



EMISSIONS TEST REPORT

Report Number: 100991570BOX-002

Project Number: G100991570

Report Issue Date: December 28, 2012

Product Designation: V7A-VP

Standards: CFR47 FCC Part 15 Subpart C:2012 15.249,
IC RSS-210 Issue 8 December 2010 Annex 2.9
CFR47 FCC Part 15 Subpart B:2012
ICES-003 Issue 5 August 2012,
RSS-Gen Issue 3 December 2010+Notice DRS 2012-DRS0126

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719

Client:
LoJack Corporation
40 Pequot Way
Canton, MA 02021

Report prepared by Reviewer

Kouma Sinn / Sr. Project Engineer, EMC

Report reviewed by

Nicholas Abbondante / Transmitter
Staff Engineer

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1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	
4	Description of Equipment Under Test	
5	System Setup and Method	
6	Fundamental Field Strength and Duty Cycle CFR47 FCC Part 15 Subpart C 15.249(a, c-e); IC RSS-210 Issue 8 December 2010 A2.9	Pass
7	Occupied Bandwidth CFR47 FCC Part 15 Subpart C 15.215(c); IC RSS-Gen Issue 3 December 2010 Section 4.6.1	Pass
8	Transmitter Spurious Radiated Emissions CFR47 FCC Part 15 Subpart C 15.209 & 15.249(a, c-e); IC RSS-210 December 2010 Annex 2.9; IC RSS-Gen Issue 3 December 2010 Sections 4.9 & 7.2.5 (Table 5)	Pass
--	Receiver Spurious Emissions FCC Part 15:2012 Subpart B Section 15.109 (a) RSS-Gen 3 December 2010, Section 6	Exempt, Below 30 MHz
9	Digital Device Spurious Emissions CFR47 FCC Part 15 Subpart B:2012 IC ICES-003 Issue 5 August 2012	Pass
--	AC Line-Conducted Emissions CFR47 FCC Part 15 Subpart B:2012, FCC Part 15:2011 Section 15.207 (a) RSS-Gen Issue 3 December 2010, 7.2.2 (Table 2) IC ICES-003 Issue 5 August 2012	Exempt, DC Power from Car Battery
10	Revision History	

3 Client Information

This EUT was tested at the request of:

Company: LoJack Corporation
40 Pequot Way
Canton, MA 02021

Contact: Mr. Vincent Ricci
Telephone: (781) 302-4332
Fax: (781) 302-2801
Email: vricci@lojack.com

4 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
2.4 GHz Transceiver	LoJack Corporation	V7A-VP	0BC41DD
2.4 GHz Transceiver	LoJack Corporation	V7A-VP	0C866F9

Receive Date:	12/12/12
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)

The equipment under test is a 2.4 GHz Transceiver that operates between 2400 MHz and 2483.5 MHz. The EUT utilizes an integral PCB antenna.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
12V (Car Battery)	N/A	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Programmed to run on 3 channel, Low (2402 MHz), Mid (2442 MHz), and High (2481 MHz). Used power cycle to step between the three programmed channels. During transmitter testing, the V7A-VP was powered from 12VDC and was transmitting repetitively. During idle mode testing, the V7A-VP was powered from 12VDC and was idle.

5 System Setup and Method

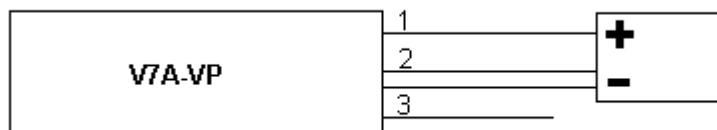
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	Battery (+) Lead	0.39	None	None	Battery
2	Battery (-) Leads	0.39	None	None	Battery
3	173.075 Transceiver Antenna (Not being tested)	1.05	None	None	None

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None			

5.1 Method:

Configuration as required by ANSI C63.4:2009 and ANSI C63.10:2009.

5.2 EUT Block Diagram:



6 Fundamental Field Strength and Duty Cycle

6.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C, IC RSS-210, and ANSI C63.10:2009.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A wooden table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$
$$NF = \text{Net Reading in dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
HORN3'	HORN ANTENNA	EMCO	3115	9610-4980	04/16/2012	04/16/2013
145128'	EMI Receiver 40 GHz (20 Hz - 40 Ghz)	Rohde & Schwarz	ESI	8392831001	09/28/2012	09/28/2013
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2012	10/04/2013

Software Utilized:

Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2010

6.3 Results:

The sample tested was found to Comply.

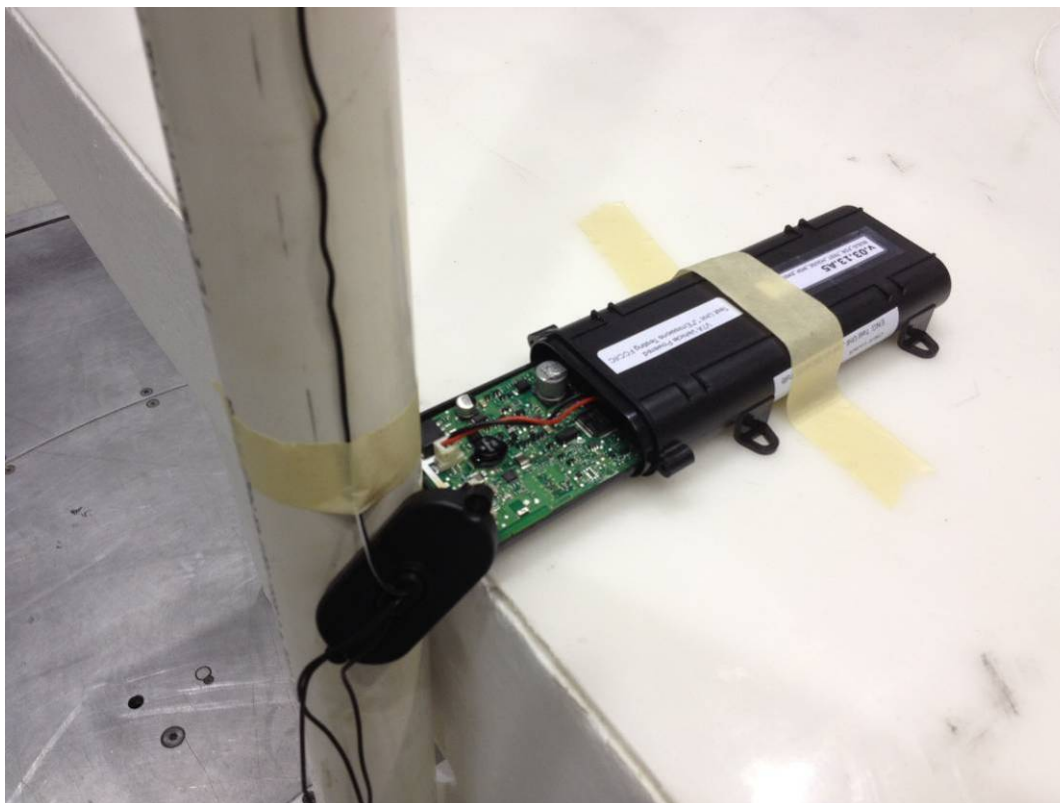
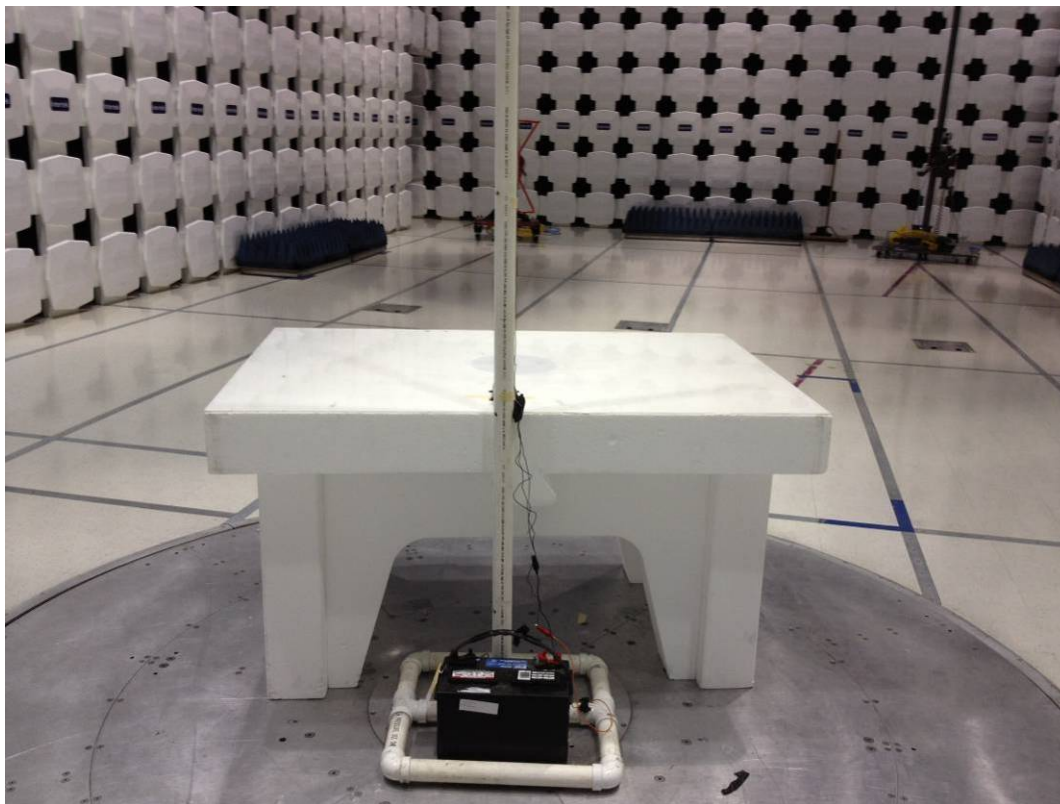
FCC 47CFR Part 15.249 and RSS-210 Annex 2.9

The field strength of emissions from intentional radiators operated within this frequency band shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)
2400-2483.5	50

Notes: Field strength limits are specified at a distance of 3 meters.

6.4 Setup Photographs:



Duty Cycle Measurement Setup



6.5 Test Data:

Radiated Emissions

Company: LoJack
 Model #: V7A-VP
 Serial #: 0BC41DD
 Engineers: Kouma Sinn
 Project #: G100991570
 Standard: FCC Part 15 Subpart C, Section 15.249 & RSS-210 Annex 2.9
 Receiver: 145-128 09-28-2013
 PreAmp: PRE145014 12-13-2013.txt
 Antenna & Cables: N Bands: N, LF, HF, SHF
 Antenna: HORN3 V3m 04-16-2013.txt HORN3 H3m 04-16-2013.txt
 Cable(s): 145-416 3mTrkB 10-04-2013.txt NONE.
 Location: 10m Chamber Barometer: DAV003 Filter:
 Date(s): 12/15/12
 Temp/Humidity/Pressure: 22C 19% 1015mbar
 Limit Distance (m): 3
 Test Distance (m): 3
 PreAmp Used? (Y or N): N Voltage/Frequency: Battery powered Frequency Range: See below
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
Low channel, 2402 MHz, at 3 meters with no pre-amp											
MaxH PK	V	2402.000	61.80	28.72	5.85	0.00	0.00	96.37	114.00	-17.63	1/3MHz
AVG	V	2402.000	20.80	28.72	5.85	0.00	0.00	55.37	94.00	-38.63	1/3MHz
MaxH PK	H	2402.000	60.84	28.56	5.85	0.00	0.00	95.25	114.00	-18.75	1/3MHz
AVG	H	2402.000	19.84	28.56	5.85	0.00	0.00	54.25	94.00	-39.75	1/3MHz
Mid channel, 2442 MHz, at 3 meters with no pre-amp											
MaxH PK	V	2442.000	57.79	28.83	5.91	0.00	0.00	92.53	114.00	-21.47	1/3MHz
AVG	V	2442.000	16.79	28.83	5.91	0.00	0.00	51.53	94.00	-42.47	1/3MHz
MaxH PK	H	2442.000	58.03	28.71	5.91	0.00	0.00	92.65	114.00	-21.35	1/3MHz
AVG	H	2442.000	17.03	28.71	5.91	0.00	0.00	51.65	94.00	-42.35	1/3MHz
High channel, 2481 MHz, at 3 meters with no pre-amp											
MaxH PK	H	2481.000	57.00	28.85	5.97	0.00	0.00	91.82	114.00	-22.18	1/3MHz
AVG	H	2481.000	16.00	28.85	5.97	0.00	0.00	50.82	94.00	-43.18	1/3MHz
MaxH PK	V	2481.000	54.82	28.94	5.97	0.00	0.00	89.74	114.00	-24.26	1/3MHz
AVG	V	2481.000	13.82	28.94	5.97	0.00	0.00	48.74	94.00	-45.26	1/3MHz

AVG = MaxH PK - Average Factor, or AVG = MaxH PK - 41 dB

Test Personnel: Kouma Sinn *KPS* Test Date: 12/15/2012
 Supervising/Reviewing Engineer: _____
 (Where Applicable) N/A
 Product Standard: FCC 15.249, RSS-210 Annex 2.9 Test Levels: Per standard
 Input Voltage: 12V (car battery) Ambient Temperature: 22 °C
 Pretest Verification w/ Ambient Signals or BB Source: Ambient Signals Relative Humidity: 19 %
 Atmospheric Pressure: 1015 mbars

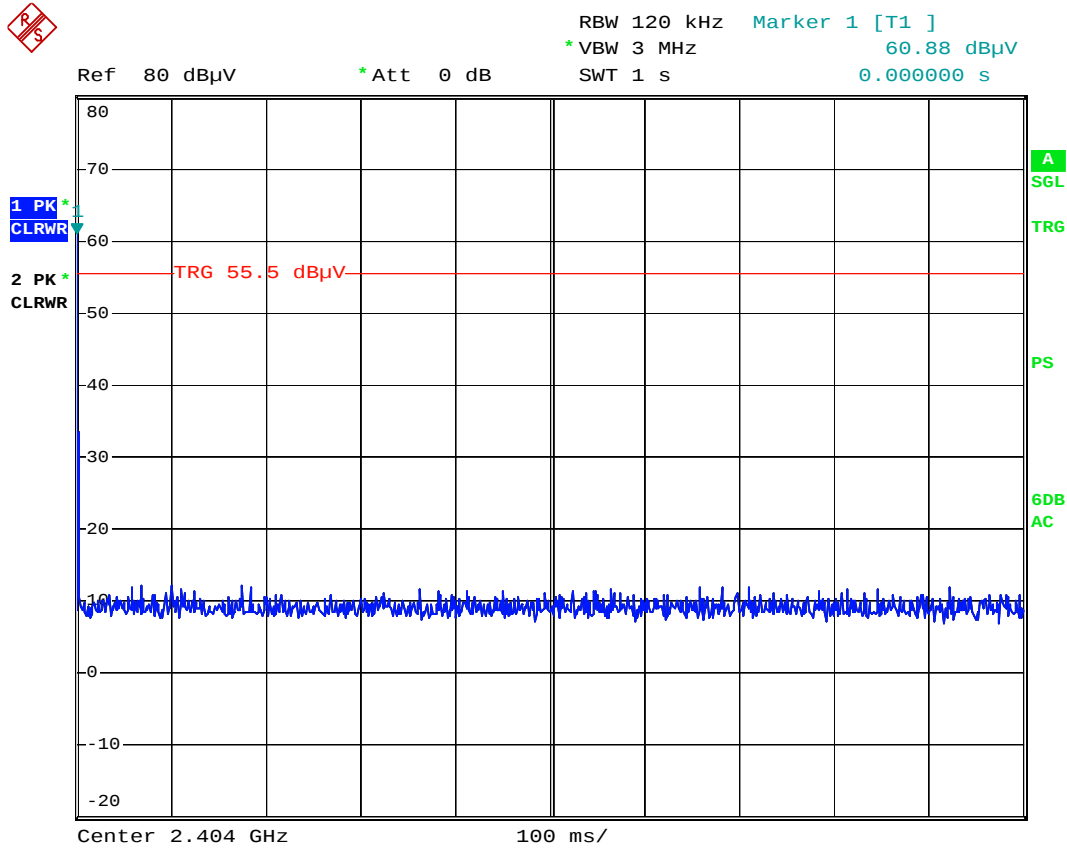
Deviations, Additions, or Exclusions: None

$$\text{Duty Cycle} = 900 \times 10^{-6} / 100 \times 10^{-3}$$

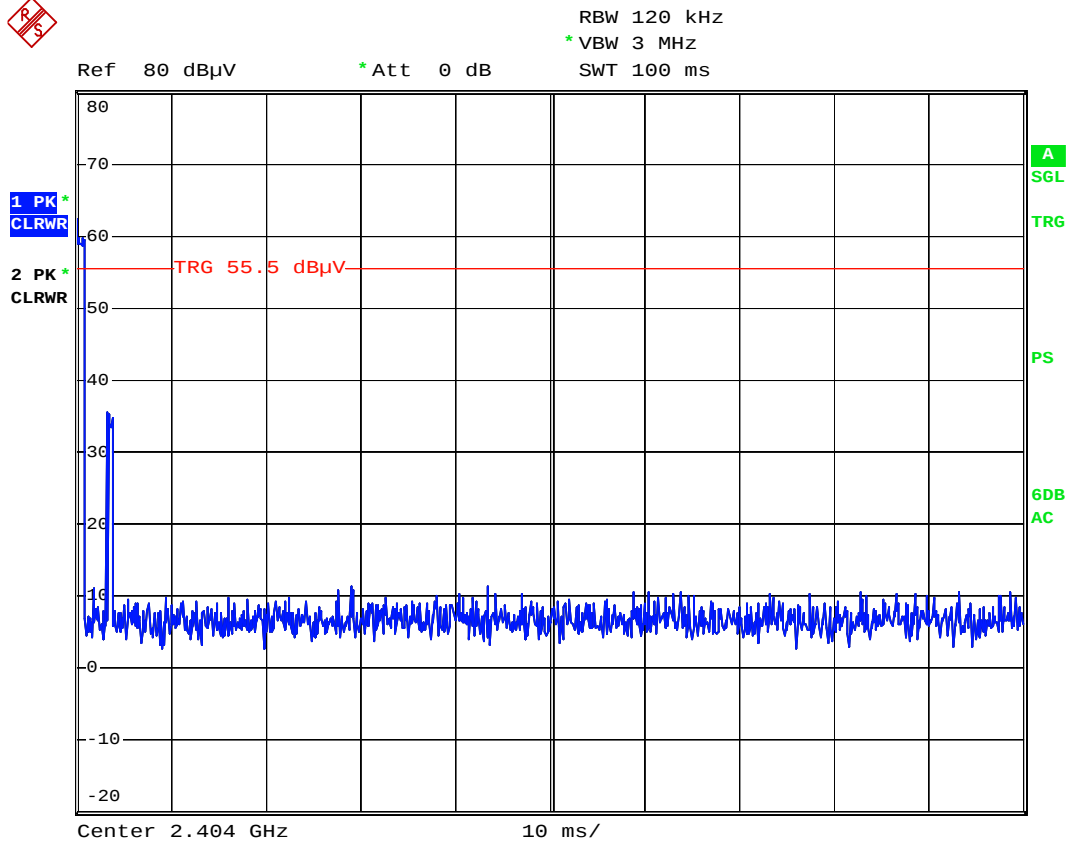
$$= 0.009 \text{ or } 0.9\%$$

$$\text{Average Factor} = 20 \times \log(0.009)$$

$$= 41 \text{ dB}$$

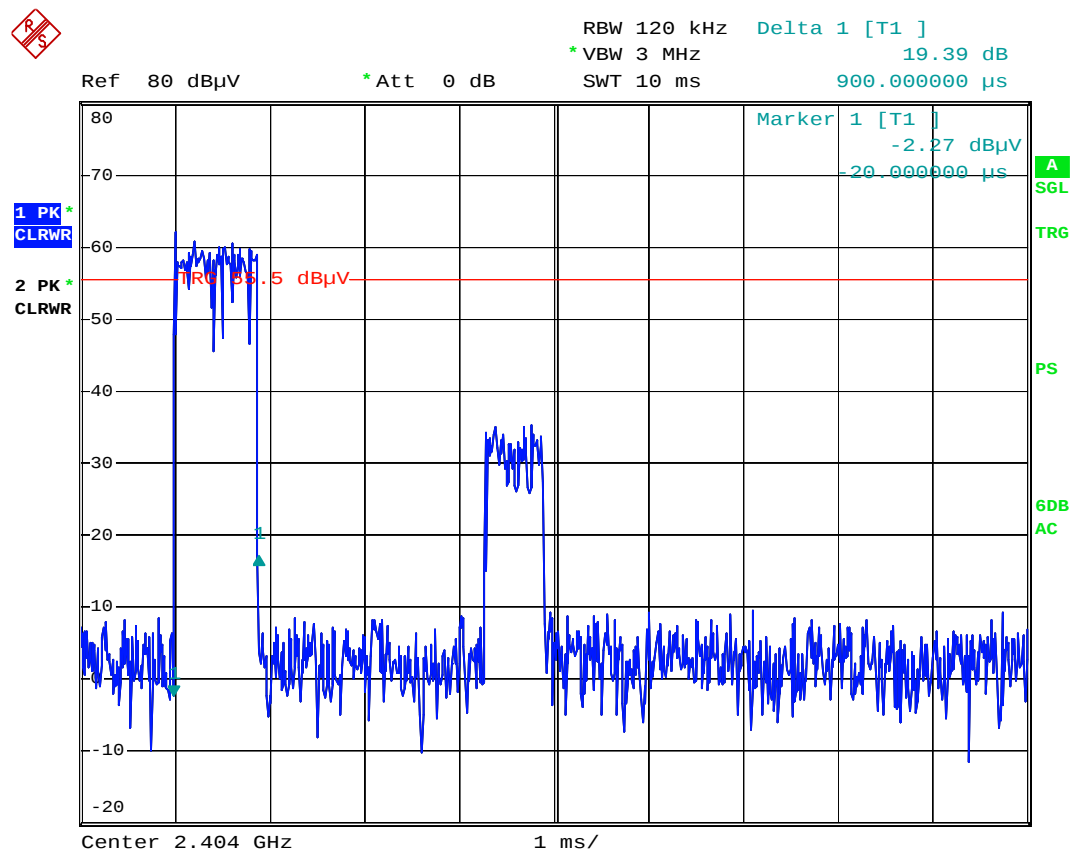


Date: 18.DEC.2012 18:42:58



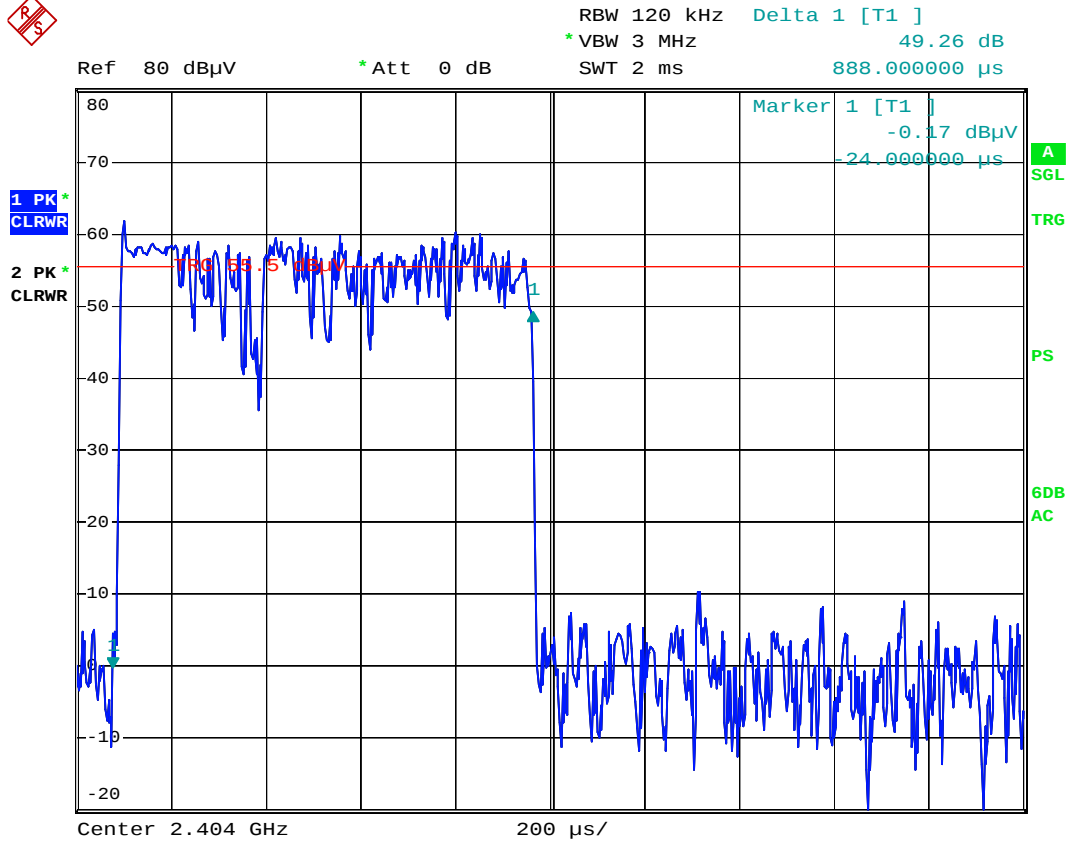
Date: 18.DEC.2012 18:42:12

The lower amplitude signal is a reply from a support unit.



Date: 18.DEC.2012 18:35:06

The lower amplitude signal is a reply from a support unit.



Date: 18.DEC.2012 18:37:58

Test Personnel: Kouma Sinn *KPS*
 Supervising/Reviewing Engineer:
 (Where Applicable) N/A
 Product Standard: FCC 15.249,
 RSS-210 Annex 2.9
 Input Voltage: 12 V Car Battery
 Pretest Verification w/
 Ambient Signals or
 BB Source: **Ambient Signals**

Test Date: 12/17/2012

Test Levels: N/A

Ambient Temperature: 22 °C

Relative Humidity: 24%

Atmospheric Pressure: 1002 mbars

Deviations, Additions, or Exclusions: None

7 Occupied Bandwidth

7.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C, IC RSS-210, and ANSI C63.10:2009.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A wooden table 80 cm high is used for table-top equipment.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
HORN3	HORN ANTENNA	EMCO	3115	9610-4980	04/16/2012	04/16/2013
145128	EMI Receiver 40 GHz (20 Hz - 40 Ghz)	Rohde & Schwarz	ESI	8392831001	09/28/2012	09/28/2013
145-416	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2012	10/04/2013

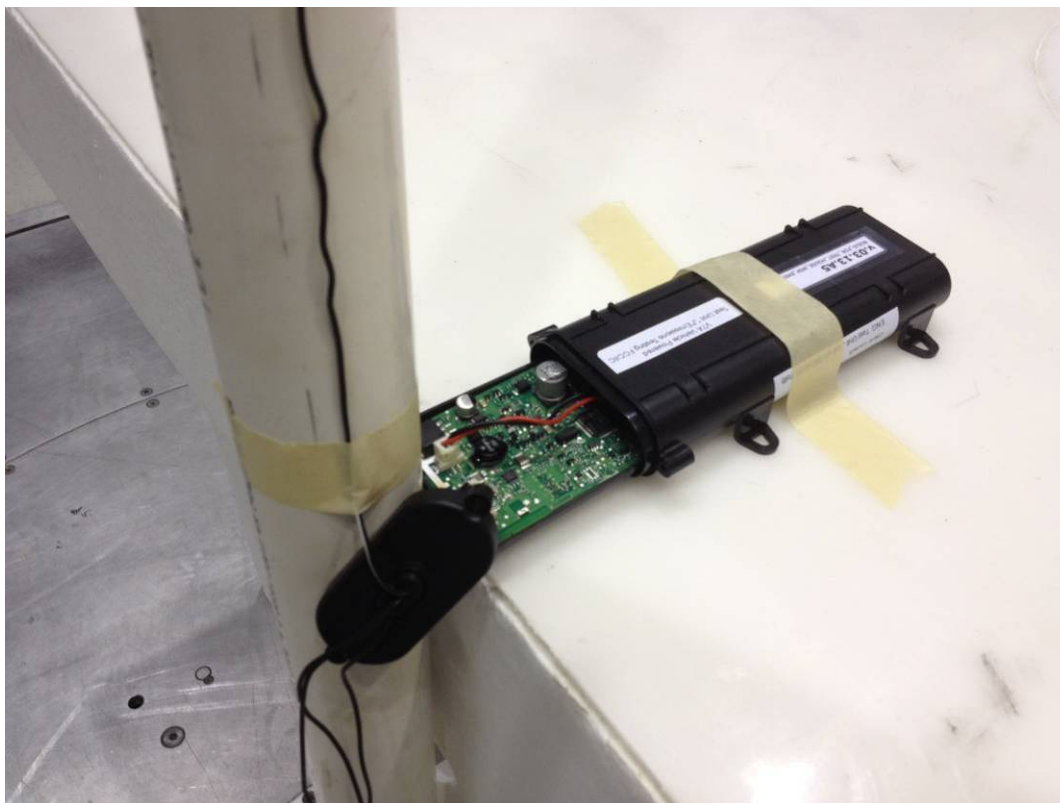
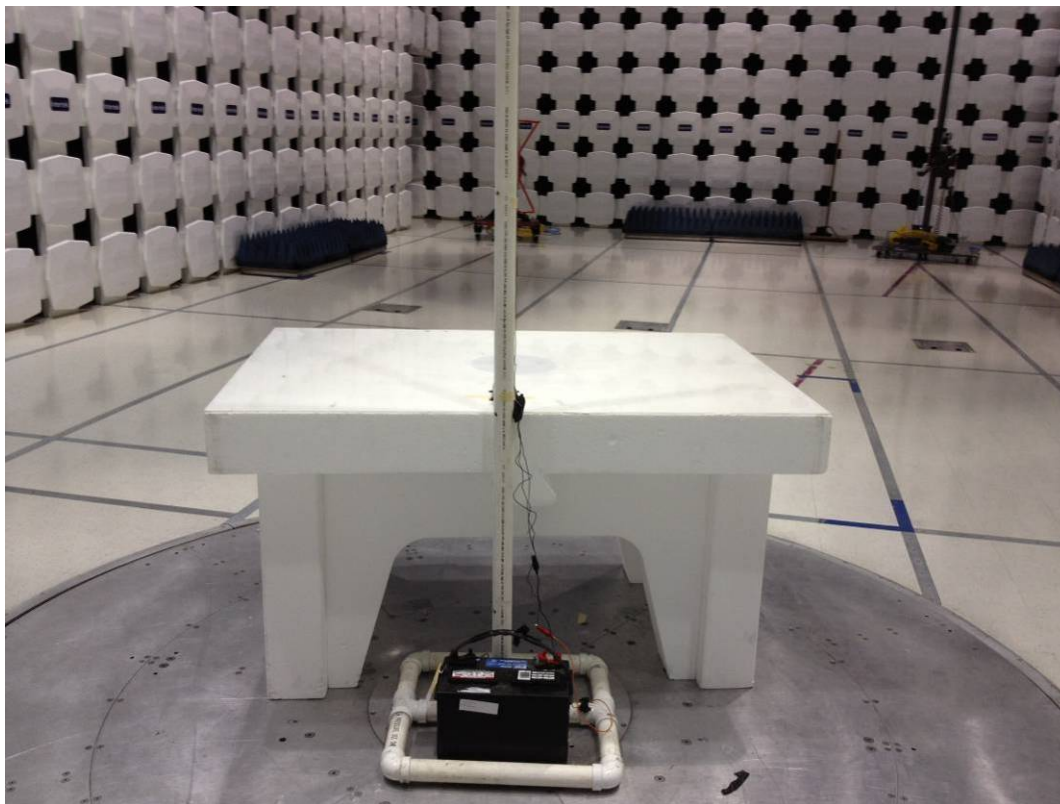
Software Utilized:

Name	Manufacturer	Version
None		

7.3 Results:

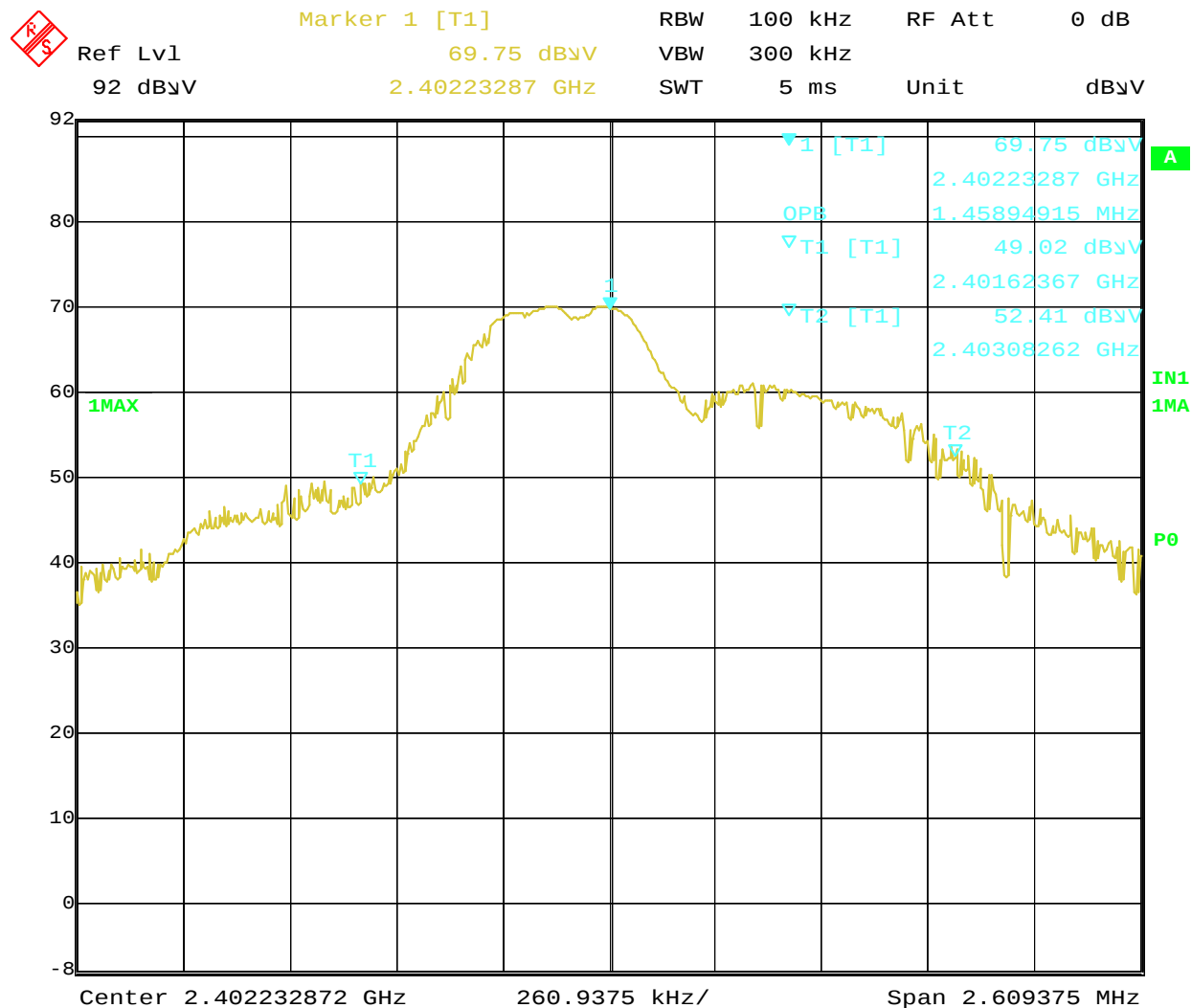
The sample tested was found to Comply.

7.4 Setup Photographs:



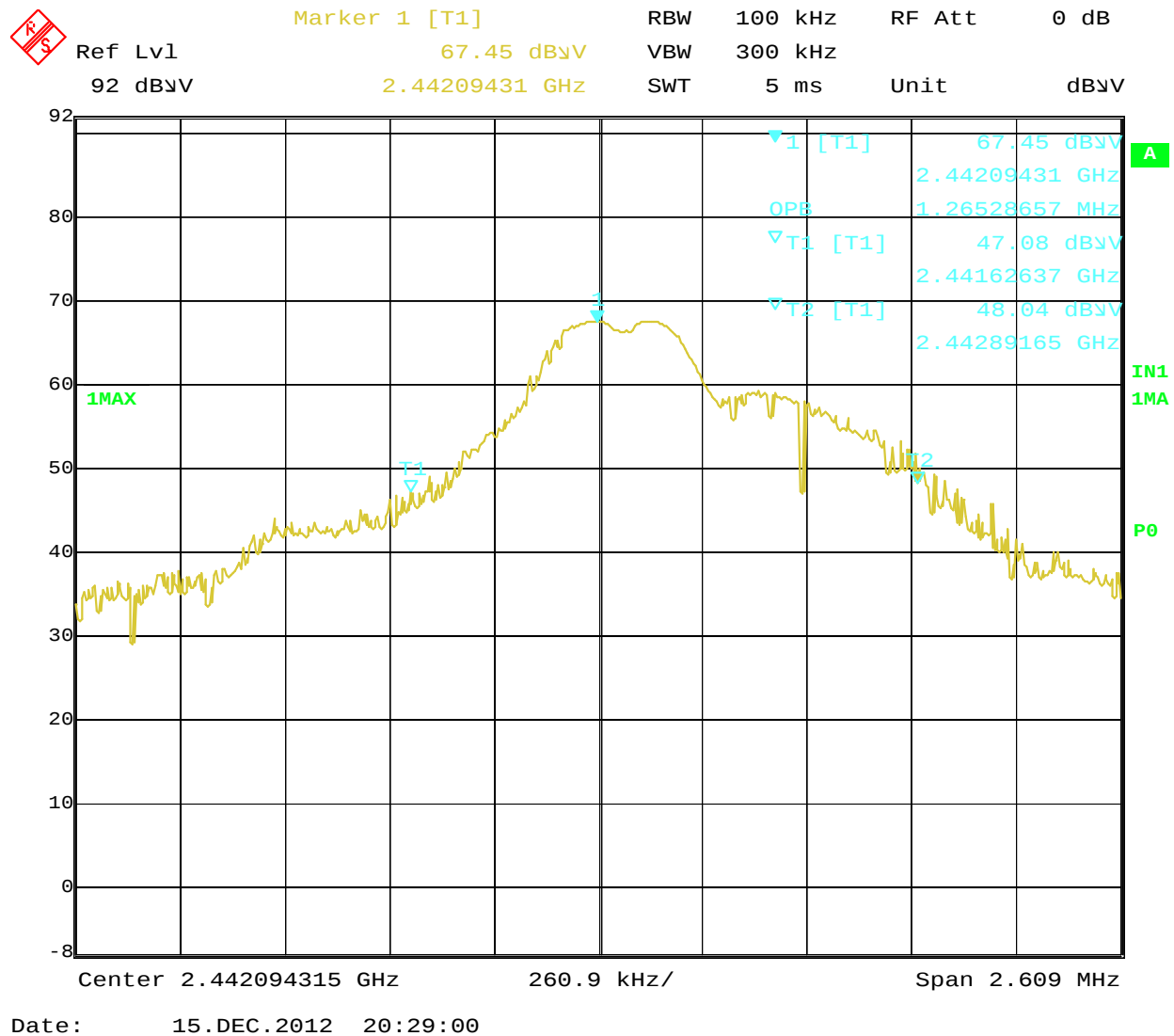
7.5 Plots/Data:

Low Channel, OPB 1.459 MHz

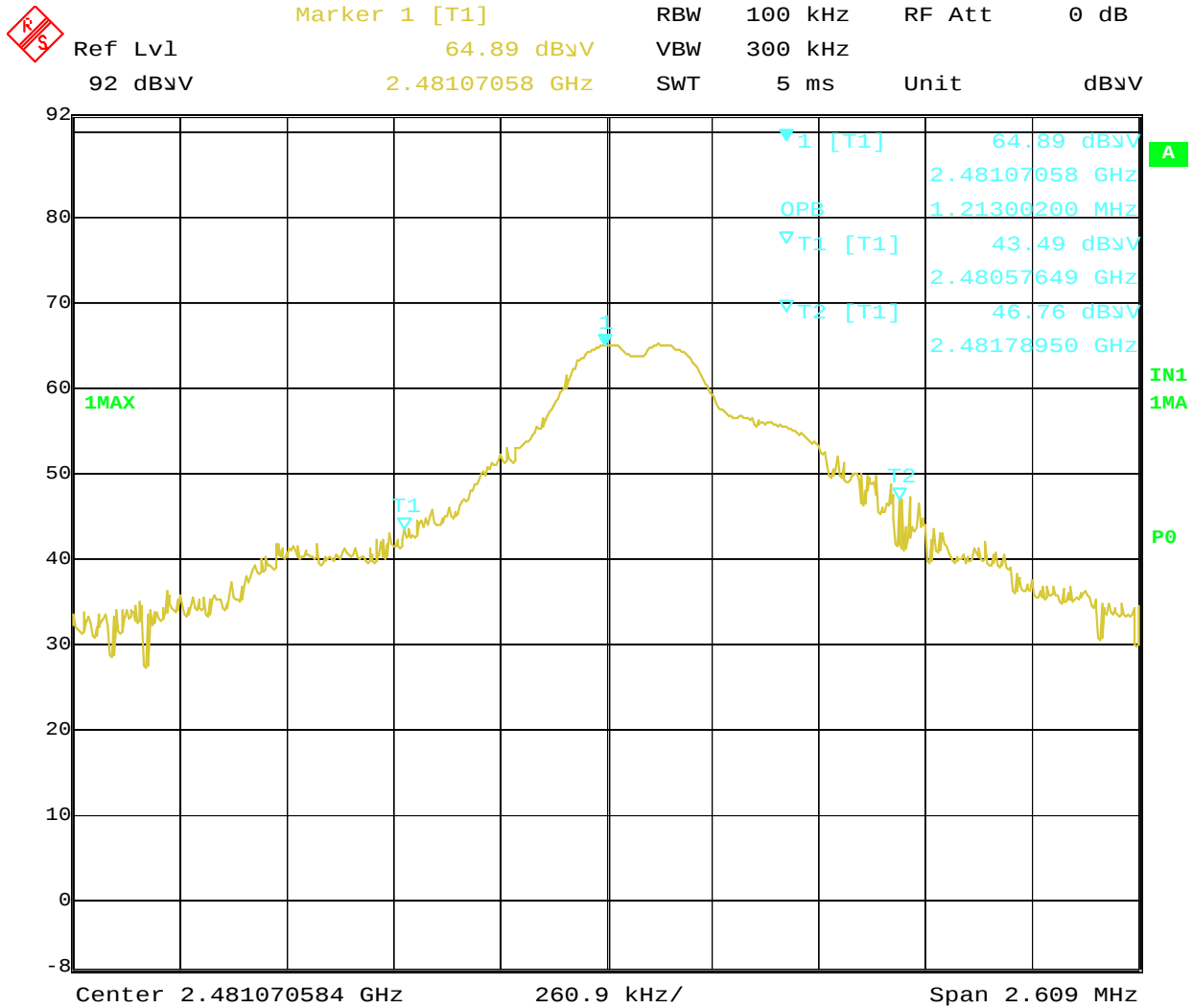


Date: 15.DEC.2012 20:09:13

Mid Channel, OPB 1.265 MHz



High Channel, OPB 1.213 MHz



Date: 15.DEC.2012 20:52:58

Test Personnel: Kouma Sinn *KPS*
 Supervising/Reviewing Engineer:
 (Where Applicable) N/A
 Product Standard: FCC 15.249, RSS-210 Annex 2.9
 Input Voltage: Battery powered
 Pretest Verification w/ Ambient Signals or BB Source: Ambient Signals

Test Date: 12/15/2012
 Test Levels: Per standard
 Ambient Temperature: 22 °C
 Relative Humidity: 19 %
 Atmospheric Pressure: 1015 mbars

Deviations, Additions, or Exclusions: None

8 Transmitter Spurious Radiated Emissions

8.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C, IC RSS-210, and ANSI C63.10:2009.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A wooden table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$
$$NF = \text{Net Reading in dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
EMC04'	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	02/08/2012	02/08/2013
CBL030'	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	02/08/2012	02/08/2013
MEG005'	High Frequency Cable	Megaphase	TM40-K1K1-197	8148601-001	02/07/2012	02/07/2013
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
ROS001'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	02/10/2012	02/10/2013
PRE9'	100MHz-40GHz Preamp	MITEQ	NSP4000-NFG	1260417	06/28/2012	06/28/2013
HORN3'	HORN ANTENNA	EMCO	3115	9610-4980	04/16/2012	04/16/2013
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	09/04/2012	09/04/2013
145128'	EMI Receiver 40 GHz (20 Hz - 40 Ghz)	Rohde & Schwarz	ESI	8392831001	09/28/2012	09/28/2013
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	10/04/2012	10/04/2013
145003'	Preamplifier (150 KHz to 1.3 GHz)	Hewlett Packard	8447D	2443A04077	10/04/2012	10/04/2013
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2012	10/04/2013
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	12/13/2012	12/13/2013

Software Utilized:

Name	Manufacturer	Version
C5	Teseq	5.26.46.46
EMI Boxborough.xls	Intertek	08/27/2010

8.3 Results:

The sample tested was found to Comply.

FCC 47CFR Part 15.249 and RSS-210 Annex 2.9

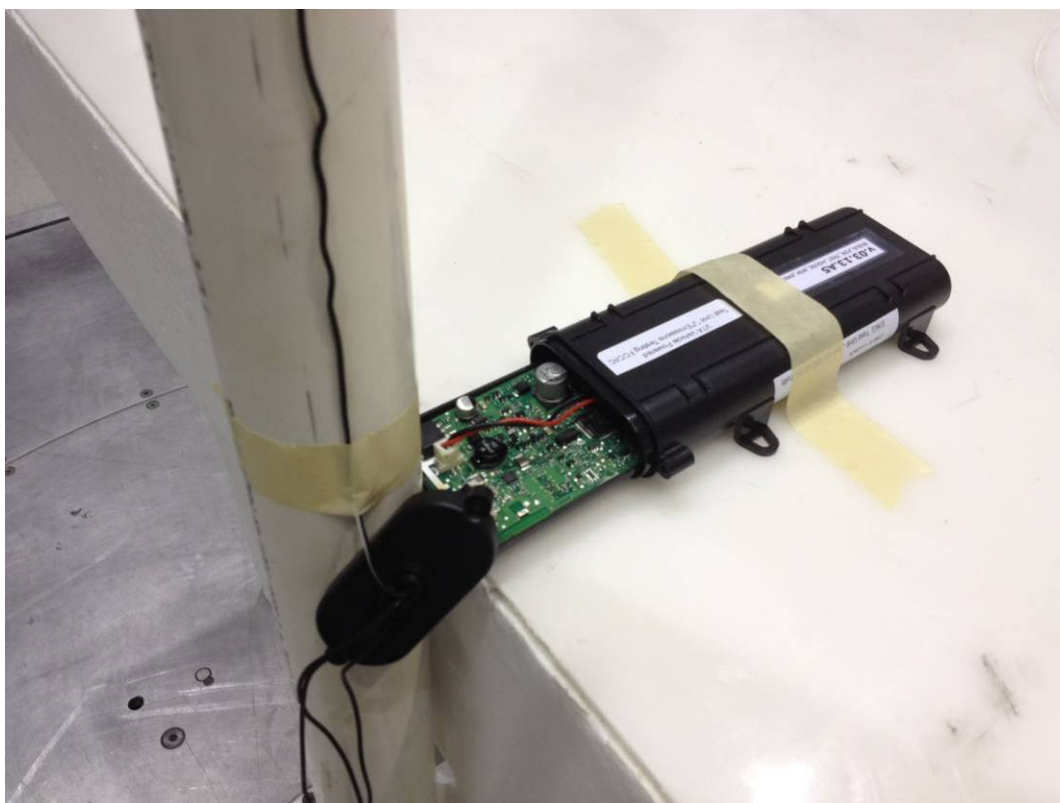
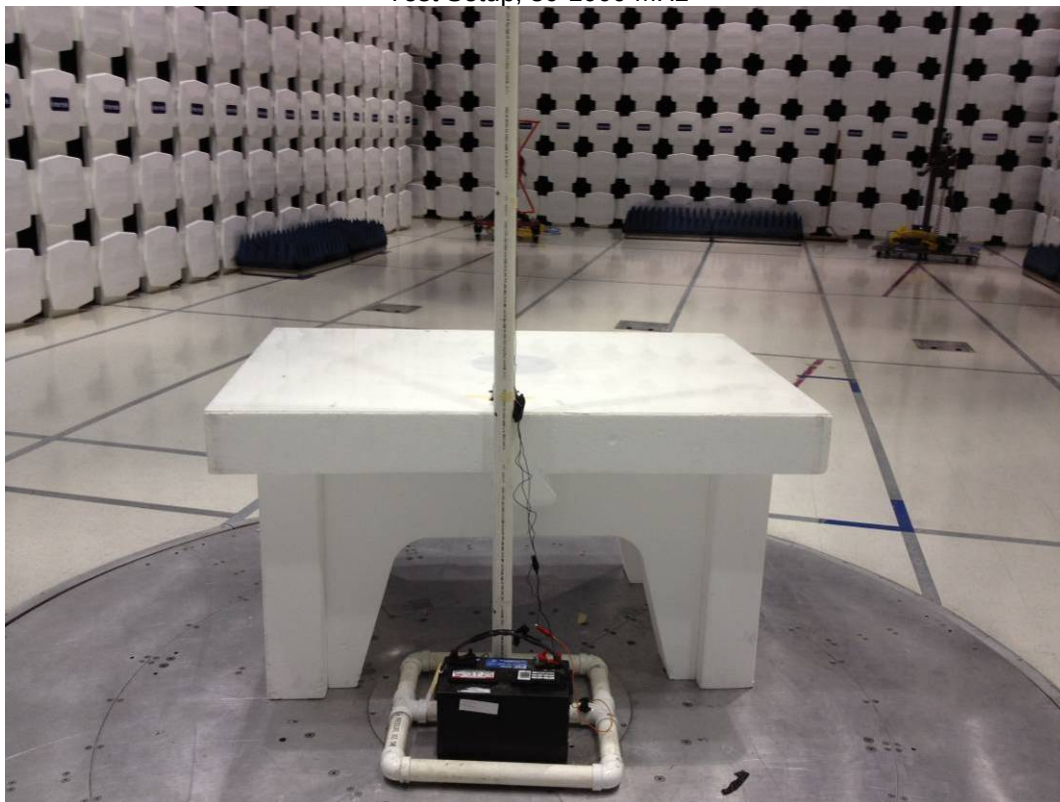
The emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to general radiated emission limits specified in 15.209 and RSS-Gen, whichever is lesser attenuation.

Fundamental frequency (MHz)	Field strength of harmonics (microvolts/meter)
2400-2483.5	500

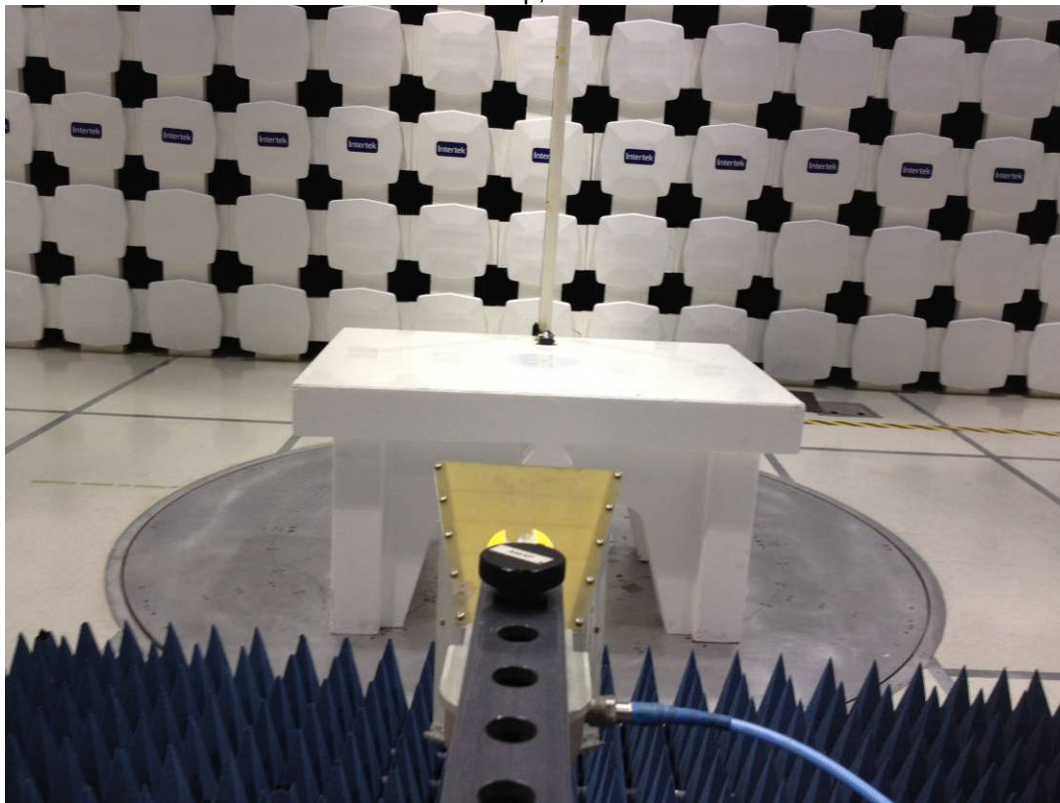
Notes: Field strength limits are specified at a distance of 3 meters.

8.4 Setup Photographs:

Test Setup, 30-1000 MHz



Test Setup, 1-18 GHz



Test Setup, 18-25 GHz



8.5 Plots/Data:

30-1000 MHz (Low Channel, 2402 MHz)

Test Information

Test Details

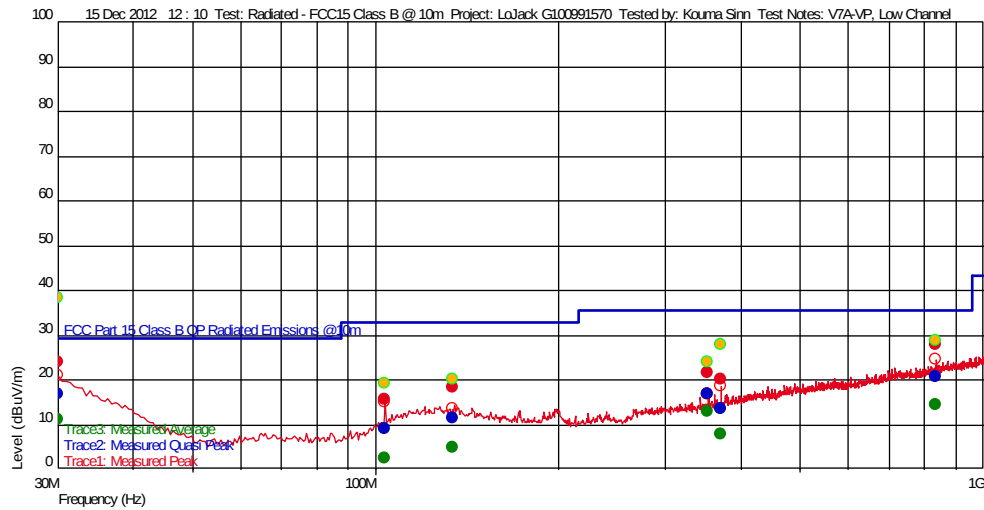
Test:
Project:
Test Notes:
Temperature:
Humidity:
Tested by:
Test Started:

User Entry

Radiated - FCC15 Class B @ 10m
LoJack G100991570
V7A-VP, Low Channel
22C
19%, 1015mbar
Kouma Sinn
15 Dec 2012 12 : 10

Additional Information

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Trace2: Measured Quasi Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
103.889378287 M	9.05	11.367	-25.445	33.040	-23.99		187	4.00	120 k	
370.260521321 M	13.58	15.200	-24.007	35.540	-21.96	--	102	1.04	120 k	
134.450901812 M	11.50	13.745	-25.170	33.040	-21.54		72	1.80	120 k	
353.021242743 M	16.81	14.681	-23.958	35.540	-18.73		29	2.12	120 k	
836.177956058 M	20.86	21.900	-23.317	35.540	-14.68		306	1.56	120 k	
30.0 M	16.89	21.300	-26.460	29.540	-12.65		321	3.28	120 k	

30-1000 MHz (Mid Channel, 2442 MHz)

Test Information

Test Details

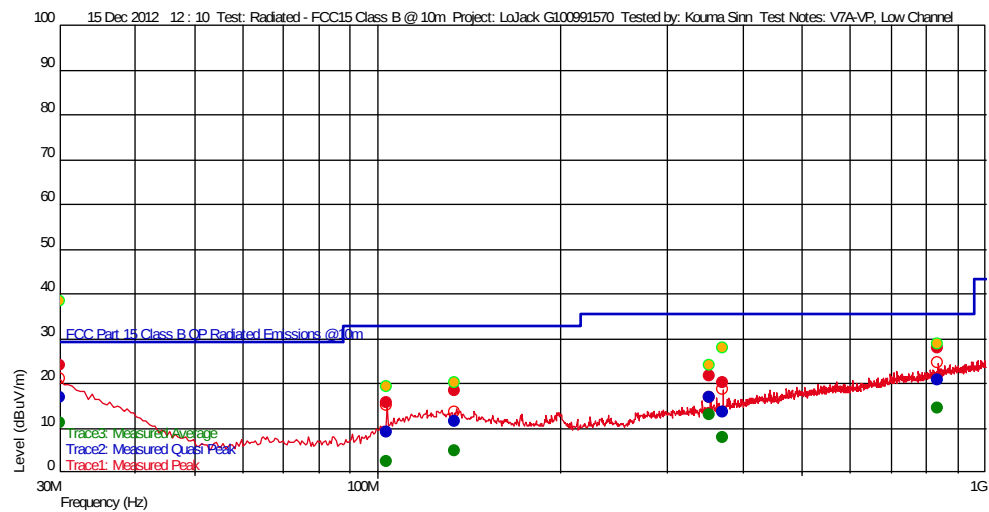
Test:
Project:
Test Notes:
Temperature:
Humidity:
Tested by:
Test Started:

User Entry

Radiated - FCC15 Class B @ 10m
LoJack G100991570
V7A-VP, Low Channel
22C
19%, 1015mbar
Kouma Sinn
15 Dec 2012 12 : 10

Additional Information

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable

- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace2: Measured Quasi Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
103.889378287 M	9.05	11.367	-25.445	33.040	-23.99		187	4.00	120 k	
370.260521321 M	13.58	15.200	-24.007	35.540	-21.96	--	102	1.04	120 k	
134.450901812 M	11.50	13.745	-25.170	33.040	-21.54		72	1.80	120 k	
353.021242743 M	16.81	14.681	-23.958	35.540	-18.73		29	2.12	120 k	
836.177956058 M	20.86	21.900	-23.317	35.540	-14.68		306	1.56	120 k	
30.0 M	16.89	21.300	-26.460	29.540	-12.65		321	3.28	120 k	

30-1000 MHz (High Channel, 2481 MHz)

Test Information

Test Details

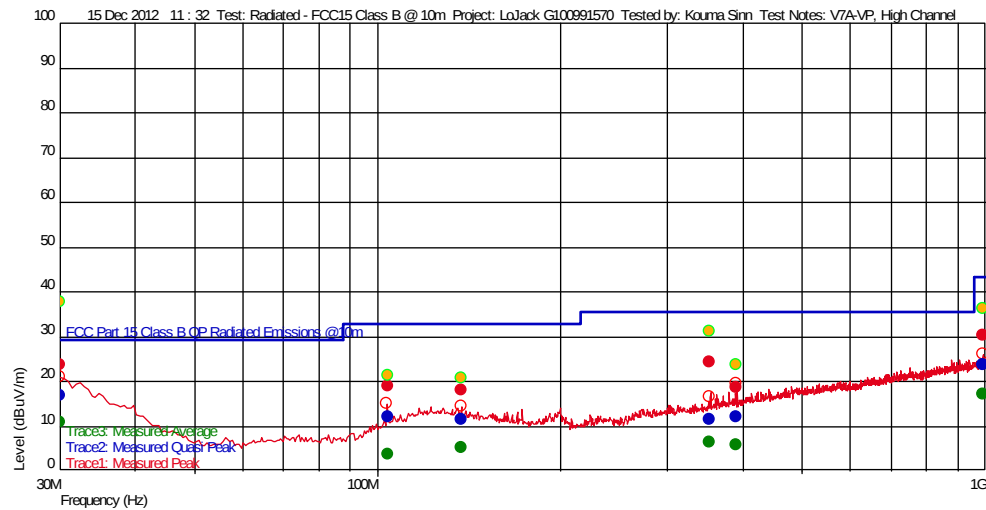
Test:
Project:
Test Notes:
Temperature:
Humidity:
Tested by:
Test Started:

User Entry

Radiated - FCC15 Class B @ 10m
LoJack G100991570
V7A-VP, High Channel
22C
19%, 1015mbar
Kouma Sinn
15 Dec 2012 11 : 32

Additional Information

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace2: Measured Quasi Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
352.145892042 M	11.37	14.629	-23.956	35.540	-24.17		198	1.64	120 k	
389.87274507 M	12.19	15.297	-24.062	35.540	-23.35		228	3.46	120 k	
137.693988377 M	11.44	13.561	-25.141	33.040	-21.60		233	1.15	120 k	
104.006412355 M	11.98	11.401	-25.444	33.040	-21.06		159	2.85	120 k	
990.574749377 M	23.67	23.000	-22.455	43.540	-19.87		56	2.73	120 k	
30.0 M	16.89	21.300	-26.460	29.540	-12.65		248	3.93	120 k	

1-25 GHz (Low Channel, 2402 MHz)

Company: LoJack
 Model #: V7A-VP
 Serial #: OBC41DD
 Engineers: Kouma Sinn
 Project #: G100991570
 Date(s): 12/15/12
 Standard: FCC Part 15 Subpart C, Section 15.249 & RSS-210 Annex 2.9
 Receiver: 145-128 09-28-2013
 PreAmp: PRE145014 12-13-2013.txt
 Antenna & Cables: N Bands: N, LF, HF, SHF
 Antenna: HORN3 V3m 04-16-2013.txt HORN3 H3m 04-16-2013.txt
 Cable(s): 145-416 3mTriKB 10-04-2013.txt NONE.
 Location: 10m Chamber Barometer: DAV003 Filter: REA004
 Temp/Humidity/Pressure: 22C 19% 1015mbar
 Limit Distance (m): 3
 Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Battery powered Frequency Range: See below
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Low channel, 2402 MHz, at 3 meters with pre-amp (145014) and filter (REA004), 1-18 GHz.													
MaxH PK	V	4804.000	53.66	33.50	8.58	34.68	0.00	61.06	74.00	-12.94	1/3MHz	RB	RB
AVG	V	4804.000	12.66	33.50	8.58	34.68	0.00	20.06	54.00	-33.94	1/3MHz	RB	RB
MaxH PK	V	7206.000	44.80	36.20	10.91	34.60	0.00	57.31	74.00	-16.69	1/3MHz		
AVG	V	7206.000	3.80	36.20	10.91	34.60	0.00	16.31	54.00	-37.69	1/3MHz		
MaxH PK	V	9608.000	37.08	39.04	12.67	35.22	0.00	53.56	74.00	-20.44	1/3MHz	NF	
AVG	V	9608.000	-3.92	39.04	12.67	35.22	0.00	12.56	54.00	-41.44	1/3MHz	NF	
MaxH PK	V	12010.000	36.50	39.64	15.02	36.23	0.00	54.93	74.00	-19.07	1/3MHz	RB, NF	RB
AVG	V	12010.000	-4.50	39.64	15.02	36.23	0.00	13.93	54.00	-40.07	1/3MHz	RB, NF	RB
MaxH PK	V	14412.000	37.50	43.46	15.16	34.45	0.00	61.67	74.00	-12.33	1/3MHz	NF	
AVG	V	14412.000	-3.50	43.46	15.16	34.45	0.00	20.67	54.00	-33.33	1/3MHz	NF	
MaxH PK	V	16814.000	35.16	40.06	17.58	34.64	0.00	58.16	74.00	-15.84	1/3MHz	NF	
AVG	V	16814.000	-5.84	40.06	17.58	34.64	0.00	17.16	54.00	-36.84	1/3MHz	NF	
AVG = MaxH PK - Average Factor, or AVG = MaxH PK - 41 dB													
Hand scan was performed from 18-25 GHz at a distance < 1 meter. No emissions were detected.													
Test equipment used: ROS001 (02/10/13), CBL030 (02/08/13), EMC04 (02/08/13)													

1-25 GHz (Mid Channel, 2442 MHz)

Company: LoJack
 Model #: V7A-VP
 Serial #: OBC41DD
 Engineers: Kouma Sinn
 Project #: G100991570
 Standard: FCC Part 15 Subpart C, Section 15.249 & RSS-210 Annex 2.9
 Receiver: 145-128 09-28-2013
 PreAmp: PRE145014 12-13-2013.txt
 Antenna & Cables: N
 Antenna: HORN3 V3m 04-16-2013.txt
 Cable(s): 145-416 3mTrkB 10-04-2013.txt
 Bands: N, LF, HF, SHF
 NONE.
 Location: 10m Chamber
 Barometer: DAV003
 Filter: REA004
 Date(s): 12/15/12
 Temp/Humidity/Pressure: 22C 19% 1015mbar
 Limit Distance (m): 3
 Test Distance (m): 3
 PreAmp Used? (Y or N): Y
 Voltage/Frequency: Battery powered
 Frequency Range: See below
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Mid channel, 2442 MHz, at 3 meters with pre-amp (145014) and filter (REA004), 1-18 GHz.													
MaxH PK	V	4884.000	50.20	33.67	8.67	34.67	0.00	57.87	74.00	-16.13	1/3MHz	RB	RB
AVG	V	4884.000	9.20	33.67	8.67	34.67	0.00	16.87	54.00	-37.13	1/3MHz	RB	RB
MaxH PK	V	7326.000	42.60	36.76	11.07	34.53	0.00	55.89	74.00	-18.11	1/3MHz	RB	RB
AVG	V	7326.000	1.60	36.76	11.07	34.53	0.00	14.89	54.00	-39.11	1/3MHz	RB	RB
MaxH PK	V	9768.000	37.20	39.52	13.05	35.66	0.00	54.11	74.00	-19.89	1/3MHz	NF	
AVG	V	9768.000	-3.80	39.52	13.05	35.66	0.00	13.11	54.00	-40.89	1/3MHz	NF	
MaxH PK	V	12210.000	36.12	39.35	14.82	36.44	0.00	53.86	74.00	-20.14	1/3MHz	RB, NF	RB
AVG	V	12210.000	-4.88	39.35	14.82	36.44	0.00	12.86	74.00	-61.14	1/3MHz	RB, NF	RB
MaxH PK	V	14652.000	34.78	43.62	15.26	34.61	0.00	59.05	74.00	-14.95	1/3MHz	NF	
AVG	V	14652.000	-6.22	43.62	15.26	34.61	0.00	18.05	54.00	-35.95	1/3MHz	NF	
MaxH PK	V	17094.000	33.82	41.57	18.79	34.39	0.00	59.80	74.00	-14.20	1/3MHz	NF	
AVG	V	17094.000	-7.18	41.57	18.79	34.39	0.00	18.80	54.00	-35.20	1/3MHz	NF	
AVG = MaxH PK - Average Factor, or AVG = MaxH PK - 41 dB													
Hand scan was performed from 18-25 GHz at a distance < 1 meter. No emissions were detected.													
Test equipment used: ROS001 (02/10/13), CBL030 (02/08/13), EMC04 (02/08/13)													

1-25 GHz (High Channel, 2481 MHz)

Company: LoJack
 Model #: V7A-VP
 Serial #: OBC41DD
 Engineers: Kouma Sinn
 Project #: G100991570
 Standard: FCC Part 15 Subpart C, Section 15.249 & RSS-210 Annex 2.9
 Receiver: 145-128 09-28-2013
 PreAmp: PRE145014 12-13-2013.txt
 Antenna & Cables: N
 Antenna: HORN3 V3m 04-16-2013.txt
 Cable(s): 145-416 3mTriKB 10-04-2013.txt
 Bands: N, LF, HF, SHF
 NONE.
 Location: 10m Chamber
 Barometer: DAV003
 Filter: REA004
 Date(s): 12/15/12
 Temp/Humidity/Pressure: 22C 19% 1015mbar
 Limit Distance (m): 3
 Test Distance (m): 3
 PreAmp Used? (Y or N): Y
 Voltage/Frequency: Battery powered
 Frequency Range: See below
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
High channel, 2481 MHz, at 3 meters with pre-amp (145014) and filter (REA004), 1-18 GHz.													
MaxH PK	V	4962.000	51.52	33.82	8.76	34.66	0.00	59.45	74.00	-14.55	1/3MHz	RB	RB
AVG	V	4962.000	10.52	33.82	8.76	34.66	0.00	18.45	54.00	-35.55	1/3MHz	RB	RB
MaxH PK	V	7443.000	41.48	36.93	11.22	34.47	0.00	55.17	74.00	-18.83	1/3MHz	RB	RB
AVG	V	7443.000	0.48	36.93	11.22	34.47	0.00	14.17	54.00	-39.83	1/3MHz	RB	RB
MaxH PK	V	9924.000	36.74	39.97	13.43	36.08	0.00	54.05	74.00	-19.95	1/3MHz	NF	
AVG	V	9924.000	-4.26	39.97	13.43	36.08	0.00	13.05	54.00	-40.95	1/3MHz	NF	
MaxH PK	V	12405.000	36.50	39.13	14.63	36.64	0.00	53.62	74.00	-20.38	1/3MHz	RB, NF	RB
AVG	V	12405.000	-4.50	39.13	14.63	36.64	0.00	12.62	54.00	-41.38	1/3MHz	RB, NF	RB
MaxH PK	V	14886.000	35.96	42.75	15.68	34.76	0.00	59.62	74.00	-14.38	1/3MHz	NF	
AVG	V	14886.000	-5.04	42.75	15.68	34.76	0.00	18.62	54.00	-35.38	1/3MHz	NF	
MaxH PK	V	17367.000	34.86	43.54	20.04	34.12	0.00	64.31	74.00	-9.69	1/3MHz	NF	
AVG	V	17367.000	-6.14	43.54	20.04	34.12	0.00	23.31	54.00	-30.69	1/3MHz	NF	
AVG = MaxH PK - Average Factor, or AVG = MaxH PK - 41 dB													
Hand scan was performed from 18-25 GHz at a distance < 1 meter. No emissions were detected.													
Test equipment used: ROS001 (02/10/13), CBL030 (02/08/13), EMC04 (02/08/13)													

Test Personnel: Kouma Sinn *KPS*
 Supervising/Reviewing Engineer:
 (Where Applicable) N/A
 Product Standard: FCC 15.249, RSS-210 Annex 2.9
 Input Voltage: Battery powered
 Pretest Verification w/ Ambient Signals or BB Source: Ambient Signals

Test Date: 12/15/2012
 Test Levels: Per standard
 Ambient Temperature: 22 °C
 Relative Humidity: 19 %
 Atmospheric Pressure: 1015 mbars

Deviations, Additions, or Exclusions: None

9 Digital Devices Spurious Radiated Emissions

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart B, IC ICES-003, and ANSI C63.4:2009.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A wooden table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
 AF = 7.4 dB/m
 CF = 1.6 dB
 AG = 29.0 dB
 FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	09/04/2012	09/04/2013
145003'	Preamplifier (150 KHz to 1.3 GHz)	Hewlett Packard	8447D	2443A04077	10/04/2012	10/04/2013
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	10/04/2012	10/04/2013
145128'	EMI Receiver 40 GHz (20 Hz - 40 GHz)	Rohde & Schwarz	ESI	8392831001	09/28/2012	09/28/2013

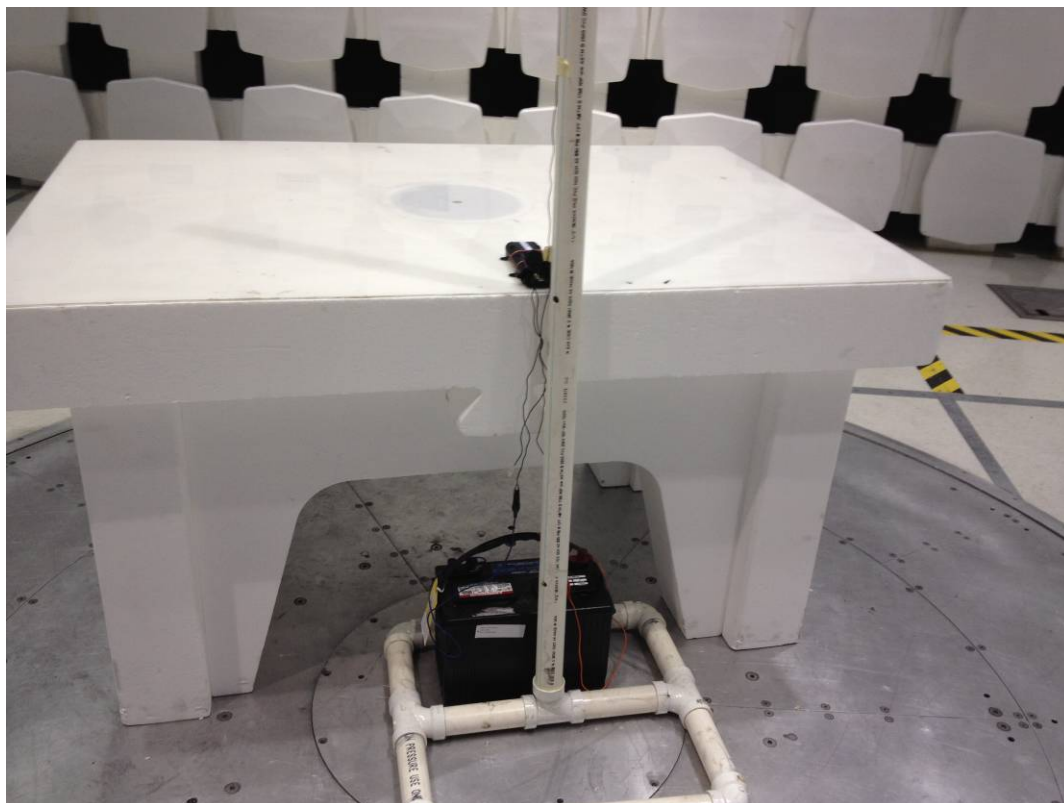
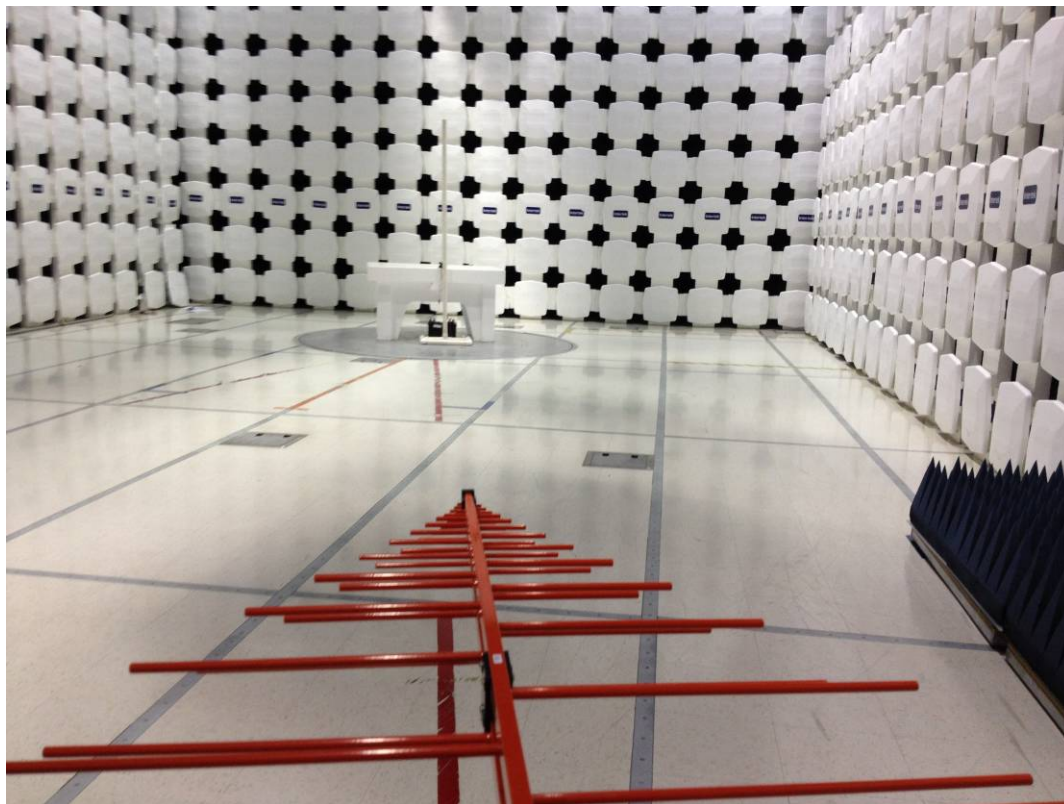
Software Utilized:

Name	Manufacturer	Version
C5 Emissions	TESEQ	5.26.46.46

9.3 Results:

The sample tested was found to Comply.

9.4 Setup Photographs:



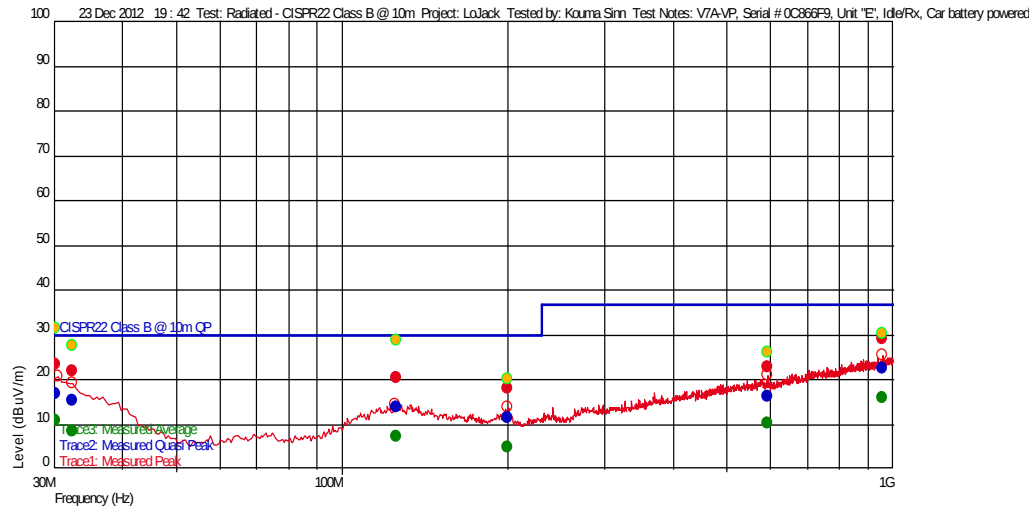
9.5 Plots/Data:

Test Information

Test Details
 Test: Radiated - CISPR22 Class B @ 10m
 Project: LoJack
 Test Notes: V7A-VP, Serial # 0C866F9, Unit "E", Idle/Rx, Car battery powered
 Temperature: 22 C
 Humidity: 16 %, 998 mbar
 Tested by: Kouma Sinn
 Test Started: 23 Dec 2012 19 : 42

Additional Information

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable

- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace2: Measured Quasi Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
592.595190359 M	16.40	18.800	-24.454	37.000	-20.60		256	3.89	120 k	
199.875951487 M	11.60	12.888	-24.412	30.000	-18.40	--	348	1.65	120 k	
125.79799599 M	13.88	13.940	-25.248	30.000	-16.12		131	3.23	120 k	
32.412224729 M	15.25	19.511	-26.421	30.000	-14.75		99	1.76	120 k	
956.714228519 M	22.68	22.800	-22.726	37.000	-14.32		279	3.06	120 k	
30.203006068 M	16.94	21.117	-26.457	30.000	-13.06		85	3.63	120 k	

Notes: Used CISPR 22 limits as referenced by FCC Part 15.109 and IC ICES-003.

Test Personnel: Kouma Sinn *KPS*
 Supervising/Reviewing Engineer:
 (Where Applicable) N/A
 Product Standard: FCC Part 15 Subpart B
 Input Voltage: IC ICES-003
 Pretest Verification w/ Ambient Signals or BB Source: 12VDC (car battery)
 Ambient

Test Date: 12/23/2012

Test Levels: See tables

Ambient Temperature: 22 °C

Relative Humidity: 16 %

Atmospheric Pressure: 998 mbars

Deviations, Additions, or Exclusions: None

10 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	12/28/2012	100991570BOX-002	<i>LPS</i>	<i>JNA</i>	Original Issue