

RADIO TEST REPORT

Test Report No. 15278634H-A

Customer	OMRON HEALTHCARE Co., Ltd.
Description of EUT	Blood Pressure Monitor
Model Number of EUT	HBP-9010C
Test Standard	ETSI EN 300 328 V2.2.2
Test Result	Complied
Issue Date	June 28, 2024
Remarks	-

Representative Test EngineerTetsuro Yoshida
Engineer**Approved By**Takumi Shimada
Engineer

CERTIFICATE 5107.02

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

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REVISION HISTORY

Original Test Report No. 15278634H-A

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15278634H-A	June 28, 2024	-

Reference: Abbreviations (Including words undescribed in this report)

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

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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
Contact Person	Mitsunori Hara

The Information provided by the customer is as follows;

- Customer, Description 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 and Test Date
- SECTION 4: Operation of EUT during testing

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	Blood Pressure Monitor
Model Number	HBP-9010C
Serial Number	Refer to SECTION 4.2
Condition	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab.
Receipt Date	May 8, 2024
Test Date	May 13 to 27, 2024

2.2 Product Description

General Specification

Rating	DC 12 V AC 100 V to 240 V, 50 Hz / 60 Hz (AC Adapter)
Operating temperature	+5 deg. C to +40 deg. C

Radio Specification

This report contains data provided by the customer which can impact the validity of results. UL Japan, Inc. is only responsible for the validity of results after the integration of the data provided by the customer. The data provided by the customer is marked "a)" in the table below.

Bluetooth (Low Energy)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	GFSK
Antenna Gain ^{a)}	0.5 dBi
Receiver Category	3

Variant Model

The EUT has following variant model:

Model No.	Difference from the base model
HBP-9010C (EUT)	- (Original)
HBP-9010C-IN	The place of destination, AC Adapter (B type)
HBP-9010C-AP	The place of destination, AC Adapter (C type)

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

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	-
Power Spectral Density	Clause 5.4.3	Clause 4.3.2.3	Conducted	-	Complied	-
Duty Cycle, Tx-sequence, Tx-gap	Clause 5.4.2	Clause 4.3.2.4	Conducted	-	N/A	*1)
Medium Utilization (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	-
Transmitter Unwanted Emissions in The Out-of-band Domain	Clause 5.4.8	Clause 4.3.2.8	Conducted	-	Complied	-
Transmitter Unwanted Emissions in The Spurious Domain	Clause 5.4.9	Clause 4.3.2.9	Radiated	24.3 dB 4804.00 MHz / 4960 MHz, Vertical	Complied	-
Receiver Spurious Emissions	Clause 5.4.10	Clause 4.3.2.10	Radiated	5.6 dB 97.54 MHz, Horizontal	Complied	-
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	-
Geo-location Capability	-	Clause 4.3.2.12	-	-	N/A	*4)

Note: UL Japan, Inc.'s EMI Work Procedure: Work Instructions-ULID-003591.

*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.

3.3 Additions or Deviations to Standards

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

3.4 Uncertainty

Measurement uncertainty is not taken into account when stating conformity with a specified requirement.
Note: When margins obtained from test results are less than the measurement uncertainty, the test results may exceed the limit.

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

Item	Unit	Required Uncertainty (+/-)	Calculated Uncertainty (+/-)
Occupied Channel Bandwidth	%	5	0.96
RF Output Power, Conducted	dB	1.5	1.46
Power Spectral Density, Conducted	dB	3	1.70
Unwanted Emissions, Conducted	dB	3	2.71
All Emissions, Radiated	dB	6	5.95
Temperature	deg C	3	0.69
Supply Voltages	%	3	2.80
Time (SA)	%	5	4.90
Receiver Blocking	dB	Not Defined	1.55
Adaptivity	dB	Not Defined	1.49

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan
Telephone: +81-596-24-8999
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.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-
Large Chamber	16.9 x 22.1 x 10.17	16.9 x 22.1	-	10 m
Small Chamber	5.3 x 6.69 x 3.59	5.3 x 6.69	-	-

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)	Maximum Packet Size, PRBS9
*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: 0 dBm Software: <Radiated Emission test> TX2402 Version 1.0 RX2402 Version 1.0 TX2480 Version 1.0 RX2480 Version 1.0 <Other tests except for Radiated Emission test> OPM_Communication_Tool.exe Version: 1.0.0.0 *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.	

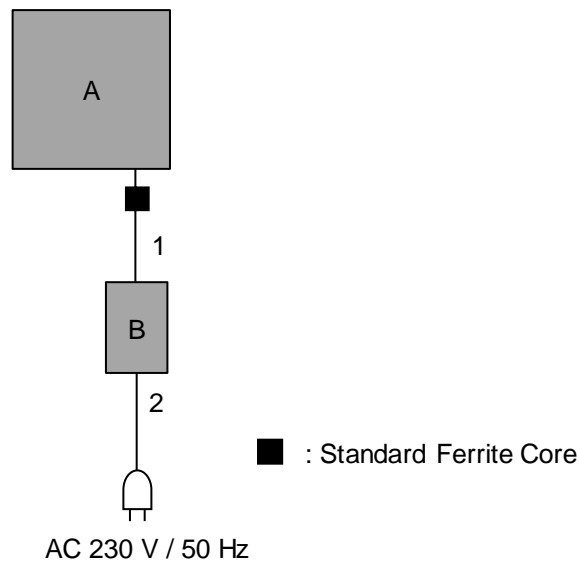
Details of Operating Mode(s)

Test Item	Operating Mode	Tested Frequency
RF Output Power, Power Spectral Density	Tx BT LE	2402 MHz 2440 MHz 2480 MHz
Occupied Channel Bandwidth	Tx BT LE	2402 MHz 2480 MHz
Transmitter Unwanted Emissions in The Out-of-band domain	Tx BT LE	2402 MHz 2480 MHz
Transmitter Unwanted Emissions in The Spurious domain (Radiated)	Tx BT LE	2402 MHz 2480 MHz
Receiver Spurious Emissions (Radiated)	Rx BT LE	2402 MHz 2480 MHz
Receiver Blocking	Communication BT LE	2402 MHz 2480 MHz

Extreme Test Condition	
Temperature	+5 deg. C to +40 deg. C

4.2 Configuration and Peripherals

Antenna Terminal Conducted (Other than Receiver Blocking) and Radiated Emission



* 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	Blood Pressure Monitor	HBP-9010C	ES064 *1) ES065 *2) ES066 *3) ES067 *4) ES053 *5)	OMRON HEALTHCARE Co., Ltd.	EUT
B	AC Adapter	HBP-ACCA-903	PM230264000751	OMRON HEALTHCARE Co. Ltd.	EUT

*1) Used for Radiated Emission Tx 2402 MHz test

*2) Used for Radiated Emission Tx 2480 MHz test

*3) Used for Radiated Emission Rx 2402 MHz test

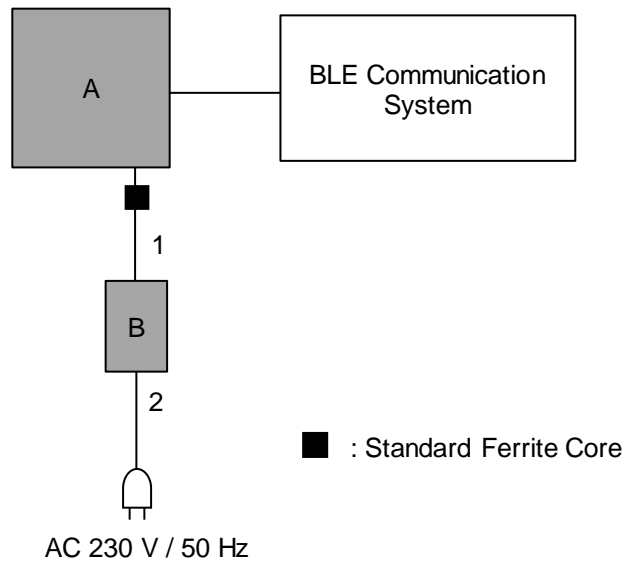
*4) Used for Radiated Emission Rx 2480 MHz test

*5) Used for Antenna Terminal Conducted test

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.9	Unshielded	Unshielded	-
2	AC Cable	3.0	Unshielded	Unshielded	-

Receiver Blocking



* 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	Blood Pressure Monitor	HBP-9010C	ES053	OMRON HEALTHCARE Co., Ltd.	EUT
B	AC Adapter	HBP-ACCA-903	PM230264000751	OMRON HEALTHCARE Co. Ltd.	EUT

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.9	Unshielded	Unshielded	-
2	AC Cable	3.0	Unshielded	Unshielded	-

SECTION 5: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Instrument Used	Remarks
RF Output Power	Power Meter	Normal and Extreme conditions
Power Spectral Density	Spectrum Analyzer	Normal condition Test method: Option 1
Adaptivity	Spectrum Analyzer	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, 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 0.5 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 test was made on EUT at the normal use position.

The test results are rounded off, so some differences might be observed.

Test Data : APPENDIX
Test Result : Pass

APPENDIX 1: Test Data

RF Output Power

Test place Ise EMC Lab. No.6 Measurement Room
Date May 17, 2024
Temperature / Humidity 22 deg. C / 44 % RH
Engineer Tetsuro Yoshida
Mode Tx BT LE

Temperature	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
nom	2402.0	-12.75	1.00	10.77	0.50	-0.48	20.00	20.48
	2440.0	-12.78	1.01	10.77	0.50	-0.50	20.00	20.50
	2480.0	-13.08	1.02	10.77	0.50	-0.79	20.00	20.79
min	2402.0	-12.49	1.00	10.77	0.50	-0.22	20.00	20.22
	2440.0	-12.55	1.01	10.77	0.50	-0.27	20.00	20.27
	2480.0	-12.65	1.02	10.77	0.50	-0.36	20.00	20.36
max	2402.0	-12.78	1.00	10.77	0.50	-0.51	20.00	20.51
	2440.0	-12.89	1.01	10.77	0.50	-0.61	20.00	20.61
	2480.0	-13.15	1.02	10.77	0.50	-0.86	20.00	20.86

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

Power Spectral Density

Test place	Ise EMC Lab. No.6 Measurement Room
Date	May 17, 2024
Temperature / Humidity	22 deg. C / 44 % RH
Engineer	Tetsuro Yoshida
Mode	Tx BT LE

Ch Freq. [MHz]	S/A Maximum Reading [dBm/MHz]	S/A Total Power Reading [dBm]	RF Output Power [dBm]	Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]
2402.00	-12.73	-12.66	-0.58	-0.65	10.00	10.65
2440.00	-13.54	-13.47	-0.60	-0.67	10.00	10.67
2480.00	-13.69	-13.62	-0.89	-0.96	10.00	10.96

Result [dBm/MHz] = S/A Maximum Reading [dBm/MHz] - S/A Total Power Reading [dBm] (*1) + RF Output Power [dBm] (*2)

(*1) Integrated value of 2400 MHz to 2483.5 MHz

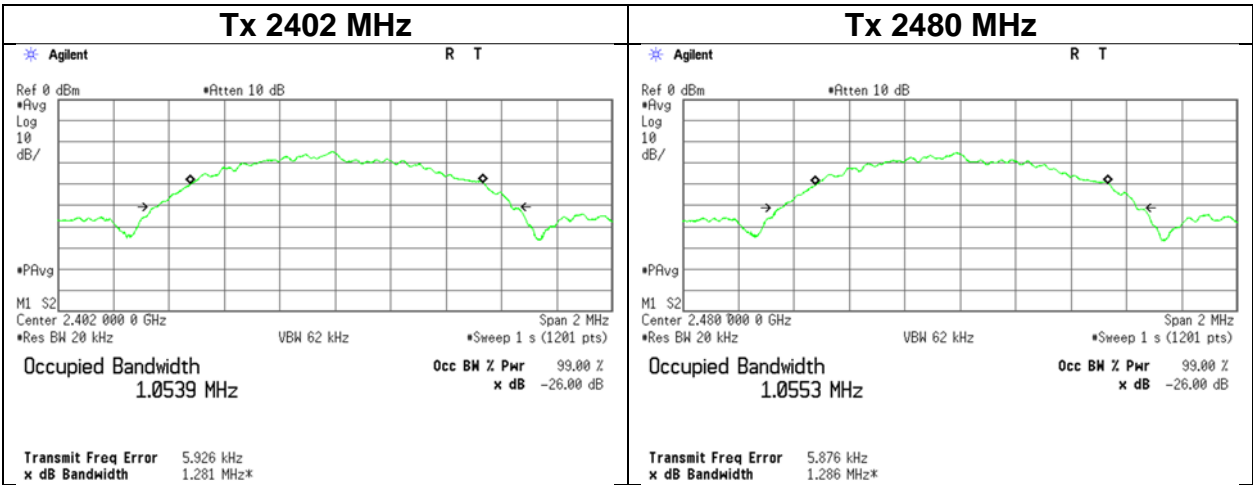
(*2) Refer to RF Output Power

Occupied Channel Bandwidth

Test place
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab. No.6 Measurement Room
May 17, 2024
22 deg. C / 44 % RH
Tetsuro Yoshida
Tx BT LE

Frequency [MHz]	Bandwidth [MHz]	Result [MHz]	Limit [MHz]
2402	1.0539	2401.4731	> 2400
2480	1.0553	2480.5277	< 2483.5



Transmitter Unwanted Emissions in The Out-of-band Domain

Test place Ise EMC Lab. No.6 Measurement Room
Date May 17, 2024
Temperature / Humidity 22 deg. C / 44 % RH
Engineer Tetsuro Yoshida
Mode 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
2398.4	-70.26	1.00	10.77	0.50	-57.99	-20.00	37.99	Lowest ch 2400 MHz - 2 BW
2399.5	-65.31	1.00	10.77	0.50	-53.04	-10.00	43.04	Lowest ch 2400 MHz - BW
2484.0	-70.77	1.02	10.77	0.50	-58.48	-10.00	48.48	Highest ch 2483.5 MHz + BW
2485.1	-76.28	1.02	10.77	0.50	-63.99	-20.00	43.99	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)

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date May 12, 2024
Temperature / Humidity 24 deg. C / 41 % RH
Engineer Takumi Nishida
Mode Tx BT LE

2402 MHz

Frequency [MHz]	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Cable Loss [dB]	Tx Ant. Gain [dBi]	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz, (EIRP) >1GHz [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
	Hori.	Vert.	Hori.	Vert.			Hori.	Vert.				Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
4804.00	34.4	35.8	-62.0	-60.7	6.1	12.5	-55.5	-54.3	-30.0	25.5	24.3	172	217	133	183	
7206.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
9608.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
12010.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

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		Tx SG		Tx Cable Loss [dB]	Tx Ant. Gain [dBi]	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz, (EIRP) >1GHz [dBm]	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]				Hori.	Vert.				Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	[MHz]	Hori.	Vert.	Hori.						Vert.	Hori.					
4960.00	33.6	34.4	-61.3	-60.8	6.2	12.7	-54.8	-54.3	-30.0	24.8	24.3	172	237	158	177	
7440.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
9920.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
12400.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

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)

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date May 12, 2024
Temperature / Humidity 24 deg. C / 41 % RH
Engineer Takumi Nishida
Mode Rx

2402 MHz

Frequency [MHz]	Rx SA/TR		Tx SG		Tx Cable Loss [dB]	Tx Ant. Gain [dBi]	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz, (EIRP) >1GHz [dBm]	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]							[dB]		Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	Hori.	Vert.	Hori.	Vert.			Hori.	Vert.		Hori.	Vert.					
93.75	NS	47.0	-	-50.1	1.6	-14.1	-	-67.9	-57.0	-	10.9	-	-	100	218	
97.52	44.0	NS	-46.1	-	1.6	-13.0	-62.9	-	-57.0	5.9	-	100	179	-	-	
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 [MHz]	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss [dB]	Tx Ant. Gain [dBi]	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz (EIRP) >1GHz [dBm]	Margin [dB]		Horizontal		Vertical		Remarks		
	Hori.	Vert.	Hori.	Vert.			Hori.	Vert.		Hori.	Vert.	Hori.	Vert.	Rx Ant. Height [cm]	Turn Table [deg.]		Rx Ant. Height [cm]	Turn Table [deg.]
93.79	NS	47.3	-	-49.8	1.6	-14.1	-	-67.6	-57.0	-	10.6	-	-	100	218			
97.54	44.2	NS	-45.9	-	1.6	-12.9	-62.6	-	-57.0	5.6	-	100	179	-	-			
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

Test place
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab. No.5 Shielded Room
May 27, 2024
21 deg. C / 60 % RH
Hiroki Numata
Communication BLE

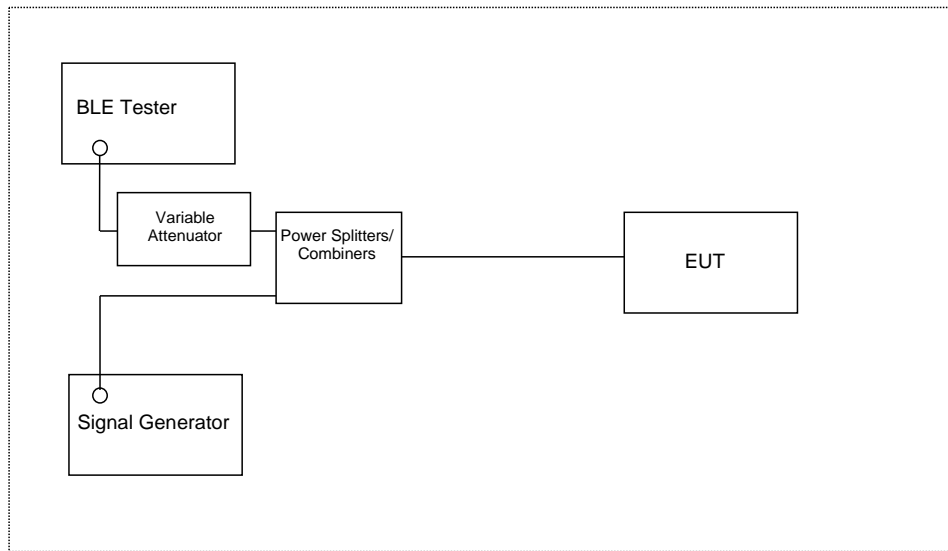
Receiver Category 3 equipment		
Wanted signal mean power from companion device (dBm)		
	Lowest Channel	Highest Channel
	-139 dBm + 10 × log10(OCBW) + 20	-58.77

OCBW=Refer to Occupied Channel Bandwidth test result

Operating Channel	Blocking signal power (dBm)	Antenna gain (dBi) *2)	Blocking signal power (corrected by the antenna gain) (dBm)	Wanted signal mean power from companion device (dBm)	Antenna gain (dBi) *3)	Wanted signal mean power from companion device (corrected by the antenna gain) (dBm)	Blocking signal frequency (MHz)	Result PER (%)	Remarks	Limit PER (%)
Lowest Channel	-34.00	0.50	-33.50	-58.77	0.50	-58.27	2380	0.60	*1)	≤ 10
				-		-	-	-	-	
				-		-	-	-	-	
				-58.77		-58.27	2300	0.80	*1)	
				-		-	-	-	-	
Highest Channel	-34.00	0.50	-33.50	-58.77	0.50	-58.27	2504	0.30	*1)	≤ 10
				-		-	-	-	-	
				-		-	-	-	-	
				-58.77		-58.27	2584	0.10	*1)	
				-		-	-	-	-	

*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) Blocking signal power was adjusted by product antenna gain
*3) Wanted signal mean power was adjusted by product antenna gain

Conducted Methods System Block Diagram of Receiver Blocking



APPENDIX 2: Test Instruments

Test Equipment

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RB	141328	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	04/01/2024	12
RB	141375	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	30817/2	05/27/2024	12
RB	141377	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	30819/2	05/27/2024	12
RB	141820	Power splitters/Combiners	Mini-Circuits	ZFSC-2-2500	0124	09/01/2023	12
RB	194879	Attenuator	Keysight Technologies Inc	8495A / 8495B	MY42150956 / MY42147424	-	-
RE	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/04/2023	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/10/2023	12
RE	141318	Coaxial Cable	UL Japan	-	-	07/20/2023	12
RE	141323	Coaxial cable	UL Japan	-	-	09/10/2023	12
RE	141424	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	1915	03/15/2024	12
RE	141464	Dipole Antenna	Schwarzbeck Mess-Elektronik OHG	VHAP	1018	12/26/2023	12
RE	141507	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	258	11/20/2023	12
RE	141514	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	01611	06/22/2023	12
RE	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	051201197	01/31/2024	12
RE	141580	Microwave System Amplifier	Keysight Technologies Inc	83017A	MY39500779	03/08/2024	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/17/2024	12
RE	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	01/26/2024	12
RE	141967	Signal Generator	Rohde & Schwarz	SMT02	51400043	08/02/2023	12
RE	142008	AC3_Semi Anechoic Chamber (NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	12/11/2023	24
RE	142183	Measure	KOMELON	KMC-36	-	10/20/2023	12
RE	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/23/2023	12
RE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	213581	Signal Generator	Rohde & Schwarz	SMW200A	107688	02/17/2024	12
RE	214065	Microwave cable	Huber+Suhner	SF-126E/11PC35/11PC35/10000	550489/126E	01/22/2024	12
RE	244709	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202103	01/25/2024	12
RE	246001	Microwave Cable	Huber+Suhner	SF103/11PC35/11PC35/1000mm / SF126E/5000mm	800673(1m) / 610204(5m)	03/06/2024	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:

AT: Antenna Terminal Conducted (Other than Receiver Blocking Test)

RB: Receiver Blocking

RE: Radiated Emission

APPENDIX 3: Photographs of Test Setup

Radiated Emission



Photo 1

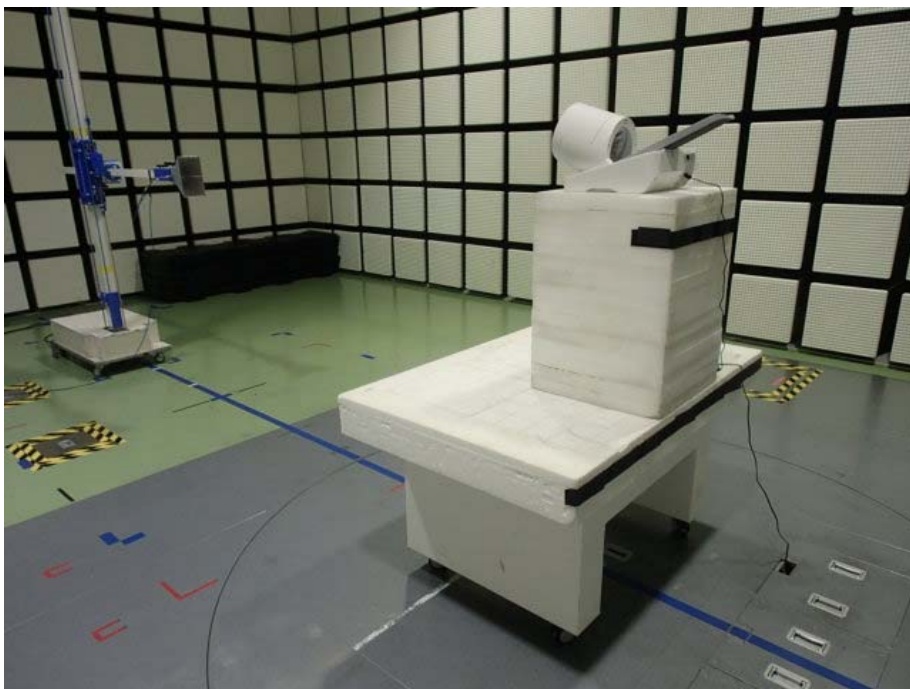


Photo 2

Antenna Terminal Conducted Test
(except for and Receiver Blocking)

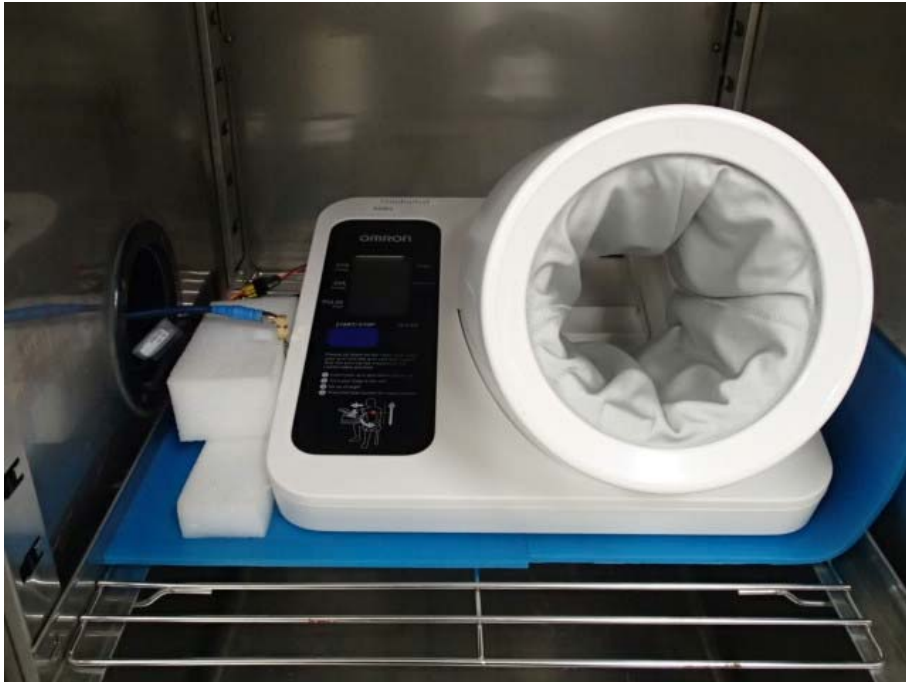


Photo 1

Receiver Blocking



Photo 1



Photo 2

End of Report