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

CERTIFICATION TEST REPORT

FOR

Bluetooth module

MODEL NUMBER: BT301FS

FCC ID: 2ABP5-XBFS880
IC: 4844A-XBFS880

REPORT NUMBER: 10185979S

ISSUE DATE: January 31, 2014

Prepared for
Toshiba Medical Systems Corporation
1385, Shimoishigami, Otawara-shi,
Tochigi, 324-8550, 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 RTL02610

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

Revision History

Rev.	Issue Date	Revisions	Revised By
--	01/31/14	Initial Issue	Tatsuya Arai

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

TABLE OF CONTENTS

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Toshiba Medical Systems Corporation
1385, Shimoishigami, Otawara-shi, Tochigi, 324-8550, Japan

EUT DESCRIPTION: Bluetooth module

MODEL: BT301FS

SERIAL NUMBER: 0001 90 D36766 (Antenna port tests),
0001 90 D36601 (other tests),

DATE TESTED: JANUARY 22 to 24, 2014

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:

T. Imamura

Toyokazu Imamura
Leader of EMC Service,
UL Verification Service

Tested By:

T. Arai

Tatsuya Arai
Engineer of WiSE Japan,
UL Verification Service

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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/system/service/testinglaboratories/accreditation/detail/335/

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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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
Radiated Emission	30MHz-300MHz(3m)	+/- 4.8 dB
	300MHz-1000MHz(3m)	+/- 4.8 dB
	1000MHz-15GHz(3m)	+/- 4.9 dB
	15GHz-18GHz(1m)	+/- 5.6 dB
	18GHz-26.5GHz(1m)	+/- 4.3 dB

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

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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. 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	2.81	1.91
2402 - 2480	Enhanced 8PSK	2.20	1.66

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

5.4. SOFTWARE AND FIRMWARE

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

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

5.5. 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.

For radiated emissions below 1 GHz the worst-case configuration is determined to be the mode and channel with the highest output power.

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	X	Z
Spurious (below 1GHz)	X	X
Spurious (above 1GHz)	X	Z
Spurious (Harmonics)	X	Z

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

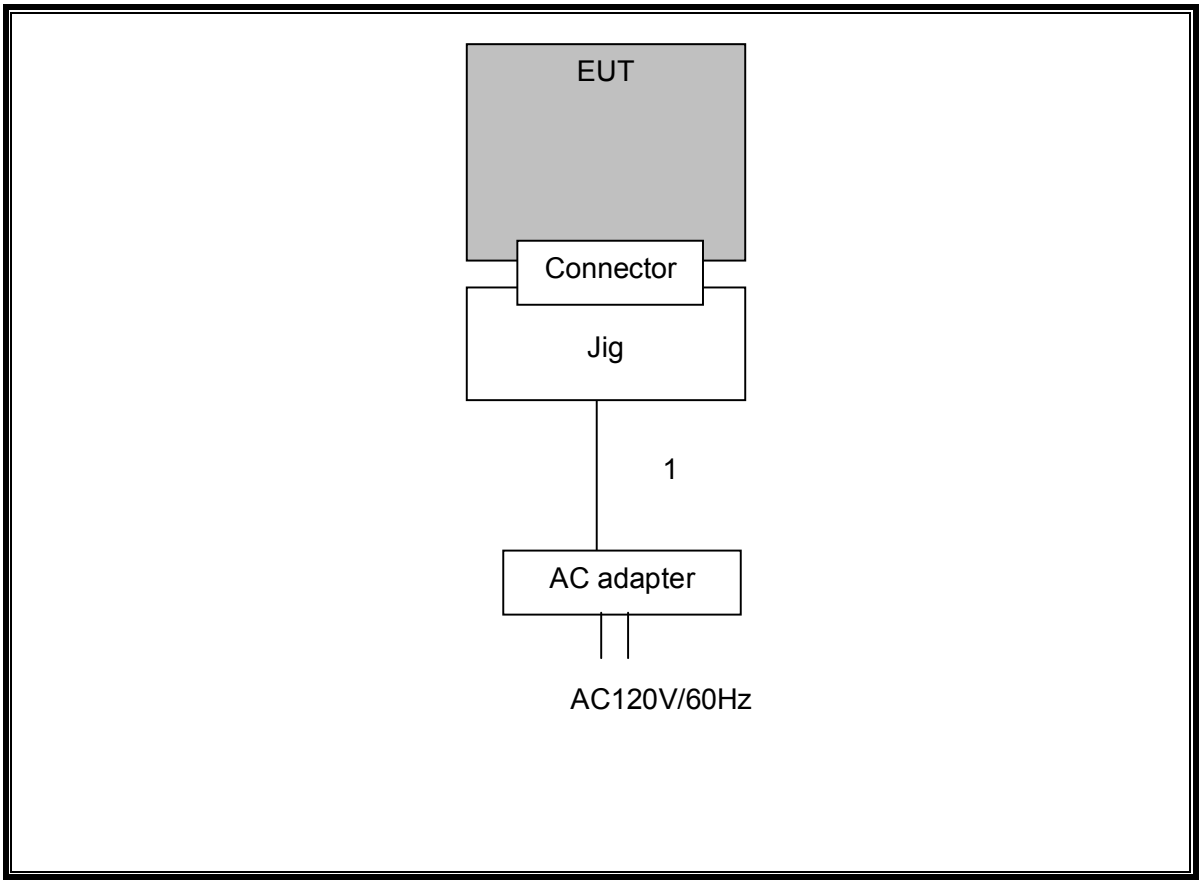
PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
Jig	SMK	PC0078	-

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	1.0m	N/A

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

SETUP DIAGRAM FOR RADIATED TESTS



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

6. TEST AND MEASUREMENT EQUIPMENT

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

Test and Measurement Equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAEC-03 (NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2013/07/09 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2013/07/22 * 12
SCC-G03	Coaxial Cable	Suhner	SUCOFLEX 104A	46499/4A	RE	2013/04/11 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2013/05/22 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2013/08/19 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2013/02/27 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2013/03/04 * 12
SJM-11	Measure	PROMART	SEN1935	-	RE, CE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV (RE,CE,RFI,MF)	-	RE, CE	-
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2013/11/22 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2013/11/22 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2013/03/14 * 12
SCC-G18	Coaxial Cable	Suhner	SUCOFLEX 104A	46292/4A	RE	2013/03/16 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2013/03/19 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2013/02/12 * 12
SAT6-06	Attenuator	JFW	50HF-006N	-	RE	2013/02/12 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2013/10/26 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	2013/04/03 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2013/10/26 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE, CE	2013/02/27 * 12
SCC-C9/C10/SRSE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-271(RF Selector)	CE	2013/04/03 * 12
SLS-02	LISN	Rohde & Schwarz	ENV216	100512	CE	2013/02/21 * 12
SAT3-06	Attenuator	JFW	50HF-003N	-	CE	2013/02/12 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2013/03/07 * 12
KPM-08	Power meter	Anritsu	ML2495A	6K00003356	AT	2013/09/04 * 12
KPSS-04	Power sensor	Anritsu	MA2411B	012088	AT	2013/09/04 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2013/01/08 * 12
SAT10-09	Attenuator	Weinschel Corp.	54A-10	W5692	AT	2013/11/27 * 12
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2013/03/16 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2013/03/07 * 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

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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

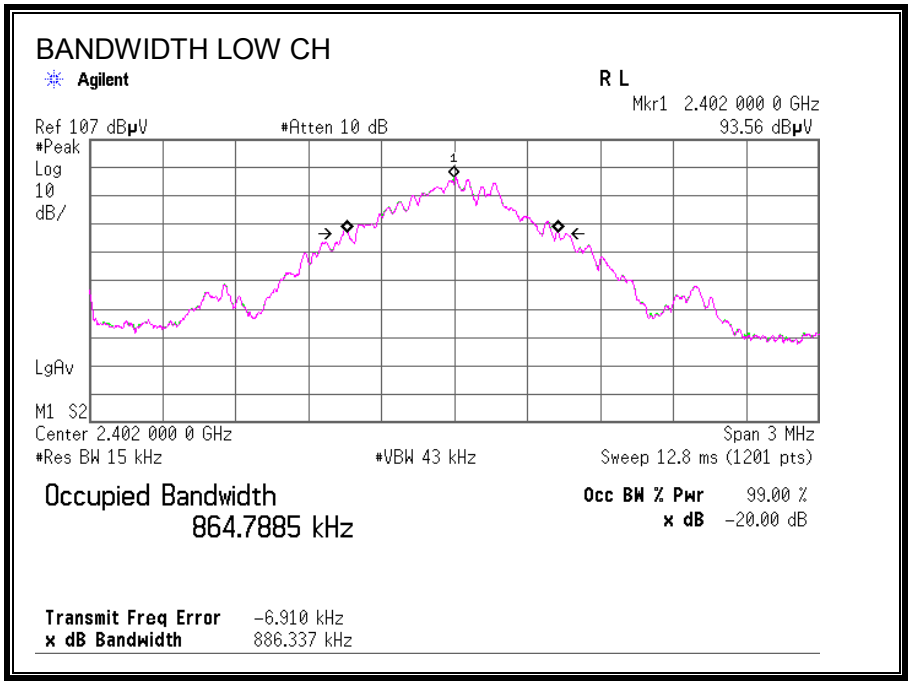
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

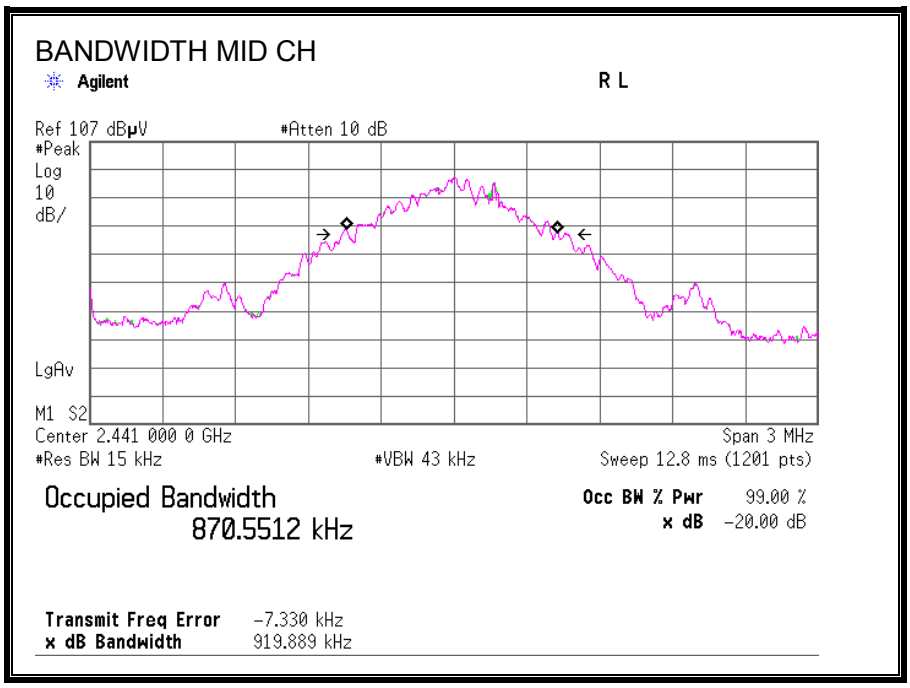
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	886.337	897.447
Middle	2441	919.889	901.267
High	2480	921.321	900.910

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

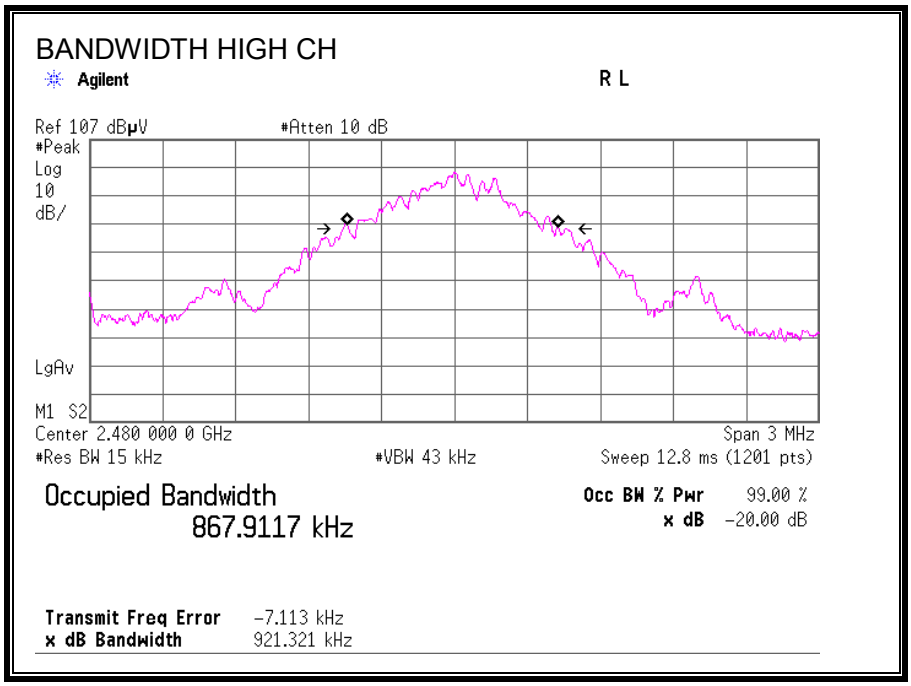
20 dB BANDWIDTH



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

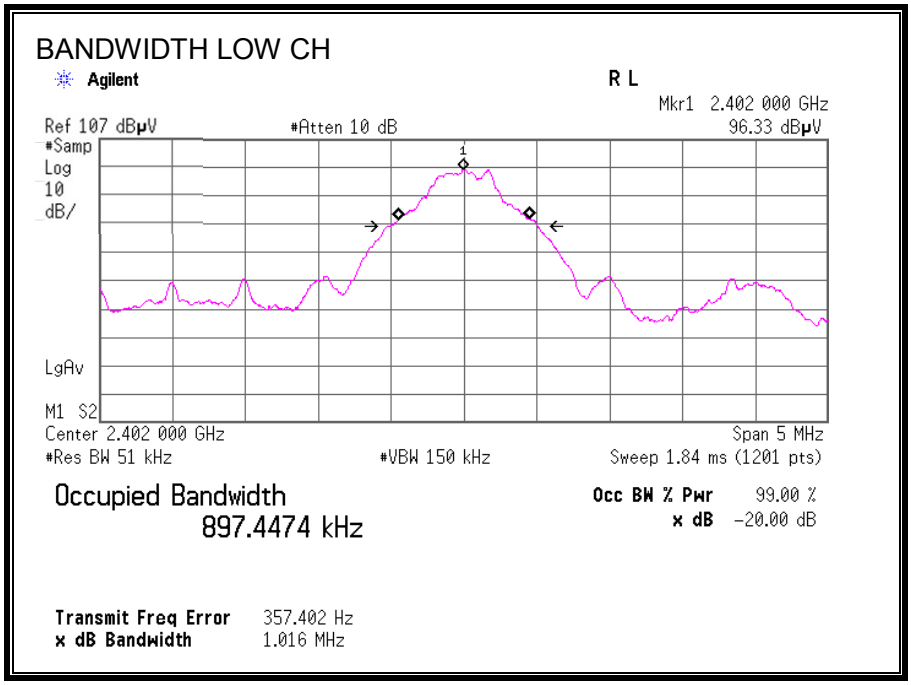


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

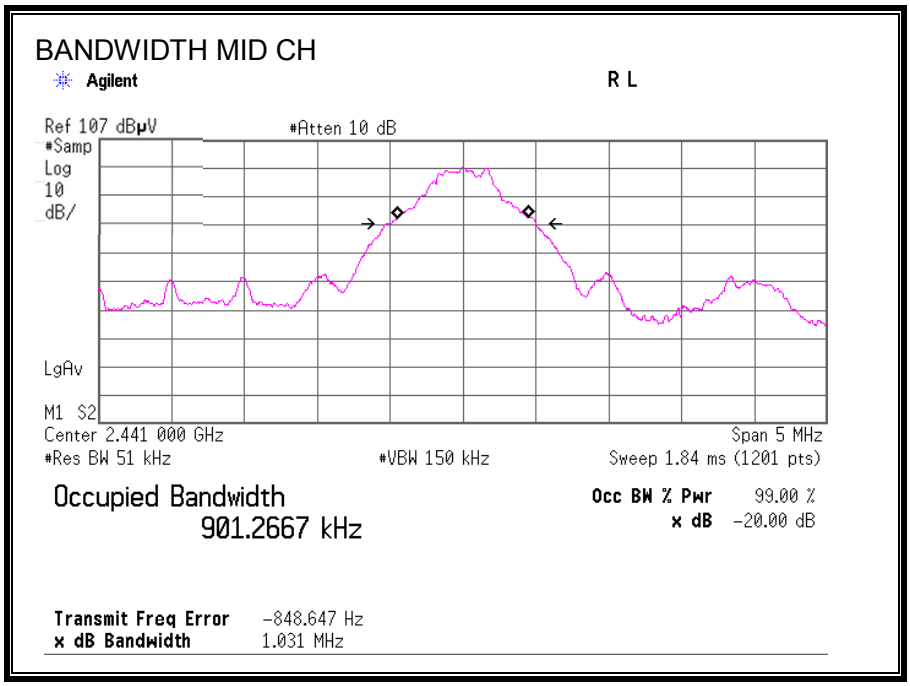


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

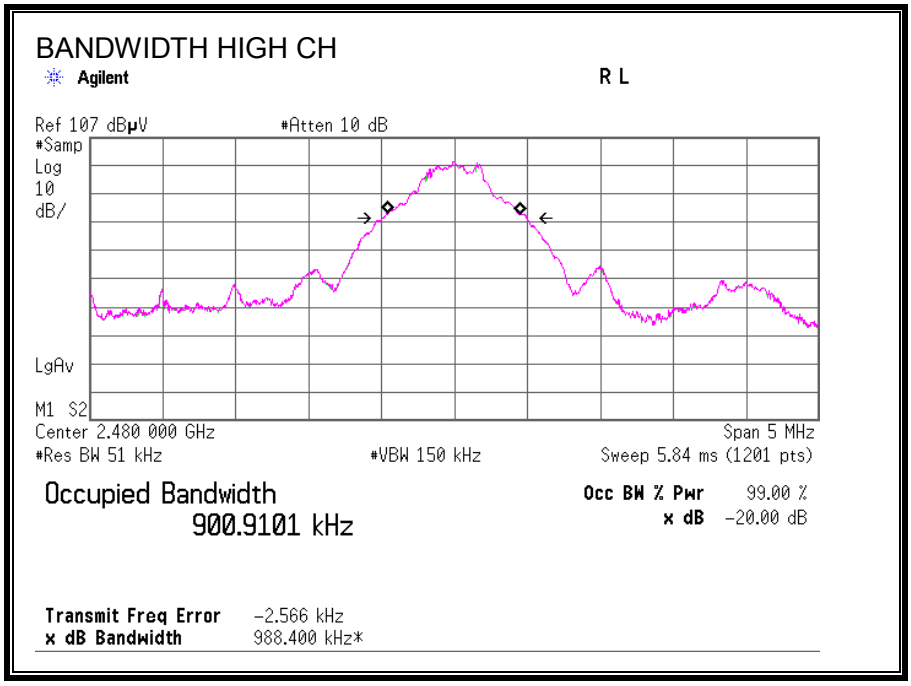
99% BANDWIDTH



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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 hoping 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.

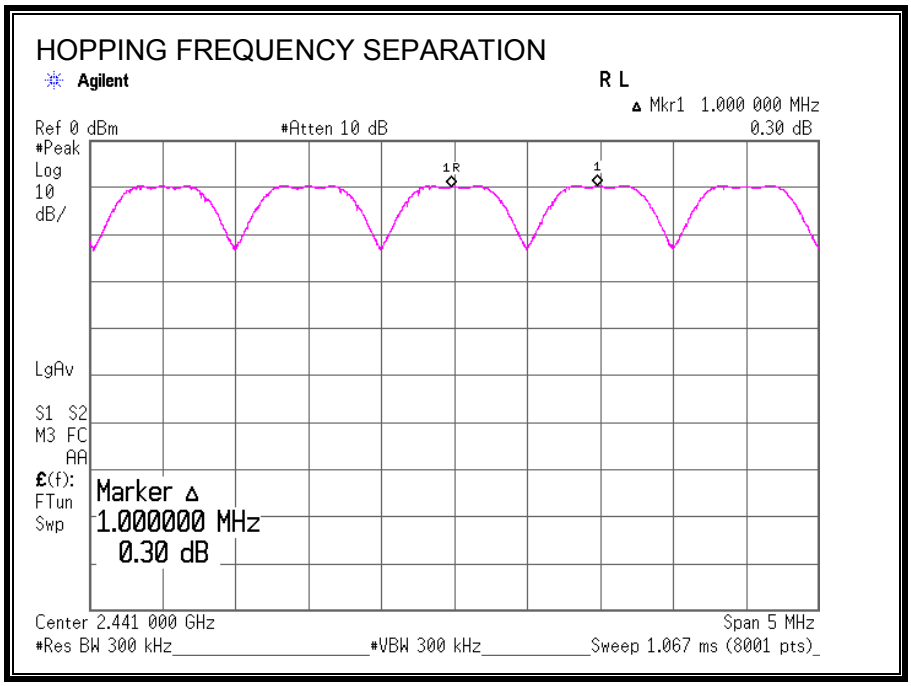
RESULTS

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

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

RESULTS

HOPPING FREQUENCY SEPARATION



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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.

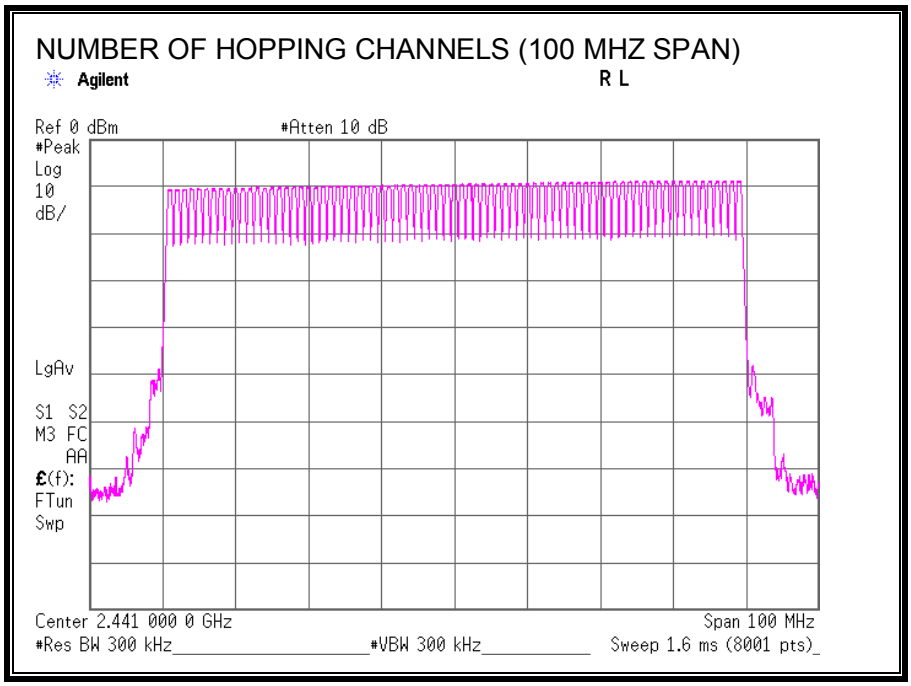
Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification 2.0.

RESULTS

79 Channels observed.

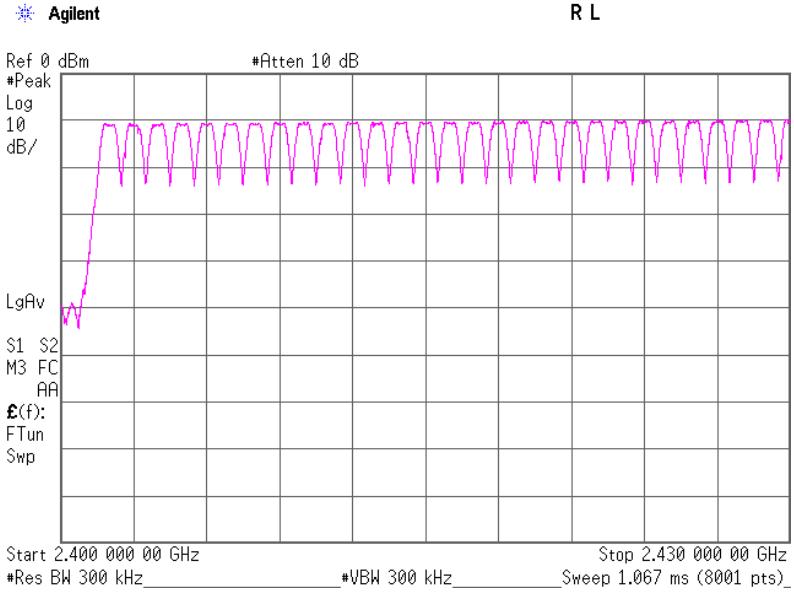
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

NUMBER OF HOPPING CHANNELS



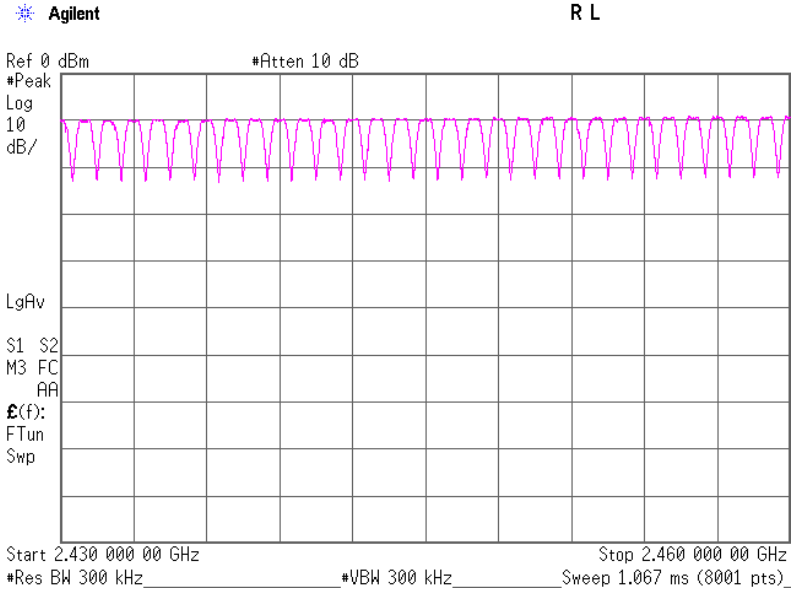
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



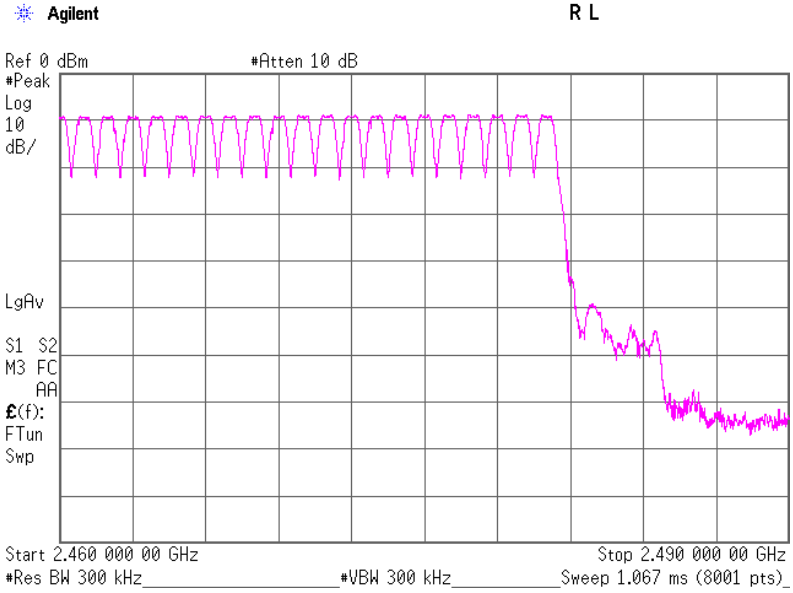
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, THIRD SEGMENT)



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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 * (# of pulses in 3.16 s) * 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 x 0.4s, where N is the number of channels being used in the hopping sequence (20 ≥ N ≤ 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

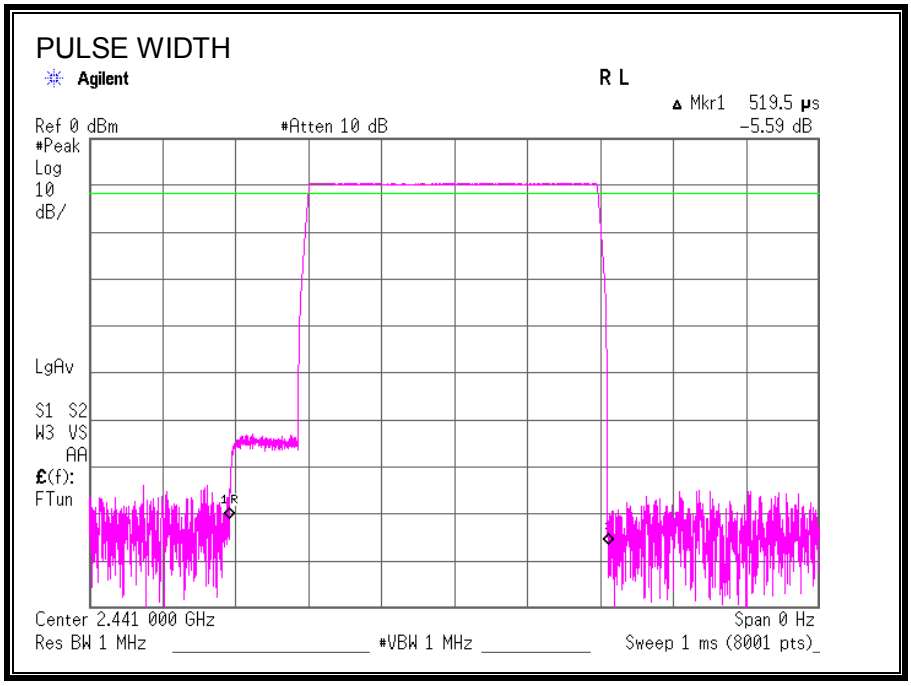
Time of Occupancy = 10 * xx pulses * yy msec = zz msec

GFSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.5195	32	0.1662	0.4	0.2338
DH3	1.7740	16	0.2838	0.4	0.1162
DH5	3.0280	11	0.3331	0.4	0.0669

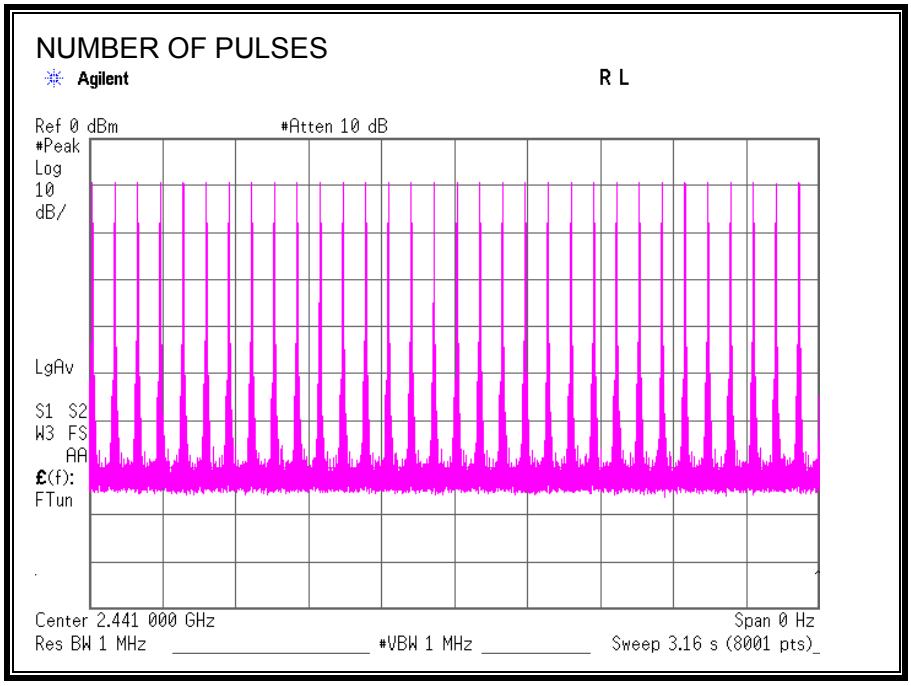
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

DH1 PULSE WIDTH



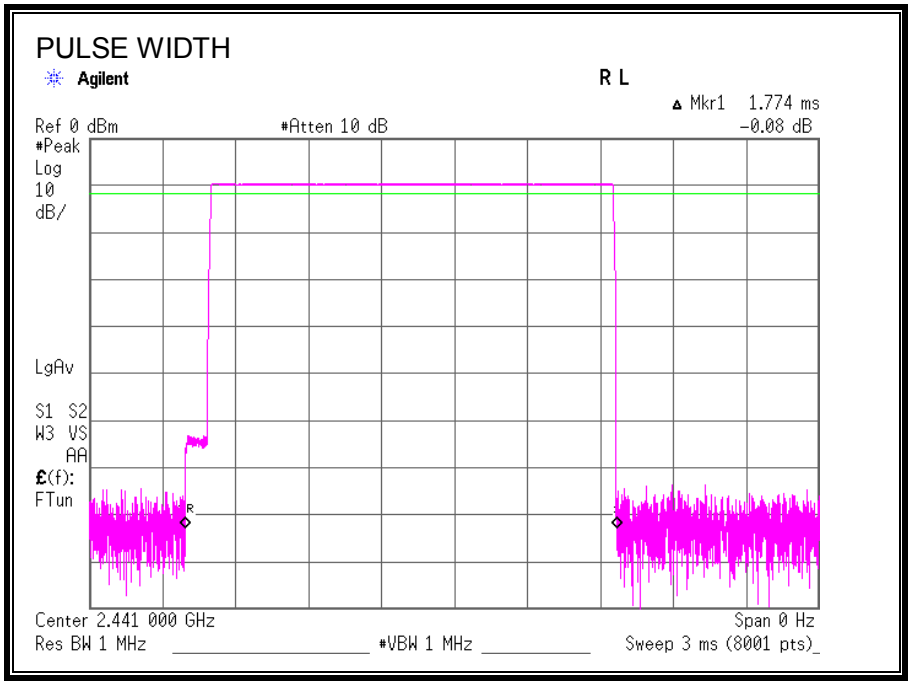
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

DH1 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



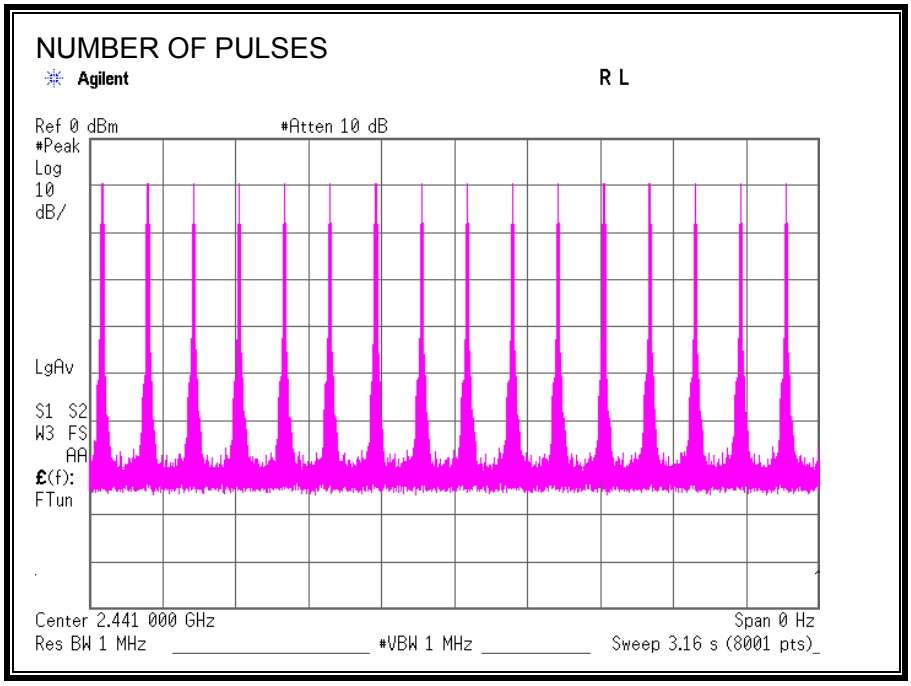
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

DH3 PULSE WIDTH



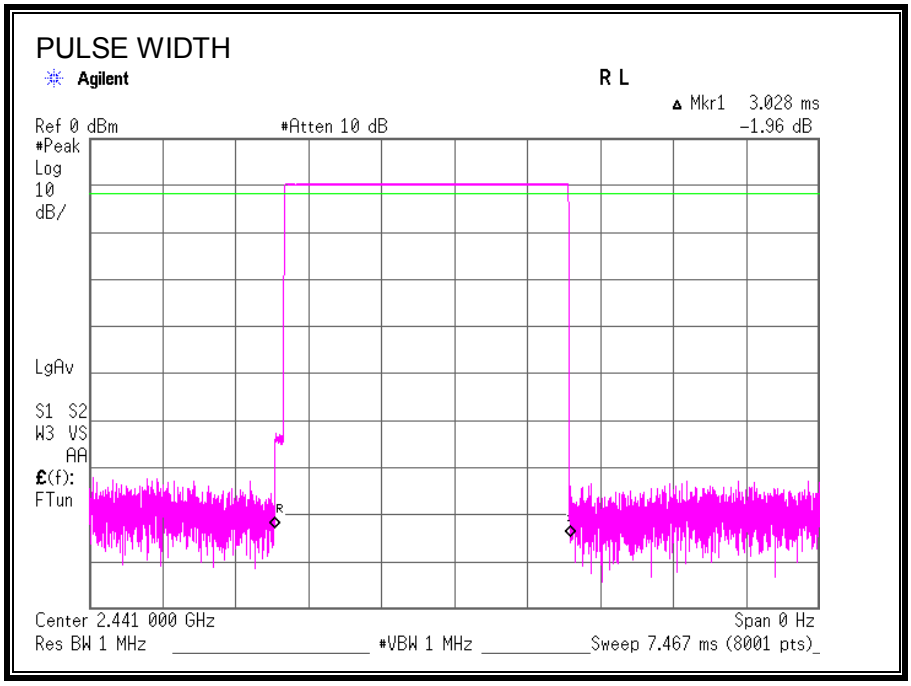
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

DH3 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



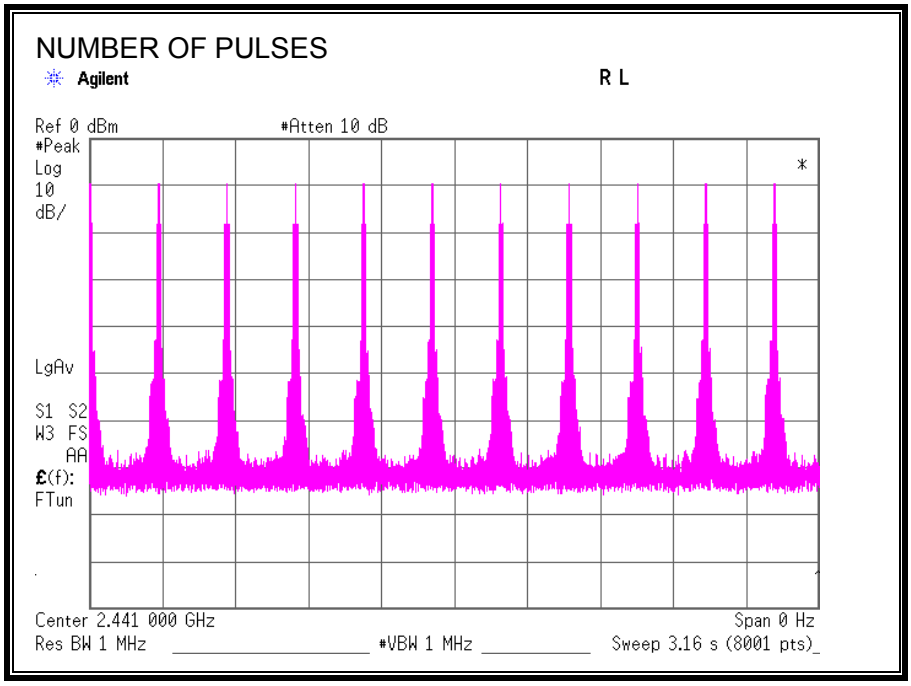
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

DH5 PULSE WIDTH



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

DH5 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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	-10.45	11.43	0.98	20.96	19.98
Middle	2441	-9.35	11.45	2.10	20.96	18.86
High	2480	-8.65	11.46	2.81	20.96	18.15

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.

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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 11.43 – 11.46 dB (including 9.65 - 9.66 dB pad and 1.78 - 1.80 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	-0.30
Middle	2441	0.87
High	2480	1.61

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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)

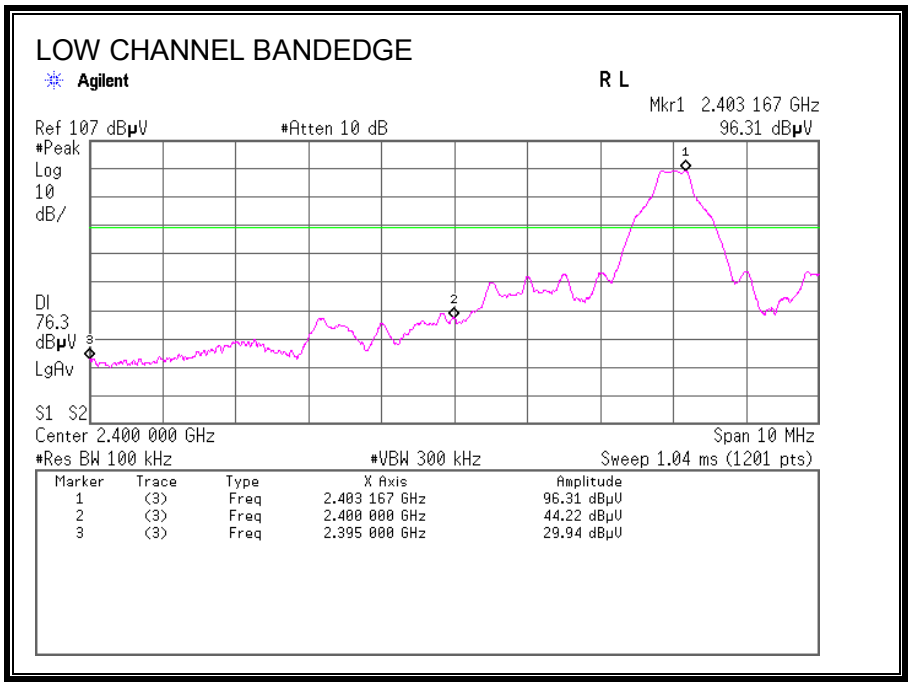
The spectrum from 9 kHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

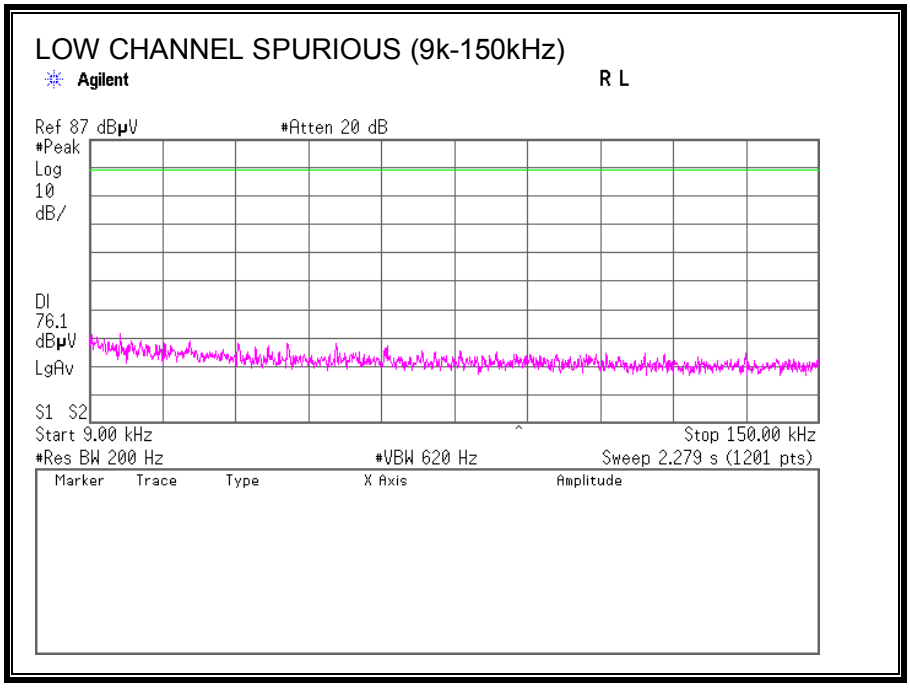
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

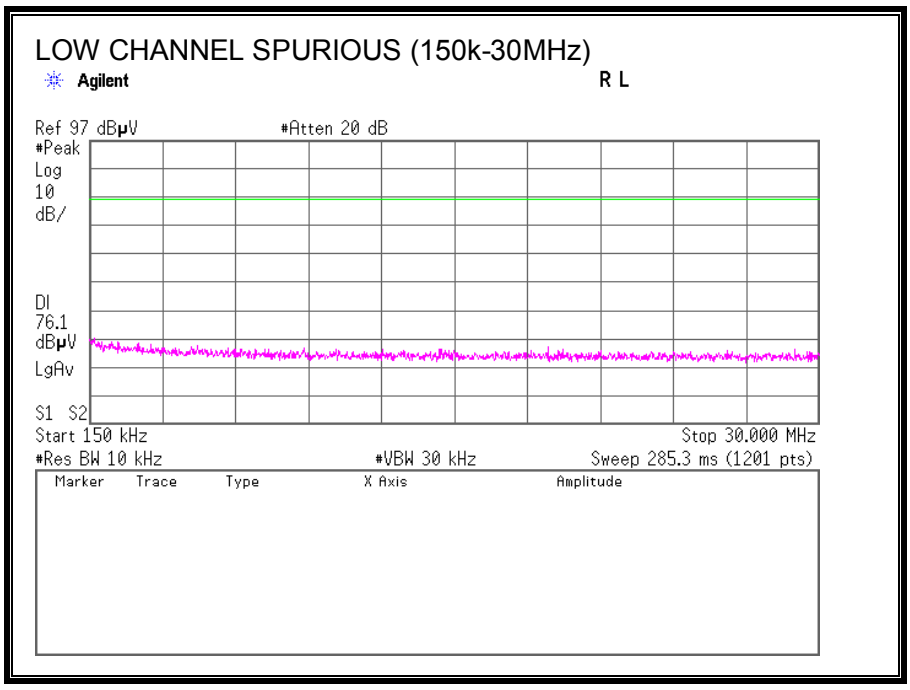
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



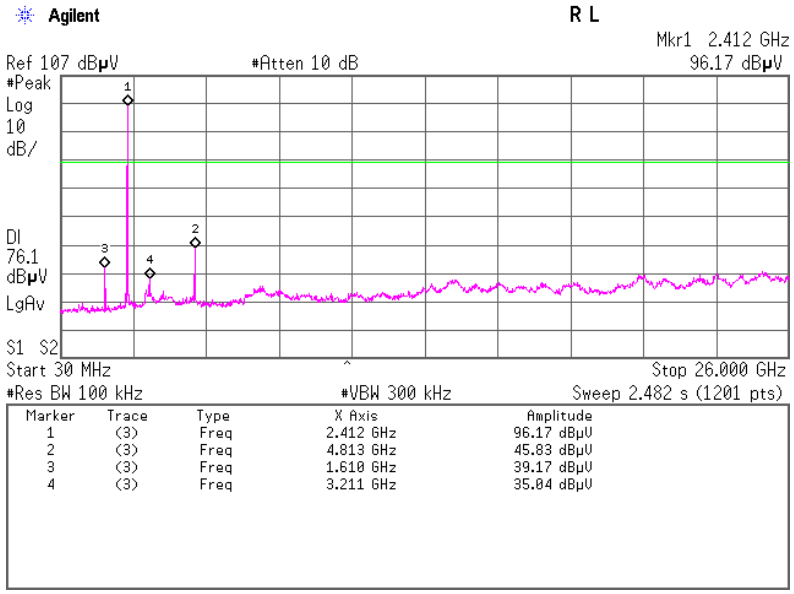
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401





UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

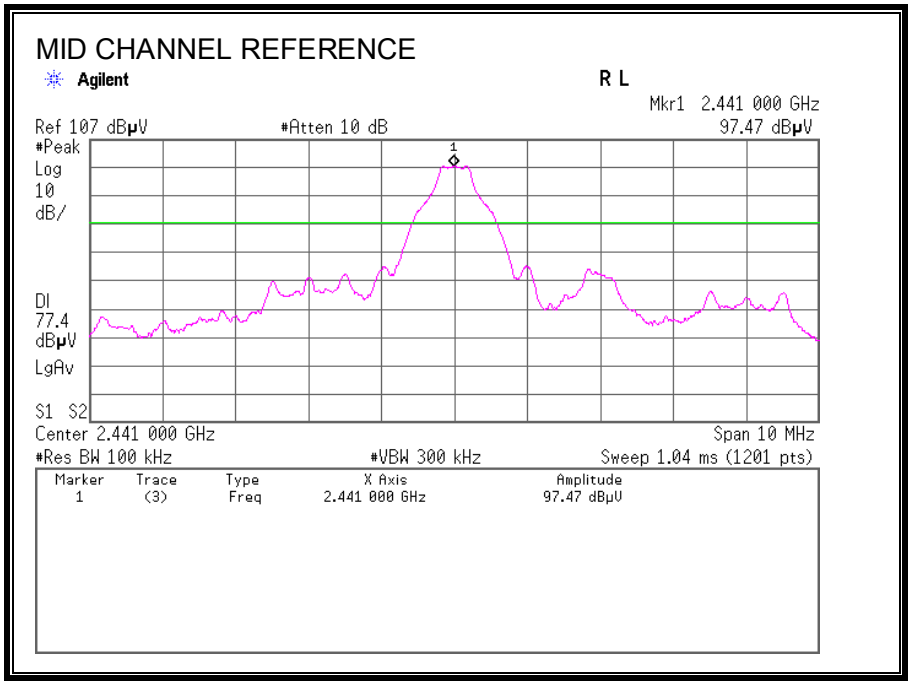
LOW CHANNEL SPURIOUS



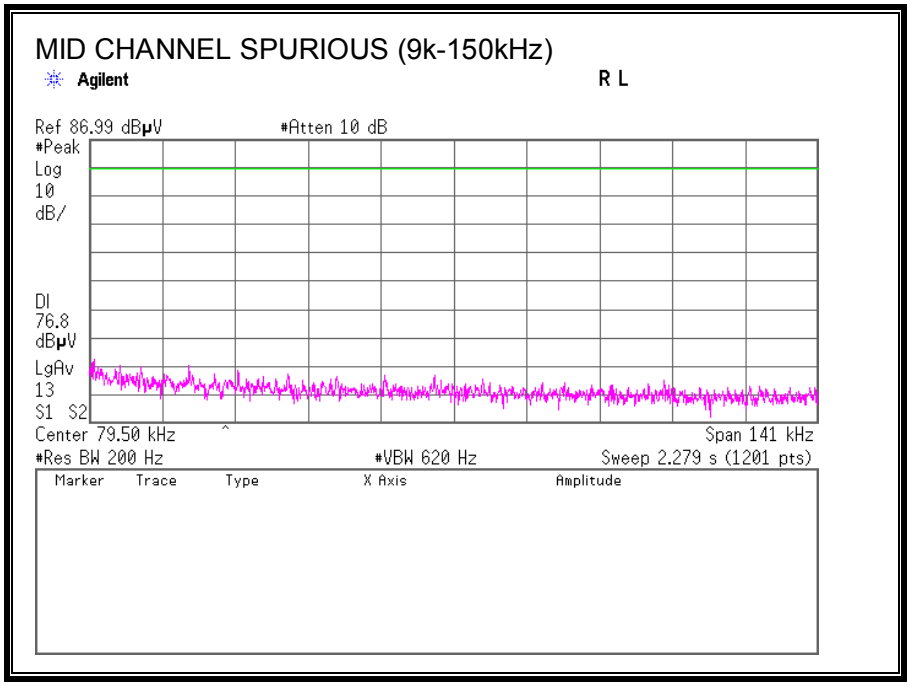
Marker	Trace	Type	X Axis	Amplitude
1	(3)	Freq	2.412 GHz	96.17 dBµV
2	(3)	Freq	4.813 GHz	45.83 dBµV
3	(3)	Freq	1.610 GHz	39.17 dBµV
4	(3)	Freq	3.211 GHz	35.04 dBµV

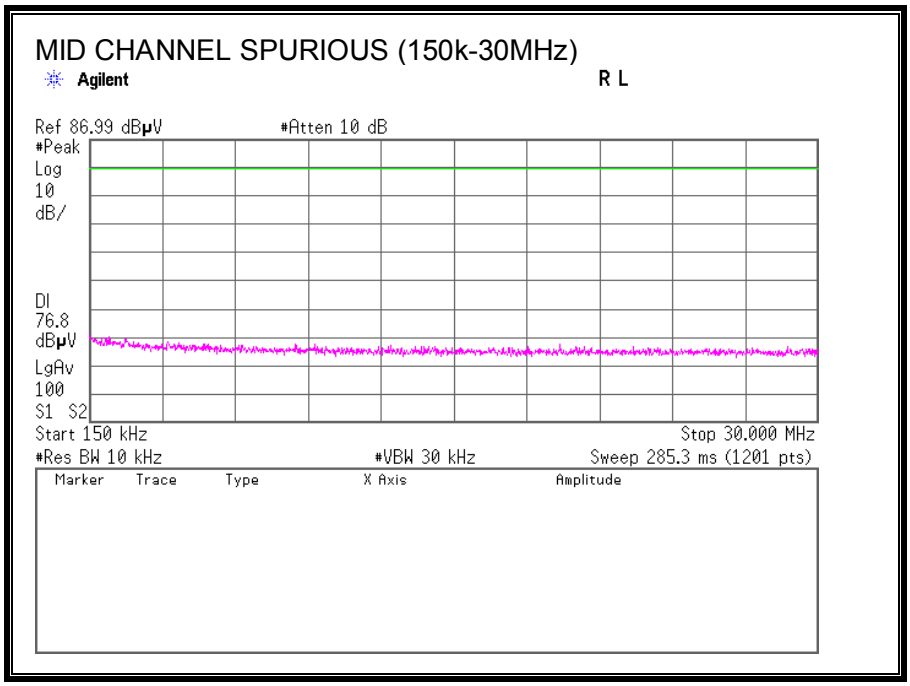
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

SPURIOUS EMISSIONS, MID CHANNEL

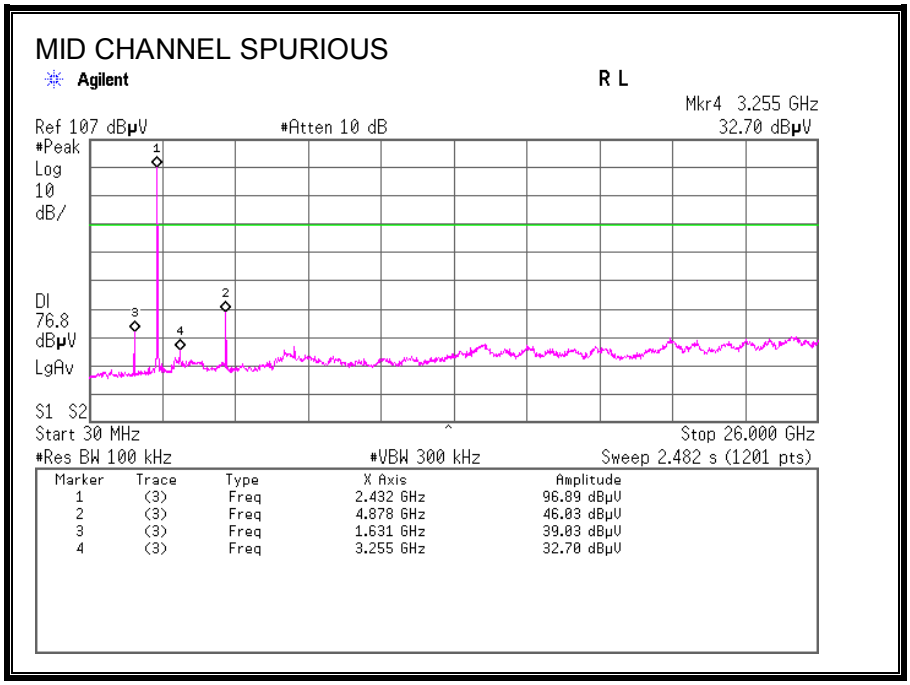


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401



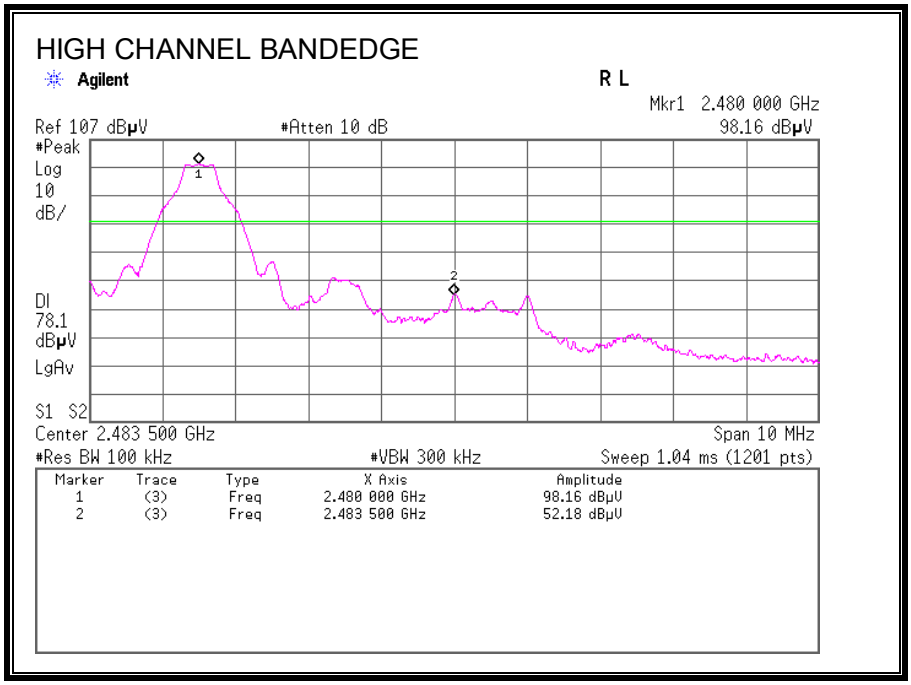


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

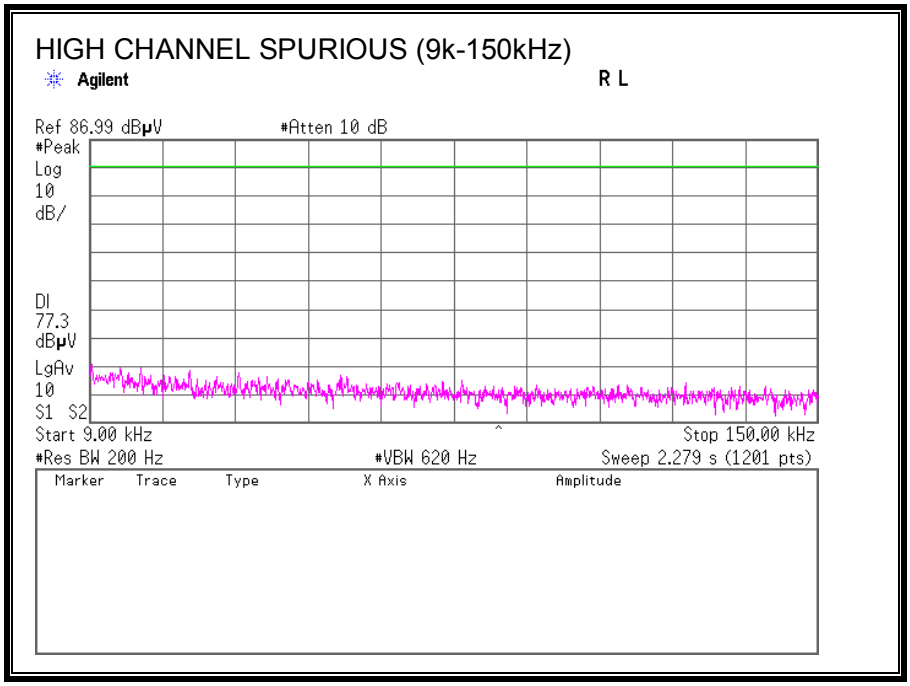


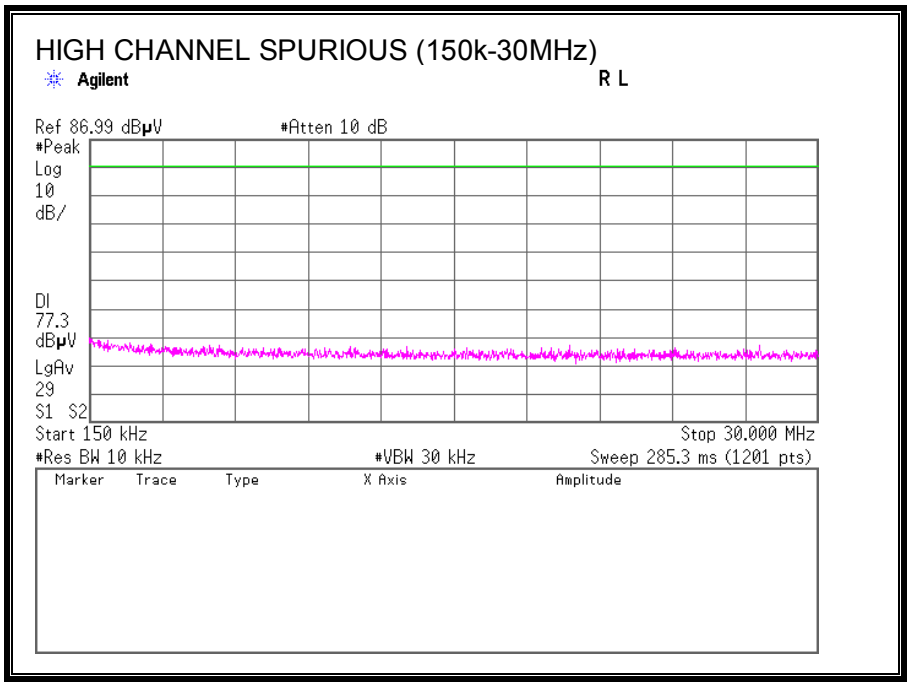
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

SPURIOUS EMISSIONS, HIGH CHANNEL



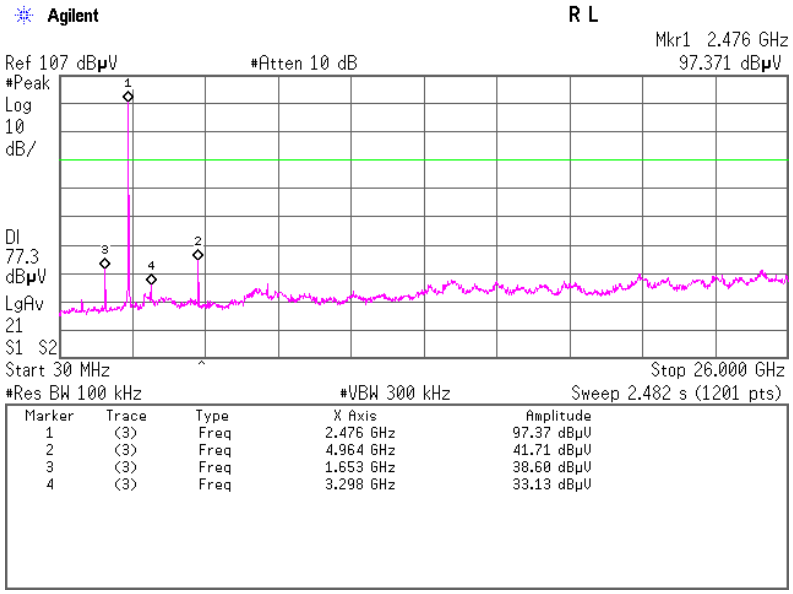
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401





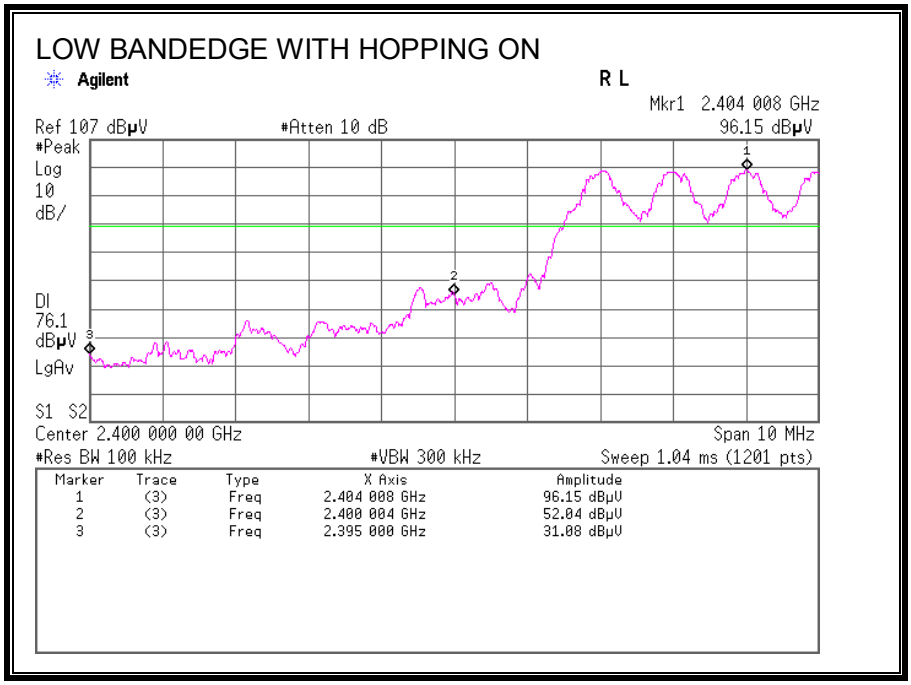
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HIGH CHANNEL SPURIOUS



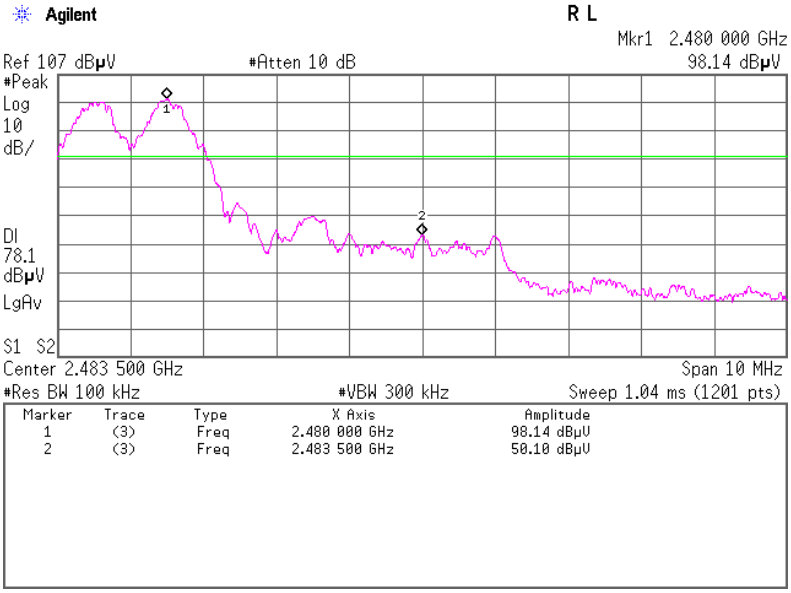
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HIGH BANDEDGE WITH HOPPING ON



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

7.2. ENHANCED DATA RATE 8PSK MODULATION

7.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

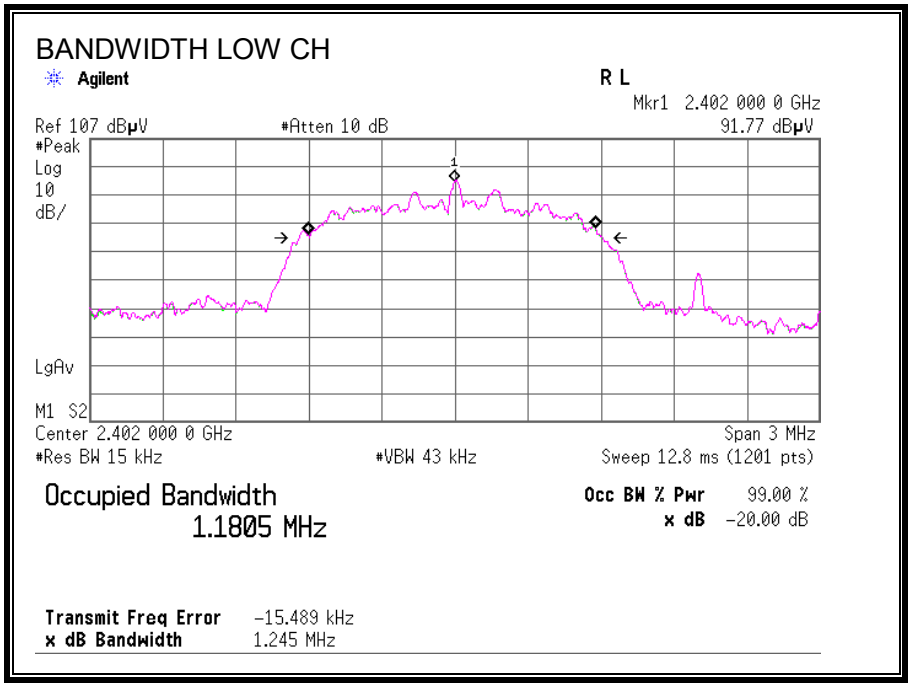
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

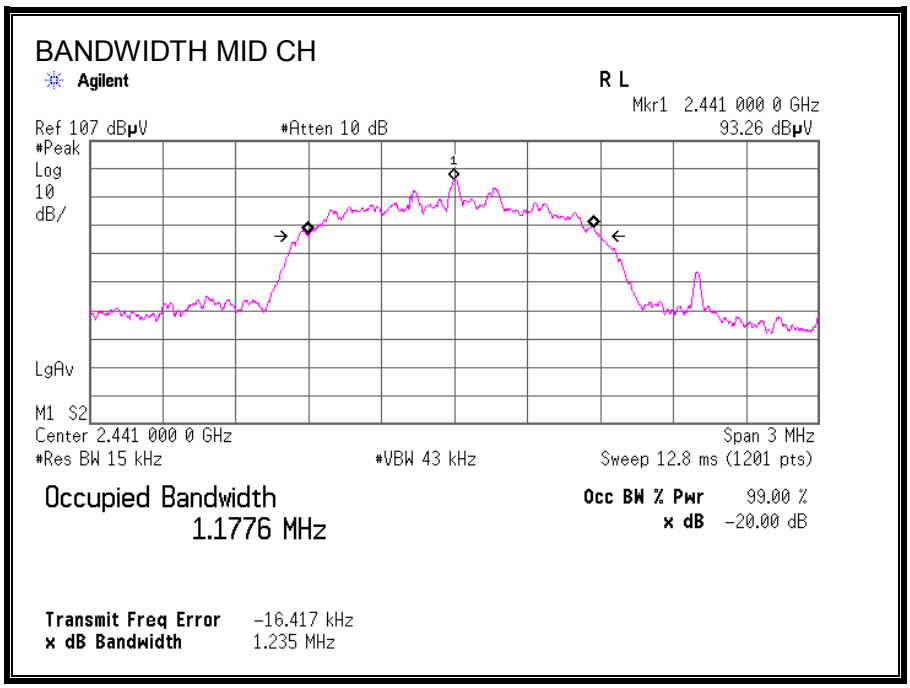
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1245.0	1176.8
Middle	2441	1235.0	1169.5
High	2480	1235.0	1166.9

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

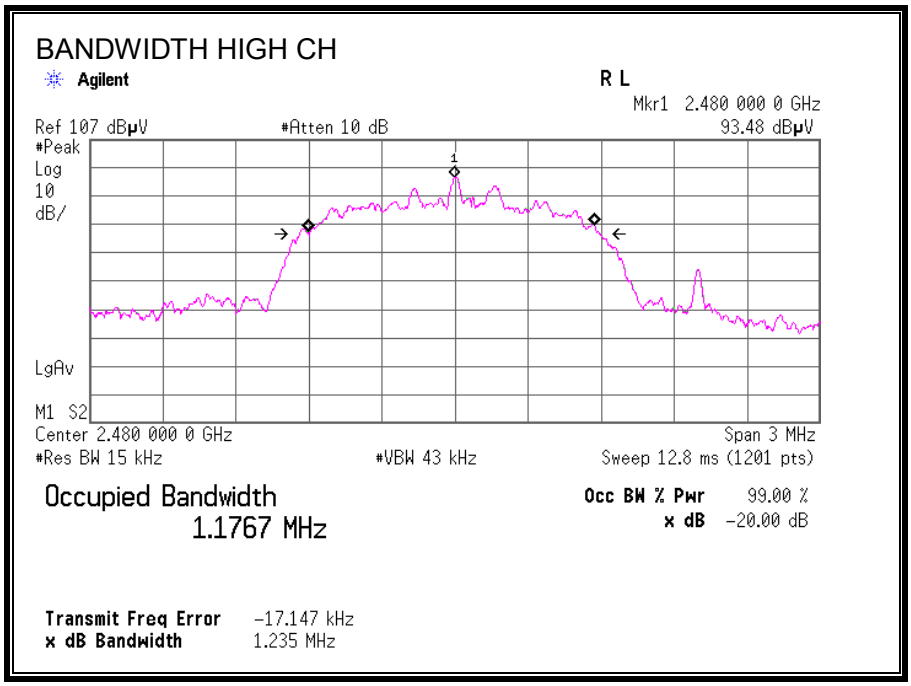
20 dB BANDWIDTH



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

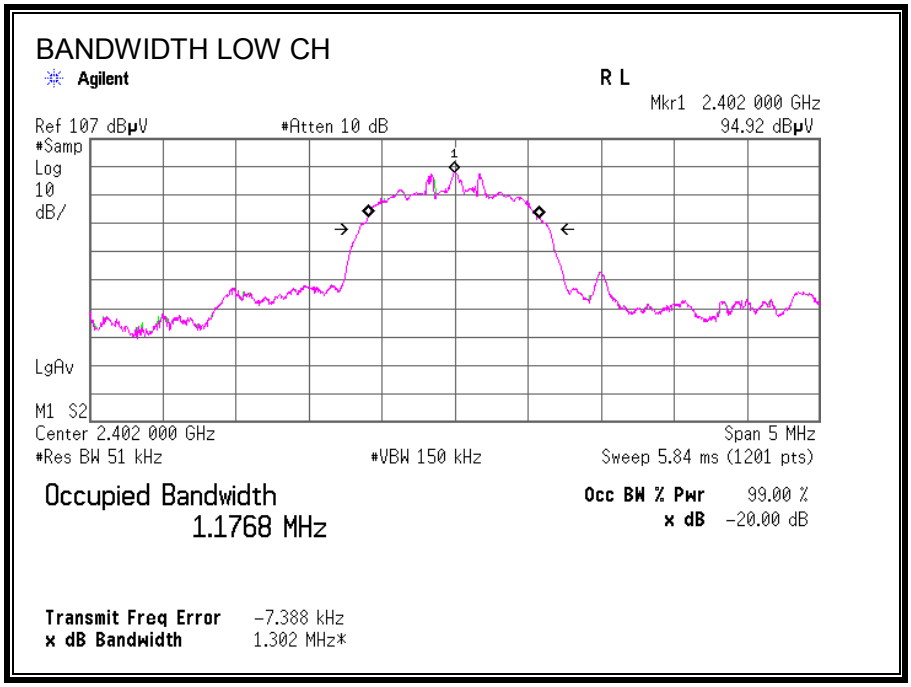


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

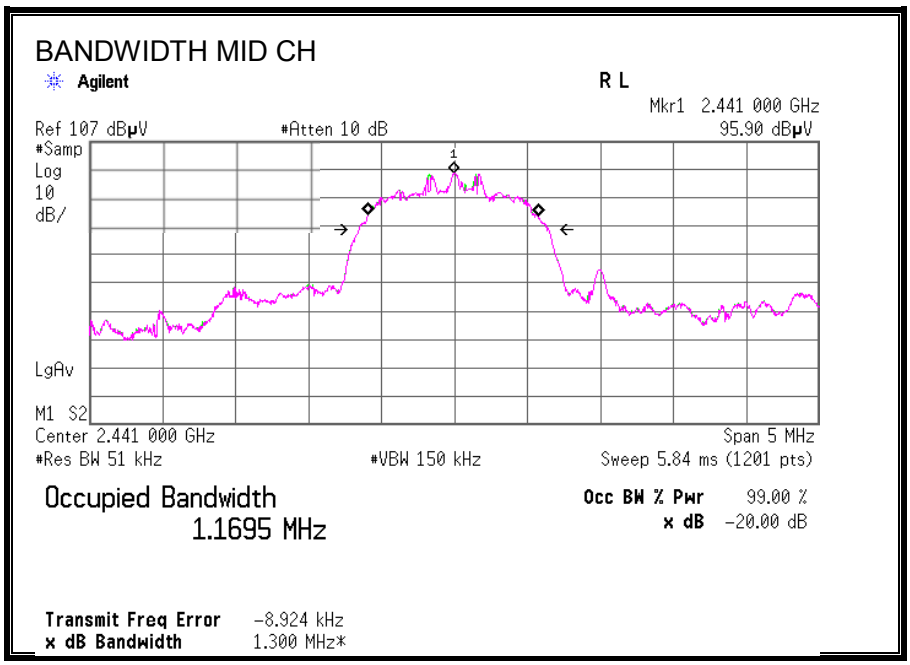


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

99% BANDWIDTH

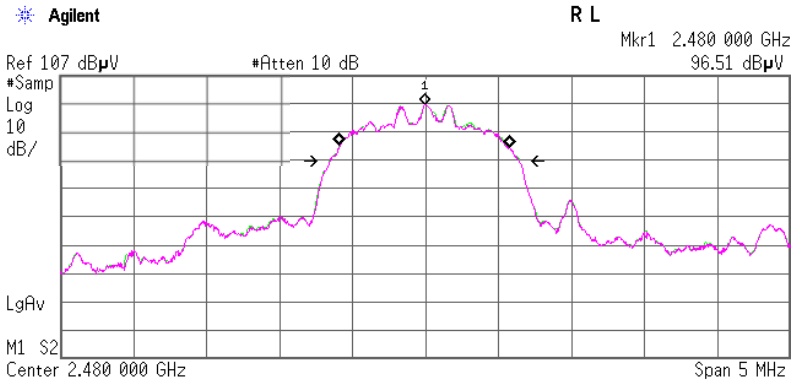


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

BANDWIDTH HIGH CH



Occupied Bandwidth
1.1669 MHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error -6.686 kHz
x dB Bandwidth 1.304 MHz*

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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 hoping 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.

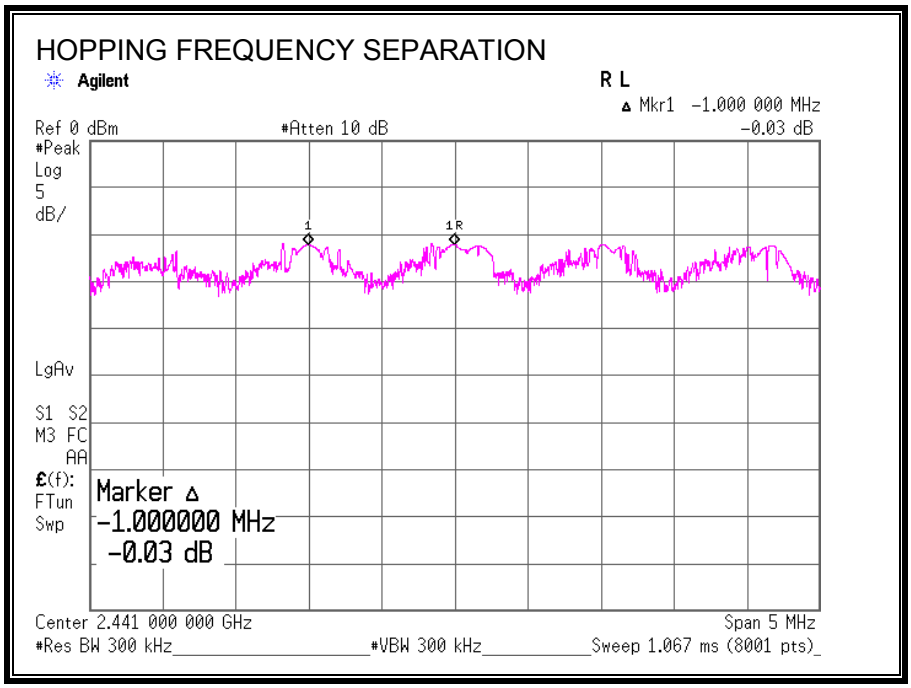
RESULTS

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

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

RESULTS

HOPPING FREQUENCY SEPARATION



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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.

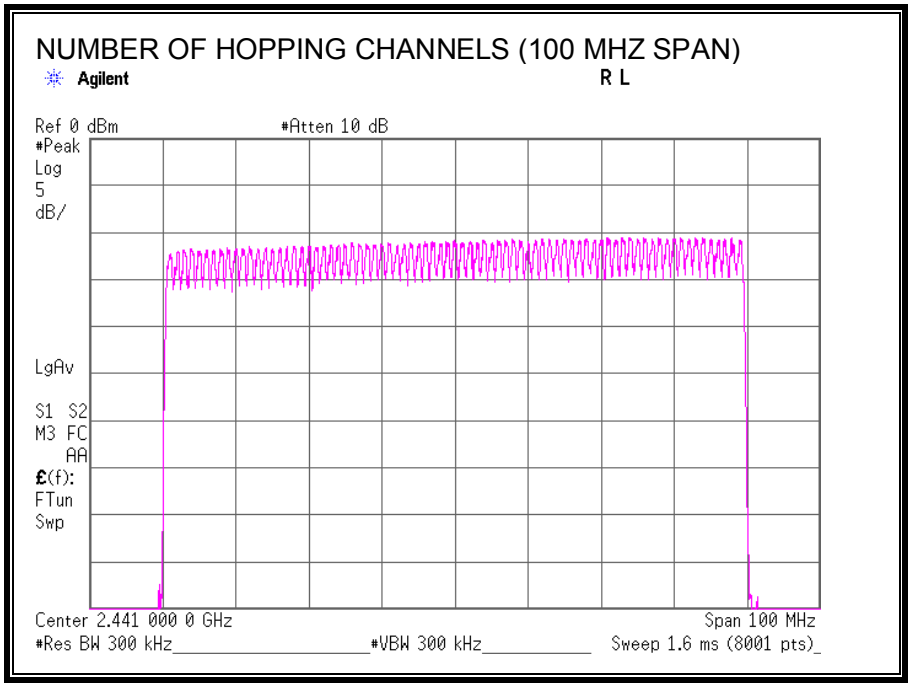
Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification 2.0.

RESULTS

79 Channels observed.

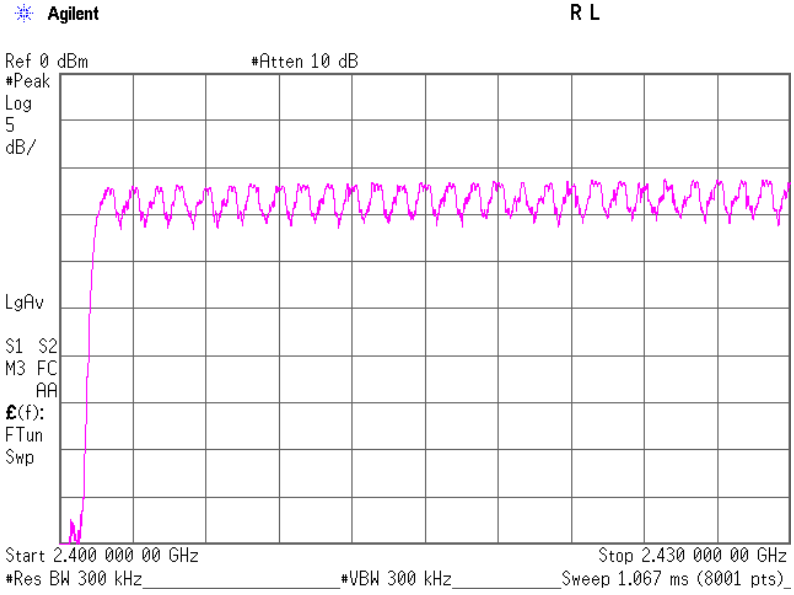
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

NUMBER OF HOPPING CHANNELS



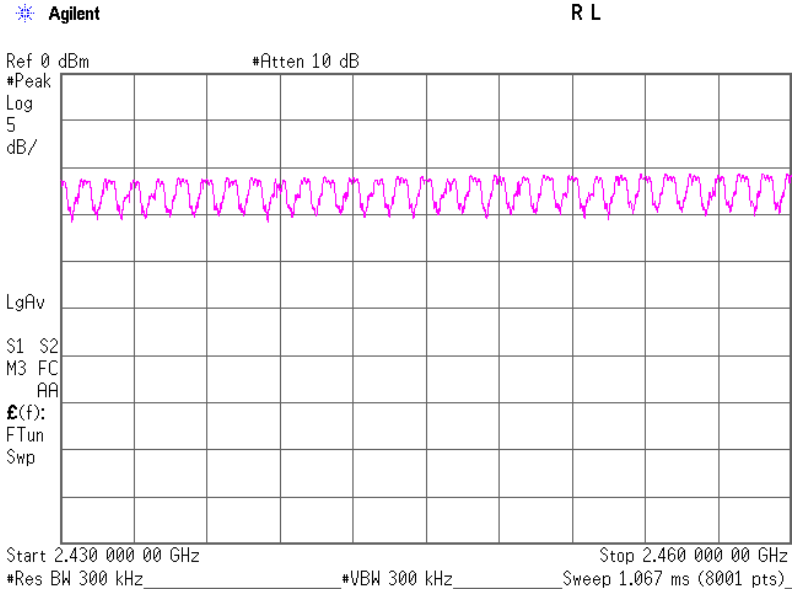
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



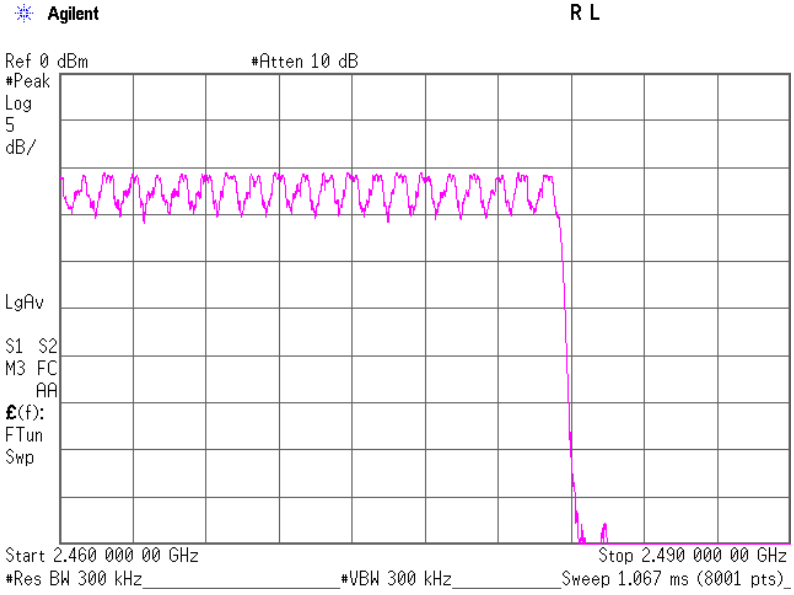
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, THIRD SEGMENT)



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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 * (# of pulses in 3.16 s) * 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 x 0.4s, where N is the number of channels being used in the hopping sequence (20 ≥ N ≤ 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

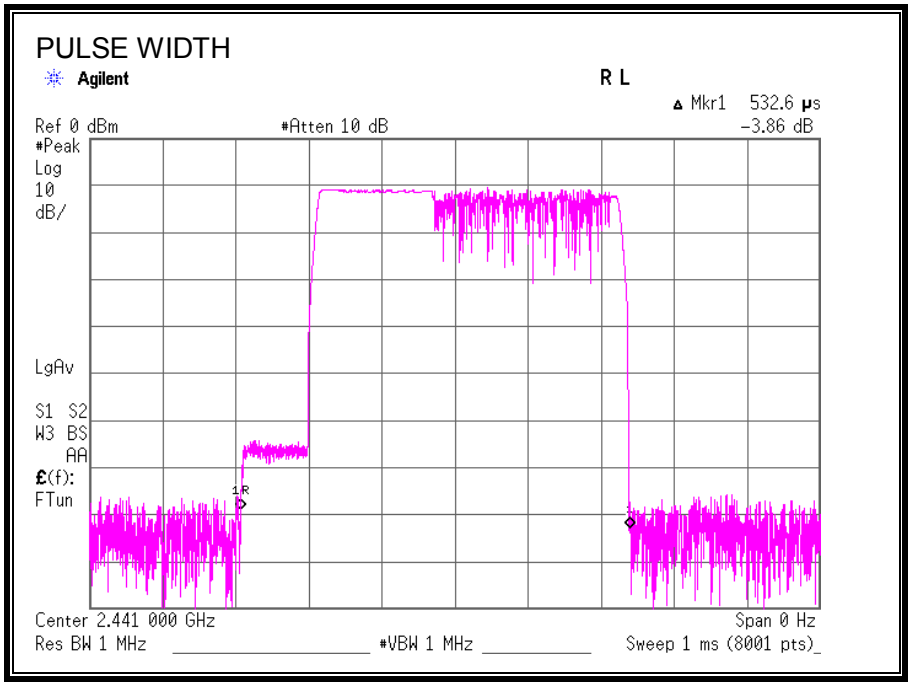
Time of Occupancy = 10 * xx pulses * yy msec = zz msec

8PSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
3-DH1	0.5326	32	0.1704	0.4	0.2296
3-DH3	1.7840	16	0.2854	0.4	0.1146
3-DH5	3.0340	11	0.3337	0.4	0.0663

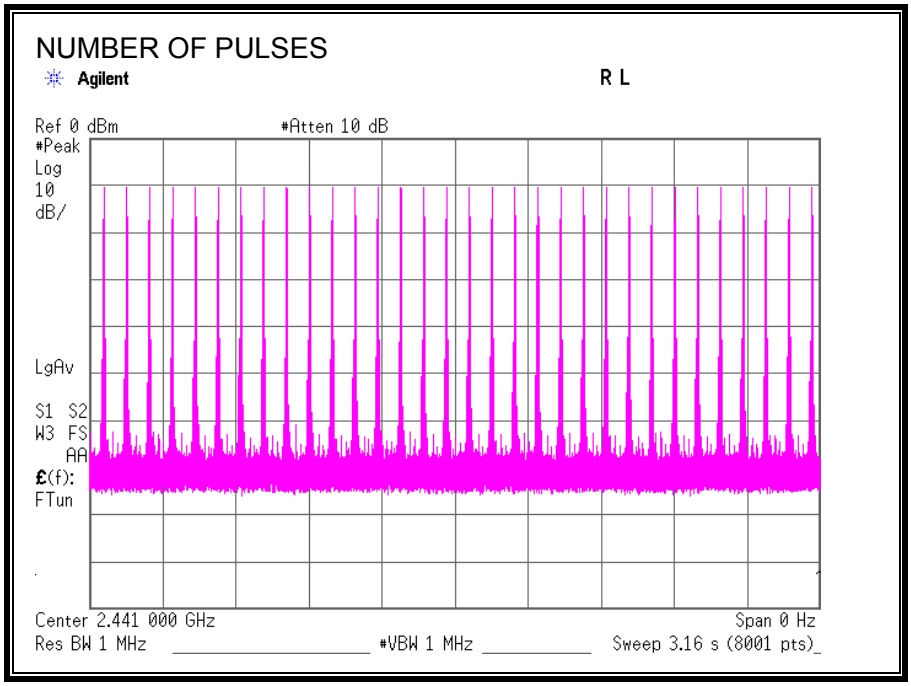
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

3-DH1 PULSE WIDTH



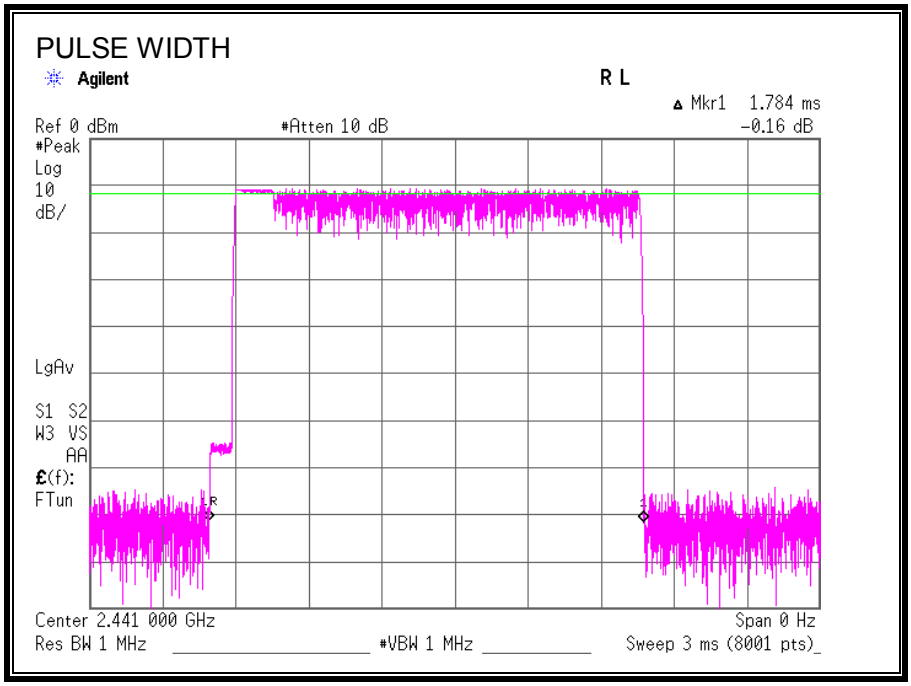
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

3-DH1 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



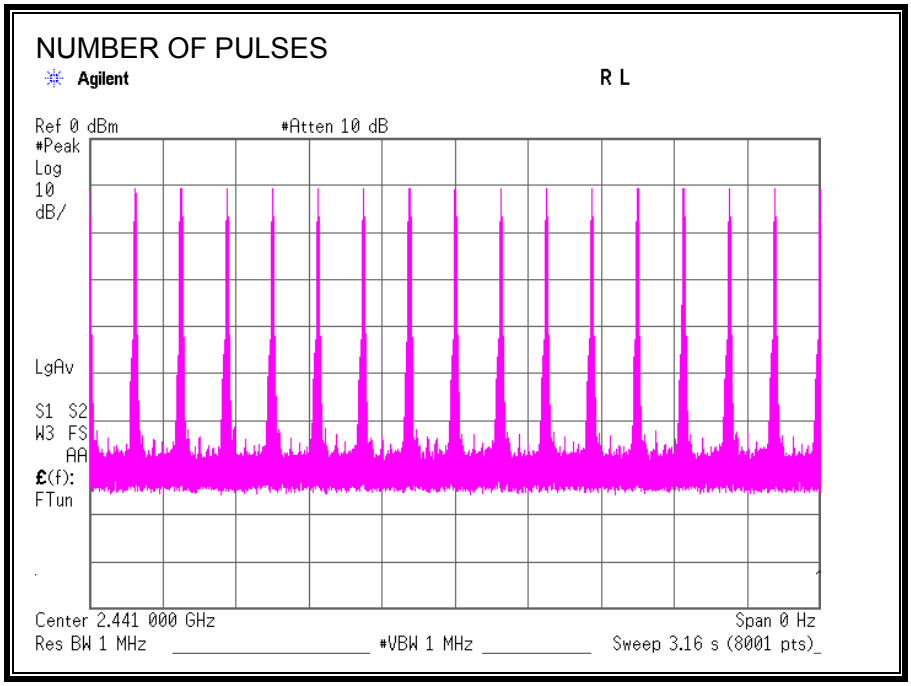
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

3-DH3 PULSE WIDTH



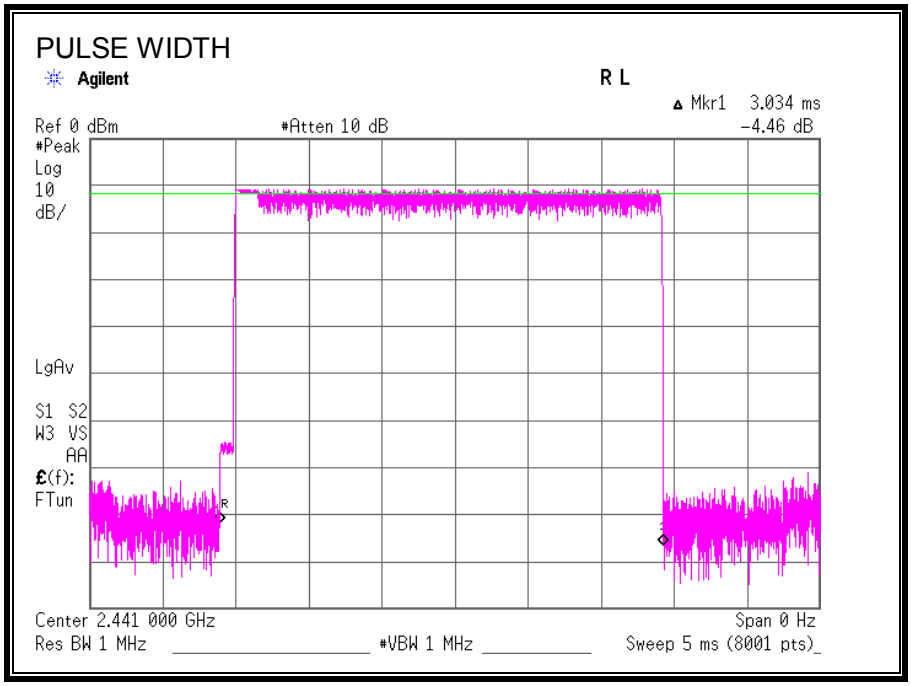
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

3-DH3 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



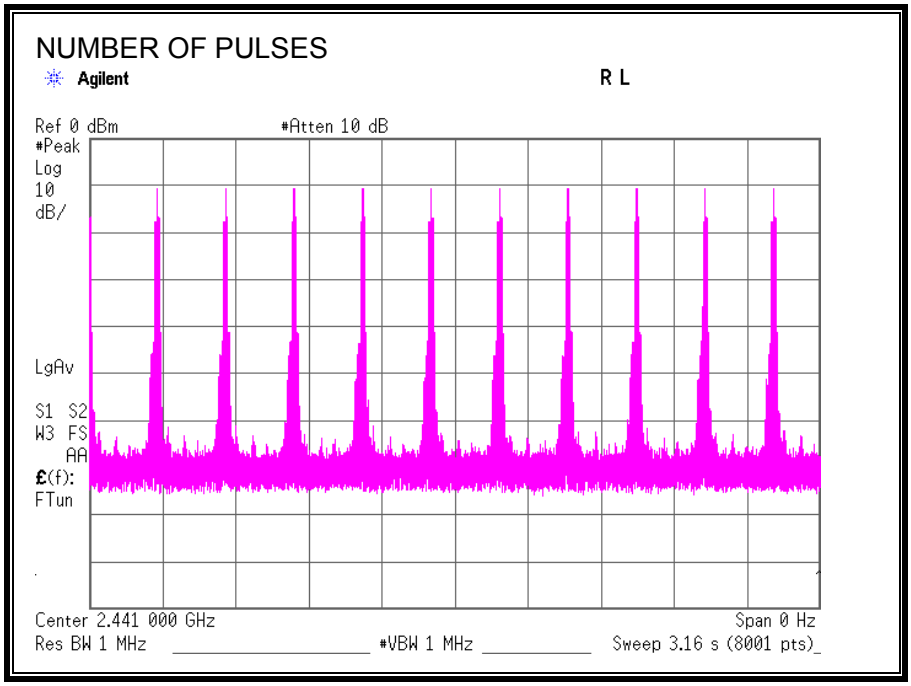
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

3-DH5 PULSE WIDTH



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

3-DH5 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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

8PSK (3-DH5)

Channel	Frequency (MHz)	Output Power Reading (dBm)	factor (cable ,ATT) (dB)	Output Power Result (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-10.55	11.43	0.88	20.96	20.08
Middle	2441	-9.61	11.45	1.84	20.96	19.12
High	2480	-9.26	11.46	2.20	20.96	18.76

pi/4DQPSK (2-DH5)

Channel	Frequency (MHz)	Output Power Reading (dBm)	factor (cable ,ATT) (dB)	Output Power Result (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-10.61	11.43	0.82	20.96	20.14
Middle	2441	-9.70	11.45	1.75	20.96	19.21
High	2480	-9.38	11.46	2.08	20.96	18.88

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.

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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 11.43 – 11.46 dB (including 9.65 - 9.66 dB pad and 1.78 - 1.80 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

8PSK (3-DH5)

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	-2.91
Middle	2441	-1.96
High	2480	-1.59

pi/4DQPSK (2-DH5)

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	-2.84
Middle	2441	-1.89
High	2480	-1.78

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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)

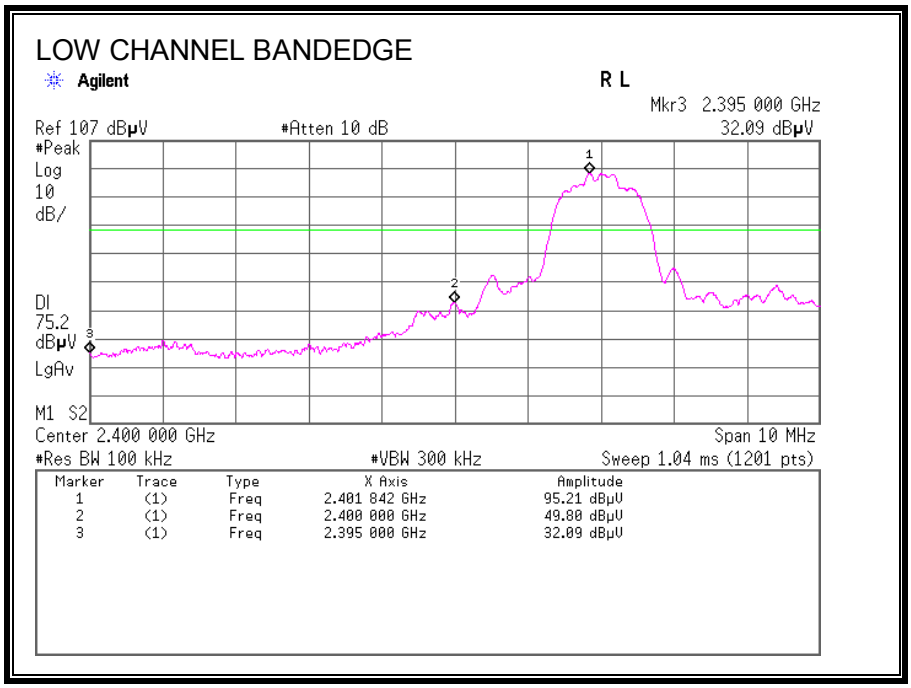
The spectrum from 9 kHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

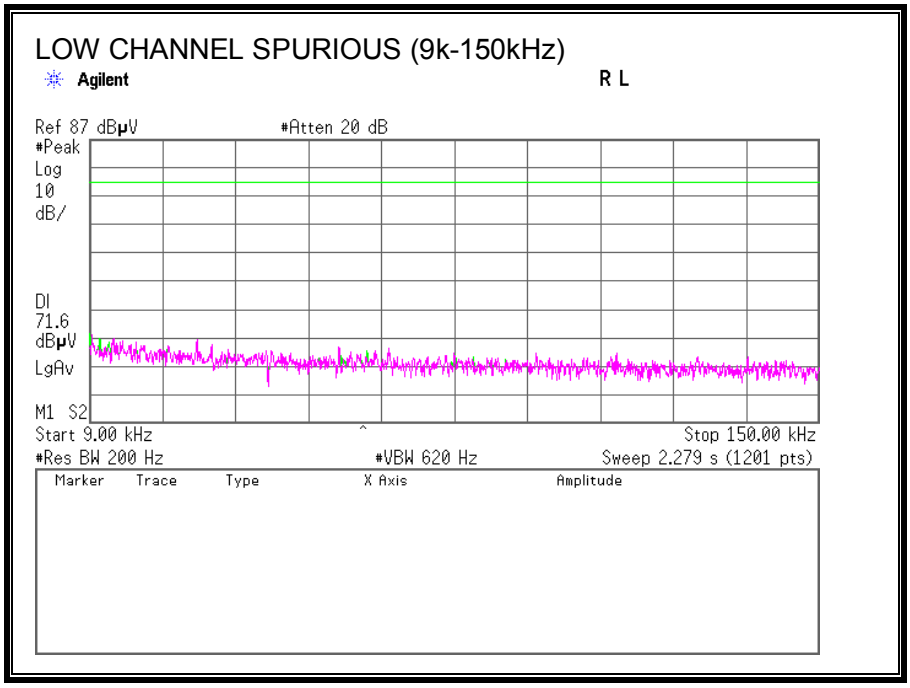
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

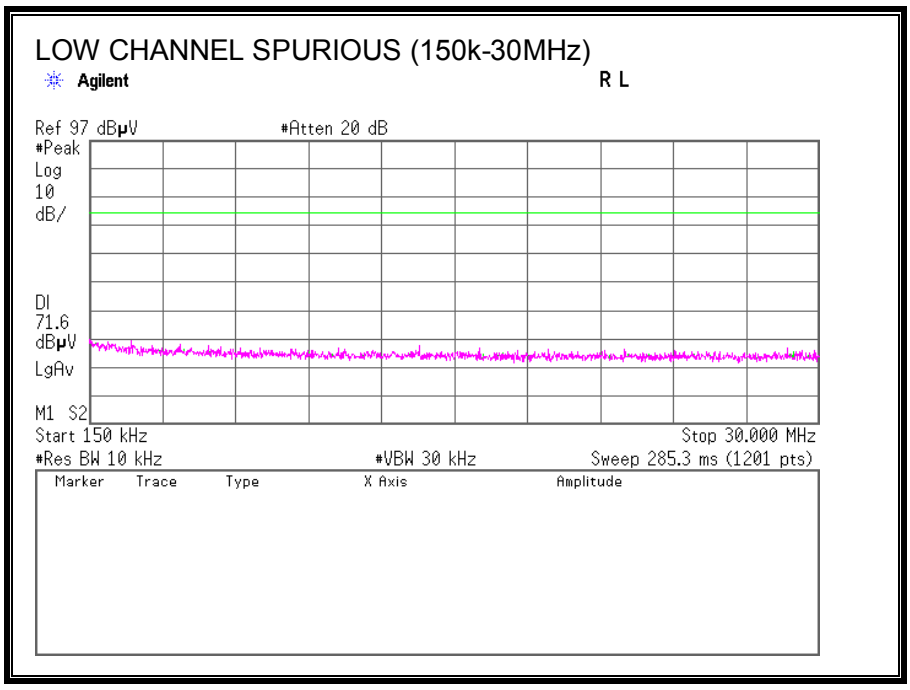
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

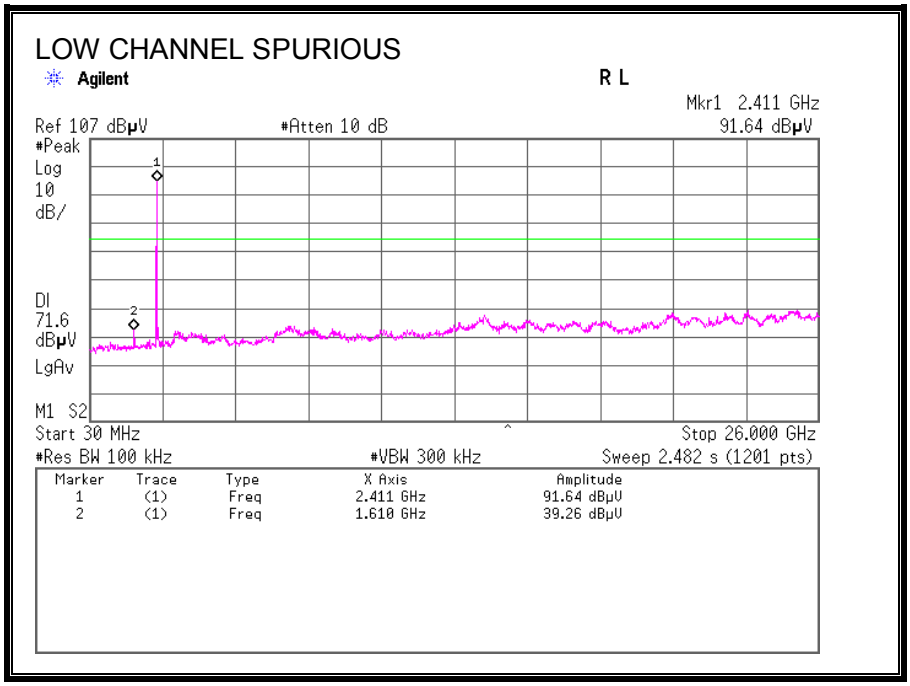


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401



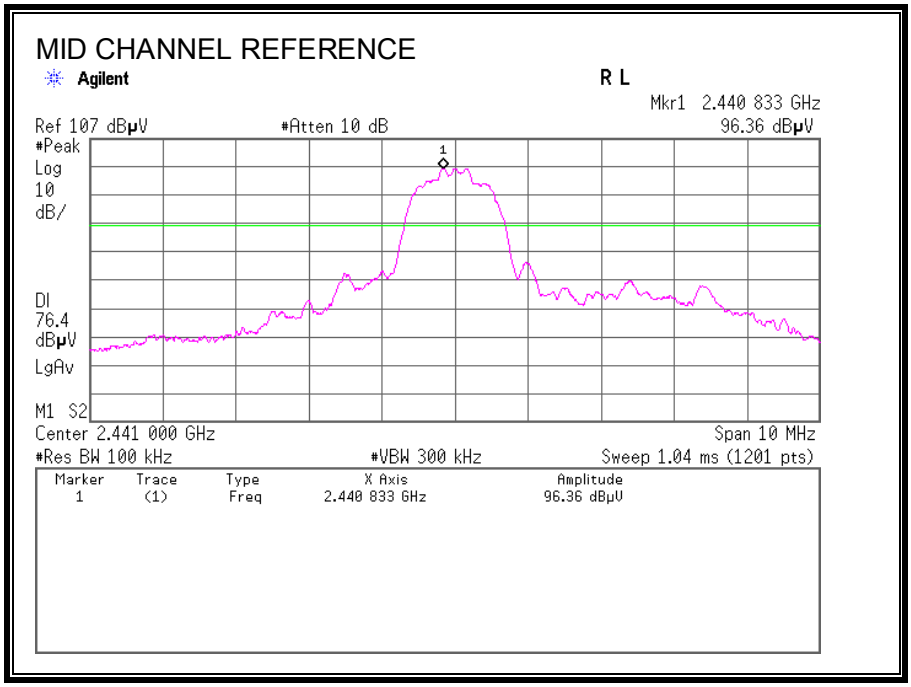


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

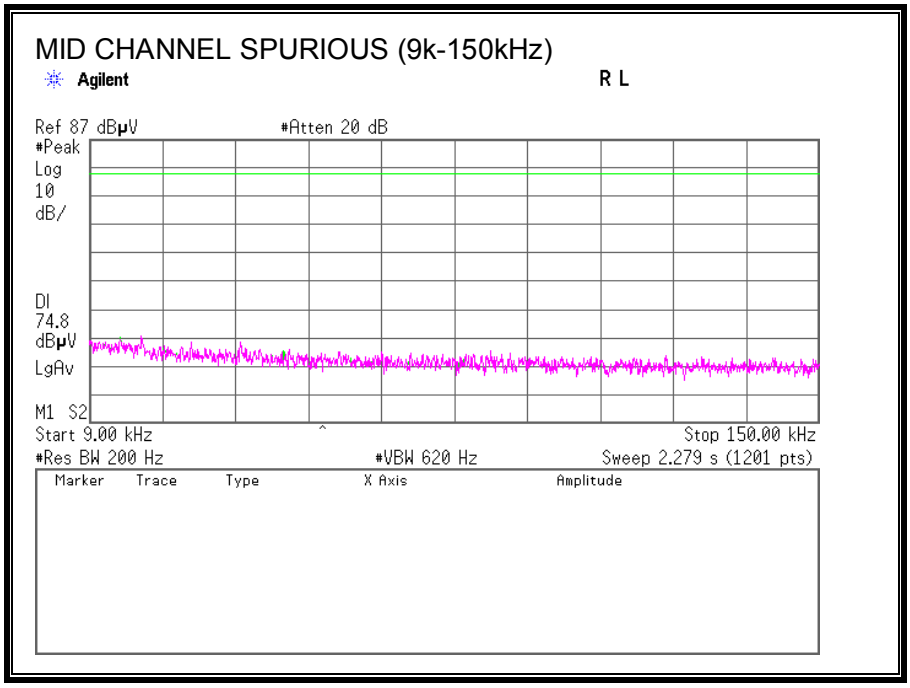


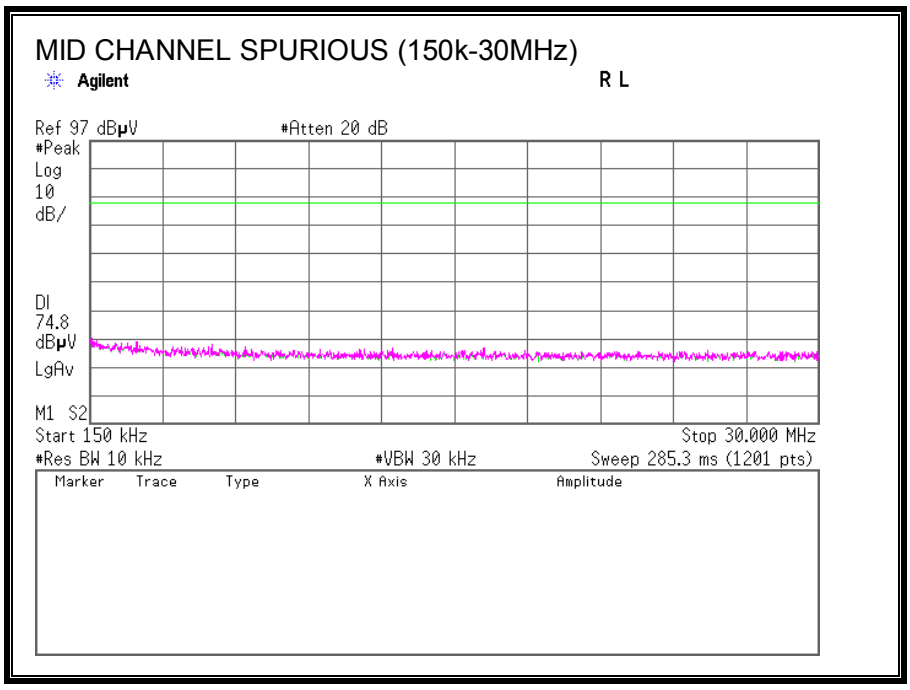
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

SPURIOUS EMISSIONS, MID CHANNEL

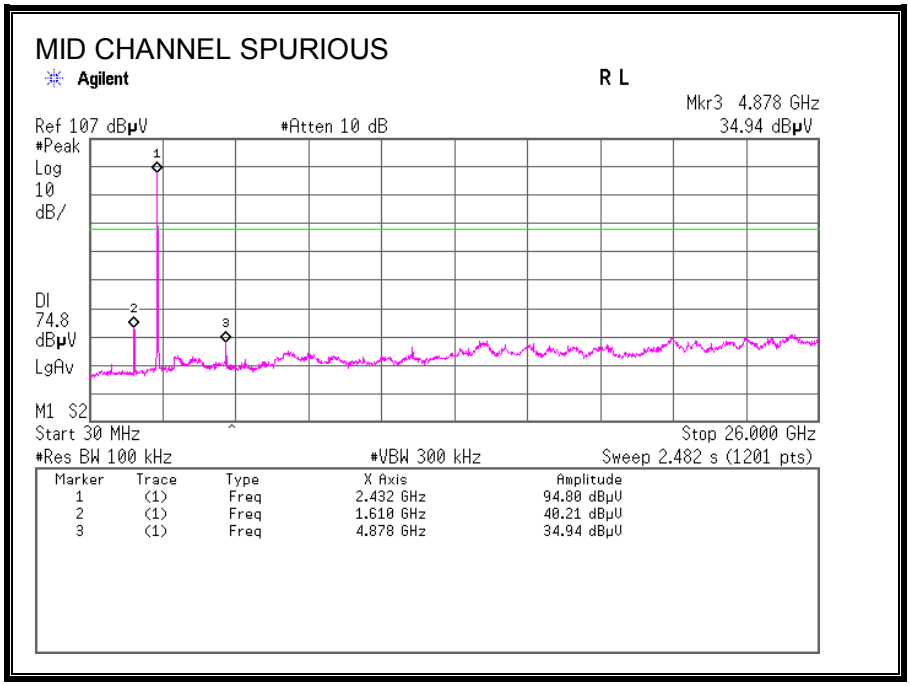


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401



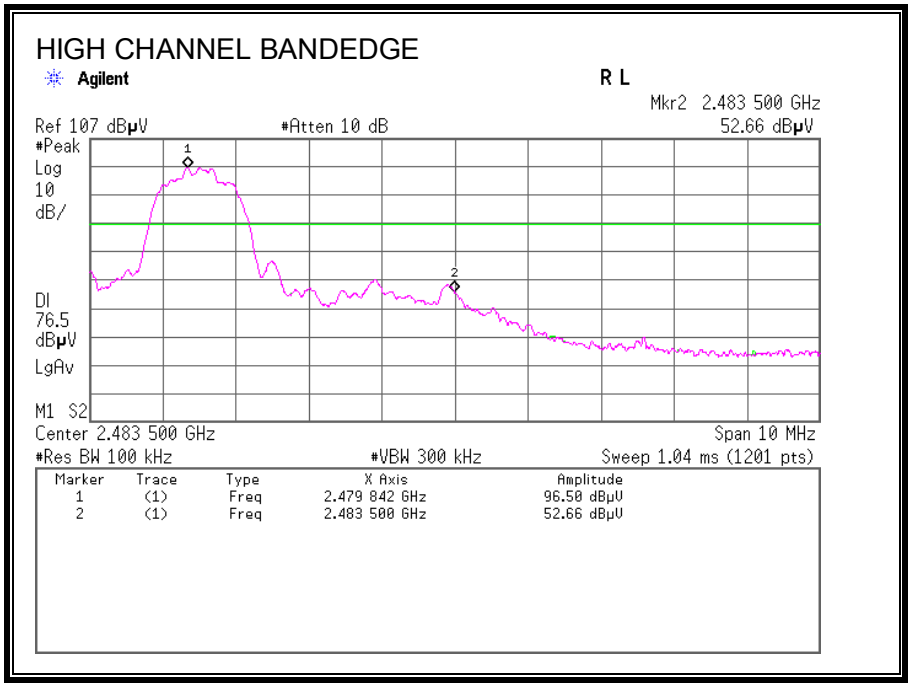


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401



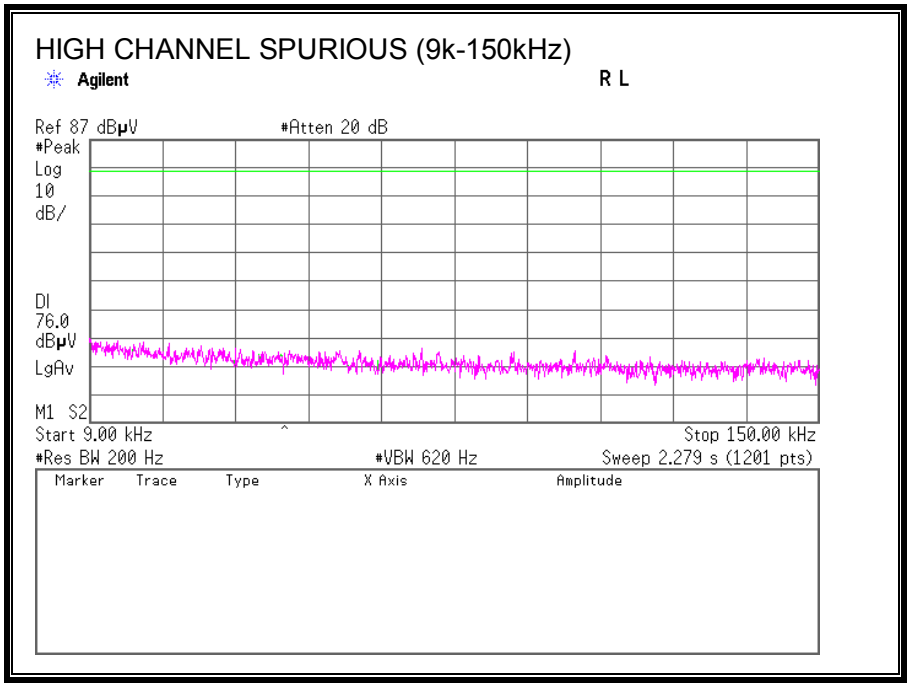
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

SPURIOUS EMISSIONS, HIGH CHANNEL

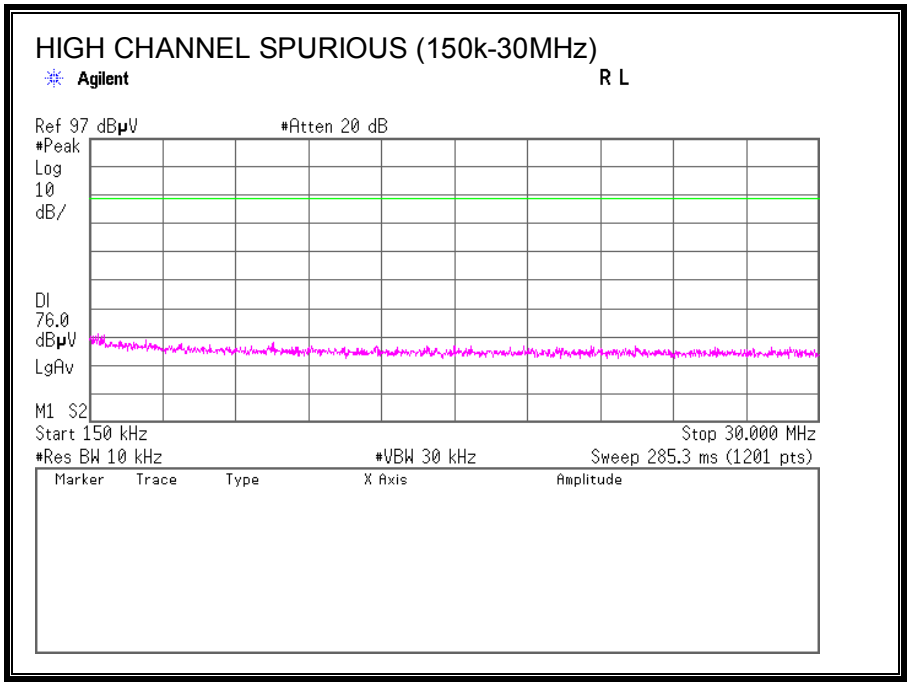


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

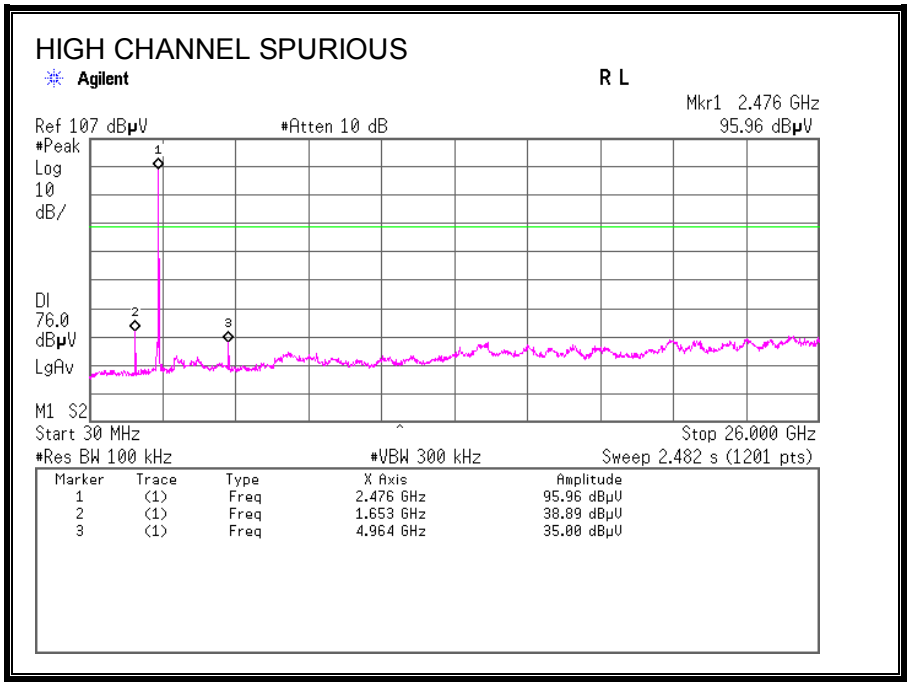
HIGH CHANNEL SPURIOUS (9k-150kHz)



HIGH CHANNEL SPURIOUS (150k-30MHz)

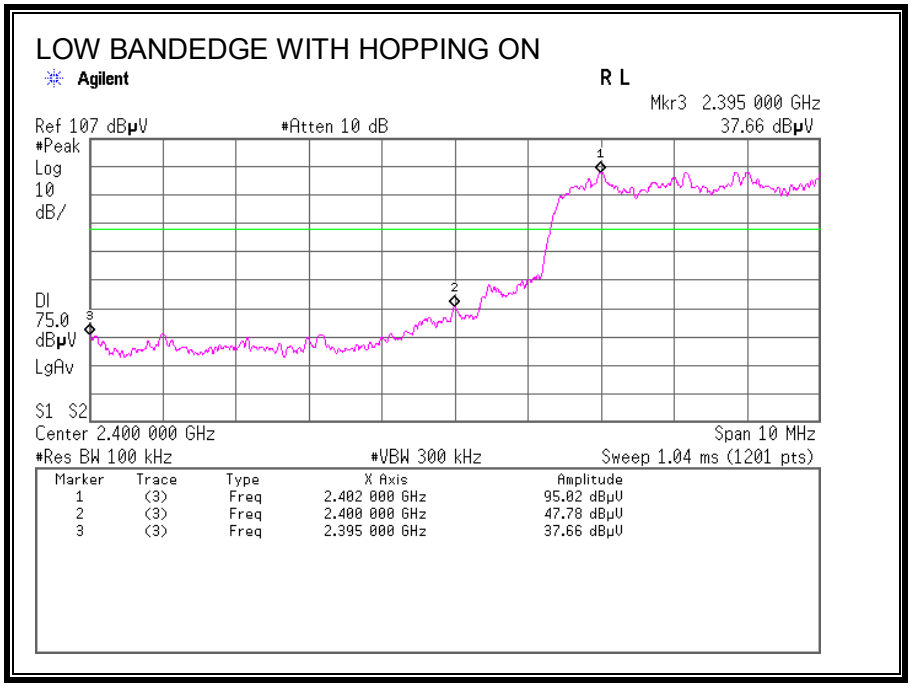


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401



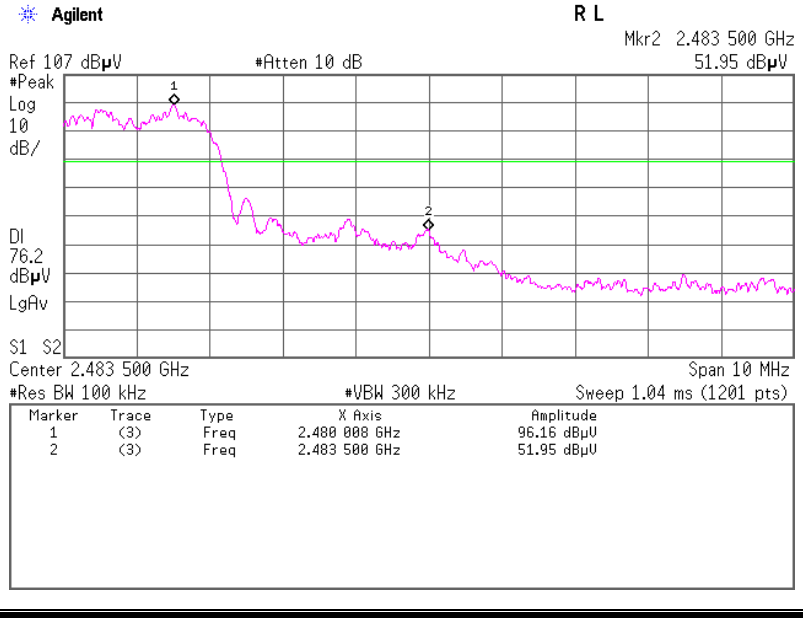
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HIGH BANDEDGE WITH HOPPING ON



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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.

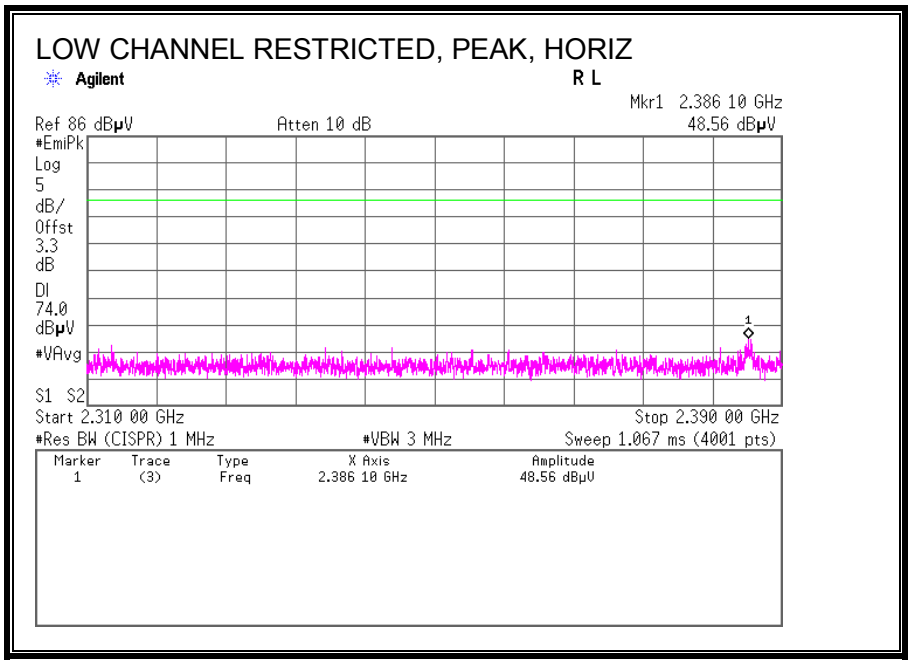
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

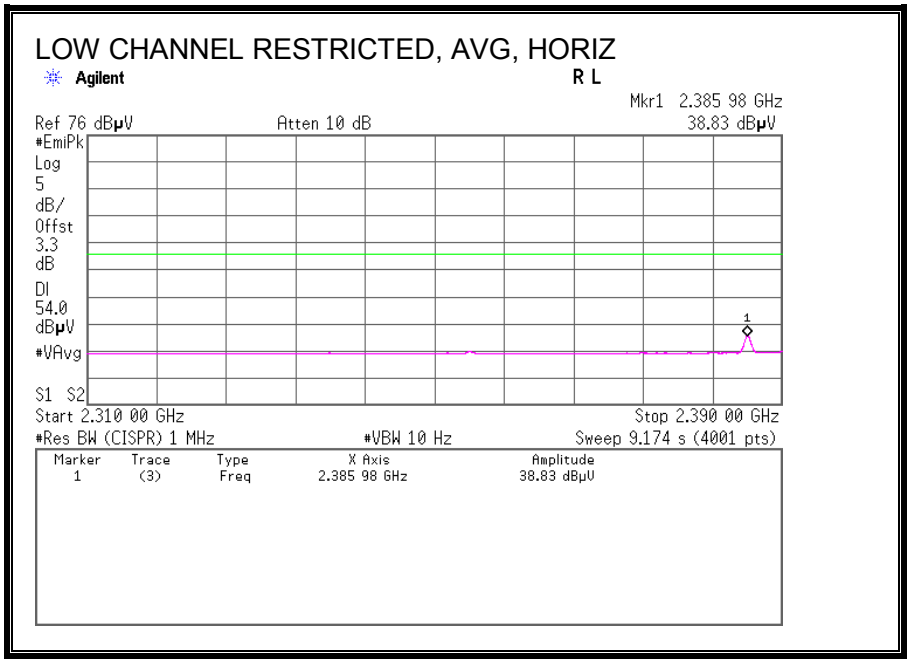
8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

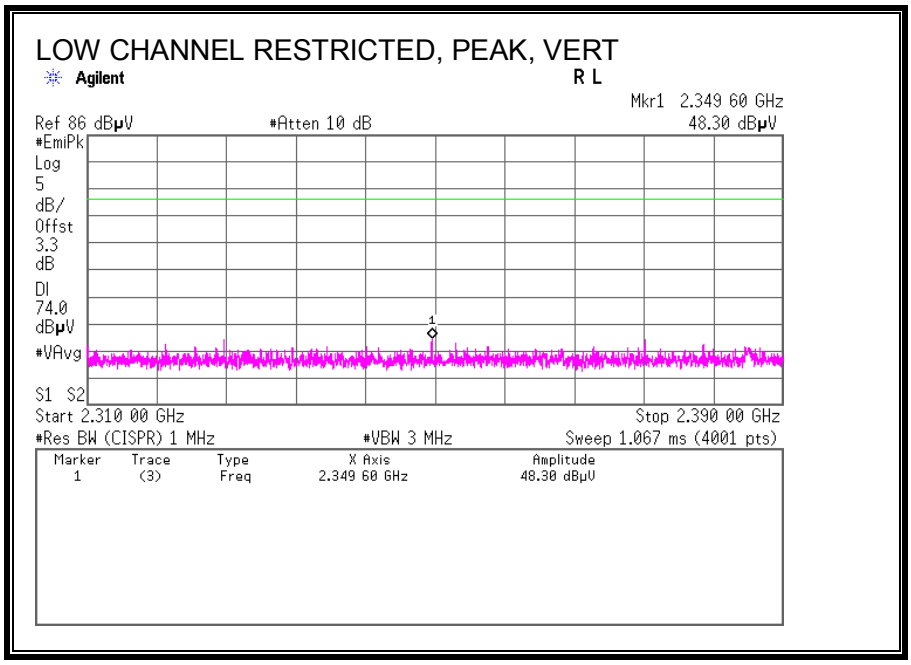


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

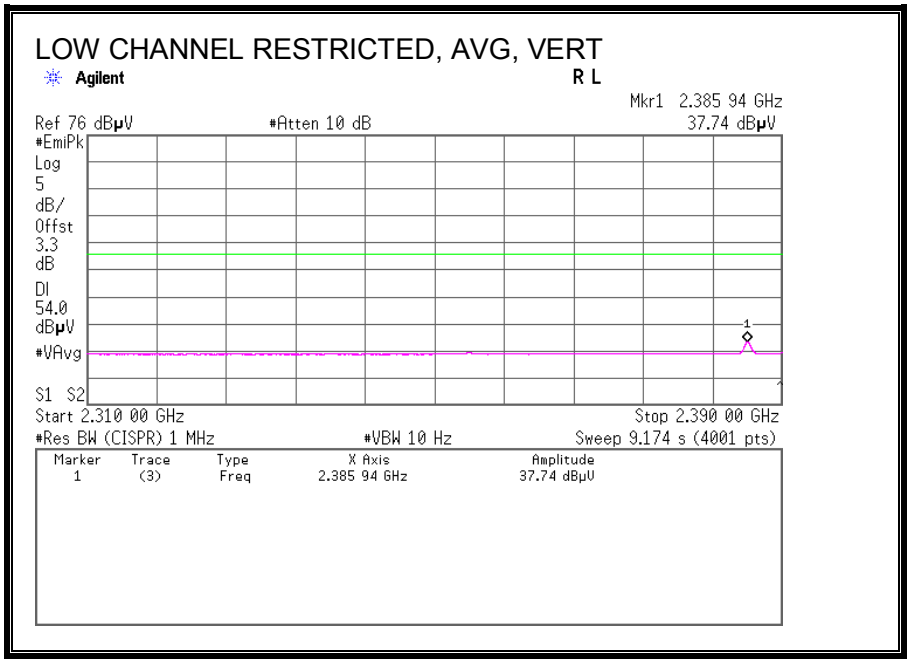


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

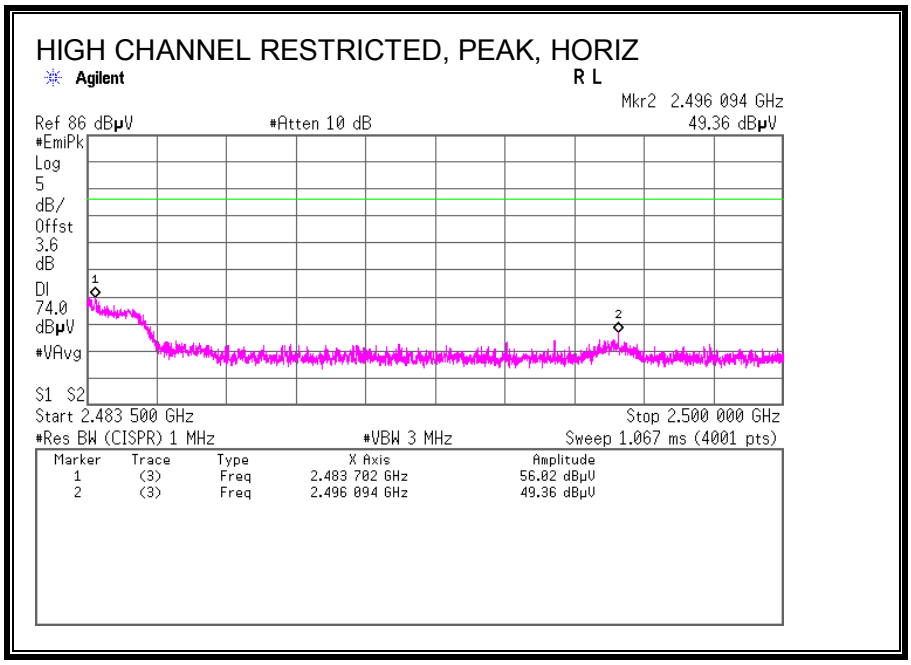


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401



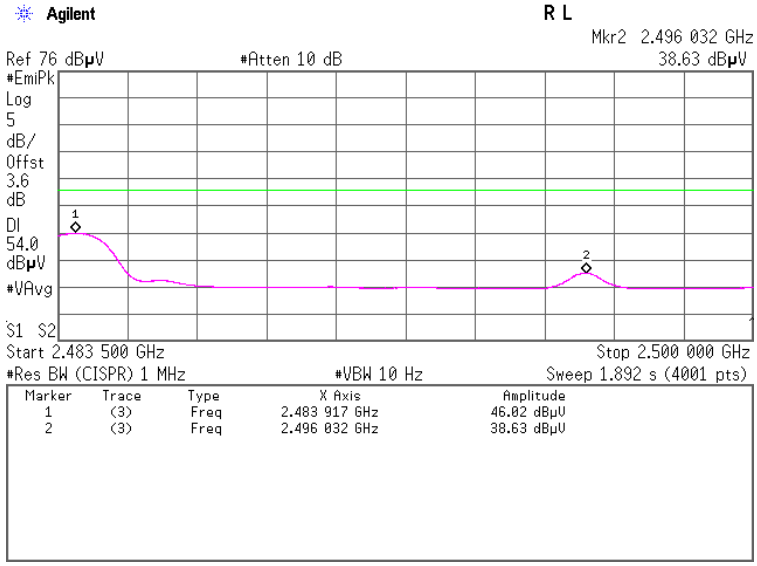
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



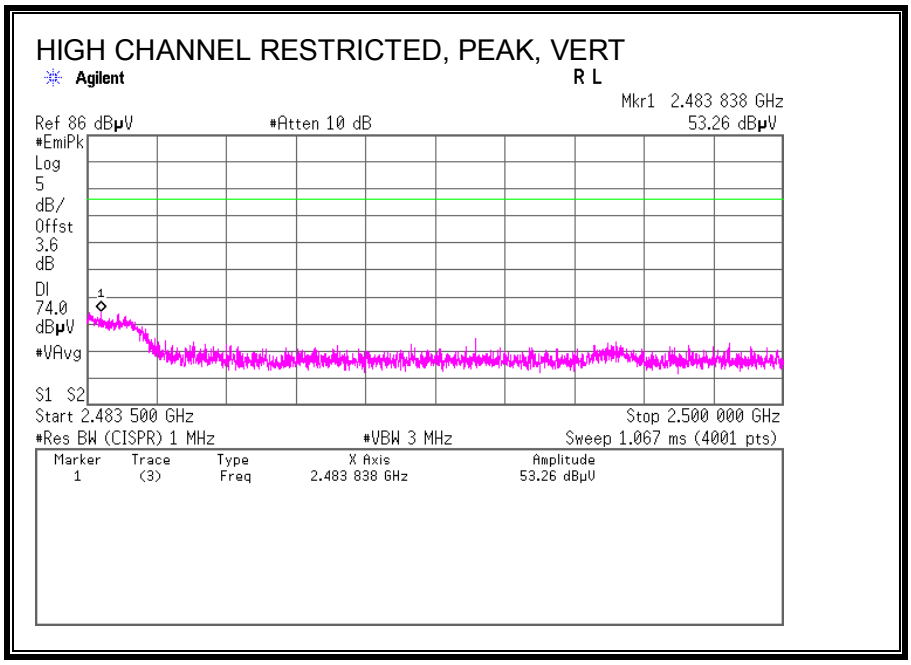
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HIGH CHANNEL RESTRICTED, AVG, HORIZ



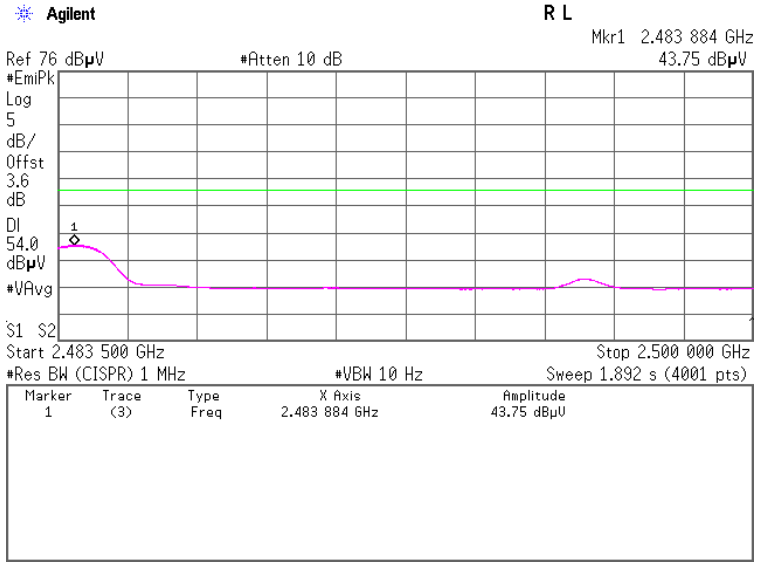
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

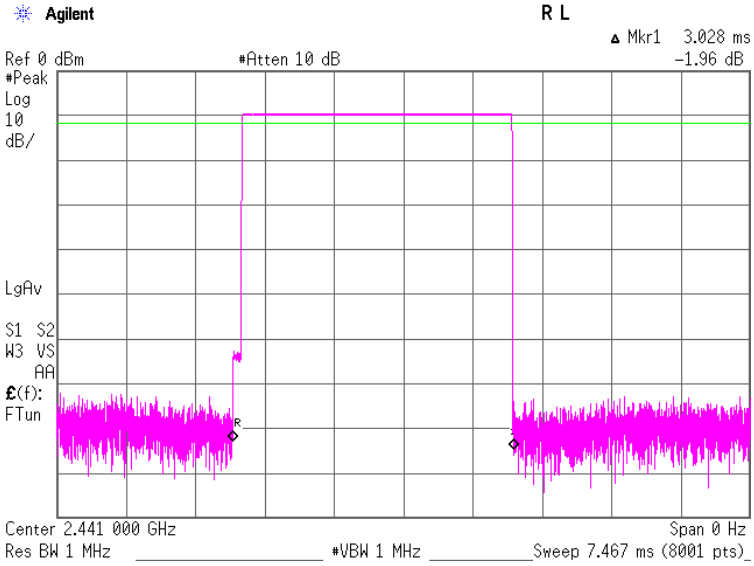
HIGH CHANNEL RESTRICTED, AVG, VERT



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

Dwell time factor Calculation chart

Tx, Bluetooth, BDR, PRBS9
1 cycle On time: 3.028ms
Dwell time factor=20log((3.028 x 2)/100)= -24.36dB



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

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HARMONICS AND SPURIOUS EMISSIONS

DH5, 2402MHz (LOW)

Radiated Emission

Test place No.3 Semi Anechoic Chamber
Date January 23, 2014
Temperature / Humidity 26 deg.C, 34 %RH
Engineer Tatsuya Arai
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	53.4	25.8	13.8	38.6	54.4	73.9	19.5	122	32	
Hori.	4804.000	PK	62.1	30.9	7.4	37.1	63.3	73.9	10.6	110	56	
Hori.	7206.000	PK	44.0	37.1	8.8	39.4	50.5	73.9	23.4	100	358	
Hori.	9608.000	PK	41.7	38.6	10.0	37.6	52.7	73.9	21.2	100	0	
Hori.	1602.000	AV	51.4	25.8	13.8	38.6	52.4	53.9	1.5	122	32	
Hori.	7206.000	AV	33.2	37.1	8.8	39.4	39.7	53.9	14.2	100	358	
Hori.	9608.000	AV	30.5	38.6	10.0	37.6	41.5	53.9	12.4	100	0	
Vert.	1602.000	PK	53.7	25.8	13.8	38.6	54.7	73.9	19.2	114	9	
Vert.	4804.000	PK	61.2	30.9	7.4	37.1	62.4	73.9	11.5	100	359	
Vert.	7206.000	PK	44.4	37.1	8.8	39.4	50.9	73.9	23.0	100	66	
Vert.	9608.000	PK	42.3	38.6	10.0	37.6	53.3	73.9	20.6	100	0	
Vert.	1602.000	AV	51.7	25.8	13.8	38.6	52.7	53.9	**1.2**	114	9	
Vert.	7206.000	AV	33.1	37.1	8.8	39.4	39.6	53.9	14.3	100	66	
Vert.	9608.000	AV	30.5	38.6	10.0	37.6	41.5	53.9	12.4	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4804.000	AV	56.3	30.9	7.4	37.1	-24.4	33.1	53.9	**20.8**	
Vert.	4804.000	AV	56.3	30.9	7.4	37.1	-24.4	33.1	53.9	**20.8**	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier) + Dwell(time)factor
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HARMONICS AND SPURIOUS EMISSIONS

DH5, 2441MHz (MID)

Radiated Emission

Test place No.3 Semi Anechoic Chamber
Date January 23, 2014
Temperature / Humidity 26 deg.C, 34 %RH
Engineer Tatsuya Arai
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	54.1	25.9	13.8	38.6	55.2	73.9	18.7	116	54	
Hori.	4882.000	PK	62.7	31.4	7.4	37.0	64.5	73.9	9.4	100	67	
Hori.	7323.000	PK	45.5	37.2	8.8	39.4	52.1	73.9	21.8	100	350	
Hori.	9764.000	PK	41.8	38.8	10.0	37.5	53.1	73.9	20.8	100	0	
Hori.	1628.000	AV	51.1	25.9	13.8	38.6	52.2	53.9	1.7	116	54	
Hori.	7323.000	AV	33.3	37.2	8.8	39.4	39.9	53.9	14.0	100	350	
Hori.	9764.000	AV	30.7	38.8	10.0	37.5	42.0	53.9	11.9	100	0	
Vert.	1628.000	PK	54.7	25.9	13.8	38.6	55.8	73.9	18.1	117	39	
Vert.	4882.000	PK	63.0	31.4	7.4	37.0	64.8	73.9	9.1	100	354	
Vert.	7323.000	PK	45.5	37.2	8.8	39.4	52.1	73.9	21.8	100	0	
Vert.	9764.000	PK	42.0	38.8	10.0	37.5	53.3	73.9	20.6	100	0	
Vert.	1628.000	AV	52.0	25.9	13.8	38.6	53.1	53.9	**0.8**	117	39	
Vert.	7323.000	AV	33.2	37.2	8.8	39.4	39.8	53.9	14.1	100	0	
Vert.	9764.000	AV	30.9	38.8	10.0	37.5	42.2	53.9	11.7	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	56.8	31.4	7.4	37.0	-24.4	34.2	53.9	19.7	
Vert.	4882.000	AV	56.9	31.4	7.4	37.0	-24.4	34.3	53.9	**19.6**	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier) + Dwell(time)factor
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HARMONICS AND SPURIOUS EMISSIONS

DH5, 2480MHz

Radiated Emission

Test place No.3 Semi Anechoic Chamber
Date January 23, 2014
Temperature / Humidity 22 deg.C, 28 %RH
Engineer Tatsuya Arai
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	54.9	25.9	13.9	38.6	56.1	73.9	17.8	117	24	
Hori.	4960.000	PK	62.9	31.8	7.4	37.0	65.1	73.9	8.8	100	65	
Hori.	7440.000	PK	45.4	37.4	8.9	39.4	52.3	73.9	21.6	100	0	
Hori.	9920.000	PK	43.2	38.9	9.9	37.5	54.5	73.9	19.4	100	0	
Hori.	1654.000	AV	51.7	25.9	13.9	38.6	52.9	53.9	1.0	117	24	
Hori.	7440.000	AV	33.5	37.4	8.9	39.4	40.4	53.9	13.5	100	0	
Hori.	9920.000	AV	31.5	38.9	9.9	37.5	42.8	53.9	11.1	100	0	
Vert.	1654.000	PK	55.1	25.9	13.9	38.6	56.3	73.9	17.6	103	45	
Vert.	4960.000	PK	63.4	31.8	7.4	37.0	65.6	73.9	8.3	100	359	
Vert.	7440.000	PK	44.0	37.4	8.9	39.4	50.9	73.9	23.0	100	0	
Vert.	9920.000	PK	42.4	38.9	9.9	37.5	53.7	73.9	20.2	100	0	
Vert.	1654.000	AV	52.4	25.9	13.9	38.6	53.6	53.9	**0.3**	103	45	
Vert.	7440.000	AV	33.4	37.4	8.9	39.4	40.3	53.9	13.6	100	0	
Vert.	9920.000	AV	31.4	38.9	9.9	37.5	42.7	53.9	11.2	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Dwell time factor relaxation

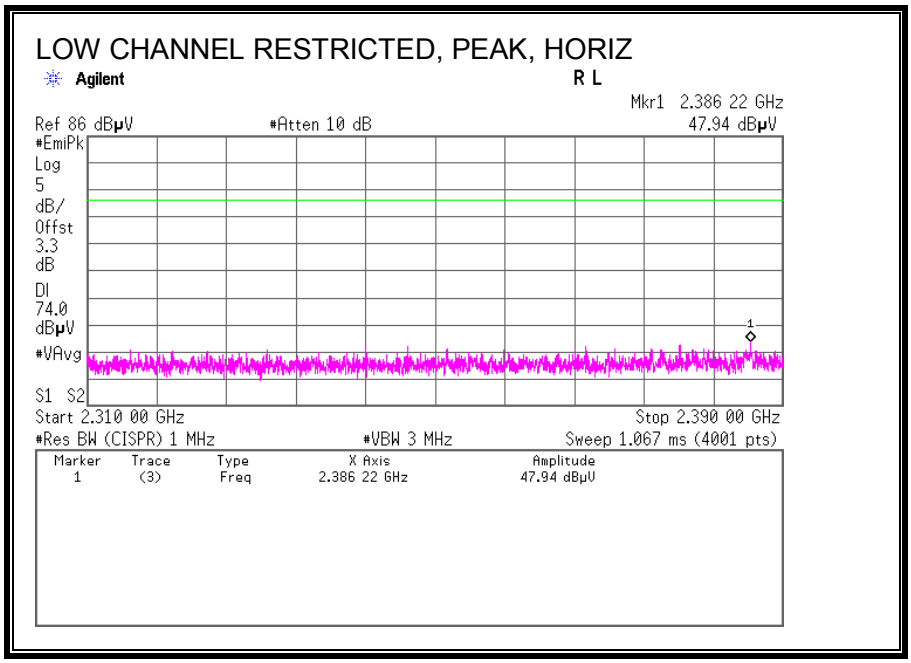
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4960.000	AV	54.9	31.8	7.4	37.0	-24.4	32.7	53.9	21.2	
Vert.	4960.000	AV	55.6	31.8	7.4	37.0	-24.4	33.4	53.9	**20.5**	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier) + Dwell(time)factor
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

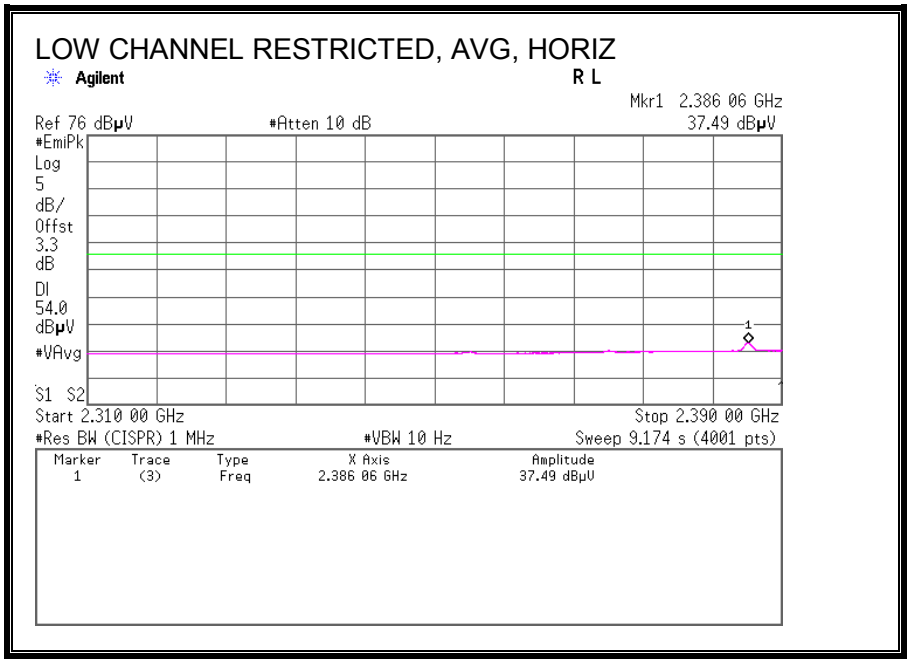
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

8.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

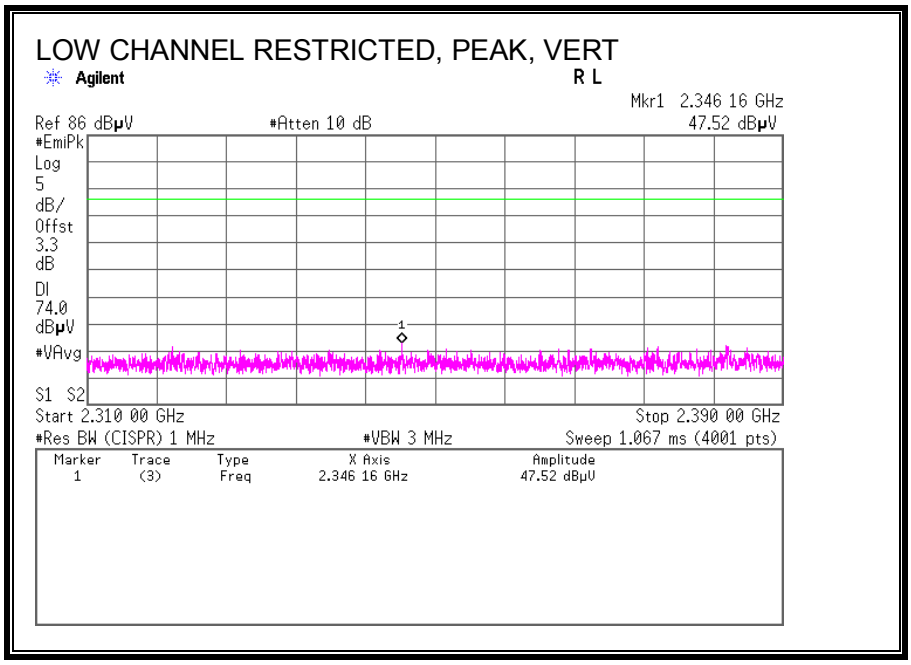


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

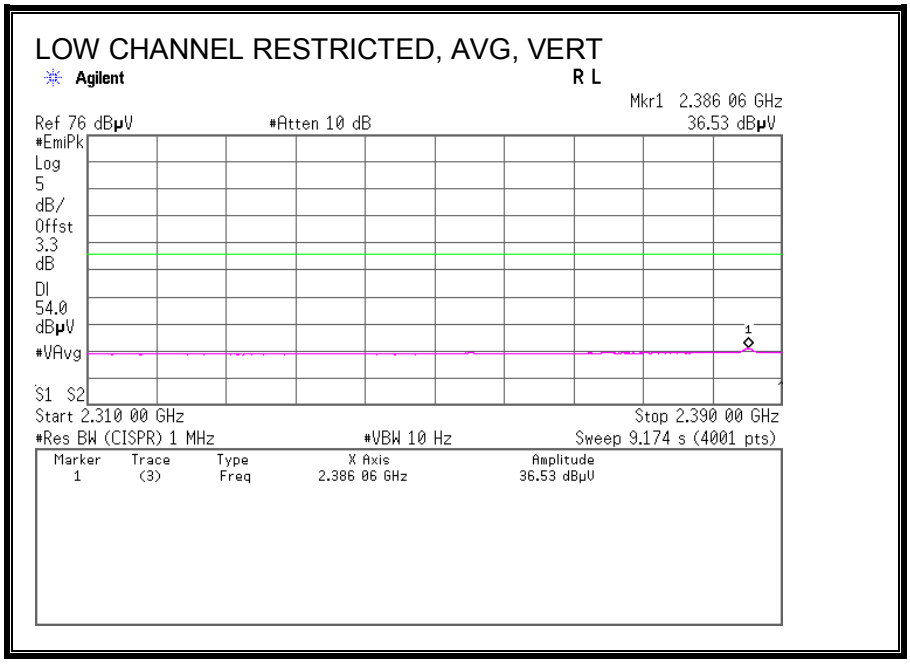


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

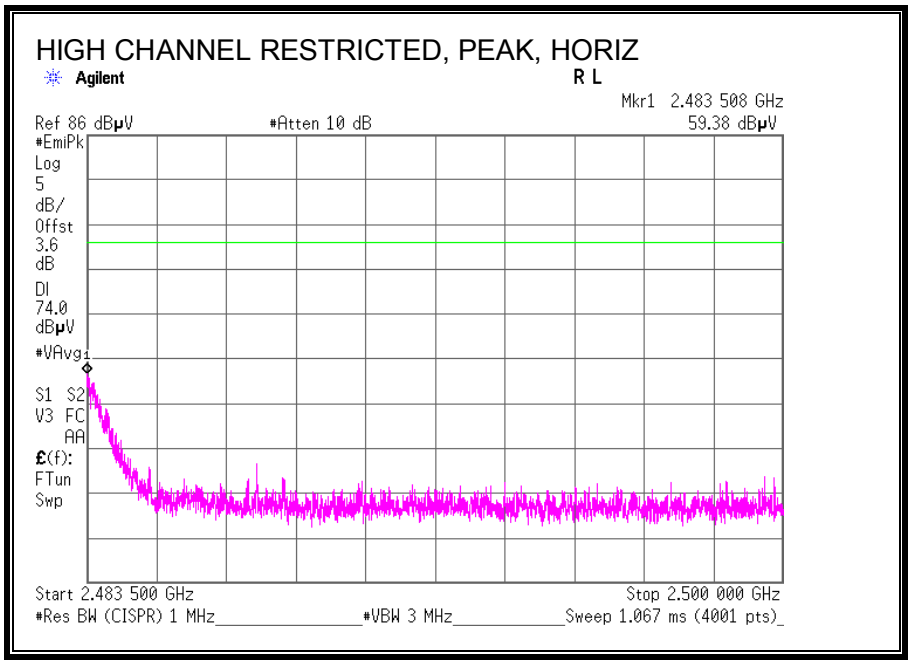


UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401



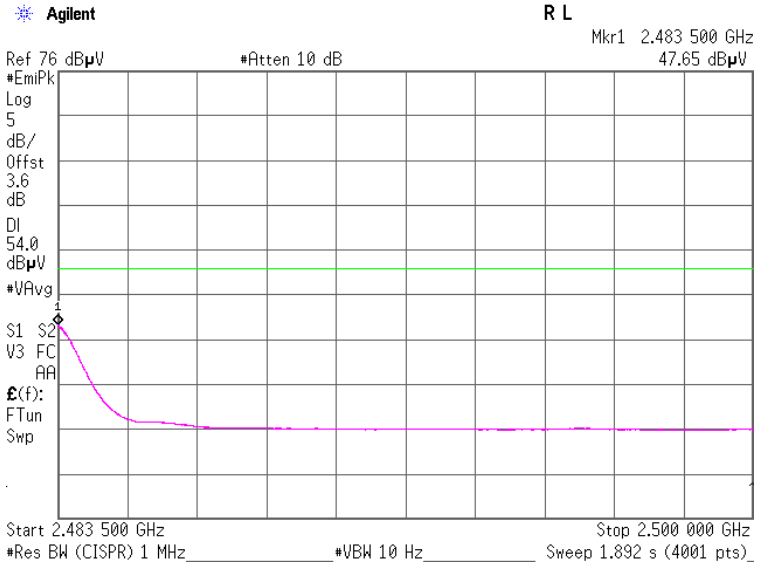
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



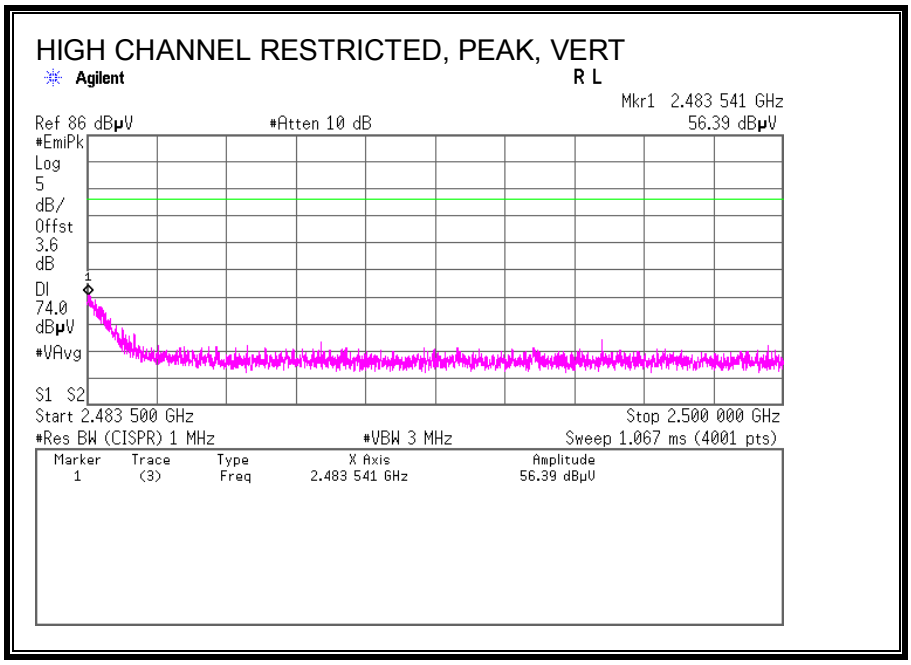
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HIGH CHANNEL RESTRICTED, AVG, HORIZ



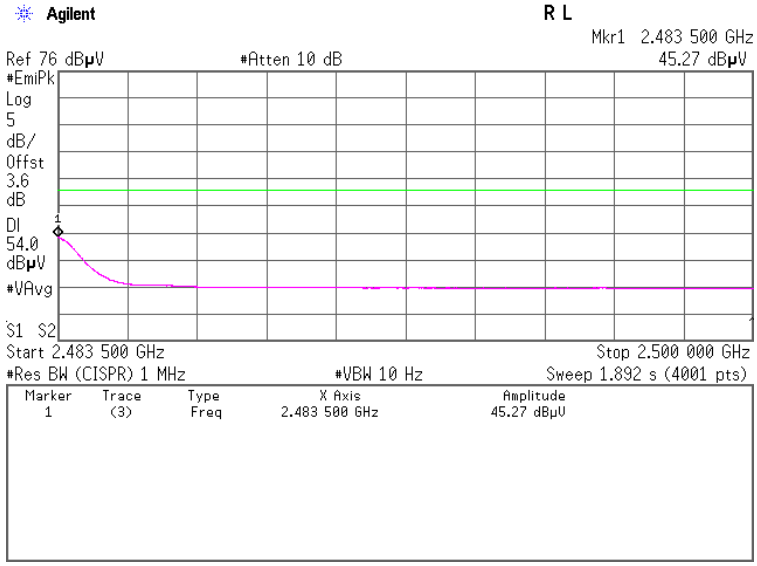
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

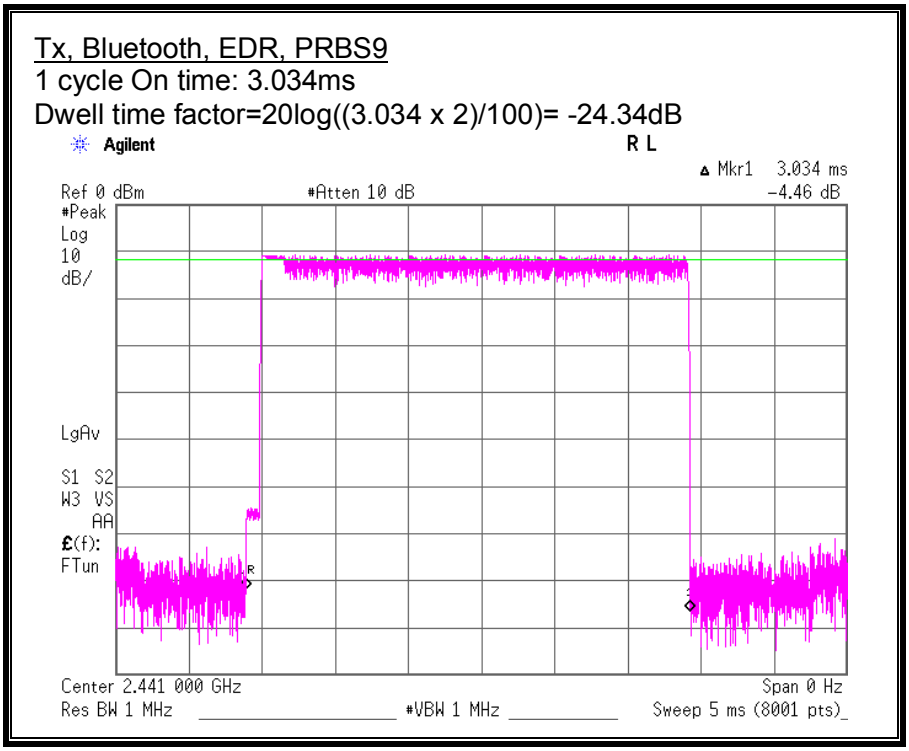
HIGH CHANNEL RESTRICTED, AVG, VERT



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

Dwell time factor Calculation chart

Tx, Bluetooth, EDR, PRBS9
1 cycle On time: 3.034ms
Dwell time factor=20log((3.034 x 2)/100)= -24.34dB



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

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HARMONICS AND SPURIOUS EMISSIONS

3-DH5, 2402MHz (LOW)

Radiated Emission

Test place No.3 Semi Anechoic Chamber
Date January 23, 2014
Temperature / Humidity 26 deg.C, 34 %RH
Engineer Tatsuya Arai
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	53.0	25.8	13.8	38.6	54.0	73.9	19.9	121	41	
Hori.	4804.000	PK	56.0	30.9	7.4	37.1	57.2	73.9	16.7	100	56	
Hori.	7206.000	PK	44.7	37.1	8.8	39.4	51.2	73.9	22.7	100	0	
Hori.	9608.000	PK	43.1	38.6	10.0	37.6	54.1	73.9	19.8	100	0	
Hori.	1602.000	AV	50.6	25.8	13.8	38.6	51.6	53.9	2.3	121	41	
Hori.	7206.000	AV	32.9	37.1	8.8	39.4	39.4	53.9	14.5	100	0	
Hori.	9608.000	AV	30.6	38.6	10.0	37.6	41.6	53.9	12.3	100	0	
Vert.	1602.000	PK	53.9	25.8	13.8	38.6	54.9	73.9	19.0	110	27	
Vert.	4804.000	PK	56.0	30.9	7.4	37.1	57.2	73.9	16.7	100	354	
Vert.	7206.000	PK	44.6	37.1	8.8	39.4	51.1	73.9	22.8	100	0	
Vert.	9608.000	PK	42.0	38.6	10.0	37.6	53.0	73.9	20.9	100	0	
Vert.	1602.000	AV	51.8	25.8	13.8	38.6	52.8	53.9	**1.1**	110	27	
Vert.	7206.000	AV	33.0	37.1	8.8	39.4	39.5	53.9	14.4	100	0	
Vert.	9608.000	AV	30.7	38.6	10.0	37.6	41.7	53.9	12.2	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4804.000	AV	38.3	30.9	7.4	37.1	-24.3	15.2	53.9	**38.7**	
Vert.	4804.000	AV	38.1	30.9	7.4	37.1	-24.3	15.0	53.9	38.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier) + Dwell(time)factor
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HARMONICS AND SPURIOUS EMISSIONS

3-DH5, 2441MHz (MIDDLE)

Radiated Emission

Test place No.3 Semi Anechoic Chamber
Date January 23, 2014
Temperature / Humidity 26 deg.C, 34 %RH
Engineer Tatsuya Arai
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	54.5	25.9	13.8	38.6	55.6	73.9	18.3	100	354	
Hori.	4882.000	PK	56.2	31.4	7.4	37.0	58.0	73.9	15.9	100	61	
Hori.	7323.000	PK	44.5	37.2	8.8	39.4	51.1	73.9	22.8	100	0	
Hori.	9764.000	PK	42.3	38.8	10.0	37.5	53.6	73.9	20.3	100	0	
Hori.	1628.000	AV	51.4	25.9	13.8	38.6	52.5	53.9	1.4	100	354	
Hori.	7323.000	AV	33.3	37.2	8.8	39.4	39.9	53.9	14.0	100	0	
Hori.	9764.000	AV	30.9	38.8	10.0	37.5	42.2	53.9	11.7	100	0	
Vert.	1628.000	PK	54.9	25.9	13.8	38.6	56.0	73.9	17.9	116	26	
Vert.	4882.000	PK	56.3	31.4	7.4	37.0	58.1	73.9	15.8	100	353	
Vert.	7323.000	PK	44.2	37.2	8.8	39.4	50.8	73.9	23.1	100	0	
Vert.	9764.000	PK	42.5	38.8	10.0	37.5	53.8	73.9	20.1	100	0	
Vert.	1628.000	AV	52.3	25.9	13.8	38.6	53.4	53.9	**0.5**	116	26	
Vert.	7323.000	AV	33.3	37.2	8.8	39.4	39.9	53.9	14.0	100	0	
Vert.	9764.000	AV	30.9	38.8	10.0	37.5	42.2	53.9	11.7	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	36.4	31.4	7.4	37.0	-24.3	13.9	53.9	40.0	
Vert.	4882.000	AV	36.5	31.4	7.4	37.0	-24.3	14.0	53.9	**39.9**	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier) + Dwell(time)factor
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HARMONICS AND SPURIOUS EMISSIONS

3-DH5, 2480MHz (HIGH)

Radiated Emission

Test place No.3 Semi Anechoic Chamber
Date January 23, 2014
Temperature / Humidity 26 deg.C, 34 %RH
Engineer Tatsuya Arai
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	55.1	25.9	13.9	38.6	56.3	73.9	17.6	114	23	
Hori.	4960.000	PK	55.0	31.8	7.4	37.0	57.2	73.9	16.7	100	58	
Hori.	7440.000	PK	44.9	37.4	8.9	39.4	51.8	73.9	22.1	100	0	
Hori.	9920.000	PK	43.0	38.9	9.9	37.5	54.3	73.9	19.6	100	0	
Hori.	1654.000	AV	51.9	25.9	13.9	38.6	53.1	53.9	0.8	114	23	
Hori.	7440.000	AV	33.5	37.4	8.9	39.4	40.4	53.9	13.5	100	0	
Hori.	9920.000	AV	31.6	38.9	9.9	37.5	42.9	53.9	11.0	100	0	
Vert.	1654.000	PK	55.3	25.9	13.9	38.6	56.5	73.9	17.4	100	28	
Vert.	4960.000	PK	57.0	31.8	7.4	37.0	59.2	73.9	14.7	100	358	
Vert.	7440.000	PK	45.1	37.4	8.9	39.4	52.0	73.9	21.9	100	0	
Vert.	9920.000	PK	42.4	38.9	9.9	37.5	53.7	73.9	20.2	100	0	
Vert.	1654.000	AV	52.5	25.9	13.9	38.6	53.7	53.9	**0.2**	100	28	
Vert.	7440.000	AV	33.5	37.4	8.9	39.4	40.4	53.9	13.5	100	0	
Vert.	9920.000	AV	31.5	38.9	9.9	37.5	42.8	53.9	11.1	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4960.000	AV	31.8	31.8	7.4	37.0	-24.3	9.7	53.9	44.2	
Vert.	4960.000	AV	32.4	31.8	7.4	37.0	-24.3	10.3	53.9	**43.6**	

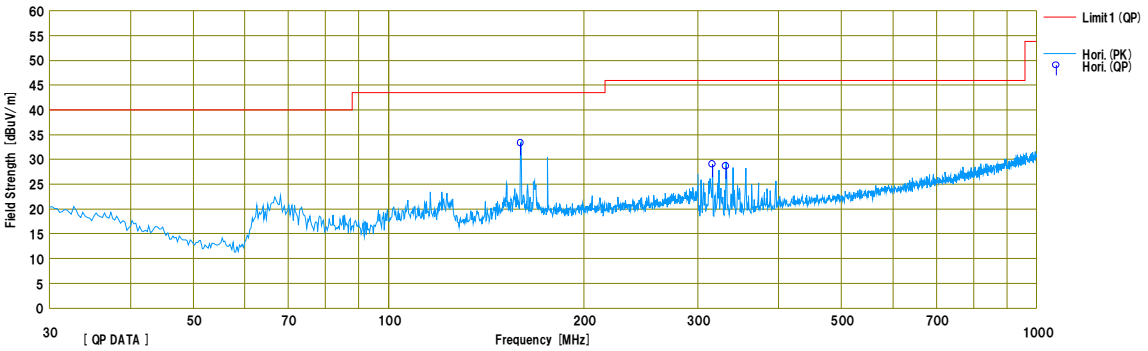
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier) + Dwell(time)factor
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

8.3. WORST-CASE BELOW 1 GHz

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

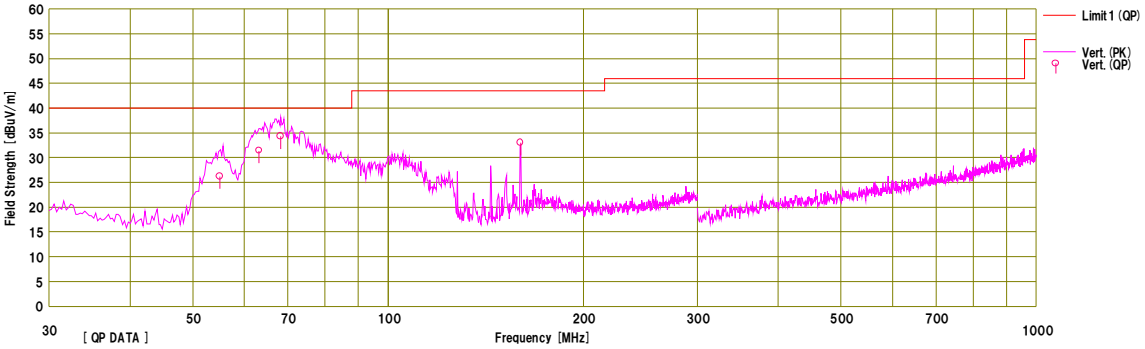
HORIZONTAL PLOT



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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

VERTICAL PLOT



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

HORIZONTAL AND VERTICAL DATA

Radiated Emission

Test place No.3 Semi Anechoic Chamber
Date January 23, 2014
Temperature / Humidity 26 deg.C, 34 %RH
Engineer Tomochika Sato
Mode Tx, 2480 MHz
Tx, Bluetooth, BDR, PRBS9

(* 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.	159.993	QP	42.8	14.8	7.8	32.1	33.3	43.5	10.2	200	80	
Hori.	316.054	QP	38.1	14.2	8.6	31.9	29.0	46.0	17.0	100	90	
Hori.	331.640	QP	37.2	14.6	8.7	31.9	28.6	46.0	17.4	100	286	
Vert.	55.065	QP	42.3	9.4	6.7	32.2	26.2	40.0	13.8	100	279	
Vert.	63.294	QP	49.5	7.5	6.5	32.1	31.4	40.0	8.6	100	333	
Vert.	68.306	QP	53.2	6.6	6.6	32.1	34.3	40.0	**5.7**	100	262	
Vert.	160.113	QP	42.4	14.9	7.8	32.1	33.0	43.5	10.5	100	124	

Result = Reading + Ant.Fac. + Loss (Cable+Attenuator) - Gain(Amprifier)

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

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

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

RESULTS

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2014/01/23

Mode : Tx DH5 2441MHz
Order No. : 10185979S
Power : AC120V/60Hz (DC3V)
Temp./Humi. : 24deg.C./35%RH

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

Engineer : Tomochika Sato

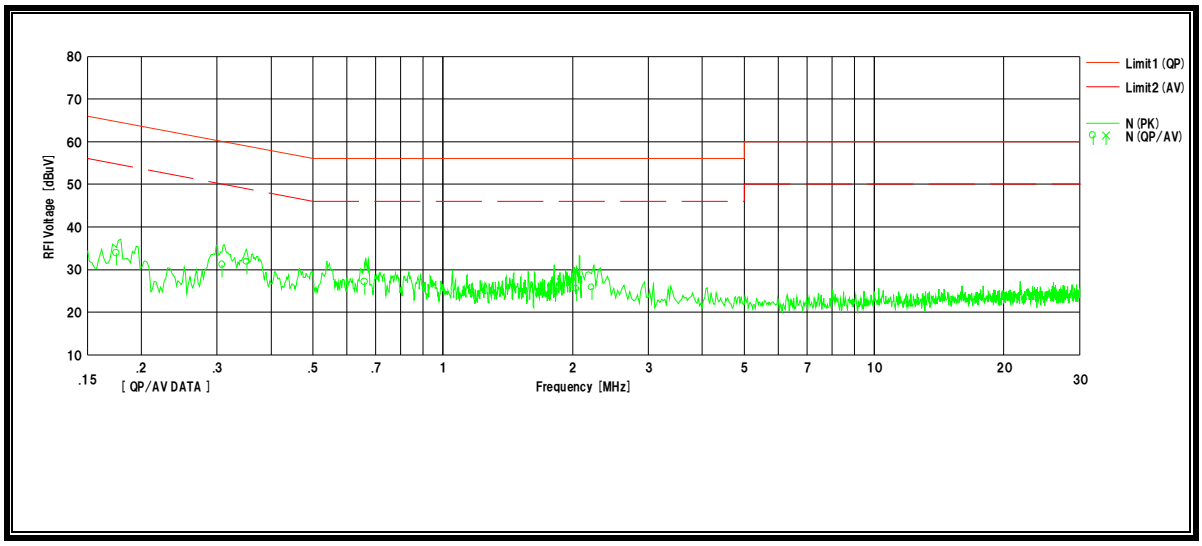
<< QP/AV DATA >>

No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP>	<AV>		<QP>	<AV>	<QP>	<AV>	<QP>	<AV>		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.17510	21.0	---	12.9	33.9	---	64.7	54.7	30.8	---	N	
2	0.30829	18.2	---	12.9	31.1	---	60.0	50.0	28.9	---	N	
3	0.35120	18.9	---	12.9	31.8	---	58.9	48.9	27.1	---	N	
4	0.66010	14.2	---	12.9	27.1	---	56.0	46.0	28.9	---	N	
5	2.04150	12.5	---	13.0	25.5	---	56.0	46.0	30.5	---	N	
6	2.21780	12.8	---	13.0	25.8	---	56.0	46.0	30.2	---	N	
7	0.17560	22.0	---	12.9	34.9	---	64.6	54.6	29.7	---	L1	
8	0.30050	14.3	---	12.9	27.2	---	60.2	50.2	33.0	---	L1	
9	0.35030	18.9	---	12.9	31.8	---	58.9	48.9	27.1	---	L1	
10	0.66200	16.4	---	12.9	29.3	---	56.0	46.0	26.7	---	L1	
11	2.04740	14.2	---	13.0	27.2	---	56.0	46.0	28.8	---	L1	
12	2.21390	9.4	---	13.0	22.4	---	56.0	46.0	33.6	---	L1	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable+ATT) [dB]
LISN:SLS-02

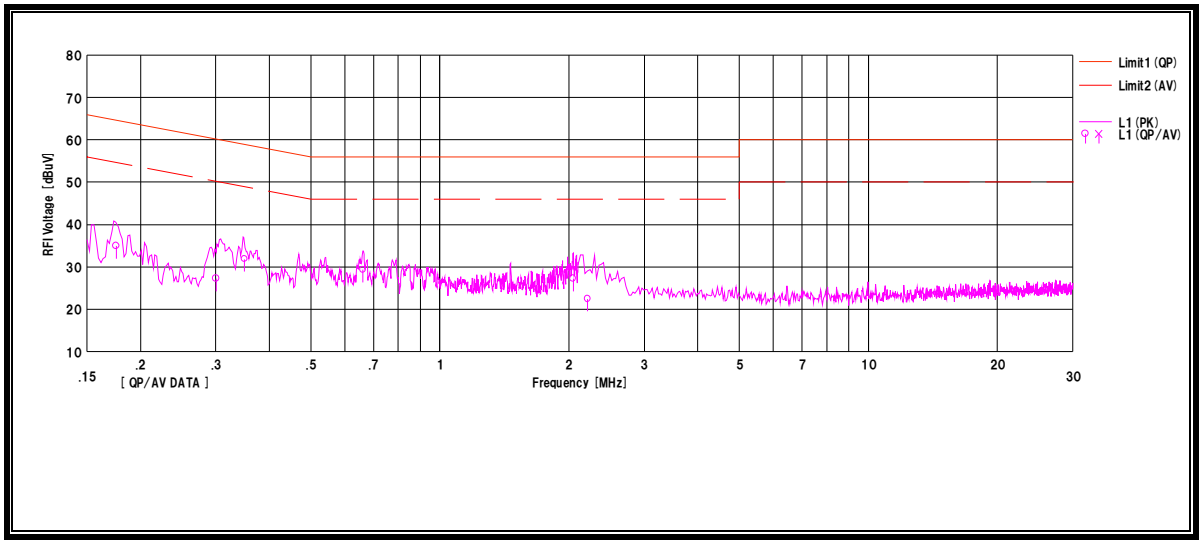
UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

LINE 1 RESULTS



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

LINE 2 RESULTS



UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m^2)	FCC Power Density (mW/cm^2)
2.4 GHz	Bluetooth	0.20	1.61	2.00	0.0046	0.0005

UL Japan, Inc. Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
TEL: +81 463 50 6400 FAX: +81 463 50 6401