FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

CELLULAR/AWS/PCS CDMA & AWS/PCS LTE PHONE WITH BLUETHOOTH AND WLAN

MODEL NUMBER: MS770, LG-MS770, LGMS770, LW770, LG-LW770, LGLW770

FCC ID: ZNFMS770

REPORT NUMBER: 12U14406-3

ISSUE DATE: MAY 9, 2012

Prepared for
LG ELECTRONICS MOBILECOMM U.S.A., INC.
1000 SYLVAN AVE.
ENGLEWOODS CLIFFS, NJ 07632

Prepared by
COMPLIANCE CERTIFICATION SERVICES (UL CCS)
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	05/09/2012	Initial Issue	T. LEE

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	LG ELECTRONICS MOBILECOMM U.S.A., INC. 1000 SYLVAN AVE. ENGLEWOODS CLIFFS, NJ 07632
EUT DESCRIPTION:	Cellular/AWS/PCS CDMA & AWS/PCS LTE Phone with Bluetooth and WLAN
MODEL:	MS770, LG-MS770, LGMS770, LW770, LG-LW770, LGLW770
SERIAL NUMBER:	99000077000285
DATE TESTED:	MAY 2-9, 2012

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	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:

TIM LEE
STAFF ENGINEER
UL CCS

Tested By:

TOM CHEN
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

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 EUT is a Cellular/AWS/PCS CDMA & AWS/PCS LTE Phone with Bluetooth and WLAN.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	Bluetooth Low Energy	9.39	8.69

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of 1.34 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT software installed during testing was LAP8960IR120417.

5.5. MODEL DIFFERNECE

Model MS770 is identical to Models LG-MS770, LGMS770, LW770, LG-LW770, and LGLW770 except for model designation.

5.6. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

5.7. DESCRIPTION OF TEST SETUP

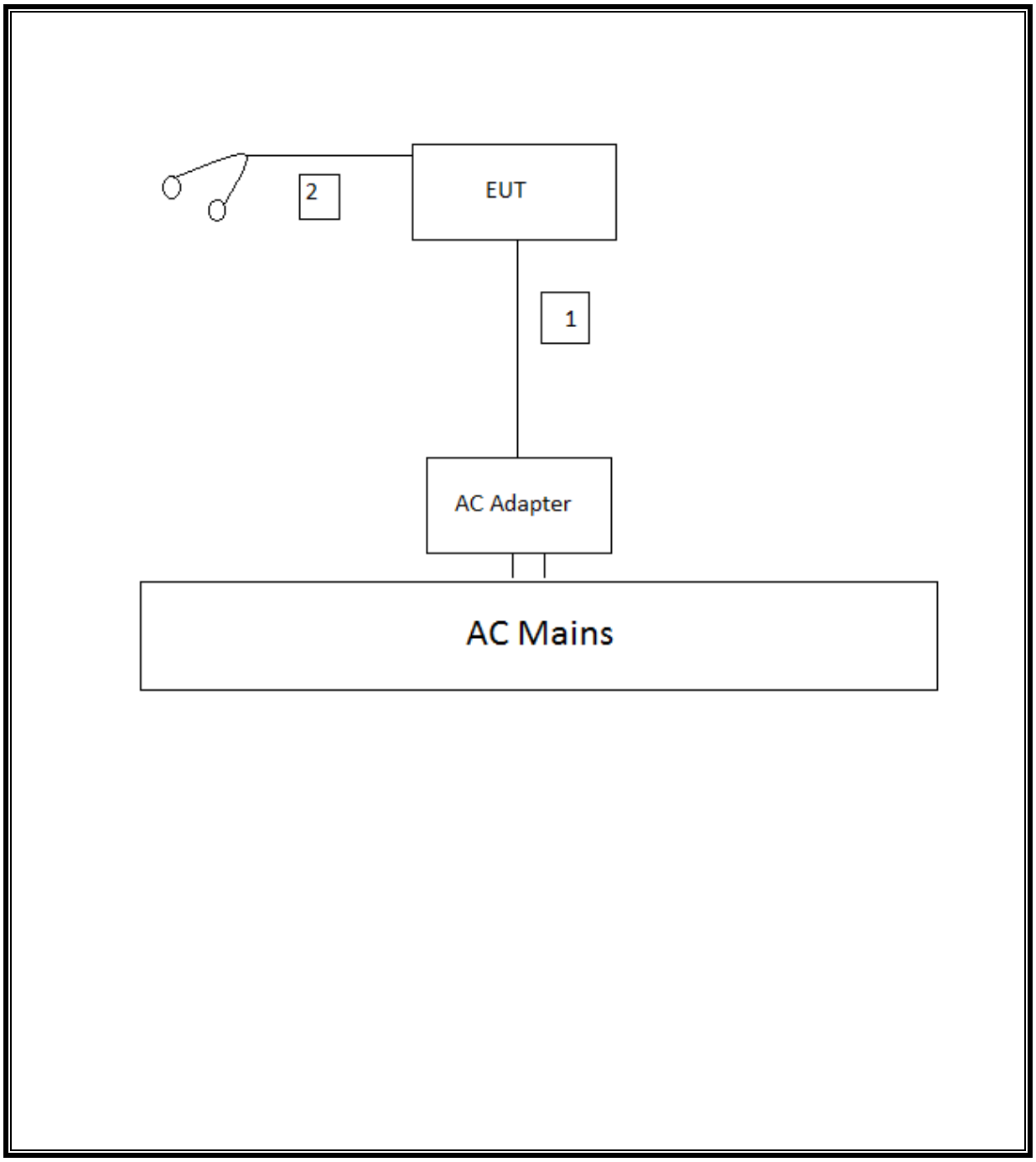
Support Equipment List			
Description	**Manufacturer**	**Model**	**Serial Number**
AC ADAPTER	LG ELECTRONICS	MCS-01WR	RA1Z0051473
HEADSET	LG ELECTRONICS	NA	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC	1	MINI USB	UN-SHELDED	1.0m	LG-DLC300 (BA21)
2	AUDIO	1	MINI JACK	UN-SHELDED	1.0m	N/A

TEST SETUP

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**
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/14/12
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	11/11/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/12/12
Horn Antenna, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/12
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	03/14/13
Reject Filter, 2.0-2.9 GHz	Micro-Tronics	BRM50702	N02684	CNR
High Pass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	04/09/13
Peak Power Meter	Agilent	N1911A	1260847C	08/04/12
Peak Power Sensor	Agilent	E9323A	1244073F	08/04/12
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR
EMI Test Receiver, 30MHz	R & S	ESHS 20	N02396	08/19/13
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	12/13/12

7. ANTENNA PORT TEST RESULTS

7.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

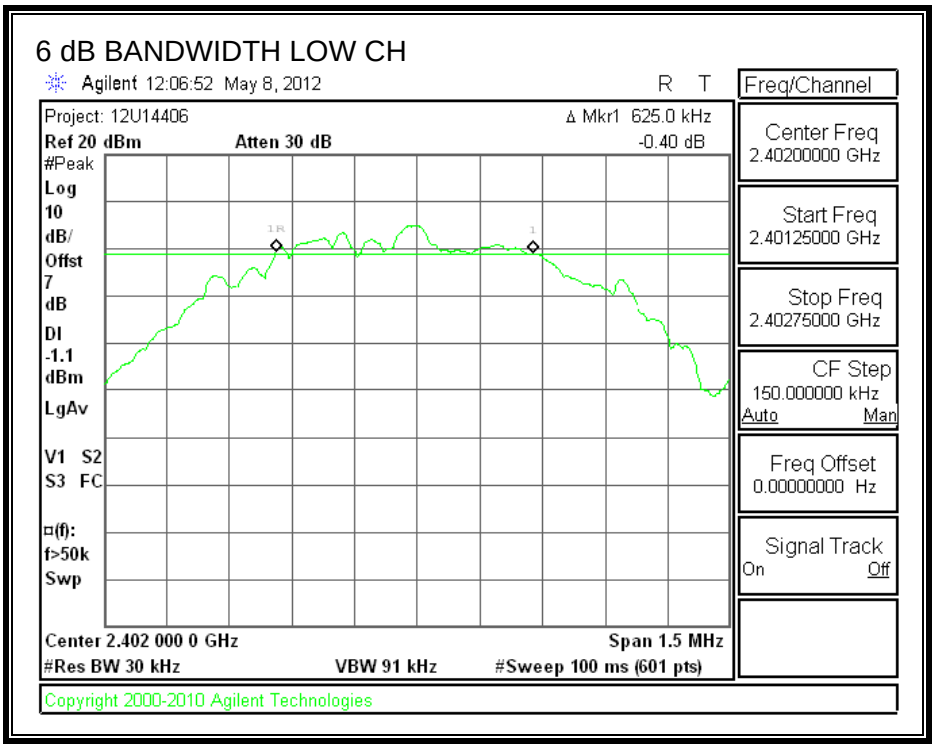
TEST PROCEDURE

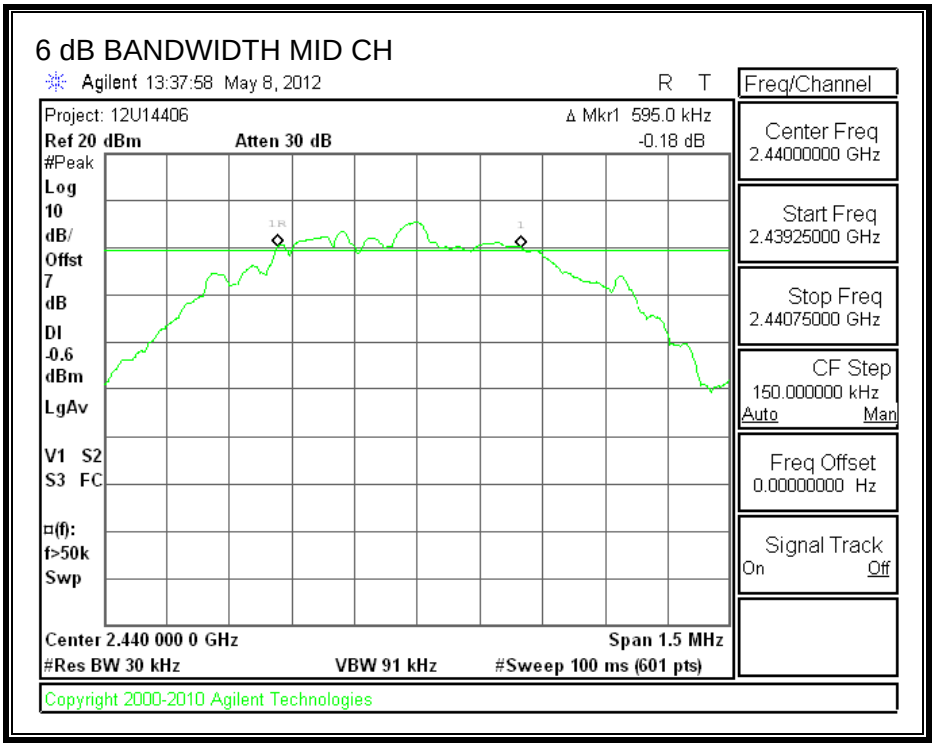
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

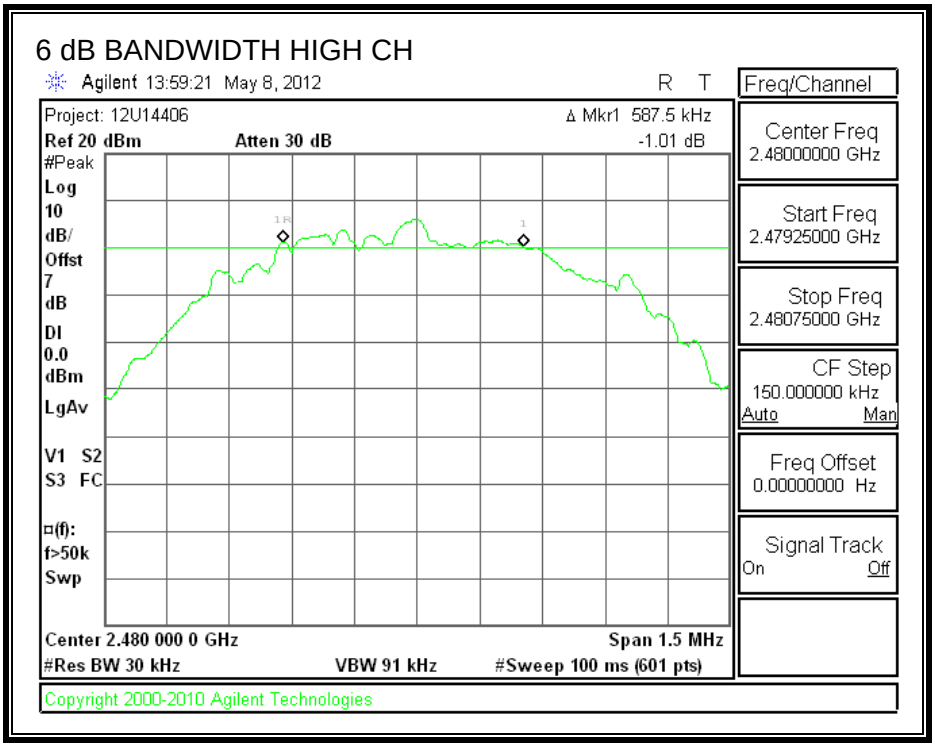
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.63	0.5
Middle	2440	0.60	0.5
High	2480	0.59	0.5

6 dB BANDWIDTH







7.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

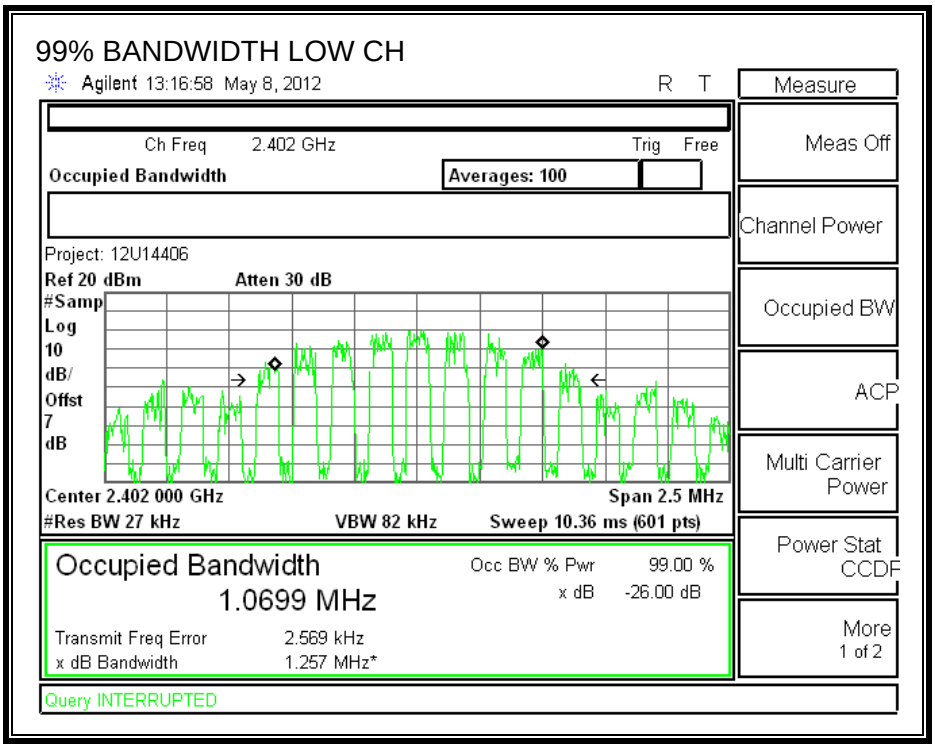
TEST PROCEDURE

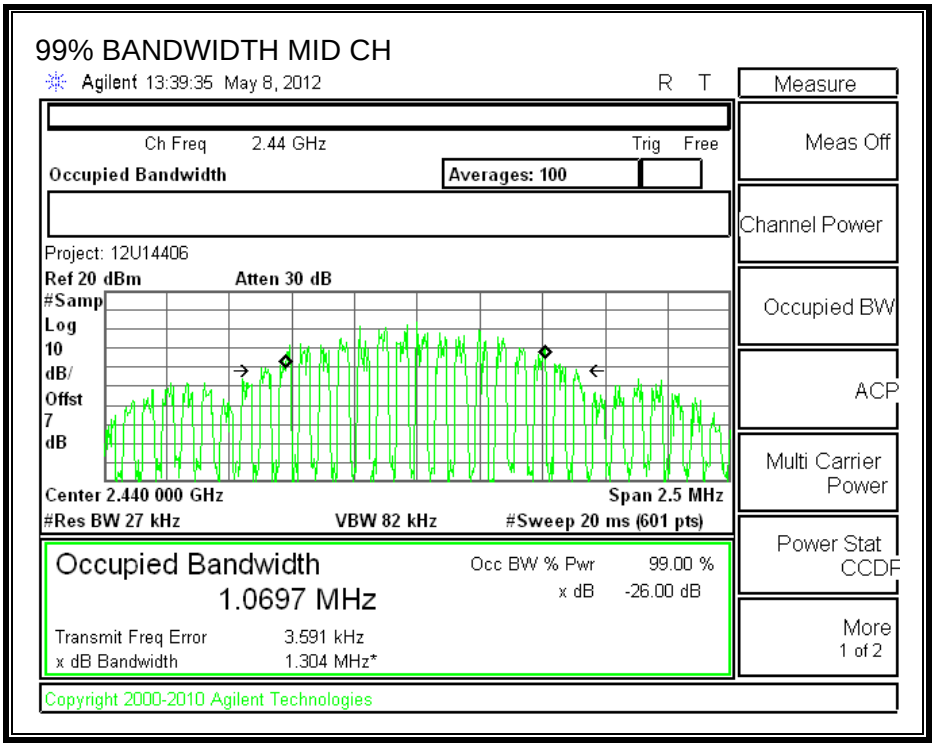
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

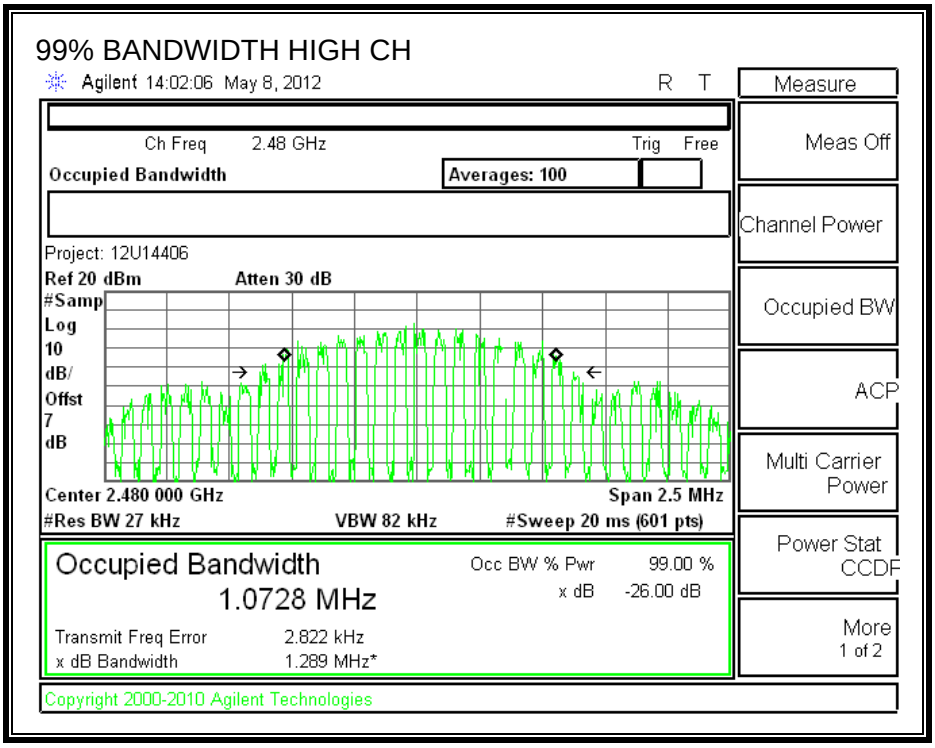
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0699
Middle	2440	1.0697
High	2480	1.0728

99% BANDWIDTH







7.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

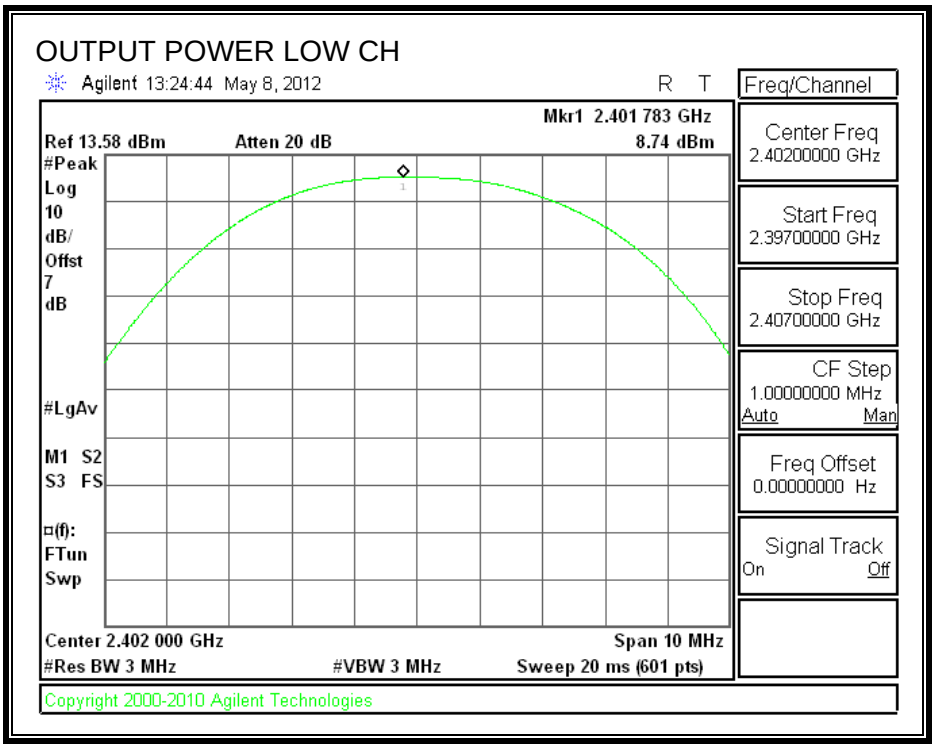
TEST PROCEDURE

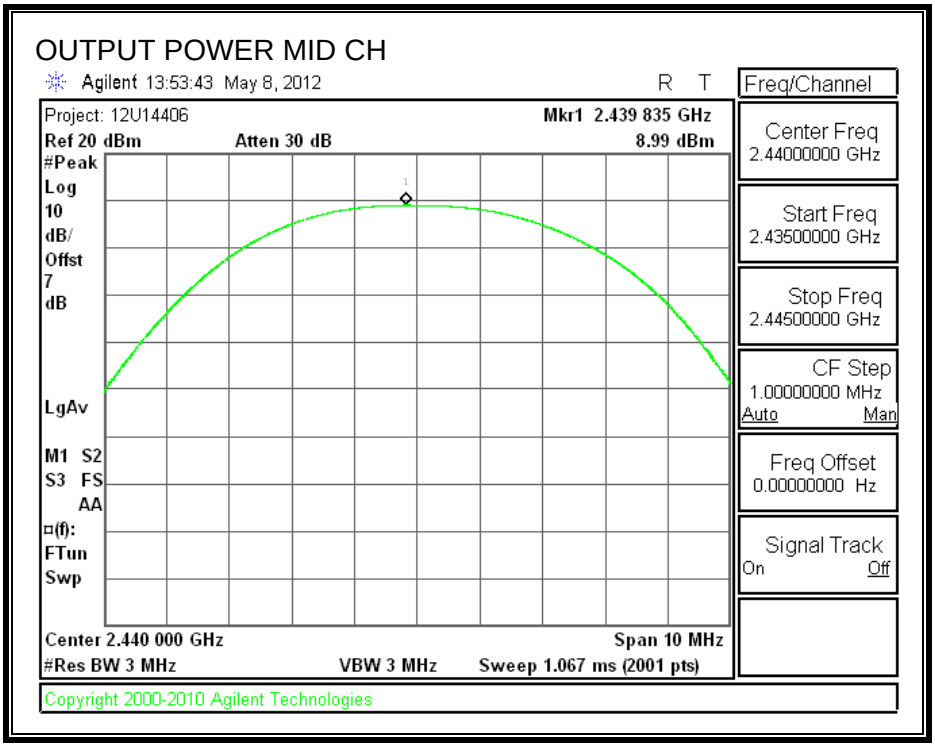
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

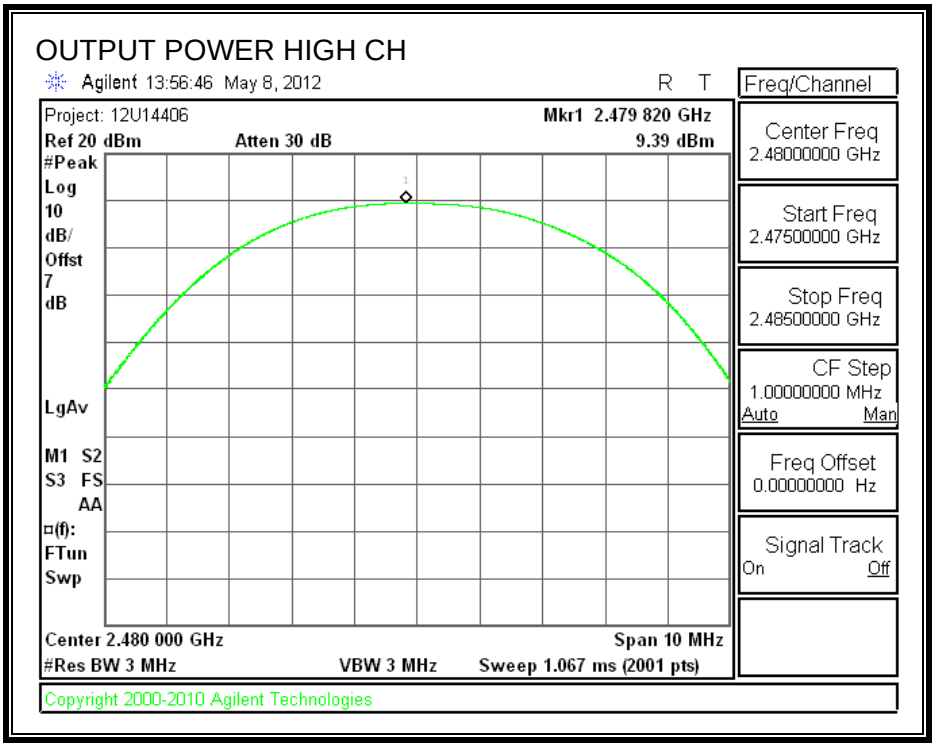
RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.74	8.74	30	-21.26
Middle	2440	8.99	8.99	30	-21.01
High	2480	9.39	9.39	30	-20.61

OUTPUT POWER







7.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	2402	5.75
Middle	2440	6.01
High	2480	6.48

7.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

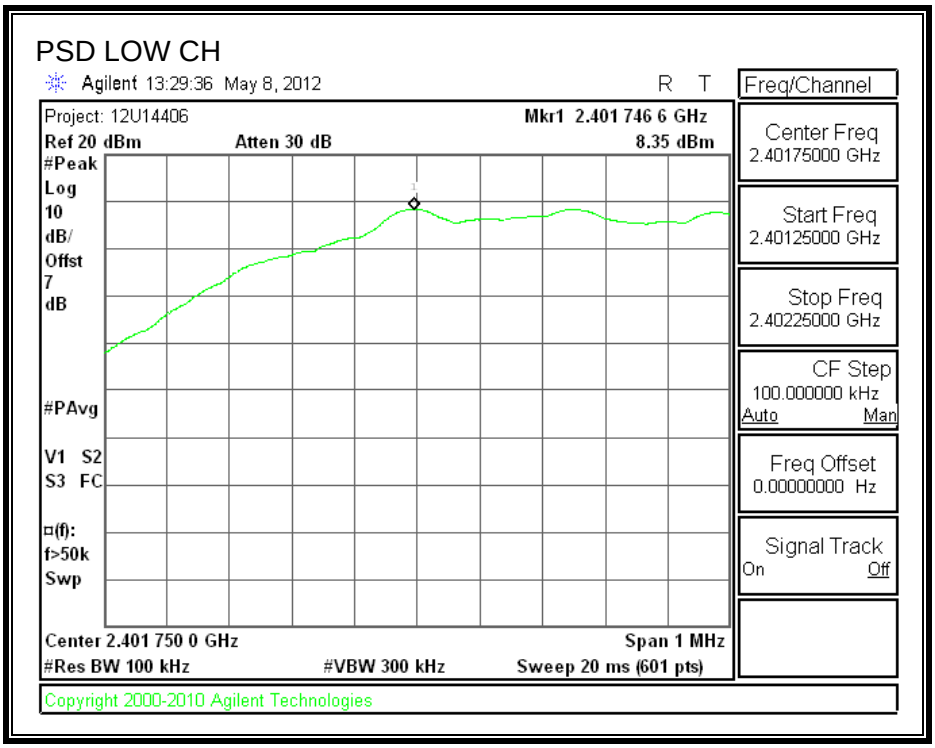
TEST PROCEDURE

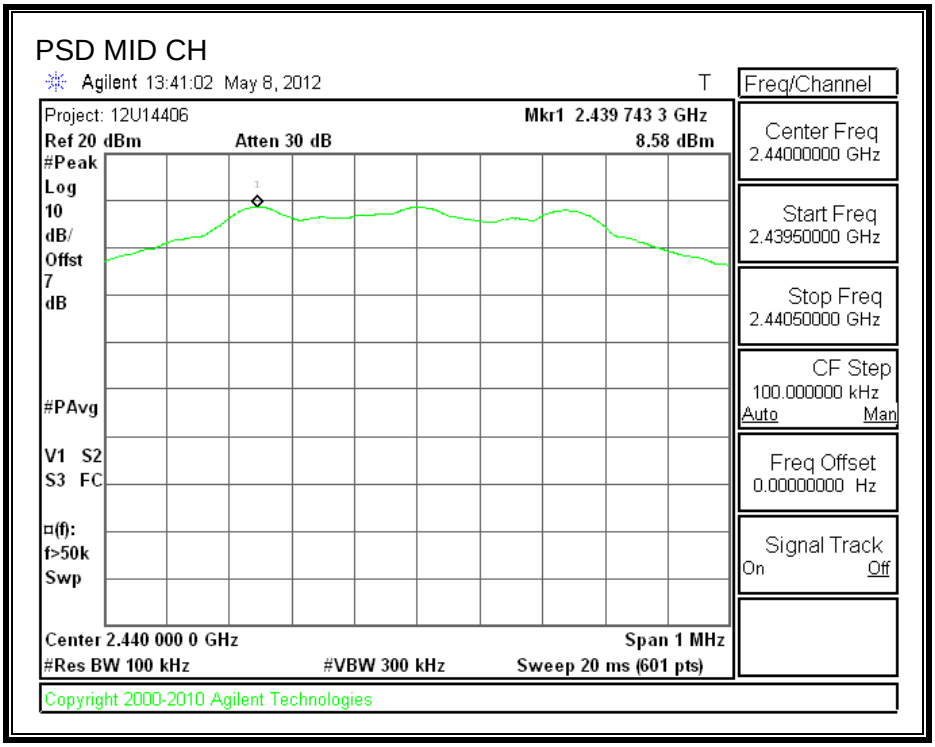
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

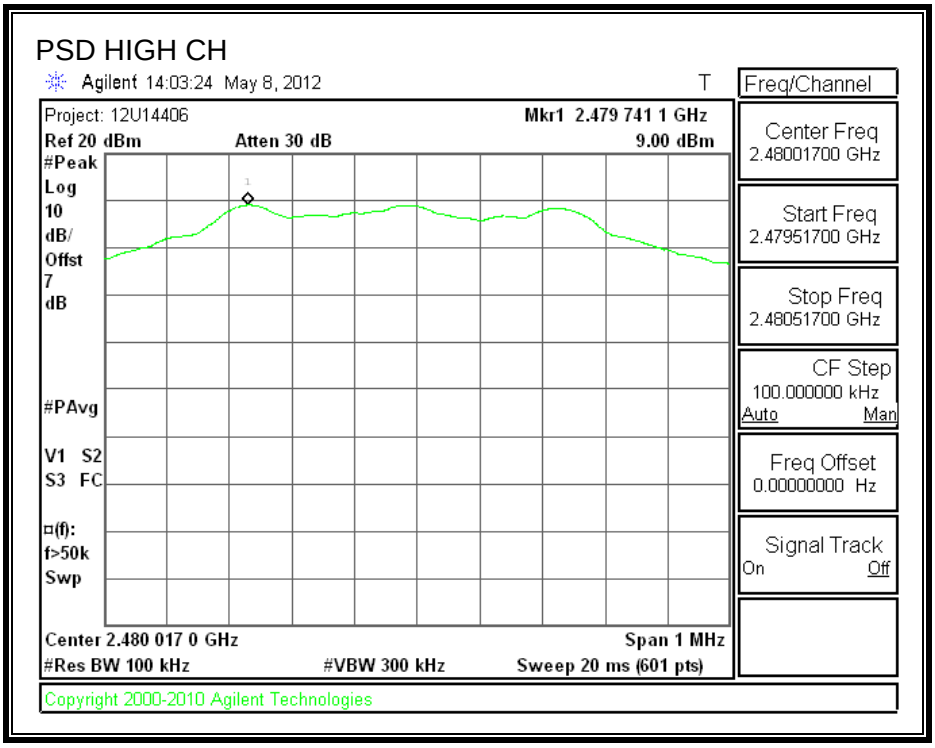
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	10log(3KHz /100KHz) = -15.2	Limit (dBm)	Margin (dB)
Low	2402	8.35	-15.2	8	-14.85
Middle	2440	8.58	-15.2	8	-14.62
High	2480	9.00	-15.2	8	-14.20

POWER SPECTRAL DENSITY







7.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

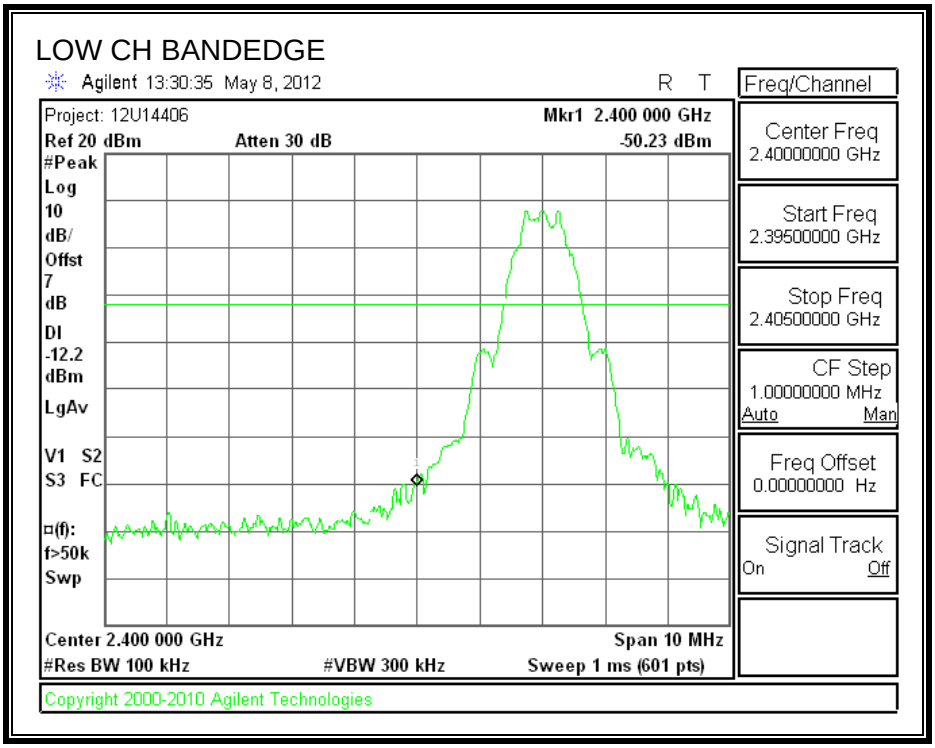
TEST PROCEDURE

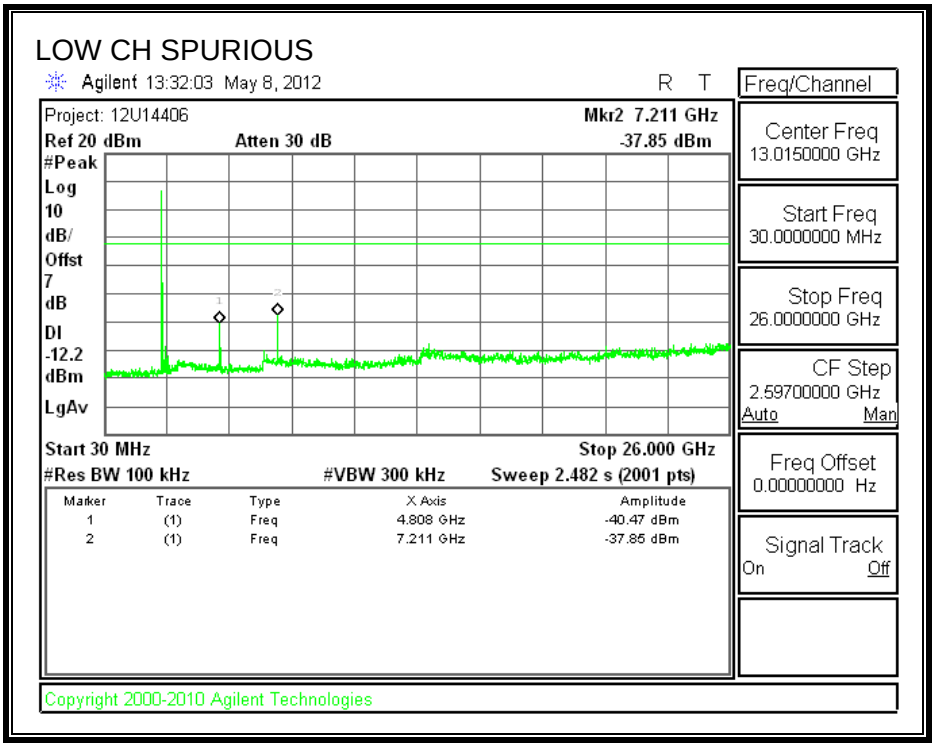
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

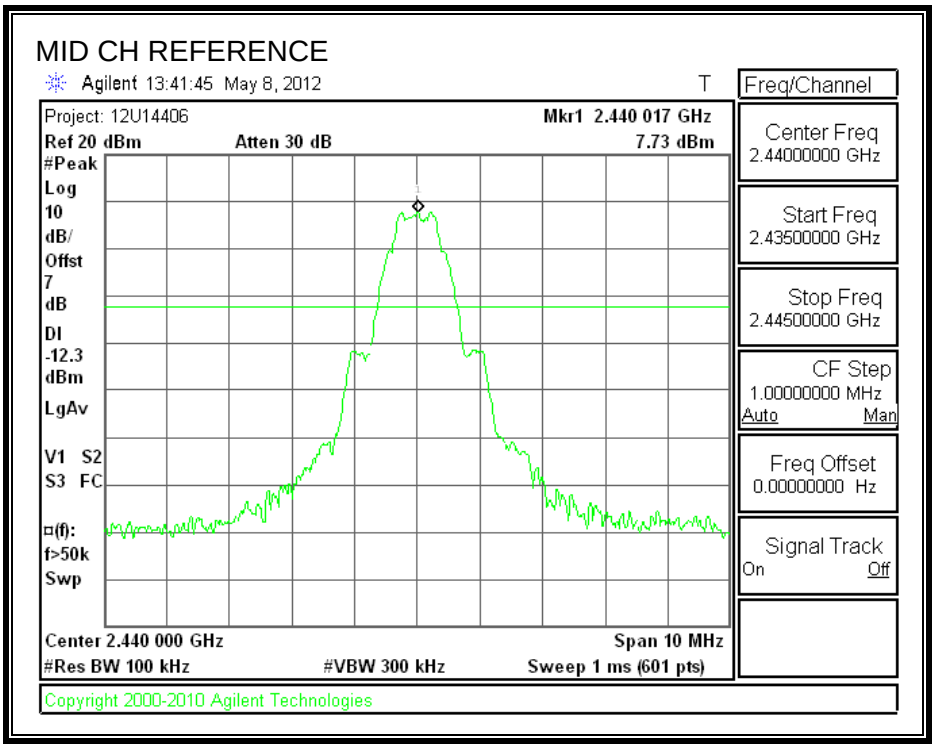
RESULTS

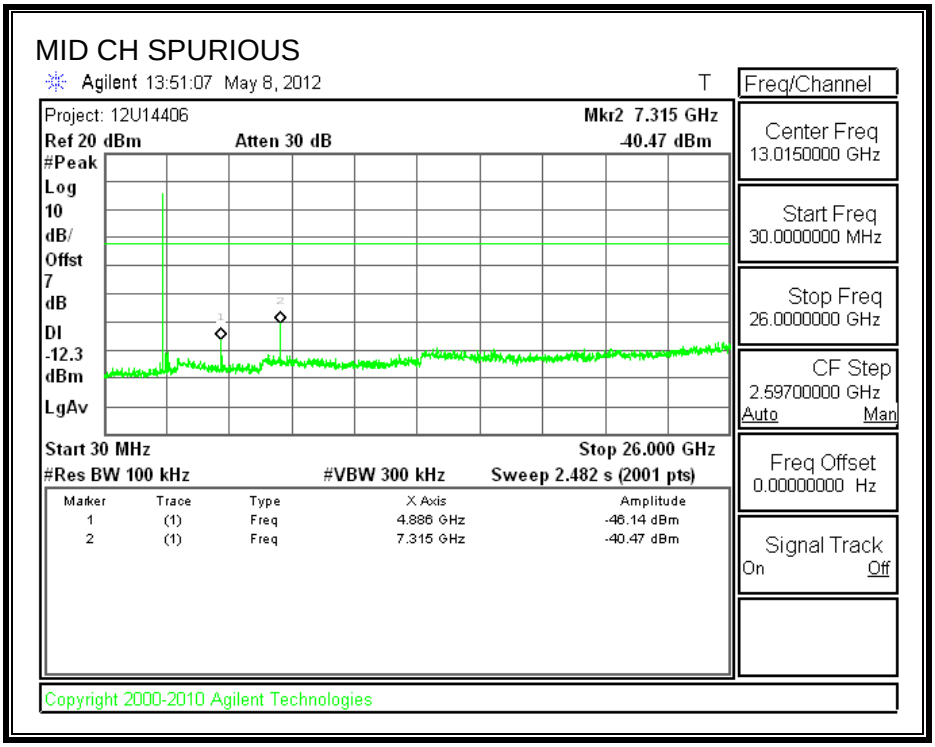
SPURIOUS EMISSIONS, LOW CHANNEL



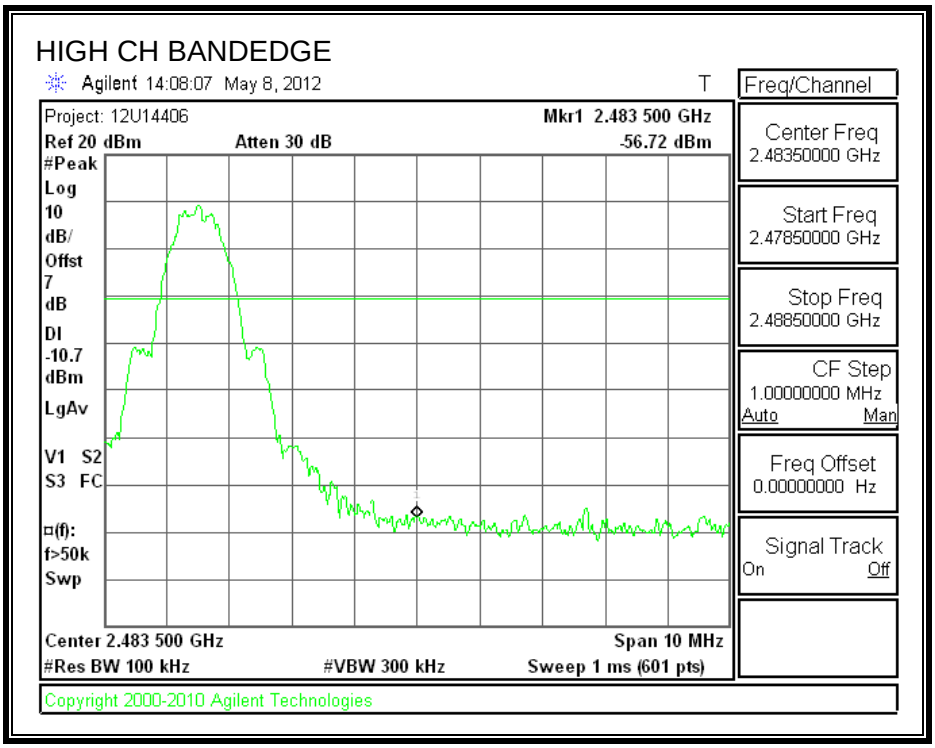


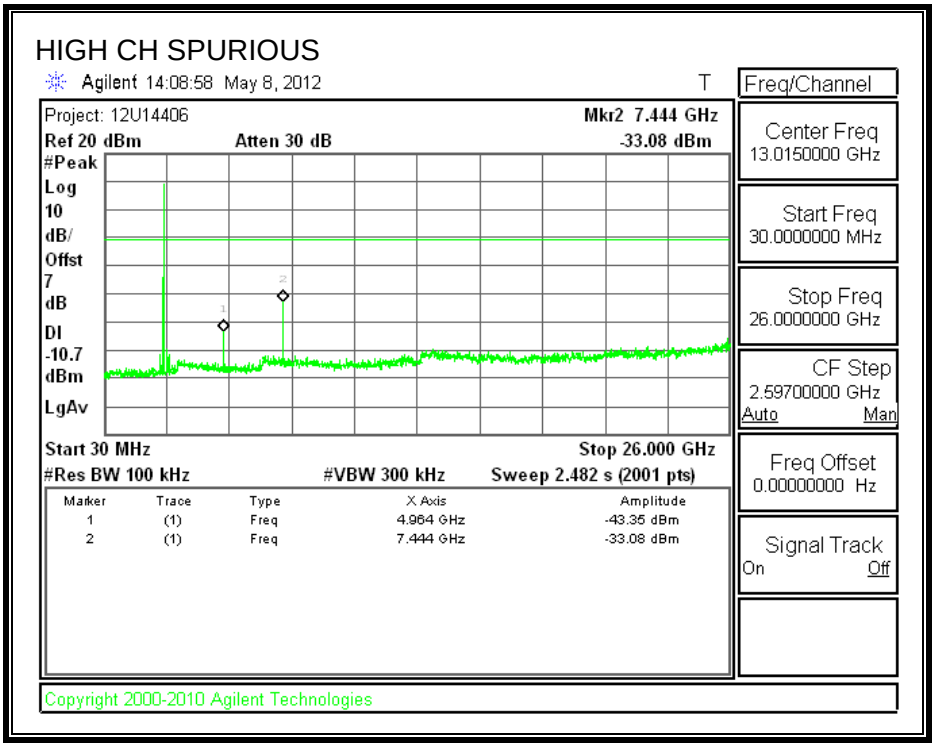
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

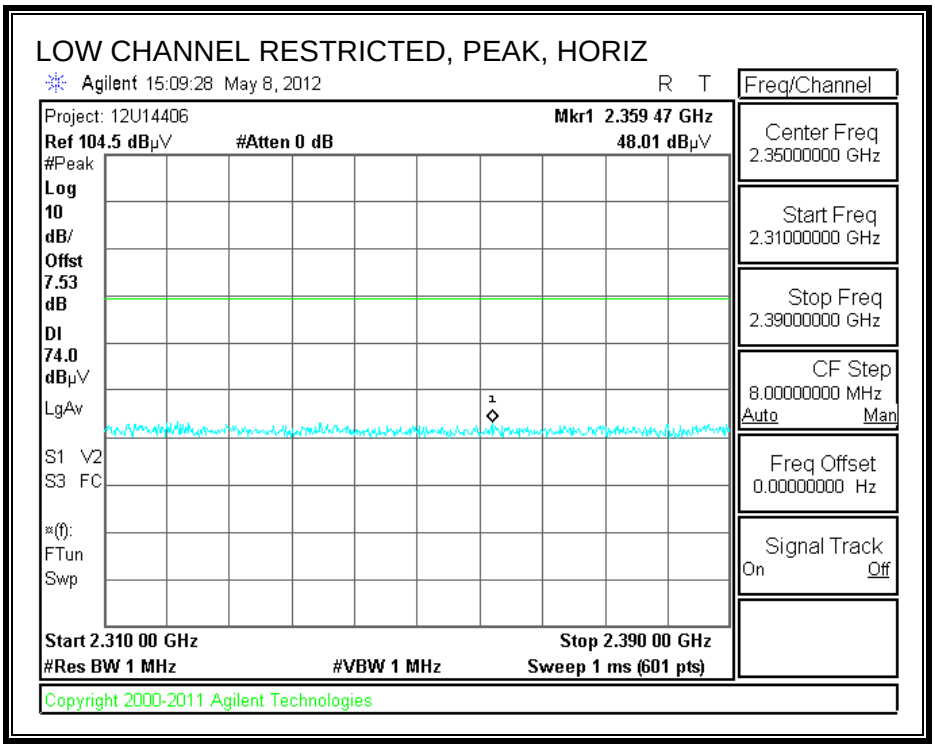
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

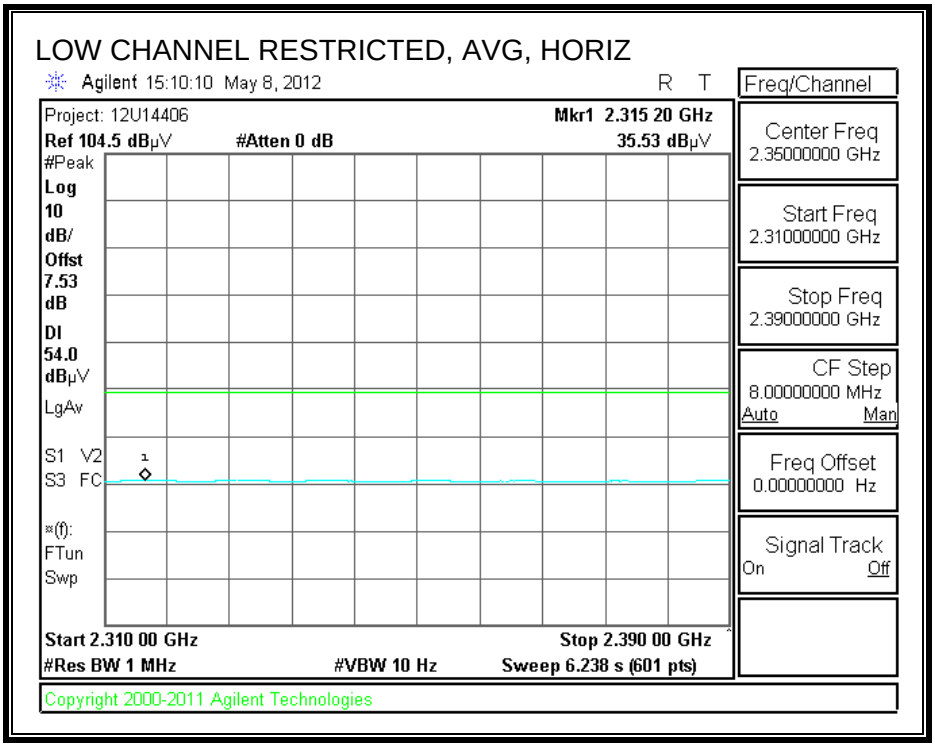
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

8.2. TRANSMITTER ABOVE 1 GHz

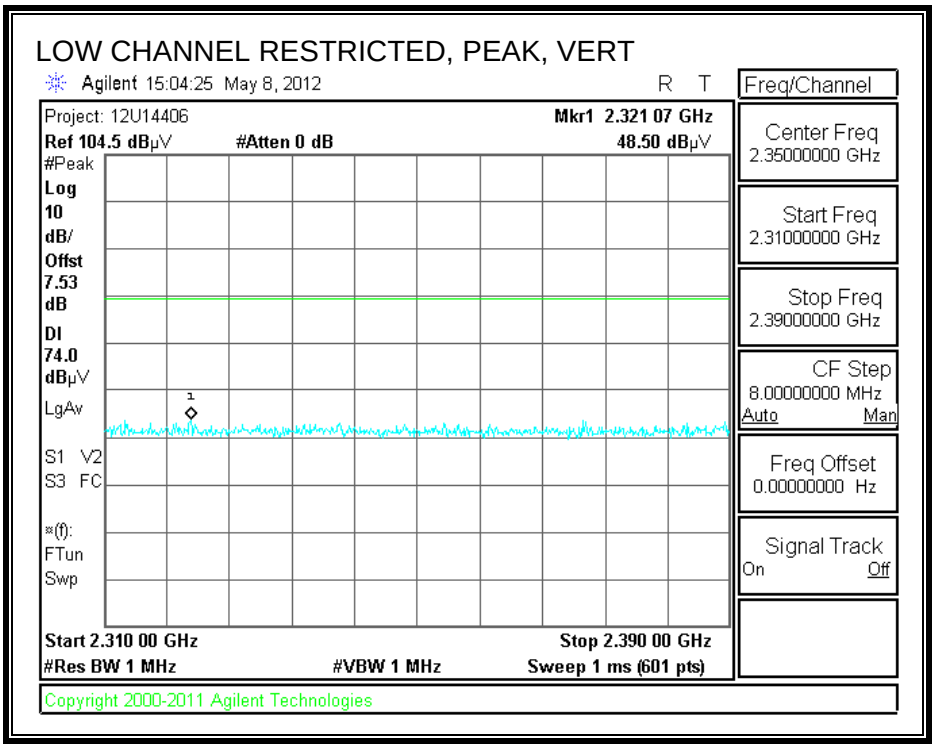
8.2.1. TX ABOVE 1 GHz FOR BLE MODE

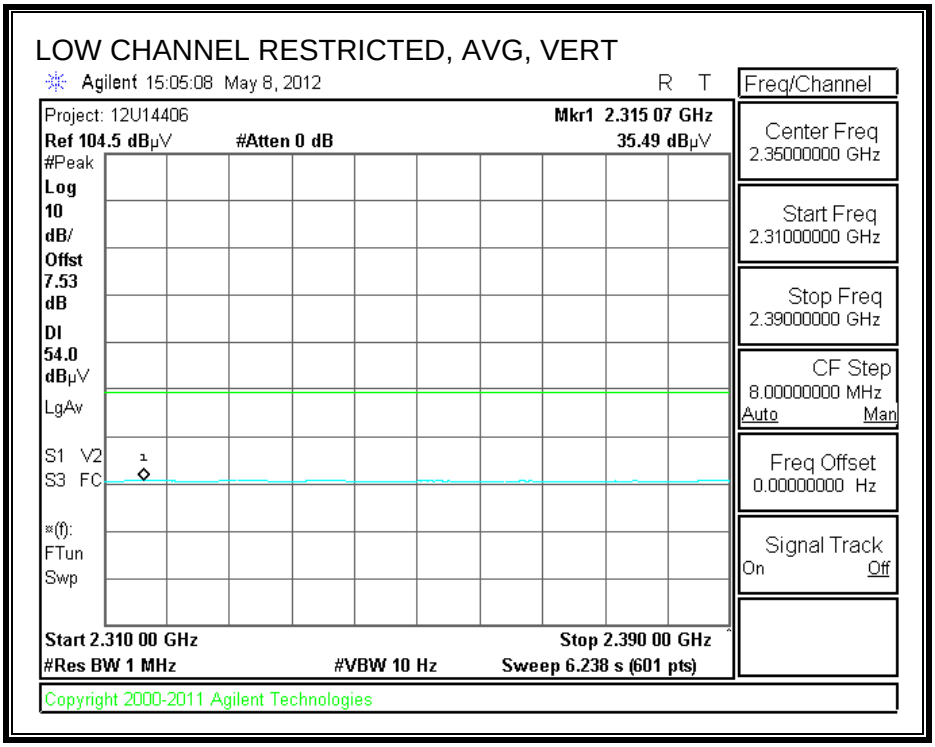
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



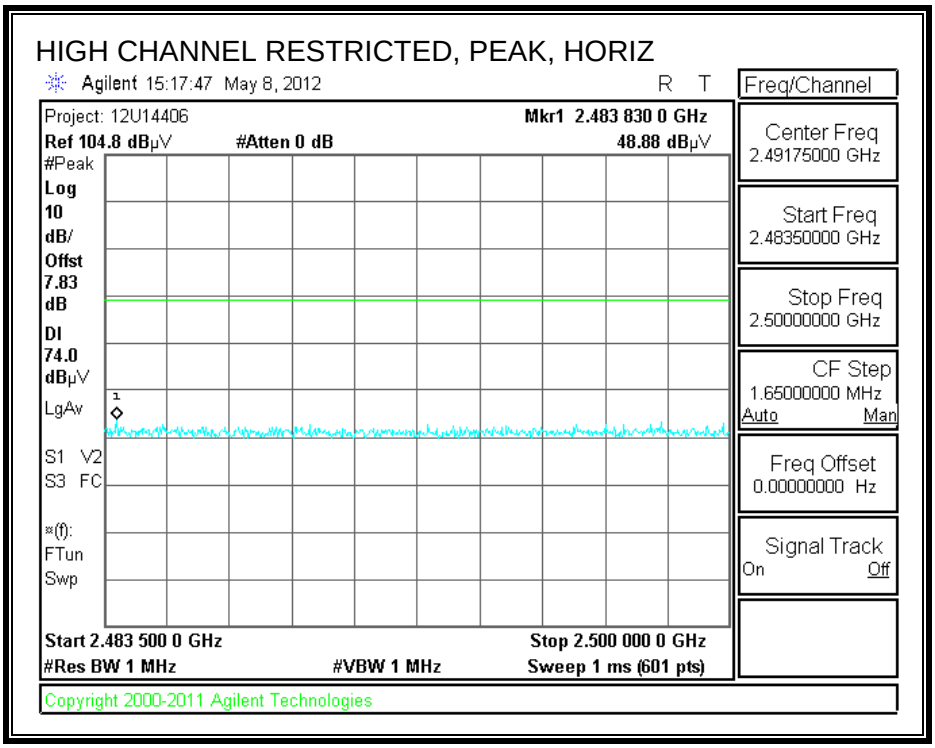


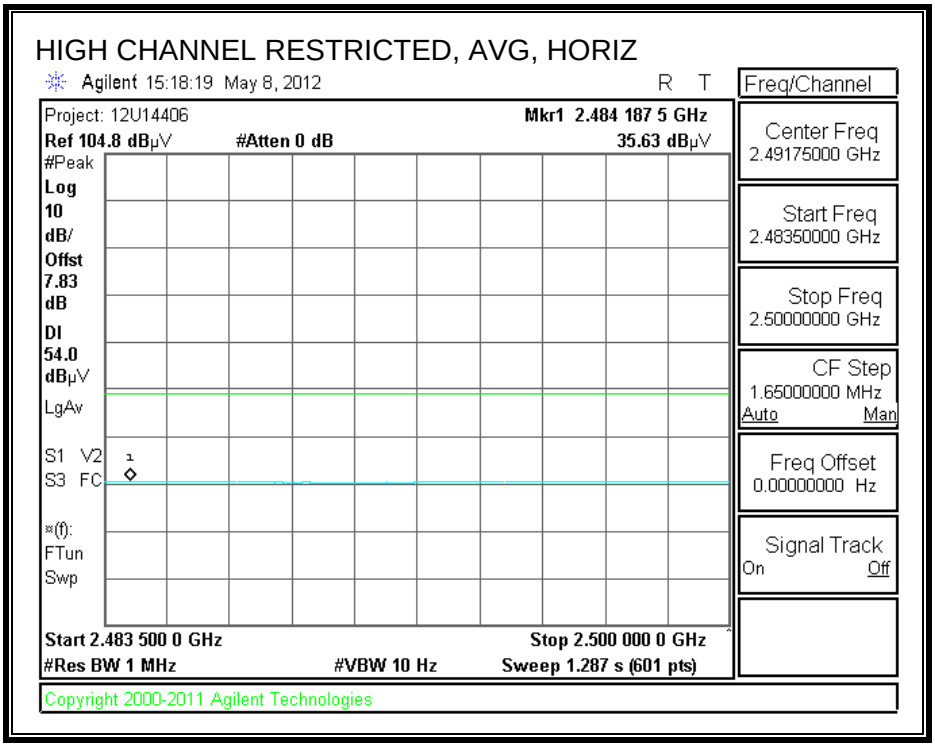
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



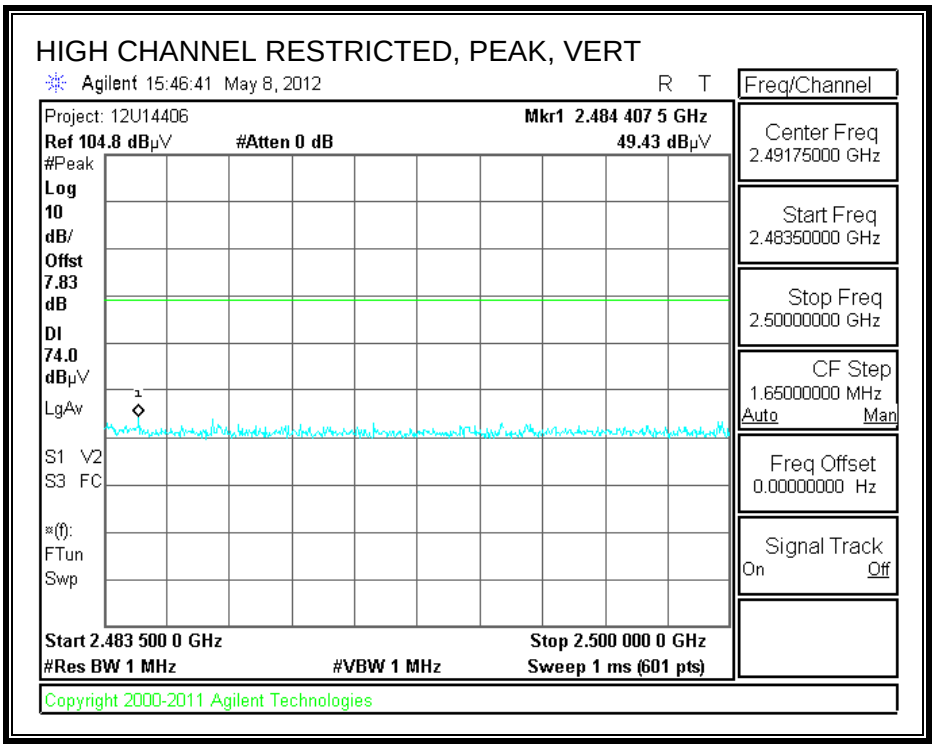


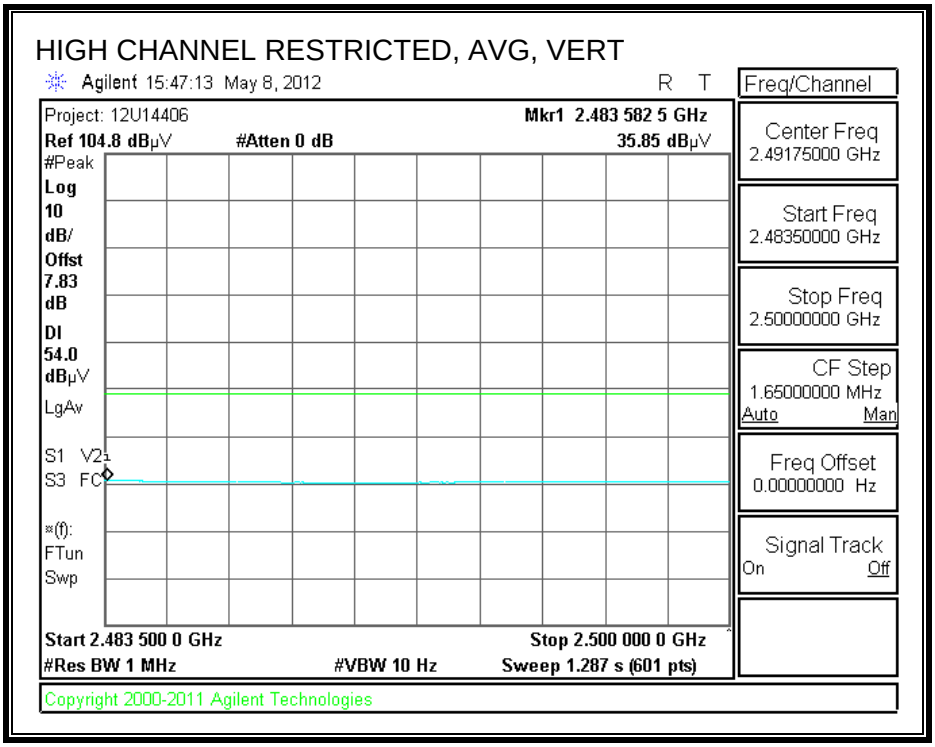
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 05/08/12
Project #: 12U14406
Company: LG Electronics Inc.
Test Target: FCC Class B
Mode Oper: BT LE, TX mode

f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter	

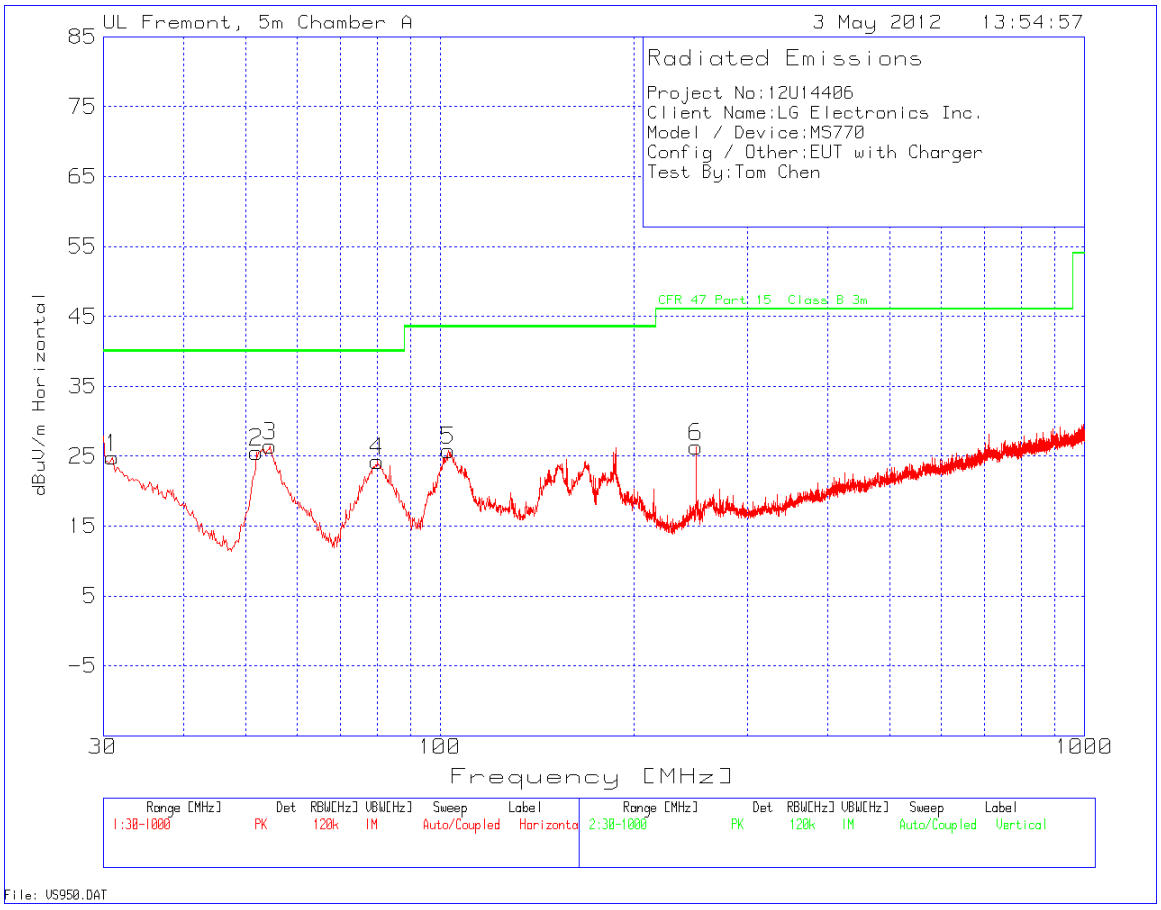
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2402 MHz													
4.804	3.0	46.2	33.1	6.3	-34.8	0.0	0.0	50.7	74.0	-23.3	V	P	
4.804	3.0	34.1	33.1	6.3	-34.8	0.0	0.0	38.6	54.0	-15.4	V	A	
4.804	3.0	46.8	33.1	6.3	-34.8	0.0	0.0	51.3	74.0	-22.7	H	P	
4.804	3.0	34.9	33.1	6.3	-34.8	0.0	0.0	39.4	54.0	-14.6	H	A	
2440 MHz													
4.880	3.0	43.7	33.1	6.3	-34.8	0.0	0.0	48.3	74.0	-25.7	H	P	
4.880	3.0	31.8	33.1	6.3	-34.8	0.0	0.0	36.5	54.0	-17.5	H	A	
4.880	3.0	41.3	33.1	6.3	-34.8	0.0	0.0	45.9	74.0	-28.1	V	P	
4.880	3.0	29.4	33.1	6.3	-34.8	0.0	0.0	34.0	54.0	-20.0	V	A	
2480 MHz													
4.960	3.0	39.7	33.2	6.4	-34.8	0.0	0.0	44.4	74.0	-29.6	V	P	
4.960	3.0	25.4	33.2	6.4	-34.8	0.0	0.0	30.1	54.0	-23.9	V	A	
4.960	3.0	40.3	33.2	6.4	-34.8	0.0	0.0	45.1	74.0	-29.0	H	P	
4.960	3.0	28.2	33.2	6.4	-34.8	0.0	0.0	32.9	54.0	-21.1	H	A	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.3. WORST-CASE BELOW 1 GHz

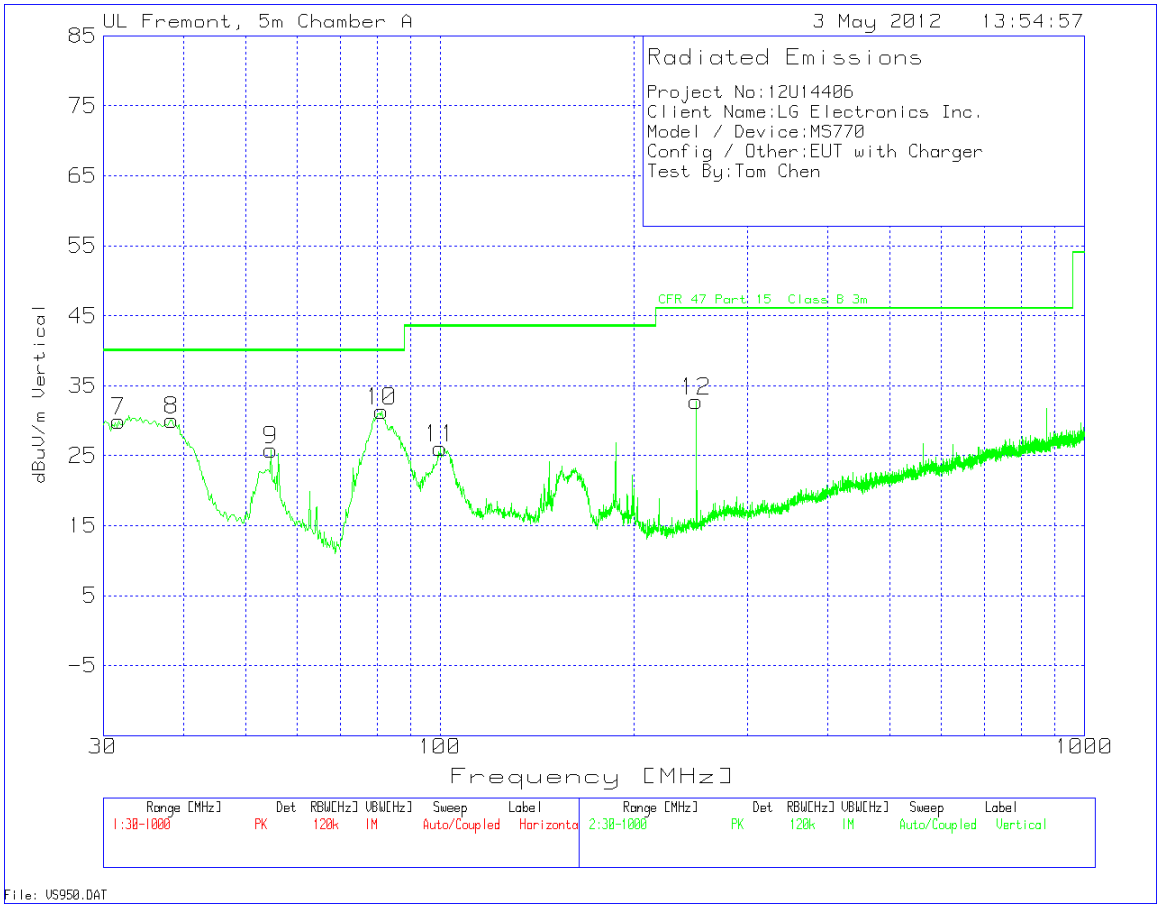
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Project No:12U14406
Client Name:LG Electronics Inc.
Model / Device:MS770
Config / Other:EUT with Charger
Test By:Tom Chen

Horizontal 30 - 1000MHz

Test Frequency	Meter Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX [dB]	T243 Sunol Bilog.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Polarity
30.9692	31.95	PK	-27.5	20.4	24.85	40	-15.15	Horz
51.9045	45.15	PK	-27.2	7.6	25.55	40	-14.45	Horz
54.4245	46.54	PK	-27.3	7.2	26.44	40	-13.56	Horz
80.012	43.72	PK	-27.1	7.7	24.32	40	-15.68	Horz
103.0795	41.69	PK	-26.9	11	25.79	43.5	-17.71	Horz
250.014	40.71	PK	-25.9	11.5	26.31	46	-19.69	Horz

Vertical 30 - 1000MHz

Test Frequency	Meter Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX [dB]	T243 Sunol Bilog.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Polarity
31.7446	37.49	PK	-27.5	20	29.99	40	-10.01	Vert
38.3353	42.37	PK	-27.4	15.1	30.07	40	-9.93	Vert
54.6183	45.87	PK	-27.3	7.2	25.77	40	-14.23	Vert
81.1751	50.82	PK	-27	7.5	31.32	40	-8.68	Vert
100.1719	42.66	PK	-26.9	10.3	26.06	43.5	-17.44	Vert
250.014	47.21	PK	-25.9	11.5	32.81	46	-13.19	Vert

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS

6 WORST EMISSIONS

Project No:12U14406
Client Name:LG Electronics Inc.
Model/Device:MS770
Test Volt/Freq:120 VAC / 60Hz
Test By:TOM CHEN

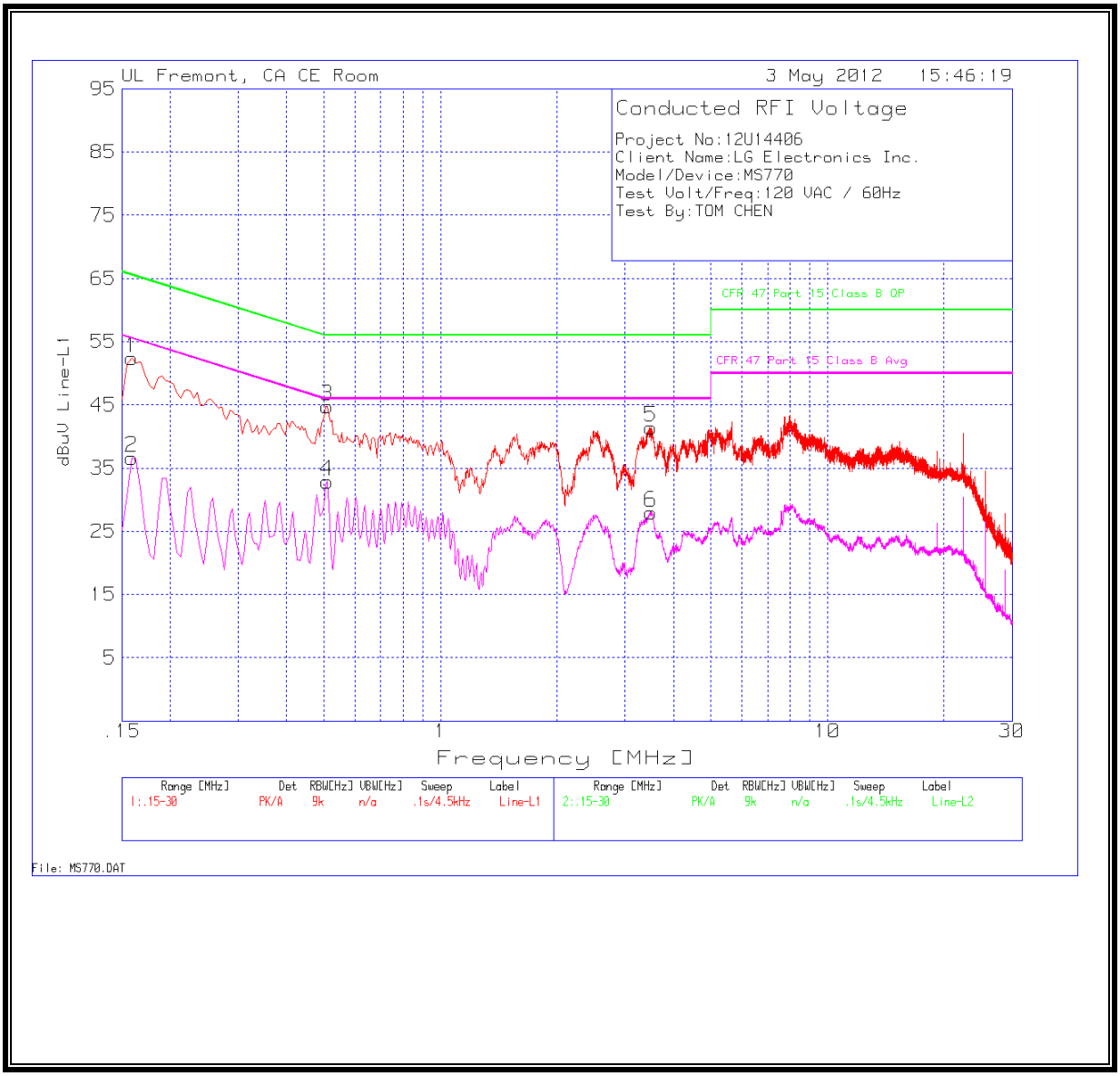
Line-L1 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dBuV	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.159	52.26	PK	0.1	0	52.36	65.5	-13.14	55.5	-3.14
0.159	36.54	Av	0.1	0	36.64	65.5	-28.86	55.5	-18.86
0.51	44.69	PK	0.1	0	44.79	56	-11.21	46	-1.21
0.51	32.73	Av	0.1	0	32.83	56	-23.17	46	-13.17
3.4935	41.26	PK	0.1	0.1	41.46	56	-14.54	46	-4.54
3.4935	27.71	Av	0.1	0.1	27.91	56	-28.09	46	-18.09

Line-L2 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L2.TXT (dB)	LC Cables 2&3.TXT (dB)	dBuV	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.1995	43.94	PK	0.1	0	44.04	63.6	-19.56	53.6	-9.56
0.1995	19.61	Av	0.1	0	19.71	63.6	-43.89	53.6	-33.89
0.3435	41.85	PK	0.1	0	41.95	59.1	-17.15	49.1	-7.15
0.3435	20.4	Av	0.1	0	20.5	59.1	-38.6	49.1	-28.6
0.582	42.71	PK	0.1	0	42.81	56	-13.19	46	-3.19
0.582	22.59	Av	0.1	0	22.69	56	-33.31	46	-23.31

LINE 1 RESULTS



LINE 2 RESULTS