RADIO TEST REPORT

Test Report No. 14987584S-R2

Customer	**Telepower Inc.**
Description of EUT	**UHF RFID Module**
Model Number of EUT	**TPURID2100**
FCC ID	**WQYURID02**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied**
Issue Date	**November 24, 2023**
Remarks	**-**

Representative Test Engineer	Approved By
S. Kobayashi	K. Takeyama
Shiro Kobayashi Engineer	Kazutaka Takeyama Leader

CERTIFICATE 1266.03

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☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 14987584S

This report is a revised version of 14987584S-R1. 14987584S-R1 is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14987584S	November 17, 2023	-
1	14987584S-R1	November 21, 2023	P.10 Addition of following note to diagram: ⬭ : Pair Cable
			P.18 Correction of Mode: From “Tx 915.25 MHz” to “Tx 927.25 MHz”
			P.16 to18, 28 to 33 Added with/without Tag in the "Mode".
2	14987584S-R2	November 24, 2023	P.9 Correction of antenna ports’ names From: To: Port 1 ANT3 Port 2 ANT2 Port 3 ANT1

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

Company Name	Telepower Inc.
Address	2-11-9 #3F, Minami-ikebukuro, Toshima-ku, Tokyo, Japan 171-0022
Telephone Number	81-3-6907-8511
Contact Person	Hiroshi Ohuchi

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	UHF RFID Module
Model Number	TPURID2100
Serial Number	Refer to SECTION 4.2
Condition	Production model
Modification	No Modification by the test lab
Receipt Date	October 19, 2023
Test Date	October 20 to November 1, 2023

2.2 Product Description

General Specification

Rating	DC 5 V +/- 10 %
Operating temperature	-20 deg. C to 80 deg. C

Radio Specification

Equipment Type	Transceiver
Frequency of Operation	902.75 MHz to 927.25 MHz
Type of Modulation	ASK
Antenna Gain	3.31 dBi
Maximum Transmission Time in 100 ms	10 ms

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	**FCC:** Section 15.207	14.3 dB, 0.34189 MHz, QP, N Tx 902.75 MHz	Complied	-
	ISED: RSS-Gen 8.8	**ISED:** RSS-Gen 8.8			
Carrier Frequency Separation	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)	See data.	Complied	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (b)			
20 dB Bandwidth	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)		Complied	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (c)			
Number of Hopping Frequency	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)(i)		Complied	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (c)			
Dwell time	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)(i)		Complied	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (c)			
Maximum Peak Output Power	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(b)(2)		Complied	Conducted
	ISED: RSS-Gen 6.12	**ISED:** RSS-247 5.4 (a)			
Spurious Emission & Band Edge Compliance	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(d)	1.3 dB 284.732 MHz, QP, Hori.	Complied	Conducted/ 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: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.
* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

*1) Radiated test was selected over 30 MHz based on section 15.247(d).

FCC Part 15.31 (e)
The RF Module has its own regulator.
The RF Module is constantly provided with voltage through the regulator regardless of input voltage.
Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement
The EUT has a unique coupling/antenna connector (MMCX). Therefore the equipment complies with the requirement.

3.3 Addition to Standard

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
99 % Occupied Bandwidth	**ISED:** RSS-Gen 6.7	**ISED:** -	N/A	-	Conducted

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.

Item	**Frequency range**	**Uncertainty (+/-)**
Conducted Emission (AC Mains) LISN	150 kHz-30 MHz	3.2 dB
Radiated Emission	9 kHz-30 MHz	3.3 dB
Radiated Emission	30 MHz-200 MHz	4.9 dB
(Measurement distance: 3 m)	200 MHz-1 GHz	6.2 dB
	1 GHz-6 GHz	4.7 dB
	6 GHz-18 GHz	5.3 dB
	18 GHz-40 GHz	5.5 dB
Radiated Emission	1 GHz-18 GHz	5.6 dB
(Measurement distance: 1 m)	18 GHz-40 GHz	5.8 dB

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector) SPM-06	1.1 dB
Power Measurement above 1 GHz (Peak Detector) SPM-06	1.8 dB
Power Measurement above 1 GHz (Average Detector) SPM-07	1.0 dB
Power Measurement above 1 GHz (Peak Detector) SPM-07	1.2 dB
Power Measurement above 1 GHz (Average Detector) SPM-13	0.81 dB
Power Measurement above 1 GHz (Peak Detector) SPM-13	1.1 dB
Spurious Emission (Conducted) below 1 GHz	0.91 dB
Conducted Emissions Power Density Measurement 1 GHz-3 GHz	1.3 dB
Conducted Emissions Power Density Measurement 3 GHz-18 GHz	2.5 dB
Spurious Emission (Conducted) 18 GHz-26.5 GHz	2.8 dB
Spurious Emission (Conducted) 26.5 GHz-40 GHz	2.6 dB
Bandwidth Measurement	0.012 %
Duty Cycle and Time Measurement	0.27 %
Temperature_SCH-01	0.96 deg. C
Humidity_SCH-01	4.0 %
Temperature_SCH-02	2.2 deg .C
Voltage	0.74 %

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
A2LA Certificate Number: 1266.03
(FCC test firm registration number: 626366, ISED lab company number: 2973D / CAB identifier: JP0001)

Test room	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	-
Wireless anechoic chamber 1	9.5 x 6.0 x 5.4	9.5 x 6.0	3 m
Wireless anechoic chamber 2	9.5 x 6.0 x 5.4	9.5 x 6.0	3 m
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	-	-
No.2 Measurement room	4.5 x 3.5 x 2.5	-	-
Wireless shielded room 1	3.0 x 4.5 x 2.7	3.0 x 4.5	-
Wireless shielded room 2	3.0 x 4.5 x 2.7	3.0 x 4.5	-

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 (Tx), with modulation	-

*The worst antenna (ANT3) was determined based on the test result of Maximum Peak Output Power.

Combination of antenna ports

Mode	Transmitting	Receiving	Remarks
Set 1	ANT3	ANT3	*Worst mode
Set 2	ANT2	ANT2	-
Set 3	ANT3	ANT1	-
Set 4	ANT2	ANT1	-

*) ANT1 is Receiving only port.

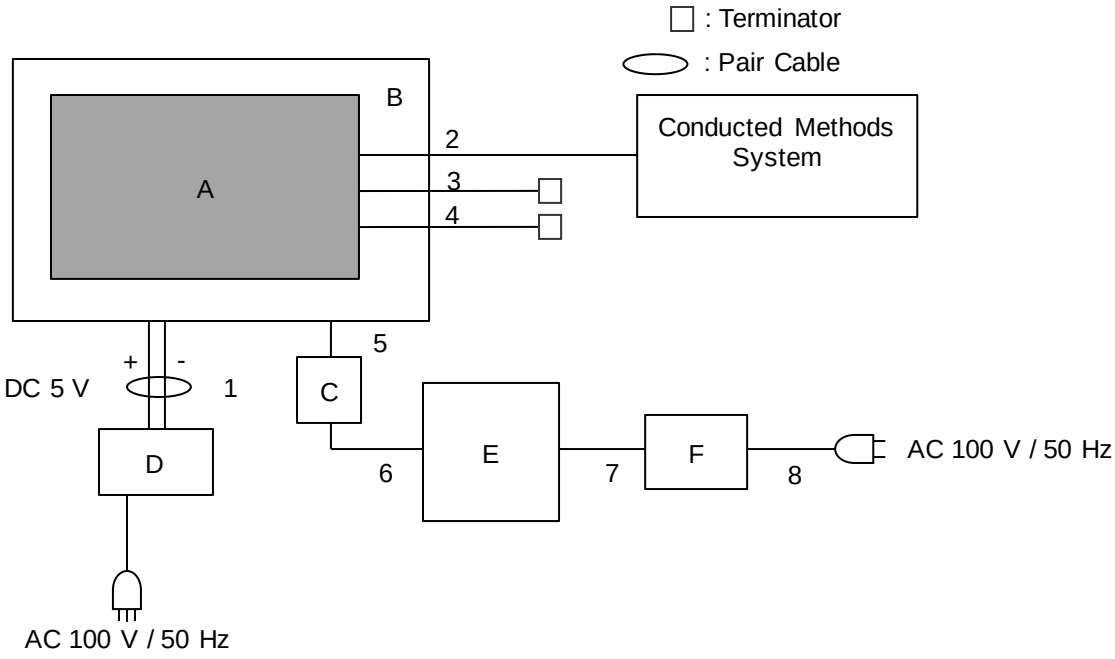
*EUT has the power settings by the software as follows;
Power Setting: 30 dBm
Software: Micro Python Version: v1.10
(Date: 2023.10.16, Storage location: EUT memory)
*This setting of software is the worst case .
Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

Details of Operating Mode(s)

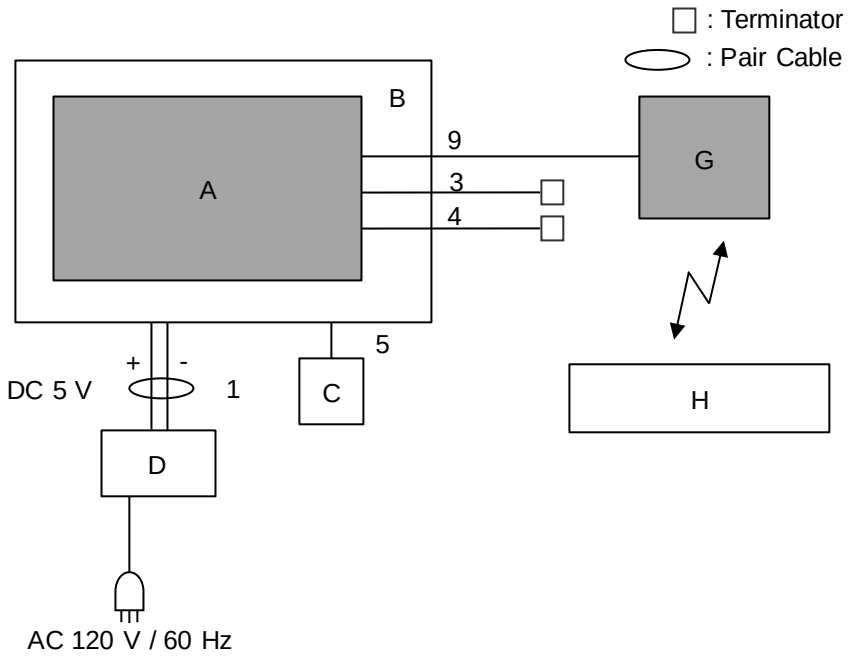
Test Item	Mode	Hopping	Tested Frequency
Conducted Emission, Radiated Spurious Emission, Conducted Spurious Emission, 20 dB Bandwidth	Set 1	Off	902.75 MHz 915.25 MHz 927.25 MHz
Carrier Frequency Separation	Set 1	On	902.75 MHz 915.25 MHz 927.25 MHz
Number of Hopping Frequency	Set 1	On	-
Dwell time	Set 1	On	-
Maximum Peak Output Power	Set 1 Set 2 Set 3 Set 4	Off	902.75 MHz 915.25 MHz 927.25 MHz
Band Edge Compliance (Conducted)	Set 1	On Off	902.75 MHz 927.25 MHz
99 % Occupied Bandwidth	Set 1	On Off	902.75 MHz 915.25 MHz 927.25 MHz

4.2 Configuration and Peripherals

<Antenna Terminal Conducted test>



< Conducted Emission test and Radiated Emission test>



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
* After the comparison of the test data between with Tag and without Tag, the tests were performed with the worst case.

Description of EUT and Support Equipment

No.	Item	Model number	Serial Number	Manufacturer	Remarks
A	UHF RFID Module	TPURID2100	No.3 *1) No.4 *2)	Telepower Inc.	EUT
B	Jig	-	-	Telepower Inc.	-
C	Jig	-	-	Telepower Inc.	-
D	Power Supply (DC)	PAN60-10A	NL002383	Kikusui Electronics Corp.	-
E	Laptop Computer	ThinkPad E14 Gen2	PF397TS8	LENOVO	-
F	AC Adapter	ADLX65YCC20D	8SSA10R16922CTJ	LENOVO	-
G	Antenna	ARRTN5-915.000MHz	1	ABRACON	EUT
H	Tag	ALN-9640 Squiggle	1	Alien Technology	-

*1) Used for Antenna Terminal conducted test.
*2) Used for Conducted Emission test and Radiated Emission test.

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	0.2+2.0	Unshielded	Unshielded	-
2	Coaxial	0.13	Shielded	Shielded	-
3	Coaxial	0.13	Shielded	Shielded	-
4	Coaxial	0.13	Shielded	Shielded	-
5	Signal	0.05	Unshielded	Unshielded	-
6	USB	0.9	Shielded	Shielded	-
7	DC	1.6	Unshielded	Unshielded	-
8	AC	0.8	Unshielded	Unshielded	-
9	Coaxial	0.09	Shielded	Shielded	-

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 was aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm 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.

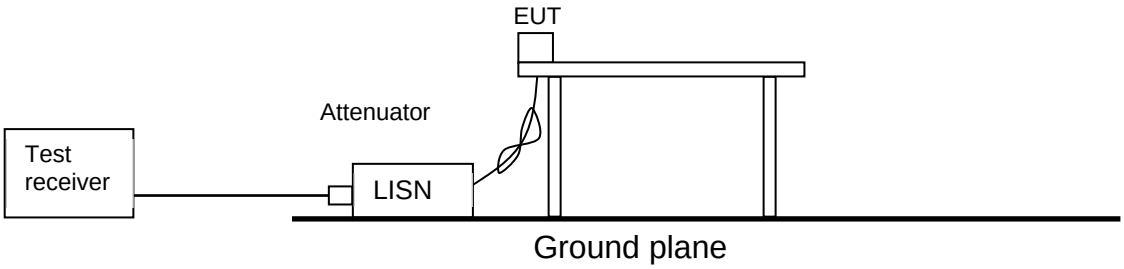
For the tests on EUT itself (as a standalone equipment)
Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN / (AMN) to the input power source.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Shielded Room.
The EUT was connected to a LISN (AMN).
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

[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.

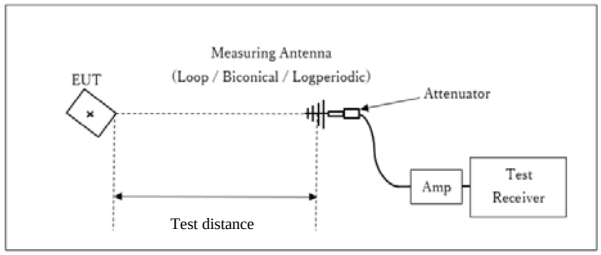
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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	-	RBW: 100 kHz VBW: 300 kHz

*1) Measurement with Average detector was not performed. The limit for Average detector is applied to the measurement value with Peak detector used Duty cycle correction factor (DCCF).

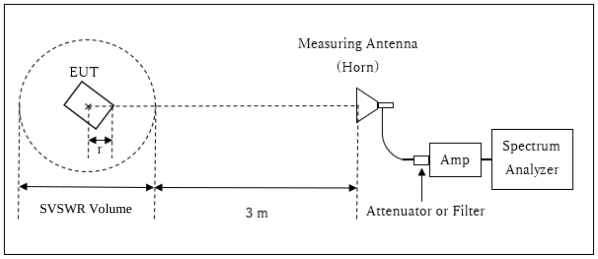
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz to 10 GHz



Distance Factor: 20 x log (3.93 m / 3.0 m) = 2.35 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.93 m

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.07 m

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

Test Range	Item	Horizontal	Vertical
Below 1 GHz	Module	X	X
	Antenna	Y	X
Above 1 GHz	Module	X	Y
	Antenna	Y	Z

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
20 dB Bandwidth	300 kHz	3 kHz	10 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 *1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 160 MHz BW)
Carrier Frequency Separation	1.2 MHz	10 kHz	30 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	75 kHz	240 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz	300 kHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				
	30 MHz to 10 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	5 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) The measurement was performed with Max Hold since the duty cycle was not 100 %. Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) 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.

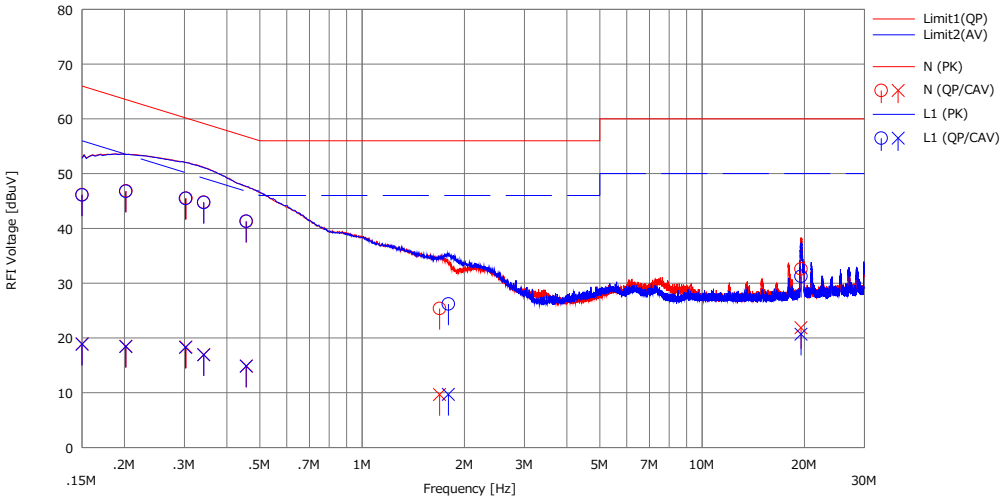
The test results and limit are rounded off to two decimals place, so some differences might be observed. The equipment and cables were not used for factor 0 dB of the data sheets.

Test Data : APPENDIX
Test Result : Pass

APPENDIX 1: Test data

Conducted Emission

Test place	Shonan EMC Lab. No.3 Sheilded Room
Date	November 1, 2023
Temperature / Humidity	22 deg. C / 34 % RH
Engineer	Shiro Kobayashi
Mode	Tx 902.75 MHz (without Tag)

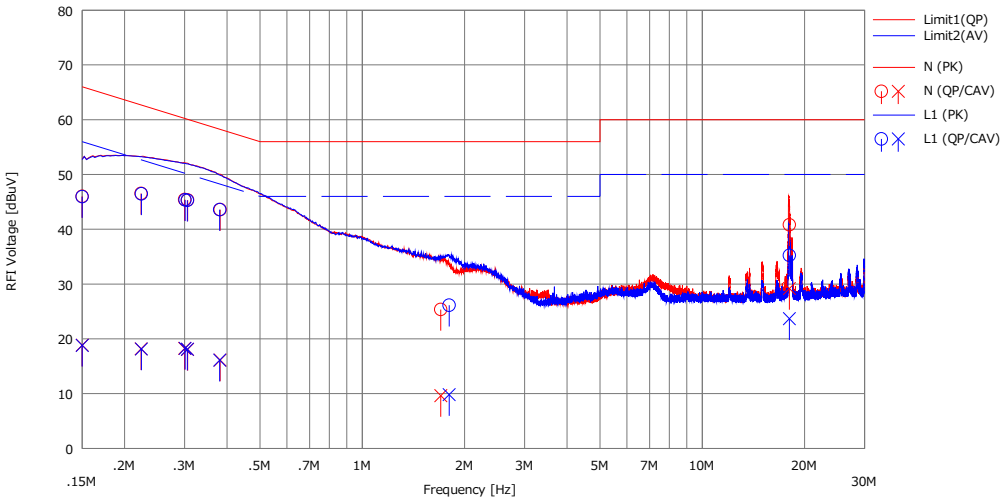


No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		〈QP〉	〈CAV〉		〈QP〉	〈CAV〉	〈QP〉	〈AV〉	〈QP〉	〈AV〉		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	33.76	6.50	12.42	46.18	18.92	66.00	56.00	19.8	37.0	N	
2	0.20207	34.42	6.06	12.42	46.84	18.48	63.53	53.53	16.6	35.0	N	
3	0.30323	33.07	5.90	12.45	45.52	18.35	60.15	50.15	14.6	31.8	N	
4	0.34189	32.34	4.50	12.45	44.79	16.95	59.16	49.16	14.3	32.2	N	
5	0.45675	28.81	2.41	12.46	41.27	14.87	56.75	46.75	15.4	31.8	N	
6	1.68879	12.83	-2.88	12.55	25.38	9.67	56.00	46.00	30.6	36.3	N	
7	19.53506	19.27	8.55	13.32	32.59	21.87	60.00	50.00	27.4	28.1	N	
8	0.15000	33.68	6.43	12.43	46.11	18.86	66.00	56.00	19.8	37.1	L1	
9	0.20179	34.35	6.00	12.43	46.78	18.43	63.54	53.54	16.7	35.1	L1	
10	0.30246	33.04	5.86	12.44	45.48	18.30	60.18	50.18	14.7	31.8	L1	
11	0.34216	32.30	4.48	12.43	44.73	16.91	59.15	49.15	14.4	32.2	L1	
12	0.45563	28.86	2.39	12.46	41.32	14.85	56.77	46.77	15.4	31.9	L1	
13	1.79296	13.65	-2.85	12.56	26.21	9.71	56.00	46.00	29.7	36.2	L1	
14	19.54109	18.14	7.58	13.11	31.25	20.69	60.00	50.00	28.7	29.3	L1	

Calculation:Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN): SLS-05

Conducted Emission

Test place	Shonan EMC Lab. No.3 Sheilded Room
Date	November 1, 2023
Temperature / Humidity	22 deg. C / 34 % RH
Engineer	Shiro Kobayashi
Mode	Tx 915.25 MHz (without Tag)

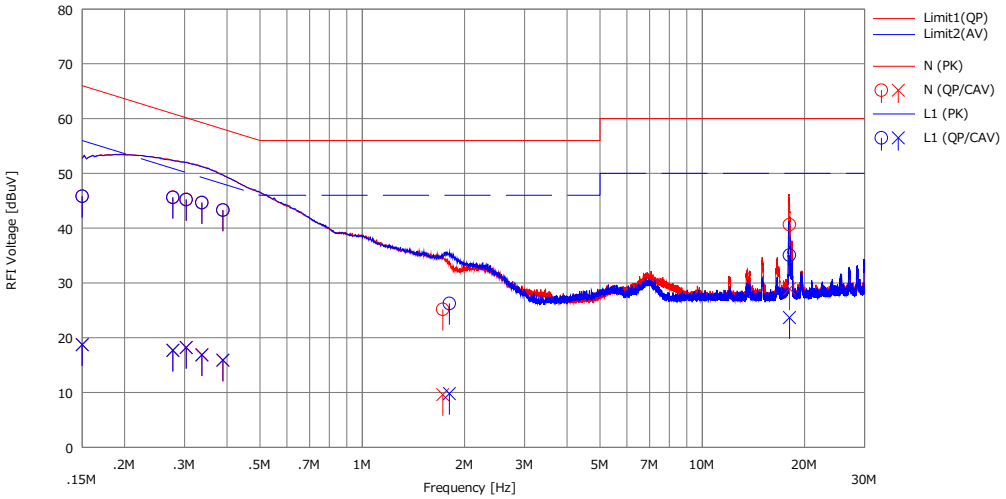


No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		〈QP〉	〈CAV〉		〈QP〉	〈CAV〉	〈QP〉	〈AV〉	〈QP〉	〈AV〉		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	33.58	6.42	12.42	46.00	18.84	66.00	56.00	20.0	37.1	N	
2	0.22354	34.10	5.75	12.43	46.53	18.18	62.69	52.69	16.1	34.5	N	
3	0.30041	32.96	5.80	12.45	45.41	18.25	60.23	50.23	14.8	31.9	N	
4	0.30640	32.89	5.62	12.45	45.34	18.07	60.07	50.07	14.7	32.0	N	
5	0.38189	31.12	3.67	12.45	43.57	16.12	58.24	48.24	14.6	32.1	N	
6	1.70096	12.80	-2.93	12.55	25.35	9.62	56.00	46.00	30.6	36.3	N	
7	18.03337	27.55	15.93	13.26	40.81	29.19	60.00	50.00	19.1	20.8	N	
8	0.15000	33.51	6.37	12.43	45.94	18.80	66.00	56.00	20.0	37.2	L1	
9	0.22403	34.04	5.71	12.43	46.47	18.14	62.67	52.67	16.2	34.5	L1	
10	0.30114	32.92	5.81	12.44	45.36	18.25	60.21	50.21	14.8	31.9	L1	
11	0.30595	32.85	5.66	12.44	45.29	18.10	60.08	50.08	14.7	31.9	L1	
12	0.38093	31.12	3.65	12.45	43.57	16.10	58.26	48.26	14.6	32.1	L1	
13	1.80143	13.57	-2.75	12.56	26.13	9.81	56.00	46.00	29.8	36.1	L1	
14	18.03211	22.14	10.59	13.08	35.22	23.67	60.00	50.00	24.7	26.3	L1	

Calculation:Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN): SLS-05

Conducted Emission

Test place	Shonan EMC Lab. No.3 Sheilded Room
Date	November 1, 2023
Temperature / Humidity	22 deg. C / 34 % RH
Engineer	Shiro Kobayashi
Mode	Tx 927.25 MHz (without Tag)



No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		〈QP〉	〈CAV〉		〈QP〉	〈CAV〉	〈QP〉	〈AV〉	〈QP〉	〈AV〉		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	33.42	6.31	12.42	45.84	18.73	66.00	56.00	20.1	37.2	N	
2	0.27751	33.20	5.27	12.44	45.64	17.71	60.89	50.89	15.2	33.1	N	
3	0.30358	32.82	5.76	12.45	45.27	18.21	60.14	50.14	14.8	31.9	N	
4	0.33763	32.23	4.45	12.45	44.68	16.90	59.26	49.26	14.5	32.3	N	
5	0.38878	30.85	3.47	12.45	43.30	15.92	58.09	48.09	14.7	32.1	N	
6	1.72490	12.63	-2.94	12.55	25.18	9.61	56.00	46.00	30.8	36.3	N	
7	18.04516	27.37	15.68	13.26	40.63	28.94	60.00	50.00	19.3	21.0	N	
8	0.15000	33.38	6.29	12.43	45.81	18.72	66.00	56.00	20.1	37.2	L1	
9	0.27699	33.16	5.27	12.43	45.59	17.70	60.91	50.91	15.3	33.2	L1	
10	0.30336	32.77	5.77	12.44	45.21	18.21	60.15	50.15	14.9	31.9	L1	
11	0.33733	32.21	4.42	12.43	44.64	16.85	59.27	49.27	14.6	32.4	L1	
12	0.38926	30.82	3.43	12.46	43.28	15.89	58.08	48.08	14.8	32.1	L1	
13	1.80422	13.68	-2.77	12.56	26.24	9.79	56.00	46.00	29.7	36.2	L1	
14	18.05092	21.99	10.59	13.08	35.07	23.67	60.00	50.00	24.9	26.3	L1	

Calculation:Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN): SLS-05

20 dB Bandwidth, 99 %Occupied Bandwidth and Carrier Frequency Separation

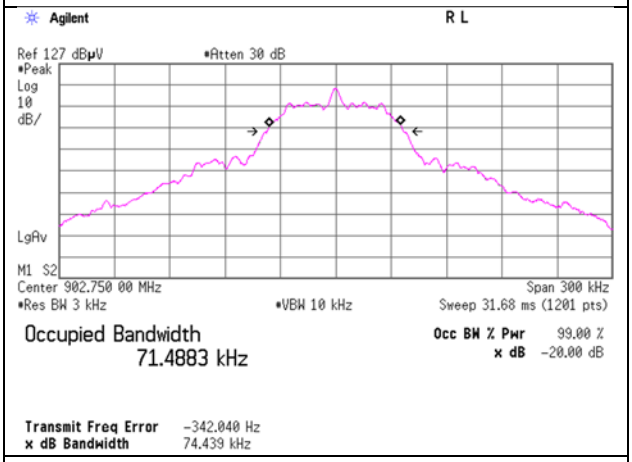
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 24, 2023
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Akihiro Oda
Mode	Tx, Hopping Off, Tx, Hopping On

Freq. [MHz]	20 dB Bandwidth [MHz]	Limit for 20 dB Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
902.75	0.074	0.250	71.488	0.500	>= 0.074
915.25	0.075	0.250	71.860	0.500	>= 0.075
927.25	0.076	0.250	***73.665***	0.500	>= 0.076
Hopping On	-	-	24861.100	-	-

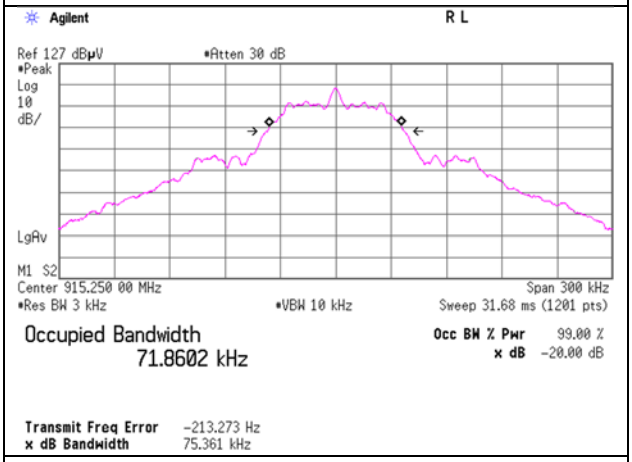
Limit for Carrier Frequency separation: 20 dB Bandwidth or 25 kHz (whichever is greater).

20 dB Bandwidth and 99 % Occupied Bandwidth

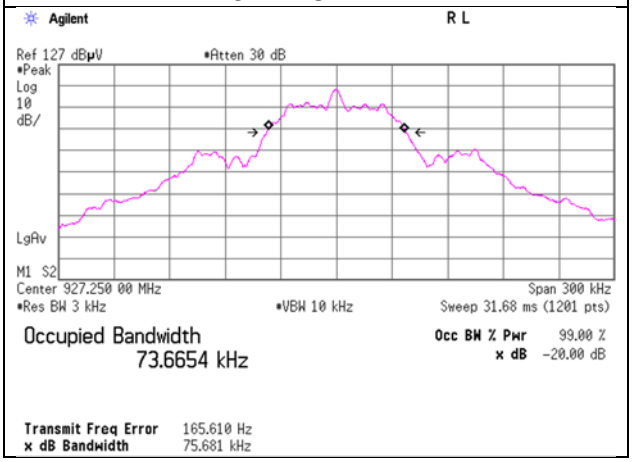
902.75 MHz



915.25 MHz

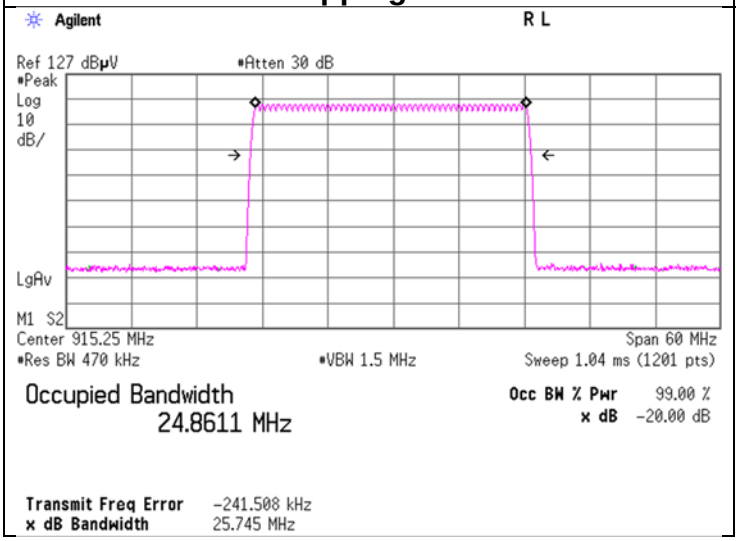


927.25 MHz



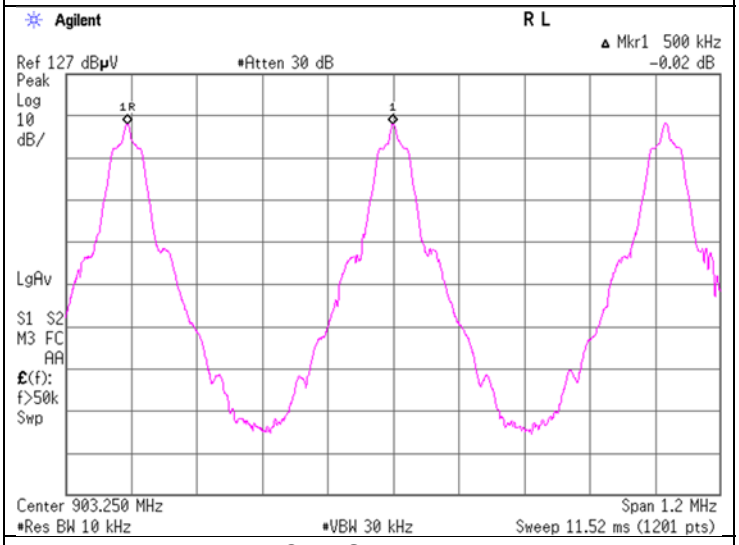
20 dB Bandwidth and 99 % Occupied Bandwidth

Hopping On

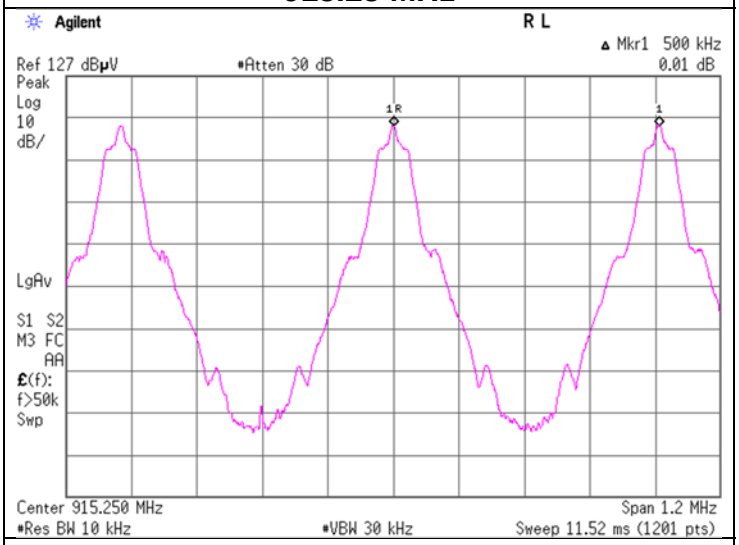


Carrier Frequency Separation

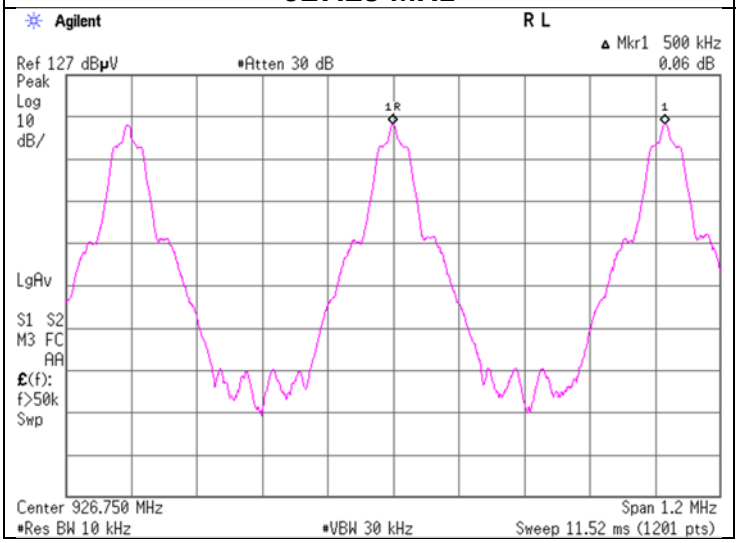
902.75 MHz



915.25 MHz



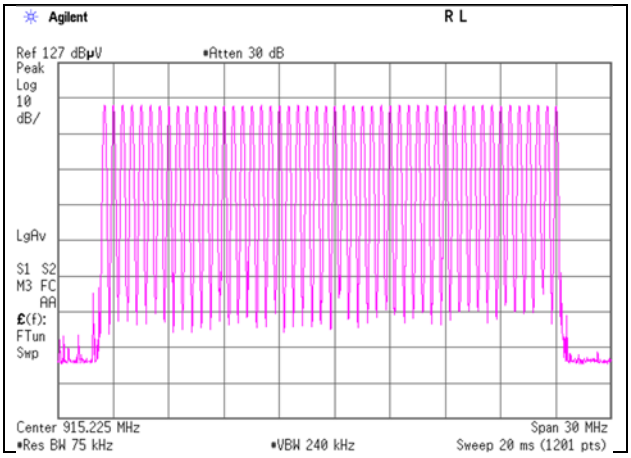
927.25 MHz



Number of Hopping Frequency

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 24, 2023
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Akihiro Oda
Mode	Tx, Hopping On

Number of channel [channels]	Limit [channels]
50	>= 50



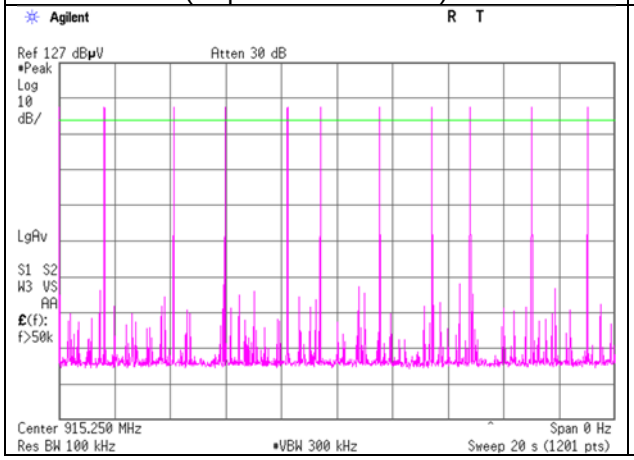
Dwell time

Test place	Shonan EMC Lab. No.3 Shielded Room
Date	November 1, 2023
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Yosuke Murakami
Mode	Tx, Hopping On

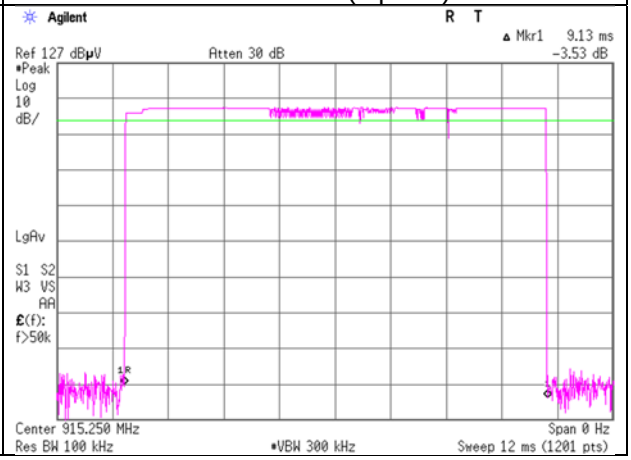
Number of transmiusson in 20 s period	Length of transmission [ms]	Result [ms]	Limit [ms]
11	9.130	100.4	400

Sample Calculation
Result = Number of transmission x Length of transmission

(Representative chart)



Transmit time (1 pulse)



Maximum Peak Output Power

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 20, 2023
Temperature / Humidity	25 deg. C / 45 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off

					Conducted Power				
	Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
Set1	902.75	8.57	1.22	19.96	***29.75***	***944.13***	30.00	1000	0.25
	915.25	8.32	1.23	19.96	29.51	893.02	30.00	1000	0.49
	927.25	8.28	1.24	19.96	29.48	886.46	30.00	1000	0.52
Set2	902.75	8.42	1.22	19.96	29.60	912.08	30.00	1000	0.40
	915.25	8.38	1.23	19.96	29.57	905.45	30.00	1000	0.43
	927.25	8.26	1.24	19.96	29.46	882.39	30.00	1000	0.54
Set3	902.75	8.15	1.22	19.96	29.33	857.10	30.00	1000	0.67
	915.25	8.31	1.23	19.96	29.50	890.97	30.00	1000	0.50
	927.25	8.25	1.24	19.96	29.45	880.36	30.00	1000	0.55
Set4	902.75	8.19	1.22	19.96	29.37	865.03	30.00	1000	0.63
	915.25	8.23	1.23	19.96	29.42	874.71	30.00	1000	0.58
	927.25	8.26	1.24	19.96	29.46	882.39	30.00	1000	0.54

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

Average Output Power
(Reference data for RF Exposure)

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 20, 2023
Temperature / Humidity	25 deg. C / 45 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off

Mode	Freq.	Reading	Cable Loss	Atten. Loss	Result (Burst power average)	
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
Set1	902.8	8.25	1.22	19.96	***29.43***	***877.07***
	915.3	8.10	1.23	19.96	29.29	848.91
	927.3	8.06	1.24	19.96	29.26	842.67
Set2	902.8	8.13	1.22	19.96	29.31	853.17
	915.3	8.10	1.23	19.96	29.29	848.91
	927.3	8.04	1.24	19.96	29.24	838.80
Set3	902.8	7.84	1.22	19.96	29.02	798.06
	915.3	8.05	1.23	19.96	29.24	839.20
	927.3	8.04	1.24	19.96	29.24	838.80
Set4	902.8	7.89	1.22	19.96	29.07	807.30
	915.3	7.94	1.23	19.96	29.13	818.21
	927.3	7.96	1.24	19.96	29.16	823.49

Sample Calculation:
Result (Burst power average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuato
*) Power was measured with using the gate function of power meter.

Duty cycle correction factor

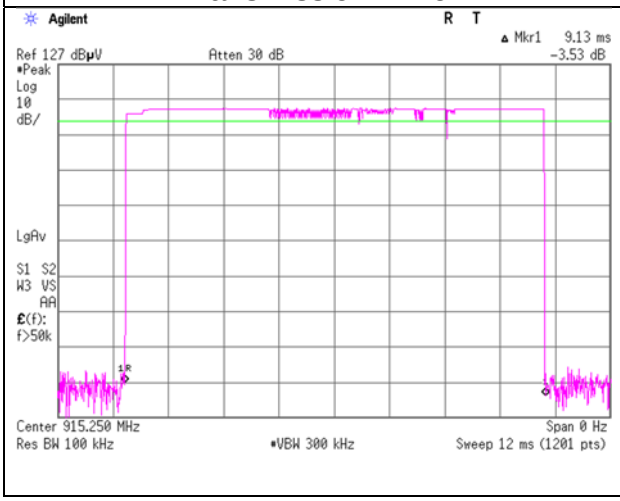
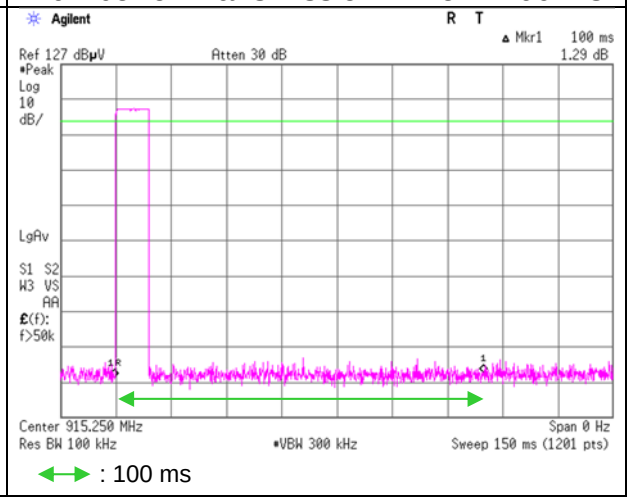
Duty cycle correction factor by customer declaration:

DCCF = 20 log(10 x 1 / 100) = -20.00 dB *

*Maximum Transmission Time: 10 ms
*Maximum opportunity for 1 channel in 100 ms: 1 time
*Maximum Transmission Time for 1 channel in 100 ms: 10 ms x 1 times

Duty cycle correction factor by actual measurement:

Test place	Shonan EMC Lab. No.3 Shielded Room
Date	November 1, 2023
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Yosuke Murakami
Mode	Tx, Hopping On

Transmission Time	Number of Transmission Time in 100 ms
	

DCCF = 20 log(9.13 x 1 / 100) = -20.79 dB *

*Transmission time: 9.13 ms
*The opportunity for 1 channel in 100 ms: 1 time
*Transmission Time for 1 channel in 100 ms: 9.13 ms x 1 times

* Duty cycle correction factor by customer declaration, which is theoretically the maximum, was applied to Radiated Spurious Emission.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	October 31, 2023	November 1, 2023
Temperature / Humidity	22 deg. C / 32 % RH	21 deg. C / 43 % RH
Engineer	Shiro Kobayashi	Yosuke Murakami
	(30 MHz to 1 GHz)	(1 GHz to 10 GHz)
Mode	Tx, Hopping Off 902.75 MHz (below 1 GHz: without Tag, above 1 GHz: with Tag)	

(* 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.	124.759	QP	40.08	13.61	7.46	32.13	0.00	29.02	43.5	14.4	162	8	-
Hori.	160.075	QP	39.93	15.26	8.04	32.09	0.00	31.14	43.5	12.3	304	80	-
Hori.	196.484	QP	36.46	16.54	8.05	32.07	0.00	28.98	43.5	14.5	179	53	-
Hori.	284.732	QP	54.20	13.71	8.75	32.00	0.00	44.66	46.0	**1.3**	184	97	-
Hori.	315.189	QP	51.70	14.23	8.93	31.99	0.00	42.87	46.0	3.1	100	153	-
Hori.	392.696	QP	44.42	15.74	9.34	31.95	0.00	37.55	46.0	8.4	100	249	-
Hori.	468.046	QP	43.71	17.06	9.72	31.94	0.00	38.55	46.0	7.4	100	265	-
Hori.	864.000	QP	37.16	21.92	11.45	31.28	0.00	39.25	46.0	6.7	100	31	-
Hori.	960.000	QP	28.51	21.97	11.71	30.62	0.00	31.57	46.0	14.4	161	231	-
Hori.	1805.500	PK	77.83	25.29	5.10	41.32	2.35	69.25	73.9	4.6	215	265	-
Hori.	2708.250	PK	72.86	28.11	6.28	41.68	2.35	67.92	73.9	5.9	110	288	-
Hori.	3611.000	PK	67.51	29.28	6.69	42.19	2.35	63.64	73.9	10.2	214	257	-
Hori.	4513.750	PK	66.64	30.73	7.29	42.82	2.35	64.19	73.9	9.7	137	316	-
Hori.	5416.500	PK	63.36	32.16	7.99	43.37	2.35	62.49	73.9	11.4	148	260	-
Hori.	6319.250	PK	64.12	33.98	8.59	43.53	2.35	65.51	73.9	8.3	131	265	-
Hori.	7222.000	PK	49.46	37.14	8.99	43.35	2.35	54.59	73.9	19.3	323	105	-
Hori.	8124.750	PK	53.44	37.96	9.43	43.02	2.35	60.16	73.9	13.7	124	336	-
Hori.	9027.500	PK	48.25	37.71	10.07	43.02	2.35	55.36	73.9	18.5	163	290	-
Hori.	9930.250	PK	48.67	38.92	10.79	42.88	2.35	57.85	73.9	16.0	131	326	-
Vert.	160.113	QP	39.91	15.26	8.04	32.09	0.00	31.12	43.5	12.3	100	262	-
Vert.	282.682	QP	52.47	13.67	8.74	32.00	0.00	42.88	46.0	3.1	100	0	-
Vert.	313.078	QP	43.82	14.14	8.92	31.99	0.00	34.89	46.0	11.1	153	94	-
Vert.	397.833	QP	41.63	15.91	9.36	31.95	0.00	34.95	46.0	11.0	149	85	-
Vert.	470.831	QP	41.08	17.13	9.73	31.94	0.00	36.00	46.0	10.0	100	53	-
Vert.	864.000	QP	35.01	21.92	11.45	31.28	0.00	37.10	46.0	8.9	150	284	-
Vert.	1805.500	PK	74.07	25.29	5.10	41.32	2.35	65.49	73.9	8.4	129	261	-
Vert.	2708.250	PK	71.06	28.11	6.28	41.68	2.35	66.12	73.9	7.7	146	277	-
Vert.	3611.000	PK	68.93	29.28	6.69	42.19	2.35	65.06	73.9	8.8	146	140	-
Vert.	4513.750	PK	63.46	30.73	7.29	42.82	2.35	61.01	73.9	12.8	169	309	-
Vert.	5416.500	PK	64.48	32.16	7.99	43.37	2.35	63.61	73.9	10.2	279	117	-
Vert.	6319.250	PK	59.13	33.98	8.59	43.53	2.35	60.52	73.9	13.3	372	278	-
Vert.	7222.000	PK	51.52	37.14	8.99	43.35	2.35	56.65	73.9	17.2	147	51	-
Vert.	8124.750	PK	51.21	37.96	9.43	43.02	2.35	57.93	73.9	15.9	141	247	-
Vert.	9027.500	PK	48.28	37.71	10.07	43.02	2.35	55.39	73.9	18.5	114	295	-
Vert.	9930.250	PK	43.57	38.92	10.79	42.88	2.35	52.75	73.9	21.1	118	38	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	DCCF [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1805.500	PK	77.83	25.29	5.10	41.32	-20.00	2.35	49.25	53.9	4.6	-
Hori.	2708.250	PK	72.86	28.11	6.28	41.68	-20.00	2.35	47.92	53.9	5.9	-
Hori.	3611.000	PK	67.51	29.28	6.69	42.19	-20.00	2.35	43.64	53.9	10.2	-
Hori.	4513.750	PK	66.64	30.73	7.29	42.82	-20.00	2.35	44.19	53.9	9.7	-
Hori.	5416.500	PK	63.36	32.16	7.99	43.37	-20.00	2.35	42.49	53.9	11.4	-
Hori.	6319.250	PK	64.12	33.98	8.59	43.53	-20.00	2.35	45.51	53.9	8.3	-
Hori.	7222.000	PK	49.46	37.14	8.99	43.35	-20.00	2.35	34.59	53.9	19.3	-
Hori.	8124.750	PK	53.44	37.96	9.43	43.02	-20.00	2.35	40.16	53.9	13.7	-
Hori.	9027.500	PK	48.25	37.71	10.07	43.02	-20.00	2.35	35.36	53.9	18.5	-
Hori.	9930.250	PK	48.67	38.92	10.79	42.88	-20.00	2.35	37.85	53.9	16.0	-
Vert.	1805.500	PK	74.07	25.29	5.10	41.32	-20.00	2.35	45.49	53.9	8.4	-
Vert.	2708.250	PK	71.06	28.11	6.28	41.68	-20.00	2.35	46.12	53.9	7.7	-
Vert.	3611.000	PK	68.93	29.28	6.69	42.19	-20.00	2.35	45.06	53.9	8.8	-
Vert.	4513.750	PK	63.46	30.73	7.29	42.82	-20.00	2.35	41.01	53.9	12.8	-
Vert.	5416.500	PK	64.48	32.16	7.99	43.37	-20.00	2.35	43.61	53.9	10.2	-
Vert.	6319.250	PK	59.13	33.98	8.59	43.53	-20.00	2.35	40.52	53.9	13.3	-
Vert.	7222.000	PK	51.52	37.14	8.99	43.35	-20.00	2.35	36.65	53.9	17.2	-
Vert.	8124.750	PK	51.21	37.96	9.43	43.02	-20.00	2.35	37.93	53.9	15.9	-
Vert.	9027.500	PK	48.28	37.71	10.07	43.02	-20.00	2.35	35.39	53.9	18.5	-
Vert.	9930.250	PK	43.57	38.92	10.79	42.88	-20.00	2.35	32.75	53.9	21.1	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + DCCF + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty cycle correction factor (DCCF) refer to "Duty cycle correction factor" sheet.

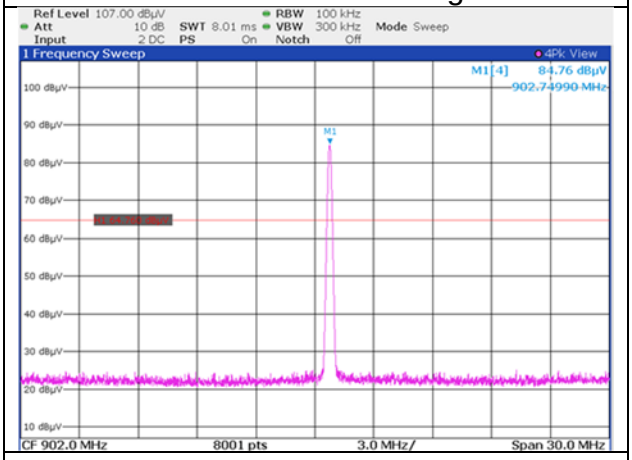
20 dBc Data Sheet **(RBW 100 kHz, VBW 300 kHz)**

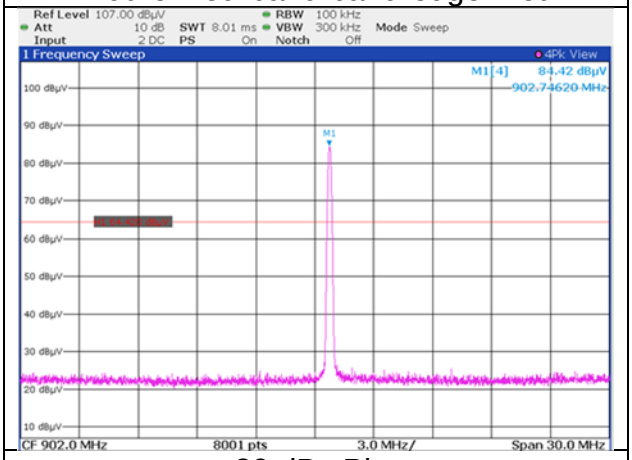
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	902.750	PK	84.76	21.98	20.86	0.00	0.00	127.60	-	-	Carrier
Hori.	902.000	PK	25.20	21.98	20.86	0.00	0.00	68.04	107.6	39.5	-
Vert.	902.750	PK	84.42	21.98	20.86	0.00	0.00	127.26	-	-	Carrier
Vert.	902.000	PK	25.27	21.98	20.86	0.00	0.00	68.11	107.2	39.0	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	October 31, 2023
Temperature / Humidity	22 deg. C / 32 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off 902.75 MHz (without Tag)

Horizontal
Authorized-band band-edge Plot

20 dBc Plot

Vertical
Authorized-band band-edge Plot

20 dBc Plot

* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	October 31, 2023	November 1, 2023
Temperature / Humidity	22 deg. C / 32 % RH	21 deg. C / 43 % RH
Engineer	Shiro Kobayashi	Yosuke Murakami
	(30 MHz to 1 GHz)	(1 GHz to 10 GHz)
Mode	Tx, Hopping Off 915.25 MHz (below 1 GHz: without Tag, above 1 GHz: with Tag)	

(* 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.	160.000	QP	37.70	15.26	8.04	32.09	0.00	28.91	43.5	14.5	207	74	-
Hori.	196.035	QP	34.31	16.50	8.04	32.07	0.00	26.78	43.5	16.7	172	26	-
Hori.	283.313	QP	49.19	13.69	8.74	32.00	0.00	39.62	46.0	6.3	162	92	-
Hori.	313.948	QP	51.41	14.18	8.92	31.99	0.00	42.52	46.0	**3.4**	100	171	-
Hori.	394.273	QP	44.80	15.79	9.35	31.95	0.00	37.99	46.0	8.0	100	261	-
Hori.	517.448	QP	34.44	17.76	9.93	31.95	0.00	30.18	46.0	15.8	100	27	-
Hori.	864.000	QP	38.81	21.92	11.45	31.28	0.00	40.90	46.0	5.1	100	38	-
Hori.	960.000	QP	33.07	21.97	11.71	30.62	0.00	36.13	46.0	9.8	162	143	-
Hori.	1830.500	PK	70.29	25.36	5.11	41.34	2.35	61.77	73.9	12.1	112	91	-
Hori.	2745.750	PK	59.64	28.20	6.30	41.69	2.35	54.80	73.9	19.1	271	317	-
Hori.	3661.000	PK	70.88	29.38	6.71	42.20	2.35	67.12	73.9	6.7	128	295	-
Hori.	4576.250	PK	61.31	30.86	7.34	42.83	2.35	59.03	73.9	14.8	104	307	-
Hori.	5491.500	PK	65.63	32.27	8.06	43.46	2.35	64.85	73.9	9.0	111	328	-
Hori.	6406.750	PK	51.84	34.33	8.64	43.57	2.35	53.59	73.9	20.3	128	305	-
Hori.	7322.000	PK	53.88	37.25	9.05	43.42	2.35	59.11	73.9	14.7	155	283	-
Hori.	8237.250	PK	51.56	37.50	9.53	43.16	2.35	57.78	73.9	16.1	116	61	-
Hori.	9152.500	PK	43.86	38.22	10.17	43.07	2.35	51.53	73.9	22.3	120	257	-
Vert.	51.247	QP	40.13	11.06	6.89	32.18	0.00	25.90	40.0	14.1	100	150	-
Vert.	160.044	QP	40.08	15.26	8.04	32.09	0.00	31.29	43.5	12.2	100	85	-
Vert.	283.499	QP	49.05	13.69	8.74	32.00	0.00	39.48	46.0	6.5	100	20	-
Vert.	314.141	QP	44.76	14.19	8.92	31.99	0.00	35.88	46.0	10.1	159	116	-
Vert.	398.914	QP	41.43	15.95	9.37	31.95	0.00	34.80	46.0	11.2	100	214	-
Vert.	439.203	QP	38.15	16.38	9.58	31.95	0.00	32.16	46.0	13.8	100	336	-
Vert.	864.000	QP	37.43	21.92	11.45	31.28	0.00	39.52	46.0	6.4	121	270	-
Vert.	1830.500	PK	69.52	25.36	5.11	41.34	2.35	61.00	73.9	12.9	101	269	-
Vert.	2745.750	PK	72.12	28.20	6.30	41.69	2.35	67.28	73.9	6.6	110	346	-
Vert.	3661.000	PK	67.27	29.38	6.71	42.20	2.35	63.51	73.9	10.3	183	306	-
Vert.	4576.250	PK	65.14	30.86	7.34	42.83	2.35	62.86	73.9	11.0	210	315	-
Vert.	5491.500	PK	64.53	32.27	8.06	43.46	2.35	63.75	73.9	10.1	268	236	-
Vert.	6406.750	PK	49.88	34.33	8.64	43.57	2.35	51.63	73.9	22.2	289	280	-
Vert.	7322.000	PK	52.91	37.25	9.05	43.42	2.35	58.14	73.9	15.7	141	43	-
Vert.	8237.250	PK	46.69	37.50	9.53	43.16	2.35	52.91	73.9	20.9	103	254	-
Vert.	9152.500	PK	46.84	38.22	10.17	43.07	2.35	54.51	73.9	19.3	189	297	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	DCCF [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1830.500	PK	70.29	25.36	5.11	41.34	-20.00	2.35	41.77	53.9	12.1	-
Hori.	2745.750	PK	59.64	28.20	6.30	41.69	-20.00	2.35	34.80	53.9	19.1	-
Hori.	3661.000	PK	70.88	29.38	6.71	42.20	-20.00	2.35	47.12	53.9	6.7	-
Hori.	4576.250	PK	61.31	30.86	7.34	42.83	-20.00	2.35	39.03	53.9	14.8	-
Hori.	5491.500	PK	65.63	32.27	8.06	43.46	-20.00	2.35	44.85	53.9	9.0	-
Hori.	6406.750	PK	51.84	34.33	8.64	43.57	-20.00	2.35	33.59	53.9	20.3	-
Hori.	7322.000	PK	53.88	37.25	9.05	43.42	-20.00	2.35	39.11	53.9	14.7	-
Hori.	8237.250	PK	51.56	37.50	9.53	43.16	-20.00	2.35	37.78	53.9	16.1	-
Hori.	9152.500	PK	43.86	38.22	10.17	43.07	-20.00	2.35	31.53	53.9	22.3	-
Vert.	1830.500	PK	69.52	25.36	5.11	41.34	-20.00	2.35	41.00	53.9	12.9	-
Vert.	2745.750	PK	72.12	28.20	6.30	41.69	-20.00	2.35	47.28	53.9	6.6	-
Vert.	3661.000	PK	67.27	29.38	6.71	42.20	-20.00	2.35	43.51	53.9	10.3	-
Vert.	4576.250	PK	65.14	30.86	7.34	42.83	-20.00	2.35	42.86	53.9	11.0	-
Vert.	5491.500	PK	64.53	32.27	8.06	43.46	-20.00	2.35	43.75	53.9	10.1	-
Vert.	6406.750	PK	49.88	34.33	8.64	43.57	-20.00	2.35	31.63	53.9	22.2	-
Vert.	7322.000	PK	52.91	37.25	9.05	43.42	-20.00	2.35	38.14	53.9	15.7	-
Vert.	8237.250	PK	46.69	37.50	9.53	43.16	-20.00	2.35	32.91	53.9	20.9	-
Vert.	9152.500	PK	46.84	38.22	10.17	43.07	-20.00	2.35	34.51	53.9	19.3	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + DCCF + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty cycle correction factor (DCCF) refer to "Duty cycle correction factor" sheet.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	October 31, 2023	November 1, 2023
Temperature / Humidity	22 deg. C / 32 % RH	21 deg. C / 43 % RH
Engineer	Shiro Kobayashi	Yosuke Murakami
	(30 MHz to 1 GHz)	(1 GHz to 10 GHz)
Mode	Tx, Hopping Off 927.25 MHz (below 1 GHz: without Tag, above 1 GHz: with Tag)	

(* 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.	160.000	QP	37.29	15.26	8.04	32.09	0.00	28.50	43.5	15.0	205	78	-
Hori.	196.058	QP	33.03	16.51	8.04	32.07	0.00	25.51	43.5	17.9	171	38	-
Hori.	283.449	QP	49.51	13.69	8.74	32.00	0.00	39.94	46.0	6.0	167	83	-
Hori.	314.022	QP	52.10	14.18	8.92	31.99	0.00	43.21	46.0	**2.7**	100	160	-
Hori.	396.739	QP	44.77	15.87	9.36	31.95	0.00	38.05	46.0	7.9	100	255	-
Hori.	517.650	QP	33.33	17.75	9.93	31.95	0.00	29.06	46.0	16.9	100	27	-
Hori.	864.000	QP	35.30	21.92	11.45	31.28	0.00	37.39	46.0	8.6	100	29	-
Hori.	960.000	QP	33.50	21.97	11.71	30.62	0.00	36.56	46.0	9.4	100	35	-
Hori.	1854.500	PK	71.23	25.45	5.12	41.36	2.35	62.79	73.9	11.1	216	91	-
Hori.	2781.750	PK	68.92	28.28	6.32	41.70	2.35	64.17	73.9	9.7	237	82	-
Hori.	3709.000	PK	69.82	29.49	6.73	42.21	2.35	66.18	73.9	7.7	107	41	-
Hori.	4636.250	PK	63.66	31.03	7.40	42.84	2.35	61.60	73.9	12.3	215	81	-
Hori.	5563.500	PK	65.89	32.31	8.09	43.46	2.35	65.18	73.9	8.7	103	353	-
Hori.	6490.750	PK	52.66	34.67	8.69	43.62	2.35	54.75	73.9	19.1	116	289	-
Hori.	7418.000	PK	51.40	37.41	9.09	43.48	2.35	56.77	73.9	17.1	115	258	-
Hori.	8345.250	PK	51.28	37.28	9.64	43.29	2.35	57.26	73.9	16.6	130	71	-
Hori.	9272.500	PK	47.23	38.63	10.26	43.11	2.35	55.36	73.9	18.5	119	252	-
Vert.	124.026	QP	36.48	13.51	7.45	32.13	0.00	25.31	43.5	18.1	100	350	-
Vert.	160.040	QP	37.98	15.26	8.04	32.09	0.00	29.19	43.5	14.3	100	82	-
Vert.	283.498	QP	48.56	13.69	8.74	32.00	0.00	38.99	46.0	7.0	100	357	-
Vert.	314.229	QP	44.31	14.19	8.92	31.99	0.00	35.43	46.0	10.5	100	335	-
Vert.	399.018	QP	41.96	15.95	9.37	31.95	0.00	35.33	46.0	10.6	100	225	-
Vert.	864.000	QP	33.29	21.92	11.45	31.28	0.00	35.38	46.0	10.6	132	92	-
Vert.	1854.500	PK	65.28	25.45	5.12	41.36	2.35	56.84	73.9	17.0	136	276	-
Vert.	2781.750	PK	62.96	28.28	6.32	41.70	2.35	58.21	73.9	15.6	102	23	-
Vert.	3709.000	PK	65.76	29.49	6.73	42.21	2.35	62.12	73.9	11.7	156	312	-
Vert.	4636.250	PK	64.43	31.03	7.40	42.84	2.35	62.37	73.9	11.5	105	310	-
Vert.	5563.500	PK	65.29	32.31	8.09	43.46	2.35	64.58	73.9	9.3	121	30	-
Vert.	6490.750	PK	49.58	34.67	8.69	43.62	2.35	51.67	73.9	22.2	126	305	-
Vert.	7418.000	PK	49.36	37.41	9.09	43.48	2.35	54.73	73.9	19.1	163	316	-
Vert.	8345.250	PK	49.46	37.28	9.64	43.29	2.35	55.44	73.9	18.4	147	287	-
Vert.	9272.500	PK	44.57	38.63	10.26	43.11	2.35	52.70	73.9	21.2	267	302	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	DCCF [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1854.500	PK	71.23	25.45	5.12	41.36	-20.00	2.35	42.79	53.9	11.1	-
Hori.	2781.750	PK	68.92	28.28	6.32	41.70	-20.00	2.35	44.17	53.9	9.7	-
Hori.	3709.000	PK	69.82	29.49	6.73	42.21	-20.00	2.35	46.18	53.9	7.7	-
Hori.	4636.250	PK	63.66	31.03	7.40	42.84	-20.00	2.35	41.60	53.9	12.3	-
Hori.	5563.500	PK	65.89	32.31	8.09	43.46	-20.00	2.35	45.18	53.9	8.7	-
Hori.	6490.750	PK	52.66	34.67	8.69	43.62	-20.00	2.35	34.75	53.9	19.1	-
Hori.	7418.000	PK	51.40	37.41	9.09	43.48	-20.00	2.35	36.77	53.9	17.1	-
Hori.	8345.250	PK	51.28	37.28	9.64	43.29	-20.00	2.35	37.26	53.9	16.6	-
Hori.	9272.500	PK	47.23	38.63	10.26	43.11	-20.00	2.35	35.36	53.9	18.5	-
Vert.	1854.500	PK	65.28	25.45	5.12	41.36	-20.00	2.35	36.84	53.9	17.0	-
Vert.	2781.750	PK	62.96	28.28	6.32	41.70	-20.00	2.35	38.21	53.9	15.6	-
Vert.	3709.000	PK	65.76	29.49	6.73	42.21	-20.00	2.35	42.12	53.9	11.7	-
Vert.	4636.250	PK	64.43	31.03	7.40	42.84	-20.00	2.35	42.37	53.9	11.5	-
Vert.	5563.500	PK	65.29	32.31	8.09	43.46	-20.00	2.35	44.58	53.9	9.3	-
Vert.	6490.750	PK	49.58	34.67	8.69	43.62	-20.00	2.35	31.67	53.9	22.2	-
Vert.	7418.000	PK	49.36	37.41	9.09	43.48	-20.00	2.35	34.73	53.9	19.1	-
Vert.	8345.250	PK	49.46	37.28	9.64	43.29	-20.00	2.35	35.44	53.9	18.4	-
Vert.	9272.500	PK	44.57	38.63	10.26	43.11	-20.00	2.35	32.70	53.9	21.2	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + DCCF + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty cycle correction factor (DCCF) refer to "Duty cycle correction factor" sheet.

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	927.250	PK	86.73	22.11	20.94	0.00	0.00	129.78	-	-	Carrier
Hori.	928.000	PK	25.64	22.11	20.94	0.00	0.00	68.69	109.7	41.0	-
Vert.	927.250	PK	82.41	22.11	20.94	0.00	0.00	125.46	-	-	Carrier
Vert.	928.000	PK	25.32	22.11	20.94	0.00	0.00	68.37	105.4	37.0	-

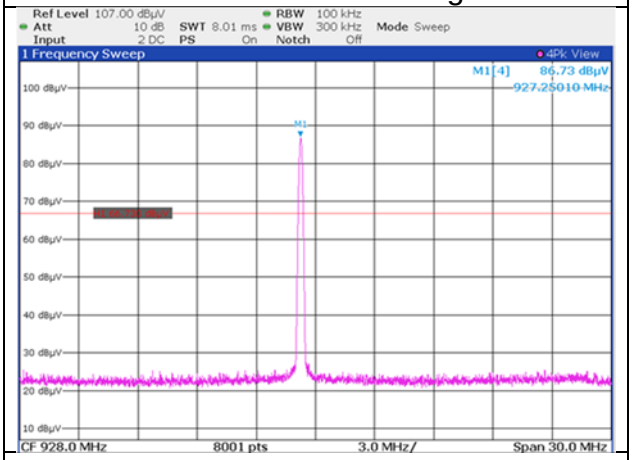
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB
10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for bandto edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	October 31, 2023
Temperature / Humidity	22 deg. C / 32 % RH
Engineer	Shiro Kobayashi
Mode	Tx, Hopping Off 927.25 MHz (without Tag)

Horizontal

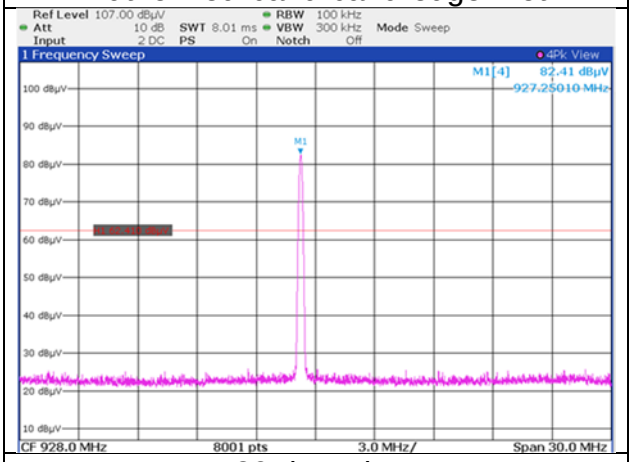
Authorized-band band-edge Plot



20 dBc Plot

Vertical

Authorized-band band-edge Plot

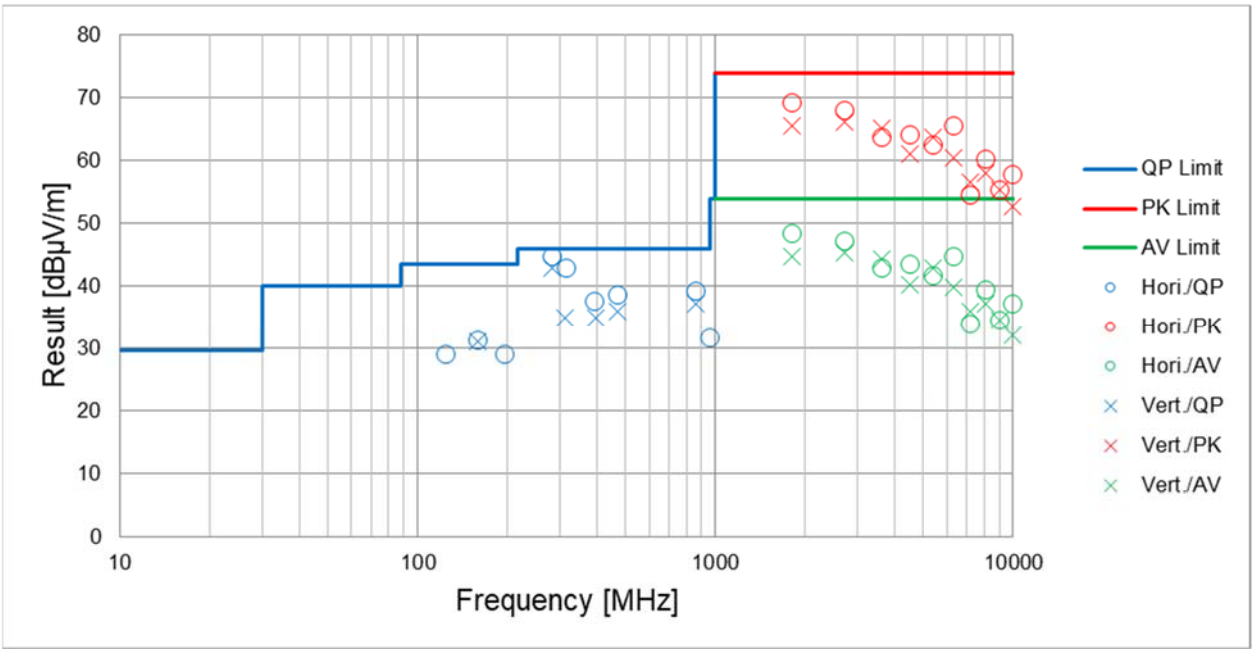


20 dBc Plot

* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	October 31, 2023	November 1, 2023
Temperature / Humidity	22 deg. C / 32 % RH	21 deg. C / 43 % RH
Engineer	Shiro Kobayashi	Yosuke Murakami
	(30 MHz to 1 GHz)	(1 GHz to 10 GHz)
Mode	Tx, Hopping Off 902.75 MHz (below 1 GHz: without Tag, above 1 GHz: with Tag)	



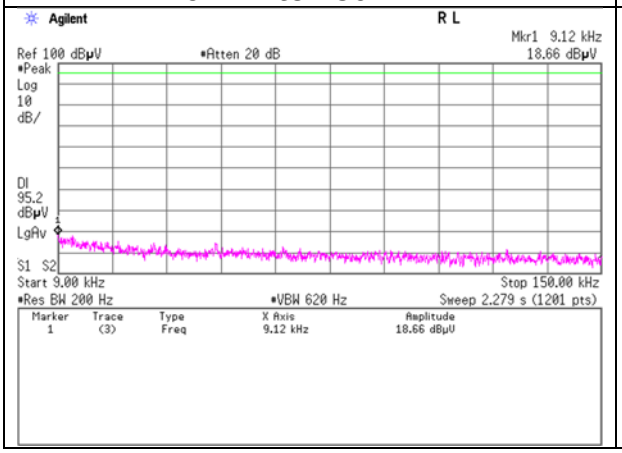
*These plots data contain sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

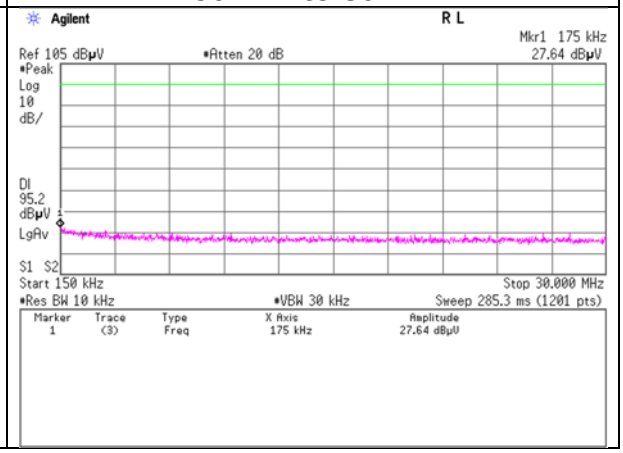
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 24, 2023
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Akihiro Oda
Mode	Tx, Hopping Off

902.75 MHz

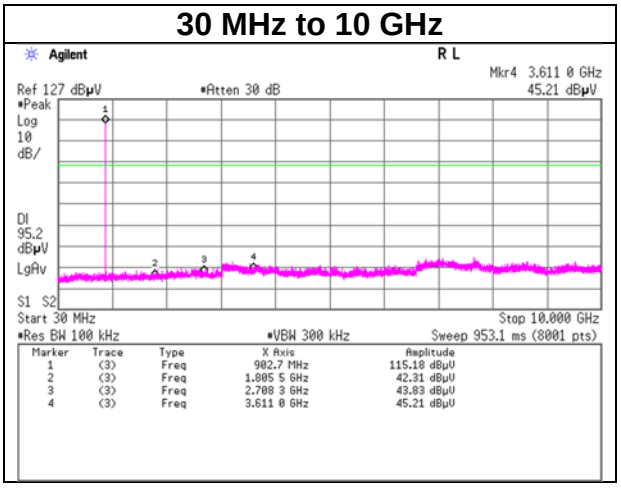
9 kHz to 150 kHz



150 kHz to 30 MHz



30 MHz to 10 GHz

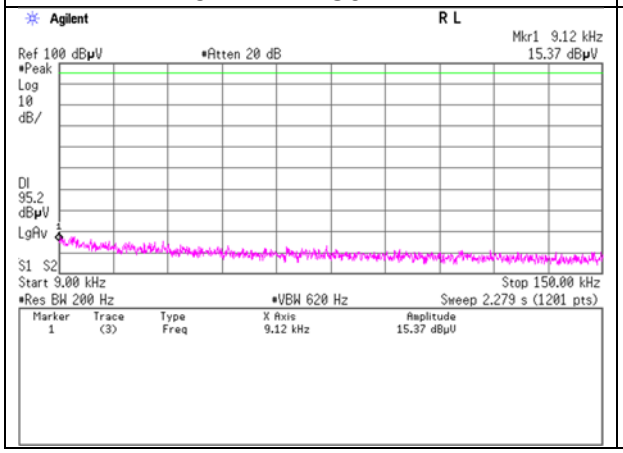


Conducted Spurious Emission

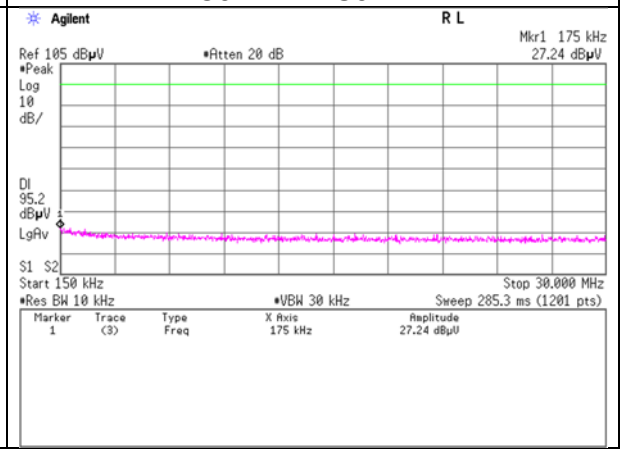
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 24, 2023
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Akihiro Oda
Mode	Tx, Hopping Off

915.25 MHz

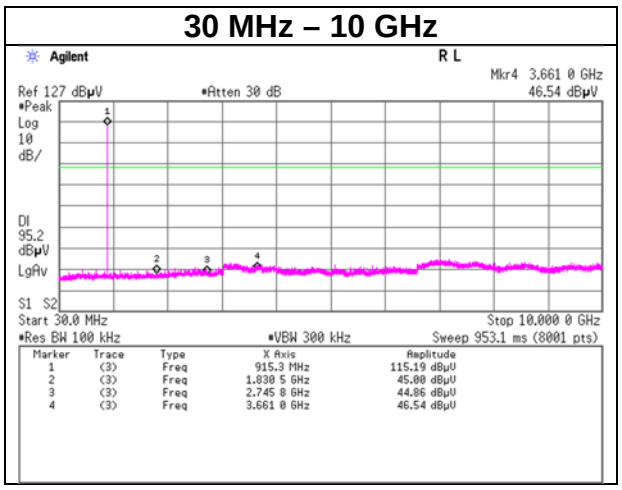
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 10 GHz

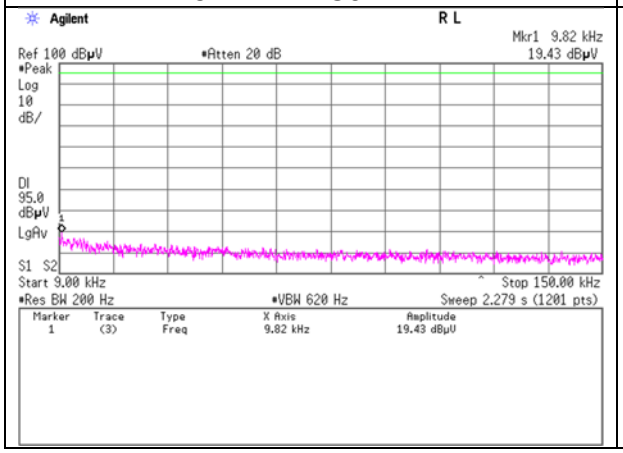


Conducted Spurious Emission

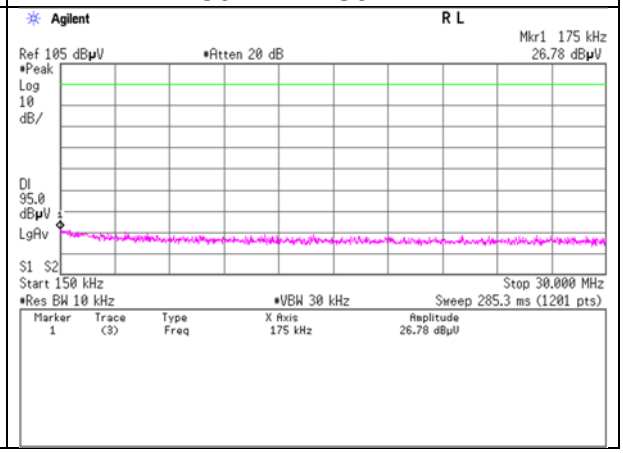
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 24, 2023
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Akihiro Oda
Mode	Tx, Hopping Off

927.25 MHz

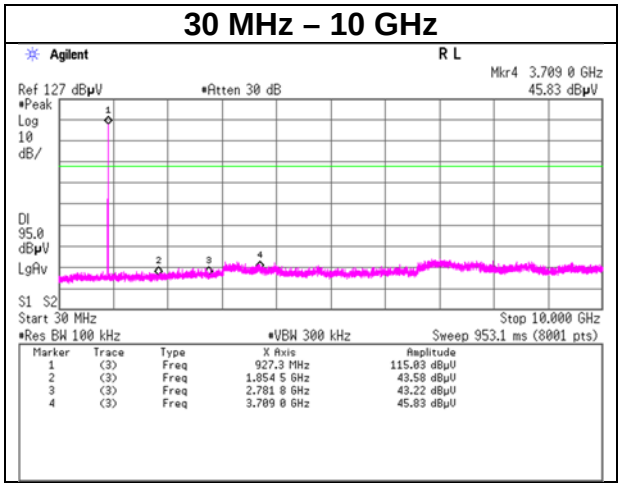
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 10 GHz

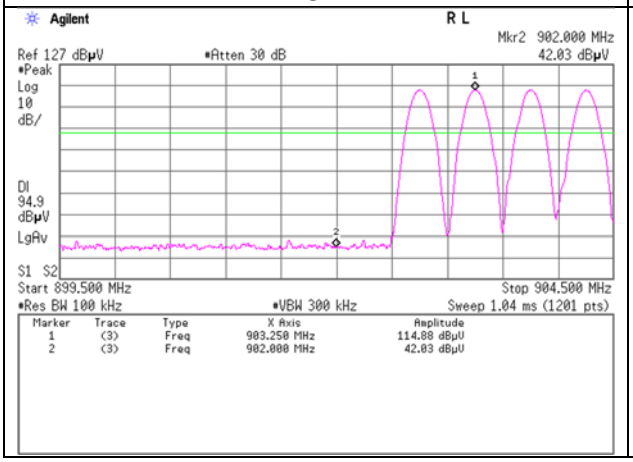


Conducted Emission Band Edge compliance

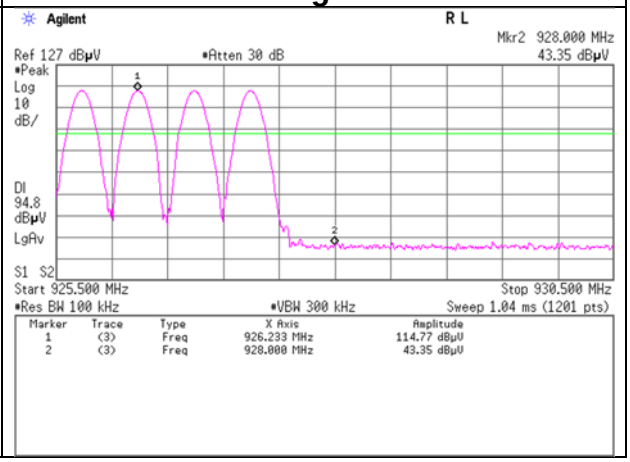
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 24, 2023
Temperature / Humidity	22 deg. C / 40 % RH
Engineer	Akihiro Oda
Mode	Tx, Hopping Off

Hopping On

Low

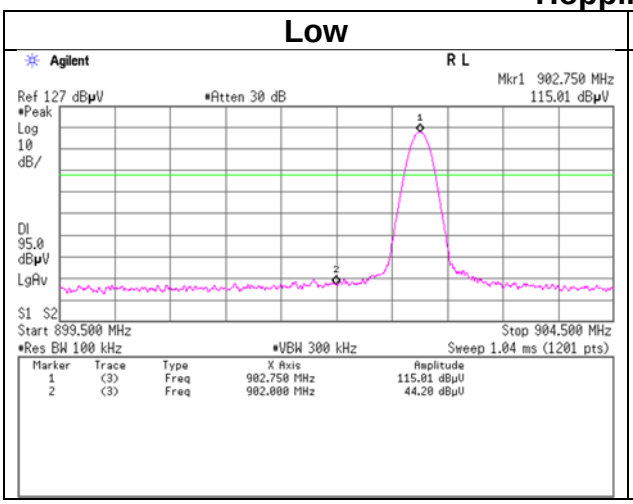


High

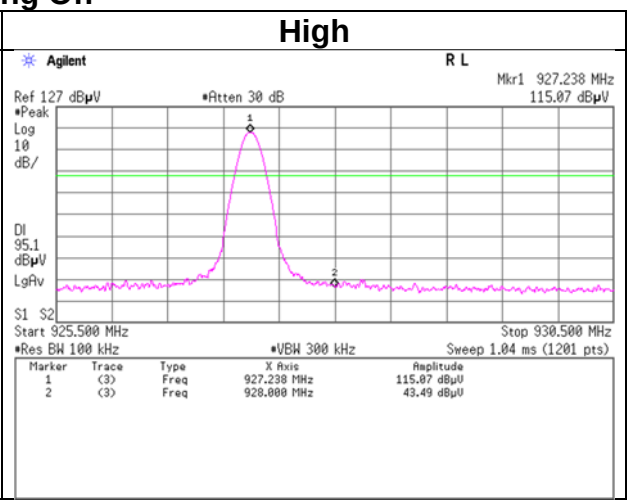


Hopping Off

Low



High



APPENDIX 2: Test Instruments

Test Equipment [1/2]

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	145111	Digital Tester	SANWA	PC500	7019232	2023/09/25	12
AT	159665	Attenuator	Pasternack Enterprises	PE7017-20	0200029075	2023/09/15	12
AT	196937	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803605/2	2023/03/02	12
AT	196947	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803478/2	2023/03/02	12
AT	145339	Tape Measure	ASKUL	-	-	-	-
AT	191841	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/08/01	12
AT	191845	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/08/07	12
AT	169910	Power Meter	Keysight Technologies Inc	8990B	MY51000448	2023/09/28	12
AT	169911	Power sensor	Keysight Technologies Inc	N1923A	MY57270004	2023/09/28	12
AT	145800	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250106	2023/03/01	12
AT	145801	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250152	2023/09/23	12
AT	146212	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997828	2023/09/25	12
AT,CE, RE	146210	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997823	2023/09/25	12
CE	144960	Attenuator	JFW	50HF-003N	-	2023/08/22	12
CE	145034	Coaxial Cable&RF Selector	Suhner/Fujikura/Suhner/ Suhner/TOYO	141PE/12DSFA/141PE/141PE/NS4906	-/0901-271(RF Selector)	2023/04/18	12
CE	145542	LISN	Rohde & Schwarz	ENV216	100516	2023/02/21	12
CE	145762	Terminator	TME	CT-01 BP	-	2022/12/16	12
CE,RE	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
CE,RE	146432	Tape Measure	TAJIMA	GL19-55	-	-	-
CE,RE	191840	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/08/03	12
CE,RE	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2023/08/25	12
RE	144939	Highpass Filter	Micro-Tronics	HPM50115	2	2023/05/10	12
RE	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2023/04/05	12
RE	145566	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	2023/05/14	12
RE	145126	Pre Amplifier	SONOMA	310N	290213	2023/02/09	12
RE	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2023/02/02	12
RE	192293	Attenuator	JFW	50HF-010N	-	2022/12/16	12
RE	167094	Attenuator	JFW	50HF-006N	-	2023/02/09	12
RE	145023	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032666	2023/05/16	12
RE	145031	Coaxial Cable	Fujikura Shoji Co., LTD	5D2W	-	2023/06/14	12
RE	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner /Suhner/Suhner/Suhner/ TOYO	8D2W/12DSFA/141PE /141PE/141PE/141PE/ NS4906	-/0901-271(RF Selector)	2023/04/18	12
RE	166491	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S005	2023/01/12	12
RE	156380	Coaxial Cable	Huber+Suhner	SUCOFLEX_104_E	SN MY 13406/4E	2023/05/19	12

Test Equipment [2/2]

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	168300	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	800375/4A	2022/11/10	12
RE	145300	Highpass Filter	Micro-Tronics	HPM50115	1	2023/10/11	12
RE	241390	Band Rejection Filter(902-928MHz)	Wakoh Communication Industrial Co., Ltd.	WFR-481	19122541	2023/01/23	12
RE	145501	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-739	2023/03/27	12
RE	145529	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	196	2023/05/16	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:

AT: Antenna Terminal Conducted test
CE: Conducted Emission
RE: Radiated Emission