RADIO TEST REPORT

Test Report No. : 13592147H-A

Applicant	:	**OMRON HEALTHCARE Co., Ltd.**
Type of EUT	:	**Body Composition Monitor**
Model Number of EUT	:	**HBF-702T**
Test standard	:	**ETSI EN 300 328 V2.2.2**
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 standard.
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. Ise 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.

Date of test: December 9 to 25, 2020

Representative test engineer:
Yuta Moriya
Engineer
Consumer Technology Division

Approved by :
Takayuki Shimada
Leader
Consumer Technology Division

CERTIFICATE 5107.02

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

REVISION HISTORY

Original Test Report No.: 13592147H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13592147H-A	January 19, 2021	-	-

UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation
AC	Alternating Current
AFH	Adaptive Frequency Hopping
AM	Amplitude Modulation
Amp, AMP	Amplifier
ANSI	American National Standards Institute
Ant, ANT	Antenna
AP	Access Point
ASK	Amplitude Shift Keying
Atten., ATT	Attenuator
AV	Average
BPSK	Binary Phase-Shift Keying
BR	Bluetooth Basic Rate
BT	Bluetooth
BT LE	Bluetooth Low Energy
BW	BandWidth
Cal Int	Calibration Interval
CCK	Complementary Code Keying
Ch., CH	Channel
CISPR	Comite International Special des Perturbations Radioelectriques
CW	Continuous Wave
DBPSK	Differential BPSK
DC	Direct Current
D-factor	Distance factor
DFS	Dynamic Frequency Selection
DQPSK	Differential QPSK
DSSS	Direct Sequence Spread Spectrum
EDR	Enhanced Data Rate
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EN	European Norm
ERP, e.r.p.	Effective Radiated Power
EU	European Union
EUT	Equipment Under Test
Fac.	Factor
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
Freq.	Frequency
FSK	Frequency Shift Keying
GFSK	Gaussian Frequency-Shift Keying
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
Hori.	Horizontal
ICES	Interference-Causing Equipment Standard
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
ILAC	International Laboratory Accreditation Conference
ISED	Innovation, Science and Economic Development Canada
ISO	International Organization for Standardization
JAB	Japan Accreditation Board
LAN	Local Area Network
LIMS	Laboratory Information Management System
MCS	Modulation and Coding Scheme
MRA	Mutual Recognition Arrangement
N/A	Not Applicable
NIST	National Institute of Standards and Technology
NS	No signal detect.
NSA	Normalized Site Attenuation
NVLAP	National Voluntary Laboratory Accreditation Program
OBW	Occupied Band Width
OFDM	Orthogonal Frequency Division Multiplexing
P/M	Power meter
PCB	Printed Circuit Board
PER	Packet Error Rate
PHY	Physical Layer
PK	Peak
PN	Pseudo random Noise
PRBS	Pseudo-Random Bit Sequence
PSD	Power Spectral Density
QAM	Quadrature Amplitude Modulation
QP	Quasi-Peak
QPSK	Quadri-Phase Shift Keying
RBW	Resolution Band Width
RDS	Radio Data System
RE	Radio Equipment
RF	Radio Frequency
RMS	Root Mean Square
RSS	Radio Standards Specifications
Rx	Receiving
SA, S/A	Spectrum Analyzer
SG	Signal Generator
SVSWR	Site-Voltage Standing Wave Ratio
TR	Test Receiver
Tx	Transmitting
VBW	Video BandWidth
Vert.	Vertical
WLAN	Wireless LAN

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CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	OMRON HEALTHCARE Co., Ltd.
Address	:	53, Kunotsubo, Terado-cho, Muko, Kyoto, 617-0002 JAPAN
Telephone Number	:	+81-75-925-2045
Facsimile Number	:	+81-75-925-2046
Contact Person	:	Yoshinori Tsurumi

The information provided from the customer is as follows;
- Applicant, Type of EUT, Model Number of EUT 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 (EUT) other than the Receipt Date
- SECTION 4: Operation of EUT 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 (EUT)

2.1 Identification of EUT

Type	:	Body Composition Monitor
Model Number	:	HBF-702T
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 6.0 V
Receipt Date	:	November 30, 2020
Country of Mass-production	:	China
Condition	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: HBF-702T (referred to as the EUT in this report) is a Body Composition Monitor.

Variant models: HBF-702T-AP
The differences among these models are as follow;
- Sales model name

Radio Specification

Bluetooth Low Energy

Equipment Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Type of Modulation	:	GFSK
Antenna Type	:	Pattern antenna
Antenna Gain	:	-1.3 dBi
Operating Temperature	:	+5 deg. C to +40 deg. C
Receiver Category	:	Category 3

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Radio	:	ETSI EN 300 328 V2.2.2
Title	:	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum
Purpose of test	:	Compliance with the following legislation. - RE directive 2014/53/EU - Radio Equipment Regulations 2017 (S.1. 2017/1206)

3.2 Procedures and results

Item	Test Procedure	Limit	Test method	Worst margin	Results	Remarks
RF output power	Clause 5.4.2	Clause 4.3.2.2	Conducted	-	Complied a)	-
Power Spectral Density	Clause 5.4.3	Clause 4.3.2.3	Conducted	-	Complied b)	-
Duty cycle, Tx-sequence, Tx-gap	Clause 5.4.2	Clause 4.3.2.4	Conducted	-	N/A	*1)
Medium Utilisation (MU) factor	Clause 5.4.2	Clause 4.3.2.5	Conducted	-	N/A	*1)
Adaptivity (adaptive equipment using modulations other than FHSS)	Clause 5.4.6	Clause 4.3.2.6	Conducted	-	N/A	*2)
Occupied Channel Bandwidth	Clause 5.4.7	Clause 4.3.2.7	Conducted	-	Complied c)	-
Transmitter unwanted emissions in the out-of-band domain	Clause 5.4.8	Clause 4.3.2.8	Conducted	-	Complied d)	-
Transmitter unwanted emissions in the spurious domain	Clause 5.4.9	Clause 4.3.2.9	Radiated	12.9 dB 4804.00 MHz, Vertical	Complied e)	-
Receiver Spurious emissions	Clause 5.4.10	Clause 4.3.2.10	Radiated	No signal detected	Complied f)	-
Transmitter unwanted emissions in the spurious domain	Clause 5.4.9	Clause 4.3.2.9	Conducted	-	N/A	*3)
Receiver Spurious emissions	Clause 5.4.10	Clause 4.3.2.10	Conducted	-	N/A	*3)
Receiver Blocking	Clause 5.4.11	Clause 4.3.2.11	Conducted	-	Complied g)	-
Geo-location capability	-	Clause 4.3.2.12	-	-	N/A	*4)

Note: UL Japan, Inc.'s EMI Work Procedure 13-EM-W0420.
*1) The test is not applicable since the EUT is an adaptive equipment and does not operate in a non-adaptive mode.
*2) The test is not applicable since the RF output power of the EUT is less than 10 dBm (e.i.r.p.).
*3) The EUT does not have antenna connector.
*4) The EUT does not have Geo-location capability.

a) Refer to APPENDIX 1 (data of RF Output Power)
b) Refer to APPENDIX 1 (data of Power Spectral Density)
c) Refer to APPENDIX 1 (data of Occupied Channel Bandwidth)
d) Refer to APPENDIX 1 (data of Transmitter unwanted emissions in the out-of-band domain)
e) Refer to APPENDIX 1 (data of Transmitter unwanted emissions in the spurious domain (Radiated))
f) Refer to APPENDIX 1 (data of Receiver spurious emissions (Radiated))
g) Refer to APPENDIX 1 (data of Receiver Blocking)

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 Additions or deviations to standards

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

3.4 Uncertainty

Although this standard determines only the limit value of uncertainty, there is no applicable rule of uncertainty in this. 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.

Ise EMC Lab.

Item	Unit	Required Uncertainty (+/-)	Calculated Uncertainty (+/-)
Occupied Channel Bandwidth	%	5	0.96
RF output power, conducted	dB	1.5	1.4
Power Spectral Density, conducted	dB	3	1.9
Unwanted Emissions, conducted	dB	3	2.4
All emissions, radiated	dB	6	5.6
Temperature	deg. C	3	0.945
Supply voltages	%	3	2.1
Time	%	5	0.10
Receiver Blocking	dB	Not Defined *1)	1.1
Adaptivity	dB	Not Defined *1)	1.1

*1) Not Defined: Although this test item is not defined in the standard, it is listed as reference.

*Measurement uncertainties of UL Japan, Inc. do not exceed the uncertainties required in the standard.

3.5 Test Location

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Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124
A2LA Certificate Number: 5107.02

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 m 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 EUT during testing

4.1 Operating Mode(s)

Mode	Remarks*
Bluetooth Low Energy (BT LE)	Continuous Tx (Tx), PN9
	Continuous Rx (Rx)

*Transmitting duty was 100 % on all tests.
*The worst condition was determined based on the test result of RF Output power.
*EUT has the power settings by the software as follows;
- Power Setting: 0dBm
- Software: OPM_Communication_Tool ver 1.00

This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

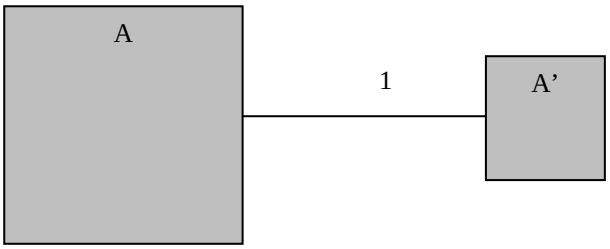
Details of Operating Mode(s)

Test item	Operating mode	Tested frequency
RF output power, Power Spectral Density	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
Occupied channel bandwidth Transmitter unwanted emissions in the out-of-band domain Transmitter unwanted emissions in the spurious domain (Radiated)	BT LE Tx	2402 MHz 2480 MHz
Receiver spurious emissions (Radiated)	BT LE Rx	2402 MHz 2480 MHz
Receiver blocking	Communication Bluetooth Low Energy (Direct test mode)	2402 MHz 2480 MHz

Extreme test condition	
Temperature	+5 deg. C to +40 deg. C
Voltage	Vnom: DC 6.0 V: operating voltage range of EUT

4.2 Configuration and peripherals

[Radiated emission test]



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

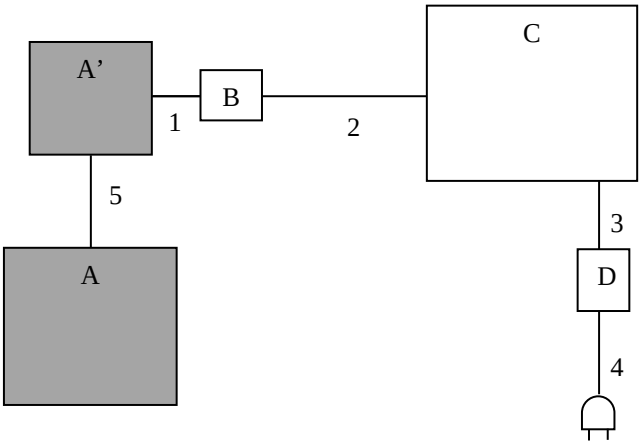
Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Body Composition Monitor (Main Unit)	HBF-702T	20191000396F	OMRON HEALTHCARE Co., Ltd.	EUT
A'	Body Composition Monitor (Display Unit)				

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	2.3	Unshielded	Unshielded	-

[Antenna Terminal Conducted test]



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

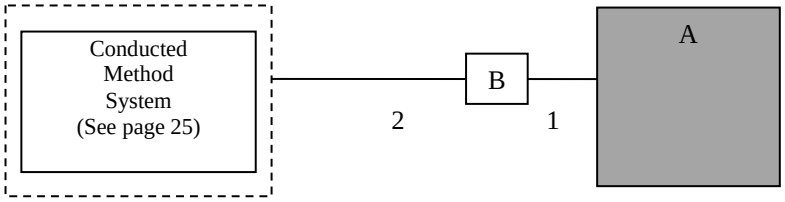
Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Body Composition Monitor (Main Unit)	HBF-702T	20191000395F	OMRON HEALTHCARE Co., Ltd.	EUT
A'	Body Composition Monitor (Display Unit)				
B	Jig	-	-	-	-
C	Laptop PC	TP00087A	MLRB0025	Lenovo	-
D	AC adapter	ADLX45NCC2A	10E75794	Lenovo	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1.	Signal Cable	0.1	Unshielded	Unshielded	-
2.	USB Cable	1.5	Shielded	Shielded	-
3.	DC Cable	1.0	Unshielded	Unshielded	-
4.	AC Cable	1.5	Unshielded	Unshielded	-
5.	Signal Cable	2.3	Unshielded	Unshielded	-

[Receiver Blocking test]



* 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	Body Composition Monitor	HBF-702T	20191000395F	OMRON HEALTHCARE Co., Ltd.	EUT
B	Jig	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.1	Unshielded	Unshielded	-
2	USB Cable	1.5	Shielded	Shielded	-

SECTION 5: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Instrument used	Remark
RF Output Power	Power Meter	Normal and Extreme conditions
Power Spectral Density	Spectrum Analyzer	Option 2 Normal condition
Occupied Channel Bandwidth	Spectrum Analyzer	Normal condition
Transmitter unwanted emissions in the out-of band domain	Spectrum Analyzer	Normal conditions - Detector mode: RMS - Trace: Single sweep - Band power was used on behalf of the time domain power function. - Filter mode: Gaussian Filter Since the data in this test report has enough margin
Receiver Blocking	Spectrum Analyzer	Normal condition

The test results are rounded off to two decimals place, so some differences might be observed.
The equipment and cables were not used for factor 0.0 dB of the data sheets.

Test data : **APPENDIX**
Test result : **Pass**

SECTION 6: Transmitter unwanted emissions in the spurious domain and Receiver spurious emissions (Radiated)

Test Procedure

1) EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength intensity has been measured in semi anechoic chamber at a distance of 3 m.
The measuring antenna height was varied between 1 m to 4 m and the turn table was rotated a full revolution in order to obtain the maximum value of the electric field strength.
The measurements were performed for both vertical and horizontal antenna polarization.
2) Exchanged the EUT to the Substitution Antenna, the measurement was set for the same height 1.5 m as the EUT. The frequency below 1 GHz of the Substitution Antenna was used the Half wave dipole Antenna, which was tuned the measured frequency in 1).
The frequency above 1 GHz of the Substitution Antenna was used Horn Antenna.
The Substitution Antenna was connected to the Signal Generator, and the polarized electromagnetic radiation of the Substitution Antenna was matched with the one of the measuring Antenna, which was set with the Signal Generator to the measured frequency in 1). Then, we set with the Output power (CW) of the Signal Generator where the measuring electromagnetic field strength is equal to the measured value in 1) by means of varying the measuring antenna height between 1 m to 4 m to obtain maximum receiving level.
Its Output power of Signal Generator was recorded.
3) Below 1 GHz:
Effective radiated power was calculated by subtracting the cable loss and the attenuator loss connected between the Signal Generator and the Substitution Antenna from the Output power of the Signal Generator recorded in 2).
For the usage of the Antenna except for the Half wave dipole Antenna for the Substitution Antenna, the Effective radiated power was calculated by compensating the finite difference in the Antenna gain of the Half wave dipole Antenna, and Substitution Antenna.
Above 1 GHz:
Equivalent isotropic radiated power was calculated by subtracting the cable loss and the attenuator loss connected between the signal generator and the substitution antenna from the output power of the signal generator recorded in 2).
For the usage of the antenna (horn antenna) for the substitution antenna, the equivalent isotropic radiated power was calculated by compensating the finite substitution antenna.

Pre-check scan setting

Frequency	Below 1 GHz	Above 1 GHz
Instrument used	Spectrum Analyzer	Spectrum Analyzer
IF Bandwidth	Peak, RBW: 100 kHz / VBW: 300 kHz	Peak, RBW: 1 MHz / VBW: 3 MHz
Trace mode	Max hold	Max hold

Measured setting

Frequency	Below 1 GHz	Above 1 GHz
Instrument used	Spectrum Analyzer	Spectrum Analyzer
IF Bandwidth	RMS, RBW: 100 kHz / VBW: 300 kHz	RMS, RBW: 1 MHz / VBW: 3 MHz
Span / Sweep time	Zero / 120 % of detected burst	Zero / 120 % of detected burst
Trace mode	Clear Write (band power)	Clear Write (band power)

- 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 are rounded off to one decimal place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

RF Output Power

Report No.	13592147H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	December 9, 2020
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Yuta Moriya
Mode	BT LE Tx

BT LE Receiver Category : 3

Test Condition		Freq.	P/M (AV)	Cable	Atten.	Antenna	Result	Limit	Margin
Temp.	Volt.		Reading	Loss	Loss	Gain			
		[MHz]	[dBm]	[dB]	[dB]	[dBi]	[dBm]	[dBm]	[dB]
nom	nom	2402.0	-12.72	1.43	9.97	-1.30	-2.62	20.00	22.62
		2440.0	-12.66	1.44	9.98	-1.30	-2.54	20.00	22.54
		2480.0	-12.51	1.45	9.98	-1.30	-2.38	20.00	22.38
min	nom	2402.0	-12.59	1.43	9.97	-1.30	-2.49	20.00	22.49
		2440.0	-12.53	1.44	9.98	-1.30	-2.41	20.00	22.41
		2480.0	-12.35	1.45	9.98	-1.30	-2.22	20.00	22.22
max	nom	2402.0	-12.03	1.43	9.97	-1.30	-1.93	20.00	21.93
		2440.0	-12.95	1.44	9.98	-1.30	-2.83	20.00	22.83
		2480.0	-12.82	1.45	9.98	-1.30	-2.69	20.00	22.69

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

Power Spectral Density

Report No.	13592147H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	December 9, 2020
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Yuta Moriya
Mode	BT LE Tx

BT LE

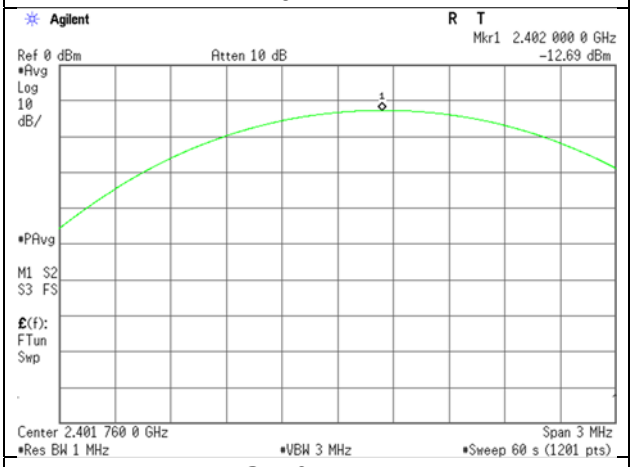
Test Condition		Tested	Reading	Cable	Atten.	Antenna	Duty	Result	Limit	Margin
Temp.	Volt.	Freq.		Loss	Loss	Gain	Factor			
		[MHz]	[dBm/MHz]	[dB]	[dB]	[dBi]	[dB]	[dBm/MHz]	[dBm/MHz]	[dB]
nom	nom	2402	-12.69	1.43	9.97	-1.30	0.00	-2.59	10.00	12.59
		2440	-12.67	1.44	9.98	-1.30	0.00	-2.55	10.00	12.55
		2480	-12.46	1.45	9.98	-1.30	0.00	-2.33	10.00	12.33

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

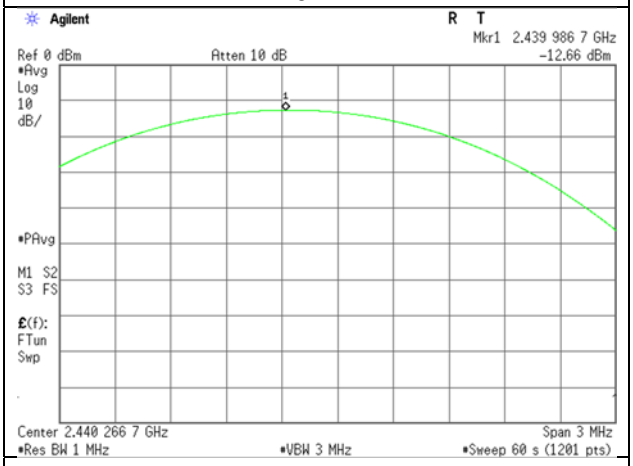
Power Spectral Density

Report No.	13592147H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	December 9, 2020
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Yuta Moriya
Mode	BT LE Tx

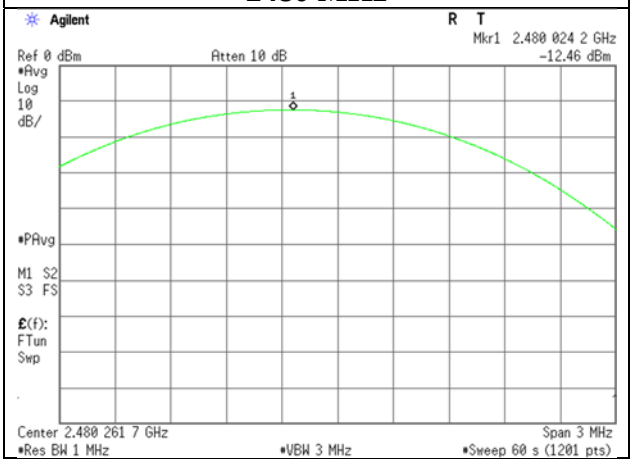
2402 MHz



2440 MHz



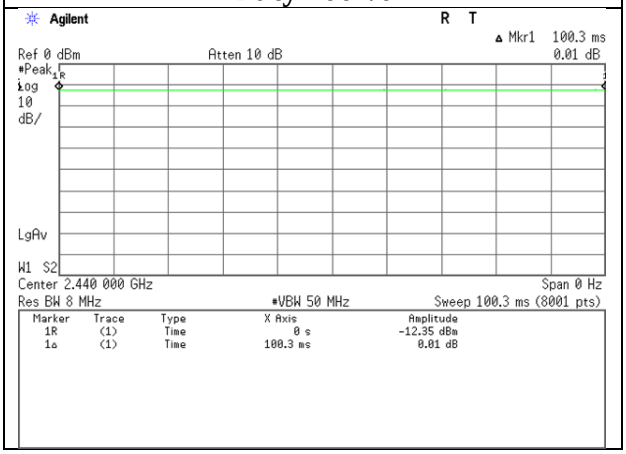
2480 MHz



Power Spectral Density
Duty factor (Worst data rate)

Report No.	13592147H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	December 9, 2020
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Yuta Moriya
Mode	BT LE Tx

Duty 100 %



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

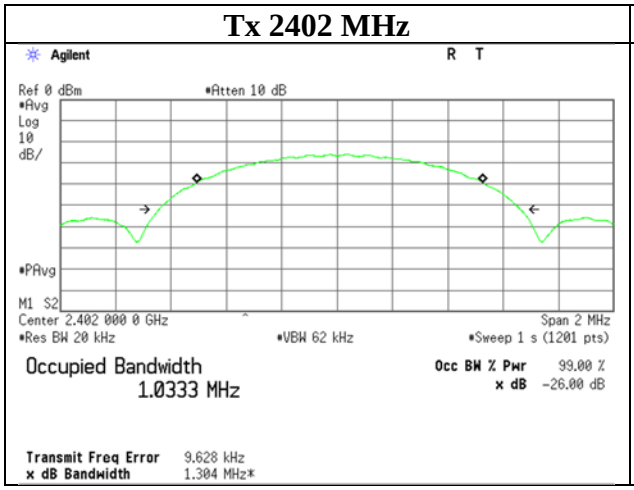
Occupied Channel Bandwidth

Report No.	13592147H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	December 9, 2020
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Yuta Moriya
Mode	BT LE Tx

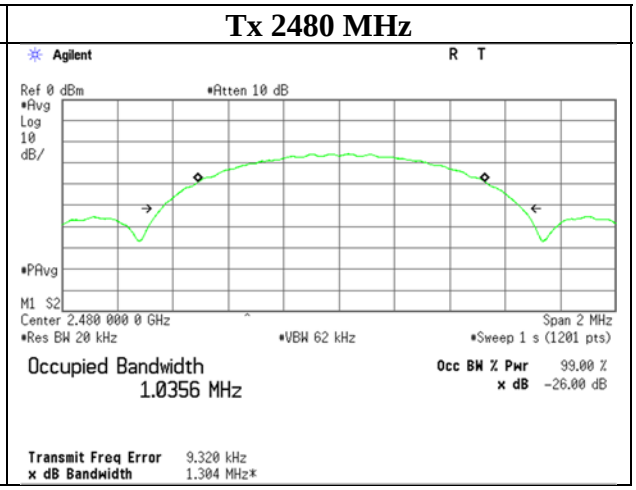
Frequency [MHz]	Bandwidth [MHz]	Result [MHz]	Limit [MHz]
2402	1.0333	2401.4834	> 2400
2480	1.0356	2480.5178	< 2483.5

Result = Center Frequency ± Bandwidth / 2

Tx 2402 MHz



Tx 2480 MHz



Transmitter unwanted emissions in the out-of-band domain

Report No.	13592147H
Test place	Ise EMC Lab. No.8 Measurement Room
Date	December 9, 2020
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Yuta Moriya
Mode	BT LE Tx

BT LE

Frequency [MHz]	S/A (AV) Reading [dBm/MHz]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Remarks
2398.5	-64.20	1.33	9.97	-1.30	-54.20	-20.00	34.20	Lowest ch 2400 MHz - 2 BW
2399.5	-62.09	1.33	9.97	-1.30	-52.09	-10.00	42.09	Lowest ch 2400 MHz - BW
2484.0	-65.30	1.35	9.98	-1.30	-55.27	-10.00	45.27	Highest ch 2483.5 MHz + BW
2485.0	-66.62	1.35	9.98	-1.30	-56.59	-20.00	36.59	Highest ch 2483.5 MHz + 2 BW

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

*Above test result was maximum value on each 1 BW.

Transmitter unwanted emissions in the spurious domain (Radiated)

Report No.	13592147H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	December 11, 2020
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Ken Fujita
Mode	BT LE Tx

2402 MHz

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz, (EIRP) >1GHz [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
												Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	Hori.	Vert.	Hori.	Vert.	[dB]	[dBi]	Hori.	Vert.		Hori.	Vert.	[cm]	[deg.]	[cm]	[deg.]	
4804.00	44.62	46.88	-51.4	-48.9	6.4	12.4	-45.4	-42.9	-30.0	15.4	***12.9***	136	194	164	203	
7206.00	40.21	38.46	-51.0	-50.7	7.8	11.3	-47.5	-47.2	-30.0	17.5	17.2	202	165	220	190	
9608.00	NS	NS	NS	NS	-	-	-	-	-30.0	-	-	0	0	0	0	
12010.00	NS	NS	NS	NS	-	-	-	-	-30.0	-	-	0	0	0	0	

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - 2.15,
Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain
Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - 12.75 GHz)
Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - 12.75 GHz)
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
NS : No signal detect.
Detector : Below 1 GHz: Spectrum Analyzer RMS Average (RBW: 100 kHz / VBW: 300 kHz)
Above 1 GHz: Spectrum Analyzer RMS Average (RBW: 1 MHz / VBW: 3 MHz)

2480 MHz

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz, (EIRP) >1GHz [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
												Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	Hori.	Vert.	Hori.	Vert.	[dB]	[dBi]	Hori.	Vert.		Hori.	Vert.	[cm]	[deg.]	[cm]	[deg.]	
4960.00	38.75	38.47	-56.8	-55.8	6.5	12.7	-50.6	-49.7	-30.0	20.6	19.7	172	191	171	205	
7440.00	42.28	38.21	-48.7	-50.8	8.0	11.2	-45.6	-47.6	-30.0	***15.6***	17.6	191	163	202	222	
9920.00	NS	NS	NS	NS	-	-	-	-	-30.0	-	-	0	0	0	0	
12400.00	NS	NS	NS	NS	-	-	-	-	-30.0	-	-	0	0	0	0	

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - 2.15,
Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain
Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - 12.75 GHz)
Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - 12.75 GHz)
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
NS : No signal detect.
Detector : Below 1 GHz: Spectrum Analyzer RMS Average (RBW: 100 kHz / VBW: 300 kHz)
Above 1 GHz: Spectrum Analyzer RMS Average (RBW: 1 MHz / VBW: 3 MHz)

Receiver spurious emissions (Radiated)

Report No.	13592147H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	December 11, 2020
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Ken Fujita
Mode	BT LE Rx

2402 MHz

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz, (EIRP) >1GHz [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
												Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	Hori.	Vert.	Hori.	Vert.	[dB]	[dBi]	Hori.	Vert.		Hori.	Vert.	[cm]	[deg.]	[cm]	[deg.]	
2402.00	NS	NS	-	-	-	-	-	-	-47.0	-	-	-	-	-	-	

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - 2.15,
Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain
Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - 12.75 GHz)
Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - 12.75 GHz)
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
NS : No signal detect.
Detector : Below 1 GHz: Spectrum Analyzer RMS Average (RBW: 100 kHz / VBW: 300 kHz)
Above 1 GHz: Spectrum Analyzer RMS Average (RBW: 1 MHz / VBW: 3 MHz)

2480 MHz

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz, (EIRP) >1GHz [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
												Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	Hori.	Vert.	Hori.	Vert.	[dB]	[dBi]	Hori.	Vert.		Hori.	Vert.	[cm]	[deg.]	[cm]	[deg.]	
2480.00	NS	NS	-	-	-	-	-	-	-47.0	-	-	-	-	-	-	

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - 2.15,
Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain
Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - 12.75 GHz)
Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - 12.75 GHz)
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
NS : No signal detect.
Detector : Below 1 GHz: Spectrum Analyzer RMS Average (RBW: 100 kHz / VBW: 300 kHz)
Above 1 GHz: Spectrum Analyzer RMS Average (RBW: 1 MHz / VBW: 3 MHz)

Receiver Blocking

Report No.	13592147H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	December 25, 2020
Temperature / Humidity	21 deg. C / 32 % RH
Engineer	Yuta Moriya
Mode	Communication BT LE

Receiver Category 3 equipment

Wanted signal mean power from companion device (dBm)		
	Lowest Channel	Highest Channel
-139 dBm + 10 × log10(OCBW) + 20	-58.86	-58.85

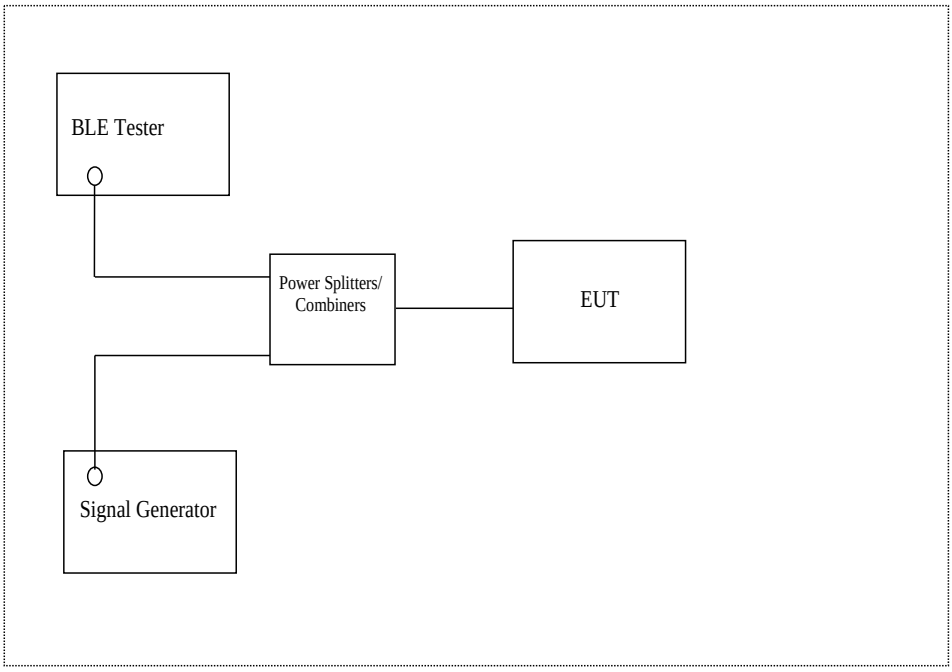
OCBW=Refer to Occupied Channel Bandwidth

Operating Channel	Blocking signal power (dBm)	Blocking signal power (corrected by the antenna assembly gain) (dBm) *2)	Wanted signal mean power from companion device (dBm)	Wanted signal mean power from companion device (corrected by the antenna assembly gain) (dBm) *2)	Blocking signal frequency (MHz)	Result PER (%)	Limit PER (%)
Lowest Channel	-34.00	-35.30	-58.86 *1)	-60.16	2380	0.00	≦10
			-	-	-	-	
			-	-	-	-	
			-58.86 *1)	-60.16	2300	0.00	
					-	-	
					-	-	
Highest Channel	-34.00	-35.30	-58.85 1*)	-60.15	2504	0.00	≦10
			-	-	-	-	
			-	-	-	-	
			-58.85 *1)	-60.15	2584	0.00	
					-	-	
					-	-	

*1) Wanted signal mean power from companion device was
(-139 dBm + 10 × log10(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less

*2) Adjusted by product antenna gain -1.3dBi.

CONDUCTED METHODS SYSTEM BLOCK DIAGRAM of Receiver Blocking



APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2020	24
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/07/2020	12
RE	MMM-08	141532	DIGITAL HiTESTER	Hioki	3805	51201197	01/06/2020	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAT-95	142314	Attenuator	Pasternack	PE7390-6	D/C 1504	06/17/2020	12
RE	MBA-03	141424	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	1915	08/13/2020	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	07/06/2020	12
RE	MLA-22	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-191	08/13/2020	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/10/2020	12
RE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	03/10/2020	12
RE	MHA-20	141507	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	258	10/01/2020	12
RE	MPA-11	141580	MicroWave System Amplifier	Keysight Technologies Inc	83017A	MY39500779	03/24/2020	12
RE	MCC-231	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/ 1902S579(5m)	03/02/2020	12
RE	MSG-20	158264	Signal Generator	Keysight Technologies Inc	N5182A	MY50142539	09/04/2020	12
RE	MHA-30	141514	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	01611	05/22/2020	12
RE	MCC-130	141409	Microwave Cable(1-30GHz)	Huber+Suhner	SF103/11PC3.5-31/11 PC3.5-31/8.0m	54308/3	01/06/2020	12
AT	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/04/2020	12
AT	MPM-16	141812	Power Meter	Keysight Technologies Inc	8990B	MY51000271	08/20/2020	12
AT	MPSE-23	141835	Power sensor	Keysight Technologies Inc	N1923A	MY54070004	08/20/2020	12
AT	MAT-91	141420	Attenuator	Weinschel Associates	WA56-10	56100307	05/25/2020	12
AT	MCC-66	141328	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	04/02/2020	12
AT	MOS-28	141567	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0008	01/07/2020	12
AT	MCH-05	141440	Temperature and Humidity Chamber	Espec	PL-1KP	14019569	04/09/2020	12
RB	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/04/2020	12
RB	MPM-08	141805	Power Meter	ANRITSU	ML2495A	6K00003338	10/15/2020	12
RB	MPSE-11	141840	Power sensor	ANRITSU	MA2411B	11737	10/15/2020	12
RB	MSG-18	141898	Signal Generator	Keysight Technologies Inc	N5182B	MY56200177	11/05/2020	12
RB	MAT-101	194879	Attenuator	Keysight Technologies Inc	8495A / 8495B	MY42150956 / MY42147424	-	-
RB	MURC-09	155908	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	140481	-	-
RB	MCC-182	142371	Microwave Cable	Junkosha	MMX221-00500DMS DMS	1502S309	-	-
RB	MCC-183	142372	Microwave Cable	Junkosha	MMX221-00500DMS DMS	1502S310	-	-
RB	MCC-184	142373	Microwave Cable	Junkosha	MMX221-00500DMS DMS	1502S311	-	-
RB	MCC-185	142374	Microwave Cable	Junkosha	MMX221-00500DMS DMS	1502S312	-	-
RB	MPSC-07	142736	Power Splitters/Combiners	PASTERNACK ENTERPRISES	ZFRSC-123-S+	ZFRSC-123-00232	-	-
RB	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2020	24
RB	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/07/2020	12

***Hyphens for Last Calibration 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.
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 test
AT: Antenna Terminal Conducted test
RB: Receiver Blocking test

APPENDIX 3: Photographs of test setup

Radiated emission

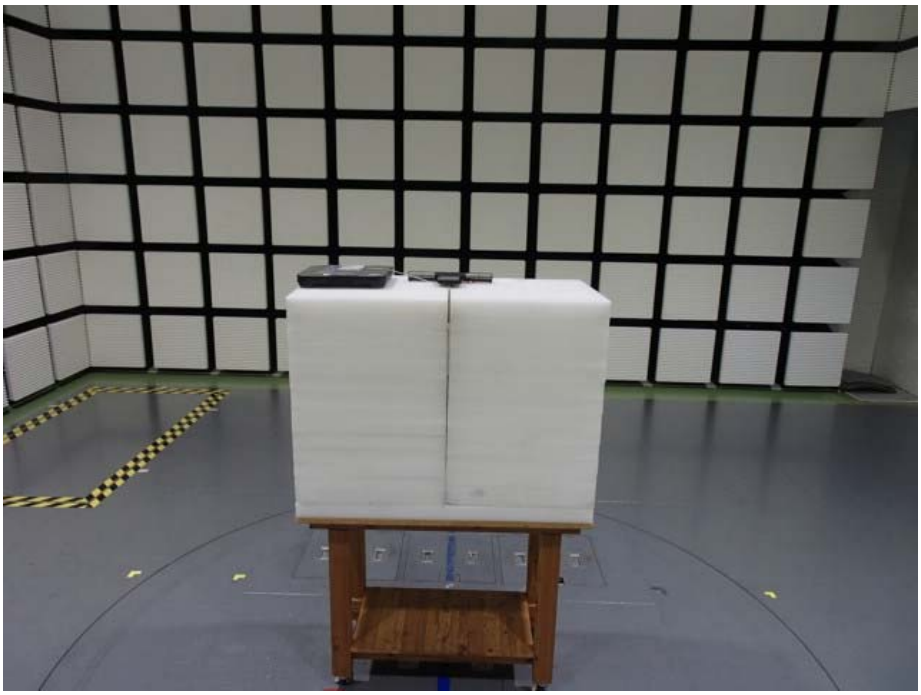


Photo 1

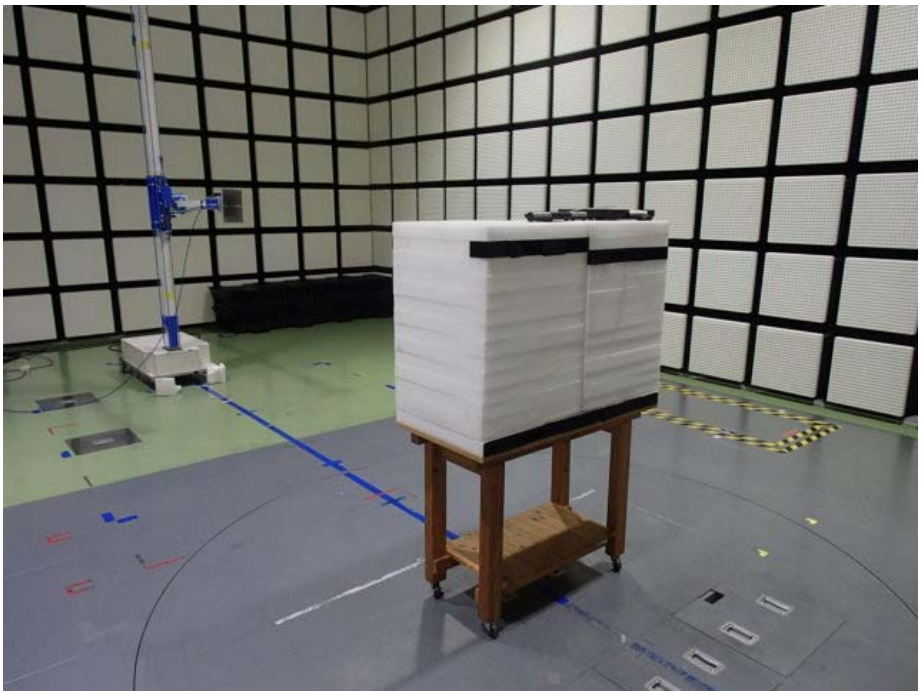


Photo 2

UL Japan, Inc.
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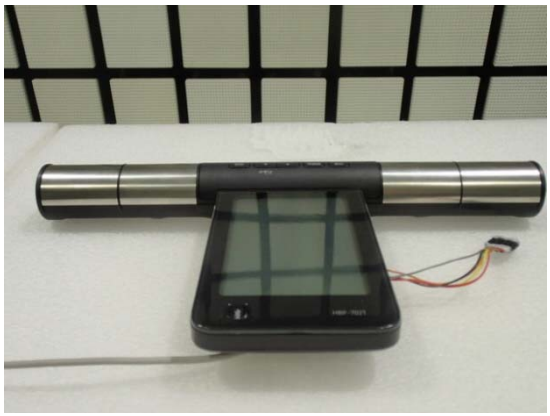
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

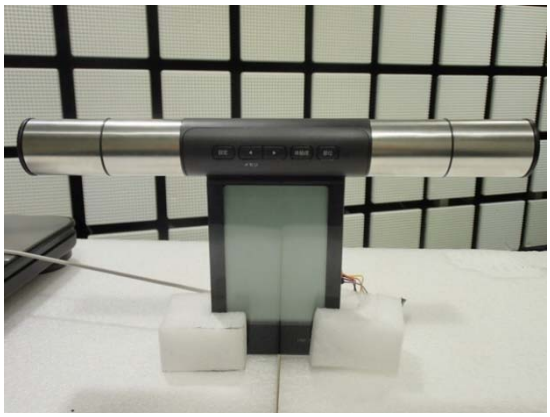
Worst Case Position

Below 1 GHz (Horizontal: X-axis / Vertical: X-axis)
Above 1 GHz (Horizontal: Z-axis / Vertical: Y-axis)

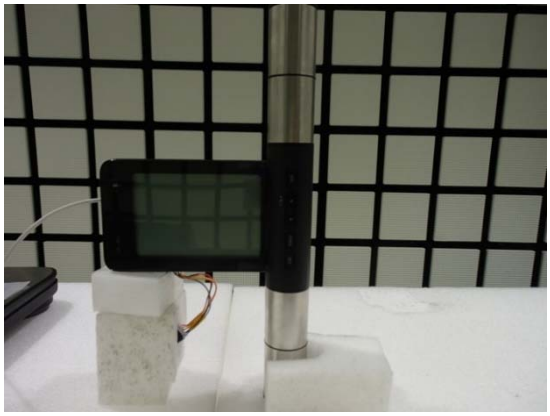
X-axis



Y-axis



Z-axis



Antenna Terminal Conducted test

(except for Adaptivity and Unwanted Signal and Receiver Blocking)

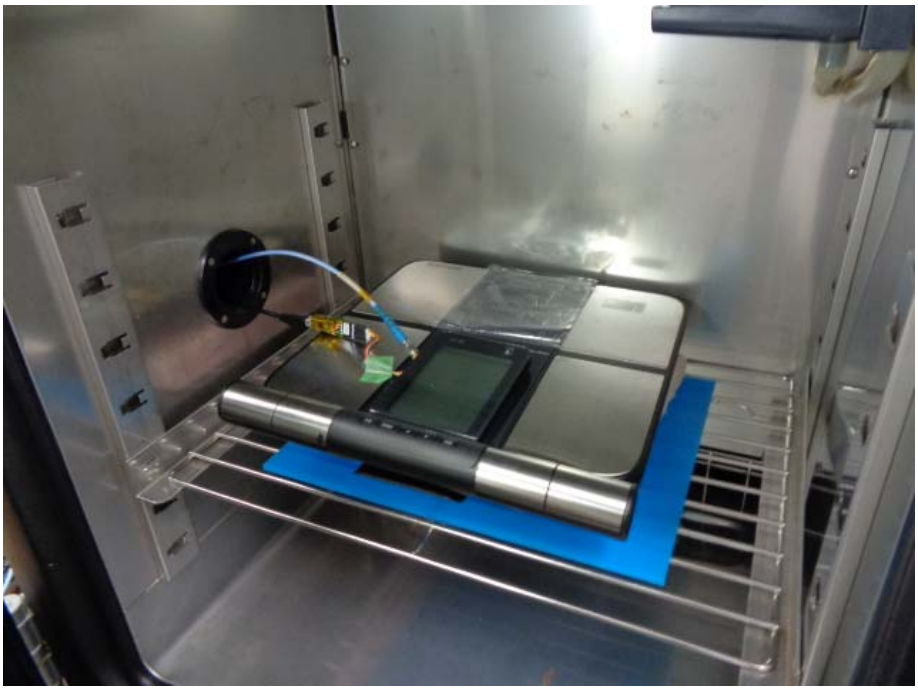


Photo 1

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Receiver Blocking

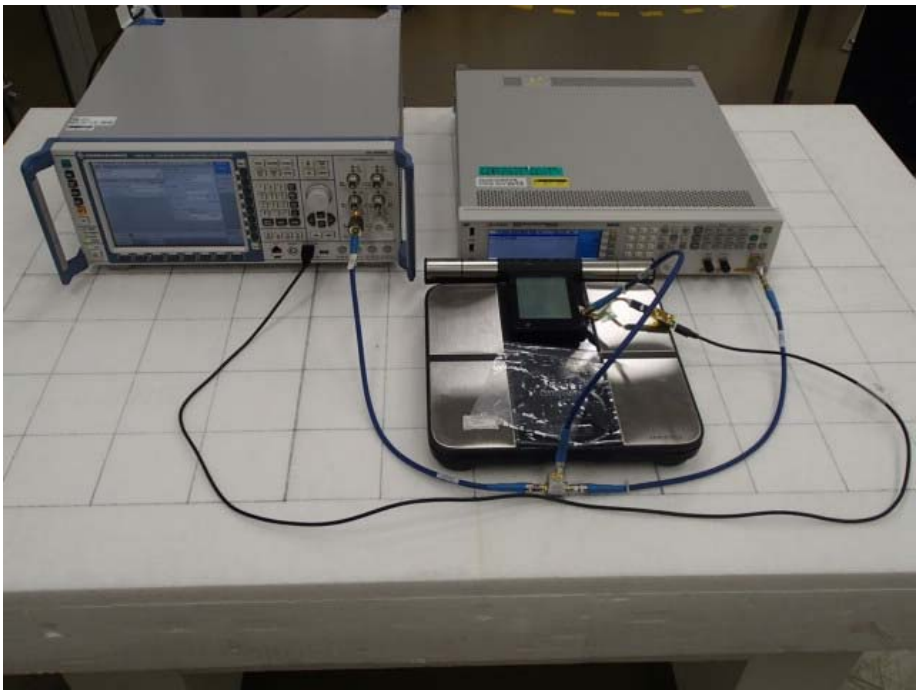

Photo 1

Photo 2

End of Report

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