



# DM3730/AM3703 Torpedo + Wireless SOM Radiated Emissions Scan

## White Paper 522

Logic PD // Products  
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## Revision History

REV	EDITOR	DESCRIPTION	APPROVAL	DATE
A	SO, NJK	-Initial Release	NJK, RAH	09/06/12

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# 1 DM3730/AM3703 Torpedo + Wireless SOM Radiated Emissions Scan

The DM3730/AM3703 Torpedo + Wireless SOM passes the United States of America Federal Communications Commission (FCC) Class B digital device threshold levels. It also passes the Industry Canada (IC) receiver spurious emission limits. This does not guarantee FCC/IC validation for end-product designs; final testing and passage is the responsibility of the customer.

## 2 Test Setup

The following configuration of the DM3730/AM3703 Torpedo + Wireless SOM was scanned for unintentional radiated emissions:

- SOMDM3730-30-2780AKCR (commercial temperature)

The test results were obtained by running the DM3730/AM3703 Torpedo + Wireless SOM on a standard Torpedo Launcher 3 Baseboard included in the Zoom DM3730 Torpedo Development Kit. The baseboard was powered by the standard kit 5V power supply; no other cables were connected to the kit during the test. The unit under test used software that looped through the RAM and NAND flash interfaces.

The tests were conducted at the [Northwest EMC](#)<sup>1</sup> test facility. All scans were done in a calibrated anechoic chamber.

## 3 Test Results

Table 3.1 below lists the known frequencies generated on the DM3730/AM3703 Torpedo + Wireless SOM with the functional test code running.

**Table 3.1: Frequencies Generated while Running Functional Test Code**

Source	Frequency
DPPLL1	600 MHz
DPPLL3	200 MHz
DPPLL4	864 MHz
DPPLL5	120 MHz
LPDDR interface	200 MHz (400 MHz actual)
GPMC bus	200 MHz (internal frequency)
System oscillator	26 MHz

<sup>1</sup> <http://www.nwemc.com/>

### 3.1 30 MHz to 1 GHz Scan

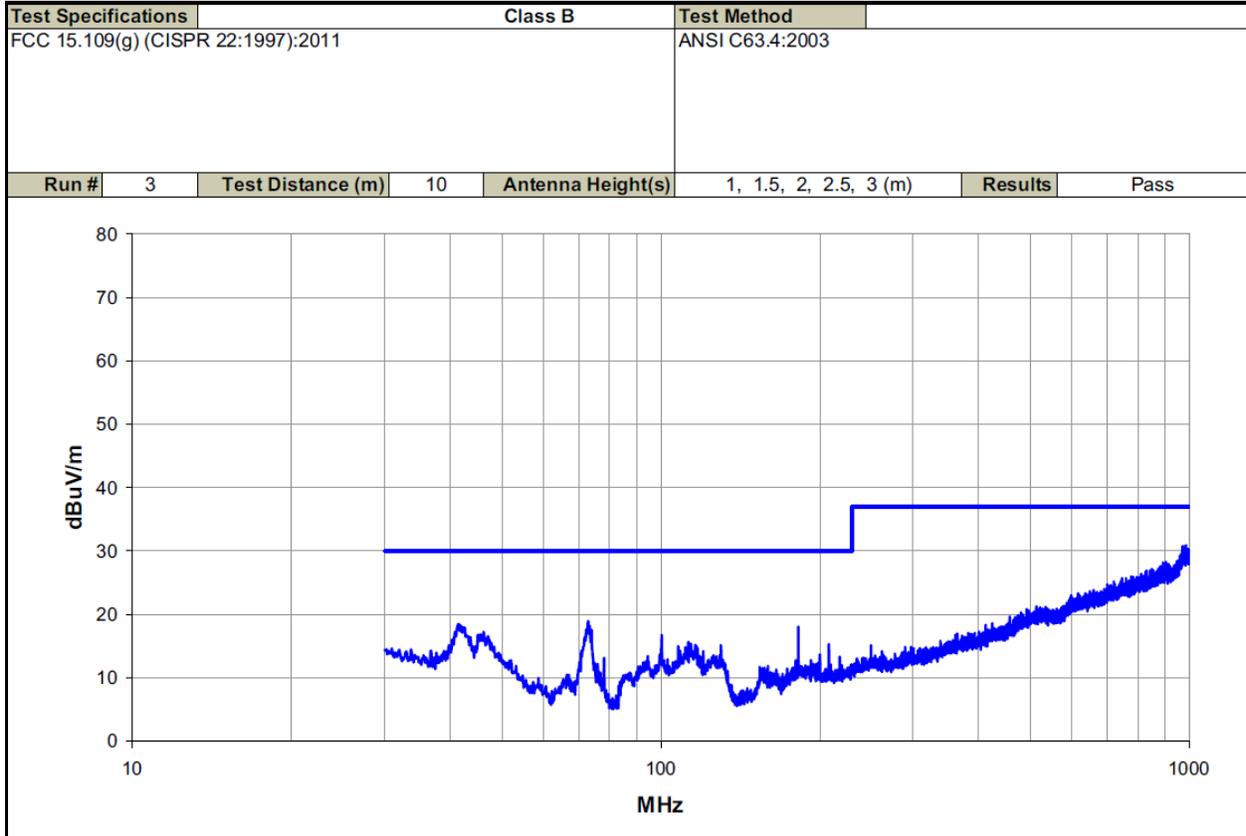


Figure 3.1: RE Scan Class B Test Results—Evaluation

## 4 FCC/IC Radiated Emissions Report

Appendix A contains the radiated emissions report from the FCC/IC certification filing completed by Logic PD. This document provides additional frequency scans and test cases of the DM3730/AM3703 Torpedo + Wireless SOM in a continuous receive mode.

## 5 Summary

This radiated emissions scan provides a baseline for the performance of the DM3730/AM3703 Torpedo + Wireless SOM alone. Radiated emissions testing of a final product designed around the DM3730/AM3703 Torpedo + Wireless SOM is the responsibility of the developer.

## LS Research, LLC

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### ENGINEERING TEST REPORT # TR 312142 D C-1489 FCCIC RX LSR Job #: C-1489

Compliance Testing of:

Logic PD 37x Torpedo + Wireless SOM

Test Date(s):

February 23<sup>rd</sup> to July 18<sup>th</sup> 2012

Prepared For:

Logic PD

411 Washington Ave N. Suite 400

Minneapolis, MN 55401

**This Test Report is issued under the Authority of:**

Khairul Aidi Zainal, Senior EMC Engineer

Signature:



Date: 8/6/2012

**Test Report Reviewed by: Tom Smith**

Signature:

Date: 8/6/2012



**Project Engineer:**

Khairul Aidi Zainal, Senior EMC Engineer

Signature:



Date: 8/6/2012

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Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
EUT: 37x Torpedo + Wireless SOM	Serial #: Refer to table in section 2.2	Template: 15.109 Class B
Report #: TR 312142 D	Customer FCC ID #: YKP1021149	<b>Page 2 of 27</b>

## EXHIBIT 1. INTRODUCTION

### 1.1 SCOPE

<b>References:</b>	RSS-GEN CFR 47 15.109
<b>Title:</b>	General Requirements and Information for the Certification of Radiocommunication Equipment
<b>Purpose of Test:</b>	To gain IC and FCC Certification Authorization for a Digital Device operated in Receive Mode
<b>Test Procedures:</b>	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
<b>Environmental Classification:</b>	<ul style="list-style-type: none"> <li>• Commercial, Industrial or Business</li> <li>• Residential</li> </ul>

### 1.2 NORMATIVE REFERENCES

Publication	Title
RSS-Gen Issue 3, 2010	Spectrum Management and Telecommunications Radio Standards Specification
CFR 47 Part 15, 2012	Radio Frequency devices
ANSI C63.4, 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
CISPR 16-1-1	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.

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### 1.3 LS Research, LLC TEST FACILITY

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted.

### 1.4 LOCATION OF TESTING

All testing was performed at LS Research, LLC, W66 N220 Commerce Court, Cedarburg, Wisconsin, 53012 USA, utilizing the facilities listed below, unless otherwise noted.

List of Facilities Located at LS Research, LLC:

- Compact Chamber
- Semi-Anechoic Chamber
- Open Area Test Site (OATS)

### 1.5 TEST EQUIPMENT UTILIZED

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated in accordance with A2LA standards.

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## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1 CLIENT INFORMATION

Manufacturer Name:	Logic PD
Address:	411 Washington Ave N. Suite 4, Minneapolis, MN 55401
Contact Name:	Joe Charboneau

### 2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	37x Torpedo + Wireless SOM
Model Number:	SOMDM3730-30-2780AKCR-B
Serial Number:	2012M00619/2012M01222 (Radiated) 2012M00625/2012M01201 (Radiated) 2411M00976/4511M01290 (Radiated) 4511M01221(Radiated)

### 2.3 ASSOCIATED ANTENNA DESCRIPTION

The antenna associated with the EUT is a dual band isolated Magnetic dipole (IMD) with gains:

1. 2.5dBi peak between 2.39 to 2.49 GHz.
2. 3.5dBi peak between 4.9 to 5.9 GHz.

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## 2.4 EUT'S TECHNICAL SPECIFICATIONS

### Additional Information:

Frequency Range (in MHz)	2402MHz to 2480MHz 2412MHz to 2462MHz 5180MHz to 5240MHz 5745MHz to 5825MHz
Operating Voltage	120 VAC
Receiver Sensitivity	-70dBm
Highest Frequency on Board	2 GHz
Receiver Spurious (worst case) at 3m measurement distance.	50.6dBµV/m at 13750MHz
Microprocessor Model # (if applicable)	DM3730 (Texas Instrument), WL1283 (Texas Instrument)
EUT will be operated under FCC part(s) and IC Rule	IC: RSS-GEN FCC: CFR 47 part 15
Portable/Mobile	<input checked="" type="checkbox"/> Portable <input type="checkbox"/> Mobile
Modular Filing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

## 2.5 PRODUCT DESCRIPTION

The 37x Torpedo + wireless SOM is an ultra-compact off-the-shelf solution for applications in markets where network connectivity is required and space is a premium. The product is used by OEM integrators to gain access to 802.11 a/b/g/n, Bluetooth, and GPS capabilities.

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### EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

#### 3.1 CLIMATE TEST CONDITIONS

<b>Temperature:</b>	70° to 71° Fahrenheit
<b>Humidity:</b>	30% to 34%
<b>Pressure:</b>	728mmHg to 749mmHg

#### 3.2 APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

RSS Paragraph	Test Requirements	Compliance (yes/no)
7.2.2	Power Line Conducted Emissions Measurements	Yes
6	Un-Intentional Radiated Emissions	Yes

CFR 47 Part 15 section	Test Requirements	Compliance (yes/no)
107	Power Line Conducted Emissions Measurements	Yes
109	Un-Intentional Radiated Emissions	Yes

#### 3.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None       Yes (explain below)

#### 3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

None       Yes (explain below)

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## EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of Industry Canada RSS-Gen and RSS-210 for non-intentional radiators.

If some emissions are seen to be within 3 dB of their respective limits:

As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

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## EXHIBIT 5. RADIATED EMISSIONS TEST

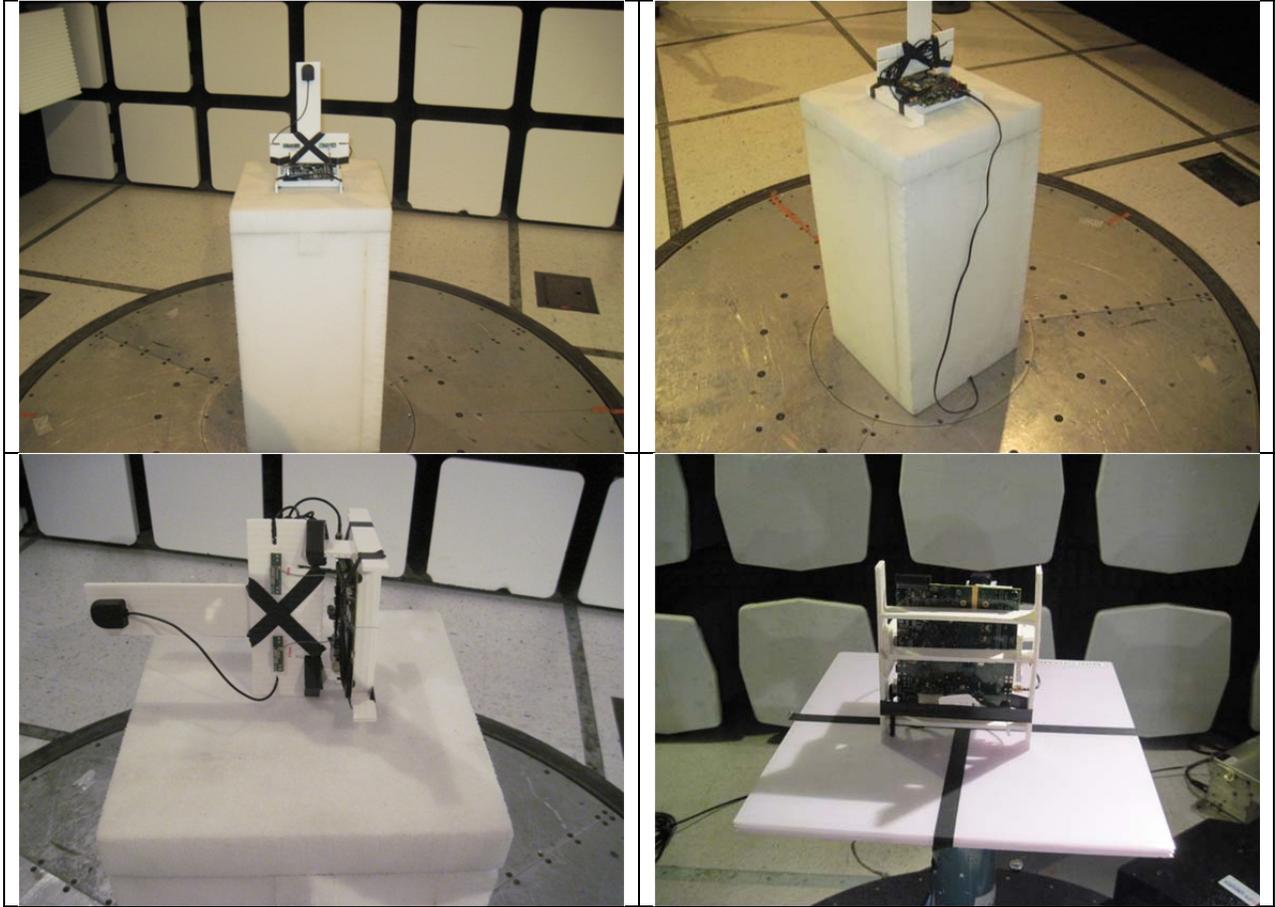
### 5.1 Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, RSS GEN and ANSI C63.4. The EUT was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated in continuously transmitting modulated mode using power as provided by the AC mains.

The applicable limits apply at a 3 meter distance. Measurements above 4 GHz were performed at a 1.0 meter separation distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment.

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**5.2 Test Setup Photo(s) – Radiated Emissions Test**



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### 5.3 Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 25000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 18 GHz. From 18 GHz to 40 GHz, the EUT was measured using a standard gain Horn Antenna and pre-amplifier.

In the frequency range of 30 MHz to 4 GHz, the maximum radiated RF emissions were found by raising and lowering the antenna between 1 and 4 meters in height while for the range of 4 GHz to 25 GHz the antenna was raised and lowered between 1 and 1.8 meters in height. In addition, the polarity of the antenna was switched between horizontal and vertical polarity.

The EUT was positioned in its normal operation orientation for the duration of the test.

### 5.4 Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an IEC/ISO 17025 accredited calibration laboratory, traceable to the SI standard. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and an EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with resolution bandwidths as prescribed in ANSI C63.4.

### 5.5 Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Canada RSS GEN, RSS-210 and CFR 47 Part 15 sections 109. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

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## 5.6 CALCULATION OF RADIATED EMISSIONS LIMITS

The following table depicts the Class **B** limits for an unintentional radiator. These limits are obtained from RSS-Gen Section 6, Table 1, for radiated emissions measurements.

Frequency (MHz)	3 m Limit $\mu\text{V/m}$	3 m Limit (dB $\mu\text{V/m}$ )	1 m Limit (dB $\mu\text{V/m}$ )
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-24,000	500	54.0	63.5

Sample conversion from field strength  $\mu\text{V/m}$  to dB $\mu\text{V/m}$ :

$$\begin{aligned} \text{dB}\mu\text{V/m} &= 20 \log_{10} (100) \\ &= 40 \text{ dB}\mu\text{V/m (from 30-88 MHz)} \end{aligned}$$

For measurements made at 1.0 meter, a 9.5 dB correction has been invoked.

$$\begin{aligned} &960 \text{ MHz to } 10,000 \text{ MHz} \\ &500\mu\text{V/m or } 54.0 \text{ dB}/\mu\text{V/m at } 3 \text{ meters} \\ &54.0 + 9.5 = 63.5 \text{ dB}/\mu\text{V/m at } 1 \text{ meter} \end{aligned}$$

For measurements made at 0.3 meter, a 20 dB correction has been invoked.

$$\begin{aligned} &960 \text{ MHz to } 10,000 \text{ MHz} \\ &500\mu\text{V/m or } 54.0 \text{ dB}/\mu\text{V/m at } 3 \text{ meters} \\ &54.0 + 20 = 74 \text{ dB}/\mu\text{V/m at } 0.3 \text{ meters} \end{aligned}$$

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## 5.7

**DATA CHART – RADIATED EMISSIONS TEST**

Manufacturer:	Logic PD					
Date(s) of Test:						
Project Engineer:	Khairul Aidi Zainal					
Test Engineer(s):	Khairul Aidi Zainal, Mike Hintzke, Peter Feilen.					
Voltage:	120 VAC					
Operation Mode:	continuous receive					
Environmental Conditions in the Lab:	Temperature: 71° F Relative Humidity: 52 %					
EUT Power:	X	Single Phase 120 VAC		3 Phase ___ VAC		
		Battery		Other:		
EUT Placement:	X	80cm non-conductive table		10cm Spacers		
EUT Test Location:	X	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary		Final
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average

The following table depicts the level of significant spurious radiated RF emissions found:

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Quasi Peak Reading (dBµV/m)	Average Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
1118.1	1.00	1.41	36.6	N/A	29.5	54.0	24.5	V	SIDE
1170.3	1.36	0	37.0	N/A	30.6	54.0	23.4	H	SIDE
1222.0	1.00	2.37	35.7	N/A	27.9	54.0	26.1	V	SIDE
1222.0	1.30	17	35.9	N/A	27.3	54.0	26.7	H	SIDE
1117.0	1.05	335	37.5	N/A	31.5	54.0	22.5	V	SIDE
1170.0	1.35	8	38.2	N/A	32.8	54.0	21.2	H	SIDE
2650.1	1.05	54	40.7	N/A	36.1	54.0	17.9	H	SIDE
1169.8	1.05	149	36.5	N/A	31.4	54.0	22.6	V	SIDE
520.0	1.64	193	43	41.6	40.6	46.0	4.4	H	VERT
520.0	1.02	73	39.3	37.1	35.5	46.0	8.9	V	VERT
520.0	1.00	254	42.1	40.9	39.9	46.0	5.1	V	SIDE
520.0	1.80	131	40.9	39.0	37.3	46.0	7.0	H	SIDE
520.0	1.66	11	44.5	43.3	42.4	46.0	2.7	H	FLAT
520.0	1.37	89	38.3	35.7	33.9	46.0	10.3	V	FLAT
101.5	1.00	160	29.9	24.1	12.4	43.0	18.9	V	FLAT
182.0	1.08	0	31.5	29.1	26.8	43.0	13.9	H	FLAT
93.9	1.00	153	33.1	28.2	13.1	43.0	14.8	V	FLAT
383.5	1.00	0	34.8	33.1	20.2	46.0	12.9	H	VERT
383.9	1.15	109	36.3	32.1	19.0	46.0	13.9	V	VERT
489.2	1.99	0	35.4	30.8	23.1	46.0	15.2	H	SIDE
572.0	1.06	248	36.2	33.1	28.2	46.0	12.9	V	FLAT
520.0	1.00	320	37.4	34.6	30.7	46.0	11.4	V	FLAT
97.3	1.00	251	32.7	28.9	24.2	43.0	14.1	V	FLAT
97.3	1.30	222	30.8	27.8	25.3	43.0	15.2	V	SIDE
182.0	1.00	170	32.5	30.0	26.2	43.0	13.0	H	SIDE
51.3	1.00	0	29.0	24.0	13.5	40.0	16.0	V	VERT
97.3	1.20	80.0	30.5	27.7	23.0	43.0	15.3	V	VERT
97.3	2.12	343.0	31.0	25.5	16.6	43.0	17.5	H	SIDE
50.8	1.00	0	30.4	24.7	14.1	40.0	15.3	V	SIDE
50.6	1.06	56.0	30.1	25.0	14.4	40.0	15.0	V	FLAT
520.0	1.62	12	45.5	44.3	43.0	46.0	1.7	H	FLAT
520.0	1.00	289	37.6	35.4	32.1	46.0	10.6	V	FLAT
520.0	1.00	237	43.5	42.2	40.6	46.0	3.8	V	SIDE
520.0	1.00	228	43.9	42.6	41	46.0	3.4	H	SIDE

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(Data continued)

FREQ (MHz)	ANT	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK (dB $\mu$ v/m)	AVERAGE (dB $\mu$ v/m)	LIMIT (dB $\mu$ v/m)	MARGIN (dB)
5745.00	H	F	1.04	141	52.9	49.7	63.5	13.8
8617.50	V	V	1.09	338	54.4	49.2	63.5	14.3
14362.50	H	F	1.00	137	60.9	58.6	63.5	4.9
5785.00	H	F	1.05	147	52.8	49.6	63.5	13.9
8677.50	V	V	1.07	335	55.5	51.1	63.5	12.5
14462.50	H	F	1.00	135	60.4	58.0	63.5	5.5
5825.00	H	F	1.08	138	54.0	50.5	63.5	13.0
8737.50	H	V	1.00	296	53.5	48.9	63.5	14.7
14562.50	H	F	1.00	143	60.2	56.8	63.5	6.7

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dB $\mu$ V/m)	Average Reading (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Antenna Polarity	EUT orientation	Channel
4800.4	1.33	315	51.21	41.63	54.0	12.4	V	V	0
4800.4	1.06	223	49.98	39.44	54.0	14.6	H	V	0
4801.4	1.04	198	50.89	41.32	54.0	12.7	H	S	0
4801.7	1.34	104	50.06	38.99	54.0	15.0	V	S	0
4801.4	1.09	115	51.81	42.67	54.0	11.3	H	F	0
4801.3	1.08	60	50.22	38.32	54.0	15.7	V	F	0
4876.3	1.00	328	48.25	39.48	54.0	14.5	H	V	19
4876.1	1.43	309	49.2	41.36	54.0	12.6	V	V	19
4877.2	1.31	112	48.78	39.25	54.0	14.8	V	S	19
4877.4	1.00	193	49.57	41.64	54.0	12.4	H	S	19
4877.2	1.00	118	50.13	42.33	54.0	11.7	H	F	19
4877.1	1.23	353	47.57	37.55	54.0	16.5	V	F	19
4955.8	1.04	161	49.33	39.55	54.0	14.5	V	V	39
4955.5	1.00	329	50.58	41.65	54.0	12.4	H	V	39
4957.0	1.00	29	51.01	41.84	54.0	12.2	H	S	39
4956.8	1.27	105	50.06	42.87	54.0	11.1	V	S	39
4956.4	1.20	348	49.49	40.07	54.0	13.9	V	F	39
4956.4	1.23	123	50.75	42.9	54.0	11.1	H	F	39

Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
EUT: 37x Torpedo + Wireless SOM	Serial #: Refer to table in section 2.2	Template: 15.109 Class B
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(Data continued)

FREQ (MHz)	ANT	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK (dB $\mu$ v/m)	AVERAGE (dB $\mu$ v/m)	LIMIT (dB $\mu$ v/m)	MARGIN (dB)
7311.00	H	S	1.07	35	53.7	48.8	63.5	14.7
12185.00	H	S	1.00	49	58.1	54.2	63.5	9.3
7236.00	H	S	1.00	14	53.7	48.0	63.5	15.6
12060.00	H	S	1.00	48	55.5	51.9	63.5	11.6
7386.00	H	S	1.05	40	54.5	50.3	63.5	13.2
12310.00	H	S	1.00	73	55.2	50.7	63.5	12.8
24370.00	V	F	1.00	206	52.8	46.1	63.5	17.4
24120.00	H	S	1.00	128	54.3	48.5	63.5	15.0
24620.00	H	S	1.00	129	54.7	48.6	63.5	14.9

FREQ (MHz)	ANT	EUT	HEIGHT (cm)	AZIMUTH (°)	PEAK (dB $\mu$ V/m)	AVG (dB $\mu$ V/m)	LIMIT (dB $\mu$ V/m)	MARGIN (dB)
5180.00	V	F	100.0	150	52.4	44.9	63.5	18.6
7770.00	H	S	100.0	145	53.3	48.5	63.5	15.0
12950.00	H	F	103.8	149	56.8	52.5	63.5	11.0
5200.00	H	F	100.0	218	49.0	42.9	63.5	20.6
7800.00	H	S	100.0	144	52.5	49.2	63.5	14.3
13000.00	H	F	105.2	146	58.6	54.6	63.5	8.9
5240.00	H	F	105.0	217	50.9	43.9	63.5	19.6
7860.00	H	S	100.0	141	54.6	47.6	63.5	15.9
13100.00	H	F	104.3	148	61.5	57.1	63.5	6.4
18340.00	V	S	100.0	43	54.7	50.6	63.5	12.9
18130.00	V	S	100.0	94	55.1	50.7	63.5	12.8
18200.00	V	S	100.0	95	54.9	49.9	63.5	13.6

Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
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(Data continued)

FREQ (MHz)	ANT	EUT	HEIGHT (cm)	AZIMUTH (°)	PEAK (dBµV/m)	AVG (dBµV/m)	LIMIT (dBµV/m)	MARGIN (dB)
5260.00	V	S	128.1	132	52.1	46.4	63.5	17.2
7890.00	V	V	107.3	321	52.4	46.1	63.5	17.4
13150.00	V	S	100.0	87	59.3	54.0	63.5	9.5
5300.00	V	S	103.0	142	53.9	47.0	63.5	16.5
7950.00	V	V	106.3	319	52.9	47.8	63.5	15.7
13250.00	V	S	100.0	86	58.2	52.1	63.5	11.4
5320.00	V	S	117.0	136	51.8	46.6	63.5	16.9
7980.00	V	V	107.7	322	53.4	46.9	63.5	16.6
13300.00	V	S	100.0	61	57.7	50.8	63.5	12.7

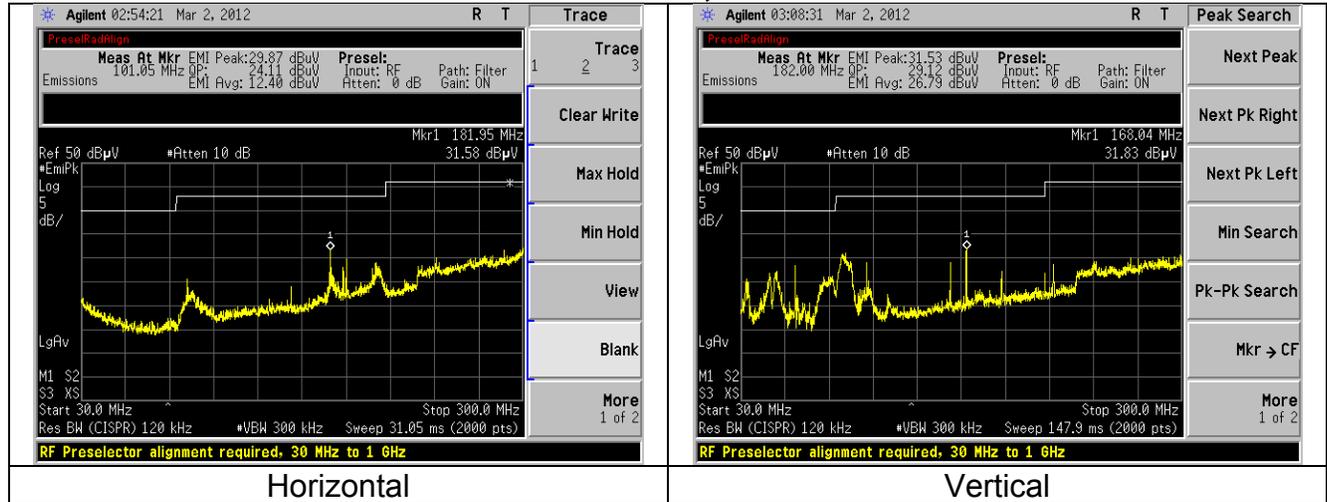
FREQ (MHz)	ANT	EUT	HEIGHT (cm)	AZIMUTH (°)	PEAK (dBµV/m)	AVG (dBµV/m)	LIMIT (dBµV/m)	MARGIN (dB)
5500.00	H	F	100.0	213	52.4	48.9	63.5	14.6
8250.00	H	S	100.9	15	57.5	51.6	63.5	11.9
13750.00	H	F	104.1	148	62.4	60.1	63.5	3.4
5580.00	H	F	104.1	213	51.8	47.6	63.5	15.9
8370.00	H	S	101.9	50	56.3	51.9	63.5	11.6
13950.00	H	F	100.0	146	61.6	58.1	63.5	5.4
5700.00	H	F	104.6	215	51.8	47.8	63.5	15.7
8550.00	H	S	100.0	61	54.1	48.1	63.5	15.4
14250.00	H	F	100.0	138	60.9	58.2	63.5	5.3

Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
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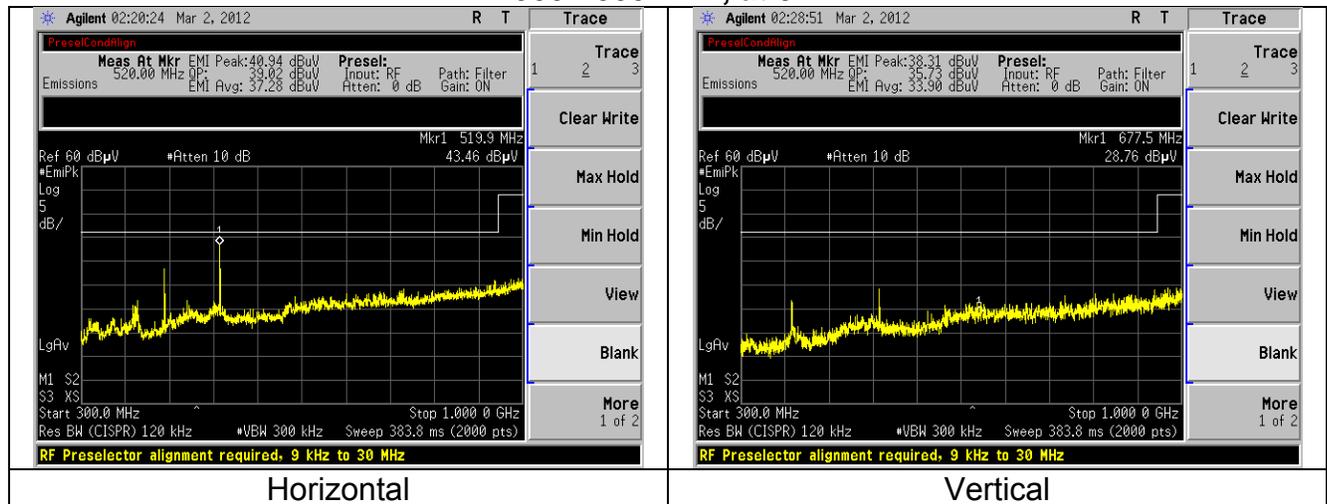
## 5.8 Screen Captures - Radiated Emissions Testing

The screen captures below are chosen to represent the different modes and bands of receiver operation. It is deemed that the following captures are representative of the overall emissions of the EUT.

### 30-300 MHz, at 3m



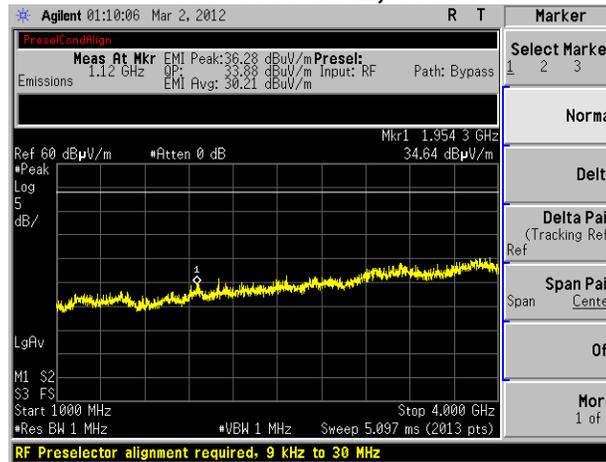
### 300-1000 MHz, at 3m



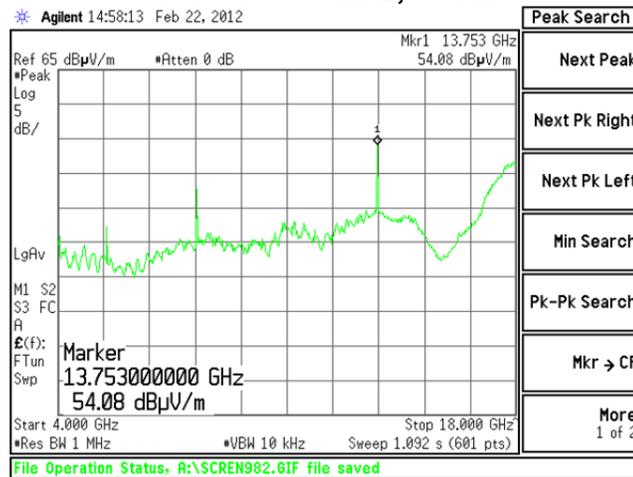
Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
EUT: 37x Torpedo + Wireless SOM	Serial #: Refer to table in section 2.2	Template: 15.109 Class B
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## Screen Captures - Radiated Emissions Testing (continued)

### 1000-4000 MHz, at 3m

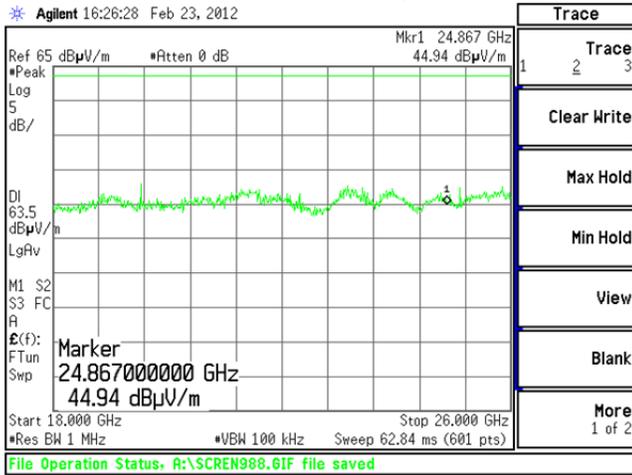


### 4000-18000 MHz, at 1m

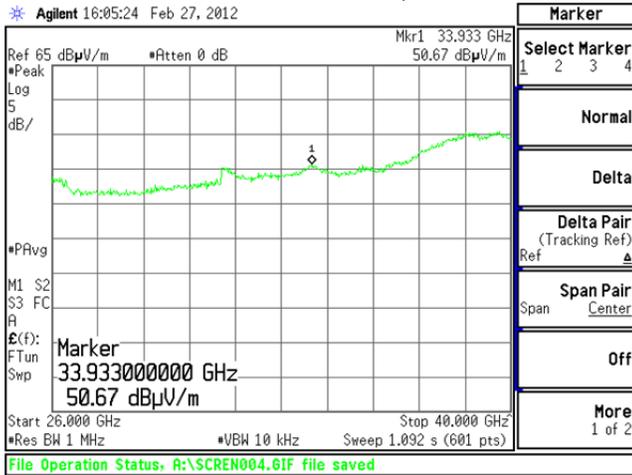


Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
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### 18000-26000 MHz, at 1m



### 26000-40000 MHz, at 1m



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**6.1 Test Setup**

The test area and setup are in accordance with ANSI C63.4 and with Title 47 CFR, FCC Part 15, Industry Canada RSS-210 and RSS GEN. The EUT was placed on a non-conductive wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to EMI receiver System. The EMCO LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

**6.2 Test Procedure**

The EUT was investigated in continuous modulated transmit mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1, Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded.

**6.3 Test Equipment Utilized**

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter were performed at an IEC/ISO 17025 accredited calibration laboratory, traceable to the SI standard. All cables are calibrated and checked periodically for conformance. The emissions are measured on the EMI System, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

**6.4 Test Results**

The EUT was found to **MEET** the Conducted Emission requirements of FCC Part 15.207 and RSS GEN 7.2.2 for Conducted Emissions for an Intentional Radiator. See the Data Charts and Graphs for more details of the test results.

Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
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**6.5 FCC Limits of Conducted Emissions at the AC Mains Ports**

Frequency Range (MHz)	Class B Limits (dB $\mu$ V)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz VBW $\geq$ 9 kHz for QP VBW = 1 Hz for Average
0.5 – 5.0	56	46	
5.0 – 30	60	50	
* The limit decreases linearly with the logarithm of the frequency in this range.			

Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
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## 6.6

### CONDUCTED EMISSIONS TEST DATA CHART

Frequency Range inspected: 150 KHz to 30 MHz

Manufacturer:	Logic PD				
Date(s) of Test:	April 2 <sup>nd</sup> 2012				
Project Engineer:	Khairul Aidi Zainal				
Test Engineer:	Mike Hlntzke				
Voltage:	120 VAC				
Operation Mode:	continuous receive				
Environmental Conditions in the Lab:	Temperature: 23° C Relative Humidity: 48 %				
Test Location:	X	AC Mains Test area			Chamber
EUT Placed On:	X	40cm from Vertical Ground Plane			10cm Spacers
	X	80cm above Ground Plane			Other:
Measurements:		Pre-Compliance		Preliminary	X Final
Detectors Used:		Peak	X	Quasi-Peak	X Average

Frequency (MHz)	Line	Quasi-Peak			Average		
		Q-Peak Reading (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.161	L1	41.7	65.4	23.7	22.0	55.4	33.4
4.882	L1	30.9	56.0	25.1	25.2	46.0	20.8
13.330	L1	29.4	60.0	30.6	19.5	50.0	30.5
0.159	L2	37.6	65.5	27.9	23.8	55.5	31.7
4.891	L2	30.3	56.0	25.7	24.8	46.0	21.2
13.480	L2	33.1	60.0	26.9	24.3	50.0	25.7

**Notes:**

- 1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.
- 2) All other emissions were better than 20 dB below the limits.

Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
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6.7 Test Setup Photo(s) – Conducted Emissions Test



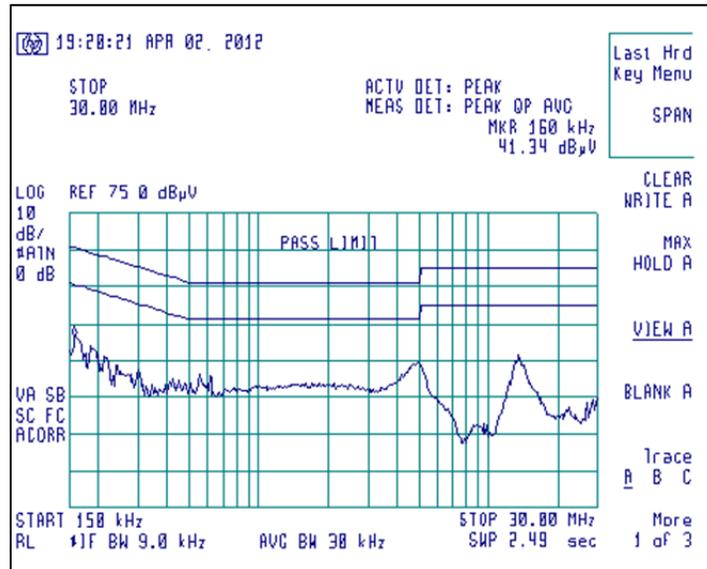
Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
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## 6.8 Screen Captures – Conducted Emissions Test

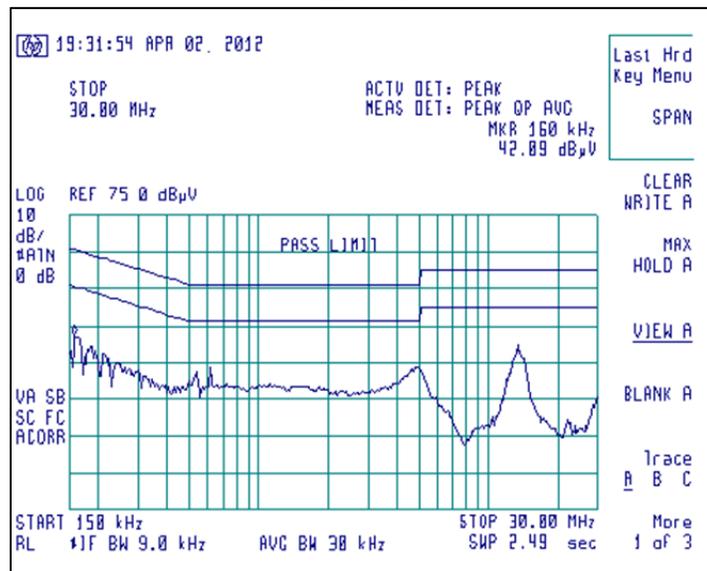
These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.107 and RSS GEN.

The signature scans shown here are from channel 2445 MHz, chosen as being a good representative of channels.

**Line 1**



**Line 2**



Prepared For: Logic PD	Model #: SOMDM3730-30-2780AKCR-B	LS Research, LLC
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## APPENDIX A: Test Equipment List



Date: 12-Dec-2011

Type Test: AC mains

Job #: C-1333 and C-1489

Prepared By: Aidi

Customer: Logic PD

Quote #: 311310

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	11/22/2011	11/22/2012	Active Calibration
2	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	11/22/2011	11/22/2012	Active Calibration
3	AA 960072	Transient Limiter	HP	18947A	3107A02515	11/22/2011	11/22/2012	Active Calibration
4	AA 960075	LSN	EMCO	38102NM	9612-1710	9/19/2011	9/19/2012	Active Calibration

Project Engineer: Aidi Zainal

Quality Assurance: Mike Hintzke



Date: 21-Jun-2012

Type Test: Rad Band-Edge

Job #: C-1333 and C-1489

Prepared By: Aidi

Customer: Logic PD

Quote #: 312142

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/29/2012	6/29/2013	Active Calibration
2	EE 960158	RF Reselector	Agilent	N9039A	MY46520110	6/29/2012	6/29/2013	Active Calibration
3	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	11/22/2011	11/22/2012	Active Calibration
4	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	11/22/2011	11/22/2012	Active Calibration
5	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	1/6/2012	1/6/2013	Active Calibration
6	EE 960161	28.5-40GHz LNA	Ducommun Techn	ALN-33144030	1103717-01	10/4/2011	10/4/2012	Active Calibration
7	EE 960148	Std. Gain Horn Ant. w/ preamp	Adv. Micro	WLA622-4	123001	11/3/2011	11/3/2012	Active Calibration
8	AA 960144	Phas eflex	Gore	EH001D010720	5800373	6/1/2011	6/1/2013	Active Calibration
9	AA 960005	Biconical Antenna	EMCO	93110B	9601-2280	6/26/2012	6/26/2013	Active Calibration
10	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	11/15/2011	11/15/2012	Active Calibration
11	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	1/6/2012	1/6/2013	Active Calibration
12	AA 960137	Standard Gain Horn Ant.	EMCO	3190-10	69259	10/4/2011	10/4/2014	Active Calibration
13	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	5/16/2012	5/16/2013	Active Calibration
14	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	11/15/2011	11/15/2012	Active Calibration

Project Engineer: Aidi

Quality Assurance: Shane

Prepared For: <u>Logic PD</u>	Model #: <u>SOMDM3730-30-2780AKCR-B</u>	LS Research, LLC
EUT: <u>37x Torpedo + Wireless SOM</u>	Serial #: <u>Refer to table in section 2.2</u>	Template: <u>15.109 Class B</u>
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This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k=2.

*Table of Expanded Uncertainty Values, (K=2) for Specified Measurements*

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V

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