



EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 102144226BOX-007a

Project Number: G102144226

Report Issue Date: 08/20/2015

Model(s) Tested: V9E-VP

Model(s) Partially Tested: V9E-SP

(Fundamental and harmonic frequencies were tested on the V9E-SP)

Standards: CFR47 "Telecommunications" FCC Part 15 Subpart C:2015
"Intentional Radiators" 15.249 "Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz"

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

Client:
LoJack Corporation
40 Pequot Way
Canton, MA 02021
USA

Report prepared by

Vathana Ven / Staff Engineer, EMC

Report reviewed by

Kouma Sinn / Staff Engineer, EMC

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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 products tested Comply with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Fundamental Field Strength (FCC§15.249(a),(e))	Pass
7	Transmitter Occupied Bandwidth (FCC15.215)	Pass
8	Transmitter and Receiver Radiated Spurious Emissions (FCC §15.209,15.249(a),(d))	Pass
9	AC Mains Conducted Emissions (FCC §15.207)	N/A*
10	Revision History	--

* - EUT is battery powered

3 Client Information

This EUT was tested at the request of:

Client: LoJack Corporation
40 Pequot Way
Canton, MA 02021
USA

Contact: Vincent Ricci
Telephone: (781) 302-4332
Fax: Not provided
Email: vricci@lojack.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: LoJack Corporation
40 Pequot Way
Canton, MA 02021
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Vehicle Location Unit	LoJack Corporation	V9E-VP	0F4B030
Vehicle Location Unit	LoJack Corporation	V9E-SP	0F4B035

Receive Date:	07/13/2015, 07/30/2015
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)

The V9E-VP and V9E-SP are mobile Vehicle Location Transponders which also incorporates a 2.4 GHz short range radio device. This radio is battery operated and transmits at 2402 to 2481 MHz and use an integral trace antenna.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
3.6 & 7.2 VDC	Not label on the device	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	The Vehicle Location Unit was powered from internal 3.6V & 7.2V Lithium battery pack and was programmed to transmit continuously during testing. During the frequency stability and the transient frequency behavior testing, the transmitter was unmodulated.

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	None

Radio/Receiver Characteristics	
Frequency Band(s)	2402-2481 MHz
Modulation Type(s)	MSK
Maximum Output Power	-0.66 dBm or 0.000859W
Test Channels	3
Occupied Bandwidth	0.847 MHz (Lo channel), 0.847 MHz (Mid channel), 1.052 MHz (Hi channel)
Frequency Hopper: Number of Hopping Channels	N/A
Frequency Hopper: Channel Dwell Time	N/A
Frequency Hopper: Max interval between two instances of use of the same channel	N/A
MIMO Information (# of Transmit and Receive antenna ports)	N/A
Equipment Type	Standalone
ETSI LBT/Adaptivity	N/A
ETSI Adaptivity Type	N/A
ETSI Temperature Category (I, II, III)	N/A
ETSI Receiver Category (1, 2, 3)	N/A
Antenna Type and Gain	Integral antenna

5 System Setup and Method

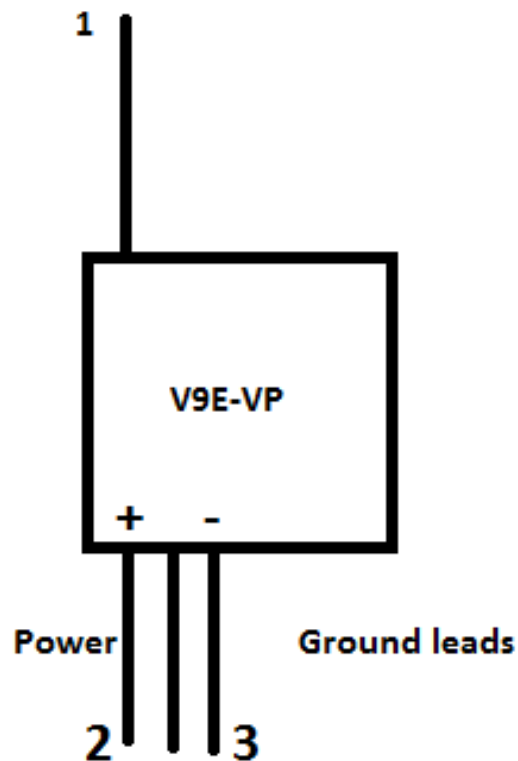
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	Antenna	1.067	None	None	Antenna
2	DC Ground	0.4	None	None	None
3	Control	0.4	None	None	None

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None			

5.1 Method:

Configuration as required by ANSI C63.10:2013.

5.2 EUT Block Diagram:



6 Fundamental Field Strength

6.1 Method

Tests are performed in accordance with FCC §15.249(a)(e).

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 Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 10m	30-1000 MHz	3.5 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	3.5 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.2 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.2 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.2 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} 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	10/06/2014	10/06/2015
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/14/2015	01/14/2016
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/14/2015	03/14/2016
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	10/04/2014	10/04/2015

Software Utilized:

Name	Manufacturer	Version
Excel 2003	Microsoft	(11.8231.8221) SP3
EMI Boxborough.xls	Intertek	08/27/10

6.3 Results:

The fundamental field strength must not exceed an average limit of 94 dBuV/m and a peak limit of 114 dBuV/m, which is 20 dB higher than the average limit.

Average factor of 15.8 dB was applied to peak readings of the emissions to obtain average readings.

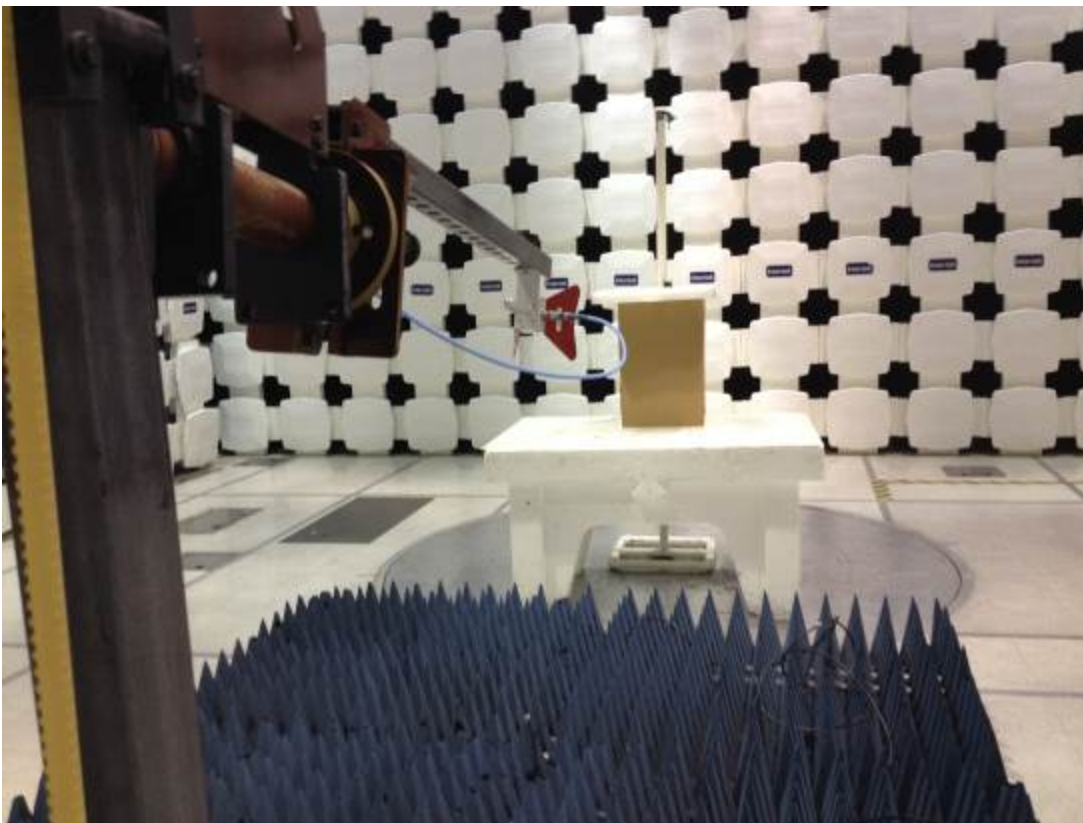
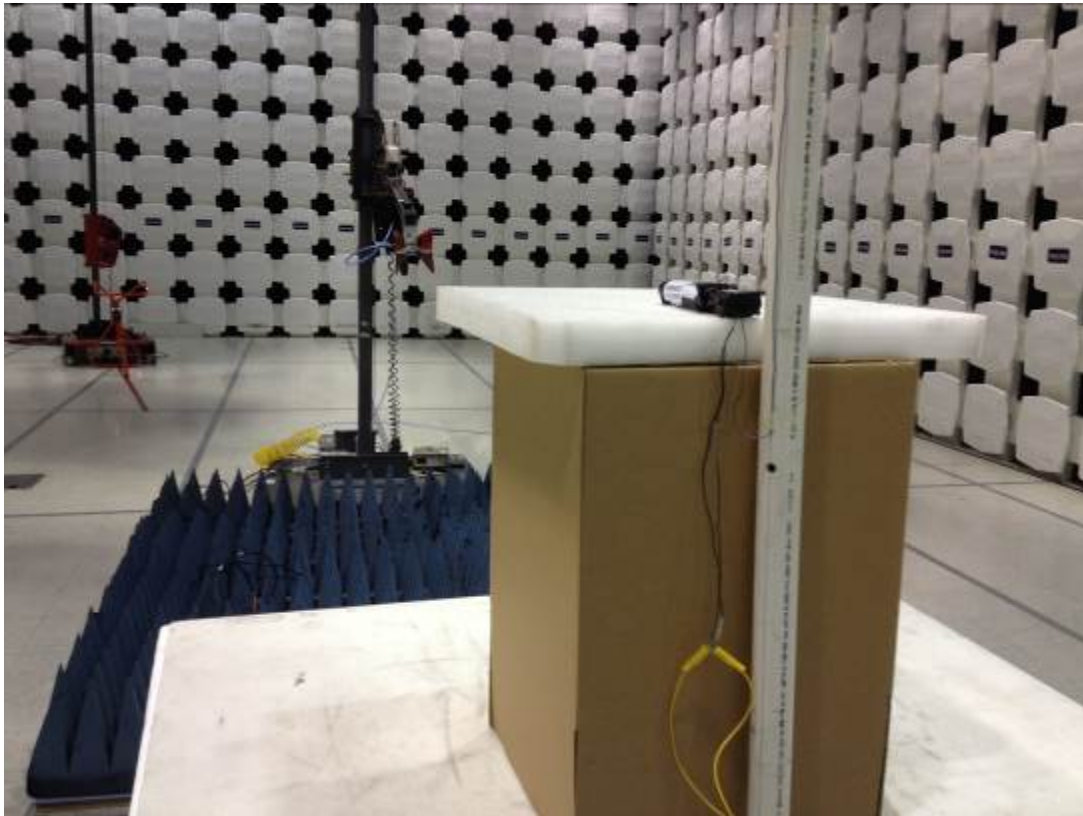
The samples tested were found to Comply.

6.4 Setup Photographs:

V9E-VP



V9E-SP



6.5 Test Data:

V9E-SP Fundamental Radiated Emissions

Company: LoJack Corporation Antenna & Cables: HF Bands: N, LF, HF, SHF
 Model #: V9E-SP Antenna: ETS001 01-14-16.txt ETS001 01-14-16.txt
 Serial #: 0F4B035 Cable(s): 145-416 3m Track B 1-15GHz Cable 10-04-15.txt NONE.
 Engineers: Vathana Ven Location: 10m Chamber Barometer: DAV004 Filter:
 Project #: G102144226 Date(s): 07/31/15
 Standard: FCC Part 15 Subpart C 15.249 Temp/Humidity/Pressure: 25 deg. C 41% 997 mB
 Receiver: 145128_03-14-16 Limit Distance (m): 3
 PreAmp: 145014 05-13-16.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Battery 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
WSP Self powered, Lo Channel													
MaxH PK	H	2402.000	55.63	31.96	5.87	0.00	0.00	93.46	114.00	-20.54	1/3MHz		
AVG	H	2402.000	39.83	31.96	5.87	0.00	0.00	77.66	94.00	-16.34	1/3MHz		
MaxH PK	V	2402.000	51.40	31.96	5.87	0.00	0.00	89.23	114.00	-24.77	1/3MHz		
AVG	V	2402.000	35.60	31.96	5.87	0.00	0.00	73.45	94.00	-20.55	1/3MHz		
WSP Self powered, Mid Channel													
MaxH PK	H	2442.000	53.31	32.11	5.93	0.00	0.00	91.35	114.00	-22.65	1/3MHz		
AVG	H	2442.000	37.51	32.11	5.93	0.00	0.00	75.55	94.00	-18.45	1/3MHz		
MaxH PK	V	2442.000	52.78	32.11	5.93	0.00	0.00	90.82	114.00	-23.18	1/3MHz		
AVG	V	2442.000	36.98	32.11	5.93	0.00	0.00	75.02	94.00	-18.98	1/3MHz		
WSP Self powered, Hi Channel													
MaxH PK	H	2481.000	53.43	32.27	5.98	0.00	0.00	91.68	114.00	-22.32	1/3MHz		
AVG	H	2481.000	37.63	32.27	5.98	0.00	0.00	76.00	94.00	-18.00	1/3MHz		
MaxH PK	V	2481.000	52.24	32.27	5.98	0.00	0.00	90.49	114.00	-23.51	1/3MHz		
AVG	V	2481.000	36.44	32.27	5.98	0.00	0.00	74.69	94.00	-19.31	1/3MHz		

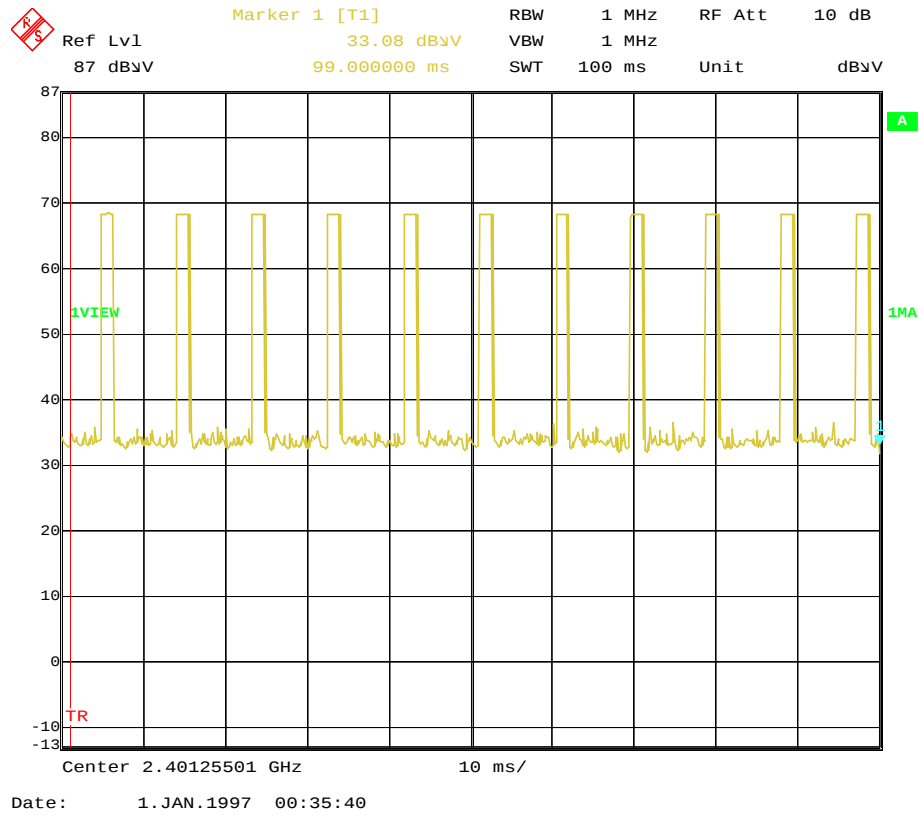
V9E-VP Radiated Emissions

Company: LoJack Corporation	Antenna & Cables: HF	Bands: N, LF, HF, SHF
Model #: V9E-VP	Antenna: ETS001 01-14-16.txt	ETS001 01-14-16.txt
Serial #: 0F4B030	Cable(s): 145-416 3m Track B 1-15GHz Cable 10-04-15.txt	NONE.
Engineers: Vathana Ven	Location: 10m Chamber	Barometer: DAV004
Project #: G102144226	Date(s): 07/30/15	Filter:
Standard: FCC Part 15 Subpart C 15.249	Temp/Humidity/Pressure: 22 deg. C	53% 998 mB
Receiver: 145128_03-14-16	Limit Distance (m): 3	
PreAmp: 145014 05-13-16.txt	Test Distance (m): 3	
PreAmp Used? (Y or N): Y	Voltage/Frequency:	Battery 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		

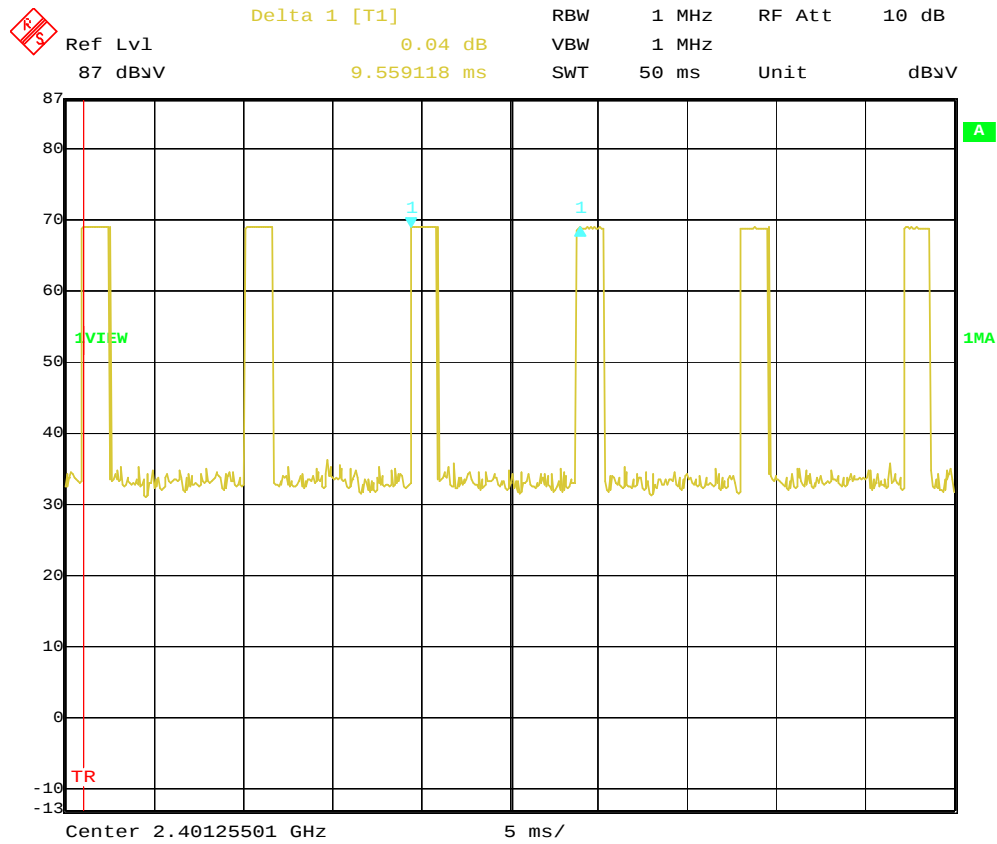
Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
WSP Vehicle powered, Lo Channel											
MaxH PK	H	2402.000	56.73	31.96	5.87	0.00	0.00	94.56	114.00	-19.44	1/3MHz
AVG	H	2402.000	40.93	31.96	5.87	0.00	0.00	78.76	94.00	-15.24	1/3MHz
MaxH PK	V	2402.000	53.70	31.96	5.87	0.00	0.00	91.53	114.00	-22.47	1/3MHz
AVG	V	2402.000	37.90	31.96	5.87	0.00	0.00	75.73	94.00	-18.27	1/3MHz
WSP Vehicle powered, Mid Channel											
MaxH PK	H	2442.000	54.04	32.11	5.93	0.00	0.00	92.08	114.00	-21.92	1/3MHz
AVG	H	2442.000	38.24	32.11	5.93	0.00	0.00	76.87	94.00	-17.13	1/3MHz
MaxH PK	V	2442.000	50.80	32.11	5.93	0.00	0.00	88.84	114.00	-25.16	1/3MHz
AVG	V	2442.000	35.00	32.11	5.93	0.00	0.00	73.04	94.00	-20.96	1/3MHz
WSP Vehicle powered, Hi Channel											
MaxH PK	H	2481.000	55.03	32.27	5.98	0.00	0.00	93.28	114.00	-20.72	1/3MHz
AVG	H	2481.000	39.23	32.27	5.98	0.00	0.00	77.48	94.00	-16.52	1/3MHz
MaxH PK	V	2481.000	52.00	32.27	5.98	0.00	0.00	90.25	114.00	-23.75	1/3MHz
AVG	V	2481.000	36.20	32.27	5.98	0.00	0.00	74.45	94.00	-19.55	1/3MHz

FCC IC

Note that the duty cycle was measured to be ~16.1%, therefore a duty cycle correction factor of 15.8 dB was applied to the peak results to obtain the average reading.

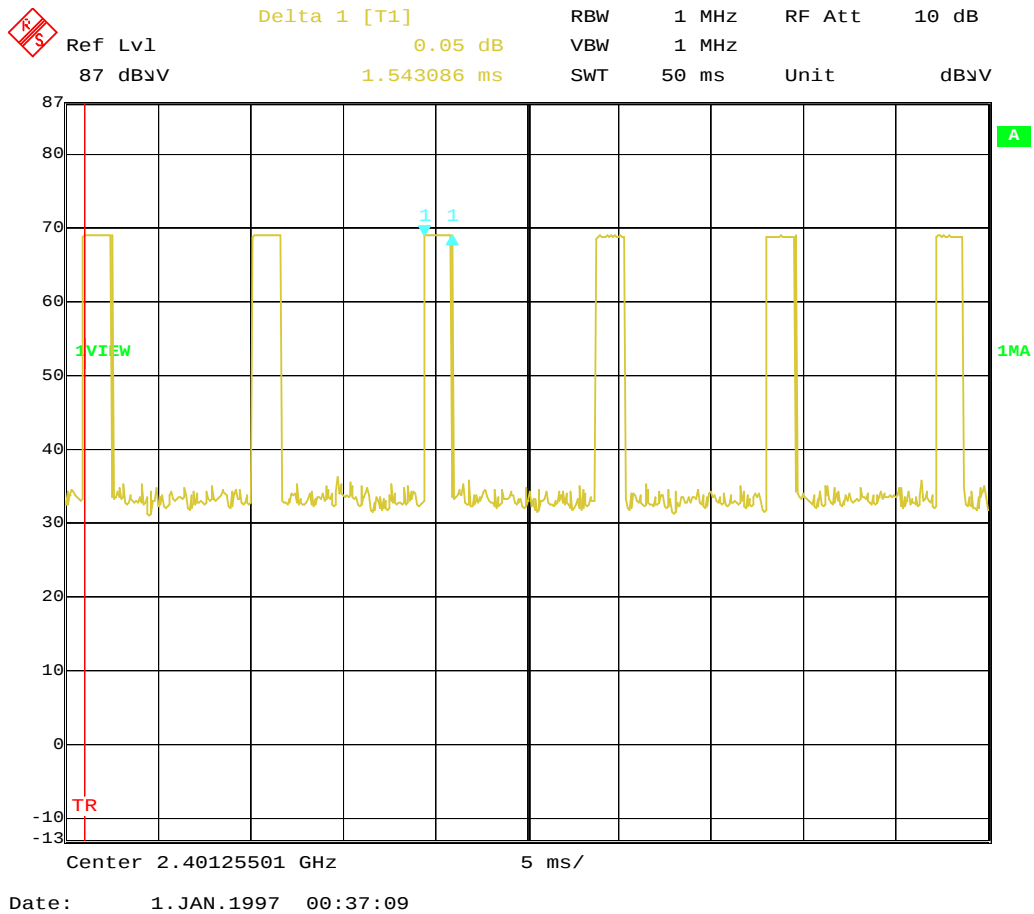


Pulse trains in 100 ms period



Date: 1.JAN.1997 00:37:48

Burst Period



Burst length

$$\text{Duty cycle factor} = 20 \cdot \log(1.543086/9.559118) = 15.8406$$

Test Personnel:	Vathana Ven
Supervising/Reviewing Engineer:	
(Where Applicable)	N/A
Product Standard:	FCC §15.249(a),(e)
Input Voltage:	12VDC (Car Battery) + 6VDC (Internal Battery)
Pretest Verification w/ Ambient Signals or BB Source:	Yes

Test Date: 07/30/2015, 07/31/2015

Limit Applied: Below specified limits

Ambient Temperature: 22, 25 °C

Relative Humidity: 53, 41 %

Atmospheric Pressure: 998, 997 mbars

Deviations, Additions, or Exclusions: None

7 Transmitter Occupied Bandwidth

7.1 Method

Tests are performed in accordance with FCC 15.215.

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 Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 10m	30-1000 MHz	3.5 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	3.5 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.2 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.2 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.2 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} 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.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	10/06/2014	10/06/2015
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/14/2015	01/14/2016
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/14/2015	03/14/2016
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	10/04/2014	10/04/2015

Software Utilized:

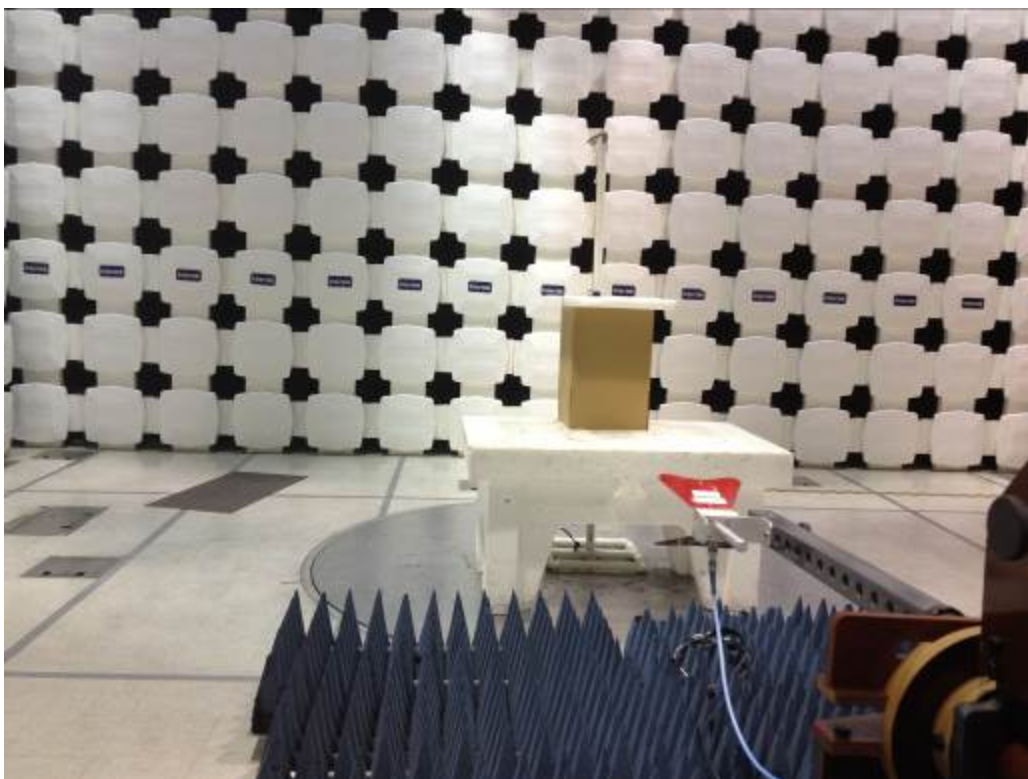
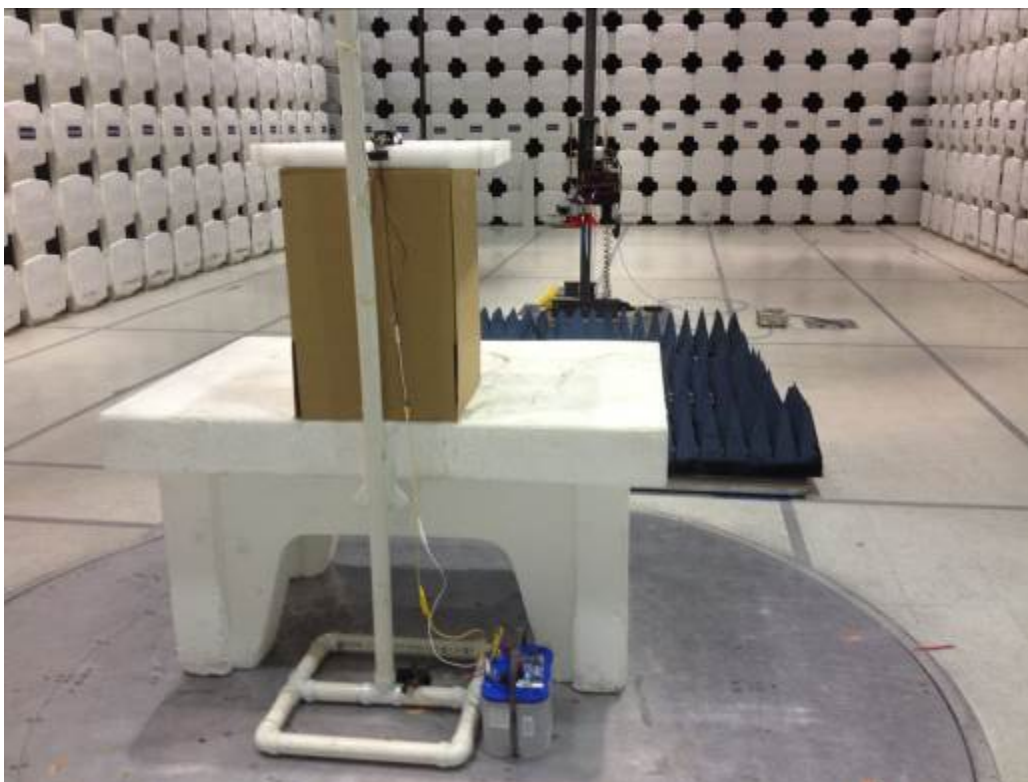
Name	Manufacturer	Version
None		

7.3 Results:

The 20 dB bandwidth of the fundamental must remain inside the band of operation, 2.4-2.4835 GHz.

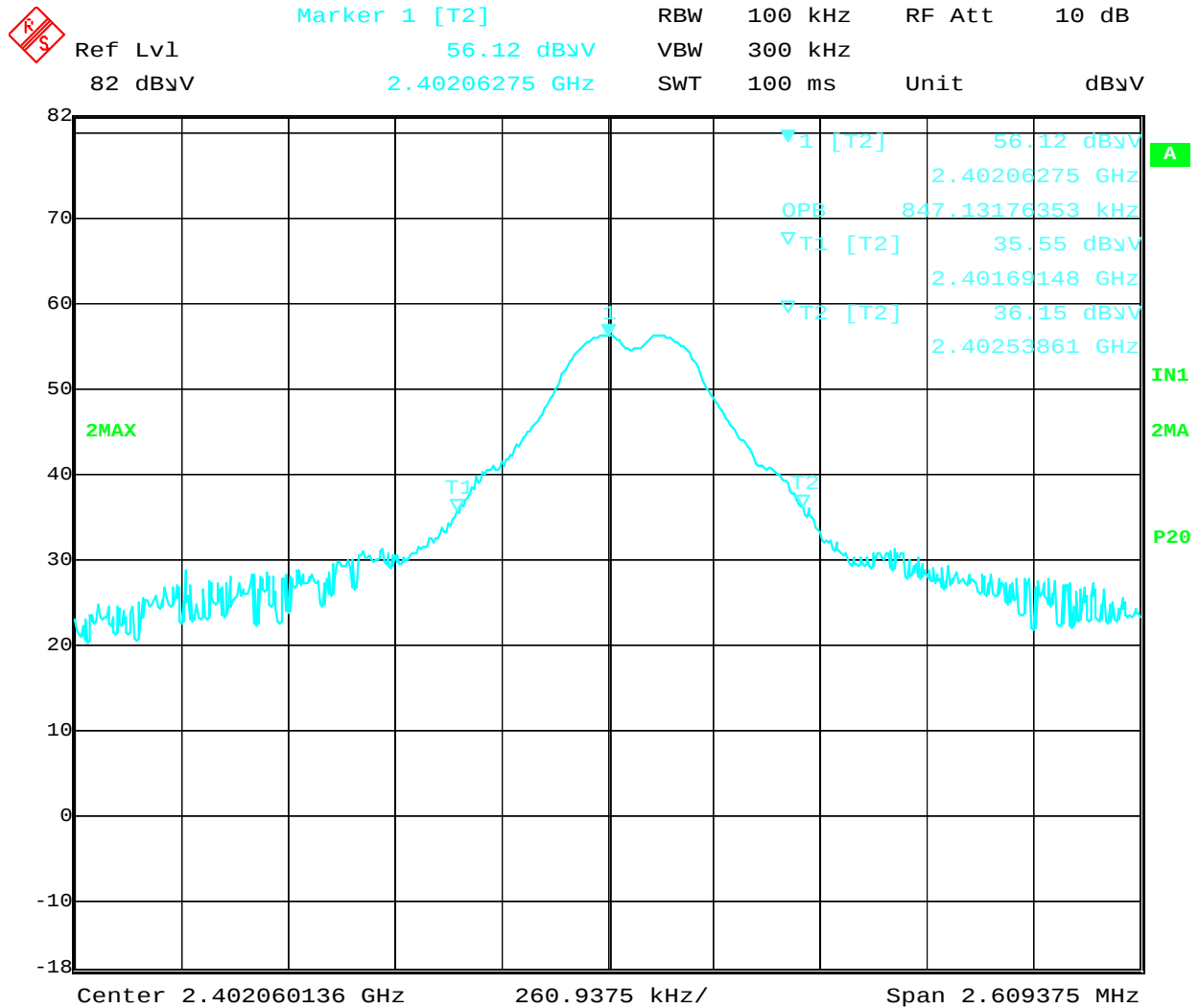
The sample tested was found to Comply.

7.4 Setup Photographs:



7.5 Plots/Data:

Lo channel, 0.847 MHz

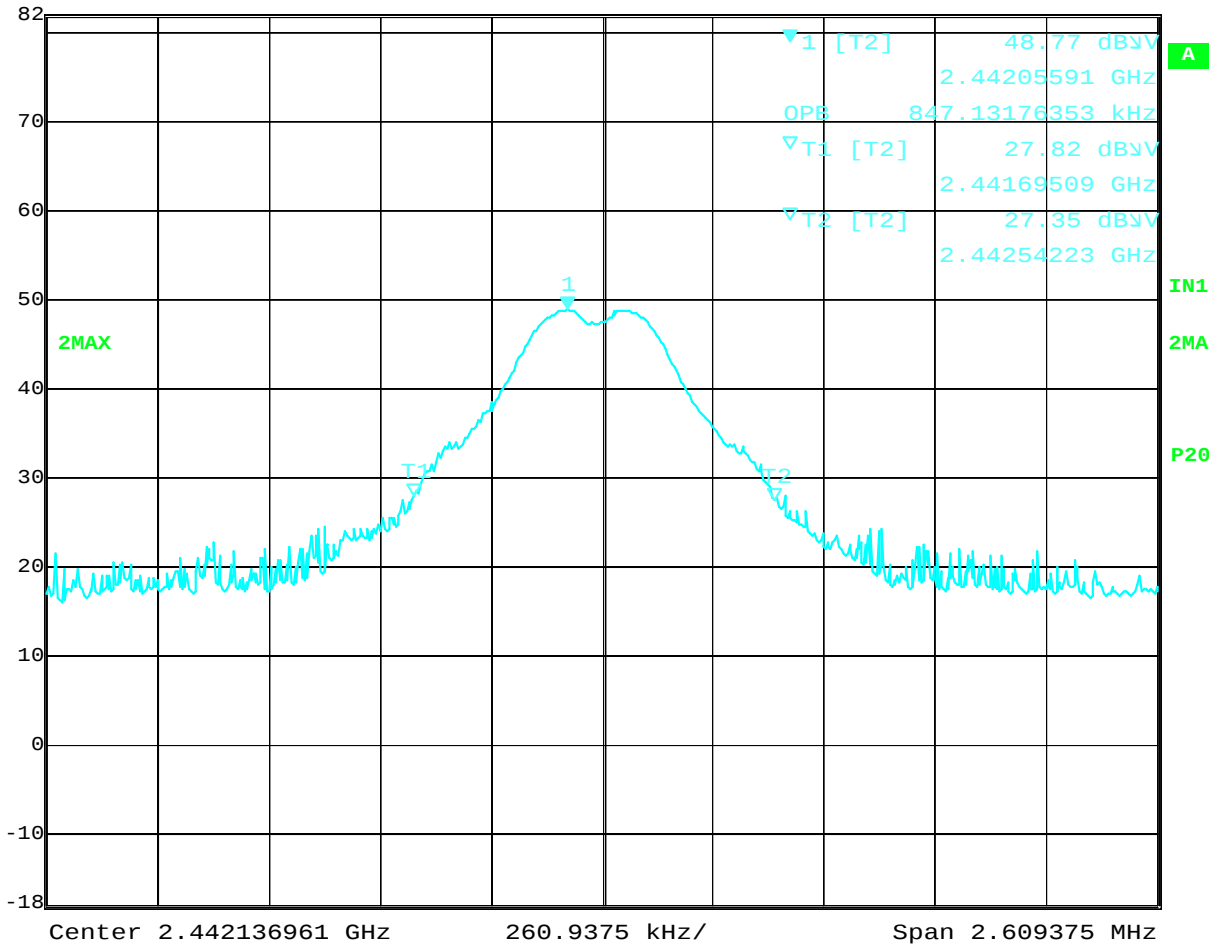


Date: 31.JUL.2015 04:39:57

Mid channel, 0.847 MHz

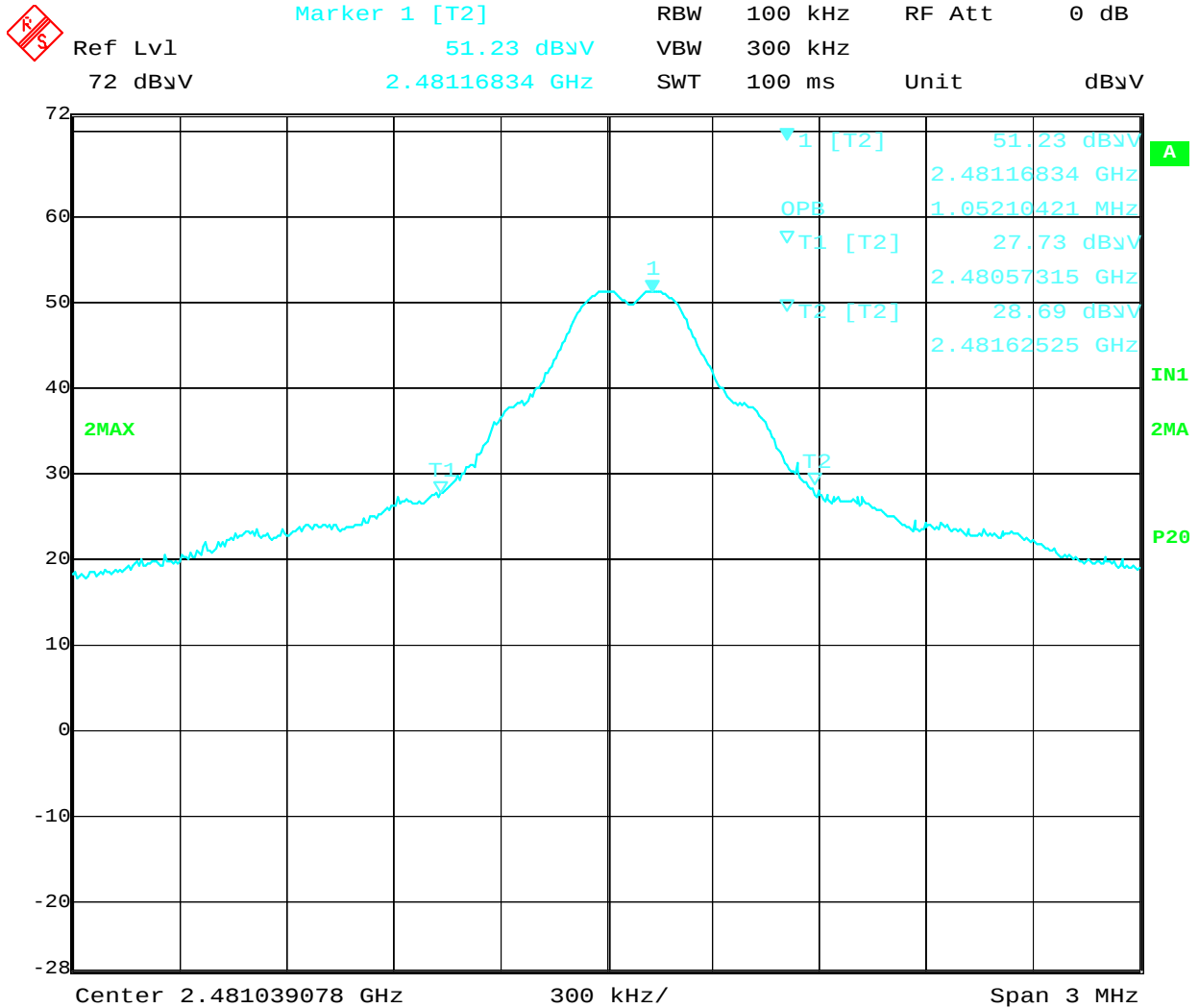


Ref Lvl	Marker 1 [T2]	RBW	100 kHz	RF Att	10 dB
82 dBμV	48.77 dBμV	VBW	300 kHz		
	2.44205591 GHz	SWT	10 ms	Unit	dBμV



Date: 31.JUL.2015 04:08:14

Hi channel, 1.052 MHz



Date: 31.JUL.2015 02:50:12

Test Personnel: Vathana Ven

Supervising/Reviewing Engineer: N/A

(Where Applicable) Product Standard: FCC 15.215

Input Voltage: 12VDC (Car Battery) + 6VDC (Internal Battery)

Pretest Verification w/ Ambient Signals or BB Source: Yes

Test Date: 07/31/2015

Limit Applied: Below specified limits

Ambient Temperature: 22 °C

Relative Humidity: 53 %

Atmospheric Pressure: 998 mbars

Deviations, Additions, or Exclusions: None

8 Transmitter and Receiver Spurious Emissions

8.1 Method

Tests are performed in accordance with FCC §15.209, 15.249(a)(d).

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

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 10m	30-1000 MHz	3.5 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	3.5 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.2 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.2 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.2 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} 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 = Net Reading in dB μ 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
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	10/06/2014	10/06/2015
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	10/24/2014	10/24/2015
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/14/2015	01/14/2016
REA003'	1GHz High Pass Filter	Reactel, Inc	7HS-1G/10G-S11	06-1	12/30/2013	12/30/2015
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	05/13/2015	05/13/2016
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/14/2015	03/14/2016
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	10/04/2014	10/04/2015
CBLHF2012 -2M-2	2m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252675002	02/05/2015	02/05/2016
EMC04'	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	04/07/2015	04/07/2016
PRE9'	100MHz-40GHz Preamp	MITEQ	NSP4000-NFG	1260417	10/13/2014	10/13/2015
CBLHF2012 -5M-2'	5m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252676002	02/05/2015	02/05/2016

Software Utilized:

Name	Manufacturer	Version
Excel 2003	Microsoft	(11.8231.8221) SP3
EMI Boxborough.xls	Intertek	08/27/10

8.3 Results:

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 the general radiated emission limits in §15.209 and RSS-Gen Table 1, whichever is the lesser attenuation. Harmonic emissions must not exceed an average limit of 54 dBuV/m and a peak limit of 74 dBuV/m.

During testing, the EUT was in receive mode in between transmit bursts. Therefore the results show compliance of the receive mode as well as the transmit mode.

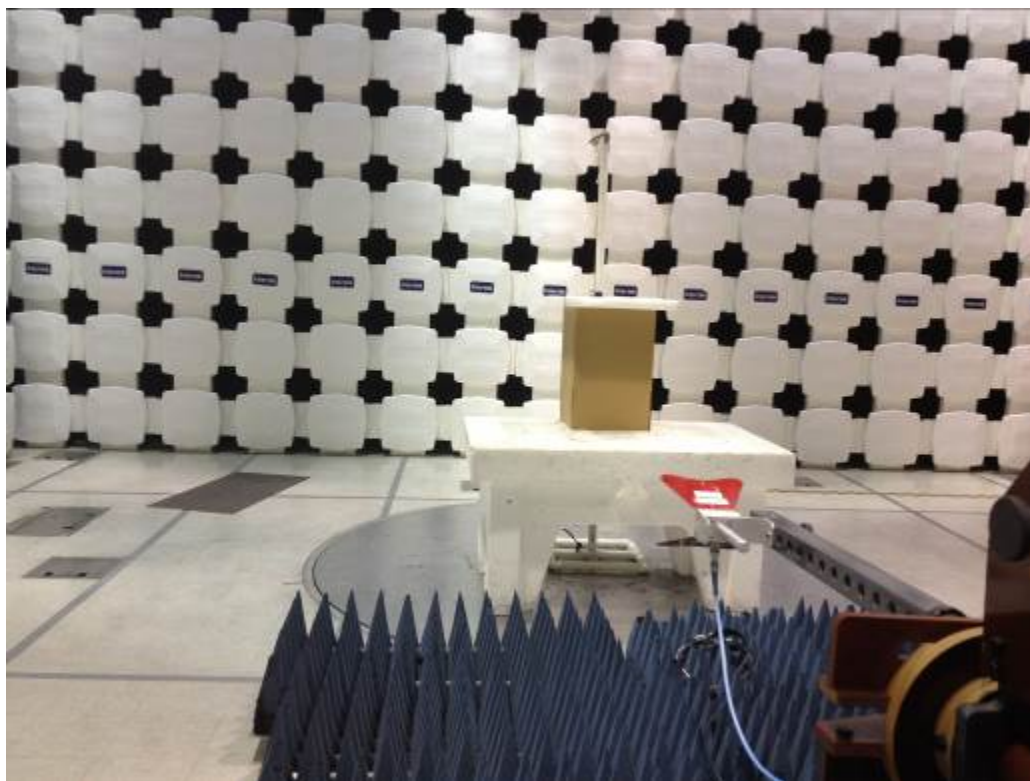
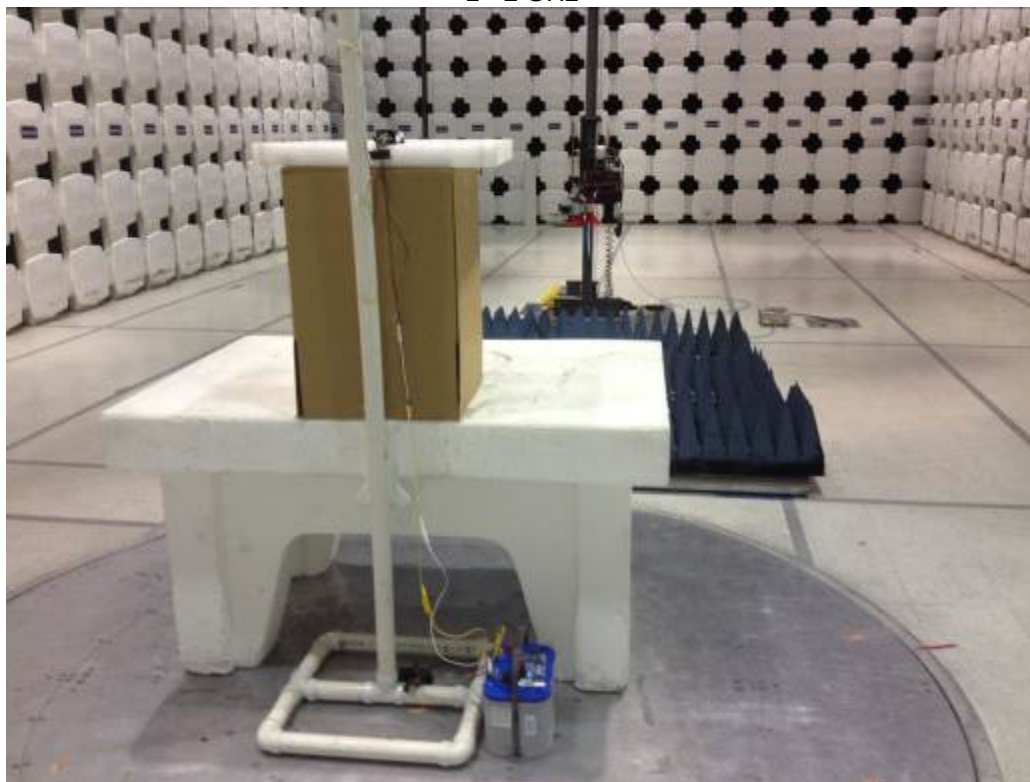
The sample tested was found to comply.

8.4 Setup Photographs:

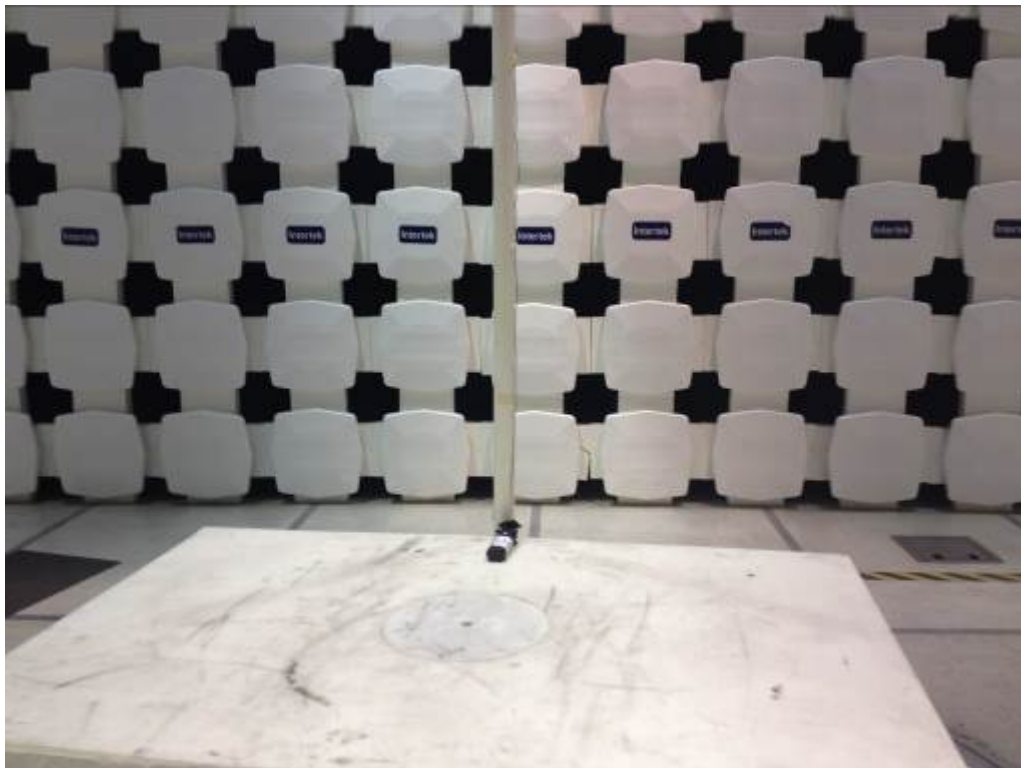
V9-VP, 30 – 1000 MHz



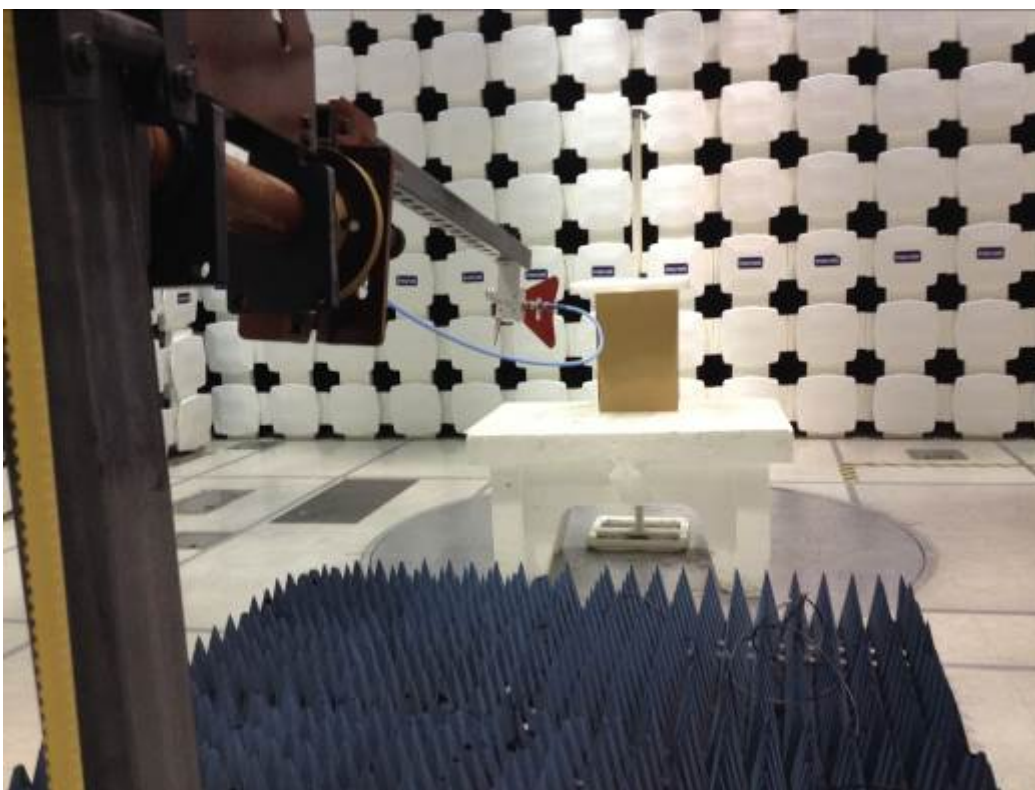
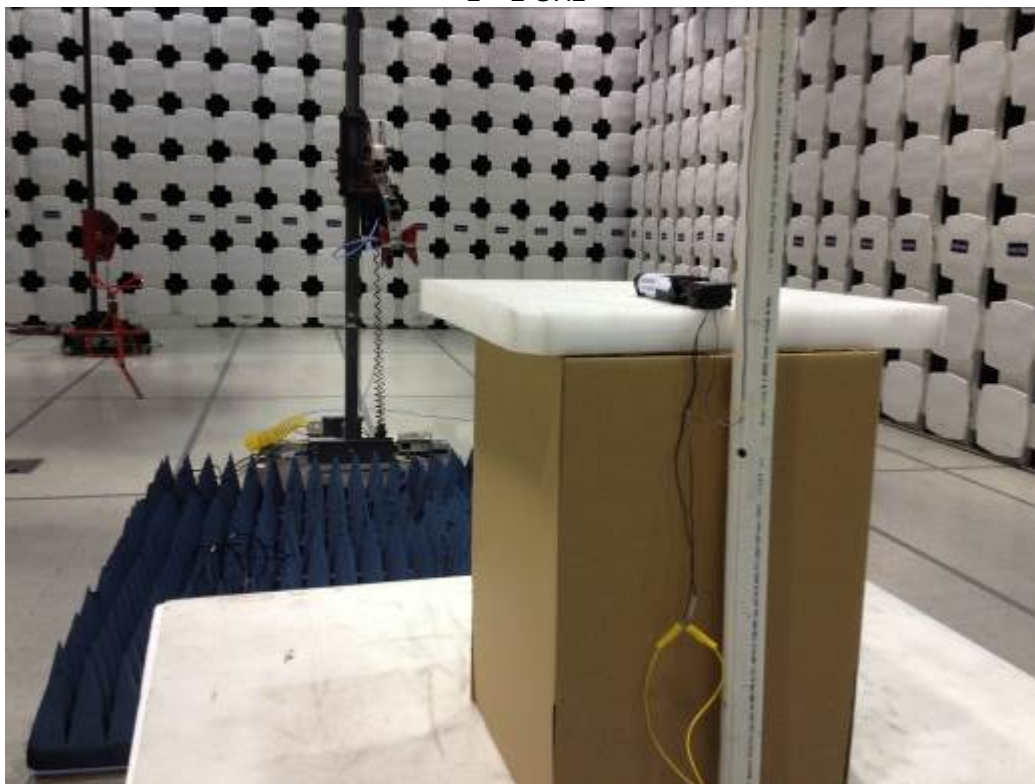
1 - 2 GHz



V9-SP, 30 – 1000 MHz



1 – 2 GHz

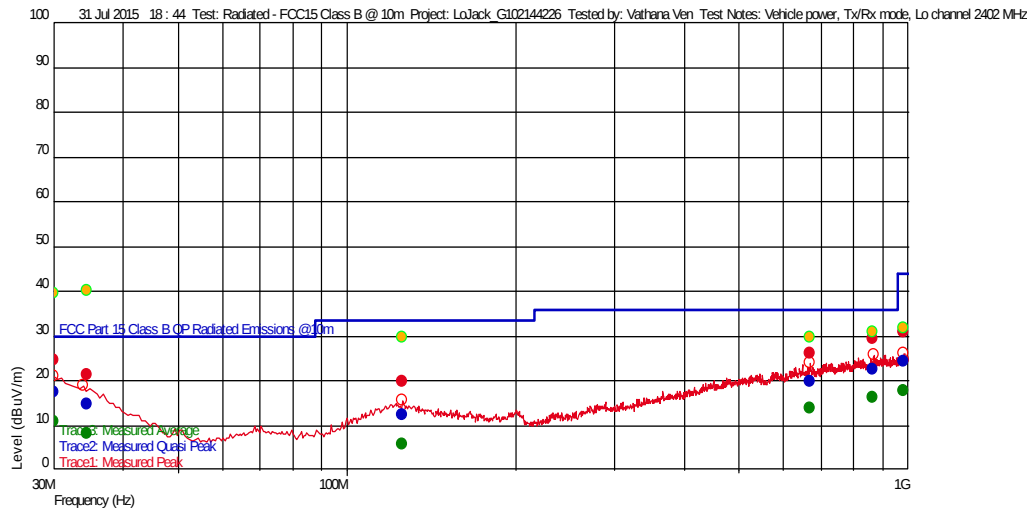


8.5 Test Data:

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	LoJack_G102144226	
Test Notes:	Vehicle power, Tx/Rx mode, Lo channel 2402 MHz	
Temperature:	25 deg C	
Humidity:	41%, 997 mB	
Tested by:	Vathana Ven	
Test Started:	31 Jul 2015 18 : 44	

Prescan Emission Graph



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

Emissions Test Data

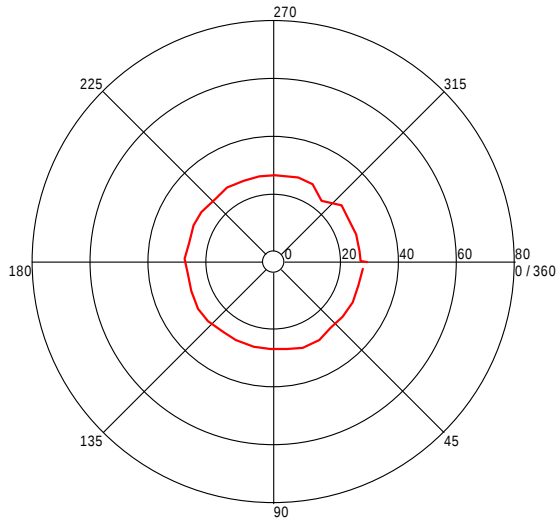
Trace2: Measured Quasi Peak

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
125.888777609 M	12.27	13.900	-24.654	33.520	-21.25		317	4.00	120 k	
983.398396886 M	24.21	22.568	-21.176	43.980	-19.77		319	1.36	120 k	
668.024448629 M	19.81	19.500	-21.859	36.020	-16.21	--	0	2.14	120 k	
34.424850148 M	14.63	17.745	-26.036	30.000	-15.37	--	47	2.23	120 k	
867.785370535 M	22.60	21.711	-21.384	36.020	-13.42		359	3.52	120 k	
30.089378758 M	17.52	20.946	-26.028	30.000	-12.48		359	3.50	120 k	

Azimuth Plots

Turntable Plot (30.089378758 MHz)

Level (dBuV/m)

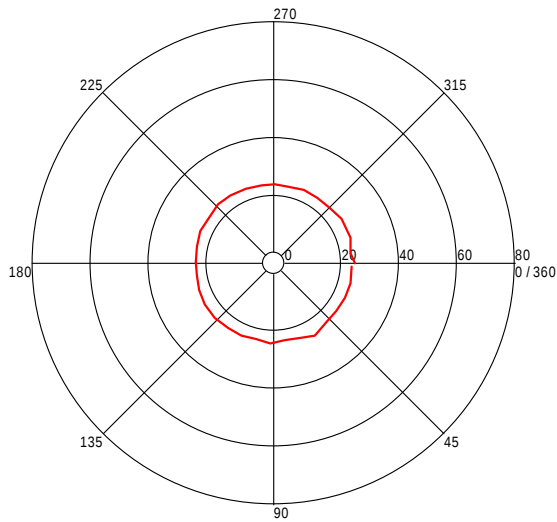


All Polarities

Azimuth (Degrees)

Turntable Plot (34.424850148 MHz)

Level (dBuV/m)

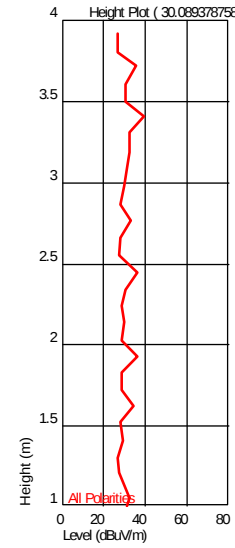


All Polarities

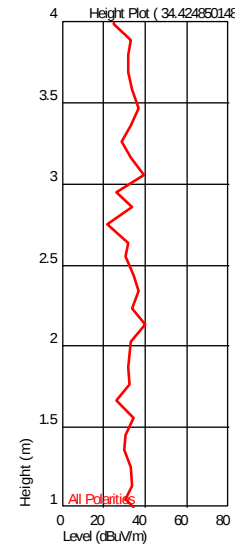
Azimuth (Degrees)

Turntable Plots

Height Plot (30.089378758 MHz)

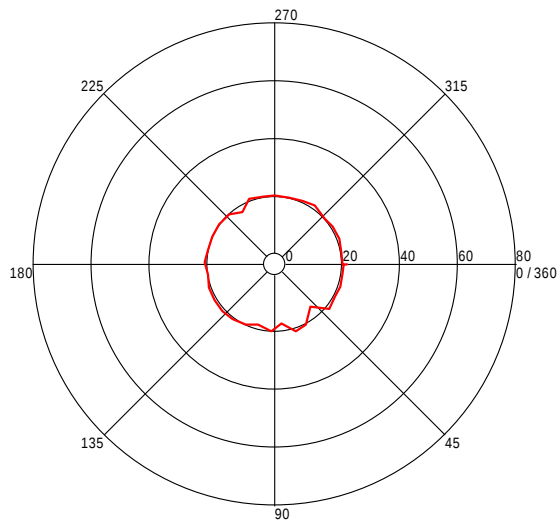


Height Plot (34.424850148 MHz)



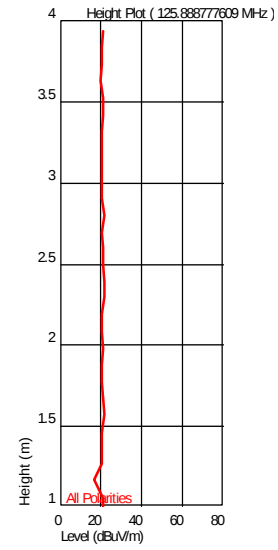
Turntable Plot (125.888777609 MHz)

Level (dBuV/m)



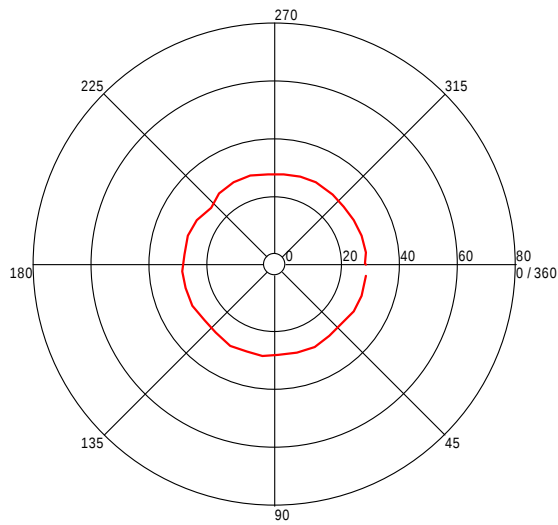
All Polarities

Azimuth (Degrees)



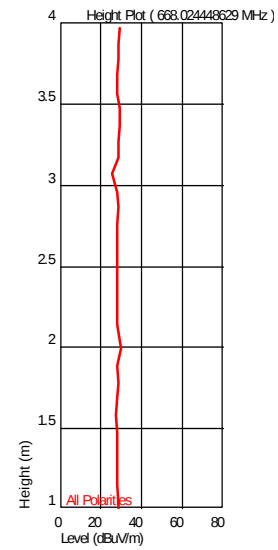
Turntable Plot (668.024448629 MHz)

Level (dBuV/m)



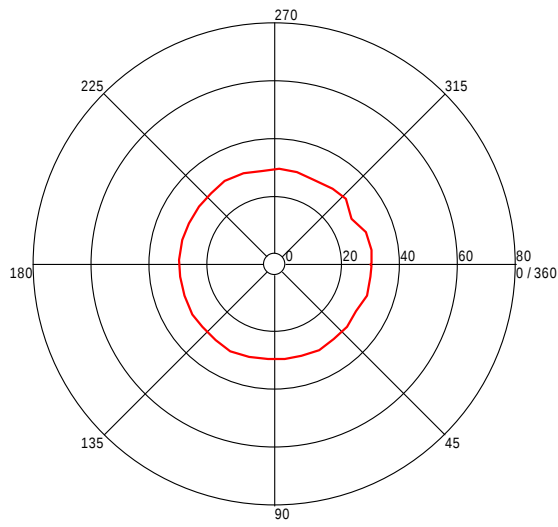
All Polarities

Azimuth (Degrees)



Turntable Plot (867.785370535 MHz)

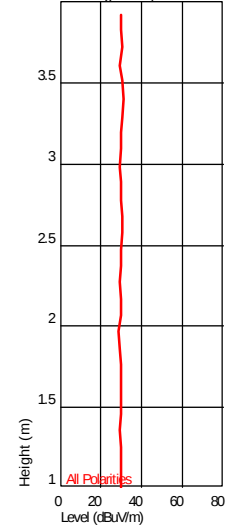
Level (dBuV/m)



All Polarities

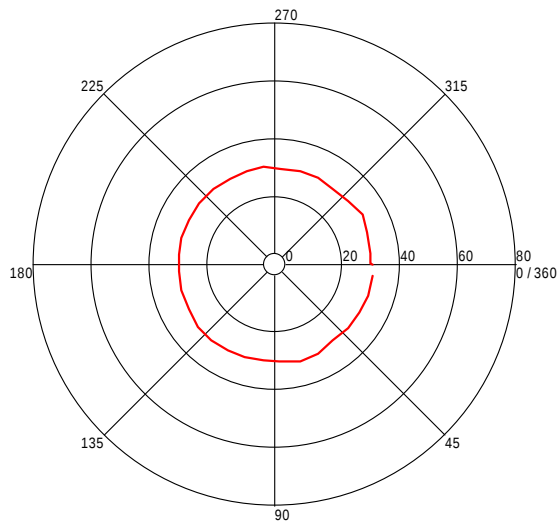
Azimuth (Degrees)

Height Plot (867.785370535 MHz)



Turntable Plot (983.398396886 MHz)

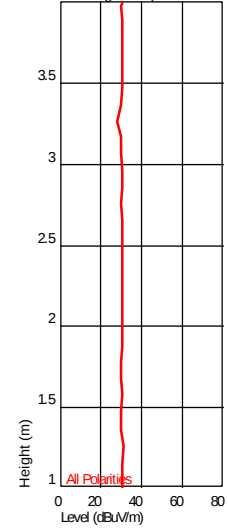
Level (dBuV/m)



All Polarities

Azimuth (Degrees)

Height Plot (983.398396886 MHz)



Test Information

Test Details

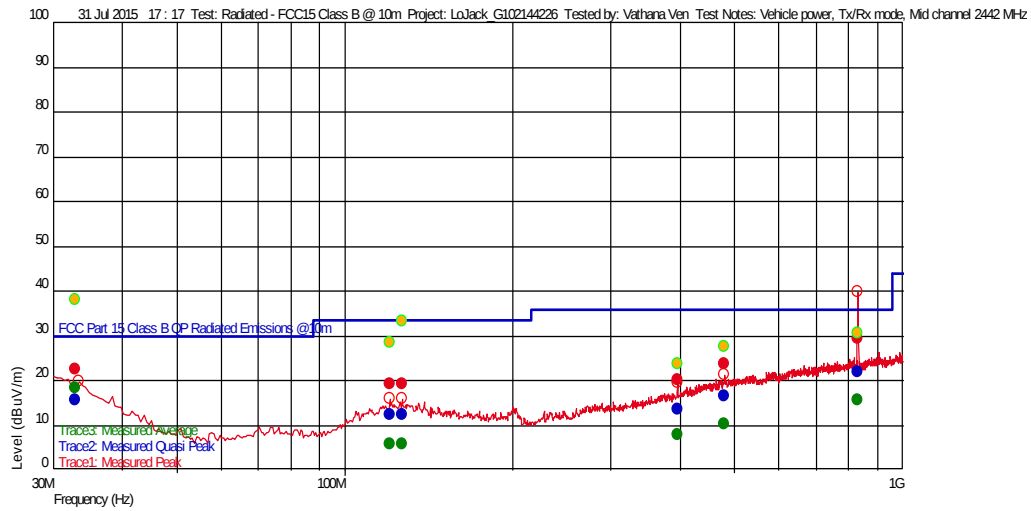
Test: Radiated - FCC15 Class B @ 10m
 Project: LoJack_G102144226
 Test Notes: Vehicle power, Tx/Rx mode, Mid channel 2442 MHz
 Temperature: 25 deg C
 Humidity: 41%, 997 mB
 Tested by: Vathana Ven
 Test Started: 31 Jul 2015 17 : 17

User Entry

Radiated - FCC15 Class B @ 10m
 LoJack_G102144226
 Vehicle power, Tx/Rx mode, Mid channel 2442 MHz
 25 deg C
 41%, 997 mB
 Vathana Ven
 31 Jul 2015 17 : 17

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

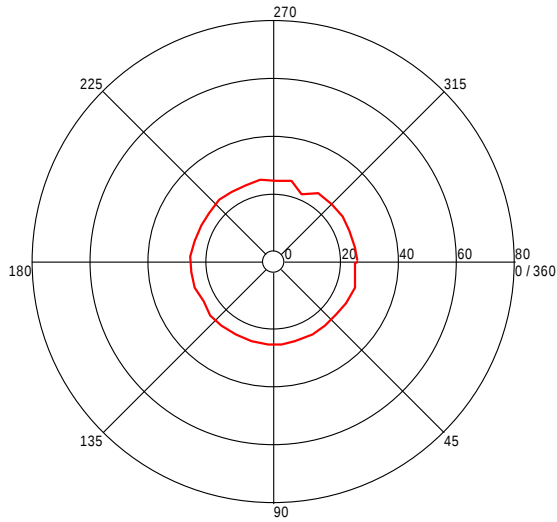
Trace2: Measured Quasi Peak

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
395.093988116 M	13.50	15.204	-22.791	36.020	-22.52		271	3.94	120 k	
126.930461088 M	12.28	13.807	-24.647	33.520	-21.24	--	1	1.14	120 k	
120.512625687 M	12.43	13.900	-24.691	33.520	-21.09	--	145	3.16	120 k	
479.898597154 M	16.65	17.498	-22.544	36.020	-19.37		228	2.80	120 k	
32.903206806 M	15.64	18.958	-26.033	30.000	-14.36	--	360	3.82	120 k	
831.875350287 M	21.97	21.262	-21.461	36.020	-14.05		197	3.41	120 k	

Azimuth Plots

Turntable Plot (32.903206806 MHz)

Level (dBuV/m)

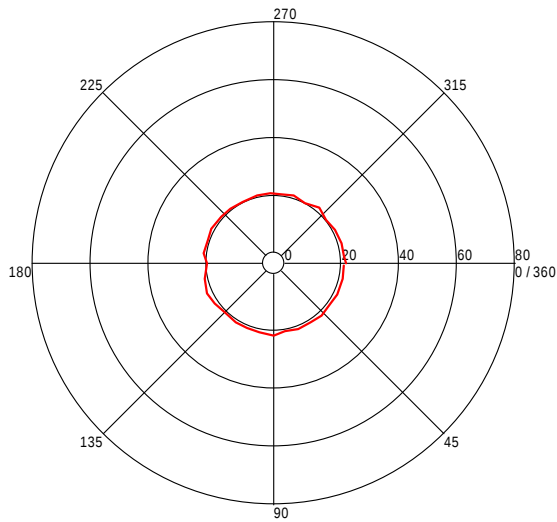


All Polarities

Azimuth (Degrees)

Turntable Plot (120.512625687 MHz)

Level (dBuV/m)

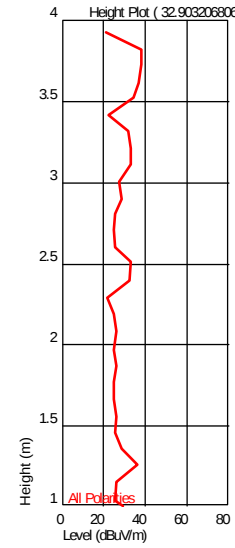


All Polarities

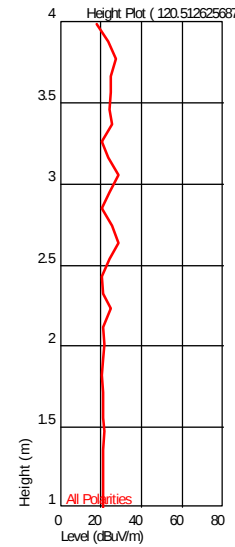
Azimuth (Degrees)

Turntable Plots

Height Plot (32.903206806 MHz)

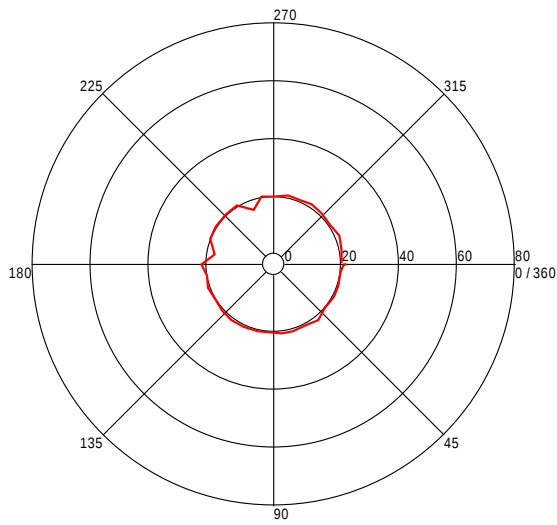


Height Plot (120.512625687 MHz)



Turntable Plot (126.930461088 MHz)

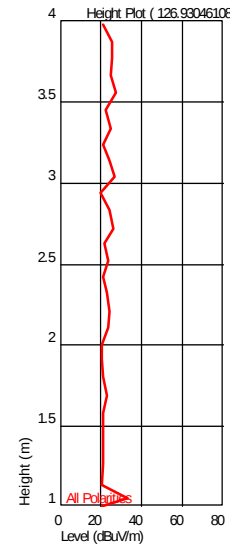
Level (dBuV/m)



All Polarities

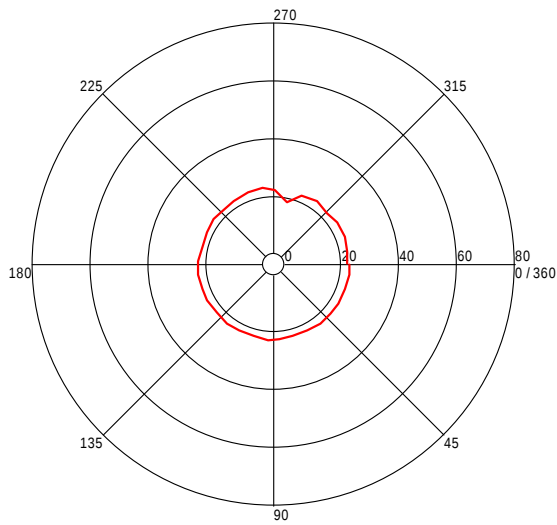
Azimuth (Degrees)

Height Plot (126.930461088 MHz)



Turntable Plot (395.093988116 MHz)

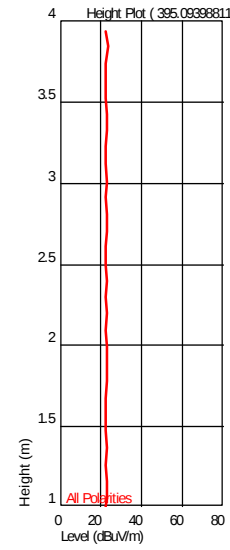
Level (dBuV/m)



All Polarities

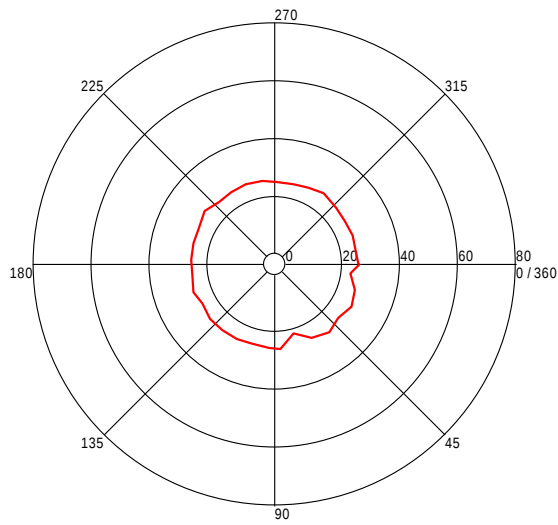
Azimuth (Degrees)

Height Plot (395.093988116 MHz)



Turntable Plot (479.898597154 MHz)

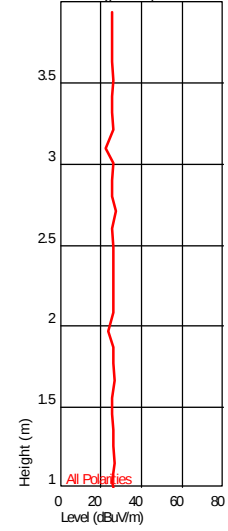
Level (dBuV/m)



All Polarities

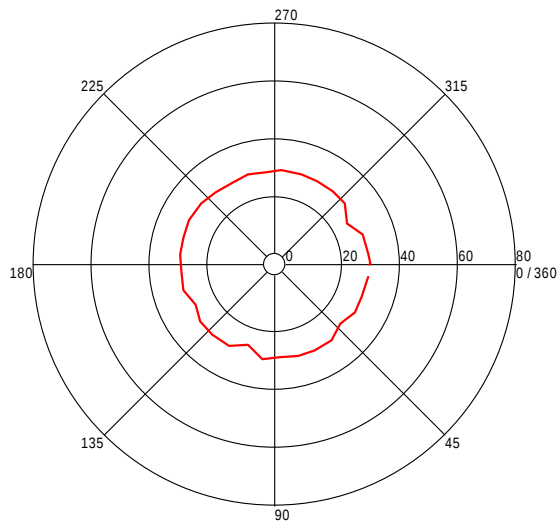
Azimuth (Degrees)

Height Plot (479.898597154 MHz)



Turntable Plot (831.875350287 MHz)

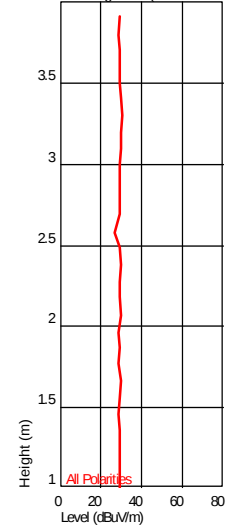
Level (dBuV/m)



All Polarities

Azimuth (Degrees)

Height Plot (831.875350287 MHz)



Test Information

Test Details

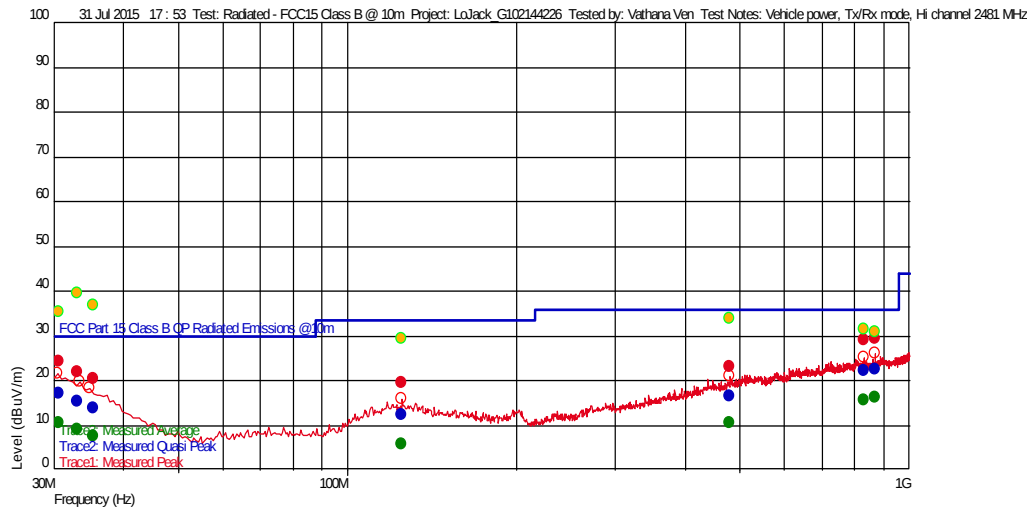
Test: Radiated - FCC15 Class B @ 10m
 Project: LoJack_G102144226
 Test Notes: Vehicle power, Tx/Rx mode, Hi channel 2481 MHz
 Temperature: 25 deg C
 Humidity: 41%, 997 mB
 Tested by: Vathana Ven
 Test Started: 31 Jul 2015 17 : 53

User Entry

Radiated - FCC15 Class B @ 10m
 LoJack_G102144226
 Vehicle power, Tx/Rx mode, Hi channel 2481 MHz
 25 deg C
 41%, 997 mB
 Vathana Ven
 31 Jul 2015 17 : 53

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

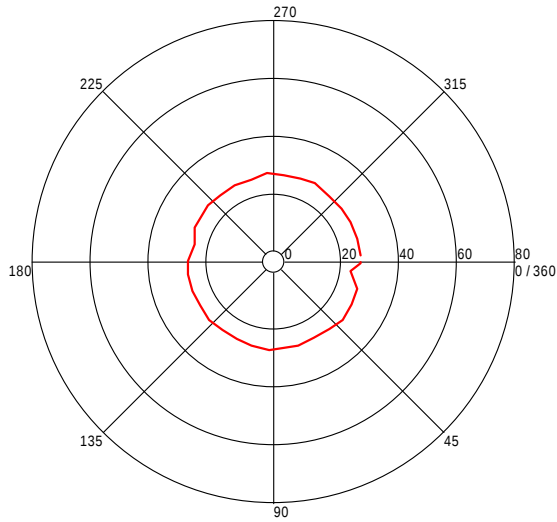
Trace2: Measured Quasi Peak

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
125.212024046 M	12.26	13.900	-24.659	33.520	-21.26	--	18	3.84	120 k	
478.924248345 M	16.63	17.478	-22.546	36.020	-19.39		108	1.14	120 k	
35.380761084 M	13.94	17.057	-26.038	30.000	-16.06		161	1.05	120 k	
33.077154701 M	15.51	18.831	-26.034	30.000	-14.49	--	0	3.72	120 k	
829.681363086 M	22.11	21.300	-21.466	36.020	-13.91	--	1	3.93	120 k	
868.314629108 M	22.63	21.733	-21.383	36.020	-13.39	--	254	2.57	120 k	
30.67835677 M	17.06	20.593	-26.029	30.000	-12.94		50	3.69	120 k	

Azimuth Plots

Turntable Plot (30.67835677 MHz)

Level (dBuV/m)

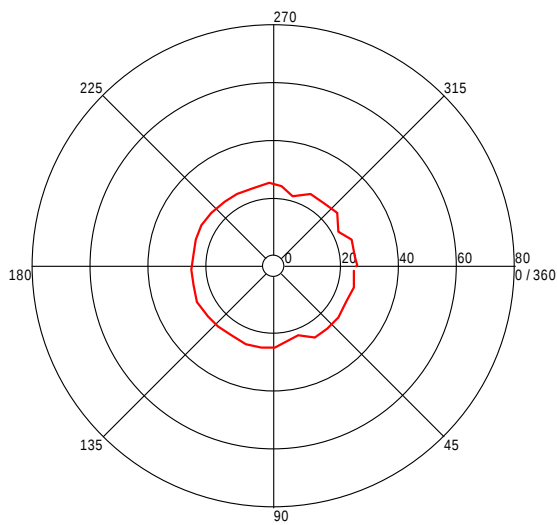


All Polarities

Azimuth (Degrees)

Turntable Plot (33.077154701 MHz)

Level (dBuV/m)

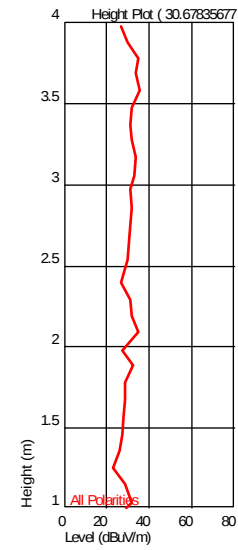


All Polarities

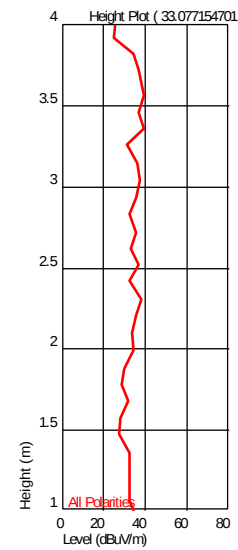
Azimuth (Degrees)

Turntable Plots

Height Plot (30.67835677 MHz)

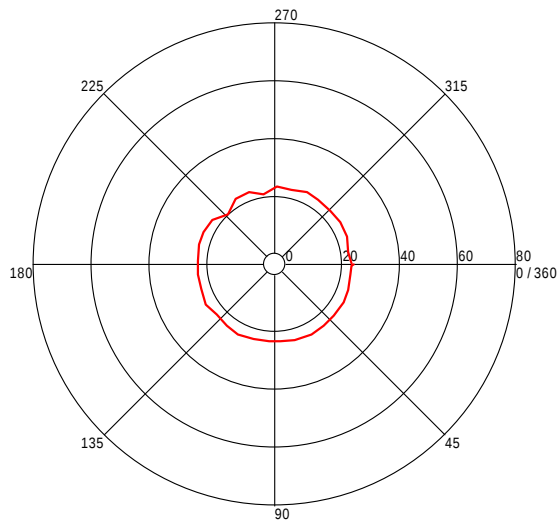


Height Plot (33.077154701 MHz)



Turntable Plot (35.380761084 MHz)

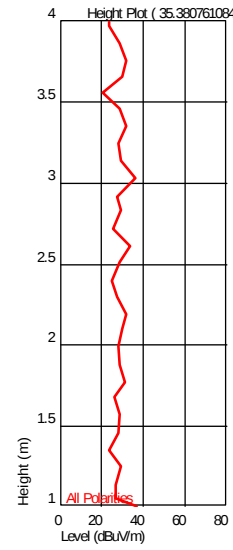
Level (dBuV/m)



All Polarities

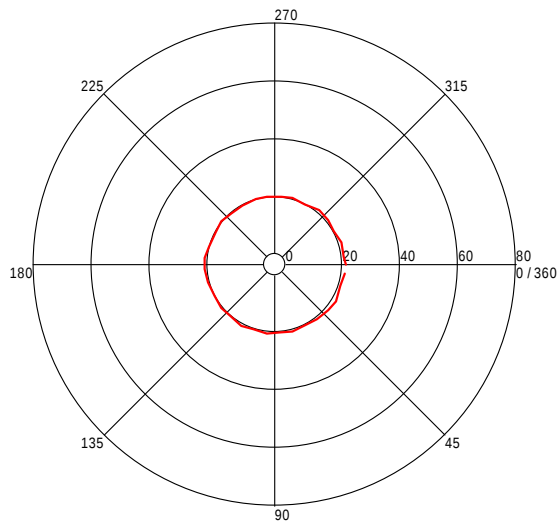
Azimuth (Degrees)

Height Plot (35.380761084 MHz)



Turntable Plot (125.212024046 MHz)

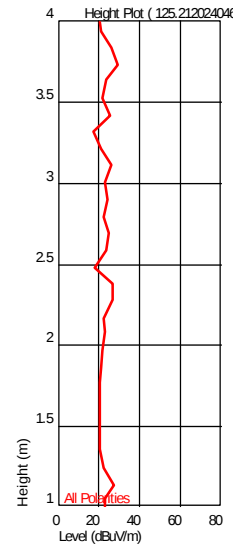
Level (dBuV/m)



All Polarities

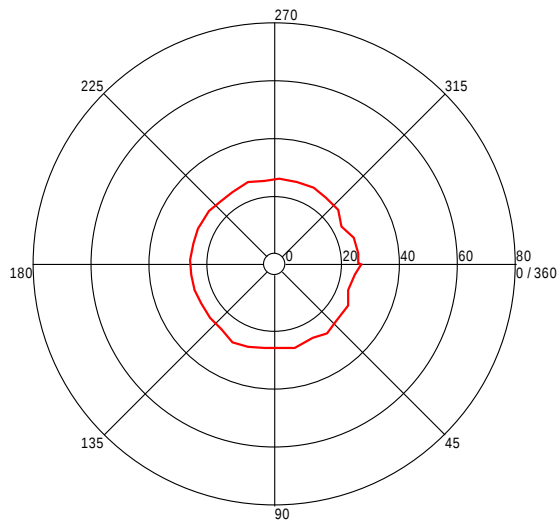
Azimuth (Degrees)

Height Plot (125.212024046 MHz)



Turntable Plot (478.924248345 MHz)

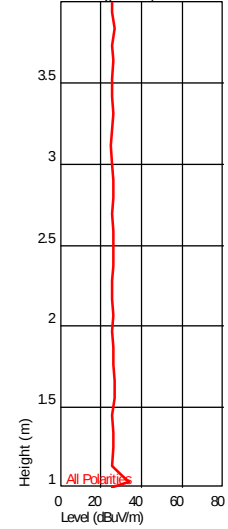
Level (dBuV/m)



All Polarities

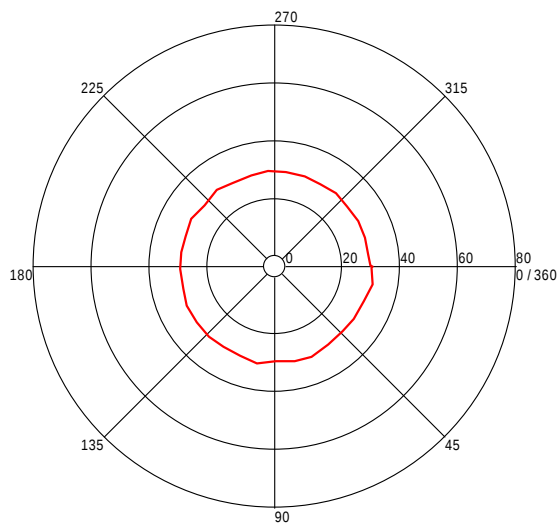
Azimuth (Degrees)

Height Plot (478.924248345 MHz)



Turntable Plot (829.681363086 MHz)

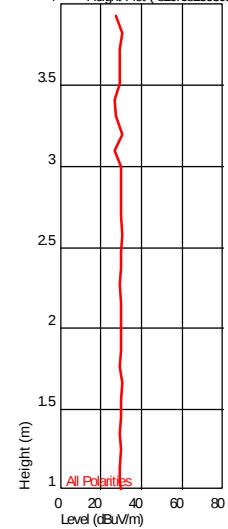
Level (dBuV/m)



All Polarities

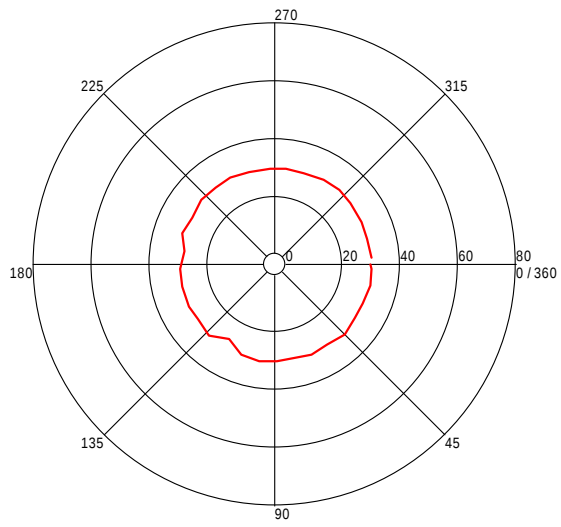
Azimuth (Degrees)

Height Plot (829.681363086 MHz)



Turntable Plot (868.314629108 MHz)

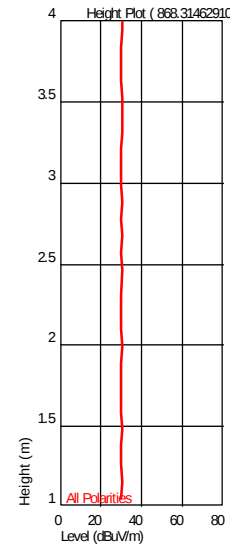
Level (dBuV/m)



All Polarities

Azimuth (Degrees)

Height Plot (868.314629108 MHz)



Height (m)
Level (dBuV/m)

V9E-VP Spurious Radiated Emissions

Company: LoJack Corporation

Model #: V9E-VP

Serial #: 0F4B030

Engineers: Vathana Ven

Project #: G102144226

Standard: FCC Part 15 Subpart C 15.249

Receiver: 145128_03-14-16

PreAmp: 145014 05-13-16.txt

PreAmp Used? (Y or N): Y

Date(s): 07/30/15

Limit Distance (m): 3

Test Distance (m): 3

Voltage/Frequency:

Antenna & Cables: HF

Antenna: ETS001 01-14-16.txt

Cable(s): 145-416 3m Track B 1-150Hz Cable 10-04-15.txt

Barometer: DAV004

Temp/Humidity/Pressure: 22 deg. C 53%

Bands: N, LF, HF, SHF

ETS001 01-14-16.txt EMC04

NONE.

Filter: REA003

998 mB

CBLHF2012-2M-2

PRE9 CBLHF2012-5M-2

Battery Frequency Range: 1-25GHz

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	Harmonic?
Band Edge Emissions														
MaxH PK	H	2483.500	25.69	32.28	5.99	0.00	0.00	63.95	74.00	-10.05	1/3MHz	RB		
AVG	H	2483.500	10.51	32.28	5.99	0.00	0.00	48.77	54.00	-5.23	1/3MHz	RB		
MaxH PK	V	2483.500	26.40	32.28	5.99	0.00	0.00	64.66	74.00	-9.34	1/3MHz	RB		
AVG	V	2483.500	11.22	32.28	5.99	0.00	0.00	49.48	54.00	-4.52	1/3MHz	RB		
Pre-Amp and filter (REA003) used, Hi Channel = 2481 MHz														
MaxH PK	H	4962.000	39.67	34.24	8.79	34.99	0.00	47.71	74.00	-26.29	1/3MHz			
AVG	H	4962.000	24.49	34.24	8.79	34.99	0.00	32.53	54.00	-21.47	1/3MHz			
MaxH PK	H	7443.000	40.73	35.63	10.83	34.99	0.00	52.20	74.00	-21.80	1/3MHz	Noise floor	RB	
AVG	H	7443.000	30.20	35.63	10.83	34.99	0.00	41.67	54.00	-12.33	1/3MHz	Noise floor	RB	
MaxH PK	H	9924.000	39.29	37.01	12.51	35.63	0.00	53.18	74.00	-20.82	1/3MHz	Noise floor	RB	
AVG	H	9924.000	29.70	37.01	12.51	35.63	0.00	43.59	54.00	-10.41	1/3MHz	Noise floor	RB	
MaxH PK	H	12405.000	41.15	39.00	11.64	35.63	0.00	56.16	74.00	-17.84	1/3MHz	Noise floor		
AVG	H	12405.000	30.30	39.00	11.64	35.63	0.00	45.31	54.00	-8.69	1/3MHz	Noise floor		
MaxH PK	H	14886.000	39.90	39.76	14.50	35.94	0.00	58.22	74.00	-15.78	1/3MHz	Noise floor		
AVG	H	14886.000	29.90	39.76	14.50	35.94	0.00	48.22	54.00	-5.78	1/3MHz	Noise floor		
MaxH PK	H	17367.000	41.00	41.84	17.04	35.94	0.00	63.94	74.00	-10.06	1/3MHz	Noise floor		
AVG	H	17367.000	30.60	41.84	17.04	35.94	0.00	53.54	54.00	-0.46	1/3MHz	Noise floor		
Pre-Amp and filter (REA003) used, Mid Channel = 2442 MHz														
MaxH PK	H	4884.000	39.00	34.16	8.66	35.63	0.00	46.18	74.00	-27.82	1/3MHz			
AVG	H	4884.000	23.82	34.16	8.66	35.63	0.00	31.00	54.00	-23.00	1/3MHz			
MaxH PK	H	7326.000	36.40	35.62	10.74	35.63	0.00	47.12	74.00	-26.88	1/3MHz	Noise floor		
AVG	H	7326.000	25.60	35.62	10.74	35.63	0.00	36.32	54.00	-17.68	1/3MHz	Noise floor		
MaxH PK	H	9768.000	37.40	36.86	12.38	34.07	0.00	52.57	74.00	-21.43	1/3MHz	Noise floor		
AVG	H	9768.000	25.60	36.86	12.38	34.07	0.00	40.77	54.00	-13.23	1/3MHz	Noise floor		
MaxH PK	H	12210.000	35.89	38.97	11.91	34.07	0.00	52.70	74.00	-21.30	1/3MHz	Noise floor		
AVG	H	12210.000	25.00	38.97	11.91	34.07	0.00	41.81	54.00	-12.19	1/3MHz	Noise floor		
MaxH PK	H	14752.000	35.45	39.73	14.24	34.87	0.00	54.55	74.00	-19.45	1/3MHz	Noise floor		
AVG	H	14752.000	25.00	39.73	14.24	34.87	0.00	44.10	54.00	-9.90	1/3MHz	Noise floor		
MaxH PK	H	17094.000	35.83	41.77	16.77	34.87	0.00	59.51	74.00	-14.49	1/3MHz	Noise floor		
AVG	H	17094.000	24.00	41.77	16.77	34.87	0.00	47.68	54.00	-6.32	1/3MHz	Noise floor		
Pre-Amp and filter (REA003) used, Lo Channel = 2402 MHz														
MaxH PK	H	4804.000	40.20	34.19	8.52	35.63	0.00	47.28	74.00	-26.72	1/3MHz			
AVG	H	4804.000	25.02	34.19	8.52	35.63	0.00	32.10	54.00	-21.90	1/3MHz			
MaxH PK	H	7206.000	38.55	35.69	10.60	35.63	0.00	49.21	74.00	-24.79	1/3MHz	Noise floor		
AVG	H	7206.000	26.20	35.69	10.60	35.63	0.00	36.86	54.00	-17.14	1/3MHz	Noise floor		
MaxH PK	H	9608.000	38.12	36.68	12.09	34.07	0.00	52.82	74.00	-21.18	1/3MHz	Noise floor		
AVG	H	9608.000	25.67	36.68	12.09	34.07	0.00	40.37	54.00	-13.63	1/3MHz	Noise floor		
MaxH PK	H	12010.000	35.88	38.80	12.19	34.07	0.00	52.79	74.00	-21.21	1/3MHz	Noise floor		
AVG	H	12010.000	23.63	38.80	12.19	34.07	0.00	40.54	54.00	-13.46	1/3MHz	Noise floor		
MaxH PK	H	14412.000	35.42	39.28	13.87	34.87	0.00	53.70	74.00	-20.30	1/3MHz	Noise floor		
AVG	H	14412.000	24.20	39.28	13.87	34.87	0.00	42.48	54.00	-11.52	1/3MHz	Noise floor		
MaxH PK	H	16814.000	35.10	41.48	16.50	34.87	0.00	58.21	74.00	-15.79	1/3MHz	Noise floor		
AVG	H	16814.000	23.59	41.48	16.50	34.87	0.00	46.70	54.00	-7.30	1/3MHz	Noise floor		

Hand scan was performed above 18GHz at a distance of less than 1m and no emissions were detected above equipment measuring noise floor.

V9E-SP Spurious Radiated Emissions

Company: LoJack Corporation		Antenna & Cables: HF	Bands: N, LF, HF, SHF
Model #: V9E-SP		Antenna: ETS001 01-14-16.txt	ETS001 01-14-16.txt EMC04
Serial #: 0F4B035		Cable(s): 145-416 3m Track B 1-15GHz Cable 10-04-15.txt	NONE CBLHF2012-2M-2
Engineers: Vathana Ven	Location: 10m Chamber	Barometer: DAV004	Filter: REA003 PRE9 CBLHF2012-5M-2
Project #: G102144226	Date(s): 07/31/15		
Standard: FCC Part 15 Subpart C 15.249	Temp/Humidity/Pressure: 25 deg. C	41%	997 mB
Receiver: 145128_03-14-16	Limit Distance (m): 3		
PreAmp: 145014 05-13-16.txt	Test Distance (m): 3		
PreAmp Used? (Y or N): Y	Voltage/Frequency:	Battery	Frequency Range: 1-25GHz
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	Harmonic?
Band Edge Emissions														
MaxH PK	H	2483.500	27.70	32.28	5.99	0.00	0.00	65.96	74.00	-8.04	1/3MHz	RB		
AVG	H	2483.500	12.52	32.28	5.99	0.00	0.00	50.78	54.00	-3.22	1/3MHz	RB		
MaxH PK	V	2483.500	26.00	32.28	5.99	0.00	0.00	64.26	74.00	-9.74	1/3MHz	RB		
AVG	V	2483.500	10.82	32.28	5.99	0.00	0.00	49.08	54.00	-4.92	1/3MHz	RB		
Pre-Amp and filter (REA003) used, Hi Channel = 2481 MHz														
MaxH PK	H	4962.000	41.10	34.24	8.79	34.99	0.00	49.14	74.00	-24.86	1/3MHz			
AVG	H	4962.000	25.92	34.24	8.79	34.99	0.00	33.96	54.00	-20.04	1/3MHz			
MaxH PK	H	7443.000	36.93	35.63	10.83	34.99	0.00	48.40	74.00	-25.60	1/3MHz	Noise floor		
AVG	H	7443.000	25.60	35.63	10.83	34.99	0.00	37.07	54.00	-16.93	1/3MHz	Noise floor		
MaxH PK	H	9924.000	37.26	37.01	12.51	35.63	0.00	51.15	74.00	-22.85	1/3MHz	Noise floor		
AVG	H	9924.000	27.00	37.01	12.51	35.63	0.00	40.89	54.00	-13.11	1/3MHz	Noise floor		
MaxH PK	H	12405.000	36.72	39.00	11.64	35.63	0.00	51.73	74.00	-22.27	1/3MHz	Noise floor		
AVG	H	12405.000	24.80	39.00	11.64	35.63	0.00	39.81	54.00	-14.19	1/3MHz	Noise floor		
MaxH PK	H	14886.000	35.56	39.76	14.50	35.94	0.00	53.88	74.00	-20.12	1/3MHz	Noise floor		
AVG	H	14886.000	25.20	39.76	14.50	35.94	0.00	43.52	54.00	-10.48	1/3MHz	Noise floor		
MaxH PK	H	17367.000	35.10	41.84	17.04	35.94	0.00	58.04	74.00	-15.96	1/3MHz	Noise floor		
AVG	H	17367.000	25.00	41.84	17.04	35.94	0.00	47.94	54.00	-6.06	1/3MHz	Noise floor		
Pre-Amp and filter (REA003) used, Mid Channel = 2442 MHz														
MaxH PK	H	4884.000	43.23	34.16	8.66	35.63	0.00	50.41	74.00	-23.59	1/3MHz			
AVG	H	4884.000	28.05	34.16	8.66	35.63	0.00	35.23	54.00	-18.77	1/3MHz			
MaxH PK	H	7326.000	37.27	35.62	10.74	35.63	0.00	47.99	74.00	-26.01	1/3MHz	Noise floor		
AVG	H	7326.000	26.30	35.62	10.74	35.63	0.00	37.02	54.00	-16.98	1/3MHz	Noise floor		
MaxH PK	H	9768.000	37.17	36.86	12.38	34.07	0.00	52.34	74.00	-21.66	1/3MHz	Noise floor		
AVG	H	9768.000	25.60	36.86	12.38	34.07	0.00	40.77	54.00	-13.23	1/3MHz	Noise floor		
MaxH PK	H	12210.000	36.24	38.97	11.91	34.07	0.00	53.05	74.00	-20.95	1/3MHz	Noise floor		
AVG	H	12210.000	25.00	38.97	11.91	34.07	0.00	41.81	54.00	-12.19	1/3MHz	Noise floor		
MaxH PK	H	14752.000	35.45	39.73	14.24	34.87	0.00	54.55	74.00	-19.45	1/3MHz	Noise floor		
AVG	H	14752.000	25.00	39.73	14.24	34.87	0.00	44.10	54.00	-9.90	1/3MHz	Noise floor		
MaxH PK	H	17094.000	34.93	41.77	16.77	34.87	0.00	58.61	74.00	-15.39	1/3MHz	Noise floor		
AVG	H	17094.000	23.00	41.77	16.77	34.87	0.00	46.68	54.00	-7.32	1/3MHz	Noise floor		
Pre-Amp and filter (REA003) used, Lo Channel = 2402 MHz														
MaxH PK	H	4804.000	42.34	34.19	8.52	35.63	0.00	49.42	74.00	-24.58	1/3MHz			
AVG	H	4804.000	26.60	34.19	8.52	35.63	0.00	33.68	54.00	-20.32	1/3MHz			
MaxH PK	H	7206.000	37.56	35.69	10.60	35.63	0.00	48.22	74.00	-25.78	1/3MHz	Noise floor		
AVG	H	7206.000	26.70	35.69	10.60	35.63	0.00	37.36	54.00	-16.64	1/3MHz	Noise floor		
MaxH PK	H	9608.000	37.27	36.68	12.09	34.07	0.00	51.97	74.00	-22.03	1/3MHz	Noise floor		
AVG	H	9608.000	25.87	36.68	12.09	34.07	0.00	40.57	54.00	-13.43	1/3MHz	Noise floor		
MaxH PK	H	12010.000	36.49	38.80	12.19	34.07	0.00	53.40	74.00	-20.60	1/3MHz	Noise floor		
AVG	H	12010.000	24.95	38.80	12.19	34.07	0.00	41.86	54.00	-12.14	1/3MHz	Noise floor		
MaxH PK	H	14412.000	35.33	39.28	13.87	34.87	0.00	53.61	74.00	-20.39	1/3MHz	Noise floor		
AVG	H	14412.000	23.34	39.28	13.87	34.87	0.00	41.62	54.00	-12.38	1/3MHz	Noise floor		
MaxH PK	H	16814.000	35.47	41.48	16.50	34.87	0.00	58.58	74.00	-15.42	1/3MHz	Noise floor		
AVG	H	16814.000	24.12	41.48	16.50	34.87	0.00	47.23	54.00	-6.77	1/3MHz	Noise floor		

Hand scan was performed above 18GHz at a distance of less than 1m and no emissions were detected above equipment measuring noise floor.

Test Personnel: Vathana Ven *VSV*
Product Standard: FCC §15.209, 15.249(a),(d)
12VDC (Car Battery) +
Input Voltage: 6VDC (Internal Battery)
Pretest Verification w/
BB Source: **BB Source**

Test Date: 07/30/2015, 07/31/2015
Test Levels: Below specified limits

Ambient Temperature: 25 °C
Relative Humidity: 41 %
Atmospheric Pressure: 997 mbars

Deviations, Additions, or Exclusions: None

9 Receiver Radiated Spurious Emissions

9.1 Method

Tests are performed in accordance with FCC 2.1053, 90.210(d).

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

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 10m	30-1000 MHz	3.5 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	3.5 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.2 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.2 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.2 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} 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:

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

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

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61 A	10/06/2014	10/06/2015
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	10/24/2014	10/24/2015
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/14/2015	01/14/2016
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	04/10/2015	04/10/2016
ANT1A'	BROADBAND ANTENNA	Compliance Design	B100	1649	11/04/2014	11/04/2015
ANT1B'	BROADBAND ANTENNA	Compliance Design	B200	1650	11/04/2014	11/04/2015
ANT1C'	BROADBAND ANTENNA	Compliance Design	B300	00668	11/04/2014	11/04/2015
REA003'	1GHz High Pass Filter	Reactel, Inc	7HS-1G/10G-S11	06-1	12/30/2013	12/30/2015
HEW62'	Synthesized Sweep Generator	Hewlett Packard	83620A	3213A01244	05/13/2015	05/13/2017
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	05/13/2015	05/13/2016
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/14/2015	03/14/2016
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	10/04/2014	10/04/2015
CBLHF2012 -2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber + Suhner	SF102	252675001	02/05/2015	02/05/2016

Software Utilized:

Name	Manufacturer	Version
Excel 2003	Microsoft	(11.8231.8221) SP3
EMI Boxborough.xls	Intertek	08/27/10

9.3 Results:

The sample tested was found to comply.

9.4 Setup Photographs:

V9-VP



9.5 Test Data:

Radiated Emissions

Company: LoJack Corporation Antenna & Cables: N Bands: N, LF, HF, SHF
 Model #: V9-VP Antenna: 145106 10mh 10-21-15.txt 145106 10mh 10-21-15.txt
 Serial #: 0F4B036 Cable(s): 145106 10mh 10-21-15.txt NONE.
 Engineers: Vathana Ven Location: 10m Chamber Barometer: DAV004 Filter: NONE
 Project #: G102144226 Date(s): 07/13/15
 Standard: FCC Part 15 Subpart B Class B Temp/Humidity/Pressure: 22 deg. C 44% 1000 mB
 Receiver: 145128_03-14-16 Limit Distance (m): 3
 PreAmp: PRE145003 9-24-2011 Test Distance (m): 10
 PreAmp Used? (Y or N): N Voltage/Frequency: Battery Frequency Range: 30-2000 MHz
 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	Harmonic?
Rx mode														
QP	V	100.000	19.85	10.30	1.59	27.10	-10.46	15.10	33.00	-17.90	120/300 kHz			Noise floor
QP	V	200.000	20.42	12.80	2.17	27.80	-10.46	18.05	36.00	-17.95	120/300 kHz			Noise floor
QP	V	400.000	16.69	15.60	3.29	28.60	-10.46	17.44	36.00	-18.56	120/300 kHz	RB	RB	Noise floor
QP	V	600.000	18.59	18.60	3.79	28.60	-10.46	22.84	36.00	-13.16	120/300 kHz			Noise floor
QP	V	800.000	19.70	21.30	4.69	28.20	-10.46	27.95	36.00	-8.05	120/300 kHz			Noise floor
QP	V	50.000	19.00	7.90	1.12	0.00	-10.46	38.48	40.00	-1.52	120/300 kHz			

During testing, the EUT was in receive mode in between transmit bursts.

Test Personnel: Vathana Ven *VSV*
 Product Standard: FCC Part 90
 12VDC (Car Battery) +
 Input Voltage: 6VDC (Internal Battery)
 Pretest Verification w/
 BB Source: N/A

Test Date: 07/13/2015
 Test Levels: Below specified limits

Ambient Temperature: 22 °C
 Relative Humidity: 44 %
 Atmospheric Pressure: 1000 mbars

Deviations, Additions, or Exclusions: None

10 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	08/17/2015	102144226BOX-007	VFV <i>VFV</i>	KPS <i>KPS</i>	Original Issue
1	08/20/2015	102144226BOX-007a	VFV <i>VFV</i>	KPS <i>KPS</i>	Address and EUT block diagram corrections