RADIO TEST REPORT

Test Report No. : 12796646S-A-R2

Applicant	:	**CASIO COMPUTER CO., LTD.**
Type of Equipment	:	**Watch (Titan version)**
Model No.	:	**GMW-B5000**
FCC ID	:	**BBQS0DW**
Test regulation	:	**FCC Part 15 Subpart C: 2018**
Test item	:	**Radiated Spurious Emission**
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.
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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 12796646S-A-R1. 12796646S-A-R1 is replaced with this report.

Date of test: September 27 and 28, 2018

Representative test engineer:
Makoto Hosaka
Engineer
Consumer Technology Division

Approved by:
Akio Hayashi
Leader
Consumer Technology Division

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

RTL02610

REVISION HISTORY

Original Test Report No.: 12796646S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12796646S-A	May 22, 2019	-	-
1	12796646S-A-R1	June 5, 2019	9-10, 12-13	Correction of Distance factor: From "20 x log (3.94 m*/3.0 m) = 2.42 dB" to "20 x log (3.96 m*/3.0 m) = 2.42 dB", From "r = 0.06 m" to "r = 0.04 m"
2	12796646S-A-R2	June 11, 2019	8	Addition of description: "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."

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
- 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 information in SECTION 2 and 4.

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Watch (Titan version)
Model No.	:	GMW-B5000
Serial No.	:	Refer to Section 4.2.
Rating	:	Typical: DC 2.5 V, Min.: DC 1.9 V, Max.: DC 2.7 V CW3459 (Module): Typical: DC 2.5 V/DC 3.0 V*, Min.: DC 1.9 V, Max.: DC 3.3 V
Receipt Date of Sample (Information from test lab.)	:	September 26, 2018
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.

* Specification of BLE module CW3459 installed in GMW-B5000
For the GMW-B5000, only DC 2.5 V battery is used and DC 3.0 V battery is not used.

2.2 Product Description

Model: GMW-B5000 (referred to as the EUT in this report) is a Watch (Titan version).
* GMW-B5000 has alternative name as R025.

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
Clock frequency (Maximum)		26 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05	**FCC:** Section15.247(d)	0.9 dB 9920.00 MHz, PK, Horizontal Tx 2480 MHz	Complied# a)	Radiated (above 30 MHz) *1)
	IC: RSS-Gen 6.13	**IC:** 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 v05 8.5 and 8.6. (Measurement was performed before issue of KDB 558074 v05r01/r02.) a) 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

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 following 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

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
JAB Accreditation No. RTL02610
FCC Test Firm Registration Number: 839876

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

3.6 Test data, Test instruments, and Test set up

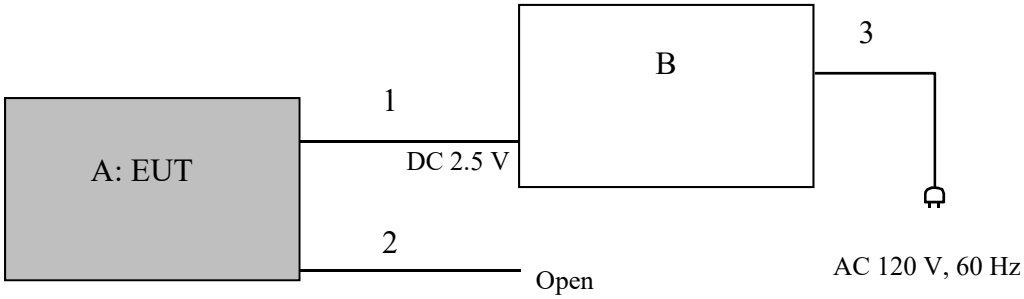
Refer to APPENDIX.

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

4.1 Operating Mode(s)

Mode	Frequency	Remarks*
Transmitting (Tx), Bluetooth Low Energy (BT LE)	2402 MHz, 2440 MHz, 2480 MHz	PRBS9
*Power of the EUT was set by the software as follows; - Power Setting: 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	Watch (Titan version)	GMW-B5000	No. 33 *1)	Casio Computer Co., Ltd.	EUT
B	Power Supply(DC)	PAN35-10A	DE001677	KIKUSUI	-

*1) Used for Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.1 + 2.0	Unshielded	Unshielded	*2)
2	Signal Cable	0.1	Unshielded	Unshielded	*3)
3	AC Cable	1.8	Unshielded	Unshielded	-

*2) Cable for test operation
*3) Cable for system reset during the development, not used for the product

SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05".

[For below 1 GHz]
EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.
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 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.

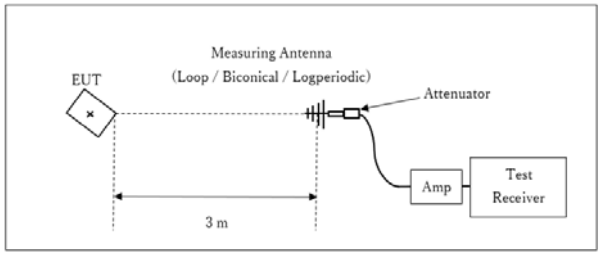
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

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 1: Test Setup

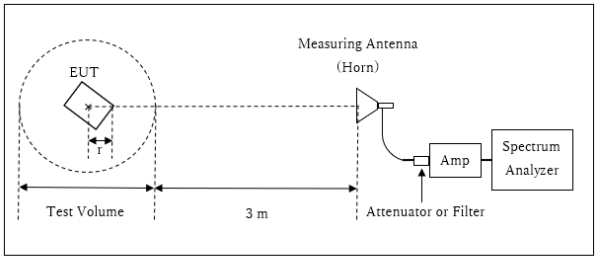
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz

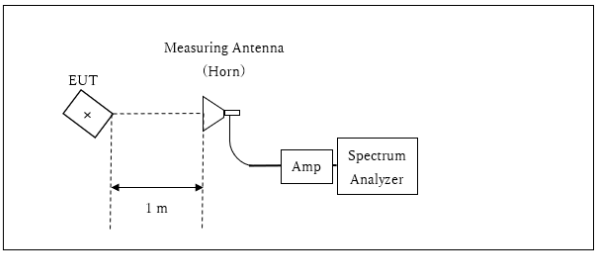


r : Radius of an outer periphery of EUT
× : Center of turn table

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 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 (Below 1 GHz)	Spurious (1 GHz -13 GHz)	Spurious (13 GHz -26.5 GHz)
Horizontal	X	X	Y	X
Vertical	Y	X	Z	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

APPENDIX 1: Test data

Radiated Spurious Emission

Report No.	12796646S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	September 28, 2018	September 27, 2018	September 28, 2018
Temperature / Humidity	24 deg. C / 59 % RH	22 deg. C / 61 % RH	24 deg. C / 59 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 GHz -26.5 GHz)
Mode	Tx BTLE 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.	78.041	QP	22.30	6.29	7.91	31.89	0.00	4.61	40.00	35.3	162	190	
Hori.	164.894	QP	22.21	15.41	8.68	31.82	0.00	14.48	43.50	29.0	188	96	
Hori.	197.930	QP	22.12	16.63	8.74	31.79	0.00	15.70	43.50	27.8	168	172	
Hori.	834.176	QP	21.48	21.16	8.82	31.22	0.00	20.24	46.00	25.7	100	81	
Hori.	909.092	QP	21.36	22.09	9.14	30.85	0.00	21.74	46.00	24.2	138	26	
Hori.	2390.000	PK	44.36	27.91	13.89	36.58	2.42	52.00	73.90	21.9	100	0	
Hori.	2400.000	PK	54.99	27.91	13.90	36.58	2.42	62.64	73.90	11.2	100	0	
Hori.	4804.000	PK	45.44	31.31	6.53	36.88	2.42	48.82	73.90	25.0	110	227	
Hori.	7206.000	PK	45.65	36.77	7.58	37.26	2.42	55.16	73.90	18.7	150	0	
Hori.	14412.000	PK	47.96	41.92	10.40	38.40	-9.54	52.34	73.90	21.5	177	307	
Vert.	31.659	QP	22.61	17.95	6.77	31.93	0.00	15.40	40.00	24.6	136	229	
Vert.	77.753	QP	22.62	6.30	7.89	31.89	0.00	4.92	40.00	35.0	190	180	
Vert.	396.016	QP	21.80	15.57	7.02	31.66	0.00	12.73	46.00	33.2	100	54	
Vert.	542.491	QP	21.84	17.74	7.61	31.72	0.00	15.47	46.00	30.5	100	266	
Vert.	954.340	QP	21.30	22.00	9.32	30.52	0.00	22.10	46.00	23.9	100	38	
Vert.	2390.000	PK	44.23	27.91	13.89	36.58	2.42	51.87	73.90	22.0	100	0	
Vert.	2400.000	PK	56.06	27.91	13.90	36.58	2.42	63.71	73.90	**10.1**	100	0	
Vert.	4804.000	PK	47.68	31.31	6.53	36.88	2.42	51.06	73.90	22.8	110	221	
Vert.	7206.000	PK	45.99	36.77	7.58	37.26	2.42	55.50	73.90	18.4	155	166	
Vert.	14412.000	PK	47.36	41.92	10.40	38.40	-9.54	51.74	73.90	22.1	175	30	

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	34.94	27.91	13.89	36.58	1.78	2.42	44.36	53.90	9.5	*1)
Hori.	2400.000	AV	38.77	27.91	13.90	36.58	1.78	2.42	48.20	53.90	5.7	
Hori.	4804.000	AV	37.08	31.31	6.53	36.88	1.78	2.42	42.24	53.90	11.7	
Hori.	7206.000	AV	36.37	36.77	7.58	37.26	1.78	2.42	47.66	53.90	6.2	
Hori.	14412.000	AV	38.25	41.92	10.40	38.40	1.78	-9.54	44.41	53.90	9.5	
Vert.	2390.000	AV	34.69	27.91	13.89	36.58	1.78	2.42	44.11	53.90	9.8	*1)
Vert.	2400.000	AV	39.44	27.91	13.90	36.58	1.78	2.42	48.87	53.90	**5.0**	
Vert.	4804.000	AV	39.88	31.31	6.53	36.88	1.78	2.42	45.04	53.90	8.9	
Vert.	7206.000	AV	36.55	36.77	7.58	37.26	1.78	2.42	47.84	53.90	6.1	
Vert.	14412.000	AV	38.10	41.92	10.40	38.40	1.78	-9.54	44.26	53.90	9.6	

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)

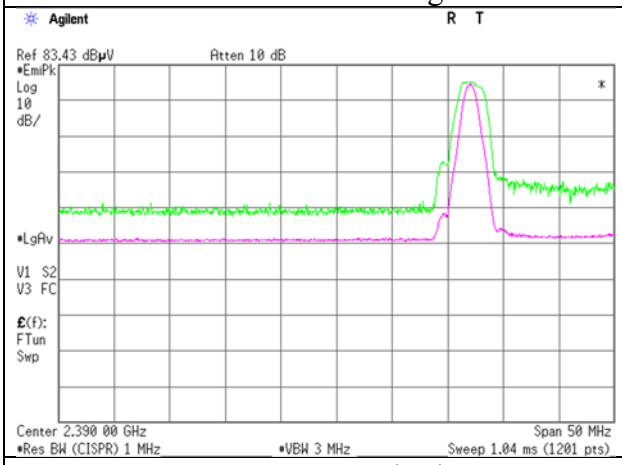
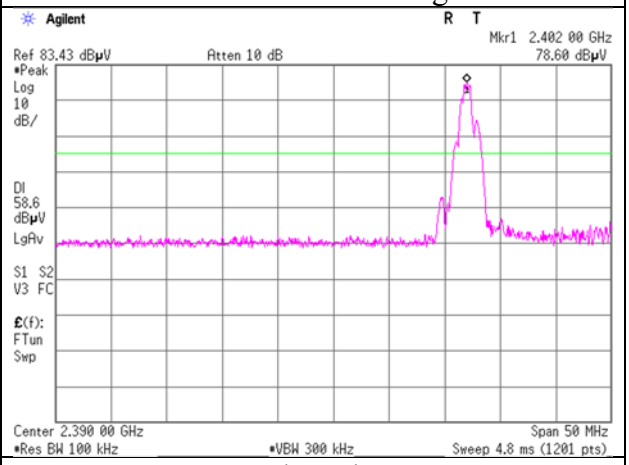
20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

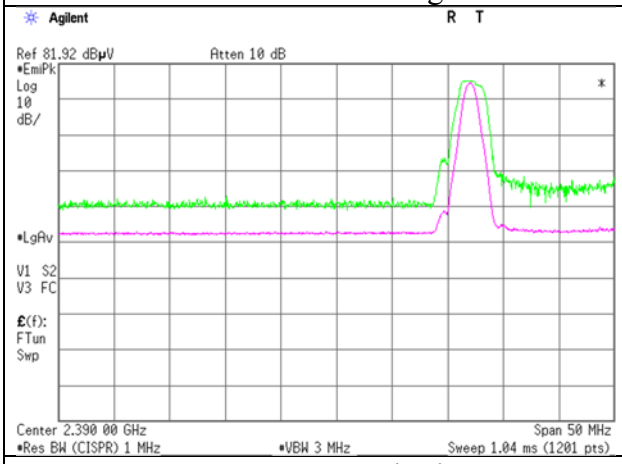
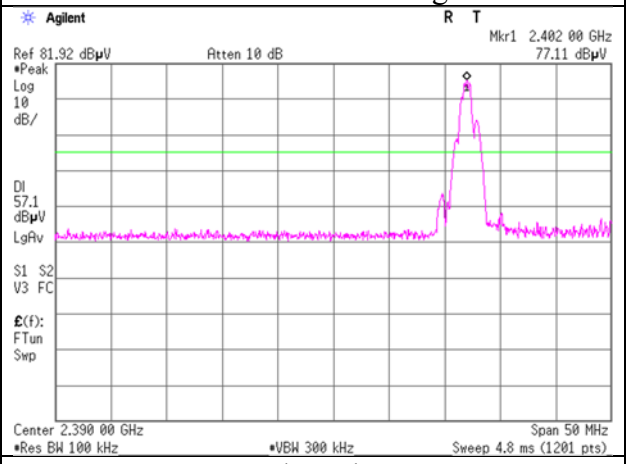
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	76.84	27.90	13.90	36.57	2.42	84.49	-	-	100k/300k
Hori.	9608.000	PK	48.20	38.11	8.65	38.47	2.42	58.91	64.49	5.6	100k/300k
Vert.	2402.000	PK	78.44	27.90	13.90	36.57	2.42	86.09	-	-	100k/300k
Vert.	9608.000	PK	47.18	38.11	8.65	38.47	2.42	57.89	66.09	8.2	100k/300k

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.	12796646S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	September 27, 2018
Temperature / Humidity	22 deg. C / 61 % RH
Engineer	Makoto Hosaka
	(1 GHz -18 GHz)
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

* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12796646S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	September 28, 2018	September 27, 2018	September 28, 2018
Temperature / Humidity	24 deg. C / 59 % RH	22 deg. C / 61 % RH	24 deg. C / 59 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 GHz -26.5 GHz)
Mode	Tx BTLE 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.	77.977	QP	21.86	6.29	7.90	31.89	0.00	4.16	40.00	35.8	176	248	
Hori.	194.994	QP	21.58	16.47	8.72	31.79	0.00	14.98	43.50	28.5	200	123	
Hori.	724.363	QP	20.96	20.10	8.37	31.54	0.00	17.89	46.00	28.1	100	23	
Hori.	877.090	QP	20.26	21.91	9.01	31.01	0.00	20.17	46.00	25.8	100	107	
Hori.	959.441	QP	20.01	22.05	9.34	30.47	0.00	20.93	46.00	25.0	171	87	
Hori.	4880.000	PK	46.88	31.15	6.56	36.90	2.42	50.11	73.90	23.7	121	196	
Hori.	7320.000	PK	44.22	36.84	7.64	37.44	2.42	53.68	73.90	20.2	100	0	
Hori.	14640.000	PK	46.07	42.01	10.37	38.34	-9.54	50.57	73.90	23.3	177	318	
Vert.	31.882	QP	22.12	17.86	6.78	31.93	0.00	14.83	40.00	25.1	100	69	
Vert.	77.977	QP	21.92	6.29	7.90	31.89	0.00	4.22	40.00	35.7	186	171	
Vert.	180.759	QP	21.68	16.11	8.68	31.80	0.00	14.67	43.50	28.8	100	197	
Vert.	603.354	QP	21.08	19.31	7.85	31.64	0.00	16.60	46.00	29.4	100	185	
Vert.	767.706	QP	20.94	20.34	8.54	31.46	0.00	18.36	46.00	27.6	100	215	
Vert.	4880.000	PK	45.16	31.15	6.56	36.90	2.42	48.39	73.90	25.5	129	236	
Vert.	7320.000	PK	44.82	36.84	7.64	37.44	2.42	54.28	73.90	**19.6**	156	137	
Vert.	14640.000	PK	46.39	42.01	10.37	38.34	-9.54	50.89	73.90	23.0	182	25	

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	38.52	31.15	6.56	36.90	1.78	2.42	43.53	53.90	10.4	
Hori.	7320.000	AV	35.89	36.84	7.64	37.44	1.78	2.42	47.13	53.90	**6.8**	
Hori.	14640.000	AV	36.82	42.01	10.37	38.34	1.78	-9.54	43.10	53.90	10.8	
Vert.	4880.000	AV	36.81	31.15	6.56	36.90	1.78	2.42	41.82	53.90	12.1	
Vert.	7320.000	AV	35.76	36.84	7.64	37.44	1.78	2.42	47.00	53.90	**6.9**	
Vert.	14640.000	AV	36.70	42.01	10.37	38.34	1.78	-9.54	42.98	53.90	10.9	

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 (3.96 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.

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.	2440.000	PK	75.31	27.81	13.93	36.55	2.42	82.92	-	-	100k/300k
Hori.	9760.000	PK	48.60	38.58	8.80	38.65	2.42	59.75	62.92	3.2	100k/300k
Vert.	2440.000	PK	76.02	27.81	13.93	36.55	2.42	83.63	-	-	100k/300k
Vert.	9760.000	PK	48.24	38.58	8.80	38.65	2.42	59.39	63.63	4.2	100k/300k

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

Report No.	12796646S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	September 28, 2018	September 27, 2018	September 28, 2018
Temperature / Humidity	24 deg. C / 59 % RH	22 deg. C / 61 % RH	24 deg. C / 59 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 GHz -26.5 GHz)
Mode	Tx BTLE 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.	31.685	QP	20.07	17.94	6.77	31.93	0.00	12.85	40.00	27.1	100	282	
Hori.	78.005	QP	21.92	6.29	7.91	31.89	0.00	4.23	40.00	35.7	190	199	
Hori.	194.119	QP	21.67	16.58	8.72	31.79	0.00	15.18	43.50	28.3	100	258	
Hori.	592.935	QP	20.95	19.03	7.81	31.65	0.00	16.14	46.00	29.8	100	115	
Hori.	957.308	QP	20.09	22.03	9.33	30.49	0.00	20.96	46.00	25.0	100	35	
Hori.	2483.500	PK	45.56	27.67	13.96	36.52	2.42	53.09	73.90	20.8	146	211	
Hori.	4960.000	PK	47.49	31.33	6.61	36.93	2.42	50.92	73.90	22.9	202	215	
Hori.	7440.000	PK	44.82	36.97	7.69	37.63	2.42	54.27	73.90	19.6	150	0	
Hori.	14880.000	PK	46.15	41.31	10.24	38.26	-9.54	49.90	73.90	24.0	185	318	
Vert.	77.978	QP	22.24	6.29	7.90	31.89	0.00	4.54	40.00	35.4	166	185	
Vert.	127.944	QP	21.52	13.78	8.05	31.85	0.00	11.50	43.50	32.0	100	216	
Vert.	180.494	QP	21.50	16.08	8.68	31.80	0.00	14.46	43.50	29.0	100	159	
Vert.	534.021	QP	21.14	17.58	7.57	31.70	0.00	14.59	46.00	31.4	100	211	
Vert.	891.145	QP	20.44	21.92	9.07	30.95	0.00	20.48	46.00	25.5	100	178	
Vert.	2483.500	PK	51.63	27.67	13.96	36.52	2.42	59.16	73.90	**14.7**	238	25	
Vert.	4960.000	PK	47.58	31.33	6.61	36.93	2.42	51.01	73.90	22.8	122	215	
Vert.	7440.000	PK	45.37	36.97	7.69	37.63	2.42	54.82	73.90	19.0	150	0	
Vert.	14880.000	PK	47.19	41.31	10.24	38.26	-9.54	50.94	73.90	22.9	184	5	

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	36.04	27.67	13.96	36.52	1.78	2.42	45.35	53.90	8.6	*1)
Hori.	4960.000	AV	39.85	31.33	6.61	36.93	1.78	2.42	45.06	53.90	8.8	
Hori.	7440.000	AV	35.12	36.97	7.69	37.63	1.78	2.42	46.35	53.90	7.6	
Hori.	14880.000	AV	36.89	41.31	10.24	38.26	1.78	-9.54	42.42	53.90	11.5	
Vert.	2483.500	AV	36.46	27.67	13.96	36.52	1.78	2.42	45.77	53.90	8.1	*1)
Vert.	4960.000	AV	39.40	31.33	6.61	36.93	1.78	2.42	44.61	53.90	9.3	
Vert.	7440.000	AV	35.39	36.97	7.69	37.63	1.78	2.42	46.62	53.90	**7.3**	
Vert.	14880.000	AV	37.19	41.31	10.24	38.26	1.78	-9.54	42.72	53.90	11.2	

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)

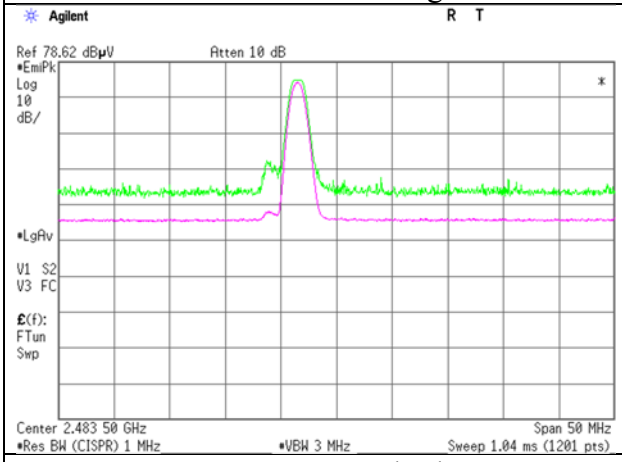
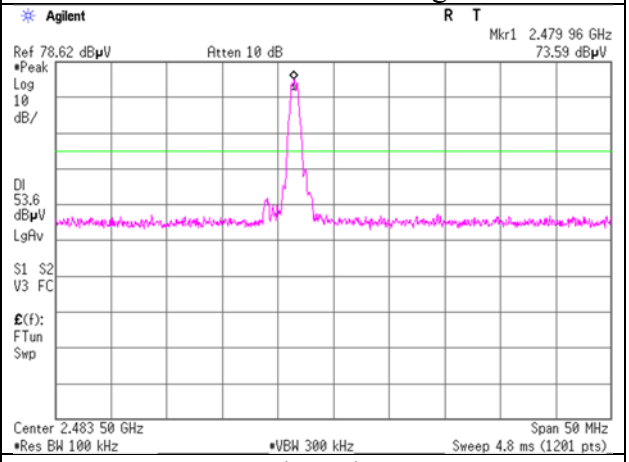
20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

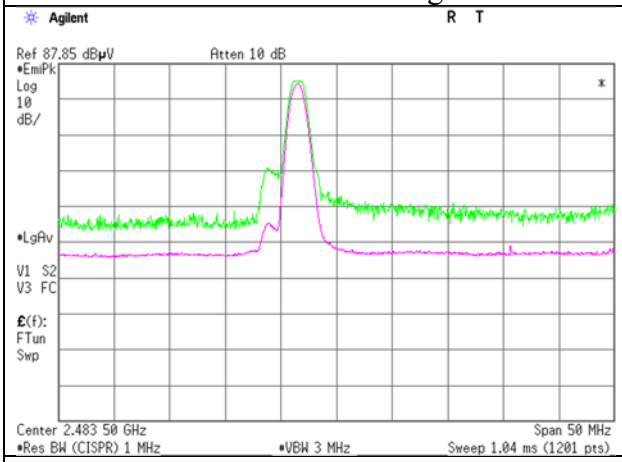
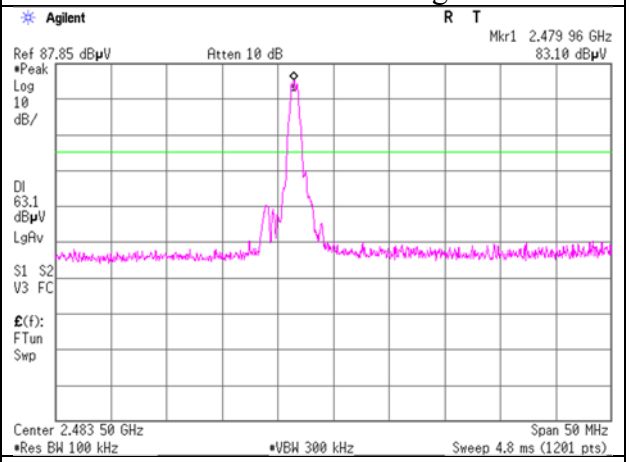
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2480.000	PK	73.40	27.68	13.96	36.52	2.42	80.94	-	-	100k/300k
Hori.	9920.000	PK	48.66	38.80	8.97	38.84	2.42	60.01	60.94	0.9	100k/300k
Vert.	2480.000	PK	82.84	27.68	13.96	36.52	2.42	90.38	-	-	100k/300k
Vert.	9920.000	PK	48.09	38.80	8.97	38.84	2.42	59.44	70.38	10.9	100k/300k

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.	12796646S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	September 28, 2018
Temperature / Humidity	24 deg. C / 59 % RH
Engineer	Makoto Hosaka
	(30 MHz -1 GHz)
Mode	Tx BLTE 2480 MHz

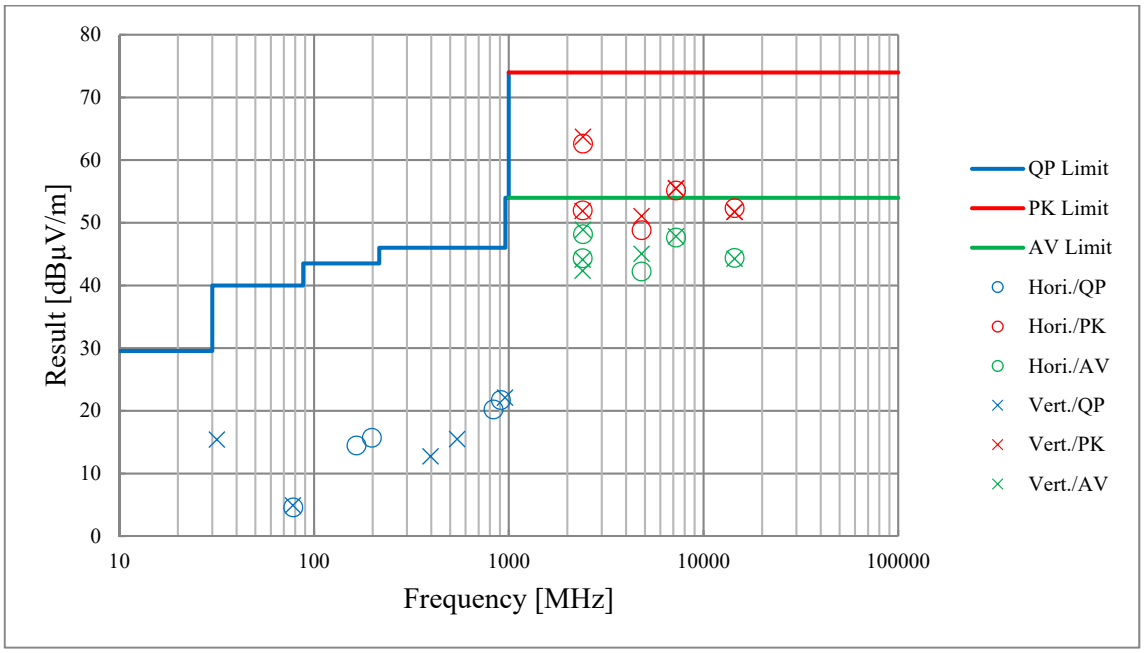
Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

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

* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12796646S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	September 28, 2018	September 27, 2018	September 28, 2018
Temperature / Humidity	24 deg. C / 59 % RH	22 deg. C / 61 % RH	24 deg. C / 59 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 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.

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)
COTS-SEMI-1	RE	144865	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	-	-	-
KSA-08	RE	145089	Spectrum Analyzer	AGILENT	E4446A	MY46180525	2017/10/10	2018/10/31	12
SAEC-02(NSA)	RE	145563	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	2018/5/31	2019/5/31	12
SAEC-02(SVSWR)	RE	145598	Semi-Anechoic Chamber	TDK	SAEC-02(SVSWR)	2	2018/7/15	2019/7/31	12
SAF-02	RE	145004	Pre Amplifier	SONOMA	310N	290212	2018/2/16	2019/2/28	12
SAF-05	RE	145128	Pre Amplifier	Toyo Corporation	TPA0118-36	1440490	2018/2/15	2019/2/28	12
SAT10-05	RE	145136	Attenuator(above1GHz)	AGILENT	8493C-010	74864	2017/11/22	2018/11/30	12
SAT3-11	RE	150921	Attenuator	JFW	50HF-003N	-	2018/2/22	2019/2/28	12
SAT6-02	RE	145045	Attenuator	JFW	50HF-006N	-	2018/2/16	2019/2/28	12
SBA-02	RE	145022	Biconical Antenna	Schwarzbeck	BBA9106	91032665	2018/6/5	2019/6/30	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)	2018/4/9	2019/4/30	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)	2018/4/7	2019/4/30	12
SCC-G16	RE	145177	Coaxial Cable	Suhner	SUCOFLEX 102	32704/2	2018/3/19	2019/3/31	12
SCC-G33	RE	145184	Coaxial Cable	Junkosha	MWX241-01000KMSKMS	-	2018/4/20	2019/4/30	12
SCC-G43	RE	156380	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104_E	SN MY 13406/4E	2018/7/10	2019/7/31	12
SCC-G44	RE	168300	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800070/4A	2018/3/28	2019/3/31	12
SCC-G45	RE	168301	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102 E	800137/2EA	2018/3/28	2019/3/31	12
SFL-18	RE	145305	Highpass Filter	MICRO-TRONICS	HPM50111	119	2018/4/20	2019/4/30	12
SHA-02	RE	145384	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	2018/7/23	2019/7/31	12
SHA-04	RE	145512	Horn Antenna	ETS LINDGREN	Sep-60	LM3640	2018/7/23	2019/7/31	12
SJM-09	RE	145336	Measure	PROMART	SEN1935	-	-	-	-
SLA-06	RE	145528	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	195	2018/6/5	2019/6/30	12
SOS-03	RE	146317	Humidity Indicator	A&D	AD-5681	4063325	2017/10/30	2018/10/31	12
SSG-02	RE	146226	Signal Generator	AGILENT	E8257D-540	MY48051404	2018/3/8	2019/3/31	12
STR-07	RE	146209	Test Receiver	Rohde & Schwarz	ESU26	100484	2017/9/26	2018/9/30	12
STS-02	RE	145793	Digital Hitester	HIOKI	3805-50	80997819	2018/3/8	2019/3/31	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: RE: Radiated Emission test