



RADIO TEST REPORT

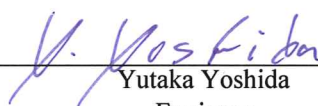
Test Report No. : 11138084H-C-R1

Applicant : FUNAI ELECTRIC CO., LTD
Type of Equipment : SUBWOOFER
Model No. : FWSB426F
FCC ID : ADTXHB00UH2
Test regulation : FCC Part 15 Subpart C: 2015
Test Result : Complied

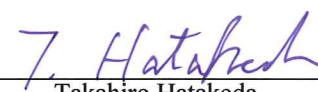
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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not 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 11138084H-C. 11138084H-C is replaced with this report.

Date of test: February 8 to 12, 2016

Representative test engineer:


Yutaka Yoshida
Engineer
Consumer Technology Division

Approved by:


Takahiro Hatakeda
Leader
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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Ise EMC Lab.

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13-EM-F0429

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SECTION 1: Customer information

Company Name	:	FUNAI ELECTRIC CO., LTD
Address	:	7-1, 7-chome, Nakagaito, Daito, Osaka 574-0013, Japan
Telephone Number	:	+81-6-6730-8785
Facsimile Number	:	+81-6-6730-8786
Contact Person	:	Masao Tani

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

2.1 Identification of E.U.T.

Type of Equipment	:	SUBWOOFER
Model No.	:	FWSB426F
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	AC 120 V / 60 Hz
Receipt Date of Sample	:	February 1, 2016
Country of Mass-production	:	China
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: FWSB426F (referred to as the EUT in this report) is a SUBWOOFER.

General Specification

Clock frequency(ies) in the system	:	98.3 MHz
------------------------------------	---	----------

Radio Specification

[Bluetooth (Ver4.1 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	:	Monopole Antenna
Antenna Gain	:	2.3 dBi
Antenna connector	:	Direct Connect

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 20.3 dB, 0.15435 MHz, L AV 26.2 dB, 0.32690 MHz, N	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(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	3.8 dB 2483.500 MHz, Horizontal, PK	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.

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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	

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 report meets the limits unless the uncertainty is taken into consideration.

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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

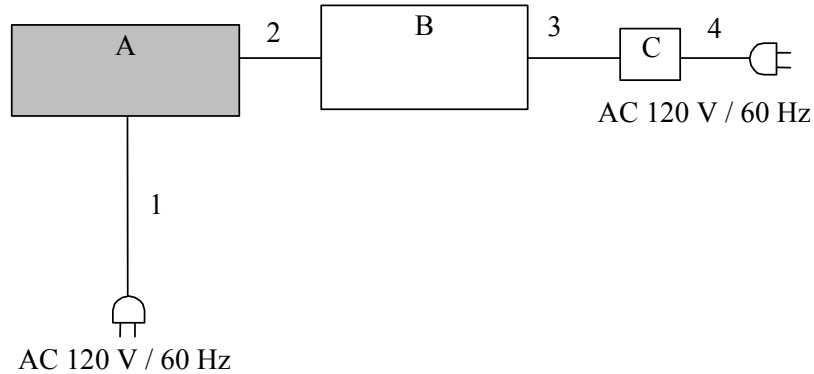
4.1 Operating Mode(s)

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
*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. *EUT has the power settings by the software as follows; Power settings: BR : 40, EDR : 35 Software: Airoha AB1500 Family LAB Test Tool Version 1.4.15.0 Bluetooth Module Firmware Version: 20160119 *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 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	Remark
A	SUBWOOFER	FWSB426F	87 *1) 22 *2)	FUNAI ELECTRIC CO., LTD	EUT
B	PERSONAL COMPUTER	PSA50N-0C3066	00045-557-620-986	TOSHIBA	-
C	AC ADAPTER	ADP-60RH A	0508 A 0156123	TOSHIBA	-

*1) Used for Conducted Emission and Radiated Emission test only.

*2) Used for Antenna Terminal Conducted test only.

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	AC Cable	1.5	Unshielded	Unshielded	-
2	USB Cable	2.0	Shielded	Shielded	-
3	DC Cable	1.8	Unshielded	Shielded	-
4	AC Cable	1.9	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 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	4.4 m *2)(below 10 GHz), 1 m *3) (above 10 GHz), 0.5 m *4) (above 26.5 GHz)		4.4 m *2)(below 10 GHz), 1 m *3) (above 10 GHz), 0.5 m *4) (above 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: $20 \times \log(4.4 \text{ m} / 3.0 \text{ m}) = 3.33 \text{ dB}$

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

*4) Distance Factor: $20 \times \log(0.5 \text{ m} / 3.0 \text{ m}) = -15.6 \text{ dB}$

The test was made on EUT at the normal use position.

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

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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 *1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *3)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	3 MHz	100 kHz	300 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

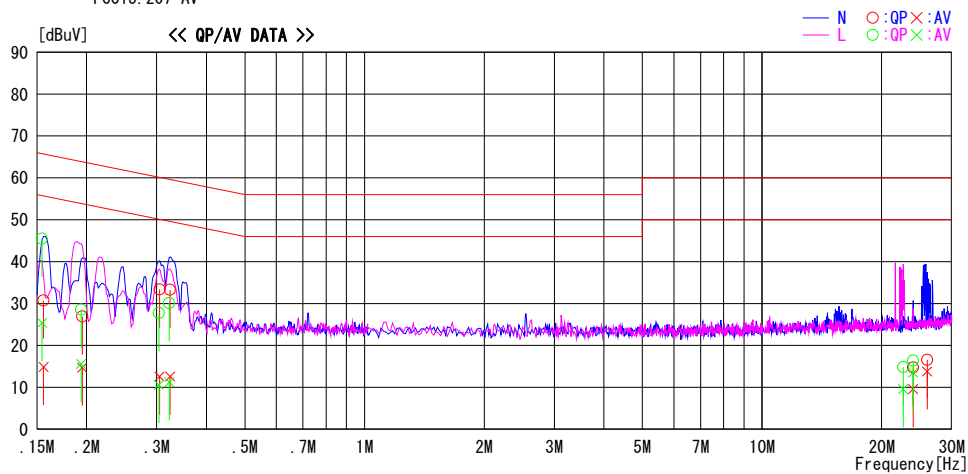
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2016/02/08

Report No. : 11138084H

Temp./Humi. : 21deg. C / 31% RH
Engineer : Ken Fujita

Mode / Remarks : DH5 2402 MHz SUBWOOFER

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15580	17.5	1.7	13.2	30.7	14.9	65.7	55.7	35.0	40.8	N	
0.19495	13.7	1.5	13.2	26.9	14.7	63.8	53.8	36.9	39.1	N	
0.30515	20.1	-0.7	13.3	33.4	12.6	60.1	50.1	26.7	37.5	N	
0.32400	20.0	-0.7	13.3	33.3	12.6	59.6	49.6	26.3	37.0	N	
23.98503	0.1	-5.0	14.6	14.7	9.6	60.0	50.0	45.3	40.4	N	
26.02345	1.8	-1.0	14.8	16.6	13.8	60.0	50.0	43.4	36.2	N	
0.15435	32.3	12.2	13.2	45.5	25.4	65.8	55.8	20.3	30.4	L	
0.19350	15.4	2.4	13.2	28.6	15.6	63.9	53.9	35.3	38.3	L	
0.30370	14.4	-2.7	13.3	27.7	10.6	60.1	50.1	32.4	39.5	L	
0.32255	16.8	-2.1	13.3	30.1	11.2	59.6	49.6	29.5	38.4	L	
22.64836	0.2	-5.0	14.6	14.8	9.6	60.0	50.0	45.2	40.4	L	
23.98503	1.8	-1.1	14.6	16.4	13.5	60.0	50.0	43.6	36.5	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.

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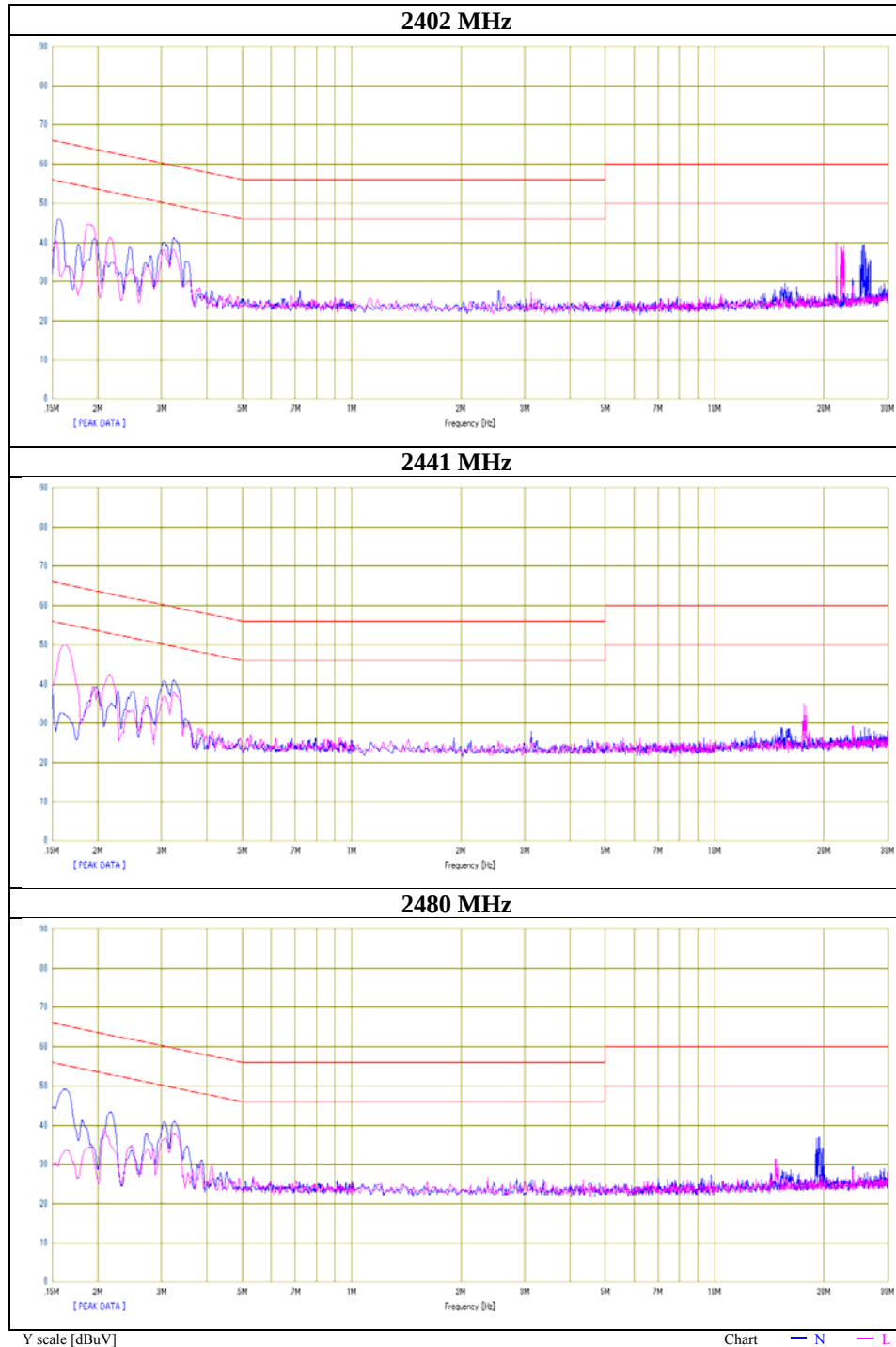
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Conducted Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11138084H
Date	February 8, 2016
Temperature / Humidity	21 deg. C / 31 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, DH5



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Conducted Emission

DATA OF CONDUCTED EMISSION TEST

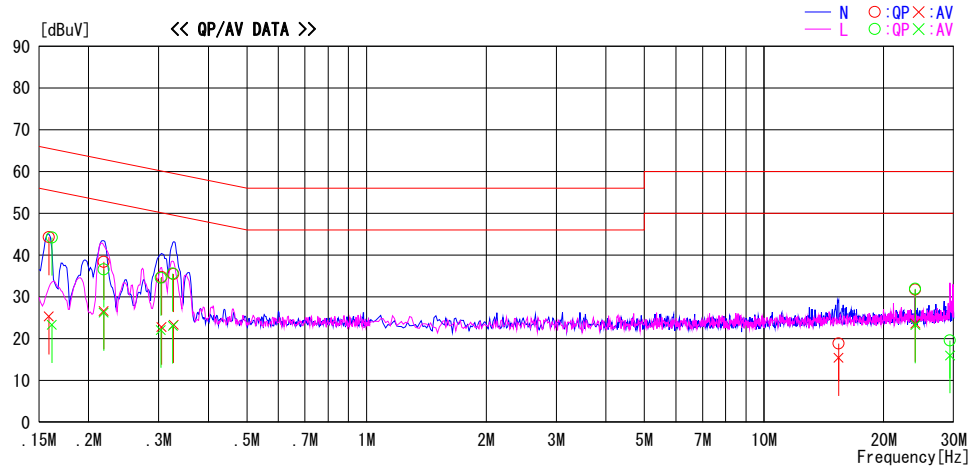
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2016/02/08

Report No. : 11138084H

Temp./Humi. : 21deg. C / 31% RH
Engineer : Ken Fujita

Mode / Remarks : 3DH5 2402 MHz SUBWOOFER

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15870	31.1	12.1	13.2	44.3	25.3	65.5	55.5	21.2	30.2	N	
0.21815	25.2	13.4	13.2	38.4	26.6	62.9	52.9	24.5	26.3	N	
0.30515	21.4	9.5	13.3	34.7	22.8	60.1	50.1	25.4	27.3	N	
0.32690	22.2	10.0	13.3	35.5	23.3	59.5	49.5	24.0	26.2	N	
15.39693	4.5	1.1	14.3	18.8	15.4	60.0	50.0	41.2	34.6	N	
24.01845	17.1	9.0	14.6	31.7	23.6	60.0	50.0	28.3	26.4	N	
0.16160	31.0	10.1	13.2	44.2	23.3	65.4	55.4	21.2	32.1	L	
0.21815	23.4	13.0	13.2	36.6	26.2	62.9	52.9	26.3	26.7	L	
0.30370	21.3	8.8	13.3	34.6	22.1	60.1	50.1	25.5	28.0	L	
0.32545	22.3	9.8	13.3	35.6	23.1	59.6	49.6	24.0	26.5	L	
24.01845	17.3	8.6	14.6	31.9	23.2	60.0	50.0	28.1	26.8	L	
29.36513	4.8	1.2	14.8	19.6	16.0	60.0	50.0	40.4	34.0	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.

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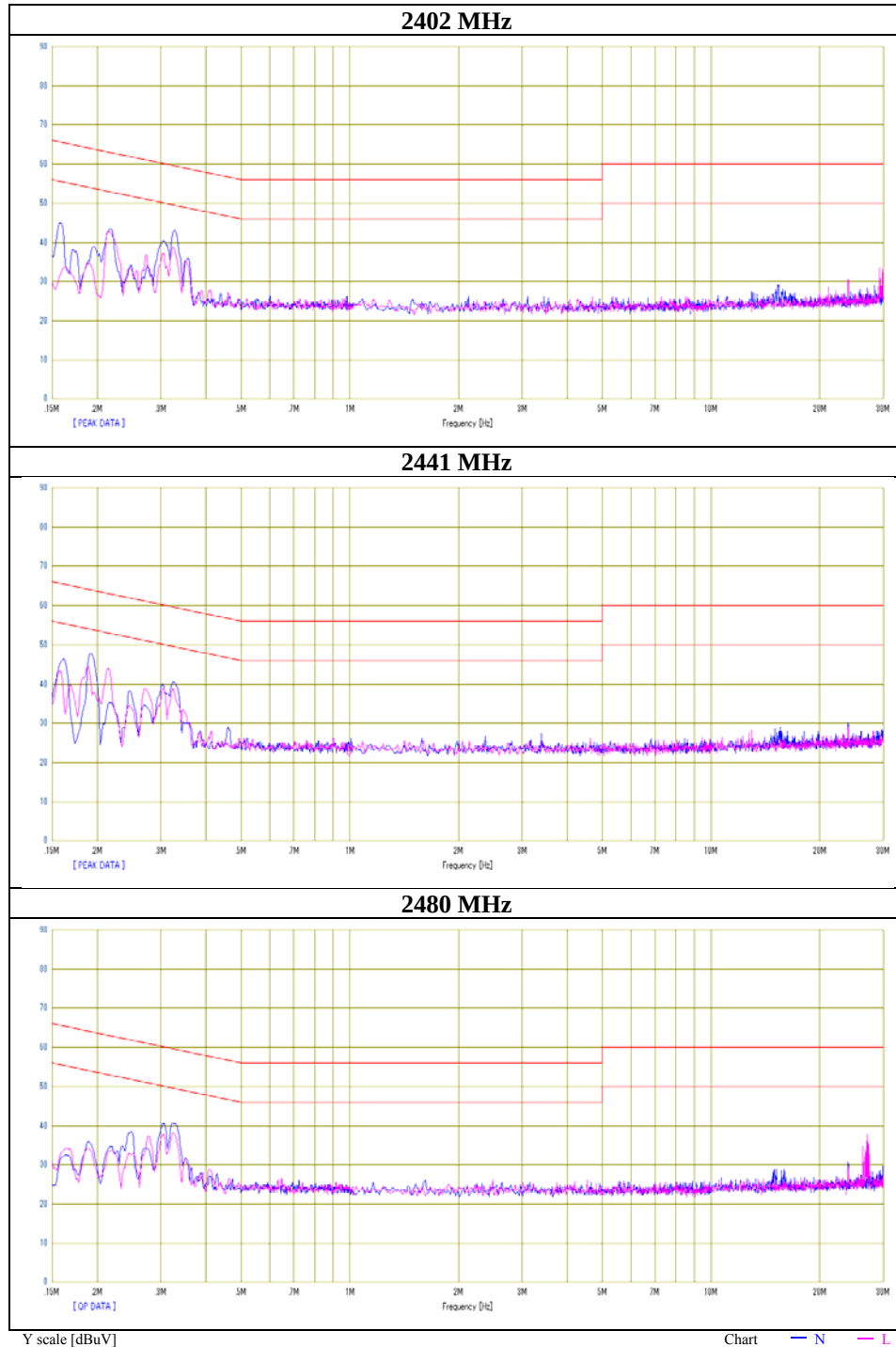
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Conducted Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11138084H
Date	February 8, 2016
Temperature / Humidity	21 deg. C / 31 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, 3DH5



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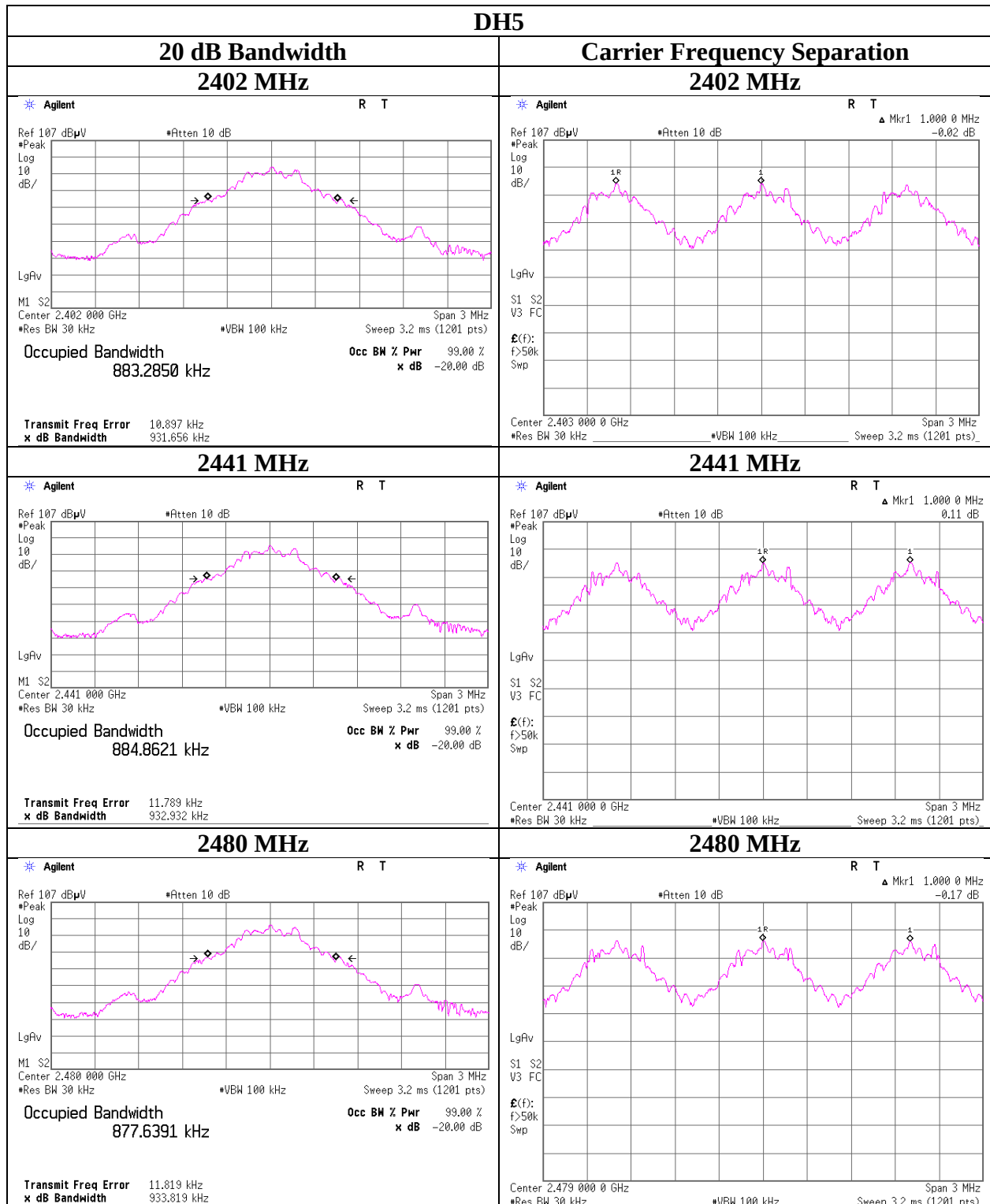
20dB Bandwidth and Carrier Frequency Separation

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11138084H
Date : February 12, 2016
Temperature / Humidity : 24 deg. C / 25 % RH
Engineer : Yutaka Yoshida
Mode : Tx Hopping Off/On

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.932	1.000	≥ 0.621
DH5	2441.0	0.933	1.000	≥ 0.622
DH5	2480.0	0.934	1.000	≥ 0.623
3DH5	2402.0	1.261	1.000	≥ 0.841
3DH5	2441.0	1.263	1.000	≥ 0.842
3DH5	2480.0	1.262	1.000	≥ 0.841

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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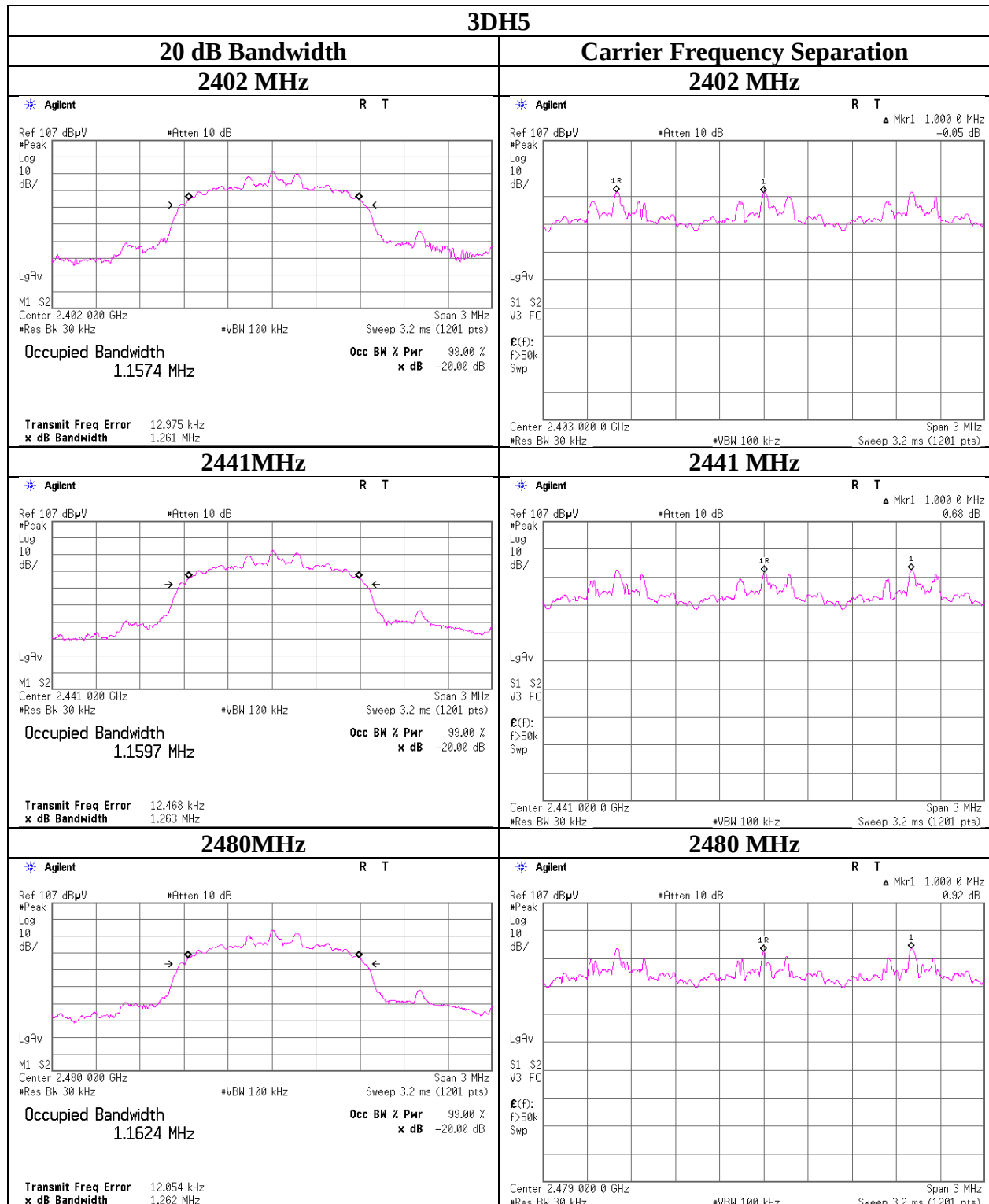
Ise EMC Lab.

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20dB Bandwidth and Carrier Frequency Separation



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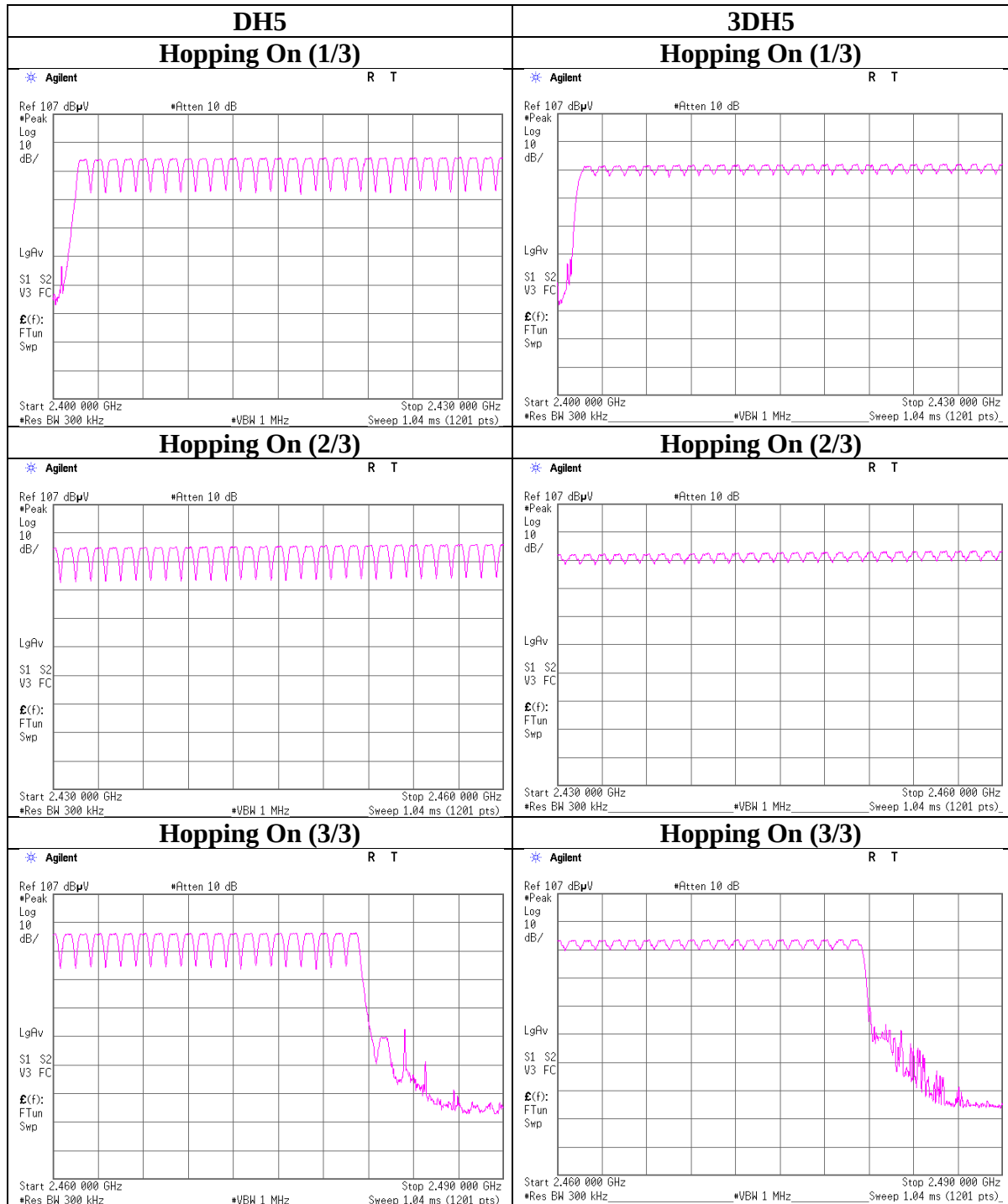
Number of Hopping Frequency

Test place Ise EMC Lab. No.7 Shielded Room
Report No. 11138084H
Date February 12, 2016
Temperature / Humidity 24 deg. C / 25 % RH
Engineer Yutaka Yosjida
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.7Shielded Room
Report No. : 11138084H
Date : February 12, 2016
Temperature / Humidity : 24 deg. C / 25 % RH
Engineer : Yutaka Yoshida
Mode : Tx, Hopping On

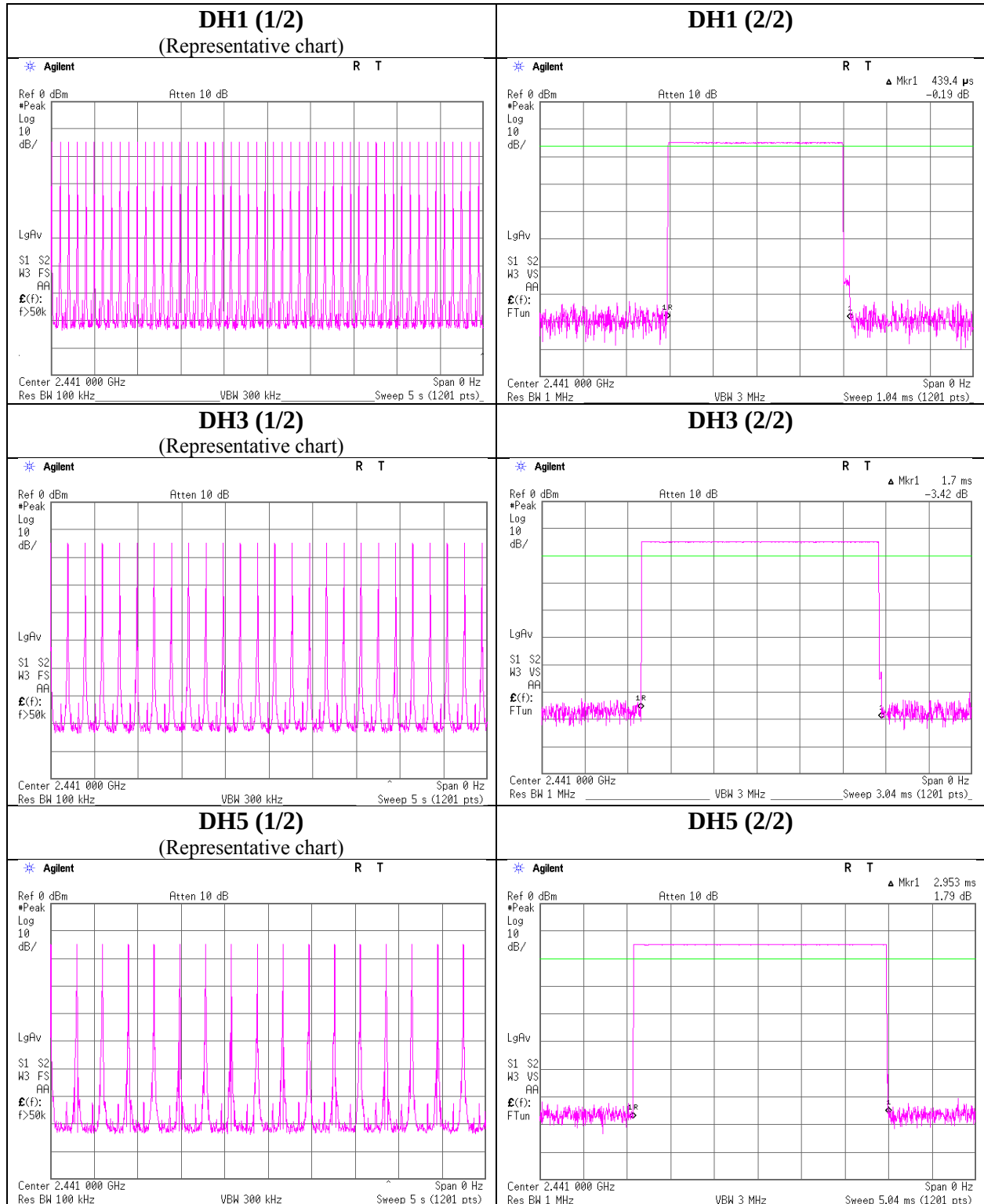
Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period				Length of transmission [msec]	Result [msec]	Limit [msec]
DH1	51.0 times	/	5 sec.	x 31.6 sec. = 323 times	0.439	142	400
DH3	26.0 times	/	5 sec.	x 31.6 sec. = 165 times	1.700	281	400
DH5	17.0 times	/	5 sec.	x 31.6 sec. = 108 times	2.953	319	400
3DH1	51.0 times	/	5 sec.	x 31.6 sec. = 323 times	0.436	141	400
3DH3	26.0 times	/	5 sec.	x 31.6 sec. = 165 times	1.687	278	400
3DH5	17.0 times	/	5 sec.	x 31.6 sec. = 108 times	2.961	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 $N \times 0.4s$, 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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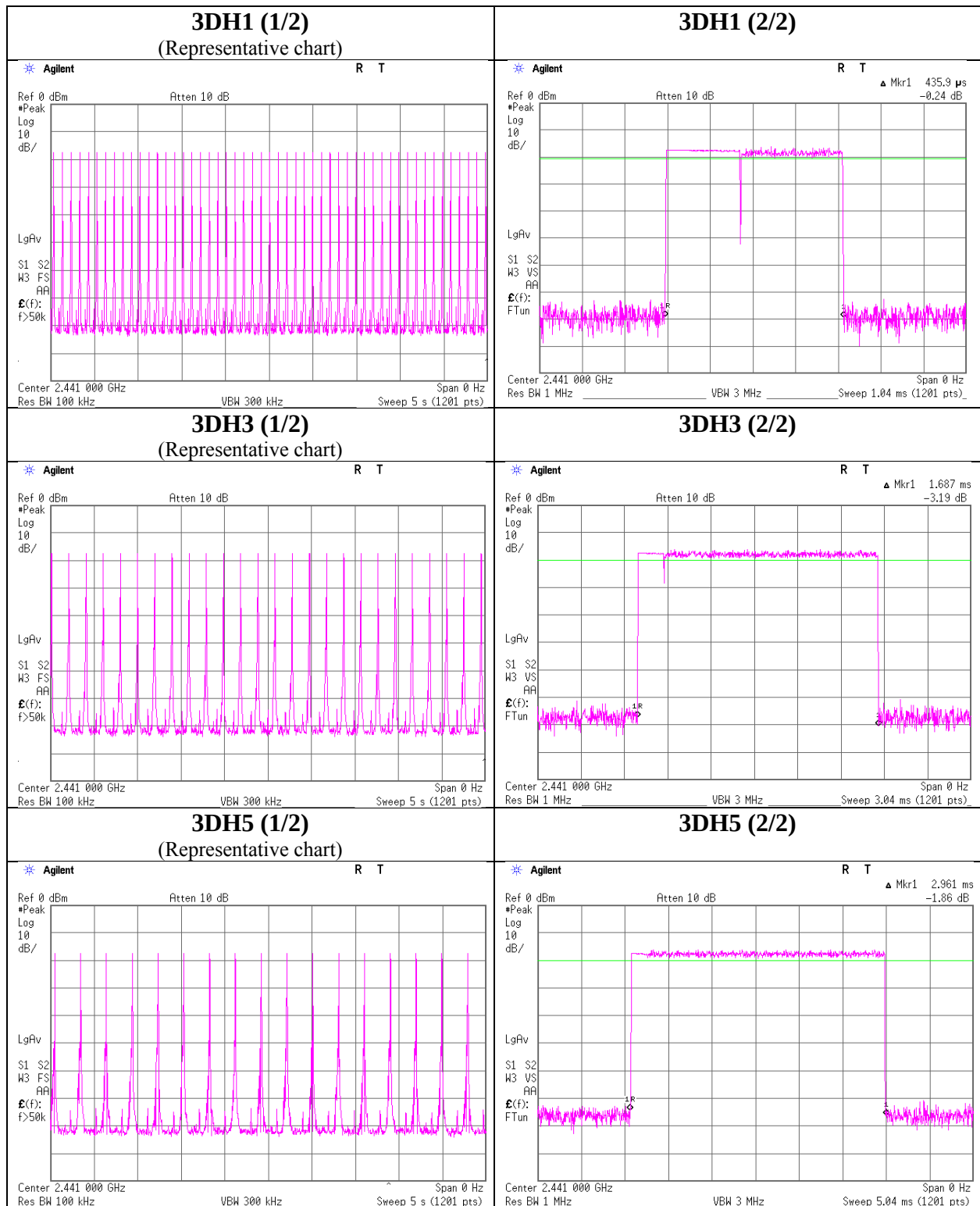
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Dwell time



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Maximum Peak Output Power

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11138084H
Date : February 12, 2016
Temperature / Humidity : 24 deg. C / 25 % RH
Engineer : Yutaka Yoshida
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	-14.96	2.83	10.02	-2.10	0.62	20.96	125	23.06
DH5	2441.0	-14.00	2.84	10.02	-1.13	0.77	20.96	125	22.09
DH5	2480.0	-12.99	2.85	10.02	-0.11	0.97	20.96	125	21.07
2DH5	2402.0	-16.32	2.83	10.02	-3.46	0.45	20.96	125	24.42
2DH5	2441.0	-15.33	2.84	10.02	-2.46	0.57	20.96	125	23.42
2DH5	2480.0	-14.31	2.85	10.02	-1.43	0.72	20.96	125	22.39
3DH5	2402.0	-15.97	2.83	10.02	-3.11	0.49	20.96	125	24.07
3DH5	2441.0	-14.94	2.84	10.02	-2.07	0.62	20.96	125	23.03
3DH5	2480.0	-13.94	2.85	10.02	-1.06	0.78	20.96	125	22.02

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)

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11138084H
Date	February 12, 2016
Temperature / Humidity	24 deg. C / 25 % RH
Engineer	Yutaka Yoshida
Mode	Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result	
					[dBm]	[mW]
DH5	2402.0	-16.90	2.83	10.02	-4.05	0.39
DH5	2441.0	-15.84	2.84	10.02	-2.98	0.50
DH5	2480.0	-14.69	2.85	10.02	-1.82	0.66
2DH5	2402.0	-20.89	2.83	10.02	-8.04	0.16
2DH5	2441.0	-19.81	2.84	10.02	-6.95	0.20
2DH5	2480.0	-18.67	2.85	10.02	-5.80	0.26
3DH5	2402.0	-20.89	2.83	10.02	-8.04	0.16
3DH5	2441.0	-19.81	2.84	10.02	-6.95	0.20
3DH5	2480.0	-18.67	2.85	10.02	-5.80	0.26

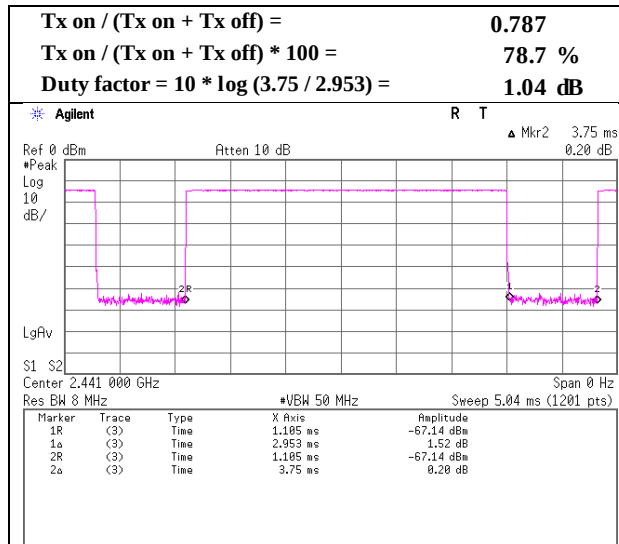
Sample Calculation:

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

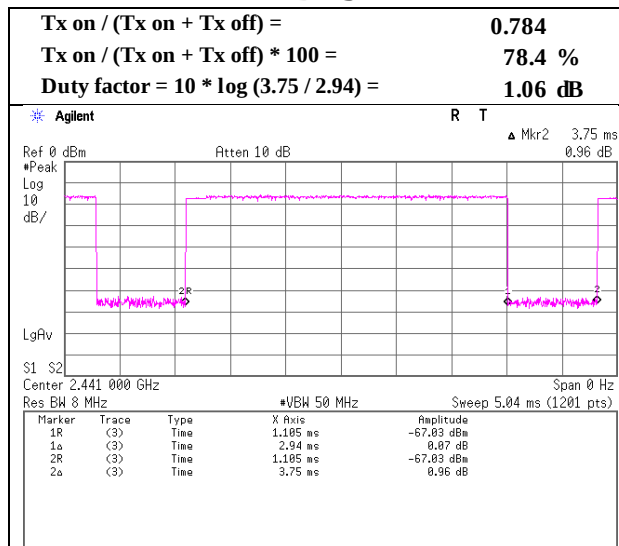
Burst Rate Confirmation

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11138084H
Date	February 12, 2016
Temperature / Humidity	24 deg. C / 25 % RH
Engineer	Yutaka Yoshida
Mode	Tx, Hopping Off

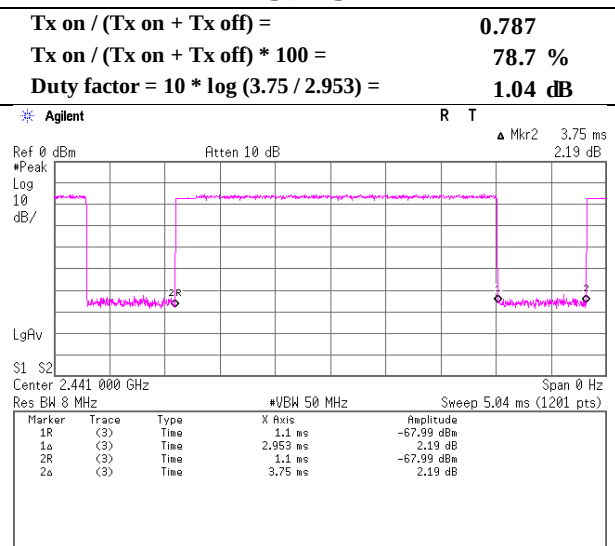
DH5



2DH5



3DH5



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Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	11138084H		
Date	February 6, 2016	February 7, 2016	February 7, 2016
Temperature / Humidity	20 deg. C / 30 % RH	22 deg. C / 32 % RH	22 deg. C / 32 % RH
Engineer	Takafumi Noguchi (1 GHz – 10 GHz)	Ken Fujita (Above 10 GHz)	Ken Fujita (Below 1 GHz)
Mode	Tx 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	39.450	QP	29.3	14.1	7.2	32.2	18.4	40.0	21.6	
Hori	84.000	QP	41.9	7.1	7.8	32.1	24.7	40.0	15.3	
Hori	107.850	QP	40.2	10.8	8.1	32.2	26.9	43.5	16.6	
Hori	143.850	QP	33.2	14.4	8.5	32.2	23.9	43.5	19.6	
Hori	202.349	QP	34.5	16.6	9.1	32.1	28.1	43.5	15.4	
Hori	876.338	QP	24.1	22.2	13.2	31.1	28.4	46.0	17.6	
Hori	2390.000	PK	42.6	26.9	6.6	32.0	44.1	73.9	29.8	
Hori	4804.000	PK	40.9	31.8	8.8	31.3	50.2	73.9	23.7	Floor Noise
Hori	7206.000	PK	42.7	36.0	10.0	32.0	56.7	73.9	17.2	Floor Noise
Hori	9608.000	PK	42.9	38.2	10.8	32.4	59.5	73.9	14.4	Floor Noise
Hori	2390.000	AV	30.1	26.9	6.6	32.0	31.6	53.9	22.3	
Hori	4804.000	AV	29.1	31.8	8.8	31.3	38.4	53.9	15.5	Floor Noise
Hori	7206.000	AV	30.8	36.0	10.0	32.0	44.8	53.9	9.1	Floor Noise
Hori	9608.000	AV	31.2	38.2	10.8	32.4	47.8	53.9	6.1	Floor Noise
Vert	39.450	QP	32.6	14.1	7.2	32.2	21.7	40.0	18.3	
Vert	84.000	QP	41.3	7.1	7.8	32.1	24.1	40.0	15.9	
Vert	107.850	QP	45.0	10.8	8.1	32.2	31.7	43.5	11.8	
Vert	143.850	QP	40.1	14.4	8.5	32.2	30.8	43.5	12.7	
Vert	199.649	QP	36.7	16.6	9.0	32.1	30.2	43.5	13.3	
Vert	883.338	QP	24.2	22.3	13.2	31.1	28.6	46.0	17.4	
Vert	2390.000	PK	42.8	26.9	6.6	32.0	44.3	73.9	29.6	
Vert	4804.000	PK	41.1	31.8	8.8	31.3	50.4	73.9	23.5	Floor Noise
Vert	7206.000	PK	42.0	36.0	10.0	32.0	56.0	73.9	17.9	Floor Noise
Vert	9608.000	PK	42.4	38.2	10.8	32.4	59.0	73.9	14.9	Floor Noise
Vert	2390.000	AV	30.2	26.9	6.6	32.0	31.7	53.9	22.2	
Vert	4804.000	AV	29.1	31.8	8.8	31.3	38.4	53.9	15.5	Floor Noise
Vert	7206.000	AV	30.7	36.0	10.0	32.0	44.7	53.9	9.2	Floor Noise
Vert	9608.000	AV	30.7	38.2	10.8	32.4	47.3	53.9	6.6	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).

*The 10th harmonic was not seen so the result was its base noise level.

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

Distance factor: 1 GHz - 10 GHz 20log (4.4 m / 3.0 m) = 3.33dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
26.5 GHz - 40 GHz 20log (0.5 m / 3.0 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	91.8	26.9	6.6	32.0	93.3	-	-	Carrier
Hori	2400.000	PK	43.9	26.9	6.6	32.0	45.4	73.3	27.9	
Vert	2402.000	PK	91.9	26.9	6.6	32.0	93.4	-	-	Carrier
Vert	2400.000	PK	44.1	26.9	6.6	32.0	45.6	73.4	27.8	

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

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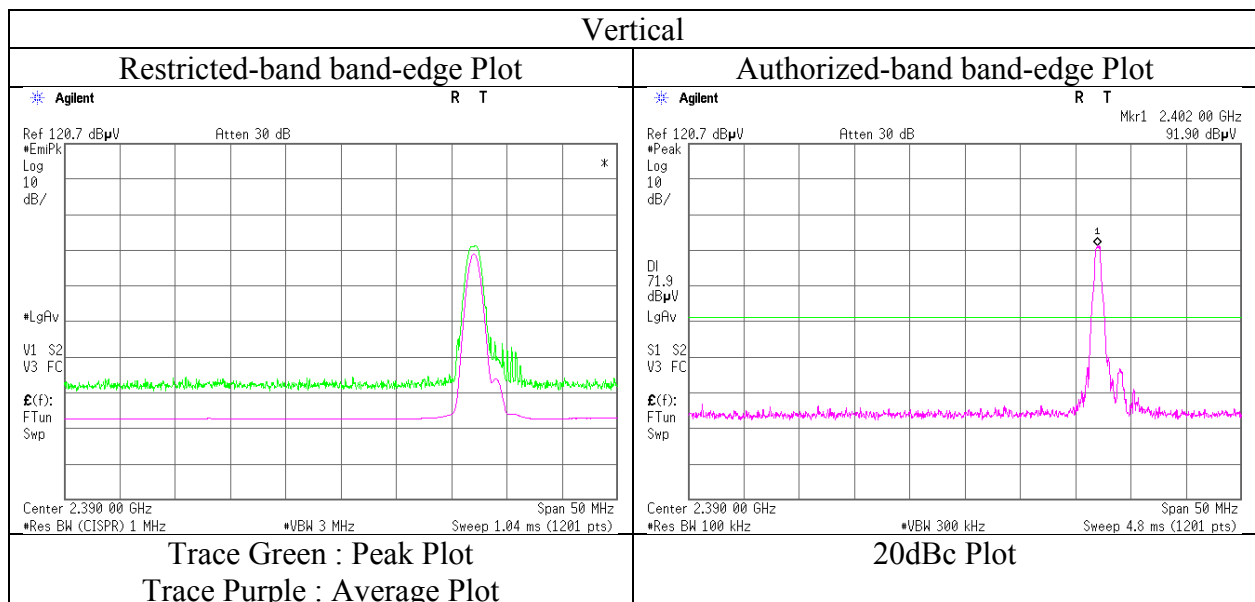
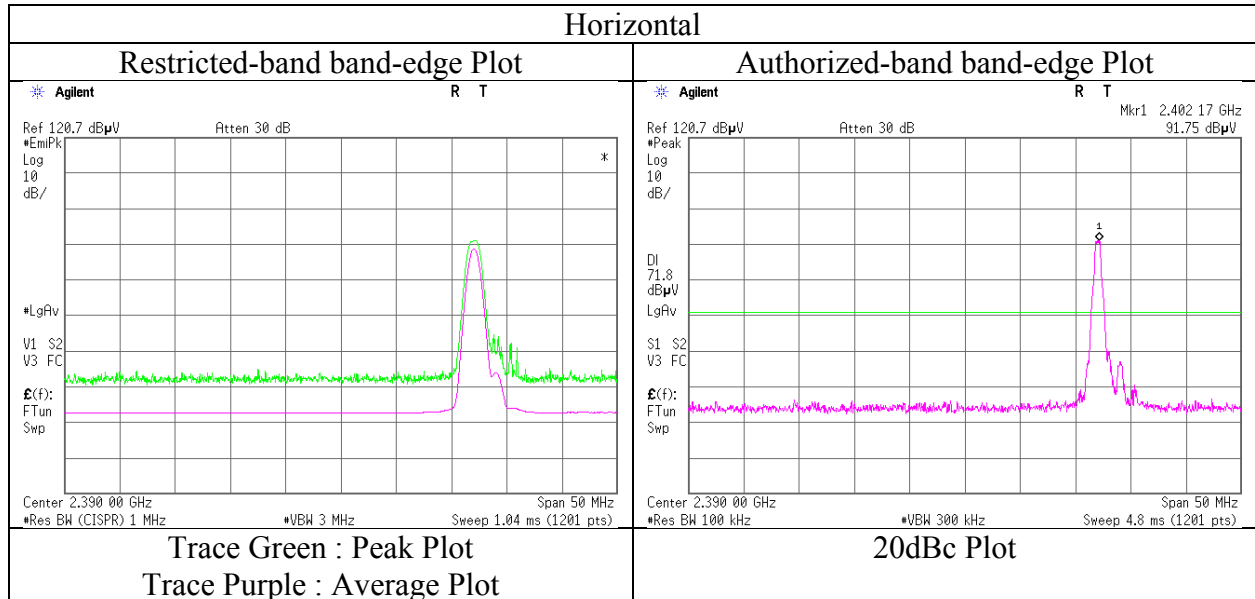
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Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	11138084H		
Date	February 6, 2016	February 7, 2016	February 7, 2016
Temperature / Humidity	20 deg. C / 30 % RH	22 deg. C / 32 % RH	22 deg. C / 32 % RH
Engineer	Takafumi Noguchi	Ken Fujita	Ken Fujita
	(1 GHz – 10 GHz)	(Above 10 GHz)	(Below 1 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz		



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

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Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	11138084H		
Date	February 6, 2016	February 7, 2016	February 7, 2016
Temperature / Humidity	20 deg. C / 30 % RH	22 deg. C / 32 % RH	22 deg. C / 32 % RH
Engineer	Takafumi Noguchi (1 GHz – 10 GHz)	Ken Fujita (Above 10 GHz)	Ken Fujita (Below 1 GHz)
Mode	Tx 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	39.332	QP	29.1	14.2	7.2	32.2	18.3	40.0	21.7	
Hori	84.212	QP	41.5	7.1	7.8	32.1	24.3	40.0	15.7	
Hori	107.678	QP	40.3	10.8	8.1	32.2	27.0	43.5	16.5	
Hori	143.812	QP	33.1	14.4	8.5	32.2	23.8	43.5	19.7	
Hori	202.343	QP	34.3	16.6	9.1	32.1	27.9	43.5	15.6	
Hori	876.321	QP	24.2	22.2	13.2	31.1	28.5	46.0	17.5	
Hori	4882.000	PK	41.3	31.9	8.8	31.3	50.7	73.9	23.2	Floor Noise
Hori	7323.000	PK	42.2	36.0	9.3	32.0	55.5	73.9	18.4	Floor Noise
Hori	9764.000	PK	42.2	38.2	10.8	32.5	58.7	73.9	15.2	Floor Noise
Hori	4882.000	AV	29.2	31.9	8.8	31.3	38.6	53.9	15.3	Floor Noise
Hori	7323.000	AV	30.6	36.0	9.3	32.0	43.9	53.9	10.0	Floor Noise
Hori	9764.000	AV	30.4	38.2	10.8	32.5	46.9	53.9	7.0	Floor Noise
Vert	39.451	QP	32.2	14.1	7.2	32.2	21.3	40.0	18.7	
Vert	84.178	QP	41.4	7.1	7.8	32.1	24.2	40.0	15.8	
Vert	107.837	QP	45.3	10.8	8.1	32.2	32.0	43.5	11.5	
Vert	143.854	QP	40.0	14.4	8.5	32.2	30.7	43.5	12.8	
Vert	199.642	QP	36.1	16.6	9.0	32.1	29.6	43.5	13.9	
Vert	883.245	QP	24.7	22.3	13.2	31.1	29.1	46.0	16.9	
Vert	4882.000	PK	41.4	31.9	8.8	31.3	50.8	73.9	23.1	Floor Noise
Vert	7323.000	PK	42.1	36.0	10.1	32.0	56.2	73.9	17.7	Floor Noise
Vert	9764.000	PK	42.2	38.2	10.8	32.5	58.7	73.9	15.2	Floor Noise
Vert	4882.000	AV	29.2	31.9	8.8	31.3	38.6	53.9	15.3	Floor Noise
Vert	7323.000	AV	30.6	36.0	10.1	32.0	44.7	53.9	9.2	Floor Noise
Vert	9764.000	AV	30.4	38.2	10.8	32.5	46.9	53.9	7.0	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).

*The 10th harmonic was not seen so the result was its base noise level.

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

Distance factor: 1 GHz - 10 GHz 20log (4.4 m / 3.0 m) = 3.33dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
 26.5 GHz - 40 GHz 20log (0.5 m / 3.0 m) = -15.6 dB

Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	11138084H		
Date	February 6, 2016	February 7, 2016	February 7, 2016
Temperature / Humidity	20 deg. C / 30 % RH	22 deg. C / 32 % RH	22 deg. C / 32 % RH
Engineer	Takafumi Noguchi (1 GHz – 10 GHz)	Ken Fujita (Above 10 GHz)	Ken Fujita (Below 1 GHz)
Mode	Tx 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	39.402	QP	29.3	14.1	7.2	32.2	18.4	40.0	21.6	
Hori	84.251	QP	41.2	7.1	7.8	32.1	24.0	40.0	16.0	
Hori	107.665	QP	40.4	10.8	8.1	32.2	27.1	43.5	16.4	
Hori	143.823	QP	33.5	14.4	8.5	32.2	24.2	43.5	19.3	
Hori	202.344	QP	34.1	16.6	9.1	32.1	27.7	43.5	15.8	
Hori	876.322	QP	24.6	22.2	13.2	31.1	28.9	46.0	17.1	
Hori	2483.500	PK	68.6	26.9	6.6	32.0	70.1	73.9	3.8	
Hori	4960.000	PK	42.4	32.1	8.7	31.2	52.0	73.9	21.9	
Hori	7440.000	PK	41.7	36.0	10.0	32.1	55.6	73.9	18.3	Floor Noise
Hori	9920.000	PK	42.4	38.2	10.9	32.5	59.0	73.9	14.9	Floor Noise
Hori	2483.500	AV	42.6	26.9	6.6	32.0	44.1	53.9	9.8	
Hori	4960.000	AV	30.1	32.1	8.7	31.2	39.7	53.9	14.2	
Hori	7440.000	AV	30.8	36.0	10.0	32.1	44.7	53.9	9.2	Floor Noise
Hori	9920.000	AV	30.7	38.2	10.9	32.5	47.3	53.9	6.6	Floor Noise
Vert	39.454	QP	35.9	14.1	7.2	32.2	25.0	40.0	15.0	
Vert	84.139	QP	41.2	7.1	7.8	32.1	24.0	40.0	16.0	
Vert	107.811	QP	45.1	10.8	8.1	32.2	31.8	43.5	11.7	
Vert	143.698	QP	40.3	14.4	8.5	32.2	31.0	43.5	12.5	
Vert	199.671	QP	36.3	16.6	9.0	32.1	29.8	43.5	13.7	
Vert	883.301	QP	24.9	22.3	13.2	31.1	29.3	46.0	16.7	
Vert	2483.500	PK	68.3	26.9	6.6	32.0	69.8	73.9	4.1	
Vert	4960.000	PK	42.0	32.1	8.7	31.2	51.6	73.9	22.3	
Vert	7440.000	PK	41.6	36.0	10.0	32.1	55.5	73.9	18.4	Floor Noise
Vert	9920.000	PK	42.3	38.2	10.9	32.5	58.9	73.9	15.0	Floor Noise
Vert	2483.500	AV	42.2	26.9	6.6	32.0	43.7	53.9	10.2	
Vert	4960.000	AV	31.8	32.1	8.7	31.2	41.4	53.9	12.5	
Vert	7440.000	AV	30.7	36.0	10.0	32.1	44.6	53.9	9.3	Floor Noise
Vert	9920.000	AV	30.7	38.2	10.9	32.5	47.3	53.9	6.6	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).

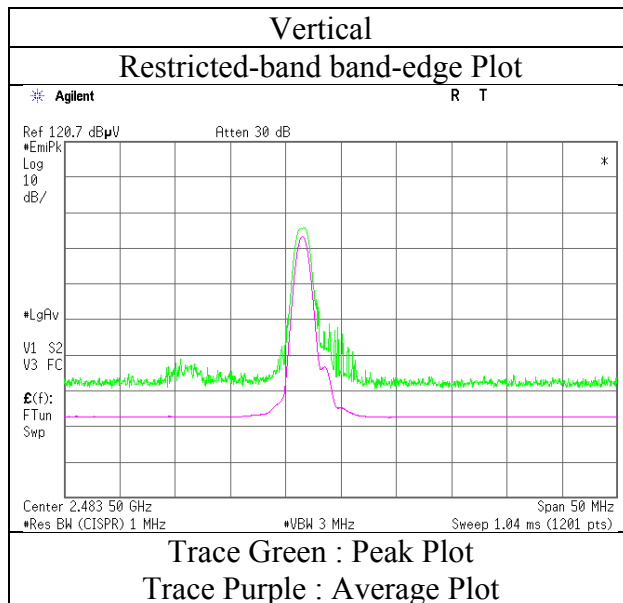
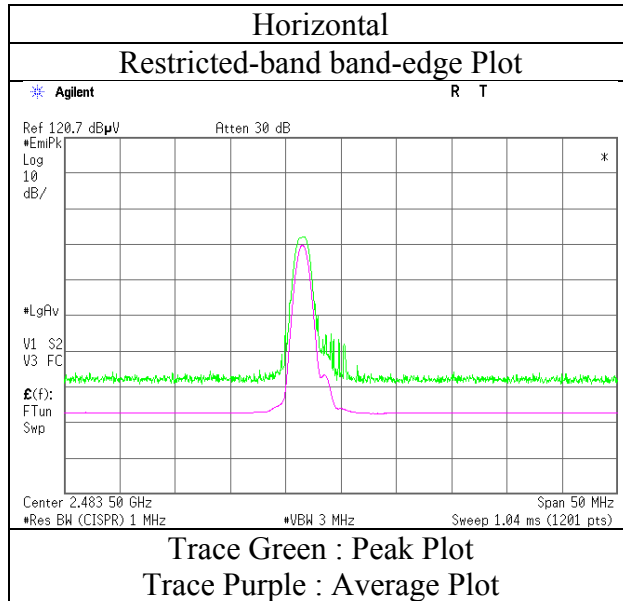
*The 10th harmonic was not seen so the result was its base noise level.

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

Distance factor: 1 GHz - 10 GHz 20log (4.4 m / 3.0 m) = 3.33dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
 26.5 GHz - 40 GHz 20log (0.5 m / 3.0 m) = -15.6 dB

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11138084H
Date	February 6, 2016
Temperature / Humidity	20 deg. C / 30 % RH
Engineer	Takafumi Noguchi
	(1 GHz – 10 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz



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

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Ise EMC Lab.

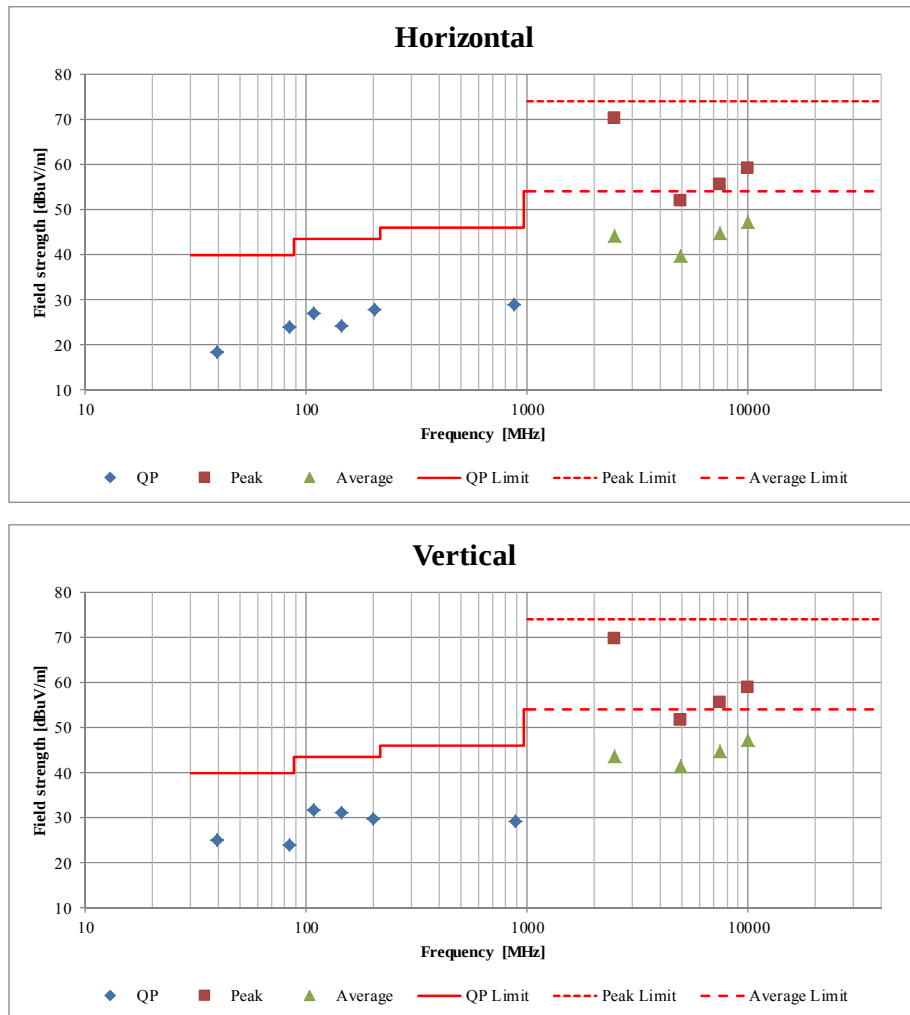
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission **(Plot data, Worst case)**

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	11138084H		
Date	February 6, 2016	February 7, 2016	February 7, 2016
Temperature / Humidity	20 deg. C / 30 % RH	22 deg. C / 32 % RH	22 deg. C / 32 % RH
Engineer	Takafumi Noguchi	Ken Fujita	Ken Fujita
	(1 GHz – 10 GHz)	(Above 10 GHz)	(Below 1 GHz)
Mode	Tx DH5 2480 MHz		



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

Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	11138084H		
Date	February 6, 2016	February 7, 2016	February 7, 2016
Temperature / Humidity	20 deg. C / 30 % RH	22 deg. C / 32 % RH	22 deg. C / 32 % RH
Engineer	Takafumi Noguchi (1 GHz – 10 GHz)	Ken Fujita (Above 10 GHz)	Ken Fujita (Below 1 GHz)
Mode	Tx 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	39.336	QP	29.1	14.2	7.2	32.2	18.3	40.0	21.7	
Hori	84.247	QP	41.4	7.1	7.8	32.1	24.2	40.0	15.8	
Hori	107.656	QP	40.6	10.8	8.1	32.2	27.3	43.5	16.2	
Hori	143.712	QP	33.7	14.4	8.5	32.2	24.4	43.5	19.1	
Hori	202.323	QP	34.3	16.6	9.1	32.1	27.9	43.5	15.6	
Hori	876.367	QP	24.4	22.2	13.2	31.1	28.7	46.0	17.3	
Hori	2390.000	PK	44.4	26.9	6.6	32.0	45.9	73.9	28.0	
Hori	4804.000	PK	41.1	31.8	8.8	31.3	50.4	73.9	23.5	Floor Noise
Hori	7206.000	PK	42.2	36.0	10.0	32.0	56.2	73.9	17.7	Floor Noise
Hori	9608.000	PK	42.5	38.2	10.8	32.4	59.1	73.9	14.8	Floor Noise
Hori	2390.000	AV	29.9	26.9	6.6	32.0	31.4	53.9	22.5	
Hori	4804.000	AV	29.1	31.8	8.8	31.3	38.4	53.9	15.5	Floor Noise
Hori	7206.000	AV	30.7	36.0	10.0	32.0	44.7	53.9	9.2	Floor Noise
Hori	9608.000	AV	30.9	38.2	10.8	32.4	47.5	53.9	6.4	Floor Noise
Vert	39.461	QP	35.2	14.1	7.2	32.2	24.3	40.0	15.7	
Vert	84.129	QP	41.1	7.1	7.8	32.1	23.9	40.0	16.1	
Vert	107.719	QP	45.6	10.8	8.1	32.2	32.3	43.5	11.2	
Vert	143.682	QP	40.8	14.4	8.5	32.2	31.5	43.5	12.0	
Vert	199.666	QP	36.3	16.6	9.0	32.1	29.8	43.5	13.7	
Vert	883.311	QP	24.2	22.3	13.2	31.1	28.6	46.0	17.4	
Vert	2390.000	PK	43.6	26.9	6.6	32.0	45.1	73.9	28.8	
Vert	4804.000	PK	41.4	31.8	8.8	31.3	50.7	73.9	23.2	Floor Noise
Vert	7206.000	PK	42.4	36.0	10.0	32.0	56.4	73.9	17.5	Floor Noise
Vert	9608.000	PK	42.7	38.2	10.8	32.4	59.3	73.9	14.6	Floor Noise
Vert	2390.000	AV	29.9	26.9	6.6	32.0	31.4	53.9	22.5	
Vert	4804.000	AV	29.3	31.8	8.8	31.3	38.6	53.9	15.3	Floor Noise
Vert	7206.000	AV	30.7	36.0	10.0	32.0	44.7	53.9	9.2	Floor Noise
Vert	9608.000	AV	30.7	38.2	10.8	32.4	47.3	53.9	6.6	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).

*The 10th harmonic was not seen so the result was its base noise level.

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

Distance factor: 1 GHz - 10 GHz 20log (4.4 m / 3.0 m) = 3.33dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
26.5 GHz - 40 GHz 20log (0.5 m / 3.0 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	89.1	26.9	6.6	32.0	90.6	-	-	Carrier
Hori	2400.000	PK	40.8	26.9	6.6	32.0	42.3	70.6	28.3	
Vert	2402.000	PK	89.4	26.9	6.6	32.0	90.9	-	-	Carrier
Vert	2400.000	PK	40.6	26.9	6.6	32.0	42.1	70.9	28.8	

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

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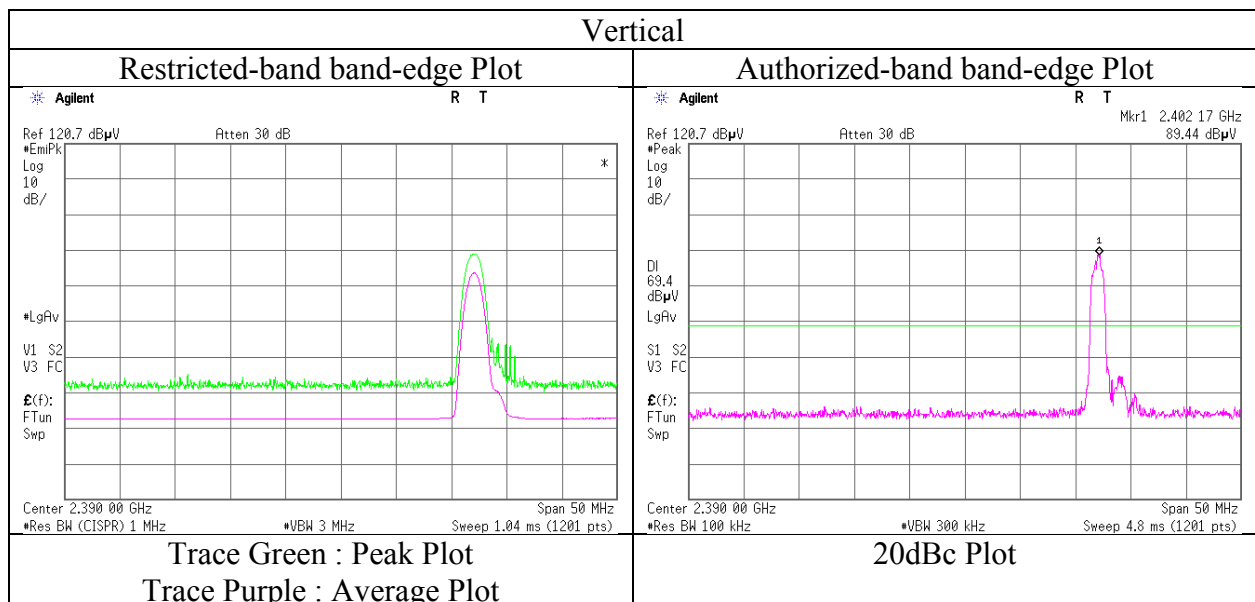
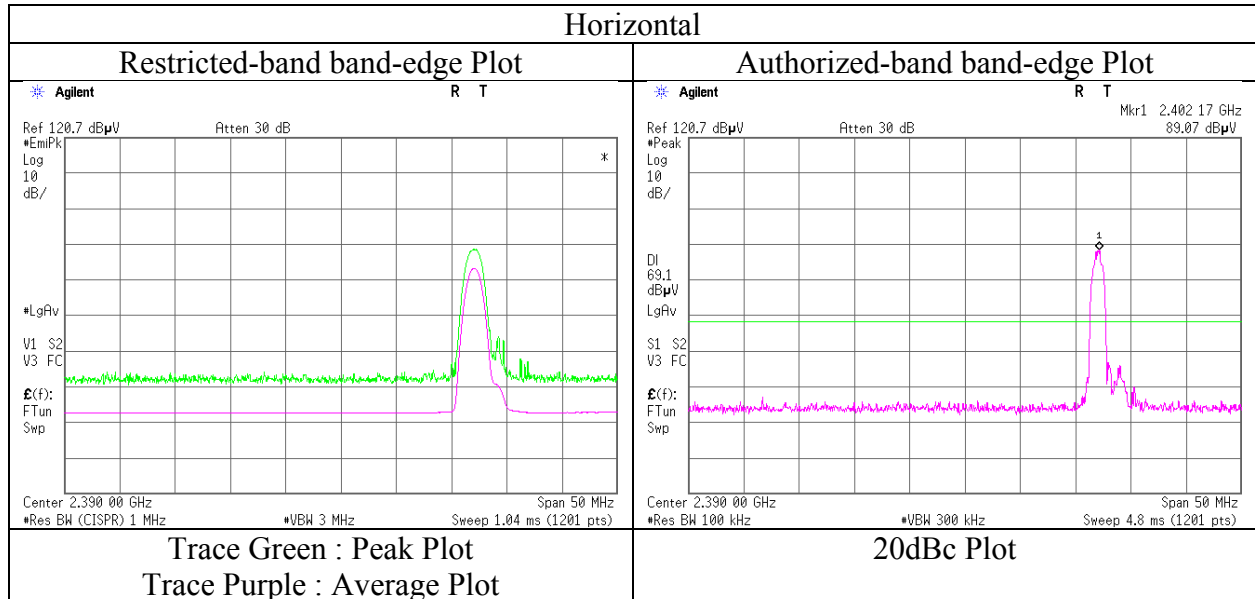
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Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11138084H
Date	February 6, 2016
Temperature / Humidity	20 deg. C / 30 % RH
Engineer	Takafumi Noguchi
	(1 GHz – 10 GHz)
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.3 Semi Anechoic Chamber		
Report No.	11138084H		
Date	February 6, 2016	February 7, 2016	February 7, 2016
Temperature / Humidity	20 deg. C / 30 % RH	22 deg. C / 32 % RH	22 deg. C / 32 % RH
Engineer	Takafumi Noguchi (1 GHz – 10 GHz)	Ken Fujita (Above 10 GHz)	Ken Fujita (Below 1 GHz)
Mode	Tx 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	41.113	QP	30.3	13.5	7.2	32.2	18.8	40.0	21.2	
Hori	84.223	QP	41.5	7.1	7.8	32.1	24.3	40.0	15.7	
Hori	107.562	QP	41.2	10.8	8.1	32.2	27.9	43.5	15.6	
Hori	144.011	QP	34.2	14.4	8.5	32.2	24.9	43.5	18.6	
Hori	202.312	QP	34.5	16.6	9.1	32.1	28.1	43.5	15.4	
Hori	876.376	QP	24.7	22.2	13.2	31.1	29.0	46.0	17.0	
Hori	4882.000	PK	41.0	31.9	8.8	31.3	50.4	73.9	23.5	Floor Noise
Hori	7323.000	PK	42.2	36.0	10.1	32.0	56.3	73.9	17.6	Floor Noise
Hori	9764.000	PK	42.3	38.2	10.8	32.5	58.8	73.9	15.1	Floor Noise
Hori	4882.000	AV	29.0	31.9	8.8	31.3	38.4	53.9	15.5	Floor Noise
Hori	7323.000	AV	30.6	36.0	10.1	32.0	44.7	53.9	9.2	Floor Noise
Hori	9764.000	AV	30.4	38.2	10.8	32.5	46.9	53.9	7.0	Floor Noise
Vert	39.462	QP	35.3	14.1	7.2	32.2	24.4	40.0	15.6	
Vert	84.128	QP	41.3	7.1	7.8	32.1	24.1	40.0	15.9	
Vert	107.721	QP	45.4	10.8	8.1	32.2	32.1	43.5	11.4	
Vert	156.221	QP	40.3	15.2	8.6	32.2	31.9	43.5	11.6	
Vert	199.681	QP	36.1	16.6	9.0	32.1	29.6	43.5	13.9	
Vert	883.322	QP	24.4	22.3	13.2	31.1	28.8	46.0	17.2	
Vert	4882.000	PK	41.7	31.9	8.8	31.3	51.1	73.9	22.8	Floor Noise
Vert	7323.000	PK	42.2	36.0	10.1	32.0	56.3	73.9	17.6	Floor Noise
Vert	9764.000	PK	42.3	38.2	10.8	32.5	58.8	73.9	15.1	Floor Noise
Vert	4882.000	AV	29.0	31.9	8.8	31.3	38.4	53.9	15.5	Floor Noise
Vert	7323.000	AV	30.6	36.0	10.1	32.0	44.7	53.9	9.2	Floor Noise
Vert	9764.000	AV	30.4	38.2	10.8	32.5	46.9	53.9	7.0	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).

*The 10th harmonic was not seen so the result was its base noise level.

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

Distance factor: 1 GHz - 10 GHz 20log (4.4 m / 3.0 m) = 3.33dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB
 26.5 GHz - 40 GHz 20log (0.5 m / 3.0 m) = -15.6 dB

Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	11138084H		
Date	February 6, 2016	February 7, 2016	February 7, 2016
Temperature / Humidity	20 deg. C / 30 % RH	22 deg. C / 32 % RH	22 deg. C / 32 % RH
Engineer	Takafumi Noguchi (1 GHz – 10 GHz)	Ken Fujita (Above 10 GHz)	Ken Fujita (Below 1 GHz)
Mode	Tx 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	41.121	QP	26.8	13.5	7.2	32.2	15.3	40.0	24.7	
Hori	84.331	QP	40.8	7.1	7.8	32.1	23.6	40.0	16.4	
Hori	107.561	QP	41.3	10.8	8.1	32.2	28.0	43.5	15.5	
Hori	144.021	QP	34.9	14.4	8.5	32.2	25.6	43.5	17.9	
Hori	202.312	QP	34.5	16.6	9.1	32.1	28.1	43.5	15.4	
Hori	876.376	QP	24.7	22.2	13.2	31.1	29.0	46.0	17.0	
Hori	2483.500	PK	68.4	26.9	6.6	32.0	69.9	73.9	4.0	
Hori	4960.000	PK	41.1	32.1	8.7	31.2	50.7	73.9	23.2	Floor Noise
Hori	7440.000	PK	41.6	36.0	10.0	32.1	55.5	73.9	18.4	Floor Noise
Hori	9920.000	PK	42.4	38.2	10.9	32.5	59.0	73.9	14.9	Floor Noise
Hori	2483.500	AV	39.7	26.9	6.6	32.0	41.2	53.9	12.7	
Hori	4960.000	AV	29.0	32.1	8.7	31.2	38.6	53.9	15.3	Floor Noise
Hori	7440.000	AV	30.8	36.0	10.0	32.1	44.7	53.9	9.2	Floor Noise
Hori	9920.000	AV	30.7	38.2	10.9	32.5	47.3	53.9	6.6	Floor Noise
Vert	40.113	QP	35.7	13.9	7.2	32.2	24.6	40.0	15.4	
Vert	84.176	QP	41.4	7.1	7.8	32.1	24.2	40.0	15.8	
Vert	107.722	QP	45.5	10.8	8.1	32.2	32.2	43.5	11.3	
Vert	156.267	QP	40.5	15.2	8.6	32.2	32.1	43.5	11.4	
Vert	199.679	QP	36.5	16.6	9.0	32.1	30.0	43.5	13.5	
Vert	883.312	QP	24.8	22.3	13.2	31.1	29.2	46.0	16.8	
Vert	2483.500	PK	66.9	26.9	6.6	32.0	68.4	73.9	5.5	
Vert	4960.000	PK	41.2	32.1	8.7	31.2	50.8	73.9	23.1	Floor Noise
Vert	7440.000	PK	41.5	36.0	10.0	32.1	55.4	73.9	18.5	Floor Noise
Vert	9920.000	PK	42.3	38.2	10.9	32.5	58.9	73.9	15.0	Floor Noise
Vert	2483.500	AV	38.5	26.9	6.6	32.0	40.0	53.9	13.9	
Vert	4960.000	AV	29.0	32.1	8.7	31.2	38.6	53.9	15.3	Floor Noise
Vert	7440.000	AV	30.7	36.0	10.0	32.1	44.6	53.9	9.3	Floor Noise
Vert	9920.000	AV	30.7	38.2	10.9	32.5	47.3	53.9	6.6	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).

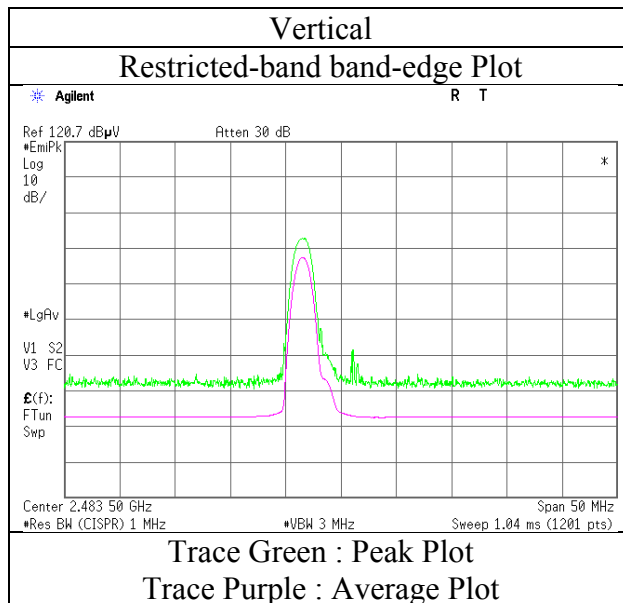
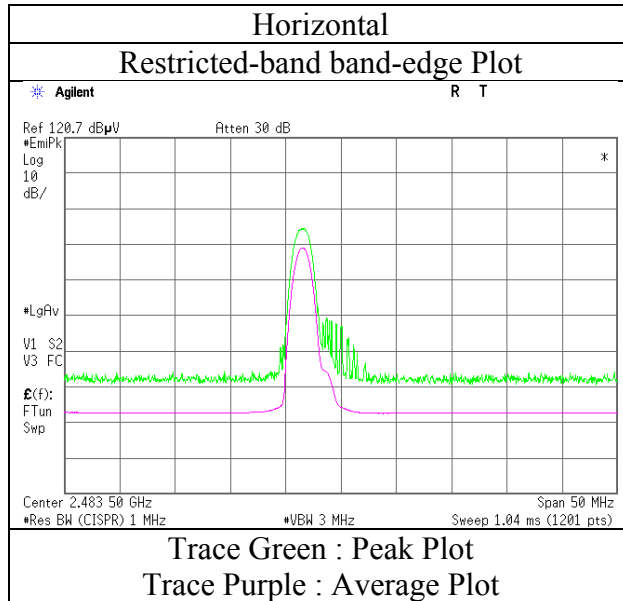
*The 10th harmonic was not seen so the result was its base noise level.

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

Distance factor: 1 GHz - 10 GHz $20\log(4.4\text{ m} / 3.0\text{ m}) = 3.33\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$
 26.5 GHz - 40 GHz $20\log(0.5\text{ m} / 3.0\text{ m}) = -15.6\text{ dB}$

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11138084H
Date	February 6, 2016
Temperature / Humidity	20 deg. C / 30 % RH
Engineer	Takafumi Noguchi
	(1 GHz – 10 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz

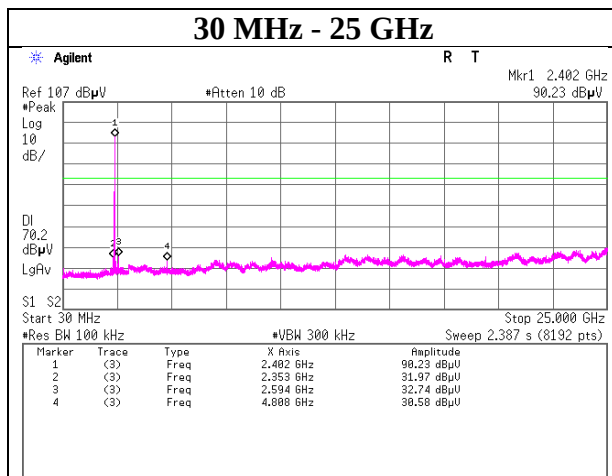
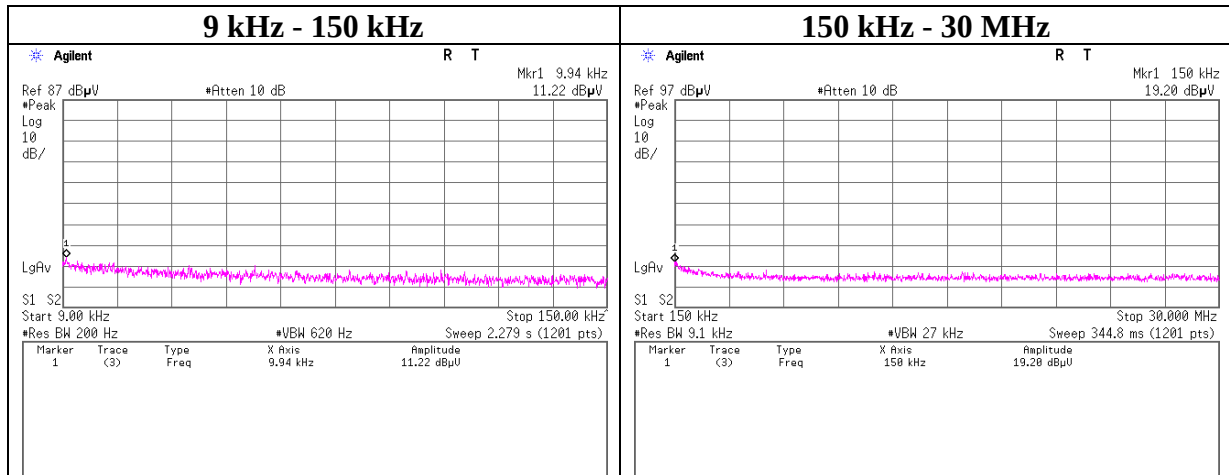


* Final result of restricted band edge was shown in tabular data.

Conducted Spurious Emission

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11138084H
Date : February 12, 2016
Temperature / Humidity : 24 deg. C / 25 % RH
Engineer : Yutaka Yoshida
Mode : Tx, Hopping Off, DH5

2402 MHz



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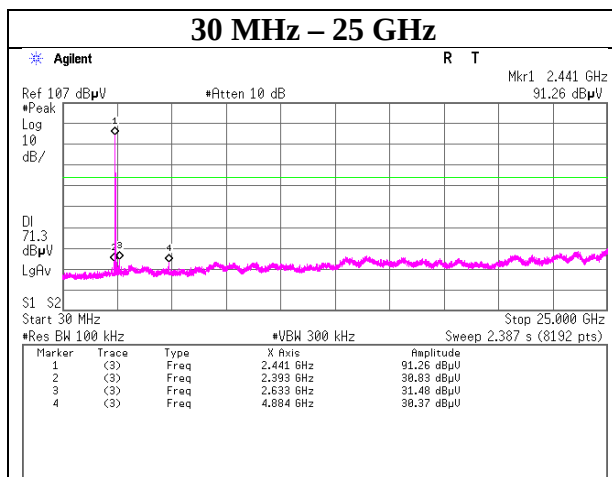
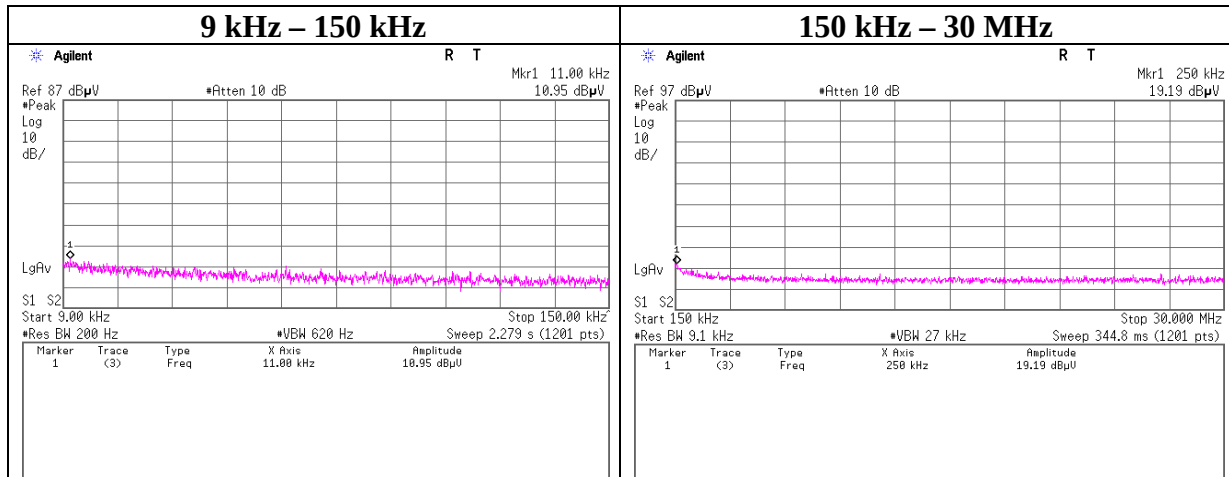
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11138084H
Date	February 12, 2016
Temperature / Humidity	24 deg. C / 25 % RH
Engineer	Yutaka Yoshida
Mode	Tx, Hopping Off, DH5

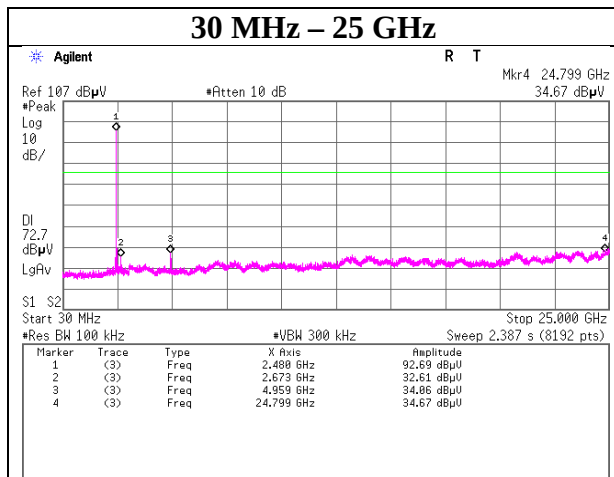
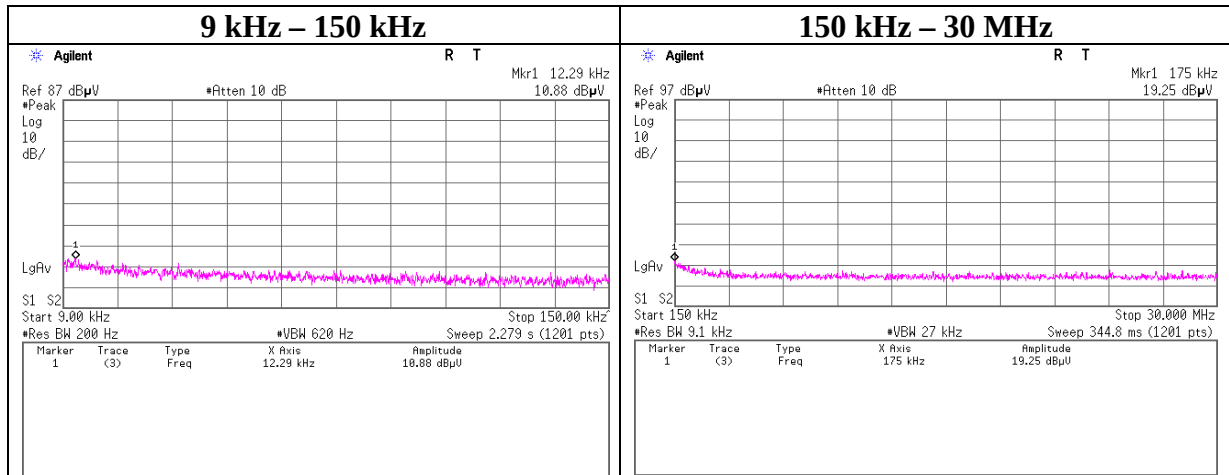
2441 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11138084H
Date	February 12, 2016
Temperature / Humidity	24 deg. C / 25 % RH
Engineer	Yutaka Yoshida
Mode	Tx, Hopping Off, DH5

2480 MHz



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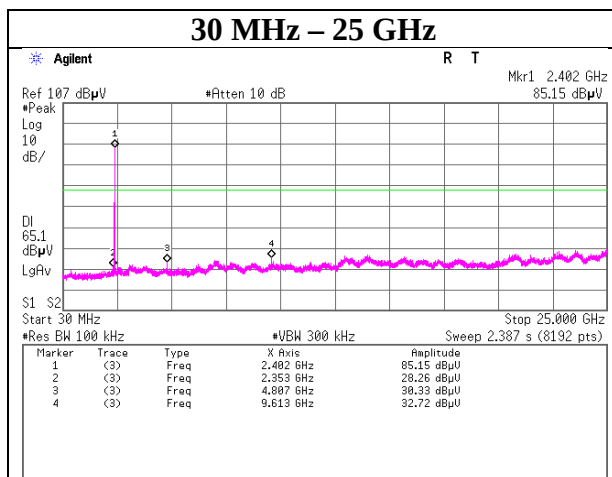
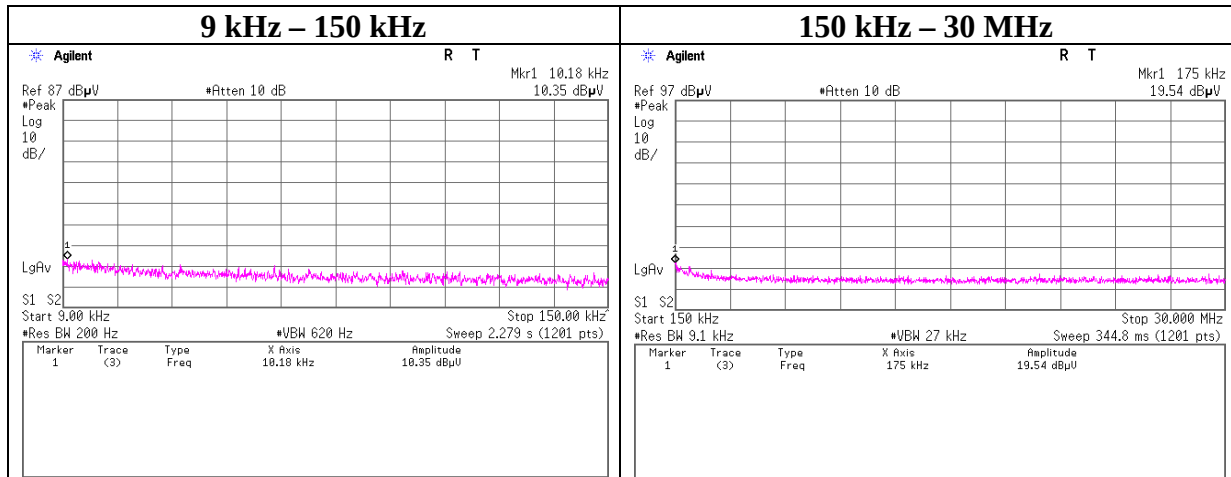
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11138084H
Date	February 12, 2016
Temperature / Humidity	24 deg. C / 25 % RH
Engineer	Yutaka Yoshida
Mode	Tx, Hopping Off, 3DH5

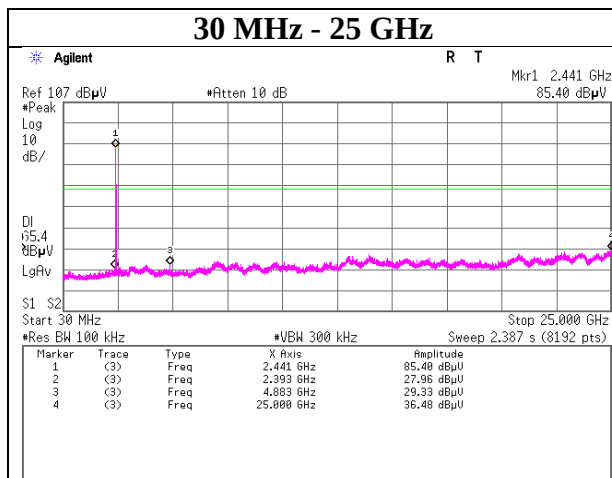
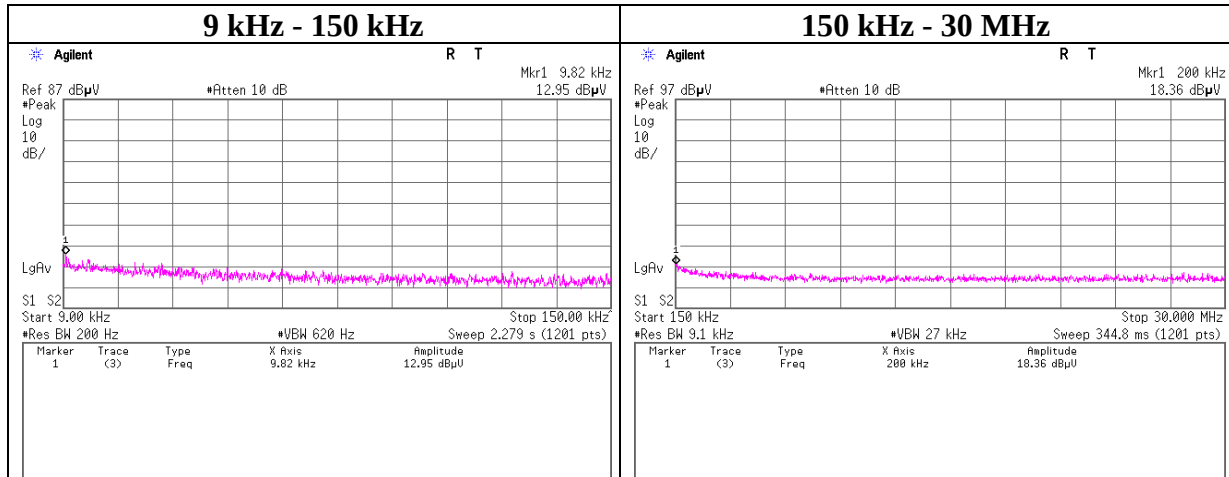
2402 MHz



Conducted Spurious Emission

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11138084H
Date : February 12, 2016
Temperature / Humidity : 24 deg. C / 25 % RH
Engineer : Yutaka Yoshida
Mode : Tx, Hopping Off, 3DH5

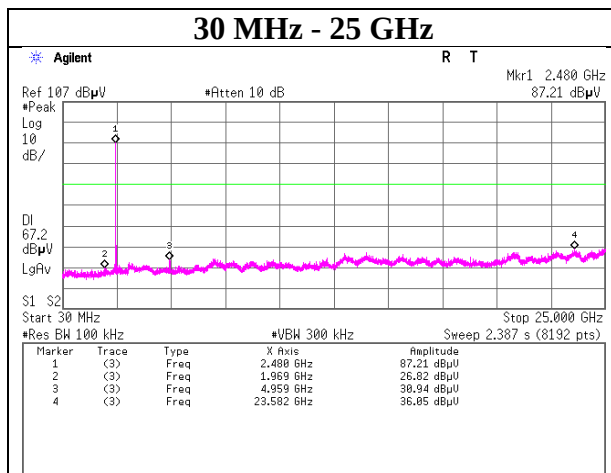
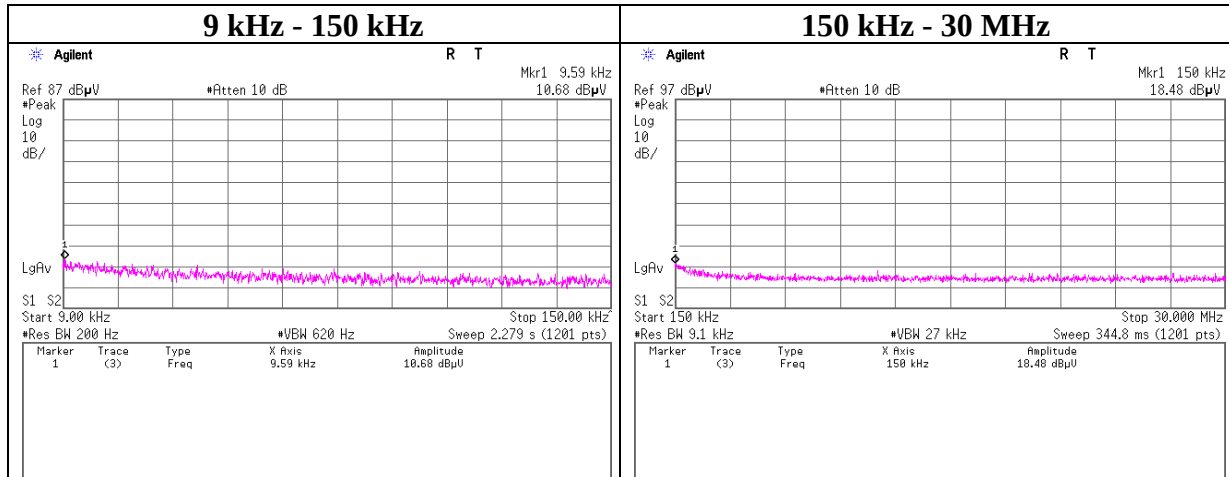
2441 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11138084H
Date	February 12, 2016
Temperature / Humidity	24 deg. C / 25 % RH
Engineer	Yutaka Yoshida
Mode	Tx, Hopping Off, 3DH5

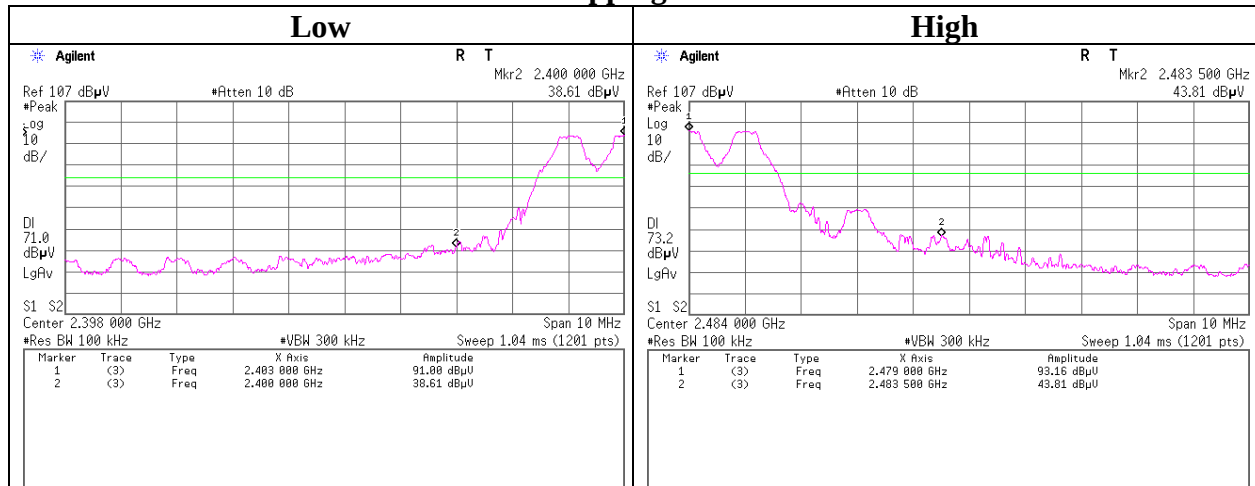
2480 MHz



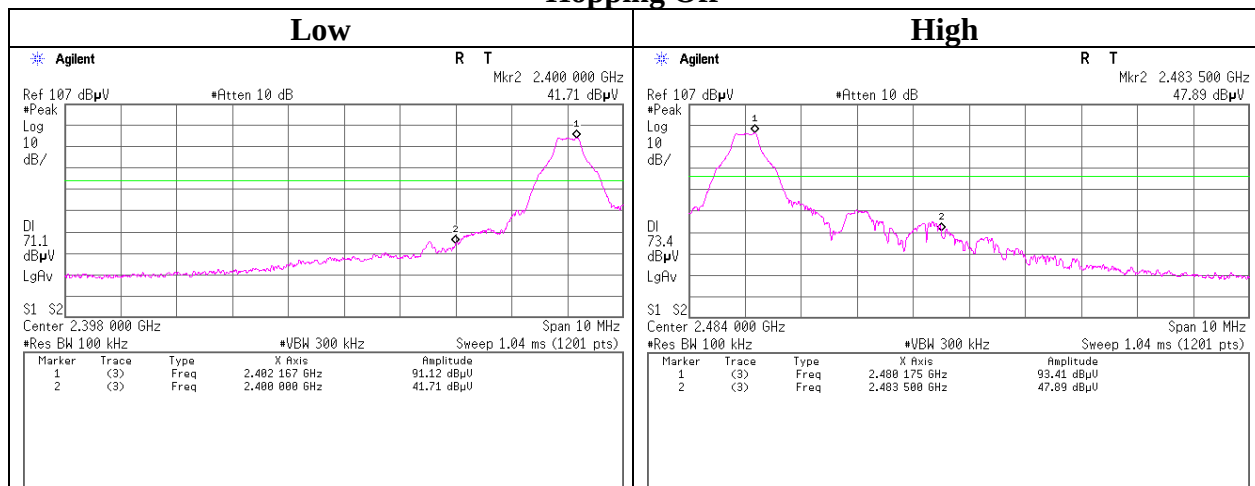
Conducted Emission Band Edge compliance

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11138084H
Date : February 12, 2016
Temperature / Humidity : 24 deg. C / 25 % RH
Engineer : Yutaka Yoshida
Mode : Tx DH5

Hopping On



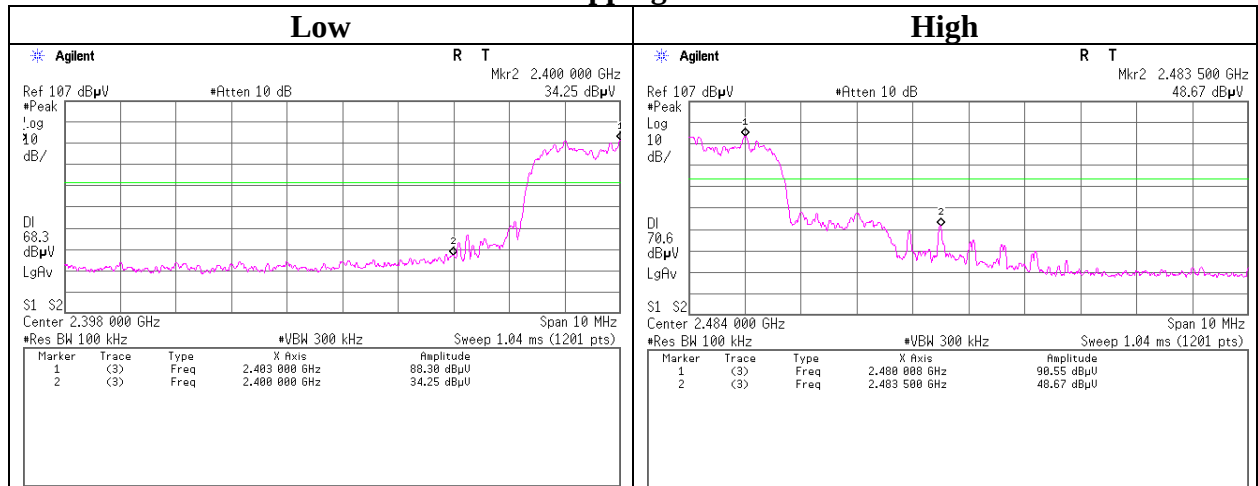
Hopping Off



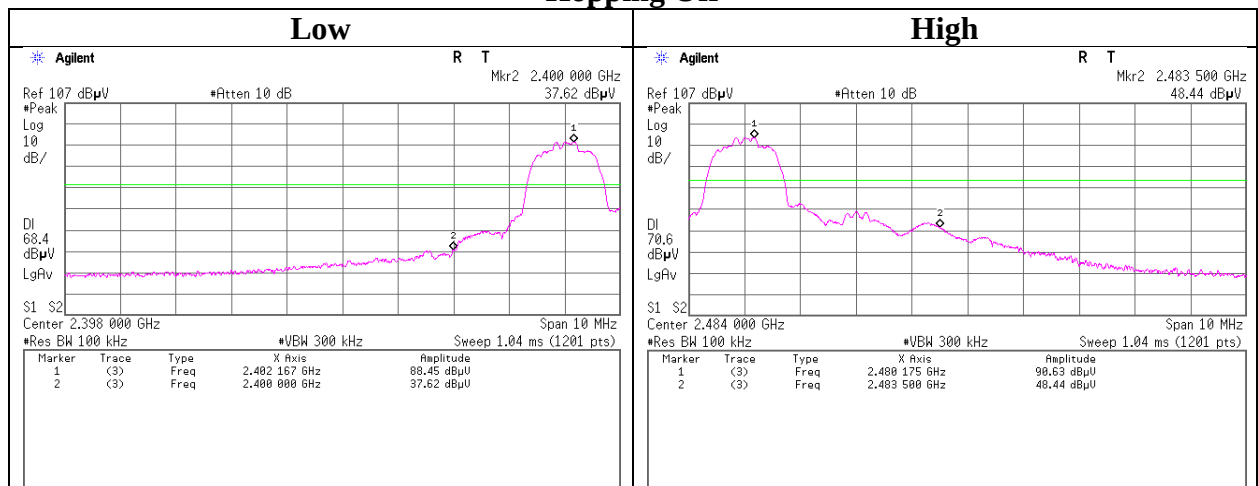
Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11138084H
Date	February 12, 2016
Temperature / Humidity	24 deg. C / 25 % RH
Engineer	Yutaka Yoshida
Mode	Tx 3DH5

Hopping On



Hopping Off



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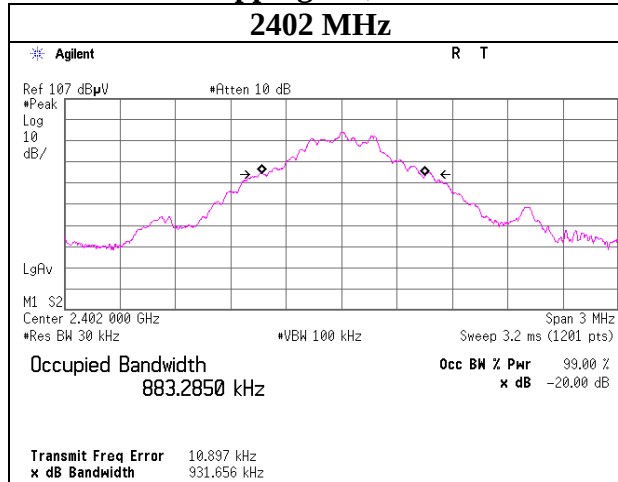
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

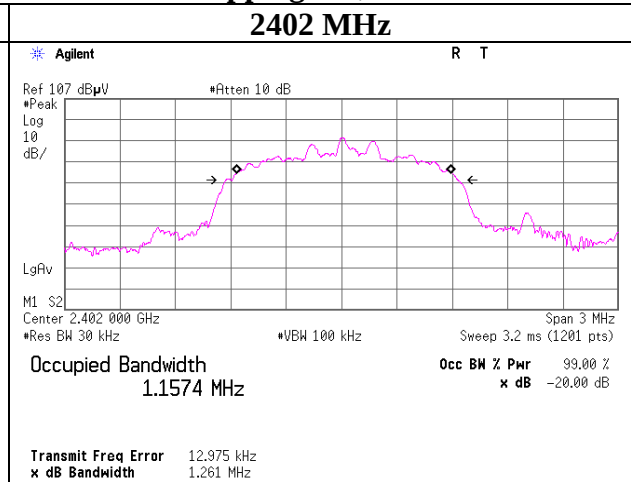
99% Occupied Bandwidth

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11138084H
Date	February 12, 2016
Temperature / Humidity	24 deg. C / 25 % RH
Engineer	Yutaka Yoshida
Mode	Tx Hopping Off

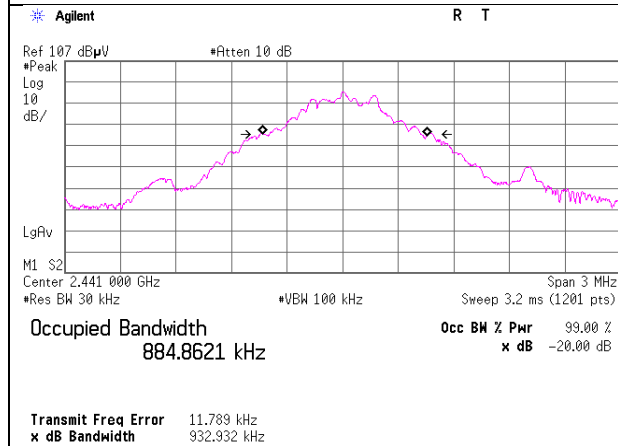
Hopping Off, DH5 2402 MHz



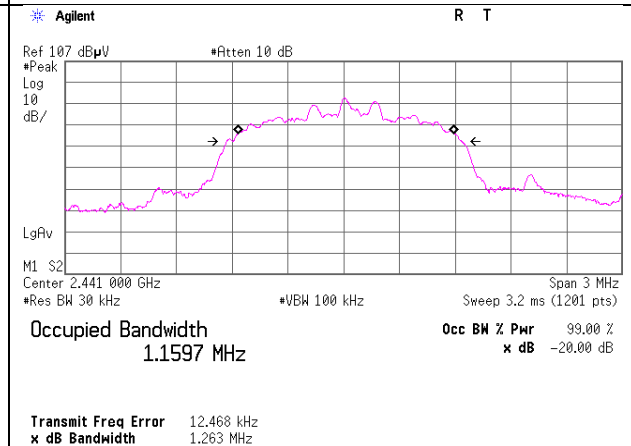
Hopping Off, 3DH5 2402 MHz



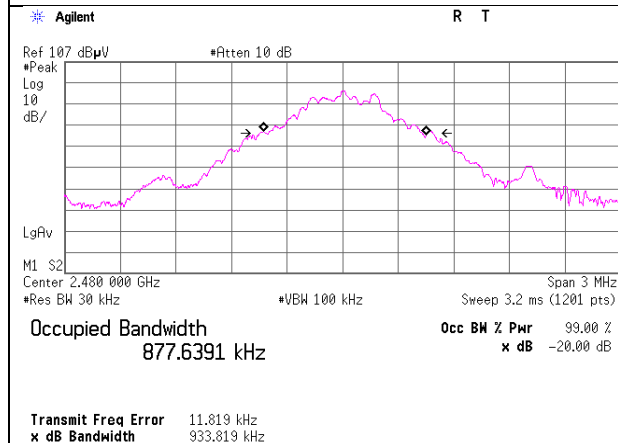
2441 MHz



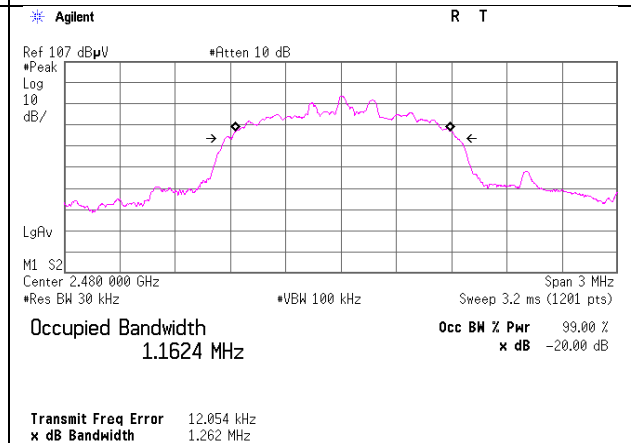
2441 MHz



2480 MHz



2480 MHz



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Ise EMC Lab.

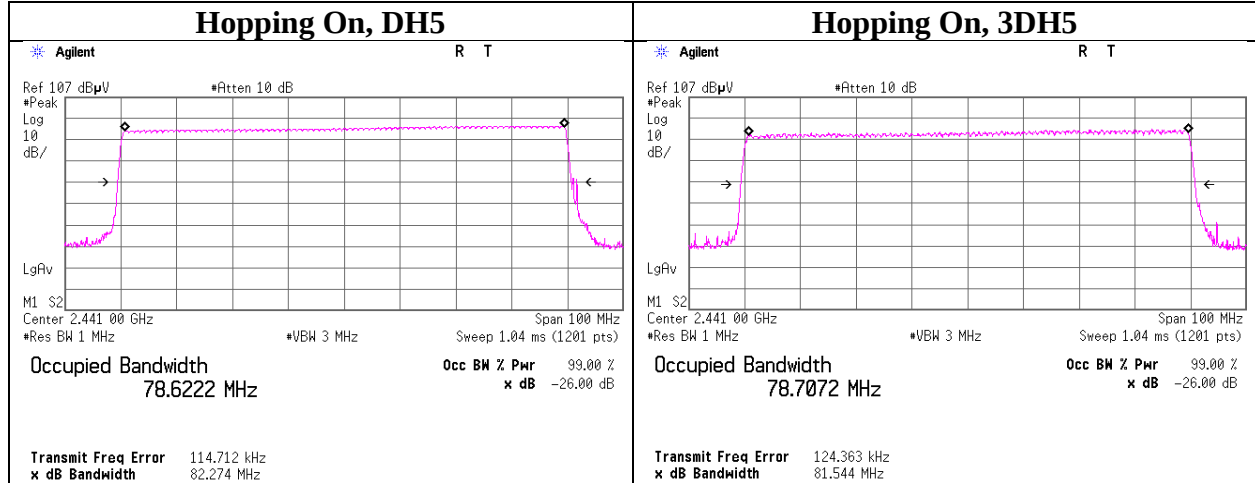
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99% Occupied Bandwidth

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11138084H
Date	February 12, 2016
Temperature / Humidity	24 deg. C / 25 % RH
Engineer	Yutaka Yoshida
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-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2015/10/01 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE/CE	2016/01/21 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE/CE	2015/11/05 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2015/05/18 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2015/05/21 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2015/03/19 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2016/01/13 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2015/09/16 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE/CE	2015/09/02 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2015/10/11 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2015/10/11 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2015/07/13 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2015/04/08 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2015/03/10 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2015/05/19 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE	2015/07/10 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(3m)/suoform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher)	-/00640	CE	2015/07/02 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/01/14 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	AT	2015/11/06 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2015/03/18 * 12
MCC-66	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	AT	2015/04/02 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2015/10/19 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2015/10/19 * 12
MOS-34	Thermo-Hygrometer	Custom	CTH-201	3401	AT	2016/01/21 * 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

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