RADIO TEST REPORT

Test Report No. 15636654S-A-R1

Customer	**AISIN CORPORATION**
Description of EUT	**UWB/NFC Module**
Model Number of EUT	**AP10**
FCC ID	**PENAP10**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied**
Issue Date	**April 17, 2025**
Remarks	**-**

Representative test engineer	Approved by
Hiromasa Sato Engineer	Toyokazu Imamura Engineer

CERTIFICATE 1266.03

☐ 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. 15636656S-A

This report is a revised version of 15636654S-A. 15636654S-A is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15636656S-A	February 27, 2025	-
1	15636654S-A-R1	April 17, 2025	p.5, Correction antenna gain of UWB part (3.58 dBi to 4.04 dBi).
			p.6, Correction error ("The stable voltage was supplied by the ECU which was required to have a power supply regulator." to "The RF part has its own regulator. The RF part is constantly provided voltage through the regulator regards of input voltage.").
			p.9, Correction the operating mode of 20 dB Bandwidth and 99 % Occupied Bandwidth of test item.(""Below 30 MHz: Tx, without Tag, Above 30 MHz: Tx, with Tag (Pattern 1)" to "Tx, without Tag"), Correction the operating mode of Electric Field Strength of Spurious Emission of test item.("Tx, without Tag" to "Below 30 MHz: Tx, without Tag, Above 30 MHz: Tx, with Tag (Pattern 1)")

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	AISIN CORPORATION
Address	2-1, Asahi-machi, Kariya, Aichi, 448-8650, JAPAN
Telephone Number	+81-50-3151-4983
Contact Person	Koji Nomura

The information provided by 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

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	UWB/NFC Module
Model Number	AP10
Serial Number	Refer to SECTION 4.2
Condition	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	January 14, 2025
Test Date	January 15 to January 16, 2025

2.2 Product Description

General Specification

Rating	DC 7.1 V (DC 6.0 V to 8.2 V)
Operating Temperature	-40 deg. C to +85 deg. C

Radio Specification

NFC

Equipment Type	Transceiver
Frequency of Operation	13.56 MHz
Type of Modulation	ASK (NFC-A)

UWB

Equipment Type	Transceiver
Frequency of Operation	6489.6 MHz (6240 MHz to 6739.2 MHz) (CH5), 7987.2 MHz (7737.6 MHz to 8236.8 MHz) (CH9)
Type of Modulation	BPM-BPSK
Antenna Gain	4.04 dBi (max)

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	<FCC> Section 15.207	N/A *1)	N/A	-
	<ISED> RSS-Gen 8.8	<ISED> RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(a)	58.1 dB, 13.560 MHz, Vertical, QP, 0 deg.	Complied	Radiated
	<ISED> RSS-Gen 6.4, 6.12	<ISED> RSS-210 B.6			
Spectrum Mask	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(b)(c)	32.6 dB, 13.347 MHz, Vertical, QP, 0 deg.	Complied	Radiated
	<ISED> RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6			
20 dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section15.215(c)	See data	Complied	Radiated
	<ISED> -	<ISED> -			
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.209, Section 15.225 (d)	9.5 dB, 108.480 MHz, Vertical, QP	Complied	Radiated
	<ISED> RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6 RSS-Gen 8.9			
Frequency Tolerance	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(e)	See data	Complied	Radiated
	<ISED> RSS-Gen 6.11, 8.11	<ISED> RSS-210 B.6			
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. *1) The test was not performed since the EUT was DC device.					

FCC Part 15.31 (e)

The RF part has its own regulator. The RF part is constantly provided voltage through the regulator regards of input voltage.
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 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 % 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.

Item	Frequency range	Uncertainty (+/-)
Conducted Emission (AC Mains) LISN	150 kHz to 30 MHz	3.0 dB
Radiated Emission (Measurement distance: 3 m)	9 kHz to 30 MHz	3.3 dB
	30 MHz to 200 MHz	4.8 dB
	200 MHz to 1 GHz	6.1 dB
	1 GHz to 6 GHz	4.7 dB
	6 GHz to 18 GHz	5.3 dB
	18 GHz to 40 GHz	5.5 dB

Antenna terminal test	Uncertainty (+/-)
Frequency Measurement (13.56 MHz)	1.6 x 10^-7
Bandwidth Measurement	0.012 %
Temperature	2.2 deg.C.
Humidity	3.4 %
Voltage	0.92 %

3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
Telephone: +81-463-50-6400
A2LA Certificate Number: 1266.03
(FCC test firm registration number: 626366, ISED lab company number: 2973D / CAB identifier: JP0001)

Test room	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber (SAC1)	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber (SAC2)	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber (SAC3)	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber (SAC4)	8.1 x 5.1 x 3.55	8.1 x 5.1	-
Wireless anechoic chamber 1 (WAC1)	9.5 x 6.0 x 5.4	9.5 x 6.0	3 m
Wireless anechoic chamber 2 (WAC2)	9.5 x 6.0 x 5.4	9.5 x 6.0	3 m
No.1 Shielded room	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 Shielded room	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	2.55 x 4.1 x 2.5	-	-
No.2 Measurement room	4.5 x 3.5 x 2.5	-	-
Wireless shielded room 1	3.0 x 4.5 x 2.7	3.0 x 4.5	-
Wireless shielded room 2	3.0 x 4.5 x 2.7	3.0 x 4.5	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

The mode is used:

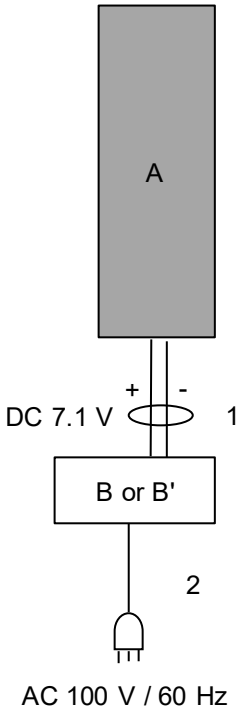
Test mode	Remarks
1) Transmitting mode (Tx) (13.56 MHz)	The EUT Transmits and Receives at the same time and there is no receiving mode.
The EUT was operated in a manner similar to typical use during the tests.	
*Power of the EUT was set by the software as follows; Software: SOFTWARE, ELECTRICAL KEY, L Version: 00001 (Date: 2024.12 10, 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*
Electric Field Strength of Fundamental Emission	Tx, without Tag
Spectrum Mask	Tx, without Tag
20 dB Bandwidth and 99 % Occupied Bandwidth	Tx, without Tag
Electric Field Strength of Spurious Emission	Below 30 MHz: Tx, without Tag Above 30 MHz: Tx, with Tag (Pattern 1)
Frequency Tolerance	Tx, without Tag

* After the comparison of the test data between with Tag and without Tag, the tests were performed with the worst case.

Frequency Tolerance	
Temperature	-20 deg. C to +50 deg.C Step 10 deg. C
Voltage	Normal Voltage DC 7.1 V Maximum Voltage DC 8.2 V (DC 7.1 V +15 %) Minimum Voltage DC 6 V (DC 7.1 V -15 %)
*This EUT provides stable voltage constantly to RF Part regardless of input voltage	

4.2 Configuration and peripherals



* Cabling and setup 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	Remark
A	UWB/NFC Module	AP10	SH2DN24171	AISIN	EUT
B	Power Supply (DC)	PNA16-10A	ER001085	Kikusui Electronics Corp.	*1)
B'	Power Supply (DC)	PAN35-10A	NA000955	KIKUSUI	*2)

*1) Used for Other Tests
*2) Used for Radiated Emission Tests

List of Cables Used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC	2.0	Unshielded	Unshielded	-
2	AC	1.8	Unshielded	Unshielded	-

SECTION 5: 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 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.

[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 2 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

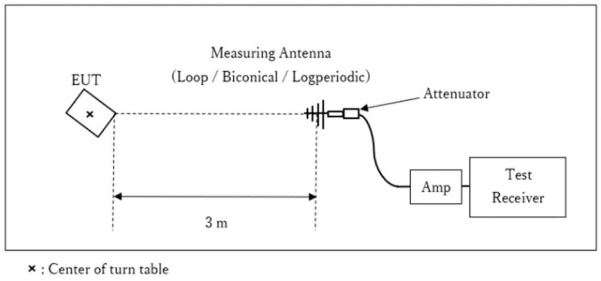
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

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

Figure 1: Test Setup

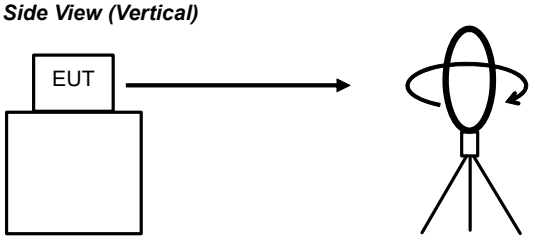
Below 1 GHz



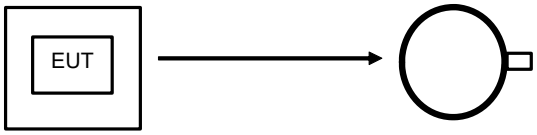
Test Distance: 3 m

Figure 2: Direction of the Loop Antenna

Side View (Vertical)

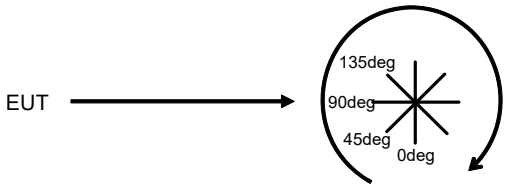


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

- 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.

Frequency / Test / Antenna	Carrier	Below 30 MHz	Above 30 MHz
Horizontal	Z	Z	X
Vertical	Y	Y	X

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 6: Other tests

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	100 kHz	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Spectrum Analyzer *1)
Peak hold was applied as Worst-case measurement. *1) The measurement was performed with Marker Frequency Counter Function.							

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Fundamental Emission and Spectrum Mask

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	SAC2
Date	January 15, 2025
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Takahiro Suzuki
Mode	Tx, without Tag
Remarks	Axis: Horizontal Z Vertical Y, Vertical polarization (antenna angle) of the worst case: 0 deg.

Fundamental emission

No.	FREQ	Test Receiver Reading		Antenna Factor	Loss	AMP GAIN	Distance factor	RESULT		LIMIT (30m)	MARGIN	
		Hor	Ver					Hor	Ver		Hor	Ver
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]
1	13.560	72.8	81.8	9.4	6.6	32.0	-40.0	16.8	25.8	83.9	67.1	58.1

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]+Distance factor[dB]
Distance factor: 40 x log (3 m/30 m) = -40 dB

Spurious emission within the band

No.	FREQ	Test Receiver Reading		Antenna Factor	Loss	AMP GAIN	Distance factor	RESULT		LIMIT (30m)	MARGIN	
		Hor	Ver					Hor	Ver		Hor	Ver
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]
1	13.110	29.6	34.9	9.6	6.6	32.0	-40.0	-26.2	-21.0	29.5	55.7	50.5
2	13.134	46.9	56.7	9.6	6.6	32.0	-40.0	-9.0	0.8	40.5	49.5	39.7
3	13.347	55.1	63.8	9.5	6.6	32.0	-40.0	-0.9	7.9	40.5	41.4	32.6
4	13.410	40.5	50.0	9.4	6.6	32.0	-40.0	-15.4	-6.01	40.5	55.9	46.5
5	13.553	58.0	66.6	9.4	6.6	32.0	-40.0	2.0	10.6	50.4	48.4	39.8
6	13.567	58.2	66.7	9.4	6.6	32.0	-40.0	2.2	10.7	50.4	48.2	39.7
7	13.710	39.6	47.4	9.4	6.6	32.0	-40.0	-16.4	-8.61	40.5	56.9	49.1
8	13.770	52.0	60.0	9.4	6.6	32.0	-40.0	-4.1	4.0	40.5	44.6	36.5
9	13.982	43.0	51.8	9.3	6.6	32.0	-40.0	-13.1	-4.3	40.5	53.6	44.8
10	14.010	28.0	30.5	9.3	6.6	32.0	-40.0	-28.1	-25.63	29.5	57.6	55.1

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]+Distance factor[dB]
Distance factor: 40 x log (3 m/30 m) = -40 dB

Outside filed strength frequencies
・Fc±7 kHz:13.553 MHz to 13.567 MHz
・Fc±150 kHz:13.410 MHz to 13.710 MHz
・Fc±450 kHz:13.110 MHz to 14.010 MHz
Fc = 13.56 MHz

Spurious Emission

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	SAC2
Date	January 15, 2025
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Takahiro Suzuki
Mode	Tx
	Below 30 MHz (Horizontal: Z-axis, Vertical: Y-axis), without Tag
	Above 30 MHz (Horizontal: X-axis, Vertical: X-axis), with Tag (Pattern 1)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	27.12	QP	33.1	7.5	6.9	32.0	-40.0	-24.5	29.5	54.0	-	178	* Limit: 30m
Hori.	189.840	QP	35.4	16.4	8.9	31.8	0.0	28.9	43.5	14.6	260	220	
Hori.	596.640	QP	30.0	19.3	8.5	31.6	0.0	26.2	46.0	19.8	162	90	
Hori.	623.760	QP	33.2	19.8	8.7	31.6	0.0	30.0	46.0	16.0	120	101	
Hori.	732.240	QP	35.3	20.9	9.2	31.5	0.0	33.9	46.0	12.1	100	70	
Hori.	759.360	QP	33.2	21.3	9.4	31.5	0.0	32.4	46.0	13.6	100	335	
Vert.	27.12	QP	39.8	7.5	6.9	32.0	-40.0	-17.8	29.5	47.3	-	181	* Limit: 30m
Vert.	40.680	QP	35.7	14.6	7.1	31.9	0.0	25.6	40.0	14.5	100	322	
Vert.	108.480	QP	46.2	11.7	8.0	31.9	0.0	34.0	43.5	**9.5**	100	175	
Vert.	135.600	QP	39.4	14.2	8.4	31.9	0.0	30.1	43.5	13.4	100	252	

Result = Reading + Ant Factor + Loss (Cable+ATT+ΔAF(above 30 MHz)) - Gain(Amprifier) + Distance factor(below 30 MHz)

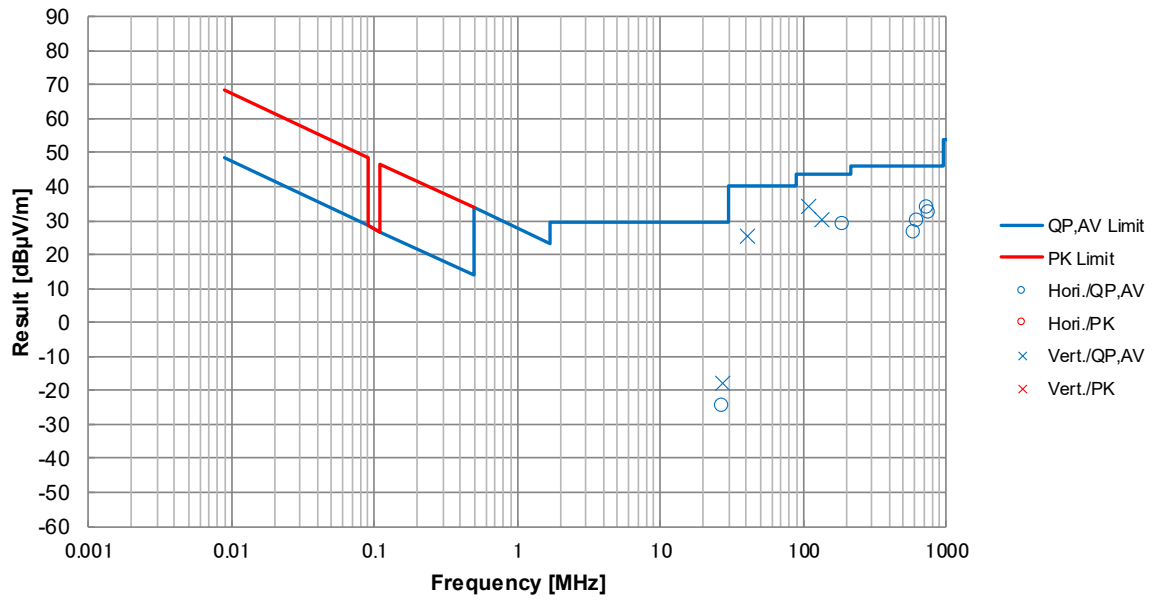
* Other frequency noises omitted in this report were not seen or have enough margin (more than 20 dB).

* Carrier level (Result at 3 m): Hor= 56.8 dBuV/m, Ver= 65.8 dBuV/m

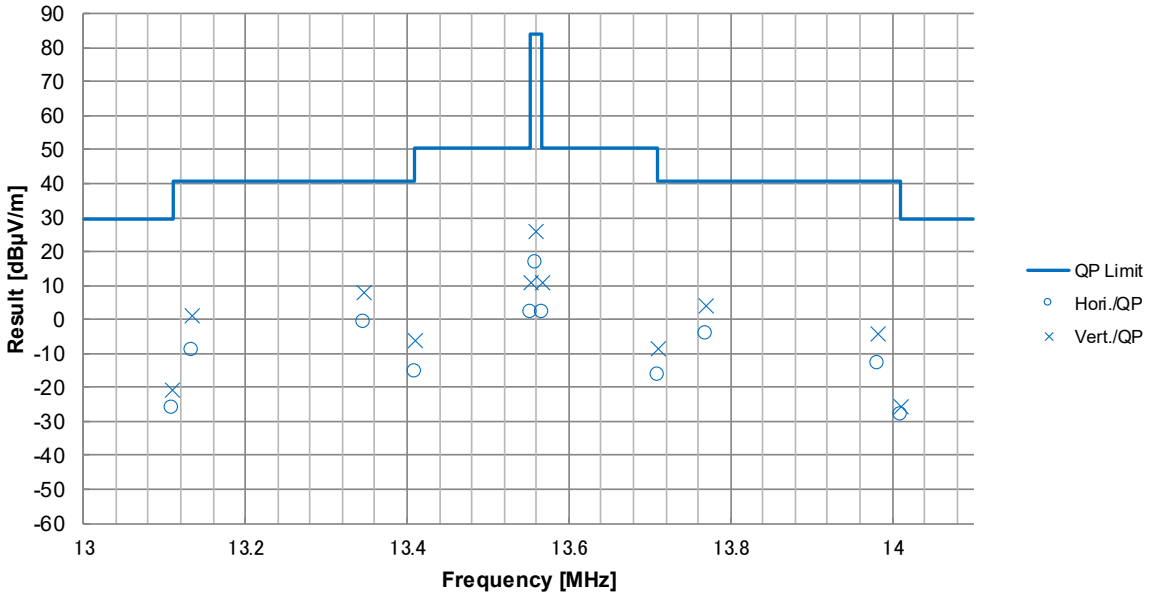
Radiated Spurious Emission
(Plot data, Worst case for Spurious Emission)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	SAC2
Date	January 15, 2025
Temperature / Humidity	20 deg. C / 38 % RH
Engineer	Takahiro Suzuki
Mode	Tx
	Below 30 MHz (Horizontal: Z-axis, Vertical: Y-axis), without Tag
	Above 30 MHz (Horizontal: X-axis, Vertical: X-axis), with Tag (Pattern 1)

Spurious emission plot



Within band plot

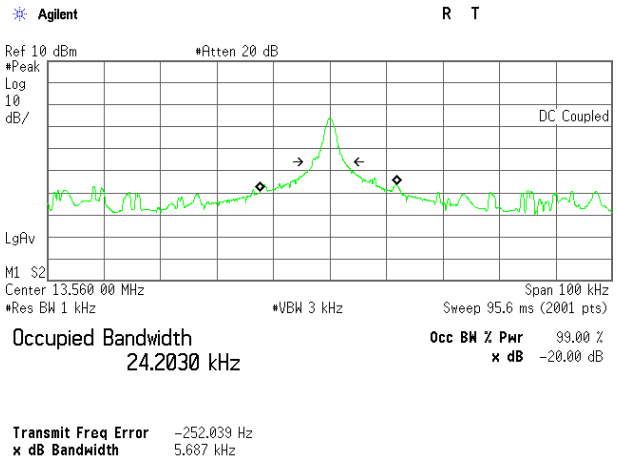


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

20 dB Bandwidth and 99% Occupied Bandwidth

Test place	Shonan EMC Lab.
Shielded Room	No.5
Date	January 16, 2025
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Hiromasa Sato
Mode	Tx, with Tag (Pattern 1)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	5.687	24.2030



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.

Frequency Tolerance

Test place	Shonan EMC Lab.
Shielded Room	No.5
Date	January 16, 2025
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Hiromasa Sato
Mode	Tx, without Tag

Test condition		Tested	Measured	Frequency	Result		Limit
Temp.	Voltage	timing	frequency	error			
[deg. C]	[V]		[MHz]	[MHz]	[%]	[ppm]	[+/- %]
50	7.1	Power on	13.560363	0.000363	0.00268	26.8	0.01
		+ 2 min.	13.560007	0.000007	0.00005	0.5	0.01
		+ 5 min.	13.560006	0.000006	0.00004	0.4	0.01
		+ 10 min.	13.560080	0.000080	0.00059	5.9	0.01
40	7.1	Power on	13.560052	0.000052	0.00039	3.9	0.01
		+ 2 min.	13.560027	0.000027	0.00020	2.0	0.01
		+ 5 min.	13.560020	0.000020	0.00015	1.5	0.01
		+ 10 min.	13.559949	-0.000051	-0.00038	-3.8	0.01
30	7.1	Power on	13.559990	-0.000010	-0.00008	-0.8	0.01
		+ 2 min.	13.560126	0.000126	0.00093	9.3	0.01
		+ 5 min.	13.560054	0.000054	0.00040	4.0	0.01
		+ 10 min.	13.560135	0.000135	0.00100	10.0	0.01
20	7.1	Power on	13.560138	0.000138	0.00102	10.2	0.01
		+ 2 min.	13.560097	0.000097	0.00072	7.2	0.01
		+ 5 min.	13.560097	0.000097	0.00071	7.1	0.01
		+ 10 min.	13.560096	0.000096	0.00071	7.1	0.01
20	6	Power on	13.560051	0.000051	0.00037	3.7	0.01
	(7.1V -15%)	+ 2 min.	13.560104	0.000104	0.00076	7.6	0.01
		+ 5 min.	13.559987	-0.000013	-0.00010	-1.0	0.01
		+ 10 min.	13.559887	-0.000113	-0.00083	-8.3	0.01
20	8.2	Power on	13.560059	0.000059	0.00043	4.3	0.01
	(7.1V +15%)	+ 2 min.	13.560202	0.000202	0.00149	14.9	0.01
		+ 5 min.	13.560111	0.000111	0.00082	8.2	0.01
		+ 10 min.	13.560145	0.000145	0.00107	10.7	0.01
10	7.1	Power on	13.560098	0.000098	0.00073	7.3	0.01
		+ 2 min.	13.560071	0.000071	0.00053	5.3	0.01
		+ 5 min.	13.560152	0.000152	0.00112	11.2	0.01
		+ 10 min.	13.560149	0.000149	0.00110	11.0	0.01
0	7.1	Power on	13.560215	0.000215	0.00158	15.8	0.01
		+ 2 min.	13.560144	0.000144	0.00106	10.6	0.01
		+ 5 min.	13.560191	0.000191	0.00141	14.1	0.01
		+ 10 min.	13.560188	0.000188	0.00139	13.9	0.01
-10	7.1	Power on	13.560150	0.000150	0.00111	11.1	0.01
		+ 2 min.	13.560217	0.000217	0.00160	16.0	0.01
		+ 5 min.	13.560019	0.000019	0.00014	1.4	0.01
		+ 10 min.	13.560215	0.000215	0.00158	15.8	0.01
-20	7.1	Power on	13.560193	0.000193	0.00142	14.2	0.01
		+ 2 min.	13.560206	0.000206	0.00152	15.2	0.01
		+ 5 min.	13.560157	0.000157	0.00116	11.6	0.01
		+ 10 min.	13.560159	0.000159	0.00117	11.7	0.01

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

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

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

APPENDIX 2: Test instruments

Test Equipment

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
BW,FT	201085	Constant Climate Cabinet	Espec	LHU-124	1013000486	2024/10/11	12
BW,FT	146178	Search coil	Langer	RF-R 400-1	02-0634	-	-
BW,FT	235604	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY45300743	2024/05/23	12
BW,FT	175822	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2024/08/11	12
RE	150921	Attenuator	JFW	50HF-003N	-	2024/02/13	12
RE	167095	Attenuator	JFW	50HF-006N	-	2024/02/13	12
RE	167096	Attenuator	JFW	50HF-006N	-	2024/02/13	12
RE	145022	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032665	2024/04/10	12
RE	194601	Coaxial Cable	Fjikura	5D-2W	-	2024/11/21	12
RE	144975	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	2024/04/10	12
RE	144976	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	2024/04/10	12
RE	145793	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997819	2024/05/29	12
RE	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	Ver 3.1.0546	-	-
RE	236418	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VULP 9118 B	00975	2024/07/03	12
RE	245074	Loop(Active) Antenna	ETS-Lindgren	6502	00262458	2024/04/02	12
RE	145004	Pre Amplifier	SONOMA	310N	290212	2024/02/13	12
RE	145563	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	2024/03/22	12
RE	207277	Tape Measure	ASKUL	-	-	-	-
RE	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2024/08/06	12
RE	235739	Thermo-Hygrometer	CUSTOM. Inc	CTH-230	-	2024/04/28	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
FT: Frequency Tolerance
BW: 20 dB bandwidth & 99 % Occupied bandwidth