



EMI TEST REPORT

Test Report No. : 12812924H-B-R2

Applicant : Sony Corporation
Type of Equipment : UHF SYNTHESIZED DIVERSITY TUNER
Model No. : URX-P40
Test regulation : FCC Part 15 Subpart C: 2019
FCC ID : AK8URXP40
Test Result : Complied (Refer to SECTION 3.2)

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 12812924H-B-R1. 12812924H-B-R1 is replaced with this report.

Date of test: May 31 to June 2, 2019

Representative test engineer:


Akihiko Maeda
Engineer
Consumer Technology Division

Approved by:


Tsubasa Takayama
Leader
Consumer Technology Division



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- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
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REVISION HISTORY

Original Test Report No.: 12812924H-B

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SECTION 1: Customer information

Company Name	:	Sony Global Manufacturing & Operations Corporation
Address	:	8-4, Shiomi, Kisarazu-shi, Chiba, 292-0834 Japan
Telephone Number	:	+81-438-37-4704
Contact Person	:	Youhei Hisano

***Remarks**

Sony Global Manufacturing & Operations Corporation (Subsidiary Company Name) is on behalf of the applicant: Sony Corporation.

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No. FCC ID on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

2.1 Identification of E.U.T.

Type of Equipment	:	UHF SYNTHESIZED DIVERSITY TUNER
Model No.	:	URX-P40
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3 V (Battery), DC 5 V (USB)
Receipt Date of Sample (Information from test lab.)	:	April 22, 2019
Country of Mass-production	:	Korea
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: URX-P40 (referred to as the EUT in this report) is a UHF SYNTHESIZED DIVERSITY TUNER.

Radio Specification

Clock frequency(ies) in the system	:	DSP: 12 MHz (SPXO) PLL: 26 MHz (TCXO)
Operating temperature	:	0 deg. C to +50 deg. C

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Radio Specification [URX-P40]

[Radio microphone part]

Radio type : Receiver
Modulation type : Frequency Modulation
Channel spacing : 125 kHz
Frequency of operation : URX-P40(UC14) : 470.125MHz - 541.875MHz
URX-P40(UC25) : 536.125MHz - 607.875MHz
URX-P40(U90) : 941.625MHz - 951.875MHz
953.000MHz - 956.125MHz
956.625MHz - 959.625MHz
IF Frequency : 1st: 243.95 MHz
2nd: 10.8 MHz
LO Frequency : 1st: Receiving frequency + 243.95 MHz
2nd: 233.15 MHz
Antenna type : 1/4 Lambda Monopole antenna

[NFC part] *1)

Radio Type : Transceiver
Modulation type : ASK (amplitude-shift keying)
Frequency of Operation : 13.56 MHz
Method of frequency generation : Crystal unit (SPXO)
Antenna Type : Loop Antenna
Antenna Gain : -63.1 dBi

*1) This test report applies to NFC part.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on June 4, 2019 and effective July 5, 2019 except 15.258

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.225 Operation within the band 13.110 MHz -14.010 MHz.

* The revision on June 4, 2019, does not affect the test specification applied to the EUT.
* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 8.8	Section 15.207 <IC>RSS-Gen 8.8	6.09 dB 0.19524 MHz QP, L, Without Tag	Complied a)	-
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.4, 6.12	Section 15.225(a) <IC>RSS-210 B.6	72.68 dB, 13.56000 MHz, QP, 0 deg.	Complied b)	Radiated
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 6.4, 6.13	Section 15.225(b)(c) <IC> RSS-210 B.6	46.54 dB, 13.11000 MHz, QP	Complied b)	Radiated
20dB Bandwidth	ANSI C63.10:2013 6 Standard test methods <IC> -	Section15.215(c) <IC> -	See data	Complied c)	Radiated
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 6.4, 6.13	Section 15.209, Section 15.225 (d) <IC>RSS-210 B.6	8.68 dB 352.560 MHz, Horizontal, QP	Complied d)	Radiated
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 6.11, 8.11	Section 15.225(e) <IC> RSS-210 B.6	See data	Complied e)	Radiated

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

- a) Refer to APPENDIX 1 (data of Conducted Emission)
b) Refer to APPENDIX 1 (data of Fundamental emission and Spectrum Mask)
c) Refer to APPENDIX 1 (data of 20dB Bandwidth and 99 % Occupied Bandwidth)
d) Refer to APPENDIX 1 (data of Spurious emission)
e) Refer to APPENDIX 1 (data of Frequency Tolerance)

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.

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FCC Part 15.31 (e)

This EUT provides stable voltage constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

However, the supply voltage was varied and tested at 85 % and 115 % of the nominal rated supply voltage during frequency tolerance test according to Section 15.225(e).

FCC Part 15.203 Antenna requirement

The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Band Width	<IC>RSS-Gen 6.7	-	N/A	- a)	Radiated

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

a) Refer to APPENDIX 1 (data of 20dB Bandwidth and 99 % Occupied Bandwidth)

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

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

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

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz to 0.15 MHz	3.8 dB
0.15 MHz to 30 MHz	3.4 dB

Test distance	Radiated emission (+/-)
	9 kHz to 30 MHz
3 m	3.3 dB
10 m	3.2 dB

*Measurement distance

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 MHz to 200 MHz	200 MHz to 1000 MHz	30 MHz to 200 MHz	200 MHz to 1000 MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	5.0 dB	6.3 dB	4.9 dB	5.0 dB

Radiated emission (Above 1 GHz)				
(3 m*)(+/-)		(1 m*)(+/-)		(10 m*)(+/-)
1 GHz to 6 GHz	6 GHz to 18 GHz	10 GHz to 26.5 GHz	26.5 GHz to 40 GHz	1 GHz to 18 GHz
5.0 dB	5.3 dB	5.8 dB	5.8 dB	5.2 dB

* Measurement distance

Antenna terminal test	Uncertainty (+/-)
Frequency error	
13.56 MHz	0.01541 ppm

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3.5 Test Location

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*NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

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)

The mode is used :

Mode	Remarks *1)
1) Transmitting mode (Tx) (USB power Supply/ Battery power Supply/ MI-Shoe power Supply)	The EUT Transmits and Receives at the same time and there is no receiving mode.
The EUT was operated in a manner similar to typical use during the tests. The EUT Transmits and Receives at the same time and there is no receiving mode.	

Test Item	Operating mode *2)
Conducted Emission	Tx Mod on, with Tag, without Tag
Electric Field Strength of Fundamental Emission	Tx Mod on, without Tag*
Spectrum Mask	Tx Mod on, without Tag*
20 dB Bandwidth 99 % Occupied Bandwidth	Tx Mod on, without Tag*
Electric Field Strength of Spurious Emission	Tx Mod on, without Tag*
Frequency Tolerance	Tx Mod off

*1) EUT has 3 kinds of power supply conditions (USB power Supply/ Battery power Supply/ MI-Shoe power Supply) , the tests were performed with the worst case.

*2) After the comparison of the test data between with Tag and without Tag, the tests were performed with the worst case.

Justification: The system was configured in typical fashion (as a user would normally use it) for testing.

Frequency Tolerance:

Temperature : -20 deg. C to +50 deg. C Step 10 deg. C (-30deg.C: Reference)
Voltage : Normal Voltage DC 3 V
(Battery) Maximum Voltage DC 3.45 V,
Minimum Voltage DC 2.55 V (DC 3 V $\pm$ 15 %)

*This EUT provides stable voltage constantly to RF Part regardless of input voltage

Frequency Tolerance:

Temperature : -20 deg. C to +50 deg. C Step 10 deg. C (-30deg.C: Reference)
Voltage : Normal Voltage DC 5 V
(USB) Maximum Voltage DC 5.75 V (DC 5 V +15 %)
Minimum Voltage DC 4.61 V (Minimum Operating Voltage)

*This EUT provides stable voltage constantly to RF Part regardless of input voltage

Frequency Tolerance:

Temperature : -20 deg. C to +50 deg. C Step 10 deg. C (-30deg.C: Reference)
Voltage : Normal Voltage DC 7.2 V
(MI-Shoe) Maximum Voltage DC 8.28 V,
Minimum Voltage DC 6.12 V (DC 7.2 V $\pm$ 15 %)

*This EUT provides stable voltage constantly to RF Part regardless of input voltage

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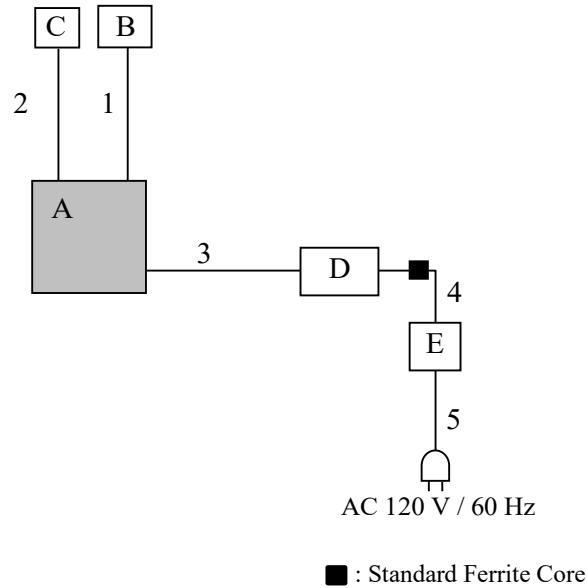
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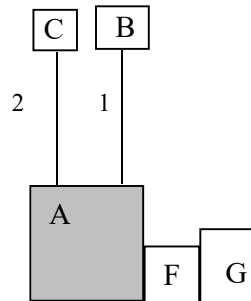
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4.2 Configuration and peripherals

(USB power Supply/ Battery power Supply)



(MI-Shoe power Supply)



* 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	Remark
A	UHF SYNTHESIZED DIVERSITY TUNER	URX-P40	ES No.001	Sony Corporation	EUT
B	47kΩ terminator	-	-	-	-
C	Stereo headphone	MDR-CD380	-	Sony Corporation	-
D	Laptop PC	CF-N8HWCDPS	OBKSA07449	Panasonic	-
E	AC Adapter	CF-AA6372B	6372BM40X17298B	Panasonic	-
F	SHOE MOUNT ADAPTOR	SMAD-P5	ES No.001	Sony Corporation	-
G	Li-ion Battery	NP-FV100	-	Sony Corporation	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Audio Cable	1.5	Shielded	Shielded	-
2	Headphone Cable	3.5	Shielded	Shielded	-
3	USB Cable	1.2	Shielded	Shielded	-
4	DC Cable	1.1	Unshielded	Unshielded	-
5	AC Cable	0.9	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

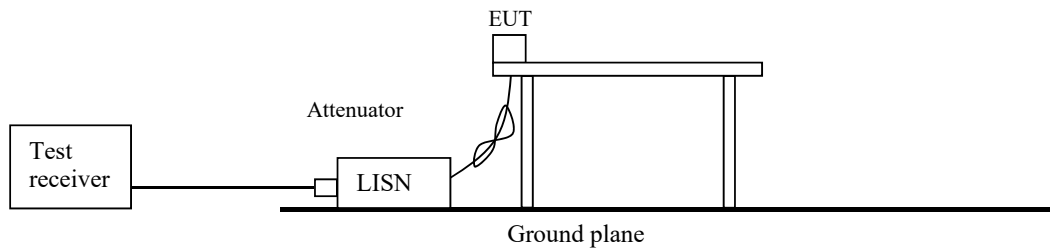
For the tests on EUT with other peripherals (as a whole system)

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

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber. The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

[Test Setup]



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

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

SECTION 6: Radiated emission (Fundamental , Spurious Emission and Spectrum Mask)

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

Frequency: From 9 kHz to 30 MHz

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz

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

The measurements were performed for both vertical and horizontal antenna polarization.

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	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz
Antenna Type	Loop	Biconical	Logperiodic

Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m

*1) Distance Factor: $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

*2) Distance Factor: $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

The test was performed on the worst mode by comparing modes, USB Supply, Battery Supply and MI-Shoe Supply.

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

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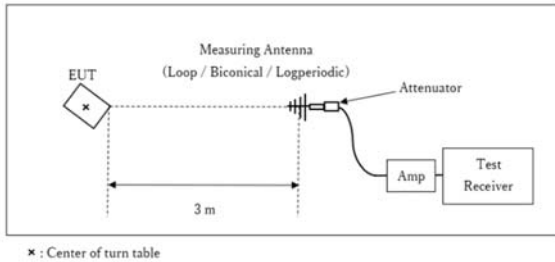
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[Test Setup]
Below 1 GHz



Test Distance: 3 m

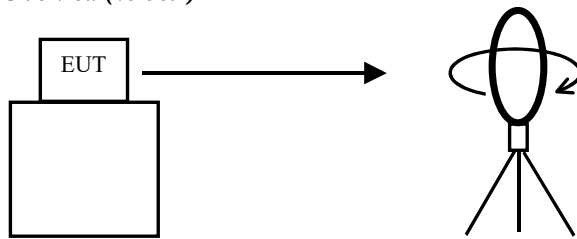
- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

Measurement range : 9 kHz - 1 GHz
Test data : APPENDIX 1
Test result : Pass

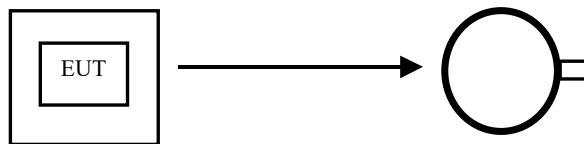
Figure 1: Direction of the Loop Antenna

Side View (Vertical)



.....

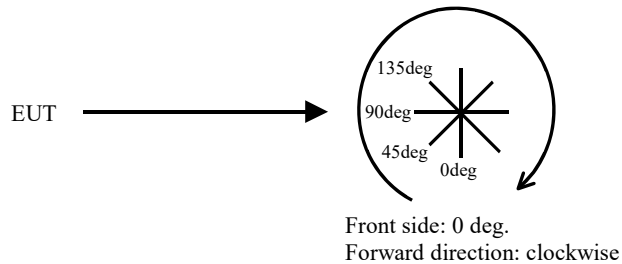
Top View (Horizontal)



Antenna was not rotated.

.....

Top View (Vertical)



SECTION 7: Other test

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	Between 2.0 times and 5.0 times of the OBW	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Between 1.5 times and 5.0 times of the OBW	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Frequency counter
*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %. Peak hold was applied as Worst-case measurement.							

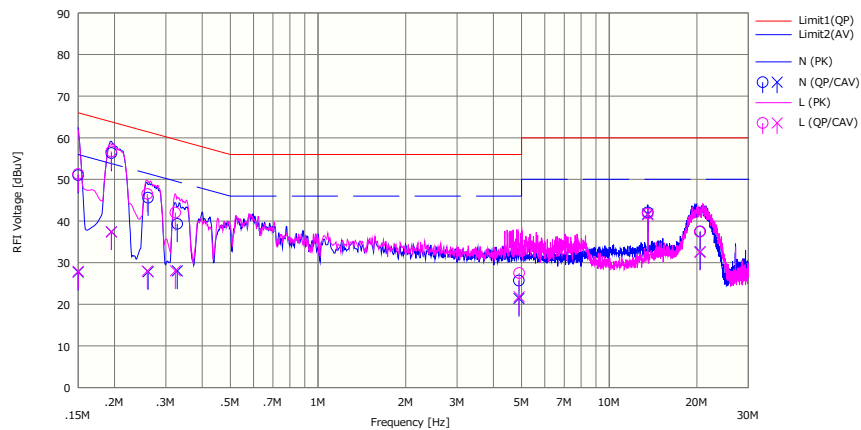
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Report No. 12812924H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date June 1, 2019
Temperature / Humidity 23 deg. C / 58 % RH
Engineer Akihiko Maeda
Mode Mode 1 (with USB power Supply), With Tag

Limit : FCC_Part 15 Subpart C(15.207)



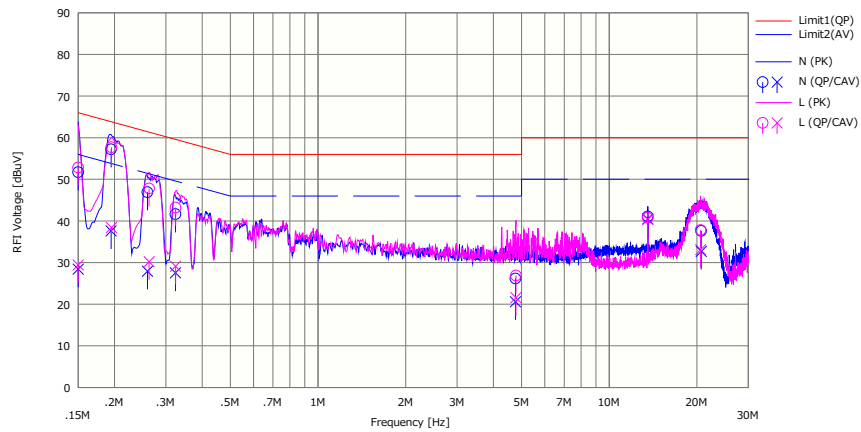
No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		(QP)	(CAV)			(QP)	(CAV)	(QP)	(AV)	(QP)	(AV)		
		[dBuV]	[dBuV]			[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	37.80	14.50	0.06	13.15	51.01	27.71	66.00	56.00	14.99	28.29	N	
2	0.19525	43.10	24.20	0.06	13.15	56.31	37.41	63.80	53.80	7.49	16.39	N	
3	0.26078	32.40	14.60	0.05	13.16	45.61	27.81	61.40	51.40	15.79	23.59	N	
4	0.32861	26.10	14.80	0.05	13.17	39.32	28.02	59.50	49.50	20.18	21.48	N	
5	4.89475	12.10	7.80	0.15	13.44	25.69	21.39	56.00	46.00	30.31	24.61	N	
6	13.56000	28.10	27.70	0.30	13.68	42.08	41.68	60.00	50.00	17.92	8.32	N	Career
7	20.51695	23.30	18.40	0.37	13.84	37.51	32.61	60.00	50.00	22.49	17.39	N	
8	0.15000	38.10	14.70	0.06	13.15	51.31	27.91	66.00	56.00	14.69	28.09	L	
9	0.19497	43.50	24.20	0.06	13.15	56.71	37.41	63.80	53.80	7.09	16.39	L	
10	0.25922	33.30	14.80	0.05	13.16	46.51	28.01	61.50	51.50	14.99	23.49	L	
11	0.32363	28.80	14.80	0.05	13.17	42.02	28.02	59.60	49.60	17.58	21.58	L	
12	4.90661	13.90	8.20	0.15	13.44	27.49	21.79	56.00	46.00	28.51	24.21	L	
13	13.56000	27.80	27.50	0.30	13.68	41.78	41.48	60.00	50.00	18.22	8.52	L	Career
14	20.44495	23.20	18.30	0.37	13.84	37.41	32.51	60.00	50.00	22.59	17.49	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission

Report No. 12812924H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date June 1, 2019
Temperature / Humidity 23 deg. C / 58 % RH
Engineer Akihiko Maeda
Mode Mode 1 (with USB power Supply), Without Tag

Limit : FCC_Part 15 Subpart C(15.207)



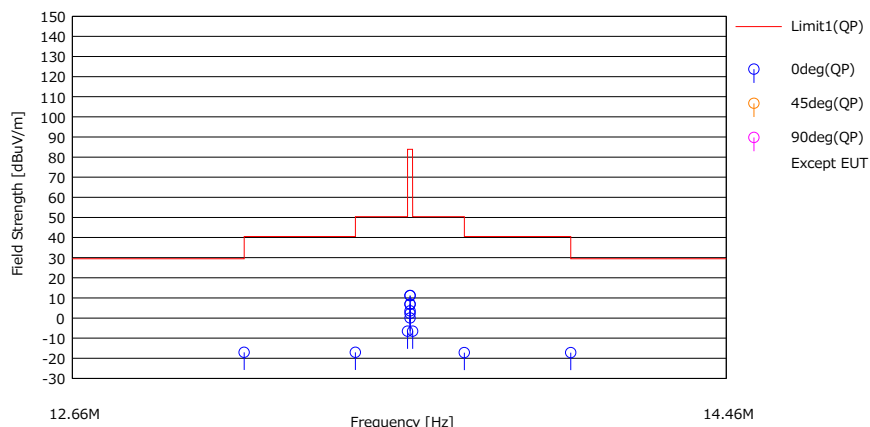
No.	Freq. [MHz]	Reading		USN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<CAV> [dBuV]			<QP> [dBuV]	<CAV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	38.50	15.20	0.06	13.15	51.71	28.41	66.00	56.00	14.29	27.59	N	
2	0.19461	44.00	24.40	0.06	13.15	57.21	37.61	63.80	53.80	6.59	16.19	N	
3	0.25941	33.70	14.70	0.05	13.16	46.91	27.91	61.50	51.50	14.59	23.59	N	
4	0.32394	28.40	14.30	0.05	13.17	41.62	27.52	59.60	49.60	17.98	22.08	N	
5	4.76219	12.60	7.00	0.15	13.43	26.18	20.58	56.00	46.00	29.82	25.42	N	
6	13.56000	27.10	26.50	0.30	13.68	41.08	40.48	60.00	50.00	18.92	9.52	N	Career
7	20.67675	23.40	18.50	0.37	13.84	37.61	32.71	60.00	50.00	22.39	17.29	N	
8	0.15000	39.60	16.20	0.06	13.15	52.81	29.41	66.00	56.00	13.19	26.59	L	
9	0.19524	44.50	25.20	0.06	13.15	57.71	38.41	63.80	53.80	6.09	15.39	L	
10	0.26310	34.60	17.00	0.05	13.16	47.81	30.21	61.30	51.30	13.49	21.09	L	
11	0.32424	30.00	15.90	0.05	13.17	43.22	29.12	59.60	49.60	16.38	20.48	L	
12	4.78033	13.30	8.00	0.15	13.43	26.88	21.58	56.00	46.00	29.12	24.42	L	
13	13.56000	26.80	26.40	0.30	13.68	40.78	40.38	60.00	50.00	19.22	9.62	L	Career
14	20.59655	23.60	18.90	0.37	13.84	37.81	33.11	60.00	50.00	22.19	16.89	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Fundamental emission and Spectrum Mask

Report No. 12812924H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date May 31, 2019
Temperature / Humidity 24 deg. C / 42 % RH
Engineer Akihiko Maeda
Mode Mode 1 (with USB power Supply)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading (QP) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP) [dBuV/m]	Limit (QP) [dBuV/m]	Margin (QP) [dB]	Antenna [deg]	Table [deg]	Comment
1	13.11000	29.20	19.29	-33.30	32.23	-17.04	29.50	46.54	0deg	183	
2	13.41000	29.20	19.26	-33.29	32.23	-17.06	40.50	57.56	0deg	183	
3	13.55300	39.70	19.24	-33.29	32.23	-6.58	50.40	56.98	0deg	183	
4	13.56000	57.50	19.24	-33.29	32.23	11.22	83.90	72.68	0deg	181	0deg
5	13.56000	53.20	19.24	-33.29	32.23	6.92	83.90	76.98	0deg	160	45deg
6	13.56000	49.80	19.24	-33.29	32.23	3.52	83.90	80.38	0deg	269	90deg
7	13.56000	53.10	19.24	-33.29	32.23	6.82	83.90	77.08	0deg	13	135deg
8	13.56000	57.40	19.24	-33.29	32.23	11.12	83.90	72.78	0deg	188	180deg
9	13.56000	46.30	19.24	-33.29	32.23	0.02	83.90	83.88	0deg	190	Horn
10	13.56000	48.50	19.24	-33.29	32.23	2.22	83.90	81.68	0deg	198	0deg with Tag
11	13.56700	39.70	19.24	-33.29	32.23	-6.58	50.40	56.98	0deg	183	
12	13.71000	29.10	19.23	-33.28	32.23	-17.18	40.50	57.68	0deg	183	
13	14.01000	29.10	19.20	-33.27	32.23	-17.20	29.50	46.70	0deg	183	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC,
1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

Result of the fundamental emission at 3 m without Distance factor

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	57.5	19.2	6.7	32.2	-	51.2	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

UL Japan, Inc.

Ise EMC Lab.

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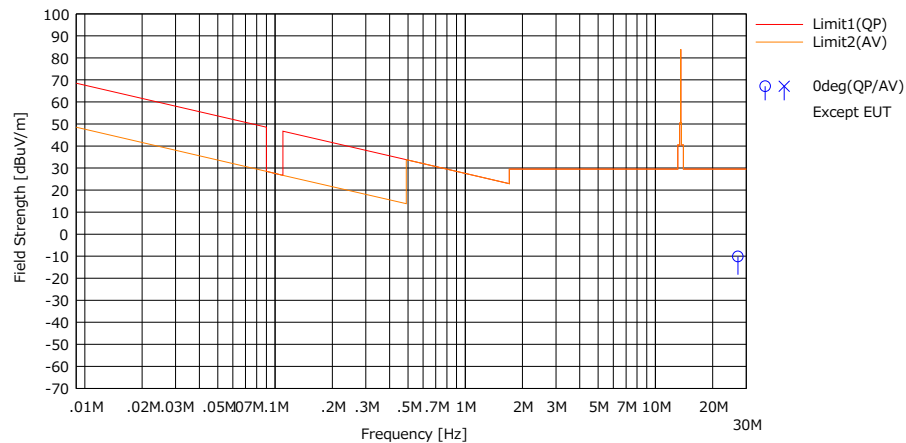
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emission

Report No. 12812924H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date May 31, 2019
Temperature / Humidity 24 deg. C / 42 % RH
Engineer Akihiko Maeda
(Below 30 MHz)
Mode Mode 1 (with USB power Supply)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna	Table	Comment
		(QP) [dBuV]	(AV) [dBuV]				(QP) [dBuV/m]	(AV) [dBuV/m]	(QP) [dBuV/m]	(AV) [dBuV/m]	(QP) [dB]	(AV) [dB]			
1	27.12000	34.90	---	20.13	-32.98	32.22	-10.17	---	29.50	29.50	39.67	---	0deg	181	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC,
1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

UL Japan, Inc.

Ise EMC Lab.

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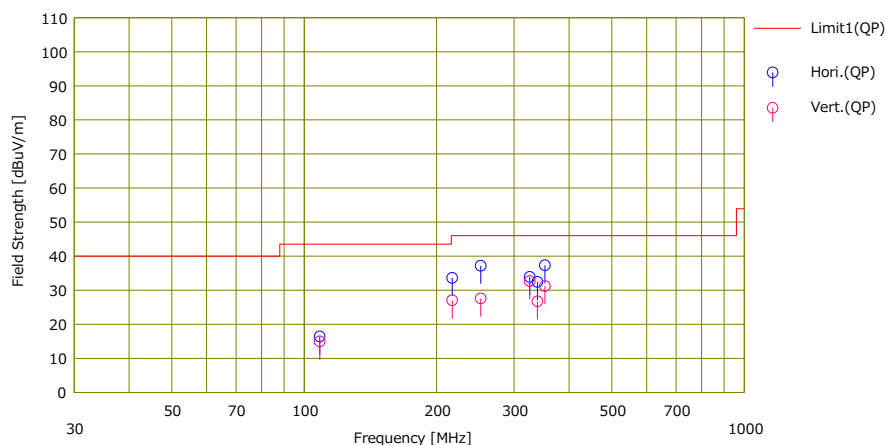
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emission

Report No. 12812924H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date June 1, 2019
Temperature / Humidity 23 deg. C / 58 % RH
Engineer Akihiko Maeda
(Above 30 MHz)
Mode Mode 1 (with MI-Shoe power Supply)

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK



No.	Freq. [MHz]	Reading [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[QP]				[QP]	[QP]	[QP]					
1	108.480	28.80	11.48	8.30	32.14	16.44	43.50	27.06	Hori.	286	154	BA	
2	216.960	45.20	11.04	9.39	32.02	33.61	46.00	12.39	Hori.	147	184	LA2.2	
3	251.903	47.70	11.76	9.69	31.98	37.17	46.00	8.83	Hori.	114	188	LA2.2	
4	325.440	41.20	14.34	10.26	31.93	33.87	46.00	12.13	Hori.	100	166	LA2.2	
5	339.000	39.20	14.79	10.36	31.93	32.42	46.00	13.58	Hori.	100	311	LA2.2	
6	352.560	43.70	15.08	10.47	31.93	37.32	46.00	8.68	Hori.	100	321	LA2.2	
7	108.480	27.30	11.48	8.30	32.14	14.94	43.50	28.56	Vert.	100	353	BA	
8	216.960	38.60	11.04	9.39	32.02	27.01	46.00	18.99	Vert.	182	98	LA2.2	
9	251.903	38.10	11.76	9.69	31.98	27.57	46.00	18.43	Vert.	160	238	LA2.2	
10	325.440	40.00	14.34	10.26	31.93	32.67	46.00	13.33	Vert.	100	266	LA2.2	
11	339.000	33.50	14.79	10.36	31.93	26.72	46.00	19.28	Vert.	100	70	LA2.2	
12	352.560	37.60	15.08	10.47	31.93	31.22	46.00	14.78	Vert.	125	70	LA2.2	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC,
1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

UL Japan, Inc.

Ise EMC Lab.

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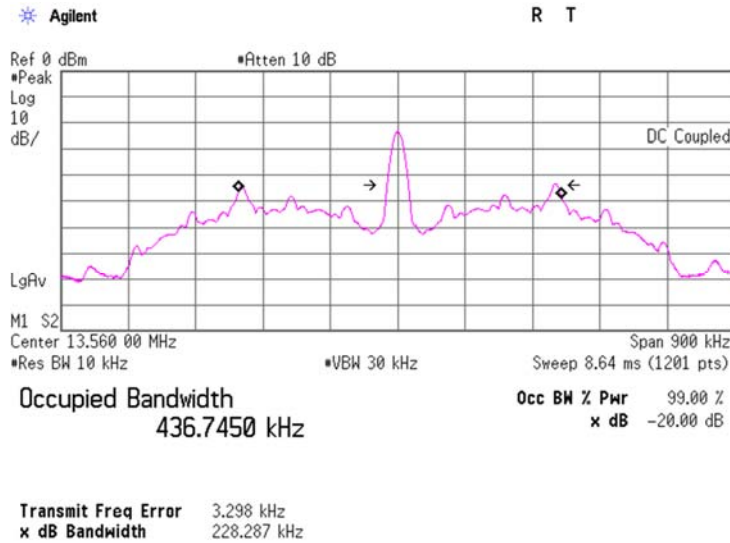
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

20dB Bandwidth and 99 % Occupied Bandwidth

Report No.	12812924H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	June 1, 2019
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Akihiko Maeda
Mode	Mode 1 (with USB power Supply), With Tag

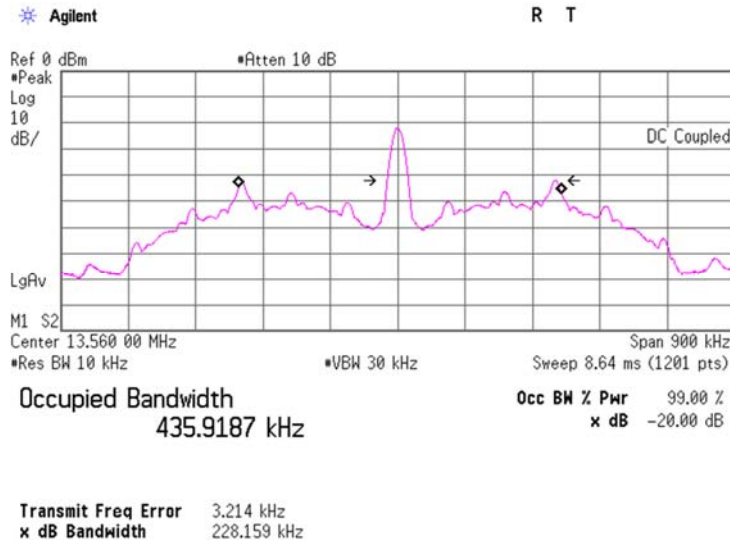
FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	228.29	436.75



20dB Bandwidth and 99 % Occupied Bandwidth

Report No.	12812924H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	June 1, 2019
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Akihiko Maeda
Mode	Mode 1, Without Tag

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	228.16	435.92



Frequency Tolerance

Report No. 12812924H
Test place Ise EMC Lab.
Shielded Room No.6
Date May 31, 2019
Temperature / Humidity 24 deg. C / 45 % RH
Engineer Hiroyuki Furutaka
Mode Mode 1 (with Battery power Supply)

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	3	Power on	13.559974	-0.000026	-0.00019	-1.9	0.01
		+ 2 min.	13.559968	-0.000032	-0.00024	-2.4	0.01
		+ 5 min.	13.559966	-0.000034	-0.00025	-2.5	0.01
		+ 10 min.	13.559966	-0.000034	-0.00025	-2.5	0.01
40	3	Power on	13.560007	0.000007	0.00005	0.5	0.01
		+ 2 min.	13.559993	-0.000007	-0.00005	-0.5	0.01
		+ 5 min.	13.559992	-0.000008	-0.00006	-0.6	0.01
		+ 10 min.	13.559991	-0.000009	-0.00007	-0.7	0.01
30	3	Power on	13.560044	0.000044	0.00032	3.2	0.01
		+ 2 min.	13.560030	0.000030	0.00022	2.2	0.01
		+ 5 min.	13.560030	0.000030	0.00022	2.2	0.01
		+ 10 min.	13.560030	0.000030	0.00022	2.2	0.01
20	3	Power on	13.560060	0.000060	0.00044	4.4	0.01
		+ 2 min.	13.560048	0.000048	0.00035	3.5	0.01
		+ 5 min.	13.560045	0.000045	0.00033	3.3	0.01
		+ 10 min.	13.560044	0.000044	0.00032	3.2	0.01
20	2.55 (3V -15%)	Power on	13.560054	0.000054	0.00040	4.0	0.01
		+ 2 min.	13.560039	0.000039	0.00029	2.9	0.01
		+ 5 min.	13.560039	0.000039	0.00029	2.9	0.01
		+ 10 min.	13.560041	0.000041	0.00030	3.0	0.01
20	3.45 (3V +15%)	Power on	13.560050	0.000050	0.00037	3.7	0.01
		+ 2 min.	13.560041	0.000041	0.00030	3.0	0.01
		+ 5 min.	13.560040	0.000040	0.00029	2.9	0.01
		+ 10 min.	13.560041	0.000041	0.00030	3.0	0.01
10	3	Power on	13.560130	0.000130	0.00096	9.6	0.01
		+ 2 min.	13.560121	0.000121	0.00089	8.9	0.01
		+ 5 min.	13.560119	0.000119	0.00088	8.8	0.01
		+ 10 min.	13.560128	0.000128	0.00094	9.4	0.01
0	3	Power on	13.560169	0.000169	0.00125	12.5	0.01
		+ 2 min.	13.560157	0.000157	0.00116	11.6	0.01
		+ 5 min.	13.560160	0.000160	0.00118	11.8	0.01
		+ 10 min.	13.560161	0.000161	0.00119	11.9	0.01
-10	3	Power on	13.560178	0.000178	0.00131	13.1	0.01
		+ 2 min.	13.560176	0.000176	0.00130	13.0	0.01
		+ 5 min.	13.560178	0.000178	0.00131	13.1	0.01
		+ 10 min.	13.560179	0.000179	0.00132	13.2	0.01
-20	3	Power on	13.560179	0.000179	0.00132	13.2	0.01
		+ 2 min.	13.560179	0.000179	0.00132	13.2	0.01
		+ 5 min.	13.560178	0.000178	0.00131	13.1	0.01
		+ 10 min.	13.560175	0.000175	0.00129	12.9	0.01

Calculation formula: Frequency error = Measured frequency - Tested frequency
Result [%] = Frequency error / Tested frequency * 100

*The test was begun from 50 deg.C and the temperature was lowered each 10 deg.C

Frequency Tolerance

Report No. 12812924H
Test place Ise EMC Lab.
Shielded Room No.6
Date June 2, 2019
Temperature / Humidity 24 deg. C / 45 % RH
Engineer Hiroyuki Furutaka
Mode Mode 1 (with USB power Supply)

Temp. [deg. C]	Test condition Voltage [V]	Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- %]
					[%]	[ppm]	
50	5	Power on	13.559962	-0.000038	-0.00028	-2.8	0.01
		+ 2 min.	13.559958	-0.000042	-0.00031	-3.1	0.01
		+ 5 min.	13.559952	-0.000048	-0.00035	-3.5	0.01
		+ 10 min.	13.559943	-0.000057	-0.00042	-4.2	0.01
40	5	Power on	13.559981	-0.000019	-0.00014	-1.4	0.01
		+ 2 min.	13.559967	-0.000033	-0.00024	-2.4	0.01
		+ 5 min.	13.559962	-0.000038	-0.00028	-2.8	0.01
		+ 10 min.	13.559960	-0.000040	-0.00029	-2.9	0.01
30	5	Power on	13.560021	0.000021	0.00015	1.5	0.01
		+ 2 min.	13.560007	0.000007	0.00005	0.5	0.01
		+ 5 min.	13.559999	-0.000001	-0.00001	-0.1	0.01
		+ 10 min.	13.559997	-0.000003	-0.00002	-0.2	0.01
20	5	Power on	13.560067	0.000067	0.00049	4.9	0.01
		+ 2 min.	13.560043	0.000043	0.00032	3.2	0.01
		+ 5 min.	13.560037	0.000037	0.00027	2.7	0.01
		+ 10 min.	13.560032	0.000032	0.00024	2.4	0.01
20	4.61 (Minimum Operating Voltage)	Power on	13.560080	0.000080	0.00059	5.9	0.01
		+ 2 min.	13.560056	0.000056	0.00041	4.1	0.01
		+ 5 min.	13.560053	0.000053	0.00039	3.9	0.01
		+ 10 min.	13.560053	0.000053	0.00039	3.9	0.01
20	5.75 (5V +15%)	Power on	13.560084	0.000084	0.00062	6.2	0.01
		+ 2 min.	13.560059	0.000059	0.00044	4.4	0.01
		+ 5 min.	13.560049	0.000049	0.00036	3.6	0.01
		+ 10 min.	13.560053	0.000053	0.00039	3.9	0.01
10	5	Power on	13.560134	0.000134	0.00099	9.9	0.01
		+ 2 min.	13.560106	0.000106	0.00078	7.8	0.01
		+ 5 min.	13.560104	0.000104	0.00077	7.7	0.01
		+ 10 min.	13.560103	0.000103	0.00076	7.6	0.01
0	5	Power on	13.560159	0.000159	0.00117	11.7	0.01
		+ 2 min.	13.560139	0.000139	0.00103	10.3	0.01
		+ 5 min.	13.560140	0.000140	0.00103	10.3	0.01
		+ 10 min.	13.560139	0.000139	0.00103	10.3	0.01
-10	5	Power on	13.560163	0.000163	0.00120	12.0	0.01
		+ 2 min.	13.560161	0.000161	0.00119	11.9	0.01
		+ 5 min.	13.560160	0.000160	0.00118	11.8	0.01
		+ 10 min.	13.560163	0.000163	0.00120	12.0	0.01
-20	5	Power on	13.560150	0.000150	0.00111	11.1	0.01
		+ 2 min.	13.560167	0.000167	0.00123	12.3	0.01
		+ 5 min.	13.560165	0.000165	0.00122	12.2	0.01
		+ 10 min.	13.560164	0.000164	0.00121	12.1	0.01

Calculation formula:

Frequency error = Measured frequency - Tested frequency
Result [%] = Frequency error / Tested frequency * 100

*The test was begun from 50 deg.C and the temperature was lowered each 10 deg.C.

** Since the EUT does not operate at voltages below 4.60 V, the voltage confirmation test was performed at 4.61 V as lower limit.

Frequency Tolerance

Report No. 12812924H
Test place Ise EMC Lab.
Shielded Room No.6
Date June 2, 2019
Temperature / Humidity 24 deg. C / 43 % RH
Engineer Tomohisa Nakagawa
Mode Mode 1 (with MI-Shoe power Supply)

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	7.2	Power on	13.559963	-0.000037	-0.00027	-2.7	0.01
		+ 2 min.	13.559948	-0.000052	-0.00038	-3.8	0.01
		+ 5 min.	13.559944	-0.000056	-0.00041	-4.1	0.01
		+ 10 min.	13.559941	-0.000059	-0.00044	-4.4	0.01
40	7.2	Power on	13.559973	-0.000027	-0.00020	-2.0	0.01
		+ 2 min.	13.559972	-0.000028	-0.00021	-2.1	0.01
		+ 5 min.	13.559961	-0.000039	-0.00029	-2.9	0.01
		+ 10 min.	13.559960	-0.000040	-0.00029	-2.9	0.01
30	7.2	Power on	13.560016	0.000016	0.00012	1.2	0.01
		+ 2 min.	13.560000	0.000000	0.00000	0.0	0.01
		+ 5 min.	13.559998	-0.000002	-0.00001	-0.1	0.01
		+ 10 min.	13.559999	-0.000001	-0.00001	-0.1	0.01
20	7.2	Power on	13.560071	0.000071	0.00052	5.2	0.01
		+ 2 min.	13.560051	0.000051	0.00038	3.8	0.01
		+ 5 min.	13.560047	0.000047	0.00035	3.5	0.01
		+ 10 min.	13.560045	0.000045	0.00033	3.3	0.01
20	6.12 (7.2V -15%)	Power on	13.560054	0.000054	0.00040	4.0	0.01
		+ 2 min.	13.560043	0.000043	0.00032	3.2	0.01
		+ 5 min.	13.560043	0.000043	0.00032	3.2	0.01
		+ 10 min.	13.560043	0.000043	0.00032	3.2	0.01
20	8.28 (7.2V +15%)	Power on	13.560054	0.000054	0.00040	4.0	0.01
		+ 2 min.	13.560043	0.000043	0.00032	3.2	0.01
		+ 5 min.	13.560043	0.000043	0.00032	3.2	0.01
		+ 10 min.	13.560043	0.000043	0.00032	3.2	0.01
10	7.2	Power on	13.560113	0.000113	0.00084	8.4	0.01
		+ 2 min.	13.560097	0.000097	0.00071	7.1	0.01
		+ 5 min.	13.560101	0.000101	0.00075	7.5	0.01
		+ 10 min.	13.560105	0.000104	0.00077	7.7	0.01
0	7.2	Power on	13.560166	0.000166	0.00122	12.2	0.01
		+ 2 min.	13.560148	0.000148	0.00109	10.9	0.01
		+ 5 min.	13.560147	0.000147	0.00108	10.8	0.01
		+ 10 min.	13.560146	0.000146	0.00108	10.8	0.01
-10	7.2	Power on	13.560165	0.000165	0.00121	12.1	0.01
		+ 2 min.	13.560163	0.000163	0.00120	12.0	0.01
		+ 5 min.	13.560163	0.000163	0.00120	12.0	0.01
		+ 10 min.	13.560164	0.000163	0.00121	12.1	0.01
-20	7.2	Power on	13.560154	0.000154	0.00114	11.4	0.01
		+ 2 min.	13.560165	0.000165	0.00122	12.2	0.01
		+ 5 min.	13.560163	0.000163	0.00120	12.0	0.01
		+ 10 min.	13.560161	0.000161	0.00119	11.9	0.01

Calculation formula: Frequency error = Measured frequency - Tested frequency
Result [%] = Frequency error / Tested frequency * 100

*The test was begun from 50 deg.C and the temperature was lowered each 10 deg.C.

APPENDIX 2: Test instruments

Test Instruments

Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
FT	141561	Thermo-Hygrometer	CUSTOM	CTH-201	1401	01/11/2019	01/31/2020	12
FT	142523	DC Power Supply	Kikusui	PMX18-2A	VJ000068	-	-	-
FT	141498	Microwave Counter	ADVANTEST	R5373	120100309	06/28/2018	06/30/2019	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/08/2019	02/29/2020	12
RE/CE	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/sucoform141-PE/421-010	-/00640	07/03/2018	07/31/2019	12
RE	141413	Coaxial Cable	UL Japan	-	-	06/12/2018	06/30/2019	12
RE	148897	Attenuator	KEYSIGHT	8491A	MY52462349	12/20/2018	12/31/2019	12
RE	141254	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	10/11/2018	10/31/2019	12
RE/CE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/06/2018	08/31/2019	12
RE	141901	Spectrum Analyzer	AGILENT	E4440A	MY48250080	10/04/2018	10/31/2019	12
RE	141532	DIGITAL HiTESTER	HIOKI	3805	51201197	01/29/2019	01/31/2020	12
RE	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	01/11/2019	01/31/2020	12
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	06/30/2020	24
FT	141430	Temperature and Humidity Chamber	TABAI ESPEC	PL-1KT	14007630	04/09/2019	04/30/2020	12
FT	141547	DIGITAL HiTESTER	HIOKI	3805	60500120	02/25/2019	02/29/2020	12
RE	178648	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	142183	Measure	KOMELON	KMC-36	-	-	-	-
FT	142645	Loop Antenna	UL Japan	-	-	-	-	-
CE	141247	Attenuator (13dB)	JFW Industries, Inc.	50FP-013H2 N	-	12/06/2018	12/31/2019	12
CE	141357	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	07/24/2018	07/31/2019	12
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	05/24/2019	05/31/2020	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	03/25/2019	03/31/2020	12

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***Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

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

FT: Frequency Tolerance