



Test report No.
Page
Issued date
FCC ID

: 14088225H-R1
: 1 of 21
: January 14, 2022
: 2ABXRBVMCN5103

RADIO TEST REPORT

Test Report No. : 14088225H-R1

Applicant : **Braveridge Co., Ltd.**

Type of EUT : **Bluetooth Low Energy Module**

Model Number of EUT : **BVMCN5103**

FCC ID : **2ABXRBVMCN5103**

Test regulation : **FCC Part 15 Subpart C: 2021**
***For Permissive Change**

Test result : **Complied (Refer to SECTION 3)**
***Spurious Emission Restricted Band Edges test only**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
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. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan, Inc. has been accredited.
9. The information provided from the customer for this report is identified in Section 1.
10. This report is a revised version of 14088225H. 14088225H is replaced with this report.

Date of test: December 3 to 12, 2021

Representative test engineer:

Hiroki Numata
Engineer

Approved by:

Takayuki Shimada
Leader



CERTIFICATE 5107.02

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

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Report Cover Page - 13-EM-F0429 Issue # 19.0

REVISION HISTORY

Original Test Report No.: 14088225H

Revision	Test report No.	Date	Page revised	Contents
- (Original)	14088225H	January 7, 2022	-	-
1	14088225H-R1	January 14, 2022	P.5	Correction of the Antenna Gain in Radio Specification of Clause 2.2. From 1.3 dBi to 1.32 dBi (Peak)
1	14088225H-R1	January 14, 2022	P.6	Deletion of the following sentence; *The customer has declared that the EUT has complies with FCC Part 15 Subpart B as SDoC.
1	14088225H-R1	January 14, 2022	P.18	Correction of the title

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	LIMS	Laboratory Information Management System
AC	Alternating Current	MCS	Modulation and Coding Scheme
AFH	Adaptive Frequency Hopping	MRA	Mutual Recognition Arrangement
AM	Amplitude Modulation	N/A	Not Applicable
Amp, AMP	Amplifier	NIST	National Institute of Standards and Technology
ANSI	American National Standards Institute	NS	No signal detect.
Ant, ANT	Antenna	NSA	Normalized Site Attenuation
AP	Access Point	OBW	Occupied BandWidth
ASK	Amplitude Shift Keying	OFDM	Orthogonal Frequency Division Multiplexing
Atten., ATT	Attenuator	P/M	Power meter
AV	Average	PCB	Printed Circuit Board
BPSK	Binary Phase-Shift Keying	PER	Packet Error Rate
BR	Bluetooth Basic Rate	PHY	Physical Layer
BT	Bluetooth	PK	Peak
BT LE	Bluetooth Low Energy	PN	Pseudo random Noise
BW	BandWidth	PRBS	Pseudo-Random Bit Sequence
Cal Int	Calibration Interval	PSD	Power Spectral Density
CCK	Complementary Code Keying	QAM	Quadrature Amplitude Modulation
Ch., CH	Channel	QP	Quasi-Peak
CISPR	Comite International Special des Perturbations Radioelectriques	QPSK	Quadrature Phase Shift Keying
CW	Continuous Wave	RBW	Resolution BandWidth
DBPSK	Differential BPSK	RDS	Radio Data System
DC	Direct Current	RE	Radio Equipment
D-factor	Distance factor	RF	Radio Frequency
DFS	Dynamic Frequency Selection	RMS	Root Mean Square
DQPSK	Differential QPSK	RNSS	Radio Navigation Satellite Service
DSSS	Direct Sequence Spread Spectrum	RSS	Radio Standards Specifications
DUT	Device Under Test	Rx	Receiving
EDR	Enhanced Data Rate	SA, S/A	Spectrum Analyzer
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	SG	Signal Generator
EMC	ElectroMagnetic Compatibility	SVSWR	Site-Voltage Standing Wave Ratio
EMI	ElectroMagnetic Interference	TR, T/R	Test Receiver
EN	European Norm	Tx	Transmitting
ERP, e.r.p.	Effective Radiated Power	VBW	Video BandWidth
ETSI	European Telecommunications Standards Institute	Vert.	Vertical
EU	European Union	WLAN	Wireless LAN
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		

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SECTION 1: Customer information

Company Name	:	Braveridge Co., Ltd.
Address	:	3-27-2 Shusenji Nishi-ku, Fukuoka-city, Fukuoka, Japan 819-0373
Telephone Number	:	+81-92-834-5789
Contact Person	:	Yuki Okawa

The information provided from the customer is as follows;

- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
 - Operating/Test Mode(s) (Mode(s)) on all the relevant pages
 - SECTION 1: Customer information
 - SECTION 2: Equipment under test (EUT) other than the Receipt Date
 - SECTION 4: Operation of EUT during testing
- * The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type	:	Bluetooth Low Energy Module
Model Number	:	BVMCN5103
Serial Number	:	Refer to SECTION 4.2
Receipt Date	:	December 2, 2021
Condition	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: BVMCN5103 (referred to as the EUT in this report) is a Bluetooth Low Energy Module.

General Specification

Rating	:	DC1.8 V - 3.6 V
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Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Antenna type	:	Multilayer Monopole Antenna
Antenna Gain	:	1.32 dBi (Peak)
Clock frequency (Maximum)	:	16 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on May 3, 2021 and effective July 2, 2021

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
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.13	FCC: Section 15.247(d) ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	2.5 dB 2382.00 MHz, AV, Vertical	Complied# a)	Radiated (above 30 MHz) *1)
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)

This EUT provides stable voltage constantly to RF part regardless of input voltage.
Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

The antenna is not removable from the EUT.
Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

3.3 Addition to standard

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

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

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		4.8 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
		5.0 dB
3 m	1 GHz to 6 GHz	4.9 dB
	6 GHz to 18 GHz	5.2 dB
1 m	10 GHz to 26.5 GHz	5.5 dB
	26.5 GHz to 40 GHz	5.5 dB
10 m	1 GHz to 18 GHz	5.2 dB

3.5 Test Location

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*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919

ISED Lab Company Number: 2973C / CAB identifier: JP0002

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Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

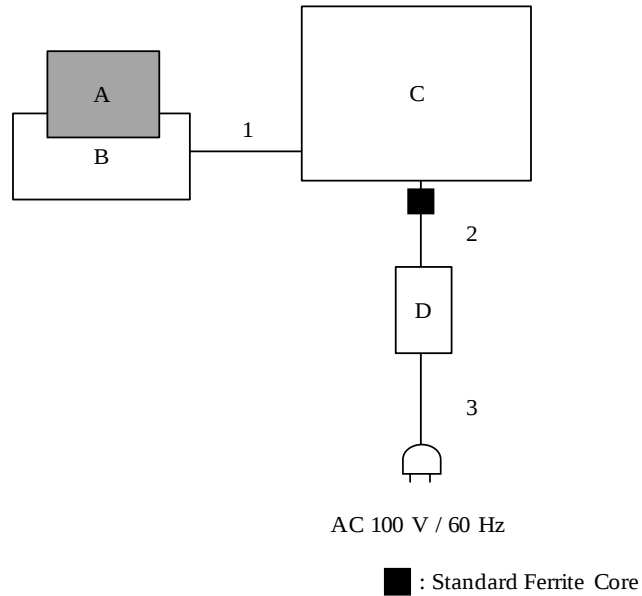
4.1 Operating Mode(s)

Mode	Remarks*
Bluetooth Low Energy (BLE) 1M-PHY Uncoded PHY (1M-PHY)	Maximum Packet Size, PRBS9
*Power of the EUT was set by the software as follows; *Transmitting duty was 100 % on all tests. Power settings: +4dBm Software: nRF Studio Version 1.21.1.1.3 (Date: December 3, 2021, Storage location: Driven by connected PC) *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Radiated Spurious Emission (Below 1 GHz)	BLE, 1M-PHY *1)	2402 MHz
Radiated Spurious Emission (Above 1 GHz),	BLE, 1M-PHY	2402 MHz 2440 MHz 2480 MHz
*1) Radiated Spurious emissions for frequencies below 1 GHz were limited to the channel that had the highest power during the antenna terminal test, as preliminary testing indicated that changing the operating frequency had no significant impact on the emissions in those frequency bands.		

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	Remark
A	Bluetooth Low Energy Module	BVMCN5103	001	Braveridge Co., Ltd.	EUT
B	Jig	-	-	-	-
C	Laptop PC	CF-W5	7HKSA86870	Panasonic	-
D	AC Adapter	08K8208	11S08K8208Z19MA5A S8NA	IBM	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	USB Cable	1.0	Shielded	Shielded	-
2	DC Cable	1.8	Unshielded	Unshielded	-
3	AC Cable	0.9	Unshielded	Unshielded	-

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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 urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

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

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	11.12.2.5.1 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces 11.12.2.5.2 The duty cycle was less than 98% for detected noise, a duty factor was added to the 11.12.2.5.1 results.	RBW: 100 kHz VBW: 300 kHz

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

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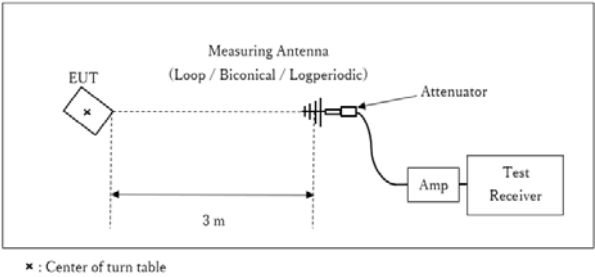
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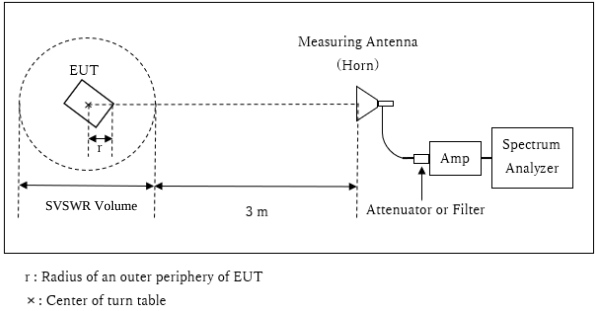
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz - 10 GHz



Distance Factor: $20 \times \log (4.0 \text{ m} / 3.0 \text{ m}) = 2.50 \text{ dB}$

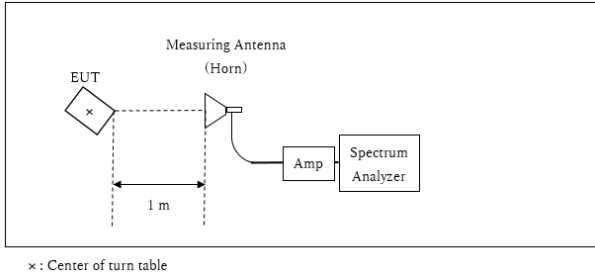
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 4.0 \text{ m}$

SVSWR Volume : 2.0 m

(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.0 \text{ m}$

* The test was performed with $r = 0.0 \text{ m}$ since EUT is small and it was the rather conservative condition.

10 GHz - 26.5 GHz



Distance Factor: $20 \times \log (1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

*Test Distance: 1 m

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range

Test data

Test result

: 30 MHz - 26.5 GHz

: APPENDIX

: Pass

APPENDIX 1: Test data

Radiated Spurious Emission

Report No.	14088225H	No.3
Test place	Ise EMC Lab.	No.3
Semi Anechoic Chamber	No.4	No.3
Date	December 3, 2021	December 9, 2021
Temperature / Humidity	20 deg. C / 40 % RH	24 deg. C / 43 % RH
Engineer	Hiroki Numata	Takumi Nishida
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx BT LE 2402 MHz	(Below 1 GHz)

Polarity	Frequency	Reading (QP / PK)	Reading (AV)	Ant. Factor	Loss	Gain	Duty Factor	Result (QP / PK)	Result (AV)	Limit (QP / PK)	Limit (AV)	Margin (QP / PK)	Margin (AV)	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	31.1	22.4	-	18.2	7.1	32.3	-	15.4	-	40.0	-	24.6	-	
Hori.	72.7	27.4	-	6.4	7.8	32.3	-	9.3	-	40.0	-	30.7	-	
Hori.	123.7	25.8	-	13.3	8.4	32.2	-	15.3	-	43.5	-	28.2	-	
Hori.	142.6	26.1	-	14.7	8.6	32.2	-	17.2	-	43.5	-	26.3	-	
Hori.	203.5	28.4	-	11.8	9.2	32.2	-	17.2	-	43.5	-	26.3	-	
Hori.	797.3	29.4	-	20.9	13.1	31.6	-	31.8	-	46.0	-	14.2	-	
Hori.	2325.0	62.2	48.2	28.0	5.5	31.8	-	63.9	49.9	73.9	53.9	10.0	4.0	
Hori.	2382.0	62.4	48.5	27.8	5.5	31.7	-	64.0	50.0	73.9	53.9	9.9	3.9	
Hori.	2390.0	54.8	41.5	27.8	5.5	31.7	-	56.3	43.0	73.9	53.9	17.6	10.9	
Hori.	4804.0	40.4	32.3	31.6	7.8	30.9	-	48.9	40.8	73.9	53.9	25.0	13.1	Floor noise
Hori.	7206.0	40.8	34.3	36.2	8.9	31.9	-	53.9	47.4	73.9	53.9	20.0	6.6	Floor noise
Hori.	9608.0	40.1	32.1	38.0	9.8	32.3	-	55.7	47.7	73.9	53.9	18.2	6.2	Floor noise
Vert.	31.1	23.1	-	18.2	7.1	32.3	-	16.1	-	40.0	-	23.9	-	
Vert.	72.7	41.3	-	6.4	7.8	32.3	-	23.2	-	40.0	-	16.8	-	
Vert.	123.7	32.8	-	13.3	8.4	32.2	-	22.3	-	43.5	-	21.2	-	
Vert.	142.6	35.3	-	14.7	8.6	32.2	-	26.4	-	43.5	-	17.1	-	
Vert.	203.5	37.2	-	11.8	9.2	32.2	-	26.0	-	43.5	-	17.5	-	
Vert.	797.3	27.3	-	20.9	13.1	31.6	-	29.7	-	46.0	-	16.3	-	
Vert.	2325.0	62.4	47.9	28.0	5.5	31.8	-	64.0	49.5	73.9	53.9	9.9	4.4	
Vert.	2382.0	63.9	49.8	27.8	5.5	31.7	-	65.5	51.4	73.9	53.9	8.4	2.5	
Vert.	2390.0	56.0	43.2	27.8	5.5	31.7	-	57.6	44.7	73.9	53.9	16.3	9.2	
Vert.	4804.0	40.4	32.1	31.6	7.8	30.9	-	48.9	40.6	73.9	53.9	25.0	13.3	Floor noise
Vert.	7206.0	40.7	34.2	36.2	8.9	31.9	-	53.8	47.3	73.9	53.9	20.1	6.6	Floor noise
Vert.	9608.0	40.1	32.1	38.0	9.8	32.3	-	55.7	47.6	73.9	53.9	18.2	6.3	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

*QP detector was used up to 1GHz.

20dBc Data Sheet

Polarity	Frequency	Reading (PK)	Ant Factor	Loss	Gain	Result	Limit	Margin	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
Hori.	2402.0	101.1	27.8	5.4	31.7	102.6	-	-	Carrier
Hori.	2400.0	53.5	27.8	5.4	31.7	54.9	82.6	27.6	
Vert.	2402.0	101.8	27.8	5.5	31.7	103.4	-	-	Carrier
Vert.	2400.0	54.6	27.8	5.5	31.7	56.1	83.4	27.2	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Distance factor: 1 GHz - 10 GHz 20log (4 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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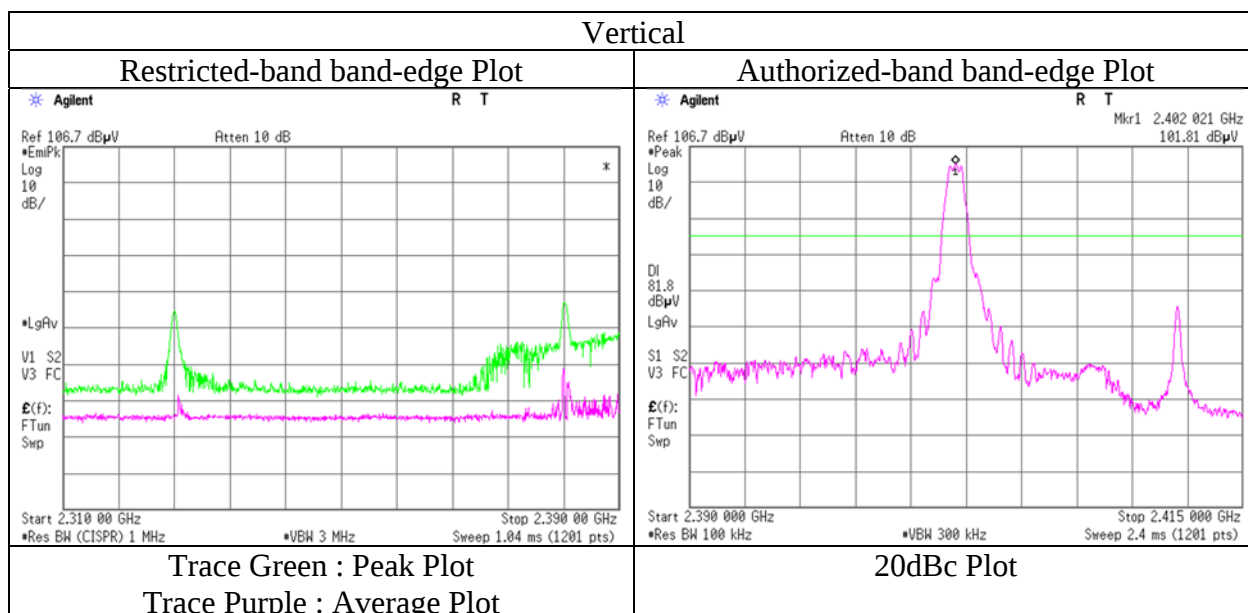
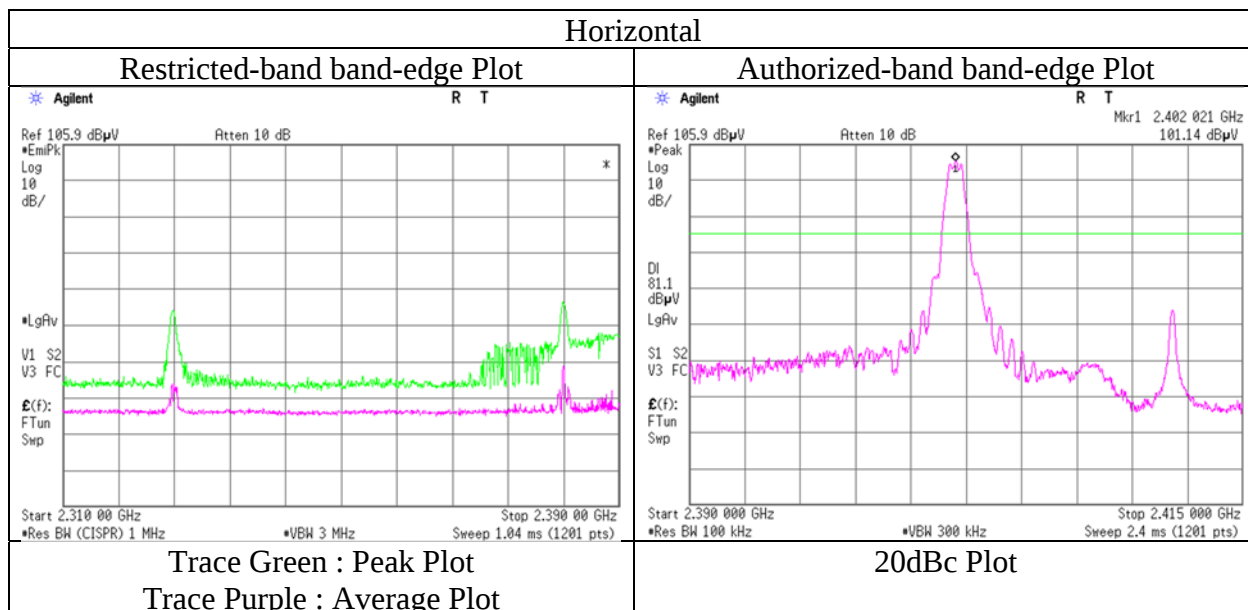
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Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	14088225H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	December 3, 2021
Temperature / Humidity	20 deg. C / 40 % RH
Engineer	Hiroki Numata
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

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Radiated Spurious Emission

Report No.	14088225H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.3
Date	December 3, 2021	December 9, 2021
Temperature / Humidity	20 deg. C / 40 % RH	24 deg. C / 43 % RH
Engineer	Hiroki Numata (1 GHz - 10 GHz)	Takumi Nishida (10 GHz - 26.5 GHz)
Mode	Tx BT LE 2440 MHz	

Polarity [Hori/Vert]	Frequency [MHz]	Reading (QP / PK) [dBuV]	Reading (AV) [dBuV]	Ant. Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result (QP / PK) [dBuV/m]	Result (AV) [dBuV/m]	Limit (QP / PK) [dBuV/m]	Limit (AV) [dBuV/m]	Margin (QP / PK) [dB]	Margin (AV) [dB]	Remark
Hori.	4880.0	40.4	32.9	31.6	7.8	30.9	-	48.9	41.5	73.9	53.9	25.0	12.4	Floor noise
Hori.	7320.0	40.3	34.0	36.3	8.9	32.0	-	53.5	47.1	73.9	53.9	20.4	6.8	Floor noise
Hori.	9760.0	40.1	31.0	38.4	9.8	32.3	-	56.0	46.9	73.9	53.9	17.9	7.0	Floor noise
Vert.	4880.0	40.3	32.7	31.6	7.8	30.9	-	48.9	41.2	73.9	53.9	25.0	12.7	Floor noise
Vert.	7320.0	40.9	33.2	36.3	8.9	32.0	-	54.1	46.3	73.9	53.9	19.8	7.6	Floor noise
Vert.	9760.0	40.0	31.0	38.4	9.8	32.3	-	55.9	46.9	73.9	53.9	18.0	7.0	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

*QP detector was used up to 1GHz.

Distance factor:	1 GHz - 10 GHz	20log (4 m / 3.0 m) = 2.5 dB
	10 GHz - 26.5 GHz	20log (1.0 m / 3.0 m) = -9.5 dB

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Radiated Spurious Emission

Report No.	14088225H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.3
Date	December 3, 2021	December 9, 2021
Temperature / Humidity	20 deg. C / 40 % RH	24 deg. C / 43 % RH
Engineer	Hiroki Numata	Takumi Nishida
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)
Mode	Tx BT LE 2480 MHz	

Polarity [Hori/Vert]	Frequency [MHz]	Reading (QP / PK) [dBuV]	Reading (AV) [dBuV]	Ant. Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result (QP / PK) [dBuV/m]	Result (AV) [dBuV/m]	Limit (QP / PK) [dBuV/m]	Limit (AV) [dBuV/m]	Margin (QP / PK) [dB]	Margin (AV) [dB]	Remark
Hori.	2483.5	53.7	40.1	27.7	5.6	31.7	-	55.2	41.7	73.9	53.9	18.7	12.3	
Hori.	2498.3	53.0	38.2	27.7	5.6	31.7	-	54.6	39.8	73.9	53.9	19.3	14.1	
Hori.	4960.0	40.8	32.7	31.7	7.8	30.8	-	49.5	41.3	73.9	53.9	24.4	12.6	Floor noise
Hori.	7440.0	40.3	34.0	36.5	8.9	32.1	-	53.6	47.2	73.9	53.9	20.3	6.7	Floor noise
Hori.	9920.0	40.0	31.1	38.6	9.9	32.4	-	56.0	47.1	73.9	53.9	17.9	6.8	Floor noise
Vert.	2483.5	52.0	39.0	27.7	5.6	31.7	-	53.6	40.6	73.9	53.9	20.3	13.3	
Vert.	2498.3	51.5	37.3	27.7	5.6	31.7	-	53.1	38.9	73.9	53.9	20.8	15.0	
Vert.	4960.0	40.4	32.8	31.7	7.8	30.8	-	49.1	41.5	73.9	53.9	24.8	12.5	Floor noise
Vert.	7440.0	40.7	34.0	36.5	8.9	32.1	-	53.9	47.2	73.9	53.9	20.0	6.7	Floor noise
Vert.	9920.0	40.0	31.1	38.6	9.9	32.4	-	56.0	47.1	73.9	53.9	17.9	6.8	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

20dBc Data Sheet

Polarity [Hori/Vert]	Frequency [MHz]	Reading (PK) [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2480.0	99.1	27.7	5.6	31.7	100.7	-	-	Carrier
Hori.	2506.4	53.8	27.7	5.6	31.7	55.4	80.7	25.3	
Hori.	2576.8	51.8	27.8	5.6	31.6	53.6	80.7	27.1	
Vert.	2480.0	97.1	27.7	5.6	31.7	98.7	-	-	Carrier
Vert.	2506.4	53.4	27.7	5.6	31.7	55.0	78.7	23.7	
Vert.	2576.8	51.1	27.8	5.6	31.6	52.9	78.7	25.8	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Distance factor:	1 GHz - 10 GHz	$20\log(4\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$
	10 GHz - 26.5 GHz	$20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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Ise EMC Lab.

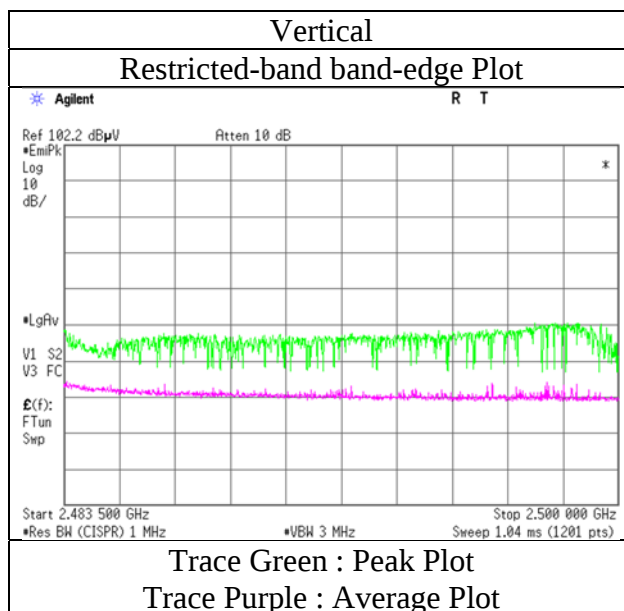
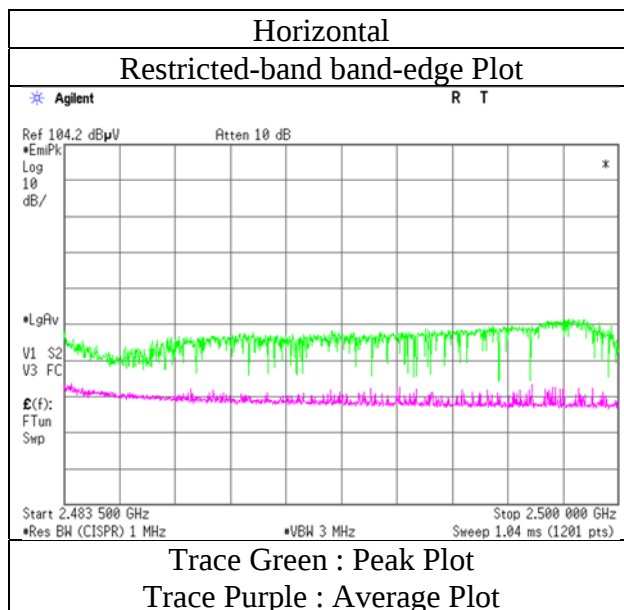
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Radiated Spurious Emission (Reference Plot for band-edge)

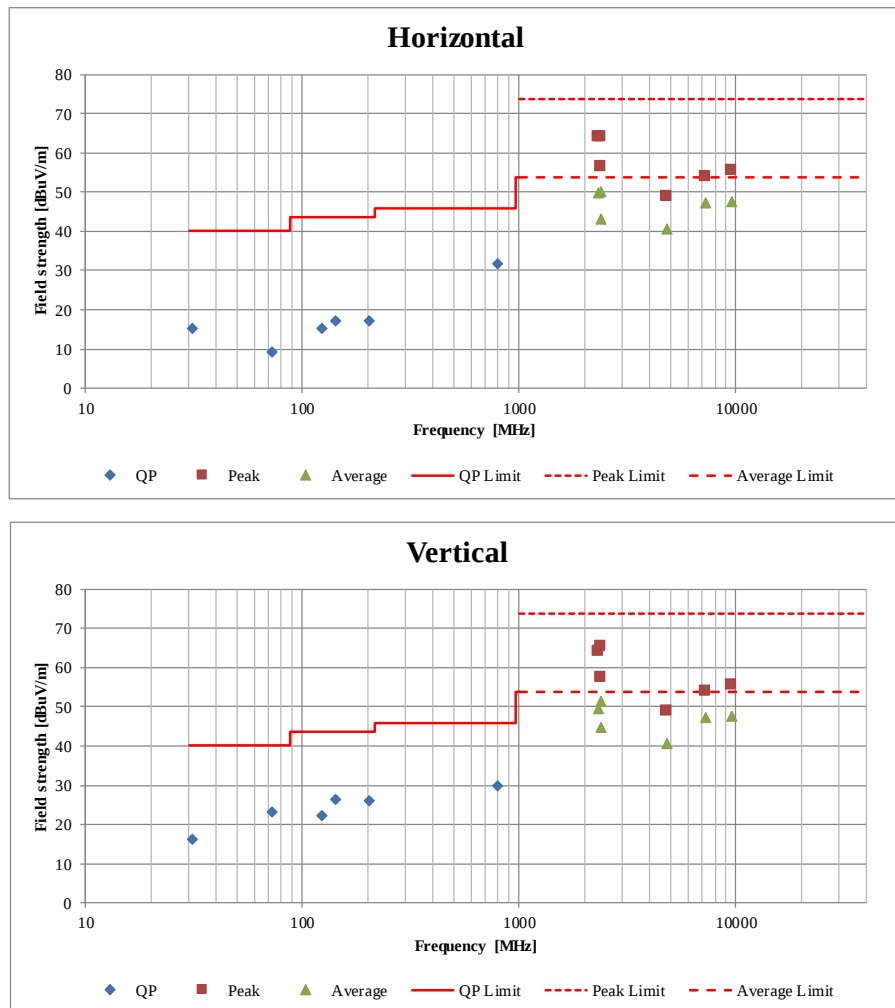
Report No. 14088225H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date December 3, 2021
Temperature / Humidity 20 deg. C / 40 % RH
Engineer Hiroki Numata
(1 GHz - 10 GHz)
Mode Tx BT LE 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case mode for Maximum Peak Output Power)

Report No.	14088225H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.3	No.3
Date	December 3, 2021	December 9, 2021 Night	December 12, 2021
Temperature / Humidity	20 deg. C / 40 % RH	24 deg. C / 43 % RH	22 deg. C / 43 % RH
Engineer	Hiroki Numata	Takumi Nishida	Hiroki Numata
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	(Below 1 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 equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/15/2021	12
RE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/07/2021	12
RE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-04-SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/12/2021	24
RE	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	557	05/10/2021	12
RE	MPA-12	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	10/07/2021	12
RE	MCC-257	208936	Microwave Cable	Huber+Suhner	SF126E/11PC35/11PC35/1000M,5000M	537061/126E / 537076/126E	07/18/2021	12
RE	MHF-26	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	09/30/2021	12
RE	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/10/2021	12
RE	MPA-11	141580	MicroWave System Amplifier	Keysight Technologies Inc	83017A	MY39500779	03/03/2021	12
RE	MHF-25	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/30/2021	12
RE	MHA-20	141507	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	258	11/09/2021	12
RE	MCC-231	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/1902S579(5m)	03/04/2021	12
RE	MHA-16	141513	Horn Antenna 15-40GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9170	BBHA9170306	06/07/2021	12
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2020	24
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/15/2021	12
RE	MMM-08	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	01/07/2021	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	-	-
RE	MAT-95	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/09/2021	12
RE	MBA-03	141424	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	1915	08/21/2021	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	07/19/2021	12
RE	MLA-22	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/21/2021	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/18/2021	12
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/05/2021	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

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