



RADIO TEST REPORT

Test Report No. : 12327512S-C-R1

Applicant : Sony Corporation
Type of Equipment : Wireless Noise Canceling Stereo Headset
Model No. : WI-C600N
FCC ID : AK8WIC600N
Test regulation : FCC Part 15 Subpart C: 2018
Test Result : Complied

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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 12327512S-C. 12327512S-C is replaced with this report.

Date of test: May 20 to 31, 2018

Representative test engineer:

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- ☐ 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

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SECTION 1: Customer information

Company Name	:	Sony Corporation
Address	:	1-7-1 Konan Minato-ku, Tokyo, 108-0075, Japan
Telephone Number	:	+604-3835019
Contact Person	:	Maizatul Akmal Binti Mat Zan

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

2.1 Identification of E.U.T.

Type of Equipment	:	Wireless Noise Canceling Stereo Headset
Model No.	:	WI-C600N
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.7 V: Built-in lithium-ion rechargeable battery DC 5 V: When charged using USB
Receipt Date of Sample	:	May 10, 2018
Country of Mass-production	:	Malaysia
Condition of EUT	:	Engineering 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: WI-C600N (referred to as the EUT in this report) is a Wireless Noise Canceling Stereo Headset.

Radio Specification

Bluetooth Low Energy

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Antenna type	:	Chip Antenna
Antenna Gain	:	2.85 dBi
Clock frequency (Maximum)	:	26 MHz (XTAL)

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

* Also the EUT complies with FCC Part 15 Subpart B. Refer to the test report: 12327512S-E.

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)
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(d)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	4.6 dB 7206.000 MHz, AV, Vert. Tx BT LE, 2402 MHz	Complied#	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

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

*1) The EUT operates with a battery. AC Line can be connected to the EUT via other device's USB port; however, the EUT stops transmission during recharging. Therefore, the test is not applicable to the EUT.

*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.

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)

The EUT is a battery-operated device and test was performed with the full-charged battery. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

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3.3 Addition to standard

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

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

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

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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	4.9 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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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

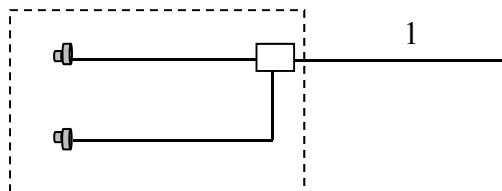
Refer to APPENDIX.

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

4.1 Operating Mode(s)

Mode	Frequency	Remarks*
Bluetooth Low Energy	2402 MHz, 2440 MHz, 2480 MHz	PN9
*Power of the EUT was set by the software as follows; - Power Setting: Fixed - Software: CSR BlueSuite BlueTest3 Version 2.6.6 *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



A: EUT

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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless Noise Canceling Stereo Headset	WI-C600N	1000232 *1) 1000227 *2)	Sony Corporation	EUT

*1) Used for Antenna Terminal conducted test

*2) Used for Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	0.2	Shielded	Shielded	-

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SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v04".

[For below 1 GHz]

EUT was placed on a platform of nominal size, 1.5 m by 1.0 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. 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 *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: <u>12.2.5.2</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	3.92 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)		3.92 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

*2) Distance Factor: $20 \times \log(3.92 \text{ m} / 3.0 \text{ m}) = 2.33 \text{ dB}$

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

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- 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.

Antenna polarization	Frequency			
	Below 1 GHz	1 GHz - 2.8 GHz	2.8 GHz - 13 GHz	13 GHz - 26.5 GHz
Horizontal	X	Z	Z	X
Vertical	X	X	Y	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
6dB Bandwidth	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				

*1) Peak hold was applied as Worst-case measurement.
 *2) Reference data
 *3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04".
 *4) 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.

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

Test data : APPENDIX
Test result : Pass

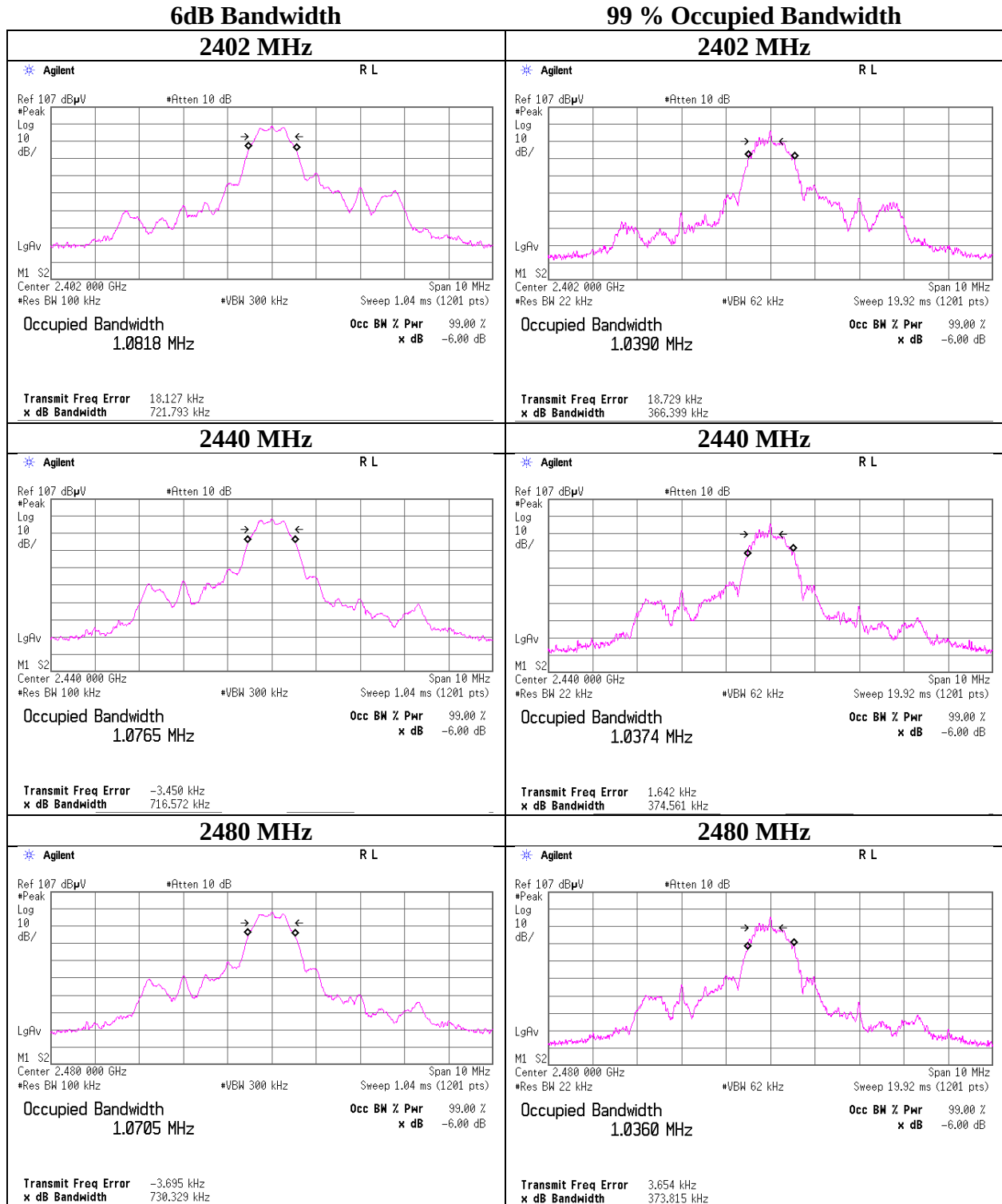
APPENDIX 1: Test data

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 12327512S-C-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date May 31, 2018
Temperature / Humidity 25 deg. C / 47 % RH
Engineer Makoto Hosaka
Mode Tx

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [kHz]	Limit for 6dB Bandwidth [MHz]
BT LE	2402	1039.0	721.793	> 0.5000
	2440	1037.4	716.572	> 0.5000
	2480	1036.0	730.329	> 0.5000

6dB Bandwidth and 99 % Occupied Bandwidth



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Maximum Peak Output Power

Report No. 12327512S-C-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date May 29, 2018
Temperature / Humidity 25 deg. C / 46 % RH
Engineer Makoto Hosaka
Mode Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power				
				Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]	
2402	-10.53	1.22	9.86	0.55	1.14	30.00	1000	29.45
2440	-10.78	1.22	9.86	0.30	1.07	30.00	1000	29.70
2480	-11.16	1.23	9.85	-0.08	0.98	30.00	1000	30.08

Sample Calculation:

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

Average Output Power
(Reference data for RF Exposure)

Report No. 12327512S-C-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date May 29, 2018
Temperature / Humidity 25 deg. C / 46 % RH
Engineer Makoto Hosaka
Mode Tx

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-13.37	1.22	9.86	-2.29	0.59	1.70	-0.59	0.87
2440	-13.64	1.22	9.86	-2.56	0.55	1.70	-0.86	0.82
2480	-13.99	1.23	9.85	-2.91	0.51	1.70	-1.21	0.76

Sample Calculation:

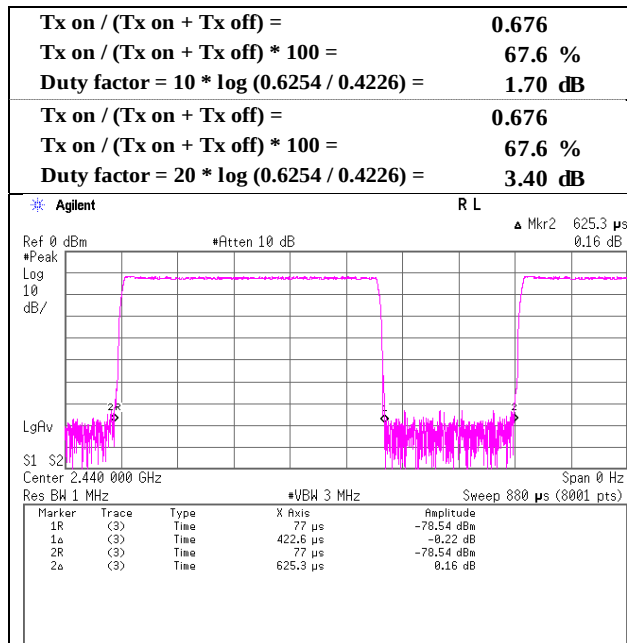
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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.	12327512S-C-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	May 31, 2018
Temperature / Humidity	25 deg. C / 47 % RH
Engineer	Makoto Hosaka
Mode	Tx



* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Radiated Spurious Emission

Report No.	12327512S-C-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	May 21, 2016	May 20, 2016	May 21, 2016
Temperature / Humidity	25 deg. C / 31 % RH	22 deg. C / 45 % RH	23 deg. C / 35 % RH
Engineer	Kazuya Noda	Yasumasa Owaki	Kazutaka Takeyama
	(30 MHz - 1 GHz)	(1 GHz - 2.8 GHz)	(2.8 GHz - 26.5 GHz)
Mode	Tx BT LE, 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.	155.999	QP	28.04	14.82	8.89	31.78	0.00	19.97	43.50	23.5	196	61	
Hori.	160.000	QP	30.17	14.94	8.92	31.78	0.00	22.25	43.50	21.2	186	244	
Hori.	595.194	QP	21.27	19.08	8.30	32.01	0.00	16.64	46.00	29.3	100	359	
Hori.	655.059	QP	21.25	19.51	8.58	32.06	0.00	17.28	46.00	28.7	100	0	
Hori.	901.429	QP	21.15	22.00	9.67	31.35	0.00	21.47	46.00	24.5	100	359	
Hori.	2390.000	PK	44.26	27.14	14.49	36.58	2.33	51.64	73.90	22.2	167	54	
Hori.	2557.984	PK	45.55	27.63	14.65	36.52	2.33	53.64	73.90	20.2	146	168	
Hori.	4804.000	PK	44.79	31.13	7.16	36.88	2.33	48.53	73.90	25.3	164	337	
Hori.	7206.000	PK	44.67	36.35	8.80	37.26	2.33	54.89	73.90	19.0	150	0	
Hori.	19219.990	PK	51.84	40.04	11.73	48.16	-9.54	45.91	73.90	27.9	157	234	
Vert.	194.781	QP	21.57	16.59	9.02	31.77	0.00	15.41	43.50	28.0	100	0	
Vert.	515.250	QP	21.58	17.89	7.98	31.94	0.00	15.51	46.00	30.4	100	359	
Vert.	616.006	QP	25.68	19.25	8.39	32.02	0.00	21.30	46.00	24.7	100	129	
Vert.	2390.000	PK	44.85	27.14	14.49	36.58	2.33	52.23	73.90	21.6	141	42	
Vert.	2558.388	PK	43.73	27.63	14.65	36.52	2.33	51.82	73.90	22.0	150	359	
Vert.	4804.000	PK	45.96	31.13	7.16	36.88	2.33	49.70	73.90	24.2	125	187	
Vert.	7206.000	PK	44.52	36.35	8.80	37.26	2.33	54.74	73.90	19.1	150	0	
Vert.	19219.990	PK	50.57	40.04	11.73	48.16	-9.54	44.64	73.90	29.2	168	163	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.92 m / 3.0 m) = 2.33 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	34.55	27.14	14.49	36.58	3.40	2.33	45.33	53.90	8.6	*1)
Hori.	2557.984	AV	35.82	27.63	14.65	36.52	3.40	2.33	47.31	53.90	6.6	*2)
Hori.	4804.000	AV	35.24	31.13	7.16	36.88	3.40	2.33	42.38	53.90	11.5	
Hori.	7206.000	AV	35.59	36.35	8.80	37.26	3.40	2.33	49.21	53.90	4.7	
Hori.	19219.990	AV	46.50	40.04	11.73	48.16	3.40	-9.54	43.97	53.90	9.9	
Vert.	2390.000	AV	33.10	27.14	14.49	36.58	3.40	2.33	43.88	53.90	10.0	*1)
Vert.	2558.388	AV	34.70	27.63	14.65	36.52	3.40	2.33	46.19	53.90	7.7	*2)
Vert.	4804.000	AV	36.79	31.13	7.16	36.88	3.40	2.33	43.93	53.90	10.0	
Vert.	7206.000	AV	35.63	36.35	8.80	37.26	3.40	2.33	49.25	53.90	4.6	
Vert.	19219.990	AV	44.11	40.04	11.73	48.16	3.40	-9.54	41.58	53.90	12.3	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.92 m / 3.0 m) = 2.33 dB

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

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

*2) This noise was the same as the carrier's duty.

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	88.67	27.18	14.50	36.57	2.33	96.11	-	-	Carrier
Hori.	2400.000	PK	42.63	27.17	14.50	36.58	2.33	50.05	76.11	26.1	
Vert.	2402.000	PK	88.01	27.18	14.50	36.57	2.33	95.45	-	-	Carrier
Vert.	2400.000	PK	38.65	27.17	14.50	36.58	2.33	46.07	75.45	29.4	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.92 m / 3.0 m) = 2.33 dB

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

UL Japan, Inc.

Shonan EMC Lab.

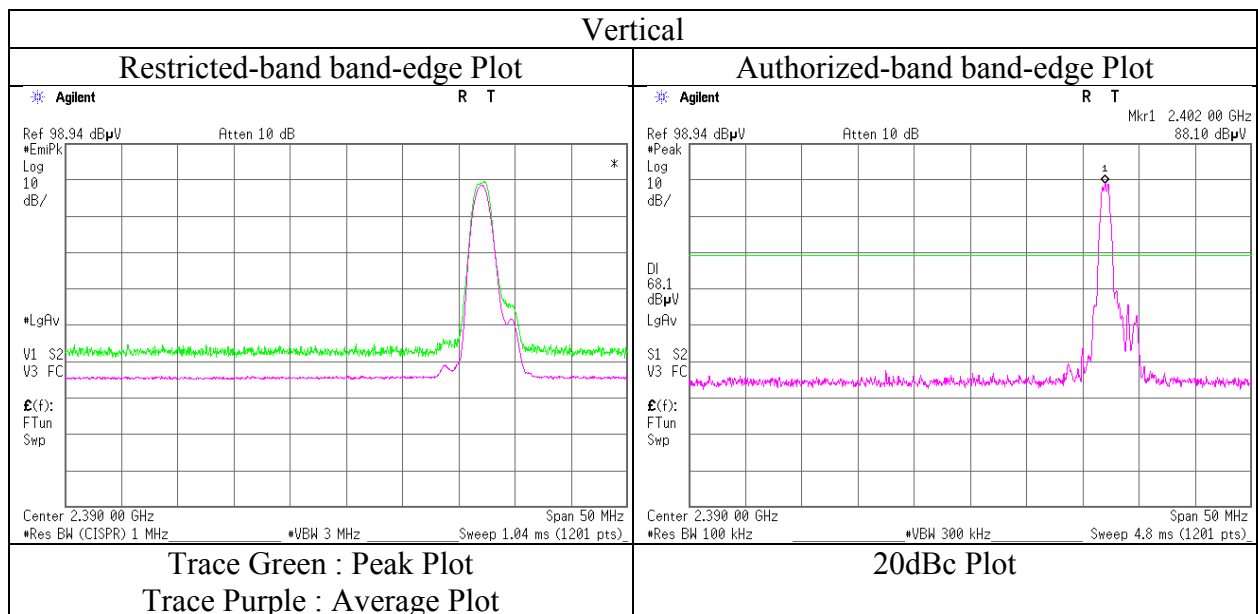
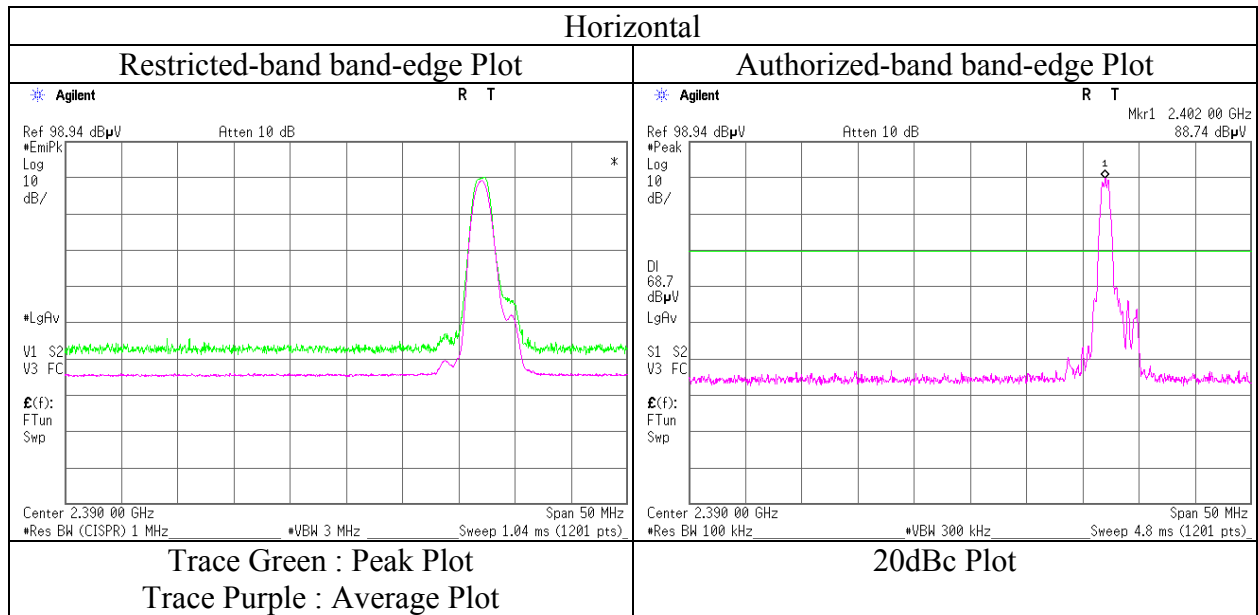
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12327512S-C-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	May 20, 2016
Temperature / Humidity	22 deg. C / 45 % RH
Engineer	Yasumasa Owaki
Mode	Tx BT LE, 2402 MHz



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

Radiated Spurious Emission

Report No.	12327512S-C-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	May 21, 2016	May 20, 2016	May 21, 2016
Temperature / Humidity	25 deg. C / 31 % RH	22 deg. C / 45 % RH	23 deg. C / 35 % RH
Engineer	Kazuya Noda	Yasumasa Owaki	Kazutaka Takeyama
	(30 MHz -1 GHz)	(1 GHz - 2.8 GHz)	(2.8 GHz - 26.5 GHz)
Mode	Tx BT LE, 2440 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.	156.001	QP	29.73	14.82	8.89	31.78	0.00	21.66	43.50	21.8	194	62	
Hori.	160.000	QP	30.64	14.94	8.92	31.78	0.00	22.72	43.50	20.7	189	235	
Hori.	336.003	QP	28.21	14.22	7.15	31.77	0.00	17.81	46.00	28.1	100	51	
Hori.	636.026	QP	21.57	19.38	8.49	32.05	0.00	17.39	46.00	28.6	100	359	
Hori.	880.432	QP	21.35	21.75	9.60	31.45	0.00	21.25	46.00	24.7	100	0	
Hori.	2598.003	PK	45.12	27.72	14.69	36.53	2.33	53.33	73.90	20.5	135	230	
Hori.	4880.000	PK	44.75	31.30	7.25	36.90	2.33	48.73	73.90	25.1	116	107	
Hori.	7320.000	PK	44.19	36.51	8.93	37.44	2.33	54.52	73.90	19.3	150	0	
Hori.	19516.230	PK	53.72	40.02	11.89	47.70	-9.54	48.39	73.90	25.5	168	231	
Vert.	174.498	QP	21.60	15.74	8.96	31.78	0.00	14.52	43.50	28.9	100	0	
Vert.	365.996	QP	21.44	14.86	7.32	31.79	0.00	11.83	46.00	34.1	100	359	
Vert.	600.011	QP	25.66	19.15	8.32	32.00	0.00	21.13	46.00	24.8	100	292	
Vert.	2598.000	PK	44.06	27.72	14.69	36.53	2.33	52.27	73.90	21.6	150	359	
Vert.	4880.000	PK	45.37	31.30	7.25	36.90	2.33	49.35	73.90	24.5	107	204	
Vert.	7320.000	PK	44.21	36.51	8.93	37.44	2.33	54.54	73.90	19.3	150	0	
Vert.	19516.010	PK	51.50	40.02	11.89	47.70	-9.54	46.17	73.90	27.7	157	199	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.92\text{ m} / 3.0\text{ m}) = 2.33\text{ dB}$

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2598.003	AV	36.18	27.72	14.69	36.53	3.40	2.33	47.79	53.90	6.1	*2)
Hori.	4880.000	AV	35.49	31.30	7.25	36.90	3.40	2.33	42.87	53.90	11.0	
Hori.	7320.000	AV	34.69	36.51	8.93	37.44	3.40	2.33	48.42	53.90	5.5	
Hori.	19516.230	AV	49.01	40.02	11.89	47.70	3.40	-9.54	47.08	53.90	6.8	
Vert.	2598.000	AV	32.96	27.72	14.69	36.53	3.40	2.33	44.57	53.90	9.3	*2)
Vert.	4880.000	AV	36.63	31.30	7.25	36.90	3.40	2.33	44.01	53.90	9.9	
Vert.	7320.000	AV	34.74	36.51	8.93	37.44	3.40	2.33	48.47	53.90	5.4	
Vert.	19516.010	AV	45.02	40.02	11.89	47.70	3.40	-9.54	43.09	53.90	10.8	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.92\text{ m} / 3.0\text{ m}) = 2.33\text{ dB}$

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

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

*2) This noise was the same as the carrier's duty.

Radiated Spurious Emission

Report No.	12327512S-C-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	May 21, 2016	May 20, 2016	May 21, 2016
Temperature / Humidity	25 deg. C / 31 % RH	22 deg. C / 45 % RH	23 deg. C / 35 % RH
Engineer	Kazuya Noda	Yasumasa Owaki	Kazutaka Takeyama
	(30 MHz -1 GHz)	(1 GHz - 2.8 GHz)	(2.8 GHz - 26.5 GHz)
Mode	Tx BT LE, 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.	156.000	QP	25.86	14.82	8.89	31.78	0.00	17.79	43.50	25.7	202	54	
Hori.	160.000	QP	32.87	14.94	8.92	31.78	0.00	24.95	43.50	18.5	196	240	
Hori.	336.004	QP	28.43	14.22	7.15	31.77	0.00	18.03	46.00	27.9	100	73	
Hori.	758.812	QP	21.74	20.34	9.04	31.93	0.00	19.19	46.00	26.8	100	0	
Hori.	930.788	QP	21.21	22.10	9.76	31.13	0.00	21.94	46.00	24.0	100	359	
Hori.	2483.500	PK	46.95	27.45	14.59	36.52	2.33	54.80	73.90	19.1	179	80	
Hori.	2635.968	PK	45.72	27.81	14.72	36.53	2.33	54.05	73.90	19.8	149	134	
Hori.	4960.000	PK	44.53	31.48	7.35	36.93	2.33	48.76	73.90	25.1	140	268	
Hori.	7440.000	PK	43.11	36.68	9.07	37.63	2.33	53.56	73.90	20.3	150	0	
Hori.	19836.000	PK	53.09	39.99	12.01	47.72	-9.54	47.83	73.90	26.0	170	99	
Vert.	176.540	QP	21.35	15.85	8.95	31.77	0.00	14.38	43.50	29.1	100	0	
Vert.	600.006	QP	24.95	19.15	8.32	32.00	0.00	20.42	46.00	25.5	100	294	
Vert.	818.229	QP	22.35	20.95	9.30	31.78	0.00	20.82	46.00	25.1	100	0	
Vert.	2483.500	PK	46.35	27.45	14.59	36.52	2.33	54.20	73.90	19.7	170	38	
Vert.	2635.988	PK	45.69	27.81	14.72	36.53	2.33	54.02	73.90	19.8	161	114	
Vert.	4960.000	PK	45.43	31.48	7.35	36.93	2.33	49.66	73.90	24.2	155	210	
Vert.	7440.000	PK	42.91	36.68	9.07	37.63	2.33	53.36	73.90	20.5	150	0	
Vert.	19836.000	PK	49.38	39.99	12.01	47.72	-9.54	44.12	73.90	29.7	156	123	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.92 m / 3.0 m) = 2.33 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	36.48	27.45	14.59	36.52	3.40	2.33	47.73	53.90	6.2	*1)
Hori.	2635.968	AV	36.64	27.81	14.72	36.53	3.40	2.33	48.37	53.90	5.5	*2)
Hori.	4960.000	AV	34.98	31.48	7.35	36.93	3.40	2.33	42.61	53.90	11.3	
Hori.	7440.000	AV	34.33	36.68	9.07	37.63	3.40	2.33	48.18	53.90	5.7	
Hori.	19836.000	AV	48.83	39.99	12.01	47.72	3.40	-9.54	46.97	53.90	6.9	
Vert.	2483.500	AV	35.78	27.45	14.59	36.52	3.40	2.33	47.03	53.90	6.9	*1)
Vert.	2635.988	AV	36.38	27.81	14.72	36.53	3.40	2.33	48.11	53.90	5.8	*2)
Vert.	4960.000	AV	35.74	31.48	7.35	36.93	3.40	2.33	43.37	53.90	10.5	
Vert.	7440.000	AV	34.23	36.68	9.07	37.63	3.40	2.33	48.08	53.90	5.8	
Vert.	19836.000	AV	43.29	39.99	12.01	47.72	3.40	-9.54	41.43	53.90	12.5	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.92 m / 3.0 m) = 2.33 dB

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

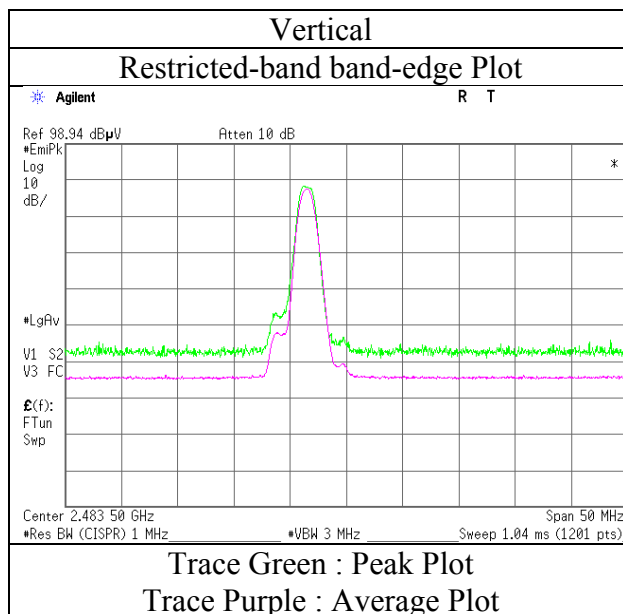
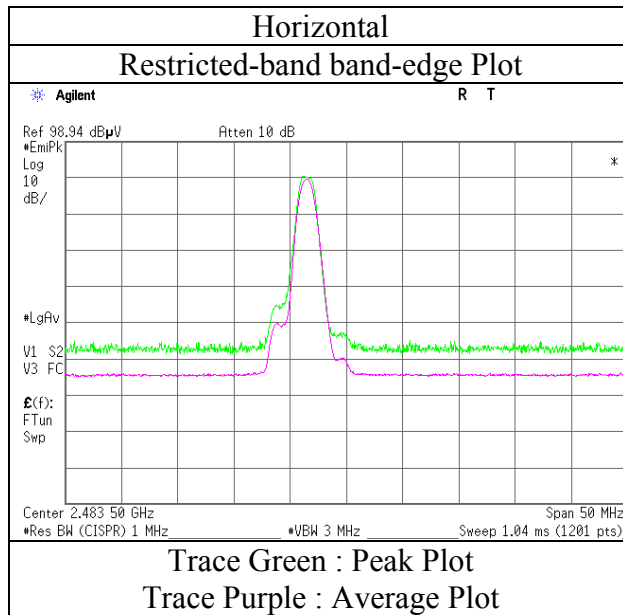
Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

*2) This noise was the same as the carrier's duty.

Radiated Spurious Emission
(Reference Plot for band-edge)

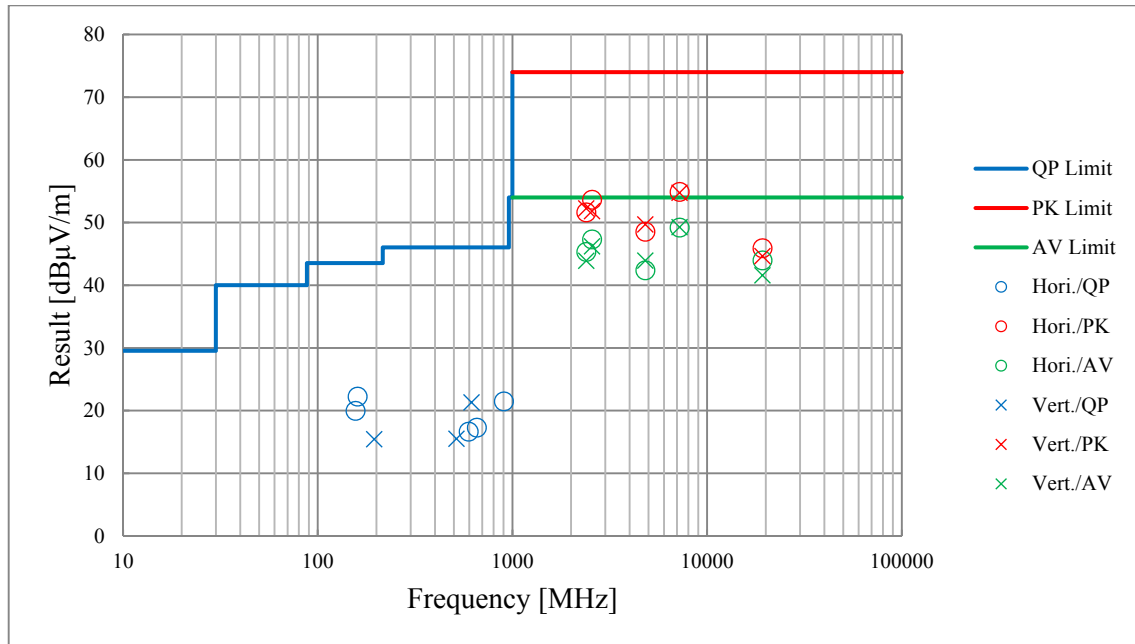
Report No. 12327512S-C-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date May 20, 2016
Temperature / Humidity 22 deg. C / 45 % RH
Engineer Yasumasa Owaki
Mode Tx BT LE, 2480 MHz



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

Radiated Spurious Emission (Plot data, Worst case)

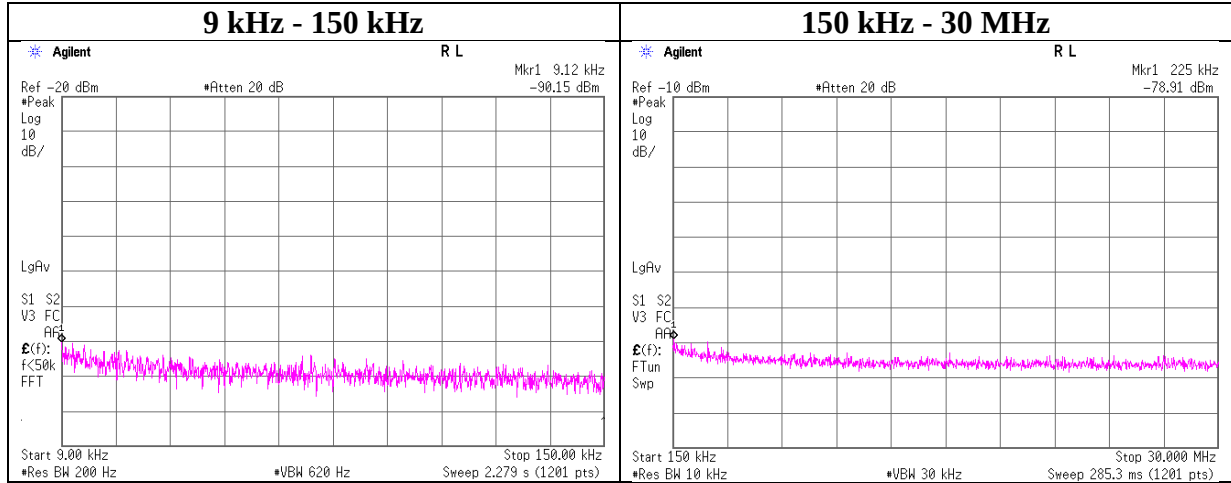
Report No.	12327512S-C-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	May 21, 2016	May 20, 2016	May 21, 2016
Temperature / Humidity	25 deg. C / 31 % RH	22 deg. C / 45 % RH	23 deg. C / 35 % RH
Engineer	Kazuya Noda (30 MHz - 1 GHz)	Yasumasa Owaki (1 GHz - 2.8 GHz)	Kazutaka Takeyama (2.8 GHz - 26.5 GHz)
Mode	Tx BT LE, 2402 MHz		



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

Conducted Spurious Emission

Report No. 12327512S-C-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date May 31, 2018
Temperature / Humidity 25 deg. C / 74 % RH
Engineer Makoto Hosaka
Mode Tx 2402 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.12	-90.15	0.01	9.83	2.85	1	-77.5	300	6.0	-16.2	48.4	64.6	
225.00	-78.91	0.01	9.83	2.85	1	-66.2	300	6.0	-5.0	20.5	25.5	

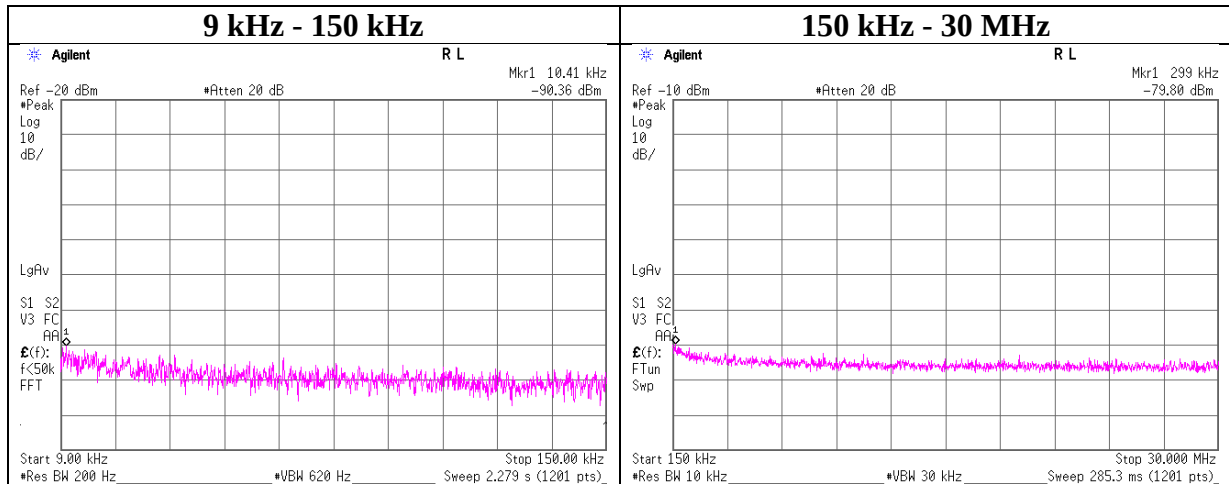
$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

Conducted Spurious Emission

Report No.	12327512S-C-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	May 31, 2018
Temperature / Humidity	25 deg. C / 74 % RH
Engineer	Makoto Hosaka
Mode	Tx 2440 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.41	-90.36	0.01	9.83	2.85	1	-77.7	300	6.0	-16.4	47.2	63.6	
299.00	-79.80	0.01	9.83	2.85	1	-67.1	300	6.0	-5.9	18.0	23.9	

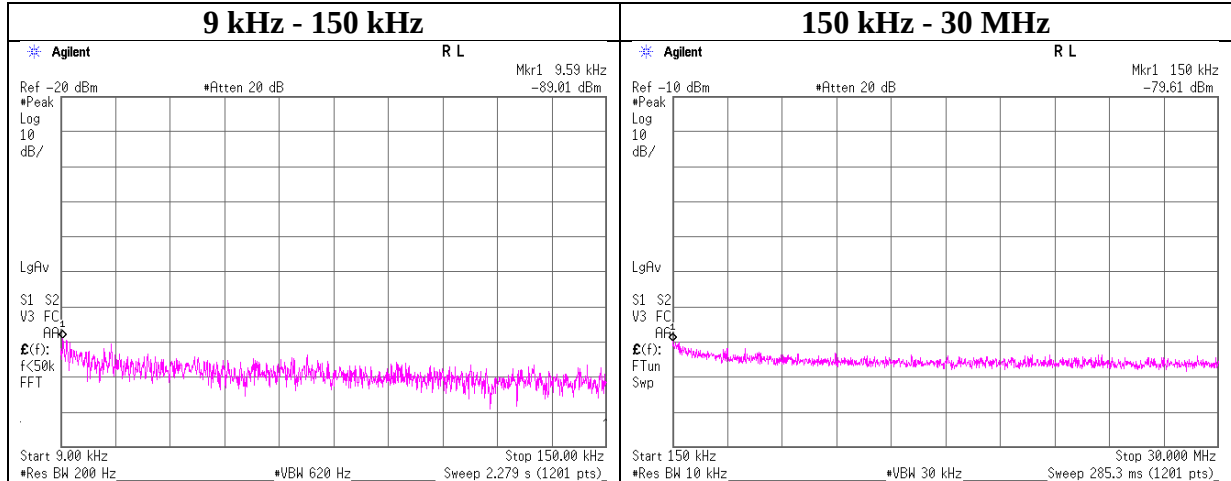
$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

Conducted Spurious Emission

Report No. 12327512S-C-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date May 31, 2018
Temperature / Humidity 25 deg. C / 74 % RH
Engineer Makoto Hosaka
Mode Tx 2480 MHz



Frequency	Reading	Cable Loss	Attenuator Loss	Antenna Gain	N (Number of Output)	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]		[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
9.59	-89.01	0.01	9.83	2.85	1	-76.3	300	6.0	-15.1	47.9	63.0	
150.00	-79.61	0.01	9.83	2.85	1	-66.9	300	6.0	-5.7	24.0	29.7	

$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

$EIRP[dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

Power Density

Report No. 12327512S-C-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date May 31, 2018
Temperature / Humidity 25 deg. C / 74 % RH
Engineer Makoto Hosaka
Mode Tx

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-26.77	1.22	9.86	-15.69	8.00	23.69
2437.00	-27.11	1.22	9.86	-16.03	8.00	24.03
2462.00	-27.42	1.23	9.85	-16.34	8.00	24.34

Sample Calculation:

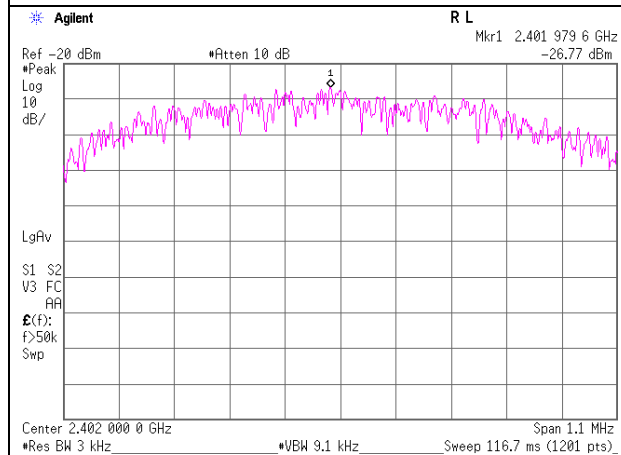
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

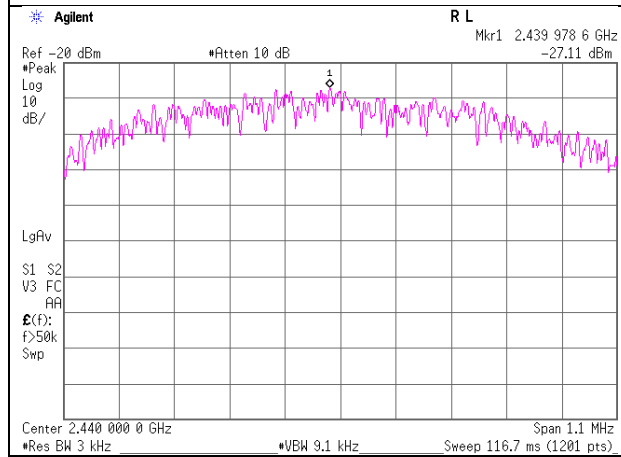
Power Density

BT LE

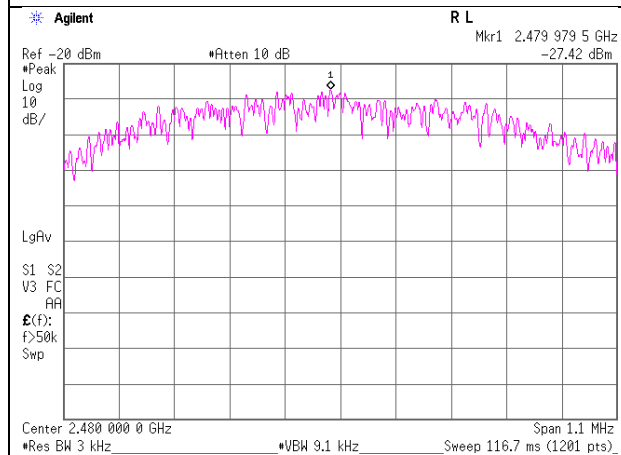
2402 MHz



2440 MHz



2480 MHz



APPENDIX 2: Test instruments

Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2018/02/15 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2018/03/27 * 12
SCC-G05	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	RE	2018/01/29 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2018/05/11 * 12
SCC-G40	Coaxial Cable	Junkosha	MWX221-01000 NFSNMS/B	1612S005	RE	2018/01/29 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000 KMSKMS	-	RE	2018/04/20 * 12
SCC-G45	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102 E	800137/2EA	RE	2018/03/28 * 12
SHA-01	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	RE	2017/08/14 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM9861	RE	2017/07/11 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2017/11/22 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2018/04/20 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2017/10/30 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2017/10/10 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2018/03/05 * 12
KJM-09	Measure	KOMELON	KMC-36	-	RE	-
SAEC-01(SVS WR)	Semi-Anechoic Chamber	TDK	SAEC-01(SVSW R)	1	RE	2017/07/20 * 12
COTS-SEMI-I	EMI Software	TSJ	TEPTO-DV(RE, CE,RFL,MF)	-	RE	-
STS-01	Digital Hitester	Hioki	3805-50	080997812	RE	2017/10/16 * 12
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2017/06/09 * 12
SAF-01	Pre Amplifier	SONOMA	310N	290211	RE	2018/02/16 * 12
KAT6-04	Attenuator	INMET	18N-6dB	-	RE	2017/12/14 * 12
SAT3-09	Attenuator	JFW	50HF-003N	-	RE	2017/08/24 * 12
SBA-01	Biconical Antenna	Schwarzbeck	BBA9106	91032664	RE	2017/10/21 * 12
SCC-A1/A3/A5/ A7/A8/A13/SRS E-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhn er/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/ 141PE/141PE/14 1PE/141PE/NS4 906	-/0901-269(RF Selector)	RE	2018/04/12 * 12
SCC-A2/A4/A6/ A7/A8/A13/SRSE -01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhn er/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/1 41PE/141PE/141 PE/141PE/NS490 6	-/0901-269(RF Selector)	RE	2018/04/12 * 12
SLA-05	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	193	RE	2017/12/10 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE	2017/09/26 * 12
SPM-13	Power Meter	KEYSIGHT	8990B	MY51000448	AT	2018/05/18 * 12
SPSS-06	Power sensor	KEYSIGHT	N1923A	MY57270004	AT	2018/05/18 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2017/08/20 * 12
SAT10-12	Attenuator	Weinschel Corp.	54A-10	81601	AT	2018/03/22 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2018/03/19 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	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: RE: Radiated Emission test
AT: Antenna Terminal Conducted test

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