Keiser Corporation

TEST REPORT FOR

Recumbent
Model: M7i

Tested To The Following Standards:

FCC Part 15 Subpart C Section(s)

15.207 & 15.247
(DTS 2400-2483.5 MHz)

Report No.: 99272-13

Date of issue: December 21, 2016

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

Testing the Future
CKC LABORATORIES, INC.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Keiser Corporation
2470 S. Cherry Avenue
Fresno, CA 93706

REPRESENTATIVE: Gus Gustafson
Customer Reference Number: EN00368

REPORT PREPARED BY:

Terri Rayle
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 99272

DATE OF EQUIPMENT RECEIPT: November 18, 2016
DATE(S) OF TESTING: November 18-19, 2016

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.02

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Mariposa A	US0103	SL2-IN-E-1147R	3082A-2	US1024	A-0136

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS)

Test Procedure	Description	Modifications	Results
15.247(a)(2)	6dB Bandwidth	NA	Pass
15.247(b)(3)	Output Power	NA	Pass
15.247(e)	Power Spectral Density	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	Pass
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable
NA1 = Not applicable because the EUT is battery powered.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
The actual testing date is stated in each section, the date/time on the plot data screen captured is incorrect.

EQUIPMENT UNDER TEST (EUT)

During testing numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
Recumbent	Keiser Corporation	M7i	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Mouse	Gigabyte	GK-KM6150-M	NA
Keyboard	Gigabyte	GK KM6150	NA
Monitor	Acer	V226HQL	4350321228985
Computer	Shuttle	xxPC	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	BLE
Operating Frequency Range:	2402-2480MHz
Modulation Type(s):	GFSK
Maximum Duty Cycle:	98%
Number of TX Chains:	1
Antenna Type(s) and Gain:	1
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	3.0V Battery
Firmware / Software used for Test:	BLE Test , nRFgo studio

FCC Part 15 Subpart C

15.247(a)(2) 6dB Bandwidth

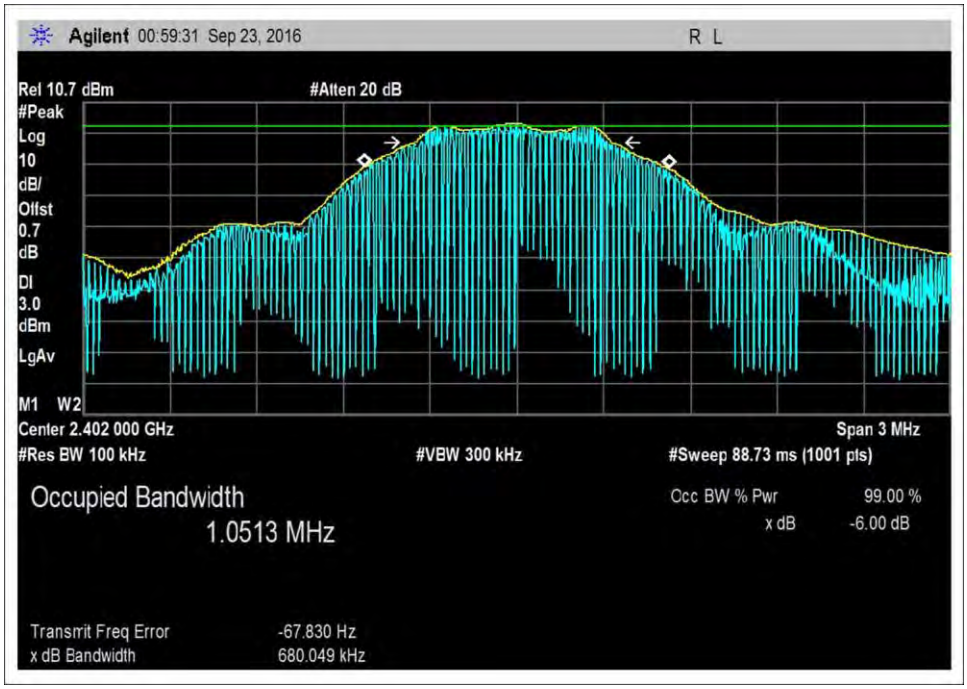
Test Setup/Conditions			
Test Location:	Mariposa Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 DTS Meas Guidance v03r05, April 8, 2016	Test Date(s):	11/18/2016
Configuration:	1		
Test Setup:	The PCB of the EUT with antenna connector installed is placed on the test bench connected to the support computer. The support computer set the device in test mode. Frequency: 2402, 2440, 2480MHz Channel selection 0,19,39 Payload model: PRBS9 Payload length: 37byte RF characteristic evaluate at the antenna port. Antenna gain: 3dBi Fresh Batteries installed. Mariposa Site A		

Environmental Conditions			
Temperature (ºC)	21	Relative Humidity (%):	38

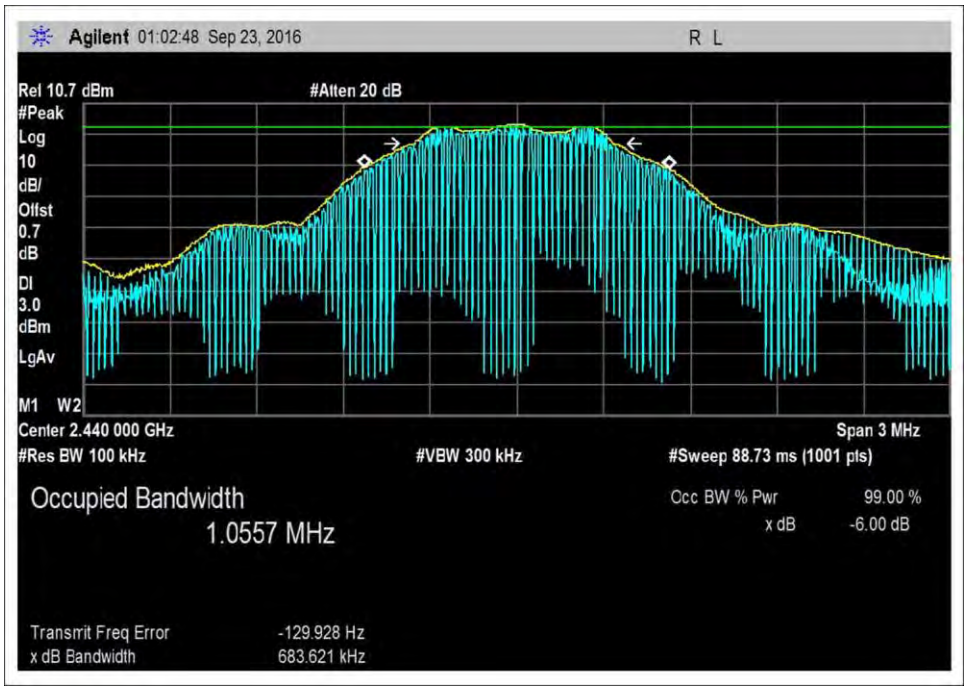
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02668	Spectrum Analyzer	Agilent	E4446A	8/26/2016	8/26/2017
03361	Cable	Astrolab	32022-2-29094-48TC	12/8/2014	12/8/2016

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2402	1	GFSK	680.04	≥500	Pass
2440	1	GFSK	683.62	≥500	Pass
2480	1	GFSK	677.46	≥500	Pass

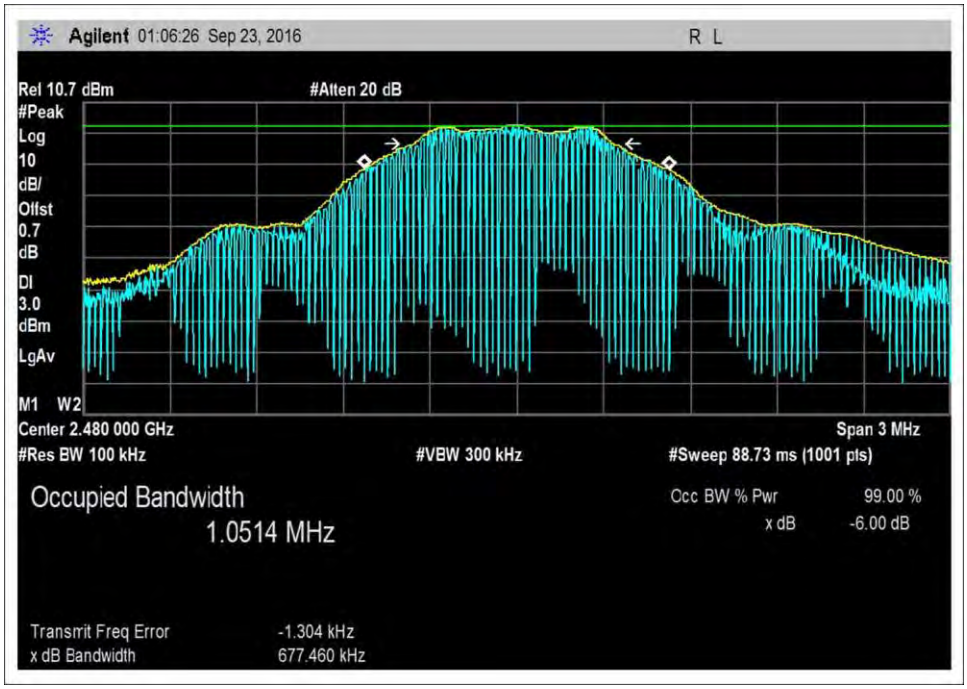
Plots



Low Channel

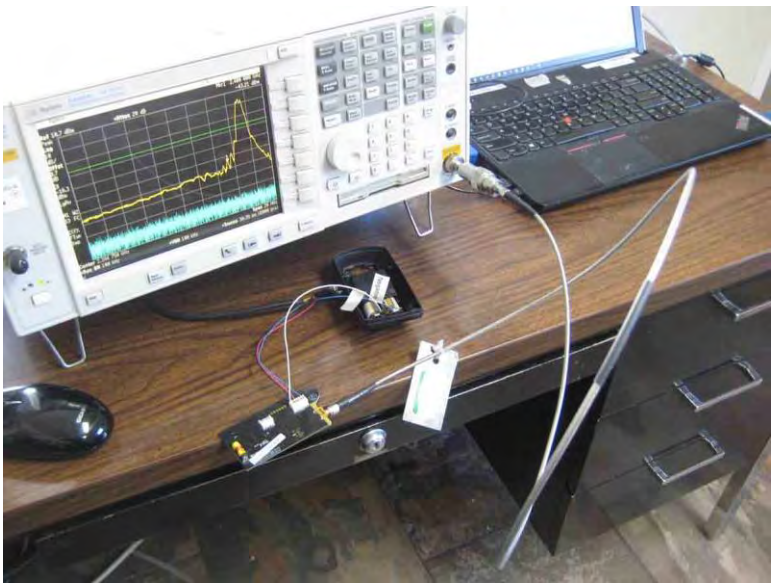


Middle Channel



High Channel

Test Setup Photo



15.247(b)(3) Output Power

Test Setup / Conditions			
Test Location:	Mariposa Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 DTS Meas Guidance v03r05, April 8, 2016	Test Date(s):	11/18/2016
Configuration:	1		
Test Setup:	The PCB of the EUT with antenna connector installed is placed on the test bench connected to the support computer. The support computer set the device in test mode. Frequency: 2402, 2440, 2480MHz Channel selection 0,19,39 Payload model: PRBS9 Payload length: 37byte RF characteristic evaluate at the antenna port. Antenna gain: 3dBi Fresh Batteries installed. Mariposa Site A		

Environmental Conditions			
Temperature (ºC)	21	Relative Humidity (%):	38

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02668	Spectrum Analyzer	Agilent	E4446A	8/26/2016	8/26/2017
03361	Cable	Astrolab	32022-2-29094-48TC	12/8/2014	12/8/2016

Test Data Summary - Voltage Variations					
Frequency (MHz)	**Modulation / Ant Port**	**$V_{Minimum}$ (dBm/ W)**	**$V_{Nominal}$ (dBm/W)**	**$V_{Maximum}$ (dBm/W)**	**Max Deviation from $V_{Nominal}$ (dB)**
2402	GFSK port 1	NA	3.78/ 0.0024	NA	NA
2440	GFSK port 1	NA	3.79/ 0.0024	NA	NA
2480	GFSK port 1	NA	3.48/ 0.0022	NA	NA

Test performed using operational mode with the highest output power, representing worst case.
NA: Not required for battery operated device, test performed with fresh battery.

Parameter Definitions:

Measurements performed at input voltage according to manufacturer specification.

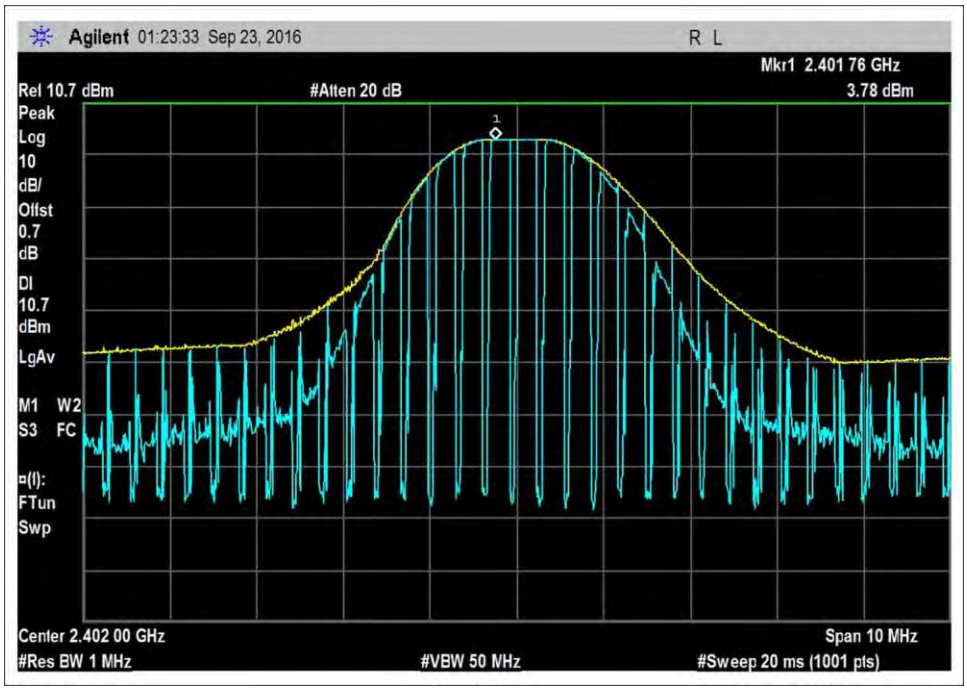
Parameter	Value
$V_{Nominal}$:	3.0V
$V_{Minimum}$:	NA
$V_{Maximum}$:	NA

Test Data Summary - Voltage Variations

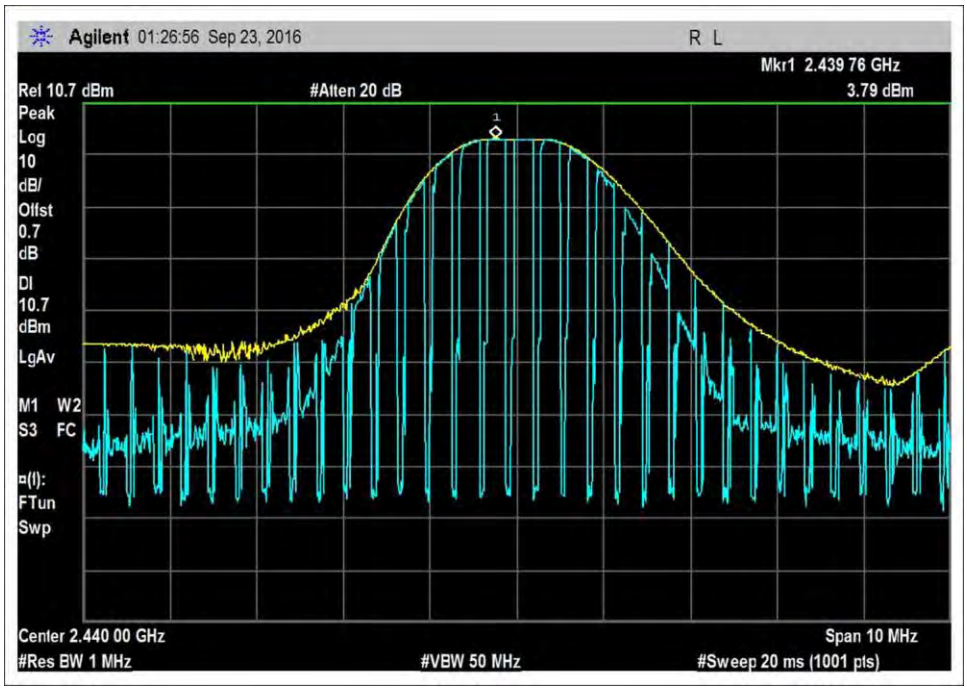
This equipment is battery powered. Power output tests were performed using a fresh battery.

Power Output Test Data Summary - RF Conducted Measurement					
Measurement Option: RBW > DTS Bandwidth					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm)**	**Limit (dBm / W)**	**Results**
2402	GFSK port 1	3.0	3.78/ 0.0024	≤ 30/1	Pass
2440	GFSK port 1	3.0	3.79/ 0.0024	≤ 30/1	Pass
2480	GFSK port 1	3.0	3.48/ 0.0022	≤ 30/1	Pass

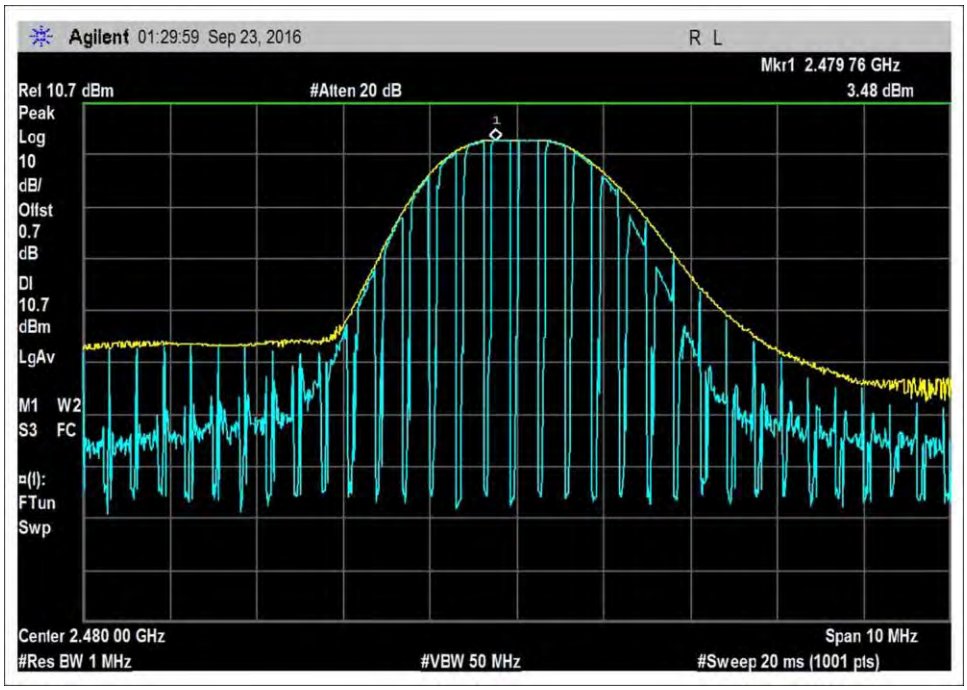
Plots



Low Channel

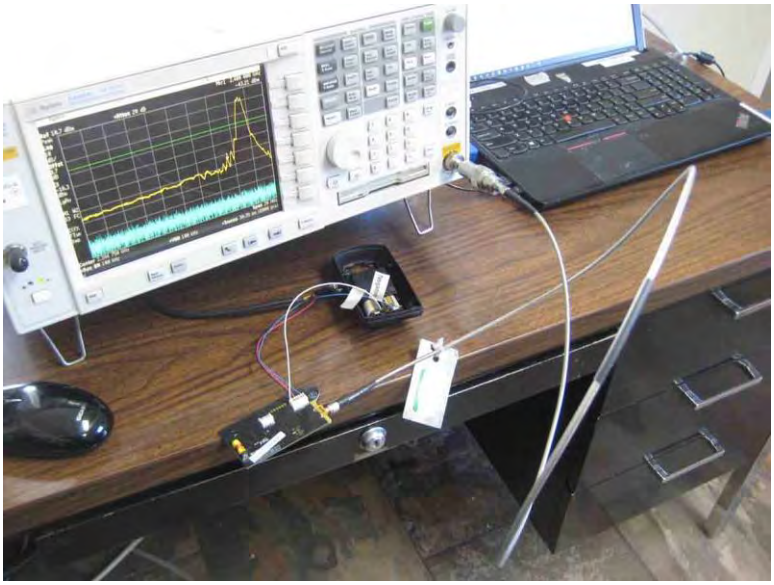


Middle Channel



High Channel

Test Setup Photo



15.247(e) Power Spectral Density

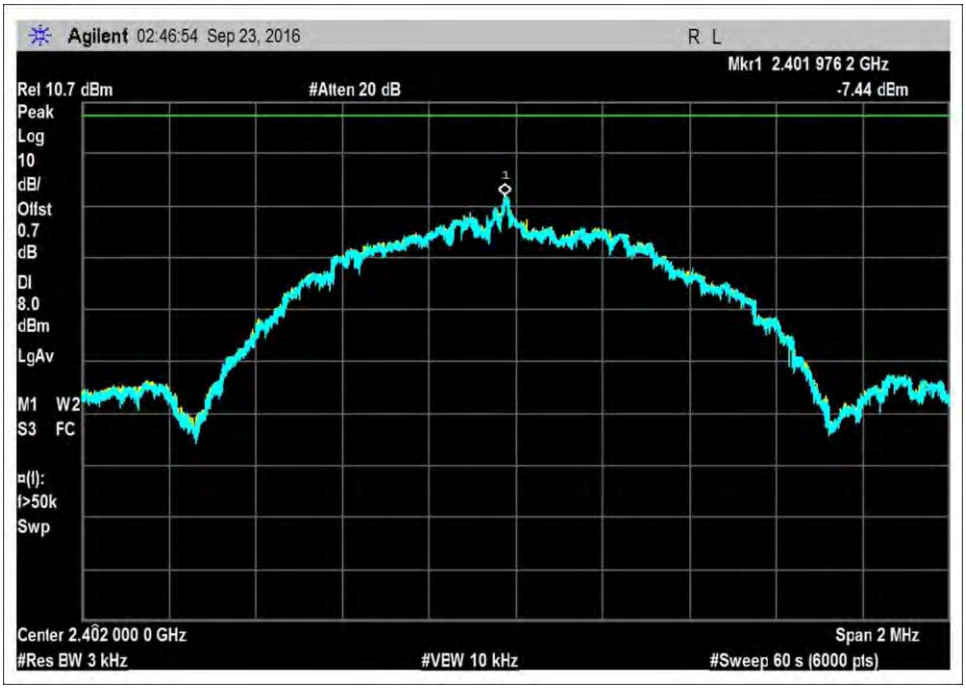
Test Setup / Conditions / Data			
Test Location:	Mariposa Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 DTS Meas Guidance v03r05, April 8, 2016	Test Date(s):	11/18/2016
Configuration:	1		
Test Setup:	The PCB of the EUT with antenna connector installed is placed on the test bench connected to the support computer. The support computer set the device in test mode. Frequency: 2402, 2440, 2480MHz Channel selection 0,19,39 Payload model: PRBS9 Payload length: 37byte RF characteristic evaluate at the antenna port. Antenna gain: 3dBi Fresh Batteries installed. Mariposa Site A		

Environmental Conditions			
Temperature (ºC)	21	Relative Humidity (%):	38

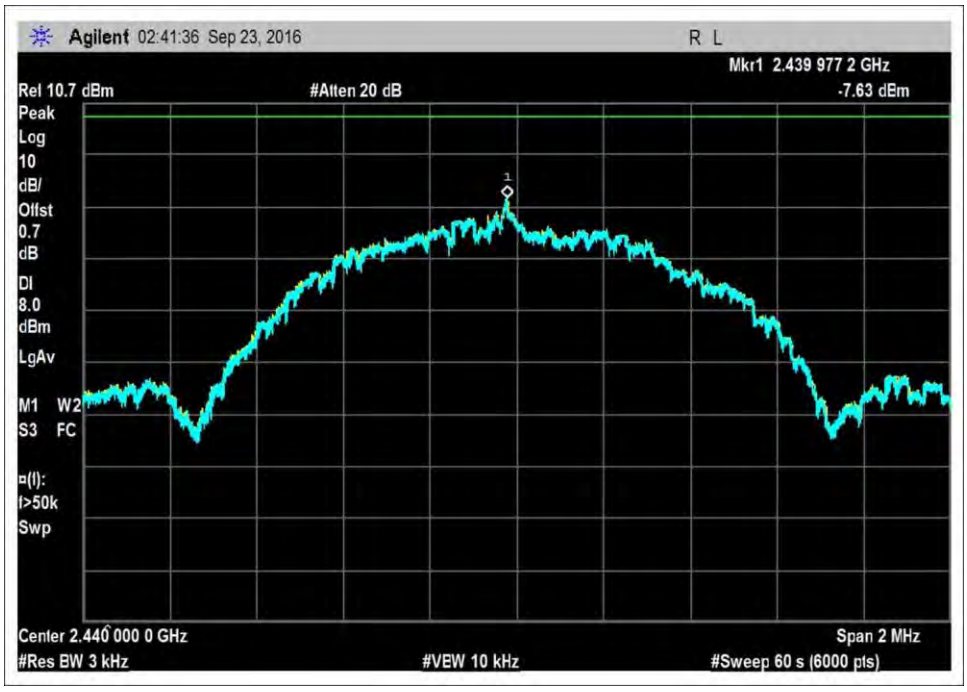
Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02668	Spectrum Analyzer	Agilent	E4446A	8/26/2016	8/26/2017
03361	Cable	Astrolab	32022-2-29094-48TC	12/8/2014	12/8/2016

PSD Test Data Summary - RF Conducted Measurement				
Measurement Method: PKPSD				
Frequency (MHz)	**Modulation**	**Measured (dBm/3kHz)**	**Limit (dBm/3kHz)**	**Results**
2402	GFSK	-7.44	≤8	Pass
2440	GFSK	-7.63	≤8	Pass
2480	GFSK	-8.27	≤8	Pass

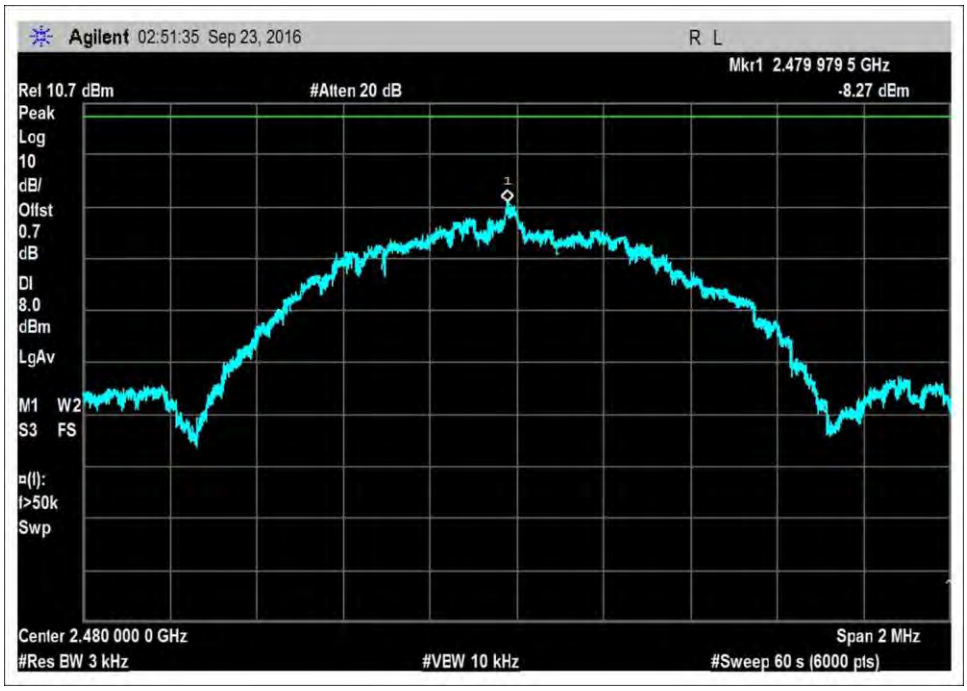
Plots



Low Channel

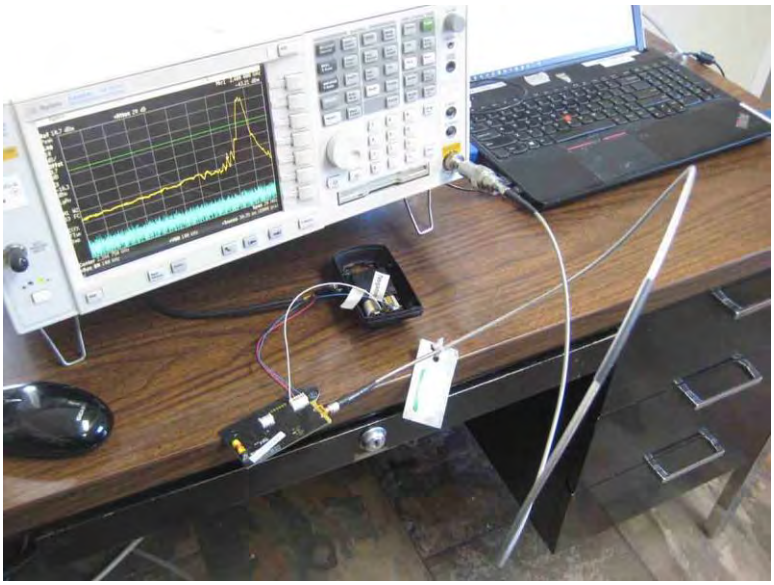


Middle Channel



High Channel

Test Setup Photo



15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 5046 Sierra Pines Drive • Mariposa, CA 95338 • 209 966-5240		
Customer:	**Keiser Corporation**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**99272**	Date:	11/18/2016
Test Type:	**Conducted Emissions**	Time:	14:41:22
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.02		3.0 V DC

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The PCB of the EUT with antenna connector installed is placed on the test bench connected to the support computer. The support computer set the device in test mode.

Protocol: BLE

Frequency range: 2402- 2480MHz
Frequency: 2402, 2440, 2480MHz
Channel selection 0,19,39
Payload model: PRBS9
Payload length: 37byte

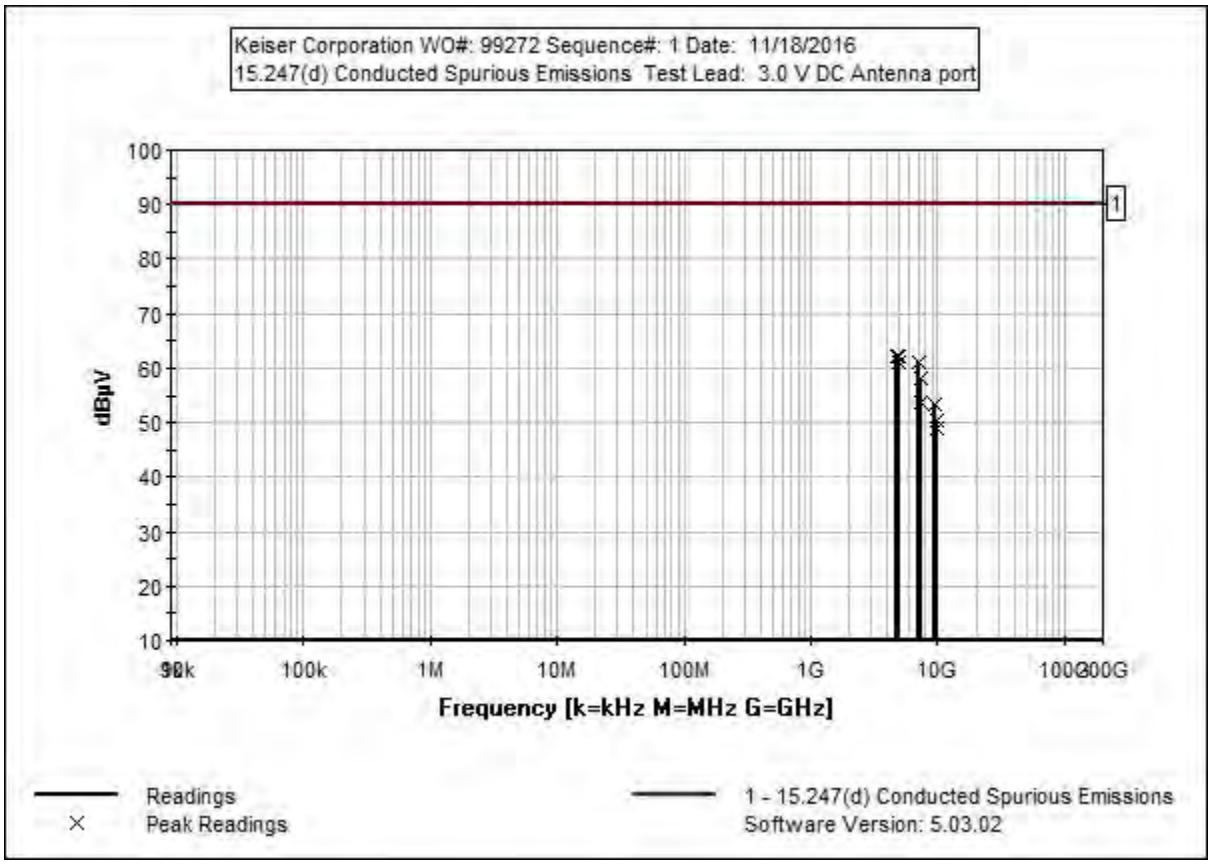
RF characteristic evaluate at the antenna port.
Antenna gain: 3dBi

Frequency range of measurement = 9 kHz- 25 GHz.
RBW=VBW=100kHz

Test environment conditions:
Temperature: 21°C
Relative Humidity: 38%
Pressure: 100kPa
Fresh Batteries installed.

Mariposa Site A
ANSI C63.10-2013

Limit= power (3dBm/110dBuV) - 20dB (100kHz)


Keiser Corporation WO#: 99272 Sequence#: 1 Date: 11/18/2016
15.247(d) Conducted Spurious Emissions Test Lead: 3.0 V DC Antenna port
100
90
80
70
60
50
40
30
20
10
dBµV
1
100k
1M
10M
100M
1G
10G
Frequency [k=kHz M=MHz G=GHz]
Readings
Peak Readings
1 - 15.247(d) Conducted Spurious Emissions
Software Version: 5.03.02

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02668	Spectrum Analyzer	E4446A	8/26/2016	8/26/2017
T1	AN03361	Cable	32022-2-29094-48TC	12/8/2014	12/8/2016

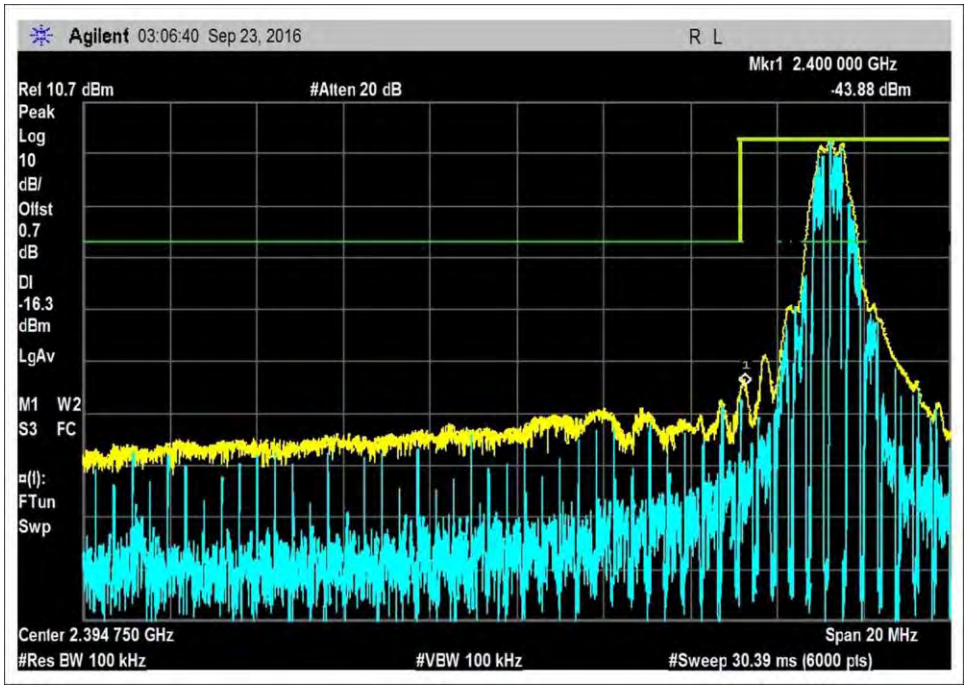
Measurement Data: Reading listed by margin. Test Lead: Antenna port

#	Freq MHz	Rdng dBµV	T1 dB	dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	4804.159M	61.1	+1.0				+0.0	62.1	90.0	-27.9	Anten
2	4960.078M	60.9	+1.1				+0.0	62.0	90.0	-28.0	Anten
3	7205.990M	59.9	+1.3				+0.0	61.2	90.0	-28.8	Anten
4	4880.136M	59.9	+1.0				+0.0	60.9	90.0	-29.1	Anten
5	7319.961M	56.8	+1.3				+0.0	58.1	90.0	-31.9	Anten
6	7439.955M	52.4	+1.3				+0.0	53.7	90.0	-36.3	Anten
7	9607.948M	51.9	+1.5				+0.0	53.4	90.0	-36.6	Anten
8	9759.964M	48.8	+1.5				+0.0	50.3	90.0	-39.7	Anten
9	9920.227M	47.4	+1.5				+0.0	48.9	90.0	-41.1	Anten

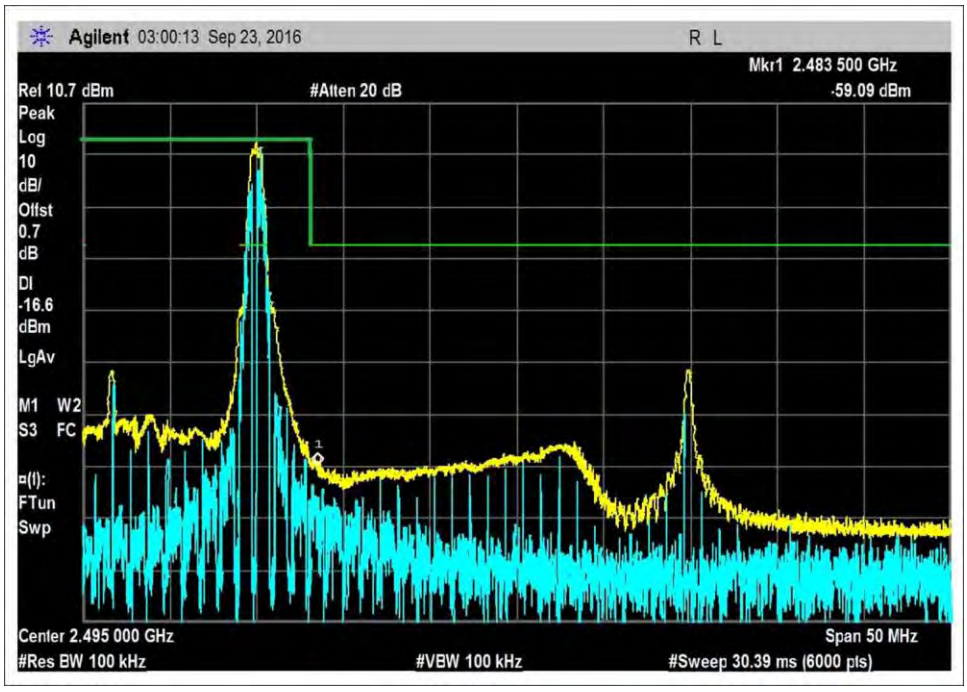
Band Edge

Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB.				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
2400.0	GFSK	-43.88	<-16.30	Pass
2483.5	GFSK	-59.09	<-16.63	Pass

Band Edge Plots

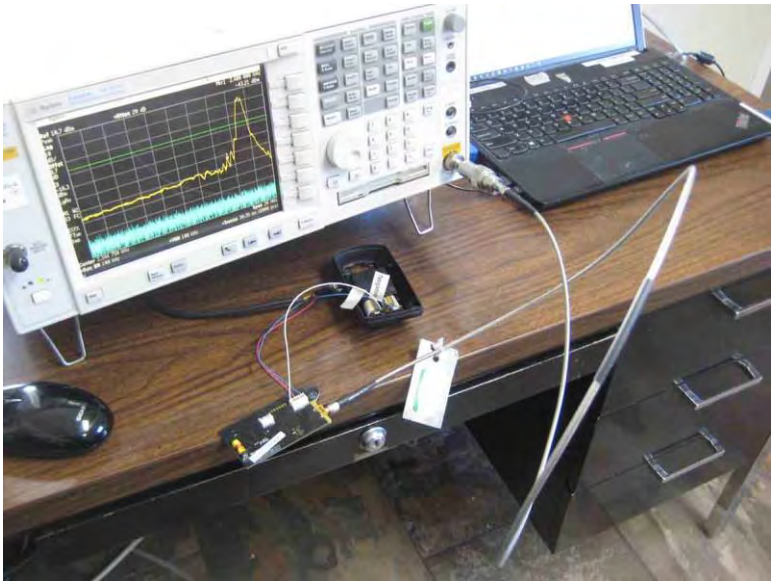


2402 MHz



2480MHz

Test Setup Photo



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 5046 Sierra Pines Drive • Mariposa, CA 95338 • 209 966-5240		
Customer:	**Keiser Corporation**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**99272**	Date:	11/19/2016
Test Type:	**Radiated Scan**	Time:	10:07:39
Tested By:	E. Wong	Sequence#:	2
Software:	EMITest 5.03.02		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The floor standing EUT is placed on the turntable and connected to the support computer. The support computer set the device in test mode.

Protocol: BLE

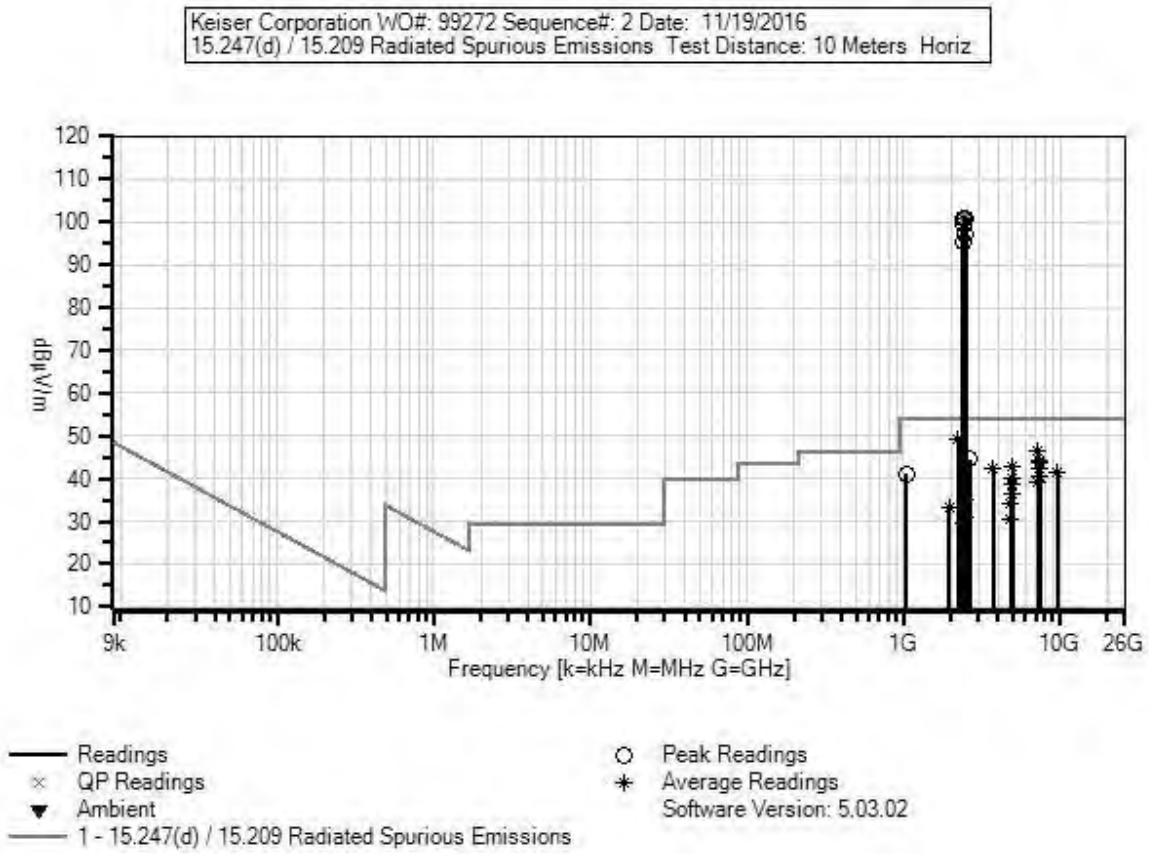
Frequency range: 2402- 2480MHz
Frequency: 2402, 2440, 2480MHz
Channel selection 0,19,39
Payload model: PRBS9
Payload length: 37byte

Antenna gain: 3dBi

Frequency range of measurement = 9 kHz- 25 GHz.
9 kHz -150 kHz;RBW=200 Hz,VBW=200 Hz;150 kHz-30 MHz;RBW=9 kHz,VBW=9 kHz;30 MHz-1000 MHz;RBW=120 kHz,VBW=120 kHz,1000 MHz-25000 MHz;RBW=1 MHz,VBW=1 MHz.

Test environment conditions:
Temperature: 21°C
Relative Humidity: 38%
Pressure: 100kPa
Fresh Batteries installed.

Mariposa Site A
ANSI C63.10-2013
No emission found from 9kHz-1GHz


Keiser Corporation WO#: 99272 Sequence#: 2 Date: 11/19/2016
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 10 Meters Horiz
120
110
100
90
80
70
60
50
40
30
20
10
dBµV/m
9k
100k
1M
10M
100M
1G
10G
26G
Frequency [k=kHz M=MHz G=GHz]
Readings
QP Readings
Ambient
1 - 15.247(d) / 15.209 Radiated Spurious Emissions
Peak Readings
Average Readings
Software Version: 5.03.02

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02668	Spectrum Analyzer	E4446A	8/26/2016	8/26/2017
T2	AN01273	Horn Antenna	3115	2/3/2015	2/3/2017
T3	AN03155	Preamp	83017A	6/30/2015	6/30/2017
T4	AN03355	Cable	32026-2-29094K-48TC	12/8/2014	12/8/2016
T5	ANP01403	Cable	58758-23	12/8/2014	12/8/2016
T6	ANP05904	Cable	32022-2-29094K-144TC	12/8/2014	12/8/2016
	AN03366	Horn Antenna-ANSI C63.5 Calibration	GH-62-25	2/9/2016	2/9/2018
T7	AN01993	Biconilog Antenna	CBL6111C	3/11/2016	3/11/2018
T8	ANP05656	Attenuator	PE7004-6	12/22/2015	12/22/2017
T9	ANP06230	Cable	CXTA04A-50	3/3/2016	3/3/2018
T10	ANP04249	Cable	CXTA04A-50	3/3/2016	3/3/2018
T11	ANP06883	Cable	LMR195-FR-3	10/27/2015	10/27/2017
T12	AN00449	Preamp-Top Amp (dB)	8447F	2/18/2016	2/18/2018
T13	AN03361	Cable	32022-2-29094-48TC	12/8/2014	12/8/2016
	AN00226	Loop Antenna	6502	4/4/2016	4/4/2018
	AN02694	Horn Antenna-ANSI C63.5 3m	AMFW-5F-18002650-20-10P	5/7/2015	5/7/2017

Measurement Data: Reading listed by margin. Test Distance: 10 Meters

#	Freq	Rdng	T1 T5 T9 T13	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2227.482M Ave	51.6	+0.0 +2.2 +0.0 +0.0	+25.8 +2.3 +0.0	-33.4 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	49.3	54.0 L	-4.7	Horiz
^	2227.482M	64.8	+0.0 +2.2 +0.0 +0.0	+25.8 +2.3 +0.0	-33.4 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	62.5	54.0 L	+8.5	Horiz
3	7206.033M Ave	36.9	+0.0 +4.3 +0.0 +0.0	+32.9 +4.1 +0.0	-33.3 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	46.4	54.0 L	-7.6	Vert
^	7206.033M	48.4	+0.0 +4.3 +0.0 +0.0	+32.9 +4.1 +0.0	-33.3 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	57.9	54.0 L	+3.9	Vert

5	2655.000M	45.0	+0.0 +2.5 +0.0 +0.0	+26.9 +2.5 +0.0	-33.3 +0.0 +0.0	+0.9 +0.0 +0.0	+0.0	44.5	54.0	-9.5	Vert
6	7319.267M Ave	34.4	+0.0 +4.3 +0.0 +0.0	+33.0 +4.2 +0.0	-33.4 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	44.0 M	54.0	-10.0	Horiz
^	7319.267M	46.9	+0.0 +4.3 +0.0 +0.0	+33.0 +4.2 +0.0	-33.4 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	56.5 M	54.0	+2.5	Horiz
8	7320.350M Ave	33.9	+0.0 +4.3 +0.0 +0.0	+33.0 +4.2 +0.0	-33.4 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	43.5 M	54.0	-10.5	Vert
^	7320.350M	46.5	+0.0 +4.3 +0.0 +0.0	+33.0 +4.2 +0.0	-33.4 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	56.1 M	54.0	+2.1	Vert
10	4960.333M Ave	36.9	+0.0 +3.4 +0.0 +0.0	+30.8 +3.4 +0.0	-32.7 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0	43.0 H	54.0	-11.0	Horiz
^	4960.333M	48.3	+0.0 +3.4 +0.0 +0.0	+30.8 +3.4 +0.0	-32.7 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0	54.4 H	54.0	+0.4	Horiz
12	3712.350M Ave	39.1	+0.0 +2.9 +0.0 +0.0	+29.4 +3.0 +0.0	-33.0 +0.0 +0.0	+1.0 +0.0 +0.0	+0.0	42.4 L	54.0	-11.6	Vert
^	3712.350M	51.9	+0.0 +2.9 +0.0 +0.0	+29.4 +3.0 +0.0	-33.0 +0.0 +0.0	+1.0 +0.0 +0.0	+0.0	55.2 L	54.0	+1.2	Vert
14	7440.500M Ave	32.7	+0.0 +4.3 +0.0 +0.0	+33.0 +4.2 +0.0	-33.5 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	42.2 H	54.0	-11.8	Vert
^	7440.500M	44.1	+0.0 +4.3 +0.0 +0.0	+33.0 +4.2 +0.0	-33.5 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	53.6 H	54.0	-0.4	Vert
16	9607.700M Ave	28.1	+0.0 +5.1 +0.0 +0.0	+34.8 +4.9 +0.0	-33.0 +0.0 +0.0	+1.7 +0.0 +0.0	+0.0	41.6 L	54.0	-12.4	Vert
^	9607.700M	40.2	+0.0 +5.1 +0.0 +0.0	+34.8 +4.9 +0.0	-33.0 +0.0 +0.0	+1.7 +0.0 +0.0	+0.0	53.7 L	54.0	-0.3	Vert

18	1039.830M	52.2	+0.0 +1.5 +0.0 +0.0	+21.2 +1.5 +0.0	-35.8 +0.0 +0.0	+0.6 +0.0 +0.0	+0.0	41.2	L	54.0	-12.8	Horiz
19	7440.083M Ave	30.8	+0.0 +4.3 +0.0 +0.0	+33.0 +4.2 +0.0	-33.5 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	40.3	H	54.0	-13.7	Horiz
^	7440.083M	42.8	+0.0 +4.3 +0.0 +0.0	+33.0 +4.2 +0.0	-33.5 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	52.3	H	54.0	-1.7	Horiz
21	4960.333M Ave	34.1	+0.0 +3.4 +0.0 +0.0	+30.8 +3.4 +0.0	-32.7 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0	40.2	H	54.0	-13.8	Vert
^	4960.333M	46.1	+0.0 +3.4 +0.0 +0.0	+30.8 +3.4 +0.0	-32.7 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0	52.2	H	54.0	-1.8	Vert
23	7206.733M Ave	29.8	+0.0 +4.3 +0.0 +0.0	+32.9 +4.1 +0.0	-33.3 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	39.3	L	54.0	-14.7	Horiz
^	7206.733M	43.0	+0.0 +4.3 +0.0 +0.0	+32.9 +4.1 +0.0	-33.3 +0.0 +0.0	+1.5 +0.0 +0.0	+0.0	52.5	L	54.0	-1.5	Horiz
25	4880.583M Ave	32.6	+0.0 +3.4 +0.0 +0.0	+30.7 +3.4 +0.0	-32.7 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0	38.6	M	54.0	-15.4	Horiz
^	4880.583M	49.0	+0.0 +3.4 +0.0 +0.0	+30.7 +3.4 +0.0	-32.7 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0	55.0	M	54.0	+1.0	Horiz
27	4880.283M Ave	30.6	+0.0 +3.4 +0.0 +0.0	+30.7 +3.4 +0.0	-32.7 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0	36.6	M	54.0	-17.4	Vert
^	4880.283M	46.6	+0.0 +3.4 +0.0 +0.0	+30.7 +3.4 +0.0	-32.7 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0	52.6	M	54.0	-1.4	Vert
29	2483.500M Ave	36.6	+0.0 +2.4 +0.0 +0.0	+26.3 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	35.2	bandedge Hi	54.0	-18.8	Vert
^	2483.500M	59.1	+0.0 +2.4 +0.0 +0.0	+26.3 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	57.7	bandedge Hi	54.0	+3.7	Vert

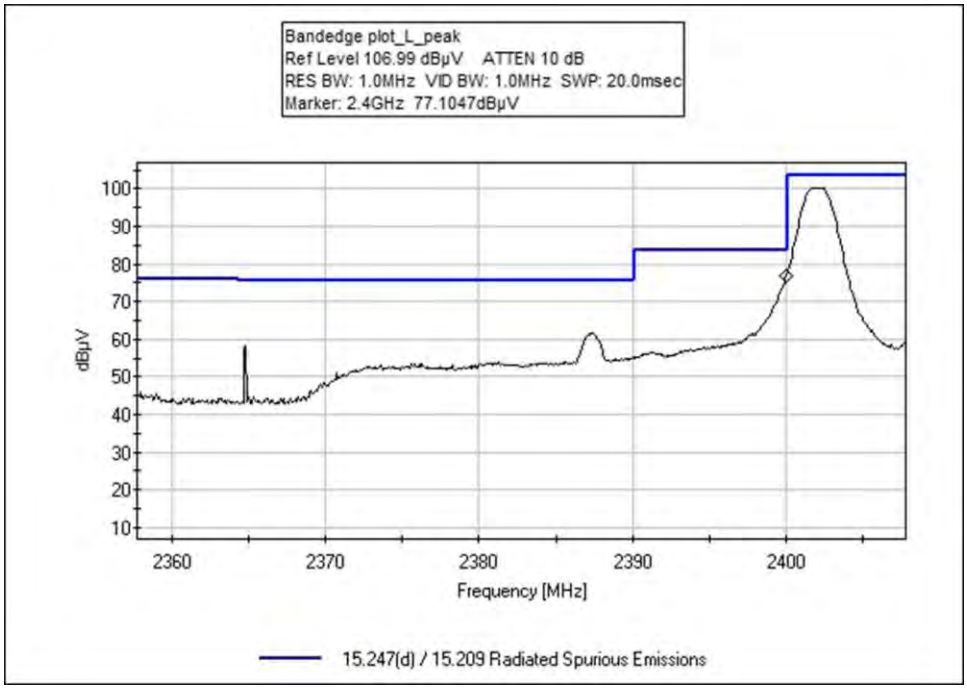
31	4804.567M Ave	28.3	+0.0 +3.4 +0.0 +0.0	+30.5 +3.4 +0.0	-32.8 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0	34.0	54.0 L	-20.0	Horiz
^	4804.567M	45.4	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	51.1	54.0 L	-2.9	Horiz
33	1958.517M Ave	36.8	+0.0 +2.1 +0.0 +0.0	+25.1 +2.2 +0.0	-33.5 +0.0 +0.0	+0.7 +0.0 +0.0	+0.0	33.4	54.0 L	-20.6	Vert
^	1958.517M	54.8	+0.0 +2.1 +0.0 +0.0	+25.1 +2.2 +0.0	-33.5 +0.0 +0.0	+0.7 +0.0 +0.0	+0.0	51.4	54.0 L	-2.6	Vert
35	2510.067M Ave	32.4	+0.0 +2.4 +0.0 +0.0	+26.3 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	31.0	54.0 H	-23.0	Vert
^	2510.067M	62.5	+0.0 +2.4 +0.0 +0.0	+26.3 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	61.1	54.0 H	+7.1	Vert
37	4804.670M Ave	29.4	+0.0 +0.0 +0.0 +1.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	30.4	54.0 L	-23.6	Vert
^	4804.670M	46.6	+0.0 +3.4 +0.0 +0.0	+30.5 +3.4 +0.0	-32.8 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0	52.3	54.0 L	-1.7	Vert
39	2440.000M	102.6	+0.0 +2.3 +0.0 +0.0	+26.2 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	101.0	125.2 Fundamental	-24.2	Vert
40	2480.000M	102.3	+0.0 +2.4 +0.0 +0.0	+26.3 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	100.9	125.2 Fundamental	-24.3	Vert
41	2390.000M Ave	31.2	+0.0 +2.3 +0.0 +0.0	+26.1 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	29.5	54.0 bandedge Low	-24.5	Vert
^	2390.000M	54.2	+0.0 +2.3 +0.0 +0.0	+26.1 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	52.5	54.0 bandedge Low	-1.5	Vert
43	2402.018M	101.3	+0.0 +2.3 +0.0 +0.0	+26.1 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	99.6	125.2 Fundamental	-25.6	Vert

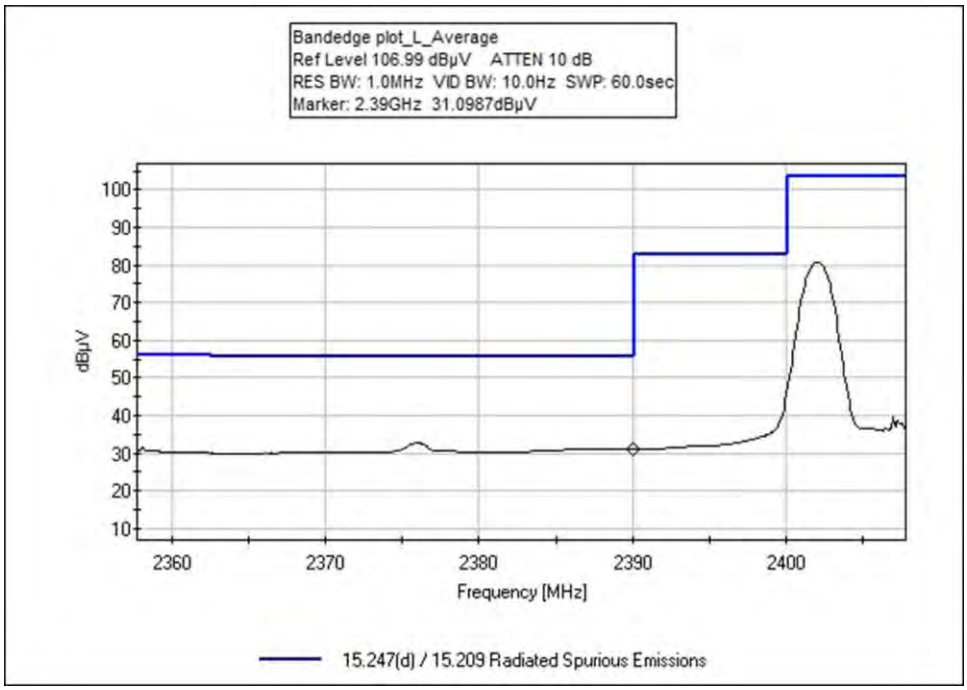
44	2480.000M	98.4	+0.0 +2.4 +0.0 +0.0	+26.3 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	97.0	125.2 Fundamental	-28.2	Horiz
45	2440.000M	97.1	+0.0 +2.3 +0.0 +0.0	+26.2 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	95.5	125.2 Fundamental	-29.7	Horiz
46	2402.018M	97.1	+0.0 +2.3 +0.0 +0.0	+26.1 +2.4 +0.0	-33.3 +0.0 +0.0	+0.8 +0.0 +0.0	+0.0	95.4	125.2 Fundamental	-29.8	Horiz

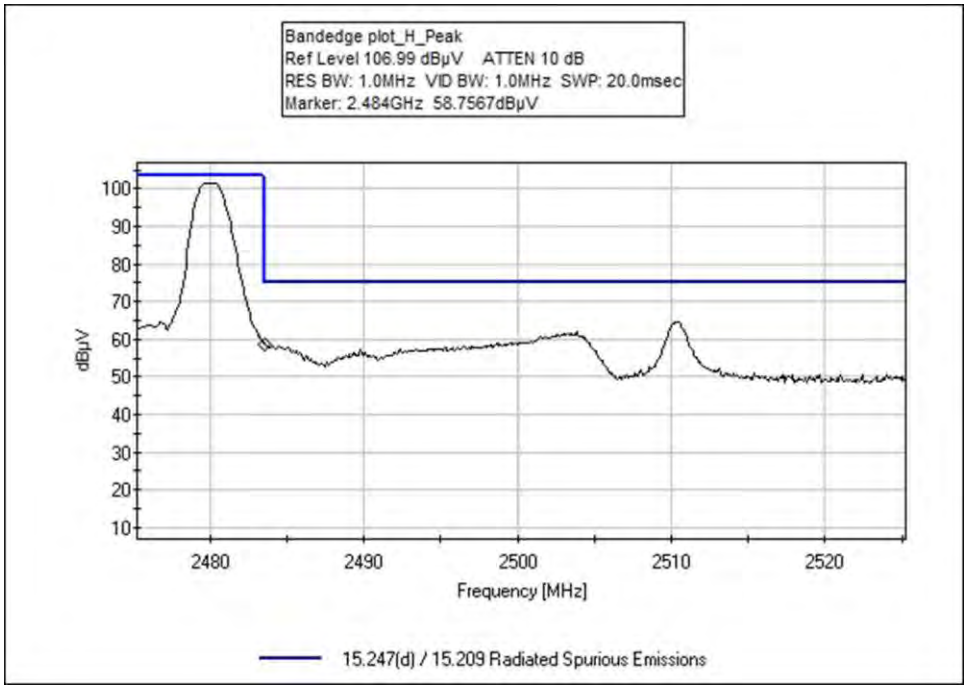
Band Edge

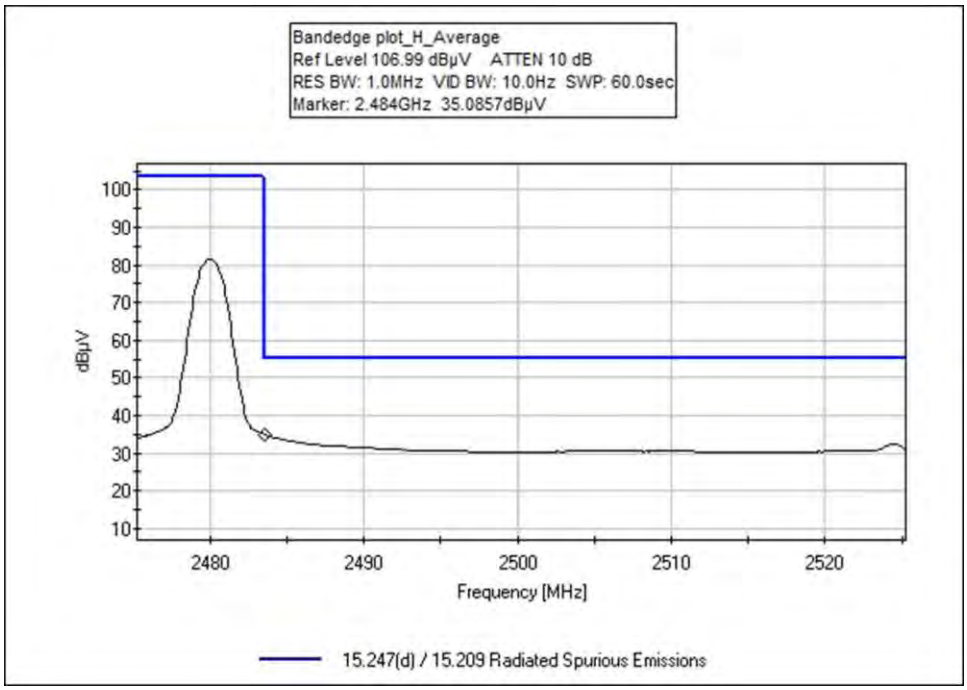
Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
2390.0	GFSK	Integral 3dBi	29.5	<54	Pass
2400.0	GFSK	Integral 3dBI	74.7	<81	Pass
2483.5	GFSK	Integral 3dBi	35.2	<54	Pass

Band Edge Plots




Bandedge plot_L_Average
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 60.0sec
Marker: 2.39GHz 31.0987dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
2360
2370
2380
2390
2400
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Bandedge plot_H_Peak
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 2.484GHz 58.7567dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
2480
2490
2500
2510
2520
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Bandedge plot_H_Average
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 60.0sec
Marker: 2.484GHz 35.0857dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
2480
2490
2500
2510
2520
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

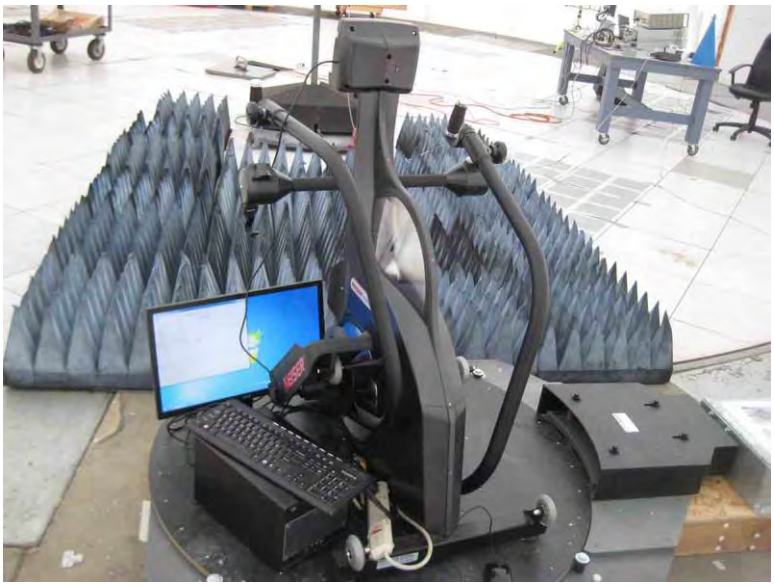
Test Setup Photos

9kHz – 1GHz

9kHz – 1GHz

1 – 25GHz Test Setup

1 – 25GHz



1 – 25GHz

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret (“^”) was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.