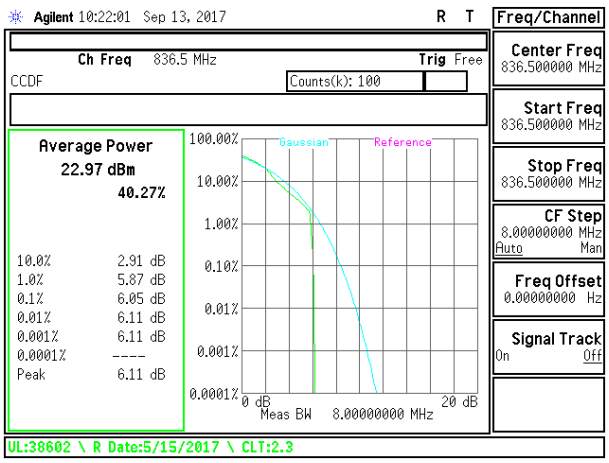
8.5.4. LTE BAND 5

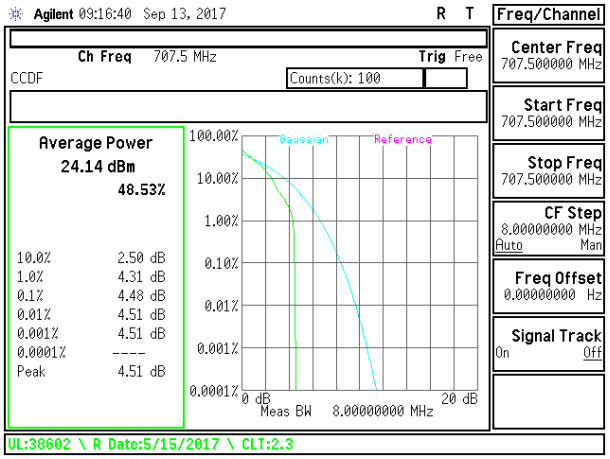


LTE B5 5MHz QPSK Middle Channel

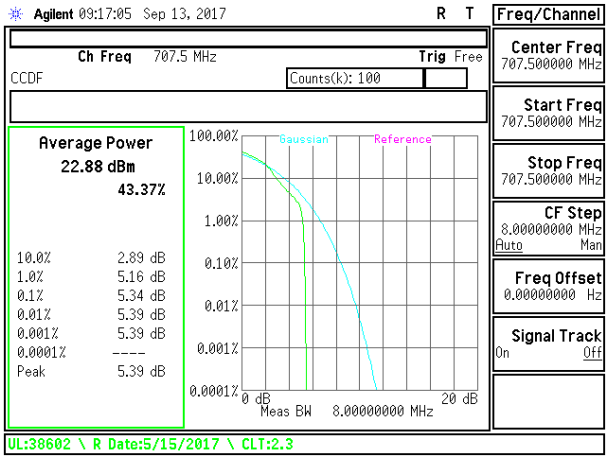


LTE B5 5MHz 16QAM Middle Channel

8.5.5. LTE BAND 12



LTE B12 5MHz QPSK Middle Channel



LTE B12 5MHz 16QAM Middle Channel

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9. RADIATED TEST RESULTS

9.1. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §22.917, §24.238, §27.53
RSS130§4.6, RSS132§5.5; RSS133§6.5, RSS139§6.6

FCC LIMIT

FCC: §22.917(a), §24.238(a), §27.53 (g), (h)
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.

RSS130§4.6
4.6.1 The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.
4.6.2 In addition to the limit outlined in Section 4.6.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:
(a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

(i) 76 + 10 log10 p (watts), dB, for base and fixed equipment, and
(ii) 65 + 10 log10 p (watts), dB, for mobile and portable equipment.

RSS132§5.5
Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts).
(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

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RSS133§6.5

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts).

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS139§6.6

(i) (i)In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block,Footnote2 which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least43 + 10 log10 p (watts) dB.

(ii) (ii)After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

TEST PROCEDURE

KDB 971168 D01 v02r02/D02 v01

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9.1.1. WCDMA

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/17/2017
Test Engineer: 43574 JS
Configuration: EUT powered by AC source
Location: Chamber B
Mode: 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, 826.4									
1652.80	-24.7	V	3.0	37.0	1.0	-60.7	-13.0	-47.7	
2479.20	-22.3	V	3.0	36.4	1.0	-57.7	-13.0	-44.7	
3305.60	-19.8	V	3.0	36.1	1.0	-54.9	-13.0	-41.9	
1652.80	-24.8	H	3.0	37.0	1.0	-60.9	-13.0	-47.9	
2479.20	-22.7	H	3.0	36.4	1.0	-58.2	-13.0	-45.2	
3305.60	-20.2	H	3.0	36.1	1.0	-55.3	-13.0	-42.3	
Mid Ch, 836.6									
1673.20	-24.4	V	3.0	37.0	1.0	-60.4	-13.0	-47.4	
2509.80	-21.7	V	3.0	36.4	1.0	-57.1	-13.0	-44.1	
3346.40	-20.9	V	3.0	36.1	1.0	-56.0	-13.0	-43.0	
1673.20	-24.7	H	3.0	37.0	1.0	-60.7	-13.0	-47.7	
2509.80	-22.6	H	3.0	36.4	1.0	-58.0	-13.0	-45.0	
3346.40	-21.0	H	3.0	36.1	1.0	-56.1	-13.0	-43.1	
High Ch, 846.6									
1693.20	-24.4	V	3.0	37.0	1.0	-60.4	-13.0	-47.4	
2539.80	-22.2	V	3.0	36.4	1.0	-57.6	-13.0	-44.6	
3386.40	-19.5	V	3.0	36.1	1.0	-54.6	-13.0	-41.6	
1693.20	-24.4	H	3.0	37.0	1.0	-60.4	-13.0	-47.4	
2539.80	-22.3	H	3.0	36.4	1.0	-57.7	-13.0	-44.7	
3386.40	-20.1	H	3.0	36.1	1.0	-55.2	-13.0	-42.2	

B5 REL99

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/17/2017
Test Engineer: 43574 JS
Configuration: EUT powered by AC source
Location: Chamber B
Mode: 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, 826.4									
1652.80	-25.0	V	3.0	37.0	1.0	-61.1	-13.0	-48.1	
2479.20	-22.2	V	3.0	36.4	1.0	-57.6	-13.0	-44.6	
3305.60	-19.6	V	3.0	36.1	1.0	-54.8	-13.0	-41.8	
1652.80	-25.2	H	3.0	37.0	1.0	-61.2	-13.0	-48.2	
2479.20	-22.9	H	3.0	36.4	1.0	-58.4	-13.0	-45.4	
3305.60	-20.1	H	3.0	36.1	1.0	-55.2	-13.0	-42.2	
Mid Ch, 836.6									
1673.20	-24.8	V	3.0	37.0	1.0	-60.8	-13.0	-47.8	
2509.80	-21.6	V	3.0	36.4	1.0	-57.0	-13.0	-44.0	
3346.40	-20.6	V	3.0	36.1	1.0	-55.8	-13.0	-42.8	
1673.20	-25.1	H	3.0	37.0	1.0	-61.1	-13.0	-48.1	
2509.80	-23.3	H	3.0	36.4	1.0	-58.7	-13.0	-45.7	
3346.40	-20.7	H	3.0	36.1	1.0	-55.8	-13.0	-42.8	
High Ch, 846.6									
1693.20	-24.6	V	3.0	37.0	1.0	-60.6	-13.0	-47.6	
2539.80	-22.0	V	3.0	36.4	1.0	-57.4	-13.0	-44.4	
3386.40	-19.3	V	3.0	36.1	1.0	-54.4	-13.0	-41.4	
1693.20	-24.4	H	3.0	37.0	1.0	-60.4	-13.0	-47.4	
2539.80	-22.4	H	3.0	36.4	1.0	-57.8	-13.0	-44.8	
3386.40	-20.0	H	3.0	36.1	1.0	-55.1	-13.0	-42.1	

B5 HSDPA

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/17/2017
Test Engineer: 43574 JS
Configuration: EUT powered by AC source
Location: Chamber B
Mode: Rel99 Band 2 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, 1852.4MHz									
3704.80	-14.5	V	3.0	35.9	1.0	-49.3	-13.0	-36.3	
5557.20	-9.9	V	3.0	35.5	1.0	-44.4	-13.0	-31.4	
7409.60	-12.1	V	3.0	35.7	1.0	-46.8	-13.0	-33.8	
3704.80	-15.1	H	3.0	35.9	1.0	-50.0	-13.0	-37.0	
5557.20	-9.8	H	3.0	35.5	1.0	-44.3	-13.0	-31.3	
7409.60	-11.3	H	3.0	35.7	1.0	-46.0	-13.0	-33.0	
Mid Ch, 1880MHz									
3760.00	-14.6	V	3.0	35.8	1.0	-49.4	-13.0	-36.4	
5640.00	-9.7	V	3.0	35.5	1.0	-44.1	-13.0	-31.1	
7520.00	-12.5	V	3.0	35.7	1.0	-47.3	-13.0	-34.3	
3760.00	-14.9	H	3.0	35.8	1.0	-49.7	-13.0	-36.7	
5640.00	-9.6	H	3.0	35.5	1.0	-44.1	-13.0	-31.1	
7520.00	-11.5	H	3.0	35.7	1.0	-46.3	-13.0	-33.3	
High Ch, 1907.6MHz									
3815.20	-14.1	V	3.0	35.8	1.0	-48.9	-13.0	-35.9	
5722.80	-9.3	V	3.0	35.5	1.0	-43.8	-13.0	-30.8	
7630.40	-10.8	V	3.0	35.8	1.0	-45.6	-13.0	-32.6	
3815.20	-14.6	H	3.0	35.8	1.0	-49.3	-13.0	-36.3	
5722.80	-9.6	H	3.0	35.5	1.0	-44.1	-13.0	-31.1	
7630.40	-11.4	H	3.0	35.8	1.0	-46.2	-13.0	-33.2	

Version 1.2.4 updated 3/13/17

B2 REL99

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/17/2017
Test Engineer: 43574 JS
Configuration: EUT powered by AC source
Location: Chamber B
Mode: HSDPA Band 2 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, 1852.4MHz									
3704.80	-14.1	V	3.0	35.9	1.0	-49.0	-13.0	-36.0	
5557.20	-12.5	V	3.0	35.5	1.0	-47.0	-13.0	-34.0	
7409.60	-10.7	V	3.0	35.7	1.0	-45.4	-13.0	-32.4	
3704.80	-14.7	H	3.0	35.9	1.0	-49.5	-13.0	-36.5	
5557.20	-10.0	H	3.0	35.5	1.0	-44.4	-13.0	-31.4	
7409.60	-10.0	H	3.0	35.7	1.0	-44.7	-13.0	-31.7	
Mid Ch, 1880MHz									
3760.00	-13.1	V	3.0	35.8	1.0	-47.9	-13.0	-34.9	
5640.00	-12.2	V	3.0	35.5	1.0	-46.7	-13.0	-33.7	
7520.00	-10.8	V	3.0	35.7	1.0	-45.5	-13.0	-32.5	
3760.00	-14.0	H	3.0	35.8	1.0	-48.8	-13.0	-35.8	
5640.00	-8.5	H	3.0	35.5	1.0	-43.0	-13.0	-30.0	
7520.00	-10.5	H	3.0	35.7	1.0	-45.2	-13.0	-32.2	
High Ch, 1907.6MHz									
3815.20	-12.5	V	3.0	35.8	1.0	-47.3	-13.0	-34.3	
5722.80	-11.6	V	3.0	35.5	1.0	-46.1	-13.0	-33.1	
7630.40	-10.6	V	3.0	35.8	1.0	-45.3	-13.0	-32.3	
3815.20	-14.7	H	3.0	35.8	1.0	-49.5	-13.0	-36.5	
5722.80	-7.7	H	3.0	35.5	1.0	-42.2	-13.0	-29.2	
7630.40	-10.6	H	3.0	35.8	1.0	-45.4	-13.0	-32.4	

Version 1.2.4 updated 3/13/17

B2 HSDPA

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9.1.2. LTE Band 2

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/17/2017
Test Engineer: 43574 JS
Configuration: EUT powered by AC source
Location: Chamber B
Mode: LTE_QPSK Band 2 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, 1852.5MHz									
3705.00	-12.6	V	3.0	35.9	1.0	-47.5	-13.0	-34.5	
5557.50	-13.1	V	3.0	35.5	1.0	-47.6	-13.0	-34.6	
7410.00	-11.4	V	3.0	35.7	1.0	-46.1	-13.0	-33.1	
3705.00	-15.5	H	3.0	35.9	1.0	-50.4	-13.0	-37.4	
5557.50	-11.2	H	3.0	35.5	1.0	-45.7	-13.0	-32.7	
7410.00	-11.6	H	3.0	35.7	1.0	-46.3	-13.0	-33.3	
Mid Ch, 1880MHz									
3760.00	-11.9	V	3.0	35.8	1.0	-46.7	-13.0	-33.7	
5640.00	-12.6	V	3.0	35.5	1.0	-47.1	-13.0	-34.1	
7520.00	-11.6	V	3.0	35.7	1.0	-46.3	-13.0	-33.3	
3760.00	-15.3	H	3.0	35.8	1.0	-50.1	-13.0	-37.1	
5640.00	-10.8	H	3.0	35.5	1.0	-45.3	-13.0	-32.3	
7520.00	-11.5	H	3.0	35.7	1.0	-46.3	-13.0	-33.3	
High Ch, 1907.5MHz									
3815.00	-13.2	V	3.0	35.8	1.0	-47.9	-13.0	-34.9	
5722.50	-12.5	V	3.0	35.5	1.0	-47.0	-13.0	-34.0	
7630.00	-11.3	V	3.0	35.8	1.0	-46.1	-13.0	-33.1	
3815.00	-15.2	H	3.0	35.8	1.0	-50.0	-13.0	-37.0	
5722.50	-10.8	H	3.0	35.5	1.0	-45.3	-13.0	-32.3	
7630.00	-11.5	H	3.0	35.8	1.0	-46.2	-13.0	-33.2	

Version 1.2.4 updated 3/13/17

LTE B2 5MHz QPSK

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/17/2017
Test Engineer: 43574 JS
Configuration: EUT powered by AC source
Location: Chamber B
Mode: LTE_16QAM Band 2 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, 1852.5MHz									
3705.00	-12.9	V	3.0	35.9	1.0	-47.8	-13.0	-34.8	
5557.50	-12.8	V	3.0	35.5	1.0	-47.3	-13.0	-34.3	
7410.00	-10.5	V	3.0	35.7	1.0	-45.2	-13.0	-32.2	
3705.00	-15.7	H	3.0	35.9	1.0	-50.5	-13.0	-37.5	
5557.50	-11.0	H	3.0	35.5	1.0	-45.5	-13.0	-32.5	
7410.00	-11.3	H	3.0	35.7	1.0	-46.1	-13.0	-33.1	
Mid Ch, 1880MHz									
3760.00	-12.1	V	3.0	35.8	1.0	-46.9	-13.0	-33.9	
5640.00	-12.5	V	3.0	35.5	1.0	-47.0	-13.0	-34.0	
7520.00	-11.2	V	3.0	35.7	1.0	-45.9	-13.0	-32.9	
3760.00	-15.5	H	3.0	35.8	1.0	-50.3	-13.0	-37.3	
5640.00	-10.8	H	3.0	35.5	1.0	-45.2	-13.0	-32.2	
7520.00	-10.3	H	3.0	35.7	1.0	-45.0	-13.0	-32.0	
High Ch, 1907.5MHz									
3815.00	-13.1	V	3.0	35.8	1.0	-47.9	-13.0	-34.9	
5722.50	-12.4	V	3.0	35.5	1.0	-46.9	-13.0	-33.9	
7630.00	-11.2	V	3.0	35.8	1.0	-45.9	-13.0	-32.9	
3815.00	-15.4	H	3.0	35.8	1.0	-50.2	-13.0	-37.2	
5722.50	-10.6	H	3.0	35.5	1.0	-45.1	-13.0	-32.1	
7630.00	-11.1	H	3.0	35.8	1.0	-45.9	-13.0	-32.9	

Version 1.2.4 updated 3/13/17

LTE B2 5MHz 16QAM

9.1.3. LTE Band 4

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/17/2015
Test Engineer: 4521 LL
Configuration: EUT powered by AC source
Location: Chamber A
Mode: LTE_QPSK Band 4 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, 1712.5MHz									
3425.00	-13.8	V	3.0	36.1	1.0	-48.8	-13.0	-35.8	
5137.50	-12.9	V	3.0	35.4	1.0	-47.4	-13.0	-34.4	
6850.00	-16.6	V	3.0	35.7	1.0	-51.3	-13.0	-38.3	
3425.00	-13.0	H	3.0	36.1	1.0	-48.1	-13.0	-35.1	
5137.50	-10.7	H	3.0	35.4	1.0	-45.2	-13.0	-32.2	
6850.00	-21.3	H	3.0	35.7	1.0	-55.9	-13.0	-42.9	
Mid Ch, 1732.5MHz									
3465.00	-9.9	V	3.0	36.0	1.0	-44.9	-13.0	-31.9	
5197.50	-15.3	V	3.0	35.4	1.0	-49.7	-13.0	-36.7	
6930.00	-18.1	V	3.0	35.7	1.0	-52.8	-13.0	-39.8	
3465.00	-8.0	H	3.0	36.0	1.0	-43.1	-13.0	-30.1	
5197.50	-14.9	H	3.0	35.4	1.0	-49.4	-13.0	-36.4	
6930.00	-16.1	H	3.0	35.7	1.0	-50.8	-13.0	-37.8	
High Ch, 1752.5MHz									
3505.00	-8.9	V	3.0	36.0	1.0	-43.9	-13.0	-30.9	
5257.50	-17.5	V	3.0	35.4	1.0	-51.9	-13.0	-38.9	
7010.00	-20.3	V	3.0	35.7	1.0	-55.0	-13.0	-42.0	
3505.00	-7.1	H	3.0	36.0	1.0	-42.1	-13.0	-29.1	
5257.50	-15.7	H	3.0	35.4	1.0	-50.1	-13.0	-37.1	
7010.00	-18.0	H	3.0	35.7	1.0	-52.7	-13.0	-39.7	

Version 1.2.4 updated 3/13/17

LTE B4 5MHz QPSK

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/17/2015
Test Engineer: 4521 LL
Configuration: EUT powered by AC source
Location: Chamber A
Mode: LTE_16QAM Band 4 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, 1712.5MHz									
3425.00	-14.5	V	3.0	36.1	1.0	-49.6	-13.0	-36.6	
5137.50	-12.8	V	3.0	35.4	1.0	-47.2	-13.0	-34.2	
6850.00	-17.0	V	3.0	35.7	1.0	-51.7	-13.0	-38.7	
3425.00	-14.3	H	3.0	36.1	1.0	-49.3	-13.0	-36.3	
5137.50	-10.7	H	3.0	35.4	1.0	-45.1	-13.0	-32.1	
6850.00	-21.4	H	3.0	35.7	1.0	-56.1	-13.0	-43.1	
Mid Ch, 1732.5MHz									
3465.00	-9.7	V	3.0	36.0	1.0	-44.7	-13.0	-31.7	
5197.50	-15.2	V	3.0	35.4	1.0	-49.6	-13.0	-36.6	
6930.00	-18.0	V	3.0	35.7	1.0	-52.7	-13.0	-39.7	
3465.00	-8.9	H	3.0	36.0	1.0	-43.9	-13.0	-30.9	
5197.50	-15.0	H	3.0	35.4	1.0	-49.4	-13.0	-36.4	
6930.00	-16.0	H	3.0	35.7	1.0	-50.7	-13.0	-37.7	
High Ch, 1752.5MHz									
3505.00	-8.8	V	3.0	36.0	1.0	-43.8	-13.0	-30.8	
5257.50	-17.4	V	3.0	35.4	1.0	-51.9	-13.0	-38.9	
7010.00	-20.5	V	3.0	35.7	1.0	-55.2	-13.0	-42.2	
3505.00	-8.1	H	3.0	36.0	1.0	-43.1	-13.0	-30.1	
5257.50	-14.9	H	3.0	35.4	1.0	-49.3	-13.0	-36.3	
7010.00	-17.9	H	3.0	35.7	1.0	-52.6	-13.0	-39.6	

Version 1.2.4 updated 3/13/17

LTE B4 5MHz 16QAM

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

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9.1.4. LTE Band 5

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/18/2017
Test Engineer: 43574 JS
Configuration: EUT powered by AC source
Location: Chamber B
Mode: LTE_QPSK Band 5 Harmonics, 3MHz 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, 825.5									
1651.00	-23.9	V	3.0	36.4	1.0	-59.2	-13.0	-46.2	
2476.50	-21.9	V	3.0	35.0	1.0	-55.9	-13.0	-42.9	
3302.00	-21.1	V	3.0	34.3	1.0	-54.4	-13.0	-41.4	
1651.00	-25.0	H	3.0	36.4	1.0	-60.3	-13.0	-47.3	
2476.50	-23.1	H	3.0	35.0	1.0	-57.0	-13.0	-44.0	
3302.00	-22.4	H	3.0	34.3	1.0	-55.7	-13.0	-42.7	
Mid Ch, 836.5									
1673.00	-23.6	V	3.0	36.3	1.0	-58.9	-13.0	-45.9	
2509.50	-21.7	V	3.0	34.9	1.0	-55.7	-13.0	-42.7	
3346.00	-21.4	V	3.0	34.2	1.0	-54.6	-13.0	-41.6	
1673.00	-24.8	H	3.0	36.3	1.0	-60.1	-13.0	-47.1	
2509.50	-23.0	H	3.0	34.9	1.0	-57.0	-13.0	-44.0	
3346.00	-22.1	H	3.0	34.2	1.0	-55.4	-13.0	-42.4	
High Ch, 847.5									
1695.00	-23.5	V	3.0	36.3	1.0	-58.8	-13.0	-45.8	
2542.50	-21.7	V	3.0	34.9	1.0	-55.6	-13.0	-42.6	
3390.00	-21.8	V	3.0	34.2	1.0	-55.0	-13.0	-42.0	
1695.00	-24.6	H	3.0	36.3	1.0	-59.9	-13.0	-46.9	
2542.50	-23.1	H	3.0	34.9	1.0	-57.0	-13.0	-44.0	
3390.00	-21.9	H	3.0	34.2	1.0	-55.1	-13.0	-42.1	

LTE B5 5MHz QPSK

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/18/2017
Test Engineer: 43574 JS
Configuration: EUT powered by AC source
Location: Chamber B
Mode: LTE_16QAM Band 5 Harmonics, 3MHz 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, 825.5									
1651.00	-24.1	V	3.0	36.4	1.0	-59.5	-13.0	-46.5	
2476.50	-22.1	V	3.0	35.0	1.0	-56.1	-13.0	-43.1	
3302.00	-21.4	V	3.0	34.3	1.0	-54.7	-13.0	-41.7	
1651.00	-25.4	H	3.0	36.4	1.0	-60.8	-13.0	-47.8	
2476.50	-23.3	H	3.0	35.0	1.0	-57.3	-13.0	-44.3	
3302.00	-22.6	H	3.0	34.3	1.0	-55.9	-13.0	-42.9	
Mid Ch, 836.5									
1673.00	-23.7	V	3.0	36.3	1.0	-59.0	-13.0	-46.0	
2509.50	-22.0	V	3.0	34.9	1.0	-55.9	-13.0	-42.9	
3346.00	-21.8	V	3.0	34.2	1.0	-55.1	-13.0	-42.1	
1673.00	-25.0	H	3.0	36.3	1.0	-60.3	-13.0	-47.3	
2509.50	-23.2	H	3.0	34.9	1.0	-57.1	-13.0	-44.1	
3346.00	-22.3	H	3.0	34.2	1.0	-55.5	-13.0	-42.5	
High Ch, 847.5									
1695.00	-23.7	V	3.0	36.3	1.0	-59.0	-13.0	-46.0	
2542.50	-21.8	V	3.0	34.9	1.0	-55.7	-13.0	-42.7	
3390.00	-21.7	V	3.0	34.2	1.0	-54.9	-13.0	-41.9	
1695.00	-24.7	H	3.0	36.3	1.0	-60.0	-13.0	-47.0	
2542.50	-23.2	H	3.0	34.9	1.0	-57.1	-13.0	-44.1	
3390.00	-22.1	H	3.0	34.2	1.0	-55.3	-13.0	-42.3	

LTE B5 5MHz 16QAM

9.1.5. LTE Band 12

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/18/2017
Test Engineer: 43574 JS
Configuration: EUT powered by AC source
Location: Chamber B
Mode: LTE_QPSK Band 12 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, 701.5MHz									
1403.00	-27.6	V	3.0	37.4	1.0	-64.0	-13.0	-51.0	
2104.50	-21.9	V	3.0	36.6	1.0	-57.5	-13.0	-44.5	
2806.00	-20.5	V	3.0	36.4	1.0	-55.9	-13.0	-42.9	
1403.00	-27.1	H	3.0	37.4	1.0	-63.5	-13.0	-50.5	
2104.50	-23.2	H	3.0	36.6	1.0	-58.8	-13.0	-45.8	
2806.00	-21.9	H	3.0	36.4	1.0	-57.3	-13.0	-44.3	
Mid Ch, 707.5MHz									
1415.00	-26.2	V	3.0	37.4	1.0	-62.6	-13.0	-49.6	
2122.50	-22.2	V	3.0	36.6	1.0	-57.8	-13.0	-44.8	
2830.00	-21.6	V	3.0	36.4	1.0	-57.0	-13.0	-44.0	
1415.00	-26.2	H	3.0	37.4	1.0	-62.5	-13.0	-49.5	
2122.50	-22.2	H	3.0	36.6	1.0	-57.8	-13.0	-44.8	
2830.00	-24.1	H	3.0	36.4	1.0	-59.5	-13.0	-46.5	
High Ch, 713.5MHz									
1427.00	-27.0	V	3.0	37.3	1.0	-63.4	-13.0	-50.4	
2140.50	-21.7	V	3.0	36.6	1.0	-57.2	-13.0	-44.2	
2854.00	-21.5	V	3.0	36.4	1.0	-56.9	-13.0	-43.9	
1427.00	-26.1	H	3.0	37.3	1.0	-62.5	-13.0	-49.5	
2140.50	-22.4	H	3.0	36.6	1.0	-57.9	-13.0	-44.9	
2854.00	-22.6	H	3.0	36.4	1.0	-58.0	-13.0	-45.0	

LTE B12 5MHz QPSK

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Qualcomm Technologies
Project #: 11692709
Date: 4/18/2017
Test Engineer: 43574 JS
Configuration: EUT powered by AC source
Location: Chamber B
Mode: LTE_16QAM Band 12 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, 701.5MHz									
1403.00	-28.2	V	3.0	37.4	1.0	-64.6	-13.0	-51.6	
2104.50	-22.0	V	3.0	36.6	1.0	-57.6	-13.0	-44.6	
2806.00	-20.8	V	3.0	36.4	1.0	-56.1	-13.0	-43.1	
1403.00	-26.9	H	3.0	37.4	1.0	-63.3	-13.0	-50.3	
2104.50	-23.7	H	3.0	36.6	1.0	-59.3	-13.0	-46.3	
2806.00	-19.2	H	3.0	36.4	1.0	-54.6	-13.0	-41.6	
Mid Ch, 707.5MHz									
1415.00	-26.4	V	3.0	37.4	1.0	-62.8	-13.0	-49.8	
2122.50	-22.3	V	3.0	36.6	1.0	-57.9	-13.0	-44.9	
2830.00	-21.8	V	3.0	36.4	1.0	-57.2	-13.0	-44.2	
1415.00	-26.3	H	3.0	37.4	1.0	-62.6	-13.0	-49.6	
2122.50	-22.5	H	3.0	36.6	1.0	-58.0	-13.0	-45.0	
2830.00	-24.2	H	3.0	36.4	1.0	-59.6	-13.0	-46.6	
High Ch, 713.5MHz									
1427.00	-27.1	V	3.0	37.3	1.0	-63.4	-13.0	-50.4	
2140.50	-21.5	V	3.0	36.6	1.0	-57.0	-13.0	-44.0	
2854.00	-21.3	V	3.0	36.4	1.0	-56.7	-13.0	-43.7	
1427.00	-26.2	H	3.0	37.3	1.0	-62.6	-13.0	-49.6	
2140.50	-22.6	H	3.0	36.6	1.0	-58.1	-13.0	-45.1	
2854.00	-22.8	H	3.0	36.4	1.0	-58.2	-13.0	-45.2	

LTE B12 5MHz 16QAM

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