



RADIO TEST REPORT

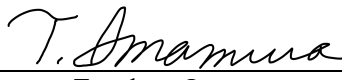
Test Report No. : 12914762S-R2

Applicant : Fukuda Denshi Co., Ltd.
Type of Equipment : ECG, Respiration and SpO₂ Transmitter
Model No. : LX-8300M
FCC ID : DV8LX8300M
Test regulation : FCC Part 95 Subpart H: 2017
FCC Part 2 Subpart J: 2019
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 the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 12914762S-R1. 12914762S-R1 is replaced with this report.

Date of test: July 16 to 22, 2019

Representative test engineer: 
Hiromasa Sato
Engineer
Consumer Technology Division

Approved by: 
Toyokazu Imamura
Leader
Consumer Technology Division



CERTIFICATE 1266.03

- 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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Shonan EMC Lab.

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REVISION HISTORY

Original Test Report No.: 12914762S

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12914762S	August 29, 2019	-	-
1	12914762S-R1	September 20, 2019	4	Correction of Rating: “DC 1.5 V (Battery)” to “DC 3.0 V (Battery)” Correction of Clock frequencies: “13 MHz” to “9.6 MHz”
2	12914762S-R2	November 20, 2019	5	Correction of “Specification” of Item WMTS field strength limits in 3.2: “FCC 95.2369 (b)” to “FCC 95.2369 (a)”
			12-14	Correction of comment in data: “FCC 95.1115(e)” to “FCC 95.2365”

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SECTION 1: Customer information

Company Name : Fukuda Denshi Co., Ltd.
Address : 35-8, Hongo 2-chome, Bunkyo-ku, Tokyo 113-8420, Japan
Telephone Number : +81-3-5684-1300
Facsimile Number : +81-3-5684-1449
Contact Person : Yasuhiro Yonekawa

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No., FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the 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 : ECG, Respiration and SpO₂ Transmitter
Model No. : LX-8300M
Serial No. : Refer to SECTION 4.2
Rating : DC 3.0 V (Battery)
Receipt Date of Sample : July 11, 2019
(Information from test lab.)
Country of Mass-production : Japan
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: LX-8300M (referred to as the EUT in this report) is a ECG, Respiration and SpO₂ Transmitter.

Clock frequency(ies) in the system : 84 kHz, 8 MHz, 9.6 MHz

Radio Specification

Radio Type : Transmitter
Frequency of Operation : 608.0125 MHz - 613.9875 MHz
Modulation : FSK
RF Output Power : 1 mW \pm 2 dB *1)
RF Output Power Limit : 200 mV/m at 3 m (= 106.0 dBuV/m at 3 m)
Antenna type : Cable antenna
Antenna gain : -1.5 dBi
Frequency stability : \pm 2.5 ppm

*1) RF Output Power is fixed as shown in the document "Theory of Operation" and this product is shipped.
(Maximum measurement value was 1.387 mW. Refer to APPENDIX 1.)

Supplied voltage

The EUT is a battery-operated device and test was performed with the new battery. Therefore, the EUT complies with power supply regulation.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test specification : FCC Part 95 Subpart H,
FCC Part 95 final revised on September 20, 2017 and effective October 20, 2017
Title : FCC 47 CFR Part 95 Personal Radio Services
Subpart H Wireless Medical Telemetry Service

Test specification : FCC Part 2 Subpart J,
FCC Part 2 final revised on June 4, 2019
Title : FCC 47 CFR Part 2 Frequency Allocations and Radio Treaty Matters;
General Rules and Regulations
Subpart J Equipment Authorization Procedures

The EUT is used for the purpose of being related with medical treatment. Therefore this device applies to §15.103(e), exempted from FCC Part 15 Subpart B.

3.2 Procedures and results

Item	Test Procedure *1)	Specification	Test method	Worst margin	Results	Remarks
Conducted emissions	ANSI C63.4: 2014	FCC 15.207	-	-	N/A	N/A *2)
WMTS field strength limits	FCC 2.1046, ANSI/TIA-603-E	FCC 95.2369 (a)	Radiated	10.8 dB (Horizontal, QP Mode: Tx 611.0000 MHz)	Complied a)	N/A
WMTS unwanted emissions limits	FCC 2.1053, ANSI/TIA-603-E	FCC 95.2379	Radiated	5.9 dB (614 MHz, Horizontal, QP Mode: Tx 613.9875 MHz)	Complied# a)	N/A
WMTS frequency accuracy	FCC 2.1055, ANSI/TIA-603-E	FCC 95.2365	Radiated	-	Complied b)	N/A
Bandwidth	FCC 2.1049, ANSI/TIA-603-E	Applicant specification	Radiated	-	Complied c)	N/A
Spurious emission at antenna terminals	FCC 2.1051, ANSI/TIA-603-E	-	Conducted	-	N/A	N/A *3)

Note: UL Japan, Inc.'s EMI Work Test Procedure 13-EM-W0420.

*1) These tests were also referred to "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards" (TIA-603-E: 2016).

*2) The test is not applicable since the EUT has no AC mains.

*3) The test is not applicable since the EUT has no antenna terminals.

a) Refer to APPENDIX 1 (data of Field Strength (Radiated Emission))

b) Refer to APPENDIX 1 (data of Bandwidth)

c) Refer to APPENDIX 1 (data of Frequency Stability)

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.

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

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3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the 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 $k=2$.

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Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR	No. 5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.9 dB	2.8 dB	2.9 dB	2.9 dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	3.0 dB	3.1 dB	-	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.7 dB	-	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.1 dB	-	-
	1 GHz-6 GHz	4.8 dB	4.8 dB	4.8 dB	-	-
	6 GHz-18 GHz	5.4 dB	5.4 dB	5.4 dB	-	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB	-	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.81 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.53 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.95 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.21 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.90 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.04 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.3 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.4 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.4 dB
Bandwidth Measurement	0.61 %

3.5 Test Location

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A2LA Certificate Number: 1266.03 (FCC Test Firm Registration Number: 626366, ISED Lab Company Number: 2973D)

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	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)

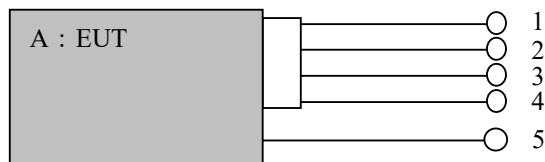
The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

Test item	Operating mode	Tested frequency
All items	Transmitting (Modulated)	608.0125 MHz 611.0000 MHz 613.9875 MHz

Software: V01-01

Power setting: Fixed

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	ECG, Respiration and SpO ₂ Transmitter	LX-8300M	No.1	FUKUDA DENSHI	EUT

List of cables used

No.	Name	Length (m)	Shield (Cable)	Shield (Connector)	Remarks
1	Signal	0.7	Shielded	Shielded	-
2	Signal	0.7	Shielded	Shielded	-
3	Signal	0.7	Shielded	Shielded	-
4	Signal	0.7	Shielded	Shielded	-
5	Signal	0.8	Shielded	Shielded	-

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SECTION 5: Bandwidth & Occupied bandwidth (99 %)

Test procedure

The bandwidth was measured with a spectrum analyzer connected to the antenna port.

Test data : APPENDIX
Test result : Pass

SECTION 6: Frequency Stability

Test procedure

The frequency stability was measured with a spectrum analyzer.
The temperature test was started after the temperature stabilization time of 30 minutes.

Tested temperature was -30 deg.C. to +50 deg.C

* The test result on 50 deg.C., 0 deg.C., -10 deg.C., -20 deg.C, and -30 deg.C were reference data, since the specification of operating temperature of EUT was 10 deg.C to 40 deg.C.
(It used the manufacturer's specified conditions (refer to FCC 95.2365))

Test data : APPENDIX
Test result : Pass

SECTION 7: Field Strength (Fundamental Emission & Out of band emissions)

Test Procedure

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 expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane, and at a distance of 3 m.

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

Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

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.

Frequency	Below 1 GHz	Above 1 GHz
Instrument used	Test Receiver	Spectrum Analyzer *1)
Detector IF Bandwidth	QP: RBW 200 Hz (9 kHz -150 kHz), QP: RBW 9 kHz (150 kHz -30 MHz), QP: BW 120 kHz (30 MHz – 1000 MHz),	AV: RBW: 1 MHz VBW: 10 Hz (No pulse emission detected)
Measuring antenna	Loop (9 kHz – 30 MHz), Biconical (30 MHz - 200 MHz) Logperiodic (200 MHz - 1 GHz)	Horn

*1) When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

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: Refer to the data.

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

Band edge

To determine the level of band-edge spurious, we use the following procedure:

Set the resolution bandwidth to 1 kHz in the peak detector mode.

Because we don't want to include in-band emission at BandEdge measurement if center frequencies are "608.0125 MHz" or "613.9875 MHz" and BandEdges are "608 MHz" or "614 MHz".

(The supplementation: There are some granted test report that were measured by 3 kHz RBW for the equipment that has 350 kHz for 26 dB bandwidth in similar case.)

We used RBW = 1 kHz (greater than 1 % bandwidth) to prevent to detect in-band emission. Refer to KDB 971168 D01 (971168 D01 Power Meas License Digital Systems v03r01).

Measure the maximum level of the in-band channel closest to the band edge and the maximum level of the out-of-band emissions close to the same band edge.

Determine the ratio of the in-band signal to the out-of-band emissions. Then, measure the level of the in-band channel in CISPR quasi-peak mode with 120 kHz bandwidth. Using the ratio obtained, we calculate the equivalent level of the out-of-band emissions to determine compliance with the limits.

The emission tests, except for the band edge, were performed with the quasi-peak mode of the spectrum analyzer. (Bandwidth: 1 MHz)

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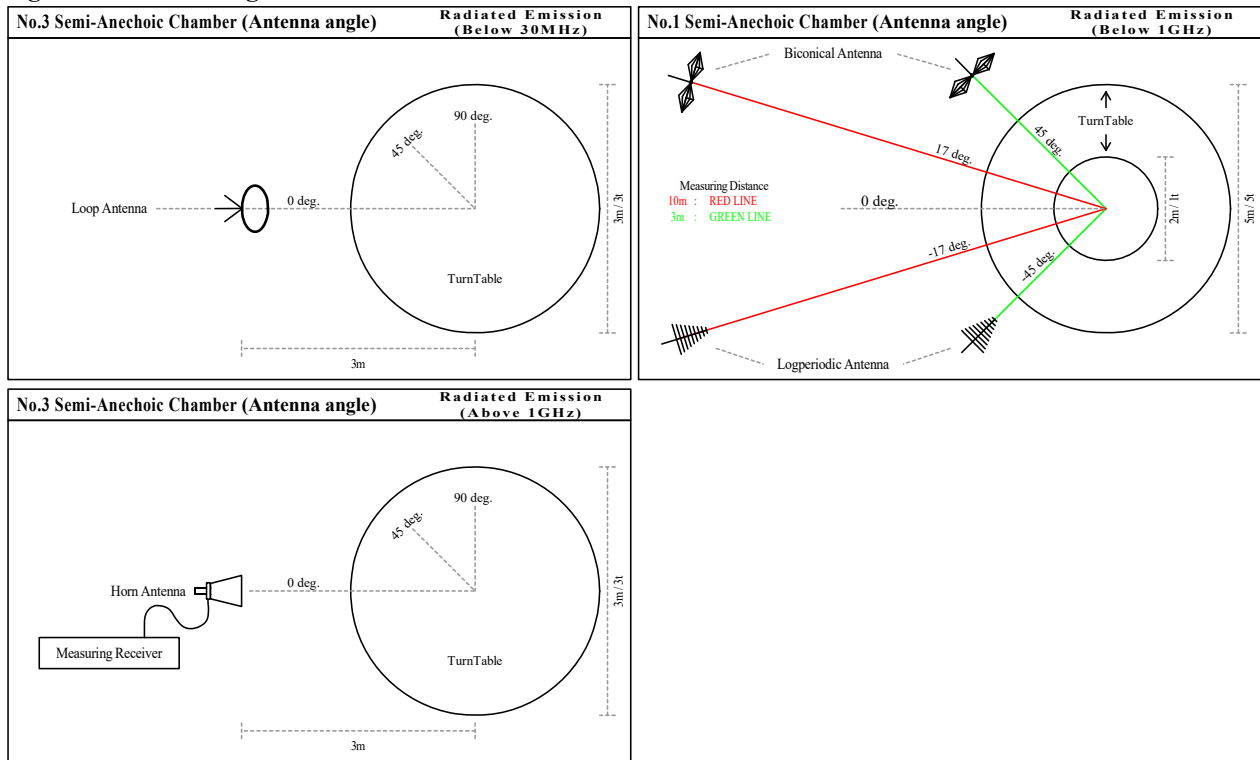
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Figure 1. Antenna angle



Measurement range : 9 kHz - 7 GHz
Test data : APPENDIX
Test result : Pass
 * No noise from radio part was detected in 9 kHz to 30 MHz.

APPENDIX 1: Data of Radio tests

Frequency Stability

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date July 18, 2019 July 22, 2019
 Temperature / Humidity 26 deg.C / 48 %RH 25 deg.C / 37 %RH
 Engineer Hiromasa Sato Hiromasa Sato
 Mode Transmitting

Test Condition deg.C Voltage	Test Timing	Measured frequency [MHz]	Frequency error [MHz]	Result [ppm]	Limit [+/- ppm]	Margin [ppm]		
20 deg.C	DC 1.88 V (Vmin)	Power on	608.012759	0.000259	0.43	2.50	2.07	
		on 2 min.	608.012840	0.000340	0.56	2.50	1.94	
		on 5 min.	608.012780	0.000280	0.46	2.50	2.04	
		on 10 min.	608.012795	0.000295	0.49	2.50	2.01	
	DC 3.0 V (Vnom)	Power on	608.012771	0.000270	0.44	2.50	2.06	
		on 2 min.	608.012902	0.000402	0.66	2.50	1.84	
		on 5 min.	608.012923	0.000423	0.69	2.50	1.81	
		on 10 min.	608.012778	0.000278	0.46	2.50	2.04	
		50 deg.C.	DC 3.0 V	Power on	608.012724	0.000223	0.37	-
on 2 min.	608.012720			0.000219	0.36	-	-	
on 5 min.	608.012707			0.000206	0.34	-	-	
on 10 min.	608.012638			0.000137	0.23	-	-	
40 deg.C.	DC 3.0 V		Power on	608.012577	0.000077	0.13	2.50	2.37
			on 2 min.	608.012550	0.000049	0.08	2.50	2.42
			on 5 min.	608.012576	0.000075	0.12	2.50	2.38
on 10 min.			608.012544	0.000044	0.07	2.50	2.43	
30 deg.C.	DC 3.0 V		Power on	608.012925	0.000425	0.70	2.50	1.80
			on 2 min.	608.012864	0.000364	0.60	2.50	1.90
			on 5 min.	608.012849	0.000349	0.57	2.50	1.93
on 10 min.			608.012911	0.000410	0.68	2.50	1.82	
20 deg.C.	DC 3.0 V	Power on	608.013104	0.000603	0.99	2.50	1.51	
		on 2 min.	608.013082	0.000582	0.96	2.50	1.54	
		on 5 min.	608.013016	0.000516	0.85	2.50	1.65	
		on 10 min.	608.013083	0.000583	0.96	2.50	1.54	
10 deg.C.	DC 3.0 V	Power on	608.013153	0.000652	1.07	2.50	1.43	
		on 2 min.	608.013191	0.000691	1.14	2.50	1.36	
		on 5 min.	608.013155	0.000654	1.08	2.50	1.42	
		on 10 min.	608.013146	0.000646	1.06	2.50	1.44	
0 deg.C.	DC 3.0 V	Power on	608.012900	0.000399	0.66	-	-	
		on 2 min.	608.012950	0.000450	0.74	-	-	
		on 5 min.	608.012857	0.000357	0.59	-	-	
		on 10 min.	608.012700	0.000200	0.33	-	-	
-10deg.C.	DC 3.0 V	Power on	608.012043	-0.000457	-0.75	-	-	
		on 2 min.	608.012048	-0.000452	-0.74	-	-	
		on 5 min.	608.011880	-0.000621	-1.02	-	-	
		on 10 min.	608.011834	-0.000667	-1.10	-	-	
-20 deg.C	DC 3.0 V	Power on	608.010201	-0.002299	-3.78	-	-	
		on 2 min.	608.010691	-0.001810	-2.98	-	-	
		on 5 min.	608.010106	-0.002395	-3.94	-	-	
		on 10 min.	608.008266	-0.004235	-6.96	-	-	
-30 deg.C	DC 3.0 V	Power on	608.006110	-0.006391	-10.51	-	-	
		on 2 min.	608.007097	-0.005403	-8.89	-	-	
		on 5 min.	608.005354	-0.007147	-11.75	-	-	
		on 10 min.	608.003628	-0.008873	-14.59	-	-	

Limit : 608.0125 MHz +/-0.00025 % (+/-2.5 ppm) = +/- 0.001520 MHz

*The test on 50deg.C., 0deg.C., -10deg.C., and -20deg.C. were not apply, since the specification of operating temperature of EUT was 10deg.C to 40deg.C. (It used the manufacturer's specified conditions (refer to FCC 95.2365))

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Frequency Stability

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	July 18, 2019	July 22, 2019
Temperature / Humidity	26 deg.C / 48 %RH	25 deg.C / 37 %RH
Engineer	Hiomasa Sato	Hiomasa Sato
Mode	Transmitting	

Test Condition deg.C	Voltage	Test Timing	Measured frequency [MHz]	Frequency error [MHz]	Result	Limit	Margin
					[ppm]	[+/- ppm]	[ppm]
20 deg.C	DC 1.88 V (Vmin)	Power on	611.000263	0.000263	0.43	2.50	2.07
		on 2 min.	611.000286	0.000286	0.47	2.50	2.03
		on 5 min.	611.000269	0.000269	0.44	2.50	2.06
		on 10 min.	611.000271	0.000270	0.44	2.50	2.06
	DC 3.0 V (Vnom)	Power on	611.000361	0.000360	0.59	2.50	1.91
		on 2 min.	611.000162	0.000162	0.27	2.50	2.23
		on 5 min.	611.000323	0.000323	0.53	2.50	1.97
		on 10 min.	611.000263	0.000263	0.43	2.50	2.07
50 deg.C.	DC 3.0 V	Power on	611.000034	0.000034	0.06	-	-
		on 2 min.	611.000102	0.000102	0.17	-	-
		on 5 min.	611.000244	0.000244	0.40	-	-
		on 10 min.	611.000087	0.000086	0.14	-	-
40 deg.C.	DC 3.0 V	Power on	611.000152	0.000152	0.25	2.50	2.25
		on 2 min.	611.000117	0.000117	0.19	2.50	2.31
		on 5 min.	611.000098	0.000098	0.16	2.50	2.34
		on 10 min.	611.000083	0.000083	0.14	2.50	2.36
30 deg.C.	DC 3.0 V	Power on	611.000344	0.000343	0.56	2.50	1.94
		on 2 min.	611.000237	0.000237	0.39	2.50	2.11
		on 5 min.	611.000310	0.000309	0.51	2.50	1.99
		on 10 min.	611.000258	0.000257	0.42	2.50	2.08
20 deg.C.	DC 3.0 V	Power on	611.000547	0.000546	0.89	2.50	1.61
		on 2 min.	611.000610	0.000610	1.00	2.50	1.50
		on 5 min.	611.000623	0.000623	1.02	2.50	1.48
		on 10 min.	611.000485	0.000485	0.79	2.50	1.71
10 deg.C.	DC 3.0 V	Power on	611.000673	0.000673	1.10	2.50	1.40
		on 2 min.	611.000627	0.000626	1.03	2.50	1.47
		on 5 min.	611.000662	0.000661	1.08	2.50	1.42
		on 10 min.	611.000671	0.000671	1.10	2.50	1.40
0 deg.C.	DC 3.0 V	Power on	611.000590	0.000589	0.96	-	-
		on 2 min.	611.000464	0.000464	0.76	-	-
		on 5 min.	611.000344	0.000344	0.56	-	-
		on 10 min.	611.000179	0.000179	0.29	-	-
-10deg.C.	DC 3.0 V	Power on	610.998823	-0.001178	-1.93	-	-
		on 2 min.	610.998819	-0.001181	-1.93	-	-
		on 5 min.	610.998823	-0.001178	-1.93	-	-
		on 10 min.	610.998841	-0.001159	-1.90	-	-
-20 deg.C	DC 3.0 V	Power on	610.996745	-0.003256	-5.33	-	-
		on 2 min.	610.997668	-0.002332	-3.82	-	-
		on 5 min.	610.997021	-0.002979	-4.88	-	-
		on 10 min.	610.995910	-0.004090	-6.69	-	-
-30 deg.C	DC 3.0 V	Power on	610.991282	-0.008718	-14.27	-	-
		on 2 min.	610.991080	-0.008920	-14.60	-	-
		on 5 min.	610.990932	-0.009069	-14.84	-	-
		on 10 min.	610.990887	-0.009114	-14.92	-	-

Limit : 611 MHz +/-0.00025 % (+/-2.5 ppm) = +/- 0.001528 MHz

*The test on 50deg.C., 0deg.C., -10deg.C., and -20deg.C. were not apply, since the specification of operating temperature of EUT was 10deg.C to 40deg.C. (It used the manufacturer's specified conditions (refer to FCC 95.2365))

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Frequency Stability

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	July 18, 2019	July 22, 2019
Temperature / Humidity	26 deg.C / 48 %RH	25 deg.C / 37 %RH
Engineer	Hiomasa Sato	Hiomasa Sato
Mode	Transmitting	

Test Condition deg.C	Voltage	Test Timing	Measured frequency [MHz]	Frequency error [MHz]	Result [ppm]	Limit [+/- ppm]	Margin [ppm]
20 deg.C	DC 1.88 V (Vmin)	Power on	613.987763	0.000263	0.43	2.50	2.07
		on 2 min.	613.987870	0.000370	0.60	2.50	1.90
		on 5 min.	613.987889	0.000389	0.63	2.50	1.87
		on 10 min.	613.987904	0.000404	0.66	2.50	1.84
	DC 3.0 V (Vnom)	Power on	613.988044	0.000544	0.89	2.50	1.61
		on 2 min.	613.988065	0.000565	0.92	2.50	1.58
		on 5 min.	613.987951	0.000451	0.73	2.50	1.77
		on 10 min.	613.988082	0.000582	0.95	2.50	1.55
50 deg.C.	DC 3.0 V	Power on	613.987576	0.000076	0.12	-	-
		on 2 min.	613.987632	0.000131	0.21	-	-
		on 5 min.	613.987613	0.000113	0.18	-	-
		on 10 min.	613.987643	0.000143	0.23	-	-
40 deg.C.	DC 3.0 V	Power on	613.987587	0.000087	0.14	2.50	2.36
		on 2 min.	613.987686	0.000186	0.30	2.50	2.20
		on 5 min.	613.987602	0.000102	0.17	2.50	2.33
		on 10 min.	613.987778	0.000278	0.45	2.50	2.05
30 deg.C.	DC 3.0 V	Power on	613.987810	0.000309	0.50	2.50	2.00
		on 2 min.	613.987823	0.000323	0.53	2.50	1.97
		on 5 min.	613.987802	0.000302	0.49	2.50	2.01
		on 10 min.	613.987836	0.000336	0.55	2.50	1.95
20 deg.C.	DC 3.0 V	Power on	613.987992	0.000492	0.80	2.50	1.70
		on 2 min.	613.988064	0.000564	0.92	2.50	1.58
		on 5 min.	613.988029	0.000529	0.86	2.50	1.64
		on 10 min.	613.988019	0.000518	0.84	2.50	1.66
10 deg.C.	DC 3.0 V	Power on	613.988199	0.000698	1.14	2.50	1.36
		on 2 min.	613.988176	0.000676	1.10	2.50	1.40
		on 5 min.	613.988184	0.000684	1.11	2.50	1.39
		on 10 min.	613.988089	0.000589	0.96	2.50	1.54
0 deg.C.	DC 3.0 V	Power on	613.987805	0.000305	0.50	-	-
		on 2 min.	613.987874	0.000374	0.61	-	-
		on 5 min.	613.987778	0.000278	0.45	-	-
		on 10 min.	613.987750	0.000250	0.41	-	-
-10deg.C.	DC 3.0 V	Power on	613.987163	-0.000337	-0.55	-	-
		on 2 min.	613.987163	-0.000337	-0.55	-	-
		on 5 min.	613.987222	-0.000278	-0.45	-	-
		on 10 min.	613.986995	-0.000505	-0.82	-	-
-20 deg.C	DC 3.0 V	Power on	613.983525	-0.003976	-6.47	-	-
		on 2 min.	613.983512	-0.003988	-6.50	-	-
		on 5 min.	613.983179	-0.004321	-7.04	-	-
		on 10 min.	613.983319	-0.004181	-6.81	-	-
-30 deg.C	DC 3.0 V	Power on	613.982660	-0.004840	-7.88	-	-
		on 2 min.	613.981882	-0.005618	-9.15	-	-
		on 5 min.	613.980462	-0.007038	-11.46	-	-
		on 10 min.	613.979453	-0.008047	-13.11	-	-

Limit : 613.9875 MHz +/-0.00025 % (+/-2.5 ppm) = +/- 0.001535 MHz

*The test on 50deg.C., 0deg.C., -10deg.C., and -20deg.C. were not apply, since the specification of operating temperature of EUT was 10deg.C to 40deg.C. (It used the manufacturer's specified conditions (refer to FCC 95.2365))

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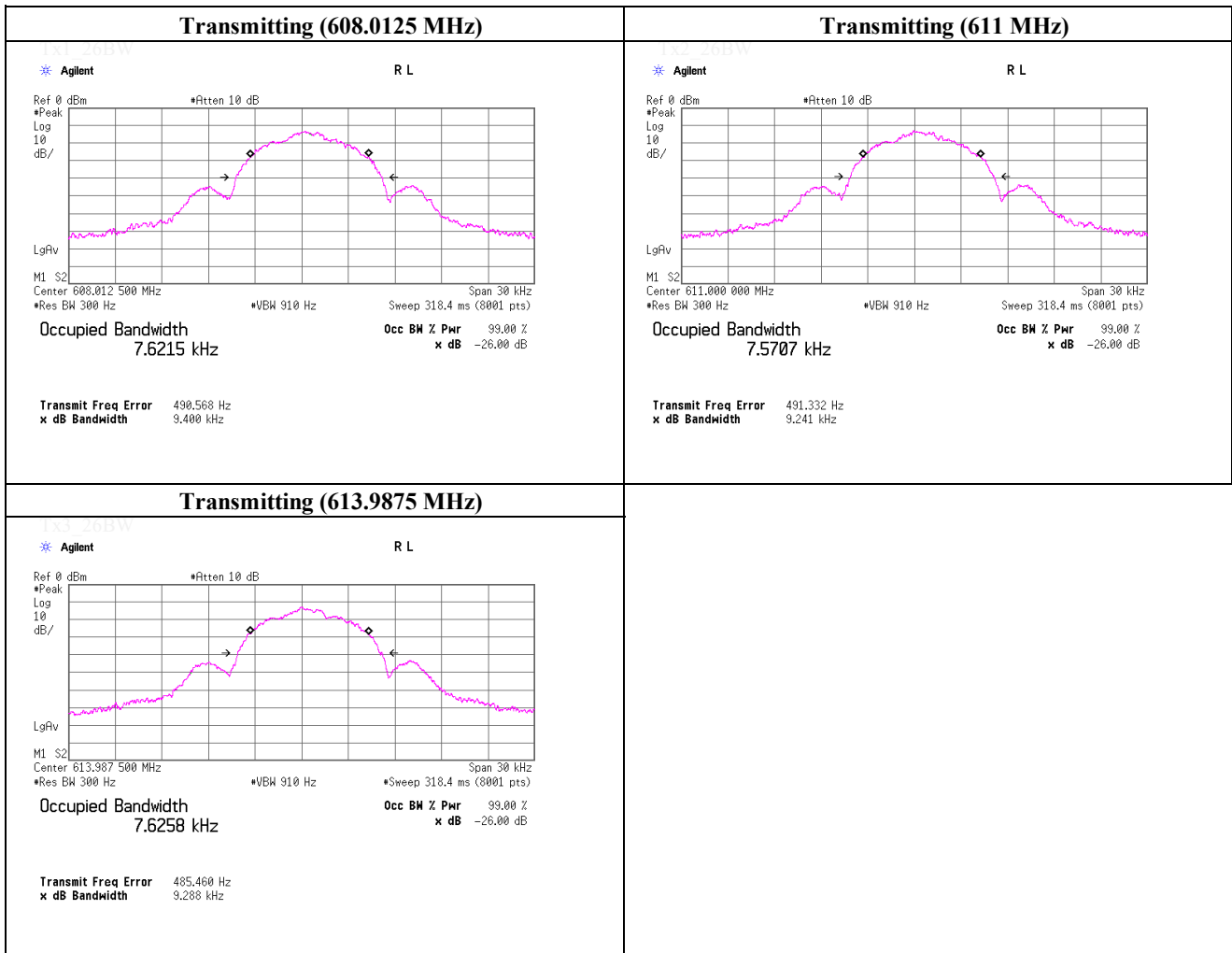
Facsimile : +81 463 50 6401

-26 dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	July 18, 2019	
Temperature / Humidity	26 deg.C / 48 %RH	
Engineer	Hiomasa Sato	
Mode	Transmitting	

Freq. [MHz]	-26 dB Bandwidth [kHz]
608.0125	9.400
611.0000	9.241
613.9875	9.288

No limit applies to -26 dB Bandwidth.

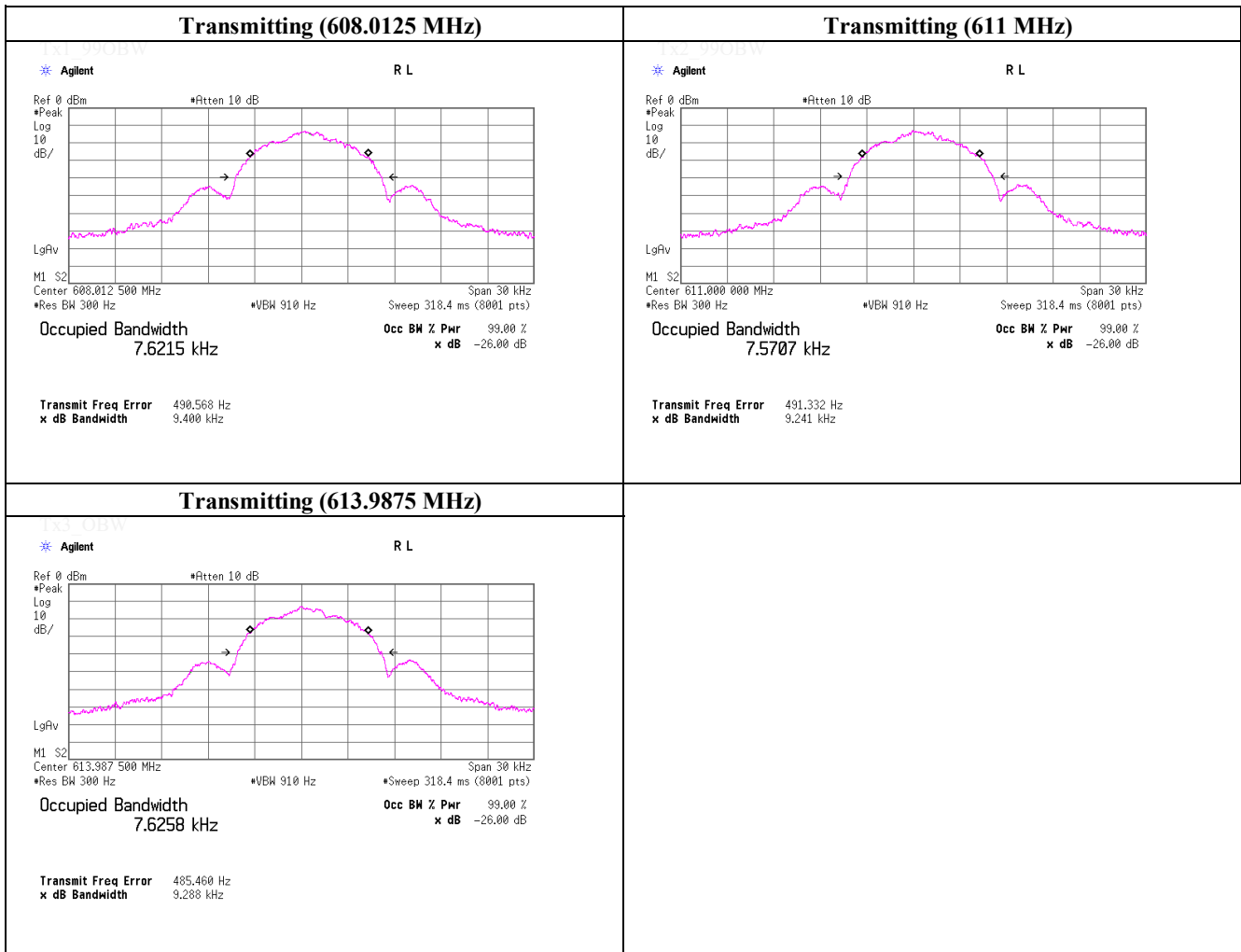


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99 % Occupied Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	July 18, 2019	
Temperature / Humidity	26 deg.C / 48 %RH	
Engineer	Hiromasa Sato	
Mode	Transmitting	

Freq. [MHz]	99 % Occupied Bandwidth [kHz]
608.0125	7.6215
611.0000	7.5707
613.9875	7.6258



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**Field Strength(Electric Field Strength of Fundamental Emission ,
Spurious Emission and Band Edge Compliance)**

Test place UL Japan, Inc. Shonan EMC Lab.
 No.3 Semi Anechoic Chamber No.1 Semi Anechoic Chamber No.3 Semi Anechoic Chamber
 Date July 22, 2019 July 16, 2019 July 17, 2019
 Temperature / Humidity 22 deg.C / 53 %RH 23 deg.C / 68 %RH 21 deg.C / 60 %RH
 Engineer Takahiro Kawakami Hiromasa Sato Hiromasa Sato
 (9 kHz - 30 MHz) (30 MHz - 1000 MHz) (1 GHz - 7 GHz)
 Mode Tx, 608.0125 MHz EUT worst axis: below 1 GHz Hori: X, Vert: Y / above 1 GHz Hori: X,Vert: Y
 Antenna worst axis: below 1 GHz Hori: X, Vert: X / above 1 GHz Hori: X,Vert: X

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	70.569	QP	35.7	6.5	7.6	31.8	17.9	46.0	28.0	310	175	
Hori.	275.690	QP	46.7	13.2	6.9	31.8	35.1	46.0	10.9	146	4	
Hori.	608.000	QP	41.9	19.5	8.6	32.0	38.0	46.0	7.9	178	166	(Refer to Marker Delta Method)
Hori.	608.013	QP	95.9	19.5	8.6	32.0	92.0	106.0	14.0	178	166	Carrier
Hori.	1216.025	AV	57.2	25.0	3.8	41.0	44.9	53.9	9.0	100	337	VBW:10Hz
Hori.	1824.037	AV	50.7	25.3	3.5	41.3	38.2	53.9	15.7	108	345	VBW:10Hz
Hori.	2432.050	AV	52.3	27.8	4.2	41.6	42.8	53.9	11.1	186	352	VBW:10Hz
Hori.	3040.063	AV	46.0	28.7	4.7	41.8	37.6	53.9	16.2	102	248	VBW:10Hz
Hori.	3648.075	AV	47.6	29.1	4.8	42.1	39.4	53.9	14.4	118	46	VBW:10Hz
Hori.	4256.087	AV	49.3	30.0	5.1	42.5	41.9	53.9	11.9	112	178	VBW:10Hz
Hori.	4864.100	AV	47.9	31.4	5.4	42.9	41.8	53.9	12.0	110	175	VBW:10Hz
Hori.	5472.112	AV	47.6	32.1	5.9	43.3	42.2	53.9	11.6	111	155	VBW:10Hz
Hori.	6080.125	AV	46.6	33.1	6.2	43.4	42.5	53.9	11.3	100	95	VBW:10Hz
Vert.	70.586	QP	28.9	6.5	7.6	31.8	11.2	46.0	34.7	100	26	
Vert.	281.818	QP	33.2	13.4	7.0	31.8	21.9	46.0	24.1	194	308	
Vert.	608.000	QP	38.5	19.5	8.6	32.0	34.6	46.0	11.4	180	298	(Refer to Marker Delta Method)
Vert.	608.013	QP	93.4	19.5	8.6	32.0	89.5	106.0	16.4	180	298	Carrier
Vert.	1216.025	AV	56.6	25.0	3.8	41.0	44.2	53.9	9.6	142	0	VBW:10Hz
Vert.	1824.037	AV	50.6	25.3	3.5	41.3	38.1	53.9	15.8	107	36	VBW:10Hz
Vert.	2432.050	AV	51.5	27.8	4.2	41.6	41.9	53.9	11.9	125	320	VBW:10Hz
Vert.	3040.063	AV	43.1	28.7	4.7	41.8	34.7	53.9	19.1	211	272	VBW:10Hz
Vert.	3648.075	AV	45.2	29.1	4.8	42.1	37.0	53.9	16.8	100	6	VBW:10Hz
Vert.	4256.087	AV	47.8	30.0	5.1	42.5	40.4	53.9	13.4	105	179	VBW:10Hz
Vert.	4864.100	AV	47.2	31.4	5.4	42.9	41.1	53.9	12.7	113	242	VBW:10Hz
Vert.	5472.112	AV	51.0	32.1	5.9	43.3	45.6	53.9	8.3	123	232	VBW:10Hz
Vert.	6080.125	AV	48.9	33.1	6.2	43.4	44.9	53.9	9.0	111	233	VBW:10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)
 *Other frequency noises omitted in this report were not seen or have enough margin (more than 20 dB).
 *The 10th harmonic was not seen so the result was its base noise level.

(for RF Exposure sheet)
 [RF output power]

	Result [dBuV/m]	Result [mW]
carrier	92.0	0.665
Level		

Calculation:
 Result [mW] = (((10^(Result [dBuV/m] / 20)) x 10^(-6)) x (distance=) 3 [m]) ^2) / (30 x (gain=) 10^(-1.5 dB / 10)) x 10^3

Marker Delta Method(Test distance 3 m)

	Polarity	AV				
		Hor.		Ver.		
		[dBuV]	[dBuV/m]	[dBuV]	[dBuV/m]	
Step1	Fundamental(608.0125 MHz)	QP	95.9	92.0	93.4	89.5
Step2	Fundamental(608.0125 MHz)	1 kHz/3 kHz	97.4	93.5	95.0	91.1
	Band-edge(608 MHz)	1 kHz/3 kHz	43.5	39.6	40.0	36.1
	Amplitude delta	-	53.9	53.9	55.0	55.0
Step3	Field strength of band-edge	-	-	38.0	-	34.6
	Limit	-	-	53.9	-	53.9
	Margin	-	-	15.9	-	19.3

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)
 *1 Amplitude delta = Fundamental(RBW:1 kHz,VBW:3 kHz) - Band-edge(RBW:1 kHz,VBW:3 kHz)
 *2 Field strength of band-edge = Fundamental(AV) - Amplitude delta
 *As we stated at section 7 ("Bandedge" section), we used RBW = 1 kHz (greater than 1 % bandwidth) to prevent to detect in-band emission. Refer to KDB 971168 D01 (KDB 971168 D01 Power Meas Licence Digital System D03r01).

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**Field Strength(Electric Field Strength of Fundamental Emission ,
Spurious Emission and Band Edge Compliance)**

Test place UL Japan, Inc. Shonan EMC Lab.
 No.3 Semi Anechoic Chamber No.1 Semi Anechoic Chamber No.3 Semi Anechoic Chamber
 Date July 22, 2019 July 16, 2019 July 17, 2019
 Temperature / Humidity 22 deg.C / 53 %RH 23 deg.C / 68 %RH 21 deg.C / 60 %RH
 Engineer Takahiro Kawakami Hiromasa Sato Hiromasa Sato
 (9 kHz - 30 MHz) (30 MHz - 1000 MHz) (1 GHz - 7 GHz)
 Mode Tx, 613.9875 MHz EUT worst axis: below 1 GHz Hori: X, Vert: Y / above 1 GHz Hori: X,Vert: Y
 Antenna worst axis: below 1 GHz Hori: X, Vert: X / above 1 GHz Hori: X,Vert: X

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	69.407	QP	32.4	6.6	7.5	31.8	14.7	46.0	31.2	364	90	
Hori.	282.382	QP	47.3	13.4	7.0	31.8	36.0	46.0	10.0	111	0	
Hori.	613.988	QP	97.4	19.5	8.6	32.0	93.6	106.0	12.4	178	276	Carrier
Hori.	614.000	QP	43.9	19.5	8.6	32.0	40.1	46.0	5.9	178	276	(Refer to Marker Delta Method)
Hori.	1227.975	AV	56.6	25.0	3.8	41.0	44.3	53.9	9.6	143	343	VBW:10Hz
Hori.	1841.963	AV	46.8	25.3	3.6	41.3	34.3	53.9	19.5	103	290	VBW:10Hz
Hori.	2455.950	AV	54.0	27.8	4.3	41.6	44.4	53.9	9.4	106	350	VBW:10Hz
Hori.	3069.938	AV	48.1	28.8	4.7	41.9	39.7	53.9	14.1	105	282	VBW:10Hz
Hori.	3683.925	AV	46.4	29.2	4.8	42.1	38.3	53.9	15.6	102	252	VBW:10Hz
Hori.	4297.913	AV	46.7	30.1	5.1	42.5	39.4	53.9	14.5	100	43	VBW:10Hz
Hori.	4911.900	AV	47.7	31.3	5.4	42.9	41.6	53.9	12.3	111	174	VBW:10Hz
Hori.	5525.888	AV	43.4	32.1	5.9	43.3	38.1	53.9	15.8	100	162	VBW:10Hz
Hori.	6139.875	AV	44.4	33.2	6.2	43.4	40.4	53.9	13.4	100	265	VBW:10Hz
Vert.	69.650	QP	26.8	6.6	7.5	31.8	9.1	46.0	36.8	362	295	
Vert.	283.712	QP	36.3	13.5	7.0	31.8	25.0	46.0	20.9	163	304	
Vert.	613.988	QP	95.0	19.5	8.6	32.0	91.2	106.0	14.8	182	303	Carrier
Vert.	614.000	QP	40.9	19.5	8.6	32.0	37.0	46.0	8.9	182	303	(Refer to Marker Delta Method)
Vert.	1227.975	AV	57.4	25.0	3.8	41.0	45.1	53.9	8.8	142	0	VBW:10Hz
Vert.	1841.963	AV	48.9	25.3	3.6	41.3	36.4	53.9	17.5	114	273	VBW:10Hz
Vert.	2455.950	AV	54.4	27.8	4.3	41.6	44.8	53.9	9.1	145	3	VBW:10Hz
Vert.	3069.938	AV	44.6	28.8	4.7	41.9	36.2	53.9	17.6	174	116	VBW:10Hz
Vert.	3683.925	AV	47.8	29.2	4.8	42.1	39.7	53.9	14.1	102	134	VBW:10Hz
Vert.	4297.913	AV	45.7	30.1	5.1	42.5	38.4	53.9	15.5	105	204	VBW:10Hz
Vert.	4911.900	AV	47.0	31.3	5.4	42.9	40.8	53.9	13.0	100	138	VBW:10Hz
Vert.	5525.888	AV	48.0	32.1	5.9	43.3	42.6	53.9	11.3	102	125	VBW:10Hz
Vert.	6139.875	AV	47.4	33.2	6.2	43.4	43.5	53.9	10.4	158	130	VBW:10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)
 *Other frequency noises omitted in this report were not seen or have enough margin (more than 20 dB).
 *The 10th harmonic was not seen so the result was its base noise level.

(for RF Exposure sheet)
 [RF output power]

	Result [dBuV/m]	Result [mW]
carrier	93.6	0.966
Level		

Calculation:
 Result [mW] = (((10^(Result [dBuV/m] / 20)) x 10^(-6))
 x (distance=) 3 [m]) ^2) / (30 x (gain=) 10^(-1.5 dB / 10)) x 10^3

Marker Delta Method(Test distance 3 m)

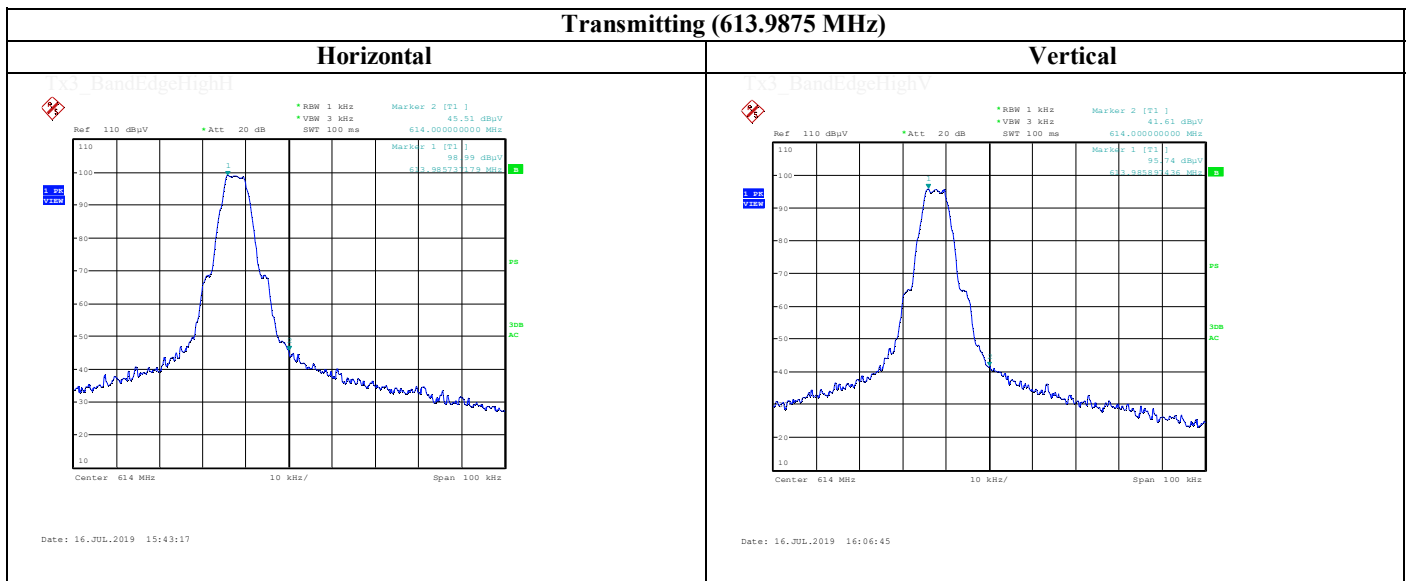
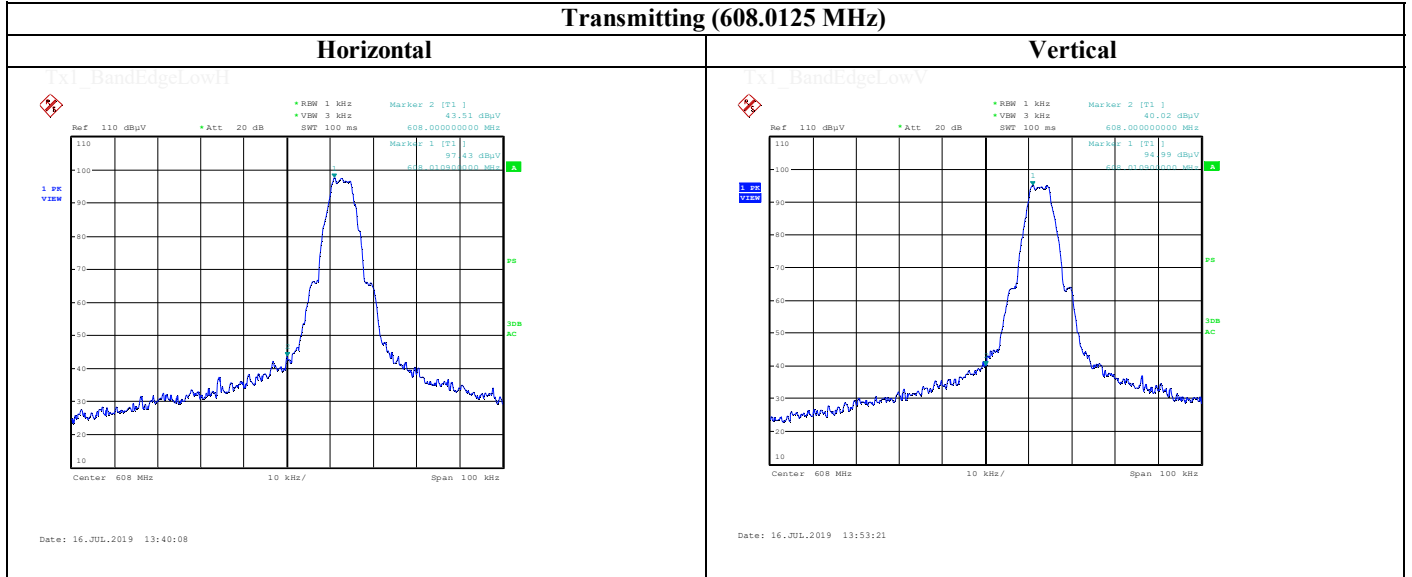
	Step	Fundamental(613.9875 MHz)	Polarity	AV				
				Hor.		Ver.		
				[dBuV]	[dBuV/m]	[dBuV]	[dBuV/m]	
			RBW	VBW	Reading	Result	Reading	Result
Step1	Fundamental(613.9875 MHz)	QP	97.4	93.6	95.0	91.2		
Step2	Fundamental(613.9875 MHz)	1 kHz/3 kHz	99.0	95.2	95.7	91.9		
	Band-edge(614 MHz)	1 kHz/3 kHz	45.5	41.7	41.6	37.8		
	Amplitude delta	-	53.5	53.5	54.1	54.1		
Step3	Field strength of band-edge	-	-	40.1	-	37.0		
	Limit	-	-	53.9	-	53.9		
	Margin	-	-	13.8	-	16.9		

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)
 *1 Amplitude delta = Fundamental(RBW:1 kHz,VBW:3 kHz) - Band-edge(RBW:1 kHz,VBW:3 kHz)
 *2 Field strength of band-edge = Fundamental(AV) - Amplitude delta
 *As we stated at section 7 ("Bandedge" section), we used RBW = 1 kHz (greater than 1 % bandwidth) to prevent to detect in-band emission. Refer to KDB 971168 D01 (KDB 971168 D01 Power Meas Licence Digital System D03r01).

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**Field Strength(Electric Field Strength of Fundamental Emission ,
 Spurious Emission and Band Edge Compliance)**

Band Edge compliance(for Marker Delta Method)



APPENDIX 2

Test Instruments

EMI test equipment

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SAF-03	ME	145126	Pre Amplifier	SONOMA	310N	290213	2019/2/5	2020/2/29	12
SAT6-12	ME	145158	Attenuator	HIROSE ELECTRIC	AT-406(40)	-	2018/8/23	2019/8/31	12
SCC-C1/C2/C3/C4/C5/C10/SRS E-03	ME	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE	-/0901-271(RF Selector)	2019/4/19	2020/4/30	12
SLP-02	ME	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2018/10/10	2019/10/31	12
STR-08	ME	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2018/11/28	2019/11/30	12
COTS-SEMI-5	ME,RE	170932	EMI Software	TSJ	TEPTO-DV3(RE,CE,ME,PE)	-	-	-	-
KJM-02	ME,RE	146432	Measure	TAJIMA	GL19-55	-	-	-	-
SAEC-03(NSA)	ME,RE	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2019/4/8	2020/4/30	12
SOS-05	ME,RE	146293	Humidity Indicator	A&D	AD-5681	4062518	2018/10/25	2019/10/31	12
KAT6-04	RE	144899	Attenuator	Inmet	18N-6dB	-	2018/12/25	2019/12/31	12
KJM-09	RE	145929	Measure	KOMELON	KMC-36	-	-	-	-
SAEC-01(NSA)	RE	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2019/4/2	2020/4/30	12
SAF-01	RE	145003	Pre Amplifier	SONOMA	310N	290211	2019/2/5	2020/2/29	12
SAF-06	RE	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2019/2/8	2020/2/29	12
SAT3-09	RE	144959	Attenuator	JFW	50HF-003N	-	2018/8/23	2019/8/31	12
SBA-01	RE	145161	Biconical Antenna	Schwarzbeck	BBA9106	91032664	2019/4/1	2020/4/30	12
SCC-A1/A3/A5/A7/A8/A13/SRS E-01	RE	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE	-/0901-269(RF Selector)	2019/4/19	2020/4/30	12
SCC-A2/A4/A6/A7/A8/A13/SRS E-01	RE	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE	-/0901-269(RF Selector)	2019/4/19	2020/4/30	12
SCC-G50	RE	178573	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104_E	MY13407/4E	2019/3/26	2020/3/31	12
SCC-G51	RE	178572	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800288 /4A	2019/3/26	2020/3/31	12
SFL-01	RE	145300	Highpass Filter	MICRO-TRONICS	HPM50115	1	2018/11/16	2019/11/30	12
SHA-03	RE	145501	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	2019/6/26	2020/6/30	12
SLA-05	RE	145527	Logperiodic Antenna	Schwarzbeck	VU5LP9111B	193	2019/4/1	2020/4/30	12
SOS-01	RE	146316	Humidity Indicator	A&D	AD-5681	4062555	2018/10/25	2019/10/31	12
SSA-02	RE	145800	Spectrum Analyzer	AGILENT	E4448A	MY48250106	2019/4/4	2020/4/30	12
STR-01	RE	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2019/4/14	2020/4/30	12
STS-01	RE	145792	Digital Hitester	HIOKI	3805-50	80997812	2018/10/16	2019/10/31	12
STS-03	RE	146210	Digital Hitester	HIOKI	3805-50	80997823	2018/10/16	2019/10/31	12
KTS-07	TF	145111	Digital Tester	SANWA	PC500	7019232	2018/10/17	2019/10/31	12
SCH-01	TF	145200	Temperature and Humidity Chamber	ESPEC	PL-1KT	14020837	2019/4/16	2020/4/30	12
SOS-09	TF	146318	Humidity Indicator	A&D	AD-5681	4061484	2018/12/5	2019/12/31	12
SSA-03	TF	145801	Spectrum Analyzer	AGILENT	E4448A	MY48250152	2018/8/30	2019/8/31	12
SSCA-01	TF	146178	Search coil	Langer	RF-R 400-1	02-0634	-	-	-

The expiration date of the calibration is the end of the expired month.

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

All equipment is calibrated with valid calibrations . Each measurement data is traceable to the national or international standards

Test Item:

- RE: Radiated emission,
- ME: Magnetic emission,
- TF: Test fixture tests,