RADIO TEST REPORT

Test Report No. : 12429781S-K-R2

Applicant	:	**RICOH COMPANY, LTD.**
Type of Equipment	:	**Digital Camera**
Model No.	:	**R02020** * Bluetooth BDR/EDR part
FCC ID	:	**BBP-R02020**
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 limits of the above regulation.
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6. This test report covers Radio technical requirements.
   It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. This report is a revised version of 12429781S-K-R1. 12429781S-K-R1 is replaced with this report.

Date of test: August 27, 2018 to February 8, 2019

Representative test engineer:

Yosuke Ishikawa
Engineer
Consumer Technology Division

Approved by:

Toyokazu Imamura
Leader
Consumer Technology Division

RTL02610

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

REVISION HISTORY

Original Test Report No.: 12429781S-K

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12429781S-K	October 24, 2018	-	-
1	12429781S-K-R1	October 26, 2018	5 6 12	Deletion of Radio Specification Correction of Antenna type Update of 3.2 Deletion of *1)
2	12429781S-K-R2	February 13, 2019	1	Correction of "Date of test"
			12	Deletion of "Synchronous noise for frequency hopping" and "Other noise" Addition of Comment "*1) Although DA 00-705 accepts…"
			20 20, 23	Addition of Date Correction of comment Add the measurement date. Since the marker placed at the hopping interval was not in the proper position, the position of the marker was adjusted to the proper position. And, Recalculated Result. from "1.108"to"1.002" from "0.960"to"1.000" from "0.983"to"0.990" from "1.165" to"1.005" from "1.330" to"1.000" from "1.038" to"1.000"
			25	Correction of comment Corrected it to the waveform of EDR because the waveform data was BDR instead of EDR. Hopping On (2/3) BDR Waveform data →EDR Waveform data Hopping On (3/3) BDR Waveform data →EDR Waveform data
			61	Deletion of SSA-02. Audio analyzer is not used for measurement.
			5	Correction of frequency (2472 MHz→2462 MHz)
			11	Correction of place ("in Semi-anechoic chamber" is "in Shielded room") and added comment "via AC adapter".

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SECTION 1: Customer information

Company Name	:	RICOH COMPANY, LTD.
Address	:	1-3-6 Nakamagome, Ohta-ku, Tokyo, 143-8555, Japan
Telephone Number	:	+81-50-3534-5214
Facsimile Number	:	+81-3-3775-8531
Contact Person	:	Kenji Daigo

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

2.1 Identification of E.U.T.

Type of Equipment	:	Digital Camera
Model No.	:	R02020
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 5.0 V (USB), DC 3.6 V (Battery)
Receipt Date of Sample	:	August 20, 2018
Country of Mass-production	:	China
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: R02020 (referred to as the EUT in this report) is a Digital Camera.

General Specification

Clock frequency (ies)

Clock	Oscillation Source	Frequency
Wireless IC (Main Clock)	Crystal Unit	48 MHz
Wireless IC (Command Clock)	ASIC	30 MHz/60 MHz

Radio Specification

Equipment type	:	Transceiver
Frequency of operation	:	2.4 GHz: 2402 MHz -2480 MHz (Bluetooth BDR/EDR/Low Energy (LE)) 2412 MHz -2462 MHz (IEEE 802.11b, 11g, 11n (HT20)) W52: 5180 MHz -5240 MHz (IEEE 802.11a, 11n (HT20), 11ac (VHT20)) 5190 MHz -5230 MHz (IEEE 802.11n (HT40), 11ac (VHT40)) 5210 MHz (IEEE 802.11ac (VHT80))
Bandwidth	:	20 MHz (IEEE 802.11a/b/g/n/ac), 40 MHz (IEEE 802.11n/ac), 80 MHz(IEEE 802.11ac) , 1 MHz (Bluetooth BDR/EDR/Low Energy (LE))
Channel spacing	:	5 MHz (Wi-Fi 2.4 GHz), 20 MHz/40 MHz/80 MHz (Wi-Fi 5 GHz), 1 MHz (Bluetooth BDR/EDR), 2 MHz (Bluetooth LE)
Type of modulation	:	DSSS (IEEE 802.11b), OFDM (IEEE 802.11a/g/n/ac), FHSS (Bluetooth BDR/EDR/ Low Energy (LE))
Antenna type	:	Pattern antenna (λ/2 dipole antenna) + Parasitic element (Cu sheet)
Antenna connector type	:	MM5829-2700 <manufactured by Murata>
Antenna gain	:	[2.4 GHz] 3.52 dBi [5 GHz] 2.87 dBi

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	**FCC:** Section 15.207	26.6 dB 1.64590 MHz, QP N Tx DH5 2441 MHz	Complied	-
	IC: RSS-Gen 8.8	**IC:** RSS-Gen 8.8			
Carrier Frequency Separation	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05	**FCC:** Section15.247(a)(1)	See data.	Complied	Conducted
	IC: -	**IC:** RSS-247 5.1 (b)			
20 dB Bandwidth	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05	**FCC:** Section15.247(a)(1)		Complied	Conducted
	IC: RSS-Gen 6.12	**IC:** RSS-247 5.1 (a)			
Number of Hopping Frequency	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05	**FCC:** Section15.247(a)(1)(iii)		Complied	Conducted
	IC: -	**IC:** RSS-247 5.1 (d)			
Dwell time	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05	**FCC:** Section15.247(a)(1)(iii)		Complied	Conducted
	IC: RSS-Gen 6.13	**IC:** RSS-247 5.1 (d)			
Maximum Peak Output Power	**FCC:** KDB 558074 D01 15.247 **Meas Guidance v05**	**FCC:** Section15.247(a)(b)(1)		Complied	Conducted
	IC: -	**IC:** RSS-247 5.4 (b)			
Spurious Emission & Band Edge Compliance	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05	**FCC:** Section15.247(d)	7.5 dB 72.799 MHz, QP, Vert. Tx, Hopping Off, 3DH5 2441 MHz with Tx 11ac-20 5180 MHz	Complied	Conducted/ Radiated (above 30 MHz) *1)
	IC: RSS-Gen 6.12	**IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *1) Radiated test was selected over 30 MHz based on section 15.247(d).					
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.

FCC Part 15.31 (e)
This EUT provides stable voltage constantly to RF Module regardless of input voltage.
Therefore, this EUT complies with the requirement.

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

3.3 Addition to standard

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

Shonan EMC Lab.

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
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.5 dB	2.5 dB	2.5 dB	2.6 dB	2.6 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.2 dB	3.2 dB	3.3 dB	-	-
	30 MHz-200 MHz	4.9 dB	4.8 dB	4.9 dB	-	-
	200 MHz-1 GHz	6.1 dB	6.1 dB	6.1 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	-	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
Radiated emission (Measurement distance: 1 m)	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
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.90 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.04 dB
Spurious emission (Conducted) below 1GHz	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 %

3.5 Test Location

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Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401
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)

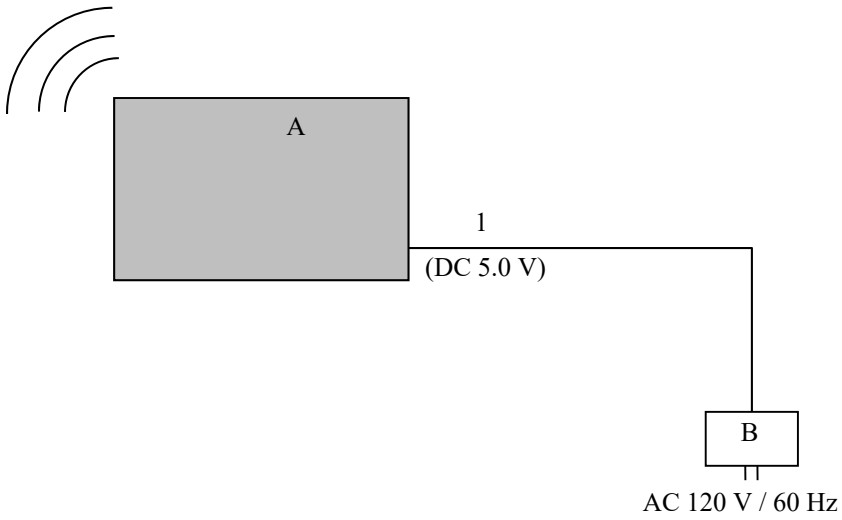
Bluetooth (BT): Transmitting (Tx), Payload: PRBS9

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2441 MHz
Spurious Emission (Radiated)	Tx (Hopping Off) 3DH5 with Tx 11ac-20 5180MHz	2441 MHz
Band Edge Compliance (Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2480 MHz
	Tx (Hopping Off) DH5, 3DH5 with Tx 11ac-20 5180MHz	2402 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz

*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)
*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.
* It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification.
*EUT has the power settings by the software as follows;
Power settings: Fixed
Software: 07020018(0803)
*This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

4.2 Configuration and peripherals



* Cabling and setup(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	Remark
A	Digital Camera	R02020	YN10001081 *1) YN10001066 *2)	RICOH	EUT
B	AC Adapter	AC-U2	18011000084	RICOH	-

*1) Used for Radiated emission test.
*2) Used for Antenna terminal conducted tests.

List of cables used

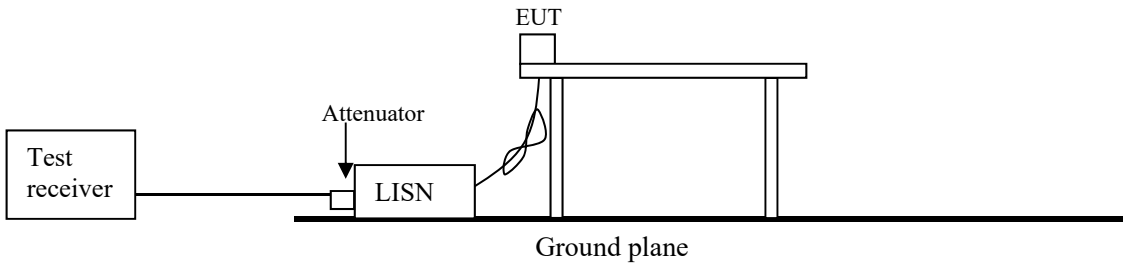
No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	USB	0.4	Shielded	Shielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

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



The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT via AC adapter in a Shielded room.
The EUT via AC adapter was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.
The test results and limit are rounded off to one decimal place, so some differences might be observed.

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

SECTION 6: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

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

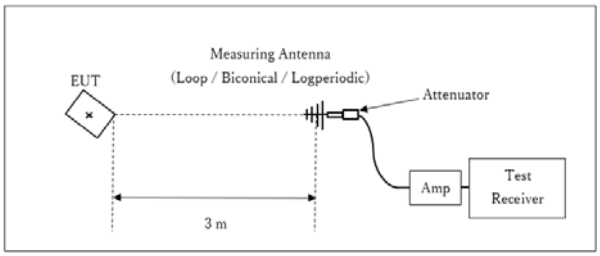
In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Synchronous noise for RF carrier duty cycle RBW: 1 MHz VBW: 10 Hz*1)	RBW: 100 kHz VBW: 300 kHz

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

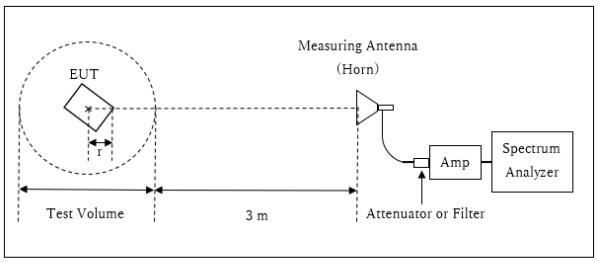
Below 1 GHz



× : Center of turn table

Test Distance : 3 m

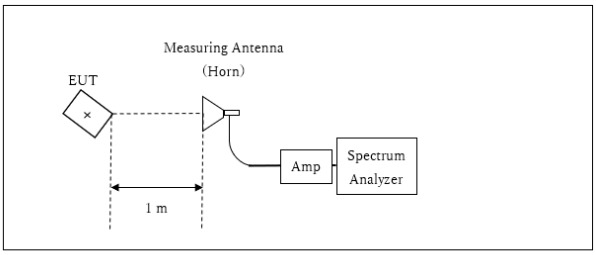
1 GHz - 13 GHz



r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.93 m*/3.0 m) = 2.35 dB
*Test Distance : (3 + Test Volume /2) - r = 3.93 m
Test Volume : 2 m (Test Volume has been calibrated based on CISPR16-1-4.)
r = 0.07 m

13 GHz - 26.5 GHz



× : Center of turn table

Distance Factor: 20 x log (1.0 m* / 3.0 m) = -9.54 dB
*Test Distance : 1 m

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Worst position:

	Below 1 GHz	1 GHz - 2.8 GHz	2.8 GHz - 13 GHz	13 GHz – 18 GHz	18 GHz – 26.5 GHz
Horizontal	X	X	X	X	X
Vertical	X	Y	X	X	X

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

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to displa emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold *1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	5 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 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 = 10 kHz)

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

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/08/31

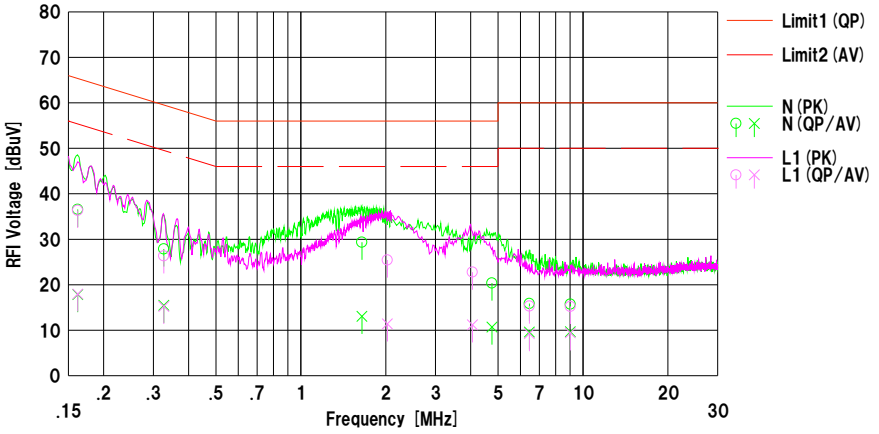
Mode : Tx DH5 2441 MHz

Power : DC 5 V (USB)
Temp./Humi. : 20 deg.C / 62 %RH

Remarks : -

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Kazutaka Takeyama



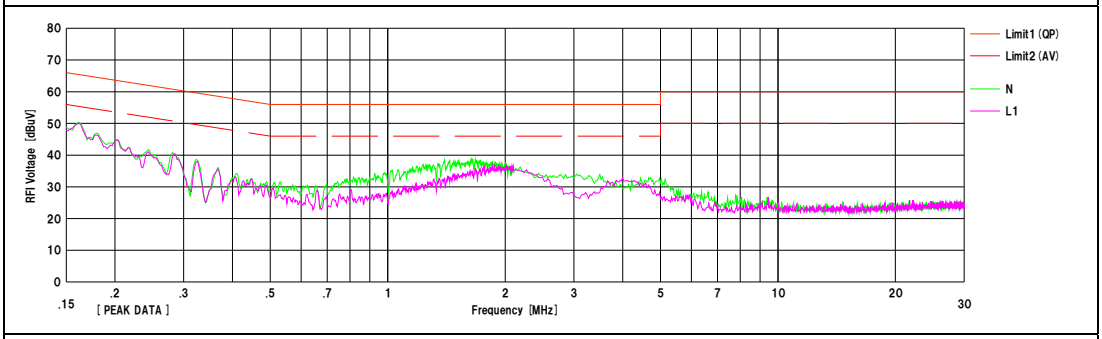
No.	Freq.	Reading <QP>	Reading <AV>	C.Fac	Results <QP>	Results <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.16200	24.19	5.45	12.38	36.57	17.83	65.36	55.36	28.7	37.5	N	
2	0.32700	15.48	3.07	12.39	27.87	15.46	59.53	49.53	31.6	34.0	N	
3	1.64590	16.87	0.56	12.48	29.35	13.04	56.00	46.00	26.6	32.9	N	
4	4.75680	7.73	-1.95	12.66	20.39	10.71	56.00	46.00	35.6	35.2	N	
5	6.45300	3.13	-3.12	12.73	15.86	9.61	60.00	50.00	44.1	40.3	N	
6	9.02000	2.84	-3.18	12.87	15.71	9.69	60.00	50.00	44.2	40.3	N	
7	0.16200	23.98	5.59	12.38	36.36	17.97	65.36	55.36	29.0	37.3	L1	
8	0.32700	13.98	2.84	12.39	26.37	15.23	59.53	49.53	33.1	34.3	L1	
9	2.02660	12.94	-1.12	12.50	25.44	11.38	56.00	46.00	30.5	34.6	L1	
10	4.05690	10.17	-1.43	12.62	22.79	11.19	56.00	46.00	33.2	34.8	L1	
11	6.45300	2.58	-3.48	12.73	15.31	9.25	60.00	50.00	44.6	40.7	L1	
12	9.02000	2.37	-3.46	12.87	15.24	9.41	60.00	50.00	44.7	40.5	L1	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN (AMN) +Cable+ATT) [dB]
LISN (AMN) =SLS-02

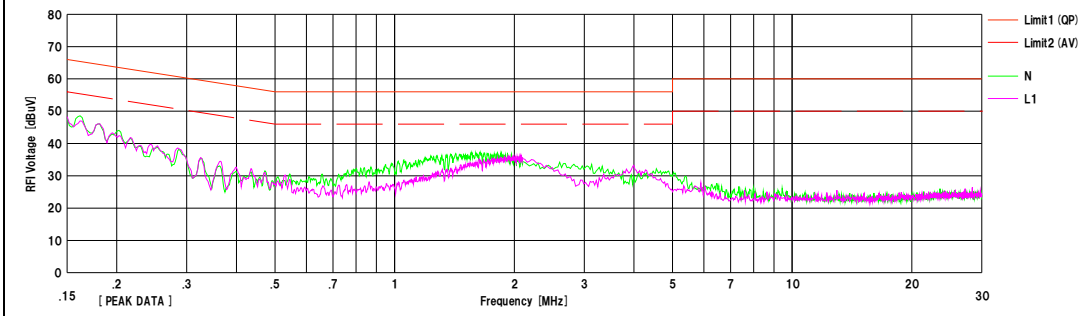
Conducted Emission

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date	August 31, 2018
Temperature / Humidity	20 deg. C / 62 % RH
Engineer	Kazutaka Takayama
Mode	Tx, Hopping Off, DH5

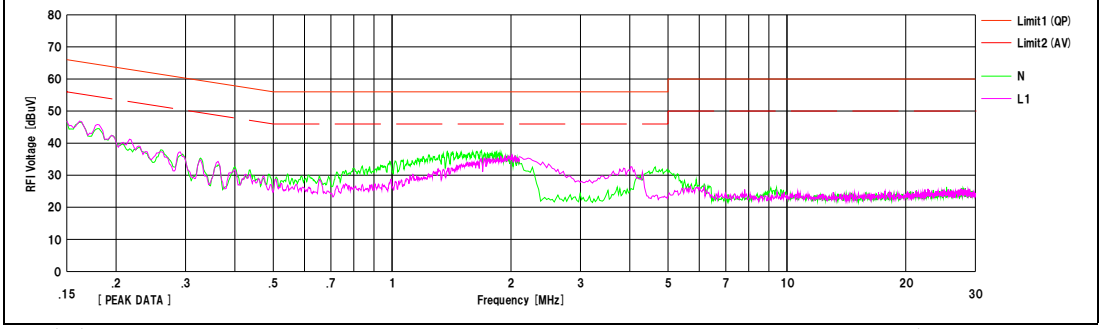
2402 MHz



2441 MHz



2480 MHz



Y scale [dBuV] Chart N L

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/08/31

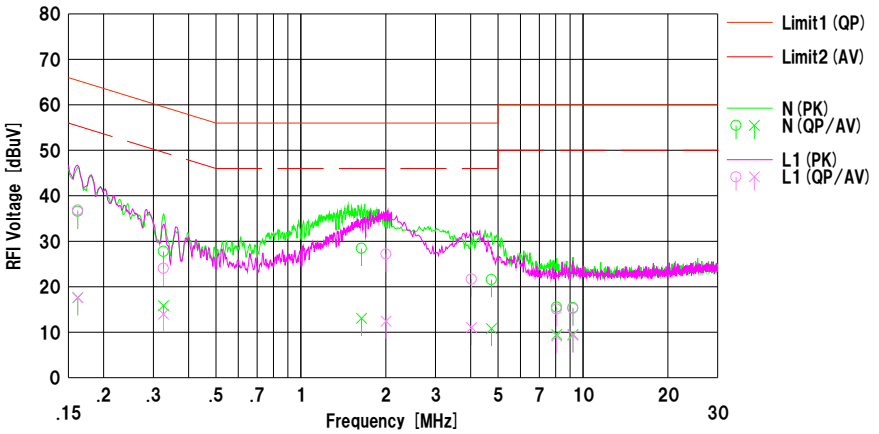
Mode : Tx 3DH5 2441 MHz

Power : DC 5 V (USB)
Temp./Humi. : 20 deg.C / 62 %RH

Remarks : -

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Kazutaka Takeyama



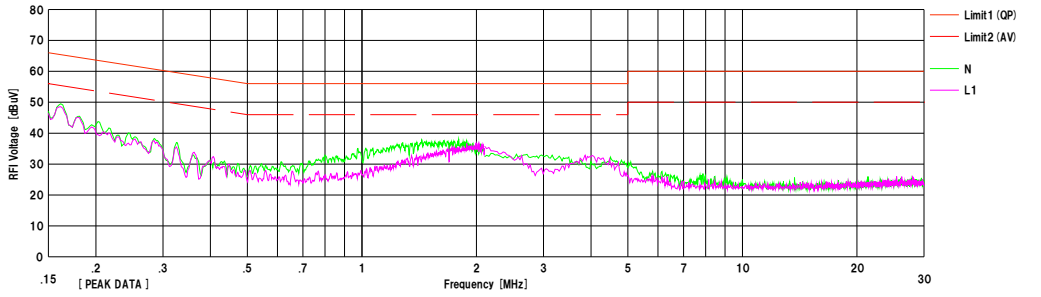
No.	Freq.	Reading <QP>	Reading <AV>	C.Fac	Results <QP>	Results <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.16200	24.19	5.21	12.38	36.57	17.59	65.36	55.36	28.7	37.7	N	
2	0.32600	15.37	3.45	12.39	27.76	15.84	59.55	49.55	31.7	33.7	N	
3	1.64090	15.97	0.57	12.48	28.45	13.05	56.00	46.00	27.5	32.9	N	
4	4.74000	8.91	-1.88	12.66	21.57	10.78	56.00	46.00	34.4	35.2	N	
5	8.07100	2.69	-3.30	12.81	15.50	9.51	60.00	50.00	44.5	40.4	N	
6	9.21500	2.49	-3.39	12.88	15.37	9.49	60.00	50.00	44.6	40.5	N	
7	0.16200	24.47	5.22	12.38	36.85	17.60	65.36	55.36	28.5	37.7	L1	
8	0.32600	11.65	1.56	12.39	24.04	13.95	59.55	49.55	35.5	35.6	L1	
9	2.00400	14.68	-0.07	12.50	27.18	12.43	56.00	46.00	28.8	33.5	L1	
10	4.02510	9.05	-1.56	12.62	21.67	11.06	56.00	46.00	34.3	34.9	L1	
11	8.07100	2.28	-3.67	12.81	15.09	9.14	60.00	50.00	44.9	40.8	L1	
12	9.21500	2.36	-3.55	12.88	15.24	9.33	60.00	50.00	44.7	40.6	L1	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN (AMN) +Cable+ATT) [dB]
LISN (AMN) =SLS-02

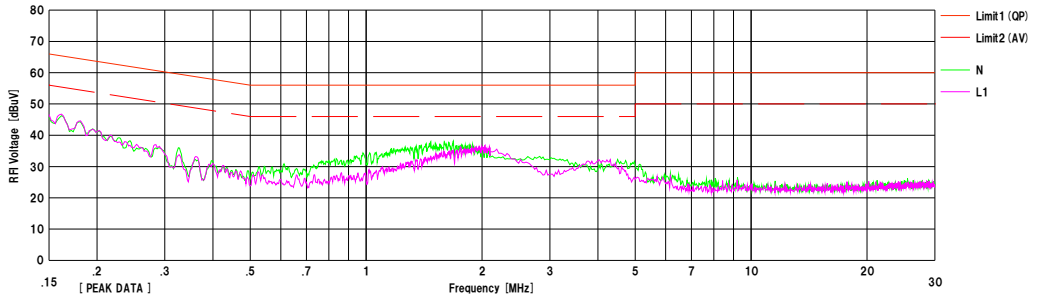
Conducted Emission

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date	August 31, 2018
Temperature / Humidity	20 deg. C / 62 % RH
Engineer	Kazutaka Takeyama
Mode	Tx, Hopping Off, 3DH5

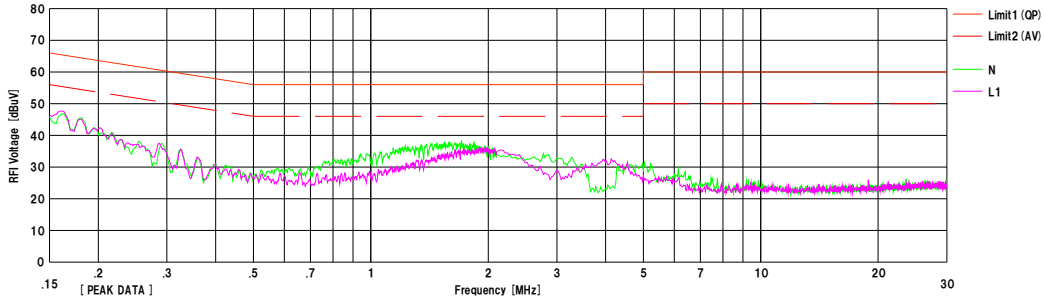
2402 MHz



2441 MHz



2480 MHz



Y scale [dBuV] Chart N L

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

Report No.	12429781S-K-R2	
Test place	Shonan EMC Lab. No.5 Shielded Room	
Date	September 5, 2018	February 8, 2019
Temperature / Humidity	27 deg. C /49 % RH	23 deg. C /30 % RH
Engineer	Shiro Kobayashi	Shiro Kobayashi
Mode	Tx, Hopping Off, Tx, Hopping On	

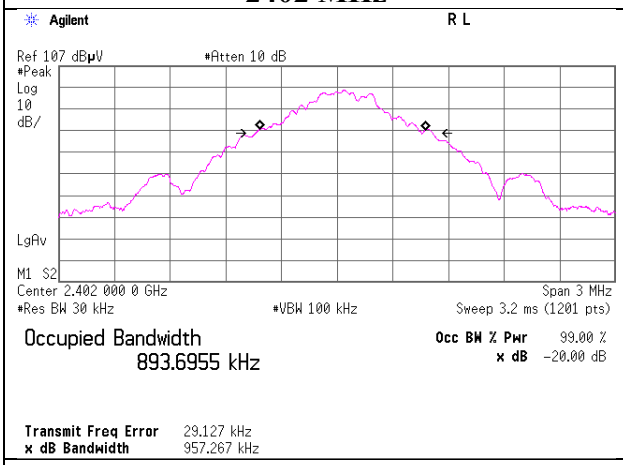
Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.957	893.696	1.002	>= 0.638
DH5	2441.0	0.958	895.256	1.000	>= 0.639
DH5	2480.0	0.959	895.804	0.990	>= 0.640
DH5	Hopping On	-	78247.700	-	-
3DH5	2402.0	1.298	1176.000	1.005	>= 0.866
3DH5	2441.0	1.305	1184.400	1.000	>= 0.870
3DH5	2480.0	1.294	1181.170	1.000	>= 0.863
3DH5	Hopping On	-	78365.300	-	-

Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).
No limit applies to 20dB Bandwidth.

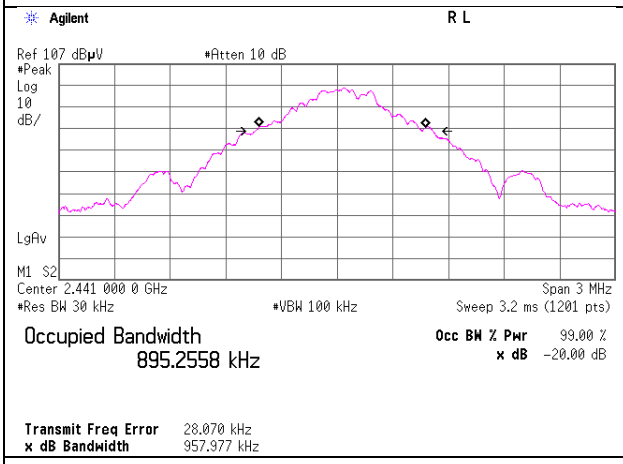
20dB Bandwidth and 99% Occupied Bandwidth

DH5

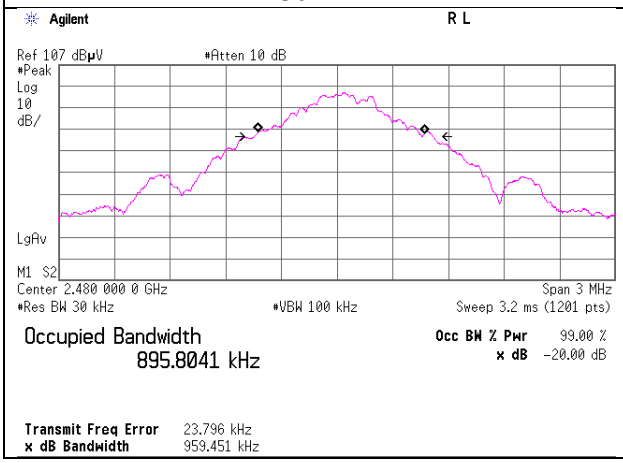
2402 MHz



2441 MHz

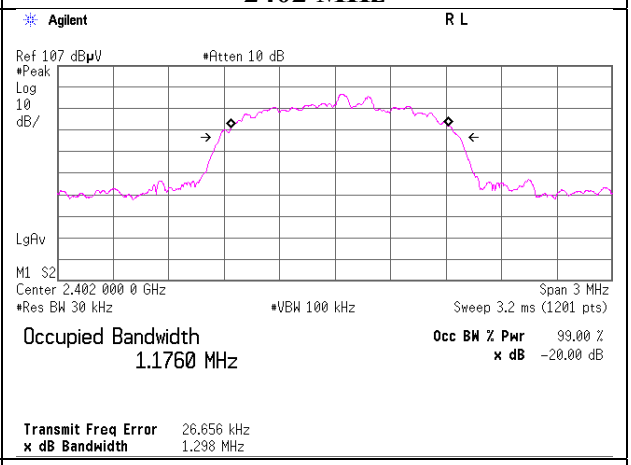


2480 MHz

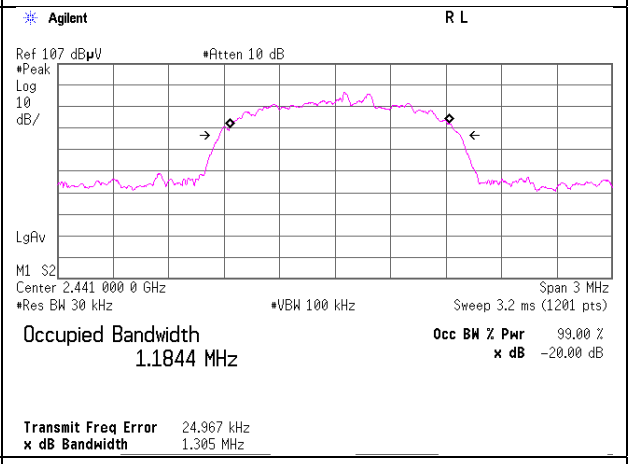


3DH5

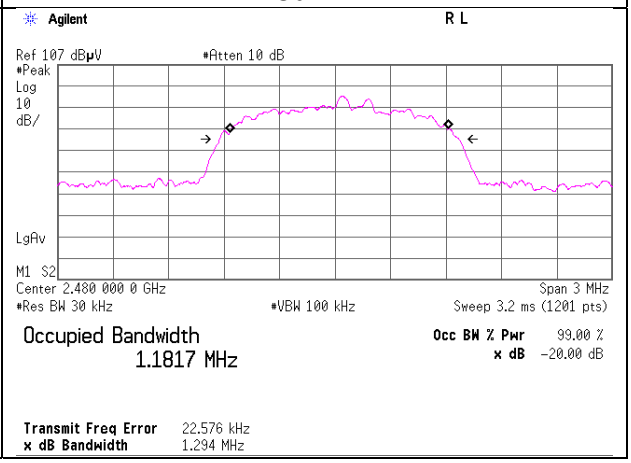
2402 MHz



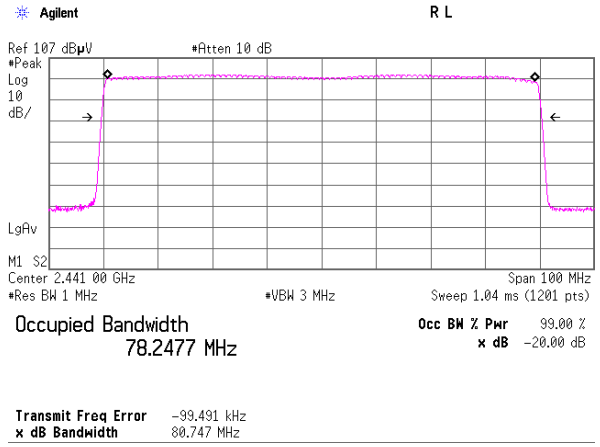
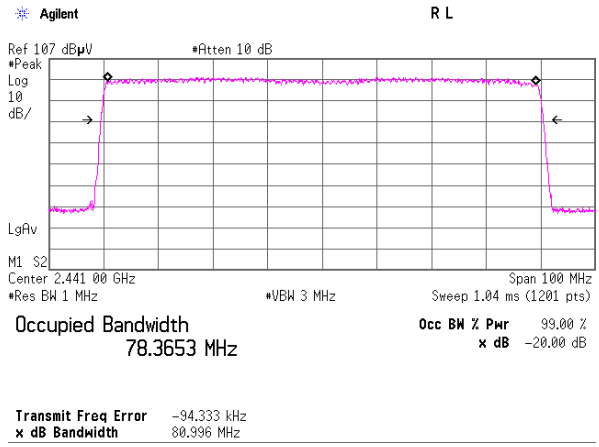
2441 MHz



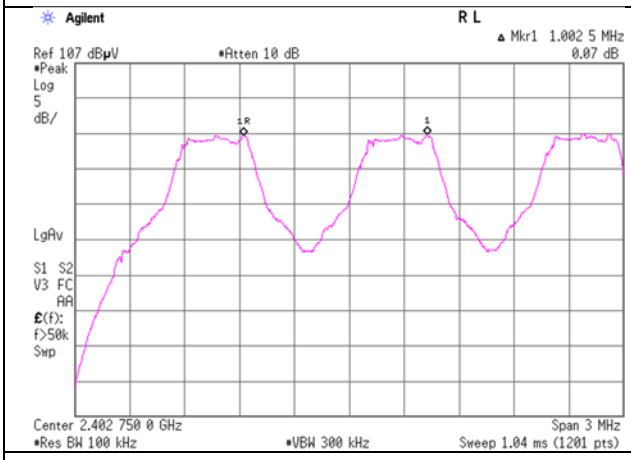
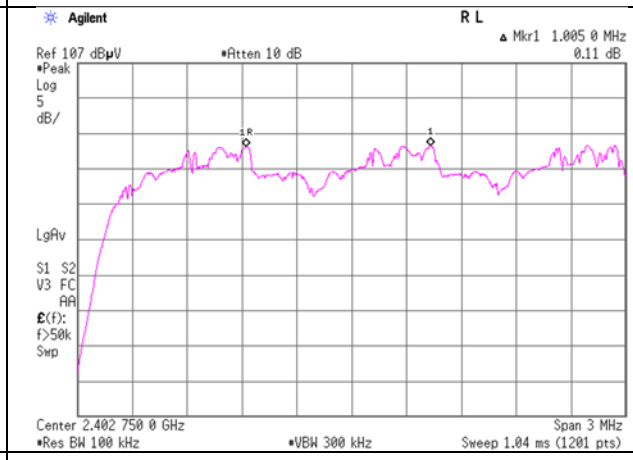
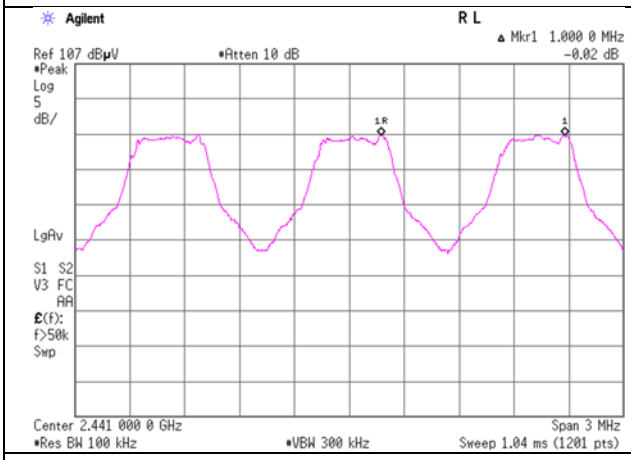
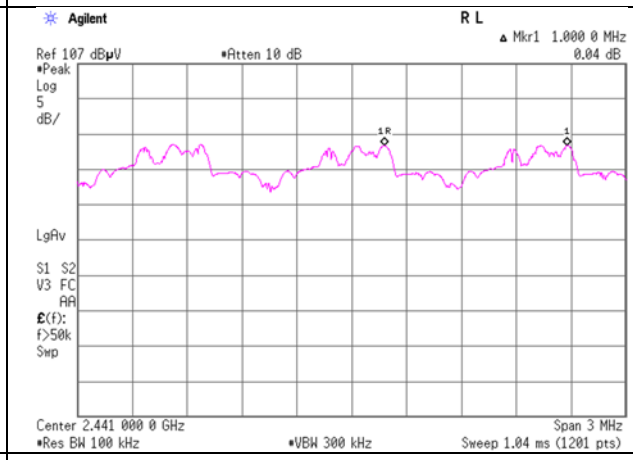
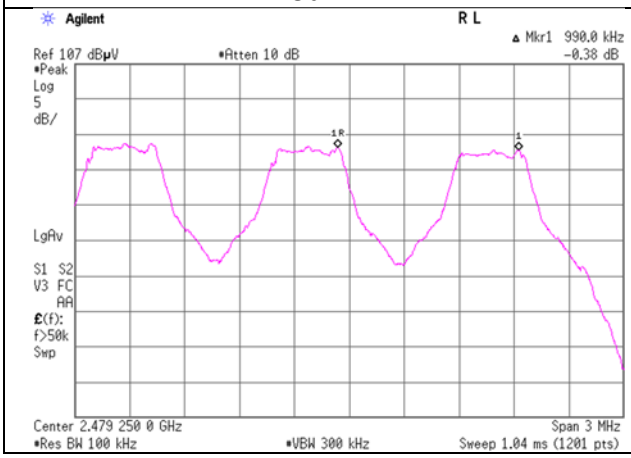
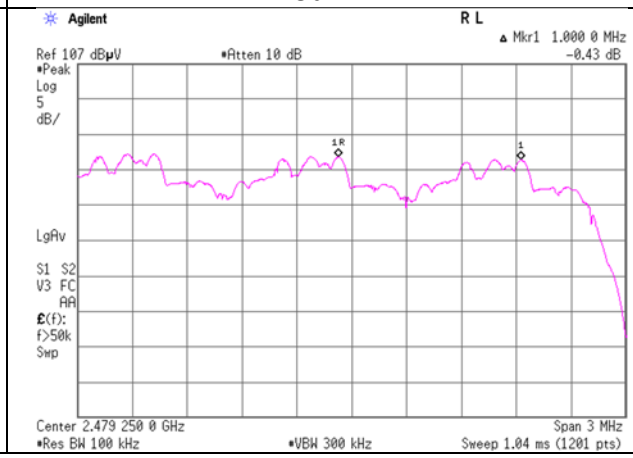
2480 MHz



20dB Bandwidth and 99% Occupied Bandwidth

DH5, Hopping On	3DH5, Hopping On
	

Carrier Frequency Separation

DH5	3DH5
2402 MHz	2402 MHz
	
2441 MHz	2441 MHz
	
2480 MHz	2480 MHz
	

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

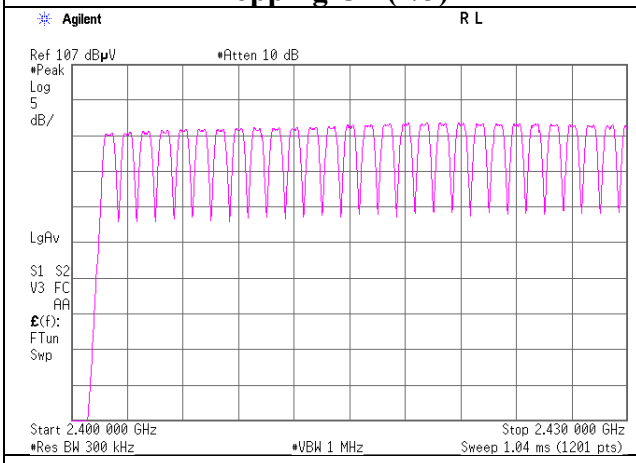
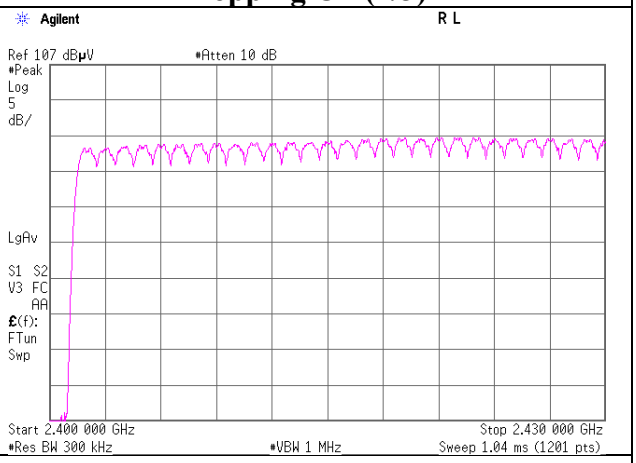
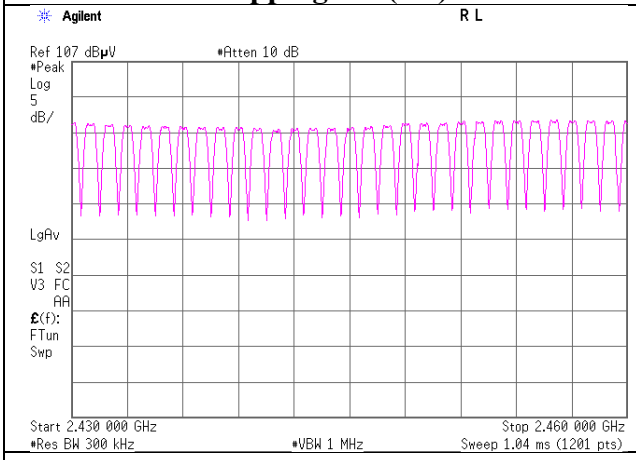
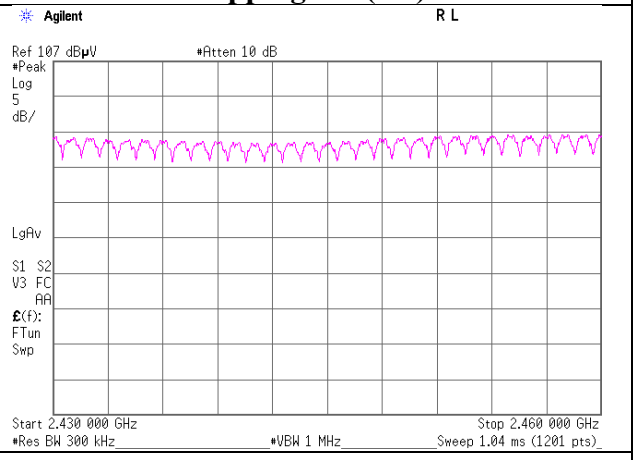
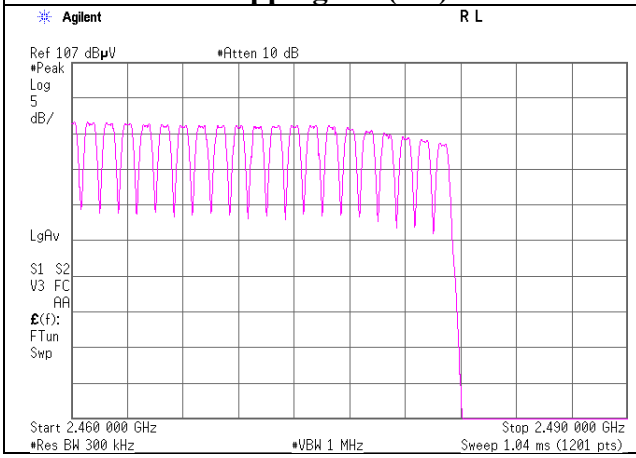
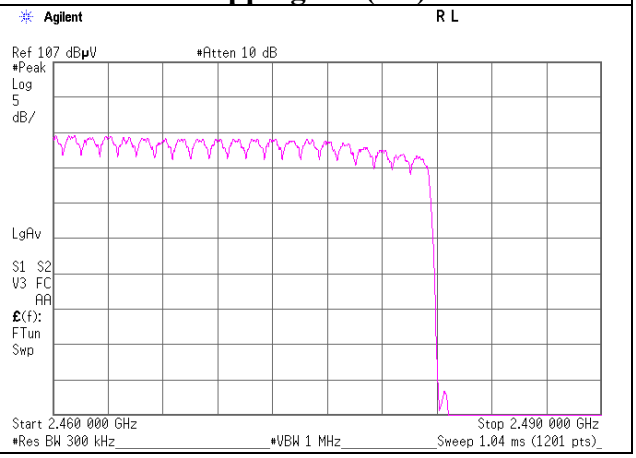
Number of Hopping Frequency

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
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

DH5	3DH5
Hopping On (1/3)	**Hopping On (1/3)**
	
Hopping On (2/3)	**Hopping On (2/3)**
	
Hopping On (3/3)	**Hopping On (3/3)**
	

Dwell time

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping On,

Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period	Length of transmission [msec]	Result [msec]	Limit [msec]
DH1	51.2 times / 5 sec. x 31.6 sec. = 324 times	0.399	129	400
DH3	23.6 times / 5 sec. x 31.6 sec. = 150 times	1.656	248	400
DH5	20.0 times / 5 sec. x 31.6 sec. = 127 times	2.905	369	400
3DH1	49.6 times / 5 sec. x 31.6 sec. = 314 times	0.407	128	400
3DH3	25.0 times / 5 sec. x 31.6 sec. = 158 times	1.657	262	400
3DH5	20.4 times / 5 sec. x 31.6 sec. = 129 times	2.909	375	400

Sample Calculation
Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

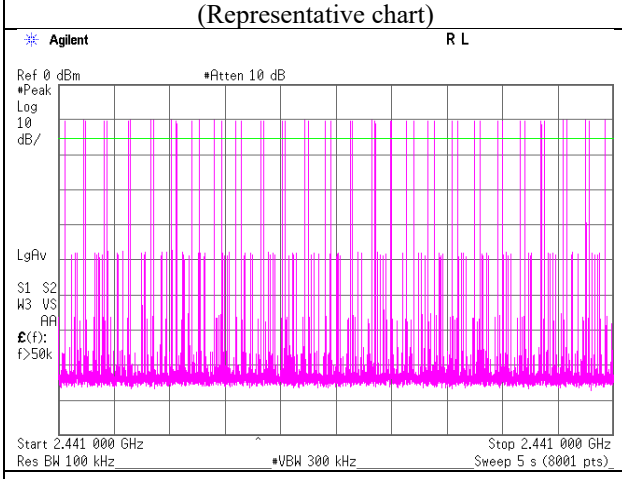
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	52	52	53	48	51.2
DH3	22	25	23	24	24	23.6
DH5	21	23	19	17	20	20
3DH1	50	49	49	49	51	49.6
3DH3	25	27	25	24	24	25
3DH5	25	17	21	19	20	20.4

Sample Calculation
Average = Summation (Sampling 1 to 5) / 5

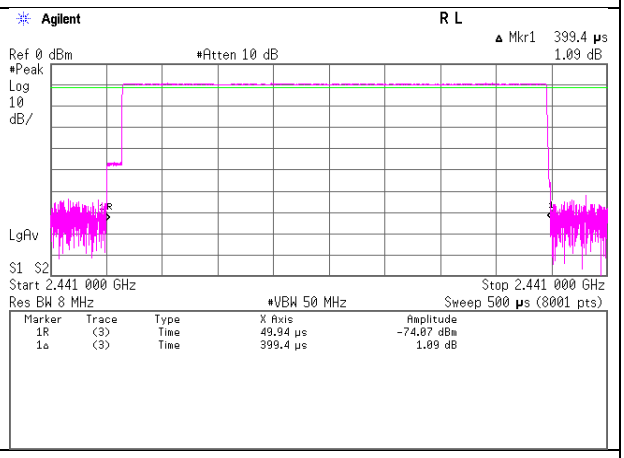
This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in N x 0.4s, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4s regardless of packet size. This is confirmed in the test report for N = 79.

Dwell time

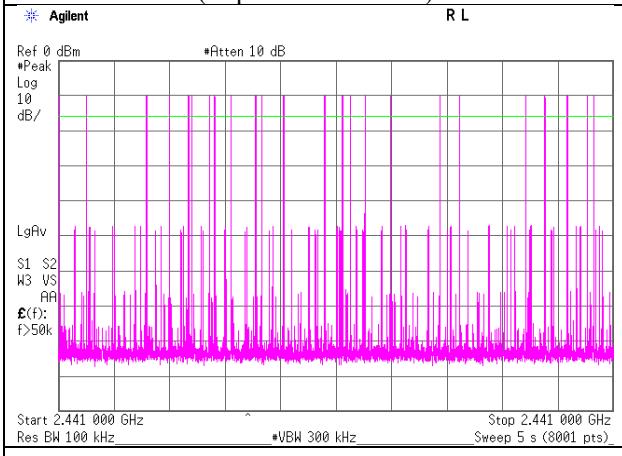
DH1 (1/2)
(Representative chart)



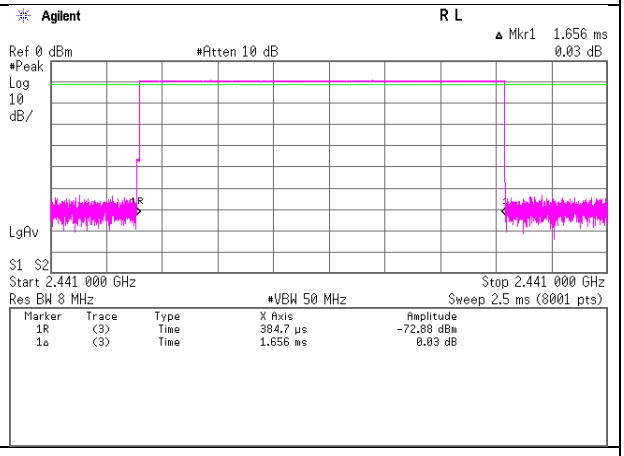
DH1 (2/2)



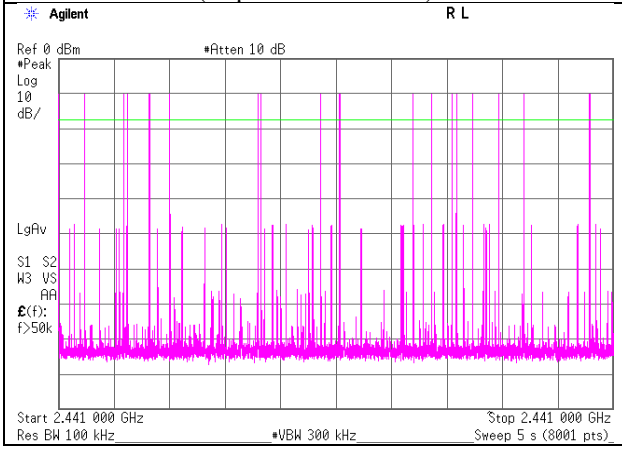
DH3 (1/2)
(Representative chart)



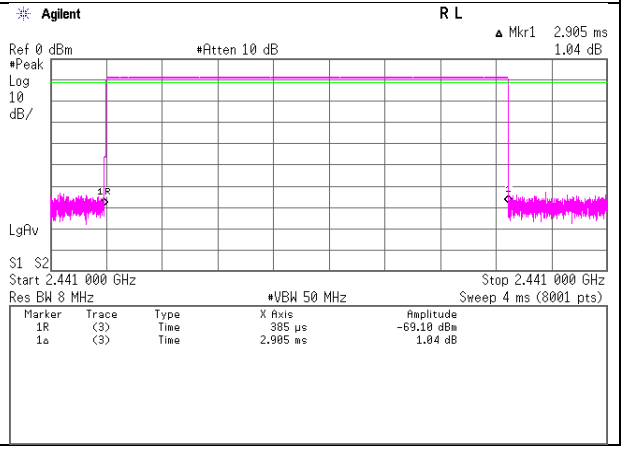
DH3 (2/2)



DH5 (1/2)
(Representative chart)

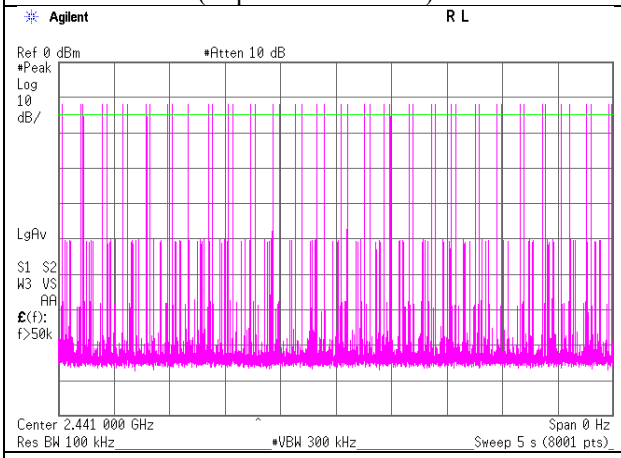


DH5 (2/2)

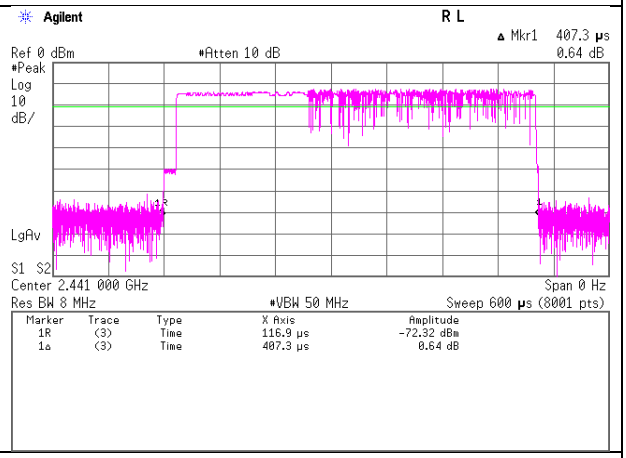


Dwell time

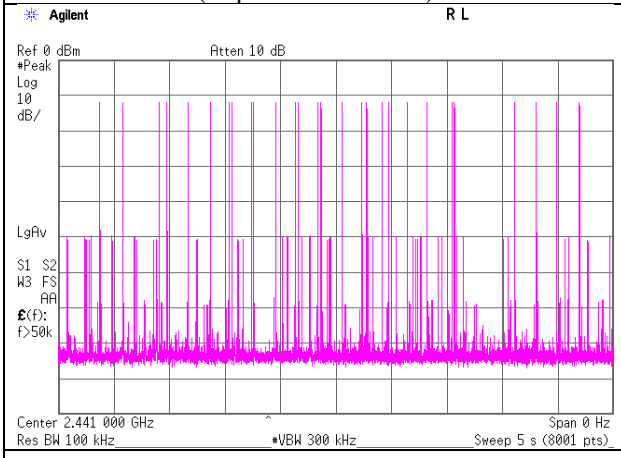
3DH1 (1/2)
(Representative chart)



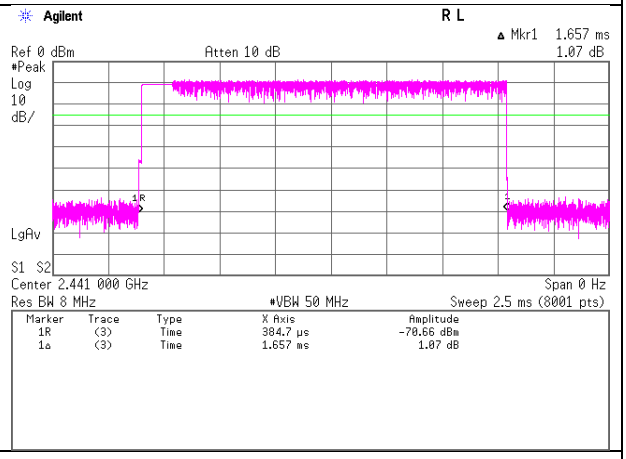
3DH1 (2/2)



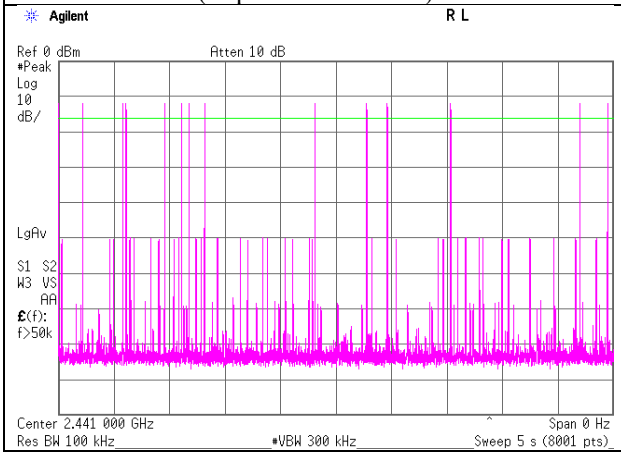
3DH3 (1/2)
(Representative chart)



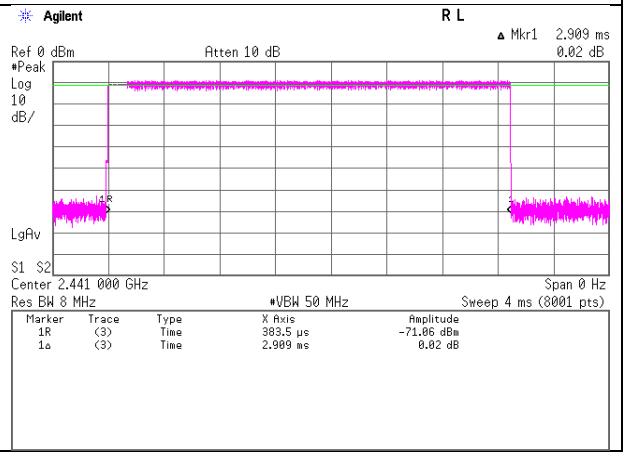
3DH3 (2/2)



3DH5 (1/2)
(Representative chart)



3DH5 (2/2)



Maximum Peak Output Power

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 7, 2018
Temperature / Humidity	25 deg. C /55 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off,

					Conducted Power					e.i.r.p. for RSS-247					
Mode	Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
DH5	2402.0	-7.80	1.94	9.68	3.82	2.41	20.96	125	17.14	3.52	7.34	5.42	36.02	4000	28.68
DH5	2441.0	-7.04	1.95	9.67	4.58	2.87	20.96	125	16.38	3.52	8.10	6.46	36.02	4000	27.92
DH5	2480.0	-9.69	1.96	9.67	1.94	1.56	20.96	125	19.02	3.52	5.46	3.52	36.02	4000	30.56
2DH5	2402.0	-6.02	1.94	9.68	5.60	3.63	20.96	125	15.36	3.52	9.12	8.17	36.02	4000	26.90
2DH5	2441.0	-5.29	1.95	9.67	6.33	4.30	20.96	125	14.63	3.52	9.85	9.66	36.02	4000	26.17
2DH5	2480.0	-8.02	1.96	9.67	3.61	2.30	20.96	125	17.35	3.52	7.13	5.16	36.02	4000	28.89
3DH5	2402.0	-5.52	1.94	9.68	6.10	4.07	20.96	125	14.86	3.52	9.62	9.16	36.02	4000	26.40
3DH5	2441.0	-4.76	1.95	9.67	6.86	4.85	20.96	125	14.10	3.52	10.38	10.91	36.02	4000	25.64
3DH5	2480.0	-7.47	1.96	9.67	4.16	2.61	20.96	125	16.80	3.52	7.68	5.86	36.02	4000	28.34

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 / SAR testing)

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off,

Mode	Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
DH5	2402.0	-9.48	1.94	9.68	2.14	1.64	1.11	3.25	2.11
DH5	2441.0	-8.75	1.95	9.67	2.87	1.94	1.11	3.98	2.50
DH5	2480.0	-11.59	1.96	9.67	0.04	1.01	1.11	1.15	1.30
2DH5	2402.0	-9.97	1.94	9.68	1.65	1.46	1.10	2.75	1.88
2DH5	2441.0	-9.21	1.95	9.67	2.41	1.74	1.10	3.51	2.24
2DH5	2480.0	-12.01	1.96	9.67	-0.38	0.92	1.10	0.72	1.18
3DH5	2402.0	-9.90	1.94	9.68	1.72	1.49	1.10	2.82	1.91
3DH5	2441.0	-9.15	1.95	9.67	2.47	1.77	1.10	3.57	2.28
3DH5	2480.0	-11.91	1.96	9.67	-0.28	0.94	1.10	0.82	1.21

Sample Calculation:
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

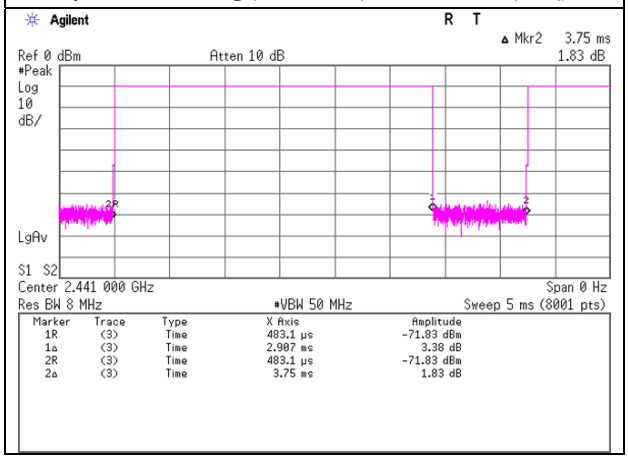
*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst Rate Confirmation

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off,

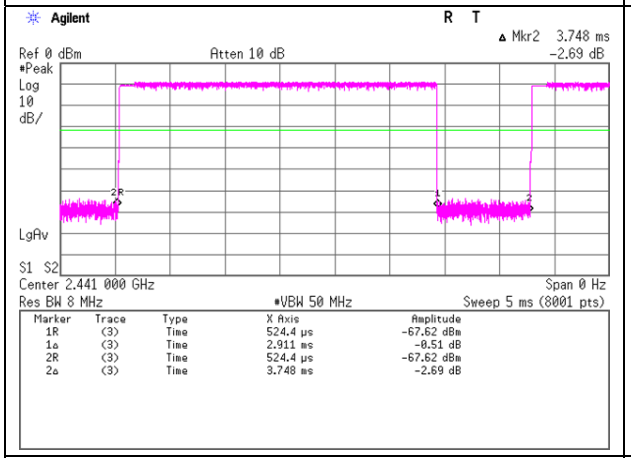
DH5

Tx on / (Tx on + Tx off) =	0.775
Tx on / (Tx on + Tx off) * 100 =	77.5 %
Duty factor = 10 * log (3.75 / 2.907) =	1.11 dB



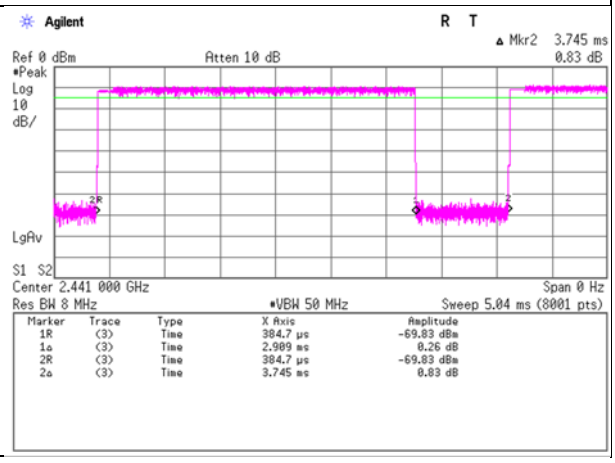
2DH5

Tx on / (Tx on + Tx off) =	0.777
Tx on / (Tx on + Tx off) * 100 =	77.7 %
Duty factor = 10 * log (3.748 / 2.911) =	1.10 dB



3DH5

Tx on / (Tx on + Tx off) =	0.777
Tx on / (Tx on + Tx off) * 100 =	77.7 %
Duty factor = 10 * log (3.745 / 2.909) =	1.10 dB



Radiated Spurious Emission

Report No.	12429781S-K-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	August 29, 2018	August 27, 2018	August 31, 2018
Temperature / Humidity	21 deg. C / 50 % RH	24 deg. C / 56 % RH	20 deg. C / 62 % RH
Engineer	Kazutaka Takeyama (30 MHz -1 GHz) (13 GHz-18 GHz)	Makoto Hosaka (30 MHz -1 GHz)	Kazutaka Takeyama (18 GHz -26.5 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.	74.280	QP	29.01	6.36	7.14	32.18	0.00	10.33	40.00	29.6	257	242	
Hori.	359.997	QP	29.10	15.19	9.07	31.95	0.00	21.41	46.00	24.5	100	83	
Hori.	2390.000	PK	48.74	27.86	14.17	44.13	2.35	48.99	73.90	24.9	150	0	
Hori.	4804.000	PK	48.81	31.43	6.49	44.45	2.35	44.63	73.90	29.2	150	0	
Hori.	7206.000	PK	48.23	36.79	8.31	43.99	2.35	51.69	73.90	22.2	150	0	
Hori.	9608.000	PK	49.37	38.51	9.20	43.83	2.35	55.60	73.90	18.3	150	0	
Hori.	2390.000	AV	36.19	27.86	14.17	44.13	2.35	36.44	53.90	17.4	150	0	
Hori.	4804.000	AV	36.42	31.43	6.49	44.45	2.35	32.24	53.90	21.6	150	0	
Hori.	7206.000	AV	36.13	36.79	8.31	43.99	2.35	39.59	53.90	14.3	150	0	
Hori.	9608.000	AV	37.15	38.51	9.20	43.83	2.35	43.38	53.90	**10.5**	150	0	
Vert.	46.141	QP	33.06	12.61	6.75	32.19	0.00	20.23	40.00	19.7	100	202	
Vert.	50.824	QP	32.62	10.90	6.78	32.19	0.00	18.11	40.00	21.8	100	251	
Vert.	71.582	QP	40.36	6.47	6.90	32.18	0.00	21.55	40.00	18.4	100	202	
Vert.	113.118	QP	41.28	12.33	7.23	32.15	0.00	28.69	43.50	14.8	100	138	
Vert.	123.096	QP	37.05	13.40	7.30	32.14	0.00	25.61	43.50	17.8	100	164	
Vert.	284.959	QP	27.16	13.44	8.61	32.01	0.00	17.20	46.00	28.8	100	123	
Vert.	2390.000	PK	49.08	27.86	14.17	44.13	2.35	49.33	73.90	24.5	150	0	
Vert.	4804.000	PK	48.42	31.43	6.49	44.45	2.35	44.24	73.90	29.6	150	0	
Vert.	7206.000	PK	47.26	36.79	8.31	43.99	2.35	50.72	73.90	23.1	150	0	
Vert.	9608.000	PK	48.91	38.51	9.20	43.83	2.35	55.14	73.90	18.7	150	0	
Vert.	2390.000	AV	36.28	27.86	14.17	44.13	2.35	36.53	53.90	17.3	150	0	
Vert.	4804.000	AV	36.46	31.43	6.49	44.45	2.35	32.28	53.90	21.6	150	0	
Vert.	7206.000	AV	35.66	36.79	8.31	43.99	2.35	39.12	53.90	14.7	150	0	
Vert.	9608.000	AV	37.10	38.51	9.20	43.83	2.35	43.33	53.90	**10.5**	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 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	95.83	27.86	14.18	44.14	2.35	96.08	-	-	Carrier
Hori.	2400.000	PK	40.18	27.86	14.18	44.14	2.35	40.43	76.08	35.7	
Vert.	2402.000	PK	97.89	27.86	14.18	44.14	2.35	98.14	-	-	Carrier
Vert.	2400.000	PK	43.94	27.86	14.18	44.14	2.35	44.19	78.14	34.0	

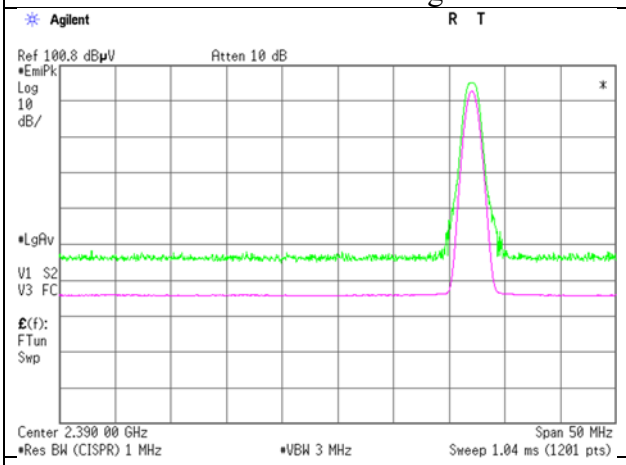
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	August 27, 2018
Temperature / Humidity	24 deg. C / 56 % RH
Engineer	Makoto Hosaka
	(1 GHz -13 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz

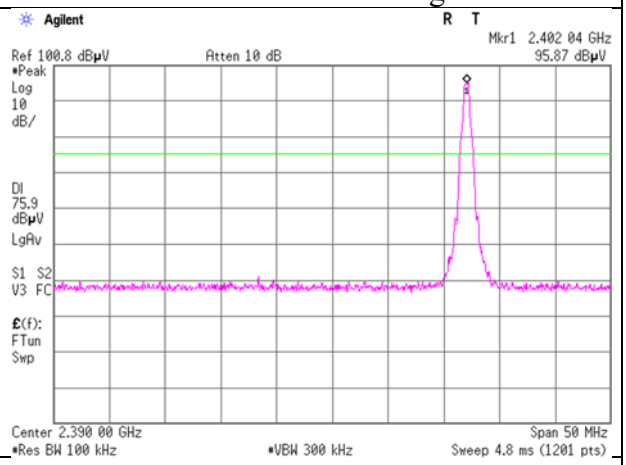
Horizontal

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

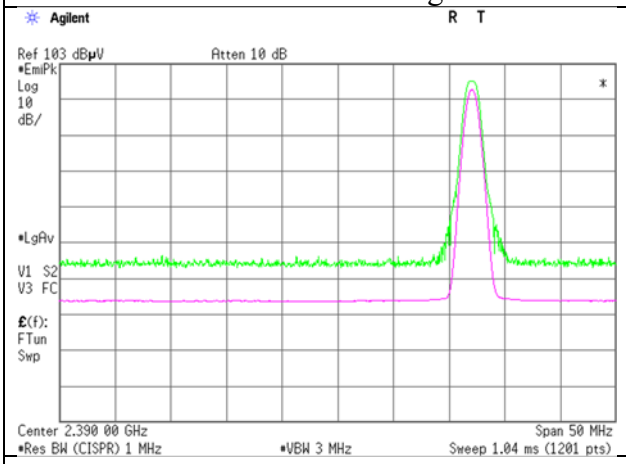
Authorized-band band-edge Plot



20dBc Plot

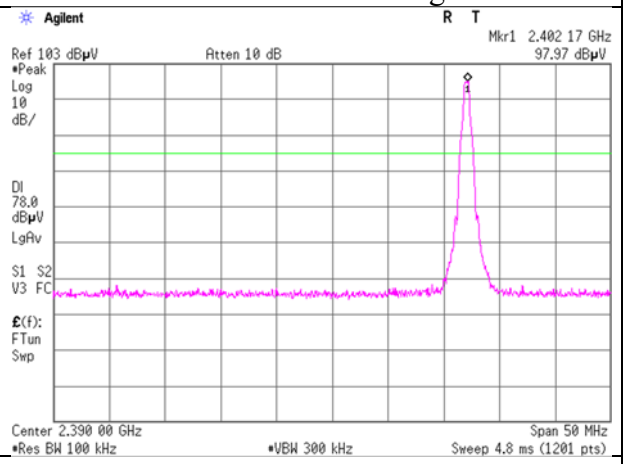
Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Authorized-band band-edge Plot



20dBc Plot

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

Radiated Spurious Emission

Report No.	12429781S-K-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	August 29, 2018	August 27, 2018	August 31, 2018
Temperature / Humidity	21 deg. C / 50 % RH	24 deg. C / 56 % RH	20 deg. C / 62 % RH
Engineer	Kazutaka Takeyama (30 MHz -1 GHz) (13 GHz-18 GHz)	Makoto Hosaka (30 MHz -1 GHz)	Kazutaka Takeyama (18 GHz -26.5 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.	72.490	QP	29.36	6.41	6.98	32.18	0.00	10.57	40.00	29.4	271	247	
Hori.	147.000	QP	21.10	14.72	7.74	32.12	0.00	11.44	43.50	32.0	200	111	
Hori.	360.017	QP	28.97	15.19	9.07	31.95	0.00	21.28	46.00	24.7	100	93	
Hori.	4882.000	PK	48.35	31.37	6.53	44.48	2.35	44.12	73.90	29.7	150	0	
Hori.	7323.000	PK	47.72	37.01	8.40	44.03	2.35	51.45	73.90	22.4	150	0	
Hori.	9764.000	PK	47.48	38.92	9.22	43.85	2.35	54.12	73.90	19.7	150	0	
Hori.	4882.000	AV	36.11	31.37	6.53	44.48	2.35	31.88	53.90	22.0	150	0	
Hori.	7323.000	AV	35.14	37.01	8.40	44.03	2.35	38.87	53.90	15.0	150	0	
Hori.	9764.000	AV	35.34	38.92	9.22	43.85	2.35	41.98	53.90	11.9	150	0	
Vert.	46.124	QP	33.20	12.62	6.75	32.19	0.00	20.38	40.00	19.6	100	222	
Vert.	50.885	QP	32.52	10.88	6.78	32.19	0.00	17.99	40.00	22.0	100	225	
Vert.	71.578	QP	40.25	6.47	6.90	32.18	0.00	21.44	40.00	18.5	100	225	
Vert.	109.363	QP	40.27	11.84	7.25	32.15	0.00	27.21	43.50	16.2	100	164	
Vert.	121.341	QP	38.10	13.21	7.27	32.14	0.00	26.44	43.50	17.0	100	152	
Vert.	290.553	QP	27.45	13.57	8.65	32.01	0.00	17.66	46.00	28.3	100	131	
Vert.	4882.000	PK	48.94	31.37	6.53	44.48	2.35	44.71	73.90	29.1	150	0	
Vert.	7323.000	PK	47.89	37.01	8.40	44.03	2.35	51.62	73.90	22.2	150	0	
Vert.	9764.000	PK	47.86	38.92	9.22	43.85	2.35	54.50	73.90	19.4	150	0	
Vert.	4882.000	AV	36.18	31.37	6.53	44.48	2.35	31.95	53.90	21.9	150	0	
Vert.	7323.000	AV	35.28	37.01	8.40	44.03	2.35	39.01	53.90	14.8	150	0	
Vert.	9764.000	AV	35.40	38.92	9.22	43.85	2.35	42.04	53.90	**11.8**	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : $20\log(3.93\text{ m} / 3.0\text{ m}) = 2.35$ dB
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54$ dB
* These results have sufficient margin without taking account Dwell time factor.

Radiated Spurious Emission

Report No.	12429781S-K-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	August 29, 2018	August 27, 2018	August 31, 2018
Temperature / Humidity	21 deg. C / 50 % RH	24 deg. C / 56 % RH	20 deg. C / 62 % RH
Engineer	Kazutaka Takeyama (30 MHz -1 GHz) (13 GHz-18 GHz)	Makoto Hosaka (1 GHz -13 GHz)	Kazutaka Takeyama (18 GHz -26.5 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.	71.253	QP	28.91	6.50	6.88	32.18	0.00	10.11	40.00	29.8	270	254	
Hori.	147.953	QP	26.01	14.72	7.75	32.12	0.00	16.36	43.50	27.1	232	105	
Hori.	359.956	QP	27.22	15.19	9.07	31.95	0.00	19.53	46.00	26.4	100	89	
Hori.	2483.500	PK	48.89	27.65	14.26	44.16	2.35	48.99	73.90	24.9	141	317	
Hori.	4960.000	PK	49.12	31.54	6.56	44.51	2.35	45.06	73.90	28.8	150	0	
Hori.	7440.000	PK	47.72	37.10	8.50	44.08	2.35	51.59	73.90	22.3	150	0	
Hori.	9920.000	PK	46.80	38.97	9.25	43.87	2.35	53.50	73.90	20.4	150	0	
Hori.	2483.500	AV	36.27	27.65	14.26	44.16	2.35	36.37	53.90	17.5	141	317	
Hori.	4960.000	AV	36.58	31.54	6.56	44.51	2.35	32.52	53.90	21.3	150	0	
Hori.	7440.000	AV	35.35	37.10	8.50	44.08	2.35	39.22	53.90	14.6	150	0	
Hori.	9920.000	AV	34.52	38.97	9.25	43.87	2.35	41.22	53.90	**12.6**	150	0	
Vert.	46.236	QP	38.00	12.58	6.75	32.19	0.00	25.14	40.00	14.8	100	248	
Vert.	50.265	QP	33.48	11.10	6.78	32.19	0.00	19.17	40.00	20.8	100	244	
Vert.	71.626	QP	40.19	6.47	6.91	32.18	0.00	21.39	40.00	18.6	100	117	
Vert.	109.023	QP	40.21	11.81	7.26	32.15	0.00	27.13	43.50	16.3	100	154	
Vert.	129.295	QP	37.62	13.96	7.38	32.14	0.00	26.82	43.50	16.6	100	148	
Vert.	290.554	QP	27.12	13.57	8.65	32.01	0.00	17.33	46.00	28.6	100	126	
Vert.	2483.500	PK	48.46	27.65	14.26	44.16	2.35	48.56	73.90	25.3	152	80	
Vert.	4960.000	PK	48.72	31.54	6.56	44.51	2.35	44.66	73.90	29.2	150	0	
Vert.	7440.000	PK	47.52	37.10	8.50	44.08	2.35	51.39	73.90	22.5	150	0	
Vert.	9920.000	PK	46.76	38.97	9.25	43.87	2.35	53.46	73.90	20.4	150	0	
Vert.	2483.500	AV	36.29	27.65	14.26	44.16	2.35	36.39	53.90	17.5	152	80	
Vert.	4960.000	AV	36.52	31.54	6.56	44.51	2.35	32.46	53.90	21.4	150	0	
Vert.	7440.000	AV	35.23	37.10	8.50	44.08	2.35	39.10	53.90	14.8	150	0	
Vert.	9920.000	AV	34.44	38.97	9.25	43.87	2.35	41.14	53.90	12.7	150	0	

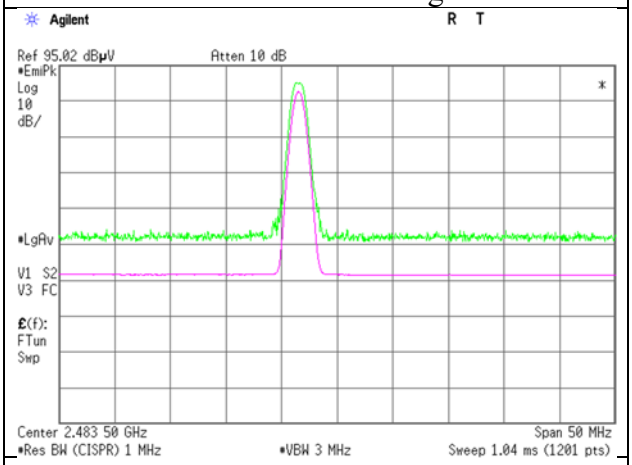
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
* These results have sufficient margin without taking account Dwell time factor.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	August 27, 2018
Temperature / Humidity	24 deg. C / 56 % RH
Engineer	Makoto Hosaka
	(1 GHz -13 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz

Horizontal

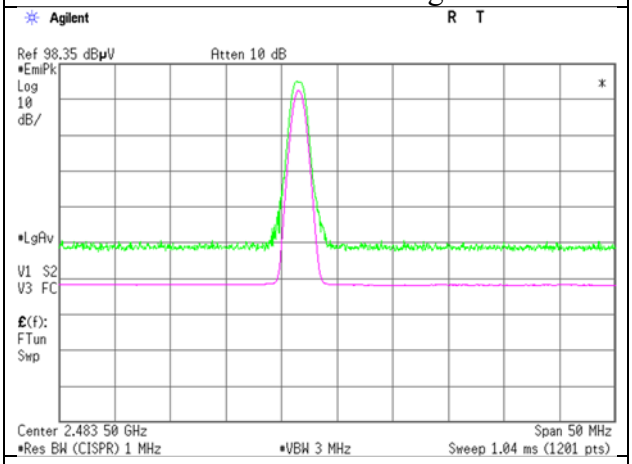
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission

Report No.	12429781S-K-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	August 29, 2018	August 27, 2018	August 31, 2018
Temperature / Humidity	21 deg. C / 50 % RH	24 deg. C / 56 % RH	20 deg. C / 62 % RH
Engineer	Kazutaka Takeyama (30 MHz -1 GHz) (13 GHz-18 GHz)	Makoto Hosaka (1 GHz -13 GHz)	Kazutaka Takeyama (18 GHz -26.5 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.	75.130	QP	27.00	6.33	7.22	32.17	0.00	8.38	40.00	31.6	260	250	
Hori.	359.970	QP	28.36	15.19	9.07	31.95	0.00	20.67	46.00	25.3	100	78	
Hori.	2390.000	PK	49.46	27.86	14.17	44.13	2.35	49.71	73.90	24.1	150	326	
Hori.	4804.000	PK	48.87	31.43	6.49	44.45	2.35	44.69	73.90	29.2	150	0	
Hori.	7206.000	PK	47.96	36.79	8.31	43.99	2.35	51.42	73.90	22.4	150	0	
Hori.	9608.000	PK	49.97	38.51	9.20	43.83	2.35	56.20	73.90	17.7	150	0	
Hori.	2390.000	AV	36.27	27.86	14.17	44.13	2.35	36.52	53.90	17.3	150	326	
Hori.	4804.000	AV	36.44	31.43	6.49	44.45	2.35	32.26	53.90	21.6	150	0	
Hori.	7206.000	AV	35.92	36.79	8.31	43.99	2.35	39.38	53.90	14.5	150	0	
Hori.	9608.000	AV	37.01	38.51	9.20	43.83	2.35	43.24	53.90	10.6	150	0	
Vert.	46.354	QP	32.18	12.53	6.76	32.19	0.00	19.28	40.00	20.7	100	215	
Vert.	51.283	QP	30.26	10.76	6.77	32.19	0.00	15.60	40.00	24.4	100	217	
Vert.	70.675	QP	39.61	6.56	6.82	32.18	0.00	20.81	40.00	19.1	100	216	
Vert.	110.475	QP	40.67	11.95	7.24	32.15	0.00	27.71	43.50	15.7	100	136	
Vert.	129.433	QP	37.60	13.95	7.39	32.14	0.00	26.80	43.50	16.7	100	163	
Vert.	290.403	QP	26.55	13.57	8.65	32.01	0.00	16.76	46.00	29.2	100	122	
Vert.	2390.000	PK	48.58	27.86	14.17	44.13	2.35	48.83	73.90	25.0	218	68	
Vert.	4804.000	PK	48.79	31.43	6.49	44.45	2.35	44.61	73.90	29.2	150	0	
Vert.	7206.000	PK	48.37	36.79	8.31	43.99	2.35	51.83	73.90	22.0	150	0	
Vert.	9608.000	PK	49.17	38.51	9.20	43.83	2.35	55.40	73.90	18.5	150	0	
Vert.	2390.000	AV	36.26	27.86	14.17	44.13	2.35	36.51	53.90	17.3	218	68	
Vert.	4804.000	AV	36.38	31.43	6.49	44.45	2.35	32.20	53.90	21.7	150	0	
Vert.	7206.000	AV	35.92	36.79	8.31	43.99	2.35	39.38	53.90	14.5	150	0	
Vert.	9608.000	AV	37.11	38.51	9.20	43.83	2.35	43.34	53.90	**10.5**	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 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	93.86	27.86	14.18	44.14	2.35	94.11	-	-	Carrier
Hori.	2400.000	PK	41.27	27.86	14.18	44.14	2.35	41.52	74.11	32.6	
Vert.	2402.000	PK	95.64	27.86	14.18	44.14	2.35	95.89	-	-	Carrier
Vert.	2400.000	PK	42.79	27.86	14.18	44.14	2.35	43.04	75.89	32.9	

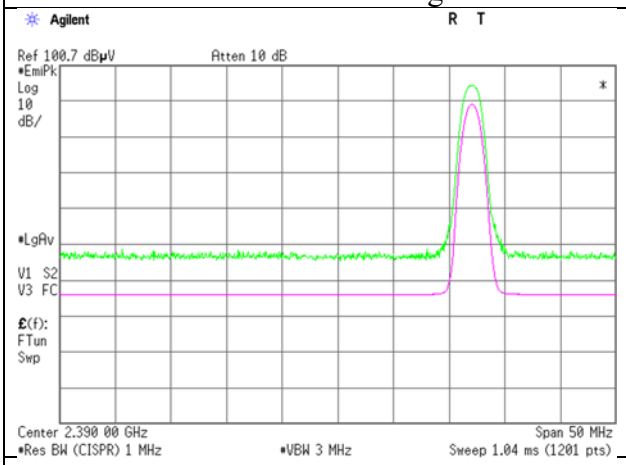
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	August 27, 2018
Temperature / Humidity	24 deg. C / 56 % RH
Engineer	Makoto Hosaka
	(1 GHz -13 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz

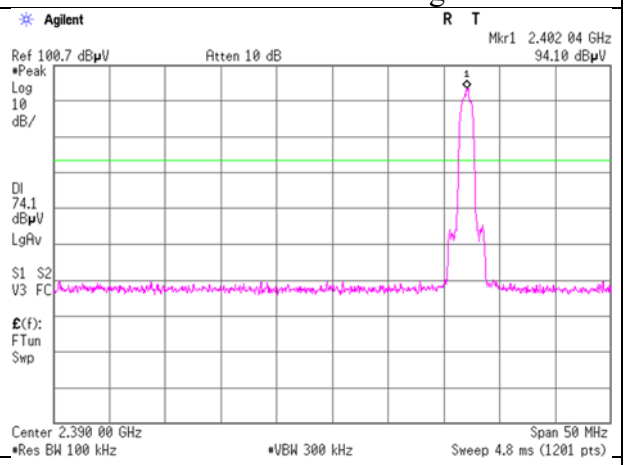
Horizontal

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

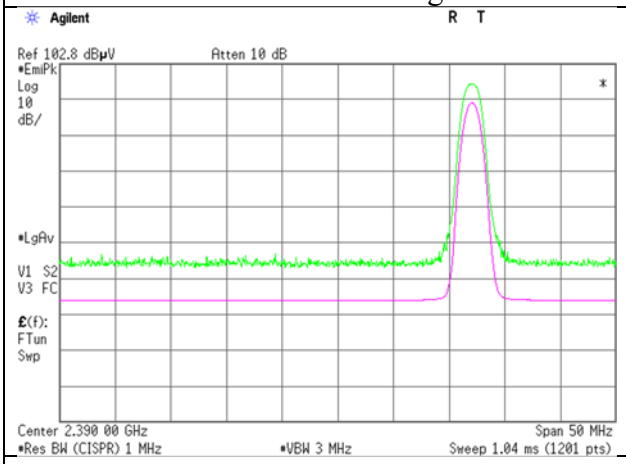
Authorized-band band-edge Plot



20dBc Plot

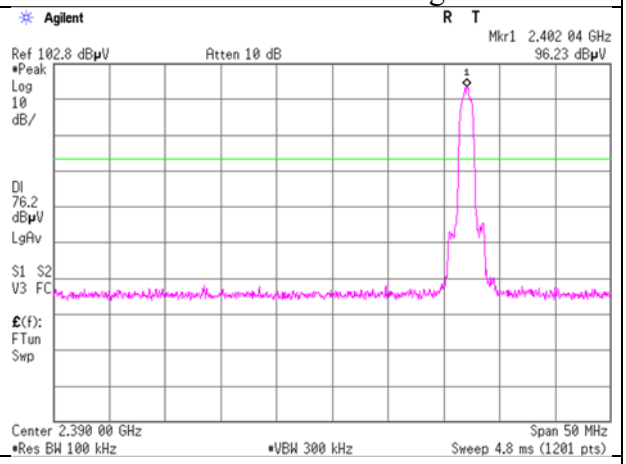
Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Authorized-band band-edge Plot



20dBc Plot

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

Radiated Spurious Emission

Report No.	12429781S-K-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	August 29, 2018	August 27, 2018	August 31, 2018
Temperature / Humidity	21 deg. C / 50 % RH	24 deg. C / 56 % RH	20 deg. C / 62 % RH
Engineer	Kazutaka Takeyama (30 MHz -1 GHz) (13 GHz-18 GHz)	Makoto Hosaka (1 GHz -13 GHz)	Kazutaka Takeyama (18 GHz -26.5 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.	73.085	QP	29.68	6.38	7.04	32.18	0.00	10.92	40.00	29.0	252	266	
Hori.	359.934	QP	26.06	15.19	9.07	31.95	0.00	18.37	46.00	27.6	100	71	
Hori.	4882.000	PK	48.05	31.37	6.53	44.48	2.35	43.82	73.90	30.0	100	0	
Hori.	7323.000	PK	47.29	37.01	8.40	44.03	2.35	51.02	73.90	22.8	100	0	
Hori.	9764.000	PK	47.79	38.92	9.22	43.85	2.35	54.43	73.90	19.4	100	0	
Hori.	4882.000	AV	36.16	31.37	6.53	44.48	2.35	31.93	53.90	21.9	100	0	
Hori.	7323.000	AV	35.16	37.01	8.40	44.03	2.35	38.89	53.90	15.0	100	0	
Hori.	9764.000	AV	35.31	38.92	9.22	43.85	2.35	41.95	53.90	**11.9**	100	0	
Vert.	46.530	QP	32.79	12.47	6.76	32.19	0.00	19.83	40.00	20.1	100	228	
Vert.	51.000	QP	33.80	10.84	6.78	32.19	0.00	19.23	40.00	20.7	100	206	
Vert.	71.415	QP	40.28	6.49	6.89	32.18	0.00	21.48	40.00	18.5	100	208	
Vert.	113.024	QP	41.25	12.32	7.23	32.15	0.00	28.65	43.50	14.8	100	159	
Vert.	129.343	QP	38.06	13.96	7.38	32.14	0.00	27.26	43.50	16.2	100	144	
Vert.	288.183	QP	26.85	13.52	8.63	32.01	0.00	16.99	46.00	29.0	100	134	
Vert.	4882.000	PK	48.37	31.37	6.53	44.48	2.35	44.14	73.90	29.7	150	0	
Vert.	7323.000	PK	47.51	37.01	8.40	44.03	2.35	51.24	73.90	22.6	150	0	
Vert.	9764.000	PK	47.76	38.92	9.22	43.85	2.35	54.40	73.90	19.5	150	0	
Vert.	4882.000	AV	36.14	31.37	6.53	44.48	2.35	31.91	53.90	21.9	150	0	
Vert.	7323.000	AV	35.02	37.01	8.40	44.03	2.35	38.75	53.90	15.1	150	0	
Vert.	9764.000	AV	35.27	38.92	9.22	43.85	2.35	41.91	53.90	**11.9**	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
* These results have sufficient margin without taking account Dwell time factor.

Radiated Spurious Emission

Report No.	12429781S-K-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	August 29, 2018	August 27, 2018	August 31, 2018
Temperature / Humidity	21 deg. C / 50 % RH	24 deg. C / 56 % RH	20 deg. C / 62 % RH
Engineer	Kazutaka Takeyama (30 MHz -1 GHz) (13 GHz-18 GHz)	Makoto Hosaka (1 GHz -13 GHz)	Kazutaka Takeyama (18 GHz -26.5 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.	71.168	QP	29.07	6.51	6.87	32.18	0.00	10.27	40.00	29.7	261	263	
Hori.	360.050	QP	26.52	15.19	9.07	31.95	0.00	18.83	46.00	27.1	100	80	
Hori.	2483.500	PK	48.71	27.65	14.26	44.16	2.35	48.81	73.90	25.0	100	0	
Hori.	4960.000	PK	48.89	31.54	6.56	44.51	2.35	44.83	73.90	29.0	100	0	
Hori.	7440.000	PK	47.95	37.10	8.50	44.08	2.35	51.82	73.90	22.0	100	0	
Hori.	9920.000	PK	47.37	38.97	9.25	43.87	2.35	54.07	73.90	19.8	100	0	
Hori.	2483.500	AV	36.26	27.65	14.26	44.16	2.35	36.36	53.90	17.5	100	0	
Hori.	4960.000	AV	36.39	31.54	6.56	44.51	2.35	32.33	53.90	21.5	100	0	
Hori.	7440.000	AV	35.12	37.10	8.50	44.08	2.35	38.99	53.90	14.9	100	0	
Hori.	9920.000	AV	34.36	38.97	9.25	43.87	2.35	41.06	53.90	**12.8**	100	0	
Vert.	46.415	QP	32.55	12.51	6.76	32.19	0.00	19.63	40.00	20.3	100	222	
Vert.	50.795	QP	33.71	10.91	6.78	32.19	0.00	19.21	40.00	20.7	100	203	
Vert.	70.486	QP	39.90	6.58	6.81	32.18	0.00	21.11	40.00	18.8	100	206	
Vert.	113.152	QP	41.39	12.33	7.23	32.15	0.00	28.80	43.50	14.7	100	140	
Vert.	129.337	QP	38.03	13.96	7.38	32.14	0.00	27.23	43.50	16.2	100	165	
Vert.	290.325	QP	26.86	13.57	8.65	32.01	0.00	17.07	46.00	28.9	100	131	
Vert.	2483.500	PK	48.71	27.65	14.26	44.16	2.35	48.81	73.90	25.0	100	0	
Vert.	4960.000	PK	49.38	31.54	6.56	44.51	2.35	45.32	73.90	28.5	100	0	
Vert.	7440.000	PK	47.64	37.10	8.50	44.08	2.35	51.51	73.90	22.3	100	0	
Vert.	9920.000	PK	47.27	38.97	9.25	43.87	2.35	53.97	73.90	19.9	100	0	
Vert.	2483.500	AV	36.29	27.65	14.26	44.16	2.35	36.39	53.90	17.5	100	0	
Vert.	4960.000	AV	36.52	31.54	6.56	44.51	2.35	32.46	53.90	21.4	100	0	
Vert.	7440.000	AV	35.18	37.10	8.50	44.08	2.35	39.05	53.90	14.8	100	0	
Vert.	9920.000	AV	34.40	38.97	9.25	43.87	2.35	41.10	53.90	**12.8**	100	0	

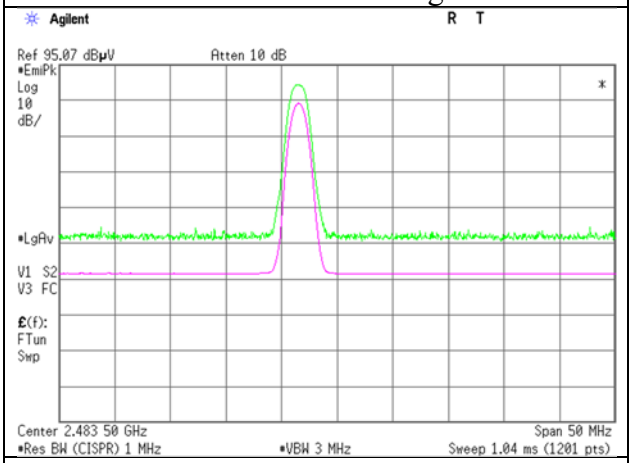
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
* These results have sufficient margin without taking account Dwell time factor.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	August 27, 2018
Temperature / Humidity	24 deg. C / 56 % RH
Engineer	Makoto Hosaka
	(1 GHz -13 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz

Horizontal

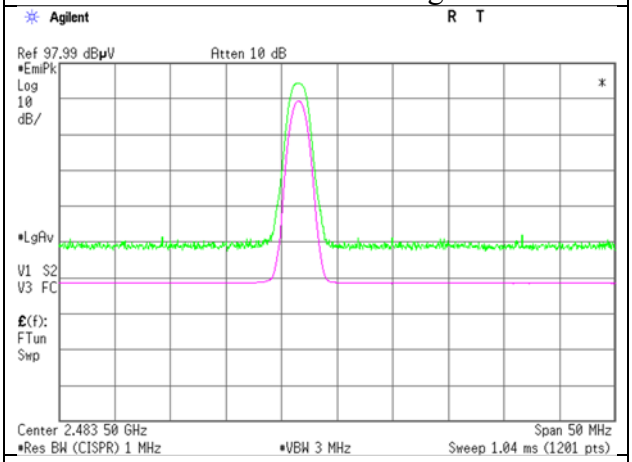
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 12, 2018
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Yosuke Ishikawa
	(1 GHz -2.8 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz with Tx 11ac-20 5180 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.	2390.000	PK	48.32	27.86	14.13	44.13	2.35	48.53	73.90	25.3	100	8	
Hori.	2390.000	AV	36.29	27.86	14.13	44.13	2.35	36.50	53.90	**17.4**	100	8	
Vert.	2390.000	PK	48.99	27.86	14.13	44.13	2.35	49.20	73.90	24.7	162	286	
Vert.	2390.000	AV	36.29	27.86	14.13	44.13	2.35	36.50	53.90	**17.4**	162	286	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 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	96.28	27.86	14.14	44.14	2.35	96.49	-	-	Carrier
Hori.	2400.000	PK	41.59	27.86	14.14	44.14	2.35	41.80	76.49	34.7	
Vert.	2402.000	PK	97.56	27.86	14.14	44.14	2.35	97.77	-	-	Carrier
Vert.	2400.000	PK	40.85	27.86	14.14	44.14	2.35	41.06	77.77	36.7	

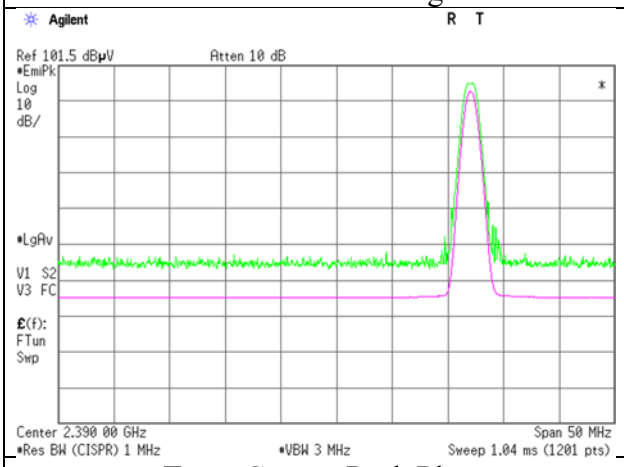
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 12, 2018
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Yosuke Ishikawa
	(1 GHz -2.8 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz with Tx 11ac-20 5180 MHz

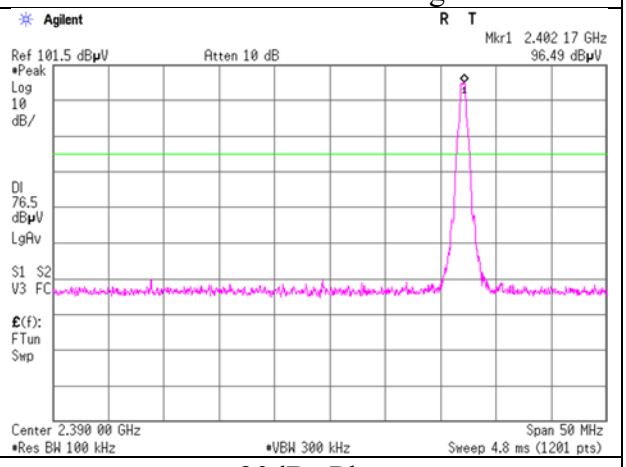
Horizontal

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

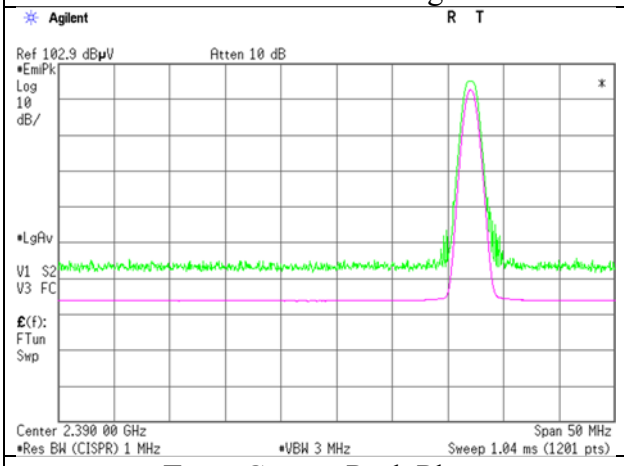
Authorized-band band-edge Plot



20dBc Plot

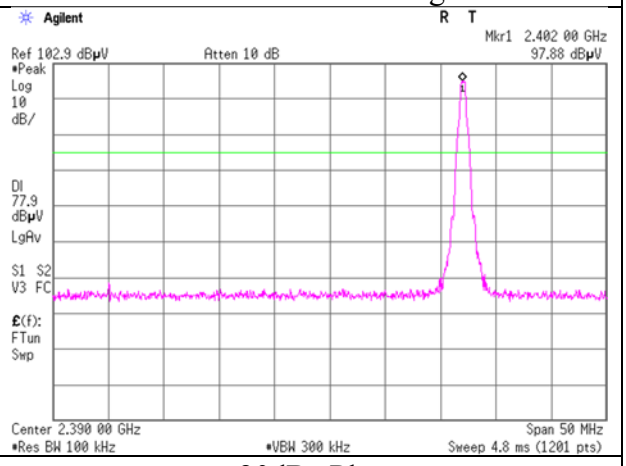
Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Authorized-band band-edge Plot



20dBc Plot

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

Radiated Spurious Emission

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 12, 2018
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Yosuke Ishikawa
	(1 GHz -2.8 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz with Tx 11ac-20 5180 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.	2483.500	PK	48.47	27.65	14.22	44.16	2.35	48.53	73.90	25.3	100	328	
Hori.	2483.500	AV	36.31	27.65	14.22	44.16	2.35	36.37	53.90	**17.5**	100	328	
Vert.	2483.500	PK	49.02	27.65	14.22	44.16	2.35	49.08	73.90	24.8	200	285	
Vert.	2483.500	AV	36.34	27.65	14.22	44.16	2.35	36.40	53.90	**17.5**	200	285	

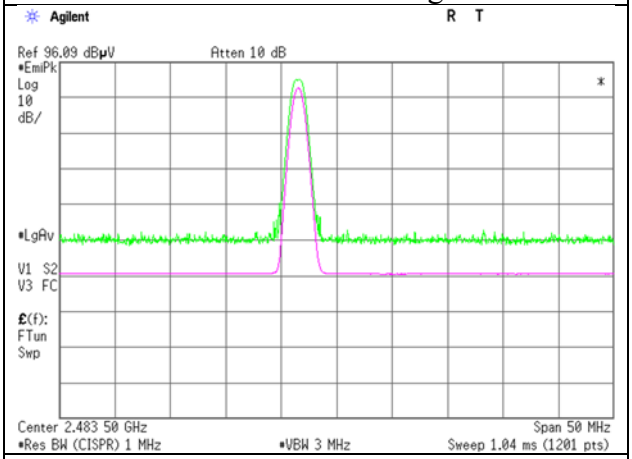
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
* These results have sufficient margin without taking account Dwell time factor.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 12, 2018
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Yosuke Ishikawa (1 GHz -2.8 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz with Tx 11ac-20 5180 MHz

Horizontal

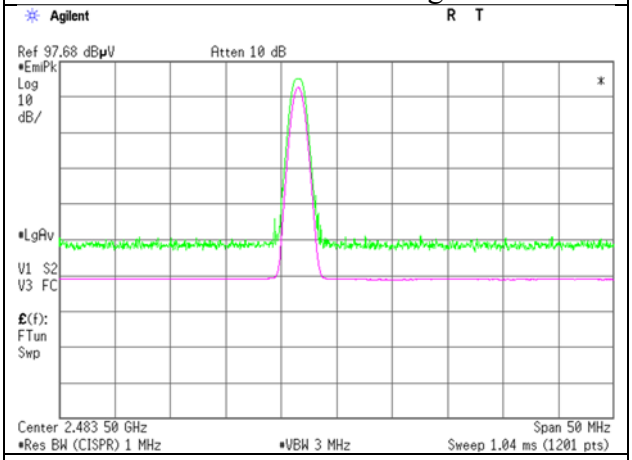
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 12, 2018
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Yosuke Ishikawa
	(1 GHz -2.8 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz with Tx 11ac-20 5180 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.	2390.000	PK	49.45	27.86	14.13	44.13	2.35	49.66	73.90	24.2	355	8	
Hori.	2390.000	AV	36.29	27.86	14.13	44.13	2.35	36.50	53.90	**17.4**	355	8	
Vert.	2390.000	PK	47.87	27.86	14.13	44.13	2.35	48.08	73.90	25.8	185	275	
Vert.	2390.000	AV	36.27	27.86	14.13	44.13	2.35	36.48	53.90	**17.4**	185	275	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
* These results have sufficient margin without taking account Dwell time factor.

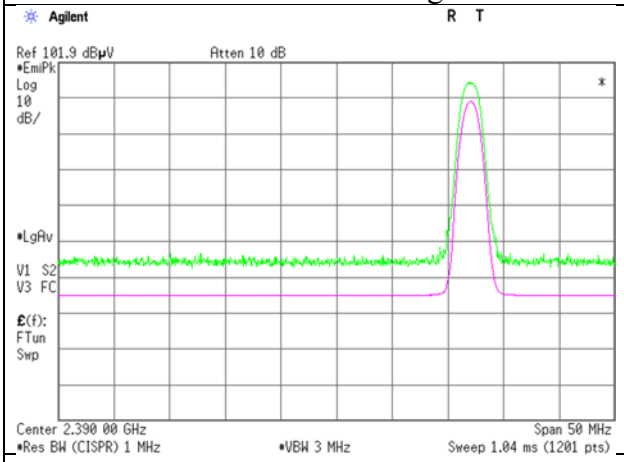
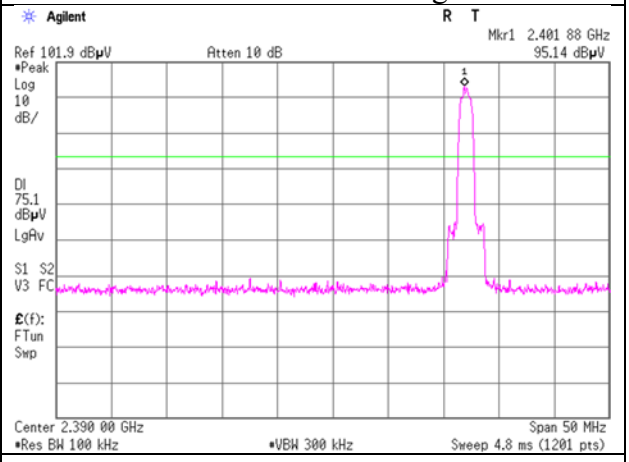
20 dBc Data Sheet **(RBW 100 kHz, VBW 300 kHz)**

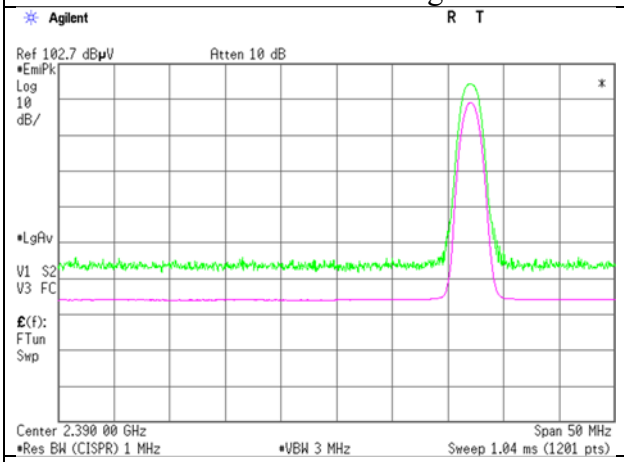
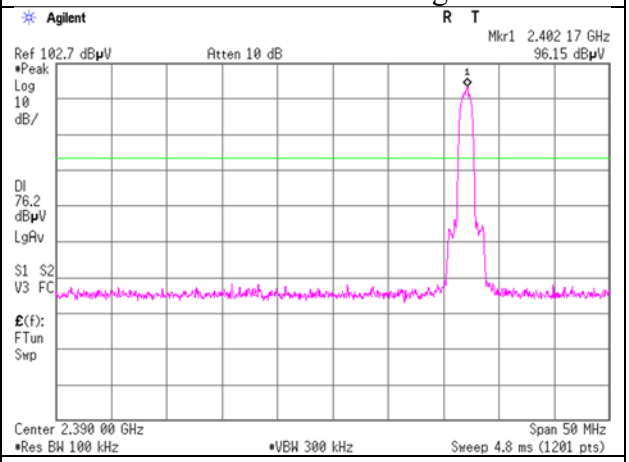
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	94.99	27.86	14.14	44.14	2.35	95.20	-	-	Carrier
Hori.	2400.000	PK	41.80	27.86	14.14	44.14	2.35	42.01	75.20	33.2	
Vert.	2402.000	PK	95.80	27.86	14.14	44.14	2.35	96.01	-	-	Carrier
Vert.	2400.000	PK	41.14	27.86	14.14	44.14	2.35	41.35	76.01	34.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 12, 2018
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Yosuke Ishikawa (1 GHz -2.8 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz with Tx 11ac-20 5180 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

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

Radiated Spurious Emission

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 13, 2018
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Yosuke Ishikawa
	(30 MHz -26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz with Tx 11ac-20 5180 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.	71.659	QP	38.10	6.46	6.91	32.18	0.00	19.29	40.00	20.7	289	227	
Hori.	138.103	QP	28.90	14.39	7.57	32.13	0.00	18.73	43.50	24.7	239	85	
Hori.	146.771	QP	30.40	14.72	7.74	32.12	0.00	20.74	43.50	22.7	245	78	
Hori.	161.752	QP	26.10	15.21	7.87	32.11	0.00	17.07	43.50	26.4	247	251	
Hori.	342.027	QP	27.20	14.98	8.98	31.96	0.00	19.20	46.00	26.8	100	127	
Hori.	4882.000	PK	49.21	31.37	16.50	44.48	2.35	54.95	73.90	18.9	100	0	
Hori.	7323.000	PK	47.10	37.01	8.86	44.03	2.35	51.29	73.90	22.6	100	0	
Hori.	9764.000	PK	48.34	38.92	9.52	43.85	2.35	55.28	73.90	18.6	100	0	
Hori.	12205.000	PK	47.57	39.22	11.29	43.36	2.35	57.07	73.90	16.8	100	0	
Hori.	4882.000	AV	37.17	31.37	16.50	44.48	2.35	42.91	53.90	10.9	100	0	
Hori.	7323.000	AV	35.91	37.01	8.86	44.03	2.35	40.10	53.90	13.8	100	0	
Hori.	9764.000	AV	36.71	38.92	9.52	43.85	2.35	43.65	53.90	10.2	100	0	
Hori.	12205.000	AV	36.43	39.22	11.29	43.36	2.35	45.93	53.90	7.9	100	0	
Vert.	55.489	QP	44.40	9.40	6.72	32.19	0.00	28.33	40.00	11.6	100	297	
Vert.	72.799	QP	51.20	6.39	7.01	32.18	0.00	32.42	40.00	**7.5**	100	170	
Vert.	142.689	QP	27.10	14.60	7.66	32.13	0.00	17.23	43.50	26.2	100	81	
Vert.	269.788	QP	25.00	12.82	8.51	32.01	0.00	14.32	46.00	31.6	100	171	
Vert.	324.000	QP	25.20	14.43	8.86	31.98	0.00	16.51	46.00	29.4	100	206	
Vert.	4882.000	PK	49.11	31.37	16.50	44.48	2.35	54.85	73.90	19.0	100	0	
Vert.	7323.000	PK	47.46	37.01	8.86	44.03	2.35	51.65	73.90	22.2	100	0	
Vert.	9764.000	PK	47.97	38.92	9.52	43.85	2.35	54.91	73.90	18.9	100	0	
Vert.	12205.000	PK	47.33	39.22	11.29	43.36	2.35	56.83	73.90	17.0	100	0	
Vert.	4882.000	AV	37.21	31.37	16.50	44.48	2.35	42.95	53.90	10.9	100	0	
Vert.	7323.000	AV	36.10	37.01	8.86	44.03	2.35	40.29	53.90	13.6	100	0	
Vert.	9764.000	AV	36.72	38.92	9.52	43.85	2.35	43.66	53.90	10.2	100	0	
Vert.	12205.000	AV	36.40	39.22	11.29	43.36	2.35	45.90	53.90	8.0	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
* These results have sufficient margin without taking account Dwell time factor.

Radiated Spurious Emission

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 12, 2018
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Yosuke Ishikawa
	(1 GHz -2.8 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz with Tx 11ac-20 5180 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.	2483.500	PK	49.32	27.65	14.22	44.16	2.35	49.38	73.90	24.5	100	333	
Hori.	2483.500	AV	36.39	27.65	14.22	44.16	2.35	36.45	53.90	**17.4**	100	333	
Vert.	2483.500	PK	48.40	27.65	14.22	44.16	2.35	48.46	73.90	25.4	135	82	
Vert.	2483.500	AV	34.98	27.65	14.22	44.16	2.35	35.04	53.90	18.8	135	82	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

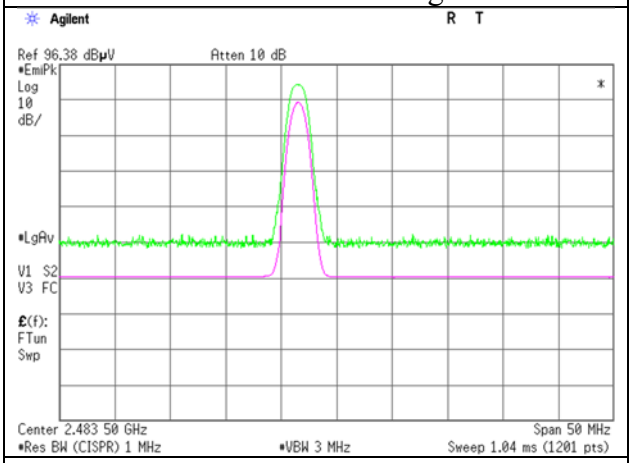
* These results have sufficient margin without taking account Dwell time factor.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 12, 2018
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Yosuke Ishikawa (1 GHz -2.8 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz with Tx 11ac-20 5180 MHz

Horizontal

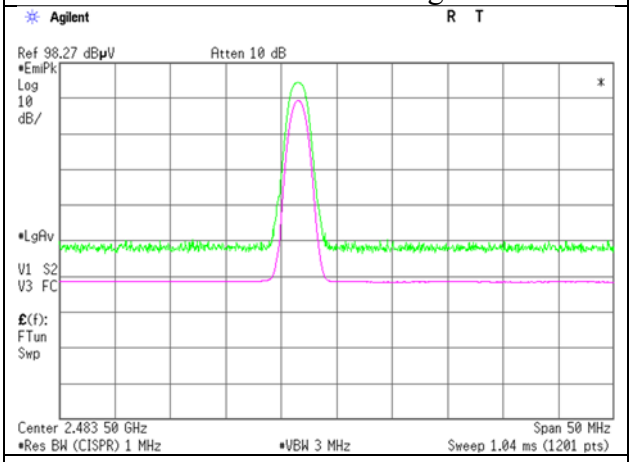
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

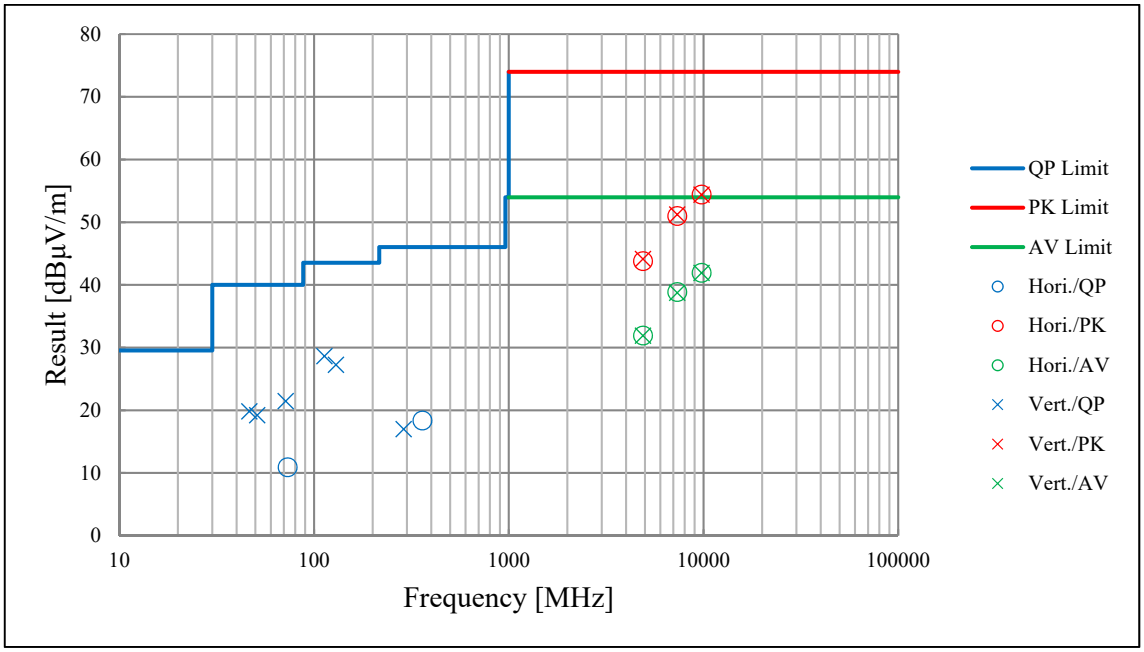


Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission
(Plot data, Worst case)

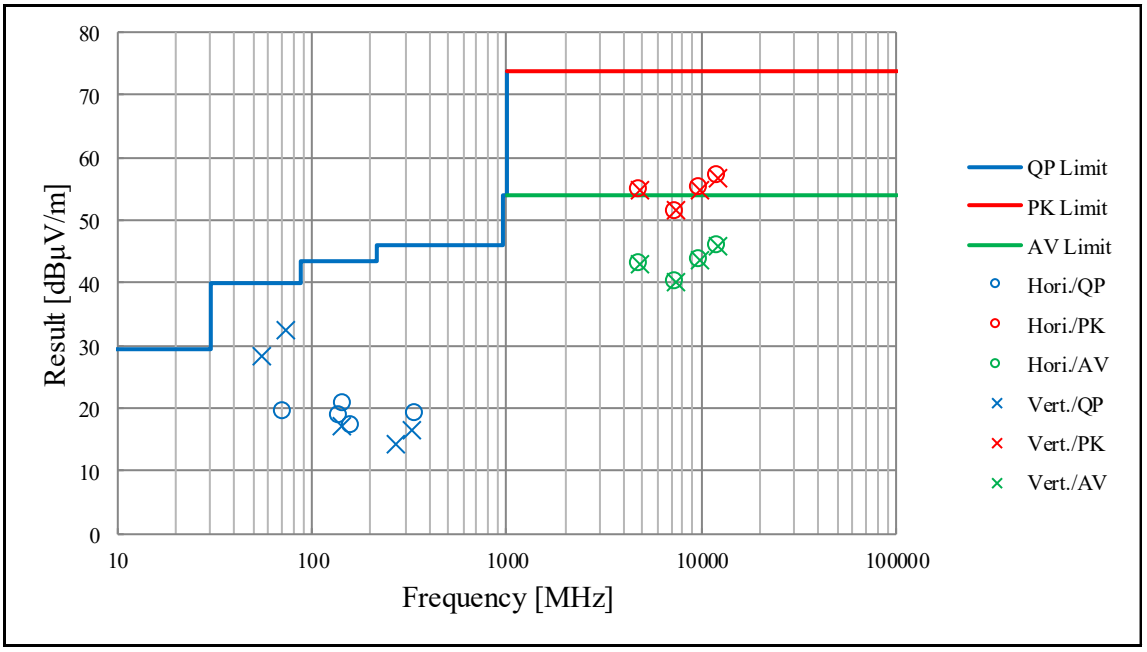
Report No.	12429781S-K-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	August 29, 2018	August 27, 2018	August 31, 2018
Temperature / Humidity	21 deg. C / 50 % RH	24 deg. C / 56 % RH	20 deg. C / 62 % RH
Engineer	Kazutaka Takeyama (30 MHz -1 GHz) (13 GHz-18 GHz)	Makoto Hosaka (30 MHz -1 GHz)	Kazutaka Takeyama (18 GHz -26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz		



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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12429781S-K-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 13, 2018
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Yosuke Ishikawa
	(30 MHz -26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz with Tx 11ac-20 5180 MHz



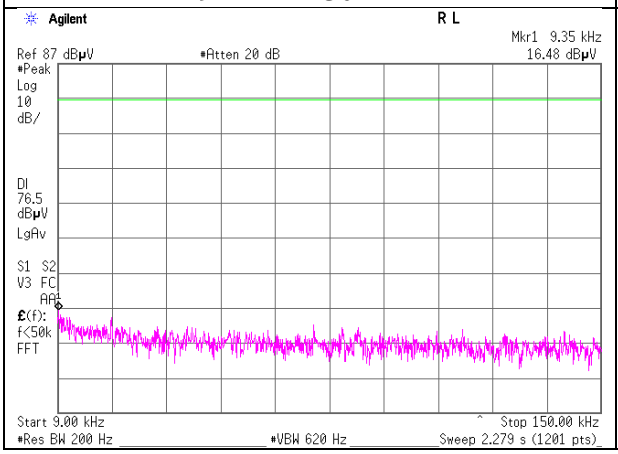
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

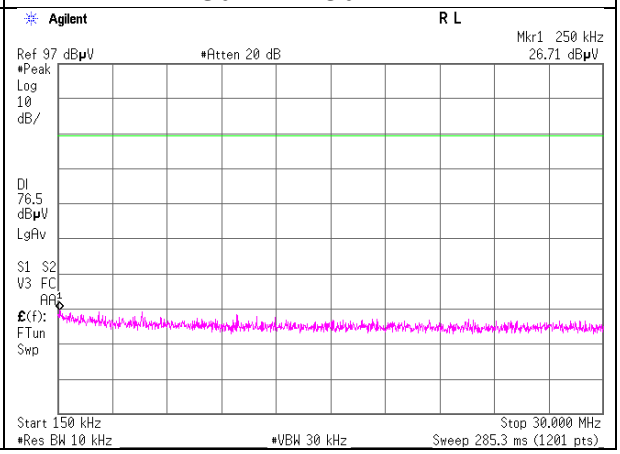
Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off, DH5,

2402 MHz

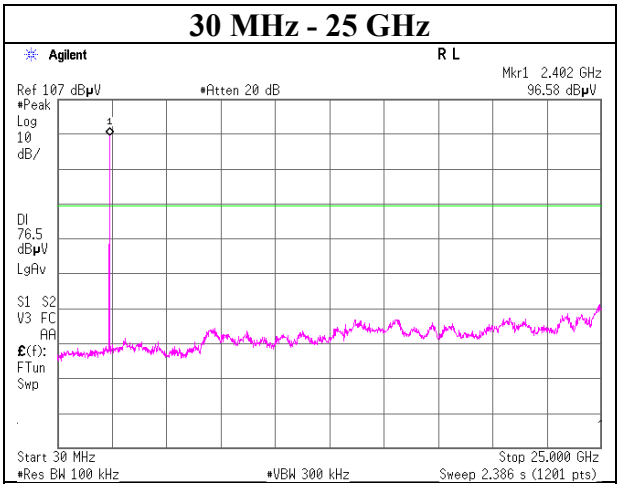
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

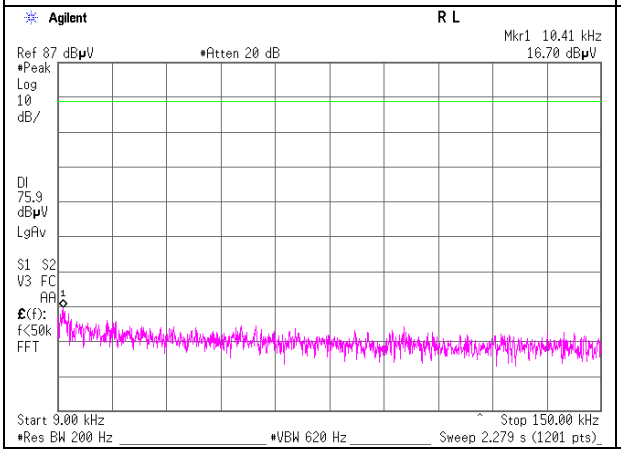


Conducted Spurious Emission

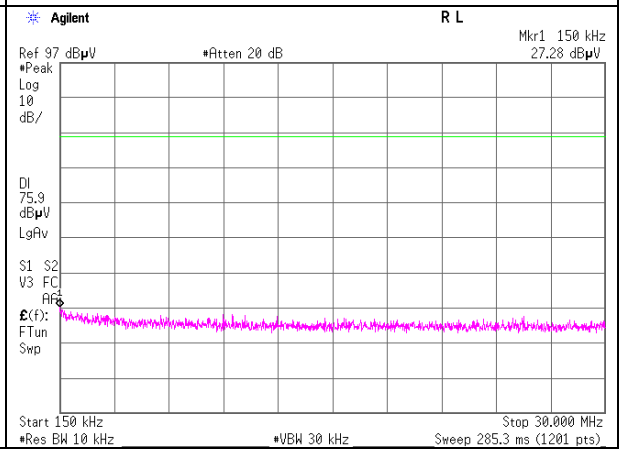
Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off, DH5,

2441 MHz

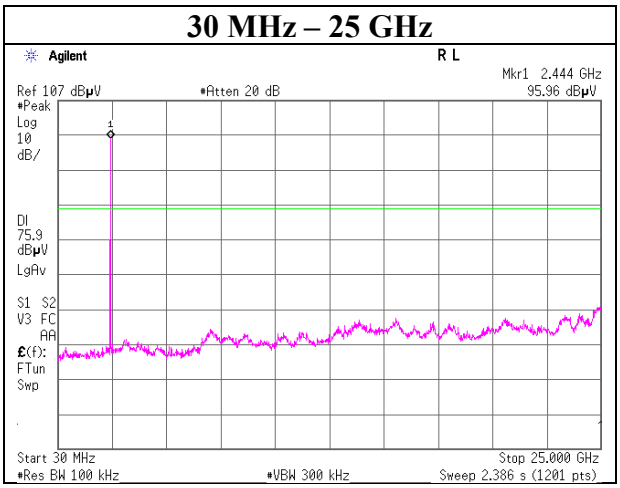
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 25 GHz

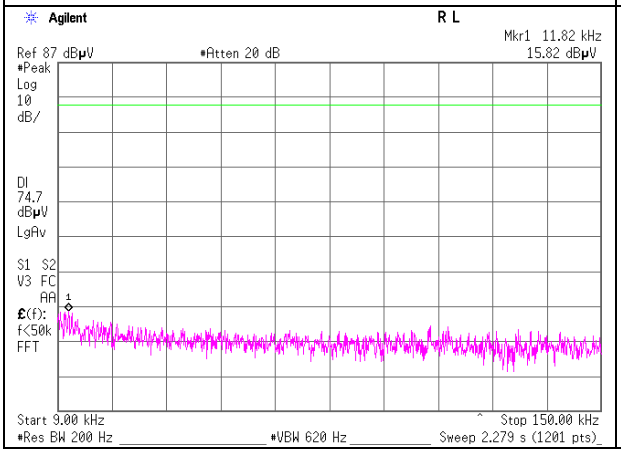


Conducted Spurious Emission

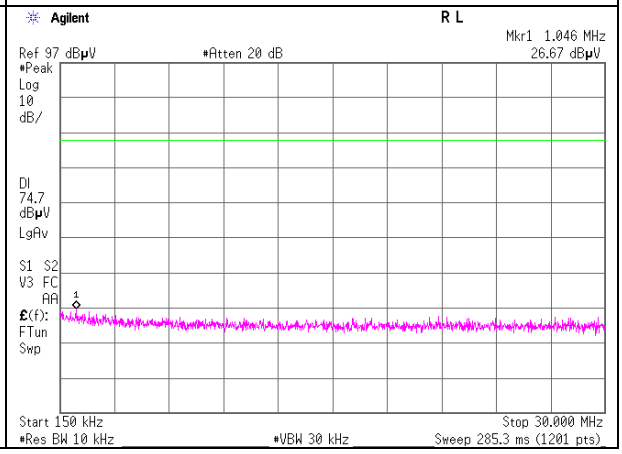
Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off, DH5,

2480 MHz

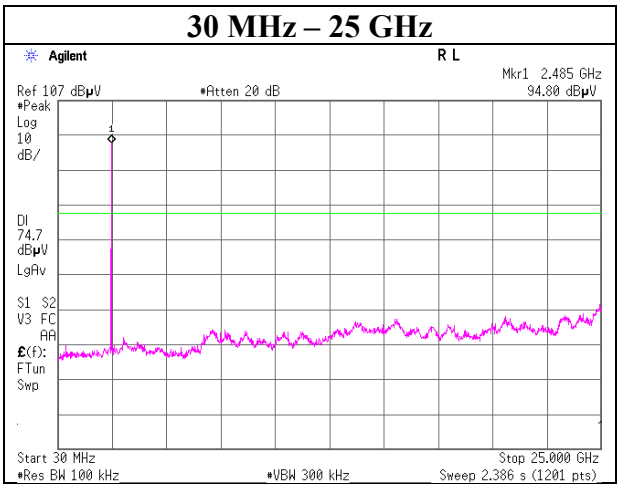
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 25 GHz

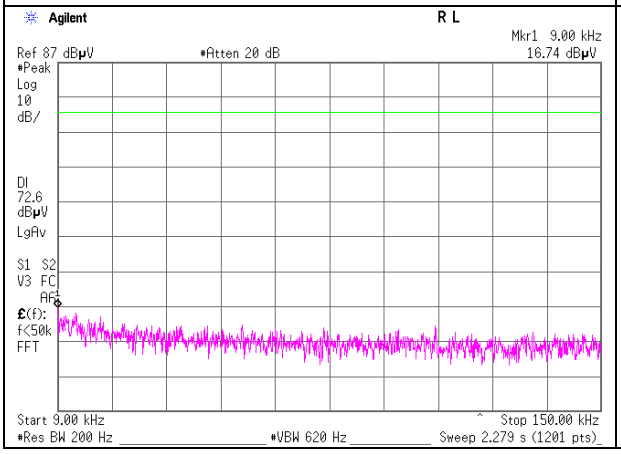


Conducted Spurious Emission

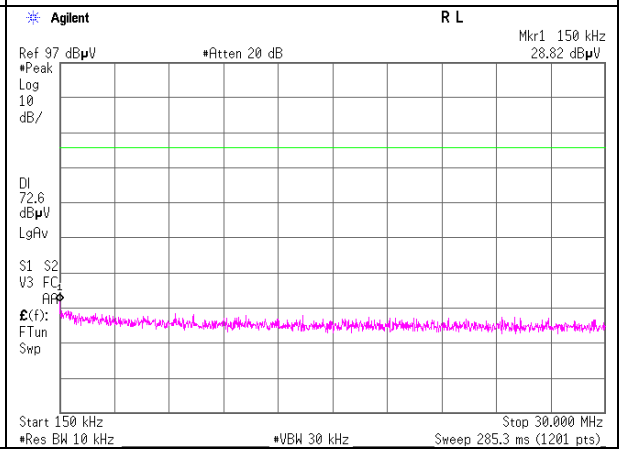
Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off, 3DH5,

2402 MHz

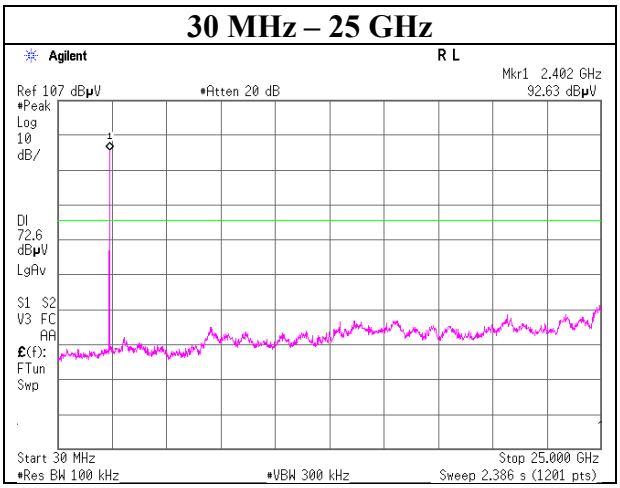
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 25 GHz

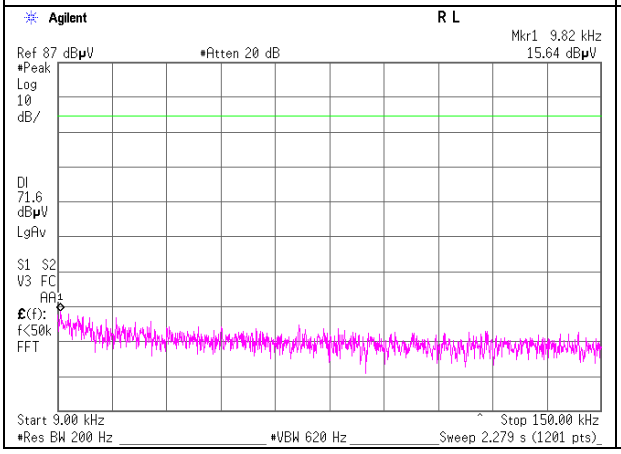


Conducted Spurious Emission

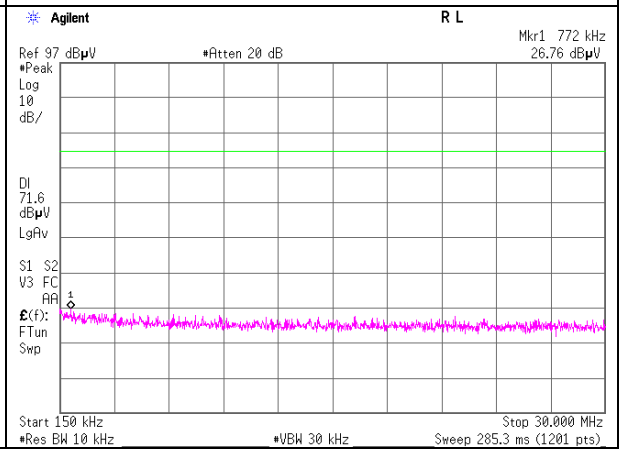
Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off, 3DH5,

2441 MHz

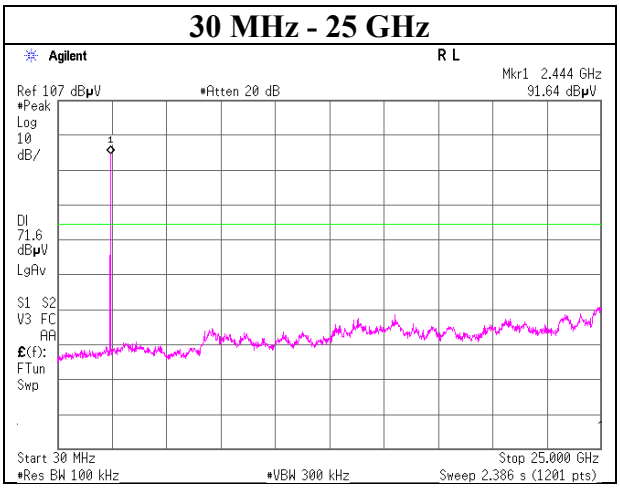
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

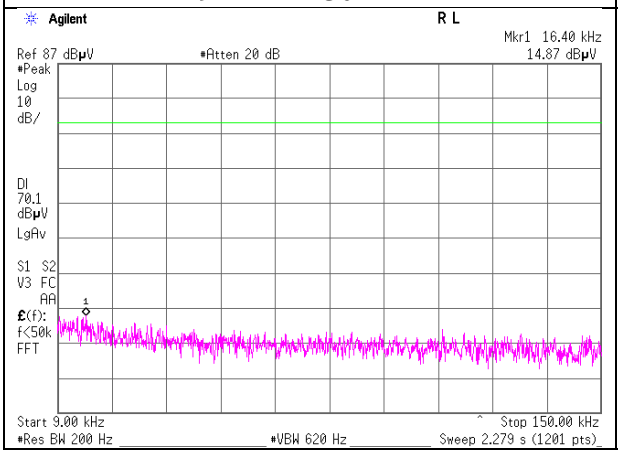


Conducted Spurious Emission

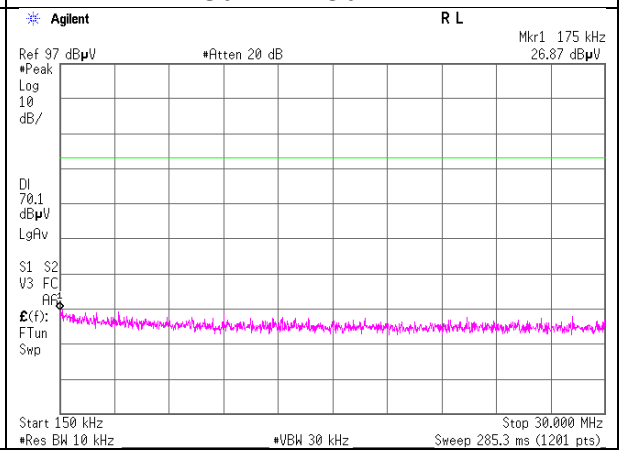
Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off, 3DH5,

2480 MHz

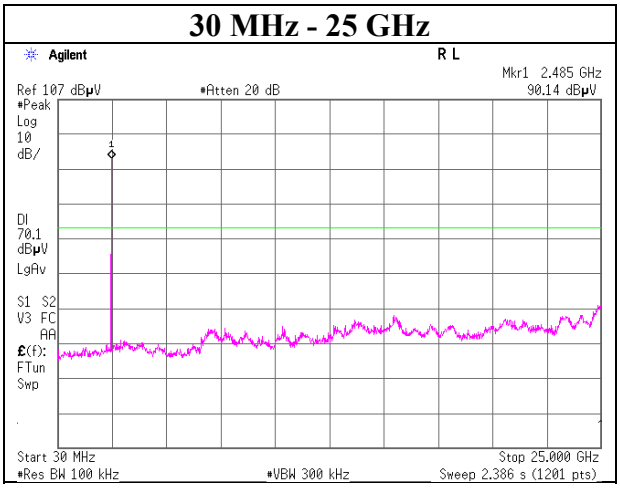
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

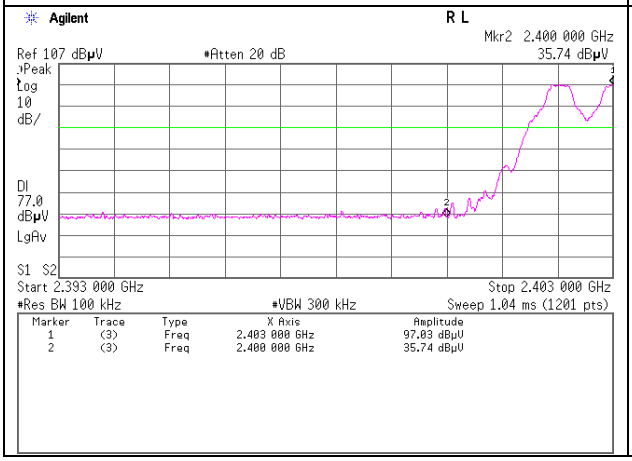


Conducted Emission Band Edge compliance

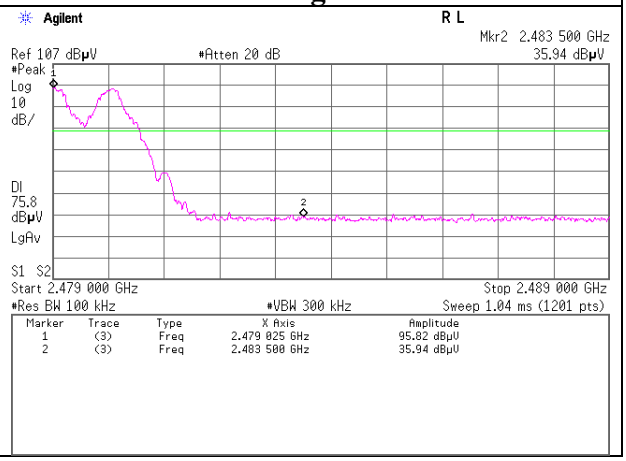
Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off, DH5, Tx, Hopping On, DH5

Hopping On

Low

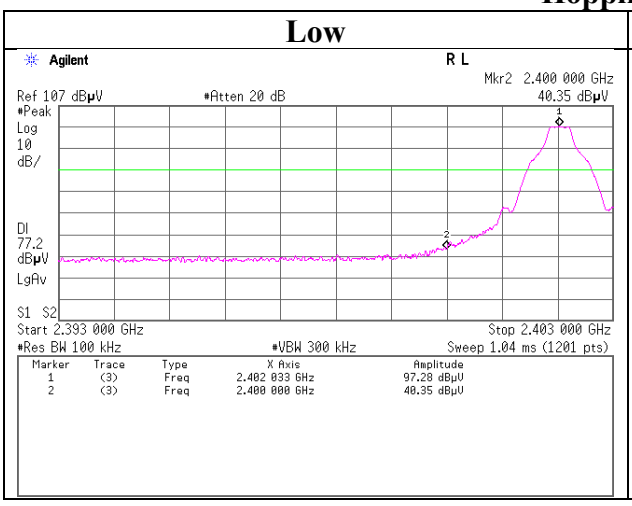


High

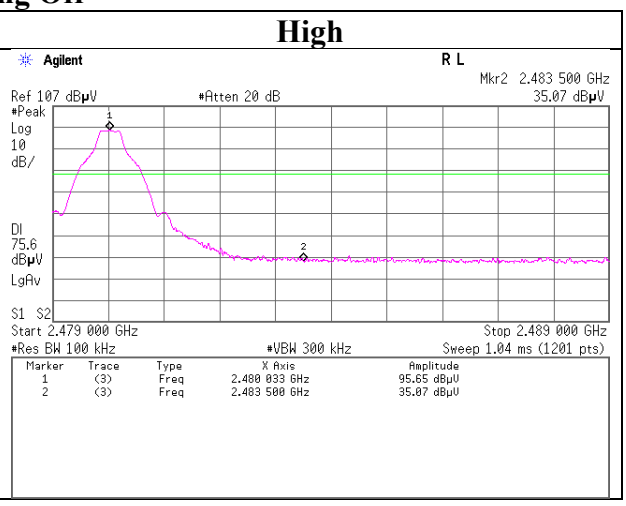


Hopping Off

Low



High

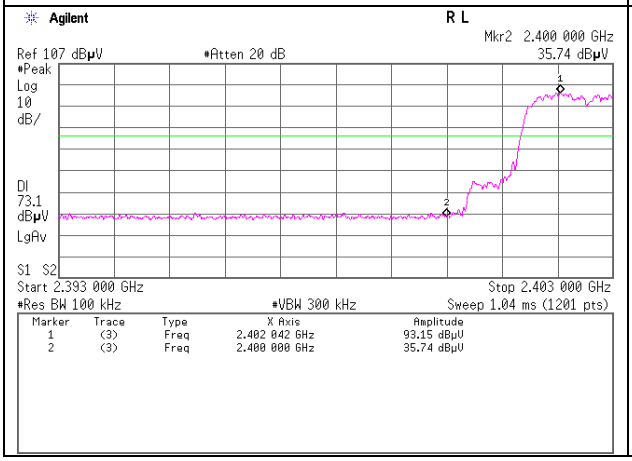


Conducted Emission Band Edge compliance

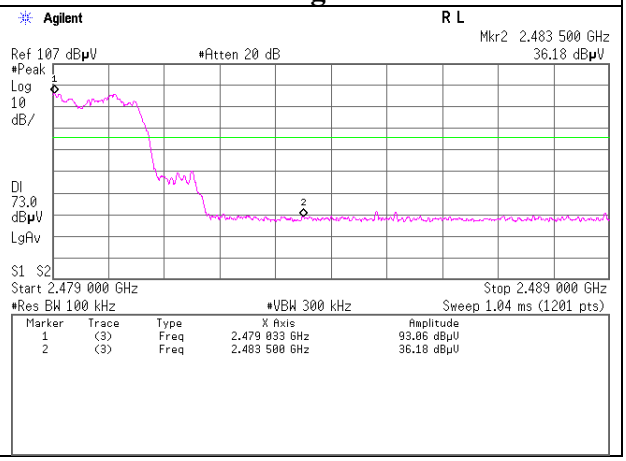
Report No.	12429781S-K-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	September 5, 2018
Temperature / Humidity	27 deg. C /49 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off, 3DH5, Tx, Hopping On, 3DH5

Hopping On

Low

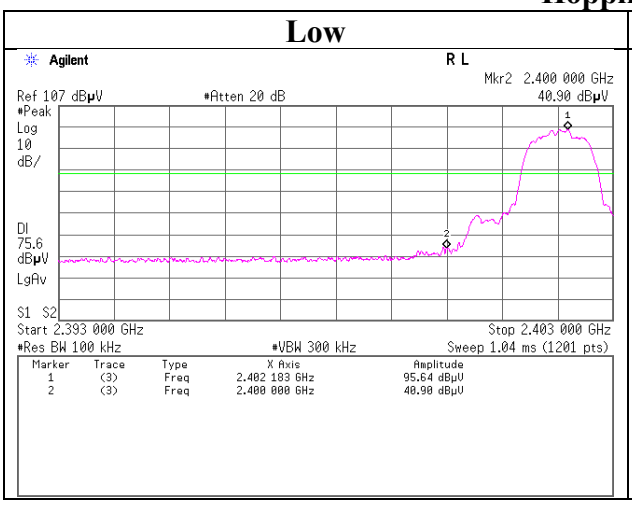


High

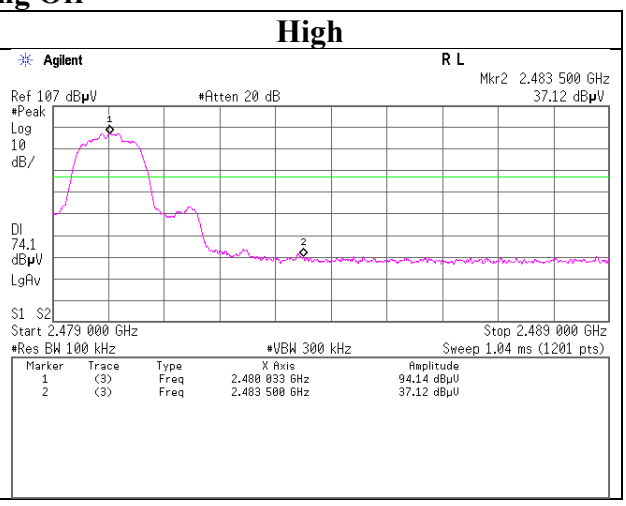


Hopping Off

Low



High



APPENDIX 2: Test instruments

Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAEC-03(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	RE	2018/07/17 * 12
SAJ-01	Antenna Tilt Jig	Intelligent System Engineering Co., Ltd	Antenna Tilt Jig	T-S001	RE	Pre Check
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2018/03/05 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2017/11/22 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2017/11/16 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2018/06/02 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2018/06/17 * 12
SLA-07	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	196	RE	2018/06/17 * 12
SAT6-13	Attenuator	JFW	50HF-006N	-	RE	2018/02/09 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	2018/04/09 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2018/02/16 * 12
STR-08	Test Receiver	Rohde & Schwarz	ESW44	101581	RE,CE	2017/11/24 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE, CE,RFI,MF)	-	RE,CE	-
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2017/10/30 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE,CE	2017/10/16 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2018/07/23 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	2046104	RE	2017/09/22 * 12
SCC-G06	Coaxial Cable	Junkosha	J12J102207-00	MAY-23-16-091	RE	2018/06/01 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2018/05/11 * 12
SCC-G41	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S006	RE	2018/01/29 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2017/10/30 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM9861	RE	2018/07/23 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2018/03/27 * 12
SCC-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2018/03/19 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000KMSKMS	-	RE	2018/04/20 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2018/07/13 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY53260009	AT	2018/07/13 * 12
SAT10-09	Attenuator	Weinschel Corp.	54A-10	W5692	AT	2017/11/22 * 12
SAT10-14	Attenuator	Weinschel Corp.	54A-10	81595	AT	2019/04/30 * 12
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2018/03/19 * 12
SCC-G14	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	AT	2019/12/31 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT	2017/10/10 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2017/12/21 * 12
SCC-C9/C10/SRSE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-271(RF Selector)	CE	2018/04/09 * 12
SLS-02	LISN	Rohde & Schwarz	ENV216	100512	CE	2018/02/26 * 12
SAT3-07	Attenuator	JFW	50HF-003N	-	CE	2018/09/14 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2017/12/21 * 12

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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

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