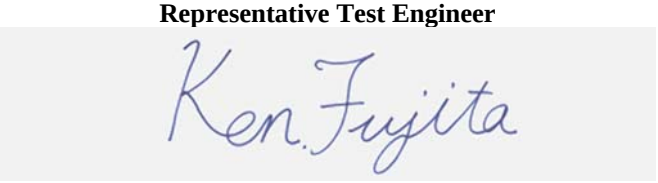
RADIO TEST REPORT

Test Report No. 14254079H-A-R1

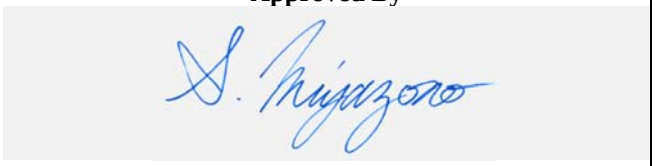
Customer	**NIDEC MOBILITY CORPORATION**
Description of EUT	**Keyless operation system**
Model Number of EUT	**R706N**
FCC ID	**OUCR706N**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied (Refer to SECTION 3)**
Issue Date	**June 1, 2022**
Remarks	**-**

Representative Test Engineer



Ken Fujita
Engineer

Approved By



Shinichi Miyazono
Engineer

CERTIFICATE 5107.02

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan, Inc.

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

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REVISION HISTORY

Original Test Report No.: 14254079H-A

This report is a revised version of 14254079H-A. 14254079H-A is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14254079H-A	May 17, 2022	-
1	14254079H-A-R1	June 1, 2022	Correction of the Model name for Clause 4.2; From GGF-M004-T05 to CGF-M004-T05 (LF Antenna (T/G)) From 5716A640WB to 5716A639WB (LF Antenna (DR))
1	14254079H-A-R1	June 1, 2022	Correction of the test equipment; From MSA-03 to MSA-13

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	NIDEC MOBILITY CORPORATION
Address	6368 Nenjozaka, Okusa, Komaki-city, Aichi-pref. 485-0802 Japan
Telephone Number	+81-568-78-6159
Contact Person	Kazushi Yamasaki

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	Keyless operation system
Model Number	R706N
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	March 17, 2022
Test Date	March 22, 2022

2.2 Product Description

General Specification

Rating	DC 12 V

Radio Specification

Push Start Switch function

Equipment Type	Transceiver
Frequency of Operation	125 kHz
Type of Modulation	ASK

Smart System: LF Transmitting function

Equipment Type	Transmitter
Frequency of Operation	125 kHz
Type of Modulation	ASK

Smart System: UHF Receiving function[*1)]

Type of Receiver	Super Heterodyne
Receiving Frequency	315 MHz
Oscillator Frequency	21.948717 MHz
Local Oscillator Frequency	315.274 MHz
Intermediate Frequency	274 kHz

*1) The test of this function was performed separately from this test report, and the conformability is confirmed.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C FCC Part 15 final revised on April 1, 2022 and effective May 2, 2022
Title	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.209 Radiated emission limits; general requirements.

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

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

3.2 Procedures and results

Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
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	-	N/A	N/A	N/A *1)
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.5, 6.12	<FCC> Section 15.209 <ISED> RSS-210 7.2 RSS-Gen 8.9	Radiated	N/A	5.4 dB 125 kHz, 0 deg. Peak with Duty factor <Mode 3>	Complied a)
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.5, 6.6, 6.13	<FCC> Section 15.209 <ISED> RSS-210 7.3 RSS-Gen 8.9	Radiated	N/A	19.2 dB 903.212 MHz, Horizontal, QP <Mode 4>	Complied a)
-20 dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> -	<FCC> Reference data <ISED> -	Radiated	N/A	N/A	Complied b)
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. *1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line. a) Refer to APPENDIX 1 (data of Radiated emission) b) Refer to APPENDIX 1 (data of -20 dB Bandwidth / 99 % emission bandwidth)						
Symbols: Complied The data of this test item has enough margin, more than the measurement uncertainty. Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration						

FCC Part 15.31 (e)

The test was performed with the New Battery and the EUT constantly provides the stable voltage to RF part through the regulator regardless of input voltage from New Battery.
Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

3.3 Addition to standard

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

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

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.
The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor *k*=2.

Test Item		Frequency range		Uncertainty (+/-)
Radiated emission	3 m	9 kHz to 30 MHz		3.2 dB
	10 m			3.0 dB
	3 m	30 MHz to 200 MHz	Horizontal	4.8 dB
			Vertical	5.0 dB
		200 MHz to 1000 MHz	Horizontal	5.1 dB
			Vertical	6.2 dB
	10 m	30 MHz to 200 MHz	Horizontal	4.8 dB
			Vertical	4.8 dB
		200 MHz to 1000 MHz	Horizontal	5.0 dB
			Vertical	5.0 dB
-20 dB Bandwidth / 99 % emission bandwidth		-		0.96 %

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919
ISED Lab Company Number: 2973C / CAB identifier: JP0002
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

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	-	-

3.6 Test data, Test instruments, and Test set up

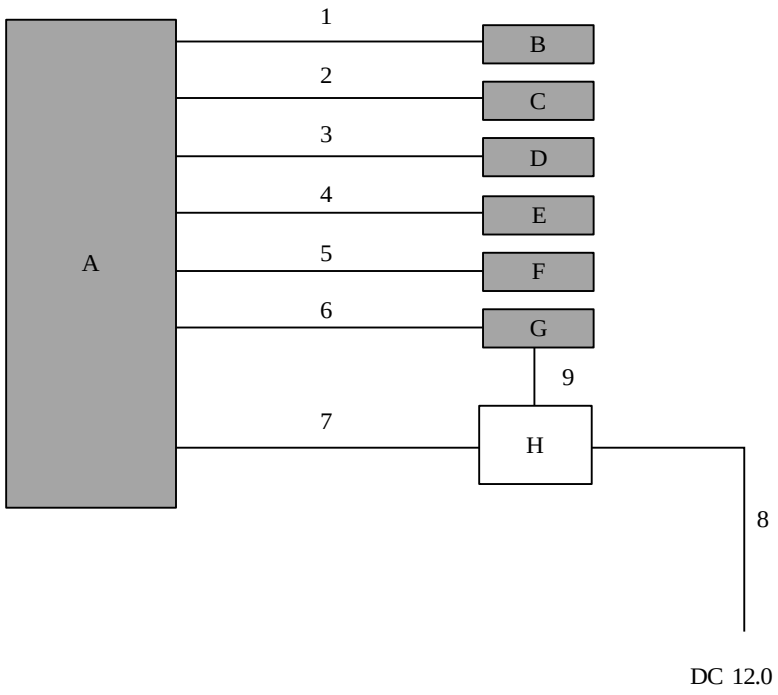
Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1. Operating Mode(s)

Test mode	Remarks
Transmitting mode (Tx) 125 kHz Mode 1: LF Antenna DR Mode 2: LF Antenna INF Mode 3: LF Antenna T/G Mode 4: Push Start Switch	-
*Power of the EUT was set by the software as follows; Software: KOS_436002 Version: 43.60.02 (Date: 2022.03 22, 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.	

4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
* The EUT does not transmit simultaneously from multiple antennas.
* Antenna was evaluated with the worst duty respectively.
* The EUT was set to transmit the data continuously from one antenna as a worst case, not to transmit it randomly from each antenna.
* The each carrier level of the two antennas (DR and AS) and two antennas (INF and INR) were compared at the pre-check. As a result, all the tests were performed with the LF Antenna DR and LF Antenna INF as representative.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Keyless operation system	R706N	#2212G1	NIDEC MOBILITY CORPORATION	EUT
B	LF Antenna (INF)	G8D-841M-ANT	19X26	NIDEC MOBILITY CORPORATION	EUT
C	LF Antenna (INR)	G8D-841M-ANT	19X26	NIDEC MOBILITY CORPORATION	EUT
D	LF Antenna (T/G)	CGF-M004-T05	19X26	NIDEC MOBILITY CORPORATION	EUT
E	LF Antenna (DR)	5716A639WB	22031601	-	EUT
F	LF Antenna (AS)	5716A640WB	22031602	-	EUT
G	Push Switch for Engine Start	CFT-M001	000332	NIDEC MOBILITY CORPORATION	EUT
H	Jig	-	-	NIDEC MOBILITY CORPORATION	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	1.6	Unshielded	Unshielded	-
2	Antenna Cable	1.6	Unshielded	Unshielded	-
3	Antenna Cable	1.6	Unshielded	Unshielded	-
4	Antenna Cable	1.6	Unshielded	Unshielded	-
5	Antenna Cable	1.6	Unshielded	Unshielded	-
6	Antenna Cable	1.5	Unshielded	Unshielded	-
7	DC and Signal Cable	1.5	Unshielded	Unshielded	-
8	DC Cable	2.0	Unshielded	Unshielded	-
9	DC Cable	0.3	Unshielded	Unshielded	-

SECTION 5: Radiated emission (Fundamental and Spurious Emission)

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.

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 1 about Direction of the Loop Antenna.

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.

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

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 x log (3 m / 300 m) = -80 dB
*2) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

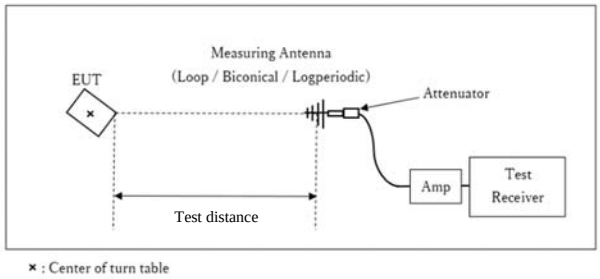
Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open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

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 Ohmes. 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.

[Test Setup]

Below 1 GHz



Test Distance: 3 m

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

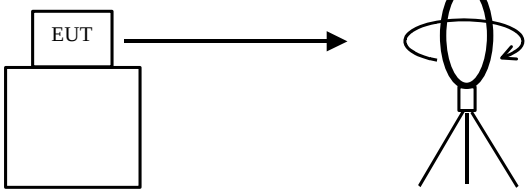
This EUT has two modes which transponder key is attached or not. The worst case was confirmed with and without transponder key attached, as a result, the test without transponder key attached was the worst case. Therefore the test without transponder key attached was performed only.

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

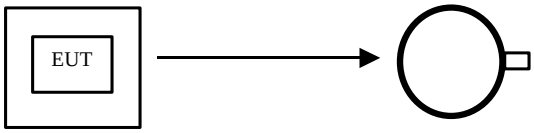
Measurement range : **9 kHz to 1 GHz**
Test data : **APPENDIX**
Test result : **Pass**

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

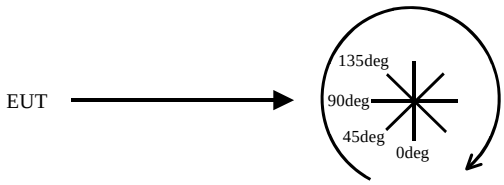


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

SECTION 6: -20 dB Bandwidth

Test Procedure
The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-20 dB Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1
Test result : Pass

SECTION 7: 99 % emission bandwidth

Test Procedure
The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
99 % emission bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *)	Spectrum Analyzer
*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %. Peak hold was applied as Worst-case measurement.							

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Radiated Emission (Fundamental and Spurious Emission)
<LF Antenna DR>

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 1

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	0.12500	PK	106.3	18.9	-74.0	32.3	-	18.9	45.6	26.7	Fundamental
0deg	0.25000	PK	66.0	18.9	-74.0	32.3	-	-21.4	39.6	61.0	
0deg	0.37500	PK	64.7	18.8	-74.0	32.2	-	-22.7	36.1	58.8	
0deg	0.50000	QP	34.1	18.8	-34.0	32.2	-	-13.3	33.6	46.9	
0deg	0.62500	QP	54.7	18.8	-34.0	32.2	-	7.3	31.7	24.4	
0deg	0.75000	QP	32.9	18.8	-33.9	32.2	-	-14.4	30.1	44.5	
0deg	0.87500	QP	48.8	18.8	-33.9	32.2	-	1.5	28.7	27.2	
0deg	1.00000	QP	31.7	18.8	-33.9	32.2	-	-15.6	27.6	43.2	
0deg	1.12500	QP	45.1	18.8	-33.9	32.2	-	-2.2	26.5	28.7	
0deg	1.25000	QP	32.1	18.8	-33.9	32.2	-	-15.2	25.6	40.8	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amprifier)

PK with Duty factor

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	0.12500	PK	106.3	18.9	-74.0	32.3	0.0	18.9	25.6	6.7	Fundamental
0deg	0.25000	PK	66.0	18.9	-74.0	32.3	0.0	-21.4	19.6	41.0	
0deg	0.37500	PK	64.7	18.8	-74.0	32.2	0.0	-22.7	16.1	38.8	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amprifier) + Duty factor *

* Since the peak emission result satisfied the average limit, duty factor was omitted.

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
0deg	0.12500	PK	106.3	18.9	6.0	32.3	-	98.9	-	-	Fundamental

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

If Gain 0.0dB shown in the above table, pre-amplifier was not used to avoid the influence of carrier power. The pre-amplifier used for carrier frequency measurement was not saturated.
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Radiated Emission (Fundamental and Spurious Emission)
<LF Antenna INF>

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 2

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	0.12500	PK	93.7	18.9	-74.0	32.3	-	6.3	45.6	39.3	Fundamental
0deg	0.25000	PK	69.8	18.9	-74.0	32.3	-	-17.6	39.6	57.2	
0deg	0.37500	PK	56.4	18.8	-74.0	32.2	-	-31.0	36.1	67.1	
0deg	0.50000	QP	33.5	18.8	-34.0	32.2	-	-13.9	33.6	47.5	
0deg	0.62500	QP	45.0	18.8	-34.0	32.2	-	-2.4	31.7	34.1	
0deg	0.75000	QP	39.4	18.8	-33.9	32.2	-	-7.9	30.1	38.0	
0deg	0.87500	QP	39.8	18.8	-33.9	32.2	-	-7.5	28.7	36.2	
0deg	1.00000	QP	32.0	18.8	-33.9	32.2	-	-15.3	27.6	42.9	
0deg	1.12500	QP	37.1	18.8	-33.9	32.2	-	-10.2	26.5	36.7	
0deg	1.25000	QP	33.6	18.8	-33.9	32.2	-	-13.7	25.6	39.3	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amprifier)

PK with Duty factor

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	0.12500	PK	93.7	18.9	-74.0	32.3	0.0	6.3	25.6	19.3	Fundamental
0deg	0.25000	PK	69.8	18.9	-74.0	32.3	0.0	-17.6	19.6	37.2	
0deg	0.37500	PK	56.4	18.8	-74.0	32.2	0.0	-31.0	16.1	47.1	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amprifier) + Duty factor *

* Since the peak emission result satisfied the average limit, duty factor was omitted.

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
0deg	0.12500	PK	93.7	18.9	6.0	32.3	-	86.3	-	-	Fundamental

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

If Gain 0.0dB shown in the above table, pre-amplifier was not used to avoid the influence of carrier power. The pre-amplifier used for carrier frequency measurement was not saturated.
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Radiated Emission (Fundamental and Spurious Emission)
<LF Antenna T/G>

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 3

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	0.12500	PK	107.6	18.9	-74.0	32.3	-	20.2	45.6	25.4	Fundamental
0deg	0.25000	PK	68.3	18.9	-74.0	32.3	-	-19.1	39.6	58.7	
0deg	0.37500	PK	64.5	18.8	-74.0	32.2	-	-22.9	36.1	59.0	
0deg	0.50000	QP	34.0	18.8	-34.0	32.2	-	-13.4	33.6	47.0	
0deg	0.62500	QP	56.3	18.8	-34.0	32.2	-	8.9	31.7	22.8	
0deg	0.75000	QP	32.6	18.8	-33.9	32.2	-	-14.7	30.1	44.8	
0deg	0.87500	QP	49.4	18.8	-33.9	32.2	-	2.1	28.7	26.6	
0deg	1.00000	QP	32.0	18.8	-33.9	32.2	-	-15.3	27.6	42.9	
0deg	1.12500	QP	45.6	18.8	-33.9	32.2	-	-1.7	26.5	28.2	
0deg	1.25000	QP	31.9	18.8	-33.9	32.2	-	-15.4	25.6	41.0	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amprifier)

PK with Duty factor

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	0.12500	PK	107.6	18.9	-74.0	32.3	0.0	20.2	25.6	5.4	Fundamental
0deg	0.25000	PK	68.3	18.9	-74.0	32.3	0.0	-19.1	19.6	38.7	
0deg	0.37500	PK	64.5	18.8	-74.0	32.2	0.0	-22.9	16.1	39.0	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amprifier) + Duty factor *

* Since the peak emission result satisfied the average limit, duty factor was omitted.

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
0deg	0.12500	PK	107.6	18.9	6.0	32.3	-	100.2	-	-	Fundamental

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

If Gain 0.0dB shown in the above table, pre-amplifier was not used to avoid the influence of carrier power. The pre-amplifier used for carrier frequency measurement was not saturated.
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Radiated Emission (Fundamental and Spurious Emission)
<Push Start Switch >

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 4

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	0.12500	PK	93.6	18.9	-74.0	32.3	-	6.2	45.6	39.4	Fundamental
0deg	0.25000	PK	68.9	18.9	-74.0	32.3	-	-18.5	39.6	58.1	
0deg	0.37500	PK	64.7	18.8	-74.0	32.2	-	-22.7	36.1	58.8	
0deg	0.50000	QP	33.3	18.8	-34.0	32.2	-	-14.1	33.6	47.7	
0deg	0.62500	QP	44.3	18.8	-34.0	32.2	-	-3.1	31.7	34.8	
0deg	0.75000	QP	38.7	18.8	-33.9	32.2	-	-8.6	30.1	38.7	
0deg	0.87500	QP	39.5	18.8	-33.9	32.2	-	-7.8	28.7	36.5	
0deg	1.00000	QP	31.9	18.8	-33.9	32.2	-	-15.4	27.6	43.0	
0deg	1.12500	QP	36.7	18.8	-33.9	32.2	-	-10.6	26.5	37.1	
0deg	1.25000	QP	33.5	18.8	-33.9	32.2	-	-13.8	25.6	39.4	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amprifier)

PK with Duty factor

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	0.12500	PK	93.6	18.9	-74.0	32.3	0.0	6.2	25.6	19.4	Fundamental
0deg	0.25000	PK	68.9	18.9	-74.0	32.3	0.0	-18.5	19.6	38.1	
0deg	0.37500	PK	64.7	18.8	-74.0	32.2	0.0	-22.7	16.1	38.8	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amprifier) + Duty factor *

* Since the peak emission result satisfied the average limit, duty factor was omitted.

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
0deg	0.12500	PK	93.6	18.9	6.0	32.3	-	86.2	-	-	Fundamental

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

If Gain 0.0dB shown in the above table, pre-amplifier was not used to avoid the influence of carrier power. The pre-amplifier used for carrier frequency measurement was not saturated.
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Radiated Emission above 30 MHz (Spurious Emission)
<LF Antenna DR>

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 1

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	56.889	QP	23.4	8.8	7.5	32.2	7.5	40.0	32.5	
Hori.	80.121	QP	28.9	6.9	7.9	32.2	11.5	40.0	28.5	
Hori.	172.286	QP	22.6	16.0	8.9	32.1	15.4	43.5	28.1	
Hori.	308.601	QP	21.6	14.0	10.1	32.0	13.7	46.0	32.4	
Hori.	316.229	QP	22.3	14.3	10.1	32.0	14.8	46.0	31.3	
Hori.	903.209	QP	21.5	22.2	13.6	30.9	26.4	46.0	19.6	
Vert.	56.889	QP	23.9	8.8	7.5	32.2	8.0	40.0	32.0	
Vert.	80.121	QP	30.9	6.9	7.9	32.2	13.5	40.0	26.5	
Vert.	172.286	QP	22.8	16.0	8.9	32.1	15.6	43.5	27.9	
Vert.	308.601	QP	28.1	14.0	10.1	32.0	20.2	46.0	25.9	
Vert.	316.229	QP	22.0	14.3	10.1	32.0	14.5	46.0	31.6	
Vert.	903.209	QP	20.9	22.2	13.6	30.9	25.8	46.0	20.2	

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

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

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Radiated Emission above 30 MHz (Spurious Emission)
<LF Antenna INF>

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 2

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	56.556	QP	23.2	8.9	7.5	32.2	7.4	40.0	32.6	
Hori.	80.227	QP	28.8	6.9	7.9	32.2	11.4	40.0	28.6	
Hori.	172.376	QP	22.8	16.0	8.9	32.1	15.6	43.5	27.9	
Hori.	308.667	QP	21.8	14.0	10.1	32.0	13.9	46.0	32.2	
Hori.	316.287	QP	22.7	14.3	10.1	32.0	15.2	46.0	30.9	
Hori.	903.210	QP	21.8	22.2	13.6	30.9	26.7	46.0	19.3	
Vert.	56.556	QP	23.8	8.9	7.5	32.2	8.0	40.0	32.0	
Vert.	80.227	QP	31.0	6.9	7.9	32.2	13.6	40.0	26.4	
Vert.	172.376	QP	22.9	16.0	8.9	32.1	15.7	43.5	27.8	
Vert.	308.667	QP	28.0	14.0	10.1	32.0	20.1	46.0	26.0	
Vert.	316.287	QP	22.1	14.3	10.1	32.0	14.6	46.0	31.5	
Vert.	903.210	QP	20.9	22.2	13.6	30.9	25.8	46.0	20.2	

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

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

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Radiated Emission above 30 MHz (Spurious Emission)
<LF Antenna T/G>

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 3

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	56.172	QP	23.5	9.0	7.5	32.2	7.8	40.0	32.2	
Hori.	80.082	QP	28.8	6.9	7.9	32.2	11.4	40.0	28.6	
Hori.	172.147	QP	22.4	16.0	8.9	32.1	15.2	43.5	28.3	
Hori.	308.567	QP	21.6	14.0	10.1	32.0	13.7	46.0	32.4	
Hori.	316.205	QP	22.1	14.3	10.1	32.0	14.6	46.0	31.5	
Hori.	903.165	QP	21.1	22.2	13.6	30.9	26.0	46.0	20.0	
Vert.	56.172	QP	23.8	9.0	7.5	32.2	8.1	40.0	31.9	
Vert.	80.082	QP	30.8	6.9	7.9	32.2	13.4	40.0	26.6	
Vert.	172.147	QP	22.3	16.0	8.9	32.1	15.1	43.5	28.4	
Vert.	308.567	QP	27.8	14.0	10.1	32.0	19.9	46.0	26.2	
Vert.	316.205	QP	21.4	14.3	10.1	32.0	13.9	46.0	32.2	
Vert.	903.165	QP	20.4	22.2	13.6	30.9	25.3	46.0	20.7	

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

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

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Radiated Emission above 30 MHz (Spurious Emission)
<Push Start Switch>

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 4

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	56.784	QP	23.4	8.8	7.5	32.2	7.5	40.0	32.5	
Hori.	80.312	QP	28.9	6.9	7.9	32.2	11.5	40.0	28.5	
Hori.	172.118	QP	23.0	16.0	8.9	32.1	15.8	43.5	27.7	
Hori.	308.687	QP	21.9	14.0	10.1	32.0	14.0	46.0	32.1	
Hori.	316.779	QP	22.9	14.4	10.1	32.0	15.4	46.0	30.6	
Hori.	903.212	QP	21.9	22.2	13.6	30.9	26.8	46.0	19.2	
Vert.	56.784	QP	23.8	8.8	7.5	32.2	7.9	40.0	32.1	
Vert.	80.312	QP	31.0	6.9	7.9	32.2	13.6	40.0	26.4	
Vert.	172.118	QP	22.8	16.0	8.9	32.1	15.6	43.5	27.9	
Vert.	308.687	QP	28.7	14.0	10.1	32.0	20.8	46.0	25.3	
Vert.	316.779	QP	22.7	14.4	10.1	32.0	15.2	46.0	30.8	
Vert.	903.212	QP	20.8	22.2	13.6	30.9	25.7	46.0	20.3	

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

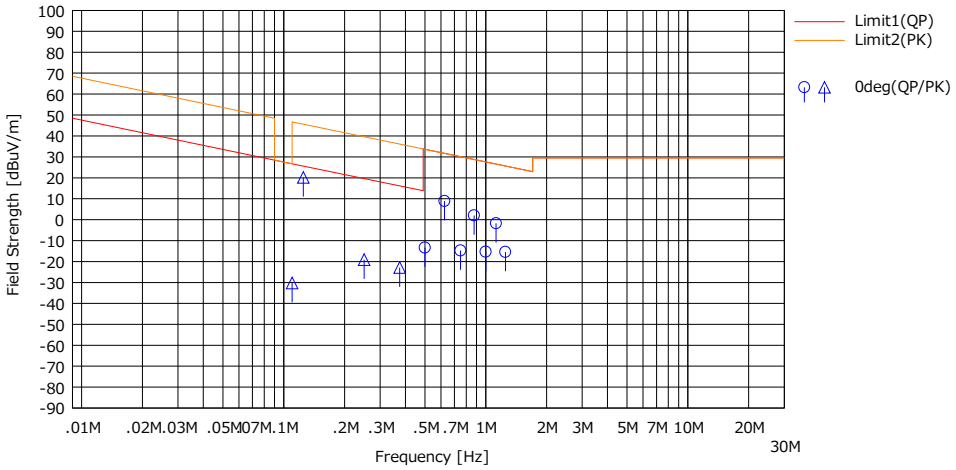
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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

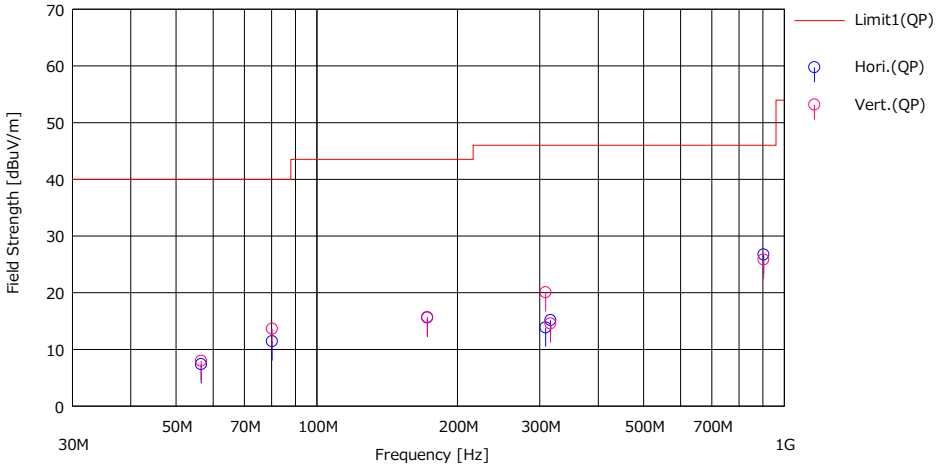
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 3

(Below 30MHz)



* Data above 490 kHz were measured using a QP detector.

(above 30MHz)



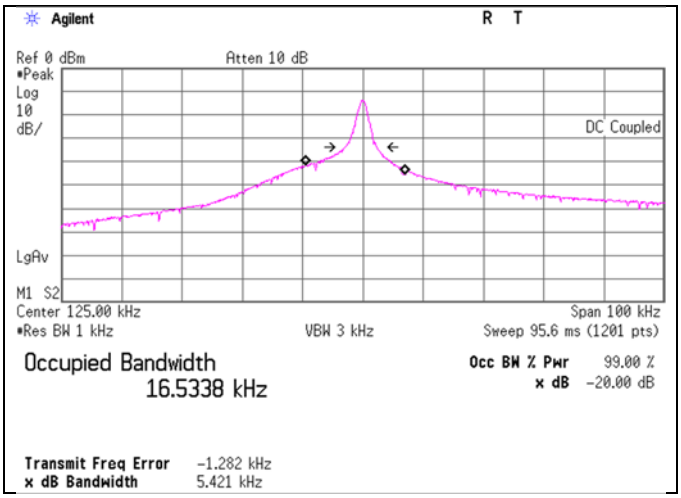
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

-20 dB Bandwidth / 99 % emission bandwidth

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 1/ Mode 2

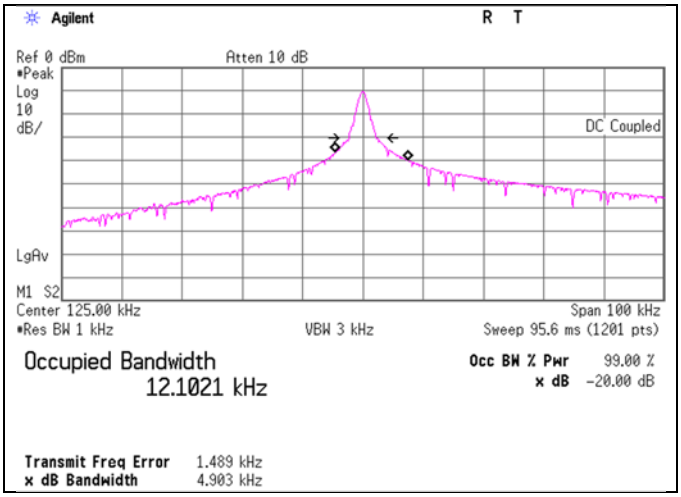
<LF Antenna DR>

-20 dB Bandwidth [kHz]	99 % emission bandwidth [kHz]
5.421	16.5338



<LF Antenna INF>

-20 dB Bandwidth [kHz]	99 % emission bandwidth [kHz]
4.903	12.1021



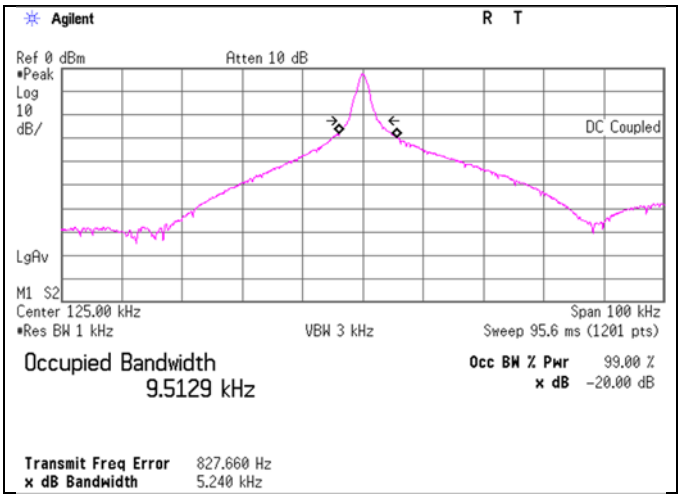
Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 - 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

-20 dB Bandwidth / 99 % emission bandwidth

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 22, 2022
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Ken Fujita
Mode	Mode 3/ Mode 4

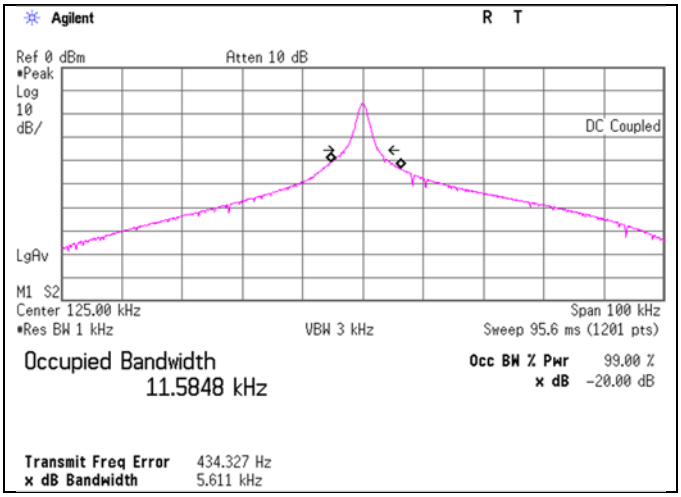
<LF Antenna T/G>

-20 dB Bandwidth [kHz]	99 % emission bandwidth [kHz]
5.240	9.5129



<Push Start Switch>

-20 dB Bandwidth [kHz]	99 % emission bandwidth [kHz]
5.611	11.5848



Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 - 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2020	24
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/10/2022	12
RE	MMM-08	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	01/16/2022	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAT-95	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/09/2021	12
RE	MBA-03	141424	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	1915	08/21/2021	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	07/19/2021	12
RE	MLA-22	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/21/2021	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/25/2022	12
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/05/2021	12
RE	MCC-112	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/ sucoform141-PE/ 421-010/RFM-E321(SW)	-/00640	07/19/2021	12
RE	MLPA-01	141254	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	04/17/2021	12
RE	MCC-255	207745	Coaxial Cable	UL Japan, Inc.	-	-	05/17/2021	12
RE	MLPA-08	202511	Loop Antenna	UL Japan	-	-	-	-
RE	MSA-13	141900	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185823	09/30/2021	12

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

The expiration date of the calibration is the end of the expired month.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

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

Test item: RE: Radiated Emission