



RADIO TEST REPORT

Test Report No. : 10991945S

Applicant : Sony Corporation
Type of Equipment : Wireless Module
Model No. : WS001
FCC ID : AK8WS001
Test regulation : **FCC Part 15 Subpart E: 2015**
(5736 MHz - 5814 MHz Band only)
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 28 to November 13, 2015

Representative test engineer:

S. Takano

Shinichi Takano
Engineer
Consumer Technology Division

Approved by:

T. Imamura

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".

UL Japan, Inc.
Shonan EMC Lab.

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SECTION 1: Customer information

Company Name : Sony EMCS Corporation
Address : 8-4 Shiomi Kisarazu-shi, Chiba, 292-0834 Japan
Telephone Number : +81-438-37-3982
Contact Person : Kazuhiko Nagano

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

2.1 Identification of E.U.T.

Type of Equipment : Wireless Module
Model No. : WS001
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 3.3 V
Receipt Date of Sample : October 27, 2015
Country of Mass-production : Philippines
Condition of EUT : Production model
Modification of EUT : No Modification by the test lab.

2.2 Product Description

Model: WS001 (referred to as the EUT in this report) is a Wireless Module.

General Specification

Clock frequency(ies) in the system : 44 MHz

Radio Specification

Equipment type : Transceiver
Frequency of operation *1) : 5180 MHz - 5240 MHz, 5736 MHz - 5814 MHz
Bandwidth : 17 MHz
Channel spacing : 30 MHz
Type of modulation : DSSS, QPSK
Antenna type : Printed antenna
Antenna gain : Antenna A:
5.2 GHz band: 1.1 dBi (max), 5.8 GHz band: 0.8 dBi (max)
Antenna B:
5.2 GHz band: 0.5 dBi (max), 5.8 GHz band: 0.1 dBi (max)
Antenna connector type : None
ITU code : G1D
Operation temperature range : -10 to +60 deg.C

*1) Refer to the test report 10064467S-D-R1 and 10064467S-F-R1 for the band which are not included in this report.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart E: 2015, final revised on November 23, 2015
Title : FCC 47CFR Part15 Radio Frequency Device Subpart E
Unlicensed National Information Infrastructure Devices
Section 15.407 General technical requirements

* Some parts are effective on and after December 17, 2015 or December 23, 2015. The revision does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.4-2009	FCC: 15.407 (b) (6) / 15.207	20.4 dB, AV 0.45400 MHz, N Tx 5736 MHz, Antenna: B	Complied	-
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
26 dB Emission Bandwidth	FCC: KDB Publication Number 789033	FCC: 15.407 (a) (1) (2) (3)	See data	N/A	Conducted
	IC: -	IC: -			
Maximum Conducted Output Power	FCC: KDB Publication Number 789033	FCC: 15.407 (a) (1) (2) (3)		Complied	Conducted
	IC: -	IC: RSS-247 6.2.1 (1) 6.2.2 (1) 6.2.3 (1) 6.2.4 (1)			
Maximum Power Spectral Density	FCC: KDB Publication Number 789033	FCC : 15.407 (a) (1) (2) (3)		Complied	Conducted
	IC: -	IC: RSS-247 6.2.1 (1) 6.2.2 (1) 6.2.3 (1) 6.2.4 (1)			
Spurious Emission Restricted Band Edge	FCC: ANSI C63.4-2009 KDB Publication Number 789033	FCC: 15.407 (b), 15.205 and 15.209	5.2 dB 86.025 MHz, QP, Horizontal, Tx 5762 MHz, Antenna: B	Complied	Conducted (< 30 MHz) / Radiated (> 30 MHz) *1)
	IC: -	IC: RSS-247 6.2.1 (2) 6.2.2 (2) 6.2.3 (2) 6.2.4 (2)			
6 dB Emission Bandwidth	FCC: ANSI C63.4-2009	FCC: 15.407 (e)	See data	Complied	Conducted
	IC: -	IC: RSS-247 6.2.4 (1)			
Dynamic frequency selection	FCC: KDB Publication Number 905462 D02	FCC: FCC 15.407 (h)	-	N/A *2)	Conducted
	IC: -	IC: RSS-247 6.3			

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 FCC 15.407 (b) and KDB 789033 D02 G.3.b).

*2) The test is not applicable since the EUT does not operate in the 5.25-5.35 GHz and 5.47-5.725 GHz bands.

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

However, there are two deviations from ANSI C63.10: 2013. Measurement height is not 1.5 m, but 0.8 m.

FCC 15.31 (e) / 212

The module is provided the stable voltage (DC 3.3 V) from the host device. Therefore, the equipment complies with the requirement.

FCC 15.203 / 212

The antenna is not removable from the EUT. Therefore, the equipment complies with the requirement.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Band Width	RSS-Gen 6.6	IC: -	N/A	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
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	3.6 dB	3.4 dB	3.4 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.7 dB	3.5 dB	3.5 dB
	30 MHz-300 MHz	4.9 dB	4.9 dB	4.7 dB
	300 MHz-1 GHz	5.0 dB	5.0 dB	4.8 dB
	1 GHz-13 GHz	4.9 dB	4.9 dB	4.9 dB
Radiated emission (Measurement distance: 1 m)	13 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB
	18 GHz-40 GHz	4.5 dB	4.3 dB	4.3 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-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

Conducted Emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test

The data listed in this test report has enough margin, more than the site margin.

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)

Test item	Mode	Tested frequency
All items	Transmitting	5736 MHz, 5762 MHz, 5814 MHz

EUT has the power settings by the software as follows;

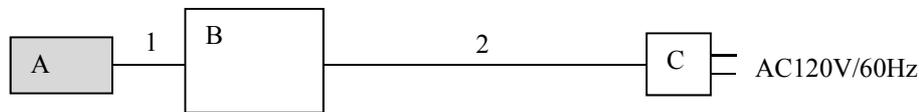
Test software: GUI_Demo_01.05.29_8192.exe, MCU version SERIAL_COM_8179

Power settings: Fixed

Antenna port used: Antenna B

* The worse antenna port was determined based on the test result of Maximum Peak Output Power.

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	Remarks
A	Wireless Module	WS001	0274091 *1) 0410975 *2)	Sony Corporation	EUT
B	Jig	-	-	Sony Corporation	-
C	AC Adaptor	AMS47-0501000FU	-	AMIGO	-

*1) Used for Antenna Terminal conducted test

*2) Used for Conducted Emission test and Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Flat	0.15	Unshielded	Unshielded	-
2	DC	1.5	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity. The rear of tabletop was located 40cm 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 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN / (AMN) to the input power source.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Shielded room. The EUT 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 Average
Measurement range : 0.15 MHz-30 MHz
Test data : APPENDIX
Test result : Pass

SECTION 6: Radiated Spurious Emission and Band Edge Compliance

Test Procedure

EUT was placed on a polystyrene 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.

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

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

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

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.

< Below 1GHz >

The result also satisfied with the general limits specified in section 15.209 (a).

< Above 1GHz >

Inside of restricted bands (Section 15.205):

Apply to limit in the Section 15.209 (a).

Outside of the restricted bands:

Apply to limit 68.2 dBuV/m, 3 m (-27 dBm e.i.r.p. *) or

78.2 dBuV/m, 3 m (-17 dBm e.i.r.p. *) in the Section 15.407 (b).

Restricted band edge:

Apply to limit in the Section 15.209 (a).

Since this limit is severer than the limit of the inside of restricted bands.

*Electric field strength to e.i.r.p. conversion:

$$E = \frac{1000000\sqrt{30P}}{3} \text{ (uV/m)} \quad :P \text{ is the e.i.r.p. (Watts)}$$

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

Frequency	Below 1 GHz	Above 1 GHz	
Instrument used	Test Receiver	Spectrum Analyzer	
Detector	QP	Peak	Average *1)
IF Bandwidth	BW: 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1MHz VBW: 10Hz
Test Distance	3 m	3 m (below 13 GHz), 1 m*2) (above 13 GHz),	

*1) The test method was referred to Section G) 6) d) Method VB (Averaging using reduced video bandwidth) of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E (Issued on June 6, 2014)"

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

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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.

Worst case:

Antenna polarization	Carrier	Spurious (Below 1GHz)	Spurious (1-13 GHz)	Spurious (Above 13 GHz)
Horizontal	X	Y	X	X
Vertical	Z	Y	Z	X

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

Measurement range : 30 MHz-40 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 and Test method
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 % to 5 % of OBW	≥ 3 RBW	Auto	Peak	Max Hold	Spectrum Analyzer
6 dB Bandwidth	Enough to capture the emission	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Conducted Output Power	-	-	-	Auto	Average	-	Power Meter (Sensor: 80 MHz BW) (Method PM)
Maximum Power Spectral Density	Encompass the entire EBW	100 kHz *2)	≥ 3 RBW	Auto	RMS Power Averaging (200 times)	Clear Write	Spectrum Analyzer
Conducted Spurious Emission*3)	9 kHz – 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz – 30 MHz	10 kHz	30 kHz				

* The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E (Issued on June 6, 2014)".

*1) Peak hold was applied as Worst-case measurement.

*2) FCC standard says that RBW is set to be 500 kHz for 5.725 GHz-5.850 GHz, but it is not possible with spectrum analyzer, so $10\log(500\text{ kHz}/100\text{ kHz})$ was added to the test result.

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

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

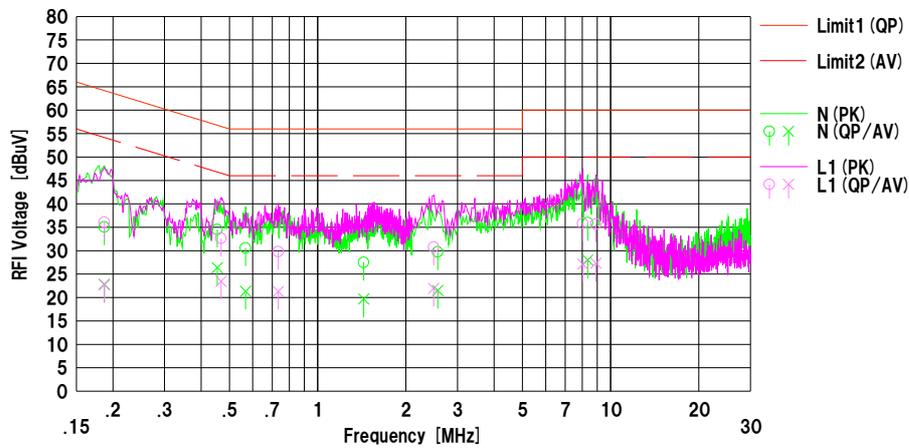
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2015/11/13

Mode : Tx, 5736 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 24 deg.C / 58 %RH

Remarks : Antenna : B

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

Engineer : Shinichi Takano



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.18696	22.41	10.18	12.64	35.05	22.82	64.17	54.17	29.1	31.3	N	
2	0.45400	21.84	13.68	12.69	34.53	26.37	56.80	46.80	22.2	20.4	N	
3	0.56734	17.85	8.59	12.72	30.57	21.31	56.00	46.00	25.4	24.6	N	
4	1.43522	14.68	6.88	12.81	27.49	19.69	56.00	46.00	28.5	26.3	N	
5	2.56889	16.83	8.56	12.92	29.75	21.48	56.00	46.00	26.2	24.5	N	
6	8.34944	22.27	14.31	13.70	35.97	28.01	60.00	50.00	24.0	21.9	N	
7	0.18708	23.45	10.09	12.64	36.09	22.73	64.17	54.17	28.0	31.4	L1	
8	0.46802	19.92	10.76	12.70	32.62	23.46	56.55	46.55	23.9	23.0	L1	
9	0.73353	17.08	8.58	12.72	29.80	21.30	56.00	46.00	26.2	24.7	L1	
10	2.48943	17.86	9.05	12.90	30.76	21.95	56.00	46.00	25.2	24.0	L1	
11	8.04313	22.15	13.48	13.66	35.81	27.14	60.00	50.00	24.1	22.8	L1	
12	8.90864	21.89	13.53	13.79	35.68	27.32	60.00	50.00	24.3	22.6	L1	

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

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

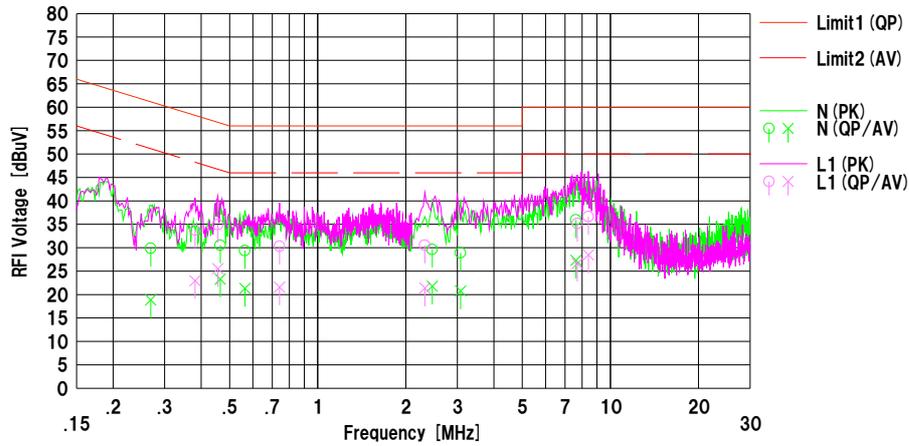
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2015/11/13

Mode : Tx, 5762 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 24 deg.C / 58 %RH

Remarks : Antenna : B

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

Engineer : Shinichi Takano



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]	<QP> [dB]	<AV> [dB]		
1	0.26893	17.21	6.20	12.65	29.86	18.85	61.15	51.15	31.2	32.3	N	
2	0.46459	17.83	10.59	12.70	30.53	23.29	56.61	46.61	26.0	23.3	N	
3	0.56414	16.68	8.59	12.72	29.40	21.31	56.00	46.00	26.6	24.6	N	
4	2.46275	16.74	8.87	12.90	29.64	21.77	56.00	46.00	26.3	24.2	N	
5	3.07645	15.92	7.78	12.99	28.91	20.77	56.00	46.00	27.0	25.2	N	
6	7.62536	22.34	13.73	13.60	35.94	27.33	60.00	50.00	24.0	22.6	N	
7	0.38096	21.08	10.26	12.69	33.77	22.95	58.26	48.26	24.4	25.3	L1	
8	0.45615	22.24	12.86	12.69	34.93	25.55	56.76	46.76	21.8	21.2	L1	
9	0.74083	17.58	8.89	12.72	30.30	21.61	56.00	46.00	25.7	24.3	L1	
10	2.32320	17.65	8.47	12.89	30.54	21.36	56.00	46.00	25.4	24.6	L1	
11	7.70964	21.58	13.02	13.61	35.19	26.63	60.00	50.00	24.8	23.3	L1	
12	8.40812	22.93	14.76	13.71	36.64	28.47	60.00	50.00	23.3	21.5	L1	

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

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

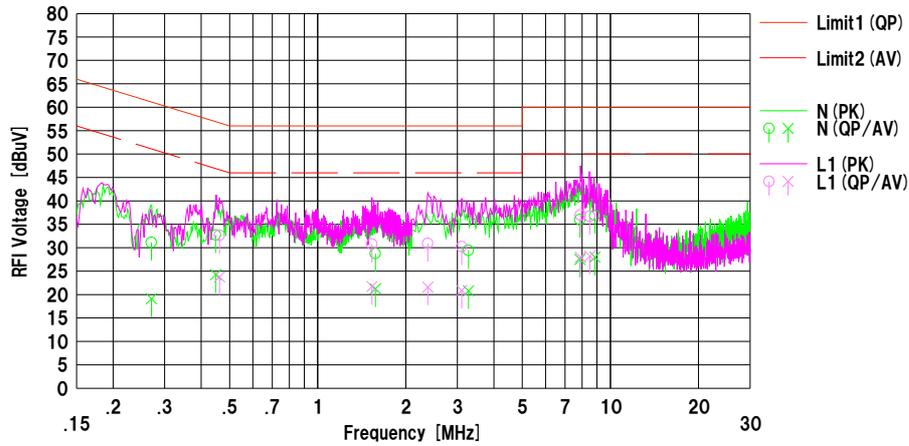
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2015/11/13

Mode : Tx, 5814 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 24 deg.C / 58 %RH

Remarks : Antenna : B

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

Engineer : Shinichi Takano



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]	<QP> [dB]	<AV> [dB]		
1	0.27035	18.48	6.45	12.65	31.13	19.10	61.11	51.11	29.9	32.0	N	
2	0.44848	20.04	11.55	12.69	32.73	24.24	56.90	46.90	24.1	22.6	N	
3	1.57553	15.94	8.41	12.82	28.76	21.23	56.00	46.00	27.2	24.7	N	
4	3.27296	16.40	7.78	13.01	29.41	20.79	56.00	46.00	26.5	25.2	N	
5	7.87192	22.35	13.86	13.64	35.99	27.50	60.00	50.00	24.0	22.5	N	
6	8.85292	23.12	14.21	13.78	36.90	27.99	60.00	50.00	23.1	22.0	N	
7	0.46203	19.92	11.07	12.70	32.62	23.77	56.66	46.66	24.0	22.8	L1	
8	1.53255	17.93	8.89	12.82	30.75	21.71	56.00	46.00	25.2	24.2	L1	
9	2.37915	18.02	8.71	12.89	30.91	21.60	56.00	46.00	25.0	24.4	L1	
10	3.10469	17.21	7.89	13.00	30.21	20.89	56.00	46.00	25.7	25.1	L1	
11	7.90320	23.32	14.30	13.64	36.96	27.94	60.00	50.00	23.0	22.0	L1	
12	8.50732	22.96	14.49	13.73	36.69	28.22	60.00	50.00	23.3	21.7	L1	

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

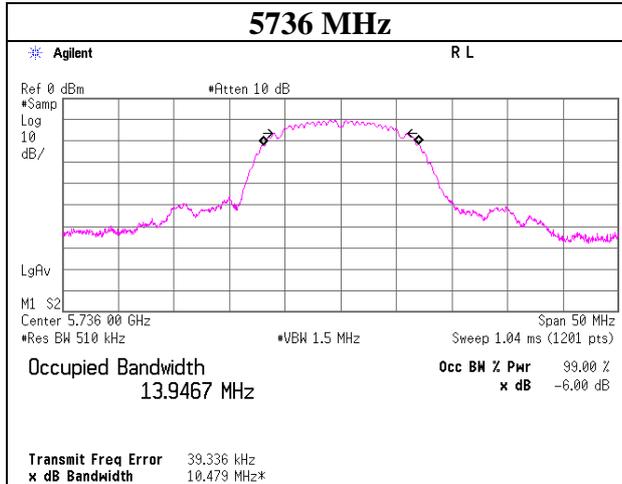
99 % Occupied Bandwidth

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 10991945S
Date October 28, 2015
Temperature / Humidity 25deg. C / 45 % RH
Engineer Hikaru Shirasawa
Mode Tx

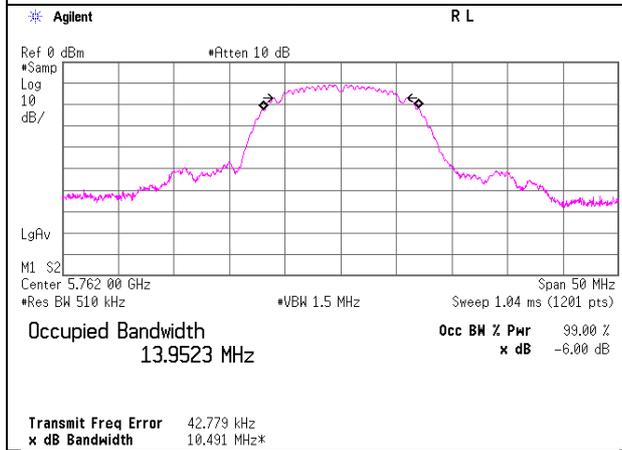
Tested Frequency [MHz]	99 % Occupied Bandwidth [MHz]	Limit [MHz]
5736	13.947	-
5762	13.952	-
5814	13.951	-

99 % Occupied Bandwidth

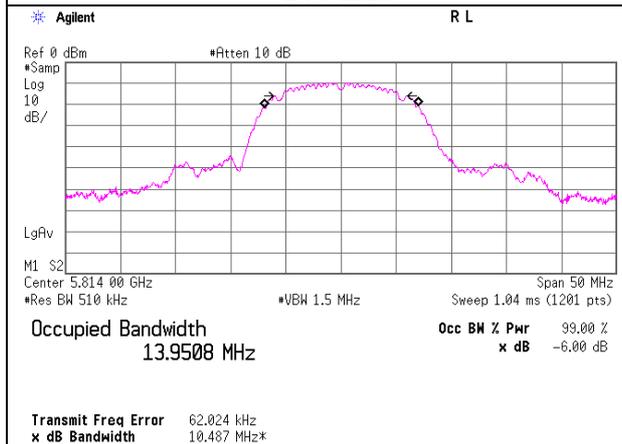
Antenna B 5736 MHz



5762 MHz



5814 MHz



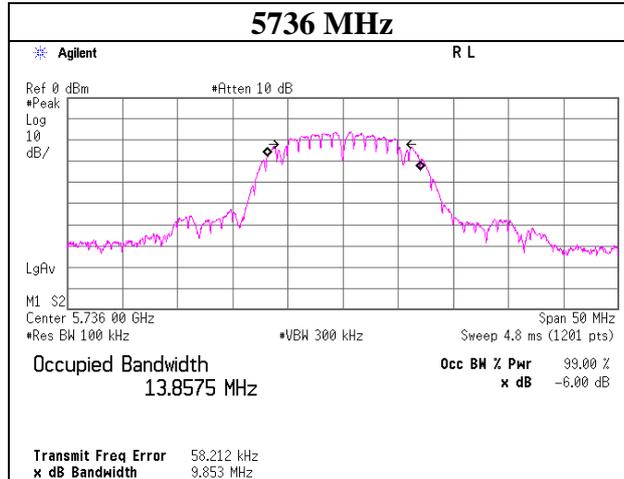
6 dB Bandwidth

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 10991945S
Date October 28, 2015
Temperature / Humidity 25deg. C / 45 % RH
Engineer Hikaru Shirasawa
Mode Tx

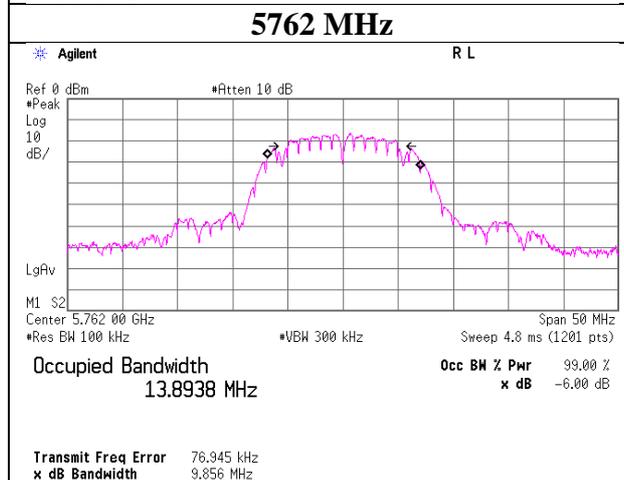
Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [kHz]
5736	13.858	> 500
5762	13.894	> 500
5814	13.919	> 500

6 dB Bandwidth

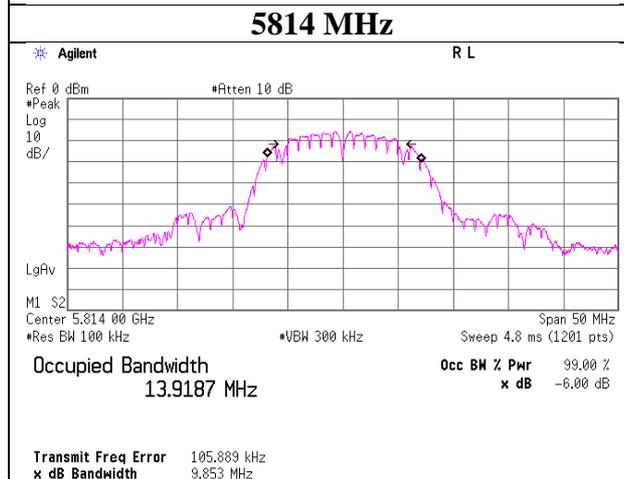
Antenna B 5736 MHz



5762 MHz



5814 MHz



Maximum Conducted Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 10991945S
Date : October 28, 2015
Temperature / Humidity : 25deg. C / 45 % RH
Engineer : Hikaru Shirasawa
Mode : Tx

Antenna B

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for IC) [MHz]	Conducted Power				e.i.r.p.			
								Result [dBm]	[mW]	Limit [dBm]	Margin [dB]	Result [dBm]	[mW]	Limit [dBm]	Margin [dB]
5736	-2.31	1.74	10.01	0.00	0.8	-	-	9.44	8.79	30.00	20.56	10.24	10.57	36.00	25.76
5762	-2.57	1.75	10.02	0.00	0.8	-	-	9.20	8.32	30.00	20.80	10.00	10.00	36.00	26.00
5814	-1.62	1.75	10.02	0.00	0.8	-	-	10.15	10.35	30.00	19.85	10.95	12.45	36.00	25.05

Sample Calculation:

Conducted Power Result = Reading + Cable Loss + Atten. Loss + Duty Factor

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

Conducted Power Limit (5250 MHz-5350 MHz, 5470 MHz-5725 MHz) = 250 mW or (11 + 10logB) dBm, whichever is lower

Maximum Conducted Output Power

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10991945S
Date	October 28, 2015
Temperature / Humidity	25deg. C / 45 % RH
Engineer	Hikaru Shirasawa
Mode	Tx

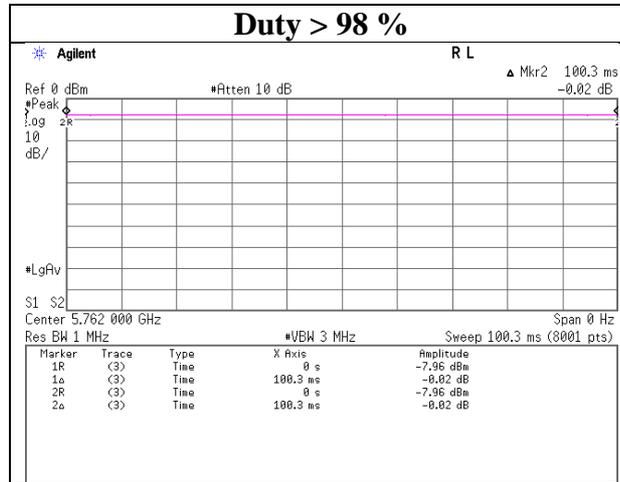
5762 MHz

Mode	Reading (timed average)						Duty factor	Burst power			Remarks
	Antenna							Antenna			
	A	B	A	B	A+B	A+B		1	2	1+2	
	[dBm]	[dBm]	[mW]	[mW]	[mW]	[dBm]	[dB]	[dBm]	[dBm]	[dBm]	
	-2.85	-2.57	-	-	-	-	0.00	-2.85	-2.57	-	

All comparison were carried out on same frequency and measurement factors.

Burst rate confirmation

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	10991945S
Date	October 28, 2015
Temperature / Humidity	25deg. C / 45 % RH
Engineer	Hikaru Shirasawa
Mode	Tx



Maximum Power Spectral Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 10991945S
Date : October 28, 2015
Temperature / Humidity : 25deg. C / 45 % RH
Engineer : Hikaru Shirasawa
Mode : Tx

Antenna B

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD Reading [dBm /100kHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted)			PSD (e.i.r.p.)		
							Result [dBm /500kHz]	Limit [dBm /500kHz]	Margin [dB]	Result [dBm /500kHz]	Limit [dBm /500kHz]	Margin [dB]
5736	-17.35	1.74	10.01	0.00	0.8	6.99	1.40	30.00	28.61	2.20	36.00	33.81
5762	-18.16	1.75	10.02	0.00	0.8	6.99	0.60	30.00	29.40	1.40	36.00	34.60
5814	-17.23	1.75	10.02	0.00	0.8	6.99	1.53	30.00	28.47	2.33	36.00	33.67

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5736 MHz to 5814 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 * \log(\text{Specified bandwidth} / \text{Measured bandwidth})$

PSD Result (Conducted) = Reading + Cable Loss + Atten. Loss + Duty Factor + RBW Correction Factor

PSD Result (e.i.r.p.) = Conducted PSD Result + Antenna Gain

The conducted PSD limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. (All frequencies for FCC, 5725 MHz-5850 MHz for IC)

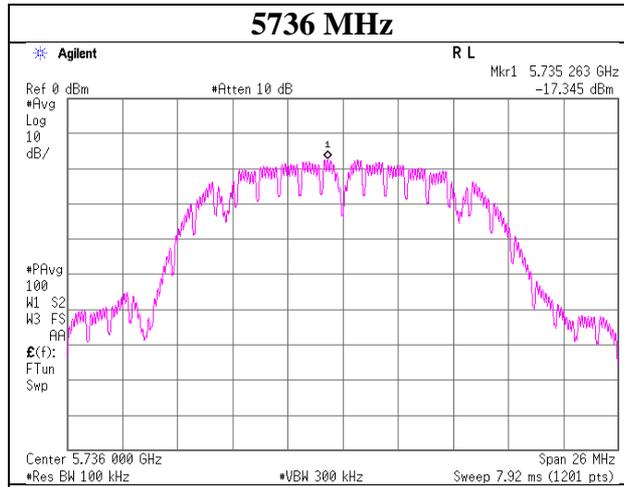
Although the EUT operates on Master mode, more stringent limit for Client device was applied.

Maximum Power Spectral Density

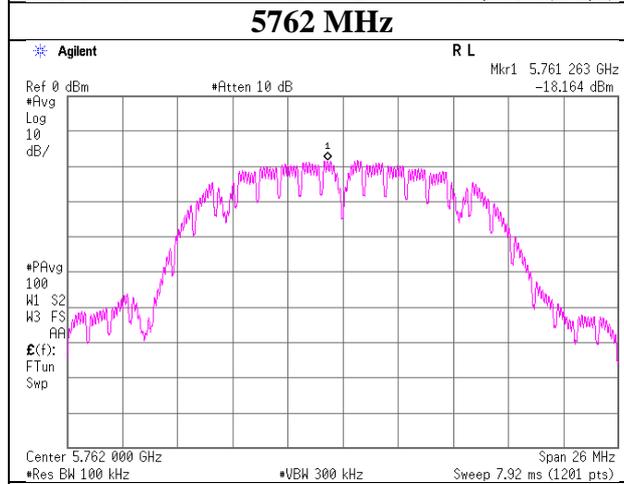
Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 10991945S
Date : October 28, 2015
Temperature / Humidity : 25deg. C / 45 % RH
Engineer : Hikaru Shirasawa
Mode : Tx

Antenna B

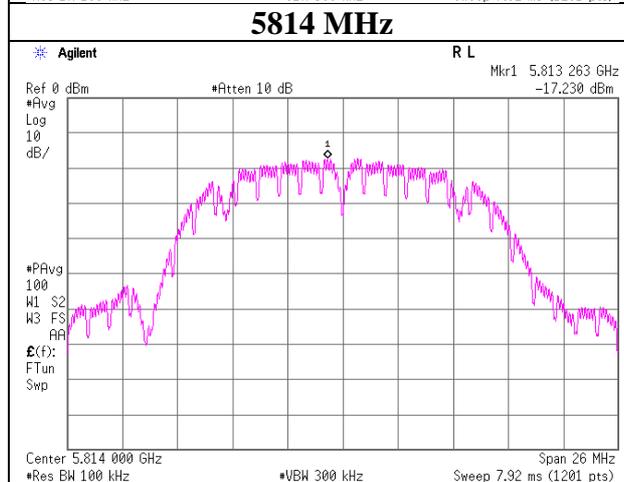
5736 MHz



5762 MHz



5814 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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber
Report No. : 10991945S
Date : November 10, 2015 November 13, 2015
Temperature / Humidity : 24 deg. C / 58 % RH 23 deg. C / 38 % RH
Engineer : Shinichi Takano Shinichi Takano
 (No.3 SAC) (No.2 SAC)
Mode : Tx 5736 MHz, Antenna B

(below 1GHz and above 1GHz Inside of the restricted band)

(* 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.	86.029	QP	51.1	7.3	8.2	31.9	0.0	34.7	40.0	5.3	204	218	
Hori.	405.562	QP	42.7	17.7	7.3	31.7	0.0	36.0	46.0	10.0	100	359	
Hori.	553.034	QP	44.1	18.9	8.1	31.6	0.0	39.5	46.0	6.5	178	163	
Hori.	577.616	QP	44.2	19.1	8.2	31.6	0.0	39.9	46.0	6.1	168	170	
Hori.	11472.000	PK	44.6	40.0	8.3	38.8	3.5	57.6	73.9	16.3	121	135	
Hori.	11472.000	AV	33.2	40.0	8.3	38.8	3.5	46.2	53.9	7.7	121	135	
Vert.	61.448	QP	49.9	7.5	7.0	31.9	0.0	32.5	40.0	7.5	100	101	
Vert.	86.027	QP	50.0	7.3	8.2	31.9	0.0	33.6	40.0	6.4	100	195	
Vert.	577.616	QP	37.0	19.1	8.2	31.6	0.0	32.7	46.0	13.3	100	27	
Vert.	11472.000	PK	45.1	40.0	8.3	38.8	3.5	58.1	73.9	15.8	100	135	
Vert.	11472.000	AV	33.2	40.0	8.3	38.8	3.5	46.2	53.9	7.7	100	135	

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

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

*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (4.49 m / 3.0 m) = 3.5 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.5 dB

(Calculation) (above 1GHz Outside of the restricted band)

(* 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]	Result (EIRP) [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	5715.000	PK	47.1	32.6	15.8	38.8	3.5	60.2	-35.0	-27.0	8.0	115	153	
Hori.	5721.692	PK	51.5	32.6	15.8	38.8	3.5	64.6	-30.6	-17.0	13.6	115	153	
Hori.	5725.000	PK	50.6	32.6	15.8	38.8	3.5	63.7	-31.5	-17.0	14.5	115	153	
Hori.	17208.000	PK	45.3	41.9	10.6	39.4	-9.5	48.9	-46.3	-27.0	19.3	100	170	
Vert.	5715.000	PK	45.7	32.6	15.8	38.8	3.5	58.8	-36.4	-27.0	9.4	100	123	
Vert.	5722.114	PK	47.5	32.6	15.8	38.8	3.5	60.6	-34.6	-17.0	17.6	100	123	
Vert.	5725.000	PK	47.0	32.6	15.8	38.8	3.5	60.1	-35.1	-17.0	18.1	100	123	
Vert.	17208.000	PK	44.4	41.9	10.6	39.4	-9.5	48.0	-47.2	-27.0	20.2	100	0	

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

Result(EIRP[dBm])=10*LOG (({ 10 ^ (Electric Field Strength [dBuV/m] / 20) * 10 ^ (-6) * Distance:3[m] } ^ 2) / 30) * 10^3)

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

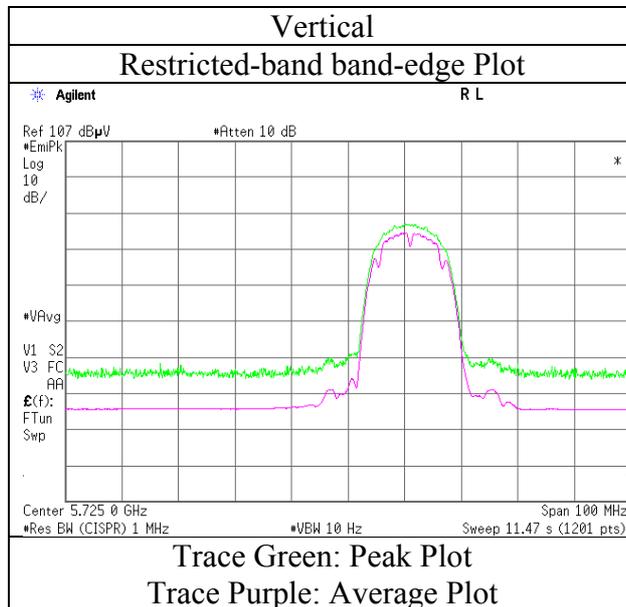
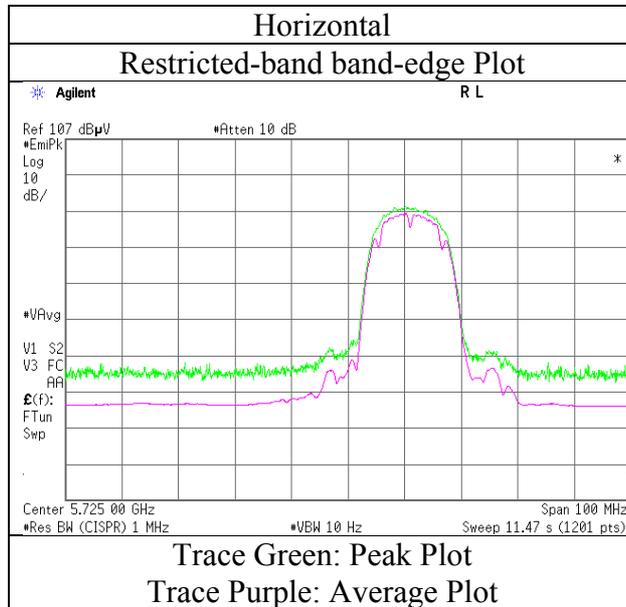
*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (4.49 m / 3.0 m) = 3.5 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10991945S
Date	November 10, 2015
Temperature / Humidity	24 deg. C / 58 % RH
Engineer	Shinichi Takano
Mode	Tx 5736 MHz, Antenna B



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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber
Report No. : 10991945S
Date : November 10, 2015 November 13, 2015
Temperature / Humidity : 24 deg. C / 58 % RH 23 deg. C / 38 % RH
Engineer : Shinichi Takano Shinichi Takano
 (No.3 SAC) (No.2 SAC)
Mode : Tx 5762 MHz, Antenna B

(below 1GHz and above 1GHz Inside of the restricted band)

(* 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.	86.025	QP	51.2	7.3	8.2	31.9	0.0	34.8	40.0	5.2	210	211	
Hori.	405.562	QP	42.7	17.7	7.3	31.7	0.0	36.0	46.0	10.0	100	359	
Hori.	553.034	QP	44.5	18.9	8.1	31.6	0.0	39.9	46.0	6.1	182	169	
Hori.	577.612	QP	44.0	19.1	8.2	31.6	0.0	39.7	46.0	6.3	172	169	
Hori.	11524.000	PK	44.8	40.0	8.3	38.8	3.5	57.8	73.9	16.1	151	359	
Hori.	11524.000	AV	33.1	40.0	8.3	38.8	3.5	46.1	53.9	7.8	151	359	
Vert.	61.450	QP	49.5	7.5	7.0	31.9	0.0	32.1	40.0	7.9	100	113	
Vert.	86.027	QP	50.4	7.3	8.2	31.9	0.0	34.0	40.0	6.0	100	197	
Vert.	577.615	QP	37.0	19.1	8.2	31.6	0.0	32.7	46.0	13.3	100	29	
Vert.	11524.000	PK	43.9	40.0	8.3	38.8	3.5	56.9	73.9	17.0	100	142	
Vert.	11524.000	AV	32.7	40.0	8.3	38.8	3.5	45.7	53.9	8.2	100	142	

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

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

*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (4.49 m / 3.0 m) = 3.5 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.5 dB

(Calculation) (above 1GHz Outside of the restricted band)

(* 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]	Result (EIRP) [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	17286.000	PK	44.6	42.2	10.7	39.3	-9.5	48.7	-46.5	-27.0	19.5	100	170	
Vert.	17286.000	PK	43.7	42.2	10.7	39.3	-9.5	47.8	-47.4	-27.0	20.4	100	0	

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

Result(EIRP[dBm])=10*LOG (({ 10 ^ (Electric Field Strength [dBuV/m] / 20) * 10 ^ (-6) * Distance:3[m]) ^ 2 } / 30) * 10 ^ 3)

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

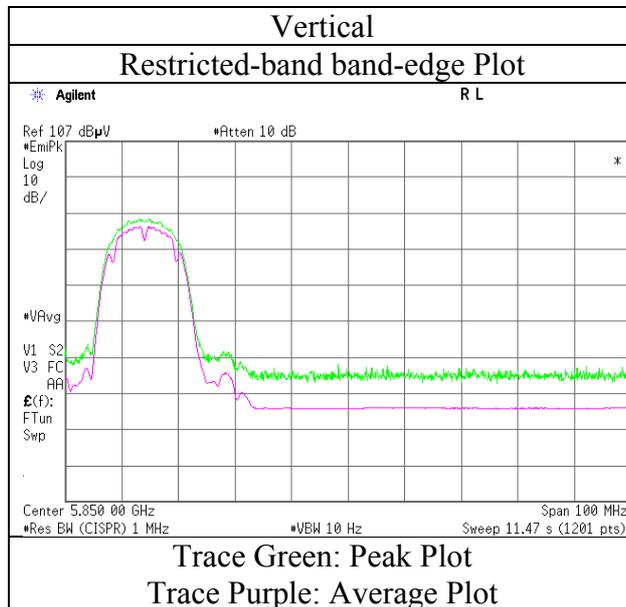
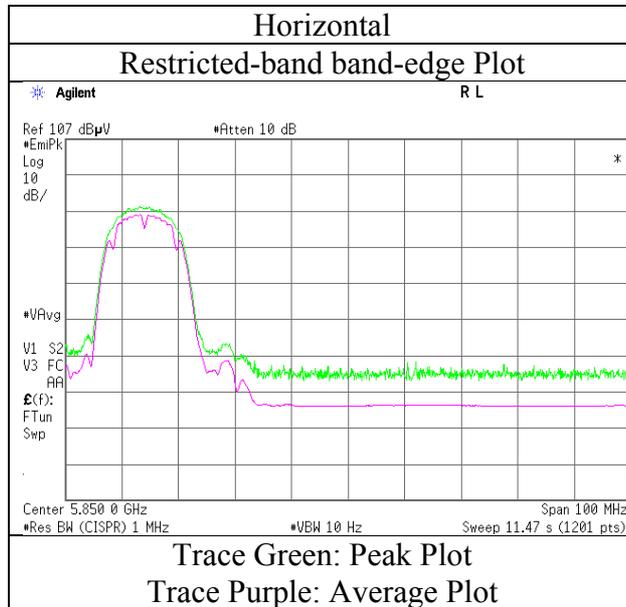
*The 4th harmonic was not seen so the result was its base noise level.

Distance factor : 1 GHz - 13 GHz : 20log (4.49 m / 3.0 m) = 3.5 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

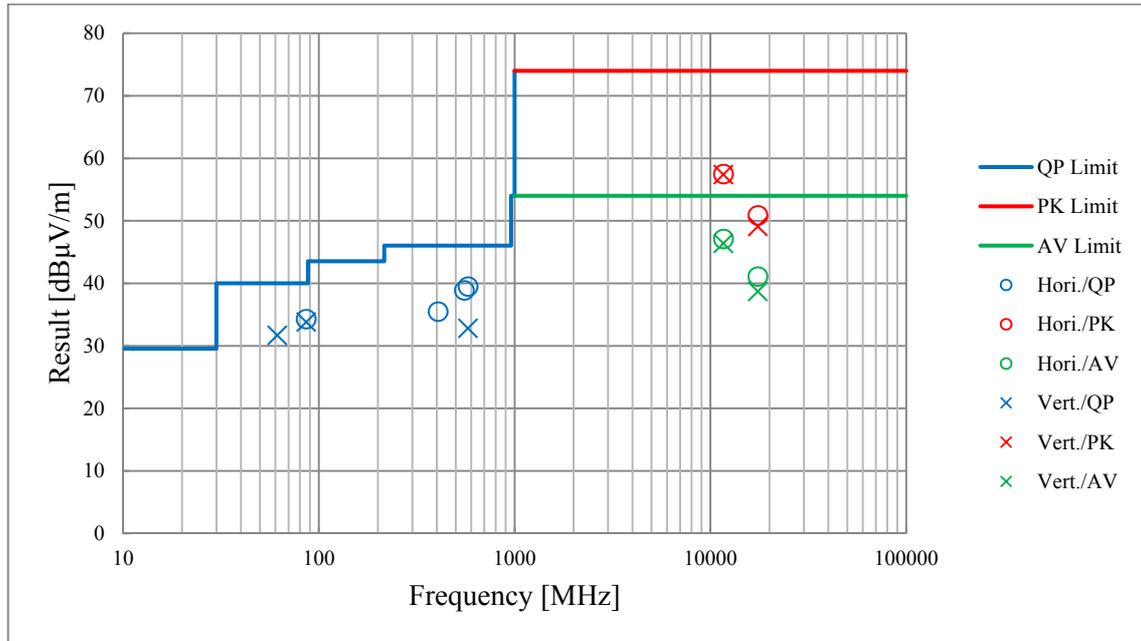
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10991945S
Date	November 10, 2015
Temperature / Humidity	24 deg. C / 58 % RH
Engineer	Shinichi Takano
Mode	Tx 5814 MHz, Antenna B



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

Radiated Spurious Emission
(Plot data, Worst case)

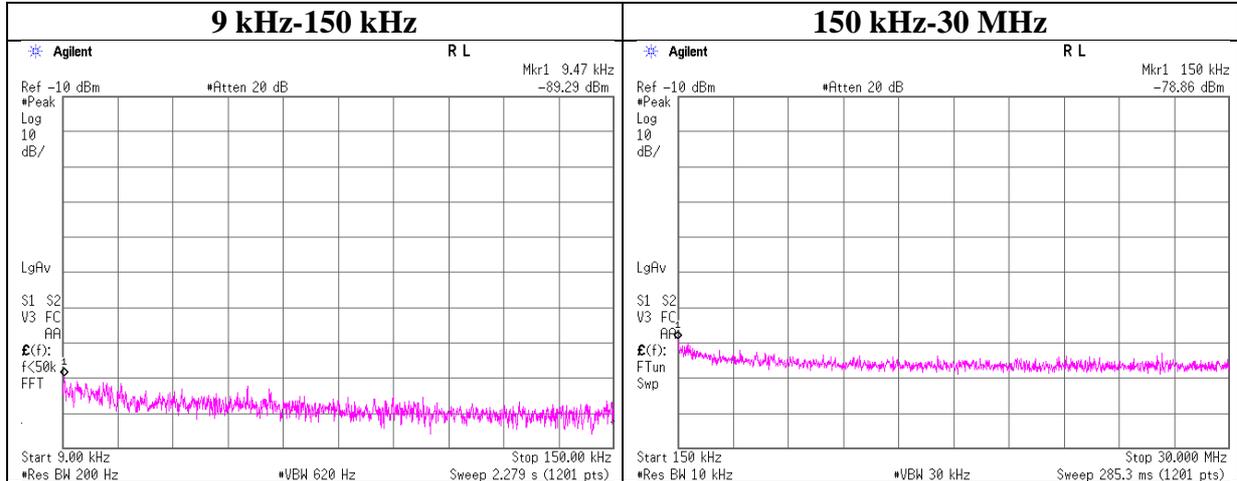
Test place	Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber	
Report No.	10991945S	
Date	November 10, 2015	November 13, 2015
Temperature / Humidity	24 deg. C / 58 % RH	23 deg. C / 38 % RH
Engineer	Shinichi Takano (No.3 SAC)	Shinichi Takano (No.2 SAC)
Mode	Tx 5814 MHz, Antenna B	



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

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 10991945S
Date : October 28, 2015
Temperature / Humidity : 25deg. C / 45 % RH
Engineer : Hikaru Shirasawa
Mode : Tx 5736 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [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
9.47	-89.3	0.01	9.9	0.8	1	-78.6	300	6.0	-17.3	48.0	65.3	
150.00	-78.9	0.15	9.9	0.8	1	-68.0	300	6.0	-6.7	24.0	30.7	

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

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

APPENDIX 2: Test instruments

Test equipment(1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SPM-07	Power Meter	Agilent	8990B	MY510027 2	AT	2015/04/02 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY532600 9	AT	2015/04/02 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY482501 52	AT	2015/09/16 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	AT	2015/11/04 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2015/03/11 * 12
STM-G1	Terminator	Hirose Electric	HRM-TMP-0 5(40)	-	AT	-
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2014/12/24 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2015/05/27 * 12
SCC-G04	Coaxial Cable	Junkosha	J12J102207-0 0	JUN-12-14- 018	RE	2015/06/08 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2015/05/19 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2015/08/11 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2015/10/22 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY482501 06	RE	2015/03/26 * 12
SJM-15	Measure	ASKUL	-	-	RE	-
SAEC-03(SVS WR)	Semi-Anechoic Chamber	TDK	SAEC-03(SV SWR)	3	RE	2015/08/28 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,M F)	-	RE, CE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2014/11/11 * 12
SAT10-05	Attenuator(above1GH z)	Agilent	8493C-010	74864	RE	2015/11/04 * 12
SFL-03	Highpass Filter	MICRO-TRONICS	HPM50112	028	RE	2014/11/21 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2015/03/17 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2015/03/23 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2015/03/11 * 12
SHA-06	Horn Antenna	ETS LINDGREN	3160-10	LM3459	RE	2015/03/17 * 12
SAF-10	Pre Amplifier	TOYO Corporation	HAP26-40W	00000010	RE	2015/03/23 * 12
SCC-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2015/03/11 * 12
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2014/11/11 * 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
RE: Radiated Emission
AT: Antenna Terminal Conducted test

UL Japan, Inc.
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Test equipment(2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2015/02/18 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2015/02/18 * 12
KAT3-11	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2015/08/31 * 12
KBA-01	Biconical Antenna	Schwarzbeck	BBA9106	1748	RE	2015/10/17 * 12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2015/04/17 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2015/04/17 * 12
KLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	170	RE	2015/10/17 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2015/10/22 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE, CE	2015/09/04 * 12
SJM-14	Measure	ASKUL	-	-	RE, CE	-
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2015/07/15 * 12
STS-02	Digital Hitester	Hioki	3805-50	080997819	RE, CE	2015/03/10 * 12
SCC-B12/B13/SRSE-02	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-270(RF Selector)	CE	2015/04/17 * 12
SLS-02	LISN	Rohde & Schwarz	ENV216	100512	CE	2015/02/24 * 12
SAT3-06	Attenuator	JFW	50HF-003N	-	CE	2015/02/18 * 12
SOS-04	Humidity Indicator	A&D	AD-5681	4061512	CE	2014/12/24 * 12

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