FCC CFR47 PART 27L

CERTIFICATION TEST REPORT
CLASS II PERMISSIVE CHANGE

FOR

IPAD WITH 802.11 abgn BT EDR / LE / GSM / WCDMA / LTE

MODEL NUMBER: A1430

FCC ID: BCGA1430
IC: 579C-A1430

REPORT NUMBER: 12U14315-1

ISSUE DATE: FEBRUARY 25, 2012

Prepared for
APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A

Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
---	02/25/12	Initial Issue	T. Chan

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: IPAD WITH 802.11 abgn BT EDR / LE / GSM / WCDMA / LTE

MODEL: A1430

SERIAL NUMBER: PT713734

DATE TESTED: DECEMBER 07, 2011 AND FEBRUARY 24-25, 2012

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 27L	Pass

Compliance Certification Services (UL CCS) 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 CCS 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS 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.

Approved & Released For UL CCS By:

THU CHAN
ENGINEERING MANAGER
UL CCS

Tested By:

CHIN PANG
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, FCC CFR 47 Part 2, and FCC CFR 47 FCC Part 27.

3. FACILITIES AND ACCREDITATION

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

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The Apple iPad is a tablet device with iPod functions (music application support and video), 802.11 a/b/g/n radio, Bluetooth radio function, and cellular using GSM 2G/3G/LTE data functions. The rechargeable battery is not user accessible

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is adding 15MHz and 20MHz bandwidth to LTE band 4 only.

5.3. MAXIMUM OUTPUT POWER

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

Part 27 LTE Band 4 MODE (15.0 MHz BANDWIDTH)					
Frequency range (MHz)	Modulation	Conducted(Average)		EIRP(Average)	
		dBm	mW	dBm	mW
1717.5	QPSK RB1-0	23.44	220.8	22.87	193.6
1732.5		23.40	218.8	23.18	208.0
1747.5		23.50	223.9	23.33	215.3
1717.5	16QAM RB1-0	22.50	177.8	21.58	143.9
1732.5		22.50	177.8	21.93	156.0
1747.5		22.50	177.8	23.03	200.9

Part 27 LTE Band 4 MODE (20.0 MHz BANDWIDTH)					
Frequency range (MHz)	Modulation	Conducted(Average)		EIRP(Average)	
		dBm	mW	dBm	mW
1720.0	QPSK RB1-0	23.40	218.8	22.43	175.0
1732.5		23.45	221.3	22.95	197.2
1745.0		23.48	222.8	24.06	254.7
1720.0	16QAM RB1-0	22.50	177.8	21.93	156.0
1732.5		22.50	177.8	22.48	177.0
1745.0		22.50	177.8	23.32	214.8

5.4. SOFTWARE AND FIRMWARE

The test software used during testing was 9B87

The EUT is link to CMW500 during test.

5.5. MAXIMUM ANTENNA GAIN

Please see table below:

	Antenna Gain (dBi)
Band 4, 15MHz Bandwidth	-1.21
Band 4, 20MHz Bandwidth	-1.31

5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case channel for RF radiated emissions below 1GHz tests is channel with highest RF output power.

Based on the investigation results, the highest peak and average power and enhanced data rate is the worst-case scenario for all measurements.

Worst-case modes:

- LTE Band 4, RB1-0 and RB75-0 for 15MHz Bandwidth and RB1-0 and RB100-0 for 20MHz Bandwidth.

For the fundamental investigation, the EUT is investigated for vertical and horizontal antenna orientations and the worst case was determined to be at Z-position.

5.7. DESCRIPTION OF TEST SETUP

RADIATED TESTS SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
Earphone	Apple	NA	NA
AC adapter	Apple	A1344	NA

I/O CABLES (RF Conducted Test)

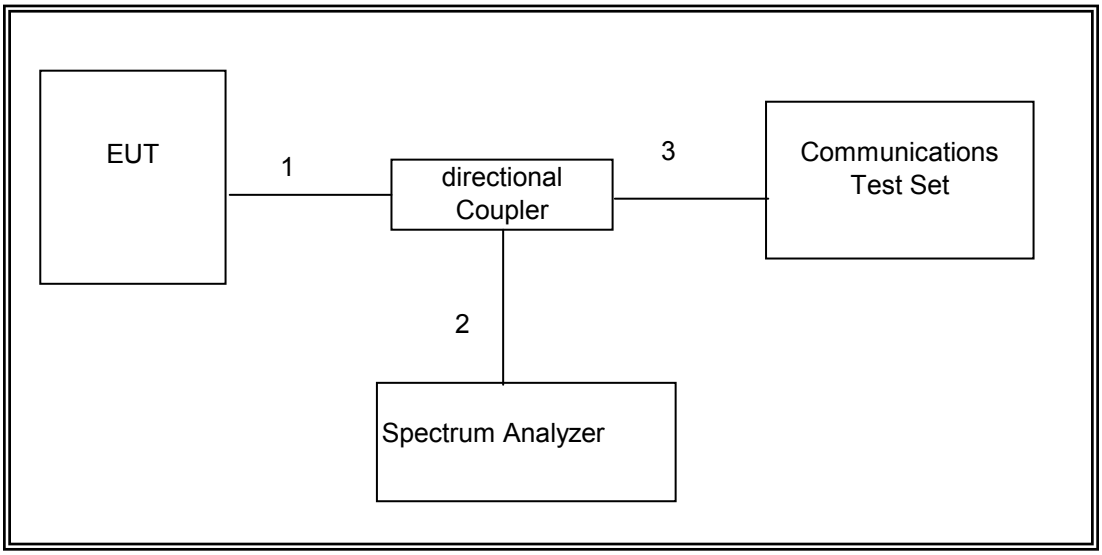
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	RFOut	1	Directional Coupler	Un-shielded	0.1m	NA
2	RF In/Out	1	Spectrum Analyzer	Un-shielded	None	NA
3	RF In/Out	1	Communications Test Set	Un-shielded	1.2m	NA

I/O CABLES (RF Radiated Test)

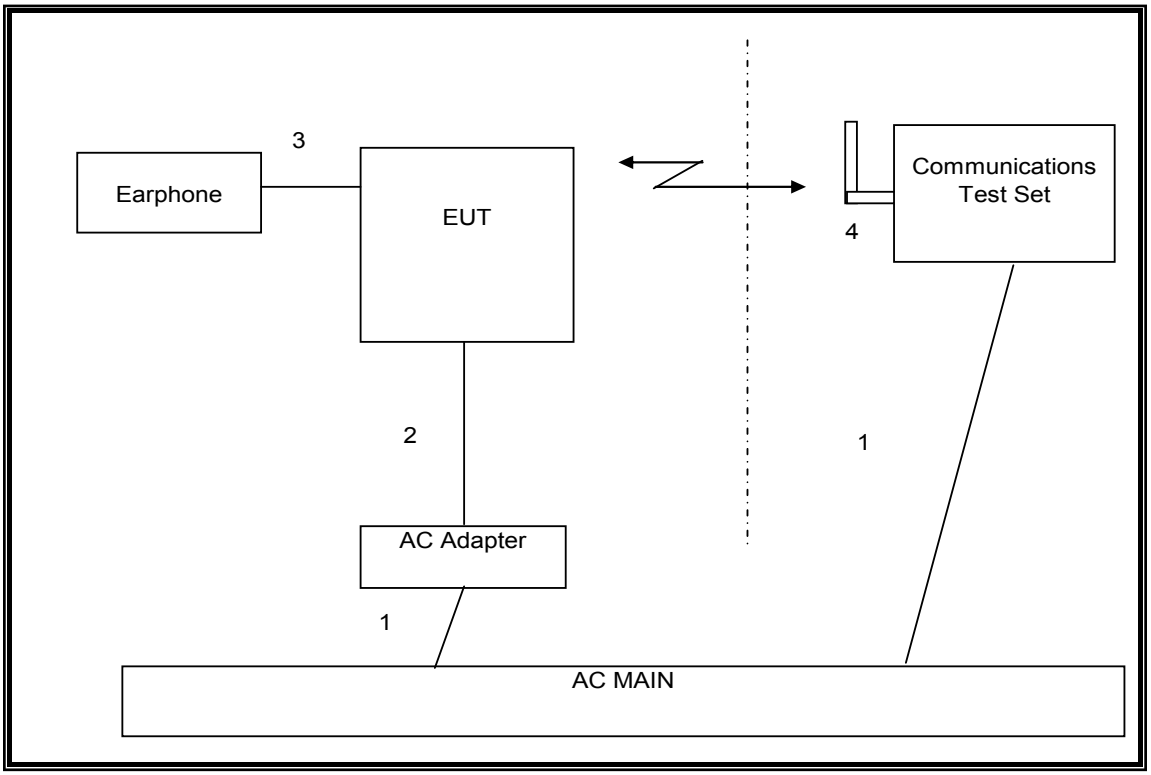
I/O CABLE LIST						
Cable No.	**Port**	**# of Identica Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	2	US 115V	Un-shielded	2m	NA
2	DC	1	US 115V	Un-shielded	1m	NA
3	Jack	1	Earphone	Un-shielded	0.5m	NA
4	RF In/Out	1	Antenna	Un-shielded	none	NA

TEST SETUP

CONDUCTED SETUP DIAGRAM FOR TESTS



RADIATED SETUP DIAGRAM FOR TESTS



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**	**Asset**	**Cal Due**
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/30/12
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/16/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/12/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	11/11/12
Communication Test Set	R & S	CMW500	N/A	05/17/12
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	10/20/12
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM13193	N02689`	CNR
Highpass Filter, 2.7 GHz	Micro-Tronics	HPM13194	N02687	CNR
Directional Coupler	RF-Lambda	RDC5M06G15	None	CNR
Sleeve Dipole 1730~2030 MHz	ETS	3126-1880	C01157	10/01/12
Signal Generator, 20 GHz	Agilent / HP	83732B	C00774	07/14/12
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121C DB4	C00993	07/10/12

7. RF POWER OUTPUT VERIFICATION

7.1. RF OUTPUT POWER FOR LTE BAND 4

Freq. (MHz)	UL Channel	BW (MHz)	RB Size	RB Offset	Modulation	Max Avg Power (dBm)	Max Pk Power (dBm)
1717.5	20025	15 (L)	1	0	QPSK	23.44	27.28
			1	74		23.35	26.77
			36	18		22.40	27.50
			75	0		22.30	27.90
			1	0	16-QAM	22.50	27.32
			1	74		22.48	26.83
			36	18		21.40	27.50
			75	0		21.40	27.80
1732.5	20175	15 (M)	1	0	QPSK	23.40	26.80
			1	74		23.38	27.20
			36	18		22.40	26.56
			75	0		22.40	27.71
			1	0	16-QAM	22.50	26.82
			1	74		22.48	27.15
			36	18		21.40	26.46
			75	0		21.50	27.64
1747.5	20325	15 (H)	1	0	QPSK	23.50	27.26
			1	74		23.50	26.90
			36	18		22.48	27.65
			75	0		22.40	28.20
			1	0	16-QAM	22.50	27.39
			1	74		22.50	26.98
			36	18		21.50	27.66
			75	0		21.50	28.10

RF OUTPUT POWER FOR LTE BAND 4

Freq. (MHz)	UL Channel	BW (MHz)	RB Size	RB Offset	Modulation	Max Avg Power (dBm)	Max Pk Power (dBm)
1720	20050	20 (L)	1	0	QPSK	23.40	27.20
			1	99		23.40	26.50
			50	24		22.40	27.50
			100	0		22.40	27.85
			1	0	16-QAM	22.50	27.52
			1	99		22.50	26.61
			50	24		21.35	27.50
			100	0		21.40	27.78
1732.5	20175	20 (M)	1	0	QPSK	23.45	26.87
			1	99		23.40	27.20
			50	24		22.45	26.62
			100	0		22.40	27.80
			1	0	16-QAM	22.50	27.01
			1	99		22.50	27.68
			50	24		21.40	26.51
			100	0		21.50	27.70
1745	20300	20 (H)	1	0	QPSK	23.48	26.74
			1	99		23.47	26.94
			50	24		22.50	27.70
			100	0		22.47	28.10
			1	0	16-QAM	22.50	26.86
			1	99		22.50	27.09
			50	24		21.48	27.65
			100	0		21.49	27.90

8. CONDUCTED TEST RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

MODES TESTED

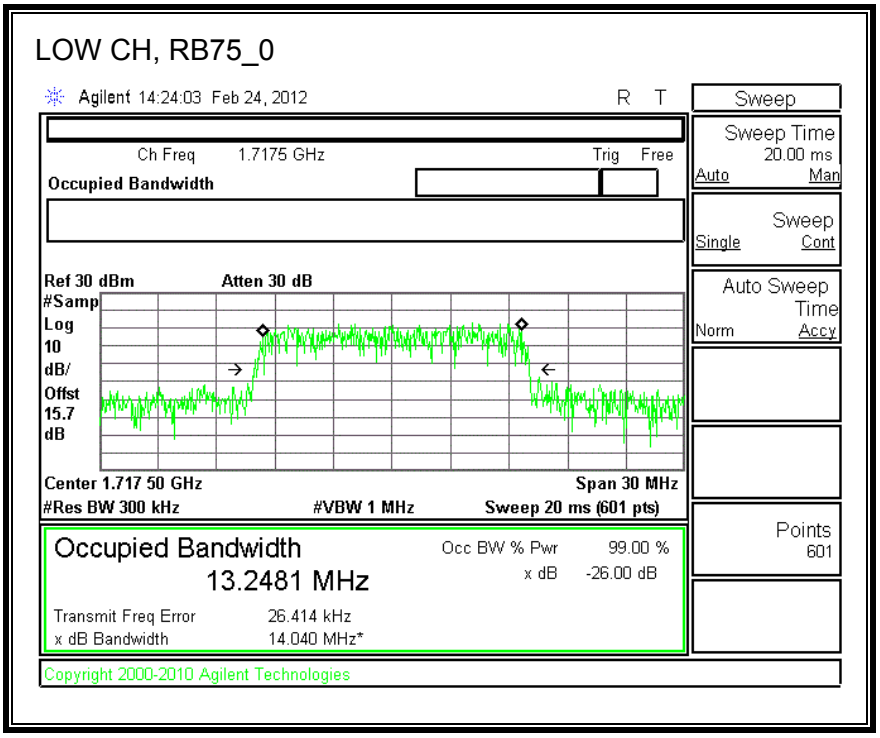
- LTE BAND 4, 15MHz and 20MHz Bandwidth

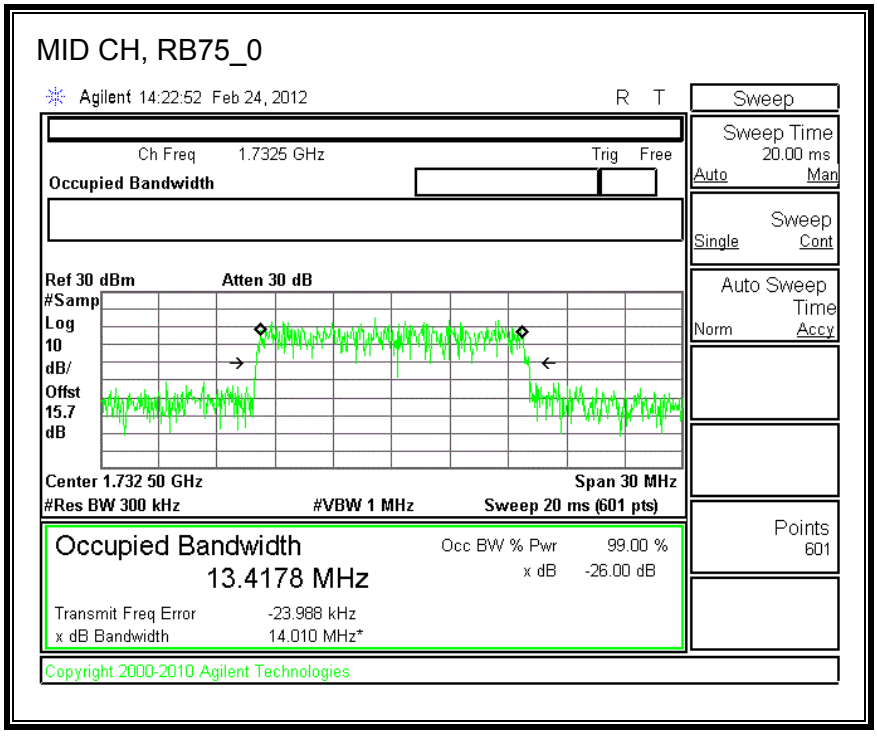
RESULTS

Band	Mode	RB/RB SIZE	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 4	15.0 MHz BAND QPSK	75/0	1717.5	13.2481	14.040
			1732.5	13.4178	14.010
			1747.5	13.3717	14.010
	15.0 MHz BAND 16QAM		1717.5	13.4278	13.927
			1732.5	13.2689	14.155
			1747.5	13.3397	14.101
	20.0 MHz BAND QPSK	100/0	1720.0	17.7904	18.812
			1732.5	17.9182	19.061
			1745.0	17.7942	18.833
	20.0 MHz BAND 16QAM		1720.0	17.7498	18.813
			1732.5	17.9302	18.885
			1745.0	17.8032	18.815

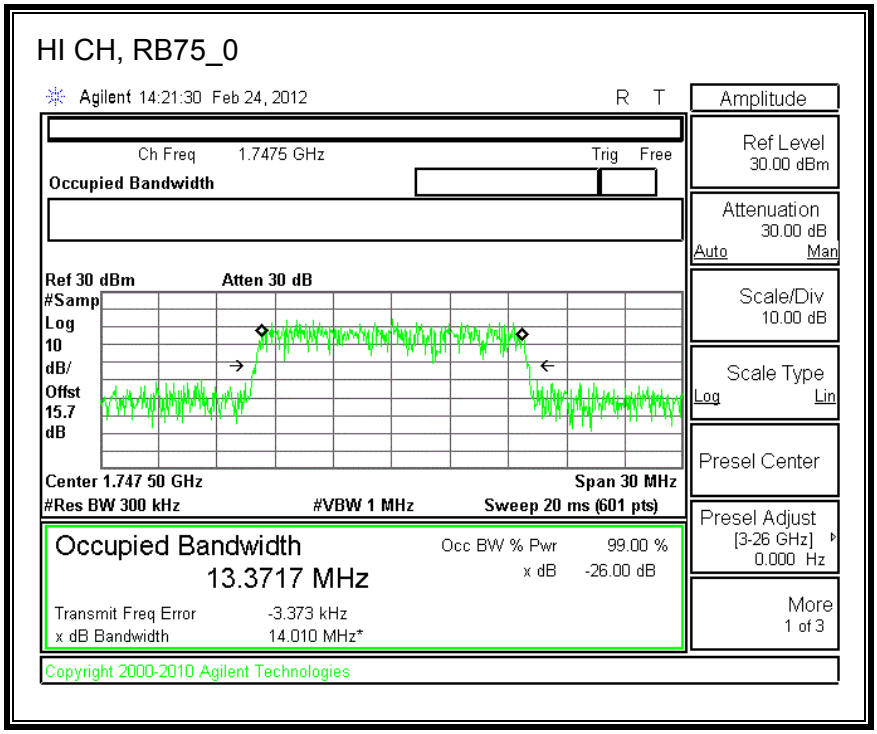
Band 4 (15.0 MHz BAND WIDTH)

LTE QPSK



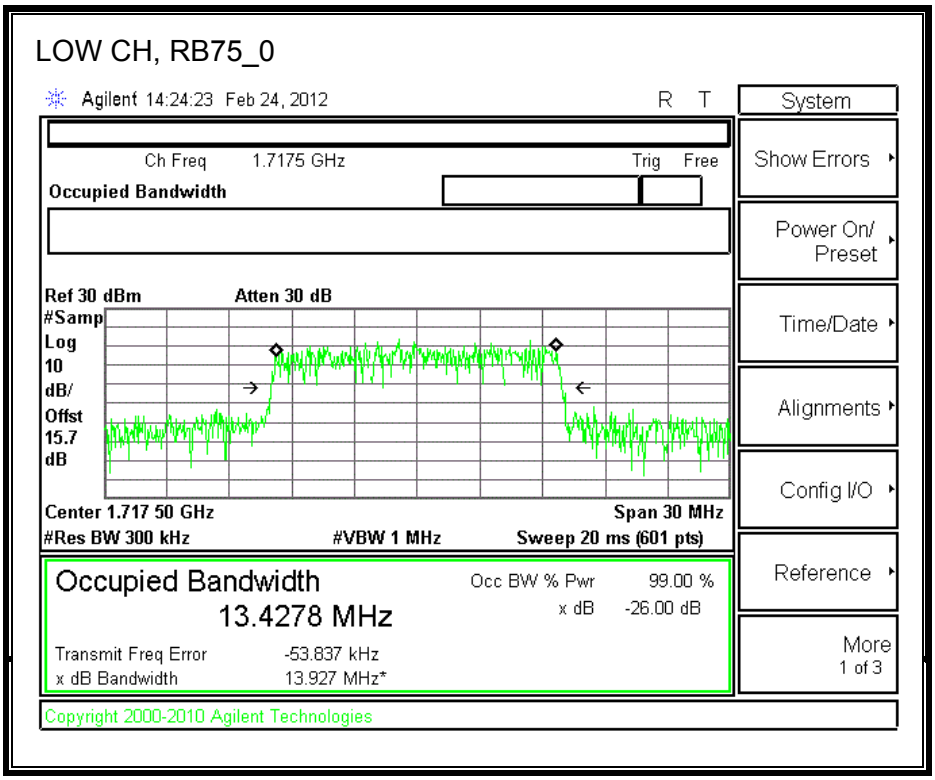


HI CH, RB75_0

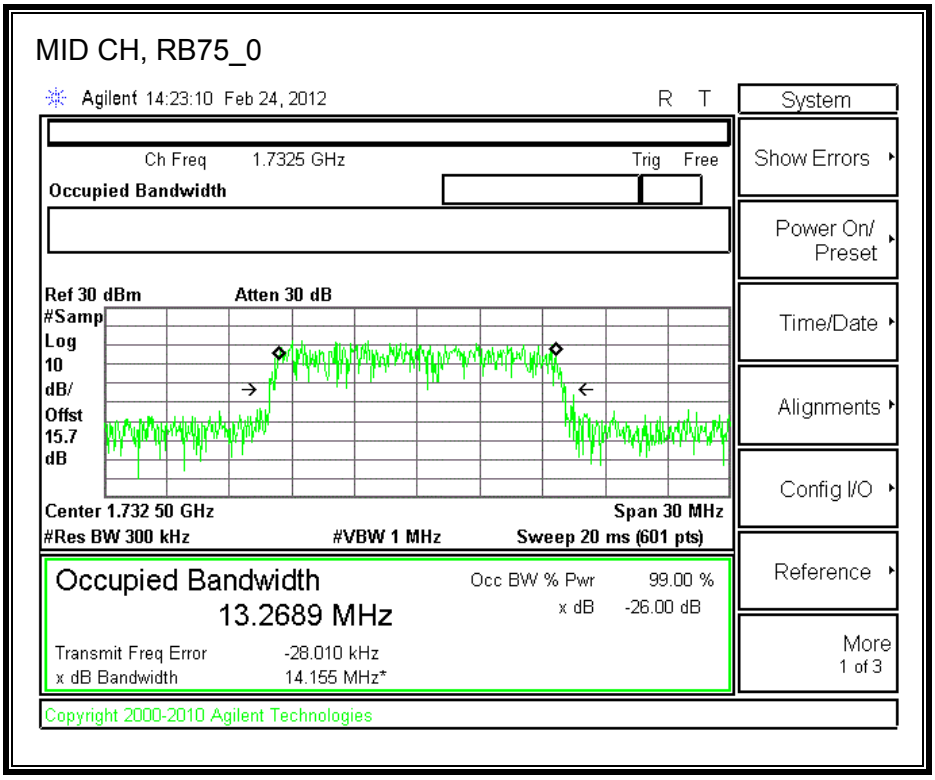


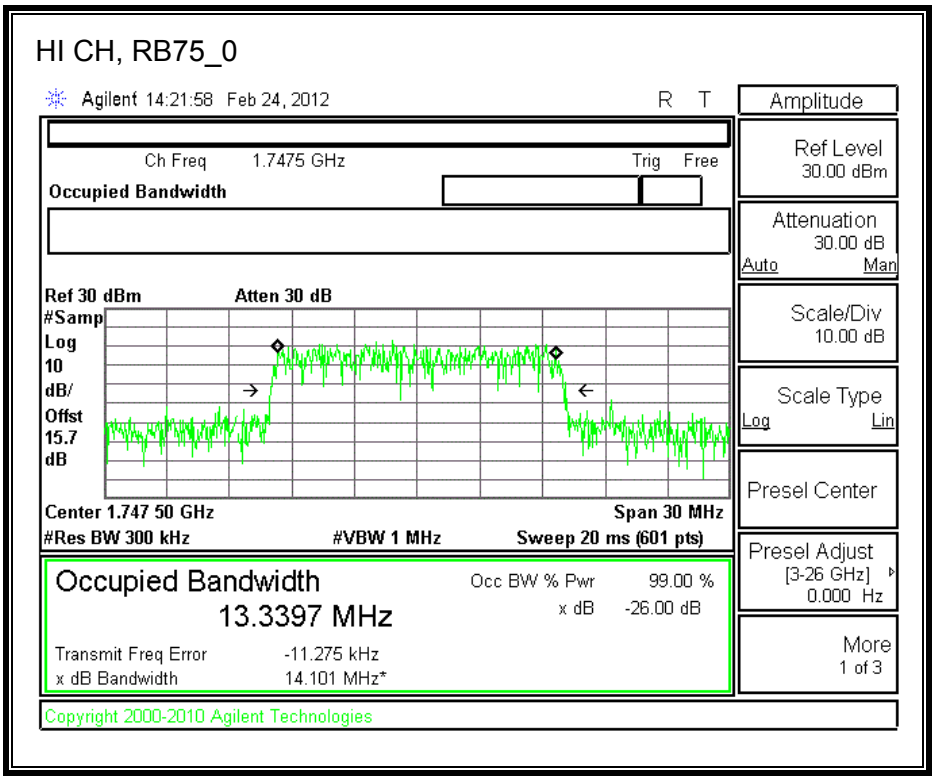
LTE 16QAM

LOW CH, RB75_0



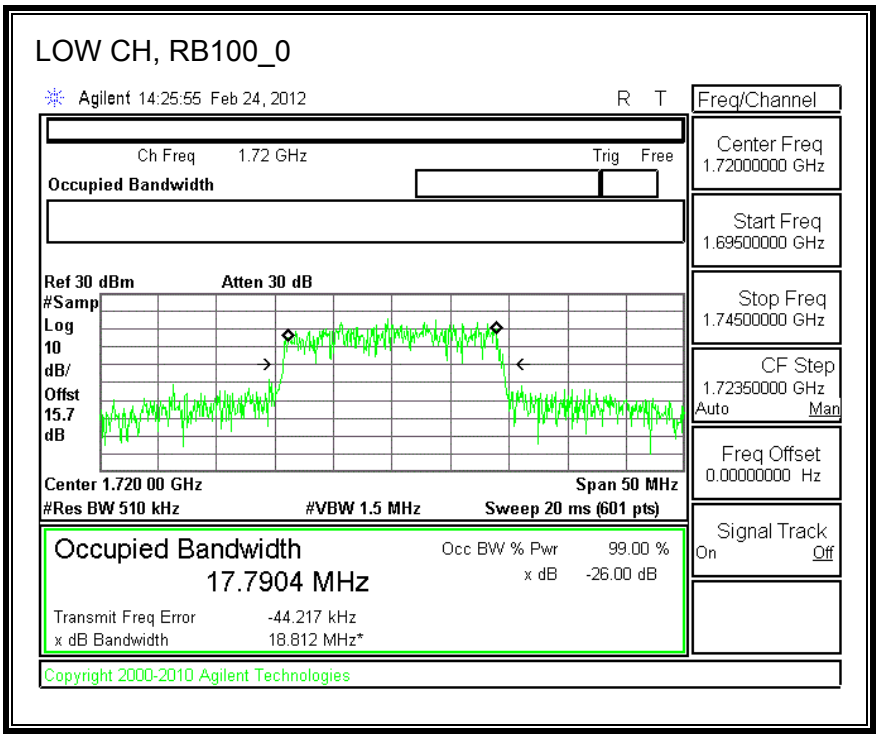
MID CH, RB75_0

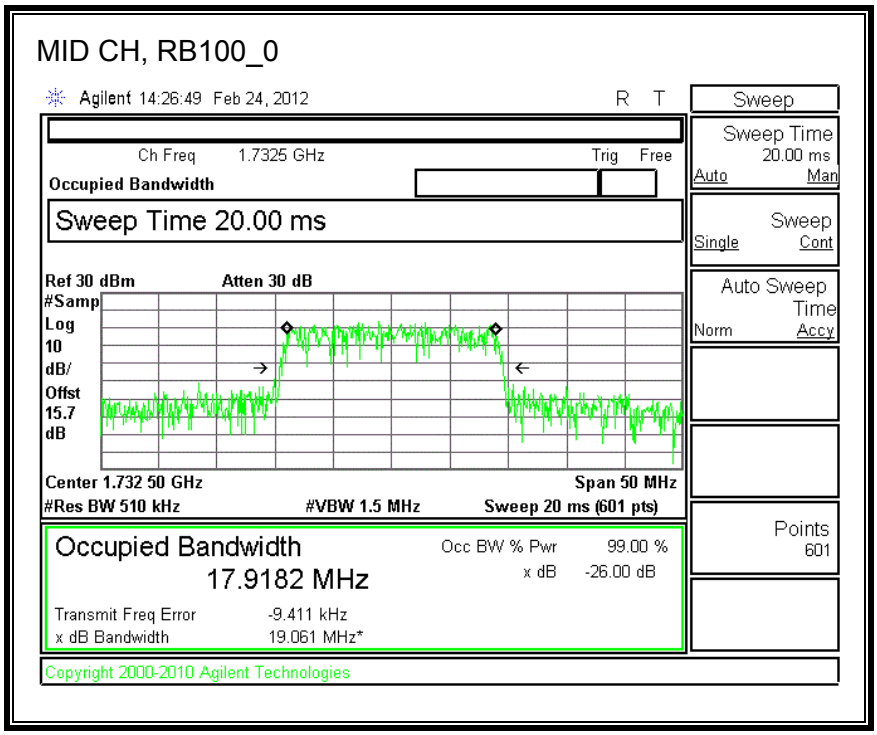




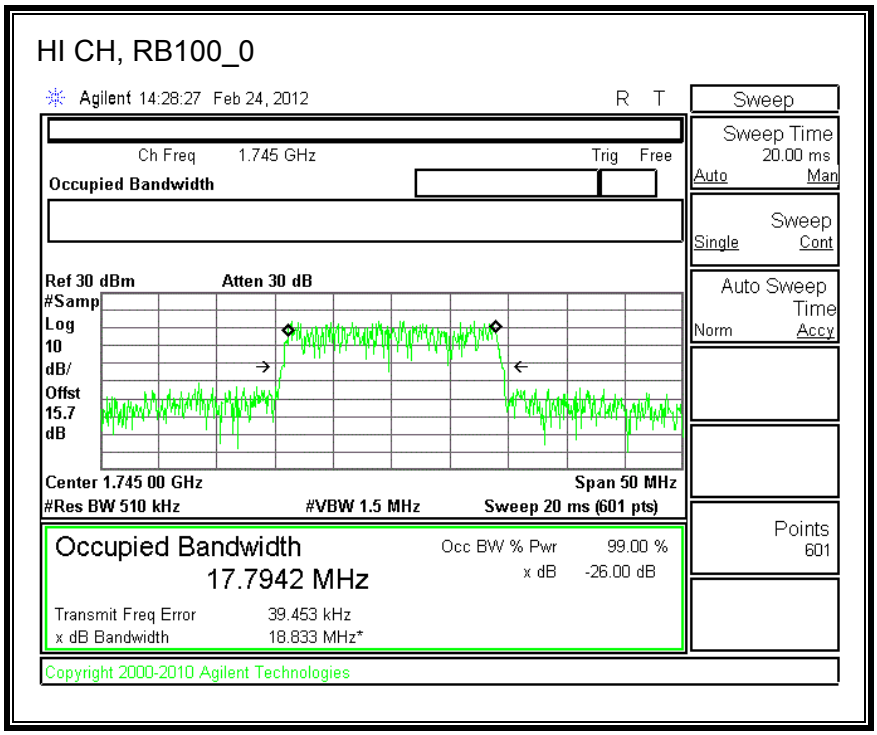
Band 4 (20 MHz BAND WIDTH)

LTE QPSK



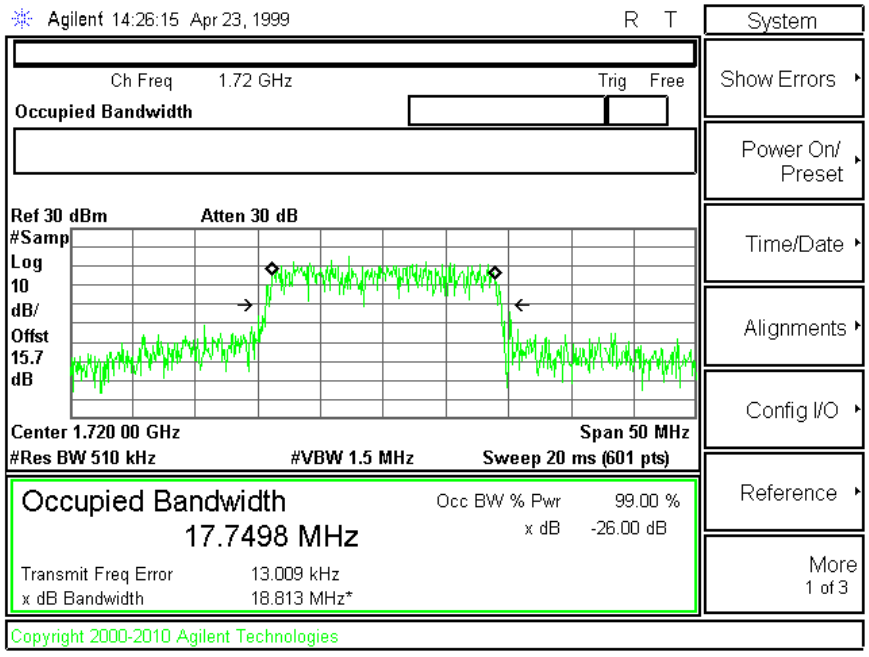


HI CH, RB100_0

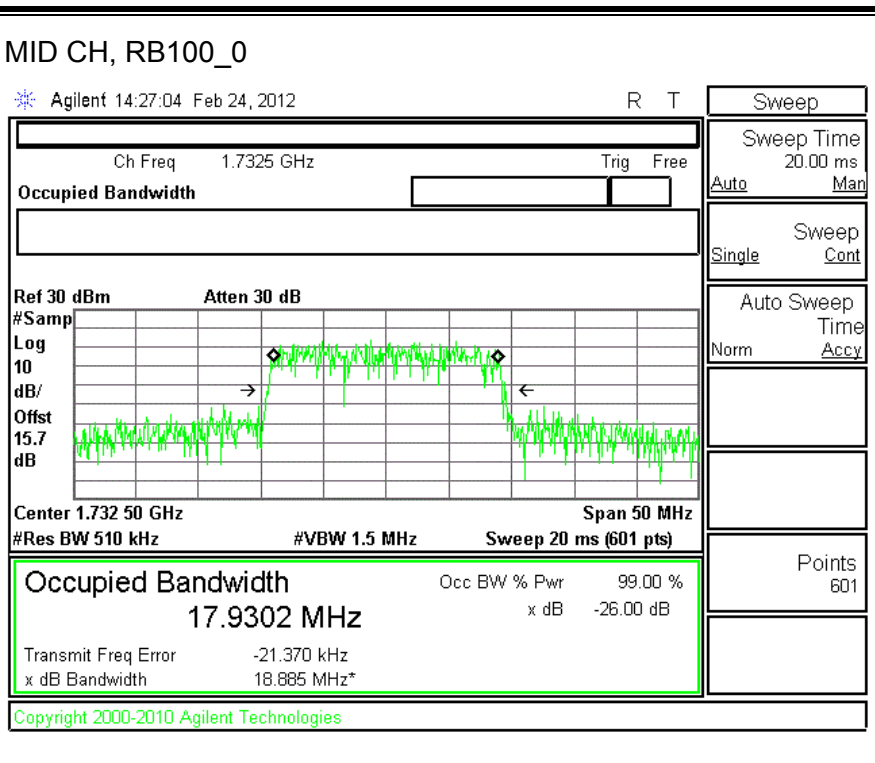


LTE 16QAM

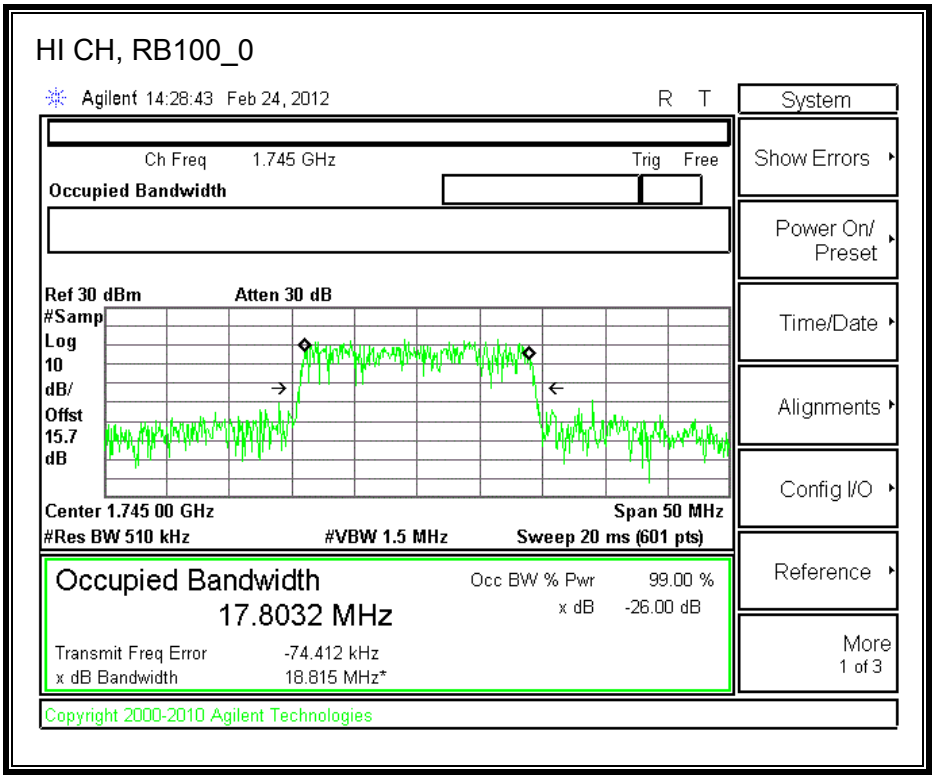
LOW CH, RB100_0



MID CH, RB100_0



HI CH, RB100_0



8.2. BAND EDGE

RULE PART(S)

FCC: 27.53

LIMITS

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

TEST PROCEDURE

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:

- Set the spectrum analyzer span to include the block edge frequency (1710 and1755MHz)
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

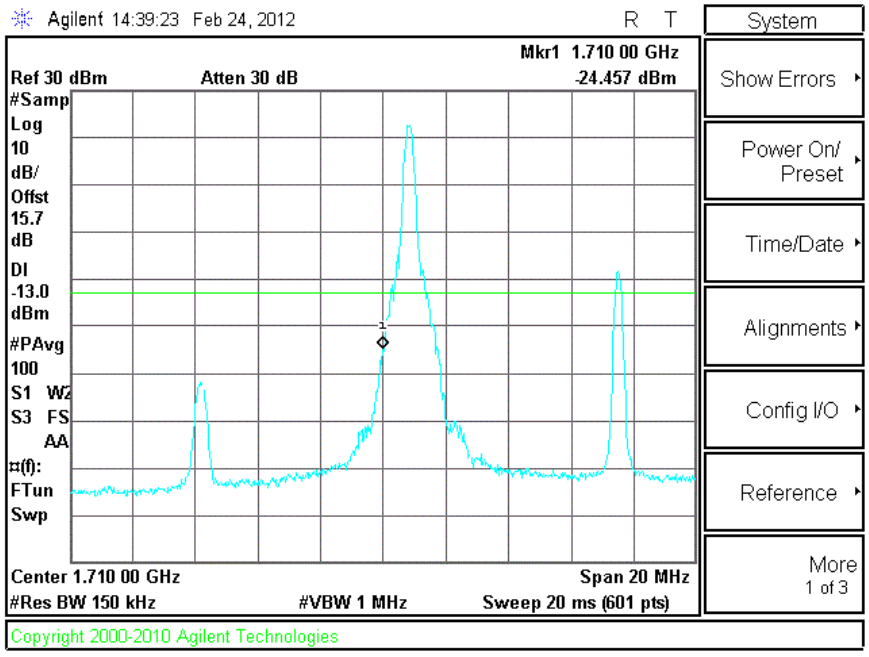
MODES TESTED

- LTE BAND 4

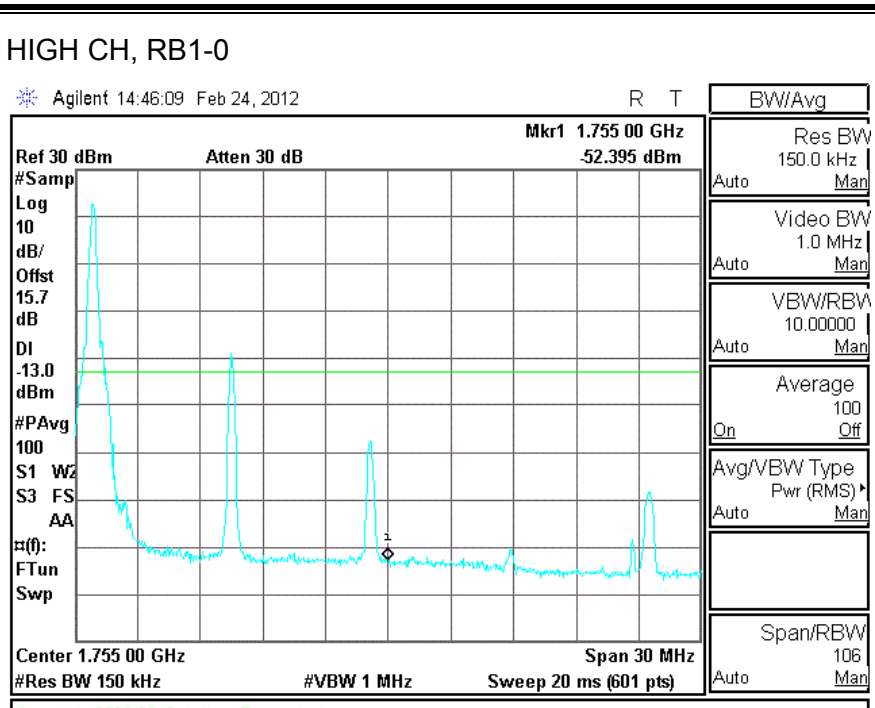
RESULTS

LTE QPSK Band 4 (15.0 MHz BAND WIDTH)

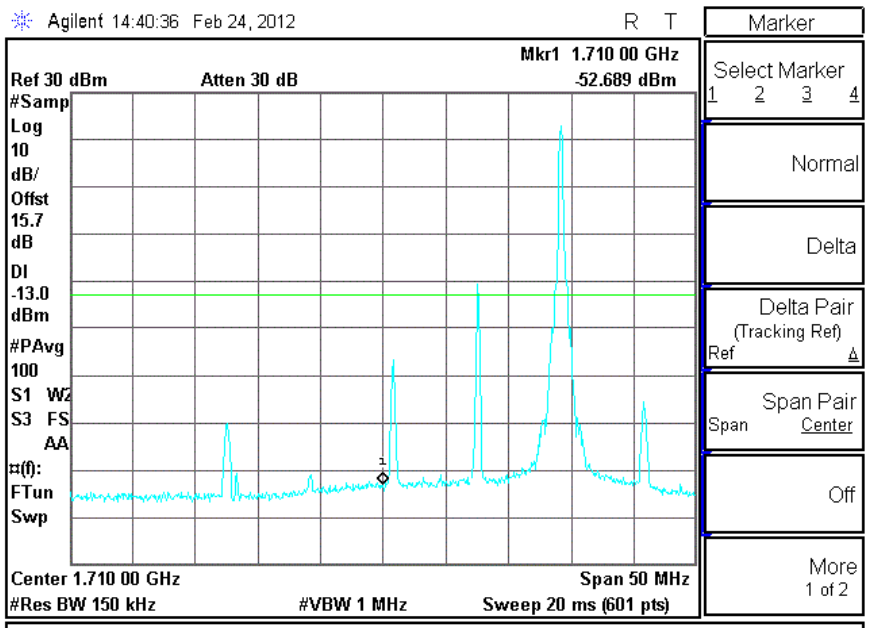
LOW CH, RB1-0



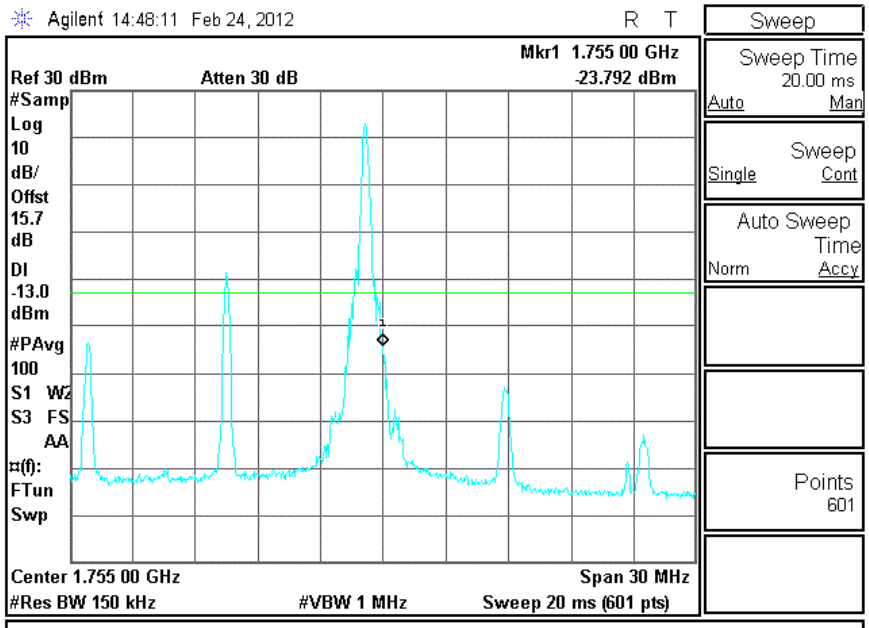
HIGH CH, RB1-0



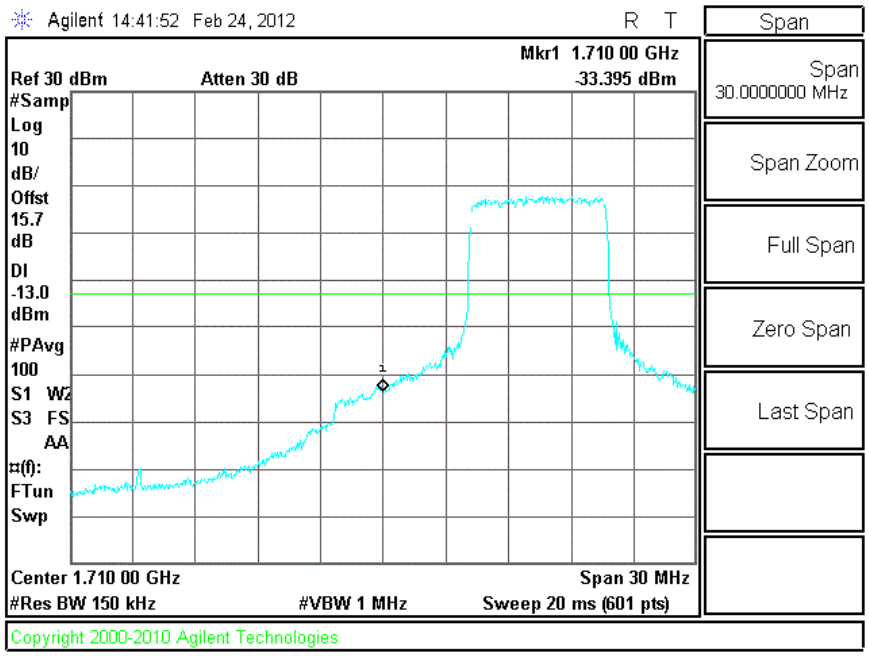
LOW CH, RB1-74



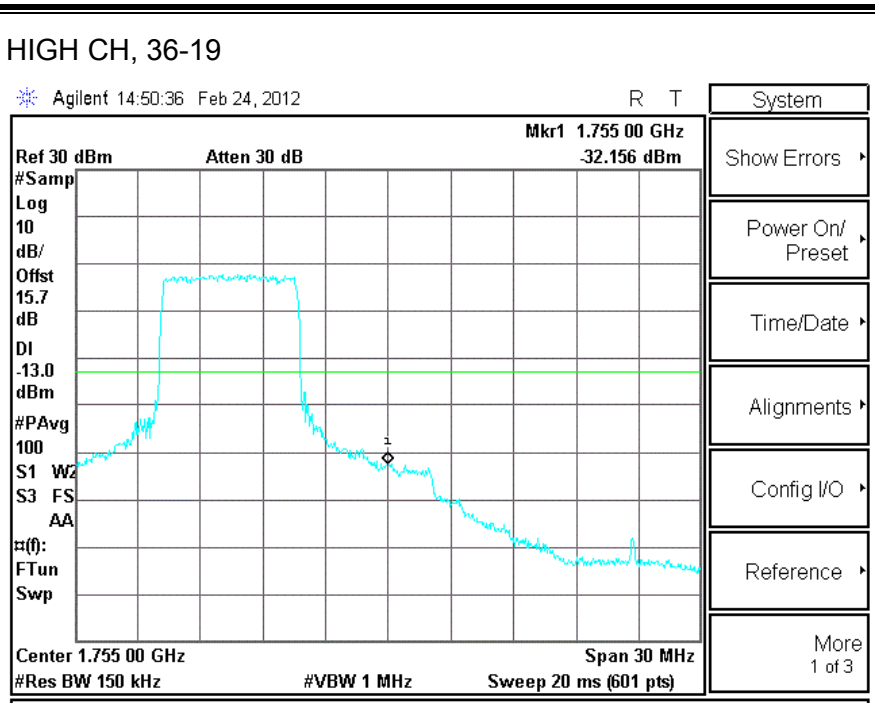
HIGH CH, RB1-74



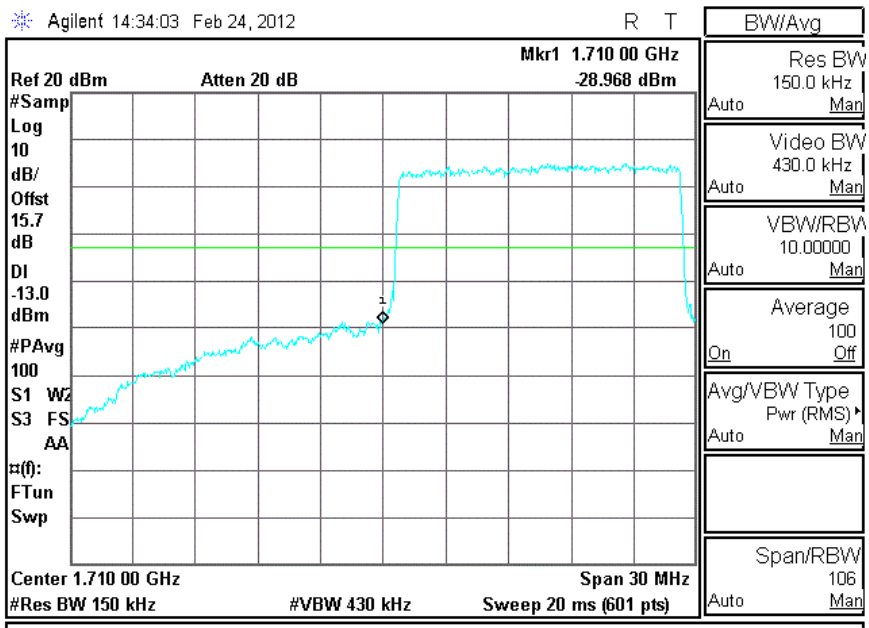
LOW CH, RB36-19



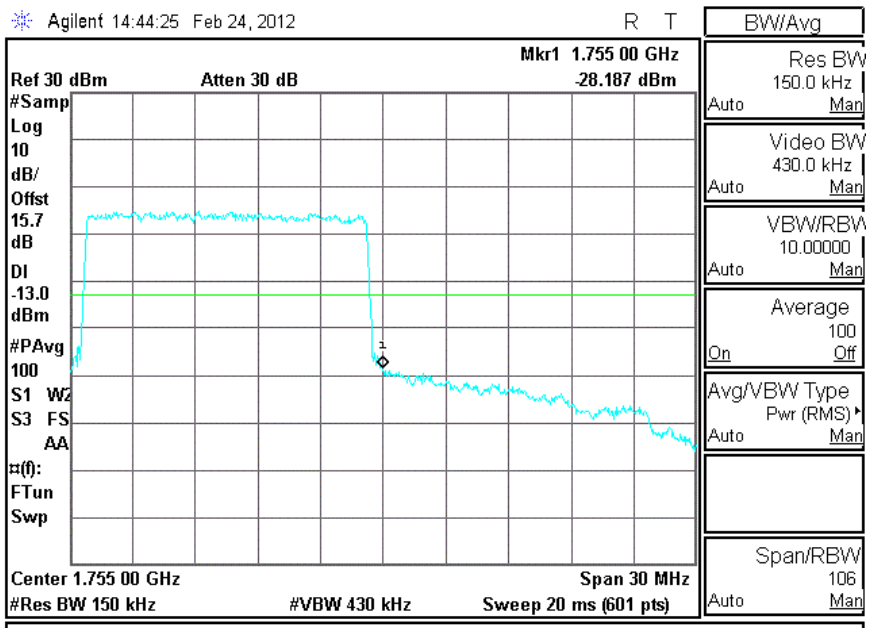
HIGH CH, 36-19



LOW CH, RB75-0

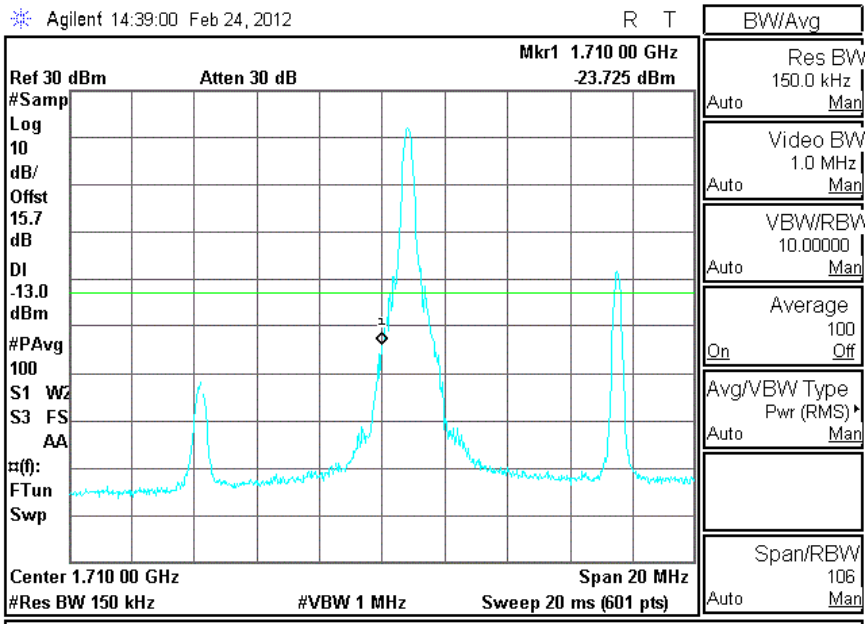


HIGH CH, RB75-0

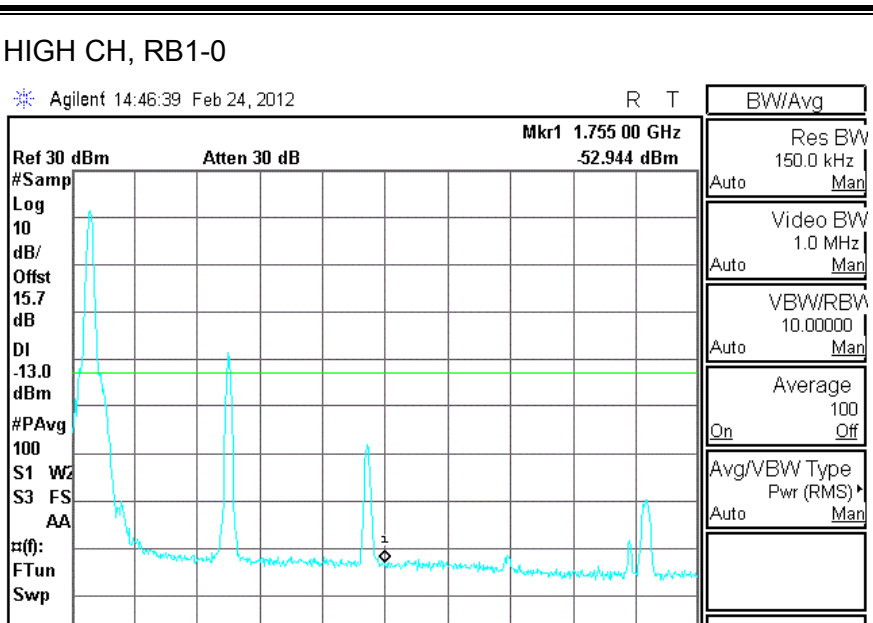


LTE 16QAM Band 4 (15.0 MHz BAND WIDTH)

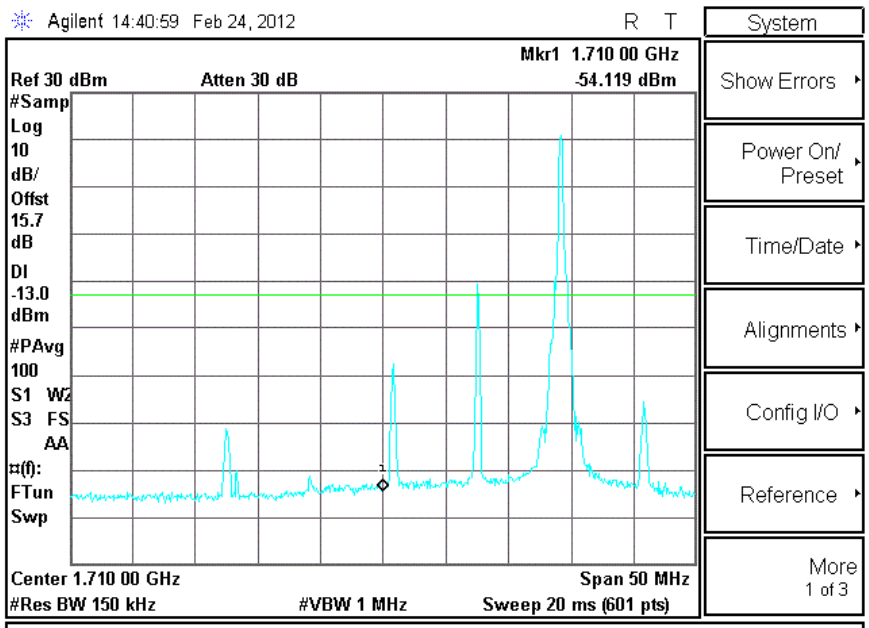
LOW CH, RB1-0



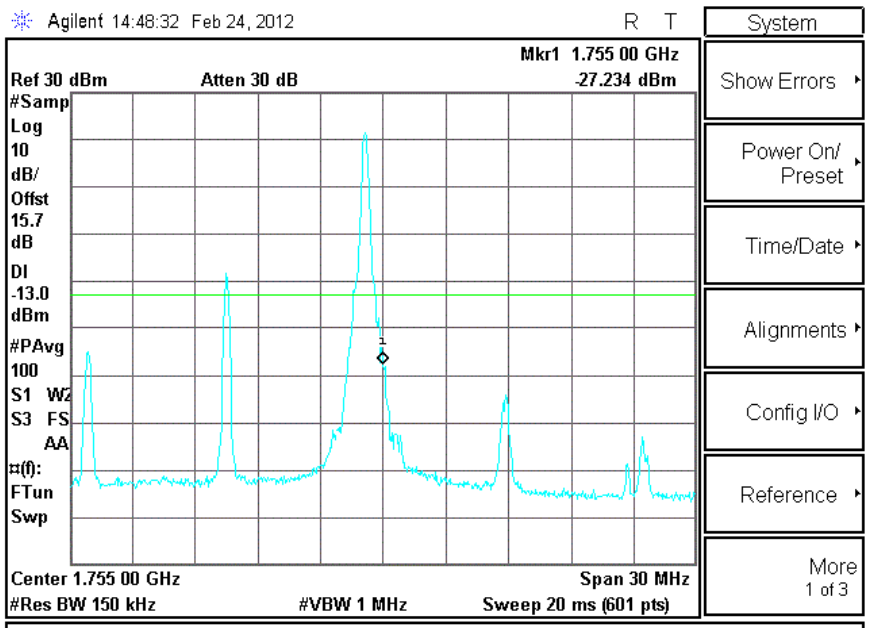
HIGH CH, RB1-0



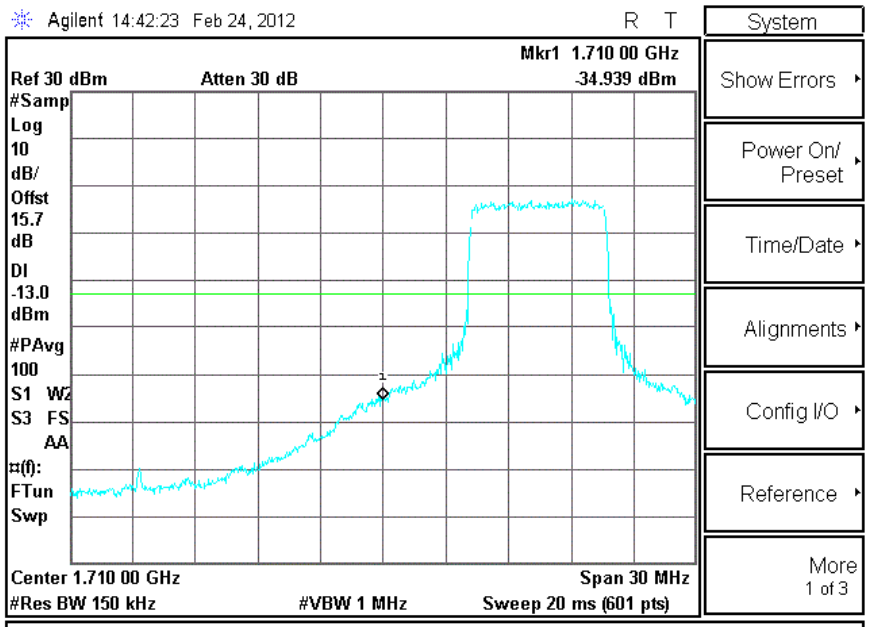
LOW CH, RB1-74



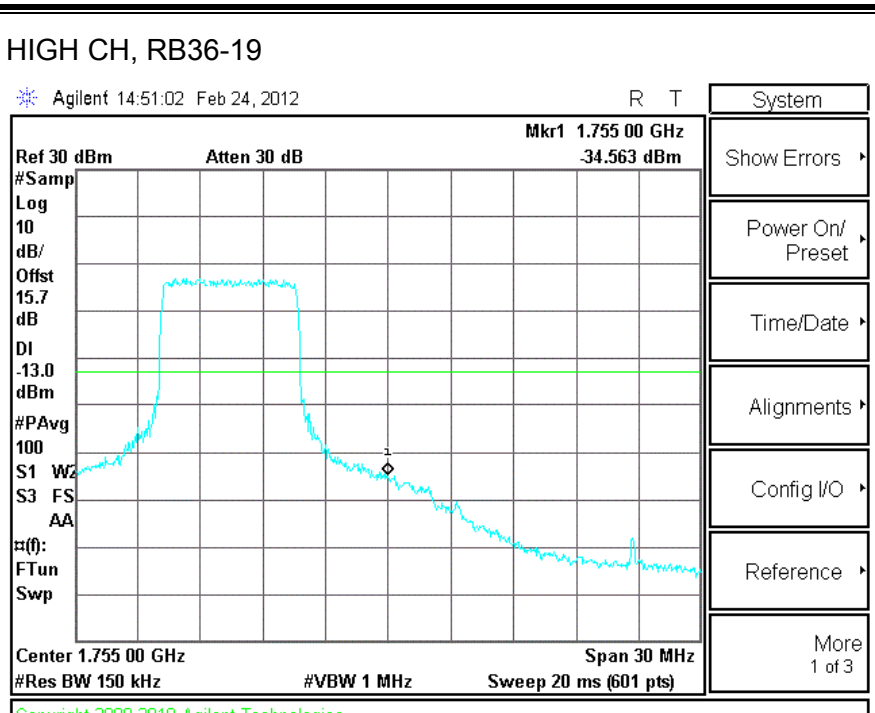
HIGH CH, RB1-74



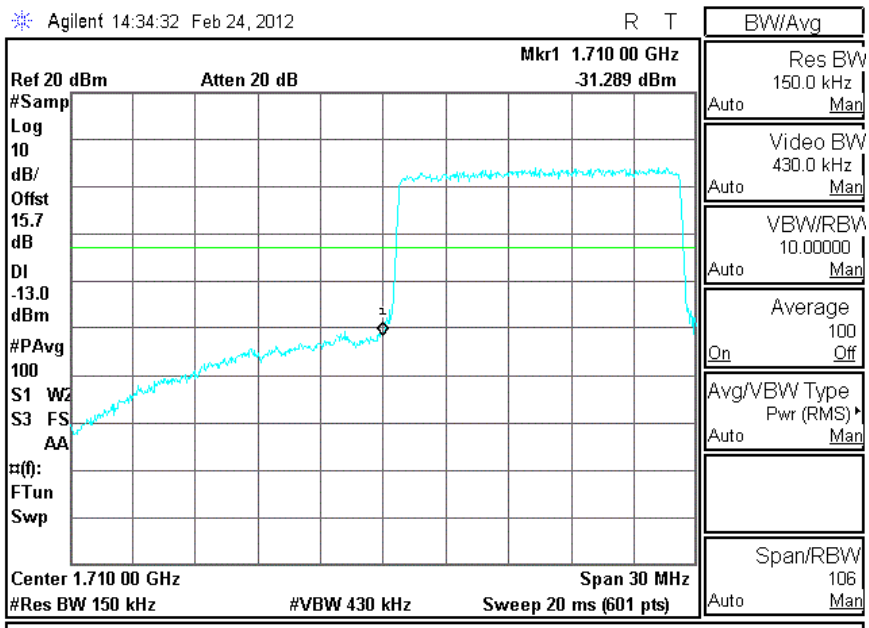
LOW CH, RB36-19



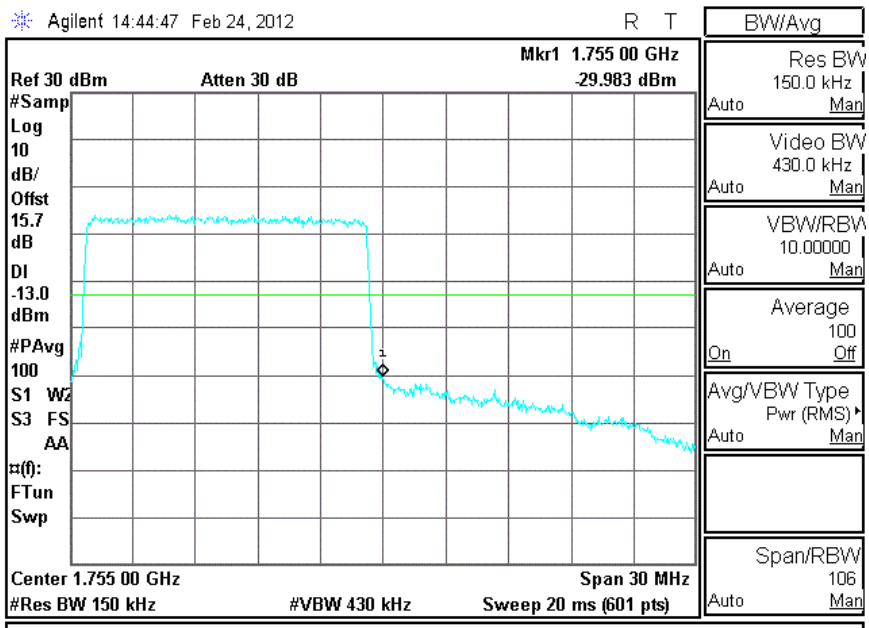
HIGH CH, RB36-19



LOW CH, RB75-0

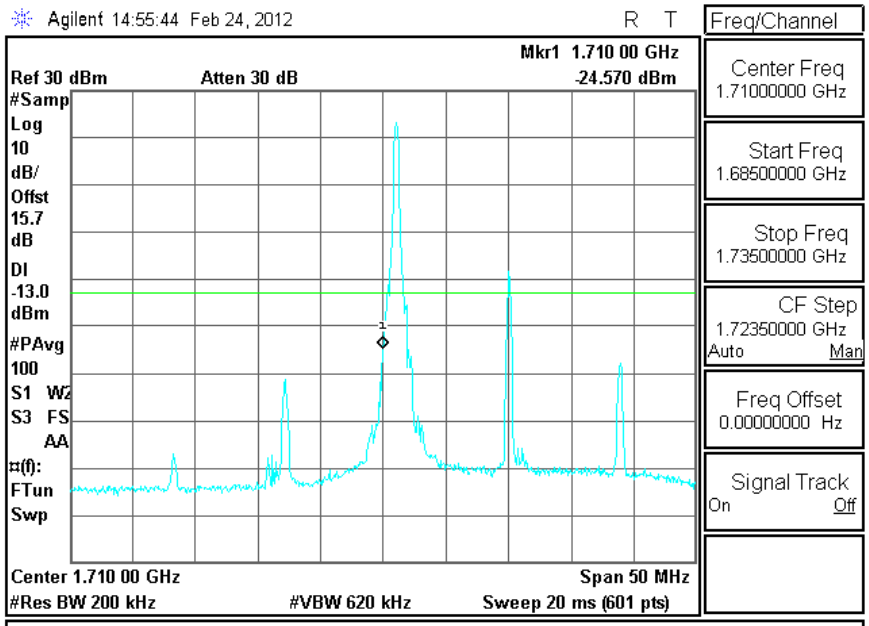


HIGH CH, RB75-0

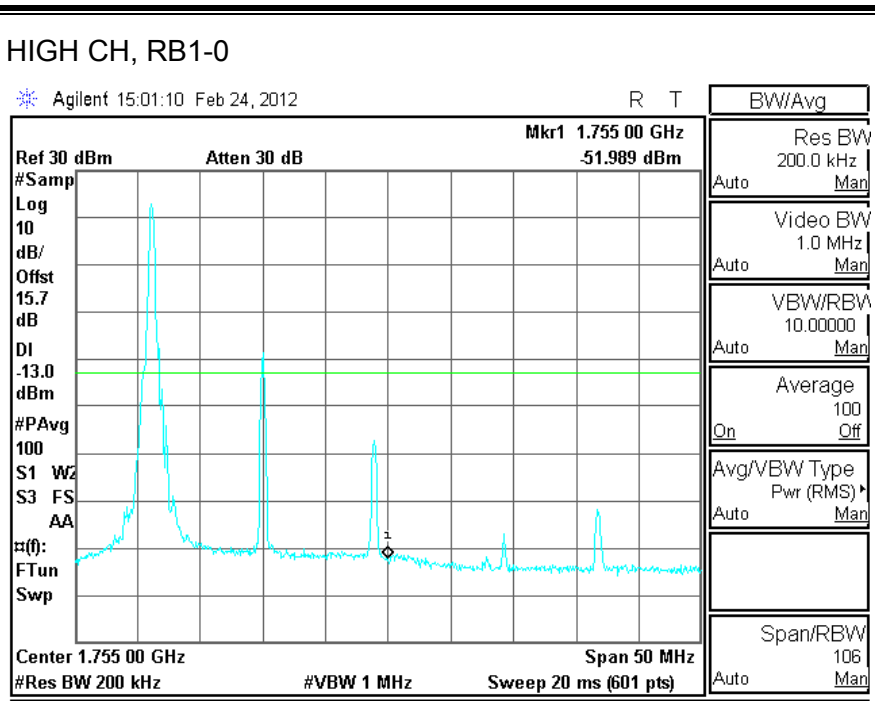


LTE QPSK Band 4 (20.0 MHz BAND WIDTH)

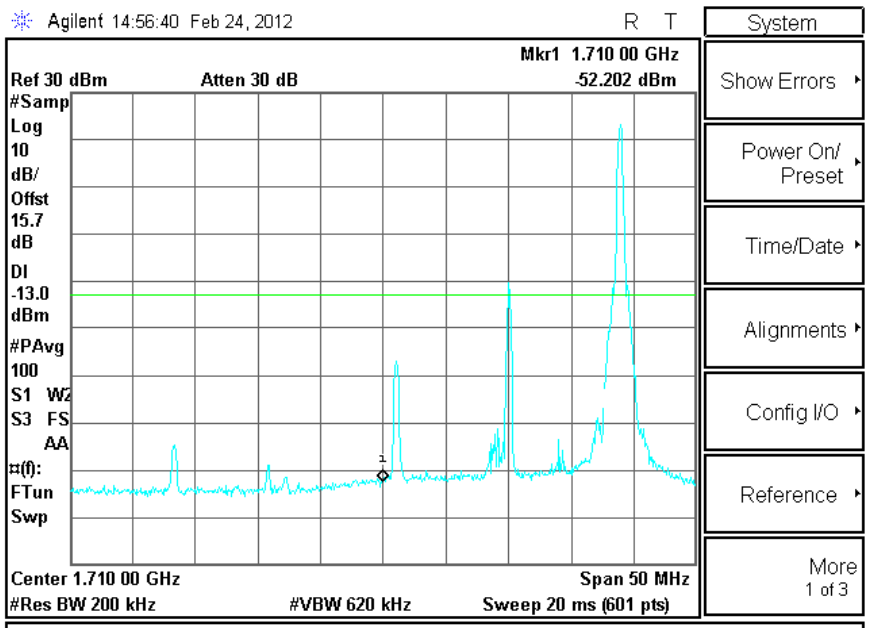
LOW CH, RB1-0



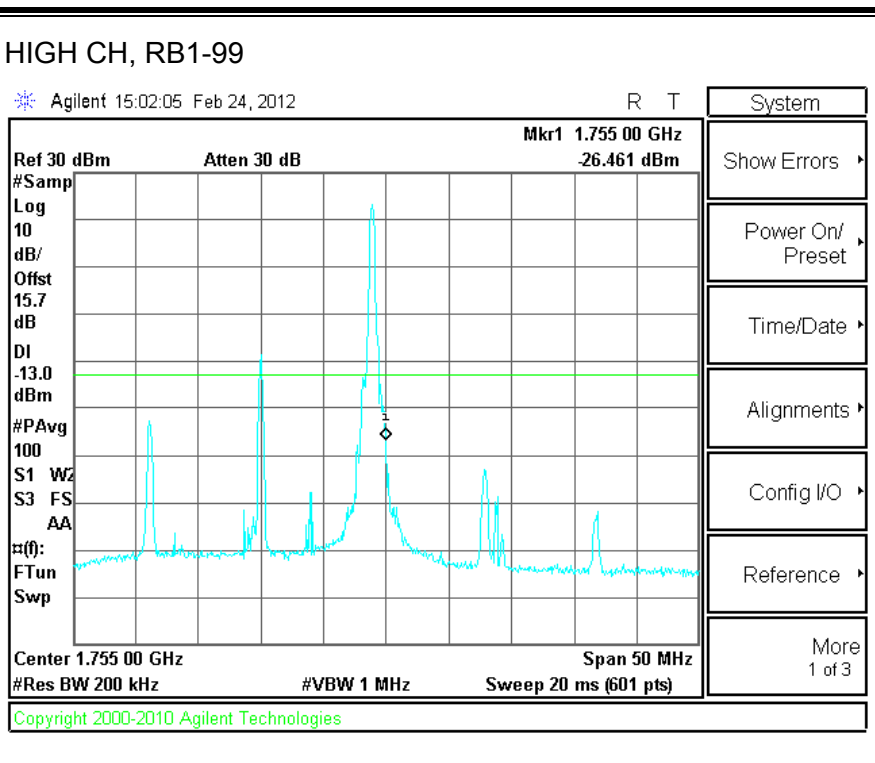
HIGH CH, RB1-0



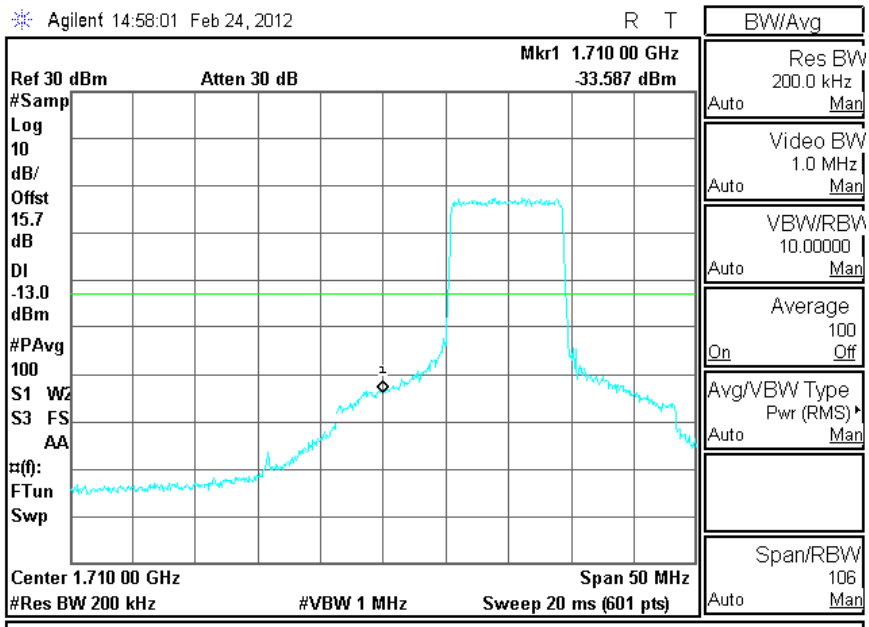
LOW CH, RB1-99



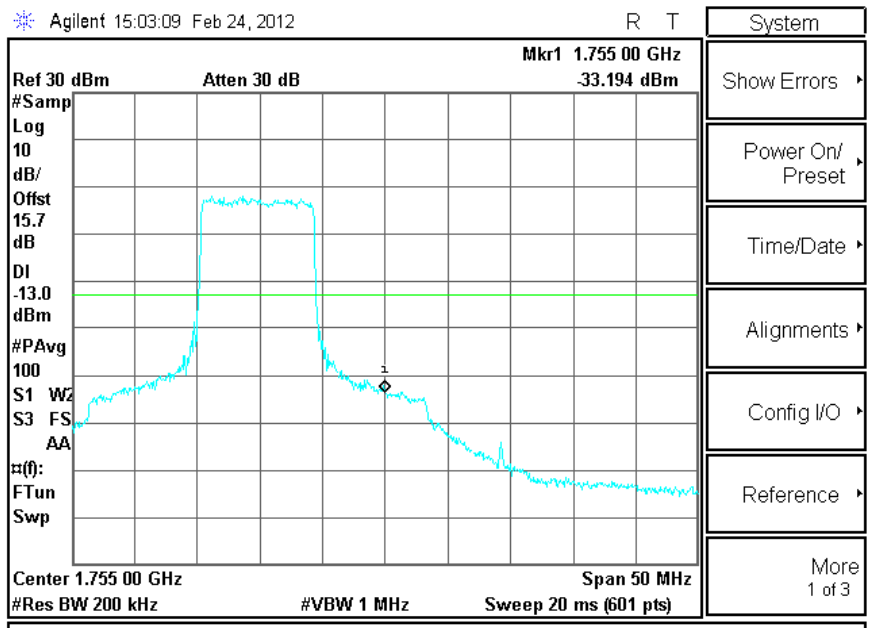
HIGH CH, RB1-99



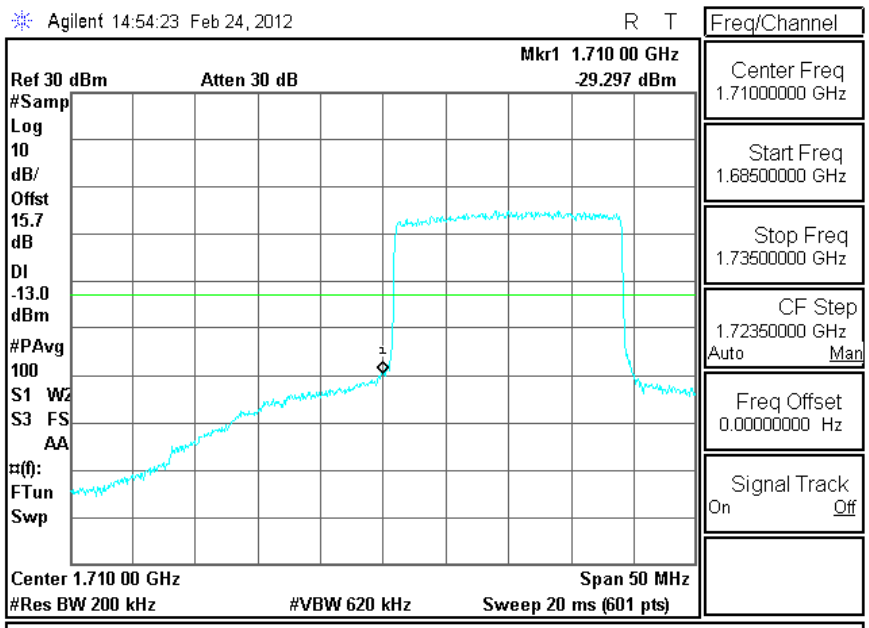
LOW CH, RB50-24



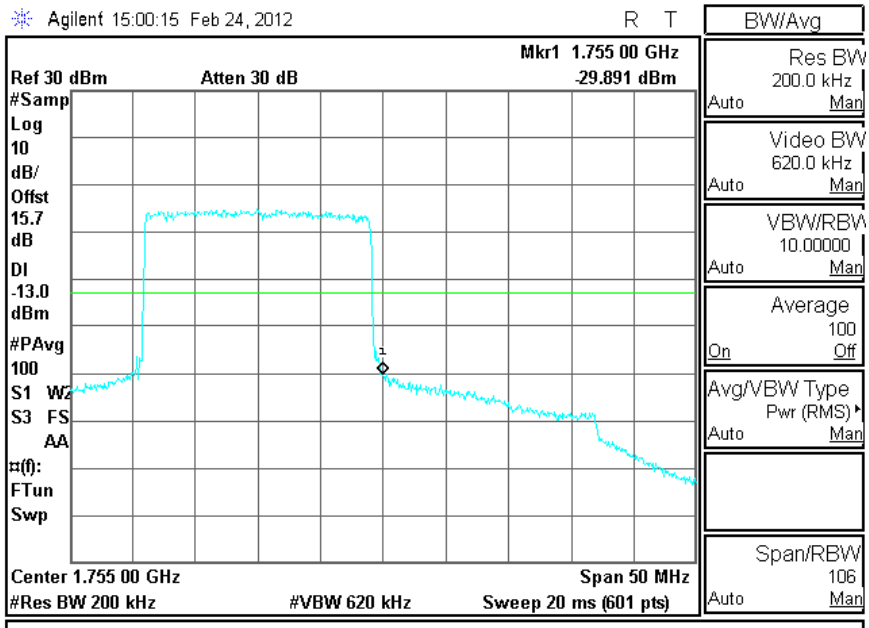
HIGH CH, RB50-24



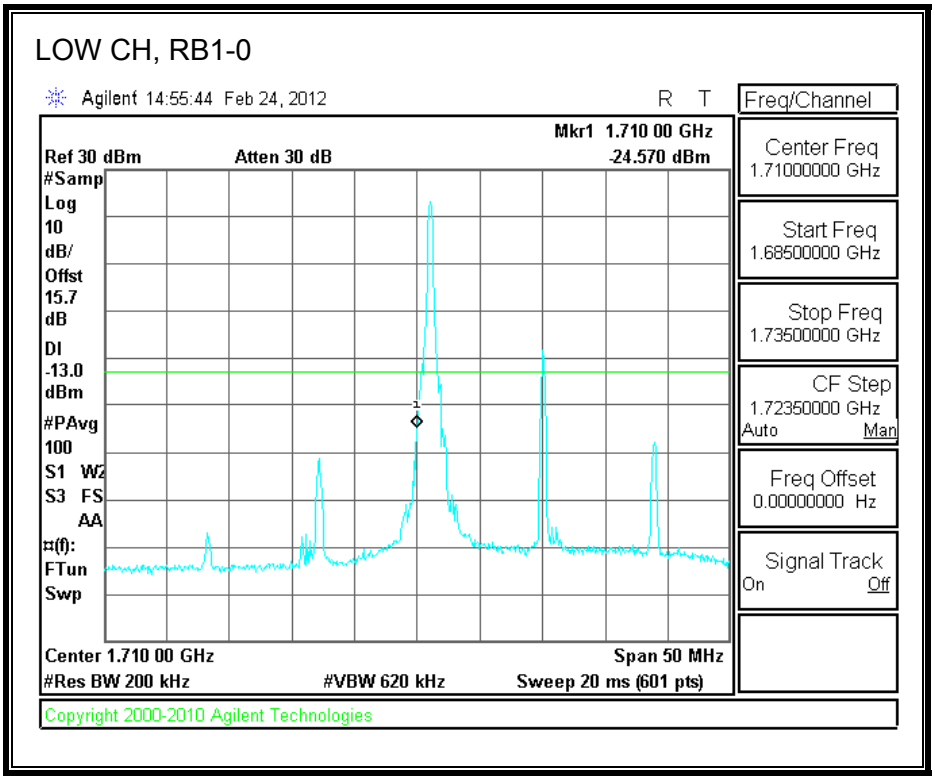
LOW CH, RB100-0

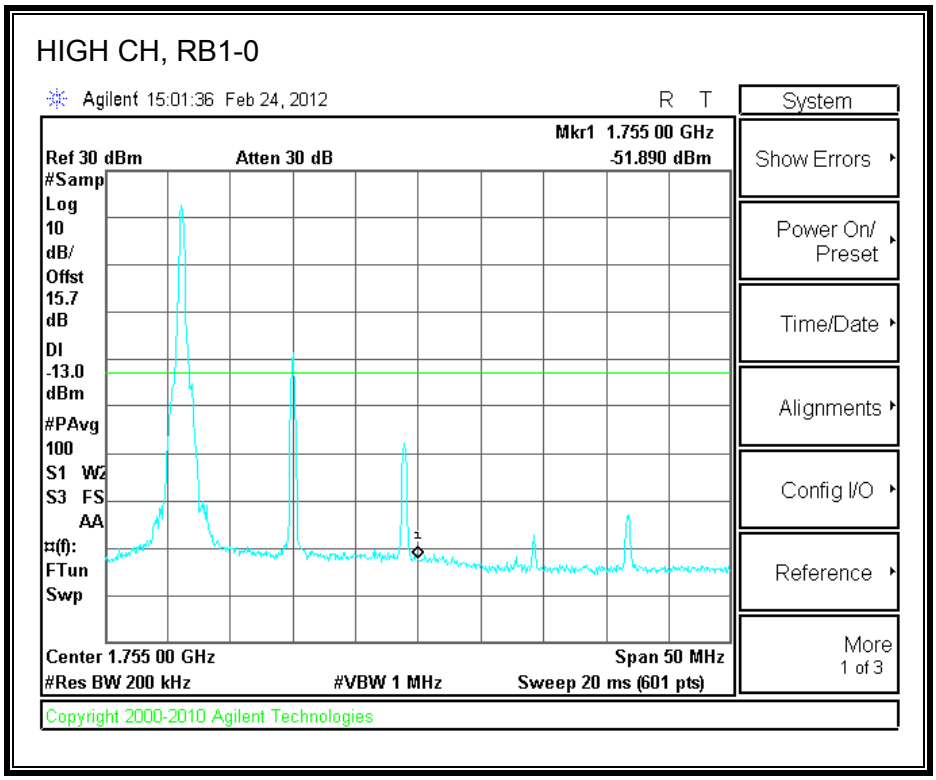


HIGH CH, RB100-0

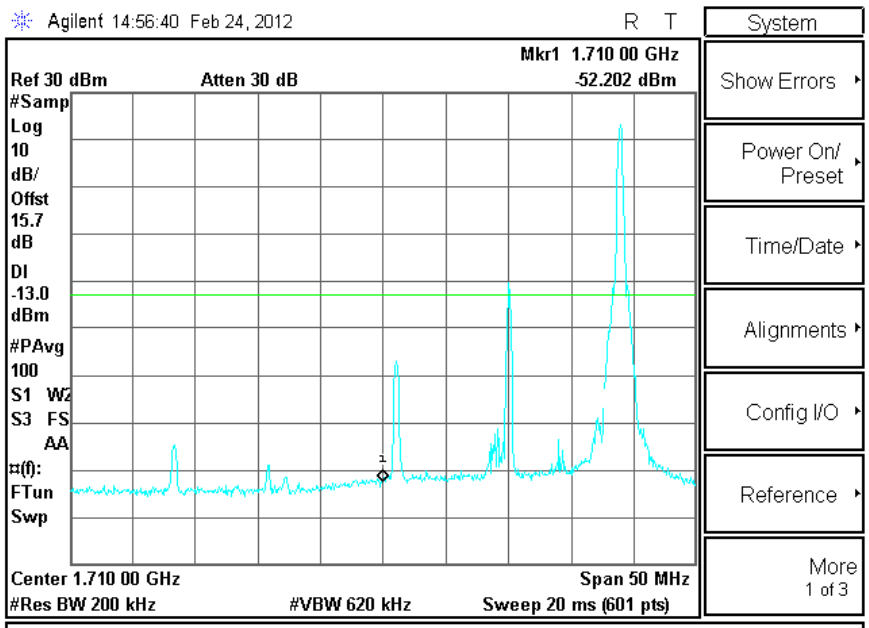


LTE 16QAM Band 4 (20.0 MHz BAND WIDTH)

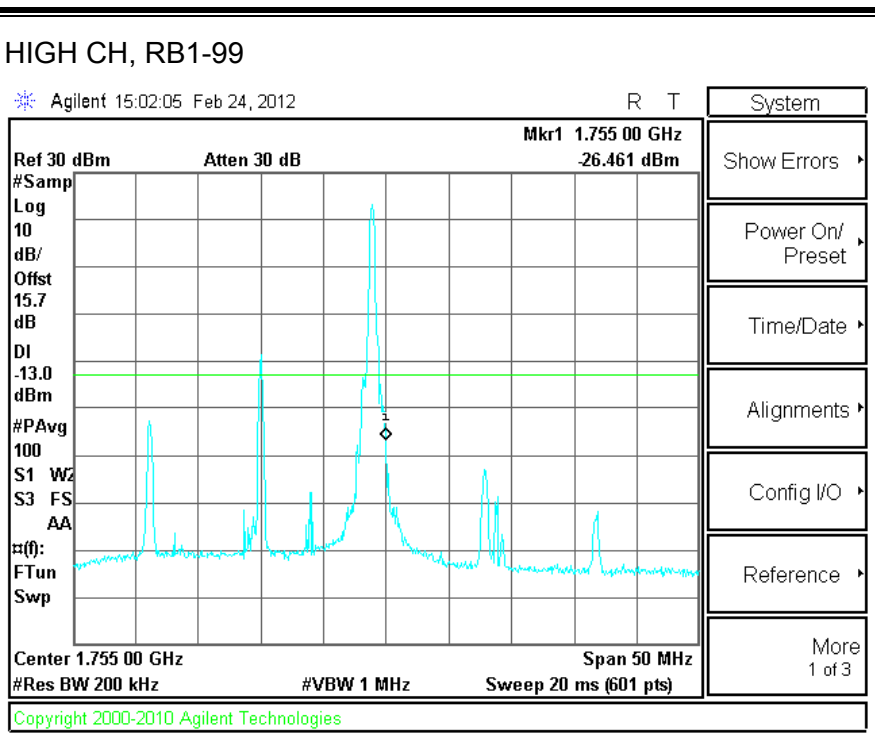




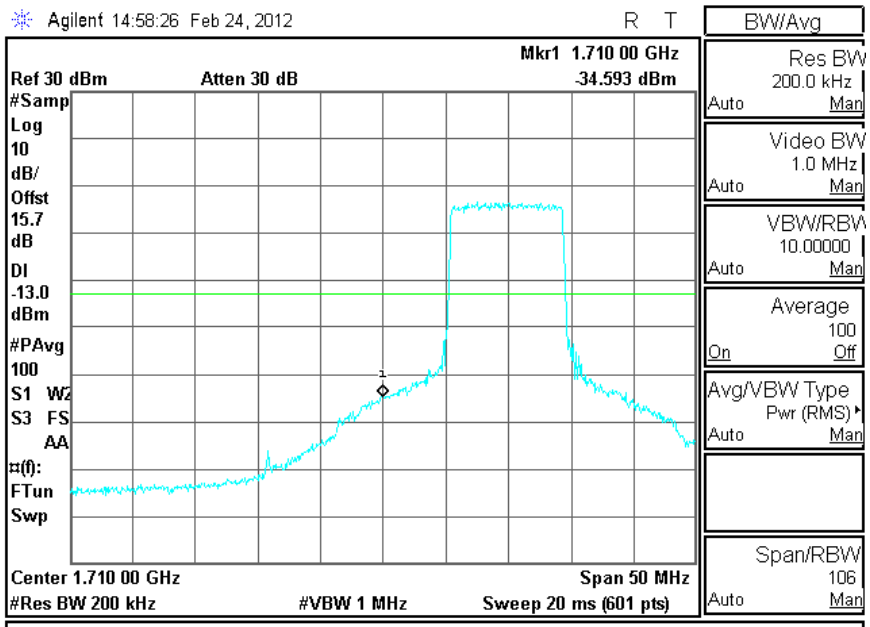
LOW CH, RB1-99



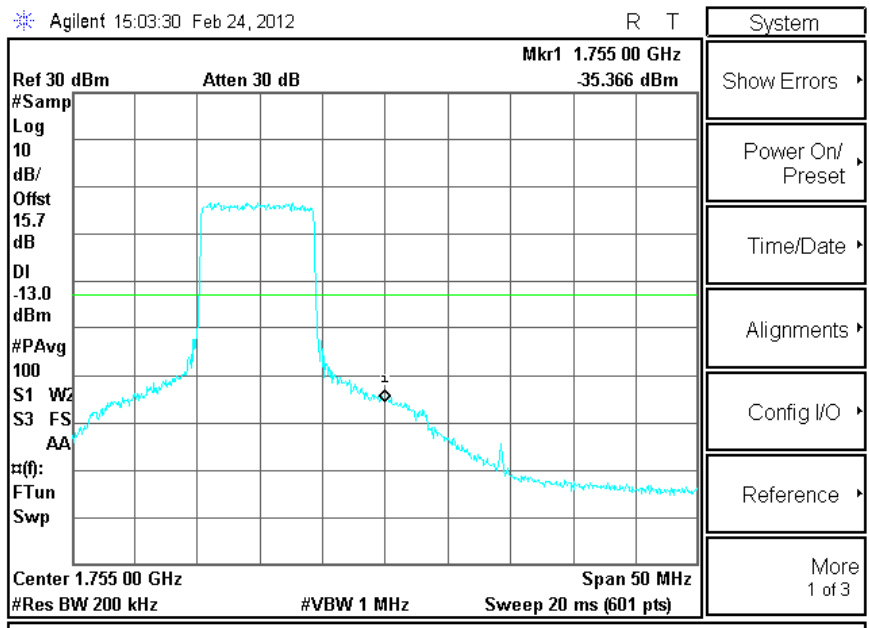
HIGH CH, RB1-99



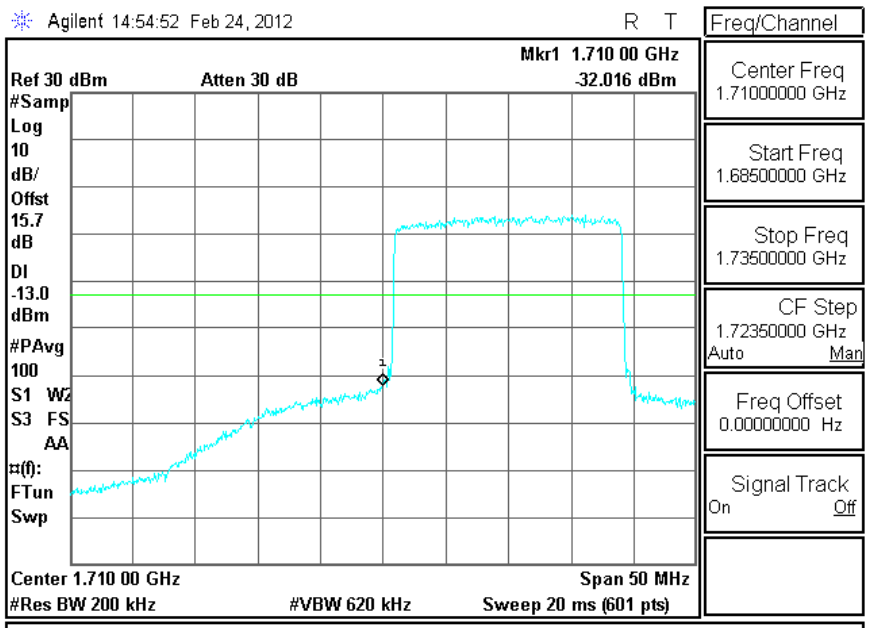
LOW CH, RB50-24



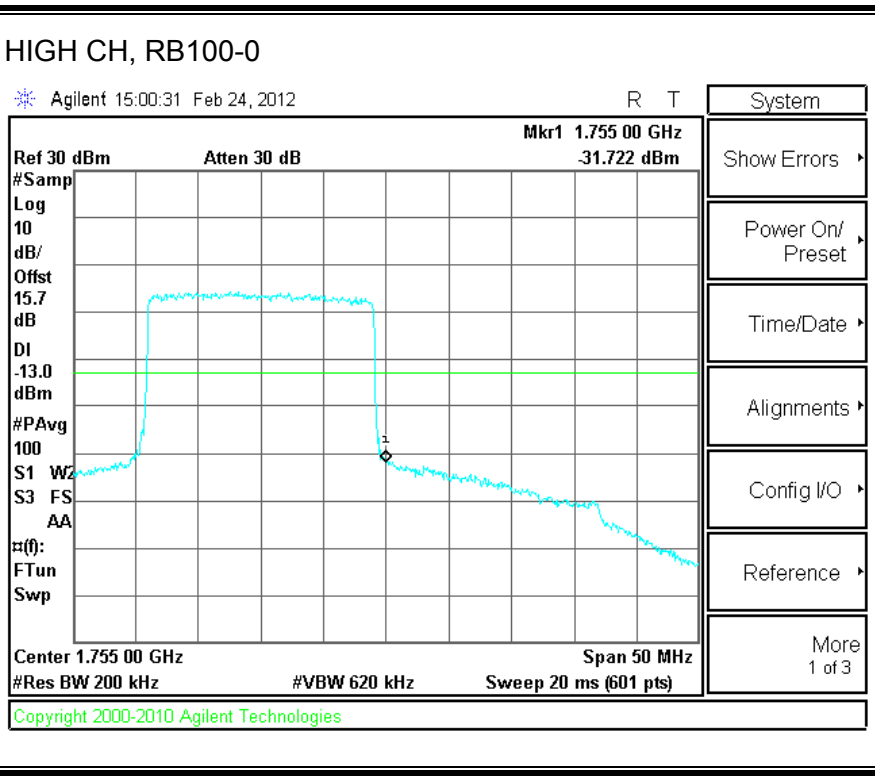
HIGH CH, RB50-24



LOW CH, RB100-0



HIGH CH, RB100-0



8.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §27.53

LIMITS

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

TEST PROCEDURE

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.

MODES TESTED

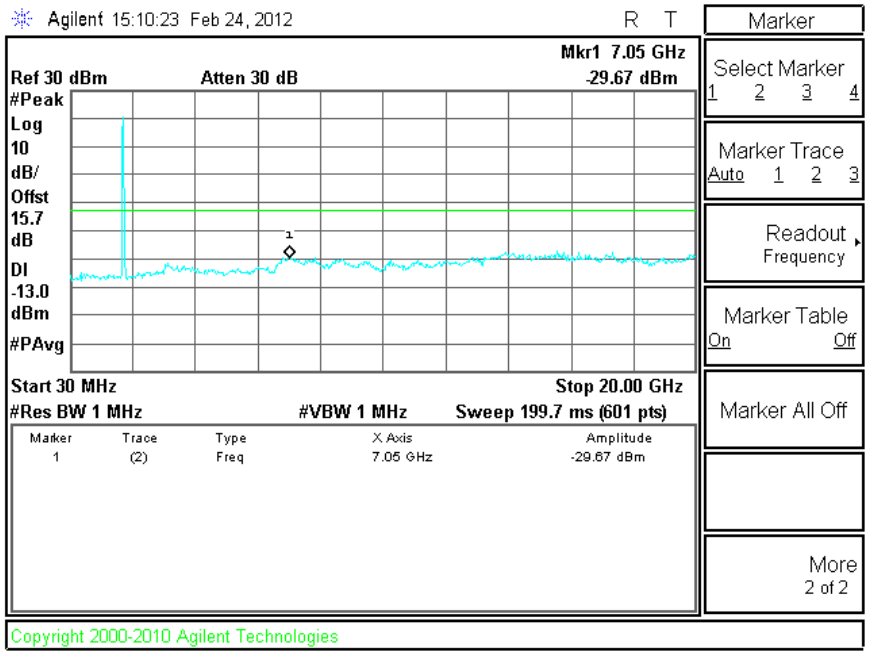
- LTE BAND 4

RESULTS

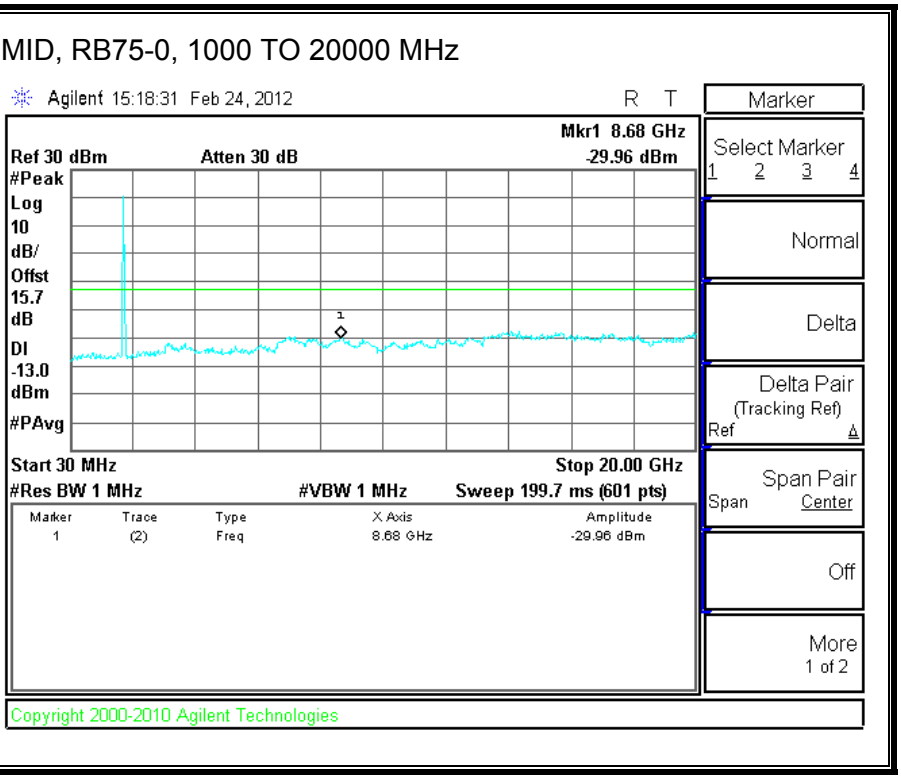
Band 4 (15.0 MHz BAND WIDTH)

LTE QPSK

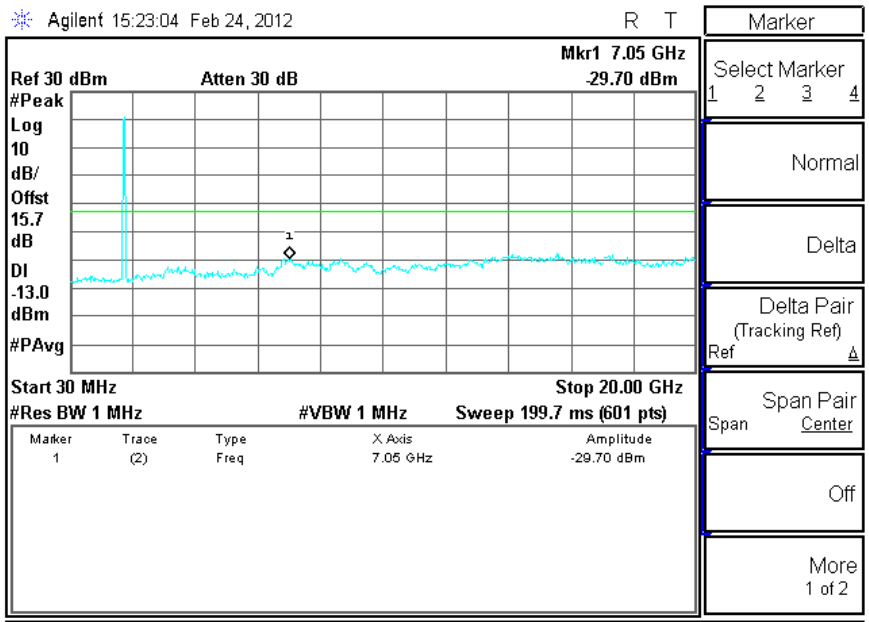
LOW, RB75-0, 30 TO 20000 MHz



MID, RB75-0, 1000 TO 20000 MHz

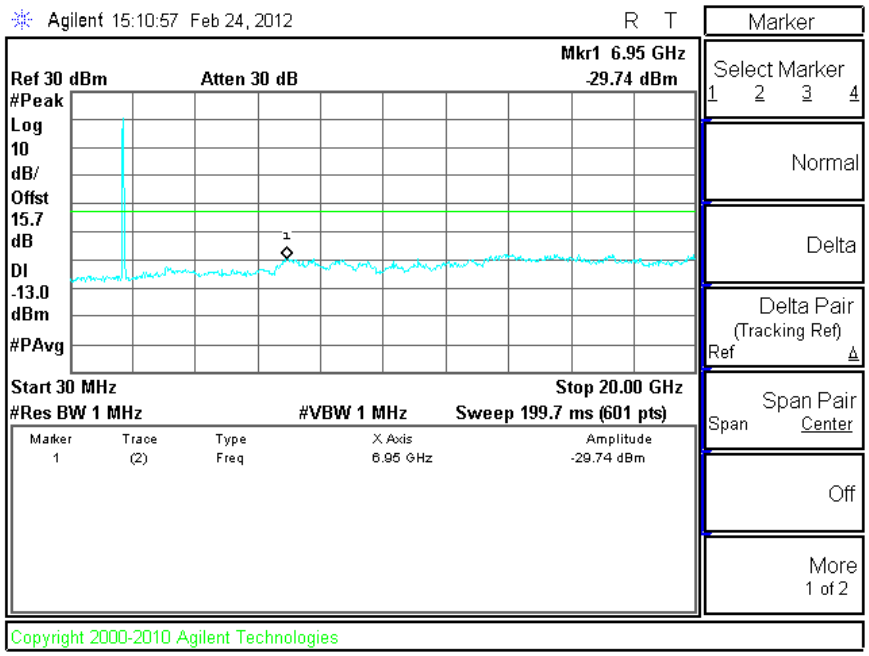


HIGH, RB75-0, 30 TO 20000 MHz

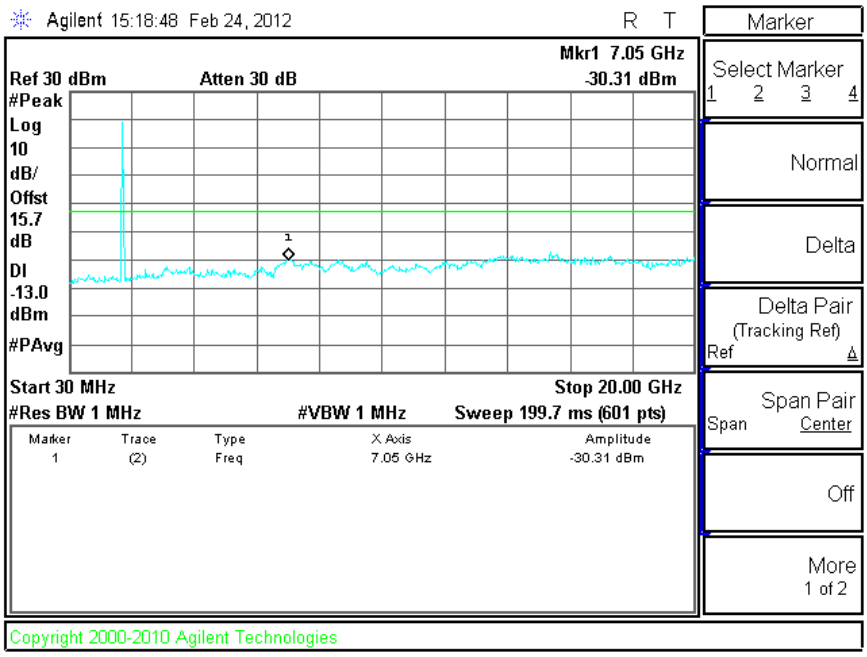


LTE 16QAM

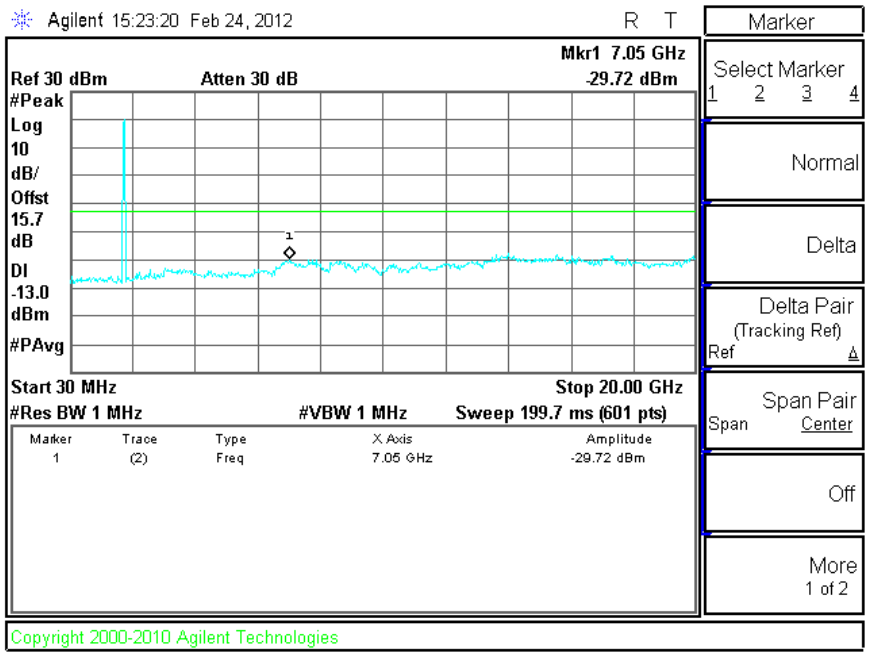
LOW, RB75-0, 30 TO 20000 MHz



MID RB75-0, 30 TO 20000 MHz



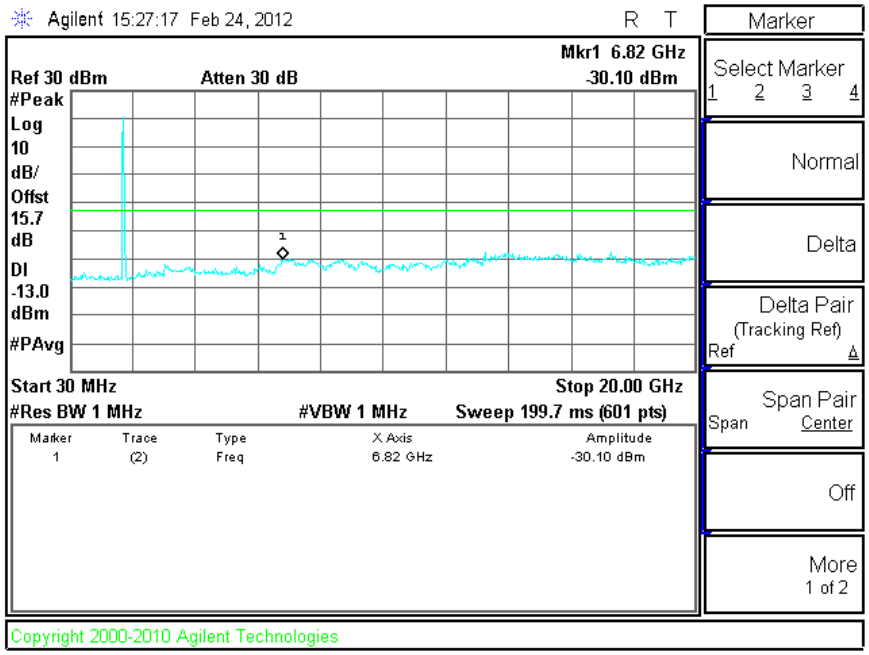
HIGH, RB75-0, 30 TO 20000 MHz



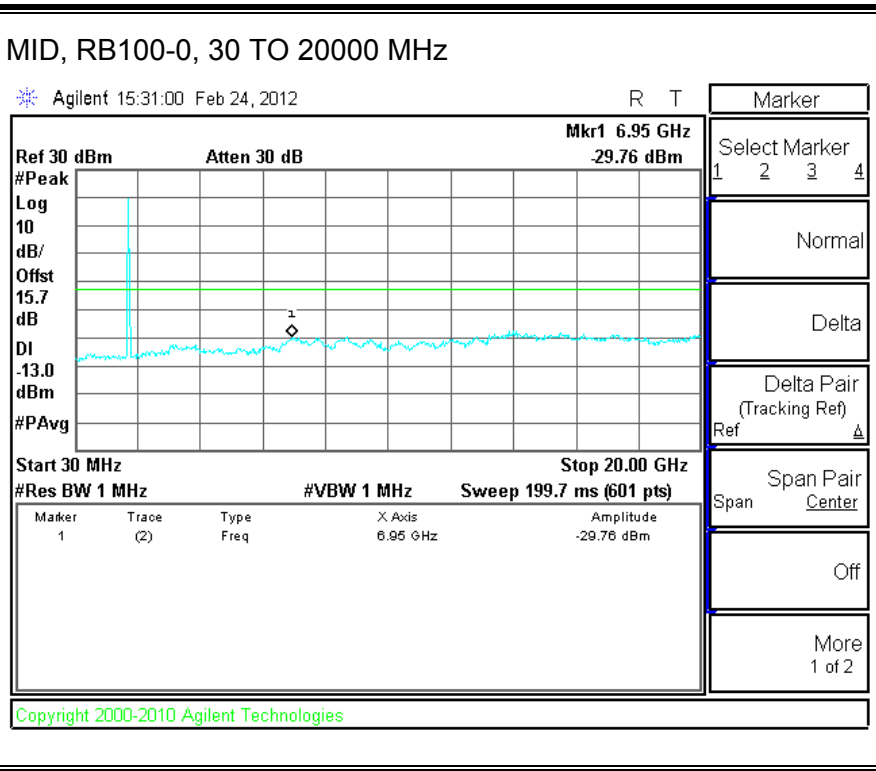
Band 4 (20.0 MHz BAND WIDTH)

LTE QPSK

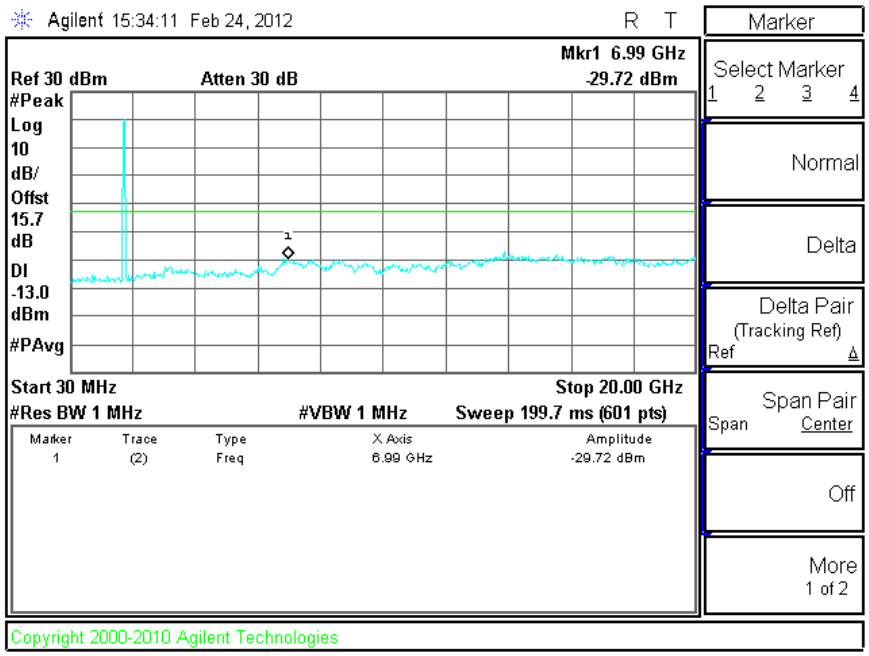
LOW, RB100-0, 30 TO 20000 MHz



MID, RB100-0, 30 TO 20000 MHz

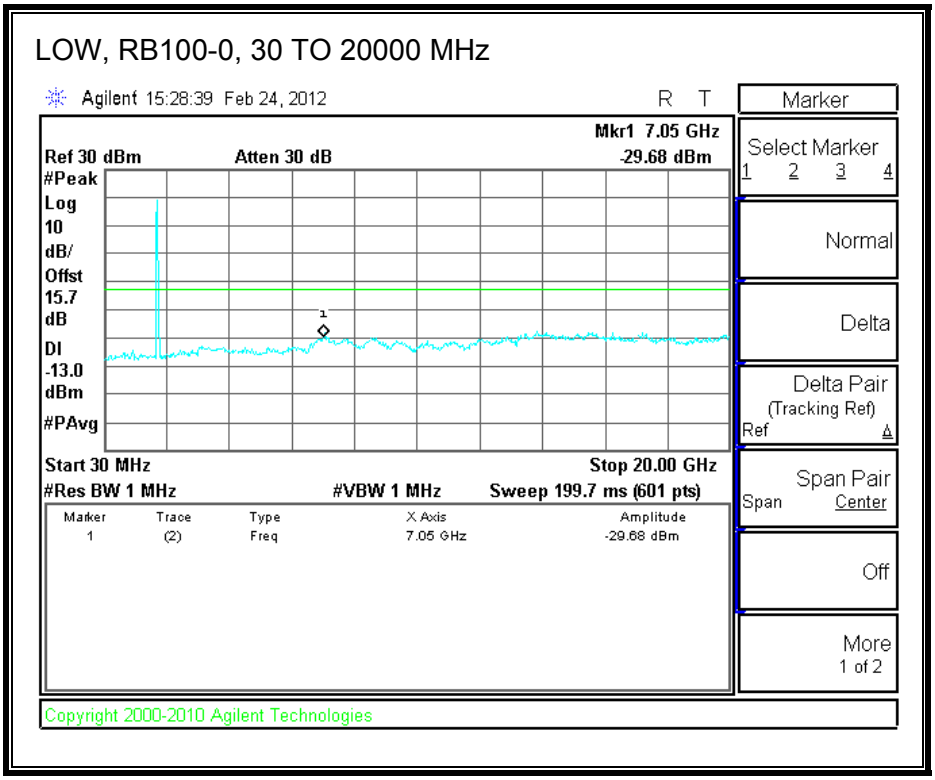


HIGH, RB100-0, 30 TO 20000 MHz

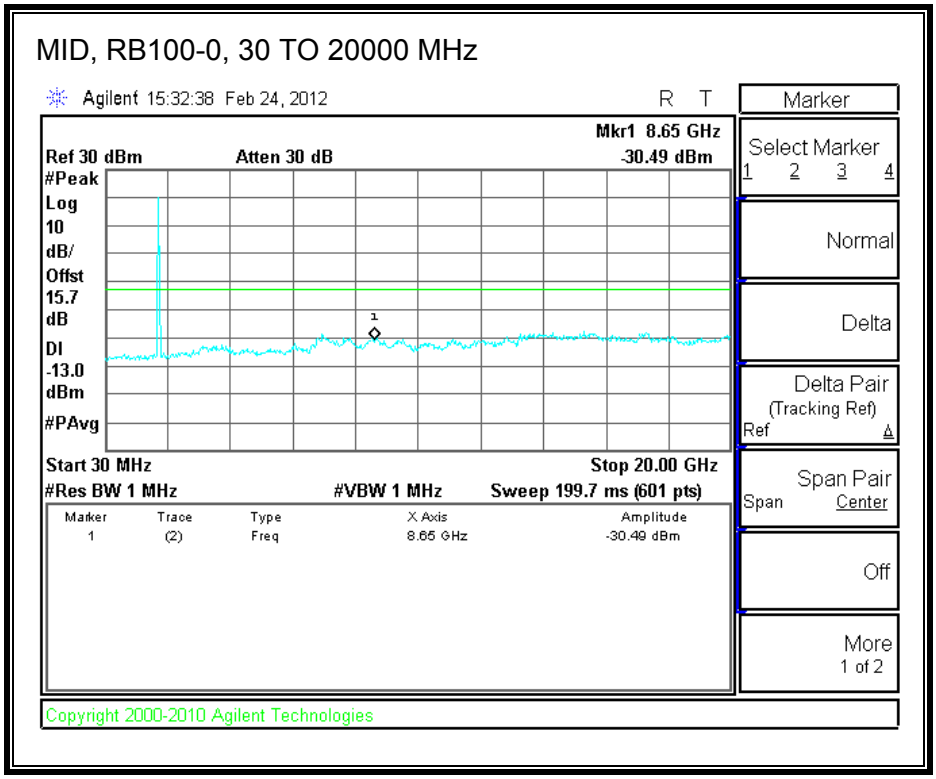


LTE 16QAM

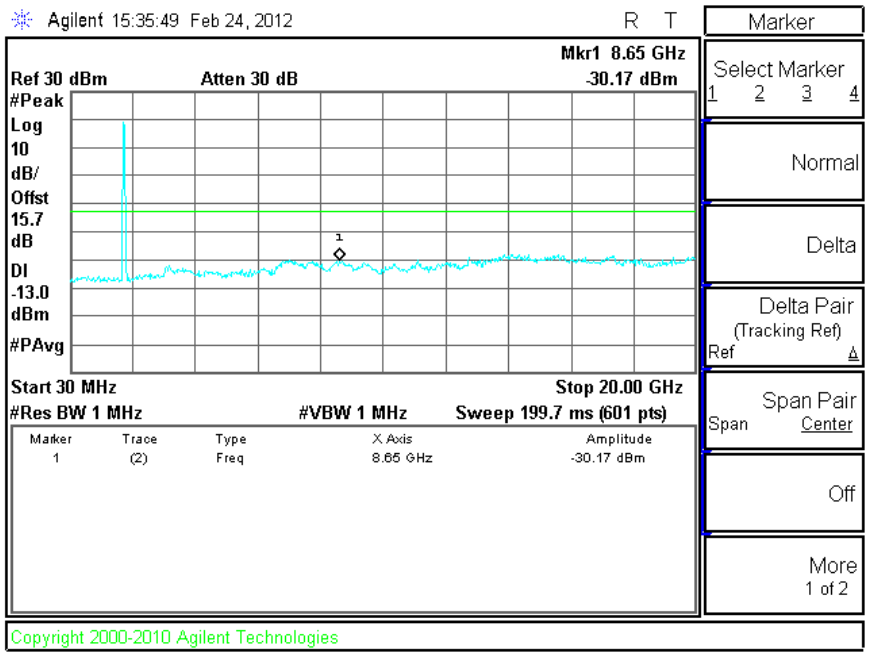
LOW, RB100-0, 30 TO 20000 MHz



MID, RB100-0, 30 TO 20000 MHz



HIGH, RB100-0, 30 TO 20000 MHz



Peak-To-Average Ratio:

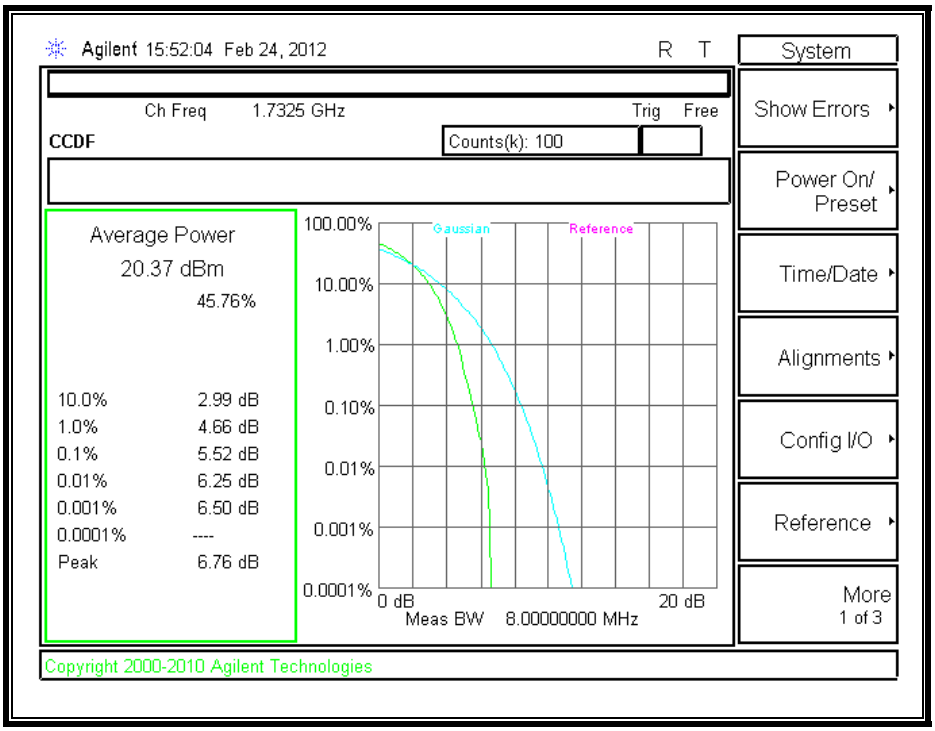
Mode	Channel Band-width (MHZ)	Modulation	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio (PAR)
				*Peak	Average	
QPSK	15	RB75 0	1732.5	27.13	20.37	6.76
Mode	Channel Band-width	Ch. No.	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio
				*Peak	Average	
16QAM	15	RB75 0	1732.5	27.44	19.61	7.83

*Peak Reading = Average Reading + Peak-to-Average Ratio

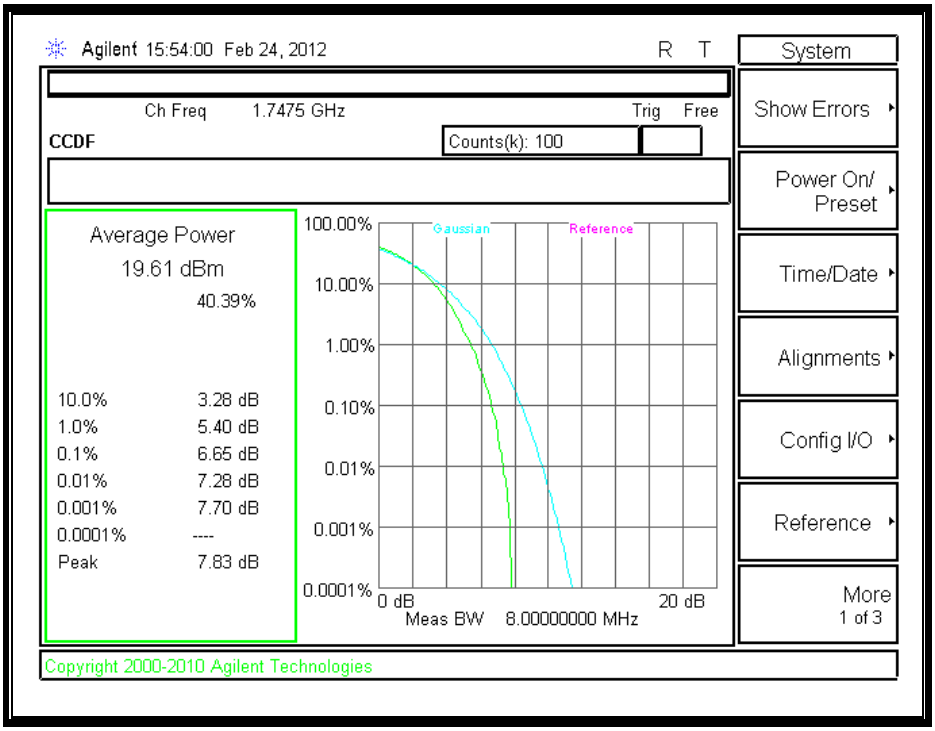
Mode	Channel Band-width (MHZ)	Modulation	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio (PAR)
				*Peak	Average	
QPSK	20	RB100 0	1732.5	26.71	19.27	7.44
Mode	Channel Band-width	Ch. No.	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio
				*Peak	Average	
16QAM	20	RB100 0	1732.5	26.98	18.31	8.67

*Peak Reading = Average Reading + Peak-to-Average Ratio

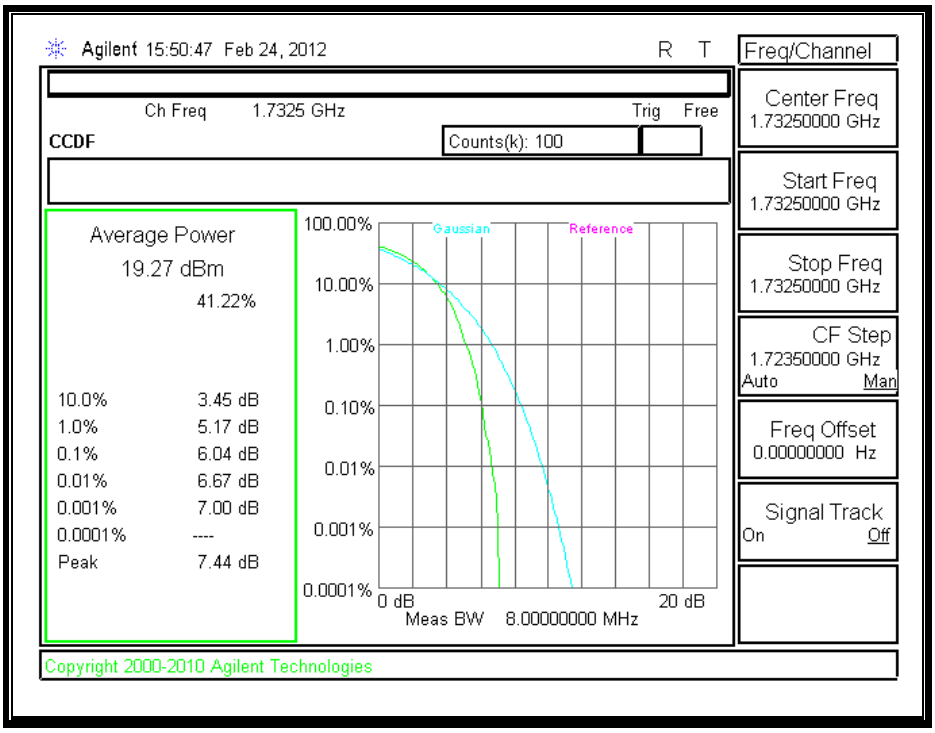
1732.5MHz, 15MHz_QPSK



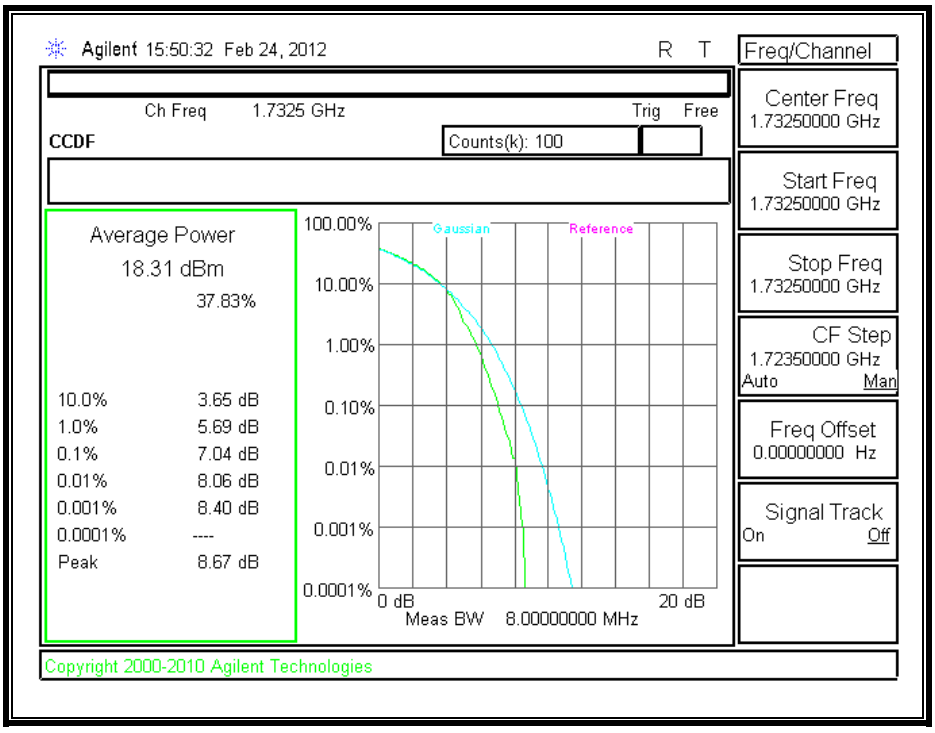
1732.5MHz, 15MHz_16QAM



1732.5MHz, 20MHz_QPSK



1732.5MHz, 20MHz_16QAM



8.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §27.54

LIMITS

- § 27.54 - The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- Temp. = −30° to +50°C
- Voltage = 3.8 Vdc (85% - 115%)

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).

MODES TESTED

- LTE BAND 4

RESULTS

See the following pages.

LTE BAND 4 (15MHz) – 1732.5 MHz

Reference Frequency: LTE Band 4_Mid Channle 1732.500005MHz @ 20°C Limit: to stay +- 2.5 ppm = 4331.250 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse (MHz)	Delta (ppm)	Limit (ppm)
3.80	50	1732.499996	0.0052	2.5
3.80	40	1732.499997	0.0046	2.5
3.80	30	1732.499998	0.0040	2.5
3.80	20	1732.500005	0.0000	2.5
3.80	10	1732.499997	0.0046	2.5
3.80	0	1732.499995	0.0058	2.5
3.80	-10	1732.499995	0.0058	2.5
3.80	-20	1732.499997	0.0046	2.5
3.80	-30	1732.499998	0.0040	2.5

Reference Frequency: LTE Band 4_Mid Channle 1732.500005MHzMHz @ 20°C Limit: to stay +- 2.5 ppm = 4331.250 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse (MHz)	Delta (ppm)	Limit (ppm)
3.80	20	1732.500005	*0.0000*	2.5
3.40	20	1732.499997	*0.0046*	2.5
4.20	20	1732.499993	*0.0069*	2.5
End Voltage(3.0)	20	1732.500035	*-0.0173*	2.5

LTE BAND 4 (20MHz) – 1732.5 MHZ,

Reference Frequency: LTE Band 4_Mid Channel 1732.499993MHz @ 20°C Limit: to stay +- 2.5 ppm = 4331.250 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse (MHz)	Delta (ppm)	Limit (ppm)
3.80	50	1732.499997	-0.0023	2.5
3.80	40	1732.499995	-0.0012	2.5
3.80	30	1732.499995	-0.0012	2.5
3.80	20	1732.499993	0.0000	2.5
3.80	10	1732.499994	-0.0006	2.5
3.80	0	1732.499995	-0.0012	2.5
3.80	-10	1732.499995	-0.0012	2.5
3.80	-20	1732.499992	0.0006	2.5
3.80	-30	1732.499991	0.0012	2.5

Reference Frequency: LTE Band 4_Mid Channel 1732.499993MHz @ 20°C Limit: to stay +- 2.5 ppm = 4331.250 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse (MHz)	Delta (ppm)	Limit (ppm)
3.80	*20*	1732.499993	*0.0000*	2.5
3.40	20	1732.499998	*-0.0029*	2.5
4.20	20	1732.500004	*-0.0063*	2.5
End voltage (3.0)	20	1732.500033	*-0.0231*	2.5

9. RADIATED TEST RESULTS

9.1. RADIATED POWER (EIRP)

RULE PART(S)

FCC: §27.50(d) (2)

LIMITS:

27.50 (d)(4) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands: Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP.

TEST PROCEDURE

ANSI / TIA / EIA 603C Clause 2.2.17

MODES TESTED

- LTE BAND 4

RESULTS

EIRP LTE Band 4 (15.0 MHz BAND WIDTH)

Mode	RB/RB SIZE	f (MHz)	EIRP(AVERAGE)	
			dBm	mW
15.0 MHZ BAND QPSK	1/0	1717.5	22.87	193.64
		1732.5	23.18	207.97
		1747.5	23.33	215.28
15.0 MHZ BAND 16QAM	1/0	1717.5	21.58	143.88
		1732.5	21.93	155.96
		1747.5	23.03	200.91

EIRP LTE Band 4 (20.0 MHz BAND WIDTH)

Mode	RB/RB SIZE	f (MHz)	EIRP(AVERAGE)	
			dBm	mW
20.0 MHZ BAND QPSK	1/0	1720.0	22.43	174.98
		1732.5	22.95	197.24
		1745.0	24.06	254.68
20.0 MHZ BAND 16QAM	1/0	1720.0	21.93	155.96
		1732.5	22.48	177.01
		1745.0	23.32	214.78

EIRP LTE QPSK Band 4 (15.0 MHz BAND WIDTH)

RB1-0

High Frequency Fundamental Measurement
Compliance Certification Services Chamber B

Company: Apple
Project #: 12U14315
Date: 02/24/12
Test Engineer: Chin Pang
Configuration: EUT ALONE
Mode: TX, LTE BAND 4_15.0 MHz BW
Average

Test Equipment:
Receiving: Horn T59, and Camber B SMA Cables
Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
RB1 0, QPSK								
1.718	15.1	V	0.67	8.40	22.87	30.0	-7.1	
1.718	9.1	H	0.67	8.50	16.93	30.0	-13.1	
RB1 0, QPSK								
1.733	15.4	V	0.67	8.45	23.18	30.0	-6.8	
1.733	8.8	H	0.67	8.54	16.67	30.0	-13.3	
RB1 0, QPSK								
1.748	15.5	V	0.67	8.47	23.33	30.0	-6.7	
1.748	11.1	H	0.67	8.50	18.93	30.0	-11.1	

Rev. 1.24.7

EIRP LTE 16QAM Band 4 (15.0 MHz BAND WIDTH)

RB1-0

High Frequency Fundamental Measurement
Compliance Certification Services Chamber B

Company: Apple
Project #: 12U14315
Date: 02/24/12
Test Engineer: Chin Pang
Configuration: EUT ALONE
Mode: TX, LTE BAND 4_15.0 MHz BW
Average

Test Equipment:
Receiving: Horn T59, and Camber B SMA Cables
Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
RB1 0, 16QAM								
1.718	13.9	V	0.67	8.40	21.58	30.0	-8.4	
1.718	7.8	H	0.67	8.50	15.63	30.0	-14.4	
RB1 0, 16QAM								
1.733	14.2	V	0.67	8.45	21.93	30.0	-8.1	
1.733	8.0	H	0.67	8.54	15.87	30.0	-14.1	
RB1 0, 16QAM								
1.748	15.2	V	0.67	8.47	23.03	30.0	-7.0	
1.748	9.6	H	0.67	8.50	17.43	30.0	-12.6	

Rev. 1.24.7

EIRP LTE QPSK Band 4 (20MHz BANDWIDTH)

RB1-0

High Frequency Fundamental Measurement
Compliance Certification Services Chamber B

Company: Apple
Project #: 12U14315
Date: 02/24/12
Test Engineer: Chin Pang
Configuration: EUT ALONE
Mode: TX, LTE BAND 4_20.0 MHz BW
Average

Test Equipment:
Receiving: Horn T59, and Camber B SMA Cables
Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
RB1 0, QPSK								
1.720	14.7	V	0.67	8.40	22.43	30.0	-7.6	
1.720	7.8	H	0.67	8.50	15.63	30.0	-14.4	
RB1 0, QPSK								
1.733	15.2	V	0.67	8.45	22.95	30.0	-7.1	
1.733	9.6	H	0.67	8.54	17.47	30.0	-12.5	
RB1 0, QPSK								
1.745	16.3	V	0.67	8.47	24.06	30.0	-5.9	
1.745	9.8	H	0.67	8.50	17.63	30.0	-12.4	

Rev. 1.24.7

EIRP LTE 16QAM Band 4 (20MHz BAND WIDTH)

RB1-0

High Frequency Fundamental Measurement
Compliance Certification Services Chamber B

Company: Apple
Project #: 12U14315
Date: 02/24/12
Test Engineer: Chin Pang
Configuration: EUT ALONE
Mode: TX, LTE BAND 4_20.0 MHz BW
Average

Test Equipment:
Receiving: Horn T59, and Camber B SMA Cables
Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
RB1 0, 16QAM								
1.720	14.2	V	0.67	8.40	21.93	30.0	-8.1	
1.720	7.1	H	0.67	8.50	14.93	30.0	-15.1	
RB1 0, 16QAM								
1.733	14.7	V	0.67	8.45	22.48	30.0	-7.5	
1.733	8.8	H	0.67	8.54	16.67	30.0	-13.3	
RB1 0, 16QAM								
1.745	15.5	V	0.67	8.47	23.32	30.0	-6.7	
1.745	8.7	H	0.67	8.50	16.53	30.0	-13.5	

Rev. 1.24.7

9.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §27.53.

LIMIT

§27.53 (h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10(P) dB.

TEST PROCEDURE

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

MODES TESTED

- LTE BAND 4

RESULTS

EIRP LTE QPSK Band 4 (15.0 MHz BANDWIDTH)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Apple
Project #: 12U14315
Date: 02/24/12
Test Engineer: Chin Pang
Configuration: EUT ALONE
Mode: TX, QPSK_15 MHz_RB#1_0 MODE

Chamber	Pre-amplifer	Filter	Limit
5m Chamber B	T145 8449B	Filter 1	Part 27

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1717.5MHz									
3.422	-9.6	V	3.0	35.5	1.0	-44.0	-13.0	-31.0	
5.132	-10.4	V	3.0	35.3	1.0	-44.7	-13.0	-31.7	
3.422	-7.1	H	3.0	35.5	1.0	-41.6	-13.0	-28.6	
5.132	-13.3	H	3.0	35.3	1.0	-47.6	-13.0	-34.6	
Mid Ch, 1732.5MHz									
3.452	-14.7	V	3.0	35.5	1.0	-49.2	-13.0	-36.2	
5.177	-14.3	V	3.0	35.3	1.0	-48.6	-13.0	-35.6	
3.452	-17.0	H	3.0	35.5	1.0	-51.5	-13.0	-38.5	
5.177	-13.7	H	3.0	35.3	1.0	-48.0	-13.0	-35.0	
High Ch, 1747.5MHz									
3.482	-12.4	V	3.0	35.5	1.0	-46.9	-13.0	-33.9	
5.223	-13.2	V	3.0	35.3	1.0	-47.5	-13.0	-34.5	
3.482	-11.9	H	3.0	35.5	1.0	-46.4	-13.0	-33.4	
5.223	-13.1	H	3.0	35.3	1.0	-47.4	-13.0	-34.4	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

EIRP LTE 16QAM Band 4 (15.0 MHz BANDWIDTH)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Apple
Project #: 12U14315
Date: 02/24/12
Test Engineer: Chin Pang
Configuration: EUT ALONE
Mode: TX, 16QAM_15 MHz_RB#1_0 MODE

Chamber	Pre-amplifer	Filter	Limit
5m Chamber B	T145 8449B	Filter 1	Part 27

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1717.5MHz									
3.422	-3.6	V	3.0	35.5	1.0	-38.0	-13.0	-25.0	
5.132	-10.6	V	3.0	35.3	1.0	-44.9	-13.0	-31.9	
3.422	-5.6	H	3.0	35.5	1.0	-40.1	-13.0	-27.1	
5.132	-10.8	H	3.0	35.3	1.0	-45.1	-13.0	-32.1	
Mid Ch, 1732.5MHz									
3.452	-15.5	V	3.0	35.5	1.0	-50.0	-13.0	-37.0	
5.177	-15.0	V	3.0	35.3	1.0	-49.3	-13.0	-36.3	
3.452	-15.7	H	3.0	35.5	1.0	-50.2	-13.0	-37.2	
5.177	-13.8	H	3.0	35.3	1.0	-48.1	-13.0	-35.1	
High Ch, 1747.5MHz									
3.482	-12.6	V	3.0	35.5	1.0	-47.1	-13.0	-34.1	
5.223	-13.2	V	3.0	35.3	1.0	-47.5	-13.0	-34.5	
3.482	-13.4	H	3.0	35.5	1.0	-47.9	-13.0	-34.9	
5.223	-13.8	H	3.0	35.3	1.0	-48.1	-13.0	-35.1	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

EIRP LTE QPSK Band 4 (20.0 MHz BANDWIDTH)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Apple
Project #: 12U14315
Date: 02/24/12
Test Engineer: Chin Pang
Configuration: EUT ALONE
Mode: TX, QPSK_20 MHz_RB#1_0 MODE

Chamber	Pre-amplifer	Filter	Limit
5m Chamber B	T145 8449B	Filter 1	Part 27

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1720MHz									
3.422	-7.1	V	3.0	35.5	1.0	-41.5	-13.0	-28.5	
5.133	-13.4	V	3.0	35.3	1.0	-47.7	-13.0	-34.7	
3.422	-5.9	H	3.0	35.5	1.0	-40.4	-13.0	-27.4	
5.132	-11.8	H	3.0	35.3	1.0	-46.1	-13.0	-33.1	
Mid Ch, 1732.5MHz									
3.422	-6.9	V	3.0	35.5	1.0	-41.3	-13.0	-28.3	
5.132	-14.4	V	3.0	35.3	1.0	-48.7	-13.0	-35.7	
3.422	-5.6	H	3.0	35.5	1.0	-40.1	-13.0	-27.1	
5.132	-12.8	H	3.0	35.3	1.0	-47.1	-13.0	-34.1	
High Ch, 1745MHz									
3.472	-12.4	V	3.0	35.5	1.0	-46.9	-13.0	-33.9	
5.207	-11.2	V	3.0	35.3	1.0	-45.5	-13.0	-32.5	
3.472	-13.0	H	3.0	35.5	1.0	-47.4	-13.0	-34.4	
5.207	-13.6	H	3.0	35.3	1.0	-47.9	-13.0	-34.9	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

EIRP LTE 16QAM Band 4 (20.0 MHz BANDWIDTH)

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Apple
Project #: 12U14315
Date: 02/24/12
Test Engineer: Chin Pang
Configuration: EUT ALONE
Mode: TX, 16QAM_20 MHz_RB#1_0 MODE

Chamber	Pre-amplifer	Filter	Limit
5m Chamber B	T145 8449B	Filter 1	Part 27

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1720MHz									
3.422	-6.6	V	3.0	35.5	1.0	-41.0	-13.0	-28.0	
5.133	-14.2	V	3.0	35.3	1.0	-48.5	-13.0	-35.5	
3.422	-5.6	H	3.0	35.5	1.0	-40.1	-13.0	-27.1	
5.133	-12.8	H	3.0	35.3	1.0	-47.1	-13.0	-34.1	
Mid Ch, 1732.5MHz									
3.447	-14.5	V	3.0	35.5	1.0	-49.0	-13.0	-36.0	
5.171	-14.3	V	3.0	35.3	1.0	-48.6	-13.0	-35.6	
3.447	-15.5	H	3.0	35.5	1.0	-50.0	-13.0	-37.0	
5.171	-13.7	H	3.0	35.3	1.0	-48.0	-13.0	-35.0	
High Ch, 1745MHz									
3.472	-12.4	V	3.0	35.5	1.0	-46.9	-13.0	-33.9	
5.207	-13.2	V	3.0	35.3	1.0	-47.5	-13.0	-34.5	
3.472	-12.6	H	3.0	35.5	1.0	-47.0	-13.0	-34.0	
5.207	-12.6	H	3.0	35.3	1.0	-46.9	-13.0	-33.9	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

9.3. RECEIVER SPURIOUS EMISSIONS

RULE PART(S)

FCC: N/A

LIMIT

Spurious Emission Limits for Receivers:

Spurious Frequency (MHz)	Field Strength (microvolts/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

TEST PROCEDURE

The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (local oscillator frequency, intermediate frequency or carrier frequency),

or 30 MHz, whichever is the higher, to at least 3 times the highest tunable and local oscillator frequencies.

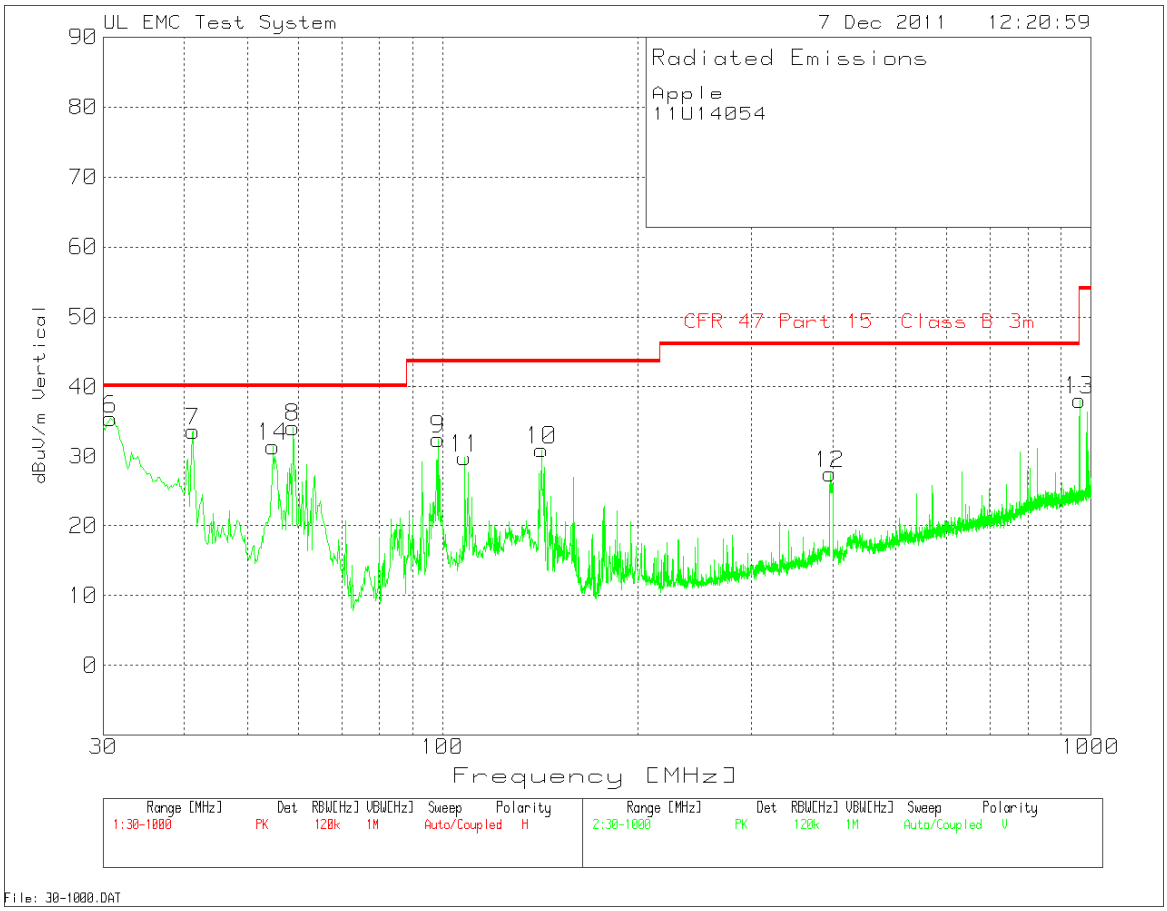
RESULTS

RECEIVER SPURIOUS EMISSIONS FOR 30 TO 1000 MHz, HORIZONTAL

HORIZONTAL PLOT

RECEIVER SPURIOUS EMISSIONS FOR 30 TO 1000 MHz, VERTICAL

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Apple								
11U14054								
Engineer: Chin Pang								
Date: Dec 7, 2011								
Range 1 30 - 1000MHz								
Frequency	Reading	Detector	ChmbrB Amp [dB]	Ant Factors.[dB]	dBuV/m	Part 15 B	Margin	Polarity
40.8553	36.63	PK	-29.2	13.6	21.03	40	-18.97	Horz
55.5875	46.58	PK	-29	7.9	25.48	40	-14.52	Horz
142.2362	46.65	PK	-28.1	13.1	31.65	43.5	-11.85	Horz
186.8205	42.38	PK	-27.7	11.1	25.78	43.5	-17.72	Horz
633.0516	37.26	PK	-26.5	18.6	29.36	46	-16.64	Horz
Range 2 30 - 1000MHz								
Frequency	Reading	Detector	ChmbrB Amp [dB]	Ant Factors.[dB]	dBuV/m	Part 15 B	Margin	Polarity
30.7754	44.75	PK	-29.3	20	35.45	40	-4.55	Vert
41.243	49.54	PK	-29.2	13.3	33.64	40	-6.36	Vert
58.8829	55.37	PK	-29	7.9	34.27	40	-5.73	Vert
98.6211	51.47	PK	-28.6	9.7	32.57	43.5	-10.93	Vert
142.2362	45.93	PK	-28.1	13.1	30.93	43.5	-12.57	Vert
108.3133	46.75	PK	-28.5	11.6	29.85	43.5	-13.65	Vert
395.9792	39.38	PK	-26.9	15	27.48	46	-18.52	Vert
961.0372	40.27	PK	-24.3	22.2	38.17	54	-15.83	Vert
54.8122	52.56	PK	-29	7.9	31.46	40	-8.54	Vert

RECEIVER SPURIOUS EMISSIONS ABOVE 1000 MHz

Note: No emissions were detected above the system noise floor.