



# RADIO TEST REPORT

Test Report No. : 13801638S-A-R1

**Applicant** : NITTOKU CO.,LTD  
**Type of Equipment** : HF-Band RFID READER/WRITER  
**Model No.** : ITS-HRW110  
**FCC ID** : 2A29TITSHRW110S2109  
**Test regulation** : FCC Part 15 Subpart C: 2021  
**Test Result** : Complied (Refer to SECTION 3)

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. Shonan 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 13801638S-A. 13801638S-A is replaced with this report.

**Date of test:** September 20 to 24, 2021

**Representative test engineer:**

Hiromasa Sato  
Engineer

**Approved by:**

Kazuya Noda  
Leader



CERTIFICATE 1266.03

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

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Report Cover Page - 13-EM-F0429 Issue # 19.0

## REVISION HISTORY

### **Original Test Report No.: 13801638S-A**

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13801638S-A	October 14, 2021	-	-
1	13801638S-A-R1	October 19, 2021	11	Correction of Volt/Freq. in Figures: From “AC 100 V / 50 Hz” to “AC 120 V / 60 Hz” Correction of Cable length of No. 1 Antenna cable: From “1.0” to “2.0”

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### Reference: Abbreviations (Including words undescribed in this report)

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

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## **SECTION 1: Customer information**

Company Name : NITTOKU CO.,LTD  
Address : 2-292-1 Azuma-cho, Omiya-ku, Saitama-city, Saitama-pref, 330-0841, Japan  
Telephone Number : +81-48-615-2117  
Facsimile Number : +81-48-615-2118  
Contact Person : Akitomo Kiriyama

The information provided from the customer is as follows:

- Applicant, Type of Equipment, Model No. on the cover page and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- Section 1: Customer information
- Section 2: Equipment under test (E.U.T.) other than the Receipt Date of Sample
- Section 4: Operation of E.U.T. during testing

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

## **SECTION 2: Equipment under test (E.U.T.)**

### **2.1 Identification of E.U.T.**

Type of Equipment : HF-Band RFID READER/WRITER  
Model No. : ITS-HRW110  
Serial No. : Refer to Section 4.2  
Rating : DC 12 V, 0.2 A  
Receipt Date of Sample : September 17, 2021  
Country of Mass-production : Japan  
Condition of EUT : Production model  
Modification of EUT : No Modification by the test lab.

### **2.2 Product description**

Model: ITS-HRW110 (referred to as the EUT in this report) is a HF-Band RFID READER/WRITER.

Clock frequency(ies) in the system: 16 MHz

### **Radio specification**

Equipment type : Transceiver  
Frequency of operation : 13.56 MHz  
Type of modulation : ASK  
Antenna type : Loop

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## **SECTION 3: Test specification, procedures & results**

### **3.1 Test specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on May 3, 2021 and effective July 2, 2021

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.209 Radiated emission limits, general requirements  
Section 15.215 Additional provisions to the general radiated emission limitations.  
Section 15.225 Operation within the band 13.110-14.010 MHz.

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

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### 3.2 Procedures & Results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.10:2013 6 Standard test methods	Section 15.207	0.5 dB, 27.12000 MHz, AV, L1	Complied# a)	-
	<ISED>RSS-Gen 8.8	<ISED>RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.225(a)	64.8 dB, 13.560 MHz, QP, Vertical 90 deg.	Complied b)	Radiated
	<ISED> RSS-Gen 6.4, 6.12	<ISED>RSS-210 B.6			
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods	Section 15.225(b)(c)	44.1 dB, 14.010 MHz, QP, Vertical 90 deg.	Complied b)	Radiated
	<ISED>RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6			
20 dB Bandwidth	ANSI C63.10:2013 6 Standard test methods	Section 15.215(c)	See data	Complied c)	Radiated
	<ISED> -	<ISED> -			
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.209, Section 15.225 (d)	4.1 dB 488.159 MHz, Horizontal, QP	Complied# d)	Radiated
	<ISED>RSS-Gen 6.4, 6.13	<ISED>RSS-210 B.6			
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods	Section 15.225(e)	See data	Complied e)	Radiated
	<ISED>RSS-Gen 6.11, 8.11	<ISED> RSS-210 B.6			

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422

a) Refer to APPENDIX 2 (data of Conducted Emission)  
 b) Refer to APPENDIX 2 (data of Data of Electric field strength of Fundamental emission and Spurious emission)  
 c) Refer to APPENDIX 2 (data of 20 dB Bandwidth and 99 % Occupied Bandwidth)  
 d) Refer to APPENDIX 2 (data of Radiated emission)  
 e) Refer to APPENDIX 2 (data of Frequency Tolerance)

Symbols:  
 Complied The data of this test item has enough margin, more than the measurement uncertainty.  
 Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

#### FCC Part 15.31 (e)

The 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).

#### FCC Part 15.203 Antenna requirement

The EUT has an external antenna connector, but it is installed by the professionals.

Therefore, the equipment complies with the antenna requirement of Section 15.203.

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### 3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
99 % Occupied Band Width	RSS-Gen 6.7	-	Radiated	N/A	N/A	a)
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.						
a) Refer to APPENDIX 2 (data of 20 dB Bandwidth / 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.						

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

### 3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor  $k = 2$ .  
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Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR	No. 5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.9 dB	2.8 dB	2.9 dB	2.9 dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	3.0 dB	3.1 dB	-	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.7 dB	-	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.1 dB	-	-
	1 GHz-6 GHz	4.8 dB	4.8 dB	4.8 dB	-	-
	6 GHz-18 GHz	5.4 dB	5.4 dB	5.4 dB	-	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB	-	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.81 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.53 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.95 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.21 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.90 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.04 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.3 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.4 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.4 dB
Bandwidth Measurement	0.61 %
Duty cycle and Time Measurement	0.012 %
Temperature_SCH-01	0.93 deg.C.
Humidity_SCH-01	4.1 %
Temperature_SCH-02	2.0 deg.C.
Humidity_SCH-02	6.6 %
Voltage	0.97 %

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### 3.5 Test location

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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 setup, Data of EMI & Test instruments

Refer to APPENDIX 1 to 3.

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## **SECTION 4: Operation of E.U.T. during testing**

### **4.1 Operating mode**

The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

Test item	Operating mode	Tested frequency
All items	Transmitting 13.56 MHz	13.56 MHz

Power setting : Fixed  
Software (Version) : V1.03  
Date : September 20, 2021

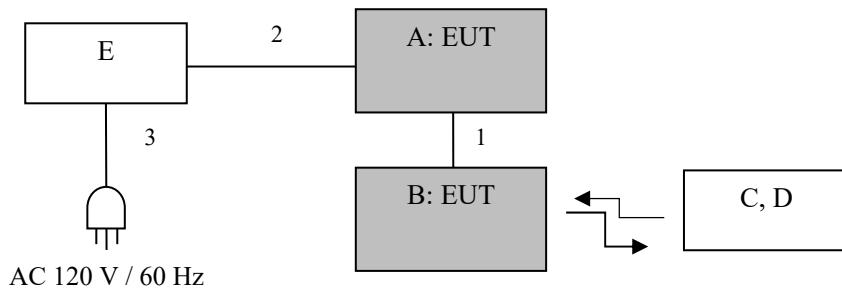
The carrier level and noise levels were confirmed with and without Tag, and the test was made with the condition that has the maximum noise.

Combinations of the worst case:

Conducted emission	Radiated emission (Carrier)	Radiated emission (Below 30 MHz)	Radiated emission (Above 30 MHz)
With Tag (ISO15693 Tag 1)	With Tag (ISO15693 Tag 1)	With Tag (ISO15693 Tag 1)	With Tag (ISO15693 Tag 1)

**Justification:** The system was configured in typical fashion (as customer would normally use it) for testing.

#### 4.2 Configuration of tested system



\* Test data was taken under worse case conditions.

#### Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	HF-Band RFID READER/WRITER	ITS-HRW110	1	NIT TOKU	EUT
B	Antenna	ITS-HAN10R	H217-2N001	NIT TOKU	EUT
C	ISO15693Tag 1	ITS-HTG61F52K	E00801424E5394A1	NIT TOKU	-
D	ISO15693Tag 2	ITS-HTG21F52K	E00801424E53A77F	NIT TOKU	-
E	DC Power Supply	PAN35-10A	DE001677	KIKUSUI	-

#### List of cables used

No.	Cable Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Antenna	2.0	Shielded	Shielded	-
2	DC	0.3+1.0	Unshielded	Unshielded	-
3	AC	1.5	Unshielded	Unshielded	-

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## **SECTION 5: Conducted emission**

### **Test Procedure and conditions**

EUT was placed on a platform of nominal size, 1.0 m by 2.0 m, raised 80 cm above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.

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.

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN / (AMN) to the input power source.

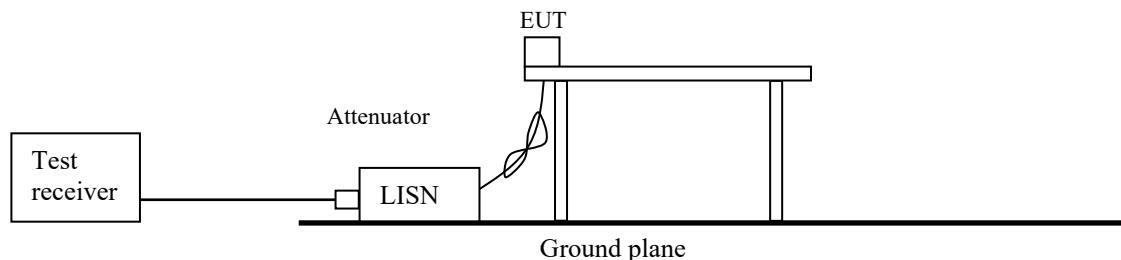
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Shielded Room. The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

**Figure 1: Test Setup**



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## **SECTION 6: Radiated emission**

### **6.1 Operating environment**

Test place : See test data (APPENDIX 2)  
Temperature : See test data (APPENDIX 2)  
Humidity : See test data (APPENDIX 2)

### **6.2 Test configuration**

EUT was placed on a platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrene and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.

Photographs of the set up are shown in APPENDIX 3.

### **6.3 Test procedure**

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane at a distance of 3 m.

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

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

The Radiated Electric Field Strength intensity has been measured with a ground plane and at a distance of 3 m.

Frequency: From 9 kHz to 30 MHz at distance 3 m (Refer to Figure 2)

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. Drawing of the antenna direction is shown in Figure 1.

Frequency: From 30 MHz to 1 GHz at distance 3 m (Refer to Figure 2).

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 intensity.

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

Measurements were performed with QP, PK, and AV detector.

The radiated emission measurements were made with the following detector function of the test receiver.

	9 kHz to 90 kHz & 110 kHz to 150 kHz	90 kHz to 110 kHz	150 kHz to 490 kHz	490 kHz to 30 MHz	30 MHz to 1 GHz
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	10 kHz	9 kHz	120 kHz
Distance factor *1)	-80 dB	-80 dB	-80 dB	-40 dB	-
Measuring antenna	Loop antenna				Biconical (30 MHz - 199.999 MHz) Logperiodic (200 MHz - 1 GHz)

\*1) FCC 15.31 (f)(2) (9 kHz-30 MHz)

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

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

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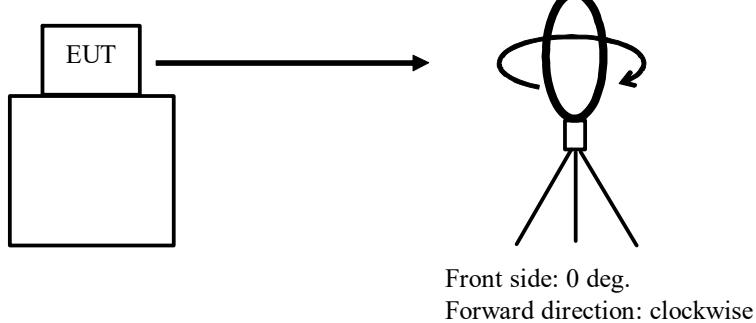
The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Combinations of the worst case

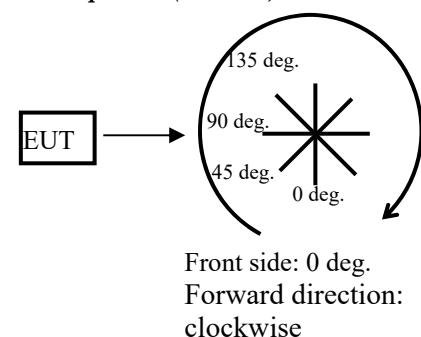
	Frequency Antenna polarization	Below 30 MHz (Carrier)	Below 30 MHz	Above 30 MHz
Module	Horizontal	X	X	X
	Vertical	X	X	X
Antenna	Horizontal	X	X	X
	Vertical	X	X	X

Figure 1: Direction of the Loop Antenna

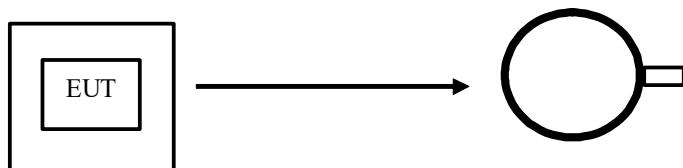
*Side View (Vertical)*



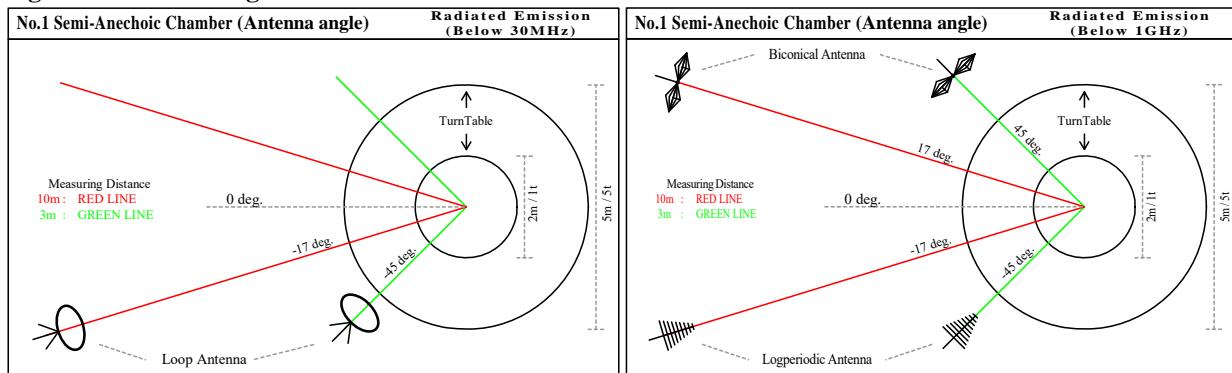
*Top View (Vertical)*



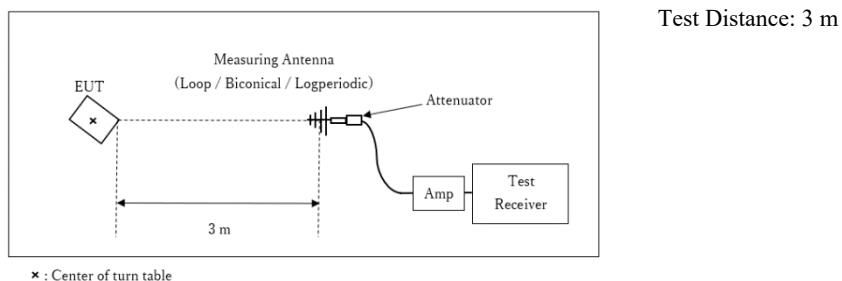
*Top View (Horizontal)*



**Figure 2. Antenna angle**



[Test Setup]  
 Below 1 GHz



#### 6.4 Results

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

**Measurement range** : 9 kHz - 1 GHz  
**Test data** : APPENDIX 2  
**Test result** : Pass

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## **SECTION 7: 20 dB bandwidth & 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	1 MHz	5.1 kHz	16 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth (OBW)	Enough width to display	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer

\*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100%.

Summary of the test results:Pass

Refer to APPENDIX 2

## **SECTION 8: Frequency Tolerance**

### **Test procedure**

The test was measured with a spectrum analyzer (with marker frequency counter function) using a test fixture.

The temperature test was started after the temperature stabilization time of 30 minutes.

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

Summary of the test results:Pass

Refer to APPENDIX 2

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