

RADIO TEST REPORT

Test Report No. 15116658S-A

Customer	Nintendo Co., Ltd.
Description of EUT	Game controller
Model Number of EUT	BEE-008
FCC ID	BKEBEE008
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied
Issue Date	October 29, 2024
Remarks	Bluetooth Low Energy part(s)

Representative Test EngineerYusuke Tanikawara
Engineer**Approved By**Akio Hayashi
Manager

CERTIFICATE 1266.03

- ☐ 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. 15116658S-A

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15116658S-A	October 29, 2024	-

Reference: Abbreviations (Including words undescribed in this report)

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

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SECTION 1: Customer Information

Company Name	Nintendo Co., Ltd.
Address	11-1 Hokotate-cho, Kamitoba, Minami-ku, Kyoto 601-8501, Japan
Telephone Number	+81-75-662-9600
Contact Person	Yosuke Ishikawa

The information provided by the customer is as follows;

- Customer, Description of EUT, Model Number of EUT, 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 (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	Game controller
Model Number	BEE-008
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 21, 2024
Test Date	June 24 to October 4, 2024

2.2 Product Description

General Specification

Rating	DC 5 V (*.Supply voltage from connector) (*. DC 3.87 V from Re-chargeable Li-ion battery for the internal circuit)
Operating temperature	5 deg. C to 35 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)}	3.24 dBi

Bluetooth (BR/BDR)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8 DPSK)
Antenna Gain ^{a)}	3.24 dBi

RFID

Equipment Type	Transceiver
Frequency of Operation	13.56 MHz
Type of Modulation	ASK

SECTION 3: Test Specification, Procedures & Results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C The latest version on the first day of the testing period
Title	FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and Results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ISED: RSS-Gen 8.8	FCC: Section 15.207 ISED: RSS-Gen 8.8	27.8 dB 0.15225 MHz, N, QP	Complied	-
6 dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(a)(2) ISED: RSS-247 5.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ISED: RSS-247 5.4(d)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(e) ISED: RSS-247 5.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.13	FCC: Section 15.247(d) ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	7.7 dB 2483.500 MHz, AV, Vertical, Mode: Tx BT LE 2M-PHY 2480 MHz	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. * In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred. *1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 8.5 and 8.6.					

FCC Part 15.31 (e)

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

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT.
Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to Standard

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
99 % Occupied Bandwidth	ISED: RSS-Gen 6.7	ISED: -	N/A	-	Conducted

Other than above, 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	Frequency range	Uncertainty (+/-)
Conducted Emission (AC Mains) LISN	150 kHz to 30 MHz	3.2 dB
Radiated Emission (Measurement distance: 3 m)	9 kHz to 30 MHz	3.3 dB
	30 MHz to 200 MHz	4.9 dB
	200 MHz to 1 GHz	6.2 dB
	1 GHz to 6 GHz	4.7 dB
	6 GHz to 18 GHz	5.3 dB
	18 GHz to 40 GHz	5.5 dB
Radiated Emission (Measurement distance: 1 m)	1 GHz to 18 GHz	5.6 dB
	18 GHz to 40 GHz	5.8 dB

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)	1.3 dB
Power Measurement above 1 GHz (Peak Detector)	1.8 dB
Spurious Emission (Conducted) below 1 GHz	0.91 dB
Conducted Emissions Power Density Measurement 1 GHz to 3 GHz	1.3 dB
Conducted Emissions Power Density Measurement 3 GHz to 18 GHz	2.5 dB
Spurious Emission (Conducted) 18 GHz to 26.5 GHz	2.8 dB
Spurious Emission (Conducted) 26.5 GHz to 40 GHz	2.6 dB
Bandwidth Measurement	0.012 %
Duty Cycle and Time Measurement	0.27 %
Temperature	2.2 deg.C.
Humidity	4.0 %
Voltage	0.74 %

3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.

1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 Japan

Telephone: +81-463-50-6400

A2LA Certificate Number: 1266.03

(FCC test firm registration number: 626366, ISED lab company number: 2973D / CAB identifier: JP0001)

Test room	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber (SAC1)	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber (SAC2)	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber (SAC3)	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber (SAC4)	8.1 x 5.1 x 3.55	8.1 x 5.1	-
Wireless anechoic chamber 1 (WAC1)	9.5 x 6.0 x 5.4	9.5 x 6.0	3 m
Wireless anechoic chamber 2 (WAC2)	9.5 x 6.0 x 5.4	9.5 x 6.0	3 m
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	-	-
No.2 Measurement room	4.5 x 3.5 x 2.5	-	-
Wireless shielded room 1	3.0 x 4.5 x 2.7	3.0 x 4.5	-
Wireless shielded room 2	3.0 x 4.5 x 2.7	3.0 x 4.5	-

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)

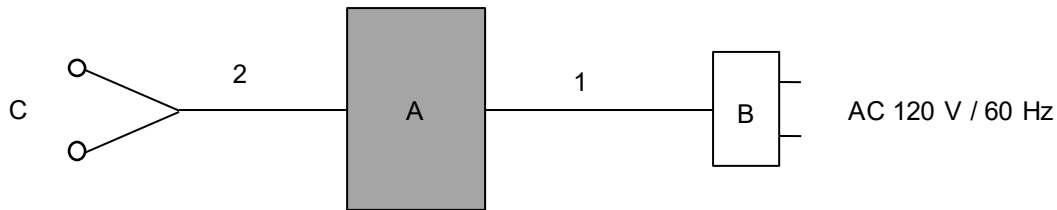
Mode	Remarks*
Bluetooth Low Energy (BT LE)	1M-PHY Uncoded PHY (1M-PHY), Maximum Packet Size, PRBS9
Bluetooth Low Energy (BT LE)	2M-PHY Uncoded PHY (2M-PHY), Maximum Packet Size, PRBS9
*Power of the EUT was set by the software as follows; Power Setting: Fixed Software: InspectionFwPackage Version: V0.15.0 (Date: 2024.05 21, Storage location: EUT memory) *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.	

*The Details of Operating Mode(s)

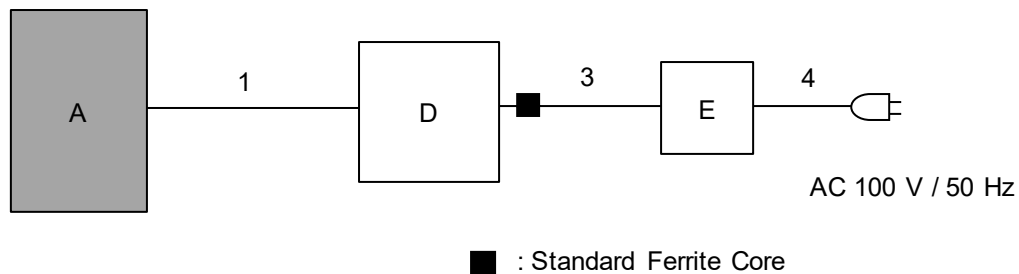
Test Item	Operating Mode	Tested Frequency
Conducted Emission, Radiated Spurious Emission (Below 1 GHz), Conducted Spurious Emission	Tx BT LE, 1M-PHY *1)	2402 MHz
Radiated Spurious Emission (Above 1 GHz), Maximum Peak Output Power, Power Density, 6 dB Bandwidth, 99 % Occupied Bandwidth	Tx BT LE, 1M-PHY Tx BT LE, 2M-PHY	2402 MHz 2440 MHz 2480 MHz
*1) Conducted emissions, Spurious emissions for frequencies below 1 GHz and Conducted Spurious Emission were limited to the channel that had the highest power during the antenna terminal test, as preliminary testing indicated that changing the operating frequency had no significant impact on the emissions in those frequency bands.		

4.2 Configuration and Peripherals

[For Radiated Emission test and Conducted Emission test]



[For Antenna Terminal test]



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

*As a result of comparing AC 120 V and AC 240 V at pre-check, conducted emission test was performed with AC 120 V of the worst voltage as representative.

Description of EUT and Support Equipment

No.	Item	Model number	Serial Number	Manufacturer	Remarks
A	Game controller	BEE-008	HEL01000022214 *1) HEL01000002285 *2)	Nintendo Co., Ltd.	-
B	AC Adapter	NGN-01	0A0000030	Nintendo Co., Ltd.	-
C	Earphones	MDR-EX255AP	-	Sony	-
D	Laptop PC	CF-SZ6RDYVS	8KKSC50259	Panasonic	-
E	AC Adaptor	CF-AA64L2C M1	64L2CM118906341A	Panasonic	-

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

*2) Used for Antenna Terminal conducted test

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	1.5	Shielded	Shielded	-
2	Earphones	1.25	Unshielded	Unshielded	-
3	DC	1.0	Unshielded	Unshielded	-
4	AC	0.8	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and Conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane.

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

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

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Shielded Room.

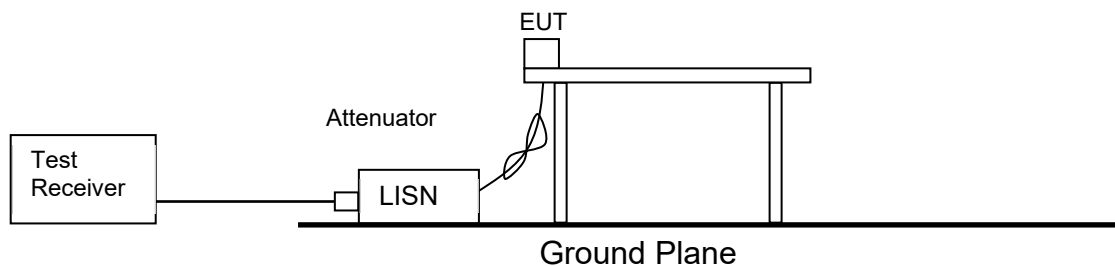
The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

Test results are rounded off and limit are rounded down, so some differences might be observed.

Detector	: QP and CISPR AV
Measurement Range	: 0.15 MHz to 30 MHz
Test Data	: APPENDIX
Test Result	: Pass

Figure 1: Test Setup



SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05r02".

[For below 1 GHz]

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

[For above 1 GHz]

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 has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane. 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 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.

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.

Test Antennas are used as below;

Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

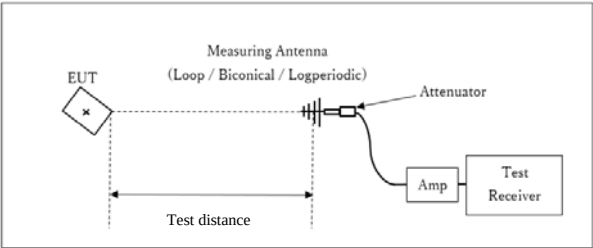
In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument Used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	11.12.2.5.2 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz

Figure 2: Test Setup

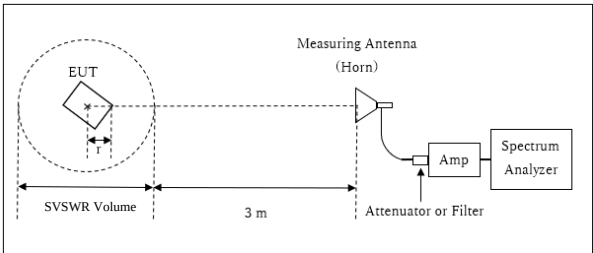
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz to 10 GHz

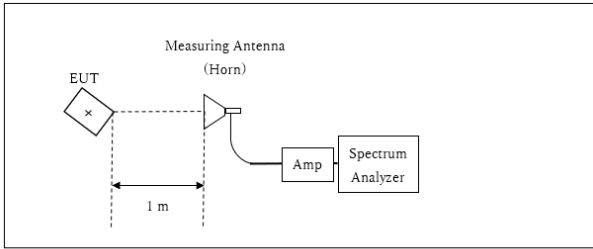


r : Radius of an outer periphery of EUT
x : Center of turn table

Distance Factor: $20 \times \log (3.925 \text{ m} / 3.0 \text{ m}) = 2.34 \text{ dB}$
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.93 \text{ m}$

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.075 \text{ m}$

10 GHz to 26.5 GHz



x : Center of turn table

Distance Factor: $20 \times \log (1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$
*Test Distance: 1 m

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

	Carrier	Spurious (30 MHz - 1 GHz)	Spurious (1 GHz - 2.8 GHz)	Spurious (2.8 GHz - 10 GHz)	Spurious (Above 10 GHz)
Horizontal	X	X	X	X	X
Vertical	Y	X	Y	Z	X

Test results are rounded off and limit are rounded down, so some differences might be observed.

Measurement Range : 30 MHz to 26.5 GHz
Test Data : APPENDIX
Test Result : Pass

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument Used
6 dB Bandwidth	Enough width to display emission skirts	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak	-	Power Meter (Sensor: 160 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *2)
Conducted Spurious Emission *3) *4)	9 kHz to 150 kHz 150 kHz to 30 MHz	200 Hz 10 kHz	620 Hz 30 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) Peak hold was applied as Worst-case measurement.
 *2) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".
 *3) In the frequency range below 30 MHz, RBW was narrowed to separate the noise contents.
 Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
 (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)
 *4) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to $45.5 - 51.5 = -6.0$ dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

Test results are rounded off and limit are rounded down, so some differences might be observed.
 The equipment and cables were not used for factor 0 dB of the data sheets.

Test Data : APPENDIX
 Test Result : Pass

APPENDIX 1: Test Data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

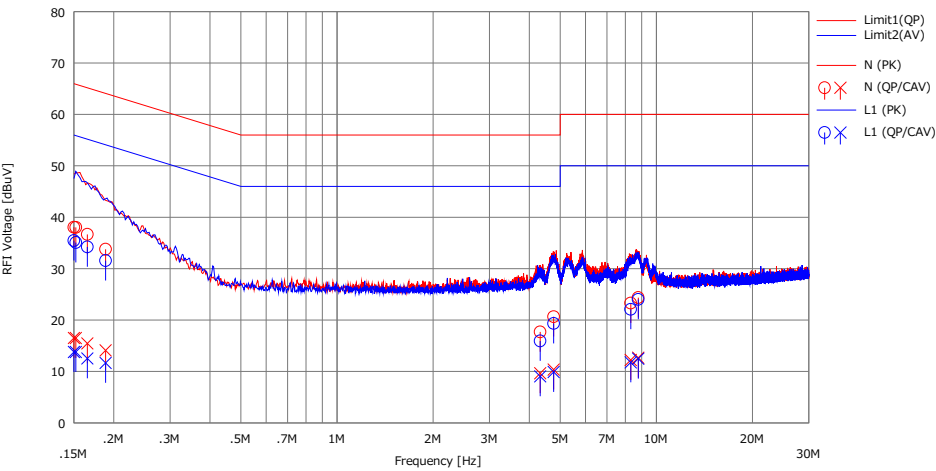
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2024/08/18

Mode : Tx, BT LE 1M-PHY, 2402 MHz
Power : AC 120 V / 60 Hz (AC adapter)
Temp./Humi. : 25 deg.C / 59 %RH

Remarks : -

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Masahide Ozaki



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(CAV) [dBuV]		(QP) [dBuV]	(CAV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	25.49	3.97	12.55	38.04	16.52	66.00	56.00	27.9	39.4	N	
2	0.15225	25.48	3.94	12.55	38.03	16.49	65.88	55.88	27.8	39.3	N	
3	0.16536	24.11	2.88	12.57	36.68	15.45	65.19	55.19	28.5	39.7	N	
4	0.18850	21.20	1.53	12.57	33.77	14.10	64.10	54.10	30.3	40.0	N	
5	4.32779	4.69	-3.36	13.00	17.69	9.64	56.00	46.00	38.3	36.3	N	
6	4.77138	7.60	-2.69	13.06	20.66	10.37	56.00	46.00	35.3	35.6	N	
7	8.31358	9.90	-1.17	13.41	23.31	12.24	60.00	50.00	36.6	37.7	N	
8	8.77955	10.92	-0.78	13.45	24.37	12.67	60.00	50.00	35.6	37.3	N	
9	0.15000	22.88	1.22	12.57	35.45	13.79	66.00	56.00	30.5	42.2	L1	
10	0.15225	22.51	1.22	12.57	35.08	13.79	65.88	55.88	30.8	42.0	L1	
11	0.16536	21.66	-0.04	12.57	34.23	12.53	65.19	55.19	30.9	42.6	L1	
12	0.18850	18.98	-0.93	12.58	31.56	11.65	64.10	54.10	32.5	42.4	L1	
13	4.32779	2.97	-3.92	12.97	15.94	9.06	56.00	46.00	40.0	36.9	L1	
14	4.77138	6.31	-3.13	13.02	19.33	9.89	56.00	46.00	36.6	36.1	L1	
15	8.31358	8.80	-1.51	13.29	22.09	11.78	60.00	50.00	37.9	38.2	L1	
16	8.77955	10.69	-0.84	13.32	24.01	12.48	60.00	50.00	35.9	37.5	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN):145539

99 % Occupied Bandwidth and 6 dB Bandwidth

Test place Shonan EMC Lab. No.1 Measurement Room
Date June 24, 2024
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Kazuya Noda
Mode Tx BT LE

BT LE 1M-PHY

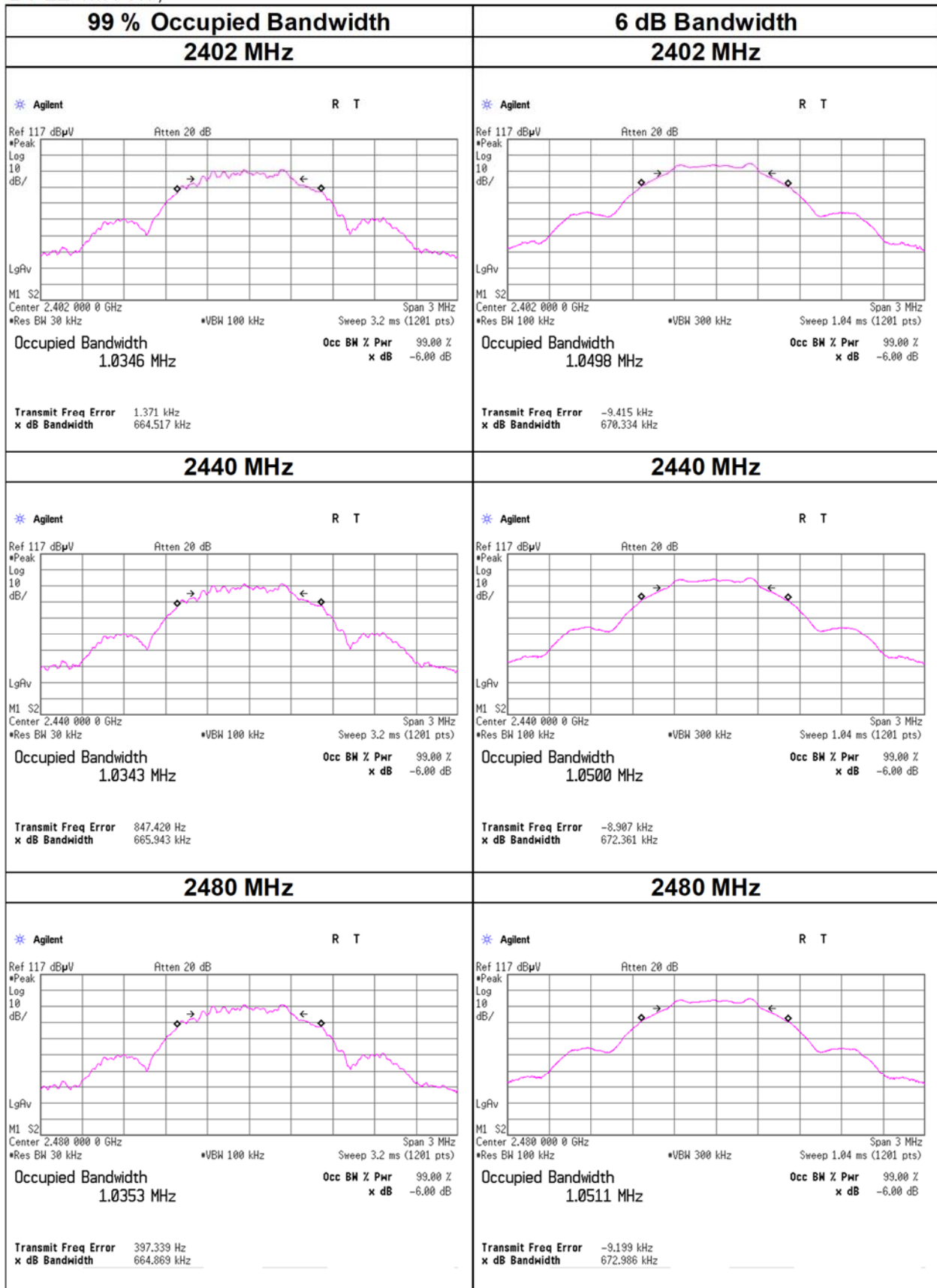
Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
2402	1034.6	0.670	> 0.5000
2440	1034.3	0.672	> 0.5000
2480	1035.3	0.673	> 0.5000

BT LE 2M-PHY

Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
2402	2060.5	1.196	> 0.5000
2440	2060.5	1.199	> 0.5000
2480	2060.7	1.198	> 0.5000

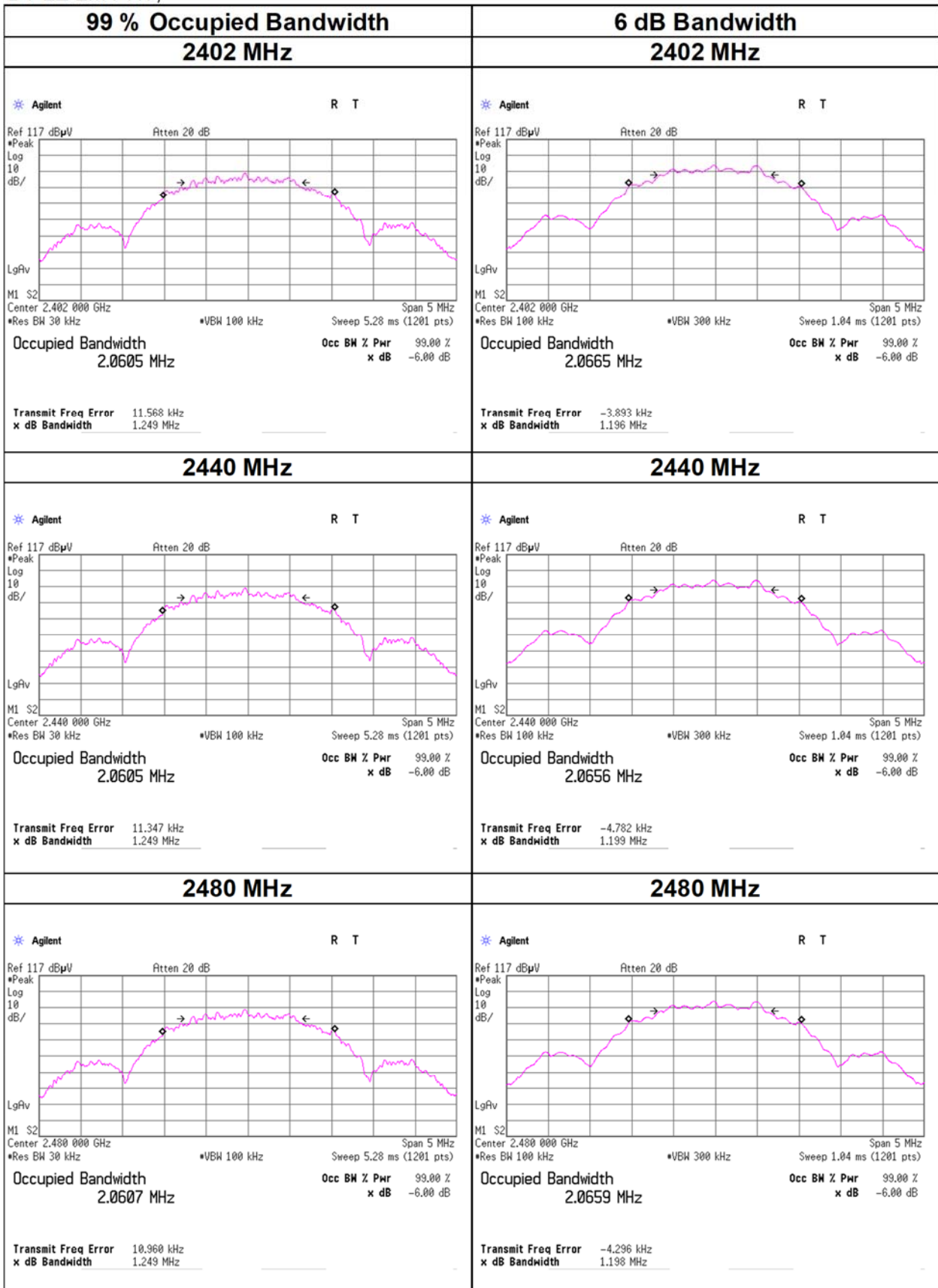
99 % Occupied Bandwidth and 6 dB Bandwidth

BT LE 1M-PHY,



99 % Occupied Bandwidth and 6 dB Bandwidth

BT LE 2M-PHY,



Maximum Peak Output Power

Test place Shonan EMC Lab. No.1 Measurement Room
Date June 24, 2024
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Kazuya Noda
Mode Tx BT LE

BT LE 1M-PHY

Maximum peak output power

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-4.84	1.62	9.94	6.72	4.70	30.00	1000	23.28	3.24	9.96	9.91	36.02	4000	26.06
2440	-4.95	1.63	9.94	6.62	4.59	30.00	1000	23.38	3.24	9.86	9.68	36.02	4000	26.16
2480	-5.01	1.63	9.94	6.56	4.53	30.00	1000	23.44	3.24	9.80	9.55	36.02	4000	26.22

BT LE 2M-PHY

Maximum peak output power

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-4.86	1.62	9.94	6.70	4.68	30.00	1000	23.30	3.24	9.94	9.86	36.02	4000	26.08
2440	-4.95	1.63	9.94	6.62	4.59	30.00	1000	23.38	3.24	9.86	9.68	36.02	4000	26.16
2480	-5.01	1.63	9.94	6.56	4.53	30.00	1000	23.44	3.24	9.80	9.55	36.02	4000	26.22

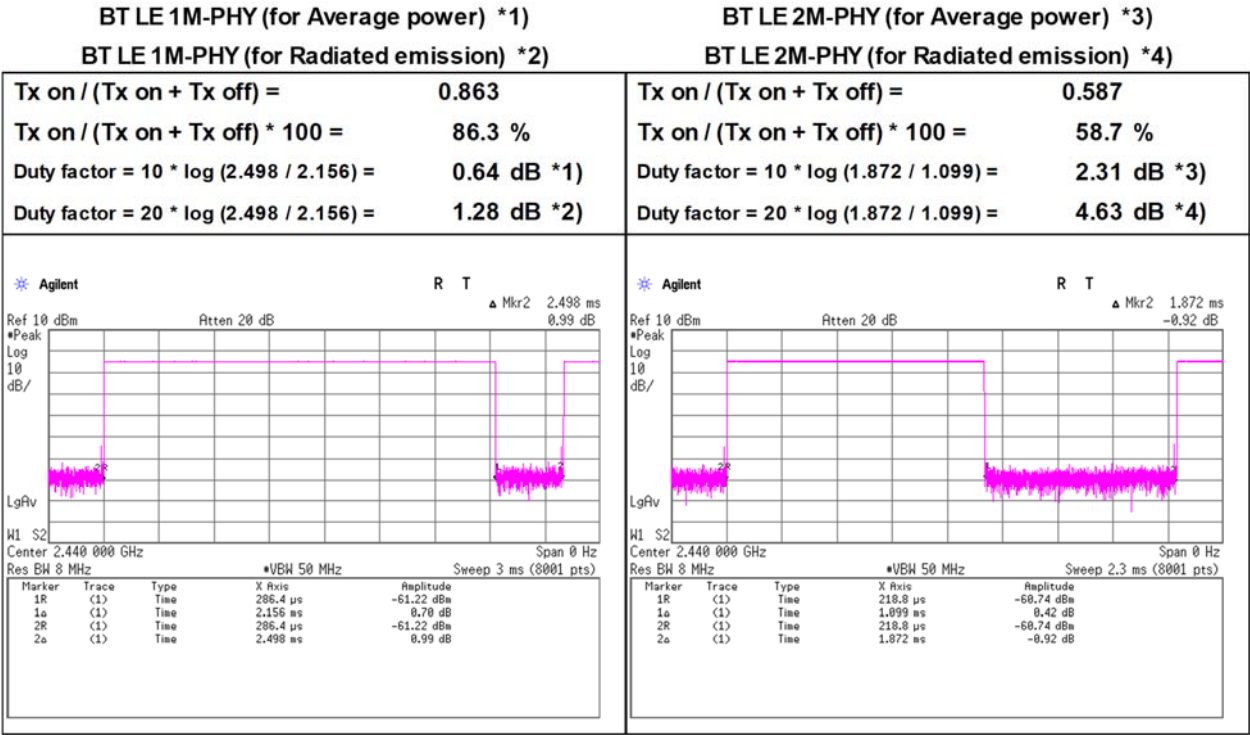
Sample Calculation:

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

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

Burst rate confirmation

Test place	Shonan EMC Lab. No.1 Measurement Room
Date	June 24, 2024
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Kazuya Noda
Mode	Tx BT LE



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

Radiated Spurious Emission

Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	WAC2	WAC2	WAC2
Date	October 4, 2024	August 13, 2024	October 2, 2024
Temperature / Humidity	22 deg. C / 54 % RH	25 deg. C / 48 % RH	24 deg. C / 55 % RH
Engineer	Yusuke Tanikawara	Makoto Hosaka	Yusuke Tanikawara
	(30 MHz to 1 GHz)	(1 GHz to 10 GHz)	(10 GHz to 26.5 GHz)
Mode	Tx BT LE 1M-PHY 2402 MHz		

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	194.013	QP	39.40	14.22	7.19	33.07	0.00	27.74	43.5	15.7	170	264	-
Hori.	197.199	QP	38.40	14.36	7.16	33.07	0.00	26.85	43.5	16.6	169	273	-
Hori.	200.603	QP	37.40	11.53	7.23	33.06	0.00	23.10	43.5	20.4	166	276	-
Hori.	2390.000	PK	48.15	27.75	-28.27	-	2.34	49.97	73.9	23.9	115	173	-
Hori.	4804.000	PK	51.09	31.56	-36.04	-	2.34	48.95	73.9	24.9	361	267	-
Hori.	7206.000	PK	46.56	36.21	-34.48	-	2.34	50.63	73.9	23.2	150	0	-
Hori.	9608.000	PK	45.87	38.14	-31.55	-	2.34	54.80	73.9	19.1	150	0	-
Hori.	7206.000	AV	35.17	36.21	-34.48	-	2.34	39.24	53.9	14.6	150	0	Floor noise
Hori.	9608.000	AV	34.12	38.14	-31.55	-	2.34	43.05	53.9	10.8	150	0	Floor noise
Vert.	33.376	QP	34.30	12.83	6.29	32.76	0.00	20.66	40.0	19.3	100	342	-
Vert.	34.891	QP	36.40	12.47	6.31	32.80	0.00	22.38	40.0	17.6	100	354	-
Vert.	197.538	QP	35.20	14.38	7.15	33.06	0.00	23.67	43.5	19.8	100	196	-
Vert.	200.493	QP	37.20	11.53	7.23	33.06	0.00	22.90	43.5	20.6	100	181	-
Vert.	367.821	QP	37.40	15.15	7.74	32.62	0.00	27.67	46.0	18.3	100	174	-
Vert.	378.715	QP	37.20	15.24	7.77	32.58	0.00	27.63	46.0	18.3	100	158	-
Vert.	491.716	QP	32.60	17.72	8.06	32.28	0.00	26.10	46.0	19.9	100	161	-
Vert.	2390.000	PK	47.94	27.75	-28.27	-	2.34	49.76	73.9	24.1	154	129	-
Vert.	4804.000	PK	51.47	31.56	-36.04	-	2.34	49.33	73.9	24.5	105	294	-
Vert.	7206.000	PK	46.79	36.21	-34.48	-	2.34	50.86	73.9	23.0	150	0	-
Vert.	9608.000	PK	45.84	38.14	-31.55	-	2.34	54.77	73.9	19.1	150	0	-
Vert.	7206.000	AV	35.11	36.21	-34.48	-	2.34	39.18	53.9	14.7	150	0	Floor noise
Vert.	9608.000	AV	34.50	38.14	-31.55	-	2.34	43.43	53.9	10.4	150	0	Floor noise

(1 GHz to 18 GHz) Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz) - Gain(Amplifier)) + Distance factor

(Other band) Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator below 1 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.925\text{ m} / 3.0\text{ m}) = 2.34\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	35.67	27.75	-28.27	-	1.28	2.34	38.77	53.9	15.1	*1)
Hori.	4804.000	AV	42.03	31.56	-36.04	-	1.28	2.34	41.17	53.9	12.7	-
Vert.	2390.000	AV	35.60	27.75	-28.27	-	1.28	2.34	38.70	53.9	15.2	*1)
Vert.	4804.000	AV	42.03	31.56	-36.04	-	1.28	2.34	41.17	53.9	12.7	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz) - Gain(Amplifier)) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.925\text{ m} / 3.0\text{ m}) = 2.34\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Burst rate confirmation" sheet.

*1) Not out of band emission (Leakage Power)

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	98.76	27.77	-28.26	-	2.34	100.61	-	-	Carrier
Hori.	2400.000	PK	42.75	27.77	-28.26	-	2.34	44.60	80.6	36.0	-
Vert.	2402.000	PK	99.92	27.77	-28.26	-	2.34	101.77	-	-	Carrier
Vert.	2400.000	PK	43.16	27.77	-28.26	-	2.34	45.01	81.7	36.6	-

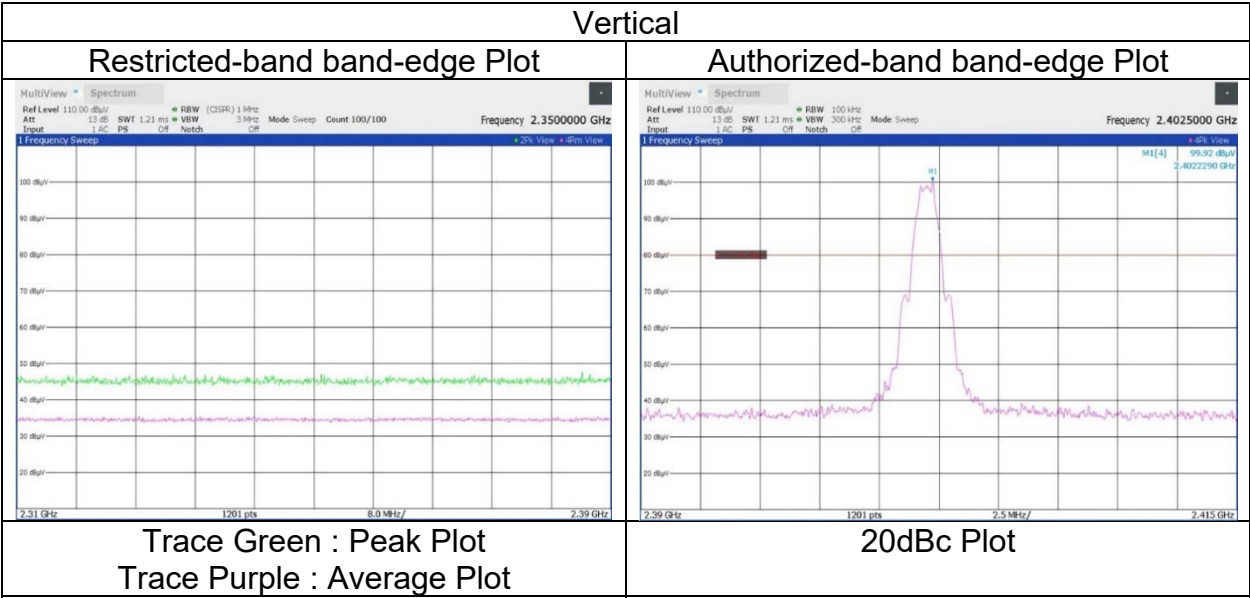
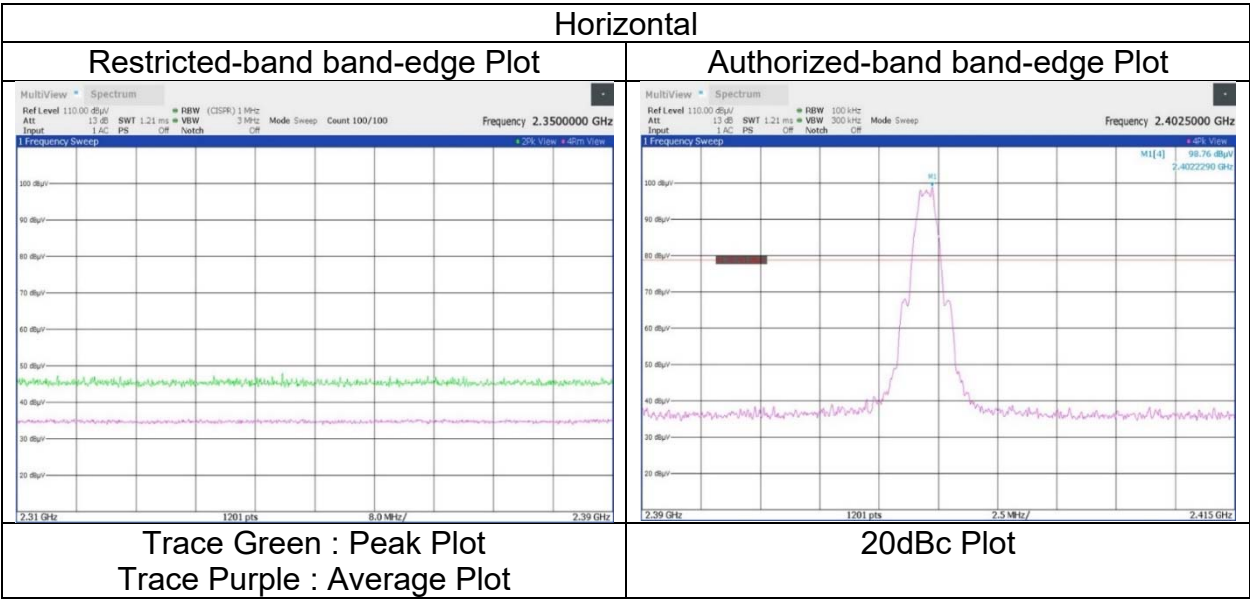
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz) - Gain(Amplifier)) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.925\text{ m} / 3.0\text{ m}) = 2.34\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	WAC2
Date	August 13, 2024
Temperature / Humidity	25 deg. C / 48 % RH
Engineer	Makoto Hosaka
Mode	Tx BT LE 1M-PHY 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge and authorized band edge were shown in tabular data.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	WAC2	WAC2
Date	August 13, 2024	October 2, 2024
Temperature / Humidity	25 deg. C / 48 % RH	24 deg. C / 55 % RH
Engineer	Makoto Hosaka	Yusuke Tanikawara
	(1 GHz to 10 GHz)	(10 GHz to 26.5 GHz)
Mode	Tx BT LE 1M-PHY 2440 MHz	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4880.000	PK	49.84	31.95	-36.01	-	2.34	48.12	73.9	25.7	322	224	-
Hori.	7320.000	PK	47.73	36.66	-34.24	-	2.34	52.49	73.9	21.4	150	0	-
Hori.	9760.000	PK	45.53	38.10	-31.33	-	2.34	54.64	73.9	19.2	150	0	-
Hori.	7320.000	AV	35.86	36.66	-34.24	-	2.34	40.62	53.9	13.2	150	0	Floor noise
Hori.	9760.000	AV	34.27	38.10	-31.33	-	2.34	43.38	53.9	10.5	150	0	Floor noise
Vert.	4880.000	PK	50.69	31.95	-36.01	-	2.34	48.97	73.9	24.9	135	101	-
Vert.	7320.000	PK	47.76	36.66	-34.24	-	2.34	52.52	73.9	21.3	150	0	-
Vert.	9760.000	PK	46.66	38.10	-31.33	-	2.34	55.77	73.9	18.1	150	0	-
Vert.	7320.000	AV	35.73	36.66	-34.24	-	2.34	40.49	53.9	13.4	150	0	Floor noise
Vert.	9760.000	AV	34.15	38.10	-31.33	-	2.34	43.26	53.9	10.6	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log (3.925 m / 3.0 m) = 2.34 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4880.000	AV	39.57	31.95	-36.01	-	1.28	2.34	39.13	53.9	14.7	-
Vert.	4880.000	AV	40.24	31.95	-36.01	-	1.28	2.34	39.80	53.9	14.1	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz) - Gain(Amplifier)) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.925 m / 3.0 m) = 2.34 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Burst rate confirmation" sheet.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	WAC2	WAC2
Date	August 13, 2024	October 2, 2024
Temperature / Humidity	25 deg. C / 48 % RH	24 deg. C / 55 % RH
Engineer	Makoto Hosaka	Yusuke Tanikawara
	(1 GHz to 10 GHz)	(10 GHz to 26.5 GHz)
Mode	Tx BT LE 1M-PHY 2480 MHz	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	49.93	27.80	-28.21	-	2.34	51.86	73.9	22.0	150	179	-
Hori.	4960.000	PK	48.97	32.23	-35.97	-	2.34	47.57	73.9	26.3	209	301	-
Hori.	7440.000	PK	47.62	36.81	-33.99	-	2.34	52.78	73.9	21.1	150	0	-
Hori.	9920.000	PK	45.68	38.04	-31.10	-	2.34	54.96	73.9	18.9	150	0	-
Hori.	7440.000	AV	35.64	36.81	-33.99	-	2.34	40.80	53.9	13.1	150	0	Floor noise
Hori.	9920.000	AV	34.04	38.04	-31.10	-	2.34	43.32	53.9	10.5	150	0	Floor noise
Vert.	2483.500	PK	51.62	27.80	-28.21	-	2.34	53.55	73.9	20.3	157	136	-
Vert.	4960.000	PK	49.73	32.23	-35.97	-	2.34	48.33	73.9	25.5	100	105	-
Vert.	7440.000	PK	46.92	36.81	-33.99	-	2.34	52.08	73.9	21.8	150	0	-
Vert.	9920.000	PK	46.08	38.04	-31.10	-	2.34	55.36	73.9	18.5	150	0	-
Vert.	7440.000	AV	35.77	36.81	-33.99	-	2.34	40.93	53.9	12.9	150	0	Floor noise
Vert.	9920.000	AV	34.37	38.04	-31.10	-	2.34	43.65	53.9	10.2	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.925\text{ m} / 3.0\text{ m}) = 2.34\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	37.68	27.80	-28.21	-	1.28	2.34	40.89	53.9	13.0	*1)
Hori.	4960.000	AV	37.87	32.23	-35.97	-	1.28	2.34	37.75	53.9	16.1	-
Vert.	2483.500	AV	37.77	27.80	-28.21	-	1.28	2.34	40.98	53.9	12.9	*1)
Vert.	4960.000	AV	39.59	32.23	-35.97	-	1.28	2.34	39.47	53.9	14.4	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz) - Gain(Amplifier)) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.925\text{ m} / 3.0\text{ m}) = 2.34\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

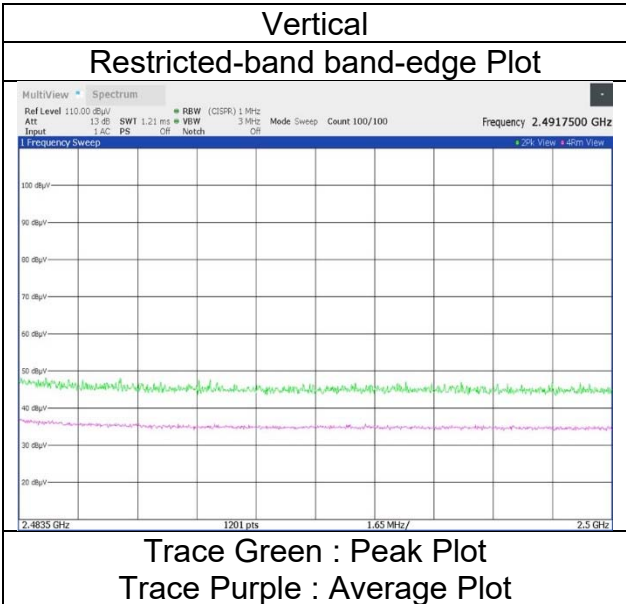
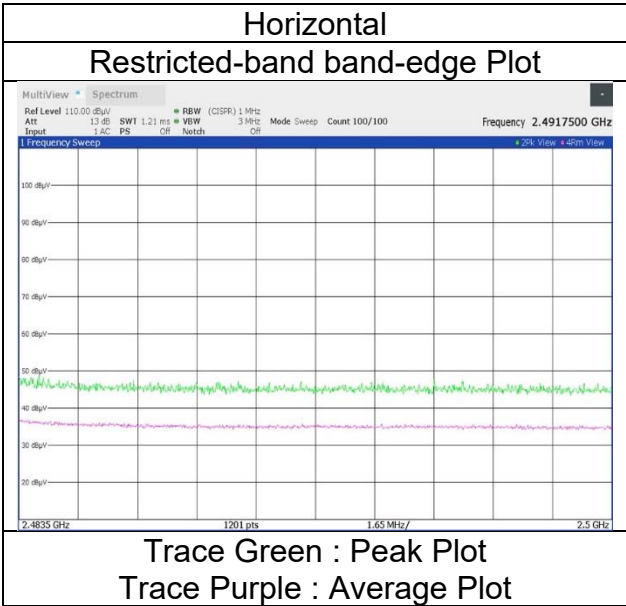
Duty factor refer to "Burst rate confirmation" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

Shonan EMC Lab.
WAC2
August 13, 2024
25 deg. C / 48 % RH
Makoto Hosaka
Tx BT LE 1M-PHY 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place Shonan EMC Lab.
Semi Anechoic Chamber WAC2
Date August 13, 2024 WAC2
Temperature / Humidity 25 deg. C / 48 % RH 24 deg. C / 55 % RH
Engineer Makoto Hosaka Yusuke Tanikawara
(1 GHz to 10 GHz) (10 GHz to 26.5 GHz)
Mode Tx BT LE 2M-PHY 2402 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	47.01	27.75	-28.27	-	2.34	48.83	73.9	25.0	118	172	-
Hori.	4804.000	PK	50.81	31.56	-36.04	-	2.34	48.67	73.9	25.2	298	266	-
Hori.	7206.000	PK	47.28	36.21	-34.48	-	2.34	51.35	73.9	22.5	150	0	-
Hori.	9608.000	PK	46.46	38.14	-31.55	-	2.34	55.39	73.9	18.5	150	0	-
Hori.	7206.000	AV	35.14	36.21	-34.48	-	2.34	39.21	53.9	14.6	150	0	Floor noise
Hori.	9608.000	AV	34.45	38.14	-31.55	-	2.34	43.38	53.9	10.5	150	0	Floor noise
Vert.	2390.000	PK	47.54	27.75	-28.27	-	2.34	49.36	73.9	24.5	137	145	-
Vert.	4804.000	PK	51.61	31.56	-36.04	-	2.34	49.47	73.9	24.4	151	142	-
Vert.	7206.000	PK	46.53	36.21	-34.48	-	2.34	50.60	73.9	23.3	150	0	-
Vert.	9608.000	PK	46.11	38.14	-31.55	-	2.34	55.04	73.9	18.8	150	0	-
Vert.	7206.000	AV	35.10	36.21	-34.48	-	2.34	39.17	53.9	14.7	150	0	Floor noise
Vert.	9608.000	AV	34.49	38.14	-31.55	-	2.34	43.42	53.9	10.4	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log (3.925 m / 3.0 m) = 2.34 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	35.87	27.75	-28.27	-	4.63	2.34	42.32	53.9	11.5	*1)
Hori.	4804.000	AV	39.10	31.56	-36.04	-	4.63	2.34	41.59	53.9	12.3	-
Vert.	2390.000	AV	35.45	27.75	-28.27	-	4.63	2.34	41.90	53.9	12.0	*1)
Vert.	4804.000	AV	39.53	31.56	-36.04	-	4.63	2.34	42.02	53.9	11.8	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz) - Gain(Amplifier)) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.925 m / 3.0 m) = 2.34 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Burst rate confirmation" sheet.

*1) Not out of band emission (Leakage Power)

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	97.49	27.77	-28.26	-	2.34	99.34	-	-	Carrier
Hori.	2400.000	PK	66.72	27.77	-28.26	-	2.34	68.57	79.3	10.7	-
Vert.	2402.000	PK	100.23	27.77	-28.26	-	2.34	102.08	-	-	Carrier
Vert.	2400.000	PK	69.14	27.77	-28.26	-	2.34	70.99	82.0	11.0	-

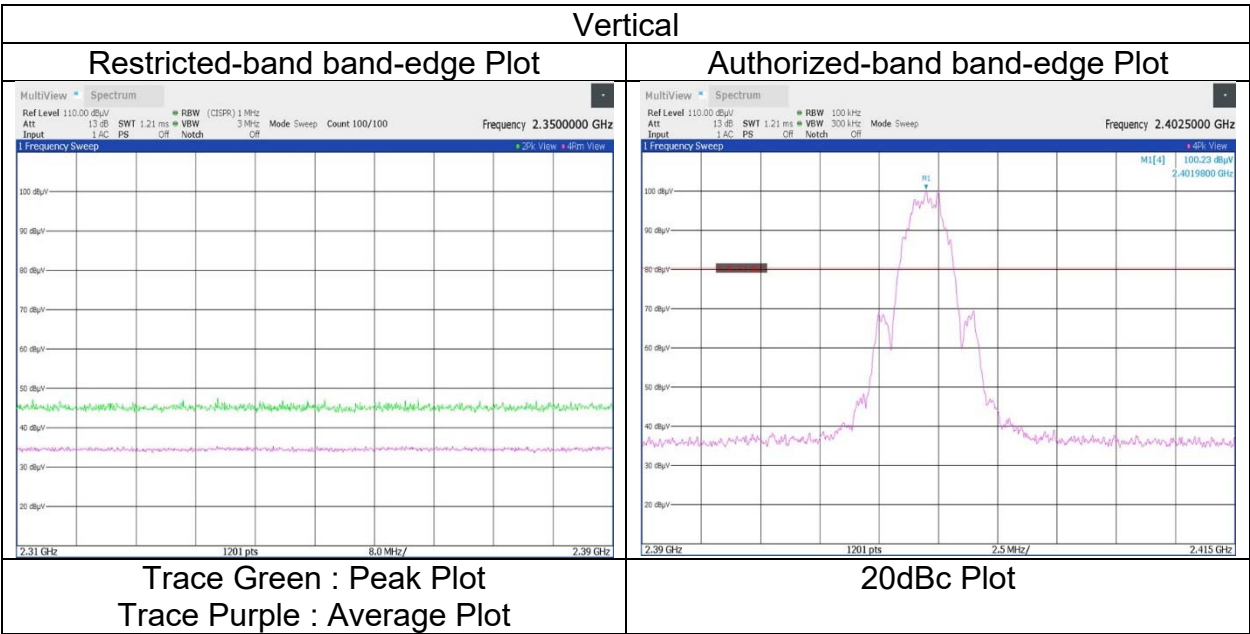
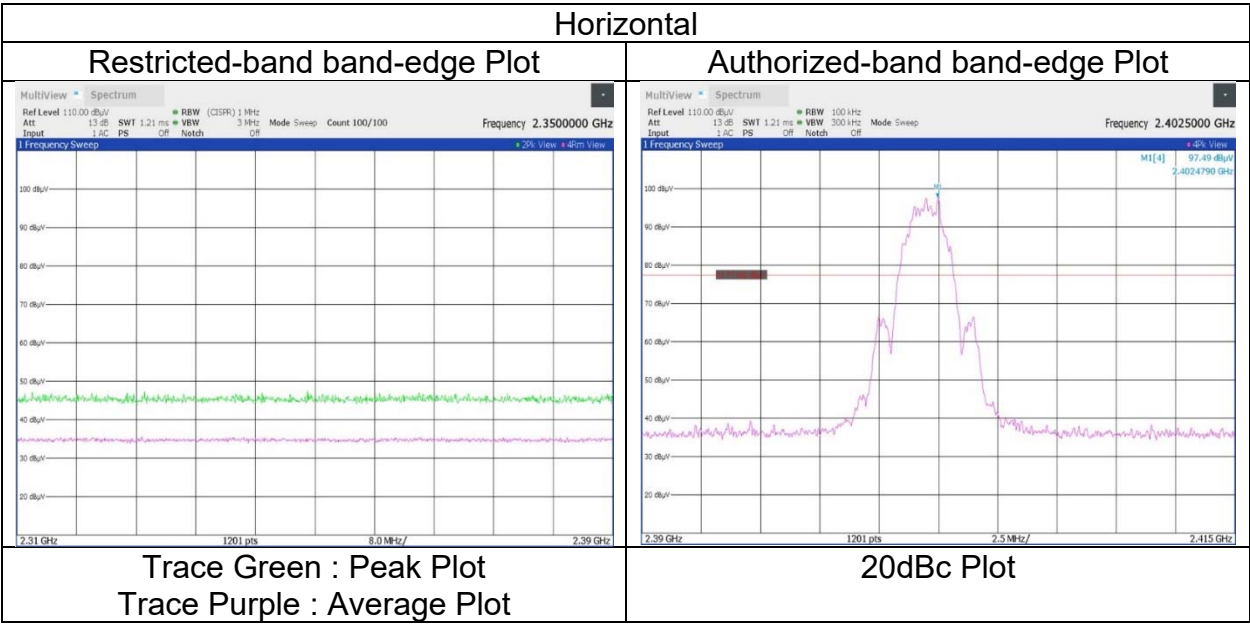
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz) - Gain(Amplifier)) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.925 m / 3.0 m) = 2.34 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	WAC2
Date	August 13, 2024
Temperature / Humidity	25 deg. C / 48 % RH
Engineer	Makoto Hosaka
Mode	Tx BT LE 2M-PHY 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge and authorized band edge were shown in tabular data.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	WAC2	WAC2
Date	August 13, 2024	October 2, 2024
Temperature / Humidity	25 deg. C / 48 % RH	24 deg. C / 55 % RH
Engineer	Makoto Hosaka	Yusuke Tanikawara
	(1 GHz to 10 GHz)	(10 GHz to 26.5 GHz)
Mode	Tx BT LE 2M-PHY 2440 MHz	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4880.000	PK	49.20	31.95	-36.01	-	2.34	47.48	73.9	26.4	260	305	-
Hori.	7320.000	PK	46.95	36.66	-34.24	-	2.34	51.71	73.9	22.1	150	0	-
Hori.	9760.000	PK	46.05	38.10	-31.33	-	2.34	55.16	73.9	18.7	150	0	-
Hori.	7320.000	AV	35.80	36.66	-34.24	-	2.34	40.56	53.9	13.3	150	0	Floor noise
Hori.	9760.000	AV	34.30	38.10	-31.33	-	2.34	43.41	53.9	10.4	150	0	Floor noise
Vert.	4880.000	PK	50.16	31.95	-36.01	-	2.34	48.44	73.9	25.4	114	107	-
Vert.	7320.000	PK	47.62	36.66	-34.24	-	2.34	52.38	73.9	21.5	150	0	-
Vert.	9760.000	PK	46.12	38.10	-31.33	-	2.34	55.23	73.9	18.6	150	0	-
Vert.	7320.000	AV	35.63	36.66	-34.24	-	2.34	40.39	53.9	13.5	150	0	Floor noise
Vert.	9760.000	AV	34.18	38.10	-31.33	-	2.34	43.29	53.9	10.6	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log (3.925 m / 3.0 m) = 2.34 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4880.000	AV	37.04	31.95	-36.01	-	4.63	2.34	39.95	53.9	13.9	-
Vert.	4880.000	AV	38.33	31.95	-36.01	-	4.63	2.34	41.24	53.9	12.6	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz) - Gain(Amplifier)) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.925 m / 3.0 m) = 2.34 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Burst rate confirmation" sheet.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	WAC2	WAC2
Date	August 13, 2024	October 2, 2024
Temperature / Humidity	25 deg. C / 48 % RH	24 deg. C / 55 % RH
Engineer	Makoto Hosaka	Yusuke Tanikawara
	(1 GHz to 10 GHz)	(10 GHz to 26.5 GHz)
Mode	Tx BT LE 2M-PHY 2480 MHz	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	51.29	27.80	-28.21	-	2.34	53.22	73.9	20.6	160	179	-
Hori.	4960.000	PK	48.83	32.23	-35.97	-	2.34	47.43	73.9	26.4	299	297	-
Hori.	7440.000	PK	48.00	36.81	-33.99	-	2.34	53.16	73.9	20.7	150	0	-
Hori.	9920.000	PK	45.97	38.04	-31.10	-	2.34	55.25	73.9	18.6	150	0	-
Hori.	7440.000	AV	35.67	36.81	-33.99	-	2.34	40.83	53.9	13.0	150	0	Floor noise
Hori.	9920.000	AV	34.26	38.04	-31.10	-	2.34	43.54	53.9	10.3	150	0	Floor noise
Vert.	2483.500	PK	52.26	27.80	-28.21	-	2.34	54.19	73.9	19.7	155	134	-
Vert.	4960.000	PK	49.52	32.23	-35.97	-	2.34	48.12	73.9	25.7	133	105	-
Vert.	7440.000	PK	47.86	36.81	-33.99	-	2.34	53.02	73.9	20.8	150	0	-
Vert.	9920.000	PK	45.75	38.04	-31.10	-	2.34	55.03	73.9	18.8	150	0	-
Vert.	7440.000	AV	35.53	36.81	-33.99	-	2.34	40.69	53.9	13.2	150	0	Floor noise
Vert.	9920.000	AV	34.22	38.04	-31.10	-	2.34	43.50	53.9	10.4	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.925\text{ m} / 3.0\text{ m}) = 2.34\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	38.73	27.80	-28.21	-	4.63	2.34	45.29	53.9	8.6	*1)
Hori.	4960.000	AV	37.29	32.23	-35.97	-	4.63	2.34	40.52	53.9	13.3	-
Vert.	2483.500	AV	39.63	27.80	-28.21	-	4.63	2.34	46.19	53.9	7.7	*1)
Vert.	4960.000	AV	38.03	32.23	-35.97	-	4.63	2.34	41.26	53.9	12.6	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz) - Gain(Amplifier)) + Duty factor + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.925\text{ m} / 3.0\text{ m}) = 2.34\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

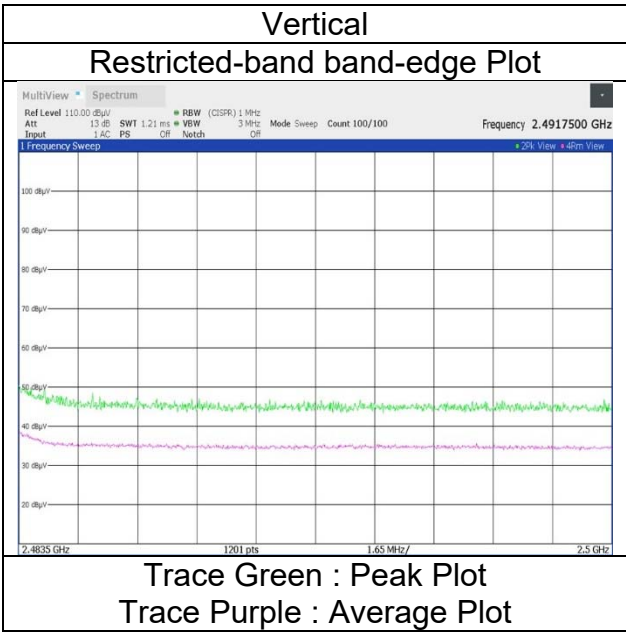
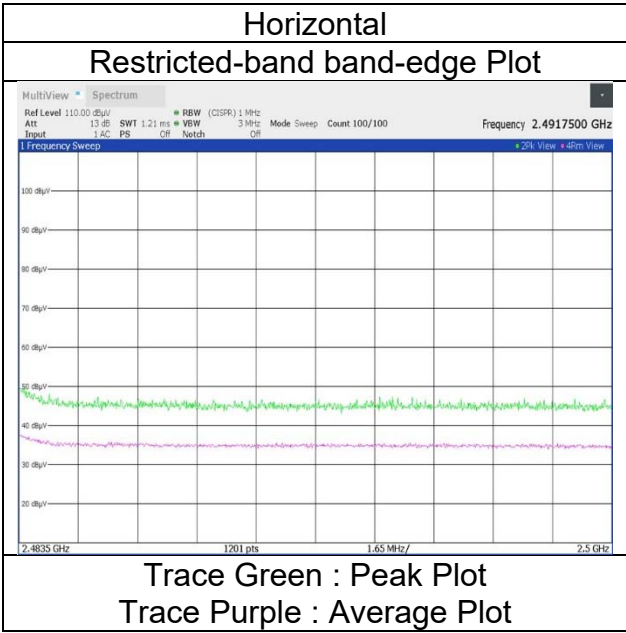
Duty factor refer to "Burst rate confirmation" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

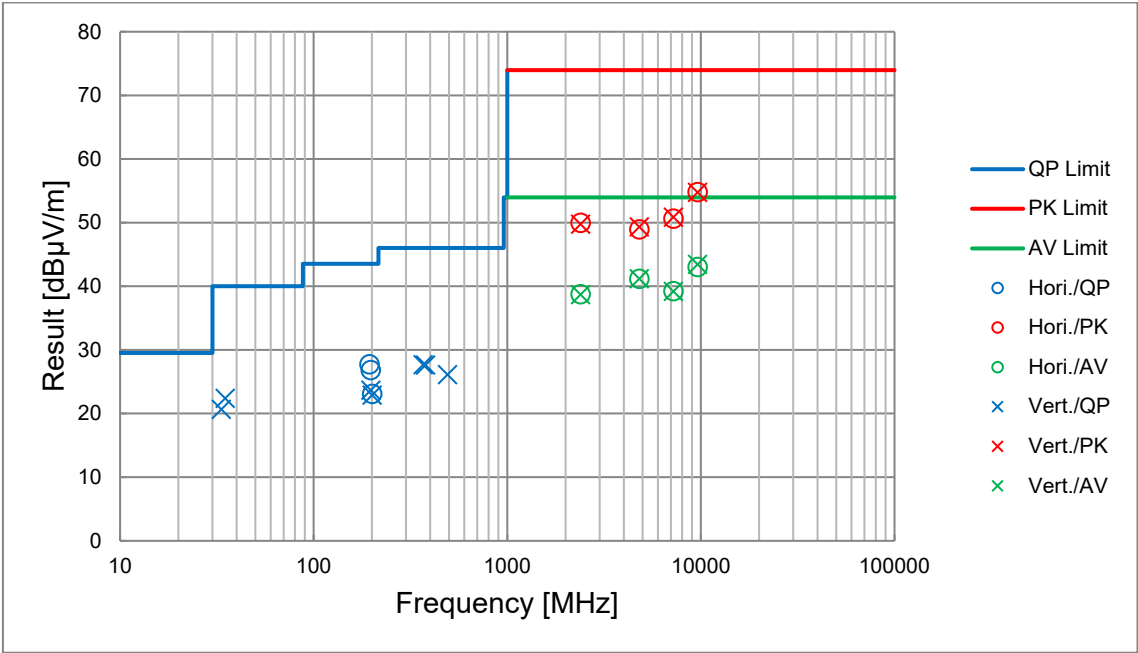
Shonan EMC Lab.
WAC2
August 13, 2024
25 deg. C / 48 % RH
Makoto Hosaka
Tx BT LE 2M-PHY 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case mode for Maximum Peak Output Power)

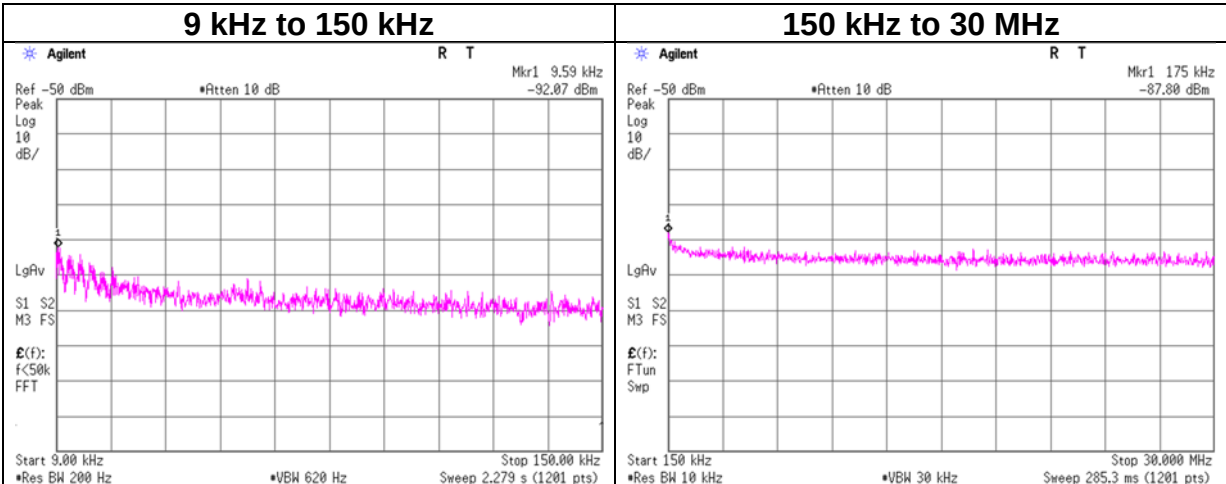
Test place	Shonan EMC Lab.	WAC2	WAC2
Semi Anechoic Chamber	WAC2	WAC2	WAC2
Date	October 4, 2024	August 13, 2024	October 2, 2024
Temperature / Humidity	22 deg. C / 54 % RH	25 deg. C / 48 % RH	24 deg. C / 55 % RH
Engineer	Yusuke Tanikawara	Makoto Hosaka	Yusuke Tanikawara
	(30 MHz to 1 GHz)	(1 GHz to 10 GHz)	(10 GHz to 26.5 GHz)
Mode	Tx BT LE 1M-PHY 2402 MHz		



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

Conducted Spurious Emission

Test place Shonan EMC Lab. No.1 Measurement Room
Date June 24, 2024
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Kazuya Noda
Mode Tx BT LE 1M-PHY 2402 MHz



Frequency	Reading	Cable	Attenuator	Antenna	N	EIRP	Distance	Ground	E	Limit	Margin	Remark
[kHz]	[dBm]	Loss	Loss	Gain	(Number	[dBm]	[m]	bounce	(field strength)	[dBuV/m]	[dB]	
		[dB]	[dB]	[dBi]	of Output)			[dB]	[dBuV/m]			
9.59	-92.1	1.00	9.86	3.24	1	-78.0	300	6.0	-16.7	47.9	64.6	-
175.00	-87.8	1.00	9.86	3.24	1	-73.7	300	6.0	-12.4	22.7	35.1	-

E [dBuV/m] = EIRP [dBm] - 20 log (Distance [m]) + Ground bounce [dB] + 104.8 [dBuV/m]
EIRP[dBm] = Reading [dBm] + Cable loss [dB] + Attenuator Loss [dB] + Antenna gain [dBi] + 10 * log (N)
N: Number of output

Power Density

Test place	Shonan EMC Lab. No.1 Measurement Room
Date	June 24, 2024
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Kazuya Noda
Mode	Tx BT LE

BT LE 1M-PHY

Frequency [MHz]	Measured Frequency [MHz]	Reading [dBm/3 kHz]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm/3 kHz]	Limit [dBm/3 kHz]	Margin [dB]
2402	2402.014	-21.17	1.62	9.94	-9.61	8.00	17.61
2440	2440.014	-21.20	1.63	9.94	-9.63	8.00	17.63
2480	2480.014	-21.34	1.63	9.94	-9.77	8.00	17.77

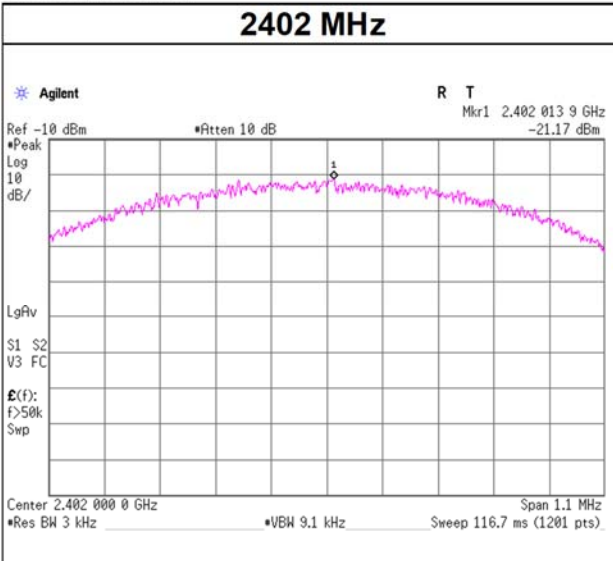
BT LE 2M-PHY

Frequency [MHz]	Measured Frequency [MHz]	Reading [dBm/3 kHz]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm/3 kHz]	Limit [dBm/3 kHz]	Margin [dB]
2402	2401.960	-23.70	1.62	9.94	-12.14	8.00	20.14
2440	2439.960	-23.62	1.63	9.94	-12.05	8.00	20.05
2480	2479.960	-23.82	1.63	9.94	-12.25	8.00	20.25

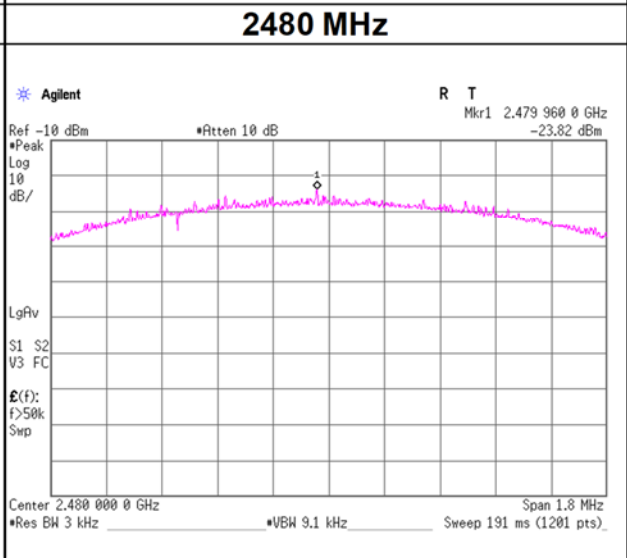
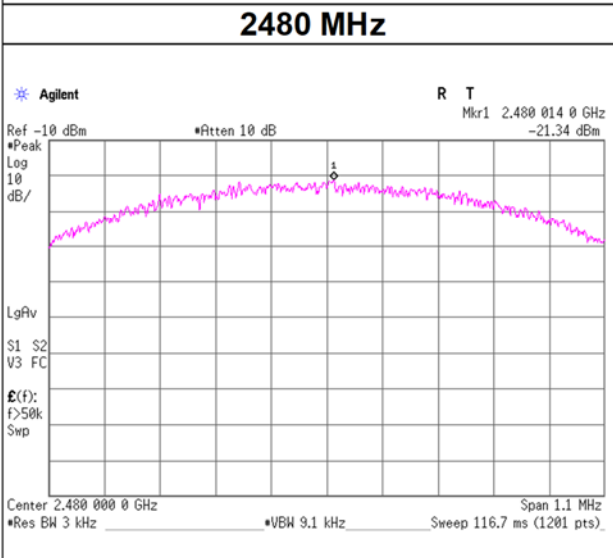
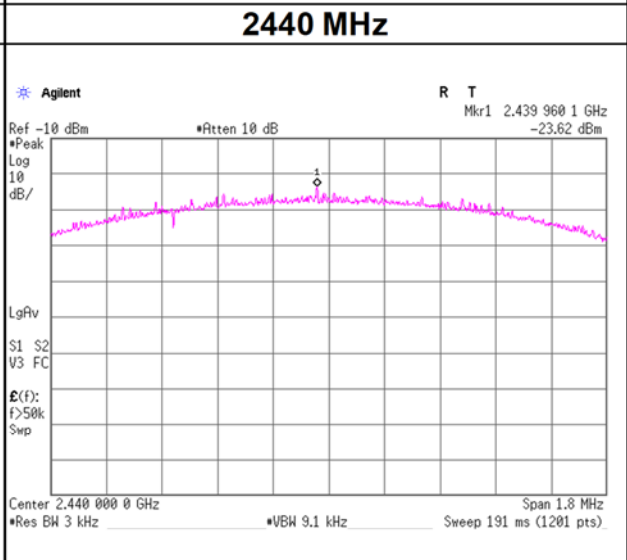
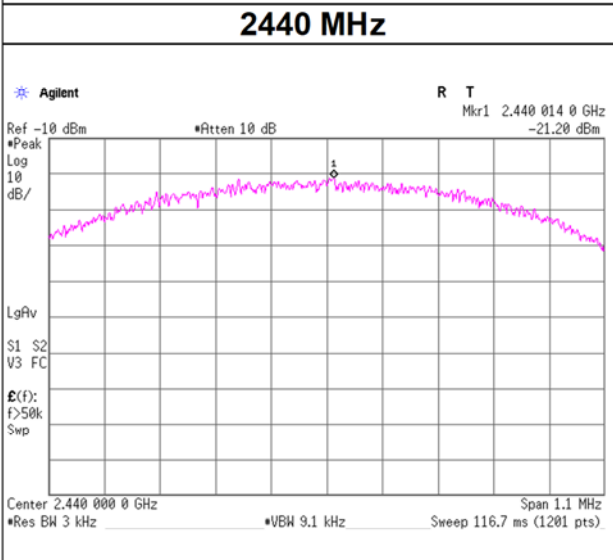
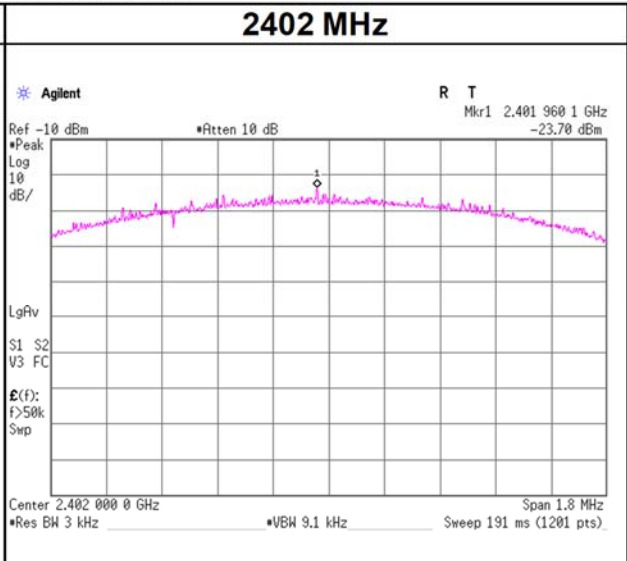
Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

Power Density

BT LE 1M-PHY



BT LE 2M-PHY



APPENDIX 2: Test Instruments

Test Equipment

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	145801	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250152	2024/02/27	12
AT	146247	Power Meter	Keysight Technologies Inc	8990B	MY51000272	2024/05/14	12
AT	146310	Power sensor	Keysight Technologies Inc	N1923A	MY5326009	2024/05/14	12
AT	196942	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803416/2	2024/03/07	12
AT	204928	Attenuator	Weinschel Corp.	54A-10	109973	2024/02/09	12
AT	175823	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/08/01	12 *1)
CE	144896	Attenuator	JFW IND. INC.	50HF-003N	-	2024/07/11	12
CE	144969	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-270(RF Selector)	2024/04/10	12
CE	145539	LISN	Rohde & Schwarz	ENV216	100512	2024/02/06	12
CE	145792	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997812	2024/09/24	12
CE	146188	Terminator	TME	CT-01 BP	-	2023/12/08	12
CE	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2024/08/06	12
CE	207277	Tape Measure	ASKUL	-	-	-	-
CE	235739	Thermo-Hygrometer	CUSTOM. Inc	CTH-230	-	2024/04/28	12
CE	242076	Terminator	Weinschel - API Technologies Corp	M1459A	121090	2023/11/17	12
CE,RE	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	Ver 3.1.0546	-	-
RE	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2024/08/21	12
RE	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2024/08/21	12
RE	145512	Horn Antenna	ETS-Lindgren	3160-09	00094868	2024/06/20	12
RE	145528	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	195	2024/04/10	12
RE	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2024/03/05	12
RE	199783	Attenuator	JFW	50HF-006N	-	2024/06/14	12
RE	207281	Tape Measure	ASKUL	-	-	-	-
RE	235268	Test Receiver	Rohde & Schwarz	ESW44	103212	2023/12/26	12
RE	235640	DIGITAL MULTIMETER	HIOKI E.E. CORPORATION	DT4261	230313157	2024/05/29	12
RE	235738	Thermo-Hygrometer	CUSTOM. Inc	CTH-230	-	2024/04/28	12
RE	236584	Horn Antenna	AINFO Inc.	LB-8180-NF	2030013000112	2024/04/04	12
RE	236615	Semi-Anechoic Chamber	TDK	SWAC-02(NSA)	2	2024/05/10	12
RE	236617	Semi-Anechoic Chamber	TDK	SWAC-02(SVSWR)	2	2024/06/06	12
RE	236687	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	788	2024/04/04	12
RE	236709	Coaxial Cable	Hayashi-Repic co., Ltd.	NMS079B-GL310C-SMS117B-2m	47256-02-04	2024/05/09	12
RE	236720	Coaxial Cable	Huber+Suhner	SF106/SF106/SF106	2001167/2001168/2001161	2024/05/10	12
RE	236724	Coaxial Cable	Hayashi-Repic co., Ltd.	SF106(HUBER+SUHNER)/LMR400UF/GL310C/GL310C	2000430/47753-2/47256-01-04/47256-01-02	2024/05/10	12
RE	236756	Coaxial Cable	Huber+Suhner	SF106/11N/11N/6000	2001167	2024/05/10	12
RE	236967	Pre Amplifier	TSJ (Techno Science Japan)	MLA-9K01-L01	23050010	2024/06/14	12
RE	237786	RF RELAY MATRIX with preamplifier	TSJ (Techno Science Japan)	RFM-E221261R	07796	2023/11/01	12
RE	239644	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	2306S022	2024/08/21	12
RE	239787	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHBB 9124+BBA9106	01908	2024/08/10	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.

The expiration*1) This test equipment was used for the tests before the expiration date of the calibration. All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

Test item:

AT: Antenna Terminal Conducted test
CE: Conducted Emission
RE: Radiated Emission