1601 North A.W. Grimes Blvd., Suite B
Round Rock, TX 78665
e-mail: info@ptitest.com
(512) 244-3371 Fax: (512) 244-1846

April 17, 2014

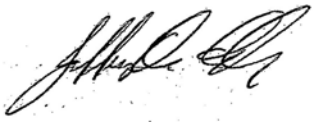
Wayne McVay
KeyTrak
200 Quality Circle
College Station, Texas 77845 USA

Dear Wayne:

Thank you for allowing Professional Testing (EMI), Inc. an opportunity to perform testing for KeyTrak. Enclosed is the Wireless Certification Report for the ActiveLot. This report can be used to demonstrate compliance with FCC requirements for wireless devices in the United States.

If you have any questions, please contact me.

Sincerely,



Jeffrey A. Lenk
President

Attachment

Project 15565-15

ActiveLot

Wireless Certification Report

Prepared for:

KeyTrak, Inc.

By

Professional Testing (EMI), Inc.
1601 North A.W. Grimes Blvd., Suite B
Round Rock, Texas 78665

April 22, 2014

Reviewed by

Larry Finn
Product Development Engineer

Written by

Eric Lifsey
Test Engineer

Revision History

Revision Number	Description	Date
00	Draft Release	March 7, 2014
01	Revised per Larry Finn comment.	March 25, 2014
02	Revised per client comments.	April 22, 2014

Table of Contents

NOTICE: (1) This Report must not be used to claim product endorsement, by NVLAP, NIST, the FCC or any other Agency. This report also does not warrant certification by NVLAP or NIST. (2) This report shall not be reproduced except in full, without the written approval of Professional Testing (EMI), Inc. (3) The significance of this report is dependent on the representative character of the test sample submitted for evaluation and the results apply only in reference to the sample tested. The manufacturer must continuously implement the changes shown herein to attain and maintain the required degree of compliance.

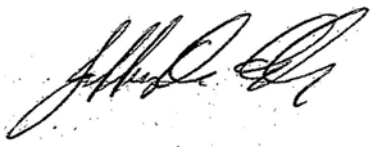
Certificate of Compliance

Applicant:	KeyTrak
Applicant's Address:	KeyTrak (Wayne McVay) 200 Quality Circle College Station, Texas 77845 USA USA
FCC ID:	2ABY5OBD1
Model:	AL OBD MODULE
Project Number:	15565-15

The **AL OBD MODULE** by **KeyTrak** was tested utilizing the following documents and found to be in compliance with the required criteria on the indicated test date.

47 CFR (USA)		
Section Reference	Parameter	Date
15.247(a)(3)	Conducted Fundamental Power, 1 W	2013-12-18
15.247(e)	Power Spectral Density	2014-01-10
15.247(a)(2)	Bandwidth, 6 dB, 20 dB	2013-12-30
15.203	Antenna Requirements	2014-02-27
15.209	Harmonic & Spurious Emissions	2014-01-02 thru 03
2.1091	Maximum Permissible Exposure	2014-02-21

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures, have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.



Jeffrey A. Lenk
President

This report has been reviewed and accepted by KeyTrak. The undersigned is responsible for ensuring that the AL OBD MODULE by KeyTrak will continue to comply with the applicable rules.

_____

Representative of KeyTrak

1.0 Introduction

1.1 Scope

This report describes the extent to which the equipment under test (EUT) conformed to the intentional radiator requirements of the United States.

Professional Testing (EMI), Inc., (PTI) follows the guidelines of National Institute of Standards and Technology (NIST) for all uncertainty calculations, estimates, and expressions thereof for electromagnetic compatibility testing. The procedures of ANSI C63.4: 2009 were used for making all radiated enclosure and mains emission measurements.

1.2 EUT Description

This device is a wireless transmitter that beacons data to a central receiver. This device is used exclusively in vehicles and gets power and data only from the OBD diagnostic connector. It is not a hand-held. The EUT as tested consisted of the following:

Table 1.2.1: Equipment Under Test

Manufacturer	Model	Serial #	Description
KeyTrak	AL OBD MODULE	None	Wireless vehicle monitor.

This device is used in vehicles at the point of sale location or sales lot. The device is composed of a nearly rectangular plastic. Three LED indicators on one edge represent power and activity states.

The antenna is internal to the device on the circuit board. There is no antenna connector. There is only one connector for power and data. The EUT beacons data when the vehicle battery voltage is near 13.8 VDC. Below this voltage the EUT assumes the vehicle is not in motion and beacons far less often.

The EUT measures approximately 8.7 x 5.0 x 2.6 cm. An external view of the EUT is provided below.

Photograph 1.2.1: EUT

1.3 EUT Operation

The EUT was exercised in a manner consistent with normal operations at operating voltage 13.8 VDC (active transmit mode) and 12.0 VDC (receive/standby mode).

The EUT internal software operated the transmitter in a continuous modulated mode.

1.4 Modifications to Equipment

No modifications were made to the EUT during the performance of the test program.

1.5 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. The site is registered with the FCC under Section 2.948 and Industry Canada per RSS-GEN, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas 78758, while the main office is located at 1601 North A.W. Grimes Boulevard, Suite B, Round Rock, Texas, 78665.

2.0 Applicable Documents and Clauses

This device operates on the 2.4 GHz ISM band, as such 47 CFR and relevant part(s) applies as shown below.

Table 2.0.1: Applicable Documents

Document #	Title/Description
47 CFR (USA)	Part 15 – Section 15.247
ANSI C63.4 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment

Table 2.0.2: Applicable Clauses

Clause Subject	Section References	Required?	Result
Conducted Fundamental Output Power	15.247(a)(3)	Yes	Pass
Occupied Bandwidth, 6 dB, 20 dB	2.1049, 15.247(a)(2)	Yes	Pass
Power Spectral Density	15.247	Yes	Pass
Field Strength of Radiated Spurious/Harmonic Emissions (30 MHz to 25 GHz)	15.247, 15.209	Yes	Pass
Antenna Construction	15.203	Yes	Pass
Maximum Permissible Exposure*	2.1091, FCC OET Bulletin 65	Yes	Pass

*Exposure is reported in a separate document.

3.0 Fundamental Power

3.1 Test Procedure

EUT is placed on a non-conducting table and rotated to record the maximum emission. Bandwidth is first determined to select correct entire bandwidth for power measurement and the fundamental power is measured.

3.2 Test Criteria

47 CFR (USA)		
Section Reference	Parameter	Date
15.247(a)(3)	Fundamental Power Conducted Limit: 1 Watt Restated as Field Strength 125.2 dBµV/m @ 3 m Restated as Field Strength 134.7 dBµV/m @ 1 m	2014-02-19

3.3 Test Results

The EUT bandwidth was found to be between 1 MHz and 3 MHz, the measurement resolution bandwidth was set to 3 MHz; video bandwidth was set to 10 MHz. Results are presented below:

Fundamental Power Measured as Field Strength **Conducted Limit 1 Watt (30 dBm)** **Limit As Field Strength 134.7** dBµV/m @ 1 m

Note that power on the lowest and highest channels is reduced in the design to insure band edge compliance. Additionally, the intended application must avoid using these channels to meet the range goals.

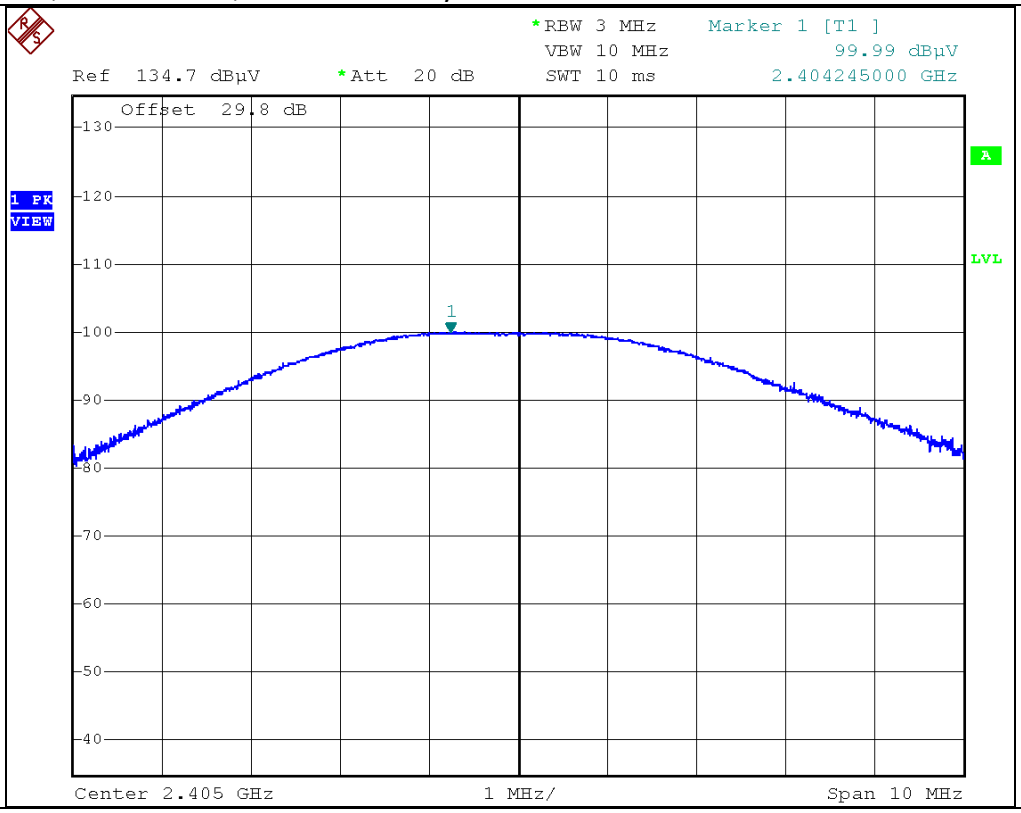
Peak Fundamental Emission, Radiated				
Frequency GHz	Table/ Polarity	Antenna Factor dB	Cable Loss dB	Corrected* Measured Peak Power at 1 m dBµV/m
2.405	180 / V	28.2	1.6	99.99
2.440	125 / H	28.2	1.6	122.89
2.480	180 / V	28.2	1.6	99.08

Measured in 3 MHz RBW, 10 MHz VBW. *Factors were added to spectrum analyzer amplitude offset to obtain a direct corrected measurement.

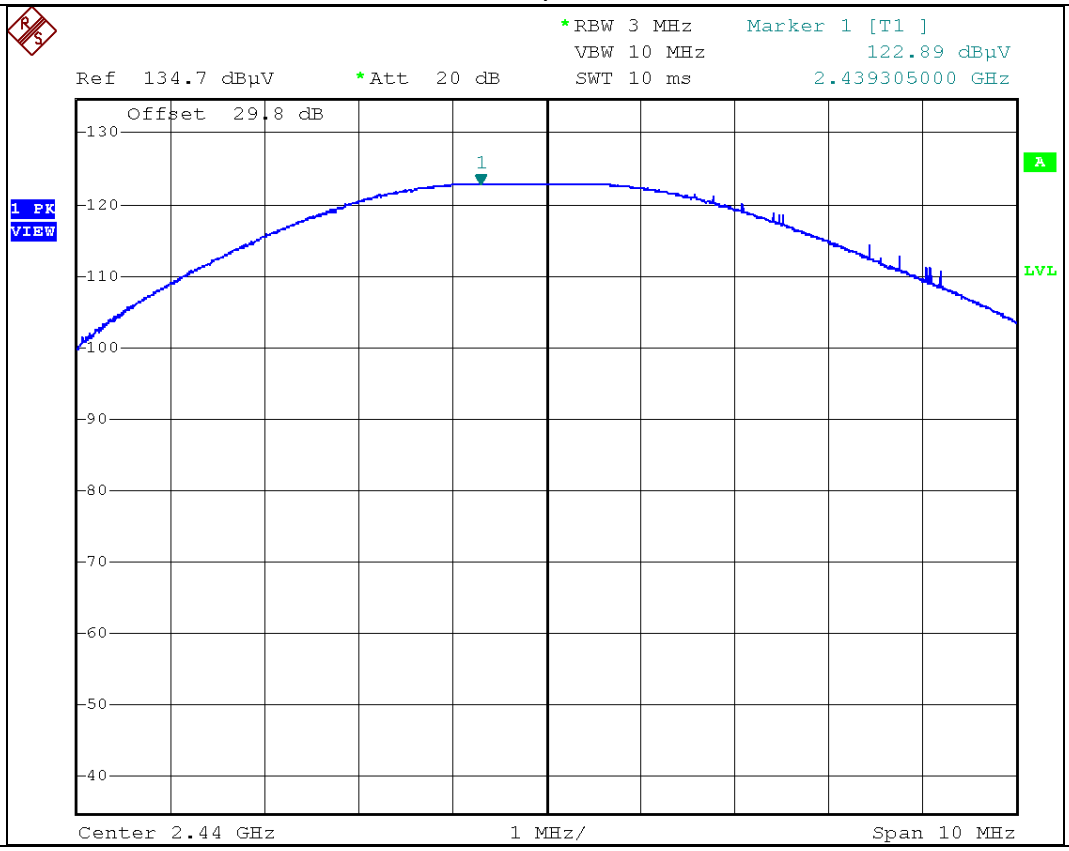
The EUT was found to be in compliance with the applicable criteria.

Plotted measurement appears below.

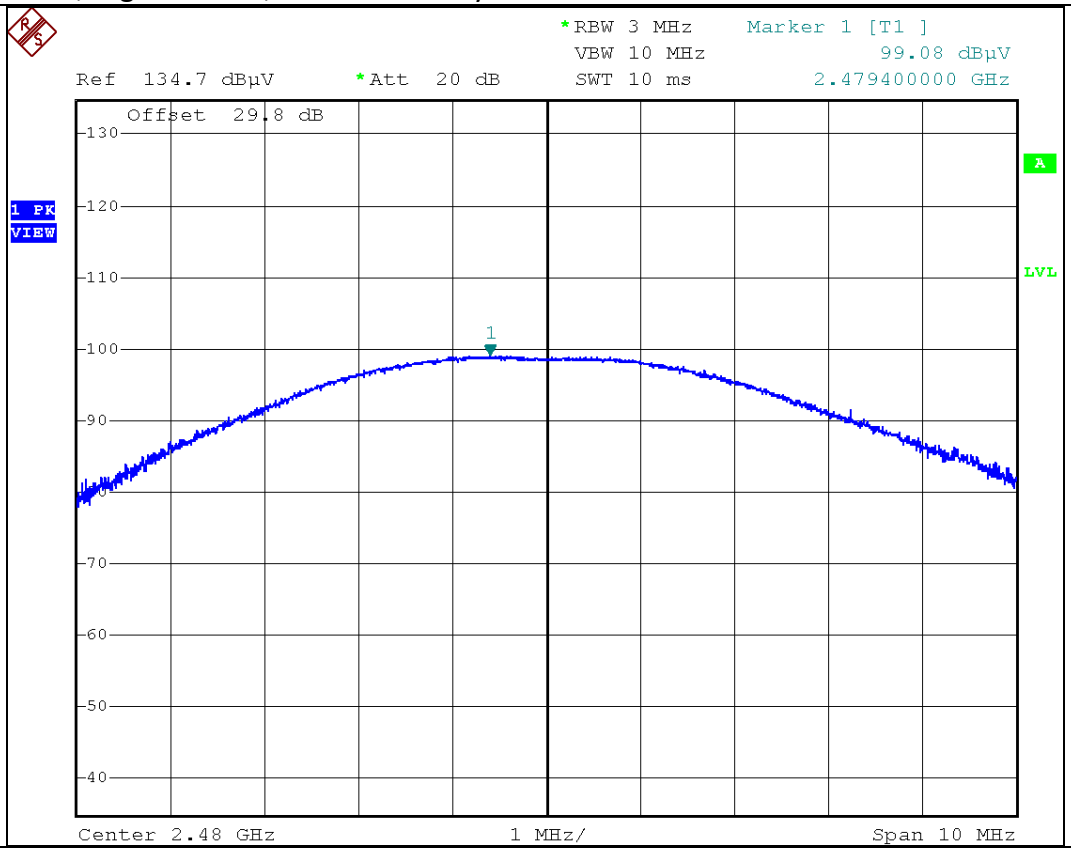
Plot 3.3.1 Power, Low Channel, Vertical Polarity



Plot 3.3.2 Power, Middle Channel, Horizontal Polarity



Plot 3.3.3 Power, High Channel, Vertical Polarity



4.0 Power Spectral Density

4.1 Test Procedure

The EUT is placed on a non-conductive table and oriented for maximum signal. A spectrum analyzer is then adjusted to encompass the highest signals and allowed to record in max-hold mode for a time sufficient to capture all transmit products.

4.2 Test Criteria

47 CFR (USA)		
Section Reference	Parameter	Date
15.247(e)	Power Spectral Density Conducted Limit: 8 dBm Restated as Field Strength 103.2 dBµV/m @ 3 m Restated as Field Strength 112.7 dBµV/m @ 1 m	2014-02-14 2014-02-19

4.3 Test Results

Power Spectral Density
Conducted Limit 8 dBm, Measured Radiated
Limit Restated as Field Strength 112.7 dBµV/m @ 1 m

Frequency GHz	Table/ Polarity	Antenna Factor dB	Cable Loss dB	Corrected* Measured Peak PSD at 1 m dBµV/m
2.440	125 / H	28.2	1.6	110.91

*Factors were added to spectrum analyzer amplitude offset to obtain a direct corrected measurement.

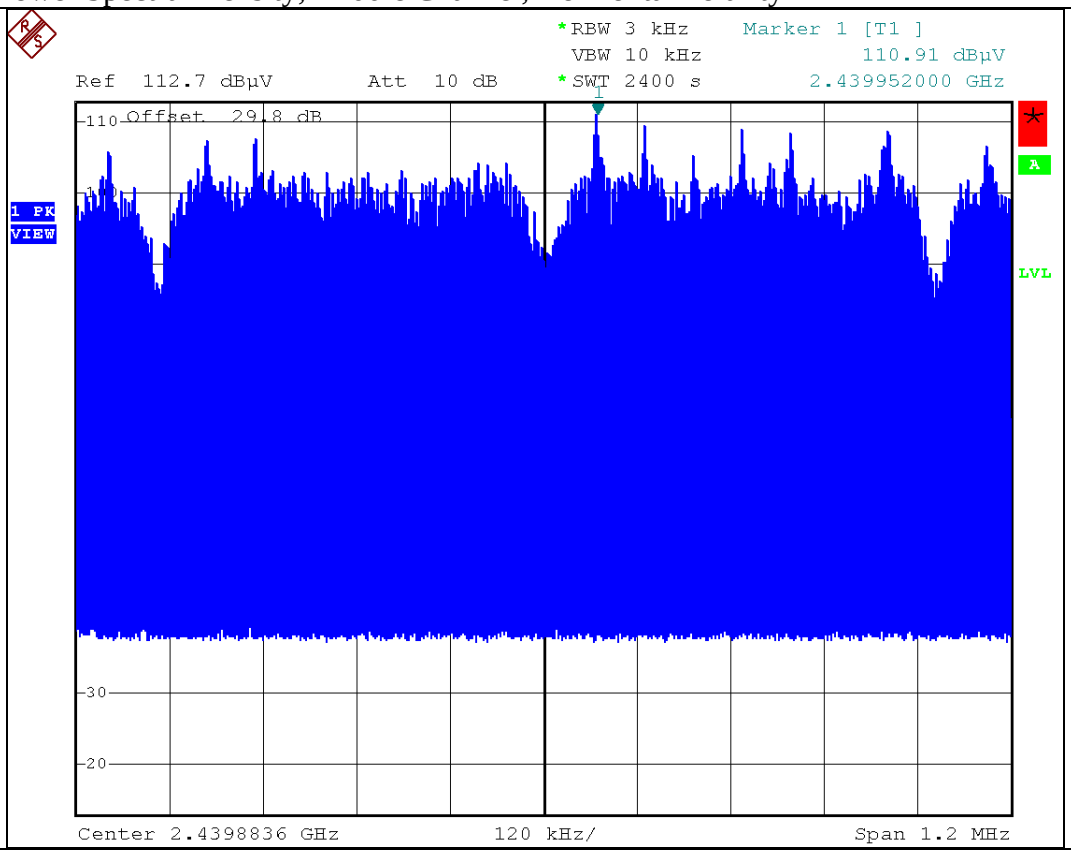
Sweep time 2400 seconds.

Based on peak power measuring more than 10 dB below the power spectral density limit, the measurement of power spectral density is not meaningful for the low and high channels.

The EUT was found to be in compliance with the applicable criteria.

Plotted measurement appears below.

Plot 4.3.3 Power Spectral Density, Middle Channel, Horizontal Polarity



5.0 Transmitter Duty Cycle

Measurements of transmitter on time and intervals between transmissions were made to determine the duty cycle factor.

5.1 Test Procedure

EUT is placed into normal transmit operation to observe and record transmitter time domain performance.

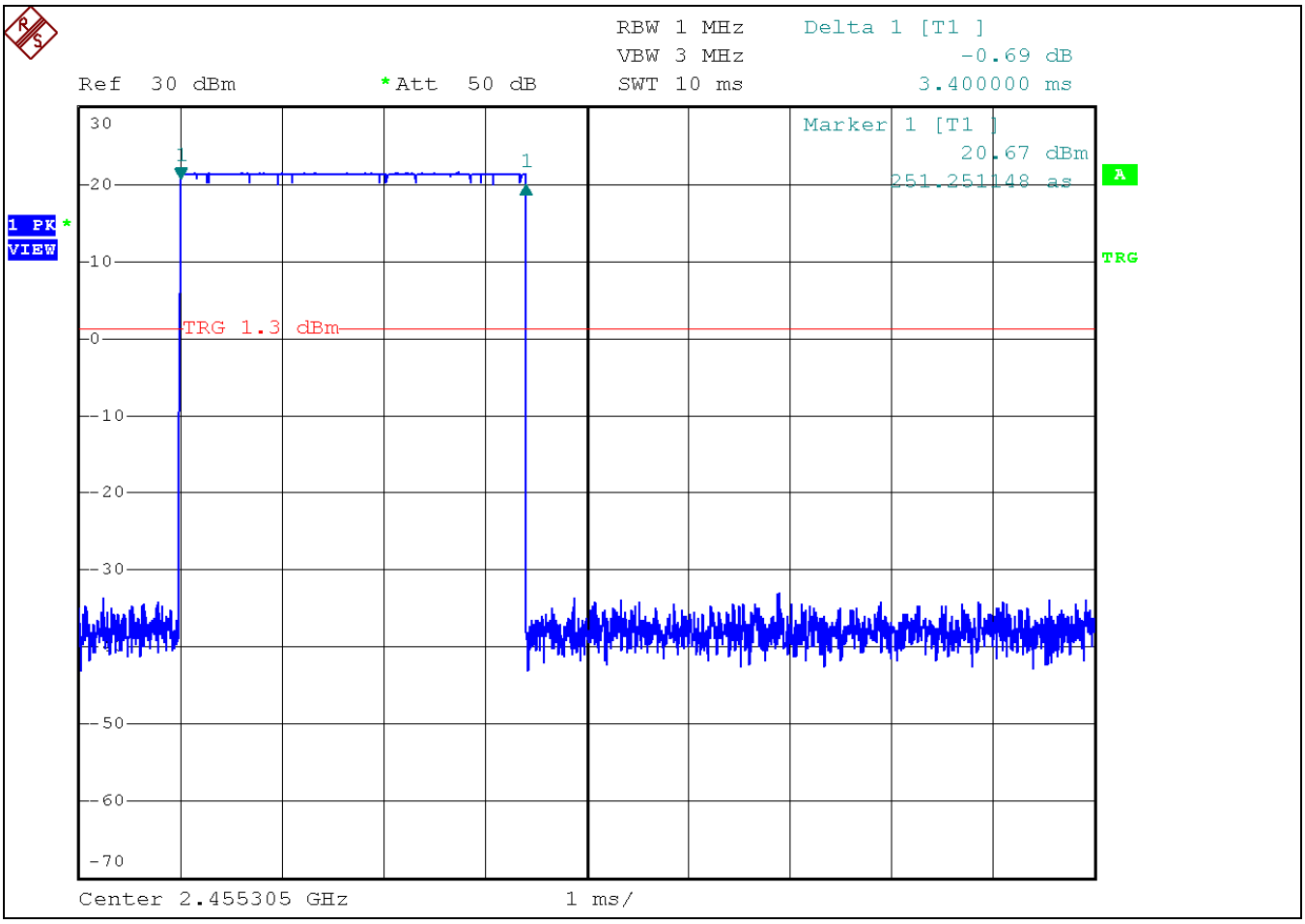
5.2 Test Criteria

Measurement is based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power. This is not a pass/fail measurement.

5.3 Test Results

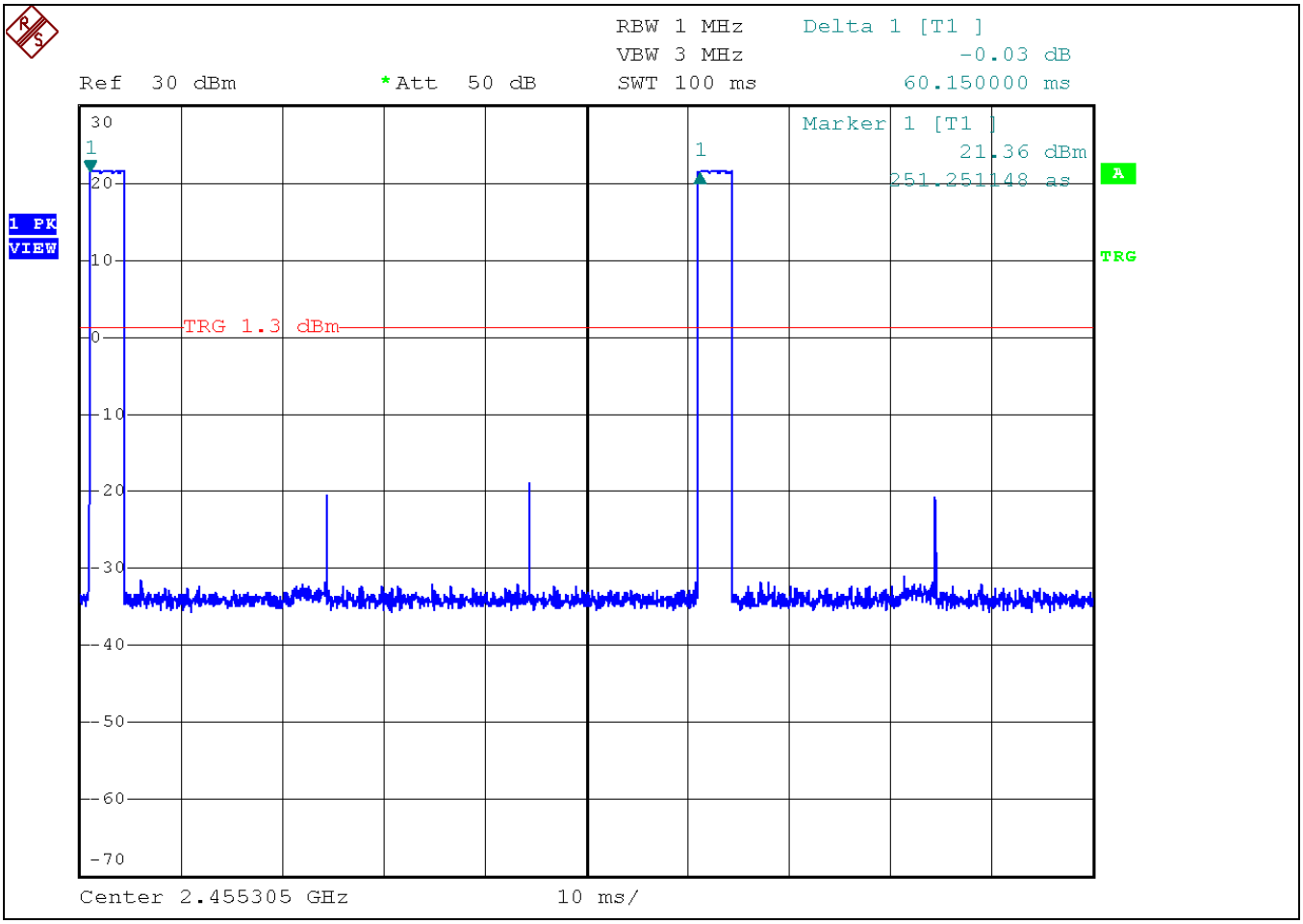
Measurements were performed on 2013-10-28 with the results appearing on the following pages.

Plot 5.3.1 Transmit On Time



Max hold recording was continued until no further change was observed. Measured maximum transmit time: 3.4 msec.

Plot 5.3.2 Transmit Interval Time



Measured minimum transmit interval time: 60.15 msec.

Table 5.3.3 Duty Cycle Factor Result

Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
3.4	60.15	= 20 * Log_{10} (3.4 msec / 60.15 msec)	-24.96	-20

The allowed duty cycle factor is applied to out of band spurious and harmonic signals as needed to determine average levels. If applicable, the Result factor above can be applied to exposure calculations.

Factor for exposure calculation: 10 * Log_{10} (3.4 msec / 60.15 msec) = -12.48 dB

6.0 Occupied Bandwidth

6.1 Test Procedure

The EUT is configured for best signal/power and the bandwidth then is measured. A recording of the results is included.

6.2 Test Criteria

Section Reference	Parameter	Date(s)
14.247(a)(2), 2.1049	Bandwidth, 6 dB, 20 dB	2014-02-14

6.3 Test Results

EUT was found to be in compliance with applicable requirements.

Bandwidth 6 dB Per 15.247 Minimum 500 kHz

Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	**Minimum BW (kHz)**
1009.5	1197.0	1311.0	**1009.5**

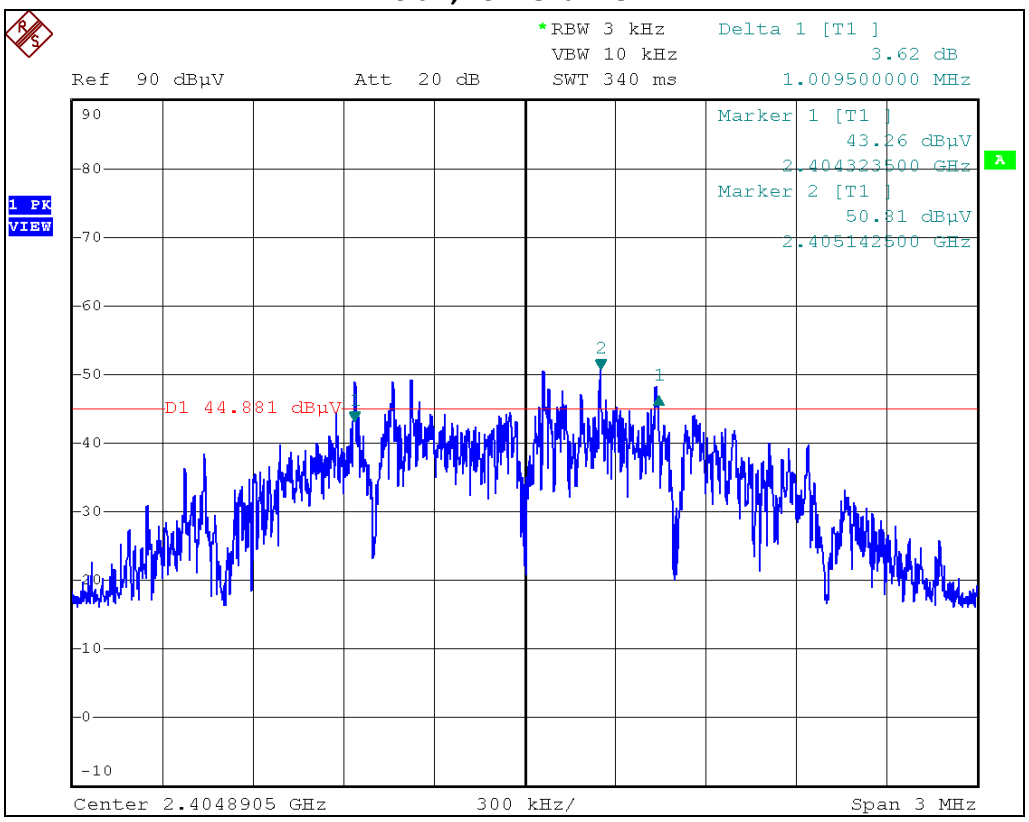
Bandwidth 20 dB Measure and Report

Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	**Reported Maximum BW (kHz)**
2344.5	2082.0	2211.0	**2344.5**

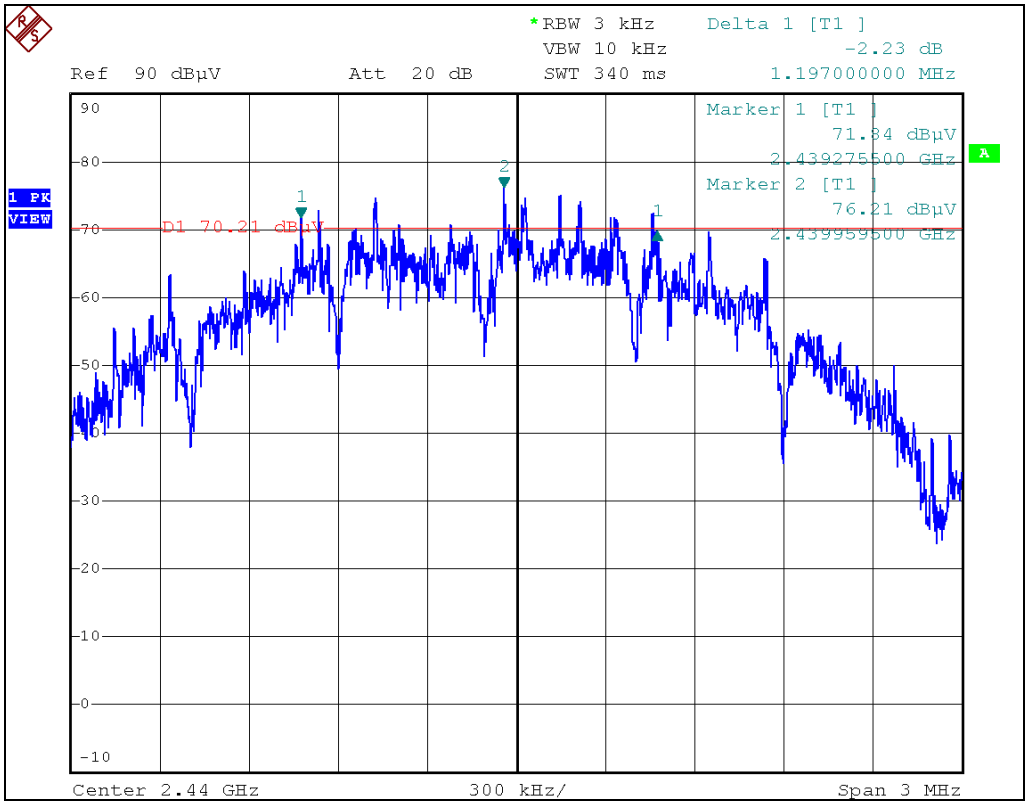
Plotted measurements appear on the following pages.

6.3.1 Bandwidth Plots, 6 dB

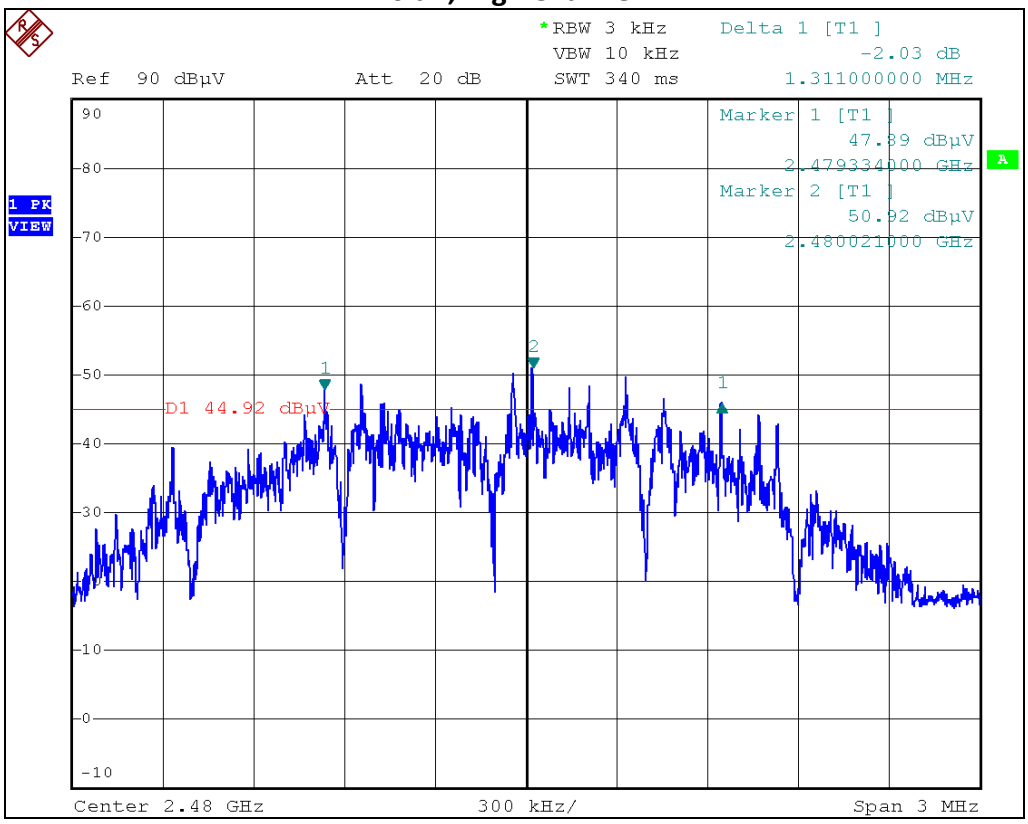
6 dB, Low Channel



6 dB, Middle Channel

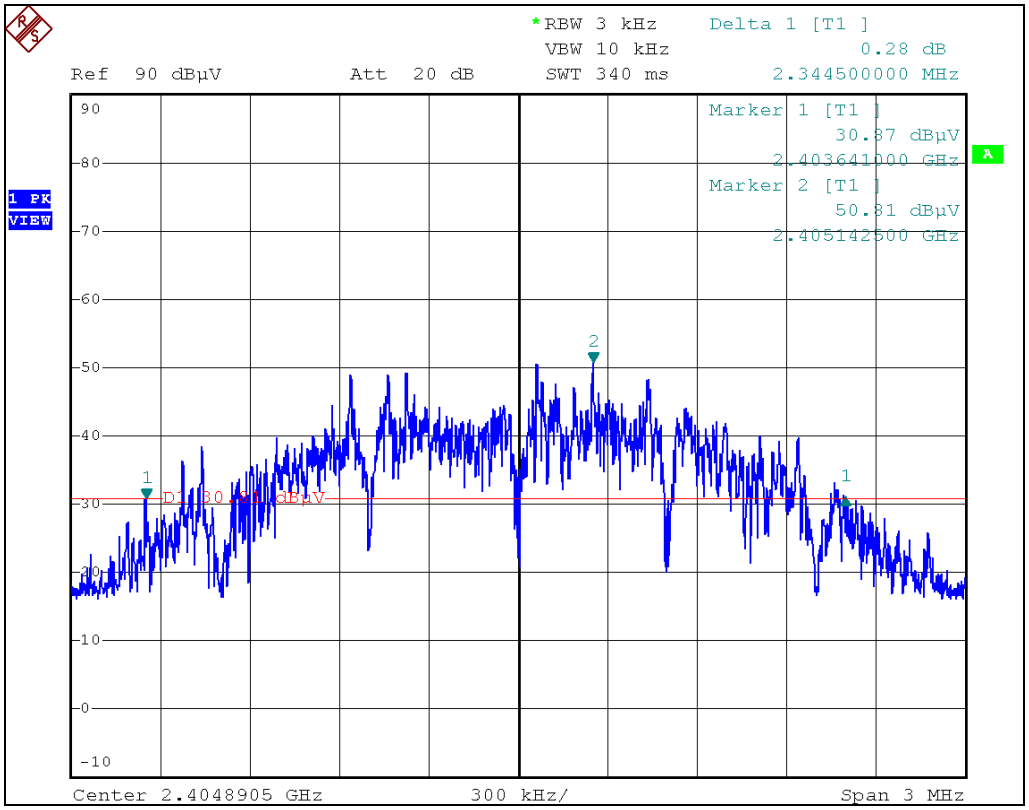


6 dB, High Channel

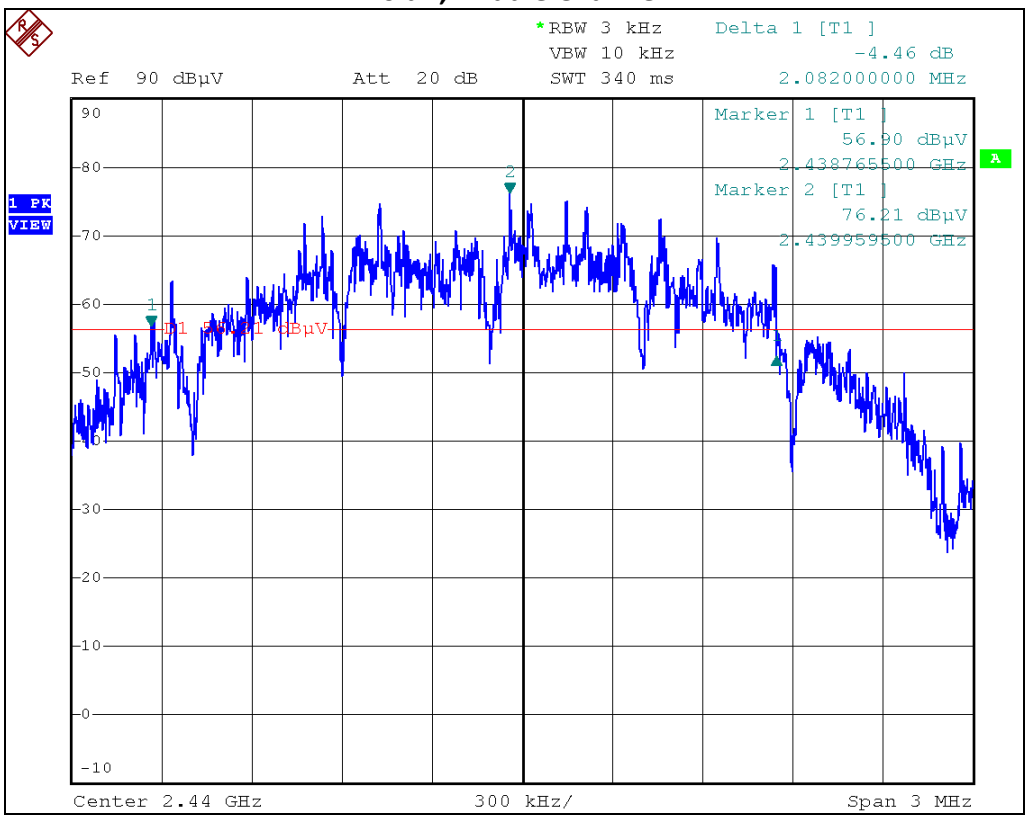


6.3.2 Bandwidth Plots, 20 dB

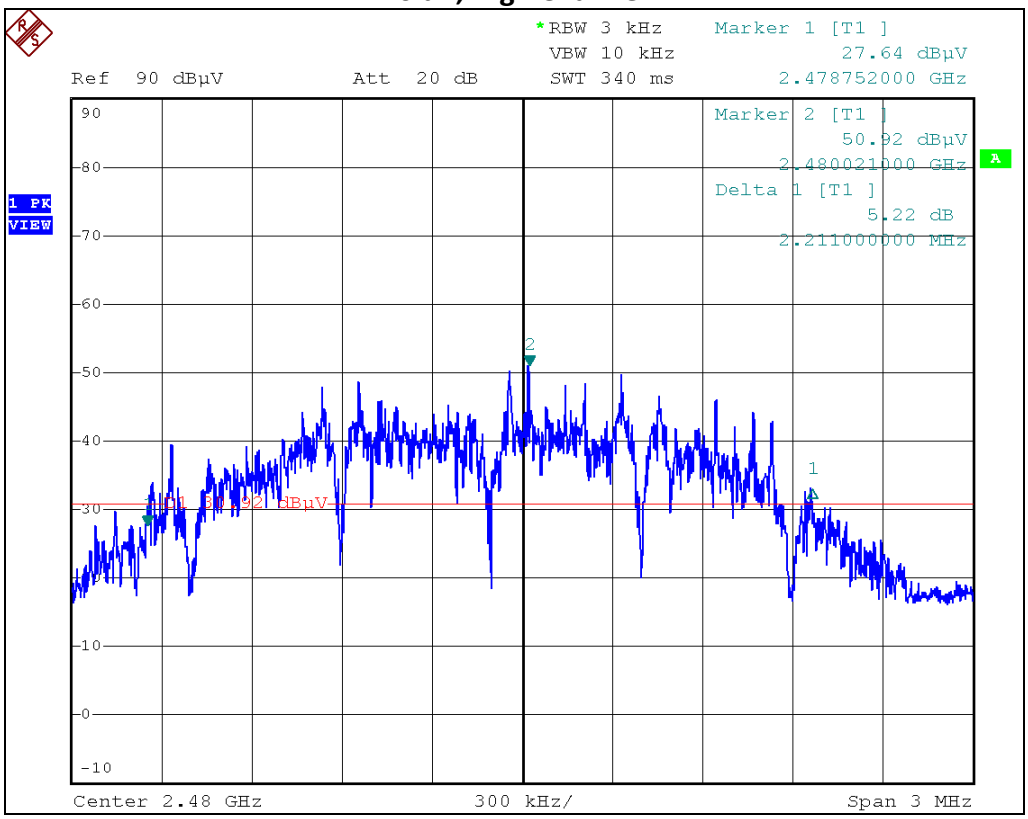
20 dB, Low Channel



20 dB, Middle Channel



20 dB, High Channel



7.0 Band Edge

Measurements of transmitter emissions at the top and bottom band edge.

7.1 Test Procedure

EUT is placed into normal transmit operation on the nearest band edge channel. The spectrum analyzer is centered on the band edge frequency with span sufficient to include the peak of the adjacent fundamental signal. Measurement includes two standard bandwidths from the respective band edge. The relative difference in signal levels from fundamental to strongest signal at the band edge are then determined and compared to limits. If required, the band-edge marker-delta method of C63.4 is utilized.

7.2 Test Criteria

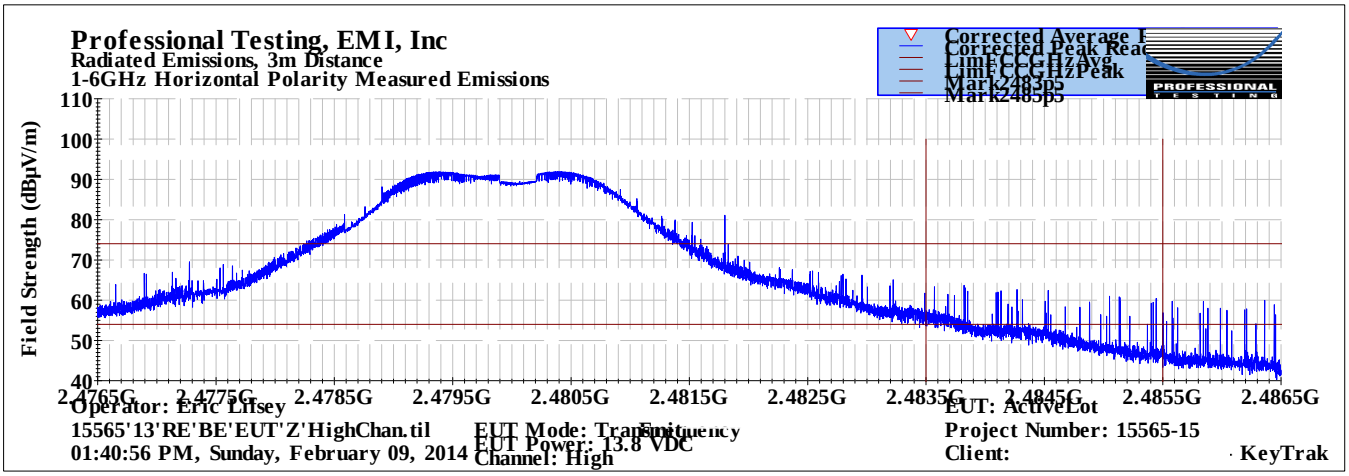
Section Reference	Parameter	Date(s)
15.205, 15.209	Emissions Outside Band	2014-01-14

7.3 Test Results

Worse-case margin to limit is in excess of -10 dB on high channel vertical polarity. The EUT satisfied the criteria. Recorded data is presented below.

7.3.1 High Channel Band Edge

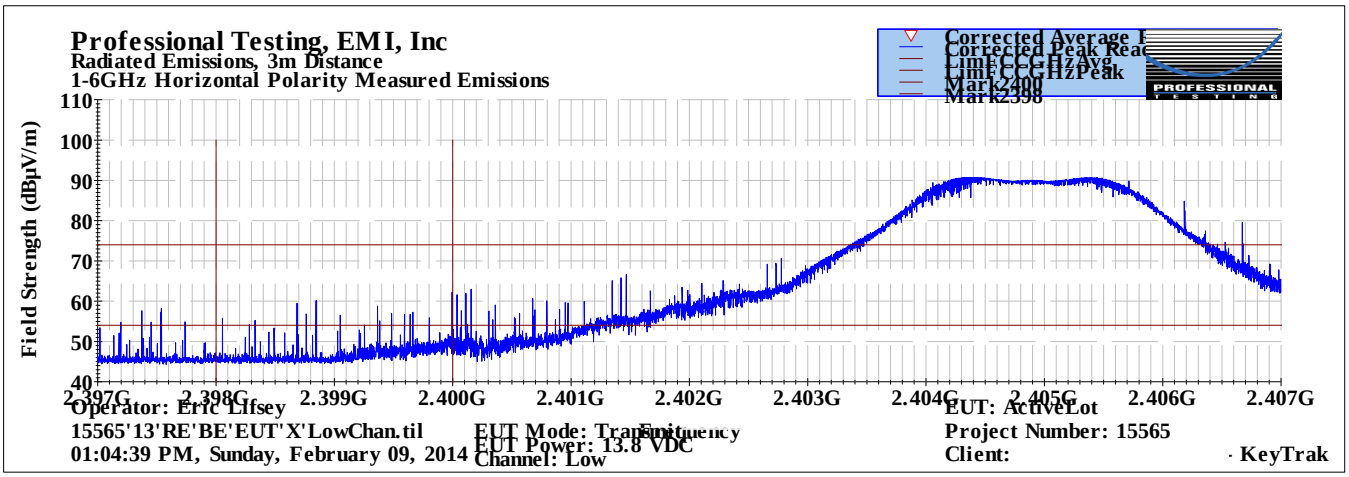
Measurements are of peak detection levels and shown for worse-case polarity. The average level would be calculated from peak by applying the duty cycle factor of -20 dB.



The curves are all under their respective peak limits with 1 MHz RBW and average would be under by an equivalent margin. Consequently the delta procedure is not required.

7.3.2 Low Channel Band Edge

Measurements are of peak detection levels and shown for worse-case polarity. The average level would be calculated from peak by applying the duty cycle factor of -20 dB.



The curves are all under their respective peak limits with 1 MHz RBW and average would be under by an equivalent margin. Consequently the delta procedure is not required.

8.0 Radiated Spurious Emissions Below 1 GHz

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to 47 CFR, Part 15.

8.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 10 meters from the measurement antenna.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. A diagram showing the test setup is given as Figure 6.1.1.

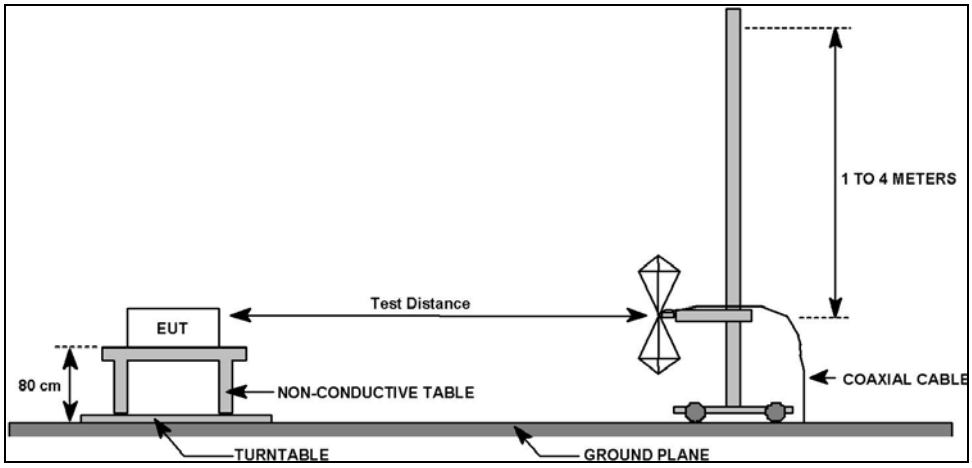


Figure 6.1.1: Field Strength of Spurious Emissions Test Setup

8.2 Test Criteria

Clause Subject	Section Number	Date
Field Strength of Radiated Spurious/Harmonic Emissions	15.247, 15.209	2014-02-04 2014-02-09 2014-02-23

8.3 Test Results

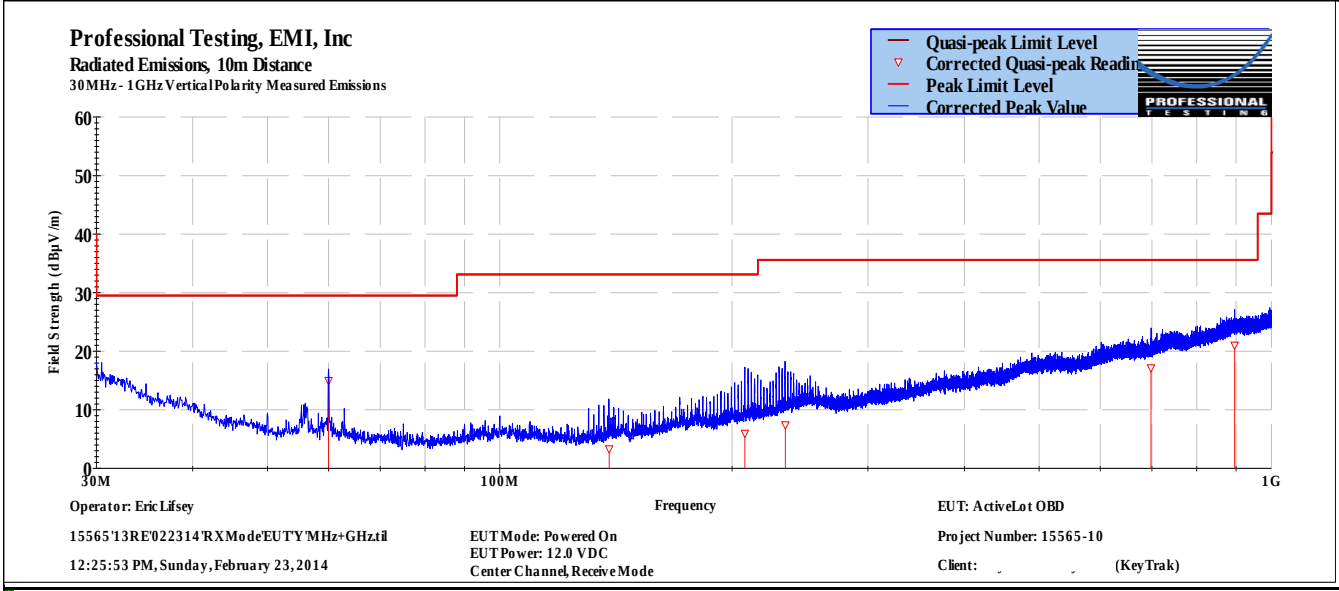
The EUT satisfied the criteria. Recorded data is presented below.

8.3.1 Radiated Spurious Emissions, Receive, Below 1 GHz

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	2/23/2014	EUT Serial #:	None
Customer:	Reynolds & Reynolds (KeyTrak)	EUT Part #:	None
Project Number:	15565-15	Test Technician:	Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Rob McCollough
Equip. Under Test:	ActiveLot	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Powered On, Receive Mode, Middle Channel	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
59.9962	10	94	3.98	Quasi-peak	36.3	14.984	29.5	-14.5	Pass
138.633	10	275	1.34	Quasi-peak	23.9	3.311	33.1	-29.8	Pass
207.739	10	210	1.45	Quasi-peak	22.4	5.95	33.1	-27.2	Pass
234.454	10	76	2.23	Quasi-peak	22.1	7.389	35.6	-28.2	Pass
698.165	10	195	3.9	Quasi-peak	21.7	17.14	35.6	-18.5	Pass
896.272	10	109	2.71	Quasi-peak	21.3	21.02	35.6	-14.6	Pass



≤ 1GHz Vertical Antenna Polarity Measured Emissions

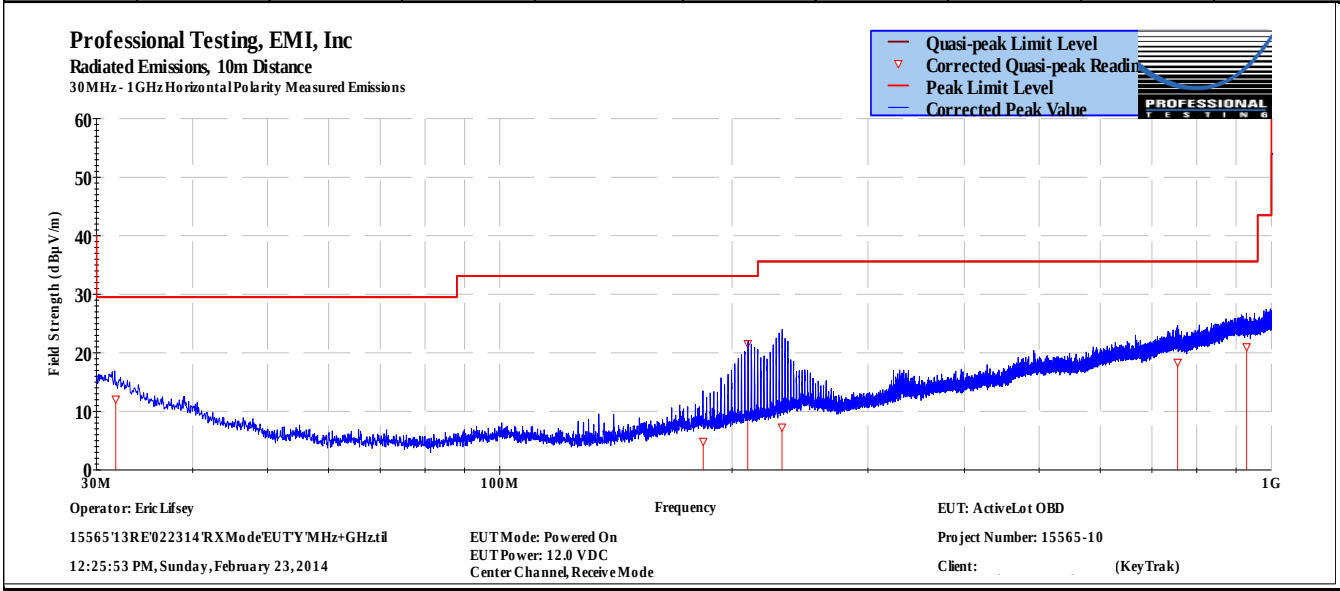
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	2/23/2014	**EUT Serial #:**	None
Customer:	Reynolds & Reynolds (KeyTrak)	**EUT Part #:**	None
Project Number:	15565-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	Not Listed	**Supervisor:**	Rob McCollough
Equip. Under Test:	ActiveLot	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	12 VDC	**EUT Power Frequency:**	- N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	30MHz to 1GHz
EUT Mode of Operation:		Powered On, Receive Mode, Middle Channel	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
31.7936	10	214	3.73	Quasi-peak	24.1	12.068	29.5	-17.4	Pass
183.563	10	237	3.68	Quasi-peak	22.4	4.857	33.1	-28.2	Pass
209.608	10	264	3.34	Quasi-peak	37.9	21.574	33.1	-11.5	Pass
232.116	10	251	2.63	Quasi-peak	22.2	7.283	35.6	-28.3	Pass
756.109	10	354	1.27	Quasi-peak	21.6	18.377	35.6	-17.2	Pass
928.79	10	119	3.18	Quasi-peak	21.1	21.013	35.6	-14.6	Pass



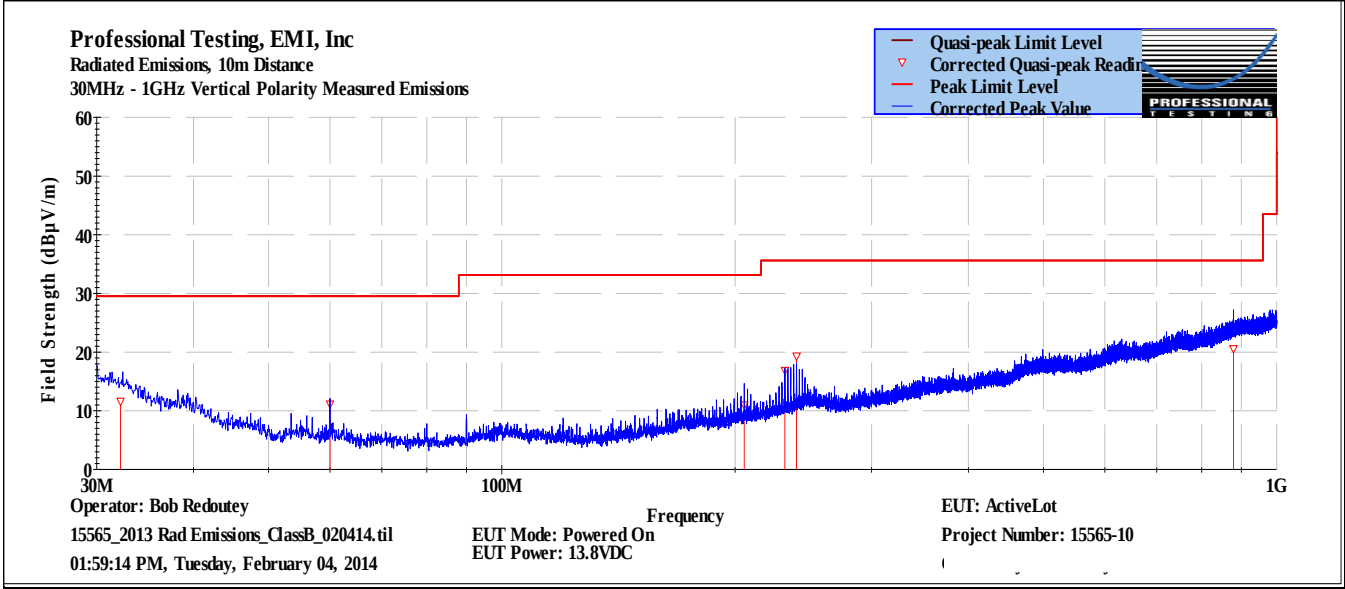
≤ 1GHz Horizontal Antenna Polarity Measured Emissions

8.3.2 Radiated Spurious Emissions, Transmit, Below 1 GHz

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	2/4/2014, 2/9/2014	EUT Serial #:	None
Customer:	Reynolds & Reynolds	EUT Part #:	None
Project Number:	15565-15	Test Technician:	Bob Redoutey 2/5, Eric Lifsey 2/9
Purchase Order #:	Not Listed	Supervisor:	Rob McCollough
Equip. Under Test:	ActiveLot	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	13.8	VDC	EUT Power Frequency:	-	N/A
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz	
EUT Mode of Operation:			Powered On, Transmit		

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
32.2043	10	188	3.58	Quasi-peak	23.8	11.58	29.5	-17.9	Pass
60.0058	10	18	2.96	Quasi-peak	32.5	11.13	29.5	-18.4	Pass
205.487	10	220	3.05	Quasi-peak	27.5	10.977	33.1	-22.1	Pass
231.824	10	110	1.47	Quasi-peak	31.8	16.869	35.6	-18.7	Pass
240.079	10	91	1.52	Quasi-peak	33.6	19.305	35.6	-16.3	Pass
879.264	10	44	3.87	Quasi-peak	21.4	20.572	35.6	-15.0	Pass



≤ 1GHz Vertical Antenna Polarity Measured Emissions

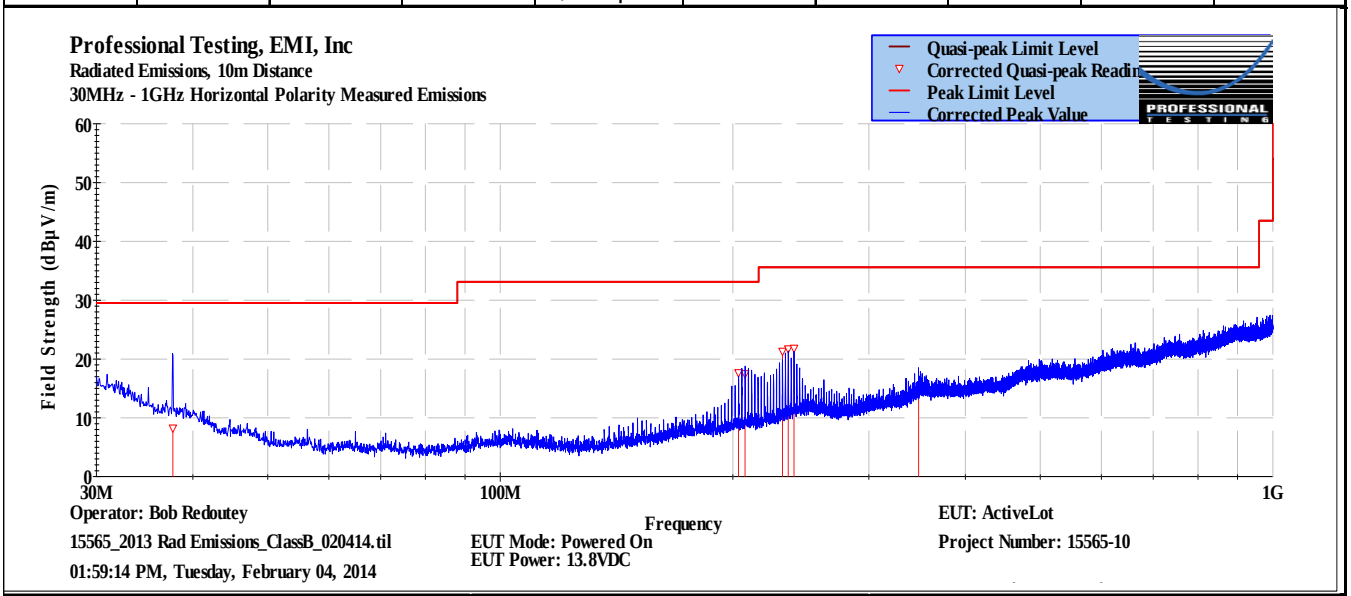
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	2/4/2014, 2/9/2014	**EUT Serial #:**	None
Customer:	Reynolds & Reynolds	**EUT Part #:**	None
Project Number:	15565-15	**Test Technician:**	Bob Redoutey 2/5, Eric Lifsey 2/9
Purchase Order #:	Not Listed	**Supervisor:**	Rob McCollough
Equip. Under Test:	ActiveLot	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	13.8 VDC	**EUT Power Frequency:**	- N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	30MHz to 1GHz
EUT Mode of Operation:		Powered On, Transmit	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
37.6737	10	173	3.01	Quasi-peak	23.5	8.227	29.5	-21.3	Pass
203.402	10	205	3.59	Quasi-peak	34.3	17.647	33.1	-15.5	Pass
207.459	10	155	3.67	Quasi-peak	33.9	17.473	33.1	-15.6	Pass
231.875	10	177	3.94	Quasi-peak	36.3	21.288	35.6	-14.3	Pass
235.901	10	165	2.84	Quasi-peak	36.3	21.701	35.6	-13.9	Pass
240.027	10	171	2.69	Quasi-peak	36.1	21.82	35.6	-13.8	Pass
347.91	10	253	2.22	Quasi-peak	26.6	14.471	35.6	-21.1	Pass



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

9.0 Radiated Spurious Emissions Above 1 GHz

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to 47 CFR, Part 15.

9.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 1 meter from the measurement antenna.

Harmonic emissions above 1 GHz peak are measured with peak detection, a resolution bandwidth of 1 MHz, and at a distance of 3 meters. If peak measurements exceeded average limits, the peak limit is applicable and duty cycle factor is then applied for average level calculation. Emissions are investigated up to the 10th harmonic of the transmitter fundamental.

Non-harmonic spurious emissions must satisfy the average limit and the peak limit (20 dB above average). A diagram showing the test setup is given as Figure 5.1.1.

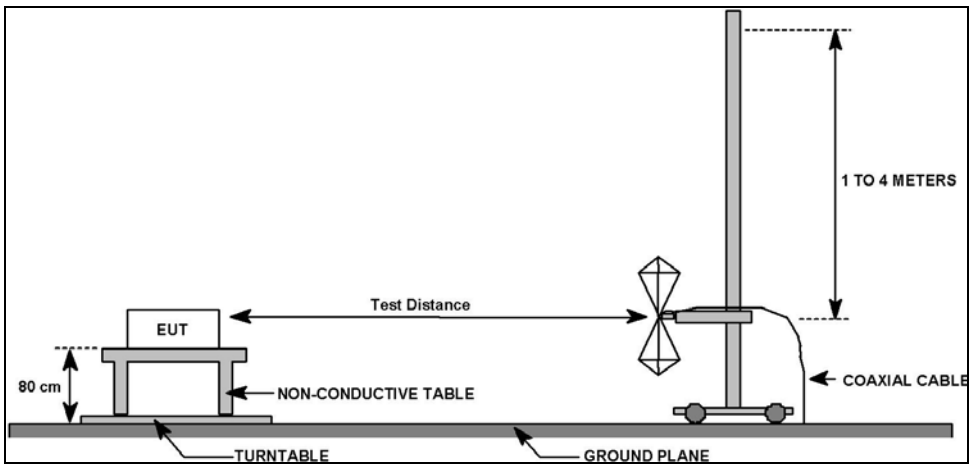


Figure 7.1.1: Field Strength of Spurious Emissions Test Setup

9.2 Test Criteria

Clause Subject	Section Number	Date
Field Strength of Radiated Spurious/Harmonic Emissions	15.247, 15.209	2014-01-03

From timing measurements reported elsewhere in this report, the average level is -20 below the measured peak values. Therefore meeting the peak limit levels also complies with the average levels.

9.3 Test Results

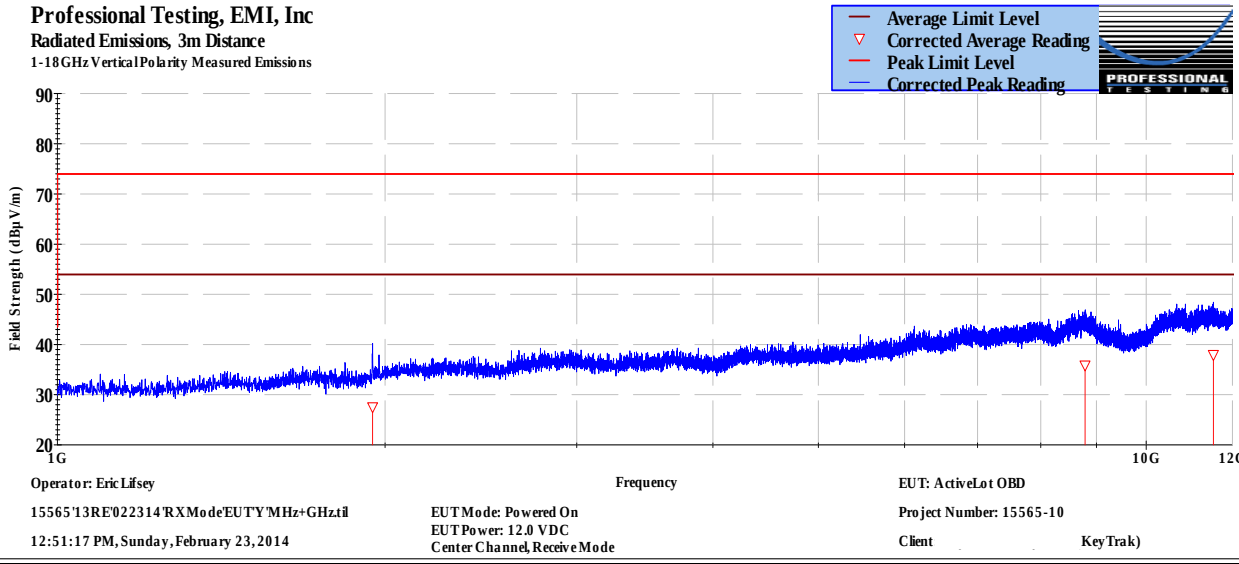
In all cases detector mode is peak, RBW 1 MHz, VBW 3 MHz. The applicable duty cycle factor for averaging is -20 dB. In transmit mode the EUT was transmitting on the indicated channel. All peak emissions can be seen as below the peak limit, meaning the duty cycle factor for averaging places the average also below its respective limit.

9.3.1 Radiated Spurious Emissions, Receive, Middle Channel, 1 GHz to 12 GHz

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	2/23/2014	EUT Serial #:	None
Customer:	KeyTrak	EUT Part #:	None
Project Number:	15565-15	Test Technician:	Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Rob McCollough
Equip. Under Test:	ActiveLot	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	12	VDC	EUT Power Frequency:	-	N/A
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz	
EUT Mode of Operation:	Powered On, Receive Mode, Middle Channel				

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1948.02	3	294	0	Average	37.8	27.531	54.0	-26.4	Pass
8787.18	3	242	0	Average	27.5	35.865	54.0	-18.1	Pass
11526.3	3	57	0	Average	26.8	37.957	54.0	-16.0	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

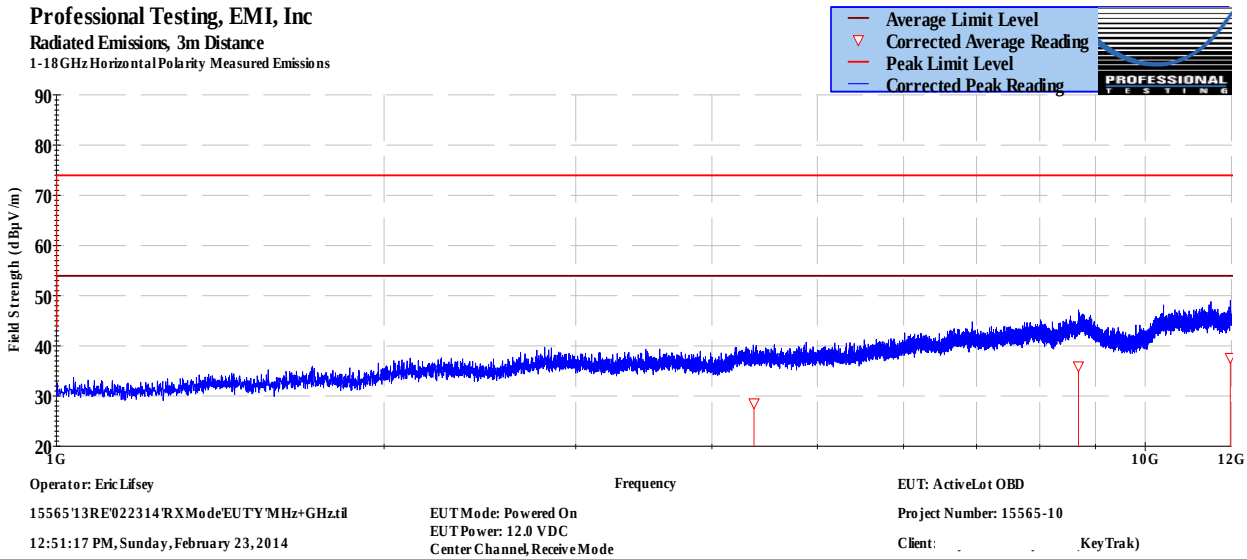
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	2/23/2014	**EUT Serial #:**	None
Customer:	Reynolds & Reynolds (KeyTrak)	**EUT Part #:**	None
Project Number:	15565-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	Not Listed	**Supervisor:**	Rob McCollough
Equip. Under Test:	ActiveLot	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	12 VDC	**EUT Power Frequency:**	- N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	Above 1GHz
EUT Mode of Operation:		Powered On, Receive Mode, Middle Channel	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
4373.05	3	111	0	Average	33.6	28.576	54.0	-25.4	Pass
8683.06	3	69	0	Average	27.6	35.962	54.0	-18.0	Pass
11970.7	3	51	0	Average	27.3	37.637	54.0	-16.3	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

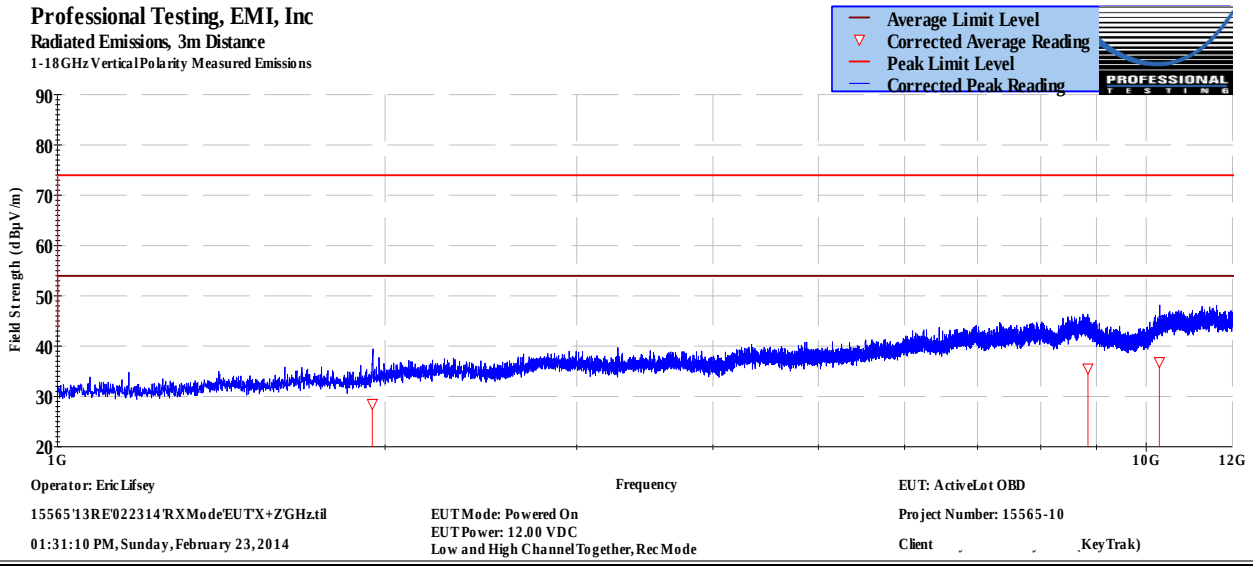
9.3.2 Radiated Spurious Emissions, Receive, Low & High Channels, 1 GHz to 12 GHz

Two individual EUTs were measured together and operating on the opposite end channels.

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	2/23/2014	EUT Serial #:	None
Customer:	KeyTrak	EUT Part #:	None
Project Number:	15565-15	Test Technician:	Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Rob McCollough
Equip. Under Test:	ActiveLot	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Powered On, Receive Mode, Low & High Channels	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1946.76	3	178	0	Average	38.8	28.547	54.0	-25.4	Pass
8840.62	3	341	0	Average	27.4	35.611	54.0	-18.3	Pass
10282.4	3	168	0	Average	26.6	36.888	54.0	-17.1	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

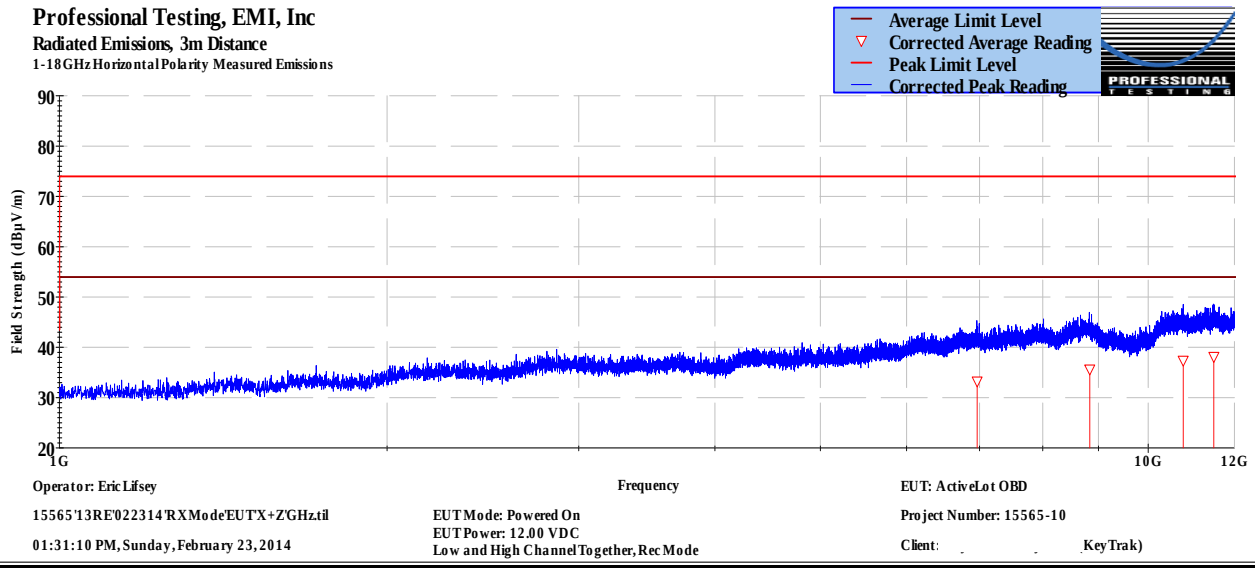
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits
Section:	15.209

Test Date(s):	2/23/2014	**EUT Serial #:**	None
Customer:	KeyTrak	**EUT Part #:**	None
Project Number:	15565-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	Not Listed	**Supervisor:**	Rob McCollough
Equip. Under Test:	ActiveLot	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	12 VDC	**EUT Power Frequency:**	- N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	Above 1GHz
EUT Mode of Operation:		Powered On, Receive Mode, Low & High Channels	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
6965.14	3	137	0	Average	30.2	33.245	54.0	-20.7	Pass
8837.24	3	328	0	Average	27.5	35.639	54.0	-18.3	Pass
10769.2	3	348	0	Average	27.4	37.391	54.0	-16.6	Pass
11488.9	3	256	0	Average	26.9	38.148	54.0	-15.8	Pass



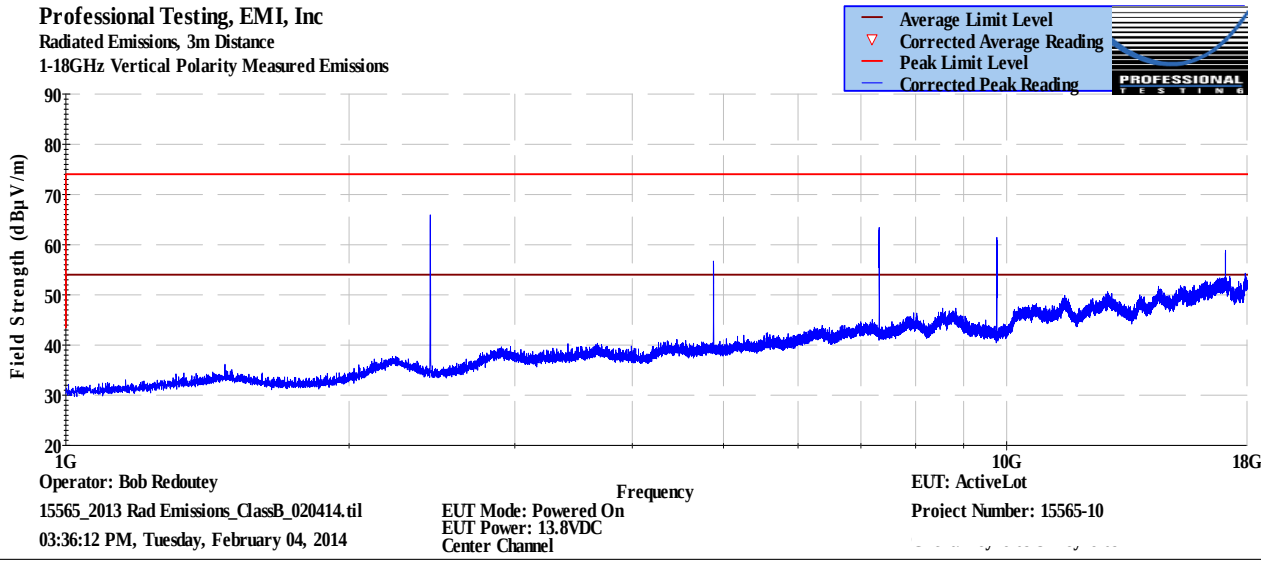
> 1GHz Horizontal Antenna Polarity Measured Emissions

9.3.3 Radiated Spurious Emissions, Transmit Middle Channel, 1 GHz to 18 GHz

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	2/4/2014	EUT Serial #:	None
Customer:	KeyTrak	EUT Part #:	None
Project Number:	15565-15	Test Technician:	Bob Redoutey
Purchase Order #:	Not Listed	Supervisor:	Rob McCollough
Equip. Under Test:	ActiveLot	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	13.8 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit, Middle Channel	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
4878.7	3	120	1	peak	56.7	56.7	74.0	-17.3	Pass
7318.2	3	120	1	peak	63.4	63.4	74.0	-10.6	Pass
9761.9	3	120	1	peak	61.4	61.4	74.0	-12.6	Pass
17083	3	120	1	peak	58.8	58.8	74.0	-15.2	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

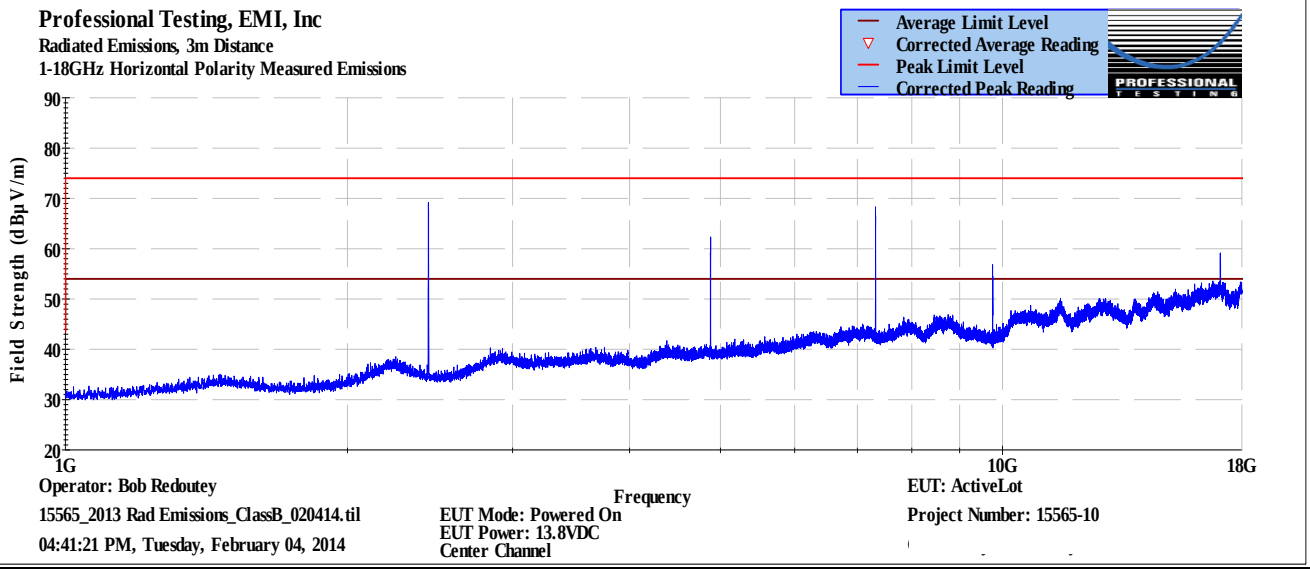
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits
Section:	15.209

Test Date(s):	2/4/2014	**EUT Serial #:**	None
Customer:	KeyTrak	**EUT Part #:**	None
Project Number:	15565-15	**Test Technician:**	Bob Redoutey
Purchase Order #:	Not Listed	**Supervisor:**	Rob McCollough
Equip. Under Test:	ActiveLot	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	13.8 VDC	**EUT Power Frequency:**	- N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	Above 1GHz
EUT Mode of Operation:		Transmit, Middle Channel	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
4878.7	3	120	1	peak	62.3	62.3	74.0	-11.7	Pass
7318.2	3	120	1	peak	68.3	68.3	74.0	-5.7	Pass
9761.9	3	120	1	peak	56.8	56.8	74.0	-17.2	Pass
17083	3	120	1	peak	59.1	59.1	74.0	-14.9	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

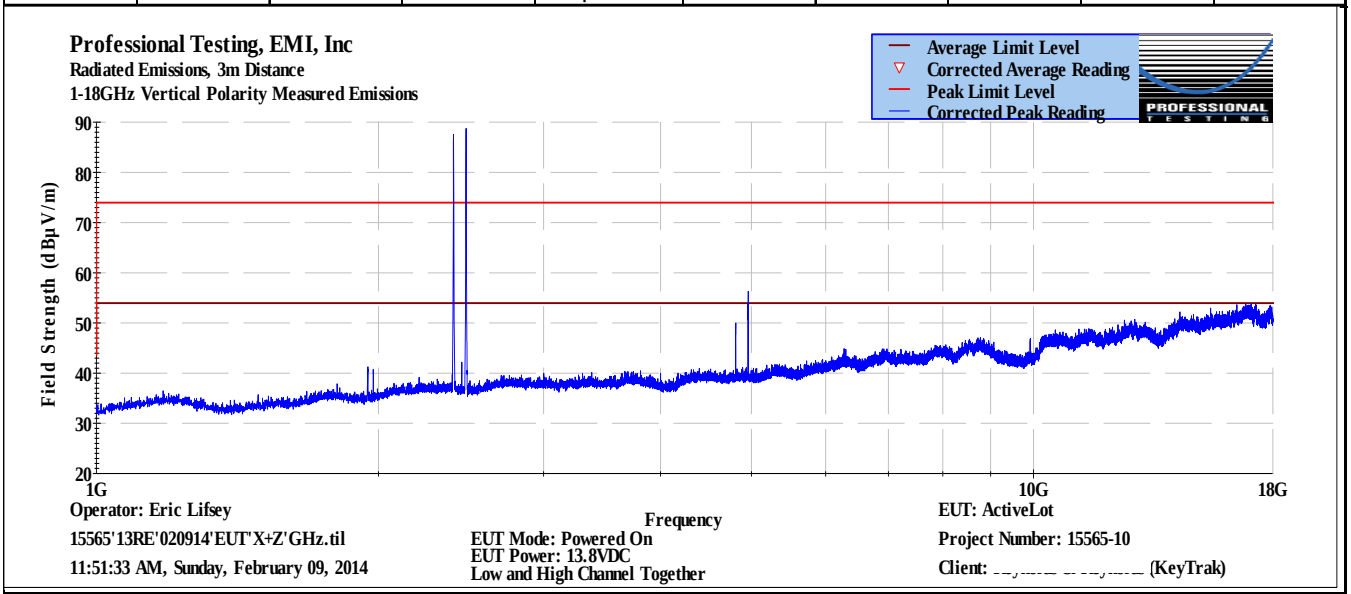
9.3.4 Radiated Spurious Emissions, Transmit Low & High Channel, 1 GHz to 18 GHz

Two individual EUTs were measured together and operating on the opposite end channels.

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	2/9/2014	EUT Serial #:	None
Customer:	KeyTrak	EUT Part #:	None
Project Number:	15565-15	Test Technician:	Eric Lifsey 2/9
Purchase Order #:	Not Listed	Supervisor:	Rob McCollough
Equip. Under Test:	ActiveLot	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	13.8 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Low & High Channel	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
4960.5	3	120	1	peak	56.3	56.3	74.0	-17.7	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

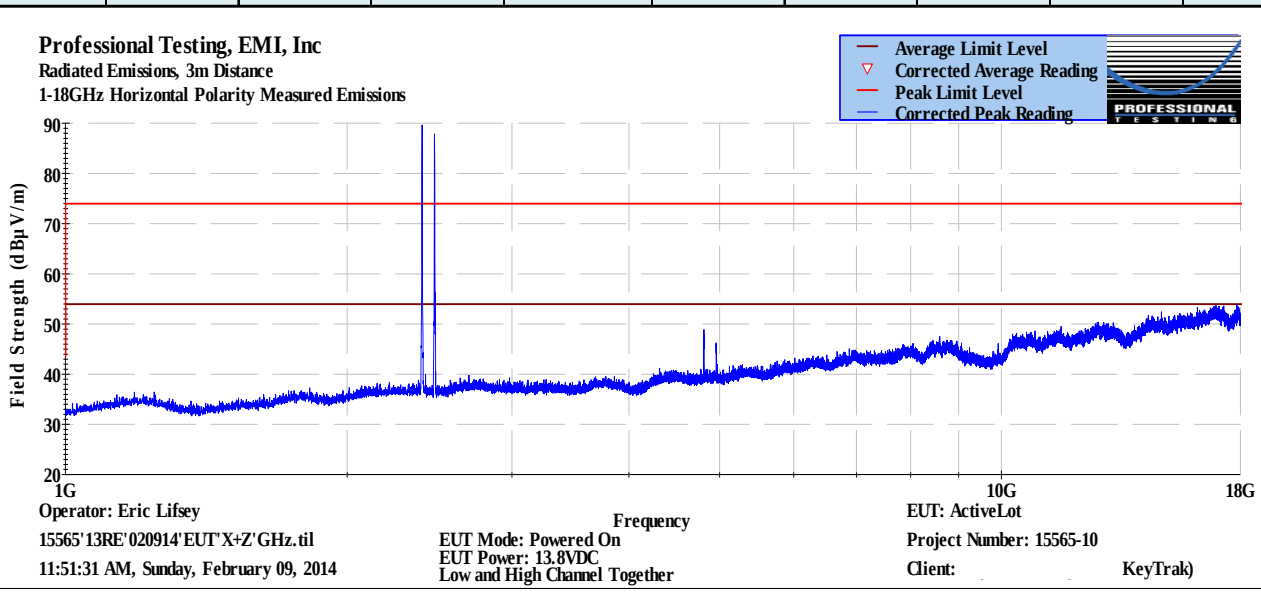
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	2/9/2014	**EUT Serial #:**	None
Customer:	KeyTrak	**EUT Part #:**	None
Project Number:	15565-15	**Test Technician:**	Eric Lifsey 2/9
Purchase Order #:	Not Listed	**Supervisor:**	Rob McCollough
Equip. Under Test:	ActiveLot	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	13.8 VDC	**EUT Power Frequency:**	- N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	Above 1GHz
EUT Mode of Operation:		Transmit Low & High Channel	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results



> 1GHz Horizontal Antenna Polarity Measured Emissions

9.3.1 Radiated Spurious Emissions, Transmit, 18 GHz to 25 GHz

One emission for the middle channel was found in one polarity as indicated below. No other emissions were found on the low and high channels.

Client:	KeyTrak Reynolds & Reynolds			Polarity:	As Shown		Distance:	0.5	meter	
Test Date:	February 20, 2014			EUT:	KeyTrak OBD					
Voltage:	13.8 VDC			Serial #:	EUT Y					
Frequency:	N/A			Project #:	15565					
Technician:	Eric Lifsey			Test Type:	15.247		D/C Factor:	20		
Corrected Level = Recorded Level - Amplifier Gain + Antenna Factor + Cable Loss - Duty Cycle Factor										
Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters) / Polarity	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m) less Duty Cycle Factor	Average Limit (dBuV/m)	Margin (dB)	Detector Function
19.52	270	1 / Horiz	71.9	25.4	36.5	3.70	66.7	69.6	-2.9	Average

10.0 Antenna Construction Requirements

The design was investigated for meeting the antenna construction requirements of the applicable rules.

10.1 Procedure

A direct examination of the antenna construction is performed and compared to rule criteria that prevent wireless device antennas from being modified by end users in ways that would void their authorization to use the device.

10.2 Criteria

Clause Subject	Section Number	Date
Antenna Construction	15.203	2014-02-27

10.3 Results

Antenna Manufacturer and Model	Specifications
KeyTrak Printed circuit antenna on circuit board. Design is an inverted F antenna.	

- The antenna is internal only to the device.
- The antenna is etched on the circuit board.
- There is no antenna connector.

The antenna design meets the requirements of the rules.

11.0 Equipment Lists

11.1 Equipment for Spurious Radiated Emissions, 30 MHz to 18 GHz

Professional Testing, EMI, Inc.			
Test Method:	**ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference,**		
In accordance with:	**FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits**		
Section:	**15.209**		
Test Date(s):	**2/4/2014, 2/9/2014**	**EUT Serial #:**	**None**
Customer:	**KeyTrak**	**EUT Part #:**	**None**
Project Number:	**15565-15**	**Test Technician:**	**Bob Redoutey 2/5, Eric Lifsey 2/9**
Purchase Order #:	**Not Listed**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**ActiveLot**	**Witness' Name:**	**None**

Radiated Emissions Test Equipment List	
Tile! Software Version:	**4.2.A, May 23, 2010, 08:38:52 AM**
Test Profile:	**Radiated Emissions_Profile Version October 12, 2011**

Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	7/29/2014
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/22/2015
1930	Agilent	E4440A-239	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY45304903	7/11/2015
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	00135454	7/29/2014
C027	N/A	RG214	Cable Coax, N-N, 25m	none	9/26/2014
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	7/16/2014
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	11/19/2014
C030	N/A	0	Cable Coax, N-N, 30m	none	9/26/2014
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	00110313	1/21/2015

11.2 Equipment for Spurious Radiated Emissions 18 GHz to 25 GHz

Asset #	Manufacturer	Model #	Description	Calibration Due
0582	EMCO	3115	Ridge Guide Antenna	2014-03-14
1974	Agilent	83017A	Microwave Preamplifier (preamp 1)	2015-02-05
1342	Rohde & Schwarz	FSP-30	Spectrum Analyzer	2015-01-29
C248	Pasternack		Cable	2014-03-13
1542	AH Systems	SAS-572	Horn Antenna, Standard Gain, 20 dB	Not Required

11.3 Equipment for Timings, Bandwidth, Peak Power, and Power Spectral Density

The following equipment was used to measure transmitter timings and bandwidth.

Asset #	Manufacturer	Model #	Description	Calibration Due
0582	EMCO	3115	Ridge Guide Antenna	2014-03-14
1342	Rohde & Schwarz	FSP-30	Spectrum Analyzer	2015-01-29
C248	Pasternack		Cable	2014-03-13

Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

Table 1: Summary of Measurement Uncertainties for Site 45

Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
	1 to 18 GHz	3 m	5.7

End of Report

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