FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

NFC MODULE

MODEL NUMBER: MIC-001

FCC ID: A8XMRDB20
IC: 5825B-MRDB20

REPORT NUMBER: 12J14232-1A

ISSUE DATE: MARCH 05, 2012

Prepared for
HONG FU JIN PRECISION ELECTRONS (YANTAI) CO., LTD.
B SECTION, EXPORT PROCESSING ZONE, NO.50, BEIJING ZHONG ROAD,
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Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	03/01/2012	Initial Issue	F. Ibrahim
A	03/05/2012	Revised type error, Re-measured AC mains line conducted emission with antenna	F. Ibrahim

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COMPLIANCE CERTIFICATION SERVICES FORM NO: CCSUP4701C
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Hong Fu Jin Precision Electrons (Yantai) Co., Ltd.
B Section, Export Processing Zone, No.50, Beijing Zhong Road, Yantai, Economic &Technological Development Area, Shandong, P.R. China

EUT DESCRIPTION: NFC MODULE

MODEL: MIC-001

SERIAL NUMBER: A2

DATE TESTED: JANUARY 16 – MARCH 01, 2012

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Pass
INDUSTRY CANADA RSS-210 Issue 8	Pass

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

FRANK IBRAHIM
EMC SUPERVISOR
UL CCS

Tested By:

MENGISTU MEKURIA
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, 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.

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 NFC Module, a 13.56MHz card reader Module.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum E field as follows:

Frequency (MHz)	Mode	Fundamental E field @ 10m distance (dBuv/m)
13.56	Normal TX mode	57.07

EIRP = E field at 3m distance – 95.2
E field at 3m distance = E field at 10m distance + 20 = 57.07 + 20 = 77.07 dBuV/m
EIRP = 77.07 -95.2 = **-18.13 dBm**

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The 13.56MHz antenna is integral PCB loop antenna.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was NFCTEST Tool.exe.

5.5. WORST-CASE CONFIGURATION AND MODE

EUT was powered by AC/DC adapter and connected to laptop PC.

Three types of tags were measured along with the radio module; type B had the highest fundamental field strength.

Type A uses almost 100% modulation depth, type B use 10% modulation depth and type F uses approximately 25 % modulation depth.

The EUT was investigated in three different positions, X, Y, & Z; it was found that X position was worst-case with highest fundamental signal; therefore, all final radiated testing was performed with the EUT in the X position.

5.6. DESCRIPTION OF TEST SETUP

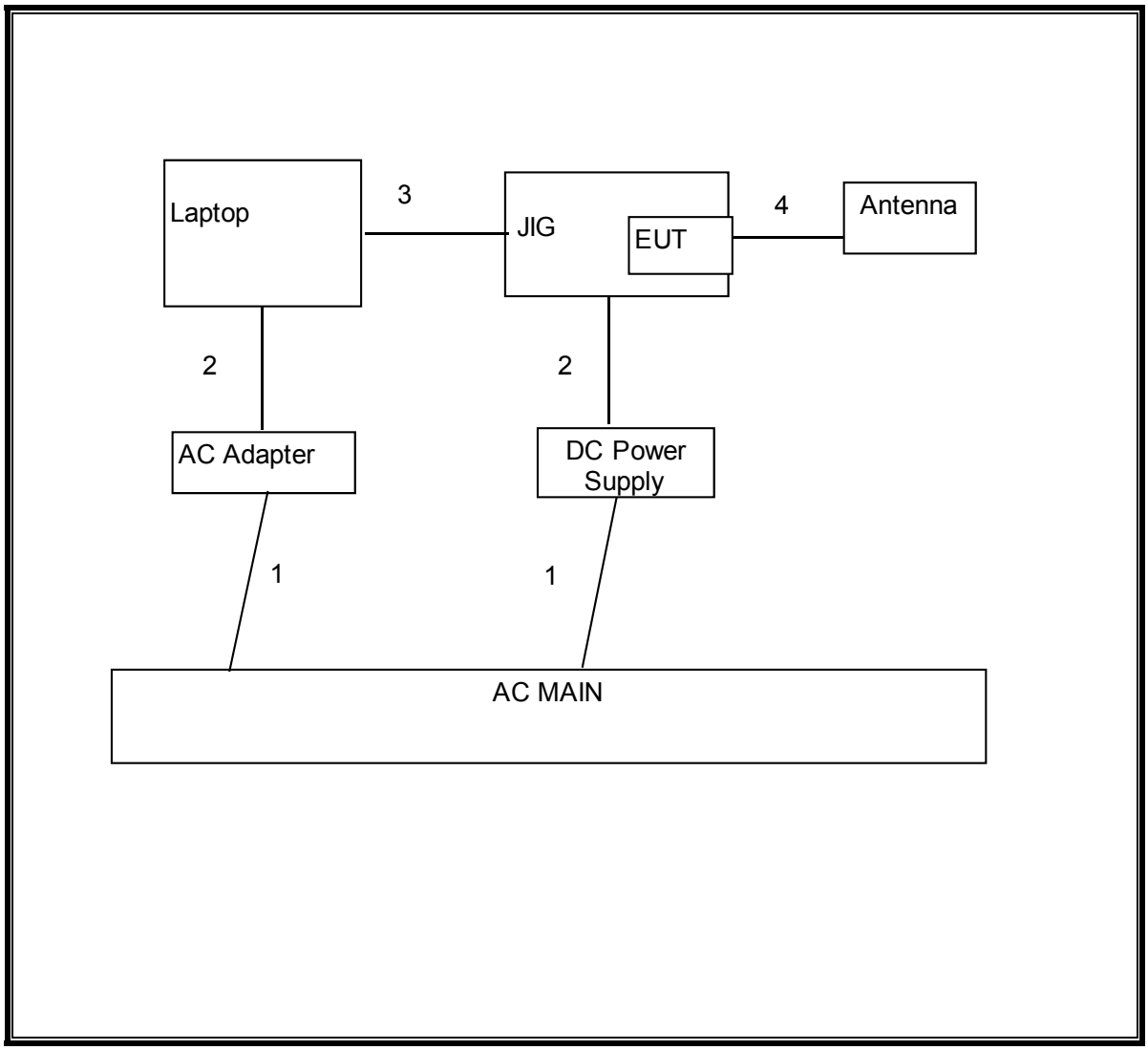
SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
LAPTOP	Compaq	Presario F700	CNF7458G3Q
AC/DC Adapter	Compaq	380467-003	F3-07091411250E
DC Power Supply	HP	E3610A	KR24104150

I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	2	US 115V	Un-shielded	2m	N/A
2	DC	2	DC	Un-shielded	2m	N/A
3	Jig	1	USB	Un-shielded	2m	N/A
4	Twisted Pair	1	Ant	Un-shielded	0.4m	N/A

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**	**S/N**	**Cal Due**
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	04/11/12
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	08/04/12
EMI Receiver, 6.5GHz	Agilent / HP	85462A	3807A00457	12/23/13
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	07/06/12
Antenna, Loop, 30 MHz	EMCO	6502	C00593	01/12/13
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	05/04/12
Bilog Antenna	Sunol Science	JB1	A121003	07/16/12
Pre-amplifier	Agilent / HP	8447D	1937A02062	11/11/12
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	12/13/12

7. RADIATED EMISSION TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMIT

§15.225
IC RSS-210, Section 2.6 (Transmitter)
IC RSS-GEN, Section 6 (Receiver)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (μV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

TEST PROCEDURE

ANSI C63.4

The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56MHz; therefore, the frequency range was investigated from 30 MHz to 1000 MHz.

The EUT uses the following frequencies:
13MHz and 13.56MHz

RESULTS

7.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)

7.2.1. TAG A

FCC Part 15, Subpart B & C **10 Meter Distance Measurement At Open Field**

Company: Foxconn
Project #: 12J14232
Model #: MIC-001
Tester: Mengistu Mekuria
Date: 02/21/12

Frequency (MHz)	PK (dBu/V)	QP (dBu/V)	AV (dBuV)	AF dB/m	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes
Loop Antenna Face On: X-Position												
13.56	37.34		N/A	10.556	-19.08	28.81	N/A	84.00	N/A	-55.2	N/A	Fundamental @ 10m Dist
Y-Poswition												
13.56	35.2		N/A	10.556	-19.08	26.67	N/A	84.00	N/A	-57.3	N/A	Fundamental @ 10m Dist
Z-Poswition												
13.56	36.47		N/A	10.556	-19.08	27.94	N/A	84.00	N/A	-56.1	N/A	Fundamental @ 10m Dist
Loop Antenna Face Off: X-Position												
13.56	39.44		N/A	10.556	-19.08	30.91	N/A	84.00	N/A	-53.1	N/A	Fundamental @ 10m Dist
Y-Position												
13.56	35.96		N/A	10.556	-19.08	27.43	N/A	84.00	N/A	-56.6	N/A	Fundamental @ 10m Dist
Z-Position												
13.56	36.31		N/A	10.556	-19.08	27.78	N/A	84.00	N/A	-56.2	N/A	Fundamental @ 10m Dist

* No more emissions were found up to 30MHz

Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector.

P.K. = Peak
Q.P. = Quasi Peak Reading
A.F. = Antenna factor

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7.2.2. TAG B

FCC Part 15, Subpart B & C **10 Meter Distance Measurement At Open Field**

Company: Foxconn
Project #: 12J14232
Model #: MIC-001
Tester: Mengistu Mekuria
Date: 1/16/2012
Tag B

Frequency (MHz)	PK (dBu/V)	QP (dBu/V)	AV (dBuV)	AF dB/m	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes
Loop Antenna Face On:												
X-Pos												
13.56	42.96	42.96	N/A	10.56	-19.08	34.43	N/A	84.00	N/A	-49.6	N/A	Fundamental @ 10m Dist
Y-Pos												
13.56	36.91	36.91	N/A	10.56	-19.08	28.38	N/A	84.00	N/A	-55.6	N/A	Fundamental @ 10m Dist
Z-Pos												
13.56	38.35	38.35	N/A	10.56	-19.08	29.82	N/A	84.00	N/A	-54.2	N/A	Fundamental @ 10m Dist
Loop Antenna Face Off:												
X-Pos												
13.56	46.51	46.51	N/A	10.56	-19.08	37.98	N/A	84.00	N/A	-46.0	N/A	Fundamental @ 10m Dist
Y-Pos												
13.56	38.44	38.44	N/A	10.56	-19.08	29.91	N/A	84.00	N/A	-54.1	N/A	Fundamental @ 10m Dist
Z-Pos												
13.56	40.48	40.48	N/A	10.56	-19.08	31.95	N/A	84.00	N/A	-52.0	N/A	Fundamental @ 10m Dist

* No more emissions were found up to 30MHz

Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector.

P.K. = Peak
Q.P. = Quasi Peak Readings
A.F. = Antenna factor

7.2.3. TAG F

FCC Part 15, Subpart B & C **10 Meter Distance Measurement At Open Field**

Company: Foxconn
Project #: 12U14232
Model #: MIC-001
Tester: Mengistu Mukuria
Date: 02/24/2012

Frequency (MHz)	PK (dBu/V)	QP (dBu/V)	AV (dBuV)	AF dB/m	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes
Loop Antenna Face On:												
X-Position												
13.56	36.17		N/A	10.56	-19.08	27.64	N/A	84.00	N/A	-56.4	N/A	Fundamental @ 10m Dist
Y-Poswition												
13.56	34.67		N/A	10.56	-19.08	26.14	N/A	84.00	N/A	-57.9	N/A	Fundamental @ 10m Dist
Z-Poswition												
13.56	33.18		N/A	10.56	-19.08	24.65	N/A	84.00	N/A	-59.3	N/A	Fundamental @ 10m Dist
Loop Antenna Face Off:												
X-Position												
13.56	35.57		N/A	10.56	-19.08	27.04	N/A	84.00	N/A	-57.0	N/A	Fundamental @ 10m Dist
Y-Position												
13.56	35.75		N/A	10.56	-19.08	27.22	N/A	84.00	N/A	-56.8	N/A	Fundamental @ 10m Dist
Z-Position												
13.56	34.23		N/A	10.56	-19.08	25.70	N/A	84.00	N/A	-58.3	N/A	Fundamental @ 10m Dist

* No more emissions were found up to 30MHz

Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector.

P.K. = Peak
Q.P. = Quasi Peak Reading
A.F. = Antenna factor

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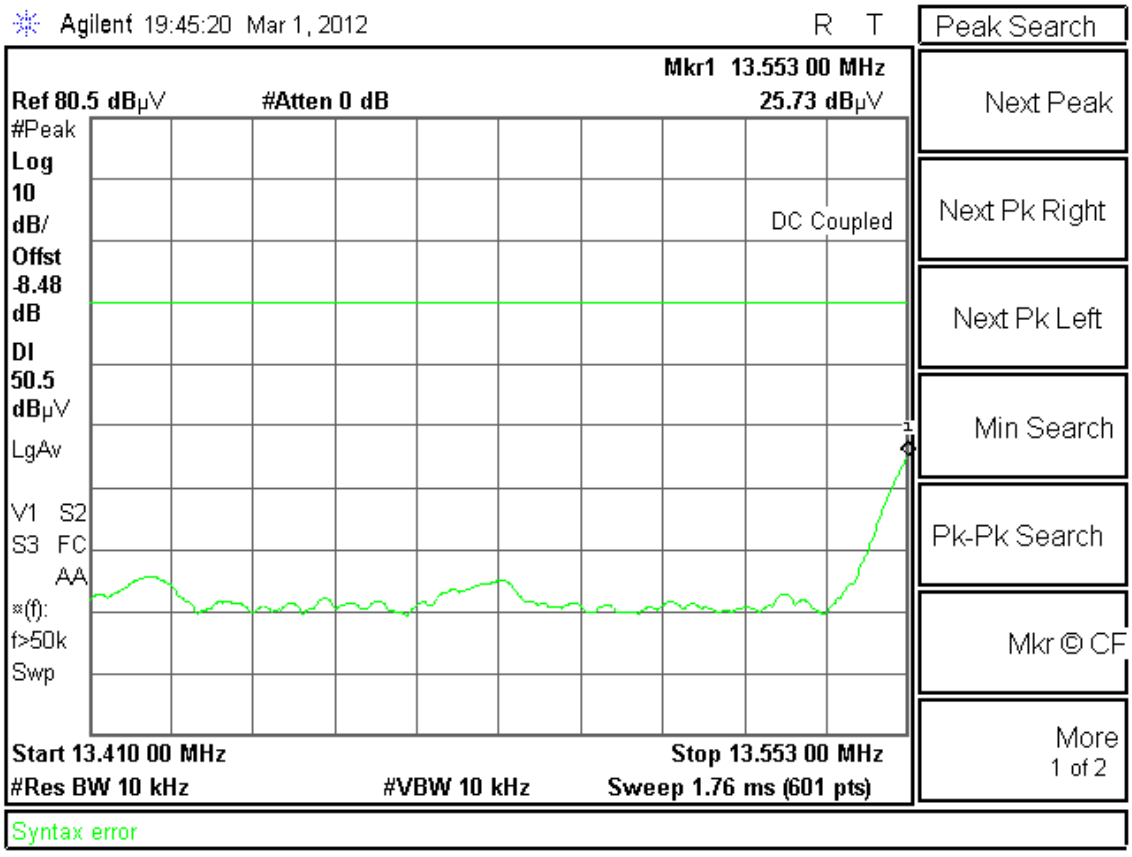
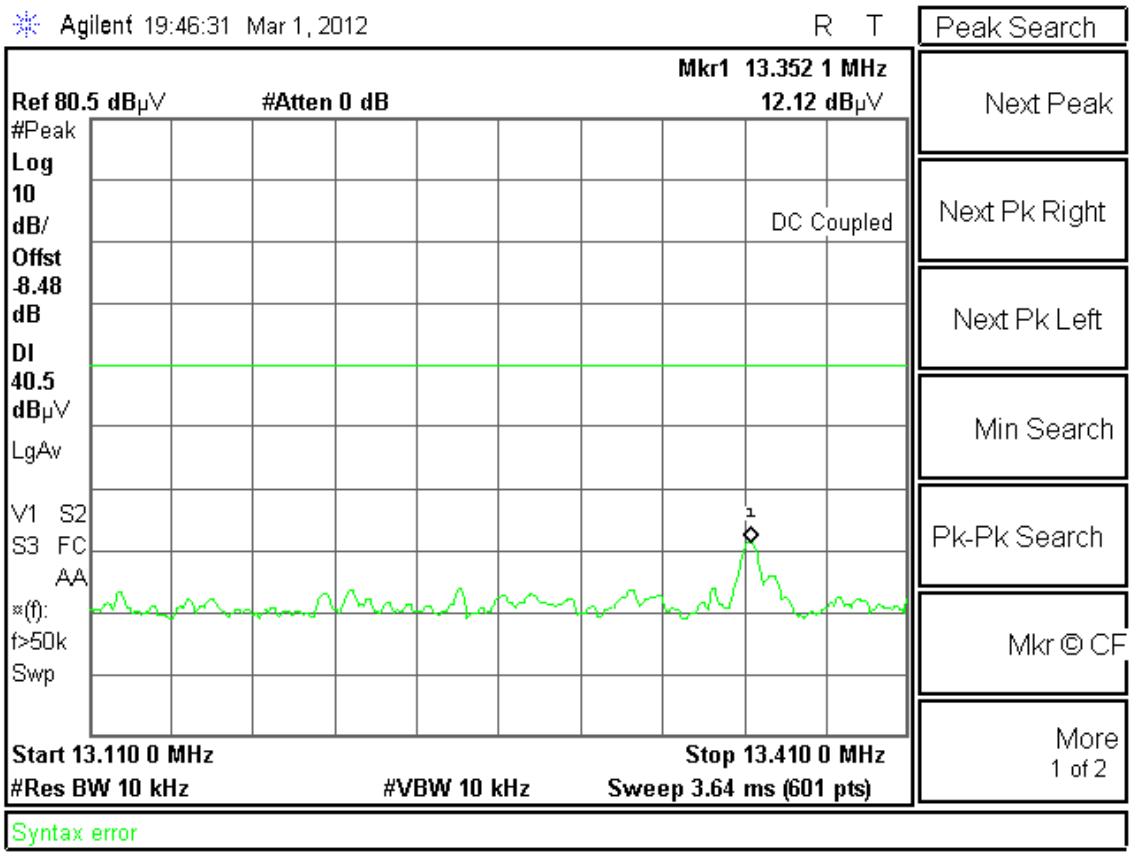
7.3. BAND EDGE MEASUREMENT

7.3.1. TAG A

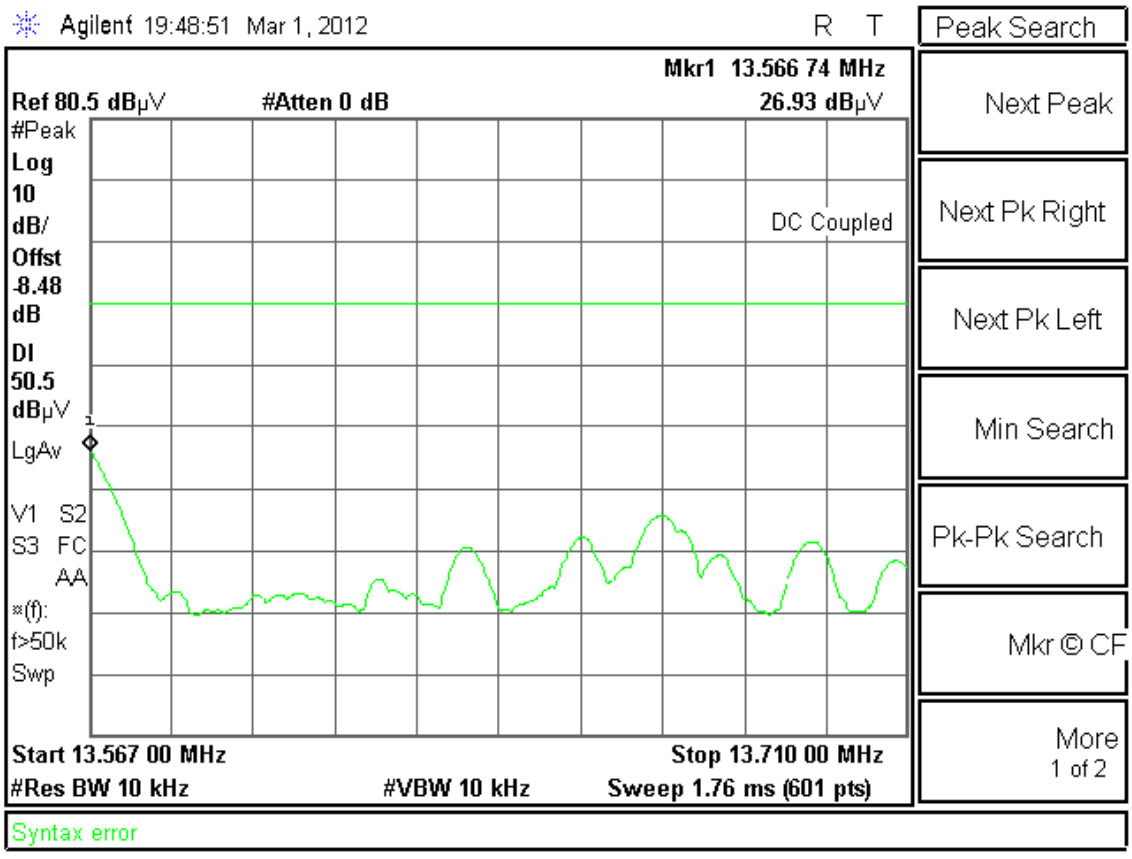
13.410–13.553 MHz



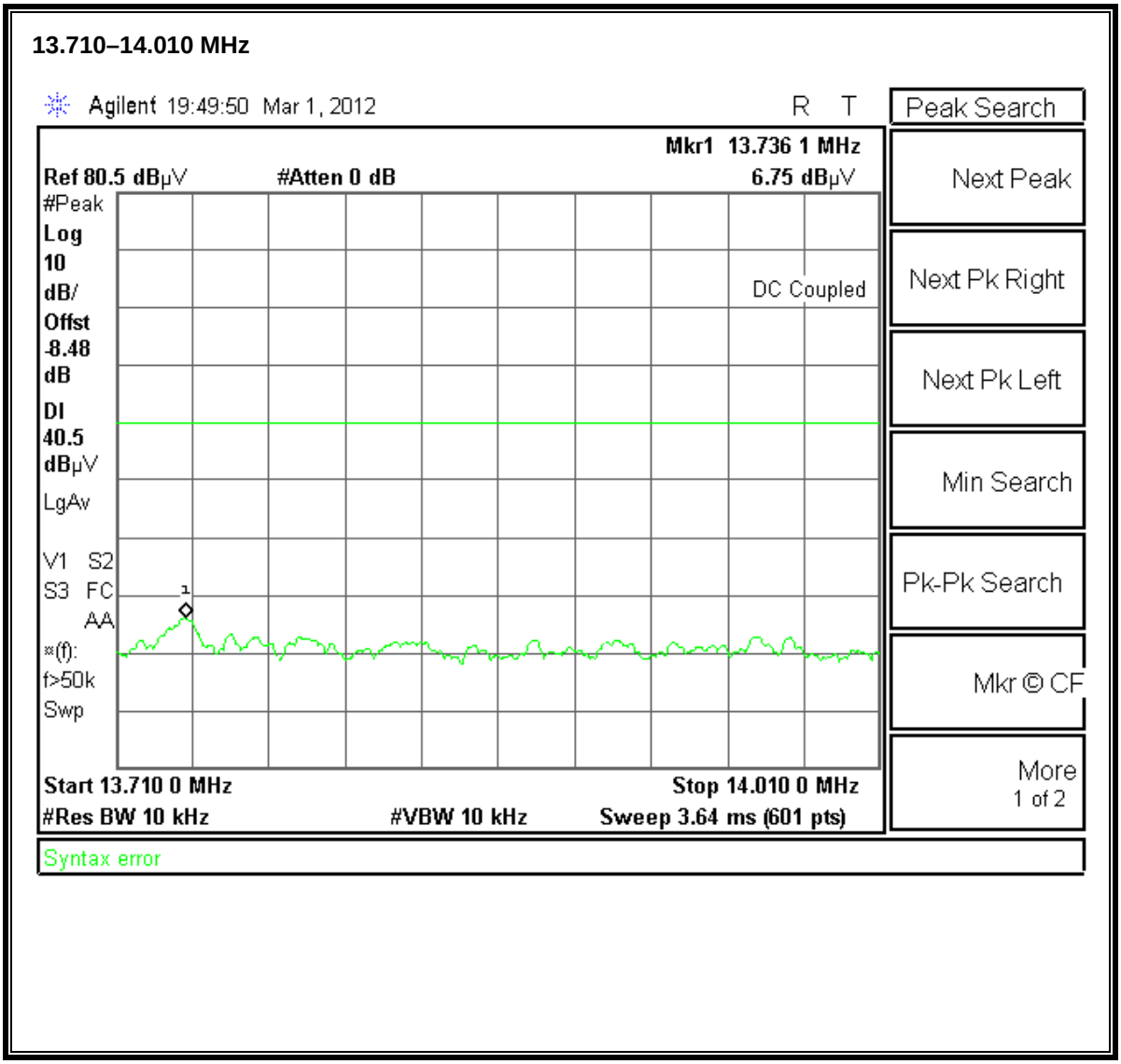
13.110–13.410



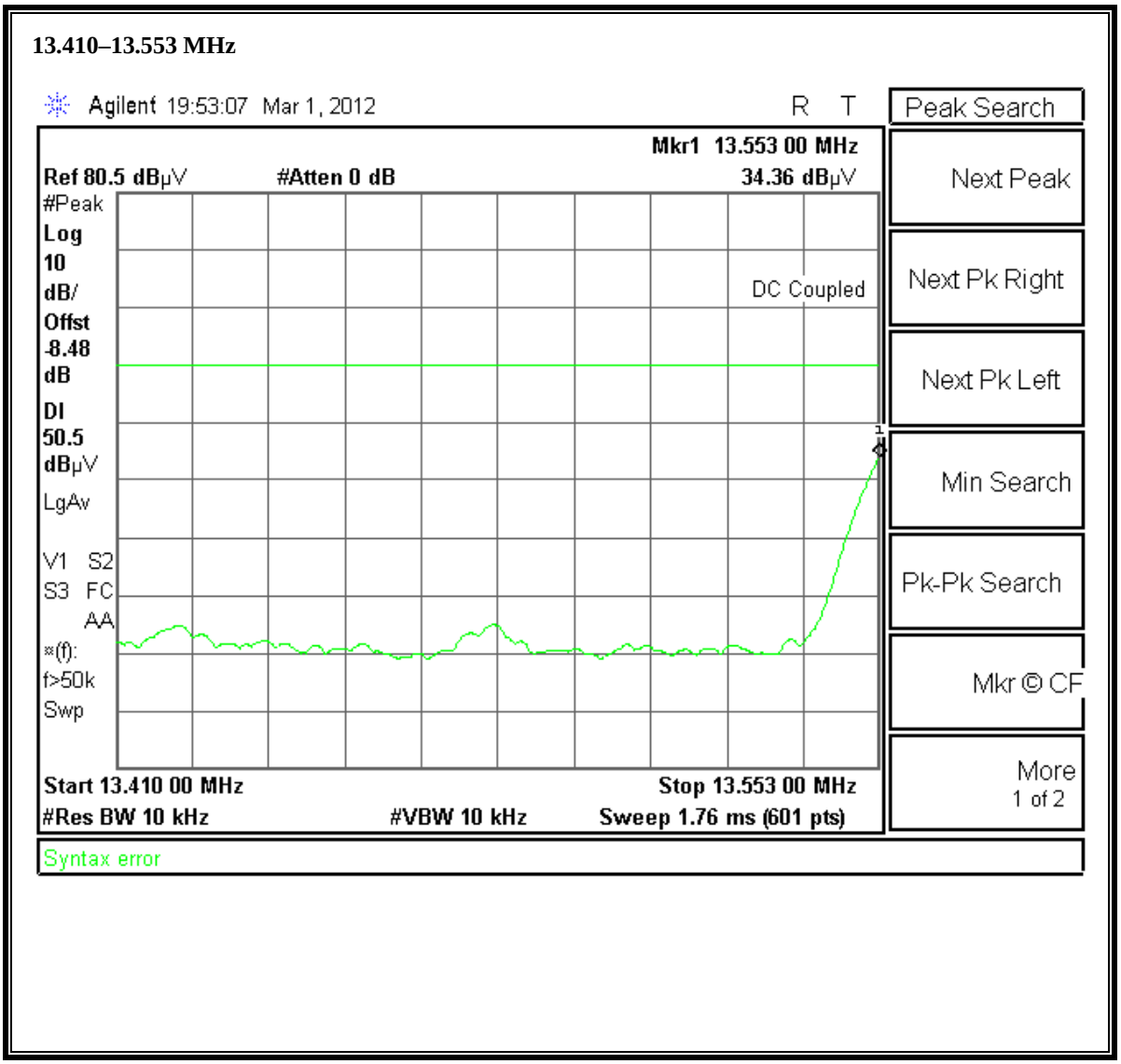
13.567–13.710 MHz



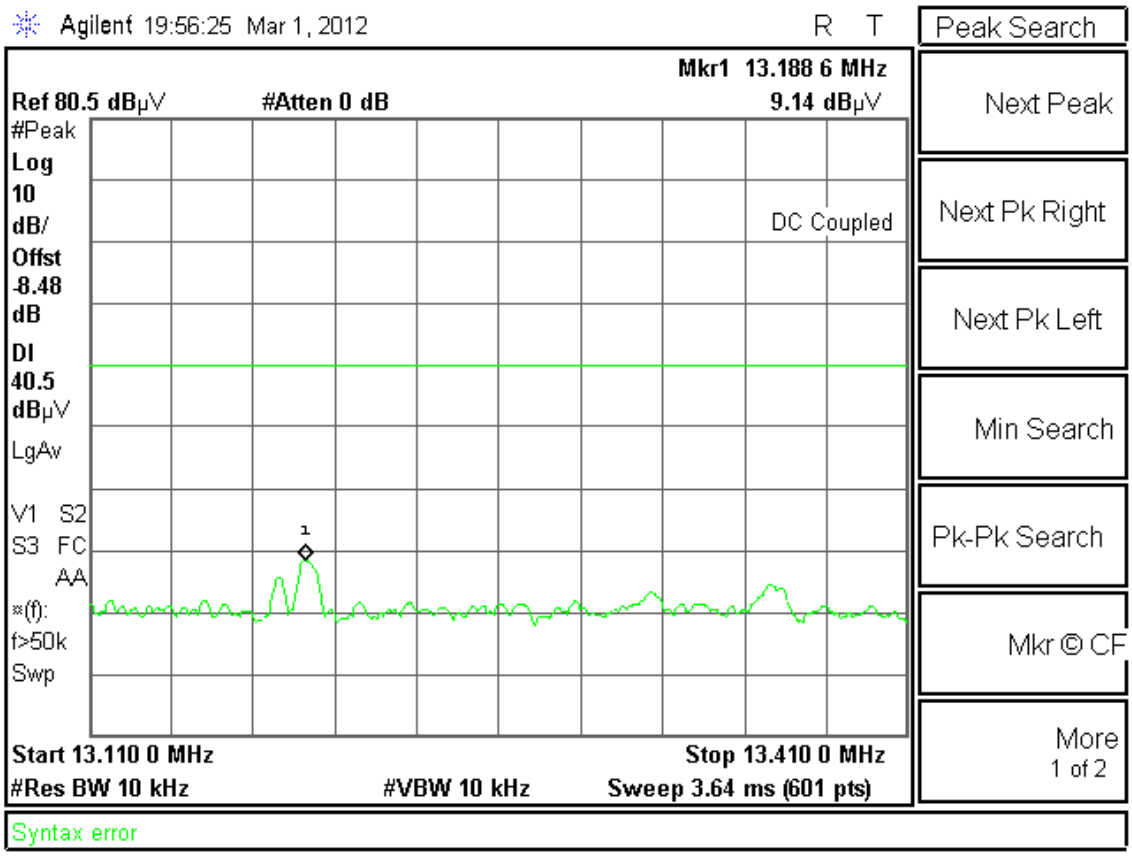
13.710–14.010 MHz



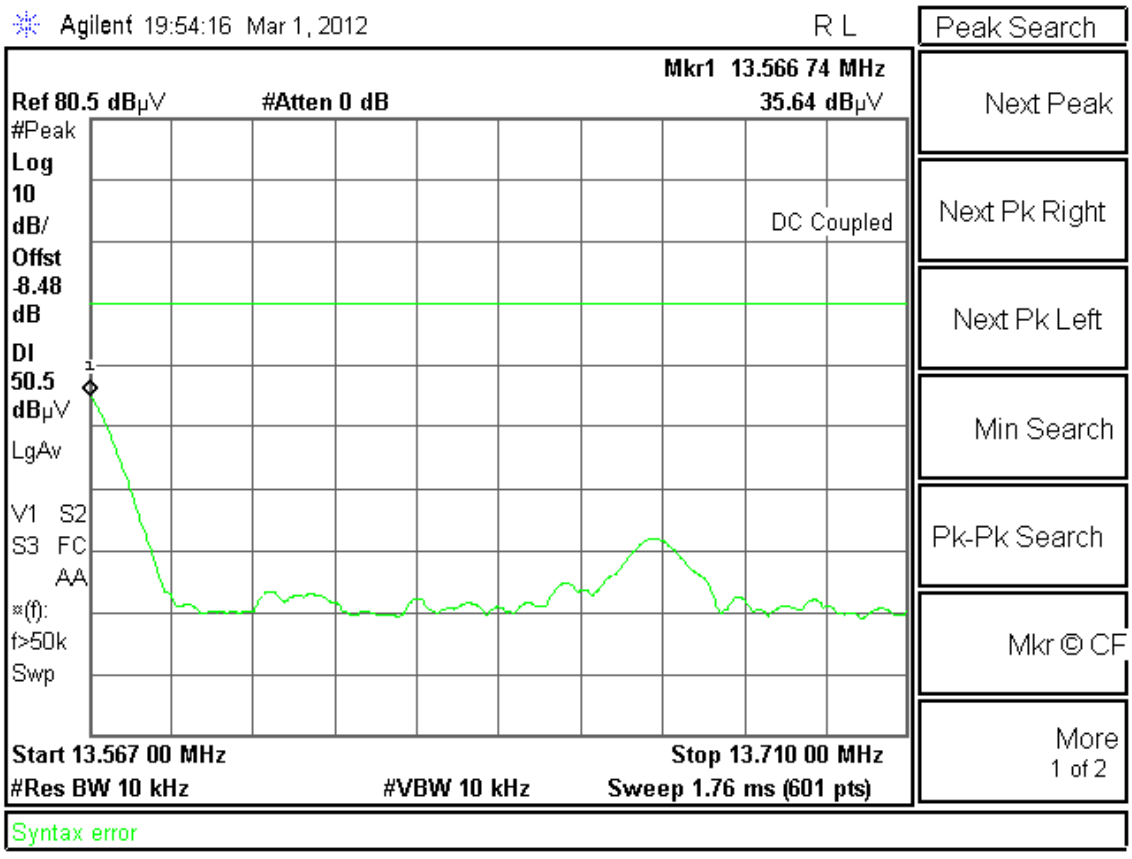
7.3.1. TAG B



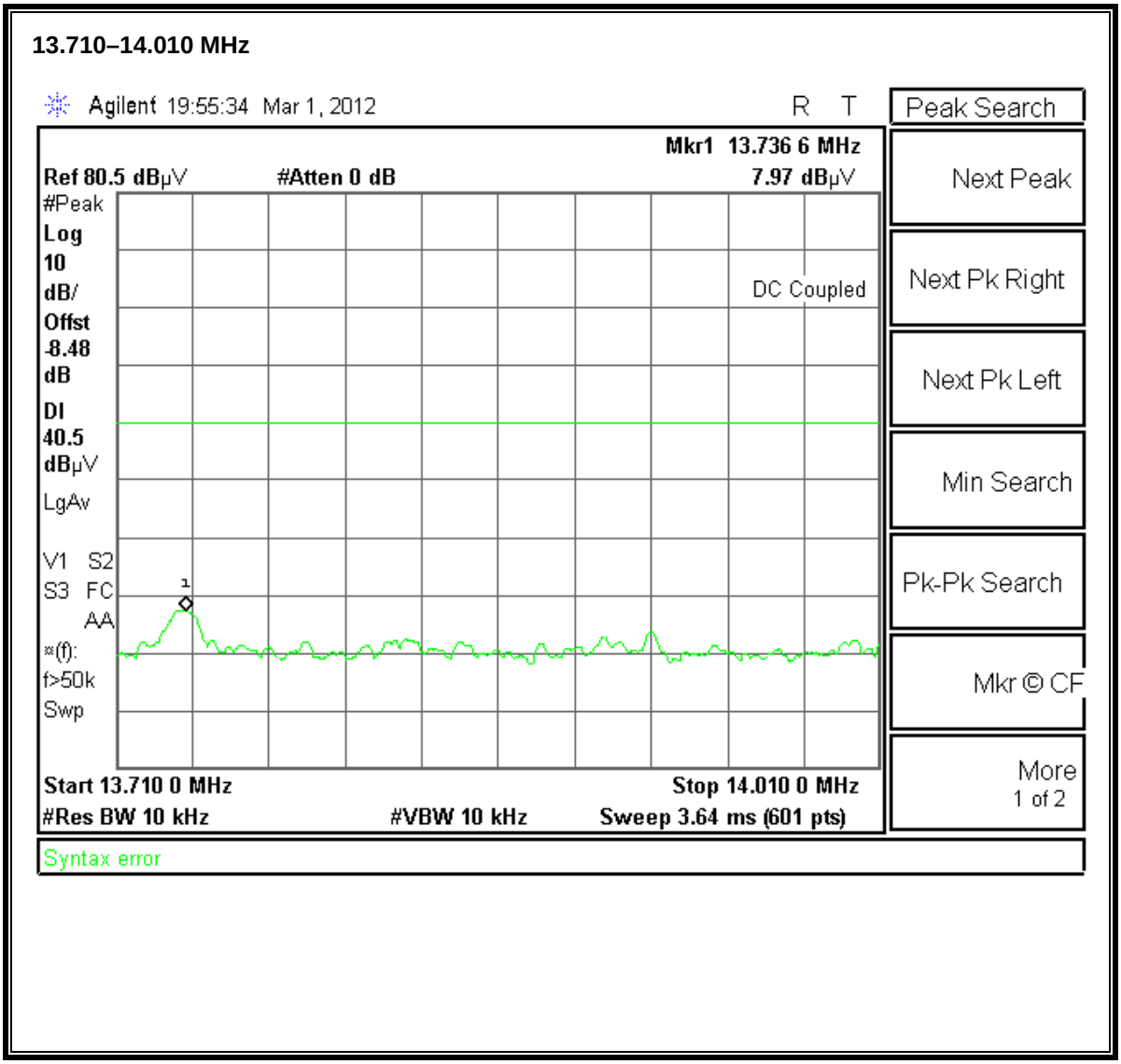
13.110–13.410



13.567–13.710 MHz

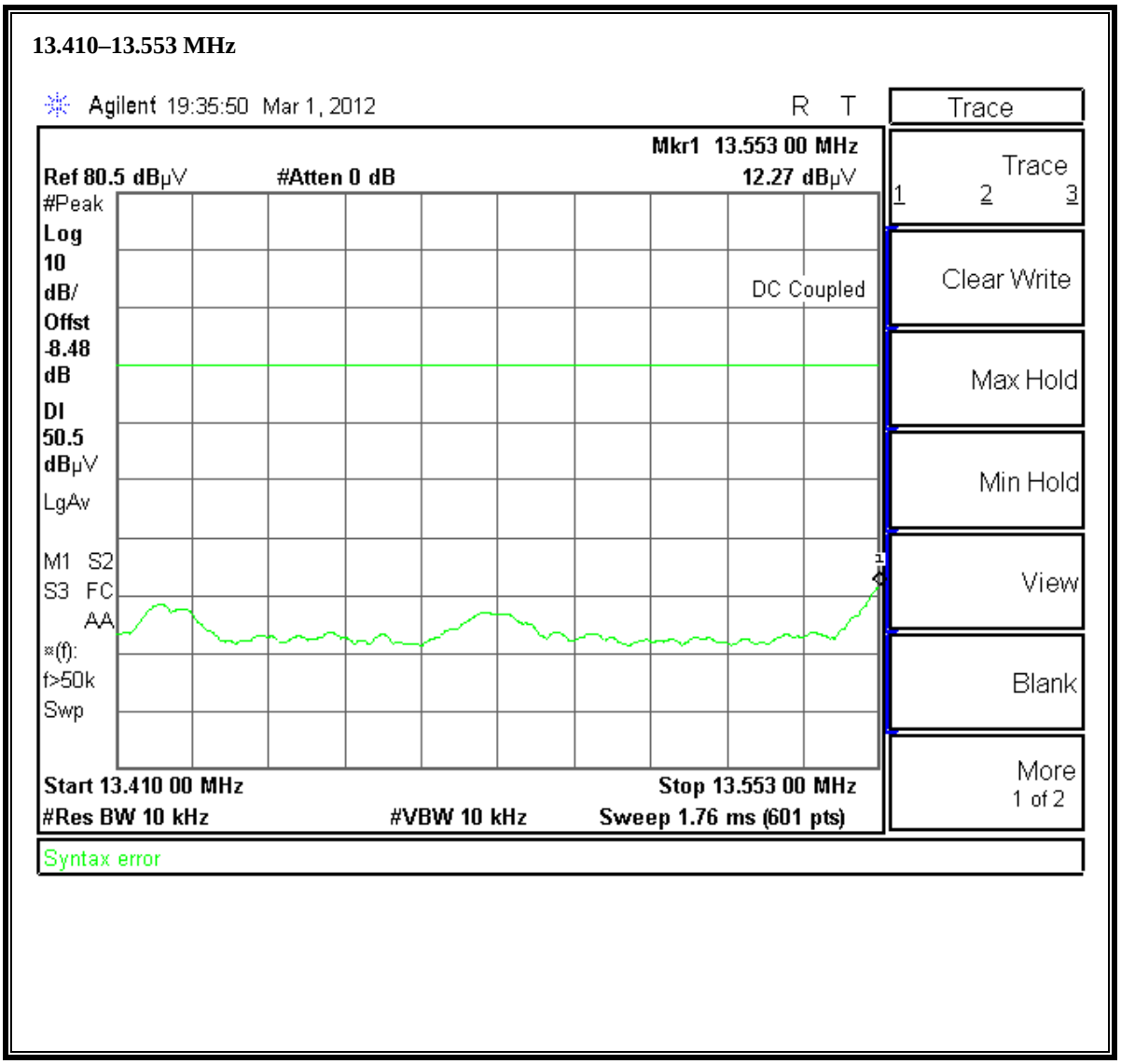


13.710–14.010 MHz

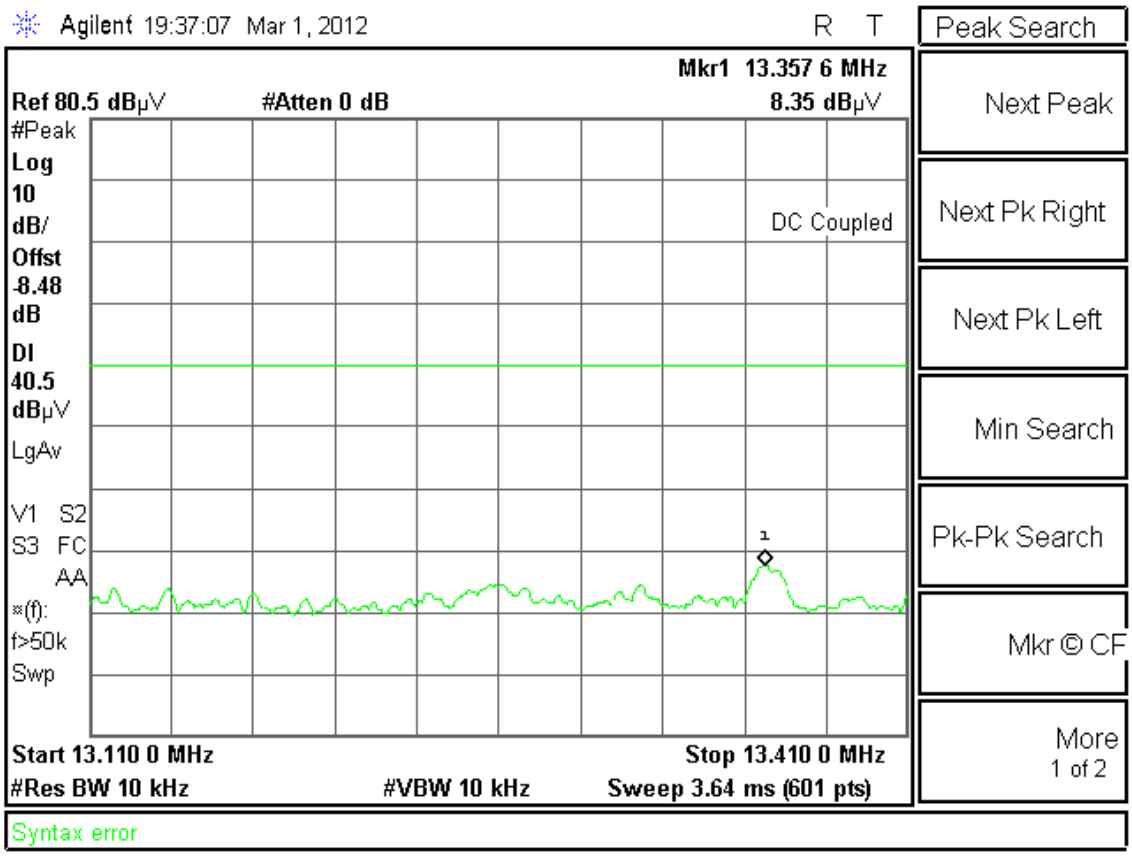


7.3.1. TAG F

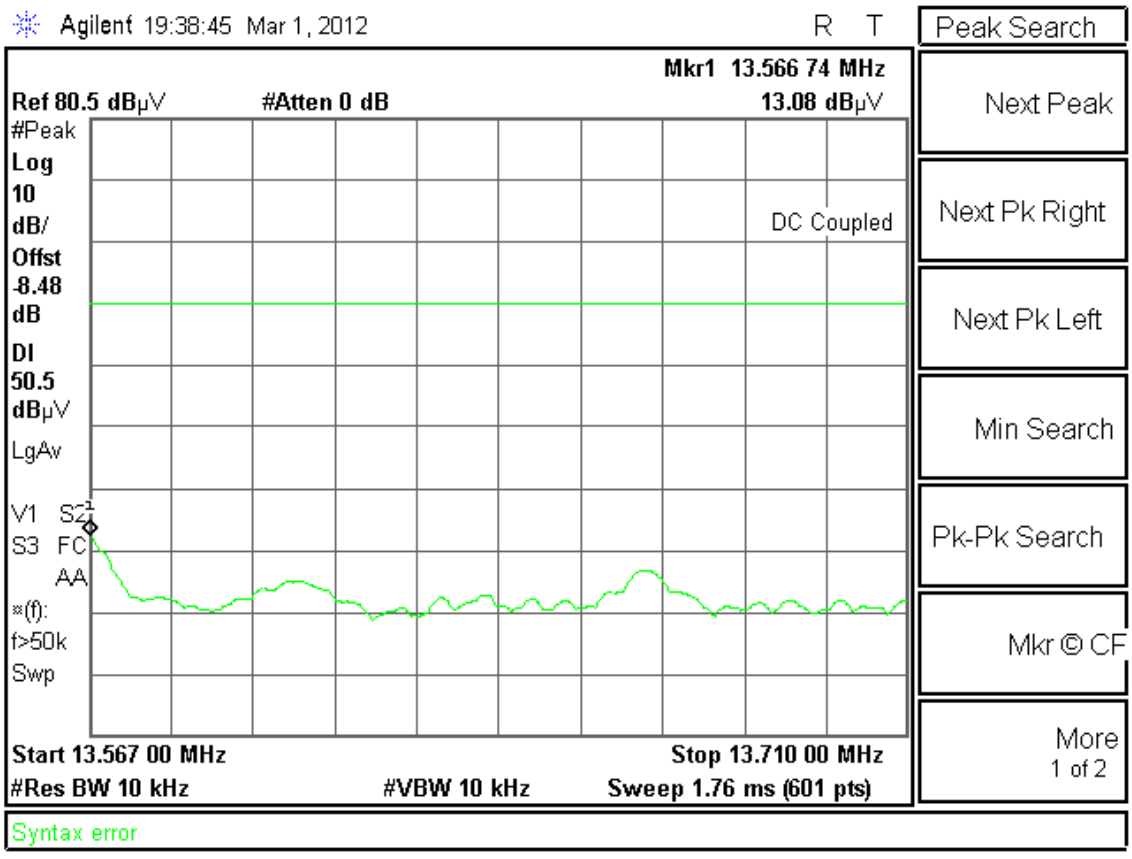
13.410–13.553 MHz



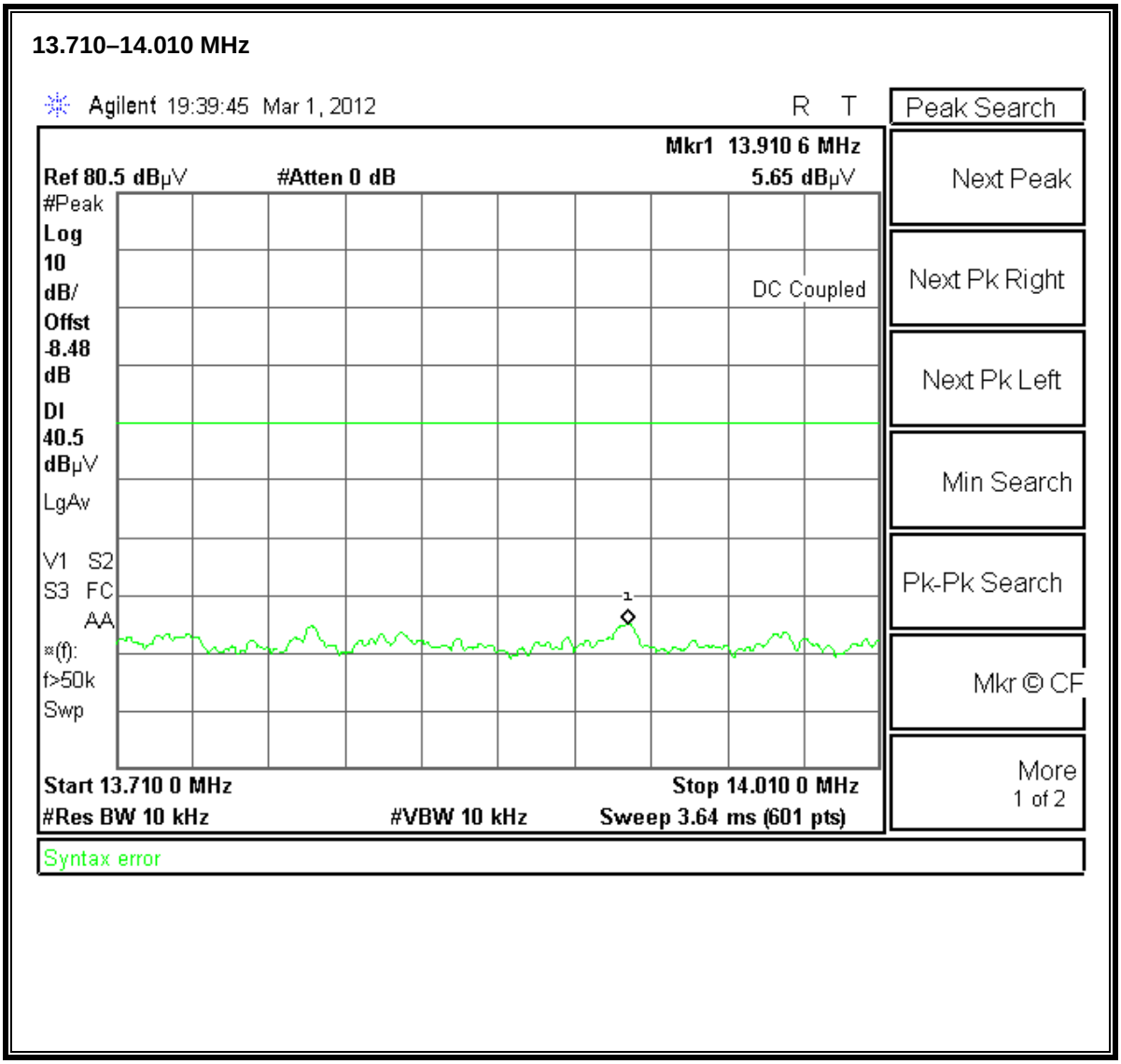
13.110–13.410



13.567–13.710 MHz

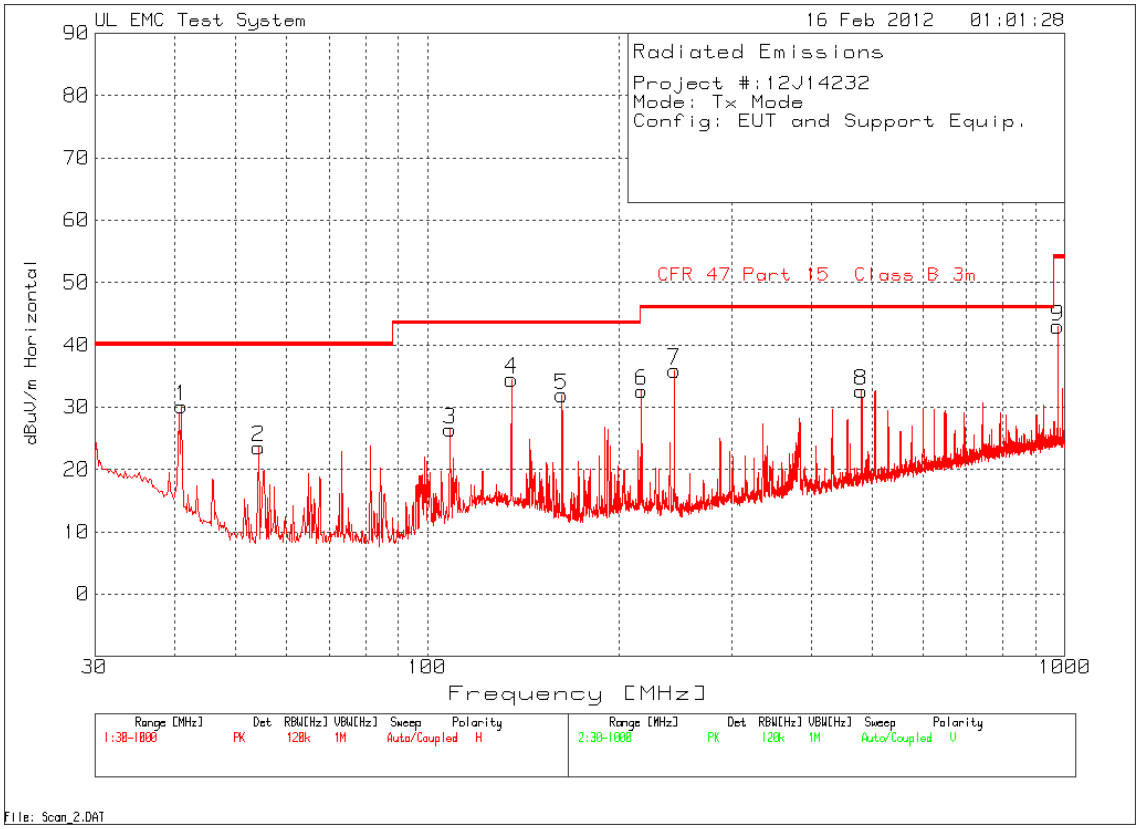


13.710–14.010 MHz

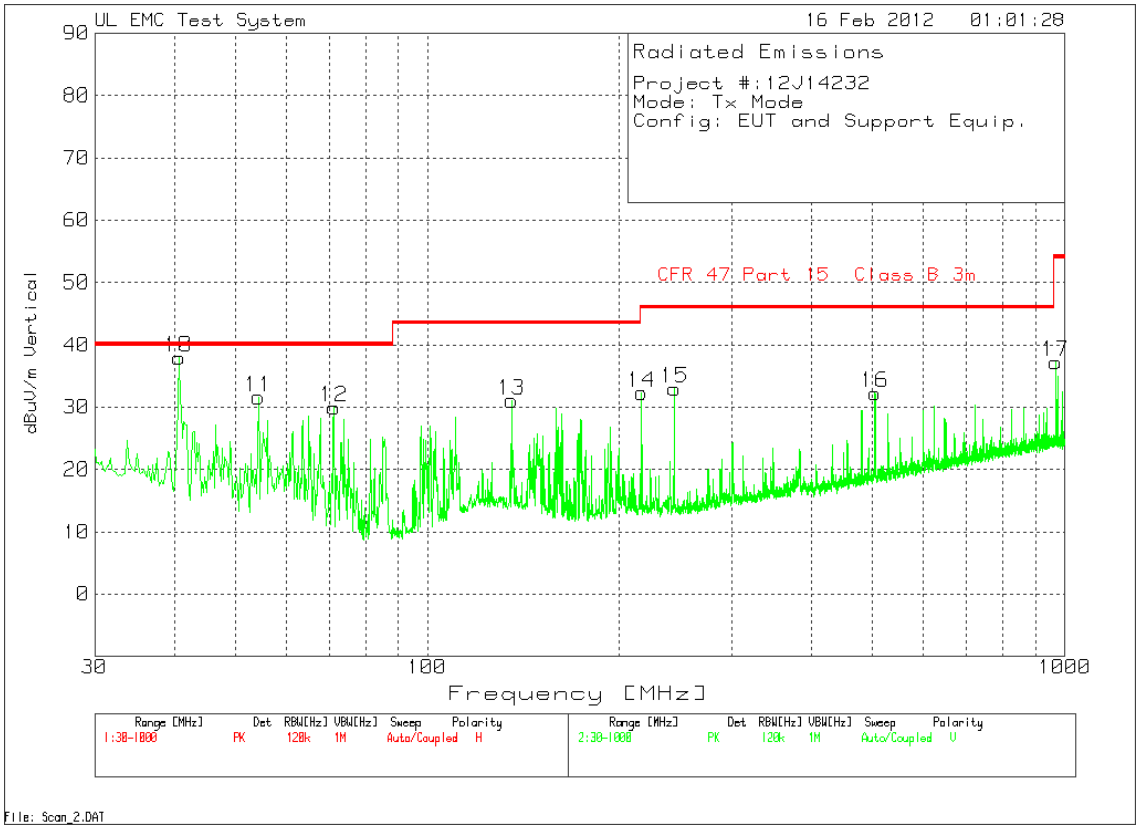


7.4. TX/RX SPURIOUS EMISSION 30 TO 1000 MHz

HORIZONTAL PLOT



VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Project #:12J14232
Mode: Tx Mode
Config: EUT and Support Equip.

Range 1 30 - 1000MHz

Frequency	Reading	Detector	Amplified	Ant Gain	dBuV/m	Part 15B	Margin	Polarity
41.0492	44.36	PK	-27.4	13.2	30.16	40	-9.84	Horz
54.2306	42.65	PK	-27.3	8.2	23.55	40	-16.45	Horz
108.5072	41.73	PK	-26.8	11.5	26.43	43.5	-17.07	Horz
135.4516	47.78	PK	-26.7	13.4	34.48	43.5	-9.02	Horz
162.5899	47.05	PK	-26.5	11.4	31.95	43.5	-11.55	Horz
216.8665	46.95	PK	-26.2	11.9	32.65	46	-13.35	Horz
244.1986	50.09	PK	-26	11.8	35.89	46	-10.11	Horz
480.1079	41.23	PK	-25	16.4	32.63	46	-13.37	Horz
976.3509	43.68	PK	-23	22.3	42.98	54	-11.02	Horz

Range 2 30 - 1000MHz

Frequency	Reading	Detector	Amplified	Ant Gain	dBuV/m	Part 15B	Margin	Polarity
40.6615	51.76	PK	-27.3	13.5	37.96	40	-2.04	Vert
54.2306	50.71	PK	-27.3	8.2	31.61	40	-8.39	Vert
71.289	49.03	PK	-27.1	8	29.93	40	-10.07	Vert
135.4516	44.37	PK	-26.7	13.4	31.07	43.5	-12.43	Vert
216.8665	46.62	PK	-26.2	11.9	32.32	46	-13.68	Vert
244.1986	47.16	PK	-26	11.8	32.96	46	-13.04	Vert
503.9508	40.15	PK	-24.7	16.8	32.25	46	-13.75	Vert
968.2094	38.04	PK	-23.1	22.3	37.24	54	-16.76	Vert

8. AC MAINS LINE CONDUCTED EMISSIONS

TEST PROCEDURE

ANSI C63.4

LIMIT

§15.207 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Notes: 1. The lower limit shall apply at the transition frequencies 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

RESULTS

EUT WITH AC ADAPTER (WITHOUT ANTENNA)

6 WORST EMISSIONS

Hong Fu Jin (Foxconn)
Project: 12J14232 : Laptop PC
Mode: Antenna Terminated with
10 ohoms Resister
Tested by: M. Mekuria

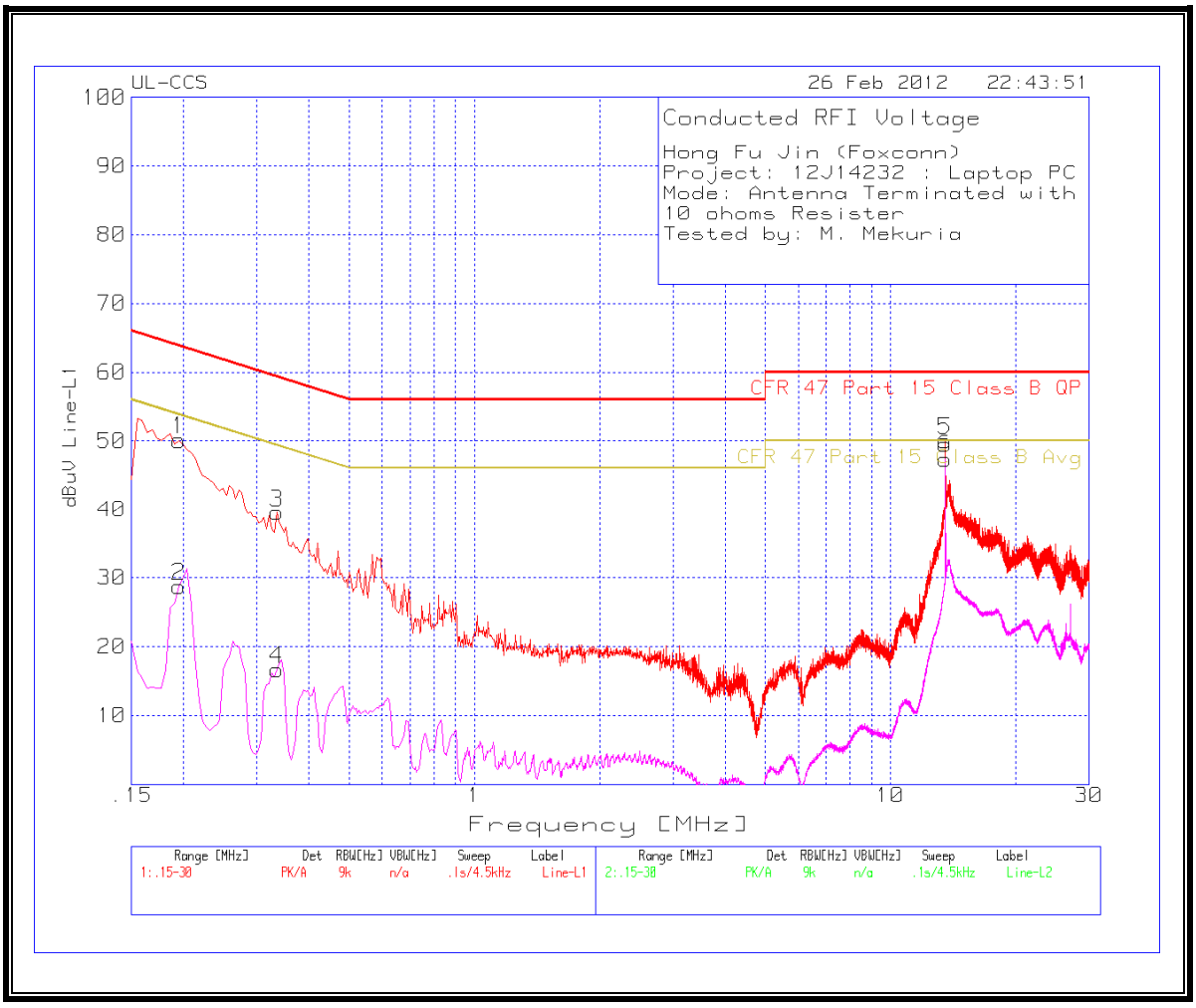
Line-L1 .15 - 30MHz

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	Margin
0.195	50.01	PK	0.1	0	50.11	63.8	-13.69	53.8	--
0.195	28.65	Av	0.1	0	28.75	63.8	--	53.8	-25.05
0.3345	39.43	PK	0.1	0	39.53	59.3	-19.77	49.3	--
0.3345	16.54	Av	0.1	0	16.64	59.3	--	49.3	-32.66
13.56	49.65	PK	0.2	0.2	50.05	60	-9.95	50	--
13.56	47.01	Av	0.2	0.2	47.41	60	--	50	-2.59

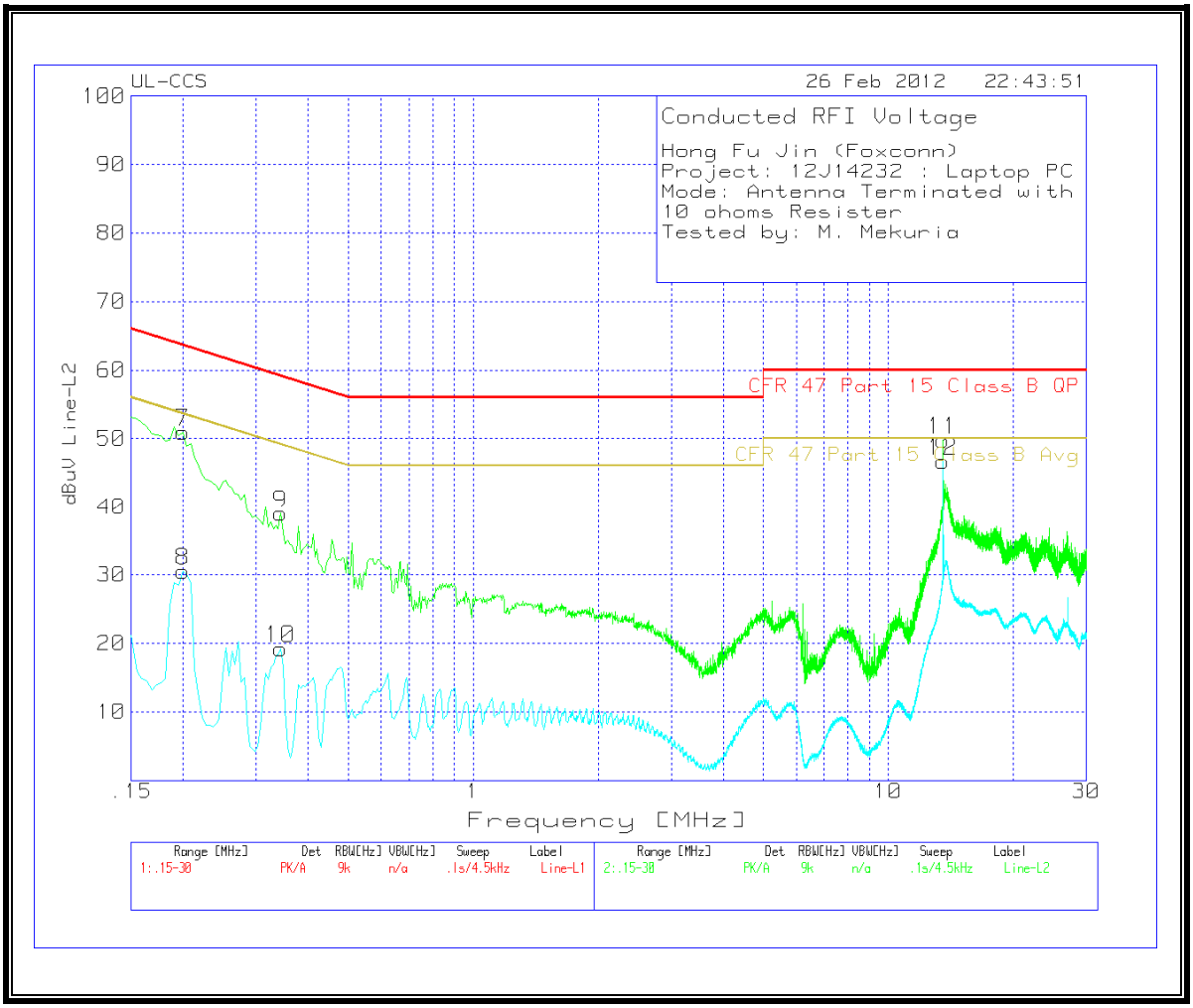
Line-L2 .15 - 30MHz

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	Margin
0.1995	50.82	PK	0.1	0	50.92	63.6	-12.68	53.6	--
0.1995	30.41	Av	0.1	0	30.51	63.6	--	53.6	-23.09
0.3435	38.93	PK	0.1	0	39.03	59.1	-20.07	49.1	--
0.3435	19.1	Av	0.1	0	19.2	59.1	--	49.1	-29.9
13.56	49.36	PK	0.2	0.2	49.76	60	-10.24	50	--
13.56	46.3	Av	0.2	0.2	46.7	60	--	50	-3.3

LINE 1 RESULT



LINE 2 RESULTS



EUT WITH ANTENNA

6 WORST EMISSIONS

Hong Fu Jin (Foxconn)
Project: 12J14232 : Laptop PC
Mode: Continuous Link with tag
Tested by: M. Mekuria

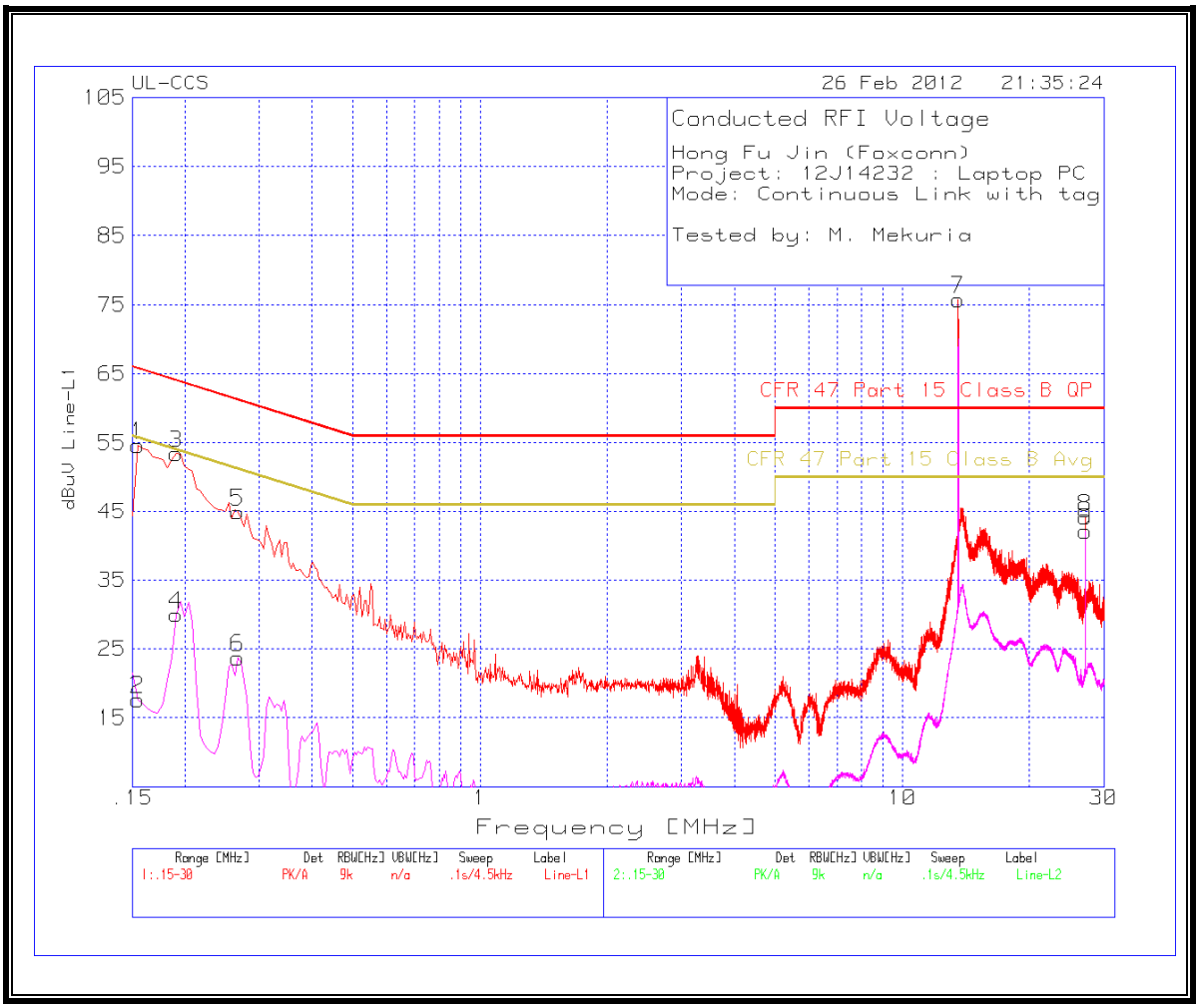
Line-L1 .15 - 30MHz

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
0.1545	54.5	PK	0.1	0	54.6	65.8	-11.2	55.8	-1.2
0.1545	17.57	Av	0.1	0	17.67	65.8	-48.13	55.8	-38.13
0.1905	53.32	PK	0.1	0	53.42	64	-10.58	54	-0.58
0.1905	29.89	Av	0.1	0	29.99	64	-34.01	54	-24.01
0.267	44.83	PK	0.1	0	44.93	61.2	-16.27	51.2	-6.27
0.267	23.56	Av	0.1	0	23.66	61.2	-37.54	51.2	-27.54
13.56	75.31	PK	0.2	0.2	75.71	60	15.71	50	25.71
27.1185	43.37	PK	0.5	0.3	44.17	60	-15.83	50	-5.83
27.1185	41.34	Av	0.5	0.3	42.14	60	-17.86	50	-7.86

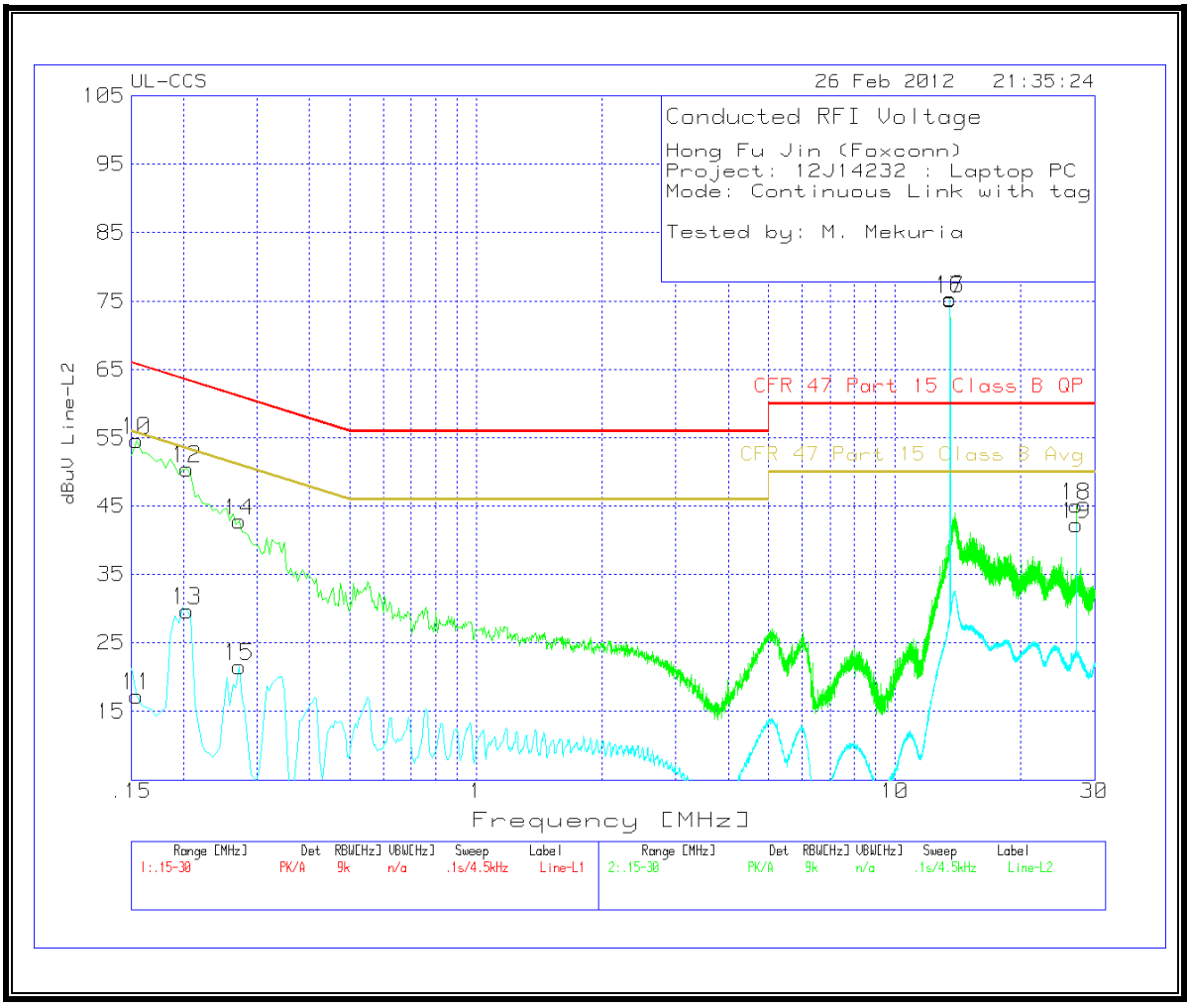
Line-L2 .15 - 30MHz

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
0.1545	54.55	PK	0.1	0	54.65	65.8	-11.15	55.8	-1.15
0.1545	17.09	Av	0.1	0	17.19	65.8	-48.61	55.8	-38.61
0.204	50.42	PK	0.1	0	50.52	63.4	-12.88	53.4	-2.88
0.204	29.54	Av	0.1	0	29.64	63.4	-33.76	53.4	-23.76
0.2715	42.66	PK	0.1	0	42.76	61.1	-18.34	51.1	-8.34
0.2715	21.47	Av	0.1	0	21.57	61.1	-39.53	51.1	-29.53
13.56	74.95	PK	0.2	0.2	75.35	60	15.35	50	25.35
13.56	74.86	Av	0.2	0.2	75.26	60	15.26	50	25.26
27.1185	44.32	PK	0.5	0.3	45.12	60	-14.88	50	-4.88
27.1185	41.41	Av	0.5	0.3	42.21	60	-17.79	50	-7.79

LINE 1 RESULT



LINE 2 RESULTS



9. FREQUENCY STABILITY

LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

TEST PROCEDURE

ANSI C63.4:2009

RESULTS

Reference Frequency: EUT Channel 13.5599686 MHz @ 20ºC Limit: ± 100 ppm = 135.600 kHz				
Power Supply	**Environment**	**Frequency Deviation Measureed with Time Elapse**		
(Vdc)	**Temperature (ºC)**	**(MHz)**	**Delta (ppm)**	**Limit (ppm)**
2.80	50	13.5599934	-0.018	± 100
2.80	40	13.5599743	-0.004	± 100
2.80	30	13.5599717	-0.002	± 100
2.80	***20***	***13.5599686***	***0.000***	***± 100***
2.80	10	13.5600058	-0.027	± 100
2.80	0	13.5600284	-0.044	± 100
2.60	20	13.5599671	0.001	± 100
2.90	20	13.5599709	-0.002	± 100

NOTE: Per the product specification, the power supply voltage conditions are; the normal supply voltage is 2.8VDC, the low supply voltage is 2.6VDC, and the high supply voltage is 2.9VDC.

10. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

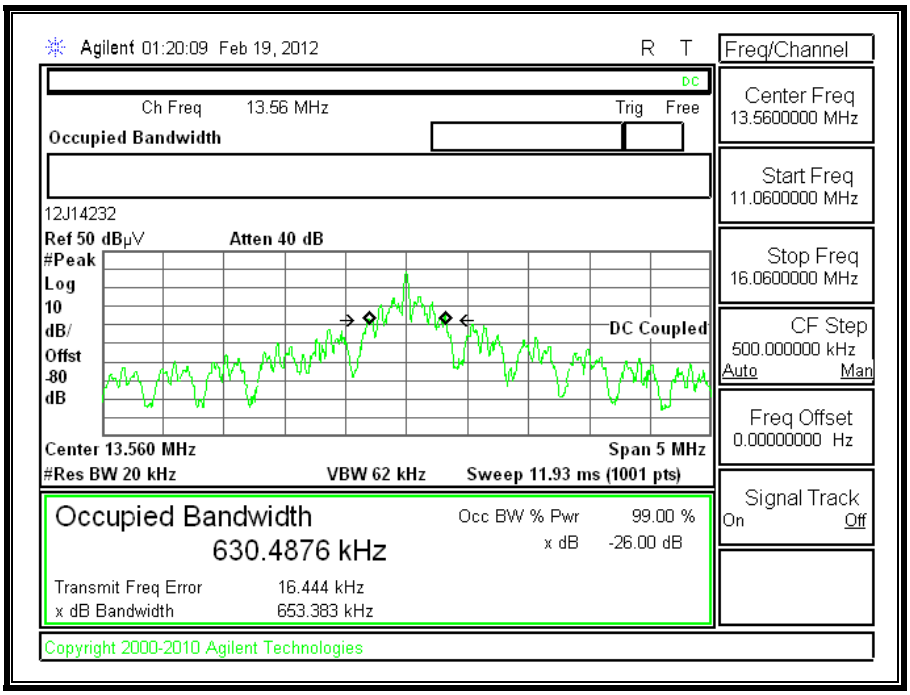
TEST PROCEDURE

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

Frequency (MHz)	99% Bandwidth kHz
13.56	630.4876

99% BANDWIDTH



11. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

Total EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

EIRP = E field at 3m distance – 95.2
E field at 3m distance = E field at 10m distance + 20 = 57.07 + 20 = 77.07 dBuV/m
EIRP = 77.07 -95.2 = **-18.13 dBm = 0.000015382 W,** this is less than 2.5 W based on section 2.2 of RSS210 therefore this test is N/A.