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**FCC PART 15.247 & IC RSS-247
CLASS II PERMISSIVE CHANGE
2.4 GHz FHSS
TEST REPORT**

Applicant	SILICON LABORATORIES FINLAND OY
Address	SINIKALLIONTE 5A
	ESPOO, FL-02630, FINLAND
FCC ID	QOQWT12
IC	5123A-BGTWT12A
Model Number	WT12
Product Description	BLUETOOTH MODULE
Date Sample Received	4/7/2016
Final Test Date	9/19/2016
Tested By	Tim Royer
Approved By	Cory Leverett

Report Number	Version Number	Description	Issue Date
1849UT16TestReport	Rev1	Initial Issue	09/15/2016
1849UT16TestReport	Rev2	Added Lower BE Plots	09/21/2016

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the items tested.

Summary

The device under test does:

- ☒ Fulfill the general approval requirements as identified in this test report
☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025: 2005 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Authorized Signatory Name:

Tested by: 

Name and Title: Tim Royer, Project Manager/Testing Technician

Date: 9/ 19/ 2016

Reviewed and approved by: 

Name and Title: Cory Leverett, Project Manager

Date: 09/ 21/ 2016

Applicant: SILICON LABORATORIES FINLAND OY
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GENERAL INFORMATION

EUT Specification

Regulatory Standards	FCC Title 47 CFR Part 15.247 IC RSS-247 Issue 1 & RSS-GEN Issue 4		
FCC ID	QOQWT12		
IC	5123A-BGTWT12A		
Model	WT12		
EUT Description	BLUETOOTH MODULE		
BT Chipset Version	BT V2.1 + EDR with Adaptive Frequency Hopping only		
Operating Frequency	TX: 2402 – 2480 MHz	RX: 2402 – 2480 MHz	
EUT Power Source	☐ 110–120Vac/50– 60Hz		
	☐ DC Power		
	☒ Battery Operated Exclusively		
Test Item	☐ Prototype	☐ Pre-Production	☒ Production
Type of Equipment	☐ Fixed	☐ Mobile	☒ Portable
Antenna Connector	None		
Antenna	Integral Chip Antenna		
Test Conditions	Temperature: 24-26°C Relative humidity: 50-65%		
Measurement Standard	ANSI C63.10-2013 (Test Procedures) ANSI C63.4-2009 (Radiated Site Validation)		
Test Exercise	Engineering Software in the EUT was used to enable the modes of operation, 3DH5 Packet types were used for all tests		

Host Equipment

Device	Manufacturer	Model	FCC ID/ IC	Supplied By	Used For
Portable Radio	Relm Wireless Corp. – BK Radio	KNG2-P800C	K95KNGP800C 2116A-KNGP800C	RELM	Host

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RESULTS SUMMARY

FCC Rule Part No.	IC Standard Ref.	Requirement	Test Item	Result
15.247(d)	RSS-247 § 5.5	Unwanted Emissions	Bandedge	Pass
			Radiated Spurious	Pass

Notes:

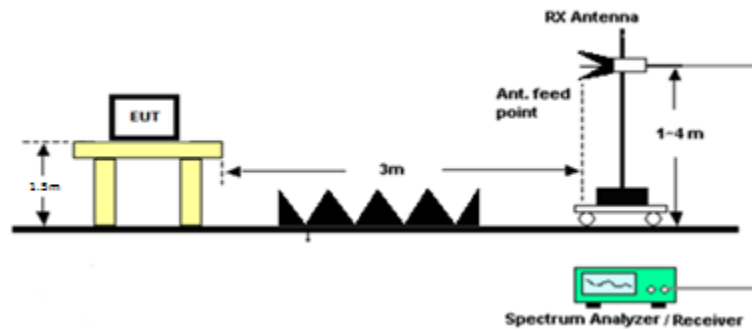
BANDEDGE

Rule Part No.: FCC 15.247(d) & 15.209, IC RSS 247 § 5.5 & RSS GEN § 8.9

Requirements: Emissions must be at least 20dB down from the highest emission level Within the authorized band as measured with a 100 kHz RBW, additionally adjacent restricted band edge emissions must comply with 15.209 and RSS-GEN 8.9 limits.

Test Method: ANSI C63.10 § 6.10.4 Authorized band-edge relative method
ANSI C63.10 § 6.10.6 Restricted band-edge marker delta method

Setup:



Notes: The marker delta method of measurement technique used for adjacent restricted bandedges may be used for measuring emissions that are up to 2 MHz removed from the bandedge. Radiated emissions that are removed by more than 2 MHz from the bandedge must be measured in the conventional manner.

RESULTS: Meets Requirements

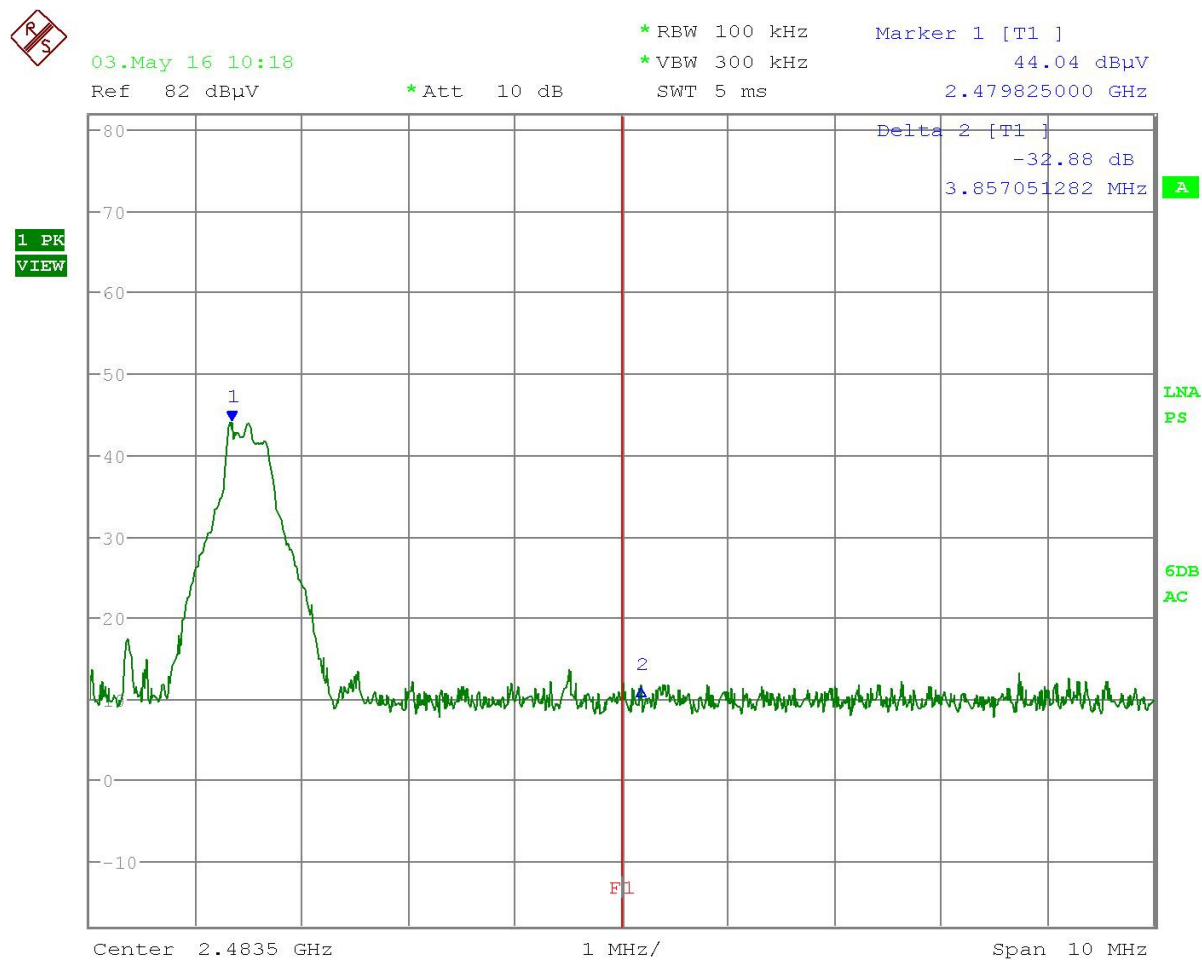
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BANDEDGE

Data: Horizontal 3DH5 Upper Restricted Band Edge Hopping Stopped

Peak/ Average	Field Strength of Carrier (dBuV/ m)	Emission Level Below Carrier (dB)	Field Strength of Emission (dBuV/ m)	Emission Limit (dBuV/ m)	Margin (dB)
Peak	80.96	32.88	48.08	74	25.92
Average	69.41	32.88	36.53	54	17.47



Date: 3.MAY.2016 10:18:32

RESULTS: Meets Requirements

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BANDEDGE

Data: Horizontal 3DH5 Upper Restricted Band Edge Hopping

Peak/ Average	Field Strength of Carrier (dBuV/ m)	Emission Level Below Carrier (dB)	Field Strength of Emission (dBuV/ m)	Emission Limit (dBuV/ m)	Margin (dB)
Peak	80.96	31.97	48.99	74	25.01
Average	69.41	31.97	37.5	54	16.5



Date: 3.MAY.2016 10:21:55

RESULTS: Meets Requirements

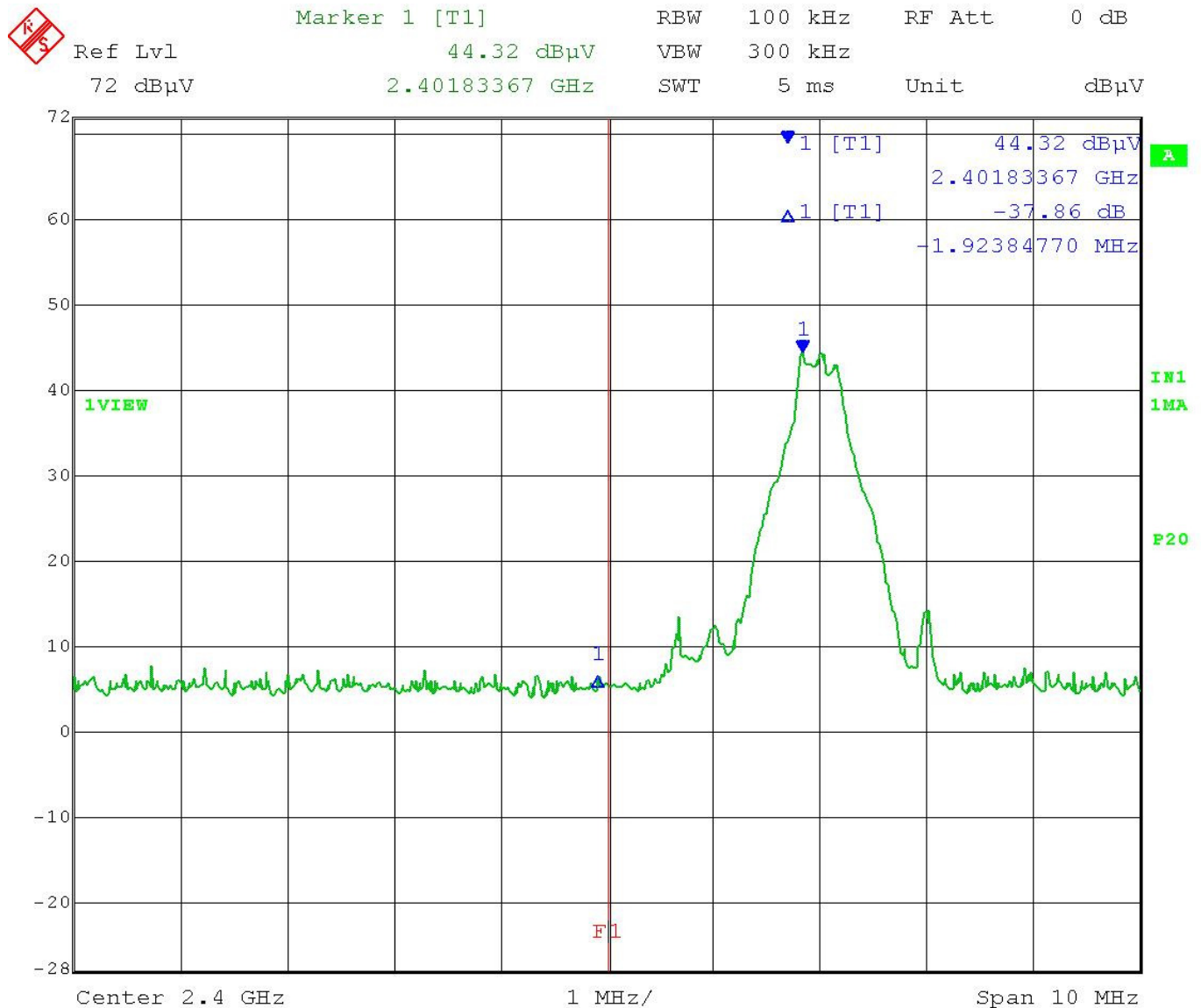
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BANDEDGE

Data: Horizontal 3DH5 Lower Restricted Band Edge Hopping Stopped

Peak/ Average	Field Strength of Carrier (dBuV/ m)	Emission Level Below Carrier (dB)	Field Strength of Emission (dBuV/ m)	Emission Limit (dBuV/ m)	Margin (dB)
80.96	31.97	48.99	74	25.01	80.96
69.41	31.97	37.5	54	16.5	69.41



Date: 19.SEP.2016 09:33:47

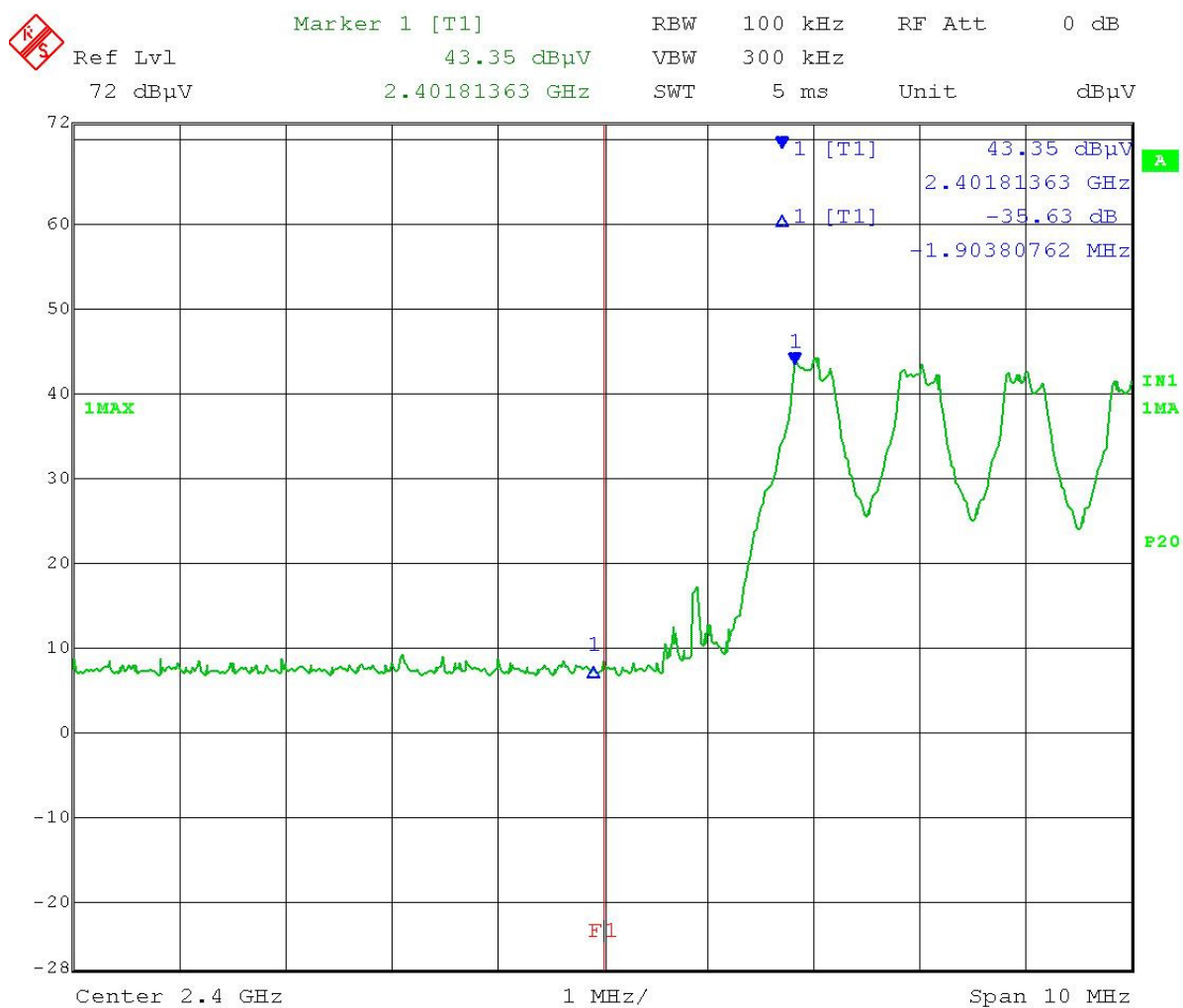
Applicant: SILICON LABORATORIES FINLAND OY
 FCC ID: QOQWT12
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BANDEDGE

Data: Horizontal 3DH5 Lower Restricted Band Edge Hopping

Peak/ Average	Field Strength of Carrier (dBuV/ m)	Emission Level Below Carrier (dB)	Field Strength of Emission (dBuV/ m)	Emission Limit (dBuV/ m)	Margin (dB)
Peak	80.96	31.97	48.99	74	25.01
Average	69.41	31.97	37.5	54	16.5



Date: 19.SEP.2016 10:05:27

Applicant: SILICON LABORATORIES FINLAND OY
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RADIATED SPURIOUS EMISSIONS

Rules Part No.: FCC part 15.247 (d) & 15.209, IC RSS 247 § 5.5 & RSS GEN § 8.9

Requirements: Emissions found in restricted bands the levels must comply with the general limits found in FCC part 15.209

Frequency	Limits
FCC Part 15.209, IC RSS-GEN 8.9	
9 to 490 kHz	2400/F (kHz) μ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) μ V/m @ 30 meters
1705 kHz to 30 MHz	29.54 dB μ V/m @ 30 meters
30 – 88	40.0 dB μ V/m @ 3 meters
80 – 216	43.5 dB μ V/m @ 3 meters
216 – 960	46.0 dB μ V/m @ 3 meters
Above 960	54.0 dB μ V/m @ 3 meters

Test Method: ANSI C63.4 § Annex D Validation of radiated emissions standard test sites
 ANSI C63.10 § 6.3 Common requirements radiated emissions
 ANSI C63.10 § 6.4 Emissions below 30 MHz
 ANSI C63.10 § 6.5 Emissions between 30 & 1000 MHz
 ANSI C63.10 § 6.6 Emissions above 1 GHz

Field Strength Calculation:

The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dB μ V) to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

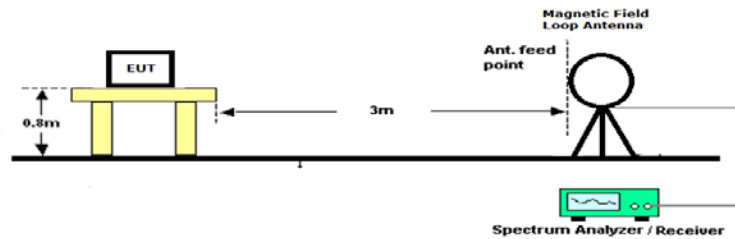
Example:

Freq (MHz)	Meter Reading	+ ACF	+ CL = FS
33	20 dB μ V	+ 10.36 dB	+ 0.5 = 30.86 dB μ V/m @ 3m

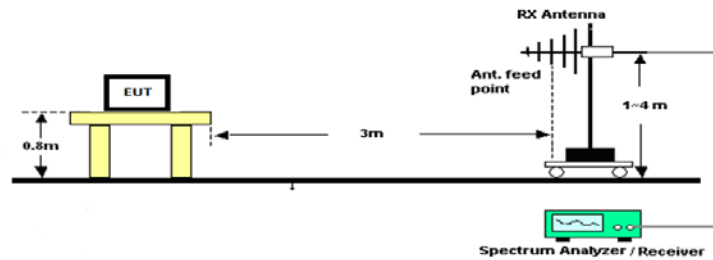
RADIATED SPURIOUS EMISSIONS

Setup:

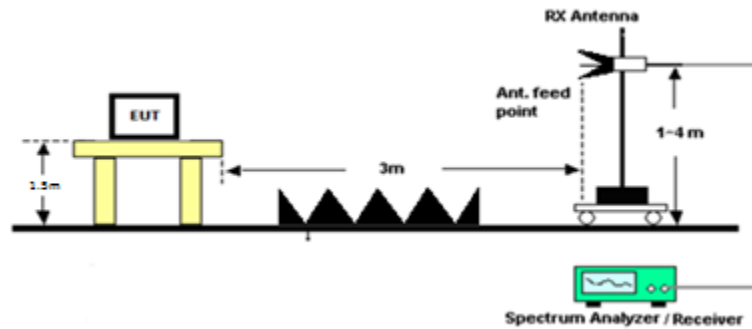
Emissions below 30 MHz



Emissions 30 – 1000 MHz



Emissions above 1 GHz



RADIATED SPURIOUS EMISSIONS

Notes: The EUT was checked in three orthogonal planes as required, a setup photo is provided to show the orientation of the worst case position.

Only the worst case data rate and Output Power which produced emissions within 20dB of the limit are reported.

The spectrum was measured from 9 KHz to 25 GHz

Test Data: **Restricted Band Emissions 3DH5 Field Strength at 3 Meters**

Tuned Freq (MHz)	Emission Freq (MHz)	Detector Type (QP/ PK/ AV)	Meter Reading (dBuV)	Ant. Polarity (H/ V)	Coax Loss (dB)	Correction Factor (dB/m)	Field Strength (dBuV/m)	Margin (dB)
2,402.00	4,804.00	AV	5.5	V	8.07	34	47.57	6.43
2,402.00	4,804.00	PK	8.13	V	8.07	34	50.2	23.8
2,402.00	12,010.00	AV	-5	V	13.05	39.3	47.35	6.65
2,402.00	12,010.00	PK	5.3	V	13.05	39.3	57.65	16.35
2,441.00	4,882.00	AV	2.2	V	8.14	33.92	44.26	9.74
2,441.00	4,882.00	PK	3.9	V	8.14	33.92	45.96	28.04
2,441.00	7,323.00	AV	1.3	V	10	35.6	46.9	7.1
2,441.00	7,323.00	PK	2.55	V	10	35.6	48.15	25.85
2,441.00	12,205.00	AV	-1.1	V	13.14	39.3	51.34	2.66
2,441.00	12,205.00	PK	4.58	V	13.14	39.3	57.02	16.98
2,480.00	4,960.00	AV	1.5	H	8.2	33.96	43.66	10.34
2,480.00	4,960.00	PK	2.25	H	8.2	33.96	44.41	29.59
2,480.00	7,440.00	AV	5	H	10.08	35.6	50.68	3.32
2,480.00	7,440.00	PK	6.65	H	10.08	35.6	52.33	21.67
2,480.00	12,400.00	AV	-1.2	V	13.24	39.2	51.24	2.76
2,480.00	12,400.00	PK	0.04	V	13.24	39.20	52.48	21.52

Results Meet Requirements

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/ Char Date	Due Date
Antenna: Biconical 1096 Chamber	Eaton	94455-1	1096	07/14/15	07/14/17
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/14/15	07/14/17
CHAMBER	Panashield	3M	N/A	04/25/16	12/31/17
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren Chamber	3117	00041534	02/25/15	02/25/17
Antenna: Double-Ridged Horn 18-40 GH	EMCO	3116	9011-2145	11/18/15	11/18/17
Software: Field Strength Program	Timco	N/A	Version 4.0	NA	NA
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	11/18/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	Chamber 3 cable set (Primary)	KMKM-0244-01; KMKM-0670-00; KFKF-0198-01	08/08/16	08/08/18
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	NA	NA	NA
High Pass Filter 18GHz	Micro-Tronics	HPS18771	-002	05/13/16	05/13/18
Band Reject Filter - 2.4 GHz	Micro-Tronics	BRM50702-02	-G042	05/13/16	15/13/18
Pre-amp	RF-LAMBDA	RLNA00M45GA	NA	01/04/16	01/04/18

* EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT

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