



# RADIO TEST REPORT

Test Report No. : 12021807S-A-R2

**Applicant** : JVC KENWOOD Corporation  
**Type of Equipment** : GPS NAVIGATION SYSTEM  
**Model No.** : DNX995S  
**FCC ID** : IOMJ5175  
**Test regulation** : FCC Part 15 Subpart C: 2018  
**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. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
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 12021807S-A-R1.12021807S-A-R1 is replaced with this report.

**Date of test:** November 7 to 16, 2017

**Representative test engineer:**

Makoto Hosaka  
Engineer  
Consumer Technology Division

**Approved by:**

Akira Sato  
Engineer  
Consumer Technology Division



- The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.  
 There is no testing item of "Non-accreditation".

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13-EM-F0429

## REVISION HISTORY

### Original Test Report No.: 12021807S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12021807S-A	December 4, 2017	-	-
1	12021807S-A-R1	December 13, 2017	4	Correction of Antenna type
2	12021807S-A-R2	January 30, 2018	4 5	Correction of Radio clock frequency Update of Test Specification

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## **SECTION 1: Customer information**

Company Name : JVC KENWOOD Corporation  
Address : 2967-3, Ishikawa-machi, Hachioji, Tokyo 192-8525 Japan  
Telephone Number : +81-42-646-5525  
Facsimile Number : +81-42-646-1440  
Contact Person : Seigo Tsutsumi

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

### **2.1 Identification of E.U.T.**

Type of Equipment : GPS NAVIGATION SYSTEM  
Model No. : DNX995S  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 12 V  
Receipt Date of Sample : November 6, 2017  
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: DNX995S (referred to as the EUT in this report) is a GPS NAVIGATION SYSTEM.

Clock frequency in the system (Maximum) : 6.3 GHz

### **Radio Specification**

Type of radio	Bluetooth (BDR/EDR)	IEEE802.11b	IEEE802.11g	IEEE802.11a	IEEE802.11n (20 M band)	IEEE802.11n (40 M band)
Frequency of operation	2402 - 2480 MHz	2412 - 2462 MHz	2412 - 2462 MHz	5745 - 5805 MHz	2412 - 2462 MHz 5745 - 5805 MHz	5755 - 5795 MHz
Type of modulation	FHSS	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)		
Channel spacing	1 MHz	5 MHz		20 MHz	<u>2.4 GHz band</u> 5 MHz <u>5 GHz band</u> 20 MHz	<u>2.4 GHz band</u> 5 MHz <u>5 GHz band</u> 40 MHz

Antenna type	Chip Antenna
Antenna Gain	-5.9 dBi (2.4 GHz), -5.2 dBi (5 GHz)
Power Supply (radio art input)	DC 3.6 V/ 3.3 V
Clock frequency (Maximum)	37.4 MHz

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### **SECTION 3: Test specification, procedures & results**

#### **3.1 Test Specification**

Test specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on January 2, 2018 and effective February 1, 2018

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928 MHz,  
2400-2483.5 MHz, and 5725-5850 MHz

\* The revision on January 2, 2018, does not affect the test specification applied to the EUT.

#### **3.2 Procedures and results**

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	N/A	N/A *1)	-
Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1 (b)	See data.	Complied	Conducted
20dB Bandwidth	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1 (a)		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 (d)		Complied	Conducted
Dwell time	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1 (d)		Complied	Conducted
Maximum Peak Output Power	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 6.12	FCC: Section15.247(a)(b)(1) IC: RSS-247 5.4 (b)		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		5.2 dB 960.272 MHz, QP, Hori. (Tx, DH5, 2402 MHz)	Complied

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

\*1) The test is not applicable since the EUT has no AC mains.

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

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

#### **FCC Part 15.31 (e)**

The EUT provides stable voltage (DC 3.6 V/ 3.3 V) constantly to the wireless transmitter regardless of input voltage. Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

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

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### 3.3 Addition to standard

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

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

### 3.4 Uncertainty

#### EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor  $k=2$ .  
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Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR	No. 5,6,8 SR
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.2 dB	3.2 dB	3.3 dB	-	-
	30 MHz-200 MHz	4.3 dB	4.3 dB	4.3 dB	-	-
	200 MHz-1 GHz	5.9 dB	5.9 dB	5.9 dB	-	-
	1 GHz-6 GHz	4.7 dB	4.7 dB	4.7 dB	-	-
	6 GHz-18 GHz	5.3 dB	5.3 dB	5.3 dB	-	-
Radiated emission (Measurement distance: 1 m)	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	1 GHz-18 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.48 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.66 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.47 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.64 dB
Spurious emission (Conducted) below 1 GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.5 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.7 dB
Bandwidth Measurement	1.01 %
Duty cycle and Time Measurement	0.012 %

#### Radiated emission test

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

### 3.5 Test Location

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JAB Accreditation No. RTL02610  
FCC Test Firm Registration Number: 839876

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

### 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

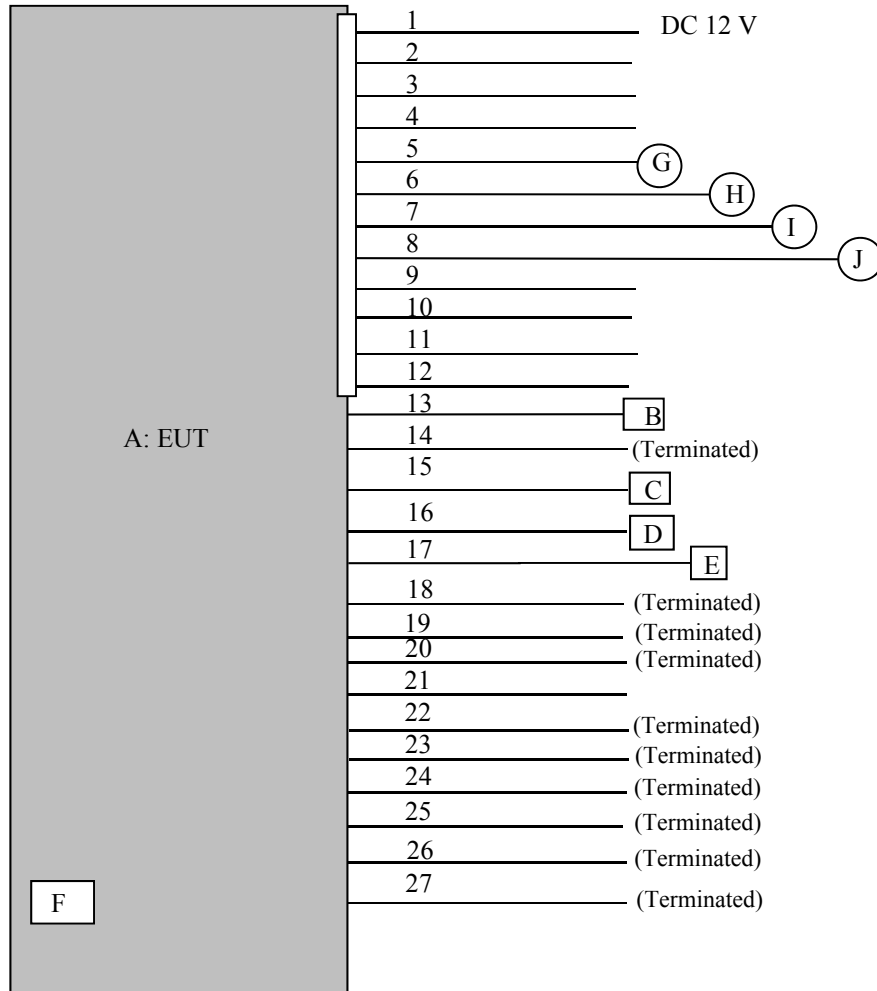
Details of Operating Mode(s)

<b>Test Item</b>	<b>Mode</b>	<b>Tested frequency</b>
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.  *EUT has the power settings by the software as follows;  Power settings: Fixed  Firmware: Version 1.0  *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>		

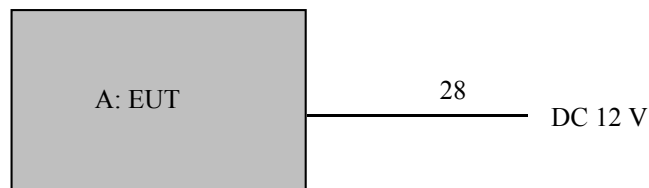


## 4.2 Configuration and peripherals

### Radiated Emission test



### Antenna Terminal conducted test



\* 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	GPS NAVIGATION SYSTEM	DNX995S	PK-X0045 *1) PK-X0046 *2)	JVC KENWOOD Corporation	EUT
B	GPS Antenna	-	-	JVC KENWOOD Corporation	-
C	USB Memory	Data Traveler	-	Kingston	-
D	USB Memory	SDK-USM1GL	-	Sony	-
E	Mic	-	-	JVC KENWOOD Corporation	-
F	micro SDHC Card	-	-	TDK	-
G	Speaker	KFC-RS160	-	JVC KENWOOD Corporation	-
H	Speaker	KFC-RS160	-	JVC KENWOOD Corporation	-
I	Speaker	KFC-RS160	-	JVC KENWOOD Corporation	-
J	Speaker	KFC-RS160	-	JVC KENWOOD Corporation	-

\*1) Used for Radiated Emission test

\*2) Used for Antenna Terminal conducted test

**List of cables used**

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	0.6 + 1.0	Unshielded	Unshielded	-
2	REMOTE CONT	0.1 + 1.0	Unshielded	Unshielded	-
3	MUTE	0.1 + 1.0	Unshielded	Unshielded	-
4	ANT. CONT	0.1 + 1.0	Unshielded	Unshielded	-
5	Speaker Front L	2.0 + 1.9	Unshielded	Unshielded	-
6	Speaker Front R	2.0 + 1.9	Unshielded	Unshielded	-
7	Speaker Rear L	2.0 + 1.9	Unshielded	Unshielded	-
8	Speaker Rear R	2.0 + 1.9	Unshielded	Unshielded	-
9	P. CONT	0.1 + 1.0	Unshielded	Unshielded	-
10	PRK SW	0.1 + 1.0	Unshielded	Unshielded	-
11	REVERSE	0.1 + 1.0	Unshielded	Unshielded	-
12	ILLUMI	0.1 + 1.0	Unshielded	Unshielded	-
13	GPS ANT	3.5	Shielded	Shielded	-
14	iDatalink I/F	0.7	Shielded	Shielded	-
15	USB	0.2 + 1.0	Shielded	Shielded	-
16	USB	0.2 + 1.0	Shielded	Shielded	-
17	MIC	3.0	Shielded	Shielded	-
18	FRONT AUDIO	1.0	Shielded	Shielded	-
19	REAR AUDIO	2.0	Shielded	Shielded	-
20	SW	2.0	Shielded	Shielded	-
21	I/F EXT	1.0	Unshielded	Unshielded	-
22	AV-IN	1.5	Shielded	Shielded	-
23	AV-OUT	1.5	Shielded	Shielded	-
24	VIDEO OUT	0.2 + 1.0	Shielded	Shielded	-
25	REAR VIEW CAMERA	0.2 + 1.0	Shielded	Shielded	-
26	FRONT VIEW CAMERA	0.2 + 1.0	Shielded	Shielded	-
27	ANT	0.1 + 3.0	Shielded	Shielded	-
28	DC	1.0	Unshielded	Unshielded	-

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## **SECTION 5: Radiated Spurious Emission**

### **Test Procedure**

[For below 1 GHz]

EUT was placed on a platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.

[For above 1 GHz]

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

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

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

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

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

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

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

### **Test Antennas are used as below;**

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

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz *1)	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	3.88 m*2) (1 GHz – 13 GHz), 1 m*3) (13 GHz – 31.5 GHz)		3.88 m*2) (1 GHz – 13 GHz), 1 m*3) (13 GHz – 31.5 GHz)

\*1) Although DA 00-705 accepts VBW = 10 Hz for AV measurements, it was confirmed that superfluous smoothing was not performed.

\*2) Distance Factor:  $20 \times \log(3.88 \text{ m}/3.0 \text{ m}) = 2.24 \text{ dB}$

\*3) Distance Factor:  $20 \times \log(1.0 \text{ m}/3.0 \text{ m}) = -9.54 \text{ dB}$

The carrier level and noise levels were confirmed at angle of 0 deg. to 30 deg. based on the product specification to see the position of maximum noise, and the test was made at the position (0 deg.)

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

**Measurement range** : 30 MHz – 31.5 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.

<b>Test</b>	<b>Span</b>	<b>RBW</b>	<b>VBW</b>	<b>Sweep time</b>	<b>Detector</b>	<b>Trace</b>	<b>Instrument used</b>
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	Sample	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Carrier Frequency Separation	5 MHz or 3 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	300 kHz	1 MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz, 1 MHz	300 kHz, 3 MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				
	30 MHz to 31.5 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
*1) The measurement was performed with Max Hold since the duty cycle was not 100 % . *2) Reference data *3) In the frequency range below 30 MHz, 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.							

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

**Test data** : APPENDIX  
**Test result** : Pass

**APPENDIX 1: Test data**

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

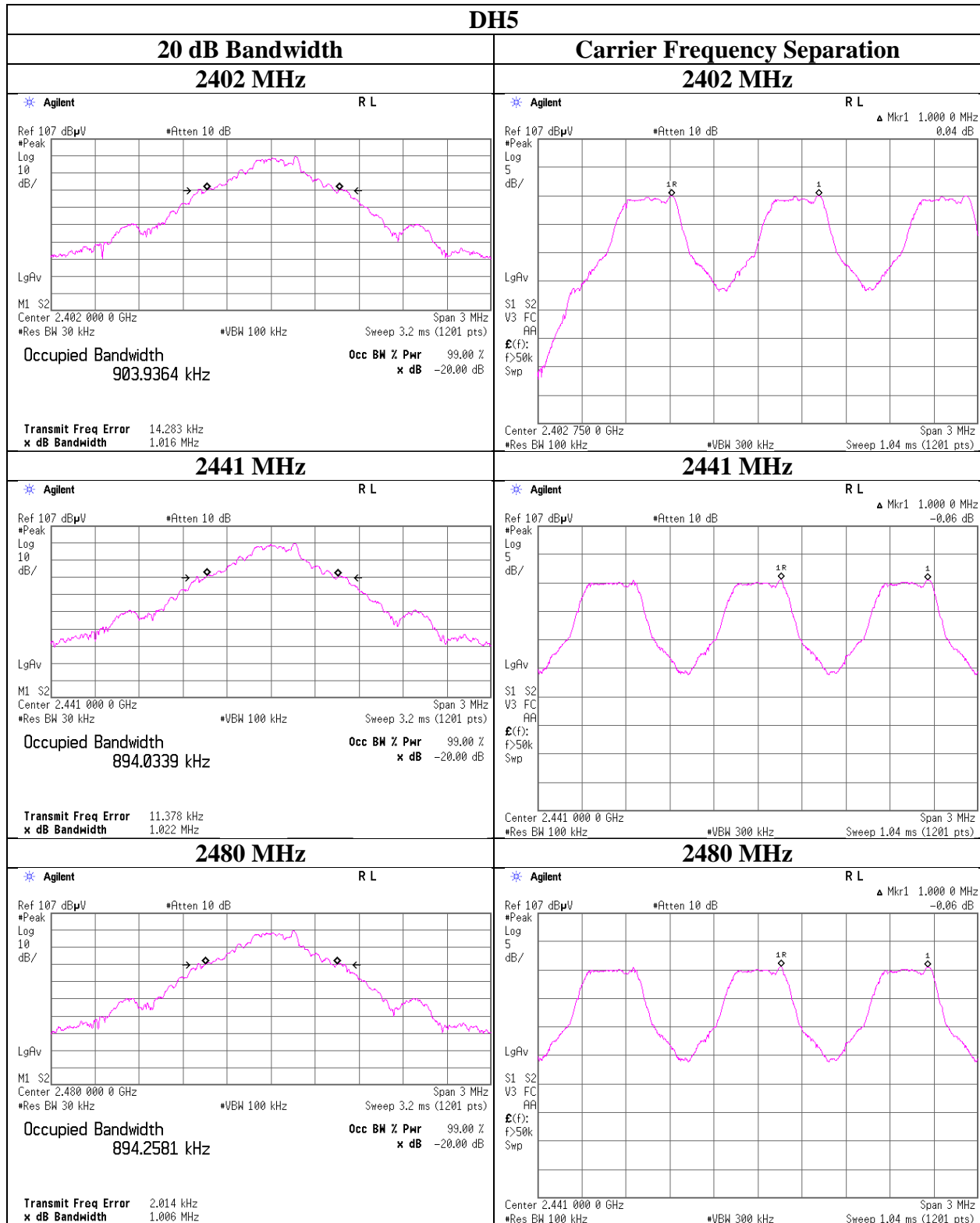
Test place	Shonan EMC Lab. No.5 Shielded Room	
Report No.	12021807S-A-R2	
Date	November 7, 2017	November 8, 2017
Temperature / Humidity	27 deg. C / 41 % RH	25 deg. C / 44 % RH
Engineer	Makoto Hosaka	Tatsuya Arai
Mode	Tx, Hopping Off, DH5	Tx, Hopping Off, 3DH5

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	1.016	897.486	1.000	$\geq 0.677$
DH5	2441.0	1.022	898.801	1.000	$\geq 0.682$
DH5	2480.0	1.006	891.384	1.000	$\geq 0.671$
DH5	Hopping On	-	78509.100	-	-
3DH5	2402.0	1.310	1203.600	1.000	$\geq 0.873$
3DH5	2441.0	1.327	1203.800	1.000	$\geq 0.885$
3DH5	2480.0	1.313	1204.800	1.000	$\geq 0.875$
3DH5	Hopping On	-	78670.500	-	-

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

No limit applies to 20dB Bandwidth.

## 20dB Bandwidth and Carrier Frequency Separation



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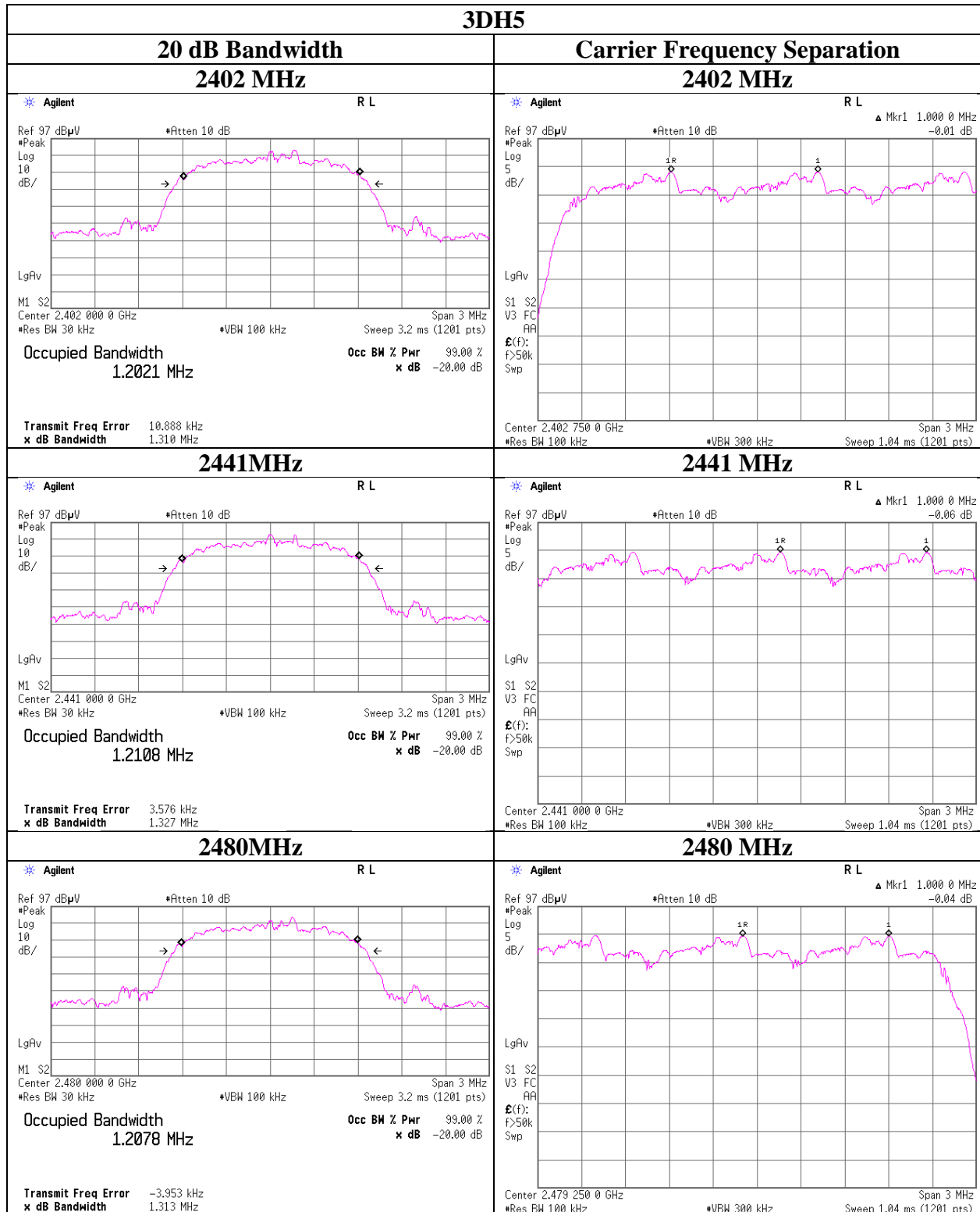
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## 20dB Bandwidth and Carrier Frequency Separation



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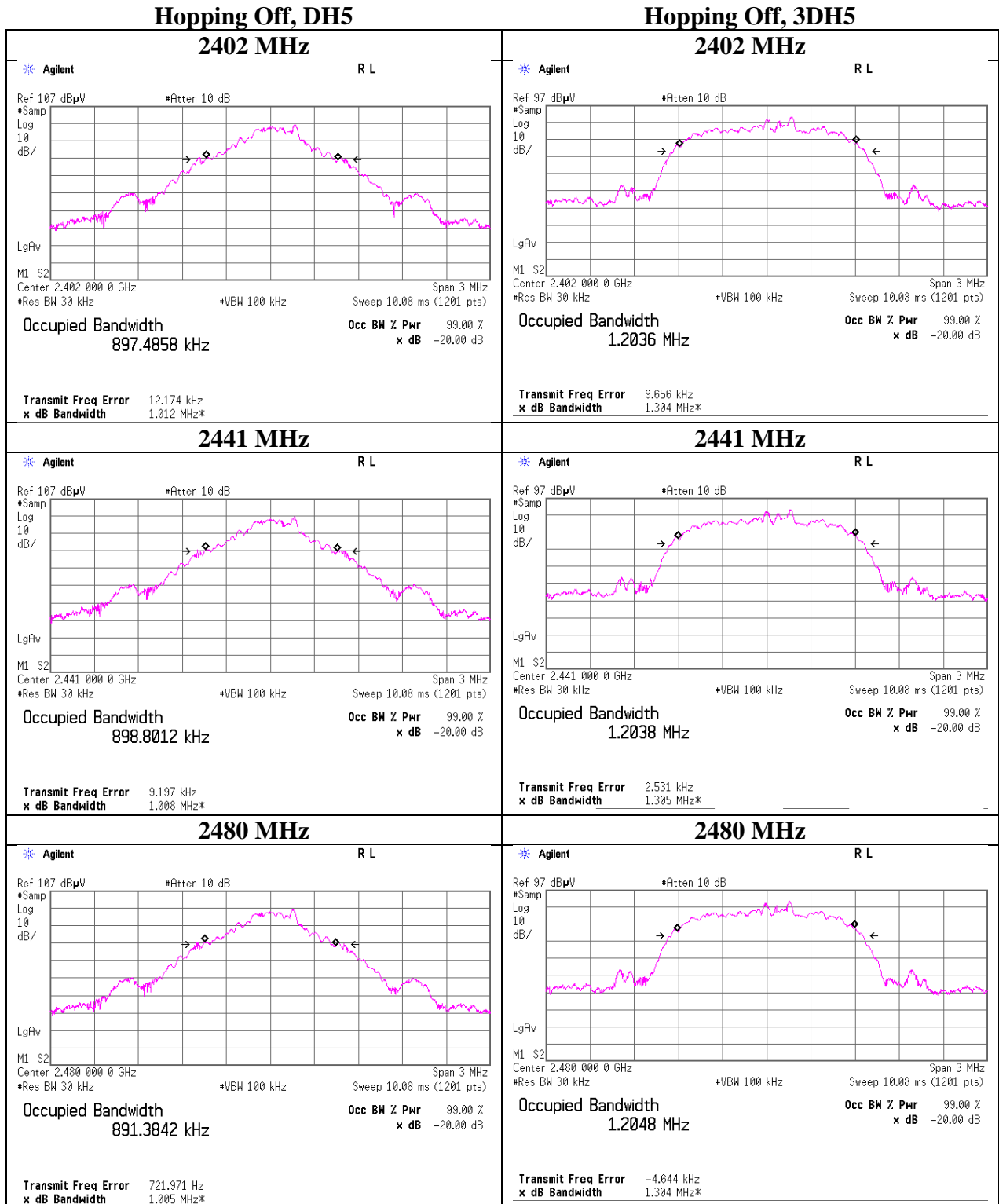
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## 99% Occupied Bandwidth



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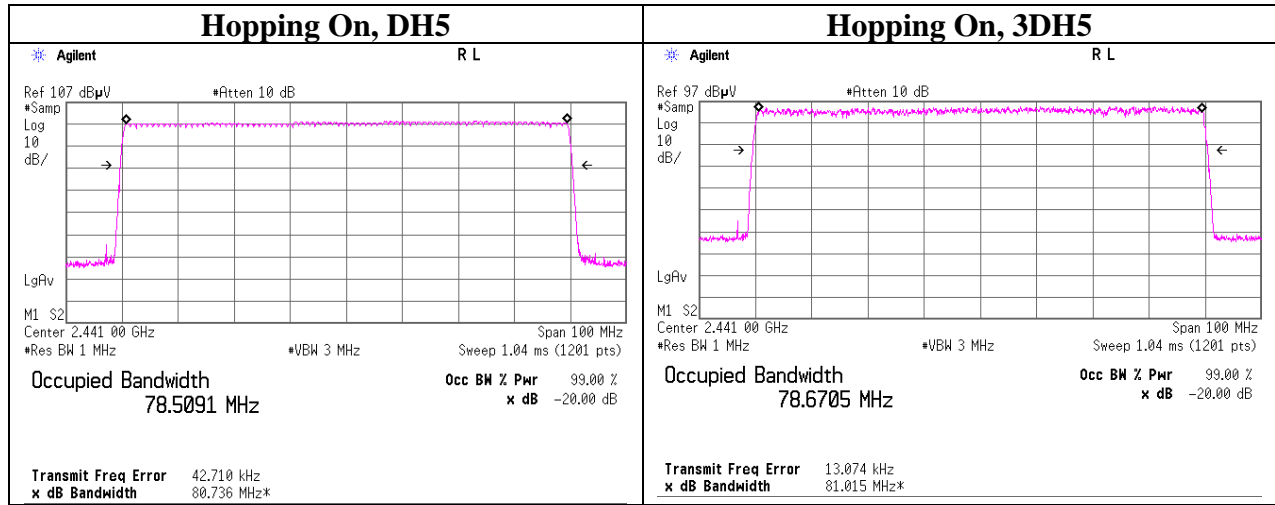
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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### 99% Occupied Bandwidth



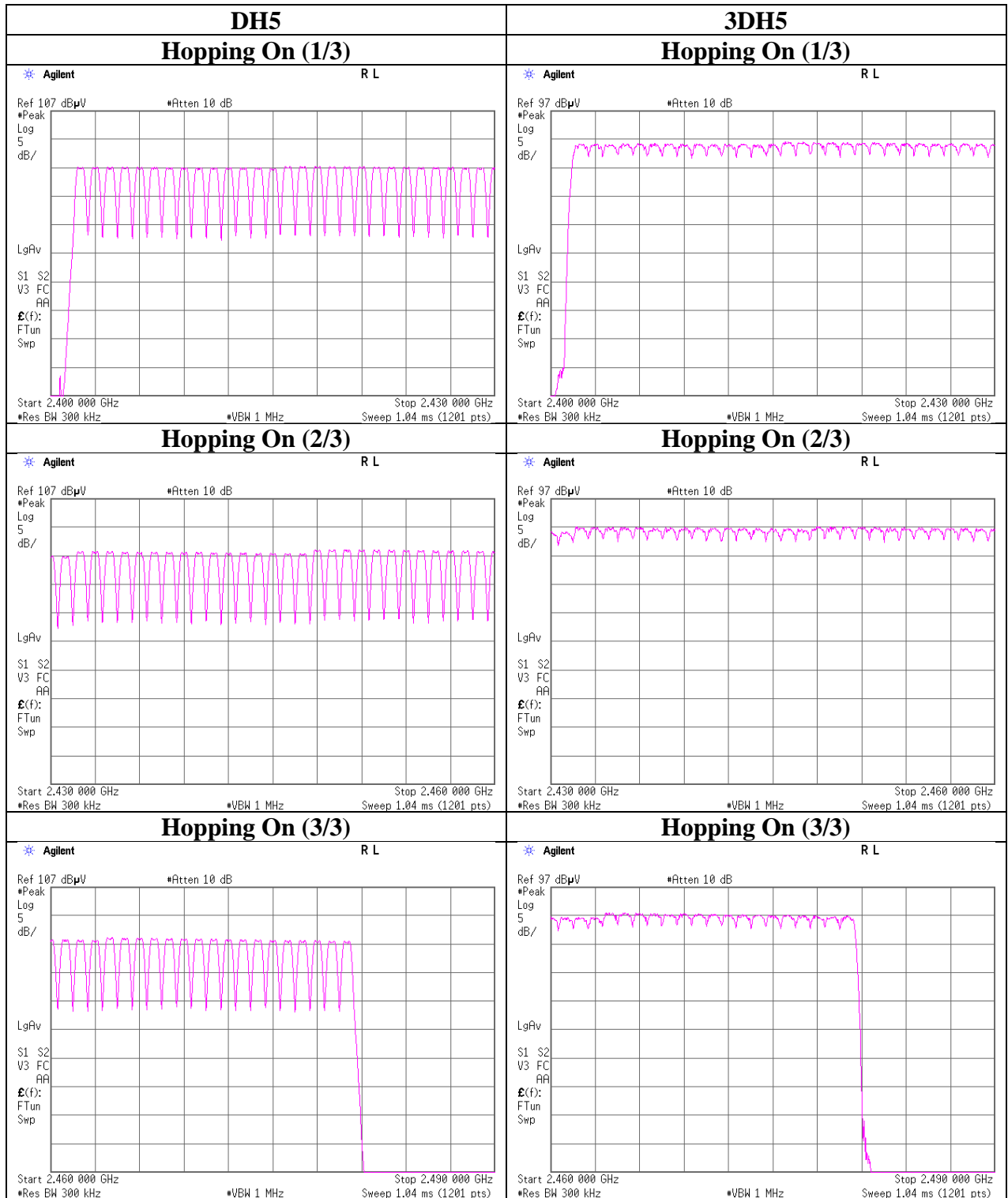
### Number of Hopping Frequency

Test place                      Shonan EMC Lab. No.5 Shielded Room  
Report No.                      12021807S-A-R2  
Date                              November 7, 2017                      November 8, 2017  
Temperature / Humidity      27 deg. C / 41 % RH                25 deg. C / 44 % RH  
Engineer                        Makoto Hosaka                        Tatsuya Arai  
Mode                              Tx, Hopping On, DH5                Tx, Hopping On, 3DH5

Mode	Number of channel [channels]	Limit [channels]
DH5	79	$\geq 15$
3DH5	79	$\geq 15$

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	Shonan EMC Lab. No.5 Shielded Room	
Report No.	12021807S-A-R2	
Date	November 7, 2017	November 8, 2017
Temperature / Humidity	27 deg. C / 41 % RH	25 deg. C / 44 % RH
Engineer	Makoto Hosaka	Tatsuya Arai
Mode	Tx, Hopping On, DH5	Tx, Hopping On, 3DH5

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	48.2 times /	5 sec. x	31.6 sec. =	305 times	0.420	128	400
DH3	26.8 times /	5 sec. x	31.6 sec. =	170 times	1.681	286	400
DH5	20.4 times /	5 sec. x	31.6 sec. =	129 times	2.932	378	400
3DH1	48.6 times /	5 sec. x	31.6 sec. =	308 times	0.427	131	400
3DH3	25.2 times /	5 sec. x	31.6 sec. =	160 times	1.677	268	400
3DH5	21.2 times /	5 sec. x	31.6 sec. =	134 times	2.935	393	400

Sample Calculation

Result = Number of transmission x Length of transmission

\*Average data of 5 tests.(except Inquiry)

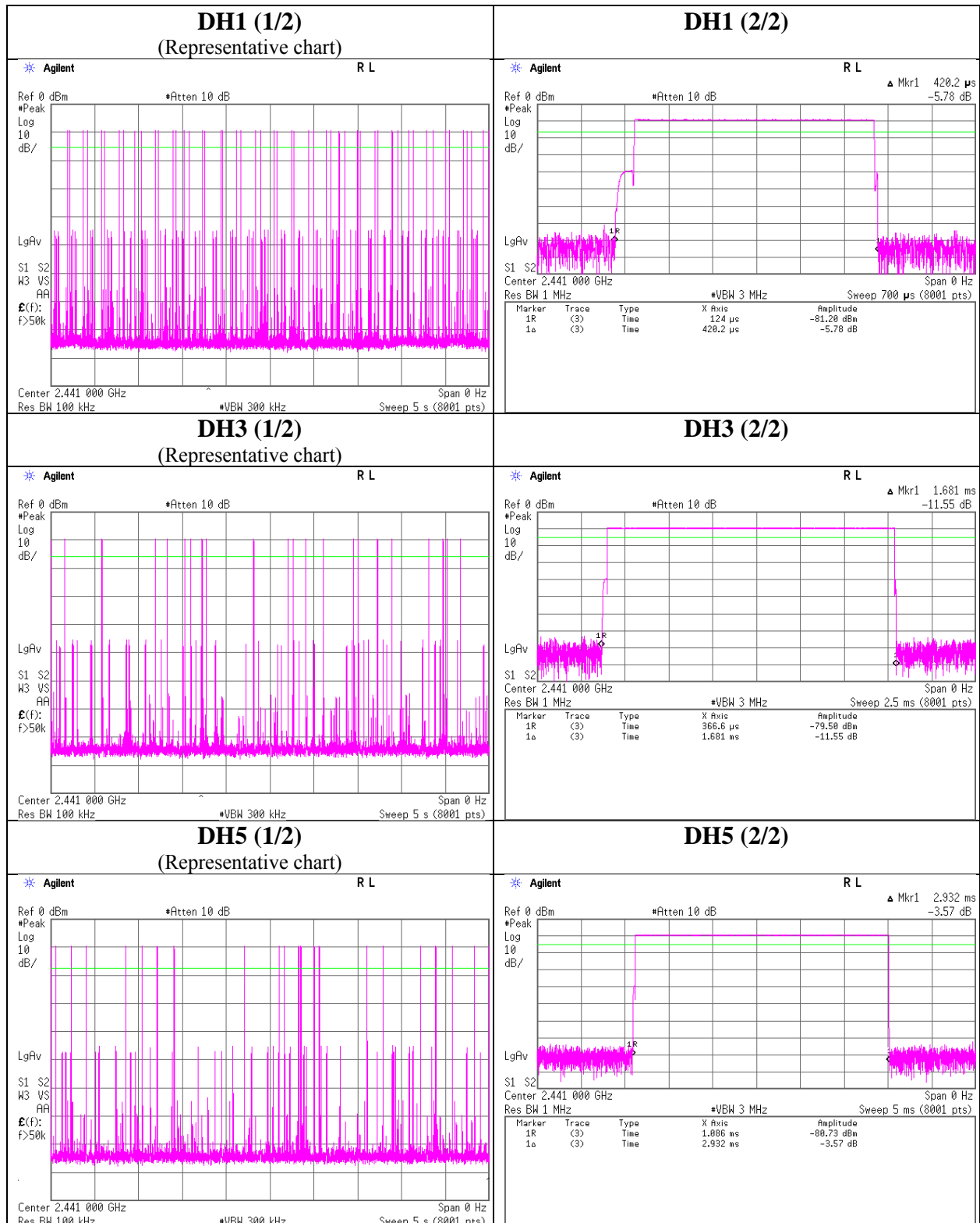
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	45	49	48	48	48.2
DH3	22	30	26	28	28	26.8
DH5	22	17	25	21	17	20.4
3DH1	48	48	48	49	50	48.6
3DH3	26	24	22	26	28	25.2
3DH5	20	21	23	19	23	21.2

Sample Calculation

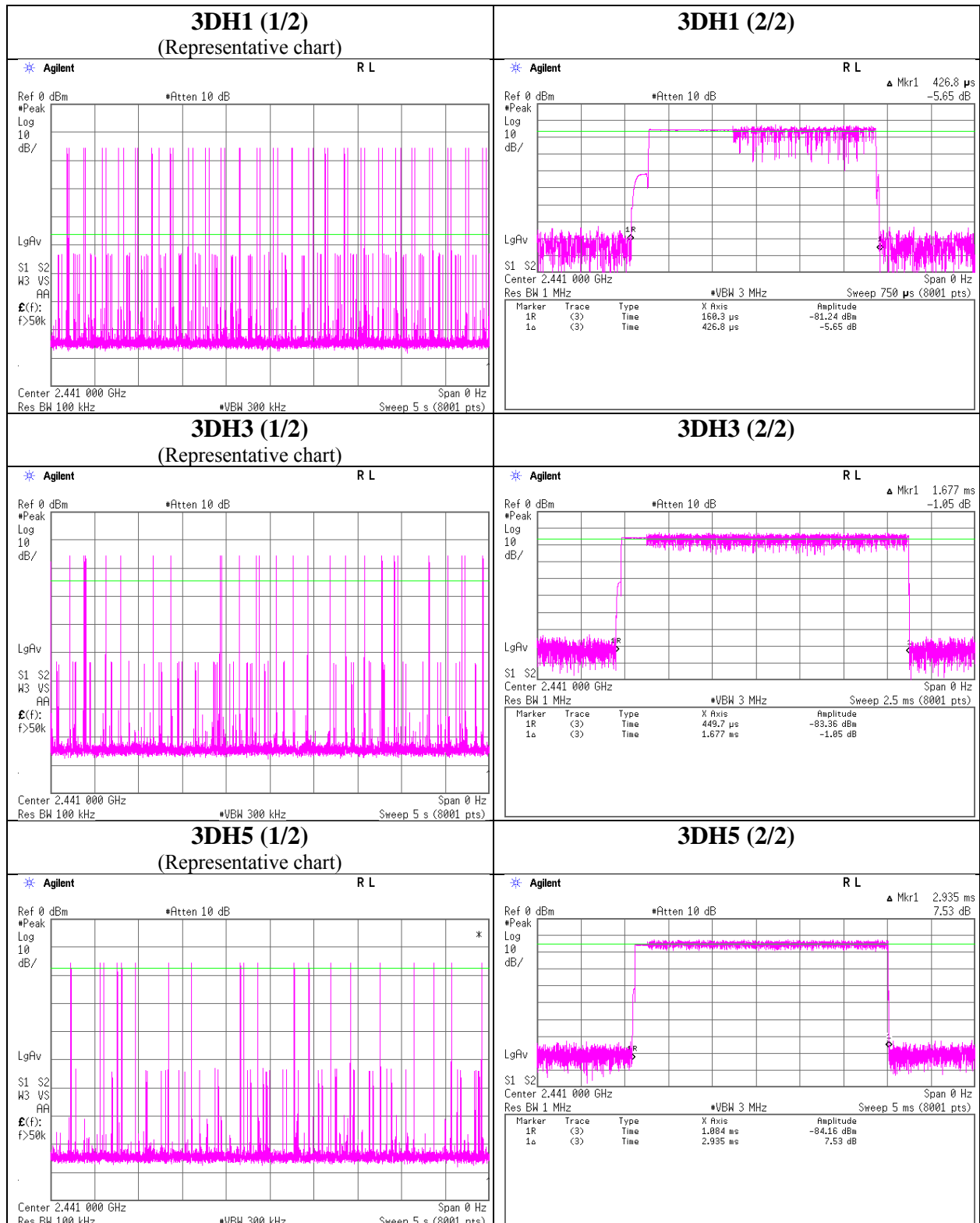
Average = Summation (Sampling 1 to 5) / 5

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**



**UL Japan, Inc.**

**Shonan EMC Lab.**

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### Maximum Peak Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room  
Report No. : 12021807S-A-R2  
Date : November 7, 2017  
Temperature / Humidity : 27 deg. C / 41 % RH  
Engineer : Makoto Hosaka  
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	-10.45	2.28	9.96	1.79	1.51	20.96	125	19.17
DH5	2441.0	-9.75	2.29	9.97	2.51	1.78	20.96	125	18.45
DH5	2480.0	-9.90	2.30	9.97	2.37	1.73	20.96	125	18.59
2DH5	2402.0	-12.68	2.28	9.96	-0.44	0.90	20.96	125	21.40
2DH5	2441.0	-12.21	2.29	9.97	0.05	1.01	20.96	125	20.91
2DH5	2480.0	-12.12	2.30	9.97	0.15	1.04	20.96	125	20.81
3DH5	2402.0	-12.35	2.28	9.96	-0.11	0.97	20.96	125	21.07
3DH5	2441.0	-11.92	2.29	9.97	0.34	1.08	20.96	125	20.62
3DH5	2480.0	-11.85	2.30	9.97	0.42	1.10	20.96	125	20.54

Sample Calculation:

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

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

Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.

As this device had AFH mode and frequency separation could not meet the requirement of over 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

**Average Output Power**  
**(Reference data for RF Exposure)**

Test place                      Shonan EMC Lab. No.5 Shielded Room  
Report No.                      12021807S-A-R2  
Date                              November 7, 2017  
Temperature / Humidity        27 deg. C / 41 % RH  
Engineer                        Makoto Hosaka  
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	-12.10	2.28	9.96	0.14	1.03	1.07	1.21	1.32
DH5	2441.0	-11.31	2.29	9.97	0.95	1.24	1.07	2.02	1.59
DH5	2480.0	-11.50	2.30	9.97	0.77	1.19	1.07	1.84	1.53
2DH5	2402.0	-17.07	2.28	9.96	-4.83	0.33	1.07	-3.76	0.42
2DH5	2441.0	-16.62	2.29	9.97	-4.36	0.37	1.07	-3.29	0.47
2DH5	2480.0	-16.56	2.30	9.97	-4.29	0.37	1.07	-3.22	0.48
3DH5	2402.0	-17.02	2.28	9.96	-4.78	0.33	1.07	-3.71	0.43
3DH5	2441.0	-16.58	2.29	9.97	-4.32	0.37	1.07	-3.25	0.47
3DH5	2480.0	-16.53	2.30	9.97	-4.26	0.37	1.07	-3.19	0.48

Sample Calculation:

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

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

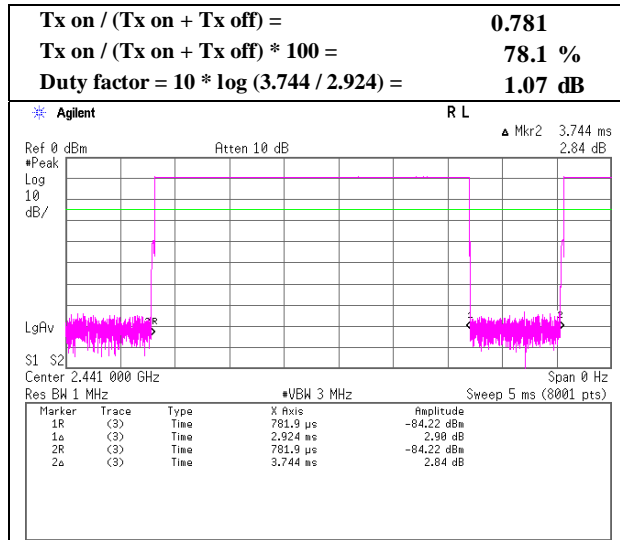
\*The equipment and cables were not used for factor 0 dB of the data sheets.



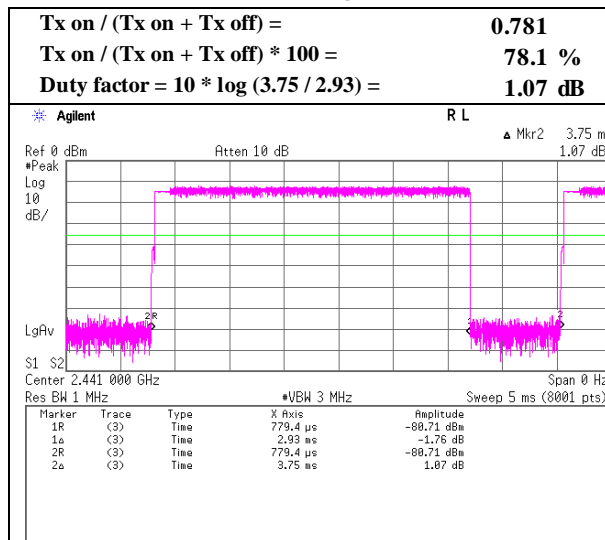
### Burst Rate Confirmation

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12021807S-A-R2
Date	November 7, 2017
Temperature / Humidity	27 deg. C / 41 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off

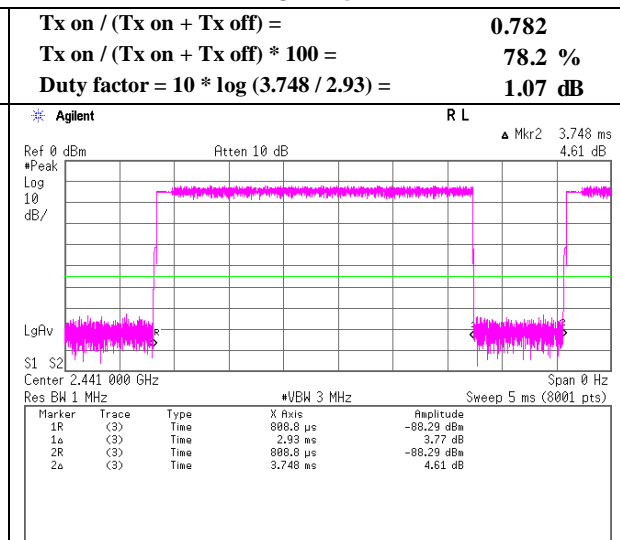
#### DH5



#### 2DH5



#### 3DH5



## Radiated Spurious Emission

Report No. 12021807S-A-R2  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 3 3 3 3 3  
Date November 11, 2017 November 15, 2017 November 15, 2017 November 16, 2017 November 16, 2017  
Temperature / Humidity 23 deg. C / 42 % RH 23 deg. C / 43 % RH 24 deg. C / 41 % RH 24 deg. C / 36 % RH 20 deg. C / 40 % RH  
Engineer Hiroyuki Morikawa Makoto Hosaka Kazuya Noda Kazuya Noda Kazutaka Takeyama  
(1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz) (26.5 GHz - 31.5 GHz) (30 MHz - 1 GHz)  
Mode Tx, Hopping Off, DH5 2402 MHz

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	73.712	QP	44.00	6.21	7.26	32.10	0.00	25.37	40.00	14.6	246	76	
Hori.	172.033	QP	38.00	15.72	8.01	32.01	0.00	29.72	43.50	13.7	200	89	
Hori.	221.186	QP	48.00	11.52	8.27	31.96	0.00	35.83	46.00	10.1	150	38	
Hori.	224.998	QP	44.40	11.54	8.29	31.96	0.00	32.27	46.00	13.7	149	46	
Hori.	319.487	QP	44.00	13.82	8.82	31.89	0.00	34.75	46.00	11.2	127	36	
Hori.	368.564	QP	42.60	14.92	9.07	31.85	0.00	34.74	46.00	11.2	100	21	
Hori.	466.943	QP	43.70	16.97	9.51	31.85	0.00	38.33	46.00	7.6	100	134	
Hori.	959.920	QP	32.00	22.12	11.23	30.40	0.00	34.95	46.00	11.0	100	214	
Hori.	960.000	QP	25.30	22.12	11.23	30.40	0.00	28.25	46.00	17.7	100	214	
Hori.	960.272	QP	45.70	22.12	11.23	30.40	0.00	48.65	53.90	5.2	100	214	
Hori.	2390.000	PK	48.77	27.26	13.60	44.13	2.24	47.74	73.90	26.1	125	99	
Hori.	4804.000	PK	48.35	31.40	5.61	44.45	2.24	43.15	73.90	30.7	156	109	
Hori.	7206.000	PK	47.05	36.56	6.86	43.99	2.24	48.72	73.90	25.1	150	0	
Hori.	9608.000	PK	47.82	38.61	7.84	43.83	2.24	52.68	73.90	21.2	150	0	
Hori.	2390.000	AV	36.72	27.26	13.60	44.13	2.24	35.69	53.90	18.2	125	99	
Hori.	4804.000	AV	37.97	31.40	5.61	44.45	2.24	32.77	53.90	21.1	156	109	
Hori.	7206.000	AV	35.56	36.56	6.86	43.99	2.24	37.23	53.90	16.6	150	0	
Hori.	9608.000	AV	35.99	38.61	7.84	43.83	2.24	40.85	53.90	13.0	150	0	
Vert.	73.731	QP	41.00	6.21	7.26	32.10	0.00	22.37	40.00	17.6	100	80	
Vert.	933.001	QP	37.00	22.04	11.15	30.63	0.00	39.56	46.00	6.4	100	334	
Vert.	2390.000	PK	48.40	27.26	13.60	44.13	2.24	47.37	73.90	26.5	284	65	
Vert.	4804.000	PK	48.18	31.40	5.61	44.45	2.24	42.98	73.90	30.9	164	168	
Vert.	7206.000	PK	47.08	36.56	6.86	43.99	2.24	48.75	73.90	25.1	150	0	
Vert.	9608.000	PK	47.05	38.61	7.84	43.83	2.24	51.91	73.90	21.9	150	0	
Vert.	2390.000	AV	36.71	27.26	13.60	44.13	2.24	35.68	53.90	18.2	284	65	
Vert.	4804.000	AV	37.38	31.40	5.61	44.45	2.24	32.18	53.90	21.7	164	168	
Vert.	7206.000	AV	35.54	36.56	6.86	43.99	2.24	37.21	53.90	16.6	150	0	
Vert.	9608.000	AV	36.07	38.61	7.84	43.83	2.24	40.93	53.90	12.9	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

### 20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	89.63	27.29	13.61	44.14	2.24	88.63	-	-	Carrier
Hori.	2400.000	PK	39.02	27.29	13.61	44.14	2.24	38.02	68.63	30.6	
Vert.	2402.000	PK	85.90	27.29	13.61	44.14	2.24	84.90	-	-	Carrier
Vert.	2400.000	PK	39.90	27.29	13.61	44.14	2.24	38.90	64.90	26.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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**Shonan EMC Lab.**

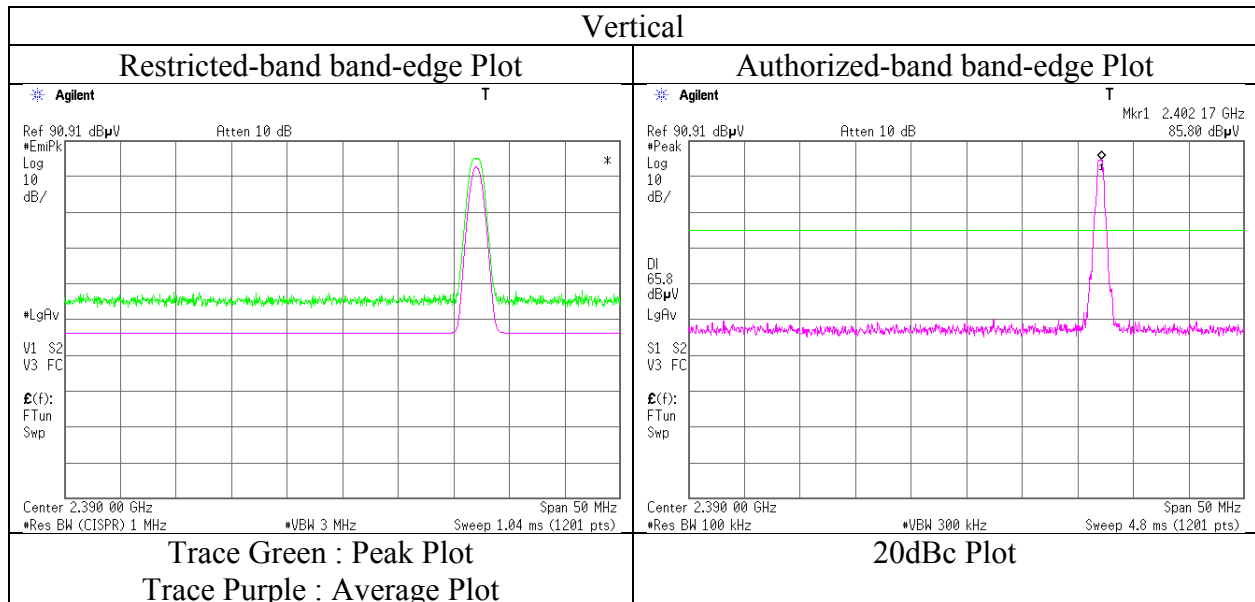
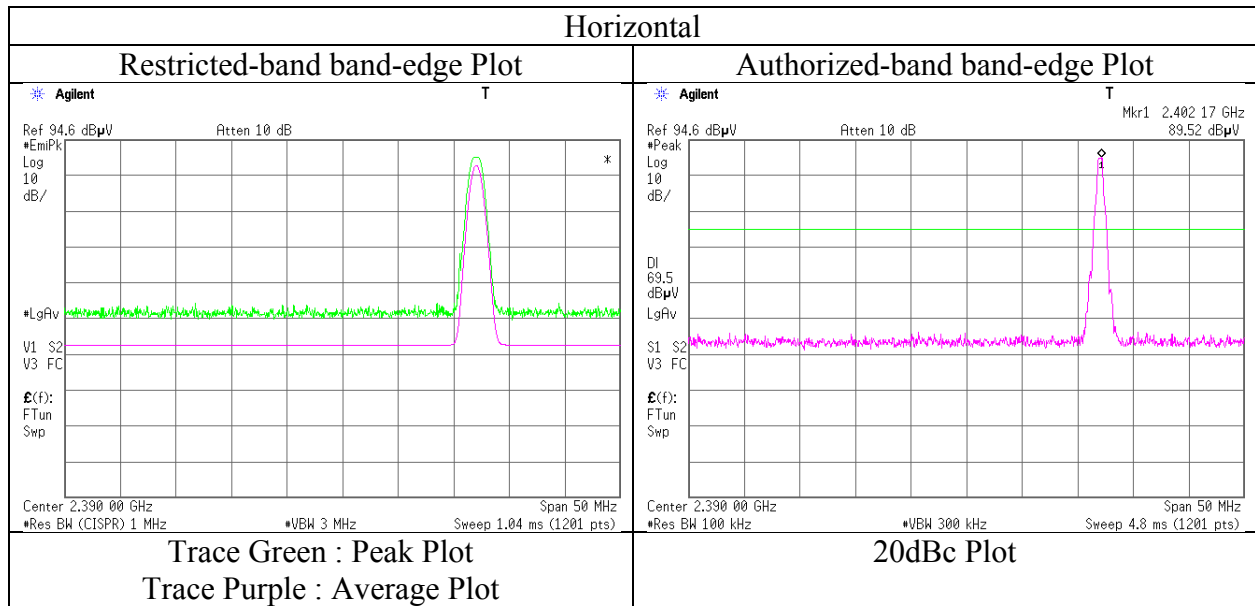
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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Report No. 12021807S-A-R2  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 3  
Date November 11, 2017  
Temperature / Humidity 23 deg. C / 42 % RH  
Engineer Hiroyuki Morikawa  
(1 GHz -13 GHz)  
Mode Tx, Hopping Off, DH5 2402 MHz



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

## Radiated Spurious Emission

Report No.	12021807S-A-R2				
Test place	Shonan EMC Lab.				
Semi Anechoic Chamber	3	3	3	3	3
Date	November 11, 2017	November 15, 2017	November 15, 2017	November 16, 2017	November 16, 2017
Temperature / Humidity	23 deg. C / 42 % RH	23 deg. C / 43 % RH	24 deg. C / 41 % RH	24 deg. C / 36 % RH	20 deg. C / 40 % RH
Engineer	Hiroyuki Morikawa (1 GHz - 13 GHz)	Makoto Hosaka (13 GHz - 18 GHz)	Kazuya Noda (18 GHz - 26.5 GHz)	Kazuya Noda (26.5 GHz - 31.5 GHz)	Kazutaka Takeyama (30 MHz - 1 GHz)
Mode	Tx, Hopping Off, DH5 2441 MHz				

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	122.882	QP	44.00	13.16	7.44	32.06	0.00	32.54	43.50	10.9	300	79	
Hori.	221.187	QP	48.00	11.52	8.27	31.96	0.00	35.83	46.00	10.1	150	37	
Hori.	224.999	QP	44.40	11.54	8.29	31.96	0.00	32.27	46.00	13.7	150	53	
Hori.	319.401	QP	44.10	13.82	8.82	31.89	0.00	34.85	46.00	11.1	125	41	
Hori.	368.595	QP	42.20	14.92	9.07	31.85	0.00	34.34	46.00	11.6	100	16	
Hori.	466.946	QP	43.50	16.97	9.51	31.85	0.00	38.13	46.00	7.8	100	135	
Hori.	959.916	QP	32.00	22.12	11.23	30.40	0.00	34.95	46.00	11.0	100	211	
Hori.	960.000	QP	25.40	22.12	11.23	30.40	0.00	28.35	46.00	17.6	100	211	
Hori.	960.271	QP	45.60	22.12	11.23	30.40	0.00	48.55	53.90	5.3	100	211	
Hori.	4880.000	PK	47.89	31.61	5.59	44.48	2.24	42.85	73.90	31.0	150	0	
Hori.	7323.000	PK	46.55	36.77	6.89	44.03	2.24	48.42	73.90	25.4	150	0	
Hori.	9764.000	PK	47.32	38.80	7.94	43.85	2.24	52.45	73.90	21.4	150	0	
Hori.	4880.000	AV	36.48	31.61	5.59	44.48	2.24	31.44	53.90	22.4	150	0	
Hori.	7323.000	AV	35.48	36.77	6.89	44.03	2.24	37.35	53.90	16.5	150	0	
Hori.	9764.000	AV	35.68	38.80	7.94	43.85	2.24	40.81	53.90	13.0	150	0	
Vert.	122.883	QP	42.40	13.16	7.44	32.06	0.00	30.94	43.50	12.5	100	286	
Vert.	933.000	QP	37.10	22.04	11.15	30.63	0.00	39.66	46.00	6.3	100	351	
Vert.	4880.000	PK	48.12	31.61	5.59	44.48	2.24	43.08	73.90	30.8	150	0	
Vert.	7323.000	PK	46.58	36.77	6.89	44.03	2.24	48.45	73.90	25.4	150	0	
Vert.	9764.000	PK	47.67	38.80	7.94	43.85	2.24	52.80	73.90	21.1	150	0	
Vert.	4880.000	AV	36.50	31.61	5.59	44.48	2.24	31.46	53.90	22.4	150	0	
Vert.	7323.000	AV	35.41	36.77	6.89	44.03	2.24	37.28	53.90	16.6	150	0	
Vert.	9764.000	AV	35.68	38.80	7.94	43.85	2.24	40.81	53.90	13.0	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

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

## Radiated Spurious Emission

Report No.	12021807S-A-R2				
Test place	Shonan EMC Lab.				
Semi Anechoic Chamber	3	3	3	3	3
Date	November 11, 2017	November 15, 2017	November 15, 2017	November 16, 2017	November 16, 2017
Temperature / Humidity	23 deg. C / 42 % RH	23 deg. C / 43 % RH	24 deg. C / 41 % RH	24 deg. C / 36 % RH	20 deg. C / 40 % RH
Engineer	Hiroyuki Morikawa (1 GHz - 13 GHz)	Makoto Hosaka (13 GHz - 18 GHz)	Kazuya Noda (18 GHz - 26.5 GHz)	Kazuya Noda (26.5 GHz - 31.5 GHz)	Kazutaka Takeyama (30 Hz - 1 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz				

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	122.882	QP	44.00	13.16	7.44	32.06	0.00	32.54	43.50	10.9	300	76	
Hori.	172.036	QP	38.40	15.72	8.01	32.01	0.00	30.12	43.50	13.3	200	85	
Hori.	221.184	QP	47.70	11.52	8.27	31.96	0.00	35.53	46.00	10.4	150	38	
Hori.	245.000	QP	44.20	11.65	8.41	31.93	0.00	32.33	46.00	13.6	150	50	
Hori.	319.494	QP	43.80	13.82	8.82	31.89	0.00	34.55	46.00	11.4	130	33	
Hori.	368.562	QP	42.50	14.92	9.07	31.85	0.00	34.64	46.00	11.3	100	16	
Hori.	466.943	QP	43.70	16.97	9.51	31.85	0.00	38.33	46.00	7.6	100	144	
Hori.	959.929	QP	32.20	22.12	11.23	30.40	0.00	35.15	46.00	10.8	100	210	
Hori.	960.000	QP	25.40	22.12	11.23	30.40	0.00	28.35	46.00	17.6	100	210	
Hori.	960.281	QP	45.50	22.12	11.23	30.40	0.00	48.45	53.90	5.4	100	210	
Hori.	2483.500	PK	48.78	27.55	13.69	44.16	2.24	48.10	73.90	25.8	146	103	
Hori.	4960.000	PK	49.75	31.83	5.59	44.51	2.24	44.90	73.90	29.0	137	142	
Hori.	7440.000	PK	47.47	36.97	6.92	44.08	2.24	49.52	73.90	24.3	150	0	
Hori.	9920.000	PK	46.89	38.98	8.04	43.87	2.24	52.28	73.90	21.6	150	0	
Hori.	2483.500	AV	36.89	27.55	13.69	44.16	2.24	36.21	53.90	17.6	146	103	
Hori.	4960.000	AV	37.64	31.83	5.59	44.51	2.24	32.79	53.90	21.1	137	142	
Hori.	7440.000	AV	36.26	36.97	6.92	44.08	2.24	38.31	53.90	15.5	150	0	
Hori.	9920.000	AV	35.51	38.98	8.04	43.87	2.24	40.90	53.90	13.0	150	0	
Vert.	184.316	QP	40.00	16.10	7.97	32.01	0.00	32.06	43.50	11.4	100	33	
Vert.	933.032	QP	37.80	22.04	11.15	30.63	0.00	40.36	46.00	5.6	100	351	
Vert.	2483.500	PK	48.57	27.55	13.69	44.16	2.24	47.89	73.90	26.0	164	139	
Vert.	4960.000	PK	48.78	31.83	5.59	44.51	2.24	43.93	73.90	29.9	119	65	
Vert.	7440.000	PK	47.54	36.97	6.92	44.08	2.24	49.59	73.90	24.3	150	0	
Vert.	9920.000	PK	47.04	38.98	8.04	43.87	2.24	52.43	73.90	21.4	150	0	
Vert.	2483.500	AV	36.77	27.55	13.69	44.16	2.24	36.09	53.90	17.8	164	139	
Vert.	4960.000	AV	37.62	31.83	5.59	44.51	2.24	32.77	53.90	21.1	119	65	
Vert.	7440.000	AV	36.29	36.97	6.92	44.08	2.24	38.34	53.90	15.5	150	0	
Vert.	9920.000	AV	35.53	38.98	8.04	43.87	2.24	40.92	53.90	12.9	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

**UL Japan, Inc.**

**Shonan EMC Lab.**

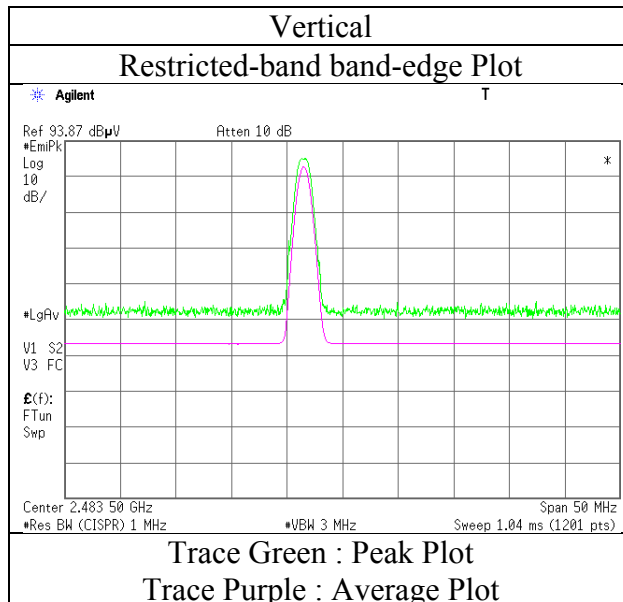
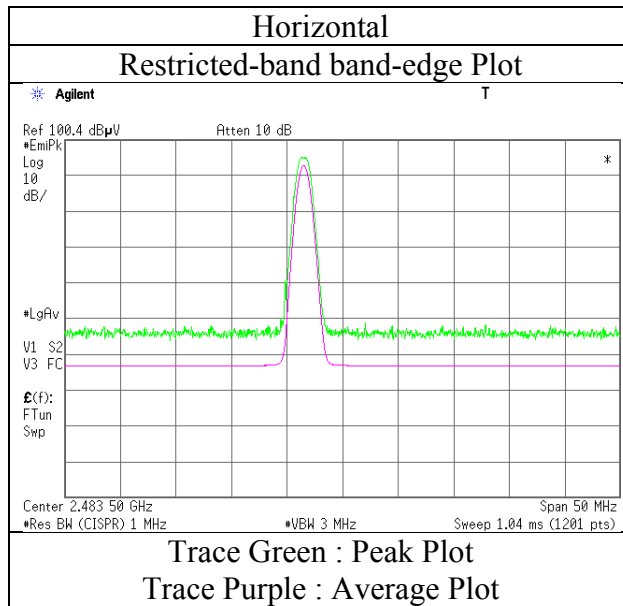
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Telephone : +81 463 50 6400

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**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Report No.	12021807S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	November 11, 2017
Temperature / Humidity	23 deg. C / 42 % RH
Engineer	Hiroyuki Morikawa (1 GHz -13 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz



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

## Radiated Spurious Emission

Report No. 12021807S-A-R2  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 3 3 3 3 3  
Date November 11, 2017 November 15, 2017 November 15, 2017 November 16, 2017 November 16, 2017  
Temperature / Humidity 23 deg. C / 42 % RH 23 deg. C / 43 % RH 24 deg. C / 41 % RH 24 deg. C / 36 % RH 20 deg. C / 40 % RH  
Engineer Hiroyuki Morikawa Makoto Hosaka Kazuya Noda Kazuya Noda Kazutaka Takeyama  
(1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz) (26.5 GHz - 31.5 GHz) (30 MHz - 1 GHz)  
Mode Tx, Hopping Off, 3DH5 2402 MHz

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	110.591	QP	45.60	11.59	7.40	32.07	0.00	32.52	43.50	10.9	300	102	
Hori.	122.884	QP	45.40	13.16	7.44	32.06	0.00	33.94	43.50	9.5	300	83	
Hori.	221.184	QP	47.50	11.52	8.27	31.96	0.00	35.33	46.00	10.6	150	33	
Hori.	245.758	QP	47.70	11.66	8.42	31.93	0.00	35.85	46.00	10.1	150	70	
Hori.	368.600	QP	42.40	14.92	9.07	31.85	0.00	34.54	46.00	11.4	100	10	
Hori.	466.945	QP	42.60	16.97	9.51	31.85	0.00	37.23	46.00	8.7	100	134	
Hori.	959.939	QP	32.00	22.12	11.23	30.40	0.00	34.95	46.00	11.0	100	210	
Hori.	960.000	QP	25.30	22.12	11.23	30.40	0.00	28.25	46.00	17.7	100	210	
Hori.	960.255	QP	45.50	22.12	11.23	30.40	0.00	48.45	53.90	5.4	100	210	
Hori.	2390.000	PK	48.31	27.26	13.60	44.13	2.24	47.28	73.90	26.6	151	245	
Hori.	4804.000	PK	48.26	31.40	5.61	44.45	2.24	43.06	73.90	30.8	150	0	
Hori.	7206.000	PK	47.13	36.56	6.86	43.99	2.24	48.80	73.90	25.1	150	0	
Hori.	9608.000	PK	46.58	38.61	7.84	43.83	2.24	51.44	73.90	22.4	150	0	
Hori.	2390.000	AV	36.74	27.26	13.60	44.13	2.24	35.71	53.90	18.1	151	245	
Hori.	4804.000	AV	36.81	31.40	5.61	44.45	2.24	31.61	53.90	22.2	150	0	
Hori.	7206.000	AV	35.50	36.56	6.86	43.99	2.24	37.17	53.90	16.7	150	0	
Hori.	9608.000	AV	35.94	38.61	7.84	43.83	2.24	40.80	53.90	13.1	150	0	
Vert.	184.315	QP	36.00	16.10	7.97	32.01	0.00	28.06	43.50	15.4	100	27	
Vert.	933.005	QP	38.00	22.04	11.15	30.63	0.00	40.56	46.00	5.4	100	2	
Vert.	2390.000	PK	48.74	27.26	13.60	44.13	2.24	47.71	73.90	26.1	281	64	
Vert.	4804.000	PK	48.25	31.40	5.61	44.45	2.24	43.05	73.90	30.8	150	0	
Vert.	7206.000	PK	47.31	36.56	6.86	43.99	2.24	48.98	73.90	24.9	150	0	
Vert.	9608.000	PK	47.37	38.61	7.84	43.83	2.24	52.23	73.90	21.6	150	0	
Vert.	2390.000	AV	36.69	27.26	13.60	44.13	2.24	35.66	53.90	18.2	281	64	
Vert.	4804.000	AV	36.77	31.40	5.61	44.45	2.24	31.57	53.90	22.3	150	0	
Vert.	7206.000	AV	35.50	36.56	6.86	43.99	2.24	37.17	53.90	16.7	150	0	
Vert.	9608.000	AV	36.01	38.61	7.84	43.83	2.24	40.87	53.90	13.0	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

### 20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	83.84	27.29	13.61	44.14	2.24	82.84	-	-	Carrier
Hori.	2400.000	PK	39.42	27.29	13.61	44.14	2.24	38.42	62.84	24.4	
Vert.	2402.000	PK	80.05	27.29	13.61	44.14	2.24	79.05	-	-	Carrier
Vert.	2400.000	PK	39.43	27.29	13.61	44.14	2.24	38.43	59.05	20.6	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

**UL Japan, Inc.**

**Shonan EMC Lab.**

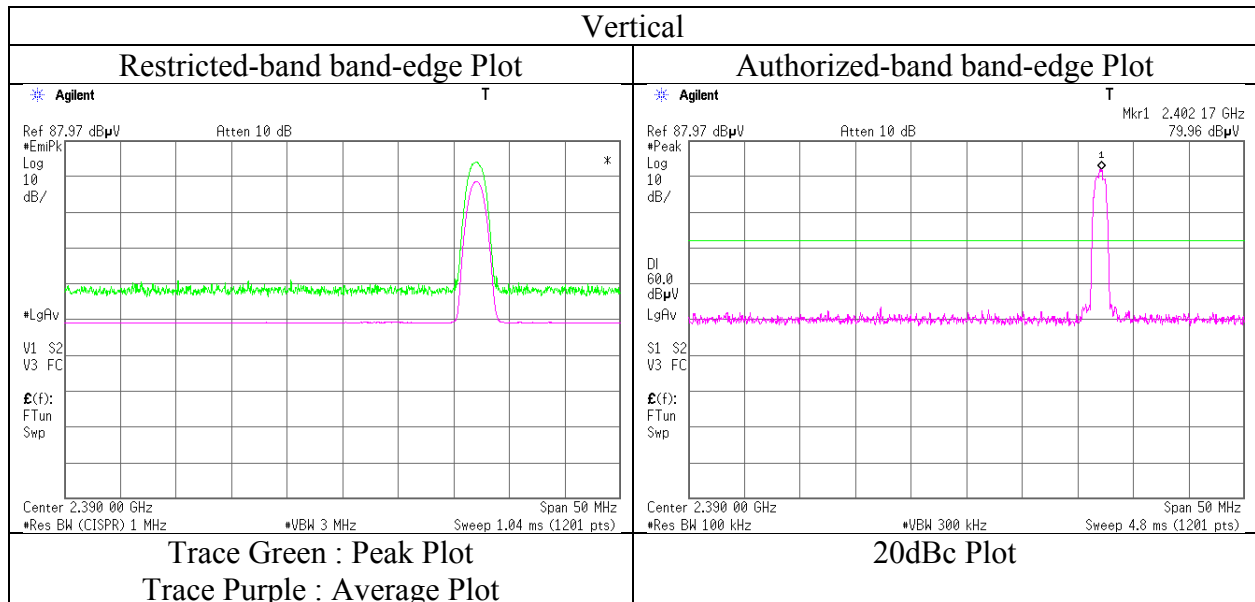
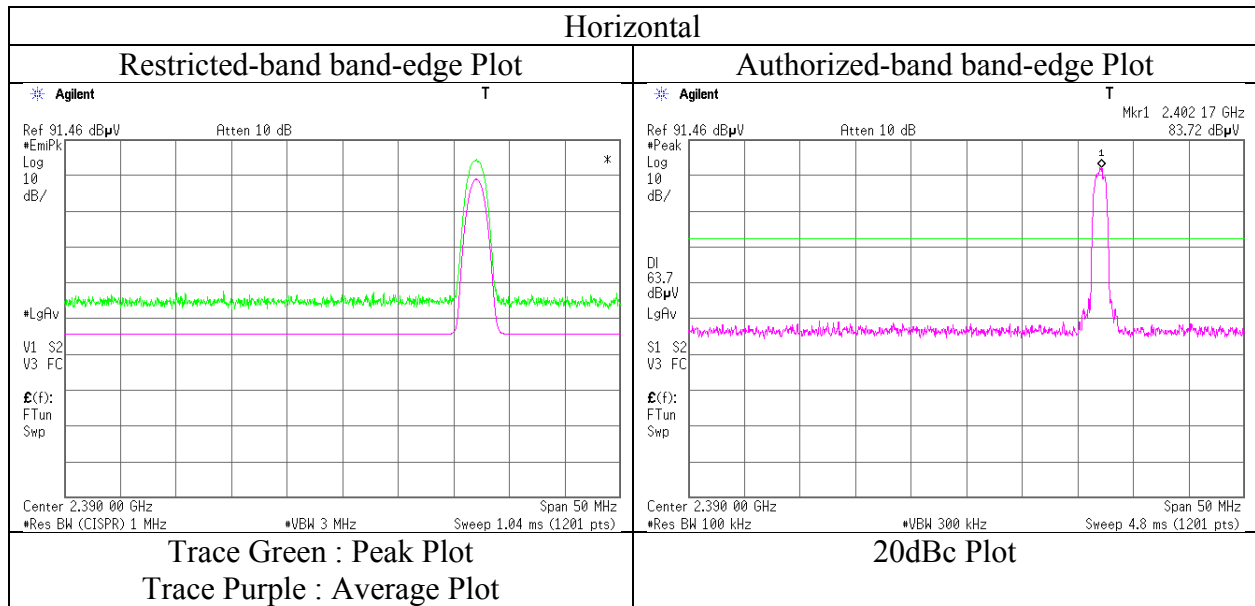
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Report No.	12021807S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	November 11, 2017
Temperature / Humidity	23 deg. C / 42 % RH
Engineer	Hiroyuki Morikawa (1 GHz -13 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz



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



## Radiated Spurious Emission

Report No.	12021807S-A-R2				
Test place	Shonan EMC Lab.				
Semi Anechoic Chamber	3	3	3	3	3
Date	November 11, 2017	November 15, 2017	November 15, 2017	November 16, 2017	November 16, 2017
Temperature / Humidity	23 deg. C / 42 % RH	23 deg. C / 43 % RH	24 deg. C / 41 % RH	24 deg. C / 36 % RH	20 deg. C / 40 % RH
Engineer	Hiroyuki Morikawa (1 GHz - 13 GHz)	Makoto Hosaka (13 GHz - 18 GHz)	Kazuya Noda (18 GHz - 26.5 GHz)	Kazuya Noda (26.5 GHz - 31.5 GHz)	Kazutaka Takeyama (30 MHz - 1 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz				

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	110.591	QP	45.80	11.59	7.40	32.07	0.00	32.72	43.50	10.7	300	123	
Hori.	122.872	QP	45.00	13.16	7.44	32.06	0.00	33.54	43.50	9.9	300	76	
Hori.	221.183	QP	52.10	11.52	8.27	31.96	0.00	39.93	46.00	6.0	150	45	
Hori.	225.000	QP	50.70	11.54	8.30	31.96	0.00	38.58	46.00	7.4	150	50	
Hori.	319.495	QP	43.30	13.82	8.82	31.89	0.00	34.05	46.00	11.9	130	34	
Hori.	368.336	QP	42.30	14.91	9.07	31.85	0.00	34.43	46.00	11.5	100	24	
Hori.	466.944	QP	42.00	16.97	9.51	31.85	0.00	36.63	46.00	9.3	100	143	
Hori.	959.929	QP	32.00	22.12	11.23	30.40	0.00	34.95	46.00	11.0	100	211	
Hori.	960.000	QP	25.40	22.12	11.23	30.40	0.00	28.35	46.00	17.6	100	211	
Hori.	960.281	QP	45.20	22.12	11.23	30.40	0.00	48.15	53.90	5.7	100	211	
Hori.	4882.000	PK	48.30	31.62	5.60	44.48	2.24	43.28	73.90	30.6	150	0	
Hori.	7323.000	PK	47.60	36.77	6.89	44.03	2.24	49.47	73.90	24.4	150	0	
Hori.	9764.000	PK	47.49	38.80	7.94	43.85	2.24	52.62	73.90	21.2	150	0	
Hori.	4882.000	AV	36.62	31.62	5.60	44.48	2.24	31.60	53.90	22.3	150	0	
Hori.	7323.000	AV	35.49	36.77	6.89	44.03	2.24	37.36	53.90	16.5	150	0	
Hori.	9764.000	AV	35.66	38.80	7.94	43.85	2.24	40.79	53.90	13.1	150	0	
Vert.	221.183	QP	47.20	11.52	8.27	31.96	0.00	35.03	46.00	10.9	100	314	
Vert.	933.010	QP	37.70	22.04	11.15	30.63	0.00	40.26	46.00	5.7	100	352	
Vert.	4882.000	PK	48.46	31.62	5.60	44.48	2.24	43.44	73.90	30.4	150	0	
Vert.	7323.000	PK	46.19	36.77	6.89	44.03	2.24	48.06	73.90	25.8	150	0	
Vert.	9764.000	PK	47.02	38.80	7.94	43.85	2.24	52.15	73.90	21.7	150	0	
Vert.	4882.000	AV	36.60	31.62	5.60	44.48	2.24	31.58	53.90	22.3	150	0	
Vert.	7323.000	AV	35.46	36.77	6.89	44.03	2.24	37.33	53.90	16.5	150	0	
Vert.	9764.000	AV	35.69	38.80	7.94	43.85	2.24	40.82	53.90	13.0	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

## Radiated Spurious Emission

Report No. 12021807S-A-R2  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 3 3 3 3 3  
Date November 11, 2017 November 15, 2017 November 15, 2017 November 16, 2017 November 16, 2017  
Temperature / Humidity 23 deg. C / 42 % RH 23 deg. C / 43 % RH 24 deg. C / 41 % RH 24 deg. C / 36 % RH 20 deg. C / 40 % RH  
Engineer Hiroyuki Morikawa Makoto Hosaka Kazuya Noda Kazuya Noda Kazutaka Takeyama  
(1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz) (26.5 GHz - 31.5 GHz) (30 MHz - 1 GHz)  
Mode Tx, Hopping Off, 3DH5 2480 MHz

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	110.574	QP	45.50	11.59	7.40	32.07	0.00	32.42	43.50	11.0	300	126	
Hori.	122.891	QP	44.90	13.17	7.44	32.06	0.00	33.45	43.50	10.0	300	98	
Hori.	221.179	QP	52.00	11.52	8.27	31.96	0.00	39.83	46.00	6.1	150	41	
Hori.	224.997	QP	50.50	11.54	8.29	31.96	0.00	38.37	46.00	7.6	150	45	
Hori.	319.413	QP	42.00	13.82	8.82	31.89	0.00	32.75	46.00	13.2	135	111	
Hori.	466.920	QP	42.10	16.97	9.51	31.85	0.00	36.73	46.00	9.2	100	145	
Hori.	933.001	QP	35.00	22.04	11.15	30.63	0.00	37.56	46.00	8.4	100	234	
Hori.	959.924	QP	32.40	22.12	11.23	30.40	0.00	35.35	46.00	10.6	100	213	
Hori.	960.000	QP	25.50	22.12	11.23	30.40	0.00	28.45	46.00	17.5	100	213	
Hori.	960.280	QP	45.40	22.12	11.23	30.40	0.00	48.35	53.90	5.5	100	213	
Hori.	2483.500	PK	48.47	27.55	13.69	44.16	2.24	47.79	73.90	26.1	145	102	
Hori.	4960.000	PK	47.95	31.83	5.59	44.51	2.24	43.10	73.90	30.8	150	0	
Hori.	7440.000	PK	47.42	36.97	6.92	44.08	2.24	49.47	73.90	24.4	150	0	
Hori.	9920.000	PK	46.43	38.98	8.04	43.87	2.24	51.82	73.90	22.0	150	0	
Hori.	2483.500	AV	36.79	27.55	13.69	44.16	2.24	36.11	53.90	17.7	145	102	
Hori.	4960.000	AV	36.89	31.83	5.59	44.51	2.24	32.04	53.90	21.8	150	0	
Hori.	7440.000	AV	36.25	36.97	6.92	44.08	2.24	38.30	53.90	15.6	150	0	
Hori.	9920.000	AV	35.51	38.98	8.04	43.87	2.24	40.90	53.90	13.0	150	0	
Vert.	221.183	QP	47.20	11.52	8.27	31.96	0.00	35.03	46.00	10.9	100	314	
Vert.	933.020	QP	37.60	22.04	11.15	30.63	0.00	40.16	46.00	5.8	100	359	
Vert.	2483.500	PK	48.91	27.55	13.69	44.16	2.24	48.23	73.90	25.6	136	208	
Vert.	4960.000	PK	48.99	31.83	5.59	44.51	2.24	44.14	73.90	29.7	150	0	
Vert.	7440.000	PK	47.86	36.97	6.92	44.08	2.24	49.91	73.90	23.9	150	0	
Vert.	9920.000	PK	46.20	38.98	8.04	43.87	2.24	51.59	73.90	22.3	150	0	
Vert.	2483.500	AV	36.73	27.55	13.69	44.16	2.24	36.05	53.90	17.8	136	208	
Vert.	4960.000	AV	36.86	31.83	5.59	44.51	2.24	32.01	53.90	21.8	150	0	
Vert.	7440.000	AV	36.27	36.97	6.92	44.08	2.24	38.32	53.90	15.5	150	0	
Vert.	9920.000	AV	35.53	38.98	8.04	43.87	2.24	40.92	53.90	12.9	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

**UL Japan, Inc.**

**Shonan EMC Lab.**

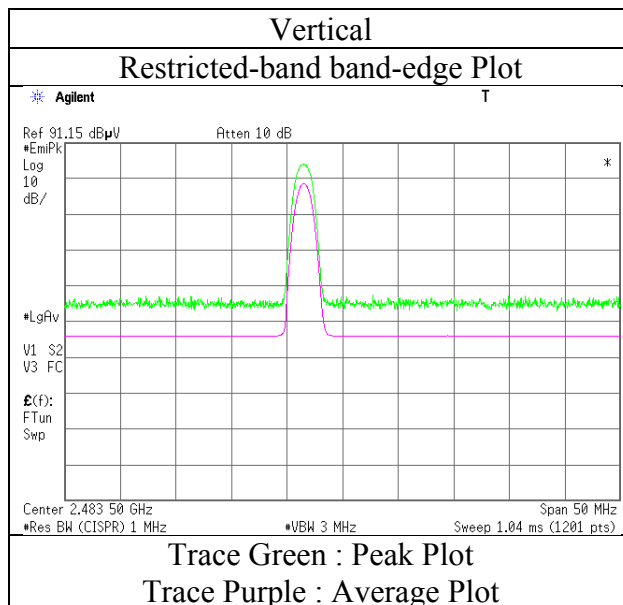
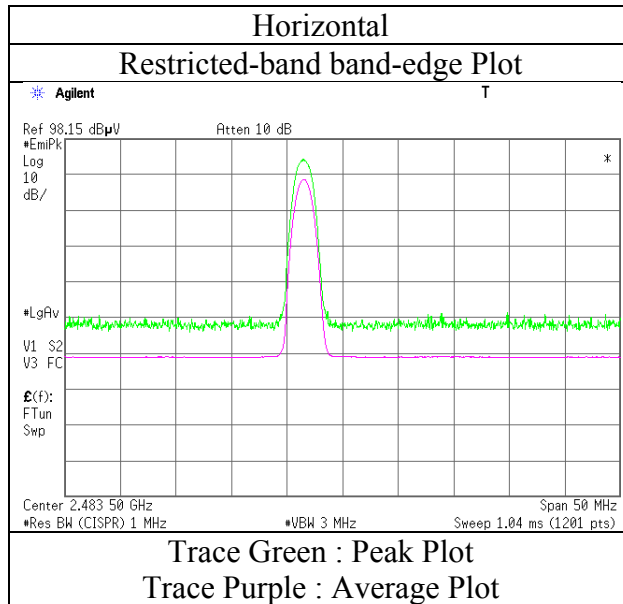
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**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

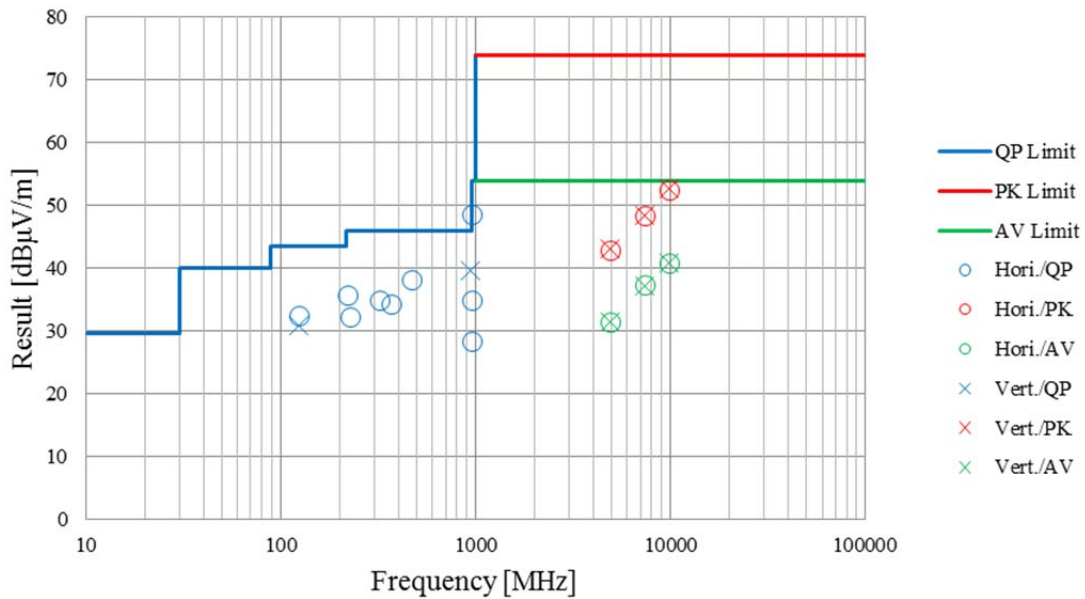
Report No.	12021807S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	November 11, 2017
Temperature / Humidity	23 deg. C / 42 % RH
Engineer	Hiroyuki Morikawa (1 GHz -13 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz



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

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

Report No.	12021807S-A-R2				
Test place	Shonan EMC Lab.				
Semi Anechoic Chamber	3	3	3	3	3
Date	November 11, 2017	November 15, 2017	November 15, 2017	November 16, 2017	November 16, 2017
Temperature / Humidity	23 deg. C / 42 % RH	23 deg. C / 43 % RH	24 deg. C / 41 % RH	24 deg. C / 36 % RH	20 deg. C / 40 % RH
Engineer	Hiroyuki Morikawa (1 GHz - 13 GHz)	Makoto Hosaka (13 GHz - 18 GHz)	Kazuya Noda (18 GHz - 26.5 GHz)	Kazuya Noda (26.5 GHz - 31.5 GHz)	Kazutaka Takeyama (30 Hz - 1 GHz)
Mode	Tx, Hopping Off, DH5 2441 MHz				

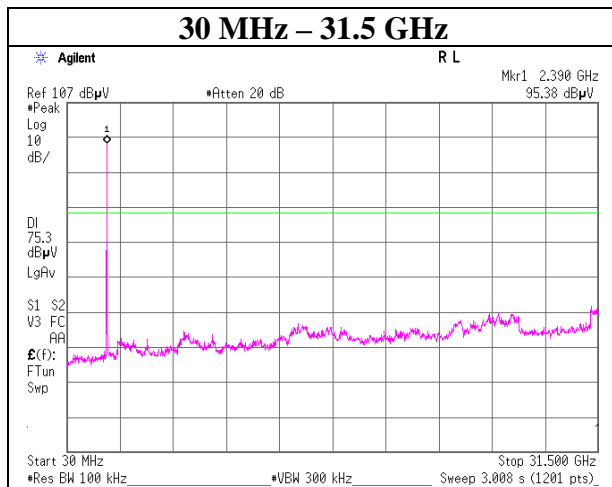
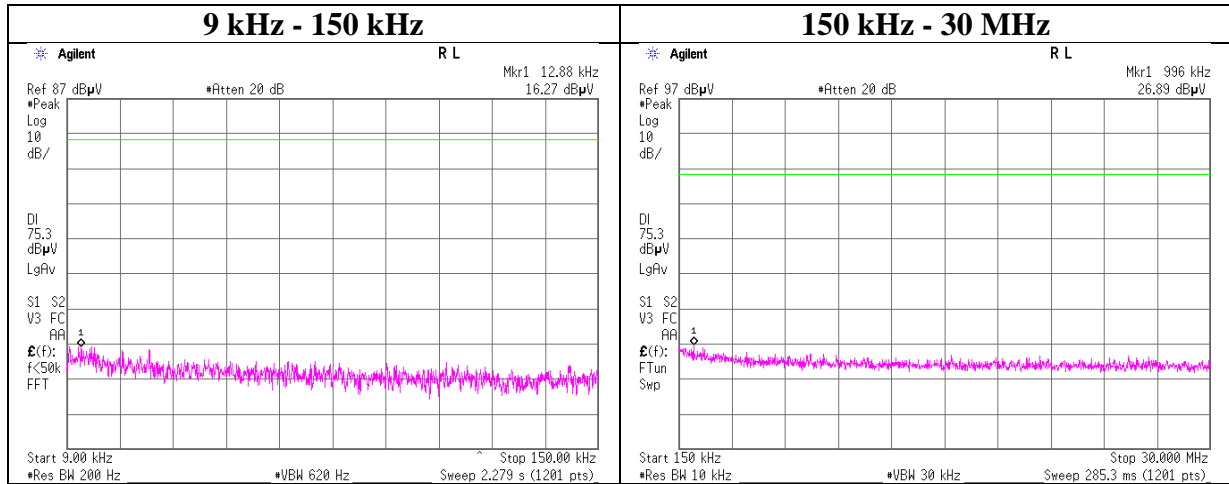


\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12021807S-A-R2
Date	November 7, 2017
Temperature / Humidity	27 deg. C / 41 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, DH5

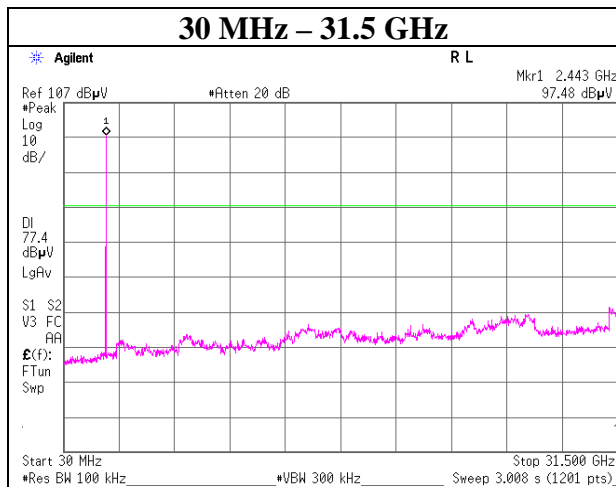
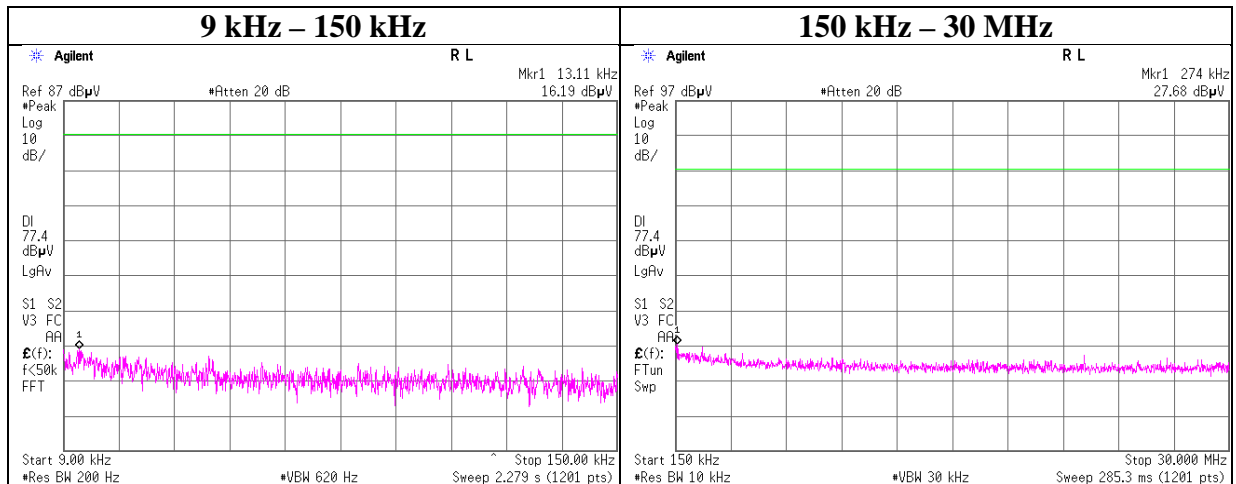
### 2402 MHz



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12021807S-A-R2
Date	November 7, 2017
Temperature / Humidity	27 deg. C / 41 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, DH5

### 2441 MHz



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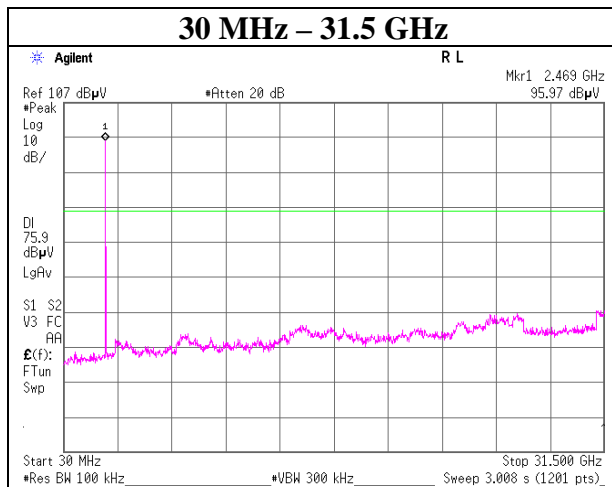
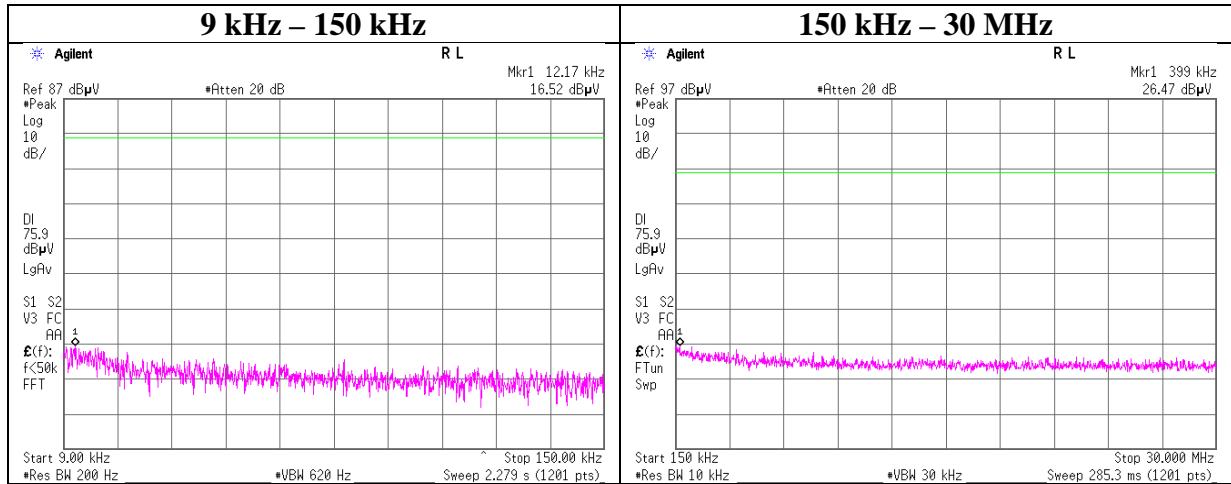
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12021807S-A-R2
Date	November 7, 2017
Temperature / Humidity	27 deg. C / 41 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, DH5

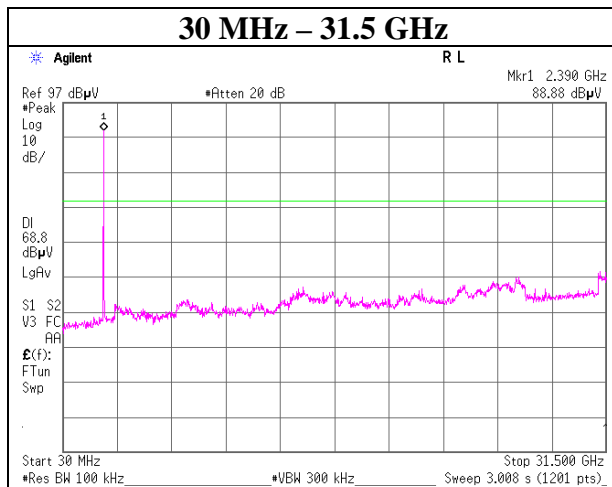
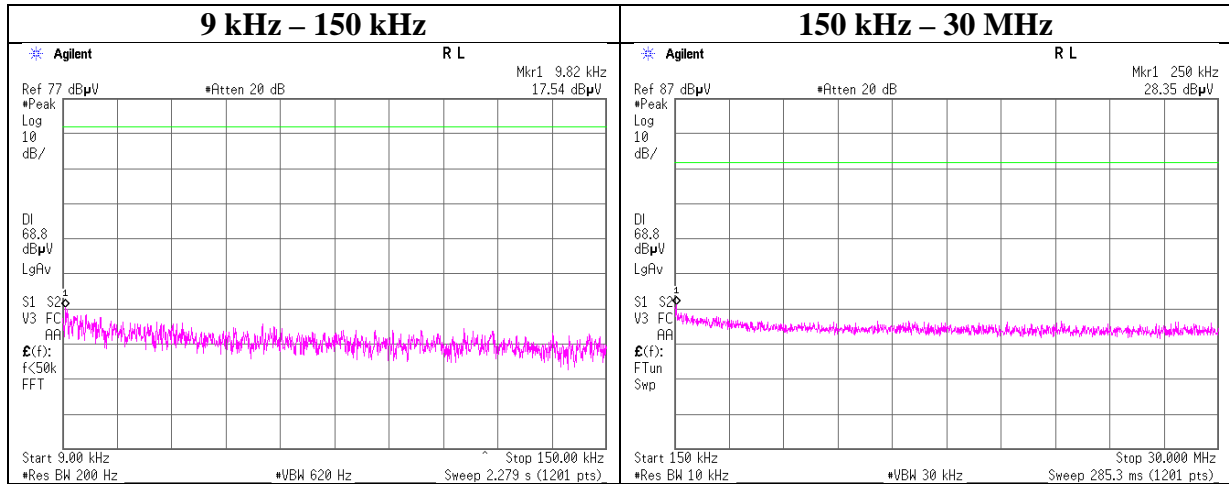
### 2480 MHz



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12021807S-A-R2
Date	November 8, 2017
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Tatsuya Arai
Mode	Tx, Hopping Off, 3DH5

### 2402 MHz

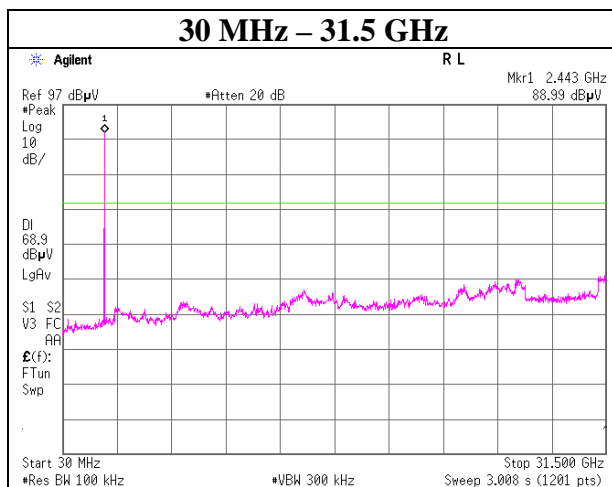
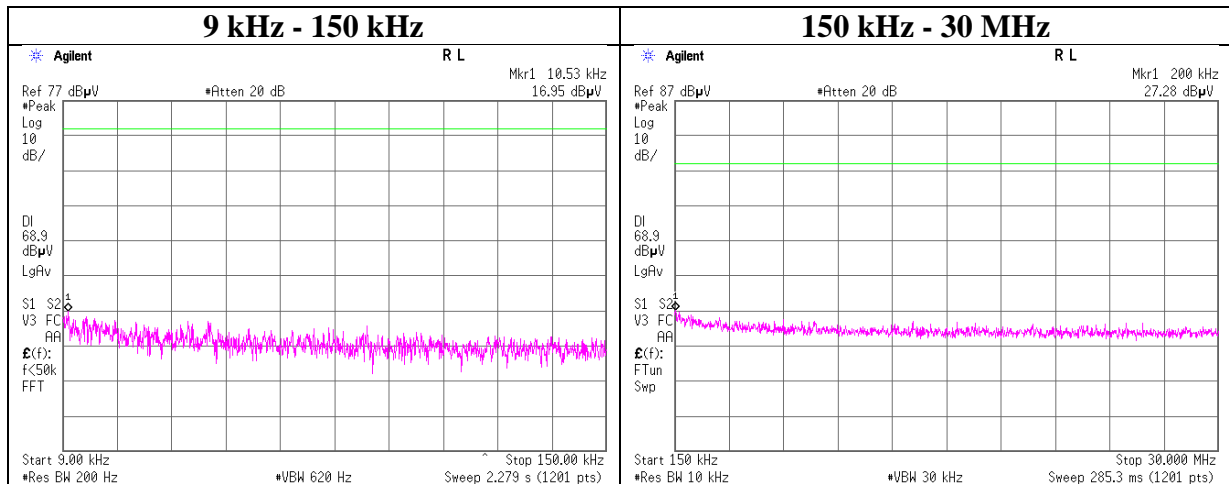




## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12021807S-A-R2
Date	November 8, 2017
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Tatsuya Arai
Mode	Tx, Hopping Off, 3DH5

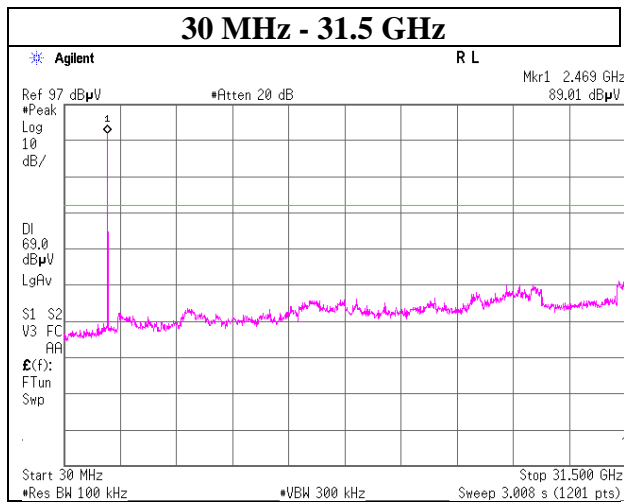
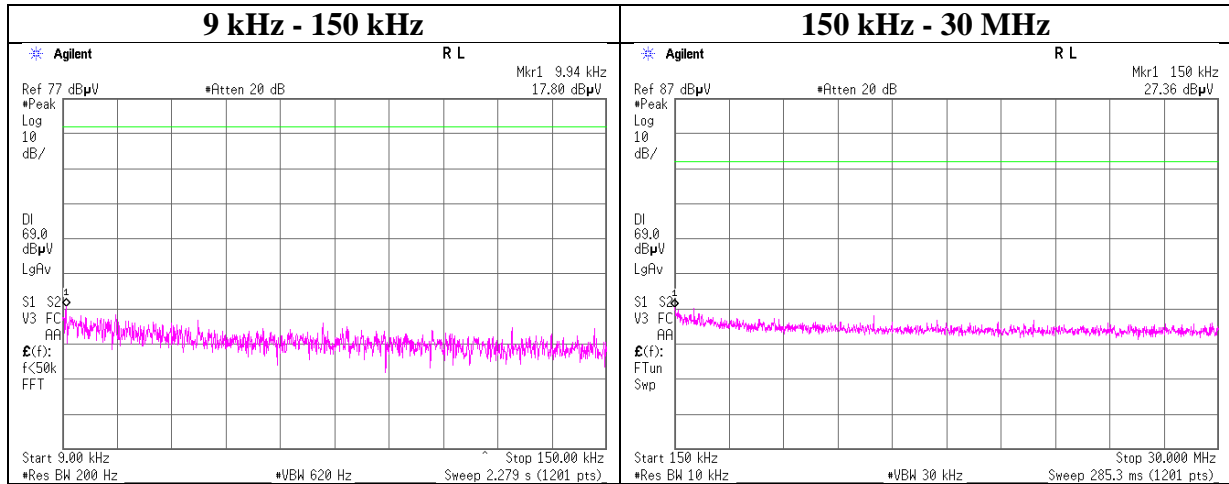
### 2441 MHz



## Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12021807S-A-R2
Date	November 8, 2017
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Tatsuya Arai
Mode	Tx, Hopping Off, 3DH5

### 2480 MHz



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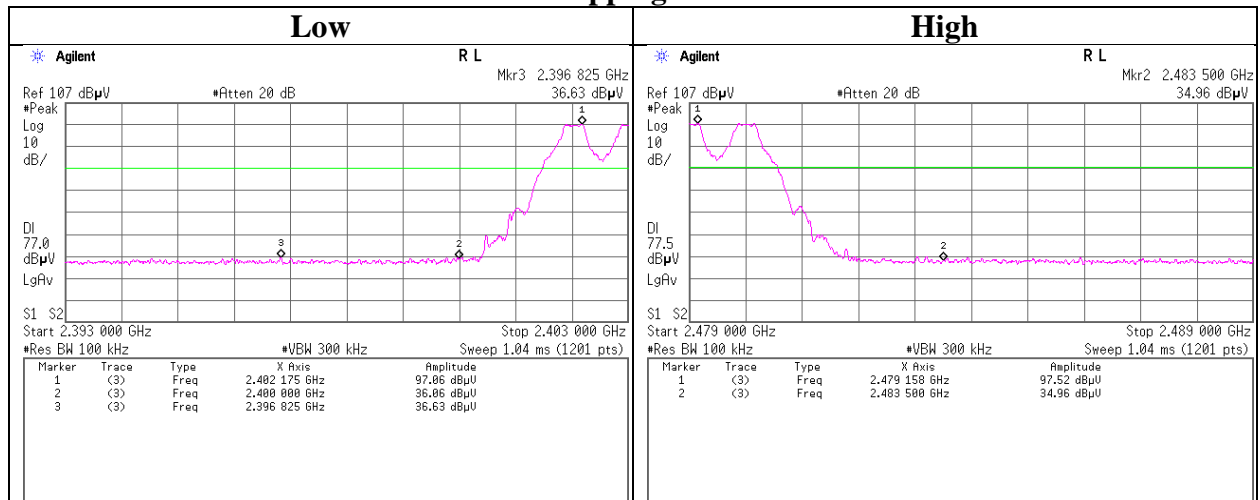
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

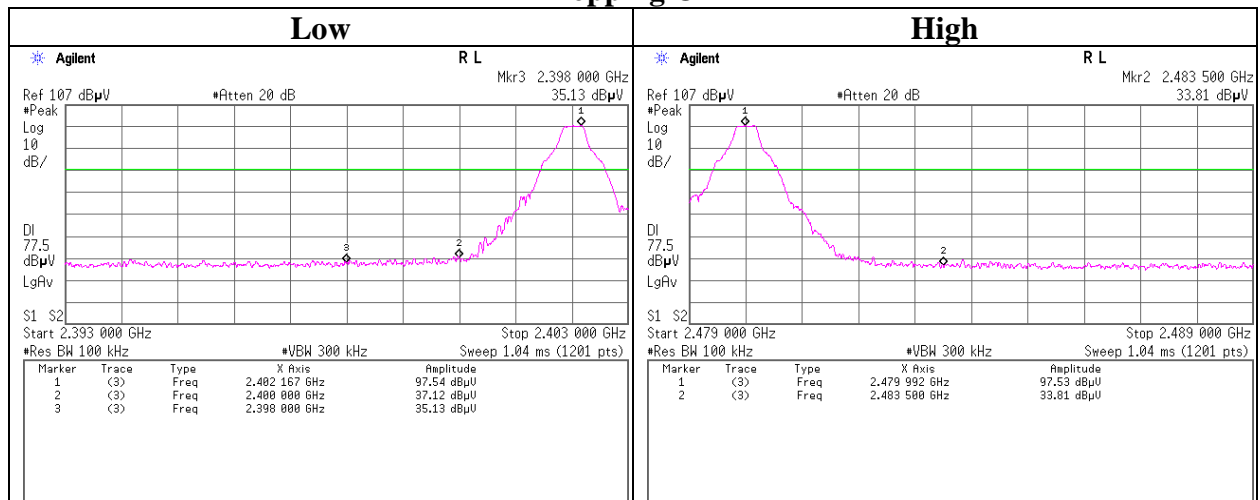
## Conducted Emission Band Edge compliance

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12021807S-A-R2
Date	November 7, 2017
Temperature / Humidity	27 deg. C / 41 % RH
Engineer	Makoto Hosaka
Mode	Tx DH5

### Hopping On



### Hopping Off



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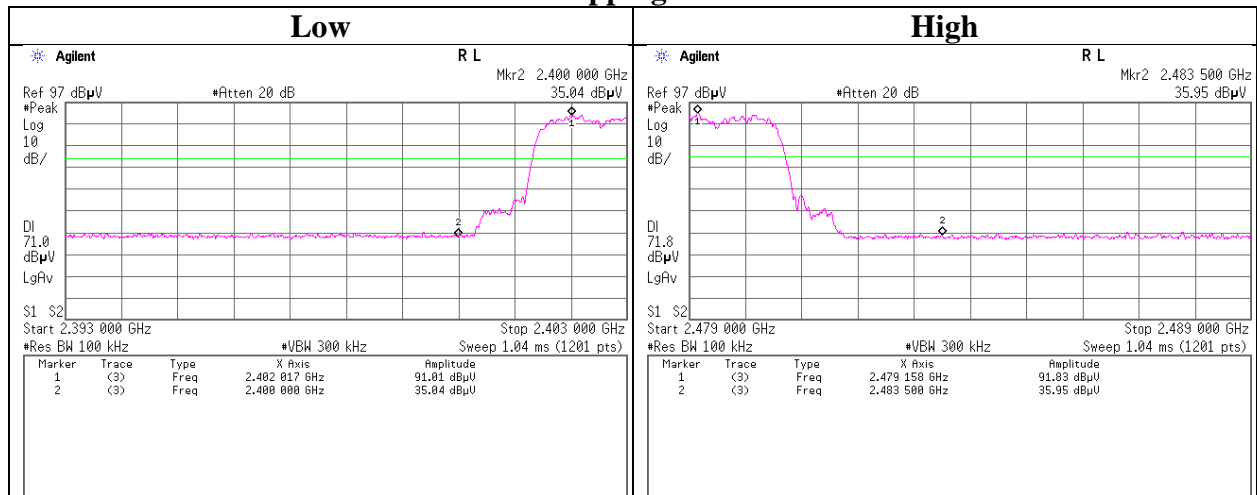
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

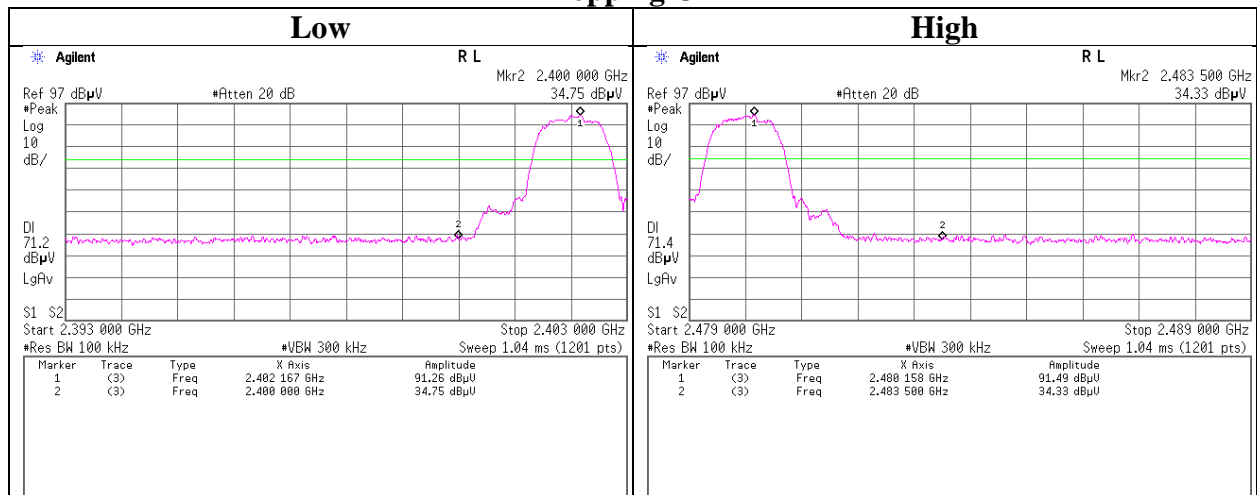
## Conducted Emission Band Edge compliance

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12021807S-A-R2
Date	November 8, 2017
Temperature / Humidity	25 deg. C / 44 % RH
Engineer	Tatsuya Arai
Mode	Tx 3DH5

### Hopping On



### Hopping Off



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## APPENDIX 2: Test instruments

### Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2017/08/20 * 12
SAT10-13	Attenuator	Weinschel Corp.	54A-10	81626	AT	2017/03/23 * 12
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2017/03/23 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2016/12/13 * 12
STS-05	Digital Hitester	Hioki	3805-50	080997828	AT	2017/10/16 * 12
SRENT-10	Spectrum Analyzer	Agilent	E4440A	US41421511	AT	2016/12/05 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2017/05/01 * 12
SPSS-05	Power sensor	Agilent	N1923A	MY5349008	AT	2017/05/01 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	2046104	RE	2017/09/22 * 12
SCC-G07	Coaxial Cable	Junkosha	J12J103316-00-R	OCT-12-17-054	RE	2017/10/23 * 12
SCC-G43	Coaxial Cable	HUBER+SUHNER	SUCOFLEX_104 E	SN MY 13406/4E	RE	2017/07/10 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2017/08/23 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2017/10/30 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2017/10/10 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
SAEC-03(SV SWR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVS WR)	3	RE	2017/07/17 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE, CE,RFI,MF)	-	RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2017/10/16 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2016/11/07 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2017/04/20 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2017/03/15 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2017/09/22 * 12
SCC-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2017/03/23 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-0100 0KMSKMS	-	RE	2017/04/20 * 12
SHA-06	Horn Antenna	ETS LINDGREN	3160-10	LM3459	RE	2017/03/15 * 12
SAF-10	Pre Amplifier	TOYO Corporation	HAP26-40W	00000010	RE	2017/03/17 * 12
SAEC-03(NS A)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2017/06/11 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2017/10/02 * 12
SLA-07	Logperiodic Antenna	Schwarzbeck	VU5LP9111B	196	RE	2017/01/26 * 12
SAT6-08	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	RE	2017/08/24 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS 4906	-/0901-271(RF Selector)	RE	2017/04/07 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2017/02/09 * 12
STR-08	Test Receiver	Rohde & Schwarz	ESW44	101581	RE	2016/11/08 * 12

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

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

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

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

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