RADIO TEST REPORT

Test Report No. : 11056806H-A-R1

Applicant	:	**Sony Corporation**
Type of Equipment	:	**LED Bulb Speaker**
Model No.	:	**LSPX-102E26**
FCC ID	:	**AK8LS26300**
Test regulation	:	**FCC Part 15 Subpart C: 2015**
Test Result	:	**Complied**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11056806H-A. 11056806H-A is replaced with this report.

Date of test: December 16 to 19, 2015

Representative test engineer:
T. Noguchi
Takafumi Noguchi
Engineer
Consumer Technology Division

Approved by:
Takayuki Shimada
Engineer
Consumer Technology Division

NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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http://japan.ul.com/resources/emc_accredited/

REVISION HISTORY

Original Test Report No.: 11056806H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11056806H-A	January 12, 2016	-	-
1	11056806H-A-R1	February 25, 2016	P.14, 16	Correction of Humidity

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SECTION 1: Customer information

Company Name	:	Sony EMCS Corporation
Address	:	30 Ibarajima Ohya-cyo, Inazawa-shi, Aichi-ken, 492-8545, JAPAN
Telephone Number	:	+81-50-3807-4243
Facsimile Number	:	+81-587-36-8570
Contact Person	:	Masayuki Sakakura

*Remarks
Sony EMCS Corporation (Subsidiary Company Name) is on behalf of the applicant: Sony Corporation.

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	LED Bulb Speaker
Model No.	:	LSPX-102E26
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	AC 120 V / 60 Hz
Receipt Date of Sample	:	December 11, 2015
Country of Mass-production	:	Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: LSPX-102E26 (referred to as the EUT in this report) is a LED Bulb Speaker.

General Specification

Clock frequency(ies) in the system	:	CPU: 26 MHz

Radio Specification

[Bluetooth (Ver. 4.1 with EDR function)]

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	FHSS
Power Supply (radio part input)	:	DC 3.3 V
Antenna type	:	Chip Antenna
Antenna Gain	:	1.9 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2015, final revised on November 23, 2015 *Some parts are effective on and after December 17, 2015 or December 23, 2015. The revision does not affect the test specification applied to the EUT.
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods **IC:** RSS-Gen 8.8	**FCC:** Section 15.207 **IC:** RSS-Gen 8.8	**QP** 5.9 dB, 1.39587 MHz, L **AV** 7.7 dB, 0.28150 MHz, L	Complied	-
Carrier Frequency Separation	**FCC:** FCC Public Notice DA 00-705 **IC:** -	**FCC:** Section15.247(a)(1) **IC:** RSS-247 5.1 (2)	See data.	Complied	Conducted
20dB Bandwidth	**FCC:** FCC Public Notice DA 00-705 **IC:** -	**FCC:** Section15.247(a)(1) **IC:** RSS-247 5.1 (1)		Complied	Conducted
Number of Hopping Frequency	**FCC:** FCC Public Notice DA 00-705 **IC:** -	**FCC:** Section15.247(a)(1)(iii) **IC:** RSS-247 5.1 (4)		Complied	Conducted
Dwell time	**FCC:** FCC Public Notice DA 00-705 **IC:** -	**FCC:** Section15.247(a)(1)(iii) **IC:** RSS-247 5.1 (4)		Complied	Conducted
Maximum Peak Output Power	**FCC:** FCC Public Notice DA 00-705 **IC:** RSS-Gen 6.12	**FCC:** Section15.247(a)(b)(1) **IC:** RSS-247 5.4 (2)		Complied	Conducted
Spurious Emission & Band Edge Compliance	**FCC:** FCC Public Notice DA 00-705 **IC:** RSS-Gen 6.13	**FCC:** Section15.247(d) **IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	6.9 dB 42.647 MHz, QP, Vert.	Complied	Conducted/ Radiated (above 30 MHz) *1)
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *1) Radiated test was selected over 30 MHz based on section 15.247(d).					

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

FCC Part 15.31 (e)

This EUT provides stable voltage (DC 3.3 V) constantly to RF Part regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	**IC:** RSS-Gen 6.6	**IC:** -	N/A	-	Conducted

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.

Ise EMC Lab.

Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz -3 GHz	3 GHz -18 GHz	18 GHz -26.5 GHz	26.5 GHz -40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	2.6 dB

Frequency range	Conducted emission using AMN(LISN) (±dB)
0.009 – 0.15MHz	3.5 dB
0.15 – 30MHz	2.9 dB

Test distance	Radiated emission (±dB) 9 kHz - 30 MHz
3m	3.8 dB
10m	3.7 dB

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(±dB)		(10 m*)(±dB)	
	30 – 300 MHz	300 – 1000MHz	30 – 300 MHz	300 – 1000MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	4.5 dB	5.9 dB	4.8 dB	5.1 dB

Radiated emission				
(3 m*)(±dB)		(1 m*)(±dB)	(0.5 m*)(±dB)	(10 m*)(±dB)
1 – 6GHz	6 – 18GHz	10 – 26.5 GHz	26.5 – 40GHz	1 -18 GHz
5.1 dB	5.3 dB	5.1 dB	5.1 dB	5.3 dB

*Measurement distance

Conducted Emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test

The data listed in this test report has enough margin, more than the site margin.

3.5 Test Location

UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

Bluetooth (BT): Transmitting (Tx), Payload: PRBS9

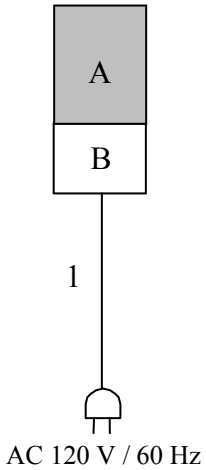
Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz

*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)
*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.
* It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all test items based on Bluetooth Core specification.
*EUT has the power settings by the software as follows;
Power settings: BR: (Ext: 29, Int: 58), EDR(Ext: 93, Int: 60)
Firmware: Host Micro: Ver.001, Bluetooth Module: Ver.001

*This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	LED Bulb Speaker	LSPX-102E26	5C LF00030: AT 5C LF00058: RE	Sony EMCS Corporation	EUT
B	Socket	-	-	-	-

AT: Antenna Terminal Conducted Tests
RE: Radiated Spurious Emission Test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	AC Cable	1.5	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8m above the conducting ground plane.
The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50 ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Detector : QP and CISPR AV
Measurement range : 0.15 MHz - 30 MHz
Test data : APPENDIX
Test result : Pass

SECTION 6: Radiated Spurious Emission

Test Procedure
[For below 1GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	30 MHz to 300 MHz	300 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz *1)	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	3 m (below 10 GHz), 1 m*2) (above 10 GHz)		3 m (below 10 GHz), 1 m*2) (above 10 GHz)

*1) Although DA 00-705 accepts VBW = 10 Hz for AV measurements, it was confirmed that superfluous smoothing was not performed.
*2) Distance Factor: 20 x log (3.0 m / 1.0 m) = 9.5 dB

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 30 M - 26.5 GHz
Test data : APPENDIX
Test result : Pass

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *3)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	300 kHz	1 MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz, 1 MHz	300 kHz, 3 MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *2)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	9.1 kHz	27 kHz				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) Peak hold was applied as Worst-case measurement.
*2) 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.
*3) Reference data

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

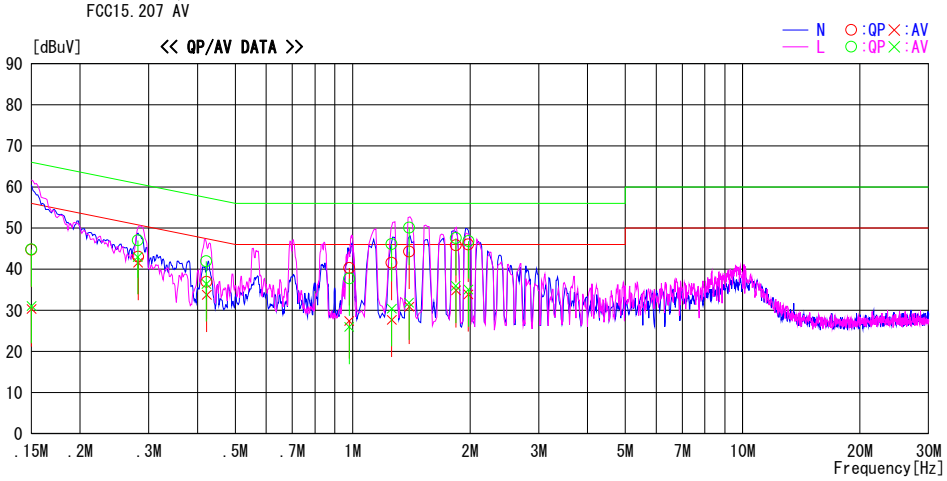
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2015/12/17

Report No. : 11056806H

Temp./Humi. : 23deg. C / 30% RH
Engineer : Takafumi Noguchi

Mode / Remarks : DH5 2480MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



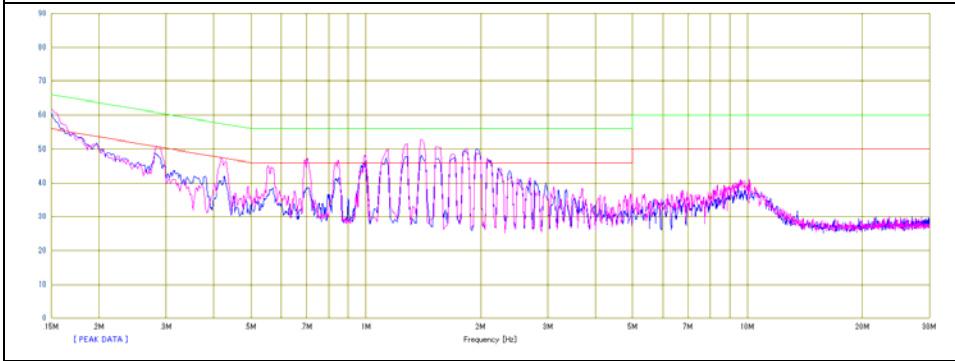
Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.15000	31.5	17.1	13.2	44.7	30.3	66.0	56.0	21.3	25.7	N	
0.28183	29.8	28.4	13.2	43.0	41.6	60.8	50.8	17.8	9.2	N	
0.42240	23.7	20.6	13.2	36.9	33.8	57.4	47.4	20.5	13.6	N	
0.98063	27.0	14.1	13.3	40.3	27.4	56.0	46.0	15.7	18.6	N	
1.25932	28.2	14.3	13.4	41.6	27.7	56.0	46.0	14.4	18.3	N	
1.39687	30.9	17.5	13.4	44.3	30.9	56.0	46.0	11.7	15.1	N	
1.84002	32.4	21.5	13.4	45.8	34.9	56.0	46.0	10.2	11.1	N	
1.97869	32.6	20.5	13.4	46.0	33.9	56.0	46.0	10.0	12.1	N	
0.15000	31.6	17.9	13.2	44.8	31.1	66.0	56.0	21.2	24.9	L	
0.28125	33.8	29.8	13.2	47.0	43.0	60.8	50.8	13.8	7.8	L	
0.42148	28.7	23.2	13.2	41.9	36.4	57.4	47.4	15.5	11.0	L	
0.98032	24.4	12.7	13.3	37.7	26.0	56.0	46.0	18.3	20.0	L	
1.25953	32.7	17.0	13.4	46.1	30.4	56.0	46.0	9.9	15.6	L	
1.39587	36.7	18.5	13.4	50.1	31.9	56.0	46.0	5.9	14.1	L	
1.83775	34.2	22.6	13.4	47.6	36.0	56.0	46.0	8.4	10.0	L	
1.98080	33.4	21.7	13.4	46.8	35.1	56.0	46.0	9.2	10.9	L	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN. + CABLE)
Except for the above table : adequate margin data below the limits.

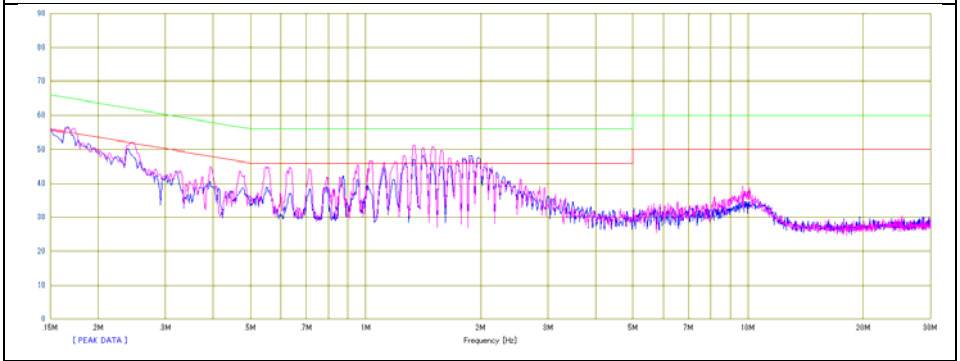
Conducted Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11056806H
Date	December 16, 2015
Temperature / Humidity	23 deg. C / 30 % RH
Engineer	Takafumi Noguchi
Mode	Tx, Hopping Off, DH5

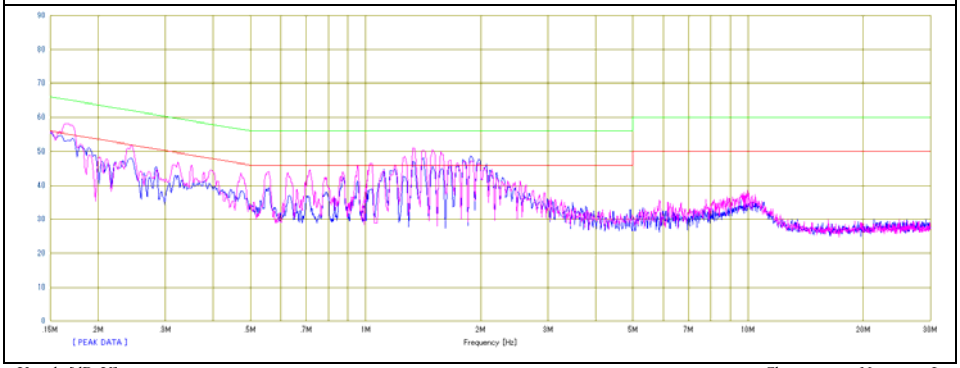
2402 MHz



2441 MHz



2480 MHz



Y scale [dBuV] Chart — N — L

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

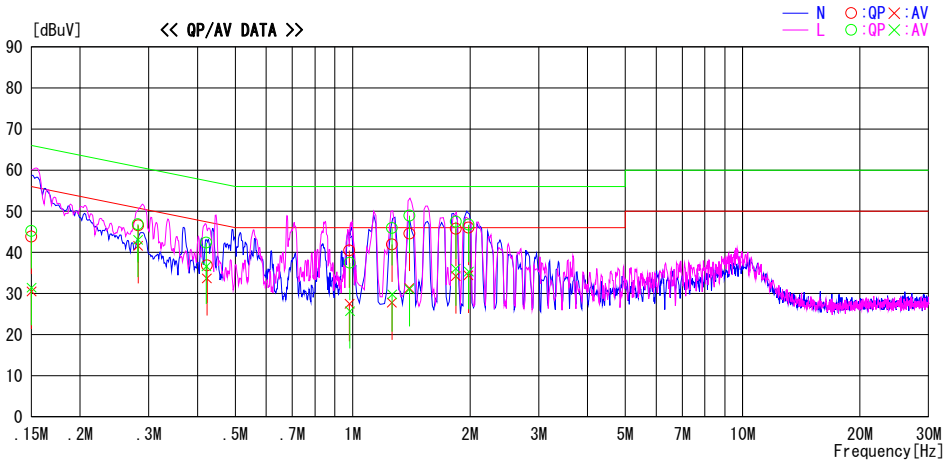
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2015/12/17

Report No. : 11056806H

Temp./Humi. : 23deg. C / 30% RH
Engineer : Takafumi Noguchi

Mode / Remarks : 3DH5 2480MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



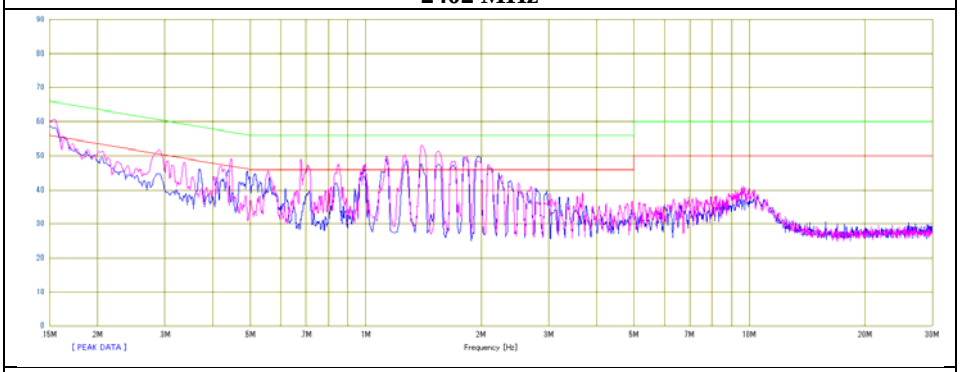
Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.15000	30.6	17.3	13.2	43.8	30.5	66.0	56.0	22.2	25.5	N	
0.28174	33.4	28.4	13.2	46.6	41.6	60.8	50.8	14.2	9.2	N	
0.42274	23.6	20.5	13.2	36.8	33.7	57.4	47.4	20.6	13.7	N	
0.98175	27.2	14.2	13.3	40.5	27.5	56.0	46.0	15.5	18.5	N	
1.26093	28.5	14.4	13.4	41.9	27.8	56.0	46.0	14.1	18.2	N	
1.39787	31.2	17.9	13.4	44.6	31.3	56.0	46.0	11.4	14.7	N	
1.83780	32.3	20.8	13.4	45.7	34.2	56.0	46.0	10.3	11.8	N	
1.98166	32.6	21.0	13.4	46.0	34.4	56.0	46.0	10.0	11.6	N	
0.15000	32.0	18.2	13.2	45.2	31.4	66.0	56.0	20.8	24.6	L	
0.28150	33.6	29.9	13.2	46.8	43.1	60.8	50.8	14.0	7.7	L	
0.42155	29.2	23.4	13.2	42.4	36.6	57.4	47.4	15.0	10.8	L	
0.98305	24.2	12.4	13.3	37.5	25.7	56.0	46.0	18.5	20.3	L	
1.26182	32.5	16.4	13.4	45.9	29.8	56.0	46.0	10.1	16.2	L	
1.39854	35.5	17.7	13.4	48.9	31.1	56.0	46.0	7.1	14.9	L	
1.83928	34.1	22.7	13.4	47.5	36.1	56.0	46.0	8.5	9.9	L	
1.98320	33.3	21.9	13.4	46.7	35.3	56.0	46.0	9.3	10.7	L	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN. + CABLE)
Except for the above table : adequate margin data below the limits.

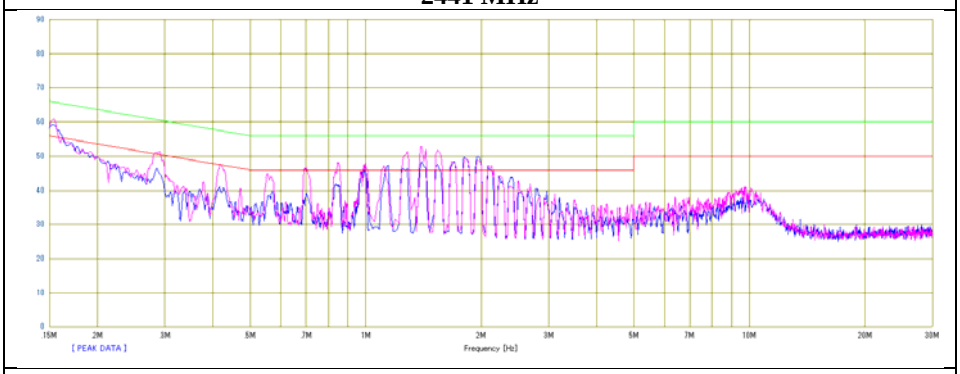
Conducted Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11056806H
Date	December 16, 2015
Temperature / Humidity	23 deg. C / 30 % RH
Engineer	Takafumi Noguchi
Mode	Tx, Hopping Off, 3DH5

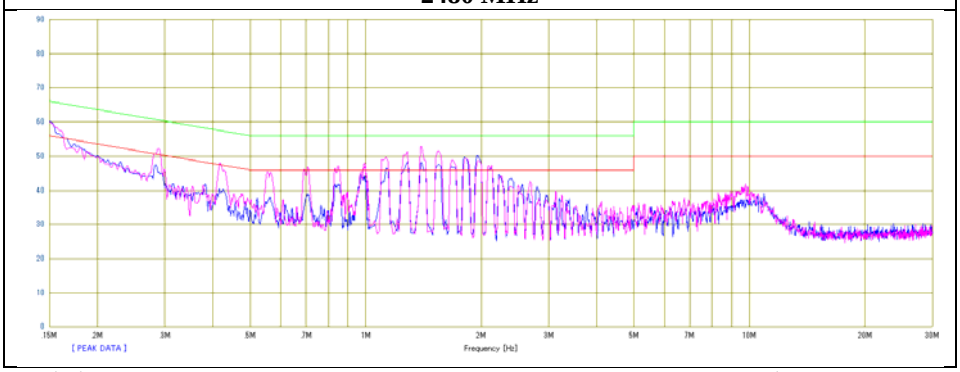
2402 MHz



2441 MHz



2480 MHz



Y scale [dBuV]

Chart — N — L

20dB Bandwidth and Carrier Frequency Separation

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off/On

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.943	1.000	>= 0.629
DH5	2441.0	0.943	1.003	>= 0.629
DH5	2480.0	0.962	1.000	>= 0.642
3DH5	2402.0	1.264	1.000	>= 0.843
3DH5	2441.0	1.269	1.003	>= 0.846
3DH5	2480.0	1.292	1.000	>= 0.861

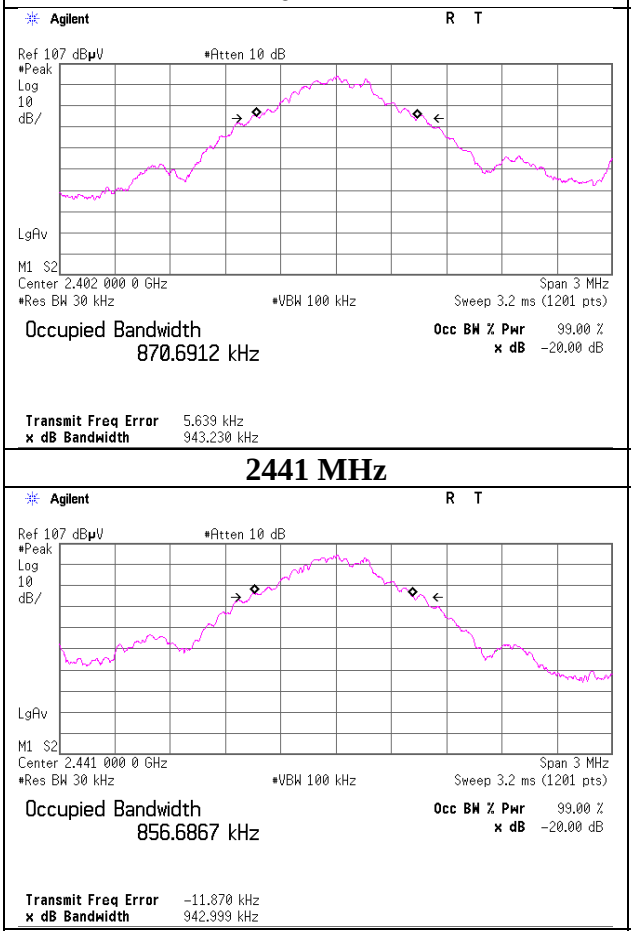
Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).
No limit applies to 20dB Bandwidth.

20dB Bandwidth and Carrier Frequency Separation

DH5

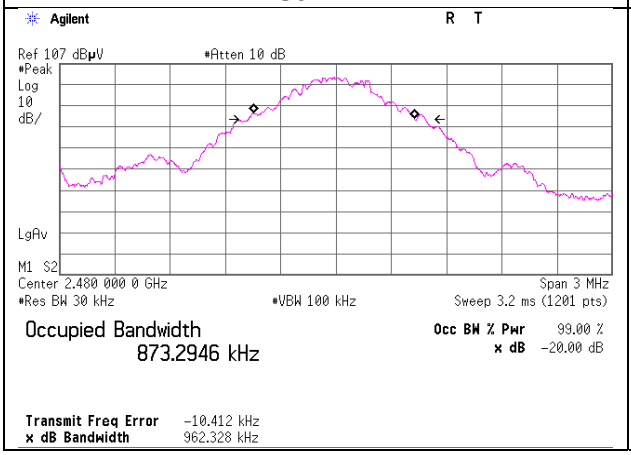
20 dB Bandwidth

2402 MHz



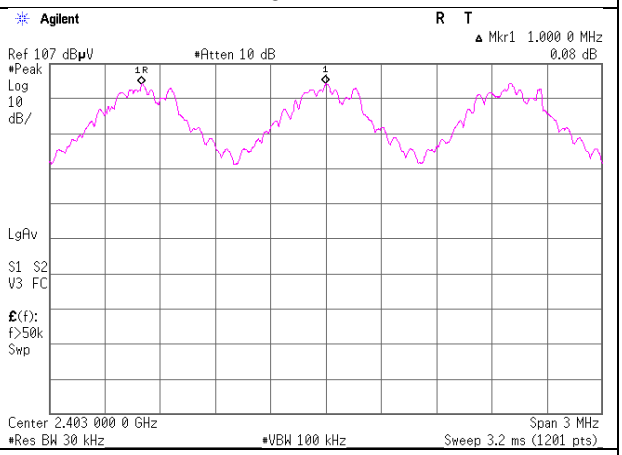
2441 MHz

2480 MHz

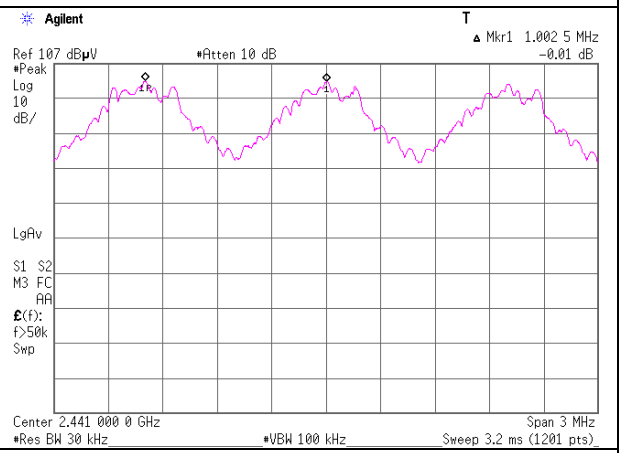


Carrier Frequency Separation

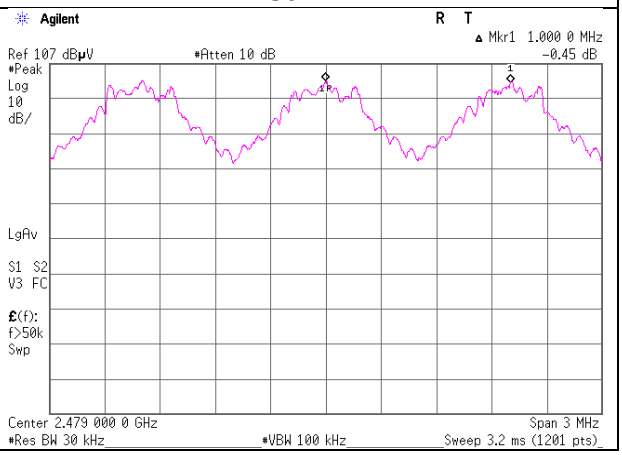
2402 MHz



2441 MHz



2480 MHz

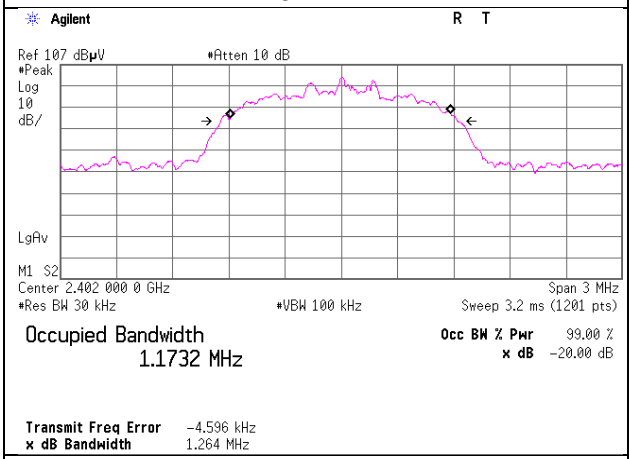


20dB Bandwidth and Carrier Frequency Separation

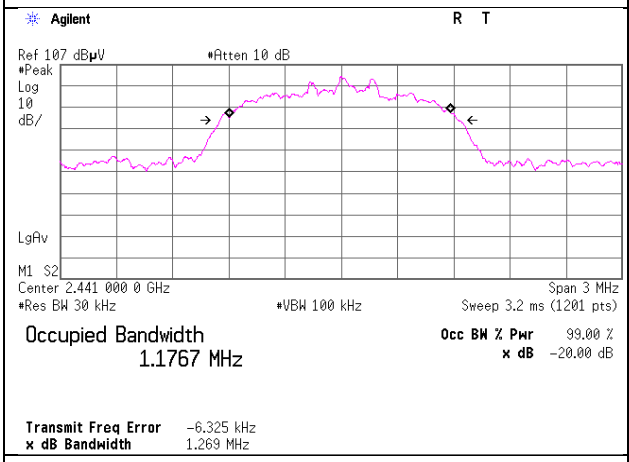
3DH5

20 dB Bandwidth

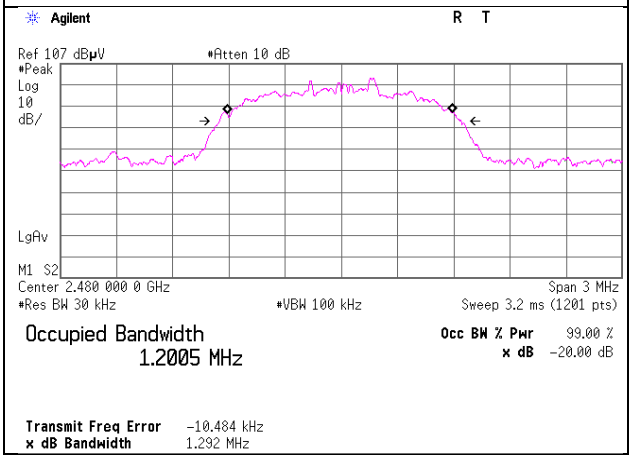
2402 MHz



2441 MHz

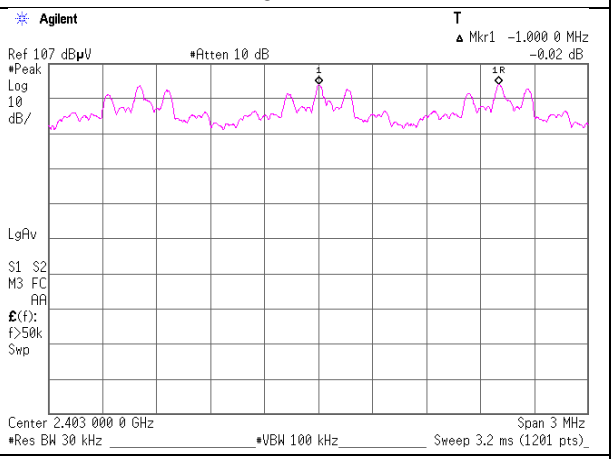


2480 MHz

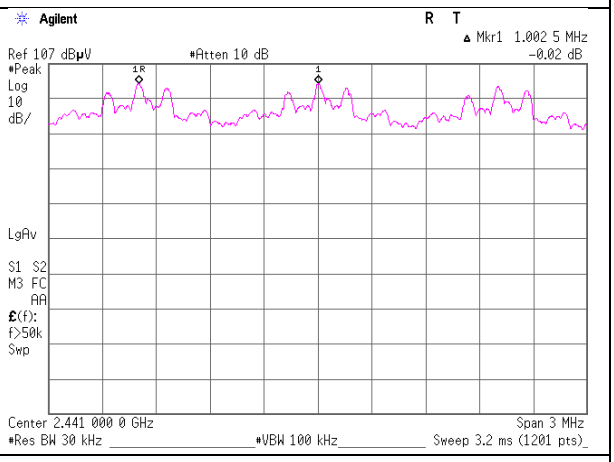


Carrier Frequency Separation

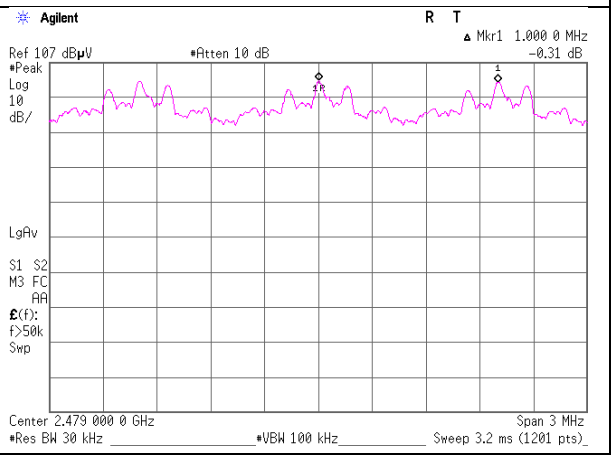
2402 MHz



2441 MHz



2480 MHz



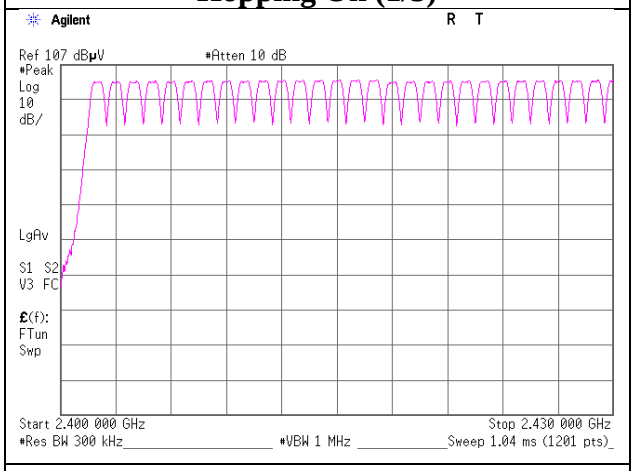
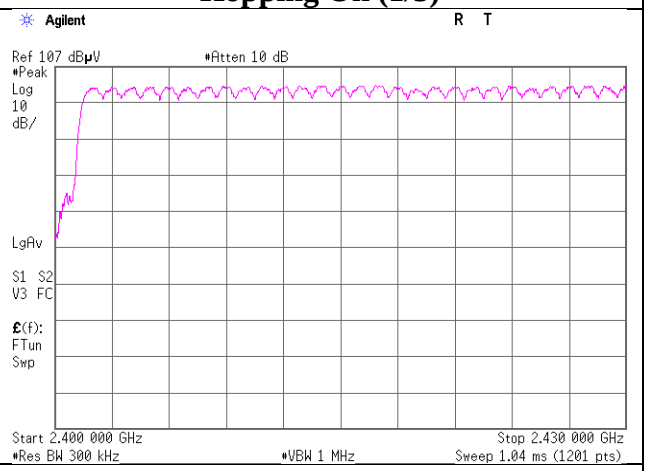
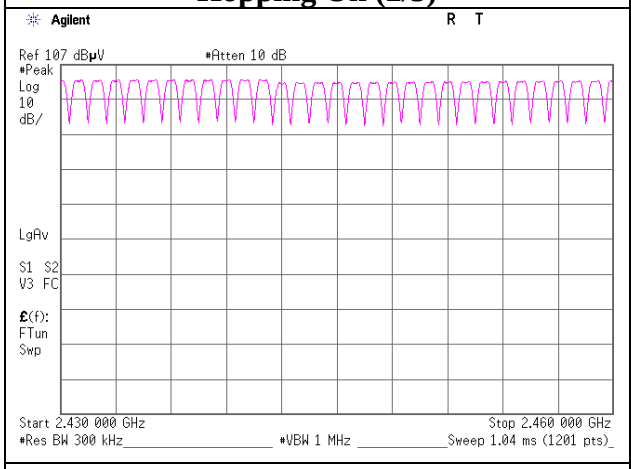
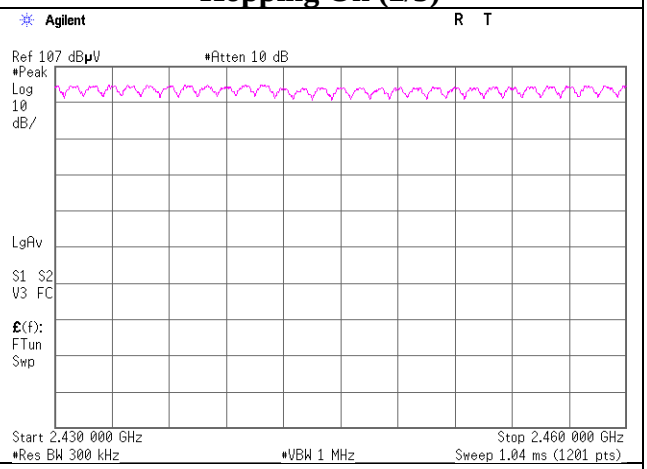
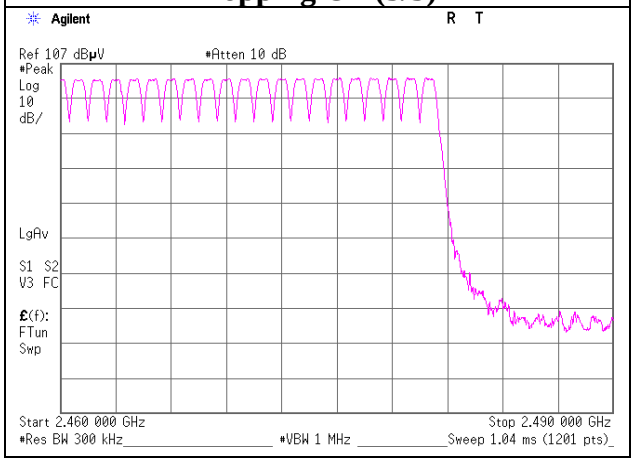
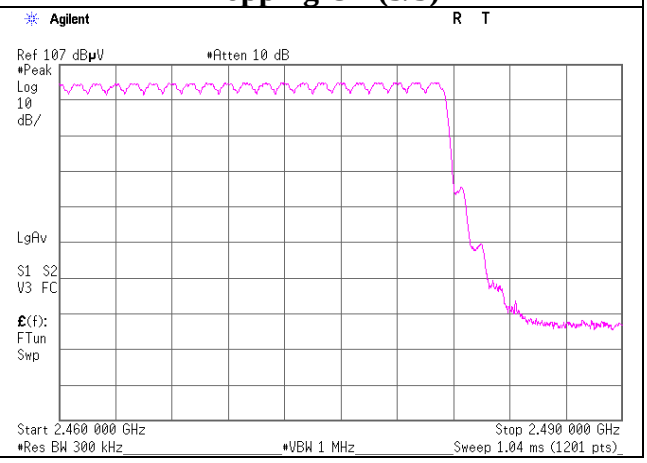
Number of Hopping Frequency

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping On

Mode	Number of channel [channels]	Limit [channels]
DH5	79	>= 15
3DH5	79	>= 15

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.

Number of Hopping Frequency

DH5	3DH5
Hopping On (1/3)	**Hopping On (1/3)**
	
Hopping On (2/3)	**Hopping On (2/3)**
	
Hopping On (3/3)	**Hopping On (3/3)**
	

Dwell time

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping On

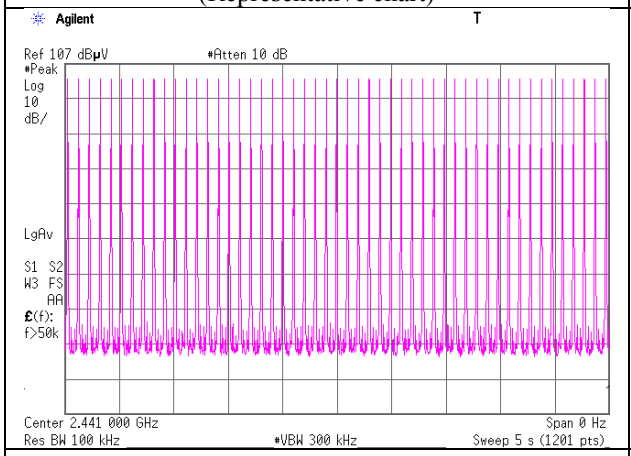
Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period	Length of transmission [msec]	Result [msec]	Limit [msec]
DH1	51.0 times / 5 sec. x 31.6 sec. = 323 times	0.434	140	400
DH3	26.0 times / 5 sec. x 31.6 sec. = 165 times	1.700	281	400
DH5	17.0 times / 5 sec. x 31.6 sec. = 108 times	2.940	318	400
3DH1	51.0 times / 5 sec. x 31.6 sec. = 323 times	0.448	145	400
3DH3	26.0 times / 5 sec. x 31.6 sec. = 165 times	1.707	282	400
3DH5	17.0 times / 5 sec. x 31.6 sec. = 108 times	2.965	320	400

Sample Calculation
Result = Number of transmission x Length of transmission

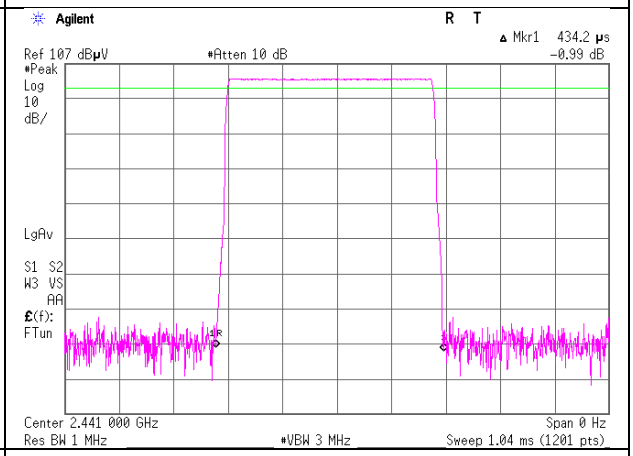
This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in N x 0.4s, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4s regardless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

Dwell time

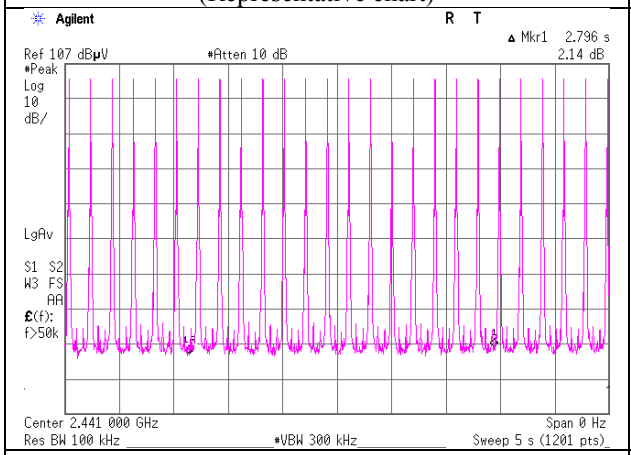
DH1 (1/2)
(Representative chart)



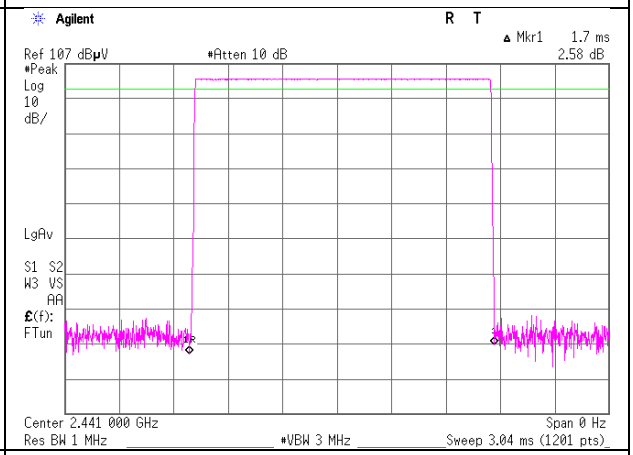
DH1 (2/2)



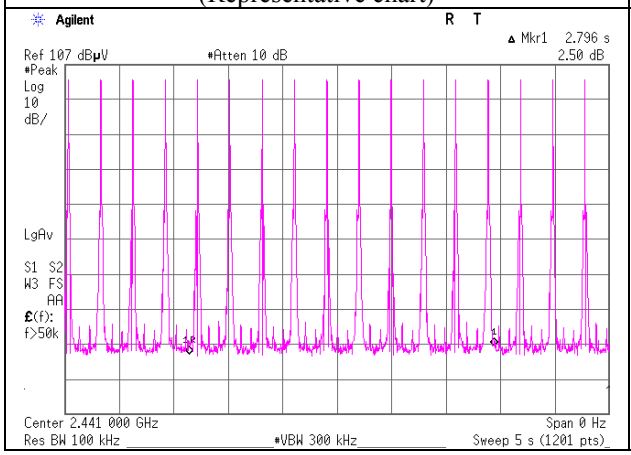
DH3 (1/2)
(Representative chart)



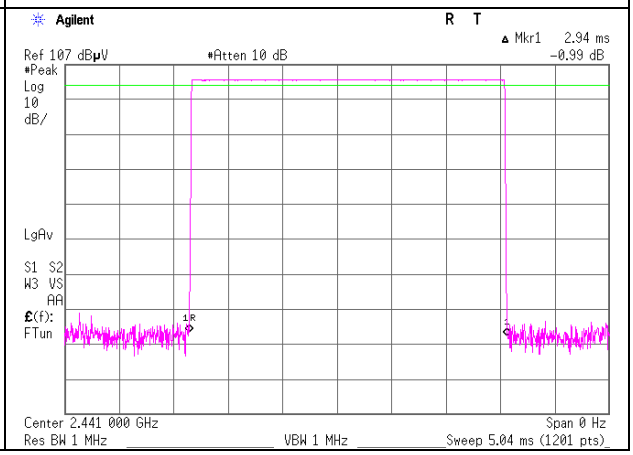
DH3 (2/2)



DH5 (1/2)
(Representative chart)

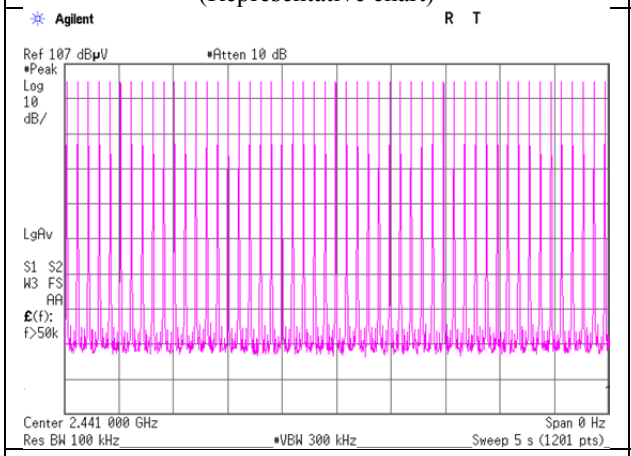


DH5 (2/2)

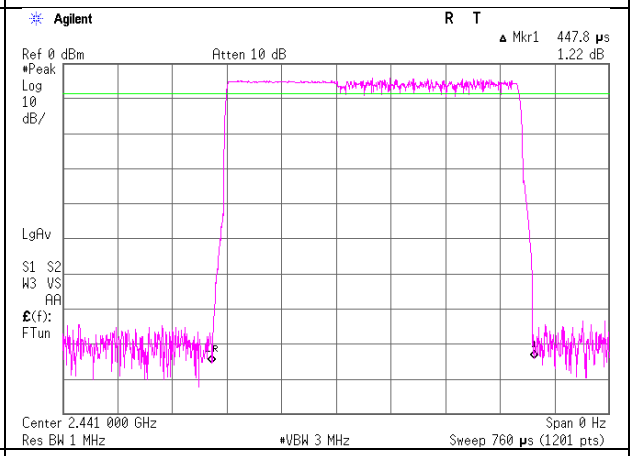


Dwell time

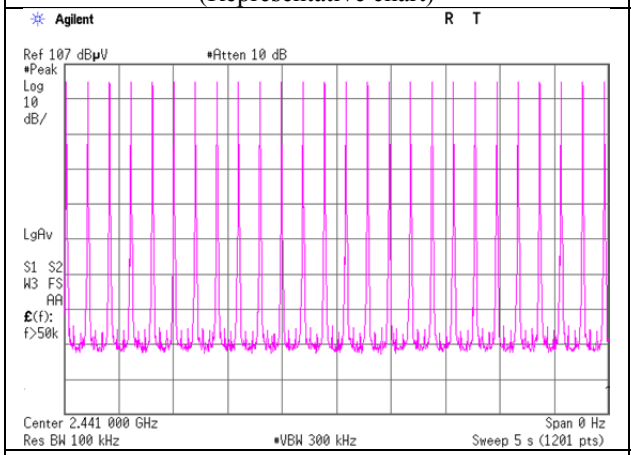
3DH1 (1/2)
(Representative chart)



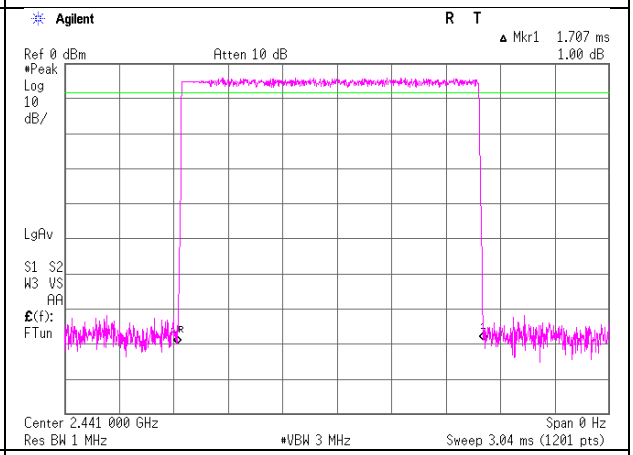
3DH1 (2/2)



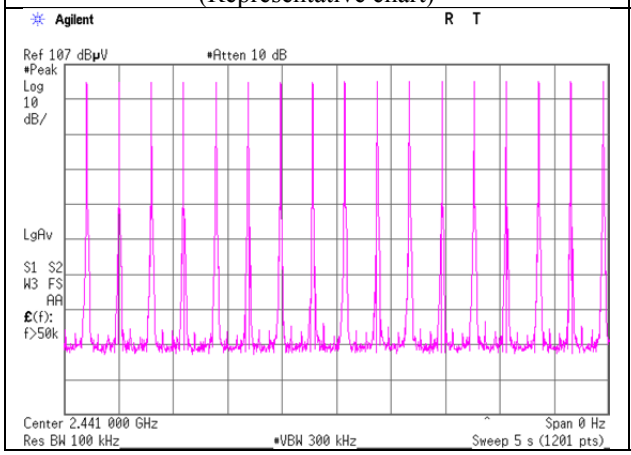
3DH3 (1/2)
(Representative chart)



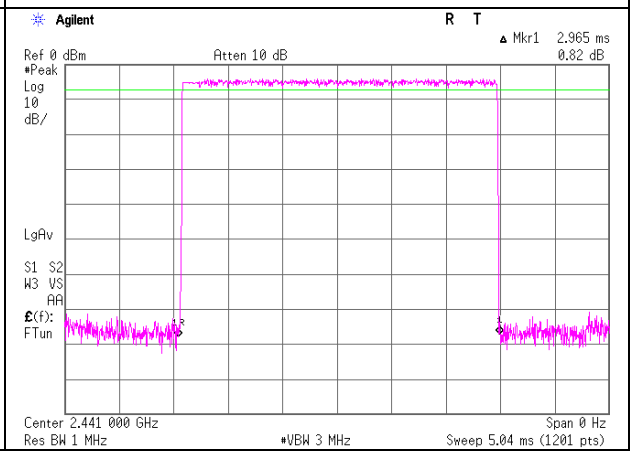
3DH3 (2/2)



3DH5 (1/2)
(Representative chart)



3DH5 (2/2)



Maximum Peak Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off

Mode	Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
DH5	2402.0	-4.97	1.43	10.02	6.48	4.45	20.96	125	14.48
DH5	2441.0	-4.28	1.45	10.02	7.19	5.23	20.96	125	13.77
DH5	2480.0	-4.20	1.46	10.02	7.28	5.35	20.96	125	13.68
2DH5	2402.0	-4.63	1.43	10.02	6.82	4.81	20.96	125	14.14
2DH5	2441.0	-4.08	1.45	10.02	7.39	5.48	20.96	125	13.57
2DH5	2480.0	-3.98	1.46	10.02	7.50	5.62	20.96	125	13.46
3DH5	2402.0	-4.43	1.43	10.02	7.02	5.04	20.96	125	13.94
3DH5	2441.0	-3.90	1.45	10.02	7.57	5.71	20.96	125	13.39
3DH5	2480.0	-3.80	1.46	10.02	7.68	5.86	20.96	125	13.28

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.
As this device had AFH mode and frequency separation could not meet the requirement of over 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

Average Output Power
(Reference data for RF Exposure / SAR testing)

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power) [dBm]	[mW]
DH5	2402.0	-6.47	1.43	10.02	4.98	3.15
DH5	2441.0	-5.71	1.45	10.02	5.76	3.76
DH5	2480.0	-5.64	1.46	10.02	5.84	3.84
2DH5	2402.0	-7.94	1.43	10.02	3.51	2.25
2DH5	2441.0	-7.34	1.45	10.02	4.13	2.59
2DH5	2480.0	-7.22	1.46	10.02	4.26	2.67
3DH5	2402.0	-7.97	1.43	10.02	3.48	2.23
3DH5	2441.0	-7.36	1.45	10.02	4.11	2.57
3DH5	2480.0	-7.25	1.46	10.02	4.23	2.65

Sample Calculation:
Result (Frame power) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

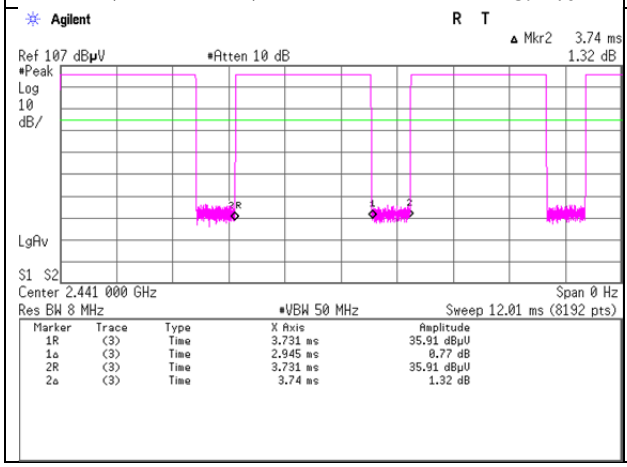
Burst Rate Confirmation

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off

DH5

Tx on / (Tx on + Tx off) = 0.787

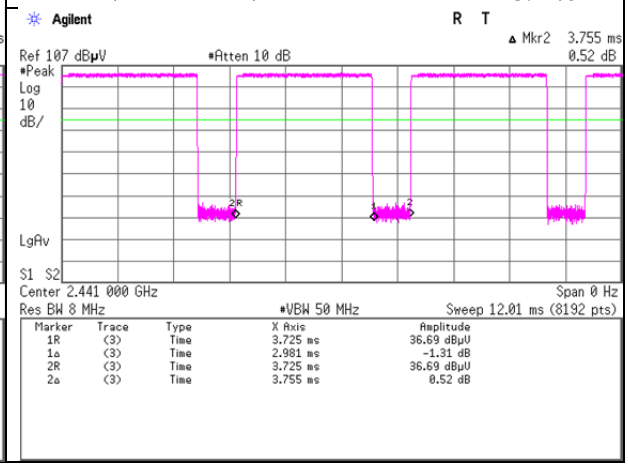
Tx on / (Tx on + Tx off) * 100 = 78.7 %



3DH5

Tx on / (Tx on + Tx off) = 0.794

Tx on / (Tx on + Tx off) * 100 = 79.4 %



Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 11056806H
Date December 19, 2015
Temperature / Humidity 21 deg. C / 31 % RH
Engineer Takumi Shimada
Mode Tx, Hopping Off, DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	42.647	QP	28.4	13.3	7.3	32.1	16.9	40.0	23.1	
Hori	59.343	QP	27.5	7.7	7.6	32.0	10.8	40.0	29.2	
Hori	85.528	QP	24.6	7.6	7.9	32.1	8.0	40.0	32.0	
Hori	136.583	QP	28.2	14.2	8.5	32.0	18.9	43.5	24.6	
Hori	289.834	QP	37.2	19.4	9.8	31.8	34.6	46.0	11.4	
Hori	368.510	QP	34.6	18.2	10.4	31.9	31.3	46.0	14.7	
Hori	2390.000	PK	42.6	27.9	6.8	32.1	45.2	73.9	28.7	
Hori	2558.000	PK	45.5	28.1	6.9	32.1	48.4	73.9	25.5	
Hori	4804.000	PK	42.8	32.8	9.2	31.3	53.5	73.9	20.4	
Hori	7206.000	PK	42.5	36.8	10.4	32.6	57.1	73.9	16.8	
Hori	9608.000	PK	41.1	38.1	11.1	32.6	57.7	73.9	16.2	
Hori	2390.000	AV	28.0	27.9	6.8	32.1	30.6	53.9	23.3	
Hori	2558.000	AV	37.1	28.1	6.9	32.1	40.0	53.9	13.9	
Hori	4804.000	AV	31.1	32.8	9.2	31.3	41.8	53.9	12.1	
Hori	7206.000	AV	29.0	36.8	10.4	32.6	43.6	53.9	10.3	
Hori	9608.000	AV	28.2	38.1	11.1	32.6	44.8	53.9	9.2	
Vert	42.647	QP	44.6	13.3	7.3	32.1	33.1	40.0	6.9	
Vert	59.343	QP	40.1	7.7	7.6	32.0	23.4	40.0	16.6	
Vert	85.528	QP	33.7	7.6	7.9	32.1	17.1	40.0	23.0	
Vert	136.583	QP	30.4	14.2	8.5	32.0	21.1	43.5	22.4	
Vert	289.834	QP	33.5	19.4	9.8	31.8	30.9	46.0	15.1	
Vert	368.510	QP	30.7	18.2	10.4	31.9	27.4	46.0	18.6	
Vert	2390.000	PK	41.1	27.9	6.8	32.1	43.7	73.9	30.2	
Vert	2558.000	PK	45.0	28.1	6.9	32.1	47.9	73.9	26.0	
Vert	4804.000	PK	43.2	32.8	9.2	31.3	53.9	73.9	20.1	
Vert	7206.000	PK	42.8	36.8	10.4	32.6	57.4	73.9	16.5	
Vert	9608.000	PK	42.0	38.1	11.1	32.6	58.6	73.9	15.3	
Vert	2390.000	AV	29.4	27.9	6.8	32.1	32.0	53.9	21.9	
Vert	2558.000	AV	34.9	28.1	6.9	32.1	37.8	53.9	16.1	
Vert	4804.000	AV	32.2	32.8	9.2	31.3	42.9	53.9	11.0	
Vert	7206.000	AV	29.7	36.8	10.4	32.6	44.3	53.9	9.6	
Vert	9608.000	AV	28.2	38.1	11.1	32.6	44.8	53.9	9.1	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
Distance factor: 10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = 9.5 dB
26.5 GHz - 40 GHz 20log (3.0 m / 0.5 m) = 15.6 dB

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	93.7	28.0	6.8	32.1	96.4	-	-	Carrier
Hori	2400.000	PK	44.0	28.0	6.8	32.1	46.7	76.4	29.7	
Vert	2402.000	PK	94.2	28.0	6.8	32.1	96.9	-	-	Carrier
Vert	2400.000	PK	44.1	28.0	6.8	32.1	46.8	76.9	30.1	

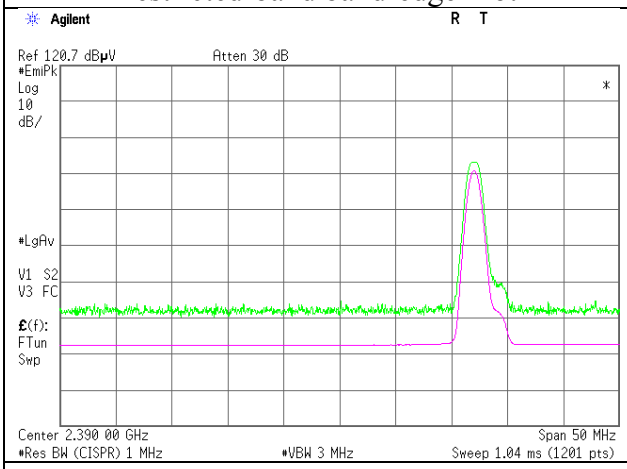
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amprifier)

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11056806H
Date	December 19, 2015
Temperature / Humidity	21 deg. C / 31 % RH
Engineer	Takumi Shimada (1-10GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz

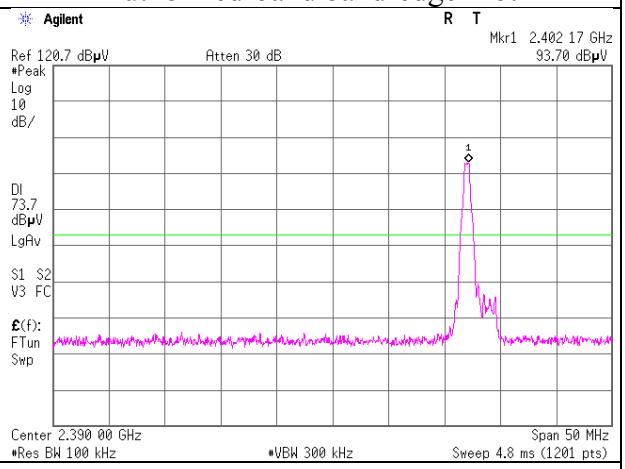
Horizontal

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

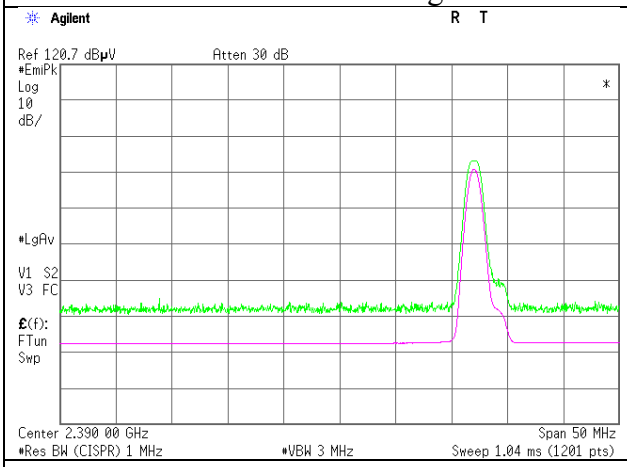
Authorized-band band-edge Plot



20dBc Plot

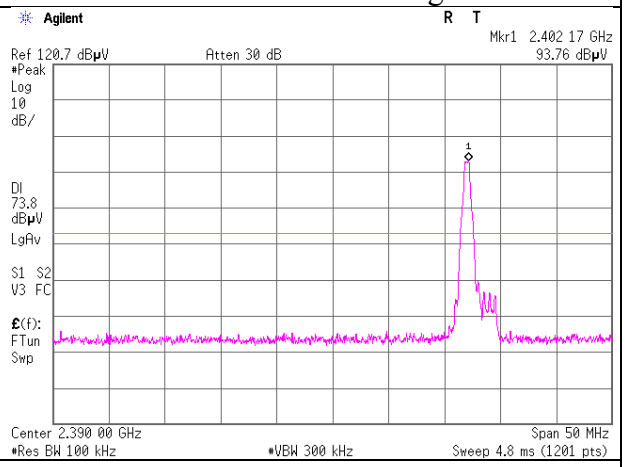
Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Authorized-band band-edge Plot



20dBc Plot

* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 11056806H
Date December 19, 2015
Temperature / Humidity 21 deg. C / 31 % RH
Engineer Takumi Shimada
Mode Tx, Hopping Off, DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	42.651	QP	28.4	13.3	7.3	32.1	16.9	40.0	23.1	
Hori	59.338	QP	27.7	7.7	7.6	32.0	11.0	40.0	29.0	
Hori	85.515	QP	24.5	7.6	7.9	32.1	7.9	40.0	32.1	
Hori	136.565	QP	28.1	14.2	8.5	32.0	18.8	43.5	24.7	
Hori	289.862	QP	36.9	19.4	9.8	31.8	34.3	46.0	11.7	
Hori	368.527	QP	34.2	18.2	10.4	31.9	30.9	46.0	15.1	
Hori	2597.000	PK	46.1	28.1	6.9	32.0	49.1	73.9	24.8	
Hori	4882.000	PK	41.4	33.1	9.3	31.3	52.5	73.9	21.4	
Hori	7323.000	PK	42.5	36.8	10.4	32.6	57.1	73.9	16.8	
Hori	9764.000	PK	41.1	38.2	11.2	32.7	57.8	73.9	16.1	
Hori	2597.000	AV	36.6	28.1	6.9	32.0	39.6	53.9	14.4	
Hori	4882.000	AV	30.2	33.1	9.3	31.3	41.3	53.9	12.6	
Hori	7323.000	AV	30.4	36.8	10.4	32.6	45.0	53.9	8.9	
Hori	9764.000	AV	29.5	38.2	11.2	32.7	46.2	53.9	7.7	
Vert	42.651	QP	44.5	13.3	7.3	32.1	33.0	40.0	7.0	
Vert	59.338	QP	40.3	7.7	7.6	32.0	23.6	40.0	16.4	
Vert	85.515	QP	33.1	7.6	7.9	32.1	16.5	40.0	23.5	
Vert	136.565	QP	30.2	14.2	8.5	32.0	20.9	43.5	22.6	
Vert	289.862	QP	33.7	19.4	9.8	31.8	31.1	46.0	14.9	
Vert	368.527	QP	30.4	18.2	10.4	31.9	27.1	46.0	18.9	
Vert	2597.000	PK	46.6	28.1	6.9	32.0	49.6	73.9	24.3	
Vert	4882.000	PK	41.3	33.1	9.3	31.3	52.4	73.9	21.5	
Vert	7323.000	PK	41.7	36.8	10.4	32.6	56.3	73.9	17.6	
Vert	9764.000	PK	40.7	38.2	11.2	32.7	57.4	73.9	16.5	
Vert	2597.000	AV	37.2	28.1	6.9	32.0	40.2	53.9	13.7	
Vert	4882.000	AV	31.6	33.1	9.3	31.3	42.7	53.9	11.3	
Vert	7323.000	AV	30.3	36.8	10.4	32.6	44.9	53.9	9.0	
Vert	9764.000	AV	29.5	38.2	11.2	32.7	46.2	53.9	7.7	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
Distance factor: 10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = 9.5 dB
26.5 GHz - 40 GHz 20log (3.0 m / 0.5 m) = 15.6 dB

Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 11056806H
Date December 19, 2015
Temperature / Humidity 21 deg. C / 31 % RH
Engineer Takumi Shimada
Mode Tx, Hopping Off, DH5 2480 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	42.624	QP	28.5	13.3	7.3	32.1	17.0	40.0	23.0	
Hori	59.341	QP	27.3	7.7	7.6	32.0	10.6	40.0	29.4	
Hori	85.497	QP	24.6	7.6	7.9	32.1	8.0	40.0	32.0	
Hori	136.518	QP	28.5	14.2	8.5	32.0	19.2	43.5	24.3	
Hori	289.827	QP	37.6	19.4	9.8	31.8	35.0	46.0	11.0	
Hori	368.534	QP	34.4	18.2	10.4	31.9	31.1	46.0	14.9	
Hori	2483.500	PK	43.2	28.1	6.9	32.1	46.1	73.9	27.8	
Hori	2636.000	PK	45.7	28.1	7.0	32.0	48.8	73.9	25.2	
Hori	4960.000	PK	40.9	33.4	9.3	31.2	52.4	73.9	21.5	
Hori	7440.000	PK	43.1	36.8	10.4	32.7	57.6	73.9	16.3	
Hori	9920.000	PK	42.1	38.3	11.2	32.8	58.8	73.9	15.1	
Hori	2483.500	AV	29.2	28.1	6.9	32.1	32.1	53.9	21.8	
Hori	2636.000	AV	36.7	28.1	7.0	32.0	39.8	53.9	14.2	
Hori	4960.000	AV	28.0	33.4	9.3	31.2	39.5	53.9	14.5	
Hori	7440.000	AV	29.5	36.8	10.4	32.7	44.0	53.9	9.9	
Hori	9920.000	AV	28.4	38.3	11.2	32.8	45.1	53.9	8.8	
Vert	42.624	QP	44.1	13.3	7.3	32.1	32.6	40.0	7.4	
Vert	59.341	QP	40.5	7.7	7.6	32.0	23.8	40.0	16.2	
Vert	85.497	QP	33.3	7.6	7.9	32.1	16.7	40.0	23.3	
Vert	136.518	QP	31.0	14.2	8.5	32.0	21.7	43.5	21.8	
Vert	289.827	QP	33.2	19.4	9.8	31.8	30.6	46.0	15.4	
Vert	368.534	QP	30.7	18.2	10.4	31.9	27.4	46.0	18.6	
Vert	2483.500	PK	43.4	28.1	6.9	32.1	46.3	73.9	27.6	
Vert	2636.000	PK	45.9	28.1	7.0	32.0	49.0	73.9	24.9	
Vert	4960.000	PK	41.8	33.4	9.3	31.2	53.3	73.9	20.6	
Vert	7440.000	PK	43.4	36.8	10.4	32.7	57.9	73.9	16.0	
Vert	9920.000	PK	42.2	38.3	11.2	32.8	58.9	73.9	15.0	
Vert	2483.500	AV	31.1	28.1	6.9	32.1	34.0	53.9	19.9	
Vert	2636.000	AV	37.5	28.1	7.0	32.0	40.6	53.9	13.3	
Vert	4960.000	AV	28.7	33.4	9.3	31.2	40.2	53.9	13.7	
Vert	7440.000	AV	30.2	36.8	10.4	32.7	44.7	53.9	9.2	
Vert	9920.000	AV	28.4	38.3	11.2	32.8	45.1	53.9	8.8	

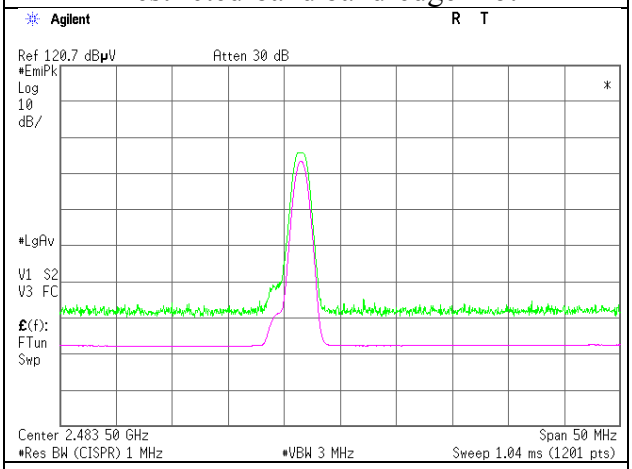
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
Distance factor: 10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = 9.5 dB
26.5 GHz - 40 GHz 20log (3.0 m / 0.5 m) = 15.6 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11056806H
Date	December 19, 2015
Temperature / Humidity	21 deg. C / 31 % RH
Engineer	Takumi Shimada (1-10GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz

Horizontal

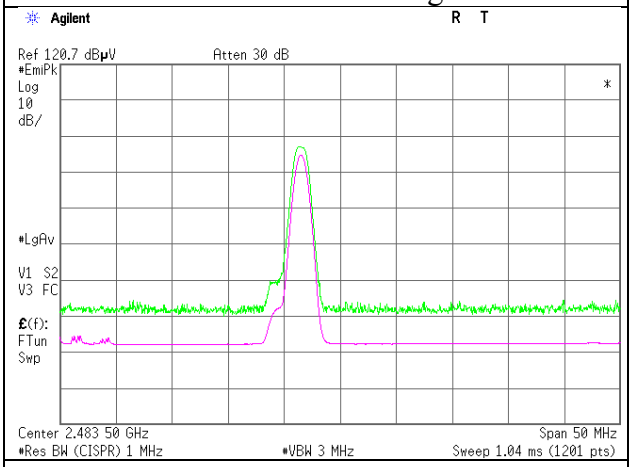
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 11056806H
Date December 19, 2015
Temperature / Humidity 21 deg. C / 31 % RH
Engineer Takumi Shimada
Mode Tx, Hopping Off, 3DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	42.619	QP	28.7	13.3	7.3	32.1	17.2	40.0	22.8	
Hori	59.360	QP	27.0	7.7	7.6	32.0	10.3	40.0	29.7	
Hori	85.524	QP	24.7	7.6	7.9	32.1	8.1	40.0	31.9	
Hori	136.546	QP	28.2	14.2	8.5	32.0	18.9	43.5	24.6	
Hori	289.842	QP	37.3	19.4	9.8	31.8	34.7	46.0	11.3	
Hori	368.464	QP	34.1	18.2	10.4	31.9	30.8	46.0	15.2	
Hori	2390.000	PK	41.9	27.9	6.8	32.1	44.5	73.9	29.4	
Hori	2558.000	PK	46.0	28.1	6.9	32.1	48.9	73.9	25.0	
Hori	4804.000	PK	40.7	32.8	9.2	31.3	51.4	73.9	22.5	
Hori	7206.000	PK	42.1	36.8	10.4	32.6	56.7	73.9	17.2	
Hori	9608.000	PK	41.5	38.1	11.1	32.6	58.1	73.9	15.8	
Hori	2390.000	AV	28.1	27.9	6.8	32.1	30.7	53.9	23.2	
Hori	2558.000	AV	34.4	28.1	6.9	32.1	37.3	53.9	16.6	
Hori	4804.000	AV	27.0	32.8	9.2	31.3	37.7	53.9	16.2	
Hori	7206.000	AV	29.3	36.8	10.4	32.6	43.9	53.9	10.0	
Hori	9608.000	AV	28.3	38.1	11.1	32.6	44.9	53.9	9.0	
Vert	42.619	QP	44.4	13.3	7.3	32.1	32.9	40.0	7.1	
Vert	59.326	QP	40.7	7.7	7.6	32.0	24.0	40.0	16.0	
Vert	85.524	QP	33.5	7.6	7.9	32.1	16.9	40.0	23.1	
Vert	136.546	QP	31.3	14.2	8.5	32.0	22.0	43.5	21.5	
Vert	289.842	QP	33.4	19.4	9.8	31.8	30.8	46.0	15.2	
Vert	368.464	QP	30.5	18.2	10.4	31.9	27.2	46.0	18.8	
Vert	2390.000	PK	41.8	27.9	6.8	32.1	44.4	73.9	29.5	
Vert	2558.000	PK	45.6	28.1	6.9	32.1	48.5	73.9	25.4	
Vert	4804.000	PK	40.8	32.8	9.2	31.3	51.5	73.9	22.4	
Vert	7206.000	PK	43.0	36.8	10.4	32.6	57.6	73.9	16.3	
Vert	9608.000	PK	42.4	38.1	11.1	32.6	59.0	73.9	14.9	
Vert	2390.000	AV	29.4	27.9	6.8	32.1	32.0	53.9	21.9	
Vert	2558.000	AV	34.4	28.1	6.9	32.1	37.3	53.9	16.6	
Vert	4804.000	AV	27.0	32.8	9.2	31.3	37.7	53.9	16.2	
Vert	7206.000	AV	29.4	36.8	10.4	32.6	44.0	53.9	9.9	
Vert	9608.000	AV	28.2	38.1	11.1	32.6	44.8	53.9	9.1	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
Distance factor: 10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = 9.5 dB
26.5 GHz - 40 GHz 20log (3.0 m / 0.5 m) = 15.6 dB

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	93.4	28.0	6.8	32.1	96.1	-	-	Carrier
Hori	2400.000	PK	53.8	28.0	6.8	32.1	56.5	76.1	19.6	
Vert	2402.000	PK	92.4	28.0	6.8	32.1	95.1	-	-	Carrier
Vert	2400.000	PK	52.7	28.0	6.8	32.1	55.4	75.1	19.7	

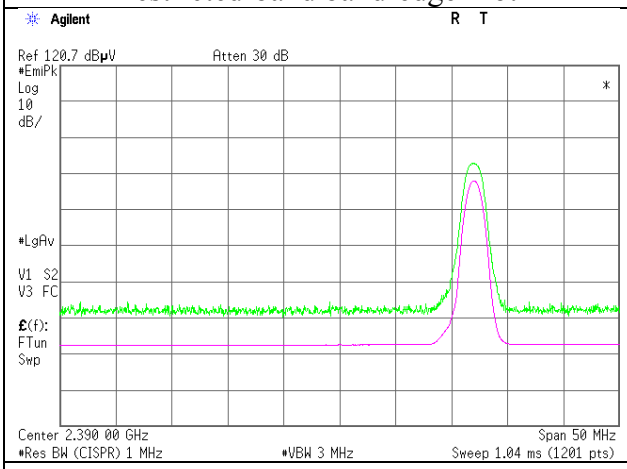
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amprifier)

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11056806H
Date	December 19, 2015
Temperature / Humidity	21 deg. C / 31 % RH
Engineer	Takumi Shimada (1-10GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz

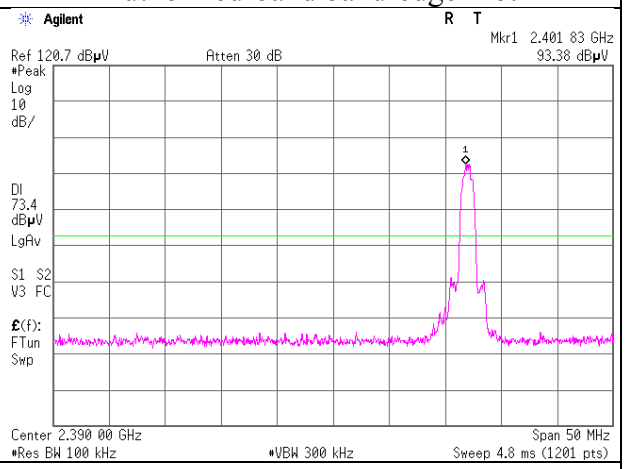
Horizontal

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

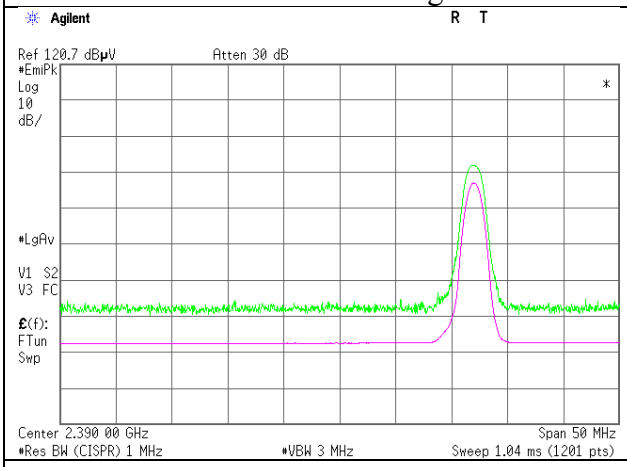
Authorized-band band-edge Plot



20dBc Plot

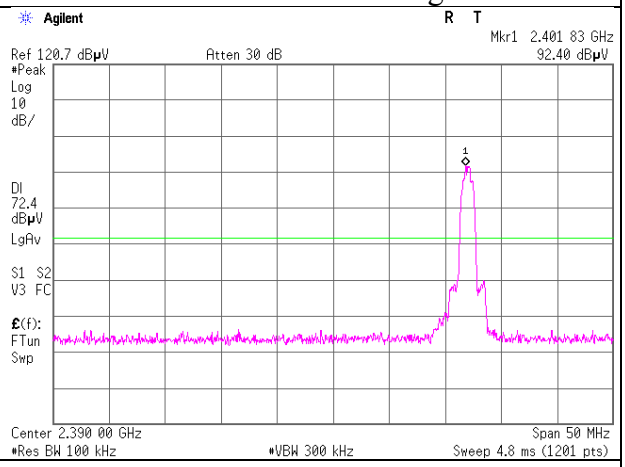
Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Authorized-band band-edge Plot



20dBc Plot

* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 11056806H
Date December 19, 2015
Temperature / Humidity 21 deg. C / 31 % RH
Engineer Takumi Shimada
Mode Tx, Hopping Off, 3DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	42.586	QP	28.5	13.3	7.3	32.1	17.0	40.0	23.0	
Hori	59.438	QP	28.6	7.7	7.6	32.0	11.9	40.0	28.1	
Hori	85.586	QP	24.5	7.6	7.9	32.1	7.9	40.0	32.1	
Hori	136.496	QP	28.3	14.2	8.5	32.0	19.0	43.5	24.5	
Hori	289.883	QP	35.8	19.4	9.8	31.8	33.2	46.0	12.8	
Hori	368.513	QP	34.3	18.2	10.4	31.9	31.0	46.0	15.0	
Hori	2597.000	PK	44.2	28.1	6.9	32.0	47.2	73.9	26.7	
Hori	4882.000	PK	40.9	33.1	9.3	31.3	52.0	73.9	21.9	
Hori	7323.000	PK	42.3	36.8	10.4	32.6	56.9	73.9	17.0	
Hori	9764.000	PK	41.3	38.2	11.2	32.7	58.0	73.9	15.9	
Hori	2597.000	AV	34.9	28.1	6.9	32.0	37.9	53.9	16.0	
Hori	4882.000	AV	29.3	33.1	9.3	31.3	40.4	53.9	13.5	
Hori	7323.000	AV	30.2	36.8	10.4	32.6	44.8	53.9	9.1	
Hori	9764.000	AV	29.5	38.2	11.2	32.7	46.2	53.9	7.7	
Vert	42.586	QP	43.6	13.3	7.3	32.1	32.1	40.0	7.9	
Vert	59.438	QP	40.9	7.7	7.6	32.0	24.2	40.0	15.8	
Vert	85.586	QP	34.0	7.6	7.9	32.1	17.4	40.0	22.6	
Vert	136.496	QP	32.0	14.2	8.5	32.0	22.7	43.5	20.8	
Vert	289.883	QP	33.7	19.4	9.8	31.8	31.1	46.0	14.9	
Vert	368.513	QP	30.2	18.2	10.4	31.9	26.9	46.0	19.1	
Vert	2597.000	PK	45.6	28.1	6.9	32.0	48.6	73.9	25.3	
Vert	4882.000	PK	41.7	33.1	9.3	31.3	52.8	73.9	21.1	
Vert	7323.000	PK	41.9	36.8	10.4	32.6	56.5	73.9	17.4	
Vert	9764.000	PK	41.9	38.2	11.2	32.7	58.6	73.9	15.3	
Vert	2597.000	AV	36.1	28.1	6.9	32.0	39.1	53.9	14.8	
Vert	4882.000	AV	29.7	33.1	9.3	31.3	40.8	53.9	13.2	
Vert	7323.000	AV	30.2	36.8	10.4	32.6	44.8	53.9	9.1	
Vert	9764.000	AV	29.6	38.2	11.2	32.7	46.3	53.9	7.6	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
Distance factor: 10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = 9.5 dB
26.5 GHz - 40 GHz 20log (3.0 m / 0.5 m) = 15.6 dB

Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 11056806H
Date December 19, 2015
Temperature / Humidity 21 deg. C / 31 % RH
Engineer Takumi Shimada
Mode Tx, Hopping Off, 3DH5 2480 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	42.572	QP	28.3	13.3	7.3	32.1	16.8	40.0	23.2	
Hori	59.441	QP	28.4	7.7	7.6	32.0	11.7	40.0	28.3	
Hori	85.613	QP	24.6	7.6	7.9	32.1	8.0	40.0	32.0	
Hori	136.477	QP	28.5	14.2	8.5	32.0	19.2	43.5	24.3	
Hori	289.824	QP	36.2	19.4	9.8	31.8	33.6	46.0	12.4	
Hori	368.498	QP	34.1	18.2	10.4	31.9	30.8	46.0	15.2	
Hori	2483.500	PK	46.6	28.1	6.9	32.1	49.5	73.9	24.4	
Hori	2636.000	PK	45.3	28.1	7.0	32.0	48.4	73.9	25.5	
Hori	4960.000	PK	41.0	33.4	9.3	31.2	52.5	73.9	21.4	
Hori	7440.000	PK	43.1	36.8	10.4	32.7	57.6	73.9	16.3	
Hori	9920.000	PK	42.3	38.3	11.2	32.8	59.0	73.9	14.9	
Hori	2483.500	AV	30.3	28.1	6.9	32.1	33.2	53.9	20.7	
Hori	2636.000	AV	34.4	28.1	7.0	32.0	37.5	53.9	16.4	
Hori	4960.000	AV	27.3	33.4	9.3	31.2	38.8	53.9	15.1	
Hori	7440.000	AV	29.2	36.8	10.4	32.7	43.7	53.9	10.2	
Hori	9920.000	AV	28.3	38.3	11.2	32.8	45.0	53.9	8.9	
Vert	42.572	QP	43.5	13.3	7.3	32.1	32.0	40.0	8.0	
Vert	59.441	QP	41.1	7.7	7.6	32.0	24.4	40.0	15.6	
Vert	85.613	QP	34.2	7.6	7.9	32.1	17.6	40.0	22.4	
Vert	136.477	QP	33.4	14.2	8.5	32.0	24.1	43.5	19.4	
Vert	289.824	QP	33.5	19.4	9.8	31.8	30.9	46.0	15.1	
Vert	368.498	QP	30.0	18.2	10.4	31.9	26.7	46.0	19.3	
Vert	2483.500	PK	43.9	28.1	6.9	32.1	46.8	73.9	27.1	
Vert	2636.000	PK	45.8	28.1	7.0	32.0	48.9	73.9	25.0	
Vert	4960.000	PK	41.5	33.4	9.3	31.2	53.0	73.9	20.9	
Vert	7440.000	PK	43.2	36.8	10.4	32.7	57.7	73.9	16.2	
Vert	9920.000	PK	42.4	38.3	11.2	32.8	59.1	73.9	14.8	
Vert	2483.500	AV	31.7	28.1	6.9	32.1	34.6	53.9	19.3	
Vert	2636.000	AV	34.5	28.1	7.0	32.0	37.6	53.9	16.4	
Vert	4960.000	AV	27.3	33.4	9.3	31.2	38.8	53.9	15.2	
Vert	7440.000	AV	30.1	36.8	10.4	32.7	44.6	53.9	9.3	
Vert	9920.000	AV	28.4	38.3	11.2	32.8	45.1	53.9	8.8	

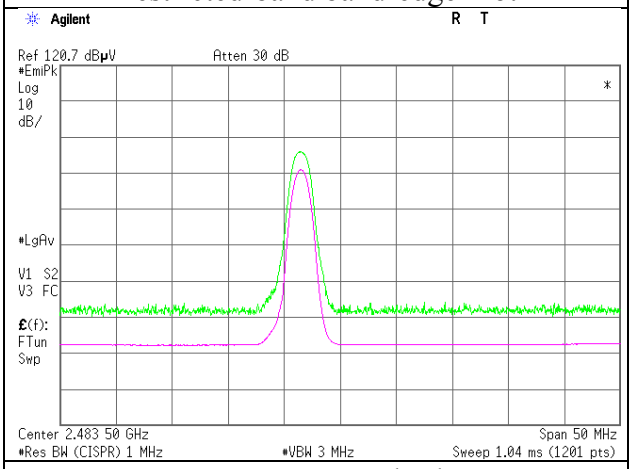
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
Distance factor: 10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = 9.5 dB
26.5 GHz - 40 GHz 20log (3.0 m / 0.5 m) = 15.6 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11056806H
Date	December 19, 2015
Temperature / Humidity	21 deg. C / 31 % RH
Engineer	Takumi Shimada
Mode	Tx, Hopping Off, 3DH5 2480 MHz

Horizontal

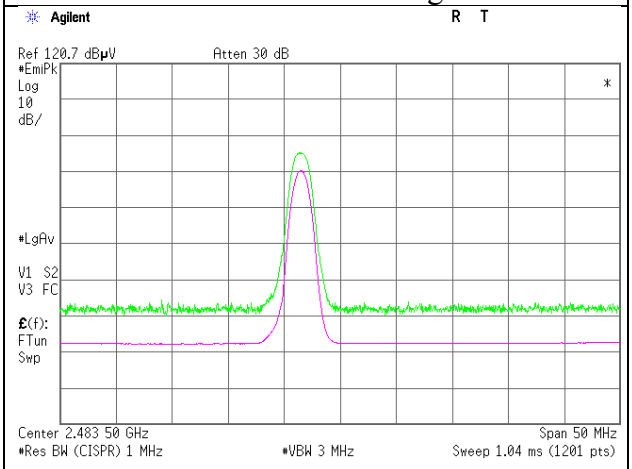
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

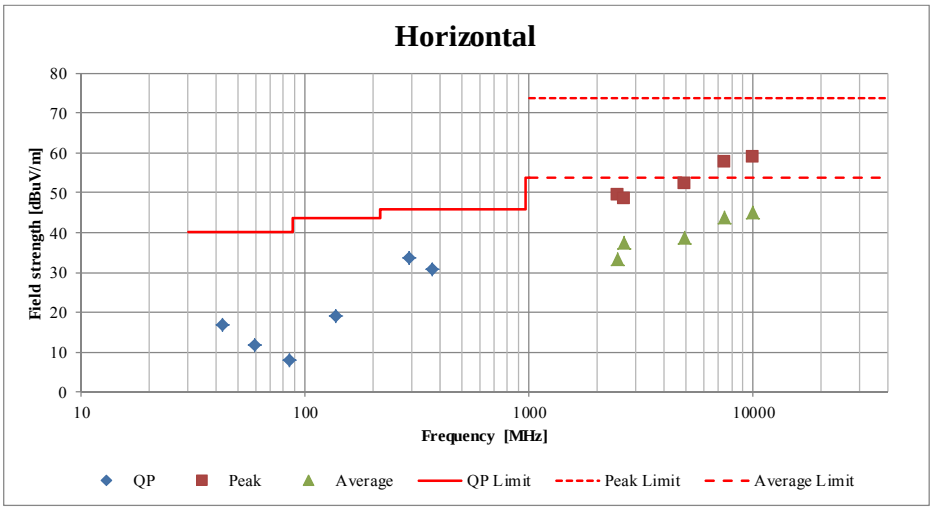


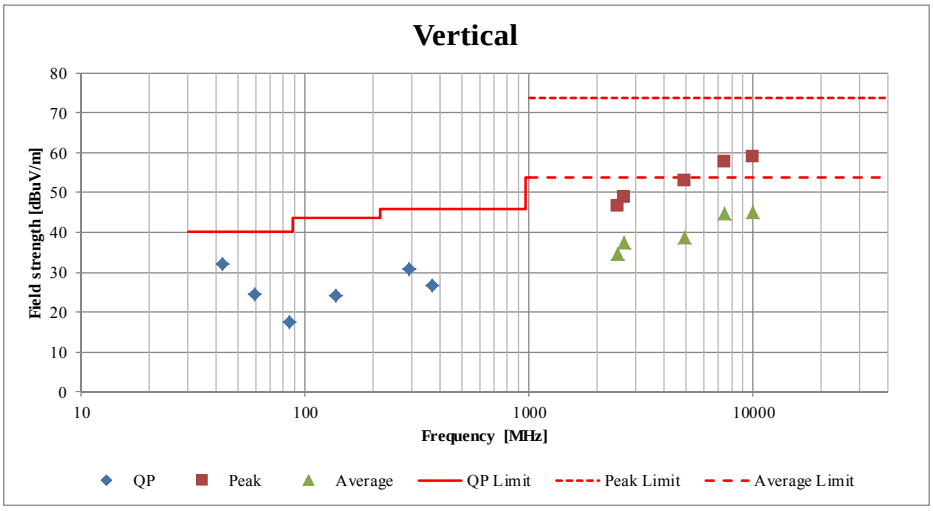
Trace Green : Peak Plot
Trace Purple : Average Plot

* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11056806H
Date	December 19, 2015
Temperature / Humidity	21 deg. C / 31 % RH
Engineer	Takumi Shimada
Mode	Tx, Hopping Off, 3DH5 2480 MHz





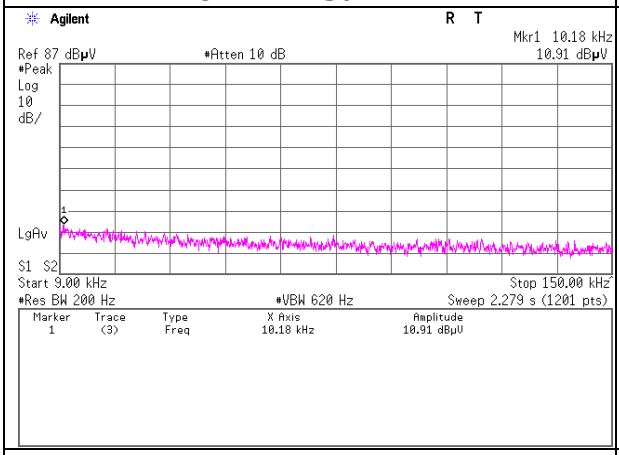
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

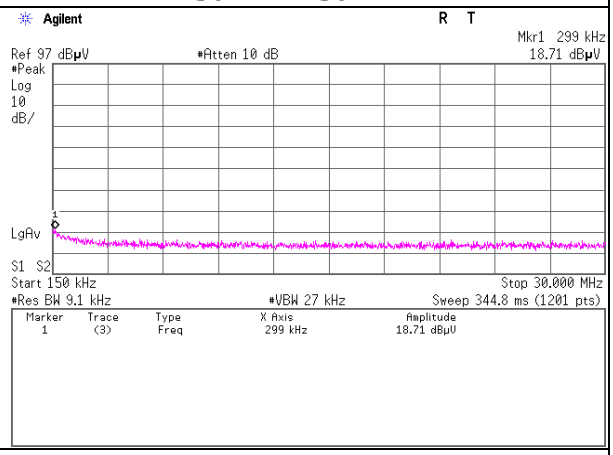
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off, DH5

Tx DH5 2402 MHz

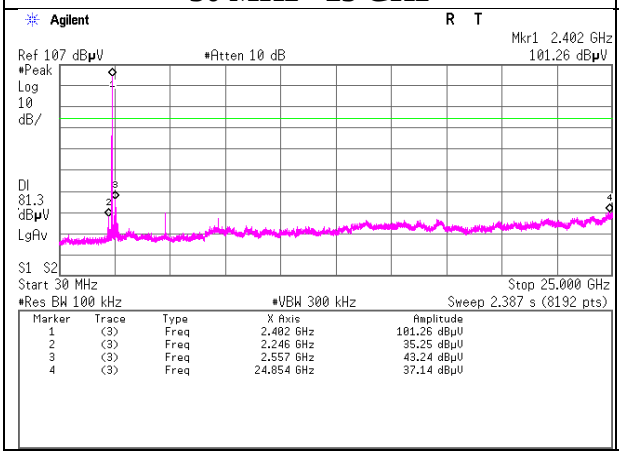
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

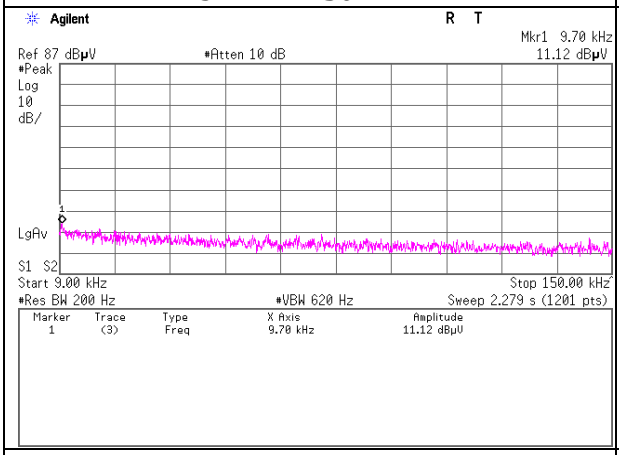


Conducted Spurious Emission

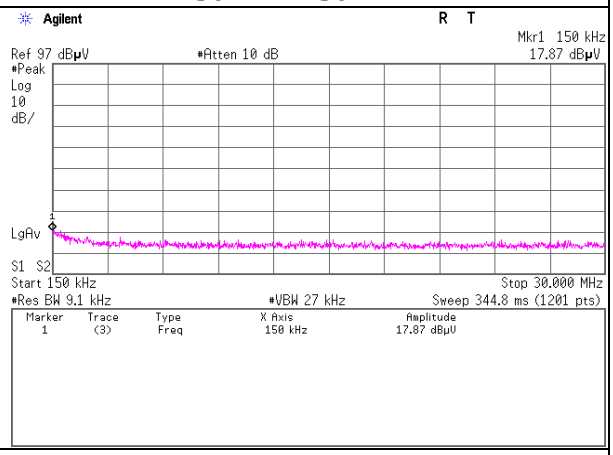
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off, DH5

Tx DH5 2441 MHz

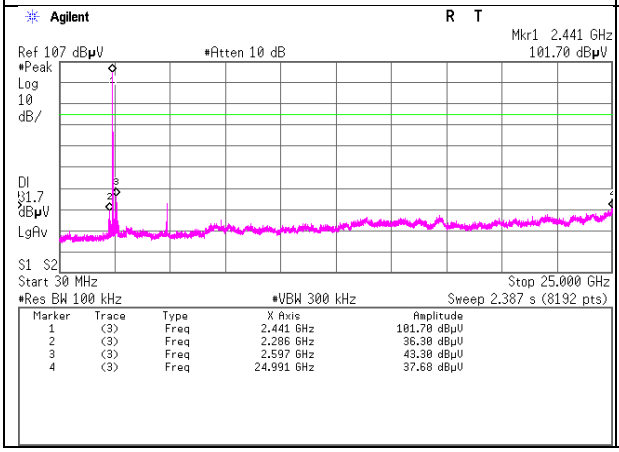
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

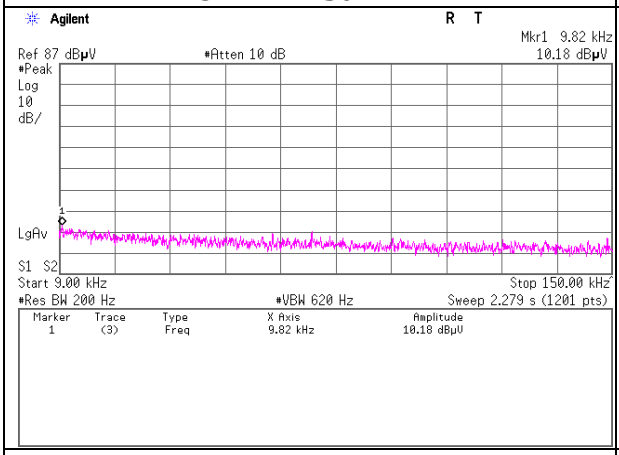


Conducted Spurious Emission

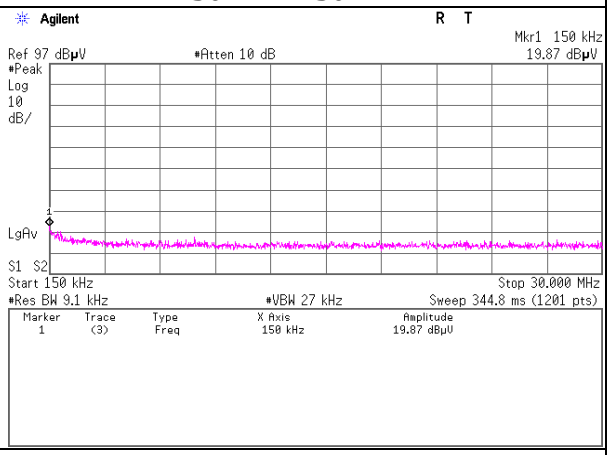
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off, DH5

Tx DH5 2480 MHz

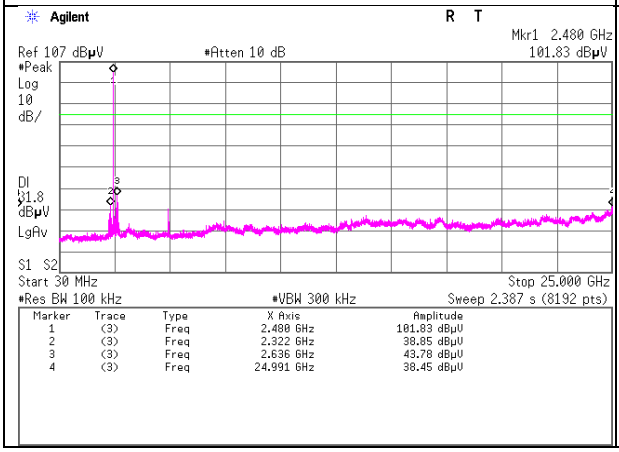
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

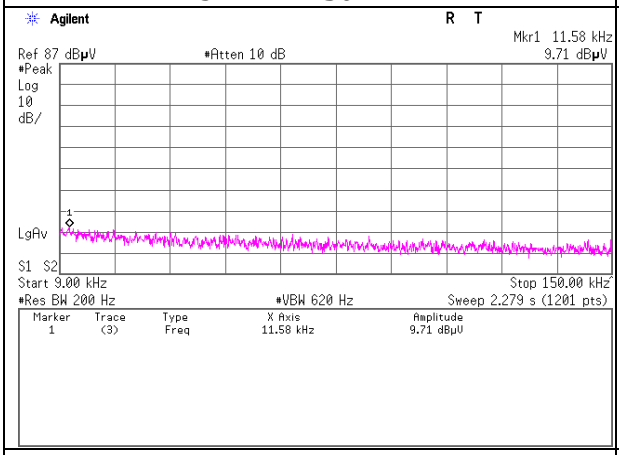


Conducted Spurious Emission

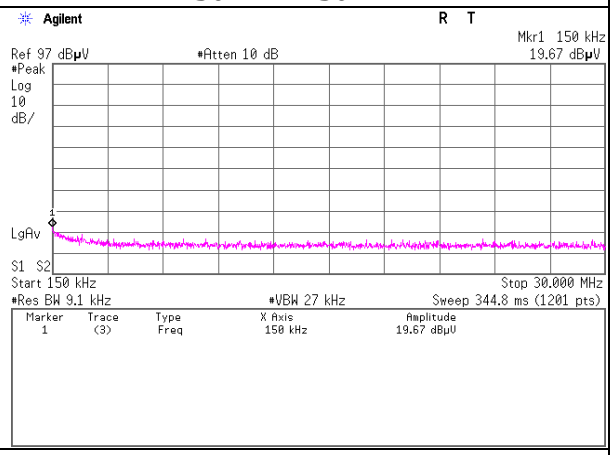
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off, 3DH5

Tx 3DH5 2402 MHz

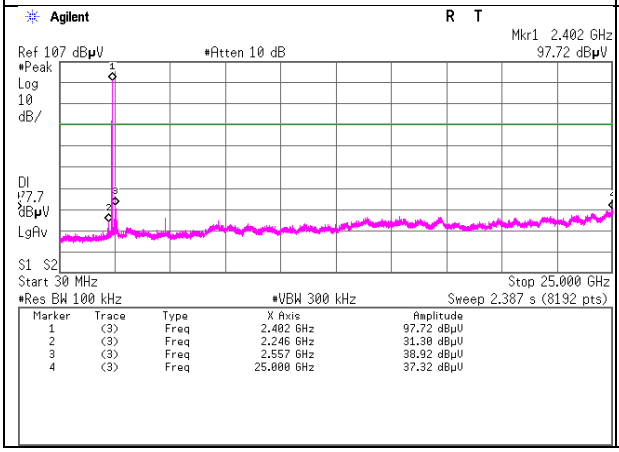
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

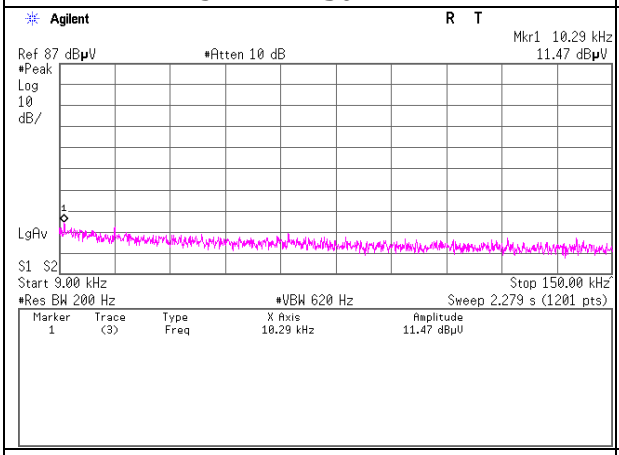


Conducted Spurious Emission

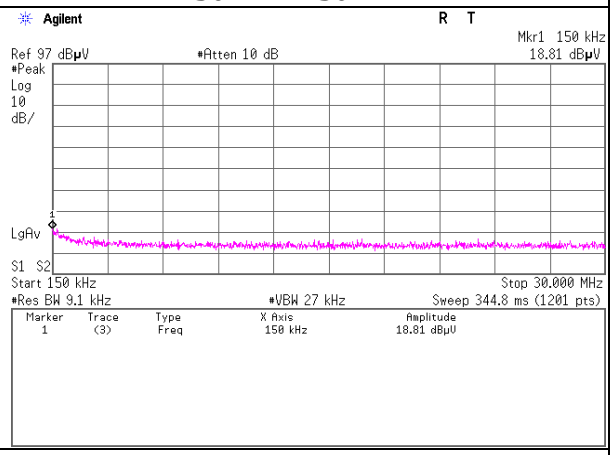
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off, 3DH5

Tx 3DH5 2441 MHz

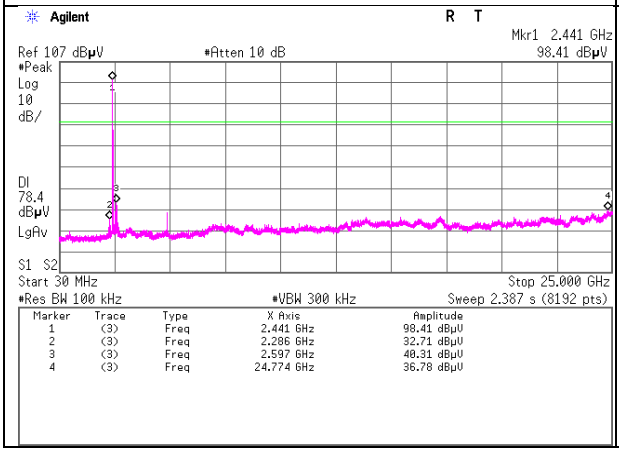
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

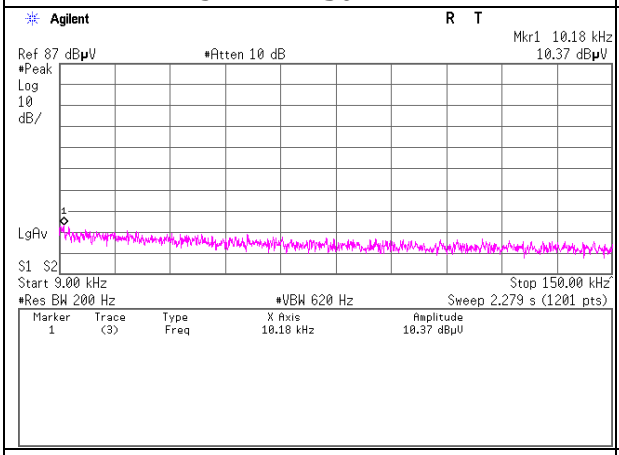


Conducted Spurious Emission

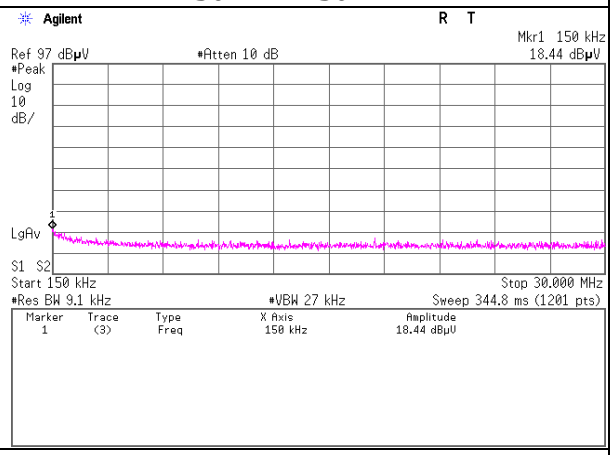
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off, 3DH5

Tx 3DH5 2480 MHz

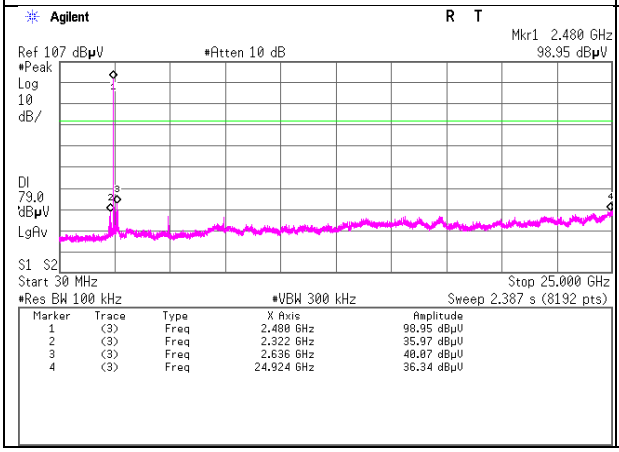
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

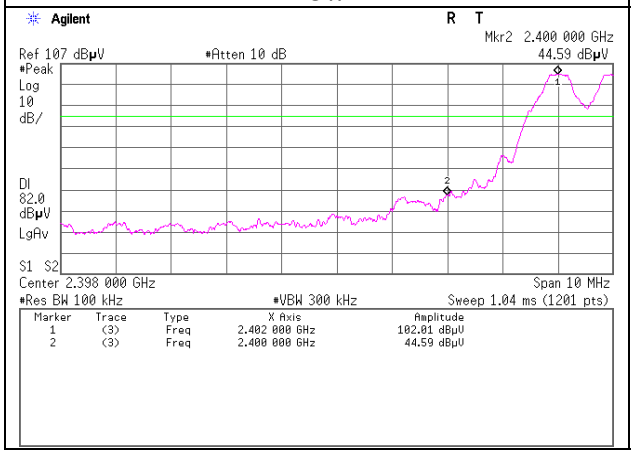


Conducted Emission Band Edge compliance

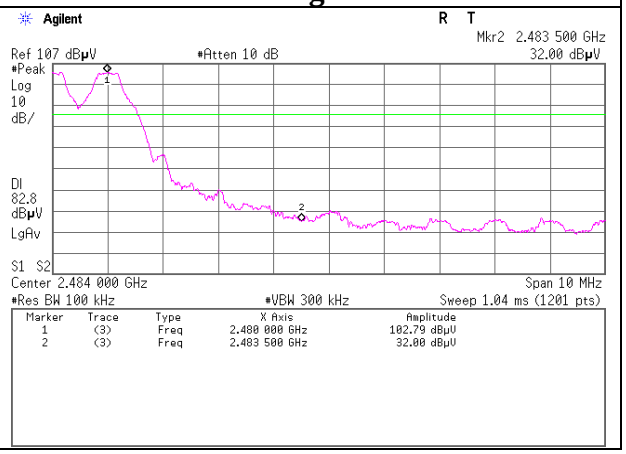
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx DH5

Hopping On

Low

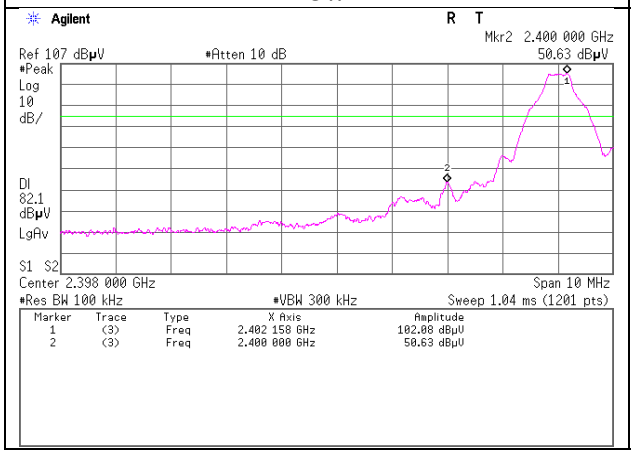


High

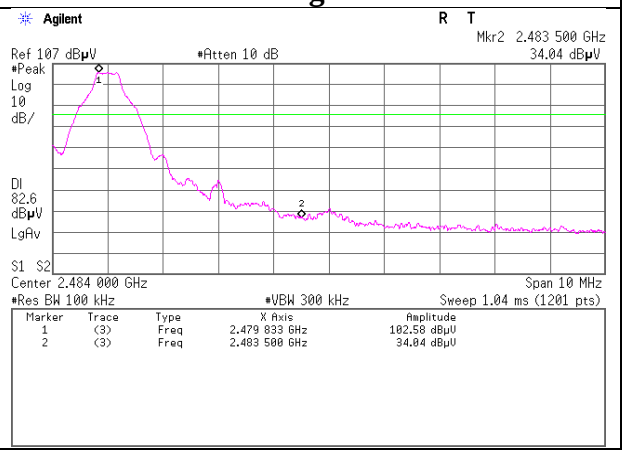


Hopping Off

Low



High

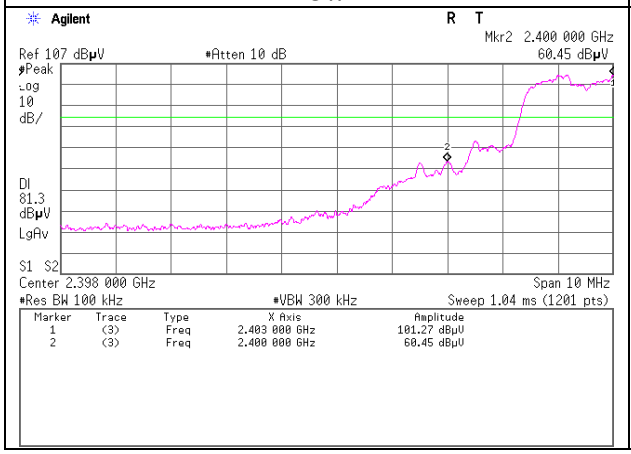


Conducted Emission Band Edge compliance

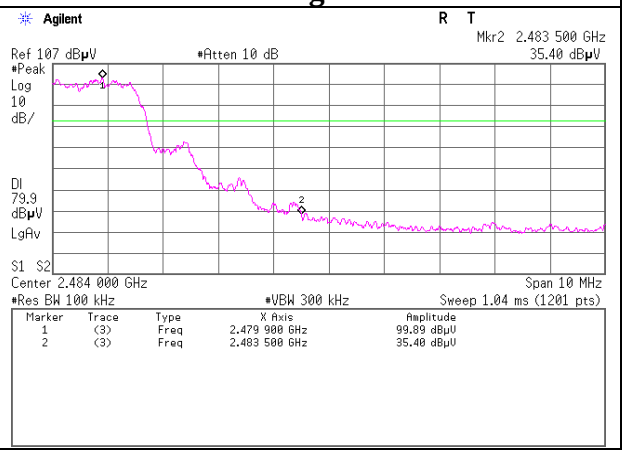
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx 3DH5

Hopping On

Low

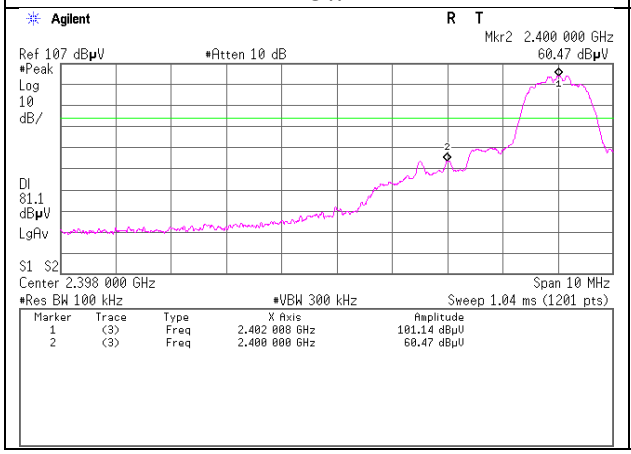


High

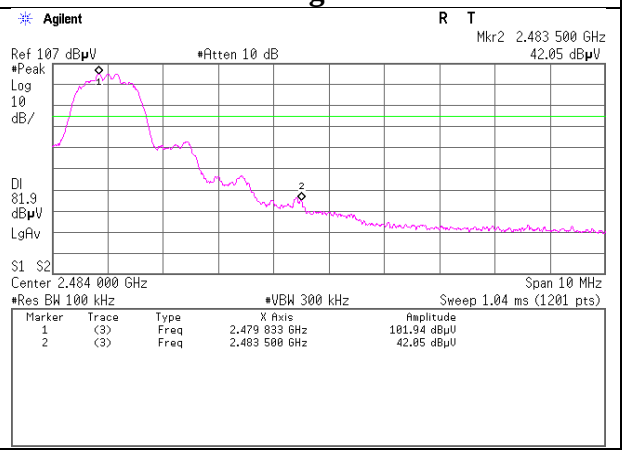


Hopping Off

Low



High

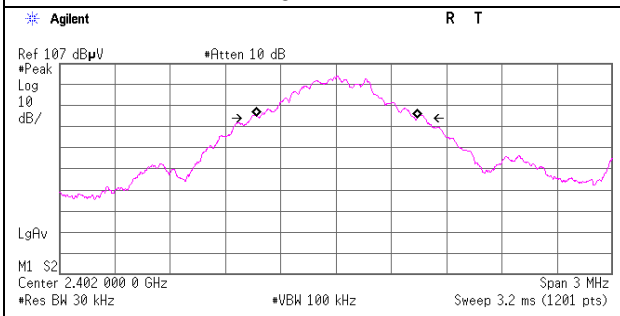


99% Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx Hopping Off

Hopping Off, DH5

2402 MHz

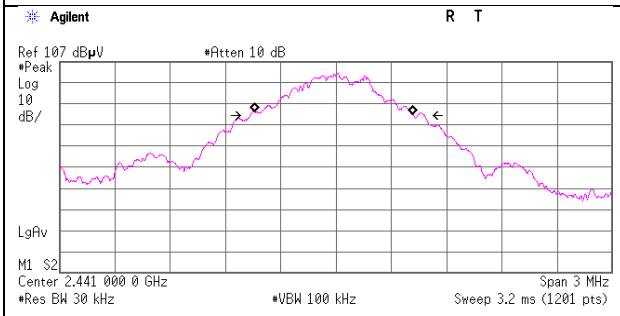


Occupied Bandwidth
870.6912 kHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error 5.639 kHz
x dB Bandwidth 943.230 kHz

2441 MHz

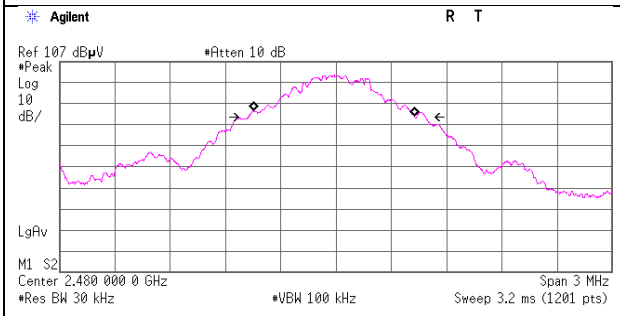


Occupied Bandwidth
856.6867 kHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error -11.870 kHz
x dB Bandwidth 942.999 kHz

2480 MHz



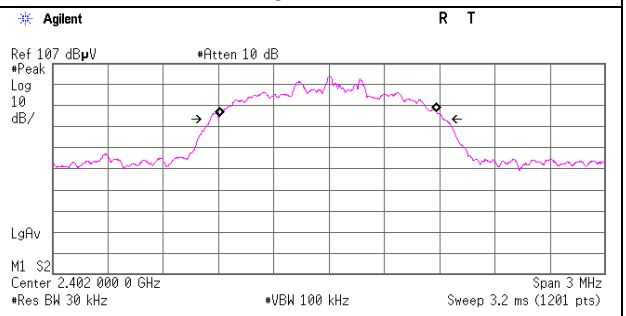
Occupied Bandwidth
873.2946 kHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error -10.412 kHz
x dB Bandwidth 962.328 kHz

Hopping Off, 3DH5

2402 MHz

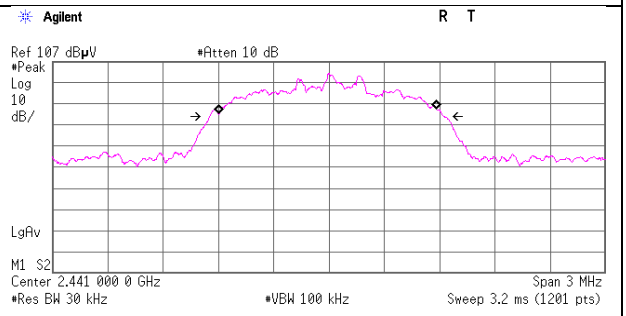


Occupied Bandwidth
1.1732 MHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error -4.596 kHz
x dB Bandwidth 1.264 MHz

2441 MHz

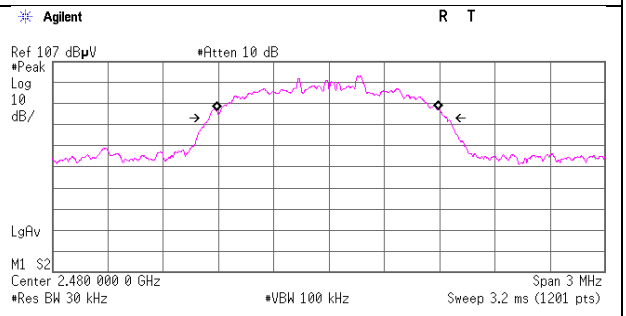


Occupied Bandwidth
1.1767 MHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error -6.325 kHz
x dB Bandwidth 1.269 MHz

2480 MHz



Occupied Bandwidth
1.2005 MHz

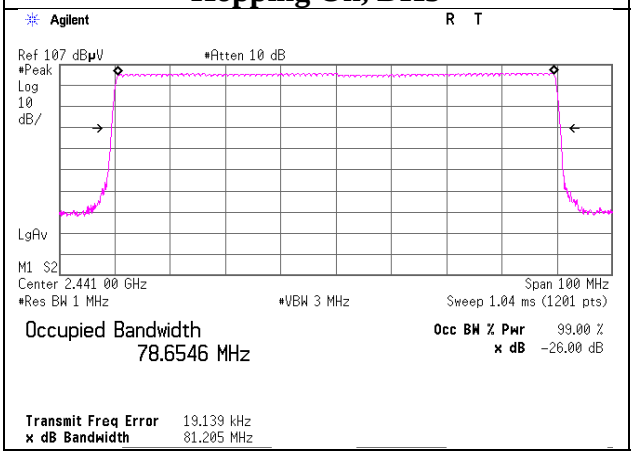
Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error -10.484 kHz
x dB Bandwidth 1.292 MHz

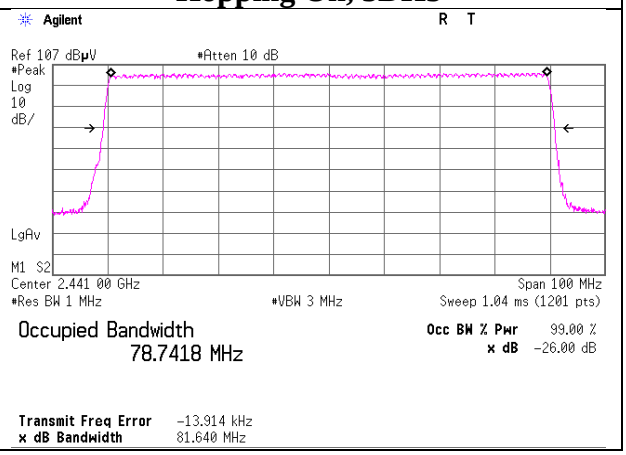
99% Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11056806H
Date	December 18, 2015
Temperature / Humidity	23 deg. C / 41 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx Hopping On

Hopping On, DH5



Hopping On, 3DH5



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2015/11/11 * 12
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2015/11/11 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	AT	2015/05/18 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2015/03/18 * 12
MCC-144	Microwave Cable	Junkosha	MWX221	1207S407	AT	2015/08/06 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2015/12/08 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	CE	2015/07/01 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	CE	2015/01/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	CE/RE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	CE	2015/11/06 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE	2015/10/11 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE	2015/07/10 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2015/02/06 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2015/01/29 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	CE	2015/08/19 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/02 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2015/01/13 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2015/11/28 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2015/11/02 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2015/11/03 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2015/06/19 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2015/11/12 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2015/03/09 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2015/01/16 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2015/02/26 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2015/08/10 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2015/06/22 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2015/10/01 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2015/06/06 * 12

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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

Test Item: **CE: Conducted Emission test**
RE: Radiated Emission test
AT: Antenna Terminal Conducted test