



RADIO TEST REPORT

Test Report No.: 14689046S-A-R1

Customer	Sony Global Manufacturing & Operations Corporation
Description of EUT	CONTACTLESS IC CARD READER/WRITER
Model Number of EUT	RC-S300
FCC ID	AK8RCS300
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied (Refer to SECTION 3)
Issue Date	May 10, 2023
Remarks	-

Representative test engineer

Y. Murakami

Yosuke Murakami
Engineer

Approved by

T. Imamura

Toyokazu Imamura
Leader



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".

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 21.0

ANNOUNCEMENT

- This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
- The results in this report apply only to the sample tested. (Laboratory was not involved in sampling.)
- This sample tested is in compliance with the limits of the above regulation.
- The test results in this test report are traceable to the national or international standards.
- This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
- This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
- The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
- The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan, Inc. has been accredited.
- The information provided from the customer for this report is identified in Section 1.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

REVISION HISTORY

Original Test Report No.: 14689046S-A

This report is a revised version of 14689046S-A. 14689046S-A is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents																												
- (Original)	14689046S-A	April 26, 2023	-																												
1	14689046S-A-R1	May 10, 2023	Page 9 Added tag type information and the reason for using those tags. [Before correction] <table><tr><th>Test Item</th><th>Operating mode</th></tr><tr><td>Conducted Emission</td><td>NFC Communication (with Tag)</td></tr><tr><td>Electric Field Strength of Fundamental Emission</td><td>NFC Communication (with Tag) NFC Transmitting (without Tag)</td></tr><tr><td>Spectrum Mask</td><td>NFC Communication (with Tag) NFC Transmitting (without Tag)</td></tr><tr><td>20 dB Bandwidth and 99 % Occupied Bandwidth</td><td>NFC Communication (with Tag)</td></tr><tr><td>Electric Field Strength of Spurious Emission</td><td>NFC Communication (with Tag)</td></tr><tr><td>Frequency Tolerance</td><td>NFC Transmitting (Unmodulated)</td></tr></table> [After correction] <table><tr><th>Test Item</th><th>Operating mode</th></tr><tr><td>Conducted Emission</td><td>NFC Communication (with Tag / Type F) *1)</td></tr><tr><td>Electric Field Strength of Fundamental Emission</td><td>NFC Communication (with Tag / Type F) *1) NFC Transmitting (without Tag)</td></tr><tr><td>Spectrum Mask</td><td>NFC Communication (with Tag / Type F) *1) NFC Transmitting (without Tag)</td></tr><tr><td>20 dB Bandwidth and 99 % Occupied Bandwidth</td><td>NFC Communication (with Tag)</td></tr><tr><td>Electric Field Strength of Spurious Emission</td><td>NFC Communication *1) Below 30 MHz (with Tag / Type F) Above 30 MHz (with Tag / Type B)</td></tr><tr><td>Frequency Tolerance</td><td>NFC Transmitting (Unmodulated)</td></tr></table> *1) As a result of comparing without / with tag and Tag type at pre-check, test was performed with the worst case as representative. Page 13 Corrected the table size from “0.5 m by 1.0 m” to “1.0 m by 1.5 m”.	Test Item	Operating mode	Conducted Emission	NFC Communication (with Tag)	Electric Field Strength of Fundamental Emission	NFC Communication (with Tag) NFC Transmitting (without Tag)	Spectrum Mask	NFC Communication (with Tag) NFC Transmitting (without Tag)	20 dB Bandwidth and 99 % Occupied Bandwidth	NFC Communication (with Tag)	Electric Field Strength of Spurious Emission	NFC Communication (with Tag)	Frequency Tolerance	NFC Transmitting (Unmodulated)	Test Item	Operating mode	Conducted Emission	NFC Communication (with Tag / Type F) *1)	Electric Field Strength of Fundamental Emission	NFC Communication (with Tag / Type F) *1) NFC Transmitting (without Tag)	Spectrum Mask	NFC Communication (with Tag / Type F) *1) NFC Transmitting (without Tag)	20 dB Bandwidth and 99 % Occupied Bandwidth	NFC Communication (with Tag)	Electric Field Strength of Spurious Emission	NFC Communication *1) Below 30 MHz (with Tag / Type F) Above 30 MHz (with Tag / Type B)	Frequency Tolerance	NFC Transmitting (Unmodulated)
Test Item	Operating mode																														
Conducted Emission	NFC Communication (with Tag)																														
Electric Field Strength of Fundamental Emission	NFC Communication (with Tag) NFC Transmitting (without Tag)																														
Spectrum Mask	NFC Communication (with Tag) NFC Transmitting (without Tag)																														
20 dB Bandwidth and 99 % Occupied Bandwidth	NFC Communication (with Tag)																														
Electric Field Strength of Spurious Emission	NFC Communication (with Tag)																														
Frequency Tolerance	NFC Transmitting (Unmodulated)																														
Test Item	Operating mode																														
Conducted Emission	NFC Communication (with Tag / Type F) *1)																														
Electric Field Strength of Fundamental Emission	NFC Communication (with Tag / Type F) *1) NFC Transmitting (without Tag)																														
Spectrum Mask	NFC Communication (with Tag / Type F) *1) NFC Transmitting (without Tag)																														
20 dB Bandwidth and 99 % Occupied Bandwidth	NFC Communication (with Tag)																														
Electric Field Strength of Spurious Emission	NFC Communication *1) Below 30 MHz (with Tag / Type F) Above 30 MHz (with Tag / Type B)																														
Frequency Tolerance	NFC Transmitting (Unmodulated)																														

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	5
SECTION 2: Equipment Under Test (EUT).....	5
SECTION 3: Test specification, procedures & results	6
SECTION 4: Operation of EUT during testing.....	9
SECTION 5: Conducted Emission	12
SECTION 6: Radiated emission (Fundamental, Spurious Emission and Spectrum Mask).....	13
SECTION 7: Other tests	16
APPENDIX 1: Test data	17
Conducted Emission	17
Data of Electric field strength of Fundamental emission and Spurious emission within the band ...	19
Radiated Emission.....	21
20 dB Bandwidth and 99 % Occupied Bandwidth.....	23
Frequency Tolerance.....	27
APPENDIX 2: Test instruments	28
APPENDIX 3: Photographs of test setup	29
Conducted Emission	29
Radiated Emission.....	30
Pre-check of Worst Case Position.....	31
Frequency Tolerance.....	33
Tag appearance	34

SECTION 1: Customer Information

Company Name	Sony Global Manufacturing & Operations Corporation
Address	8-4, Shiomi Kisarazu-shi, Chiba, 292-0834 Japan.
Telephone Number	+81-438-37-4704
Contact Person	Youhei Hisano

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	CONTACTLESS IC CARD READER/WRITER
Model Number	RC-S300
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 8, 2023
Test Date	March 8 to April 20, 2023

2.2 Product Description

General Specification

Rating	DC 5 V, 200 mA
Operating Temperature	+5 deg. C to +35 deg. C

Radio Specification

Equipment Type	Transceiver
Frequency of Operation	13.56 MHz
Type of Modulation	ASK
Antenna Gain	-56.5 dBi

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.

* The customer has declared that the EUT has complied with FCC Part 15 Subpart B as SDoC.

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	17.2 dB 27.12 MHz AV, N Mode: NFC Communication (with Tag, Type-F)	Complied a)	-
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods ----- <ISED> RSS-Gen 6.4, 6.12	<FCC> Section 15.225(a) ----- <ISED> RSS-210 B.6	52.9 dB, 13.560 MHz, QP, 0 deg. Mode: NFC Transmitting (without Tag)	Complied b)	Radiated
Spectrum Mask	<FCC> ANSI C63.10:2013 6 Standard test methods ----- <ISED> RSS-Gen 6.4, 6.13	<FCC> Section 15.225(b)(c) ----- <ISED> RSS-210 B.6	34.0 dB, 13.553 MHz, QP, 0 deg. Mode: NFC Transmitting (without Tag)	Complied b)	Radiated
20 dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods ----- <ISED> -	<FCC> Section15.215(c) ----- <ISED> -	See data	Complied c)	Radiated
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods ----- <ISED> RSS-Gen 6.4, 6.13	<FCC> Section 15.209, Section 15.225 (d) ----- <ISED> RSS-210 B.6 RSS-Gen 8.9	3.6 dB 40.68 MHz, Vertical, QP Mode: NFC Communication (without Tag)	Complied d)	Radiated
Frequency Tolerance	<FCC> ANSI C63.10:2013 6 Standard test methods ----- <ISED> RSS-Gen 6.11, 8.11	<FCC> Section 15.225(e) ----- <ISED> RSS-210 B.6	See data	Complied e)	Radiated

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

- a) Refer to APPENDIX 1 (data of Conducted Emission)
- b) Refer to APPENDIX 1 (data of Fundamental emission and Spectrum Mask)
- c) Refer to APPENDIX 1 (data of 20 dB Bandwidth and 99 % Occupied Bandwidth)
- d) Refer to APPENDIX 1 (data of Radiated Emission)
- e) Refer to APPENDIX 1 (data of Frequency Tolerance)

FCC Part 15.31 (e)

The stable voltage was supplied by the end product which was required to have a power supply regulator. Therefore, the EUT complies with the requirement.

However, the supply voltage was varied and tested at 85 % and 115 % of the nominal rated supply voltage during frequency tolerance test according to Section 15.225(e), since EUT cannot be operated at 110 % of the nominal rated voltage (the EUT will be damaged if a voltage of 110 % rated voltage is supplied).

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because it is printed pattern circuit on the circuit board. 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	- a)	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. a) Refer to APPENDIX 1 (data of 20 dB Bandwidth and 99 % Occupied Bandwidth)					

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 $k = 2$.

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	3.1 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.3 dB
	30 MHz-200 MHz	4.8 dB
	200 MHz-1 GHz	6.1 dB

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Other test	Uncertainty (+/-)
Bandwidth Measurement	0.012 %
Temperature_SCH-01	0.87 deg.C.
Humidity_SCH-01	3.5 %
Temperature_SCH-02	2.0 deg.C.
Humidity_SCH-02	6.7 %
Voltage	0.92 %
Frequency Measurement (Spectrum Analyzer)	1.4×10^{-7}
Frequency Measurement (Frequency Counter)	8.3×10^{-8}

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 site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
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	-	-

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 :

Mode	Operating mode	Tested frequency
All items except for frequency tolerance, with tag	NFC Communication	13.56 MHz
All items except for frequency tolerance, without tag	NFC Transmitting	13.56 MHz
Frequency tolerance	NFC Transmitting (Unmodulated)	13.56 MHz
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;		
Power Setting: Fixed Software: Version: 00000120 (Date: 2023.03 08, Storage location: EUT memory)		
*This setting of software is the worst case.		
Any conditions under the normal use do not exceed the condition of setting.		
In addition, end users cannot change the settings of the output power of the product.		
Justification: The system was configured in typical fashion (as a user would normally use it) for testing.		

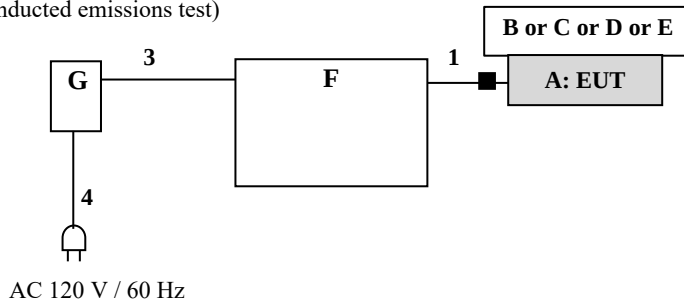
Test Item	Operating mode
Conducted Emission	NFC Communication (with Tag / Type F) *1)
Electric Field Strength of Fundamental Emission	NFC Communication (with Tag / Type F) *1) NFC Transmitting (without Tag)
Spectrum Mask	NFC Communication (with Tag / Type F) *1) NFC Transmitting (without Tag)
20 dB Bandwidth and 99 % Occupied Bandwidth	NFC Communication (with Tag)
Electric Field Strength of Spurious Emission	NFC Communication *1) Below 30 MHz (with Tag / Type F) Above 30 MHz (with Tag / Type B)
Frequency Tolerance	NFC Transmitting (Unmodulated)

*1) As a result of comparing without / with tag and Tag type at pre-check, test was performed with the worst case as representative.

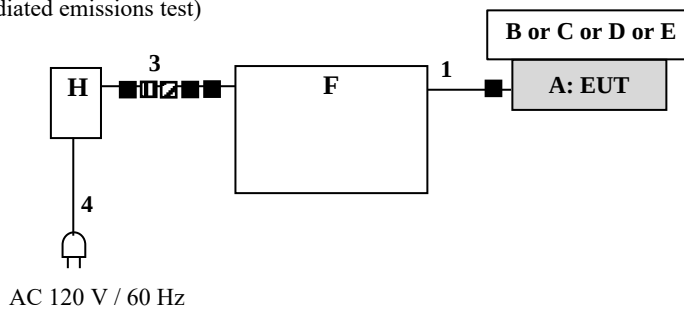
Frequency Tolerance:	
Temperature	-20 deg. C to +50 deg. C Step 10 deg. C
Voltage	Normal Voltage DC 5 V Maximum Voltage DC 5.5 V (DC 5 V +10 %) (The EUT will be damaged if a voltage of 115 % rated voltage is supplied) Minimum Voltage DC 4.25 V (DC 5 V -15 %)
*This EUT provides stable voltage constantly to RF Part regardless of input voltage	

4.2 Configuration and peripherals

(For Conducted emissions test)



(For Radiated emissions test)



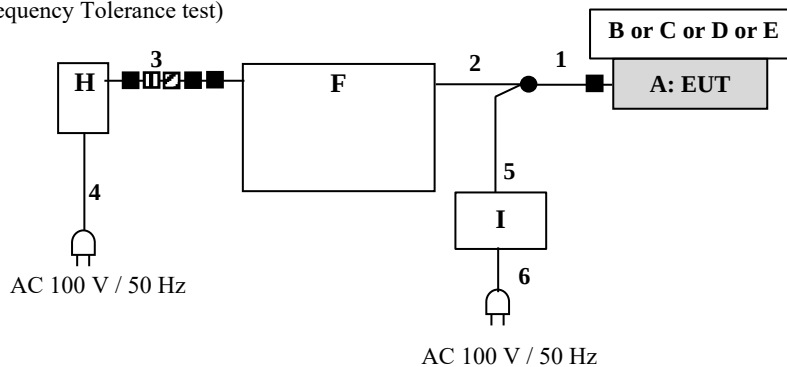
■: Standard ferrite core

▣: Ferrite Core (1 turn)
(ZCAT2035-0930)

▢: Ferrite Core (1 turn)
(ZCAT1730-0730)

■: Ferrite Core (1 turn)
(ZCAT1325-0530)

(For Frequency Tolerance test)



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

* The ferrite core attached to DC cable is not used to reduce the noise from the EUT. Therefore, that does not affect the emission level of the EUT.

* As a result of comparing AC 120 V and AC 240 V at pre-check, conducted emission test was performed with AC 120 V of the worst voltage as representative.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	CONTACTLESS IC CARD READER/WRITER	RC-S300	9999367 9999368 *1)	Sony	EUT
B	IC Card	-	-	-	type-F *2)
C	IC Card	-	-	-	type-A
D	IC Card	-	-	-	type-B
E	IC Card	-	-	-	type-V
F	Laptop PC	VGN-G1	J001YGP3	Sony	-
G	AC Adapter	PCGA-AC16V6	147774951 0795512	Sony	-
H	AC Adapter	PCGA-AC16V6	147774951 0795514	Sony	-
I	Power Supply (DC)	PW18-2ATP	19050351	TEXIO	-

*1) Used for Conducted emissions test. (Antenna Terminated)

*2) RC-S300 is used with Type-F (FeliCa), Type-A, Type-B or Type V.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	0.7	Shielded	Shielded	-
2	USB	2.0	Shielded	Shielded	-
3	DC	1.8	Unshielded	Unshielded	-
4	AC	0.75	Unshielded	Unshielded	-
5	DC	0.8	Unshielded	Unshielded	-
6	AC	2.0	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a wooden platform of nominal size 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane.

The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

1) For the tests on EUT with other peripherals (as a whole system)

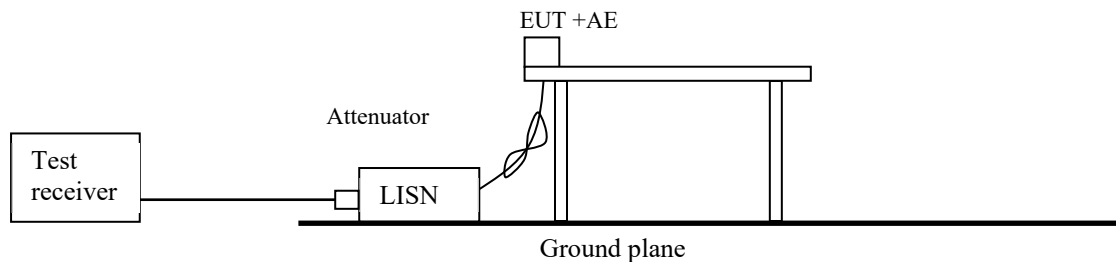
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50 ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected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

The AC Mains Terminal Continuous Disturbance Voltage has been measured with the EUT via AE (PC's AC Adapter) in a Shield room.

The EUT via AE (PC's AC Adapter) was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

Figure 1: Test Setup



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

Detector	: QP and CISPR AV
Measurement range	: 0.15 MHz - 30 MHz
Test data	: APPENDIX
Test result	: Pass

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

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[Limit conversion]

The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to $45.5 - 51.5 = -6.0$ dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

[Frequency: From 9 kHz to 30 MHz]

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

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

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

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

[Frequency: From 30 MHz to 1 GHz]

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

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

[Test instruments and test settings]

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

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

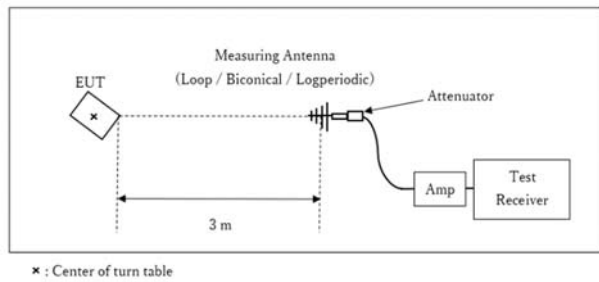
Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)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

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

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

Figure 2: Test Setup

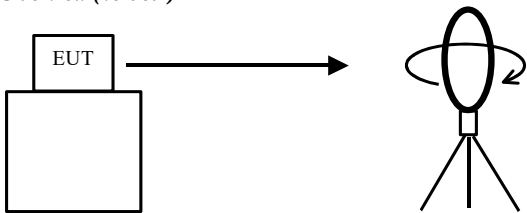
Below 1 GHz



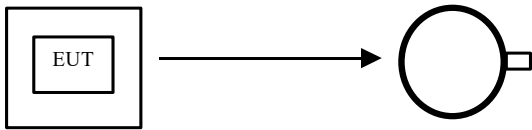
Test Distance: 3 m

Figure 3: Direction of the Loop Antenna

Side View (Vertical)

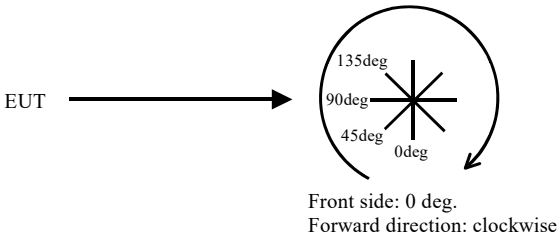


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



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

Combinations of the worst case

	Frequency Antenna polarization	Below 30 MHz	Above 30 MHz
Module	Horizontal	Y	Y
	Vertical	Z	Y

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

Measurement range : 9 kHz to 1 GHz

Test data : APPENDIX

Test result : Pass

SECTION 7: Other tests

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	100 kHz	1 kHz	3 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 *1)	Max Hold *1)	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Frequency counter
*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

Conducted Emission

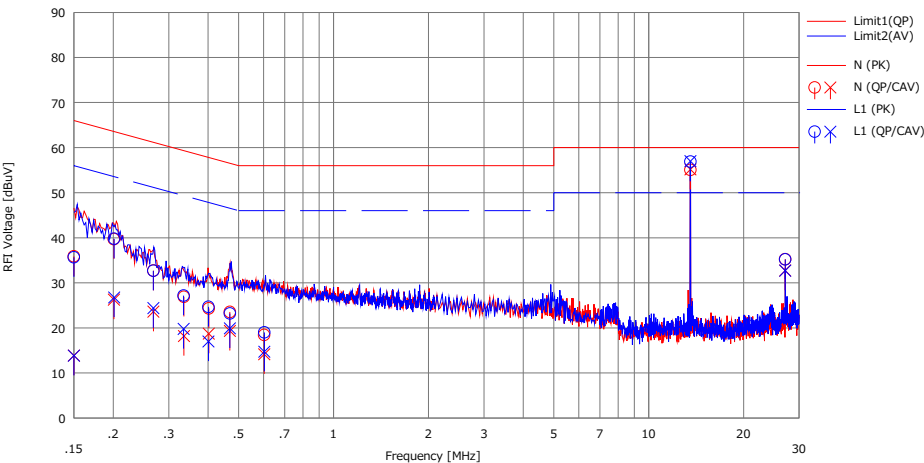
DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2023/03/16

Mode : NFC Communication
Power : DC 5.0 V (AC Adapter: 120 V / 60 Hz)
Temp./Humi. : 24 deg.C / 34 %RH

Remarks : with Tag (Type F)

Limit : FCC_Part 15 Subpart C(15.207) Engineer : Kouki Yamada



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<CAV> [dBuV]		<QP> [dBuV]	<CAV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	23.40	1.40	12.47	35.87	13.87	66.00	56.00	30.1	42.1	N	
2	0.20095	27.20	13.80	12.49	39.69	26.29	63.57	53.57	23.8	27.2	N	
3	0.26824	20.20	11.10	12.50	32.70	23.60	61.17	51.17	28.4	27.5	N	
4	0.33526	14.40	5.70	12.50	26.90	18.20	59.32	49.32	32.4	31.1	N	
5	0.40196	11.80	6.20	12.52	24.32	18.72	57.81	47.81	33.4	29.0	N	
6	0.46910	11.00	6.80	12.54	23.54	19.34	56.53	46.53	32.9	27.1	N	
7	0.60285	5.90	1.60	12.55	18.45	14.15	56.00	46.00	37.5	31.8	N	
8	13.56000	41.80	41.90	13.26	55.06	55.16	60.00	50.00	4.9	-5.2	N	carrier (Reference data)
9	27.12000	21.50	19.00	13.74	35.24	32.74	60.00	50.00	24.7	17.2	N	
10	0.15000	23.20	1.40	12.46	35.66	13.86	66.00	56.00	30.3	42.1	L1	
11	0.20128	27.30	14.30	12.47	39.77	26.77	63.56	53.56	23.7	26.7	L1	
12	0.26817	20.20	11.90	12.48	32.68	24.38	61.17	51.17	28.4	26.7	L1	
13	0.33457	14.70	7.30	12.48	27.18	19.78	59.34	49.34	32.1	29.5	L1	
14	0.40102	12.20	4.50	12.48	24.68	16.98	57.83	47.83	33.1	30.8	L1	
15	0.46895	10.70	7.40	12.50	23.20	19.90	56.53	46.53	33.3	26.6	L1	
16	0.60320	6.50	2.20	12.52	19.02	14.72	56.00	46.00	36.9	31.2	L1	
17	13.56000	43.60	43.70	13.29	56.89	56.99	60.00	50.00	3.1	-7.0	L1	carrier (Reference data)
18	27.12000	21.20	18.70	14.00	35.20	32.70	60.00	50.00	24.8	17.3	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN)=SLS-01

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2023/03/16

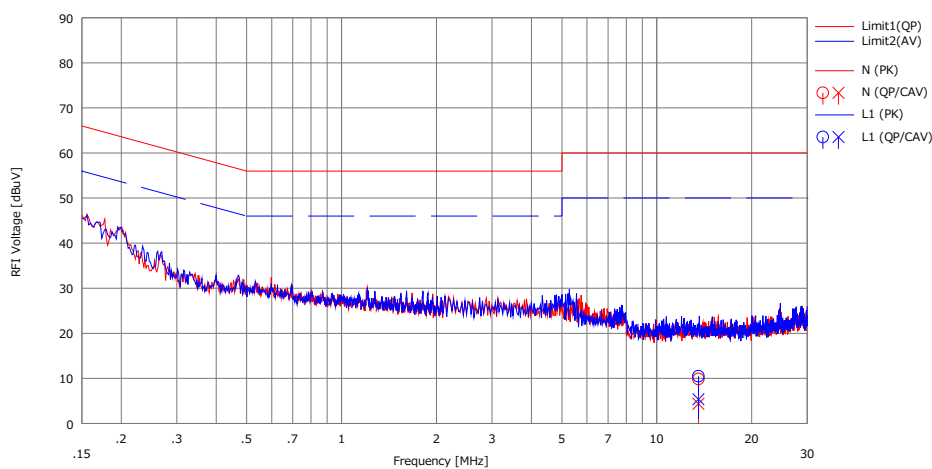
Mode : NFC Communication

Power : DC 5.0 V (AC Adapter: 120 V / 60 Hz)
Temp./Humi. : 24 deg.C / 34 %RH

Remarks : antenna terminated

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Kouki Yamada

[illegible]

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN)=SLS-01

Data of Electric field strength of Fundamental emission and Spurious emission within the band

Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date April 20, 2023
Temperature / Humidity 23 deg. C / 41 % RH
Engineer Yohsuke Matsuzawa
Mode NFC Communication (with Tag)
NFC type F (Axis:Hor_Y / Ver_Z), Vertical polarization
(antenna angle) of the worst case: 0 deg.

Fundamental emission

No.	FREQ [MHz]	Test Receiver Reading		Antenna Factor [dB/m]	Loss [dB]	AMP GAIN [dB]	Distance factor [dB]	RESULT		LIMIT (30 m) [dBuV/m]	MARGIN	
		Hor [dBuV]	Ver [dBuV]					Hor [dBuV/m]	Ver [dBuV/m]		Hor [dB]	Ver [dB]
1	13.560	61.3	70.3	20.0	6.4	32.2	-40.0	15.5	24.5	83.9	68.4	59.4

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

Limits (30 m)

• 13.553 MHz to 13.567 MHz : 83.9 dBuV/m (FCC 15.225(a))

Spurious emission within the band

No.	FREQ [MHz]	Test Receiver Reading		Antenna Factor [dB/m]	Loss [dB]	AMP GAIN [dB]	Distance factor [dB]	RESULT		LIMIT (30 m) [dBuV/m]	MARGIN	
		Hor [dBuV]	Ver [dBuV]					Hor [dBuV/m]	Ver [dBuV/m]		Hor [dB]	Ver [dB]
1	12.660	30.6	30.4	20.0	6.4	32.2	-40.0	-15.3	-15.5	29.5	44.8	45.0
2	12.925	31.0	37.3	20.0	6.4	32.2	-40.0	-14.9	-8.6	29.5	44.4	38.1
3	13.110	30.5	30.5	20.0	6.4	32.2	-40.0	-15.4	-15.4	29.5	44.9	44.9
4	13.349	37.5	45.7	20.0	6.4	32.2	-40.0	-8.4	-0.2	40.5	48.9	40.7
5	13.410	30.6	35.7	20.0	6.4	32.2	-40.0	-15.3	-10.15	40.5	55.8	50.7
6	13.417	31.1	40.6	20.0	6.4	32.2	-40.0	-14.8	-5.25	50.4	65.2	55.7
7	13.553	48.6	57.1	20.0	6.4	32.2	-40.0	2.8	11.27	50.4	47.6	39.1
8	13.567	48.1	56.8	20.0	6.4	32.2	-40.0	2.3	10.97	50.4	48.1	39.4
9	13.705	30.7	38.7	20.0	6.4	32.2	-40.0	-15.1	-7.12	50.4	65.5	57.5
10	13.710	31.0	35.8	20.0	6.4	32.2	-40.0	-14.8	-10.0	40.5	55.3	50.5
11	13.771	34.2	43.5	20.0	6.4	32.2	-40.0	-11.6	-2.3	40.5	52.1	42.8
12	14.010	30.7	30.4	20.1	6.4	32.2	-40.0	-15.1	-15.4	29.5	44.6	44.9
13	14.198	30.8	33.7	20.1	6.4	32.2	-40.0	-15.0	-12.06	29.5	44.5	41.6
14	14.460	30.6	30.3	20.1	6.4	32.2	-40.0	-15.1	-15.44	29.5	44.6	44.9

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

Limits (30 m)

• 13.410 MHz to 13.553 MHz and 13.567 MHz to 13.710 MHz : 50.4 dBuV/m (FCC 15.225(b))

• 13.110 MHz to 13.410 MHz and 13.710 MHz to 14.010 MHz : 40.5 dBuV/m (FCC 15.225(c))

• Below 13.110 MHz and Above 14.010 MHz : 29.5 dBuV/m (FCC 15.225(d) and FCC 15.209)

Data of Electric field strength of Fundamental emission and Spurious emission within the band

Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date March 8, 2023
Temperature / Humidity 23 deg. C / 30 % RH
Engineer Shiro Kobayashi
Mode NFC Transmitting (without Tag)
NFC type F (Axis:Hor_Y / Ver_Z), Vertical polarization
(antenna angle) of the worst case: 0 deg.

Fundamental emission

No.	FREQ [MHz]	Test Receiver Reading		Antenna Factor [dB/m]	Loss [dB]	AMP GAIN [dB]	Distance factor [dB]	RESULT		LIMIT (30 m) [dBuV/m]	MARGIN	
		Hor [dBuV]	Ver [dBuV]					Hor [dBuV/m]	Ver [dBuV/m]		Hor [dB]	Ver [dB]
1	13.560	66.8	76.3	20.0	6.6	31.9	-40.0	21.5	31.0	83.9	62.4	52.9

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

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

Limits (30 m)

• 13.553 MHz to 13.567 MHz : 83.9 dBuV/m (FCC 15.225(a))

Spurious emission within the band

No.	FREQ [MHz]	Test Receiver Reading		Antenna Factor [dB/m]	Loss [dB]	AMP GAIN [dB]	Distance factor [dB]	RESULT		LIMIT (30 m) [dBuV/m]	MARGIN	
		Hor [dBuV]	Ver [dBuV]					Hor [dBuV/m]	Ver [dBuV/m]		Hor [dB]	Ver [dB]
1	12.660	29.9	30.0	20.0	6.5	31.9	-40.0	-15.5	-15.5	29.5	45.0	45.0
2	12.924	30.0	37.0	20.0	6.5	31.9	-40.0	-15.5	-8.4	29.5	45.0	37.9
3	13.110	30.0	29.9	20.0	6.5	31.9	-40.0	-15.4	-15.5	29.5	44.9	45.0
4	13.347	39.3	48.8	20.0	6.5	31.9	-40.0	-6.1	3.4	40.5	46.6	37.1
5	13.410	30.6	37.2	20.0	6.6	31.9	-40.0	-14.7	-8.1	40.5	55.2	48.6
6	13.416	30.9	40.8	20.0	6.6	31.9	-40.0	-14.5	-4.62	50.4	64.9	55.0
7	13.553	51.8	61.7	20.0	6.6	31.9	-40.0	6.4	16.37	50.4	44.0	34.0
8	13.567	51.2	61.2	20.0	6.6	31.9	-40.0	5.8	15.85	50.4	44.6	34.6
9	13.705	33.4	42.1	20.0	6.6	31.9	-40.0	-12.0	-3.24	50.4	62.4	53.6
10	13.710	31.3	38.5	20.0	6.6	31.9	-40.0	-14.1	-6.9	40.5	54.6	47.4
11	13.772	40.9	51.3	20.0	6.6	31.9	-40.0	-4.4	5.9	40.5	44.9	34.6
12	14.010	29.9	29.9	20.1	6.6	31.9	-40.0	-15.5	-15.5	29.5	45.0	45.0
13	14.193	30.5	38.7	20.1	6.6	31.9	-40.0	-14.8	-6.56	29.5	44.3	36.1
14	14.460	29.9	29.9	20.1	6.6	31.9	-40.0	-15.4	-15.36	29.5	44.9	44.9

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

Outside filed strength frequencies

- $F_c \pm 7 \text{ kHz}$: 13.553 MHz to 13.567 MHz
- $F_c \pm 150 \text{ kHz}$: 13.410 MHz to 13.710 MHz
- $F_c \pm 450 \text{ kHz}$: 13.110 MHz to 14.010 MHz

$F_c = 13.56 \text{ MHz}$

Limits (30 m)

- 13.410 MHz to 13.553 MHz and 13.567 MHz to 13.710 MHz : 50.4 dBuV/m (FCC 15.225(b))
- 13.110 MHz to 13.410 MHz and 13.710 MHz to 14.010 MHz : 40.5 dBuV/m (FCC 15.225(c))
- Below 13.110 MHz and Above 14.010 MHz : 29.5 dBuV/m (FCC 15.225(d) and FCC 15.209)

Radiated Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.2
Date	April 20, 2023	March 29, 2023
Temperature / Humidity	23 deg. C / 41 % RH	20 deg. C / 35 % RH
Engineer	Yohsuke Matsuzawa (Below 30 MHz)	Yosuke Murakami (Above 30 MHz)
Mode	NFC Communication (with Tag)	
	Below 30 MHz (Horizontal X-axis, Vertical Z-axis), NFC type F	
	Vertical polarization (antenna angle): worst case 90 deg.	
	Above 30 MHz (Horizontal: Y-axis, Vertical: Y-axis), NFC type B	

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	30.00	21.23	6.64	32.20	-40.0	-14.3	29.5	43.8	-	211	* Limit: 30 m
Hori.	40.680	QP	40.50	14.72	7.09	31.90	0.0	30.4	40.0	9.5	290	139	
Hori.	67.800	QP	49.90	6.88	7.20	31.89	0.0	32.1	40.0	7.9	273	146	
Hori.	189.841	QP	41.80	16.45	8.83	31.77	0.0	35.3	43.5	8.1	170	317	
Hori.	216.960	QP	51.70	11.27	5.86	31.74	0.0	37.1	46.0	8.9	152	241	
Hori.	244.078	QP	53.20	11.73	6.08	31.71	0.0	39.3	46.0	6.7	134	258	
Hori.	257.639	QP	49.70	12.14	6.19	31.70	0.0	36.3	46.0	9.6	128	57	
Hori.	271.199	QP	49.40	12.95	6.28	31.69	0.0	36.9	46.0	9.0	120	44	
Hori.	298.320	QP	50.00	13.72	6.48	31.68	0.0	38.5	46.0	7.4	100	41	
Hori.	420.360	QP	49.60	16.06	7.29	31.62	0.0	41.3	46.0	4.6	100	8	
Hori.	648.639	QP	38.30	19.28	8.53	31.59	0.0	34.5	46.0	11.4	152	110	
Vert.	27.12	QP	31.10	21.23	6.64	32.20	-40.0	-13.2	29.5	42.7	-	245	* Limit: 30 m
Vert.	40.68	QP	46.40	14.72	7.09	31.90	0.0	36.3	40.0	3.6	100	50	
Vert.	41.52	QP	43.90	14.40	7.11	31.90	0.0	33.5	40.0	6.4	100	62	
Vert.	49.60	QP	49.60	6.88	7.20	31.89	0.0	31.8	40.0	8.2	100	234	

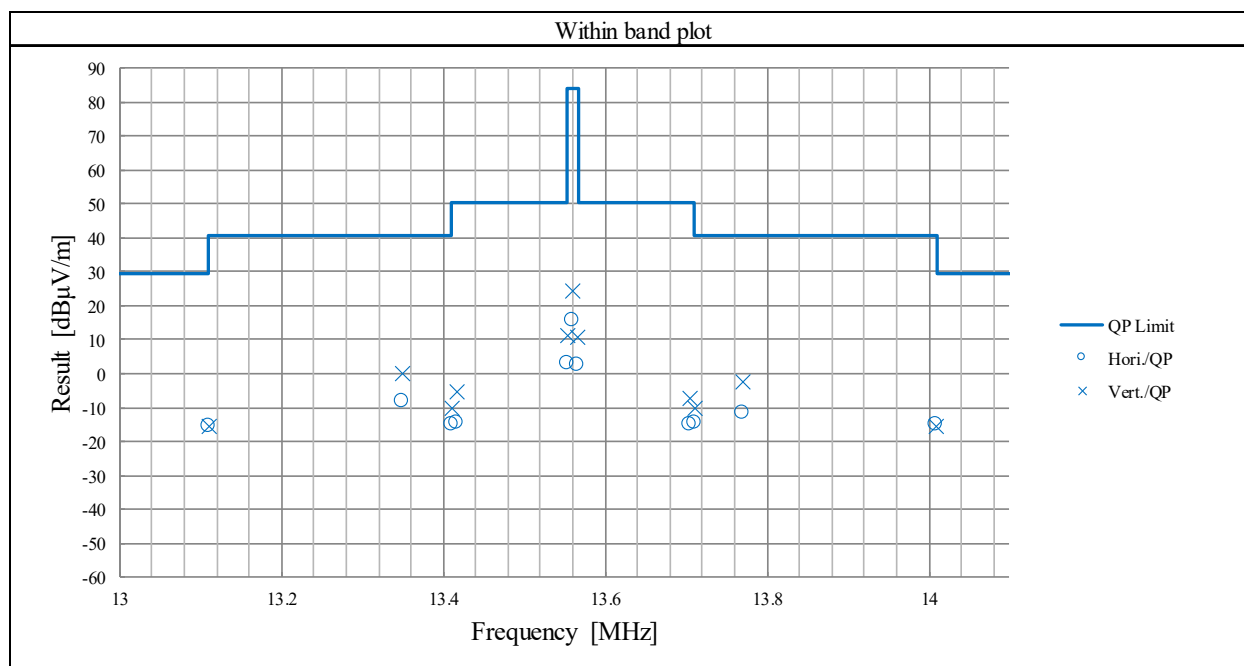
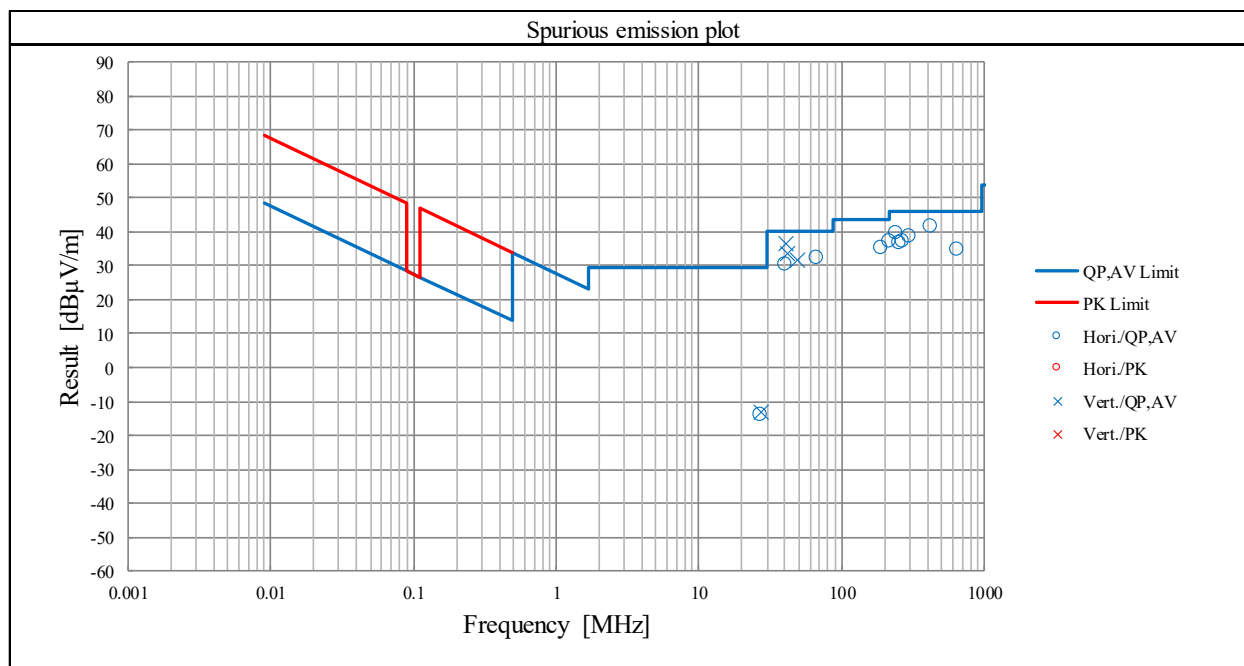
Result = Reading + Ant Factor + Loss (Cable+ATT+ΔAF(above 30 MHz)) - Gain(Amplifier) + Distance factor(below 30 MHz)

* 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= 55.5 dBuV/m, Ver= 64.5 dBuV/m

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

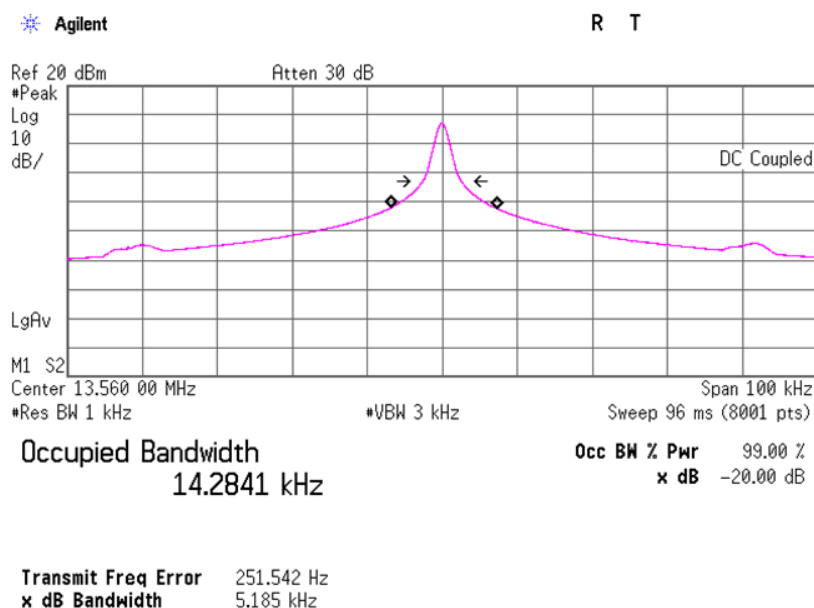
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	No.2
Date	April 20, 2023	March 29, 2023
Temperature / Humidity	23 deg. C / 41 % RH	20 deg. C / 35 % RH
Engineer	Yohsuke Matsuzawa (Below 30 MHz)	Yosuke Murakami (Above 30 MHz)
Mode	NFC Communication (with Tag) Below 30 MHz (Horizontal X-axis, Vertical Z-axis), NFC type F Vertical polarization (antenna angle): worst case 90 deg. Above 30 MHz (Horizontal: Y-axis, Vertical: Y-axis), NFC type B	



20 dB Bandwidth and 99 % Occupied Bandwidth

Test place Shonan EMC Lab.
Shielded room No.5
Date March 8, 2023
Temperature / Humidity 22 deg. C / 26 % RH
Engineer Miku Ikudome
Mode NFC communication type-A

FREQ [MHz]	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.56	5.19	14.28

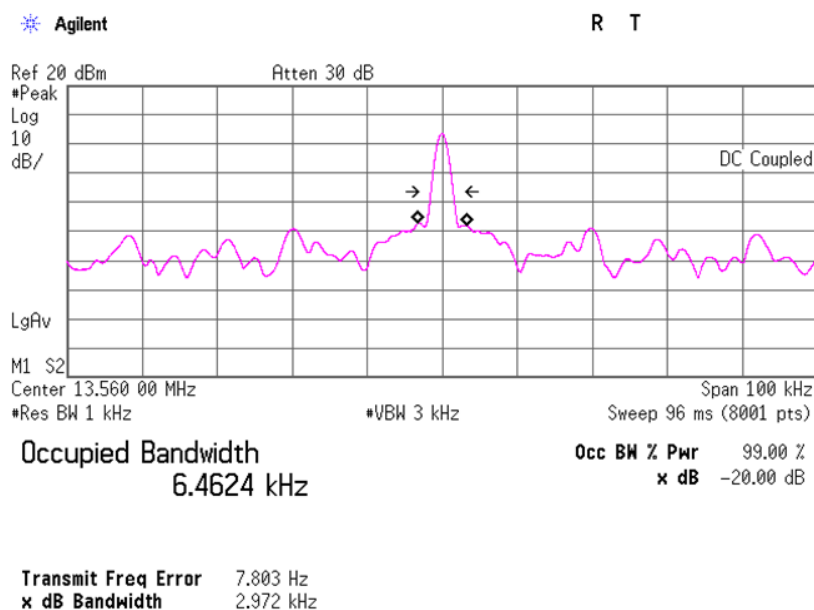


*Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 – 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

20 dB Bandwidth and 99 % Occupied Bandwidth

Test place Shonan EMC Lab.
Shielded room No.5
Date March 8, 2023
Temperature / Humidity 22 deg. C / 26 % RH
Engineer Miku Ikudome
Mode NFC communication type-B

FREQ [MHz]	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.56	2.97	6.46

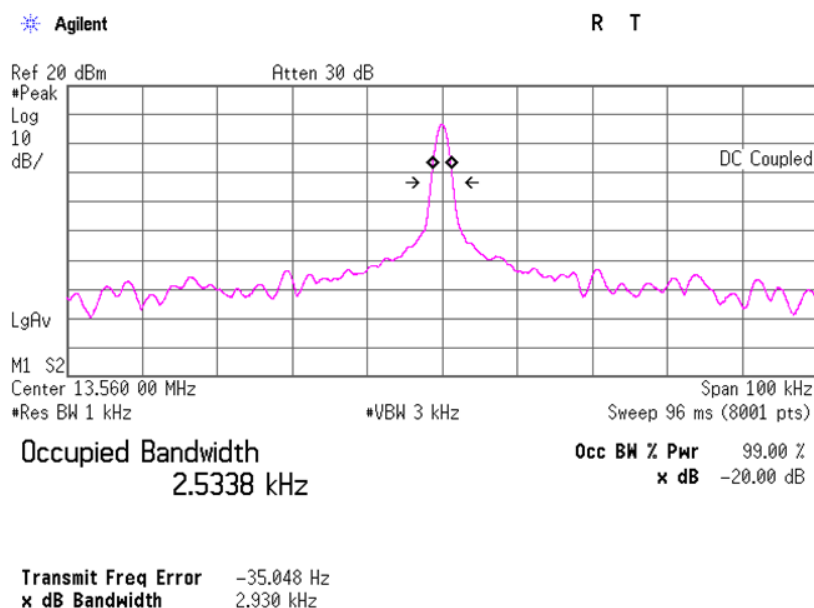


*Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 – 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

20 dB Bandwidth and 99 % Occupied Bandwidth

Test place Shonan EMC Lab.
Shielded room No.5
Date March 8, 2023
Temperature / Humidity 22 deg. C / 26 % RH
Engineer Miku Ikudome
Mode NFC communication type-F

FREQ [MHz]	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.56	2.93	2.53

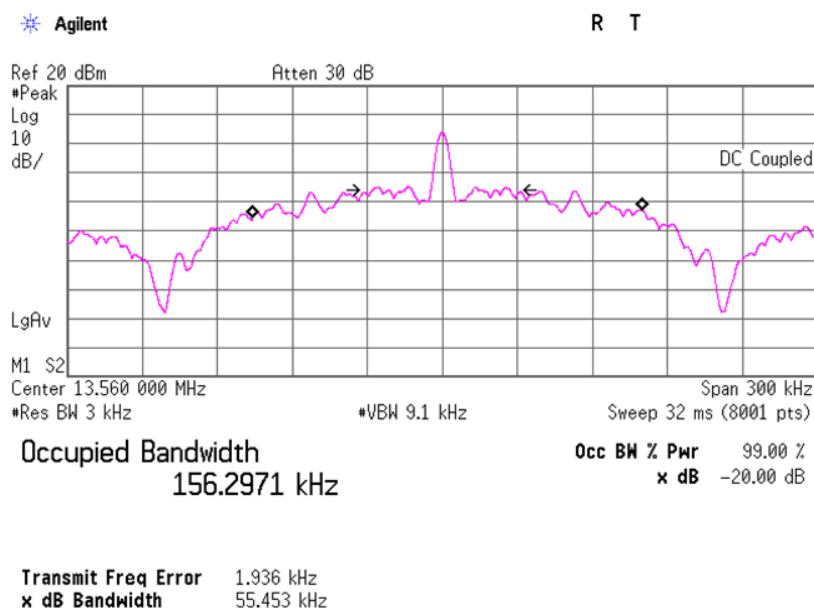


*Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 – 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

20 dB Bandwidth and 99 % Occupied Bandwidth

Test place Shonan EMC Lab.
Shielded room No.5
Date March 8, 2023
Temperature / Humidity 22 deg. C / 26 % RH
Engineer Miku Ikudome
Mode NFC communication type-V

FREQ [MHz]	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.56	55.45	156.30



*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.	No.5
Semi Anechoic Chamber	No.5	No.5
Date	March 8, 2023	March 9, 2023
Temperature / Humidity	22 deg. C / 26 % RH	25 deg. C / 40 % RH
Engineer	Miku Ikudome	Miku Ikudome
Mode	NFC Transmitting (Unmodulated)	

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	5	Power on	13.559981	-0.000019	-0.00014	-1.4	0.01
		+ 2 min.	13.559990	-0.000010	-0.00007	-0.7	0.01
		+ 5 min.	13.559993	-0.000007	-0.00005	-0.5	0.01
		+ 10 min.	13.559995	-0.000005	-0.00004	-0.4	0.01
40	5	Power on	13.559980	-0.000020	-0.00015	-1.5	0.01
		+ 2 min.	13.559980	-0.000020	-0.00015	-1.5	0.01
		+ 5 min.	13.559979	-0.000021	-0.00015	-1.5	0.01
		+ 10 min.	13.559980	-0.000020	-0.00015	-1.5	0.01
30	5	Power on	13.559992	-0.000008	-0.00006	-0.6	0.01
		+ 2 min.	13.559985	-0.000015	-0.00011	-1.1	0.01
		+ 5 min.	13.559983	-0.000017	-0.00013	-1.3	0.01
		+ 10 min.	13.559983	-0.000017	-0.00013	-1.3	0.01
20	5	Power on	13.560002	0.000002	0.00001	0.1	0.01
		+ 2 min.	13.560000	0.000000	0.00000	0.0	0.01
		+ 5 min.	13.559999	-0.000001	-0.00001	-0.1	0.01
		+ 10 min.	13.559999	-0.000001	-0.00001	-0.1	0.01
20	4.25 (5V -15%)	Power on	13.559974	-0.000026	-0.00019	-1.9	0.01
		+ 2 min.	13.559972	-0.000028	-0.00021	-2.1	0.01
		+ 5 min.	13.559971	-0.000029	-0.00021	-2.1	0.01
		+ 10 min.	13.559972	-0.000028	-0.00021	-2.1	0.01
20	5.5 (5V +10%)	Power on	13.559982	-0.000018	-0.00013	-1.3	0.01
		+ 2 min.	13.559975	-0.000025	-0.00018	-1.8	0.01
		+ 5 min.	13.559971	-0.000029	-0.00021	-2.1	0.01
		+ 10 min.	13.559970	-0.000030	-0.00022	-2.2	0.01
10	5	Power on	13.560018	0.000018	0.00013	1.3	0.01
		+ 2 min.	13.560017	0.000017	0.00013	1.3	0.01
		+ 5 min.	13.560016	0.000016	0.00012	1.2	0.01
		+ 10 min.	13.560015	0.000015	0.00011	1.1	0.01
0	5	Power on	13.560016	0.000016	0.00012	1.2	0.01
		+ 2 min.	13.560018	0.000018	0.00013	1.3	0.01
		+ 5 min.	13.560018	0.000018	0.00013	1.3	0.01
		+ 10 min.	13.560017	0.000017	0.00013	1.3	0.01
-10	5	Power on	13.559976	-0.000024	-0.00018	-1.8	0.01
		+ 2 min.	13.559995	-0.000005	-0.00004	-0.4	0.01
		+ 5 min.	13.559998	-0.000002	-0.00001	-0.1	0.01
		+ 10 min.	13.559999	-0.000001	-0.00001	-0.1	0.01
-20	5	Power on	13.559915	-0.000085	-0.00063	-6.3	0.01
		+ 2 min.	13.559948	-0.000052	-0.00038	-3.8	0.01
		+ 5 min.	13.559952	-0.000048	-0.00035	-3.5	0.01
		+ 10 min.	13.559953	-0.000047	-0.00035	-3.5	0.01

Calculation formula:

Frequency error = Measured frequency - Tested frequency

Result [%] = Frequency error / Tested frequency * 100

Tested frequency:

13.56 MHz

Limit (+/-):

0.01 %

(± 100ppm)

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

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	SAT3-13	150923	Attenuator	JFW	50HF-003N	-	2023/02/09	12
CE	SCC-A12/A13 /SRSE-01	144966	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-269 (RF Selector)	2022/04/20	12
CE	SJM-22	207279	Tape Measure	ASKUL	-	-	-	-
CE	SLS-01	145538	LISN	Rohde & Schwarz	ENV216	100511	2023/02/21	12
CE	SOS-16	167990	Thermo-Hygrometer	CUSTOM. Inc	CTH-202	708Q08R	2022/10/18	12
CE	STR-01	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2022/04/28	12
CE	STS-01	145792	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997812	2022/09/20	12
CE,RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
RE	KJM-02	146432	Measure	TAJIMA	GL19-55	-	-	-
RE	SAEC-02(NSA)	145563	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	2023/03/28	12
RE	SAEC-03(NSA)	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2023/04/05	12
RE	SAEC-ALL	145568	Semi Anechoic Chamber(ME)	TDK	Semi Anechoic Chamber 3m/10m	1, 2, 3	2022/12/24	24
RE	SAF-02	145004	Pre Amplifier	SONOMA	310N	290212	2023/02/09	12
RE	SAF-03	145126	Pre Amplifier	SONOMA	310N	290213	2023/02/09	12
RE	SAT3-11	150921	Attenuator	JFW	50HF-003N	-	2023/02/09	12
RE	SAT6-13	167094	Attenuator	JFW	50HF-006N	-	2023/02/09	12
RE	SAT6-14	167095	Attenuator	JFW	50HF-006N	-	2023/02/09	12
RE	SAT6-15	167096	Attenuator	JFW	50HF-006N	-	2023/02/09	12
RE	SBA-02	145022	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032665	2023/04/12	12
RE	SCC-B1/B3/B5/B7/B8/ B13/SRSE-02	144975	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/ 141PE/141PE/NS4906	-/0901-270 (RF Selector)	2022/04/20	12
RE	SCC-B2/B4/B6/B7/B8/ B13/SRSE-02	144976	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/ 141PE/141PE/NS4906	-/0901-270 (RF Selector)	2022/04/20	12
RE	SCC-C1/C2/C3/C4/C5/ C10/SRSE-03	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/ 141PE/141PE/NS4906	-/0901-271 (RF Selector)	2022/04/20	12
RE	SCC-M1	194601	Coaxial Cable	Fujikura	5D-2W	-	2022/12/16	12
RE	SJM-20	207277	Measuring	ASKUL	-	-	-	-
RE	SLA-06	145528	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	195	2023/04/12	12
RE	SLP-02	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2023/04/10	12
RE	SOS-21	191838	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2022/08/08	12
RE	SOS-23	191840	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2022/08/08	12
RE	STR-07	146209	Test Receiver	Rohde & Schwarz	ESU26	100484	2022/09/14	12
RE	STR-09	213530	Test Receiver	Rohde & Schwarz	ESW44	103068	2023/01/12	12
RE	STS-02	145793	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997819	2022/04/07	12
RE	STS-03	146210	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997823	2022/09/20	12
TF	SCH-01	145200	Temperature and Humidity Chamber	Espec	PL-1KT	14020837	2022/04/05	12
TF	SFC-03	183119	Microwave Counter	Keysight Technologies Inc	53151A	US40511493	2022/11/14	12
TF	SOS-27	235735	Thermo-Hygrometer	CUSTOM. Inc	CTH-230	-	-	-
TF	SRENT-15	160899	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185516	2023/01/26	12
TF	SSCA-01	146178	Search coil	Langer	RF-R 400-1	02-0634	-	-
TF	STS-05	146212	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997828	2022/09/20	12

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

The expiration date of the calibration is the end of the expired month.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

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

Test item:

CE: Conducted Emission
RE: Radiated Emission
TF: Test Fixture