

# TEST RESULT SUMMARY

## FCC Part 15 Subpart C Section 15.247 Industry Canada RSS-210 Issue 8

MANUFACTURER	Digi International 11001 Bren Road East Minnetonka MN 55343
DESCRIPTION OF EQUIPMENT	Truck vehicle data bus to WiFi / Bluetooth adapter
NAME OF EQUIPMENT	Vehicle Adapter (Bluetooth radio)
MODEL NUMBER(S) TESTED	50001817-02
SERIAL NUMBER(S) TESTED	0001
TEST REPORT NUMBER	NC1305468.3
TEST DATE(S)	08 July – 28 August 2013

TÜV SÜD America Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the applicable requirements of FCC Part 15 Subpart C Section 15.247 *“Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz”*, and Industry Canada RSS-210 Issue 8 *“Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment”*.


It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

Date: 22 October 2013

Tested by:

Approved by:

Location: Taylors Falls MN  
USA

  
Greg Jakubowski  
Senior EMC Technician

  
Joel T Schneider  
Senior EMC Engineer

Not Transferable

# EMC TEST REPORT

Test Report No. NC1305468.3 Date of issue: 22 October 2013

Product Description Truck vehicle data bus to WiFi / Bluetooth adapter

Product Name Vehicle Adapter (Bluetooth radio)

Model No(s) Tested 50001817-02

Serial No(s) Tested 0001

Manufacturer Digi International

Address 11001 Bren Road East  
Minnetonka MN 55343

Test Result ☒ **Positive** ☐ **Negative**

*TÜV SÜD America Inc reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. TÜV SÜD America Inc shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD America Inc issued reports.*

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*TÜV SÜD America Inc and its professional staff hold government and professional organization certifications and are members of AAMI, ACIL, AEA, ANSI, IEEE, NARTE, and VCCI.*

## REVISION RECORD

REVISION	TOTAL NUMBER OF PAGES	DATE	DESCRIPTION
	47	22 October 2013	Initial Release



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#### EMC TEST REGULATIONS:

The tests were performed according to the following regulations:

- FCC Part 15 Subpart C Sections 15.247(a)1, (b)1), (d)
- Industry Canada RSS-210 Issue 8 Sections A8.1(a)(b)(d), A8.4(2), A8.5

#### ENVIRONMENTAL CONDITIONS IN THE LAB

	<u>Actual</u>
Temperature:	: 20-23°C
Atmospheric pressure	: 98-99 kPa
Relative Humidity	: 65-75%

#### POWER SUPPLY UTILIZED

Power supply system : 13.5 VDC

#### TEST EQUIPMENT

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated according to internal procedure.

#### SIGN EXPLANATIONS

- ☐ - not applicable
- ☒ - applicable.

## Carrier frequency separation

FCC 15.247(a)1, IC RSS-210 A8.1(b)

### Test summary

The requirements are: ☒ - MET ☐ - NOT MET

Testing per FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"

Carrier frequency separation is 1 MHz, which is the 20 dB bandwidth

### Test location

☐ - Wild River Lab Large Test Site (Open Area Test Site)

☐ - Wild River Lab Small Test Site (Open Area Test Site)

☒ - Wild River Shield Room 2

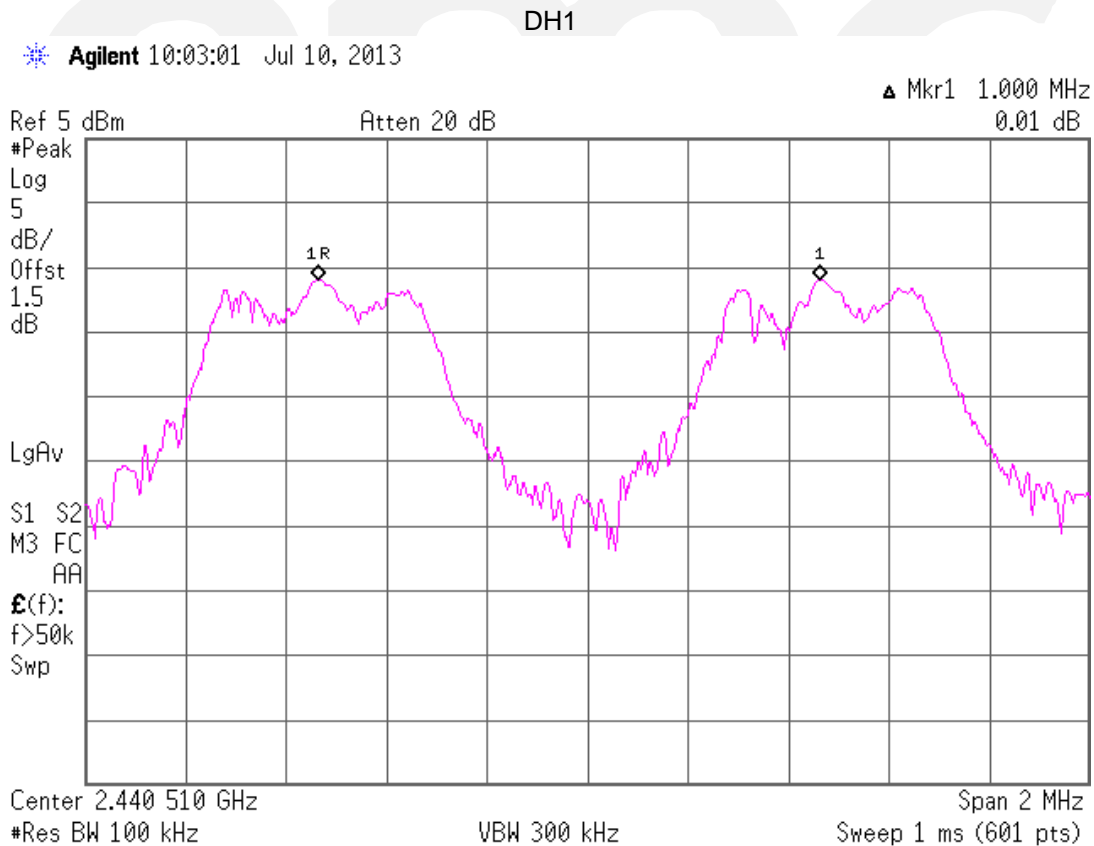
### Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13

### Test limit

Separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

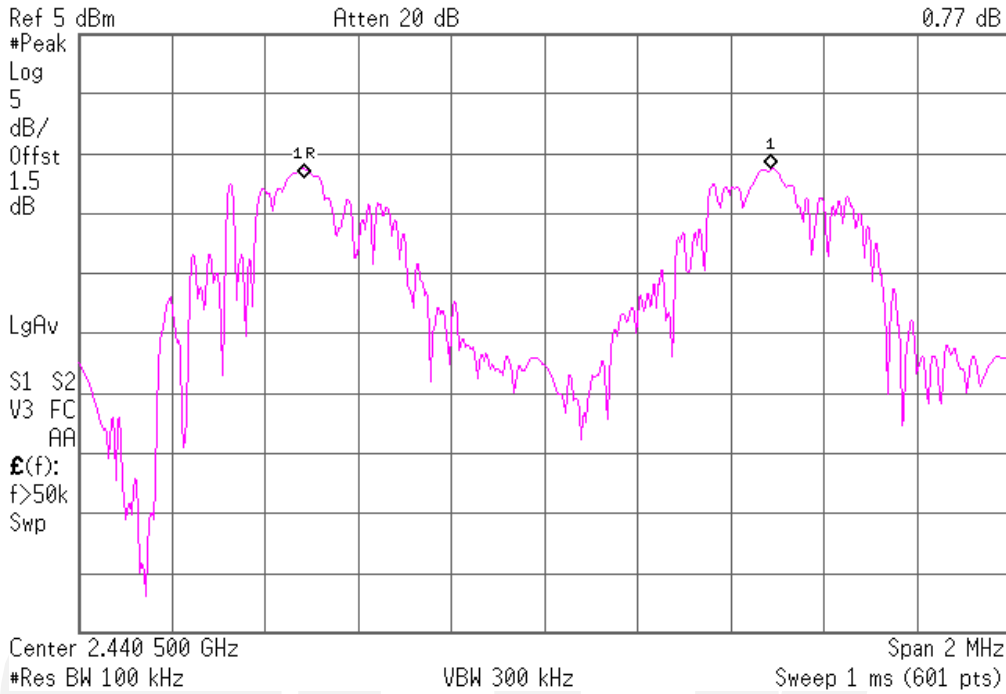
### Test data



### DH3

Agilent 13:06:55 Jul 10, 2013

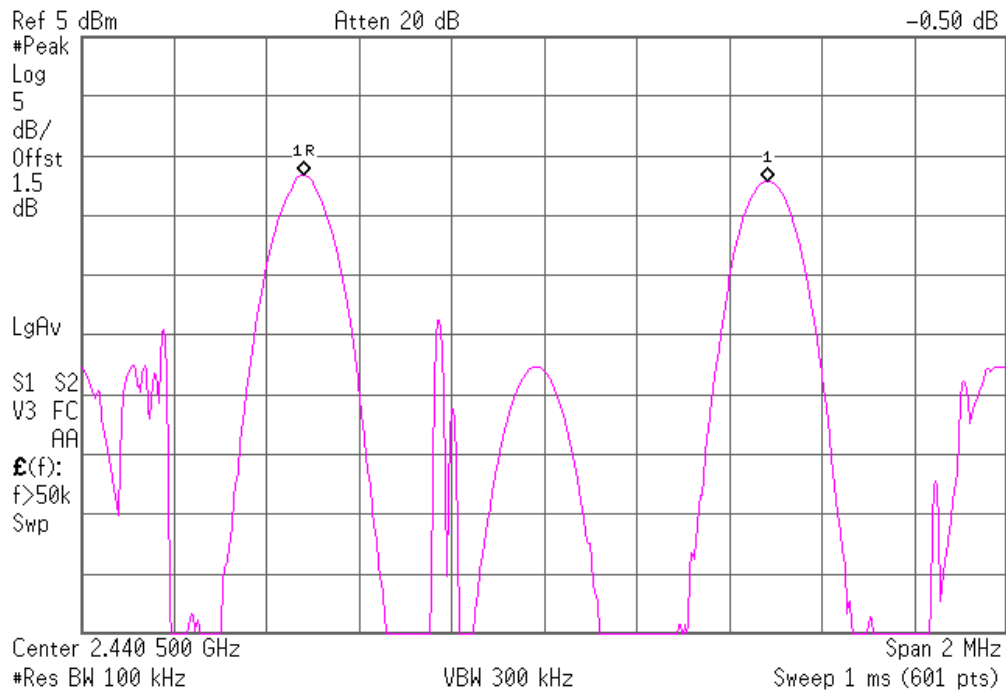
Mkr1 1.003 MHz  
0.77 dB



### DH5

Agilent 12:58:18 Jul 10, 2013

Mkr1 1.003 MHz  
-0.50 dB



## Number of Hopping Frequencies

FCC 15.247(a)(1)(iii), IC RSS-210 A8.1(d)

### Test summary

The requirements are: ☒ - MET ☐ - NOT MET

Testing per FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"

Number of Hopping Frequencies is 79

### Test location

☐ - Wild River Lab Large Test Site (Open Area Test Site)

☐ - Wild River Lab Small Test Site (Open Area Test Site)

☒ - Wild River Shield Room 2

### Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13

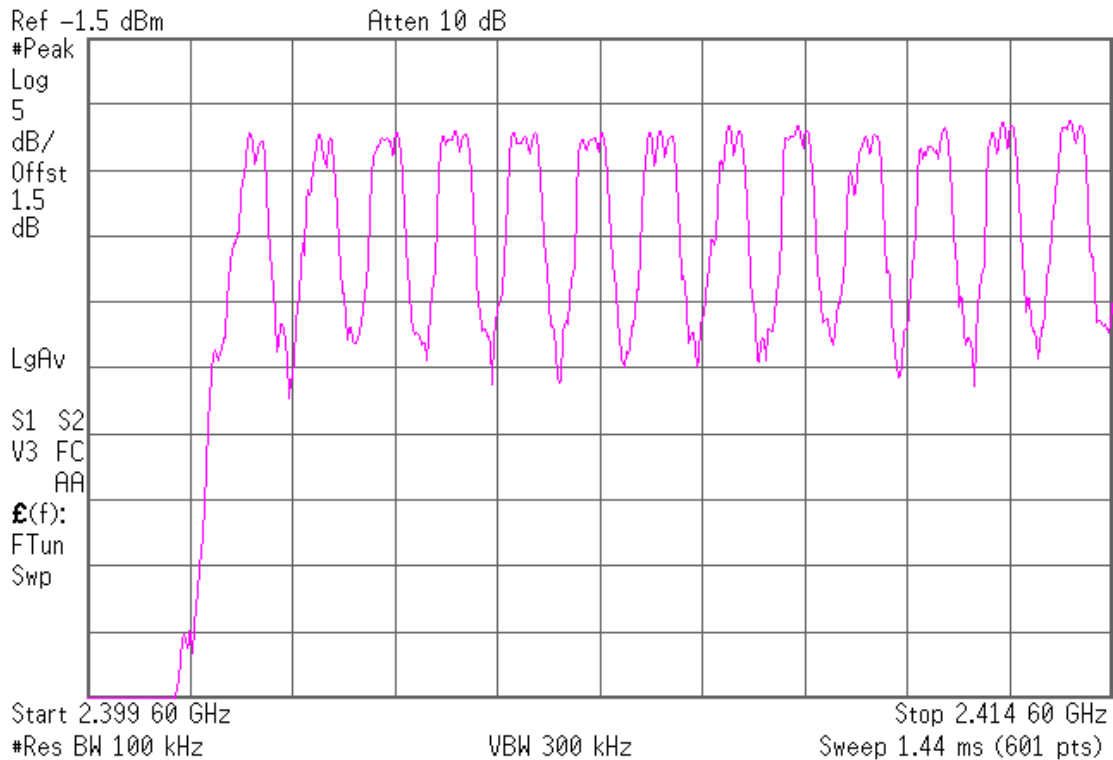
### Test limit

At least 15 channels

### Test data

1 of 6

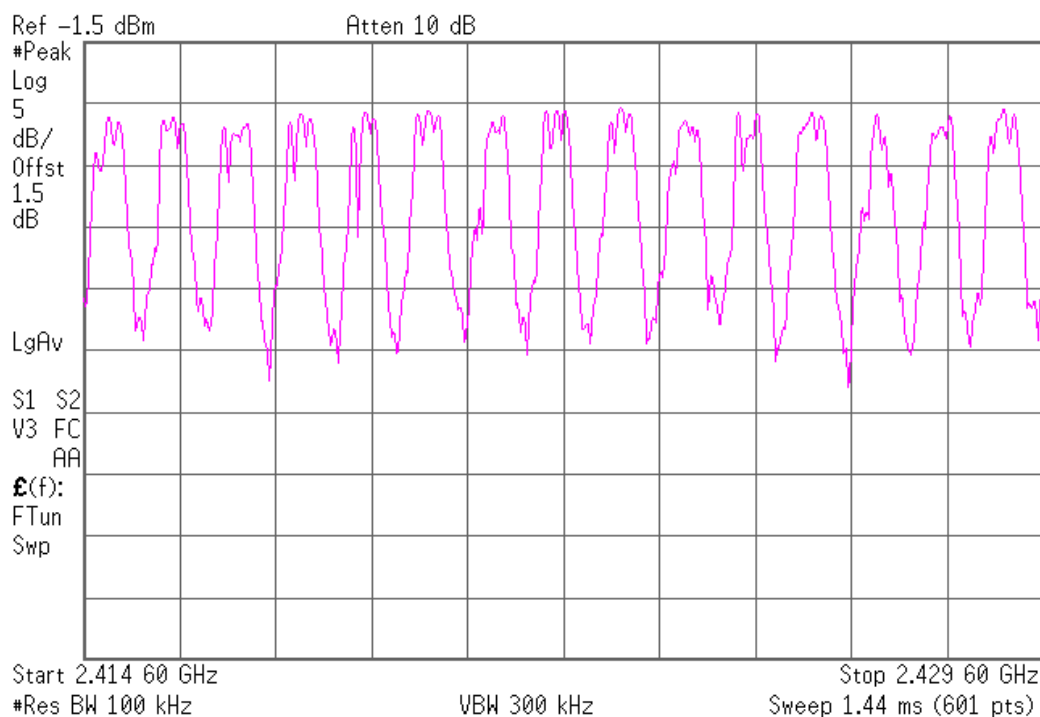
\* Agilent 10:14:03 Jul 10, 2013





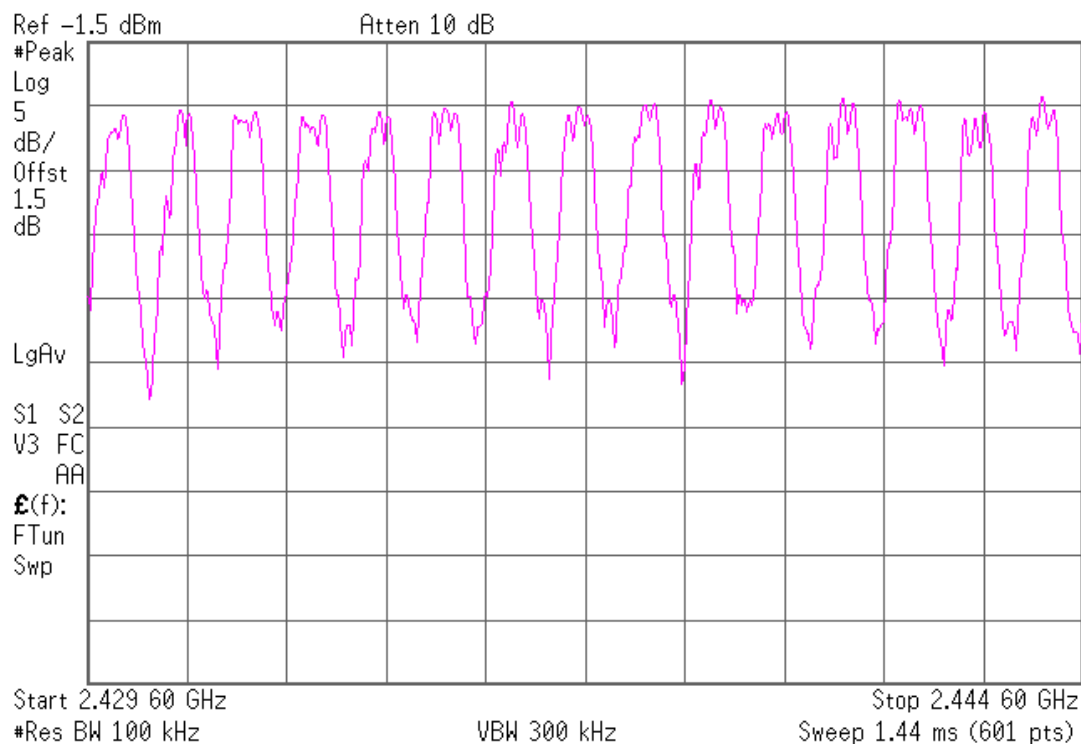
2 of 6

✱ Agilent 10:17:06 Jul 10, 2013



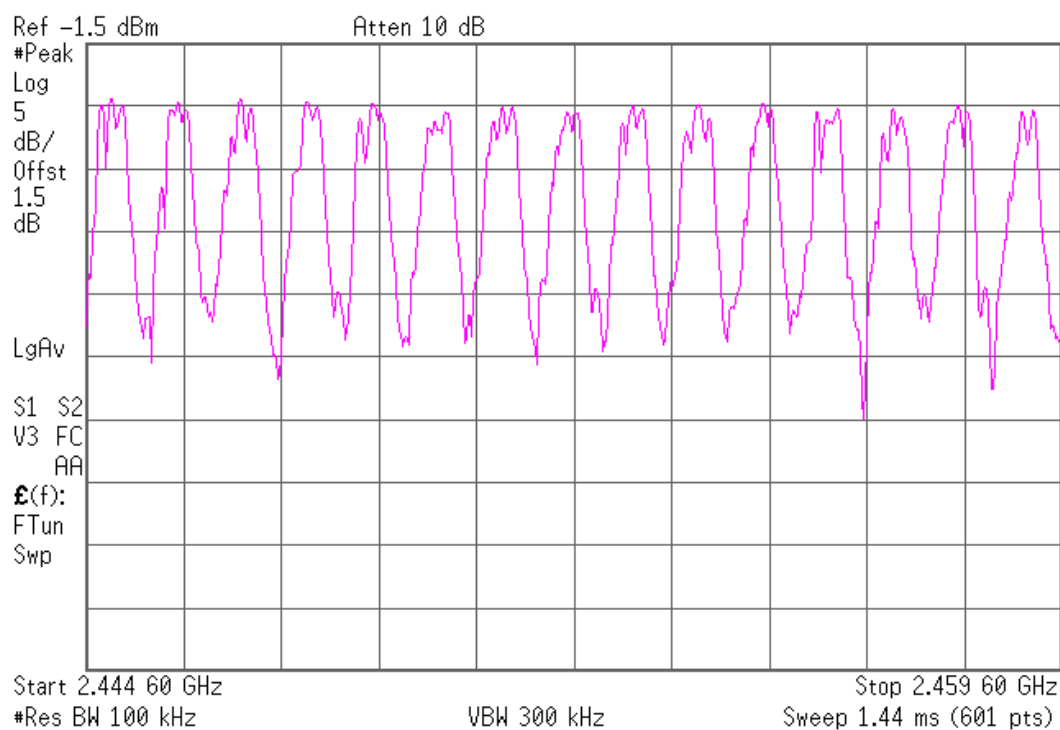
3 of 6

✱ Agilent 10:25:44 Jul 10, 2013



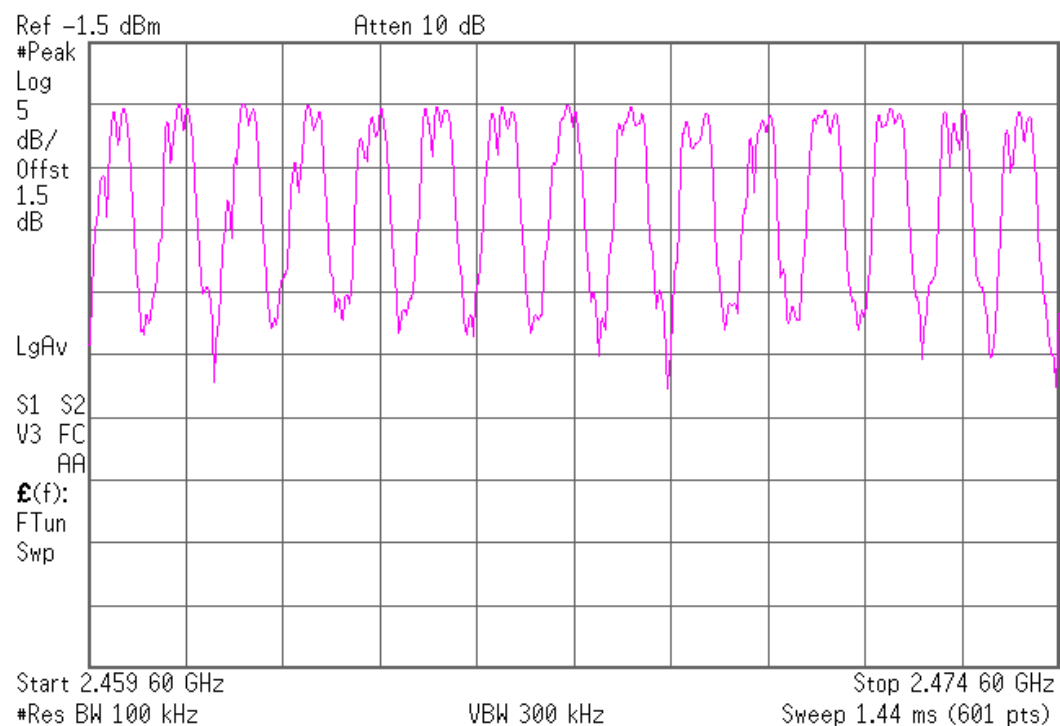
4 of 6

Agilent 10:19:53 Jul 10, 2013



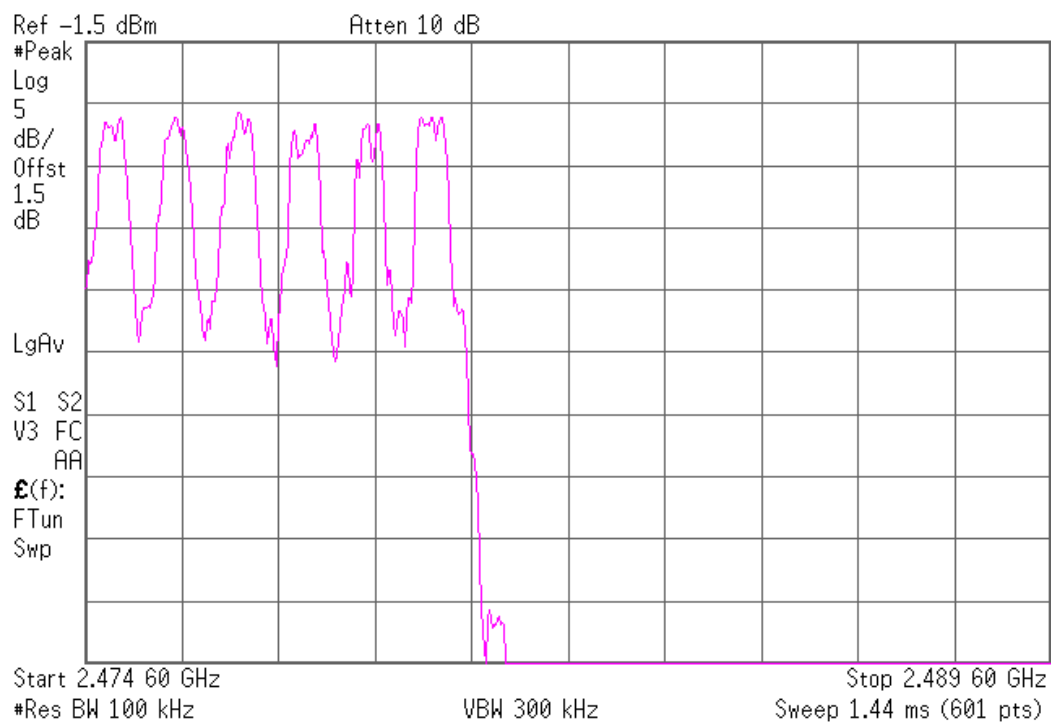
5 of 6

Agilent 10:21:23 Jul 10, 2013



6 of 6

✱ Agilent 10:22:33 Jul 10, 2013



## Time of Occupancy

FCC 15.247(a)(1)iii, IC RSS-210 A8.1(d)

### Test summary

The requirements are: ■ - MET □ - NOT MET

Testing per FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"  
2.908 millisecond pulses

Typically, Bluetooth 1xEDR w/DH5 operation mode has a channel hopping rate of 1600 hops/s. 1xEDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the BT transmitter hopping at a rate of  $1600/6 = 266.67$  hops/s/slot.

$266.67 \text{ hops/second} / 79 \text{ channels} = 3.38 \text{ hops/s on one channel}$

$3.38 \text{ hops/second/channel} \times 31.6 \text{ seconds} = 106.67 \text{ hops}$

$106.67 \text{ hops} \times 2.908 \text{ msec/channel} = 310.1 \text{ msec time of occupancy per 31.6 seconds}$

### Test location

■ - Wild River Shield Room 2

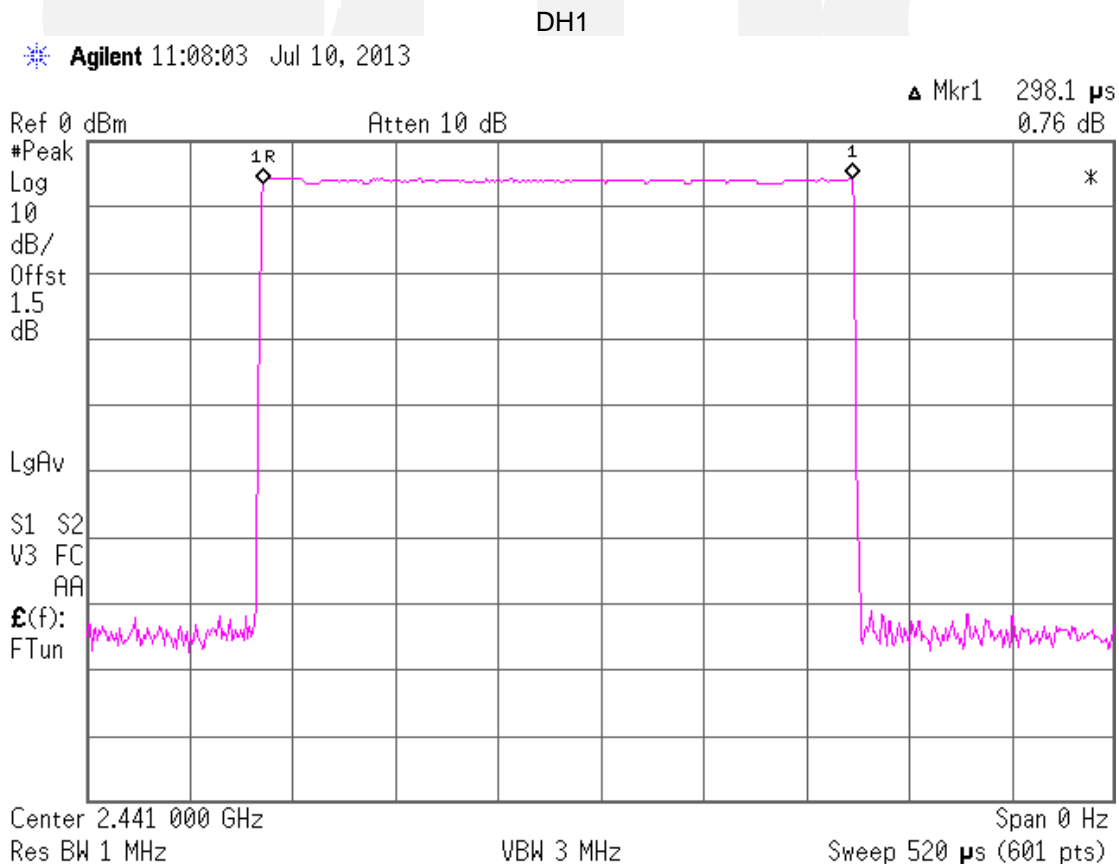
### Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13

### Test limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed.  $0.4 \times 79 = 31.6$  seconds.

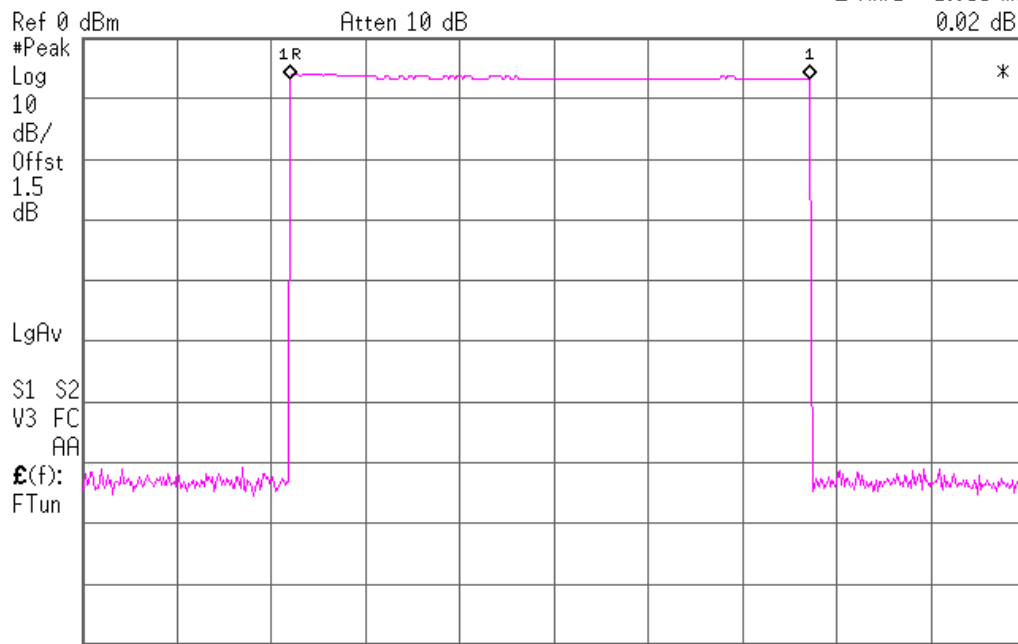
### Test data



### DH3

Agilent 11:48:00 Jul 10, 2013

▲ Mkr1 1.655 ms  
0.02 dB

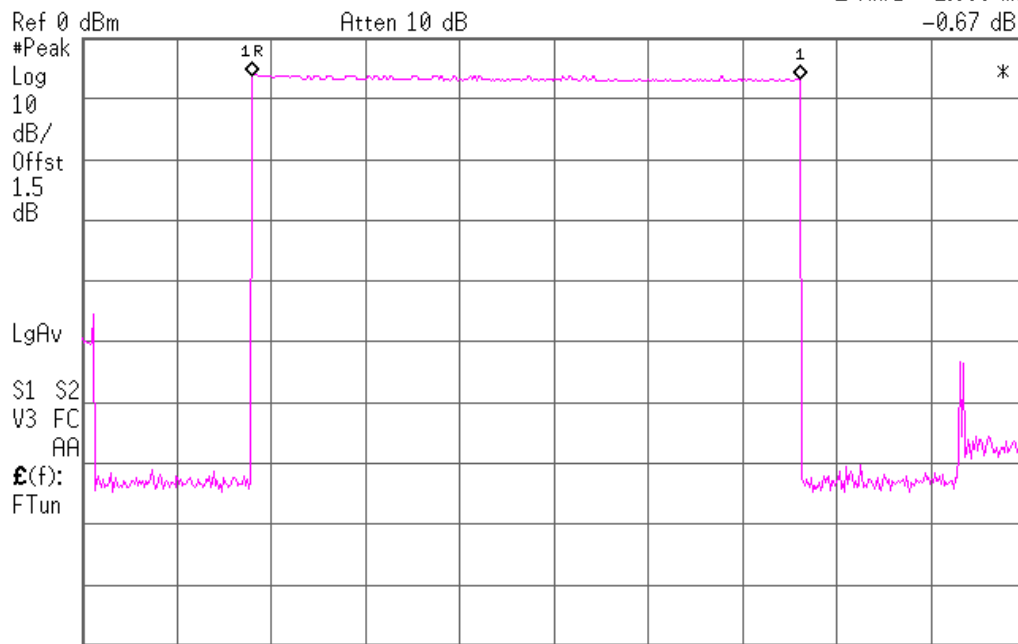


Center 2.441 000 GHz Span 0 Hz  
Res BW 1 MHz VBW 3 MHz Sweep 3 ms (601 pts)

### DH5

Agilent 11:54:02 Jul 10, 2013

▲ Mkr1 2.908 ms  
-0.67 dB



Center 2.441 000 GHz Span 0 Hz  
Res BW 1 MHz VBW 3 MHz Sweep 5 ms (601 pts)

## 20 dB Bandwidth

FCC 15.247(a)(1), IC RSS-210 A8.1(a)

### Test summary

The requirements are: ■ - MET □ - NOT MET

Testing per FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"

The 20 dB bandwidth is 1.0 MHz

### Test location

- - Wild River Lab Large Test Site (Open Area Test Site)
- - Wild River Lab Small Test Site (Open Area Test Site)
- - Wild River Shield Room 2

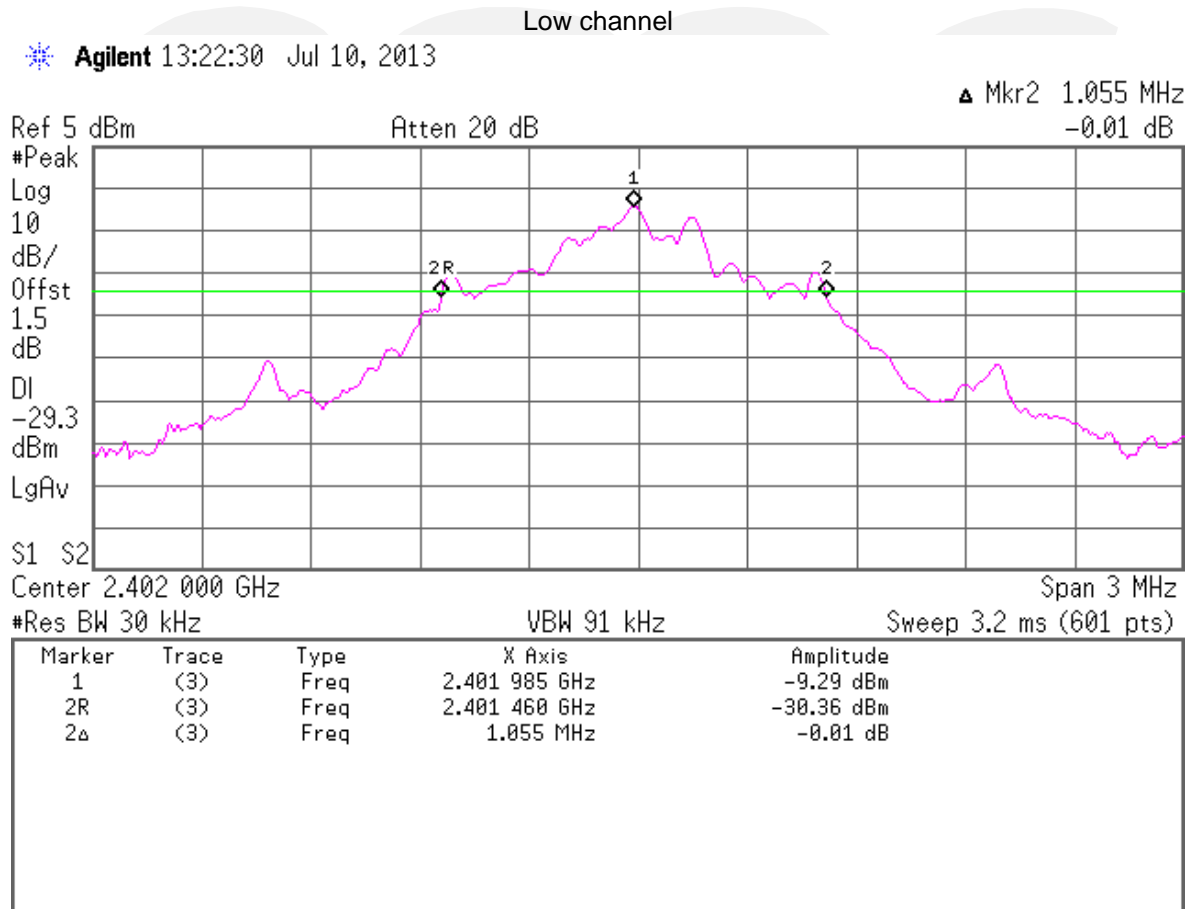
### Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13

### Test limit

Unspecified

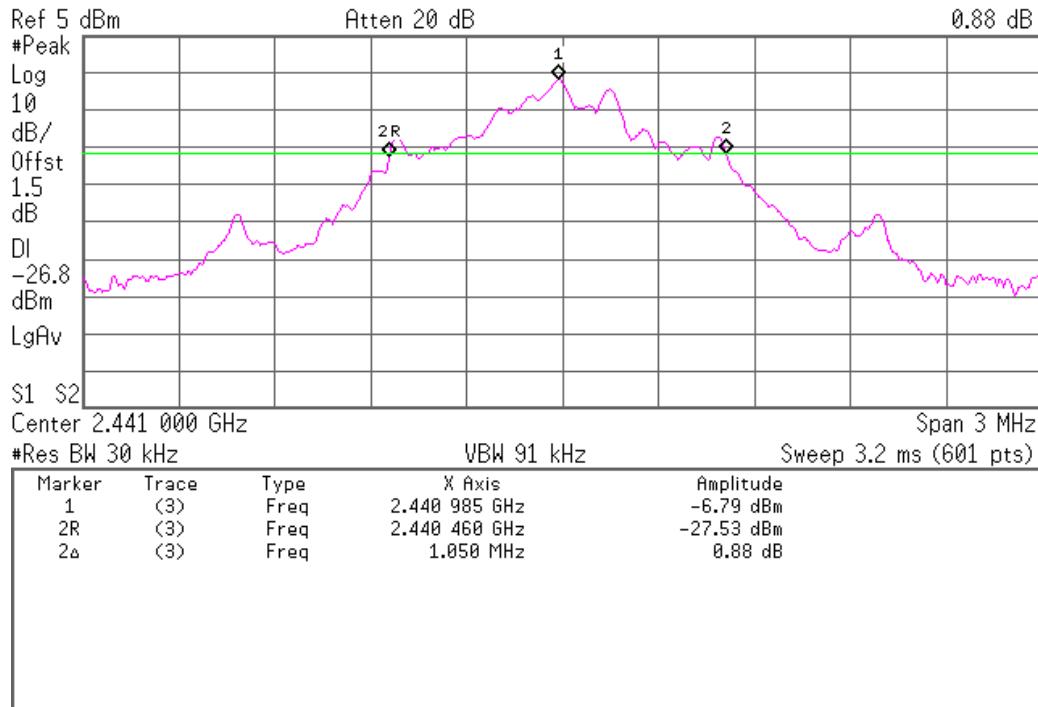
### Test data



### Mid channel

✱ Agilent 13:26:52 Jul 10, 2013

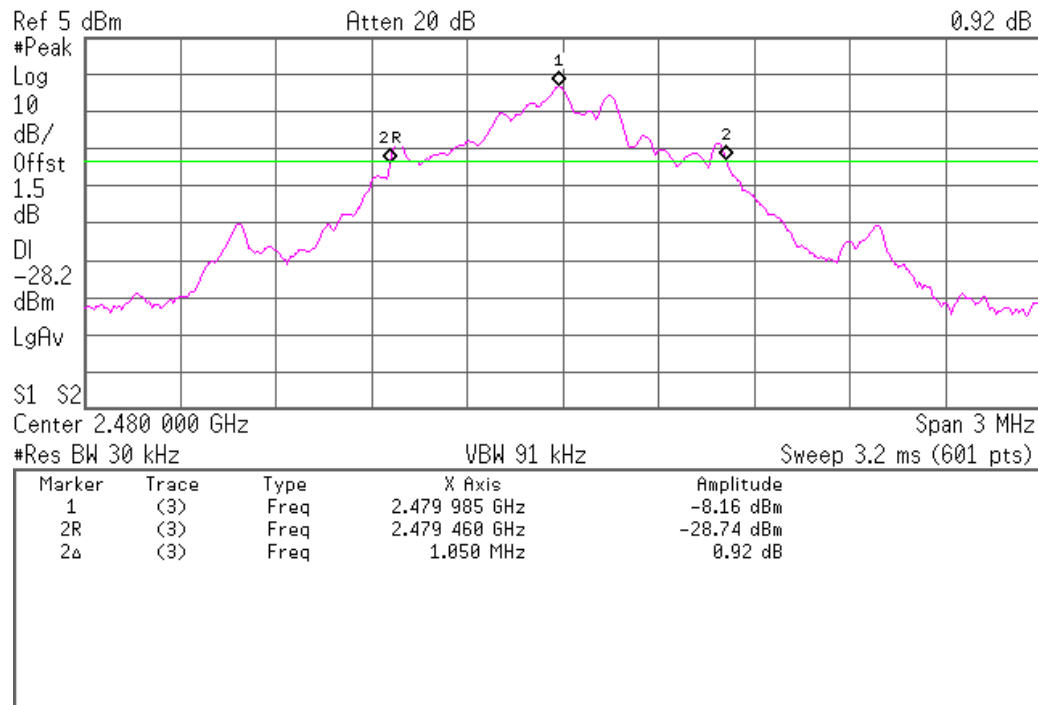
▲ Mkr2 1.050 MHz  
0.88 dB



### High channel

✱ Agilent 13:29:08 Jul 10, 2013

▲ Mkr2 1.050 MHz  
0.92 dB



## Peak output power

FCC 15.247(b)(1), IC RSS-210 A8.4(2)

## Test summary

The requirements are: ☒ - MET ☐ - NOT MET

Testing per FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"

The maximum conducted peak output power is 7.93 dBm or 6.22 mW

## Test location

- ☐ - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☒ - Wild River Shield Room 2

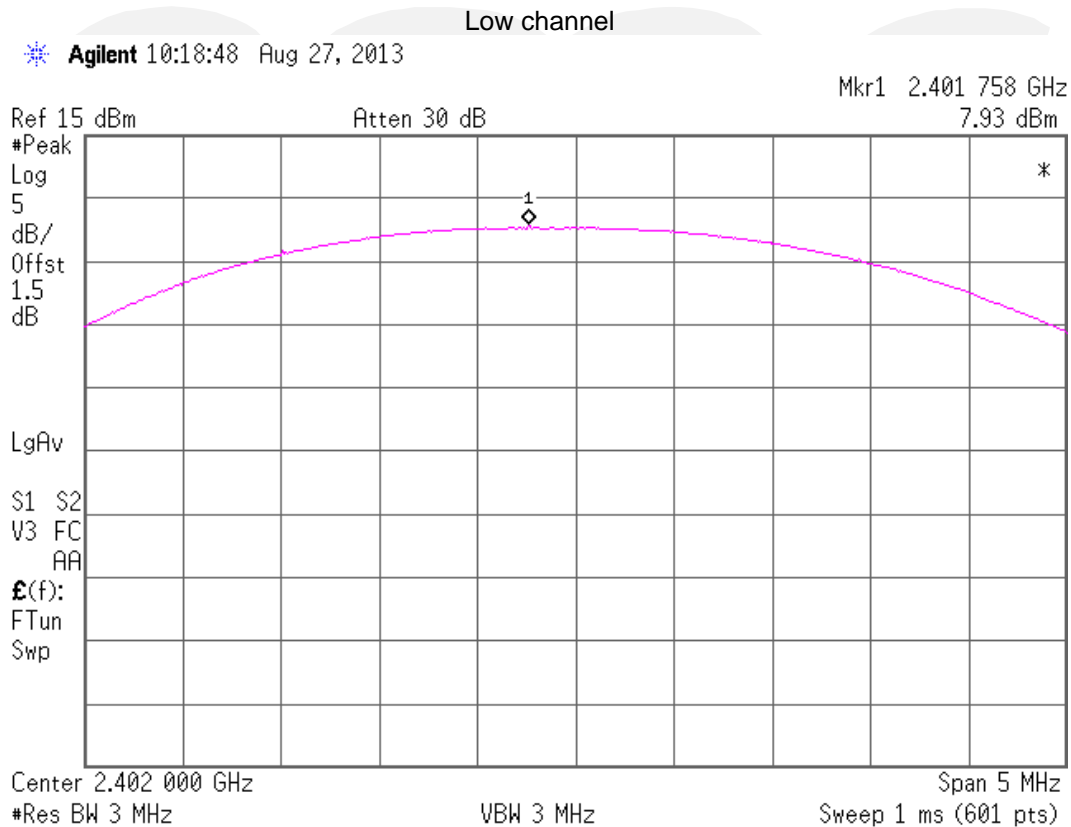
## Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13

## Test limit

1 Watt

## Test data, DH1

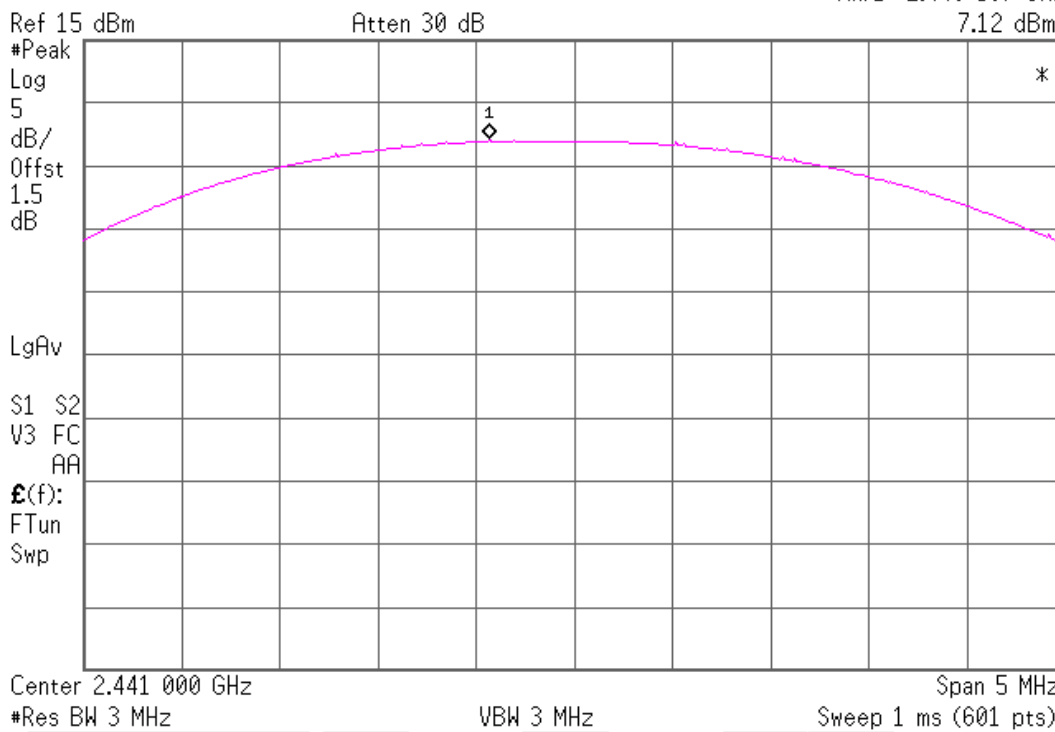




### Mid channel

Agilent 10:35:23 Aug 27, 2013

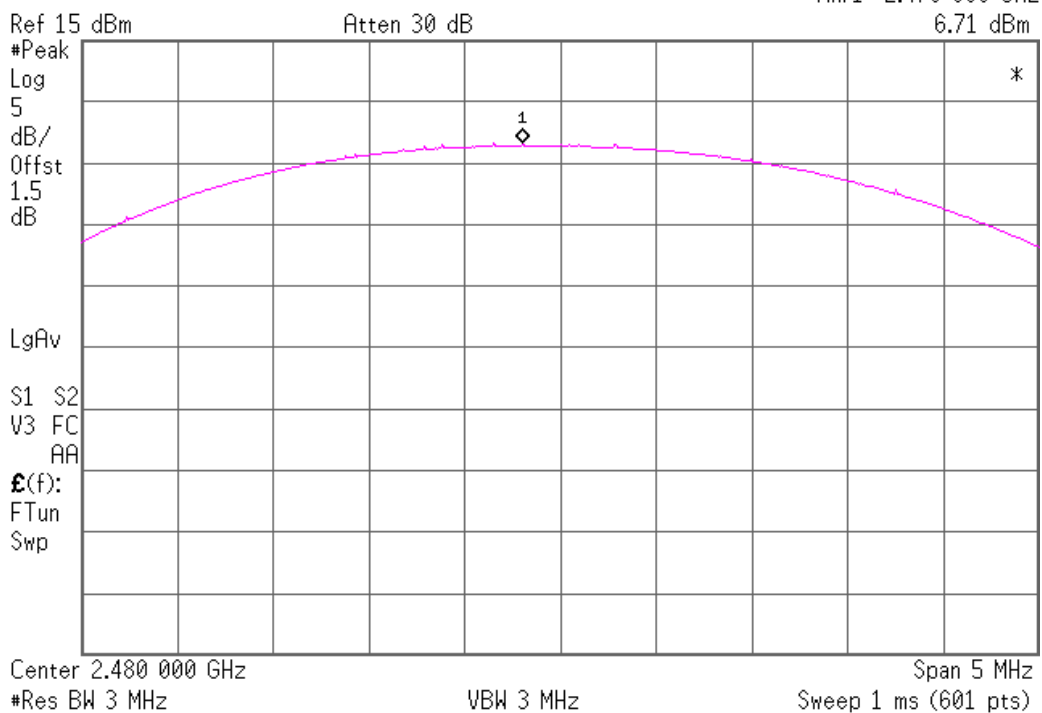
Mkr1 2.440 567 GHz  
7.12 dBm



### High channel

Agilent 10:39:35 Aug 27, 2013

Mkr1 2.479 800 GHz  
6.71 dBm

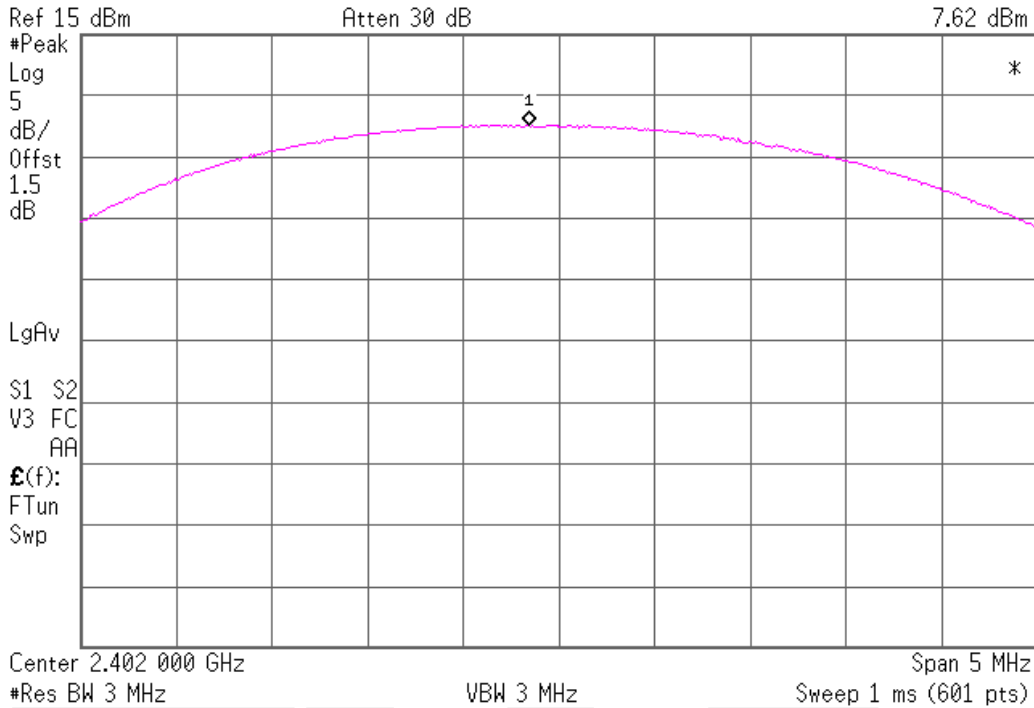


### Test data, DH3

#### Low channel

✱ Agilent 10:28:40 Aug 27, 2013

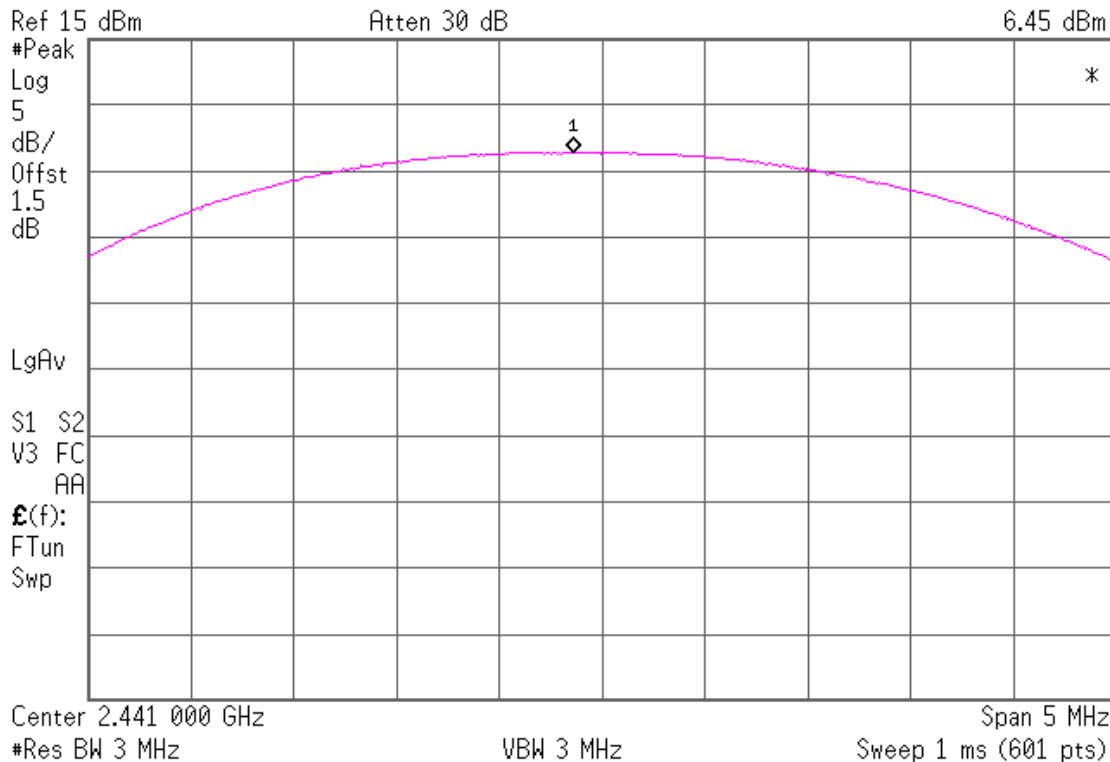
Mkr1 2.401 842 GHz  
7.62 dBm



#### Mid channel

✱ Agilent 10:35:50 Aug 27, 2013

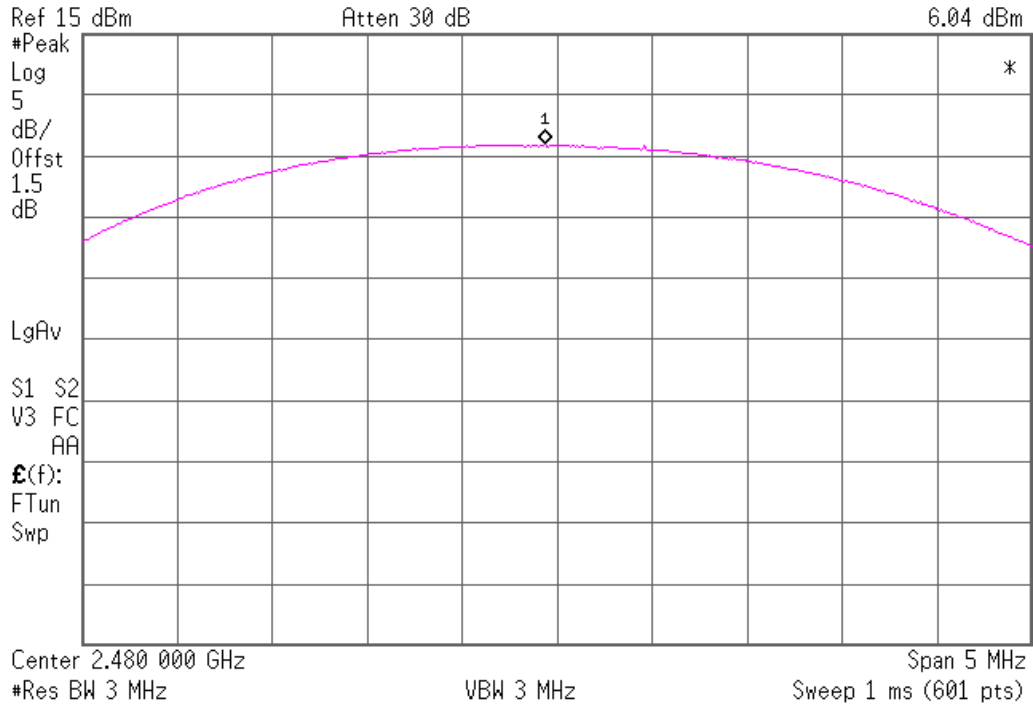
Mkr1 2.440 858 GHz  
6.45 dBm



### High channel

Agilent 10:40:11 Aug 27, 2013

Mkr1 2.479 933 GHz

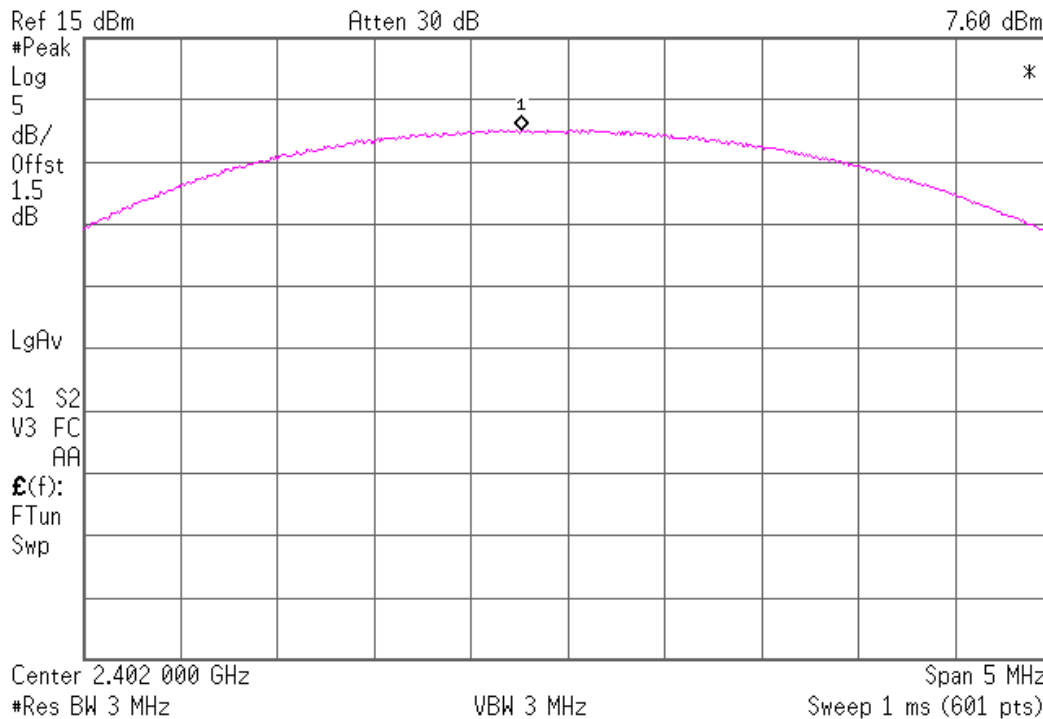


### Test data, DH5

### Low channel

Agilent 10:29:16 Aug 27, 2013

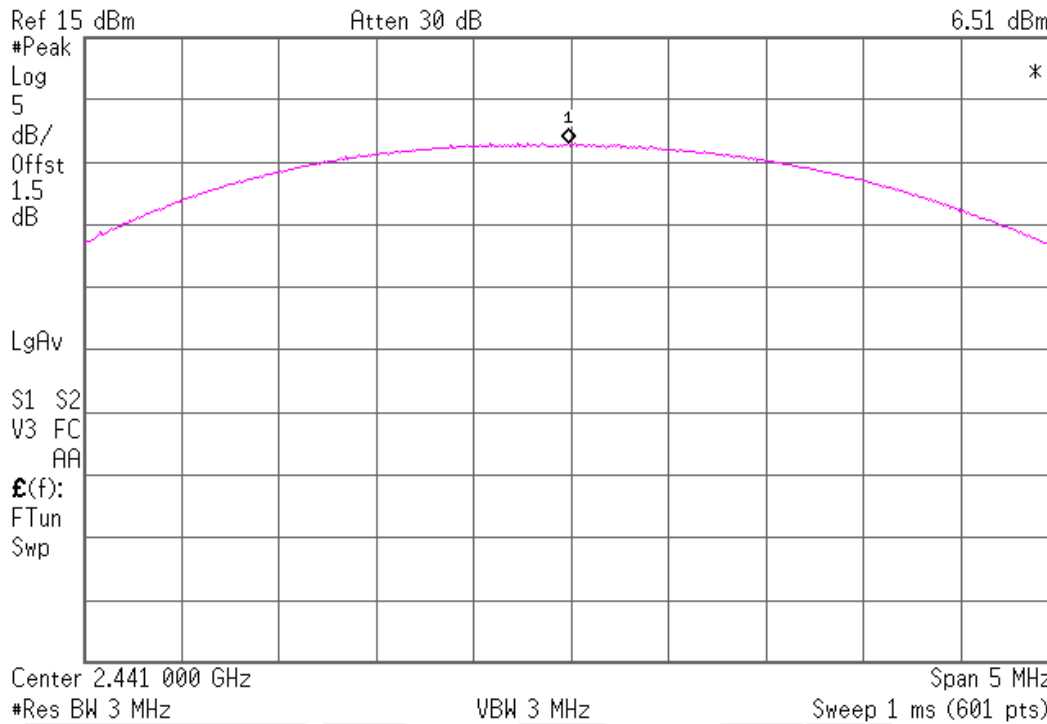
Mkr1 2.401 758 GHz



mid channel

Agilent 10:36:15 Aug 27, 2013

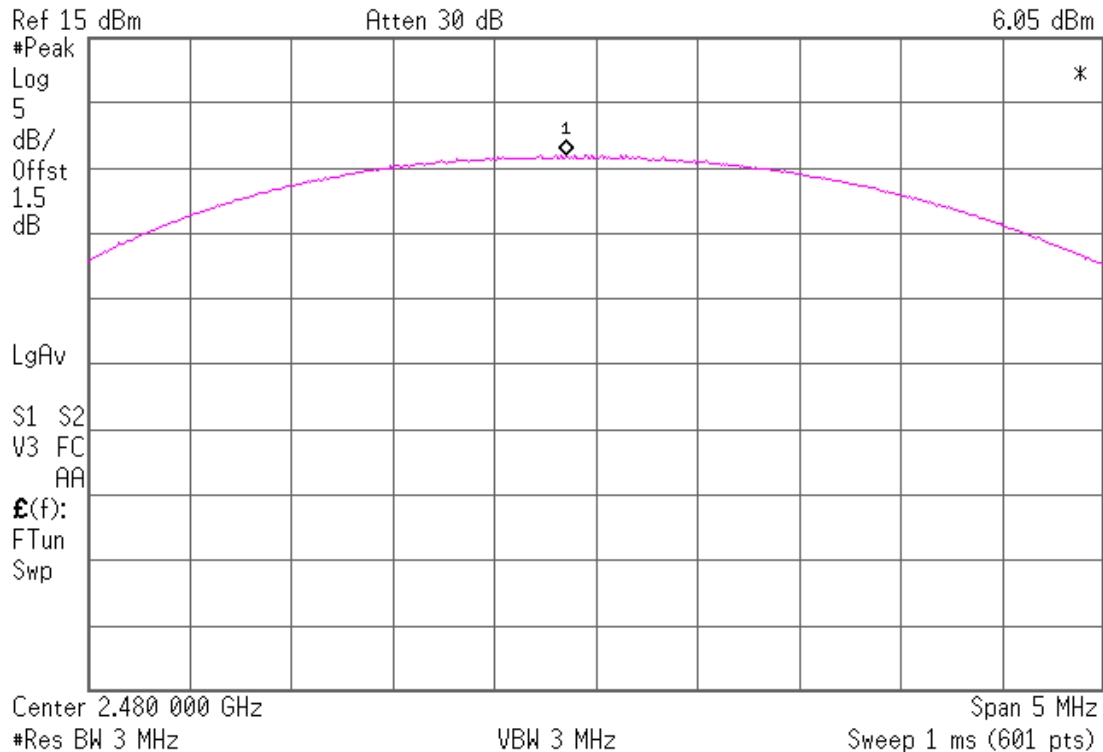
Mkr1 2.440 983 GHz  
6.51 dBm



High channel

Agilent 10:40:37 Aug 27, 2013

Mkr1 2.479 850 GHz  
6.05 dBm



## Band edge

FCC 15.247(d) RSS-210 A8.5

## Test summary

The requirements are: ☒ - MET ☐ - NOT MET

Testing per FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"

Maximum average field strength of a bandedge emission is 52.87 dBuV/m at 3m at 2.4835 GHz

Minimum margin of compliance is 1.13 dB

Maximum peak field strength of a bandedge emission is 63.79 dBuV/m at 3m at 2.4835 GHz

Minimum margin of compliance is 10.21 dB

## Test location

☒ - Wild River Lab Large Test Site (Open Area Test Site)

☐ - Wild River Lab Small Test Site (Open Area Test Site)

☐ - Wild River Lab Large Test Site Tech Area

## Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE02075	3115	EMCO	Ridge Guide Ant. 1-18 GHz	9001-3275	12-Feb-14
WRLE10527	SL18B4020	Phase One Microwave	Preamplifier 1 – 18 GHz	0001	Code B 08-Jan-14
WRLE03058	2	Inmet	20 dB Attenuator	18N20W-20dB	Code B 04-Feb-14
WRLE02689	8566B	Hewlett-Packard	Spectrum Analyzer	2416A00321	22-Apr-14
WRLE03295	85662A	Hewlett-Packard	Analyzer Display	2349A06144	22-Apr-14

## Test limit

Radiated emissions in the restricted bands

Frequency (GHz)	Field strength (μV/meter)	Field strength (dBμV/meter)
2.39 & 2.4835	500 – AV 5000 – PK	54.0 74.0

Allowed Frequency Band edge

-20 dBc

## Test data

### Measurement summary for limit1: FCC 15.247 >1GHz 3m (Pk)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC 15.247 >1GHz 3m pk
High channel					
2.4835 GHz	52.95 Pk	4.66 / 28.59 / 43.36 / 20.96	63.79	V / 1.03 / 323	-10.21
Low channel					
2.39 GHz	50.1 Pk	4.49 / 28.25 / 43.26 / 21.02	60.6	V / 1.03 / 323	-13.4

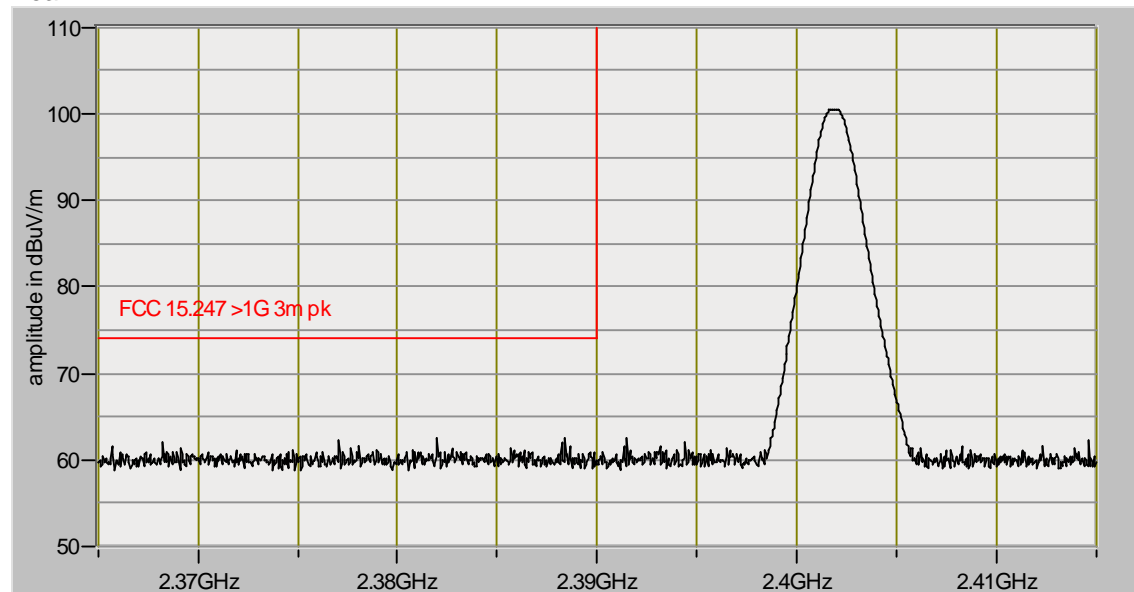
### Measurement summary for limit2: FCC 15.247 >1GHz 3m av (Av)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA2 FCC 15.247 >1GHz 3m av
High channel					
2.4835 GHz	42.03 Av	4.66 / 28.59 / 43.36 / 20.96	52.87	V / 1.03 / 323	-1.13
Low channel					
2.39 GHz	40.06 Av	4.49 / 28.25 / 43.26 / 21.02	50.56	V / 1.03 / 323	-3.44

Band edge

Bluetooth Low channel, DH1 packet type

Peak

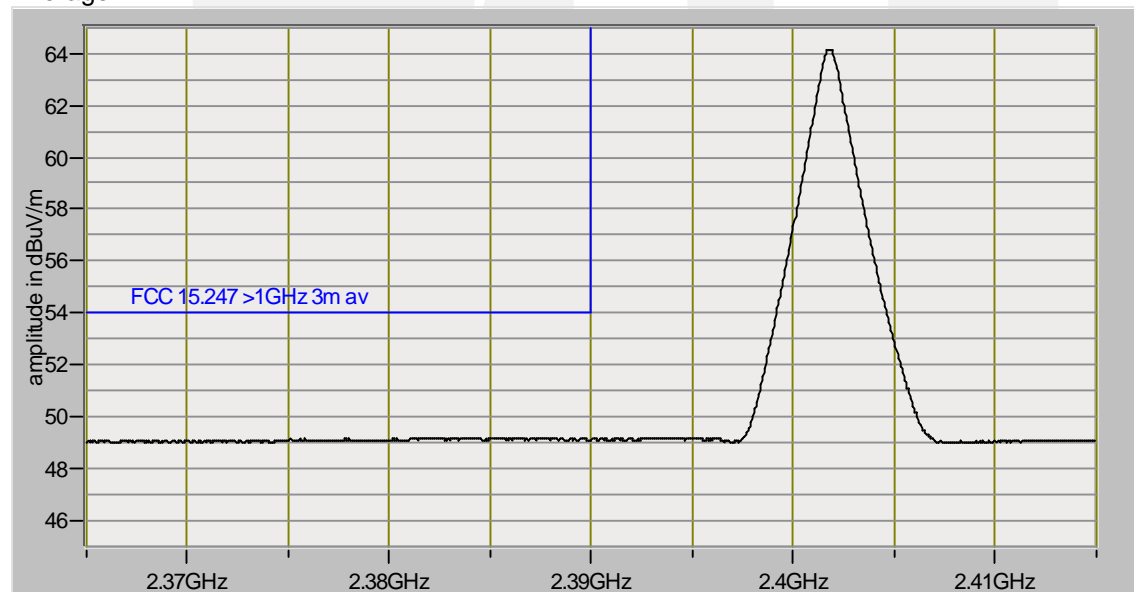


RBW 1 MHz

VBW 1 MHz

Also demonstrates -20 dBc compliance at 2.4 GHz band edge.

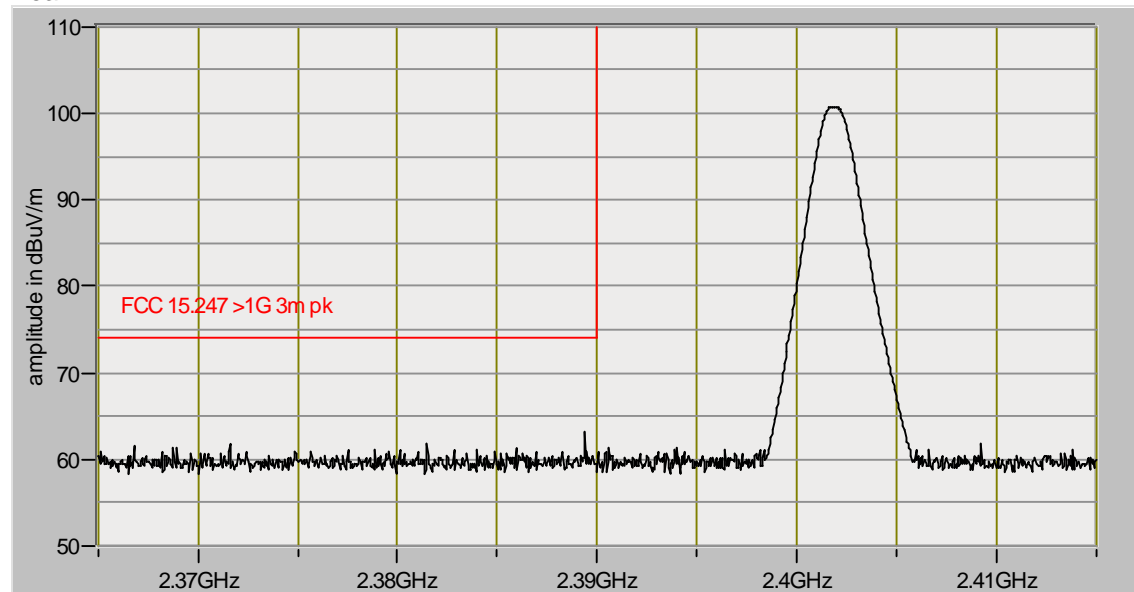
Average



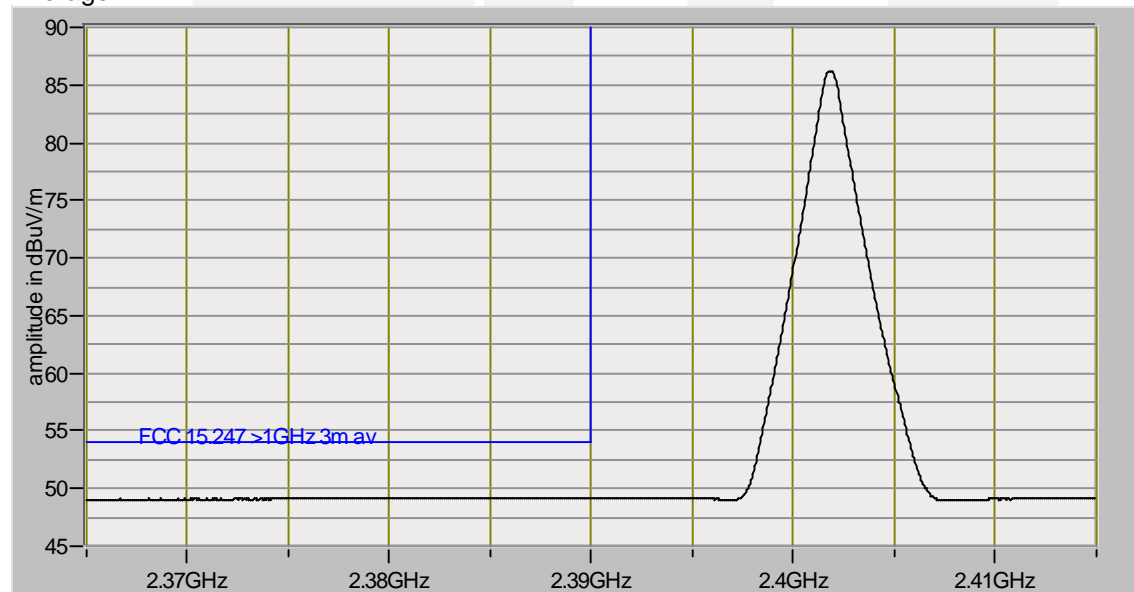
RBW 1 MHz

VBW 10 Hz

Bluetooth Low channel, DH3 packet type  
Peak

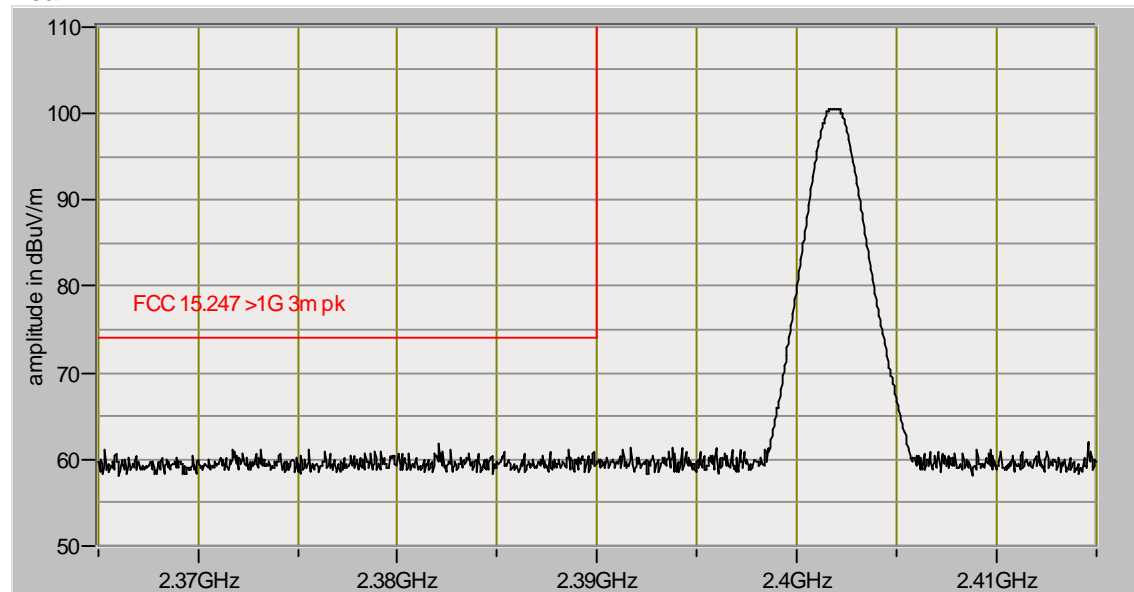


RBW 1 MHz VBW 1 MHz  
Also demonstrates -20 dBc band edge compliance at 2.4 GHz  
Average



RBW 1 MHz VBW 10 Hz

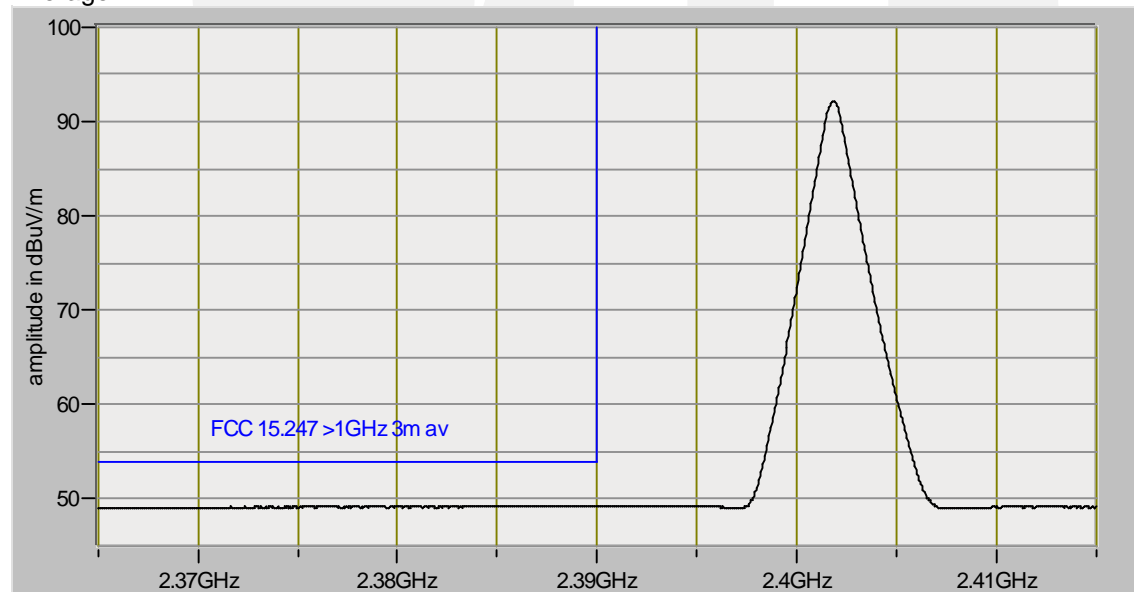
Bluetooth Low channel, DH5 packet type  
Peak



RBW 1 MHz

VBW 1 MHz

Average



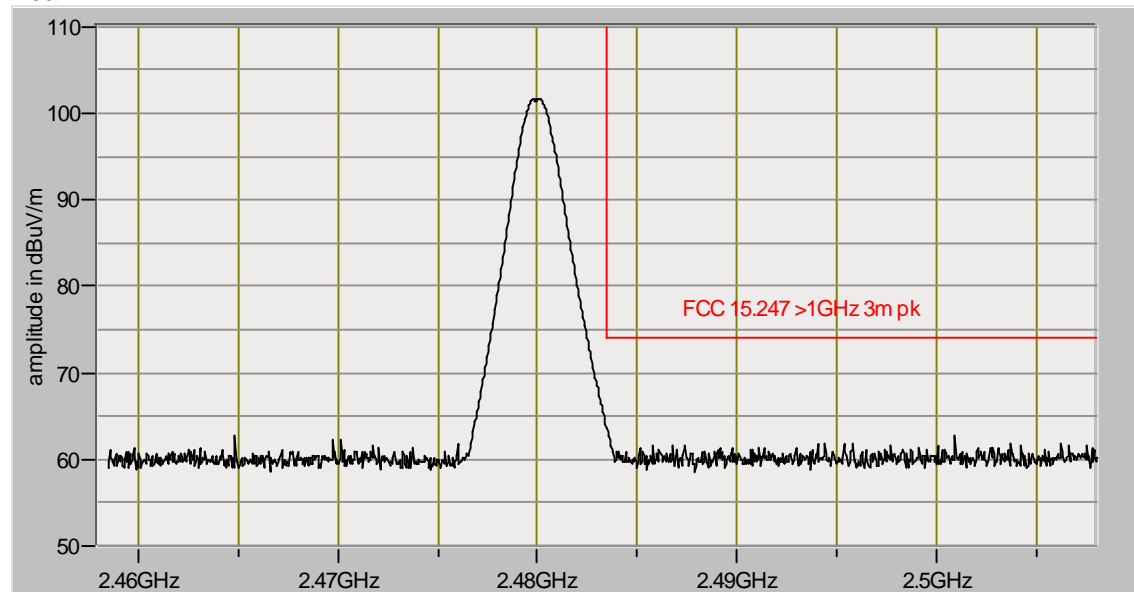
RBW 1 MHz

VBW 10 Hz



Bluetooth High channel, DH1 packet type

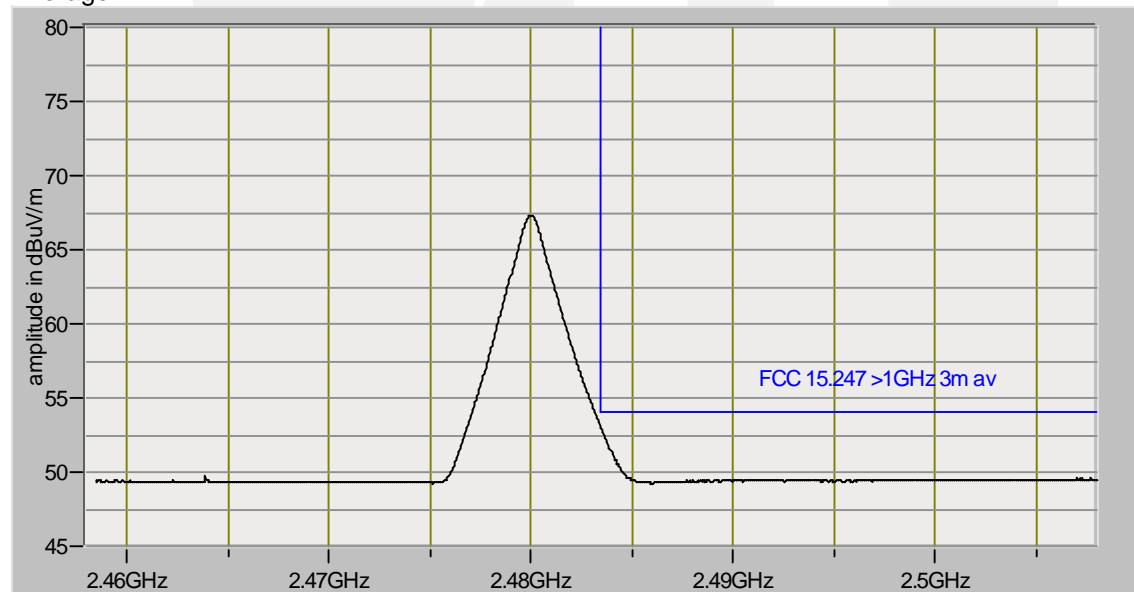
Peak



RBW 1 MHz

VBW 1 MHz

Average

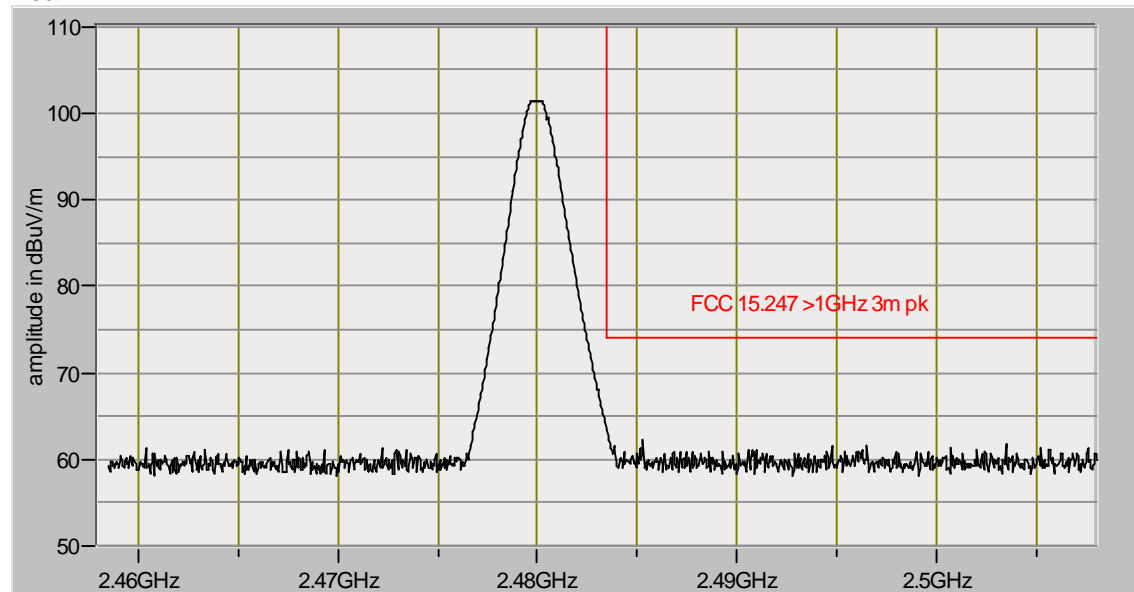


RBW 1 MHz

VBW 10 Hz

Bluetooth High channel, DH3 packet type

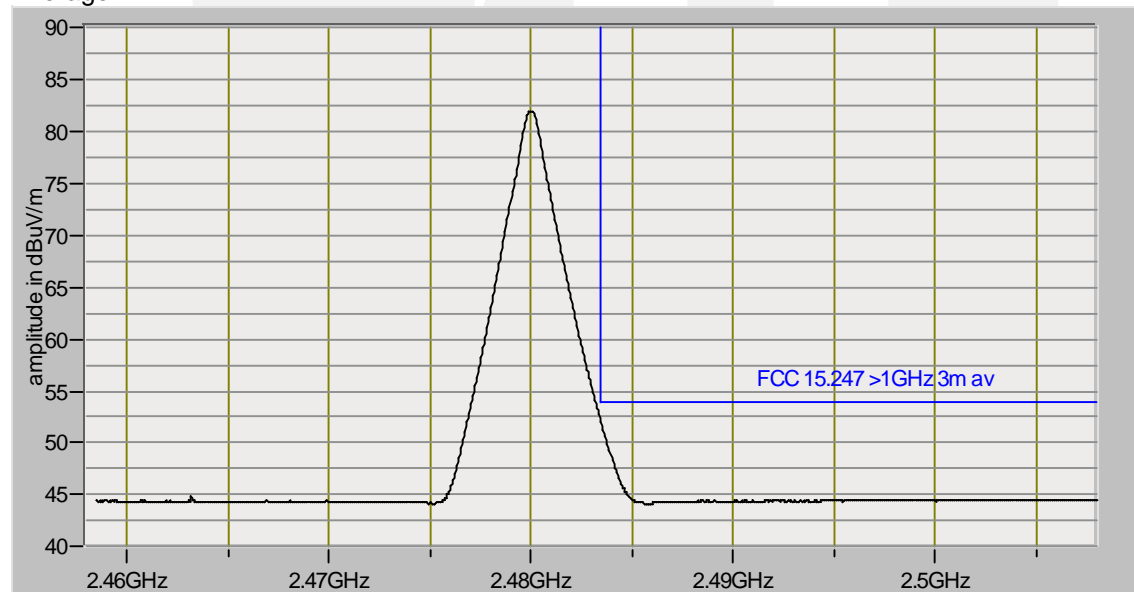
Peak



RBW 1 MHz

VBW 1 MHz

Average

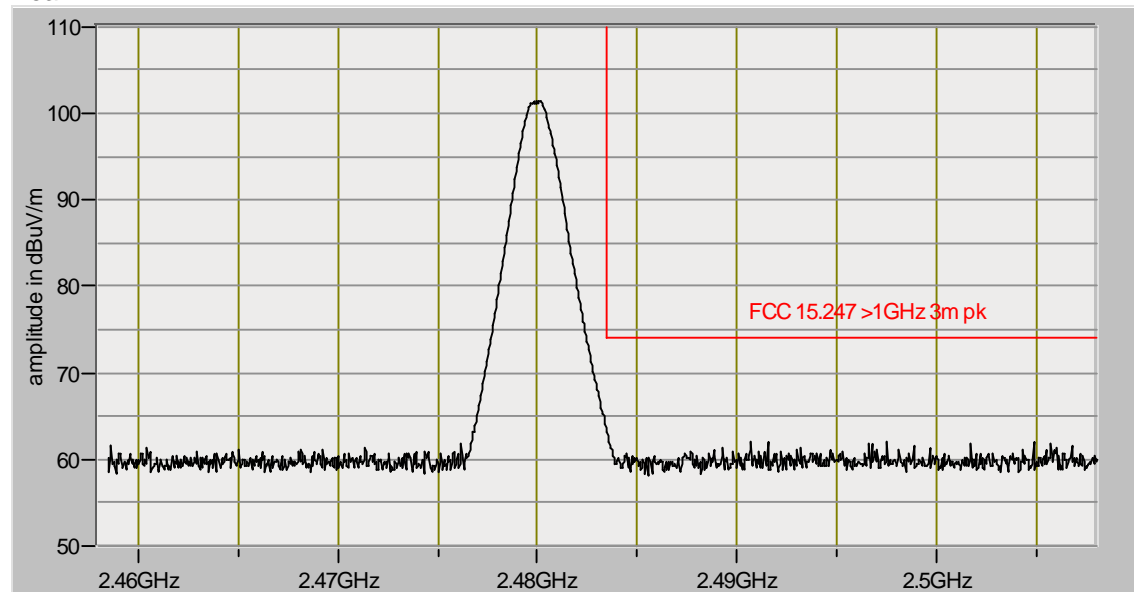


RBW 1 MHz

VBW 10 Hz

Bluetooth High channel, DH5 packet type

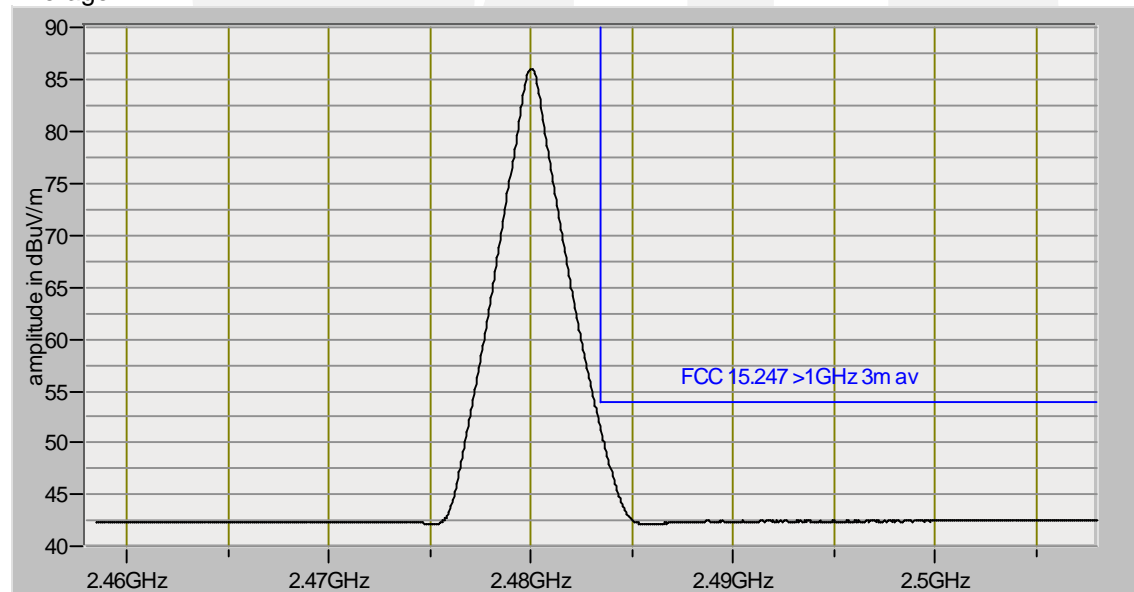
Peak



RBW 1 MHz

VBW 1 MHz

Average



RBW 1 MHz

VBW 10 Hz

## Spurious Emissions - Conducted

FCC 15.247(d) IC RSS-210 A8.5

### Test summary

The requirements are: ☒ - MET ☐ - NOT MET

Testing per FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"

Maximum spurious emission level relative to the limit is -60.74 dBm at 6.431 GHz, fundamental on high channel

Minimum margin of compliance is 47.94 dB

### Test location

☐ - Wild River Lab Large Test Site (Open Area Test Site)

☐ - Wild River Lab Small Test Site (Open Area Test Site)

☒ - Wild River Shield Room 2

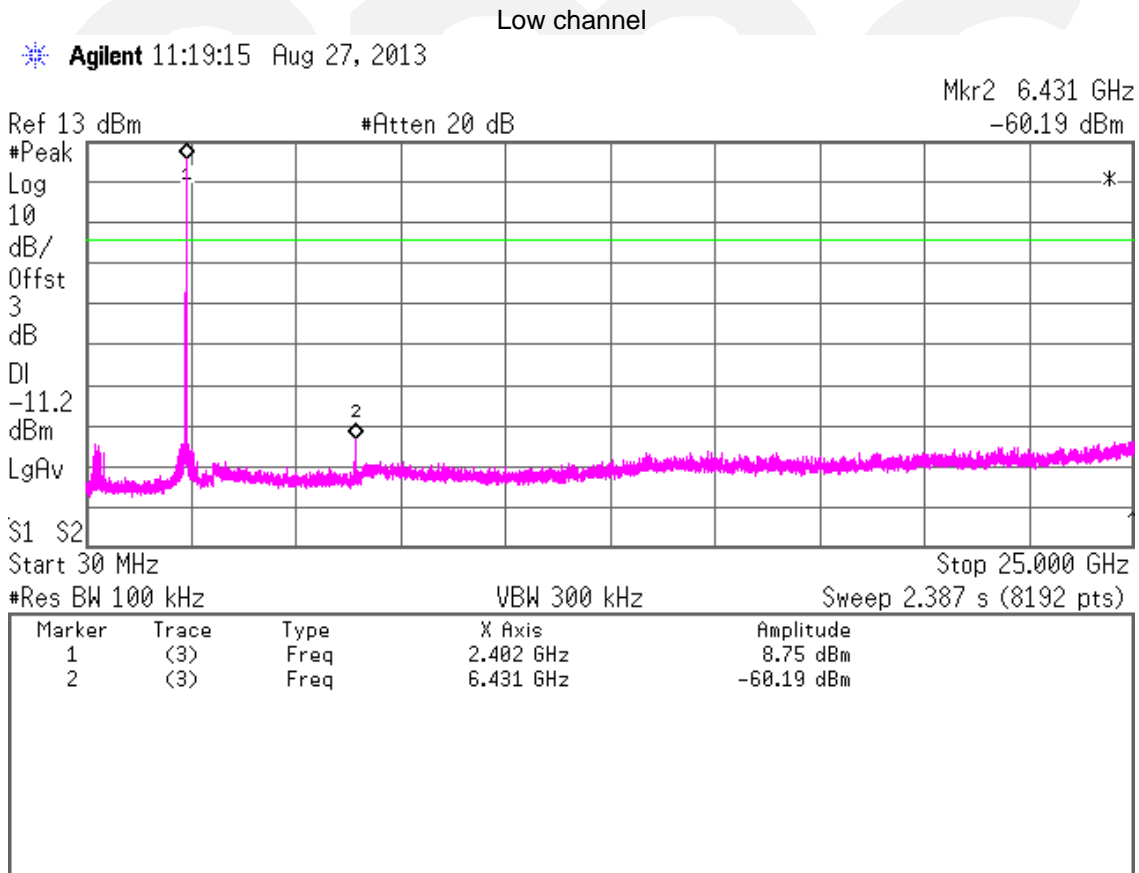
### Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13

### Test limit

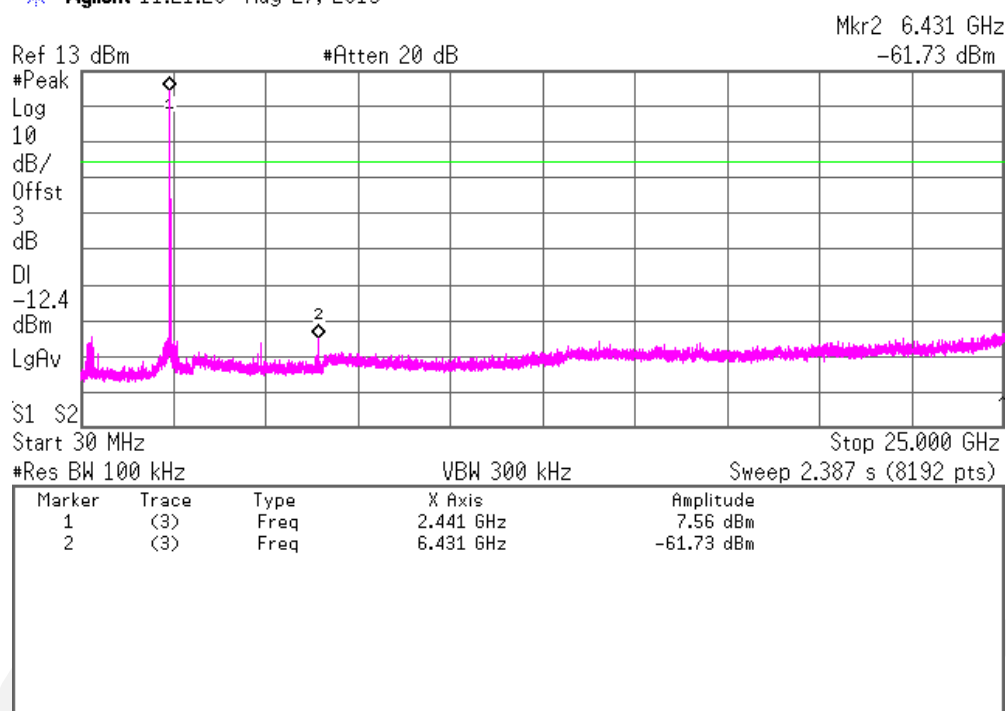
-20 dBc

### Test data



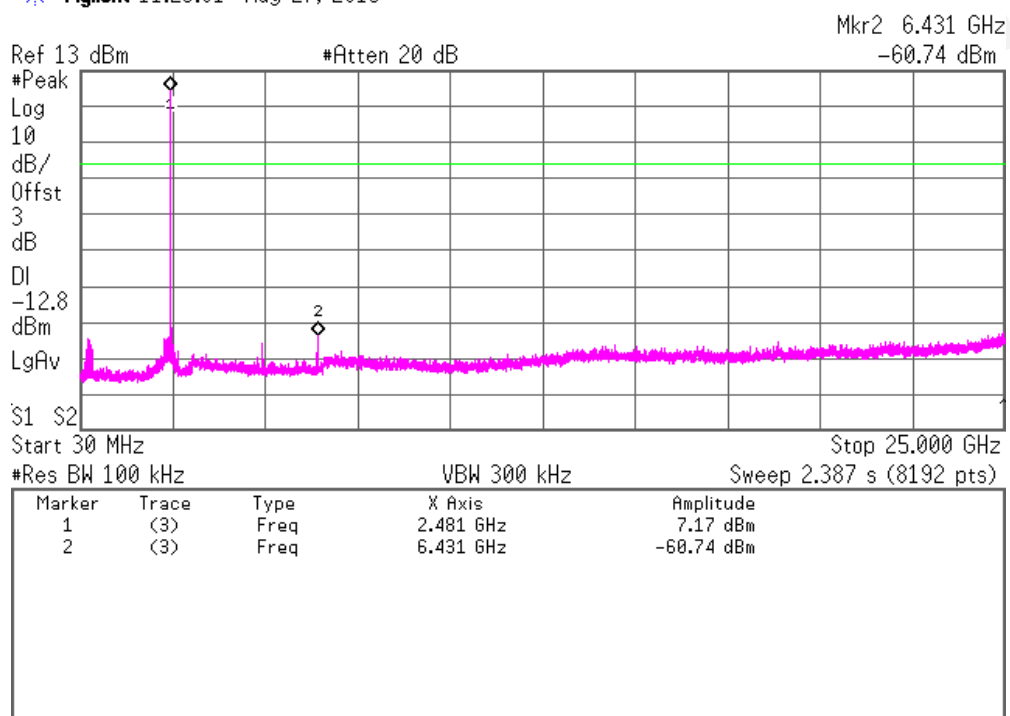
### Mid channel

Agilent 11:21:20 Aug 27, 2013



### High channel

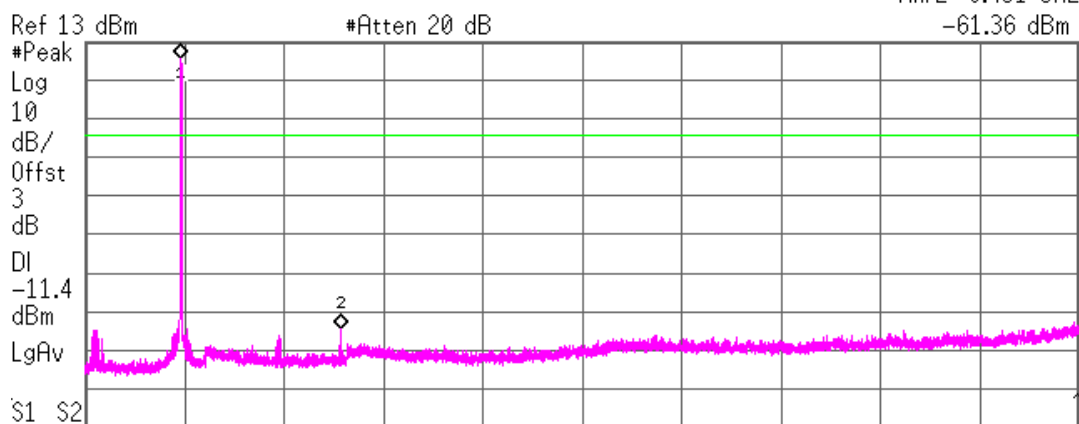
Agilent 11:23:01 Aug 27, 2013



# Hopping

Agilent 11:24:51 Aug 27, 2013

Mkr2 6.431 GHz



Start 30 MHz Stop 25.000 GHz  
#Res BW 100 kHz VBW 300 kHz Sweep 2.387 s (8192 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(3)	Freq	2.408 GHz	8.59 dBm
2	(3)	Freq	6.431 GHz	-61.36 dBm

## Spurious Emissions - Radiated in restricted bands

FCC 15.209(d), IC RSS-210 A8.5

### Test summary

The requirements are: ■ - MET □ - NOT MET

Testing per FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"

Minimum margin of compliance is 3.88 dB at 960.024 MHz

### Test location

- - Wild River Lab Large Test Site (Open Area Test Site)
- - Oakwood Lab Medium Test Site (Open Area Test Site)
- - Wild River Lab Small Test Site (Open Area Test Site)
- - Wild River Lab Large Test Site Tech Area

### Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03995	EM-6917B	Electro-Metrics	Biconicalog Periodic	151	17-Jun-14
OWLE02671	8447D	Hewlett-Packard	Preamplifier	2648A04942	Code B 07-Feb-14
WRLE03997	EWT-14-0066	EWT	2.4 GHz Notch filter	E2	Code B 08-Jan-14
NBLE03196	8566B	Hewlett-Packard	Spectrum Analyzer	2240A01856	13-Jan-14
NBLE03195	85662A	Hewlett-Packard	Analyzer Display	2648A13518	13-Jan-14
OWLE02682	85650A	Hewlett-Packard	Quasi-Peak Adapter	2811A01127	19-Mar-14
WRLE02075	3115	EMCO	RidgeGuide Ant. 1-18 GHz	9001-3275	12-Feb-14
WRLE10527	SL18B4020	Phase One Microwave	Preamplifier 1 – 18 GHz	0001	Code B 08-Jan-14
WRLE03997	EWT-14-0066	EWT	2.4 GHz Notch filter	E2	Code B 08-Jan-14
WRLE02003	F550B1	Acronetics	4-8 GHz Bandpass Filter	010	Code B 08-Jan-14
WRLE03933	F551B-1	Acronetics	8-12 GHz Bandpass Filter	010	Code B 08-Jan-14
WRLE02689	8566B	Hewlett-Packard	Spectrum Analyzer	2416A00321	22-Apr-14
WRLE03295	85662A	Hewlett-Packard	Analyzer Display	2349A06144	22-Apr-14
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13
OWLE03996	SAS-572	A.H. Systems	STD Gain Horn	183	Code Y
WRLE03978	SL26-3010	Phase One Microwave	Amplifier 18-26.5 GHz	0005	Code B 02-Jan-14

### Test limit (in restricted bands)

Frequency (MHz)	Field strength (μV/meter)	Field strength (dBμV/meter)
30 - 88	100 – QP	40.0
88 - 216	150 – QP	43.5
216 - 960	200 – QP	46.0
960-1000	500 – QP	54.0
>1000	500 – AV	54.0
	5000 – PK	74.0

### Test data

See following pages

30-1000 MHz

**Measurement summary for limit1: FCC 15.247 <1GHz 3m (Qp)**

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC 15.247 <1GHz 3m
960.024 MHz	48.35 Qp	3.02 / 22.8 / 24.14 / 0.09	50.12	H / 1.00 / 208	-3.88
240.006 MHz	33.95 Qp	1.24 / 11.69 / 24.3 / 0.02	22.61	V / 1.00 / 90	-23.39
120.0 MHz	33.9 Qp	0.8 / 8.88 / 24.27 / 0.01	19.33	V / 1.00 / 180	-24.17
112.008 MHz	32.28 Qp	0.77 / 9.3 / 24.32 / 0.01	18.04	V / 1.00 / 0	-25.46
132.912 MHz	31.8 Qp	0.85 / 8.21 / 24.22 / 0.01	16.65	V / 1.00 / 180	-26.85
128.01 MHz	28.8 Qp	0.83 / 8.46 / 24.21 / 0.01	13.89	V / 1.00 / 90	-29.61

1-25 GHz

**Measurement summary for limit1: FCC 15.247 >1GHz 3m pk (Pk)**

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC 15.247 >1GHz 3m pk
1.14 GHz	50.55 Pk	3.3 / 26.84 / 40.57 / 0.1	40.23	H / 1.00 / 239	-33.77
1.62 GHz	51.4 Pk	3.72 / 25.93 / 42.04 / 0.15	39.16	H / 1.00 / 289	-34.84
1.5 GHz	50.2 Pk	3.61 / 25.53 / 41.3 / 0.14	38.18	H / 1.10 / 281	-35.82

**Measurement summary for limit2: FCC 15.247 >1GHz 3m av (Av)**

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA2 FCC 15.247 >1GHz 3m av
1.14 GHz	44.87 Av	3.3 / 26.84 / 40.57 / 0.1	34.54	H / 1.00 / 245	-19.46
1.62 GHz	44.88 Av	3.72 / 25.93 / 42.04 / 0.15	32.64	H / 1.00 / 289	-21.36
1.5 GHz	43.78 Av	3.61 / 25.53 / 41.3 / 0.14	31.76	H / 1.10 / 281	-22.24



Test-setup photo(s):  
Radiated measurements



Test-setup photo(s):  
Radiated measurements

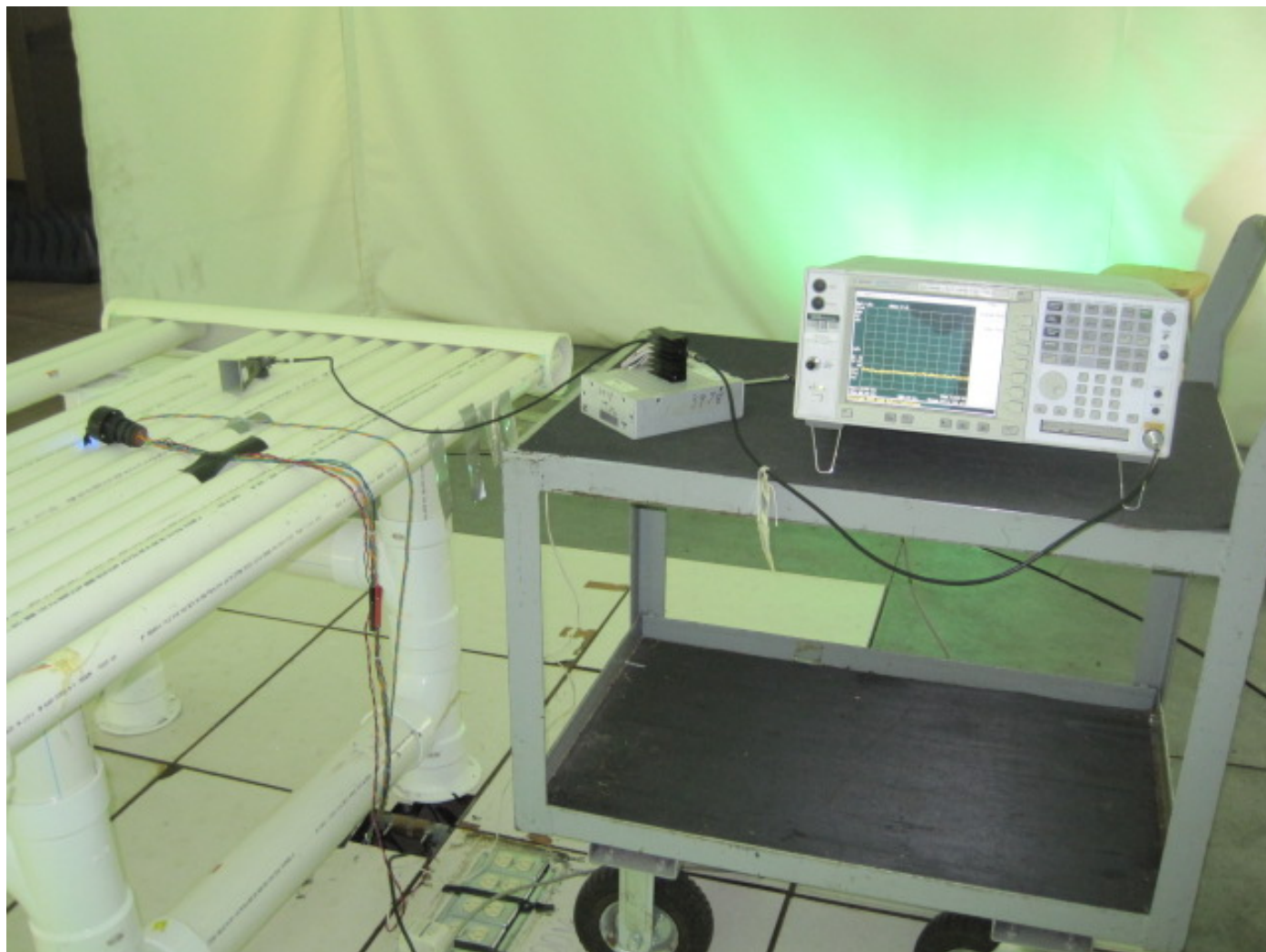


Test-setup photo(s):  
Radiated measurements





Test-setup photo(s):  
Radiated measurements



**Equipment Under Test (EUT) Test Operation Mode:**

**The device under test was operated under the following conditions during emissions testing:**

- ☐ - Standby
- ☐ - Test program (H - Pattern)
- ☐ - Test program (color bar)
- ☐ - Test program (customer specific)
- ☐ - Practice operation
- ☐ - Normal Operating Mode
- ☒ - Fundamental set on low, mid & high channels. Continuous on. Maximum power. Protocols DH1, DH3, DH5

**Configuration of the device under test:**

- ☒ - See Constructional Data Form and Block Diagram in Appendix A
- ☐ - See Product Information Form in Appendix B

## GENERAL REMARKS:

None

### Modifications required to pass:

- ☒ None
- ☐ As indicated on the data sheet(s)

### Test Specification Deviations: Additions to or Exclusions from:

- ☒ None
- ☐ As indicated in the Test Plan

## SUMMARY:

The requirements according to the technical regulations are

- ☒ - met and the equipment under test does fulfill the general approval requirements.
- ☐ - **not** met and the equipment under test does **not** fulfill the general approval requirements.

EUT Received Date:	<u>08 July 2013</u>
Condition of EUT:	<u>Normal</u>
Testing Start Date:	<u>08 July 2013</u>
Testing End Date:	<u>28 August 2013</u>

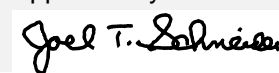
## TÜV SÜD AMERICA INC

Tested by:



Greg Jakubowski  
Senior EMC Technician

Approved by:



Joel T Schneider  
Senior EMC Engineer

## Appendix A

### Constructional Data Form



Form



## EMC Test Plan and Constructional Data Form

PLEASE COMPLETE THIS DOCUMENT IN FULL, ENTERING N/A IF THE FIELD IS NOT APPLICABLE. IF TESTING RESULTS IN MODIFICATIONS TO THE EQUIPMENT, PLEASE SUBMIT A REVISED TP/CDF INDICATING THOSE MODIFICATIONS.  
**NOTE: This information will be input into your test report as shown below. Press the F1 key at any time to get HELP for the current field selected.**

Company: Digi International  
Address: 11001 Bren Road East  
Minnetonka MN 55343  
Contact: Nathan Carlson Position: Lead Hardware Engineer  
Phone: 952-912-3474 Fax: \_\_\_\_\_  
E-mail Address: nathan.carlson@digi.com

**General Equipment Description -- NOTE: This information will be input into your test report as shown below.**

EUT Description Truck vehicle data bus to WiFi adapter  
EUT Name WiFi Vehicle Adapter  
Model No.: 50001817-02 Serial No.: 0001  
Product Options: Only one variant available  
Configurations to be tested: Maximally populated product with all possible functions added and enabled

**Equipment Modification (If applicable, indicate modifications since EUT was last tested. If modifications are made during this testing, submit revised TP/CDF after testing is complete.)**

Modifications since last test: \_\_\_\_\_  
Modifications made during test: \_\_\_\_\_

**Test Objective(s): Please indicate the tests to be performed, entering the applicable standard(s) where noted.**

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> EMC Directive 2004/108/EC (EMC)<br>Std: <u>EN55022, EN55024</u>   | <input checked="" type="checkbox"/> FCC: Class <input type="checkbox"/> A <input checked="" type="checkbox"/> B Part <u>15</u> |
| <input type="checkbox"/> Machinery Directive 89/392/EEC (EMC)<br>Std: _____   | <input type="checkbox"/> VCCI: Class <input type="checkbox"/> A <input type="checkbox"/> B                                     |
| <input type="checkbox"/> Medical Device Directive 93/42/EEC (EMC)<br>Std: _____   | <input type="checkbox"/> BSMI: Class <input type="checkbox"/> A <input type="checkbox"/> B (Separate Report)                   |
| <input checked="" type="checkbox"/> Vehicle Directive - 2004/104/EC (EMC)<br><input checked="" type="checkbox"/> Other Vehicle Std: <u>Cispr 25, ISO7637-2,-3, ISO11452-2,-4, sae1113/2, ISO10605</u> | <input type="checkbox"/> Canada: Class <input type="checkbox"/> A <input type="checkbox"/> B                                   |
| <input type="checkbox"/> FDA Reviewers Guidance for Premarket Notification Submissions (EMC)  | <input type="checkbox"/> Australia: Class <input type="checkbox"/> A <input type="checkbox"/> B                                |
|   | <input type="checkbox"/> Other: _____  |
|   | <input type="checkbox"/> Ag Directive *2009/64/EC (EMC)  |



Form



EMC Test Plan and Constructional Data Form

Third Party Certification (contact TÜV for quote), if applicable (\*Signature on last page required).

<input type="checkbox"/> Attestation of Compliance (AoC)*	<input type="checkbox"/> EMC Certification (used with Octagon Mark)*
<input type="checkbox"/> Statement of Compliance (SoC, previously CoC)* - All aspects of the essential requirements were assessed	
Protection Class (Req'd for AoC, SoC, EMC Cert. N/A for vehicles) <input type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III (Press F1 when field is selected to show additional information on Protection Class.)	
<input type="checkbox"/> FCC / TCB Certification	<input type="checkbox"/> Taiwan Certification
<input type="checkbox"/> Industry Canada / FCB Certification	<input type="checkbox"/> Korean Certification
<input checked="" type="checkbox"/> e-Mark Certification	

Attendance

Test will be: ☒ Attended by the customer ☐ Unattended by the customer

Failure - Complete this section if testing will not be attended by the customer.

If a failure occurs, TÜV SÜD America should:

- ☐ Call contact listed above, if not available then stop testing. (After hrs phone): \_\_\_\_\_
- ☐ Continue testing to complete test series.
- ☐ Continue testing to define corrective action.
- ☐ Stop testing.

EUT Specifications and Requirements

Length: 2.15" Width: 2.15" Height: 2.1" Weight: 0.2 lbs.

Power Requirements

Regulations require testing to be performed at typical power ratings in the countries of intended use. (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)

Voltage: 12VDC (If battery powered, make sure battery life is sufficient to complete testing.)

# of Phases: N.A.

Current (Amps/phase(max)): 1A Current (Amps/phase(nominal)): 0.15A

Other \_\_\_\_\_

Other Special Requirements

Typical Installation and/or Operating Environment

(ie. Hospital, Small Business, Industrial/Factory, etc.)

EUT Power Cable

☐ Permanent OR ☒ Removable Length (in meters): 5  
☐ Shielded OR ☒ Unshielded  
☐ Not Applicable

Form



# EMC Test Plan and Constructional Data Form

EUT Interface Ports and Cables														
Type	Analog	Digital	During Test		Qty	Shielding		Termination	Connector Type	Port Termination	Length tested (in meters)	Removable	Permanent	
			Active	Passive		Yes	No							Type
<b>EXAMPLE:</b> RS232	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Foil over braid	Coaxial	Metallized 9-pin D-Sub	Characteristic Impedance	6	<input checked="" type="checkbox"/>	<input type="checkbox"/>
CAN	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2	<input type="checkbox"/>	<input checked="" type="checkbox"/>			Deutsch 9 pin	60 ohms	5	<input checked="" type="checkbox"/>	<input type="checkbox"/>
J1708	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>			Deutsch 9 pin		5	<input checked="" type="checkbox"/>	<input type="checkbox"/>
USB	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	metal can	USB memory stick	USB A		0.02	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>

## Form



### EMC Test Plan and Constructional Data Form

#### EUT Software.

Revision Level: beta

Description: Special software test application that activates and queries all subsystems and reports back status

**Equipment Under Test (EUT) Operating Modes to be Tested --** list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing. Consult with your TÜV Product Service Representative if additional assistance is required.

1. Normal operation - running immunity script in the EOS and also running python script. These scripts exercise all of the interfaces and peripherals - I2C bus accesses, memory accesses, J1708 and CAN/J1939 activity, WiFi searching for AP, power PIC functionality, Bluetooth functions, LED and beeper, RTC, accelerometer, RNG, USB.
- 2.
- 3.

**Equipment Under Test (EUT) System Components --** List and describe all components which are part of the EUT. For FCC & Taiwan testing a minimum configuration is required. (ie. Mouse, Printer, Monitor, External Disk Drive, Motherboard, etc)

Description	Model #	Serial #	FCC ID #
WiFi Vehicle Adapter	50001817-02	0001	

# Form



## EMC Test Plan and Constructional Data Form

**Support Equipment** -- List and describe all support equipment which is not part of the EUT. (i.e. peripherals, simulators, etc)  
This information is required for FCC & Taiwan testing.

Description	Model #	Serial #	FCC ID #
Digi Can repeater box	55001444-01	001	
Digi USB to TTL Rs232	55001217-02	001	
Dell PC laptop	PP03L	10319260105	

### Oscillator Frequencies

Manufacturer	Frequency	Derived Frequency	Component # / Location	Description of Use
Various	32.768 Khz	32.768 Khz	Y2/power board	RTC in Power PIC
Various	16 Mhz	16 Mhz	Y1/power board	Power PIC main clock
Various	24 Mhz	360 Mhz	Y1/processor board	IMX28 main clock
Various	32.768 Khz	32.768 Khz	Y2/processor board	Standalone I2C RTC
Atheros	?	2.4 Ghz	MOD1/RF board	WiFi tranciever

### Power Supply

Manufacturer	Model #	Serial #	Type
			<input type="checkbox"/> Switched-mode: (Frequency) _____ <input type="checkbox"/> Linear <input type="checkbox"/> Other: _____
			<input type="checkbox"/> Switched-mode: (Frequency) _____ <input type="checkbox"/> Linear <input type="checkbox"/> Other: _____

### Power Line Filters

Manufacturer	Model #	Location in EUT
Various, ferrite bead 0805	600ohm/2A	L3, L4

# Form



## EMC Test Plan and Constructional Data Form

### Critical EMI Components (Capacitors, ferrites, etc.)

Description	Manufacturer	Part # or Value	Qty	Component # / Location
Ferrite Bead 0805	Various	600 ohm 2A	3	L3,L4,L5 power board
CAN common mode choke	TDK	11uH	2	L1,L2 power board
Drum inductor 0.3x0.2	Various	22uH 1.5A	1	L6 power board
USB common mode choke	Würth	120uH	1	L1 processor board

### EMC Critical Detail -- Describe other EMC Design details used to reduce high frequency noise.

Full shield covering all of the IMX processor, flash, DDR ram, IMX power supply.

PLEASE ENTER NAMES BELOW (INSERT ELECTRONIC SIGNATURE IF POSSIBLE)

### Authorization (Signature Required if a Third Party Certification is checked on pg 1)

Nathan Carlson

04-25-2013

Customer authorization to perform tests according to this test plan.

Date

Nathan Carlson

04-25-2013

Test Plan/CDF Prepared By (please print)

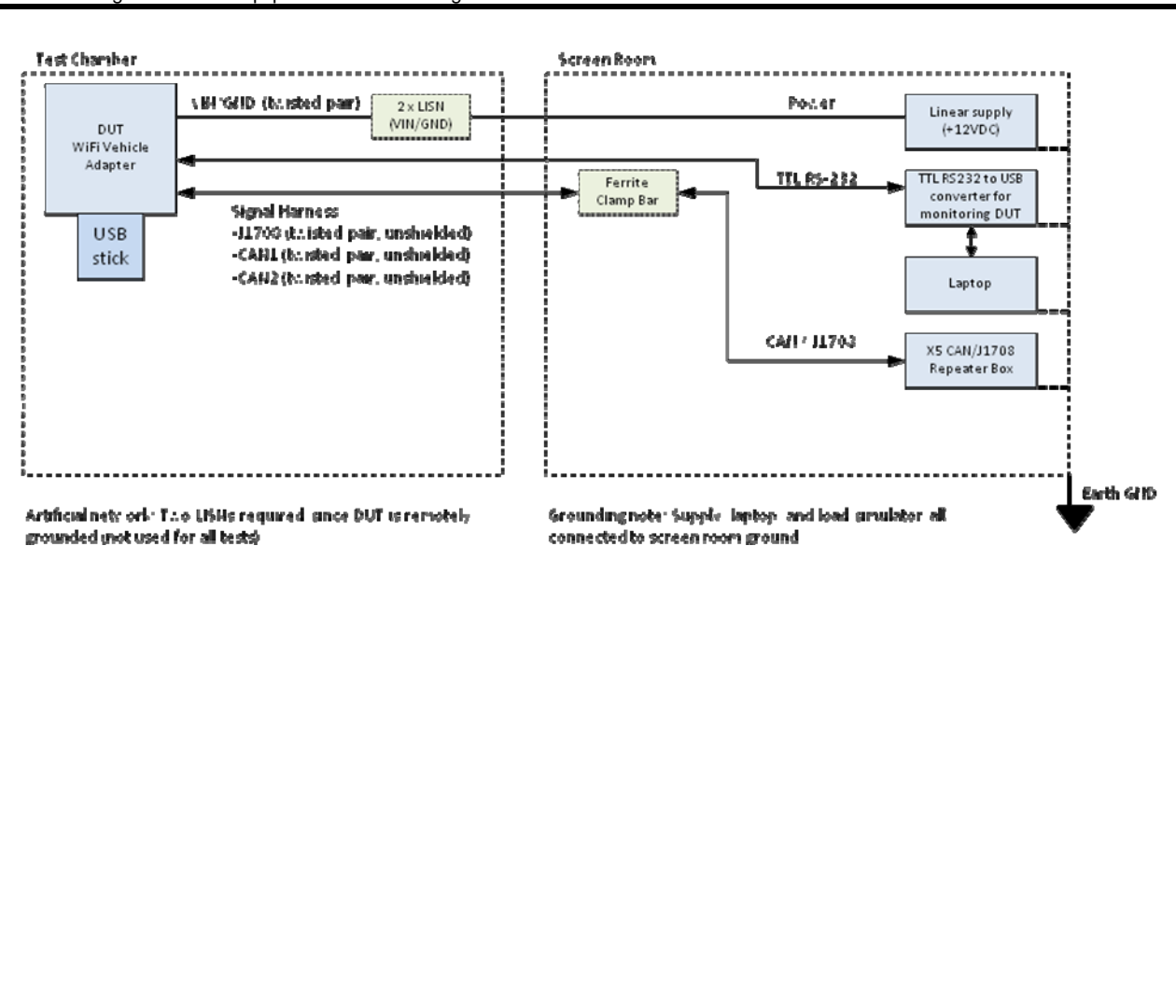
Date

# Form



## EMC Block Diagram Form

**System Configuration Block Diagram** -- Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, power cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside testing field.



### Authorization Signatures

Nathan Carlson

04-26-2013

Customer authorization to perform tests according to this test plan.

Date

Nathan Carlson

04-26-2013

Test Plan/CDF Prepared By (please print)

Date

## Appendix B

### Measurement Protocol



## MEASUREMENT PROTOCOL

### GENERAL INFORMATION

#### Test Methodology

Emission testing is performed according to the procedures in ANSI C63.4-2009 and FCC KDB Publication DA 00-705.

#### Measurement Uncertainty

The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. The test system has a measurement uncertainty of  $\pm 4.8$  dB. The equipment comprising the test systems is calibrated on an annual basis.

#### Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

#### Conducted Emissions

Final measurement levels are determined by connecting the antenna port of the DUT to a spectrum analyzer input via coaxial adapters, high frequency coax, and attenuators as necessary. The loss created by the interconnect apparatus is offset by settings within the analyzer. Specific analyzer settings are determined by the procedures throughout this report.

#### Radiated Emissions

The spectrum analyzer uses a quasi-peak detector for frequencies up to and including 1 GHz. For measurements above 1 GHz, peak and average detectors are used. The bandwidths used are equal to or greater than 100 Hz from 9 kHz to 150 kHz, 9 kHz from 150 kHz to 30 MHz, 100 kHz from 30 MHz to 1000 MHz, and 1 MHz from 1 GHz to 40 GHz. Video bandwidths are at least three times greater than the IF bandwidth. Average measurements above 1 GHz are also achieved using a peak detector with 1 MHz RBW and 10 Hz VBW.

The final level, in dB $\mu$ V/m, equals the reading from the spectrum analyzer (Level dB $\mu$ V), adding the antenna correction factor and cable loss factor (Factor dB) to it, and subtracting the preamp gain (and duty cycle correction factor, if applicable). This result then has the limit subtracted from it to provide the Delta, which gives the tabular data as shown in the data. Intentional radiators are rotated through 3 orthogonal axes to determine the test position yielding the maximum emission levels.

Example:

FREQ (MHz)	LEVEL (dB $\mu$ V)	CABLE/ANT/PREAMP (dB) (dB/m) (dB)	FINAL (dB $\mu$ V/m)	POL/HGT/AZ (m) (deg)	DELTA1
60.80	42.5Qp +	1.2 + 10.9 - 25.5 =	29.1	V 1.0 0.0	-10.9

#### Test Equipment

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated according to internal procedure.