RADIO TEST REPORT

Test Report No. : 12945978S-A-R2

Applicant	:	**CASIO COMPUTER CO., LTD.**
Type of Equipment	:	**RF Module**
Model No.	:	**M1**
FCC ID	:	**BBQM1**
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.
10. This report is a revised version of 12945978S-A-R1. 12945978S-A-R1 is replaced with this report.

Date of test: August 29 to September 11, 2019

Representative test engineer:
K. Noda
Kazuya Noda
Engineer
Consumer Technology Division

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".

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

REVISION HISTORY

Original Test Report No.: 12945978S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12945978S-A	September 26, 2019	-	-
1	12945978S-A-R1	November 14, 2019	9	Addition of Item D (Jig board) in 4.2
2	12945978S-A-R2	November 19, 2019	9	Addition of comment to *1) in 4.2: "Pattern and Matching Circuit of Jig board are designed in perfectly accordance with "Instruction Manual for M1"." Correction of "Shield" of Cable No. 4 (AC) in 4.2: "Shielded" to "Unshielded"

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
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
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
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
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 Equipment, Model No., 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 (E.U.T.)
- SECTION 4: Operation of E.U.T. 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 (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	RF Module
Model No.	:	M1
Serial No.	:	Refer to SECTION 4.2
Rating	:	Typical: DC 3.0 V, Min.: DC 1.9 V, Max.: DC 3.3 V
Receipt Date of Sample (Information from test lab.)	:	August 28, 2019
Country of Mass-production	:	China, Thailand, Japan
Condition of EUT	:	Engineering 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: M1 (referred to as the EUT in this report) is an RF Module.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Channel spacing	:	2 MHz
Antenna type	:	Chip (Monopole)
Antenna Gain	:	2.5 dBi
Operating Temperature	:	-10 deg.C to +60 deg.C
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

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	21.8 dB, 0.41983 MHz & 0.49272 MHz, N, QP Mode: Tx 2480 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)	5.4 dB 7440.00 MHz, AV, Horizontal Mode: Tx 2480 MHz	Complied e), f)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
	ISED: RSS-Gen 6.13	**ISED:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

Note: UL Japan, Inc.'s EMI Work Procedures 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 RF Module has its own regulator. The RF Module is constantly provided voltage through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement
It is impossible for end users to replace the antenna, because it is soldered on the circuit board. Therefore the equipment complies with the requirement.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	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	No. 4 SAC / SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.9 dB	2.8 dB	2.9 dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	3.0 dB	3.1 dB	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.7 dB	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.1 dB	-
	1 GHz-6 GHz	4.8 dB	4.8 dB	4.8 dB	-
	6 GHz-18 GHz	5.4 dB	5.4 dB	5.4 dB	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-

SAC=Semi-Anechoic Chamber
SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.81 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.53 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.95 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.21 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.90 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.04 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.3 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.4 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.4 dB
Bandwidth Measurement	0.61 %
Duty cycle and Time Measurement	0.012 %

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

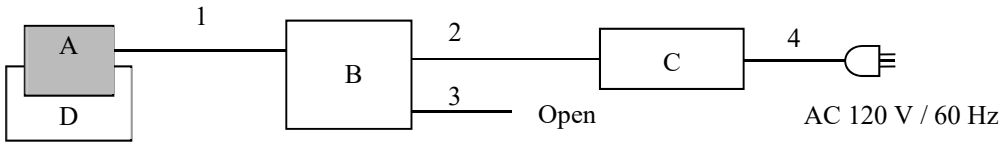
Refer to APPENDIX.

SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

Mode	Remarks*
Tx (Transmitting), Bluetooth Low Energy	Maximum Packet Size, PRBS9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: Fixed Software: BLE RF Test Version 9.9 *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.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	RF Module	M1	16	Casio	EUT
B	Watch	ECB-10	16	Casio	-
C	Power Supply(DC)	PAN35-10A	NA000955	KIKUSUI	-
D	Jig board	-	-	Casio	*1)

*1) Jig board to connect between RF module and Antenna. Pattern and Matching Circuit of Jig board are designed in perfectly accordance with “Instruction Manual for M1”.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.11	Unshielded	Unshielded	-
2	DC	0.1 + 2.1	Unshielded	Unshielded	*2)
3	Signal Cable	0.1	Unshielded	Unshielded	*3)
4	AC	2.0	Unshielded	Unshielded	-

*2) Cable for test operation
*3) Cable for system reset during the development, for the product

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.
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.

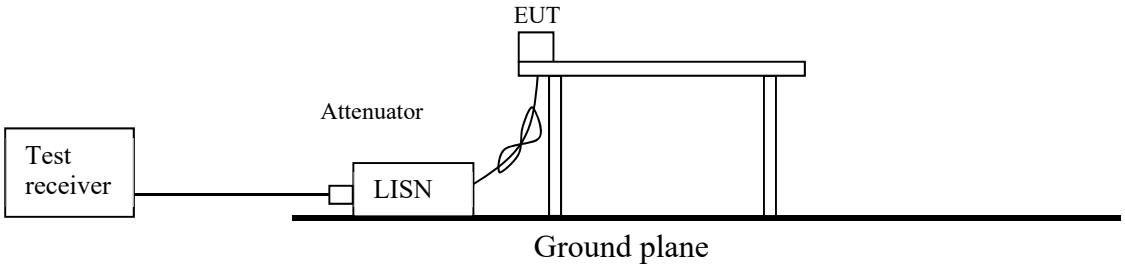
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

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) via DC power supply.
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, 0.5 m by 0.5 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.

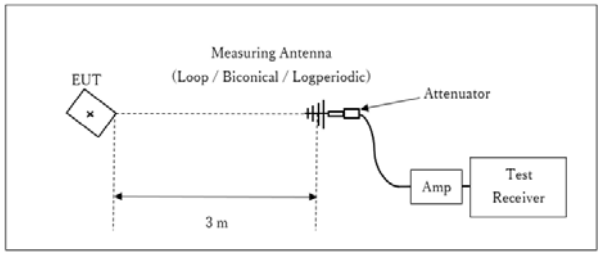
Test Antennas are used as below;

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

Frequency	Below 1 GHz	Above 1 GHz	
Instrument used	Test Receiver	Spectrum Analyzer	
Detector	QP	PK	AV
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 3 MHz

Figure 2: Test Setup

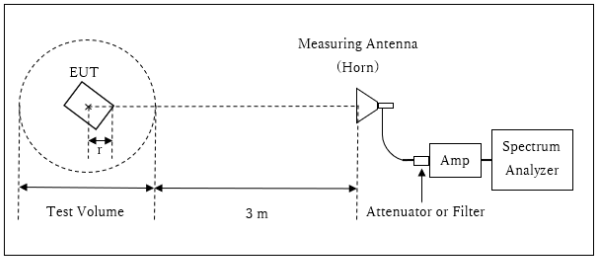
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz

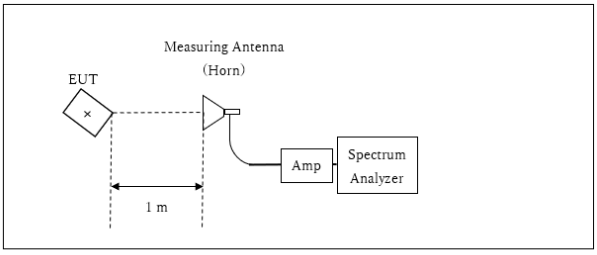


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.995 m / 3.0 m) = 2.49 dB
* Test Distance: (3 + Test Volume /2) - r = 3.995 m

Test Volume : 2.0 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.005 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 (Below 1 GHz)	Spurious (1 GHz - 2.8 GHz)	Spurious (2.8 GHz - 13 GHz)	Spurious (13 GHz - 18 GHz)	Spurious (18 GHz - 26.5 GHz)
Horizontal	Y	X	Y	Y	X	X
Vertical	Z	X	Z	Z	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

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: 160 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 *4)	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".
*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 low enough as shown in the chart.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz).

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

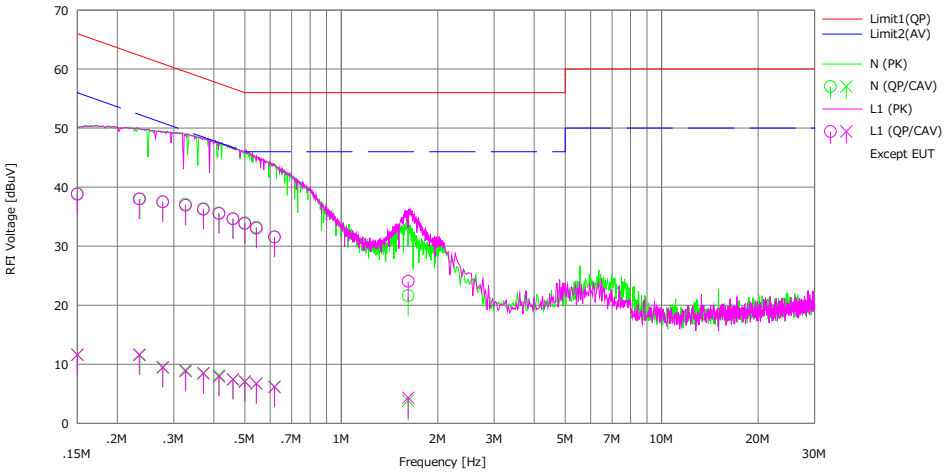
UL Japan,Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2019/09/10

Company : CASIO COMPUTER CO., LTD
Kind of EUT : RF Module
Model No. : M1
Serial No. : 16
Remarks : -

Mode : Tx, BLE, 2402 MHz
Order No. : 12945978S
Power : AC 120 V / 60 Hz (DC 3 V)
Temp./Humi. : 22 deg.C / 58 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Kazuya Noda



No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		〈QP〉	〈CAV〉		〈QP〉	〈CAV〉	〈QP〉	〈AV〉	〈QP〉	〈AV〉		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	26.40	-0.90	12.50	38.90	11.60	66.00	56.00	27.1	44.4	N	
2	0.23512	25.50	-0.90	12.50	38.00	11.60	62.27	52.27	24.2	40.6	N	
3	0.27698	25.00	-3.10	12.50	37.50	9.40	60.91	50.91	23.4	41.5	N	
4	0.32592	24.60	-3.50	12.52	37.12	9.02	59.55	49.55	22.4	40.5	N	
5	0.37130	23.80	-4.00	12.53	36.33	8.53	58.47	48.47	22.1	39.9	N	
6	0.41506	23.10	-4.40	12.52	35.62	8.12	57.55	47.55	21.9	39.4	N	
7	0.45929	22.10	-5.10	12.53	34.63	7.43	56.71	46.71	22.0	39.2	N	
8	0.49998	21.40	-5.40	12.53	33.93	7.13	56.00	46.00	22.0	38.8	N	
9	0.54295	20.70	-5.80	12.53	33.23	6.73	56.00	46.00	22.7	39.2	N	
10	0.61902	19.00	-6.30	12.54	31.54	6.24	56.00	46.00	24.4	39.7	N	
11	1.61772	9.00	-8.80	12.63	21.63	3.83	56.00	46.00	34.3	42.1	N	
12	0.15000	26.30	-0.90	12.50	38.80	11.60	66.00	56.00	27.2	44.4	L1	
13	0.23420	25.50	-0.90	12.50	38.00	11.60	62.30	52.30	24.3	40.7	L1	
14	0.27732	25.00	-3.00	12.50	37.50	9.50	60.90	50.90	23.4	41.4	L1	
15	0.32678	24.40	-3.70	12.52	36.92	8.82	59.53	49.53	22.6	40.7	L1	
16	0.37123	23.70	-4.10	12.53	36.23	8.43	58.47	48.47	22.2	40.0	L1	
17	0.41528	23.00	-4.60	12.52	35.52	7.92	57.54	47.54	22.0	39.6	L1	
18	0.45919	22.10	-5.10	12.53	34.63	7.43	56.71	46.71	22.0	39.2	L1	
19	0.49973	21.30	-5.50	12.53	33.83	7.03	56.00	46.00	22.1	38.9	L1	
20	0.54342	20.50	-5.80	12.53	33.03	6.73	56.00	46.00	22.9	39.2	L1	
21	0.61892	19.00	-6.40	12.54	31.54	6.14	56.00	46.00	24.4	39.8	L1	
22	1.61838	11.40	-8.30	12.63	24.03	4.33	56.00	46.00	31.9	41.6	L1	

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

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

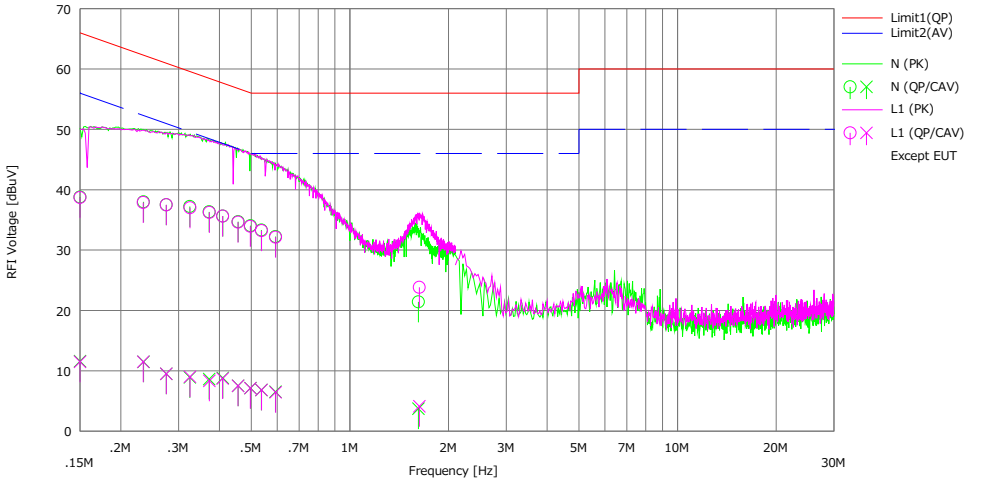
UL Japan,Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2019/09/11

Company : CASIO COMPUTER CO., LTD
Kind of EUT : RF Module
Model No. : M1
Serial No. : 16
Remarks : -

Mode : Tx, BLE, 2440 MHz
Order No. : 12945978S
Power : AC 120 V / 60 Hz (DC 3 V)
Temp./Humi. : 22 deg.C / 58 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Kazuya Noda



No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		〈QP〉	〈CAV〉		〈QP〉	〈CAV〉	〈QP〉	〈AV〉	〈QP〉	〈AV〉		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	26.30	-0.90	12.50	38.80	11.60	66.00	56.00	27.2	44.4	N	
2	0.23449	25.50	-1.00	12.50	38.00	11.50	62.29	52.29	24.2	40.7	N	
3	0.27502	25.00	-3.00	12.50	37.50	9.50	60.96	50.96	23.4	41.4	N	
4	0.32451	24.70	-3.60	12.51	37.21	8.91	59.59	49.59	22.3	40.6	N	
5	0.37198	23.80	-3.90	12.53	36.33	8.63	58.46	48.46	22.1	39.8	N	
6	0.40931	23.10	-3.70	12.52	35.62	8.82	57.66	47.66	22.0	38.8	N	
7	0.45610	22.20	-5.00	12.52	34.72	7.52	56.76	46.76	22.0	39.2	N	
8	0.49749	21.50	-5.40	12.53	34.03	7.13	56.04	46.04	22.0	38.9	N	
9	0.53688	20.80	-5.70	12.53	33.33	6.83	56.00	46.00	22.6	39.1	N	
10	0.59314	19.70	-6.00	12.54	32.24	6.54	56.00	46.00	23.7	39.4	N	
11	1.61790	8.80	-8.90	12.63	21.43	3.73	56.00	46.00	34.5	42.2	N	
12	0.15000	26.20	-1.00	12.50	38.70	11.50	66.00	56.00	27.3	44.5	L1	
13	0.23397	25.40	-1.00	12.50	37.90	11.50	62.31	52.31	24.4	40.8	L1	
14	0.27532	25.00	-3.00	12.50	37.50	9.50	60.96	50.96	23.4	41.4	L1	
15	0.32512	24.50	-3.50	12.52	37.02	9.02	59.57	49.57	22.5	40.5	L1	
16	0.37246	23.70	-4.20	12.53	36.23	8.33	58.45	48.45	22.2	40.1	L1	
17	0.40882	23.10	-3.80	12.52	35.62	8.72	57.67	47.67	22.0	38.9	L1	
18	0.45564	22.10	-5.00	12.52	34.62	7.52	56.77	46.77	22.1	39.2	L1	
19	0.49696	21.40	-5.40	12.53	33.93	7.13	56.05	46.05	22.1	38.9	L1	
20	0.53732	20.70	-5.70	12.53	33.23	6.83	56.00	46.00	22.7	39.1	L1	
21	0.59331	19.60	-6.10	12.54	32.14	6.44	56.00	46.00	23.8	39.5	L1	
22	1.62850	11.20	-8.50	12.63	23.83	4.13	56.00	46.00	32.1	41.8	L1	

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

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

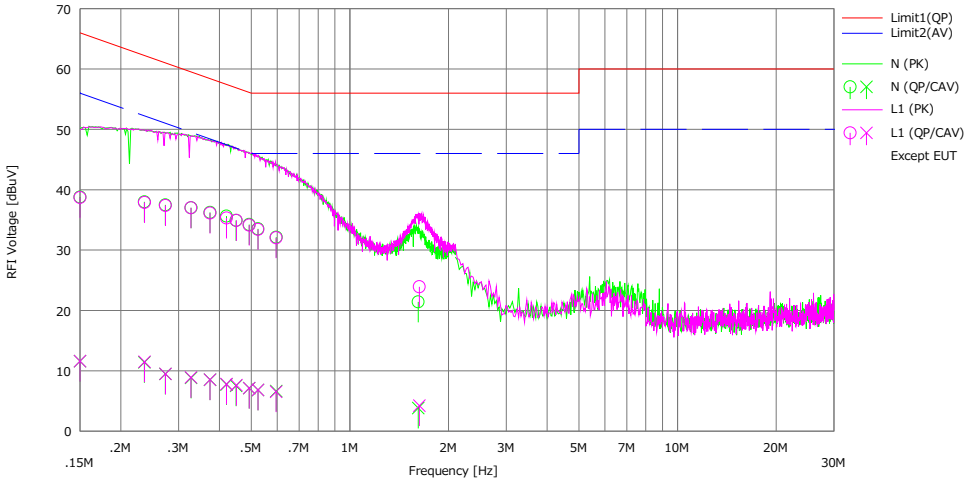
UL Japan,Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2019/09/11

Company : CASIO COMPUTER CO., LTD
Kind of EUT : RF Module
Model No. : M1
Serial No. : 16
Remarks : -

Mode : Tx, BLE, 2480 MHz
Order No. : 12945978S
Power : AC 120 V / 60 Hz (DC 3 V)
Temp./Humi. : 22 deg.C / 58 %RH

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Kazuya Noda



No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		〈QP〉	〈CAV〉		〈QP〉	〈CAV〉	〈QP〉	〈AV〉	〈QP〉	〈AV〉		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	26.30	-0.90	12.50	38.80	11.60	66.00	56.00	27.2	44.4	N	
2	0.23604	25.50	-1.10	12.50	38.00	11.40	62.23	52.23	24.2	40.8	N	
3	0.27339	25.00	-3.00	12.49	37.49	9.49	61.01	51.01	23.5	41.5	N	
4	0.32758	24.50	-3.70	12.52	37.02	8.82	59.51	49.51	22.4	40.6	N	
5	0.37445	23.70	-4.00	12.53	36.23	8.53	58.40	48.40	22.1	39.8	N	
6	0.41983	23.10	-4.80	12.52	35.62	7.72	57.45	47.45	21.8	39.7	N	
7	0.44979	22.40	-5.00	12.52	34.92	7.52	56.88	46.88	21.9	39.3	N	
8	0.49272	21.70	-5.40	12.53	34.23	7.13	56.12	46.12	21.8	38.9	N	
9	0.52404	21.00	-5.70	12.53	33.53	6.83	56.00	46.00	22.4	39.1	N	
10	0.59590	19.60	-5.90	12.54	32.14	6.64	56.00	46.00	23.8	39.3	N	
11	1.61650	8.80	-8.80	12.63	21.43	3.83	56.00	46.00	34.5	42.1	N	
12	0.15000	26.20	-0.90	12.50	38.70	11.60	66.00	56.00	27.3	44.4	L1	
13	0.23608	25.40	-1.00	12.50	37.90	11.50	62.23	52.23	24.3	40.7	L1	
14	0.27346	24.90	-3.00	12.49	37.39	9.49	61.01	51.01	23.6	41.5	L1	
15	0.32724	24.50	-3.60	12.52	37.02	8.92	59.52	49.52	22.5	40.6	L1	
16	0.37412	23.60	-4.00	12.53	36.13	8.53	58.41	48.41	22.2	39.8	L1	
17	0.42019	22.80	-4.70	12.52	35.32	7.82	57.44	47.44	22.1	39.6	L1	
18	0.45018	22.40	-4.90	12.52	34.92	7.62	56.87	46.87	21.9	39.2	L1	
19	0.49312	21.60	-5.40	12.53	34.13	7.13	56.12	46.12	21.9	38.9	L1	
20	0.52416	20.90	-5.70	12.53	33.43	6.83	56.00	46.00	22.5	39.1	L1	
21	0.59559	19.50	-6.00	12.54	32.04	6.54	56.00	46.00	23.9	39.4	L1	
22	1.62890	11.30	-8.40	12.63	23.93	4.23	56.00	46.00	32.0	41.7	L1	

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

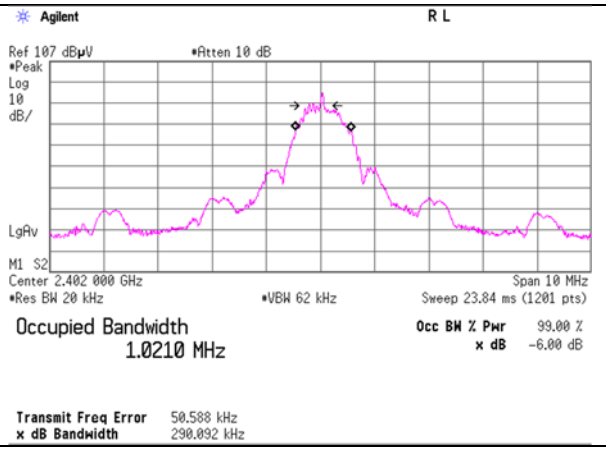
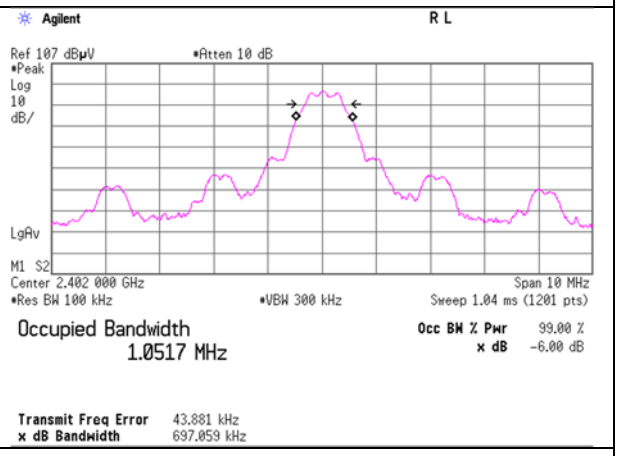
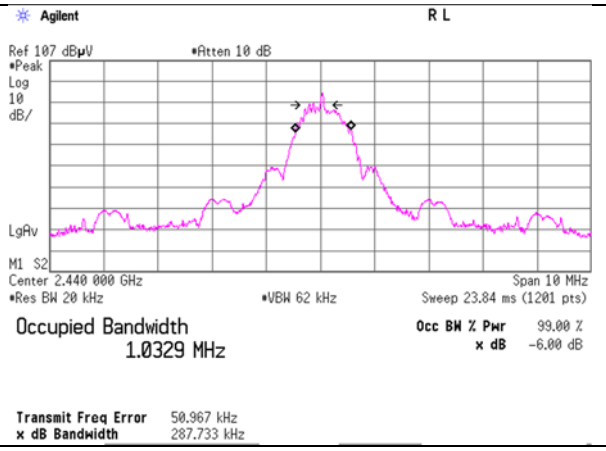
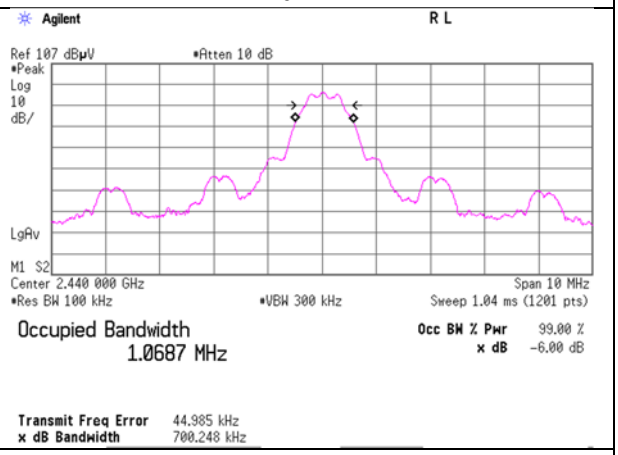
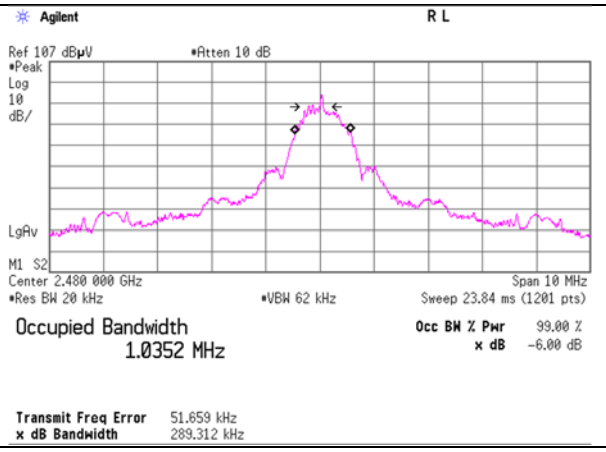
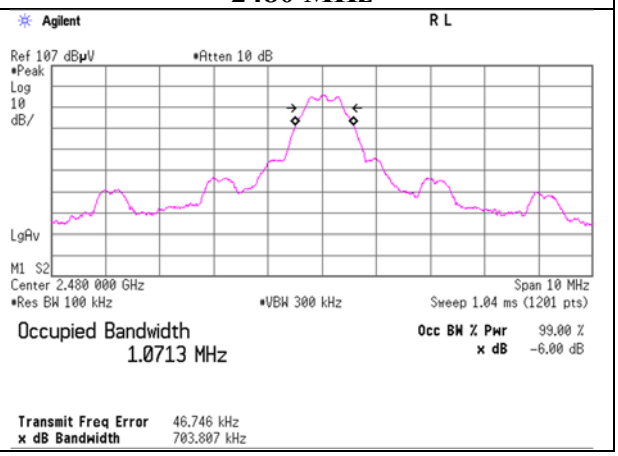
6 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	12945978S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	August 29, 2019
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuya Noda
Mode	Tx BT LE

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
BT LE	2402	1021.0	0.697	> 0.5000
	2440	1032.9	0.700	> 0.5000
	2480	1035.2	0.704	> 0.5000

99%Occupied Bandwidth

BT LE

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

Maximum Peak Output Power

Report No.	12945978S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	August 29, 2019
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuya Noda
Mode	Tx 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	-13.12	1.23	9.82	-2.07	0.62	30.00	1000	32.07	2.50	0.43	1.10	36.02	4000	35.59
2440	-13.49	1.24	9.82	-2.43	0.57	30.00	1000	32.43	2.50	0.07	1.02	36.02	4000	35.95
2480	-13.76	1.25	9.82	-2.69	0.54	30.00	1000	32.69	2.50	-0.19	0.96	36.02	4000	36.21

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 / SAR testing)

Report No.	12945978S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	August 29, 2019
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuya Noda
Mode	Tx 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	-15.58	1.23	9.82	-4.53	0.35	1.49	-3.04	0.50
2440	-16.02	1.24	9.82	-4.96	0.32	1.49	-3.47	0.45
2480	-16.37	1.25	9.82	-5.30	0.30	1.49	-3.81	0.42

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

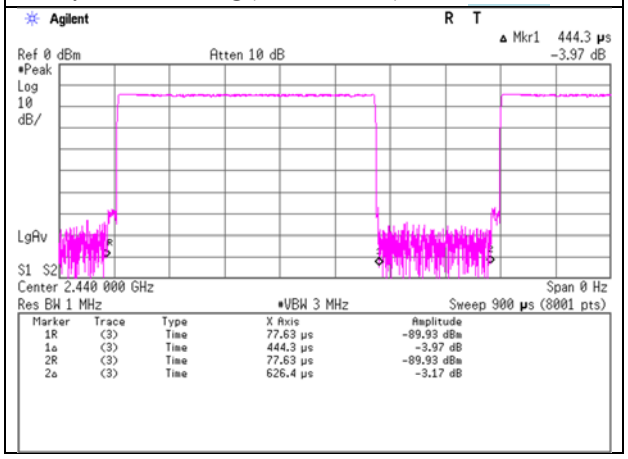
*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst rate confirmation

Report No.	12945978S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	August 29, 2019
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuya Noda
Mode	Tx BT LE

BT LE

Tx on / (Tx on + Tx off) =	**0.709**
Tx on / (Tx on + Tx off) * 100 =	**70.9 %**
(For Average power)	
Duty factor = 10 * log (0.6264 / 0.4443) =	**1.49 dB**
(For Spurious emissions)	
Duty factor = 20 * log (0.6264 / 0.4443) =	**2.98 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.	12945978S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.2	No.1
Date	September 10, 2019	September 8, 2019
Temperature / Humidity	22 deg. C / 58 % RH	23 deg. C / 60 % RH
Engineer	Kazuya Noda	Kenichi Adachi
	(30 MHz - 1000 MHz)	(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.	32.000	QP	22.70	17.92	6.89	31.93	0.00	15.58	40.00	24.4	100	2	
Hori.	480.000	QP	22.40	17.24	8.00	31.63	0.00	16.01	46.00	29.9	100	71	
Hori.	640.000	QP	21.50	19.27	8.70	31.63	0.00	17.84	46.00	28.1	100	1	
Hori.	758.543	QP	21.30	20.22	9.23	31.46	0.00	19.29	46.00	26.7	100	359	
Hori.	896.000	QP	20.90	22.05	9.83	30.93	0.00	21.85	46.00	24.1	100	2	
Hori.	2390.000	PK	45.23	28.31	14.62	39.59	2.49	51.06	73.90	22.8	154	206	
Hori.	2400.000	PK	46.21	28.29	14.63	39.59	2.49	52.03	73.90	21.8	154	206	
Hori.	4804.000	PK	48.00	31.60	7.10	39.75	2.49	49.44	73.90	24.4	193	50	
Hori.	7206.000	PK	46.02	37.15	9.00	39.53	2.49	55.13	73.90	**18.7**	210	229	
Vert.	192.000	QP	21.80	16.36	8.98	31.81	0.00	15.33	43.50	28.1	100	1	
Vert.	456.194	QP	21.60	16.75	7.92	31.65	0.00	14.62	46.00	31.3	100	358	
Vert.	736.000	QP	21.40	20.12	9.12	31.51	0.00	19.13	46.00	26.8	100	3	
Vert.	800.000	QP	21.30	20.84	9.40	31.34	0.00	20.20	46.00	25.8	100	358	
Vert.	864.000	QP	21.10	21.79	9.68	31.08	0.00	21.49	46.00	24.5	100	1	
Vert.	2390.000	PK	45.00	28.31	14.62	39.59	2.49	50.83	73.90	23.0	181	192	
Vert.	2400.000	PK	46.59	28.29	14.63	39.59	2.49	52.41	73.90	21.4	181	192	
Vert.	4804.000	PK	48.33	31.60	7.10	39.75	2.49	49.77	73.90	24.1	167	227	
Vert.	7206.000	PK	45.85	37.15	9.00	39.53	2.49	54.96	73.90	18.9	160	2	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.995 m / 3.0 m) = 2.49 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	35.51	28.31	14.62	39.59	2.98	2.49	44.32	53.90	9.5	*1)
Hori.	2400.000	AV	35.45	28.29	14.63	39.59	2.98	2.49	44.25	53.90	9.6	
Hori.	4804.000	AV	39.83	31.60	7.10	39.75	2.98	2.49	44.25	53.90	9.6	
Hori.	7206.000	AV	35.88	37.15	9.00	39.53	2.98	2.49	47.97	53.90	**5.9**	
Vert.	2390.000	AV	36.00	28.31	14.62	39.59	2.98	2.49	44.81	53.90	9.0	*1)
Vert.	2400.000	AV	35.77	28.29	14.63	39.59	2.98	2.49	44.57	53.90	9.3	
Vert.	4804.000	AV	40.00	31.60	7.10	39.75	2.98	2.49	44.42	53.90	9.4	
Vert.	7206.000	AV	35.36	37.15	9.00	39.53	2.98	2.49	47.45	53.90	6.4	

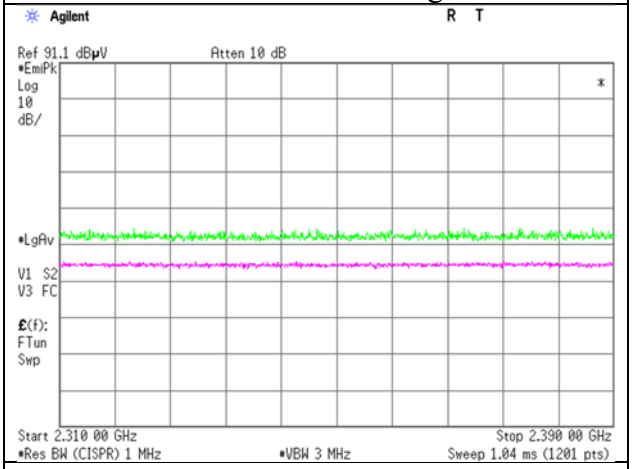
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.995 m / 3.0 m) = 2.49 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty factor refer to "Duty factor Calculation chart" sheet.
*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12945978S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	September 8, 2019
Temperature / Humidity	23 deg. C / 60 % RH
Engineer	Kenichi Adachi
	(1 GHz – 26.5 GHz)
Mode	Tx BT LE 2402 MHz

Horizontal

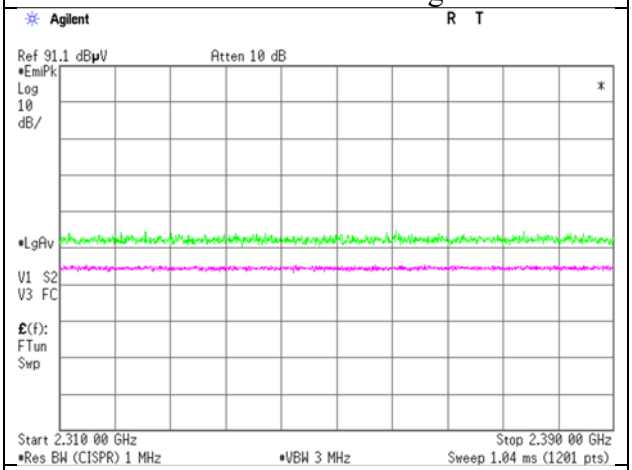
Restricted-band band-edge Plot



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

Report No.	12945978S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.2	No.1
Date	September 10, 2019	September 8, 2019
Temperature / Humidity	22 deg. C / 58 % RH	23 deg. C / 60 % RH
Engineer	Kazuya Noda	Kenichi Adachi
	(30 MHz - 1000 MHz)	(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.	32.000	QP	22.70	17.92	6.89	31.93	0.00	15.58	40.00	24.4	100	359	
Hori.	439.986	QP	21.90	16.37	7.83	31.65	0.00	14.45	46.00	31.5	100	3	
Hori.	480.000	QP	22.50	17.24	8.00	31.63	0.00	16.11	46.00	29.8	100	74	
Hori.	640.000	QP	21.50	19.27	8.70	31.63	0.00	17.84	46.00	28.1	100	1	
Hori.	896.000	QP	21.00	22.05	9.83	30.93	0.00	21.95	46.00	24.0	100	358	
Hori.	4880.000	PK	47.67	31.66	7.14	39.74	2.49	49.22	73.90	24.6	166	54	
Hori.	7320.000	PK	45.35	37.24	9.03	39.60	2.49	54.51	73.90	19.3	171	122	
Vert.	192.000	QP	21.90	16.36	8.98	31.81	0.00	15.43	43.50	28.0	100	2	
Vert.	683.966	QP	21.50	19.61	8.88	31.58	0.00	18.41	46.00	27.5	100	359	
Vert.	736.000	QP	21.50	20.12	9.12	31.51	0.00	19.23	46.00	26.7	100	1	
Vert.	800.000	QP	21.30	20.84	9.40	31.34	0.00	20.20	46.00	25.8	100	357	
Vert.	864.000	QP	21.10	21.79	9.68	31.08	0.00	21.49	46.00	24.5	100	1	
Vert.	4880.000	PK	48.22	31.66	7.14	39.74	2.49	49.77	73.90	24.1	173	84	
Vert.	7320.000	PK	46.04	37.24	9.03	39.60	2.49	55.20	73.90	**18.7**	196	279	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.995 m / 3.0 m) = 2.49 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	40.28	31.66	7.14	39.74	2.98	2.49	44.81	53.90	9.0	
Hori.	7320.000	AV	35.77	37.24	9.03	39.60	2.98	2.49	47.91	53.90	**5.9**	
Vert.	4880.000	AV	40.31	31.66	7.14	39.74	2.98	2.49	44.84	53.90	9.0	
Vert.	7320.000	AV	35.86	37.24	9.03	39.60	2.98	2.49	48.00	53.90	**5.9**	

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 (3.995 m / 3.0 m) = 2.49 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

Report No.	12945978S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.2	No.1
Date	September 10, 2019	September 8, 2019
Temperature / Humidity	22 deg. C / 58 % RH	23 deg. C / 60 % RH
Engineer	Kazuya Noda	Kenichi Adachi
	(30 MHz - 1000 MHz)	(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.	32.000	QP	22.70	17.92	6.89	31.93	0.00	15.58	40.00	24.4	100	358	
Hori.	480.000	QP	22.50	17.24	8.00	31.63	0.00	16.11	46.00	29.8	100	81	
Hori.	640.000	QP	21.40	19.27	8.70	31.63	0.00	17.74	46.00	28.2	100	357	
Hori.	896.000	QP	20.90	22.05	9.83	30.93	0.00	21.85	46.00	24.1	100	1	
Hori.	917.426	QP	20.60	22.02	9.92	30.77	0.00	21.77	46.00	24.2	100	358	
Hori.	2483.500	PK	45.35	28.16	14.71	39.62	2.49	51.09	73.90	22.8	201	287	
Hori.	4960.000	PK	46.27	31.83	7.18	39.72	2.49	48.05	73.90	25.8	206	61	
Hori.	7440.000	PK	45.88	37.38	9.04	39.68	2.49	55.11	73.90	**18.7**	175	161	
Vert.	192.000	QP	21.90	16.36	8.98	31.81	0.00	15.43	43.50	28.0	100	1	
Vert.	619.020	QP	21.40	19.51	8.60	31.62	0.00	17.89	46.00	28.1	100	358	
Vert.	736.000	QP	21.40	20.12	9.12	31.51	0.00	19.13	46.00	26.8	100	2	
Vert.	800.000	QP	21.20	20.84	9.40	31.34	0.00	20.10	46.00	25.9	100	359	
Vert.	864.000	QP	21.00	21.79	9.68	31.08	0.00	21.39	46.00	24.6	100	1	
Vert.	2483.500	PK	45.77	28.16	14.71	39.62	2.49	51.51	73.90	22.3	165	156	
Vert.	4960.000	PK	47.35	31.83	7.18	39.72	2.49	49.13	73.90	24.7	170	88	
Vert.	7440.000	PK	45.82	37.38	9.04	39.68	2.49	55.05	73.90	18.8	154	73	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.995 m / 3.0 m) = 2.49 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	36.13	28.16	14.71	39.62	2.98	2.49	44.85	53.90	9.0	*1)
Hori.	4960.000	AV	37.82	31.83	7.18	39.72	2.98	2.49	42.58	53.90	11.3	
Hori.	7440.000	AV	36.23	37.38	9.04	39.68	2.98	2.49	48.44	53.90	**5.4**	
Vert.	2483.500	AV	36.23	28.16	14.71	39.62	2.98	2.49	44.95	53.90	8.9	*1)
Vert.	4960.000	AV	37.72	31.83	7.18	39.72	2.98	2.49	42.48	53.90	11.4	
Vert.	7440.000	AV	36.11	37.38	9.04	39.68	2.98	2.49	48.32	53.90	5.5	

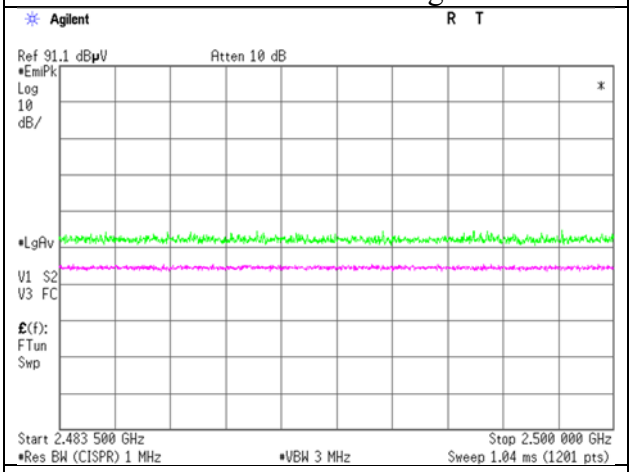
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.995 m / 3.0 m) = 2.49 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty factor refer to "Duty factor Calculation chart" sheet.
*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12945978S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	September 8, 2019
Temperature / Humidity	23 deg. C / 60 % RH
Engineer	Kenichi Adachi (1 GHz – 26.5 GHz)
Mode	Tx BT LE 2480 MHz

Horizontal

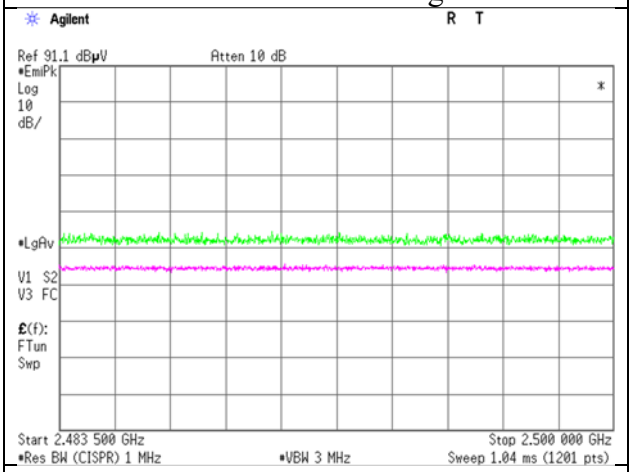
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

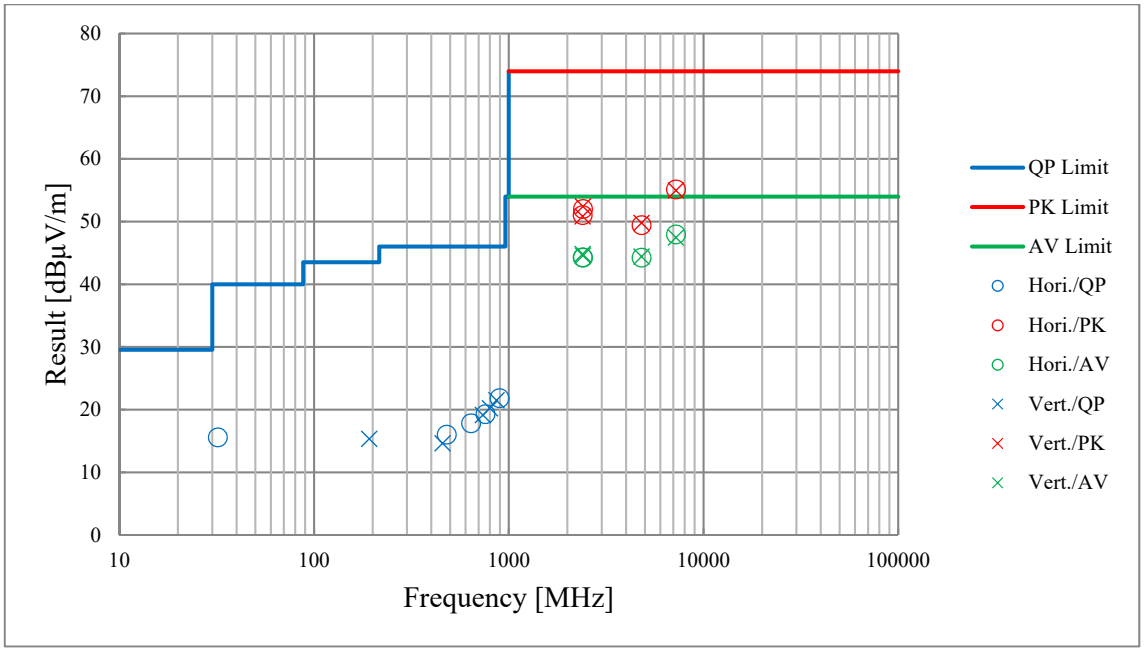


Trace Green : Peak Plot
Trace Purple : Average Plot

* 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.	12945978S-A-R2	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.2	No.1
Date	September 10, 2019	September 8, 2019
Temperature / Humidity	22 deg. C / 58 % RH	23 deg. C / 60 % RH
Engineer	Kazuya Noda	Kenichi Adachi
	(30 MHz - 1000 MHz)	(1 GHz – 26.5 GHz)
Mode	Tx BT LE 2402 MHz	

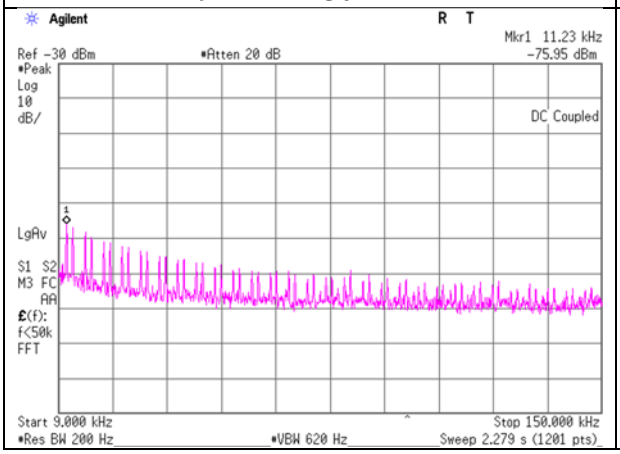


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

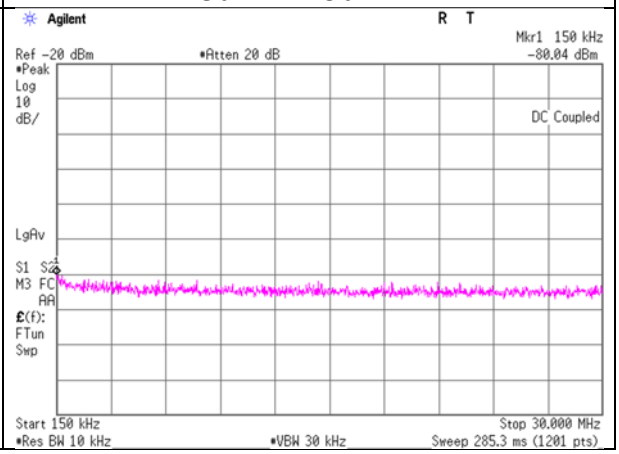
Conducted Spurious Emission

Report No.	12945978S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	August 29, 2019
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuya Noda
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
11.23	-75.95	0.02	9.74	2.5	1	-63.69	300	6.00	-2.44	46.50	48.94	
150.00	-80.04	0.02	9.74	2.5	1	-67.78	300	6.00	-6.53	24.00	30.53	

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

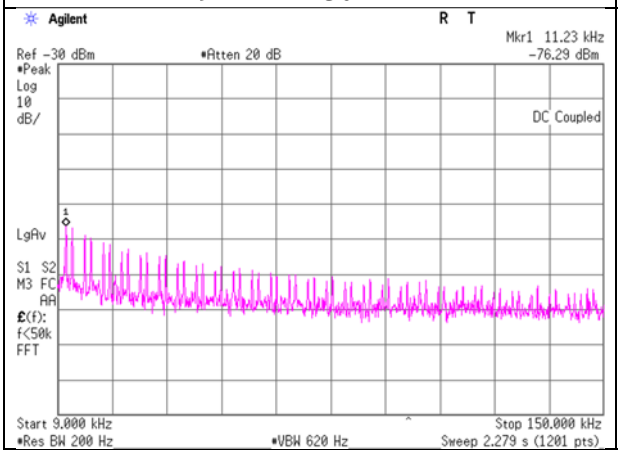
EIRP[dBm] = Reading [dBm] + Cable loss [dB] + Attenuator Loss [dB] + Antenna gain [dBi] + 10 * log (N)

N: Number of output

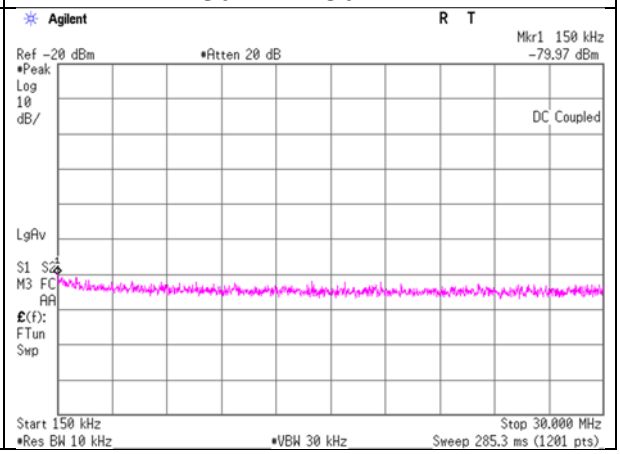
Conducted Spurious Emission

Report No.	12945978S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	August 29, 2019
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuya Noda
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
11.23	-76.29	0.02	9.74	2.5	1	-64.03	300	6.00	-2.78	46.50	49.28	
150.00	-79.97	0.02	9.74	2.5	1	-67.71	300	6.00	-6.46	24.00	30.46	

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

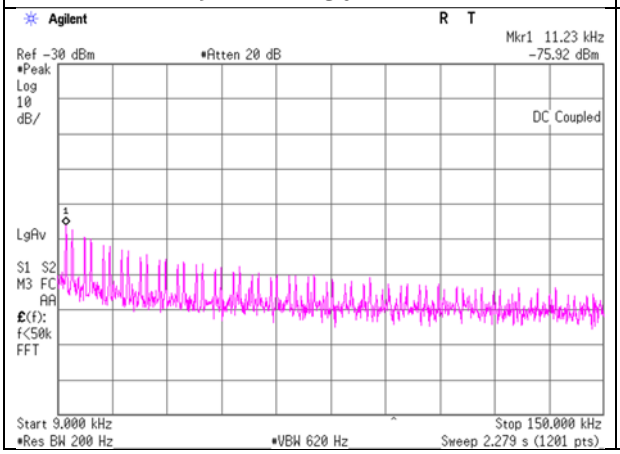
EIRP[dBm] = Reading [dBm] + Cable loss [dB] + Attenuator Loss [dB] + Antenna gain [dBi] + 10 * log (N)

N: Number of output

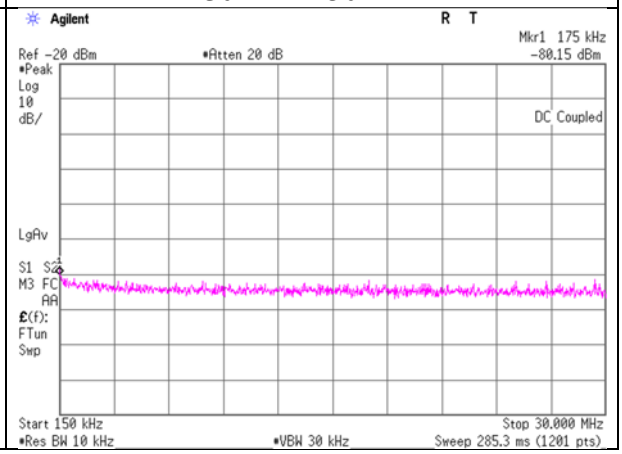
Conducted Spurious Emission

Report No.	12945978S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	August 29, 2019
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuya Noda
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
11.23	-75.92	0.02	9.74	2.5	1	-63.66	300	6.00	-2.41	46.50	48.91	
175.00	-80.15	0.02	9.74	2.5	1	-67.89	300	6.00	-6.64	22.70	29.34	

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.	12945978S-A-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	August 29, 2019
Temperature / Humidity	24 deg. C / 53 % RH
Engineer	Kazuya Noda
Mode	Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402	-28.18	1.23	9.82	-17.13	8.00	25.13
2440	-28.54	1.24	9.82	-17.48	8.00	25.48
2480	-28.80	1.25	9.82	-17.73	8.00	25.73

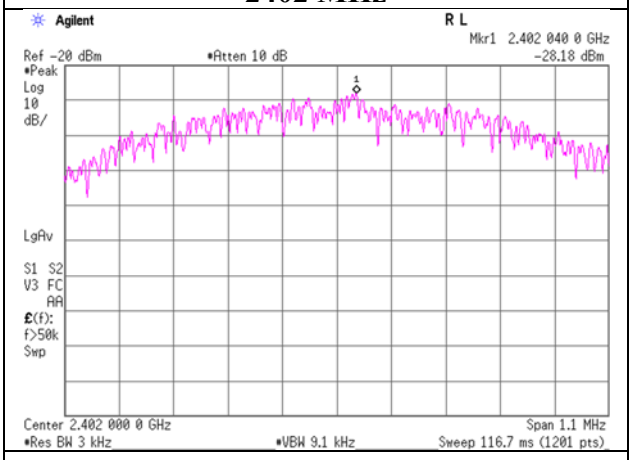
Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

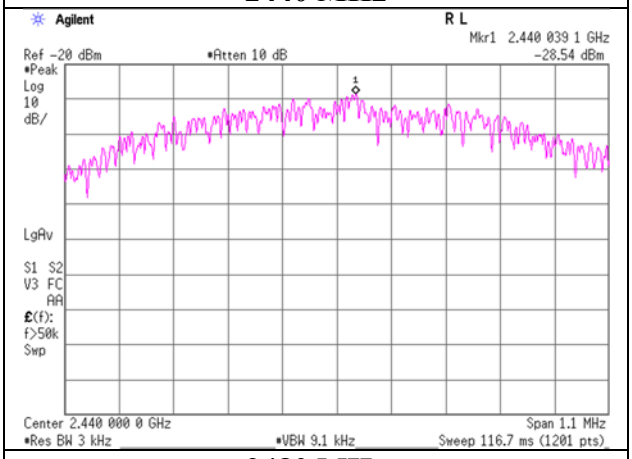
Power Density

BT LE

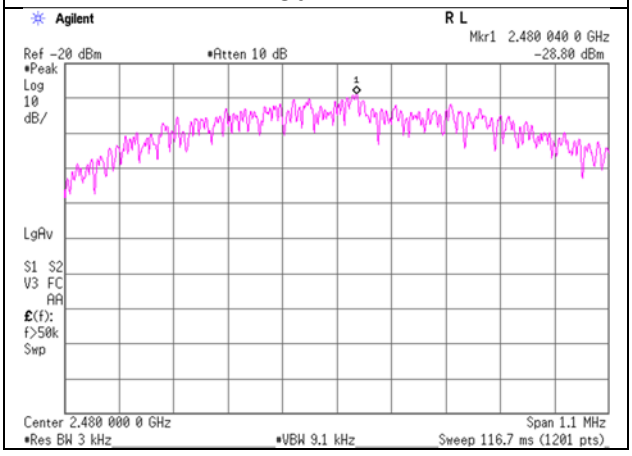
2402 MHz



2440 MHz



2480 MHz



APPENDIX 2: Test instruments

Test Instruments

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
KTS-08	AT	145095	Digital Tester	SANWA	PC500	7019224	4/2/2019	4/30/2020	12
SAT10-14	AT	154591	Attenuator	Weinschel Corp.	54A-10	81595	4/16/2019	4/30/2020	12
SCC-G31	AT	145042	Coaxial Cable	Junkosha	MWX241-01000KMSKMS	OCT-08-13-046	4/16/2019	4/30/2020	12
SOS-13	AT	146321	Humidity Indicator	CUSTOM	CTH-202	Q.C.17	12/5/2018	12/31/2019	12
SPM-07	AT	146247	Power Meter	AGILENT	8990B	MY51002712	7/16/2019	7/31/2020	12
SPSS-04	AT	146310	Power sensor	AGILENT	N1923A	MY53260009	7/16/2019	7/31/2020	12
SRENT-09	AT	150461	Spectrum Analyzer	AGILENT (KEYSIGHT)	E4440A	MY46186392	1/3/2019	1/31/2020	12
KAT3-12	CE	144896	Attenuator	JFW IND. INC.	50HF-003N	-	7/18/2019	7/31/2020	12
SCC-B12/B13/SRSE-02	CE	144969	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-270(RF Selector)	4/19/2019	4/30/2020	12
SLS-03	CE	145540	LISN	Rohde & Schwarz	ENV216	100513	2/21/2019	2/29/2020	12
SOS-04	CE	146292	Humidity Indicator	A&D	AD-5681	4061512	12/5/2018	12/31/2019	12
COTS-SEMI-5	CE,RE	170932	EMI Software	TSJ	TEPTO-DV3(RE,CE,ME,PE)	-	-	-	-
SJM-09	CE,RE	145336	Measure	PROMART	SEN1935	-	-	-	-
STR-02	CE,RE	145791	Test Receiver	Rohde & Schwarz	ESCI	100575	10/19/2018	10/31/2019	12
STS-02	CE,RE	145793	Digital Hitester	HIOKI	3805-50	80997819	4/2/2019	4/30/2020	12
KJM-09	RE	145929	Measure	KOMELON	KMC-36	-	-	-	-
SAEC-01(SVSWR)	RE	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	5/6/2019	5/30/2020	12
SAEC-02(NSA)	RE	145563	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	4/4/2019	4/30/2020	12
SAF-02	RE	145004	Pre Amplifier	SONOMA	310N	290212	2/5/2019	2/29/2020	12
SAF-04	RE	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	6/4/2019	6/30/2020	12
SAF-08	RE	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	3/5/2019	3/31/2020	12
SAT10-05	RE	145136	Attenuator(above1GHz)	AGILENT	8493C-010	74864	11/25/2018	11/30/2019	12
SAT3-11	RE	150921	Attenuator	JFW	50HF-003N	-	1/25/2019	1/31/2020	12
SAT6-14	RE	167095	Attenuator	JFW	50HF-006N	-	2/5/2019	2/29/2020	12
SBA-02	RE	145022	Biconical Antenna	Schwarzbeck	BBA9106	91032665	4/1/2019	4/30/2020	12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	RE	144975	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141P	-/0901-270(RF Selector)	4/19/2019	4/30/2020	12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	RE	144976	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141P	-/0901-270(RF Selector)	4/19/2019	4/30/2020	12
SCC-G05	RE	145039	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	1/25/2019	1/31/2020	12
SCC-G15	RE	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	3/27/2019	3/31/2020	12

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SCC-G56	RE	179539	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	803289/4	5/16/2019	5/31/2020	12
SCC-G57	RE	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	5/16/2019	5/31/2020	12
SFL-02	RE	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	11/16/2018	11/30/2019	12
SHA-01	RE	145383	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	5/9/2019	5/31/2020	12
SHA-04	RE	145512	Horn Antenna	ETS LINDGREN	Sep-60	LM3640	6/26/2019	6/30/2020	12
SLA-06	RE	145528	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	195	4/1/2019	4/30/2020	12
SOS-01	RE	146316	Humidity Indicator	A&D	AD-5681	4062555	10/25/2018	10/31/2019	12
SOS-03	RE	146317	Humidity Indicator	A&D	AD-5681	4063325	10/25/2018	10/31/2019	12
SSA-03	RE	145801	Spectrum Analyzer	AGILENT	E4448A	MY48250152	2019/8/8	2020/8/31	12
STS-01	RE	145792	Digital Hitester	HIOKI	3805-50	80997812	2018/10/16	2019/10/31	12

***Hyphens for Last Calibration Date, Calibration Due 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.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test item: **CE: Conducted Emission test**
RE: Radiated Emission test
AT: Antenna Terminal Conducted test