



**FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8**

CERTIFICATION TEST REPORT

FOR

Bluetooth Interface board for POS printer

MODEL NUMBER: M212B

FCC ID: BKMFBM212B

REPORT NUMBER: 32LE0153-SH-A-R2

ISSUE DATE: SEPTEMBER 5, 2012

Prepared for

SEIKO EPSON CORPORATION

3-3-5 Owa Suwa-Shi, Nagano-Ken 392-8502 Japan

Prepared by

UL Japan, Inc. Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN

Telephone number : +81 463 50 6400

Facsimile number : +81 463 50 6401

JAB Accreditation No. : RTL02610



JAB
Testing
RTL2610

Revision History

Rev.	Issue Date	Revisions	Revised By
--	08/06/12	Initial Issue	S.Takano
1	08/27/12	Correction of misdescription (limit value) (P34,P69) *This report is a revised version of 32LE0153-SH-A, which is replaced with this report.	S.Takano
2	09/05/12	Addition of Radiated Spurious Emissions and AC Power Line Conducted Emissions in the configuration: Host device with EUT (Page 5, 7 to 12, 96 to 107, 120 to 131, 135 to 137, 142 to 144, 151 and 153)	S.Takano

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	6
4.1. MEASURING INSTRUMENT CALIBRATION.....	6
4.2. SAMPLE CALCULATION.....	6
4.3. MEASUREMENT UNCERTAINTY.....	6
5. EQUIPMENT UNDER TEST.....	7
5.1. DESCRIPTION OF EUT.....	7
5.2. DESCRIPTION OF HOSTS.....	7
5.3. MAXIMUM OUTPUT POWER	7
5.4. DESCRIPTION OF AVAILABLE ANTENNAS.....	7
5.5. SOFTWARE AND FIRMWARE	7
5.6. WORST-CASE CONFIGURATION AND MODE.....	8
5.7. DESCRIPTION OF TEST SETUP	9
6. TEST AND MEASUREMENT EQUIPMENT	11
7. ANTENNA PORT TEST RESULTS.....	13
7.1. BASIC DATA RATE GFSK MODULATION.....	13
7.1.1. 20 dB AND 99% BANDWIDTH	13
7.1.2. HOPPING FREQUENCY SEPARATION	20
7.1.3. NUMBER OF HOPPING CHANNELS.....	22
7.1.4. AVERAGE TIME OF OCCUPANCY	27
7.1.5. OUTPUT POWER	34
7.1.6. AVERAGE POWER.....	35
7.1.7. CONDUCTED SPURIOUS EMISSIONS.....	36
7.2. ENHANCED DATA RATE 8PSK MODULATION.....	48
7.2.1. 20 dB AND 99% BANDWIDTH	48
7.2.2. HOPPING FREQUENCY SEPARATION	55
7.2.3. NUMBER OF HOPPING CHANNELS.....	57
7.2.4. AVERAGE TIME OF OCCUPANCY	62
7.2.5. OUTPUT POWER	69
7.2.6. AVERAGE POWER.....	70
7.2.7. CONDUCTED SPURIOUS EMISSIONS.....	71
8. RADIATED TEST RESULTS.....	83

8.1. LIMITS AND PROCEDURE.....	83
8.2. TRANSMITTER ABOVE 1 GHz.....	84
8.2.1. BASIC DATA RATE GFSK MODULATION.....	84
8.2.2. ENHANCED DATA RATE 8PSK MODULATION	108
8.3. WORST-CASE BELOW 1 GHz	132
9. AC POWER LINE CONDUCTED EMISSIONS.....	138
10. MAXIMUM PERMISSIBLE EXPOSURE.....	145
11. SETUP PHOTOS.....	148

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SEIKO EPSON CORPORATION
3-3-5 Owa Suwa-Shi, Nagno-Ken 392-8502 Japan

EUT DESCRIPTION: Bluetooth Interface board for POS printer

MODEL: M212B

SERIAL NUMBER: 15 (Antenna port tests),
02 (Radiated Spurious Emissions and AC Power Line Conducted Emissions
(Host device with EUT)),
18 (other tests)

DATE TESTED: JULY 17 to 19 and September 4 to 5, 2012

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

UL Japan Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Japan, Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Japan, Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Japan, Inc. will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by any government agency.

Approved & Released For UL Japan, Inc. By:

Tested By:



Toyokazu Imamura
Leader of EMC Service,
UL Verification Service



Shinichi Takano
Engineer of WiSE Japan,
UL Verification Service

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN.

UL Japan is accredited by JAB, Laboratory Code RTL02610. The full scope of accreditation can be viewed at

http://www.jab.or.jp/cgi-bin/jab_exam_proof_j.cgi?page=2&authorization_number=RTL02610

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER		UNCERTAINTY
Power Line Conducted Emission	150kHz-30MHz	+/- 3.5 dB
	30MHz-300MHz(3m)	+/- 4.9 dB
Radiated Emission	300MHz-1000MHz(3m)	+/- 4.9 dB
	1000MHz-15GHz(3m)	+/- 4.9 dB
	15GHz-18GHz(1m)	+/- 5.6 dB
	18GHz-26.5GHz(1m)	+/- 4.4 dB

Uncertainty figures are valid to a confidence level of 95% using a coverage factor k=2.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Bluetooth Module (Power Class 2).

The radio module is manufactured by SMK Corporation.

5.2. DESCRIPTION OF HOSTS

There are 3 models for hosts, and all 3 models are a family model of Seiko Epson TM printer. The TM-T88V is tested as the worst-case host.

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	2.97	1.98
2402 - 2480	Enhanced 8PSK	1.63	1.46

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes Chip Antenna, with a maximum gain of +2.0 dBi.

5.5. SOFTWARE AND FIRMWARE

The test utility software used during testing was RF Test Tool for Bluetooth Device Ver1.2.2

5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case data rate for each mode is determined to be as follows, based on preliminary tests of the chipset utilized in this radio.

All final tests in the GFSK mode were made at 1 Mb/s.

All final tests in the 8PSK mode were made at 3 Mb/s.

The radiated emissions and AC Power Line Conducted Emissions are performed in 2 configurations i.e. EUT stand-alone and Host device with EUT.

For radiated emissions below 1 GHz, all modes and channels are measured and the worst result is described.

The fundamental and spurious was measured in three different orientations X, Y and Z to find worst-case orientation, and final testing for radiated emissions was performed with EUT in following orientation.

	Horizontal	Vertical
Carrier	Y	X
Spurious (below 1GHz)	X	X
Spurious (above 1GHz)	Z	Y
Spurious (Harmonics)	Z	Y

5.7. DESCRIPTION OF TEST SETUP

EUT STAND-ALONE

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Jig	SMK	BE005	-

I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	DC	1	DC	Un-Shielded	1.6m	N/A

HOST DEVICE WITH EUT

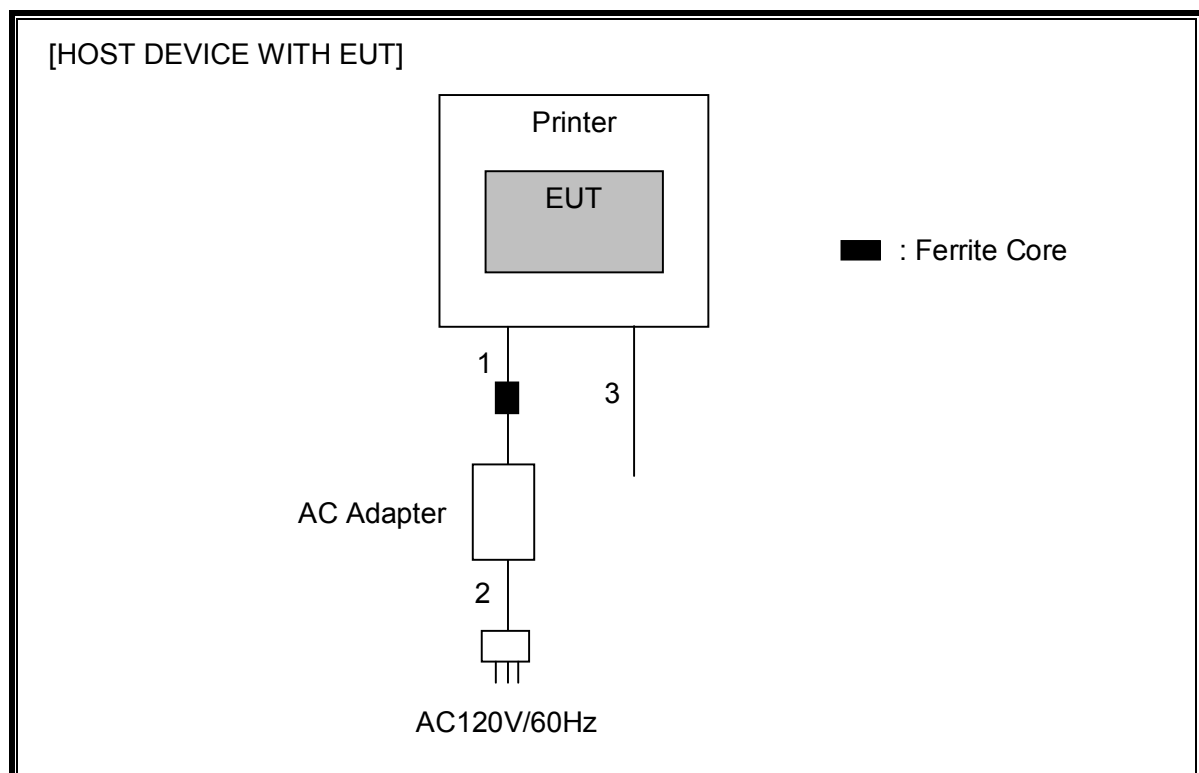
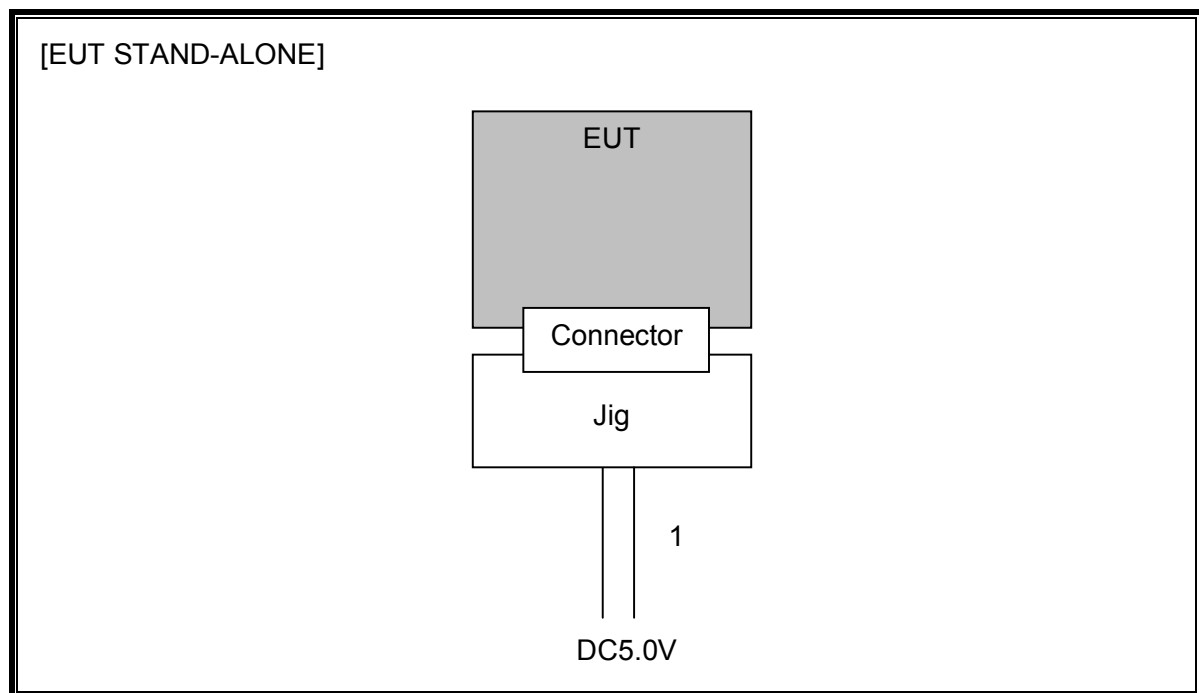
SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Receipt Printer	EPSON	TM-T88V	MQDF000309
AC Adapter	EPSON	PS-180	CYYZJ57342A

I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
2	DC	1	DC	Un-Shielded	1.5m	N/A
3	AC	1	AC	Un-Shielded	1.7m	N/A
4	USB	1	USB	Shielded	1.5m	N/A

SETUP DIAGRAM FOR RADIATED TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test and Measurement Equipment (1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	07/18/2012 * 12
SCC-G03	Coaxial Cable	Suhner	SUCOFLEX 104A	46499/4A	RE	04/10/2012 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	05/22/2012 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	08/28/2011 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	02/06/2012 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	03/16/2012 * 12
SJM-10	Measure	PROMART	SEN1935	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	RE, CE	-
SAT20-01	Attenuator(above1GHz)	Agilent	8493C-020	74889	RE	12/27/2011 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	12/27/2011 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	03/30/2012 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	03/12/2012 * 12
SCC-G17	Coaxial Cable	Suhner	SUCOFLEX 104A	46291/4A	RE	03/12/2012 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	02/10/2012 * 12
SAT6-03	Attenuator	JFW	50HF-006N	-	RE	02/10/2012 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	10/23/2011 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	04/10/2012 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	10/23/2011 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	02/07/2012 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	09/23/2011 * 12

The expiration date of the calibration is the end of the expired month.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

Test Item:

CE: Conducted emission,

RE: Radiated emission,

AT: Antenna terminal conducted tests

Test and Measurement Equipment (2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY4825015 2	AT	12/05/2011 * 12
SAT10-08	Attenuator	Weinschel	W54-10	-	AT	03/12/2012 * 12
SCC-G11	Coaxial Cable	Suhner	SUCOFLEX 102	31595/2	AT	03/12/2012 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	04/19/2012 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	04/19/2012 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	03/26/2012 * 12
SCC- A12/A13/SRSE- 01	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/N S4906	-/0901- 269(RF Selector)	CE	04/10/2012 * 12
SLS-01	LISN	Rohde & Schwarz	ENV216	100511	CE	02/20/2012 * 12
SAT3-03	Attenuator	JFW	50HF-003N	-	CE	02/17/2012 * 12
SOS-02	Humidity Indicator	A&D	AD-5681	4063343	CE	03/26/2012 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	CE	10/22/2011 * 12
SJM-12	Measure	PROMART	SEN1935	-	CE	-
SAF-01	Pre Amplifier	SONOMA	310N	290211	RE	2012/02/10 * 12
SAT6-05	Attenuator	JFW	50HF-006N	-	RE	2012/02/10 * 12
SAT3-04	Attenuator	JFW	50HF-003N	-	RE	2012/02/10 * 12
SBA-01	Biconical Antenna	Schwarzbeck	BBA9106	91032664	RE	2011/10/15 * 12
SCC- A1/A3/A5/A7/A 8/A13/SRSE-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhn er/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/14 1PE/141PE/141P E/141PE/NS4906	-/0901-269(RF Selector)	RE	2012/04/10 * 12
SCC- A2/A4/A6/A7/A 8/A13/SRSE-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhn er/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/14 1PE/141PE/141P E/141PE/NS4906	-/0901-269(RF Selector)	RE	2012/04/10 * 12
SLA-01	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0888	RE	2011/11/23 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2012/02/06 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE, CE	2012/02/07 * 12
SJM-12	Measure	PROMART	SEN1935	-	RE, CE	-
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE, CE	2011/09/01 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO- DV(RE,CE,RFI,MF)	-	RE	-
SAF-04	Pre Amplifier	TOYO Corporation	TPA0118-36	1440489	RE	2012/03/12 * 12
SCC-G01	Coaxial Cable	Suhner	SUCOFLEX 104A	46497/4A	RE	2012/04/10 * 12
SCC-G21	Coaxial Cable	Suhner	SUCOFLEX 104	296169/4	RE	2012/05/22 * 12
SAT10-05	Attenuator(above1GHz)	Agilent	8493C-010	74864	RE	2011/12/27 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	51	RE	2011/12/27 * 12
SHA-01	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	RE	2012/08/20 * 12
SAF-01	Pre Amplifier	SONOMA	310N	290211	RE	2012/02/10 * 12
SAT6-05	Attenuator	JFW	50HF-006N	-	RE	2012/02/10 * 12
SAT3-04	Attenuator	JFW	50HF-003N	-	RE	2012/02/10 * 12

The expiration date of the calibration is the end of the expired month.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

Test Item:

CE: Conducted emission,

RE: Radiated emission,

AT: Antenna terminal conducted tests

7. ANTENNA PORT TEST RESULTS

7.1. BASIC DATA RATE GFSK MODULATION

7.1.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

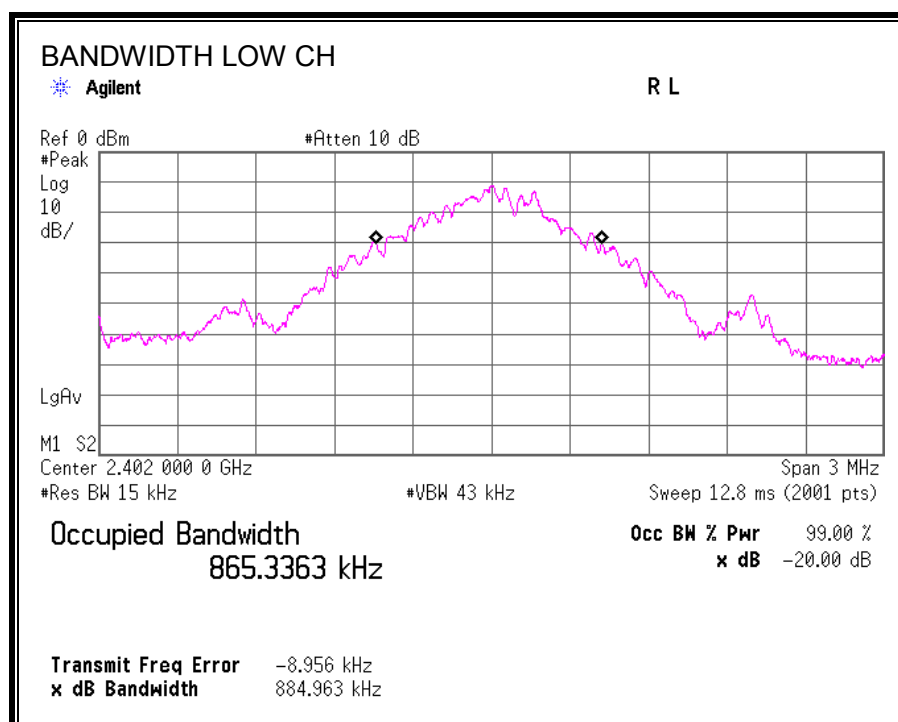
TEST PROCEDURE

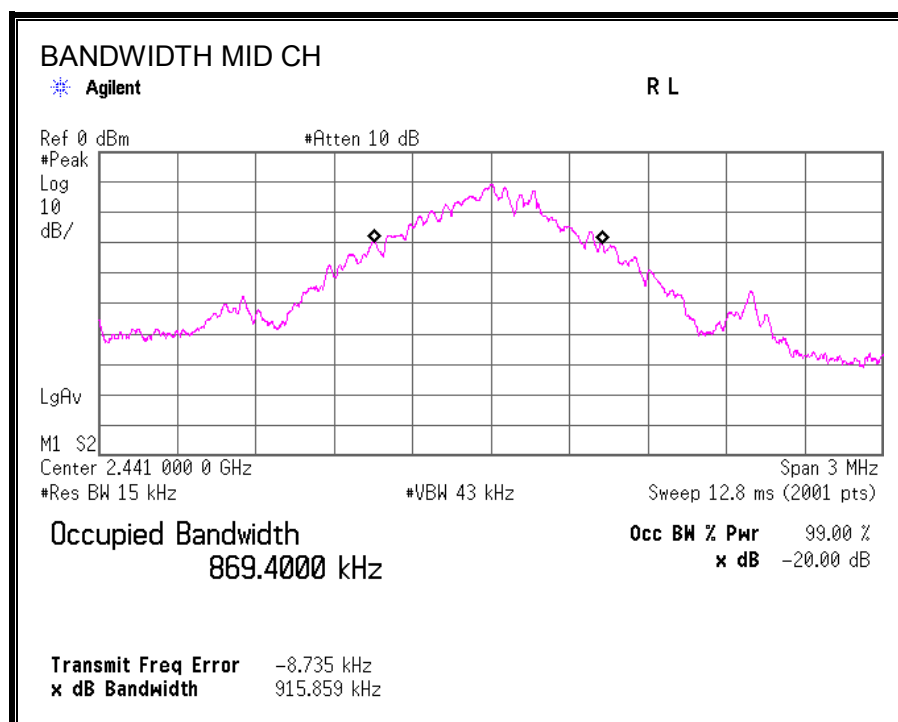
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to $\geq$ RBW. The sweep time is coupled.

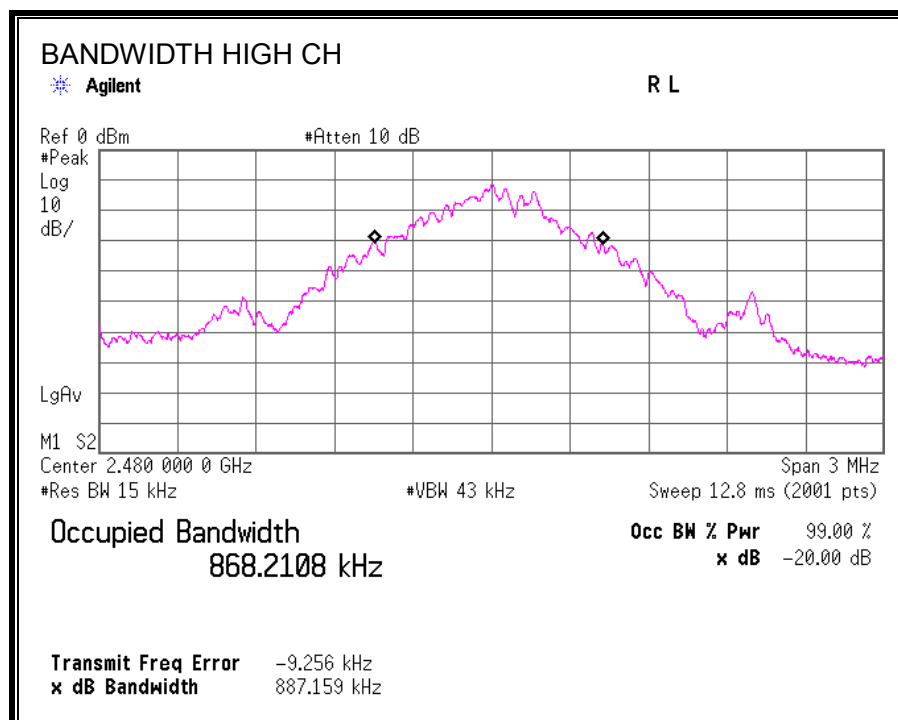
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	884.963	898.0649
Middle	2441	915.859	900.5446
High	2480	887.159	900.3134

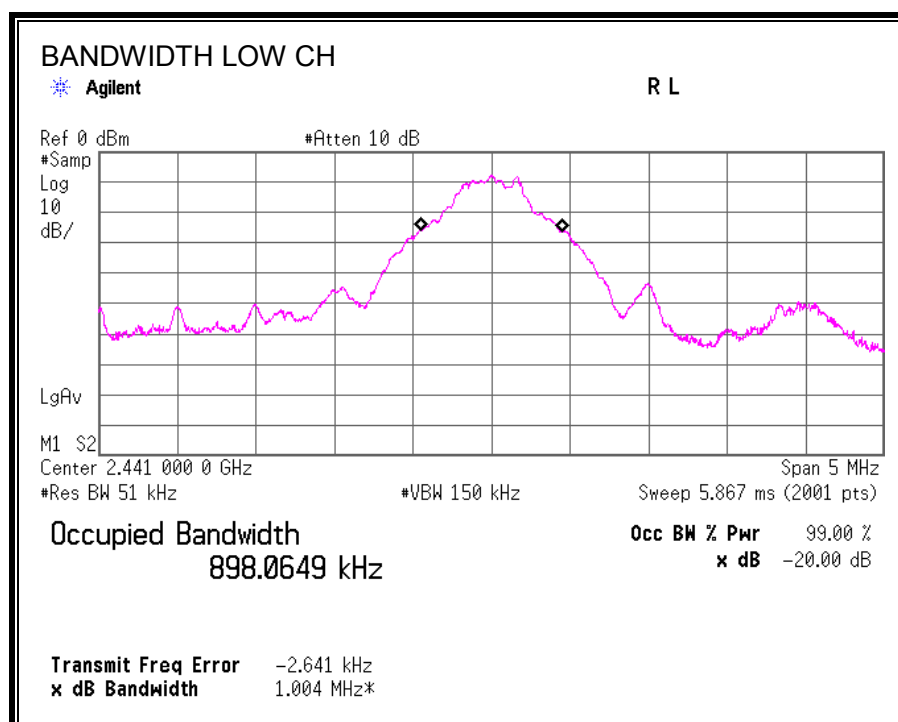
20 dB BANDWIDTH

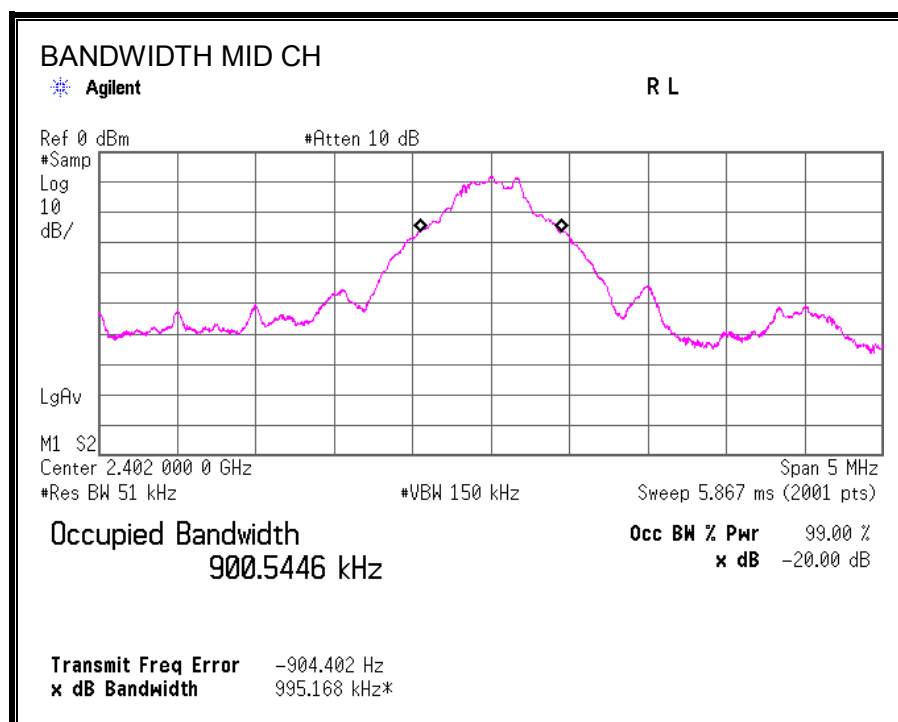


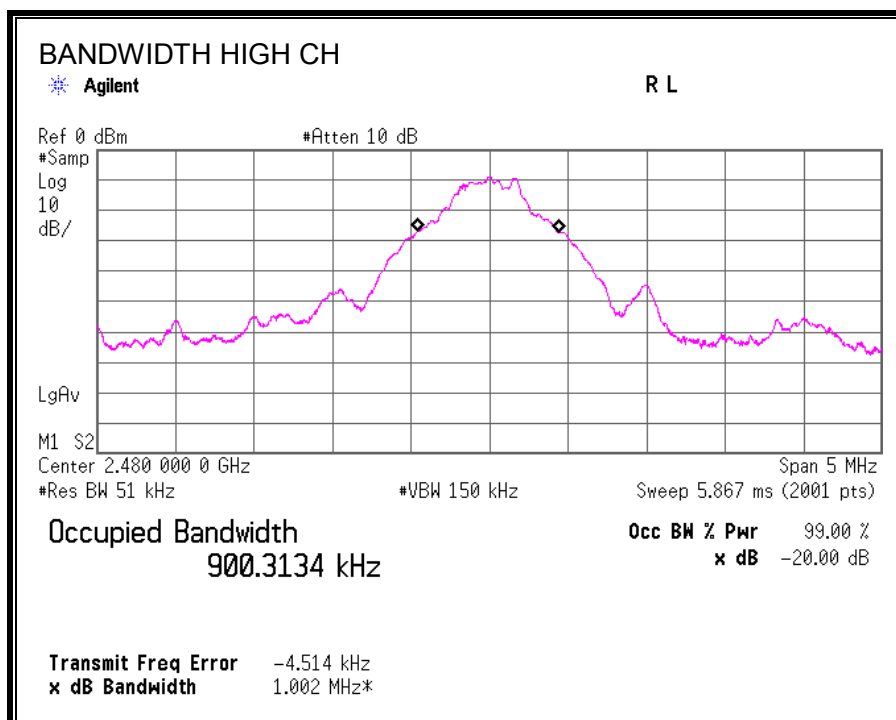




99% BANDWIDTH







7.1.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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 2400-2483.5 MHz band 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 the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

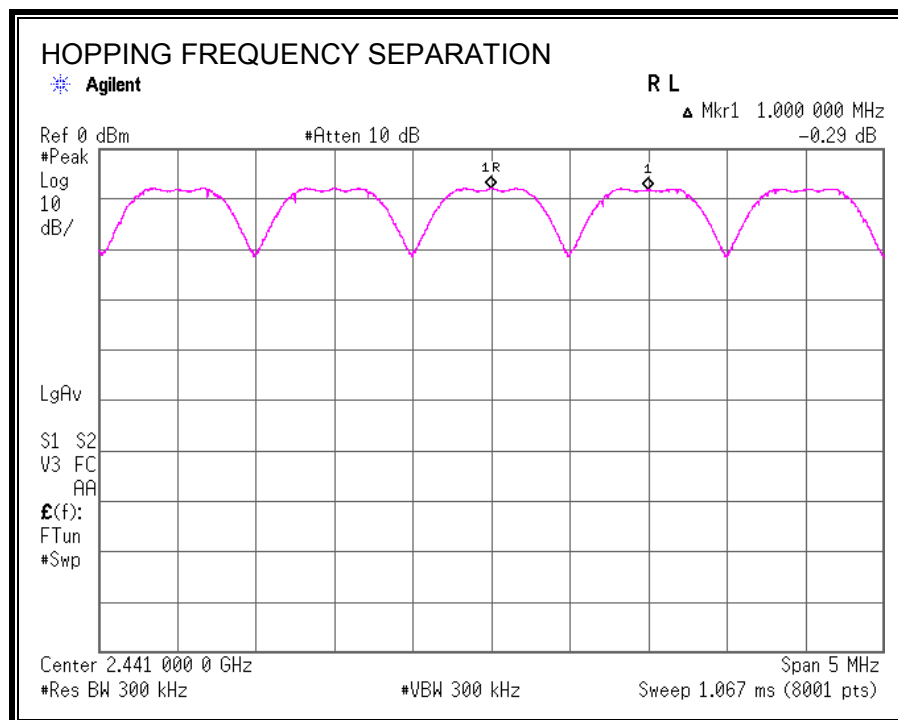
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

The channel separation was 1MHz and the test result was greater than the requirement that was 2/3 of 20 dB channel bandwidth.

RESULTS

HOPPING FREQUENCY SEPARATION



7.1.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

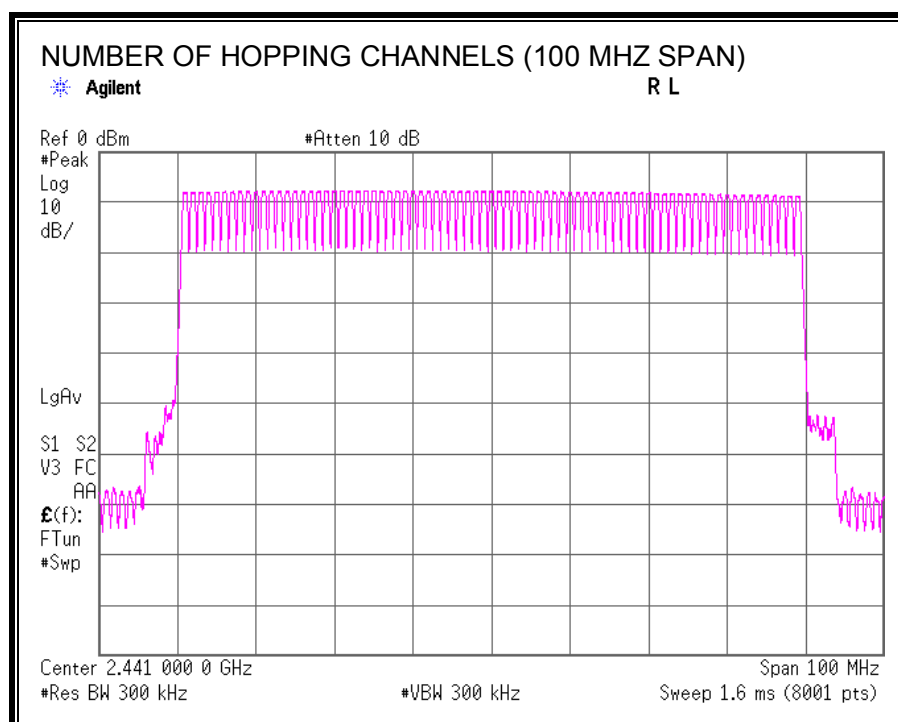
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

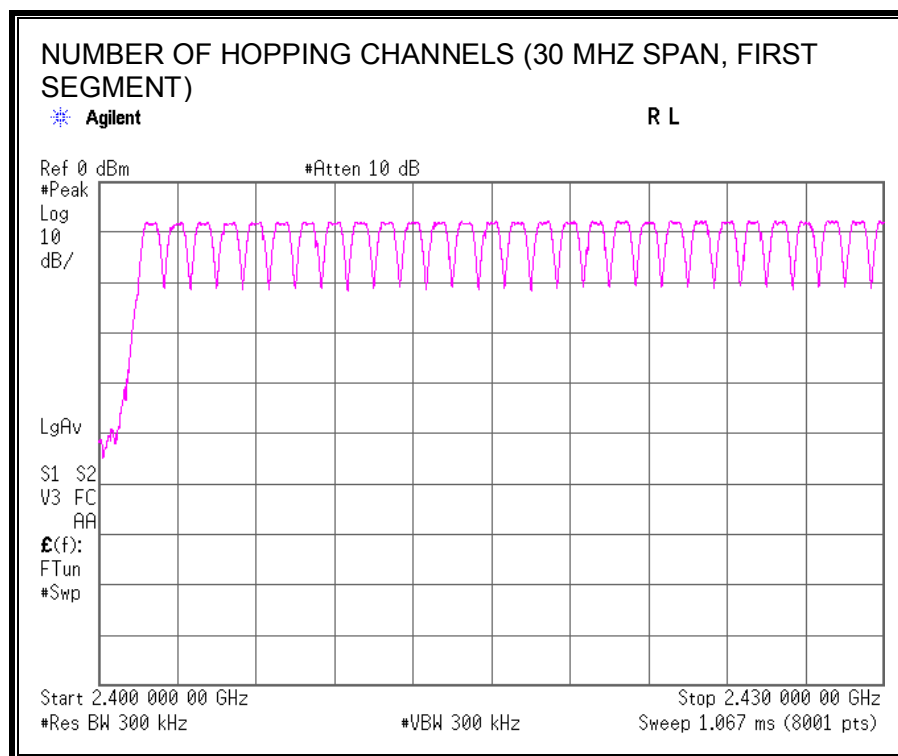
Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification 2.1.

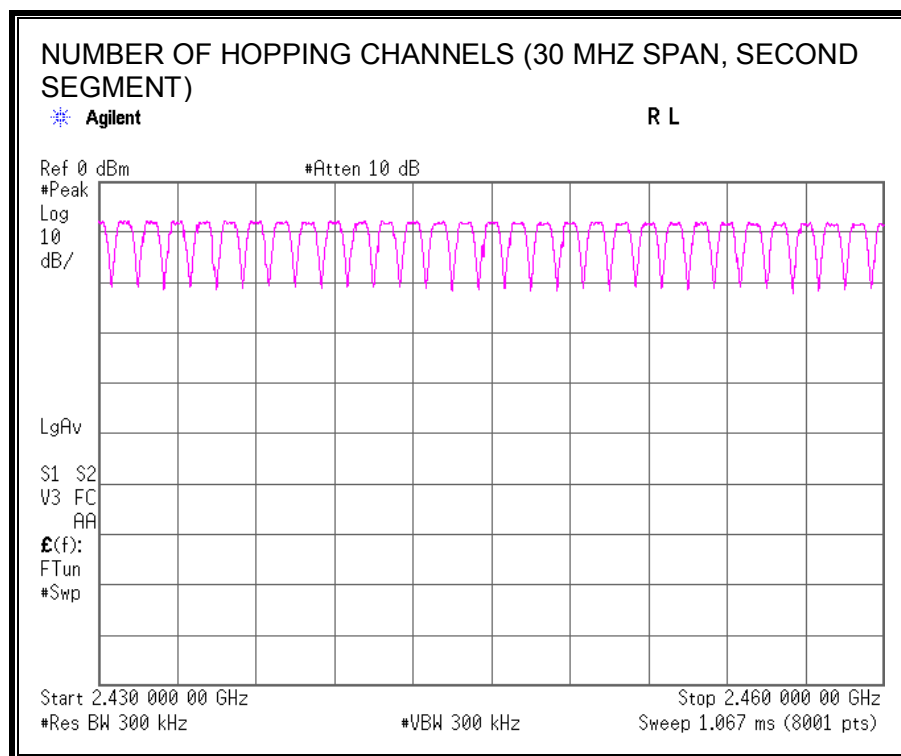
RESULTS

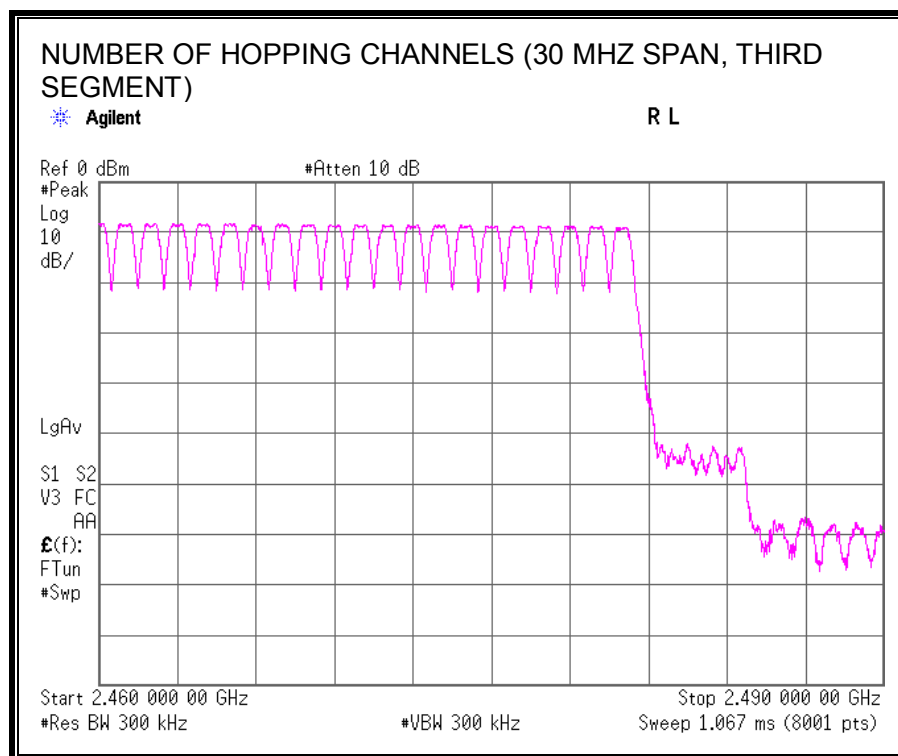
79 Channels observed.

NUMBER OF HOPPING CHANNELS









7.1.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in 3.16 s}) * \text{pulse width}$.

This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in $N \times 0.4\text{s}$, where N is the number of channels being used in the hopping sequence ($20 \geq N \leq 79$), is always less than 0.4s regardless of packet size (DH1, DH3 or DH5). This is confirmed in the test report for N=79.

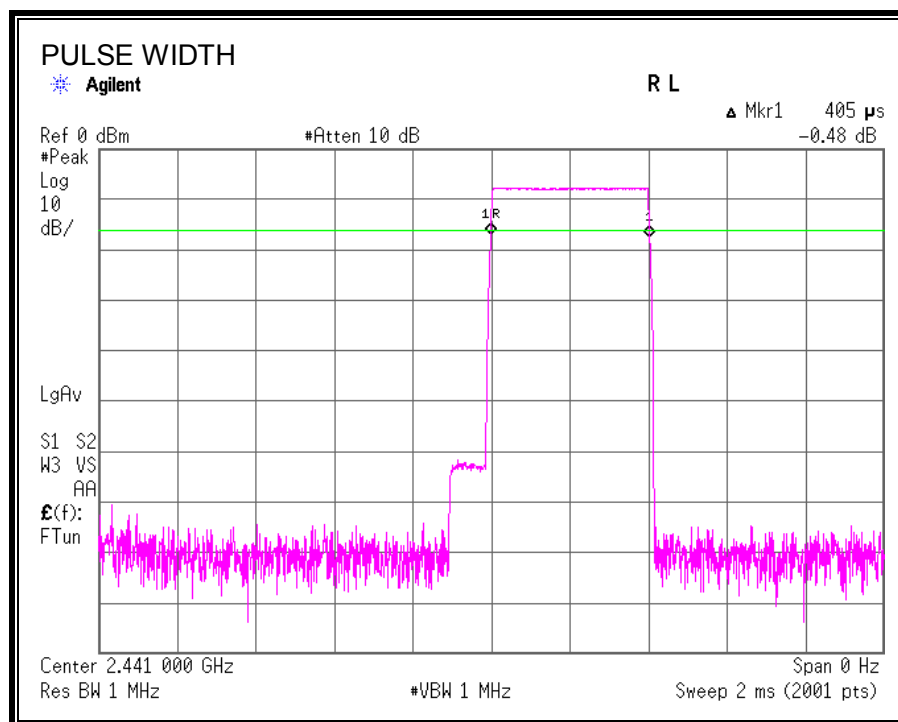
RESULTS

Time Of Occupancy = $10 * xx \text{ pulses} * yy \text{ msec} = zz \text{ msec}$

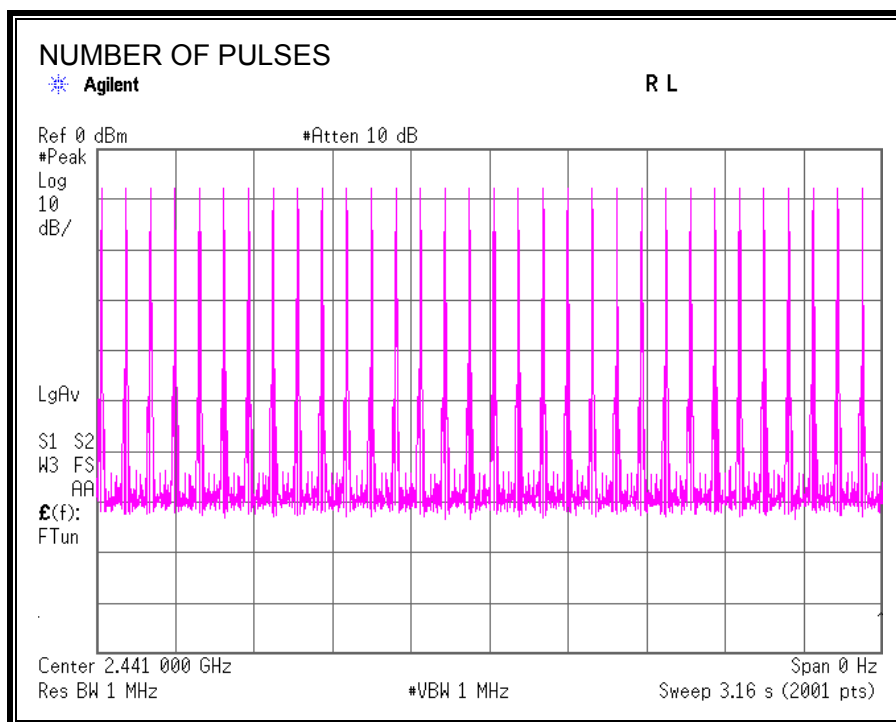
GFSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.4050	32	0.1296	0.4	0.2704
DH3	1.6640	16	0.2662	0.4	0.1338
DH5	2.9150	11	0.3207	0.4	0.0794

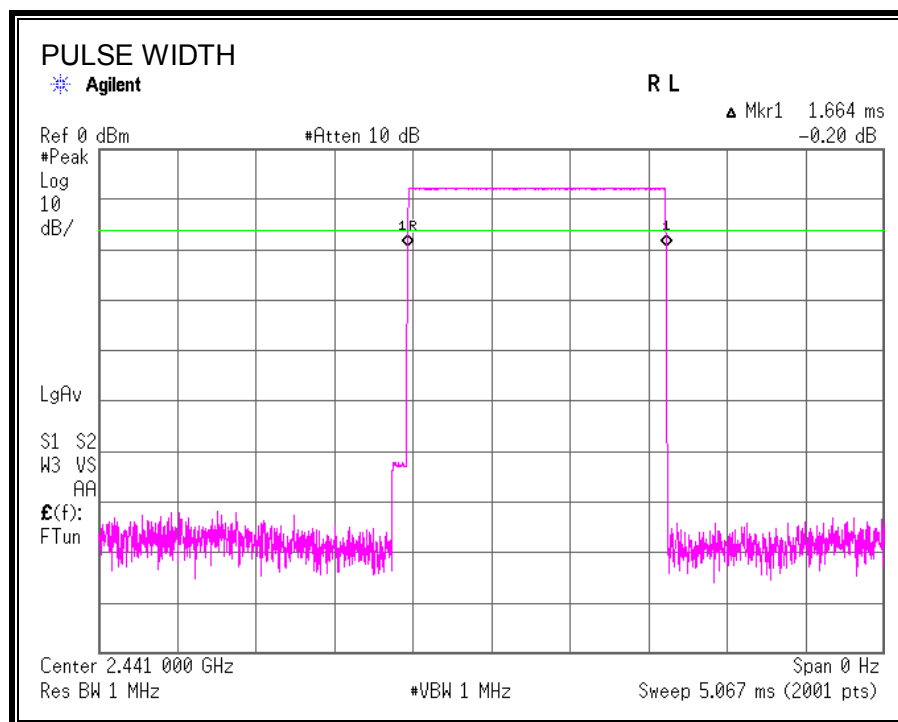
DH1 PULSE WIDTH



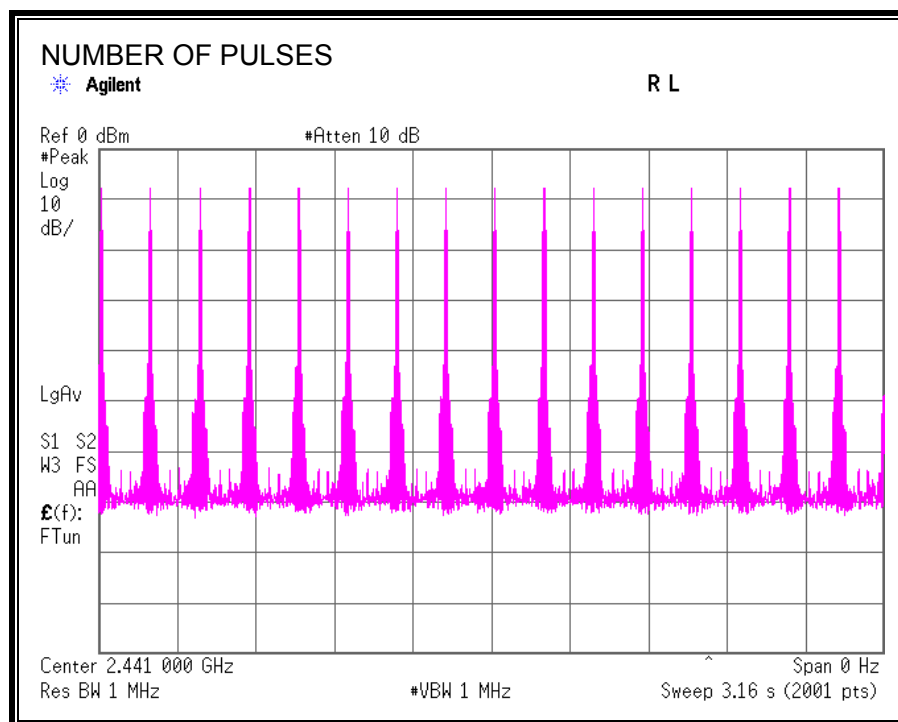
DH1 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



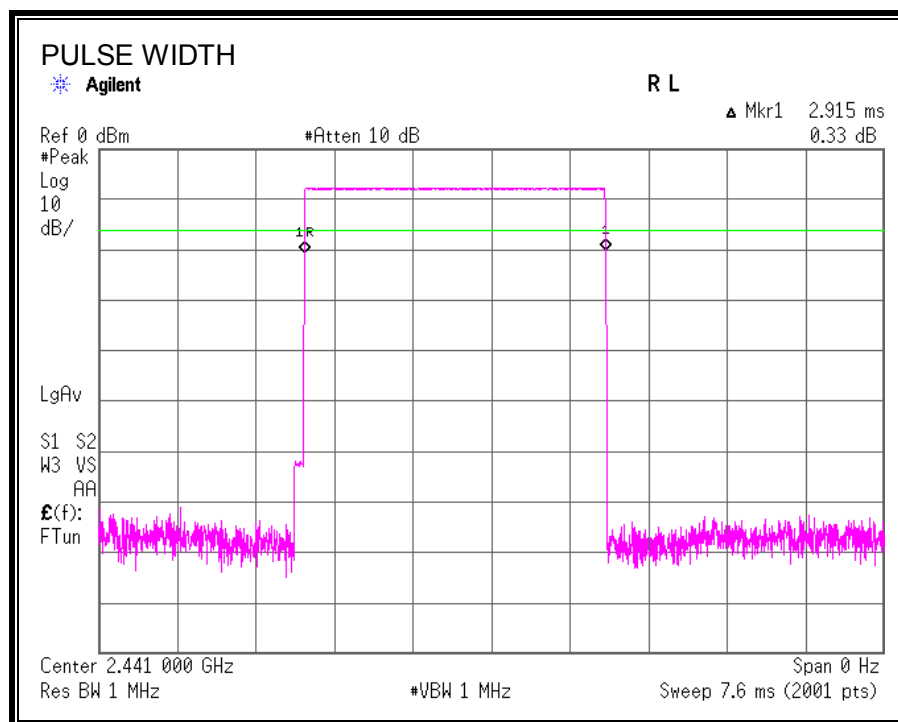
DH3 PULSE WIDTH



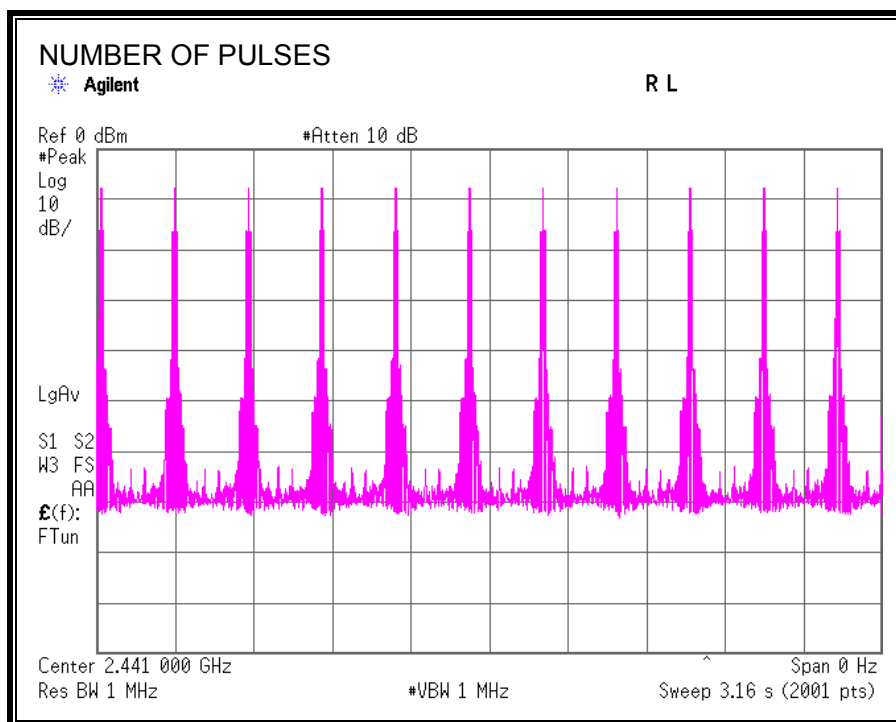
DH3 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



DH5 PULSE WIDTH



DH5 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



7.1.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 20.96 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

Channel	Frequency (MHz)	Output Power Reading (dBm)	factor (cable ,ATT) (dB)	Output Power Result (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-7.91	10.70	2.79	20.96	18.17
Middle	2441	-7.74	10.71	2.97	20.96	17.99
High	2480	-8.73	10.71	1.98	20.96	18.98

Sample calculation: Output Power Reading [dBm] + factor [dB]

Test was not performed at AFH mode because this Bluetooth radio is in compliance of Bluetooth Specification 2.0 and the output power at non-AFH mode is less than 20.96dBm.

7.1.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.70 – 10.71 dB (including 9.86 dB pad and 0.84 - 0.85 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	1.52
Middle	2441	1.72
High	2480	0.67

7.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

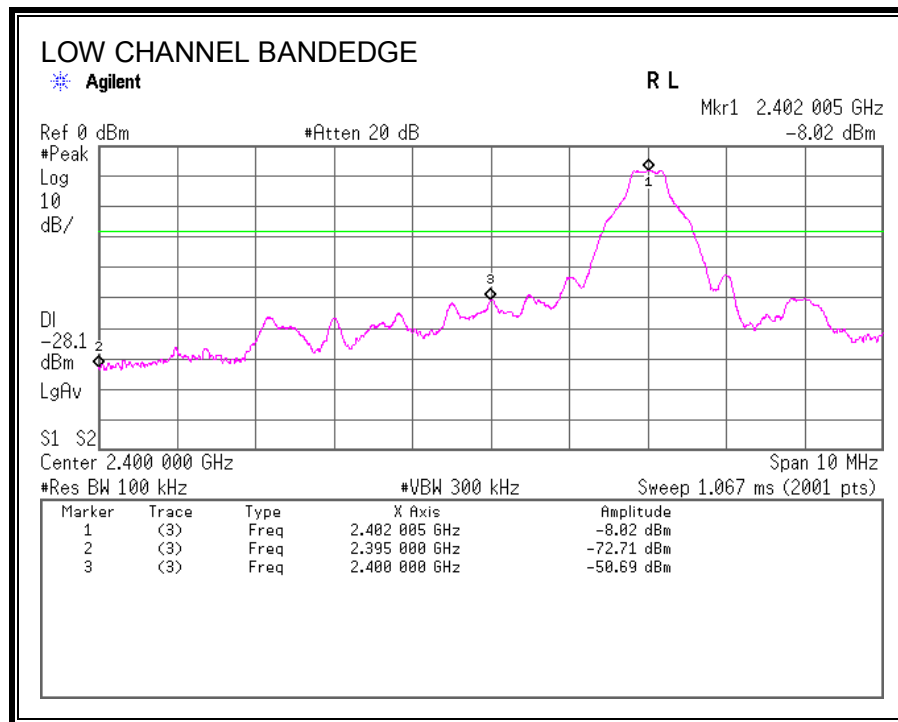
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=10kHz)

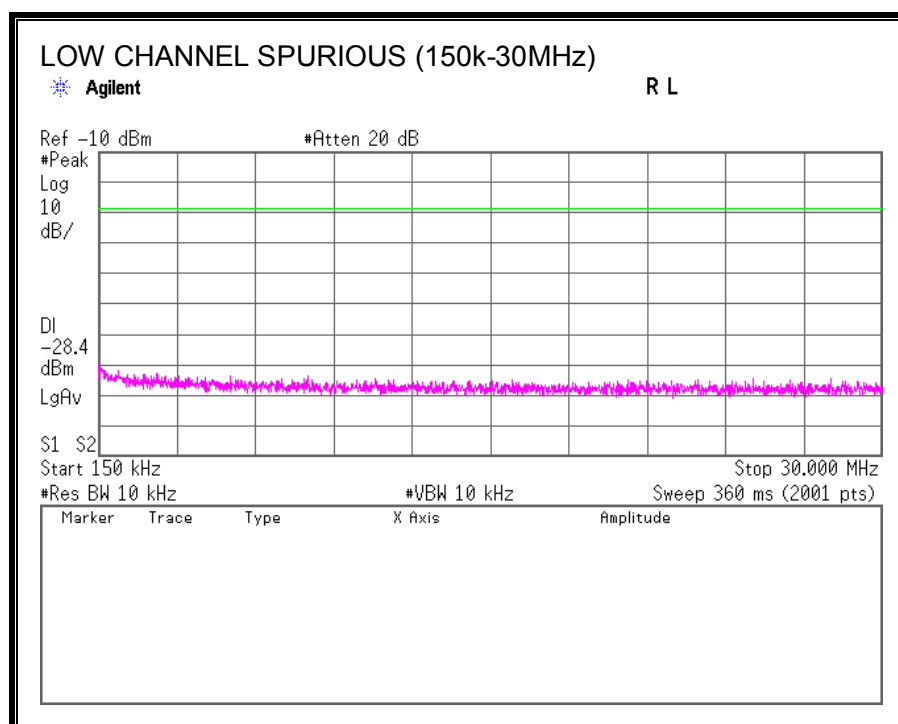
The spectrum from 9 kHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

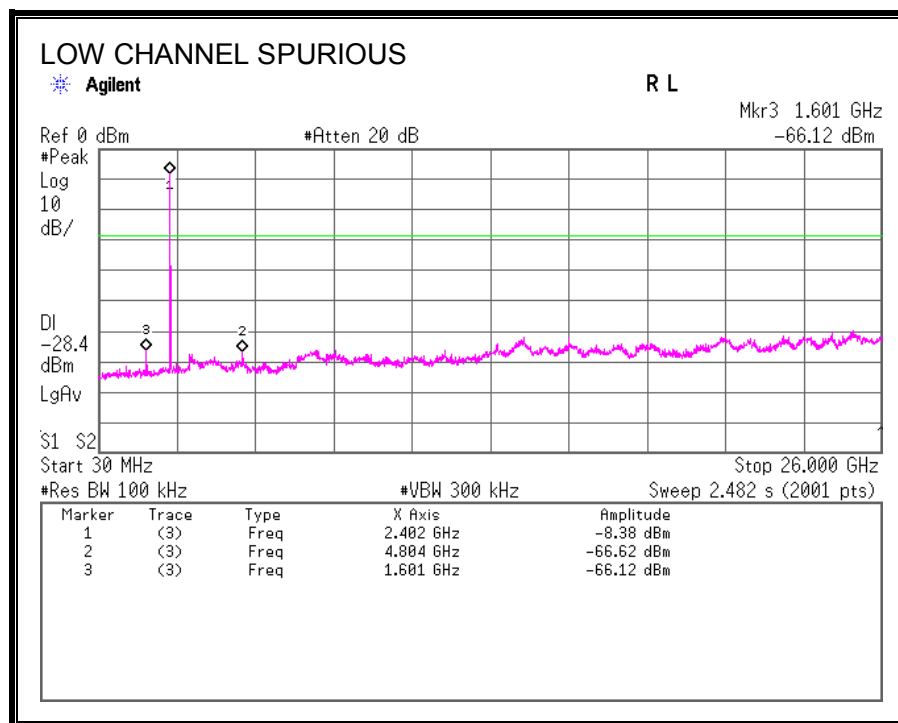
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

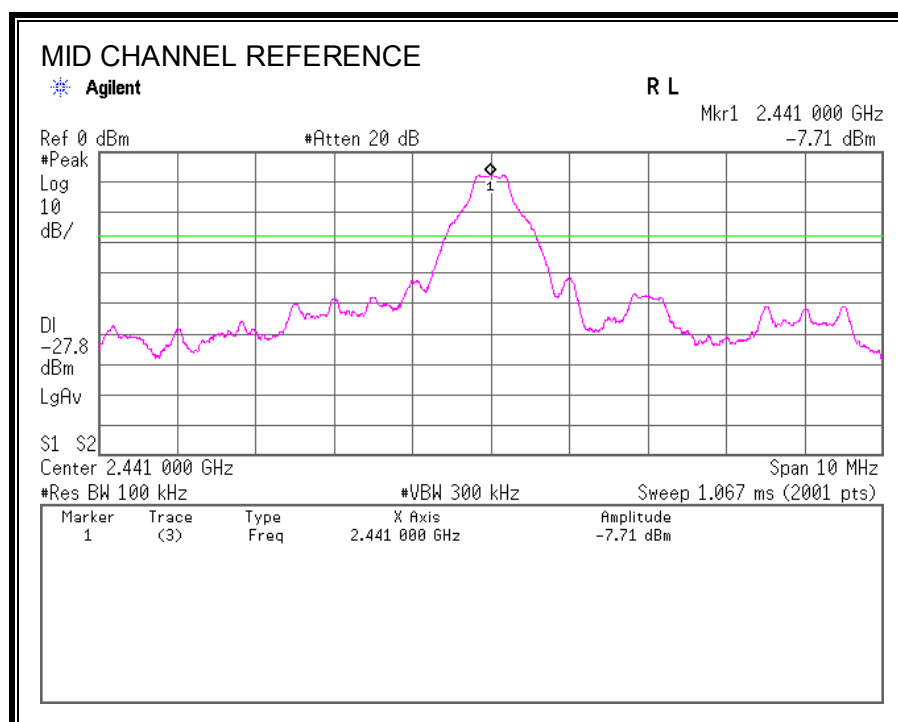
SPURIOUS EMISSIONS, LOW CHANNEL

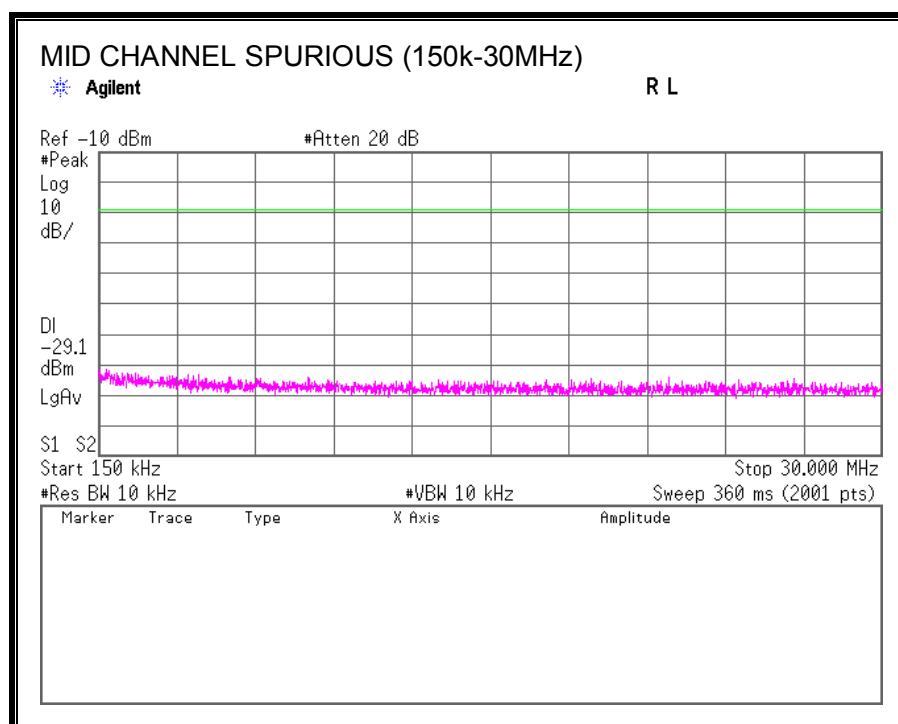


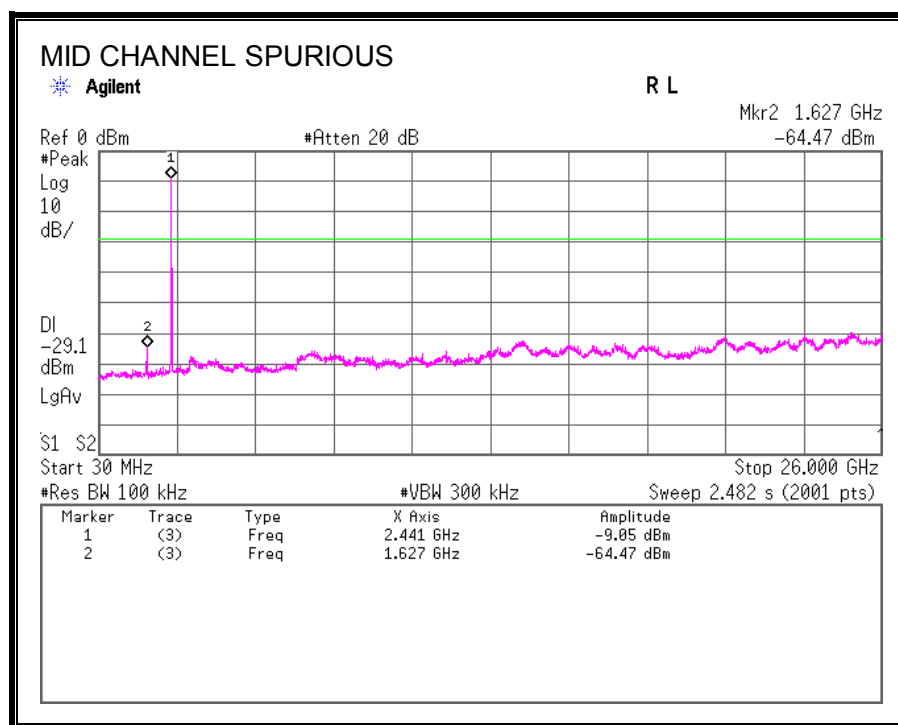




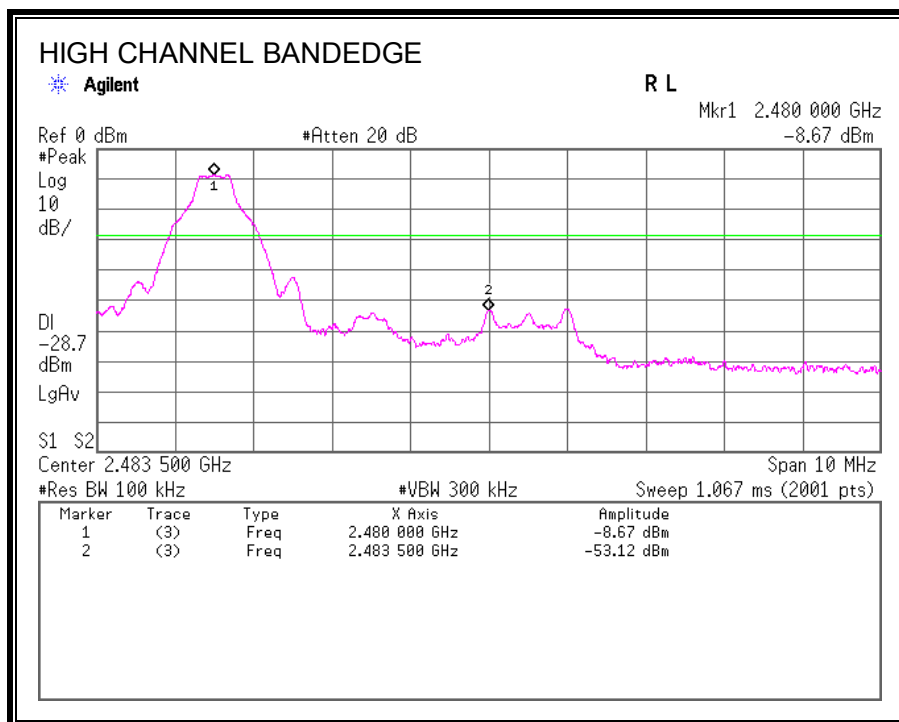
SPURIOUS EMISSIONS, MID CHANNEL

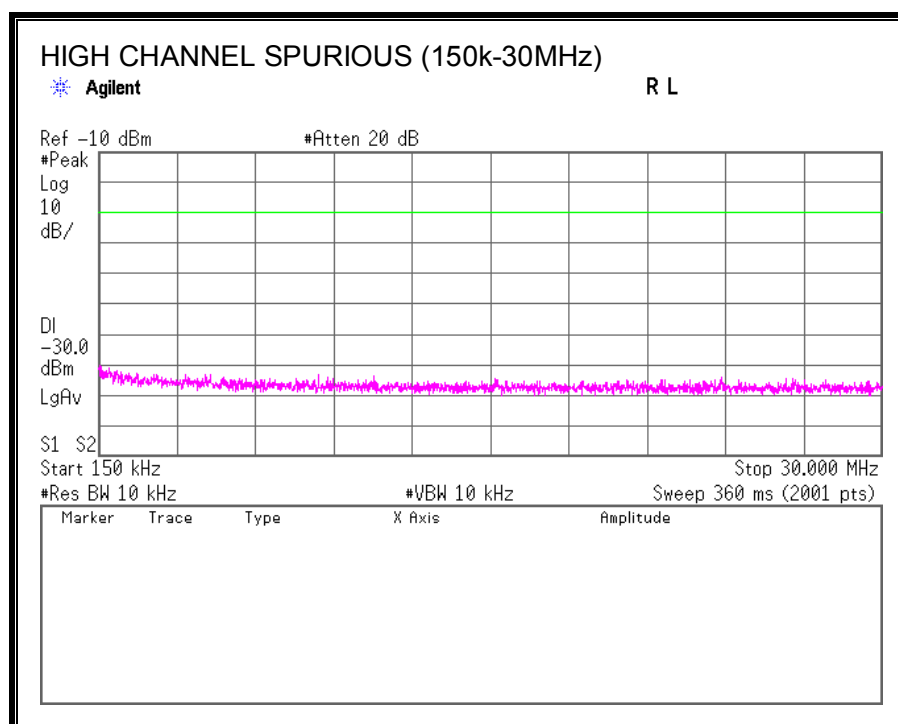


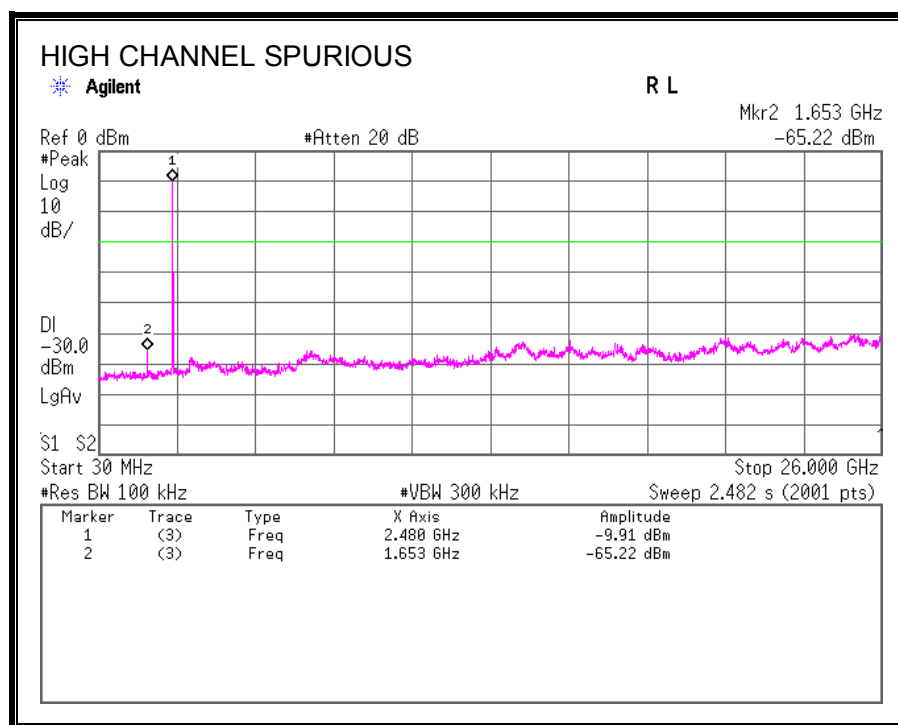




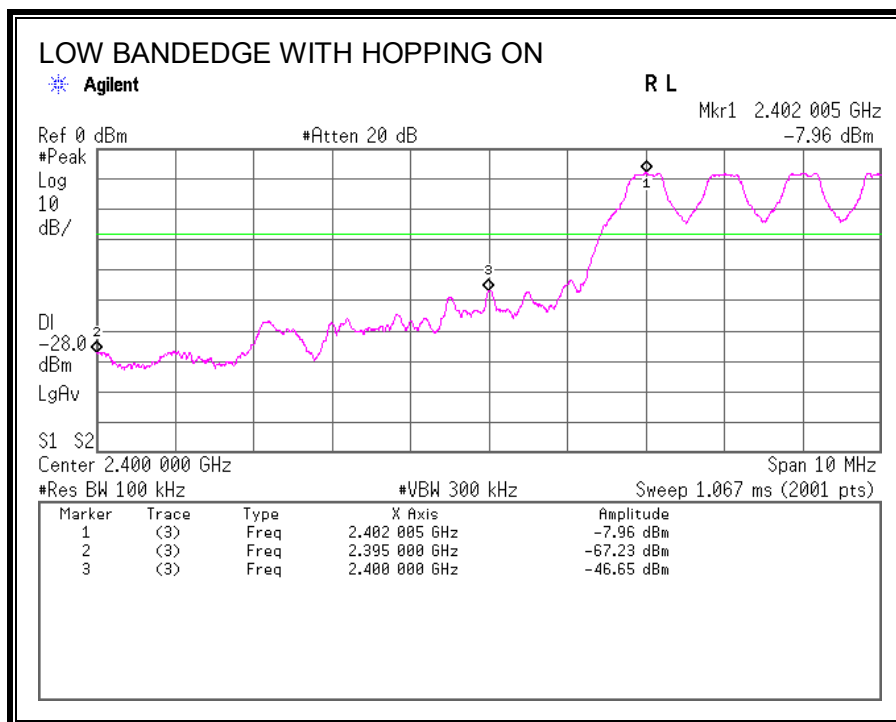
SPURIOUS EMISSIONS, HIGH CHANNEL

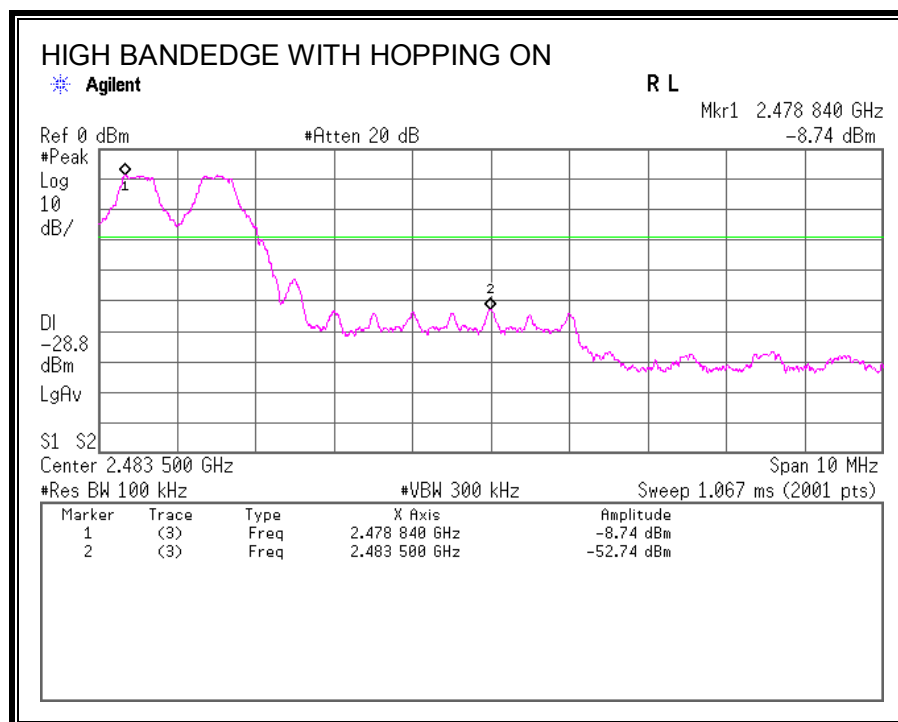






SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





7.2. ENHANCED DATA RATE 8PSK MODULATION

7.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

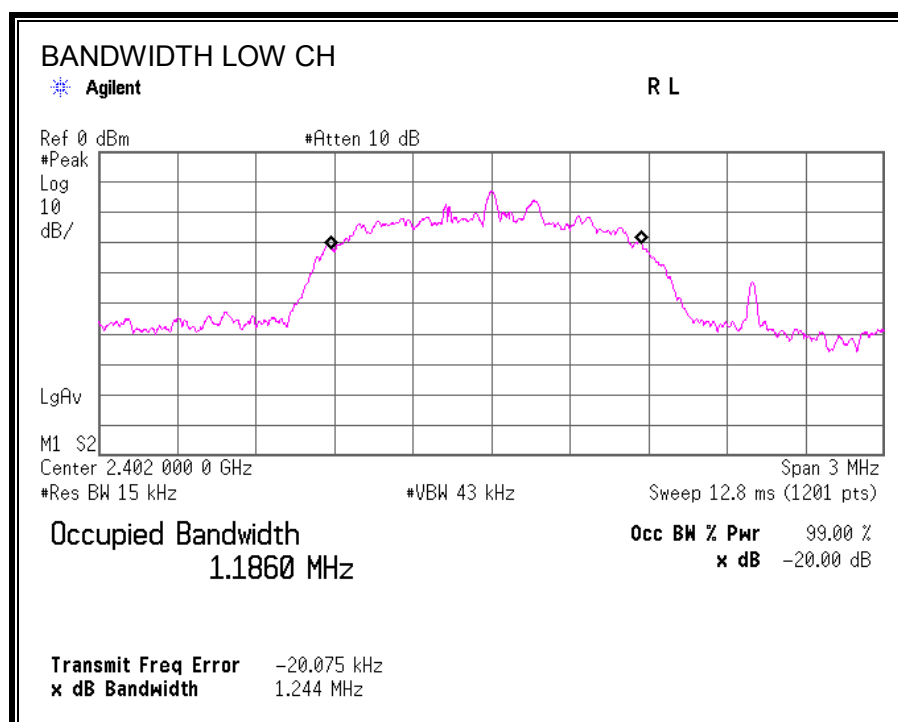
TEST PROCEDURE

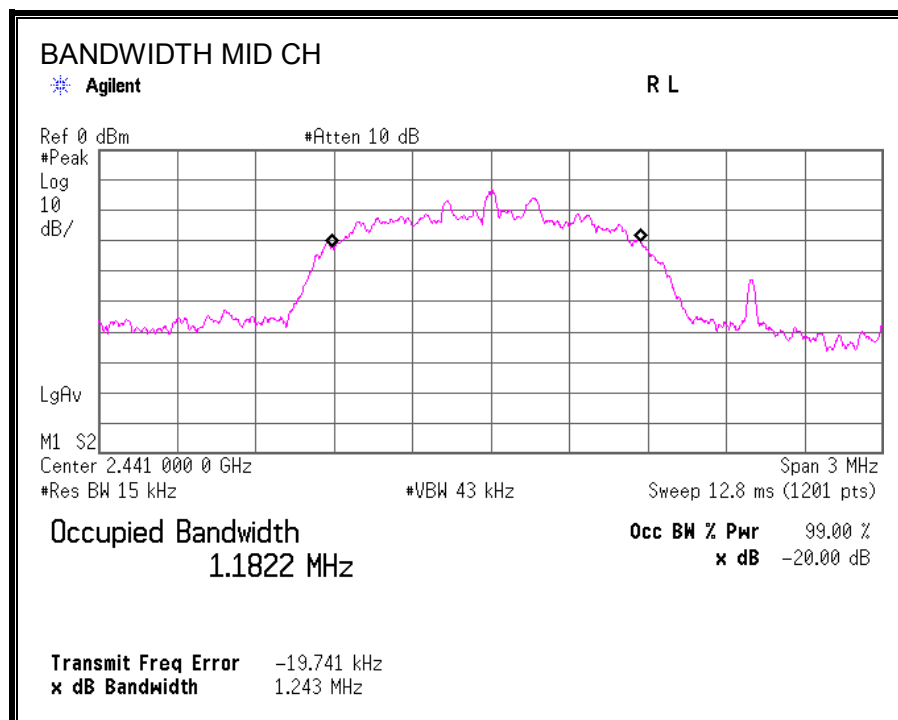
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to $\geq$ RBW. The sweep time is coupled.

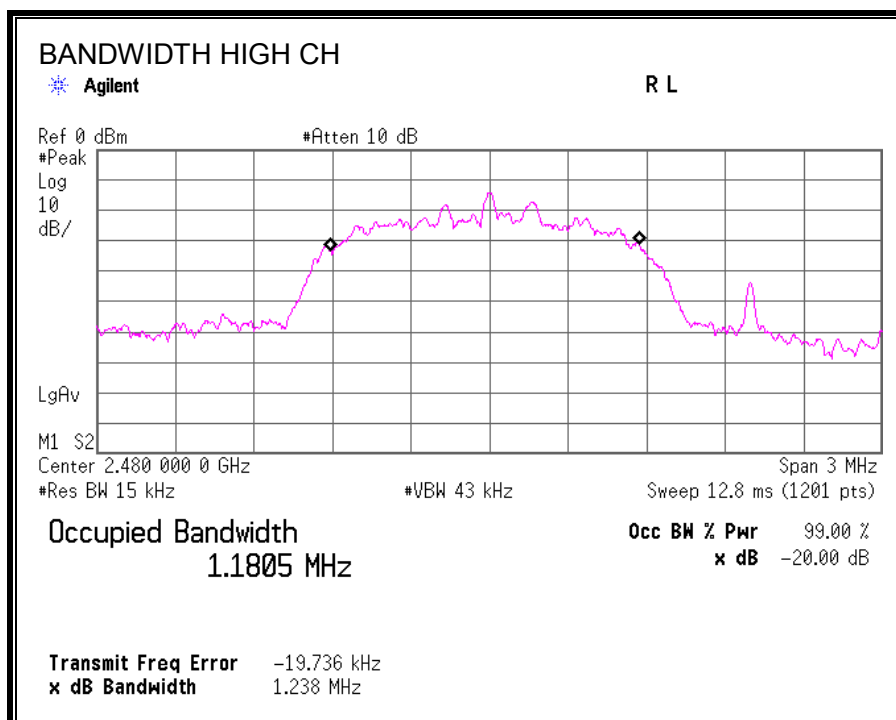
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1244	1173.9
Middle	2441	1243	1179
High	2480	1238	1170.6

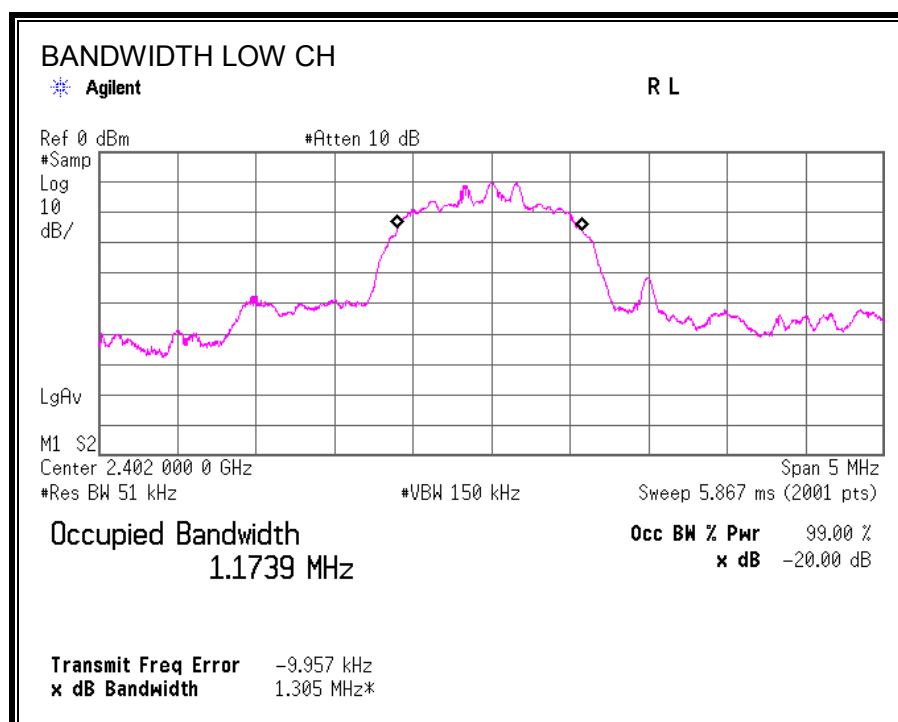
20 dB BANDWIDTH

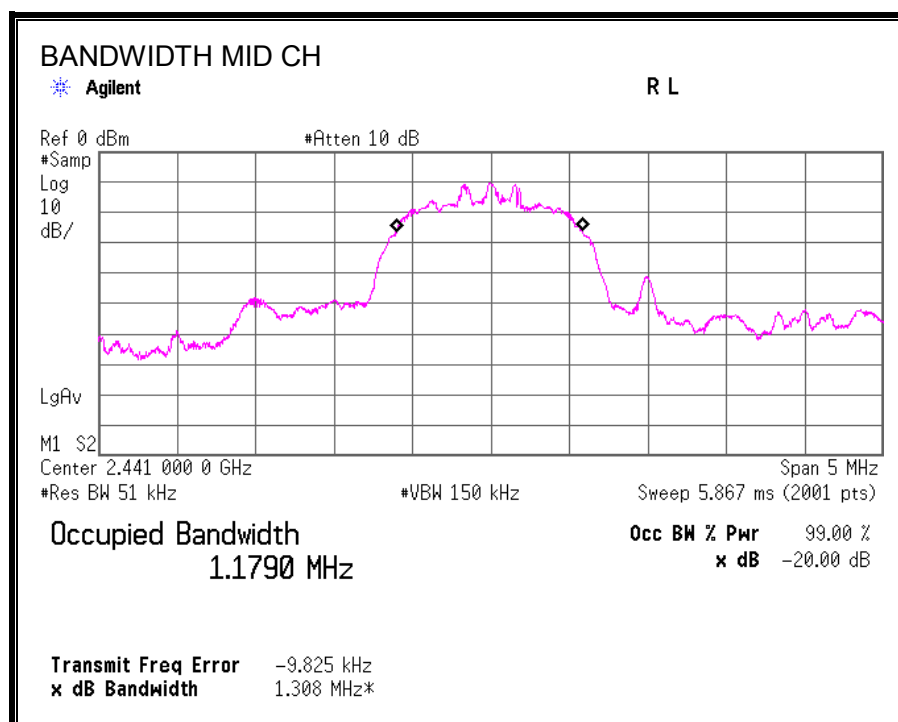


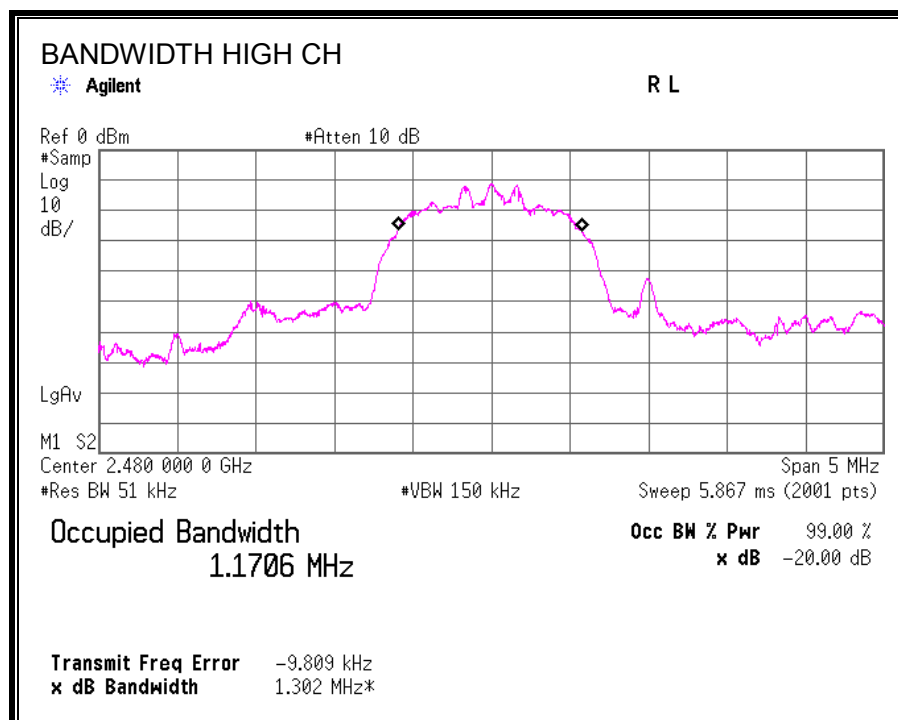




99% BANDWIDTH







7.2.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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 2400-2483.5 MHz band 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 the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

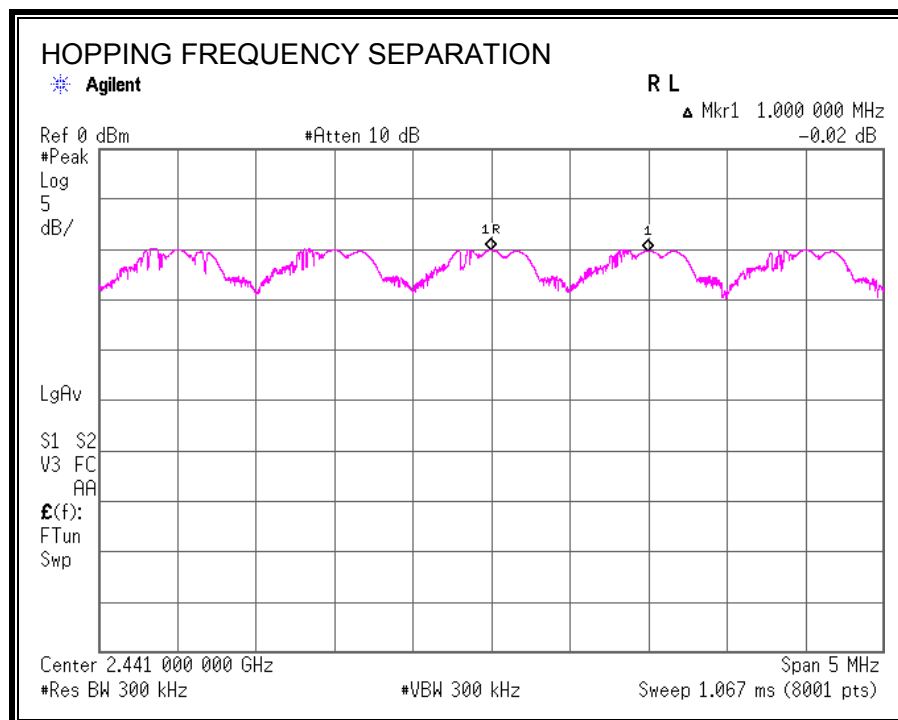
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

The channel separation was 1MHz and the test result was greater than the requirement that was 2/3 of 20 dB channel bandwidth.

RESULTS

HOPPING FREQUENCY SEPARATION



7.2.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

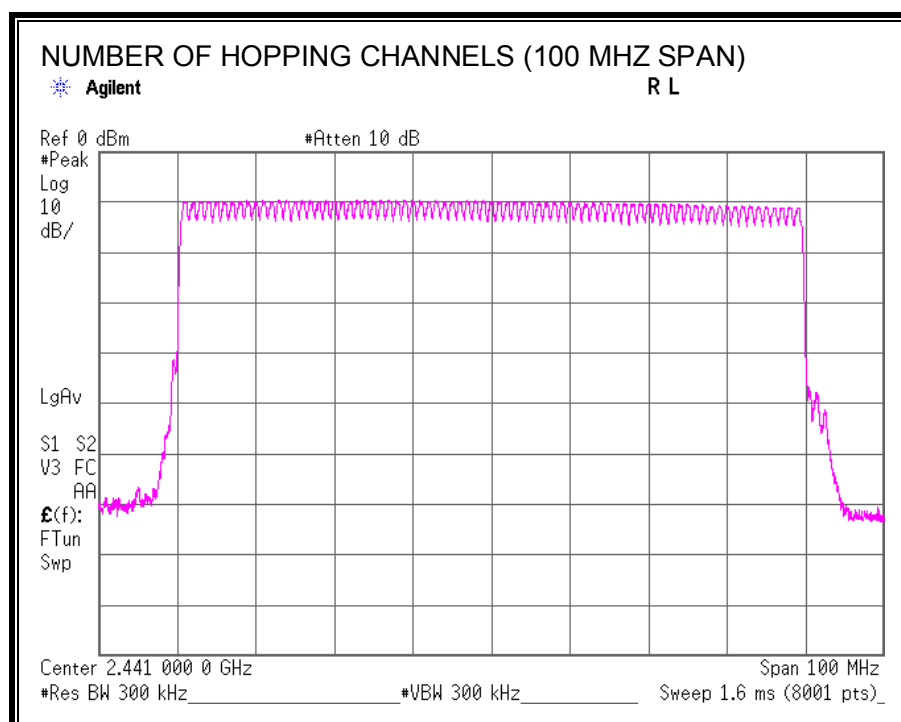
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

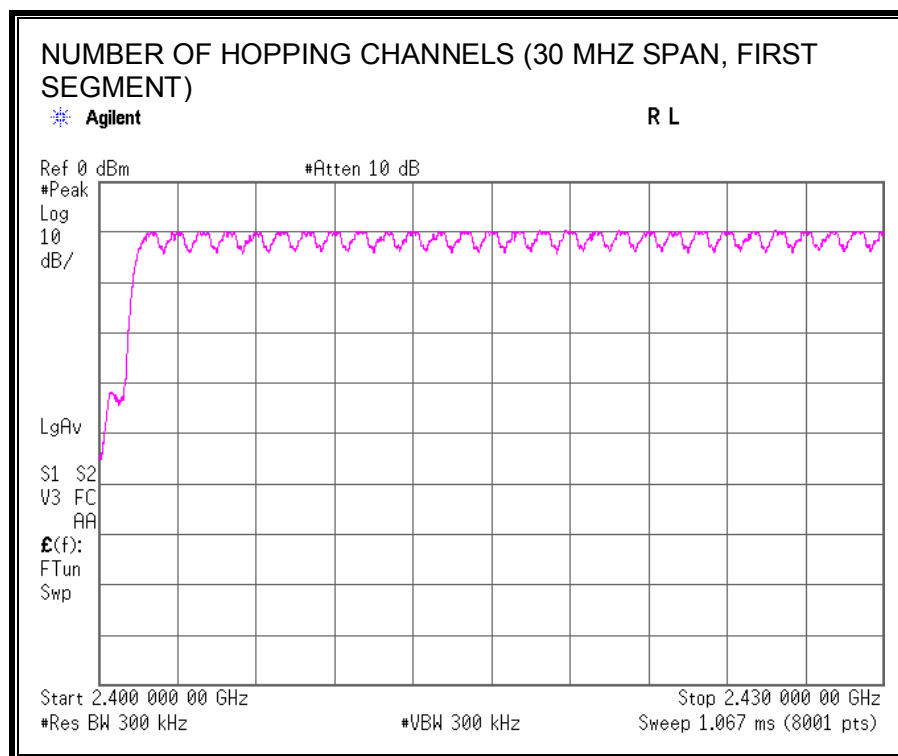
Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification 2.1.

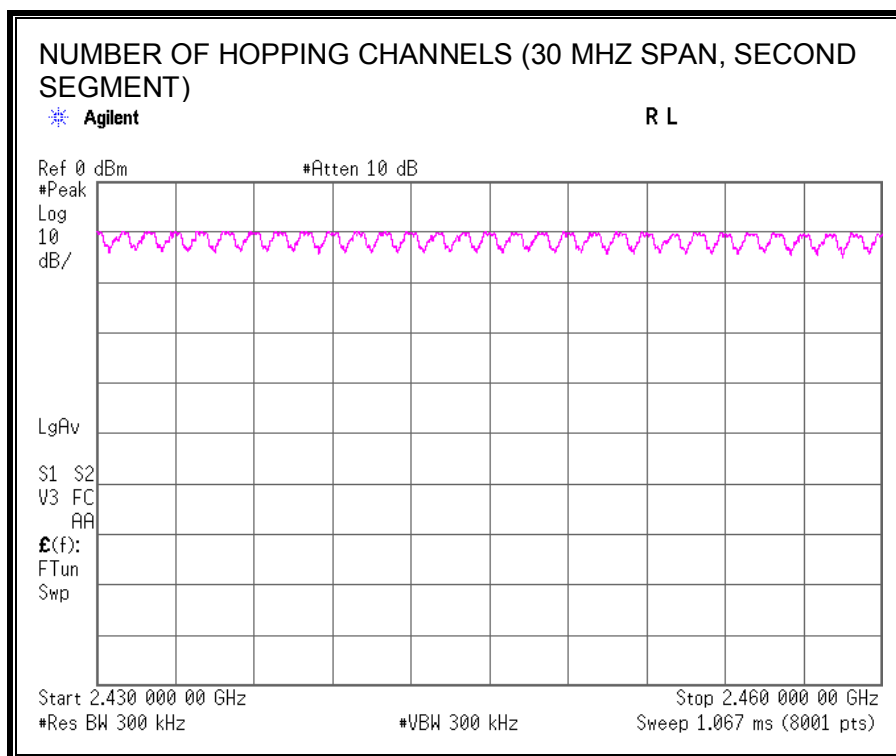
RESULTS

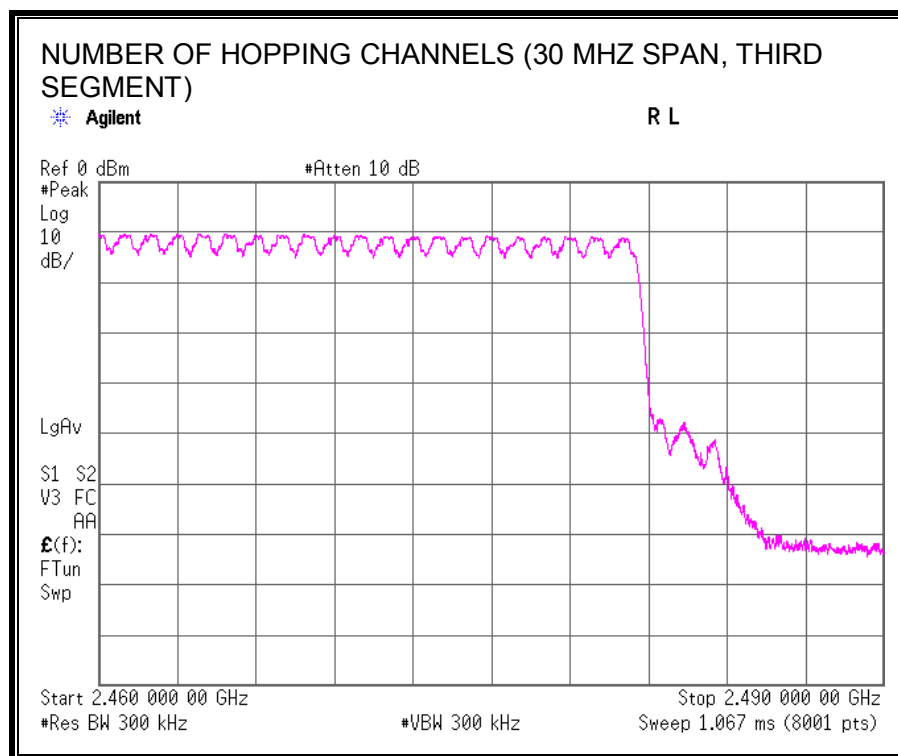
79 Channels observed.

NUMBER OF HOPPING CHANNELS









7.2.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in 3.16 s}) * \text{pulse width}$.

This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in $N \times 0.4\text{s}$, where N is the number of channels being used in the hopping sequence ($20 \geq N \leq 79$), is always less than 0.4s regardless of packet size (DH1, DH3 or DH5). This is confirmed in the test report for N=79.

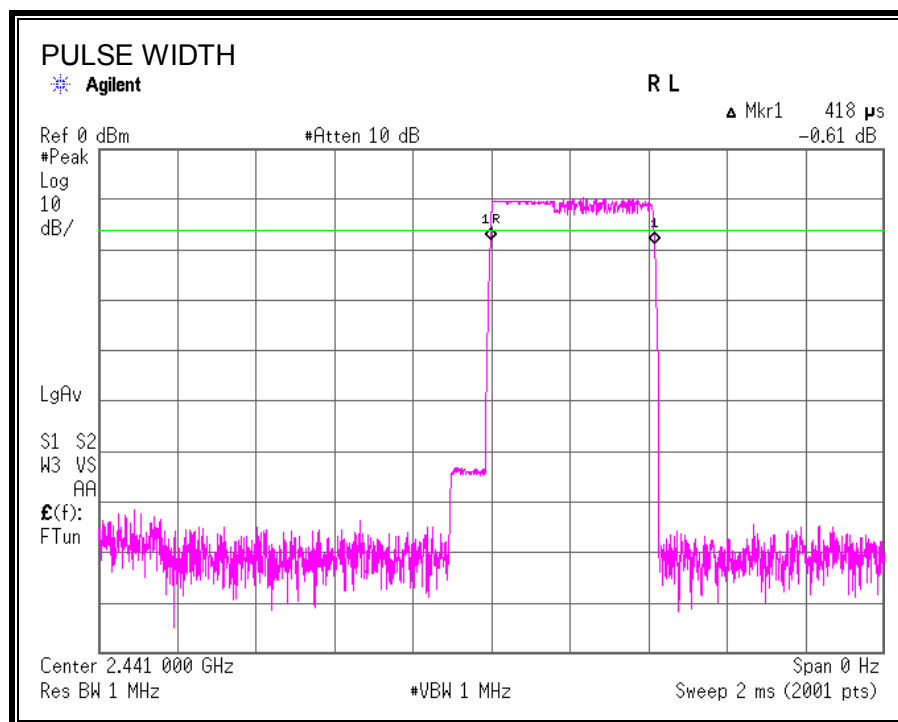
RESULTS

Time of Occupancy = $10 * \text{xx pulses} * \text{yy msec} = \text{zz msec}$

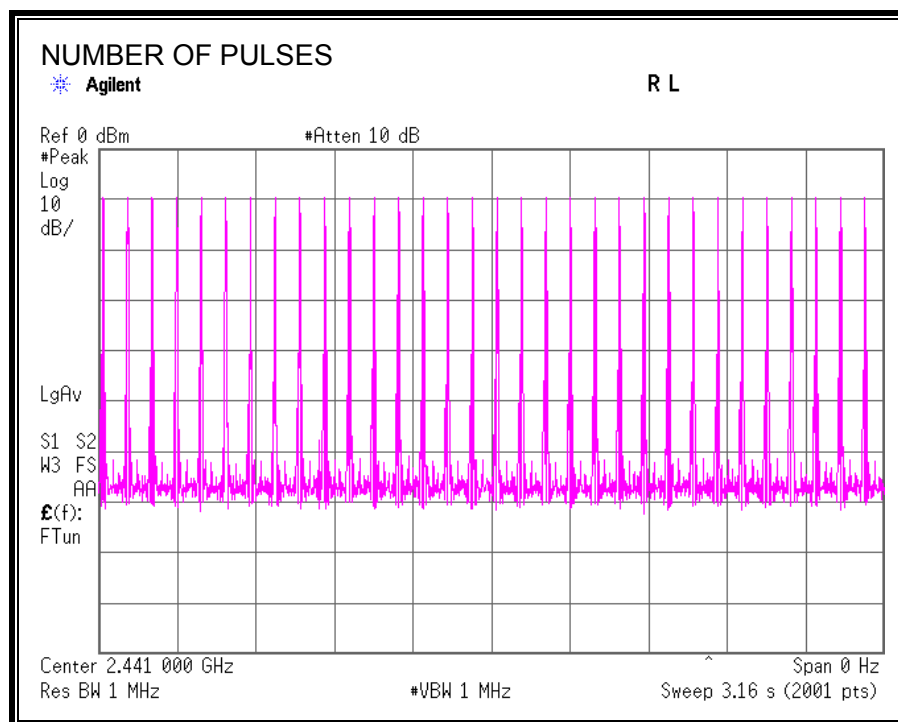
8PSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
3DH1	0.418	32	0.134	0.4	0.266
3DH3	1.669	16	0.267	0.4	0.133
3DH5	2.922	11	0.321	0.4	0.079

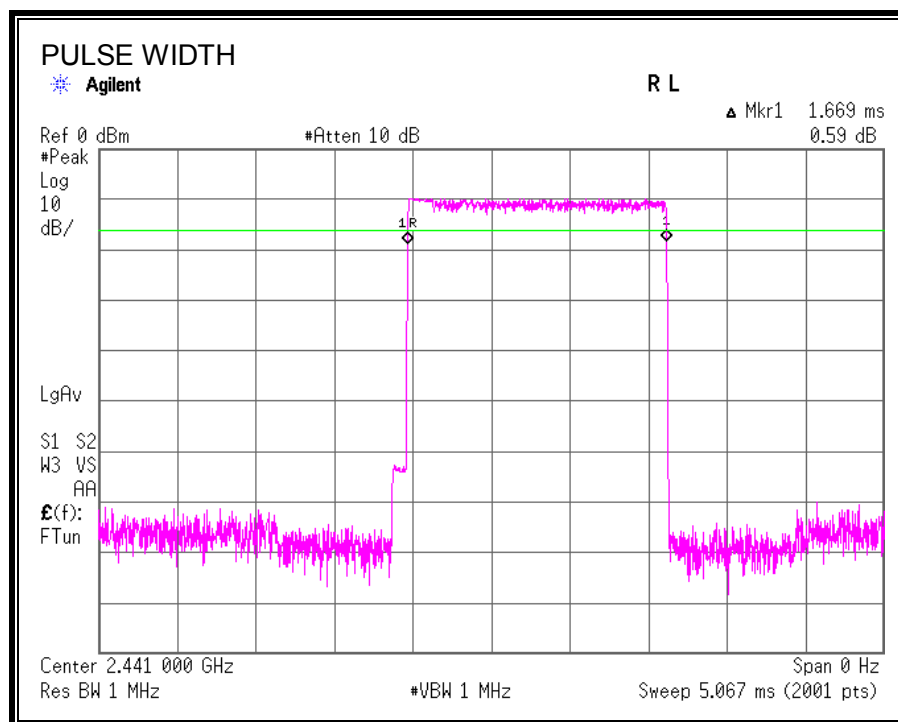
3DH1 PULSE WIDTH



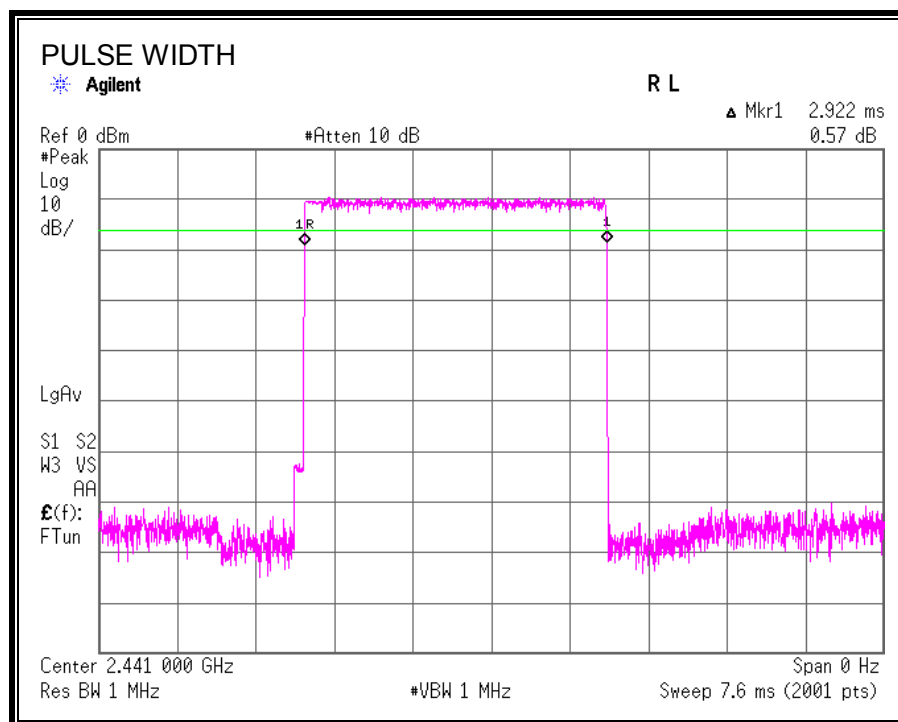
3DH1 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



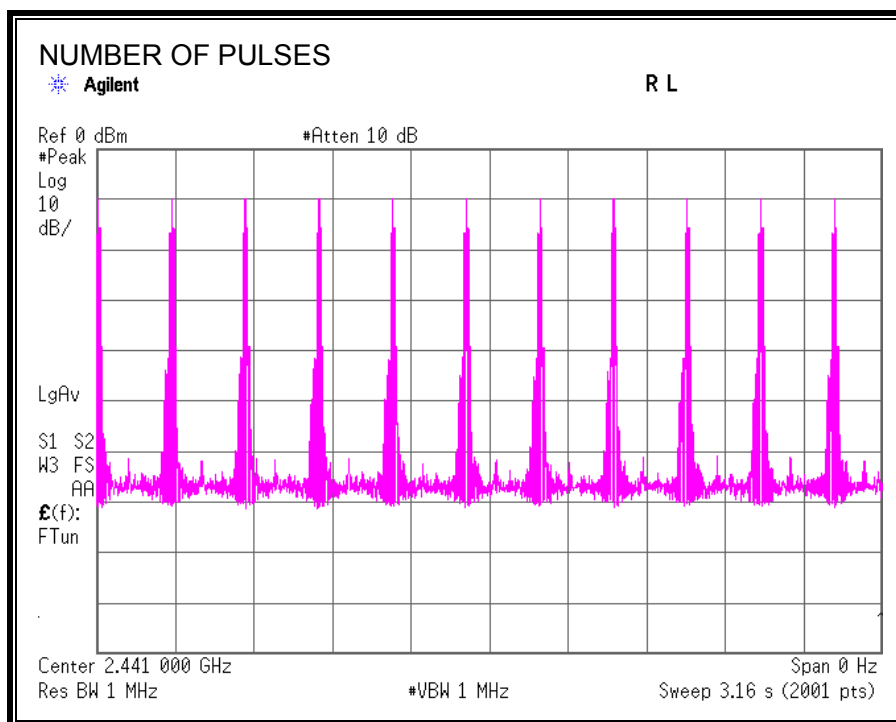
3DH3 PULSE WIDTH



3DH5 PULSE WIDTH



3DH5 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



7.2.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 20.96 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

Channel	Frequency (MHz)	Output Power Reading (dBm)	factor (cable ,ATT) (dB)	Output Power Result (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-9.11	10.70	1.59	20.96	19.37
Middle	2441	-9.08	10.71	1.63	20.96	19.33
High	2480	-10.14	10.71	0.57	20.96	20.39

Sample calculation: Output Power Reading [dBm] + factor [dB]

Test was not performed at AFH mode because this Bluetooth radio is in compliance of Bluetooth Specification 2.0 and the output power at non-AFH mode is less than 20.96dBm.

7.2.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.70 – 10.71 dB (including 9.86 dB pad and 0.84 - 0.85 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	-1.81
Middle	2441	-1.79
High	2480	-3.11

7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

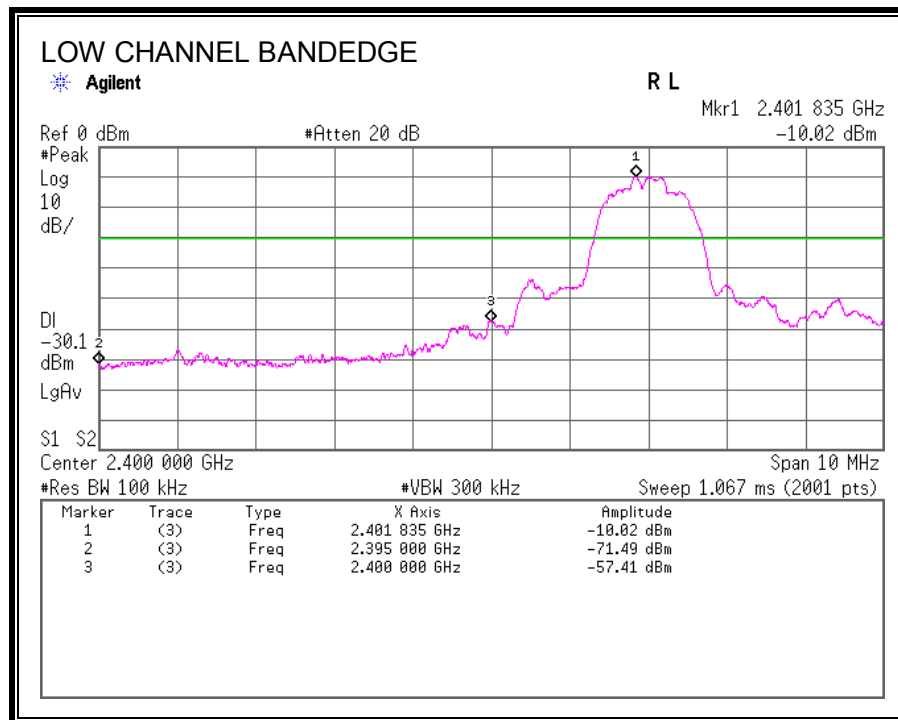
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=10kHz)

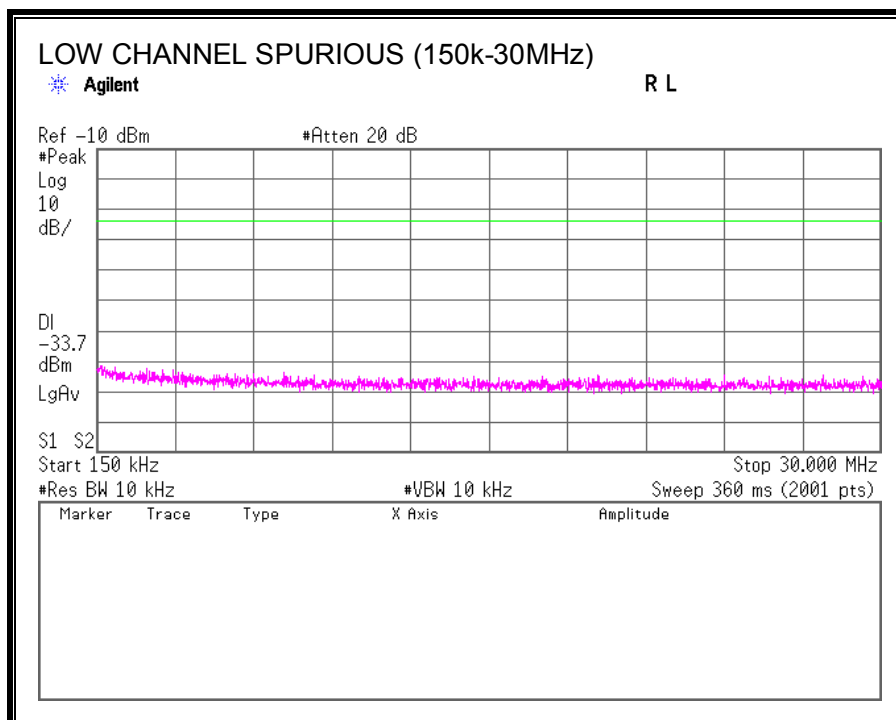
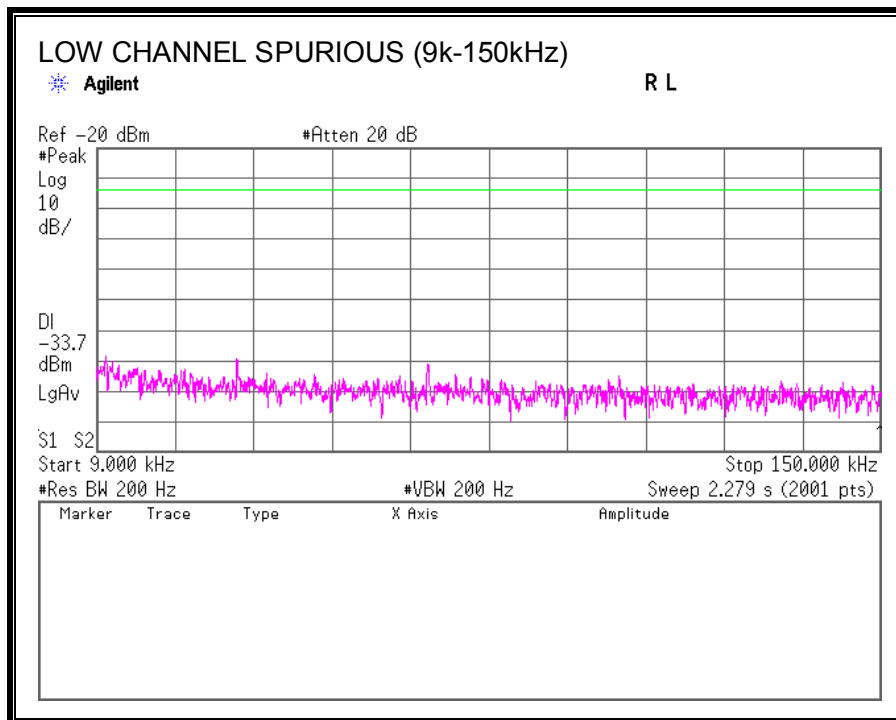
The spectrum from 9 kHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

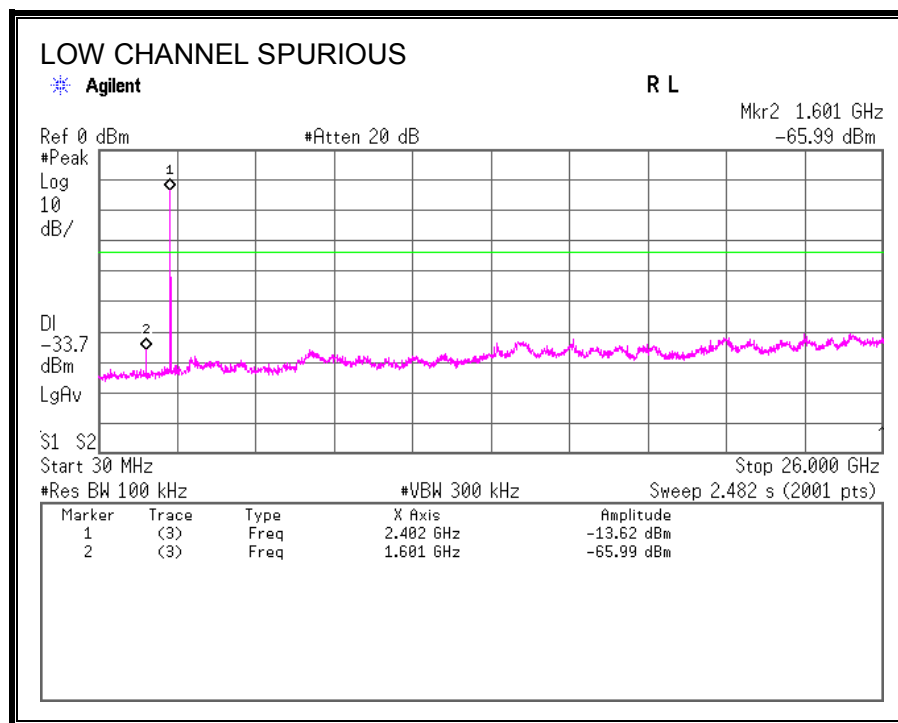
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

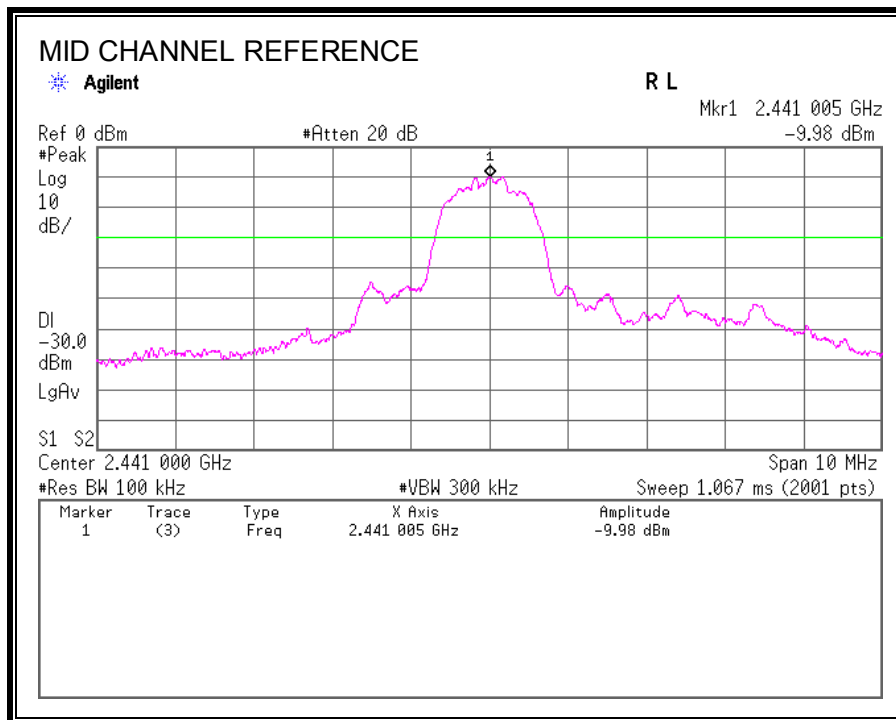
SPURIOUS EMISSIONS, LOW CHANNEL

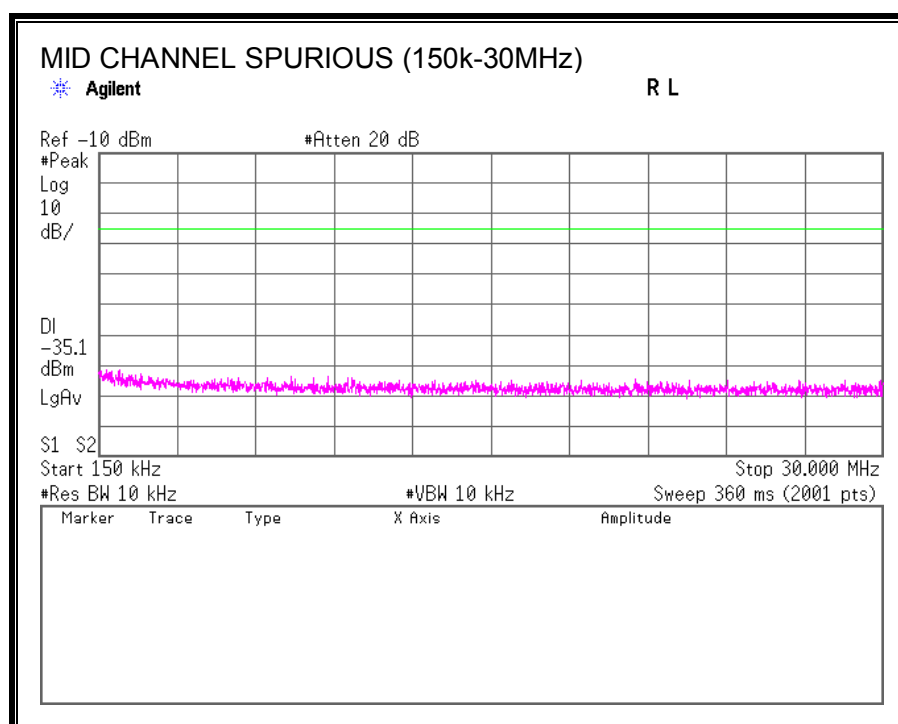
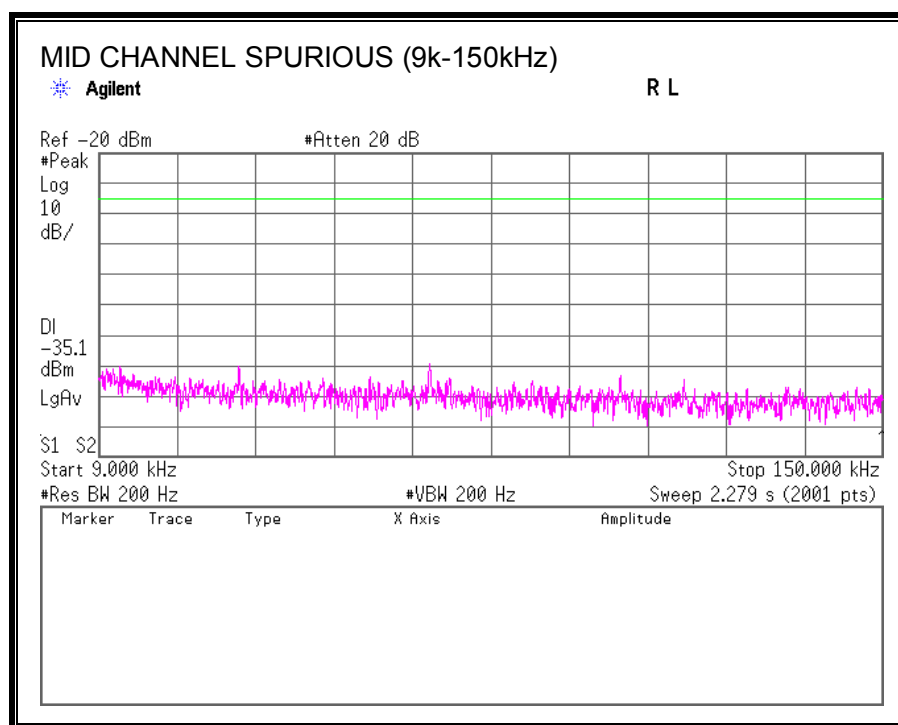


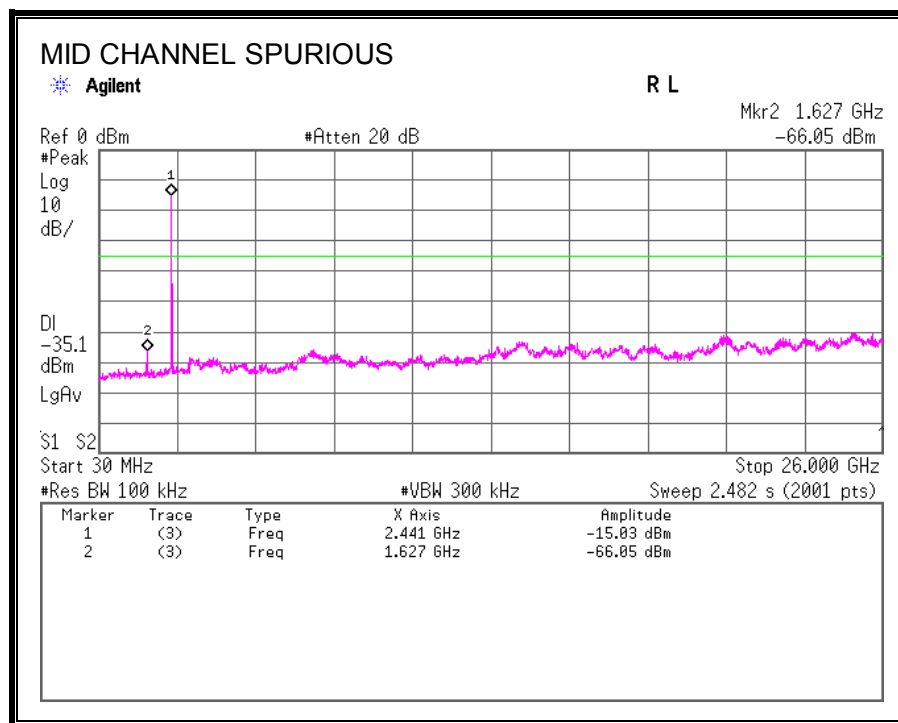




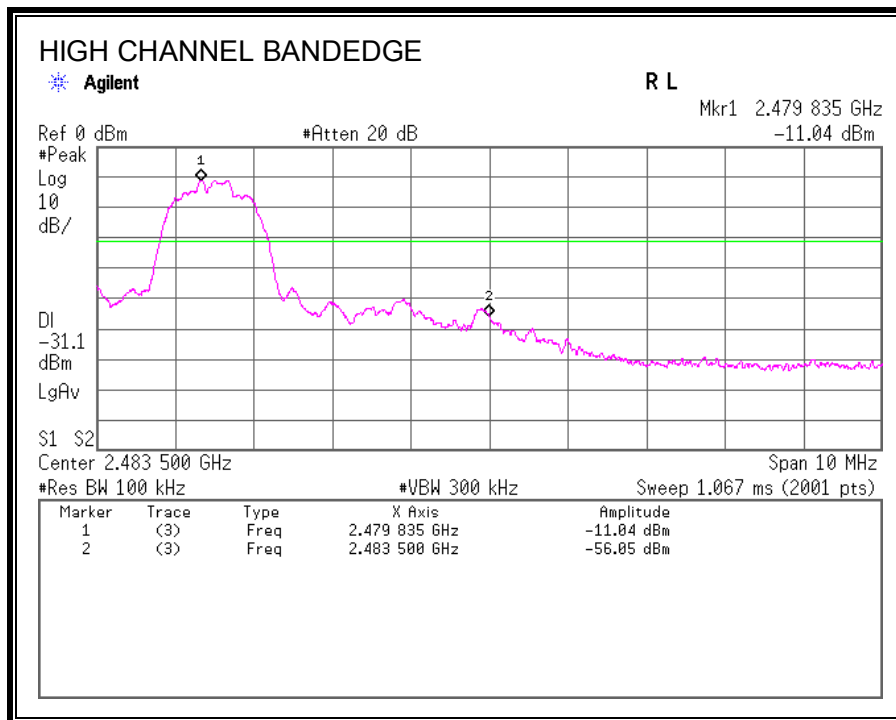
SPURIOUS EMISSIONS, MID CHANNEL

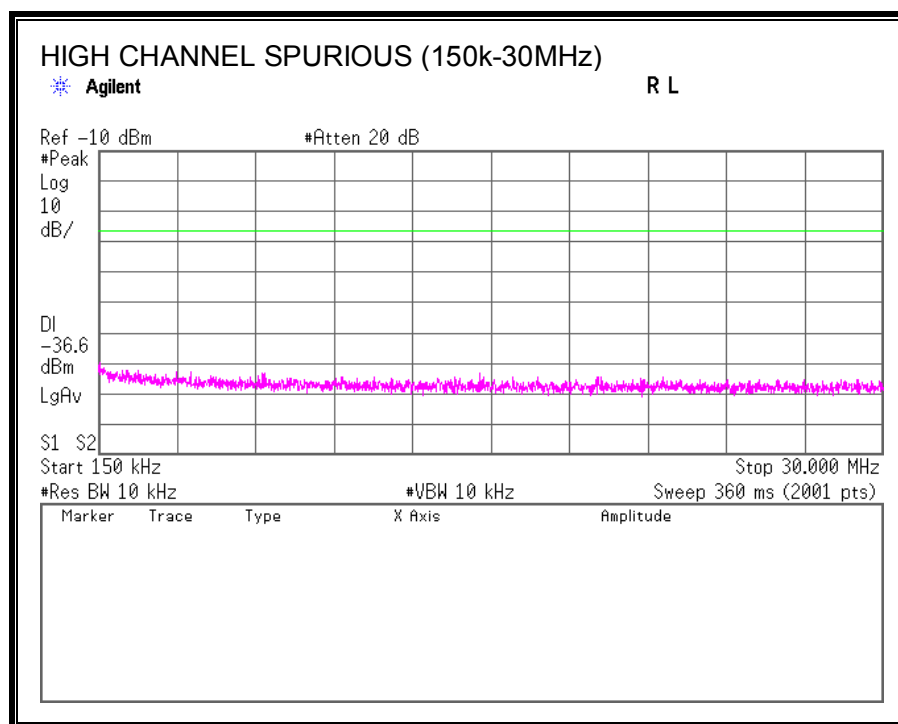


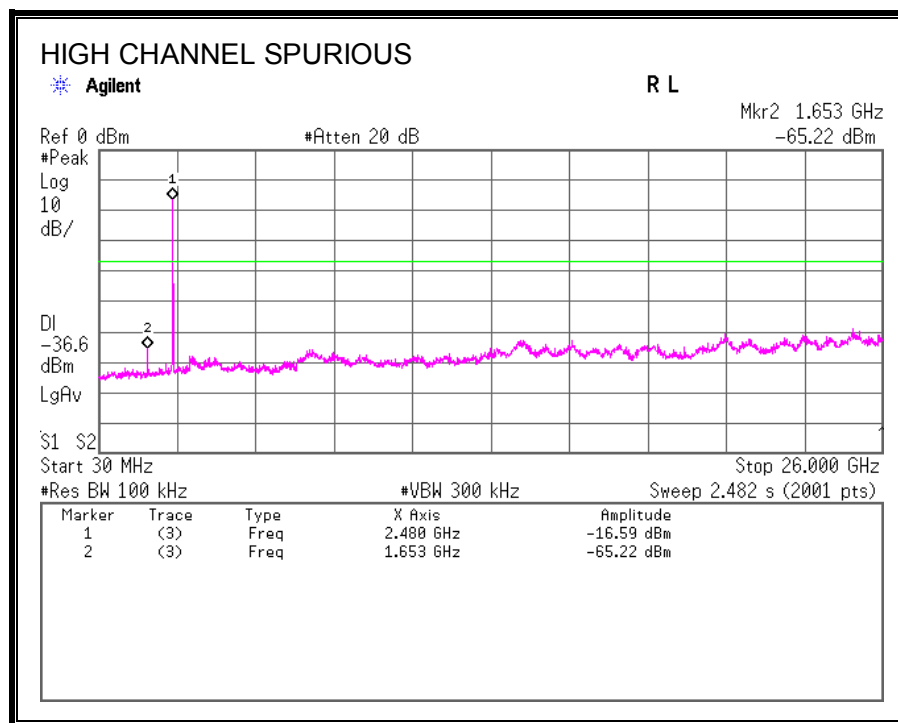




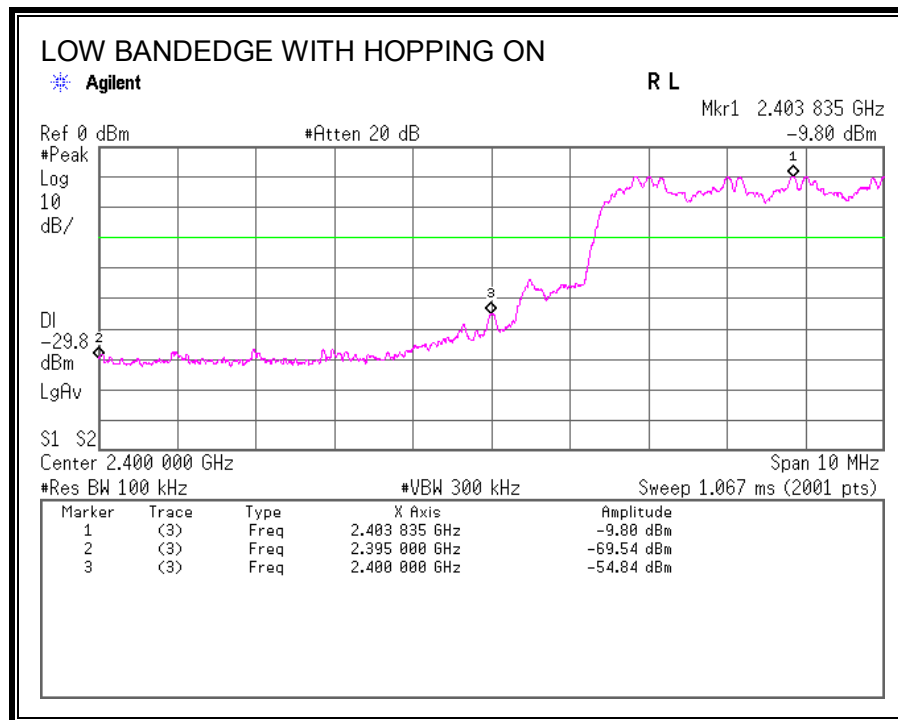
SPURIOUS EMISSIONS, HIGH CHANNEL

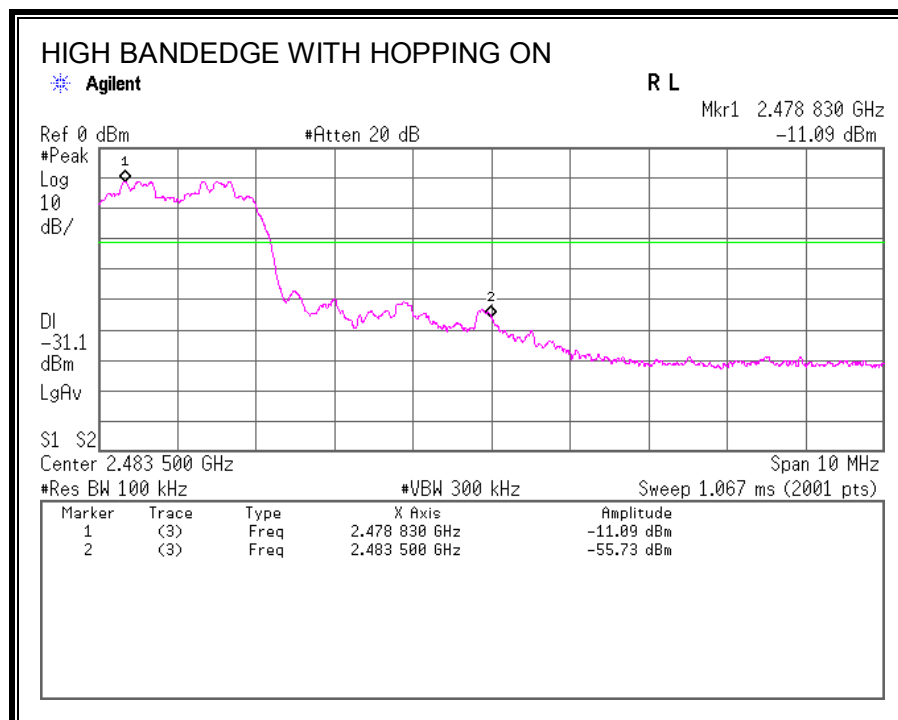






SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.5 (Transmitter)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

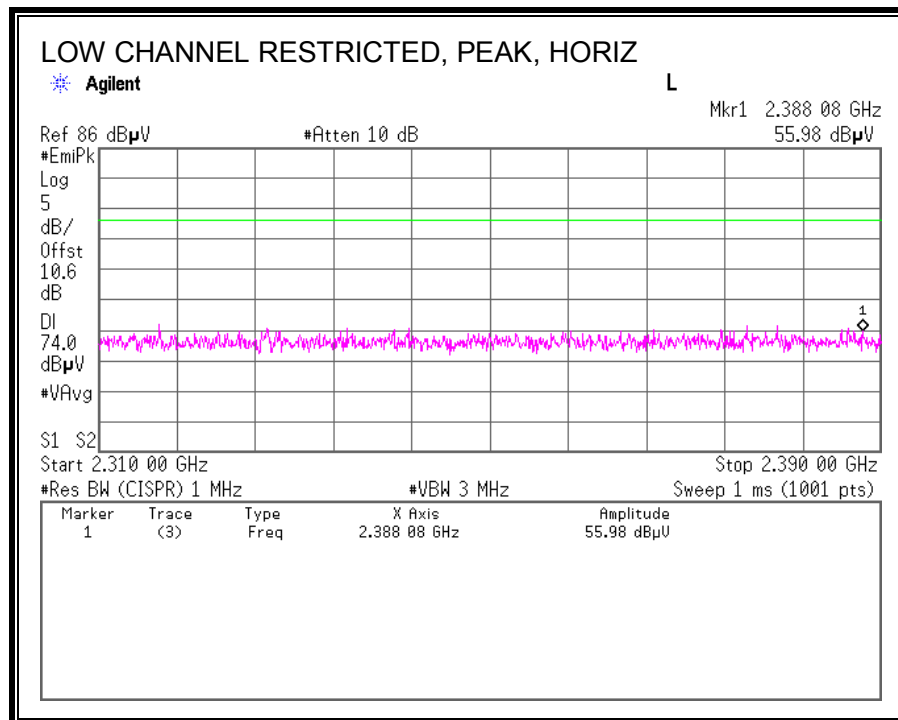
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

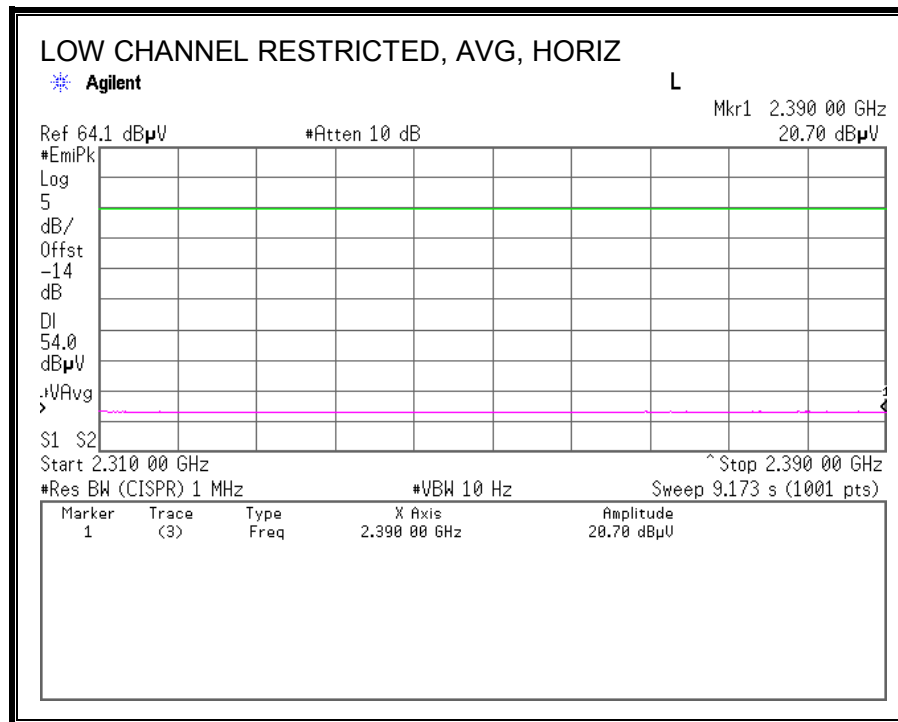
8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. BASIC DATA RATE GFSK MODULATION

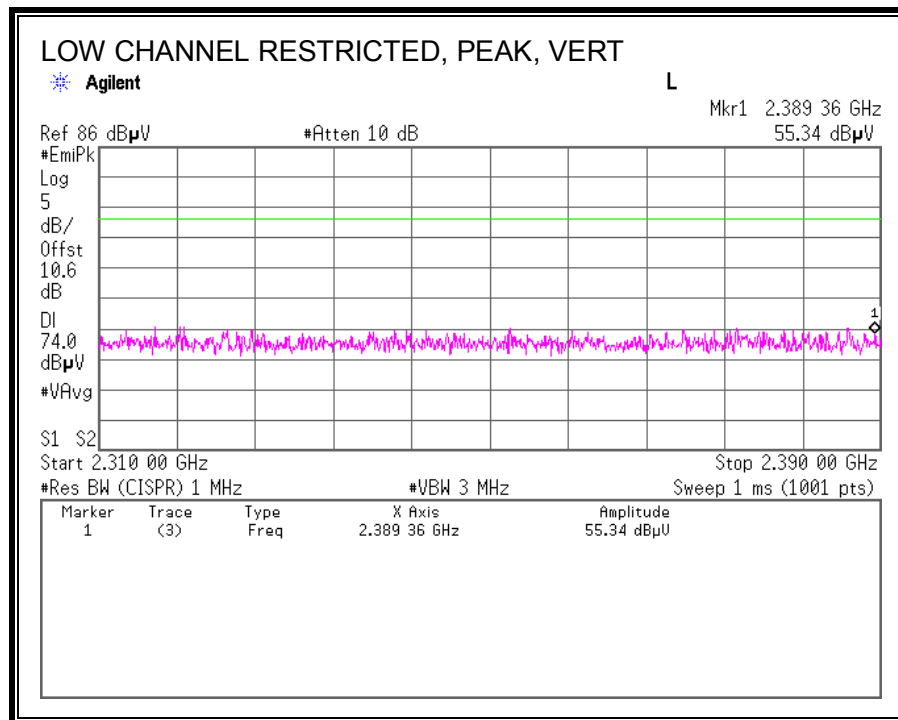
EUT STAND-ALONE

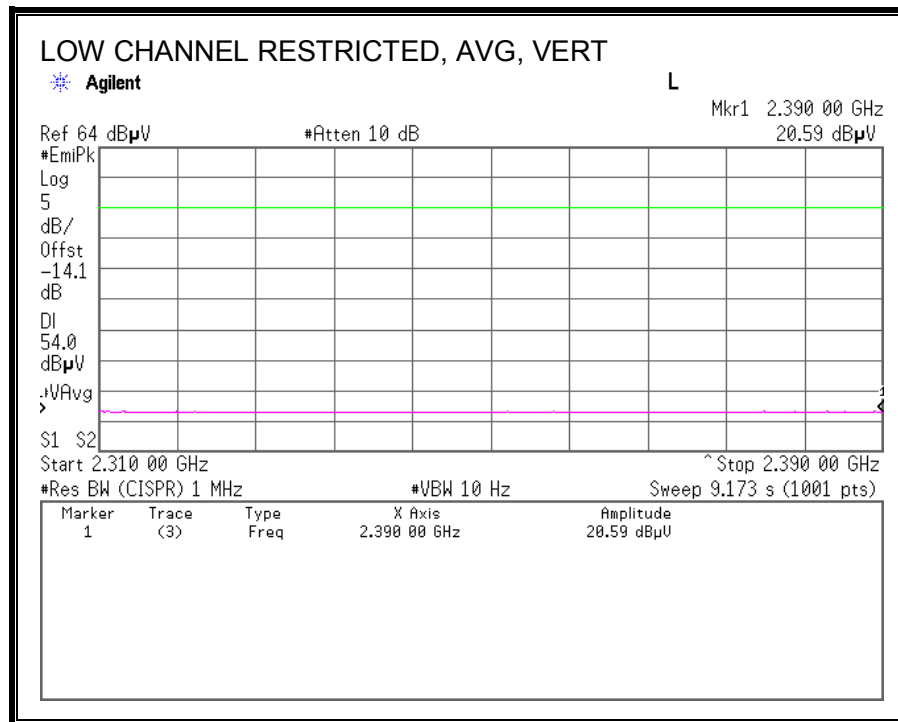
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



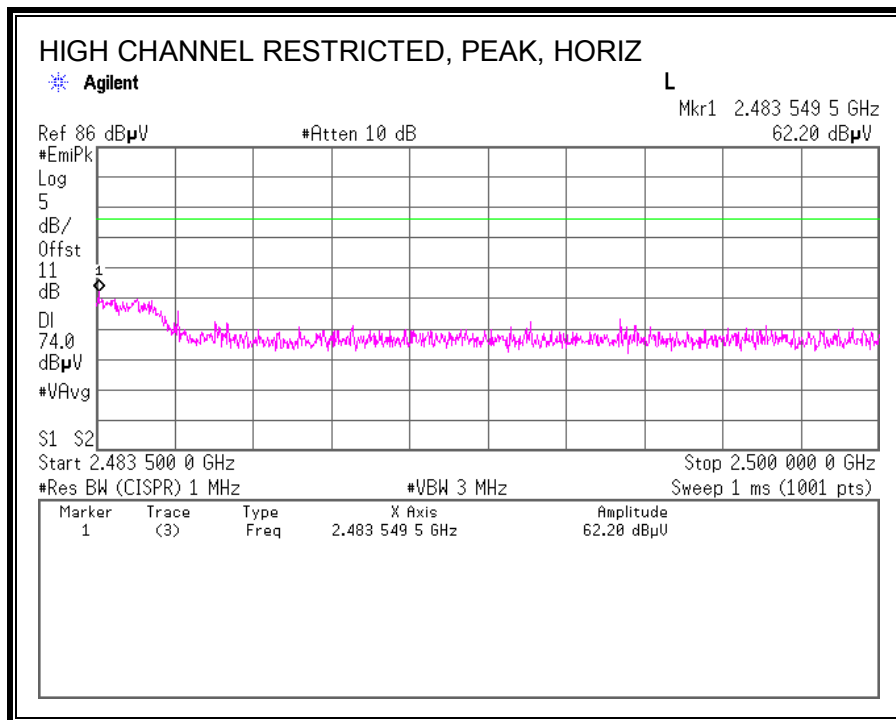


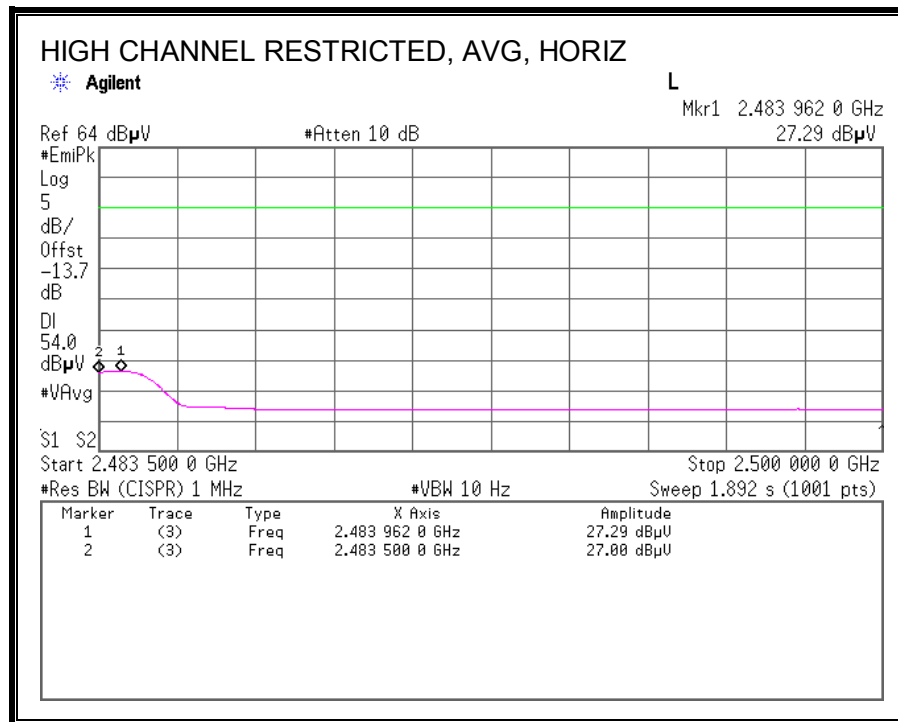
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



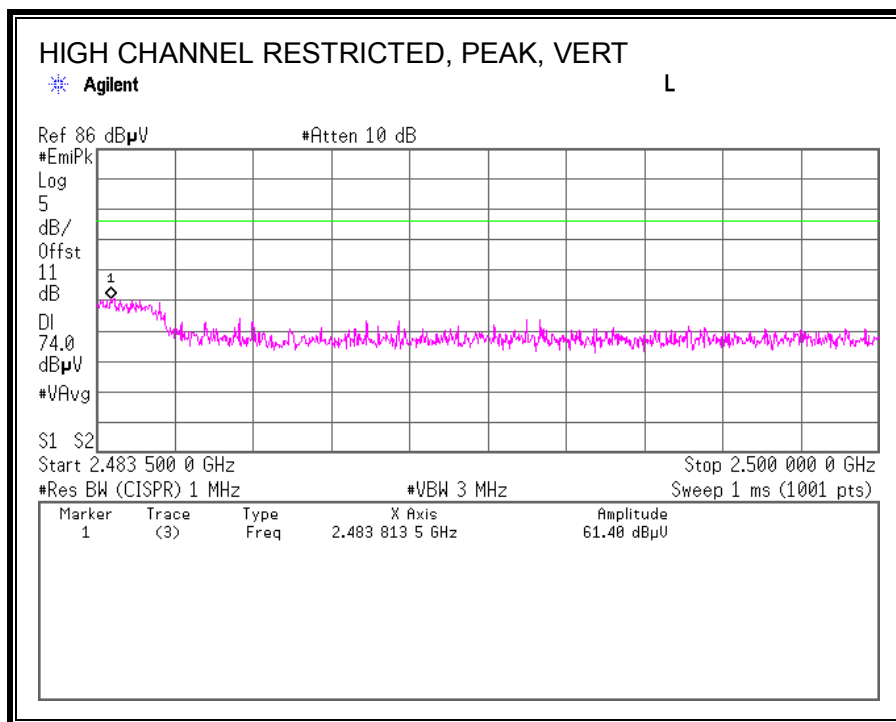


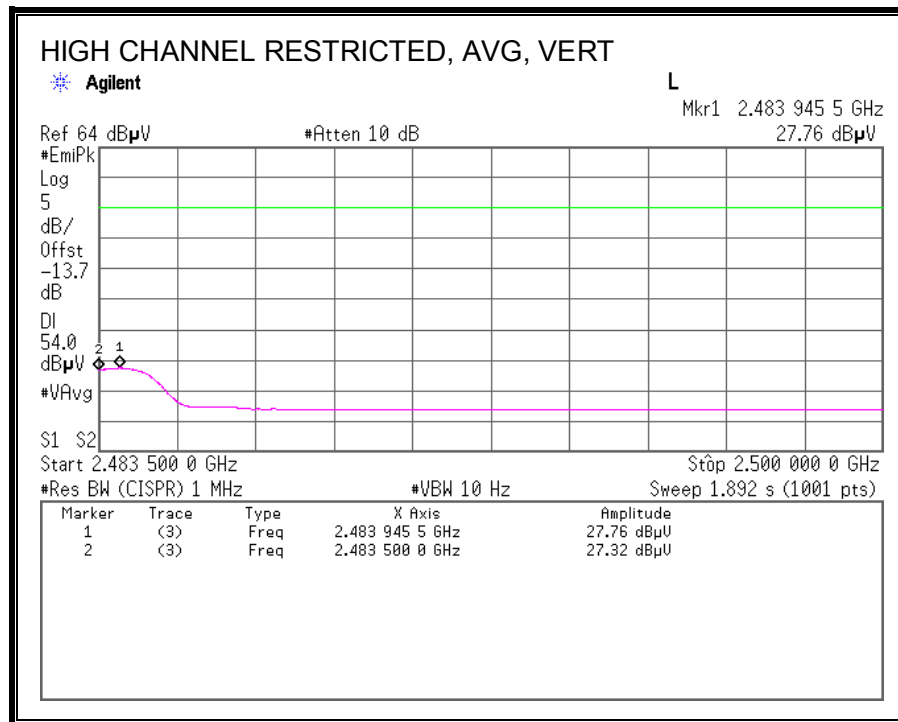
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



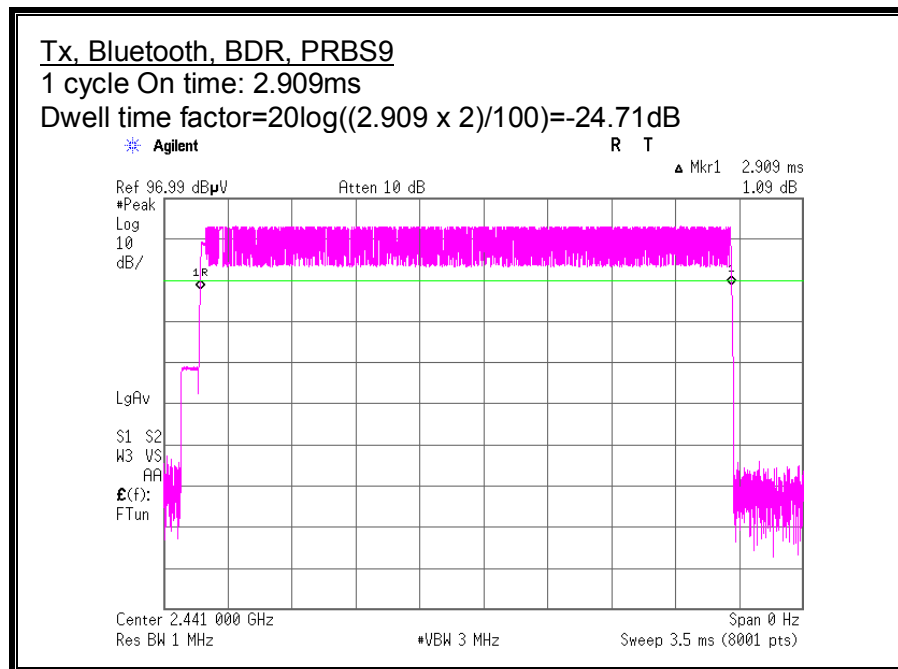


RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





Dwell time factor Calculation chart



On time of some channel during 100ms: Twice
This is the worst case in hopping sequence of Bluetooth.

HARMONICS AND SPURIOUS EMISSIONS

DH5, 2402MHz (LOW)

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date July 17, 2012
Temperature / Humidity 24 deg.C , 57 %RH
Engineer Akio Hayashi
Mode Tx, 2402 MHz
Tx, Bluetooth, BDR, PRBS9

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	1602.000	PK	48.2	25.4	23.6	40.9	56.3	73.9	17.6	114	299	
Hori.	4804.000	PK	75.0	31.1	6.8	41.1	71.8	73.9	2.1	111	28	
Hori.	7206.000	PK	48.6	36.5	8.3	41.3	52.1	73.9	21.8	155	197	
Hori.	1602.000	AV	39.2	25.4	23.6	40.9	47.3	53.9	6.6	114	299	
Hori.	7206.000	AV	36.2	36.5	8.3	41.3	39.7	53.9	14.2	155	197	
Vert.	1602.000	PK	48.4	25.4	23.6	40.9	56.5	73.9	17.4	124	266	
Vert.	4804.000	PK	73.2	31.1	6.8	41.1	70.0	73.9	3.9	112	351	
Vert.	7206.000	PK	48.4	36.5	8.3	41.3	51.9	73.9	22.0	100	227	
Vert.	1602.000	AV	37.8	25.4	23.6	40.9	45.9	53.9	8.0	124	266	
Vert.	7206.000	AV	35.8	36.5	8.3	41.3	39.3	53.9	14.6	100	227	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4804.000	AV	66.8	31.1	6.8	41.1	-24.7	38.9	53.9	15.0	(AV)/VBW:10Hz
Vert.	4804.000	AV	64.7	31.1	6.8	41.1	-24.7	36.8	53.9	17.1	(AV)/VBW:10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*No noise was detected above the 4th order harmonics.

Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m) = 9.5dB$

HARMONICS AND SPURIOUS EMISSIONS

DH5, 2441MHz (MID)

Radiated Emission

Test place	UL Japan, Inc. Shonan EMC Lab.	No.3 Semi Anechoic Chamber
Date	July 17, 2012	
Temperature / Humidity	24 deg.C , 57 %RH	
Engineer	Akio Hayashi	
Mode	Tx, 2441 MHz	
	Tx, Bluetooth, BDR, PRBS9	
(* PK: Peak, AV: Average, QP: Quasi-Peak)		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	1628.000	PK	49.5	25.4	23.7	40.9		57.7	73.9	16.2	105	296	
Hori.	4882.000	PK	74.9	31.2	6.9	40.9		72.1	73.9	1.8	100	32	
Hori.	7323.000	PK	48.0	36.8	8.6	41.4		52.0	73.9	21.9	100	359	
Hori.	1628.000	AV	40.0	25.4	23.7	40.9		48.2	53.9	5.7	105	296	
Hori.	7323.000	AV	35.8	36.8	8.6	41.4		39.8	53.9	14.1	100	359	
Vert.	1628.000	PK	48.8	25.4	23.7	40.9		57.0	73.9	16.9	194	273	
Vert.	4882.000	PK	72.8	31.2	6.9	40.9		70.0	73.9	3.9	100	32	
Vert.	7323.000	PK	48.1	36.8	8.6	41.4		52.1	73.9	21.8	100	309	
Vert.	1628.000	AV	38.7	25.4	23.7	40.9		46.9	53.9	7.0	194	273	
Vert.	7323.000	AV	36.5	36.8	8.6	41.4		40.5	53.9	13.4	100	309	

(* PK: Peak, AV: Average, QP: Quasi-Peak)												
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark	
Hori.	4882.000	AV	66.7	31.2	6.9	40.9	-24.7	39.2	53.9	14.7	(AV)VBW:10Hz	
Vert.	4882.000	AV	65.3	31.2	6.9	40.9	-24.7	37.8	53.9	16.1	(AV)VBW:10Hz	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation)

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*No noise was detected above the 4th order harmonics.

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

HARMONICS AND SPURIOUS EMISSIONS

DH5, 2480MHz

Radiated Emission

Test place	UL Japan, Inc. Shonan EMC Lab.	No.3 Semi Anechoic Chamber
Date	July 17, 2012	
Temperature / Humidity	24 deg.C , 57 %RH	
Engineer	Akio Hayashi	
Mode	Tx, 2480 MHz	
	Tx, Bluetooth, BDR, PRBS9	
(* PK: Peak, AV: Average, QP: Quasi-Peak)		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	1654.000	PK	48.3	25.5	23.7	40.9		56.6	73.9	17.3	100	303	
Hori.	4960.000	PK	72.4	31.4	6.9	40.8		69.9	73.9	4.0	100	6	
Hori.	7440.000	PK	45.5	37.0	8.8	41.5		49.8	73.9	24.1	161	204	
Hori.	1654.000	AV	38.3	25.5	23.7	40.9		46.6	53.9	7.3	100	303	
Hori.	7440.000	AV	35.2	37.0	8.8	41.5		39.5	53.9	14.4	161	204	
Vert.	1654.000	PK	48.0	25.5	23.7	40.9		56.3	73.9	17.6	181	263	
Vert.	4960.000	PK	73.0	31.4	6.9	40.8		70.5	73.9	3.4	100	349	
Vert.	7440.000	PK	47.3	37.0	8.8	41.5		51.6	73.9	22.3	100	206	
Vert.	1654.000	AV	37.3	25.5	23.7	40.9		45.6	53.9	8.3	181	263	
Vert.	7440.000	AV	34.7	37.0	8.8	41.5		39.0	53.9	14.9	100	206	

(* PK: Peak, AV: Average, QP: Quasi-Peak)													
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark		
Hori.	4960.000	AV	64.0	31.4	6.9	40.8	-24.7	36.8	53.9	17.1	(AV)VBW:10Hz		
Vert.	4960.000	AV	65.1	31.4	6.9	40.8	-24.7	37.9	53.9	16.0	(AV)VBW:10Hz		

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

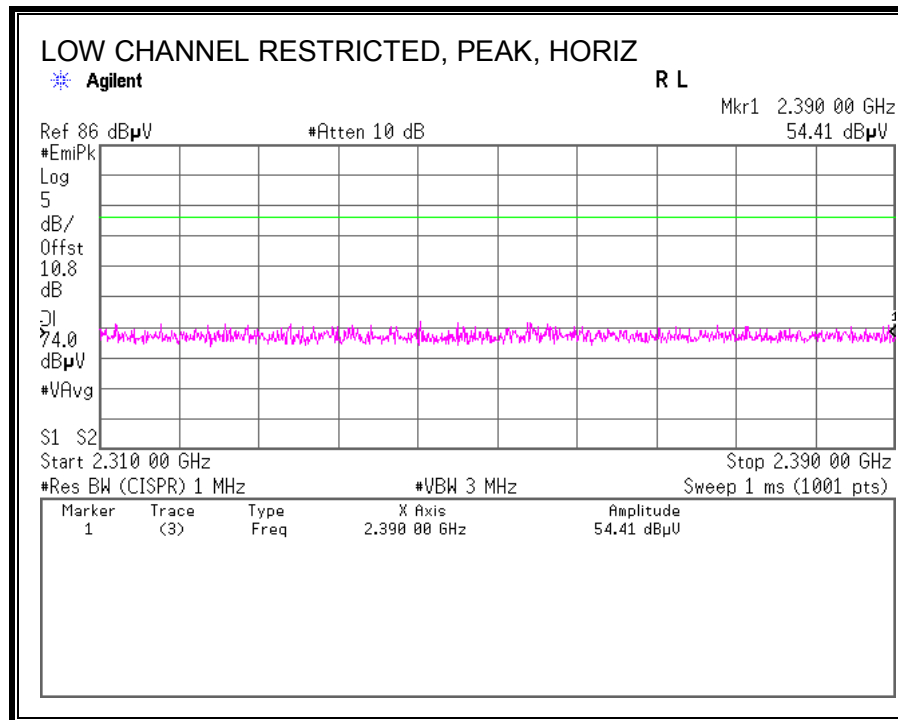
*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

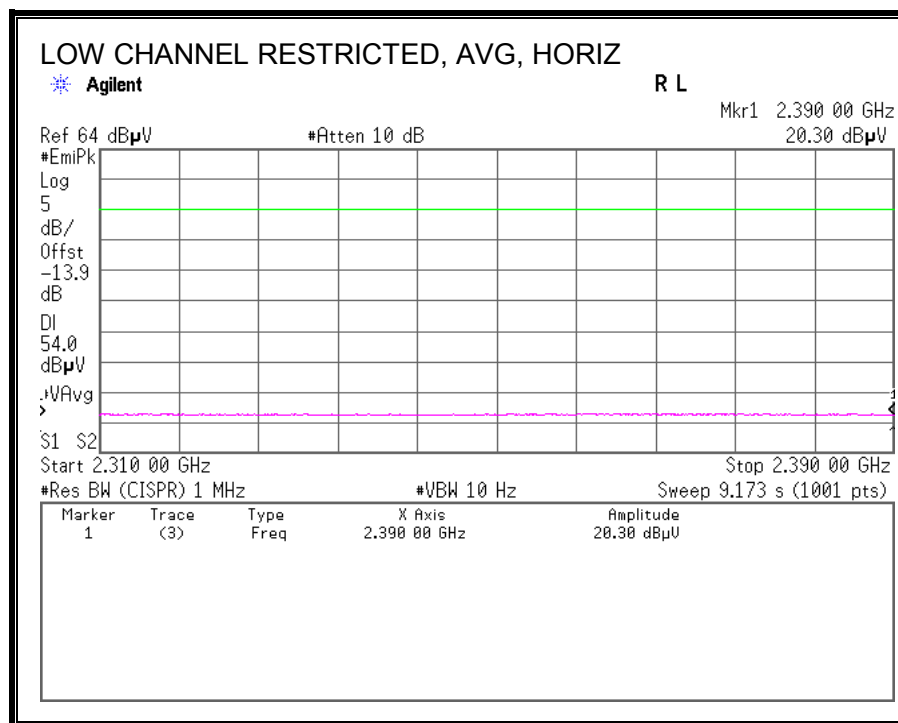
*No noise was detected above the 4th order harmonics.

Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m)= 9.5dB$

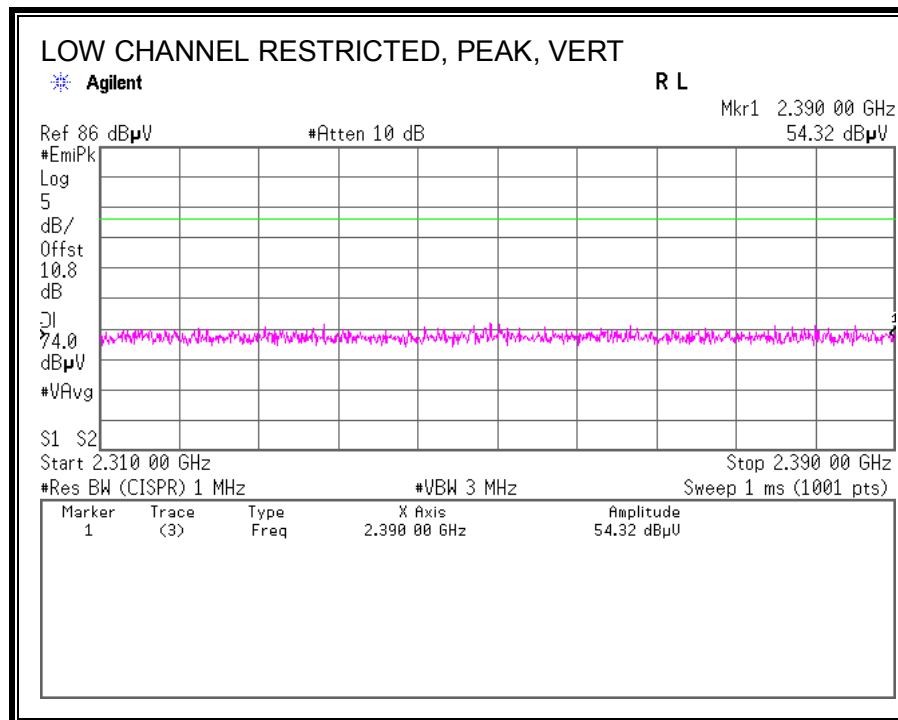
HOST DEVICE WITH EUT

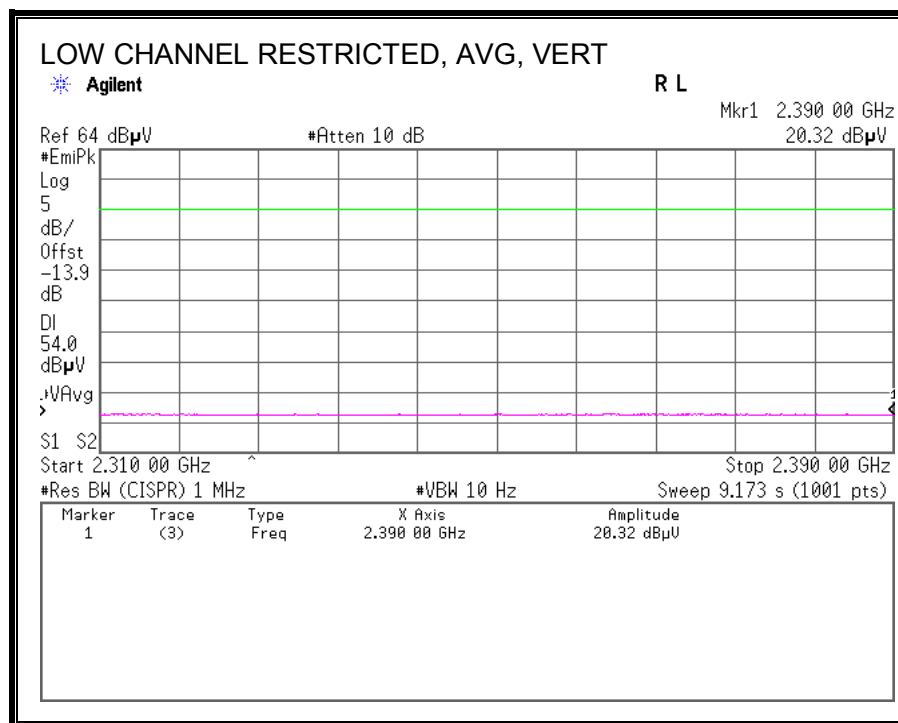
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



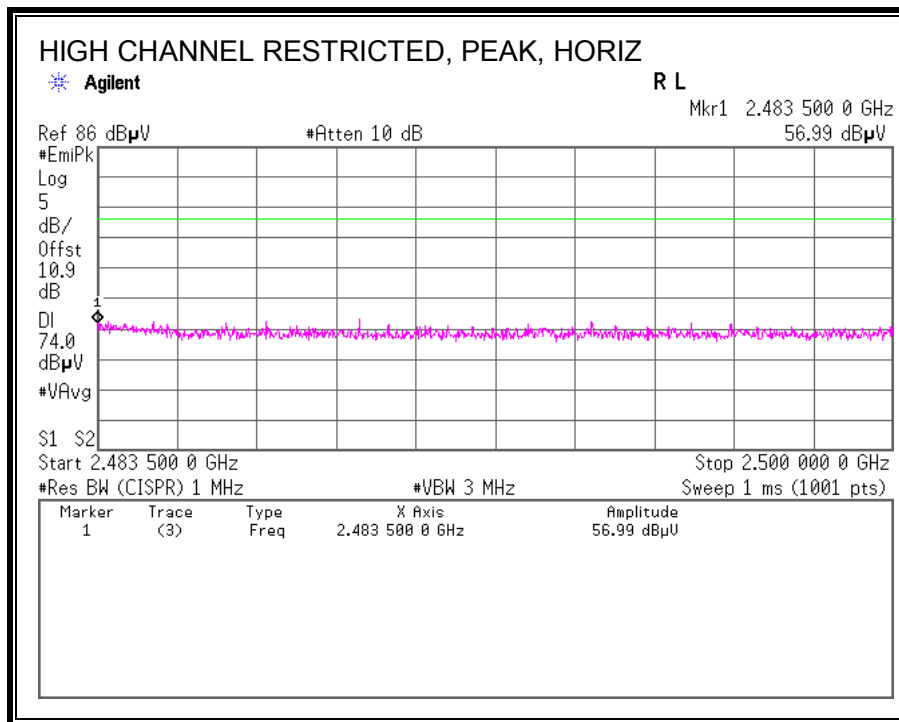


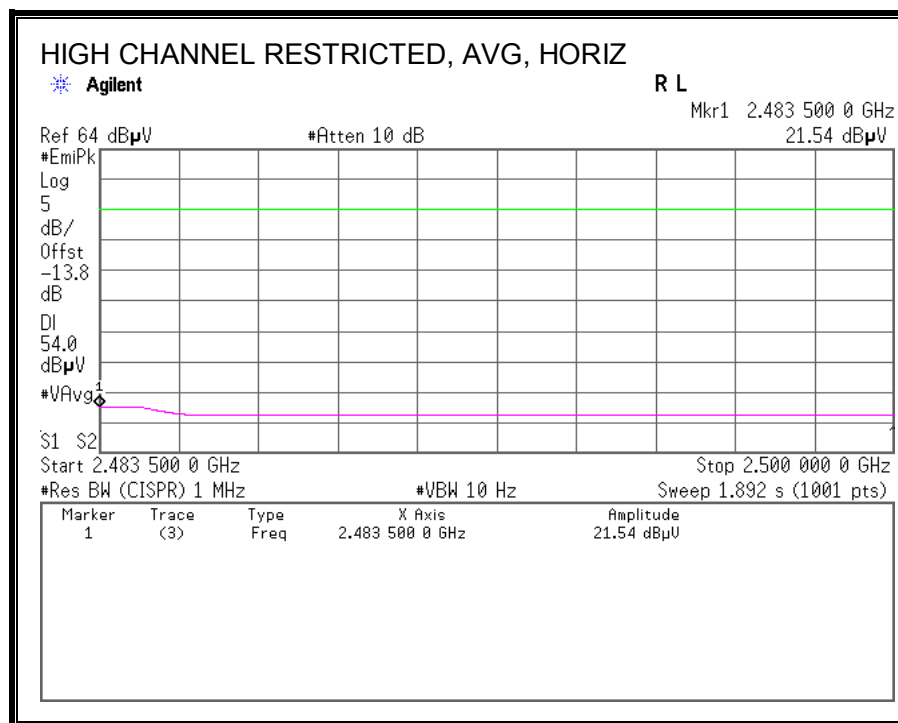
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



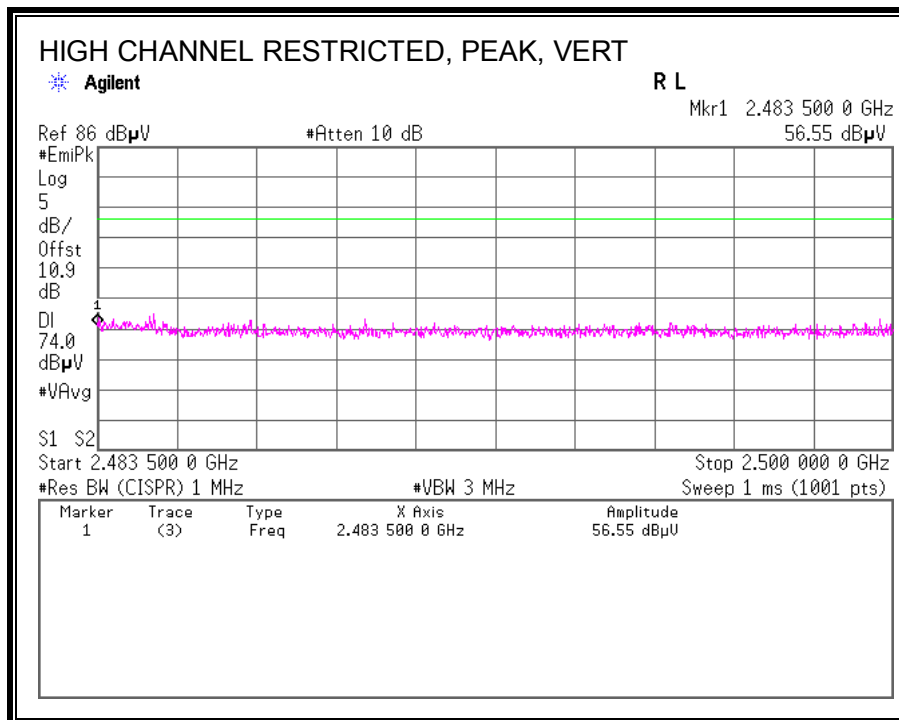


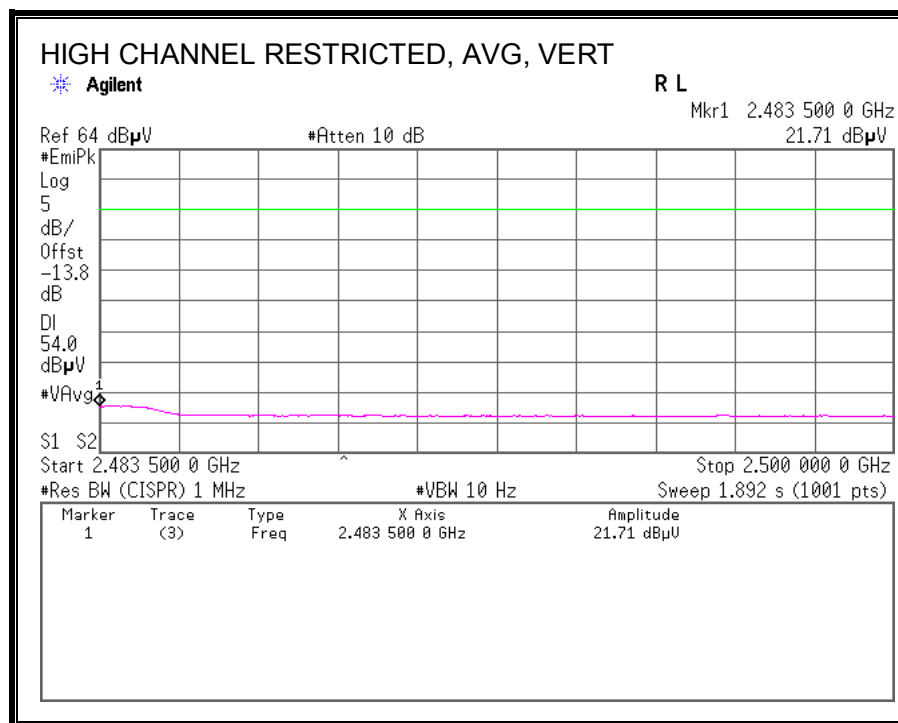
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



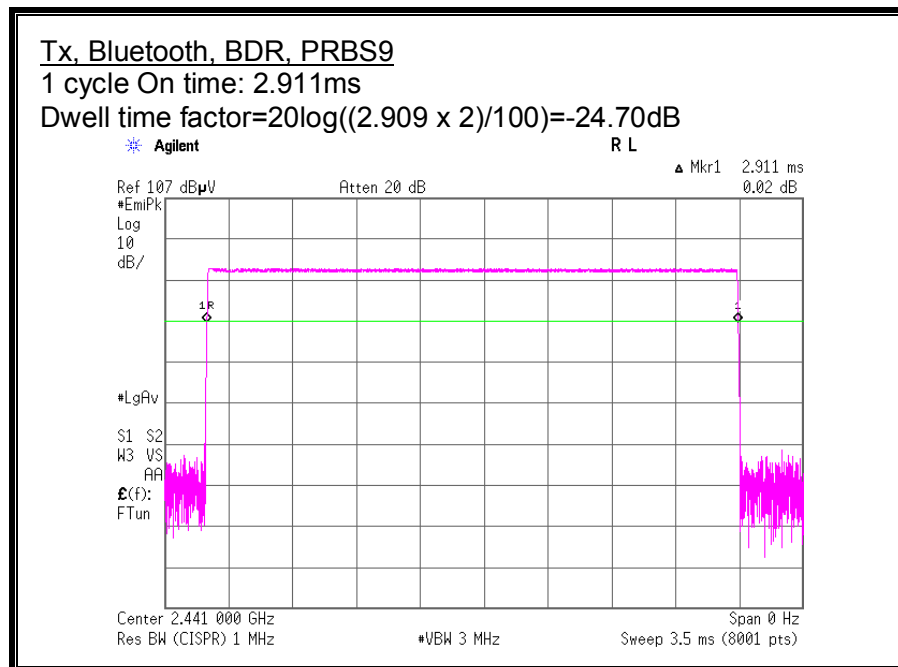


RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





Dwell time factor Calculation chart



On time of some channel during 100ms: Twice
This is the worst case in hopping sequence of Bluetooth.

HARMONICS AND SPURIOUS EMISSIONS

DH5, 2402MHz (LOW)

Radiated Emission

Test place: UL Japan, Inc. Shonan EMC Lab. No.1 Semi Anechoic Chamber
Date: September 4, 2012
Temperature / Humidity: 23 deg.C , 64 %RH
Engineer: Shinichi Takano
Mode: Tx, 2402 MHz
Tx, Bluetooth, BDR, PRBS9
(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1602.063	PK	48.6	25.5	13.2	40.8	46.5	73.9	27.4	100	22	
Hori.	4804.000	PK	63.8	31.2	6.4	41.6	59.8	73.9	14.1	105	127	
Hori.	7206.000	PK	46.0	36.0	7.7	41.2	48.5	73.9	25.4	100	0	
Hori.	1602.063	AV	39.2	25.5	13.2	40.8	37.1	53.9	16.8	100	22	
Hori.	7206.000	AV	35.6	36.0	7.7	41.2	38.1	53.9	15.8	100	0	
Vert.	1602.063	PK	48.7	25.5	13.2	40.8	46.6	73.9	27.3	205	251	
Vert.	4804.000	PK	72.1	31.2	6.4	41.6	68.1	73.9	5.8	100	104	
Vert.	7206.000	PK	46.5	36.0	7.7	41.2	49.0	73.9	24.9	100	0	
Vert.	1602.063	AV	41.9	25.5	13.2	40.8	39.8	53.9	14.1	205	251	
Vert.	7206.000	AV	35.1	36.0	7.7	41.2	37.6	53.9	16.3	100	0	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4804.000	AV	57.6	31.2	6.4	41.6	-24.7	28.9	53.9	25.0	
Vert.	4804.000	AV	66.2	31.2	6.4	41.6	-24.7	37.5	53.9	16.4	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*No noise was detected above the 3rd order harmonics.

Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m)= 9.5dB$

HARMONICS AND SPURIOUS EMISSIONS

DH5, 2441MHz (MID)

Radiated Emission

Test place: UL Japan, Inc. Shonan EMC Lab. No.1 Semi Anechoic Chamber
Date: September 4, 2012
Temperature / Humidity: 23 deg.C , 64 %RH
Engineer: Shinichi Takano
Mode: Tx, 2441 MHz
Tx, Bluetooth, BDR, PRBS9
(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1628.000	PK	48.2	25.6	13.2	40.8	46.2	73.9	27.7	100	92	
Hori.	4882.000	PK	65.9	31.3	6.4	41.5	62.1	73.9	11.8	100	0	
Hori.	7323.000	PK	47.5	36.2	8.1	41.2	50.6	73.9	23.3	100	0	
Hori.	1628.000	AV	39.5	25.6	13.2	40.8	37.5	53.9	16.4	100	92	
Hori.	7323.000	AV	36.8	36.2	8.1	41.2	39.9	53.9	14.0	100	0	
Vert.	1628.000	PK	48.8	25.6	13.2	40.8	46.8	73.9	27.1	130	235	
Vert.	4882.000	PK	65.6	31.3	6.4	41.5	61.8	73.9	12.1	106	116	
Vert.	7323.000	PK	47.0	36.2	8.1	41.2	50.1	73.9	23.8	100	0	
Vert.	1628.000	AV	40.7	25.6	13.2	40.8	38.7	53.9	15.2	130	235	
Vert.	7323.000	AV	36.5	36.2	8.1	41.2	39.6	53.9	14.3	100	0	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	59.6	31.3	6.4	41.5	-24.7	31.1	53.9	22.8	
Vert.	4882.000	AV	59.8	31.3	6.4	41.5	-24.7	31.3	53.9	22.6	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*No noise was detected above the 3rd order harmonics.

Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m) = 9.5dB$

HARMONICS AND SPURIOUS EMISSIONS

DH5, 2480MHz

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.1 Semi Anechoic Chamber
Date September 4, 2012
Temperature / Humidity 23 deg.C , 64 %RH
Engineer Shinichi Takano
Mode Tx, 2480 MHz
Tx, Bluetooth, BDR, PRBS9
(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1654.000	PK	47.2	25.7	13.2	40.8	45.3	73.9	28.6	100	82	
Hori.	4960.000	PK	64.0	31.5	6.5	41.4	60.6	73.9	13.3	171	123	
Hori.	7440.000	PK	46.8	36.3	8.2	41.3	50.0	73.9	23.9	100	0	
Hori.	1654.000	AV	38.9	25.7	13.2	40.8	37.0	53.9	16.9	100	82	
Hori.	7440.000	AV	35.7	36.3	8.2	41.3	38.9	53.9	15.0	100	0	
Vert.	1654.000	PK	47.1	25.7	13.2	40.8	45.2	73.9	28.7	131	235	
Vert.	4960.000	PK	65.5	31.5	6.5	41.4	62.1	73.9	11.8	109	228	
Vert.	7440.000	PK	46.4	36.3	8.2	41.3	49.6	73.9	24.3	100	0	
Vert.	1654.000	AV	39.2	25.7	13.2	40.8	37.3	53.9	16.6	131	235	
Vert.	7440.000	AV	35.4	36.3	8.2	41.3	38.6	53.9	15.3	100	0	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4960.000	AV	54.1	31.5	6.5	41.4	-24.7	26.0	53.9	27.9	
Vert.	4960.000	AV	58.2	31.5	6.5	41.4	-24.7	30.1	53.9	23.8	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

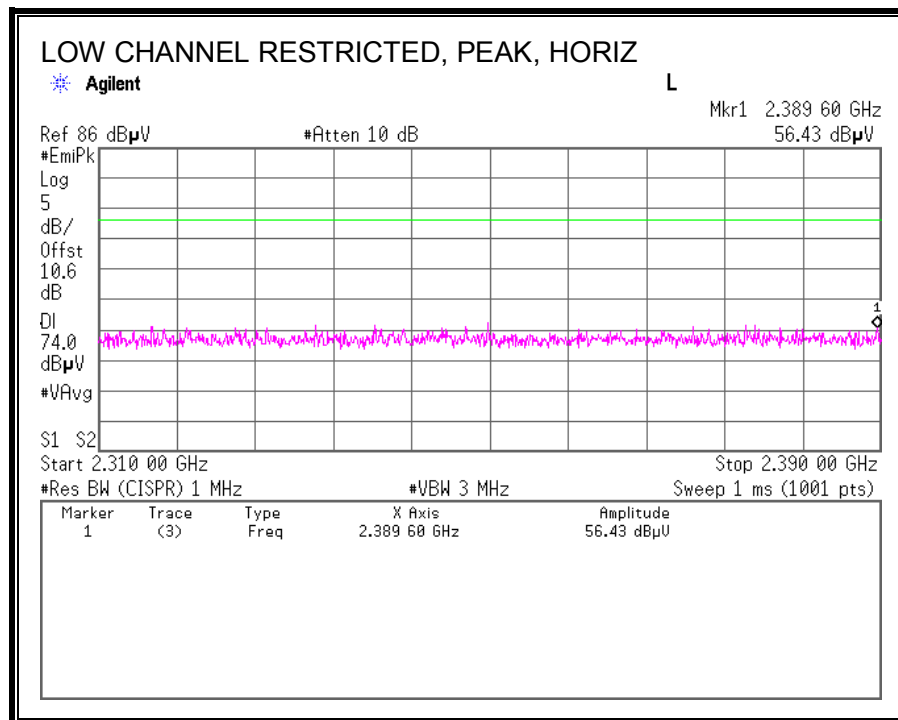
*No noise was detected above the 3rd order harmonics.

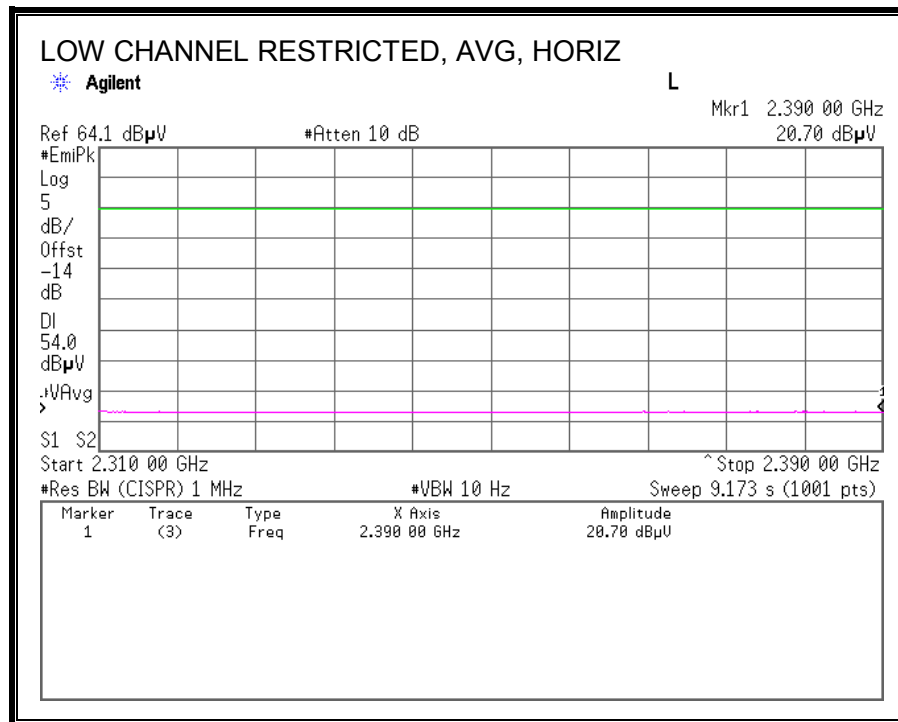
Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m)= 9.5dB$

8.2.2. ENHANCED DATA RATE 8PSK MODULATION

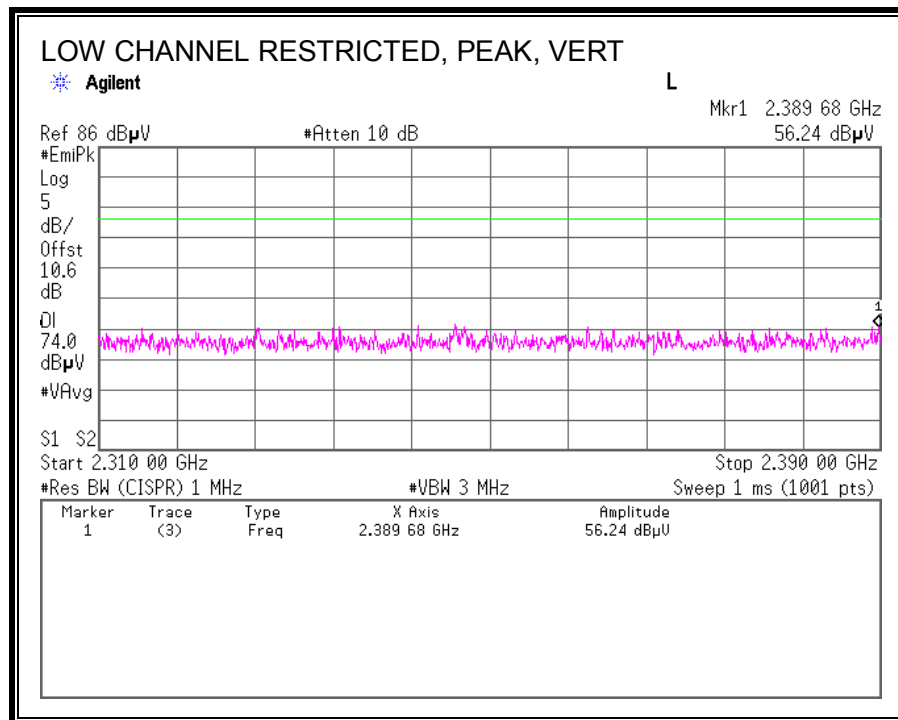
EUT STAND-ALONE

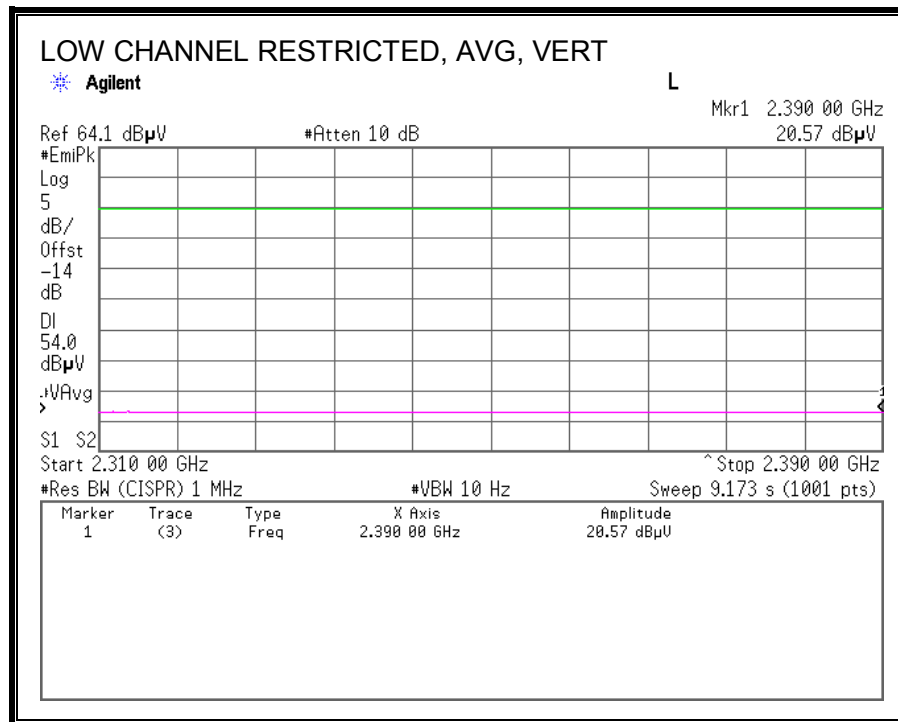
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



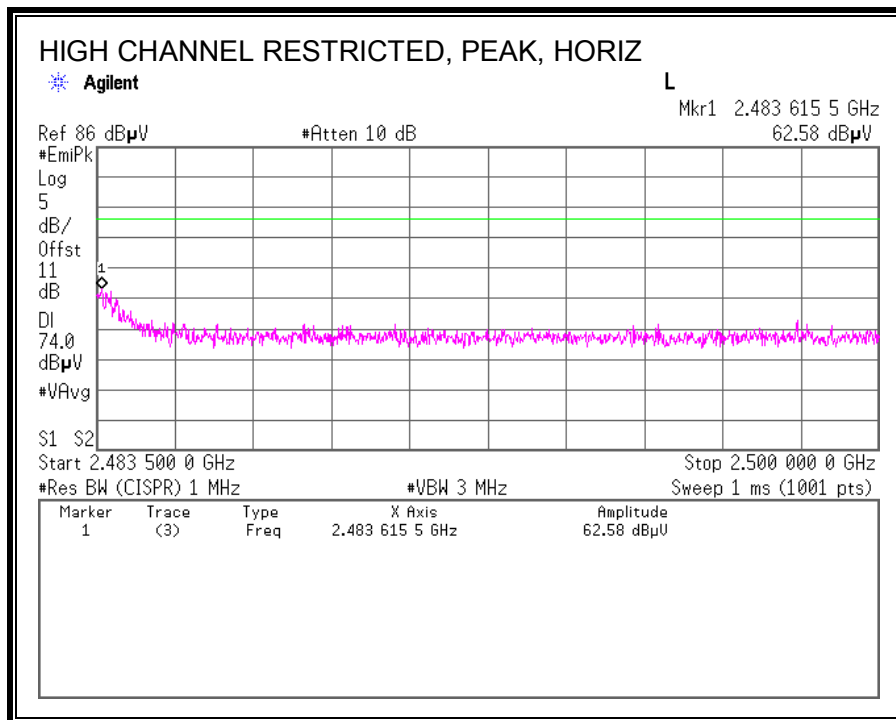


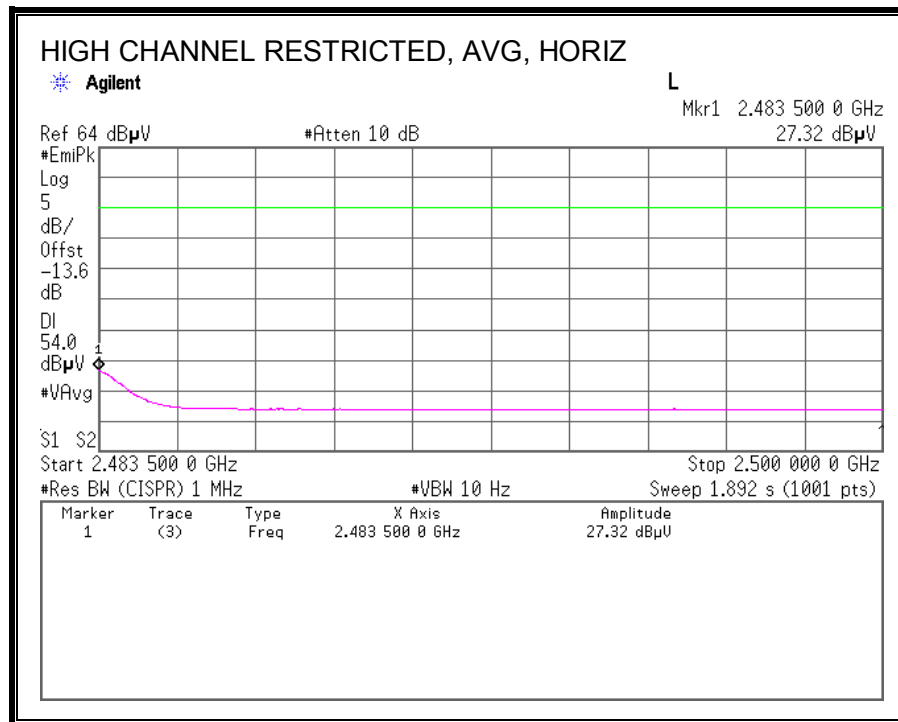
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



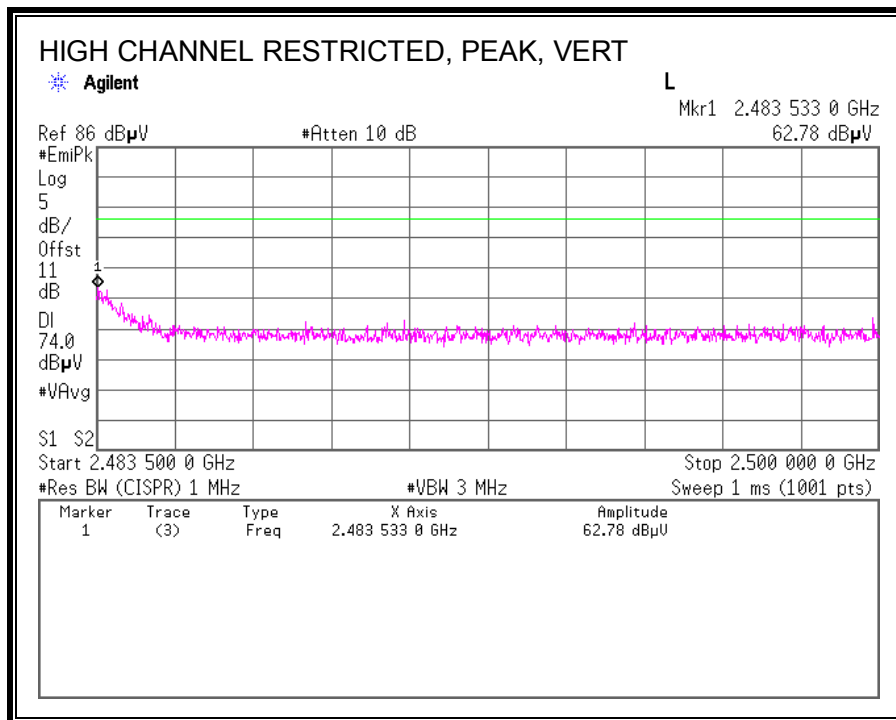


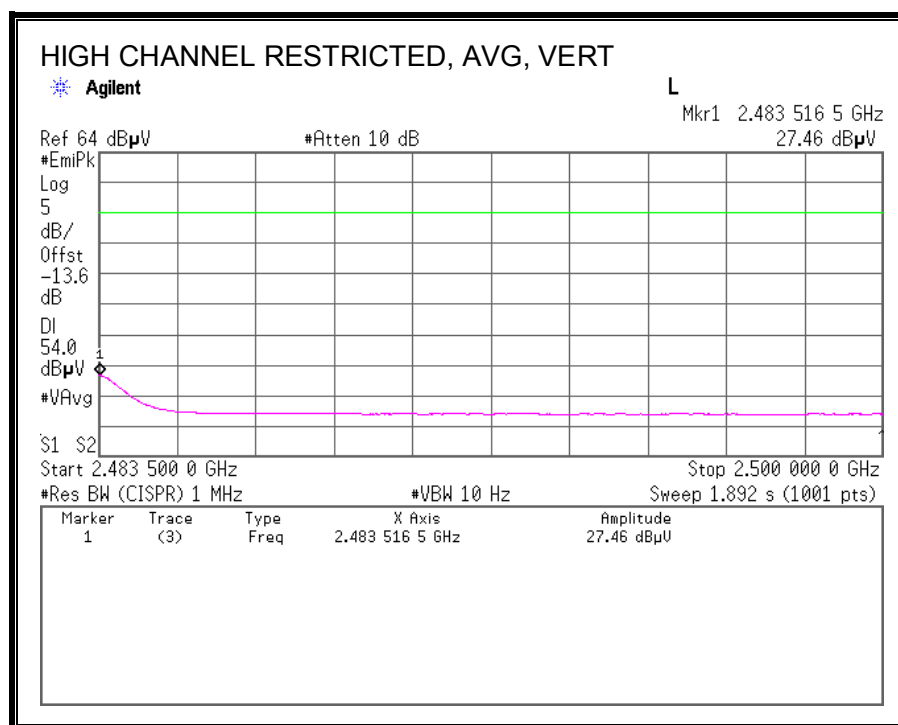
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



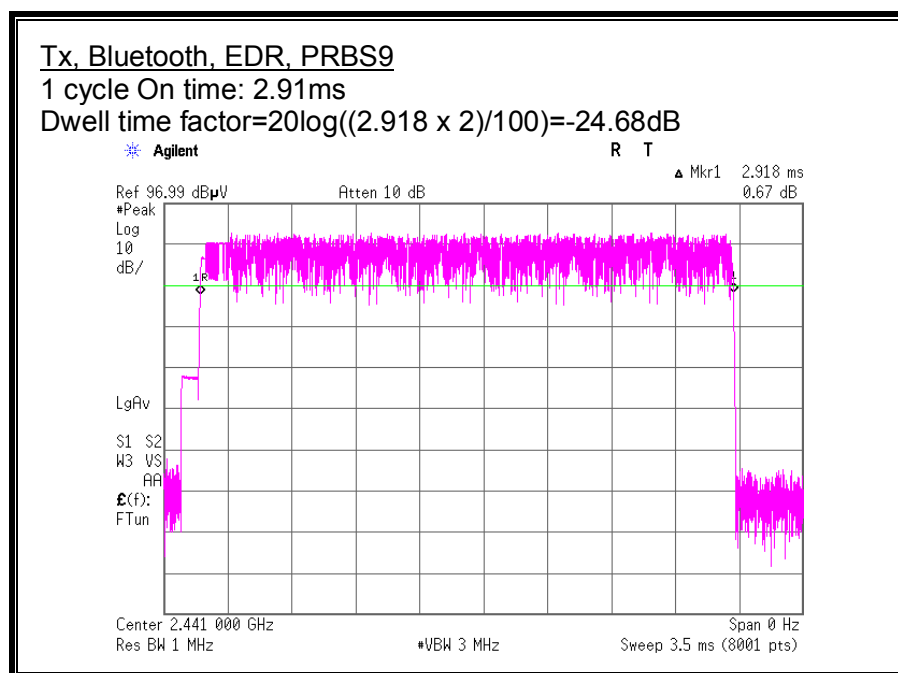


RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





Dwell time factor Calculation chart



On time of some channel during 100ms: Twice
This is the worst case in hopping sequence of Bluetooth.

HARMONICS AND SPURIOUS EMISSIONS

3-DH5, 2402MHz (LOW)

Radiated Emission

Test place

UL Japan, Inc. Shonan EMC Lab.

No.3 Semi Anechoic Chamber

Date

July 17, 2012

Temperature / Humidity

24 deg.C , 57 %RH

Engineer

Akio Hayashi

Mode

Tx, 2402 MHz

Tx, Bluetooth, EDR, PRBS9

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	1602.000	PK	48.3	25.4	23.6	40.9		56.4	73.9	17.5	109	302	
Hori.	4804.000	PK	69.5	31.1	6.8	41.1		66.3	73.9	7.6	100	12	
Hori.	1602.000	AV	39.1	25.4	23.6	40.9		47.2	53.9	6.7	109	302	
Vert.	1602.000	PK	48.0	25.4	23.6	40.9		56.1	73.9	17.8	127	260	
Vert.	4804.000	PK	67.8	31.1	6.8	41.1		64.6	73.9	9.3	105	355	
Vert.	1602.000	AV	37.9	25.4	23.6	40.9		46.0	53.9	7.9	127	260	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4804.000	AV	53.9	31.1	6.8	41.1	-24.7	26.0	53.9	27.9	(AV)/VBW:10Hz
Vert.	4804.000	AV	52.3	31.1	6.8	41.1	-24.7	24.4	53.9	29.5	(AV)/VBW:10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*No noise was detected above the 3rd order harmonics.

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

HARMONICS AND SPURIOUS EMISSIONS

3-DH5, 2441MHz (MIDDLE)

Radiated Emission

Test place

UL Japan, Inc. Shonan EMC Lab.

No.3 Semi Anechoic Chamber

Date

July 17, 2012

Temperature / Humidity

24 deg.C , 57 %RH

Engineer

Akio Hayashi

Mode

Tx, 2441 MHz

Tx, Bluetooth, EDR, PRBS9

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	1628.000	PK	49.1	25.4	23.7	40.9		57.3	73.9	16.6	108	298	
Hori.	4882.000	PK	68.3	31.2	6.9	40.9		65.5	73.9	8.4	100	4	
Hori.	1628.000	AV	39.2	25.4	23.7	40.9		8.2	53.9	45.7	108	298	
Vert.	1628.000	PK	47.3	25.4	23.7	40.9		55.5	73.9	18.4	189	263	
Vert.	4882.000	PK	69.2	31.2	6.9	40.9		66.4	73.9	7.5	110	352	
Vert.	1628.000	AV	37.4	25.4	23.7	40.9		8.2	53.9	45.7	189	263	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell time factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	53.4	31.2	6.9	40.9	-24.7	25.9	53.9	28.0	(AV)/VBW:10Hz
Vert.	4882.000	AV	54.1	31.2	6.9	40.9	-24.7	26.6	53.9	27.3	(AV)/VBW:10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*No noise was detected above the 3rd order harmonics.

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

HARMONICS AND SPURIOUS EMISSIONS

3-DH5, 2480MHz (HIGH)

Radiated Emission

Test place

UL Japan, Inc. Shonan EMC Lab.

No.3 Semi Anechoic Chamber

Date

July 17, 2012

Temperature / Humidity

24 deg.C , 57 %RH

Engineer

Akio Hayashi

Mode

Tx, 2480 MHz

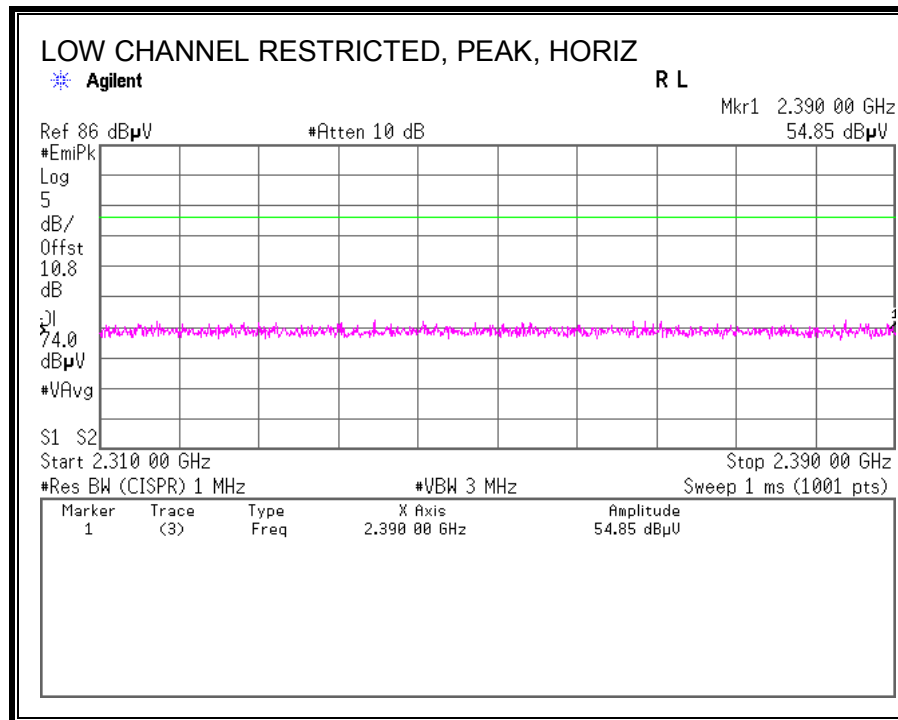
Tx, Bluetooth, EDR, PRBS9

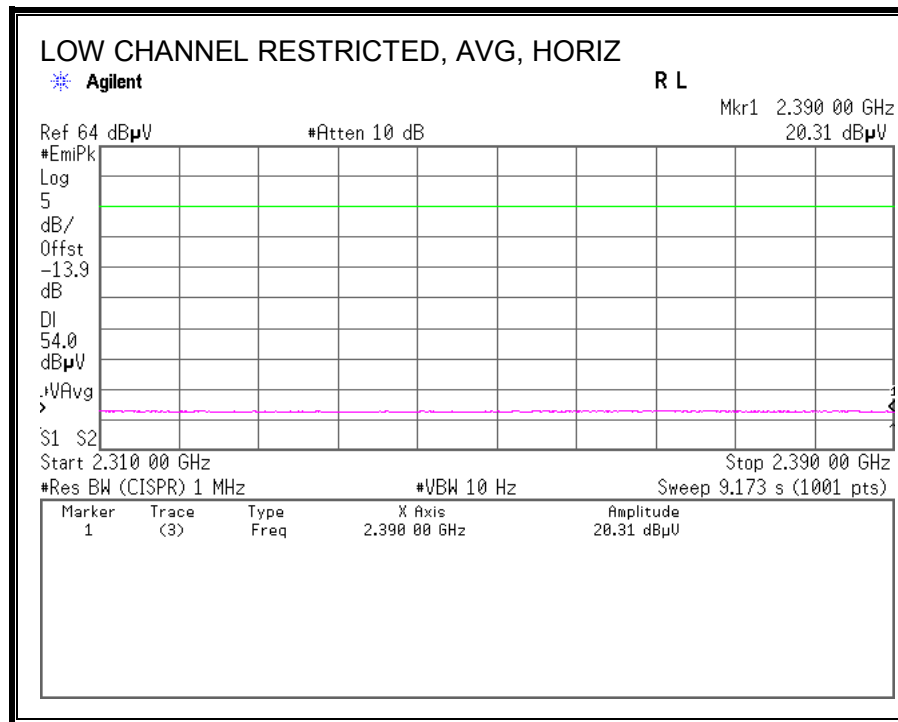
(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	1654.006	PK	48.8	25.5	23.7	40.9		57.1	73.9	16.8	100	301	
Hori.	4960.000	PK	66.5	31.4	6.9	40.8		64.0	73.9	9.9	100	25	
Hori.	1654.006	AV	38.4	25.5	23.7	40.9		46.7	53.9	7.2	100	301	
Vert.	1654.006	PK	47.5	25.5	23.7	40.9		55.8	73.9	18.1	195	260	
Vert.	4960.000	PK	66.5	31.4	6.9	40.8		64.0	73.9	9.9	100	350	
Vert.	1654.006	AV	37.3	25.5	23.7	40.9		45.6	53.9	8.3	195	260	

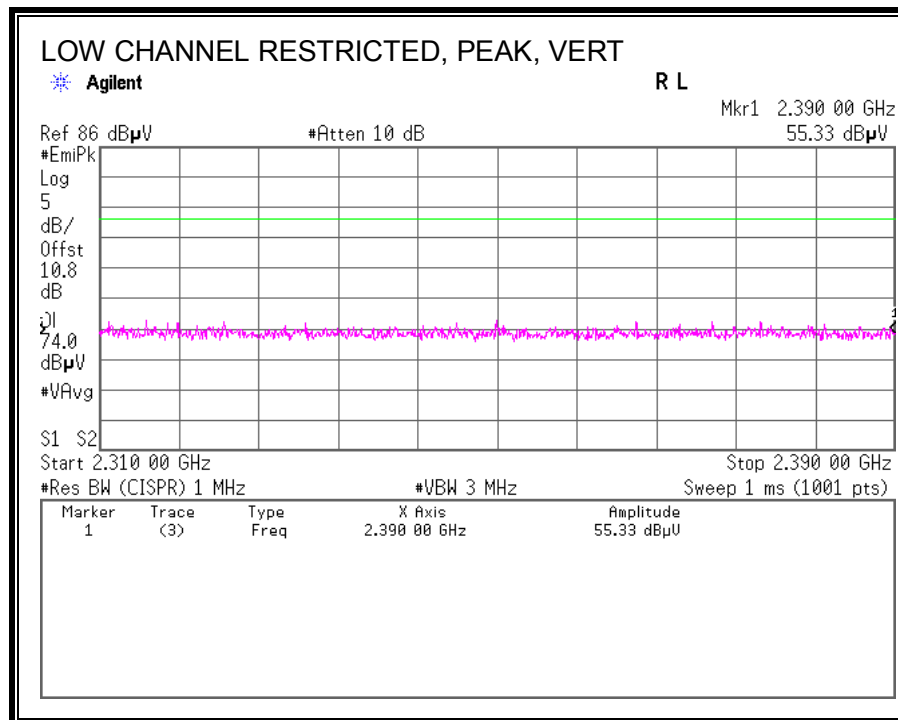
HOST DEVICE WITH EUT

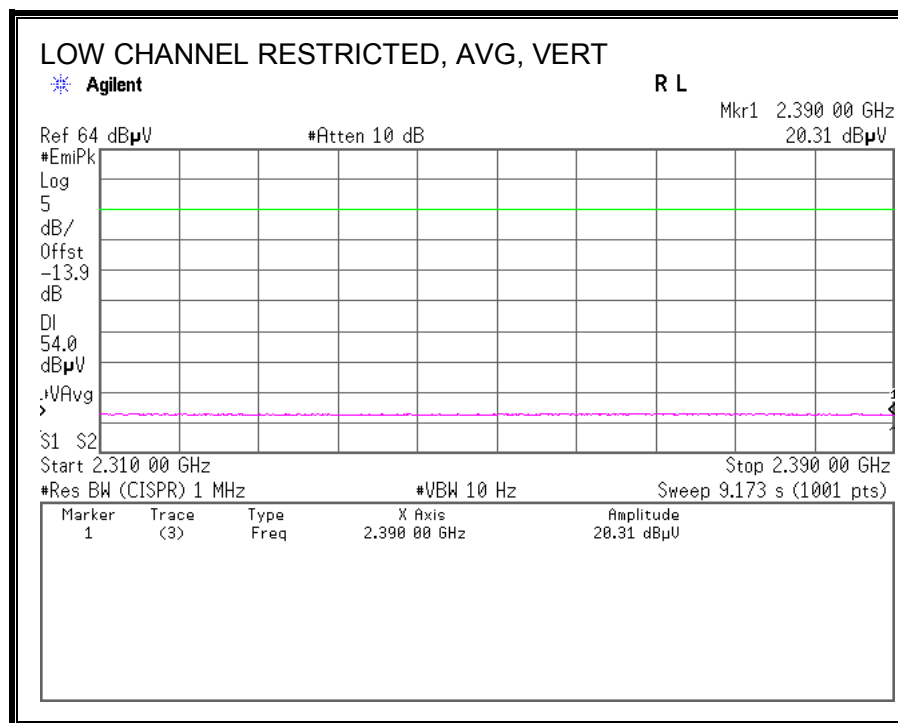
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



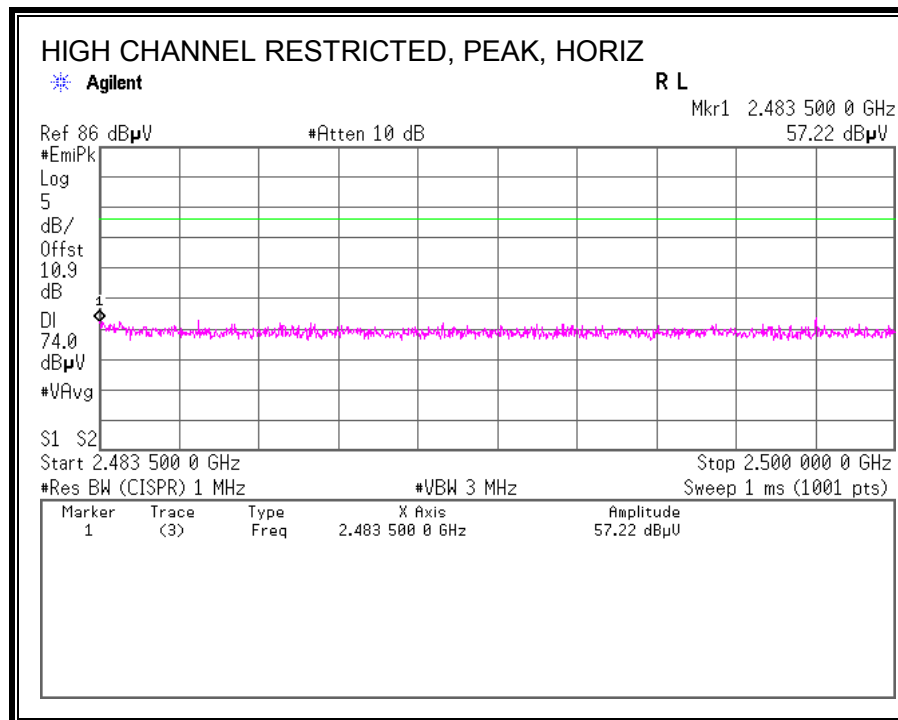


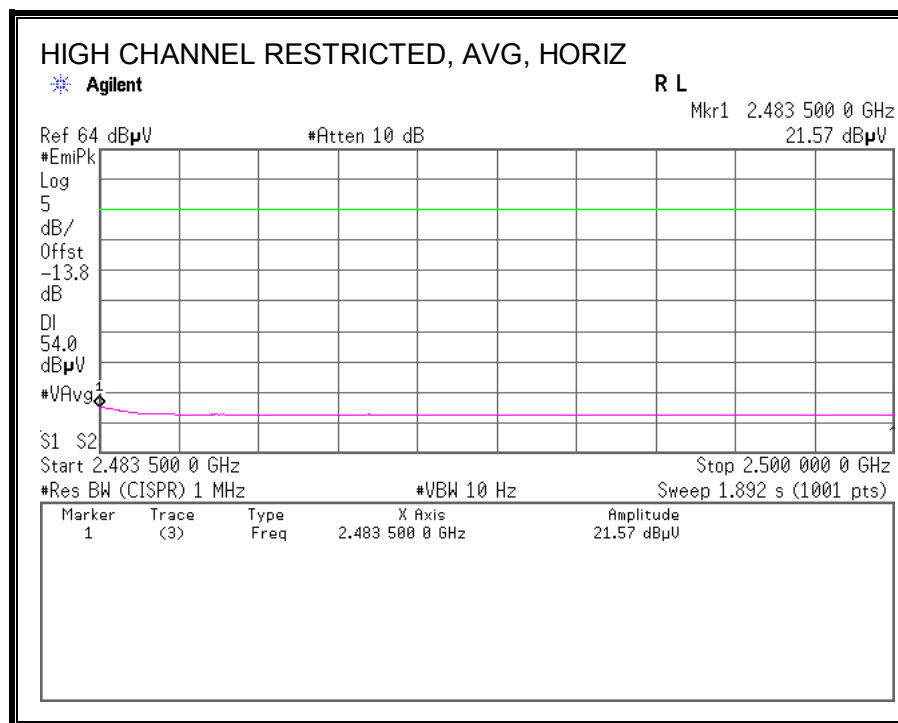
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



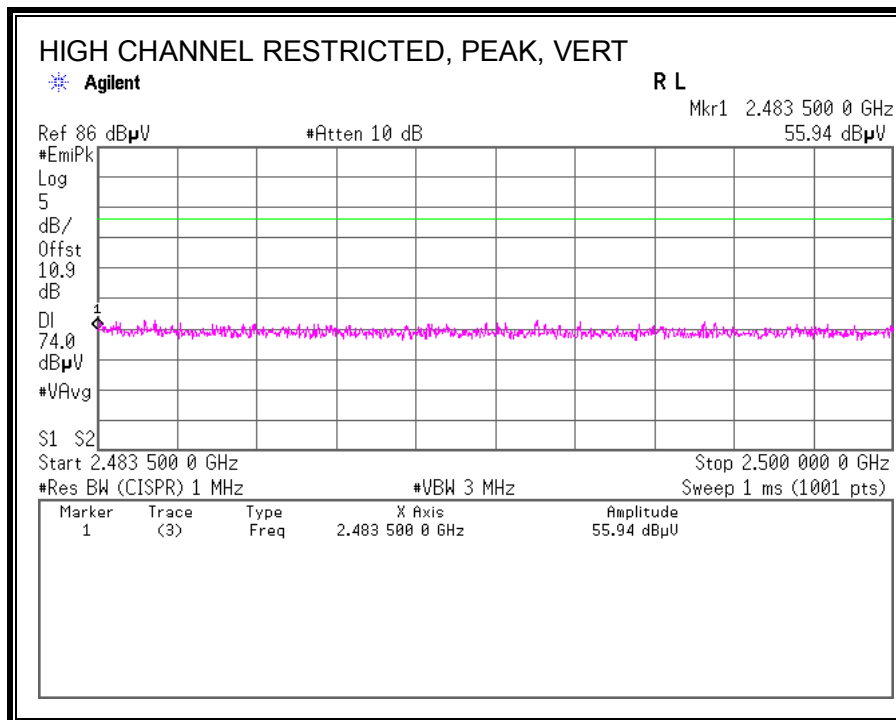


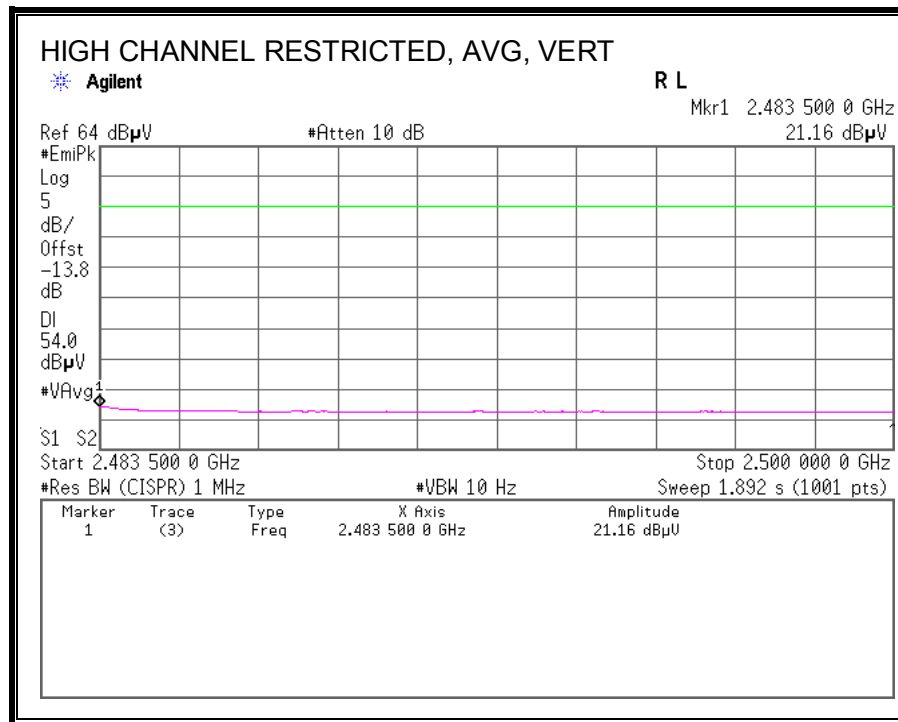
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



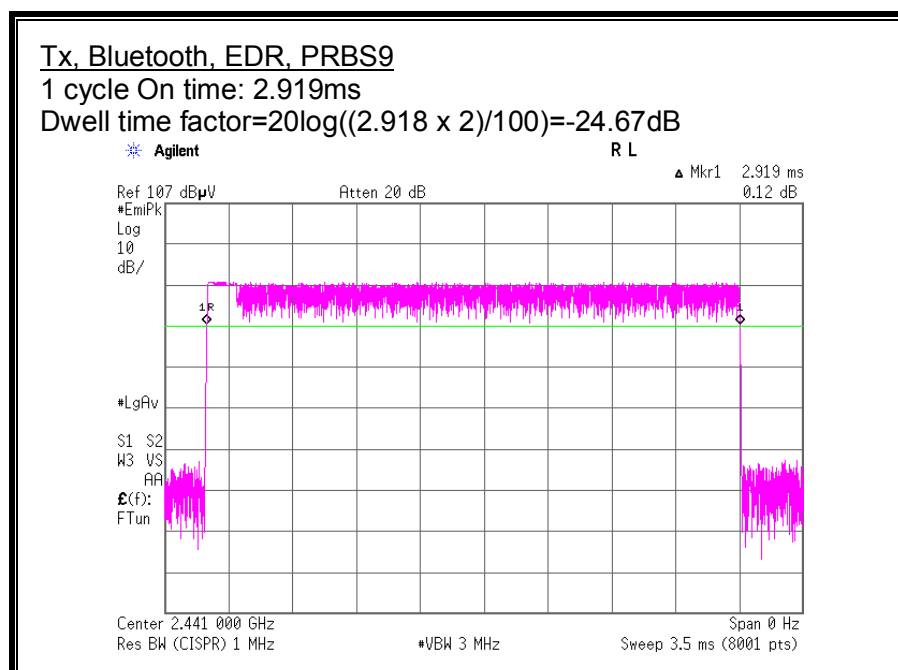


RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





Dwell time factor Calculation chart



On time of some channel during 100ms: Twice
This is the worst case in hopping sequence of Bluetooth.

HARMONICS AND SPURIOUS EMISSIONS

3-DH5, 2402MHz (LOW)

Radiated Emission

Test place: UL Japan, Inc. Shonan EMC Lab. No.1 Semi Anechoic Chamber
Date: September 4, 2012
Temperature / Humidity: 23 deg.C , 64 %RH
Engineer: Shinichi Takano
Mode: Tx, 2402 MHz
Tx, Bluetooth, EDR, PRBS9
(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1602.000	PK	48.2	25.5	13.2	40.8	46.1	73.9	27.8	100	200	
Hori.	4804.000	PK	60.6	31.2	6.4	41.6	56.6	73.9	17.3	100	213	
Hori.	7206.000	PK	47.0	36.0	7.7	41.2	49.5	73.9	24.4	100	0	
Hori.	1602.000	AV	41.0	25.5	13.2	40.8	38.9	53.9	15.0	100	200	
Hori.	7206.000	AV	35.0	36.0	7.7	41.2	37.5	53.9	16.4	100	0	
Vert.	1602.000	PK	48.0	25.5	13.2	40.8	45.9	73.9	28.0	111	210	
Vert.	4804.000	PK	67.0	31.2	6.4	41.6	63.0	73.9	10.9	108	113	
Vert.	7206.000	PK	47.6	36.0	7.7	41.2	50.1	73.9	23.8	100	0	
Vert.	1602.000	AV	41.2	25.5	13.2	40.8	39.1	53.9	14.8	111	210	
Vert.	7206.000	AV	36.4	36.0	7.7	41.2	38.9	53.9	15.0	100	0	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4804.000	AV	48.5	31.2	6.4	41.6	-24.7	19.8	53.9	34.1	
Vert.	4804.000	AV	54.3	31.2	6.4	41.6	-24.7	25.6	53.9	28.3	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*No noise was detected above the 3rd order harmonics.

Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m) = 9.5dB$

HARMONICS AND SPURIOUS EMISSIONS

3-DH5, 2441MHz (MIDDLE)

Radiated Emission

Test place: UL Japan, Inc. Shonan EMC Lab. No.1 Semi Anechoic Chamber
Date: September 4, 2012
Temperature / Humidity: 23 deg.C , 64 %RH
Engineer: Shinichi Takano
Mode: Tx, 2441 MHz
Tx, Bluetooth, EDR, PRBS9
(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1628.000	PK	47.9	25.6	13.2	40.8	45.9	73.9	28.0	108	205	
Hori.	4882.000	PK	59.2	31.3	6.4	41.5	55.4	73.9	18.5	142	88	
Hori.	7323.000	PK	47.3	36.2	8.1	41.2	50.4	73.9	23.5	100	0	
Hori.	1628.000	AV	42.8	25.6	13.2	40.8	40.8	53.9	13.1	108	205	
Hori.	7323.000	AV	35.7	36.2	8.1	41.2	38.8	53.9	15.1	100	0	
Vert.	1628.000	PK	48.1	25.6	13.2	40.8	46.1	73.9	27.8	120	221	
Vert.	4882.000	PK	61.9	31.3	6.4	41.5	58.1	73.9	15.8	102	226	
Vert.	7323.000	PK	47.8	36.2	8.1	41.2	50.9	73.9	23.0	100	0	
Vert.	1628.000	AV	41.0	25.6	13.2	40.8	39.0	53.9	14.9	120	221	
Vert.	7323.000	AV	36.0	36.2	8.1	41.2	39.1	53.9	14.8	100	0	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	46.7	31.3	6.4	41.5	-24.7	18.2	53.9	35.7	
Vert.	4882.000	AV	49.4	31.3	6.4	41.5	-24.7	20.9	53.9	33.0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*No noise was detected above the 3rd order harmonics.

Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m) = 9.5dB$

HARMONICS AND SPURIOUS EMISSIONS

3-DH5, 2480MHz (HIGH)

Radiated Emission

Test place: UL Japan, Inc. Shonan EMC Lab. No.1 Semi Anechoic Chamber
Date: September 4, 2012
Temperature / Humidity: 23 deg.C , 64 %RH
Engineer: Shinichi Takano
Mode: Tx, 2480 MHz
Tx, Bluetooth, EDR, PRBS9
(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	1654.000	PK	48.9	25.7	13.2	40.8	47.0	73.9	26.9	100	222	
Hori.	4960.000	PK	59.7	31.5	6.5	41.4	56.3	73.9	17.6	102	126	
Hori.	7440.000	PK	48.0	36.3	8.2	41.3	51.2	73.9	22.7	100	0	
Hori.	1654.000	AV	41.2	25.7	13.2	40.8	39.3	53.9	14.6	100	222	
Hori.	7440.000	AV	35.7	36.3	8.2	41.3	38.9	53.9	15.0	100	0	
Vert.	1654.000	PK	48.6	25.7	13.2	40.8	46.7	73.9	27.2	100	209	
Vert.	4960.000	PK	61.3	31.5	6.5	41.4	57.9	73.9	16.0	100	233	
Vert.	7440.000	PK	48.2	36.3	8.2	41.3	51.4	73.9	22.5	100	0	
Vert.	1654.000	AV	42.3	25.7	13.2	40.8	40.4	53.9	13.5	100	209	
Vert.	7440.000	AV	35.8	36.3	8.2	41.3	39.0	53.9	14.9	100	0	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4960.000	AV	41.2	31.5	6.5	41.4	-24.7	13.1	53.9	40.8	
Vert.	4960.000	AV	44.7	31.5	6.5	41.4	-24.7	16.6	53.9	37.3	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

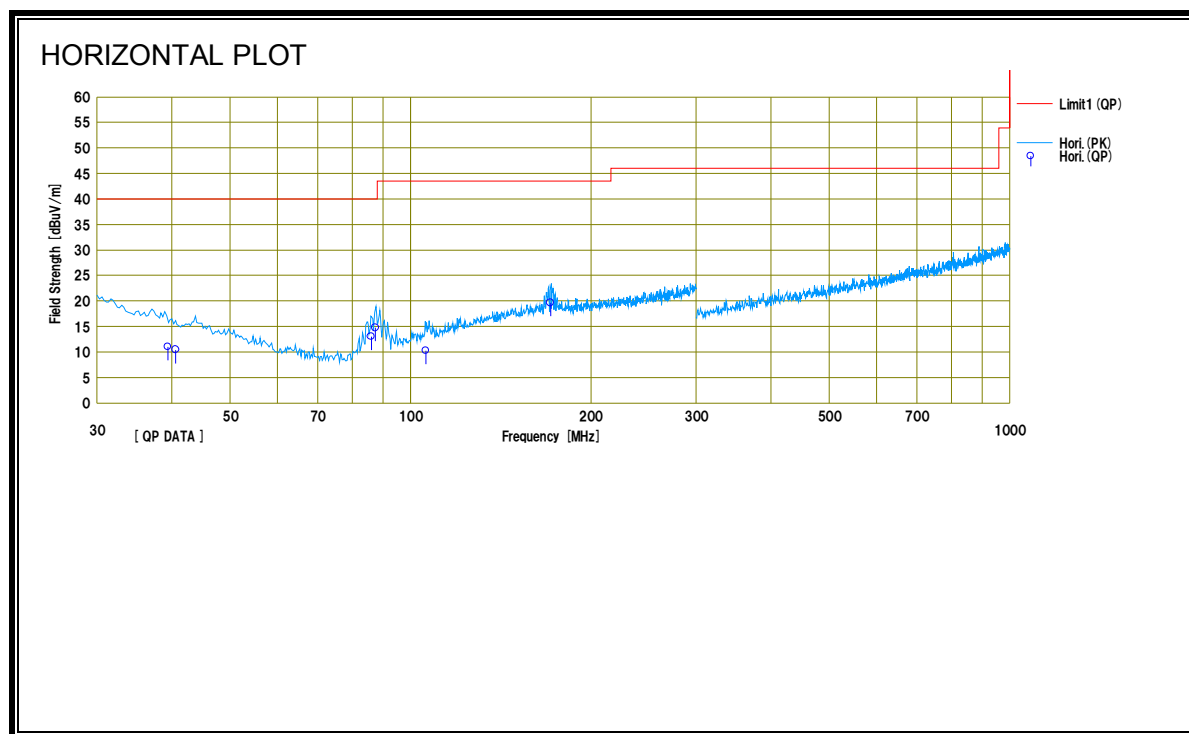
*No noise was detected above the 3rd order harmonics.

Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m) = 9.5dB$

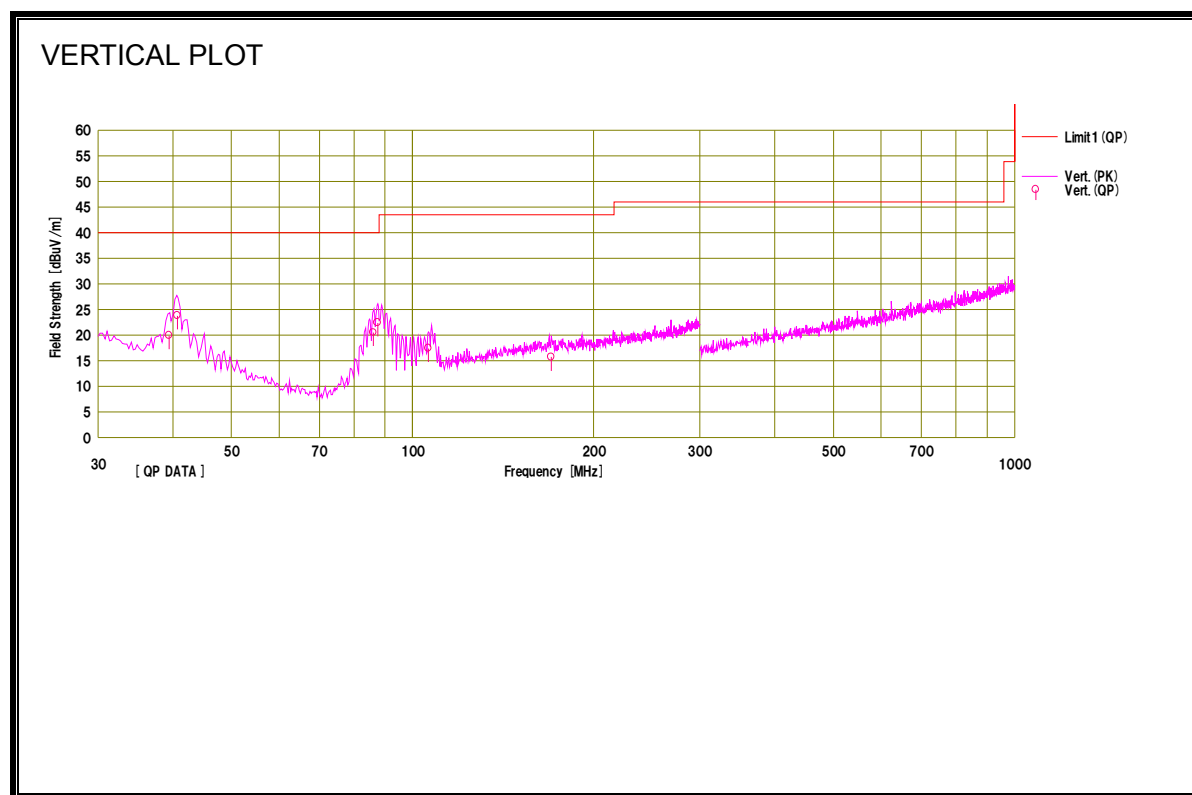
8.3. WORST-CASE BELOW 1 GHz

EUT STAND-ALONE

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



HORIZONTAL AND VERTICAL DATA

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Semi-Anechoic Chamber
Date : 2012/07/18

Company : SEIKO EPSON CORPORATION
Kind of EUT : Bluetooth Interface board for printer
Model No. : M212B
Serial No. : 18

Mode : Tx DH5 2441MHz
Report No. : 32LE0153-SH-A
Power : DC5.0V
Temp./Humi. : 24deg.C. / 57%RH

Remarks : Hor:X-axis, Ver:X-axis

Limit1 : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK

Engineer : Akio Hayashi

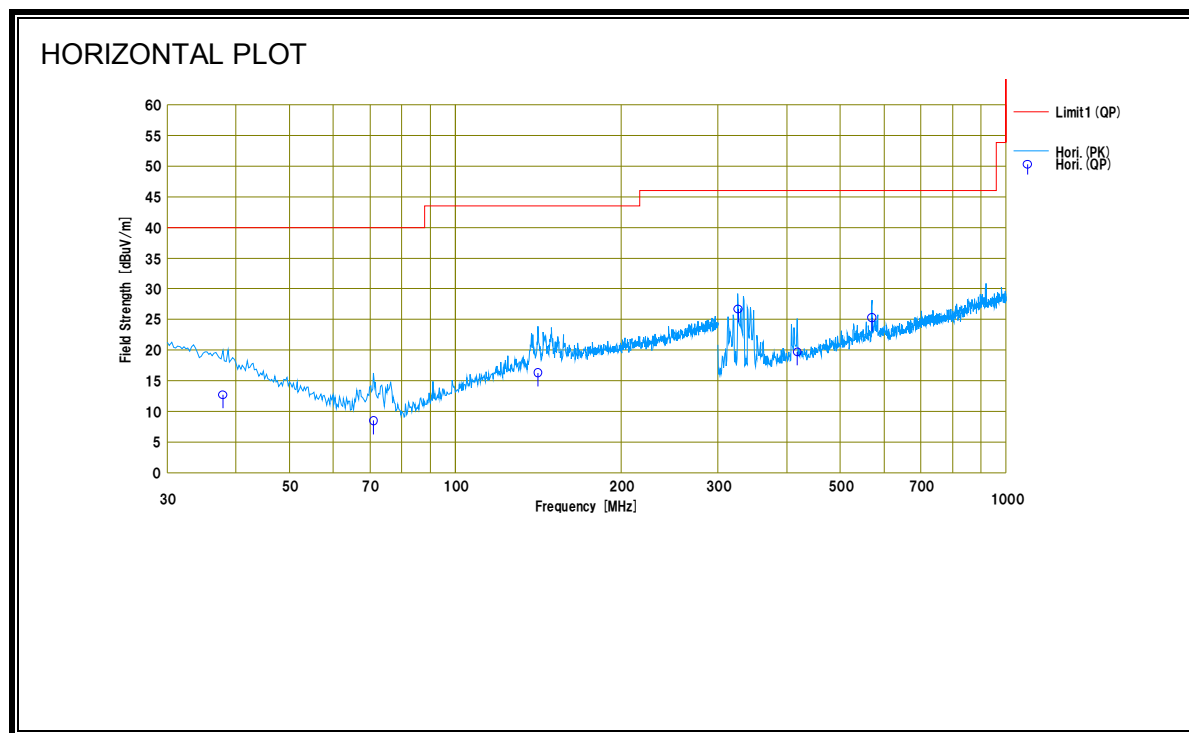
<< QP DATA >>

No.	Freq. [MHz]	Reading <QP>	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result <QP>	Limit <QP>	Margin <QP>	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[dBuV]				[dBuV/m]	[dBuV/m]	[dB]					
1	39.400	22.3	14.3	6.6	32.2	11.0	40.0	29.0	Hori.	282	270	BC	
2	40.605	22.1	13.9	6.6	32.2	10.4	40.0	29.6	Hori.	282	262	BC	
3	86.047	30.7	7.0	7.5	32.2	13.0	40.0	27.0	Hori.	212	264	BC	
4	87.485	32.1	7.3	7.5	32.2	14.7	40.0	25.3	Hori.	218	263	BC	
5	106.120	24.4	10.7	7.2	32.1	10.2	43.5	33.3	Hori.	298	262	BC	
6	171.320	28.3	15.6	7.8	32.1	19.6	43.5	23.9	Hori.	180	264	BC	
7	39.400	31.2	14.3	6.6	32.2	19.9	40.0	20.1	Vert.	100	183	BC	
8	40.660	35.5	13.9	6.6	32.2	23.6	40.0	16.2	Vert.	100	191	BC	
9	86.072	38.2	7.0	7.5	32.2	20.5	40.0	19.5	Vert.	126	188	BC	
10	87.500	39.8	7.3	7.5	32.2	22.4	40.0	17.6	Vert.	112	193	BC	
11	106.212	31.6	10.7	7.2	32.1	17.4	43.5	26.1	Vert.	100	182	BC	
12	169.926	24.5	15.5	7.8	32.1	15.7	43.5	27.8	Vert.	100	241	BC	

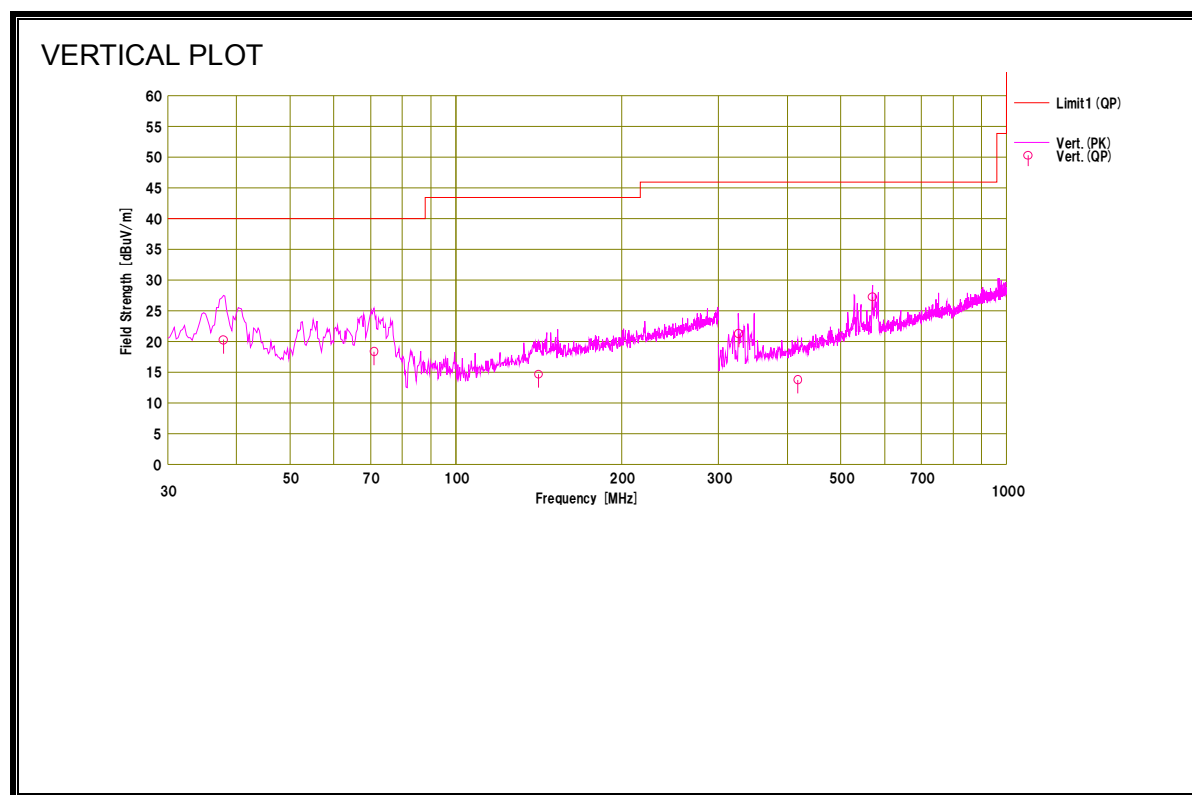
Calculation:Result [dBuV/m] = Reading [dBuV] + Ant.Fac [dB/m] + Loss (Cable+ATT) [dB] - Gain (AMP) [dB]
Ant.Type=BC:Biconical Antenna LP:Logperiodic Antenna SHA*:Horn

HOST DEVICE WITH EUT

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



HORIZONTAL AND VERTICAL DATA

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Semi-Anechoic Chamber
Date : 2012/09/04

Company : SEIKO EPSON CORPORATION
Kind of EUT : Bluetooth Interface board for printer
Model No. : M212B
Serial No. : 2

Mode : Tx DH5 2441MHz
Report No. : 32LE0153-SH-A
Power : AC 120V / 60Hz (DC5.0V)
Temp./Humi. : 23deg.C. / 64%RH

Remarks :

Limit1 : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK

Engineer : Shinichi Takano

<< QP DATA >>

No.	Freq. [MHz]	Reading <QP>	Ant.Fac	Loss	Gain	Result <QP>	Limit <QP>	Margin <QP>	Pola.	Height	Angle	Ant. Type	Comment
		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]		
1	37.837	21.7	15.7	7.1	31.8	12.7	40.0	27.3	Hori.	187	8	BC	
2	71.050	26.2	6.5	7.6	31.8	8.5	40.0	31.5	Hori.	304	335	BC	
3	141.270	25.3	14.3	8.5	31.8	16.3	43.5	27.2	Hori.	229	136	BC	
4	326.094	36.6	14.6	7.2	31.7	26.7	46.0	19.3	Hori.	100	16	LP	
5	417.650	27.5	16.2	7.8	31.8	19.7	46.0	26.3	Hori.	100	159	LP	
6	570.629	30.1	18.5	8.6	31.9	25.3	46.0	20.7	Hori.	155	272	LP	
7	37.837	29.3	15.7	7.1	31.8	20.3	40.0	19.7	Vert.	100	3	BC	
8	71.050	35.1	6.5	7.6	31.8	18.4	40.0	21.6	Vert.	100	28	BC	
9	141.270	23.7	14.3	8.5	31.8	14.7	43.5	28.8	Vert.	100	148	BC	
10	326.099	31.2	14.6	7.2	31.7	21.3	46.0	24.7	Vert.	100	209	LP	
11	417.650	21.6	16.2	7.8	31.8	13.8	46.0	32.2	Vert.	100	358	LP	
12	570.573	32.1	18.5	8.6	31.9	27.3	46.0	18.7	Vert.	100	196	LP	

Calculation:Result [dBuV/m]=Reading [dBuV]+Ant.Fac [dB/m]+Loss (Cable+ATT) [dB]-Gain (AMP) [dB]
Ant.Type=BC:Biconical Antenna LP:Logperiodic Antenna SHA*: Horn

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 [*]	56 to 46 [*]
0.5-5	56	46
5-30	60	50

^{*} Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS (EUT STAND-ALONE)

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2012/07/19

Company : SEIKO EPSON CORPORATION
Kind of EUT : Bluetooth interface board for printer
Model No. : M212B
Serial No. : 18

Mode : Tx 3DH5 2441MHz
Report No. : 32LE0153-SH-A
Power : AC 120V / 60Hz (DC5.0V)
Temp./Humi. : 26deg.C. / 56%RH

Remarks : -

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

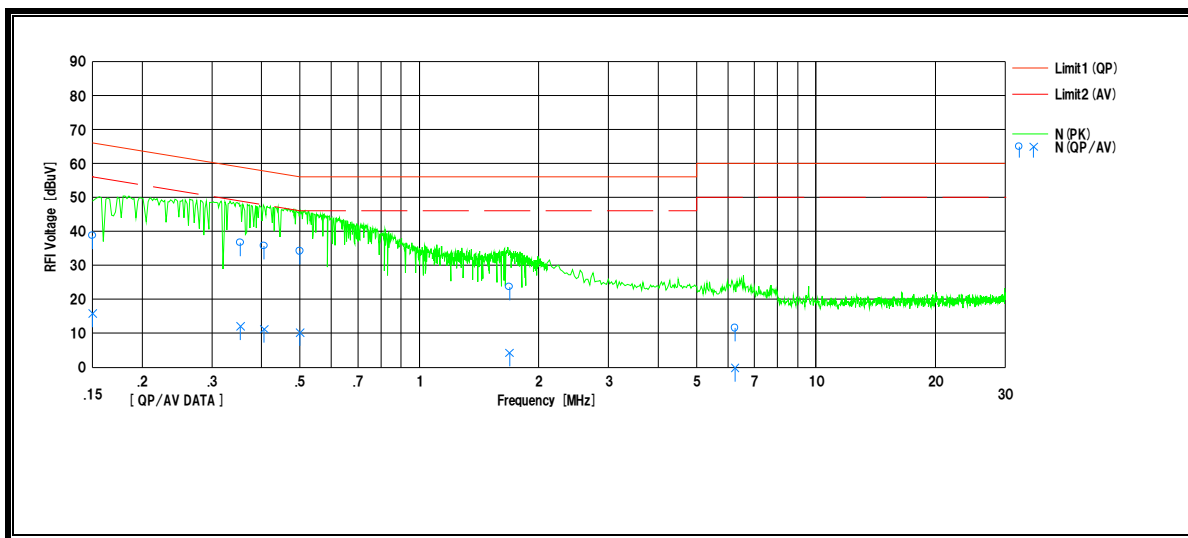
Engineer : Akio Hayashi

<< QP/AV DATA >>

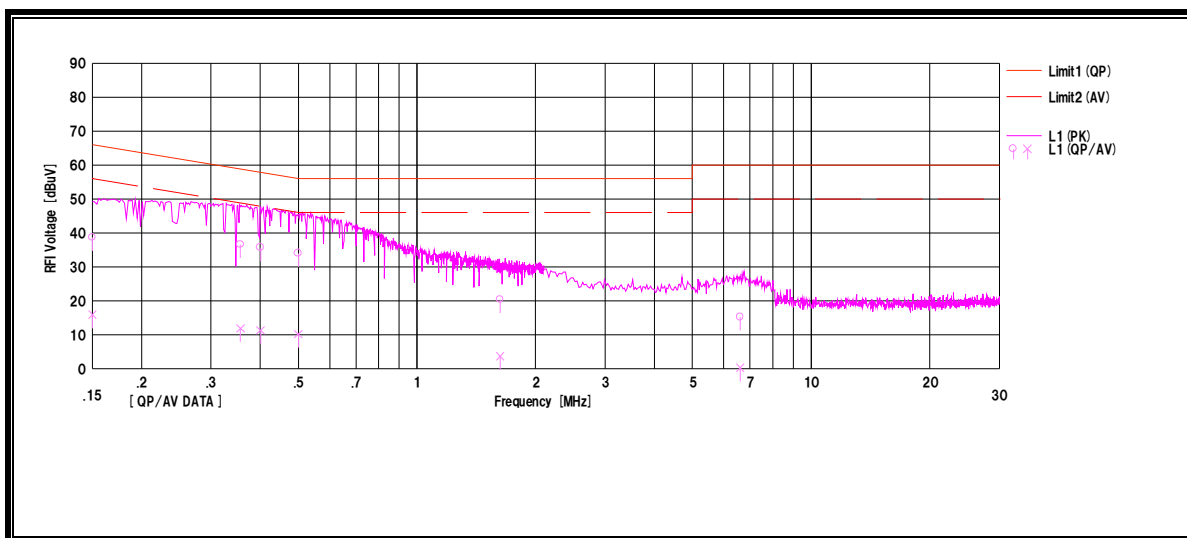
No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	26.1	3.2	126	38.7	15.8	66.0	56.0	27.3	40.2	N	
2	0.35384	24.0	-0.6	126	36.6	12.0	58.8	48.8	22.2	36.8	N	
3	0.40597	23.1	-1.4	126	35.7	11.2	57.7	47.7	22.0	36.5	N	
4	0.49999	21.5	-2.4	126	34.1	10.2	56.0	46.0	21.9	35.8	N	
5	1.68750	10.9	-8.5	127	23.6	4.2	56.0	46.0	32.4	41.8	N	
6	6.25453	-1.5	-13.2	130	11.5	-0.2	60.0	50.0	48.5	50.2	N	
7	0.15000	26.1	3.3	126	38.7	15.9	66.0	56.0	27.3	40.1	L1	
8	0.35655	24.0	-0.7	126	36.6	11.9	58.8	48.8	22.2	36.9	L1	
9	0.40070	23.1	-1.3	126	35.7	11.3	57.8	47.8	22.1	36.5	L1	
10	0.49999	21.4	-2.4	126	34.0	10.2	56.0	46.0	22.0	35.8	L1	
11	1.62600	7.7	-9.1	127	20.4	3.6	56.0	46.0	35.6	42.4	L1	
12	6.61121	2.2	-12.8	130	15.2	0.2	60.0	50.0	44.8	49.8	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-01

LINE 1 RESULTS



LINE 2 RESULTS



RESULTS (HOST DEVICE WITH EUT)

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2012/09/05

Company : SEIKO EPSON CORPORATION
Kind of EUT : Bluetooth interface board for printer
Model No. : M212B
Serial No. : 2

Mode : Tx 3DH5 2441MHz
Report No. : 32LE0153-SH-A
Power : AC 120V / 60Hz (DC5.0V)
Temp./Humi. : 24deg.C. / 65%RH

Remarks :

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

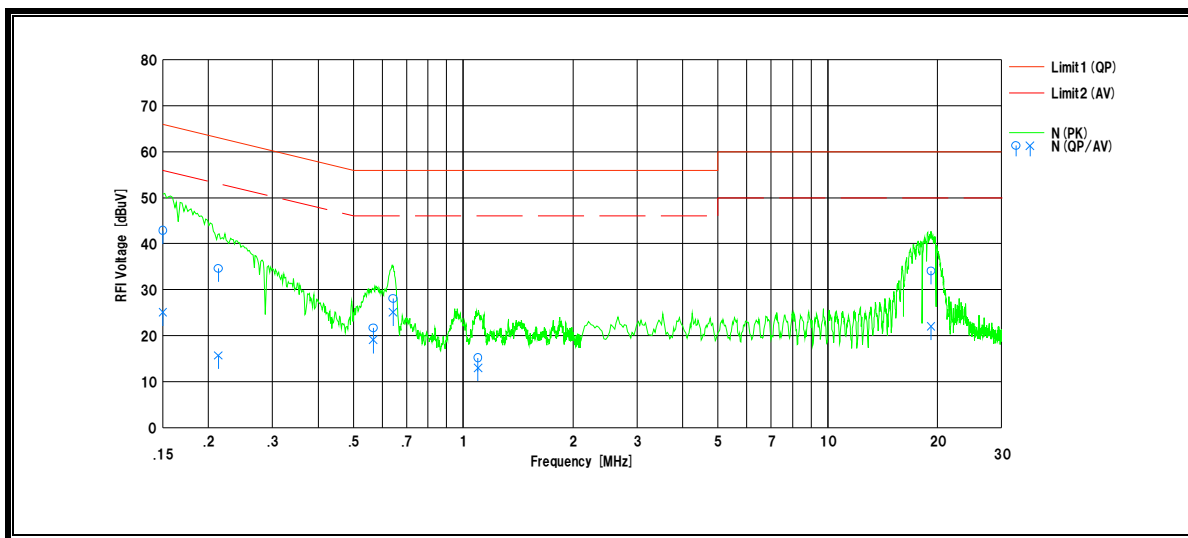
Engineer : Shinichi Takano

<< QP/AV DATA >>

No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	30.3	12.5	12.6	42.9	25.1	66.0	56.0	23.1	30.9	N	
2	0.21300	22.0	3.1	12.6	34.6	15.7	63.0	53.0	28.4	37.3	N	
3	0.56700	9.1	6.5	12.6	21.7	19.1	56.0	46.0	34.3	26.9	N	
4	0.64200	15.5	12.5	12.6	28.1	25.1	56.0	46.0	27.9	20.9	N	
5	1.09800	2.5	0.3	12.7	15.2	13.0	56.0	46.0	40.8	33.0	N	
6	19.19300	20.7	8.6	13.4	34.1	22.0	60.0	50.0	25.9	28.0	N	
7	0.15000	30.1	12.7	12.6	42.7	25.3	66.0	56.0	23.3	30.7	L1	
8	0.21300	21.9	3.9	12.6	34.5	16.5	63.0	53.0	28.5	36.5	L1	
9	0.56700	8.9	6.1	12.6	21.5	18.7	56.0	46.0	34.5	27.3	L1	
10	0.64200	15.4	12.1	12.6	28.0	24.7	56.0	46.0	28.0	21.3	L1	
11	1.09800	3.0	0.9	12.7	15.7	13.6	56.0	46.0	40.3	32.4	L1	
12	19.19400	20.5	8.1	13.4	33.9	21.5	60.0	50.0	26.1	28.5	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+HighPassFilter) [dB]
LISN:SLS-01

LINE 1 RESULTS



LINE 2 RESULTS

