



RADIO TEST REPORT

Test Report No. : 12608632H-B-R1

Applicant : MITSUBISHI ELECTRIC CORPORATION
SANDA WORKS

Type of Equipment : Display Audio

Model No. : R1 LOW

FCC ID : UJHR1LOW

Test regulation : FCC Part 15 Subpart C: 2018
* Bluetooth part

Test Result : Complied (Refer to Section 3.2)

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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 covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. 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.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 12608632H-B. 12608632H-B is replaced with this report.

Date of test: March 19 to April 4, 2019

Representative test engineer:

Hiroyuki Furutaka
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Consumer Technology Division

Approved by:

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Leader
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NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
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REVISION HISTORY

Original Test Report No.: 12608632H-B

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SECTION 1: Customer information

Company Name	:	MITSUBISHI ELECTRIC CORPORATION SANDA WORKS
Address	:	2-3-33, Miwa, Sanda-city, Hyogo, 669-1513, Japan
Telephone Number	:	+81-79-559-3952
Facsimile Number	:	+81-79-559-3875
Contact Person	:	Hiroataka Minato

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No., FCC ID on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

2.1 Identification of E.U.T.

Type of Equipment	:	Display Audio
Model No.	:	R1 LOW
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12.0 V
Receipt Date of Sample (Information from test lab.)	:	February 4, 2018
Country of Mass-production	:	Mexico, China, Thailand, Japan
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab

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2.2 Product Description

Model: R1 LOW (referred to as the EUT in this report) is a Display Audio.

Radio Specification

Wireless LAN (IEEE802.11b/g/a/n-20/n-40/11ac-20/11ac-40/11ac-80)

Type of radio	IEEE802.11b	IEEE802.11g/n (20 M band)	IEEE802.11a/n/ac (20 M band)	IEEE802.11n/ac (40 M band)	IEEE802.11ac (80 M band)
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5700 MHz 5745 MHz - 5825 MHz	5190 MHz - 5230 MHz 5270 MHz - 5310 MHz 5510 MHz - 5670 MHz 5755 MHz - 5795 MHz	5210 MHz 5290 MHz 5530 MHz, 5610 MHz 5775 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM(IEEE802.11ac only))		
Channel spacing	5 MHz		20 MHz	40 MHz	80 MHz
Antenna type	Sheet metal antenna				
Antenna Gain	Antenna 0: 2.4 GHz: 1.61 dBi / 5 GHz: 3.54 dBi Antenna 1: 2.4 GHz: 3.01 dBi / 5 GHz: 1.68 dBi				
Directional Antenna Gain*2)	2.4 GHz: 5.35 dBi 5 GHz: 5.67 dBi				

Bluetooth

Type of radio	Bluetooth *1)
Frequency of operation	2402 MHz - 2480 MHz
Type of modulation	BT: FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK) LE: GFSK
Channel spacing	BT: 1 MHz LE: 2 MHz
Antenna type	Sheet metal antenna
Antenna Gain	1.61 dBi

*1) This test report applies to Bluetooth.

*2) Directional Antenna Gain = $10\log\left(\left(10^{\frac{G_{Anto}}{20}} + 10^{\frac{G_{Ant1}}{20}}\right)^2 / 2\right)$

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

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	Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ----- IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	-	N/A *1)	-
Carrier Frequency Separation	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: -	FCC: Section 15.247(a)(1) ----- IC: RSS-247 5.1 (b)	See data.	Complied a)	Conducted
20dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: -	FCC: Section 15.247(a)(1) ----- IC: RSS-247 5.1 (a)		Complied a)	Conducted
Number of Hopping Frequency	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: -	FCC: Section 15.247(a)(1)(iii) ----- IC: RSS-247 5.1 (d)		Complied b)	Conducted
Dwell time	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: -	FCC: Section 15.247(a)(1)(iii) ----- IC: RSS-247 5.1 (d)		Complied c)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: RSS-Gen 6.12	FCC: Section 15.247(a)(b)(1) ----- IC: RSS-247 5.4 (b)		Complied d)	Conducted
Spurious Emission & Band Edge Compliance	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: RSS-Gen 6.13	FCC: Section 15.247(d) ----- IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	12.7 dB 143.512 MHz, QP, Vert.	Complied e) / f)	Conducted/ Radiated (above 30 MHz) *1)

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

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

*2) Radiated test was selected over 30 MHz based on section 15.247(d).

a) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)

b) Refer to APPENDIX 1 (data of Number of Hopping Frequency)

c) Refer to APPENDIX 1 (data of Dwell time)

d) Refer to APPENDIX 1 (data of Maximum Peak Output Power)

e) Refer to APPENDIX 1 (data of Conducted Spurious Emission)

f) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

Supplied Voltage Information

This EUT provides stable voltage constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

Antenna Information

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	RSS-Gen 6.7	IC: -	N/A	- a)	Conducted
a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)					

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

3.4 Uncertainty

EMI

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

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

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %
Maximum Peak Output Power / Average Output Power	1.3 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.7 dB

Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		4.9 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
		5.0 dB
3 m	1 GHz to 6 GHz	5.0 dB
	6 GHz to 18 GHz	5.3 dB
1 m	10 GHz to 26.5 GHz	5.8 dB
	26.5 GHz to 40 GHz	5.8 dB
10 m	1 GHz to 18 GHz	5.2 dB

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3.5 Test Location

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NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

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	3.1 x 5.0	-	-
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, 3DH	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH	-
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)</p> <p>*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.</p> <p>* 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: Same as Production model Software: BTM.RM.2.4.1-00019-QCABTFMSWPZ-1</p> <p>*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> <p>* Transmit simultaneously mode was performed with WLAN part. Test data refer to test report No. 12608632H-A and 12608632H-C.</p>		

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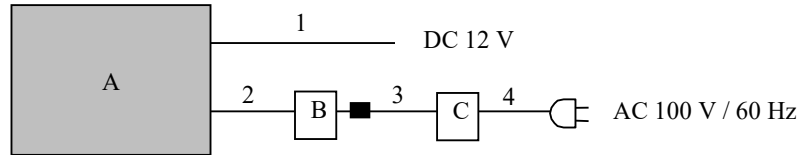
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4.2 Configuration and peripherals

For Antenna Terminal Conducted Tests



■ : Standard Ferrite Core

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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Display Audio	R1 LOW	PV1-UNIT-027 *1) PV1-UNIT-042 *2)	MITSUBISHI ELECTRIC CORPORATION SANDA WORKS	EUT
B	Laptop PC	CF-N8HWCDPS	OBKSA08704	Panasonic	-
C	AC Adaptor	CF-AA6372B	6372BM409907232B	Panasonic	-

*1) Used for Antenna Terminal conducted test

*2) Used for Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.9	Unshielded	Unshielded	-
2	USB Cable	1.0	Shielded	Shielded	-
3	DC Cable	0.8	Unshielded	Unshielded	-
4	AC Cable	1.0	Unshielded	Unshielded	-

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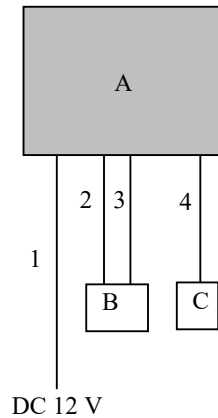
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For Radiated Spurious Emission



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Display Audio	R1 LOW	PV1-UNIT-042	MITSUBISHI ELECTRIC CORPORATION SANDA WORKS	EUT
B	Jig	-	-	-	-
C	GNSS Antenna	BY-GPS-03	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.0	Unshielded	Unshielded	-
2	USB Cable	0.9	Shielded	Shielded	-
3	Signal Cable	2.0	Unshielded	Unshielded	-
4	GNSS Cable	5.0	Unshielded	Unshielded	-

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SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]

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

[For above 1 GHz]

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

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

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

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

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

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

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

Test Antennas are used as below;

Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer *a)		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz

*1) Average Power Measurement was performed based on KDB 558074 D01 15.247 Meas Guidance v05r02.

*a) The Spectrum Analyzer was used in 3 dB resolution bandwidth.

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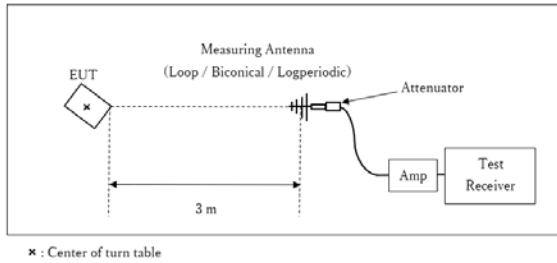
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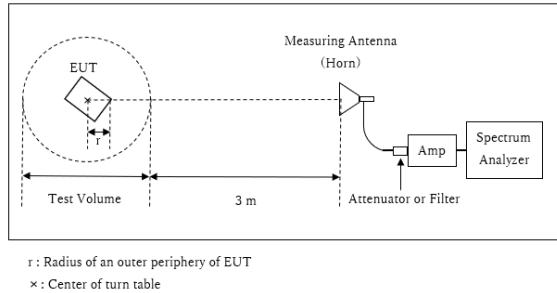
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz - 10 GHz



Distance Factor: $20 \times \log (3.65 \text{ m} / 3.0 \text{ m}) = 1.71 \text{ dB}$

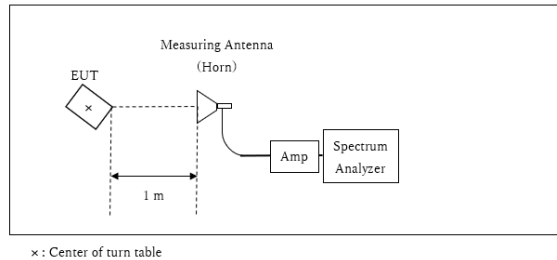
* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.65 \text{ m}$

Test Volume : 1.5 m

(Test Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.1 \text{ m}$

10 GHz - 26.5 GHz



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

*Test Distance: 1 m

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

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SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	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	200 kHz	620 kHz	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 *3)	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) Reference data

*3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.

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

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

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

Test data : APPENDIX

Test result : Pass

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APPENDIX 1: Test data

20 dB Bandwidth, 99 % Occupied Bandwidth and Carrier Frequency Separation

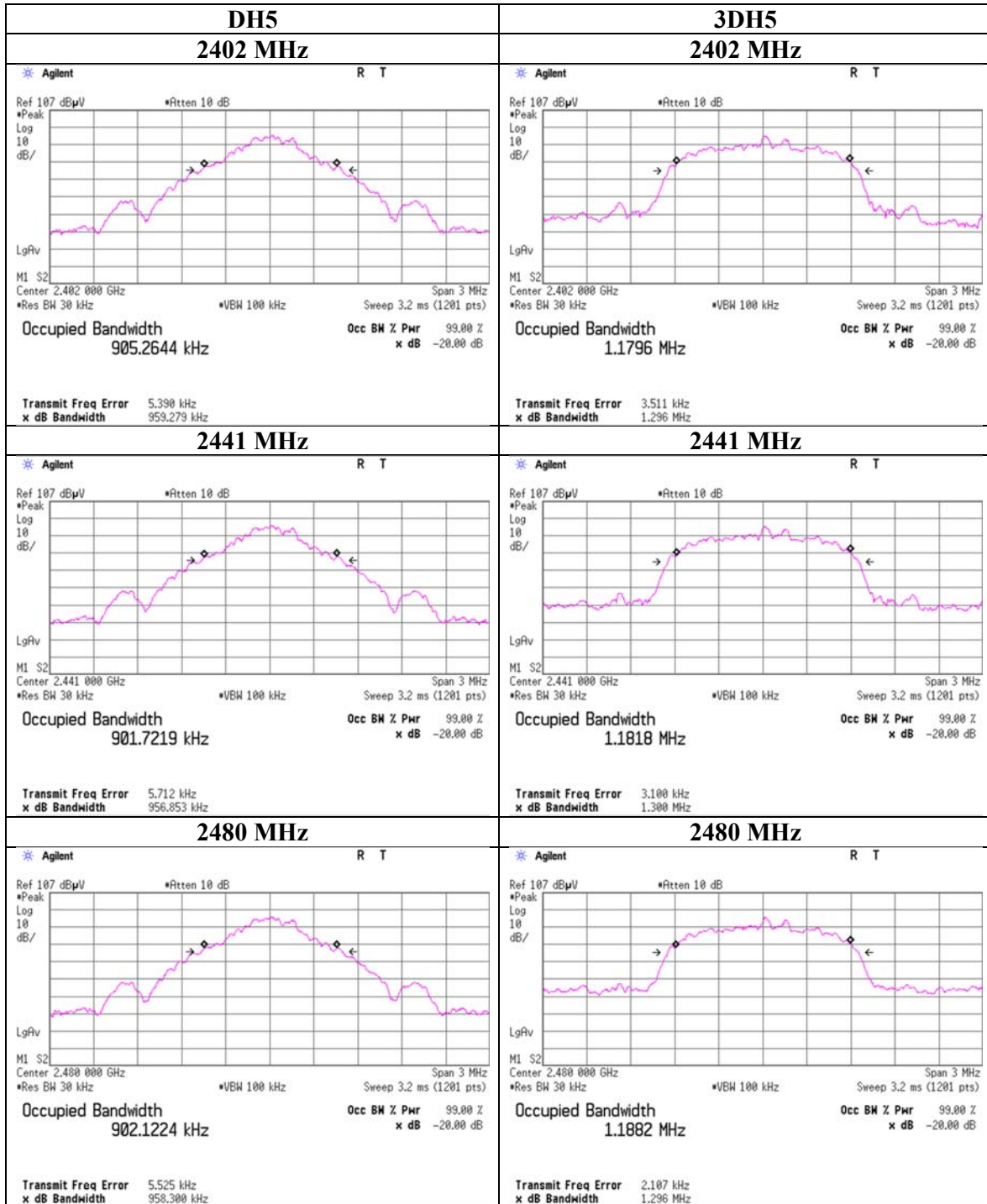
Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx, Hopping Off, Tx, Hopping On

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.959	905.264	1.000	≥ 0.640
DH5	2441.0	0.957	901.722	1.000	≥ 0.638
DH5	2480.0	0.958	902.122	1.000	≥ 0.639
DH5	Hopping On	-	77617.400	-	-
3DH5	2402.0	1.296	1.180	1.000	≥ 0.864
3DH5	2441.0	1.300	1.182	1.000	≥ 0.867
3DH5	2480.0	1.296	1.188	1.000	≥ 0.864
3DH5	Hopping On	-	78720.000	-	-

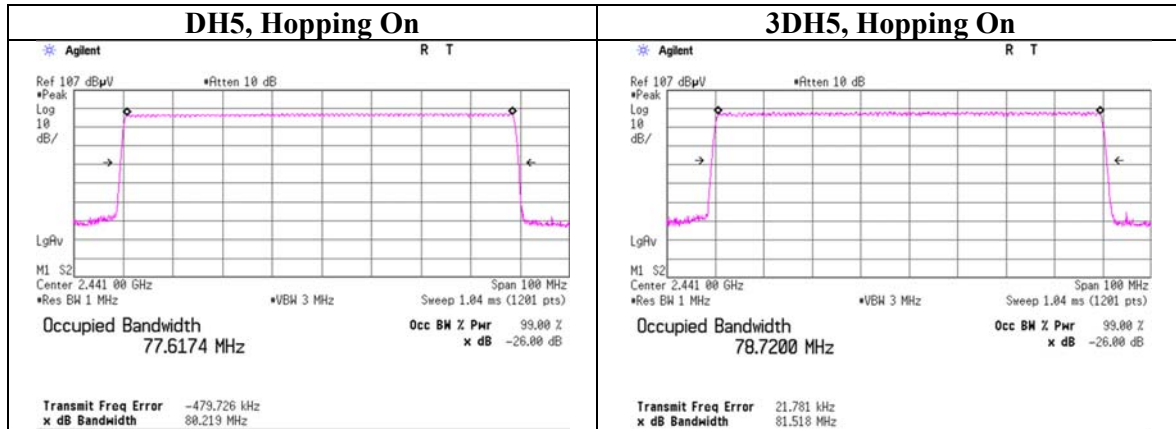
Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

20 dB Bandwidth and 99 % Occupied Bandwidth



20 dB Bandwidth and 99 % Occupied Bandwidth



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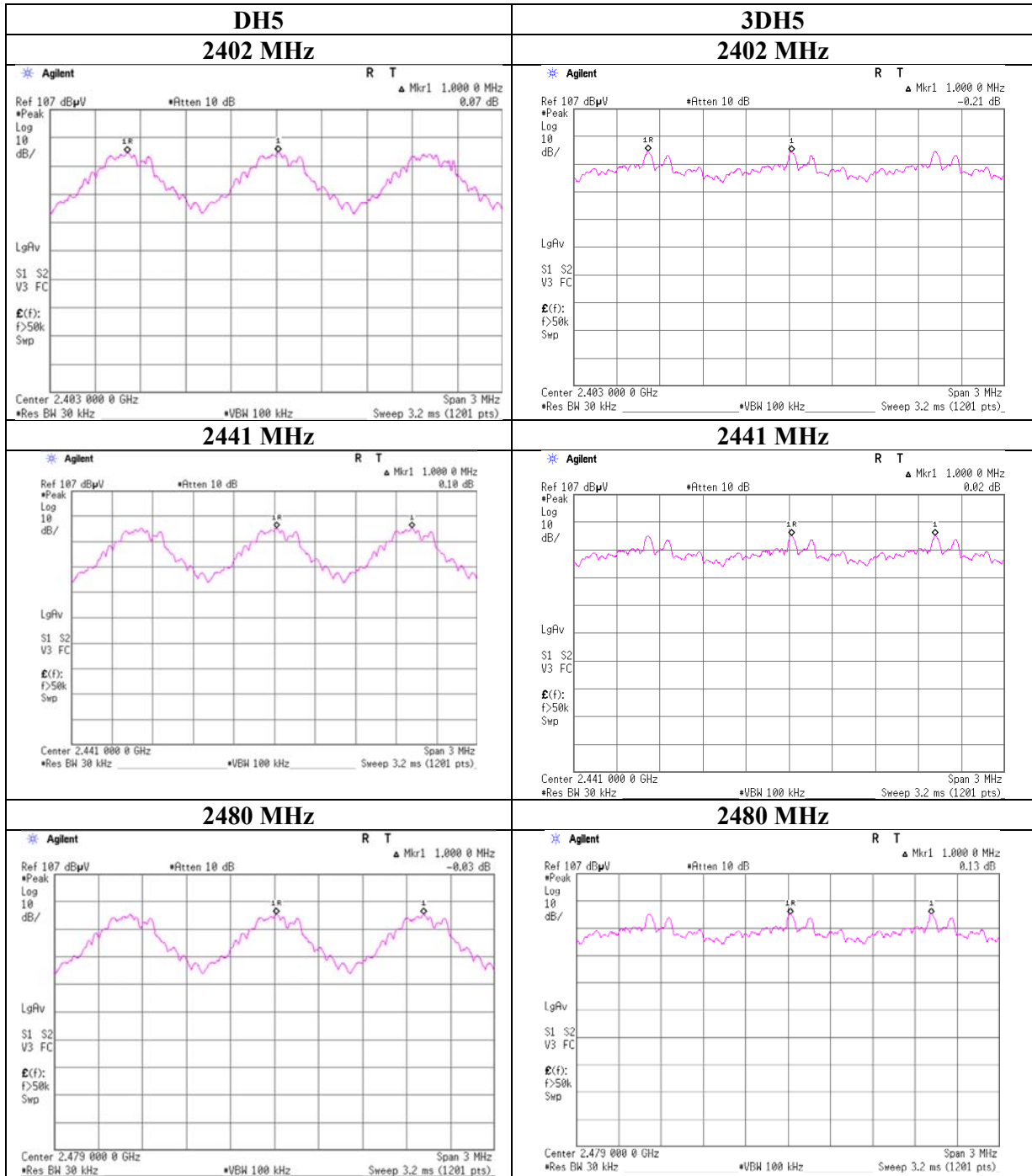
Ise EMC Lab.

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Facsimile : +81 596 24 8124

Carrier Frequency Separation



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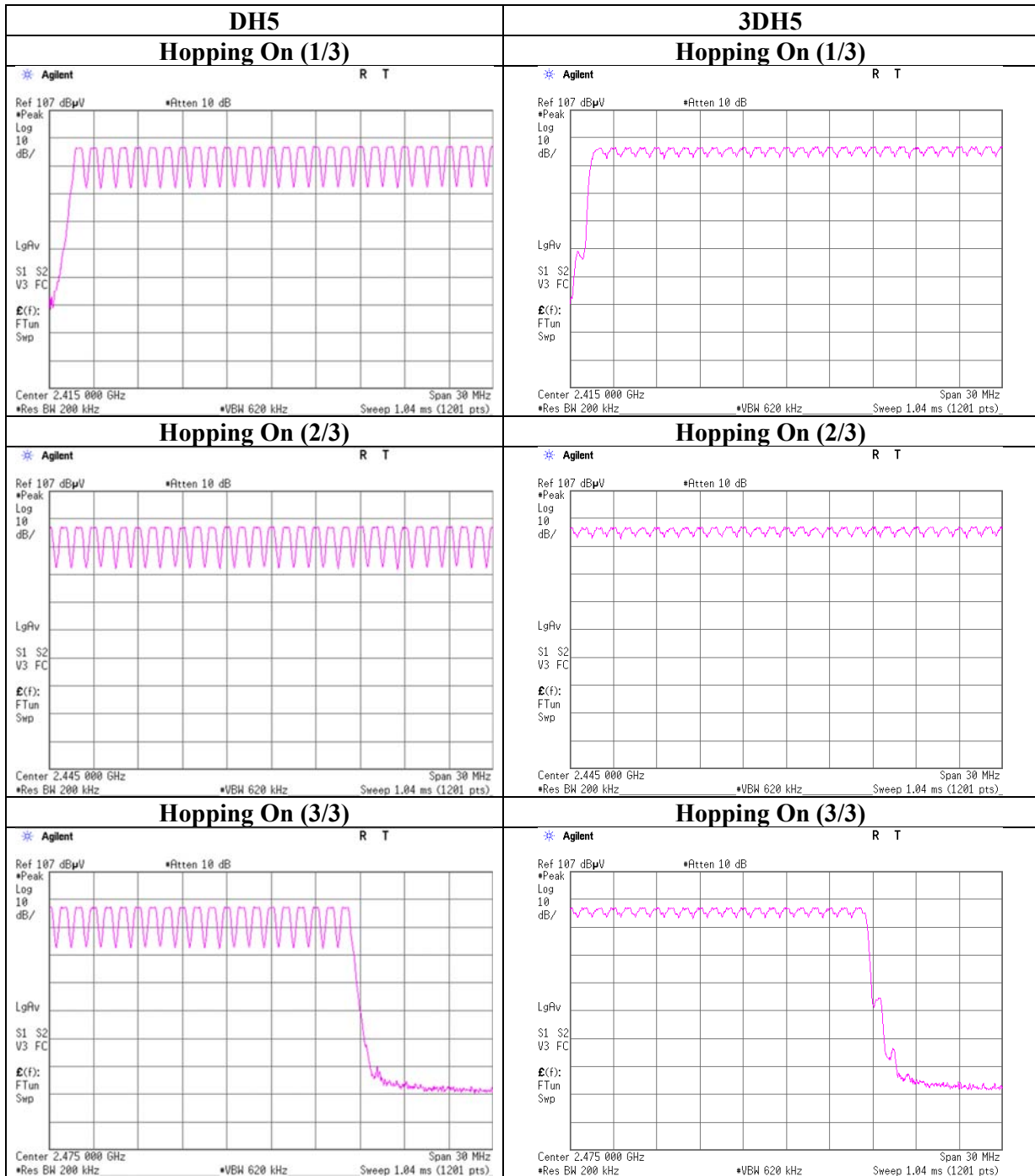
Number of Hopping Frequency

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx, Hopping On

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

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

Number of Hopping Frequency



Dwell time

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx, Hopping On

Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period				Length of transmission [msec]	Result [msec]	Limit [msec]
DH1	49.6 times	/	5 sec.	x 31.6 sec. = 314 times	0.402	126	400
DH3	24.8 times	/	5 sec.	x 31.6 sec. = 157 times	1.669	262	400
DH5	20.2 times	/	5 sec.	x 31.6 sec. = 128 times	2.927	375	400
3DH1	49.2 times	/	5 sec.	x 31.6 sec. = 311 times	0.406	126	400
3DH3	25.8 times	/	5 sec.	x 31.6 sec. = 164 times	1.675	275	400
3DH5	16.4 times	/	5 sec.	x 31.6 sec. = 104 times	2.920	304	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

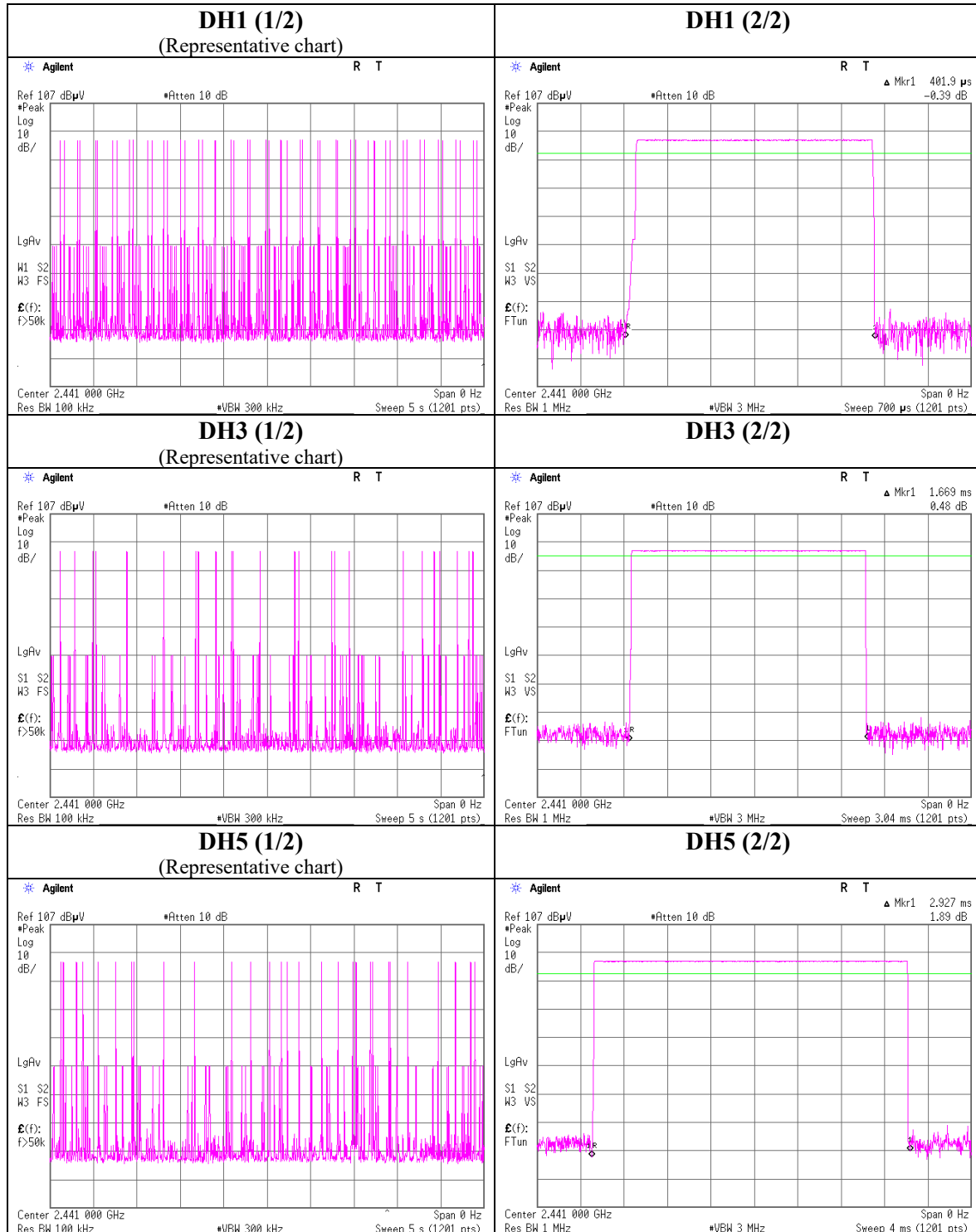
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	49	49	50	50	50	49.6
DH3	24	25	26	20	29	24.8
DH5	16	15	23	23	24	20.2
3DH1	48	51	49	49	49	49.2
3DH3	26	23	28	27	25	25.8
3DH5	14	13	19	19	17	16.4

Sample Calculation

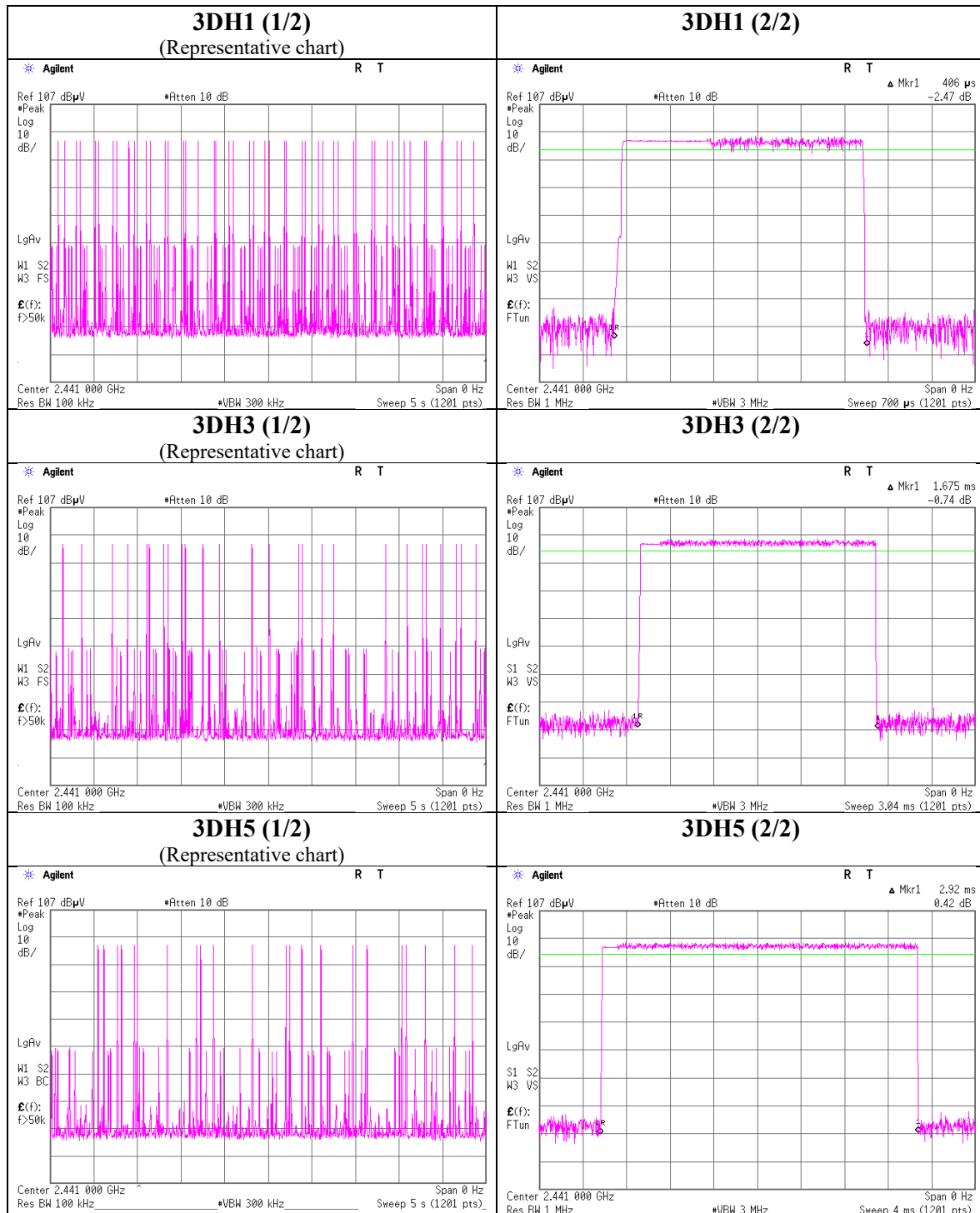
Average = Summation (Sampling 1 to 5) / 5

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



Dwell time



Maximum Peak Output Power

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 19, 2019
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Yuichiro Yamazaki
Mode Tx, Hopping Off

					Conducted Power					e.i.r.p. for RSS-247					
Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-12.49	1.00	10.10	-1.39	0.73	20.96	125	22.35	1.61	0.22	1.05	36.02	4000	35.80
DH5	2441.0	-11.97	1.00	10.10	-0.87	0.82	20.96	125	21.83	1.61	0.74	1.19	36.02	4000	35.28
DH5	2480.0	-12.05	1.00	10.10	-0.95	0.80	20.96	125	21.91	1.61	0.66	1.16	36.02	4000	35.36
2DH5	2402.0	-10.95	1.00	10.10	0.15	1.04	20.96	125	20.81	1.61	1.76	1.50	36.02	4000	34.26
2DH5	2441.0	-10.52	1.00	10.10	0.58	1.14	20.96	125	20.38	1.61	2.19	1.66	36.02	4000	33.83
2DH5	2480.0	-10.72	1.00	10.10	0.38	1.09	20.96	125	20.58	1.61	1.99	1.58	36.02	4000	34.03
3DH5	2402.0	-10.52	1.00	10.10	0.58	1.14	20.96	125	20.38	1.61	2.19	1.66	36.02	4000	33.83
3DH5	2441.0	-10.26	1.00	10.10	0.84	1.21	20.96	125	20.12	1.61	2.45	1.76	36.02	4000	33.57
3DH5	2480.0	-10.47	1.00	10.10	0.63	1.16	20.96	125	20.33	1.61	2.24	1.67	36.02	4000	33.78

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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)

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 19, 2019
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Yuichiro Yamazaki
Mode Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
					[dBm]	[mW]		[dBm]	[mW]
DH5	2402.0	-14.31	1.00	10.10	-3.21	0.48	1.11	-2.10	0.62
DH5	2441.0	-13.73	1.00	10.10	-2.63	0.55	1.11	-1.52	0.70
DH5	2480.0	-13.78	1.00	10.10	-2.68	0.54	1.11	-1.57	0.70
2DH5	2402.0	-14.85	1.00	10.10	-3.75	0.42	1.11	-2.64	0.54
2DH5	2441.0	-14.31	1.00	10.10	-3.21	0.48	1.11	-2.10	0.62
2DH5	2480.0	-14.35	1.00	10.10	-3.25	0.47	1.11	-2.14	0.61
3DH5	2402.0	-14.94	1.00	10.10	-3.84	0.41	1.10	-2.74	0.53
3DH5	2441.0	-14.41	1.00	10.10	-3.31	0.47	1.10	-2.21	0.60
3DH5	2480.0	-14.38	1.00	10.10	-3.28	0.47	1.10	-2.18	0.61

Sample Calculation:

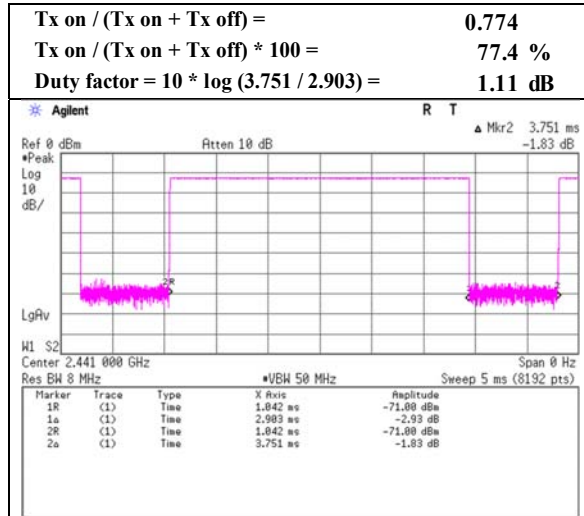
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

Result (Burst power average) = Time average + Duty factor

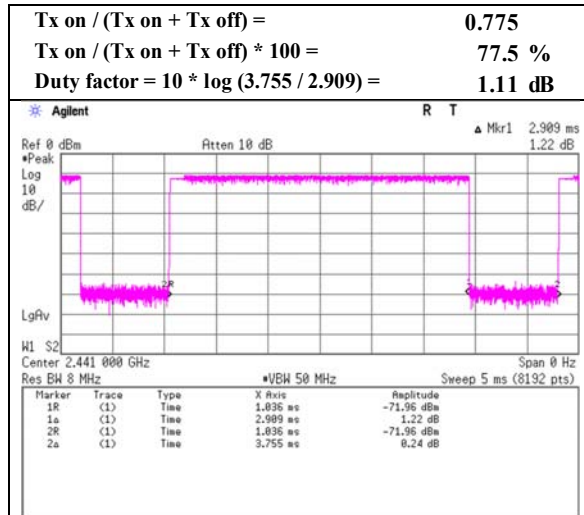
Burst Rate Confirmation

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 19, 2019
Temperature / Humidity 23 deg. C / 35 % RH
Engineer Yuichiro Yamazaki
Mode Tx, Hopping Off

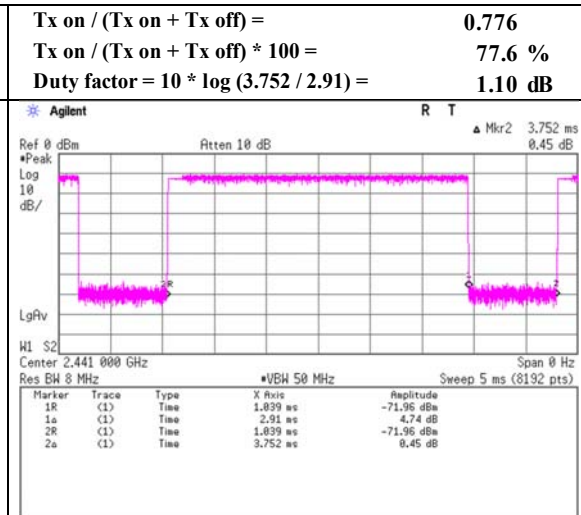
DH5



2DH5



3DH5



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Ise EMC Lab.

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Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 12608632H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2 No.2
Date March 26, 2019 March 26, 2019 April 4, 2019
Temperature / Humidity 21 deg. C / 35 % RH 21 deg. C / 35 % RH 22 deg. C / 29 % RH
Engineer Yuichiro Yamazaki Yuta Moriya Takafumi Noguchi
(1 GHz -10 GHz) (10 GHz - 26.5 GHz) (30 MHz - 1 GHz)
Mode Tx, Hopping Off, DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	120.012	QP	30.1	12.9	7.6	30.2	-	20.5	43.5	23.0	
Hori.	124.711	QP	33.3	13.3	7.6	30.1	-	24.1	43.5	19.4	
Hori.	129.413	QP	29.1	13.8	7.7	30.1	-	20.4	43.5	23.1	
Hori.	143.512	QP	34.3	14.5	7.8	30.0	-	26.6	43.5	16.9	
Hori.	148.321	QP	33.1	14.7	7.8	30.0	-	25.6	43.5	17.9	
Hori.	290.533	QP	32.7	13.4	8.8	29.2	-	25.7	46.0	20.3	
Hori.	2390.000	PK	43.9	27.7	4.9	34.3	-	42.2	73.9	31.7	
Hori.	4804.000	PK	42.4	31.2	7.0	33.5	-	47.2	73.9	26.8	Floor noise
Hori.	7206.000	PK	42.5	35.5	8.4	33.4	-	53.0	73.9	20.9	Floor noise
Hori.	9608.000	PK	43.1	38.4	8.9	33.8	-	56.5	73.9	17.4	Floor noise
Hori.	2390.000	AV	33.0	27.7	4.9	34.3	1.1	32.5	53.9	21.5	*1)
Hori.	4804.000	AV	31.9	31.2	7.0	33.5	-	36.7	53.9	17.2	Floor noise
Hori.	7206.000	AV	32.9	35.5	8.4	33.4	-	43.3	53.9	10.6	Floor noise
Hori.	9608.000	AV	33.1	38.4	8.9	33.8	-	46.6	53.9	7.3	Floor noise
Vert.	120.013	QP	34.1	12.9	7.6	30.2	-	24.5	43.5	19.0	
Vert.	124.714	QP	37.1	13.3	7.6	30.1	-	27.9	43.5	15.6	
Vert.	131.733	QP	35.3	14.0	7.7	30.1	-	26.9	43.5	16.6	
Vert.	143.524	QP	38.3	14.5	7.8	30.0	-	30.6	43.5	12.9	
Vert.	148.231	QP	36.1	14.7	7.8	30.0	-	28.6	43.5	14.9	
Vert.	304.518	QP	34.3	13.6	8.9	29.2	-	27.6	46.0	18.4	
Vert.	2390.000	PK	44.4	27.7	4.9	34.3	-	42.8	73.9	31.1	
Vert.	4804.000	PK	42.1	31.2	7.0	33.5	-	46.9	73.9	27.0	Floor noise
Vert.	7206.000	PK	42.8	35.5	8.4	33.4	-	53.3	73.9	20.7	Floor noise
Vert.	9608.000	PK	43.3	38.4	8.9	33.8	-	56.8	73.9	17.2	Floor noise
Vert.	2390.000	AV	33.1	27.7	4.9	34.3	1.1	32.6	53.9	21.3	*1)
Vert.	4804.000	AV	31.5	31.2	7.0	33.5	-	36.3	53.9	17.6	Floor noise
Vert.	7206.000	AV	32.8	35.5	8.4	33.4	-	43.2	53.9	10.7	Floor noise
Vert.	9608.000	AV	33.2	38.4	8.9	33.8	-	46.7	53.9	7.2	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (3.65 m / 3.0 m) = 1.71 dB

10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

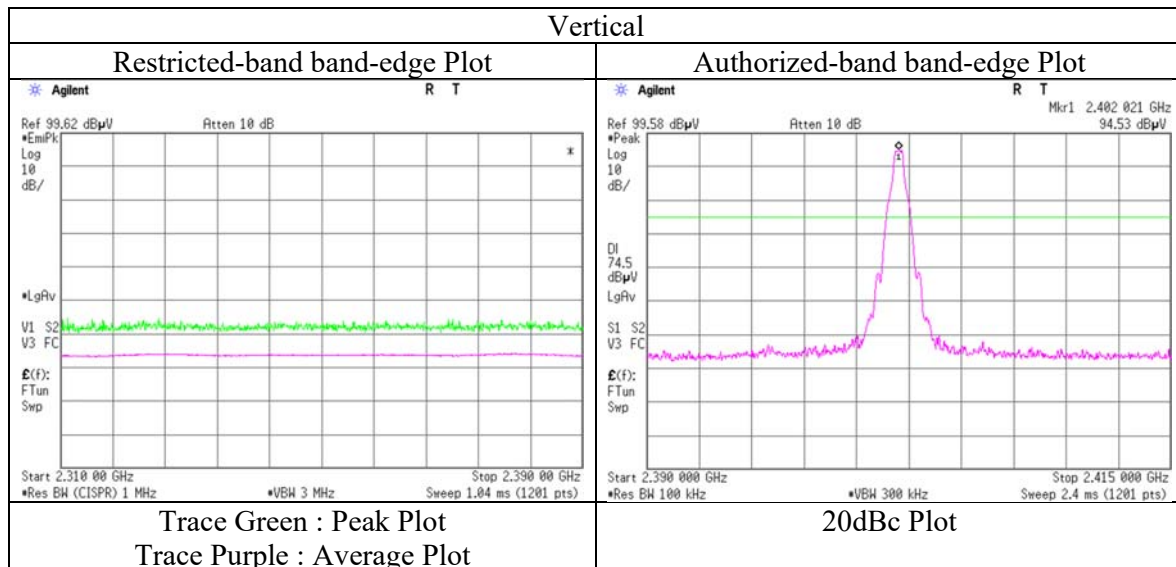
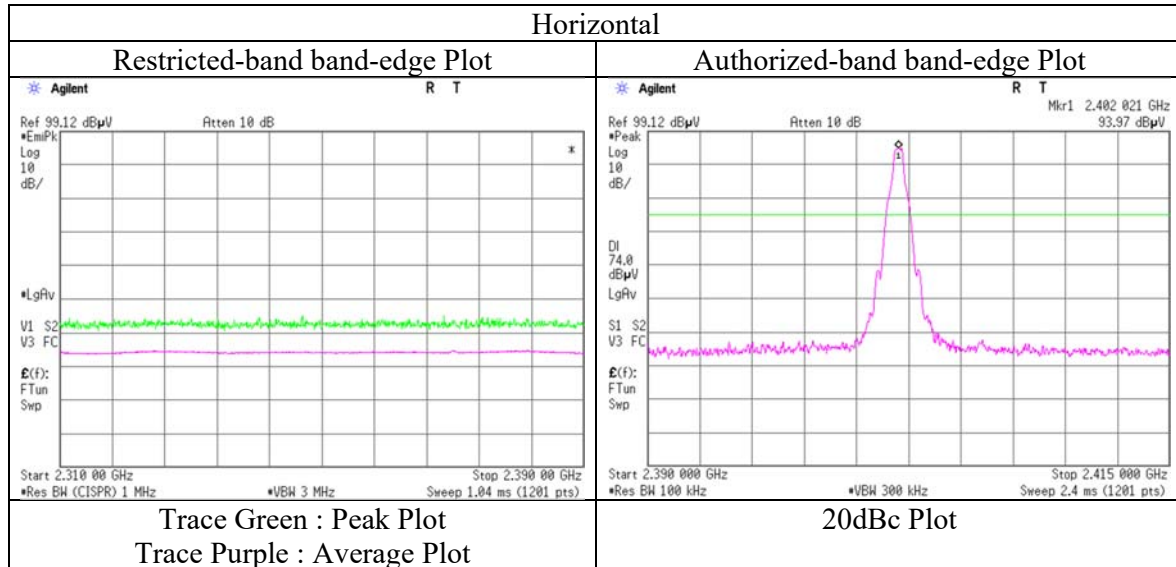
20dBc Data Sheet

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	94.0	27.7	4.9	34.3	92.4	-	-	Carrier
Hori.	2400.000	PK	36.7	27.8	4.9	34.3	35.2	72.4	37.2	
Vert.	2402.000	PK	94.5	27.7	4.9	34.3	93.0	-	-	Carrier
Vert.	2400.000	PK	40.4	27.8	4.9	34.3	38.8	73.0	34.1	

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12608632H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	March 26, 2019
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yuichiro Yamazaki
Mode	Tx, Hopping Off, DH5 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12608632H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	March 26, 2019	March 26, 2019	April 4, 2019
Temperature / Humidity	21 deg. C / 35 % RH	21 deg. C / 35 % RH	22 deg. C / 29 % RH
Engineer	Yuichiro Yamazaki	Yuta Moriya	Takafumi Noguchi
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	(30 MHz - 1 GHz)
Mode	Tx, Hopping Off, DH5 2441 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	120.006	QP	30.2	12.9	7.6	30.2	-	20.6	43.5	22.9	
Hori.	124.708	QP	33.1	13.3	7.6	30.1	-	23.9	43.5	19.6	
Hori.	129.409	QP	29.4	13.8	7.7	30.1	-	20.7	43.5	22.8	
Hori.	143.516	QP	34.1	14.5	7.8	30.0	-	26.4	43.5	17.1	
Hori.	148.331	QP	32.3	14.7	7.8	30.0	-	24.8	43.5	18.7	
Hori.	290.532	QP	32.4	13.4	8.8	29.2	-	25.4	46.0	20.6	
Hori.	4882.000	PK	41.9	31.5	7.1	33.5	-	47.0	73.9	26.9	Floor noise
Hori.	7323.000	PK	42.7	35.9	8.4	33.5	-	53.5	73.9	20.4	Floor noise
Hori.	9764.000	PK	44.2	38.6	8.9	33.8	-	57.9	73.9	16.0	Floor noise
Hori.	4882.000	AV	32.1	31.5	7.1	33.5	-	37.1	53.9	16.8	Floor noise
Hori.	7323.000	AV	32.7	35.9	8.4	33.5	-	43.5	53.9	10.4	Floor noise
Hori.	9764.000	AV	33.7	38.6	8.9	33.8	-	47.4	53.9	6.5	Floor noise
Vert.	120.011	QP	34.0	12.9	7.6	30.2	-	24.4	43.5	19.1	
Vert.	124.713	QP	37.4	13.3	7.6	30.1	-	28.2	43.5	15.3	
Vert.	131.741	QP	35.1	14.0	7.7	30.1	-	26.7	43.5	16.8	
Vert.	143.521	QP	38.0	14.5	7.8	30.0	-	30.3	43.5	13.2	
Vert.	148.233	QP	35.7	14.7	7.8	30.0	-	28.2	43.5	15.3	
Vert.	304.521	QP	33.1	13.6	8.9	29.2	-	26.4	46.0	19.6	
Vert.	4882.000	PK	41.9	31.5	7.1	33.5	-	46.9	73.9	27.0	Floor noise
Vert.	7323.000	PK	42.9	35.9	8.4	33.5	-	53.7	73.9	20.2	Floor noise
Vert.	9764.000	PK	44.2	38.6	8.9	33.8	-	57.9	73.9	16.0	Floor noise
Vert.	4882.000	AV	31.8	31.5	7.1	33.5	-	36.8	53.9	17.1	Floor noise
Vert.	7323.000	AV	32.9	35.9	8.4	33.5	-	43.7	53.9	10.2	Floor noise
Vert.	9764.000	AV	33.6	38.6	8.9	33.8	-	47.2	53.9	6.7	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (3.65 m / 3.0 m) = 1.71 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	12608632H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	March 26, 2019	March 26, 2019	April 4, 2019
Temperature / Humidity	21 deg. C / 35 % RH	21 deg. C / 35 % RH	22 deg. C / 29 % RH
Engineer	Yuichiro Yamazaki	Yuta Moriya	Takafumi Noguchi
	(1 GHz -10 GHz)	(10 GHz - 26.5 GHz)	(30 MHz - 1 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	120.008	QP	30.4	12.9	7.6	30.2	-	20.8	43.5	22.7	
Hori.	124.711	QP	33.2	13.3	7.6	30.1	-	24.0	43.5	19.5	
Hori.	129.412	QP	29.3	13.8	7.7	30.1	-	20.6	43.5	22.9	
Hori.	143.513	QP	34.5	14.5	7.8	30.0	-	26.8	43.5	16.7	
Hori.	148.327	QP	32.0	14.7	7.8	30.0	-	24.5	43.5	19.0	
Hori.	290.537	QP	32.4	13.4	8.8	29.2	-	25.4	46.0	20.6	
Hori.	2483.500	PK	50.6	27.5	5.0	34.2	-	48.9	73.9	25.0	
Hori.	4960.000	PK	42.7	31.7	7.1	33.5	-	48.0	73.9	25.9	Floor noise
Hori.	7440.000	PK	43.1	36.1	8.4	33.5	-	54.0	73.9	19.9	Floor noise
Hori.	9920.000	PK	43.7	38.5	8.9	33.8	-	57.3	73.9	16.6	Floor noise
Hori.	2483.500	AV	36.8	27.5	5.0	34.2	1.1	36.2	53.9	17.7	*1)
Hori.	4960.000	AV	32.1	31.7	7.1	33.5	-	37.4	53.9	16.6	Floor noise
Hori.	7440.000	AV	32.5	36.1	8.4	33.5	-	43.4	53.9	10.5	Floor noise
Hori.	9920.000	AV	33.6	38.5	8.9	33.8	-	47.2	53.9	6.7	Floor noise
Vert.	120.013	QP	34.1	12.9	7.6	30.2	-	24.5	43.5	19.0	
Vert.	124.721	QP	37.1	13.3	7.6	30.1	-	27.9	43.5	15.6	
Vert.	131.735	QP	35.4	14.0	7.7	30.1	-	27.0	43.5	16.5	
Vert.	143.513	QP	38.1	14.5	7.8	30.0	-	30.4	43.5	13.1	
Vert.	148.241	QP	35.5	14.7	7.8	30.0	-	28.0	43.5	15.5	
Vert.	304.522	QP	33.3	13.6	8.9	29.2	-	26.6	46.0	19.4	
Vert.	2483.500	PK	49.3	27.5	5.0	34.2	-	47.5	73.9	26.4	
Vert.	4960.000	PK	42.7	31.7	7.1	33.5	-	48.0	73.9	25.9	Floor noise
Vert.	7440.000	PK	43.2	36.1	8.4	33.5	-	54.1	73.9	19.8	Floor noise
Vert.	9920.000	PK	44.0	38.5	8.9	33.8	-	57.6	73.9	16.4	Floor noise
Vert.	2483.500	AV	35.4	27.5	5.0	34.2	1.1	34.8	53.9	19.1	*1)
Vert.	4960.000	AV	32.0	31.7	7.1	33.5	-	37.3	53.9	16.6	Floor noise
Vert.	7440.000	AV	32.7	36.1	8.4	33.5	-	43.6	53.9	10.3	Floor noise
Vert.	9920.000	AV	33.8	38.5	8.9	33.8	-	47.4	53.9	6.5	Floor noise

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

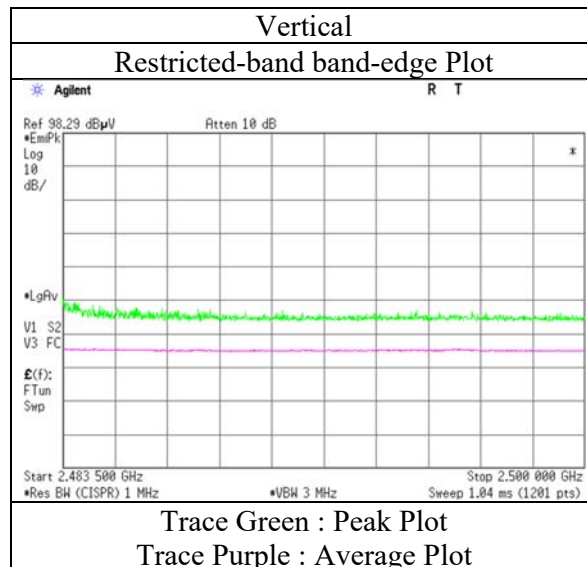
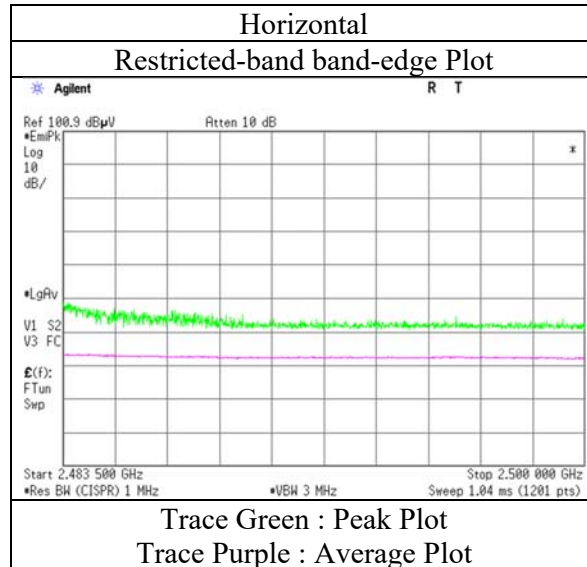
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12608632H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	March 26, 2019
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yuichiro Yamazaki
Mode	Tx, Hopping Off, DH5 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 12608632H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date March 26, 2019 April 4, 2019
Temperature / Humidity 21 deg. C / 35 % RH 22 deg. C / 29 % RH
Engineer Yuta Moriya Takafumi Noguchi
(Above 1 GHz) (30 MHz - 1 GHz)
Mode Tx, Hopping Off, 3DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	120.003	QP	30.3	12.9	7.6	30.2	-	20.7	43.5	22.8	
Hori.	124.711	QP	31.8	13.3	7.6	30.1	-	22.6	43.5	20.9	
Hori.	129.408	QP	29.1	13.8	7.7	30.1	-	20.4	43.5	23.1	
Hori.	143.532	QP	35.3	14.5	7.8	30.0	-	27.6	43.5	15.9	
Hori.	148.237	QP	30.7	14.7	7.8	30.0	-	23.2	43.5	20.3	
Hori.	290.001	QP	33.3	13.4	8.8	29.2	-	26.3	46.0	19.8	
Hori.	2390.000	PK	46.2	27.7	4.9	34.3	-	44.6	73.9	29.3	
Hori.	4804.000	PK	42.8	31.2	7.1	33.5	-	47.6	73.9	26.3	Floor noise
Hori.	7206.000	PK	43.3	35.5	8.2	33.4	-	53.6	73.9	20.3	Floor noise
Hori.	9608.000	PK	44.0	38.4	9.3	33.8	-	57.8	73.9	16.1	Floor noise
Hori.	2390.000	AV	34.2	27.7	4.9	34.3	1.1	33.7	53.9	20.3	*1)
Hori.	4804.000	AV	33.7	31.2	7.1	33.5	-	38.5	53.9	15.4	Floor noise
Hori.	7206.000	AV	33.8	35.5	8.2	33.4	-	44.0	53.9	9.9	Floor noise
Hori.	9608.000	AV	34.0	38.4	9.3	33.8	-	47.8	53.9	6.1	Floor noise
Vert.	120.003	QP	34.2	12.9	7.6	30.2	-	24.6	43.5	18.9	
Vert.	124.707	QP	37.9	13.3	7.6	30.1	-	28.7	43.5	14.8	
Vert.	131.767	QP	34.7	14.0	7.7	30.1	-	26.3	43.5	17.2	
Vert.	143.529	QP	37.8	14.5	7.8	30.0	-	30.1	43.5	13.4	
Vert.	148.234	QP	34.8	14.7	7.8	30.0	-	27.3	43.5	16.2	
Vert.	304.500	QP	31.8	13.6	8.9	29.2	-	25.1	46.0	20.9	
Vert.	2390.000	PK	44.6	27.7	4.9	34.3	-	43.0	73.9	30.9	
Vert.	4804.000	PK	42.9	31.2	7.1	33.5	-	47.7	73.9	26.2	Floor noise
Vert.	7206.000	PK	43.5	35.5	8.2	33.4	-	53.7	73.9	20.2	Floor noise
Vert.	9608.000	PK	43.5	38.4	9.3	33.8	-	57.3	73.9	16.6	Floor noise
Vert.	2390.000	AV	34.1	27.7	4.9	34.3	1.1	33.6	53.9	20.3	*1)
Vert.	4804.000	AV	33.6	31.2	7.1	33.5	-	38.4	53.9	15.5	Floor noise
Vert.	7206.000	AV	33.6	35.5	8.2	33.4	-	43.9	53.9	10.0	Floor noise
Vert.	9608.000	AV	33.7	38.4	9.3	33.8	-	47.5	53.9	6.4	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (3.65 m / 3.0 m) = 1.71 dB

10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

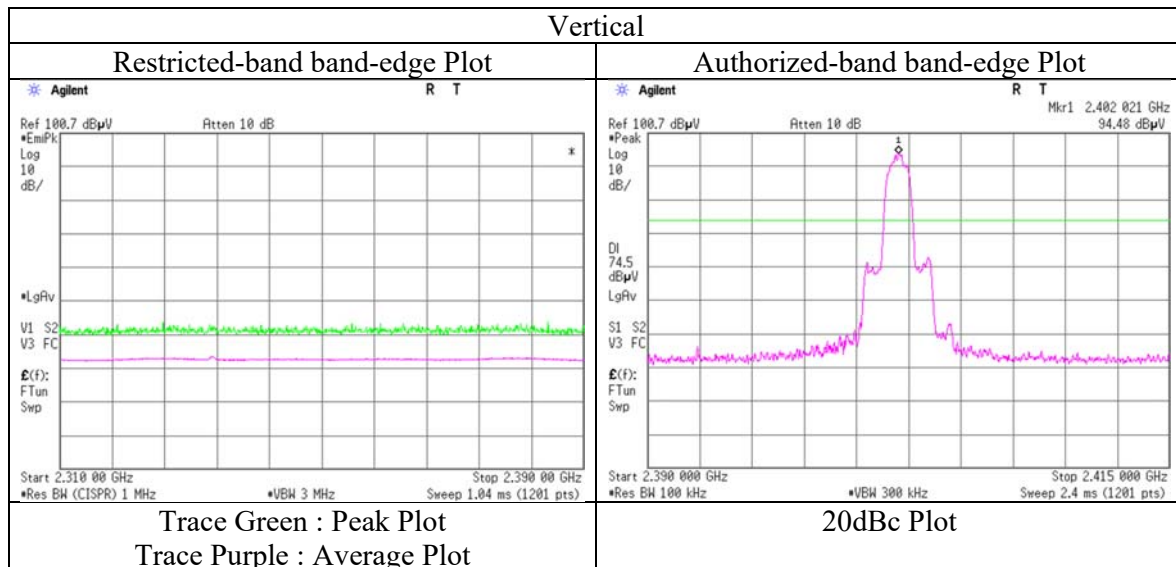
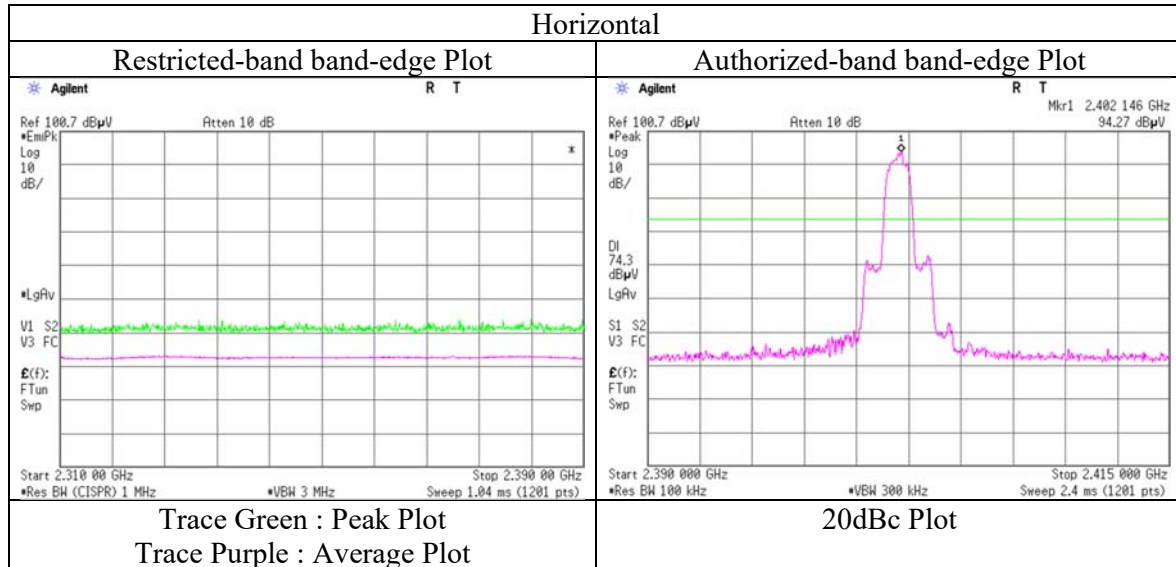
20dBc Data Sheet

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	94.3	27.7	4.9	34.3	92.7	-	-	Carrier
Hori.	2400.000	PK	41.3	27.8	4.9	34.3	39.8	72.7	32.9	
Vert.	2402.000	PK	94.5	27.7	4.9	34.3	92.9	-	-	Carrier
Vert.	2400.000	PK	41.3	27.8	4.9	34.3	39.8	72.9	33.2	

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12608632H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	March 26, 2019
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, 3DH5 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 12608632H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date March 26, 2019 No.2
Temperature / Humidity 21 deg. C / 35 % RH 22 deg. C / 29 % RH
Engineer Yuta Moriya Takafumi Noguchi
(Above 1 GHz) (30 MHz - 1 GHz)
Mode Tx, Hopping Off, 3DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	120.003	QP	30.1	12.9	7.6	30.2	-	20.5	43.5	23.0	
Hori.	124.723	QP	32.1	13.3	7.6	30.1	-	22.9	43.5	20.6	
Hori.	129.412	QP	29.3	13.8	7.7	30.1	-	20.6	43.5	22.9	
Hori.	143.521	QP	35.1	14.5	7.8	30.0	-	27.4	43.5	16.1	
Hori.	148.222	QP	30.5	14.7	7.8	30.0	-	23.0	43.5	20.5	
Hori.	290.552	QP	32.8	13.4	8.8	29.2	-	25.8	46.0	20.2	
Hori.	4882.000	PK	42.6	31.5	7.1	33.5	-	47.7	73.9	26.2	Floor noise
Hori.	7323.000	PK	43.2	35.9	8.2	33.5	-	53.8	73.9	20.1	Floor noise
Hori.	9764.000	PK	44.6	38.6	9.3	33.8	-	58.7	73.9	15.2	Floor noise
Hori.	4882.000	AV	32.7	31.5	7.1	33.5	-	37.8	53.9	16.1	Floor noise
Hori.	7323.000	AV	33.2	35.9	8.2	33.5	-	43.9	53.9	10.0	Floor noise
Hori.	9764.000	AV	33.4	38.6	9.3	33.8	-	47.5	53.9	6.4	Floor noise
Vert.	120.011	QP	33.6	12.9	7.6	30.2	-	24.0	43.5	19.5	
Vert.	124.712	QP	37.7	13.3	7.6	30.1	-	28.5	43.5	15.0	
Vert.	131.754	QP	35.1	14.0	7.7	30.1	-	26.7	43.5	16.8	
Vert.	143.521	QP	38.3	14.5	7.8	30.0	-	30.6	43.5	12.9	
Vert.	148.237	QP	35.2	14.7	7.8	30.0	-	27.7	43.5	15.8	
Vert.	304.511	QP	32.1	13.6	8.9	29.2	-	25.4	46.0	20.6	
Vert.	4882.000	PK	42.9	31.5	7.1	33.5	-	48.0	73.9	25.9	Floor noise
Vert.	7323.000	PK	43.0	35.9	8.2	33.5	-	53.7	73.9	20.2	Floor noise
Vert.	9764.000	PK	44.8	38.6	9.3	33.8	-	58.9	73.9	15.0	Floor noise
Vert.	4882.000	AV	32.8	31.5	7.1	33.5	-	37.9	53.9	16.0	Floor noise
Vert.	7323.000	AV	33.3	35.9	8.2	33.5	-	44.0	53.9	10.0	Floor noise
Vert.	9764.000	AV	33.6	38.6	9.3	33.8	-	47.7	53.9	6.2	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log(3.65 m / 3.0 m) = 1.71 dB
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 12608632H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date March 26, 2019 No.2
Temperature / Humidity 21 deg. C / 35 % RH 22 deg. C / 29 % RH
Engineer Yuta Moriya Takafumi Noguchi
(Above 1 GHz) (30 MHz - 1 GHz)
Mode Tx, Hopping Off, 3DH5 2480 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	120.012	QP	30.0	12.9	7.6	30.2	-	20.4	43.5	23.1	
Hori.	124.725	QP	32.4	13.3	7.6	30.1	-	23.2	43.5	20.3	
Hori.	129.408	QP	29.1	13.8	7.7	30.1	-	20.4	43.5	23.1	
Hori.	143.511	QP	34.8	14.5	7.8	30.0	-	27.1	43.5	16.4	
Hori.	148.321	QP	32.1	14.7	7.8	30.0	-	24.6	43.5	18.9	
Hori.	290.545	QP	32.3	13.4	8.8	29.2	-	25.3	46.0	20.7	
Hori.	2483.500	PK	51.4	27.5	5.0	34.2	-	49.7	73.9	24.2	
Hori.	4960.000	PK	42.8	31.7	7.1	33.5	-	48.1	73.9	25.8	Floor noise
Hori.	7440.000	PK	43.2	36.1	8.3	33.5	-	54.1	73.9	19.8	Floor noise
Hori.	9920.000	PK	43.2	38.5	9.4	33.8	-	57.3	73.9	16.6	Floor noise
Hori.	2483.500	AV	38.6	27.5	5.0	34.2	1.1	37.9	53.9	16.0	*1)
Hori.	4960.000	AV	33.3	31.7	7.1	33.5	-	38.6	53.9	15.3	Floor noise
Hori.	7440.000	AV	33.4	36.1	8.3	33.5	-	44.3	53.9	9.7	Floor noise
Hori.	9920.000	AV	33.7	38.5	9.4	33.8	-	47.8	53.9	6.1	Floor noise
Vert.	120.001	QP	33.9	12.9	7.6	30.2	-	24.3	43.5	19.2	
Vert.	124.723	QP	37.4	13.3	7.6	30.1	-	28.2	43.5	15.3	
Vert.	131.733	QP	35.0	14.0	7.7	30.1	-	26.6	43.5	16.9	
Vert.	143.512	QP	38.5	14.5	7.8	30.0	-	30.8	43.5	12.7	
Vert.	148.222	QP	35.8	14.7	7.8	30.0	-	28.3	43.5	15.2	
Vert.	304.542	QP	33.1	13.6	8.9	29.2	-	26.4	46.0	19.6	
Vert.	2483.500	PK	48.9	27.5	5.0	34.2	-	47.2	73.9	26.7	
Vert.	4960.000	PK	41.9	31.7	7.1	33.5	-	47.3	73.9	26.6	Floor noise
Vert.	7440.000	PK	42.7	36.1	8.3	33.5	-	53.5	73.9	20.4	Floor noise
Vert.	9920.000	PK	43.7	38.5	9.4	33.8	-	57.7	73.9	16.2	Floor noise
Vert.	2483.500	AV	36.2	27.5	5.0	34.2	1.1	35.6	53.9	18.3	*1)
Vert.	4960.000	AV	33.1	31.7	7.1	33.5	-	38.5	53.9	15.4	Floor noise
Vert.	7440.000	AV	33.6	36.1	8.3	33.5	-	44.4	53.9	9.5	Floor noise
Vert.	9920.000	AV	33.6	38.5	9.4	33.8	-	47.7	53.9	6.2	Floor noise

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

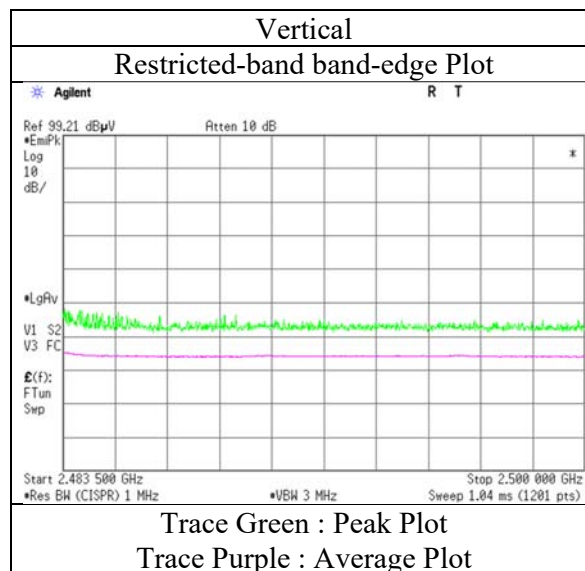
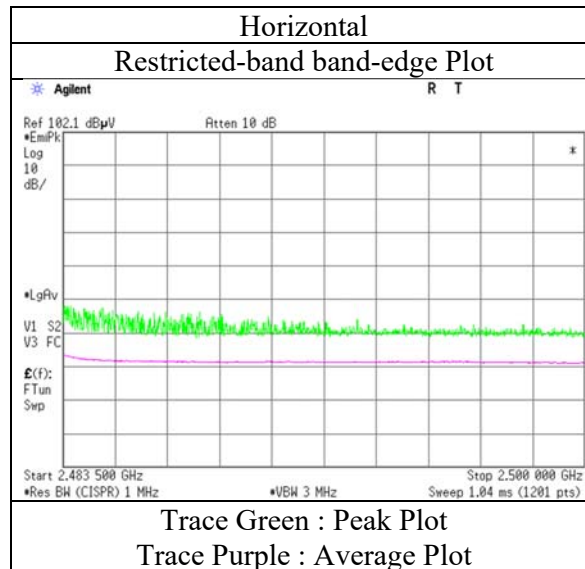
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log(3.65 m / 3.0 m) = 1.71 dB
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

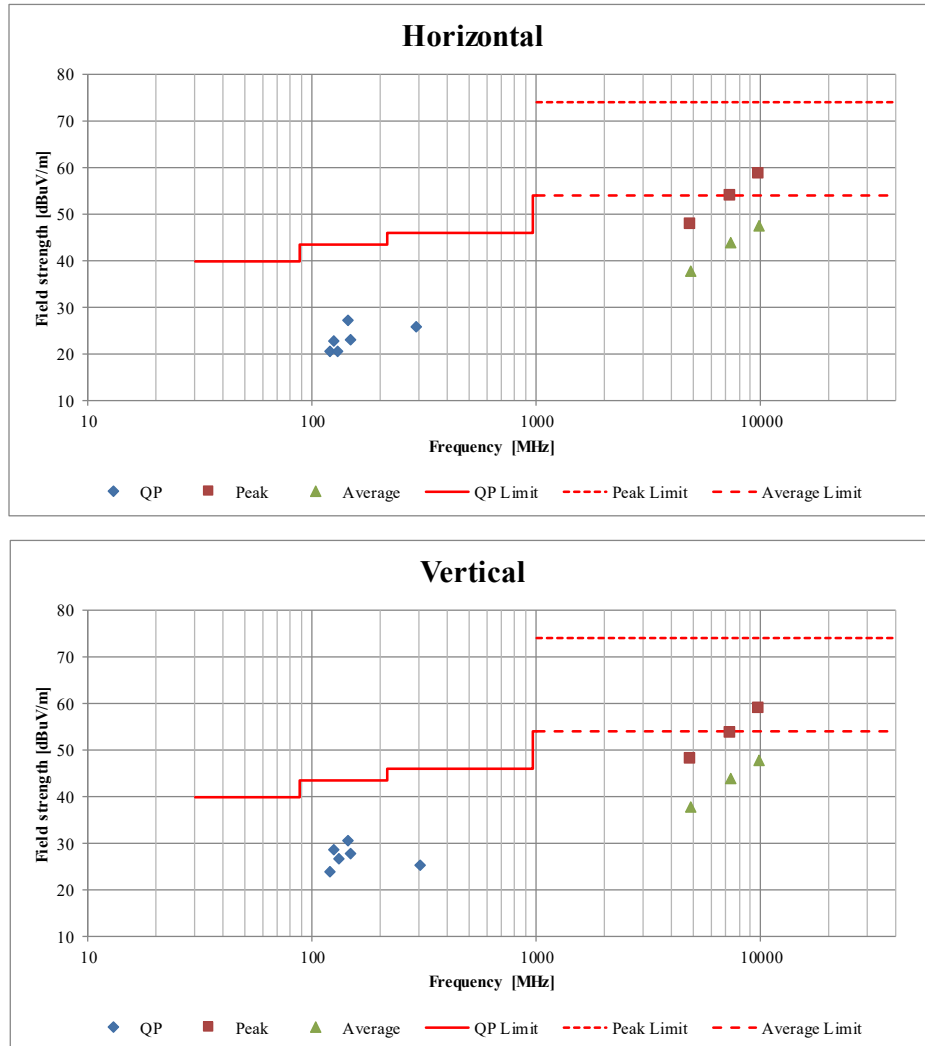
Report No.	12608632H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	March 26, 2019
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, 3DH5 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission (Plot data, Worst case)

Report No.	12608632H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	March 26, 2019	April 4, 2019
Temperature / Humidity	21 deg. C / 35 % RH	22 deg. C / 29 % RH
Engineer	Yuta Moriya (Above 1 GHz)	Takafumi Noguchi (Below 1 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz	

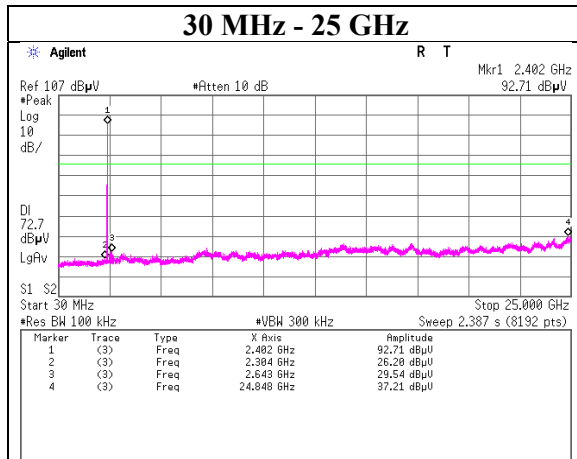
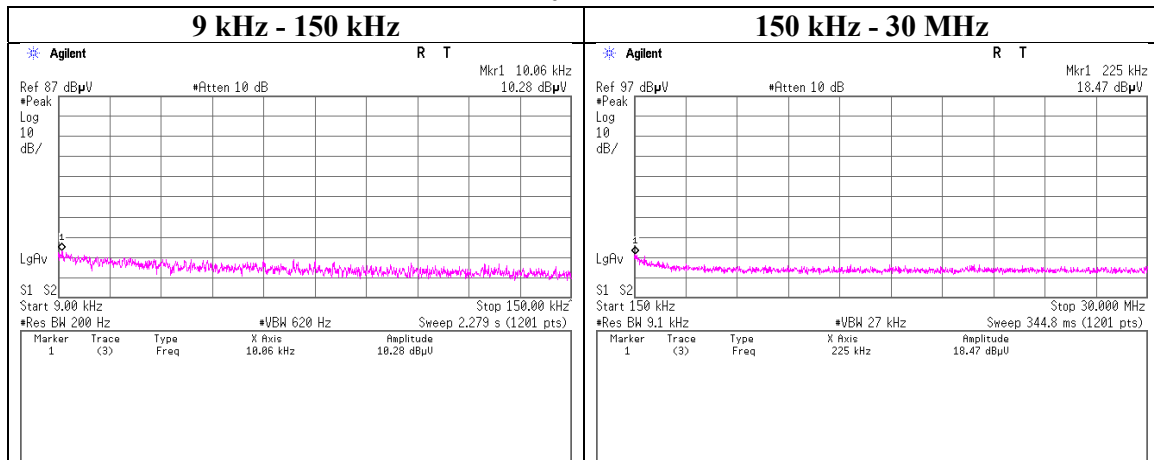


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx, Hopping Off, DH5

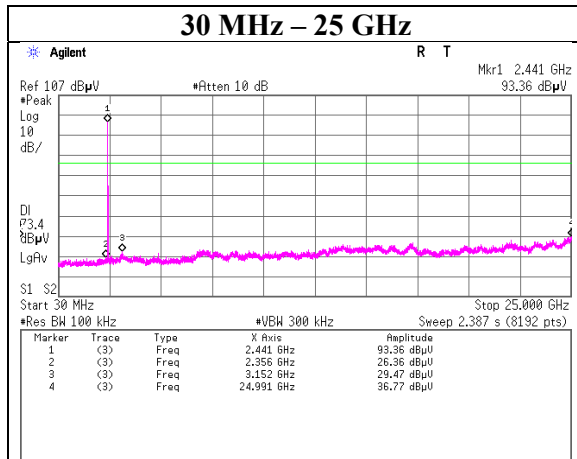
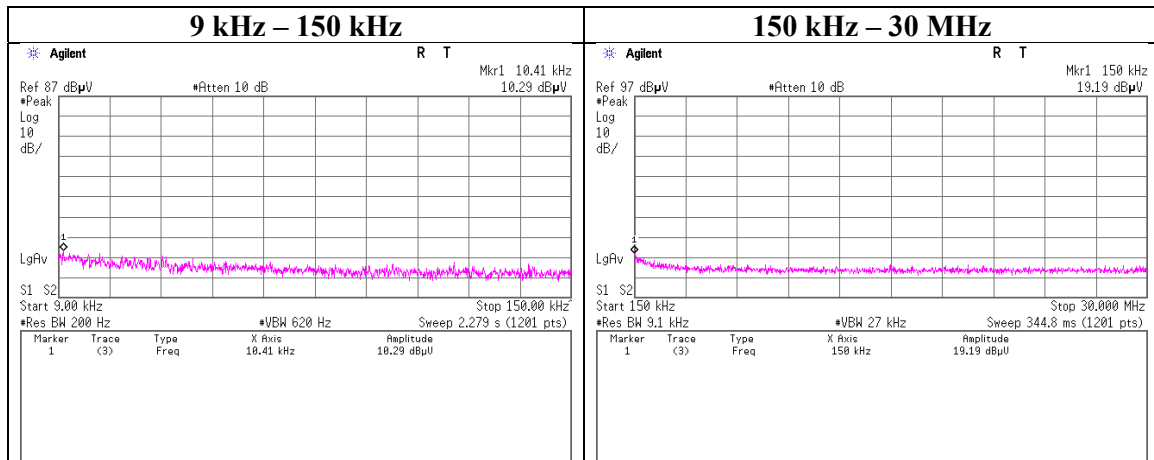
2402 MHz



Conducted Spurious Emission

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx, Hopping Off, DH5

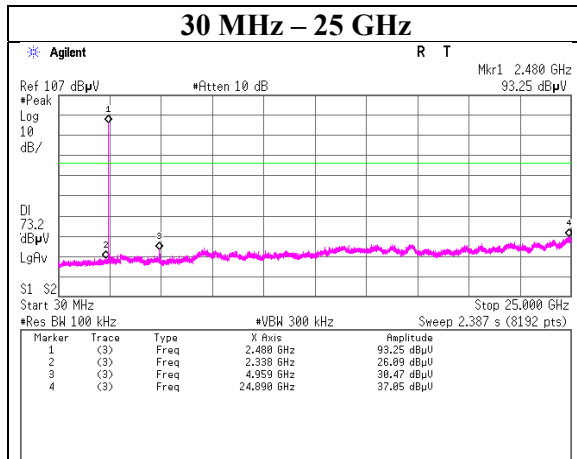
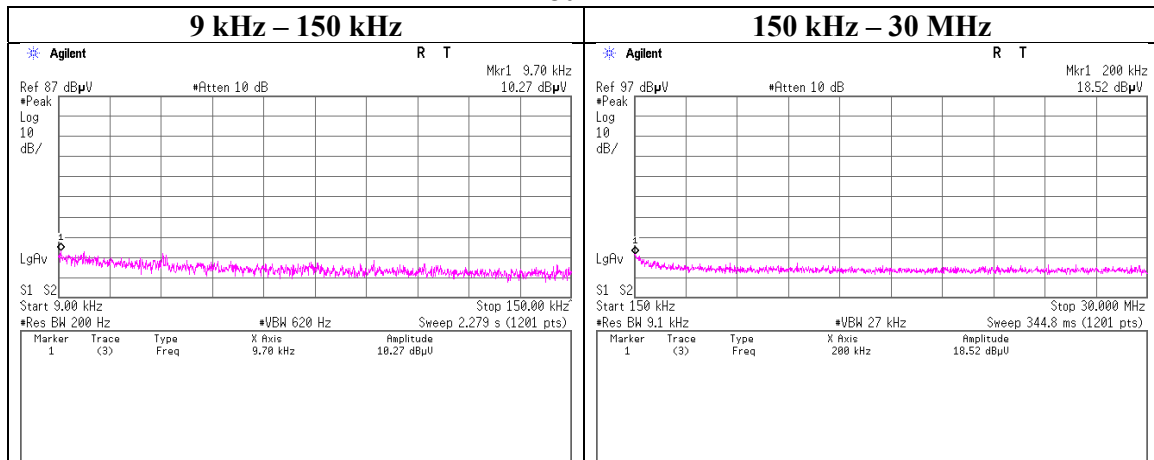
2441 MHz



Conducted Spurious Emission

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx, Hopping Off, DH5

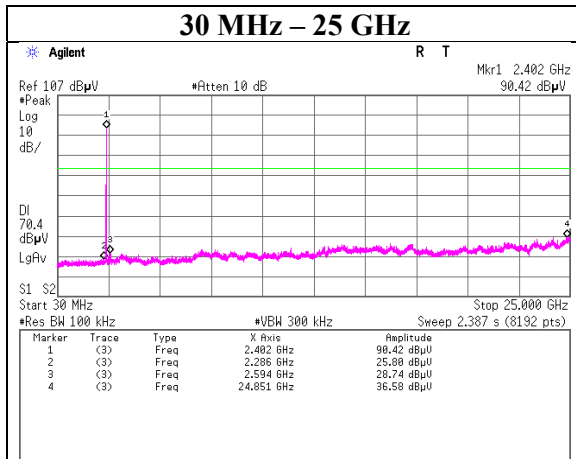
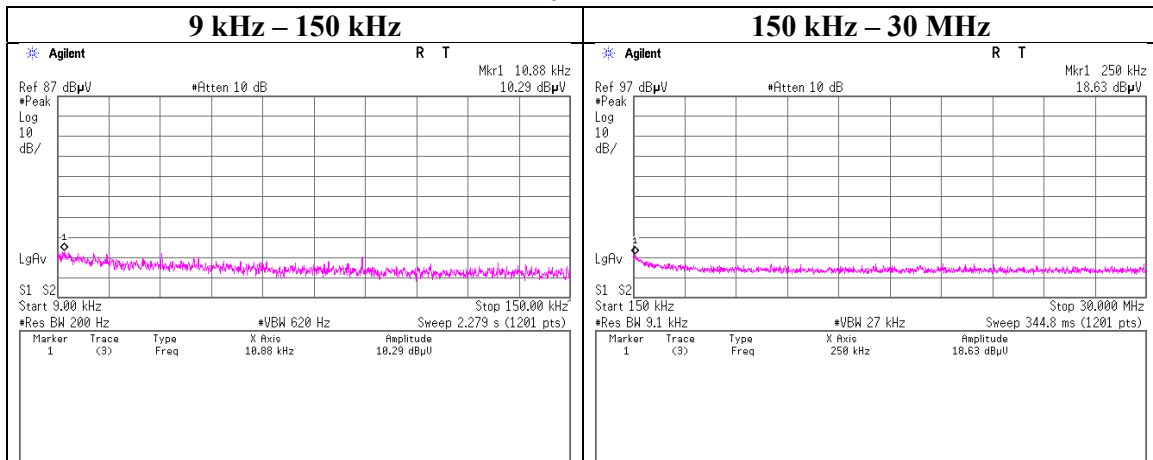
2480 MHz



Conducted Spurious Emission

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx, Hopping Off, 3DH5

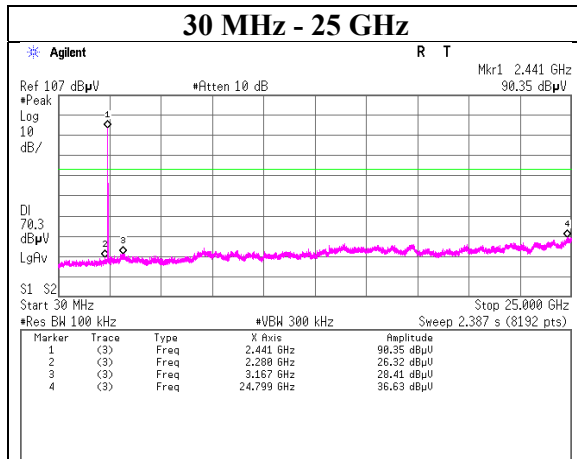
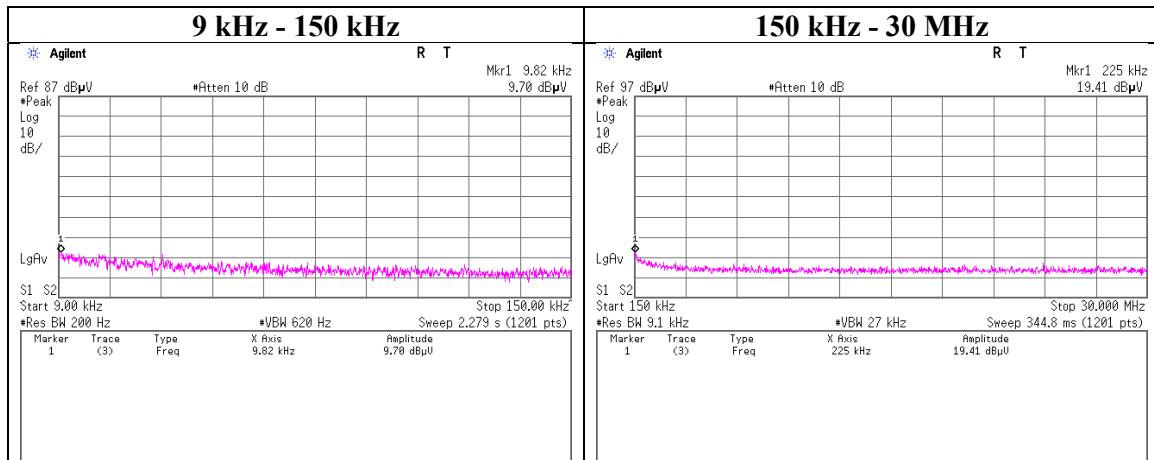
2402 MHz



Conducted Spurious Emission

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx, Hopping Off, 3DH5

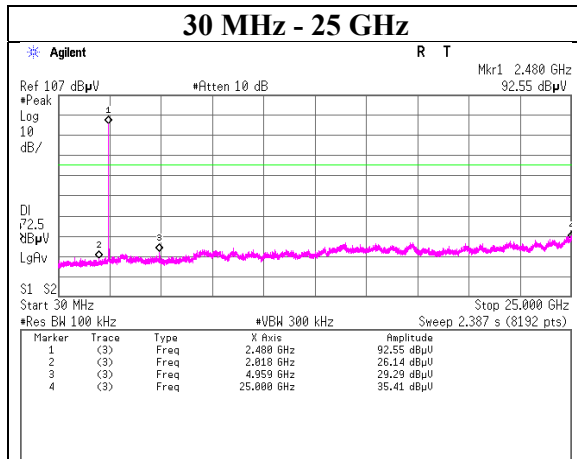
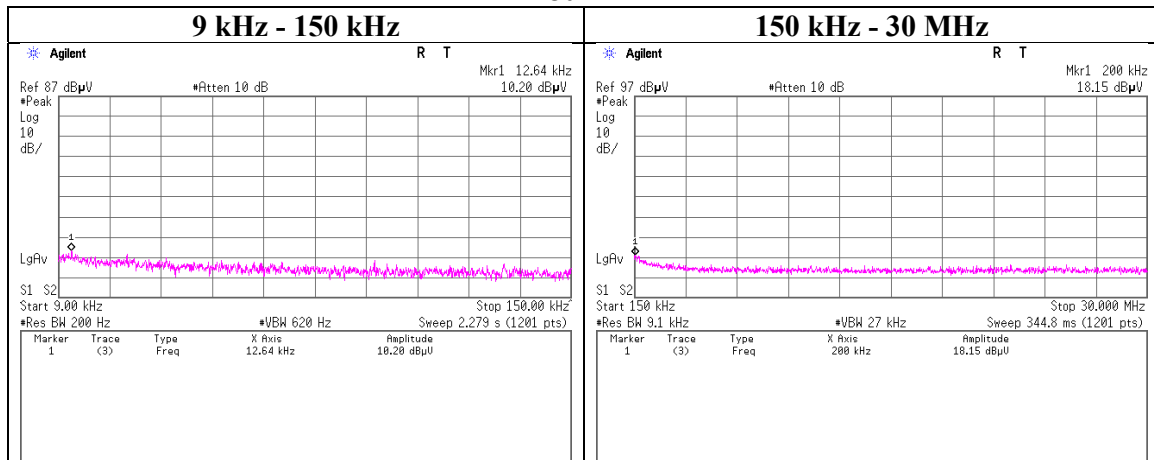
2441 MHz



Conducted Spurious Emission

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx, Hopping Off, 3DH5

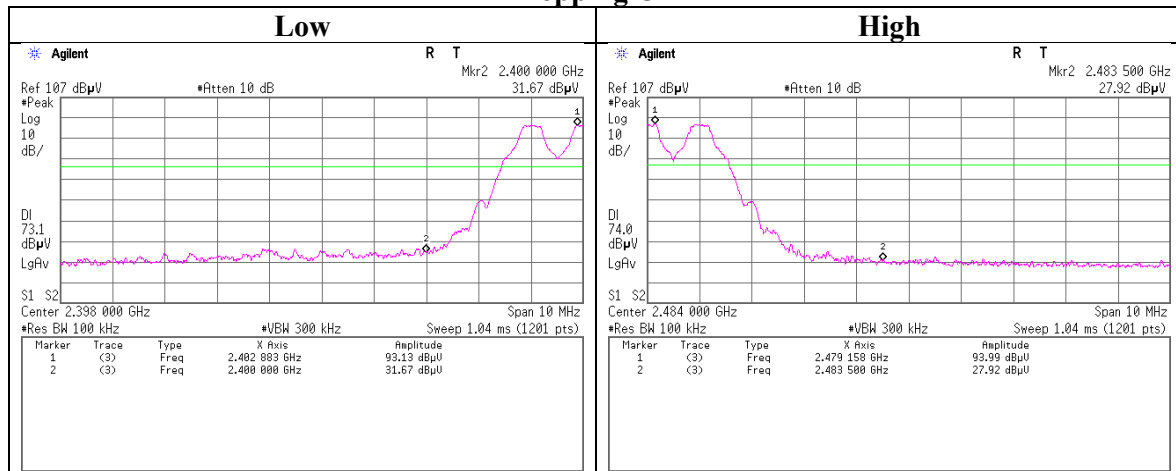
2480 MHz



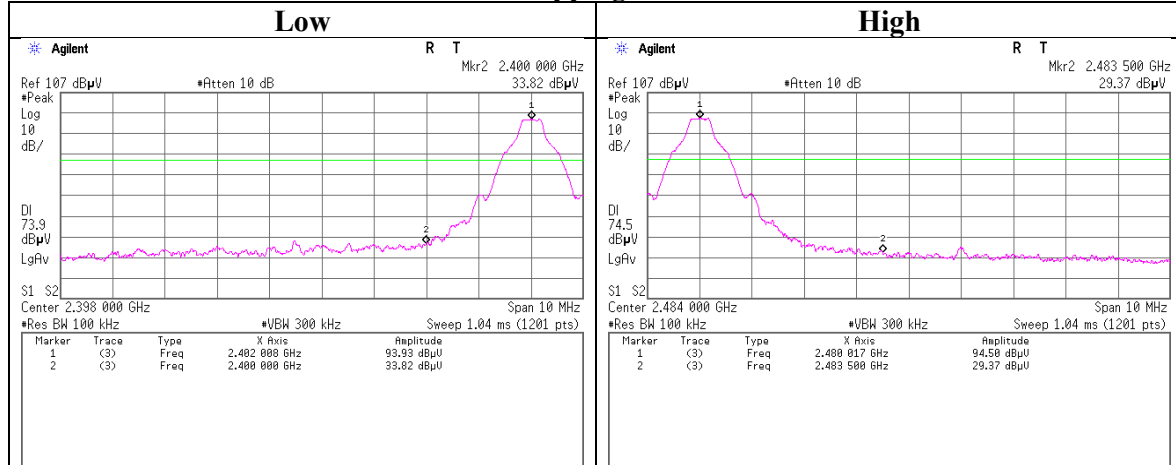
Conducted Emission Band Edge compliance

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx DH5

Hopping On



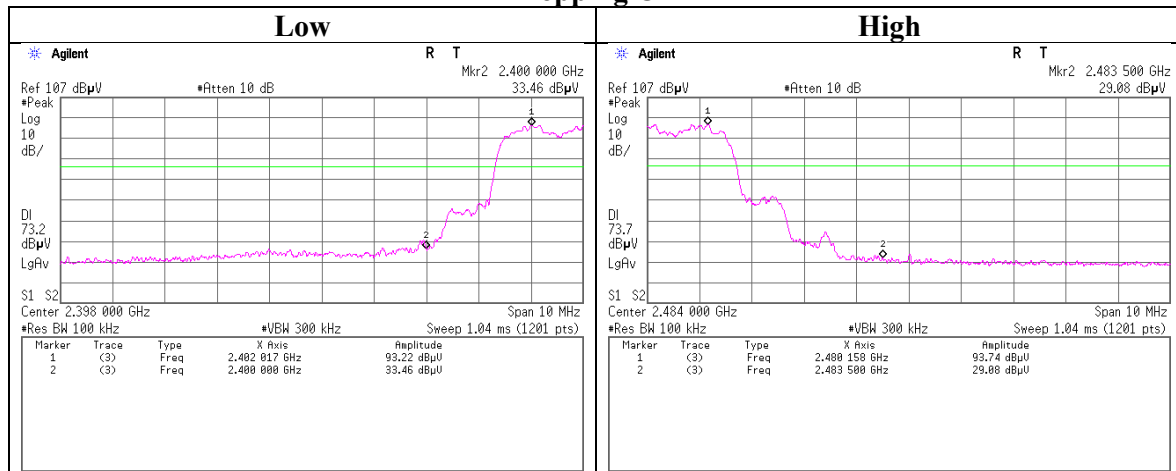
Hopping Off



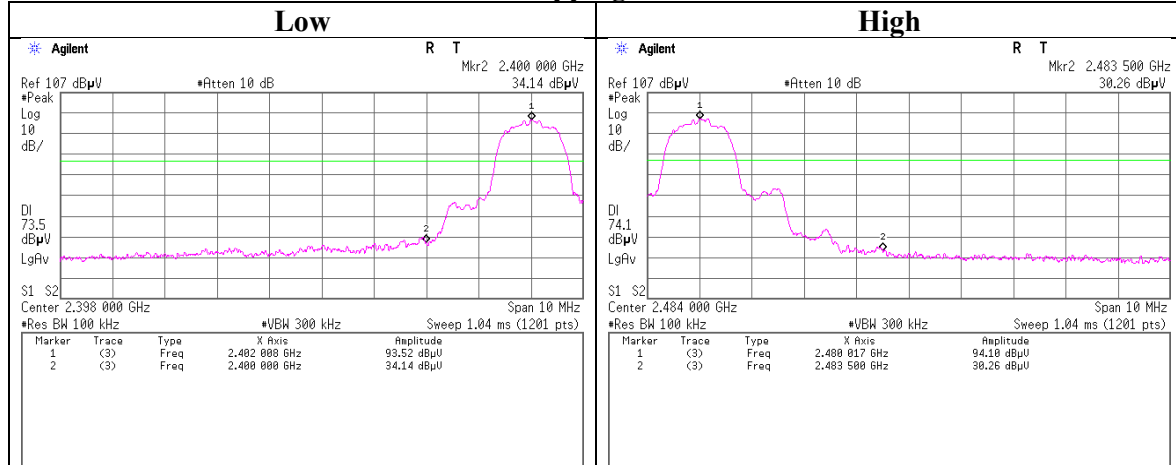
Conducted Emission Band Edge compliance

Report No. 12608632H
Test place Ise EMC Lab. No.8 Measurement Room
Date March 20, 2019
Temperature / Humidity 26 deg. C / 30 % RH
Engineer Hiroyuki Furutaka
Mode Tx 3DH5

Hopping On



Hopping Off



APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
AT	141810	Power Meter	ANRITSU	ML2495A	824014	10/9/2018	10/31/2019	12
AT	141832	Power sensor	ANRITSU	MA2411B	738174	10/9/2018	10/31/2019	12
AT	141362	Attenuator(10dB) (above1GHz)	AGILENT	8493C	71642	05/29/2018	05/31/2019	12
AT	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/2/2018	11/30/2019	12
AT	141225	Microwave Cable	Junkosha	MWX221	1409S497	03/04/2018	03/31/2019	
AT	141395	Coaxial Cable	UL Japan	-	-	11/13/2018	11/30/2019	12
AT	141572	Thermo-Hygrometer	CUSTOM	CTH-201	3401	01/11/2019	01/31/2020	12
AT	141855	Spectrum Analyzer	AGILENT	E4440A	MY46187750	11/9/2018	11/30/2019	12
AT	141563	Thermo-Hygrometer	CUSTOM	CTH-180	1701	01/11/2019	01/31/2020	12
AT	141901	Spectrum Analyzer	AGILENT	E4440A	MY48250080	10/4/2018	10/31/2019	12
AT	141937	Terminator	TME	CT-01BP	-	12/5/2018	12/31/2019	12
AT	141334	Attenuator(10dB)	Suhner	6810.19.A	-	12/6/2018	12/31/2019	12
AT	141414	Microwave Cable	Junkosha	MWX221	1207S407	08/21/2018	08/31/2019	12
AT	141327	Coaxial Cable	UL Japan	-	-	02/7/2019	02/29/2020	12
AT	141361	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	03/4/2019	03/31/2020	12
AT	141812	Power Meter	AGILENT	8990B	MY51000271	08/21/2018	08/31/2019	12
AT	141842	Power sensor	AGILENT	N1923A	MY54070003	08/21/2018	08/31/2019	12
AT	141561	Thermo-Hygrometer	CUSTOM	CTH-201	1401	01/11/2019	01/31/2020	12
AT	141329	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	04/11/2018	04/30/2019	12
AT	141173	Attenuator(10dB) (above1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-110	-	12/17/2018	12/31/2019	12
AT	141841	Power sensor	ANRITSU	MA2411B	11598	10/31/2018	10/31/2019	12
AT	141806	Power Meter	ANRITSU	ML2495A	6K00003348	10/31/2018	10/31/2019	12
AT	141902	Spectrum Analyzer	AGILENT	E4440A	MY46187105	10/4/2018	10/31/2019	12
AT	141343	Barometer	Sunoh	SBR121	596	02/8/2018	02/28/2021	36
AT	141884	Spectrum Analyzer	AGILENT	E4448A	MY44020357	03/13/2019	03/31/2020	12
AT	141557	DIGITAL HiTESTER	HIOKI	3805	70900530	01/29/2019	01/31/2020	12
AT	141567	Thermo-Hygrometer	CUSTOM	CTH-201	0008	01/11/2019	01/31/2020	12
AT	141835	Power sensor	AGILENT	N1923A	MY54070004	08/21/2018	08/31/2019	12
RE	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	01/11/2019	01/31/2020	12
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/6/2018	08/31/2019	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/8/2019	02/29/2020	12
RE	142183	Measure	KOMELON	KMC-36	-	-	-	-
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	03/25/2019	03/31/2020	12
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	141532	DIGITAL HiTESTER	HIOKI	3805	51201197	01/29/2019	01/31/2020	12
RE	141323	Coaxial cable	UL Japan	-	-	07/3/2018	07/31/2019	12
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	06/4/2018	06/30/2019	12
RE	148897	Attenuator	KEYSIGHT	8491A	MY52462349	12/20/2018	12/31/2019	12
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	06/30/2020	24
RE	141900	Spectrum Analyzer	AGILENT	E4440A	MY46185823	11/15/2018	11/30/2019	12
RE	141503	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	06/06/2018	06/30/2019	12
RE	141556	Thermo-Hygrometer	CUSTOM	CTH-201	3	12/05/2018	12/31/2019	12
RE	141579	Pre Amplifier	AGILENT	8449B	3008A02142	01/21/2019	01/31/2020	12
RE	141392	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	08/08/2018	08/31/2019	12
RE	141512	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	06/06/2018	06/30/2019	12
RE	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/01/2018	04/29/2019	12
RE	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/21/2018	08/31/2019	12
RE	142228	Measure	KOMELON	KMC-36	-	-	-	-
RE	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	2	09/19/2018	09/30/2019	12

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*Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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

Test item: RE: Radiated Emission test
 AT: Antenna Terminal Conducted test