RADIO TEST REPORT

Test Report No. 14199213S-A-R1

Customer	**Mitutoyo Corporation**
Description of EUT	**Wireless Communication Unit for Measuring instrument**
Model Number of EUT	**264-628**
FCC ID	**VXU-264628**
Test Regulation	**FCC Part 15 Subpart C: 2022**
Test Result	**Complied (Refer to SECTION 3)**
Issue Date	**May 13, 2022**
Remarks	**Bluetooth Low Energy part(s)**

Representative Test Engineer	Approved By
Akihiro Oda Engineer	Kazutaka Takeyama Leader

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".

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 20.0

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REVISION HISTORY

Original Test Report No.: 14199213S-A

This report is a revised version of 14199213S-A. 14199213S-A is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14199213S-A	April 19, 2022	-
1	14199213S-A-R1	May 13, 2022	Page 11: - Corrected from “AC 100 V / 50Hz” to “AC 120 V / 60 Hz” in “<The other test>”. - Added “AC 120 V of” to “*As a result of comparing …”. Page 12: Added *3) to “List of Cables Used”.

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

CONTENTS **PAGE**

SECTION 1: Customer Information

Company Name	Mitutoyo Corporation
Address	20-1, Sakado 1-Chome, Takatsu-ku, Kawasaki-shi, Kanagawa 213-8533, Japan
Telephone Number	+81-44-822-4137
Contact Person	Tomoharu Yamada

The information provided from 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

* 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

Description	Wireless Communication Unit for Measuring instrument
Model Number	264-628
Serial Number	Refer to SECTION 4.2
Condition	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	March 7, 2022
Test Date	March 8 to 25, 2022

2.2 Product Description

General Specification

Rating	DC 3.3 V, 0.02 A
Operating temperature	0 deg. C to +50 deg. C

Radio Specification

Bluetooth (Low Energy)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	GFSK
Antenna Gain	0 dBi

SECTION 3: Test Specification, Procedures & Results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C FCC Part 15 final revised on April 1, 2022 and effective May 2, 2022
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

* The revision does not affect the test result conducted before its effective date.
* 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	**FCC:** Section 15.207	14.1 dB, 0.15000 MHz, QP, N	Complied a)	-
	ISED: RSS-Gen 8.8	**ISED:** RSS-Gen 8.8			
6 dB Bandwidth	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section 15.247(a)(2)	See data.	Complied b)	Conducted
	ISED: -	**ISED:** RSS-247 5.2(a)			
Maximum Peak Output Power	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section 15.247(b)(3)		Complied c)	Conducted
	ISED: RSS-Gen 6.12	**ISED:** RSS-247 5.4(d)			
Power Density	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section 15.247(e)		Complied d)	Conducted
	ISED: -	**ISED:** RSS-247 5.2(b)			
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(d)	6.9 dB 2483.500 MHz, AV, Hori. Mode: Tx BT LE 2 M-PHY 2480 MHz	Complied e), f)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
	ISED: RSS-Gen 6.13	**ISED:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

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.

a) Refer to APPENDIX 1 (data of Conducted Emission)
b) Refer to APPENDIX 1 (data of 99 % Occupied Bandwidth and 6 dB Bandwidth)
c) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
d) Refer to APPENDIX 1 (data of Power Density)
e) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
f) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

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

FCC Part 15.31 (e)
This EUT provides the stable voltage constantly to RF Part 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	- a)	Conducted
a) Refer to APPENDIX 1 (data of 99 % Occupied Bandwidth and 6 dB Bandwidth)					

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

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the 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.

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)			
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4,5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.6 dB	2.6 dB	2.7 dB	2.7 dB
Radiated emission	9 kHz-30 MHz	2.9 dB	2.9 dB	2.9 dB	-
(Measurement distance: 3 m)	30 MHz-200 MHz	4.6 dB	4.6 dB	4.6 dB	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.0 dB	-
	1 GHz-6 GHz	4.8 dB	4.8 dB	4.8 dB	-
	6 GHz-18 GHz	5.4 dB	5.4 dB	5.4 dB	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.7 dB	-
Radiated emission	1 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB	-
(Measurement distance: 1 m)	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	1.2 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	2.0 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	1.2 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.3 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	1.3 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.3 dB
Spurious emission (Conducted) below 1GHz	0.93 dB
Spurious emission (Conducted), Power Density measurement 1 GHz-3 GHz	0.92 dB
Spurious emission (Conducted), Power Density measurement 3 GHz-18 GHz	2.3 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.3 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.3 dB
Bandwidth Measurement	0.012 %
Duty cycle and Time Measurement	0.27 %
Temperature_SCH-01	0.93 deg.C.
Humidity_SCH-01	4.1 %
Temperature_SCH-02	2.0 deg.C.

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, Facsimile: +81 463 50 6401
A2LA Certificate Number: 1266.03
(FCC test firm registration number: 626366, ISED lab company number: 2973D / CAB identifier: JP0001)

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 Shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test Data, Test Instruments, and Test Set Up

Refer to APPENDIX.

SECTION 4: Operation of 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: Firmware for Radio test Ver1.0.0
(Date: 2021.9.14, 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.

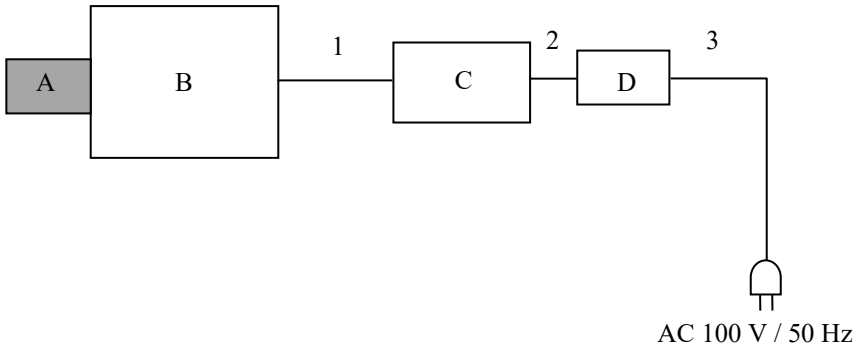
*The Details of Operating Mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission, Radiated Spurious Emission (Below 1 GHz)	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, Conducted Spurious Emission	Tx BT LE, 1M-PHY Tx BT LE, 2M-PHY	2402 MHz 2440 MHz 2480 MHz

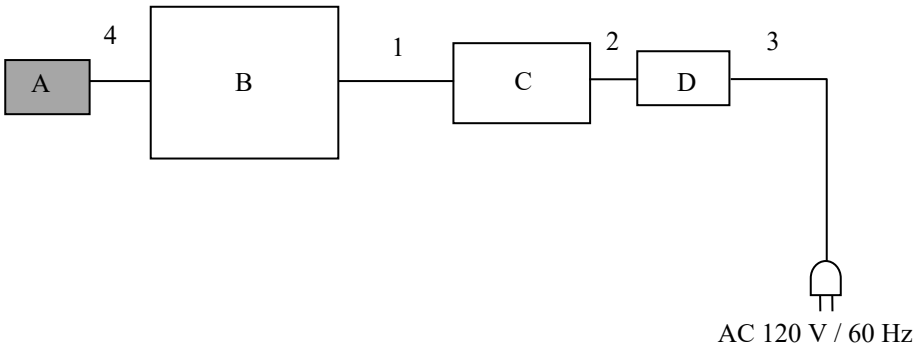
*1) Conducted emissions and Spurious emissions for frequencies below 1 GHz were limited to the channel that had the highest power during the antenna terminal test, as preliminary testing indicated that changing the operating frequency had no significant impact on the emissions in those frequency bands.

4.2 Configuration and Peripherals

<Antenna Terminal Conducted test>



<The other 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	Wireless Communication Unit for Measuring instrument	264-628	10000014 *1) 10000004 *2)	Mitutoyo	EUT
B	Jig Unit	-	14	Mitutoyo	-
C	Laptop Computer	VJS111D11N	7032658	Sony	-
D	AC Adapter	ADP-50ZH	1492339210151692	Sony	-

*1) Used for Antenna Terminal Conducted test
*2) Used for the other test

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	1.0	Shielded	Shielded	-
2	DC	1.8	Unshielded	Unshielded	-
3	AC	0.7 2.0 *3)	Unshielded	Unshielded	-
4	Extension	1.2	Unshielded	Unshielded	-

*3) Used for Conducted test

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

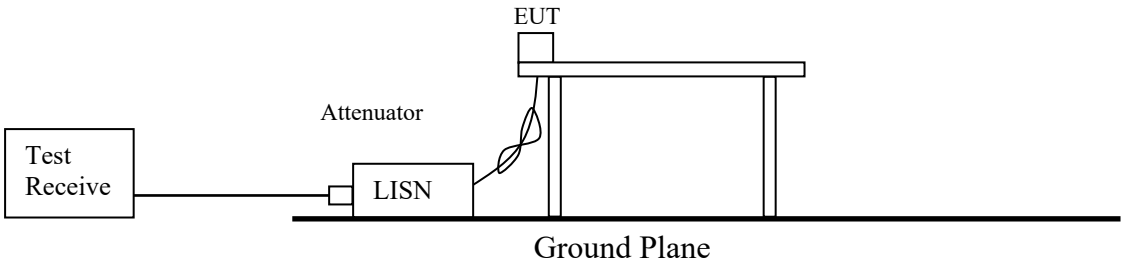
1) For the tests on EUT with other peripherals (as a whole system)
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN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

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a shielded room.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

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

Detector : QP and CISPR AV
Measurement Range : 0.15 MHz 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, 1.5 m by 1.0 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.

The height of the measuring antenna varied between 1 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

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.

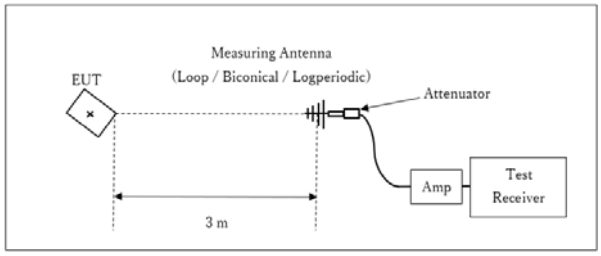
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument Used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	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	RBW: 100 kHz VBW: 300 kHz

*1) Average Power Measurement was performed based on ANSI C63.10-2013.

Figure 2: Test Setup

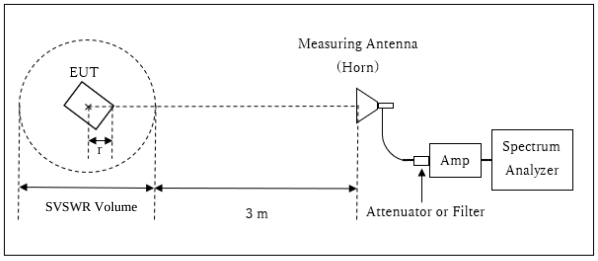
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz to 10 GHz

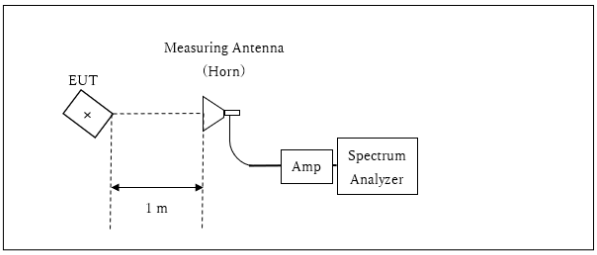


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.99 m / 3.0 m) = 2.48 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.99 m

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.01 m

10 GHz to 26.5 GHz



× : Center of turn table

Distance Factor: 20 x log (1.0 m / 3.0 m) = -9.54 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.

Antenna polarization	Carrier	Spurious (30 MHz - 1 GHz)	Spurious (1 GHz - 2.8 GHz)	Spurious (2.8 GHz - 10 GHz)	Spurious (10 GHz - 18 GHz)	Spurious (18 GHz - 26.5 GHz)
Horizontal	Y	X	Y	X	X	X
Vertical	X	X	X	Y	X	X

The test results and limit are rounded off to one decimal place, 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/ Average *2)	-	Power Meter (Sensor: 160 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4) *5)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 kHz				

*1) Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".
*4) In the frequency range below 30MHz, 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.
*5) 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 Ohmes. 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.

The test results and limit are rounded off to two decimals place, 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

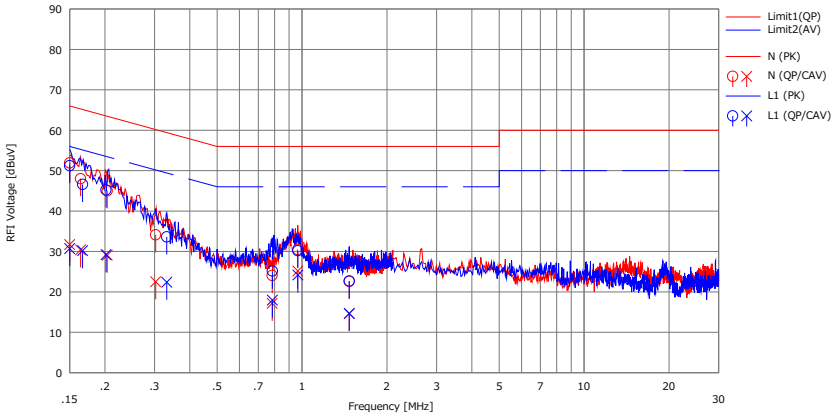
UL Japan,Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2022/03/23

Mode : Tx_BLE_1Mbps_2402 MHz
Order No. : 14199213
Temp./Humi. : 22 deg.C / 36 %RH

Remarks : -

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yohsuke Matsuzawa



No.	Freq.	Reading ⟨QP⟩	Reading ⟨CAV⟩	C.Fac	Results ⟨QP⟩	Results ⟨CAV⟩	Limit ⟨QP⟩	Limit ⟨AV⟩	Margin ⟨QP⟩	Margin ⟨AV⟩	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	39.50	19.30	12.40	51.90	31.70	66.00	56.00	14.1	24.3	N	
2	0.16400	35.60	18.00	12.41	48.01	30.41	65.26	55.26	17.2	24.8	N	
3	0.20386	32.60	16.70	12.40	45.00	29.10	63.45	53.45	18.4	24.3	N	
4	0.30270	21.70	10.10	12.41	34.11	22.51	60.17	50.17	26.0	27.6	N	
5	0.78378	11.60	4.70	12.46	24.06	17.16	56.00	46.00	31.9	28.8	N	
6	0.96581	18.00	12.70	12.48	30.48	25.18	56.00	46.00	25.5	20.8	N	
7	1.47028	10.10	2.10	12.51	22.61	14.61	56.00	46.00	33.3	31.3	N	
8	0.15000	38.80	18.30	12.42	51.22	30.72	66.00	56.00	14.7	25.2	L1	
9	0.16672	34.20	17.80	12.41	46.61	30.21	65.12	55.12	18.5	24.9	L1	
10	0.20183	32.80	16.80	12.42	45.22	29.22	63.53	53.53	18.3	24.3	L1	
11	0.33134	21.20	10.00	12.41	33.61	22.41	59.42	49.42	25.8	27.0	L1	
12	0.78544	12.70	5.50	12.46	25.16	17.96	56.00	46.00	30.8	28.0	L1	
13	0.96644	17.70	11.70	12.48	30.18	24.18	56.00	46.00	25.8	21.8	L1	
14	1.47104	10.20	2.20	12.49	22.69	14.69	56.00	46.00	33.3	31.3	L1	

Calculation:Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN): SLS-03

Except for the above table: adequate margin data below the limits.

99 % Occupied Bandwidth and 6 dB Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 8, 2022
Temperature / Humidity	23 deg. C / 23 % RH
Engineer	Takahiro Kawakami
Mode	Tx

BT LE 1 M-PHY

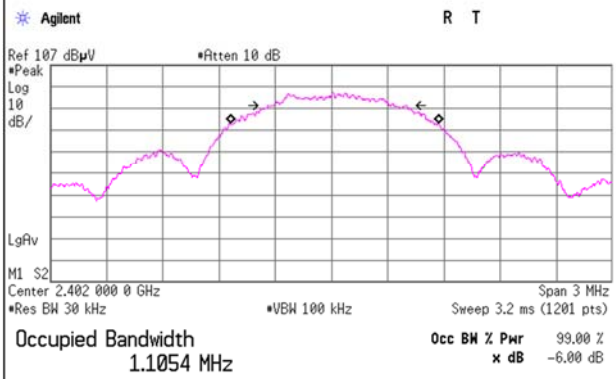
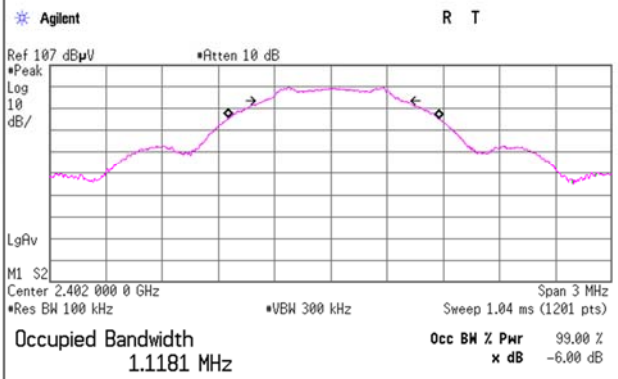
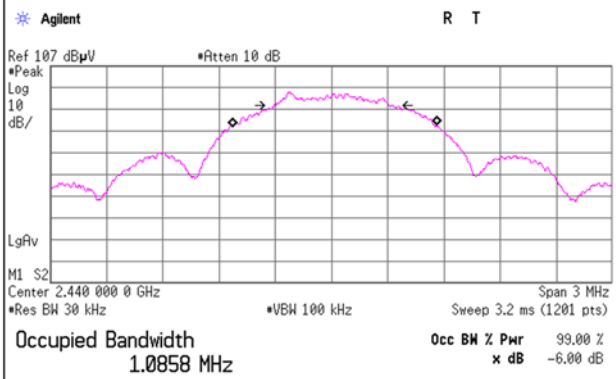
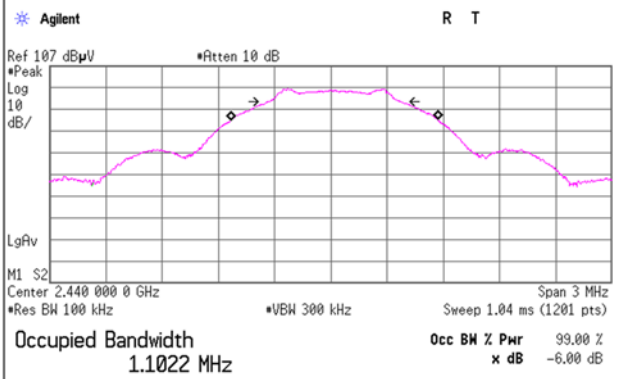
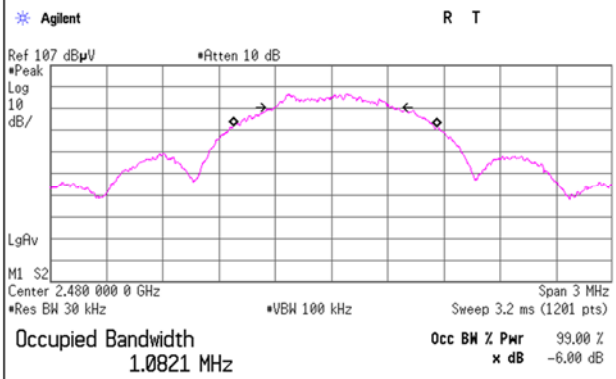
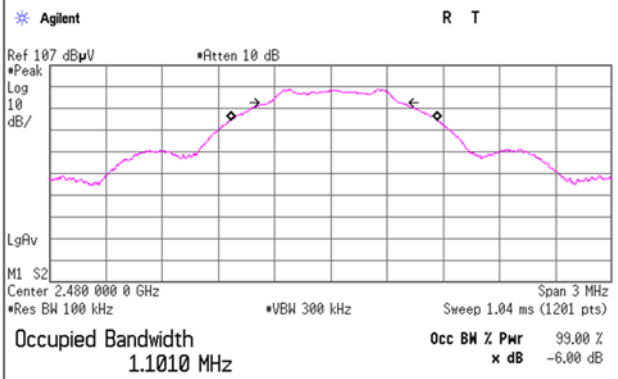
Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
2402	1105.4	0.727	> 0.5000
2440	1085.8	0.711	> 0.5000
2480	1082.1	0.699	> 0.5000

BT LE 2 M-PHY

Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
2402	2080.8	1.400	> 0.5000
2440	2065.9	1.401	> 0.5000
2480	2072.5	1.441	> 0.5000

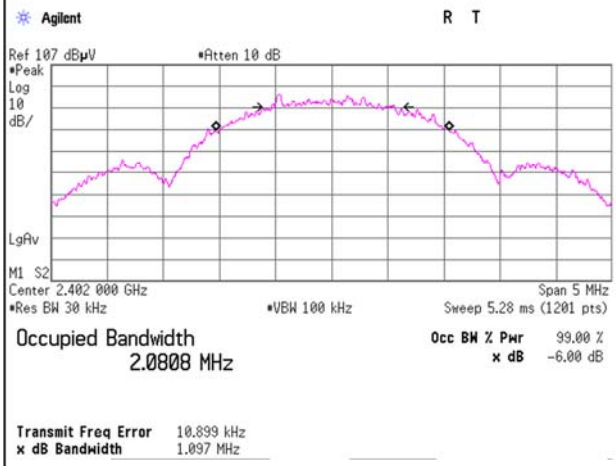
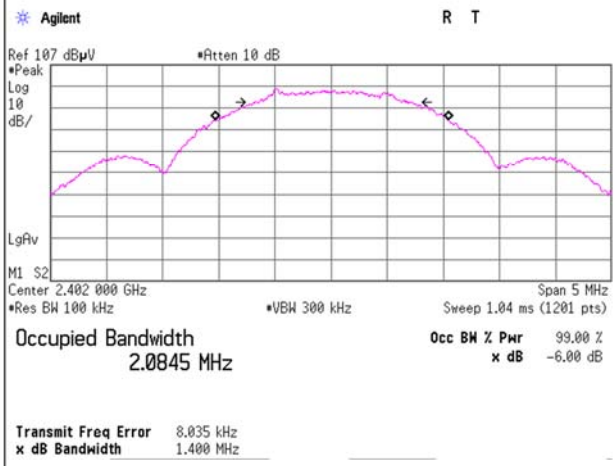
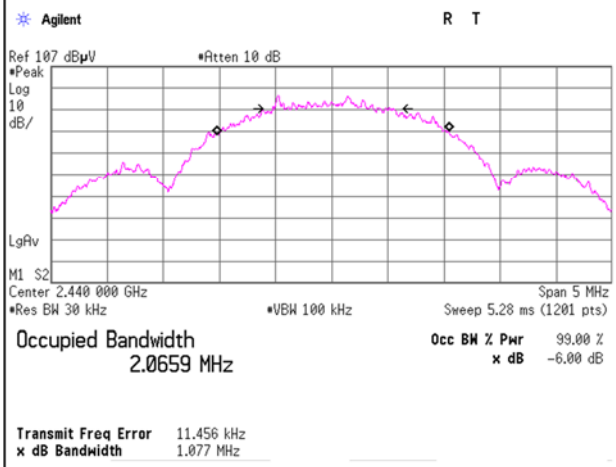
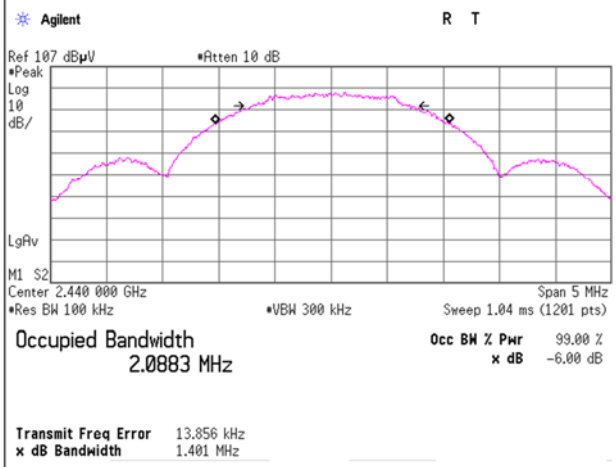
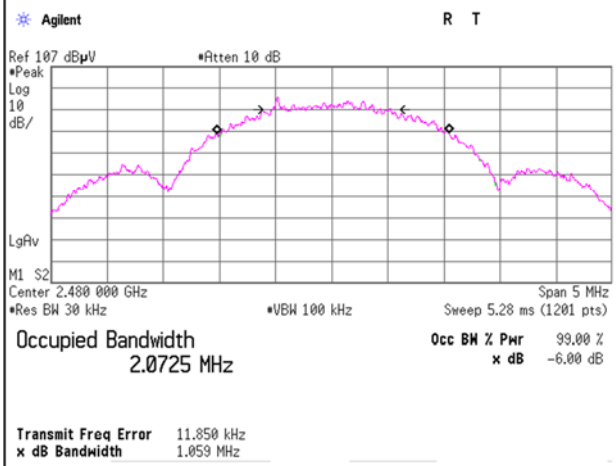
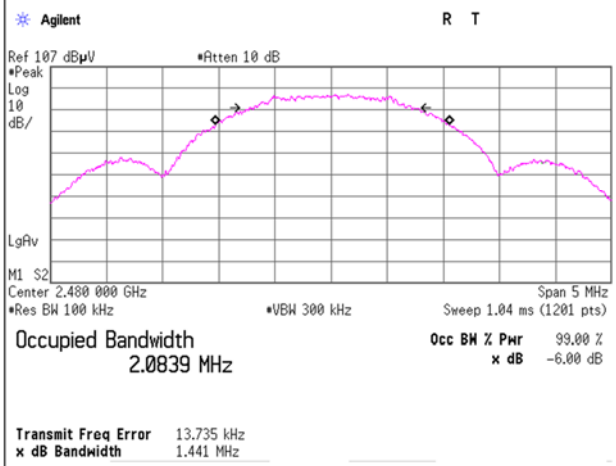
99 % Occupied Bandwidth and 6 dB Bandwidth

BT LE 1 M-PHY

99 % Occupied Bandwidth	6 dB Bandwidth
2402 MHz	2402 MHz
	
2440 MHz	2440 MHz
	
2480 MHz	2480 MHz
	

99 % Occupied Bandwidth and 6 dB Bandwidth

BT LE 2 M-PHY

99 % Occupied Bandwidth	6 dB Bandwidth
2402 MHz	2402 MHz
	
2440 MHz	2440 MHz
	
2480 MHz	2480 MHz
	

Maximum Peak Output Power/Average power(Reference data for RF Exposure)

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 8, 2022
Temperature / Humidity	23 deg. C / 23 % RH
Engineer	Takahiro Kawakami
Mode	Tx

BT LE 1 M-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	-9.43	2.90	10.17	3.64	2.31	30.00	1000	26.36	0.00	3.64	2.31	36.02	4000	32.38
2440	-9.91	2.91	10.18	3.18	2.08	30.00	1000	26.82	0.00	3.18	2.08	36.02	4000	32.84
2480	-10.40	2.92	10.18	2.70	1.86	30.00	1000	27.30	0.00	2.70	1.86	36.02	4000	33.32

BT LE 2 M-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	-9.49	2.90	10.17	3.58	2.28	30.00	1000	26.42	0.00	3.58	2.28	36.02	4000	32.44
2440	-9.89	2.91	10.18	3.20	2.09	30.00	1000	26.80	0.00	3.20	2.09	36.02	4000	32.82
2480	-10.41	2.92	10.18	2.69	1.86	30.00	1000	27.31	0.00	2.69	1.86	36.02	4000	33.33

Sample Calculation:

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

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

BT LE 1 M-PHY

Average power

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2402	-9.76	2.90	10.17	3.31	2.14	0.00	3.31	2.14
2440	-10.26	2.91	10.18	2.83	1.92	0.00	2.83	1.92
2480	-10.81	2.92	10.18	2.29	1.69	0.00	2.29	1.69

BT LE 2 M-PHY

Average power

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2402	-9.82	2.90	10.17	3.25	2.11	0.00	3.25	2.11
2440	-10.27	2.91	10.18	2.82	1.91	0.00	2.82	1.91
2480	-10.82	2.92	10.18	2.28	1.69	0.00	2.28	1.69

Sample Calculation:

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

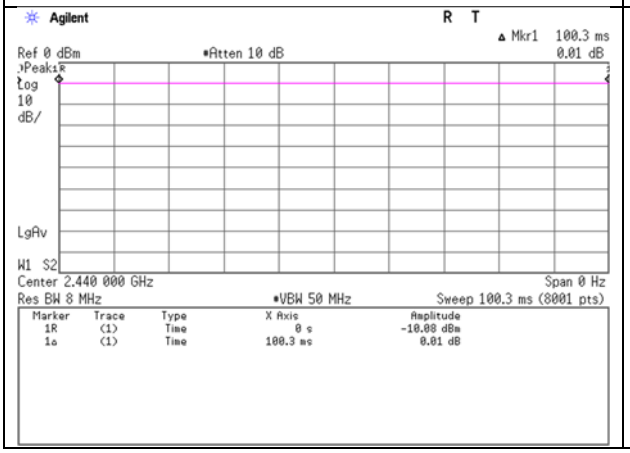
Result (Burst power average) = Result (Time average) + Duty factor

Burst rate confirmation

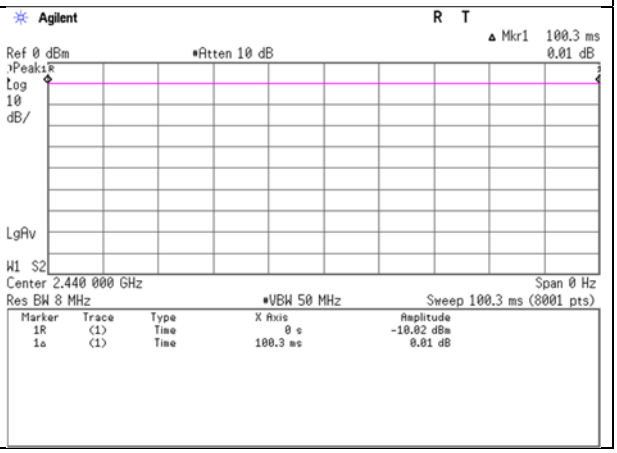
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 8, 2022
Temperature / Humidity	23 deg. C / 23 % RH
Engineer	Takahiro Kawakami
Mode	Tx

Duty 100 %

BT LE 1 M-PHY



BT LE 2 M-PHY



* 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	No.1	No.2
Date	March 25, 2022	March 24, 2022
Temperature / Humidity	23 deg.C, 39 %RH	22 deg.C, 36 %RH
Engineer	Akihiro Oda	Akihiro Oda
	(30 MHz -1 GHz, 10 GHz -26.5 GHz)	(1 GHz -10 GHz)
Mode	Tx BT LE 1 M-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.	120.001	QP	34.30	13.09	8.20	31.80	0.00	23.79	43.5	19.7	260	167	-
Hori.	239.999	QP	44.40	11.54	6.10	31.76	0.00	30.28	46.0	15.7	155	83	-
Hori.	2390.000	PK	45.38	28.57	14.18	38.72	2.48	51.89	73.9	22.0	125	14	-
Hori.	4804.000	PK	47.81	31.90	6.76	38.55	2.48	50.40	73.9	23.5	130	0	-
Hori.	7206.000	PK	46.03	37.57	8.33	39.16	2.48	55.25	73.9	18.6	150	0	-
Hori.	9608.000	PK	44.99	38.87	9.56	39.70	2.48	56.20	73.9	17.7	150	0	-
Hori.	2390.000	AV	35.70	28.57	14.18	38.72	2.48	42.21	53.9	11.6	125	14	-
Hori.	4804.000	AV	41.18	31.90	6.76	38.55	2.48	43.77	53.9	10.1	130	0	-
Hori.	7206.000	AV	37.74	37.57	8.33	39.16	2.48	46.96	53.9	6.9	150	0	Floor noise
Hori.	9608.000	AV	36.38	38.87	9.56	39.70	2.48	47.59	53.9	**6.3**	150	0	Floor noise
Vert.	45.980	QP	25.80	12.64	7.41	31.83	0.00	14.02	40.0	25.9	100	277	-
Vert.	60.001	QP	36.90	8.19	7.27	31.83	0.00	20.53	40.0	19.4	100	248	-
Vert.	72.001	QP	37.90	6.36	7.72	31.82	0.00	20.16	40.0	19.8	100	19	-
Vert.	96.002	QP	29.70	9.43	8.32	31.81	0.00	15.64	43.5	27.8	100	340	-
Vert.	120.037	QP	46.10	13.09	8.20	31.80	0.00	35.59	43.5	7.9	100	270	-
Vert.	239.999	QP	52.80	11.54	6.10	31.76	0.00	38.68	46.0	7.3	100	134	-
Vert.	360.000	QP	41.10	15.11	6.97	31.79	0.00	31.39	46.0	14.6	150	45	-
Vert.	600.003	QP	29.90	19.27	8.35	32.00	0.00	25.52	46.0	20.4	100	99	-
Vert.	2390.000	PK	45.24	28.57	14.18	38.72	2.48	51.75	73.9	22.1	111	25	-
Vert.	4804.000	PK	48.81	31.90	6.76	38.55	2.48	51.40	73.9	22.5	106	270	-
Vert.	7206.000	PK	45.93	37.57	8.33	39.16	2.48	55.15	73.9	18.7	150	0	-
Vert.	9608.000	PK	45.50	38.87	9.56	39.70	2.48	56.71	73.9	17.1	150	0	-
Vert.	2390.000	AV	35.67	28.57	14.18	38.72	2.48	42.18	53.9	11.7	111	25	-
Vert.	4804.000	AV	42.49	31.90	6.76	38.55	2.48	45.08	53.9	8.8	106	270	-
Vert.	7206.000	AV	37.88	37.57	8.33	39.16	2.48	47.10	53.9	6.8	150	0	Floor noise
Vert.	9608.000	AV	36.33	38.87	9.56	39.70	2.48	47.54	53.9	**6.3**	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 (3.99 m / 3.0 m) = 2.48 dB
10 GHz - 26.5 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

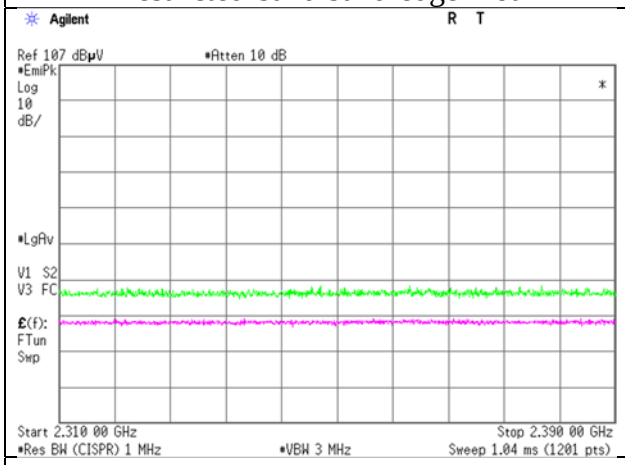
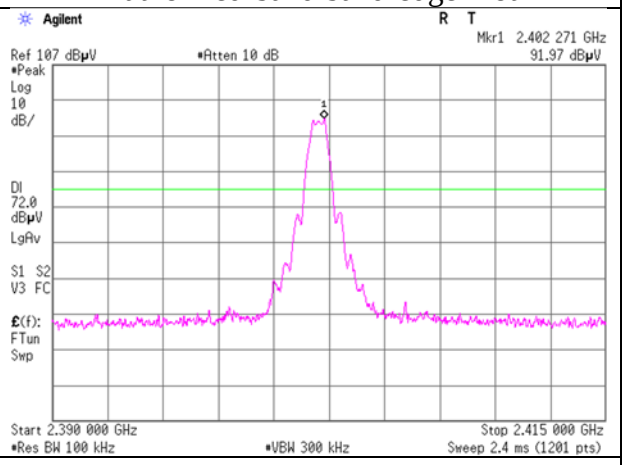
20 dBc Data Sheet **(RBW 100 kHz, VBW 300 kHz)**

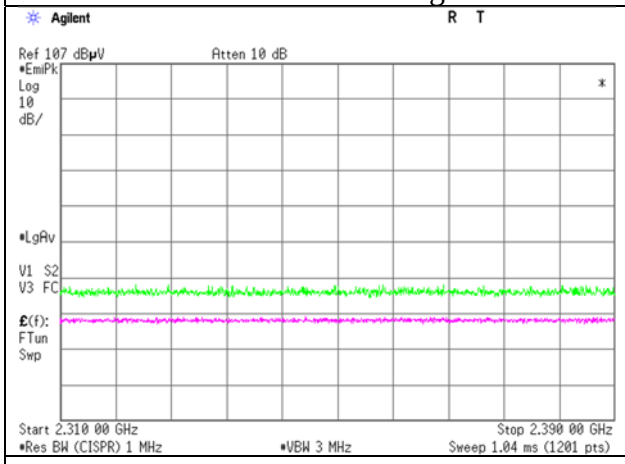
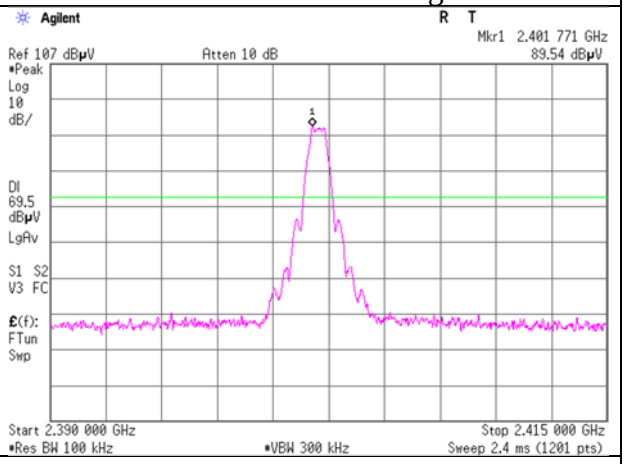
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	91.02	28.55	14.20	38.72	2.48	97.53	-	-	Carrier
Hori.	2400.000	PK	46.43	28.55	14.19	38.72	2.48	52.93	77.5	24.5	-
Vert.	2402.000	PK	89.81	28.55	14.20	38.72	2.48	96.32	-	-	Carrier
Vert.	2400.000	PK	46.21	28.55	14.19	38.72	2.48	52.71	76.3	23.5	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.99 m / 3.0 m) = 2.48 dB
10 GHz - 26.5 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	No.2
Date	March 24, 2022
Temperature / Humidity	22 deg.C, 36 %RH
Engineer	Akihiro Oda
	(1 GHz -10 GHz)
Mode	Tx BT LE 1 M-PHY 2402 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

* 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	No.2	No.1
Date	March 24, 2022	March 25, 2022
Temperature / Humidity	22 deg.C, 36 %RH	23 deg.C, 39 %RH
Engineer	Akihiro Oda	Akihiro Oda
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx BT LE 1 M-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	46.98	31.92	6.81	38.58	2.48	49.61	73.9	24.2	104	357	-
Hori.	7320.000	PK	45.88	37.66	8.43	39.22	2.48	55.23	73.9	18.6	150	0	-
Hori.	9760.000	PK	45.29	39.28	9.65	39.73	2.48	56.97	73.9	16.9	150	0	-
Hori.	4880.000	AV	40.45	31.92	6.81	38.58	2.48	43.08	53.9	10.8	104	357	-
Hori.	7320.000	AV	37.72	37.66	8.43	39.22	2.48	47.07	53.9	6.8	150	0	Floor noise
Hori.	9760.000	AV	36.61	39.28	9.65	39.73	2.48	48.29	53.9	5.6	150	0	Floor noise
Vert.	4880.000	PK	46.84	31.92	6.81	38.58	2.48	49.47	73.9	24.4	152	13	-
Vert.	7320.000	PK	44.40	37.66	8.43	39.22	2.48	53.75	73.9	20.1	150	0	-
Vert.	9760.000	PK	44.97	39.28	9.65	39.73	2.48	56.65	73.9	17.2	150	0	-
Vert.	4880.000	AV	39.41	31.92	6.81	38.58	2.48	42.04	53.9	11.8	152	13	-
Vert.	7320.000	AV	36.99	37.66	8.43	39.22	2.48	46.34	53.9	7.5	150	0	Floor noise
Vert.	9760.000	AV	36.72	39.28	9.65	39.73	2.48	48.40	53.9	**5.5**	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 (3.99 m / 3.0 m) = 2.48 dB

10 GHz - 26.5 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.2	No.1
Date	March 24, 2022	March 25, 2022
Temperature / Humidity	22 deg.C, 36 %RH	23 deg.C, 39 %RH
Engineer	Akihiro Oda	Akihiro Oda
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx BT LE 1 M-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	45.85	28.44	14.28	38.67	2.48	52.38	73.9	21.5	120	76	-
Hori.	4960.000	PK	47.03	32.10	6.86	38.62	2.48	49.85	73.9	24.0	124	0	-
Hori.	7440.000	PK	44.73	37.82	8.51	39.28	2.48	54.26	73.9	19.6	150	0	-
Hori.	9920.000	PK	44.16	39.36	9.75	39.76	2.48	55.99	73.9	17.9	150	0	-
Hori.	2483.500	AV	37.25	28.44	14.28	38.67	2.48	43.78	53.9	10.1	120	76	-
Hori.	4960.000	AV	39.20	32.10	6.86	38.62	2.48	42.02	53.9	11.8	124	0	-
Hori.	7440.000	AV	37.46	37.82	8.51	39.28	2.48	46.99	53.9	6.9	150	0	Floor noise
Hori.	9920.000	AV	36.40	39.36	9.75	39.76	2.48	48.23	53.9	5.6	150	0	Floor noise
Vert.	2483.500	PK	45.68	28.44	14.28	38.67	2.48	52.21	73.9	21.6	116	39	-
Vert.	4960.000	PK	46.32	32.10	6.86	38.62	2.48	49.14	73.9	24.7	115	356	-
Vert.	7440.000	PK	44.38	37.82	8.51	39.28	2.48	53.91	73.9	19.9	150	0	-
Vert.	9920.000	PK	45.04	39.36	9.75	39.76	2.48	56.87	73.9	17.0	150	0	-
Vert.	2483.500	AV	36.41	28.44	14.28	38.67	2.48	42.94	53.9	10.9	116	39	-
Vert.	4960.000	AV	38.20	32.10	6.86	38.62	2.48	41.02	53.9	12.8	115	356	-
Vert.	7440.000	AV	37.22	37.82	8.51	39.28	2.48	46.75	53.9	7.1	150	0	Floor noise
Vert.	9920.000	AV	36.64	39.36	9.75	39.76	2.48	48.47	53.9	**5.4**	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 (3.99 m / 3.0 m) = 2.48 dB

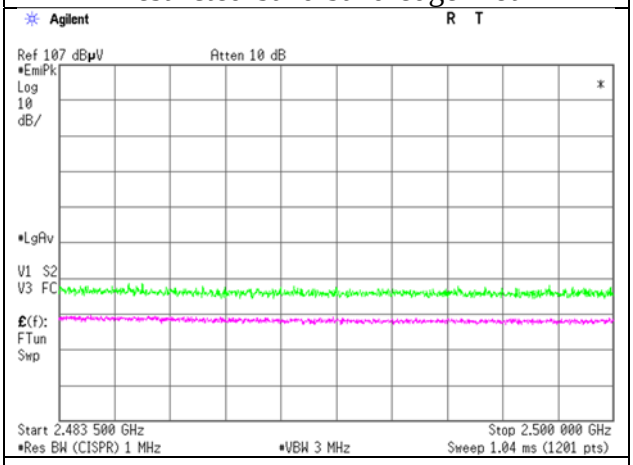
10 GHz - 26.5 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	March 24, 2022
Temperature / Humidity	22 deg.C, 36 %RH
Engineer	Akihiro Oda
	(1 GHz -10 GHz)
Mode	Tx BT LE 1 M-PHY 2480 MHz

Horizontal

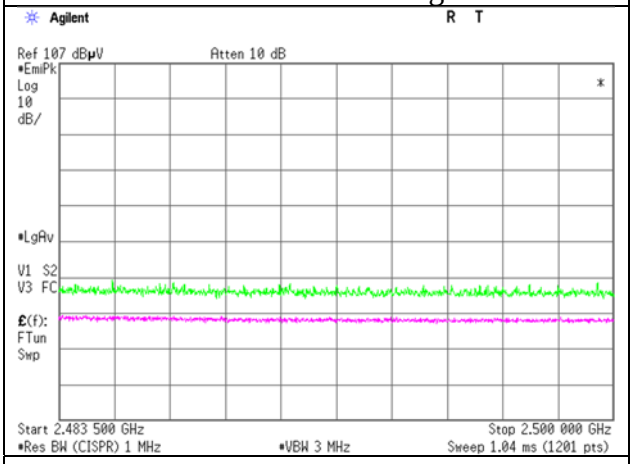
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

* 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	No.2	No.1
Date	March 24, 2022	March 25, 2022
Temperature / Humidity	22 deg.C, 36 %RH	23 deg.C, 39 %RH
Engineer	Akihiro Oda	Akihiro Oda
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx BT LE 2 M-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	46.77	28.57	14.18	38.72	2.48	53.28	73.9	20.6	112	71	-
Hori.	4804.000	PK	47.36	31.90	6.76	38.55	2.48	49.95	73.9	23.9	111	0	-
Hori.	7206.000	PK	46.18	37.57	8.33	39.16	2.48	55.40	73.9	18.5	150	0	-
Hori.	9608.000	PK	45.14	38.87	9.56	39.70	2.48	56.35	73.9	17.5	150	0	-
Hori.	2390.000	AV	36.06	28.57	14.18	38.72	2.48	42.57	53.9	11.3	112	71	-
Hori.	4804.000	AV	39.15	31.90	6.76	38.55	2.48	41.74	53.9	12.1	111	0	-
Hori.	7206.000	AV	37.48	37.57	8.33	39.16	2.48	46.70	53.9	7.2	150	0	Floor noise
Hori.	9608.000	AV	36.00	38.87	9.56	39.70	2.48	47.21	53.9	6.6	150	0	Floor noise
Vert.	2390.000	PK	44.44	28.57	14.18	38.72	2.48	50.95	73.9	22.9	115	40	-
Vert.	4804.000	PK	47.30	31.90	6.76	38.55	2.48	49.89	73.9	24.0	109	0	-
Vert.	7206.000	PK	45.45	37.57	8.33	39.16	2.48	54.67	73.9	19.2	150	0	-
Vert.	9608.000	PK	45.22	38.87	9.56	39.70	2.48	56.43	73.9	17.4	150	0	-
Vert.	2390.000	AV	35.54	28.57	14.18	38.72	2.48	42.05	53.9	11.8	115	40	-
Vert.	4804.000	AV	39.04	31.90	6.76	38.55	2.48	41.63	53.9	12.2	109	0	-
Vert.	7206.000	AV	37.12	37.57	8.33	39.16	2.48	46.34	53.9	7.5	150	0	Floor noise
Vert.	9608.000	AV	36.29	38.87	9.56	39.70	2.48	47.50	53.9	**6.4**	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 (3.99 m / 3.0 m) = 2.48 dB
10 GHz - 26.5 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

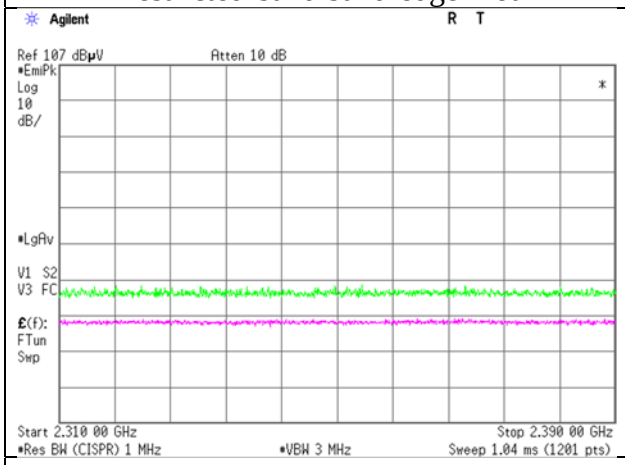
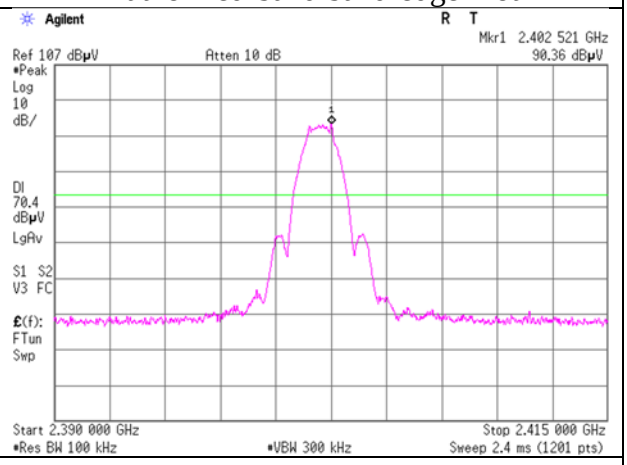
20 dBc Data Sheet **(RBW 100 kHz, VBW 300 kHz)**

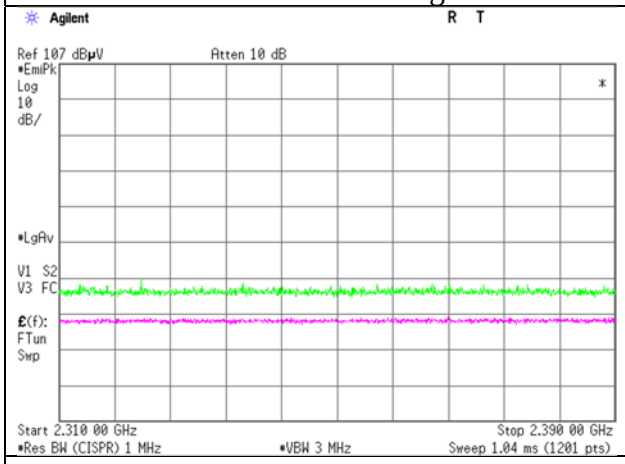
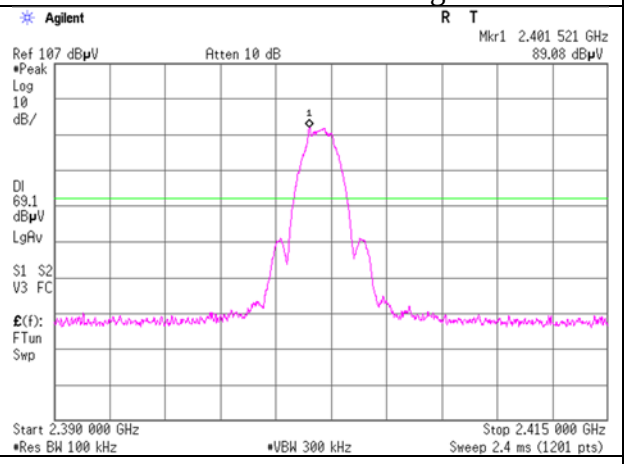
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	90.15	28.55	14.20	38.72	2.48	96.66	-	-	Carrier
Hori.	2400.000	PK	58.74	28.55	14.19	38.72	2.48	65.24	76.6	11.3	-
Vert.	2402.000	PK	88.71	28.55	14.20	38.72	2.48	95.22	-	-	Carrier
Vert.	2400.000	PK	57.68	28.55	14.19	38.72	2.48	64.18	75.2	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 (3.99 m / 3.0 m) = 2.48 dB
10 GHz - 26.5 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	No.2
Date	March 24, 2022
Temperature / Humidity	22 deg.C, 36 %RH
Engineer	Akihiro Oda
	(1 GHz -10 GHz)
Mode	Tx BT LE 2 M-PHY 2402 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

* 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	No.2	No.1
Date	March 24, 2022	March 25, 2022
Temperature / Humidity	22 deg.C, 36 %RH	23 deg.C, 39 %RH
Engineer	Akihiro Oda	Akihiro Oda
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx BT LE 2 M-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	46.46	31.92	6.81	38.58	2.48	49.09	73.9	24.8	100	359	-
Hori.	7320.000	PK	45.22	37.66	8.43	39.22	2.48	54.57	73.9	19.3	150	0	-
Hori.	9760.000	PK	46.17	39.28	9.65	39.73	2.48	57.85	73.9	16.0	150	0	-
Hori.	4880.000	AV	38.40	31.92	6.81	38.58	2.48	41.03	53.9	12.8	100	359	-
Hori.	7320.000	AV	36.78	37.66	8.43	39.22	2.48	46.13	53.9	7.7	150	0	Floor noise
Hori.	9760.000	AV	36.92	39.28	9.65	39.73	2.48	48.60	53.9	5.3	150	0	Floor noise
Vert.	4880.000	PK	46.65	31.92	6.81	38.58	2.48	49.28	73.9	24.6	121	4	-
Vert.	7320.000	PK	45.47	37.66	8.43	39.22	2.48	54.82	73.9	19.0	150	0	-
Vert.	9760.000	PK	45.06	39.28	9.65	39.73	2.48	56.74	73.9	17.1	150	0	-
Vert.	4880.000	AV	37.94	31.92	6.81	38.58	2.48	40.57	53.9	13.3	121	4	-
Vert.	7320.000	AV	36.64	37.66	8.43	39.22	2.48	45.99	53.9	7.9	150	0	Floor noise
Vert.	9760.000	AV	37.08	39.28	9.65	39.73	2.48	48.76	53.9	**5.1**	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 (3.99 m / 3.0 m) = 2.48 dB

10 GHz - 26.5 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.2	No.1
Date	March 24, 2022	March 25, 2022
Temperature / Humidity	22 deg.C, 36 %RH	23 deg.C, 39 %RH
Engineer	Akihiro Oda	Akihiro Oda
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx BT LE 2 M-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	50.13	28.44	14.28	38.67	2.48	56.66	73.9	17.2	118	64	-
Hori.	4960.000	PK	45.92	32.10	6.86	38.62	2.48	48.74	73.9	25.1	103	305	-
Hori.	7440.000	PK	44.14	37.82	8.51	39.28	2.48	53.67	73.9	20.2	150	0	-
Hori.	9920.000	PK	45.40	39.36	9.75	39.76	2.48	57.23	73.9	16.6	150	0	-
Hori.	2483.500	AV	40.44	28.44	14.28	38.67	2.48	46.97	53.9	6.9	118	64	-
Hori.	4960.000	AV	37.33	32.10	6.86	38.62	2.48	40.15	53.9	13.7	103	305	-
Hori.	7440.000	AV	35.84	37.82	8.51	39.28	2.48	45.37	53.9	8.5	150	0	Floor noise
Hori.	9920.000	AV	36.45	39.36	9.75	39.76	2.48	48.28	53.9	5.6	150	0	Floor noise
Vert.	2483.500	PK	48.29	28.44	14.28	38.67	2.48	54.82	73.9	19.0	134	13	-
Vert.	4960.000	PK	46.11	32.10	6.86	38.62	2.48	48.93	73.9	24.9	128	342	-
Vert.	7440.000	PK	45.29	37.82	8.51	39.28	2.48	54.82	73.9	19.0	150	0	-
Vert.	9920.000	PK	45.20	39.36	9.75	39.76	2.48	57.03	73.9	16.8	150	0	-
Vert.	2483.500	AV	38.74	28.44	14.28	38.67	2.48	45.27	53.9	8.6	134	13	-
Vert.	4960.000	AV	37.52	32.10	6.86	38.62	2.48	40.34	53.9	13.5	128	342	-
Vert.	7440.000	AV	35.71	37.82	8.51	39.28	2.48	45.24	53.9	8.6	150	0	Floor noise
Vert.	9920.000	AV	36.60	39.36	9.75	39.76	2.48	48.43	53.9	**5.4**	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 (3.99 m / 3.0 m) = 2.48 dB

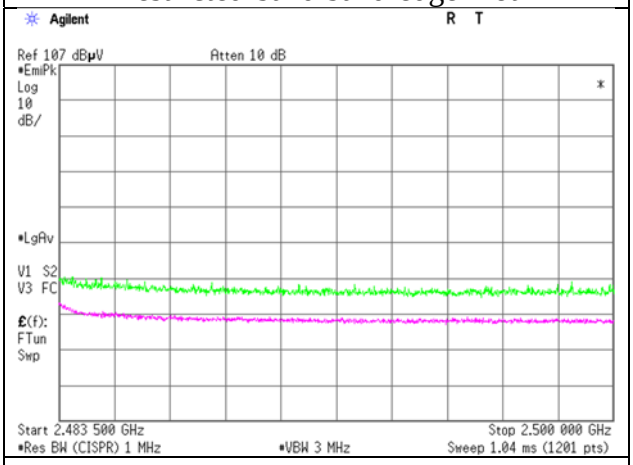
10 GHz - 26.5 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	March 24, 2022
Temperature / Humidity	22 deg.C, 36 %RH
Engineer	Akihiro Oda
	(1 GHz -10 GHz)
Mode	Tx BT LE 2 M-PHY 2480 MHz

Horizontal

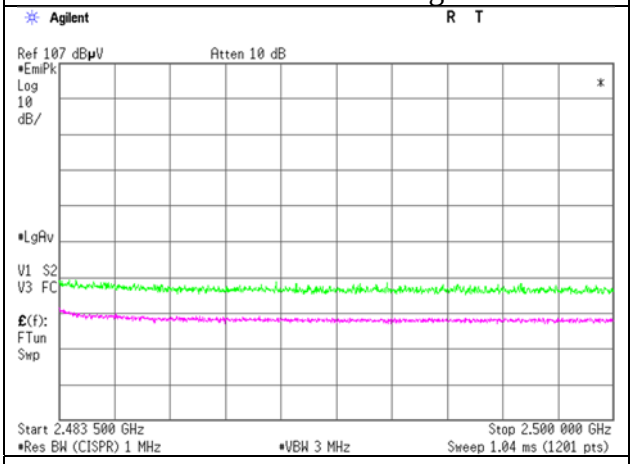
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

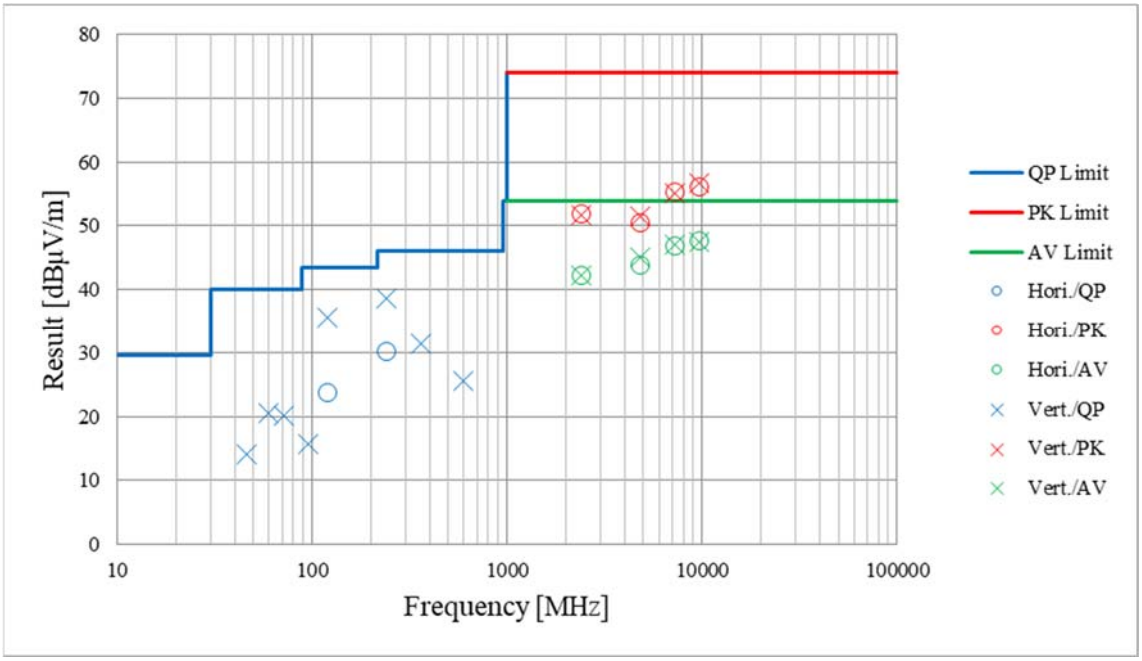


Trace Green : Peak Plot
Trace Purple : Average Plot

* 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.	
Semi Anechoic Chamber	No.1	No.2
Date	March 25, 2022	March 24, 2022
Temperature / Humidity	23 deg.C, 39 %RH	22 deg.C, 36 %RH
Engineer	Akihiro Oda	Akihiro Oda
	(30 MHz -1 GHz, 10 GHz -26.5 GHz)	(1 GHz -10 GHz)
Mode	Tx BT LE 1 M-PHY 2402 MHz	

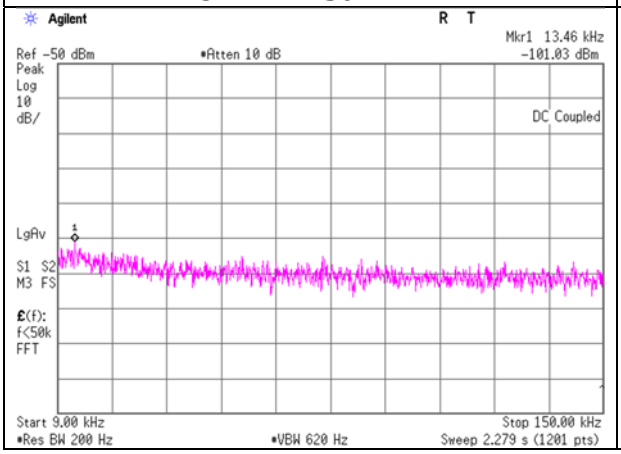


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

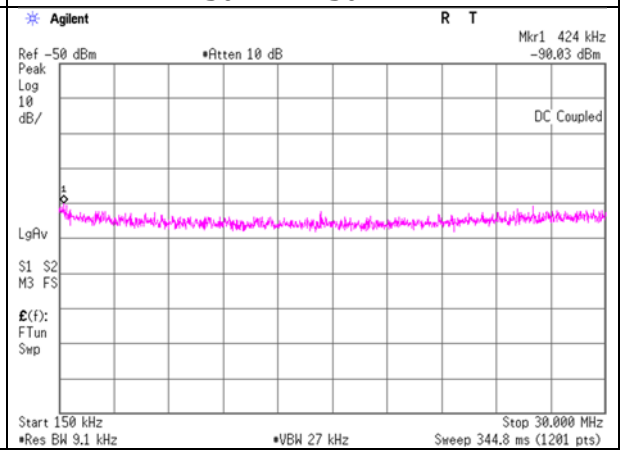
Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 8, 2022
Temperature / Humidity	23 deg. C / 23 % RH
Engineer	Takahiro Kawakami
Mode	Tx BT LE 1 M-PHY 2402 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
13.46	-101.0	1.51	10.1	2.0	1	-87.4	300	6.0	-26.2	45.0	71.2	-
424.00	-90.0	1.52	10.1	2.0	1	-76.4	300	6.0	-15.1	15.0	30.1	-

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)

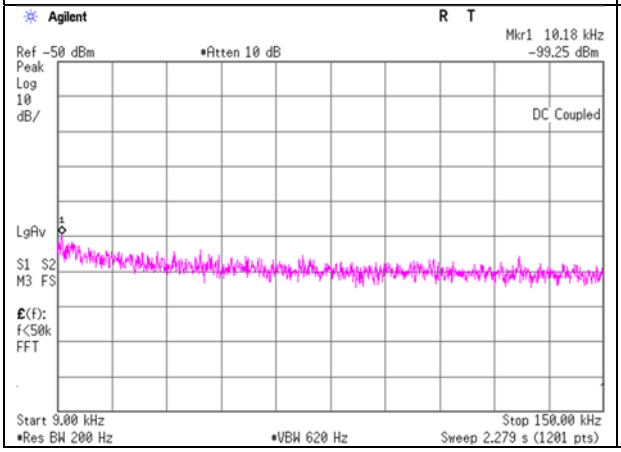
N: Number of output

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

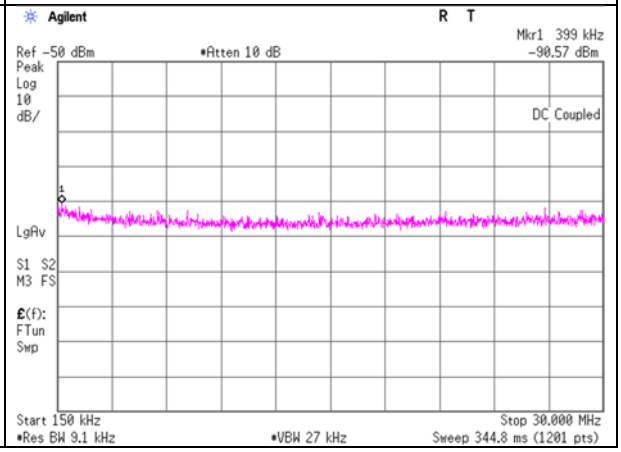
Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 8, 2022
Temperature / Humidity	23 deg. C / 23 % RH
Engineer	Takahiro Kawakami
Mode	Tx BT LE 1 M-PHY 2440 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.18	-99.3	1.51	10.1	2.0	1	-85.6	300	6.0	-24.4	47.4	71.8	-
399.00	-90.6	1.52	10.1	2.0	1	-76.9	300	6.0	-15.7	15.5	31.2	-

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)

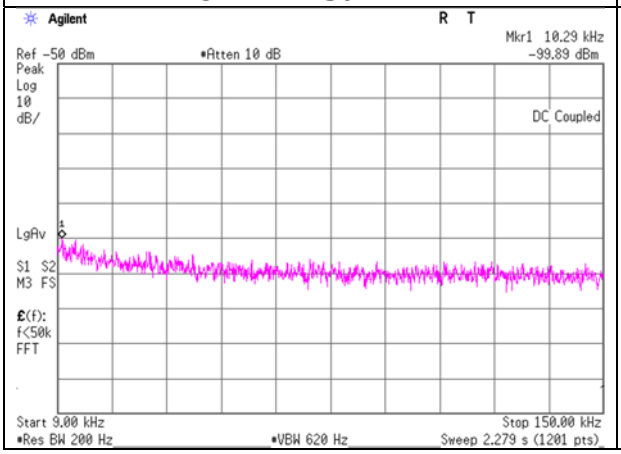
N: Number of output

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

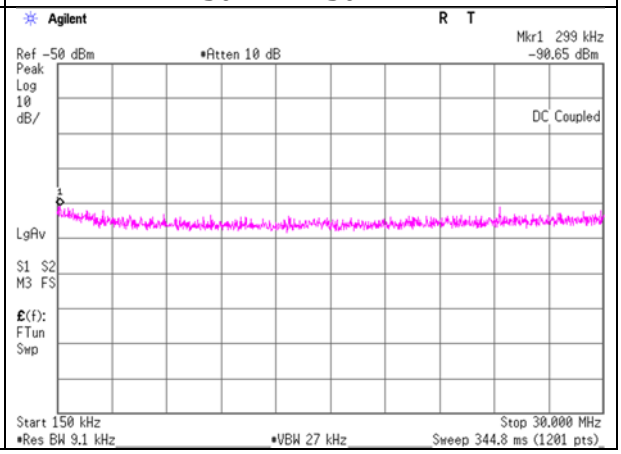
Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 8, 2022
Temperature / Humidity	23 deg. C / 23 % RH
Engineer	Takahiro Kawakami
Mode	Tx BT LE 1 M-PHY 2480 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.29	-99.9	1.51	10.1	2.0	1	-86.3	300	6.0	-25.0	47.3	72.3	-
299.00	-90.7	1.52	10.1	2.0	1	-77.0	300	6.0	-15.8	18.0	33.8	-

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)

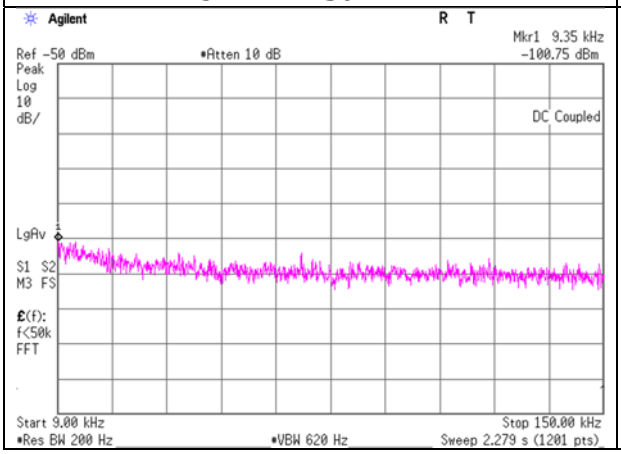
N: Number of output

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

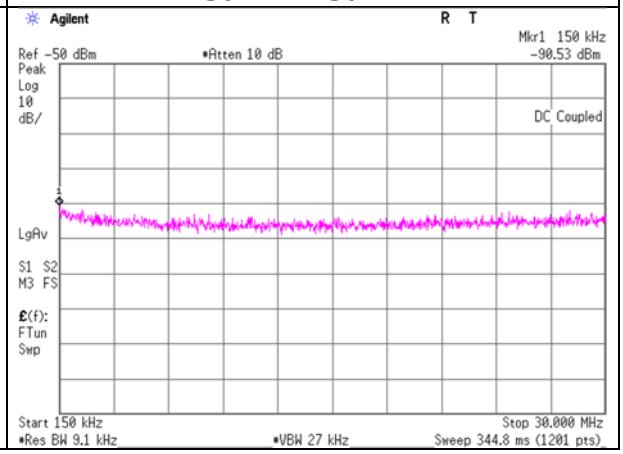
Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 8, 2022
Temperature / Humidity	23 deg. C / 23 % RH
Engineer	Takahiro Kawakami
Mode	Tx BT LE 2 M-PHY 2402 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.35	-100.8	1.51	10.1	2.0	1	-87.1	300	6.0	-25.9	48.1	74.0	-
150.00	-90.5	1.52	10.1	2.0	1	-76.9	300	6.0	-15.6	24.0	39.6	-

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)

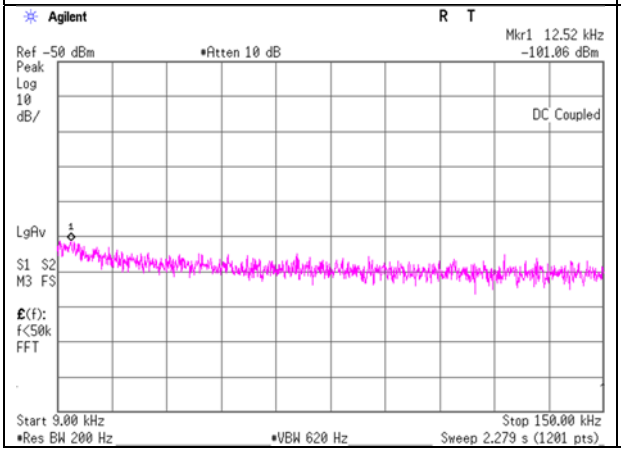
N: Number of output

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

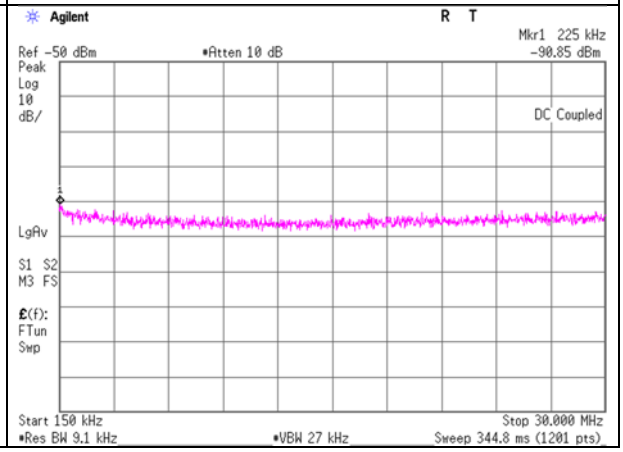
Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 8, 2022
Temperature / Humidity	23 deg. C / 23 % RH
Engineer	Takahiro Kawakami
Mode	Tx BT LE 2 M-PHY 2440 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
12.52	-100.1	1.51	10.1	2.0	1	-86.4	300	6.0	-25.2	45.6	70.8	-
225.00	-90.9	1.52	10.1	2.0	1	-77.2	300	6.0	-16.0	20.5	36.5	-

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)

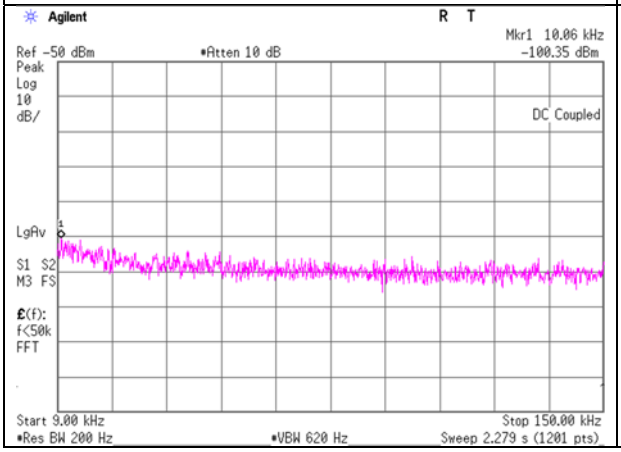
N: Number of output

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

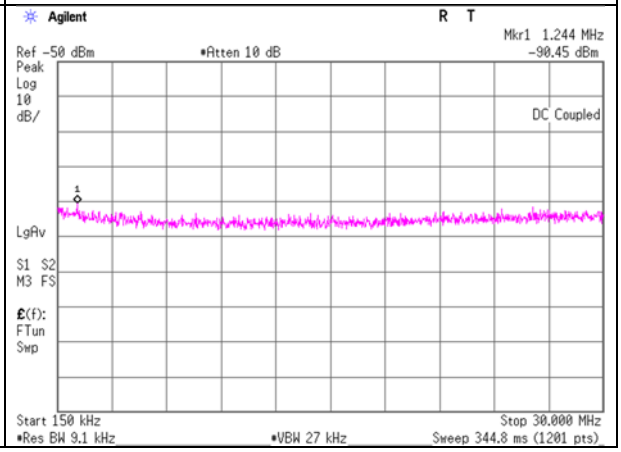
Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 8, 2022
Temperature / Humidity	23 deg. C / 23 % RH
Engineer	Takahiro Kawakami
Mode	Tx BT LE 2 M-PHY 2480 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.06	-100.4	1.51	10.1	2.0	1	-86.7	300	6.0	-25.5	47.5	73.0	-
1244.00	-90.5	1.53	10.1	2.0	1	-76.8	30	6.0	4.4	25.7	21.3	-

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

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

Power Density

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 8, 2022
Temperature / Humidity	23 deg. C / 23 % RH
Engineer	Takahiro Kawakami
Mode	Tx

BT LE 1 M-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	2402.000	-20.63	2.90	10.17	-7.56	8.00	15.56
2440	2440.000	-21.85	2.91	10.18	-8.76	8.00	16.76
2480	2480.000	-20.36	2.92	10.18	-7.26	8.00	15.26

BT LE 2 M-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	2402.000	-22.81	2.90	10.17	-9.74	8.00	17.74
2440	2440.000	-22.96	2.91	10.18	-9.87	8.00	17.87
2480	2480.000	-24.06	2.92	10.18	-10.96	8.00	18.96

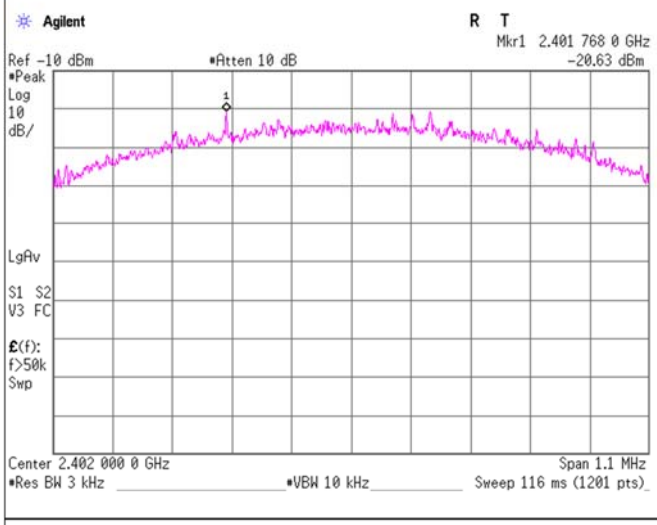
Sample Calculation:

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

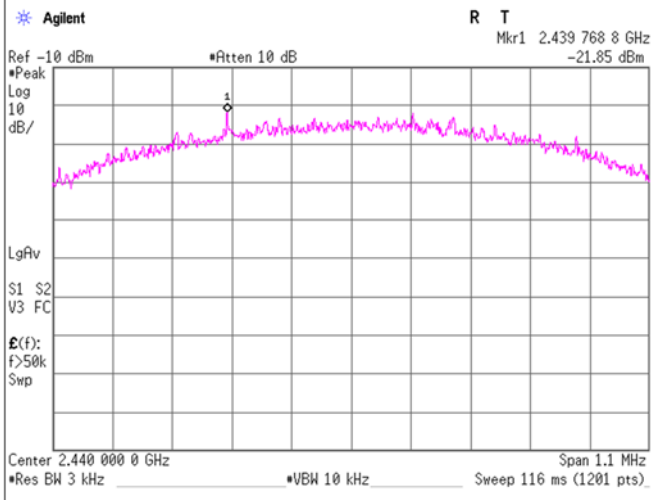
Power Density

BT LE 1 M-PHY

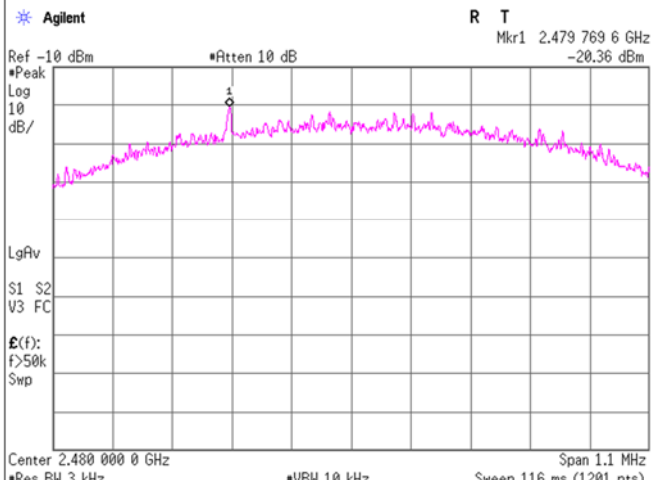
2402 MHz



2440 MHz

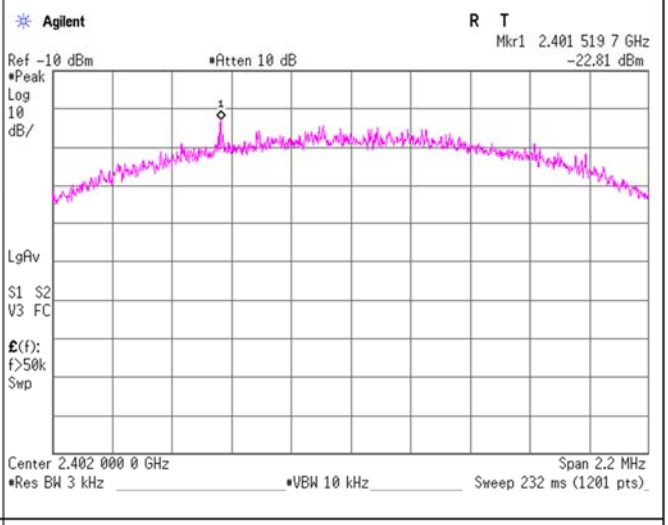


2480 MHz

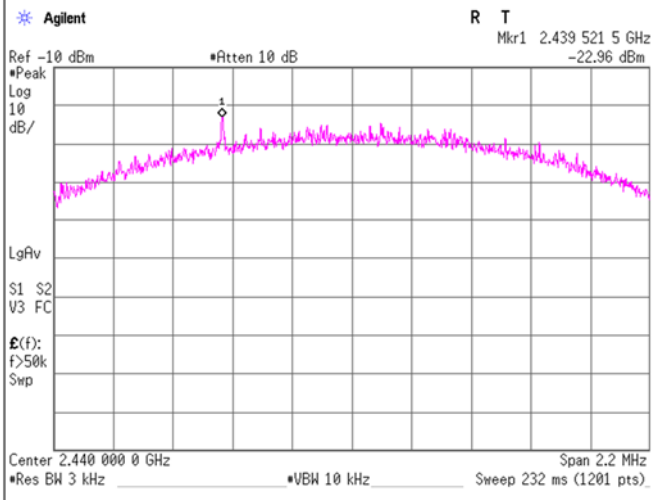


BT LE 2 M-PHY

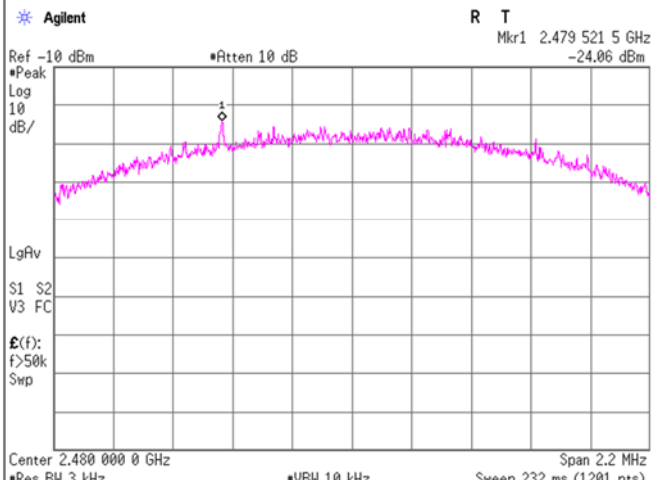
2402 MHz



2440 MHz



2480 MHz



APPENDIX 2: Test Instruments

Test Equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	KTS-07	145111	Digital Tester	SANWA	PC500	7019232	2021/09/14	12
AT	SAT10-15	160493	Attenuator	Weinschel Corp.	54A-10	83406	2021/12/07	12
AT	SCC-G14	145175	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	2021/12/06	12
AT	SOS-19	175823	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/10/14	12
AT	SPM-07	146247	Power Meter	Keysight Technologies Inc	8990B	MY5100272	2021/05/25	12
AT	SPSS-04	146310	Power sensor	Keysight Technologies Inc	N1923A	MY5326009	2021/05/25	12
AT	SRENT-22	202830	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250036	2021/12/01	12
CE	KAT3-12	144896	Attenuator	JFW IND. INC.	50HF-003N	-	2021/07/12	12
CE	SCC-C9	145035	Coaxial Cable	Suhner	RG223U	-	2021/04/12	12
CE	SLS-03	145540	LISN	Rohde & Schwarz	ENV216	100513	2022/02/23	12
CE	SOS-22	191839	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/10/14	12
CE	STR-07	146209	Test Receiver	Rohde & Schwarz	ESU26	100484	2021/09/17	12
CE,RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
CE,RE	SJM-20	207277	Measuring	ASKUL	-	-	-	-
CE,RE	STS-02	145793	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997819	2021/04/28	12
RE	KAT6-04	144899	Attenuator	Inmet	18N-6dB	-	2021/12/10	12
RE	SAEC-01(NSA)	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2021/04/30	12
RE	SAEC-01(SVSWR)	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	2021/05/09	12
RE	SAEC-02(SVSWR)	145598	Semi-Anechoic Chamber	TDK	SAEC-02(SVSWR)	2	2021/05/20	12
RE	SAF-01	145003	Pre Amplifier	SONOMA	310N	290211	2022/02/24	12
RE	SAF-04	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2021/05/17	12
RE	SAF-05	145128	Pre Amplifier	Toyo Corporation	TPA0118-36	1440490	2021/05/17	12
RE	SAF-08	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2022/03/03	12
RE	SAT10-05	145136	Attenuator	Keysight Technologies Inc	8493C-010	74864	2021/10/07	12
RE	SAT3-09	144959	Attenuator	JFW	50HF-003N	-	2021/08/16	12
RE	SBA-01	145161	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032664	2021/04/10	12
RE	SCC-A1/A3/A5/A7/A8/A13/SRSE-01	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2021/04/13	12
RE	SCC-A2/A4/A6/A7/A8/A13/SRSE-01	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2021/04/12	12
RE	SCC-G05	145039	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	2022/01/06	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2022/03/03	12
RE	SCC-G41	151617	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S006	2022/01/06	12
RE	SCC-G50	178573	Coaxial Cable	Huber+Suhner	SUCOFLEX_104_E	MY13407/4E	2022/03/03	12
RE	SCC-G51	178572	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	800288 /4A	2022/03/03	12
RE	SCC-G57	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2021/05/18	12

RE	SCC-G62	196985	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803650/2	2022/03/08	12
RE	SCC-G68	200008	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	575616/4	2021/07/06	12
RE	SFL-02	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2021/10/07	12
RE	SFL-18	145305	Highpass Filter	MICRO-TRONICS	HPM50111	119	2022/03/02	12
RE	SHA-01	145383	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-725	2022/03/01	12
RE	SHA-02	145384	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-726	2022/03/10	12
RE	SHA-04	145512	Horn Antenna	ETS-Lindgren	3160-09	00094868	2021/06/14	12
RE	SHA-08	194683	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	694	2022/03/01	12
RE	SJM-22	207279	Measuring Tool, Tape Measure	ASKUL	-	-	-	-
RE	SLA-05	145527	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	193	2021/04/10	12
RE	SOS-20	191837	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
RE	SOS-21	191838	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
RE	SSA-03	145801	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250152	2021/08/09	12
RE	STR-01	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2021/04/27	12
RE	STS-01	145792	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997812	2021/09/14	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: **CE: Conducted Emission**
RE: Radiated Emission
AT: Antenna Terminal Conducted