EMC Test Report

Project Number: 3986695

Report Number: 3986695EMC06 **Revision Level:** 0

Client: Hi-P Electronics Pte. Ltd.

Equipment Under Test: iDEN Cellular Phone with Bluetooth

Model: H375iS

FCC ID: 2ACUZ375iS

Applicable Standards: FCC Part 15 Subpart C, § 15.247

ANSI C63.10: 2013

Report issued on: 15 July 2016

Test Result: Compliant

Tested by: Fabian Nica, Senior Technician

Reviewed by: Jeremy Pickens, Senior EMC Engineer

Remarks:
This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

Table of Contents

1 Summary of Test Results

Test Description	Test Specification	Test Result
Occupied Bandwidth	15.247(a) (1)	Compliant
Peak Power Output	15.247(a) (1)	Compliant
Conducted Spurious Emissions	15.247(d)	Compliant
Band Edge	15.247(d)	Compliant
Radiated Spurious Emissions	15.247(d), 15.35(b),15.209	Compliant
Dwell time	15.247(a) (1)(iii)	Compliant
Number of Hopping Frequencies	15.247(a) (1)(iii)	Compliant
Channel separation	15.247(a) (1)(iii)	Compliant

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Hi-P Electronics Pte. Ltd.
Address:	12 ANG MO KIO STREET 64 #03-02, UE BIZHUB CENTRAL (BLK A)
City, State, Zip, Country:	SINGAPORE 569088

2.2 *Test Laboratory*

Name:	SGS North America, Inc.
Address:	620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country:	Suwanee, GA 30024, USA

2.3 *General Information of EUT*

Marketing Name:	iDEN Cellular Phone with Bluetooth
Model Number:	H375iS
Serial Number:	364KSL01GQ (Radiated Measurements) 364KRE009J (Conducted Measurements)

Frequency Range:	2402 to 2480 MHz
Number of channels:	79
Modulation type:	GFSK, DQPSK, 8DPSK
Channel spacing:	1 MHz
Antenna:	Integral

Rated Voltage:	3.7 VDC Internal Battery

Sample Received Date:	24 June 2016 (radiated sample) 22 April 2015 (conducted sample)
Dates of testing:	28 April – 13 May 2015 (Conducted Measurements) 10 – 11 July, 2016

Note: Conducted measurements were taken on a model H375i certified under FCC ID: 2ACUZ H375I. The Bluetooth chipset and power configurations are identical to the previous evaluation, and therefore, the conducted results are unchanged. Only radiated spurious and radiated band edge measurements were performed on the mode H375iS to cover the new phone configuration.

Operating Modes and Conditions

The EUT was configured in software to allow the user to the control the EUT to run continuously exercising all modes of operation.

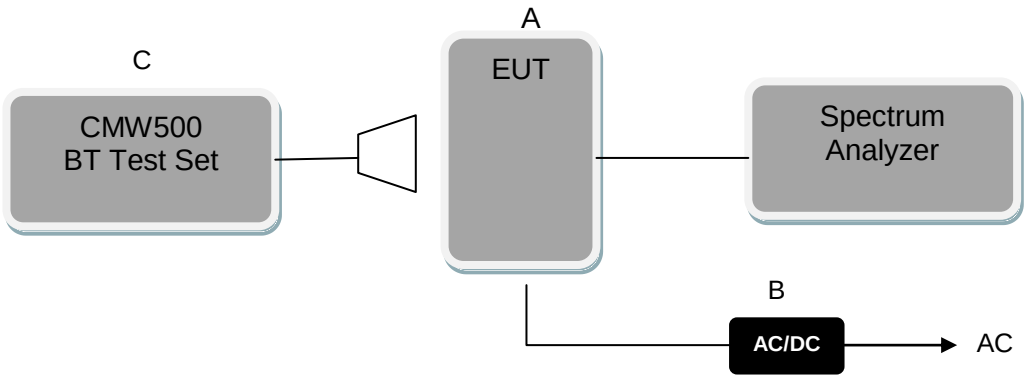
During testing, the hopping sequence was stopped in accordance with Section 5.1 of ANSI C63.10:2013 so that the low, mid and high channels could be tested independently.

Modulations used: For fundamental and spurious measurements, the EUT was configured to operate continuously with Bluetooth modulation enabled.

As specified in Section 5.10.5 of ANSI C63.10:2013:

- Software was designed to allow the EUT to operate
  - at 100 % duty cycle
  - at the worst-case duty cycle to allow measurements in instances where an average correction factor needs to be determined to calculate the average field strength from the measured peak field strength
- The software allowed configuration and operation on all available unlicensed wireless device channels.
- The software allowed configuration and operation using all available modulations and data rates
- The software allowed configuration and operation on all available power out levels
- Since this is a frequency hopping system, the software allowed the hopping sequence to be turned off

2.4 *EUT Connection Block Diagram (Conducted)*



2.5 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Hi-P Technology	iDEN Cellular Phone with Bluetooth	H375iS	Radiated: 364KSL01GQ Conducted: 364KRE009J
B	Phihong	Switching Power Supply	PSB05R-050Q	Not Labeled
C	R&S	Communications Analyzer	CMW500	100232

3 Occupied Bandwidth

3.1 *Test Result*

Test Description	Basic Standards	Test Result
20 dB bandwidth	15.247(a)(1)	Pass

3.2 *Test Method*

The procedures from ANSI C63.10 Clause 6.9.2 were used to determine the 20 dB bandwidth.

3.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.7 °C
Relative Humidity: 36.9 %

3.4 *Test Equipment*

Test Date: 28 April 2015

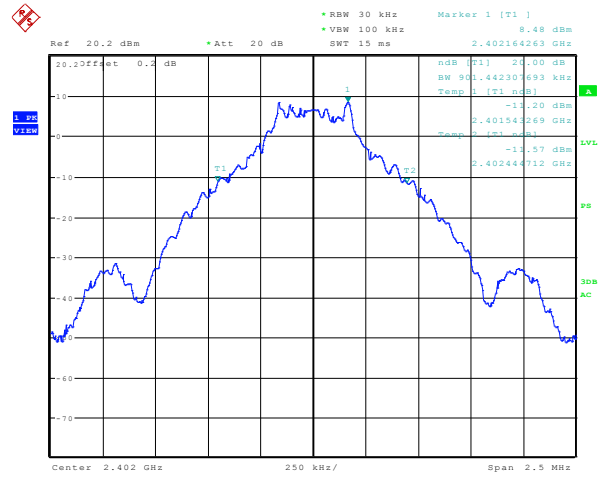
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R&S	B079629	28 JUL 2015
RF Cable	Sucoflex 102	Huber-Suhner	B079823	06 AUG 2015

Note: The equipment calibration period is 1 year.

3.5 *Test Data*

Frequency	Channel No	Modulation	20 dB bandwidth kHz
2402	0	GFSK	901
		EDR-2	1298
		EDR-3	1338
2441	39	GFSK	909
		EDR-2	1346
		EDR-3	1334
2480	78	GFSK	953
		EDR-2	1342
		EDR-3	1334

GFSK



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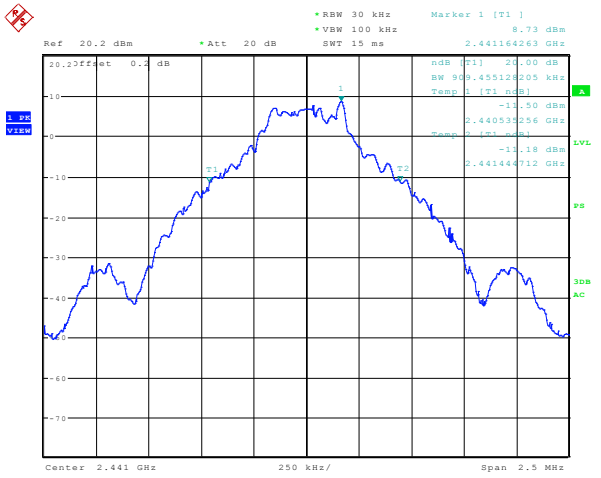

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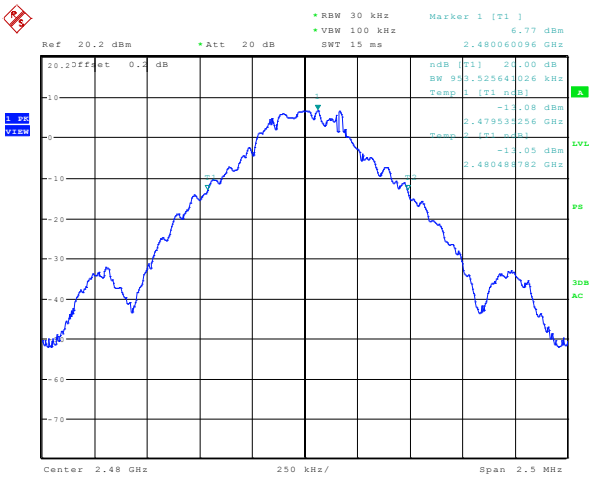

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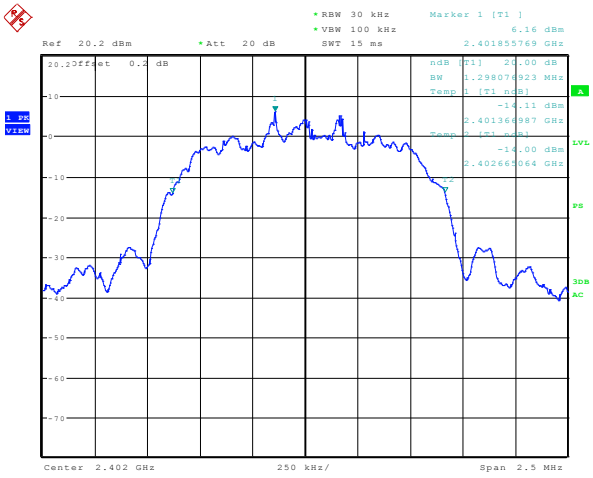
EDR 2



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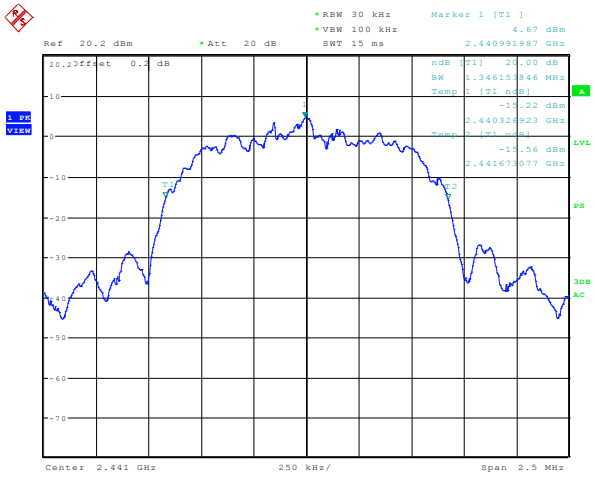

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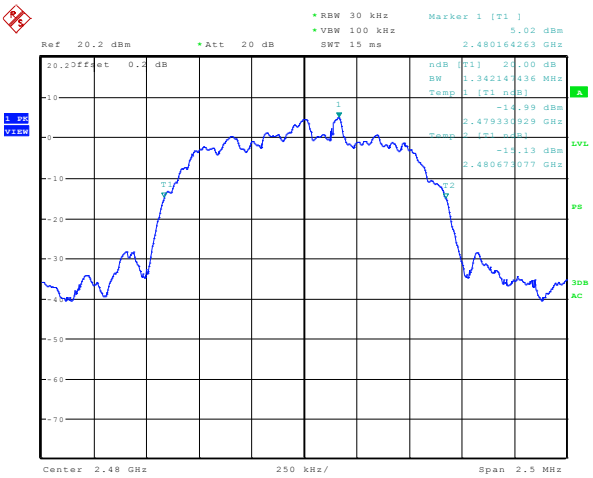

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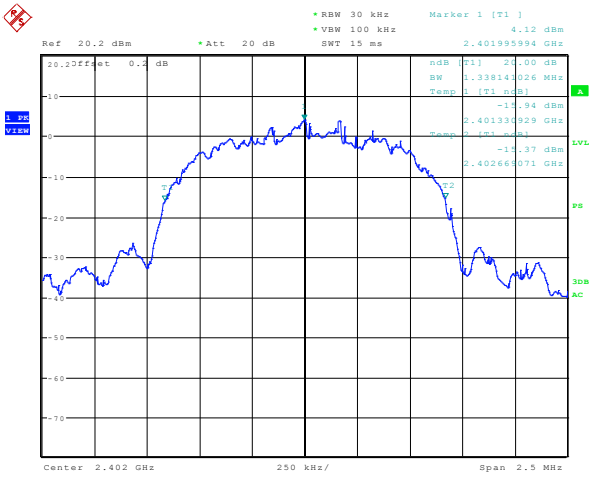
EDR-3



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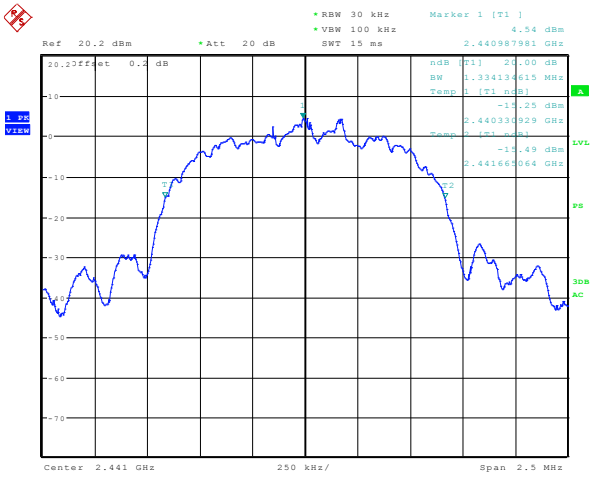

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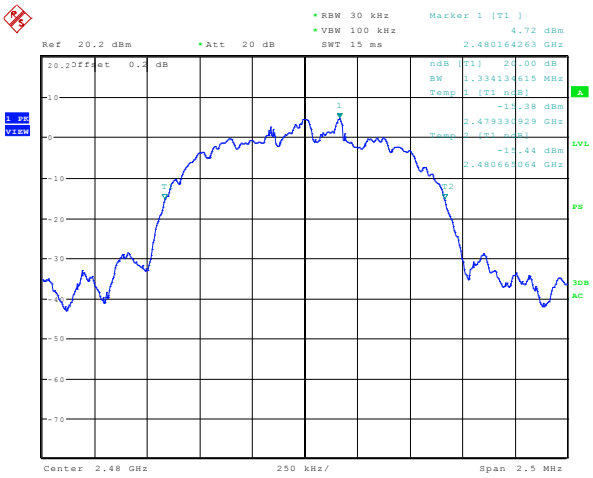

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4 Peak Output Power

4.1 *Test Result*

Test Description	Test Specification	Test Result
Peak Output Power	15.247(a) (1)	Compliant

4.2 *Test Method*

Measurements were recorded using the test methods defined in ANS C63.10, Clause 7.8.5.

Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt.

4.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.7 °C
Relative Humidity: 36.9 %

4.4 *Test Equipment*

Test Date: 28 April 2015

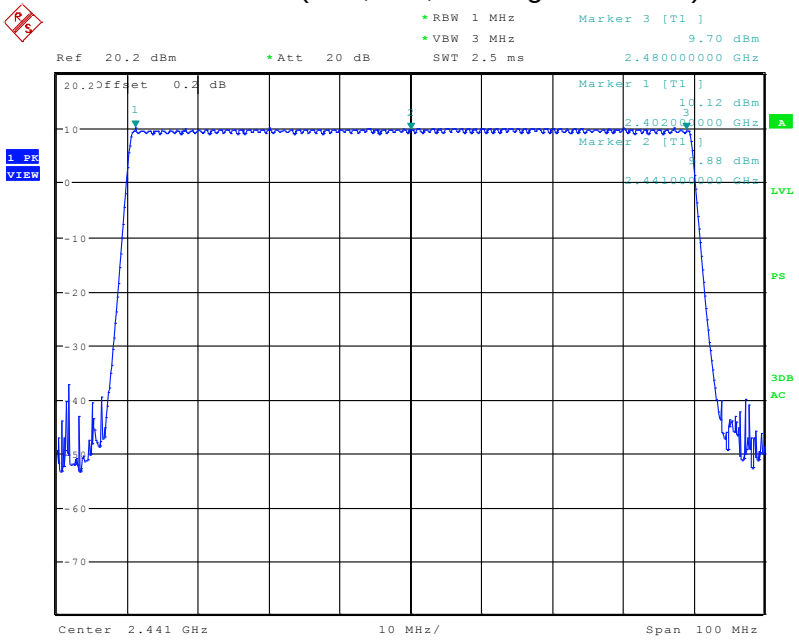
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R&S	B079629	28 JUL 2015
RF Cable	Sucoflex 102	Huber-Suhner	B079823	06 AUG 2015

Note: The equipment calibration period is 1 year.

4.5 *Test Data*

Frequency	Channel No	Modulation	Peak Output Power (dBm)	Peak Output Power (W)
2402	0	GFSK	10.1	0.010
		EDR-2	9.1	0.008
		EDR-3	9.3	0.008
2441	39	GFSK	9.9	0.010
		EDR-2	9.4	0.009
		EDR-3	9.8	0.010
2480	78	GFSK	9.7	0.009
		EDR-2	9.3	0.008
		EDR-3	9.6	0.009

GFSK (Low, Mid, and High Channels)



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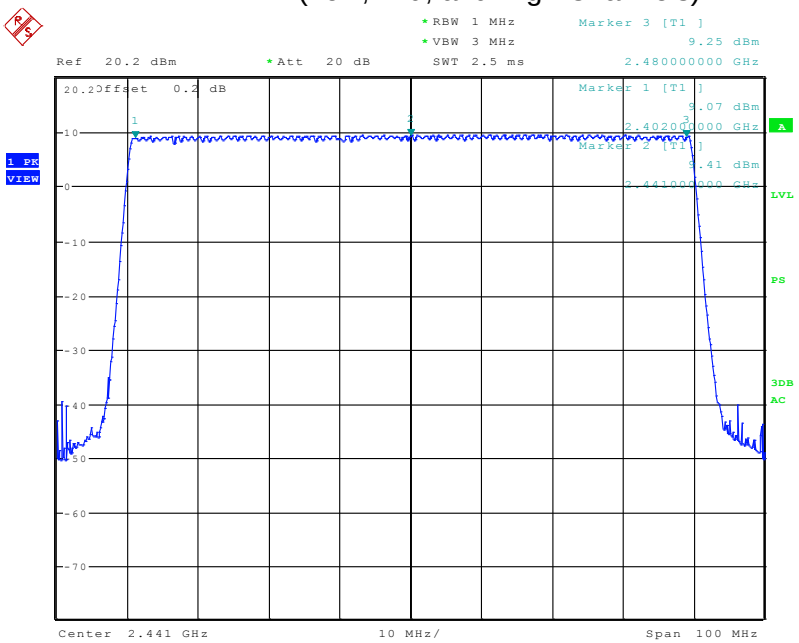
EDR2 (Low, Mid, and High Channels)



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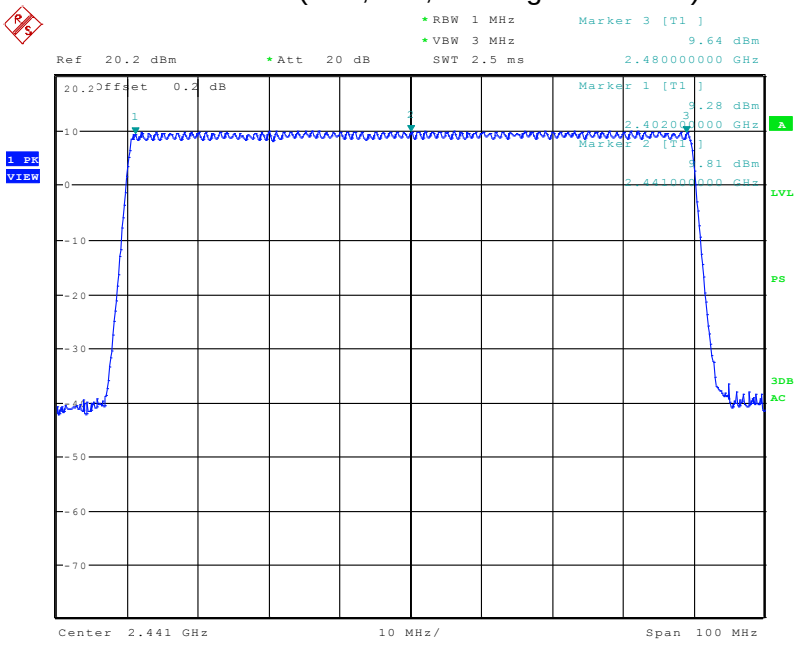
EDR3 (Low, Mid, and High Channels)



Date: 28.APR.2015 05:31:58

5 Conducted Spurious Emissions and Band Edge Measurements

5.1 *Test Result*

Test Description	Test Specification	Test Result
Conducted Spurious Emissions	15.247(d)	Compliant

5.2 *Test Method*

Measurements were recorded using the test methods defined in ANS C63.10, Clause 7.8.8.

The limit is 20 dB below the measured peak power.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.7 °C
Relative Humidity: 37.1 %

5.4 *Test Equipment*

Test Date: 28 April 2015

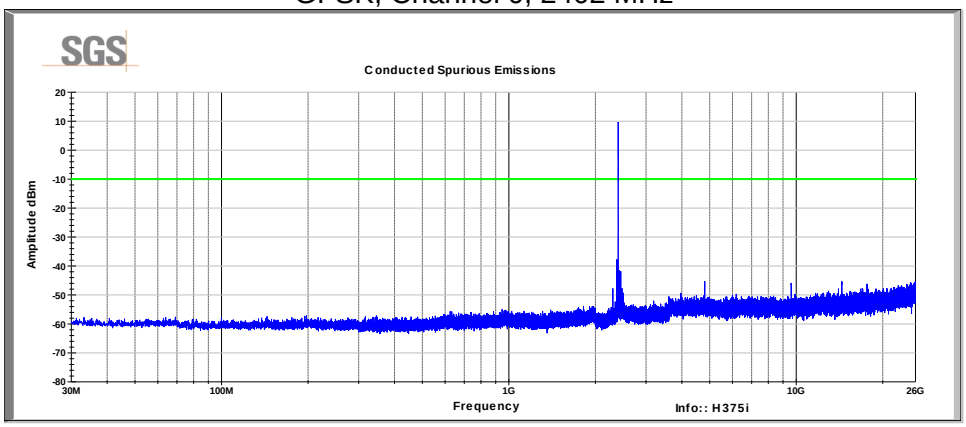
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R&S	B079629	28 JUL 2015
RF Cable	Sucoflex 102	Huber-Suhner	B079823	06 AUG 2015

Note: The equipment calibration period is 1 year.

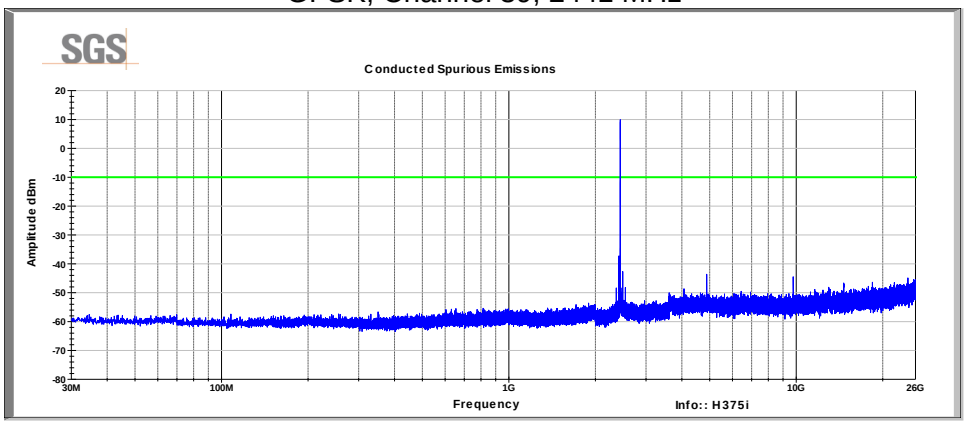
5.5 *Test Data (Spurious Emissions)*

No spurious emissions detected within 20dB of the limit.

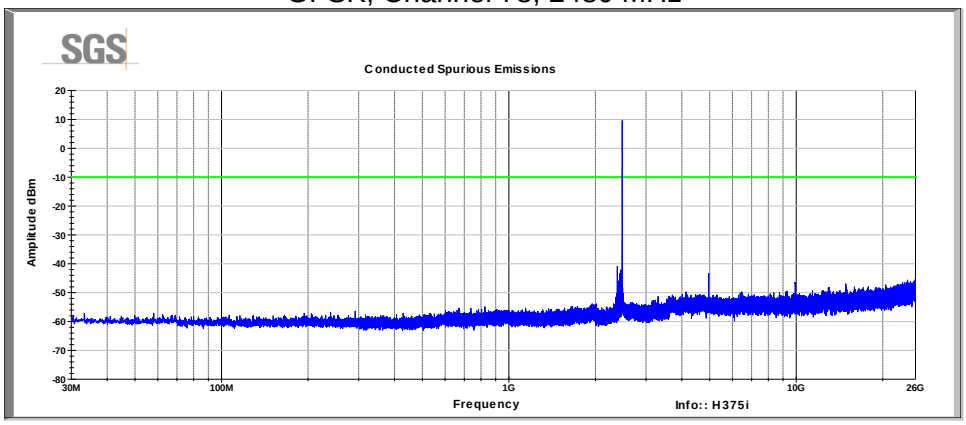
GFSK, Channel 0, 2402 MHz



GFSK, Channel 39, 2441 MHz



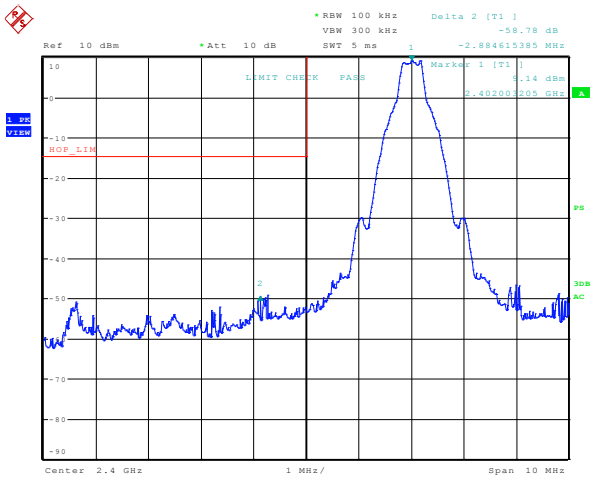
GFSK, Channel 78, 2480 MHz

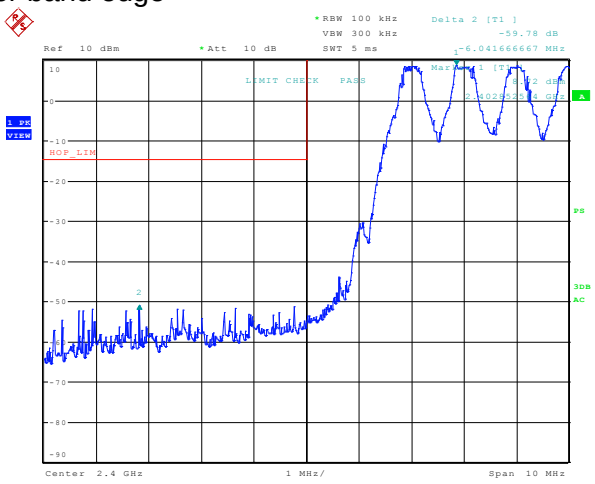


5.6 *Test Data (Band Edges)*

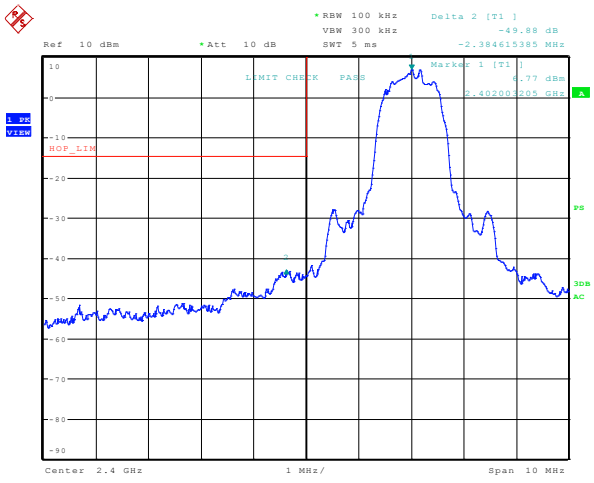
There were no emissions within 20 dB of the limit.
Tests performed in hopping and non-hopping modes.

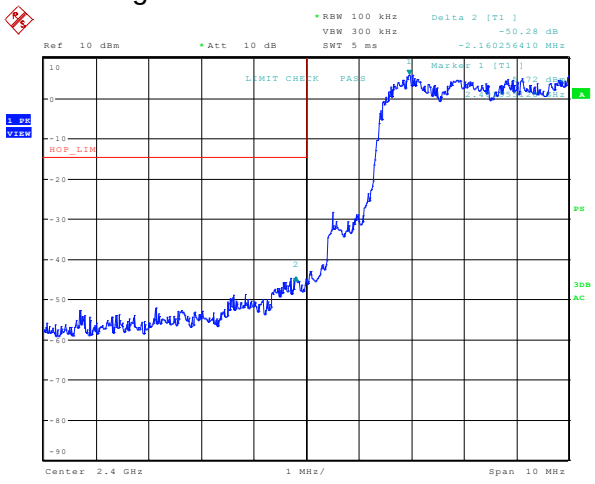
GFSK, Lower band edge



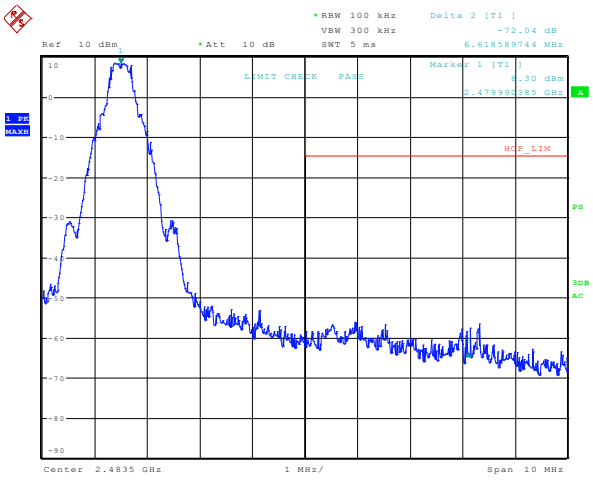


EDR3, Lower band edge





GFSK, Upper band edge



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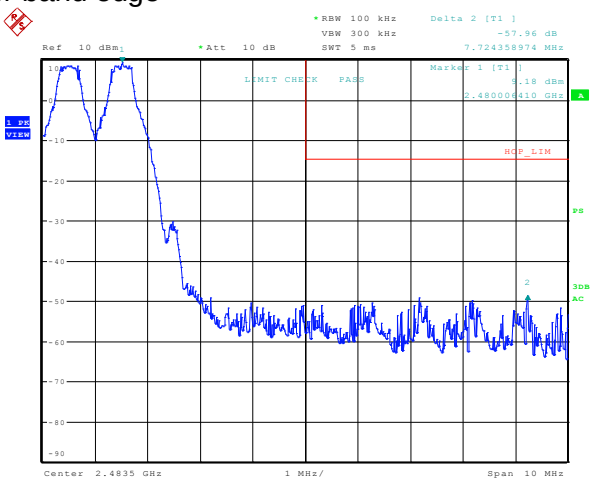
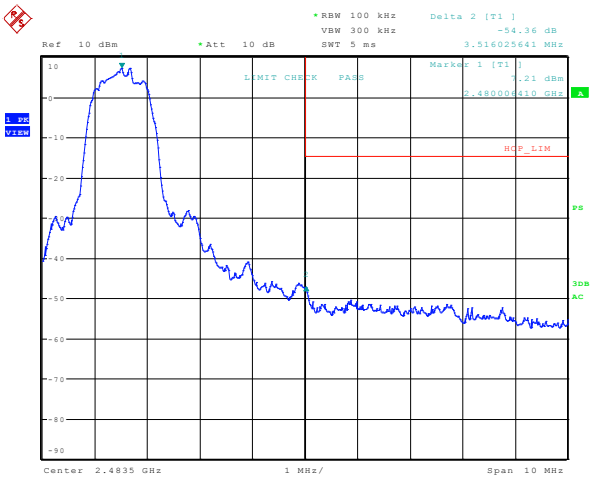


Date: 28.APR.2015 07:01:22

EDR3, Upper band edge



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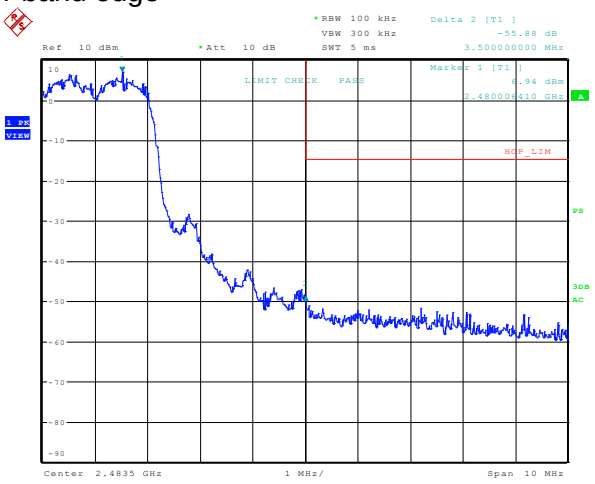


Date: 28.APR.2015 07:06:09

6 Field Strength of Spurious Radiation

6.1 *Test Result*

Test Description	Test Specification	Test Result
Field strength of spurious radiation	15.247(d), 15.35(b),15.205, 15.209	Compliant

6.2 *Test Method*

Radiated spurious emissions measurements were recorded with the device configured to transmit at the lowest, middle, and highest channels. The frequency range investigated was up through the 10th harmonic of the fundamental transmit frequency. The methods defined in ANSI C63.10: 2013 were used.

For measurements below 1GHz, the device was placed in hopping mode and manipulated through three orthogonal axes.

Above 1GHz, the device was tested with the transmit frequency fixed at low, middle, and high channels and the alternative method defined in ANSI C63.10 Clause 6.6.5 was used.

Test distance:

30 MHz to 1 GHz - The EUT to measurement antenna distance is 3 meters
1 to 18 GHz - The EUT to measurement antenna distance is 3 meters
18 to 40 GHz - The EUT to measurement antenna distance is 1 meter

Frequency	Limits(1)		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 (2)	--
88 - 216 MHz	150	43.5 (2)	--
216 - 960 MHz	200	46 (2)	--
960 - 1000 MHz	500	54 (2)	--
1 - 40 GHz	500	54 (3)	74

(1) These limits are applicable to emissions within the restricted bands of operation defined in FCC §15.205.
(2) Quasi-peak limit
(3) Average limit

6.3 *Test Site*

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.8 °C
Relative Humidity: 46.6 %

6.4 *Test Equipment*

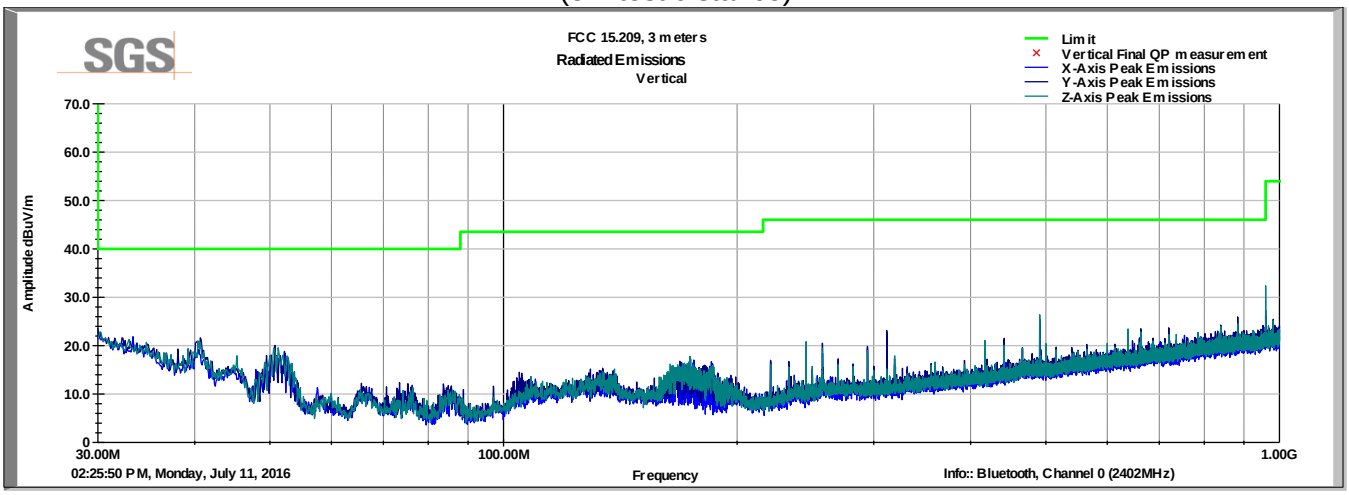
Test End Date: 11-Jul-2016 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	4-Aug-2016
ANTENNA, BILOG	JB6	SUNOL	B079690	21-Oct-2016
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	26-Apr-2017
PREAMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	4-Aug-2016
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	4-Aug-2016
RF CABLE - 7500MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079713	3-Aug-2016
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079716	3-Aug-2016
COAXIAL CABLE	SUCOFLEX 100	HUBER&SUHNER	B108523	27-Oct-2016
RF CABLE	SF106	HUBER&SUHNER	B085892	3-Aug-2016
COAXIAL CABLE	1134	GORE	B094785	4-Aug-2016
WIDEBAND RADIO	CMW500	ROHDE & SCHWARZ	B079788	21-Oct-2017
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079822	4-Aug-2016
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079824	4-Aug-2016
FIXED GAIN AMPLIFIER	NSP1840-HG	MITEQ	B087572	15-Oct-2016
DRG HORN (SMALL)	3116B	ETS-LINDGREN	B079697	29-Mar-2017

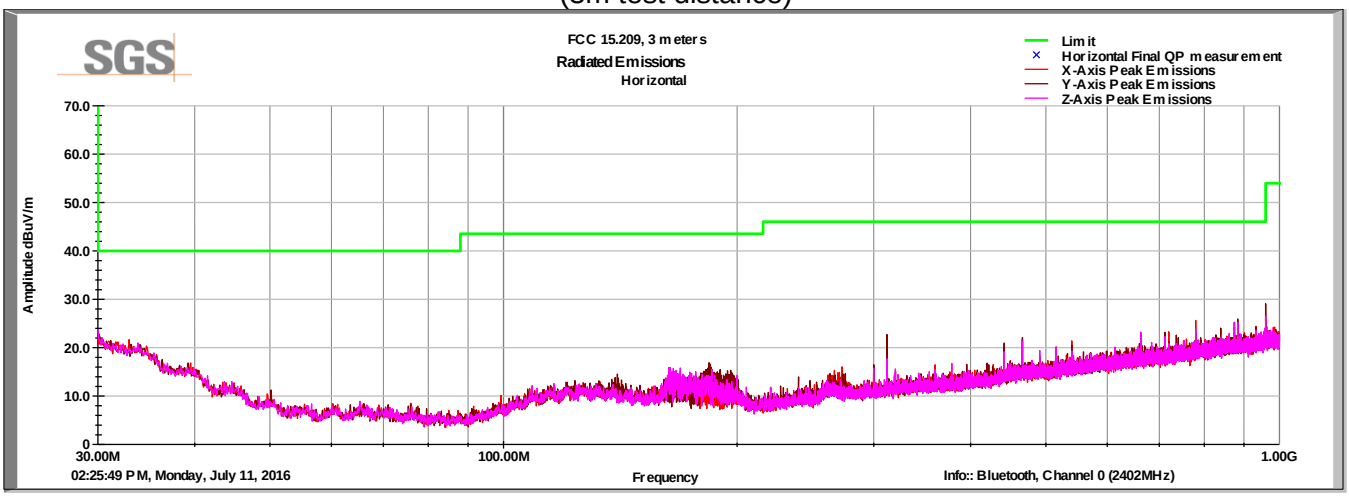
Note: The equipment calibration period is 1 year.

6.5 *Test Data (Spurious Emissions)*

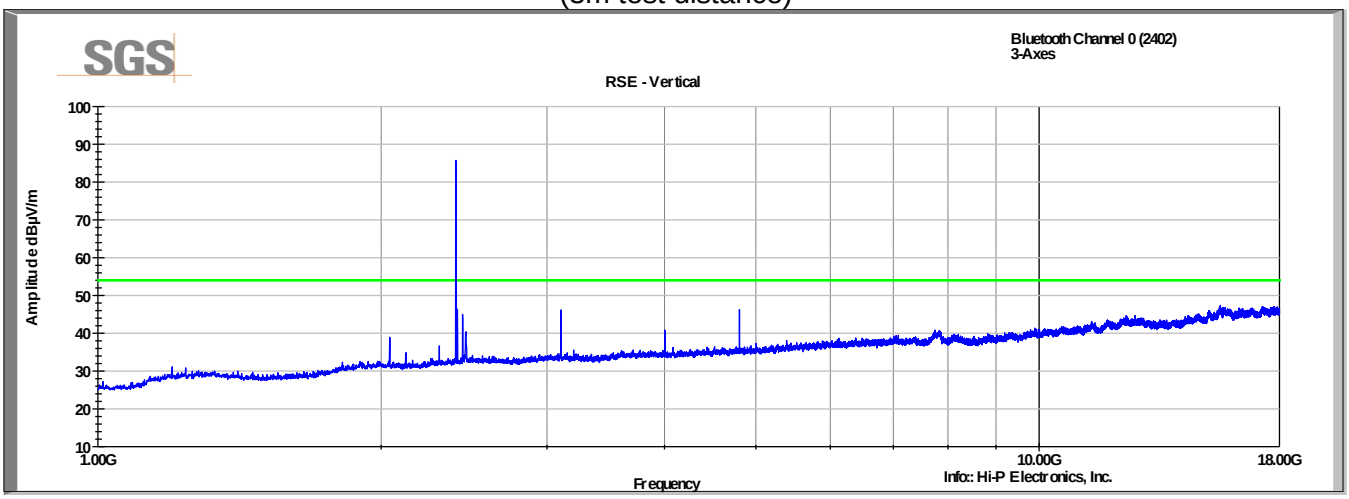
Bluetooth, Hopping on all 79 Channels
30-1000MHz
Vertical
(3m test distance)



Bluetooth, Hopping on all 79 Channels
30-1000MHz
Horizontal
(3m test distance)

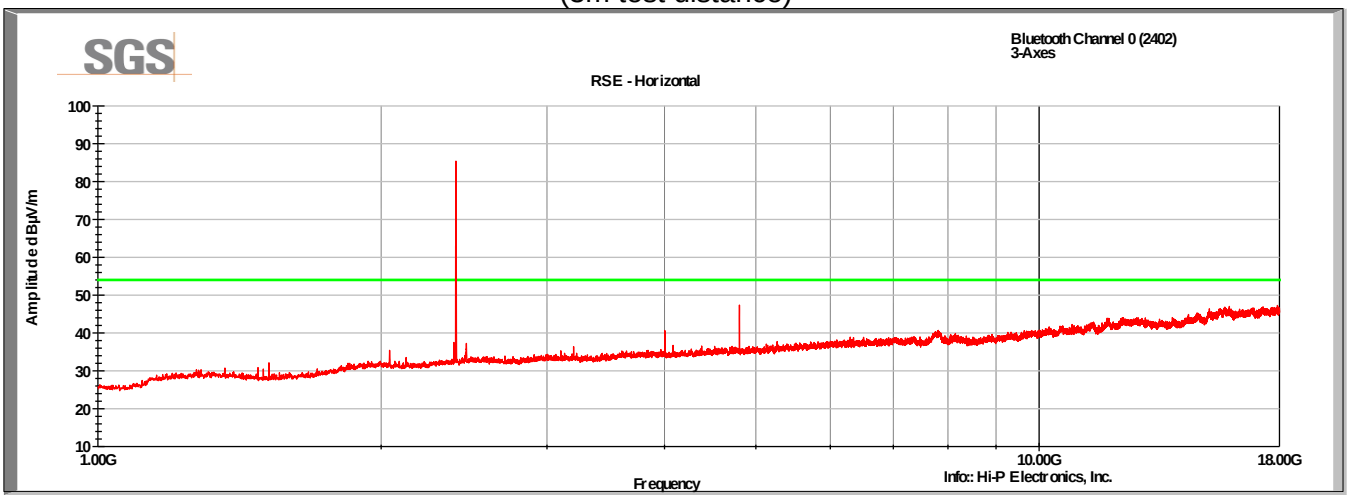


Bluetooth, Channel 0
1-18GHz
Vertical
(3m test distance)



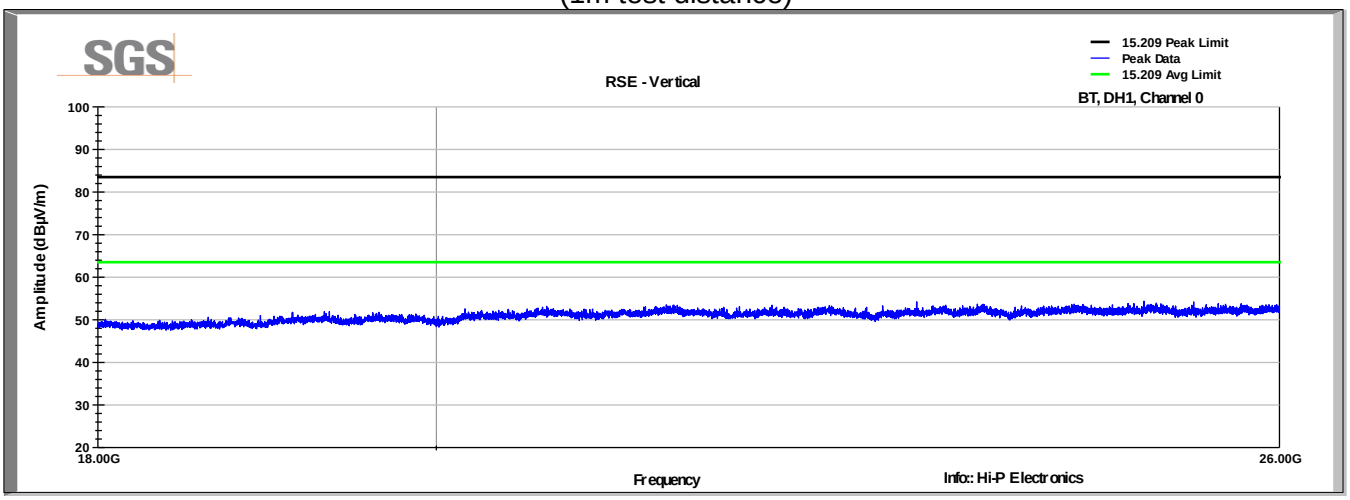
46.2dBµV/m Peak @ 4804MHz (7.8dB below AVG limit)

Bluetooth, Channel 0
1-3GHz
Horizontal
(3m test distance)

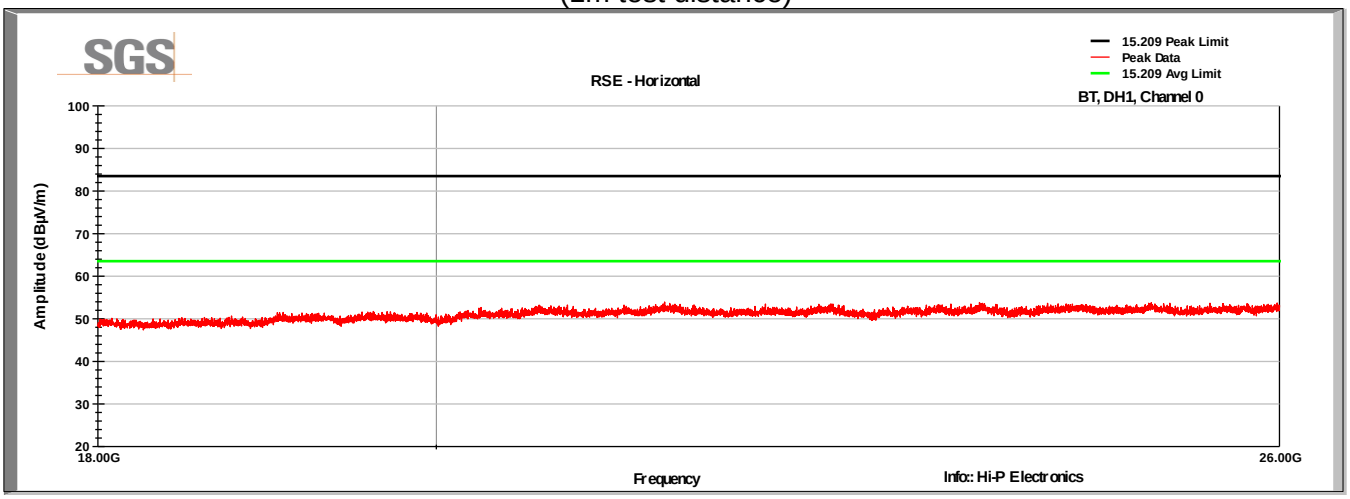


47.3dBµV/m Peak @ 4804MHz (6.7dB below AVG limit)

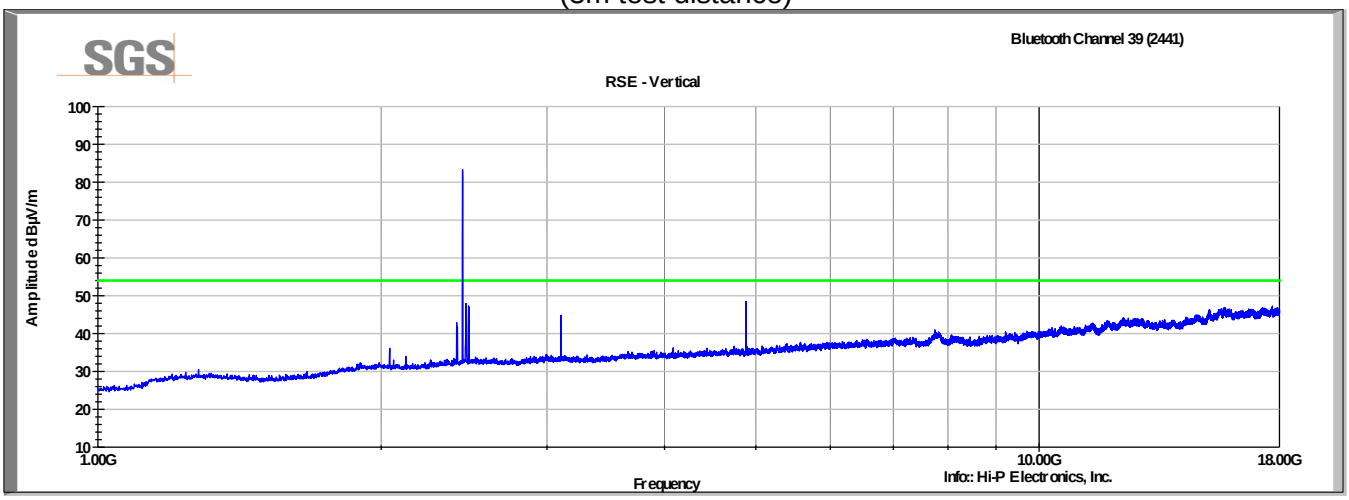
Bluetooth, Channel 0
18-26GHz
Vertical
(1m test distance)



Bluetooth, Channel 0
18-26GHz
Horizontal
(1m test distance)

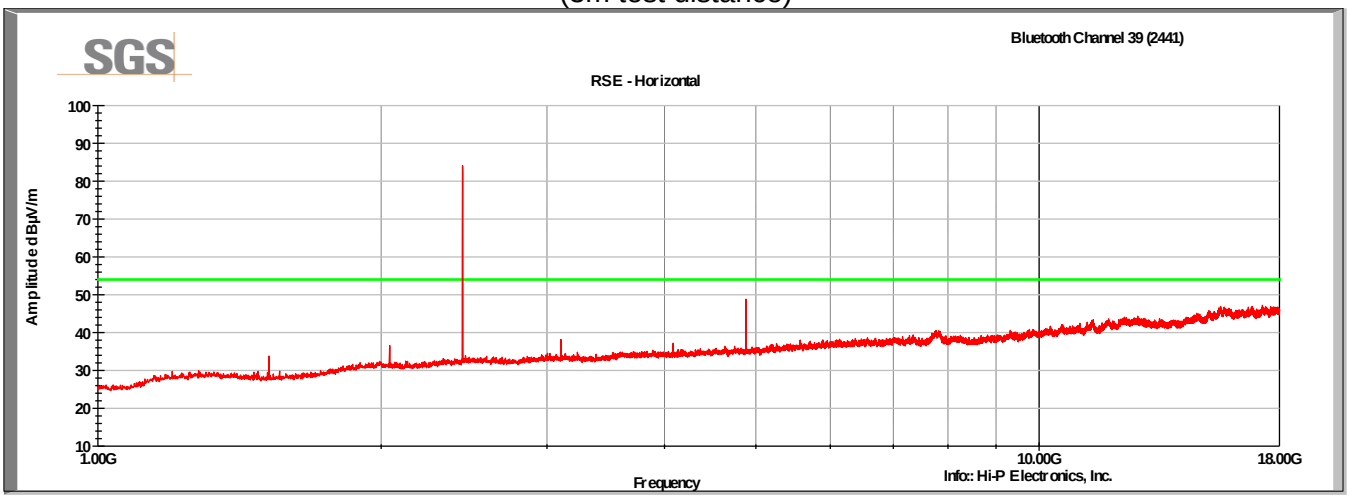


Bluetooth, Channel 39
1-18GHz
Vertical
(3m test distance)



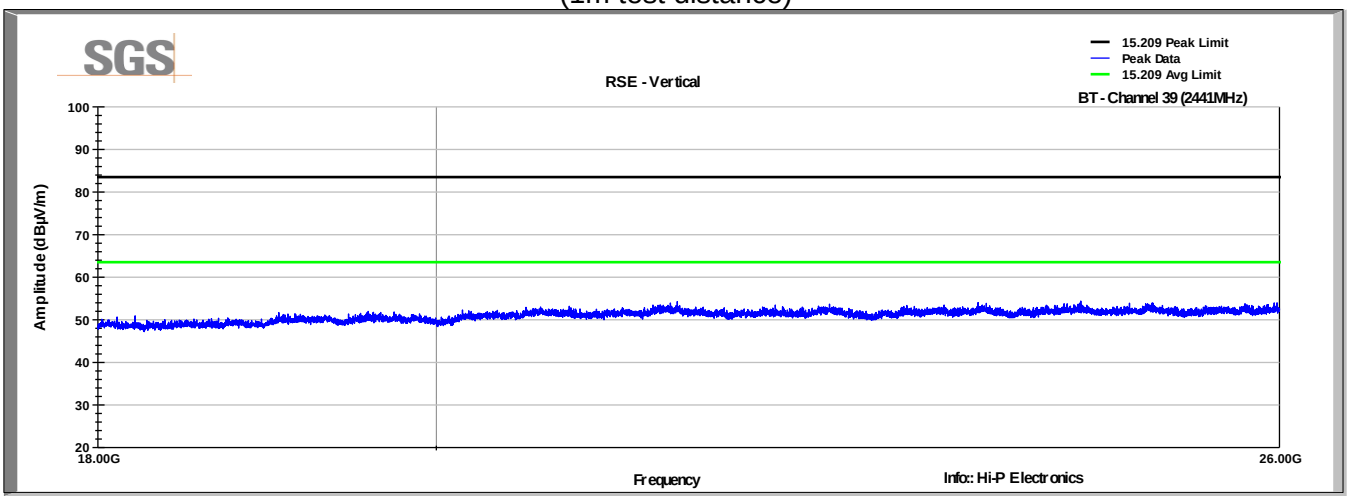
48.5dBµV/m Peak @ 4882MHz (5.5dB below AVG limit)

Bluetooth, Channel 39
1-18GHz
Horizontal
(3m test distance)

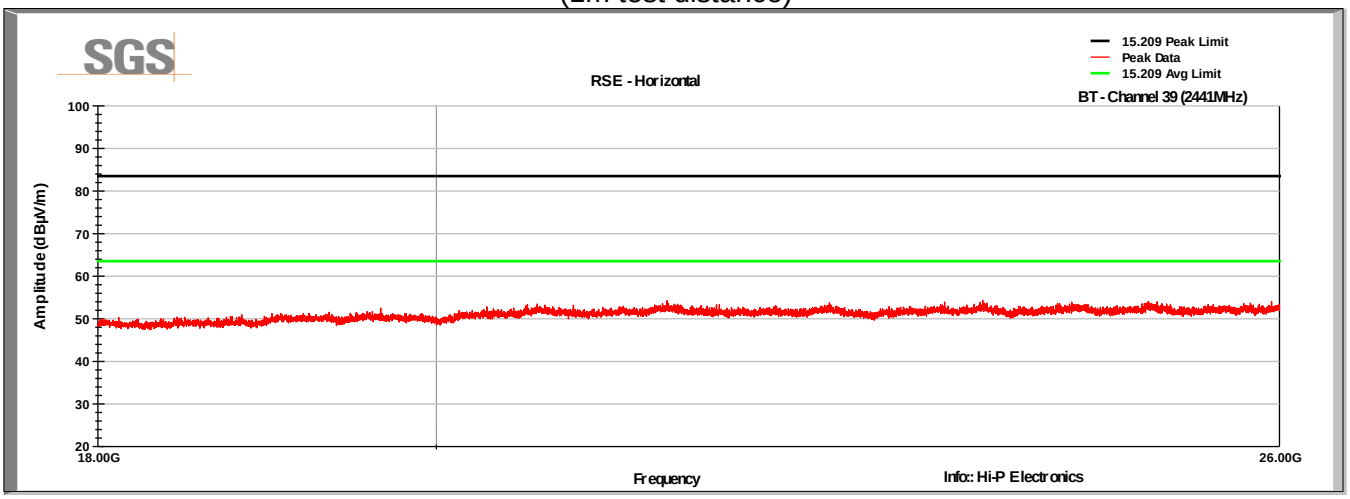


48.8dBµV/m Peak @ 4882MHz (5.2dB below AVG limit)

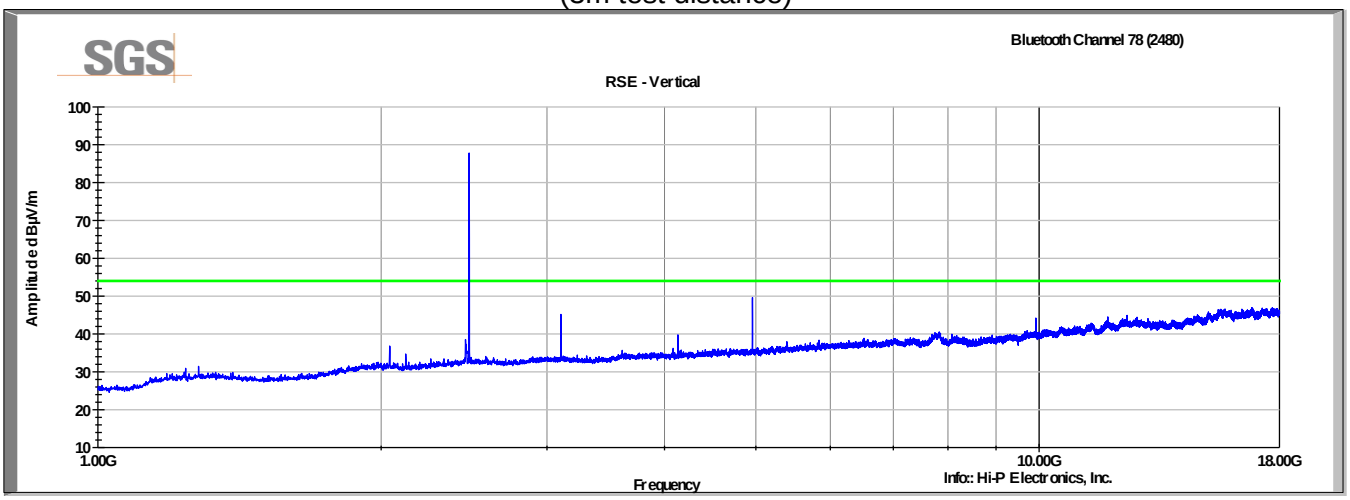
Bluetooth, Channel 39
18-26GHz
Vertical
(1m test distance)



Bluetooth, Channel 39
18-26GHz
Horizontal
(1m test distance)

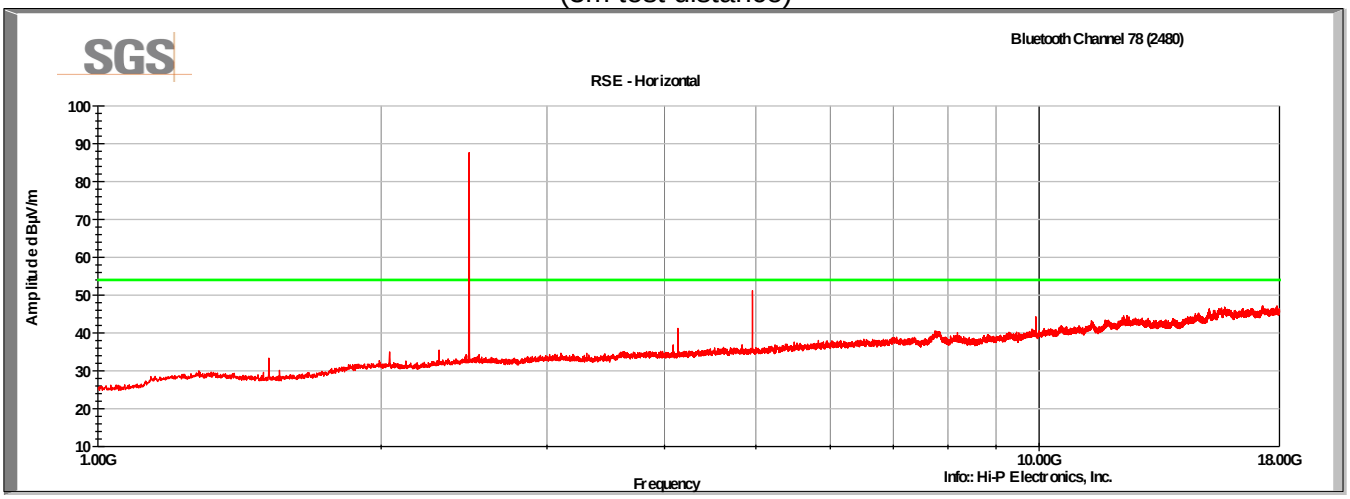


Bluetooth, Channel 78
1-18GHz
Vertical
(3m test distance)



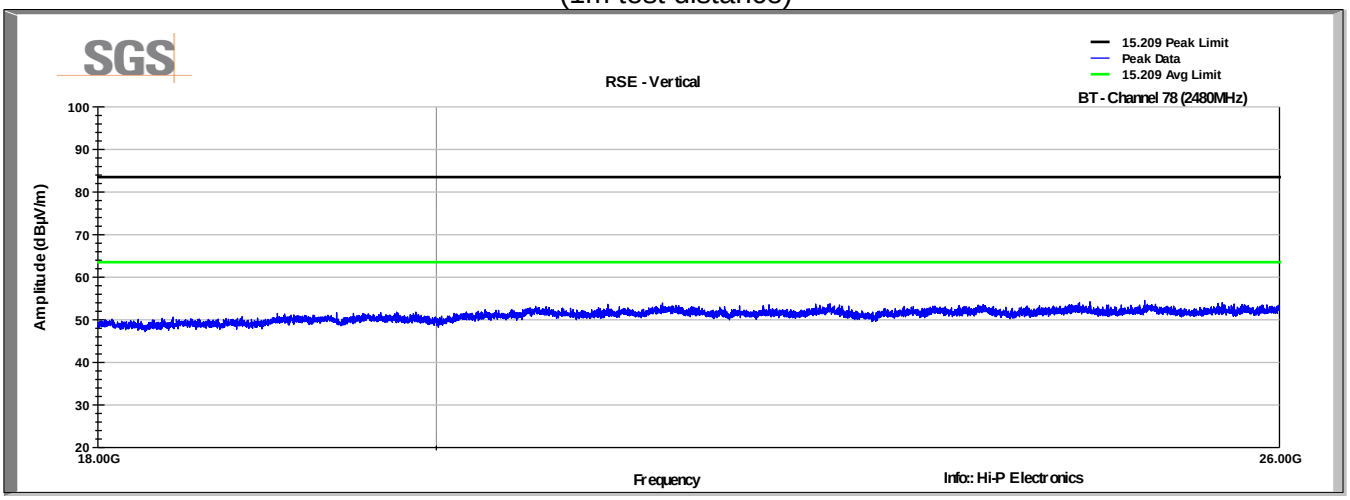
49.6dBµV/m Peak @ 4960MHz (4.4dB below AVG limit)

Bluetooth, Channel 78
1-18GHz
Horizontal
(3m test distance)

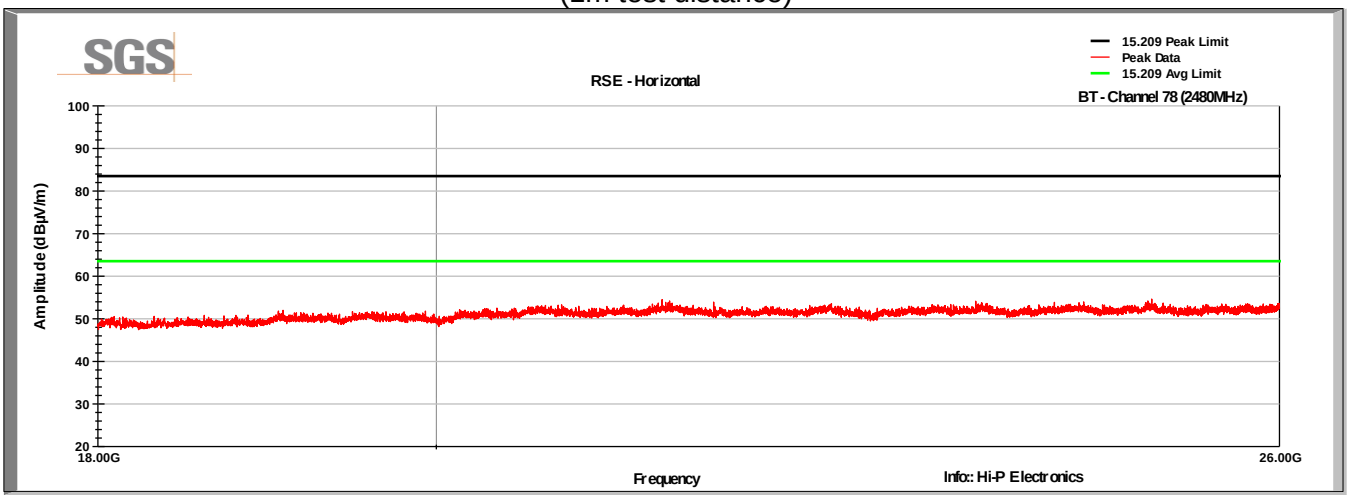


51.2dBµV/m Peak @ 4960MHz (2.8dB below AVG limit)

Bluetooth, Channel 78
18-26GHz
Vertical
(1m test distance)

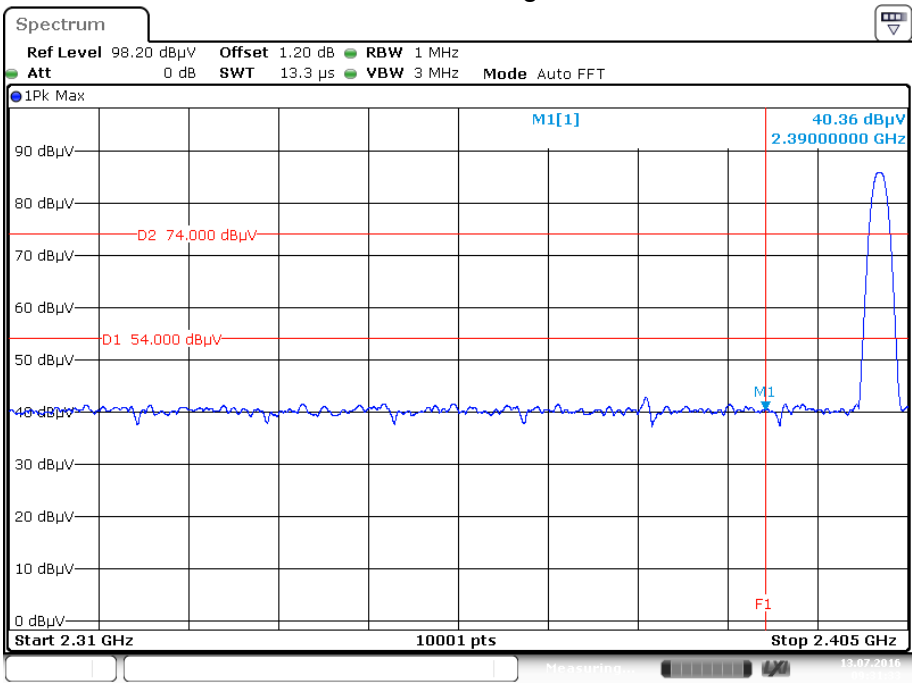


Bluetooth, Channel 78
18-26GHz
Horizontal
(1m test distance)



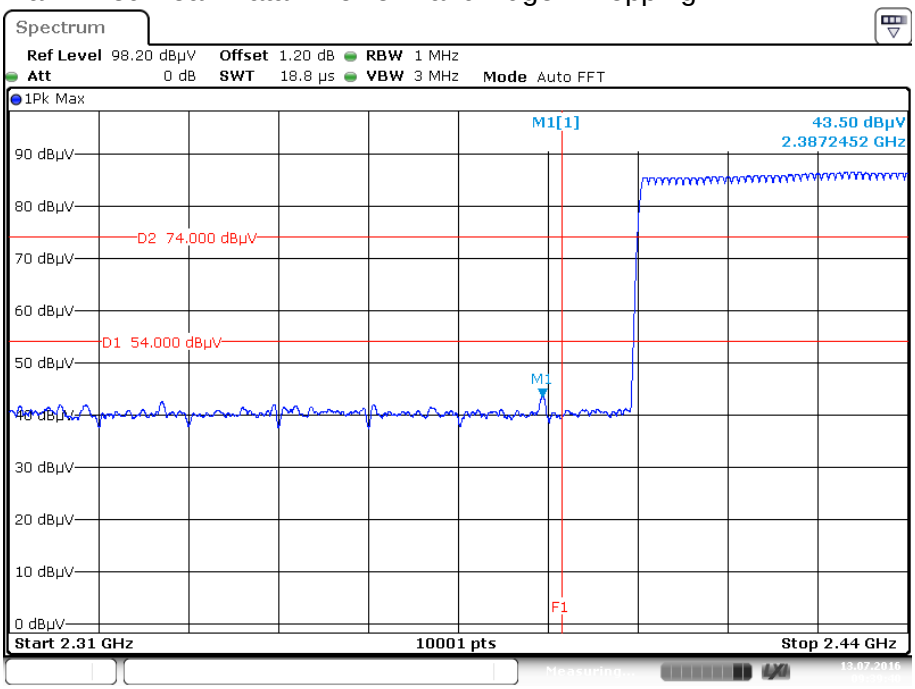
6.6 *Test Data (Band Eges)*

Maximized Peak Data – Lower Band Edge– Channel 0



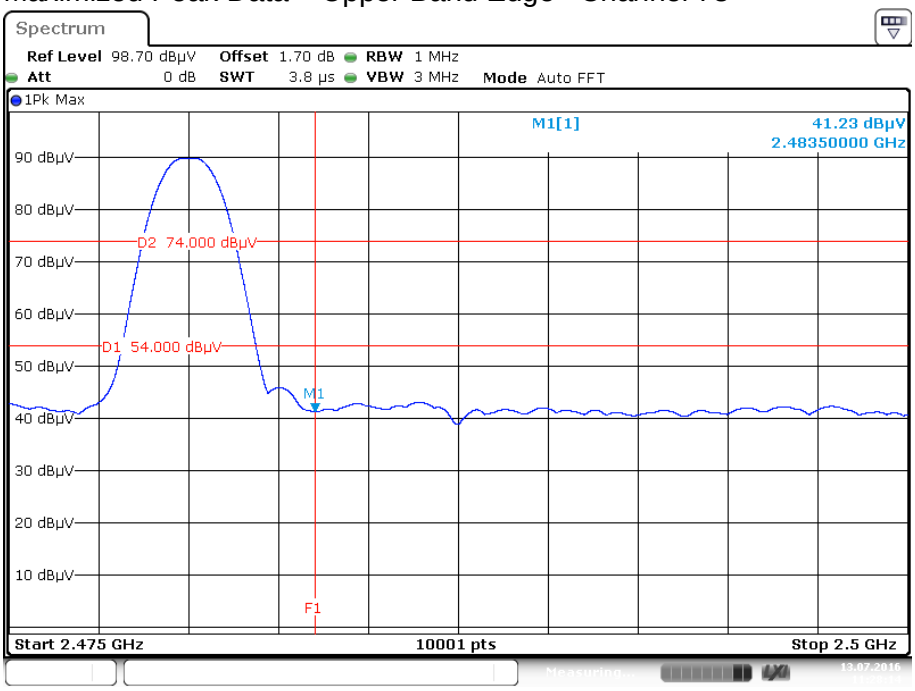
Date: 13.JUL.2016 09:31:34

Maximized Peak Data – Lower Band Edge – Hopping



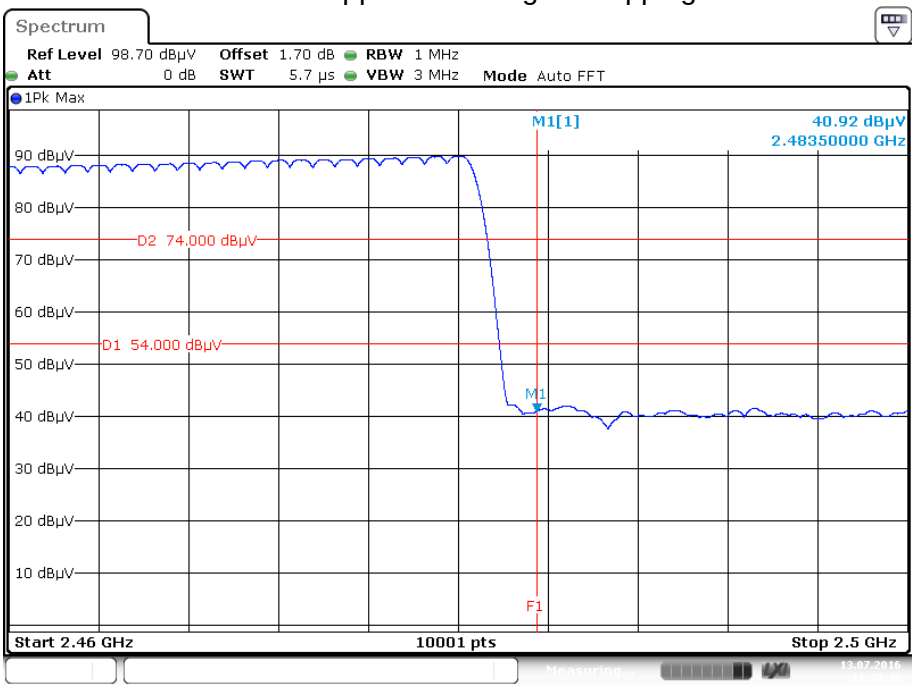
Date: 13.JUL.2016 09:39:40

Maximized Peak Data – Upper Band Edge– Channel 78



Date: 13.JUL.2016 11:28:15

Maximized Peak Data – Upper Band Edge – Hopping



Date: 13.JUL.2016 11:30:46

7 Pseudo-Random Hop Sequence

7.1 *Test Result*

Test Description	Test Specification	Test Result
Pseudo-Random Hop Sequence	15.247(d)	Compliant(1)

Note (1): The theory of operation states that the device is Bluetooth and operates using a pseudo-random hopping technique.

7.2 *Test Method*

Compliance is demonstrated by Manufacturer's declaration or is stated in the Theory of Operation.

Requirement

The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.

8 Channel Separation

8.1 *Test Result*

Test Description	Test Specification	Test Result
Number of Hopping Channels	15.247(a)(1)	Compliant

8.2 *Test Method*

The test data was measured using a spectrum analyzer with Peak detector (max hold) and a resolution bandwidth of 100 kHz. The trace was allowed to stabilize until all channels were displayed.

Requirement

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the -20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

8.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.9 °C
Relative Humidity: 49.4 %

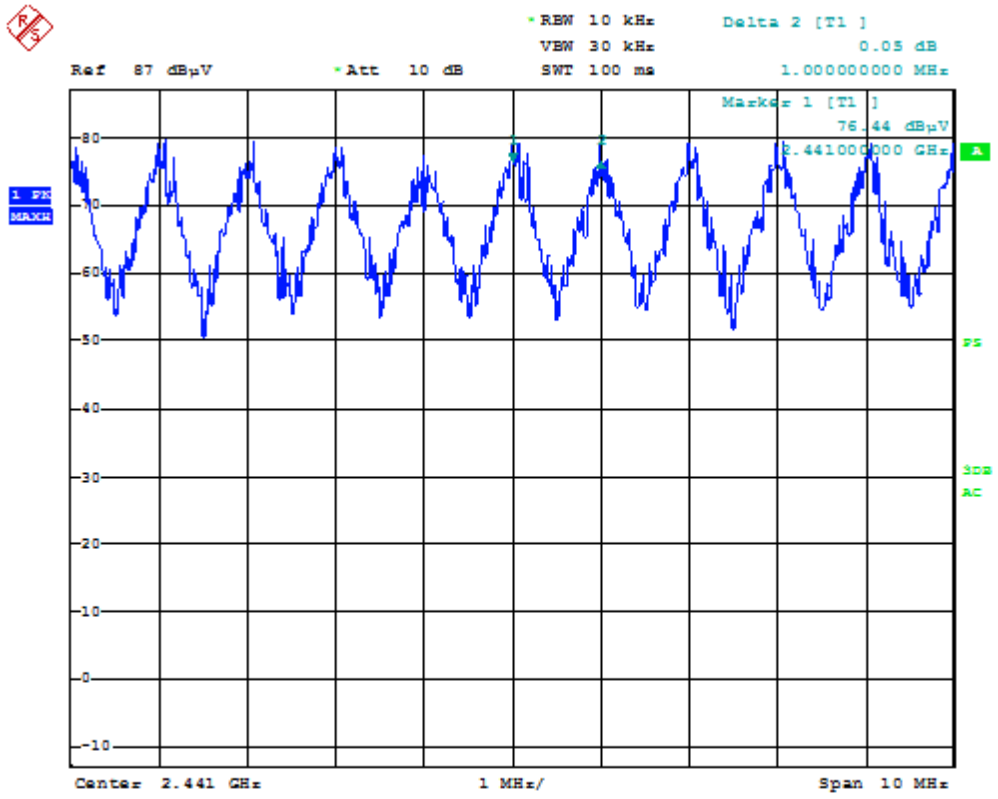
8.4 *Test Equipment*

Test Date: 12 May 2015

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU08	R&S	B085759	26 JUN 2015
Coaxial Cable	141	Huber-Suhner	B095589	06 AUG 2015

Note: The equipment calibration period is 1 year.

8.5 *Test Data*



Date: 12.MAY.2015 08:29:36

9 Number of Hopping Channels

9.1 *Test Result*

Test Description	Test Specification	Test Result
Number of Hopping Channels	15.247(a)(1)(i)	Compliant

9.2 *Test Method*

The test data was measured using a spectrum analyzer with Peak detector (max hold) and a resolution bandwidth of 30 kHz. The trace was allowed to stabilize until all channels were displayed.

Requirement
Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

9.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.1 °C
Relative Humidity: 43.9 %

9.4 *Test Equipment*

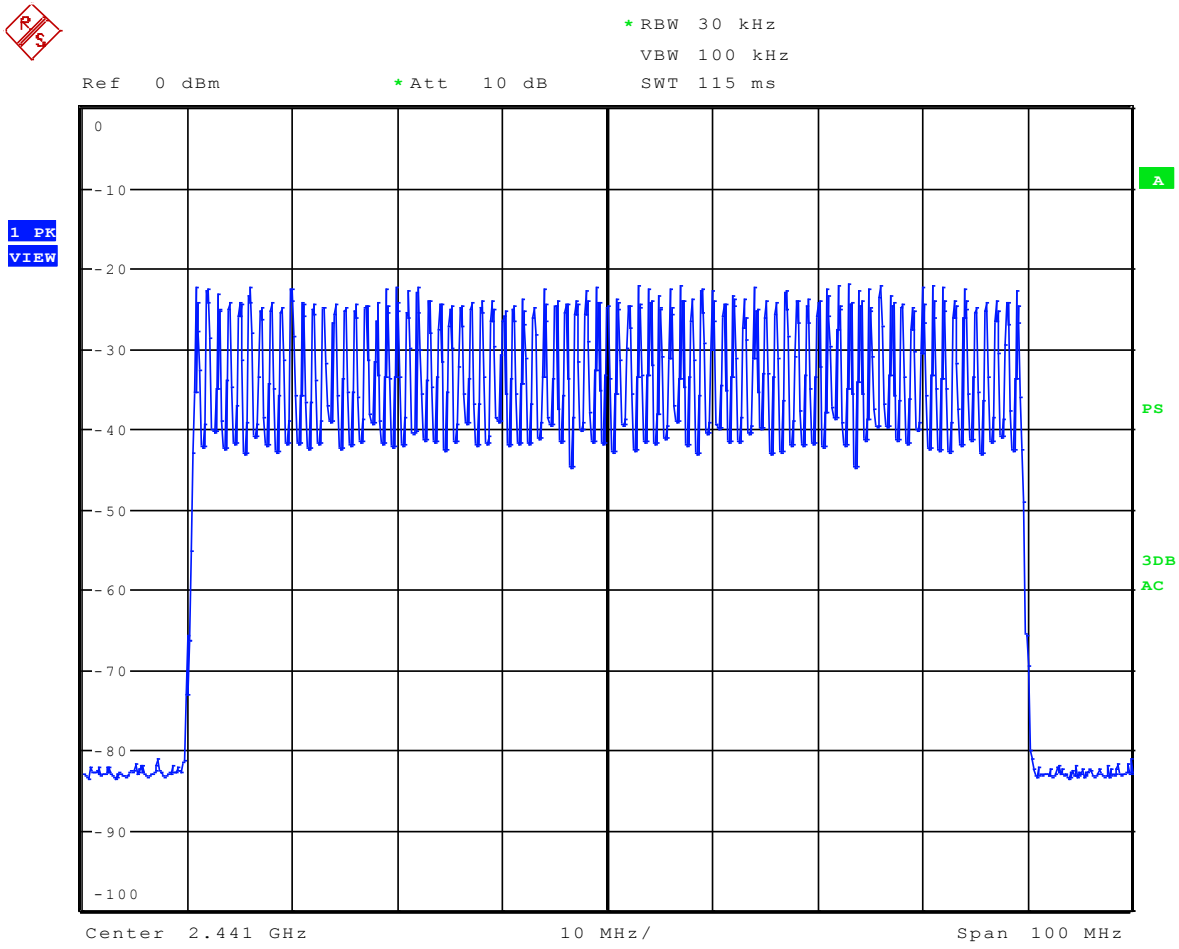
Test Date: 12 May 2015

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU08	R&S	B085759	26 JUN 2015
Coaxial Cable	141	Huber-Suhner	B095589	06 AUG 2015

Note: The equipment calibration period is 1 year.

9.5 *Test Data*

There are 79 Channels.



Date: 12.MAY.2015 09:16:27

10 Dwell Time

10.1 *Test Result*

Test Description	Test Specification	Test Result
Dwell Time	15.247(a)(1)(i)	Compliant

10.2 *Test Method*

Bluetooth BR/EDR mode has a channel hopping rate of 1600 hops/s. Since BR/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of 1600 / 6 = 266.67 hops/s.

- 400ms x 79 hopping channels = 31.6 sec (Time of Occupancy Limit)
- Worst case BT has 266.67 hops/second (for BR/EDR modes with DH5 operation)
- 266.67 hops/second / 79 channels = 3.38 hops/second (# hops/second on one channel)
- 3.38 hops/second/channel * 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- 106.67 hops x 2.9 ms/channel = 309.34 ms (worst case dwell time for one channel in BR/EDR modes)

Requirement

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.

10.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.1 °C
Relative Humidity: 43.9 %

10.4 *Test Equipment*

Test Date: 12 May 2015

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU08	R&S	B085759	26 JUN 2015
Coaxial Cable	141	Huber-Suhner	B095589	06 AUG 2015

Note: The equipment calibration period is 1 year.

10.5 *Test Data*

	Packet Type	Pulse Width ms	Dwell Time Sec	Limit	Result
BR	DH1	0.399	0.13	0.4	PASS
	DH3	1.657	0.27	0.4	PASS
	DH5	2.907	0.31	0.4	PASS
EDR2	DH1	0.399	0.13	0.4	PASS
	DH3	1.657	0.27	0.4	PASS
	DH5	2.907	0.31	0.4	PASS
EDR3	DH1	0.399	0.13	0.4	PASS
	DH3	1.657	0.27	0.4	PASS
	DH5	2.907	0.31	0.4	PASS

11 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	15 July 2016