RADIO TEST REPORT

Test Report No. : 13523442H-A-R1

Applicant	:	**DENSO CORPORATION**
Type of EUT	:	**Smart Card Key**
Model Number of EUT	:	**14CCP**
FCC ID	:	**HYQ14CCP**
Test regulation	:	**FCC Part 15 Subpart C: 2020**
Test Result	:	**Complied (Refer to SECTION 3.2)**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in Section 1.
10. This report is a revised version of 13523442H-A. 13523442H-A is replaced with this report.

Date of test: November 15, 2020

Representative test engineer:
Yuta Moriya
Engineer
Consumer Technology Division

Approved by:
Motoya Imura
Leader
Consumer Technology Division

CERTIFICATE 5107.02

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

UL Japan, Inc.
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REVISION HISTORY

Original Test Report No.: 13523442H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13523442H-A	November 25, 2020	-	-
1	13523442H-A-R1	December 2, 2020	P.14	Deletion of the note sentences under the test data; "* The EUT transmits UHF when LF signal is received from a car or a button on the EUT is pressed. In both cases, the UHF transmission is stopped within 5 seconds. So the test was performed by a button-pressed operation as the worst case. Please refer to the "Theory of Operation" for details"
1	13523442H-A-R1	December 2, 2020	P.15, 16	Deletion of the following sentence under the test data; "Although Duty of this product was 100% or less, the result of AV (PK with Duty factor) was calculated by applying Duty 100% as worst."

Reference: Abbreviations (Including words undescribed in this report)

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

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	DENSO CORPORATION
Address	:	1-1, Showa-cho, Kariya-shi, Aichi-ken, 448-8661, Japan
Telephone Number	:	+81-566-20-3955
Facsimile Number	:	+81-566-25-4837
Contact Person	:	TAKAYUKI HATTORI

The information provided from the customer is as follows;
- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT) other than the Receipt Date
- SECTION 4: Operation of EUT during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type	:	Smart Card Key
Model Number	:	14CCP
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 3.0 V
Receipt Date	:	October 20, 2020
Country of Mass-production	:	Japan, China and United States of America
Condition	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab

2.2 Product Description

Model: 14CCP (referred to as the EUT in this report) is a Smart Card Key.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	433.58 MHz / 434.42 MHz* *These two different frequencies are not emitted simultaneously.
Modulation	:	FSK (F1D)
Type of Battery	:	One lithium battery
Antenna type	:	Built-in type (Fixed)
Clock frequency (Maximum)	:	32 MHz

Radio Type	:	Receiver
Frequency of Operation	:	134.2 kHz *1)

*1) The test of receiver part 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 October 13, 2020

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 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	N/A	N/A	*1)
Automatically Deactivate	**FCC:** ANSI C63.10:2013 6 Standard test methods **ISED:** -	**FCC:** Section 15.231(a)(1) **ISED:** RSS-210 A1.1	N/A	Complied a)	Radiated
Electric Field Strength of Fundamental Emission	**FCC:** ANSI C63.10:2013 6 Standard test methods **ISED:** RSS-Gen 6.12	**FCC:** Section 15.231(b) **ISED:** RSS-210 A1.2	9.0 dB 433.580 MHz Horizontal PK with Duty factor	Complied b)	Radiated
Electric Field Strength of Spurious Emission	**FCC:** ANSI C63.10:2013 6 Standard test methods **ISED:** RSS-Gen 6.13	**FCC:** Section 15.205 Section 15.209 Section 15.231(b) **ISED:** RSS-210 A1.2 RSS-Gen 8.9	5.0 dB 3909.780 MHz Horizontal PK with Duty factor <434.42 MHz >	Complied b)	Radiated
-20dB Bandwidth	**FCC:** ANSI C63.10:2013 6 Standard test methods **ISED:** -	**FCC:** Section 15.231(c) **ISED:** Reference data	N/A	Complied c)	Radiated

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) The test is not applicable since the EUT does not have AC Mains.

a) Refer to APPENDIX 1 (data of Automatically deactivate)
b) Refer to APPENDIX 1 (data of Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission))
c) Refer to APPENDIX 1 (data of -20dB and 99% Occupied 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)
This test was performed with the New Battery (DC 3.0 V) and the constant voltage was supplied to the EUT during the tests. Therefore, the 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 EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Bandwidth	**ISED:** RSS-Gen 6.7	**ISED:** RSS-210 A1.3	N/A	-	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.					

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 following 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 $k = 2$.

Radiated emission

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

Antenna Terminal test

Test Item	Uncertainty (+/-)
Automatically Deactivate	0.10 %
-20 dB Emission Bandwidth / 99 % Occupied Bandwidth	0.96 %

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
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Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

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

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

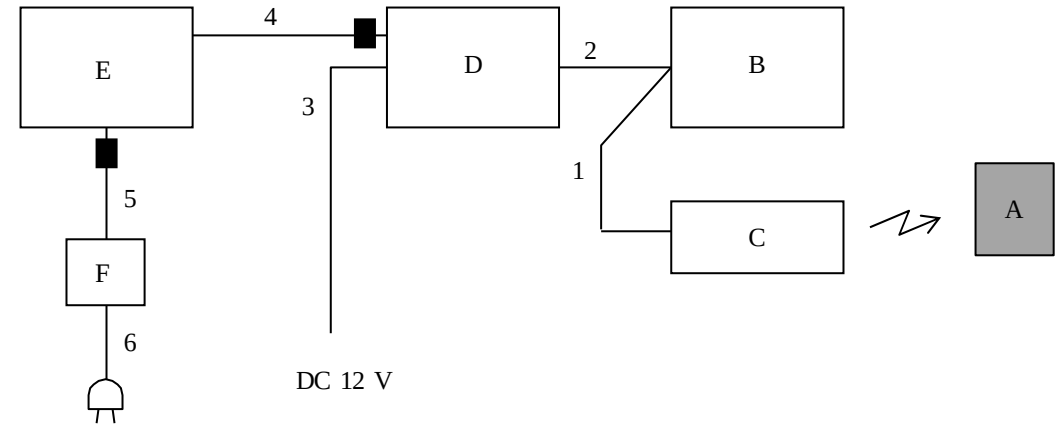
Test Item*	Mode
Automatically Deactivate	Normal use mode, 433.58 MHz *1) Normal use mode, 434.42 MHz *1)
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20 dB & 99 % Occupied Bandwidth	Transmitting mode (Tx), 433.58 MHz *2) Transmitting mode (Tx), 434.42 MHz *2)

* The system was configured in typical fashion (as a user would normally use it) for testing.
*1) The EUT transmits only when it receives 134.2 kHz radio signal. End users cannot change the settings of the output power of the product.
*2) The software of this mode is the same as one of normal product, except that EUT continues to transmit when transmitter button is being pressed. This button was attached just for testing (for making continuous transmission).

* EUT was set by the software as follows;
Software: Product program Version00001103
(Date: 2020/08/07, 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.

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Smart Card Key	14CCP	No.1 *1) No.2 *2)	DENSO CORPORATION	EUT
B	Oscillator	-	-	-	*1)
C	LF Antenna	-	-	-	*1)
D	Check Bench	-	-	DENSO CORPORATION	*1)
E	Laptop PC	CF-LX4EDHCS	5GKSA17377	Panasonic	*1)
F	AC Adapter	CF-AA62J2C	64B2CM114703755B	Panasonic	*1)

*1) Used for Normal use mode
*2) Used for Transmitting mode

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.3	Unshielded	Unshielded	*1)
2	DC and Signal Cable	0.1	Unshielded	Unshielded	*1)
3	DC Cable	1.1	Unshielded	Unshielded	*1)
4	USB Cable	1.5	Shielded	Shielded	*1)
5	DC Cable	0.9	Unshielded	Unshielded	*1)
6	AC Cable	0.8	Unshielded	Unshielded	*1)

*1) Used for Normal use mode

SECTION 5: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)

Test Procedure and conditions

[For below 30 MHz]
The noise level was checked by moving a search-coil (Loop Antenna) close to the EUT.

[For 30 MHz to 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The measuring antenna height was varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.
The measurements were performed for both vertical and horizontal antenna polarization.
The radiated emission measurements were made with the following detector function of the test receiver / spectrum analyzer.

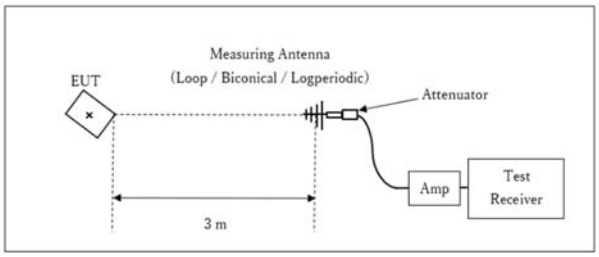
Test Antennas are used as below;

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

	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	Above 1 GHz
Detector Type	Peak	Peak	Peak	Peak	Peak and Peak with Duty factor	Peak and Peak with Duty factor
IF Bandwidth	200 Hz	200 Hz	9.1 kHz	9.1 kHz	120 kHz	PK: S/A: RBW 1 MHz, VBW: 3 MHz

[Test Setup]

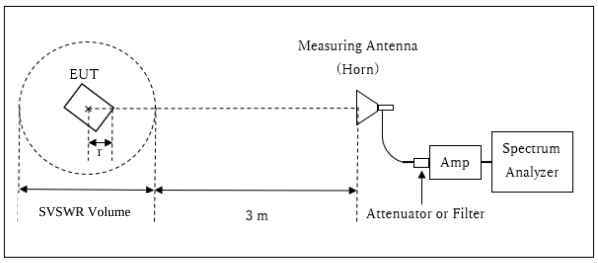
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (4.00 m*/3.0 m) = 2.50 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 4.00 m

SVSWR Volume: 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.00 m

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

- The carrier level (or, noise levels) was (or were) measured at each position of all three axes X, Y and Z, and the position that has the maximum noise was determined.
Noise levels of all the frequencies were measured at the position.

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

*The result is rounded off to the second decimal place, so some differences might be observed.

Measurement range : 9 kHz - 4.4 GHz
Test data : APPENDIX
Test result : Pass

SECTION 6: Automatically deactivate

Test Procedure

The measurement was performed with Electric field strength using a spectrum analyzer.

Test data : APPENDIX
Test result : Pass

SECTION 7: -20 dB and 99 % Occupied 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	150 kHz	1.5 kHz	5.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Peak hold was applied as Worst-case measurement.							

Test data : APPENDIX
Test result : Pass

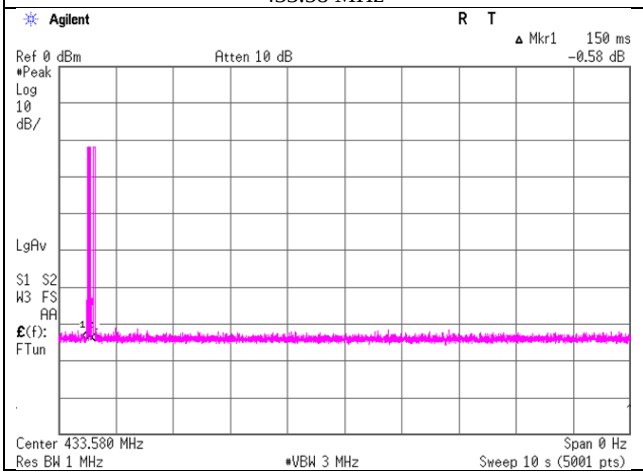
APPENDIX 1: Test data

Automatically deactivate

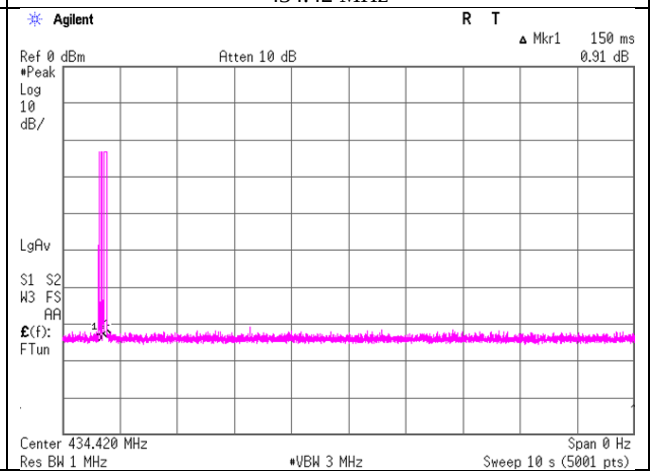
Report No.	13523442H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	November 15, 2020
Temperature / Humidity	23 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Normal use mode 433.58 MHz / 434.42 MHz

Tx Frequency [MHz]	Time of Transmitting [sec]	Limit [sec]	Result
433.58	0.150	5.00	Pass
434.42	0.150	5.00	Pass

433.58 MHz



434.42 MHz



Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Report No.	13523442H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	November 15, 2020
Temperature / Humidity	23 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Transmitting mode 433.58 MHz

QP or PK

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark Inside or Outside
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	of Restricted Bands
433.580	PK	83.7	83.3	16.2	10.4	38.5	-	71.9	71.5	100.8	29.0	29.4	Carrier
867.160	PK	36.9	36.0	21.7	12.2	38.1	-	32.7	31.8	80.8	48.1	49.0	Outside
1300.740	PK	45.2	44.8	25.6	6.0	33.7	-	43.1	42.7	73.9	30.8	31.2	Inside
1734.320	PK	48.2	46.4	25.1	5.5	32.6	-	46.1	44.4	80.8	34.7	36.4	Outside
2167.900	PK	42.7	43.1	28.1	5.5	31.9	-	44.4	44.8	80.8	36.4	36.0	Outside
2601.480	Pk	42.4	40.1	28.0	5.7	31.8	-	44.4	42.0	80.8	36.4	38.8	Outside
3035.060	PK	42.9	42.6	28.5	5.8	31.6	-	45.7	45.4	80.8	35.1	35.4	Outside
3468.640	PK	42.1	42.6	28.8	6.0	31.5	-	45.4	45.9	80.8	35.4	34.9	Outside
3902.220	PK	43.2	43.3	29.9	6.2	31.4	-	47.9	48.0	73.9	26.0	25.9	Inside
4335.800	PK	42.4	41.2	30.5	6.4	31.3	-	48.0	46.7	73.9	25.9	27.2	Inside

PK with Duty factor

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	
433.580	PK	83.7	83.3	16.2	10.4	38.5	0.0	71.9	71.5	80.8	9.0	9.4	Carrier
867.160	PK	36.9	36.0	21.7	12.2	38.1	0.0	32.7	31.8	60.8	28.1	29.0	Outside
1300.740	PK	45.2	44.8	25.6	6.0	33.7	0.0	43.1	42.7	53.9	10.8	11.2	Inside
1734.320	PK	48.2	46.4	25.1	5.5	32.6	0.0	46.1	44.4	60.8	14.7	16.4	Outside
2167.900	PK	42.7	43.1	28.1	5.5	31.9	0.0	44.4	44.8	60.8	16.4	16.0	Outside
2601.480	Pk	42.4	40.1	28.0	5.7	31.8	0.0	44.4	42.0	60.8	16.4	18.8	Outside
3035.060	PK	42.9	42.6	28.5	5.8	31.6	0.0	45.7	45.4	60.8	15.1	15.4	Outside
3468.640	PK	42.1	42.6	28.8	6.0	31.5	0.0	45.4	45.9	60.8	15.4	14.9	Outside
3902.220	PK	43.2	43.3	29.9	6.2	31.4	0.0	47.9	48.0	53.9	6.0	5.9	Inside
4335.800	PK	42.4	41.2	30.5	6.4	31.3	0.0	48.0	46.7	53.9	5.9	7.2	Inside

Sample calculation:
Result of PK = Reading + Ant Factor + Loss {Cable + Attenuator + Filter (above 1GHz) +Distance factor (above 1 GHz)} - Gain (Amplifier)
Result of PK with Duty factor = Reading + Ant Factor + Loss {Cable + Attenuator + Filter (above 1 GHz) +Distance factor (above 1 GHz)} - Gain (Amplifier) + Duty factor

For above 1GHz : Distance Factor: 20 x log (4.0 m/3.0 m) = 2.50 dB
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

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

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Report No.	13523442H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	November 15, 2020
Temperature / Humidity	23 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Transmitting mode 434.42 MHz

QP or PK

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark Inside or Outside
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	of Restricted Bands
434.420	PK	83.2	82.8	16.2	10.4	38.5	-	71.4	71.0	100.8	29.4	29.8	Carrier
868.840	PK	36.5	36.2	21.7	12.3	38.1	-	32.3	32.0	80.8	48.5	48.8	Outside
1303.260	PK	45.8	43.0	25.6	6.0	33.7	-	43.7	40.9	73.9	30.2	33.0	Inside
1737.680	PK	46.8	48.6	25.1	5.5	32.6	-	44.8	46.5	80.8	36.0	34.3	Outside
2172.100	PK	42.7	43.7	28.1	5.5	31.9	-	44.4	45.4	80.8	36.4	35.4	Outside
2606.520	PK	43.0	40.5	28.0	5.7	31.8	-	45.0	42.5	80.8	35.8	38.3	Outside
3040.940	PK	42.0	43.7	28.6	5.8	31.6	-	44.8	46.5	80.8	36.0	34.3	Outside
3475.360	PK	43.1	42.3	28.8	6.0	31.5	-	46.4	45.7	80.8	34.4	35.1	Outside
3909.780	PK	44.2	43.9	29.8	6.2	31.4	-	48.9	48.5	73.9	25.0	25.4	Inside
4344.200	PK	41.9	40.9	30.5	6.4	31.3	-	47.5	46.5	73.9	26.4	27.4	Inside

PK with Duty factor

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	
434.420	PK	83.2	82.8	16.2	10.4	38.5	0.0	71.4	71.0	80.8	9.4	9.8	Carrier
868.840	PK	36.5	36.2	21.7	12.3	38.1	0.0	32.3	32.0	60.8	28.5	28.8	Outside
1303.260	PK	45.8	43.0	25.6	6.0	33.7	0.0	43.7	40.9	53.9	10.2	13.0	Inside
1737.680	PK	46.8	48.6	25.1	5.5	32.6	0.0	44.8	46.5	60.8	16.0	14.3	Outside
2172.100	PK	42.7	43.7	28.1	5.5	31.9	0.0	44.4	45.4	60.8	16.4	15.4	Outside
2606.520	PK	43.0	40.5	28.0	5.7	31.8	0.0	45.0	42.5	60.8	15.8	18.3	Outside
3040.940	PK	42.0	43.7	28.6	5.8	31.6	0.0	44.8	46.5	60.8	16.0	14.3	Outside
3475.360	PK	43.1	42.3	28.8	6.0	31.5	0.0	46.4	45.7	60.8	14.4	15.1	Outside
3909.780	PK	44.2	43.9	29.8	6.2	31.4	0.0	48.9	48.5	53.9	5.0	5.4	Inside
4344.200	PK	41.9	40.9	30.5	6.4	31.3	0.0	47.5	46.5	53.9	6.4	7.4	Inside

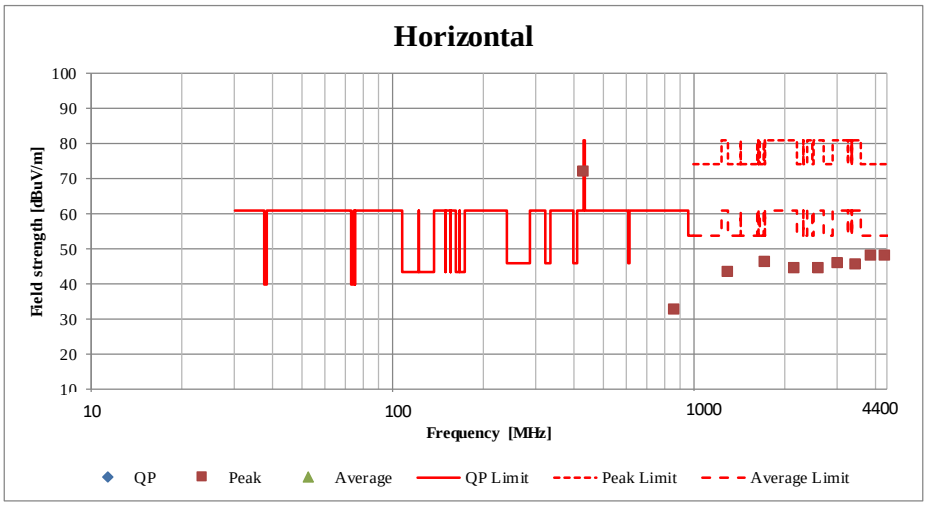
Sample calculation:
Result of PK = Reading + Ant Factor + Loss {Cable + Attenuator + Filter (above 1GHz) +Distance factor (above 1 GHz)} - Gain (Amplifier)
Result of PK with Duty factor = Reading + Ant Factor + Loss {Cable + Attenuator + Filter (above 1 GHz) +Distance factor (above 1 GHz)} - Gain (Amplifier) + Duty factor

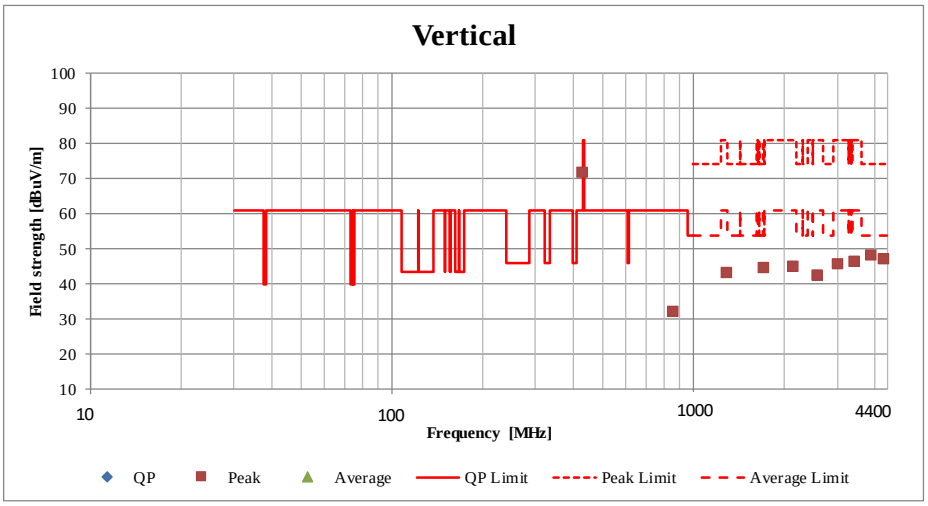
For above 1GHz : Distance Factor: 20 x log (4.0 m/3.0 m) = 2.50 dB
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	13523442H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	November 15, 2020
Temperature / Humidity	23 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Transmitting mode 433.58 MHz





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

-20dB and 99% Occupied Bandwidth

433.58 MHz / 434.42 MHz

Report No.	13523442H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	November 15, 2020
Temperature / Humidity	23 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Transmitting mode 433.58 MHz / 434.42 MHz

Bandwidth Limit : Fundamental Frequency **433.58** MHz x 0.25% = 1083.95 kHz

* The above limit was calculated from more stringent nominal frequency.

* Method of KDB 926416 for systems employing non sweeping frequencies was referred.

433.58MHz

-20dB Bandwidth [kHz]
38.631

434.42MHz

-20dB Bandwidth [kHz]
38.266

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
76.897	1083.95	Pass

Bandwidth Limit : Fundamental Frequency **433.58** MHz x 0.25% = 1083.95 kHz

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
38.8989	1083.95	Pass

Bandwidth Limit : Fundamental Frequency **434.42** MHz x 0.25% = 1086.05 kHz

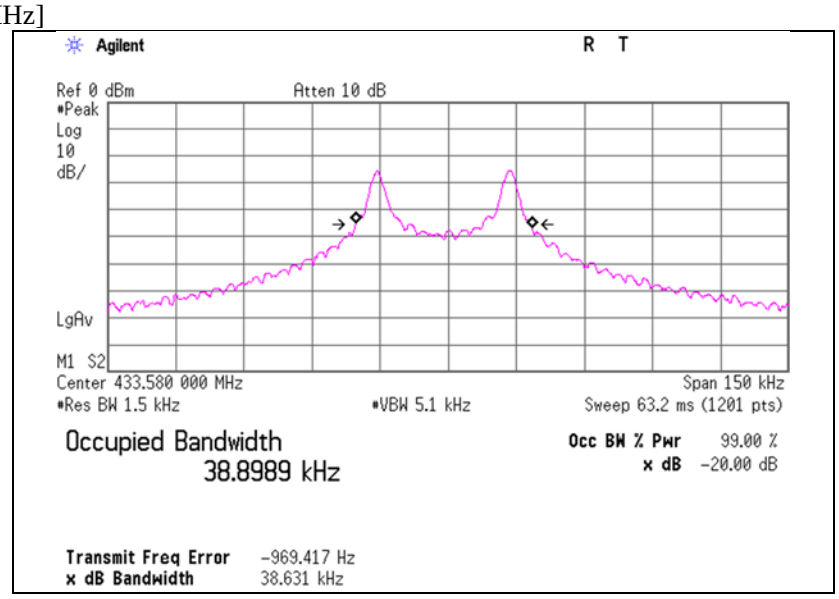
99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
38.4486	1086.05	Pass

-20dB and 99% Occupied Bandwidth

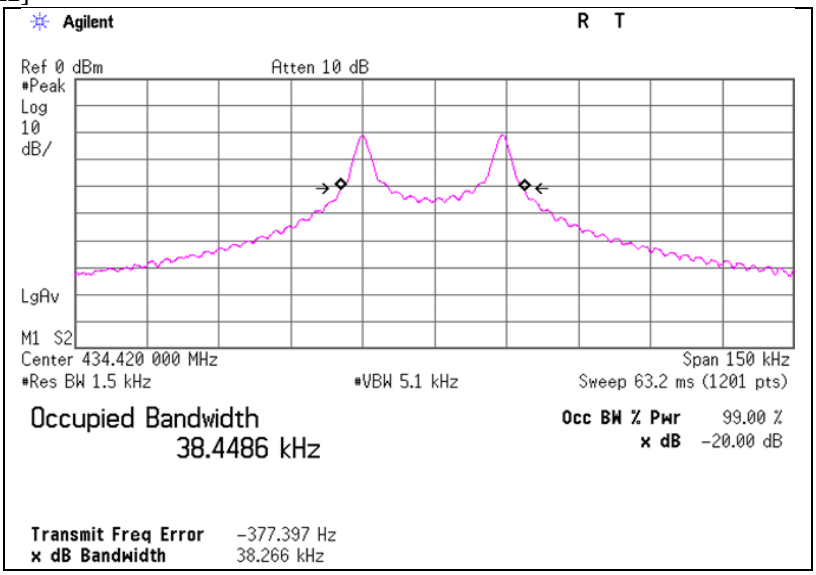
433.58 MHz / 434.42 MHz

Report No.	13523442H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	November 15, 2020
Temperature / Humidity	23 deg. C / 44 % RH
Engineer	Yuta Moriya
Mode	Transmitting mode 433.58 MHz / 434.42 MHz

[433.58 MHz]



[434.42 MHz]



APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/05/2020	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	VHA 91031302	08/31/2020	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	11/06/2020	12
RE	MLA-23	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-192	09/02/2020	12
RE	MPM-19	141815	Power Meter	DARE!! Instruments	RPR3006W	14I00048SNO083	11/06/2020	12
RE	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	557	05/22/2020	12
RE	MCC-246	199563	Microwave Cable	HUBER+SUNER	SF126E/11PC35/ 11PC35/1000M,5000M	537061/126E / 537072/126E	06/11/2020	12
RE	MHF-27	141297	High Pass Filter (1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	01/09/2020	12
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/07/2020	12
RE	MMM-10	141545	DIGITAL HiTESTER	Hioki	3805	51201148	01/06/2020	12
RE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-ME MI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-04-SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/04/2019	24
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/18/2020	12
RE	MRENT-130	141855	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187750	11/19/2019	12
RE	MPM-12	141809	Power Meter	ANRITSU	ML2495A	825002	05/07/2020	12
RE	MLPA-07	142645	Loop Antenna	UL Japan	-	-	-	-

***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, 99 % Occupied Bandwidth, -20 dB bandwidth, and Automatically deactivate tests