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TEST REPORT

FCC Part 15
Radio Frequency Devices
Subpart C – Intentional Radiators

Report Reference No. ..... :	ETRB30315, Rev. B
Compiled by (+ signature) ..... :	Kevin Johnson.
Approved by (+ signature) ..... :	Vincent W. Greb
Date of issue ..... :	30 June 2013
Report Revision ..... :	Initial Release
Total number of pages ..... :	61
Testing Laboratory ..... :	EMC Integrity, Inc.
Address ..... :	1736 Vista View Drive. Longmont, CO 80504 USA Tel: +1 303-776-7249 Fax: +1 303-776-7314
Applicant's name ..... :	Radius Alert Systems.
Address..... :	1012 Pinefield Lane, Castle Pines, CO 80108.
Model(s) Tested..... :	LassoTag
Test specification:	
Standard ..... :	FCC Part 15, Subpart C
Test procedure..... :	ANSI C63.4:2009
Non-standard test method ..... :	N/A
TRF Revision..... :	30 June 2013

Revision History

#	Description	Date
-	Original Report Release	2 May 2013.
A	Revised to incorporate additional measurements specified by DTS, updated block diagram and clarification that testing was performed on 3 orthogonal axes.	18 June 2013
B	Revised to incorporate more additional comments from TCB (ref. 6-20-2013 memo)	30 June 2013

Notices:

1. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
2. The test results presented in this report relate only to the object tested.
3. The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.
4. "(see Enclosure #)" refers to additional information appended to the report.
5. Throughout this report a point is used as the decimal separator.
6. Dimensions in English units for convenience only, metric units prevail.

Table of Contents

Normative References

The following document(s) have been appropriately considered in the performance of the test results detailed in this report.

CFR Title 47, Part 15
Radio Frequency Devices

Guidance for Performing Compliance Measurements on Digtial Transmission Systems (DTS) Operating Under 15.247 (April 9, 2013)

ANSI C63.4: 2009
American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Equipment Under Test (EUT)

Details:

Test item description:

Model ..... : LassoTag

Serial Number ..... : EMC001.

Production Status ..... : ☒ Production* ☐ Pre-Production ☐ Prototype
*Production unit was specially modified with Mode Button

Other Status Info ..... : N/A.

EUT Received Date ..... : 6 March 2013.

Ratings ..... : 3.7 Vdc ☐ 1ϕ ☐ 3ϕ ☒ Internal Battery

General product description:

- The LassoTag is a key fob which attaches to a device (backpack, briefcase, etc.). When used in conjunction with the mobile app, detects motion and connectivity in and out of a 50-80 foot radius.

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Modifications to the EUT required for compliance:

There have been no modifications to the EUT as a result of this evaluation. However, as stated above, the EUT was modified with a “mode button” so that the test engineer could easily switch between different operational modes.

Deviations from Test Methodology:

There have been no deviations, additions to, or exclusions from the specified test standard.

Engineering Judgements:

No engineering judgments based on the results in this test report have been made.

Approved by (+ signature) ..... : Vincent W. Greb

Table 1 – EUT Internal Operating Frequencies

Frequency (MHz)	Description	Frequency (MHz)	Description
0.032768	Watchdog Timer		
32.000	Processor		
2,400	Transmitter		

Table 2 – EUT Operating Modes Used During Testing

Mode #	Description
1	Normal Operation (burst BT discovery 1/6 duty)
2	Frequency Hopping transmit modulated
3	Receive mode, Channel 0 (lowest Ch.)
4	Transmit, unmodulated, Channel 0 (lowest Ch.)
5	Transmit, modulated, Channel 0 (lowest Ch.)
6	Receive mode, Channel 20 (middle Ch.)
7	Transmit, unmodulated, Channel 20 (middle Ch.)
8	Transmit, modulated, Channel 20 (middle Ch.)
9	Receive mode, Channel 39 (highest Ch.)
10	Transmit, unmodulated, Channel 39 (highest Ch.)
11	Transmit, modulated, Channel 39 (highest Ch.)

EUT Configuration

A minimum representative configuration, as defined by the manufacturer, has been used for the testing performed herein. The selection of hardware (including interface ports), software, and cables were chosen by the manufacturer as being representative of the product's intended use. The interconnection of various articles of equipment and the types of cables used has also been defined by the manufacturer.

Testing was performed for all three orthogonal axes of the UUT, and the worst-case orientation was used for the final measurements. The final placement of the equipment under test has been, to the extent practical, arranged to maximize emissions. The UUT was operated using a continuous (i.e., 100%) duty cycle for all testing.

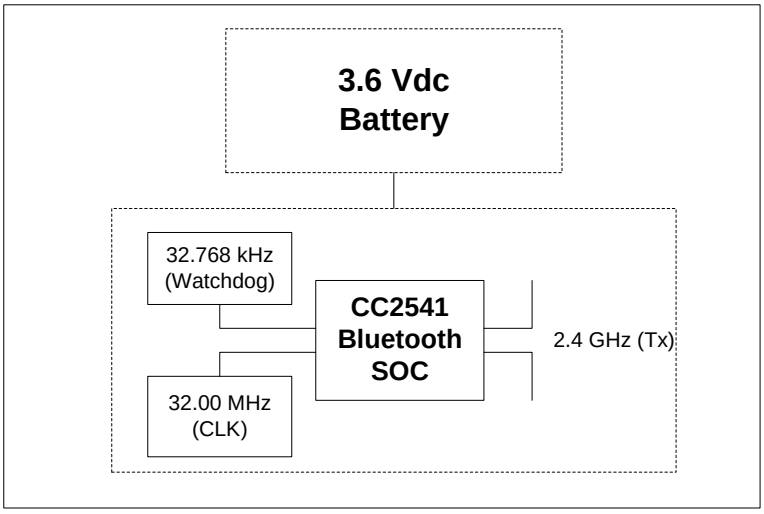
Cables, of the type and length specified by the manufacturer, were connected to at least one of each type of interface port provided by the EUT and if practical, were terminated by a device typical of actual usage. For multiple ports of the same type, the addition of cables did not significantly affect the emission level (i.e. < 2B variation).

The arrangement of external power supply units was as follows:

a) If the mains input cable of the external power supply unit is greater than 0,8 m, the external power supply unit shall be placed on the tabletop, with a nominal 0,1 m separation from the host unit.
b) If the external power supply unit has a mains input cable that is less than 0,8 m, the external power supply unit shall be placed at a height above the ground plane such that its power cable is fully extended in the vertical direction.
c) If the external power supply unit is incorporated into the mains power plug, it shall be placed on the tabletop. An extension cable shall be used between the external power supply unit and the source of

power . The extension cable should be connected in a manner such that it takes the most direct path between the external power supply unit and the source of power.

Figure 1 - EUT Configuration Diagram



Note: Antenna integral to PCB.

Table 3 – EUT & Auxiliary Equipment List

Item	Use*	Product Type	Manufacturer	Model	Serial No.
AA	EUT	LassoTag	Radius Alert Systems	LassoTag	EMC001
BB					
C					
D					
E					
F					

Note:
* Use = EUT - Equipment Under Test,
AE - Auxiliary/Associated Equipment, or
SIM - Simulator (Not Subjected to Test)

Table 4 - Interconnecting Cables List

Item	Use*	Cable Type
1	Charging	USB Cable
2		
3		
4		
5		
6		
7		

EUT Photo(s)

Photo 1	**EUT Photo – Front View**	

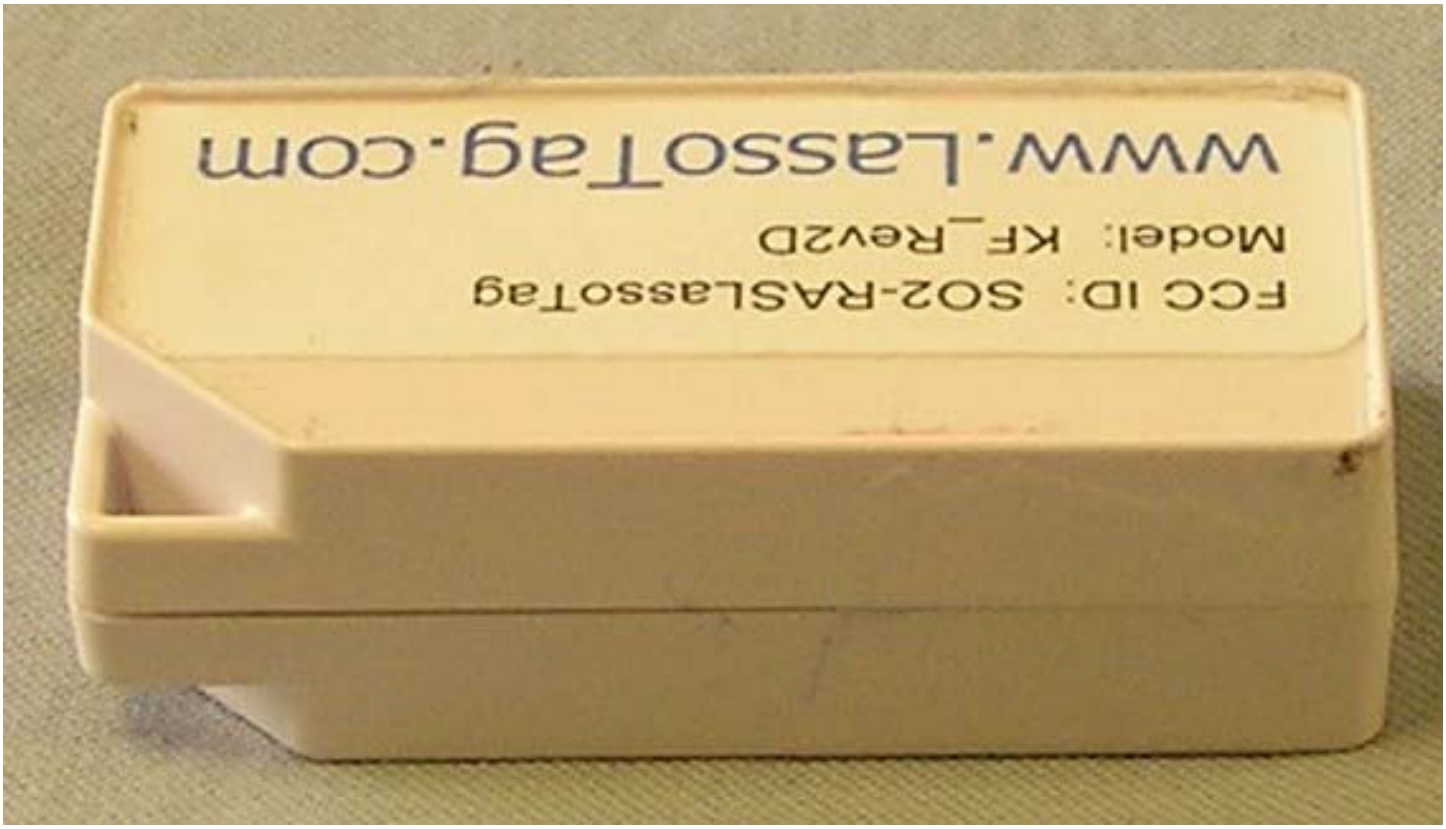
Supplemental Information:

Photo 2	**EUT Photo – Bottom View**	

Supplemental Information:

Red arrow points to “mode switch”, which is not available on production units. This switch was added to allow the test engineer to easily change modes.

Photo 3	**EUT Photo – Left Side View**	



Supplemental Information:

Photo 4	**EUT Photo – Right Side View**	

Supplemental Information:

Red arrow points to “mode switch”, which is not available on production units. This switch was added to allow the test engineer to easily change modes.

Photo 5	**EUT Photo – Left End View**	

Supplemental Information:

Blue arrow points to micro USB connector used for charging the EUT.

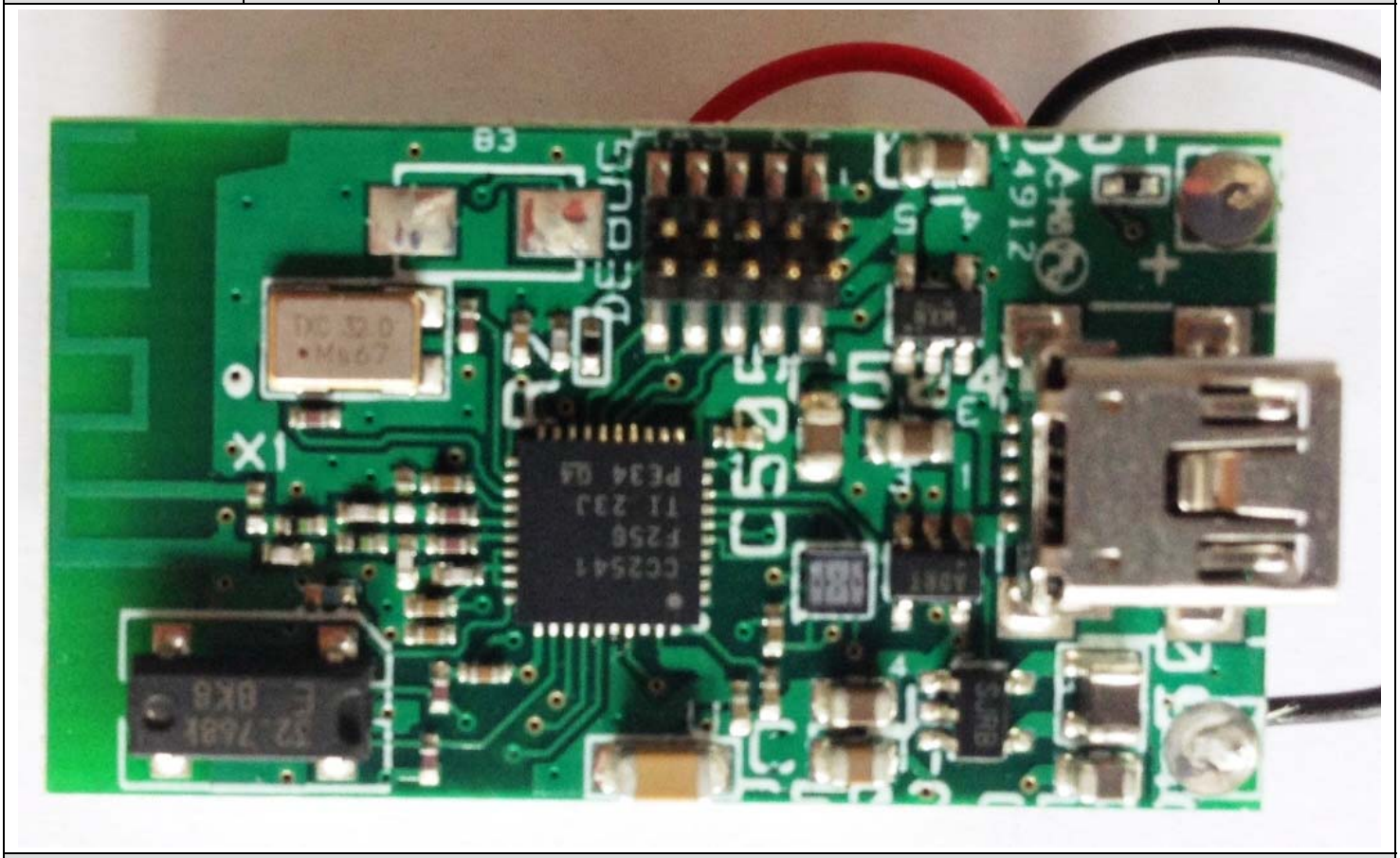
Red arrow points to “mode switch”, which is not available on production units. This switch was added to allow the test engineer to easily change modes.

Photo 6	**EUT Photo – Right End View**	

Supplemental Information:

Red arrow points to “mode switch”, which is not available on production units. This switch was added to allow the test engineer to easily change modes.

Photo 7	**EUT Photo – PCB – Component Side**	

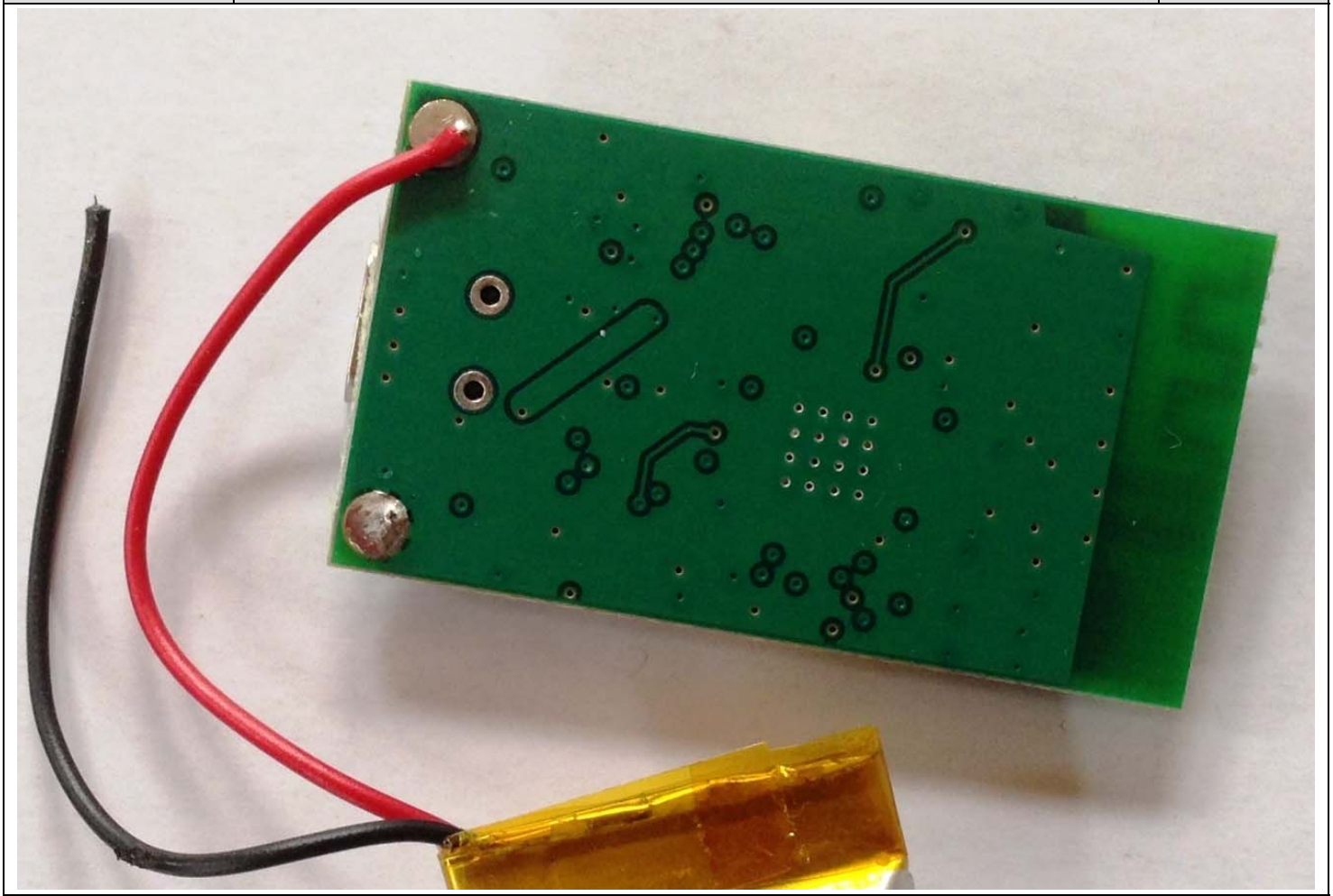


Supplemental Information:

Photo 8	**EUT Photo – Battery on Bottom Side of PCB**	

Supplemental Information:

Photo 9	**EUT Photo - Bottom Side of PCB (Battery Removed)**	



Supplemental Information:

Summary of Testing

Possible test case verdicts:

- test case does not apply to the test object : N/A
- test object does meet the requirement .....: P (Pass)
- test object does not meet the requirement : F (Fail)
- not tested (not part of this evaluation) .....: NT

Date(s) of performance of tests .....: Click here to enter text.

Clause	Test Description	Verdict	Comment
47 CFR			
15.203	Antenna Requirement	P	
15.207	Conducted Emissions - Mains	NT	
15.209	Radiated Emissions – Spurious Out of Band Emissions and Restricted Bands	P	
15.247(a)(1)	20 dB Occupied Bandwidth	P	
15.247(b)	Peak RF Output Power	P	
15.247(e)	RF Exposure	P	
DTS Operating Under 15.247			
8.0	DTS Bandwidth	P	
9.0	Fundamental Emission Output Power	P	
10.0	Power Spectral Density	P	
11.0	Emissions in non-Restricted Bands	P	
12.0	Emissions in Restricted Bands	P	
13.0	Spurious Emissions – Band Edge	P	

Notes:

The EUT was powered from an internal 3.7 Vdc battery which was recharged via USB. It had no connection to the AC mains and therefore, conducted emissions on the AC mains was not applicable and therefore, not tested.

General remarks:

Summary of compliance with national requirements:

Compliance with this standard provides a means of conformity with the United States Federal Communication Commission (FCC) verification, certification, or declaration of conformity authorization procedures and Industry Canada (IC) rules.

Testing Location		
Testing Laboratory:		
Testing location/ address ..... :	EMC Integrity, Inc. 1736 Vista View Drive Longmont, CO 80504	
Testing procedure: TMP		
Tested by (name + signature) :	Kevin Johnson	
Approved by (+ signature) :	Vincent W. Greb	
Testing location/ address ..... :	EMC Integrity, Inc. 1736 Vista View Drive Longmont, CO 80504	
Supplemental Information:		
Testing results contained herein were performed at the location(s) listed above.		

Procedural Requirements

The following requirements are taken from the appropriate rules, other rules may apply and the manufacturer should consult the full text of the appropriate laws prior to marketing any device.

United States

Mandated procedures for digital devices are defined in 47 CFR 15.201, *Equipment authorization requirement*. Details of the authorization procedures (verification, declaration of conformity, and certification) can be found in 47 CFR, Part 2, Subpart J, *Equipment Authorization Procedures*.

Information to the User and Labeling Requirements

The following requirements are taken from the appropriate rules, other rules may apply and the manufacturer should consult the full text of the appropriate laws prior to marketing any device.

United States

Labeling

47 CFR 2.925

(a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in §2.926. The FCC Identifier shall be preceded by the term *FCC ID* in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID XXX123. XXX—Grantee Code 123—Equipment Product Code

47 CFR 15.19

(a) In addition to the requirements in part 2 of this chapter, a device subject to certification, or verification shall be labeled as follows:

(3) All other devices shall bear the following statement in a conspicuous location on the device:

> This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

47 CFR 15.19(b)(2) Label text and information should be in a size of type large enough to be readily legible, consistent with the dimensions of the equipment and the label. However, the type size for the text is not required to be larger than eight point.

47 CFR 15.19(b)(3): When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (b)(1) of this section on it, such as for a CPU board or a plug-in circuit board peripheral device, the text associated with the logo may be placed in a prominent location in the instruction manual or pamphlet supplied to the user. However, the unique identification (trade name and model number) and the logo must be displayed on the device.

47 CFR 15.19(b)(4): The label shall not be a stick-on, paper label. The label on these products shall be permanently affixed to the product and shall be readily visible to the purchaser at the time of purchase, as described in §2.925(d) of this chapter. “Permanently affixed” means that the label is etched, engraved, stamped, silkscreened, indelibly printed, or otherwise permanently marked on a permanently attached part of the equipment or on a nameplate of metal, plastic, or other material fastened to the equipment by welding, riveting, or a permanent adhesive. The label must be designed to last the expected lifetime of the equipment in the environment in which the equipment may be operated and must not be readily detachable.

Information to User

47 CFR 15.21: The user’s manual or instruction manual for an intentional or unintentional radiator shall caution the user that:

> Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

Technical Requirements

The testing requirements, as appropriate, were derived from ANSI C63.4; 47 CFR, Subpart A.

Conducted Emissions

The mains cable of the EUT or EUT host unit was connected to the LISN defined in this standard and is bonded to the reference plane. Where applicable, remaining auxiliary equipment was powered through an additional LISN (also bonded to the reference plane), using a multi-socket outlet strip if necessary. The LISNs were at least 0.8m away from the EUT. A vertical ground plane was used while the table-top EUTs were placed on a wooden table 0.8m high. Floor-standing EUTs were insulated from the ground plane and grounded according to the manufacturer's instructions.

Signal cables were positioned for their entire lengths, as far as possible, at a nominal distance of 0.4 m from the ground reference plane. Where the mains cable supplied by the manufacturer was longer than 1 m, the excess was folded at the centre into a bundle no longer than 0.4 m, so that its length is shortened to 1 m. If the 1 m cable length cannot be achieved owing to physical limitations of the EUT arrangement, the cable length shall be as near to 1 m as possible.

All telecommunication and signal ports were correctly terminated using either appropriate associated equipment or a representative termination during the measurement of the conducted disturbances at the mains. If an ISN is connected to a telecommunications port during the measurement of conducted disturbances at the mains port, then the ISN receiver port was terminated in 50Ω. The ISNs were at least 0.8m away from the EUT.

Mains

Any power cable(s) from the equipment under test that were directly connected to the AC Mains have been tested. In the event that the equipment under test had no direct connection to the Mains, that is, it was connected to a Host unit (example: USB powered); then conducted emissions was performed on the Mains of the Host unit. Battery powered equipment was not tested for conducted emissions; however, if the equipment makes provisions for connections to a battery charger that is connected to the Mains, then conducted emissions were performed on the battery charger.

Table 5 – Class B Conducted Emissions Limits - Mains

Frequency	Limits (dBµV)	
	Quasi-peak	Average
150 kHz – 500 kHz	66 - 56	5-46
500 kHz – 5 MHz	56	46
5 MHz – 30 MHz	60	50
NOTE 1: The lower limit shall apply at the transition frequency. NOTE 2: The limit decreases linearly with the logarithm of the frequency in the range 150 kHz to 500 kHz.		

Radiated Emissions – Restricted Bands

The arrangement of the equipment is typical of a normal installation practice and as was practical, the arrangement was varied and emissions investigated for maximum amplitude. Final measurements were performed in a semi-anechoic chamber. The equipment was rotated 360° and the antenna height has been varied between 1m and 4m. Measurements were taken at both horizontal and vertical antenna polarities. The receiver bandwidth was set to 120 kHz for measurements below 1 GHz, and 1 MHz for measurements above 1 GHz. A peak detector is used to detect an emission; a quasi-peak detector may be used to record a final measurement below 1 GHz and an average detector may be used above 1 GHz. An inverse proportionality factor of 20 dB/decade (10 dB) was used, as noted in 15.31(f)(1), to normalize the measured data to the specified test distance for determining compliance.

Frequency range of radiated measurements (15.33(a)):

Operating frequency of intentional radiator	Lowest frequency searched	Highest frequency searched
Below 10 GHz	9 kHz or lowest operating frequency generated in the device, whichever is highest	10th harmonic of highest fundamental frequency or 40 GHz, whichever is lower
10 – 30 GHz	9 kHz or lowest operating frequency generated in the device, whichever is highest	5th harmonic of highest fundamental frequency or 100 GHz, whichever is lower
At or above 30 GHz	9 kHz or lowest operating frequency generated in the device, whichever is highest	5th harmonic of highest fundamental frequency or 200 GHz, whichever is lower

Restricted Bands 47 CFR 15.205

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1]0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41			

Radiated Emission Limit – Restricted Bands

Reading on the measuring receiver showing fluctuations close to the limit, were observed for at least 15 s at each measurement frequency; the highest reading was recorded.

Table 6 – Radiated Emissions Limits per 47 CFR 15.209(a) & RSS-GEN 7.2.5

Frequency Range	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (m)
9 kHz – 490 kHz	2400/F(kHz)	48.5 – 13.8	300
490 kHz – 1.705 MHz	24000/F(kHz)	33.6 – 23.0	30
1.705 MHz – 30 MHz	30	29.5	30
30 MHz – 88 MHz	100	40.0	3
88 MHz – 216 MHz	150	43.5	3
216 MHz – 960 MHz	200	46.0	3
Above 960 MHz	500	54.0	3

DTS Bandwidth

Section 8.0: DTS bandwidth was measured using **Option 1** given under Section 8.0 of the FCC's "*Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247*", dated April 9, 2013. The following verbiage describes this procedure.

EUT configuration: The EUT is set to normal Tx mode for low, middle and high Tx frequencies.

Spectrum analyzer settings:

RBW = 100 kHz

VBW $\geq$ 3 x RBW

Detector = Peak

Sweep = auto

Allow trace to stabilize

Measure the maximum width of the emissions that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuation by 6 dB relative to the maximum level measured in the fundamental emission.

Fundamental Emission Output Power

Section 9.0: Fundamental emission output power was measured as outlined in **Section 9.1.1** of the FCC's "*Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247*", dated April 9, 2013. (This method was chosen as the DTS BW was less than 1 MHz.)The following verbiage describes this procedure.

EUT configuration: The EUT is set to normal Tx mode for low, middle and high Tx frequencies.

Spectrum analyzer settings:

RBW $\geq$ DTS Bandwidth, or 1 MHz

VBW $\geq$ 3 x RBW, or 3 MHz

Span $\geq$ 3 x RBW, or 3 MHz)

Detector = Peak

Trace = Max Hold

Allow trace to stabilize

Use peak marker to determine the peak amplitude level.

*Since the EUT had an integral antenna, the EIRP method was used.

Power Spectral Density

Section 10.0: Power spectral density was measured as outlined in **Section 10.2 Method PKPSD** of the FCC's "*Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247*", dated April 9, 2013. The following verbiage describes this procedure. Since the maximum peak conducted output power (EIRP) method was used to demonstrate compliance, the peak PSD method specified in Section 10.2 was used for this measurement, as follows:

EUT configuration: The EUT is set to normal Tx mode for low, middle and high Tx frequencies.

Analyzer center frequency was set to DTS channel center frequency.

Span was set to 1.5 x DTS bandwidth

RBW was 3 kHz $\leq$ RBW $\leq$ 100 kHz

Video Bandwidth was $\geq$ 3 x RBW

Sweep time = auto couple

Detector = Peak

Trace = Max Hold

Allow trace to stabilize

Use peak marker to determine the peak amplitude within the RBW. In the event that measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

20 dB Occupied Bandwidth

15.247(a)(1)(i): The maximum 20 dB occupied bandwidth for…transmitters operating in the 902 – 928 MHz band is 500 kHz.

15.247(a)(1)(ii): The maximum 20 dB bandwidth of the hopping channel is 1 MHz for…systems operating in the 5725 – 5850 MHz.

The 20 dB Occupied Bandwidth is measured at low, mid, and high channels and with each modulation mode.

Spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW ≥ 1% of the 20 dB bandwidth

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Emissions in Non-Restricted Bands

Section 12.0. Same method and data as for emissions in restricted bands.

Band-Edge

Section 13.0 Band-edge was measured as outlined in **Section 13.3.1 Peak Detection** of the FCC's "*Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247*", dated April 9, 2013. The following verbiage describes this procedure.

EUT test mode: The EUT is set in its normal Tx mode for lowest and highest channels.

Spectrum analyzer settings:

Set the spectrum analyzer center frequency to the frequency of the emission to be measured.

Span = 2 MHz

RBW = 100 kHz

VBW ≥ 3 x RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow sweep to continue until trace stabilizes.

Verify that emissions at band-edge and below/above band-edge comply with FCC 15.209 limit.

Peak RF Output Power

15.247(2)(b)(1):

Frequency Band	Minimum No. of Non-Overlapping Hopping Channels	Maximum Peak RF Power at antenna
2400-2483.5 MHz	75	1 watt
2400-2483.5 MHz	All other	0.125 watt
5725-5850 MHz	-	1 watt

15.247(2)(b)(2): For…systems operating in the 902–928 MHz band:

Frequency Band	Minimum No. of Non-Overlapping Hopping Channels	Maximum Peak RF Power at antenna
902-928 MHz	50	1 watt
902-928 MHz	<50 but at least 25	0.250 watt

EUT test mode: The peak rf output power shall be measured at low, mid, and high channels and for each modulation mode.

Spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW > the 20 dB bandwidth of the emission being measured

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Spurious Emissions

15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits is not required. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits specified.

Spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Band edge spurious emissions:

Measurement shall be made in the following bands:

2310 – 2390 MHz

2483.5 – 2500 MHz

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Measurement Uncertainty

Determining compliance with the limits in these standards was based on the results of the measurement, and does not take into account the measurement instrumentation uncertainty.

Referencing the measurement instrumentation uncertainty considerations contained in CISPR 16-4-2, the expanded measurement uncertainty is ±4.67 dB for radiated emissions, ±3.04 dB for mains conducted emissions, and ±4.30 dB for telecommunication ports conducted emissions.

List of Test Equipment

The following test equipment was used in the performance of the testing herein.

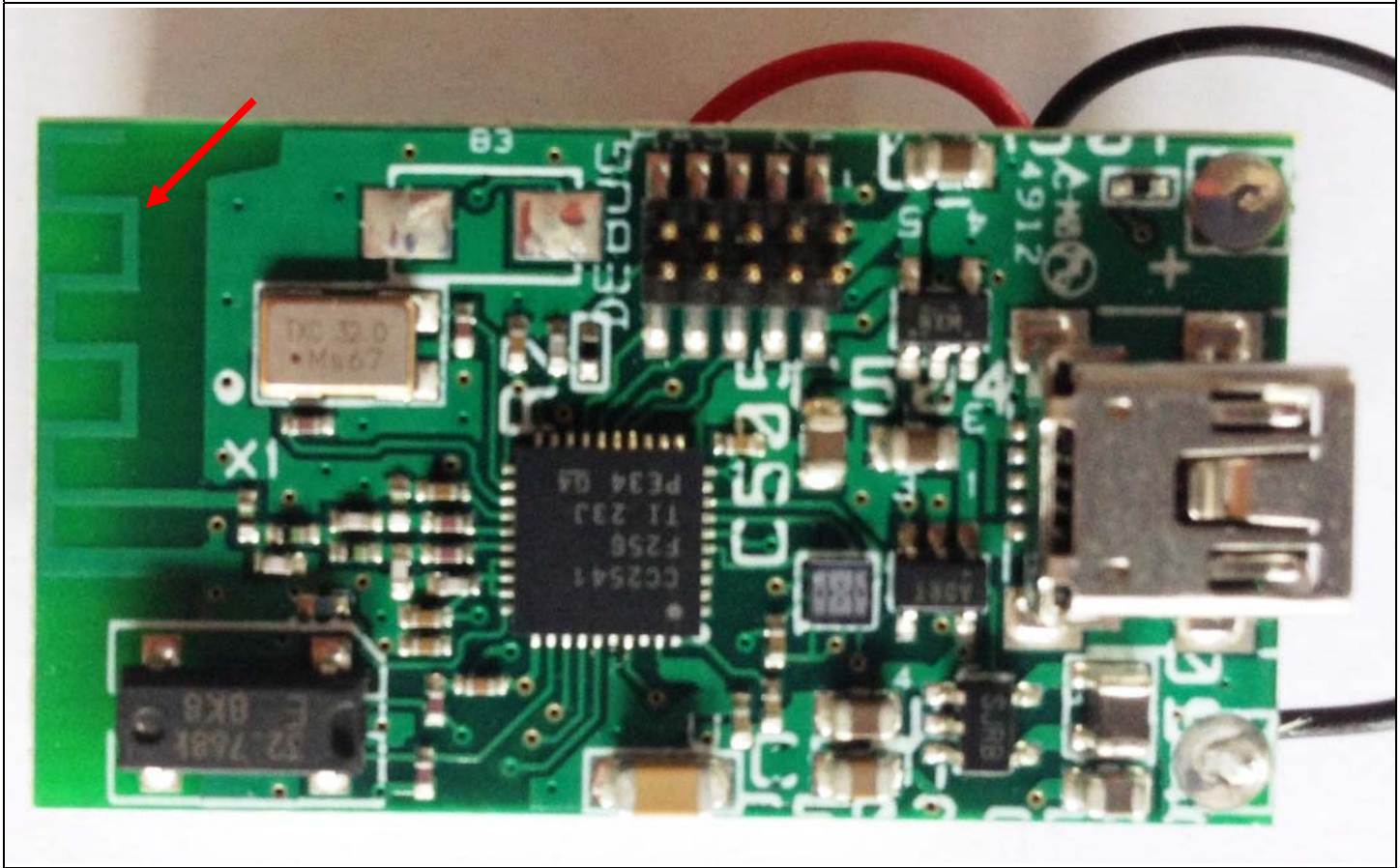
Table 7 – Test Equipment Used

Asset Tag	Manufacturer	Description	Model	Serial Number	Cal. Date	Cal. Due
1197	EMCO	DRG Horn 18-40 GHz	00040962	00040962	10/25/2012	10/25/2013
1215	Hewlett Packard	9kHz-40GHz Portable Spectrum Analyzer	3943A01645	3943A01645	02/06/2013	02/06/2014
1220	LNA, 10 - 2000 MHz, 30 dB	Mini-Circuits	ZKL-2	NA	03/07/2013	03/07/2014
1229	Hewlett Packard	RF Preselector	3010A01077	3010A01077	01/04/2013	01/04/2014
1253	Narda West	18 to 40 GHz Preamplifier, 40dB Gain Nominal	010-100	010-100	03/11/2013	03/11/2014
1062	Tektronix	Digital Oscilloscope (500 MHz Bandwidth)	TDS3052	B014233	10/31/2012	10/31/2013
1255	EMCO	Active Loop Antenna, 10kHz to 30MHz	6502	9105-2619	04/22/2012	04/22/2013
1263	Hewlett Packard	Spectrum Analyzer, 100 Hz to 22 GHz	3014A06873	3014A06873	01/04/2013	01/04/2014
1264	Hewlett Packard	Spectrum Analyzer Display	2848A18247	2848A18247	01/04/2013	01/04/2014
1265	Hewlett Packard	Quasi-Peak Adapter	2521A00641	2521A00641	01/04/2013	01/04/2014
1392	Sunol	1-18 GHz Double-Ridged Horn Antenna	A020311	A020311	01/30/2013	01/30/2014
1396	CIR Enterprises	10m Chamber with 4m turntable	002	002	06/12/2012	06/12/2013
1403	Ciao Wireless	Preamp Assembly, 1-18 GHz, 56 dB gain	105+106	105+106	08/30/2012	08/30/2013
1405	EXTECH Instruments	Hygro-Thermometer	N/A	N/A	08/13/2012	08/13/2013
1410	Sunol Sciences	System Controller 10meter #2	021611-1	021611-1	NA	NA
1470	Sunol Sciences	10 Meter #2 Turn table, 4 Meter Table	NA	NA	08/10/2012	08/10/2013

Test Results – Antenna Requirement

Table No. 1	Antenna requirement	Verdict
		P

Type of antenna connection	☒ Integral antenna	☐ Permanently attached	☐ Unique connector
Type of unique connector	No rf connector		
Method of permanent connection	PCB antenna		



Supplemental Information:

Red arrow points to antenna which is integral to the PCB. There is no facility for connecting an external antenna.

Tested by (+ signature) .....: Kevin Johnson.

Test Results – Radiated Emissions – Spurious Out of Band Emissions & Restricted Bands

Table No. 2	**Radiated Emissions – Spurious Out of Band Emissions & Restricted Bands, Tx - Lowest Channel**	Verdict
		P

Frequency Range ..... : 30 MHz to 1 GHz Test Location ..... : 10m Chamber
Test Method..... : ANSI C63.4
Test Distance ..... : 10 m (30 MHz to 1 GHz); 3 m (1-18 GHz); 1 m (18-25 GHz)
EUT Configuration ..... : Transmit, modulated, Channel 0 (lowest channel)
Test Date ..... : 3-25-2013.
Temperature ..... : 22°C Relative Humidity .... : 24 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470

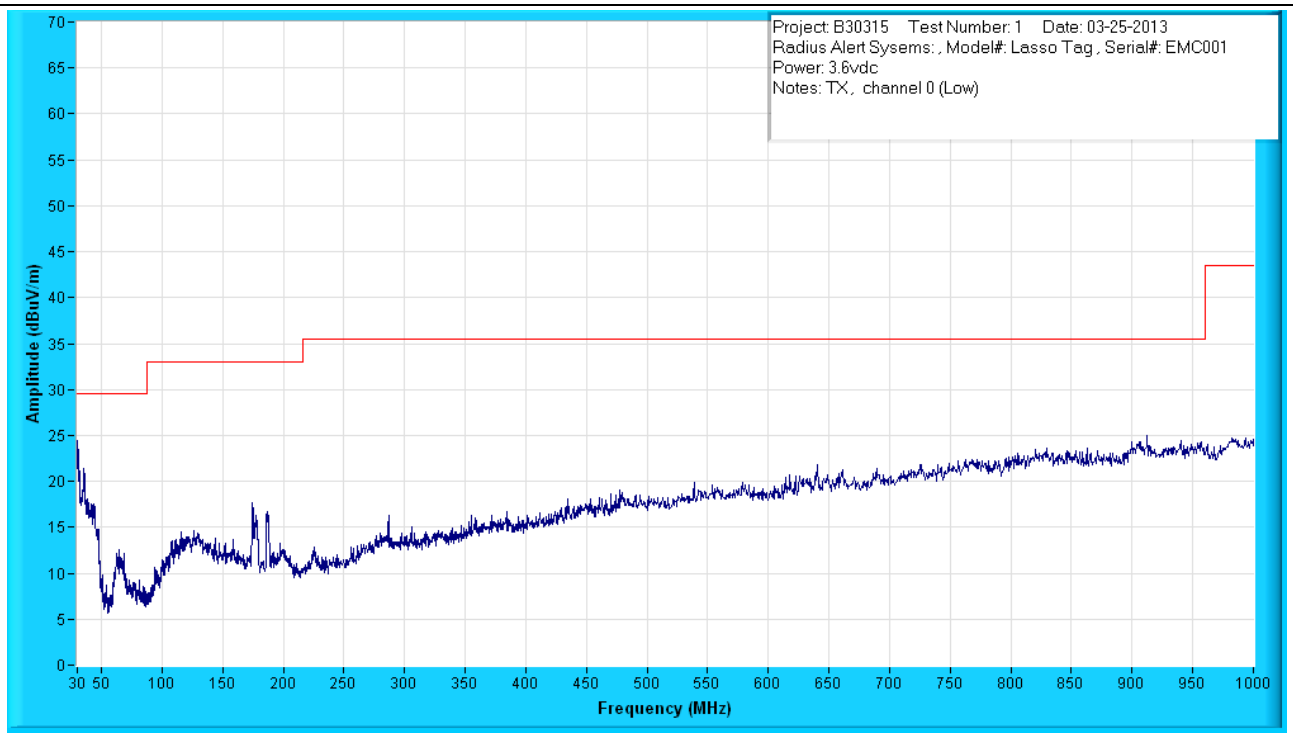


Figure: Radiated Emissions Prescan, 30MHz to 1000MHz, Peak Measurements at 10m Distance

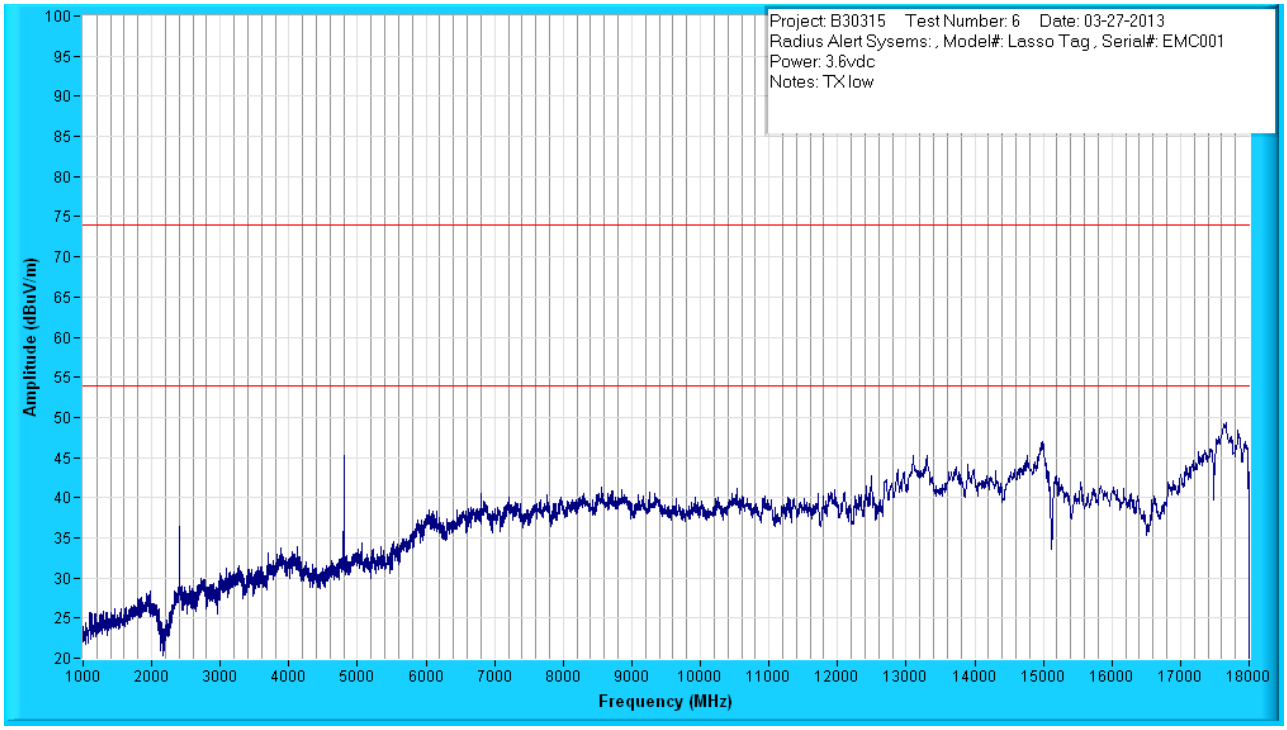


Figure : Radiated Emissions Prescan, 1GHz to 18GHz, Peak Measurements at 3m Distance

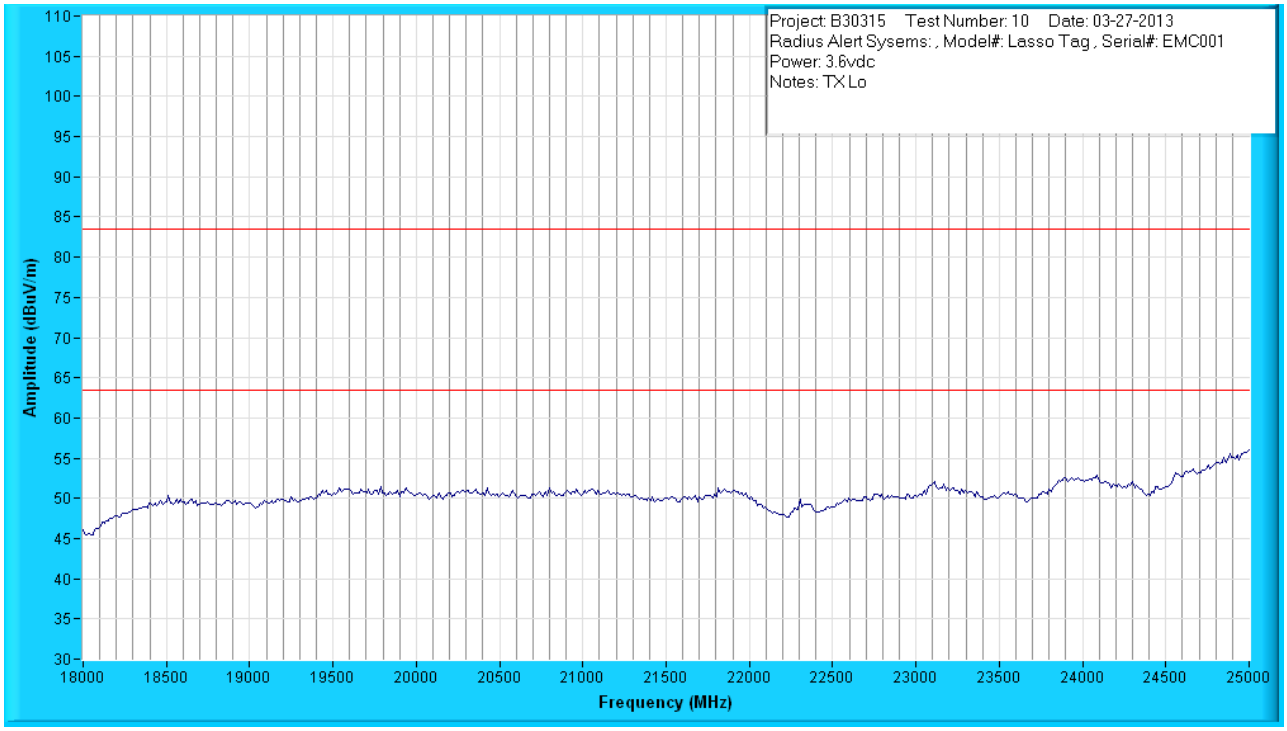


Figure : Radiated Emissions Prescan, 18GHz to 25GHz, Peak Measurements at 1m Distance

Type	Frequency (MHz)	Level (dBuV)	Transducer (dB/m)	Gain / Loss (dB)	Final (dBuV/m)	Azm(deg)/Pol /Hgt(m)	Margin: FCC Class B QP (dB)	Margin: FCC Class B AV (dB)
QP	30.383	31.6	21.0	-29.8	22.8	26/V-Pole/1.01	6.76	-
QP	35.834	32.2	17.1	-29.8	19.5	100/V-Pole/2.63	9.99	-
QP	197.495	24.7	12.2	-29.6	7.4	188/H-Pole/2.68	25.68	-
QP	226.157	24.9	11.8	-29.6	7.2	11/H-Pole/3.93	28.38	-
QP	287.509	24.9	13.5	-29.4	9.0	192/V-Pole/3.99	26.51	-
QP	538.014	25.1	18.0	-28.7	14.4	152/H-Pole/2.56	21.18	-
QP	639.468	24.8	19.1	-28.4	15.5	298/H-Pole/4.00	20.04	-
QP	911.575	24.2	22.1	-27.1	19.2	15/H-Pole/3.95	16.32	-
Type	**Frequency (MHz)**	**Level (dBuV)**	**Transducer (dB/m)**	**Gain / Loss (dB)**	**Final (dBuV/m)**	**Azm(deg)/Pol /Hgt(m)**	**Margin: FCC Class B >1GHz PK (dB)**	**Margin: FCC Class B >1GHz AV (dB)**
AV	4804.027	85.0	33.4	-69.8	48.5	252/V-Pole/1.50	-	5.43
PK	4804.027	88.6	33.4	-69.8	52.2	252/V-Pole/1.50	21.78	-

The highest emission measured was at **4804.027 MHz,** which was **5.43 dB** below the limit.

Supplemental Information:

- "Type" refers to the type of measurement performed. The type of measurement made is based on the requirements of the particular standard:
  - PK = Peak Measurement: RBW is 120kHz, VBW is 3 MHz
  - QP = Quasi-Peak Measurement: RBW is 120kHz, VBW is 3 MHz, and QP Detection is ENABLED
  - AV = Video Average Measurement: RBW is 1 MHz, VBW is 10 Hz
- The "Final" emissions level is attained by taking the "Level" and adding the "Transducer" factor and the "Gain/Loss" factor. Final measurements are made with the Azimuth, Polarity, Height, and EUT Cables positioned for maximum radiation. If applicable, cables positions are noted in the test log. (Sample Calculation: 49.6 dBuV + 11.4 dB/m – 28.8 dB = 32.2 dBuV/m. **Important Note**: This is a sample calculation only for the purpose of demonstration, and does not reflect data in this report.)
- The "Azm/Pol/Hgt" indicates the turn-table *azimuth*, the antenna *polarity*, and the antenna *height* where the maximum emissions level was measured.
- The "Margin" is with reference to the emissions limit. A positive number indicates that the emission measurement is below the limit. A negative number indicates that the emission measurement exceeds the limit.

The PRESCAN is a peak measurement and is performed with the RBW set to 120 kHz, VBW set to 3 MHz (30 MHz to 1 GHz), and the RBW set to 1 MHz, VBW set to 100 kHz (> 1 GHz)

Tested by (+ signature) .....: Kevin Johnson.

Table No. 3	**Radiated Emissions – Spurious Out of Band Emissions & Restricted Bands** **Tx – Middle Channel**	Verdict
		P

Frequency Range ..... : 30 MHz to 1 GHz Test Location ..... : 10m Chamber
Test Method..... : ANSI C63.4
Test Distance ..... : 10 m (30 MHz to 1 GHz); 3 m (1-18 GHz); 1 m (18-25 GHz)
EUT Configuration ..... : Transmit, modulated, Channel 20 (middle channel)
Test Date ..... : 3-26-2013.
Temperature ..... : 22°C Relative Humidity .... : 24 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1255, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470

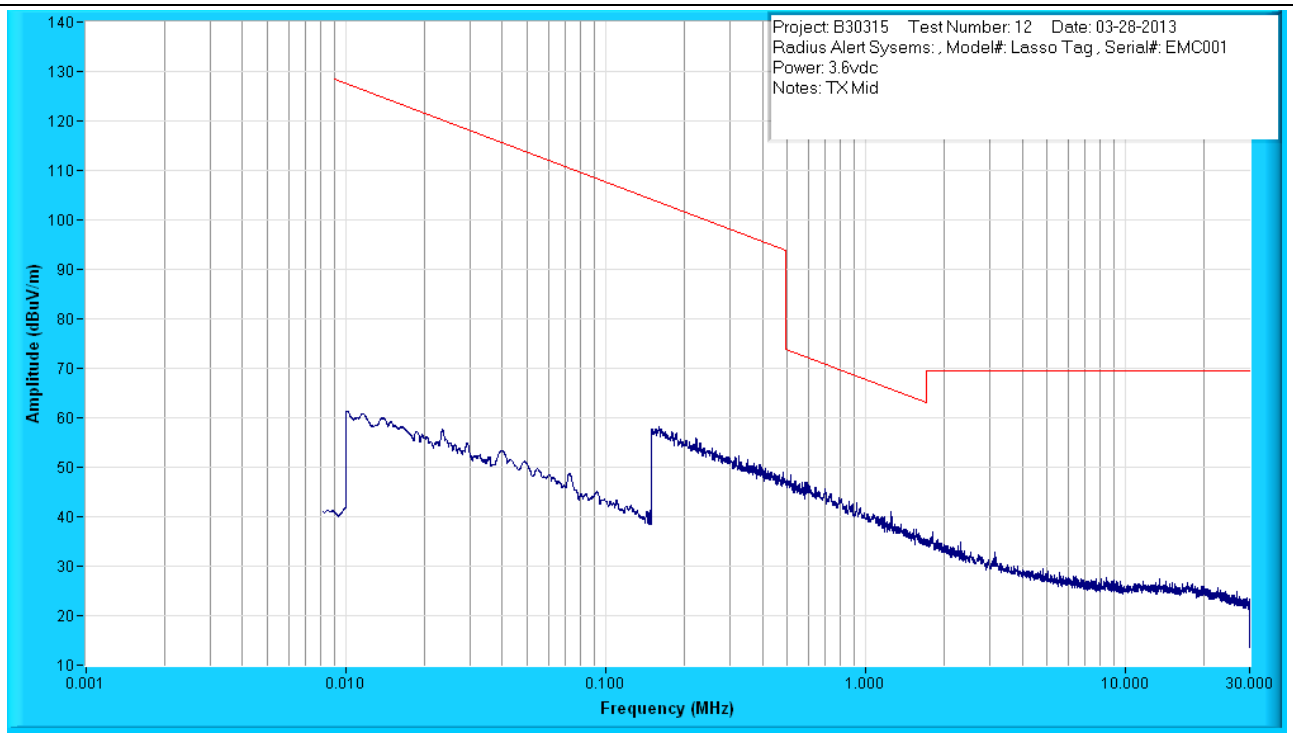


Figure : Radiated Emissions Prescan, 9 kHz to 30MHz, Peak Measurements at 3m Distance

Frequency (kHz)	Field Strength (uV/m)	Distance (m)	Field Strength (dBuV/m)	Limit (Corrected for 3 m Spacing)
9	266.67	300	48.52	128.52
490	4.90	300	13.80	93.80
490	48.98	30	33.80	73.80
1705	14.08	30	22.97	62.97
1705	30.00	30	29.54	69.54
30000	30.00	30	29.54	69.54

Limit Correction for 3-meter Antenna Spacing.

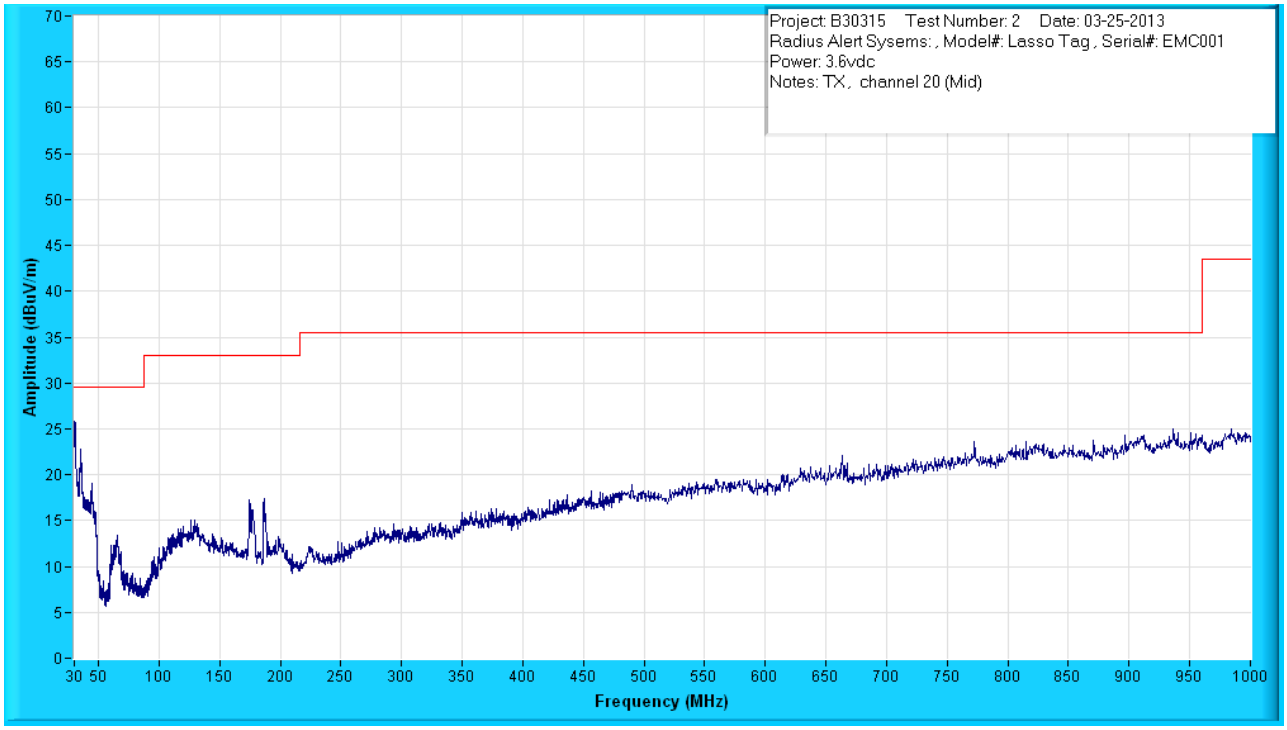


Figure : Radiated Emissions Prescan, 30MHz to 1000MHz, Peak Measurements at 10m Distance

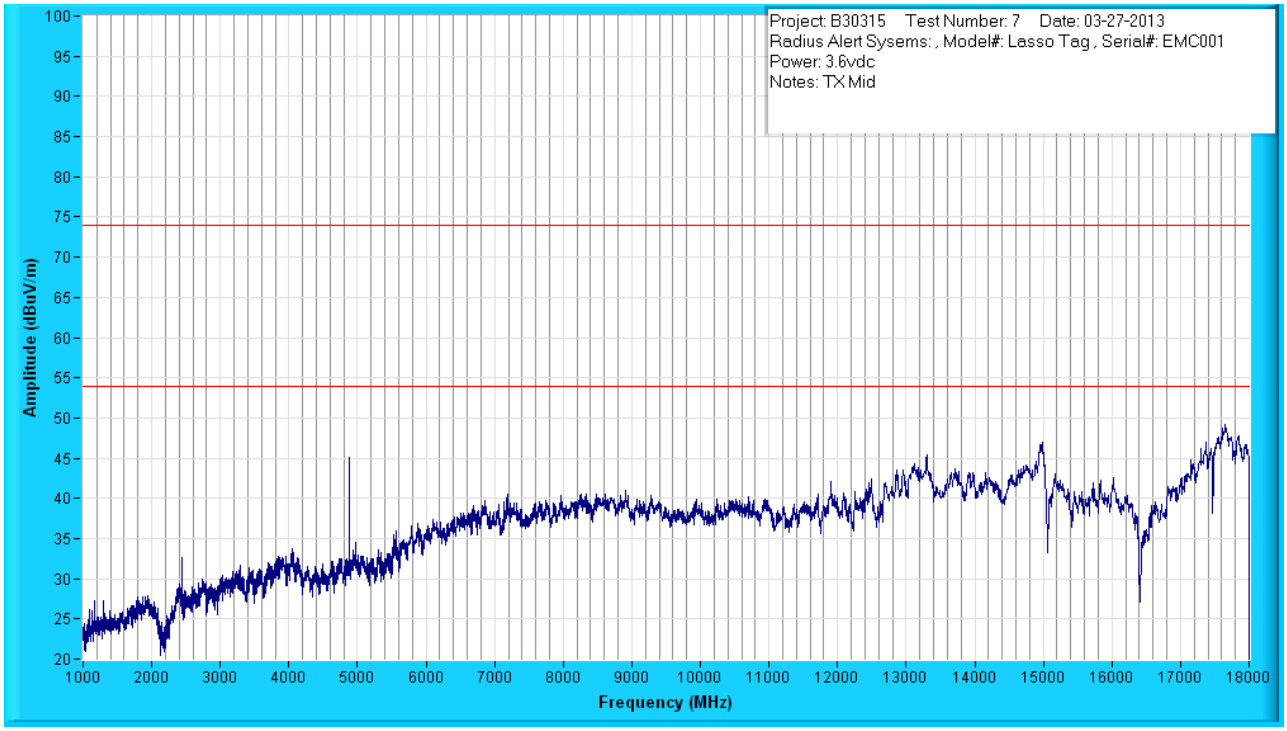


Figure : Radiated Emissions Prescan, 1GHz to 18GHz, Peak Measurements at 3m Distance

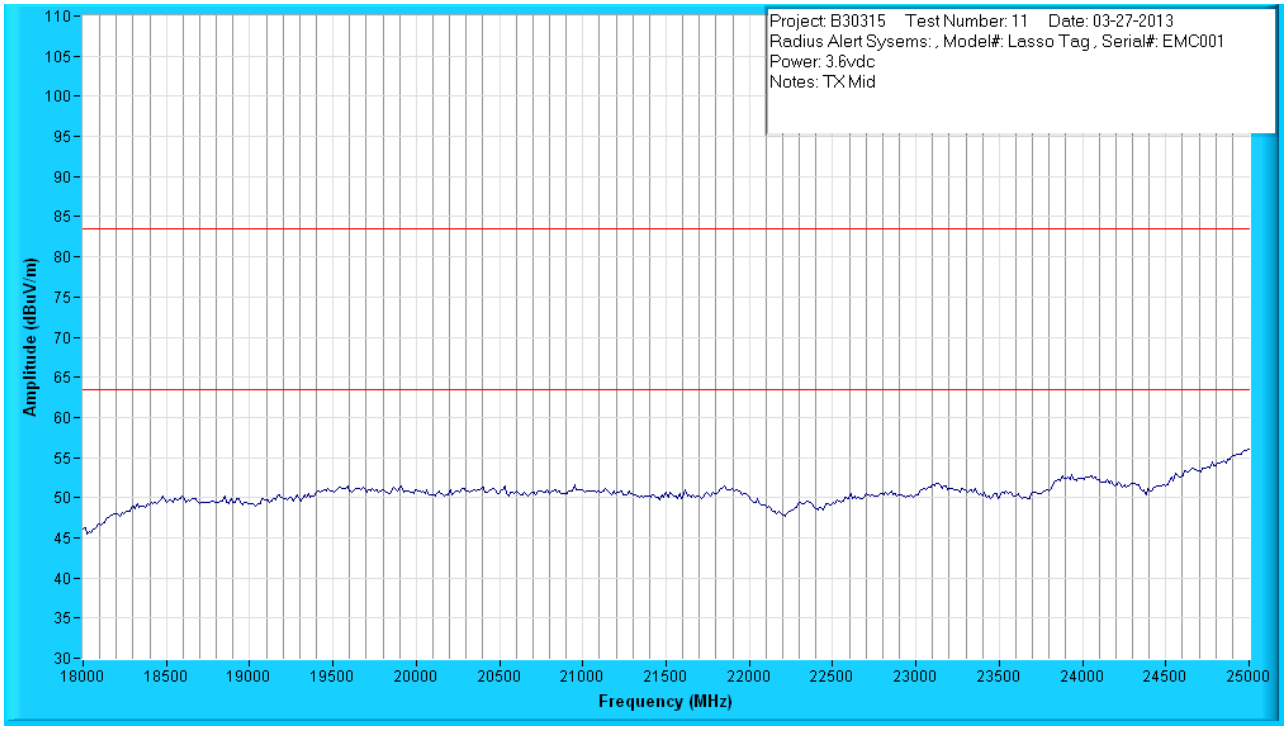


Figure : Radiated Emissions Prescan, 18GHz to 25GHz, Peak Measurements at 1m Distance

Type	Frequency (MHz)	Level (dBuV)	Transducer (dB/m)	Gain / Loss (dB)	Final (dBuV/m)	Azm(deg)/Pol /Hgt(m)	Margin: FCC Class B QP (dB)	Margin: FCC Class B AV (dB)
QP	30.537	30.9	20.9	-29.8	22.0	31/V-Pole/1.00	7.57	-
QP	35.330	32.6	17.4	-29.8	20.2	110/V-Pole/1.03	9.37	-
QP	44.529	36.0	10.6	-29.9	16.8	221/V-Pole/1.02	12.75	-
QP	126.241	24.4	13.9	-29.7	8.5	146/V-Pole/2.18	24.50	-
QP	199.078	28.9	12.5	-29.6	11.8	189/V-Pole/2.37	21.25	-
QP	662.246	25.0	19.2	-28.2	15.9	156/H-Pole/2.34	19.60	-
QP	770.742	24.7	20.7	-27.7	17.7	209/H-Pole/1.34	17.84	-
QP	937.645	23.7	22.1	-26.9	18.8	24/H-Pole/3.26	16.70	-

Type	Frequency (MHz)	Level (dBuV)	Transducer (dB/m)	Gain / Loss (dB)	Final (dBuV/m)	Azm(deg)/Pol /Hgt(m)	Margin: FCC Class B >1GHz PK (dB)	Margin: FCC Class B >1GHz AV (dB)
AV	4884.048	82.0	33.6	-69.7	45.9	92/V-Pole/1.15	-	8.10
PK	4884.048	86.0	33.6	-69.7	49.9	66/V-Pole/1.15	24.10	-

The highest emission measured was at **30.537 MHz,** which was **7.57 dB** below the limit.

Supplemental Information:

- "Type" refers to the type of measurement performed. The type of measurement made is based on the requirements of the particular standard:
  - PK = Peak Measurement: RBW is 120kHz, VBW is 3 MHz
  - QP = Quasi-Peak Measurement: RBW is 120kHz, VBW is 3 MHz, and QP Detection is ENABLED
  - AV = Video Average Measurement: RBW is 1 MHz, VBW is 10 Hz
- The "Final" emissions level is attained by taking the "Level" and adding the "Transducer" factor and the "Gain/Loss" factor. Final measurements are made with the Azimuth, Polarity, Height, and EUT Cables positioned for maximum radiation. If applicable, cables positions are noted in the test log. (Sample Calculation: 49.6 dBuV + 11.4 dB/m – 28.8 dB = 32.2 dBuV/m. **Important Note**: This is a sample calculation only for the purpose of demonstration, and does not reflect data in this report.)
- The "Azm/Pol/Hgt" indicates the turn-table *azimuth*, the antenna *polarity*, and the antenna *height* where the maximum emissions level was measured.
- The "Margin" is with reference to the emissions limit. A positive number indicates that the emission measurement is below the limit. A negative number indicates that the emission measurement exceeds the limit.

The PRESCAN is a peak measurement and is performed with the RBW set to 120 kHz, VBW set to 3 MHz (30 MHz to 1 GHz), and the RBW set to 1 MHz, VBW set to 100 kHz (> 1 GHz)

Tested by (+ signature) .....: Kevin Johnson.

Table No. 4	**Radiated Emissions – Spurious Out of Band Emissions & Restricted Bands** **Tx – Highest Channel**	Verdict
		P

Frequency Range ..... : 30 MHz to 1 GHz Test Location ..... : 10m Chamber
Test Method..... : ANSI C63.4
Test Distance ..... : 10 m (30 MHz to 1 GHz); 3 m (1-18 GHz); 1 m (18-25 GHz)
EUT Configuration ..... : Transmit, modulated, Channel 39 (highest channel)
Test Date ..... : 3-27-2013.
Temperature ..... : 22°C Relative Humidity .... : 26 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470

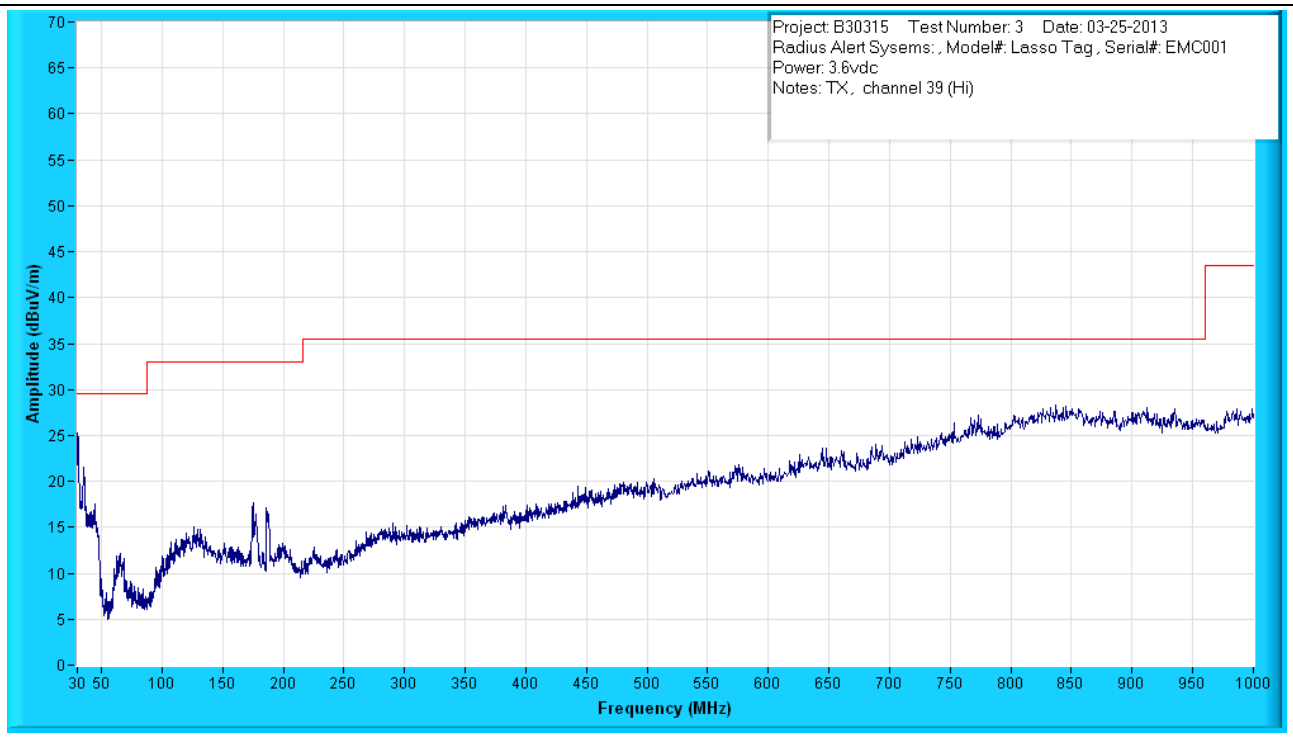


Figure : Radiated Emissions Prescan, 30MHz to 1000MHz, Peak Measurements at 10m Distance

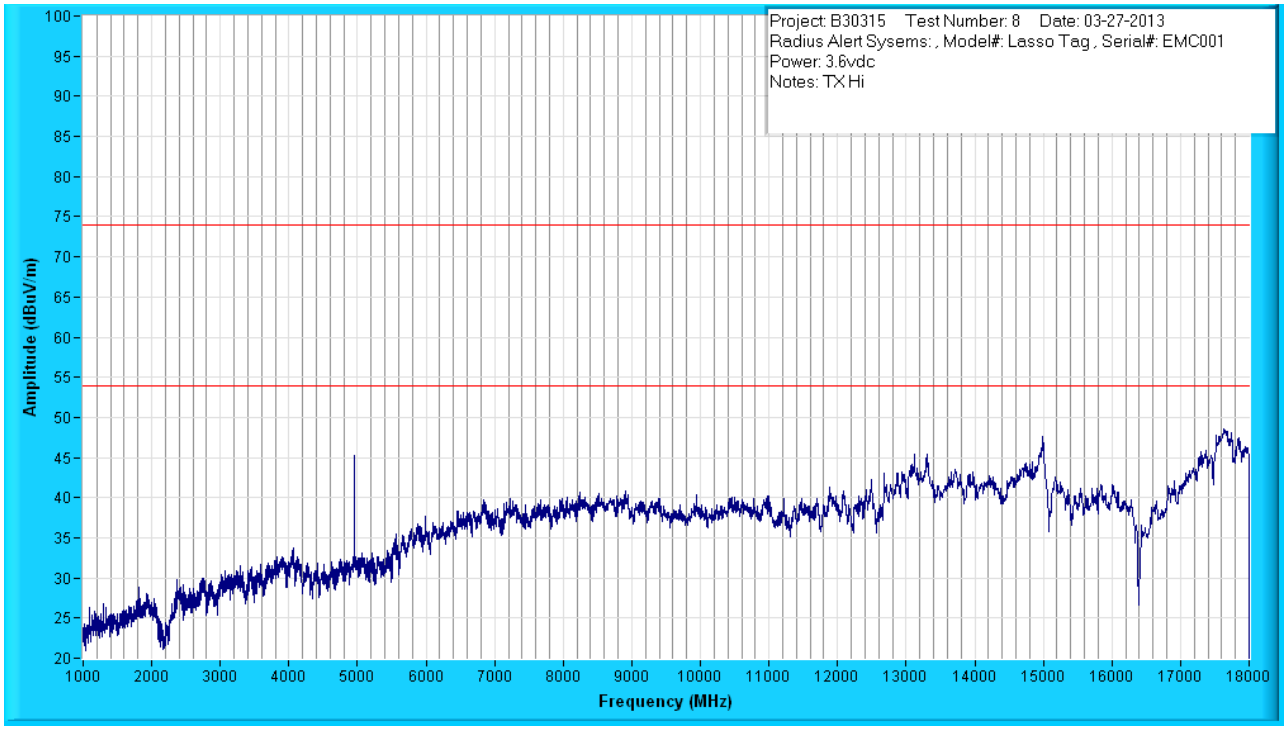


Figure : Radiated Emissions Prescan, 1GHz to 18GHz, Peak Measurements at 3m Distance

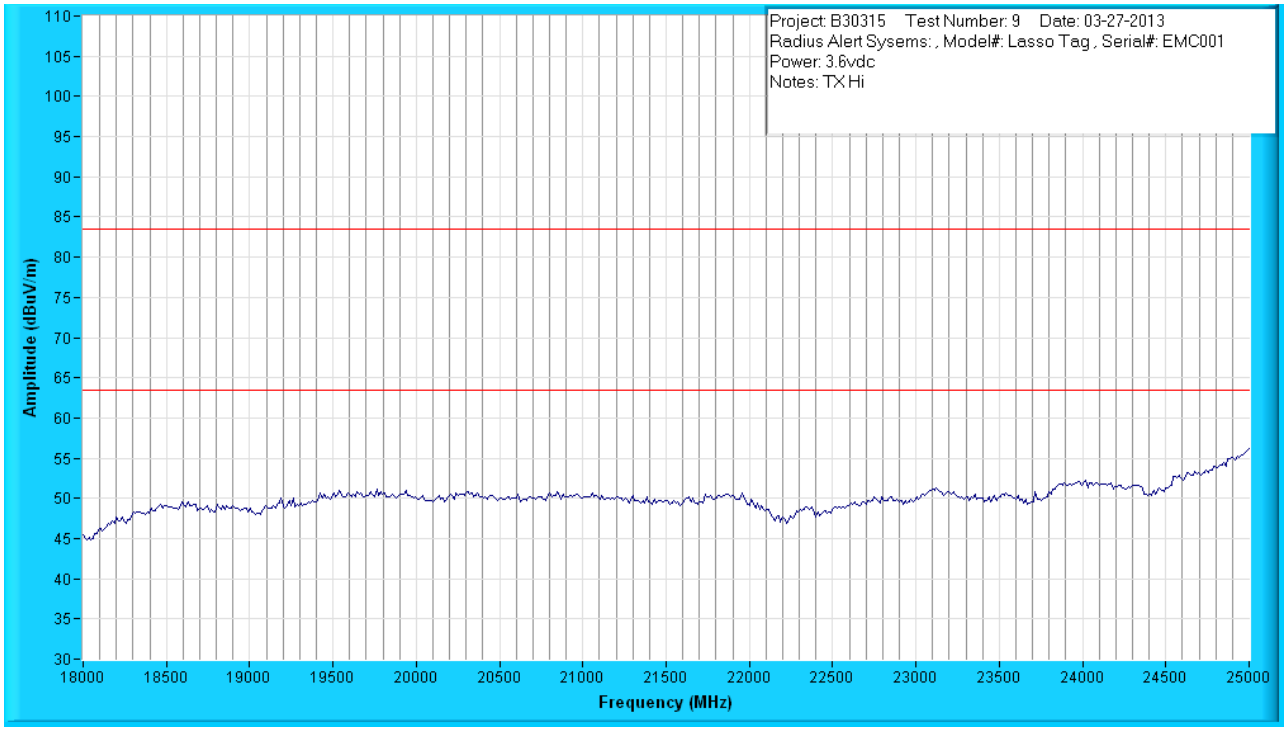


Figure : Radiated Emissions Prescan, 18GHz to 25GHz, Peak Measurements at 1m Distance

Type	Frequency (MHz)	Level (dBuV)	Transducer (dB/m)	Gain / Loss (dB)	Final (dBuV/m)	Azm(deg)/Pol /Hgt(m)	Margin: FCC Class B QP (dB)	Margin: FCC Class B AV (dB)
QP	30.473	31.7	20.9	-30.5	22.1	0/V-Pole/1.00	7.44	-
QP	35.325	32.7	17.4	-30.5	19.6	238/V-Pole/1.02	9.97	-
QP	44.318	35.4	10.8	-30.5	15.6	59/V-Pole/1.01	13.94	-
QP	125.531	24.2	13.9	-29.9	8.3	85/V-Pole/1.01	24.79	-
QP	200.943	26.4	12.3	-29.3	9.4	174/V-Pole/2.52	23.62	-
QP	384.095	25.0	15.0	-28.2	11.8	299/H-Pole/3.90	23.77	-
QP	649.150	25.6	19.0	-26.1	18.6	356/H-Pole/3.06	16.99	-
QP	933.285	23.7	21.8	-23.9	21.7	192/H-Pole/1.09	13.89	-

Type	Frequency (MHz)	Level (dBuV)	Transducer (dB/m)	Gain / Loss (dB)	Final (dBuV/m)	Azm(deg)/Pol /Hgt(m)	Margin: FCC Class B >1GHz PK (dB)	Margin: FCC Class B >1GHz AV (dB)
AV	4960.065	80.2	33.8	-69.2	44.8	204/H-Pole/1.50	-	9.15
PK	4960.065	85.8	33.8	-69.2	50.5	204/H-Pole/1.50	23.50	-

The highest emission measured was at **30.473 MHz,** which was **7.44 dB** below the limit.

Supplemental Information:

- "Type" refers to the type of measurement performed. The type of measurement made is based on the requirements of the particular standard:
  - PK = Peak Measurement: RBW is 120kHz, VBW is 3 MHz
  - QP = Quasi-Peak Measurement: RBW is 120kHz, VBW is 3 MHz, and QP Detection is ENABLED
  - AV = Video Average Measurement: RBW is 1 MHz, VBW is 10 Hz
- The "Final" emissions level is attained by taking the "Level" and adding the "Transducer" factor and the "Gain/Loss" factor. Final measurements are made with the Azimuth, Polarity, Height, and EUT Cables positioned for maximum radiation. If applicable, cables positions are noted in the test log. (Sample Calculation: 49.6 dBuV + 11.4 dB/m – 28.8 dB = 32.2 dBuV/m. **Important Note**: This is a sample calculation only for the purpose of demonstration, and does not reflect data in this report.)
- The "Azm/Pol/Hgt" indicates the turn-table *azimuth*, the antenna *polarity*, and the antenna *height* where the maximum emissions level was measured.
- The "Margin" is with reference to the emissions limit. A positive number indicates that the emission measurement is below the limit. A negative number indicates that the emission measurement exceeds the limit.

The PRESCAN is a peak measurement and is performed with the RBW set to 120 kHz, VBW set to 3 MHz (30 MHz to 1 GHz), and the RBW set to 1 MHz, VBW set to 100 kHz (> 1 GHz)

Tested by (+ signature) .....: Kevin Johnson.

Table No. 5	**Radiated Emissions – Spurious Out of Band Emissions & Restricted Bands** **Rx Mode**	Verdict
		P

Frequency Range ..... : 30 MHz to 1 GHz Test Location ..... : 10m Chamber
Test Method..... : ANSI C63.4
Test Distance ..... : 10 m (30 MHz to 1 GHz); 3 m (1-18 GHz); 1 m (18-25 GHz)
EUT Configuration ..... : Receive Mode, Channel 20 (middle channel)
Test Date ..... : 3-27-2013.
Temperature ..... : 22°C Relative Humidity .... : 26 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470

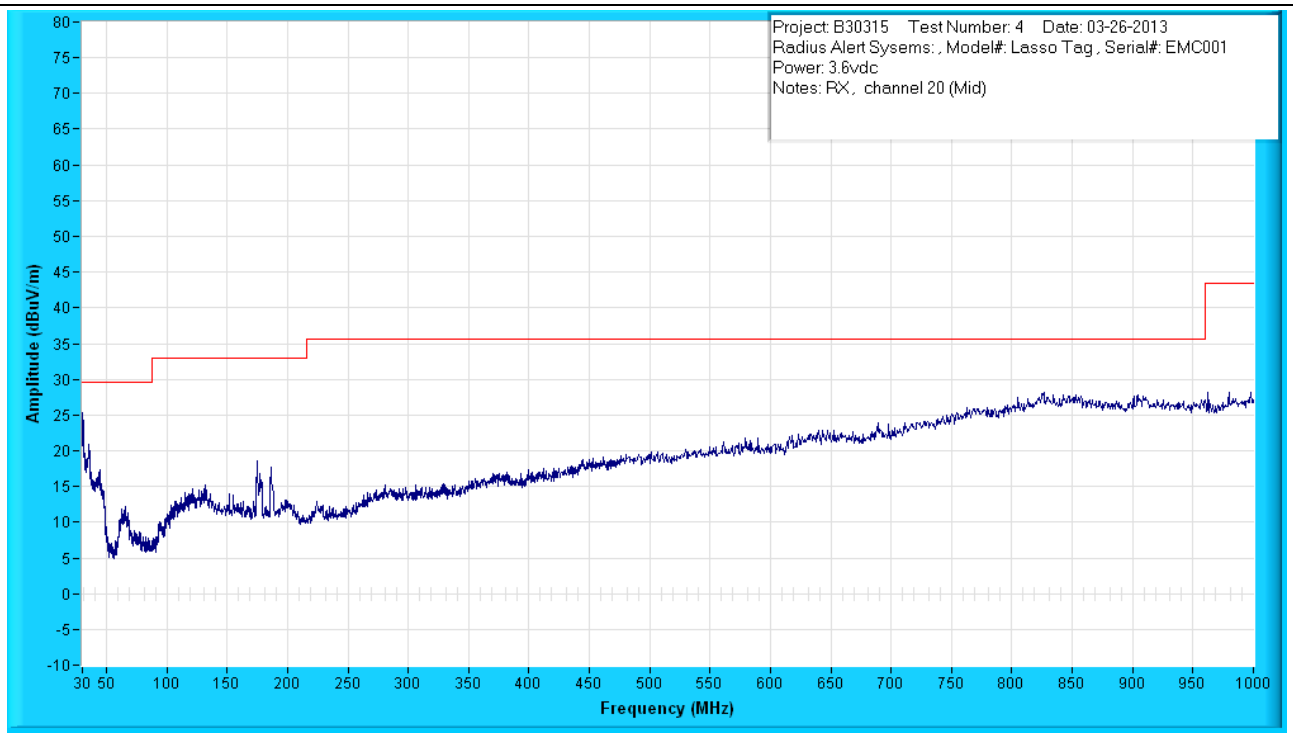


Figure : Radiated Emissions Prescan, 30MHz to 1000MHz, Peak Measurements at 10m Distance

Type	Frequency (MHz)	Level (dBuV)	Transducer (dB/m)	Gain / Loss (dB)	Final (dBuV/m)	Azm(deg)/Pol /Hgt(m)	Margin: FCC Class B QP (dB)	Margin: FCC Class B AV (dB)
QP	30.269	30.5	21.1	-30.5	21.1	360/V-Pole/1.00	8.45	-
QP	35.398	32.3	17.4	-30.5	19.2	124/V-Pole/1.02	10.37	-
QP	44.379	34.1	10.7	-30.5	14.3	278/V-Pole/1.02	15.28	-
QP	65.160	33.0	7.9	-30.5	10.4	188/V-Pole/1.00	19.17	-
QP	132.018	25.4	13.7	-29.8	9.2	24/H-Pole/3.88	23.82	-
QP	280.521	25.3	13.3	-28.7	9.9	81/H-Pole/2.14	25.66	-
QP	690.609	25.1	19.6	-25.8	18.9	234/V-Pole/1.00	16.61	-
QP	826.952	24.7	21.1	-22.8	23.0	262/H-Pole/3.79	12.50	-

The highest emission measured was at **30.269 MHz,** which was **8.45 dB** below the limit.

Supplemental Information:

- "Type" refers to the type of measurement performed. The type of measurement made is based on the requirements of the particular standard:
  - PK = Peak Measurement: RBW is 120kHz, VBW is 3 MHz
  - QP = Quasi-Peak Measurement: RBW is 120kHz, VBW is 3 MHz, and QP Detection is ENABLED
  - AV = Video Average Measurement: RBW is 1 MHz, VBW is 10 Hz
- The "Final" emissions level is attained by taking the "Level" and adding the "Transducer" factor and the "Gain/Loss" factor. Final measurements are made with the Azimuth, Polarity, Height, and EUT Cables positioned for maximum radiation. If applicable, cables positions are noted in the test log. (Sample Calculation: 49.6 dBuV + 11.4 dB/m – 28.8 dB = 32.2 dBuV/m. **Important Note**: This is a sample calculation only for the purpose of demonstration, and does not reflect data in this report.)
- The "Azm/Pol/Hgt" indicates the turn-table *azimuth*, the antenna *polarity*, and the antenna *height* where the maximum emissions level was measured.
- The "Margin" is with reference to the emissions limit. A positive number indicates that the emission measurement is below the limit. A negative number indicates that the emission measurement exceeds the limit.

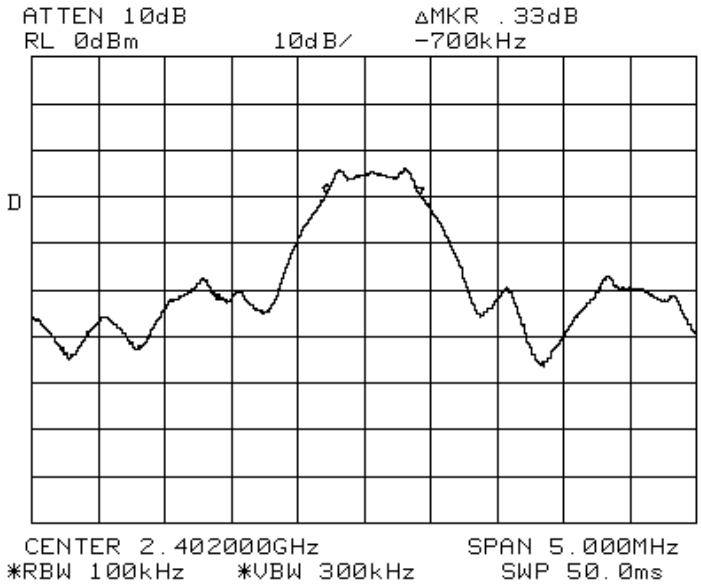
The PRESCAN is a peak measurement and is performed with the RBW set to 120 kHz, VBW set to 3 MHz (30 MHz to 1 GHz), and the RBW set to 1 MHz, VBW set to 100 kHz (> 1 GHz)

Tested by (+ signature) .....: Kevin Johnson.

Test Results – DTS Bandwidth

Table No. 6	DTS Bandwidth - Low	Verdict
		P

Test Method……: DTS 247, Section 8.1
Test Method.....: ANSI C63.4
EUT Configuration .....: Tx Low
Power Input.....: 3.7.VDC ☐ 1ϕ ☐ 3ϕ
Test Date .....: 13-Jun-2013
Temperature .....: 23°C Relative Humidity .... :30 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470

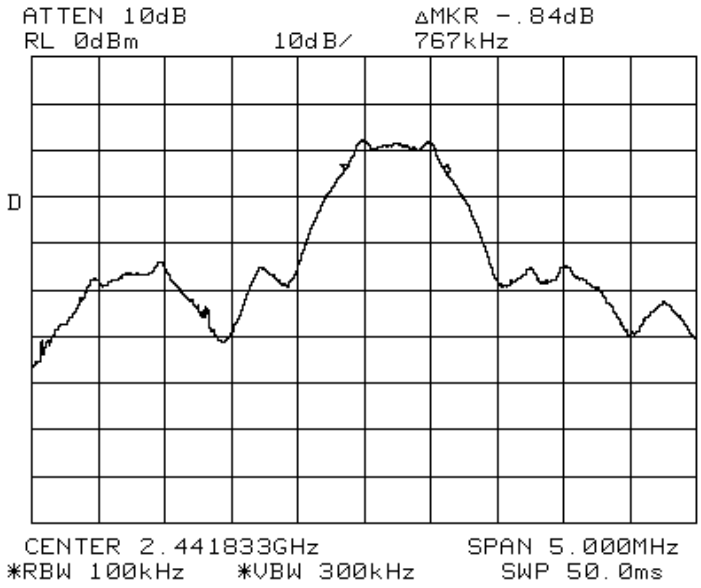


Supplemental Information:

Tested by (+ signature) .....: Kevin Johnson.

Table No. 6	DTS Bandwidth - Middle	Verdict
		P

Test Method……: DTS 247, Section 8.1
Test Method.....: ANSI C63.4
EUT Configuration .....: Tx Middle
Power Input.....: 3.7.VDC ☐ 1ϕ ☐ 3ϕ
Test Date .....: 13-Jun-2013
Temperature .....: 23°C Relative Humidity .... :30 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470

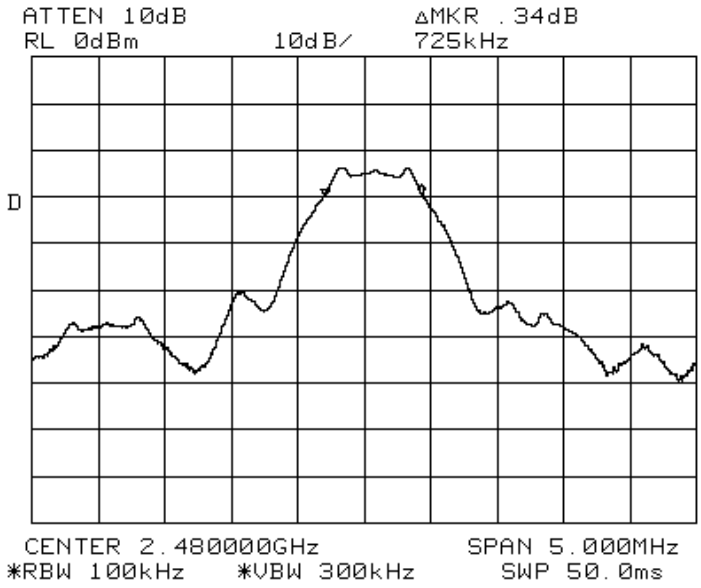


Supplemental Information:

Tested by (+ signature) .....: Kevin Johnson.

Table No. 6	DTS Bandwidth	Verdict
		P

Test Method……: DTS 247, Section 8.1
Test Method.....: ANSI C63.4
EUT Configuration .....: Tx High
Power Input.....: 3.7.VDC ☐ 1ϕ ☐ 3ϕ
Test Date .....: 13-Jun-2013
Temperature .....: 23°C Relative Humidity .... :30 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470



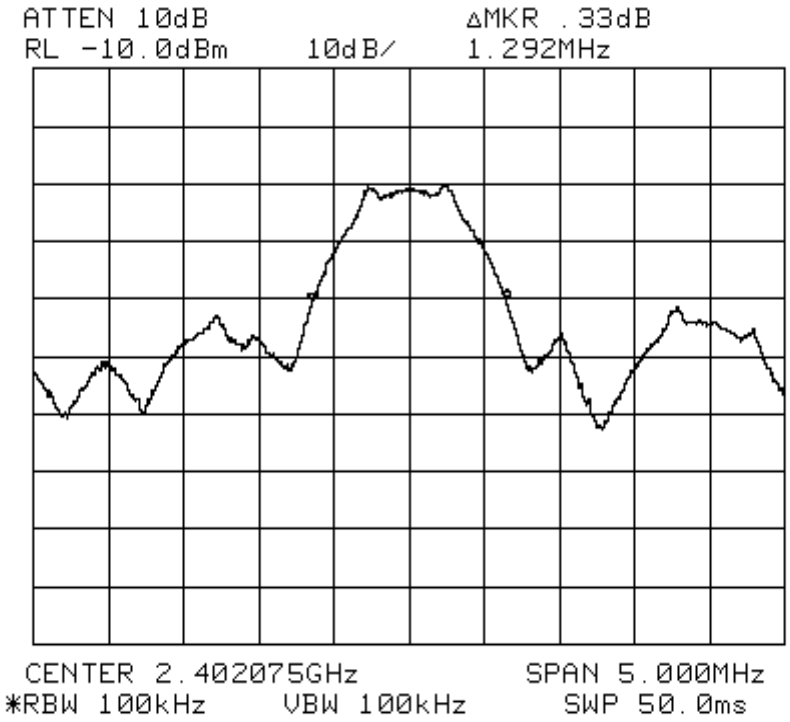
Supplemental Information:

Tested by (+ signature) .....: Kevin Johnson.

Test Results - 20 dB Occupied Bandwidth

Table No. 7	20 dB Occupied Bandwidth – Lowest Channel	Verdict
		P

Test Method.....: ANSI C63.4
EUT Configuration .....: GFSK modulation
Power Input.....: Internal Battery @ 3.7 VDC ☐ 1ϕ ☐ 3ϕ
Test Date .....: 26-Mar-2013
Temperature .....: 23°C Relative Humidity .... :34 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470

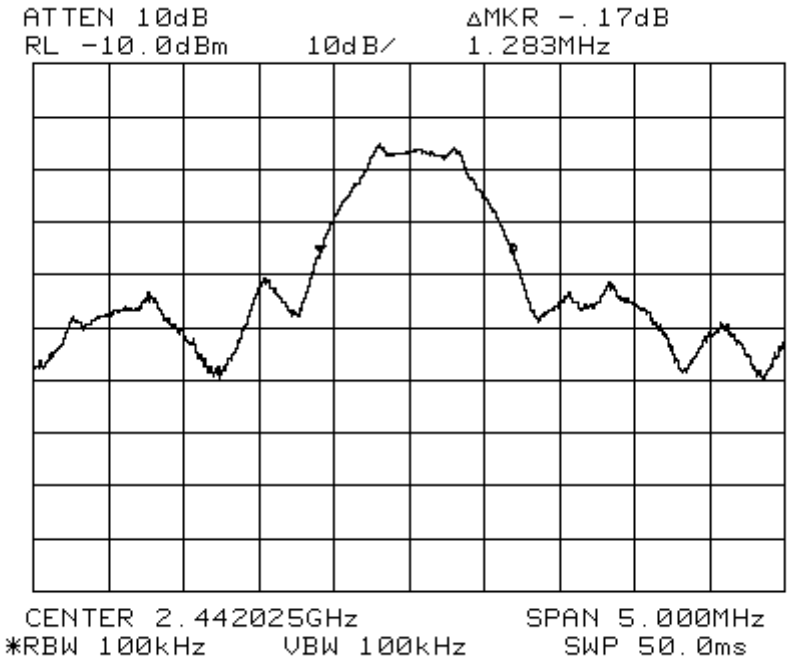


Supplemental Information:

Tested by (+ signature) .....: Kevin Johnson.

Table No. 8	20 dB Occupied Bandwidth – Middle Channel	Verdict
		P

Test Method.....: ANSI C63.4
EUT Configuration .....: GFSK modulation
Power Input.....: Internal Battery @ 3.7 VDC ☐ 1ϕ ☐ 3ϕ
Test Date .....: 26-Mar-2013
Temperature .....: 23°C Relative Humidity .... :34 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470

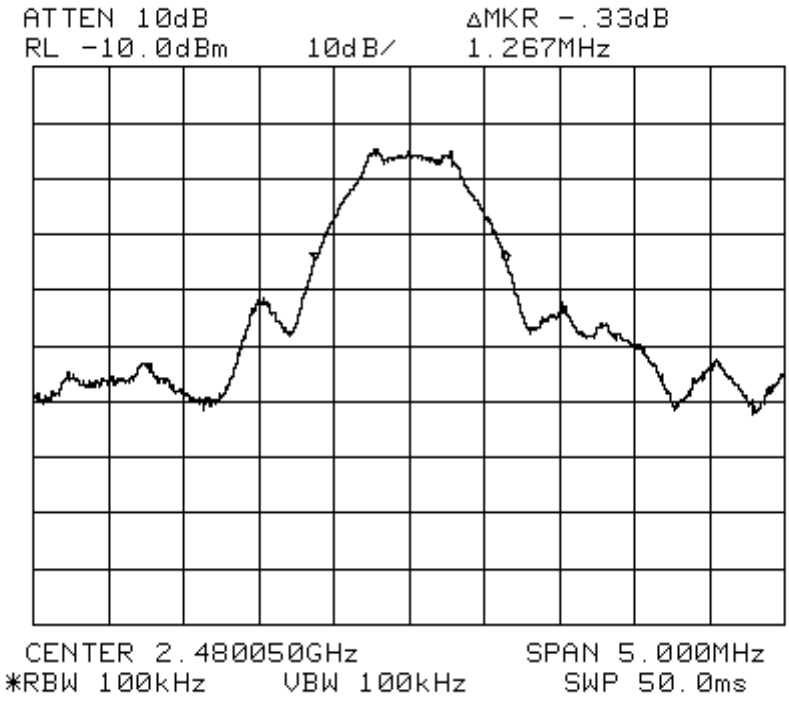


Supplemental Information:

Tested by (+ signature) .....: Kevin Johnson.

Table No. 9	20 dB Occupied Bandwidth – Highest Channel	Verdict
		P

Test Method.....: ANSI C63.4
EUT Configuration .....: GFSK modulation
Power Input.....: Internal Battery @ 3.7 VDC ☐ 1ϕ ☐ 3ϕ
Test Date .....: 26-Nov-2013
Temperature .....: 23°C Relative Humidity .... :34 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470



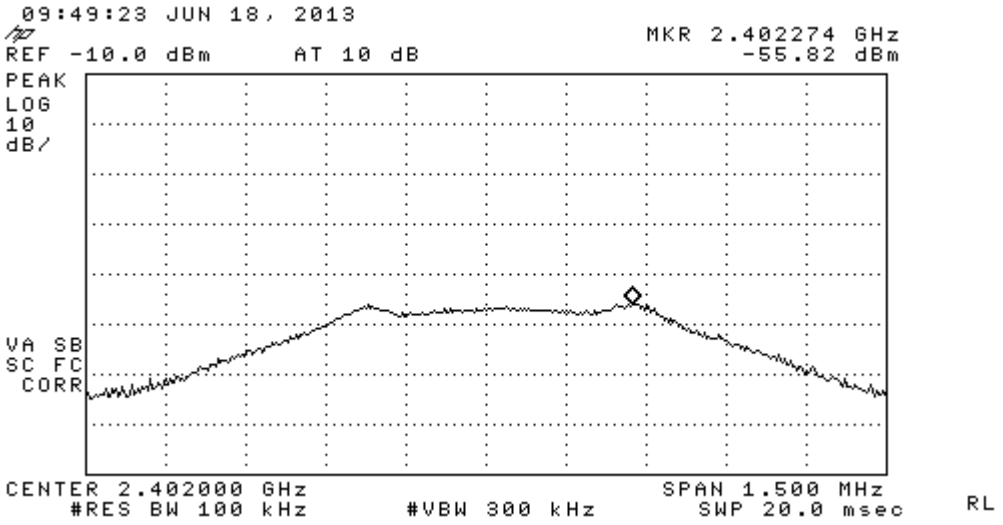
Supplemental Information:

Tested by (+ signature) .....: Kevin Johnson.

Test Results – Power Spectral Density

Table No. 11	Power Spectral Density - Low	Verdict
		P

Test Method.....: DTS 247, Section 10.2
EUT Configuration .....: Tx Low
Power Input.....: 3.7.VDC ☐ 1ϕ ☐ 3ϕ
Test Date .....: 13-Jun-12013
Temperature .....: 23°C Relative Humidity .... :30 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470



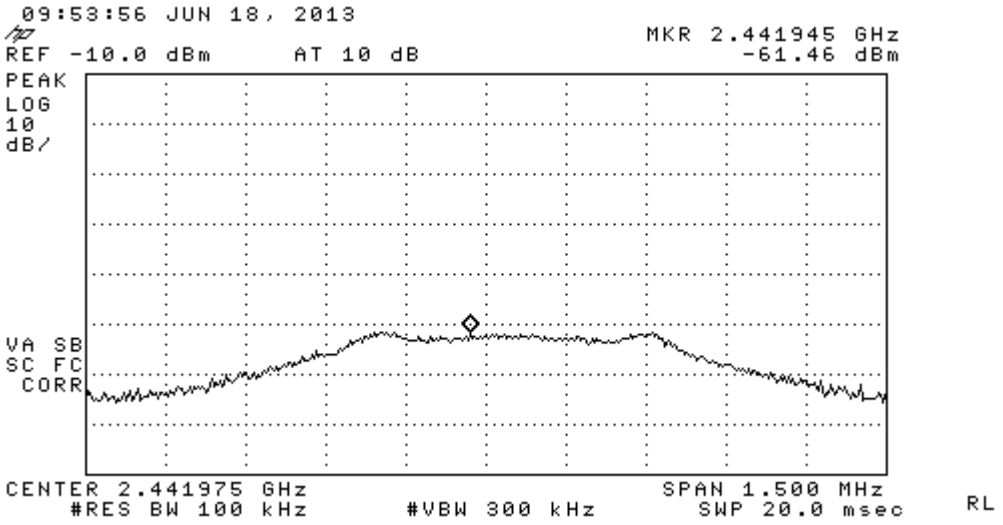
Frequency (MHz)	P_{meas} Meter reading (dBm)	G_R RX antenna gain (dBi)	L_C Cable loss (dB)	G_{amp} Pre-amp Gain (dB)	P_R Adjusted RX Power (dBm)	L_P Free-space propogation loss (dB)	**EIRP (dBm)**	G_T TX antenna gain (dBi)	**P_T Transmit power at antenna port (dBm)**	P_T Transmit power at antenna port (mW)
2402.00	-55.8	8.3	5.7	0.0	-58.4	49.7	**-8.8**	5.3	**-14.1**	0.039

Supplemental Information:

Tested by (+ signature) .....: Kevin Johnson.

Table No. 11	Power Spectral Density - Middle	Verdict
		P

Test Method.....: DTS 247, Section 10.2
EUT Configuration .....: Tx Middle
Power Input.....: 3.7.VDC ☐ 1ϕ ☐ 3ϕ
Test Date .....: 13-Jun-12013
Temperature .....: 23°C Relative Humidity .... :30 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470



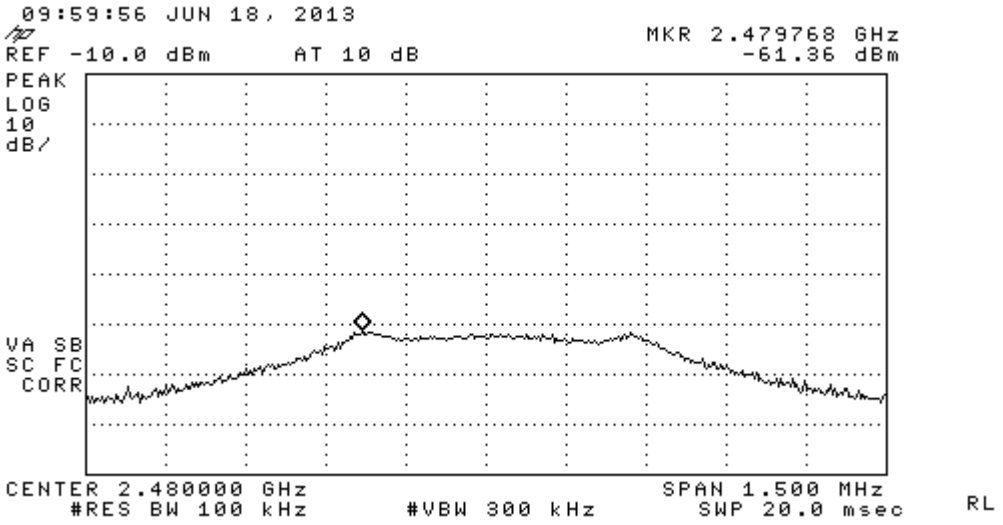
Frequency (MHz)	P_{meas} Meter reading (dBm)	G_R RX antenna gain (dBi)	L_C Cable loss (dB)	G_{amp} Pre-amp Gain (dB)	P_R Adjusted RX Power (dBm)	L_P Free-space propogation loss (dB)	**EIRP (dBm)**	G_T TX antenna gain (dBi)	**P_T Transmit power at antenna port (dBm)**	P_T Transmit power at antenna port (mW)
2442.00	-61.5	8.3	6.3	0.0	-63.5	49.8	**-13.7**	5.3	**-19.0**	0.013

Supplemental Information:

Tested by (+ signature) .....: Kevin Johnson.

Table No. 11	Power Spectral Density - High	Verdict
		P

Test Method.....: DTS 247, Section 10.2
EUT Configuration .....: Tx High
Power Input.....: 3.7.VDC ☐ 1ϕ ☐ 3ϕ
Test Date .....: 13-Jun-12013
Temperature .....: 23°C Relative Humidity .... :30 %
Test Equipment Asset Tag List : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470



Frequency (MHz)	P_{meas} Meter reading (dBm)	G_R RX antenna gain (dBi)	L_C Cable loss (dB)	G_{amp} Pre-amp Gain (dB)	P_R Adjusted RX Power (dBm)	L_P Free-space propogation loss (dB)	**EIRP (dBm)**	G_T TX antenna gain (dBi)	**P_T Transmit power at antenna port (dBm)**	P_T Transmit power at antenna port (mW)
2480.00	-61.4	8.3	7.5	0.0	-62.2	49.9	**-12.2**	5.3	**-17.5**	0.018

Supplemental Information:

Tested by (+ signature) .....: Kevin Johnson.

Test Results - Peak RF Output Power

Table No. 13	Peak RF Output Power	Verdict
		P

Measured Peak Power at Antenna Connector. :

Test Method..... : ANSI C63.4

EUT Configuration ..... : Transmit, modulated Channel 0, Transmit, modulated Channel 20, Transmit, modulated Channel 39

Power Input..... : 3.7.VDC, 50 Hz ☐ 1ϕ ☐ 3ϕ

Test Date ..... : 26-Mar-2013.

Temperature ..... : 23.°C Relative Humidity .... :32. %

Test Equipment Asset Tag List ..... : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470

Frequency (MHz)	P_{meas} Meter reading (dBm)	G_R RX antenna gain (dBi)	L_C Cable loss (dB)	G_{amp} Pre-amp Gain (dB)	P_R Adjusted RX Power (dBm)	L_P Free-space propogation loss (dB)	**EIRP (dBm)**	G_T TX antenna gain (dBi)	**P_T Transmit power at antenna port (dBm)**	P_T Transmit power at antenna port (mW)
2402.000	-44.3	8.3	5.7	0.0	-46.9	49.7	**2.8**	5.3	**-2.5**	0.556
2442.000	-45.0	8.3	6.3	0.0	-47.0	49.8	**2.8**	5.3	**-2.5**	0.562
2480.000	-45.1	8.3	7.5	0.0	-45.9	49.9	**4.0**	5.3	**-1.3**	0.747

Supplemental Information:

Power is measured radiated and calculated using FCC guidance note 412172.

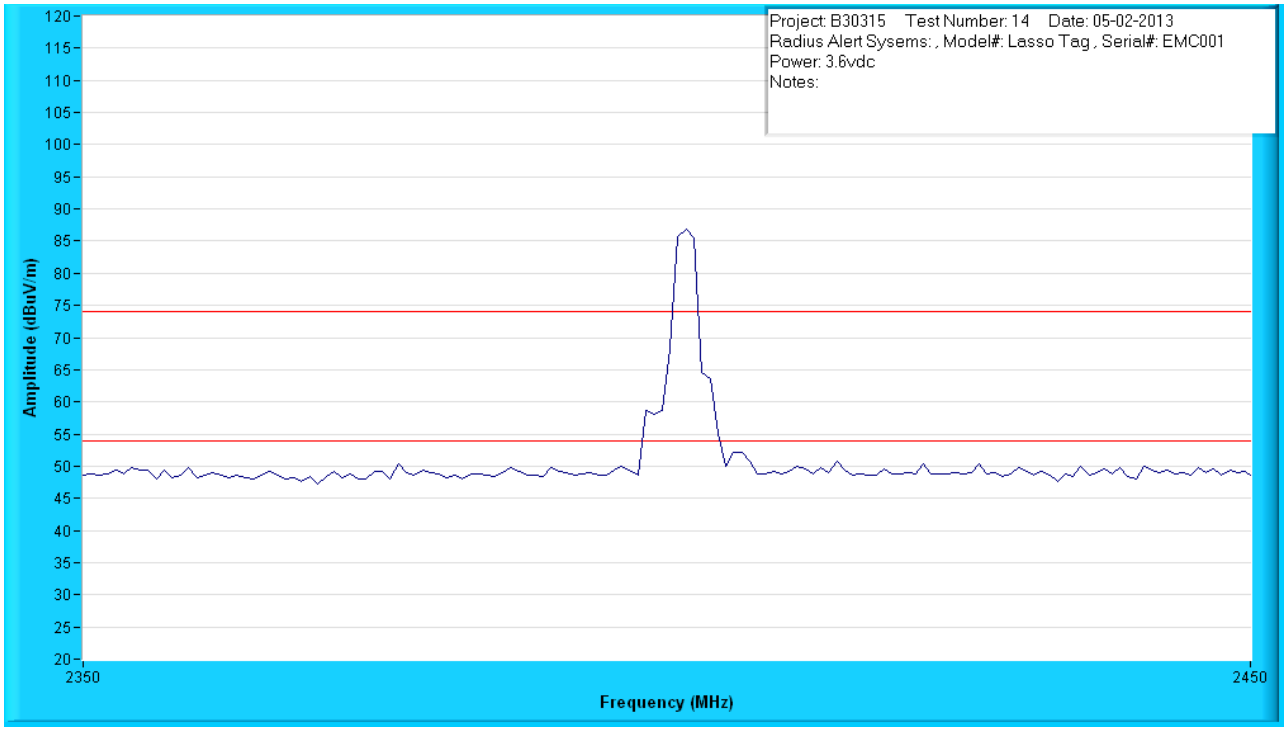
$P_R=P_{MEAS}-G_R+L_C$ $L_P=20LOG(FREQ.)+20LOG(3M)-27.5$

Tested by (+ signature) ..... : Kevin Johnson.

Test Results - Band Edge

Table No. 2	Spurious Emissions – Lower Band Edge	Verdict
		P

Test Method..... : ANSI C63.4
EUT Configuration ..... : Transmit, modulated, Channel 0 (lowest channel)
Power Input..... : 3.7.VDC, ☐ 1ϕ ☐ 3ϕ
Test Date ..... : 02-May-2013.
Temperature ..... : 20.°C Relative Humidity .... :33. %
Test Equipment Asset Tag List ..... :



Supplemental Information:

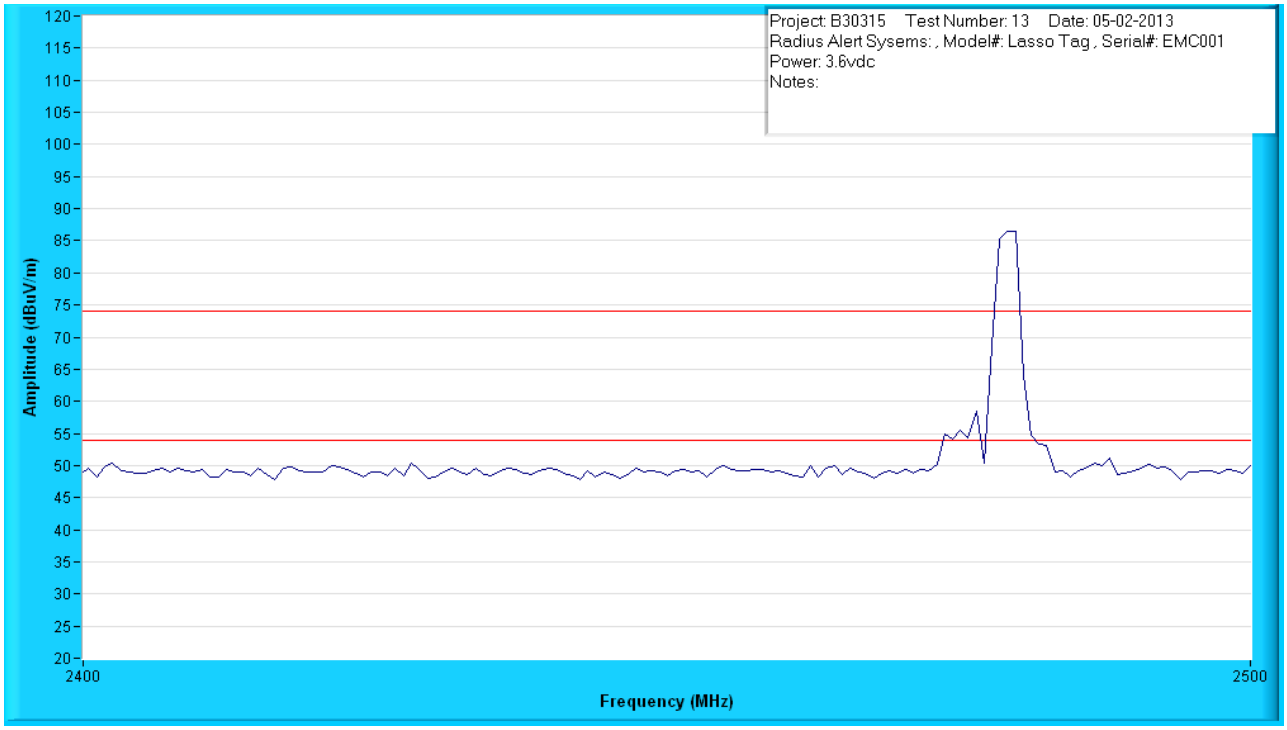
Type	Frequency (MHz)	Level (dBuV)	Transducer (dB/m)	Gain / Loss (dB)	Final (dBuV/m)	Azm(deg)/Pol/Hgt(m)	Margin: FCC Class B >1GHz PK (dB)	Margin: FCC Class B >1GHz AV (dB)
AV	2400.000	23.2	29.6	0.0	52.8	338/V-Pole/2.00	-	1.20
PK	2400.000	30.6	29.6	0.0	60.2	338/V-Pole/2.00	13.8	-

Emission at lower band edge of 2,400 GHz was 52.8 dBuV/m, or 1.20 dB below the limit.

Tested by (+ signature) .....: Kevin Johnson.

Table No. 3	Spurious Emissions – Upper Band Edge	Verdict
		P

Test Method..... : ANSI C63.4
EUT Configuration ..... : Transmit, modulated, Channel 39 (highest channel)
Power Input..... : 3.7 Vdc ☐ 1ϕ ☐ 3ϕ
Test Date ..... : 02-May-2013
Temperature ..... : 20°C Relative Humidity .... :33 %
Test Equipment Asset Tag List ..... :



Supplemental Information:

Type	Frequency (MHz)	Level (dBuV)	Transducer (dB/m)	Gain / Loss (dB)	Final (dBuV/m)	Azm(deg)/Pol/Hgt(m)	Margin: FCC Class B >1GHz PK (dB)	Margin: FCC Class B >1GHz AV (dB)
AV	2483.500	19.1	29.7	0.0	48.7	338/V-Pole/2.00	-	5.25
PK	2483.500	32.6	29.7	0.0	62.3	338/V-Pole/2.00	11.70	-

Emission at upper band edge of 2,483.5 GHz was 48.7 dBuV/m, or 5.25 dB below the limit.

Tested by (+ signature) .....: Kevin Johnson.

Test Results - RF Exposure

Table No. 4	RF Exposure	Verdict
		P

Test Method..... : ANSI C63.4
EUT Configuration ..... :
Power Input..... : 3.7 Vdc Hz ☐ 1ϕ ☐ 3ϕ
Test Date ..... : 26 Mar 2013.
Temperature ..... : 21.5°C Relative Humidity .....: 29. %
Test Equipment Asset Tag List ..... : 1197, 1215, 1229, 1253, 1263, 1264, 1265, 1392, 1396, 1403, 1405, 1410, 1470

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

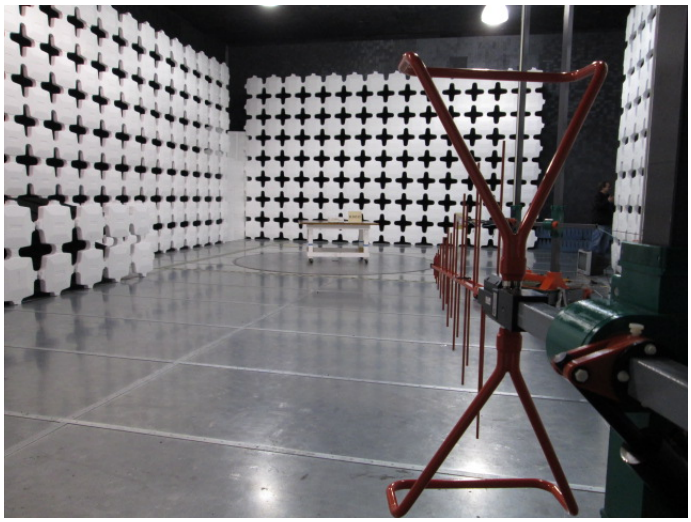
Maximum peak output power at antenna input terminal:	-1.3	(dBm)	*
Maximum peak output power at antenna input terminal:	0.7	(mW)	
Antenna gain(maximum):	5.3	(dBi)	*
Maximum antenna gain:	3.39	(numeric)	
Time Averaging:	100	(%)	*
Prediction distance:	20	(cm)	*
Prediction frequency:	2480	(MHz)	*
MPE limit for uncontrolled exposure at prediction frequency:	1.000	(mW/cm^2)	
Power density at prediction frequency:	0.0005	(mW/cm^2)	
This equates to:	0.0050	W/m^2	

Supplemental Information:

Tested by (+ signature) ..... : Kevin Johnson.

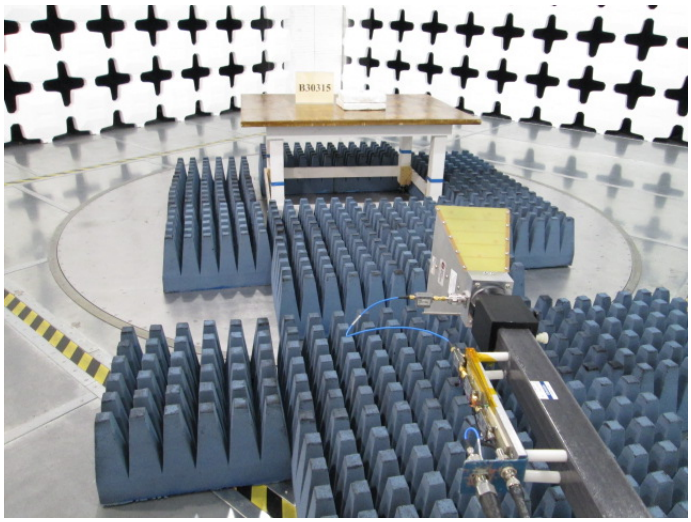
Setup Photos

Photo 4	**Test Setup – Radiated Emissions (below 1 GHz)**	



Supplemental Information:

Photo 5	**Test Setup – Radiated Emissions (above 1 GHz)**	



Supplemental Information: