RADIO TEST REPORT

Test Report No. : 13534936S

Applicant	:	**TAKUMA SEIKO CO., LTD.**
Type of EUT	:	**Address sensor unit**
Model Number of EUT	:	**AS1 READER, AS1 WRITER**
FCC ID	:	**2AYPCAS1**
Test regulation	:	**FCC Part 15 Subpart C: 2020**
Test Result	:	**Complied (Refer to SECTION 3.2)**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers Radio technical requirements.
   It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. 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.

Date of test: November 26, 2020

Representative test engineer:
Shiro Kobayashi
Engineer
Consumer Technology Division

Approved by:
Hikaru Shirasawa
Engineer
Consumer Technology Division

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".

REVISION HISTORY

Original Test Report No.: 13534936S

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13534936S	March 16, 2021	-	-

Reference: Abbreviations (Including words undescribed in this report)

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

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SECTION 1: Customer information

Company Name	:	TAKUMA SEIKO CO., LTD.
Address	:	747 Shake, Ebina Kanagawa, Japan, 243-0424
Telephone Number	:	+81-46-239-0755
Facsimile Number	:	+81-46-239-0750
Contact Person	:	Masahiro Ito

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

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

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type of Equipment	:	Address sensor unit
Model No.	:	AS1 READER, AS1 WRITER
Serial No.	:	Refer to SECTION 4.2
Rating	:	DC 12 V
Receipt Date of Sample (Information from test lab.)	:	November 26, 2020
Country of Mass-production	:	Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab.

2.2 Product Description

Model: AS1 READER, AS1 WRITER (referred to as the EUT in this report) is a Address sensor unit.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	134.2 kHz
Modulation	:	ASK
Antenna type	:	Loop coil
Operating Temperature	:	5 deg.C to 35 deg C.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on October 13, 2020

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.209 Radiated emission limits; general requirements.

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

3.2 Procedures and results

Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
Conducted Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 8.8	<FCC> Section 15.207 <ISED> RSS-Gen 8.8	-	N/A	N/A	N/A *1)
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.5, 6.12	<FCC> Section 15.209 <ISED> RSS-210 4.4 RSS-Gen 8.9	Radiated	N/A	7.3 dB 134.2 kHz, Horizontal Peak with Duty factor Continuous Reading/Writing mode	Complied a)
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.5, 6.6, 6.13	<FCC> Section 15.209 <ISED> RSS-210 4.4 RSS-Gen 8.9	Radiated	N/A	11.5 dB 48.448 MHz, Vertical, QP Continuous Reading/Writing mode	Complied a)
-26 dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> -	<FCC> Reference data <ISED> -	Radiated	N/A	N/A	Complied b)
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line. a) Refer to APPENDIX 1 (data of Radiated emission) b) Refer to APPENDIX 1 (data of -26 dB Bandwidth)						
Symbols: Complied The data of this test item has enough margin, more than the measurement uncertainty. Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.						

FCC Part 15.31 (e)
The EUT provides stable voltage constantly to the RF Part regardless of input voltage.
Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

FCC Part 15.203
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	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 1 (data of -26 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

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

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)			
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4,5,6,8 SR
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	2.7 dB	2.7 dB	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.6 dB	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.0 dB	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

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, Facsimile: +81 463 50 6401
A2LA Certificate Number: 1266.03 (FCC Test Firm Registration Number: 626366)

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.

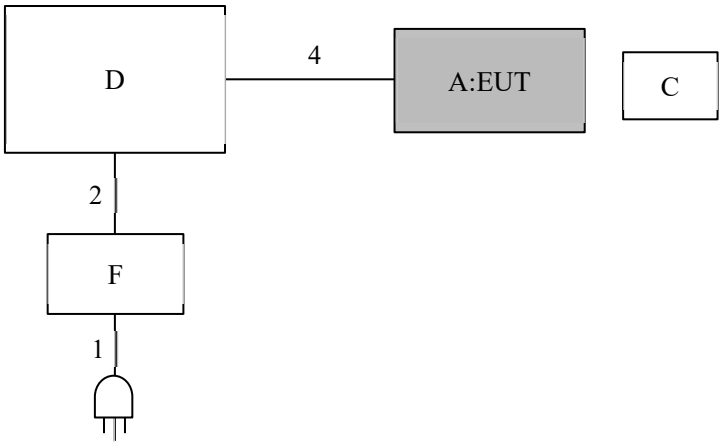
SECTION 4: SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

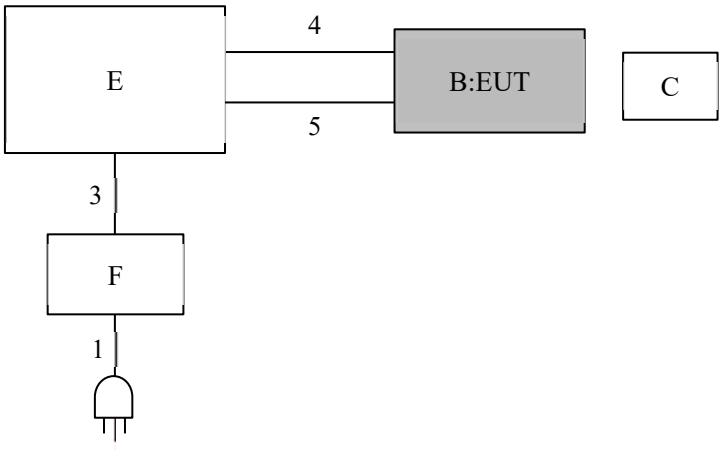
Test mode	Remarks
1) Continuous Reading mode for AS-1 READER 2) Continuous Reading/Writing mode for AS-1 WRITER	-
* EUT was set by the software as follows; Software: AS1 Reader: AS1, Ver. D (Date: 2020.11.26, Storage location: EUT memory) AS1 Writer: AS1_Writer, Ver. FCC (Date: 2020.11.26, Storage location: EUT memory) *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

4.2 Configuration and peripherals

[AS-1 READER]



[AS-1 WRITER]



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
* Pre-check has been performed with Tag and without Tag, and measurement was conducted with the worst case with Tag.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Address sensor unit	AS1 READER	1	TAKUMA SEIKO CO.,LTD.	EUT
B	Address sensor unit	AS1 WRITER	2	TAKUMA SEIKO CO.,LTD.	EUT
C	RFID TAG	RI-TRP-WR3P-30	-	Texas Instruments	-
D	READER JIGU	-	-	TAKUMA SEIKO CO.,LTD.	-
E	WRITER JIGU	-	-	TAKUMA SEIKO CO.,LTD.	-
F	DC Power Supply	PAN35-10A	DE001677	KIKUSUI	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	AC	2.0	Unshielded	Unshielded	-
2	DC	0.6	Unshielded	Unshielded	-
3	DC	1.0	Unshielded	Unshielded	-
4	Signal	0.3	Unshielded	Unshielded	12 Pin
5	Signal	0.5	Unshielded	Unshielded	6 Pin

SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

Frequency: From 9 kHz to 30 MHz (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.
*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz (Refer to Figure 2)
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.

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 - 199.99 MHz) Logperiodic (200 MHz - 1 GHz)

*1) FCC 15.31 (f)(2) (9 kHz-30 MHz)
Distance Factor: 40 x log (3 m / 300 m) = -80 dB
Distance Factor: 40 x log (3 m / 30 m) = -40 dB

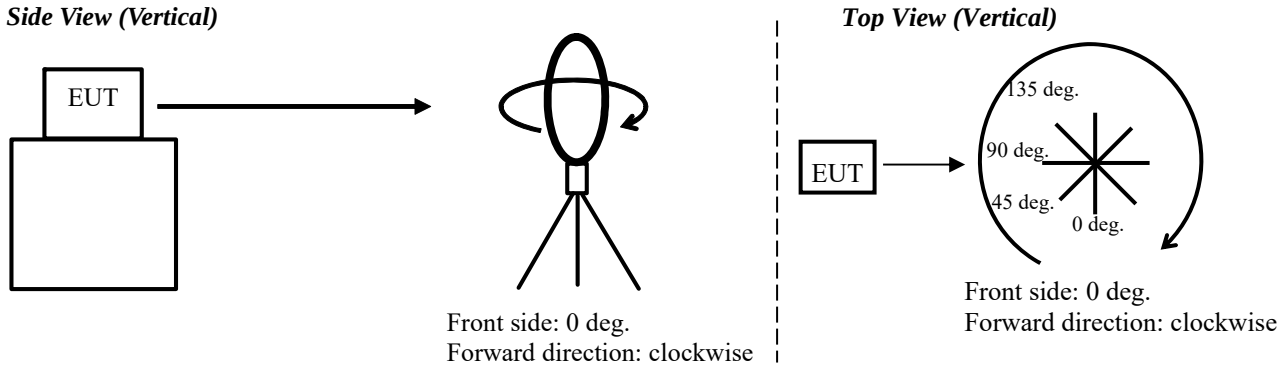
Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open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

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

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

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

Figure 1: Direction of the Loop Antenna



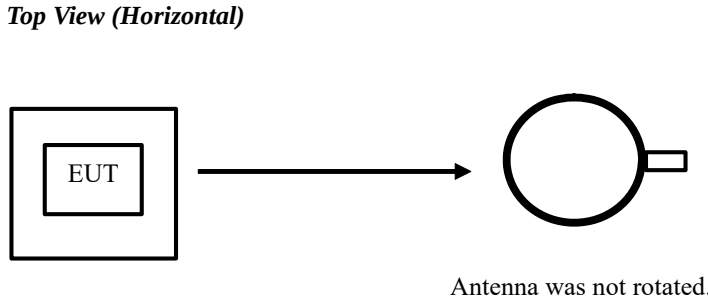
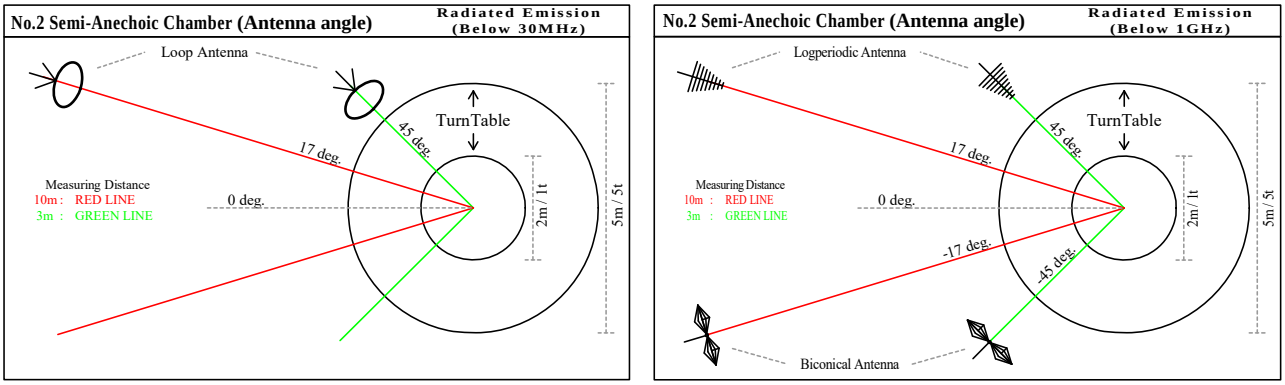
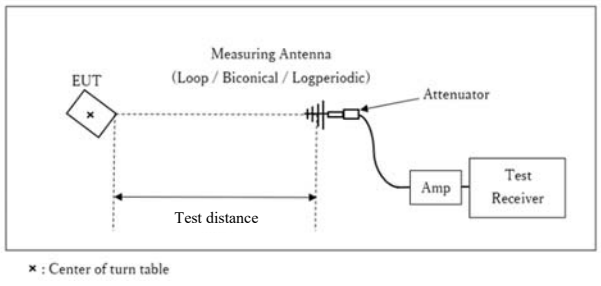


Figure 2. Antenna angle



[Test Setup]

Below 1 GHz



Test Distance: 3 m

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

UL Japan, Inc.
Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
Telephone : +81 463 50 6400
Facsimile : +81 463 50 6401

SECTION 6: -26 dB Bandwidth

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

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26 dB Bandwidth	15 kHz	300 Hz	1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1
Test result : Pass

SECTION 7: 99 % Bandwidth

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

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *)	Max Hold *)	Spectrum Analyzer
*) 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 1
Test result : Pass

APPENDIX 1: Test data

Radiated Emission (Fundamental and Spurious Emission)

Report No.	13534936S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 26, 2020
Temperature / Humidity	20 deg. C / 49 % RH
Engineer	Shiro Kobayashi
Model	AS1 READER
Mode	Continuous Reading mode
Remarks	Below 30 MHz Vertical polarization(Antenna Angle) of the worst case: 0 deg.

(* PK: Peak, AV: Average, QP: Quasi-Peak)

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.	0.1342	PK	89.30	19.43	20.08	31.75	-80.0	17.06	44.98	27.9	-	117	Fundamental
Hori.	0.5370	QP	43.90	19.43	20.12	31.94	-40.0	11.51	33.00	21.4	-	104	-
Hori.	0.6710	QP	34.70	19.33	20.14	31.94	-40.0	2.23	31.05	28.8	-	125	-
Hori.	0.8053	QP	38.70	19.32	20.16	31.93	-40.0	6.25	29.46	23.2	-	136	-
Hori.	1.0735	QP	33.70	19.32	20.18	31.93	-40.0	1.27	26.94	25.6	-	136	-
Hori.	199.562	QP	31.90	16.59	8.82	31.76	0.0	25.55	43.50	17.9	162	76	-
Hori.	291.357	QP	38.30	13.50	6.33	31.67	0.0	26.46	46.00	19.5	100	196	-
Vert.	0.1342	PK	87.40	19.43	20.08	31.75	-80.00	15.16	44.98	29.8	-	143	Fundamental
Vert.	0.5369	QP	42.20	19.33	20.12	31.94	-40.00	9.71	33.00	23.2	-	141	-
Vert.	0.6710	QP	33.40	19.32	20.14	31.94	-40.00	0.92	31.05	30.1	-	152	-
Vert.	0.8053	QP	37.20	19.32	20.16	31.93	-40.00	4.75	29.45	24.7	-	119	-
Vert.	1.0736	QP	32.50	19.32	20.18	31.93	-40.00	0.07	26.94	26.8	-	109	-
Vert.	52.206	QP	39.30	10.45	7.24	31.89	0.0	25.10	40.00	14.9	100	118	-
Vert.	62.272	QP	40.90	7.72	7.02	31.88	0.0	23.76	40.00	16.2	100	19	-
Vert.	49.924	QP	42.20	6.75	7.20	31.88	0.0	24.27	40.00	15.7	100	70	-
Vert.	68.310	QP	43.20	6.45	7.41	31.88	0.0	25.18	40.00	14.8	100	54	-
Vert.	71.262	QP	41.60	7.55	8.18	31.87	0.0	25.46	40.00	**14.5**	100	26	-
Vert.	86.427	QP	38.60	12.01	7.93	31.85	0.0	26.69	43.50	16.8	100	187	-

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).

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	DCCF [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	0.1342	PK	89.30	19.43	20.08	31.75	-80.0	0.00	17.06	24.98	**7.9**	Fundamental
Vert.	0.1342	PK	87.40	19.43	20.08	31.75	-80.0	0.00	15.26	24.98	9.7	Fundamental

Result = Reading + Ant.Fac. + Loss (Cable+Attenuator) - Gain(Amprifier) + Distance factor + DCCF

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

Result of the fundamental emission at 3 m without Distance factor

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]	Remark
Hori.	0.1342	PK	89.30	19.43	20.08	31.75	0.0	-	97.06	-	-	Fundamental
Vert.	0.1342	PK	87.40	19.43	20.08	31.75	0.0	-	95.16	-	-	Fundamental

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

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

Radiated Emission (Fundamental and Spurious Emission)

Report No.	13534936S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 26, 2020
Temperature / Humidity	20 deg. C / 49 % RH
Engineer	Shiro Kobayashi
Model	AS1 WRITER
Mode	Continuous Reading/Writing mode
Remarks	Below 30 MHz Vertical polarization(Antenna Angle) of the worst case: 0 deg.

(* PK: Peak, AV: Average, QP: Quasi-Peak)

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.	0.1342	PK	89.90	19.43	20.08	31.75	-80.0	17.66	44.98	27.3	-	130	Fundamental
Hori.	0.5368	QP	41.90	19.33	20.12	31.94	-40.0	9.41	33.00	23.5	-	138	-
Hori.	0.6710	QP	38.46	19.32	20.14	31.94	-40.0	5.98	31.05	25.0	-	113	-
Hori.	0.8052	QP	37.60	19.32	20.16	31.93	-40.0	5.15	29.46	24.3	-	117	-
Hori.	1.0736	QP	34.10	19.32	20.18	31.93	-40.0	1.67	26.94	25.2	-	119	-
Hori.	270.823	QP	33.50	12.84	6.19	31.69	0.0	20.84	46.00	25.1	120	346	-
Vert.	0.1342	PK	87.50	19.43	20.08	31.75	-80.00	15.26	44.98	29.7	-	147	Fundamental
Vert.	0.5370	QP	40.20	19.33	20.12	31.94	-40.00	7.71	33.00	25.2	-	134	-
Vert.	0.6715	QP	36.40	19.32	20.14	31.94	-40.00	3.92	31.05	27.1	-	132	-
Vert.	0.8056	QP	35.80	19.32	20.16	31.93	-40.00	3.35	29.45	26.1	-	113	-
Vert.	1.0740	QP	32.50	19.32	20.18	31.93	-40.00	0.07	26.94	26.8	-	101	-
Vert.	40.083	QP	31.30	14.90	7.05	31.89	0.0	21.36	40.00	18.6	100	321	-
Vert.	48.448	QP	41.40	11.76	7.22	31.89	0.0	28.49	40.00	**11.5**	100	119	-
Vert.	49.924	QP	39.40	11.23	7.25	31.88	0.0	26.00	40.00	14.0	100	285	-
Vert.	61.465	QP	42.60	7.87	7.02	31.88	0.0	25.61	40.00	14.3	100	60	-
Vert.	67.505	QP	37.60	7.85	7.14	31.88	0.0	20.71	40.00	19.2	100	56	-
Vert.	72.470	QP	37.40	6.36	7.52	31.88	0.0	19.40	40.00	20.6	100	63	-

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).

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	DCCF [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	0.1342	PK	89.90	19.43	20.08	31.75	-80.0	0.00	17.66	24.98	**7.3**	Fundamental
Vert.	0.1342	PK	87.50	19.43	20.08	31.75	-80.0	0.00	15.26	24.98	9.7	Fundamental

Result = Reading + Ant.Fac. + Loss (Cable+Attenuator) - Gain(Amprifier) + Distance factor + DCCF

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

Result of the fundamental emission at 3 m without Distance factor

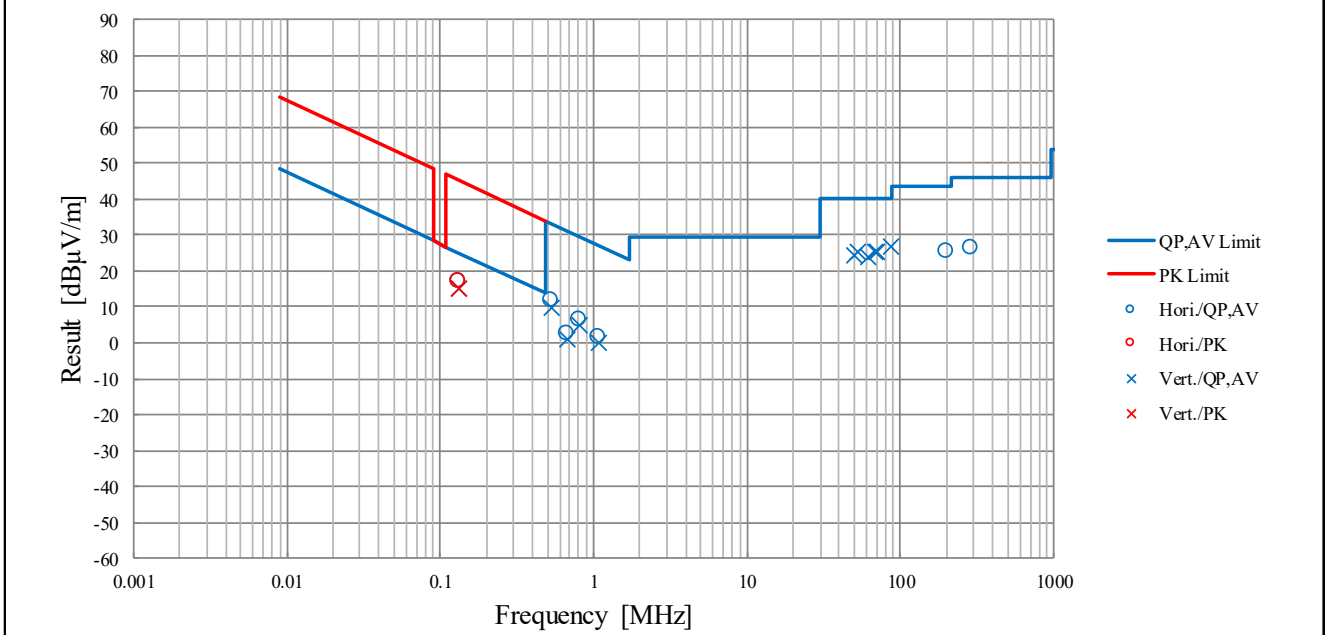
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	-	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	0.1342	PK	89.90	19.43	20.08	31.75	0.0	-	97.66	-	-	Fundamental
Vert.	0.1342	PK	87.50	19.43	20.08	31.75	0.0	-	95.26	-	-	Fundamental

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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	13534936S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 26, 2020
Temperature / Humidity	20 deg. C / 49 % RH
Engineer	Shiro Kobayashi
Model	AS1 READER
Mode	Continuous Reading mode
Remarks	Below 30 MHz Vertical polarization(Antenna Angle) of the worst case: 0 deg.

Spurious emission plot

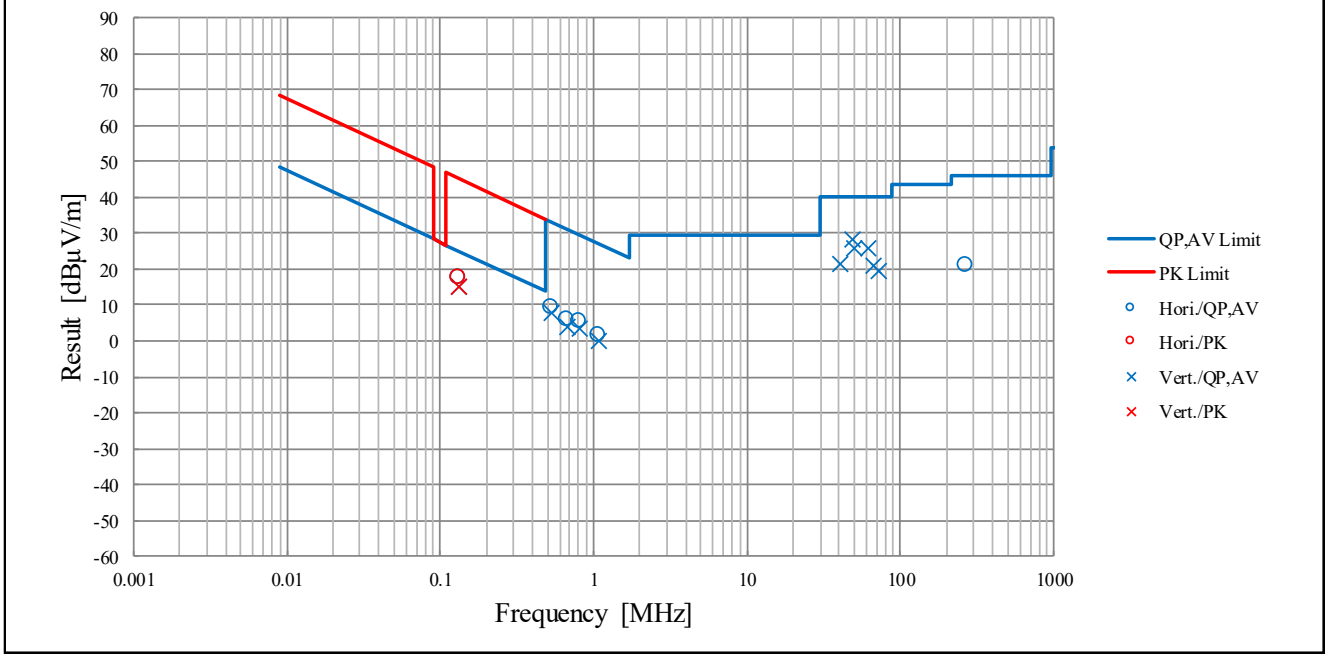


UL Japan, Inc.
Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
Telephone : +81 463 50 6400
Facsimile : +81 463 50 6401

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	13534936S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 26, 2020
Temperature / Humidity	20 deg. C / 49 % RH
Engineer	Shiro Kobayashi
Model	AS1 WRITER
Mode	Continuous Reading/Writing mode
Remarks	Below 30 MHz Vertical polarization(Antenna Angle) of the worst case: 0 deg.

Spurious emission plot



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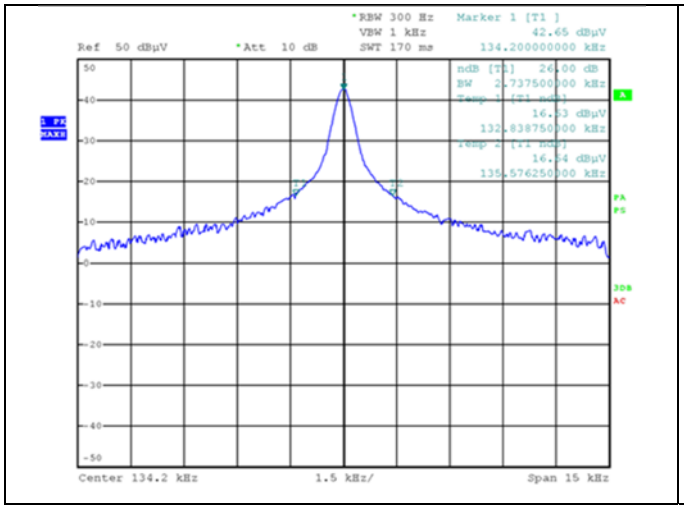
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
Telephone : +81 463 50 6400
Facsimile : +81 463 50 6401

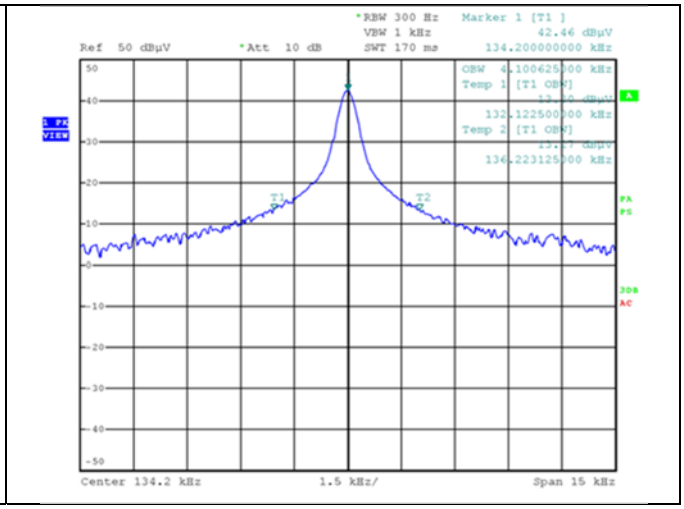
-26 dB Bandwidth / 99 % Occupied Bandwidth

Report No.	13534936S
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 26, 2020
Temperature / Humidity	20 deg. C / 49 % RH
Engineer	Shiro Kobayashi

Model : AS-1 READER

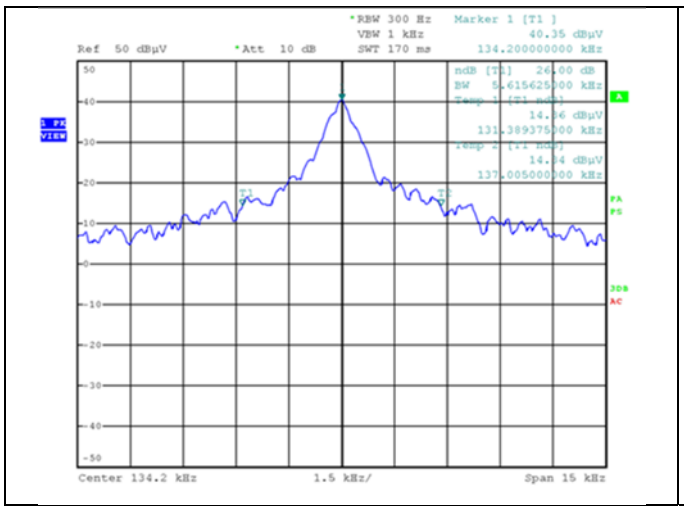
-26 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
2.7375	4.100625

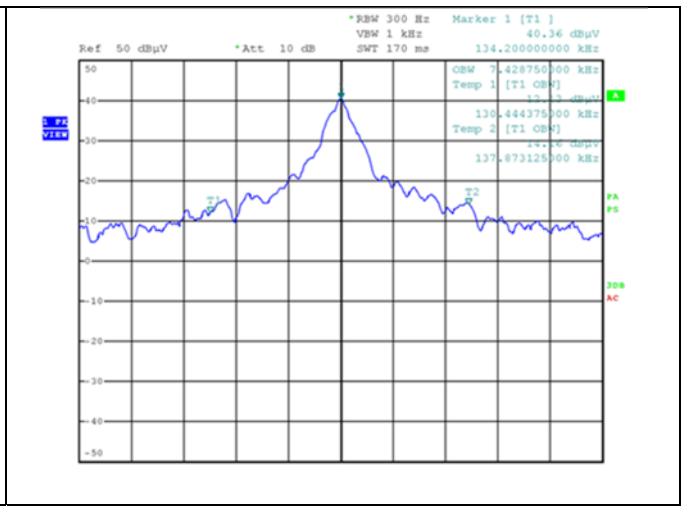




Mode : AS-1 WRITER

-26 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
5.615625	7.42875





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

APPENDIX 2: Test instruments

Test equipment

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
RE	KJM-10	146454	Measure	KOMELON	KMC-36	-	-	-
RE	SAEC-02(NSA)	145563	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	2020/03/20	12
RE	SAF-02	145004	Pre Amplifier	SONOMA	310N	290212	2020/02/19	12
RE	SAT20-04	145145	Attenuator	JFW	50HF-020N	-	2020/08/18	12
RE	SAT3-11	150921	Attenuator	JFW	50HF-003N	-	2020/01/30	12
RE	SAT6-14	167095	Attenuator	JFW	50HF-006N	-	2020/02/21	12
RE	SBA-02	145022	Biconical Antenna	Schwarzbeck Mess - Elektronik	BBA9106	91032665	2020/04/04	12
RE	SCC-B1/B3/B5/B7/B8/B13/SRSE-02	144975	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	2020/04/17	12
RE	SCC-B2/B4/B6/B7/B8/B13/SRSE-02	144976	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	2020/04/17	12
RE	SCC-M1	194601	Coaxial Cable	Fjikura	5D-2W	-	2019/12/17	12
RE	SLA-06	145528	Logperiodic Antenna	Schwarzbeck Mess - Elektronik	VUSLP9111B	195	2020/04/04	12
RE	SLP-02	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2020/04/15	12
RE	SOS-21	191838	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2020/09/28	12
RE	STR-06	146208	Test Receiver	Rohde & Schwarz	ESCI	101259	2020/04/01	12
RE	STS-02	145793	Digital Hitester	Hioki	3805-50	80997819	2020/04/09	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 test