



RADIO TEST REPORT

Test Report No. : 11157080H-B-R1

Applicant : CASIO COMPUTER CO., LTD.
Type of Equipment : Digital Camera
Model No. : EX-FR200CA
FCC ID : BBQEXFR200CA
Test regulation : FCC Part 15 Subpart C: 2015
(Bluetooth part)
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 11157080H-B. 11157080H-B is replaced with this report.

Date of test: March 2 to April 28, 2016

Representative test engineer:

T. Noguchi

Takafumi Noguchi
Engineer
Consumer Technology Division

Approved by:

Takayuki Shimada

Takayuki Shimada
Engineer
Consumer Technology Division

NVLAP[®]

NVLAP LAB CODE: 200572-0

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SECTION 1: Customer information

Company Name : CASIO COMPUTER CO., LTD.
Address : 2-1, Sakaecho 3-chome, Hamura-shi, Tokyo 205-8555, Japan
Telephone Number : +81-42-579-7282
Facsimile Number : +81-42-579-7702
Contact Person : Hiroaki Suzuki

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

2.1 Identification of E.U.T.

Type of Equipment : Digital Camera
Model No. : EX-FR200CA
Serial No. : Refer to Section 4, Clause 4.2
Rating : Li-ion Battery(NP-170)
DC 3.7V, 950mAh, 3.6Wh
Receipt Date of Sample : February 27, 2016
Country of Mass-production : Indonesia
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: EX-FR200CA (referred to as the EUT in this report) is a Digital Camera.

General Specification

Clock frequency(ies) in the system : 48 MHz and 32.768 kHz for main system
37.4 MHz for WLAN and Bluetooth Low Energy module
26 MHz for Bluetooth classic module (Bluetooth 2.1+EDR(for IC241 of CP-1
circuit board))
Operating temperature : -5 deg. C to +40 deg. C

Radio Specification

<WLAN + Bluetooth Low Energy module>

WLAN (IEEE802.11b/g/n-20)

Equipment Type	Transceiver
Frequency of Operation	2412 MHz - 2462 MHz
Type of Modulation	DSSS, OFDM
Bandwidth & Channel spacing	20 MHz & 5 MHz
Method of frequency generation	Synthesizer
Power Supply (inner)	DC 1.2 V / DC 3.3 V
Antenna Type	Monopole Pattern Antenna
Antenna Gain	-3.3dBi

Bluetooth (Ver. 4.1 Low Energy)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz - 2480 MHz
Type of Modulation	GFSK
Bandwidth & Channel spacing	2 MHz & 2 MHz
Method of frequency generation	Synthesizer
Power Supply (inner)	DC 1.2 V / DC 3.3 V
Antenna Type	Monopole Pattern Antenna
Antenna Gain	-3.3dBi

<Bluetooth classic module>

Bluetooth (Ver. 2.1 + EDR)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz - 2480 MHz
Type of Modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK)
Bandwidth & Channel spacing	1 MHz & 1 MHz
Method of frequency generation	Synthesizer
Power Supply (inner)	DC 1.2 V / DC 3.3 V
Antenna Type	Monopole Pattern Antenna
Antenna Gain	+0.6dBi

*This test report applies for Bluetooth part.

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

* The EUT complies with FCC Part 15 Subpart B: 2015, final revised on November 23, 2015.

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 22.4 dB, 0.17985 MHz, N AV 29.2 dB, 0.46196 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		10.3 dB 4804.00 MHz, AV, Horizontal 4882.00 MHz, AV, Horizontal	Complied

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 1.2 V / 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 $k = 2$.
Ise EMC Lab.

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

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

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

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(+dB)		(10 m*)(+dB)	
	30 – 200 MHz	200 – 1000MHz	30 – 200 MHz	200 – 1000MHz
Horizontal	4.9 dB	5.2 dB	4.9 dB	5.0 dB
Vertical	4.6 dB	5.9 dB	5.0 dB	5.0 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
5.0 dB	5.2 dB	5.1 dB	5.0 dB	5.2 dB

*Measurement distance

Conducted Emission test

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

Radiated emission test

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

3.5 Test Location

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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.

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

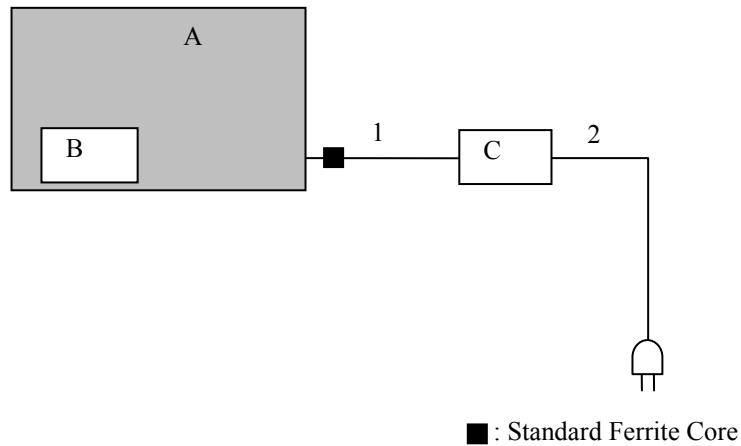
4.1 Operating Mode(s)

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 test items based on Bluetooth Core specification.</p> <p>*EUT has the power settings by the software as follows; Power settings: 2dBm Software: C597A wireless test firmware Ver.0226 *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>		

4.2 Configuration and peripherals



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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Digital Camera	EX-FR200CA	P115011000197 *1) P115011000200 *2)	CASIO COMPUTER CO., LTD.	EUT
B	Micro SD	SD-C01G	-	Toshiba	-
C	AC Adaptor	AD-C53U	130816	CASIO	-

*1) Used for Antenna Terminal conducted test

*2) Used for Conducted Emission test and Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	0.8	Shielded	Shielded	-
2	AC Cable	1.5	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8m above the conducting ground plane.

The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)

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

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

SECTION 6: Radiated Spurious Emission

Test Procedure

[For below 1GHz]

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

[For above 1GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

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

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz *1)	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	4.5 m*2) (1 GHz – 10 GHz), 1 m*3) (10 GHz – 26.5 GHz)		4.5 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: $20 \times \log(4.5 \text{ m} / 3.0 \text{ m}) = 3.5 \text{ dB}$

*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 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	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 low enough as shown in the chart. (9 kHz - 150 kHz: RBW = 200Hz, 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

Conducted Emission

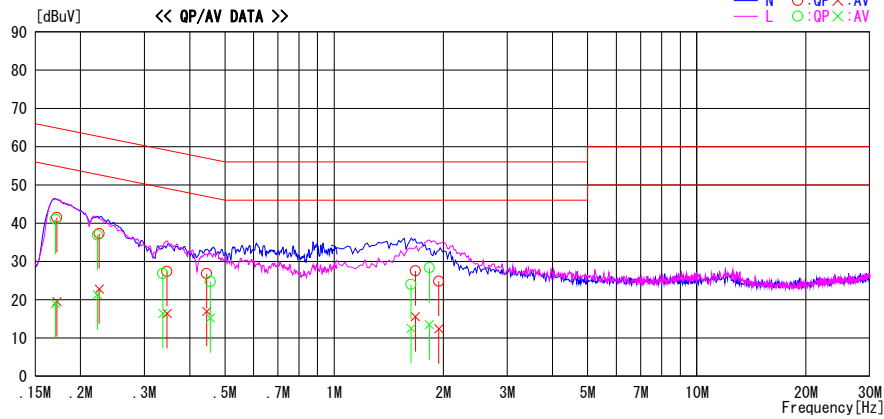
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
 Date : 2016/04/28

Report No. : 11157080H
 Temp./Humi. : 24deg. C / 60% RH
 Engineer : Takafumi Noguchi

Mode / Remarks : DH5 2402MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV

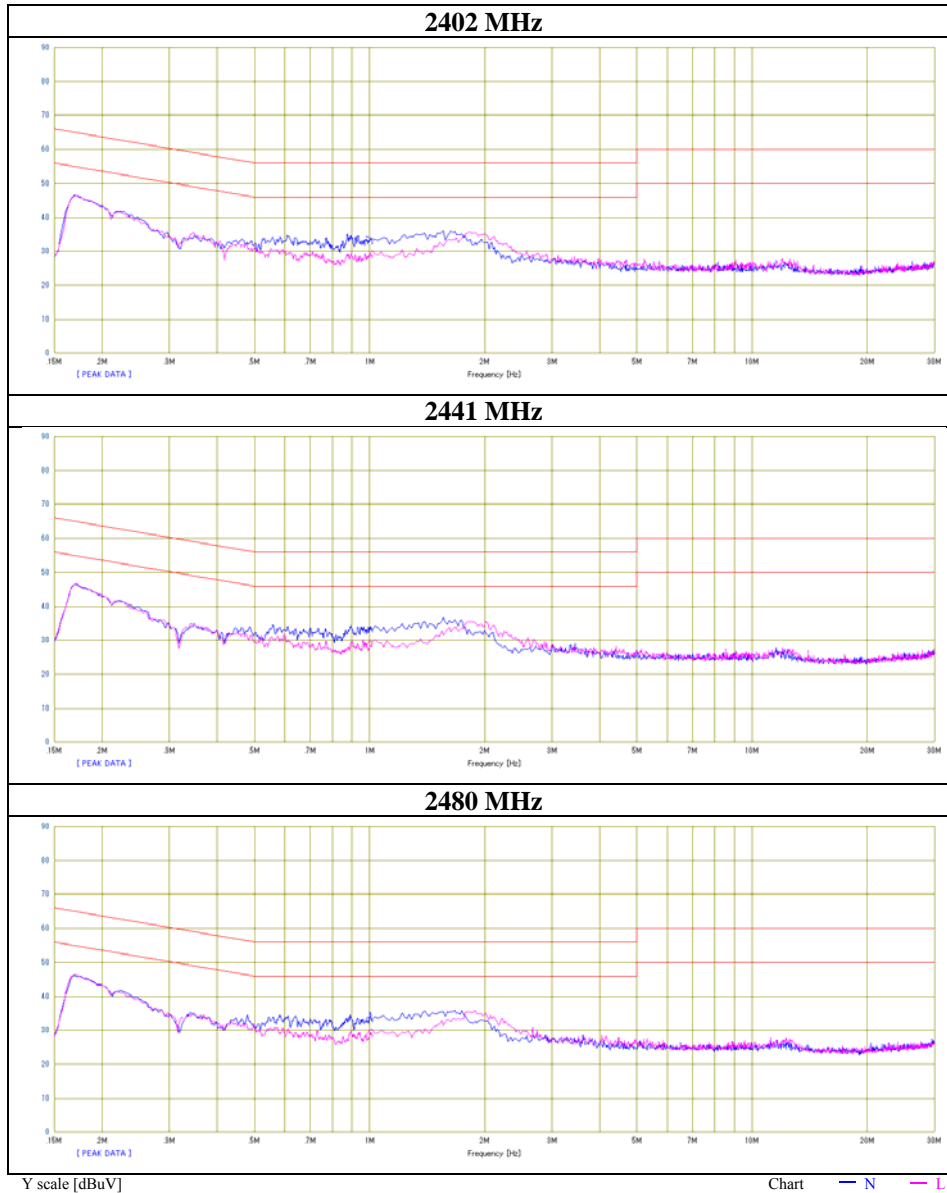


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.17206	28.1	6.1	13.4	41.5	19.5	64.9	54.9	23.4	35.4	N	
0.22525	23.9	9.4	13.4	37.3	22.8	62.6	52.6	25.3	29.8	N	
0.34615	14.0	3.0	13.4	27.4	16.4	59.1	49.1	31.7	32.7	N	
0.44523	13.4	3.6	13.4	26.8	17.0	57.0	47.0	30.2	30.0	N	
1.67645	14.1	2.1	13.5	27.6	15.6	56.0	46.0	28.4	30.4	N	
1.94557	11.3	-1.1	13.5	24.8	12.4	56.0	46.0	31.2	33.6	N	
0.17053	27.6	5.6	13.4	41.0	19.0	64.9	54.9	23.9	35.9	L	
0.22253	23.5	7.9	13.4	36.9	21.3	62.7	52.7	25.8	31.4	L	
0.33726	13.4	3.0	13.4	26.8	16.4	59.3	49.3	32.5	32.9	L	
0.45575	11.3	1.8	13.4	24.7	15.2	56.8	46.8	32.1	31.6	L	
1.63094	10.5	-1.0	13.5	24.0	12.5	56.0	46.0	32.0	33.5	L	
1.83111	14.9	0.0	13.5	28.4	13.5	56.0	46.0	27.6	32.5	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.

Conducted Emission

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 11157080H
Date : April 28, 2016
Temperature / Humidity : 24 deg. C / 60 % RH
Engineer : Takafumi Noguchi
Mode : Tx, Hopping Off, DH5



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Conducted Emission

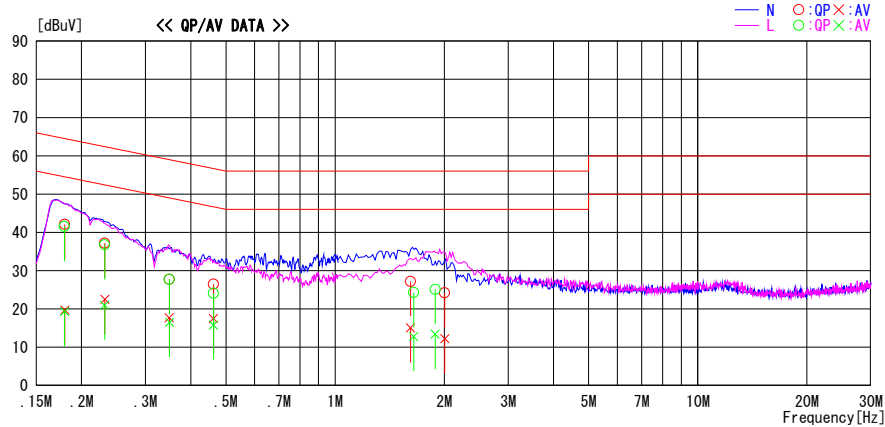
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No. 4 Semi Anechoic Chamber
Date : 2016/04/28

Report No. : 11157080H
 Temp./Humi. : 24deg. C / 60% RH
 Engineer : Takafumi Noguchi

Mode / Remarks : 3DH5 2402MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV

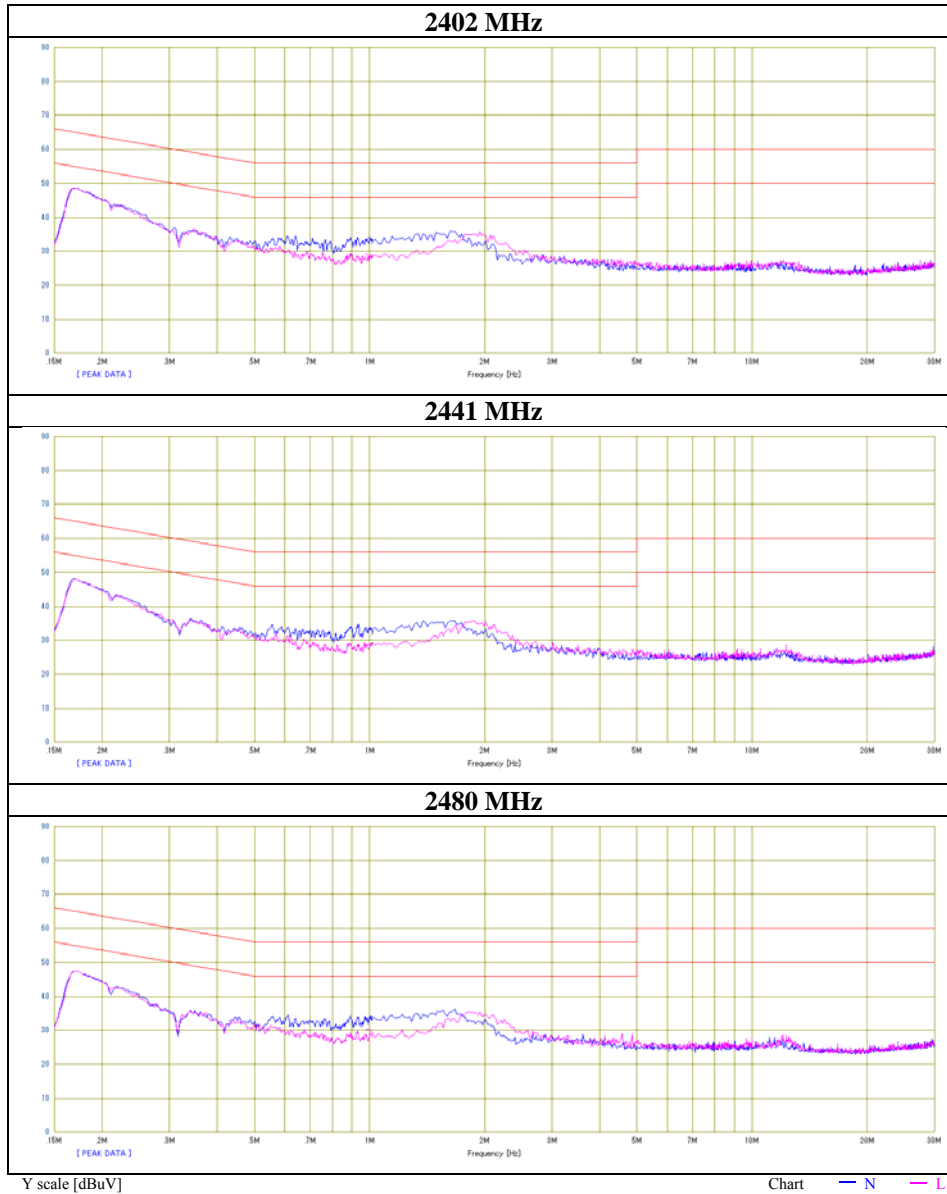


Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.17985	28.7	6.3	13.4	42.1	19.7	64.5	54.5	22.4	34.8	N	
0.23173	23.8	9.1	13.4	37.2	22.5	62.4	52.4	25.2	29.9	N	
0.34909	14.3	4.3	13.4	27.7	17.7	59.0	49.0	31.3	31.3	N	
0.46196	13.1	4.1	13.4	26.5	17.5	56.7	46.7	30.2	29.2	N	
1.61338	13.7	1.6	13.5	27.2	15.1	56.0	46.0	28.8	30.9	N	
2.00487	10.7	-1.3	13.5	24.2	12.2	56.0	46.0	31.8	33.8	N	
0.17949	28.2	5.9	13.4	41.6	19.3	64.5	54.5	22.9	35.2	L	
0.23142	23.3	7.6	13.4	36.7	21.0	62.4	52.4	25.7	31.4	L	
0.34949	14.3	3.1	13.4	27.7	16.5	59.0	49.0	31.3	32.5	L	
0.46204	10.7	2.4	13.4	24.1	15.8	56.7	46.7	32.6	30.9	L	
1.64611	10.8	-0.7	13.5	24.3	12.8	56.0	46.0	31.7	33.2	L	
1.88701	11.6	-0.1	13.5	25.1	13.4	56.0	46.0	30.9	32.6	L	

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

Conducted Emission

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11157080H
Date	April 28, 2016
Temperature / Humidity	24 deg. C / 60 % RH
Engineer	Takafumi Noguchi
Mode	Tx, Hopping Off, 3DH5



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20dB Bandwidth and Carrier Frequency Separation

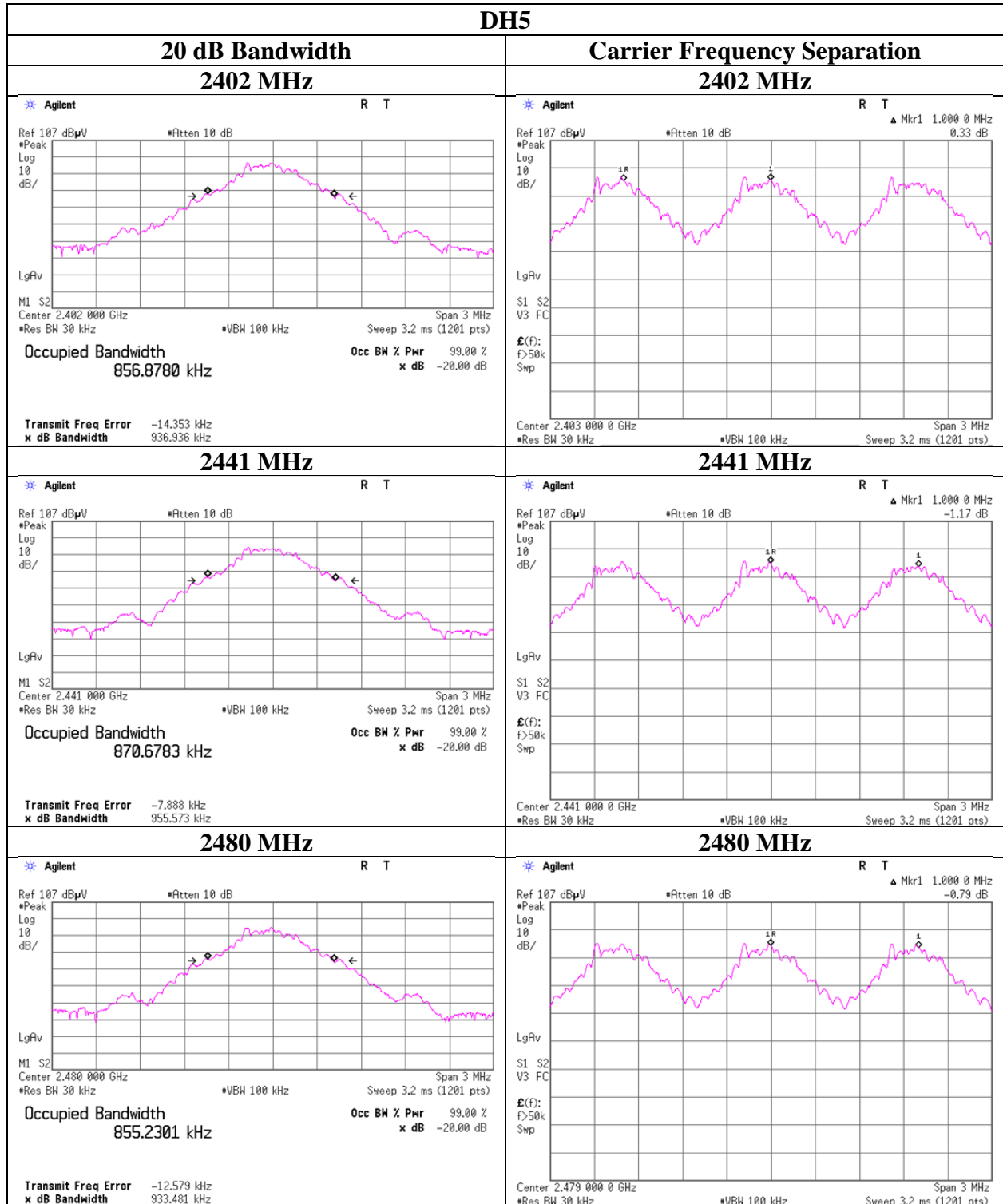
Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11157080H
Date March 2, 2016
Temperature / Humidity 21 deg. C / 41 % RH
Engineer Shinichi Miyazono
Mode Tx, Hopping Off, DH5

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	0.956	1.000	≥ 0.637
DH5	2480.0	0.934	1.000	≥ 0.623
3DH5	2402.0	1.295	1.000	≥ 0.863
3DH5	2441.0	1.279	1.000	≥ 0.853
3DH5	2480.0	1.275	1.000	≥ 0.850

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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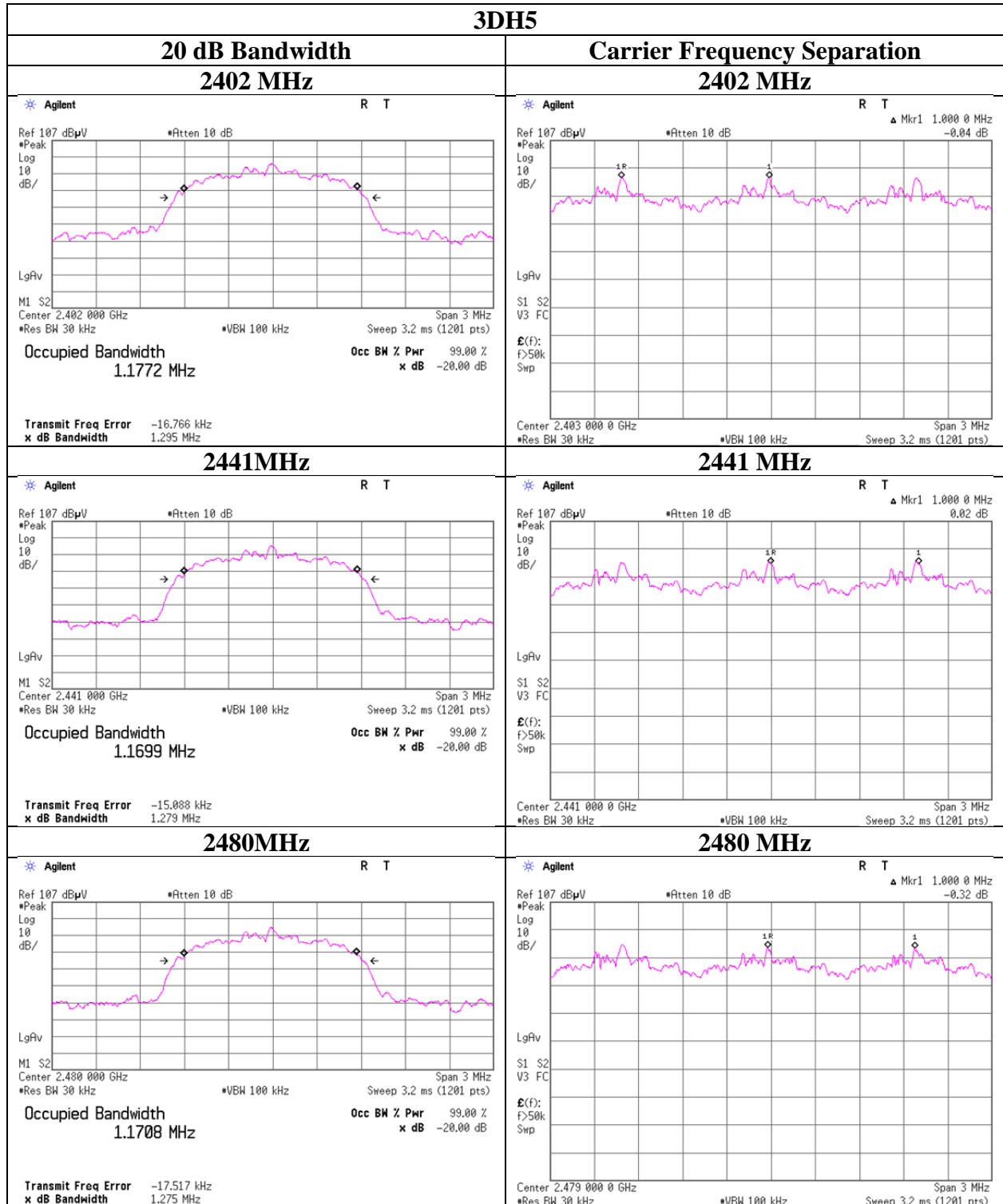
Ise EMC Lab.

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20dB Bandwidth and Carrier Frequency Separation



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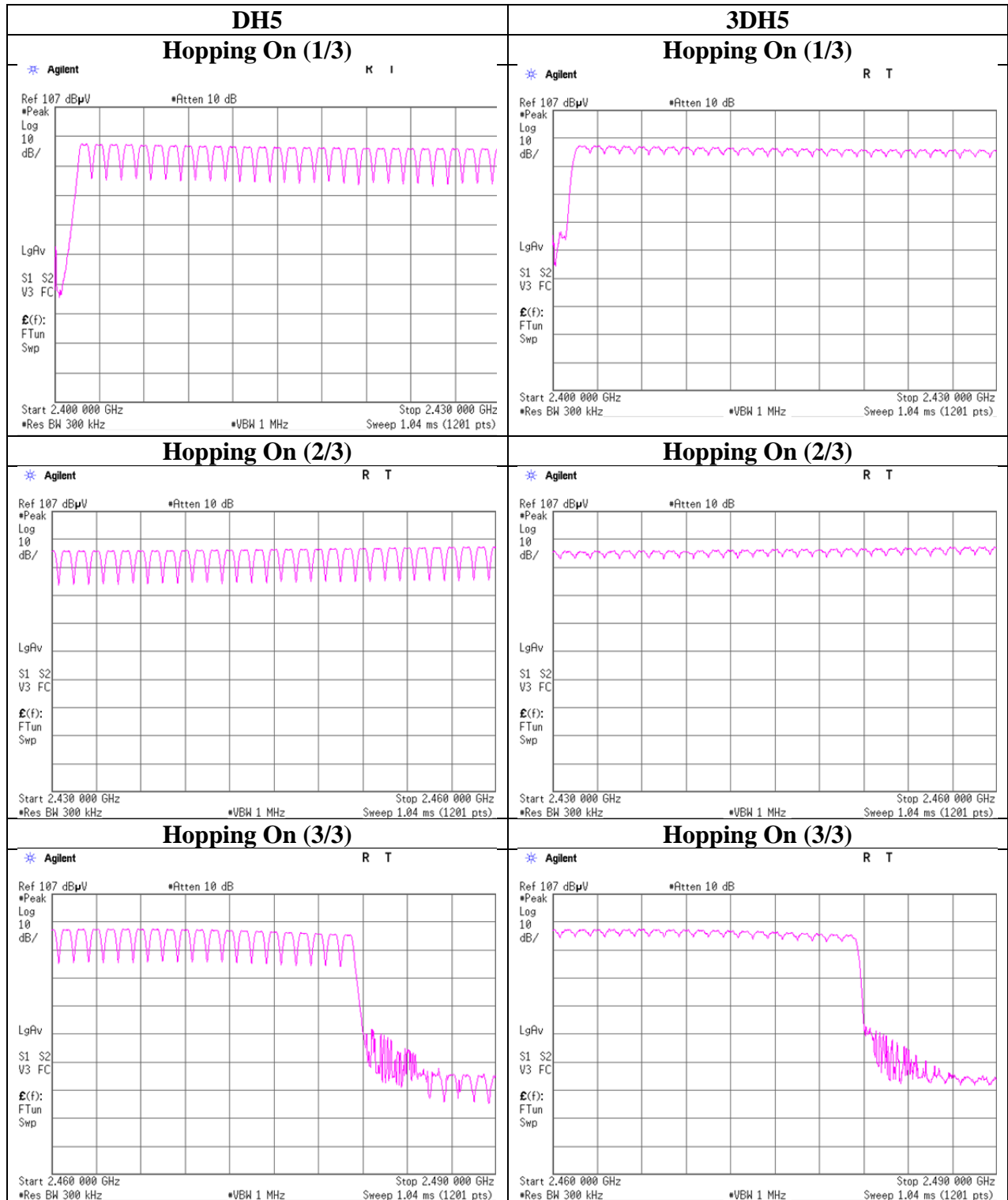
Number of Hopping Frequency

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11157080H
Date March 2, 2016
Temperature / Humidity 21 deg. C / 41 % RH
Engineer Shinichi Miyazono
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.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
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	49.6 times / 5 sec. x 31.6 sec. = 314 times	0.459	144	400
DH3	27.2 times / 5 sec. x 31.6 sec. = 172 times	1.735	298	400
DH5	20.2 times / 5 sec. x 31.6 sec. = 128 times	2.995	383	400
3DH1	50.4 times / 5 sec. x 31.6 sec. = 319 times	0.459	146	400
3DH3	29.0 times / 5 sec. x 31.6 sec. = 184 times	1.710	315	400
3DH5	20.4 times / 5 sec. x 31.6 sec. = 129 times	2.986	385	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

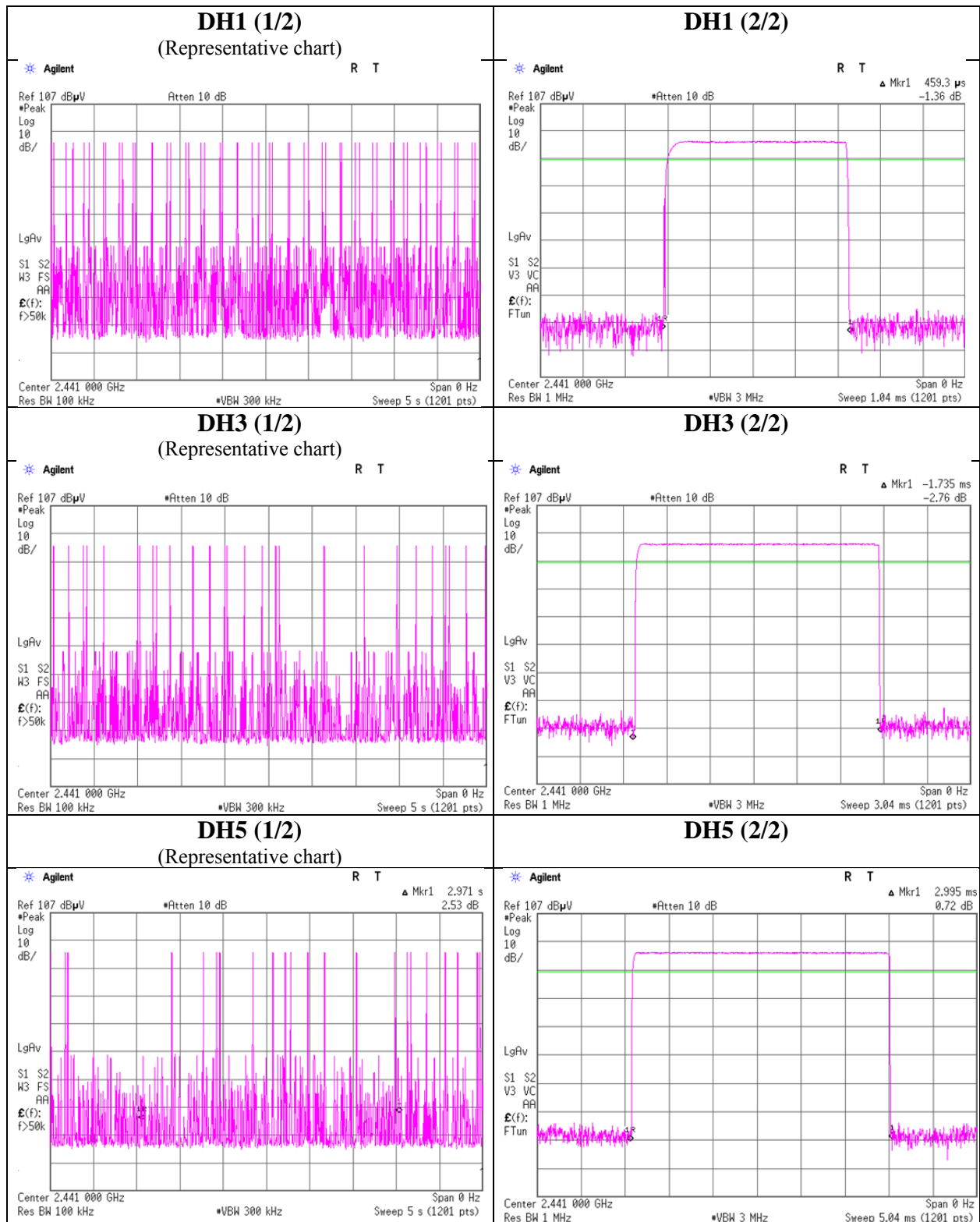
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	50	49	50	49	50	49.6
DH3	27	27	27	29	26	27.2
DH5	22	20	20	19	20	20.2
3DH1	52	50	49	50	51	50.4
3DH3	30	28	30	29	28	29
3DH5	20	21	20	20	21	20.4

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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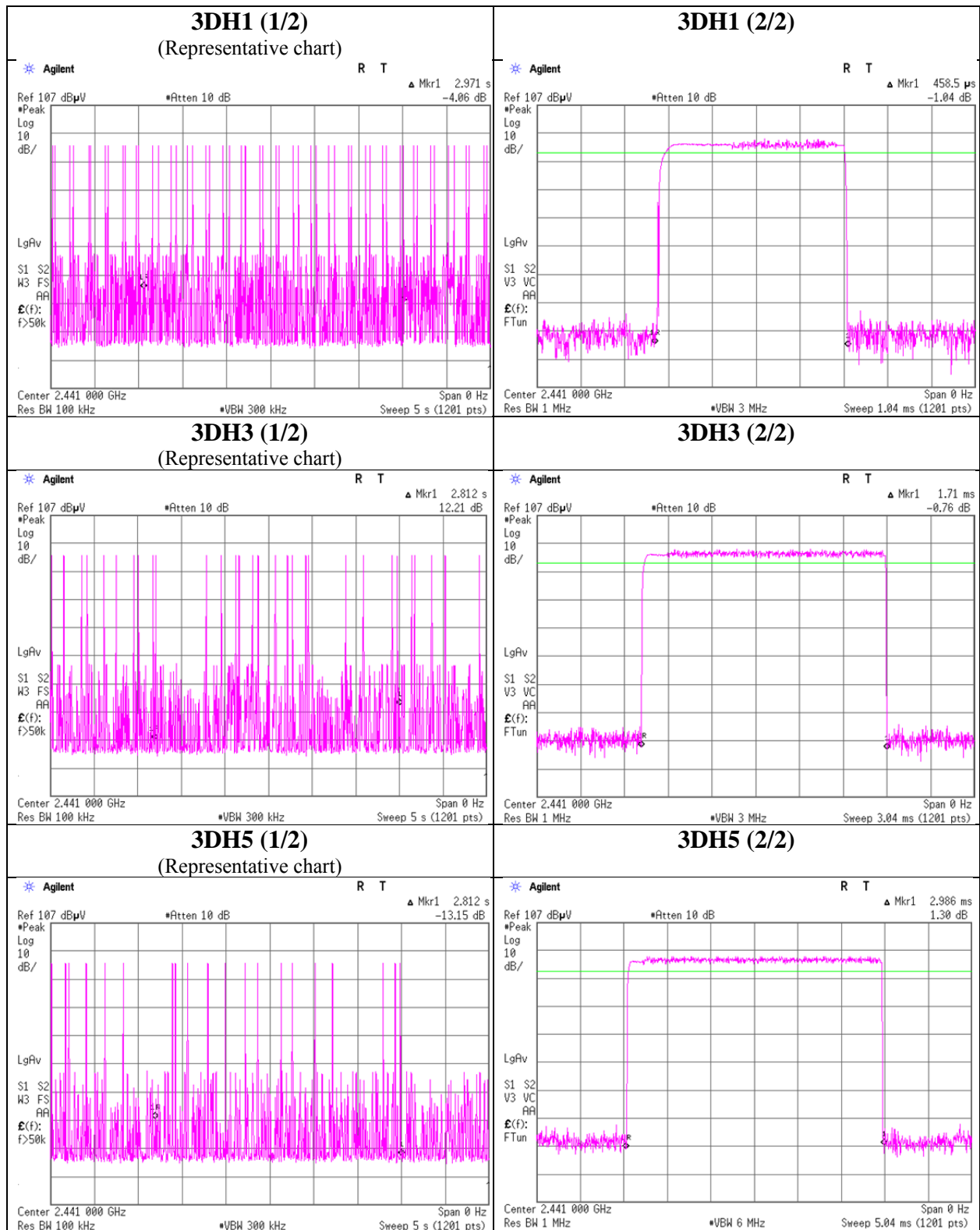
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Dwell time



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Maximum Peak Output Power

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11157080H
Date March 2, 2016
Temperature / Humidity 21 deg. C / 41 % RH
Engineer Shinichi Miyazono
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	-12.20	2.66	10.02	0.48	1.12	20.96	125	20.48
DH5	2441.0	-13.56	2.67	10.02	-0.87	0.82	20.96	125	21.83
DH5	2480.0	-13.99	2.68	10.02	-1.29	0.74	20.96	125	22.25
2DH5	2402.0	-10.84	2.66	10.02	1.84	1.53	20.96	125	19.12
2DH5	2441.0	-12.12	2.67	10.02	0.57	1.14	20.96	125	20.39
2DH5	2480.0	-12.54	2.68	10.02	0.16	1.04	20.96	125	20.80
3DH5	2402.0	-10.61	2.66	10.02	2.07	1.61	20.96	125	18.89
3DH5	2441.0	-11.70	2.67	10.02	0.99	1.26	20.96	125	19.97
3DH5	2480.0	-12.23	2.68	10.02	0.47	1.11	20.96	125	20.49

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 / SAR testing)

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11157080H
Date : March 2, 2016
Temperature / Humidity : 21 deg. C / 41 % RH
Engineer : Shinichi Miyazono
Mode : Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)	
					[dBm]	[mW]
DH5	2402.0	-13.70	2.66	10.02	-1.02	0.79
DH5	2441.0	-14.66	2.67	10.02	-1.97	0.64
DH5	2480.0	-16.04	2.68	10.02	-3.34	0.46
2DH5	2402.0	-14.34	2.66	10.02	-1.66	0.68
2DH5	2441.0	-15.26	2.67	10.02	-2.57	0.55
2DH5	2480.0	-16.47	2.68	10.02	-3.77	0.42
3DH5	2402.0	-14.33	2.66	10.02	-1.65	0.68
3DH5	2441.0	-15.16	2.67	10.02	-2.47	0.57
3DH5	2480.0	-16.44	2.68	10.02	-3.74	0.42

Sample Calculation:

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

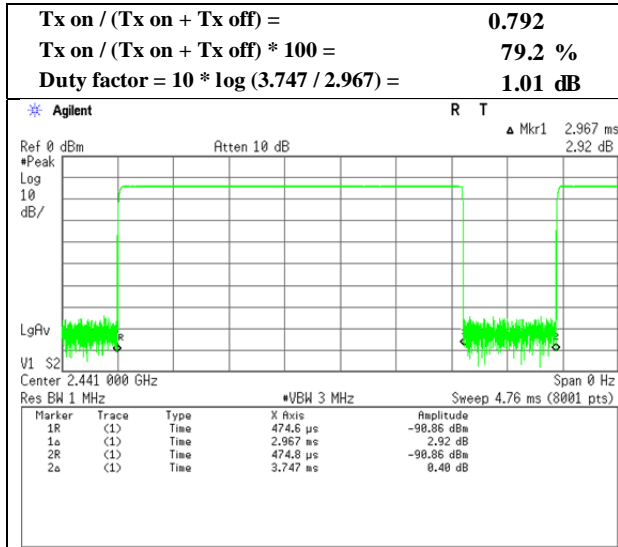
Result (Burst power) = Frame power + Duty factor

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

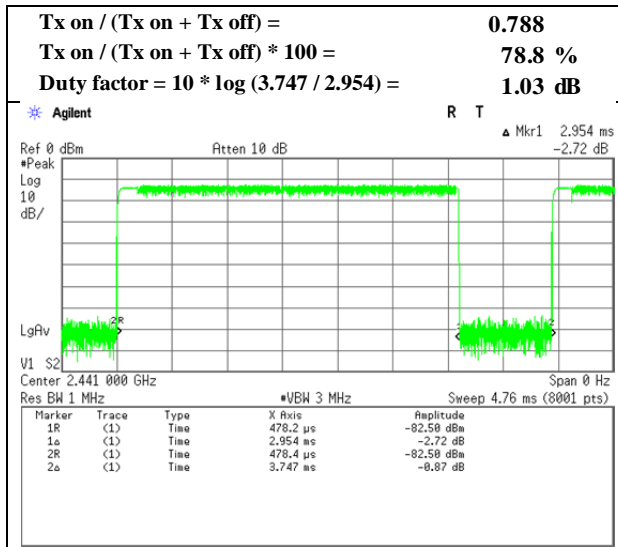
Burst Rate Confirmation

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx, Hopping Off

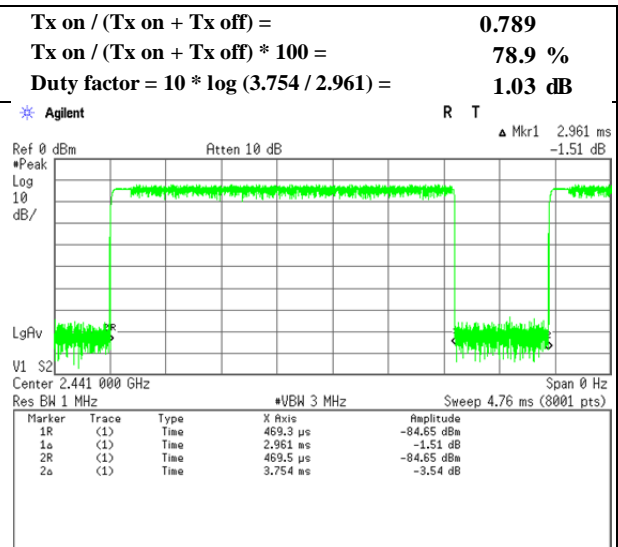
DH5



2DH5



3DH5



Radiated Spurious Emission

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.4
Report No.	11157080H		
Date	March 4, 2016	March 7, 2016	April 28, 2016
Temperature / Humidity	25 deg. C / 29 % RH	23 deg. C / 57 % RH	24 deg. C / 60 % RH
Engineer	Takafumi Noguchi	Satofumi Matsuyama	Takafumi Noguchi
	(1-10GHz)	(Above 10GHz)	(Below 1GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	215.996	QP	29.3	11.5	9.2	31.9	18.1	43.5	25.4	
Hori	265.596	QP	39.3	12.7	9.6	31.9	29.7	46.0	16.3	
Hori	287.996	QP	33.0	13.2	9.8	31.8	24.2	46.0	21.8	
Hori	335.783	QP	36.2	14.3	10.2	31.9	28.8	46.0	17.2	
Hori	512.992	QP	31.9	17.8	11.3	32.2	28.8	46.0	17.2	
Hori	769.489	QP	29.8	20.5	12.7	31.8	31.2	46.0	14.8	
Hori	2390.000	PK	43.0	26.9	6.8	32.0	44.7	73.9	29.2	
Hori	4804.000	PK	43.6	31.8	9.0	31.3	53.1	73.9	20.8	
Hori	7206.000	PK	40.8	36.0	10.2	32.0	55.0	73.9	18.9	Floor Noise
Hori	9608.000	PK	41.3	38.2	11.0	32.4	58.1	73.9	15.8	Floor Noise
Hori	2390.000	AV	29.0	26.9	6.8	32.0	30.7	53.9	23.2	
Hori	4804.000	AV	34.1	31.8	9.0	31.3	43.6	53.9	10.3	
Hori	7206.000	AV	29.3	36.0	10.2	32.0	43.5	53.9	10.4	Floor Noise
Hori	9608.000	AV	29.5	38.2	11.0	32.4	46.3	53.9	7.6	Floor Noise
Vert	215.996	QP	29.5	11.5	9.2	31.9	18.3	43.5	25.2	
Vert	265.596	QP	36.0	12.7	9.6	31.9	26.4	46.0	19.6	
Vert	287.996	QP	31.0	13.2	9.8	31.8	22.2	46.0	23.8	
Vert	335.783	QP	38.0	14.3	10.2	31.9	30.6	46.0	15.4	
Vert	512.992	QP	37.0	17.8	11.3	32.2	33.9	46.0	12.1	
Vert	769.489	QP	30.9	20.5	12.7	31.8	32.3	46.0	13.7	
Vert	2390.000	PK	42.3	26.9	6.8	32.0	44.0	73.9	29.9	
Vert	4804.000	PK	43.2	31.8	9.0	31.3	52.7	73.9	21.2	
Vert	7206.000	PK	40.5	36.0	10.2	32.0	54.7	73.9	19.2	Floor Noise
Vert	9608.000	PK	41.1	38.2	11.0	32.4	57.9	73.9	16.0	Floor Noise
Vert	2390.000	AV	28.9	26.9	6.8	32.0	30.6	53.9	23.3	
Vert	4804.000	AV	33.1	31.8	9.0	31.3	42.6	53.9	11.3	
Vert	7206.000	AV	29.2	36.0	10.2	32.0	43.4	53.9	10.5	Floor Noise
Vert	9608.000	AV	29.4	38.2	11.0	32.4	46.2	53.9	7.7	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).

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

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

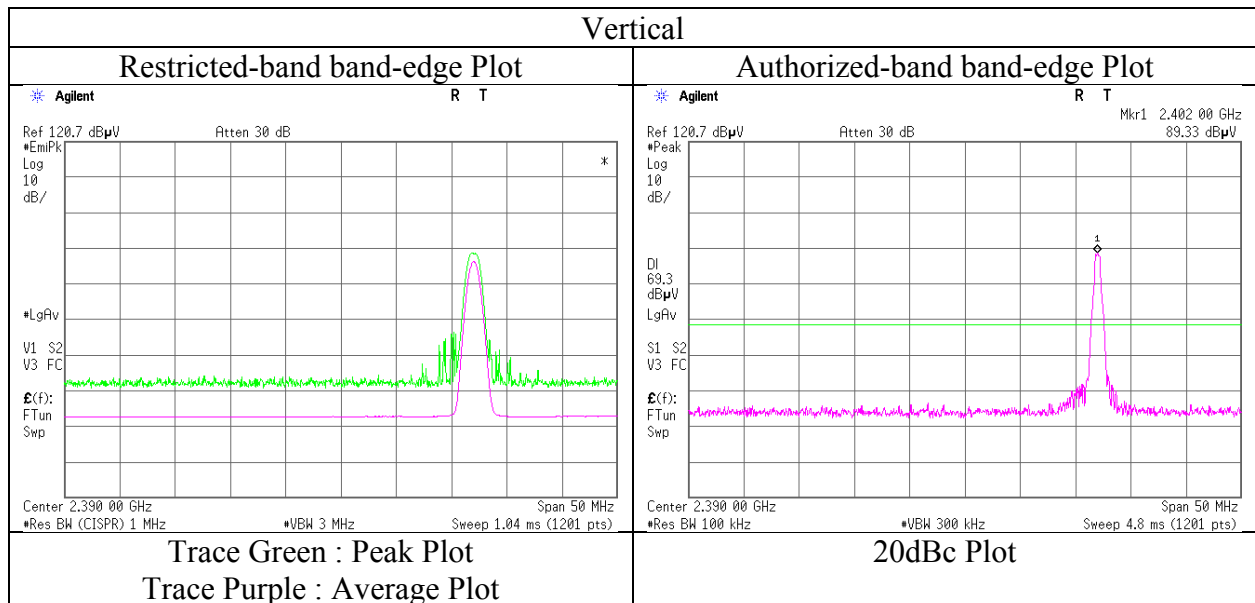
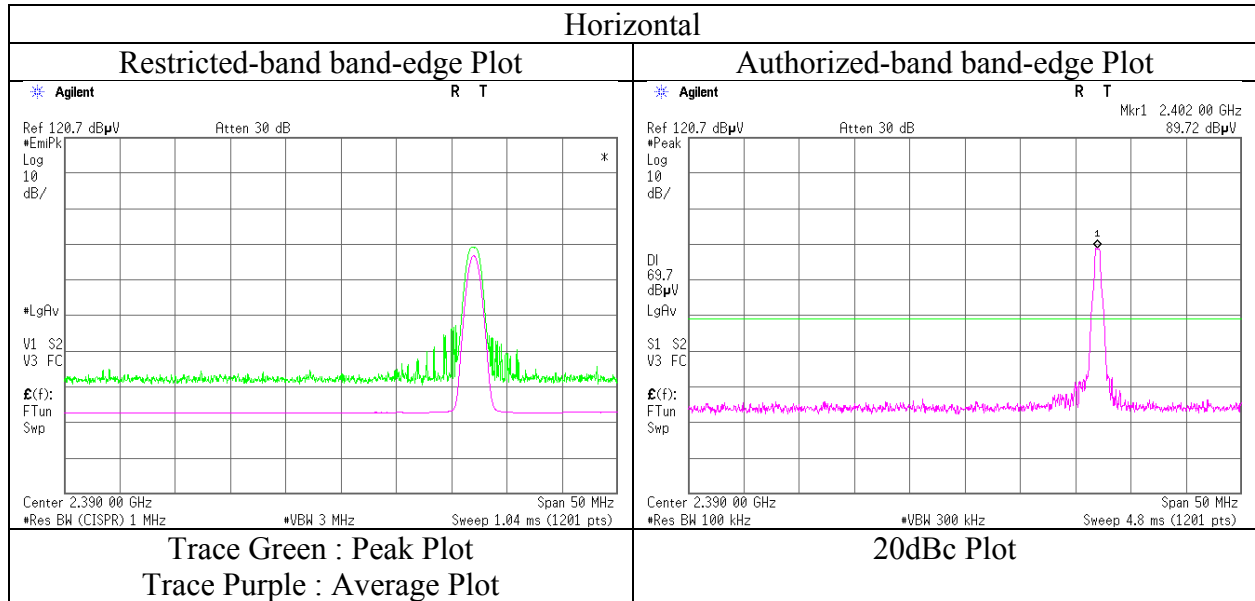
20dBc Data Sheet

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	89.7	26.9	6.8	32.0	91.4	-	-	Carrier
Hori	2400.000	PK	50.9	26.9	6.8	32.0	52.6	71.4	18.8	
Vert	2402.000	PK	89.3	26.9	6.8	32.0	91.0	-	-	Carrier
Vert	2400.000	PK	50.2	26.9	6.8	32.0	51.9	71.0	19.1	

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

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11157080H
Date	March 4, 2016
Temperature / Humidity	25 deg. C / 29 % RH
Engineer	Takafumi Noguchi (1-10GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz



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

Radiated Spurious Emission

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.4
Report No.	11157080H		
Date	March 4, 2016	March 7, 2016	April 28, 2016
Temperature / Humidity	25 deg. C / 29 % RH	23 deg. C / 57 % RH	24 deg. C / 60 % RH
Engineer	Takafumi Noguchi	Satofumi Matsuyama	Takafumi Noguchi
	(1-10GHz)	(Above 10GHz)	(Below 1GHz)
Mode	Tx, Hopping Off, DH5 2441 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	215.996	QP	29.3	11.5	9.2	31.9	18.1	43.5	25.4	
Hori	265.596	QP	39.4	12.7	9.6	31.9	29.8	46.0	16.2	
Hori	287.996	QP	33.0	13.2	9.8	31.8	24.2	46.0	21.8	
Hori	335.783	QP	35.5	14.3	10.2	31.9	28.1	46.0	17.9	
Hori	512.992	QP	31.9	17.8	11.3	32.2	28.8	46.0	17.2	
Hori	769.489	QP	29.8	20.5	12.7	31.8	31.2	46.0	14.8	
Hori	4882.000	PK	43.5	31.9	9.0	31.3	53.1	73.9	20.8	
Hori	7323.000	PK	40.4	36.0	10.3	32.0	54.7	73.9	19.2	Floor Noise
Hori	9764.000	PK	40.4	38.2	11.0	32.5	57.1	73.9	16.8	Floor Noise
Hori	4882.000	AV	34.0	31.9	9.0	31.3	43.6	53.9	10.3	
Hori	7323.000	AV	29.1	36.0	10.3	32.0	43.4	53.9	10.5	Floor Noise
Hori	9764.000	AV	29.0	38.2	11.0	32.5	45.7	53.9	8.2	Floor Noise
Vert	215.996	QP	29.6	11.5	9.2	31.9	18.4	43.5	25.1	
Vert	265.596	QP	36.2	12.7	9.6	31.9	26.6	46.0	19.4	
Vert	287.996	QP	31.0	13.2	9.8	31.8	22.2	46.0	23.8	
Vert	335.783	QP	36.0	14.3	10.2	31.9	28.6	46.0	17.4	
Vert	512.992	QP	33.1	17.8	11.3	32.2	30.0	46.0	16.0	
Vert	769.489	QP	30.9	20.5	12.7	31.8	32.3	46.0	13.7	
Vert	4882.000	PK	43.1	31.9	9.0	31.3	52.7	73.9	21.2	
Vert	7323.000	PK	40.3	36.0	10.3	32.0	54.6	73.9	19.3	Floor Noise
Vert	9764.000	PK	40.3	38.2	11.0	32.5	57.0	73.9	16.9	Floor Noise
Vert	4882.000	AV	33.1	31.9	9.0	31.3	42.7	53.9	11.2	
Vert	7323.000	AV	29.2	36.0	10.3	32.0	43.5	53.9	10.4	Floor Noise
Vert	9764.000	AV	29.1	38.2	11.0	32.5	45.8	53.9	8.1	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.

Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

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.**

Radiated Spurious Emission

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.4
Report No.	11157080H		
Date	March 4, 2016	March 7, 2016	April 28, 2016
Temperature / Humidity	25 deg. C / 29 % RH	23 deg. C / 57 % RH	24 deg. C / 60 % RH
Engineer	Takafumi Noguchi	Satofumi Matsuyama	Takafumi Noguchi
	(1-10GHz)	(Above 10GHz)	(Below 1GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	215.996	QP	29.3	11.5	9.2	31.9	18.1	43.5	25.4	
Hori	265.596	QP	39.4	12.7	9.6	31.9	29.8	46.0	16.2	
Hori	287.996	QP	33.0	13.2	9.8	31.8	24.2	46.0	21.8	
Hori	335.783	QP	38.0	14.3	10.2	31.9	30.6	46.0	15.4	
Hori	512.992	QP	31.9	17.8	11.3	32.2	28.8	46.0	17.2	
Hori	769.489	QP	29.8	20.5	12.7	31.8	31.2	46.0	14.8	
Hori	2483.500	PK	59.0	26.9	6.8	32.0	60.7	73.9	13.2	
Hori	4960.000	PK	41.9	32.1	8.9	31.2	51.7	73.9	22.2	
Hori	7440.000	PK	40.3	36.0	10.2	32.1	54.4	73.9	19.5	Floor Noise
Hori	9920.000	PK	40.4	38.2	11.1	32.5	57.2	73.9	16.7	Floor Noise
Hori	2483.500	AV	31.3	26.9	6.8	32.0	33.0	53.9	20.9	
Hori	4960.000	AV	32.7	32.1	8.9	31.2	42.5	53.9	11.4	
Hori	7440.000	AV	29.1	36.0	10.2	32.1	43.2	53.9	10.7	Floor Noise
Hori	9920.000	AV	29.2	38.2	11.1	32.5	46.0	53.9	7.9	Floor Noise
Vert	215.996	QP	29.6	11.5	9.2	31.9	18.4	43.5	25.1	
Vert	265.596	QP	36.2	12.7	9.6	31.9	26.6	46.0	19.4	
Vert	287.996	QP	31.0	13.2	9.8	31.8	22.2	46.0	23.8	
Vert	335.783	QP	38.0	14.3	10.2	31.9	30.6	46.0	15.4	
Vert	512.992	QP	34.0	17.8	11.3	32.2	30.9	46.0	15.1	
Vert	769.489	QP	30.9	20.5	12.7	31.8	32.3	46.0	13.7	
Vert	2483.500	PK	58.8	26.9	6.8	32.0	60.5	73.9	13.4	
Vert	4960.000	PK	41.8	32.1	8.9	31.2	51.6	73.9	22.3	
Vert	7440.000	PK	40.3	36.0	10.2	32.1	54.4	73.9	19.5	Floor Noise
Vert	9920.000	PK	40.4	38.2	11.1	32.5	57.2	73.9	16.7	Floor Noise
Vert	2483.500	AV	31.2	26.9	6.8	32.0	32.9	53.9	21.0	
Vert	4960.000	AV	32.5	32.1	8.9	31.2	42.3	53.9	11.6	
Vert	7440.000	AV	29.2	36.0	10.2	32.1	43.3	53.9	10.6	Floor Noise
Vert	9920.000	AV	29.2	38.2	11.1	32.5	46.0	53.9	7.9	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).

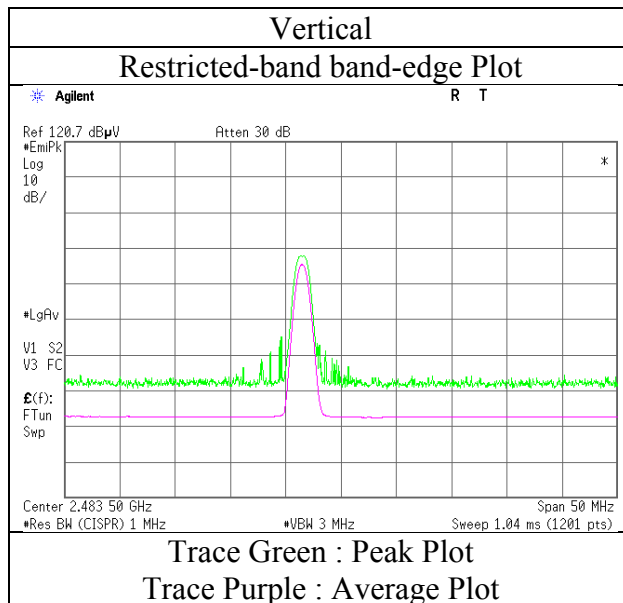
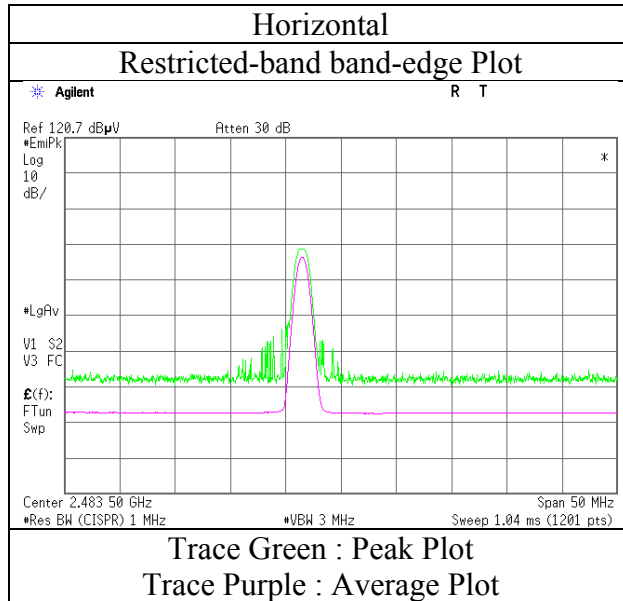
*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
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.**

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11157080H
Date	March 4, 2016
Temperature / Humidity	25 deg. C / 29 % RH
Engineer	Takafumi Noguchi
	(1-10GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz



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

Radiated Spurious Emission

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.4
Report No.	11157080H		
Date	March 4, 2016	March 7, 2016	April 28, 2016
Temperature / Humidity	25 deg. C / 29 % RH	23 deg. C / 57 % RH	24 deg. C / 60 % RH
Engineer	Takafumi Noguchi	Satofumi Matsuyama	Takafumi Noguchi
	(1-10GHz)	(Above 10GHz)	(Below 1GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	215.996	QP	29.0	11.5	9.2	31.9	17.8	43.5	25.7	
Hori	265.596	QP	39.4	12.7	9.6	31.9	29.8	46.0	16.2	
Hori	287.996	QP	33.9	13.2	9.8	31.8	25.1	46.0	20.9	
Hori	335.783	QP	37.9	14.3	10.2	31.9	30.5	46.0	15.5	
Hori	512.992	QP	31.8	17.8	11.3	32.2	28.7	46.0	17.3	
Hori	769.489	QP	29.8	20.5	12.7	31.8	31.2	46.0	14.8	
Hori	2390.000	PK	44.0	26.9	6.8	32.0	45.7	73.9	28.2	
Hori	4804.000	PK	43.7	31.8	9.0	31.3	53.2	73.9	20.7	
Hori	7206.000	PK	40.7	36.0	10.2	32.0	54.9	73.9	19.0	Floor Noise
Hori	9608.000	PK	41.0	38.2	11.0	32.4	57.8	73.9	16.1	Floor Noise
Hori	2390.000	AV	29.2	26.9	6.8	32.0	30.9	53.9	23.0	
Hori	4804.000	AV	33.2	31.8	9.0	31.3	42.7	53.9	11.2	
Hori	7206.000	AV	29.3	36.0	10.2	32.0	43.5	53.9	10.4	Floor Noise
Hori	9608.000	AV	29.4	38.2	11.0	32.4	46.2	53.9	7.7	Floor Noise
Vert	215.996	QP	29.6	11.5	9.2	31.9	18.4	43.5	25.1	
Vert	265.596	QP	36.2	12.7	9.6	31.9	26.6	46.0	19.4	
Vert	287.996	QP	31.0	13.2	9.8	31.8	22.2	46.0	23.8	
Vert	335.783	QP	37.8	14.3	10.2	31.9	30.4	46.0	15.6	
Vert	512.992	QP	33.9	17.8	11.3	32.2	30.8	46.0	15.2	
Vert	769.489	QP	30.9	20.5	12.7	31.8	32.3	46.0	13.7	
Vert	2390.000	PK	42.9	26.9	6.8	32.0	44.6	73.9	29.3	
Vert	4804.000	PK	42.9	31.8	9.0	31.3	52.4	73.9	21.5	
Vert	7206.000	PK	40.6	36.0	10.2	32.0	54.8	73.9	19.1	Floor Noise
Vert	9608.000	PK	41.0	38.2	11.0	32.4	57.8	73.9	16.1	Floor Noise
Vert	2390.000	AV	29.1	26.9	6.8	32.0	30.8	53.9	23.1	
Vert	4804.000	AV	32.6	31.8	9.0	31.3	42.1	53.9	11.8	
Vert	7206.000	AV	29.2	36.0	10.2	32.0	43.4	53.9	10.5	Floor Noise
Vert	9608.000	AV	29.4	38.2	11.0	32.4	46.2	53.9	7.7	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).

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

Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$

10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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	90.4	26.9	6.8	32.0	92.1	-	-	Carrier
Hori	2400.000	PK	51.5	26.9	6.8	32.0	53.2	72.1	18.9	
Vert	2402.000	PK	89.9	26.9	6.8	32.0	91.6	-	-	Carrier
Vert	2400.000	PK	51.0	26.9	6.8	32.0	52.7	71.6	18.9	

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

UL Japan, Inc.

Ise EMC Lab.

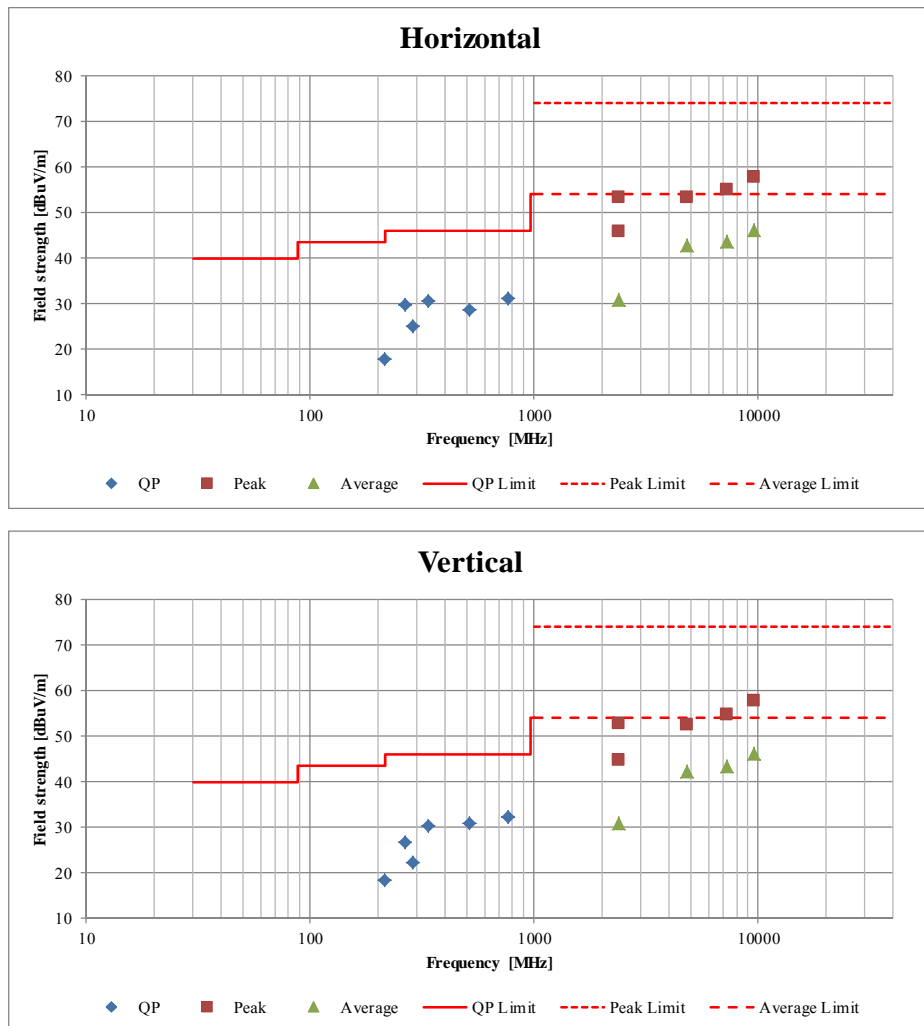
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.4
Report No.	11157080H		
Date	March 4, 2016	March 7, 2016	April 28, 2016
Temperature / Humidity	25 deg. C / 29 % RH	23 deg. C / 57 % RH	24 deg. C / 60 % RH
Engineer	Takafumi Noguchi (1-10GHz)	Satofumi Matsuyama (Above 10GHz)	Takafumi Noguchi (Below 1GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz		



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

UL Japan, Inc.

Ise EMC Lab.

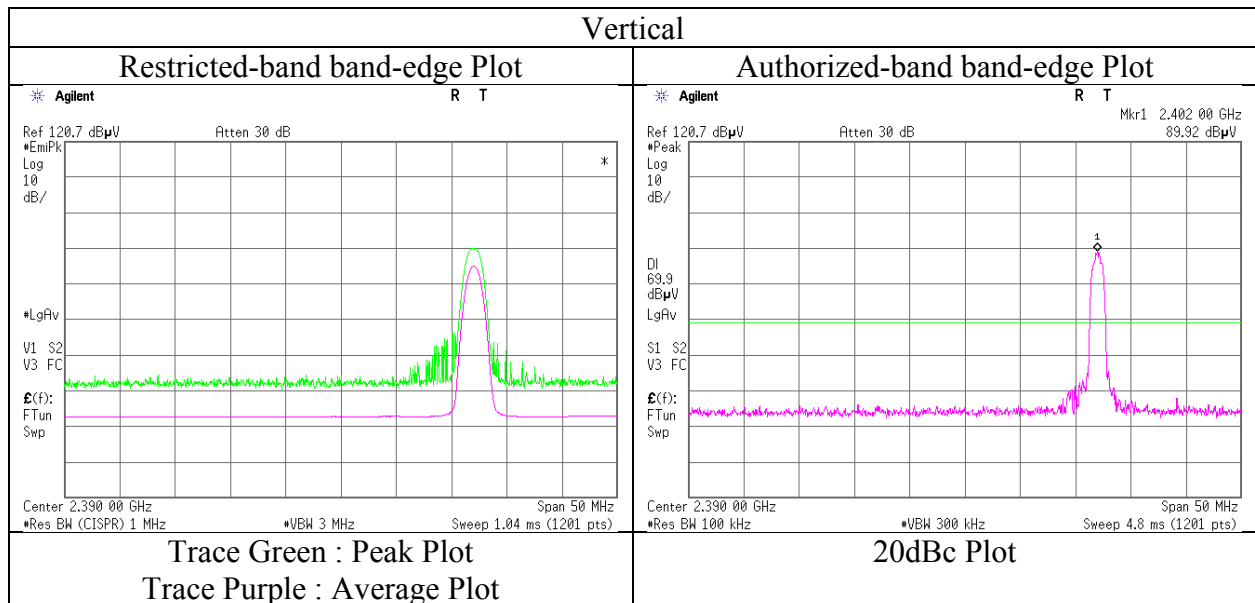
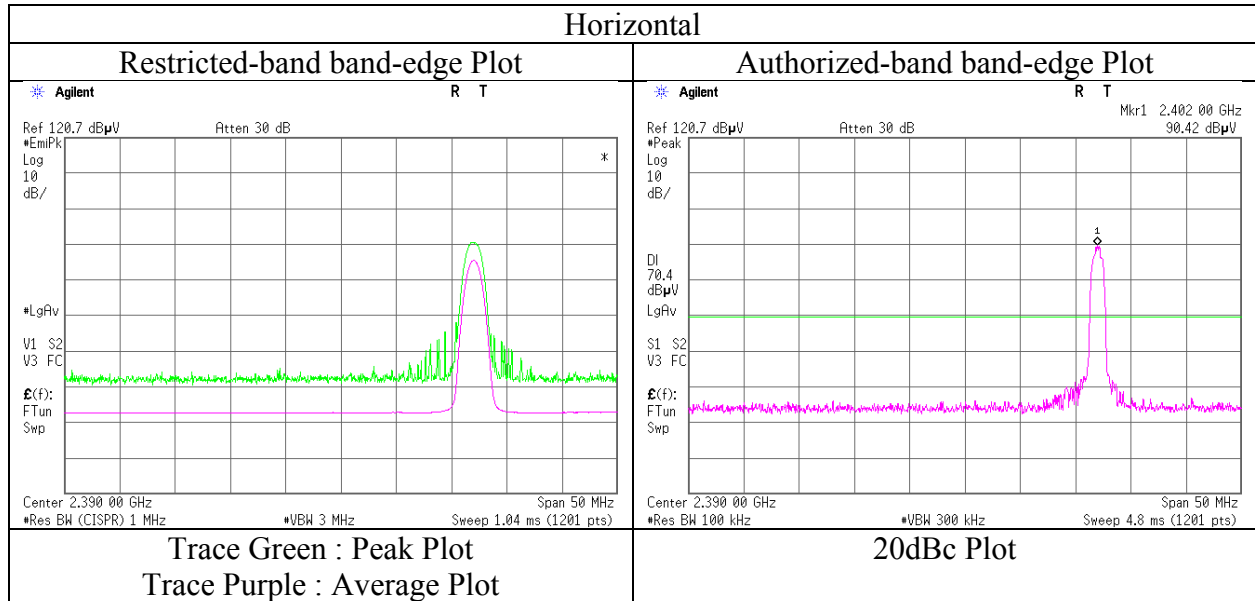
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11157080H
Date	March 4, 2016
Temperature / Humidity	25 deg. C / 29 % RH
Engineer	Takafumi Noguchi (1-10GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz



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

Radiated Spurious Emission

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.4
Report No.	11157080H		
Date	March 4, 2016	March 7, 2016	April 28, 2016
Temperature / Humidity	25 deg. C / 29 % RH	23 deg. C / 57 % RH	24 deg. C / 60 % RH
Engineer	Takafumi Noguchi	Satofumi Matsuyama	Takafumi Noguchi
	(1-10GHz)	(Above 10GHz)	(Below 1GHz)
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	215.996	QP	28.6	11.5	9.2	31.9	17.4	43.5	26.1	
Hori	265.596	QP	39.0	12.7	9.6	31.9	29.4	46.0	16.6	
Hori	287.996	QP	34.1	13.2	9.8	31.8	25.3	46.0	20.7	
Hori	335.783	QP	33.5	14.3	10.2	31.9	26.1	46.0	19.9	
Hori	512.992	QP	28.0	17.8	11.3	32.2	24.9	46.0	21.1	
Hori	769.489	QP	30.5	20.5	12.7	31.8	31.9	46.0	14.1	
Hori	4882.000	PK	42.3	31.9	9.0	31.3	51.9	73.9	22.0	
Hori	7323.000	PK	40.3	36.0	10.3	32.0	54.6	73.9	19.3	Floor Noise
Hori	9764.000	PK	40.4	38.2	11.0	32.5	57.1	73.9	16.8	Floor Noise
Hori	4882.000	AV	32.7	31.9	9.0	31.3	42.3	53.9	11.6	
Hori	7323.000	AV	29.0	36.0	10.3	32.0	43.3	53.9	10.6	Floor Noise
Hori	9764.000	AV	28.9	38.2	11.0	32.5	45.6	53.9	8.3	Floor Noise
Vert	215.996	QP	28.5	11.5	9.2	31.9	17.3	43.5	26.2	
Vert	265.596	QP	35.6	12.7	9.6	31.9	26.0	46.0	20.0	
Vert	287.996	QP	29.3	13.2	9.8	31.8	20.5	46.0	25.5	
Vert	335.783	QP	36.3	14.3	10.2	31.9	28.9	46.0	17.1	
Vert	512.992	QP	33.5	17.8	11.3	32.2	30.4	46.0	15.6	
Vert	769.489	QP	32.1	20.5	12.7	31.8	33.5	46.0	12.5	
Vert	4882.000	PK	42.2	31.9	9.0	31.3	51.8	73.9	22.1	
Vert	7323.000	PK	40.3	36.0	10.3	32.0	54.6	73.9	19.3	Floor Noise
Vert	9764.000	PK	40.2	38.2	11.0	32.5	56.9	73.9	17.0	Floor Noise
Vert	4882.000	AV	32.6	31.9	9.0	31.3	42.2	53.9	11.7	
Vert	7323.000	AV	29.0	36.0	10.3	32.0	43.3	53.9	10.6	Floor Noise
Vert	9764.000	AV	28.9	38.2	11.0	32.5	45.6	53.9	8.3	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).

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

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.5 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.**

Radiated Spurious Emission

Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.4
Report No.	11157080H		
Date	March 4, 2016	March 7, 2016	April 28, 2016
Temperature / Humidity	25 deg. C / 29 % RH	23 deg. C / 57 % RH	24 deg. C / 60 % RH
Engineer	Takafumi Noguchi	Satofumi Matsuyama	Takafumi Noguchi
	(1-10GHz)	(Above 10GHz)	(Below 1GHz)
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	215.996	QP	28.6	11.5	9.2	31.9	17.4	43.5	26.1	
Hori	265.596	QP	39.1	12.7	9.6	31.9	29.5	46.0	16.5	
Hori	287.996	QP	34.0	13.2	9.8	31.8	25.2	46.0	20.8	
Hori	335.783	QP	33.7	14.3	10.2	31.9	26.3	46.0	19.7	
Hori	512.992	QP	28.3	17.8	11.3	32.2	25.2	46.0	20.8	
Hori	769.489	QP	30.5	20.5	12.7	31.8	31.9	46.0	14.1	
Hori	2483.500	PK	59.1	26.9	6.8	32.0	60.8	73.9	13.1	
Hori	4960.000	PK	42.3	32.1	8.9	31.2	52.1	73.9	21.8	
Hori	7440.000	PK	40.5	36.0	10.2	32.1	54.6	73.9	19.3	Floor Noise
Hori	9920.000	PK	40.4	38.2	11.1	32.5	57.2	73.9	16.7	Floor Noise
Hori	2483.500	AV	31.8	26.9	6.8	32.0	33.5	53.9	20.4	
Hori	4960.000	AV	32.6	32.1	8.9	31.2	42.4	53.9	11.5	
Hori	7440.000	AV	29.2	36.0	10.2	32.1	43.3	53.9	10.6	Floor Noise
Hori	9920.000	AV	29.2	38.2	11.1	32.5	46.0	53.9	7.9	Floor Noise
Vert	215.996	QP	28.5	11.5	9.2	31.9	17.3	43.5	26.2	
Vert	265.596	QP	35.7	12.7	9.6	31.9	26.1	46.0	19.9	
Vert	287.996	QP	29.6	13.2	9.8	31.8	20.8	46.0	25.2	
Vert	335.783	QP	36.3	14.3	10.2	31.9	28.9	46.0	17.1	
Vert	512.992	QP	33.5	17.8	11.3	32.2	30.4	46.0	15.6	
Vert	769.489	QP	32.0	20.5	12.7	31.8	33.4	46.0	12.6	
Vert	2483.500	PK	57.4	26.9	6.8	32.0	59.1	73.9	14.8	
Vert	4960.000	PK	42.1	32.1	8.9	31.2	51.9	73.9	22.0	
Vert	7440.000	PK	40.4	36.0	10.2	32.1	54.5	73.9	19.4	Floor Noise
Vert	9920.000	PK	40.5	38.2	11.1	32.5	57.3	73.9	16.6	Floor Noise
Vert	2483.500	AV	31.0	26.9	6.8	32.0	32.7	53.9	21.2	
Vert	4960.000	AV	32.5	32.1	8.9	31.2	42.3	53.9	11.6	
Vert	7440.000	AV	29.1	36.0	10.2	32.1	43.2	53.9	10.7	Floor Noise
Vert	9920.000	AV	29.2	38.2	11.1	32.5	46.0	53.9	7.9	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).

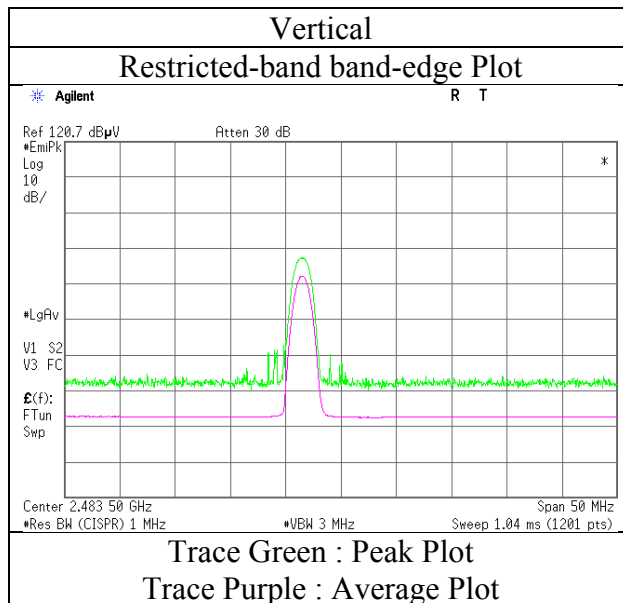
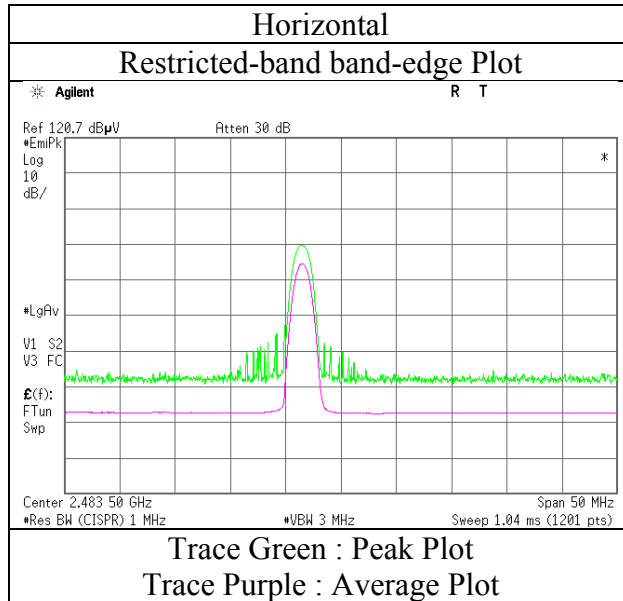
*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.5\text{ dB}$
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.**

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11157080H
Date	March 4, 2016
Temperature / Humidity	25 deg. C / 29 % RH
Engineer	Takafumi Noguchi
	(1-10GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz

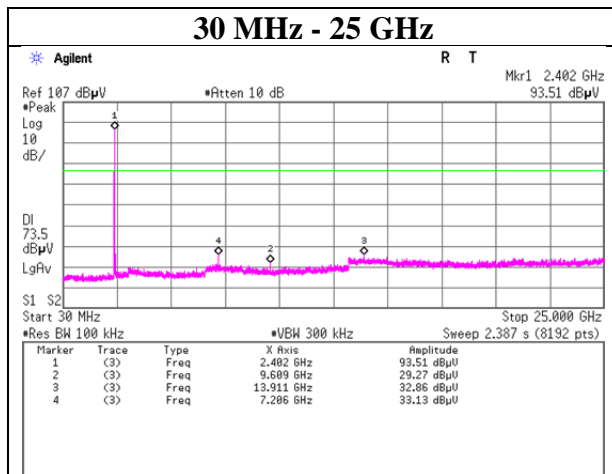
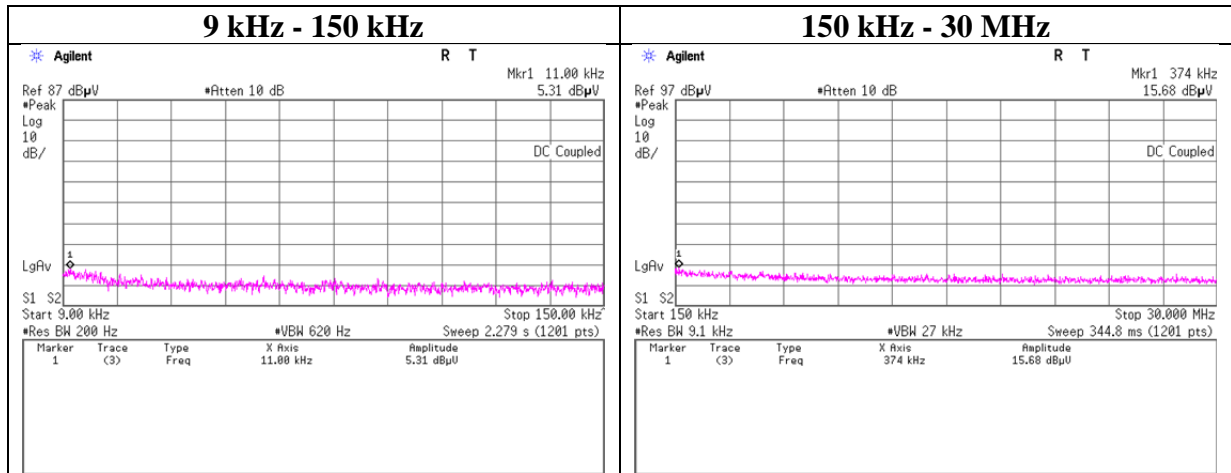


* Final result of restricted band edge was shown in tabular data.

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx, Hopping Off, DHS

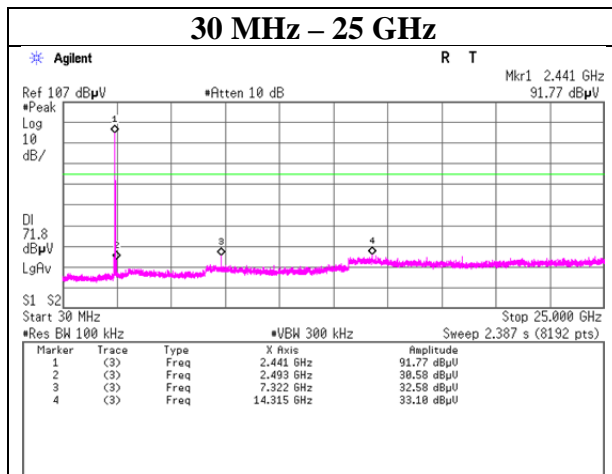
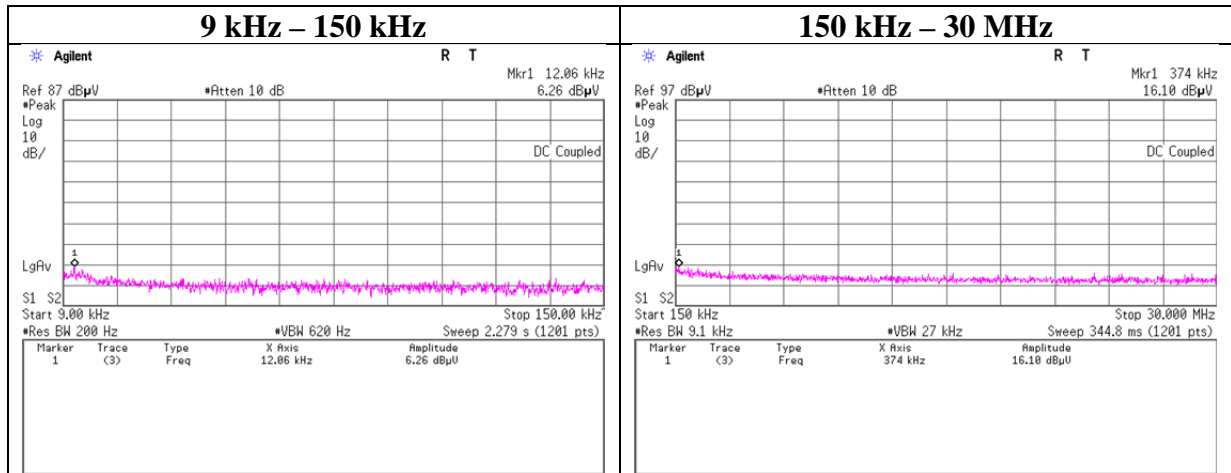
2402 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx, Hopping Off, DHS

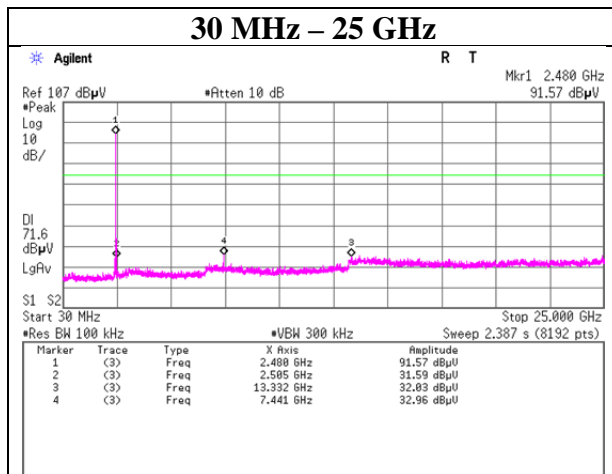
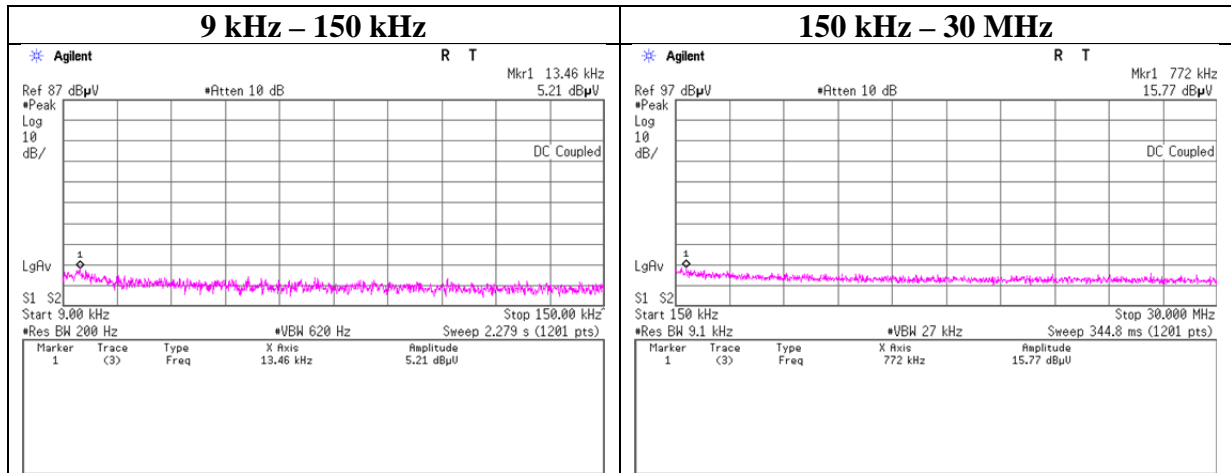
2441 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx, Hopping Off, DHS

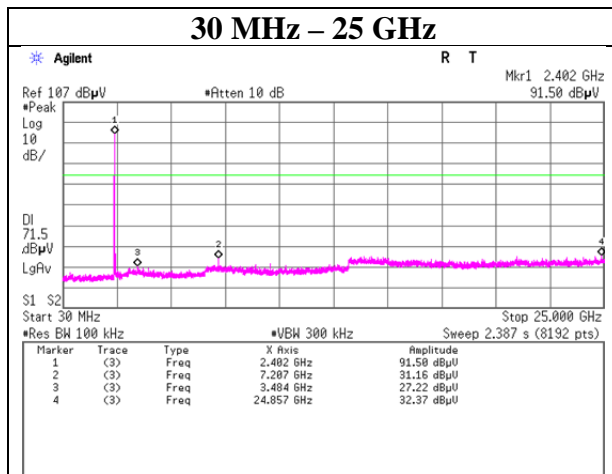
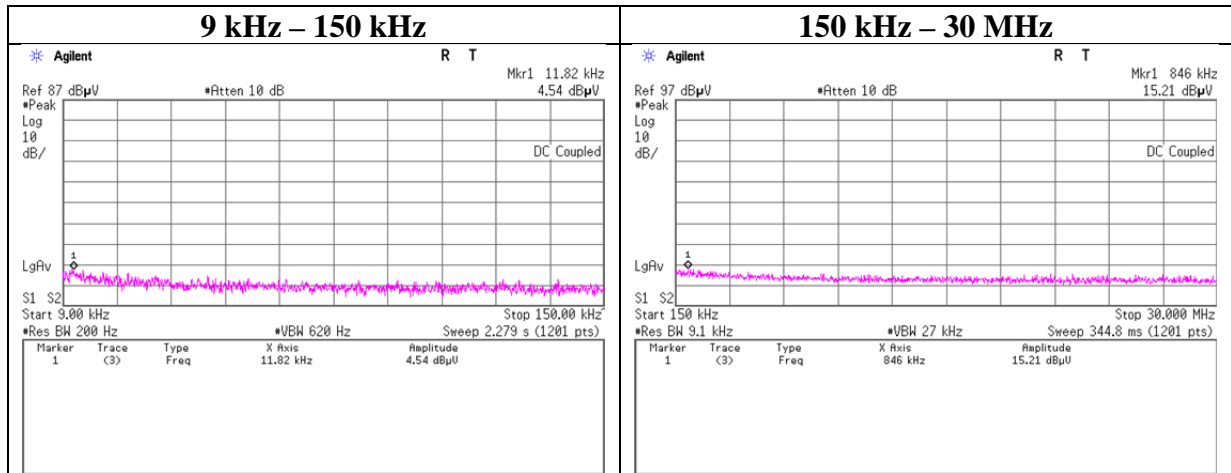
2480 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx, Hopping Off, 3DH5

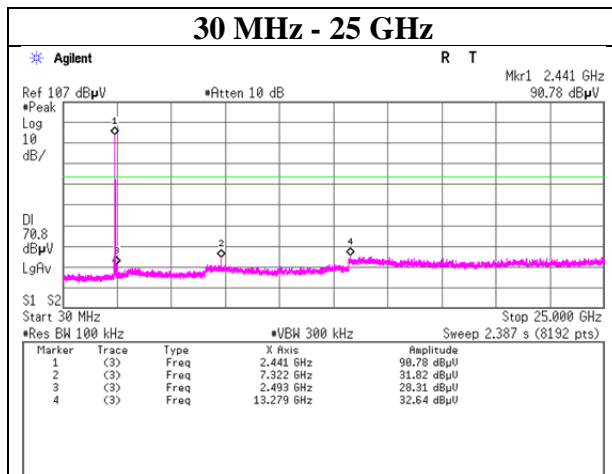
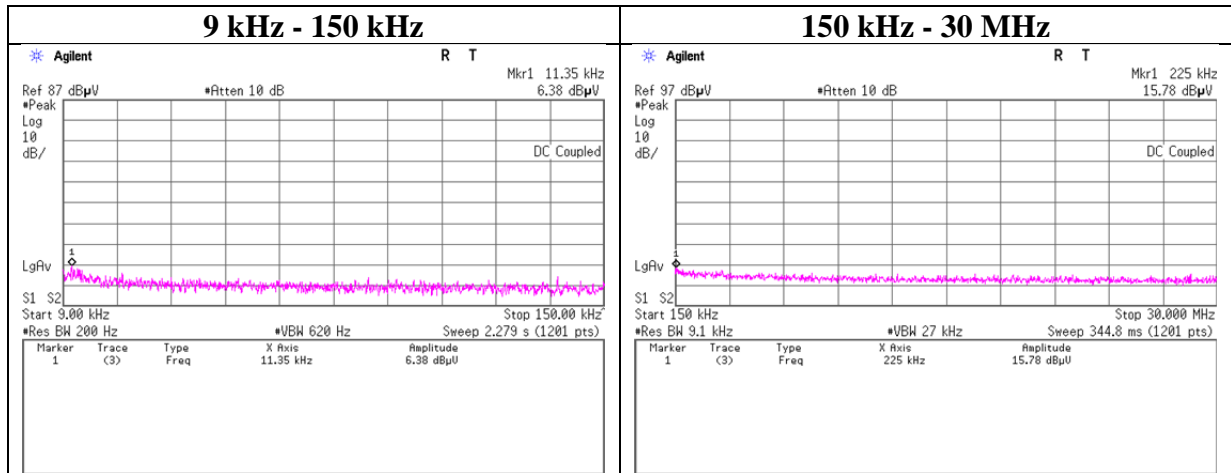
2402 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx, Hopping Off, 3DH5

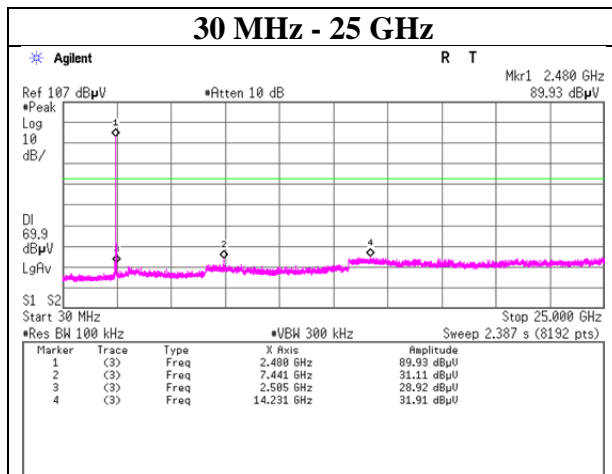
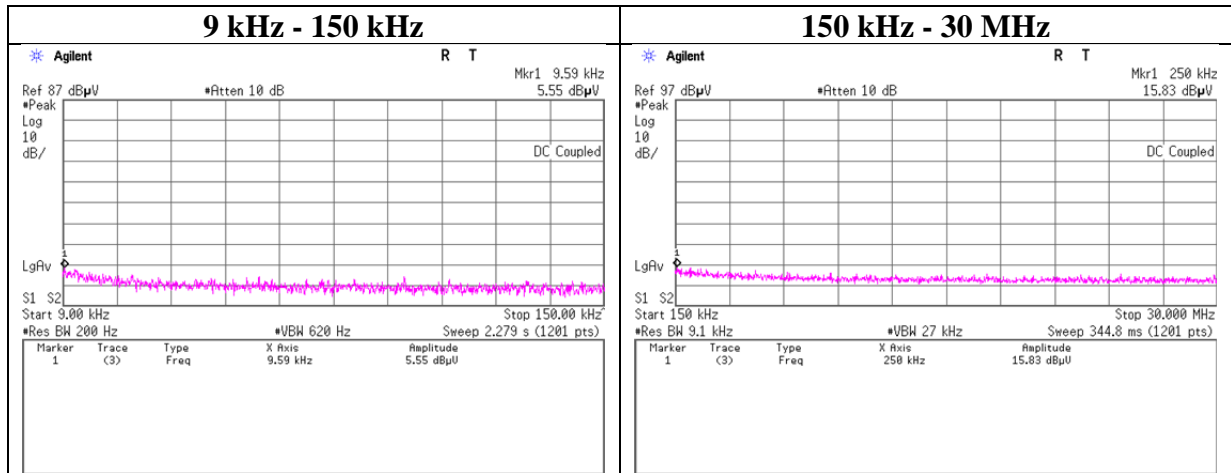
2441 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx, Hopping Off, 3DH5

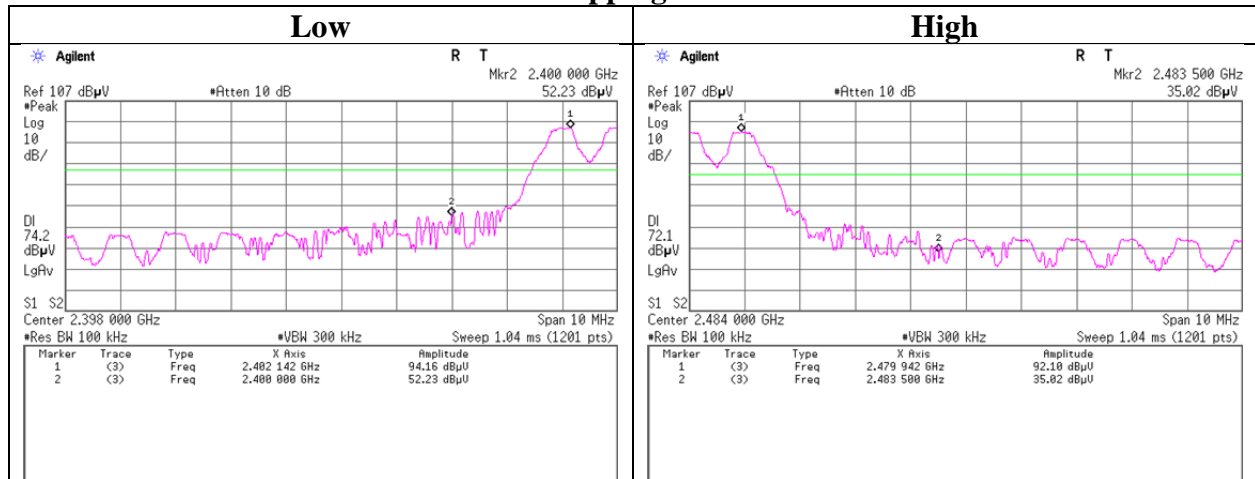
2480 MHz



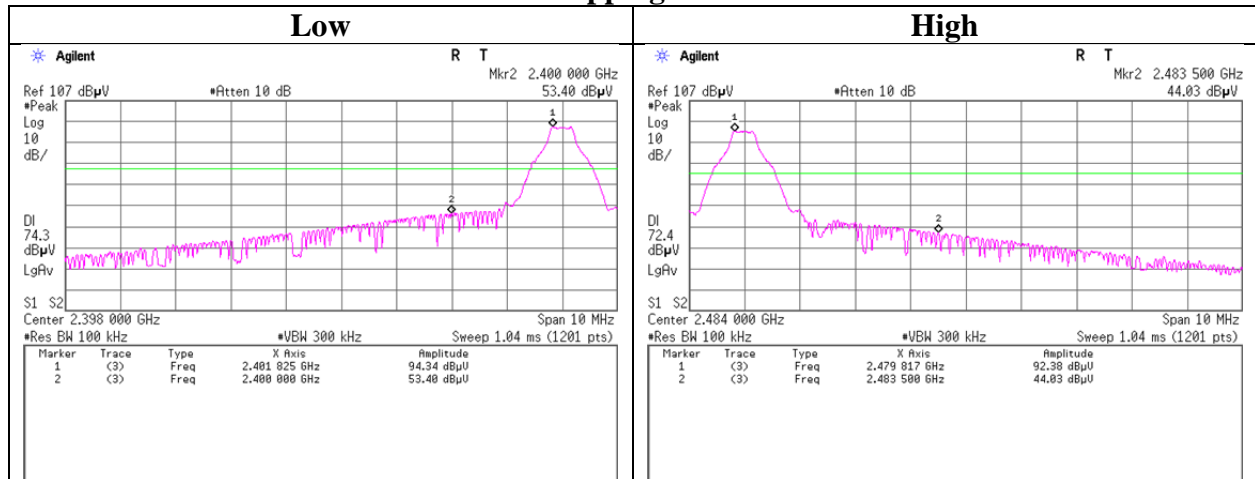
Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx DH5

Hopping On



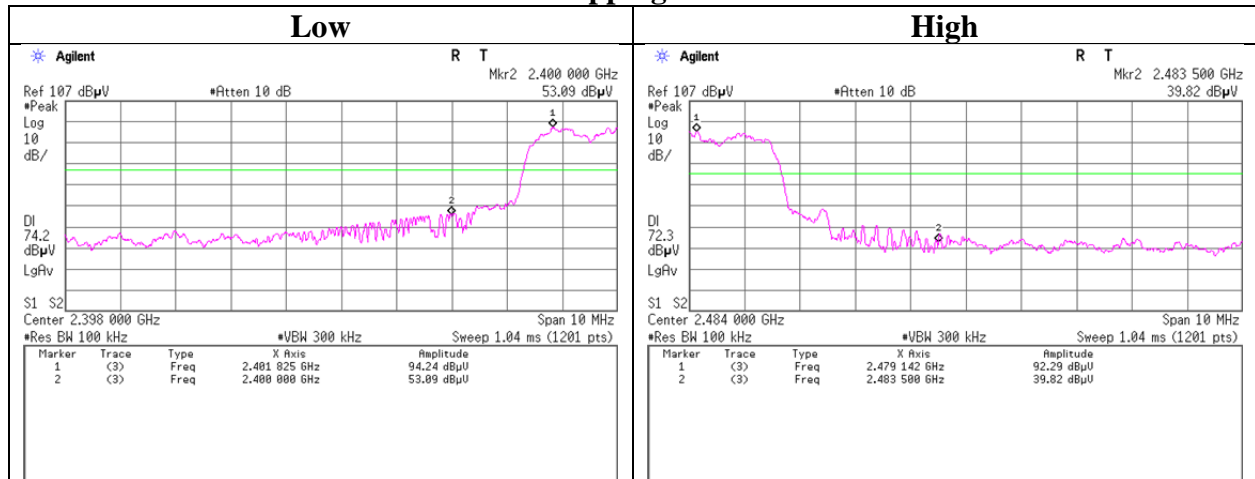
Hopping Off



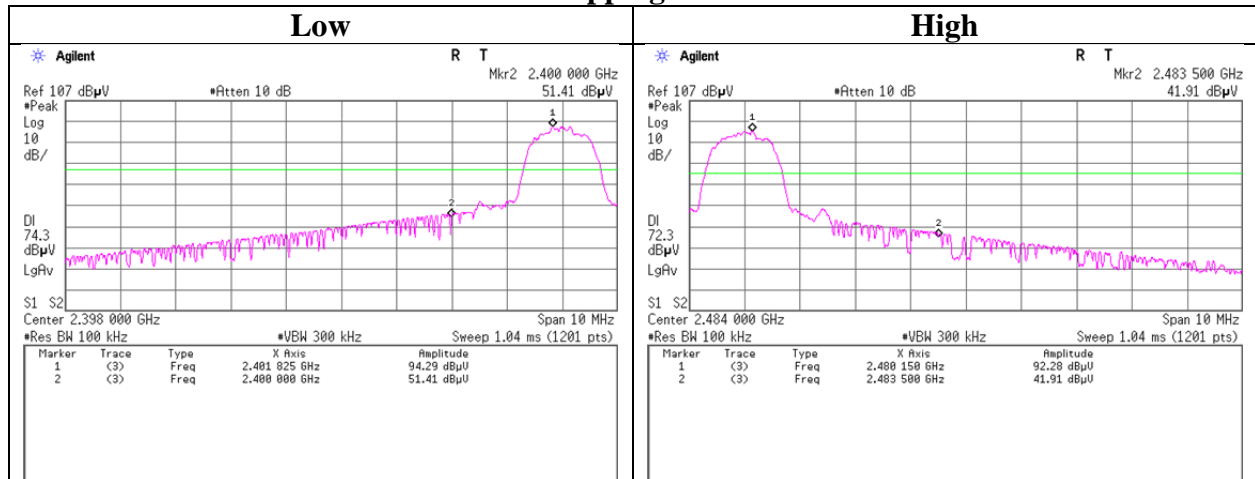
Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx 3DH5

Hopping On



Hopping Off

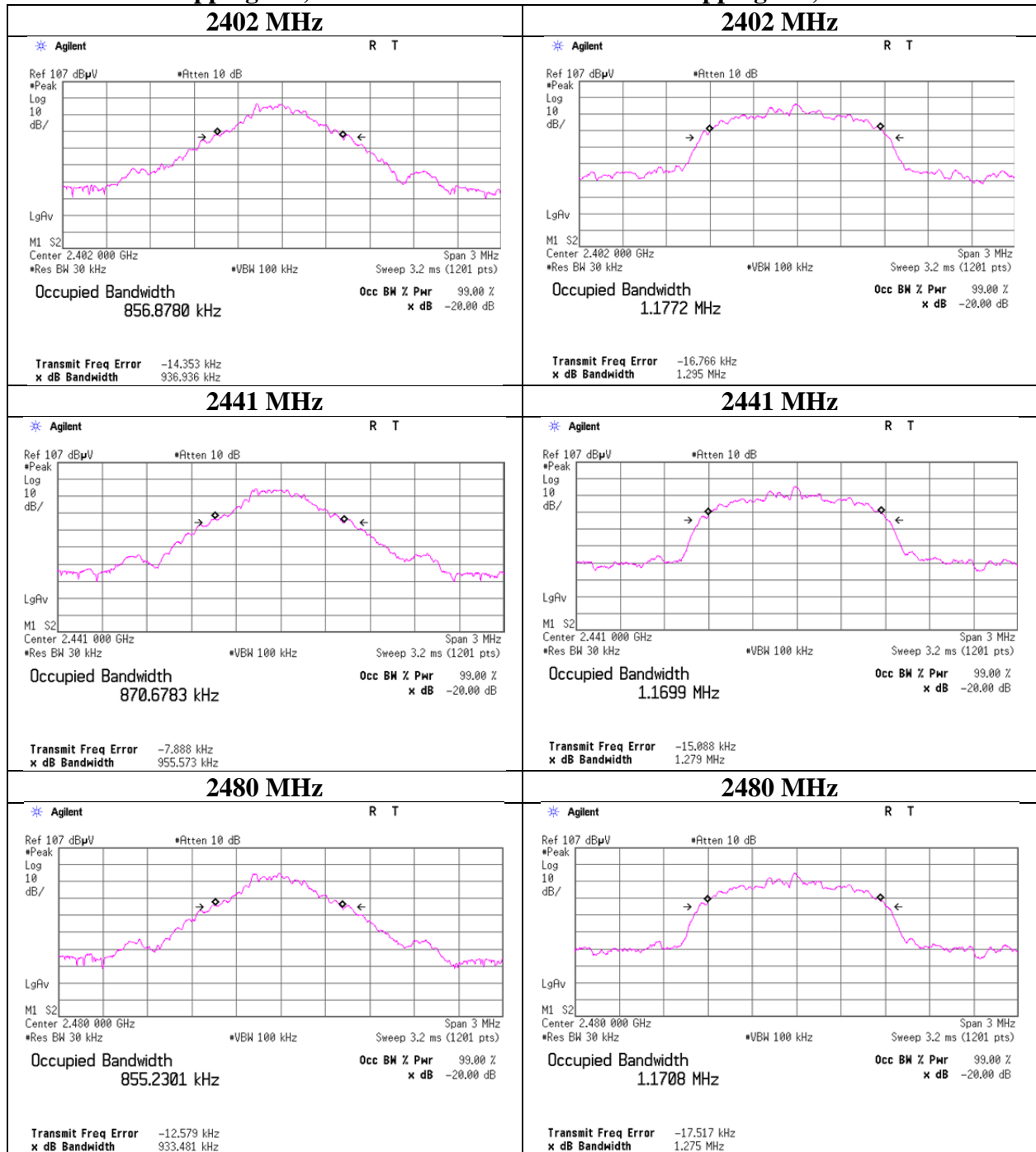


99%Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx Hopping Off

Hopping Off, DH5

Hopping Off, 3DH5



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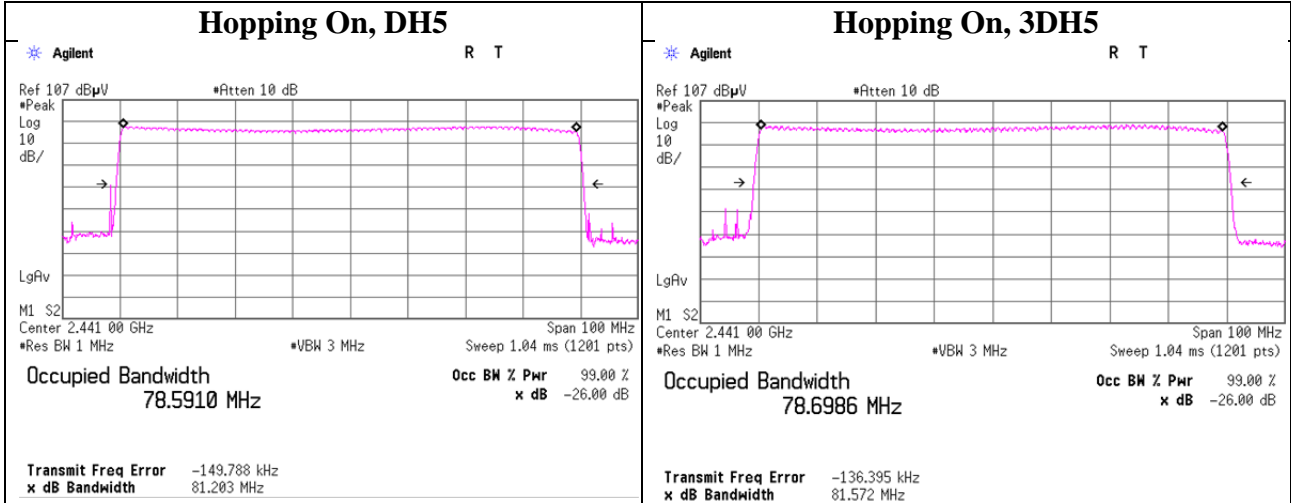
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

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99% Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11157080H
Date	March 2, 2016
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx Hopping On



*Refer to 20dB Bandwidth for 99% Bandwidth inquiry mode.

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APPENDIX 2: Test instruments

Test equipment (1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2015/10/02 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE/CE	-
MMM-10	DIGITAL HiTESTER	Hioki	3805	51201148	RE/CE	2016/01/18 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE/CE	2016/01/21 * 12
MTR-10	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	RE/CE	2016/01/29 * 12
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/01 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2015/11/12 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2015/11/02 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2015/06/22 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2015/05/21 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2015/06/19 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2015/06/06 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2015/05/18 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2015/08/10 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MLA-23	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-192	RE	2016/01/30 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	51201197	RE	2016/01/13 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2016/01/21 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2015/03/19 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	650	RE	2015/10/01 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2016/03/18 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2015/05/18 * 12
MAT-67	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/01/14 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SF M141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	CE	2015/07/02 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE	2015/07/10 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	CE	2015/11/06 * 12

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Test equipment (2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2015/12/08 * 12
MCC-137	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37954/2	AT	2015/10/08 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2015/03/18 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2015/10/08 * 12
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	AT	2015/10/07 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2015/10/08 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2015/11/10 * 12
MCC-38	Coaxial Cable	UL Japan	-	-	AT	2015/12/07 * 12
MMM-17	DIGITAL HiTESTER	Hioki	3805	070900530	AT	2016/01/13 * 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