




RADIO TEST REPORT

Test Report No. : 13862055S-A-R1

Applicant : CITIZEN WATCH CO., LTD.
Type of EUT : Hybrid Smart Watch
Model Number of EUT : YF20MV-01
FCC ID : YUQ-YF20MV01
Test regulation : FCC Part 15 Subpart C: 2021
Test Result : Complied (Refer to SECTION 3)

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2. The results in this report apply only to the sample tested.
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7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan, Inc. has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 13862055S-A. 13862055S-A is replaced with this report.

Date of test: June 22 to 24, 2021

Representative test engineer: 
Akihiro Oda
Engineer

Approved by: 
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".

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REVISION HISTORY

Original Test Report No.: 13862055S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13862055S-A	July 30, 2021	-	-
1	13862055S-A-R1	August 27, 2021	7	<p>Modification of Worst margin: From “5.4 dB, 9608.000 MHz, AV, Hori., Tx BT LE 2402 MHz” To “5.6 dB, 9760.000 MHz, AV, Hori., Tx BT LE 2440 MHz”</p> <p>Modification of 4.2 Configuration and peripherals: Conducted Emission / Radiated Emission test</p> <div style="border: 1px solid black; padding: 5px;"> <p>From</p> <p><small>Radiated Emission test</small></p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>To</p> <p><small>Conducted Emission / Radiated Emission test</small></p> <p>Addition of remarks: “* For conducted emission test, pre-check had been done with AC 240 V and 120 V and tested at the worst case 120 V.”</p> </div> <p>Antenna Terminal conducted test:</p> <div style="border: 1px solid black; padding: 5px;"> <p>From</p> <p><small>Antenna Terminal conducted test</small></p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>To</p> <p><small>Antenna Terminal conducted test</small></p> <p>Addition of cable No.10, to the List of cables used</p> </div>

Reference: Abbreviations (Including words undescribed in this report)

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

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SECTION 1: Customer information

Company Name : CITIZEN WATCH CO., LTD.
Address : 6-1-12, Tanashi-cho, Nishi-Tokyo-shi, Tokyo 188-8511, Japan
Telephone Number : +81-42-468-4549
Facsimile Number : +81-42-468-4969
Contact Person : Fumio Takagi

The information provided from the customer is as follows;

- Applicant, Type 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
- SECTION 4: Operation of EUT during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type : Hybrid Smart Watch
Model Number : YF20MV-01
Serial Number : Refer to SECTION 4.2
Rating : DC 3.8 V, 0.26 mA
Receipt Date : June 18, 2021
Country of Mass-production : China
Condition : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification : No Modification by the test lab.

2.2 Product Description

Model: YF20MV-01 (referred to as the EUT in this report) is a Hybrid Smart Watch.

Radio Specification

Bluetooth Low Energy

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : GFSK
Antenna type : Loop Trace antenna
Antenna Gain : -7.60 dBi
Clock frequency (Maximum) : 16 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on May 3, 2021 and effective July 2, 2021
* The revision does not affect the test result conducted before its effective date.

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	17.5 dB 0.78035 MHz, L1, AV	Complied a)	-
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 b)	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 c)	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 d)	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		5.6 dB 9760.000 MHz, AV, Hori. Tx BT LE 2440 MHz	Complied e), f)
<p>Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *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.</p> <p>a) Refer to APPENDIX 1 (data of Conducted Emission) b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied 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)</p> <p>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.</p>					

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

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.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Bandwidth	ISED: RSS-Gen 6.7	ISED: -	N/A	- b)	Conducted
b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied 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 $k = 2$.
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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	2.6 dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	2.7 dB	2.7 dB	-
	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	5.3 dB	5.3 dB	5.3 dB	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 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	1.4 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.6 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.89 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.2 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.91 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.2 dB
Spurious emission (Conducted) below 1GHz	0.87 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.96 dB
Spurious emission (Conducted) 3 GHz-18 GHz	3.0 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.2 dB
Bandwidth Measurement	0.012 %
Duty cycle and Time Measurement	0.27 %
Temperature_SCH-01	0.87 deg.C.
Humidity_SCH-01	4.3 %
Temperature_SCH-02	2.0 deg.C.
Humidity_SCH-02	6.6 %
Voltage	0.86 %

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3.5 Test Location

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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)

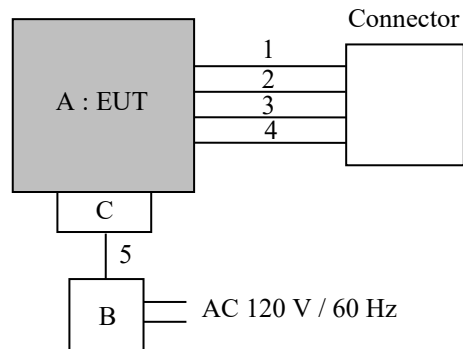
Mode	Remarks*
Bluetooth (BT) Low Energy (LE)	Uncoded 1 M-PHY, Maximum Packet Size, PRBS9
*Transmitting duty was 100 % on all tests.	
*Power of the EUT was set by the software as follows; Power settings: Fixed Software: SmartSnippets Toolbox Version 5.0.10.2434 (Date: 2019.3.19, Storage location: Driven by connected PC)	
*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, Spurious Emission, 6 dB Bandwidth, Maximum Peak Output Power, Power Density, 99 % Occupied Bandwidth	Tx BT LE	2402 MHz 2440 MHz 2480 MHz

4.2 Configuration and peripherals

Conducted Emission / Radiated Emission test



- * Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
- * It was preliminary confirmed that there was no difference in emission level due to a standard ferrite core.
- * For conducted emission test, pre-check had been done with AC 240 V and 120 V and tested at the worst case 120 V.

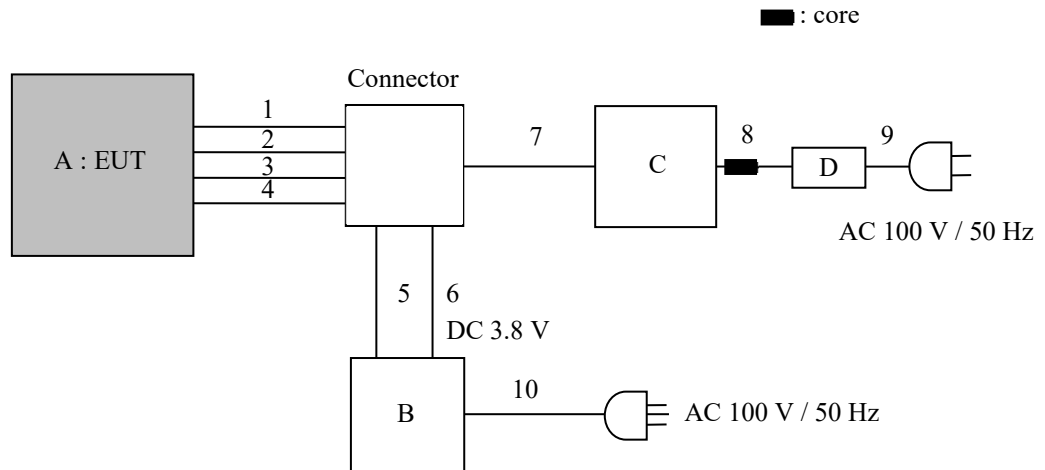
Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Hybrid Smart Watch	YF20MV-01	YF212	CITIZEN WATCH CO., LTD.	EUT
B	AC Adapter	A1385	E186249	Apple	-
C	Charging connector	YF20-C	-	-	-

List of cables used

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

Antenna Terminal conducted test



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Hybrid Smart Watch	YF20MV-01	YF208	CITIZEN WATCH CO., LTD.	EUT
B	DC Power Supply	PW8-5ADPS	14086035	TEXIO	-
C	Laptop computer	CF-SZ6ADLVS	9AKSC75153	Panasonic	-
D	AC Adapter	CF-AA64L2C M1	64L2CM118924073A	Panasonic	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal	0.1	Unshielded	Unshielded	-
2	Signal	0.1	Unshielded	Unshielded	-
3	Signal	0.1	Unshielded	Unshielded	-
4	Signal	0.1	Unshielded	Unshielded	-
5	DC (+)	0.15	Unshielded	Unshielded	-
6	DC (-)	0.15	Unshielded	Unshielded	-
7	USB	1.8	Shielded	Shielded	-
8	DC	0.9	Unshielded	Unshielded	-
9	AC	0.8	Unshielded	Unshielded	-
10	AC	1.0	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

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 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 80 cm 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.

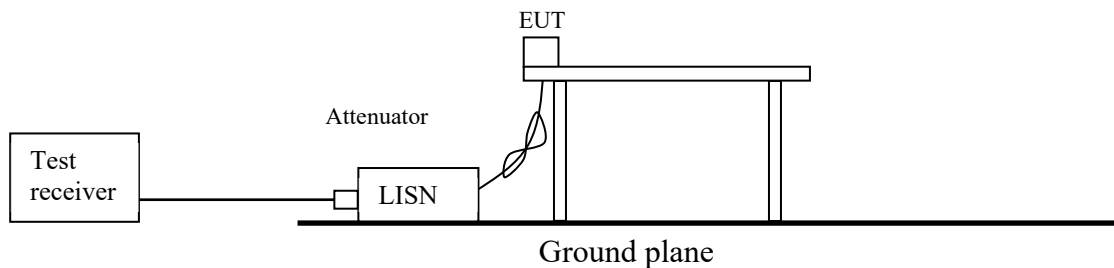
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber. The EUT was connected to a LISN (AMN).

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 - 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.

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	11.12.2.5.1 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces	RBW: 100 kHz VBW: 300 kHz

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

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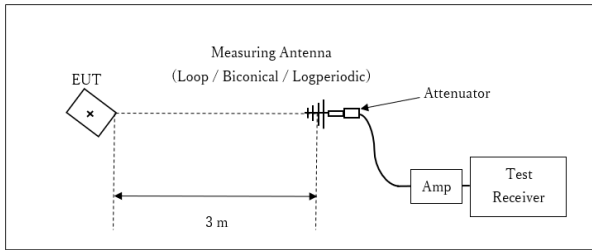
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Figure 2: Test Setup

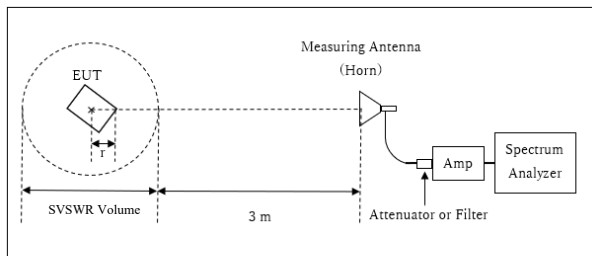
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz

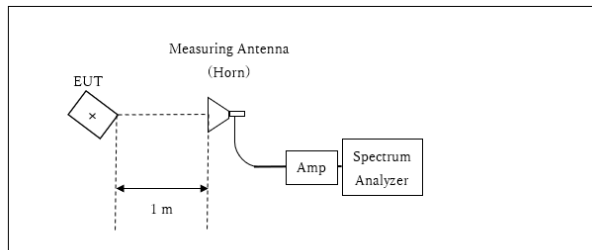


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: $20 \times \log(3.97 \text{ m} / 3.0 \text{ m}) = 2.44 \text{ dB}$
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.97 \text{ m}$

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.03 m

10 GHz – 26.5 GHz



× : 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.

Antenna polarization	Carrier (Band edge)	Spurious				
		Below 1 GHz	Above 1 GHz			
			1 GHz - 2.8 GHz	2.8 GHz - 10 GHz	10 GHz - 18 GHz	18 GHz - 26.5 GHz
Horizontal	Y	X	Y	Y	X	X
Vertical	Y	X	Y	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 - 26.5 GHz
Test data : APPENDIX
Test result : Pass

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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	10 MHz	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 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4) *5)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 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.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)
*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 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.

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

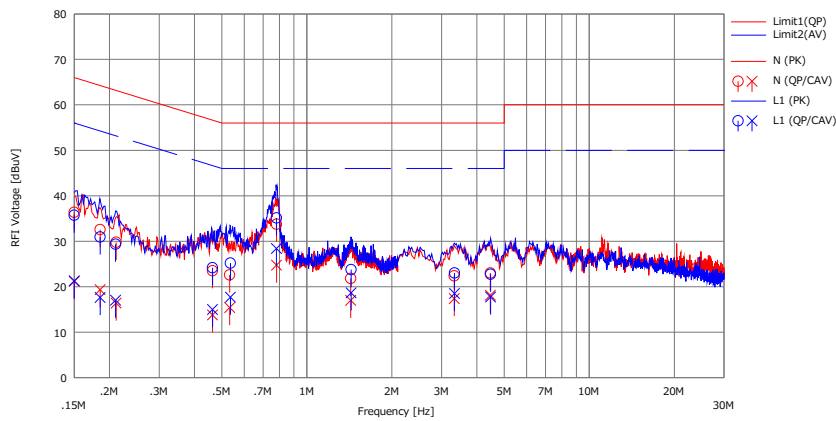
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2021/06/24

Mode : Tx, BTLE, 2402 MHz
Power : DC 5 V(AC 120 V/ 60 Hz)
Temp./Humi. : 24 deg.C / 51 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yosuke Murakami



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(CAV) [dBuV]		(QP) [dBuV]	(CAV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	23.80	8.60	12.57	36.37	21.17	66.00	56.00	29.6	34.8	N	
2	0.18537	20.00	6.80	12.58	32.58	19.38	64.24	54.24	31.6	34.8	N	
3	0.21113	17.20	3.80	12.59	29.79	16.39	63.16	53.16	33.3	36.7	N	
4	0.46317	10.90	1.20	12.61	23.51	13.81	56.64	46.64	33.1	32.8	N	
5	0.53293	10.00	2.80	12.61	22.61	15.41	56.00	46.00	33.3	30.5	N	
6	0.78110	21.10	12.10	12.66	33.76	24.76	56.00	46.00	22.2	21.2	N	
7	1.42902	9.10	4.30	12.72	21.82	17.02	56.00	46.00	34.1	28.9	N	
8	3.32540	9.50	4.50	12.90	22.40	17.40	56.00	46.00	33.6	28.6	N	
9	4.46340	10.00	5.10	13.02	23.02	18.12	56.00	46.00	32.9	27.8	N	
10	0.15000	23.10	8.70	12.62	35.72	21.32	66.00	56.00	30.2	34.6	L1	
11	0.18534	18.30	5.00	12.64	30.94	17.64	64.24	54.24	33.3	36.6	L1	
12	0.21025	16.70	4.40	12.65	29.35	17.05	63.20	53.20	33.8	36.1	L1	
13	0.46317	11.50	2.30	12.68	24.18	14.98	56.64	46.64	32.4	31.6	L1	
14	0.53629	12.50	5.00	12.69	25.19	17.69	56.00	46.00	30.8	28.3	L1	
15	0.78035	22.40	15.70	12.72	35.12	28.42	56.00	46.00	20.8	17.5	L1	
16	1.43447	11.00	5.90	12.76	23.76	18.66	56.00	46.00	32.2	27.3	L1	
17	3.33226	10.10	5.60	12.93	23.03	18.53	56.00	46.00	32.9	27.4	L1	
18	4.47160	9.70	4.70	13.04	22.74	17.74	56.00	46.00	33.2	28.2	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN): SLS-02

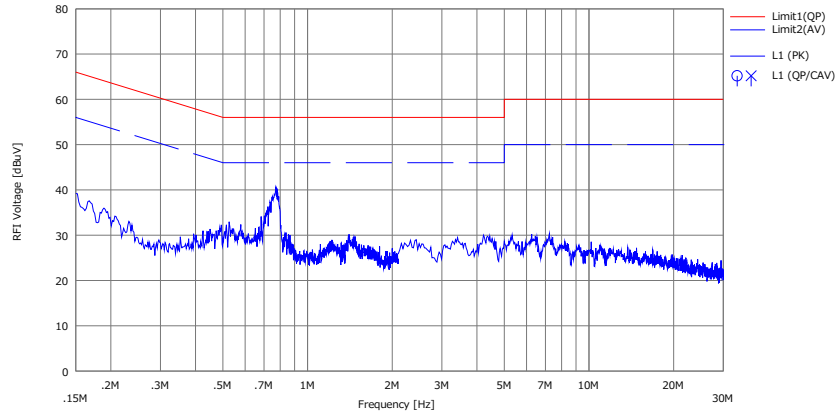
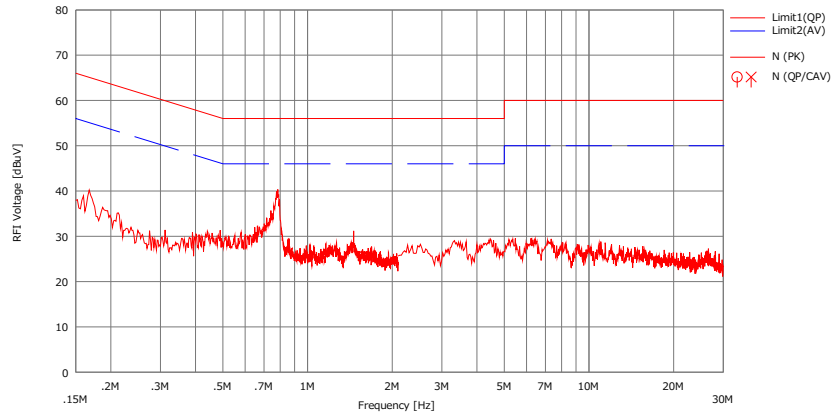
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
 Date : 2021/06/24

Mode : Tx, BTLE, 2440 MHz
 Power : DC 5 V(AC 120 V/ 60 Hz)
 Temp./Humi. : 24 deg.C / 51 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yosuke Murakami



Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
 LISN(AMN):SLS-02

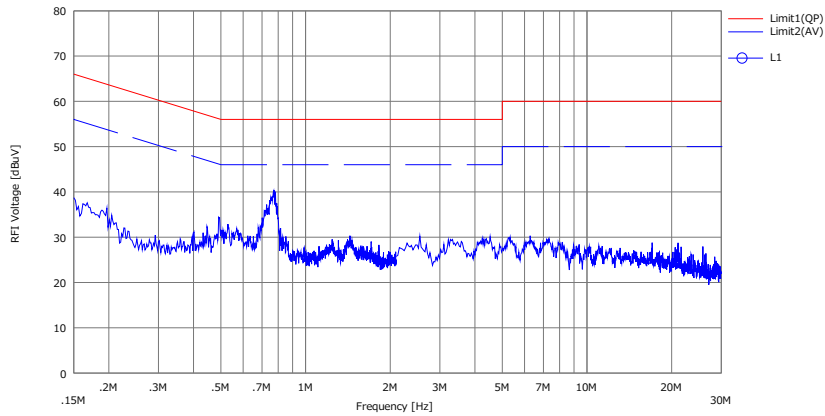
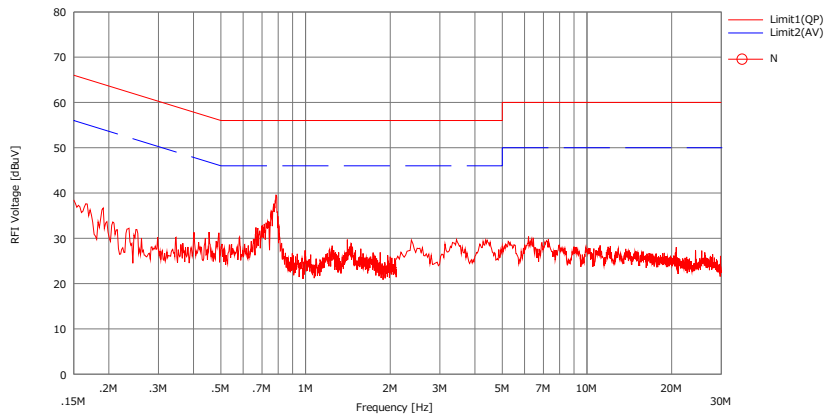
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2021/06/24

Mode : Tx. BTLE. 2480 MHz
Power : DC 5 V(AC 120 V/ 60 Hz)
Temp./Humi. : 24 deg.C / 51 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yosuke Murakami



Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN))+Cable+ATT)[dB]
LISN(AMN):SLS-02

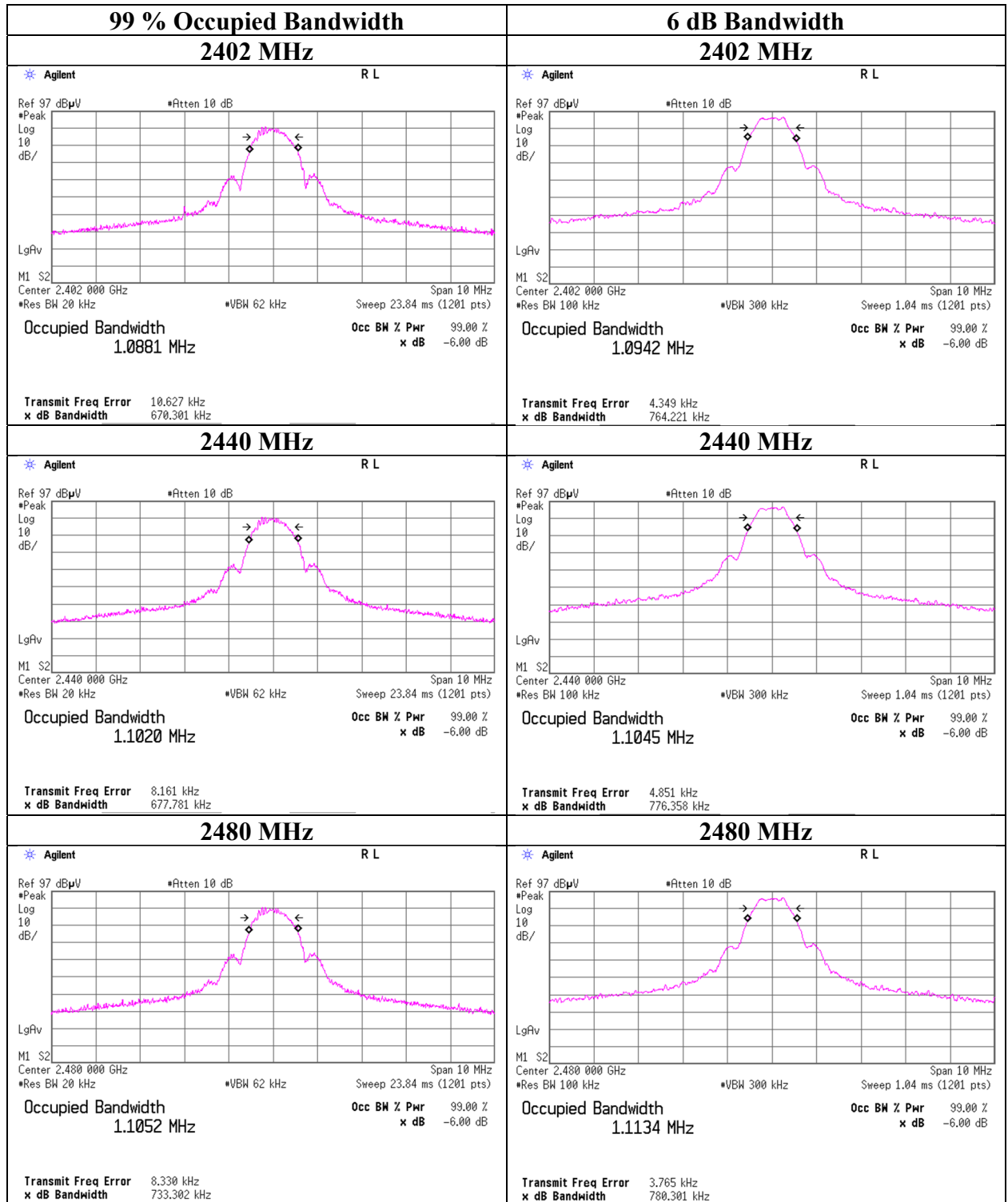
99 % Occupied Bandwidth and 6 dB Bandwidth

Report No. 13862055S-A-R1
Test place Shonan EMC Lab. No.6 Shielded Room
Date June 22, 2021
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Akihiro Oda
Mode Tx BT LE

Mode	Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
BT LE	2402	1088.1	0.764	> 0.5000
	2440	1102.0	0.776	> 0.5000
	2480	1105.2	0.780	> 0.5000

99 % Occupied Bandwidth and 6 dB Bandwidth

BT LE



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Maximum Peak Output Power

Report No. 13862055S-A-R1
Test place Shonan EMC Lab. No.6 Shielded Room
Date June 22, 2021
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Akihiro Oda
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-12.32	1.76	9.94	-0.62	0.87	30.00	1000	30.62	-7.60	-8.22	0.15	36.02	4000	44.24
2440	-12.33	1.77	9.94	-0.62	0.87	30.00	1000	30.62	-7.60	-8.22	0.15	36.02	4000	44.24
2480	-12.56	1.78	9.94	-0.84	0.82	30.00	1000	30.84	-7.60	-8.44	0.14	36.02	4000	44.46

Sample Calculation:

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

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

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Average Output Power
(Reference data for RF Exposure)

Report No. 13862055S-A-R1
Test place Shonan EMC Lab. No.6 Shielded Room
Date June 22, 2021
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Akihiro Oda
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-12.89	1.76	9.94	-1.19	0.76	0.00	-1.19	0.76
2440	-12.98	1.77	9.94	-1.27	0.75	0.00	-1.27	0.75
2480	-13.23	1.78	9.94	-1.51	0.71	0.00	-1.51	0.71

Sample Calculation:

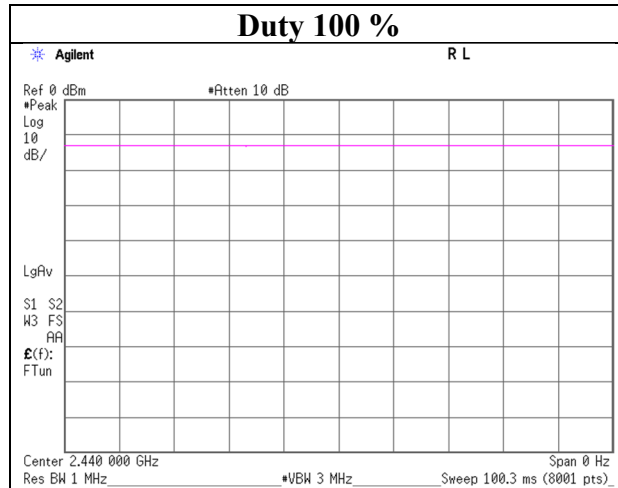
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst rate confirmation

Report No. 13862055S-A-R1
Test place Shonan EMC Lab. No.6 Shielded Room
Date June 22, 2021
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Akihiro Oda
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

Report No. 13862055S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date June 24, 2021
Temperature / Humidity 21 deg. C / 56 % RH
Engineer Hiromasa Sato
(30 MHz - 1 GHz)
(1 GHz - 26.5 GHz)
Mode Tx BT LE 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.	30.501	QP	21.50	18.40	7.04	31.83	0.00	15.11	40.0	24.8	100	2	-
Hori.	874.279	QP	21.30	21.98	9.78	31.60	0.00	21.46	46.0	24.5	100	217	-
Hori.	2390.000	PK	45.29	27.73	14.89	39.61	2.44	50.74	73.9	23.1	110	13	-
Hori.	4804.000	PK	51.30	31.22	7.49	39.69	2.44	52.76	73.9	21.1	111	44	-
Hori.	7206.000	PK	44.85	36.56	9.09	39.49	2.44	53.45	73.9	20.4	150	0	-
Hori.	9608.000	PK	45.48	38.15	10.67	39.68	2.44	57.06	73.9	16.8	150	0	-
Hori.	2390.000	AV	35.59	27.73	14.89	39.61	2.44	41.04	53.9	12.8	110	13	-
Hori.	4804.000	AV	46.05	31.22	7.49	39.69	2.44	47.51	53.9	6.3	111	44	-
Hori.	7206.000	AV	36.43	36.56	9.09	39.49	2.44	45.03	53.9	8.8	150	0	floomoise
Hori.	9608.000	AV	36.89	38.15	10.67	39.68	2.44	48.47	53.9	5.4	150	0	floomoise
Vert.	32.581	QP	22.00	17.66	7.09	31.83	0.00	14.92	40.0	25.0	100	18	-
Vert.	122.313	QP	23.40	13.28	8.24	31.79	0.00	13.13	43.5	30.3	100	175	-
Vert.	180.562	QP	23.30	16.18	8.96	31.77	0.00	16.67	43.5	26.8	100	118	-
Vert.	196.202	QP	21.90	16.68	9.02	31.77	0.00	15.83	43.5	27.6	100	155	-
Vert.	942.884	QP	20.90	21.93	10.08	31.09	0.00	21.82	46.0	24.1	100	63	-
Vert.	2390.000	PK	45.42	27.73	14.89	39.61	2.44	50.87	73.9	23.0	105	7	-
Vert.	4804.000	PK	49.53	31.22	7.49	39.69	2.44	50.99	73.9	22.9	148	193	-
Vert.	7206.000	PK	44.76	36.56	9.09	39.49	2.44	53.36	73.9	20.5	150	0	-
Vert.	9608.000	PK	45.50	38.15	10.67	39.68	2.44	57.08	73.9	16.8	150	0	-
Vert.	2390.000	AV	35.93	27.73	14.89	39.61	2.44	41.38	53.9	12.5	105	7	-
Vert.	4804.000	AV	43.38	31.22	7.49	39.69	2.44	44.84	53.9	9.0	148	193	-
Vert.	7206.000	AV	36.58	36.56	9.09	39.49	2.44	45.18	53.9	8.7	150	0	floomoise
Vert.	9608.000	AV	36.83	38.15	10.67	39.68	2.44	48.41	53.9	5.4	150	0	floomoise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

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

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	80.43	27.71	14.91	39.62	2.44	85.87	-	-	Carrier
Hori.	2400.000	PK	38.02	27.71	14.90	39.62	2.44	43.45	65.8	22.3	-
Vert.	2402.000	PK	81.06	27.71	14.91	39.62	2.44	86.50	-	-	Carrier
Vert.	2400.000	PK	38.17	27.71	14.90	39.62	2.44	43.60	66.5	22.9	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

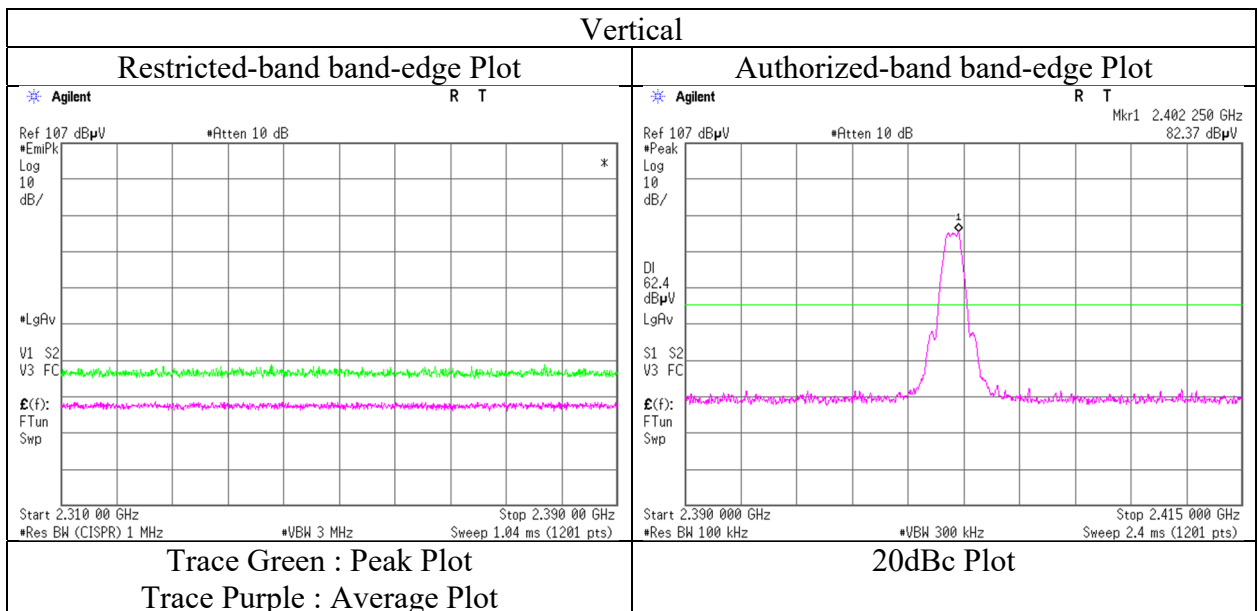
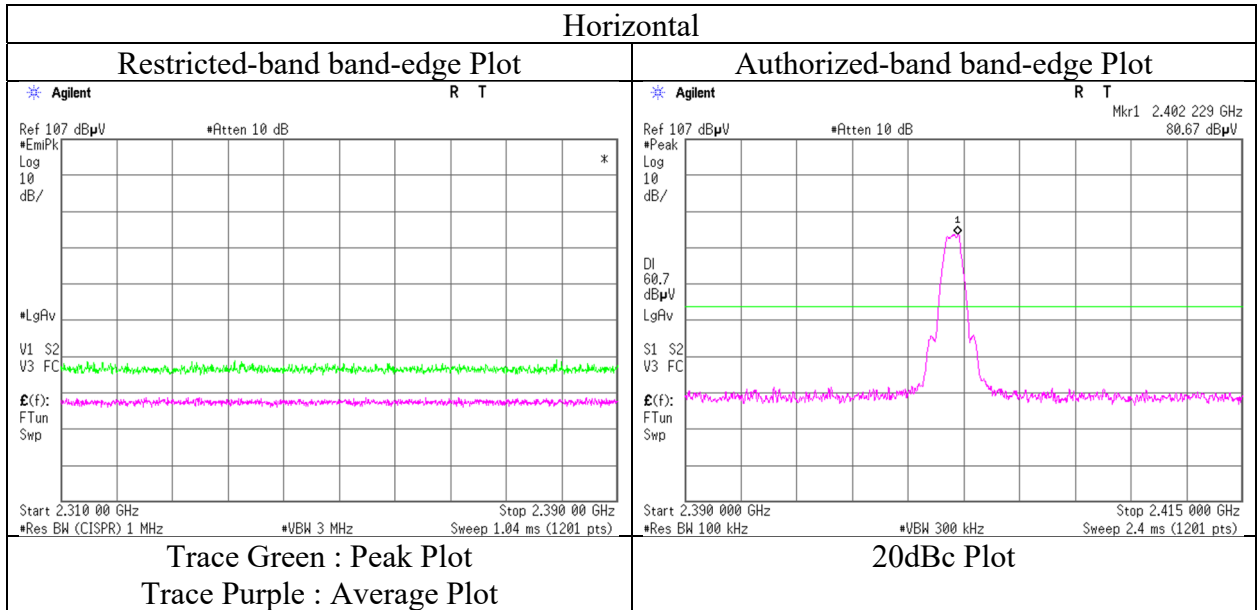
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**Radiated Spurious Emission
(Reference Plot for band-edge)**

Report No. 13862055S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date June 24, 2021
Temperature / Humidity 21 deg. C / 56 % RH
Engineer Hiromasa Sato
Mode Tx BT LE 2402 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

Report No. 13862055S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date June 24, 2021
Temperature / Humidity 21 deg. C / 56 % RH
Engineer Hiromasa Sato
(30 MHz - 1 GHz)
(1 GHz - 26.5 GHz)
Mode Tx BT LE 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.	30.557	QP	21.40	18.38	7.04	31.83	0.00	14.99	40.0	25.0	100	37	-
Hori.	197.110	QP	21.40	16.66	9.03	31.77	0.00	15.32	43.5	28.1	100	104	-
Hori.	852.419	QP	21.30	21.67	9.67	31.72	0.00	20.92	46.0	25.0	100	267	-
Hori.	4880.000	PK	51.66	31.25	7.53	39.70	2.44	53.18	73.9	20.7	149	40	-
Hori.	7320.000	PK	45.07	36.69	9.15	39.46	2.44	53.89	73.9	20.0	150	0	-
Hori.	9760.000	PK	45.72	38.62	10.67	39.60	2.44	57.85	73.9	16.0	150	0	-
Hori.	4880.000	AV	46.43	31.25	7.53	39.70	2.44	47.95	53.9	5.9	149	40	-
Hori.	7320.000	AV	35.53	36.69	9.15	39.46	2.44	44.35	53.9	9.5	150	0	floormoise
Hori.	9760.000	AV	36.15	38.62	10.67	39.60	2.44	48.28	53.9	5.6	150	0	floormoise
Vert.	32.386	QP	22.10	17.72	7.09	31.83	0.00	15.08	40.0	24.9	100	31	-
Vert.	123.342	QP	23.00	13.40	8.26	31.79	0.00	12.87	43.5	30.6	100	191	-
Vert.	177.274	QP	22.70	16.12	8.96	31.77	0.00	16.01	43.5	27.4	100	138	-
Vert.	944.805	QP	22.60	21.93	10.09	31.07	0.00	23.55	46.0	22.4	100	290	-
Vert.	4880.000	PK	48.66	31.25	7.53	39.70	2.44	50.18	73.9	23.7	146	277	-
Vert.	7320.000	PK	44.54	36.69	9.15	39.46	2.44	53.36	73.9	20.5	150	0	-
Vert.	9760.000	PK	45.42	38.62	10.67	39.60	2.44	57.55	73.9	16.3	150	0	-
Vert.	4880.000	AV	42.52	31.25	7.53	39.70	2.44	44.04	53.9	9.8	146	277	-
Vert.	7320.000	AV	35.46	36.69	9.15	39.46	2.44	44.28	53.9	9.6	150	0	floormoise
Vert.	9760.000	AV	35.71	38.62	10.67	39.60	2.44	47.84	53.9	6.0	150	0	floormoise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

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

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Radiated Spurious Emission

Report No. 13862055S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date June 24, 2021
Temperature / Humidity 21 deg. C / 56 % RH
Engineer Hiromasa Sato
(30 MHz - 1 GHz)
(1 GHz - 26.5 GHz)
Mode Tx BT LE 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.	30.616	QP	21.40	18.35	7.04	31.83	0.00	14.96	40.0	25.0	100	349	-
Hori.	192.849	QP	21.60	16.52	9.00	31.77	0.00	15.35	43.5	28.1	100	253	-
Hori.	900.419	QP	21.10	22.08	9.91	31.46	0.00	21.63	46.0	24.3	100	119	-
Hori.	2483.500	PK	44.92	27.61	15.00	39.64	2.44	50.33	73.9	23.5	149	252	-
Hori.	4960.000	PK	51.42	31.43	7.60	39.72	2.44	53.17	73.9	20.7	100	44	-
Hori.	7440.000	PK	44.66	36.84	9.22	39.42	2.44	53.74	73.9	20.1	150	0	-
Hori.	9920.000	PK	43.70	38.71	10.68	39.52	2.44	56.01	73.9	17.8	150	0	-
Hori.	2483.500	AV	36.26	27.61	15.00	39.64	2.44	41.67	53.9	12.2	149	252	-
Hori.	4960.000	AV	46.48	31.43	7.60	39.72	2.44	48.23	53.9	5.6	100	44	-
Hori.	7440.000	AV	35.57	36.84	9.22	39.42	2.44	44.65	53.9	9.2	150	0	floornoise
Hori.	9920.000	AV	34.65	38.71	10.68	39.52	2.44	46.96	53.9	6.9	150	0	floornoise
Vert.	50.686	QP	21.50	10.97	7.47	31.81	0.00	8.13	40.0	31.8	100	3	-
Vert.	69.383	QP	23.30	6.60	7.49	31.81	0.00	5.58	40.0	34.4	100	201	-
Vert.	161.127	QP	21.50	15.32	8.95	31.78	0.00	13.99	43.5	29.5	100	86	-
Vert.	192.750	QP	22.30	16.52	9.00	31.77	0.00	16.05	43.5	27.4	100	116	-
Vert.	208.166	QP	27.10	11.28	5.85	31.77	0.00	12.46	43.5	31.0	100	4	-
Vert.	2483.500	PK	45.00	27.61	15.00	39.64	2.44	50.41	73.9	23.4	151	359	-
Vert.	4960.000	PK	48.76	31.43	7.60	39.72	2.44	50.51	73.9	23.3	191	137	-
Vert.	7440.000	PK	44.29	36.84	9.22	39.42	2.44	53.37	73.9	20.5	150	0	-
Vert.	9920.000	PK	43.61	38.71	10.68	39.52	2.44	55.92	73.9	17.9	150	0	-
Vert.	2483.500	AV	36.30	27.61	15.00	39.64	2.44	41.71	53.9	12.1	151	359	-
Vert.	4960.000	AV	42.56	31.43	7.60	39.72	2.44	44.31	53.9	9.5	191	137	-
Vert.	7440.000	AV	35.30	36.84	9.22	39.42	2.44	44.38	53.9	9.5	150	0	floornoise
Vert.	9920.000	AV	34.48	38.71	10.68	39.52	2.44	46.79	53.9	7.1	150	0	floornoise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

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

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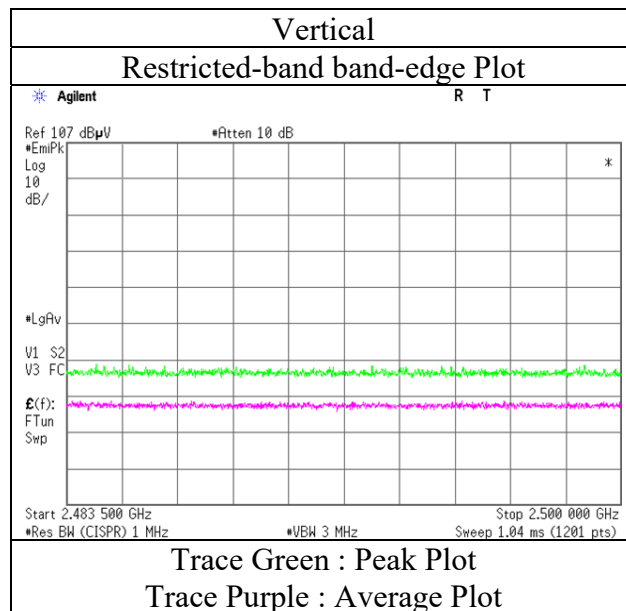
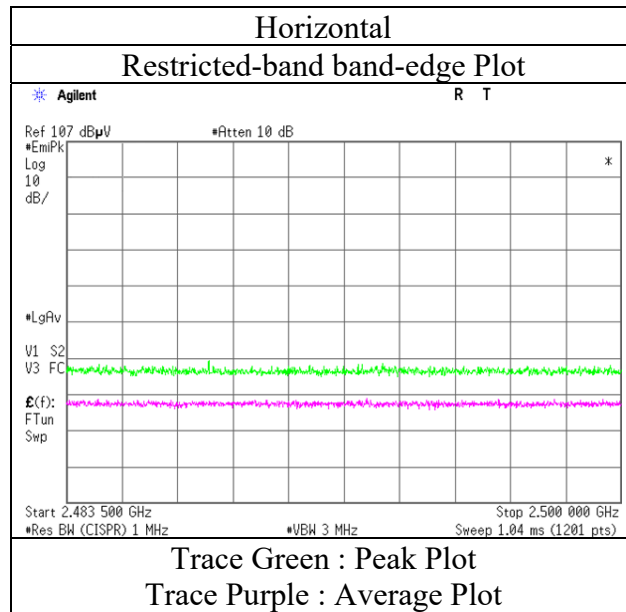
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Radiated Spurious Emission
(Reference Plot for band-edge)

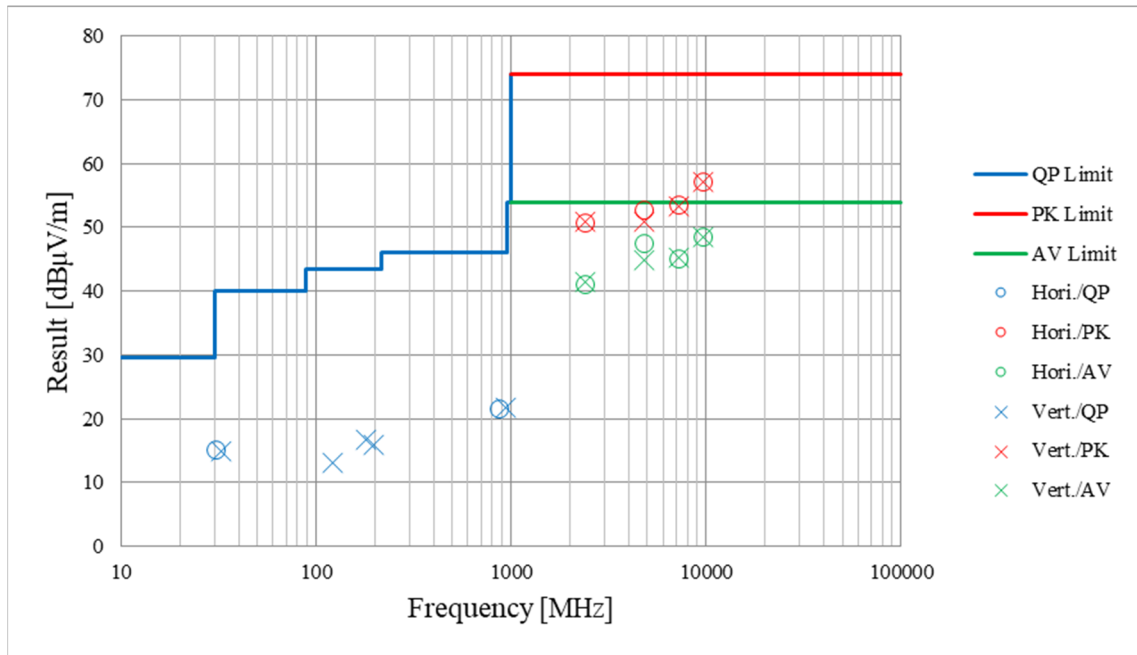
Report No. 13862055S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date June 24, 2021
Temperature / Humidity 21 deg. C / 56 % RH
Engineer Hiromasa Sato
Mode Tx BT LE 2480 MHz



* 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)

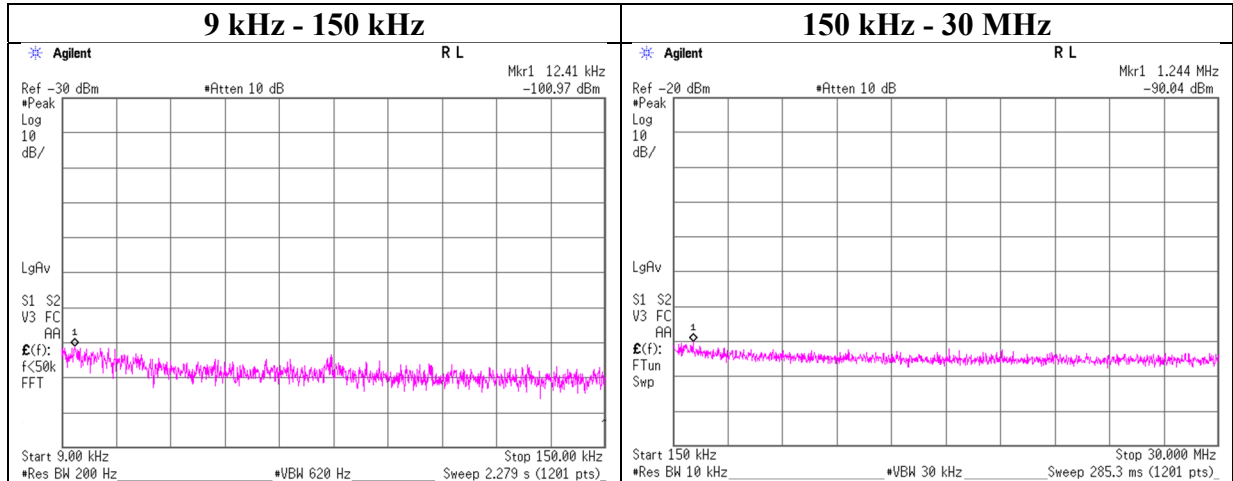
Report No. 13862055S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date June 24, 2021
Temperature / Humidity 21 deg. C / 56 % RH
Engineer Hiromasa Sato
(30 MHz - 1 GHz)
(1 GHz - 26.5 GHz)
Mode Tx BT LE 2440 MHz



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

Conducted Spurious Emission

Report No. 13862055S-A-R1
Test place Shonan EMC Lab. No.6 Shielded Room
Date June 22, 2021
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Akihiro Oda
Mode Tx BT LE 2402 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
12.41	-101.0	0.01	9.9	2.0	1	-89.1	300	6.0	-27.8	45.7	73.5	-
1244.00	-90.0	0.01	9.9	2.0	1	-78.2	30	6.0	3.1	25.7	22.6	-

$$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log(\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$$

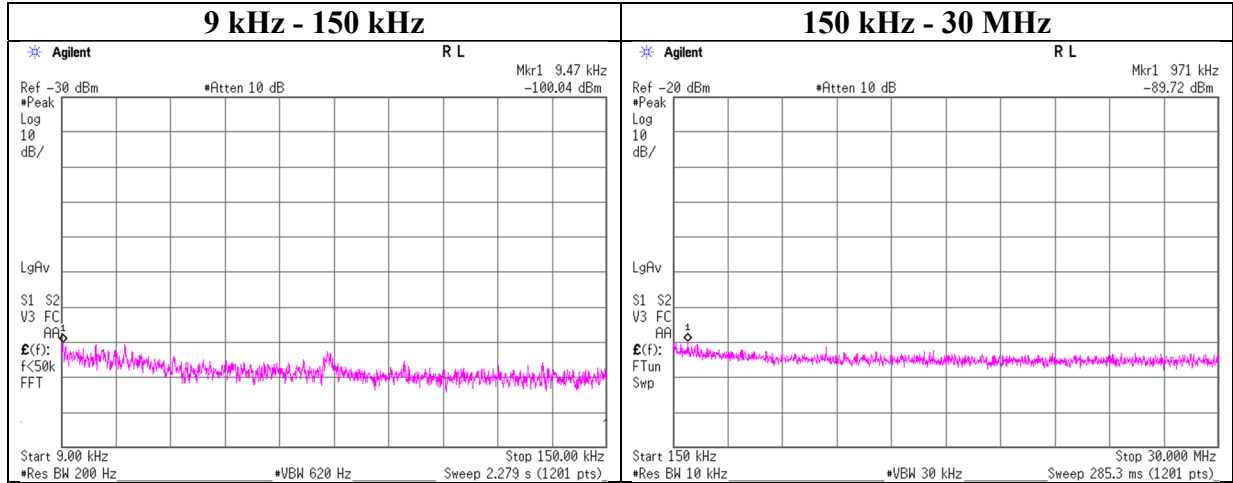
$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$$

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

Report No. 13862055S-A-R1
Test place Shonan EMC Lab. No.6 Shielded Room
Date June 22, 2021
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Akihiro Oda
Mode Tx BT LE 2440 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
9.47	-100.0	0.01	9.9	2.0	1	-88.2	300	6.0	-26.9	48.0	74.9	-
971.00	-89.7	0.01	9.9	2.0	1	-77.8	30	6.0	3.4	27.8	24.4	-

$$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log(\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$$

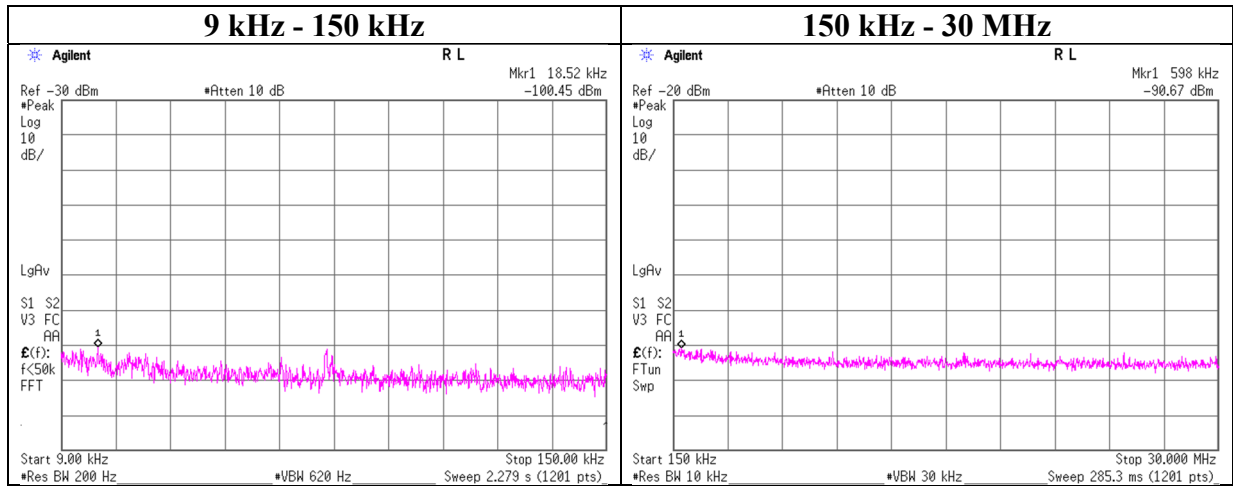
$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$$

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

Report No. 13862055S-A-R1
Test place Shonan EMC Lab. No.6 Shielded Room
Date June 22, 2021
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Akihiro Oda
Mode Tx BT LE 2480 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
18.52	-100.5	0.01	9.9	2.0	1	-88.6	300	6.0	-27.3	42.2	69.5	-
598.00	-90.7	0.01	9.9	2.0	1	-78.8	30	6.0	2.5	32.0	29.5	-

$$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log(\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$$

$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$$

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

Report No. 13862055S-A-R1
Test place Shonan EMC Lab. No.6 Shielded Room
Date June 22, 2021
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Akihiro Oda
Mode Tx BT LE

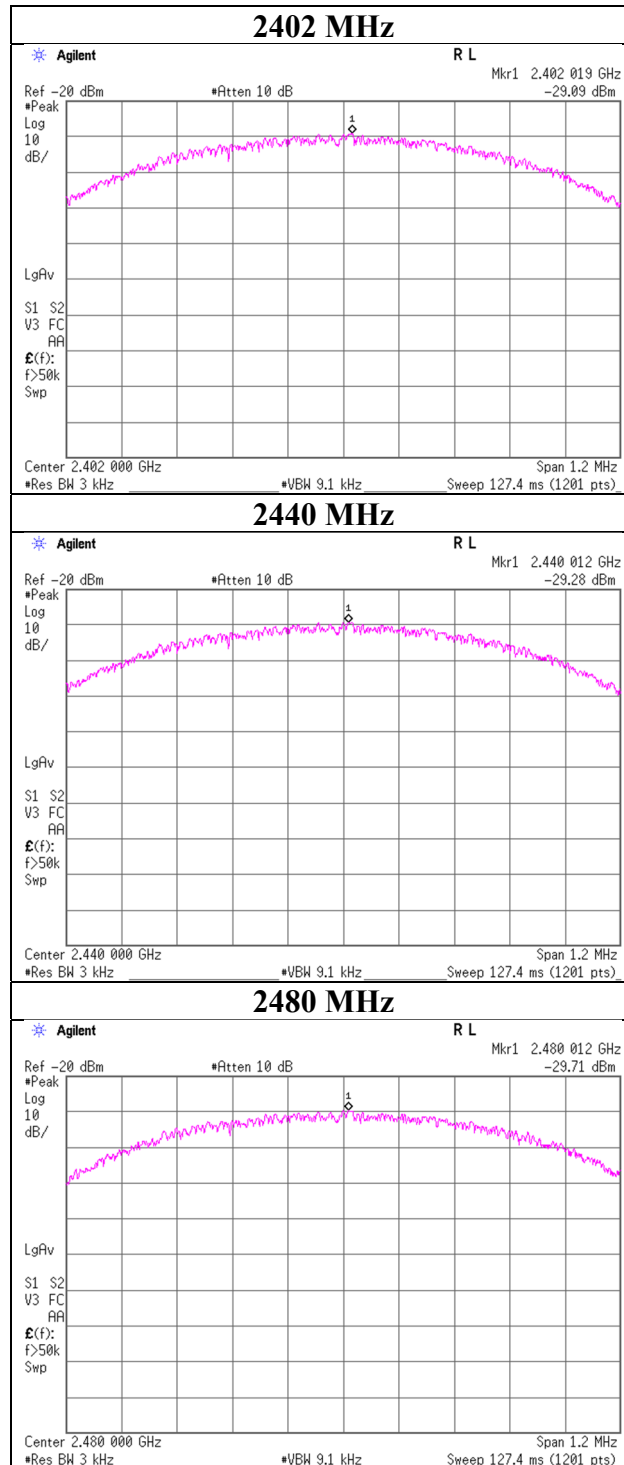
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm / 3 kHz]	[dB]	[dB]	[dBm / 3 kHz]	[dBm / 3 kHz]	[dB]
2402	-29.09	1.76	9.94	-17.39	8.00	25.39
2440	-29.28	1.77	9.94	-17.57	8.00	25.57
2480	-29.71	1.78	9.94	-17.99	8.00	25.99

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Power Density



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APPENDIX 2: Test instruments

Test equipment (1/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	KSA-08	145089	Spectrum Analyzer	Keysight Technologies Inc	E4446A	MY46180525	2020/11/24	12
AT	KTS-06	145110	Digital Tester	SANWA	PC500	7019240	2021/04/26	12
AT	SAT10-21	204925	Attenuator	Weinschel Corp.	54A-10	-	2021/02/09	12
AT	SCC-G66	196947	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803478/2	2021/03/01	12
AT	SOS-05	146293	Humidity Indicator	A&D Company	AD-5681	4062518	2020/09/30	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
CE	KJM-10	146454	Measure	KOMELON	KMC-36	-	-	-
CE	SAT3-13	150923	Attenuator	JFW	50HF-003N	-	2021/01/26	12
CE	SCC-B12/B13/SRSE-02	144969	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-270(RF Selector)	2021/04/12	12
CE	SLS-02	145539	LISN	Rohde & Schwarz	ENV216	100512	2021/02/24	12
CE	SOS-22	191839	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2020/10/01	12
CE	STR-07	146209	Test Receiver	Rohde & Schwarz	ESU26	100484	2020/09/07	12
CE	STS-02	145793	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997819	2021/04/28	12
CE,RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-

Test equipment (2/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	KAT6-04	144899	Attenuator	Inmet	18N-6dB	-	2020/12/10	12
RE	KJM-09	145929	Measure	KOMELON	KMC-36	-	-	-
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	SAF-01	145003	Pre Amplifier	SONOMA	310N	290211	2021/02/10	12
RE	SAF-04	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2021/05/17	12
RE	SAF-09	145008	Pre Amplifier	Toyo Corporation	HAP18-26W	18	2020/09/02	12
RE	SAT10-06	145137	Attenuator	Keysight Technologies Inc	8493C-010	74865	2020/10/05	12
RE	SAT3-09	144959	Attenuator	JFW	50HF-003N	-	2020/08/18	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	2021/01/26	12
RE	SCC-G19	145178	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	2021/03/01	12
RE	SCC-G62	196985	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803650/2	2021/03/01	12
RE	SCC-G68	200008	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	575616/4	2020/07/07	12
RE	SFL-18	145305	Highpass Filter	MICRO-TRONICS	HPM50111	119	2021/04/08	12
RE	SHA-01	145383	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-725	2021/05/20	12
RE	SHA-05	145513	Horn Antenna	ETS-Lindgren	3160-09	00094867	2021/06/14	12
RE	SHA-08	194683	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	694	2021/03/03	12
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	-	2020/09/28	12
RE	SSA-02	145800	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250106	2021/04/13	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	2020/10/19	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 test
RE: Radiated Emission test
AT: Antenna Terminal Conducted test

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