RADIO TEST REPORT

Test Report No. : 13270745S-A

Applicant	:	**CASIO COMPUTER CO., LTD.**
Type of EUT	:	**Watch**
Model Number of EUT	:	**GSR-H1000**
FCC ID	:	**BBQS0NW**
Test regulation	:	**FCC Part 15 Subpart C: 2019**
Test Result	:	**Complied (Refer to SECTION 3.2)**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers Radio technical requirements.
   It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.

Date of test: March 11 to 31, 2020

Representative test engineer: Y. Tanikawara
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Approved by: A. Hayashi
Akio Hayashi
Leader
Consumer Technology Division

CERTIFICATE 1266.03

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

REVISION HISTORY

Original Test Report No.: 13270745S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13270745S-A	April 21, 2020	-	-

Reference: Abbreviations (Including words undescribed in this report)

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

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	CASIO COMPUTER CO., LTD.
Address	:	2-1, Sakaecho 3 chome, Hamura-shi, Tokyo 205-8555 Japan
Telephone Number	:	+81-42-579-7282
Facsimile Number	:	+81-42-579-7702
Contact Person	:	Hiroaki Suzuki

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)
- 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 of Equipment	:	Watch
Model No.	:	GSR-H1000
Serial No.	:	Refer to SECTION 4.2
Rating	:	Typical (Battery): DC 3.7 V, Min.: DC 3.5 V, Max.: DC 4.2 V Typical (Charging Terminal): DC 5.0 V, Min.: DC 4.75 V, Max.: DC 5.25 V CW3491 (Module): Typical: DC 3.7 V CW3491 (Charging Terminal): DC 5.0 V
Receipt Date of Sample (Information from test lab.)	:	March 11, 2020
Country of Mass-production	:	China, Thailand, Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab.

2.2 Product Description

Model: GSR-H1000 (referred to as the EUT in this report) is a Watch.
* GSR-H1000 has alternative name as R031.

Radio Specification

Equipment Type	:	Transceiver
Frequency of Operation	:	2402 MHz – 2480 MHz
Type of Modulation	:	GFSK
Channel spacing	:	2 MHz
Antenna Type	:	Chip (Mono Pole), SMD
Antenna Gain	:	2.5 dBi
Clock frequency (Maximum)	:	32 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on July 19, 2019 and effective August 19, 2019 except 15.258

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	**FCC:** Section 15.207	28.4 dB, 0.43271 MHz, QP, N Mode: TX BLE 2402 MHz	Complied a)	-
	ISED: RSS-Gen 8.8	**ISED:** RSS-Gen 8.8			
6dB 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)	2.2 dB 7320.000 MHz, AV, Horizontal Mode: Tx BT LE 2440 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 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.

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)

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.

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

FCC Part 15.31 (e)
The EUT provides stable voltage constantly to the wireless transmitter regardless of input voltage.
Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the 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 requirement.

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.

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)		
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.6 dB	2.6 dB	2.5 dB
Radiated emission	9 kHz-30 MHz	3.0 dB	3.0 dB	3.0 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	4.9 dB	4.9 dB	4.9 dB
	6 GHz-18 GHz	5.5 dB	5.5 dB	5.5 dB
	18 GHz-40 GHz	5.4 dB	5.4 dB	5.4 dB
Radiated emission	1 GHz-18 GHz	5.8 dB	5.8 dB	5.8 dB
(Measurement distance: 1 m)	18 GHz-40 GHz	5.7 dB	5.7 dB	5.7 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	0.98 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.75 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.89 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.12 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	1.06 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.24 dB
Spurious emission (Conducted) below 1GHz	0.9 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.9 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.9 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.0 dB
Bandwidth Measurement	0.07 %
Duty cycle and Time Measurement	0.262 %

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)

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	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

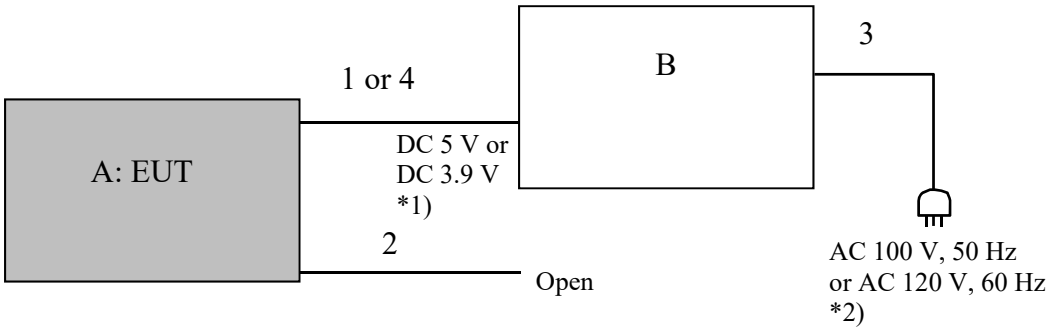
4.1 Operating Mode(s)

Mode	Frequency	Remarks*
Transmitting Bluetooth Low Energy	2402 MHz, 2440 MHz, 2480 MHz	PRBS9

*Power of the EUT was set by the software as follows;
Power settings: Fixed
Software: BLE RF Test Version 9.9
(Date: 2020.3.11, 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.

4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
* For radiated emission test, pre-check had been done with DC 5 V (Charging Terminal) and DC 3.9 V (Battery) and the test was carried out with the worst case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Watch	GSR-H1000	20 *3) 17 *4)	Casio Computer., Ltd	EUT
B	Power Supply (DC)	PAN35-10A	NA000955	KIKUSUI	-

*1) For Radiated Emission test (above 1 GHz) and Conducted Emission test, supplied voltage is DC 5 V. For other test, supplied voltage is DC 3.9 V. Although the typical battery voltage is DC 3.7 V, the test was conducted with DC 3.9 V according to the customer's request.
*2) For other than Conducted Emission test: AC 100 V, 50 Hz. For Conducted Emission test: AC 120 V, 60 Hz.
*3) Used for Antenna Terminal conducted test
*4) Used for Conducted Emission test and Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	0.1 + 1.5	Unshielded	Unshielded	*5) *6)
2	Signal Cable	0.1	Unshielded	Unshielded	*7)
3	AC	2.0	Unshielded	Unshielded	-
4	DC	0.6 + 1.5	Unshielded	Unshielded	*5) *8)

*5) Cable for test operation
*6) For battery use (Cable No.4 is unused when Battery is used)
*7) Cable for system reset during the development, not used for the product.
*8) For Charging Terminal Use (Cable No.1 is unused when Charging Terminal used)

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.

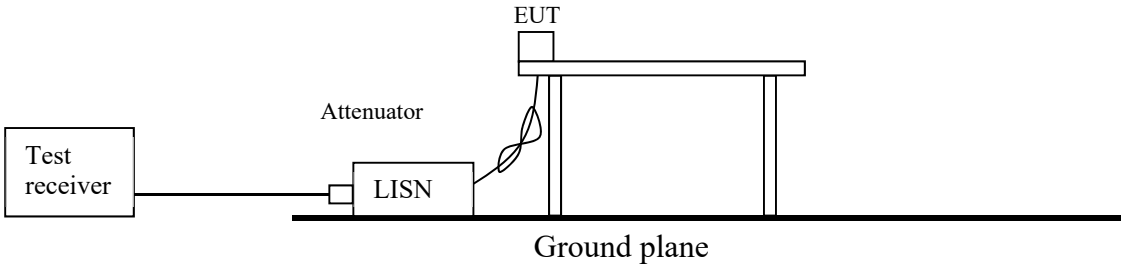
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

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

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.

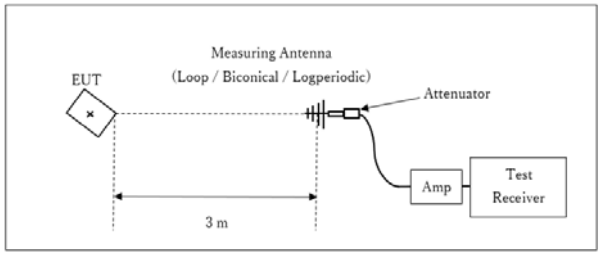
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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	11.12.2.5.2 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz

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

Figure 2: Test Setup

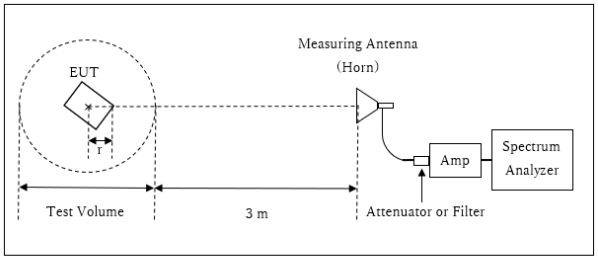
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz

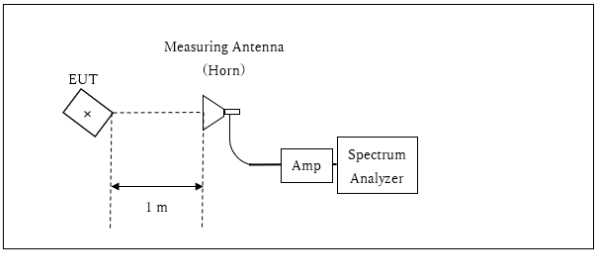


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.96 m / 3.0 m) = 2.42 dB
* Test Distance: (3 + Test Volume /2) - r = 3.96 m

Test Volume : 2.0 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.04 m

13 GHz – 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 to 1 GHz)	Spurious (1 GHz -13 GHz)	Spurious (13 GHz -26.5 GHz)
Horizontal	X	X	X	X
Vertical	Y	X	Y	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

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
6dB 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: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *5) *6)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	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".
*5) 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 low enough as shown in the chart.
*6) 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

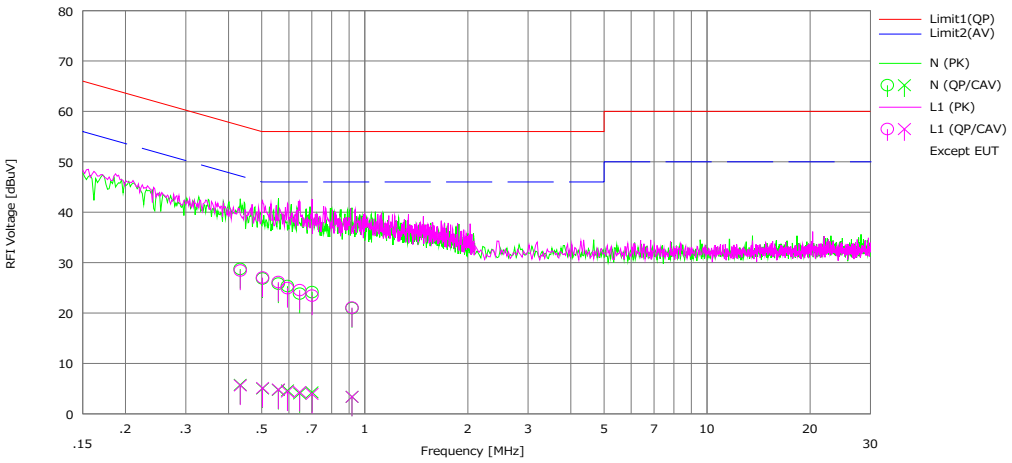
UL Japan,Inc. Shonan EMC Lab. No.5 Shielded Room
Date : 2020/03/31

Mode : Tx, BLE, 2402 MHz

Power : DC 5.0 V (AC 120 V / 60 Hz)
Temp./Humi. : 23 deg.C / 40 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yusuke Tanikawara



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	0.43271	16.30	-6.70	12.43	28.73	5.73	57.20	47.20	28.4	41.4	N	
2	0.50291	14.40	-7.40	12.42	26.82	5.02	56.00	46.00	29.1	40.9	N	
3	0.55946	13.40	-7.70	12.42	25.82	4.72	56.00	46.00	30.1	41.2	N	
4	0.59459	12.90	-7.80	12.43	25.33	4.63	56.00	46.00	30.6	41.3	N	
5	0.64536	11.40	-8.40	12.43	23.83	4.03	56.00	46.00	32.1	41.9	N	
6	0.70184	11.70	-8.20	12.44	24.14	4.24	56.00	46.00	31.8	41.7	N	
7	0.91814	8.50	-9.10	12.45	20.95	3.35	56.00	46.00	35.0	42.6	N	
8	0.43298	16.00	-6.80	12.41	28.41	5.61	57.20	47.20	28.7	41.5	L1	
9	0.50291	14.60	-7.30	12.41	27.01	5.11	56.00	46.00	28.9	40.8	L1	
10	0.55948	13.70	-7.60	12.42	26.12	4.82	56.00	46.00	29.8	41.1	L1	
11	0.59461	12.50	-8.00	12.43	24.93	4.43	56.00	46.00	31.0	41.5	L1	
12	0.64529	12.10	-8.10	12.43	24.53	4.33	56.00	46.00	31.4	41.6	L1	
13	0.70181	11.00	-8.50	12.44	23.44	3.94	56.00	46.00	32.5	42.0	L1	
14	0.91818	8.60	-9.10	12.45	21.05	3.35	56.00	46.00	34.9	42.6	L1	

Calculation:Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN)=SLS-05

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

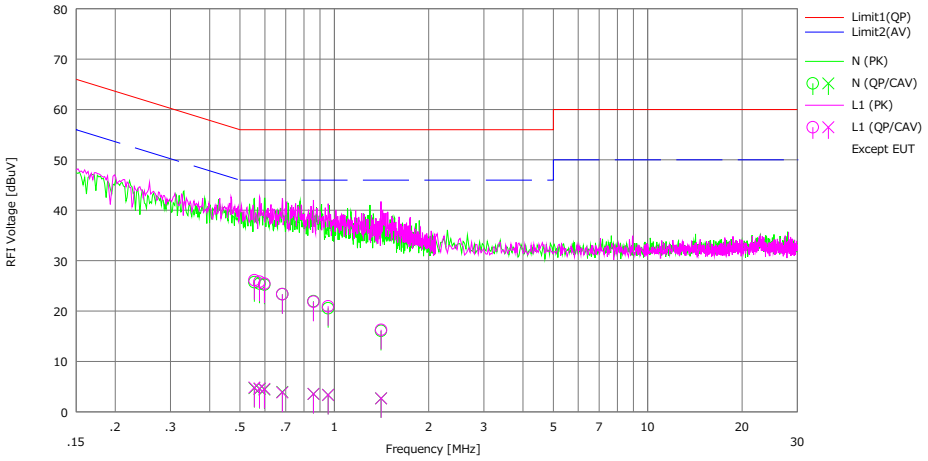
UL Japan,Inc. Shonan EMC Lab. No.5 Shielded Room
Date : 2020/03/31

Mode : Tx, BLE, 2440 MHz

Power : DC 5.0 V (AC 120 V / 60 Hz)
Temp./Humi. : 23 deg.C / 40 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yusuke Tanikawara



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	0.55567	13.30	-7.70	12.42	25.72	4.72	56.00	46.00	30.2	41.2	N	
2	0.57705	13.00	-7.90	12.43	25.43	4.53	56.00	46.00	30.5	41.4	N	
3	0.59859	12.80	-8.00	12.43	25.23	4.43	56.00	46.00	30.7	41.5	N	
4	0.68245	10.90	-8.50	12.44	23.34	3.94	56.00	46.00	32.6	42.0	N	
5	0.85784	9.50	-8.90	12.45	21.95	3.55	56.00	46.00	34.0	42.4	N	
6	0.95531	8.10	-9.10	12.45	20.55	3.35	56.00	46.00	35.4	42.6	N	
7	1.40965	3.60	-9.80	12.47	16.07	2.67	56.00	46.00	39.9	43.3	N	
8	0.55561	13.70	-7.60	12.42	26.12	4.82	56.00	46.00	29.8	41.1	L1	
9	0.57708	13.40	-7.80	12.43	25.83	4.63	56.00	46.00	30.1	41.3	L1	
10	0.59853	13.00	-7.90	12.43	25.43	4.53	56.00	46.00	30.5	41.4	L1	
11	0.68241	10.90	-8.60	12.44	23.34	3.84	56.00	46.00	32.6	42.1	L1	
12	0.85779	9.40	-8.90	12.45	21.85	3.55	56.00	46.00	34.1	42.4	L1	
13	0.95531	8.50	-9.10	12.45	20.95	3.35	56.00	46.00	35.0	42.6	L1	
14	1.40979	3.80	-9.80	12.48	16.28	2.68	56.00	46.00	39.7	43.3	L1	

Calculation:Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN)=SLS-05

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

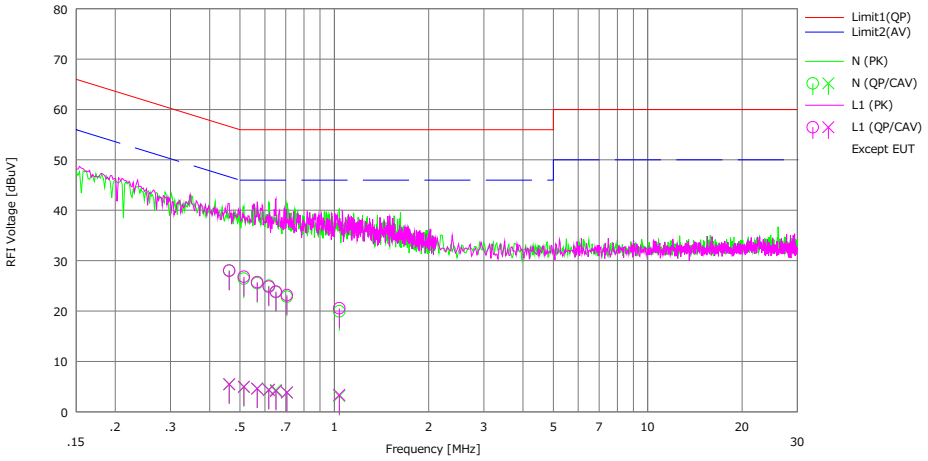
UL Japan,Inc. Shonan EMC Lab. No.5 Shielded Room
Date : 2020/03/31

Mode : Tx, BLE, 2480 MHz

Power : DC 5.0 V (AC 120 V / 60 Hz)
Temp./Humi. : 23 deg.C / 40 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yusuke Tanikawara



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	0.46203	15.60	-7.00	12.43	28.03	5.43	56.66	46.66	28.6	41.2	N	
2	0.51417	14.00	-7.50	12.42	26.42	4.92	56.00	46.00	29.5	41.0	N	
3	0.56721	13.10	-7.80	12.42	25.52	4.62	56.00	46.00	30.4	41.3	N	
4	0.61812	12.60	-8.00	12.43	25.03	4.43	56.00	46.00	30.9	41.5	N	
5	0.65101	11.30	-8.10	12.44	23.74	4.34	56.00	46.00	32.2	41.6	N	
6	0.70566	10.40	-8.60	12.44	22.84	3.84	56.00	46.00	33.1	42.1	N	
7	1.03728	7.50	-9.30	12.45	19.95	3.15	56.00	46.00	36.0	42.8	N	
8	0.46211	15.60	-6.90	12.41	28.01	5.51	56.65	46.65	28.6	41.1	L1	
9	0.51461	14.40	-7.40	12.41	26.81	5.01	56.00	46.00	29.1	40.9	L1	
10	0.56725	13.30	-7.80	12.42	25.72	4.62	56.00	46.00	30.2	41.3	L1	
11	0.61818	12.40	-8.10	12.43	24.83	4.33	56.00	46.00	31.1	41.6	L1	
12	0.65102	11.40	-8.30	12.44	23.84	4.14	56.00	46.00	32.1	41.8	L1	
13	0.70561	10.70	-8.60	12.44	23.14	3.84	56.00	46.00	32.8	42.1	L1	
14	1.03724	8.10	-9.10	12.45	20.55	3.35	56.00	46.00	35.4	42.6	L1	

Calculation:Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN)=SLS-05

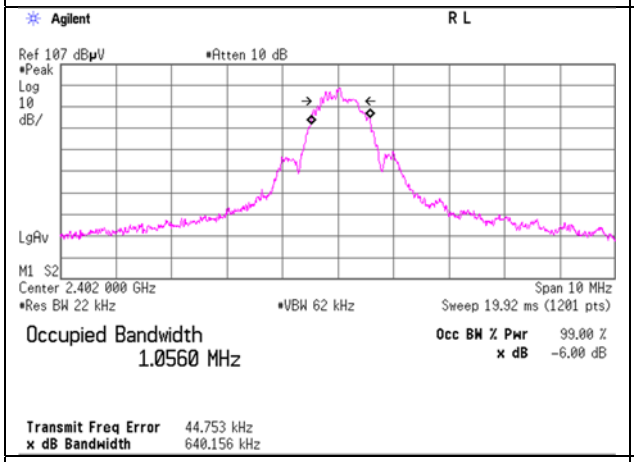
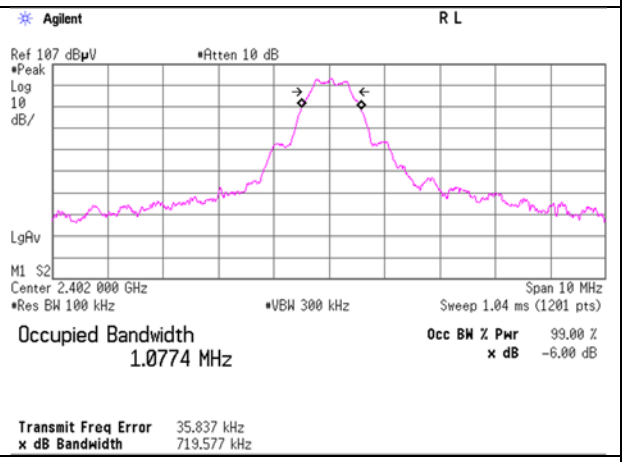
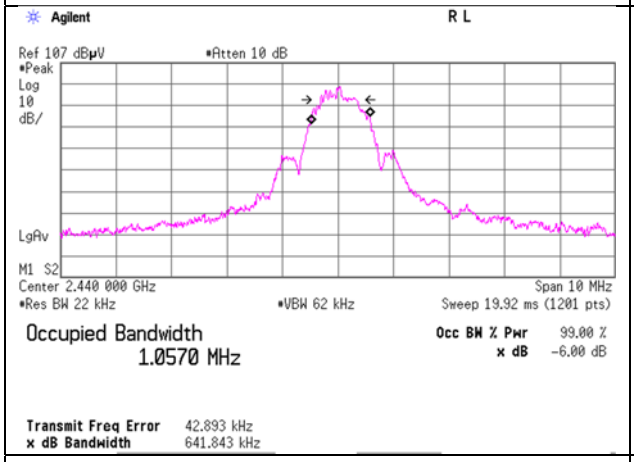
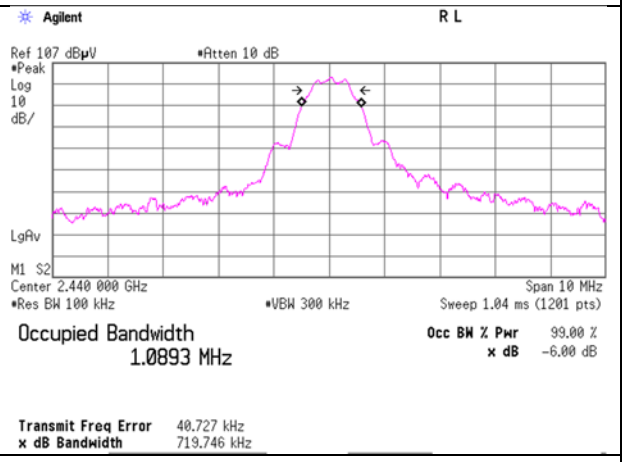
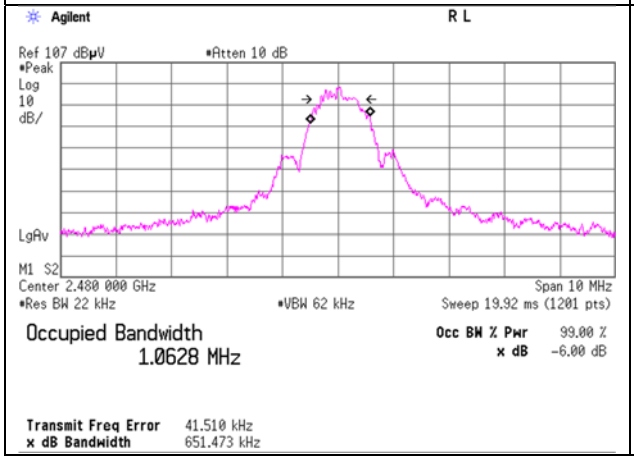
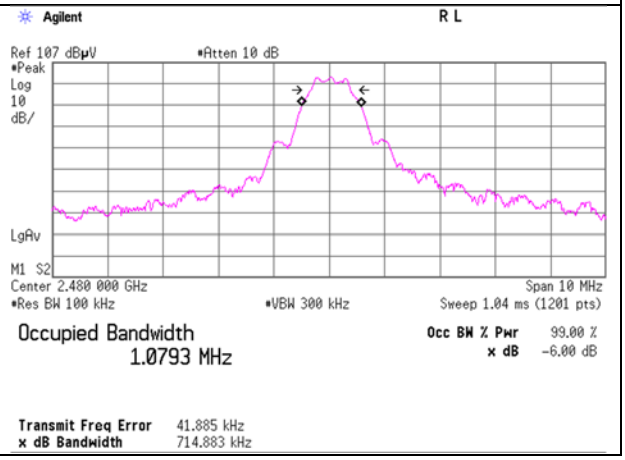
6 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	13270745S-A
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 24, 2020
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yusuke Tanikawara
Mode	Tx BT LE

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
BT LE	2402	1056.0	0.720	> 0.5000
	2440	1057.0	0.720	> 0.5000
	2480	1062.8	0.715	> 0.5000

6 dB Bandwidth and 99 % Occupied Bandwidth

BT LE

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

Maximum Peak Output Power

Report No.	13270745S-A
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 24, 2020
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yusuke Tanikawara
Mode	Tx BT LE

BT LE				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	-6.81	1.61	9.63	4.43	2.77	30.00	1000	25.57	2.50	6.93	4.93	36.02	4000	29.09
2440	-6.85	1.64	9.63	4.42	2.77	30.00	1000	25.58	2.50	6.92	4.92	36.02	4000	29.10
2480	-6.90	1.63	9.63	4.36	2.73	30.00	1000	25.64	2.50	6.86	4.85	36.02	4000	29.16

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.

Average Output Power
(Reference data for RF Exposure)

Report No.	13270745S-A
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 24, 2020
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yusuke Tanikawara
Mode	Tx BT LE

BT LE

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	-9.12	1.61	9.63	2.12	1.63	2.06	4.18	2.62
2440	-9.16	1.64	9.63	2.11	1.63	2.06	4.17	2.61
2480	-9.21	1.63	9.63	2.05	1.60	2.06	4.11	2.58

Sample Calculation:
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

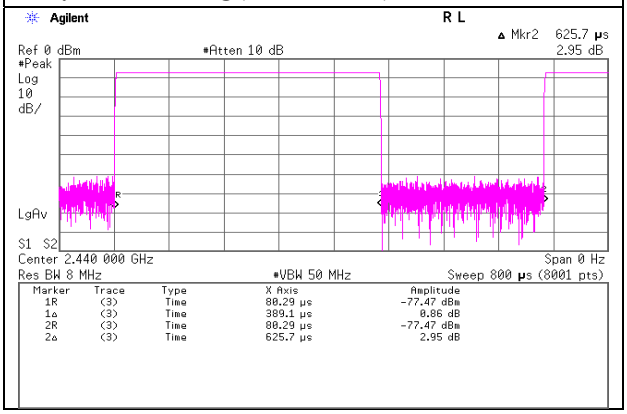
*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst rate confirmation

Report No.	13270745S-A
Test place	Shonan EMC Lab. No.1 Shielded Room
Date	March 12, 2020
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Takahiro Suzuki
Mode	Tx BT LE

BT LE

Tx on / (Tx on + Tx off) =	**0.622**
Tx on / (Tx on + Tx off) * 100 =	**62.2 %**
(for Average power)	
Duty factor = 10 * log (0.6257 / 0.3891) =	**2.06 dB**
(for Spurious emission)	
Duty factor = 20 * log (0.6257 / 0.3891) =	**4.13 dB**



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

Radiated Spurious Emission

Report No.	13270745S-A	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.1	
Date	March 11, 2020	March 12, 2020
Temperature / Humidity	23 deg. C / 44 % RH	22 deg. C / 48 % RH
Engineer	Yusuke Tanikawara	Takahiro Suzuki
	(30 MHz – 2.8 GHz)	(2.8 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.	31.870	QP	21.70	17.93	7.06	31.83	0.00	14.86	40.00	25.1	201	3	
Hori.	194.117	QP	21.30	16.67	9.19	31.78	0.00	15.38	43.50	28.1	196	351	
Hori.	624.007	QP	27.50	19.54	8.66	32.12	0.00	23.58	46.00	22.4	146	91	
Hori.	680.014	QP	30.40	19.60	8.94	32.16	0.00	26.78	46.00	19.2	126	101	
Hori.	688.010	QP	30.00	19.67	8.99	32.16	0.00	26.50	46.00	19.5	122	101	
Hori.	902.851	QP	21.10	22.10	9.86	31.47	0.00	21.59	46.00	24.4	100	349	
Hori.	2390.000	PK	45.16	28.31	14.37	39.59	2.42	50.67	73.90	23.2	219	252	
Hori.	4804.000	PK	48.91	31.60	7.01	39.75	2.42	50.19	73.90	23.7	100	218	
Hori.	7206.000	PK	48.64	37.15	8.70	39.53	2.42	57.38	73.90	16.5	100	291	
Hori.	9608.000	PK	47.34	38.53	10.19	39.67	2.42	58.81	73.90	**15.0**	150	0	
Vert.	30.413	QP	21.60	18.50	7.03	31.83	0.00	15.30	40.00	24.7	100	8	
Vert.	191.960	QP	21.70	16.44	9.18	31.78	0.00	15.54	43.50	27.9	100	2	
Vert.	898.715	QP	21.00	22.10	9.85	31.49	0.00	21.46	46.00	24.5	100	356	
Vert.	943.192	QP	20.80	21.94	10.01	31.17	0.00	21.58	46.00	24.4	100	5	
Vert.	2390.000	PK	45.45	28.31	14.37	39.59	2.42	50.96	73.90	22.9	132	206	
Vert.	4804.000	PK	49.08	31.60	7.01	39.75	2.42	50.36	73.90	23.5	100	162	
Vert.	7206.000	PK	47.49	37.15	8.70	39.53	2.42	56.23	73.90	17.6	100	138	
Vert.	9608.000	PK	46.60	38.53	10.19	39.67	2.42	58.07	73.90	15.8	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	36.08	28.31	14.37	39.59	4.13	2.42	45.69	53.9	8.2	*1)
Hori.	4804.000	AV	37.68	31.60	7.01	39.75	4.13	2.42	43.06	53.9	10.8	
Hori.	7206.000	AV	36.32	37.15	8.70	39.53	4.13	2.42	49.16	53.9	4.7	
Hori.	9608.000	AV	35.02	38.53	10.19	39.67	4.13	2.42	50.59	53.9	**3.3**	
Vert.	2390.000	AV	36.16	28.31	14.37	39.59	4.13	2.42	45.77	53.9	8.1	*1)
Vert.	4804.000	AV	37.59	31.60	7.01	39.75	4.13	2.42	42.97	53.9	10.9	
Vert.	7206.000	AV	35.76	37.15	8.70	39.53	4.13	2.42	48.60	53.9	5.3	
Vert.	9608.000	AV	34.89	38.53	10.19	39.67	4.13	2.42	50.46	53.9	3.4	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty factor refer to "Duty factor Calculation chart" sheet.
*1) Not out of band emission (Leakage Power)

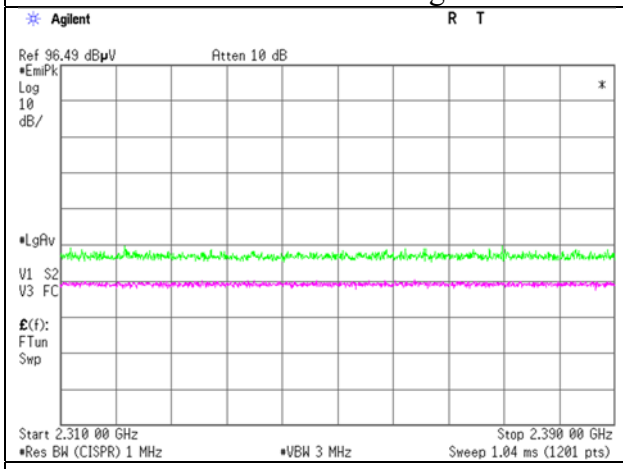
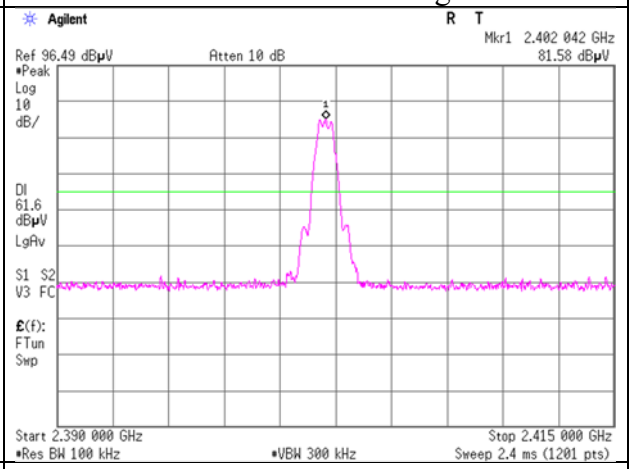
20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

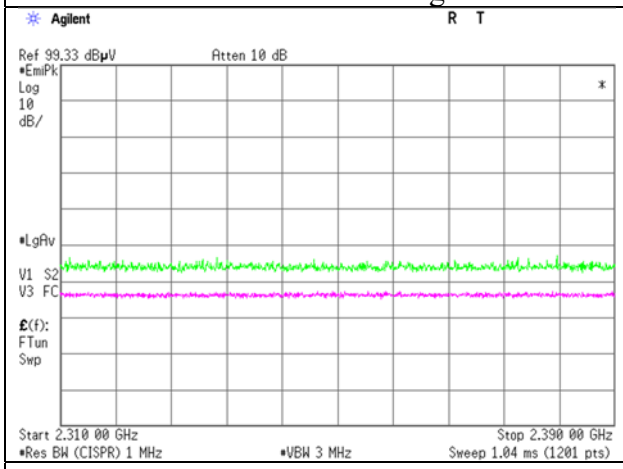
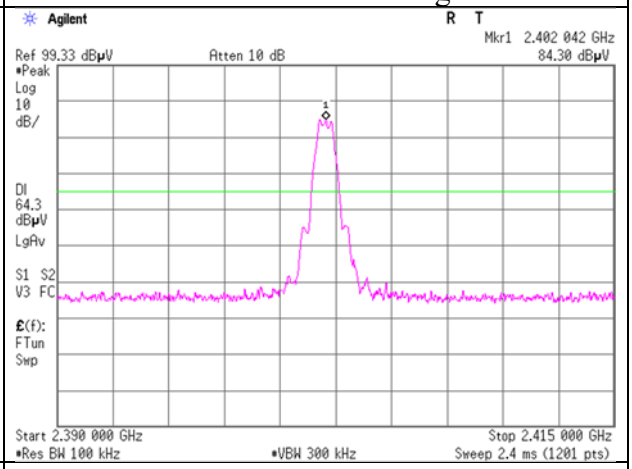
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	82.39	28.28	14.38	39.59	2.42	87.88	-	-	Carrier
Hori.	2400.000	PK	36.36	28.29	14.38	39.59	2.42	41.86	67.88	26.0	
Vert.	2402.000	PK	84.09	28.28	14.38	39.59	2.42	89.58	-	-	Carrier
Vert.	2400.000	PK	37.18	28.29	14.38	39.59	2.42	42.68	69.58	26.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13270745S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	March 11, 2020
Temperature / Humidity	23 deg. C / 44 % RH
Engineer	Yusuke Tanikawara
Mode	Tx BT LE 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

Report No.	13270745S-A	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.1	
Date	March 11, 2020	March 12, 2020
Temperature / Humidity	23 deg. C / 44 % RH	22 deg. C / 48 % RH
Engineer	Yusuke Tanikawara	Takahiro Suzuki
	(30 MHz – 2.8 GHz)	(2.8 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.	32.365	QP	21.90	17.71	7.08	31.83	0.00	14.86	40.00	25.1	202	2	
Hori.	193.111	QP	21.30	16.52	9.19	31.78	0.00	15.23	43.50	28.2	297	8	
Hori.	680.012	QP	30.00	19.60	8.94	32.16	0.00	26.38	46.00	19.6	126	100	
Hori.	688.013	QP	29.50	19.67	8.99	32.16	0.00	26.00	46.00	20.0	123	108	
Hori.	739.353	QP	21.50	20.13	9.16	32.07	0.00	18.72	46.00	27.2	100	358	
Hori.	755.118	QP	21.60	20.21	9.22	32.05	0.00	18.98	46.00	27.0	100	3	
Hori.	4880.000	PK	46.99	31.66	7.06	39.74	2.42	48.39	73.90	25.5	124	333	
Hori.	7320.000	PK	49.32	37.24	8.78	39.60	2.42	58.16	73.90	15.7	121	18	
Hori.	9760.000	PK	47.43	39.12	10.23	39.48	2.42	59.72	73.90	**14.1**	150	0	
Vert.	33.516	QP	21.80	17.27	7.11	31.83	0.00	14.35	40.00	25.6	100	348	
Vert.	188.449	QP	21.60	16.40	9.16	31.78	0.00	15.38	43.50	28.1	100	4	
Vert.	803.515	QP	21.20	20.89	9.46	32.01	0.00	19.54	46.00	26.4	100	7	
Vert.	888.505	QP	21.00	22.13	9.81	31.54	0.00	21.40	46.00	24.6	100	11	
Vert.	4880.000	PK	48.63	31.66	7.06	39.74	2.42	50.03	73.90	23.8	167	168	
Vert.	7320.000	PK	48.35	37.24	8.78	39.60	2.42	57.19	73.90	16.7	136	94	
Vert.	9760.000	PK	46.54	39.12	10.23	39.48	2.42	58.83	73.90	15.0	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4880.000	AV	36.73	31.66	7.06	39.74	4.13	2.42	42.23	53.9	11.7	
Hori.	7320.000	AV	38.72	37.24	8.78	39.60	4.13	2.42	51.66	53.9	**2.2**	
Hori.	9760.000	AV	35.08	39.12	10.23	39.48	4.13	2.42	51.47	53.9	2.4	
Vert.	4880.000	AV	37.21	31.66	7.06	39.74	4.13	2.42	42.71	53.9	11.2	
Vert.	7320.000	AV	36.86	37.24	8.78	39.60	4.13	2.42	49.80	53.9	4.1	
Vert.	9760.000	AV	34.77	39.12	10.23	39.48	4.13	2.42	51.16	53.9	2.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty factor refer to "Duty factor Calculation chart" sheet.

Radiated Spurious Emission

Report No.	13270745S-A	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.1	
Date	March 11, 2020	March 12, 2020
Temperature / Humidity	23 deg. C / 44 % RH	22 deg. C / 48 % RH
Engineer	Yusuke Tanikawara	Takahiro Suzuki
	(30 MHz – 2.8 GHz)	(2.8 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.	30.583	QP	21.50	18.44	7.03	31.83	0.00	15.14	40.00	24.8	151	357	
Hori.	195.748	QP	21.50	16.56	9.21	31.78	0.00	15.49	43.50	28.0	149	3	
Hori.	672.011	QP	29.40	19.53	8.90	32.16	0.00	25.67	46.00	20.3	131	101	
Hori.	680.013	QP	29.80	19.60	8.94	32.16	0.00	26.18	46.00	19.8	127	100	
Hori.	840.022	QP	24.40	21.26	9.62	31.79	0.00	23.49	46.00	22.5	100	284	
Hori.	922.499	QP	20.70	22.03	9.94	31.32	0.00	21.35	46.00	24.6	100	2	
Hori.	2483.500	PK	45.43	28.16	14.47	39.62	2.42	50.86	73.90	23.0	152	128	
Hori.	4960.000	PK	48.23	31.83	7.12	39.72	2.42	49.88	73.90	24.0	138	162	
Hori.	7440.000	PK	49.87	37.38	8.86	39.68	2.42	58.85	73.90	15.0	138	249	
Hori.	9920.000	PK	47.19	39.17	10.27	39.28	2.42	59.77	73.90	**14.1**	150	0	
Vert.	30.412	QP	21.40	18.50	7.03	31.83	0.00	15.10	40.00	24.9	100	356	
Vert.	184.919	QP	21.60	16.31	9.14	31.78	0.00	15.27	43.50	28.2	100	5	
Vert.	696.011	QP	24.20	19.76	9.03	32.16	0.00	20.83	46.00	25.1	127	144	
Vert.	941.690	QP	21.00	21.93	10.01	31.18	0.00	21.76	46.00	24.2	100	4	
Vert.	2483.500	PK	45.27	28.16	14.47	39.62	2.42	50.70	73.90	23.2	137	195	
Vert.	4960.000	PK	49.19	31.83	7.12	39.72	2.42	50.84	73.90	23.0	145	180	
Vert.	7440.000	PK	49.93	37.38	8.86	39.68	2.42	58.91	73.90	14.9	143	359	
Vert.	9920.000	PK	46.37	39.17	10.27	39.28	2.42	58.95	73.90	14.9	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	36.10	28.16	14.47	39.62	4.13	2.42	45.63	53.9	8.3	*1)
Hori.	4960.000	AV	36.03	31.83	7.12	39.72	4.13	2.42	41.78	53.9	12.1	
Hori.	7440.000	AV	37.92	37.38	8.86	39.68	4.13	2.42	51.00	53.9	2.9	
Hori.	9920.000	AV	34.96	39.17	10.27	39.28	4.13	2.42	51.64	53.9	**2.3**	
Vert.	2483.500	AV	36.21	28.16	14.47	39.62	4.13	2.42	45.74	53.9	8.2	*1)
Vert.	4960.000	AV	37.35	31.83	7.12	39.72	4.13	2.42	43.10	53.9	10.8	
Vert.	7440.000	AV	37.61	37.38	8.86	39.68	4.13	2.42	50.69	53.9	3.2	
Vert.	9920.000	AV	34.52	39.17	10.27	39.28	4.13	2.42	51.20	53.9	2.7	

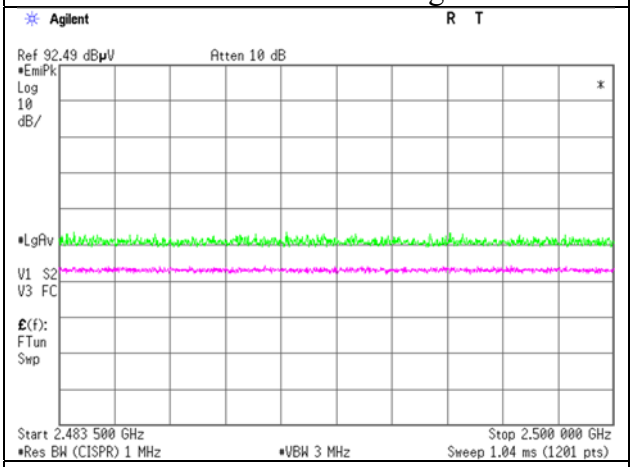
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty factor refer to "Duty factor Calculation chart" sheet.
*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13270745S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	March 11, 2020
Temperature / Humidity	23 deg. C / 44 % RH
Engineer	Yusuke Tanikawara
Mode	Tx BT LE 2480 MHz

Horizontal

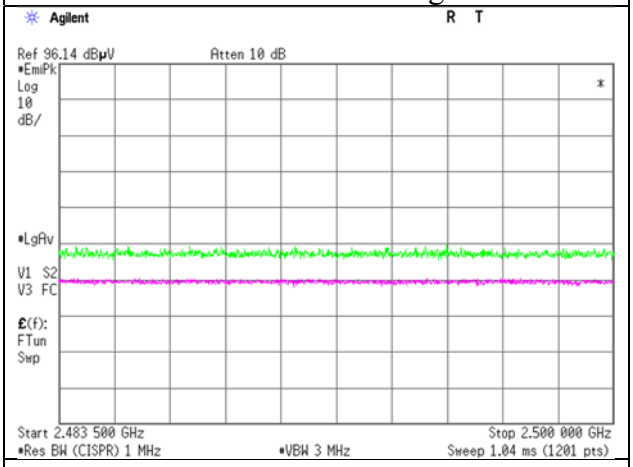
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

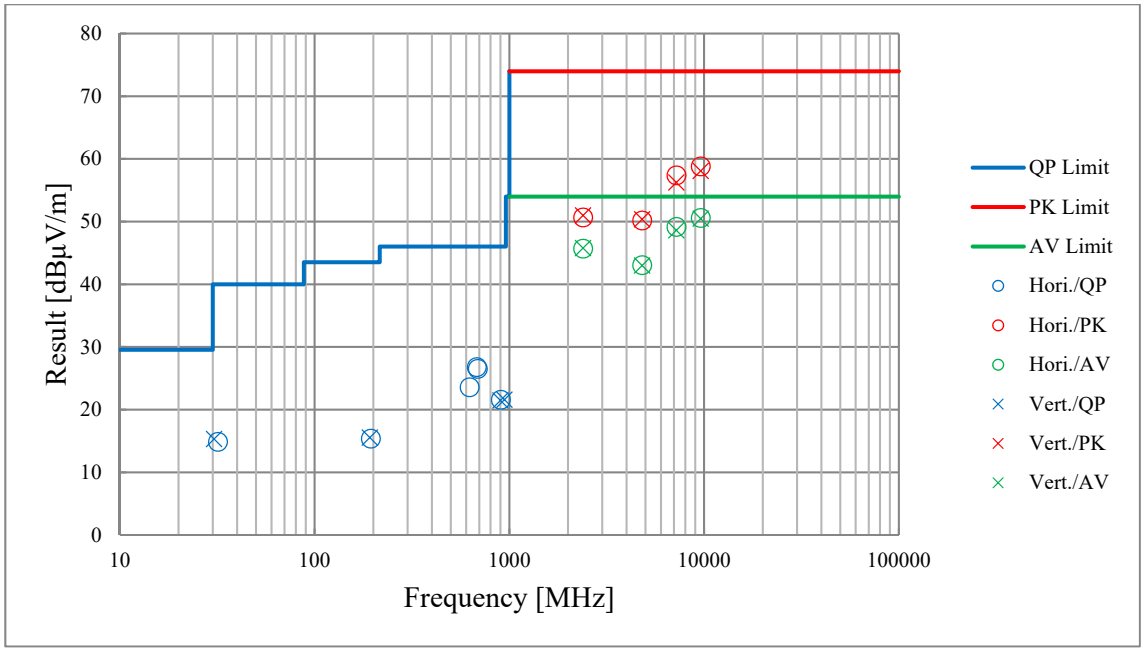


Trace Green : Peak Plot
Trace Purple : Average Plot

* 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)

Report No.	13270745S-A	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.1	
Date	March 11, 2020	March 12, 2020
Temperature / Humidity	23 deg. C / 44 % RH	22 deg. C / 48 % RH
Engineer	Yusuke Tanikawara (30 MHz – 2.8 GHz)	Takahiro Suzuki (2.8 GHz – 26.5 GHz)
Mode	Tx BT LE 2402 MHz	

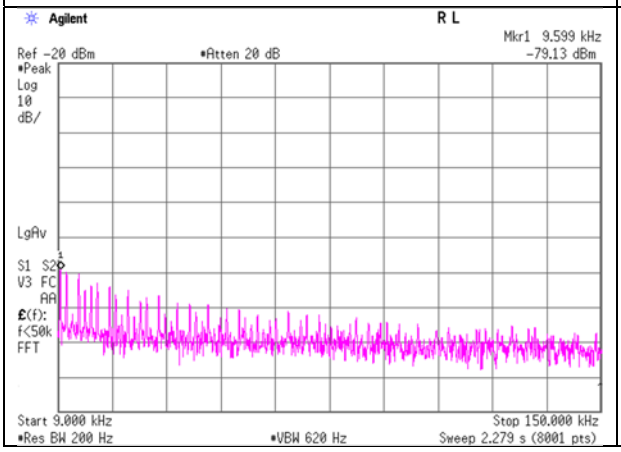


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

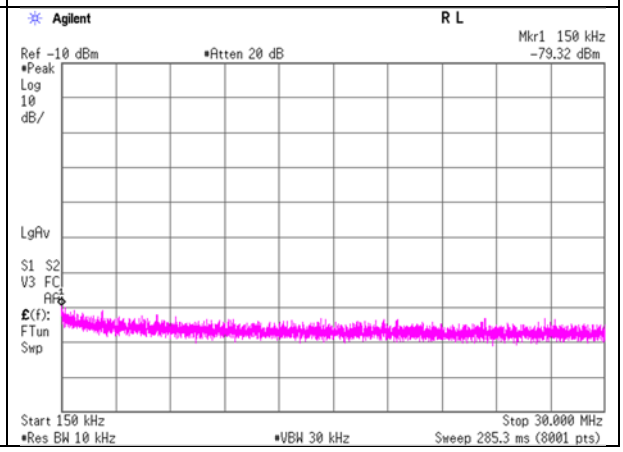
Conducted Spurious Emission

Report No.	13270745S-A
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 24, 2020
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yusuke Tanikawara
Mode	Tx BT LE 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
9.60	-79.1	0.01	9.5	2.5	1	-67.1	300	6.0	-5.8	47.9	53.7	-
150.00	-79.3	0.01	9.5	2.5	1	-67.3	300	6.0	-6.0	24.0	30.0	-

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

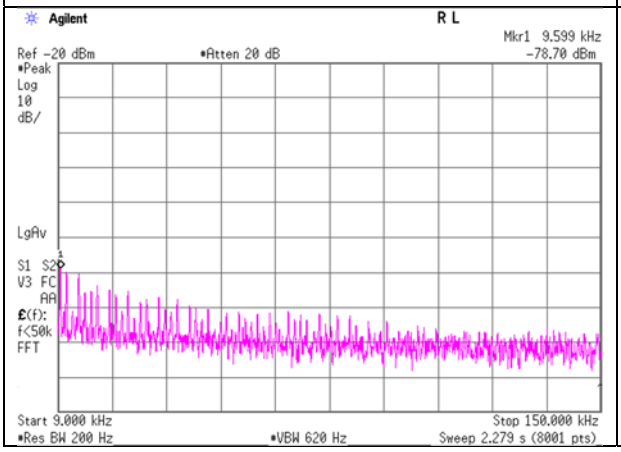
EIRP[dBm] = Reading [dBm] + Cable loss [dB] + Attenuator Loss [dB] + Antenna gain [dBi] + 10 * log (N)

N: Number of output

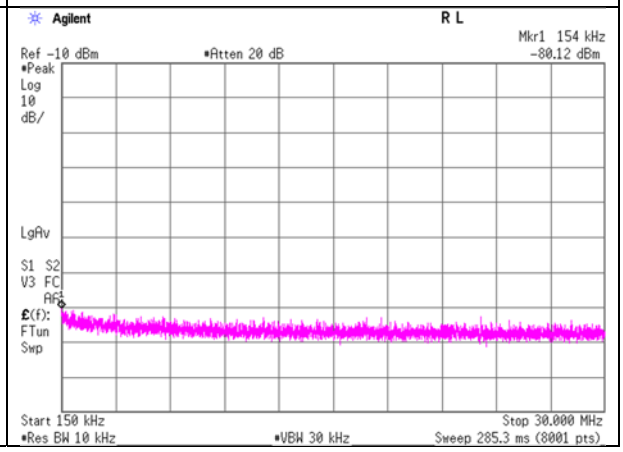
Conducted Spurious Emission

Report No.	13270745S-A
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 24, 2020
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yusuke Tanikawara
Mode	Tx BT LE 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
9.60	-78.7	0.01	9.5	2.5	1	-66.7	300	6.0	-5.4	47.9	53.3	-
154.00	-80.1	0.01	9.5	2.5	1	-68.1	300	6.0	-6.8	23.8	30.6	-

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

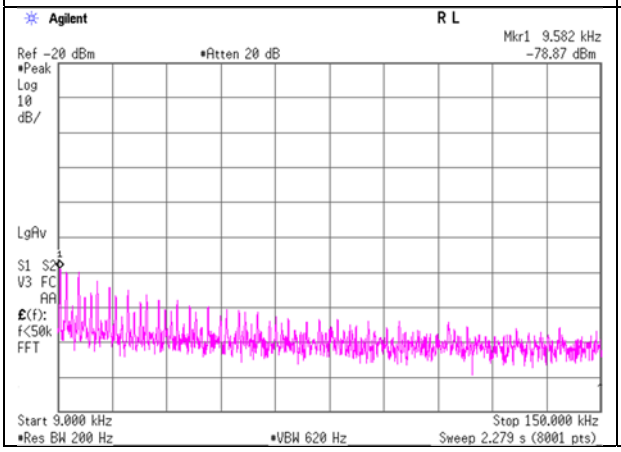
EIRP[dBm] = Reading [dBm] + Cable loss [dB] + Attenuator Loss [dB] + Antenna gain [dBi] + 10 * log (N)

N: Number of output

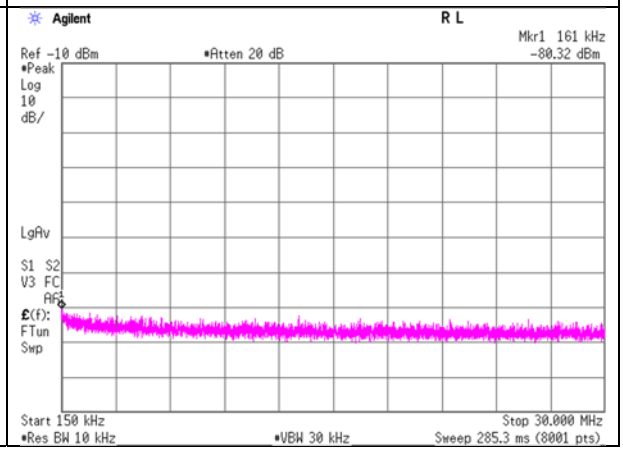
Conducted Spurious Emission

Report No.	13270745S-A
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 24, 2020
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yusuke Tanikawara
Mode	Tx BT LE 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
9.58	-78.9	0.01	9.5	2.5	1	-66.8	300	6.0	-5.6	47.9	53.5	-
161.00	-80.3	0.01	9.5	2.5	1	-68.3	300	6.0	-7.0	23.4	30.4	-

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

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

N: Number of output

Power Density

Report No.	13270745S-A
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	March 24, 2020
Temperature / Humidity	21 deg. C / 35 % RH
Engineer	Yusuke Tanikawara
Mode	Tx BT LE

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402	-21.35	1.61	9.63	-10.11	8.00	18.11
2440	-21.51	1.64	9.63	-10.24	8.00	18.24
2480	-21.61	1.63	9.63	-10.35	8.00	18.35

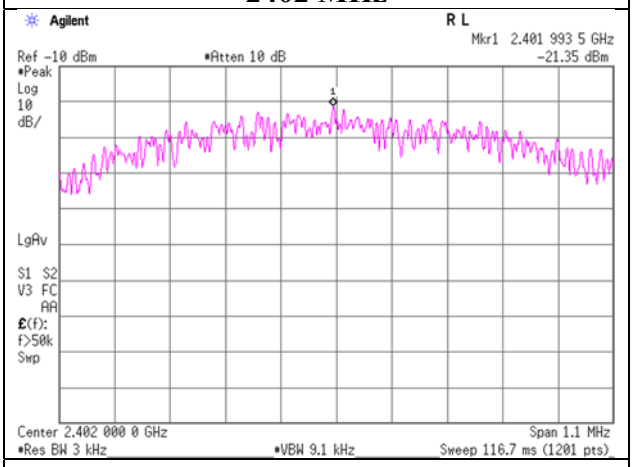
Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

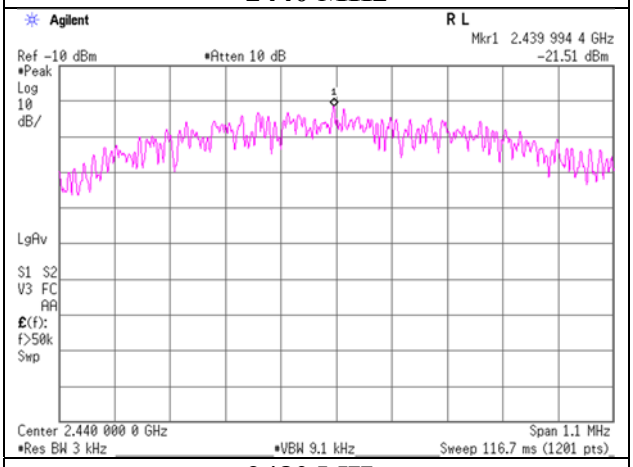
Power Density

BT LE

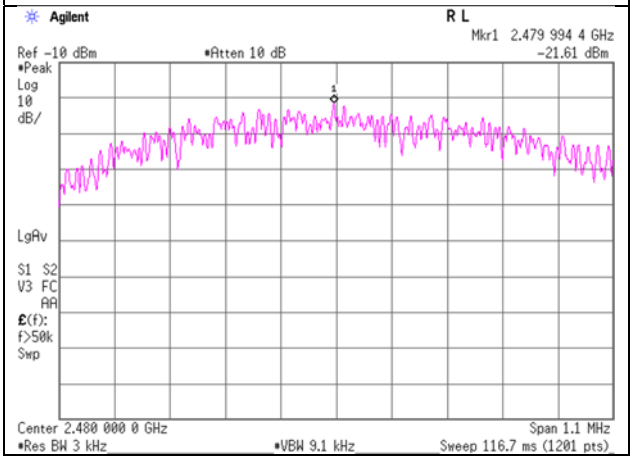
2402 MHz



2440 MHz



2480 MHz



APPENDIX 2: Test instruments

Test equipment (1/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	SAT10-09	145132	Attenuator	Weinschel Corp.	54A-10	W5692	2019/11/05	12
AT	SCC-G12	145040	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	2020/03/02	12
AT	SPM-07	146247	Power Meter	Keysight Technologies Inc	8990B	MY5100272	2019/07/16	12
AT	SPSS-04	146310	Power sensor	Keysight Technologies Inc	N1923A	MY5326009	2019/07/16	12
AT	SSA-02	145800	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250106	2019/04/04	12
AT,CE	SOS-27	191845	Humidity Indicator	Not Indicated or Known	CTH-201	-	2019/12/12	12
AT,CE	STS-05	146212	Digital Hitester	Hioki	3805-50	80997828	2019/10/01	12
CE	SAT3-10	144960	Attenuator	JFW	50HF-003N	-	2019/08/06	12
CE	SCC-C9	145035	Coaxial Cable	Suhner	RG223U	-	2019/04/19	12
CE	SJM-17	145339	Measure	ASKUL	-	-	-	-
CE	SLS-05	145542	LISN	Rohde & Schwarz	ENV216	100516	2020/02/18	12
CE	STR-02	145791	Test Receiver	Rohde & Schwarz	ESCI	100575	2019/09/25	12
CE,RE	COTS-SEMI-5	170932	EMI Software	TSJ	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
RE	KAT6-04	144899	Attenuator	Inmet	18N-6dB	-	2019/12/05	12
RE	KJM-09	145929	Measure	KOMELON	KMC-36	-	-	-
RE	KSA-08	145089	Spectrum Analyzer	Keysight Technologies Inc	E4446A	MY46180525	2019/11/05	12
RE	SAEC-01(NSA)	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2020/04/08	12
RE	SAEC-01(SVSWR)	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	2019/05/07	12
RE	SAF-01	145003	Pre Amplifier	SONOMA	310N	290211	2020/02/19	12
RE	SAF-04	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2019/06/04	12
RE	SAF-08	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2020/03/03	12
RE	SAT10-05	145136	Attenuator(above1GHz)	Keysight Technologies Inc	8493C-010	74864	2019/11/06	12
RE	SAT3-09	144959	Attenuator	JFW	50HF-003N	-	2019/08/06	12
RE	SBA-01	145161	Biconical Antenna	Schwarzbeck Mess - Elektronik	BBA9106	91032664	2019/04/01	12
RE	SCC-A1/A3/A5/A7/A8/A13/SRSE-01	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2019/04/19	12
RE	SCC-A2/A4/A6/A7/A8/A13/SRSE-01	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2019/04/19	12
RE	SCC-G05	145039	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	2020/01/31	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2020/03/04	12
RE	SCC-G41	151617	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S006	2020/01/08	12
RE	SCC-G56	179539	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	803289/4	2019/05/16	12
RE	SCC-G57	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2019/05/16	12

Test equipment (2/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	SFL-02	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2019/11/06	12
RE	SHA-01	145383	Horn Antenna	Schwarzbeck Mess Elektronik	BBHA9120D	9120D-725	2019/05/09	12
RE	SHA-04	145512	Horn Antenna	ETS LINDGREN	3160-09	00094868	2019/06/26	12
RE	SLA-05	145527	Logperiodic Antenna	Schwarzbeck Mess Elektronik	VUSLP9111B	193	2019/04/01	12
RE	SOS-20	191837	Humidity Indicator	CUSTOM	CTH-201	-	2019/12/12	12
RE	STR-01	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2019/04/14	12
RE	STS-01	145792	Digital Hitester	Hioki	3805-50	80997812	2019/10/01	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