



RADIO TEST REPORT

Test Report No.: 14324388H-A-R1

Customer	HERUTU ELECTRONICS CORPORATION
Description of EUT	Sub-GHz Wireless Module
Model Number of EUT	HRF-SG01-US
FCC ID	T82-HRFSG01US
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied (Refer to SECTION 3)
Issue Date	January 6, 2023
Remarks	-

Representative Test Engineer

Sayaka Hara
Engineer

Approved By

Satofumi Matsuyama
Engineer



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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- The information provided from the customer for this report is identified in Section 1.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

REVISION HISTORY

Original Test Report No.: 14324388H-A

This report is a revised version of 14324388H-A. 14324388H-A is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14324388H-A	December 16, 2022	-
1	14324388H-A-R1	January 6, 2023	<u>APPENDIX 2: Test Instruments</u> - Added MLA-22, MBA-05, and MAT-95 for RE - Deleted MAEC-01 for RE

Reference: Abbreviations (Including words undescribed in this report)

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

CONTENTS	PAGE
SECTION 1: Customer Information	5
SECTION 2: Equipment Under Test (EUT).....	5
SECTION 3: Test Specification, Procedures & Results	6
SECTION 4: Operation of EUT during testing.....	9
SECTION 5: Conducted Emission	13
SECTION 6: Radiated Spurious Emission	14
SECTION 7: Antenna Terminal Conducted Tests.....	16
APPENDIX 1: Test Data	17
Conducted Emission	17
99 % Occupied Bandwidth and 6 dB Bandwidth	19
Maximum Peak Output Power.....	21
Average Output Power.....	22
Radiated Spurious Emission	24
Conducted Spurious Emission	36
Power Density	39
APPENDIX 2: Test Instruments.....	41
APPENDIX 3: Photographs of Test Setup	43
Conducted Emission	43
Radiated Spurious Emission	45
Worst Case Position	49
Antenna Terminal Conducted Tests.....	53

SECTION 1: Customer Information

Company Name	HERUTU ELECTRONICS CORPORATION
Address	422-1 Higashimikata-cho, Kita-ku, Hamamatsu-shi, Shizuoka, 433-8104 Japan
Telephone Number	+81-53-438-3511
Contact Person	Yoshihisa Murakami

The information provided from the customer is as follows;

- Customer, Description 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 and Test 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

Description	Sub-GHz Wireless Module
Model Number	HRF-SG01-US
Serial Number	Refer to SECTION 4.2
Condition	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	May 26, 2022 ^(*) (Tested on May 31, 2022) November 14, 2022 ^(*) (Tested on November 21 to 22, 2022) *In LPF circuit on the RF transmission circuit, attenuation width of signal above 1186 MHz was modified from 10 dB ^(*) to 30 dB ^(*) . It does not have influence on carrier characteristic.
Test Date	May 31 to November 22, 2022

2.2 Product Description

General Specification

Rating	DC 3 V
Operating temperature	-10 deg. C to 80 deg. C

Radio Specification

Equipment Type	Transceiver	
Frequency of Operation	902.6 MHz to 927.4 MHz	
Type of Modulation	LoRa	
Antenna Type	1/4λ Monopole antenna	1/2λ Dipole antenna
Antenna Gain	1 dBi	2 dBi

SECTION 3: Test Specification, Procedures & Results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C The latest version on the first day of the testing period
Title	FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

3.2 Procedures and Results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ISED: RSS-Gen 8.8	FCC: Section 15.207 ISED: RSS-Gen 8.8	31.74 dB, 0.15000 MHz, L (Dipole Antenna / Monopole Antenna)	Complied a)	-
6dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(a)(2) ISED: RSS-247 5.2(a)	See data.	Complied b)	Conducted *1)
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ISED: RSS-247 5.4(d)		Complied c)	Conducted
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(e) ISED: RSS-247 5.2(b)		Complied d)	Conducted *1)
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	1.6 dB 7316.8 MHz, AV, Horizontal (Dipole Antenna)	Complied e), f)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1), *2)
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. * In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred. * The preliminary test for Maximum Peak Output Power was conducted under conditions of operating voltage range of Vmin (2.7 V), Vnom (3.0 V), Vmax (3.3 V), and as a result, Vmax (3.3 V) was the worst. Therefore, all tests were conducted with Vmax (3.3 V). *1) As a result of the preliminary test was conducted with the sample after modification, there is no difference in the test results between before and after modification sample. Therefore, the test data of sample before modification were described in this report. (Except above 1 GHz of Spurious Emission) *2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 8.5 and 8.6. a) Refer to APPENDIX 1 (data of Conducted Emission) b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth) c) Refer to APPENDIX 1 (data of Maximum Peak Output Power) d) Refer to APPENDIX 1 (data of Power Density) e) Refer to APPENDIX 1 (data of Conducted Spurious Emission) f) Refer to APPENDIX 1 (data of Radiated Spurious Emission)					

FCC Part 15.31 (e)

The worst case stable voltage was provided to the EUT during the all tests.
And maximum and minimum voltage were provided to the EUT during the output power measurement test.
Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

The EUT has a unique coupling/antenna connector (Reverse SMA Plug).
Therefore the equipment complies with the requirement of 15.203.

3.3 Addition to Standard

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
99% Occupied Bandwidth	ISED: RSS-Gen 6.7	ISED: -	N/A	- a)	Conducted *1)
*1) As a result of the preliminary test was conducted with the sample after modification, there is no difference in the test results between before and after modification sample. Therefore, the test data of sample before modification were described in this report.					
a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)					

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

3.4 Uncertainty

Measurement uncertainty is not taken into account when stating conformity with a specified requirement.

Note: When margins obtained from test results are less than the measurement uncertainty, the test results may exceed the limit.

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

Conducted emission

Using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.7 dB
	0.15 MHz to 30 MHz	3.3 dB

Radiated emission

Measurement distance	Frequency range		Uncertainty (+/-)
3 m	9 kHz to 30 MHz		3.2 dB
10 m			3.0 dB
3 m	30 MHz to 200 MHz	Horizontal	4.8 dB
		Vertical	5.0 dB
	200 MHz to 1000 MHz	Horizontal	5.1 dB
		Vertical	6.2 dB
10 m	30 MHz to 200 MHz	Horizontal	4.8 dB
		Vertical	4.8 dB
	200 MHz to 1000 MHz	Horizontal	5.0 dB
		Vertical	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		5.4 dB
	26.5 GHz to 40 GHz		5.4 dB
10 m	1 GHz to 18 GHz		5.4 dB

Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %
Maximum Peak Output Power / Average Output Power	1.5 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.7 dB

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

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

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

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan

Telephone: +81-596-24-8999

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	-	-
Large Chamber	16.9 x 22.1 x 10.17	16.9 x 22.1	-	10 m
Small Chamber	5.3 x 6.69 x 3.59	5.3 x 6.69	-	-

* 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)

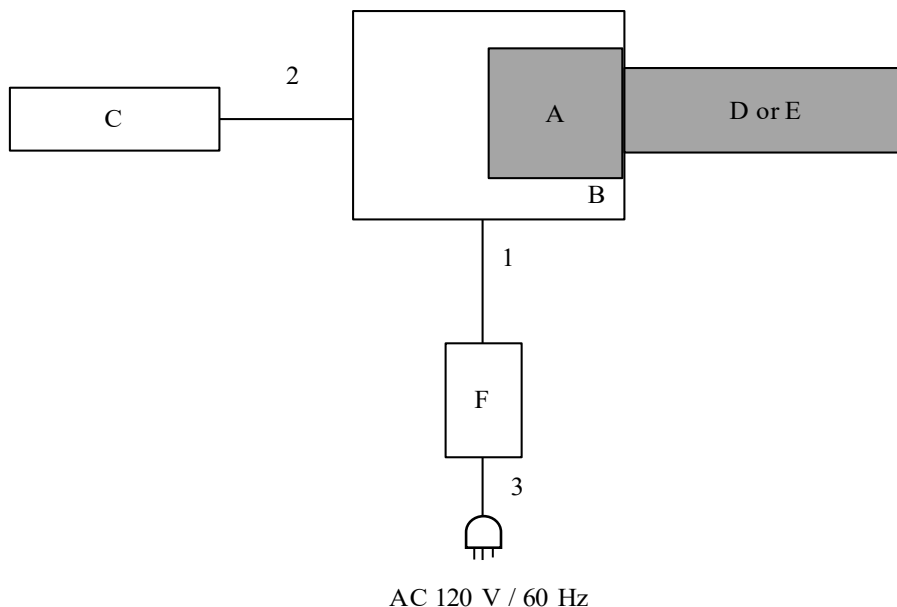
Mode	Remarks*
Transmitting mode (Tx)	-
*Power of the EUT was set by the software as follows; Power Setting: +14 dBm Software: HRF-SG01.bin V1.10 (Date: May 6, 2022, Storage location: MCU STM32L072KZU6) *This setting of software is the worst case. Any conditions under the normal use do not exceed the 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 Antenna	Tested frequency
Conducted Emission	Tx	Dipole Antenna Monopole Antenna	927.4 MHz
6dB Bandwidth, 99% Occupied Bandwidth, Maximum Peak Output Power, Conducted Spurious Emission, Power Density	Tx	-	902.6 MHz 914.6 MHz 927.4 MHz
Radiated Spurious Emission	Tx	Dipole Antenna Monopole Antenna	902.6 MHz 914.6 MHz 927.4 MHz

4.2 Configuration and Peripherals

Conducted Emission Test



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

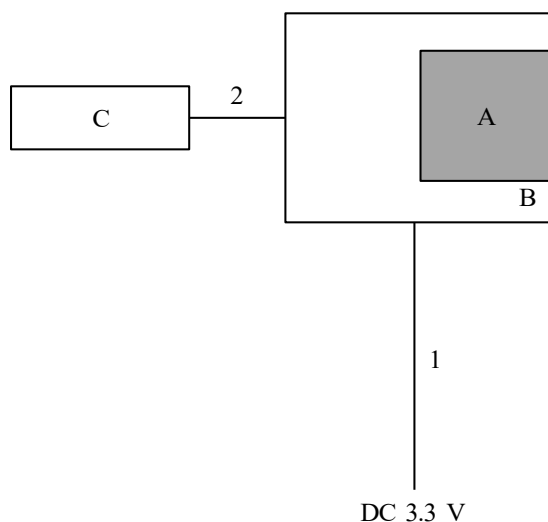
Description of EUT and Support Equipment

No.	Item	Model number	Serial Number	Manufacturer	Remarks
A	Sub-GHz Wireless Module	HRF-SG01-US	0302E00004	HERUTU ELECTRONICS CORPORATION	EUT
B	Jig	-	-	-	-
C	Switch	-	-	-	-
D	Dipole Antenna	MEGWX-467XRSBX-920	No.3	JOYMAX ELECTRONICS CO., LTD.	EUT
E	Monopole Antenna	MEGWX-241XRSBX-920A	No.4	JOYMAX ELECTRONICS CO., LTD.	EUT
F	DC Power Supply	PMC35-2A	13090501	KIKUSUI	-

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.3	Unshielded	Unshielded	-
2	Signal Cable	0.3	Unshielded	Unshielded	-
3	AC Cable	2.0	Unshielded	Unshielded	-

Antenna Terminal Conducted Tests



* 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	Sub-GHz Wireless Module	HRF-SG01-US	0302E00001 *1) 0302E00004 *2)	HERUTU ELECTRONICS CORPORATION	EUT
B	Jig	-	-	-	-
C	Switch	-	-	-	-

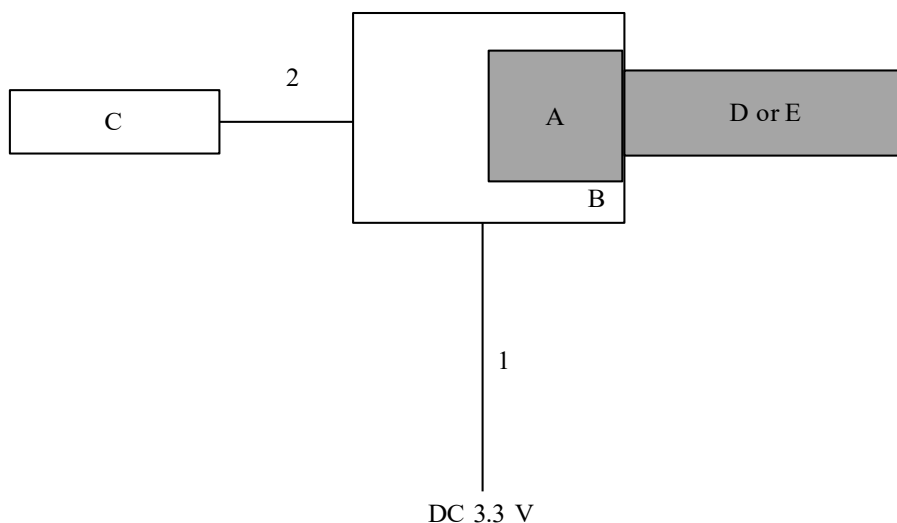
*1) Used for 99 % Occupied Bandwidth and 6 dB Bandwidth, Conducted Spurious Emission, Power Density

*2) Used for Maximum Peak Output Power, Average Output Power

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.3	Unshielded	Unshielded	-
2	Signal Cable	0.3	Unshielded	Unshielded	-

Radiated Spurious Emission Test



* 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	Sub-GHz Wireless Module	HRF-SG01-US	0302E00001 *1) 0302E00004 *2)	HERUTU ELECTRONICS CORPORATION	EUT
B	Jig	-	-	-	-
C	Switch	-	-	-	-
D	Dipole Antenna	MEGWX-467XRSBX-920	No.3	JOYMAX ELECTRONICS CO., LTD.	EUT
E	Monopole Antenna	MEGWX-241XRSBX-920A	No.4	JOYMAX ELECTRONICS CO., LTD.	EUT

*1) Below 1 GHz

*2) Above 1 GHz

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.3	Unshielded	Unshielded	-
2	Signal Cable	0.3	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and Conditions

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 rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

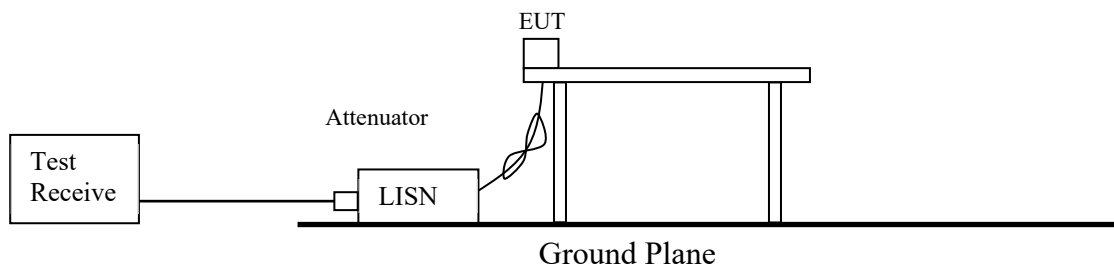
The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector	: QP and CISPR AV
Measurement Range	: 0.15 MHz to 30 MHz
Test Data	: APPENDIX
Test Result	: Pass

Figure 1: Test Setup



SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05r02".

[For below 1 GHz]

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

[For above 1 GHz]

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

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.

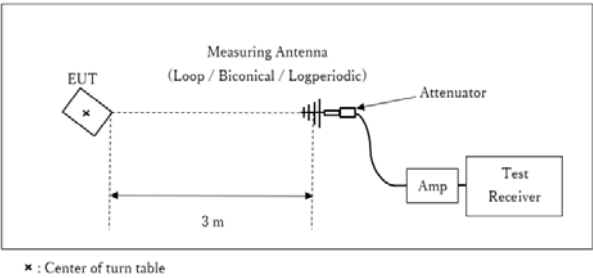
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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	RBW: 100 kHz VBW: 300 kHz

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

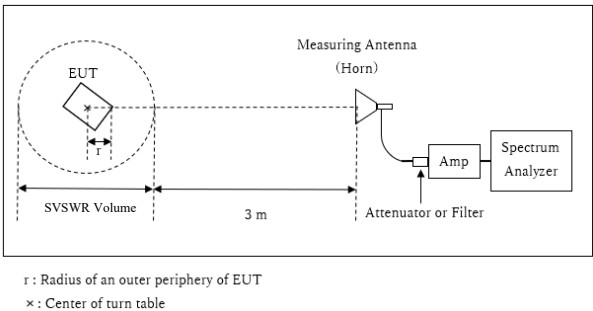
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz to 10 GHz



Distance Factor: $20 \times \log (3.95 \text{ m} / 3.0 \text{ m}) = 2.39 \text{ dB}$
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.95 \text{ m}$

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.05 \text{ m}$

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT (including antennas) 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 : 30 MHz to 10 GHz
Test Data : APPENDIX
Test Result : Pass

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument Used
6dB Bandwidth	3 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4) *5)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 kHz				

*1) Peak hold was applied as Worst-case measurement.

*2) Reference data

*3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".

*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)

*5) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to 45.5 – 51.5 = -6.0 dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

The test results and limit are rounded off to two decimals place, so some differences might be observed.
 The equipment and cables were not used for factor 0 dB of the data sheets.

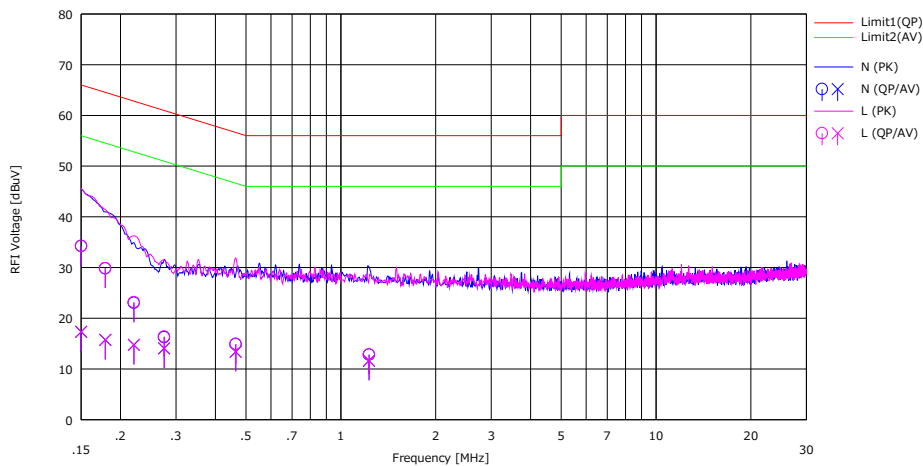
Test Data : APPENDIX
Test Result : Pass

APPENDIX 1: Test Data

Conducted Emission (Dipole Antenna)

Test place Ise EMC Lab. No.1 Semi Anechoic Chamber
Date November 22, 2022
Temperature / Humidity 23 deg. C / 46 % RH
Engineer Junya Okuno
Mode Tx 927.4 MHz

Limit : FCC_Part 15 Subpart C(15.207)



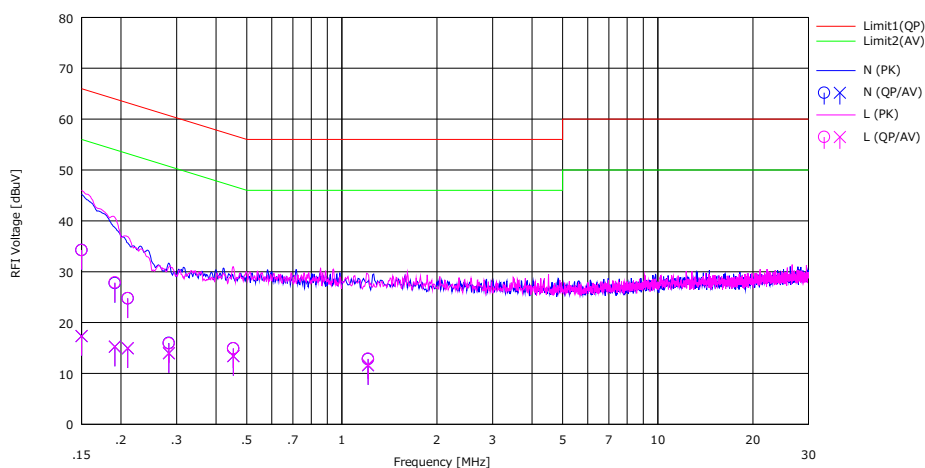
No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	21.10	4.20	0.04	13.09	34.23	17.33	66.00	56.00	31.77	38.67	N	
2	0.17890	16.70	2.60	0.04	13.10	29.84	15.74	64.54	54.54	34.70	38.80	N	
3	0.22055	9.90	1.60	0.04	13.11	23.05	14.75	62.80	52.80	39.75	38.05	N	
4	0.27506	3.10	0.90	0.04	13.13	16.27	14.07	60.96	50.96	44.69	36.89	N	
5	0.46407	1.70	0.20	0.04	13.16	14.90	13.40	56.62	46.62	41.72	33.22	N	
6	1.22914	-0.50	-1.70	0.04	13.28	12.82	11.62	56.00	46.00	43.18	34.38	N	
7	0.15000	21.10	4.20	0.07	13.09	34.26	17.36	66.00	56.00	31.74	38.64	L	
8	0.17890	16.70	2.60	0.06	13.10	29.86	15.76	64.54	54.54	34.68	38.78	L	
9	0.22055	10.00	1.60	0.06	13.11	23.17	14.77	62.80	52.80	39.63	38.03	L	
10	0.27506	3.20	0.90	0.07	13.13	16.40	14.10	60.96	50.96	44.56	36.86	L	
11	0.46407	1.70	0.20	0.06	13.16	14.92	13.42	56.62	46.62	41.70	33.20	L	
12	1.22914	-0.50	-1.70	0.07	13.28	12.85	11.65	56.00	46.00	43.15	34.35	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission (Monopole Antenna)

Test place Ise EMC Lab. No.1 Semi Anechoic Chamber
Date November 22, 2022
Temperature / Humidity 23 deg. C / 46 % RH
Engineer Junya Okuno
Mode Tx 927.4 MHz

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq. [MHz]	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	21.10	4.20	0.04	13.09	34.23	17.33	66.00	56.00	31.77	38.67	N	
2	0.19117	14.60	2.10	0.04	13.11	27.75	15.25	63.99	53.99	36.24	38.74	N	
3	0.21017	11.60	1.80	0.04	13.11	24.75	14.95	63.20	53.20	38.45	38.25	N	
4	0.28353	2.80	0.80	0.04	13.13	15.97	13.97	60.71	50.71	44.74	36.74	N	
5	0.45363	1.70	0.20	0.04	13.16	14.90	13.40	56.81	46.81	41.91	33.41	N	
6	1.21065	-0.50	-1.70	0.04	13.28	12.82	11.62	56.00	46.00	43.18	34.38	N	
7	0.15000	21.10	4.20	0.07	13.09	34.26	17.36	66.00	56.00	31.74	38.64	L	
8	0.19117	14.70	2.10	0.06	13.11	27.87	15.27	63.99	53.99	36.12	38.72	L	
9	0.21017	11.60	1.80	0.06	13.11	24.77	14.97	63.20	53.20	38.43	38.23	L	
10	0.28353	2.70	0.80	0.07	13.13	15.90	14.00	60.71	50.71	44.81	36.71	L	
11	0.45363	1.70	0.20	0.06	13.16	14.92	13.42	56.81	46.81	41.89	33.39	L	
12	1.21065	-0.50	-1.70	0.07	13.28	12.85	11.65	56.00	46.00	43.15	34.35	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

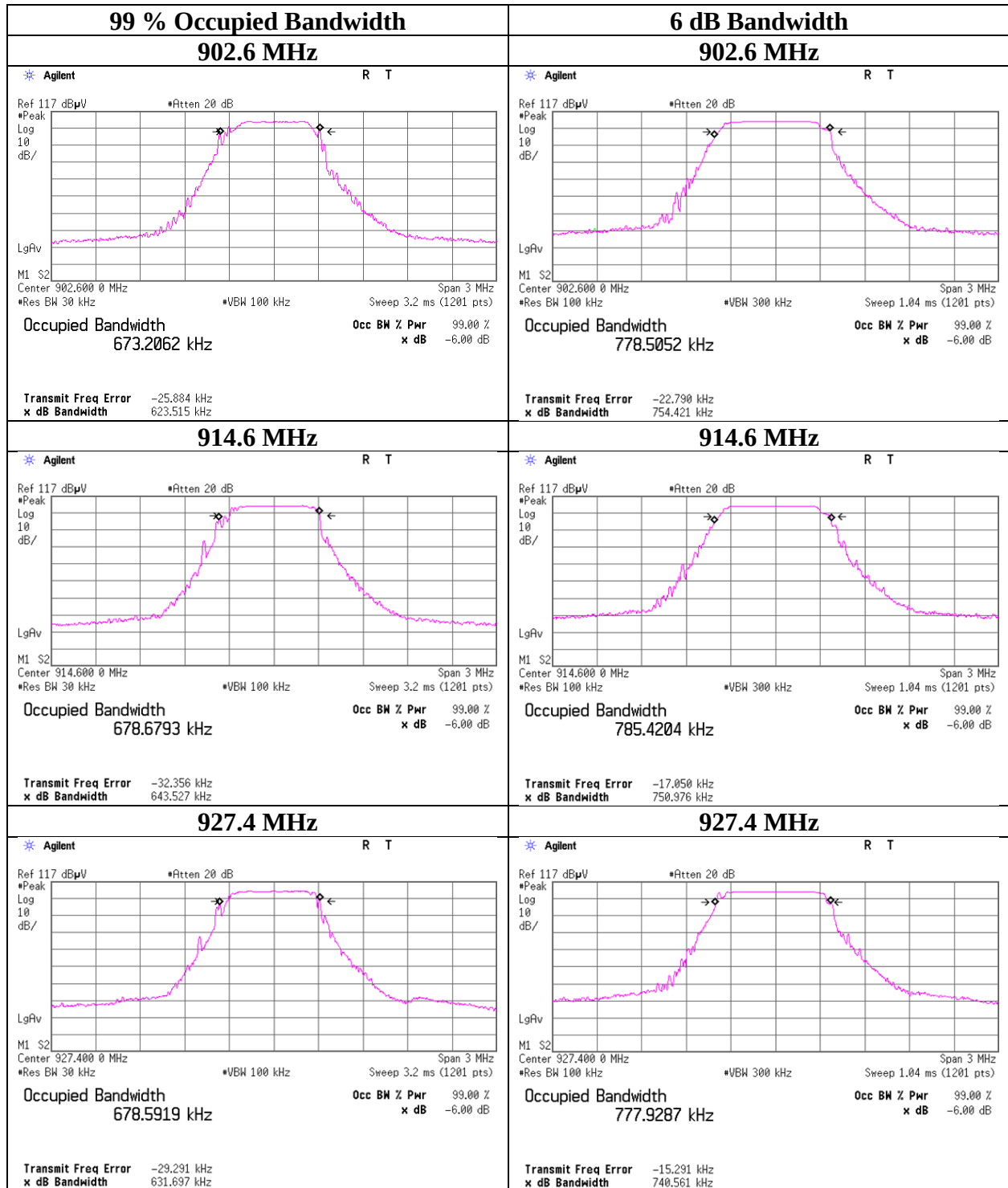
99 % Occupied Bandwidth and 6 dB Bandwidth

Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 31, 2022
Temperature / Humidity	24 deg. C / 61 % RH
Engineer	Sayaka Hara
Mode	Tx

Mode	Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [kHz]	Limit for 6 dB Bandwidth [kHz]
Tx	902.6	673.2062	754.421	> 500
	914.6	678.6793	750.976	> 500
	927.4	678.5919	740.561	> 500

99 % Occupied Bandwidth and 6 dB Bandwidth

Tx



Maximum Peak Output Power

Test place	Ise EMC Lab. No.1 Measurement Room
Date	November 22, 2022
Temperature / Humidity	23 deg. C / 46 % RH
Engineer	Junya Okuno
Mode	Tx

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power						e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin	
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]		
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]	
902.6	3.86	0.00	9.92	13.78	23.88	30.00	1000	16.22	2.00	15.78	37.84	36.02	4000	20.24	
914.6	3.97	0.00	9.92	13.89	24.49	30.00	1000	16.11	2.00	15.89	38.82	36.02	4000	20.13	
927.4	3.98	0.00	9.92	13.90	24.55	30.00	1000	16.10	2.00	15.90	38.90	36.02	4000	20.12	

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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

*The worst antenna gain was applied.

Average Output Power
(Reference data for RF Exposure)

Test place	Ise EMC Lab. No.1 Measurement Room
Date	November 22, 2022
Temperature / Humidity	23 deg. C / 46 % RH
Engineer	Junya Okuno
Mode	Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
902.6	3.81	0.00	9.92	13.73	23.60	0.00	13.73	23.60
914.6	3.92	0.00	9.92	13.84	24.21	0.00	13.84	24.21
927.4	3.93	0.00	9.92	13.85	24.27	0.00	13.85	24.27

Sample Calculation:

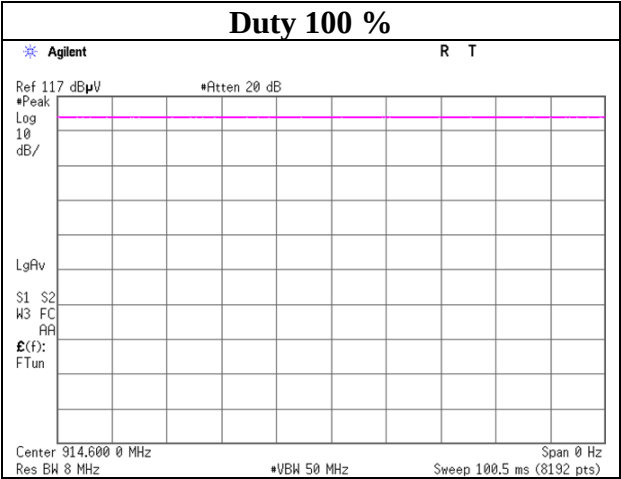
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

Result (Burst power average) = Time average + Duty factor

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

Burst rate confirmation

Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 31, 2022
Temperature / Humidity	24 deg. C / 61 % RH
Engineer	Sayaka Hara
Mode	Tx



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

Radiated Spurious Emission (Dipole Antenna)

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.3	November 21, 2022
Date	May 31, 2022	20 deg. C / 50 % RH
Temperature / Humidity	19 deg. C / 58 % RH	Junya Okuno
Engineer	Keiya Ido	(Above 1 GHz)
	(Below 1 GHz)	
Mode	Tx 902.6 MHz	

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.	2707.8	46.9	39.3	28.0	5.9	36.3	-	44.6	37.0	73.9	53.9	29.4	16.9	
Hori.	3610.4	55.8	51.0	29.1	6.4	36.1	-	55.3	50.5	73.9	53.9	18.6	3.4	
Hori.	4513.0	53.7	47.1	30.9	6.8	35.8	-	55.7	49.0	73.9	53.9	18.2	4.9	
Hori.	5415.6	51.4	44.5	31.7	7.3	35.7	-	54.7	47.8	73.9	53.9	19.2	6.1	
Hori.	8123.4	50.2	40.7	36.7	8.1	36.0	-	58.9	49.4	73.9	53.9	15.0	4.5	
Hori.	9026.0	44.0	35.3	37.5	8.4	36.1	-	53.9	45.2	73.9	53.9	20.1	8.7	Floor noise
Vert.	2707.8	47.6	39.0	28.0	5.9	36.3	-	45.3	36.6	73.9	53.9	28.6	17.3	
Vert.	3610.4	56.3	51.8	29.1	6.4	36.1	-	55.8	51.3	73.9	53.9	18.1	2.6	
Vert.	4513.0	51.5	43.4	30.9	6.8	35.8	-	53.5	45.3	73.9	53.9	20.5	8.6	
Vert.	5415.6	51.4	43.0	31.7	7.3	35.7	-	54.7	46.3	73.9	53.9	19.3	7.6	
Vert.	8123.4	45.2	36.1	36.7	8.1	36.0	-	53.8	44.8	73.9	53.9	20.1	9.1	Floor noise
Vert.	9026.0	44.1	35.3	37.5	8.4	36.1	-	54.0	45.1	73.9	53.9	19.9	8.8	Floor noise

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

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

*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.	902.6	81.1	22.2	13.6	0.0	116.9	-	-	Carrier
Hori.	902.0	52.6	22.2	13.6	0.0	88.4	96.9	8.4	
Hori.	1805.2	57.0	25.3	5.7	36.4	51.7	96.9	45.2	
Hori.	6318.2	66.7	33.2	7.7	35.7	71.9	96.9	25.0	
Hori.	7220.8	50.1	35.9	7.8	35.9	57.9	96.9	38.9	
Vert.	902.6	79.8	22.2	13.6	0.0	115.6	-	-	Carrier
Vert.	902.0	51.9	22.2	13.6	0.0	87.7	95.6	7.9	
Vert.	1805.2	57.4	25.3	5.7	36.4	52.0	95.6	43.6	
Vert.	6318.2	57.5	33.2	7.7	35.7	62.7	95.6	33.0	
Vert.	7220.8	47.4	35.9	7.8	35.9	55.3	95.6	40.4	

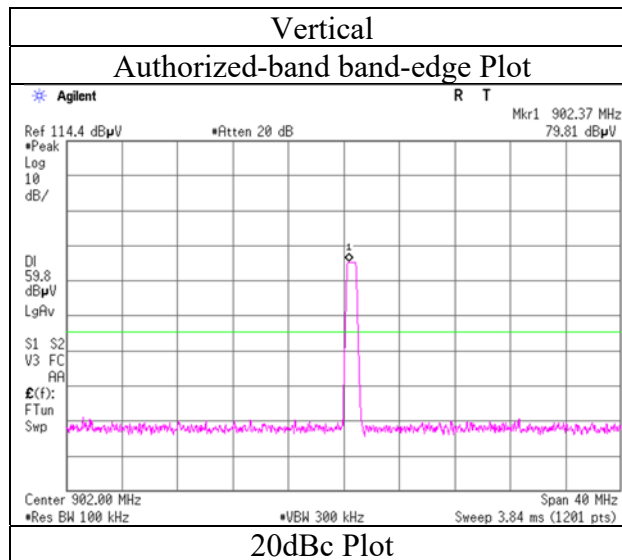
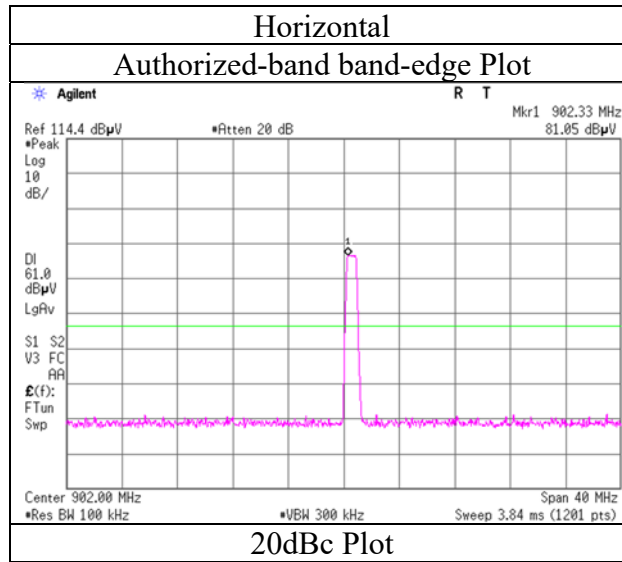
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Distance factor: 1 GHz - 10 GHz 20log (3.95 m / 3.0 m) = 2.39 dB

Radiated Spurious Emission
(Reference Plot for band-edge)
(Dipole Antenna)

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab.
No.3
May 31, 2022
19 deg. C / 58 % RH
Keiya Ido
(Below 1 GHz)
Tx 902.6 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 (Dipole Antenna)

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.3	No.1
Date	May 31, 2022	November 21, 2022
Temperature / Humidity	19 deg. C / 58 % RH	20 deg. C / 50 % RH
Engineer	Keiya Ido	Junya Okuno
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx 914.6 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.	2743.8	48.5	40.5	28.2	5.9	36.3	-	46.3	38.3	73.9	53.9	27.6	15.6	
Hori.	3658.4	55.7	51.4	29.3	6.4	36.0	-	55.4	51.1	73.9	53.9	18.5	2.8	
Hori.	4573.0	52.7	45.6	31.0	6.8	35.8	-	54.7	47.7	73.9	53.9	19.2	6.2	
Hori.	7316.8	52.3	44.3	36.1	7.8	35.9	-	60.4	52.3	73.9	53.9	13.5	1.6	
Hori.	8231.4	50.9	42.2	36.3	8.1	36.0	-	59.3	50.6	73.9	53.9	14.6	3.3	
Hori.	9146.0	44.5	35.3	38.0	8.5	36.1	-	54.9	45.7	73.9	53.9	19.1	8.2	Floor noise
Vert.	2743.8	47.9	40.4	28.2	5.9	36.3	-	45.7	38.2	73.9	53.9	28.2	15.7	
Vert.	3658.4	56.4	51.9	29.3	6.4	36.0	-	56.1	51.6	73.9	53.9	17.8	2.3	
Vert.	4573.0	49.6	40.2	31.0	6.8	35.8	-	51.7	42.3	73.9	53.9	22.2	11.6	
Vert.	7316.8	49.7	39.9	36.1	7.8	35.9	-	57.7	48.0	73.9	53.9	16.2	5.9	
Vert.	8231.4	45.4	36.4	36.3	8.1	36.0	-	53.8	44.8	73.9	53.9	20.1	9.1	Floor noise
Vert.	9146.0	44.4	35.3	38.0	8.5	36.1	-	54.8	45.7	73.9	53.9	19.1	8.2	Floor noise

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

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

*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 [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.	914.6	81.2	22.3	13.7	0.0	117.1	-	-	Carrier
Hori.	1829.2	55.8	25.4	5.7	36.3	50.5	97.1	46.6	
Hori.	5487.6	50.4	31.8	7.3	35.7	53.8	97.1	43.4	
Hori.	6402.2	65.8	33.6	7.7	35.7	71.3	97.1	25.9	
Vert.	914.6	79.1	22.3	13.7	0.0	115.0	-	-	Carrier
Vert.	1829.2	55.3	25.4	5.7	36.3	50.1	95.0	44.9	
Vert.	5487.6	48.3	31.8	7.3	35.7	51.7	95.0	43.3	
Vert.	6402.2	55.8	33.6	7.7	35.7	61.3	95.0	33.6	

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

Distance factor: 1 GHz - 10 GHz 20log(3.95 m / 3.0 m) = 2.39 dB

Radiated Spurious Emission (Dipole Antenna)

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.3	No.1
Date	May 31, 2022	November 21, 2022
Temperature / Humidity	19 deg. C / 58 % RH	20 deg. C / 50 % RH
Engineer	Keiya Ido	Junya Okuno
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx 927.4 MHz	

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.	49.1	28.1	-	11.5	7.6	32.2	-	14.9	-	40.0	-	25.1	-	
Hori.	320.0	32.1	-	14.5	10.7	32.0	-	25.3	-	46.0	-	20.7	-	
Hori.	400.0	32.3	-	16.1	11.5	32.0	-	27.8	-	46.0	-	18.2	-	
Hori.	480.0	29.2	-	17.5	12.1	32.0	-	26.8	-	46.0	-	19.2	-	
Hori.	512.0	24.6	-	17.9	12.3	32.0	-	22.8	-	46.0	-	23.2	-	
Hori.	2782.2	49.3	42.2	28.3	6.0	36.3	-	47.2	40.1	73.9	53.9	26.7	13.8	
Hori.	3709.6	54.9	50.1	29.4	6.5	36.0	-	54.7	49.9	73.9	53.9	19.2	4.0	
Hori.	4637.0	50.2	42.5	31.2	6.9	35.8	-	52.5	44.7	73.9	53.9	21.4	9.2	
Hori.	7419.2	51.6	43.2	36.2	7.9	35.9	-	59.8	51.4	73.9	53.9	14.1	2.5	
Hori.	8346.6	51.4	41.6	36.2	8.2	36.1	-	59.7	49.9	73.9	53.9	14.2	4.0	
Vert.	49.1	31.0	-	11.5	7.6	32.2	-	17.8	-	40.0	-	22.2	-	
Vert.	320.0	31.1	-	14.5	10.7	32.0	-	24.3	-	46.0	-	21.7	-	
Vert.	400.0	31.3	-	16.1	11.5	32.0	-	26.8	-	46.0	-	19.2	-	
Vert.	480.0	29.3	-	17.5	12.1	32.0	-	26.9	-	46.0	-	19.1	-	
Vert.	512.0	27.5	-	17.9	12.3	32.0	-	25.7	-	46.0	-	20.3	-	
Vert.	2782.2	49.0	41.7	28.3	6.0	36.3	-	46.9	39.7	73.9	53.9	27.0	14.3	
Vert.	3709.6	55.5	50.4	29.4	6.5	36.0	-	55.3	50.2	73.9	53.9	18.7	3.7	
Vert.	4637.0	49.7	41.8	31.2	6.9	35.8	-	52.0	44.0	73.9	53.9	21.9	9.9	
Vert.	7419.2	48.1	39.1	36.2	7.9	35.9	-	56.3	47.3	73.9	53.9	17.6	6.6	
Vert.	8346.6	46.0	36.9	36.2	8.2	36.1	-	54.3	45.2	73.9	53.9	19.6	8.7	Floor noise

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

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

*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.	927.4	81.2	22.2	13.7	0.0	117.1	-	-	Carrier
Hori.	928.0	45.2	22.2	13.7	0.0	81.1	97.1	16.0	
Hori.	1854.8	48.8	25.5	5.7	36.3	43.6	97.1	53.5	
Hori.	5564.4	52.6	31.7	7.3	35.7	56.0	97.1	41.1	
Hori.	6491.8	51.7	34.0	7.7	35.8	57.6	97.1	39.5	
Hori.	9274.0	34.8	38.6	8.5	36.2	45.8	97.1	51.3	Floor noise
Vert.	927.4	79.2	22.2	13.7	0.0	115.1	-	-	Carrier
Vert.	928.0	43.0	22.2	13.7	0.0	78.9	95.1	16.2	
Vert.	1854.8	48.3	25.5	5.7	36.3	43.1	95.1	52.0	
Vert.	5564.4	48.8	31.7	7.3	35.7	52.2	95.1	42.9	
Vert.	6491.8	43.4	34.0	7.7	35.8	49.3	95.1	45.8	
Vert.	9274.0	34.8	38.6	8.5	36.2	45.8	95.1	49.3	Floor noise

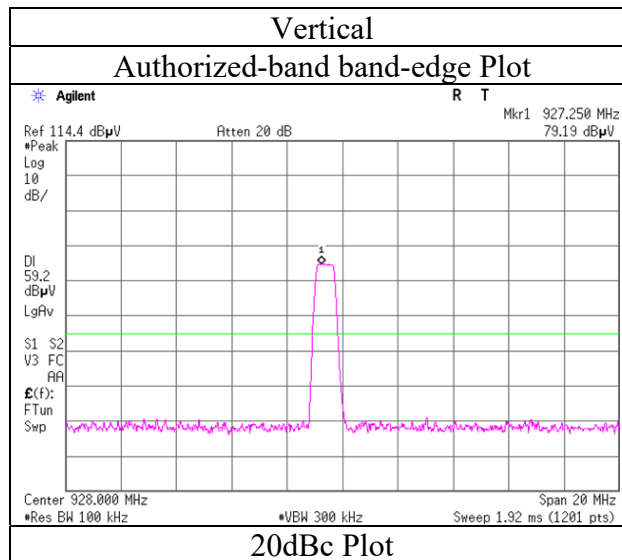
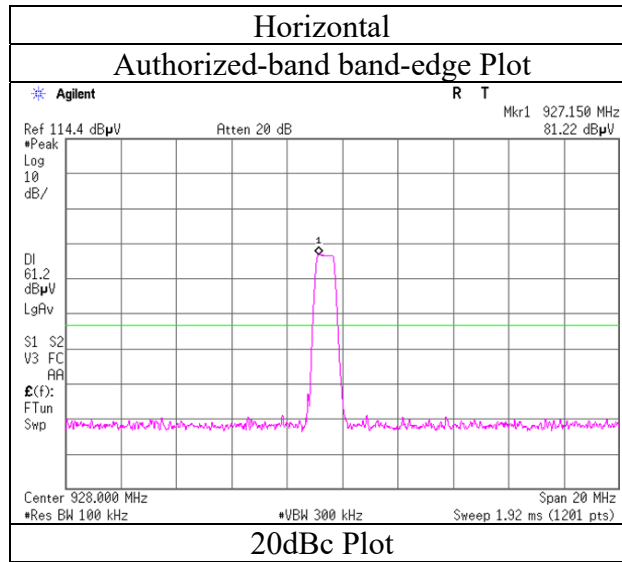
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Distance factor: 1 GHz - 10 GHz 20log (3.95 m / 3.0 m) = 2.39 dB

Radiated Spurious Emission
(Reference Plot for band-edge)
(Dipole Antenna)

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab.
No.3
May 31, 2022
19 deg. C / 58 % RH
Keiya Ido
(Below 1 GHz)
Tx 927.4 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 (Monopole Antenna)

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.3	No.1
Date	May 31, 2022	November 21, 2022
Temperature / Humidity	19 deg. C / 58 % RH	20 deg. C / 50 % RH
Engineer	Keiya Ido	Junya Okuno
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx 902.6 MHz	

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.	2707.8	46.2	36.6	28.0	5.9	36.3	-	43.8	34.2	73.9	53.9	30.1	19.7	
Hori.	3610.4	53.9	48.9	29.1	6.4	36.1	-	53.4	48.3	73.9	53.9	20.5	5.6	
Hori.	4513.0	51.9	45.4	30.9	6.8	35.8	-	53.8	47.3	73.9	53.9	20.1	6.6	
Hori.	5415.6	52.2	45.4	31.7	7.3	35.7	-	55.5	48.7	73.9	53.9	18.4	5.2	
Hori.	8123.4	48.2	38.1	36.7	8.1	36.0	-	56.8	46.8	73.9	53.9	17.1	7.1	
Hori.	9026.0	44.1	35.4	37.5	8.4	36.1	-	53.9	45.3	73.9	53.9	20.0	8.7	Floor noise
Vert.	2707.8	45.3	37.0	28.0	5.9	36.3	-	43.0	34.7	73.9	53.9	30.9	19.3	
Vert.	3610.4	55.8	51.4	29.1	6.4	36.1	-	55.3	50.9	73.9	53.9	18.6	3.0	
Vert.	4513.0	51.5	45.1	30.9	6.8	35.8	-	53.4	47.0	73.9	53.9	20.5	6.9	
Vert.	5415.6	50.6	43.2	31.7	7.3	35.7	-	53.9	46.5	73.9	53.9	20.0	7.4	
Vert.	8123.4	45.2	36.1	36.7	8.1	36.0	-	53.9	44.8	73.9	53.9	20.0	9.1	Floor noise
Vert.	9026.0	44.2	35.4	37.5	8.4	36.1	-	54.0	45.2	73.9	53.9	19.9	8.7	Floor noise

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

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

*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

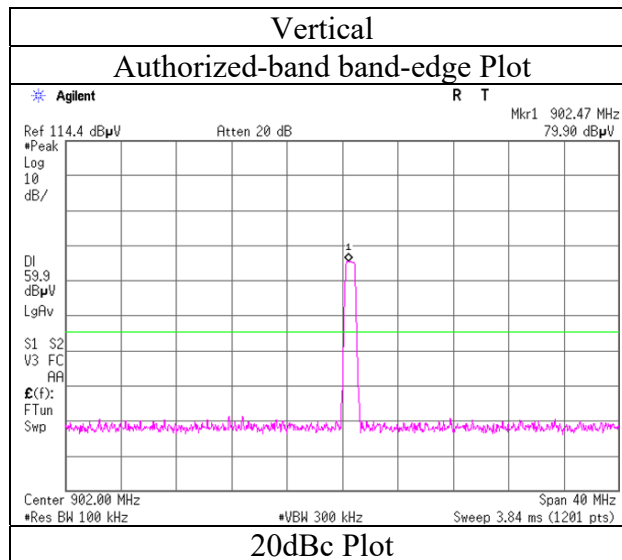
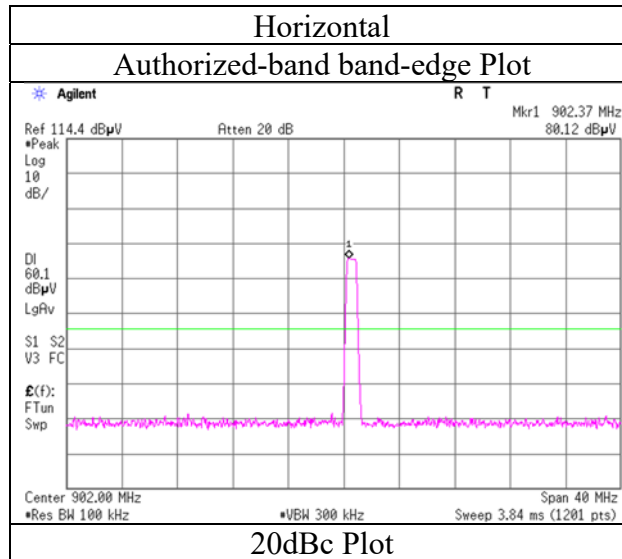
Polarity	Frequency	Reading (PK)	Ant Factor	Loss	Gain	Result	Limit	Margin	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
Hori.	902.6	80.1	22.2	13.6	0.0	115.9	-	-	Carrier
Hori.	902.0	51.9	22.2	13.6	0.0	87.7	95.9	8.3	
Hori.	1805.2	51.1	25.3	5.7	36.4	45.7	95.9	50.3	
Hori.	6318.2	71.2	33.2	7.7	35.7	76.4	95.9	19.6	
Hori.	7220.8	47.0	35.9	7.8	35.9	54.9	95.9	41.0	
Vert.	902.6	79.9	22.2	13.6	0.0	115.7	-	-	Carrier
Vert.	902.0	51.8	22.2	13.6	0.0	87.6	95.7	8.1	
Vert.	1805.2	53.5	25.3	5.7	36.4	48.1	95.7	47.6	
Vert.	6318.2	61.4	33.2	7.7	35.7	66.6	95.7	29.1	
Vert.	7220.8	42.7	35.9	7.8	35.9	50.6	95.7	45.1	

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

Distance factor: 1 GHz - 10 GHz 20log (3.95 m / 3.0 m) = 2.39 dB

Radiated Spurious Emission
(Reference Plot for band-edge)
(Monopole Antenna)

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.3	November 21, 2022
Date	May 31, 2022	20 deg. C / 50 % RH
Temperature / Humidity	19 deg. C / 58 % RH	Junya Okuno
Engineer	Keiya Ido	(Above 1 GHz)
	(Below 1 GHz)	
Mode	Tx 902.6 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 (Monopole Antenna)

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.3	No.1
Date	May 31, 2022	November 21, 2022
Temperature / Humidity	19 deg. C / 58 % RH	20 deg. C / 50 % RH
Engineer	Keiya Ido	Junya Okuno
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx 914.6 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.	2743.8	48.6	36.4	28.2	5.9	36.3	-	46.4	34.2	73.9	53.9	27.6	19.7	
Hori.	3658.4	53.2	48.2	29.3	6.4	36.0	-	52.9	47.9	73.9	53.9	21.0	6.0	
Hori.	4573.0	52.4	46.4	31.0	6.8	35.8	-	54.5	48.5	73.9	53.9	19.4	5.5	
Hori.	7316.8	52.4	43.6	36.1	7.8	35.9	-	60.4	51.7	73.9	53.9	13.5	2.2	
Hori.	8231.4	49.1	39.7	36.3	8.1	36.0	-	57.5	48.1	73.9	53.9	16.4	5.8	
Hori.	9146.0	44.5	35.4	38.0	8.5	36.1	-	54.9	45.8	73.9	53.9	19.0	8.1	Floor noise
Vert.	2743.8	45.9	36.8	28.2	5.9	36.3	-	43.7	34.6	73.9	53.9	30.2	19.3	
Vert.	3658.4	55.7	51.3	29.3	6.4	36.0	-	55.4	50.9	73.9	53.9	18.5	3.0	
Vert.	4573.0	52.0	45.5	31.0	6.8	35.8	-	54.1	47.5	73.9	53.9	19.8	6.4	
Vert.	7316.8	46.1	36.9	36.1	7.8	35.9	-	54.1	44.9	73.9	53.9	19.8	9.0	
Vert.	8231.4	45.4	36.4	36.3	8.1	36.0	-	53.8	44.8	73.9	53.9	20.2	9.2	Floor noise
Vert.	9146.0	44.6	35.4	38.0	8.5	36.1	-	54.9	45.8	73.9	53.9	19.0	8.1	Floor noise

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

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

*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 [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.	914.6	80.3	22.3	13.7	0.0	116.2	-	-	Carrier
Hori.	1829.2	47.2	25.4	5.7	36.3	42.0	96.2	54.2	
Hori.	5487.6	50.1	31.8	7.3	35.7	53.5	96.2	42.7	
Hori.	6402.2	72.9	33.6	7.7	35.7	78.5	96.2	17.7	
Vert.	914.6	79.8	22.3	13.7	0.0	115.7	-	-	Carrier
Vert.	1829.2	49.6	25.4	5.7	36.3	44.3	95.7	51.3	
Vert.	5487.6	48.4	31.8	7.3	35.7	51.9	95.7	43.8	
Vert.	6402.2	63.9	33.6	7.7	35.7	69.5	95.7	26.2	

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

Distance factor: 1 GHz - 10 GHz 20log (3.95 m / 3.0 m) = 2.39 dB

Radiated Spurious Emission (Monopole Antenna)

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.3	No.1
Date	May 31, 2022	November 21, 2022
Temperature / Humidity	19 deg. C / 58 % RH	20 deg. C / 50 % RH
Engineer	Keiya Ido	Junya Okuno
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx 927.4 MHz	

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.	49.1	28.2	-	11.5	7.6	32.2	-	15.0	-	40.0	-	25.0	-	
Hori.	320.0	32.1	-	14.5	10.7	32.0	-	25.3	-	46.0	-	20.7	-	
Hori.	400.0	31.9	-	16.1	11.5	32.0	-	27.4	-	46.0	-	18.6	-	
Hori.	480.0	28.9	-	17.5	12.1	32.0	-	26.5	-	46.0	-	19.5	-	
Hori.	512.0	24.5	-	17.9	12.3	32.0	-	22.7	-	46.0	-	23.3	-	
Hori.	2782.2	45.3	35.9	28.3	6.0	36.3	-	43.2	33.8	73.9	53.9	30.7	20.1	
Hori.	3709.6	54.0	48.5	29.4	6.5	36.0	-	53.8	48.3	73.9	53.9	20.1	5.6	
Hori.	4637.0	52.0	45.8	31.2	6.9	35.8	-	54.3	48.0	73.9	53.9	19.7	5.9	
Hori.	7419.2	48.8	40.3	36.2	7.9	35.9	-	57.0	48.5	73.9	53.9	16.9	5.4	
Hori.	8346.6	50.0	40.7	36.2	8.2	36.1	-	58.3	49.1	73.9	53.9	15.6	4.9	
Vert.	49.1	31.0	-	11.5	7.6	32.2	-	17.8	-	40.0	-	22.2	-	
Vert.	320.0	31.2	-	14.5	10.7	32.0	-	24.4	-	46.0	-	21.6	-	
Vert.	400.0	31.9	-	16.1	11.5	32.0	-	27.4	-	46.0	-	18.6	-	
Vert.	480.0	29.2	-	17.5	12.1	32.0	-	26.8	-	46.0	-	19.2	-	
Vert.	512.0	27.0	-	17.9	12.3	32.0	-	25.2	-	46.0	-	20.8	-	
Vert.	2782.2	45.1	36.5	28.3	6.0	36.3	-	43.0	34.4	73.9	53.9	30.9	19.5	
Vert.	3709.6	55.1	50.6	29.4	6.5	36.0	-	54.9	50.4	73.9	53.9	19.0	3.5	
Vert.	4637.0	51.6	45.3	31.2	6.9	35.8	-	53.8	47.6	73.9	53.9	20.1	6.3	
Vert.	7419.2	44.6	34.7	36.2	7.9	35.9	-	52.8	42.9	73.9	53.9	21.1	11.0	
Vert.	8346.6	46.0	36.9	36.2	8.2	36.1	-	54.3	45.2	73.9	53.9	19.6	8.7	Floor noise

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

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

*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.	927.4	80.6	22.2	13.7	0.0	116.5	-	-	Carrier
Hori.	928.0	45.9	22.2	13.7	0.0	81.8	96.5	14.7	
Hori.	1854.8	46.7	25.5	5.7	36.3	41.6	96.5	54.9	
Hori.	5564.4	47.7	31.7	7.3	35.7	51.1	96.5	45.4	
Hori.	6491.8	73.7	34.0	7.7	35.8	79.6	96.5	16.9	
Hori.	9274.0	34.9	38.6	8.5	36.2	45.8	96.5	50.7	Floor noise
Vert.	927.4	79.9	22.2	13.7	0.0	115.8	-	-	Carrier
Vert.	928.0	44.6	22.2	13.7	0.0	80.5	95.8	15.3	
Vert.	1854.8	49.0	25.5	5.7	36.3	43.8	95.8	52.0	
Vert.	5564.4	46.8	31.7	7.3	35.7	50.2	95.8	45.7	
Vert.	6491.8	64.4	34.0	7.7	35.8	70.4	95.8	25.5	
Vert.	9274.0	34.8	38.6	8.5	36.2	45.8	95.8	50.0	Floor noise

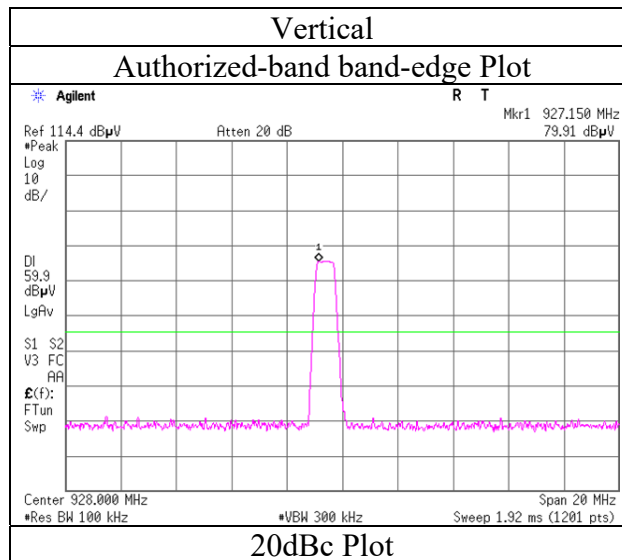
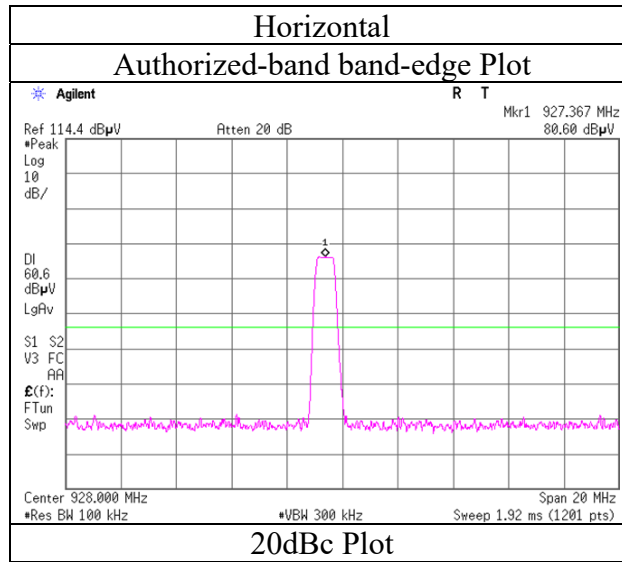
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Distance factor: 1 GHz - 10 GHz 20log (3.95 m / 3.0 m) = 2.39 dB

Radiated Spurious Emission
(Reference Plot for band-edge)
(Monopole Antenna)

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

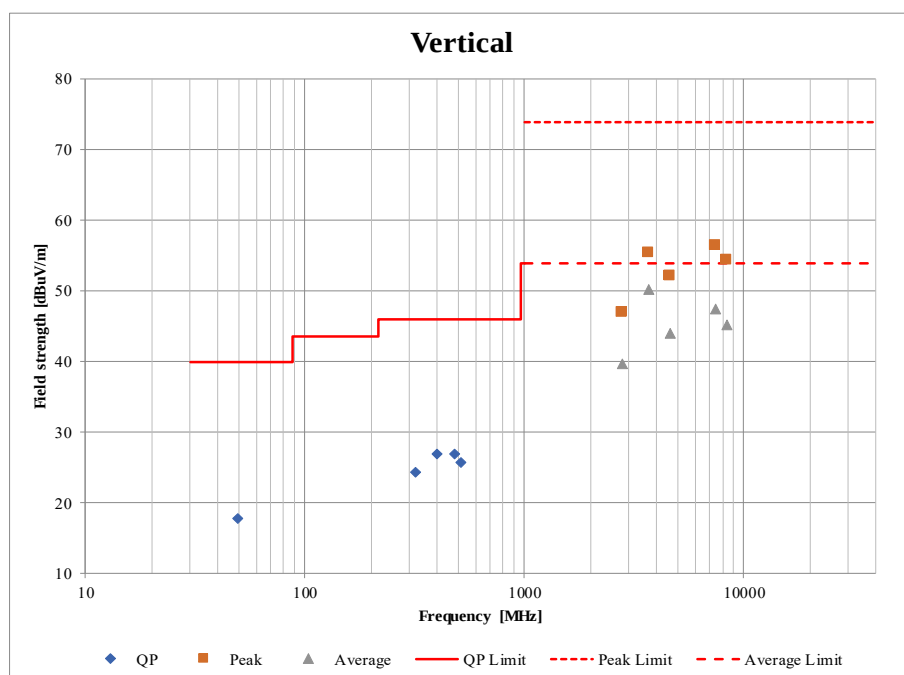
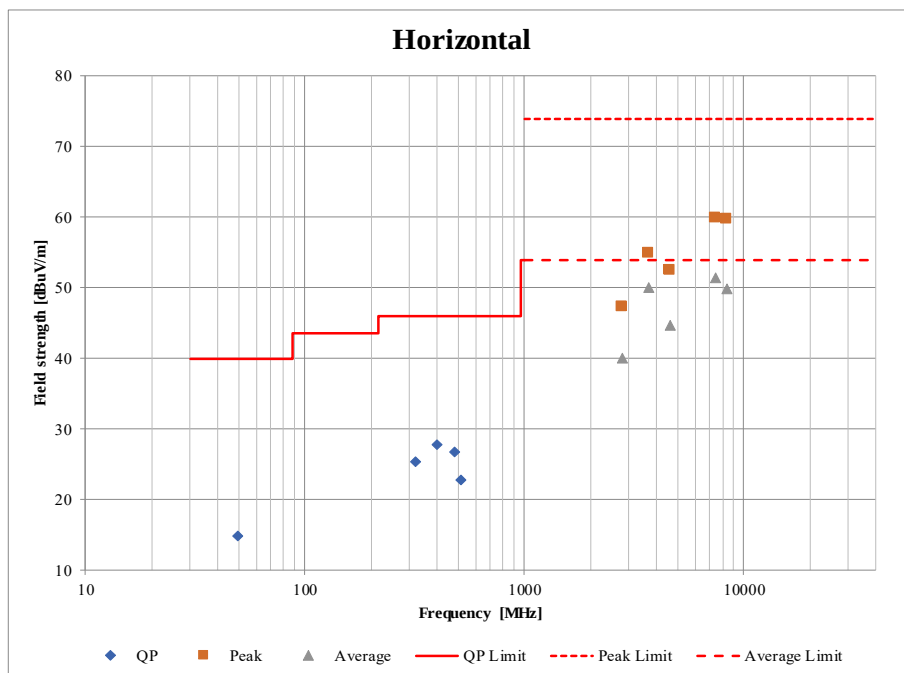
Ise EMC Lab.
No.3
May 31, 2022
19 deg. C / 58 % RH
Keiya Ido
(Below 1 GHz)
Tx 927.4 MHz



* 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)
(Dipole Antenna)

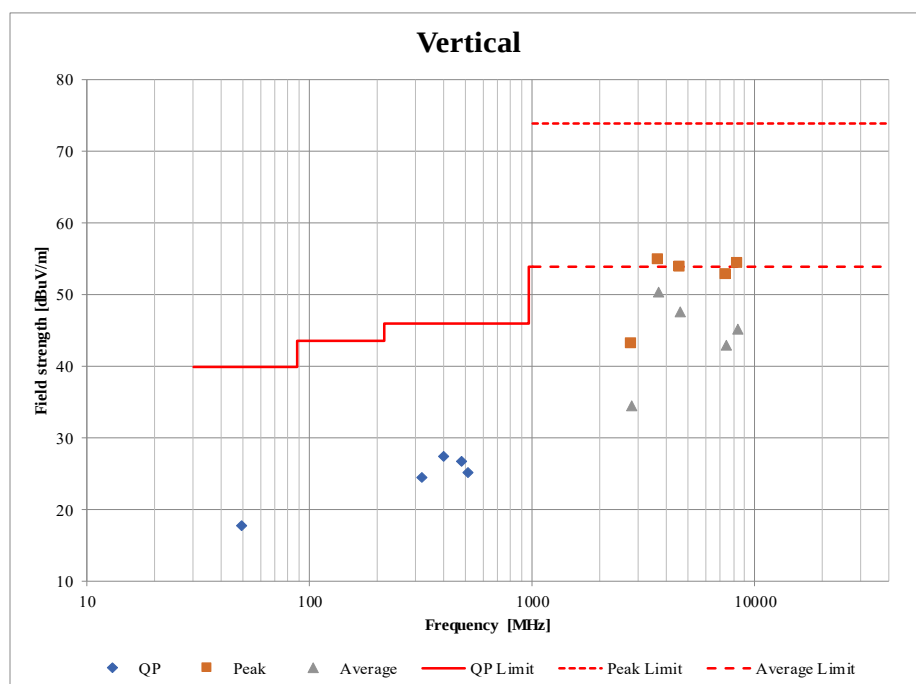
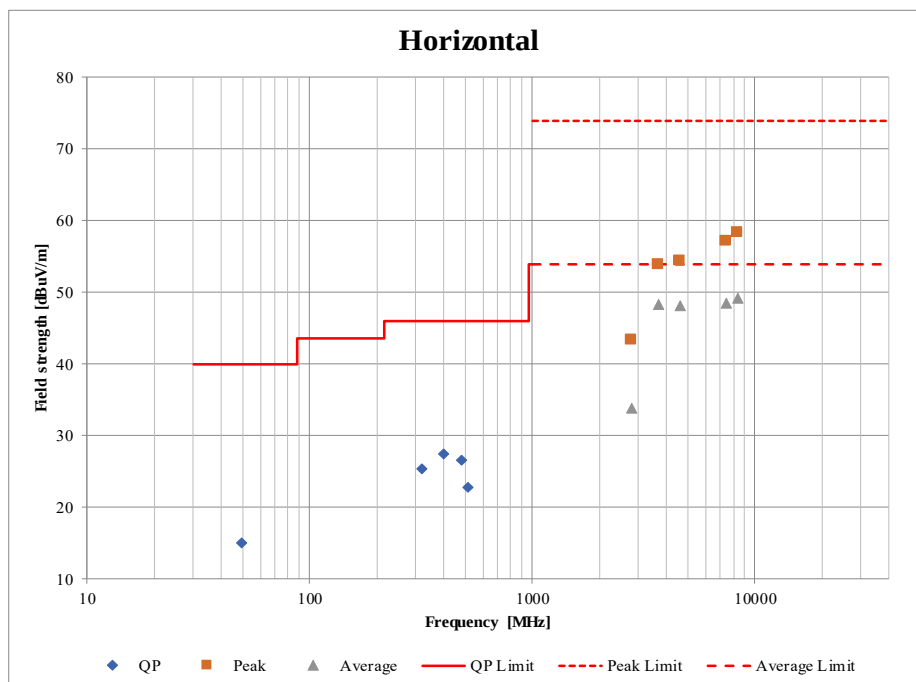
Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.3	
Date	May 31, 2022	November 21, 2022
Temperature / Humidity	19 deg. C / 58 % RH	20 deg. C / 50 % RH
Engineer	Keiya Ido (Below 1 GHz)	Junya Okuno (Above 1 GHz)
Mode	Tx 927.4 MHz	



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

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

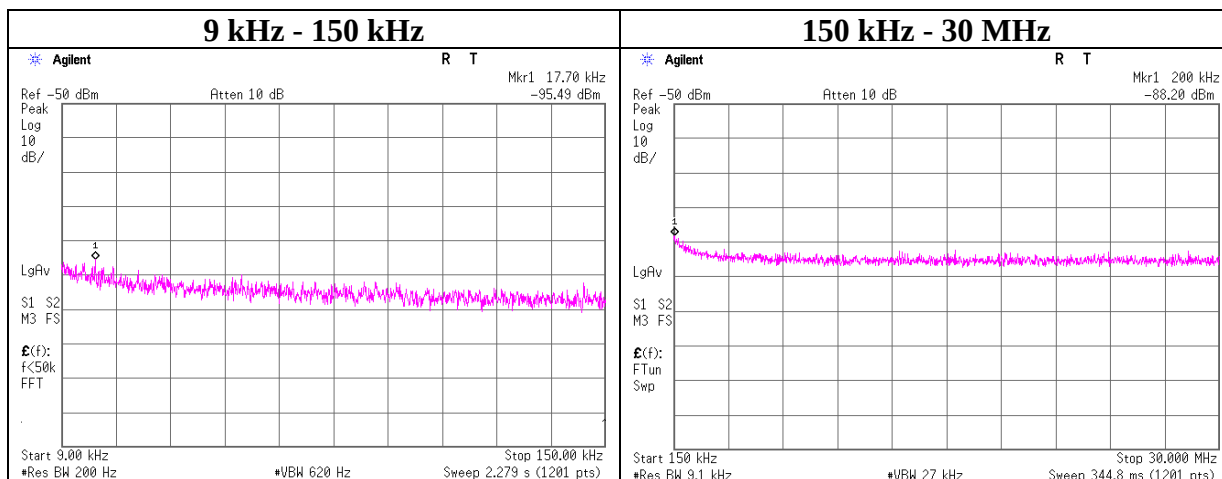
Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.3	November 21, 2022
Date	May 31, 2022	20 deg. C / 50 % RH
Temperature / Humidity	19 deg. C / 58 % RH	Junya Okuno
Engineer	Keiya Ido	(Above 1 GHz)
	(Below 1 GHz)	
Mode	Tx 927.4 MHz	



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

Conducted Spurious Emission

Test place Ise EMC Lab. No.8 Measurement Room
Date May 31, 2022
Temperature / Humidity 24 deg. C / 61 % RH
Engineer Sayaka Hara
Mode Tx 902.6 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
17.70	-95.5	0.00	9.84	2.0	1	-83.7	300	6.0	-22.4	42.6	65.0	
200.00	-88.2	0.00	9.84	2.0	1	-76.4	300	6.0	-15.1	21.5	36.6	

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

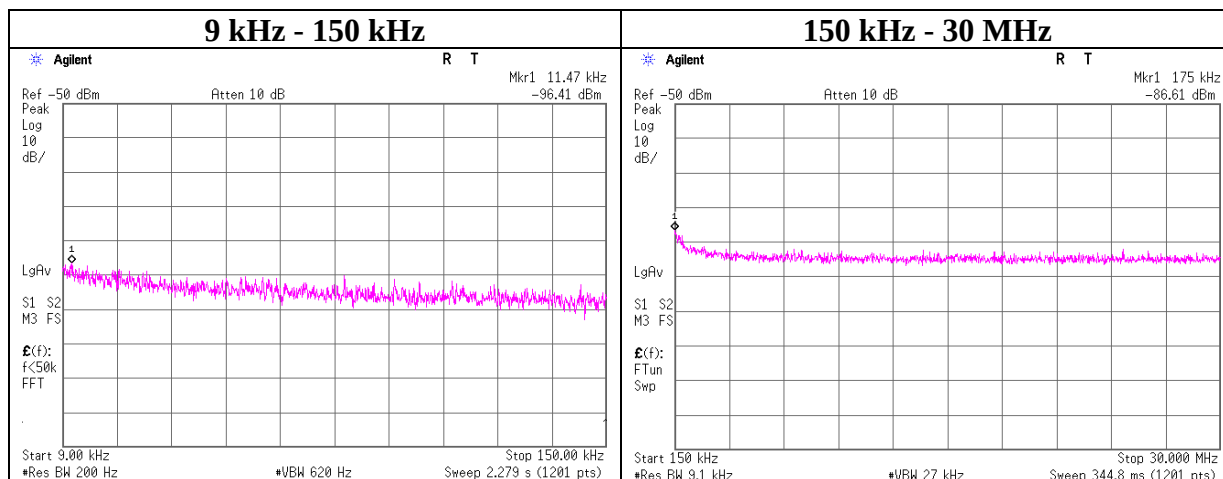
$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log(N)$

N: Number of output

*The worst antenna gain was applied.

Conducted Spurious Emission

Test place Ise EMC Lab. No.8 Measurement Room
Date May 31, 2022
Temperature / Humidity 24 deg. C / 61 % RH
Engineer Sayaka Hara
Mode Tx 914.6 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.47	-96.4	0.00	9.84	2.0	1	-84.6	300	6.0	-23.3	46.4	69.7	
175.00	-86.6	0.00	9.84	2.0	1	-74.8	300	6.0	-13.5	22.7	36.2	

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

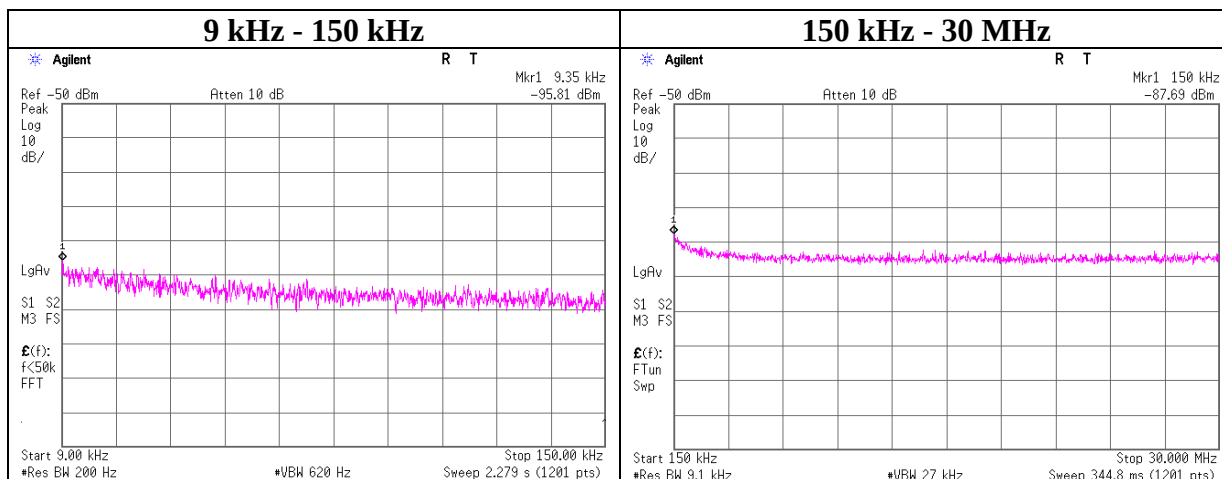
$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$$

N: Number of output

*The worst antenna gain was applied.

Conducted Spurious Emission

Test place Ise EMC Lab. No.8 Measurement Room
Date May 31, 2022
Temperature / Humidity 24 deg. C / 61 % RH
Engineer Sayaka Hara
Mode Tx 927.4 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.35	-95.8	0.00	9.84	2.0	1	-84.0	300	6.0	-22.7	48.1	70.8	
150.00	-87.7	0.00	9.84	2.0	1	-75.9	300	6.0	-14.6	24.0	38.6	

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

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

N: Number of output

*The worst antenna gain was applied.

Power Density

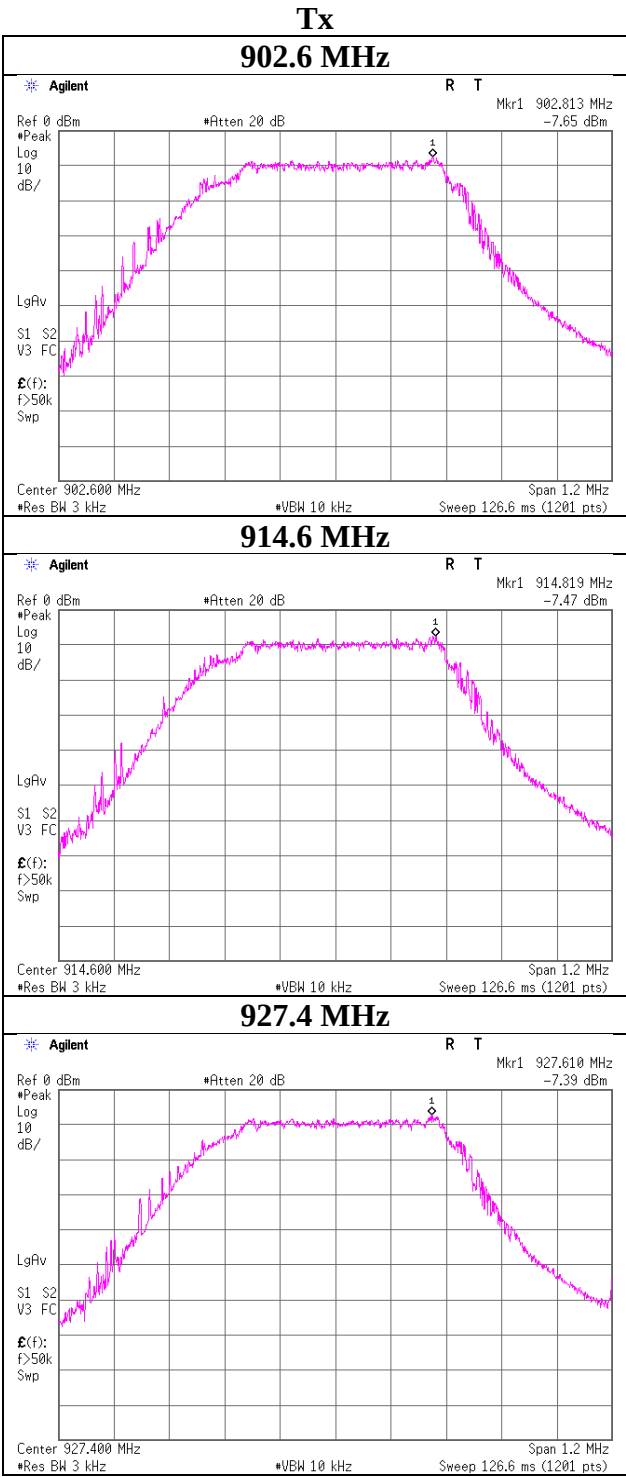
Test place	Ise EMC Lab. No.8 Measurement Room
Date	May 31, 2022
Temperature / Humidity	24 deg. C / 61 % RH
Engineer	Sayaka Hara
Mode	Tx

Freq.	Reading	Cable	Atten.	Result	Limit	Margin
[MHz]	dBm / 3 kHz	Loss [dB]	Loss [dB]	[dBm / 3 kHz]	[dBm / 3 kHz]	[dB]
902.6	-7.65	0.28	9.92	2.55	8.00	5.45
914.6	-7.47	0.28	9.92	2.73	8.00	5.27
927.4	-7.39	0.29	9.92	2.82	8.00	5.18

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

Power Density



APPENDIX 2: Test Instruments**Test Equipment**

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	MAT-10	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/10/2022	12
AT	MCC-38	141395	Coaxial Cable	UL Japan	-	-	11/18/2022	12
AT	MMM-09	141533	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201195	01/16/2022	12
AT	MMM-17	141557	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	70900530	01/16/2022	12
AT	MOS-28	141567	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0008	01/10/2022	12
AT	MOS-40	192302	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0012	12/19/2021	12
AT	MPM-12	141809	Power Meter	Anritsu Corporation	ML2495A	825002	05/18/2022	12
AT	MPSE-18	141832	Power sensor	Anritsu Corporation	MA2411B	738174	12/22/2021	12
AT	MSA-04	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/21/2022	12
CE	MJM-25	142226	Measure	KOMELON	KMC-36	-	-	-
CE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
CE	MLS-26	141538	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-732	07/25/2022	12
CE	MAEC-01	141998	AC1_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	06/28/2022	24
CE	MCC-03	141215	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W/3D-2W/RG400u/RFM-E421(SW)	-/01068 (Switcher)	06/11/2022	12
CE	MAT-67	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	12/17/2021	12
CE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	07/25/2022	12
CE	MOS-27	141566	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	A08Q26	01/10/2022	12
CE	MMM-09	141533	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201195	01/16/2022	12
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-01-SVSWR	141994	AC1_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 10m	DA-06881	04/05/2021	24
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/23/2022	24
RE	MCC-217	141393	Microwave Cable	Junkosha	MWX221	1604S254(1 m) / 1608S088(5 m)	08/02/2022	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	09/27/2022	12
RE	MCC-64	141327	Coaxial Cable	UL Japan	-	-	02/28/2022	12
RE	MHA-05	141511	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	253	09/20/2022	12
RE	MHF-27	141297	High Pass Filter (1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	01/23/2022	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	10/03/2022	12
RE	MJM-25	142226	Measure	KOMELON	KMC-36	-	-	-
RE	MMM-08	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	01/16/2022	12
RE	MMM-09	141533	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201195	01/16/2022	12
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/10/2022	12
RE	MOS-27	141566	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	A08Q26	01/10/2022	12
RE	MPA-01	141576	Pre Amplifier	Keysight Technologies Inc	8449B	3008A01671	02/22/2022	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/25/2022	12
RE	MRF-12	192072	Band Rejection Filter(902-928MHz)	Wakoh Communication Industrial Co., Ltd.	WFR-481	19122541	03/02/2022	12
RE	MSA-10	141899	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180655	02/18/2022	12
RE	MTR-09	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	10/11/2022	12
RE	MLA-22	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/26/2022	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+ BBA9106	VHA 91031302	08/26/2022	12
RE	MAT-95	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/13/2022	12

***Hyphens for Last Calibration Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

The expiration date of the calibration is the end of the expired month.

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

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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