



FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

***Electric Field Strength of Fundamental Emission,
Spectrum Mask,
Electric Field Strength of Spurious Emission, and
20 dB Bandwidth and 99 % Occupied
Band Width tests only**

FOR

RFID MODULE

MODEL NUMBER: RI16A

FCC ID: ACJ9TGRI16A

REPORT NUMBER: 13278113H-A-R1

ISSUE DATE: April 15, 2020

Prepared for
PANASONIC CORPORATION OF NORTH AMERICA
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This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
http://japan.ul.com/resources/emc_accredited/

- ☐ This report contains data that are not covered by the NVLAP accreditation.
- ☒ There is no testing item of "Non-accreditation".

Revision History

Rev.	Issue Date	Revisions	Revised By
--	04/10/2020	Initial Issue	T. Shimada
1	04/15/2020	Addition of description about Test Antennas and Distance Factor	T. Shimada

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: PANASONIC CORPORATION OF NORTH AMERICA
Two Riverfront Plaza, 9th Floor, Newark, NJ 07102-5490

EUT DESCRIPTION: RFID MODULE

MODEL: RI16A

SERIAL NUMBER: 7JTSA05837

DATE TESTED: April 5, 2020

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Pass

UL Japan, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Japan, Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Japan, Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Japan, Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL Japan, Inc. By:

Tested By:



Takayuki Shimada
Leader
Consumer Technology Division



Yuichiro Yamazaki
Engineer
Consumer Technology Division

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN.

UL Japan, Inc. is accredited by NVLAP, Laboratory Code 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

The full scope of accreditation can be viewed at http://japan.ul.com/resources/emc_accredited/

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\quad \text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor $k = 2$.

Radiated emission

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

Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %

5. TEST PROCEDURE AND RESULTS

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.4, 6.12	Section 15.225(a) <ISED>RSS-210 B.6	58.63 dB, 13.56000MHz, QP, 135 deg. <Mode 1, 3>	Complied a)	Radiated
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods <ISED>RSS-Gen 6.4, 6.13	Section 15.225(b)(c) <ISED> RSS-210 B.6	39.59 dB, 13.56700 MHz, QP, 135deg. <Mode 1>	Complied a)	Radiated
20 dB Bandwidth	ANSI C63.10:2013 6 Standard test methods <ISED> -	Section15.215(c) <ISED> -	See data	Complied b)	Radiated
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods <ISED>RSS-Gen 6.4, 6.13	Section 15.209, Section 15.225 (d) <ISED>RSS-210 B.6	8.00 dB 40.680 MHz, Vertical, QP <Mode 4>	Complied c)	Radiated

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

- a) Refer to APPENDIX 1 (data of FUNDAMENTAL EMISSION and Spectrum Mask)
b) Refer to APPENDIX 1 (data of 20 dB BANDWIDTH and 99 % Occupied Bandwidth)
c) Refer to APPENDIX 1 (data of SPURIOUS EMISSIONS)

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.

Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Band Width	<IC>RSS-Gen 6.7	-	See data	-	Radiated

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

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The EUT is an RFID module that is embedded inside Panasonic PC model CF-33. The radio module is manufactured by NXP.

6.2. MAXIMUM TRANSMITTER FIELD STRENGTH

The field strength of the transmitter is as follows:

Frequency Range (MHz)	Mode	Output Power (dBuV/m @ 30m)
13.56	1) Transmitting mode (Tx) Without Tag Type A	25.27
13.56	2) Transmitting mode (Tx) With Tag Type A	24.57
13.56	3) Transmitting mode (Tx) Without Tag Type B	25.27
13.56	4) Transmitting mode (Tx) With Tag Type B	23.77

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Loop antenna.

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.

6.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Regulation test EMVco_loopback.exe

6.5. WORST-CASE CONFIGURATION AND MODE

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

6.6. MODIFICATIONS

No modifications were made during testing.

6.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Personal Computer	Panasonic	CF-33	7JTSA05837	-
AC Adapter	Panasonic	CF-AA5713A M6	5713AM6194000146WA	-
Tag	Type A	-	-	-
	Typw B	-	-	-

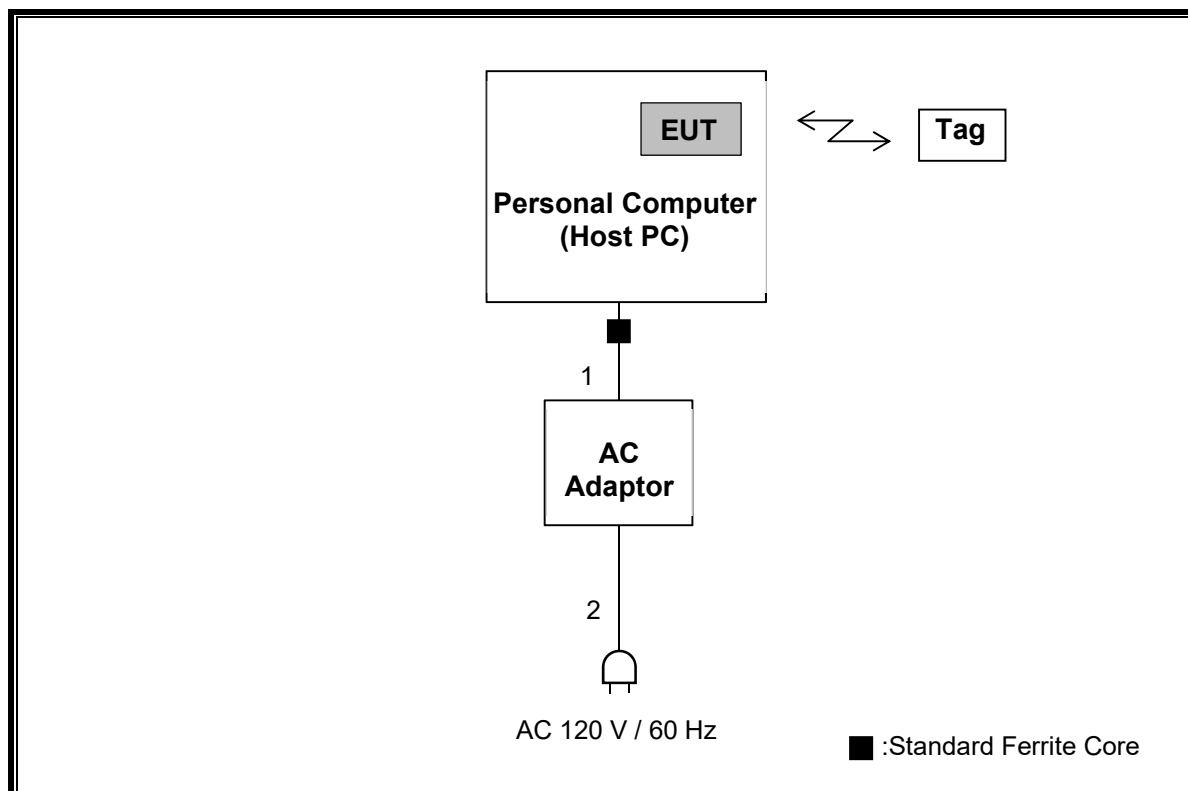
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	DC	1	DC	Un-Shielded	1.4 m	N/A
2	AC	1	AC	Un-Shielded	1.8 m	N/A

TEST SETUP

The EUT is installed in a host tablet computer during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/05/2020	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	1302	08/24/2019	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	03/24/2020	12
RE	MLA-23	141267	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-192	08/24/2019	12
RE	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/18/2020	12
RE	MAEC-04	142011	AC4 Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/28/2018	24
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/07/2020	12
RE	MMM-10	141545	DIGITAL HiTESTER	Hioki	3805	51201148	01/06/2020	12
RE	MJM-26	142227	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ	TEPTO-DV	-	-	-
RE	MCC-113	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/421-010/sucoform141-PE/RFM-E121(SW)	-/04178	06/18/2019	12
RE	MLPA-01	141254	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	10/04/2019	12
RE	MCC-143	141413	Coaxial Cable	UL Japan	-	-	06/07/2019	12
RE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	03/10/2020	12
RE	MRENT-130	141855	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187750	11/19/2019	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

8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMIT

§15.225

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (µV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the field strength from µV/m to dBµV/m is:

Limit (dBµV/m) = 20 log limit (µV/m)

In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in § 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

TEST PROCEDURE

ANSI C63.10-2013

The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 9 kHz to 1000 MHz.

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.

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 1 about Direction of the Loop Antenna.

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.

Test Antennas are used as below;

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

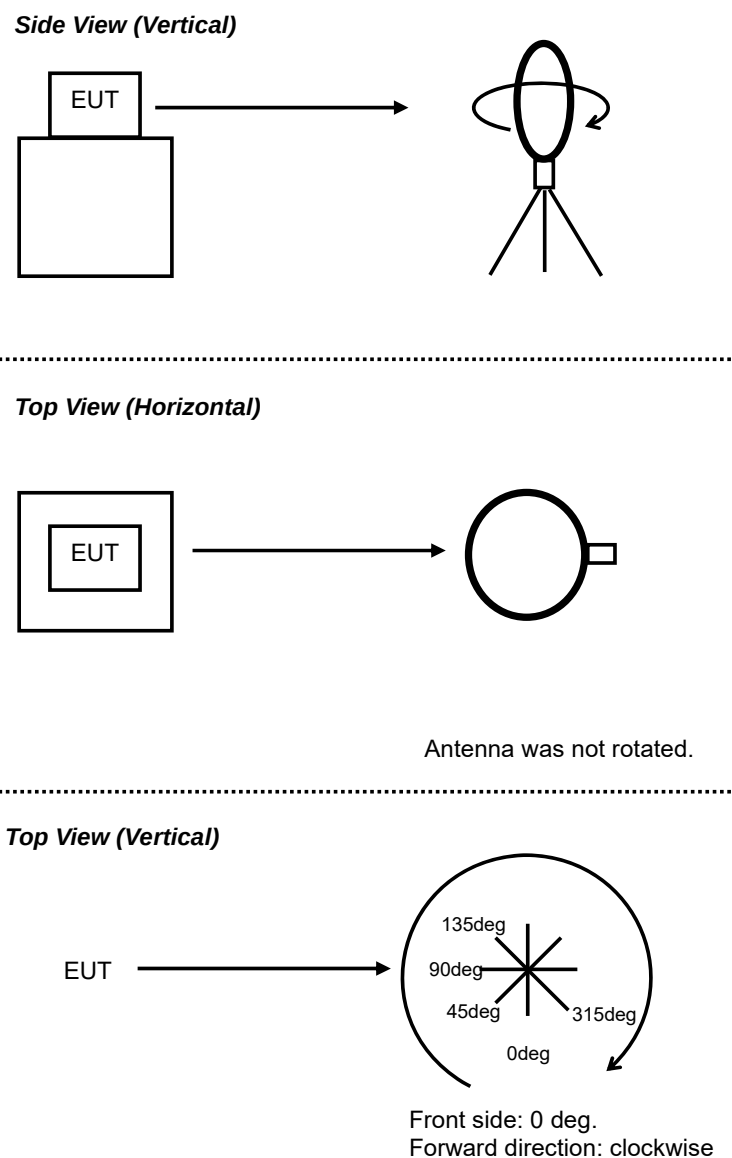
Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)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

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

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

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.

Figure 1: Direction of the Loop Antenna

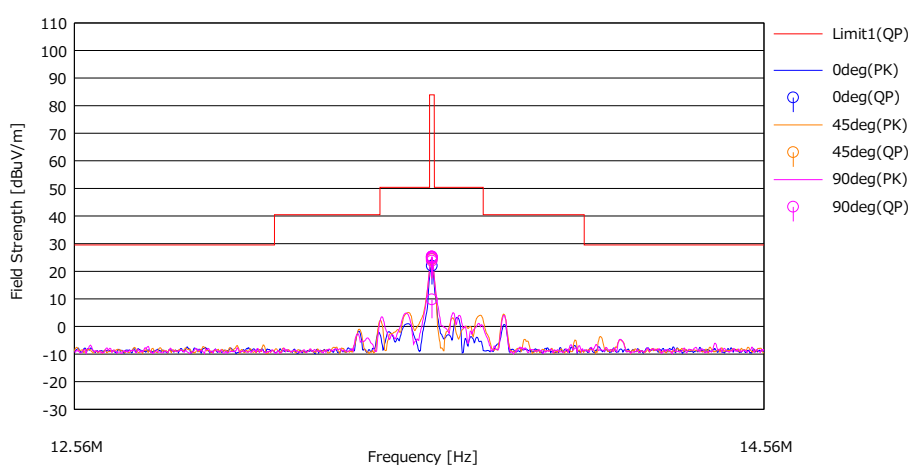


RESULTS

8.2. FUNDAMENTAL EMISSION and Spectrum Mask

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 1 without Tag (Type A)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP

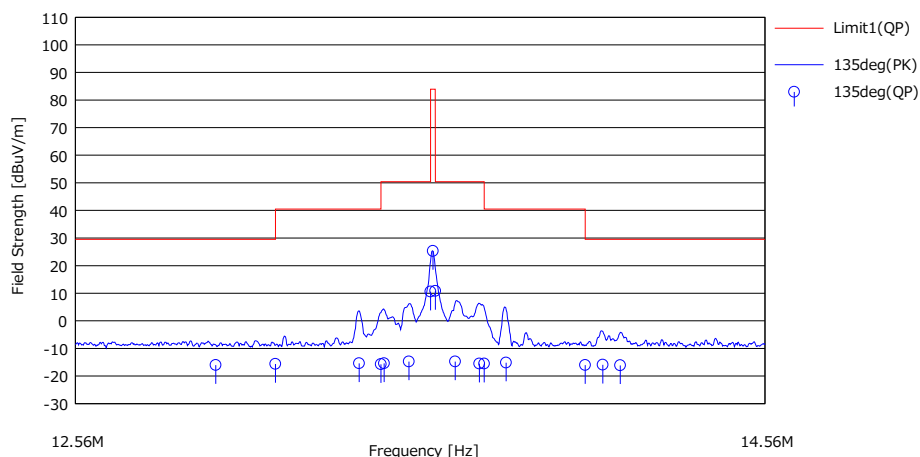


No.	Freq. [MHz]	Reading	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result	Limit	Margin	Antenna	Table	Comment
		[QP] [dBuV]				[QP] [dBuV/m]	[QP] [dBuV/m]	[QP] [dB]		[deg]	
1	13.56000	67.47	19.45	-32.97	32.01	21.94	83.90	61.96	0deg	7	0deg
2	13.56000	69.90	19.45	-32.97	32.01	24.37	83.90	59.53	45deg	146	45deg
3	13.56000	70.40	19.45	-32.97	32.01	24.87	83.90	59.03	90deg	114	90deg
4	13.56000	70.80	19.45	-32.97	32.01	25.27	83.90	58.63	90deg	51	135deg
5	13.56000	70.70	19.45	-32.97	32.01	25.17	83.90	58.73	90deg	55	315deg
6	13.56000	55.30	19.45	-32.97	32.01	9.77	83.90	74.13	90deg	220	Hor
7	13.56000	70.10	19.45	-32.97	32.01	24.57	83.90	59.33	90deg	50	135deg with Tag (Type A)
8	13.56000	69.30	19.45	-32.97	32.01	23.77	83.90	60.13	90deg	53	135deg with Tag (Type B)
9	13.56000	70.80	19.45	-32.97	32.01	25.27	83.90	58.63	90deg	50	135deg without Tag (Type B)

CHART: WITH FACTOR ANT TYPE: -30MHz: LOOP, 30-200MHz: BICONICAL, 200-1000MHz: LOGPERIODIC,
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 1 without Tag (Type A)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading [QP] [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [QP] [dBuV/m]	Limit [QP] [dBuV/m]	Margin [QP] [dB]	Antenna	Table [deg]	Comment
1	12.94350	29.50	19.47	-32.99	32.01	-16.03	29.50	45.53	135deg	51	
2	13.11000	29.90	19.46	-32.99	32.01	-15.64	29.50	45.14	135deg	51	
3	13.34730	30.10	19.45	-32.98	32.01	-15.44	40.50	55.94	135deg	51	
4	13.41000	29.80	19.45	-32.98	32.01	-15.74	40.50	56.24	135deg	51	
5	13.41907	30.10	19.45	-32.98	32.01	-15.44	50.40	65.84	135deg	51	
6	13.49052	30.80	19.45	-32.98	32.01	-14.74	50.40	65.14	135deg	51	
7	13.55300	56.10	19.45	-32.97	32.01	10.57	50.40	39.83	135deg	51	
8	13.56000	70.80	19.45	-32.97	32.01	25.27	83.90	58.63	135deg	51	
9	13.56700	56.34	19.45	-32.97	32.01	10.81	50.40	39.59	135deg	51	
10	13.62494	30.80	19.44	-32.97	32.01	-14.74	50.40	65.14	135deg	51	
11	13.69593	30.00	19.44	-32.97	32.01	-15.54	50.40	65.94	135deg	51	
12	13.71000	30.00	19.44	-32.97	32.01	-15.54	40.50	56.04	135deg	51	
13	13.77436	30.40	19.44	-32.97	32.01	-15.14	40.50	55.64	135deg	51	
14	14.01000	29.50	19.43	-32.96	32.01	-16.04	29.50	45.54	135deg	51	
15	14.06278	29.60	19.43	-32.96	32.01	-15.94	29.50	45.44	135deg	51	
16	14.11538	29.40	19.43	-32.96	32.01	-16.14	29.50	45.64	135deg	51	

CHART: WITH FACTOR ANT TYPE: -30MHz: LOOP, 30-200MHz: BICONICAL, 200-1000MHz: LOGPERIODIC,
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Result of the fundamental emission at 3 m without Distance factor

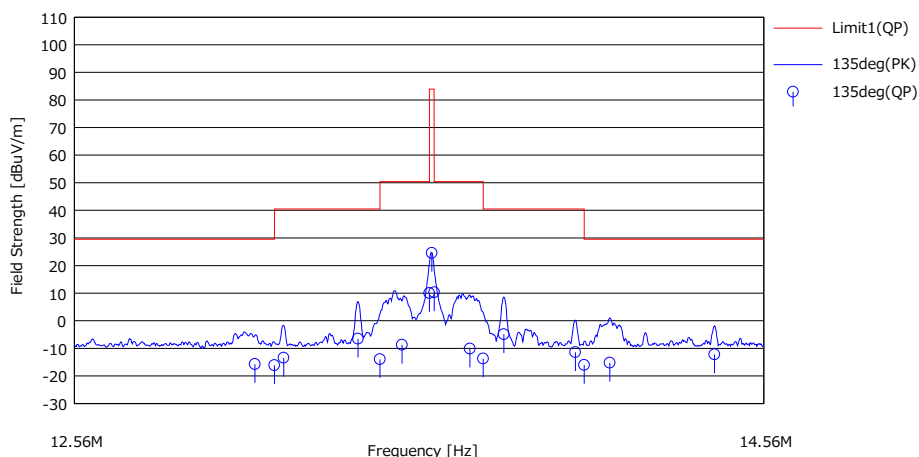
QP

Ant Deg [deg]	Frequency	Detector	Reading	Ant Factor	Loss	Gain	Duty Factor	Result	Limit	Margin	Remark
	[MHz]		[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
135	13.56000	QP	70.80	19.45	7.03	32.01	-	65.27	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 2 with Tag (Type A)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna [deg]	Table	Comment
1	13.06537	29.80	19.46	-32.99	32.01	-15.74	29.50	45.24	135deg	50	
2	13.11000	29.40	19.46	-32.99	32.01	-16.14	29.50	45.64	135deg	50	
3	13.13611	32.10	19.46	-32.98	32.01	-13.43	40.50	53.93	135deg	50	
4	13.34718	39.00	19.45	-32.98	32.01	-6.54	40.50	47.04	135deg	50	
5	13.41000	31.60	19.45	-32.98	32.01	-13.94	40.50	54.44	135deg	50	
6	13.47358	36.80	19.45	-32.98	32.01	-8.74	50.40	59.14	135deg	50	
7	13.55300	55.50	19.45	-32.97	32.01	9.97	50.40	40.43	135deg	50	
8	13.56000	70.10	19.45	-32.97	32.01	24.57	83.90	59.33	135deg	50	
9	13.56700	55.80	19.45	-32.97	32.01	10.27	50.40	40.13	135deg	50	
10	13.67112	35.40	19.44	-32.97	32.01	-10.14	50.40	60.54	135deg	50	
11	13.71000	31.80	19.44	-32.97	32.01	-13.74	40.50	54.24	135deg	50	
12	13.77107	40.60	19.44	-32.97	32.01	-4.94	40.50	45.44	135deg	50	
13	13.98339	34.10	19.43	-32.96	32.01	-11.44	40.50	51.94	135deg	50	
14	14.01000	29.50	19.43	-32.96	32.01	-16.04	29.50	45.54	135deg	50	
15	14.08715	30.30	19.43	-32.96	32.01	-15.24	29.50	44.74	135deg	50	
16	14.40682	33.30	19.42	-32.95	32.01	-12.24	29.50	41.74	135deg	50	

CHART: WITH FACTOR ANT TYPE: -30MHz: LOOP, 30-200MHz: BICONICAL, 200-1000MHz: LOGPERIODIC,
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Result of the fundamental emission at 3 m without Distance factor

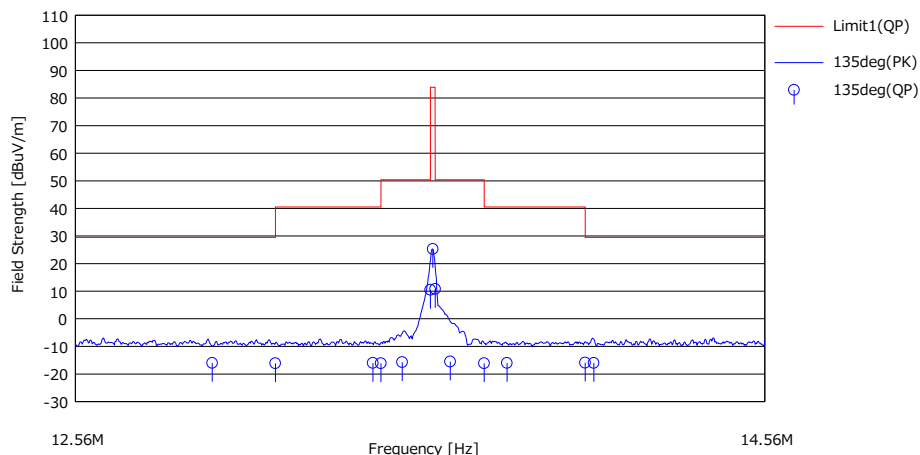
QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
135	13.56000	QP	70.10	19.45	7.03	32.01	-	64.57	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 3 without Tag (Type B)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading [QP] [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [QP] [dBuV/m]	Limit [QP] [dBuV/m]	Margin [QP] [dB]	Antenna [deg]	Table [deg]	Comment
1	12.93392	29.50	19.47	-32.99	32.01	-16.03	29.50	45.53	135deg	50	
2	13.11000	29.40	19.46	-32.99	32.01	-16.14	29.50	45.64	135deg	50	
3	13.38714	29.50	19.45	-32.98	32.01	-16.04	40.50	56.54	135deg	50	
4	13.41000	29.40	19.45	-32.98	32.01	-16.14	40.50	56.64	135deg	50	
5	13.47152	29.80	19.45	-32.98	32.01	-15.74	50.40	66.14	135deg	50	
6	13.55300	56.00	19.45	-32.97	32.01	10.47	50.40	39.93	135deg	50	
7	13.56000	70.80	19.45	-32.97	32.01	25.27	83.90	58.63	135deg	50	
8	13.56700	56.30	19.45	-32.97	32.01	10.77	50.40	39.63	135deg	50	
9	13.61056	30.00	19.44	-32.97	32.01	-15.54	50.40	65.94	135deg	50	
10	13.71000	29.40	19.44	-32.97	32.01	-16.14	40.50	56.64	135deg	50	
11	13.77719	29.50	19.44	-32.97	32.01	-16.04	40.50	56.54	135deg	50	
12	14.01000	29.60	19.43	-32.96	32.01	-15.94	29.50	45.44	135deg	50	
13	14.03601	29.50	19.43	-32.96	32.01	-16.04	29.50	45.54	135deg	50	

CHART: WITH FACTOR ANT TYPE: -30MHz: LOOP, 30-200MHz: BICONICAL, 200-1000MHz: LOGPERIODIC,
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Result of the fundamental emission at 3 m without Distance factor

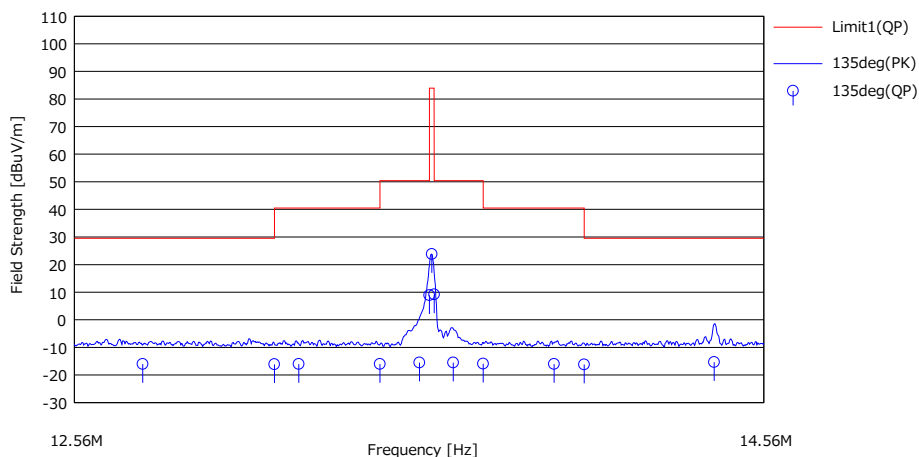
QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
135	13.56000	QP	70.80	19.45	7.03	32.01	-	65.27	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 4 with Tag (Type B)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading [QP] [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [QP] [dBuV/m]	Limit [QP] [dBuV/m]	Margin [QP] [dB]	Antenna	Table [deg]	Comment
1	12.74524	29.50	19.47	-32.99	32.01	-16.03	29.50	45.53	135deg	53	
2	13.11000	29.40	19.46	-32.99	32.01	-16.14	29.50	45.64	135deg	53	
3	13.17882	29.50	19.46	-32.98	32.01	-16.03	40.50	56.53	135deg	53	
4	13.41000	29.50	19.45	-32.98	32.01	-16.04	40.50	56.54	135deg	53	
5	13.52401	30.00	19.45	-32.98	32.01	-15.54	50.40	65.94	135deg	53	
6	13.55300	54.40	19.45	-32.97	32.01	8.87	50.40	41.53	135deg	53	
7	13.56000	69.30	19.45	-32.97	32.01	23.77	83.90	60.13	135deg	53	
8	13.56700	54.70	19.45	-32.97	32.01	9.17	50.40	41.23	135deg	53	
9	13.62254	30.00	19.44	-32.97	32.01	-15.54	50.40	65.94	135deg	53	
10	13.71000	29.60	19.44	-32.97	32.01	-15.94	40.50	56.44	135deg	53	
11	13.91995	29.50	19.43	-32.97	32.01	-16.05	40.50	56.55	135deg	53	
12	14.01000	29.30	19.43	-32.96	32.01	-16.24	29.50	45.74	135deg	53	
13	14.40580	30.20	19.42	-32.95	32.01	-15.34	29.50	44.84	135deg	53	

CHART: WITH FACTOR ANT TYPE: -30MHz: LOOP, 30-200MHz: BICONICAL, 200-1000MHz: LOGPERIODIC,
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Result of the fundamental emission at 3 m without Distance factor

QP

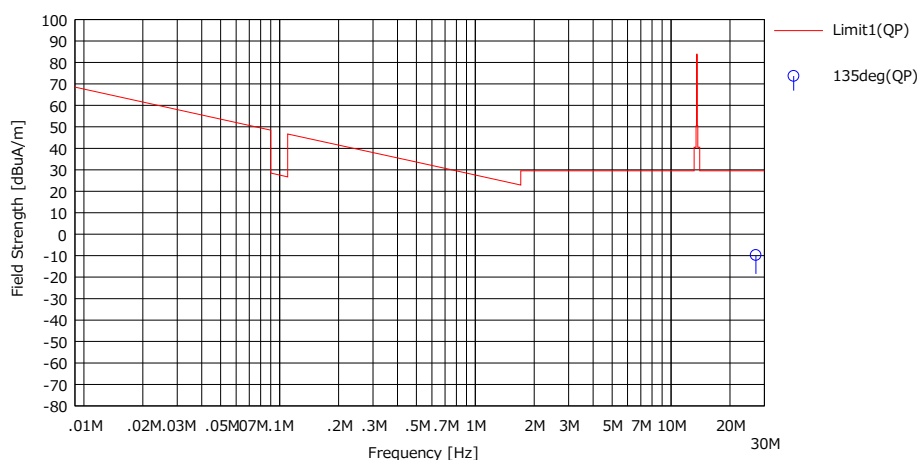
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
135	13.56000	QP	69.30	19.45	7.03	32.01	-	63.77	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

8.3. SPURIOUS EMISSIONS (0.009 MHz - 30 MHz)

Report No.	13278113H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	April 05, 2020
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Yuichiro Yamazaki
Mode	Mode 1 without Tag (Type A)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



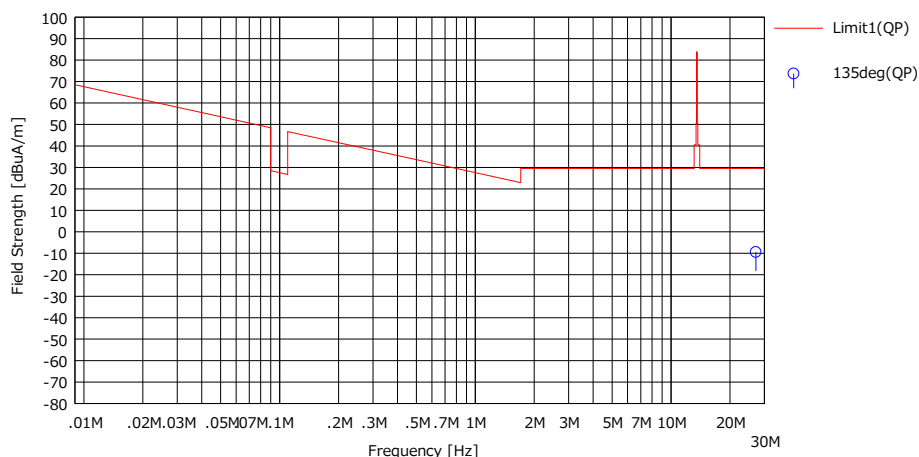
No.	Freq. [MHz]	Reading (QP)	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP)	Limit (QP)	Margin (QP)	Antenna	Table	Comment
		[dBuV]				[dBuA/m]	[dBuA/m]	[dB]			
1	27.12000	35.70	19.19	-32.65	31.99	-9.75	29.50	39.25	135deg	165	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 2 with Tag (Type A)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuA/m]	Limit [dBuA/m]	Margin [dB]	Antenna	Table [deg]	Comment
1	27.12000	36.00	19.19	-32.65	31.99	-9.45	29.50	38.95	135deg	156	

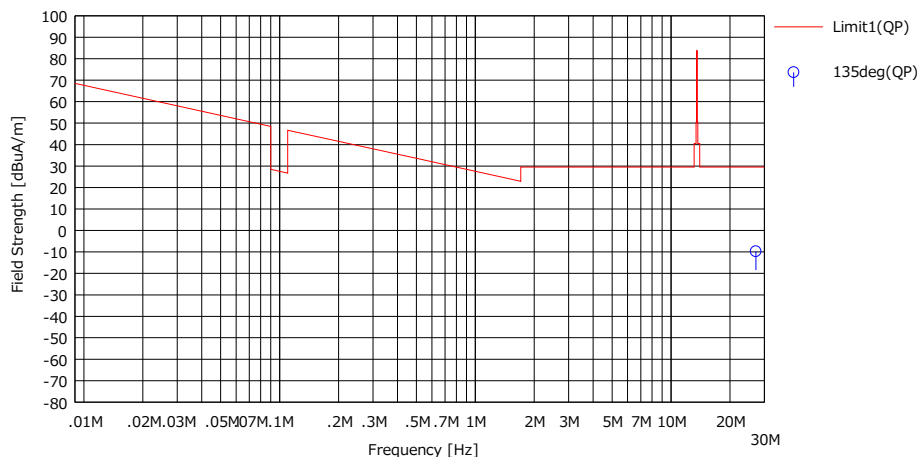
CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 3 without Tag (Type B)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



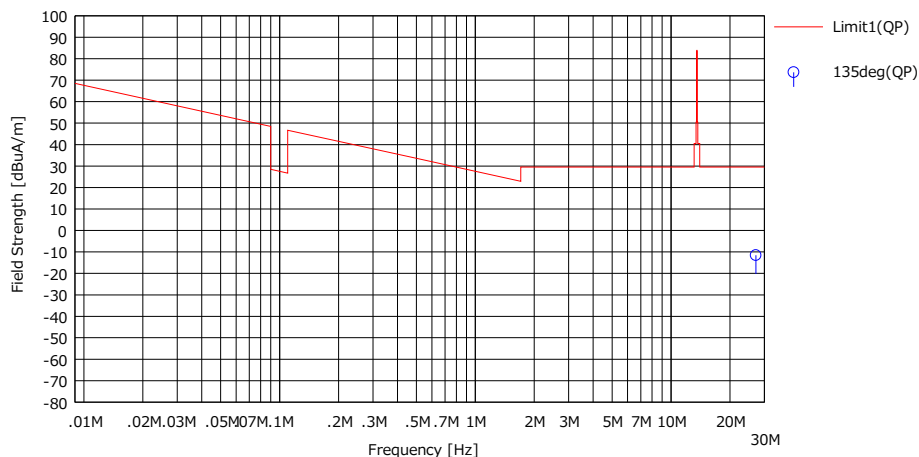
No.	Freq. [MHz]	Reading (QP) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP) [dBuA/m]	Limit (QP) [dBuA/m]	Margin (QP) [dB]	Antenna	Table [deg]	Comment
1	27.12000	35.70	19.19	-32.65	31.99	-9.75	29.50	39.25	135deg	186	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 4 with Tag (Type B)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq.	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuA/m]	[dBuA/m]	[dB]		[deg]	
1	27.12000	33.90	19.19	-32.65	31.99	-11.55	29.50	41.05	135deg	193	

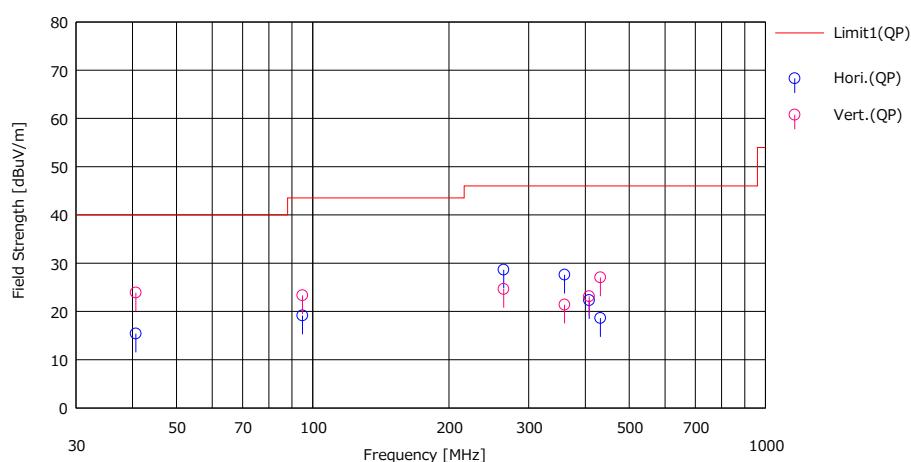
CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

8.4. SPURIOUS EMISSION (30 MHz - 1000 MHz)

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 1 without Tag (Type A)

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK



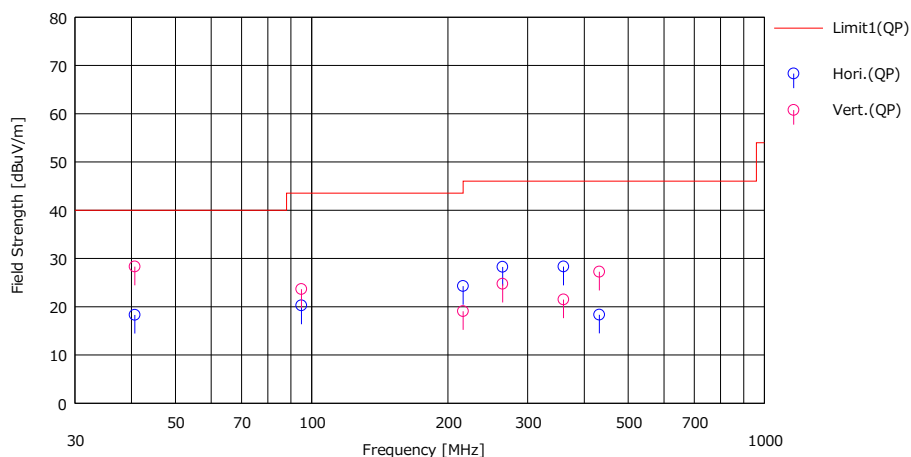
No.	Freq. [MHz]	Reading (QP) [dBuV]	AntFac [dB/m]	Loss [dB]	Gain [dB]	Result (QP) [dBuV/m]	Limit (QP) [dBuV/m]	Margn (QP) [dB]	Pda. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	40.680	25.50	14.55	7.33	31.98	15.40	40.00	24.60	Hori.	254	171	BA	
2	94.920	33.70	9.34	8.02	31.92	19.14	43.50	24.36	Hori.	247	207	BA	
3	264.000	38.40	12.54	9.48	31.78	28.64	46.00	17.36	Hori.	121	359	LA23	
4	359.998	34.20	15.07	10.11	31.79	27.59	46.00	18.41	Hori.	100	0	LA23	
5	408.001	27.80	15.93	10.40	31.81	22.32	46.00	23.68	Hori.	232	303	LA23	
6	432.007	23.60	16.32	10.54	31.83	18.63	46.00	27.37	Hori.	171	10	LA23	
7	40.680	34.00	14.55	7.33	31.98	23.90	40.00	16.10	Vert.	100	259	BA	
8	94.920	37.90	9.34	8.02	31.92	23.34	43.50	20.16	Vert.	100	218	BA	
9	264.000	34.40	12.54	9.48	31.78	24.64	46.00	21.36	Vert.	100	183	LA23	
10	359.998	28.00	15.07	10.11	31.79	21.39	46.00	24.61	Vert.	125	3	LA23	
11	408.001	28.60	15.93	10.40	31.81	23.12	46.00	22.88	Vert.	100	354	LA23	
12	432.007	32.00	16.32	10.54	31.83	27.03	46.00	18.97	Vert.	100	357	LA23	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 2 with Tag (Type A)

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK



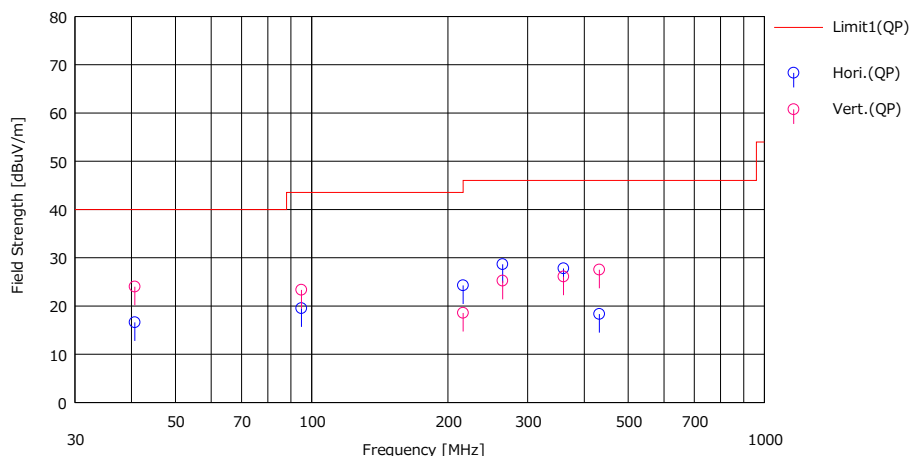
No.	Freq. [MHz]	Reading [QP] [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [QP] [dBuV/m]	Limit [QP] [dBuV/m]	Margn [QP] [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	40.680	28.40	14.55	7.33	31.98	18.30	40.00	21.70	Hori.	297	187	BA	
2	94.920	34.80	9.34	8.02	31.92	20.24	43.50	23.26	Hori.	302	217	BA	
3	216.000	35.90	11.07	9.11	31.81	24.27	43.50	19.23	Hori.	100	20	LA23	
4	264.000	38.00	12.54	9.48	31.78	28.24	46.00	17.76	Hori.	120	359	LA23	
5	359.998	34.90	15.07	10.11	31.79	28.29	46.00	17.71	Hori.	100	6	LA23	
6	432.001	23.30	16.32	10.54	31.83	18.33	46.00	27.67	Hori.	165	11	LA23	
7	40.680	38.40	14.55	7.33	31.98	28.30	40.00	11.70	Vert.	100	270	BA	
8	94.920	38.20	9.34	8.02	31.92	23.64	43.50	19.86	Vert.	100	224	BA	
9	216.000	30.70	11.07	9.11	31.81	19.07	43.50	24.43	Vert.	100	183	LA23	
10	264.000	34.50	12.54	9.48	31.78	24.74	46.00	21.26	Vert.	100	177	LA23	
11	359.998	28.10	15.07	10.11	31.79	21.49	46.00	24.51	Vert.	134	4	LA23	
12	432.001	32.20	16.32	10.54	31.83	27.23	46.00	18.77	Vert.	100	359	LA23	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 3 without Tag (Type B)

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK



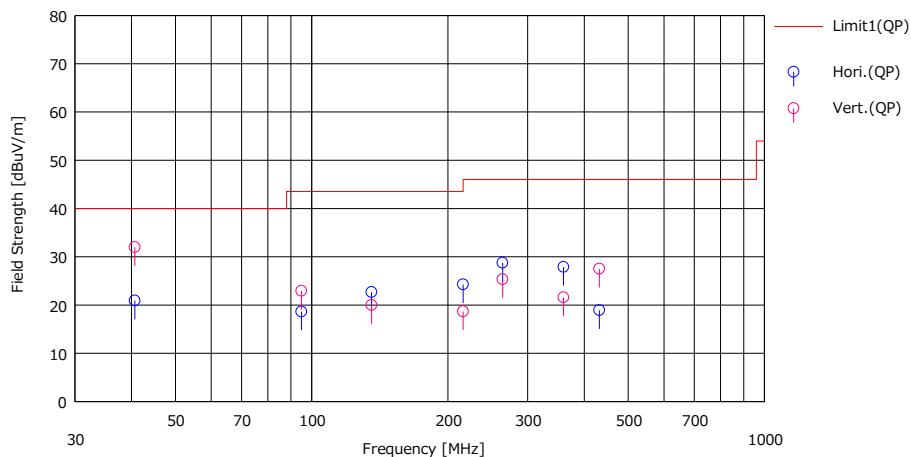
No.	Freq. [MHz]	Reading [QP] [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [QP] [dBuV/m]	Limit [QP] [dBuV/m]	Margin [QP] [dB]	Pola [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	40.680	26.70	14.55	7.33	31.98	16.60	40.00	23.40	Hori.	238	330	BA	
2	94.920	34.10	9.34	8.02	31.92	19.54	43.50	23.96	Hori.	290	207	BA	
3	216.000	35.90	11.07	9.11	31.81	24.27	43.50	19.23	Hori.	100	18	LA23	
4	264.000	38.40	12.54	9.48	31.78	28.64	46.00	17.36	Hori.	122	357	LA23	
5	359.997	34.40	15.07	10.11	31.79	27.79	46.00	18.21	Hori.	100	358	LA23	
6	432.000	23.30	16.32	10.54	31.83	18.33	46.00	27.67	Hori.	164	163	LA23	
7	40.680	34.10	14.55	7.33	31.98	24.00	40.00	16.00	Vert.	100	267	BA	
8	94.920	37.90	9.34	8.02	31.92	23.34	43.50	20.16	Vert.	100	224	BA	
9	216.000	30.20	11.07	9.11	31.81	18.57	43.50	24.93	Vert.	100	176	LA23	
10	264.000	35.00	12.54	9.48	31.78	25.24	46.00	20.76	Vert.	100	324	LA23	
11	359.997	32.70	15.07	10.11	31.79	26.09	46.00	19.91	Vert.	150	21	LA23	
12	432.000	32.50	16.32	10.54	31.83	27.53	46.00	18.47	Vert.	114	359	LA23	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Report No. 13278113H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date April 05, 2020
Temperature / Humidity 24 deg. C / 33 % RH
Engineer Yuichiro Yamazaki
Mode Mode 4 with Tag (Type B)

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK



No.	Freq. [MHz]	Reading [QP] [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [QP] [dBuV/m]	Limit [QP] [dBuV/m]	Margn [QP] [dB]	Pols. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	40.680	31.00	14.55	7.33	31.98	20.90	40.00	19.10	Hori.	286	0	BA	
2	94.920	33.20	9.34	8.02	31.92	18.64	43.50	24.86	Hori.	304	213	BA	
3	135.600	31.90	14.24	8.43	31.88	22.69	43.50	20.81	Hori.	189	25	BA	
4	216.000	35.90	11.07	9.11	31.81	24.27	43.50	19.23	Hori.	100	32	LA23	
5	264.000	38.50	12.54	9.48	31.78	28.74	46.00	17.26	Hori.	122	355	LA23	
6	359.997	34.50	15.07	10.11	31.79	27.89	46.00	18.11	Hori.	100	358	LA23	
7	432.000	23.90	16.32	10.54	31.83	18.93	46.00	27.07	Hori.	170	167	LA23	
8	40.680	42.10	14.55	7.33	31.98	32.00	40.00	8.00	Vert.	100	285	BA	
9	94.920	37.50	9.34	8.02	31.92	22.94	43.50	20.56	Vert.	100	217	BA	
10	135.600	29.20	14.24	8.43	31.88	19.99	43.50	23.51	Vert.	100	313	BA	
11	216.000	30.30	11.07	9.11	31.81	18.67	43.50	24.83	Vert.	100	175	LA23	
12	264.000	35.10	12.54	9.48	31.78	25.34	46.00	20.66	Vert.	100	323	LA23	
13	359.997	28.20	15.07	10.11	31.79	21.59	46.00	24.41	Vert.	136	15	LA23	
14	432.000	32.50	16.32	10.54	31.83	27.53	46.00	18.47	Vert.	105	0	LA23	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

9. 20 dB BANDWIDTH and 99 % Occupied Bandwidth

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

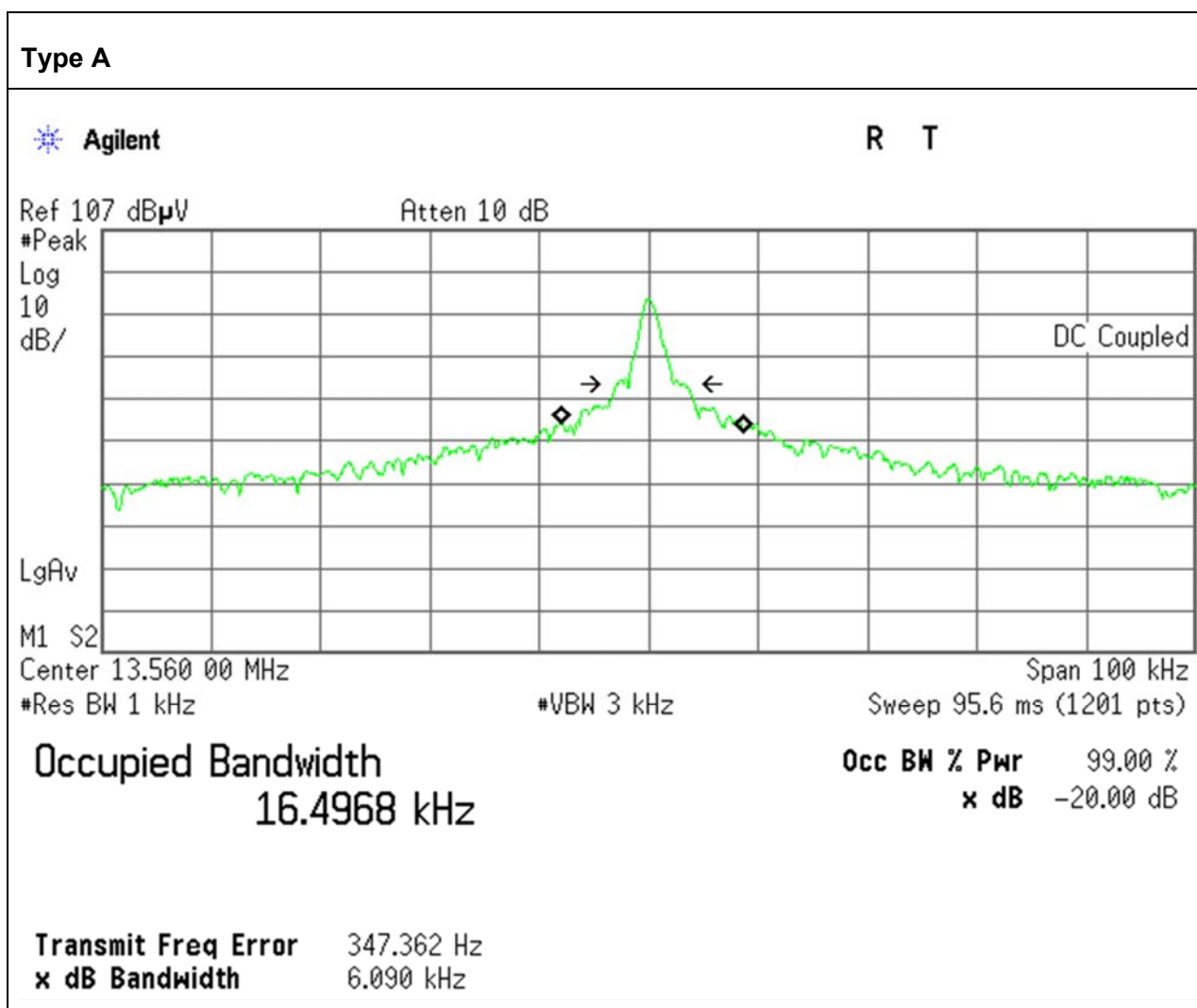
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1 % to 5 % of the 20dB bandwidth and 99 % Occupied Bandwidth. The VBW is set to 3 times the RBW. Because ASK modulation signal is CW-like signal that the RBW cannot be adjusting to meet 1% to 5% of OBW requirements. Therefore, the test was performed with RBW: 1 kHz, VBW: 3 kHz. The sweep time is coupled. The spectrum analyzer internal 20dB bandwidth and 99 % Occupied Bandwidth function is utilized.

RESULTS

Frequency (MHz)	20dB Bandwidth (KHz)
13.56, Type A without Tag	6.09
13.56, Type A with Tag	5.97
13.56, Type B without Tag	4.09
13.56, Type B with Tag	3.92

Report No.	13278113H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	April 05, 2020
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Yuichiro Yamazaki
Mode	Mode 1

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	6.09	16.50



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Engineer	Yuichiro Yamazaki
Mode	Mode 2

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	5.97	20.22

Type A

Agilent

R T

Ref 107 dB μ V

Atten 10 dB

#Peak

Log

10

dB/

DC Coupled

LgAv

M1 S2

Center 13.560 00 MHz

Span 100 kHz

#Res BW 1 kHz

#VBW 3 kHz

Sweep 95.6 ms (1201 pts)

Occupied Bandwidth

20.2168 kHz

Occ BW % Pwr 99.00 %

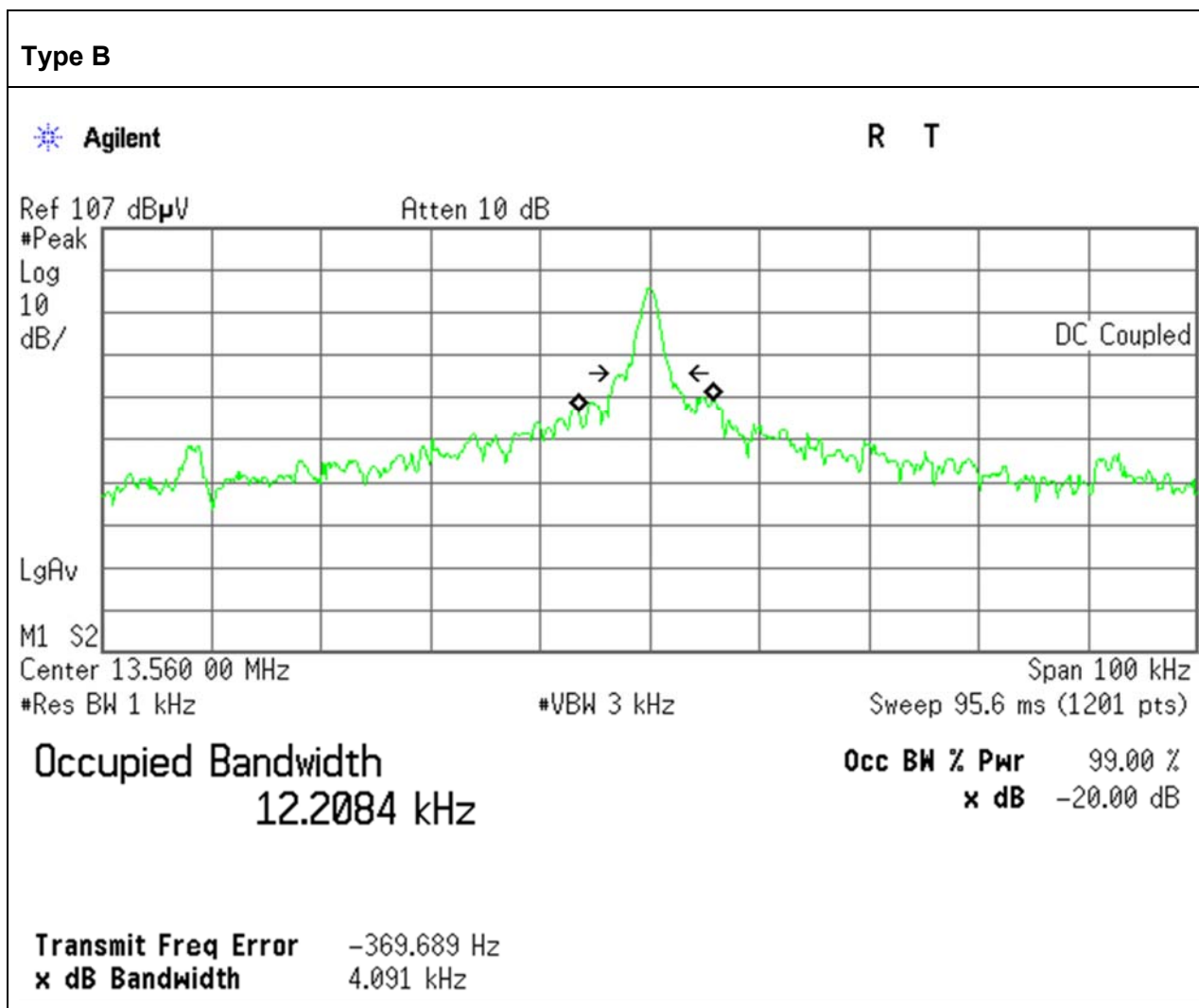
x dB -20.00 dB

Transmit Freq Error 18.730 Hz

x dB Bandwidth 5.971 kHz

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Engineer	Yuichiro Yamazaki
Mode	Mode 3

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	4.09	12.21



Report No.	13278113H
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Semi Anechoic Chamber	No.4
Date	April 05, 2020
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Yuichiro Yamazaki
Mode	Mode 4

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	3.92	13.06

Type B

Agilent

R T

Ref 107 dB μ V

Atten 10 dB

#Peak
Log
10
dB/

LgAv

M1 S2

Center 13.560 00 MHz

#Res BW 1 kHz

#VBW 3 kHz

Span 100 kHz

Sweep 95.6 ms (1201 pts)

Occupied Bandwidth

13.0626 kHz

Occ BW % Pwr 99.00 %

x dB -20.00 dB

Transmit Freq Error 235.273 Hz

x dB Bandwidth 3.916 kHz