



RADIO TEST REPORT

Test Report No. : 11485102S-B

Applicant : Sony Corporation
Type of Equipment : Wireless Noise Canceling Stereo Headset
Model No. : MDR-XB950N1
FCC ID : AK8XB950N1
Test regulation : FCC Part 15 Subpart C: 2016
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: October 25 to 27, 2016

Representative test engineer:

Yosuke Ishikawa
Engineer
Consumer Technology Division

Approved by:

Toyokazu Imamura
Leader
Consumer Technology Division



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

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SECTION 1: Customer information

Company Name : Sony Corporation
Address : 1-7-1 Konan Minato-ku, Tokyo, 108-0075 Japan
Telephone Number : +604-3835333
Contact Person : Wan Nurfazwina binti Mat Soti

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. : MDR-XB950N1
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 3.65 V: Built-in lithium-ion rechargeable battery
DC 5 V: When charged using USB
Receipt Date of Sample : October 7, 2016
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: MDR-XB950N1 (referred to as the EUT in this report) is a Wireless Noise Canceling Stereo Headset.

The clock frequencies used in the EUT: 26 MHz

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : FHSS, GFSK
Power Supply (radio part input) : DC 1.35 V
Antenna type : Chip
Antenna Gain : 2.03 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC part 15 final revised on April 6, 2016
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

The EUT has been tested for compliance with FCC Part 15 Subpart B. Refer to the test report: 11485102S-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 *1)
6 dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	4.9 dB 9760.000 MHz, AV, Vertical Tx 2440 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 PC; 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 v03r05 12.2.7.

* 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.

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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

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
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.1 dB	2.1 dB	2.6 dB	2.2 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	2.7 dB	2.7 dB	3.1 dB	-
	30 MHz-300 MHz	4.4 dB	4.4 dB	4.6 dB	-
	300 MHz-1 GHz	5.6 dB	5.5 dB	5.3 dB	-
	1 GHz-13 GHz	5.2 dB	5.2 dB	5.2 dB	-
Radiated emission (Measurement distance: 1 m)	13 GHz-18 GHz	4.9 dB	4.9 dB	4.9 dB	-
	18 GHz-40 GHz	4.9 dB	4.9 dB	4.9 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	0.76 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.79 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.08 dB
Spurious emission (Conducted) below 1GHz	1.5 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.4 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.5 dB
Bandwidth Measurement	0.66 %
Duty cycle and Time Measurement	0.012 %

Radiated emission test

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

3.5 Test Location

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JAB Accreditation No. RTL02610

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	Tested frequency	Remarks*
Bluetooth Low Energy	2402 MHz, 2440 MHz, 2480 MHz	PRBS9
*Power of the EUT was set by the software as follows; Power settings: Fixed Software: CSR BlueSuite BuleTest 3 Version 2.5.0.93		

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless Noise Canceling Stereo Headset	MDR-XB950N1	1200027	Sony	EUT

List of cables used

No.	Name	Length (m)	Cable Shield	Connector Shield	Remarks
1	Audio	1.2	Unshielded	Unshielded	-
2	USB	0.5	Shielded	Shielded	-

SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r05".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 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 300 MHz	300 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *3)	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: 300kHz
Test Distance	3 m	3.86 m*1) (1 GHz – 13 GHz), 1 m*2) (13 GHz – 26.5 GHz),		3.86 m*1) (1 GHz – 13 GHz), 1 m*2) (13 GHz – 26.5 GHz)

*1) Distance Factor: $20 \times \log(3.86 \text{ m}/3.0 \text{ m}) = 2.19 \text{ dB}$

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

*3) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r05"

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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	Carrier (Band edge)	Spurious			
		Below 1 GHz	Above 1 GHz		
			1 GHz -2.8 GHz	2.8 GHz -13 GHz	13 GHz -26.5 GHz
Horizontal	Y	Y	Y	Y	X
Vertical	X	Z	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 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6 dB 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	Sample	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 6 dB 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 v03r05".

*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

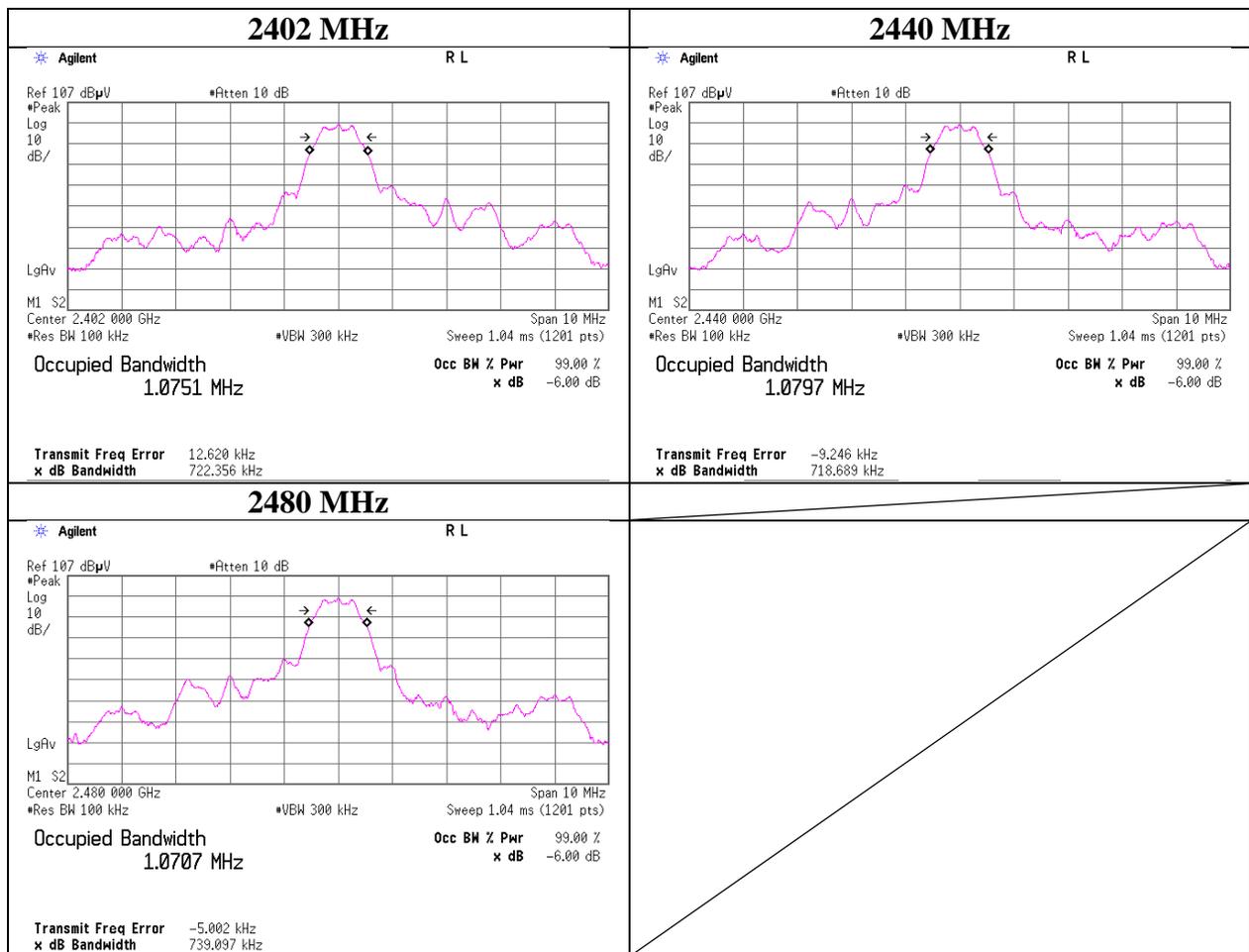
Test result : Pass

APPENDIX 1: Test data

6 dB Bandwidth

Test place : Shonan EMC Lab. No.3 Shielded Room
Report No. : 11485102S-B
Date : October 26, 2016
Temperature / Humidity : 25 deg. C / 47 % RH
Engineer : Kenichi Adachi
Mode : Tx BT LE

Mode	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [kHz]
BT LE	2402	0.722	> 500
	2440	0.719	> 500
	2480	0.739	> 500



Maximum Peak Output Power

Test place : Shonan EMC Lab. No.3 Shielded Room
Report No. : 11485102S-B
Date : October 26, 2016
Temperature / Humidity : 25 deg. C / 47 % RH
Engineer : Kenichi Adachi
Mode : Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-10.29	0.93	9.67	0.31	1.07	30.00	1000	29.69
2440	-10.26	0.94	9.67	0.35	1.08	30.00	1000	29.65
2480	-10.34	0.94	9.67	0.27	1.06	30.00	1000	29.73

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.

Average Output Power (Reference data for RF Exposure / SAR testing)

Test place : Shonan EMC Lab. No.3 Shielded Room
Report No. : 11485102S-B
Date : October 26, 2016
Temperature / Humidity : 25 deg. C / 47 % RH
Engineer : Kenichi Adachi
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	-13.04	0.93	9.67	-2.44	0.57	1.86	-0.58	0.87
2440	-12.96	0.94	9.67	-2.35	0.58	1.86	-0.49	0.89
2480	-13.02	0.94	9.67	-2.41	0.57	1.86	-0.55	0.88

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.

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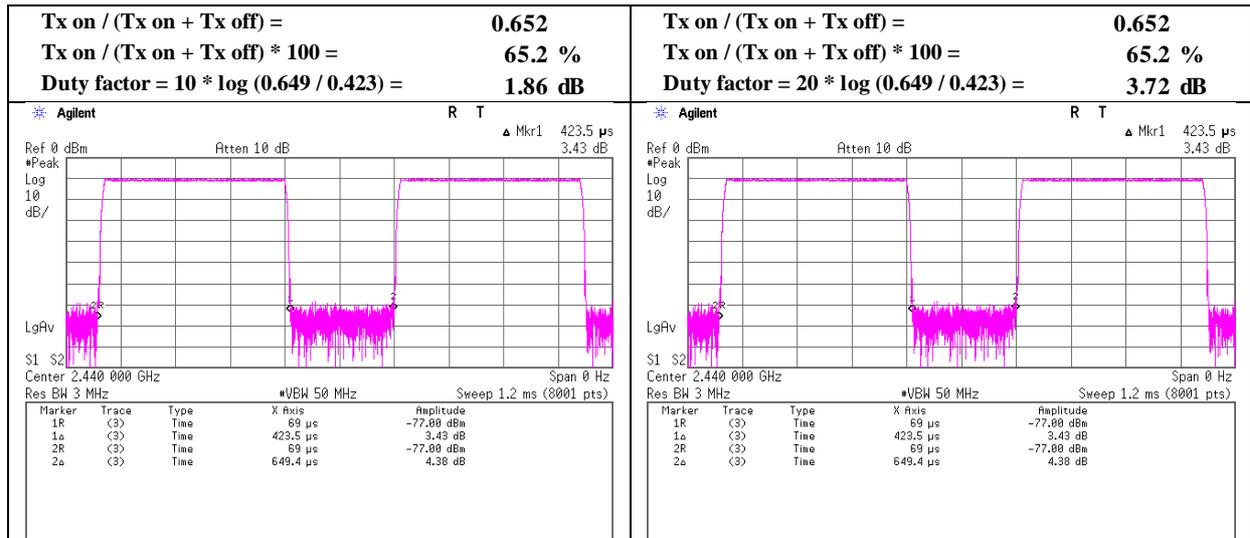
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Burst rate confirmation

Test place	Shonan EMC Lab. No.3 Shielded Room
Report No.	11485102S-B
Date	October 26, 2016
Temperature / Humidity	25 deg. C / 47 % RH
Engineer	Kenichi Adachi
Mode	Tx BT LE



Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11485102S-B
Date : October 25, 2016 October 26, 2016 October 27, 2016
Temperature / Humidity : 22 deg. C / 40 % RH 24 deg. C / 56 % RH 25 deg. C / 49 % RH
Engineer : Yosuke Ishikawa Yosuke Ishikawa Yosuke Ishikawa
 (1 GHz -13 GHz) (13 GHz -26.5 GHz) (30 MHz -1000 MHz)
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.	112.007	QP	28.10	11.91	7.91	31.84	0.00	16.08	43.50	27.4	161	212	
Hori.	316.005	QP	31.50	13.98	6.67	31.66	0.00	20.49	46.00	25.5	100	302	
Hori.	604.006	QP	31.60	18.99	8.38	31.60	0.00	27.37	46.00	18.6	144	284	
Hori.	612.015	QP	29.80	19.10	8.42	31.60	0.00	25.72	46.00	20.2	136	317	
Hori.	2390.000	PK	42.23	27.17	13.70	37.06	2.19	48.23	73.90	25.6	141	209	
Hori.	4804.000	PK	44.93	31.13	5.98	37.12	2.19	47.11	73.90	26.7	125	213	
Hori.	7206.000	PK	44.02	36.43	7.40	37.84	2.19	52.20	73.90	21.7	150	0	
Hori.	9608.000	PK	43.57	38.28	7.93	39.13	2.19	52.84	73.90	21.0	150	0	
Vert.	108.008	QP	34.70	11.31	7.92	31.84	0.00	22.09	43.50	21.4	100	113	
Vert.	112.004	QP	36.20	11.91	7.91	31.84	0.00	24.18	43.50	19.3	100	112	
Vert.	135.961	QP	22.70	14.09	8.28	31.82	0.00	13.25	43.50	30.2	100	221	
Vert.	316.005	QP	32.60	13.98	6.67	31.66	0.00	21.59	46.00	24.4	100	33	
Vert.	588.010	QP	30.80	18.77	8.30	31.61	0.00	26.26	46.00	19.7	100	156	
Vert.	596.013	QP	32.20	18.88	8.34	31.60	0.00	27.82	46.00	18.1	100	144	
Vert.	2390.000	PK	42.40	27.17	13.70	37.06	2.19	48.40	73.90	25.5	187	231	
Vert.	4804.000	PK	47.36	31.13	5.98	37.12	2.19	49.54	73.90	24.3	140	129	
Vert.	7206.000	PK	43.52	36.43	7.40	37.84	2.19	51.70	73.90	22.2	150	0	
Vert.	9608.000	PK	44.32	38.28	7.93	39.13	2.19	53.59	73.90	20.3	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.86 m / 3.0 m) = 2.19 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	32.84	27.17	13.70	37.06	3.72	2.19	42.56	53.90	11.3	*1)
Hori.	4804.000	AV	37.13	31.13	5.98	37.12	3.72	2.19	43.03	53.90	10.9	
Hori.	7206.000	AV	34.94	36.43	7.40	37.84	3.72	2.19	46.84	53.90	7.1	
Hori.	9608.000	AV	35.31	38.28	7.93	39.13	3.72	2.19	48.30	53.90	5.6	
Vert.	2390.000	AV	33.42	27.17	13.70	37.06	3.72	2.19	43.14	53.90	10.8	*1)
Vert.	4804.000	AV	40.40	31.13	5.98	37.12	3.72	2.19	46.30	53.90	7.6	
Vert.	7206.000	AV	35.18	36.43	7.40	37.84	3.72	2.19	47.08	53.90	6.8	
Vert.	9608.000	AV	35.51	38.28	7.93	39.13	3.72	2.19	48.50	53.90	5.4	

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(3.86 m / 3.0 m) = 2.19 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)

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	87.13	27.21	13.71	37.05	2.19	93.19	-	-	Carrier
Hori.	2398.701	PK	41.89	27.20	13.71	37.05	2.19	47.94	73.19	25.3	
Hori.	2400.000	PK	43.69	27.20	13.71	37.05	2.19	49.74	73.19	23.5	
Vert.	2402.000	PK	85.11	27.21	13.71	37.05	2.19	91.17	-	-	Carrier
Vert.	2398.659	PK	39.88	27.20	13.71	37.05	2.19	45.93	71.17	25.2	
Vert.	2400.000	PK	42.33	27.20	13.71	37.05	2.19	48.38	71.17	22.8	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

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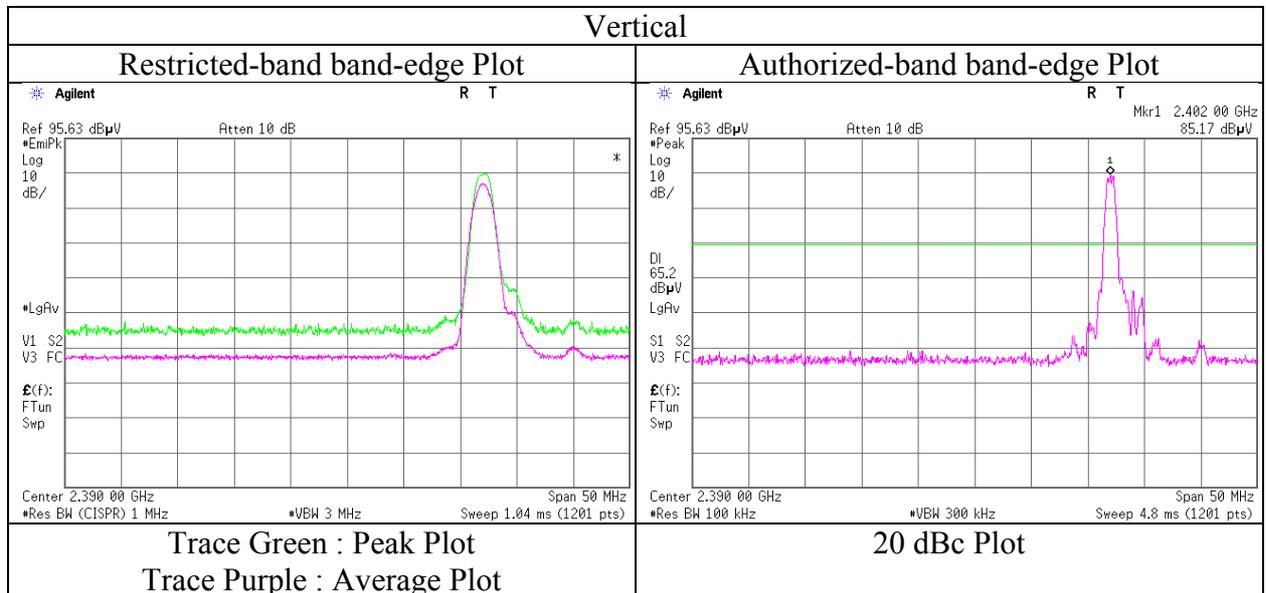
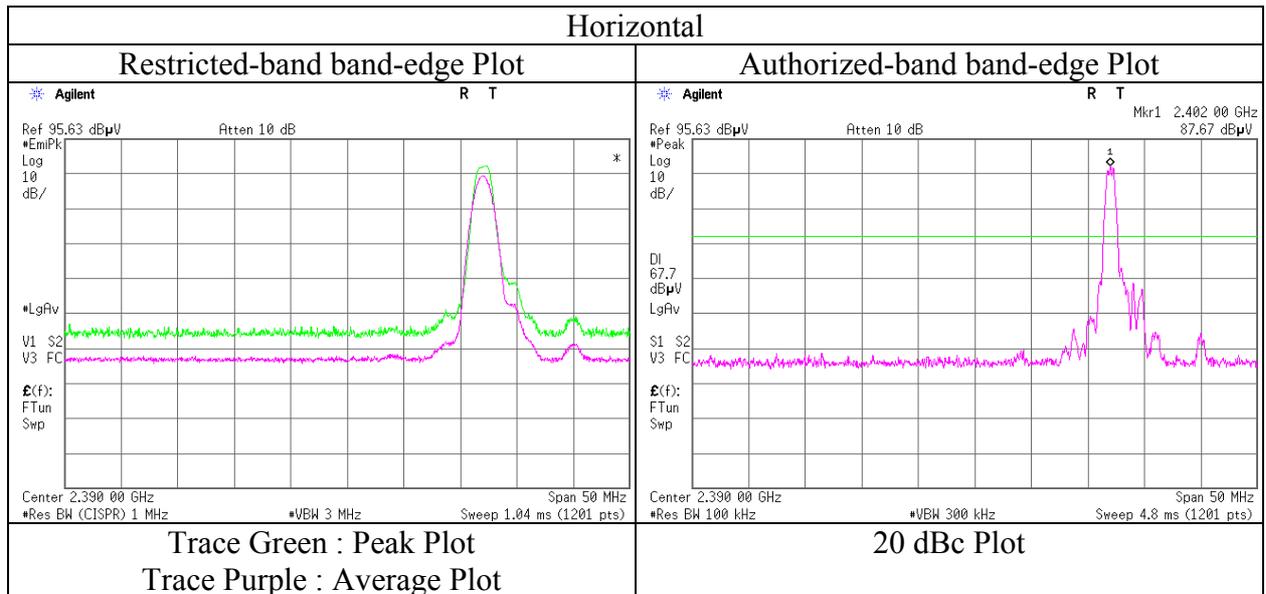
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11485102S-B
Date	October 25, 2016
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Yosuke Ishikawa (1 GHz -13 GHz)
Mode	Tx BT LE 2402 MHz



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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11485102S-B
Date : October 25, 2016 October 26, 2016 October 27, 2016
Temperature / Humidity : 22 deg. C / 40 % RH 24 deg. C / 56 % RH 25 deg. C / 49 % RH
Engineer : Yosuke Ishikawa Yosuke Ishikawa Yosuke Ishikawa
 (1 GHz -13 GHz) (13 GHz -26.5 GHz) (30 MHz -1000 MHz)
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.	136.005	QP	29.70	14.10	8.28	31.82	0.00	20.26	43.50	23.2	237	176	
Hori.	316.006	QP	32.40	13.98	6.67	31.66	0.00	21.39	46.00	24.6	100	293	
Hori.	596.010	QP	31.20	18.88	8.34	31.60	0.00	26.82	46.00	19.1	155	303	
Hori.	624.013	QP	28.80	19.26	8.48	31.60	0.00	24.94	46.00	21.0	154	113	
Hori.	4880.000	PK	45.36	31.29	6.04	37.15	2.19	47.73	73.90	26.1	133	222	
Hori.	7320.000	PK	44.33	36.63	7.54	37.91	2.19	52.78	73.90	21.1	150	0	
Hori.	9760.000	PK	43.53	38.52	8.12	39.19	2.19	53.17	73.90	20.7	150	0	
Vert.	108.006	QP	34.30	11.31	7.92	31.84	0.00	21.69	43.50	21.8	100	111	
Vert.	112.004	QP	33.90	11.91	7.91	31.84	0.00	21.88	43.50	21.6	100	107	
Vert.	116.005	QP	30.30	12.52	7.92	31.84	0.00	18.90	43.50	24.6	100	85	
Vert.	136.003	QP	29.50	14.10	8.28	31.82	0.00	20.06	43.50	23.4	100	238	
Vert.	316.007	QP	33.00	13.98	6.67	31.66	0.00	21.99	46.00	24.0	100	58	
Vert.	588.008	QP	30.40	18.77	8.30	31.61	0.00	25.86	46.00	20.1	100	156	
Vert.	604.009	QP	31.40	18.99	8.38	31.60	0.00	27.17	46.00	18.8	100	144	
Vert.	4880.000	PK	46.02	31.29	6.04	37.15	2.19	48.39	73.90	25.5	144	144	
Vert.	7320.000	PK	44.33	36.63	7.54	37.91	2.19	52.78	73.90	21.1	150	0	
Vert.	9760.000	PK	44.35	38.52	8.12	39.19	2.19	53.99	73.90	19.9	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.86 m / 3.0 m) = 2.19 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.	4880.000	AV	36.92	31.29	6.04	37.15	3.72	2.19	43.01	53.90	10.9	
Hori.	7320.000	AV	34.51	36.63	7.54	37.91	3.72	2.19	46.68	53.90	7.2	
Hori.	9760.000	AV	35.26	38.52	8.12	39.19	3.72	2.19	48.62	53.90	5.3	
Vert.	4880.000	AV	38.27	31.29	6.04	37.15	3.72	2.19	44.36	53.90	9.5	
Vert.	7320.000	AV	34.94	36.63	7.54	37.91	3.72	2.19	47.11	53.90	6.8	
Vert.	9760.000	AV	35.61	38.52	8.12	39.19	3.72	2.19	48.97	53.90	4.9	

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(3.86 m / 3.0 m) = 2.19 dB

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

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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11485102S-B
Date : October 25, 2016 October 26, 2016 October 27, 2016
Temperature / Humidity : 22 deg. C / 40 % RH 24 deg. C / 56 % RH 25 deg. C / 49 % RH
Engineer : Yosuke Ishikawa Yosuke Ishikawa Yosuke Ishikawa
(1 GHz -13 GHz) (13 GHz -26.5 GHz) (30 MHz -1000 MHz)
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.	136.012	QP	29.00	14.10	8.28	31.82	0.00	19.56	43.50	23.9	238	200	
Hori.	316.007	QP	32.30	13.98	6.67	31.66	0.00	21.29	46.00	24.7	100	298	
Hori.	336.004	QP	30.80	14.53	6.82	31.65	0.00	20.50	46.00	25.5	100	119	
Hori.	596.010	QP	31.40	18.88	8.34	31.60	0.00	27.02	46.00	18.9	156	302	
Hori.	612.005	QP	29.60	19.10	8.42	31.60	0.00	25.52	46.00	20.4	151	313	
Hori.	2483.500	PK	46.51	27.49	13.79	37.01	2.19	52.97	73.90	20.9	217	239	
Hori.	2484.052	PK	46.20	27.49	13.79	37.01	2.19	52.66	73.90	21.2	217	239	
Hori.	4960.000	PK	44.72	31.46	6.10	37.19	2.19	47.28	73.90	26.6	159	196	
Hori.	7440.000	PK	43.63	36.84	7.69	37.99	2.19	52.36	73.90	21.5	150	0	
Hori.	9920.000	PK	44.71	38.76	8.32	39.26	2.19	54.72	73.90	19.1	150	0	
Vert.	108.008	QP	34.70	11.31	7.92	31.84	0.00	22.09	43.50	21.4	100	109	
Vert.	112.006	QP	34.10	11.91	7.91	31.84	0.00	22.08	43.50	21.4	100	104	
Vert.	136.002	QP	29.20	14.10	8.28	31.82	0.00	19.76	43.50	23.7	100	33	
Vert.	170.054	QP	21.70	15.47	8.73	31.79	0.00	14.11	43.50	29.3	100	138	
Vert.	316.004	QP	33.80	13.98	6.67	31.66	0.00	22.79	46.00	23.2	100	41	
Vert.	596.008	QP	31.50	18.88	8.34	31.60	0.00	27.12	46.00	18.8	100	149	
Vert.	616.010	QP	29.90	19.16	8.44	31.60	0.00	25.90	46.00	20.1	100	155	
Vert.	2483.500	PK	46.96	27.49	13.79	37.01	2.19	53.42	73.90	20.4	111	225	
Vert.	2484.004	PK	47.09	27.49	13.79	37.01	2.19	53.55	73.90	20.3	111	225	
Vert.	4960.000	PK	44.72	31.46	6.10	37.19	2.19	47.28	73.90	26.6	146	142	
Vert.	7440.000	PK	42.67	36.84	7.69	37.99	2.19	51.40	73.90	22.5	150	0	
Vert.	9920.000	PK	44.62	38.76	8.32	39.26	2.19	54.63	73.90	19.2	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log(3.86 m / 3.0 m) = 2.19 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	38.12	27.49	13.79	37.01	3.72	2.19	48.30	53.90	5.6	*1)
Hori.	2484.052	AV	38.07	27.49	13.79	37.01	3.72	2.19	48.25	53.90	5.7	
Hori.	4960.000	AV	36.02	31.46	6.10	37.19	3.72	2.19	42.30	53.90	11.6	
Hori.	7440.000	AV	34.41	36.84	7.69	37.99	3.72	2.19	46.86	53.90	7.0	
Hori.	9920.000	AV	34.67	38.76	8.32	39.26	3.72	2.19	48.40	53.90	5.5	
Vert.	2483.500	AV	38.36	27.49	13.79	37.01	3.72	2.19	48.54	53.90	5.4	*1)
Vert.	2484.004	AV	38.11	27.49	13.79	37.01	3.72	2.19	48.29	53.90	5.6	
Vert.	4960.000	AV	37.72	31.46	6.10	37.19	3.72	2.19	44.00	53.90	9.9	
Vert.	7440.000	AV	34.65	36.84	7.69	37.99	3.72	2.19	47.10	53.90	6.8	
Vert.	9920.000	AV	34.91	38.76	8.32	39.26	3.72	2.19	48.64	53.90	5.3	

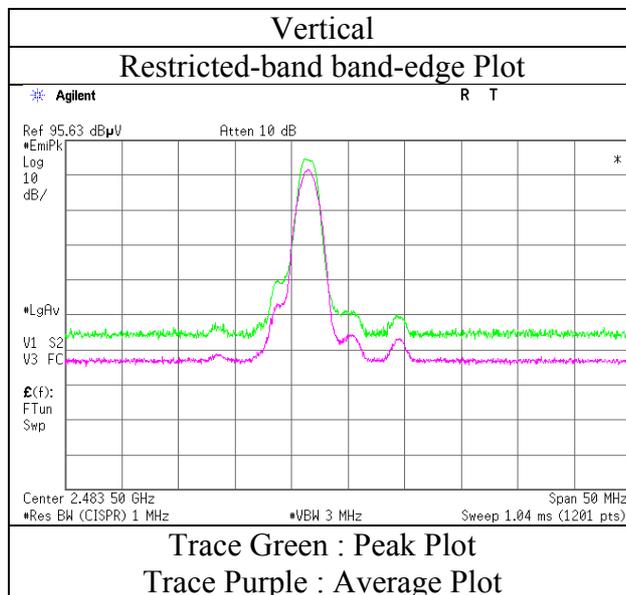
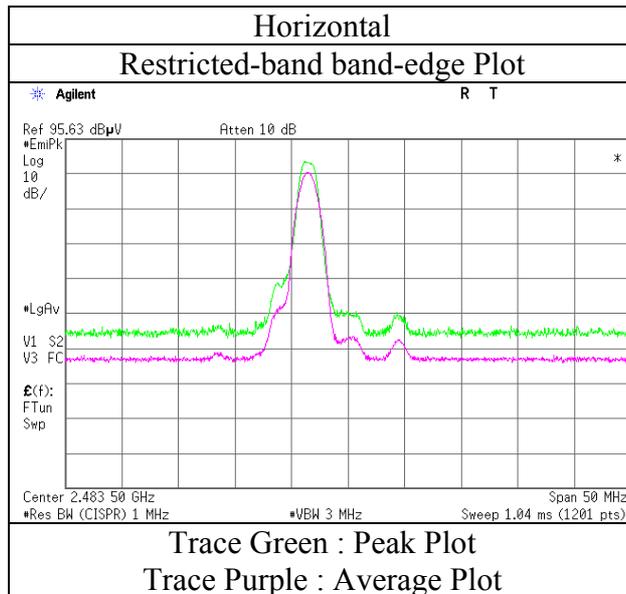
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB
13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

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

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

Radiated Spurious Emission
(Reference Plot for band-edge)

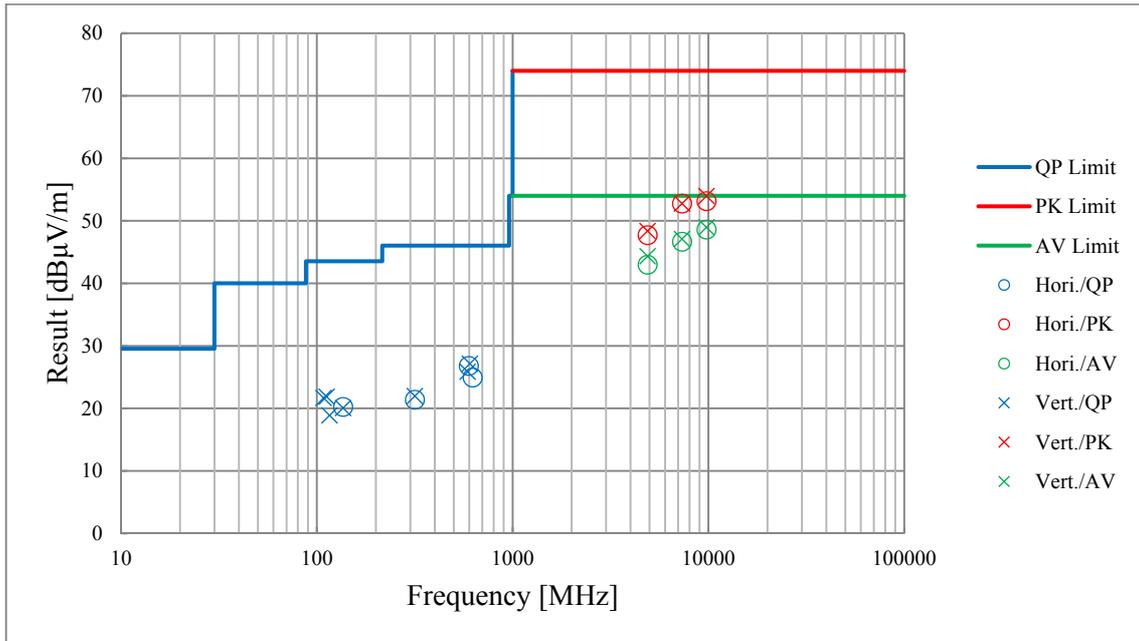
Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11485102S-B
Date	October 25, 2016
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Yosuke Ishikawa (1 GHz -13 GHz)
Mode	Tx BT LE 2480 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

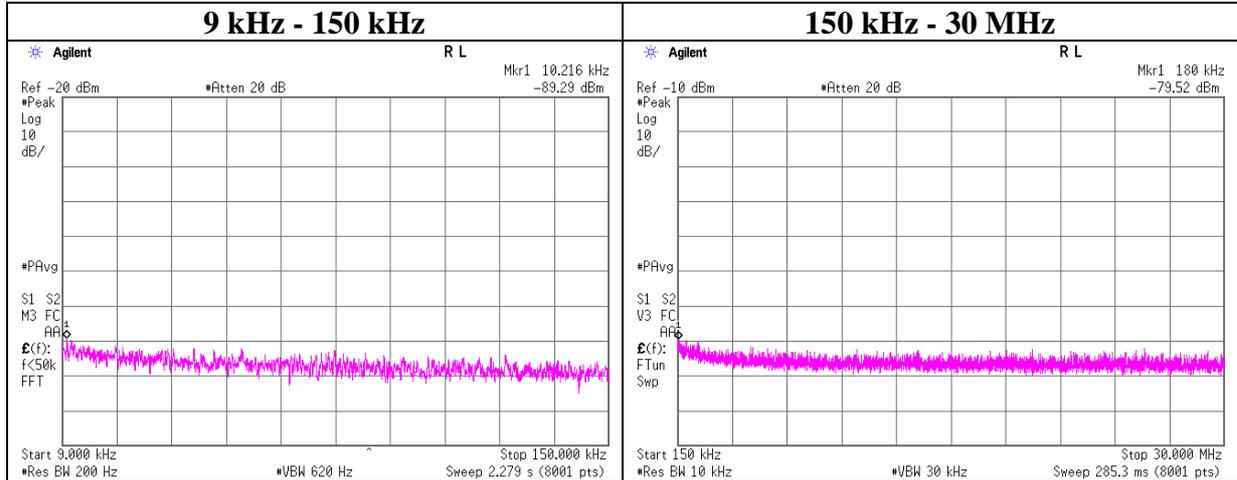
Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber		
Report No.	11485102S-B		
Date	October 25, 2016	October 26, 2016	October 27, 2016
Temperature / Humidity	22 deg. C / 40 % RH	24 deg. C / 56 % RH	25 deg. C / 49 % RH
Engineer	Yosuke Ishikawa (1 GHz -13 GHz)	Yosuke Ishikawa (13 GHz -26.5 GHz)	Yosuke Ishikawa (30 MHz -1000 MHz)
Mode	Tx BT LE 2440 MHz		



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

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.3 Shielded Room
 Report No. : 11485102S-B
 Date : October 26, 2016
 Temperature / Humidity : 25 deg. C / 47 % RH
 Engineer : Kenichi Adachi
 Mode : Tx BT LE, 2402 MHz



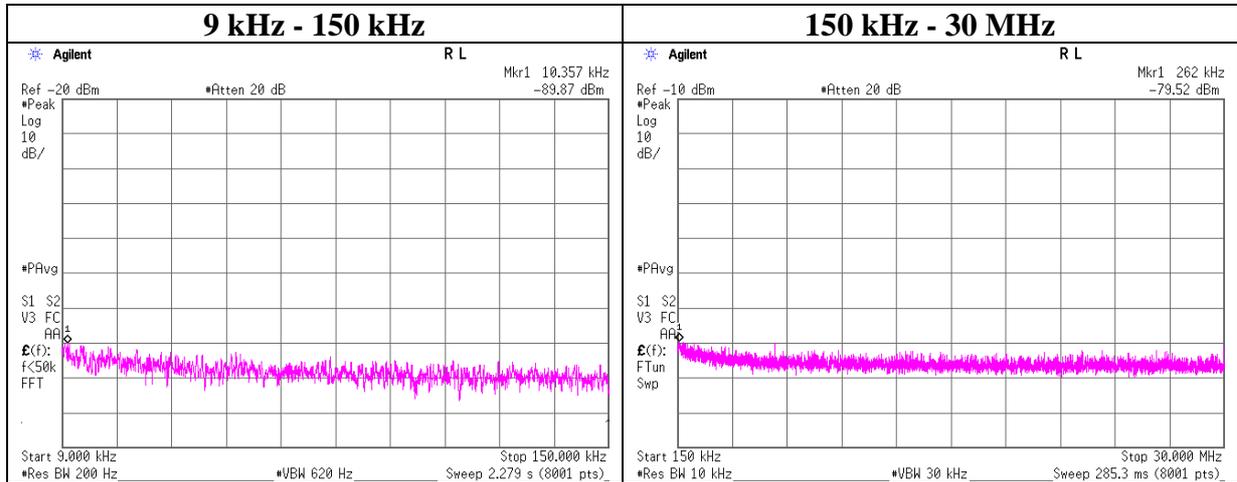
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.22	-89.3	0.01	9.7	2.0	1	-77.6	300	6.0	-16.3	47.4	63.7	
180.00	-79.5	0.01	9.7	2.0	1	-67.8	300	6.0	-6.6	22.4	29.0	

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

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.3 Shielded Room
 Report No. : 11485102S-B
 Date : October 26, 2016
 Temperature / Humidity : 25 deg. C / 47 % RH
 Engineer : Kenichi Adachi
 Mode : Tx BT LE, 2440 MHz



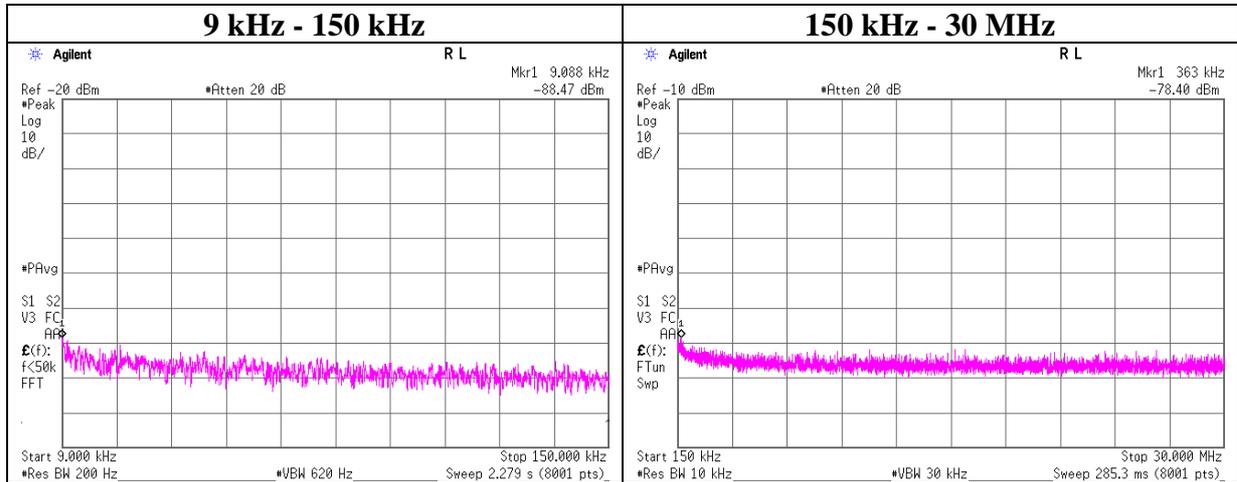
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.36	-89.9	0.01	9.7	2.0	1	-78.2	300	6.0	-16.9	47.2	64.1	
262.00	-79.5	0.01	9.7	2.0	1	-67.8	300	6.0	-6.6	19.2	25.8	

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

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.3 Shielded Room
 Report No. : 11485102S-B
 Date : October 26, 2016
 Temperature / Humidity : 25 deg. C / 47 % RH
 Engineer : Kenichi Adachi
 Mode : Tx BT LE, 2480 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
9.09	-88.5	0.01	9.7	2.0	1	-76.8	300	6.0	-15.5	48.4	63.9	
363.00	-78.4	0.01	9.7	2.0	1	-66.7	300	6.0	-5.4	16.4	21.8	

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

$$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$$

Power Density

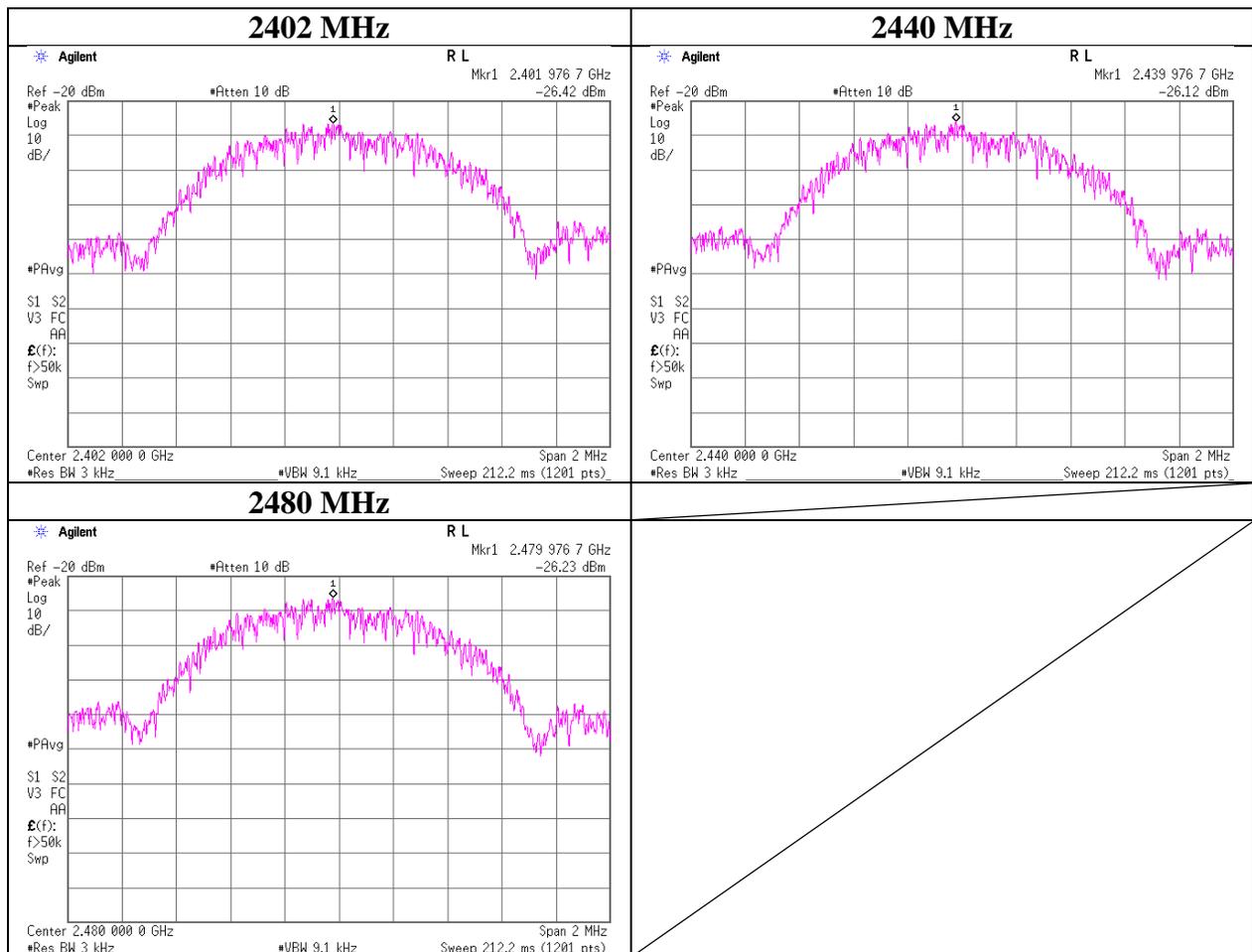
Test place	Shonan EMC Lab. No.3 Shielded Room
Report No.	11485102S-B
Date	October 26, 2016
Temperature / Humidity	25 deg. C / 47 % RH
Engineer	Kenichi Adachi
Mode	Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-26.42	0.93	9.67	-15.82	8.00	23.82
2440.00	-26.12	0.94	9.67	-15.51	8.00	23.51
2480.00	-26.23	0.94	9.67	-15.62	8.00	23.62

Sample Calculation:

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

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



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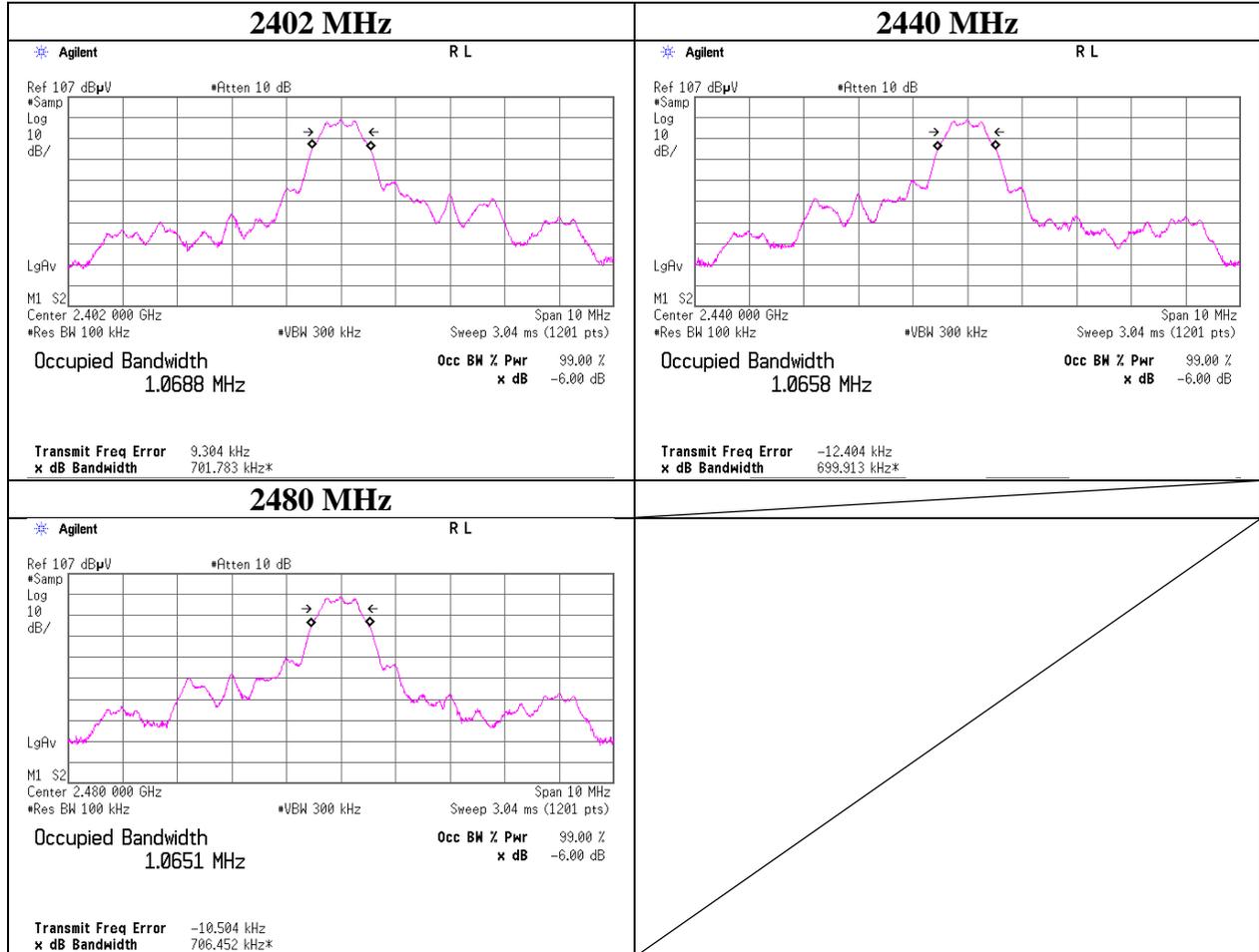
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99 % Occupied Bandwidth

Test place	Shonan EMC Lab. No.3 Shielded Room
Report No.	11485102S-B
Date	October 26, 2016
Temperature / Humidity	25 deg. C / 47 % RH
Engineer	Kenichi Adachi
Mode	Tx BT LE



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2016/02/10 * 12
SCC-G05	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	RE	2016/05/24 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2016/05/11 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2016/08/09 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2016/10/12 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2016/10/11 * 12
SJM-09	Measure	PROMART	SEN1935	-	RE	-
SAEC-02(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-02(SVSWR)	2	RE	2016/07/22 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	RE	-
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2015/11/16 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2015/11/04 * 12
SSA-01	Spectrum Analyzer	Agilent	N9010A-526	MY48031482	RE	2016/04/28 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2016/03/15 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2016/03/23 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2016/03/08 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000KMSKMS	-	RE	2016/04/18 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2016/02/19 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2016/02/25 * 12
KAT3-10	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2016/07/26 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2015/11/02 * 12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/T OYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(R F Selector)	RE	2016/04/22 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/T OYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(R F Selector)	RE	2016/04/22 * 12
SLA-02	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0893	RE	2015/11/03 * 12
TR-09	Test Receiver	Rohde & Schwarz	ESCI	100769	RE	2016/10/07 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2016/07/13 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2016/04/01 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2016/04/01 * 12
SRENT-08	Spectrum Analyzer	Agilent	E4448A	MY50180019	AT	2016/10/24 * 12
SAT10-09	Attenuator	Weinschel Corp.	54A-10	W5692	AT	2015/11/04 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2016/03/23 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	AT	2015/12/07 * 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

UL Japan, Inc.

Shonan EMC Lab.

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