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

May 23, 2014

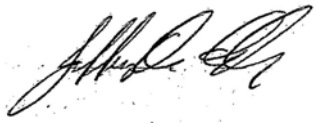
Steve Proffitt, Mickey Malone
Ketra, Inc.
3815 S Capital of Texas Hwy
Suite 100
Austin, TX 78704

Dear Steve, Mickey:

Thank you for allowing Professional Testing (EMI), Inc. an opportunity to perform testing for Ketra, Inc. Enclosed is the Wireless Certification Report for the VER003 2.4GHz Zigbee Module. This report can be used to demonstrate compliance with FCC and IC requirements for wireless devices in North America.

If you have any questions, please contact me.

Sincerely,



Jeffrey A. Lenk
President

Attachment

Project 15714-15

VER003 2.4GHz Zigbee Module

Wireless Certification Report

Prepared for:

Ketra, Inc.

By

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

May 23, 2014

Reviewed by	Written by
	
Larry Finn	Eric Lifsey
Product Development Engineer	Test Engineer

Revision History

Revision Number	Description	Date
00	Draft Release	April 17, 2014
01	Revised per comments Larry Finn	April 17, 2014

Table of Contents

Certificate of Compliance

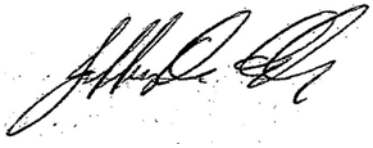
Applicant:	Ketra, Inc.
Applicant's Address:	Ketra, Inc. (Mickey Malone) 3815 S Capital of Texas Hwy Suite 100 Austin, TX 78704 USA
FCC ID:	2AB3CJA7
Model:	VER003 2.4GHz Zigbee Module, P/N 830-000005-xx
Project Number:	15714-15
Date:	May 23, 2014

The **VER003 2.4GHz Zigbee Module** by **Ketra, Inc.** was tested utilizing the following documents and found to be in compliance with the required criteria.

Standard	Reference	Detail
FCC 47 CFR Part 15 C	15.247	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
FCC 47 CFR Part 15 C	15.209	Radiated emission limits; general requirements.
FCC 47 CFR Part 15 C	15.207	Conducted limits.
FCC 47 CFR Part 15 C	15.205	Restricted Bands of Operation
KDB718828	DR01	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
KDB412172	D01	Guidelines for Determining the ERP and EIRP of an RF Transmitting System
OET Bulletin 65*	Edition 97-01, and Supplement C, Ed. 01-01	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
RSS-210	Issue 8	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS-Gen	Issue 3	General Requirements and Information for the Certification of Radio Apparatus
RSS-102	Issue 4	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

*MPE is reported separately from this document.

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 Ketra, Inc. The undersigned is responsible for ensuring that the VER003 2.4GHz Zigbee Module by Ketra, Inc. will continue to comply with the applicable rules.

_____

Representative of Ketra, Inc.

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

The EUT is a small wireless transceiver module and is identified below:

Table 1.2.1: Equipment Under Test

Manufacturer	Model	Serial #	Description
Ketra, Inc.	VER003 2.4GHz Zigbee Module P/N 830-000005-xx	None	Wireless modular radio.

The antenna is etched on the circuit board. There is no antenna connector on the finished product. The EUT is powered by a 3 V power source.

The EUT measures approximately 18 x 24 mm. A photograph 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. The EUT is held down in a fixture that makes electrical contact with the modules edge connectors to supply power and commands.

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

Commanding the EUT to operate was accomplished by software on a laptop application then passed through a development adapter, a Silabs model EM-ISA3-76E. The Silabs EM-ISA3-76E and the EUT received power from a wall-pluggable commercial USB power supply. Once the desired EUT operation was initiated, the laptop was disconnected and removed from the test configuration.

This is not a hand held device.

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 Fundamental Power

2.1 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 then measured.

2.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247(a)(3) // RSS-210 Issue 8, A2.9	Fundamental Power Conducted Limit: 1 Watt Restated as Field Strength 125.2 dBµV/m @ 3 m	2014-03-25 2014-05-04

2.3 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 3 MHz. Results are presented below:

Fundamental Power Measured as Field Strength Conducted Limit 1 Watt (30 dBm) Limit Restated as Field Strength 125.2 dBµV/m @ 3 m

Vertical Polarity	
Frequency GHz	Corrected Measured Peak Power at 3 m dBµV/m
2.405	97.7
2.440	93.2
2.480	90.5

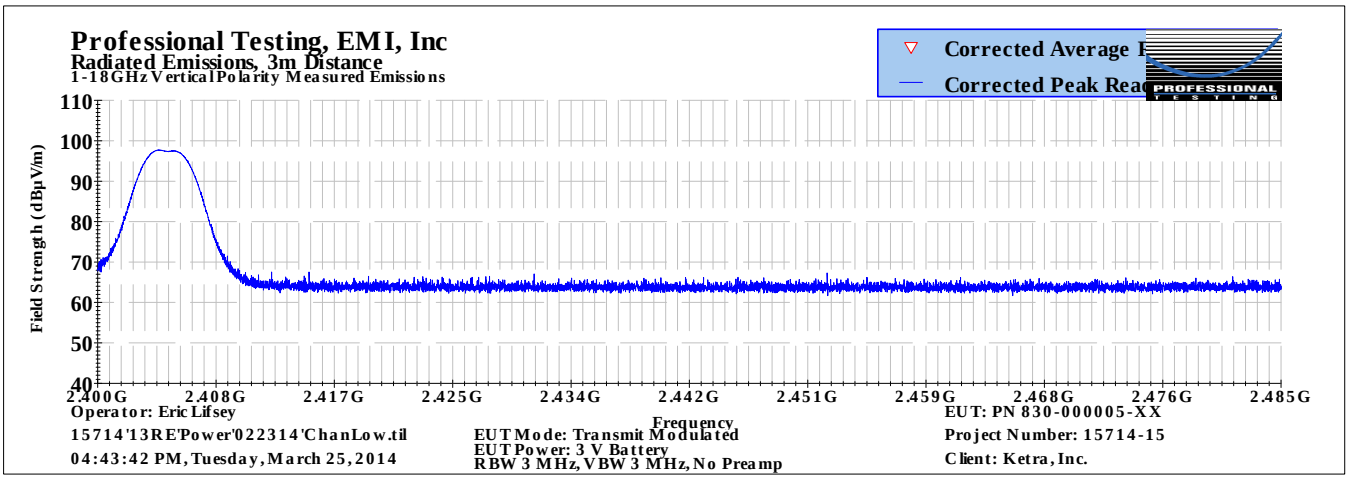
Measured in 3 MHz RBW, 3 MHz VBW.

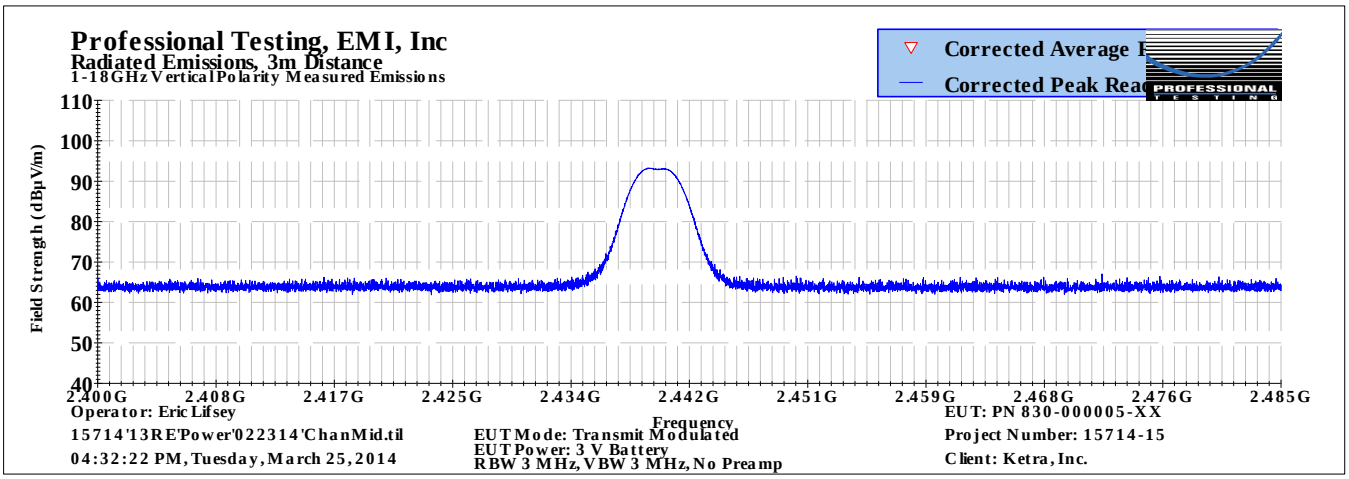
Horizontal Polarity	
Frequency GHz	Corrected Measured Peak Power at 3 m dBµV/m
2.405	97.7
2.440	95.9
2.480	90.1

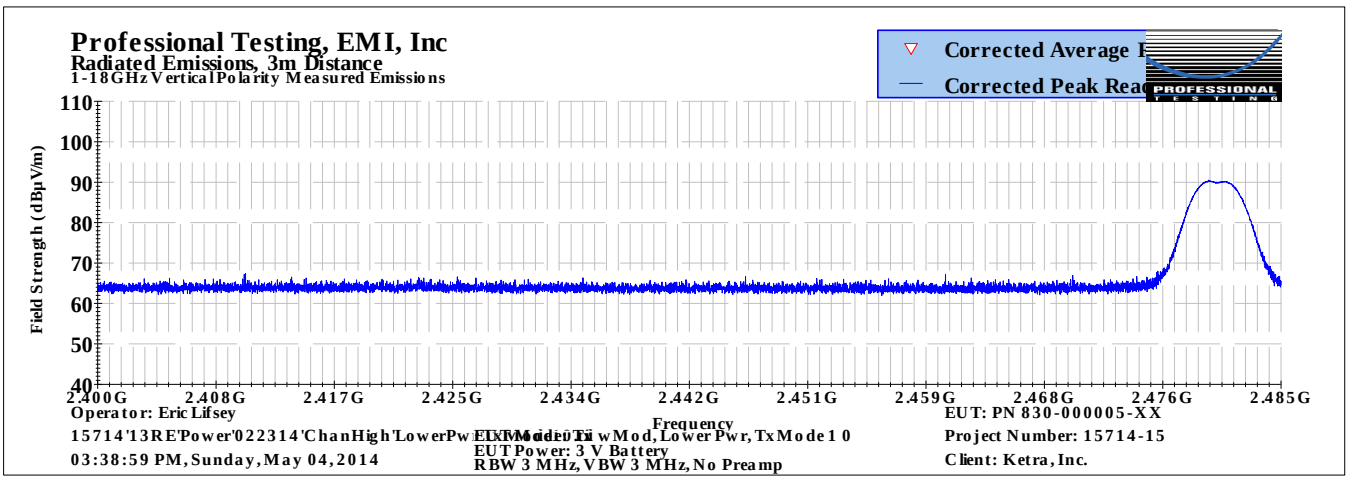
Measured in 3 MHz RBW, 3 MHz VBW.

The EUT was found to be in compliance with the applicable criteria. Plotted measurement appears below. Highest emissions were in horizontal polarity. Note that the highest frequency channel has power reduced to satisfy band-edge emissions.

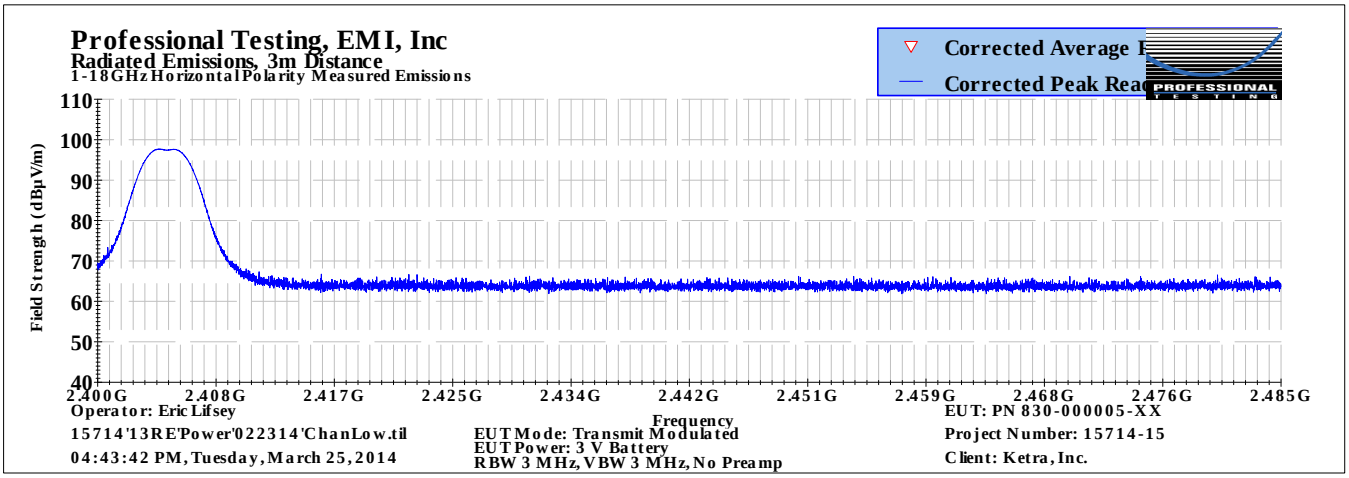
2.3.1 Vertical Polarity

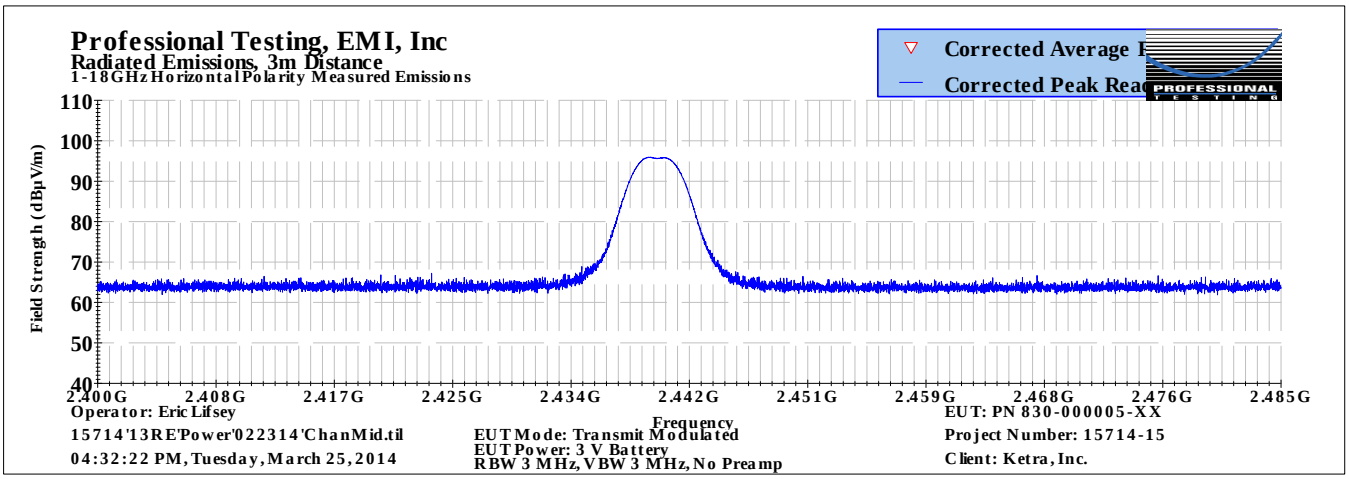


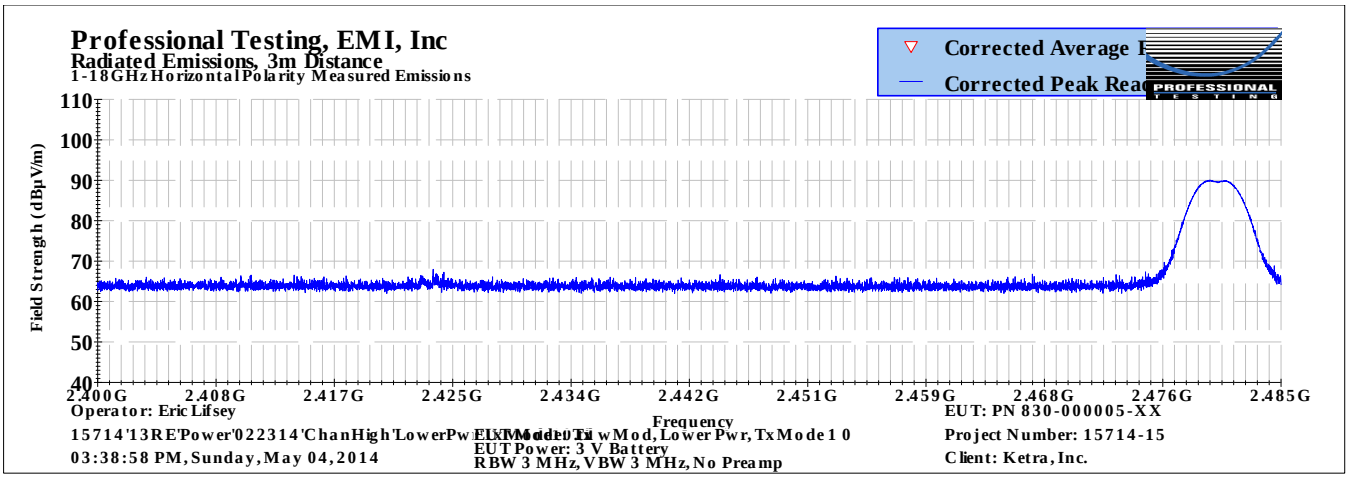




2.3.2 Horizontal Polarity







3.0 Power Spectral Density

3.1 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.

3.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247e // RSS-210 Issue 8, A2.9	Power Spectral Density Conducted Limit: 8 dBm / 3 kHz Restated as Field Strength 103.2 dBµV/m @ 3 m Restated as Field Strength 112.7 dBµV/m @ 1 m	2014-04-02

3.3 Test Results

Power Spectral Density
Conducted Limit 8 dBm, Measured Radiated
Polarity Per Highest Measured for Peak Power

Frequency GHz	Polarity	Raw Measured Field Strength dBµV	Antenna Factor dB	Cable Loss dB	Corrected* Measured Peak PSD at 1 m dBµV/m
2.405	H	60.61	28.2	1.6	90.41
2.440	H	58.97	28.2	1.6	88.77
2.480	H	54.89	28.2	1.6	84.69

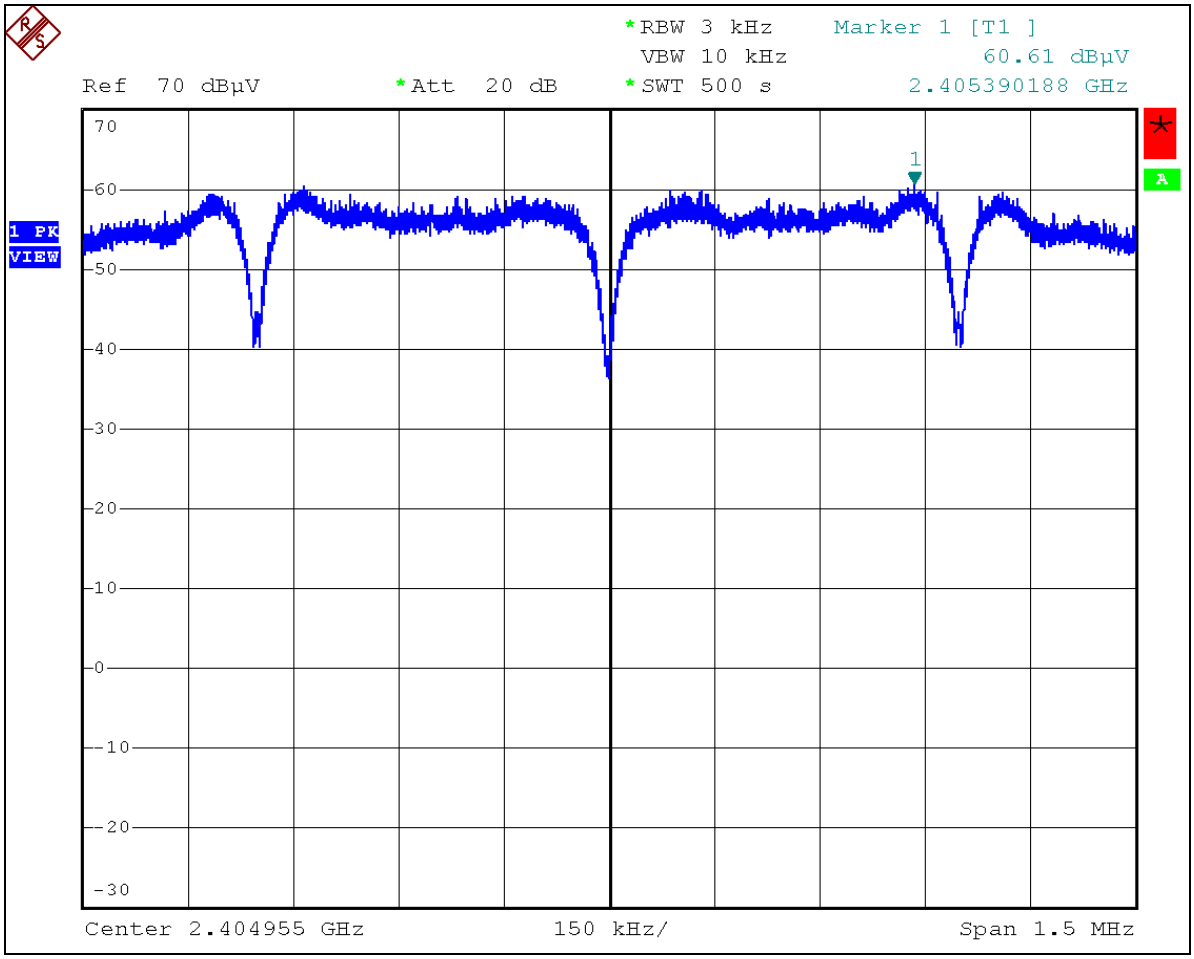
*Factors were added to spectrum analyzer amplitude offset to obtain a direct corrected measurement.

Sweep time 500 seconds.

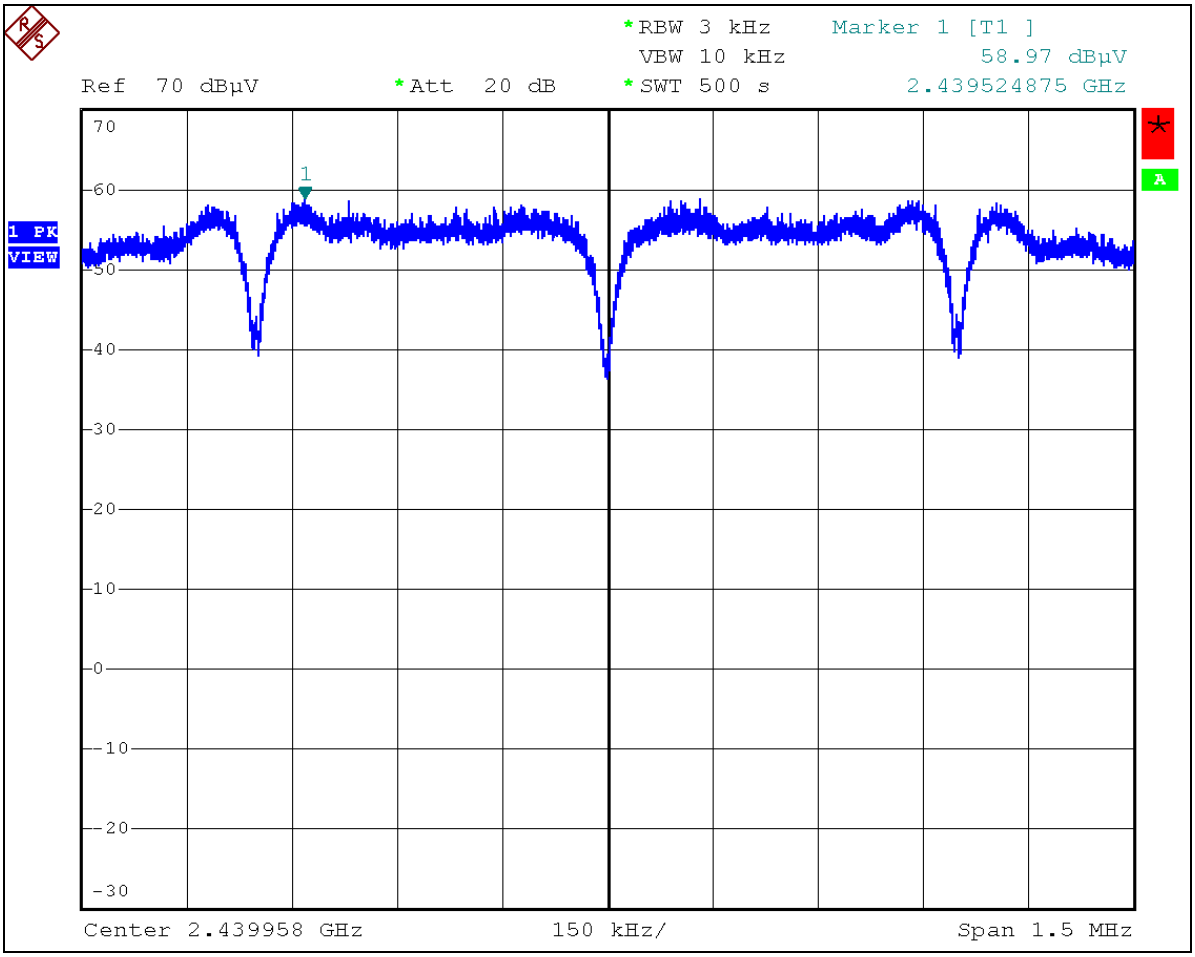
The EUT was found to be in compliance with the applicable criteria.

Plotted measurements appear below.

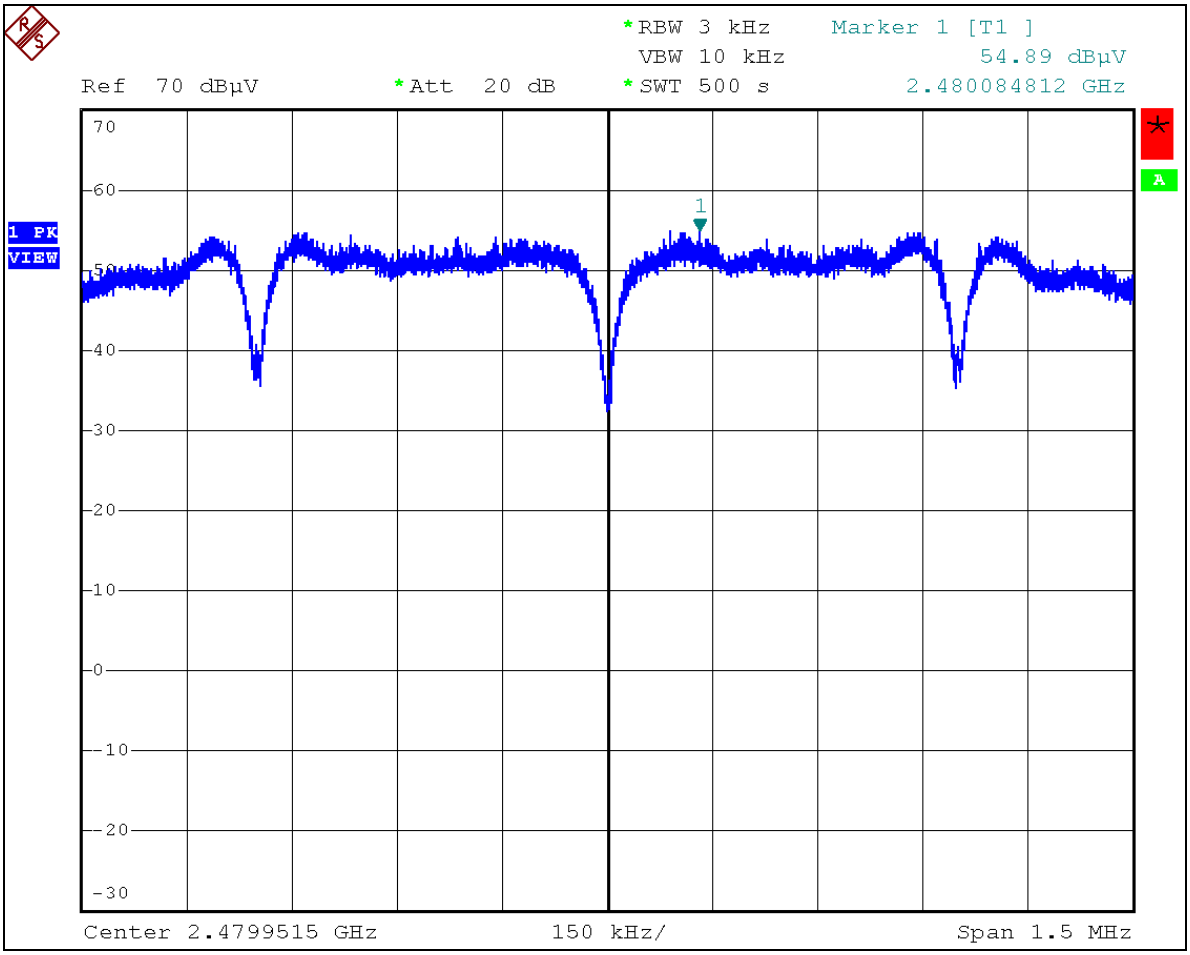
3.3.1 Low Channel PSD



3.3.2 Middle Channel PSD



3.3.3 High Channel PSD



4.0 Transmitter Duty Cycle

4.1 Test Procedure

EUT is placed into worse-case transmit operation to observe and record transmitter time domain performance.

4.2 Test Criteria

Section Reference	Parameter	Date(s)
15.247, RSS210 A2.9(a)	Transmit Duty Cycle	2014-05-02

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.

4.3 Test Results

Table 4.3.1 Duty Cycle Factor Result

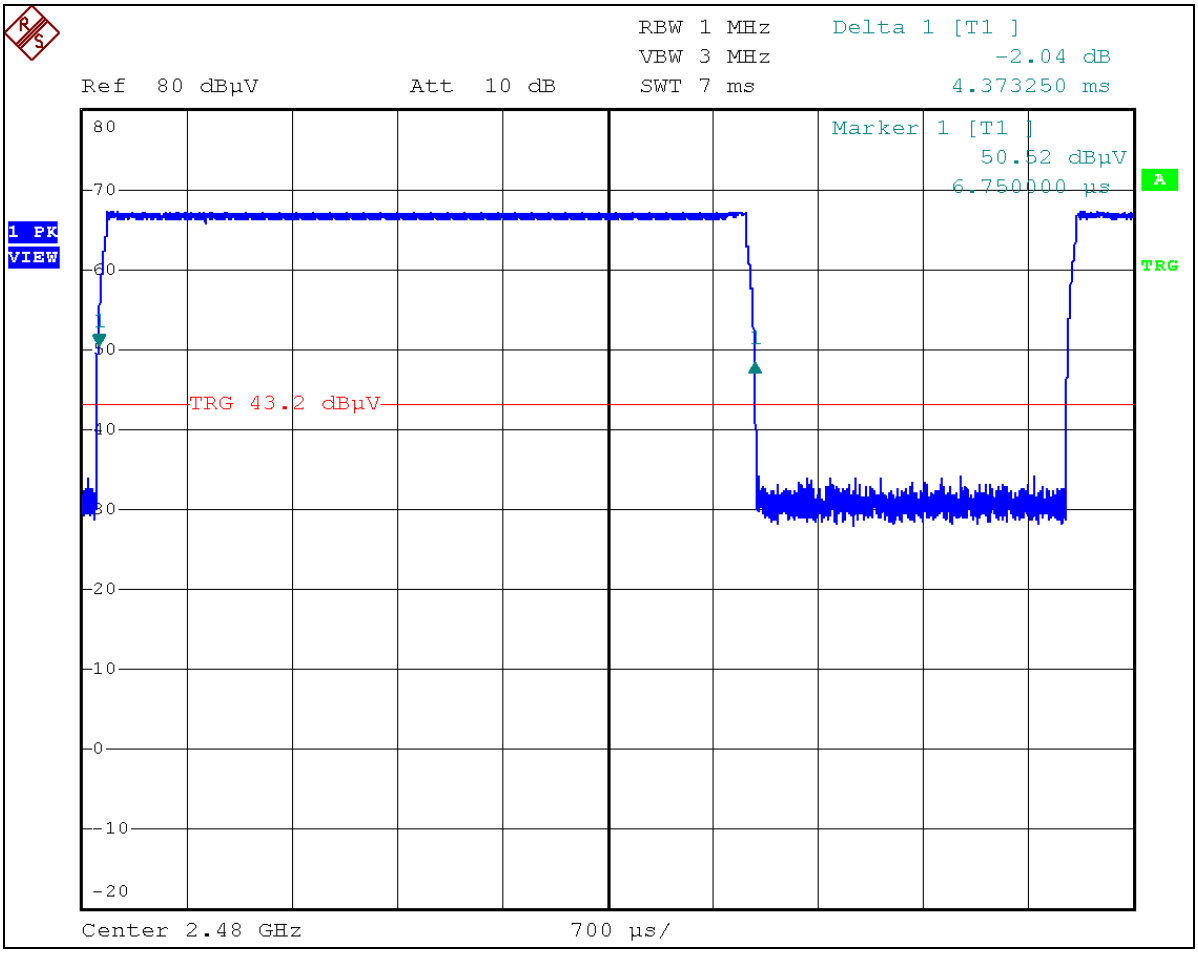
Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
4.373	6.459	= 20 * Log_{10} (4.373 msec / 6.459 msec)	-2.87	-2.87

The allowed duty cycle factor is applied to peak measured fundamental and harmonic signals to find average levels.

The source based factor for exposure is half of the above or: -1.435 dB

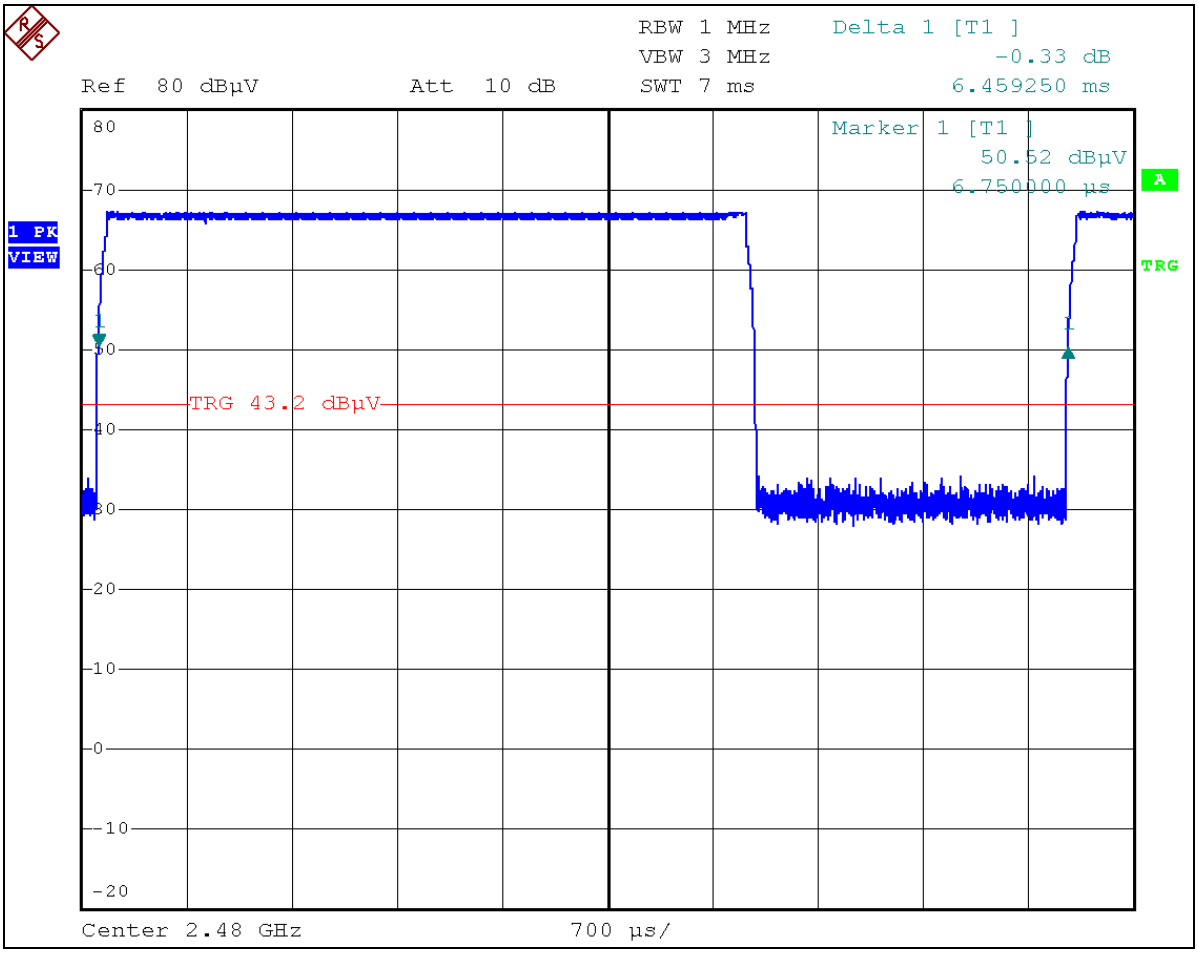
Plotted results appear on the following pages.

Plot 4.3.1 Transmit On Time



Marker 1 delta = 4.373 ms of transmit on time.

Plot 4.3.2 Transmit Period



Marker 1 delta = 6.750 ms of transmit period.

5.0 Occupied Bandwidth

5.1 Test Procedure

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

5.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
14.247(a)(2), 2.1049 // RSS-Gen Issue 3, 4.6	Bandwidth, 6 dB, 20 dB	2014-03-28

5.3 Test Results

EUT was found to be in compliance with applicable requirements.

Bandwidth 6 dB Minimum 500 kHz

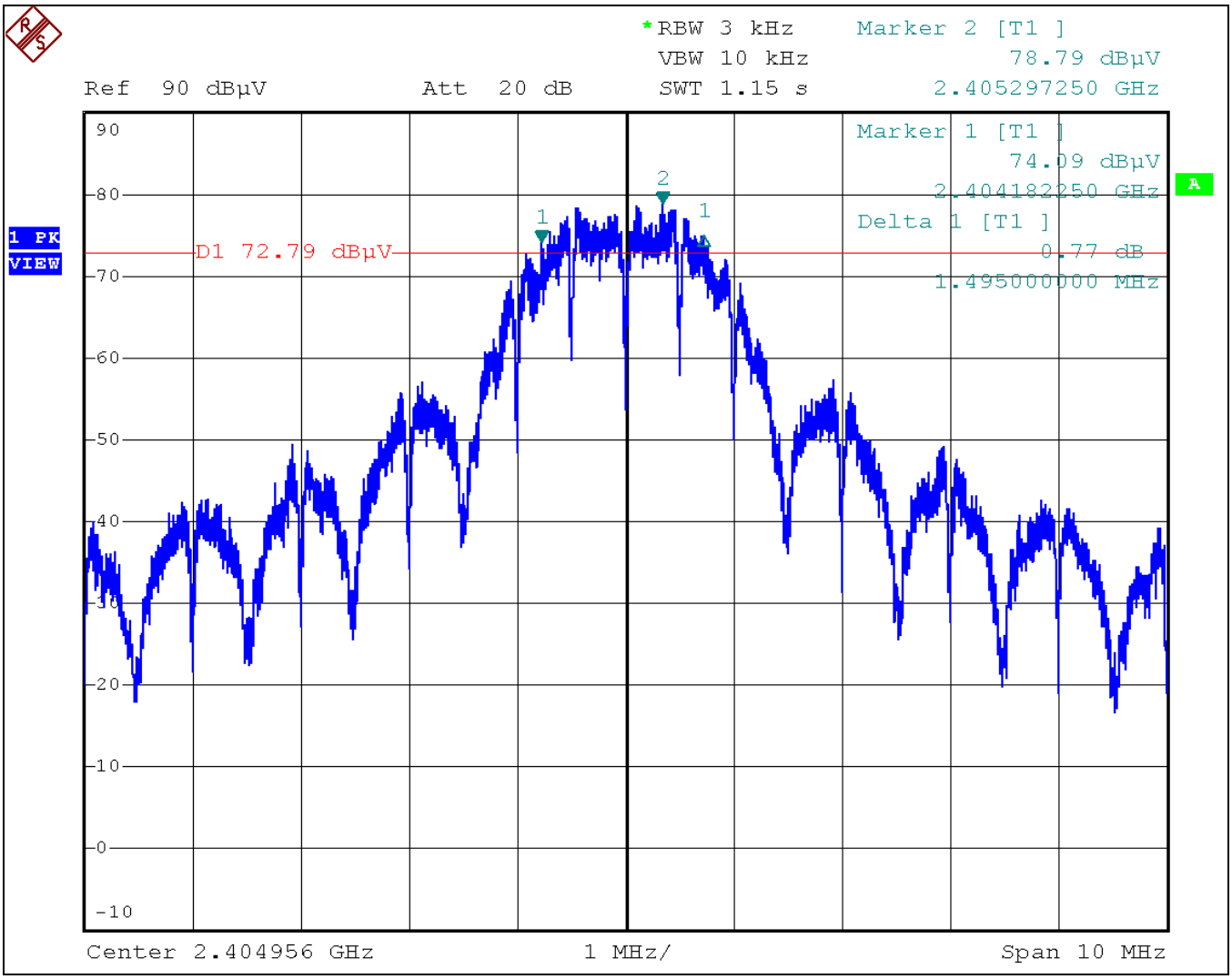
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	**Minimum BW (kHz)**
1495	1486	1529	**1486**

Bandwidth 20 dB Measure and Report

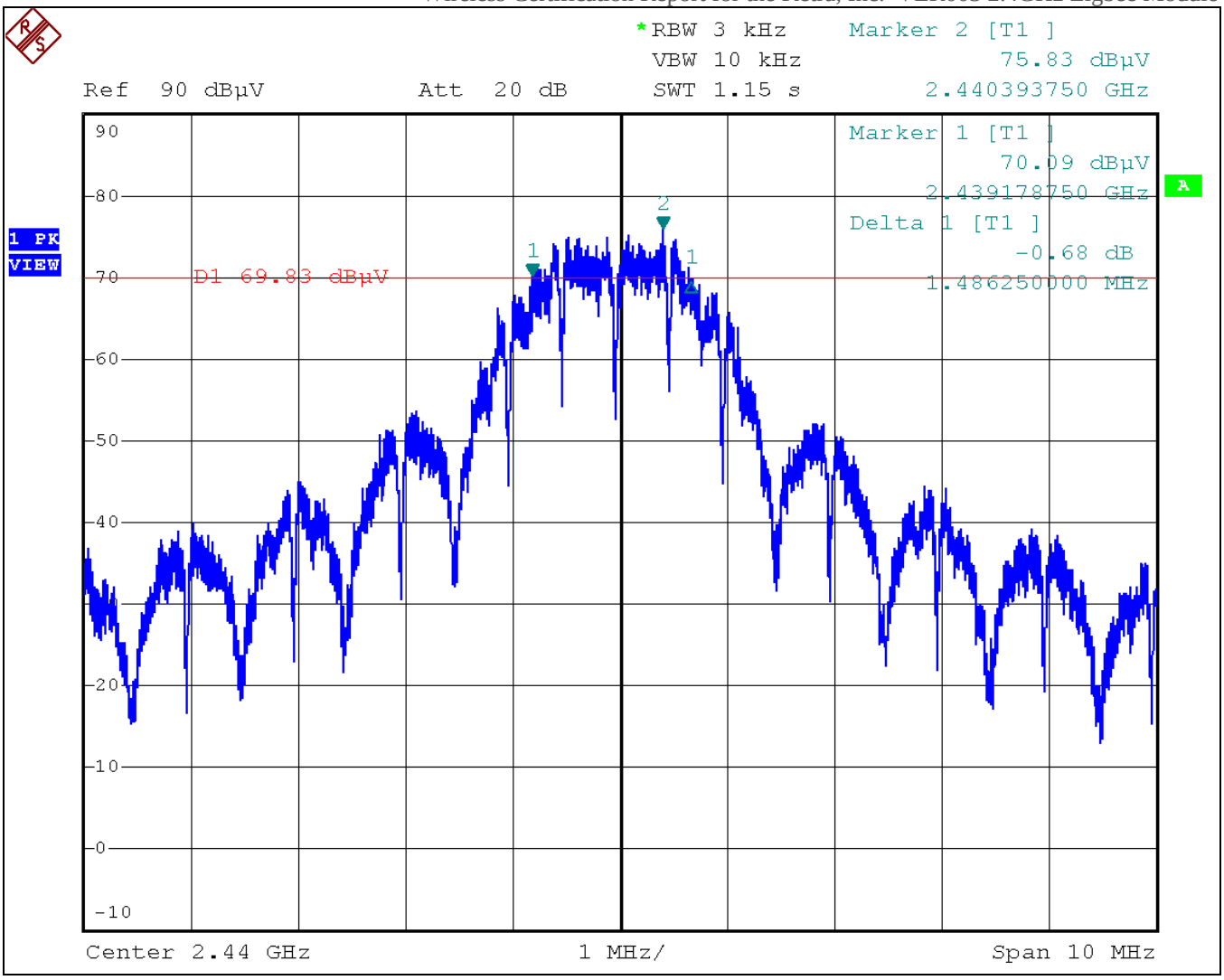
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	**Reported Maximum BW (kHz)**
2600	2559	2617	**2617**

Plotted measurements appear on the following pages.

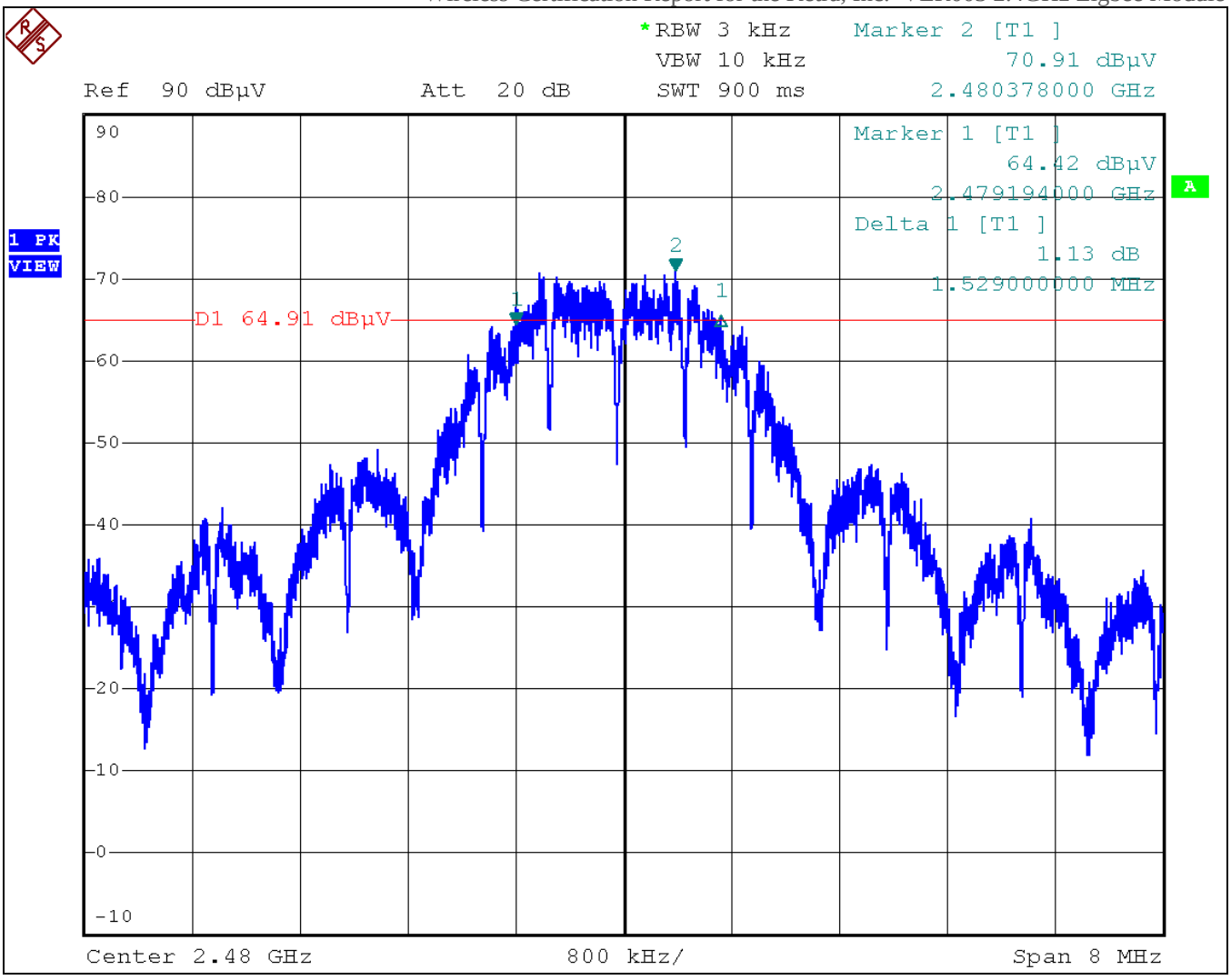
5.3.1 Bandwidth Plots, 6 dB



6 dB, Low Channel

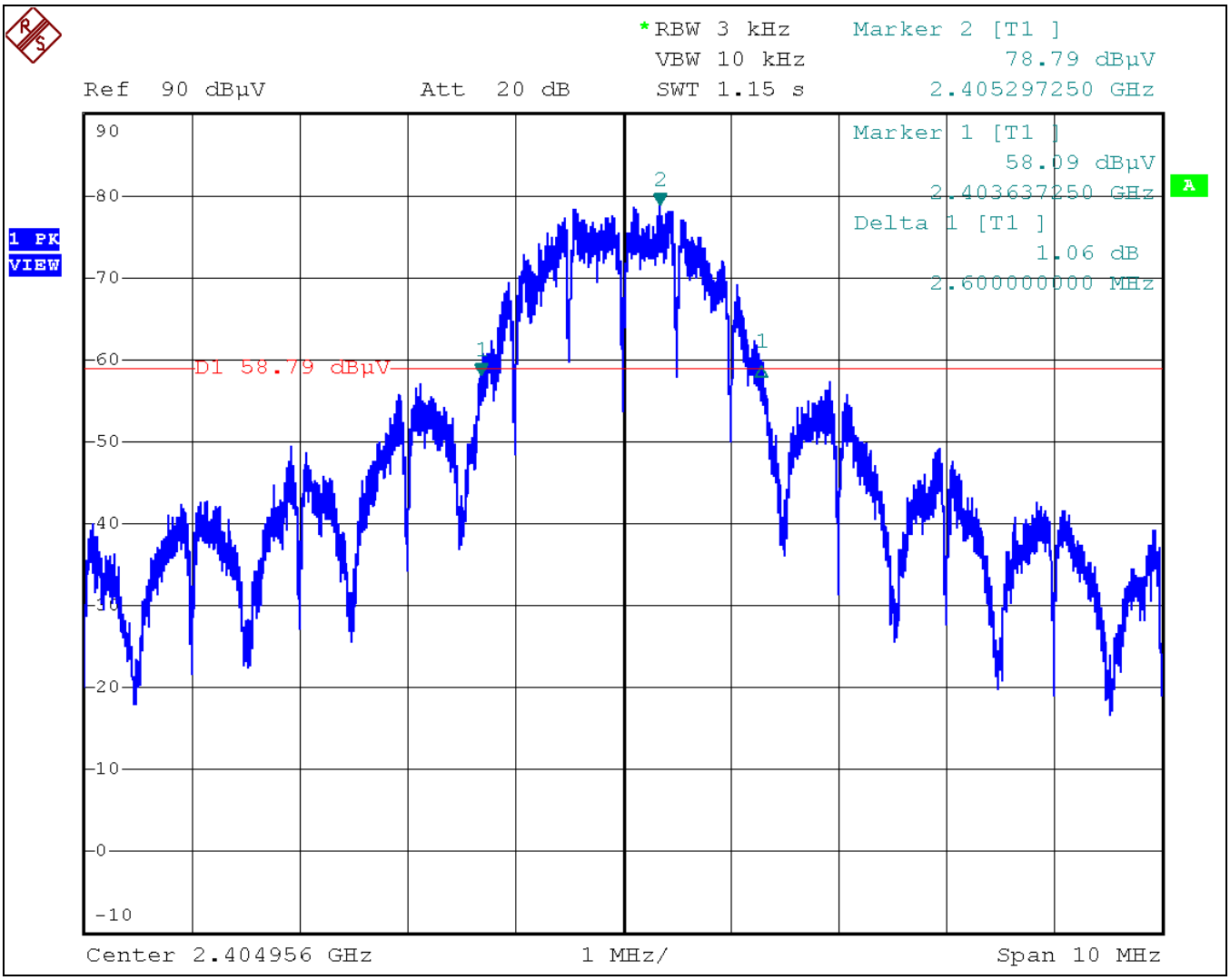


6 dB, Middle Channel

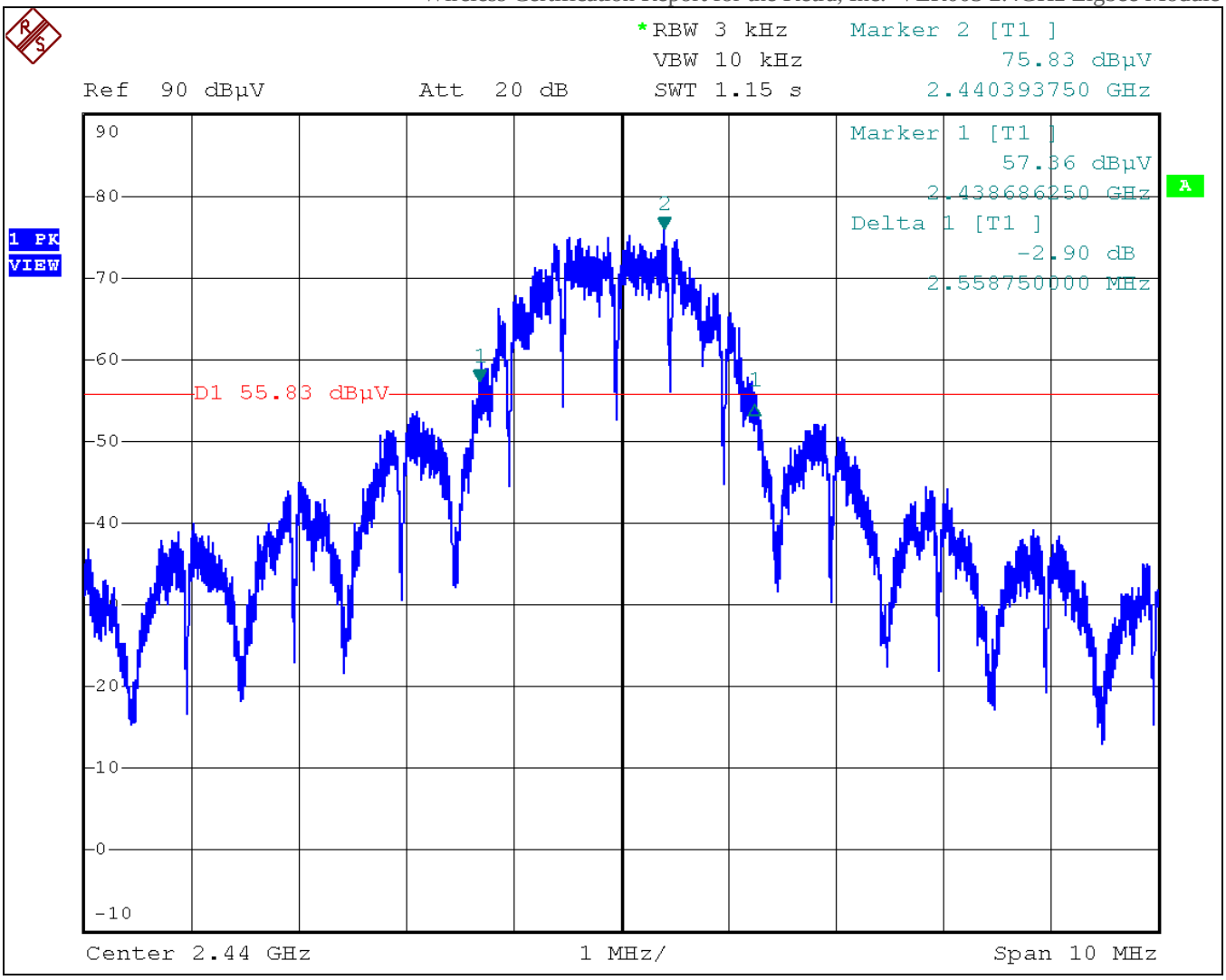


6 dB, High Channel

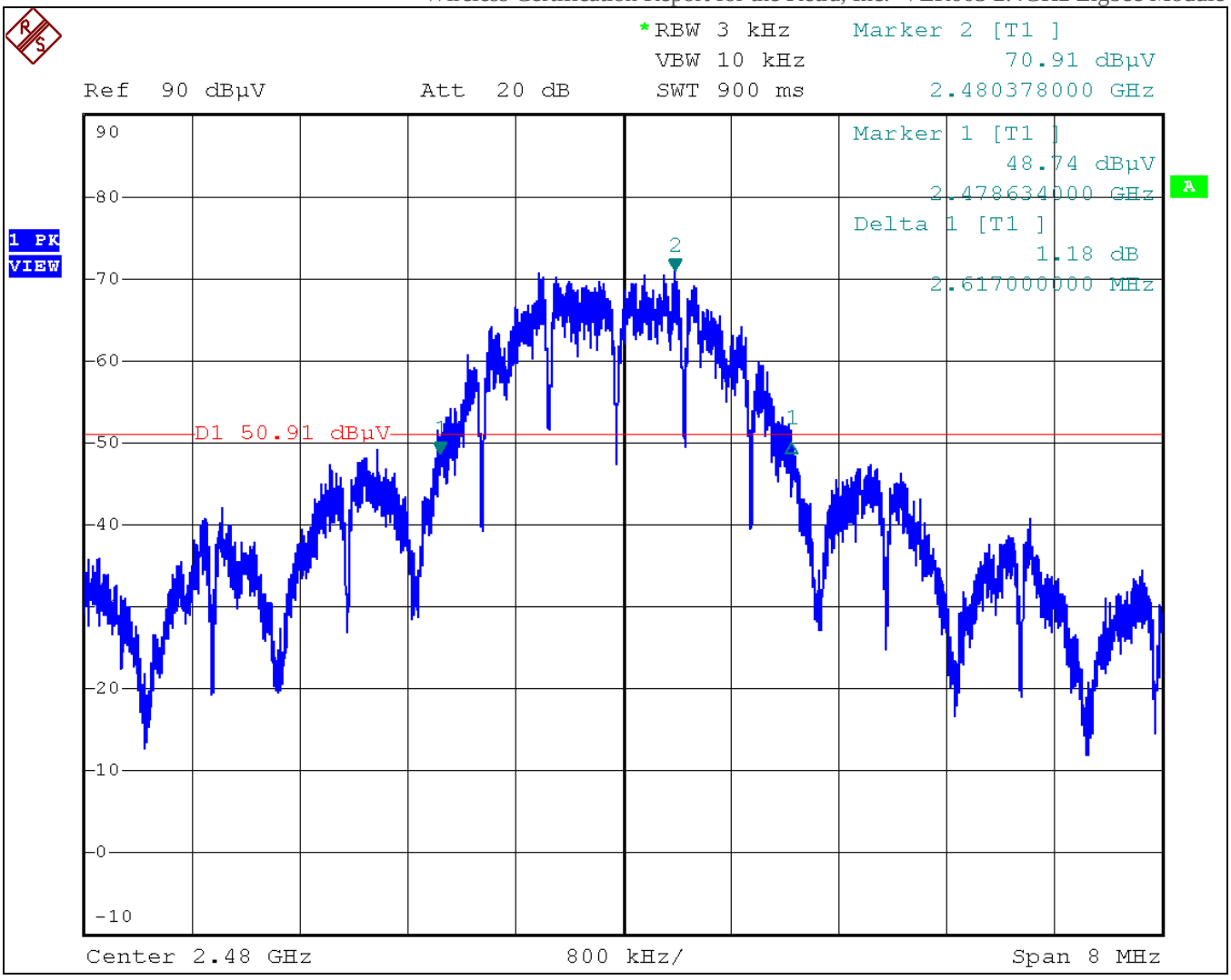
5.3.2 Bandwidth Plots, 20 dB



20 dB, Low Channel



20 dB, Middle Channel



20 dB, High Channel

6.0 Band Edge

6.1 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 3 meters from the measurement antenna.

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. Using peak detection, the analyzer measures emissions in max-hold mode. The measurement range includes two standard bandwidths from the respective band edge and some beyond to see the emission profile clearly. If required, the band-edge marker-delta method of C63.4 is utilized.

6.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.205, 15.209 // RSS-Gen Issue 3, 4.9	Unwanted Emissions Adjacent to Authorized Band, Radiated	2014-04-02

6.3 Test Results

Table 6.3.1 Highest Band Edge Emissions

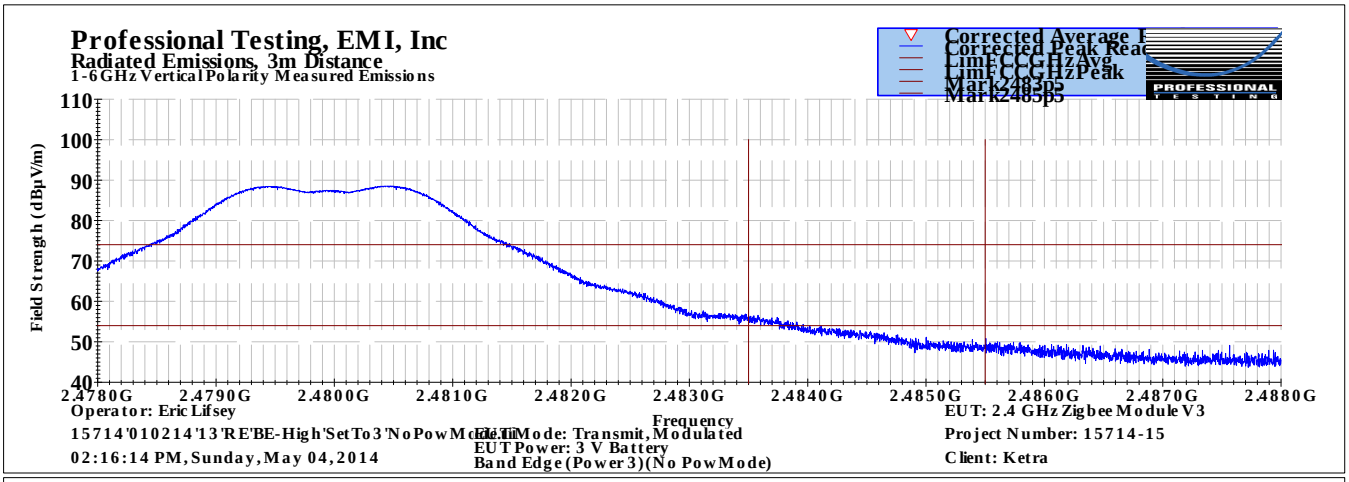
Channel	Polarity	Frequency GHz	Peak Level dBµV/m	Duty Cycle Factor dB	Calculated Average dBµV/m
High*	V	2.483545	56.55	-2.87	53.73
High*	H	2.483556	56.71	-2.87	53.84
Low	V	2.399405	55.51	-2.87	52.64
Low	H	2.399587	56.56	-2.87	53.69

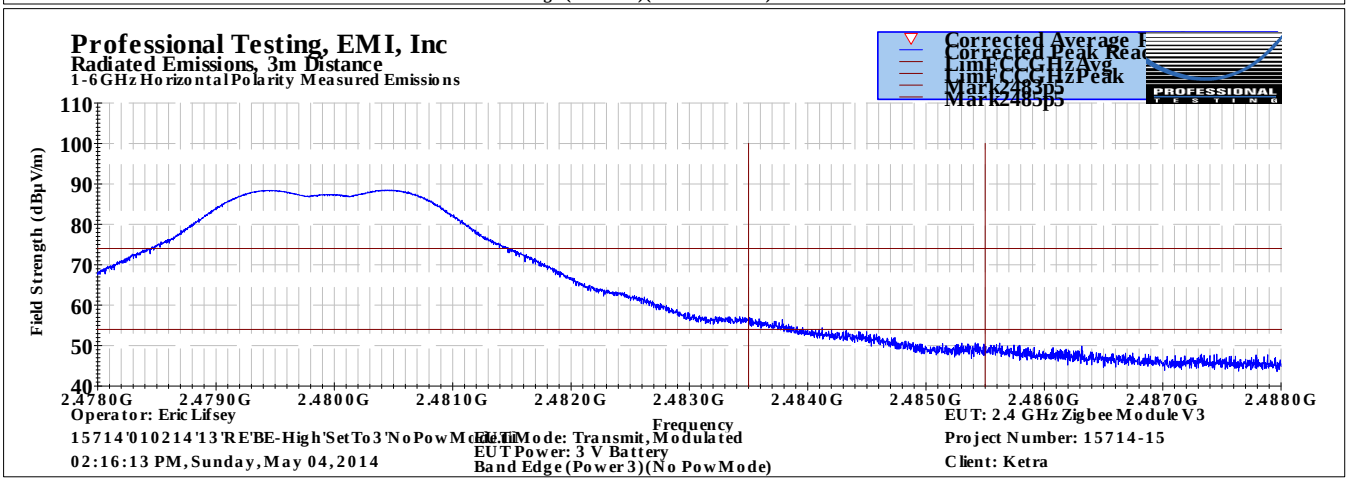
*Restricted band region.

Peak detection emissions at band edges were below the general emission peak limits.

With the duty cycle factor of -2.87 dB applied the EUT satisfied the criteria. Recorded data is presented below.

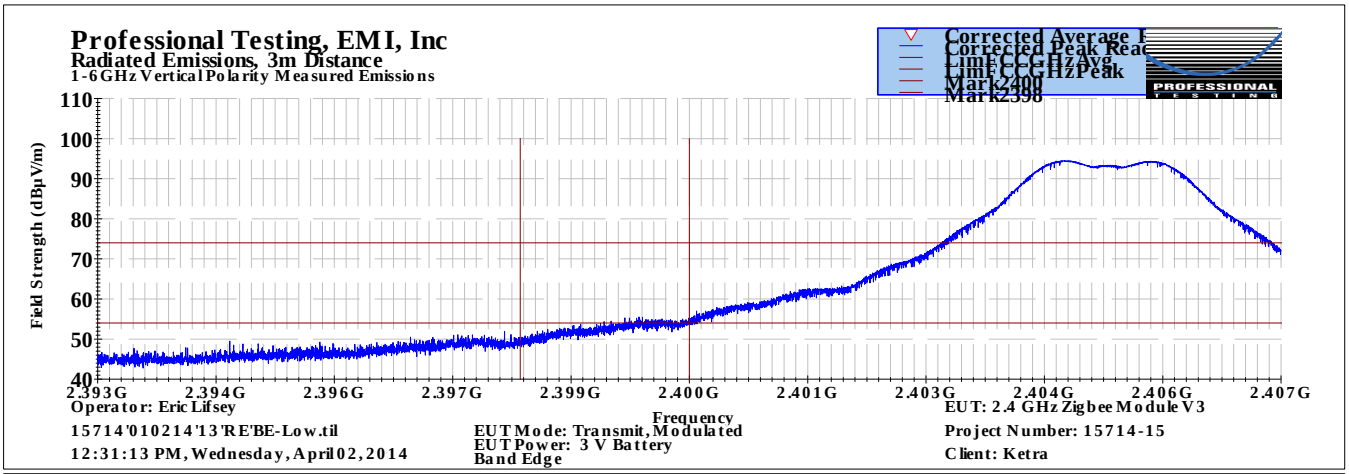
6.3.1 High Channel Band Edge

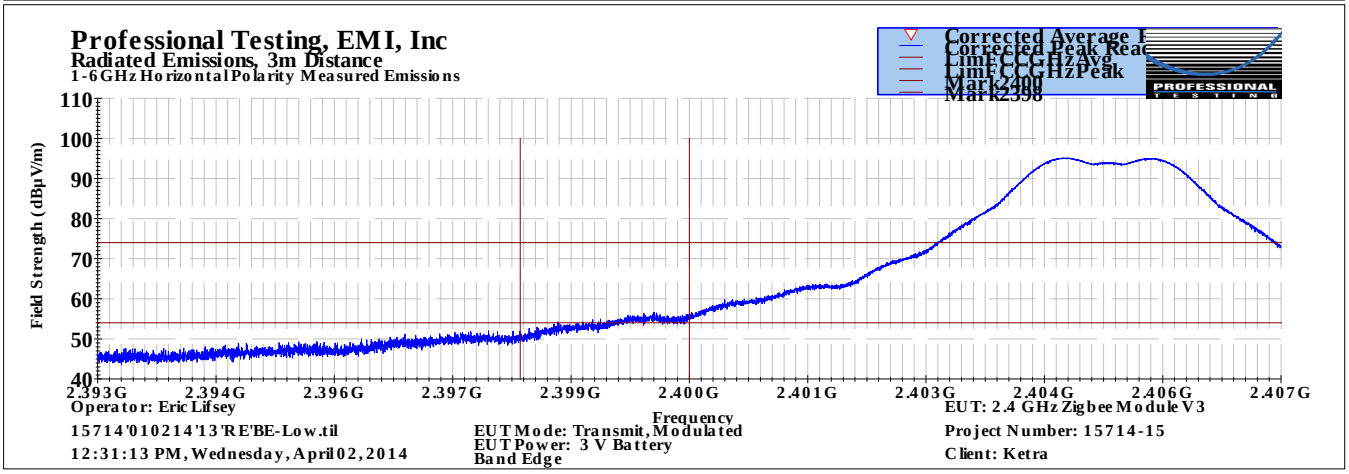




Peak detection levels shown. Vertical markers represent band edge and 2 standard bandwidths beyond.

6.3.2 Low Channel Band Edge





Peak detection levels shown. Vertical markers represent band edge and 2 standard bandwidths beyond.

7.0 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.

7.1 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. The measurement antenna is scanned from 1 to 4 meters in height.

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

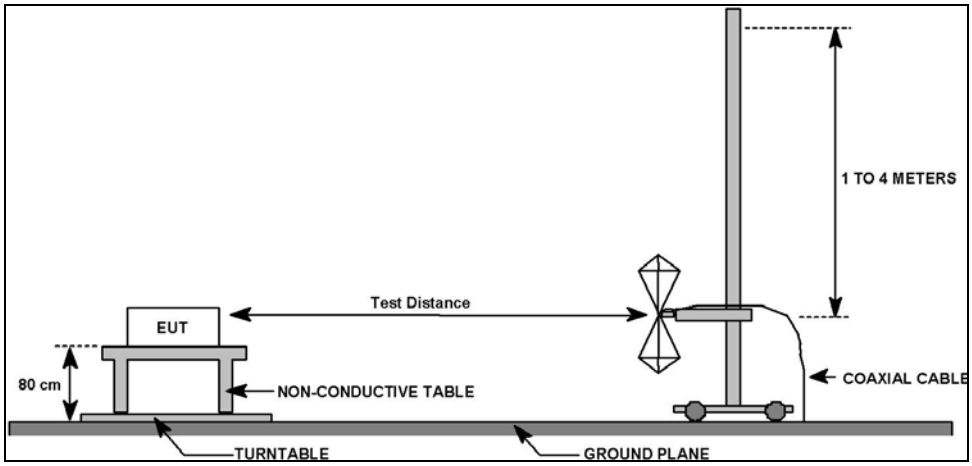


Figure 7.1.1: Field Strength of Spurious Emissions Test Setup

7.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-Gen Issue 3, 4.9, 4.10	Field Strength of Radiated Spurious/Harmonic Emissions	2014-03-25

7.3 Test Results

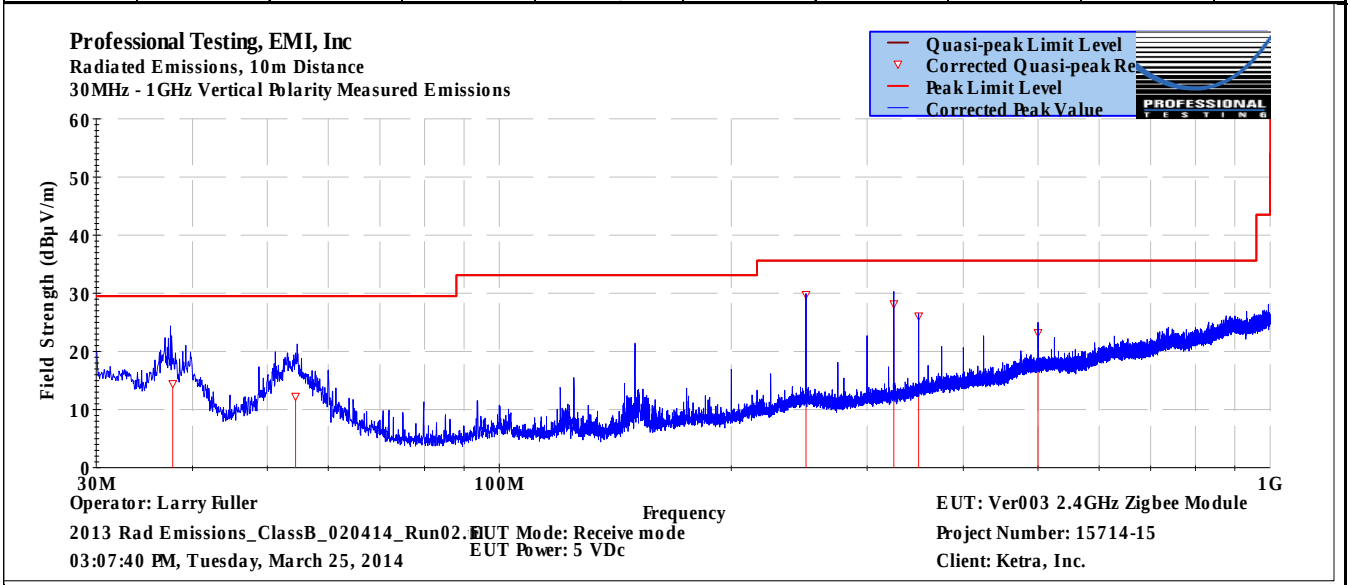
The EUT satisfied the criteria. Recorded data is presented below.

Table 7.3.1: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Vertical Polarity

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	3/25/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Larry Fuller
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	Craig T Phillips

Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	3	VDC	EUT Power Frequency:	0	N/A
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz	
EUT Mode of Operation:			Receive mode		

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
37.7001	10	104	1.29	Quasi-peak	29.7	14.448	39.1	-24.7	Pass
54.4205	10	32	1.73	Quasi-peak	33	12.246	39.1	-26.9	Pass
250.001	10	345	1.23	Quasi-peak	43.1	29.749	46.4	-16.7	Pass
325.001	10	232	1.22	Quasi-peak	41	28.174	46.4	-18.2	Pass
350.007	10	236	1.39	Quasi-peak	38.1	26.075	46.4	-20.3	Pass
500.017	10	206	3.78	Quasi-peak	31.1	23.216	46.4	-23.2	Pass



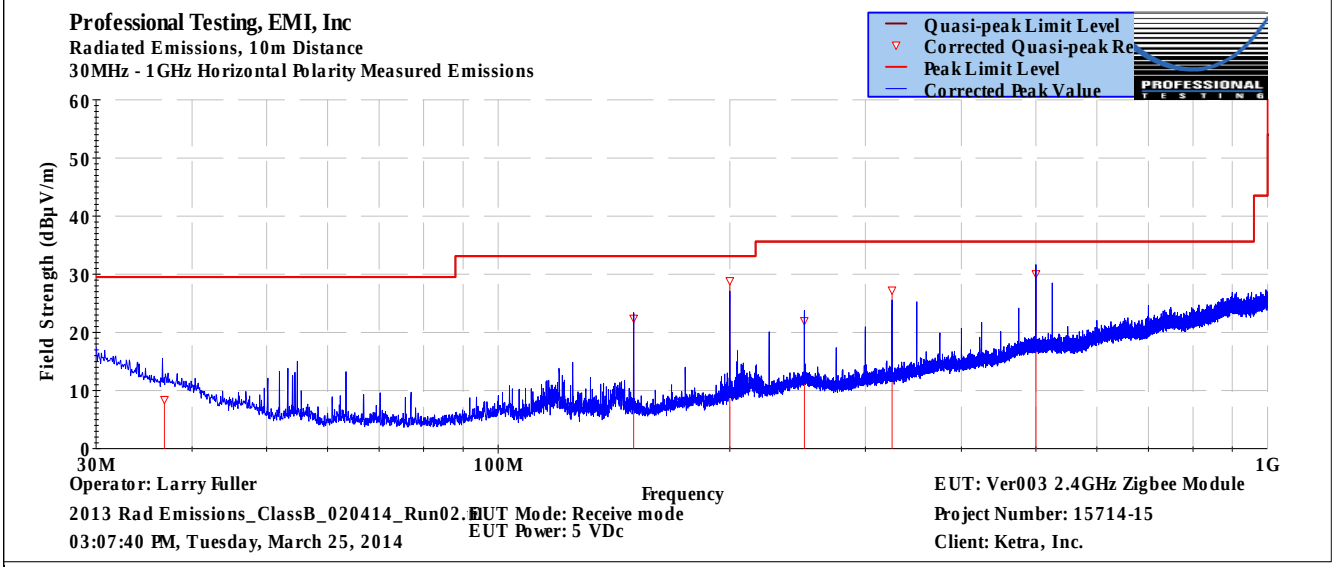
≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.2: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Horizontal Polarity

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	3/25/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Larry Fuller
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	Craig T Phillips

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Receive mode	

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
36.824	10	355	2.8	Quasi-peak	23.2	8.452	39.1	-30.6	Pass
149.994	10	266	3.95	Quasi-peak	42.1	22.42	43.5	-21.1	Pass
200.001	10	141	3.81	Quasi-peak	45.7	28.877	43.5	-14.6	Pass
250.016	10	306	3.74	Quasi-peak	35.4	22.018	46.4	-24.4	Pass
325.017	10	216	2.4	Quasi-peak	40	27.248	46.4	-19.2	Pass
500.006	10	261	1.59	Quasi-peak	38	30.073	46.4	-16.3	Pass



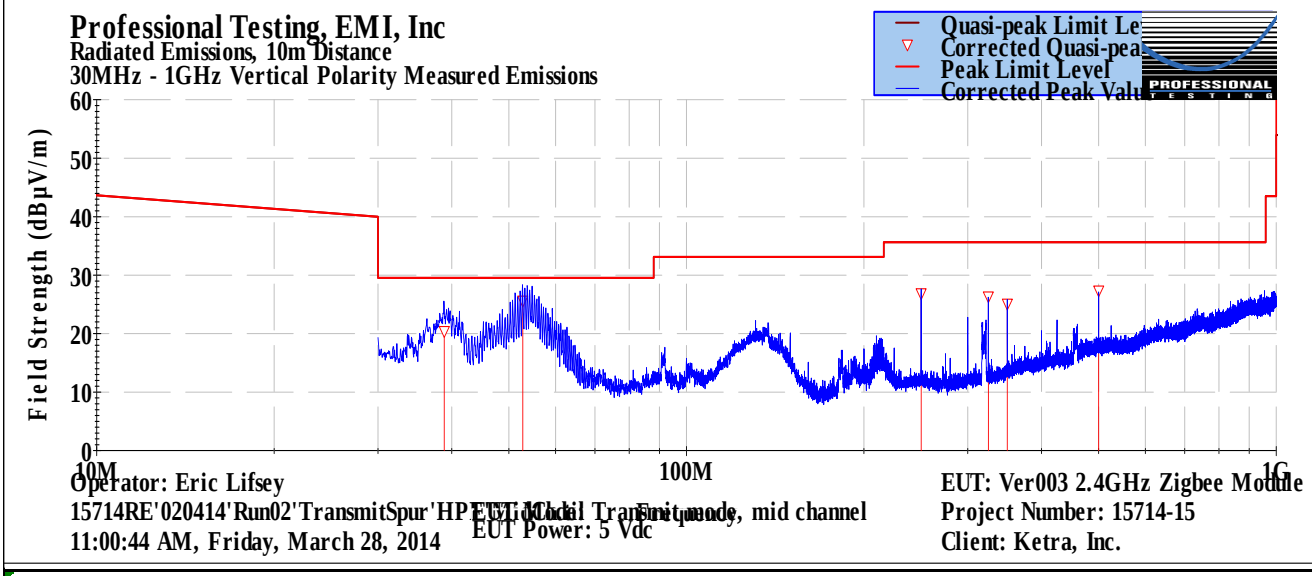
≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.3: Radiated Spurious Emissions, Transmit Mode, Below 1 GHz, Middle Channel, Vertical Polarity

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	3/28/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Eric Lifsey
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	Craig T Phillips

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	120 VDC	EUT Power Frequency:	60 N/A
Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Transmit Mode	

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
38.8596	10	355	1.27	Quasi-peak	36.3	20.42	39.1	-18.7	Pass
52.7708	10	137	3.13	Quasi-peak	46.2	25.624	39.1	-13.5	Pass
250.019	10	357	1.23	Quasi-peak	40.3	26.862	46.4	-19.5	Pass
325.004	10	243	1.3	Quasi-peak	39.1	26.355	46.4	-20.0	Pass
350.005	10	253	1.45	Quasi-peak	37.2	25.087	46.4	-21.3	Pass
500.011	10	66	4.09	Quasi-peak	35.3	27.36	46.4	-19.0	Pass



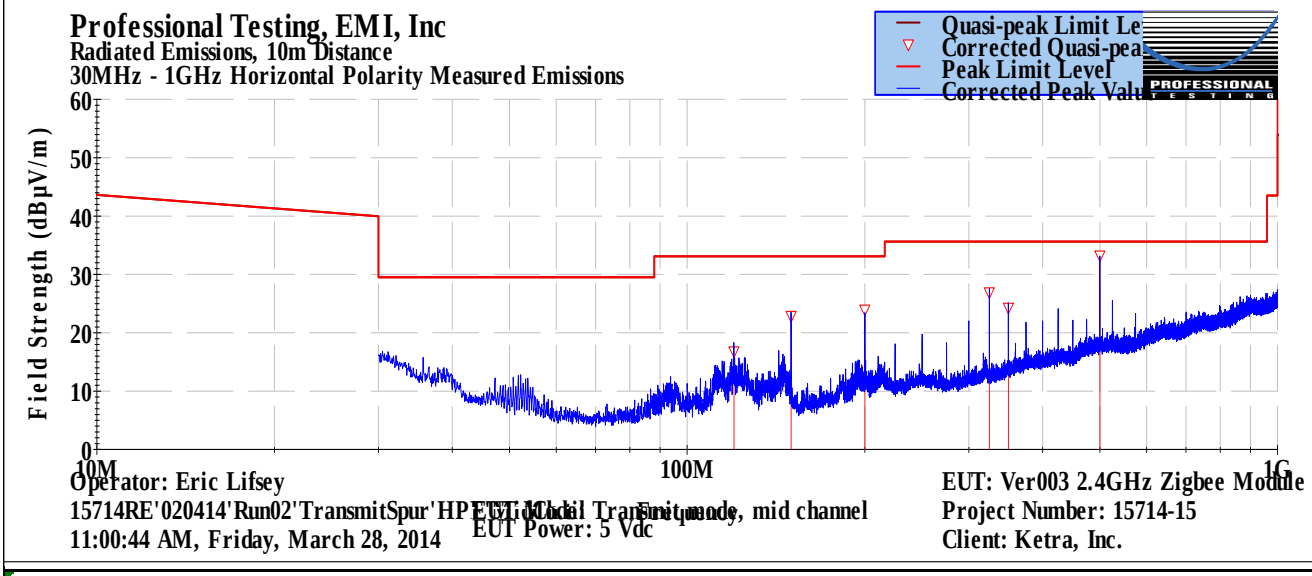
≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.4: Radiated Spurious Emissions, Transmit Mode, Below 1 GHz, Middle Channel, Horizontal Polarity

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	3/28/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Eric Lifsey
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	Craig T Phillips

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Transmit Mode	

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
120.006	10	91	3.66	Quasi-peak	37.7	16.805	43.5	-26.7	Pass
149.993	10	111	3.96	Quasi-peak	42.6	22.878	43.5	-20.6	Pass
199.993	10	304	3.65	Quasi-peak	40.8	23.955	43.5	-19.5	Pass
325.002	10	57	3.06	Quasi-peak	39.7	26.919	46.4	-19.5	Pass
350.005	10	261	2.14	Quasi-peak	36.3	24.273	46.4	-22.1	Pass
500.002	10	61	1.79	Quasi-peak	41.2	33.229	46.4	-13.2	Pass



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

8.0 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.

8.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The EUT was centered on a rotating turntable.

Emissions from 1 GHz to 12 GHz 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. For 12 GHz to 18 GHz, the measurement distance is 1 meter. Above 18 GHz, the measurement distance is 0.5 meters. Emissions are investigated up to 25 GHz to include the 10^{th} 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 in the figure below.

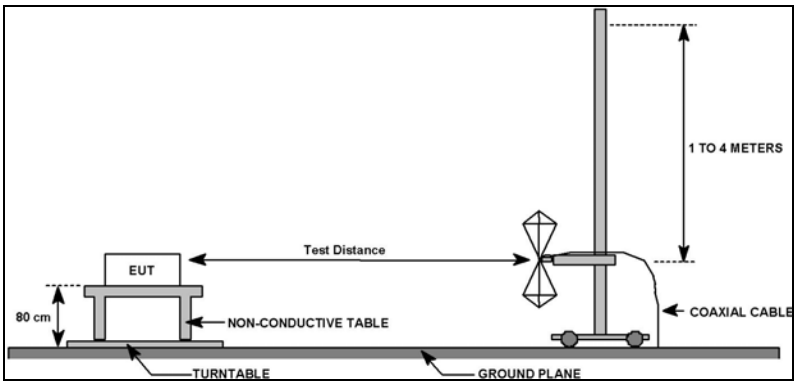


Figure 8.1.1: Field Strength of Spurious Emissions Test Setup

8.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-Gen Issue 3, 4.9, 4.10	Field Strength of Radiated Spurious/Harmonic Emissions	2014-03-25 2014-03-28 2014-05-04

8.3 Test Results

In all cases detector mode is peak, RBW 1 MHz, VBW 3 MHz. The applicable duty cycle factor for averaging is 0 dB. The EUT was receiving on the center channel or transmitting on the indicated channel. All peak emissions can be seen as below the average limit, meaning the average level would also be under the average limit.

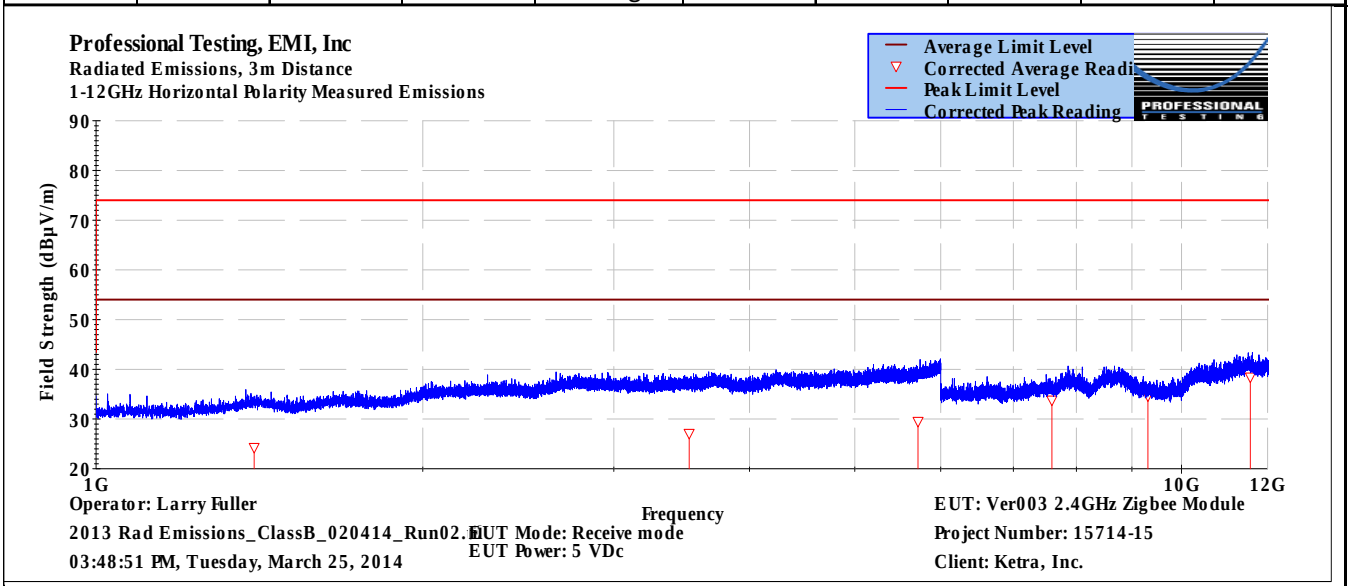
A pre-scan of emissions from 12 GHz to 25 GHz found no measurable signals.

Table 8.3.1: Radiated Spurious Emissions, Receive Mode, 1 to 12 GHz, Vertical Polarity

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	3/25/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Larry Fuller
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	Craig T Phillips

Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	3	VDC	EUT Power Frequency:	0	N/A
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz	
EUT Mode of Operation:	Receive mode				

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
1403.17	3	79	1	Average	35.9	23.192	60.0	-36.8	Pass
3503.7	3	38	1	Average	34.5	27.016	60.0	-32.9	Pass
5739.01	3	128	1	Average	31.5	29.698	60.0	-30.3	Pass
7579.13	3	231	1	Average	28.5	33.805	60.0	-26.2	Pass
9314.66	3	85	1	Average	26.5	34.634	60.0	-25.3	Pass
11572	3	39	1	Average	27.4	38.39	60.0	-21.6	Pass



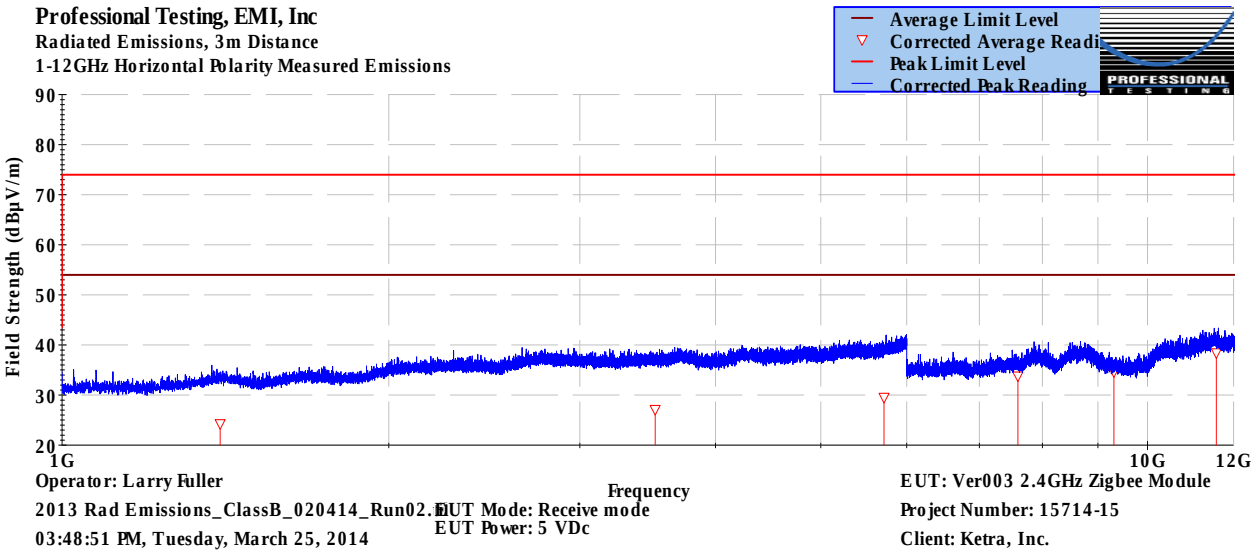
> 1GHz Vertical Antenna Polarity Measured Emissions

Table 8.3.2: Radiated Spurious Emissions, Receive Mode, 1 to 12 GHz, Horizontal Polarity

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	3/25/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Larry Fuller
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	Craig T Phillips

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Receive mode	

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
1398.72	3	279	1	Average	36.9	24.263	60.0	-35.7	Pass
3518.96	3	221	1	Average	34.6	27.105	60.0	-32.9	Pass
5717.8	3	68	1	Average	31.4	29.533	60.0	-30.4	Pass
7595.96	3	352	1	Average	28.3	33.782	60.0	-26.2	Pass
9312.72	3	80	1	Average	26.5	34.649	60.0	-25.3	Pass
11570.2	3	338	1	Average	27.4	38.418	60.0	-21.5	Pass



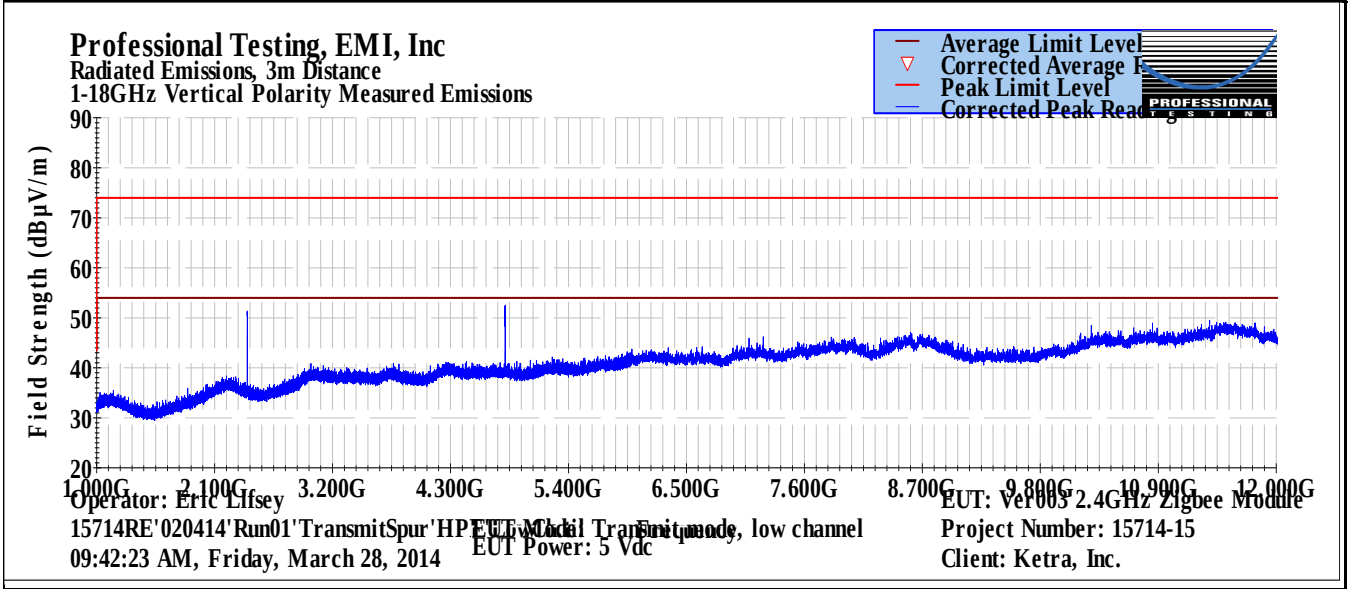
> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 8.3.3: Radiated Spurious Emissions, Transmit Mode, 1 to 12 GHz, Low Channel, Vertical Polarity

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	3/28/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Eric Lifsey
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	Craig T Phillips

Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	3	VDC	EUT Power Frequency:	0	N/A
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz	
EUT Mode of Operation:	Transmit Mode				

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
4811	3	0	1	Peak	52.5	52.5	74.0	-21.5	Pass



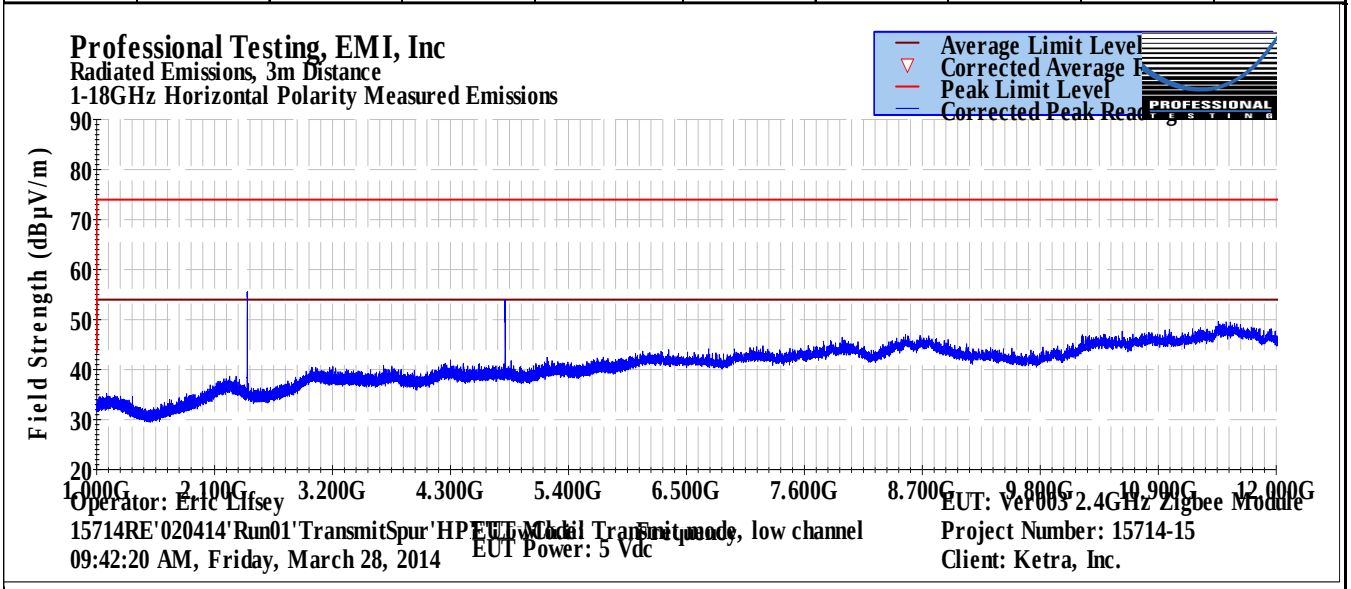
> 1GHz Vertical Antenna Polarity Measured Emissions

Table 8.3.4: Radiated Spurious Emissions, Transmit Mode, 1 to 12 GHz, Low Channel, Horizontal Polarity

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	3/28/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Eric Lifsey
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	Craig T Phillips

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode	

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
4811	3	0	1	Peak	53.9	53.9	74.0	-20.1	Pass



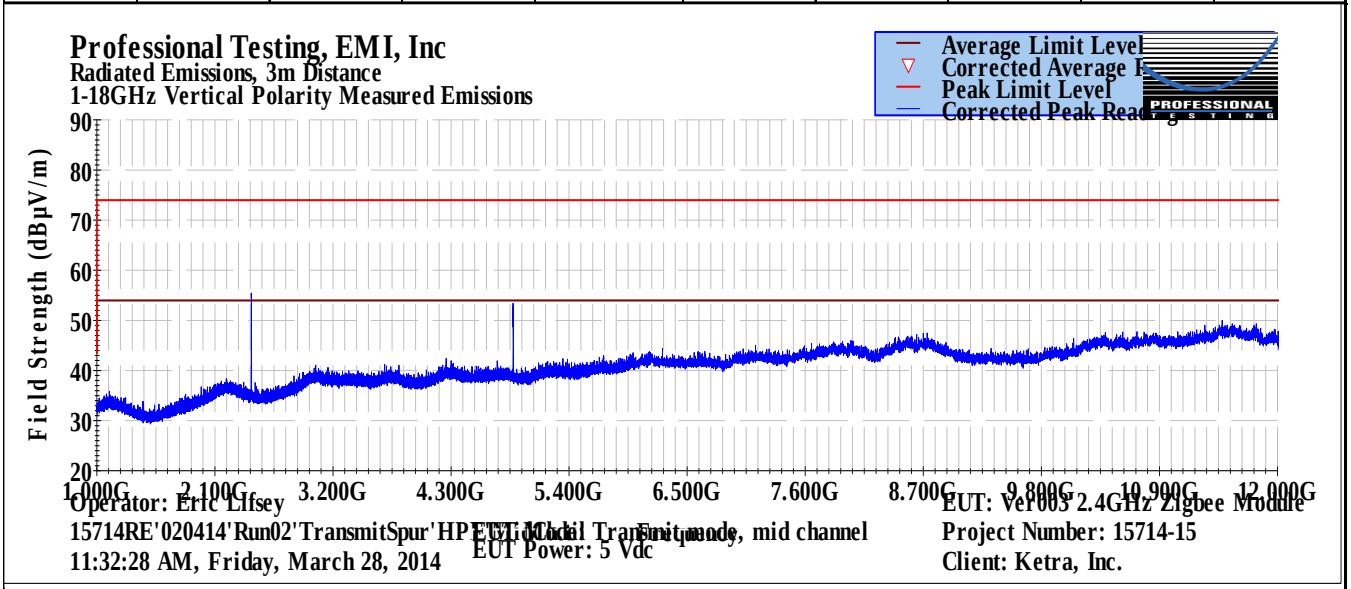
> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 8.3.5: Radiated Spurious Emissions, Transmit Mode, 1 to 12 GHz, Middle Channel, Vertical Polarity

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	3/28/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Eric Lifsey
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	Craig T Phillips

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode	

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
4879	3	0	1	Peak	53.4	53.4	74.0	-20.6	Pass



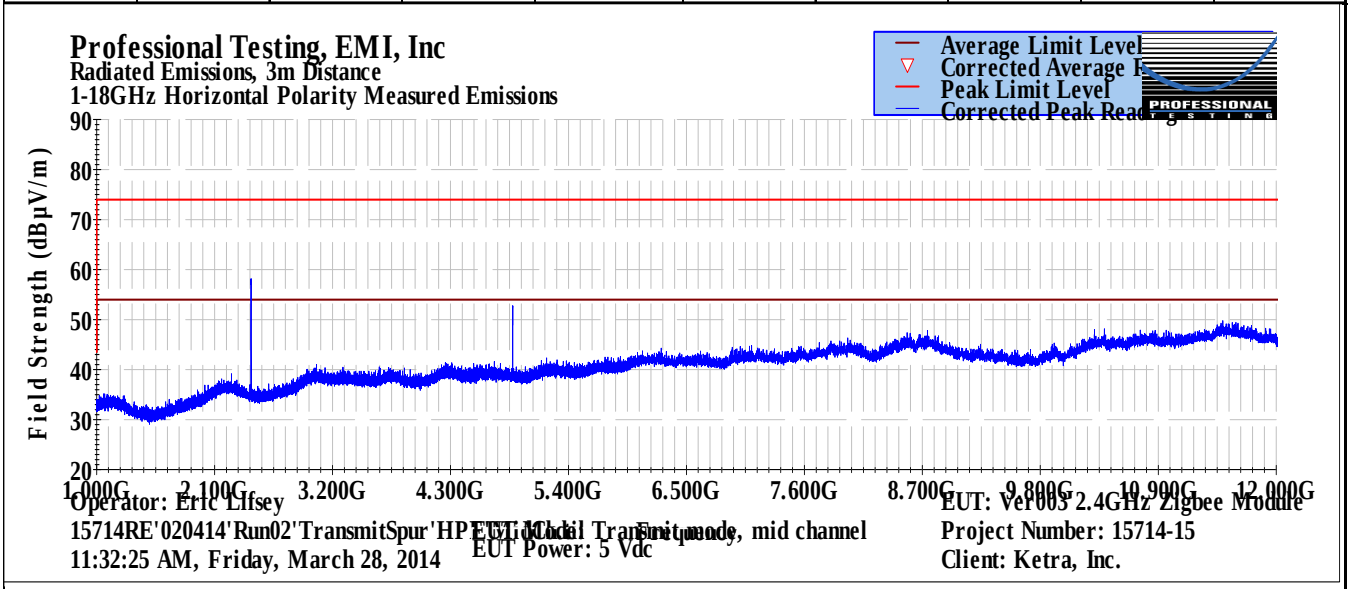
> 1GHz Vertical Antenna Polarity Measured Emissions

Table 8.3.6: Radiated Spurious Emissions, Transmit Mode, 1 to 12 GHz, Middle Channel, Horizontal Polarity

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	3/28/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Eric Lifsey
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	Craig T Phillips

Radiated Emissions Test Results Data Sheet				Page: 1 of 1
EUT Line Voltage:	3 VDC	EUT Power Frequency:	0 N/A	
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz	
EUT Mode of Operation:		Transmit Mode		

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
4879	3	0	1	Peak	52.7	52.7	74.0	-21.3	Pass



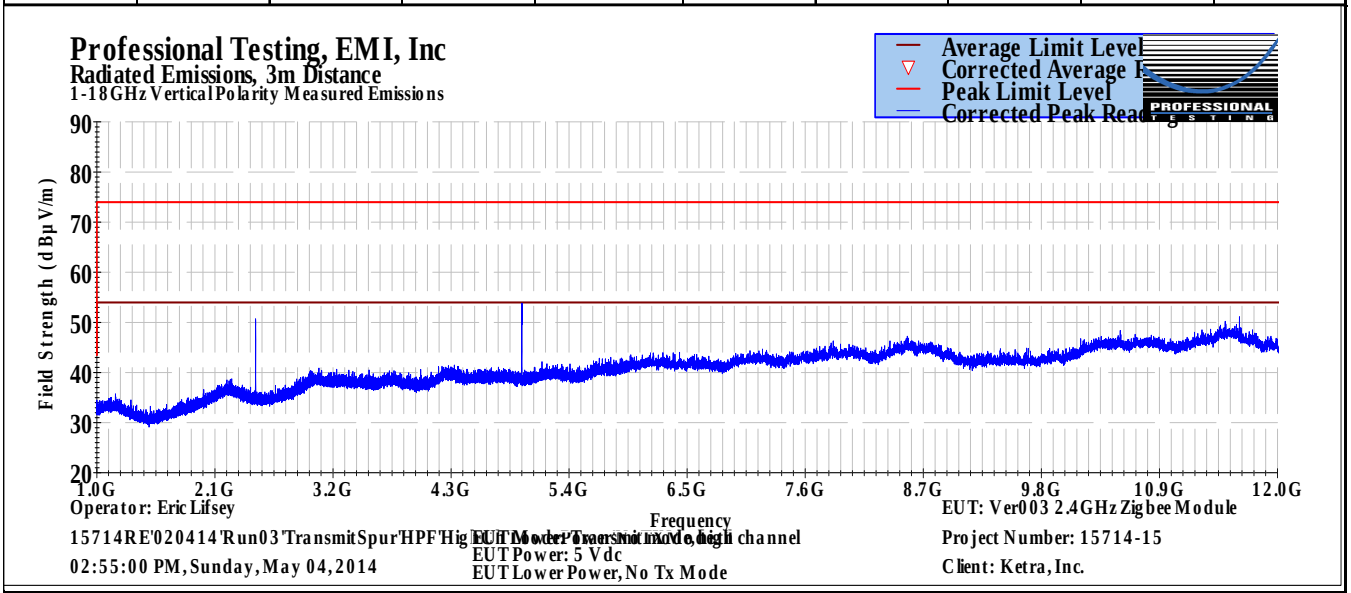
> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 8.3.7: Radiated Spurious Emissions, Transmit Mode, 1 to 12 GHz, High Channel, Vertical Polarity

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):	5/4/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Eric Lifsey
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	3	VDC	EUT Power Frequency:	0	N/A
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz	
EUT Mode of Operation:			Transmit Mode, High Channel, Reduced Power		

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
4960.9	3	120	1	Peak	53.79	53.79	54.0	-0.2	Pass



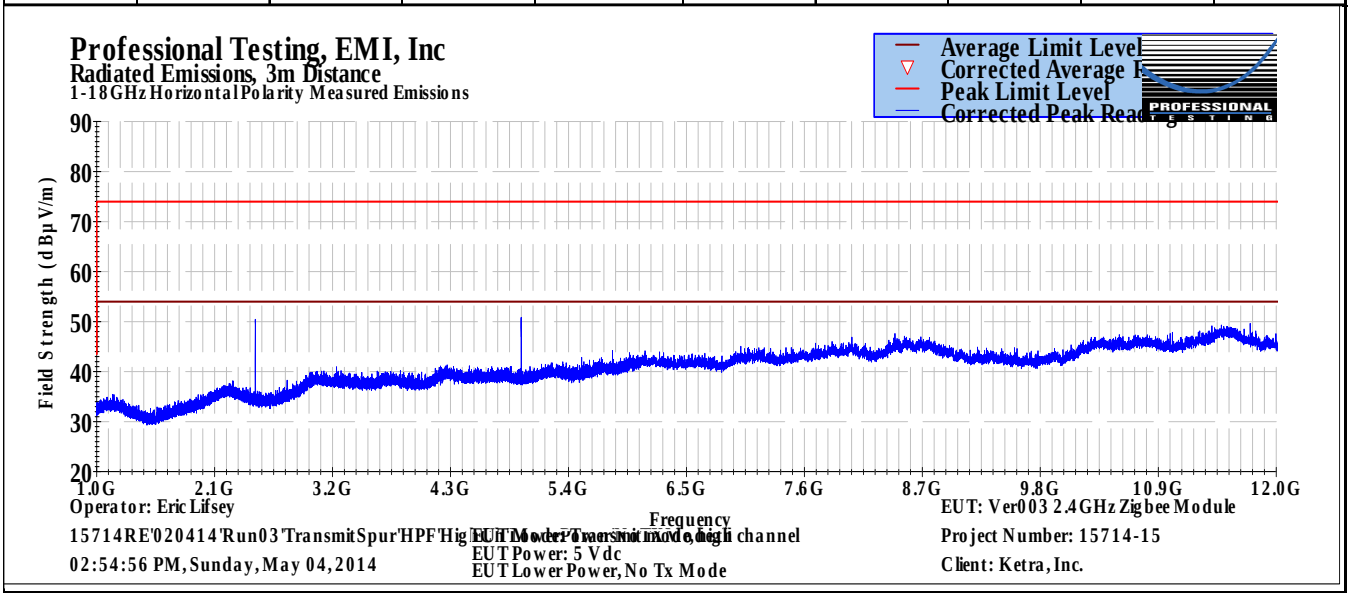
> 1GHz Vertical Antenna Polarity Measured Emissions

Table 8.3.8: Radiated Spurious Emissions, Transmit Mode, 1 to 12 GHz, High Channel, Horizontal Polarity

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):	5/4/2014	EUT Serial #:	N/A
Customer:	Ketra, Inc.	EUT Part #:	None
Project Number:	15714-15	Test Technician:	Eric Lifsey
Purchase Order #:		Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet					Page: 1 of 1
EUT Line Voltage:	3	VDC	EUT Power Frequency:	0	N/A
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz	
EUT Mode of Operation:	Transmit Mode, High Channel, Reduced Power				

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
4960.9	3	120	1	Peak	50.8	50.8	54.0	-3.2	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

9.0 Conducted Emissions, Mains

9.1 Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor and 0.4 meters from the conductive reference plane (wall). The EUT is powered through a line impedance stabilization network (LISN) that provides a measurement tap and a termination approximating 50 Ohms in the measurement range of 150 kHz to 30 MHz. A spectrum analyzer is connected, in turn, to each mains line measurement tap and software is employed to measure the radio frequency noise generated by the EUT.

9.2 Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.207 // RSS-210 Issue 8	Mains conducted emissions	2014-03-28

9.3 Results

The EUT satisfied the criteria. Tabular and plotted measurements appear on the following pages.

Table 9.3.1 Equipment List

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2009: 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 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	3/28/2014	EUT Serial #:	None
Customer:	Ketra	EUT Part #:	830-000005-xx
Project Number:	15714-15	Test Technician:	Bob Redoutey
Purchase Order #:	Not Listed	Supervisor:	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	Witness' Name:	None

Conducted Emissions Test Equipment List	
Tile! Software Version:	4.1.A.0, April 14, 2009, 11:01:00PM
Test Profile:	Profile#: CE_2010.til, dated December 16, 2010

Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1842	HP	8568B	Spectrum Analyzer	2732A03633	5/17/2014
0045	HP	85662A	Spec Anal Dsply for AN1842	2816A16413	N/A
0990	HP	85685A	RF Preselector	3010A01119	8/29/2014
1281	HP	85650A	Quasi Peak Adapter	2043A00063	6/5/2014
1173	PTI	100k HPF	Filter, High Pass, 100kHz	none	10/30/2014
1087	PTI	PTI-ALF3	Attenuator Limiter Filter	none	5/6/2014
C107	Pomona	RG-223	Cable 9 ft BNC RG-223 (black)	none	7/10/2014
C108	Pomona	RG-223	Cable 5.5 ft BNC RG-223 (black)	none	7/10/2014
0939	EMCO	3825/2	LISN, 10kHz-100MHz	9603-2521	10/31/2014
C109	HP	none	Cable 19 inch BNC (grey)	none	7/10/2014
1185	EMCO	3825/2	LISN, 10kHz-100MHz	1235	10/31/2014

Table 9.3.2 Measurement Bandwidth

Conducted Emissions Spectrum Analyzer Bandwidth and Measurement Time				
Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range
0.01	0.15	0.3	7	Five 1 second sweeps
0.15	30	9	20	Five 1 second sweeps

*Notes:
1. The settings above are specifically calculated for the HP856X series of spectrum analyzers, which have 1,000 data points per range.
2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 10-150 kHz.
3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.

Table 9.3.3 Mains Emissions, Receive Mode, Neutral Line

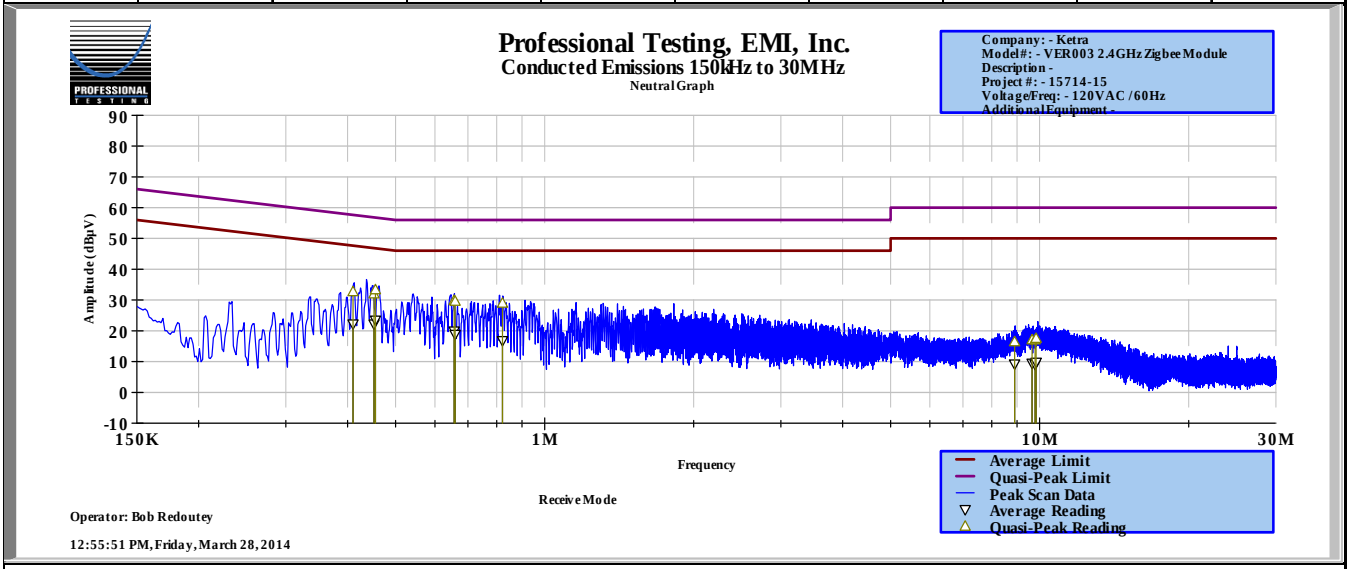
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2009: 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 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	3/28/2014	**EUT Serial #:**	None
Customer:	Ketra	**EUT Part #:**	830-000005-xx
Project Number:	15714-15	**Test Technician:**	Bob Redoutey
Purchase Order #:	Not Listed	**Supervisor:**	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	**Witness' Name:**	None

Conducted Emissions Test Results Data Sheet - Neutral Lead **Page: 1 of 2**

EUT Line Voltage:	**120**	**VAC**	**EUT Line Frequency:**	**60**	**Hz**

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.41004	36.2	32.7	57.6	-25	PASS	22.2	47.6	-25.4	PASS
0.45204	37.9	32	56.8	-24.9	PASS	22.2	46.8	-24.6	PASS
0.45506	37.6	33.3	56.8	-23.5	PASS	23.5	46.8	-23.3	PASS
0.6563	33.1	29.9	56	-26.1	PASS	19.9	46	-26.1	PASS
0.6593	33.7	29.6	56	-26.4	PASS	18.9	46	-27.1	PASS
0.8217	34.4	28.9	56	-27.1	PASS	16.8	46	-29.2	PASS
8.9001	23.6	16.4	60	-43.6	PASS	9.2	50	-40.8	PASS
9.6529	24.3	17	60	-43	PASS	9.5	50	-40.5	PASS
9.7905	24.1	17	60	-43	PASS	9.1	50	-40.9	PASS
9.8362	24.2	17.5	60	-42.5	PASS	9.8	50	-40.2	PASS



Measured Conducted Emissions - Neutral Lead

Table 9.3.4 Mains Emissions, Receive Mode, Phase Line

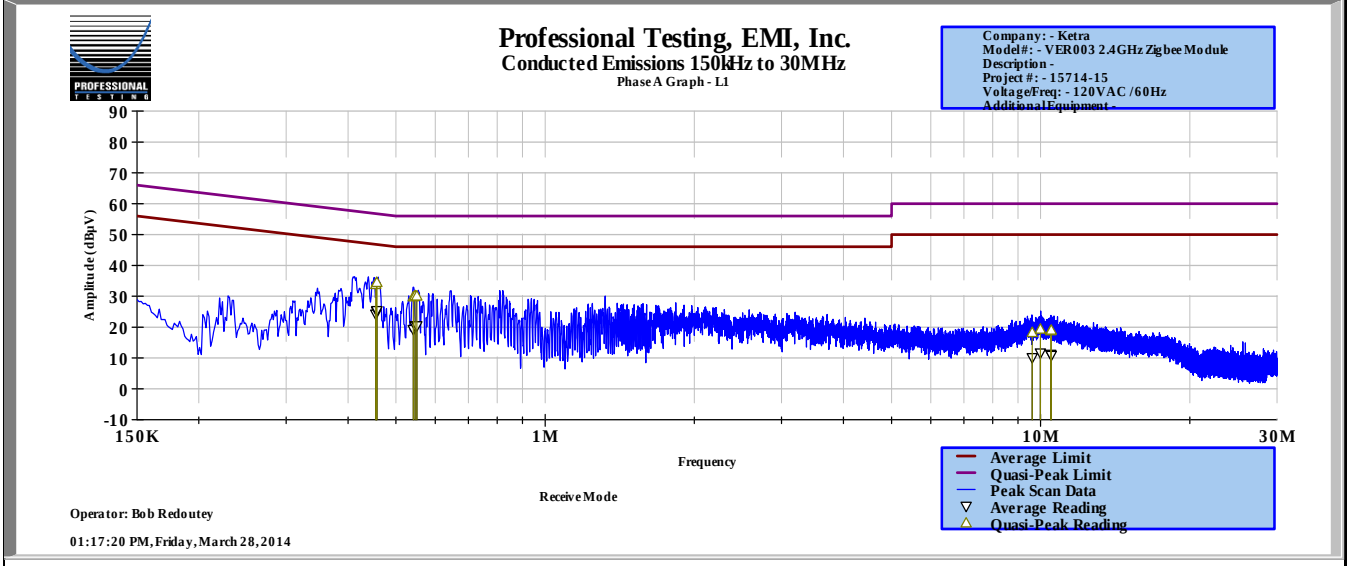
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2009: 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 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	3/28/2014	**EUT Serial #:**	None
Customer:	Ketra	**EUT Part #:**	830-000005-xx
Project Number:	15714-15	**Test Technician:**	Bob Redoutey
Purchase Order #:	Not Listed	**Supervisor:**	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	**Witness' Name:**	None

Conducted Emissions Test Results Data Sheet - Phase Lead (Line 1) **Page: 2 of 2**

EUT Line Voltage:	120	VAC	EUT Line Frequency:	60	Hz

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.45506	37.6	33.7	56.8	-23	PASS	24.2	46.8	-22.5	PASS
0.45687	37.6	34.4	56.7	-22.3	PASS	25.2	46.7	-21.5	PASS
0.45737	38	34.4	56.7	-22.3	PASS	25.4	46.7	-21.4	PASS
0.5418	35.5	29.8	56	-26.2	PASS	19.2	46	-26.8	PASS
0.5462	34.2	30.2	56	-25.8	PASS	20.4	46	-25.6	PASS
0.5508	34.5	30	56	-26	PASS	20.4	46	-25.6	PASS
9.6176	25.5	18.2	60	-41.8	PASS	10.1	50	-39.9	PASS
9.9885	26	19.3	60	-40.7	PASS	11.6	50	-38.4	PASS
10.4778	26.5	18.8	60	-41.2	PASS	11.2	50	-38.8	PASS
10.5034	25.8	19	60	-41	PASS	10.8	50	-39.2	PASS



Measured Conducted Emissions - Phase Lead (Line 1)

Table 9.3.5 Mains Emissions, Transmit Mode, Neutral Line

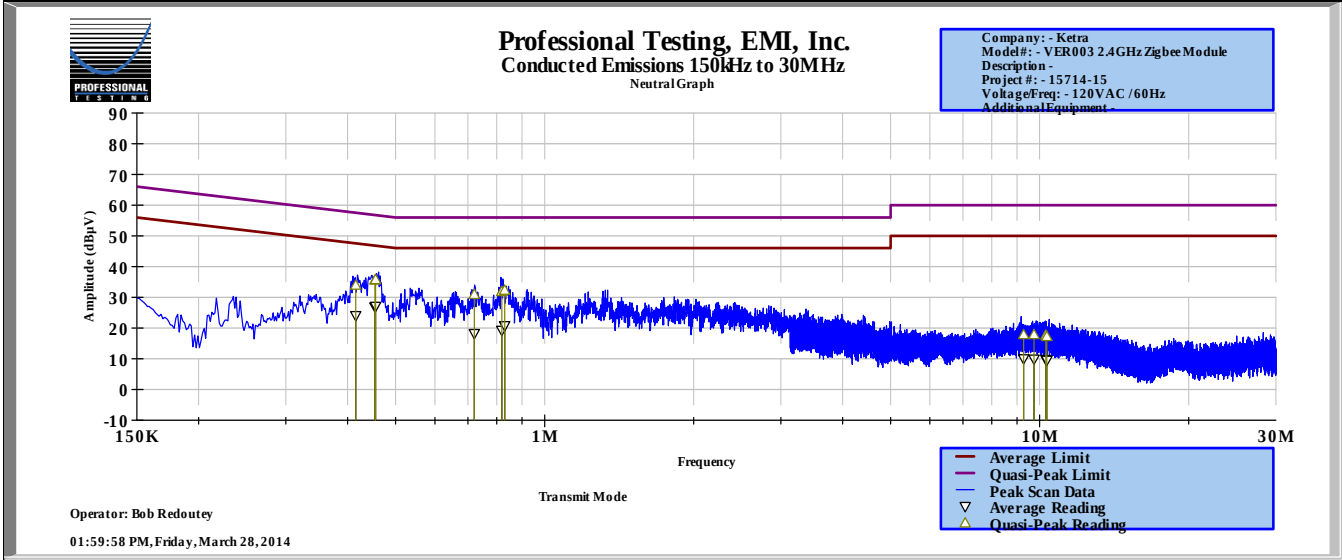
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2009: 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 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	3/28/2014	**EUT Serial #:**	None
Customer:	Ketra	**EUT Part #:**	830-000005-xx
Project Number:	15714-15	**Test Technician:**	Bob Redoutey
Purchase Order #:	Not Listed	**Supervisor:**	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	**Witness' Name:**	None

Conducted Emissions Test Results Data Sheet - Neutral Lead **Page: 1 of 2**

EUT Line Voltage:	120	VAC	EUT Line Frequency:	60	Hz

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.41514	37.9	33.9	57.5	-23.7	PASS	24.1	47.5	-23.5	PASS
0.45395	38.8	35.6	56.8	-21.2	PASS	26.9	46.8	-19.9	PASS
0.45557	39.1	35.7	56.8	-21	PASS	27.1	46.8	-19.7	PASS
0.7211	35.2	30.9	56	-25.1	PASS	18.2	46	-27.8	PASS
0.8191	37	31.8	56	-24.2	PASS	19.2	46	-26.8	PASS
0.8301	36.5	32.3	56	-23.7	PASS	20.8	46	-25.2	PASS
9.2804	25	17.8	60	-42.2	PASS	10	50	-40	PASS
9.7412	25.2	17.8	60	-42.2	PASS	9.9	50	-40.1	PASS
10.2905	25.6	17.6	60	-42.4	PASS	9.8	50	-40.2	PASS
10.3393	24.5	17.2	60	-42.8	PASS	9.5	50	-40.5	PASS



Measured Conducted Emissions - Neutral Lead

Table 9.3.6 Mains Emissions, Transmit Mode, Phase Line

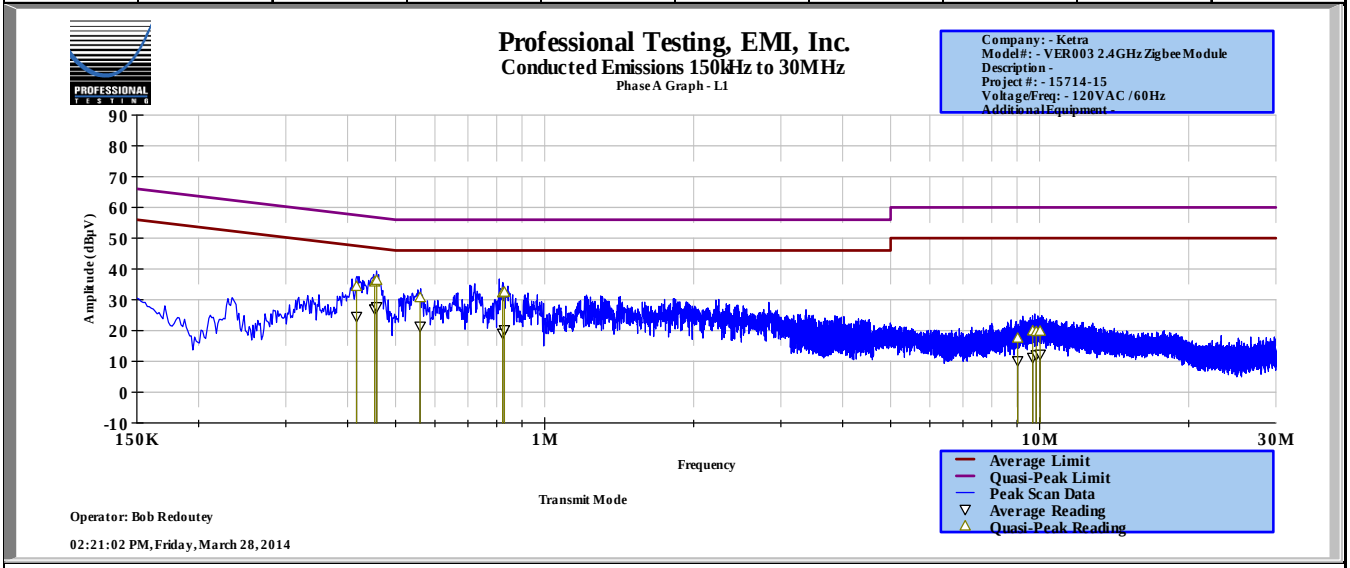
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2009: 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 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	3/28/2014	**EUT Serial #:**	None
Customer:	Ketra	**EUT Part #:**	830-000005-xx
Project Number:	15714-15	**Test Technician:**	Bob Redoutey
Purchase Order #:	Not Listed	**Supervisor:**	Rob McCollough
Equip. Under Test:	VER003 2.4GHz Zigbee Module	**Witness' Name:**	None

Conducted Emissions Test Results Data Sheet - Phase Lead (Line 1) Page: 1 of 2

EUT Line Voltage: 120 VAC **EUT Line Frequency:** 60 Hz

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.41681	39	34.3	57.5	-23.2	PASS	24.6	47.5	-22.9	PASS
0.45344	39.6	35.7	56.8	-21.1	PASS	27.1	46.8	-19.7	PASS
0.45766	39.4	36.3	56.7	-20.4	PASS	27.8	46.7	-19	PASS
0.5602	34.7	30.7	56	-25.3	PASS	21.4	46	-24.6	PASS
0.8224	36.8	32.2	56	-23.8	PASS	19.2	46	-26.8	PASS
0.8289	37.6	32.4	56	-23.6	PASS	20.3	46	-25.7	PASS
9.0293	26.5	17.5	60	-42.5	PASS	10.2	50	-39.8	PASS
9.6806	26.8	19.8	60	-40.2	PASS	11.3	50	-38.7	PASS
9.8428	27.3	19.6	60	-40.4	PASS	12.1	50	-37.9	PASS
10.0237	26.6	19.8	60	-40.2	PASS	12.3	50	-37.7	PASS



Measured Conducted Emissions - Phase Lead (Line 1)

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

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.203 // RSS-210 Issue 8, A2.9	Antenna Construction	2014-04-16

10.3 Results

Antenna Manufacturer and Model	Specifications
Ketra Printed circuit antenna on circuit board.	F-style

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

The antenna design meets the requirements of the rules.

11.0 Equipment and Bandwidths

11.1 Equipment for Spurious Radiated Emissions 30 MHz 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,**		
In accordance with:	**FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits**		
Section:	**15.109**		
Test Date(s):	**3/25/2014**	**EUT Serial #:**	**N/A**
Customer:	**Ketra, Inc.**	**EUT Part #:**	**None**
Project Number:	**15714-15**	**Test Technician:**	**Larry Fuller**
Purchase Order #:		**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**VER003 2.4GHz Zigbee Module**	**Witness' Name:**	**Craig T Phillips**

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
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	12/2/2014
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
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
Loaner-ETS	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	135203	1/14/2015
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A

Same list also applies to spurious measurements on 3/28/2014.

11.2 Equipment for Timings, Bandwidth, and Spurious from 12 to 25 GHz

Asset #	Manufacturer	Model #	Description	Calibration Due
0582	EMCO	3115	Ridge Guide Antenna	2014-04-14
1974	Agilent	83017A	Microwave Preamplifier (preamp 1)	2015-02-05
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	2015-01-29
C248	Pasternack	-	Cable, Low Loss	2014-04-12
1542	AH Systems	SAS-572	Horn Antenna, Standard Gain, 20 dB	Not Required

11.3 Measurement Bandwidths, Radiated

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits**		
Section:	**15.109**		
Test Date(s):	**3/25/2014**	**EUT Serial #:**	**N/A**
Customer:	**Ketra, Inc.**	**EUT Part #:**	**None**
Project Number:	**15714-15**	**Test Technician:**	**Larry Fuller 3/25, Eric Lifsey 3/28**
Purchase Order #:		**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**VER003 2.4GHz Zigbee Module**	**Witness' Name:**	**Craig T Phillips**

Radiated Emissions Spectrum Analyzer Bandwidth and Measurement Time - Peak Scan

Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range
0.009	0.15	0.3	2	Multiple Sweeps
0.15	30	9	6	Multiple Sweeps
30	1000	120	2	Multiple 800 mS Sweeps
1000	6000	1000	2	Multiple Sweeps
6000	18000	300	2	Multiple Sweeps

*Notes:
1. The settings above are specifically calculated for the E4440A series of spectrum analyzers, which have 8,000 data points per range.
2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 9-150 kHz.
3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.
4. The measurement receiver resolution bandwidth setting was 120 kHz for quasi-peak measurements from 30-1000 MHz.
5. The measurement receiver resolution bandwidth setting was 1 MHz for average measurements from 1-18 GHz.

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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