





RADIO TEST REPORT

Test Report No. 14868886H-A

Customer	Panasonic Corporation of North America
Description of EUT	RFID Module
Model Number of EUT	RI23A
FCC ID	ACJ9TGRI23A
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied
Issue Date	August 9, 2023
Remarks	-

Representative test engineer	Approved by
	
Hiroyuki Furutaka Engineer	Takayuki Shimada Leader
	
	
CERTIFICATE 5107.02	
<input type="checkbox"/> The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan, Inc.	
<input checked="" type="checkbox"/> There is no testing item of "Non-accreditation".	

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 22.0

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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. 14868886H-A

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14868886H-A	August 9, 2023	-

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

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SECTION 1: Customer Information

Company Name	Panasonic Corporation of North America
Address	Two Riverfront Plaza, 9th Floor Newark, NEW JERSEY, 07102-5940, USA
Telephone Number	+1-201-348-7760
Contact Person	Ben Botros

***Remarks:**

Panasonic Connect Co., Ltd. is on behalf of the applicant: Panasonic Corporation of North America (Company incorporated abroad).

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	RFID Module
Model Number	RI23A
Serial Number	Refer to SECTION 4.2
Condition	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	July 23, 2023
Test Date	July 24 to August 3, 2023

2.2 Product Description

General Specification

Rating	DC 5.0 V
Operating Temperature	-20 deg. C to 50 deg. C

Radio Specification

Equipment Type	Transceiver
Frequency of Operation	13.56 MHz
Type of Modulation	ASK

2.3 Information of the Host device

Device name	Contactless Smart Card Reader (dedicated for Personal Computer FZ-40)
Model Number	FZ-VNF402
Rating	DC 5.0 V DC 10.8 V (Battery for FZ-40) AC 100 V to 240 V, 50/60 Hz (AC Adaptor for FZ-40)

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 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.225 Operation within the band 13.110-14.010 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	16.60 dB 0.22100 MHz, AV, Phase: L (Mode 3 with Tag)	Complied	-
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.4, 6.12	<FCC> Section 15.225(a) ----- <ISED> RSS-210 B.6	78.47 dB, 13.56000 MHz, QP, 0 deg. (Mode 4 without Tag)	Complied	Radiated
Spectrum Mask	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.4, 6.13	<FCC> Section 15.225(b)(c) ----- <ISED> RSS-210 B.6	45.38 dB, 13.11000 MHz, QP, 0 deg. (Mode 4 without Tag)	Complied	Radiated
20 dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> -	<FCC> Section15.215(c) ----- <ISED> -	See data	Complied	Radiated
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.4, 6.13	<FCC> Section 15.209, Section 15.225 (d) ----- <ISED> RSS-210 B.6 RSS-Gen 8.9	23.49 dB 31.029 MHz, Vertical, QP (Mode 4 without Tag)	Complied	Radiated
Frequency Tolerance	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.11, 8.11	<FCC> Section 15.225(e) ----- <ISED> RSS-210 B.6	See data	Complied	Radiated

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.

FCC Part 15.31 (e)

The RF Module has its own regulator.

The RF Module is constantly provided voltage through the regulator regardless of input voltage.

Therefore, this EUT complies with the requirement.

However, the supply voltage was varied and tested at 85 % and 115 % of the nominal rated supply voltage during frequency tolerance test according to Section 15.225(e).

FCC Part 15.203/212 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the host device. Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% emission bandwidth	<ISED>RSS-Gen 6.7	-	N/A	-	Radiated

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.

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

Item	Frequency Range	Unit	Calculated Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	dB	3.7
	0.15 MHz to 30 MHz	dB	3.3

Radiated emission

Measurement distance	Frequency Range	Unit	Calculated Uncertainty (+/-)
3 m	9 kHz to 30 MHz	dB	3.3
		dB	3.1
3 m	30 MHz to 200 MHz	Horizontal	4.8
		Vertical	5.0
	200 MHz to 1000 MHz	Horizontal	5.1
		Vertical	6.2
10 m	30 MHz to 200 MHz	Horizontal	4.8
		Vertical	4.8
	200 MHz to 1000 MHz	Horizontal	4.9
		Vertical	5.0
3 m	1 GHz to 6 GHz	dB	4.9
	6 GHz to 18 GHz	dB	5.2
1 m	10 GHz to 26.5 GHz	dB	5.5
	26.5 GHz to 40 GHz	dB	5.4

20 dB Bandwidth and 99% Occupied Bandwidth, Frequency Tolerance

Item	Unit	Calculated Uncertainty (+/-)
Bandwidth (OBW)	%	0.96
Frequency Readout (Frequency counter)	ppm	0.67
Frequency Readout (Spectrum analyzer frequency readout function)	ppm	1.61

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan
Telephone: +81-596-24-8999

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

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

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 3.0 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)

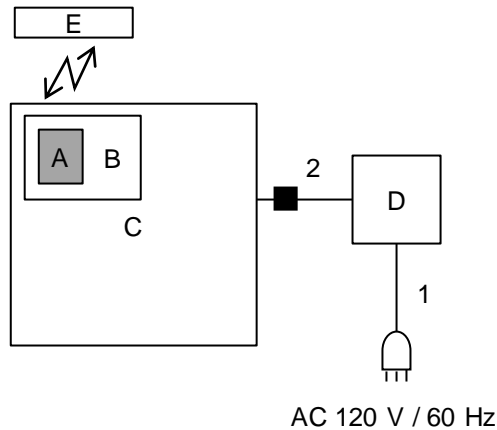
The mode is used:

Test mode	Remarks
1. Transmitting mode (Tx) Type A (106 kbps)	Modulation on, With Tag / Without Tag
2. Transmitting mode (Tx) Type B (106 kbps)	Modulation on, With Tag / Without Tag
3. Transmitting mode (Tx) FeliCa (212 kbps)	Modulation on, With Tag / Without Tag
4. Transmitting mode (Tx) ISO15693 (26.48 kbps)	Modulation on, With Tag / Without Tag
5. Transmitting mode (Tx) CW	Modulation off
The EUT was operated in a manner similar to typical use during the tests.	
*Power of the EUT was set by the software as follows; Software: Inspection.exe Version 1.0 (Date: July 13, 2023, 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.	
Justification: The system was configured in typical fashion (as a user would normally use it) for testing.	

Test Item	Operating mode
Conducted Emission, Electric Field Strength of Fundamental Emission, Spectrum Mask, Electric Field Strength of Spurious Emission, 20 dB Bandwidth and 99 % Occupied Bandwidth	Mode 1, 2, 3, 4 (Without Tag) ----- Mode 1, 2, 3, 4 (With Tag)
Frequency Tolerance	Mode 5

Frequency Tolerance:			
Temperature	-20 deg. C to +50 deg. C Step 10 deg. C		
Voltage	Normal Voltage	DC 10.8 V	AC 120 V
	Maximum Voltage	DC 12.42 V (DC 10.8 V +15 %)	AC 102 V (AC 120 V +15 %)
	Minimum Voltage	DC 9.18 V (DC 10.8 V -15 %)	AC 138 V (AC 120 V -15 %)
*This EUT provides stable voltage constantly to RF Part regardless of input voltage			

4.2 Configuration and peripherals



■ : Standard Ferrite Core

* Cabling and setup were taken into consideration and test data was taken under worse case conditions.
* As a result of comparing AC 120 V and AC 240 V at pre-check, conducted emission test was performed with AC 120 V of the worst voltage as representative.

Description of EUT and Support Equipment

No.	Item	Model number	Serial Number	Manufacturer	Remark
A	RFID Module	RI23A	*1)	Panasonic Connect Co., Ltd.	EUT
B	Contactless Smart Card Reader	FZ-VNF402	3FTSA00006	Panasonic Connect Co., Ltd.	-
C	Personal Computer	FZ-40	1JTSA00070	Panasonic Connect Co., Ltd.	-
D	AC Adaptor	CF-AA5713A M7	5713AM7223013130WB	Panasonic Connect Co., Ltd.	-
E	Tag	-	-	-	Type A Type B FeliCa ISO 15693

*1) This item is controlled with B: Contactless Smart Card Reader

List of Cables Used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	AC Cable	1.8	Unshielded	Unshielded	-
2	DC Cable	1.2	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 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 with other peripherals (as a whole system)

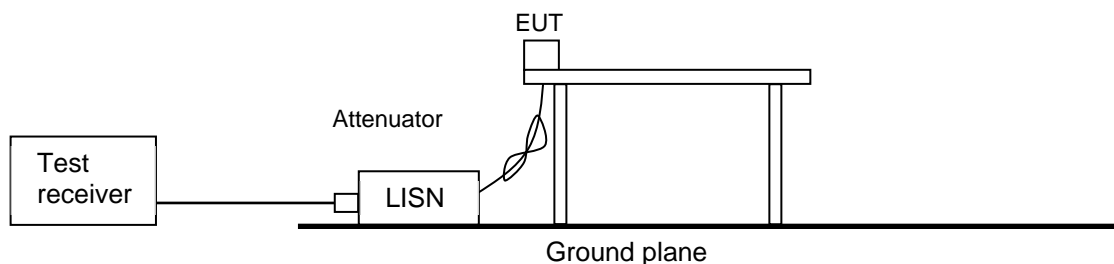
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50 ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected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

Figure 1: Test Setup



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

SECTION 6: Radiated Emission (Fundamental, Spurious Emission and Spectrum Mask)

Test Procedure

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.

[Limit conversion]

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.

[Frequency: From 9 kHz to 30 MHz]

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

*Refer to Figure 3 about Direction of the Loop Antenna.

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane. However test results were confirmed to pass against standard limit.

[Frequency: From 30 MHz to 1 GHz]

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

The measurements were performed for both vertical and horizontal antenna polarization.

[Test instruments and test settings]

Frequency	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz
Antenna Type	Loop	Biconical	Logperiodic

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.

Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m

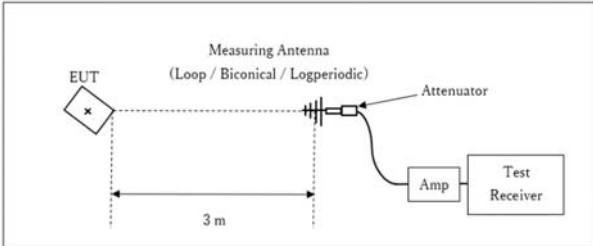
*1) Distance Factor: $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

*2) Distance Factor: $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Figure 2: Test Setup

Below 1 GHz

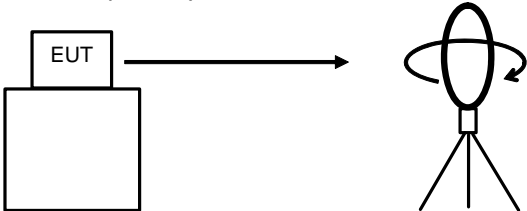
Test Distance: 3 m



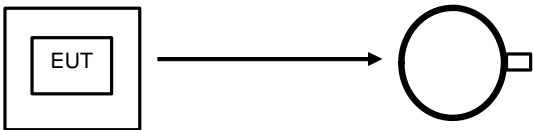
x : Center of turn table

Figure 3: Direction of the Loop Antenna

Side View (Vertical)

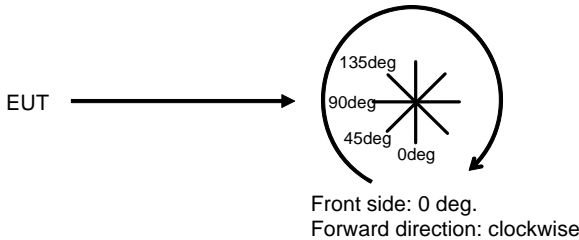


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



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

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

Measurement range : 9 kHz to 1 GHz
Test data : APPENDIX
Test result : Pass

SECTION 7: Other tests

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	4 MHz *1)	12 kHz	36 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
		3 kHz *1)	10 kHz				
		6.2 kHz *1)	20 kHz				
		5.1 kHz	16 kHz				
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *2)	Max Hold *2)	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Spectrum Analyzer *3)

*1) The transmitter signal is CW-like it is impractical to use a RBW setting of 1 to 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW. And for the same reason, the span setting of 20 dB Bandwidth does not affect the test results. Therefore, this test was performed with same setting as 99 % Occupied Bandwidth test.
*2) The measurement was performed with Peak detector, Max Hold as Worst-case measurement.
*3) The measurement was performed with Marker Frequency Counter Function.

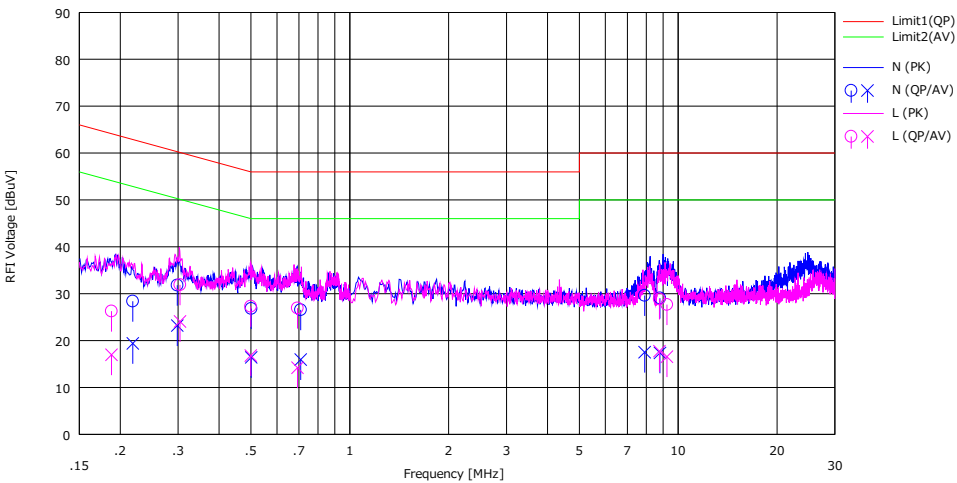
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Takeshi Hiyaji
Mode Mode 1 Without Tag

Limit : FCC_Part 15 Subpart C(15.207)



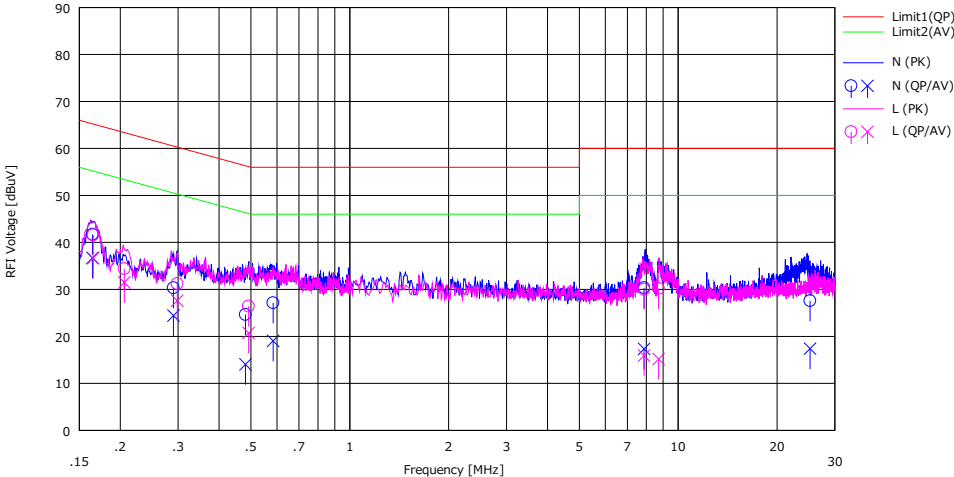
No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.21827	15.20	6.20	0.06	13.14	28.40	19.40	62.88	52.88	34.48	33.48	N	
2	0.29849	18.60	10.00	0.06	13.15	31.81	23.21	60.28	50.28	28.47	27.07	N	
3	0.50118	13.60	3.20	0.06	13.17	26.83	16.43	56.00	46.00	29.17	29.57	N	
4	0.70844	13.30	2.70	0.07	13.19	26.56	15.96	56.00	46.00	29.44	30.04	N	
5	7.90354	15.90	3.80	0.20	13.53	29.63	17.53	60.00	50.00	30.37	32.47	N	
6	8.80376	15.30	3.60	0.22	13.55	29.07	17.37	60.00	50.00	30.93	32.63	N	
7	0.18815	13.10	3.80	0.04	13.14	26.28	16.98	64.12	54.12	37.84	37.14	L	
8	0.30430	18.70	10.90	0.04	13.15	31.89	24.09	60.12	50.12	28.23	26.03	L	
9	0.49934	14.10	3.60	0.04	13.17	27.31	16.81	56.01	46.01	28.70	29.20	L	
10	0.69295	13.70	1.00	0.04	13.19	26.93	14.23	56.00	46.00	29.07	31.77	L	
11	8.76440	15.10	4.00	0.20	13.55	28.85	17.75	60.00	50.00	31.15	32.25	L	
12	9.24138	13.90	2.80	0.21	13.57	27.68	16.58	60.00	50.00	32.32	33.42	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

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Takeshi Hiyaji
Mode Mode 1 With Tag

Limit : FCC_Part 15 Subpart C(15.207)



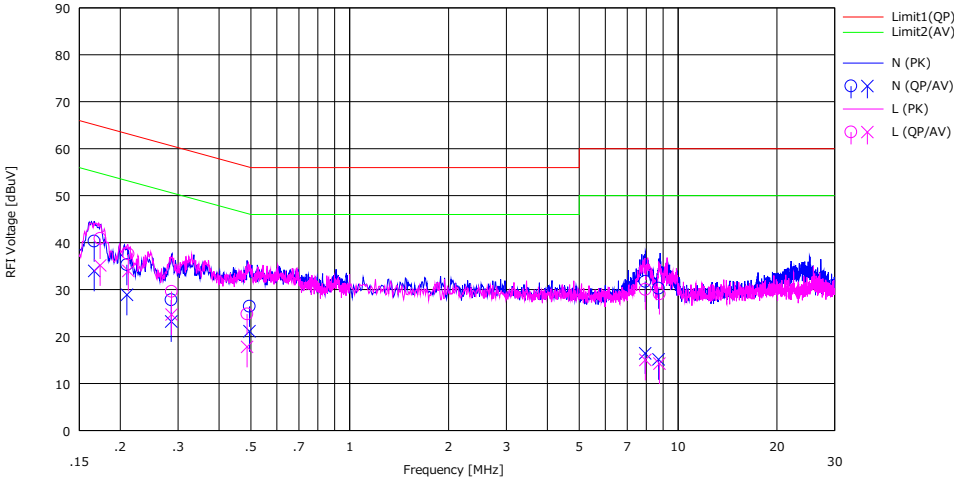
No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]				
1	0.16463	28.50	23.50	0.06	13.13	41.69	36.69	65.23	55.23	23.54	18.54	N	
2	0.29034	17.10	11.20	0.06	13.15	30.31	24.41	60.51	50.51	30.20	26.10	N	
3	0.48100	11.40	0.80	0.06	13.17	24.63	14.03	56.32	46.32	31.69	32.29	N	
4	0.58430	13.90	5.80	0.06	13.18	27.14	19.04	56.00	46.00	28.86	26.96	N	
5	7.87744	16.60	3.60	0.20	13.53	30.33	17.33	60.00	50.00	29.67	32.67	N	
6	25.21089	13.10	2.90	0.53	13.94	27.57	17.37	60.00	50.00	32.43	32.63	N	
7	0.16540	28.40	23.50	0.03	13.13	41.56	36.66	65.19	55.19	23.63	18.53	L	
8	0.20585	21.20	18.30	0.04	13.14	34.38	31.48	63.37	53.37	28.99	21.89	L	
9	0.29841	18.00	14.40	0.04	13.15	31.19	27.59	60.29	50.29	29.10	22.70	L	
10	0.49197	13.20	7.50	0.04	13.17	26.41	20.71	56.13	46.13	29.72	25.42	L	
11	7.86801	16.30	2.20	0.18	13.53	30.01	15.91	60.00	50.00	29.99	34.09	L	
12	8.72241	16.40	1.40	0.20	13.55	30.15	15.15	60.00	50.00	29.85	34.85	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

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Takeshi Hiyaji
Mode Mode 2 Without Tag

Limit : FCC_Part 15 Subpart C(15.207)



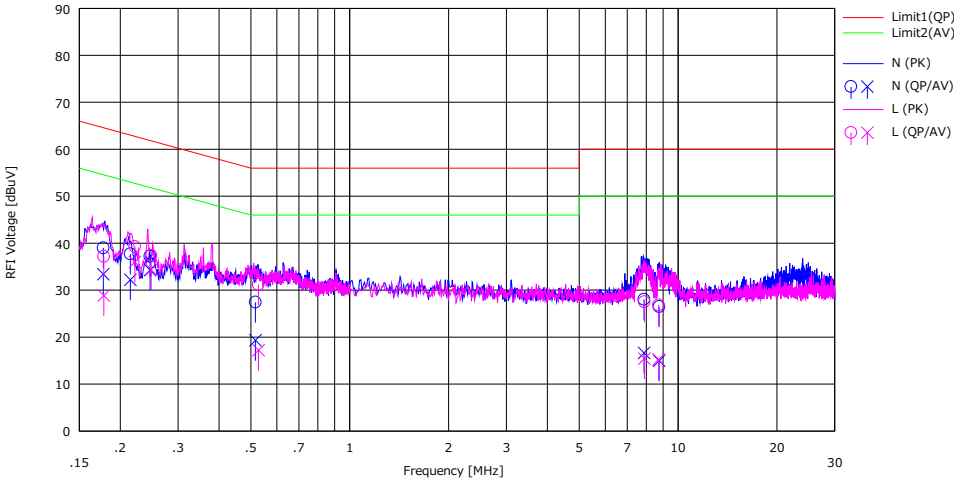
No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]				
1	0.16667	27.10	20.80	0.06	13.13	40.29	33.99	65.12	55.12	24.83	21.13	N	
2	0.20964	22.10	15.70	0.06	13.14	35.30	28.90	63.22	53.22	27.92	24.32	N	
3	0.28613	14.60	10.00	0.06	13.15	27.81	23.21	60.64	50.64	32.83	27.43	N	
4	0.49500	13.20	7.90	0.06	13.17	26.43	21.13	56.08	46.08	29.65	24.95	N	
5	7.94603	18.00	2.70	0.20	13.53	31.73	16.43	60.00	50.00	28.27	33.57	N	
6	8.72241	16.50	1.40	0.21	13.55	30.26	15.16	60.00	50.00	29.74	34.84	N	
7	0.17374	27.70	22.00	0.03	13.13	40.86	35.16	64.78	54.78	23.92	19.62	L	
8	0.21165	24.40	20.80	0.04	13.14	37.58	33.98	63.14	53.14	25.56	19.16	L	
9	0.28676	16.40	11.50	0.04	13.15	29.59	24.69	60.62	50.62	31.03	25.93	L	
10	0.48708	11.60	4.60	0.04	13.17	24.81	17.81	56.22	46.22	31.41	28.41	L	
11	7.94646	16.30	1.30	0.19	13.53	30.02	15.02	60.00	50.00	29.98	34.98	L	
12	8.77209	15.30	0.50	0.20	13.55	29.05	14.25	60.00	50.00	30.95	35.75	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

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Takeshi Hiyaji
Mode Mode 2 With Tag

Limit : FCC_Part 15 Subpart C(15.207)



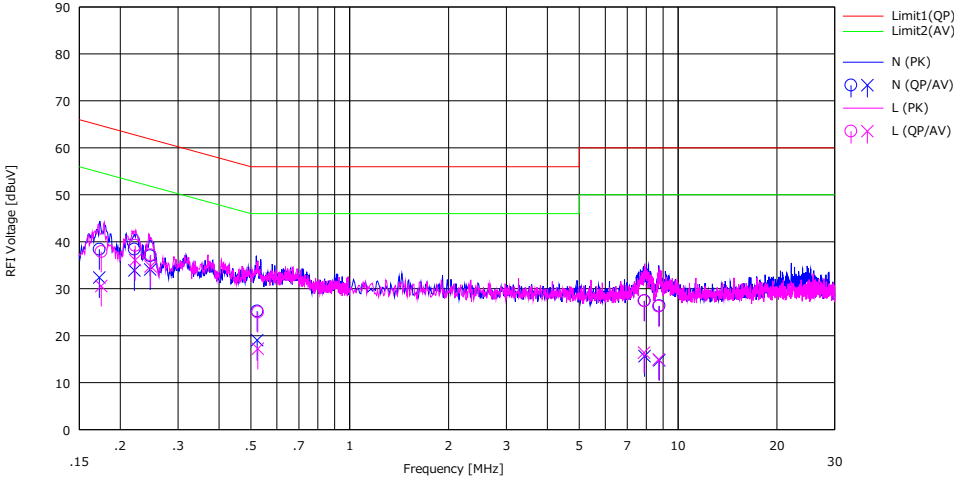
No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]				
1	0.17765	25.80	20.20	0.06	13.14	39.00	33.40	64.59	54.59	25.59	21.19	N	
2	0.21476	24.50	19.00	0.06	13.14	37.70	32.20	63.02	53.02	25.32	20.82	N	
3	0.24667	24.00	21.10	0.06	13.14	37.20	34.30	61.87	51.87	24.67	17.57	N	
4	0.51620	14.20	6.10	0.06	13.17	27.43	19.33	56.00	46.00	28.57	26.67	N	
5	7.87396	14.30	2.90	0.20	13.53	28.03	16.63	60.00	50.00	31.97	33.37	N	
6	8.76797	12.70	1.20	0.22	13.55	26.47	14.97	60.00	50.00	33.53	35.03	N	
7	0.17828	24.00	15.70	0.04	13.14	37.18	28.88	64.57	54.57	27.39	25.69	L	
8	0.22162	26.10	22.80	0.04	13.14	39.28	35.98	62.76	52.76	23.48	16.78	L	
9	0.24837	24.20	21.20	0.04	13.14	37.38	34.38	61.81	51.81	24.43	17.43	L	
10	0.52742	18.00	4.00	0.04	13.17	31.21	17.21	56.00	46.00	24.79	28.79	L	
11	7.88995	13.80	1.70	0.18	13.53	27.51	15.41	60.00	50.00	32.49	34.59	L	
12	8.72756	13.10	1.50	0.20	13.55	26.85	15.25	60.00	50.00	33.15	34.75	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

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Takeshi Hiyaji
Mode Mode 3 Without Tag

Limit : FCC_Part 15 Subpart C(15.207)



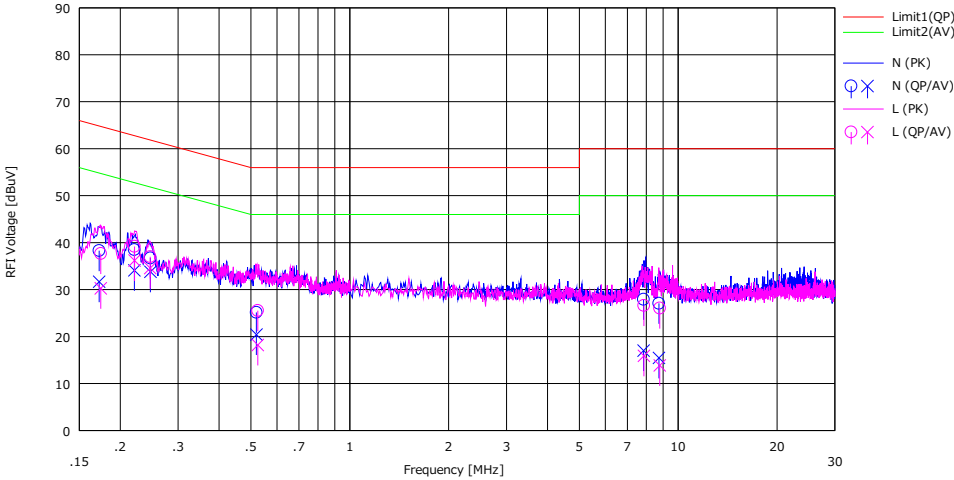
No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(AV) [dBuV]			(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]				
1	0.17283	25.20	19.20	0.06	13.13	38.39	32.39	64.82	54.82	26.43	22.43	N	
2	0.22084	25.20	20.70	0.06	13.14	38.40	33.90	62.79	52.79	24.39	18.89	N	
3	0.24689	23.80	20.90	0.06	13.14	37.00	34.10	61.86	51.86	24.86	17.76	N	
4	0.52282	12.00	5.80	0.06	13.17	25.23	19.03	56.00	46.00	30.77	26.97	N	
5	7.90139	13.70	1.90	0.20	13.53	27.43	15.63	60.00	50.00	32.57	34.37	N	
6	8.76349	12.60	1.00	0.22	13.55	26.37	14.77	60.00	50.00	33.63	35.23	N	
7	0.17519	24.70	17.40	0.04	13.14	37.88	30.58	64.71	54.71	26.83	24.13	L	
8	0.22215	26.00	22.90	0.04	13.14	39.18	36.08	62.74	52.74	23.56	16.66	L	
9	0.24751	24.00	21.60	0.04	13.14	37.18	34.78	61.84	51.84	24.66	17.06	L	
10	0.52495	11.80	4.00	0.04	13.17	25.01	17.21	56.00	46.00	30.99	28.79	L	
11	7.88104	13.70	2.70	0.18	13.53	27.41	16.41	60.00	50.00	32.59	33.59	L	
12	8.72564	12.50	1.20	0.20	13.55	26.25	14.95	60.00	50.00	33.75	35.05	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

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Takeshi Hiyaji
Mode Mode 3 With Tag

Limit : FCC_Part 15 Subpart C(15.207)



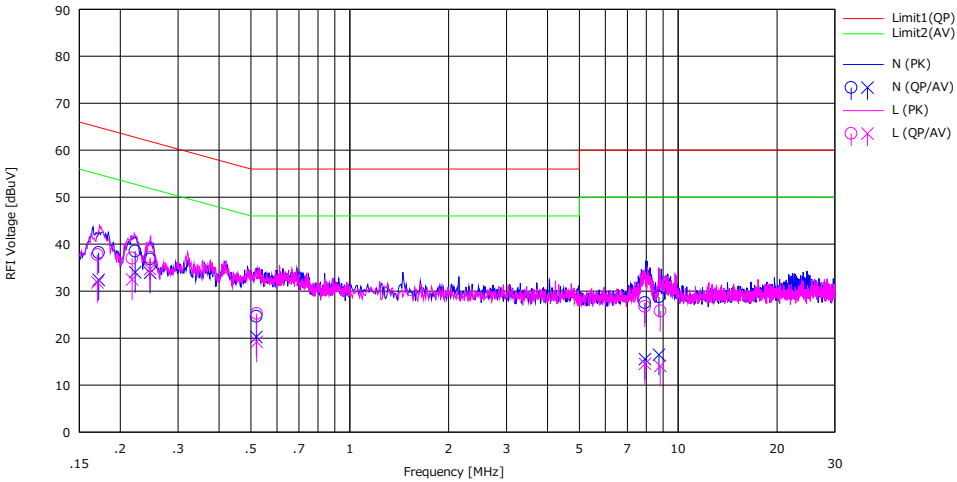
No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]				
1	0.17260	25.10	18.50	0.06	13.13	38.29	31.69	64.83	54.83	26.54	23.14	N	
2	0.22091	25.30	20.90	0.06	13.14	38.50	34.10	62.78	52.78	24.28	18.68	N	
3	0.24712	23.50	20.60	0.06	13.14	36.70	33.80	61.85	51.85	25.15	18.05	N	
4	0.51966	11.90	7.20	0.06	13.17	25.13	20.43	56.00	46.00	30.87	25.57	N	
5	7.84666	14.20	3.30	0.20	13.52	27.92	17.02	60.00	50.00	32.08	32.98	N	
6	8.74267	13.30	1.70	0.21	13.55	27.06	15.46	60.00	50.00	32.94	34.54	N	
7	0.17450	24.50	17.10	0.03	13.13	37.66	30.26	64.74	54.74	27.08	24.48	L	
8	0.22100	26.00	23.00	0.04	13.14	39.18	36.18	62.78	52.78	23.60	16.60	L	
9	0.24684	23.80	21.40	0.04	13.14	36.98	34.58	61.86	51.86	24.88	17.28	L	
10	0.52463	12.30	5.00	0.04	13.17	25.51	18.21	56.00	46.00	30.49	27.79	L	
11	7.86392	12.90	2.20	0.18	13.53	26.61	15.91	60.00	50.00	33.39	34.09	L	
12	8.79044	12.30	0.10	0.20	13.55	26.05	13.85	60.00	50.00	33.95	36.15	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

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Takeshi Hiyaji
Mode Mode 4 Without Tag

Limit : FCC_Part 15 Subpart C(15.207)



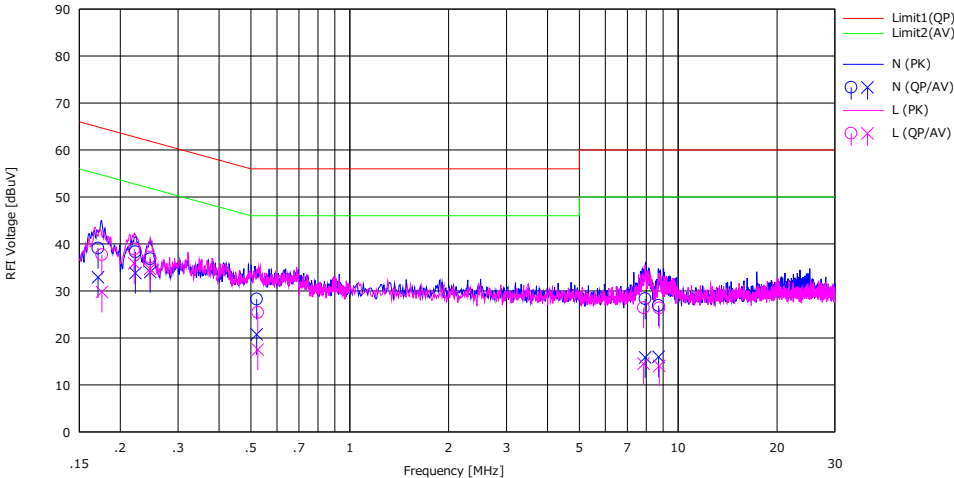
No.	Freq. [MHz]	Reading		USN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(AV) [dBuV]			(QP) [dBuV]	(AV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.17197	25.00	19.20	0.06	13.13	38.19	32.39	64.86	54.86	26.67	22.47	N	
2	0.22219	25.30	20.80	0.06	13.14	38.50	34.00	62.74	52.74	24.24	18.74	N	
3	0.24667	23.60	20.70	0.06	13.14	36.80	33.90	61.87	51.87	25.07	17.97	N	
4	0.51939	11.40	7.00	0.06	13.17	24.63	20.23	56.00	46.00	31.37	25.77	N	
5	7.92222	13.80	1.80	0.20	13.53	27.53	15.53	60.00	50.00	32.47	34.47	N	
6	8.73810	15.00	2.70	0.21	13.55	28.76	16.46	60.00	50.00	31.24	33.54	N	
7	0.17043	24.60	18.70	0.03	13.13	37.76	31.86	64.94	54.94	27.18	23.08	L	
8	0.21741	23.80	19.30	0.04	13.14	36.98	32.48	62.92	52.92	25.94	20.44	L	
9	0.24654	24.00	21.50	0.04	13.14	37.18	34.68	61.87	51.87	24.69	17.19	L	
10	0.52084	12.00	6.00	0.04	13.17	25.21	19.21	56.00	46.00	30.79	26.79	L	
11	7.91910	13.00	0.80	0.19	13.53	26.72	14.52	60.00	50.00	33.28	35.48	L	
12	8.82169	12.00	0.30	0.20	13.55	25.75	14.05	60.00	50.00	34.25	35.95	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

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Takeshi Hiyaji
Mode Mode 4 With Tag

Limit : FCC_Part 15 Subpart C(15.207)



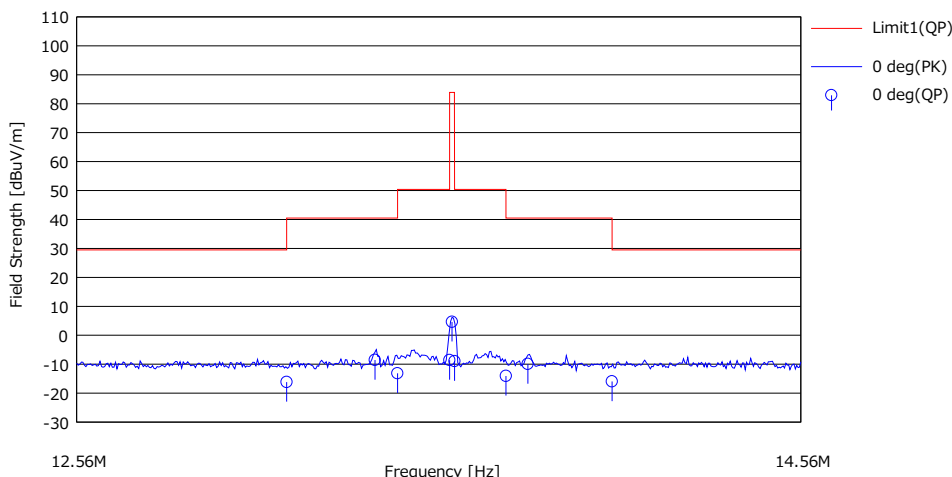
No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]				
1	0.17123	25.90	19.70	0.06	13.13	39.09	32.89	64.90	54.90	25.81	22.01	N	
2	0.22250	25.10	20.60	0.06	13.14	38.30	33.80	62.73	52.73	24.43	18.93	N	
3	0.24678	23.60	20.80	0.06	13.14	36.80	34.00	61.86	51.86	25.06	17.86	N	
4	0.52061	15.00	7.50	0.06	13.17	28.23	20.73	56.00	46.00	27.77	25.27	N	
5	7.93801	14.60	2.10	0.20	13.53	28.33	15.83	60.00	50.00	31.67	34.17	N	
6	8.71264	13.10	2.20	0.21	13.55	26.86	15.96	60.00	50.00	33.14	34.04	N	
7	0.17596	24.50	16.60	0.04	13.14	37.68	29.78	64.67	54.67	26.99	24.89	L	
8	0.22077	25.70	22.70	0.04	13.14	38.88	35.88	62.79	52.79	23.91	16.91	L	
9	0.24656	24.00	21.50	0.04	13.14	37.18	34.68	61.87	51.87	24.69	17.19	L	
10	0.52495	12.20	4.30	0.04	13.17	25.41	17.51	56.00	46.00	30.59	28.49	L	
11	7.84673	12.70	0.80	0.18	13.52	26.40	14.50	60.00	50.00	33.60	35.50	L	
12	8.75569	12.60	0.30	0.20	13.55	26.35	14.05	60.00	50.00	33.65	35.95	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.

Fundamental Emission and Spectrum Mask

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 24, 2023
Temperature / Humidity	21 deg. C / 58 % RH
Engineer	Tetsuro Yoshida
Mode	Mode 1 Without Tag

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
		[dBuV]				[dB/m]	[dB]	[dB]			
1	13.11000	28.90	20.55	-33.43	32.20	-16.18	29.50	45.68	0 deg	82	
2	13.34840	36.50	20.55	-33.42	32.19	-8.56	40.50	49.06	0 deg	82	
3	13.41000	31.90	20.55	-33.42	32.19	-13.16	40.50	53.66	0 deg	82	
4	13.55300	36.50	20.54	-33.42	32.19	-8.57	50.40	58.97	0 deg	82	
5	13.56000	49.70	20.54	-33.42	32.19	4.63	83.90	79.27	0 deg	82	
6	13.56700	36.10	20.54	-33.42	32.19	-8.97	50.40	59.37	0 deg	82	
7	13.71000	31.00	20.54	-33.41	32.19	-14.06	40.50	54.56	0 deg	82	
8	13.77140	35.10	20.54	-33.40	32.19	-9.95	40.50	50.45	0 deg	82	
9	14.01000	29.10	20.54	-33.40	32.19	-15.95	29.50	45.45	0 deg	82	

RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP)

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Result of the fundamental Emission at 3 m without Distance factor

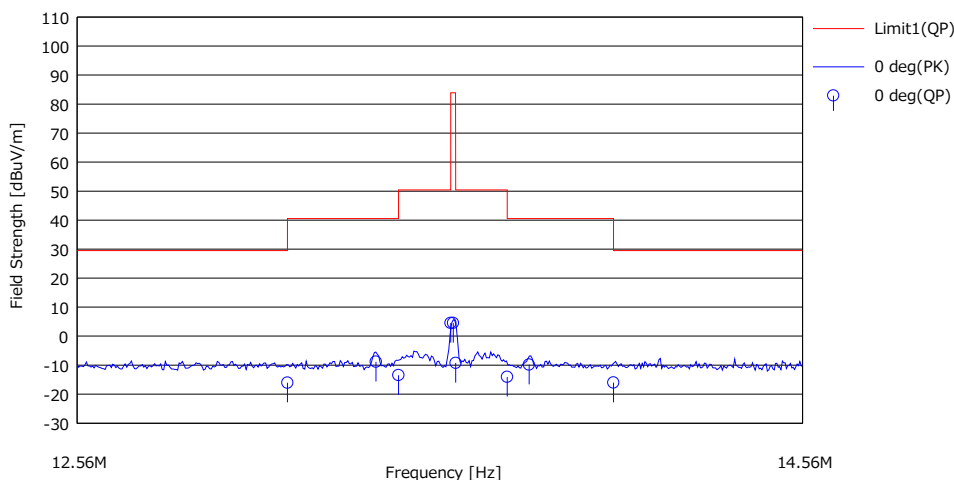
QP											
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	49.70	20.54	6.58	32.19	-	44.63	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

Fundamental Emission and Spectrum Mask

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 24, 2023
Temperature / Humidity	21 deg. C / 58 % RH
Engineer	Tetsuro Yoshida
Mode	Mode 1 With Tag

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
		<QP> [dBuV]	[dB/m]	[dB]	[dB]	<QP> [dBuV/m]	<QP> [dBuV/m]	<QP> [dB]			
1	13.11000	29.00	20.55	-3.343	32.20	-1.608	29.50	45.58	0 deg	82	
2	13.34840	36.20	20.55	-3.342	32.19	-8.86	40.50	49.36	0 deg	82	
3	13.41000	31.60	20.55	-3.342	32.19	-13.46	40.50	53.96	0 deg	82	
4	13.55300	49.60	20.54	-3.342	32.19	4.53	50.40	45.87	0 deg	82	
5	13.56000	49.60	20.54	-3.342	32.19	4.53	83.90	79.37	0 deg	82	
6	13.56700	35.80	20.54	-3.342	32.19	-9.27	50.40	59.67	0 deg	82	
7	13.71000	31.00	20.54	-3.341	32.19	-14.06	40.50	54.56	0 deg	82	
8	13.77140	35.20	20.54	-3.340	32.19	-9.85	40.50	50.35	0 deg	82	
9	14.01000	29.00	20.54	-3.340	32.19	-16.05	29.50	45.55	0 deg	82	

RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Result of the fundamental Emission at 3 m without Distance factor

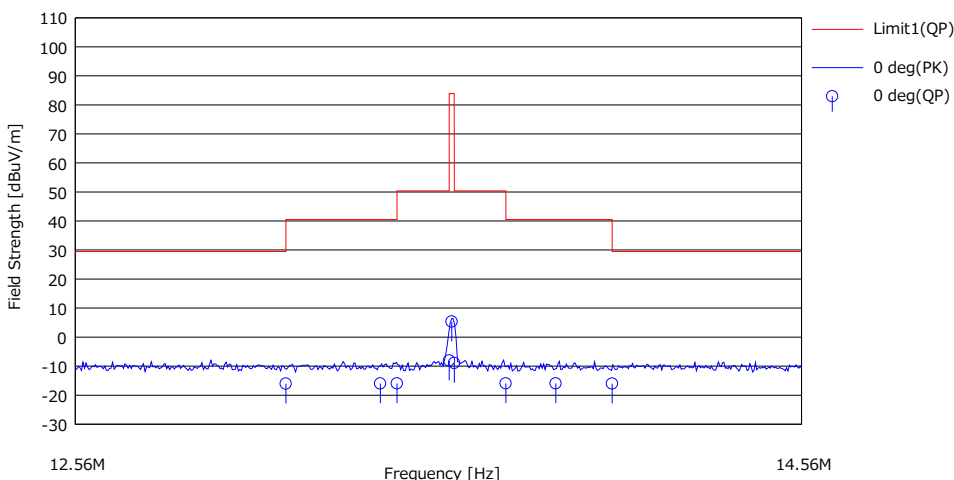
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	49.60	20.54	6.58	32.19	-	44.53	-	-	- Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

Fundamental Emission and Spectrum Mask

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 24, 2023
Temperature / Humidity	21 deg. C / 58 % RH
Engineer	Tetsuro Yoshida
Mode	Mode 2 Without Tag

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading <QP>	Ant.Fac	Loss	Gain	Result <QP>	Limit <QP>	Margin <QP>	Antenna	Table [deg]	Comment
		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]			
1	13.11000	29.00	20.55	-3.343	32.20	-1.608	29.50	45.58	0 deg	82	
2	13.36434	29.07	20.55	-3.342	32.19	-1.599	40.50	56.49	0 deg	82	
3	13.41000	29.10	20.55	-3.342	32.19	-1.596	40.50	56.46	0 deg	82	
4	13.55300	37.00	20.54	-3.342	32.19	-8.07	50.40	58.47	0 deg	82	
5	13.56000	50.40	20.54	-3.342	32.19	5.33	83.90	78.57	0 deg	82	
6	13.56700	36.10	20.54	-3.342	32.19	-8.97	50.40	59.37	0 deg	82	
7	13.71000	29.10	20.54	-3.341	32.19	-1.596	40.50	56.46	0 deg	82	
8	13.85000	29.10	20.54	-3.340	32.19	-1.595	40.50	56.45	0 deg	82	
9	14.01000	29.00	20.54	-3.340	32.19	-1.605	29.50	45.55	0 deg	82	

RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP)

*) Distance Factor: $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Result of the fundamental Emission at 3 m without Distance factor

QP

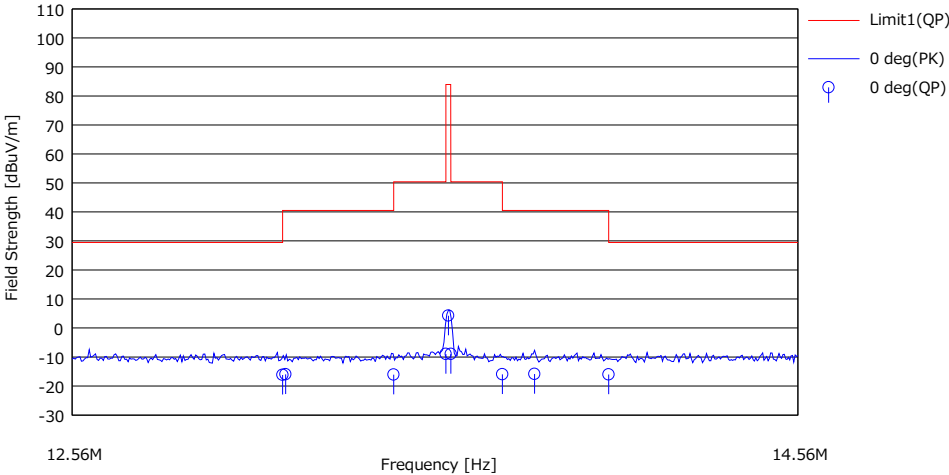
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	50.40	20.54	6.58	32.19	-	45.33	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

Fundamental Emission and Spectrum Mask

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Tetsuro Yoshida
Mode Mode 2 With Tag

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]			
1	13.11000	28.90	20.55	-33.43	32.20	-1.618	29.50	45.68	0 deg	82	
2	13.11810	29.10	20.55	-33.43	32.20	-1.598	40.50	56.48	0 deg	82	
3	13.41000	29.00	20.55	-33.42	32.19	-1.606	40.50	56.56	0 deg	82	
4	13.55300	36.10	20.54	-33.42	32.19	-8.97	50.40	59.37	0 deg	82	
5	13.56000	49.30	20.54	-33.42	32.19	4.23	83.90	79.67	0 deg	82	
6	13.56700	36.10	20.54	-33.42	32.19	-8.97	50.40	59.37	0 deg	82	
7	13.71000	29.10	20.54	-33.41	32.19	-1.596	40.50	56.46	0 deg	82	
8	13.80002	29.20	20.54	-33.40	32.19	-1.585	40.50	56.35	0 deg	82	
9	14.01000	29.00	20.54	-33.40	32.19	-1.605	29.50	45.55	0 deg	82	

RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP)
*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Result of the fundamental Emission at 3 m without Distance factor

QP

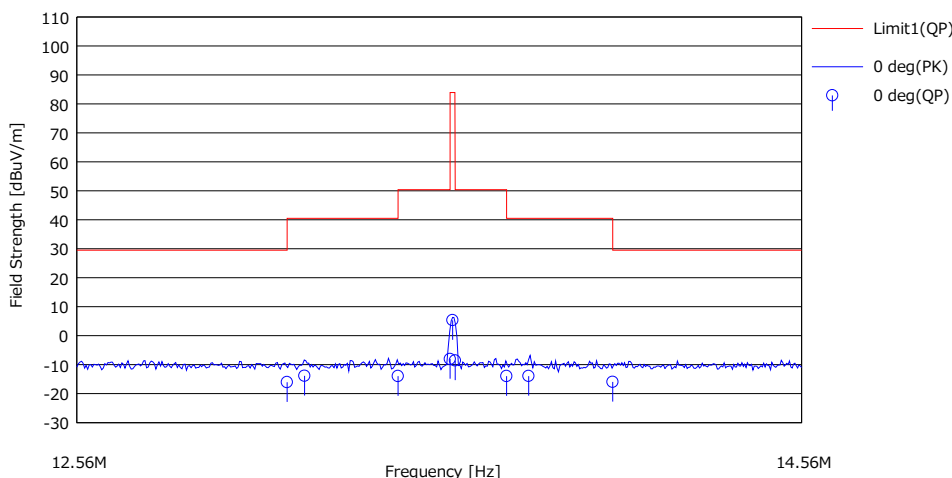
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	49.30	20.54	6.58	32.19	-	44.23	-	-	- Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

Fundamental Emission and Spectrum Mask

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 24, 2023
Temperature / Humidity	21 deg. C / 58 % RH
Engineer	Tetsuro Yoshida
Mode	Mode 3 Without Tag

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
		[QP]	[dB/m]	[dB]	[dB]	[QP]	[QP]	[QP]			
1	13.11000	29.00	20.55	-33.43	32.20	-1.608	29.50	45.58	0 deg	82	
2	13.15682	31.20	20.55	-33.43	32.20	-1.388	40.50	54.38	0 deg	82	
3	13.41000	31.10	20.55	-33.42	32.19	-1.396	40.50	54.46	0 deg	82	
4	13.55300	37.00	20.54	-33.42	32.19	-8.07	50.40	58.47	0 deg	82	
5	13.56000	50.40	20.54	-33.42	32.19	5.33	83.90	78.57	0 deg	82	
6	13.56700	36.50	20.54	-33.42	32.19	-8.57	50.40	58.97	0 deg	82	
7	13.71000	31.10	20.54	-33.41	32.19	-1.396	40.50	54.46	0 deg	82	
8	13.77170	31.10	20.54	-33.40	32.19	-1.395	40.50	54.45	0 deg	82	
9	14.01000	29.10	20.54	-33.40	32.19	-1.595	29.50	45.45	0 deg	82	

RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP)

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Result of the fundamental Emission at 3 m without Distance factor

QP

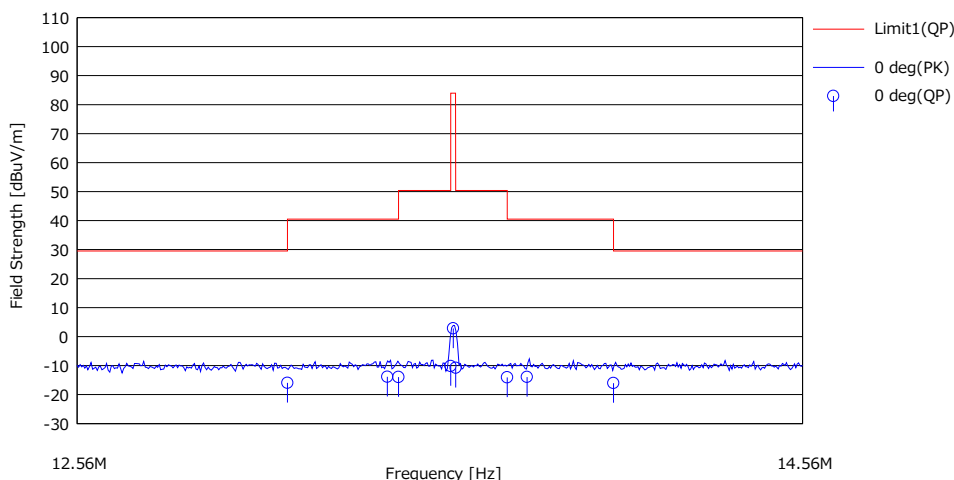
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	50.40	20.54	6.58	32.19	-	45.33	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

Fundamental Emission and Spectrum Mask

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 24, 2023
Temperature / Humidity	21 deg. C / 58 % RH
Engineer	Tetsuro Yoshida
Mode	Mode 3 With Tag

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result	Limit	Margin	Antenna	Table	Comment
		<QP> [dBuV]				<QP> [dBuV/m]	<QP> [dB]				
1	13.11000	29.10	20.55	-3.343	32.20	-15.98	29.50	45.48	0 deg	82	
2	13.37960	31.20	20.55	-3.342	32.19	-13.86	40.50	54.36	0 deg	82	
3	13.41000	31.10	20.55	-3.342	32.19	-13.96	40.50	54.46	0 deg	82	
4	13.55300	34.90	20.54	-3.342	32.19	-10.17	50.40	60.57	0 deg	82	
5	13.56000	47.90	20.54	-3.342	32.19	2.83	83.90	81.07	0 deg	82	
6	13.56700	34.30	20.54	-3.342	32.19	-10.77	50.40	61.17	0 deg	82	
7	13.71000	31.00	20.54	-3.341	32.19	-14.06	40.50	54.56	0 deg	82	
8	13.76548	31.10	20.54	-3.340	32.19	-13.95	40.50	54.45	0 deg	82	
9	14.01000	29.00	20.54	-3.340	32.19	-16.05	29.50	45.55	0 deg	82	

RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP)

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Result of the fundamental Emission at 3 m without Distance factor

QP

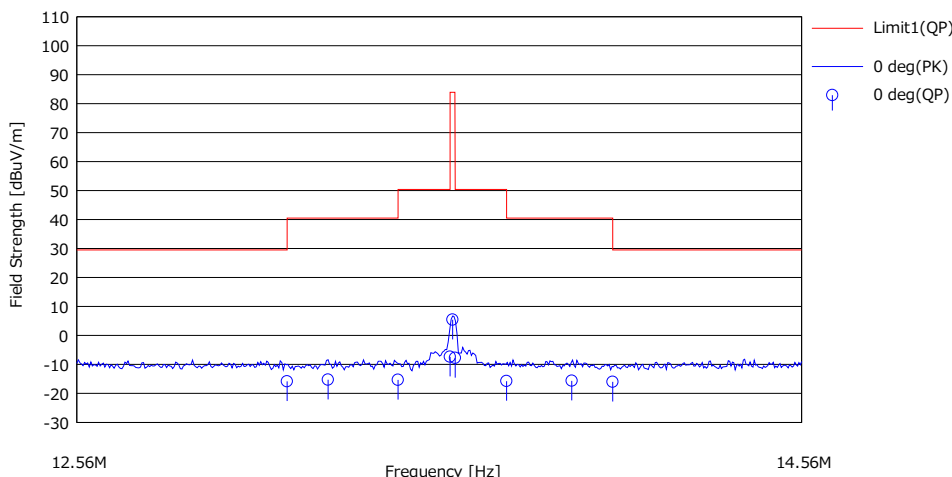
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	47.90	20.54	6.58	32.19	-	42.83	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

Fundamental Emission and Spectrum Mask

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 24, 2023
Temperature / Humidity	21 deg. C / 58 % RH
Engineer	Tetsuro Yoshida
Mode	Mode 4 Without Tag

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading (QP)	Ant.Fac	Loss	Gain	Result (QP)	Limit (QP)	Margin (QP)	Antenna [deg]	Table [deg]	Comment
		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]			
1	13.11000	29.20	20.55	-33.43	32.20	-1.588	29.50	45.38	0 deg	82	
2	13.22020	29.80	20.55	-33.43	32.20	-1.528	40.50	55.78	0 deg	82	
3	13.41000	29.70	20.55	-33.42	32.19	-1.536	40.50	55.86	0 deg	82	
4	13.55300	37.70	20.54	-33.42	32.19	-7.37	50.40	57.77	0 deg	82	
5	13.56000	50.50	20.54	-33.42	32.19	5.43	83.90	78.47	0 deg	82	
6	13.56700	37.30	20.54	-33.42	32.19	-7.77	50.40	58.17	0 deg	82	
7	13.71000	29.30	20.54	-33.41	32.19	-1.576	40.50	56.26	0 deg	82	
8	13.89377	29.40	20.54	-33.40	32.19	-1.565	40.50	56.15	0 deg	82	
9	14.01000	29.00	20.54	-33.40	32.19	-1.605	29.50	45.55	0 deg	82	

RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP)

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Result of the fundamental Emission at 3 m without Distance factor

QP

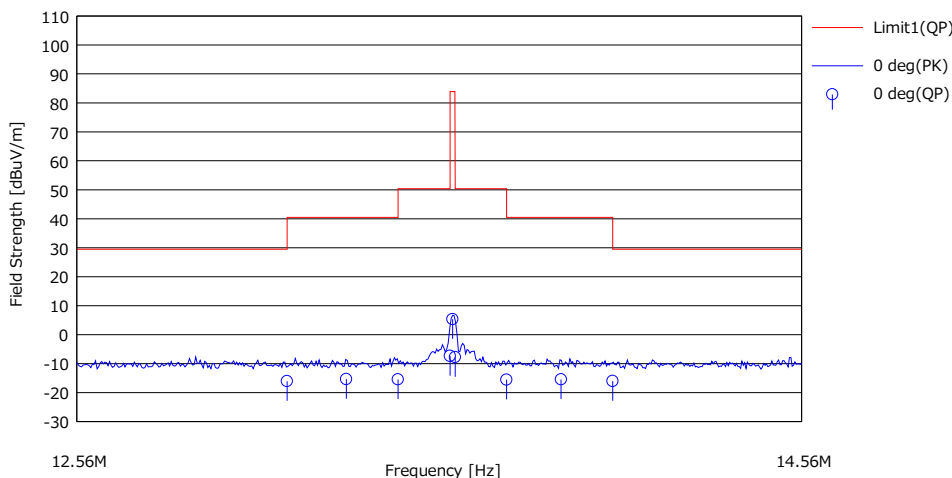
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	50.50	20.54	6.58	32.19	-	45.43	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

Fundamental Emission and Spectrum Mask

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 24, 2023
Temperature / Humidity	21 deg. C / 58 % RH
Engineer	Tetsuro Yoshida
Mode	Mode 4 With Tag

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading (QP)	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP)	Limit (QP)	Margin (QP)	Antenna	Table [deg]	Comment
		[dBuV]				[dBuV/m]	[dBuV/m]	[dB]			
1	13.11000	29.00	20.55	-33.43	32.20	-16.08	29.50	45.58	0 deg	82	
2	13.26924	29.70	20.55	-33.42	32.20	-15.37	40.50	55.87	0 deg	82	
3	13.41000	29.60	20.55	-33.42	32.19	-15.46	40.50	55.96	0 deg	82	
4	13.55300	37.70	20.54	-33.42	32.19	-7.37	50.40	57.77	0 deg	82	
5	13.56000	50.40	20.54	-33.42	32.19	5.33	83.90	78.57	0 deg	82	
6	13.56700	37.30	20.54	-33.42	32.19	-7.77	50.40	58.17	0 deg	82	
7	13.71000	29.50	20.54	-33.41	32.19	-15.56	40.50	56.06	0 deg	82	
8	13.86320	29.60	20.54	-33.40	32.19	-15.45	40.50	55.95	0 deg	82	
9	14.01000	29.00	20.54	-33.40	32.19	-16.05	29.50	45.55	0 deg	82	

RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP)
*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Result of the fundamental Emission at 3 m without Distance factor

QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	50.40	20.54	6.58	32.19	-	45.33	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

Spurious Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Tetsuro Yoshida
Mode Mode 1 Without Tag

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	27.120	QP	28.50	19.90	-33.07	32.17	-	-16.84	29.5	46.34	Floor Noise
Hori.	31.029	QP	22.80	18.14	7.04	32.17	-	15.81	40.0	24.19	Floor Noise
Hori.	86.769	QP	22.50	8.01	7.93	32.13	-	6.31	40.0	33.69	
Hori.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Hori.	243.185	QP	23.80	12.02	9.54	32.01	-	13.35	46.0	32.67	
Hori.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Hori.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise
Vert.	31.029	QP	23.40	18.14	7.04	32.17	-	16.41	40.0	23.59	
Vert.	86.769	QP	25.40	8.01	7.93	32.13	-	9.21	40.0	30.79	
Vert.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Vert.	243.185	QP	25.00	12.02	9.54	32.01	-	14.55	46.0	31.47	
Vert.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Vert.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise

Below 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))

Above 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator) - GAIN(AMP))

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Spurious Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Tetsuro Yoshida
Mode Mode 1 With Tag

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	27.120	QP	28.50	19.90	-33.07	32.17	-	-16.84	29.5	46.34	Floor Noise
Hori.	31.029	QP	22.80	18.14	7.04	32.17	-	15.81	40.0	24.19	Floor Noise
Hori.	86.769	QP	22.30	8.01	7.93	32.13	-	6.11	40.0	33.89	
Hori.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Hori.	243.185	QP	23.80	12.02	9.54	32.01	-	13.35	46.0	32.67	
Hori.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Hori.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise
Vert.	31.029	QP	23.30	18.14	7.04	32.17	-	16.31	40.0	23.69	
Vert.	86.769	QP	25.00	8.01	7.93	32.13	-	8.81	40.0	31.19	
Vert.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Vert.	243.185	QP	25.00	12.02	9.54	32.01	-	14.55	46.0	31.47	
Vert.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Vert.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise

Below 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))

Above 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator) - GAIN(AMP))

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Spurious Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Tetsuro Yoshida
Mode Mode 2 Without Tag

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	27.120	QP	28.50	19.90	-33.07	32.17	-	-16.84	29.5	46.34	Floor Noise
Hori.	31.029	QP	22.80	18.14	7.04	32.17	-	15.81	40.0	24.19	Floor Noise
Hori.	86.769	QP	22.30	8.01	7.93	32.13	-	6.11	40.0	33.89	
Hori.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Hori.	243.185	QP	23.40	12.02	9.54	32.01	-	12.95	46.0	33.07	
Hori.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Hori.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise
Vert.	31.029	QP	23.30	18.14	7.04	32.17	-	16.31	40.0	23.69	
Vert.	86.769	QP	24.30	8.01	7.93	32.13	-	8.11	40.0	31.89	
Vert.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Vert.	243.185	QP	25.00	12.02	9.54	32.01	-	14.55	46.0	31.47	
Vert.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Vert.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise

Below 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))

Above 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator) - GAIN(AMP))

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Spurious Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Tetsuro Yoshida
Mode Mode 2 With Tag

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	27.120	QP	28.50	19.90	-33.07	32.17	-	-16.84	29.5	46.34	Floor Noise
Hori.	31.029	QP	22.80	18.14	7.04	32.17	-	15.81	40.0	24.19	Floor Noise
Hori.	86.769	QP	22.20	8.01	7.93	32.13	-	6.01	40.0	33.99	
Hori.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Hori.	243.185	QP	23.50	12.02	9.54	32.01	-	13.05	46.0	32.97	
Hori.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Hori.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise
Vert.	31.029	QP	23.30	18.14	7.04	32.17	-	16.31	40.0	23.69	
Vert.	86.769	QP	24.20	8.01	7.93	32.13	-	8.01	40.0	31.99	
Vert.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Vert.	243.185	QP	24.40	12.02	9.54	32.01	-	13.95	46.0	32.07	
Vert.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Vert.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise

Below 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))

Above 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator) - GAIN(AMP))

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Spurious Emission

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 24, 2023
Temperature / Humidity	21 deg. C / 58 % RH
Engineer	Tetsuro Yoshida
Mode	Mode 3 Without Tag

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	27.120	QP	28.50	19.90	-33.07	32.17	-	-16.84	29.5	46.34	Floor Noise
Hori.	31.029	QP	22.80	18.14	7.04	32.17	-	15.81	40.0	24.19	Floor Noise
Hori.	86.769	QP	22.20	8.01	7.93	32.13	-	6.01	40.0	33.99	
Hori.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Hori.	243.185	QP	23.60	12.02	9.54	32.01	-	13.15	46.0	32.87	
Hori.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Hori.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise
Vert.	31.029	QP	23.30	18.14	7.04	32.17	-	16.31	40.0	23.69	
Vert.	86.769	QP	25.00	8.01	7.93	32.13	-	8.81	40.0	31.19	
Vert.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Vert.	243.185	QP	25.20	12.02	9.54	32.01	-	14.75	46.0	31.27	
Vert.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Vert.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise

Below 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))

Above 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator) - GAIN(AMP))

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Spurious Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Tetsuro Yoshida
Mode Mode 3 With Tag

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	27.120	QP	28.50	19.90	-33.07	32.17	-	-16.84	29.5	46.34	Floor Noise
Hori.	31.029	QP	22.80	18.14	7.04	32.17	-	15.81	40.0	24.19	Floor Noise
Hori.	86.769	QP	22.20	8.01	7.93	32.13	-	6.01	40.0	33.99	
Hori.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Hori.	243.185	QP	23.80	12.02	9.54	32.01	-	13.35	46.0	32.67	
Hori.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Hori.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise
Vert.	31.029	QP	23.10	18.14	7.04	32.17	-	16.11	40.0	23.89	
Vert.	86.769	QP	25.00	8.01	7.93	32.13	-	8.81	40.0	31.19	
Vert.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Vert.	243.185	QP	24.50	12.02	9.54	32.01	-	14.05	46.0	31.97	
Vert.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Vert.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise

Below 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))

Above 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator) - GAIN(AMP))

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Spurious Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Tetsuro Yoshida
Mode Mode 4 Without Tag

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	27.120	QP	28.50	19.90	-33.07	32.17	-	-16.84	29.5	46.34	Floor Noise
Hori.	31.029	QP	22.80	18.14	7.04	32.17	-	15.81	40.0	24.19	Floor Noise
Hori.	86.769	QP	22.30	8.01	7.93	32.13	-	6.11	40.0	33.89	
Hori.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Hori.	243.185	QP	23.80	12.02	9.54	32.01	-	13.35	46.0	32.67	
Hori.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Hori.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise
Vert.	31.029	QP	23.50	18.14	7.04	32.17	-	16.51	40.0	23.49	
Vert.	86.769	QP	24.50	8.01	7.93	32.13	-	8.31	40.0	31.69	
Vert.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Vert.	243.185	QP	24.70	12.02	9.54	32.01	-	14.25	46.0	31.77	
Vert.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Vert.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise

Below 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))

Above 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator) - GAIN(AMP))

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Spurious Emission

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 24, 2023
Temperature / Humidity	21 deg. C / 58 % RH
Engineer	Tetsuro Yoshida
Mode	Mode 4 With Tag

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	27.120	QP	28.50	19.90	-33.07	32.17	-	-16.84	29.5	46.34	Floor Noise
Hori.	31.029	QP	22.80	18.14	7.04	32.17	-	15.81	40.0	24.19	Floor Noise
Hori.	86.769	QP	22.30	8.01	7.93	32.13	-	6.11	40.0	33.89	
Hori.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Hori.	243.185	QP	23.50	12.02	9.54	32.01	-	13.05	46.0	32.97	
Hori.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Hori.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise
Vert.	31.029	QP	23.20	18.14	7.04	32.17	-	16.21	40.0	23.79	
Vert.	86.769	QP	25.00	8.01	7.93	32.13	-	8.81	40.0	31.19	
Vert.	162.606	QP	22.90	15.53	8.79	32.07	-	15.15	43.5	28.37	Floor Noise
Vert.	243.185	QP	24.50	12.02	9.54	32.01	-	14.05	46.0	31.97	
Vert.	415.660	QP	22.10	16.21	10.85	31.97	-	17.19	46.0	28.83	Floor Noise
Vert.	717.281	QP	21.60	20.17	12.71	31.83	-	22.65	46.0	23.37	Floor Noise

Below 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator + Distance Factor*) - GAIN(AMP))

Above 30 MHz : RESULT = READING + ANT FACTOR + LOSS (CABLE + Attenuator) - GAIN(AMP))

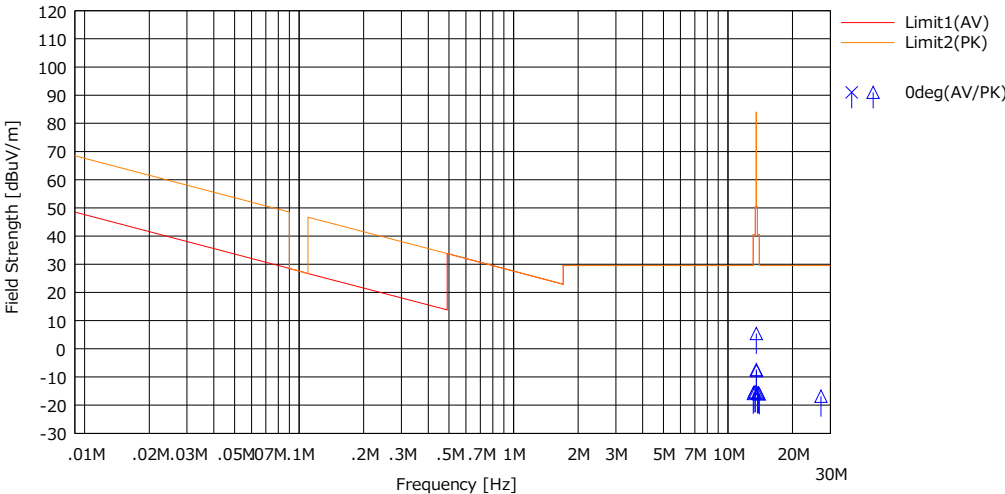
*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Spurious Emission
(Plot data, Worst case for Spurious Emission)

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 24, 2023
Temperature / Humidity 21 deg. C / 58 % RH
Engineer Tetsuro Yoshida
Mode Mode 4 Without Tag

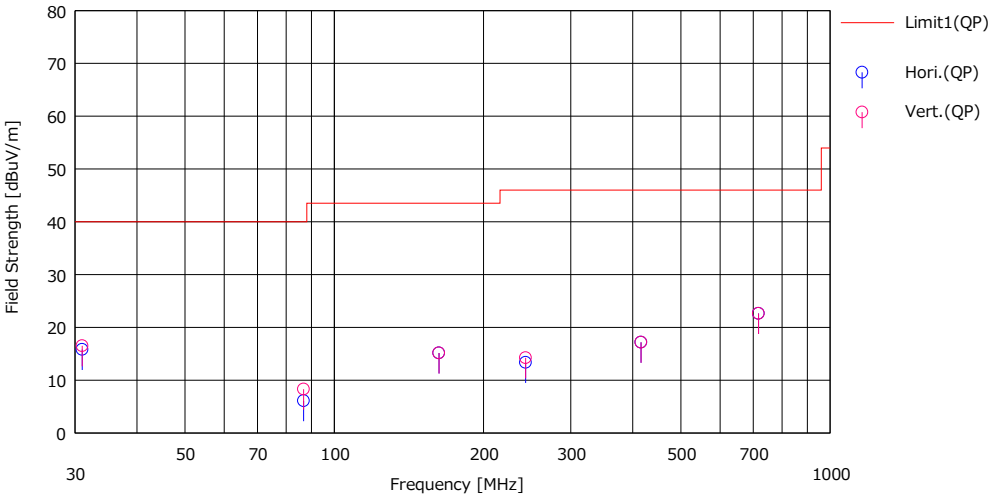
(below 30MHz)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



(above 30MHz)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP

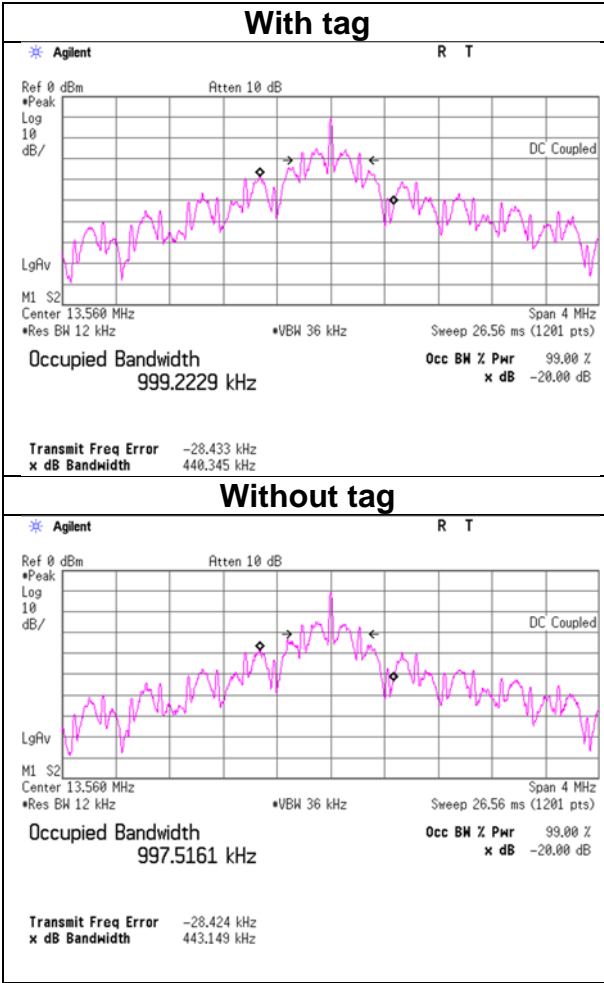


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

20 dB Bandwidth and 99% Occupied Bandwidth

Test place Ise EMC Lab.
Semi Anechoic Chamber No.6
Date August 3, 2023
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Junya Okuno
Mode Mode 1

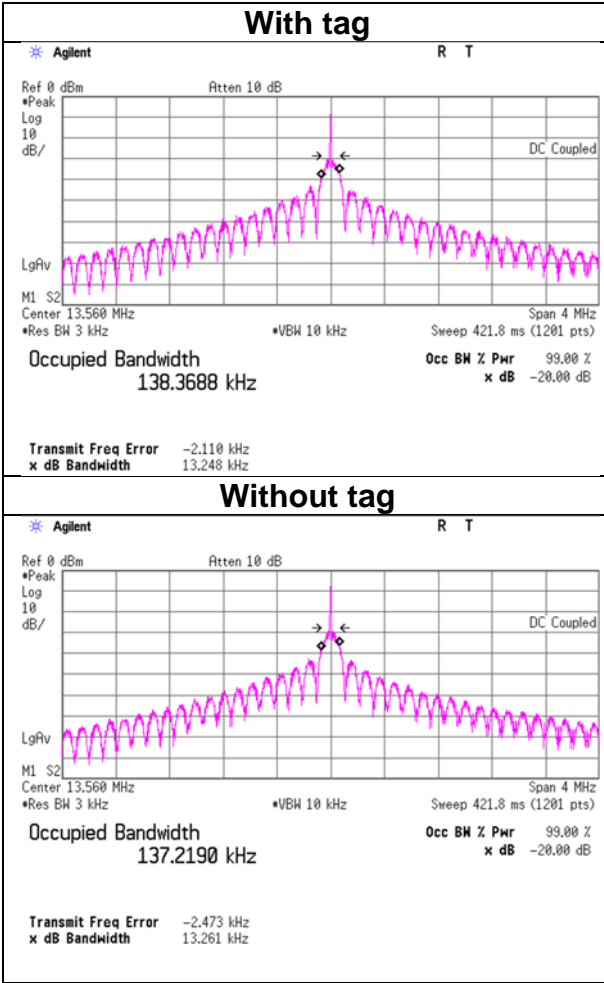
FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	With Tag	440.345	999.2229
	Without Tag	443.149	997.5161



20 dB Bandwidth and 99% Occupied Bandwidth

Test place Ise EMC Lab.
Semi Anechoic Chamber No.6
Date August 3, 2023
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Junya Okuno
Mode Mode 2

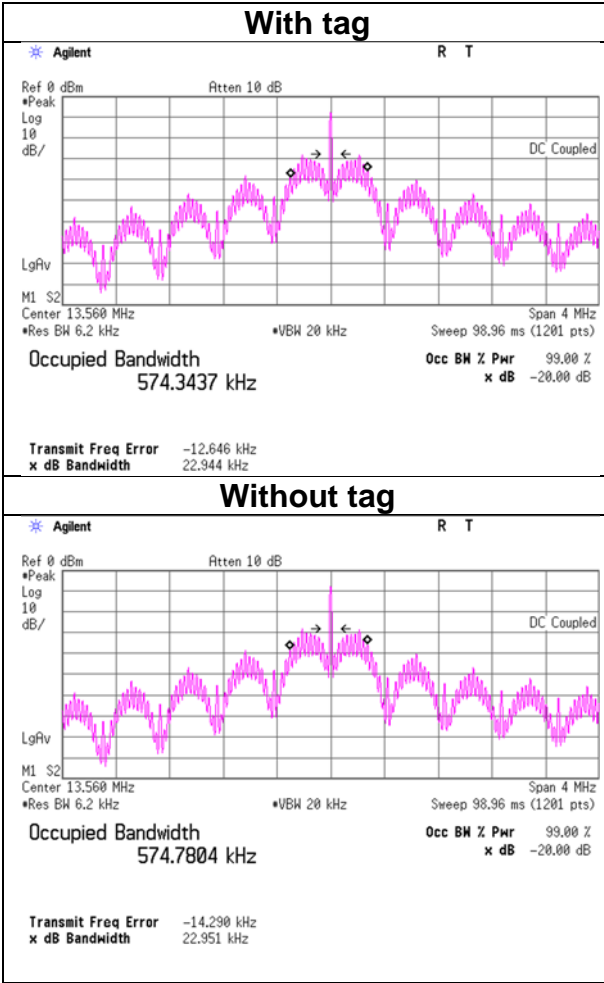
FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	With Tag	13.248	138.3688
	Without Tag	13.261	137.2190



20 dB Bandwidth and 99% Occupied Bandwidth

Test place Ise EMC Lab.
 Semi Anechoic Chamber No.6
 Date August 3, 2023
 Temperature / Humidity 22 deg. C / 48 % RH
 Engineer Junya Okuno
 Mode Mode 3

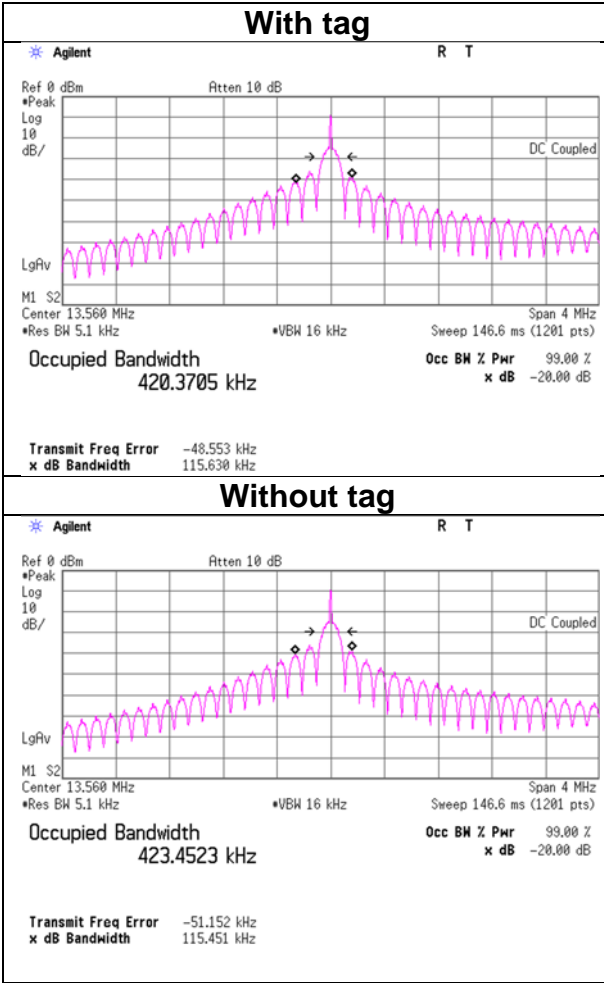
FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	With Tag	22.944	574.3437
	Without Tag	22.951	574.7804



20 dB Bandwidth and 99% Occupied Bandwidth

Test place Ise EMC Lab.
Semi Anechoic Chamber No.6
Date August 3, 2023
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Junya Okuno
Mode Mode 4

FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	With Tag	115.630	420.3705
	Without Tag	115.451	423.4523



Frequency Tolerance

Test place Ise EMC Lab.
 Measurement Room No.6
 Date July 25, 2023
 Temperature / Humidity 24 deg. C / 37 % RH
 Engineer Junya Okuno
 Mode Mode 5

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- %]
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	120	Power on	13.559835	-0.000165	-0.00122	-12.2	0.01
		+ 2 min.	13.559817	-0.000183	-0.00135	-13.5	0.01
		+ 5 min.	13.559815	-0.000185	-0.00136	-13.6	0.01
		+ 10 min.	13.559814	-0.000186	-0.00137	-13.7	0.01
40	120	Power on	13.559839	-0.000161	-0.00118	-11.8	0.01
		+ 2 min.	13.559832	-0.000168	-0.00124	-12.4	0.01
		+ 5 min.	13.559832	-0.000168	-0.00124	-12.4	0.01
		+ 10 min.	13.559837	-0.000163	-0.00120	-12.0	0.01
30	120	Power on	13.559857	-0.000143	-0.00105	-10.5	0.01
		+ 2 min.	13.559846	-0.000154	-0.00113	-11.3	0.01
		+ 5 min.	13.559853	-0.000147	-0.00109	-10.9	0.01
		+ 10 min.	13.559361	-0.000639	-0.00471	-47.1	0.01
20	120	Power on	13.559926	-0.000074	-0.00054	-5.4	0.01
		+ 2 min.	13.559915	-0.000085	-0.00063	-6.3	0.01
		+ 5 min.	13.559913	-0.000087	-0.00064	-6.4	0.01
		+ 10 min.	13.559911	-0.000089	-0.00066	-6.6	0.01
20	102 (120V -15%)	Power on	13.560089	0.000089	0.00066	6.6	0.01
		+ 2 min.	13.559988	-0.000012	-0.00009	-0.9	0.01
		+ 5 min.	13.560001	0.000001	0.00001	0.1	0.01
		+ 10 min.	13.559936	-0.000064	-0.00047	-4.7	0.01
20	138 (120V +15%)	Power on	13.559957	-0.000043	-0.00032	-3.2	0.01
		+ 2 min.	13.559926	-0.000074	-0.00054	-5.4	0.01
		+ 5 min.	13.559921	-0.000079	-0.00058	-5.8	0.01
		+ 10 min.	13.559916	-0.000084	-0.00062	-6.2	0.01
10	120	Power on	13.559968	-0.000032	-0.00023	-2.3	0.01
		+ 2 min.	13.559947	-0.000053	-0.00039	-3.9	0.01
		+ 5 min.	13.559953	-0.000047	-0.00035	-3.5	0.01
		+ 10 min.	13.559960	-0.000040	-0.00030	-3.0	0.01
0	120	Power on	13.559997	-0.000003	-0.00002	-0.2	0.01
		+ 2 min.	13.559997	-0.000003	-0.00002	-0.2	0.01
		+ 5 min.	13.559997	-0.000003	-0.00002	-0.2	0.01
		+ 10 min.	13.560032	0.000032	0.00024	2.4	0.01
-10	120	Power on	13.560104	0.000104	0.00077	7.7	0.01
		+ 2 min.	13.560027	0.000027	0.00020	2.0	0.01
		+ 5 min.	13.560064	0.000064	0.00047	4.7	0.01
		+ 10 min.	13.560129	0.000129	0.00095	9.5	0.01
-20	120	Power on	13.559999	-0.000001	-0.00001	-0.1	0.01
		+ 2 min.	13.560137	0.000137	0.00101	10.1	0.01
		+ 5 min.	13.560098	0.000098	0.00072	7.2	0.01
		+ 10 min.	13.560075	0.000075	0.00055	5.5	0.01

Calculation formula: Frequency error = Measured frequency - Tested frequency
 Result [%] = Frequency error / Tested frequency * 100

Tested frequency: 13.56 MHz
 Limit (+/-): 0.01 % (+/- 100ppm)

*The test was begun from 50 deg. C and the temperature was lowered each 10 deg. C.

Frequency Tolerance

Test place	Ise EMC Lab.
Measurement Room	No.6
Date	July 25, 2023
Temperature / Humidity	24 deg. C / 37 % RH
Engineer	Junya Okuno
Mode	Mode 5 (Battery Voltage Operation)

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- %]
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
20	10.8	Power on	13.559878	-0.000122	-0.00090	-9.0	0.01
		+ 2 min.	13.559837	-0.000163	-0.00120	-12.0	0.01
		+ 5 min.	13.559895	-0.000105	-0.00077	-7.7	0.01
		+ 10 min.	13.559905	-0.000095	-0.00070	-7.0	0.01
20	9.18 (10.8V -15%)	Power on	13.559922	-0.000078	-0.00058	-5.8	0.01
		+ 2 min.	13.559914	-0.000086	-0.00063	-6.3	0.01
		+ 5 min.	13.559915	-0.000085	-0.00062	-6.2	0.01
		+ 10 min.	13.559918	-0.000082	-0.00061	-6.1	0.01
20	12.42 (10.8V +15%)	Power on	13.559944	-0.000056	-0.00041	-4.1	0.01
		+ 2 min.	13.559920	-0.000080	-0.00059	-5.9	0.01
		+ 5 min.	13.559920	-0.000080	-0.00059	-5.9	0.01
		+ 10 min.	13.559920	-0.000080	-0.00059	-5.9	0.01

Calculation formula: Frequency error = Measured frequency - Tested frequency
 Result [%] = Frequency error / Tested frequency * 100

Tested frequency: 13.56 MHz
 Limit (+/-): 0.01 % (+/- 100ppm)

APPENDIX 2: Test instruments

Test Equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
CE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/23/2022	24
CE	MAT-67	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	12/22/2022	12
CE	MCC-112	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/sucoform141-PE/421-010/RFM-E321(SW)	-/00640	07/25/2023	12
CE	MJM-16	142183	Measure	KOMELON	KMC-36	-	10/03/2022	12
CE	MLS-24	141358	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-730	07/13/2023	12
CE	MMM-08	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	01/17/2023	12
CE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/13/2023	12
CE	MTR-09	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	10/11/2022	12
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/23/2022	24
RE	MAT-95	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/23/2023	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+ BBA9106	VHA 91031302	08/26/2022	12
RE	MCC-112	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/sucoform141-PE/421-010/RFM-E321(SW)	-/00640	07/25/2023	12
RE	MCC-219	159670	Coaxial Cable	UL Japan	-	-	11/18/2022	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	09/27/2022	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	10/03/2022	12
RE	MLA-22	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/26/2022	12
RE	MLPA-02	142152	Loop Antenna	Rohde & Schwarz	HFH2-Z2	836553/009	10/11/2022	12
RE	MMM-08	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	01/17/2023	12
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/13/2023	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/07/2023	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	05/17/2023	12
RE	MSA-13	141900	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185823	06/16/2023	12
RE	MLPA-07	142645	Loop Antenna	UL Japan	-	-	-	-
RE	MMM-18	141558	Digital Tester(TRUE RMS MULTIMETER)	Fluke Corporation	115	17930030	05/29/2023	12
RE	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/13/2023	12
FT	MCH-04	141429	Temperature and Humidity Chamber	Espec	PL-2KP	14015723	08/11/2022	12
FT	MLPA-07	142645	Loop Antenna	UL Japan	-	-	-	-
FT	MMM-18	141558	Digital Tester(TRUE RMS MULTIMETER)	Fluke Corporation	115	17930030	05/29/2023	12
FT	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/13/2023	12
FT	MSA-13	141900	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185823	06/16/2023	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, FT: Frequency Tolerance