



RADIO TEST REPORT

Test Report No. : 11520402H-A

Applicant : Panasonic Corporation
Type of Equipment : Digital Wireless Stereo Earphones
Model No. : RP-HJE120B
FCC ID : ACJ-RP-HJE120B
Test regulation : FCC Part 15 Subpart C: 2016
Test Result : Complied

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2. The results in this report apply only to the sample tested.
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4. The test results in this report are traceable to the national or international standards.
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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)

Date of test: November 10 to 21, 2016

Representative test engineer:

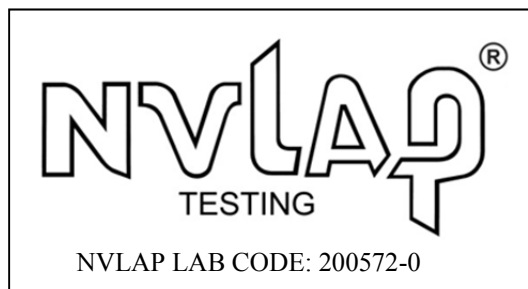


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Approved by:



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13-EM-F0429

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SECTION 1: Customer information

Company Name : Panasonic Corporation
Address : 1-15 Matsuo-cho, Kadoma-shi, Osaka, 571-8504 Japan
Telephone Number : +81-6-6905-4787
Contact Person : Tsuyoshi Maruoka

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

2.1 Identification of E.U.T.

Type of Equipment : Digital Wireless Stereo Earphones
Model No. : RP-HJE120B
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 3.7 V (Battery)
Receipt Date of Sample : November 9, 2016
Country of Mass-production : China
Condition of EUT : Engineering 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 No: RP-HJE120B (referred to as the EUT in this report) is the Digital Wireless Stereo Earphones.

General Specification

Clock frequency(ies) in the system : 26 MHz

Radio Specification

Bluetooth (Ver.4.1)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz - 2480 MHz
Bandwidth & Channel spacing	Bandwidth : 1 MHz Ch spacing : 1 MHz
Type of Modulation	FHSS
Antenna Type / Antenna Gain	Chip antenna / 0 dBi
Power Supply (inner)	DC 3.3 V / DC 1.2 V / DC 1.5 V
Operating temperature range	0 deg. C to +40 deg. C

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016

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

* The revision on November 14, 2016, does not affect the test specification applied to the EUT.

* Also the EUT complies with FCC Part 15 Subpart B.

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	N/A	N/A *1)	-
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		4.0 dB 2483.500 MHz, AV, Horizontal / 4960.00 MHz AV, Vertical	Complied

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line and during USB charging EUT can not transmit Radio frequency.

*2) 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)

The EUT is a battery-operated device and test was performed with the full-charged battery.

This EUT provides stable voltage (DC 3.3 V / DC 1.2 V / DC 1.5 V) constantly to RF Module 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.

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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 $k = 2$.
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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

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

Polarity	Radiated emission (Below 1GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 - 200 MHz	200 - 1000MHz	30 - 200 MHz	200 - 1000MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 - 6GHz	6 - 18GHz	10 - 26.5 GHz	26.5 - 40GHz	1 - 18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

Radiated emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

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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
<p>*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 the test items based on Bluetooth Core specification. *EUT has the power settings by the software as follows; - Power settings: 0x1D1D - Software: AST Test Tool ver. 2.3.8.10 *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.</p>		

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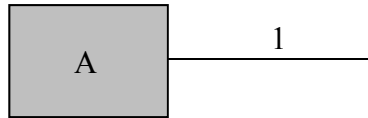
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4.2 Configuration and peripherals



*Setup was taken into consideration and test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Digital Wireless Stereo Earphones	RP-HJE120B	52 *1) 59 *2)	Panasonic Corporation	EUT

*1) Used for Radiated emission test

*2) Used for Antenna Terminal Conducted test

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Jig Cable	0.15	Unshielded	Unshielded	*1)

*1) The use of a jig does not influence on the test result.

SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]

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 1 GHz]

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 200 MHz	200 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	3.75 m*2) (1 GHz – 10 GHz), 1 m*3) (10 GHz – 26.5 GHz)		3.75 m*2) (1 GHz – 10 GHz), 1 m*3) (10 GHz – 26.5 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: $20 \times \log(3.75 \text{ m}/3.0 \text{ m}) = 1.94 \text{ dB}$

*3) Distance Factor: $20 \times \log(1.0 \text{ m}/3.0 \text{ m}) = -9.5 \text{ dB}$

- 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 MHz - 26.5 GHz
Test data : APPENDIX
Test result : Pass

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SECTION 6: 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.

(9 kHz -150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)

*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

20dB Bandwidth and Carrier Frequency Separation

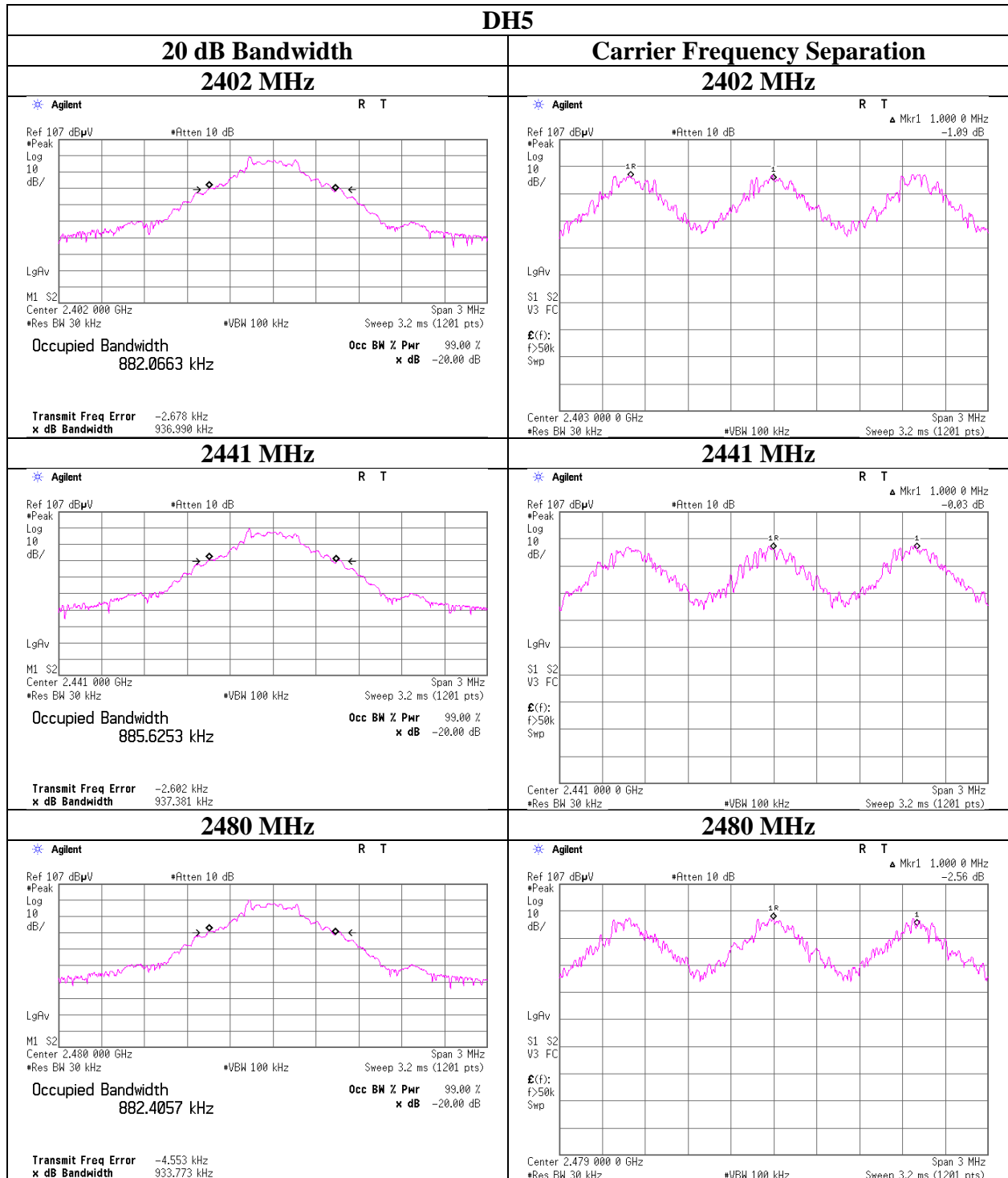
Test place : Ise EMC Lab. No.2 Measurement Room
Report No. : 11520402H
Date : November 10, 2016
Temperature / Humidity : 22 deg. C / 30 % RH
Engineer : Takafumi Noguchi
Mode : Tx, Hopping Off

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.937	1.000	≥ 0.625
DH5	2441.0	0.937	1.000	≥ 0.625
DH5	2480.0	0.934	1.000	≥ 0.623
3DH5	2402.0	1.279	1.000	≥ 0.853
3DH5	2441.0	1.291	1.000	≥ 0.861
3DH5	2480.0	1.308	1.000	≥ 0.872

Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

20dB Bandwidth and Carrier Frequency Separation



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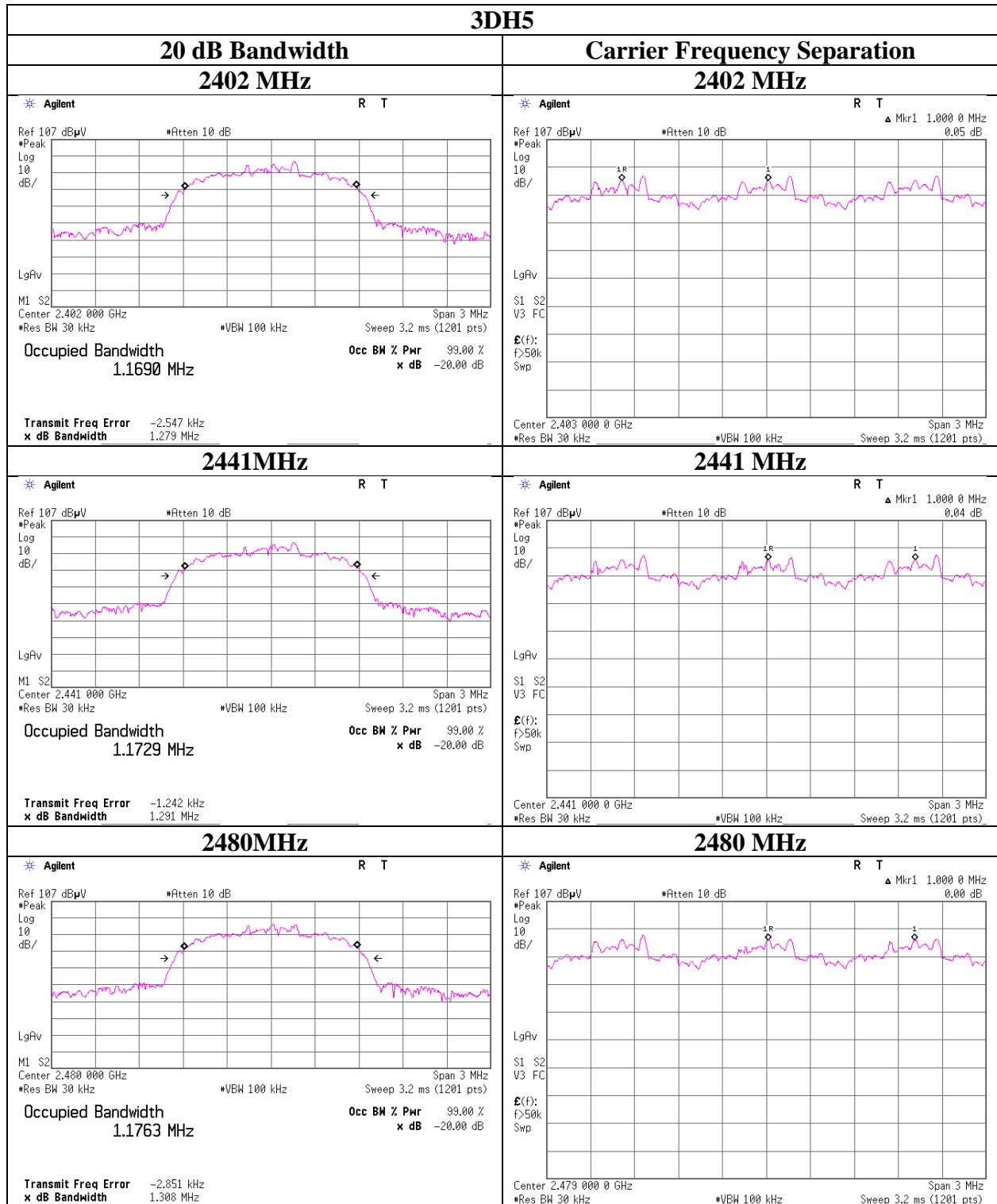
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20dB Bandwidth and Carrier Frequency Separation



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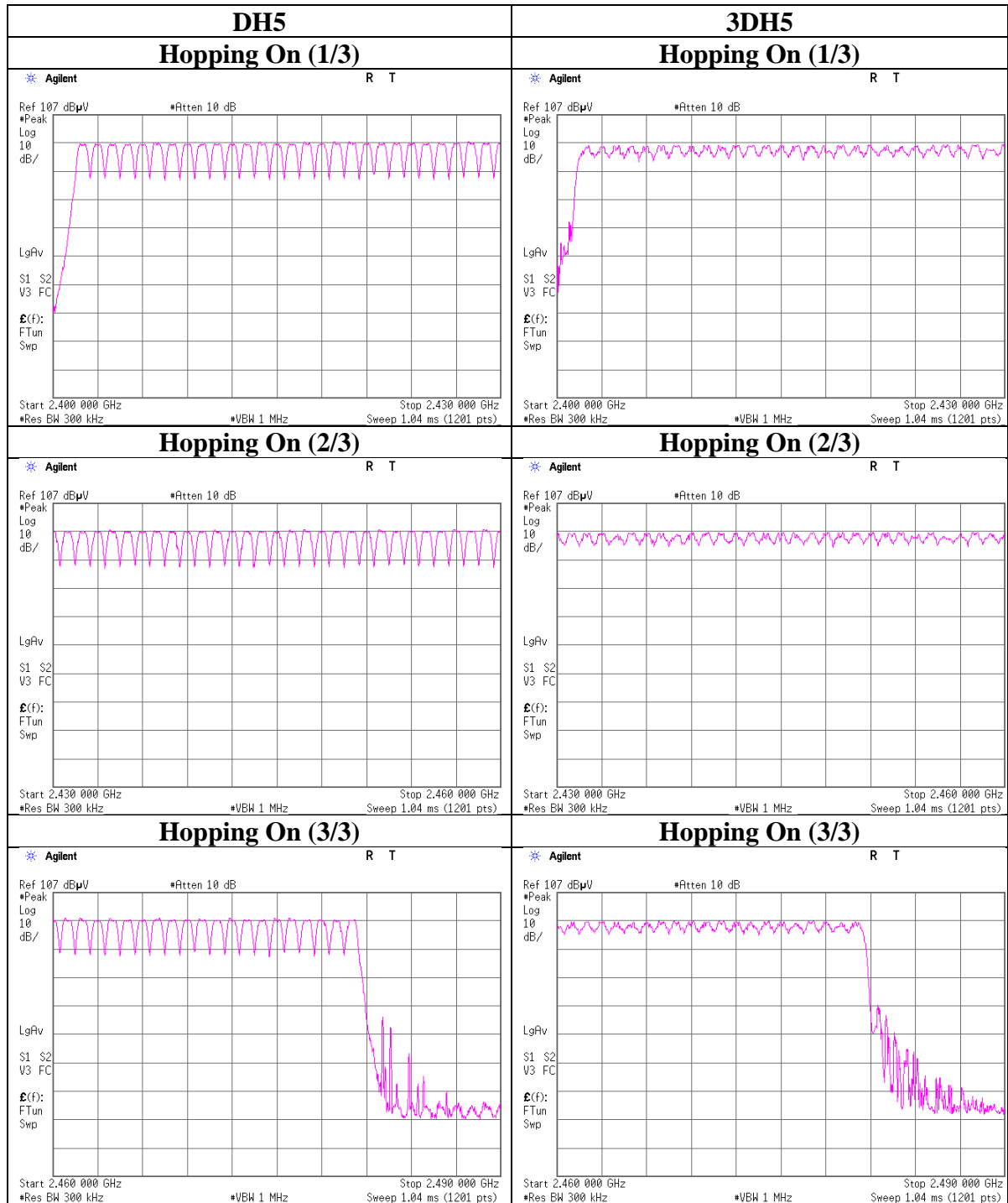
Number of Hopping Frequency

Test place Ise EMC Lab. No.2 Measurement Room
Report No. 11520402H
Date November 10, 2016
Temperature / Humidity 22 deg. C / 30 % RH
Engineer Takafumi Noguchi
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



Dwell time

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 11520402H
Date November 21, 2016
Temperature / Humidity 25 deg. C / 44 % RH
Engineer Yuta Moriya
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]
	49.4 times / 5 sec.	x	31.6 sec. =	times			
DH1	49.4 times / 5 sec.	x	31.6 sec. =	313 times	0.401	125	400
DH3	25.6 times / 5 sec.	x	31.6 sec. =	162 times	1.654	268	400
DH5	21.0 times / 5 sec.	x	31.6 sec. =	133 times	2.903	386	400
3DH1	49.2 times / 5 sec.	x	31.6 sec. =	311 times	0.391	122	400
3DH3	25.4 times / 5 sec.	x	31.6 sec. =	161 times	1.649	265	400
3DH5	20.4 times / 5 sec.	x	31.6 sec. =	129 times	2.898	374	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

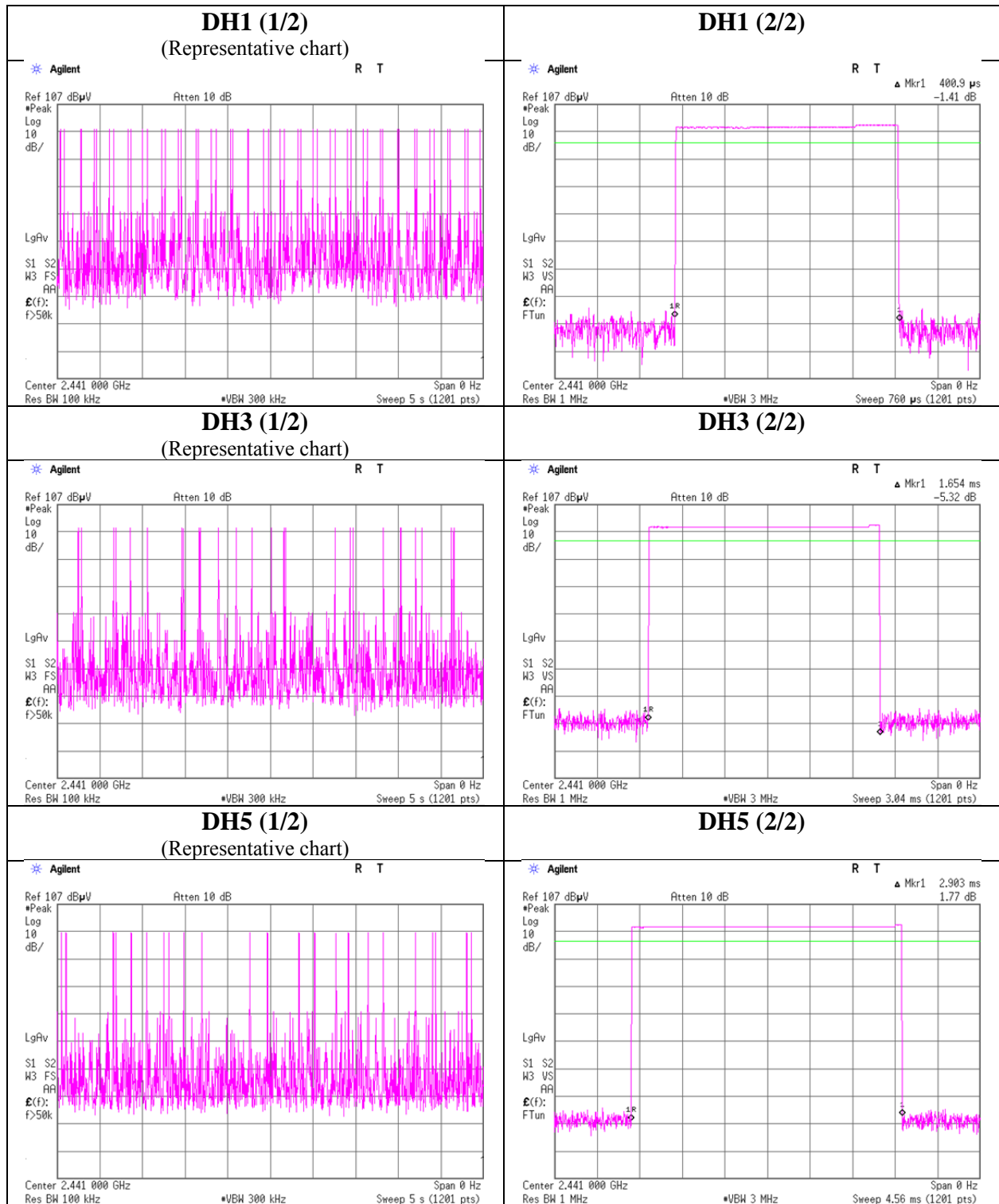
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	48	49	48	51	51	49.4
DH3	25	24	22	33	24	25.6
DH5	24	17	23	23	18	21
3DH1	50	50	50	46	50	49.2
3DH3	20	29	27	28	23	25.4
3DH5	25	20	19	19	19	20.4

Sample Calculation

Average = Summation (Sampling 1 to 5) / 5

This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in $N \times 0.4s$, 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



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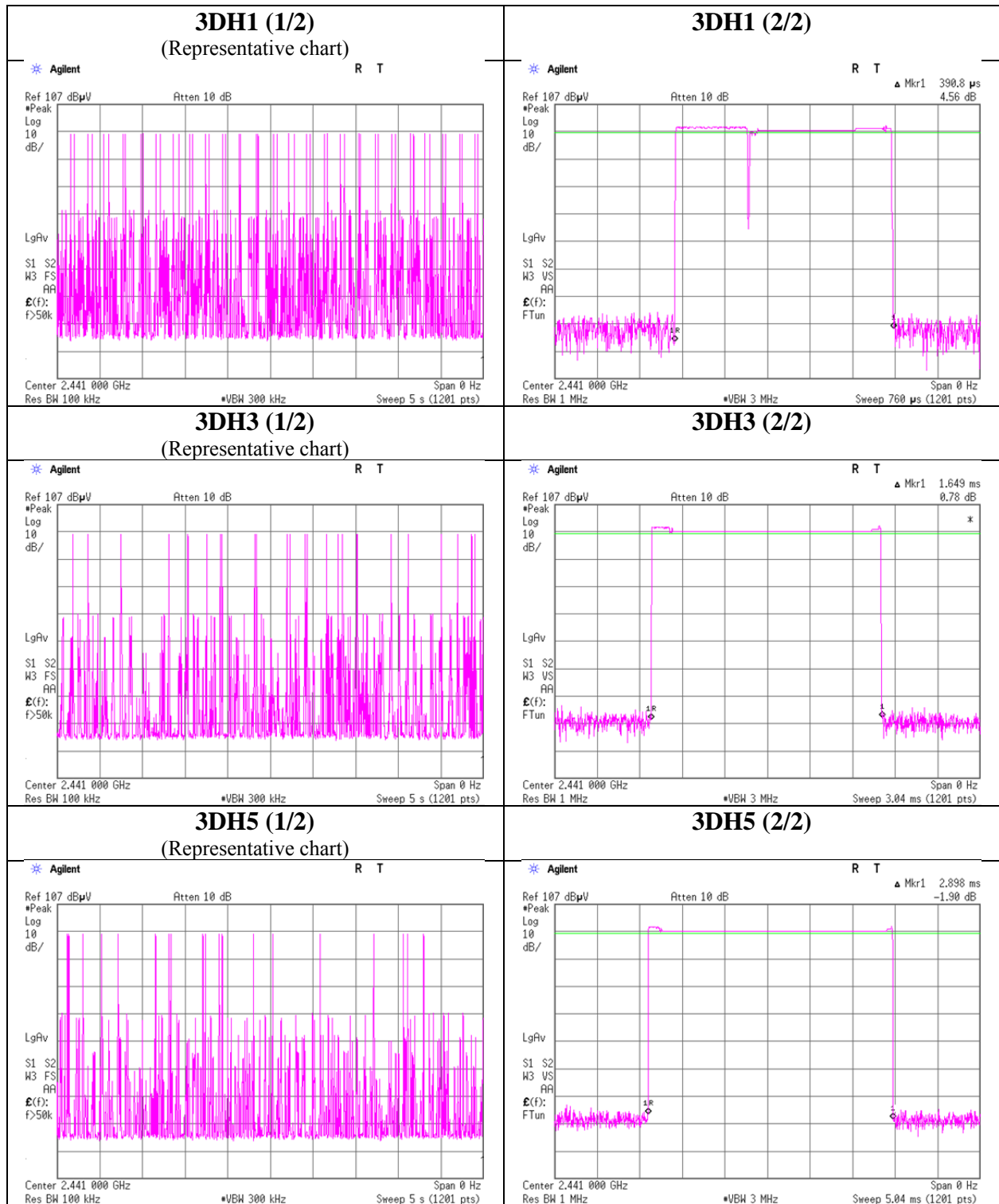
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Dwell time



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Maximum Peak Output Power

Test place : Ise EMC Lab. No.2 Measurement Room
Report No. : 11520402H
Date : November 16, 2016
Temperature / Humidity : 20 deg. C / 34 % RH
Engineer : Keisuke Kawamura
Mode : Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	3.38	0.50	0.00	3.88	2.44	20.96	125	17.08
DH5	2441.0	3.57	0.50	0.00	4.07	2.55	20.96	125	16.89
DH5	2480.0	3.67	0.50	0.00	4.17	2.61	20.96	125	16.79
2DH5	2402.0	3.78	0.50	0.00	4.28	2.68	20.96	125	16.68
2DH5	2441.0	3.96	0.50	0.00	4.46	2.79	20.96	125	16.50
2DH5	2480.0	4.03	0.50	0.00	4.53	2.84	20.96	125	16.43
3DH5	2402.0	3.98	0.50	0.00	4.48	2.81	20.96	125	16.48
3DH5	2441.0	4.17	0.50	0.00	4.67	2.93	20.96	125	16.29
3DH5	2480.0	4.22	0.50	0.00	4.72	2.96	20.96	125	16.24

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

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)

Test place : Ise EMC Lab. No.2 Measurement Room
Report No. : 11520402H
Date : November 16, 2016
Temperature / Humidity : 20 deg. C / 34 % RH
Engineer : Keisuke Kawamura
Mode : Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
					[dBm]	[mW]		[dBm]	[mW]
DH5	2402.0	1.42	0.50	0.00	1.92	1.56	1.12	3.04	2.01
DH5	2441.0	1.59	0.50	0.00	2.09	1.62	1.12	3.21	2.09
DH5	2480.0	1.66	0.50	0.00	2.16	1.64	1.12	3.28	2.13
2DH5	2402.0	-0.11	0.50	0.00	0.39	1.09	1.13	1.52	1.42
2DH5	2441.0	0.08	0.50	0.00	0.58	1.14	1.13	1.71	1.48
2DH5	2480.0	0.16	0.50	0.00	0.66	1.16	1.13	1.79	1.51
3DH5	2402.0	-0.08	0.50	0.00	0.42	1.10	1.13	1.55	1.43
3DH5	2441.0	0.13	0.50	0.00	0.63	1.16	1.13	1.76	1.50
3DH5	2480.0	0.21	0.50	0.00	0.71	1.18	1.13	1.84	1.53

Sample Calculation:

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

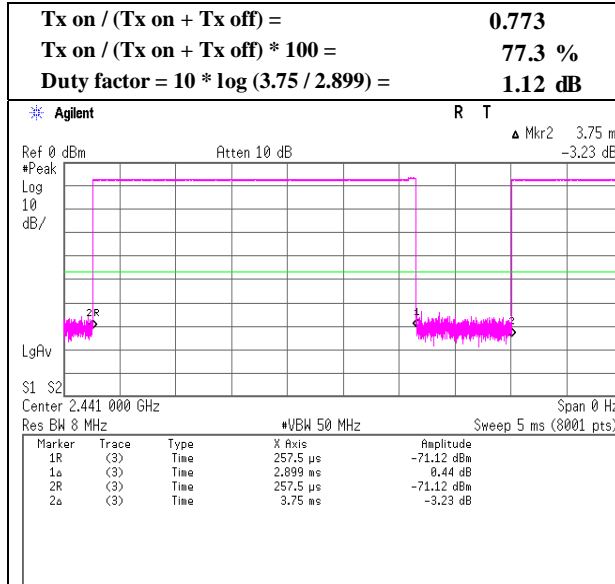
Result (Burst power) = Frame power + Duty factor

*The equipment and cables were not used for factor 0 dB of the data sheets.

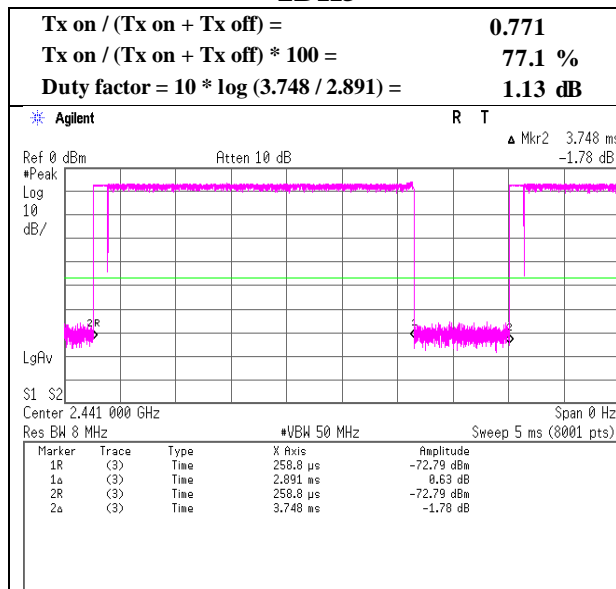
Burst Rate Confirmation

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	11520402H
Date	November 16, 2016
Temperature / Humidity	20 deg. C / 34 % RH
Engineer	Keisuke Kawamura
Mode	Tx, Hopping Off

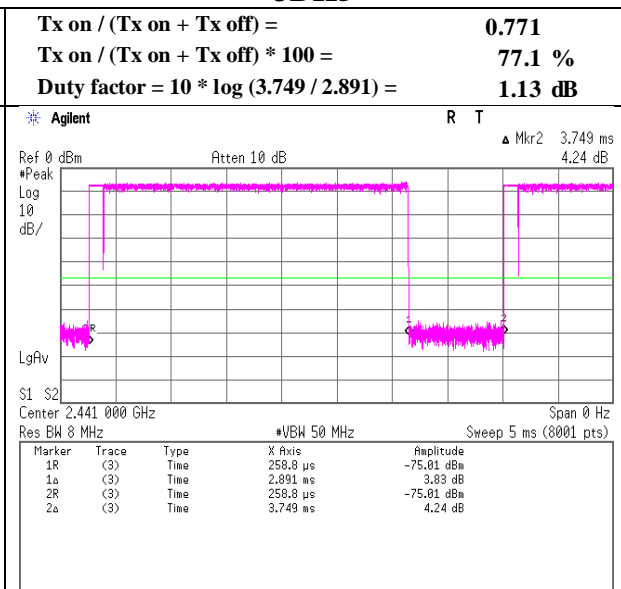
DH5



2DH5

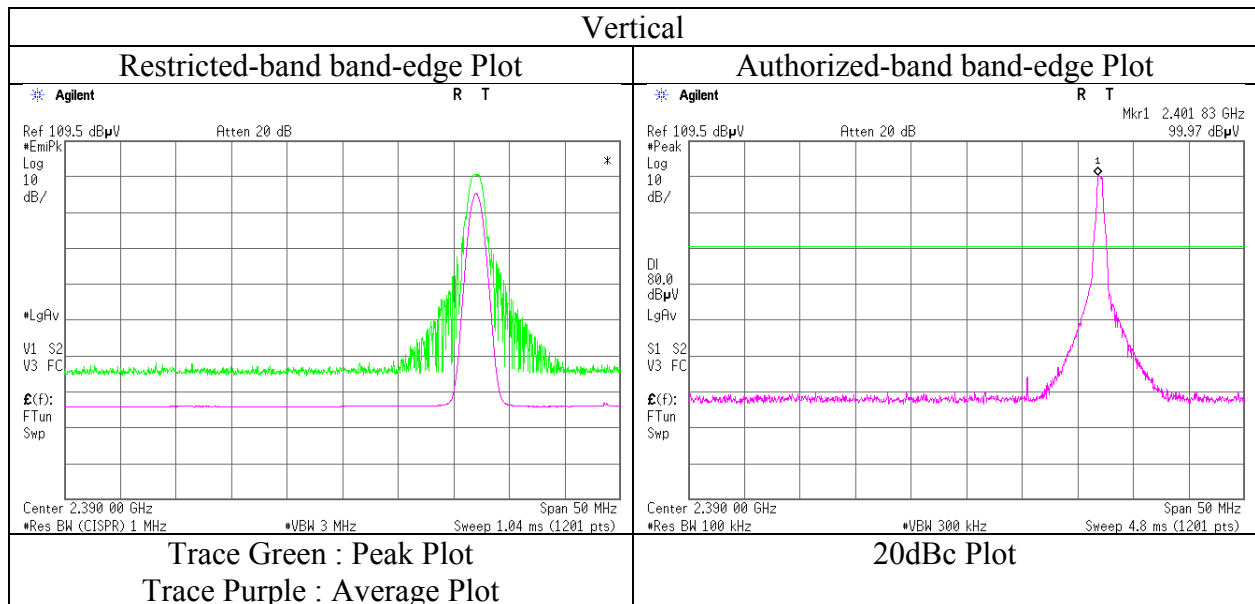
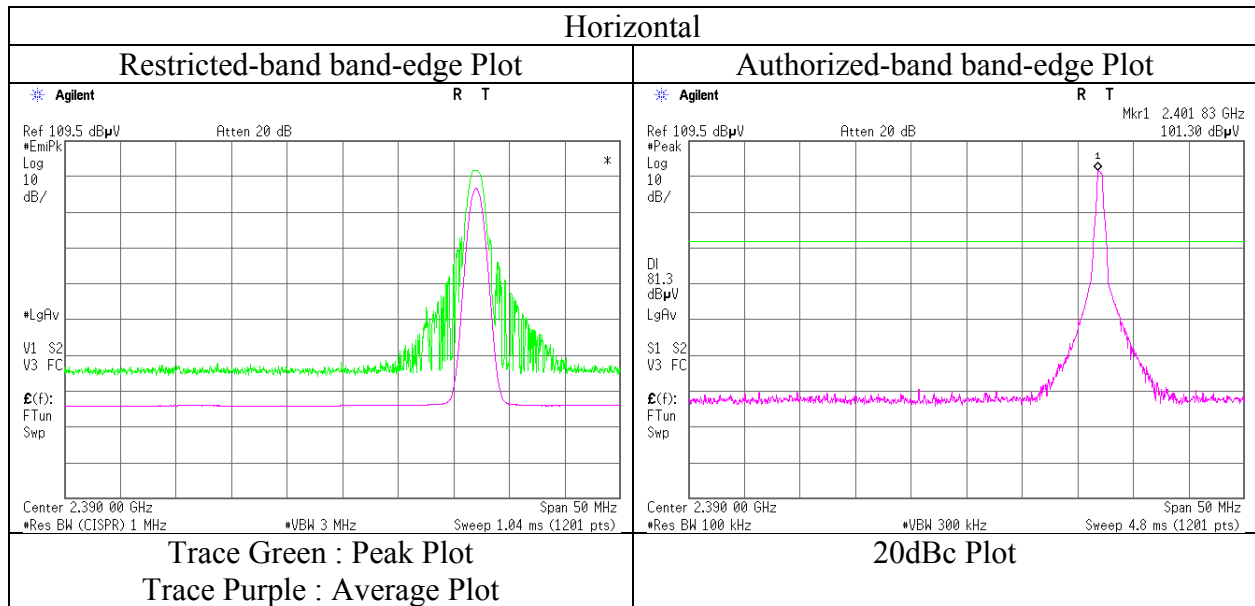


3DH5



Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11520402H
Date	November 10, 2016
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Shuichi Ohyama (1-10GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz



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

UL Japan, Inc.

Ise EMC Lab.

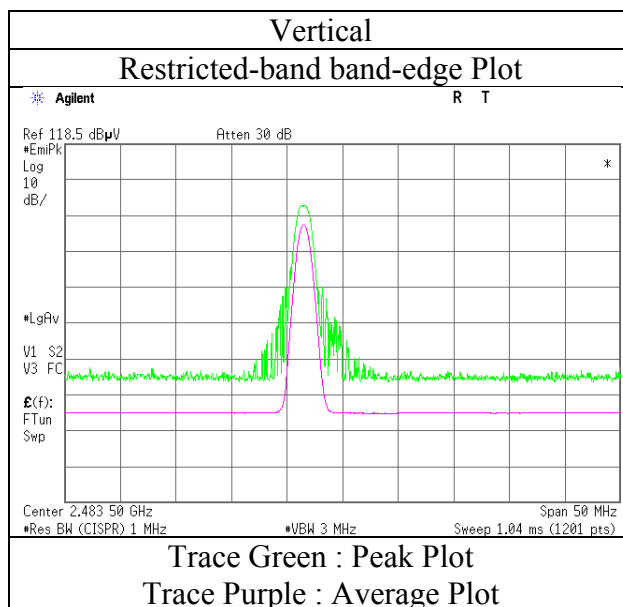
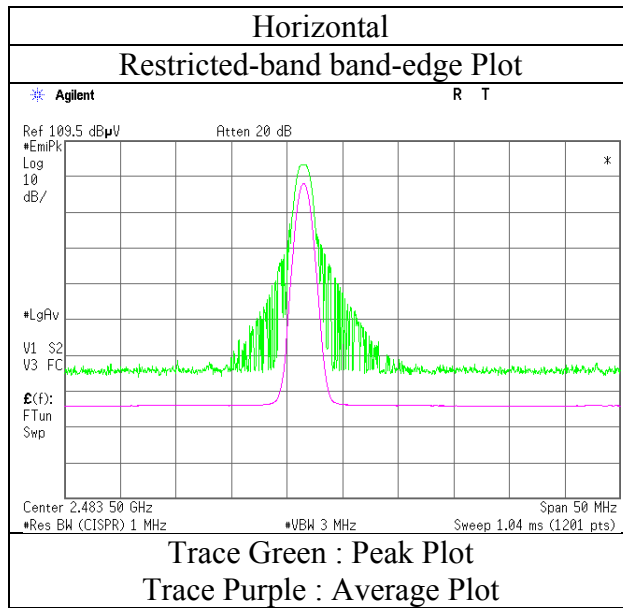
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission
(Reference Plot for band-edge)

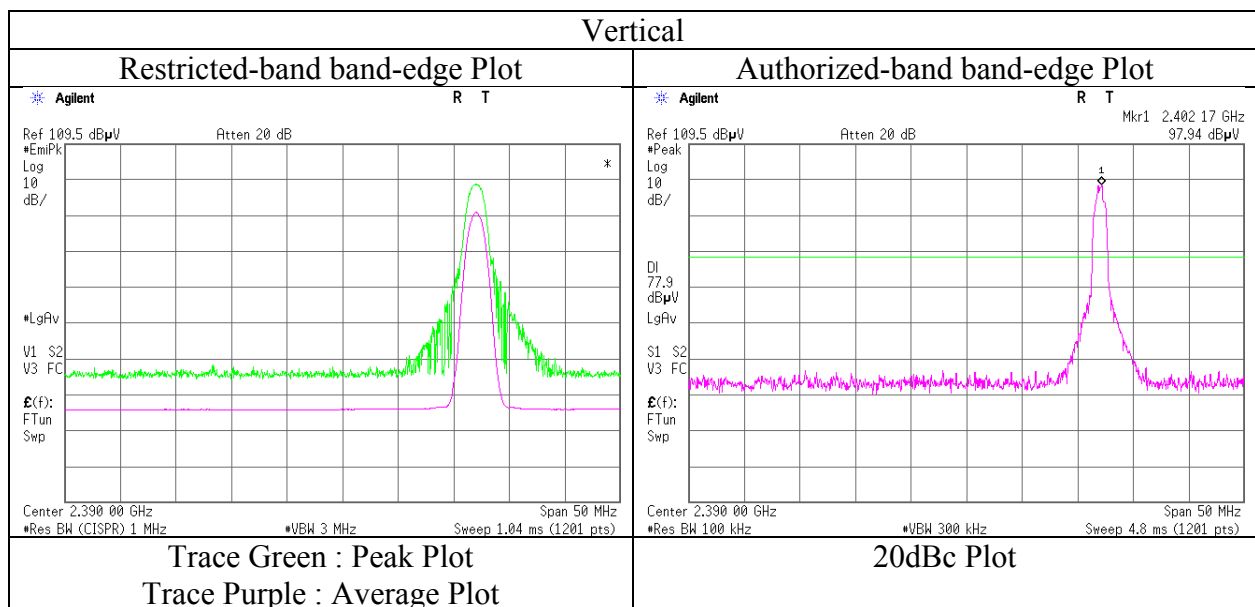
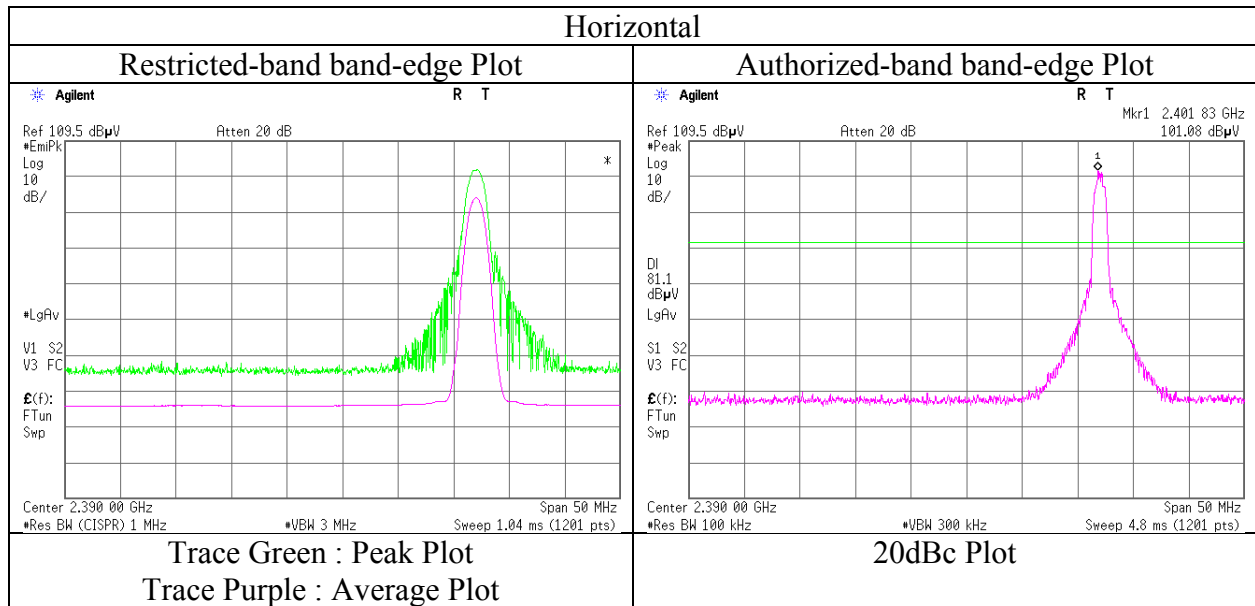
Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11520402H
Date : November 10, 2016
Temperature / Humidity : 20 deg. C / 38 % RH
Engineer : Shuichi Ohyama
(1-10GHz)
Mode : Tx, Hopping Off, DH5 2480 MHz



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

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11520402H
Date	November 10, 2016
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Shuichi Ohyama (1-10GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz



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

UL Japan, Inc.

Ise EMC Lab.

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Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	11520402H	
Date	November 9, 2016	November 10, 2016
Temperature / Humidity	21 deg. C / 40 % RH	20 deg. C / 38 % RH
Engineer	Keisuke Kawamura	Shuichi Ohyama
	(Above 10GHz & Below 1GHz)	(1-10GHz)
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	38.123	QP	23.2	14.7	6.8	28.2	16.5	40.0	23.5	
Hori	94.317	QP	22.7	9.1	7.4	28.0	11.2	43.5	32.3	
Hori	169.345	QP	22.0	15.7	7.9	27.6	18.0	43.5	25.5	
Hori	258.667	QP	21.6	12.7	8.5	27.1	15.7	46.0	30.3	
Hori	358.667	QP	21.7	14.8	9.2	27.5	18.2	46.0	27.8	
Hori	537.335	QP	22.4	18.0	9.8	28.1	22.1	46.0	23.9	
Hori	2537.000	PK	52.6	27.8	5.1	34.7	50.8	73.9	23.1	
Hori	4882.000	PK	49.9	31.7	7.5	34.1	55.0	73.9	18.9	
Hori	7323.000	PK	42.3	36.3	8.5	34.1	53.0	73.9	20.9	Floor noise
Hori	9764.000	PK	44.2	38.5	9.2	34.8	57.1	73.9	16.8	Floor noise
Hori	2537.000	AV	43.7	27.8	5.1	34.7	41.9	53.9	12.0	
Hori	4882.000	AV	39.2	31.7	7.5	34.1	44.3	53.9	9.6	
Hori	7323.000	AV	30.8	36.3	8.5	34.1	41.5	53.9	12.4	Floor noise
Hori	9764.000	AV	31.0	38.5	9.2	34.8	43.9	53.9	10.0	Floor noise
Vert	38.123	QP	23.2	14.7	6.8	28.2	16.5	40.0	23.5	
Vert	94.317	QP	22.9	9.1	7.4	28.0	11.4	43.5	32.1	
Vert	169.345	QP	22.2	15.7	7.9	27.6	18.2	43.5	25.3	
Vert	258.667	QP	21.6	12.7	8.5	27.1	15.7	46.0	30.3	
Vert	358.667	QP	21.7	14.8	9.2	27.5	18.2	46.0	27.8	
Vert	537.335	QP	22.4	18.0	9.8	28.1	22.1	46.0	23.9	
Vert	2537.000	PK	47.6	27.8	5.1	34.7	45.8	73.9	28.1	
Vert	4882.000	PK	48.5	31.7	7.5	34.1	53.6	73.9	20.3	
Vert	7323.000	PK	42.2	36.3	8.5	34.1	52.9	73.9	21.0	Floor noise
Vert	9764.000	PK	43.6	38.5	9.2	34.8	56.5	73.9	17.4	Floor noise
Vert	2537.000	AV	36.4	27.8	5.1	34.7	34.6	53.9	19.3	
Vert	4882.000	AV	37.5	31.7	7.5	34.1	42.6	53.9	11.3	
Vert	7323.000	AV	30.9	36.3	8.5	34.1	41.6	53.9	12.3	Floor noise
Vert	9764.000	AV	31.3	38.5	9.2	34.8	44.2	53.9	9.7	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*These results have sufficient margin without taking account Dwell time factor.

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Ise EMC Lab.

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Telephone : +81 596 24 8999

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Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 11520402H
Date November 9, 2016 November 10, 2016
Temperature / Humidity 21 deg. C / 40 % RH 20 deg. C / 38 % RH
Engineer Keisuke Kawamura Shuichi Ohyama
(Above 10GHz & Below 1GHz) (1-10GHz)
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	38.123	QP	23.2	14.7	6.8	28.2	16.5	40.0	23.5	
Hori	94.317	QP	22.7	9.1	7.4	28.0	11.2	43.5	32.3	
Hori	169.345	QP	22.0	15.7	7.9	27.6	18.0	43.5	25.5	
Hori	258.667	QP	21.6	12.7	8.5	27.1	15.7	46.0	30.3	
Hori	358.667	QP	21.7	14.8	9.2	27.5	18.2	46.0	27.8	
Hori	537.335	QP	22.4	18.0	9.8	28.1	22.1	46.0	23.9	
Hori	2483.500	PK	68.1	27.7	5.1	34.7	66.2	73.9	7.7	
Hori	2576.000	PK	49.2	27.8	5.2	34.6	47.6	73.9	26.3	
Hori	4960.000	PK	50.2	32.0	7.6	34.2	55.6	73.9	18.3	
Hori	7440.000	PK	43.6	36.4	8.5	34.1	54.4	73.9	19.5	Floor noise
Hori	9920.000	PK	43.2	38.6	9.3	34.9	56.2	73.9	17.7	Floor noise
Hori	2483.500	AV	50.0	27.7	5.1	34.7	48.1	53.9	5.8	
Hori	2576.000	AV	39.6	27.8	5.2	34.6	38.0	53.9	15.9	
Hori	4960.000	AV	38.5	32.0	7.6	34.2	43.9	53.9	10.0	
Hori	7440.000	AV	29.9	36.4	8.5	34.1	40.7	53.9	13.2	Floor noise
Hori	9920.000	AV	29.7	38.6	9.3	34.9	42.7	53.9	11.2	Floor noise
Vert	38.123	QP	23.2	14.7	6.8	28.2	16.5	40.0	23.5	
Vert	94.317	QP	22.9	9.1	7.4	28.0	11.4	43.5	32.1	
Vert	169.345	QP	22.2	15.7	7.9	27.6	18.2	43.5	25.3	
Vert	258.667	QP	21.6	12.7	8.5	27.1	15.7	46.0	30.3	
Vert	358.667	QP	21.7	14.8	9.2	27.5	18.2	46.0	27.8	
Vert	537.335	QP	22.4	18.0	9.8	28.1	22.1	46.0	23.9	
Vert	2483.500	PK	65.4	27.7	5.1	34.7	63.5	73.9	10.4	
Vert	2576.000	PK	48.9	27.8	5.2	34.6	47.3	73.9	26.6	
Vert	4960.000	PK	50.9	32.0	7.6	34.2	56.3	73.9	17.6	
Vert	7440.000	PK	42.6	36.4	8.5	34.1	53.4	73.9	20.5	Floor noise
Vert	9920.000	PK	43.0	38.6	9.3	34.9	56.0	73.9	17.9	Floor noise
Vert	2483.500	AV	50.7	27.7	5.1	34.7	48.8	53.9	5.1	
Vert	2576.000	AV	39.9	27.8	5.2	34.6	38.3	53.9	15.6	
Vert	4960.000	AV	37.8	32.0	7.6	34.2	43.2	53.9	10.7	
Vert	7440.000	AV	29.6	36.4	8.5	34.1	40.4	53.9	13.5	Floor noise
Vert	9920.000	AV	29.6	38.6	9.3	34.9	42.6	53.9	11.3	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

***These results have sufficient margin without taking account Dwell time factor.**

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Ise EMC Lab.

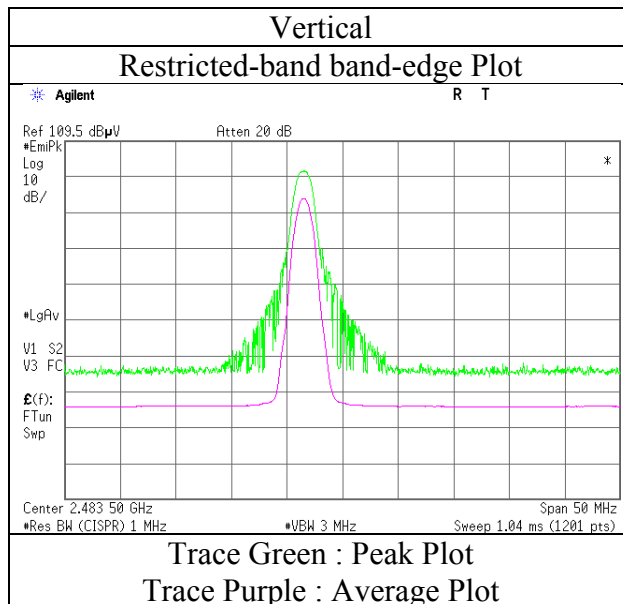
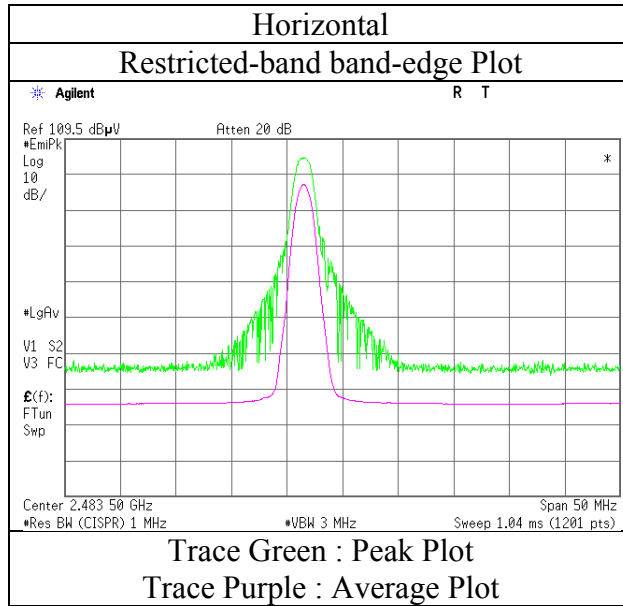
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission
(Reference Plot for band-edge)

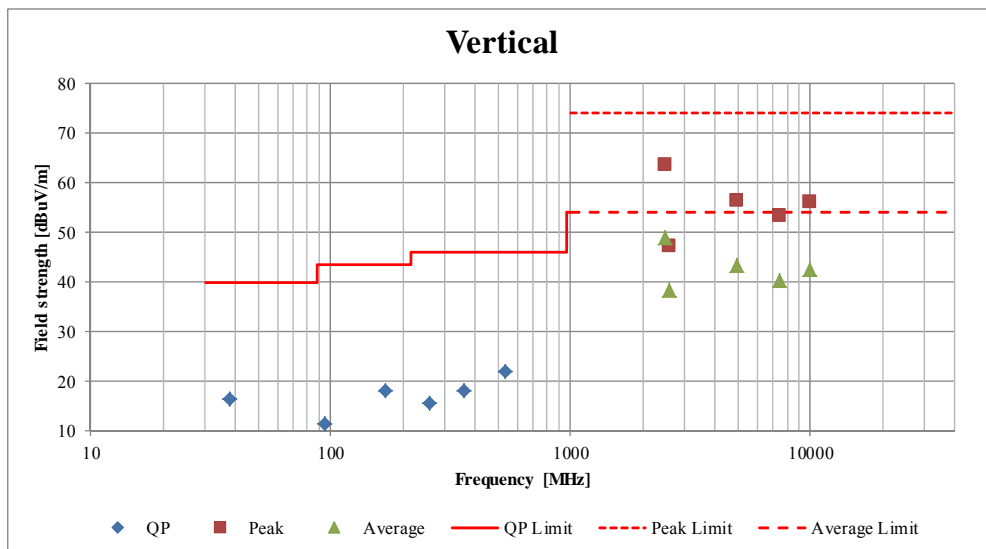
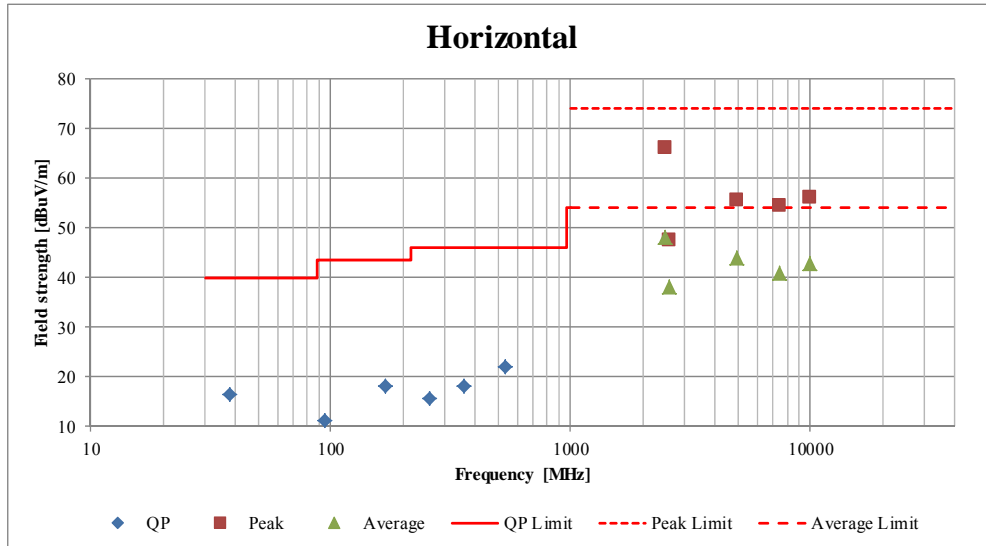
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11520402H
Date	November 10, 2016
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Shuichi Ohyama (1-10GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	11520402H	
Date	November 9, 2016	November 10, 2016
Temperature / Humidity	21 deg. C / 40 % RH	20 deg. C / 38 % RH
Engineer	Keisuke Kawamura (Above 10GHz & Below 1GHz)	Shuichi Ohyama (1-10GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz	

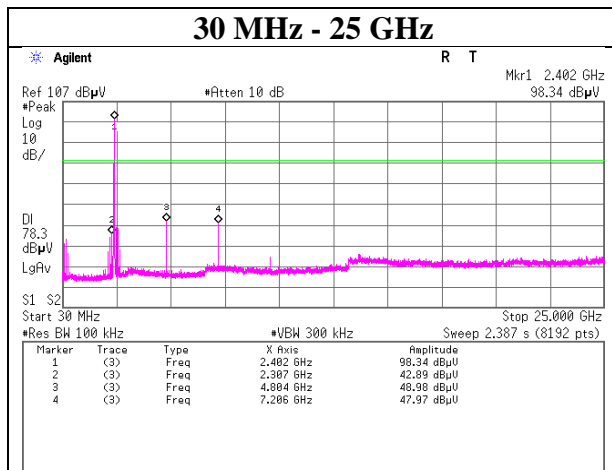
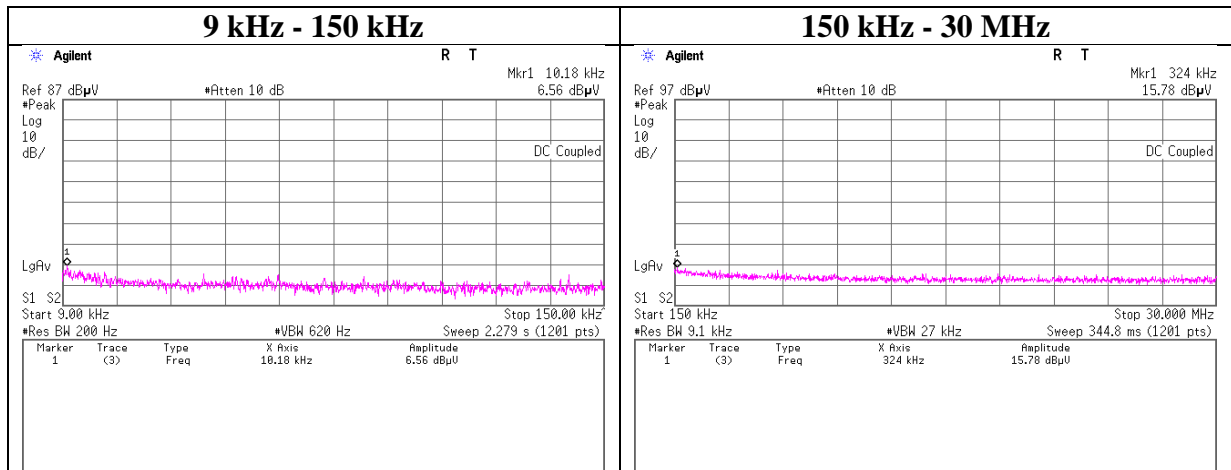


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11520402H
Date	November 21, 2016
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, DH5

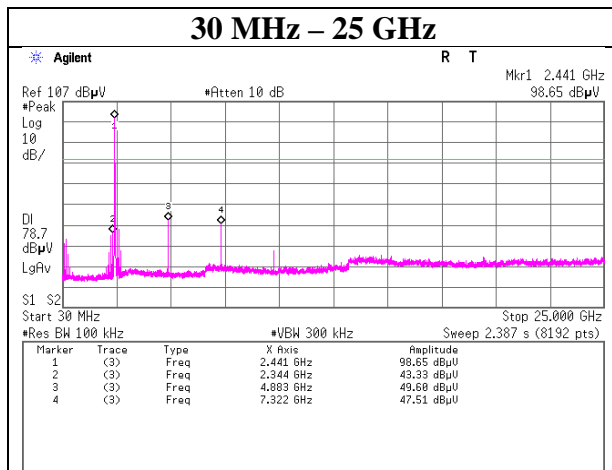
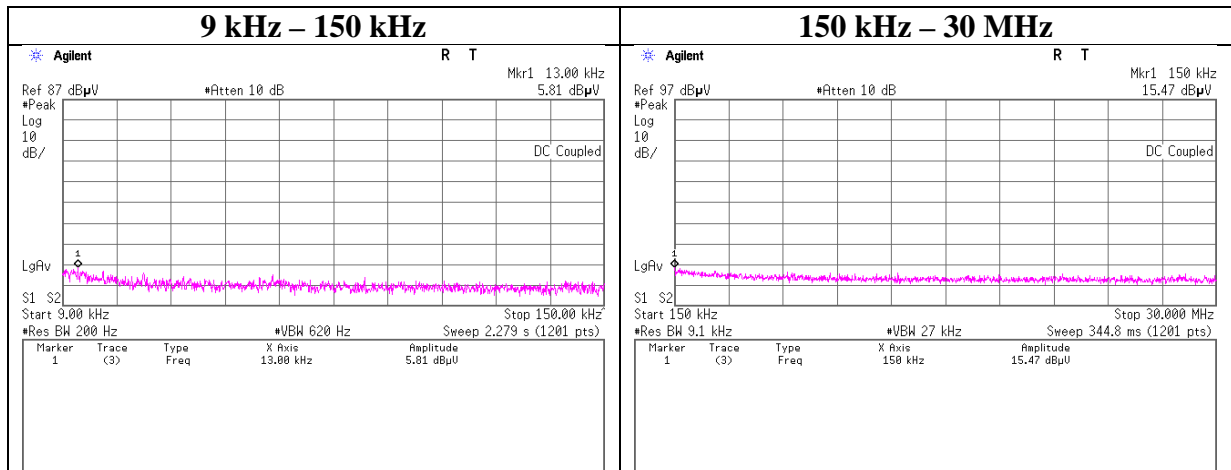
2402 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11520402H
Date	November 21, 2016
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, DH5

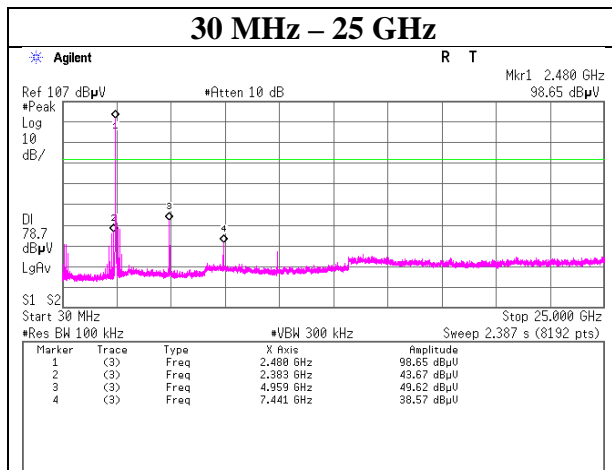
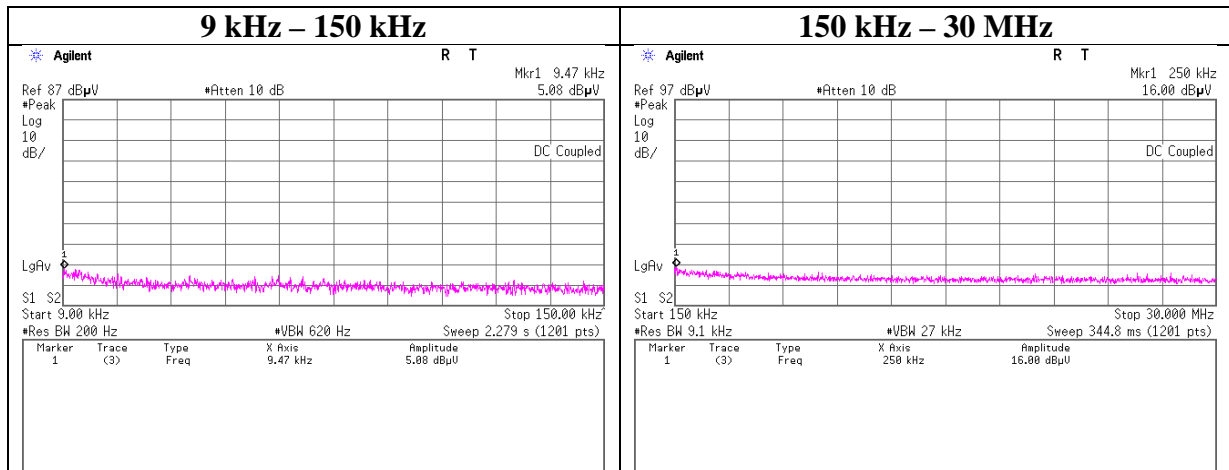
2441 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11520402H
Date	November 21, 2016
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, DH5

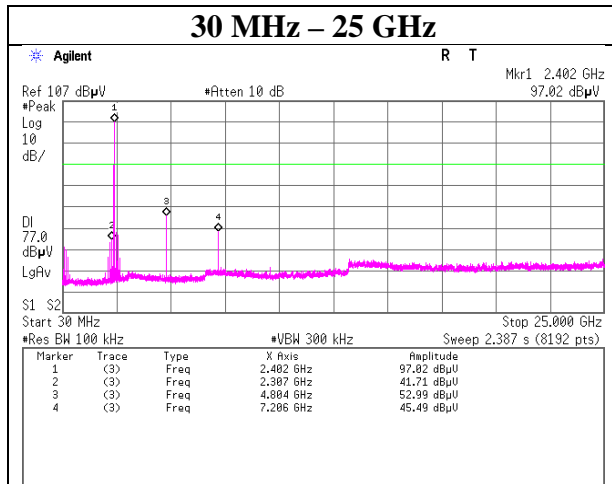
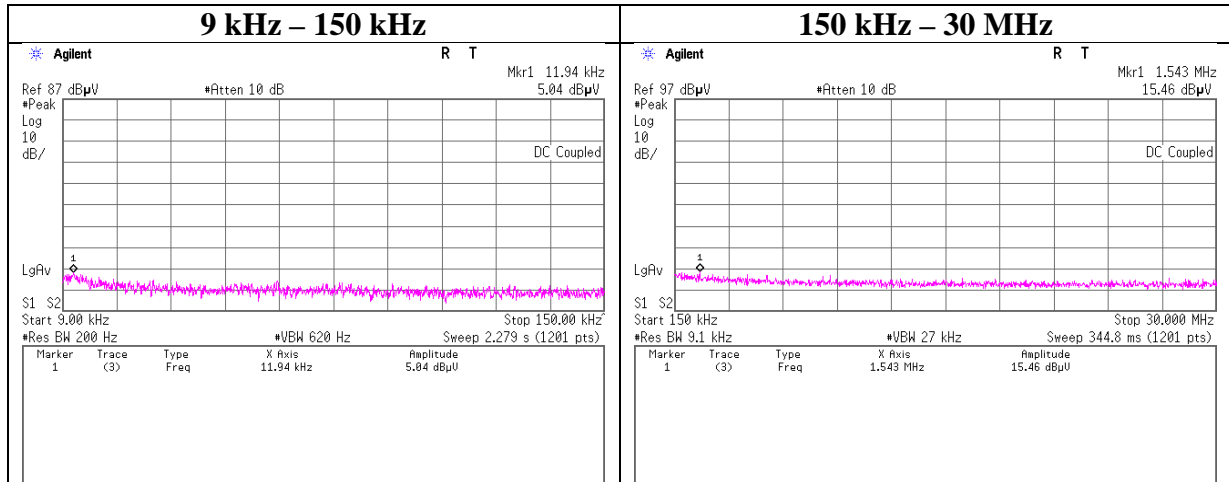
2480 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11520402H
Date	November 21, 2016
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, 3DH5

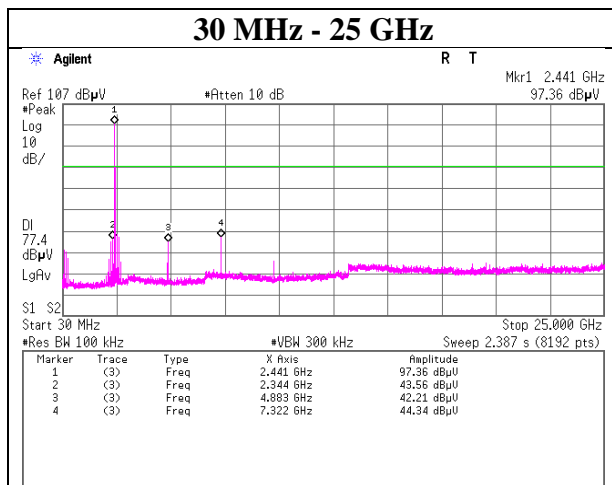
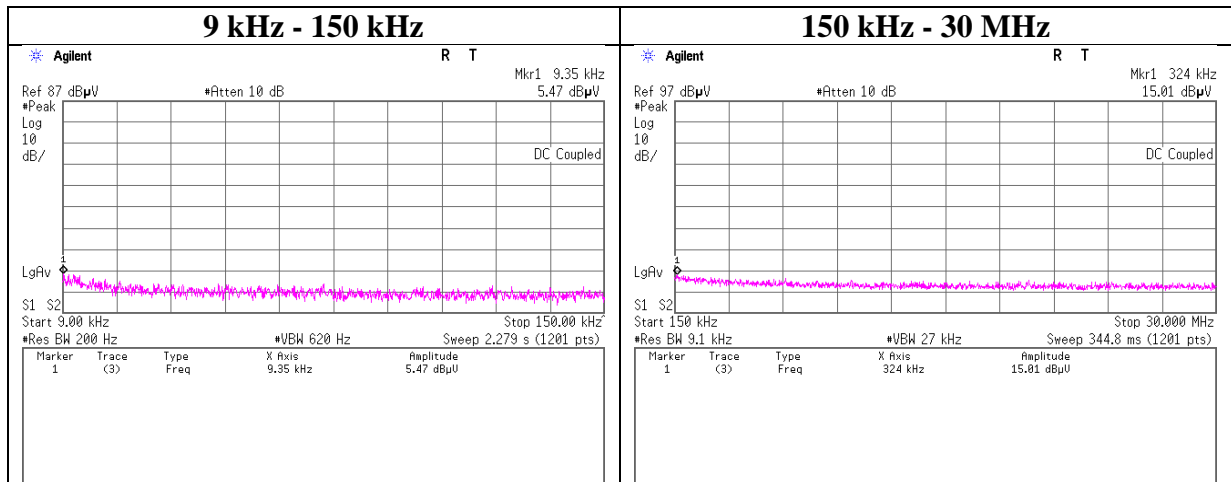
2402 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11520402H
Date	November 21, 2016
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, 3DH5

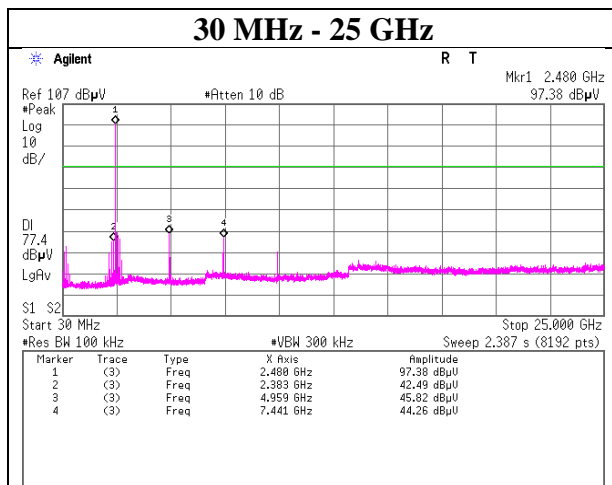
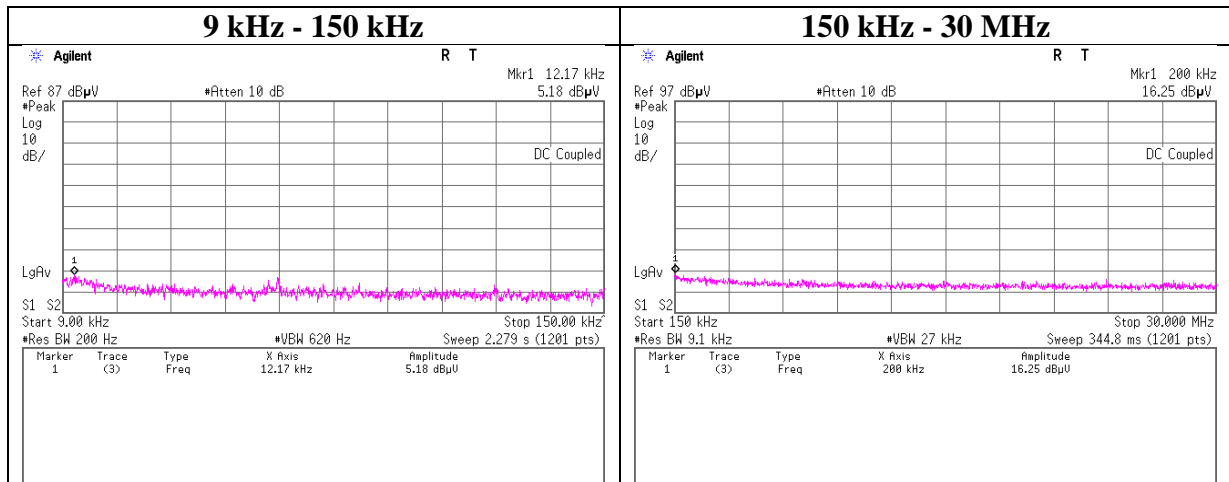
2441 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11520402H
Date	November 21, 2016
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, 3DH5

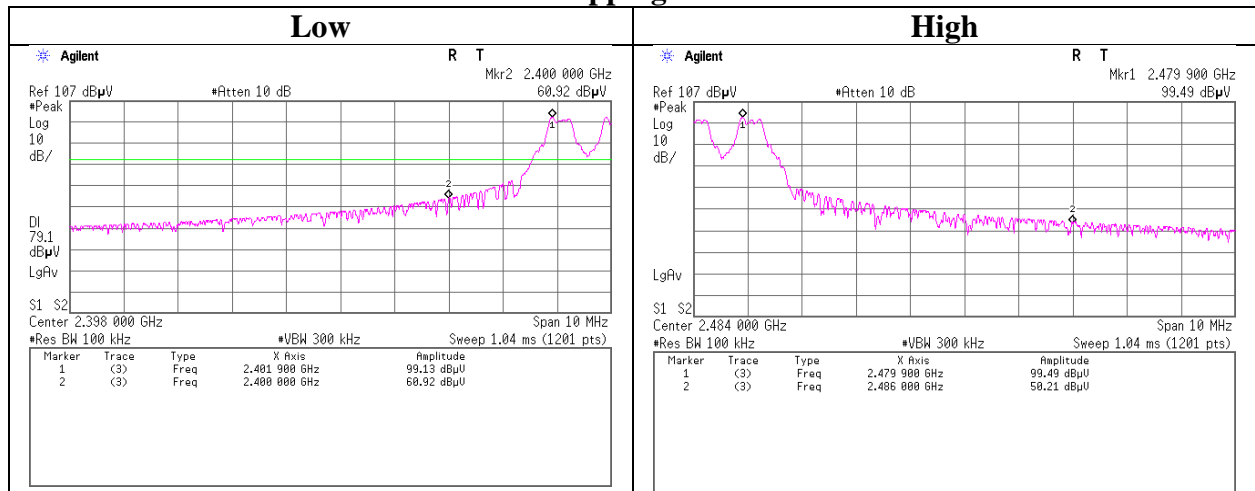
2480 MHz



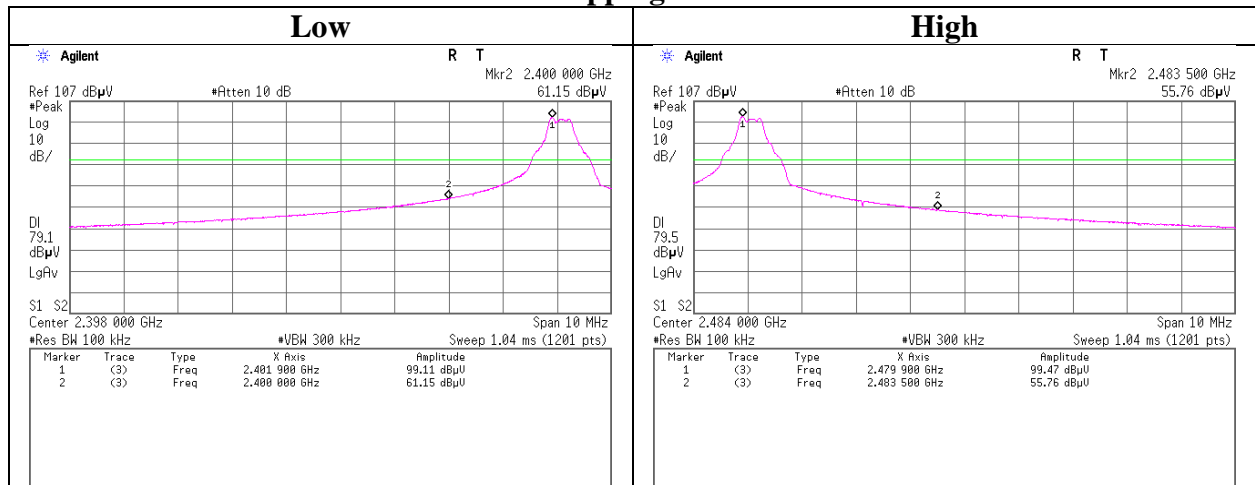
Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11520402H
Date	November 21, 2016
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Tx DH5

Hopping On



Hopping Off



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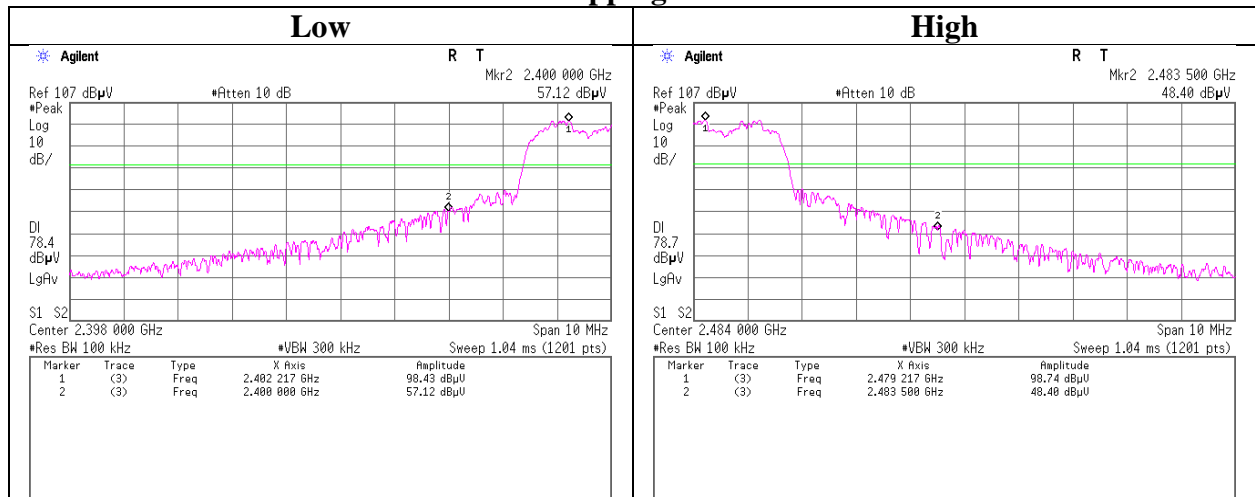
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

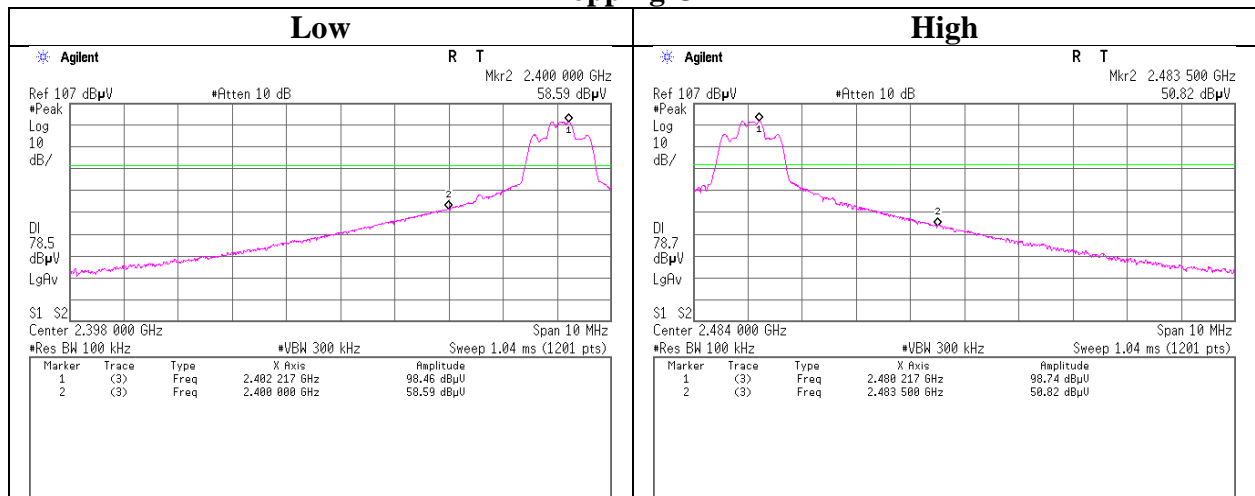
Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11520402H
Date	November 21, 2016
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Tx 3DH5

Hopping On



Hopping Off



UL Japan, Inc.

Ise EMC Lab.

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Telephone : +81 596 24 8999

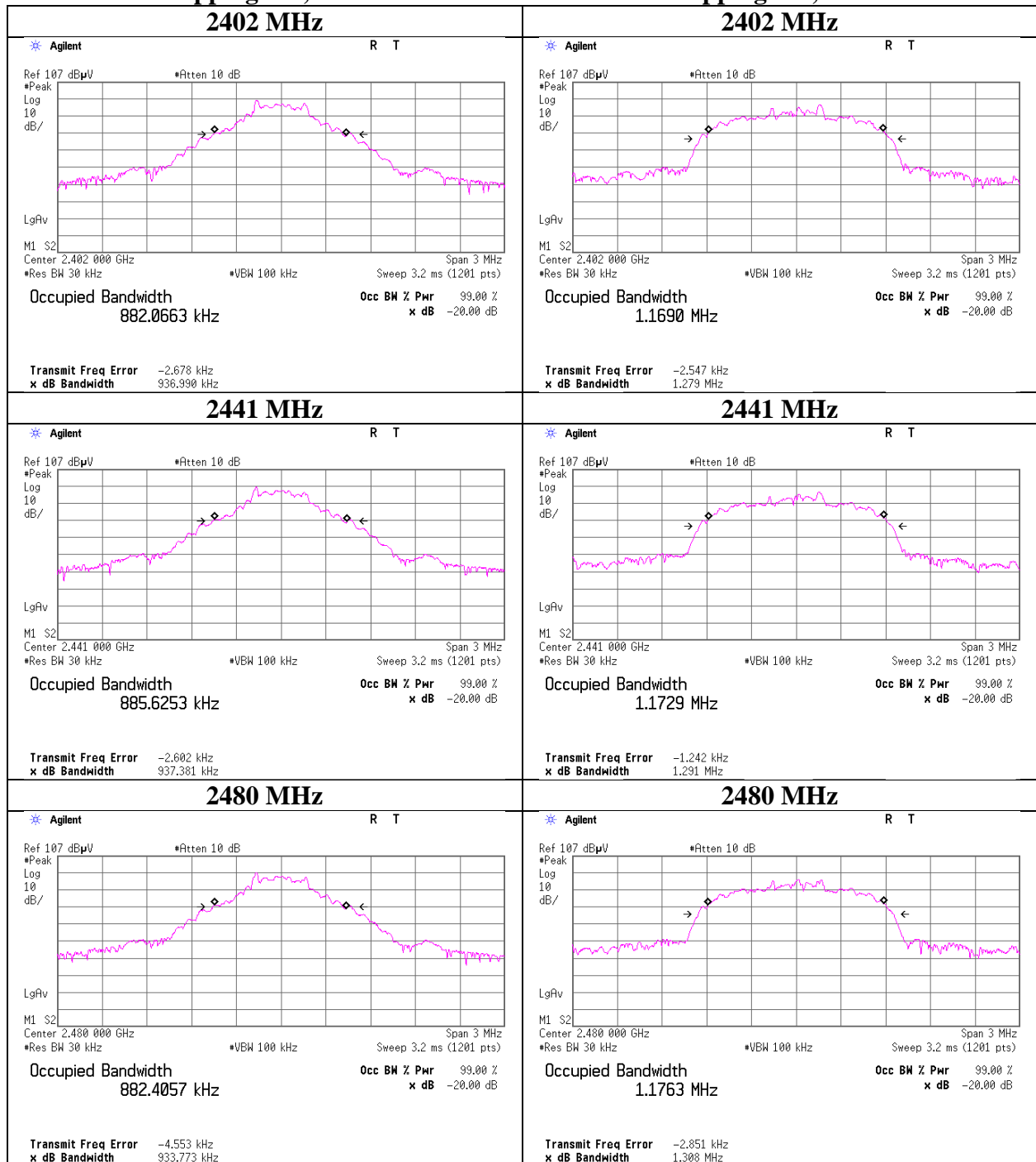
Facsimile : +81 596 24 8124

99% Occupied Bandwidth

Test place Report No. Date Temperature / Humidity Engineer Mode	Ise EMC Lab. No.2 Measurement Room 11520402H November 10, 2016 22 deg. C / 30 % RH Takafumi Noguchi Tx Hopping Off
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Hopping Off, DH5

Hopping Off, 3DH5



UL Japan, Inc.

Ise EMC Lab.

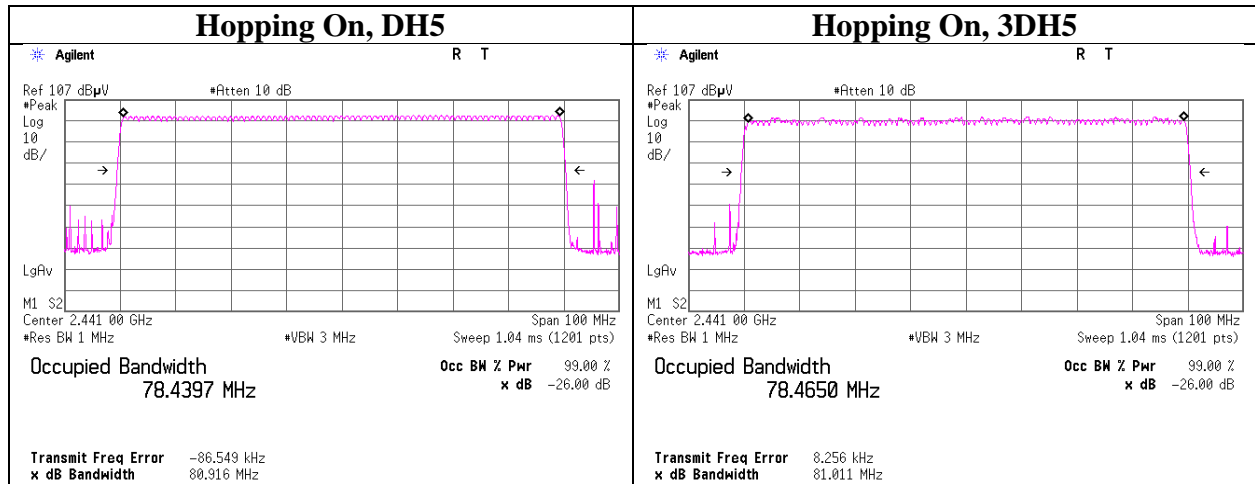
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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99% Occupied Bandwidth

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	11520402H
Date	November 10, 2016
Temperature / Humidity	22 deg. C / 30 % RH
Engineer	Takafumi Noguchi
Mode	Tx Hopping On



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APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2016/08/02 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/AT	2016/01/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2016/05/19 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2016/10/21 * 12
MBA-08	Biconical Antenna	Schwarzbeck	VHA9103B	08031	RE	2016/09/29 * 12
MLA-21	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2016/01/30 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2016/02/08 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2015/11/10 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2016/09/13 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2016/08/23 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2016/02/29 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2016/08/29 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2016/01/19 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2016/02/29 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2016/09/19 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	AT	2016/01/21 * 12
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2016/11/02 * 12
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	AT	2016/10/14 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2016/11/02 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2016/03/18 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2016/01/21 * 12
MAT-57	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2016/01/18 * 12
MCC-173	Microwave Cable	Junkosha	MWX221	1409S496	AT	2016/03/11 * 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: RE: Radiated Emission test
AT: Antenna Terminal Conducted test**

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