RADIO TEST REPORT

Test Report No. : 13172683S-A

Applicant	:	**CASIO COMPUTER CO., LTD.**
Type of EUT	:	**Watch**
Model Number of EUT	:	**GR-B200**
FCC ID	:	**BBQS0IW**
Test regulation	:	**FCC Part 15 Subpart C: 2020 For Permissive Change (Radiated Spurious Emission tests only)**
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: January 20 to 22, 2020

Representative test engineer:
Hiromasa Sato
Engineer
Consumer Technology Division

Approved by:
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.: 13172683S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13172683S-A	June 1, 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 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	:	Watch
Model No.	:	GR-B200
Serial No.	:	Refer to SECTION 4.2
Rating	:	GR-B200 (Watch): Typical: DC 3.0 V, Min.: DC 1.9 V, Max.: DC 3.3 V CW5594 (Module): Normal: DC 3.0 V, Min.: DC 1.9 V, Max.: DC 3.3 V
Receipt Date of Sample (Information from test lab.)	:	December 18, 2019
Country of Mass-production	:	Thailand, Japan, China
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: GR-B200 (referred to as the EUT in this report) is a Watch.

* GR-B200 has alternative name as R029.

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 April 1, 2020 and effective June 1, 2020 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

* The revision does not affect the test result conducted before its effective date.

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(d)	5.1 dB 9920.000 MHz, AV, Vert. Tx BT LE 2480 MHz	Complied# a)	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 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 antenna 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 results are derived depending on whether or not laboratory uncertainty is applied.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor *k*=2.

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)			
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4,5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.6 dB	2.6 dB	2.5 dB	2.6 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 %
Temperature	0.95 deg.C.
Voltage	0.83 %

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

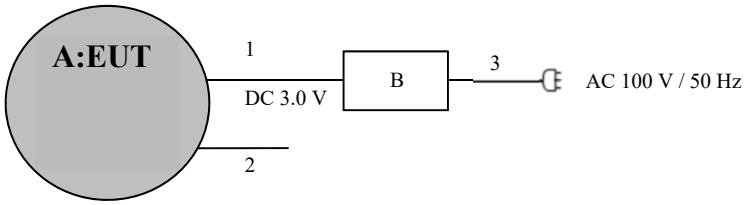
4.1 Operating Mode(s)

Mode	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 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	GR-B200	79	CASIO COMPUTER CO., LTD.	EUT
B	DC Power Supply	DE001677	PAN35-10A	KIKUSUI	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	0.1 + 1.5	Unshielded	Unshielded	*1)
2	Signal	0.1	Unshielded	Unshielded	*2)
3	AC	1.5	Unshielded	Unshielded	-

*1) These cable are extracted for testing.
*2) 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 v05r02".

[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 expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate.
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 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.

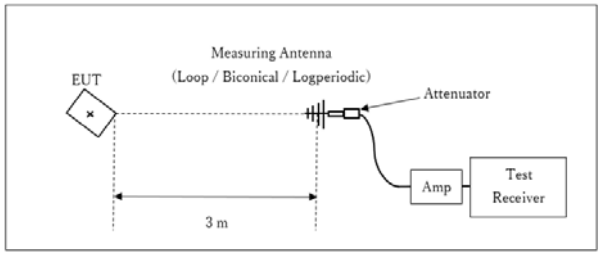
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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 1: Test Setup

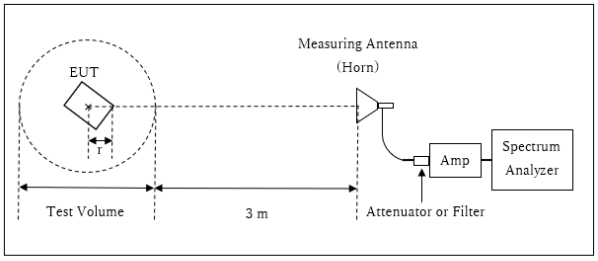
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz

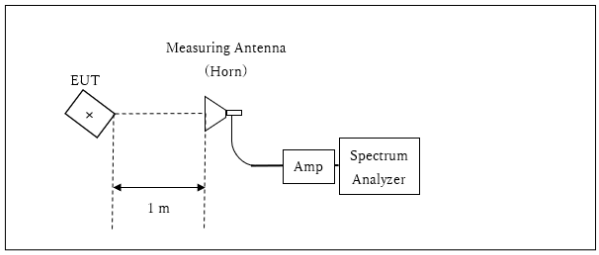


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.98 m / 3.0 m) = 2.46 dB
* Test Distance: (3 + Test Volume /2) - r = 3.98 m

Test Volume : 2.0 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.02 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.

	Below 1 GHz	1 GHz - 2.8 GHz	2.8 GHz - 13 GHz	13 GHz - 26.5 GHz
Horizontal	Z	Y	X	X
Vertical	Z	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

APPENDIX 1: Test data

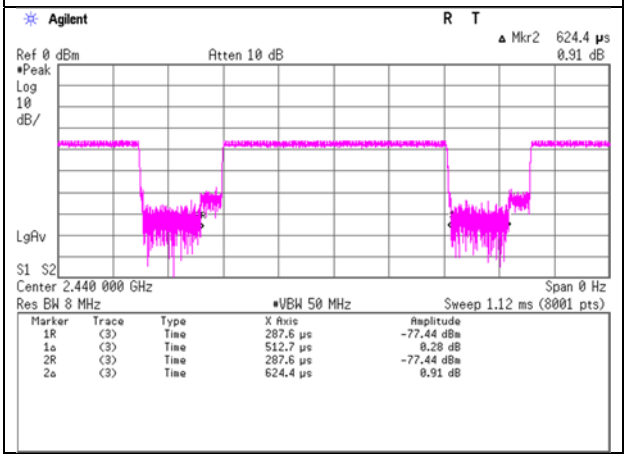
Burst rate confirmation

Report No.	13172683S-A
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date	January 22, 2020
Temperature / Humidity	23 deg. C / 40 % RH
Engineer	Hiromasa Sato
Mode	Tx BT LE

BT LE

for Radiated Emission Power

Tx on / (Tx on + Tx off) =	**0.821**
Tx on / (Tx on + Tx off) * 100 =	**82.1 %**
Duty factor = 20 * log (0.6244 / 0.5127) =	**1.71 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.	13172683S-A			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.3
Date	January 21, 2020	January 22, 2020	January 20, 2020	January 22, 2020
Temperature / Humidity	21 deg. C / 28 % RH	23 deg. C / 40 % RH	20 deg. C / 30 % RH	23 deg. C / 32 % RH
Engineer	Hiromasa Sato	Hiromasa Sato	Takahiro Suzuki	Kazuya Noda
	(30 MHz – 1 GHz)	(1 GHz – 13 GHz)	(13 GHz – 18 GHz)	(18 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.	31.827	QP	22.20	17.67	6.50	32.19	0.00	14.18	40.00	25.8	100	350	
Hori.	138.683	QP	30.40	14.21	7.62	32.13	0.00	20.10	43.50	23.4	246	96	
Hori.	175.218	QP	22.60	15.72	7.89	32.09	0.00	14.12	43.50	29.3	192	85	
Hori.	911.617	QP	20.80	21.60	11.05	30.99	0.00	22.46	46.00	23.5	100	5	
Hori.	2390.000	PK	47.17	28.33	14.07	41.59	2.46	50.44	73.90	23.4	131	28	
Hori.	4804.000	PK	53.42	31.62	6.58	42.88	2.46	51.20	73.90	22.7	177	120	
Hori.	7206.000	PK	47.68	37.23	8.08	42.92	2.46	52.53	73.90	21.3	100	0	
Hori.	9608.000	PK	48.01	38.84	9.21	43.17	2.46	55.35	73.90	18.5	100	0	
Vert.	55.988	QP	24.70	9.13	6.72	32.19	0.00	8.36	40.00	31.6	100	259	
Vert.	107.952	QP	29.60	11.46	7.29	32.15	0.00	16.20	43.50	27.3	100	67	
Vert.	194.414	QP	22.00	16.31	7.88	32.08	0.00	14.11	43.50	29.3	100	2	
Vert.	954.961	QP	20.40	21.54	11.19	30.60	0.00	22.53	46.00	23.4	100	9	
Vert.	2390.000	PK	46.81	28.33	14.07	41.59	2.46	50.08	73.90	23.8	166	12	
Vert.	4804.000	PK	53.89	31.62	6.58	42.88	2.46	51.67	73.90	22.2	200	83	
Vert.	7206.000	PK	48.50	37.23	8.08	42.92	2.46	53.35	73.90	20.5	100	0	
Vert.	9608.000	PK	47.32	38.84	9.21	43.17	2.46	54.66	73.90	19.2	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.46 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	38.43	28.33	14.07	41.59	1.71	2.46	43.41	53.90	10.4	*1)
Hori.	4804.000	AV	45.95	31.62	6.58	42.88	1.71	2.46	45.44	53.90	8.4	
Hori.	7206.000	AV	38.45	37.23	8.08	42.92	1.71	2.46	45.01	53.90	8.8	
Hori.	9608.000	AV	37.71	38.84	9.21	43.17	1.71	2.46	46.76	53.90	**7.1**	
Vert.	2390.000	AV	38.71	28.33	14.07	41.59	1.71	2.46	43.69	53.90	10.2	*1)
Vert.	4804.000	AV	46.63	31.62	6.58	42.88	1.71	2.46	46.12	53.90	7.7	
Vert.	7206.000	AV	38.67	37.23	8.08	42.92	1.71	2.46	45.23	53.90	8.6	
Vert.	9608.000	AV	37.65	38.84	9.21	43.17	1.71	2.46	46.70	53.90	7.2	

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 (3.98 m / 3.0 m) = 2.46 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)

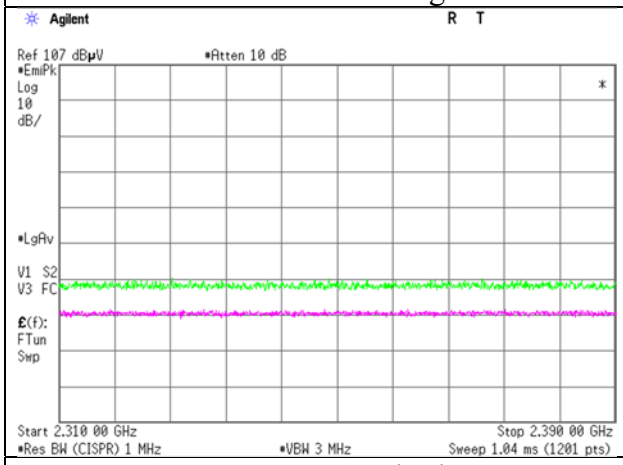
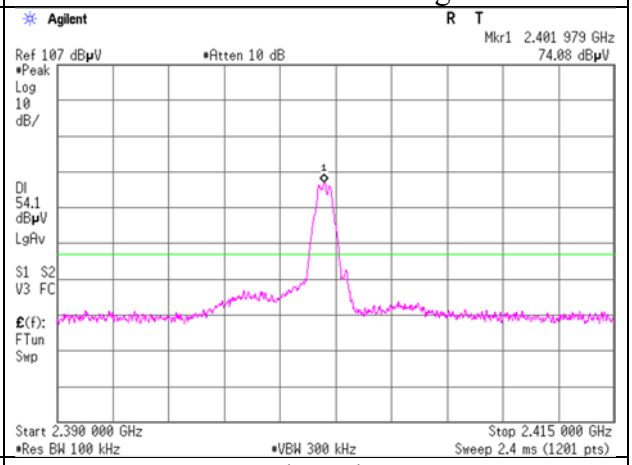
20 dBc Data Sheet **(RBW 100 kHz, VBW 300 kHz)**

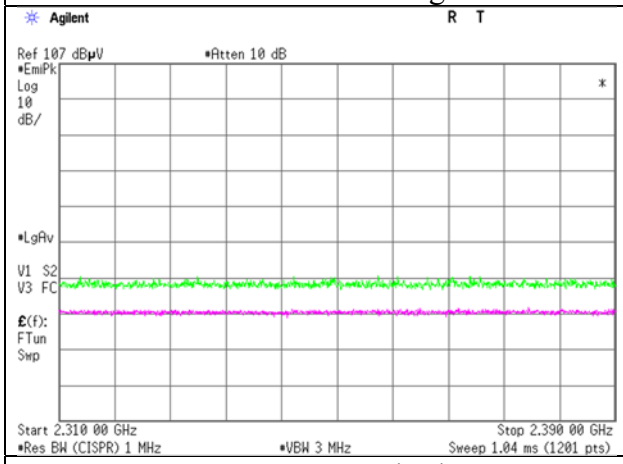
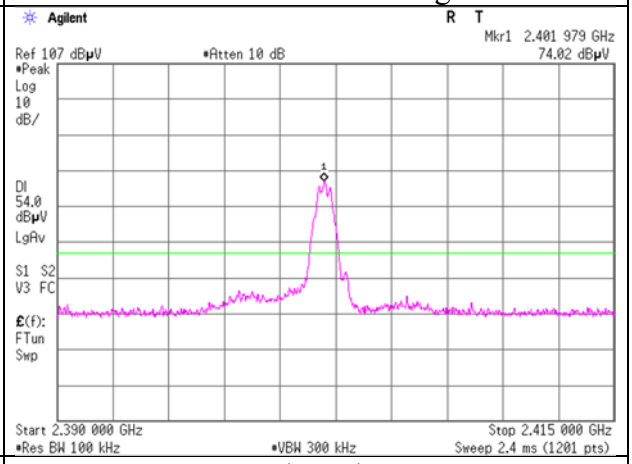
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	73.62	28.31	14.08	41.60	2.46	76.87	-	-	Carrier
Hori.	2399.717	PK	42.57	28.31	14.07	41.60	2.46	45.81	56.87	**11.0**	
Hori.	2400.000	PK	39.94	28.31	14.07	41.60	2.46	43.18	56.87	13.6	
Vert.	2402.000	PK	74.33	28.31	14.08	41.60	2.46	77.58	-	-	Carrier
Vert.	2399.853	PK	40.94	28.31	14.07	41.60	2.46	44.18	57.58	13.4	
Vert.	2400.000	PK	38.36	28.31	14.07	41.60	2.46	41.60	57.58	15.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.46 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.	13172683S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	January 22, 2020
Temperature / Humidity	23 deg. C / 40 % RH
Engineer	Hiromasa Sato
	(1 GHz – 13 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

* 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.	13172683S-A			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.3
Date	January 21, 2020	January 22, 2020	January 20, 2020	January 22, 2020
Temperature / Humidity	21 deg. C / 28 % RH	23 deg. C / 40 % RH	20 deg. C / 30 % RH	23 deg. C / 32 % RH
Engineer	Hiromasa Sato	Hiromasa Sato	Takahiro Suzuki	Kazuya Noda
	(30 MHz – 1 GHz)	(1 GHz – 13 GHz)	(13 GHz – 18 GHz)	(18 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.	138.682	QP	28.60	14.21	7.62	32.13	0.00	18.30	43.50	25.2	229	99	
Hori.	153.032	QP	22.10	14.82	7.86	32.12	0.00	12.66	43.50	30.8	162	99	
Hori.	167.870	QP	22.00	15.38	7.92	32.10	0.00	13.20	43.50	30.3	195	89	
Hori.	182.026	QP	22.20	15.94	7.87	32.09	0.00	13.92	43.50	29.5	164	235	
Hori.	936.051	QP	20.40	21.60	11.13	30.77	0.00	22.36	46.00	23.6	100	344	
Hori.	4880.000	PK	50.96	31.71	6.62	42.89	2.46	48.86	73.90	25.0	104	356	
Hori.	7320.000	PK	47.95	37.38	8.14	43.15	2.46	52.78	73.90	21.1	100	0	
Hori.	9760.000	PK	47.32	39.33	9.31	43.01	2.46	55.41	73.90	18.4	100	0	
Vert.	33.484	QP	21.70	17.15	6.54	32.19	0.00	13.20	40.00	26.8	100	0	
Vert.	55.869	QP	25.00	9.16	6.73	32.19	0.00	8.70	40.00	31.3	100	252	
Vert.	107.628	QP	29.10	11.40	7.30	32.15	0.00	15.65	43.50	27.8	100	70	
Vert.	955.899	QP	20.40	21.58	11.19	30.59	0.00	22.58	46.00	23.4	100	356	
Vert.	4880.000	PK	52.18	31.71	6.62	42.89	2.46	50.08	73.90	23.8	112	24	
Vert.	7320.000	PK	47.97	37.38	8.14	43.15	2.46	52.80	73.90	21.1	100	0	
Vert.	9760.000	PK	47.59	39.33	9.31	43.01	2.46	55.68	73.90	18.2	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.46 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	41.61	31.71	6.62	42.89	1.71	2.46	41.22	53.9	12.6	
Hori.	7320.000	AV	39.11	37.38	8.14	43.15	1.71	2.46	45.65	53.9	8.2	
Hori.	9760.000	AV	38.74	39.33	9.31	43.01	1.71	2.46	48.54	53.9	**5.3**	
Vert.	4880.000	AV	44.53	31.71	6.62	42.89	1.71	2.46	44.14	53.9	9.7	
Vert.	7320.000	AV	39.29	37.38	8.14	43.15	1.71	2.46	45.83	53.9	8.0	
Vert.	9760.000	AV	38.70	39.33	9.31	43.01	1.71	2.46	48.50	53.9	5.4	

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 (3.98 m / 3.0 m) = 2.46 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.	13172683S-A			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.3
Date	January 21, 2020	January 22, 2020	January 20, 2020	January 22, 2020
Temperature / Humidity	21 deg. C / 28 % RH	23 deg. C / 40 % RH	20 deg. C / 30 % RH	23 deg. C / 32 % RH
Engineer	Hiromasa Sato	Hiromasa Sato	Takahiro Suzuki	Kazuya Noda
	(30 MHz – 1 GHz)	(1 GHz – 13 GHz)	(13 GHz – 18 GHz)	(18 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.	130.608	QP	23.30	13.76	7.45	32.13	0.00	12.38	43.50	31.1	218	86	
Hori.	138.406	QP	28.80	14.20	7.61	32.13	0.00	18.48	43.50	25.0	233	96	
Hori.	157.307	QP	22.40	14.95	7.90	32.11	0.00	13.14	43.50	30.3	189	81	
Hori.	856.788	QP	21.30	21.30	10.89	31.33	0.00	22.16	46.00	23.8	100	44	
Hori.	2483.500	PK	50.82	28.24	14.16	41.62	2.46	54.06	73.90	19.8	269	0	
Hori.	2484.049	PK	49.91	28.24	14.16	41.62	2.46	53.15	73.90	20.7	269	0	
Hori.	4960.000	PK	49.37	31.96	6.67	42.91	2.46	47.55	73.90	26.3	160	33	
Hori.	7440.000	PK	47.89	37.56	8.21	43.38	2.46	52.74	73.90	21.1	100	0	
Hori.	9920.000	PK	47.52	39.18	9.42	42.84	2.46	55.74	73.90	18.1	100	0	
Vert.	55.787	QP	24.50	9.18	6.73	32.19	0.00	8.22	40.00	31.7	100	253	
Vert.	107.663	QP	28.60	11.41	7.30	32.15	0.00	15.16	43.50	28.3	100	73	
Vert.	176.748	QP	22.10	15.79	7.88	32.09	0.00	13.68	43.50	29.8	100	79	
Vert.	920.531	QP	20.80	21.67	11.08	30.91	0.00	22.64	46.00	23.3	100	346	
Vert.	2483.500	PK	50.50	28.24	14.16	41.62	2.46	53.74	73.90	20.1	269	333	
Vert.	2484.036	PK	50.34	28.24	14.16	41.62	2.46	53.58	73.90	20.3	269	333	
Vert.	4960.000	PK	50.30	31.96	6.67	42.91	2.46	48.48	73.90	25.4	105	28	
Vert.	7440.000	PK	47.59	37.56	8.21	43.38	2.46	52.44	73.90	21.4	100	0	
Vert.	9920.000	PK	47.66	39.18	9.42	42.84	2.46	55.88	73.90	18.0	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.46 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	40.70	28.24	14.16	41.62	1.71	2.46	45.65	53.9	8.2	*1)
Hori.	2484.049	AV	40.53	28.24	14.16	41.62	1.71	2.46	45.48	53.9	8.4	
Hori.	4960.000	AV	41.63	31.96	6.67	42.91	1.71	2.46	41.52	53.9	12.3	
Hori.	7440.000	AV	39.27	37.56	8.21	43.38	1.71	2.46	45.83	53.9	8.0	
Hori.	9920.000	AV	38.55	39.18	9.42	42.84	1.71	2.46	48.48	53.9	5.4	
Vert.	2483.500	AV	41.37	28.24	14.16	41.62	1.71	2.46	46.32	53.9	7.5	*1)
Vert.	2484.036	AV	40.86	28.24	14.16	41.62	1.71	2.46	45.81	53.9	8.0	
Vert.	4960.000	AV	41.75	31.96	6.67	42.91	1.71	2.46	41.64	53.9	12.2	
Vert.	7440.000	AV	38.91	37.56	8.21	43.38	1.71	2.46	45.47	53.9	8.4	
Vert.	9920.000	AV	38.80	39.18	9.42	42.84	1.71	2.46	48.73	53.9	**5.1**	

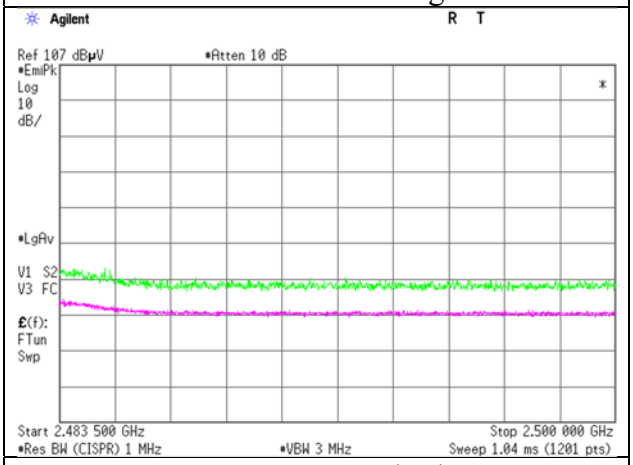
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.46 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty factor refer to "Duty factor Calculation chart" sheet.
*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13172683S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	January 22, 2020
Temperature / Humidity	23 deg. C / 40 % RH
Engineer	Hiromasa Sato
	(1 GHz – 13 GHz)
Mode	Tx BT LE 2480 MHz

Horizontal

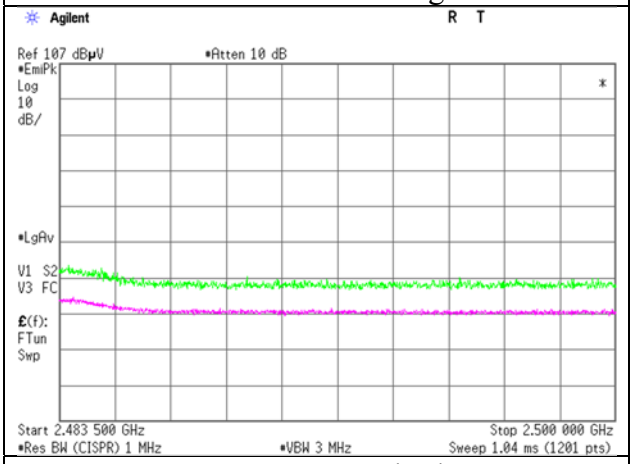
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

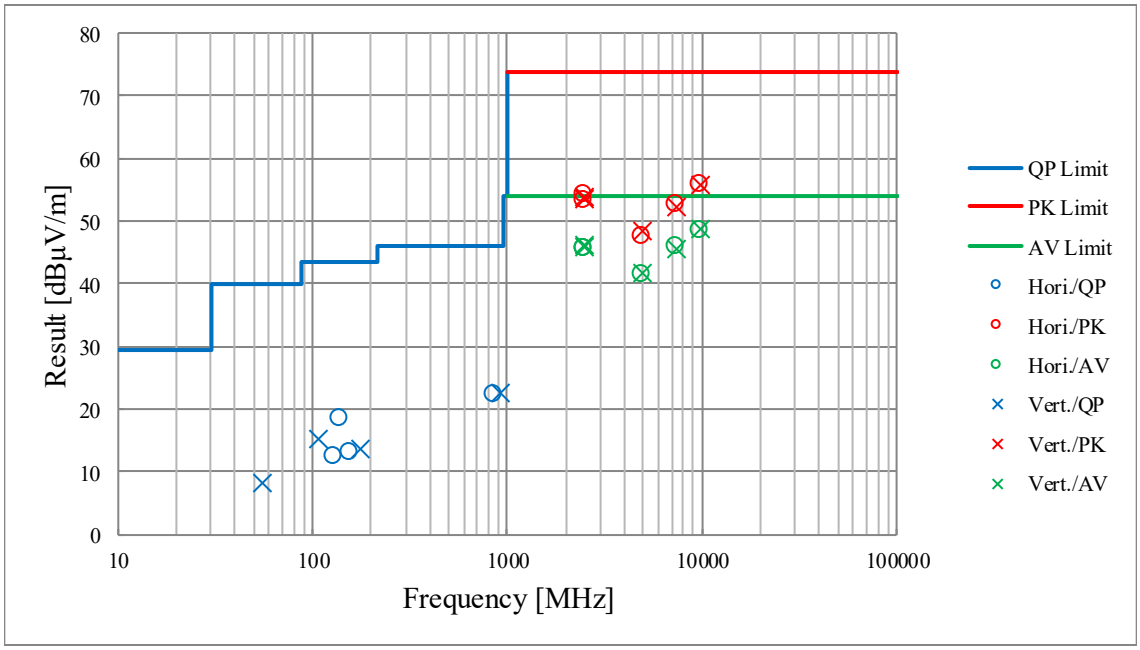


Trace Green : Peak Plot
Trace Purple : Average Plot

* 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.	13172683S-A			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3	No.3	No.3	No.3
Date	January 21, 2020	January 22, 2020	January 20, 2020	January 22, 2020
Temperature / Humidity	21 deg. C / 28 % RH	23 deg. C / 40 % RH	20 deg. C / 30 % RH	23 deg. C / 32 % RH
Engineer	Hiromasa Sato	Hiromasa Sato	Takahiro Suzuki	Kazuya Noda
	(30 MHz – 1 GHz)	(1 GHz – 13 GHz)	(13 GHz – 18 GHz)	(18 GHz – 26.5 GHz)
Mode	Tx BT LE 2480 MHz			



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

APPENDIX 2: Test instruments

Test equipment (1 / 2)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
RE	KJM-02	146432	Measure	TAJIMA	GL19-55	-	-	-
RE	SAEC-03(NSA)	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2020/04/12	12
RE	SAEC-03(SVSWR)	145566	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	2019/05/03	12
RE	SAF-03	145126	Pre Amplifier	SONOMA	310N	290213	2020/02/19	12
RE	SAF-06	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2020/02/20	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	SAT6-13	167094	Attenuator	JFW	50HF-006N	-	2020/02/21	12
RE	SBA-03	145023	Biconical Antenna	Schwarzbeck Mess - Elektronik	BBA9106	91032666	2019/05/07	12
RE	SCC-C1/C2/C3/C4/C5/C10/SRSE-03	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	2020/04/12	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2020/03/04	12
RE	SCC-G40	166491	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S005	2020/01/08	12
RE	SCC-G43	156380	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104_E	SN MY 13406/4E	2019/07/03	12
RE	SCC-G57	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2020/05/12	12
RE	SCC-G58	183047	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800287/4A	2019/07/23	12

Test equipment (2 / 2)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	SFL-02	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2019/11/06	12
RE	SHA-03	145501	Horn Antenna	Schwarzbeck Mess - Elektronik	BBHA9120D	9120D-739	2019/06/26	12
RE	SHA-04	145512	Horn Antenna	ETS LINDGREN	3160-09	00094868	2019/06/26	12
RE	SLA-07	145529	Logperiodic Antenna	Schwarzbeck Mess - Elektronik	VUSLP9111B	196	2019/05/07	12
RE	SOS-05	146293	Humidity Indicator	A&D Company	AD-5681	4062518	2019/10/08	12
RE	SOS-23	191840	Humidity Indicator	CUSTOM	CTH-201	-	2019/12/12	12
RE	SSA-02	145800	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250106	2020/04/16	12
RE	STR-08	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2019/11/22	12
RE	STS-03	146210	Digital Hitester	Hioki	3805-50	80997823	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: RE: Radiated Emission test