

TEST REPORT

Applicant : Sharp Corporation
Address : 4-1-33, Atobe-honmachi, Yao-city, Osaka, 581-8581, Japan

Products : Handy Terminal for Digital Picking
Model No. : DS-10HR
Serial No. : --

FCC ID : APY-BSC0003

Test Standard : CFR 47 FCC Rules and Regulations Part 15

Test Results : **Passed**

Date of Test : November 29 ~ December 5, 2018



Kousei Shibata
Manager
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KITA-KANSAI Testing Center
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7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

- The test results in this test report was made by using the measuring instruments which are traceable to national standards of measurement in accordance with ISO/IEC 17025.
- The applicable standard, testing condition and testing method which were used for the tests are based on the request of the applicant.
- The test results presented in this report relate only to the offered test sample.
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- VLAC does not approve, certify or warrant the product by this test report.

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DEFINITIONS FOR ABBREVIATION AND SYMBOLS USED IN THIS TEST REPORT

EUT : Equipment Under Test**EMC** : Electromagnetic Compatibility**AE** : Associated Equipment**EMI** : Electromagnetic Interference**N/A** : Not Applicable**EMS** : Electromagnetic Susceptibility**N/T** : Not Tested☒ - indicates that the listed condition, standard or equipment is applicable for this report.☐ - indicates that the listed condition, standard or equipment is not applicable for this report.

1 Description of the Equipment Under Test

- | | | |
|---------------------------|---|---|
| 1. Manufacturer | : | Sharp Corporation
4-1-33, Atobe-honmachi, Yao-city, Osaka, 581-8581, Japan |
| 2. Products | : | Handy Terminal for Digital Picking |
| 3. Model No. | : | DS-10HR |
| 4. Serial No. | : | -- |
| 5. Product Type | : | Prototype |
| 6. Date of Manufacture | : | November, 2018 |
| 7. Power Rating | : | 3.7VDC (Lithium-ion Battery DREEM 1200mAh) |
| 8. Grounding | : | None |
| 9. Transmitting Frequency | : | 13.56 MHz |
| 10. Receiving Frequency | : | 13.56 MHz |
| 11. Antenna Type | : | Internal Antenna (Integral) |
| 12. EUT Authorization | : | Certification |
| 13. Received Date of EUT | : | November 27, 2018 |

2 Summary of Test Results

Applied Standard : CFR 47 FCC Rules and Regulations Part 15
Subpart C – Intentional Radiators

The EUT described in clause 1 was tested according to the applied standard shown above.

Details of the test configuration is shown in clause 6.

The conclusion for the test items of which are required by the applied standard is indicated under the test result.

- ☒ - The test result was **passed** for the test requirements of the applied standard.
- ☐ - The test result was **failed** for the test requirements of the applied standard.
- ☐ - The test result was **not judged** the test requirements of the applied standard.

In the approval of test results,

- Determining compliance with the limits in this report was based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- No deviations were employed from the applied standard.
- No modifications were conducted by JQA to achieve compliance to the limitations.

Reviewed by:

Tested by:



Shigeru Kinoshita
Assistant Manager
JQA KITA-KANSAI Testing Center
SAITO EMC Branch



Shigeru Osawa
Deputy Manager
JQA KITA-KANSAI Testing Center
SAITO EMC Branch

3 Test Procedure

Test Requirements : §15.225, §15.207 and §15.209

Test Procedure : ANSI C63.10–2013
Testing unlicensed wireless devices.
KDB 414788 D01
Radiated Test Site v01r01: July 12, 2018
KDB 174176 D01
Line Conducted FAQ v01r01: June 3, 2015

4 Test Location

Japan Quality Assurance Organization (JQA)
KITA-KANSAI Testing Center
7-7, Ishimaru, 1-chome, Minoh-shi, Osaka, 562-0027, Japan
SAITO EMC Branch
7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

5 Recognition of Test Laboratory

JQA KITA-KANSAI Testing Center SAITO EMC Branch is accredited under ISO/IEC 17025 by following accreditation bodies and the test facility is registered by the following bodies.

VLAC Accreditation No. : VLAC-001-2 (Expiry date : March 30, 2020)
VCCI Registration No. : A-0002 (Expiry date : March 30, 2020)
FCC Accreditation No. : JP5008 (Expiry date : March 30, 2020)
IC Registration No. : 2079E-3, 2079E-4 (Expiry date : June 26, 2020)
BSMI Registration No. : SL2-IS-E-6006, SL2-IN-E-6006, SL2-R1/R2-E-6006, SL2-A1-E-6006
(Expiry date : September 14, 2019)
CNAS Accreditation No. : L8352 (Expiry date : February 19, 2019)

Accredited as conformity assessment body for Japan electrical appliances and material law by METI.
(Expiry date : February 22, 2019)

6 Description of Test Setup

6.1 Test Configuration

The equipment under test (EUT) consists of :

	Item	Manufacturer	Model No.	Serial No.	FCC ID
A	Handy Terminal for Digital Picking	Sharp	DS-10HR	--	APY-BSC0003

The auxiliary equipment used for testing :

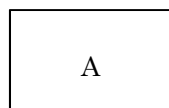
	Item	Manufacturer	Model No.	Serial No.	FCC ID
B	USB Battery Charger	RAVPOWER	RP-PC028	0JPHJF8D	N/A

Type of Cable:

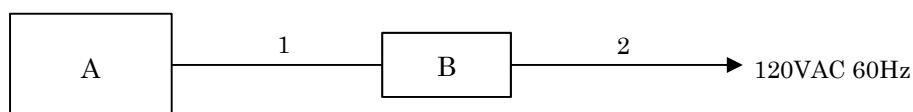
No.	Description	Identification (Manu. etc.)	Connector Shielded	Cable Shielded	Ferrite Core	Length (m)
1	USB Cable	--	YES	YES	NO	0.7
2	AC Cord	--	--	NO	NO	1.5

6.2 Test Arrangement (Drawings)

1) Battery Operation



2) USB Bus Power Operation



6.3 Operating Condition

Power Supply Voltage : 3.7 VDC (for Battery)
120 VAC 60 Hz (for USB Battery Charger)

The test were carried under 1 mode shown as follows:

1. TX modulation (Maximum Power setting)

The Radiated Emission test were carried under 1) and 2) test configurations shown in clause 6.2.

Detailed Transmitter portion:

Transmitter frequency : 13.560 MHz

Detailed Receiver portion:

Receiver frequency : 13.560 MHz

Other Clock Frequency

16MHz

The EUT was rotated through three orthogonal axis (X, Y and Z axis) in radiated measurement.

The test mode is instructed by the applicant.

Internal Test Mode

7 Test Requirements

7.0 Summary of the Test Results

Test Item	FCC Specification	Reference of the Test Report	Results	Remarks
Antenna Requirement	Section 15.203	Section 1.11	Passed	-
AC Powerline Conducted Emission	Section 15.207	Section 7.1	Passed	KDB 174176 D01
Radiated Emission	Section 15.225(a)(b)(c)(d)	Section 7.2	Passed	-
Occupied Bandwidth	Section 15.215(c)	Section 7.3	Passed	-
Frequency Stability	Section 15.225(e)	Section 7.4	Passed	-

7.1 AC Powerline Conducted Emission

For the requirements, ☒ - Applicable [☒ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.1.1 Test Results

For the standard, ☒ - Passed ☐ - Failed ☐ - Not judged

Min. Limit Margin (Quasi-Peak) 23.9 dB at 0.6585 MHz

Uncertainty of Measurement Results ± 2.6 dB(2σ)

Remarks : The temporary RF output was terminated with a dummy load in the fundamental frequency band (KDB 174176 D1 Q5).

7.1.2 Test Instruments

Measurement Room M2				
Type	Model	Serial No. (ID)	Manufacturer	Cal. Due
Test Receiver	ESU 26	100170 (A-6)	Rohde & Schwarz	2019/11/08
AMN (main)	KNW-407FR	8-2019-1 (D-103)	Kyoritsu	2019/10/18
RF Cable	RG223/U	--- (H-34)	HUBER+SUHNER	2019/06/06

NOTE : The calibration interval of the above test instruments is 12 months.

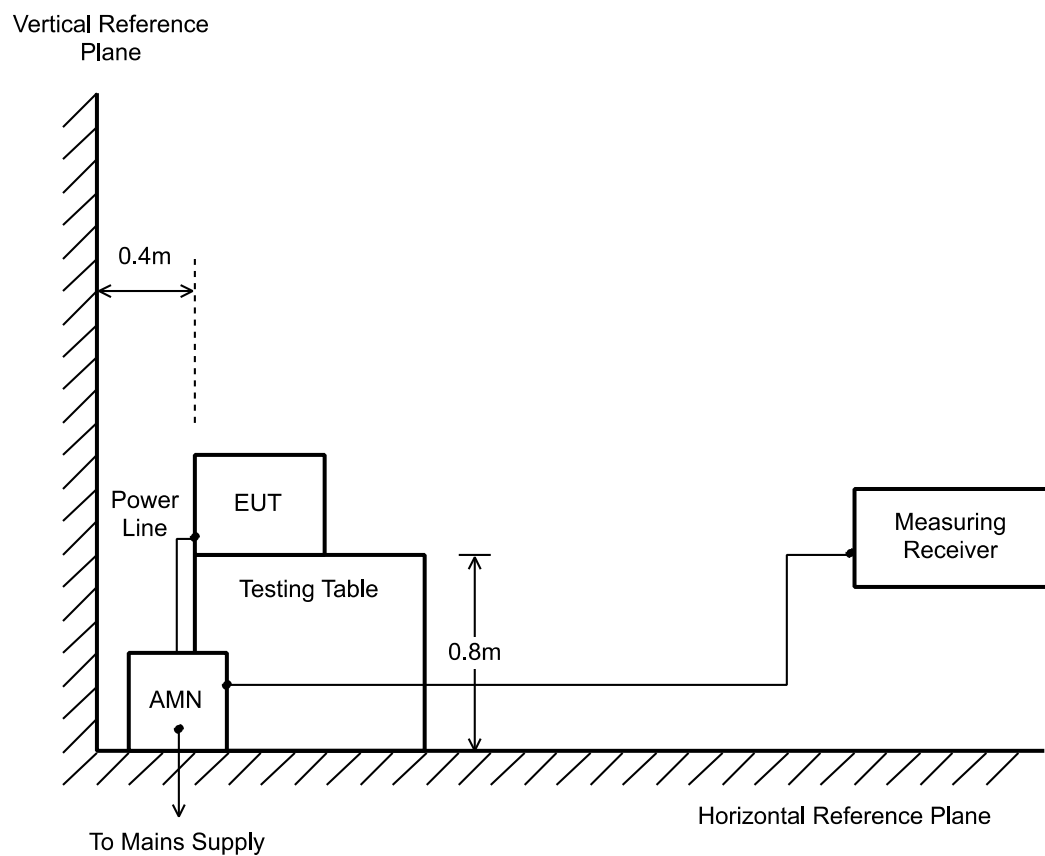
7.1.3 Test Method and Test Setup (Diagrammatic illustration)

The preliminary tests were performed using the scan mode of test receiver or spectrum analyzer to observe the emissions characteristics of the EUT.

The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emissions.

This configurations was used for final tests.

– Side View –



NOTE

AMN : Artificial Mains Network

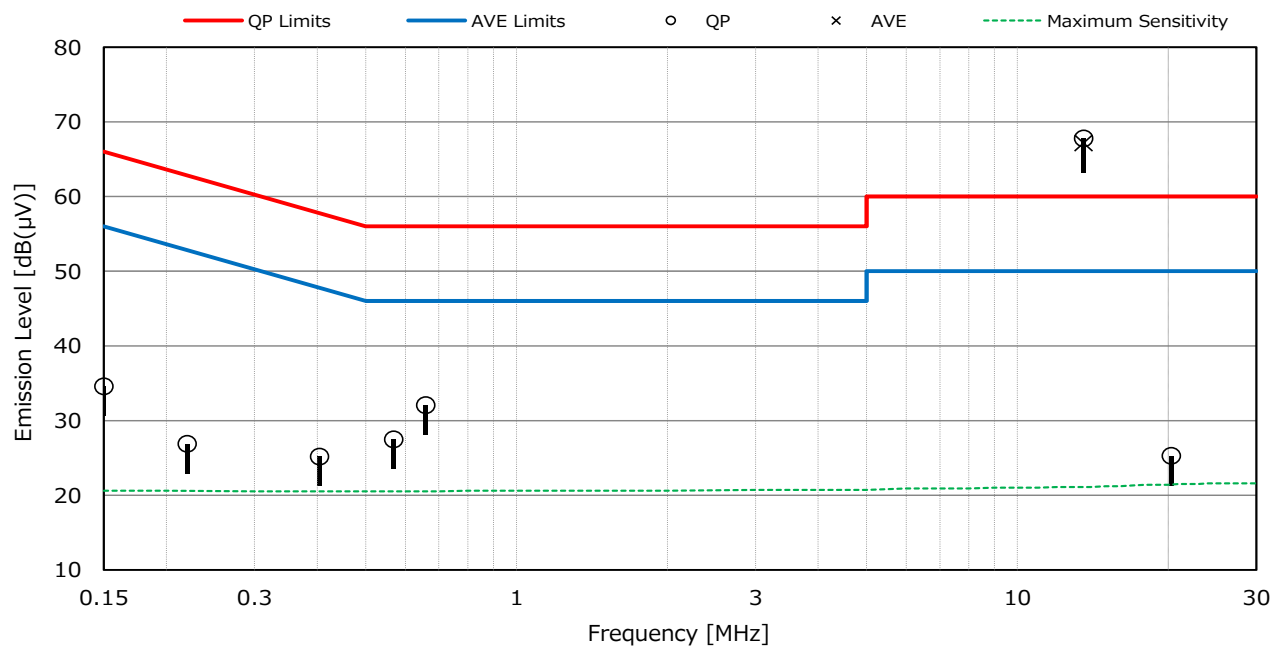
7.1.4 Test Data

Test voltage : 120VAC 60Hz**Test condition : TX(the actual antenna connected)****Measured phase : L1**

Test Date: December 4, 2018

Temp.: 21 °C, RH: 67 %, Atm.: 1000 hPa

Frequency [MHz]	Factor [dB]	Readings [dB(μV)]		Limits [dB(μV)]		Results [dB(μV)]		Margin [dB]		Remarks
		QP	AVE	QP	AVE	QP	AVE	QP	AVE	
0.1500	10.6	24.0	--	66.0	56.0	34.6	--	+ 31.4	--	-
0.2200	10.5	16.4	--	62.8	52.8	26.9	--	+ 35.9	--	-
0.4042	10.5	14.7	--	57.8	47.8	25.2	--	+ 32.6	--	-
0.5685	10.5	17.0	--	56.0	46.0	27.5	--	+ 28.5	--	-
0.6585	10.5	21.6	--	56.0	46.0	32.1	--	+ 23.9	--	-
13.5600	11.1	56.7	56.1	60.0	50.0	67.8	67.2	- 7.8	- 17.2	-
20.2700	11.5	13.8	--	60.0	50.0	25.3	--	+ 34.7	--	-



NOTES

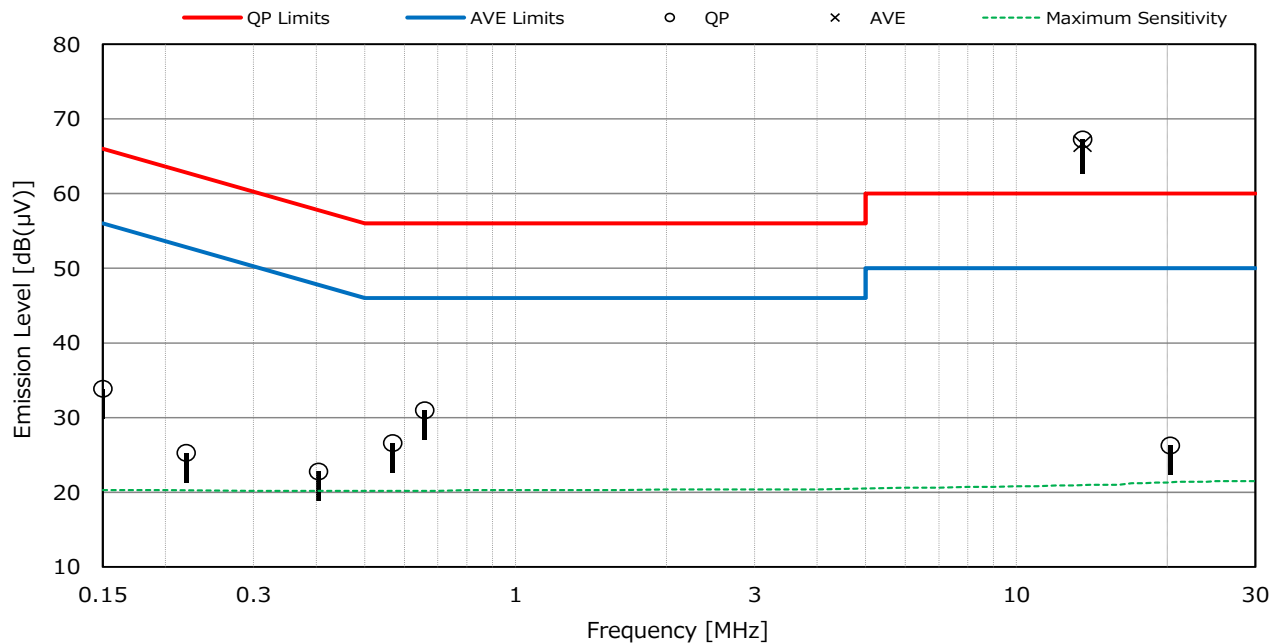
- 1) The spectrum was checked from 150 kHz to 30 MHz.
- 2) The factor includes the AMN voltage division factor and the cable loss.
- 3) The symbol of "--" means "not applicable".
- 4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = 11.1 + 56.1 = 67.2 dB(μV) at 13.5600 MHz
- 5) QP : Quasi-Peak detector, AVE : Average detector
- 6) Bandwidth : 9 kHz (150 kHz - 30 MHz)

Test voltage : 120VAC 60Hz**Test condition : TX(the actual antenna connected)****Measured phase : L2**

Test Date: December 4, 2018

Temp.: 21 °C, RH: 67 %, Atm.: 1000 hPa

Frequency [MHz]	Factor [dB]	Readings [dB(μV)]		Limits [dB(μV)]		Results [dB(μV)]		Margin [dB]		Remarks
		QP	AVE	QP	AVE	QP	AVE	QP	AVE	
0.1500	10.3	23.6	--	66.0	56.0	33.9	--	+ 32.1	--	-
0.2200	10.2	15.1	--	62.8	52.8	25.3	--	+ 37.5	--	-
0.4042	10.2	12.6	--	57.8	47.8	22.8	--	+ 35.0	--	-
0.5685	10.2	16.4	--	56.0	46.0	26.6	--	+ 29.4	--	-
0.6585	10.2	20.8	--	56.0	46.0	31.0	--	+ 25.0	--	-
13.5600	10.9	56.4	55.8	60.0	50.0	67.3	66.7	- 7.3	- 16.7	-
20.2700	11.3	15.0	--	60.0	50.0	26.3	--	+ 33.7	--	-



NOTES

- 1) The spectrum was checked from 150 kHz to 30 MHz.
- 2) The factor includes the AMN voltage division factor and the cable loss.
- 3) The symbol of "--" means "not applicable".
- 4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = 10.9 + 55.8 = 66.7 dB(μV) at 13.5600 MHz
- 5) QP : Quasi-Peak detector, AVE : Average detector
- 6) Bandwidth : 9 kHz (150 kHz - 30 MHz)

Fundamental Measurement

Test voltage : 120VAC 60Hz

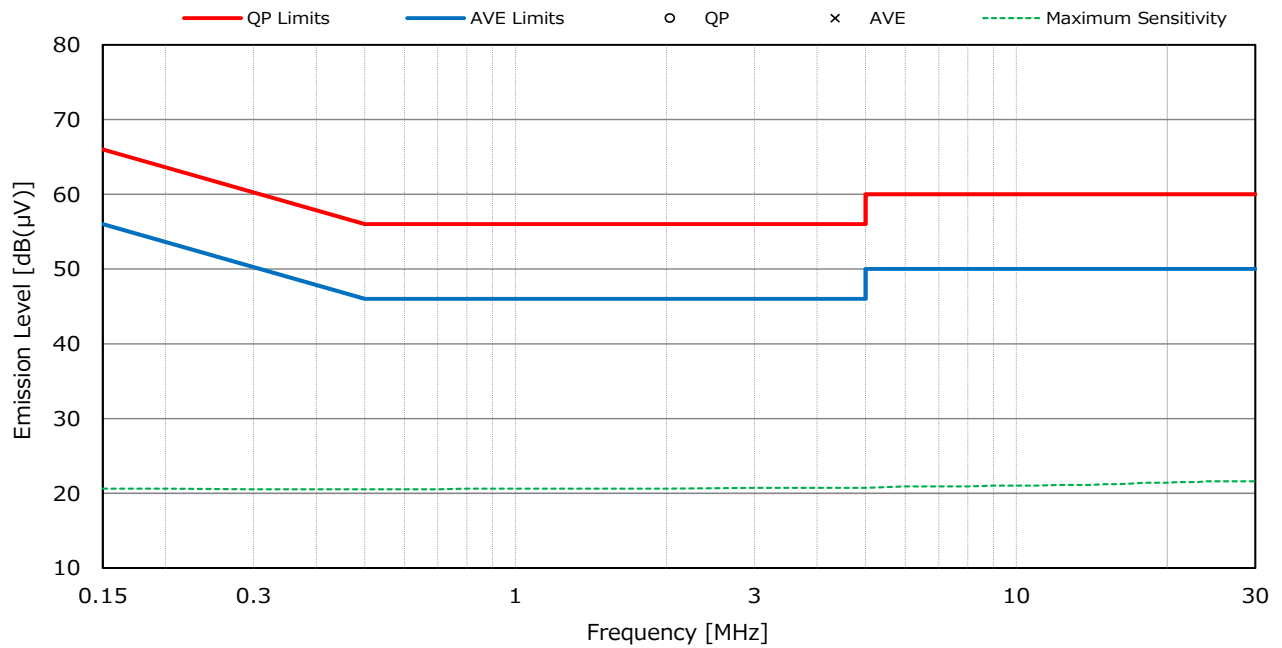
Test condition : TX(a dummy load connected)

Measured phase : L1

Test Date: December 4, 2018

Temp.: 21 °C, RH: 67 %, Atm.: 1000 hPa

Frequency [MHz]	Factor [dB]	Readings [dB(μV)]		Limits [dB(μV)]		Results [dB(μV)]		Margin [dB]		Remarks
		QP	AVE	QP	AVE	QP	AVE	QP	AVE	
13.5600	11.1	< 10.0	--	60.0	50.0	< 21.1	--	> + 38.9	--	-



NOTES

- 1) The spectrum was checked from 150 kHz to 30 MHz.
- 2) QP : Quasi-Peak detector, AVE : Average detector
- 3) Bandwidth : 9 kHz (150 kHz - 30 MHz)
- 4) All emission levels were below the noise floor, or more than 15 dB below the applied limits.

Test voltage : 120VAC 60Hz

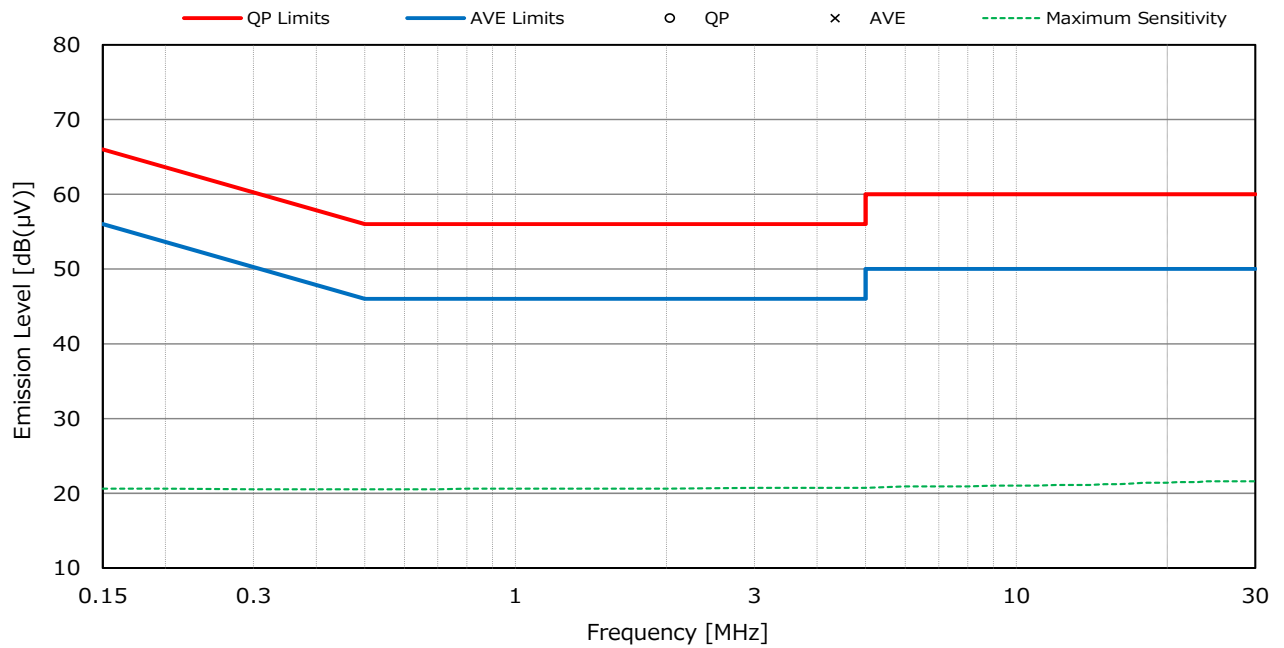
Test condition : TX(a dummy load connected)

Measured phase : L2

Test Date: December 4, 2018

Temp.: 21 °C, RH: 67 %, Atm.: 1000 hPa

Frequency [MHz]	Factor [dB]	Readings [dB(μV)]		Limits [dB(μV)]		Results [dB(μV)]		Margin [dB]		Remarks
		QP	AVE	QP	AVE	QP	AVE	QP	AVE	
13.5600	11.1	< 10.0	--	60.0	50.0	< 21.1	--	> + 38.9	--	-



NOTES

- 1) The spectrum was checked from 150 kHz to 30 MHz.
- 2) QP : Quasi-Peak detector, AVE : Average detector
- 3) Bandwidth : 9 kHz (150 kHz - 30 MHz)
- 4) All emission levels were below the noise floor, or more than 15 dB below the applied limits.

7.2 Radiated Emission

For the requirements, ☒ - Applicable [☒ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.2.1 Test Results

7.2.1.1 Radiated Emission (§15.225(a)(b)(c))

For the standard, ☒ - Passed ☐ - Failed ☐ - Not judged

Min. Limit Margin (§15.225(a)) (Quasi-Peak)	<u>71.7</u>	dB	at	<u>13.560</u>	MHz
Min. Limit Margin (§15.225(b)) (Quasi-Peak)	<u>52.0</u>	dB	at	<u>13.567</u>	MHz
Min. Limit Margin (§15.225(c)) (Quasi-Peak)	<u>>51.4</u>	dB	at	<u>13.41/13.71</u>	MHz

Uncertainty of Measurement Results 9 kHz – 30 MHz ± 3.0 dB(2 σ)

Remarks : The Radited Emission at 30m of 13.560 MHz is 12.3 dB(uV/m). Y axis position. Antenna Orientation: parallel. The emission mask (§15.225(a), (b) and (c)) complies with the limits.

7.2.1.2 Radiated Emission (§15.225(d))

For the standard, ☒ - Passed ☐ - Failed ☐ - Not judged

Min. Limit Margin (Quasi-Peak)	<u>5.7</u>	dB	at	<u>41.34</u>	MHz
--------------------------------	------------	----	----	--------------	-----

Uncertainty of Measurement Results	9 kHz – 30 MHz	<u>± 3.0</u>	dB(2 σ)
	30 MHz – 200 MHz	<u>± 3.6</u>	dB(2 σ)
	200 MHz – 1000 MHz	<u>± 5.2</u>	dB(2 σ)

Remarks : X axis position.

7.2.2 Test Instruments

Anechoic Chamber A2				
Type	Model	Serial No. (ID)	Manufacturer	Cal. Due
Test Receiver	ESU 26	100170 (A-6)	Rohde & Schwarz	2019/11/08
Loop Antenna	HFH2-Z2	860605/030 (C-3)	Rohde & Schwarz	2019/08/02
RF Cable	RG213/U	--- (H-29)	HUBER+SUHNER	2019/08/02
Biconical Antenna	VHA9103/BBA9106	2355 (C-30)	Schwarzbeck	2019/05/30
Log-periodic Antenna	VULP9118B	870 (C-25)	Schwarzbeck	2019/11/14
RF Cable	S 10162 B-11 etc.	--- (H-4)	HUBER+SUHNER	2019/04/01

NOTE : The calibration interval of the above test instruments is 12 months.

7.2.3 Test Method and Test Setup (Diagrammatic illustration)

7.2.3.1 Radiated Emission 9 kHz – 30 MHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.

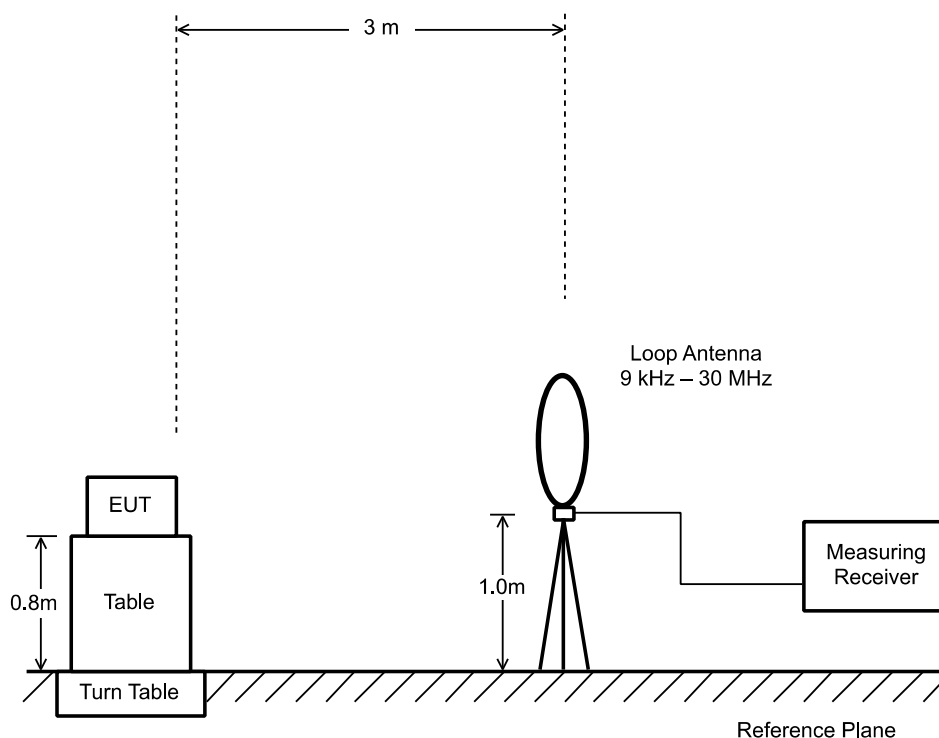
The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.

The measurement were performed about three antenna orientations (parallel, perpendicular, and ground-parallel).

According to KDB 414788, a used anechoic chamber were equivalent to those on an open fields site based on comparison measurements.

This configurations was used for the final tests.

– Side View –



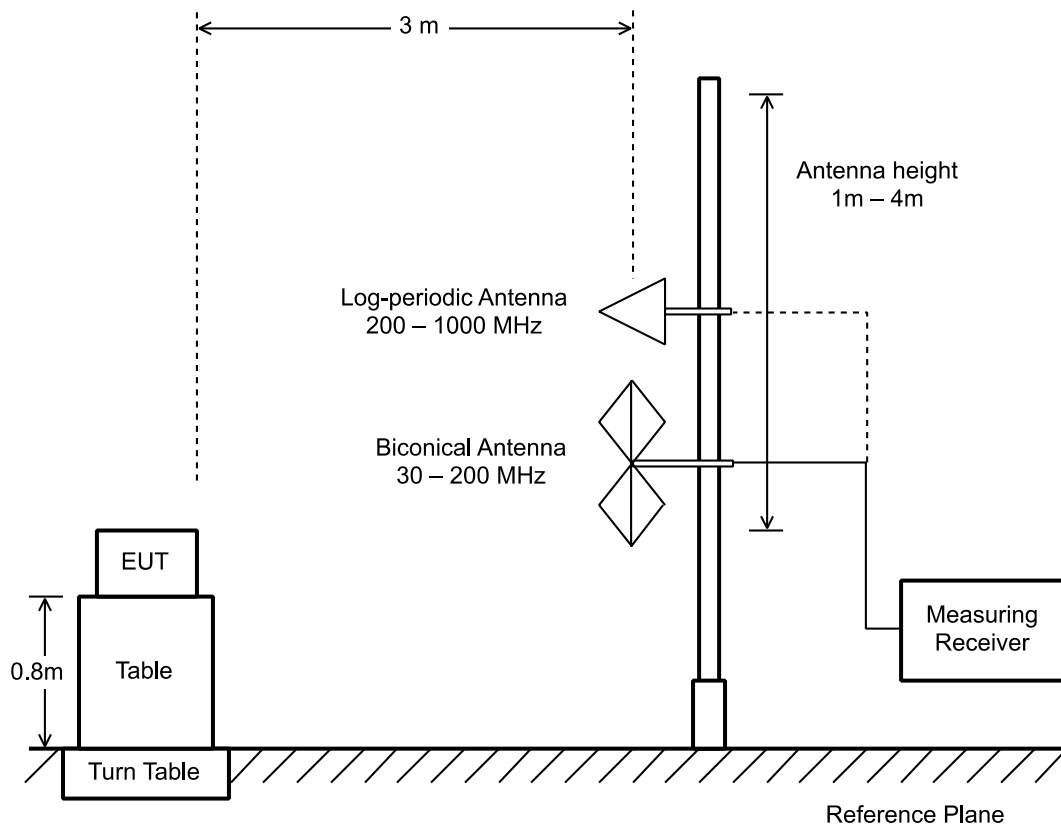
7.2.3.2 Radiated Emission 30 MHz – 1000 MHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.

The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.

This configurations was used for the final tests.

– Side View –



7.2.4 Test Data

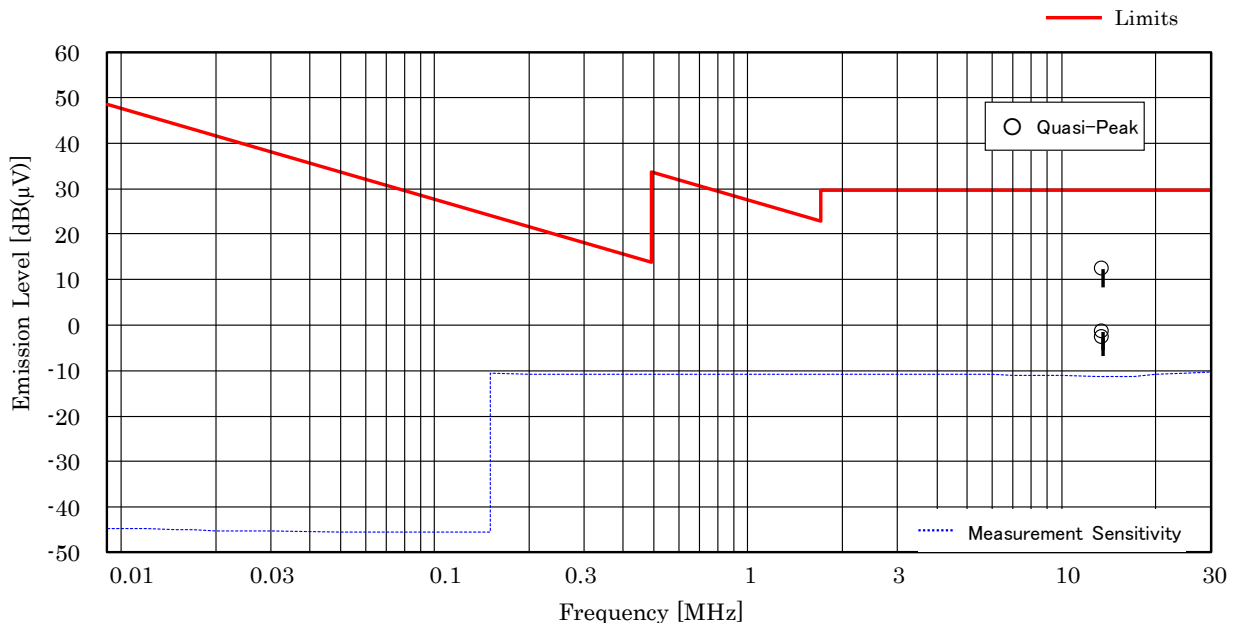
7.2.4.1 Radiated Emission (§15.225(a)(b)(c) & §15.209(a))

Test Date: November 29, 2018

Temp.: 19 °C. Humi: 53 %

Test condition : TX:Battery Operation(worst case)

Frequency [MHz]	Correction Factor [dB(1/m)]	Meter Readings at 3 m [dB(μV)]	Limits [dB(μV/m)]	Specified Distance [m]	Extrapolated Results [dB(μV/m)]	Margin [dB]	Remarks
13.410	19.1	< 10.0	40.5	30.0	< -10.9	> +51.4	-
13.553	19.1	18.1	50.5	30.0	- 2.8	+53.3	-
13.560	19.1	33.2	84.0	30.0	12.3	+71.7	-
13.567	19.1	19.4	50.5	30.0	- 1.5	+52.0	-
13.710	19.1	< 10.0	40.5	30.0	< -10.9	> +51.4	-
27.120	20.2	< 10.0	29.5	30.0	< - 9.8	> +39.3	-



NOTES

1. Test Distance : 3 m
2. The spectrum was checked from 9 kHz to 30 MHz.
3. The correction factor includes the antenna factor and the cable loss.
4. The symbol of "<" means "or less".
5. The symbol of ">" means "more than".
6. The testing loop antenna was rotated at the vertical and horizontal axis to maximize received emissions.
The above Meter Reading was maximum emission level.

7. Calculation:

For fundamental, the measured field strength was extrapolated to distance 30m, using the formula that field strength using the formula that field strength aries as the inverse distance square(40 dB per decade of distance).

Fundamental : Correction Factor + Meter Reading = 19.1 + 33.2 = 52.3 dB(μV/m)

Result at 30 m = -40 + 52.3 = 12.3 dB(μV/m) (Conversion Factor : 40dB/decade)

Limits for 13.553-13.567MHz(§15.225(a)) = 20log10(15848) = 84.0 dBμV/m

Limits for 13.410-13.553,13.567-13.710MHz(§15.225(b)) = 20log10(334) = 50.5 dBμV/m

Limits for 13.110-13.410,13.710-14.010MHz (§15.225(c)) = 20log10(106) = 40.5 dBμV/m

Harmonics : Correction Factor + Meter Reading = 20.2 + <10.0 = <30.2 dB(μV/m)

Result at 30 m = -40 + <30.2 = <-9.8 dB(μV/m) (Conversion Factor : 40dB/decade)

Limits for Harmonics(§15.209(a)) = 20log10(30) = 29.5 dBμV/m

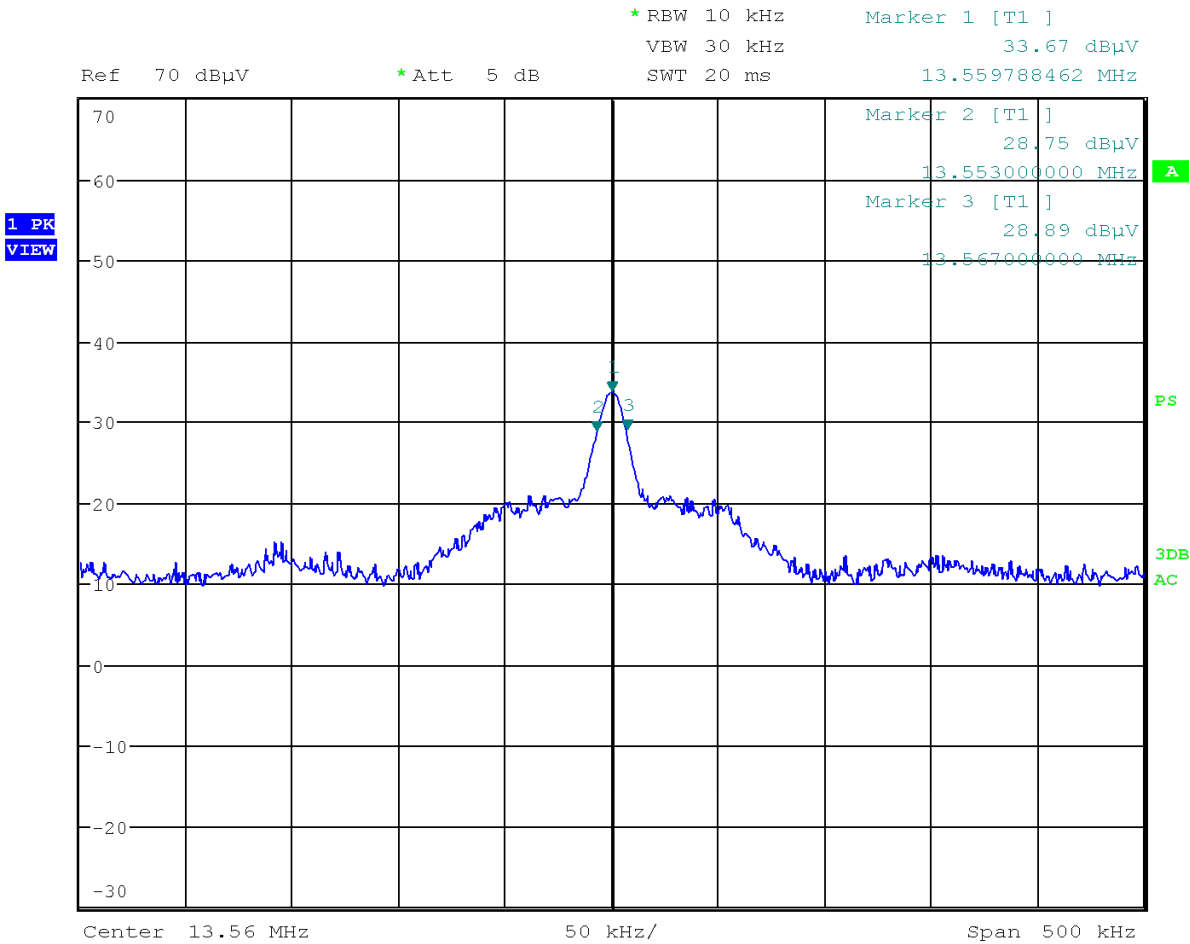
7. Test receiver setting(s) :

Quasi-Peak Detector IF Bandwidth: 9kHz or 200Hz(Except for 9 kHz -90 kHz, 110 kHz -490 kHz)

Average Detector, IF Bandwidth: 9kHz or 200Hz(9 kHz -90 kHz, 110 kHz -490 kHz)

Emission Mask (§15.225(a)(b)(c))

Because the fundamental level is low, the level complies with §15.225(a), (b) and (c) limits for the level.



Fundamental Emission (Detector: Peak)

7.2.4.2 Radiated Emission (§15.209(a))(30MHz – 1000MHz)

Test voltage : 120VAC 60Hz

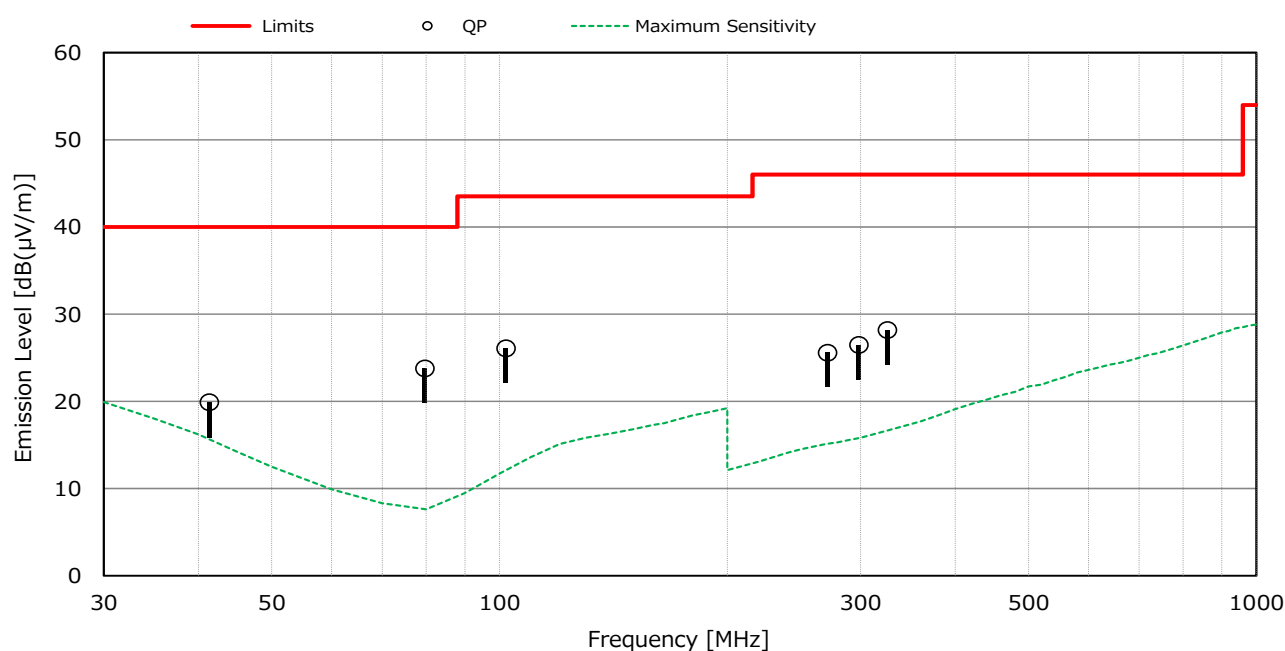
Test condition : TX: USB Bus Power Operation (worst case)

Antenna polarization : Horizontal

Test Date: December 4, 2018

Temp.: 21 °C, RH: 67 %, Atm.: 1000 hPa

Frequency	Factor	Readings	Limits	Results	Margin	Remarks
[MHz]	[dB]	[dB(μV)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	
41.340	15.6	4.3	40.0	19.9	+ 20.1	-
79.688	7.6	16.2	40.0	23.8	+ 16.2	-
101.973	12.1	14.0	43.5	26.1	+ 17.4	-
271.200	15.1	10.5	46.0	25.6	+ 20.4	-
298.320	15.8	10.7	46.0	26.5	+ 19.5	-
325.440	16.7	11.5	46.0	28.2	+ 17.8	-



NOTES

- 1) Measurement Distance : 3 m
- 2) The spectrum was checked from 30 MHz to 1000 MHz.
- 3) The factor includes the antenna factor and the cable loss.
- 4) Calculated result as the worst point shown on underline :
Factor + Reading (QP) = 7.6 + 16.2 = 23.8 dB(μV) at 79.688 MHz
Antenna Height : 228 cm, Turntable Rotation Position : 64 °
- 5) QP : Quasi-Peak detector
- 6) Bandwidth : 120 kHz (30 MHz - 1000 MHz)

Test voltage : 120VAC 60Hz

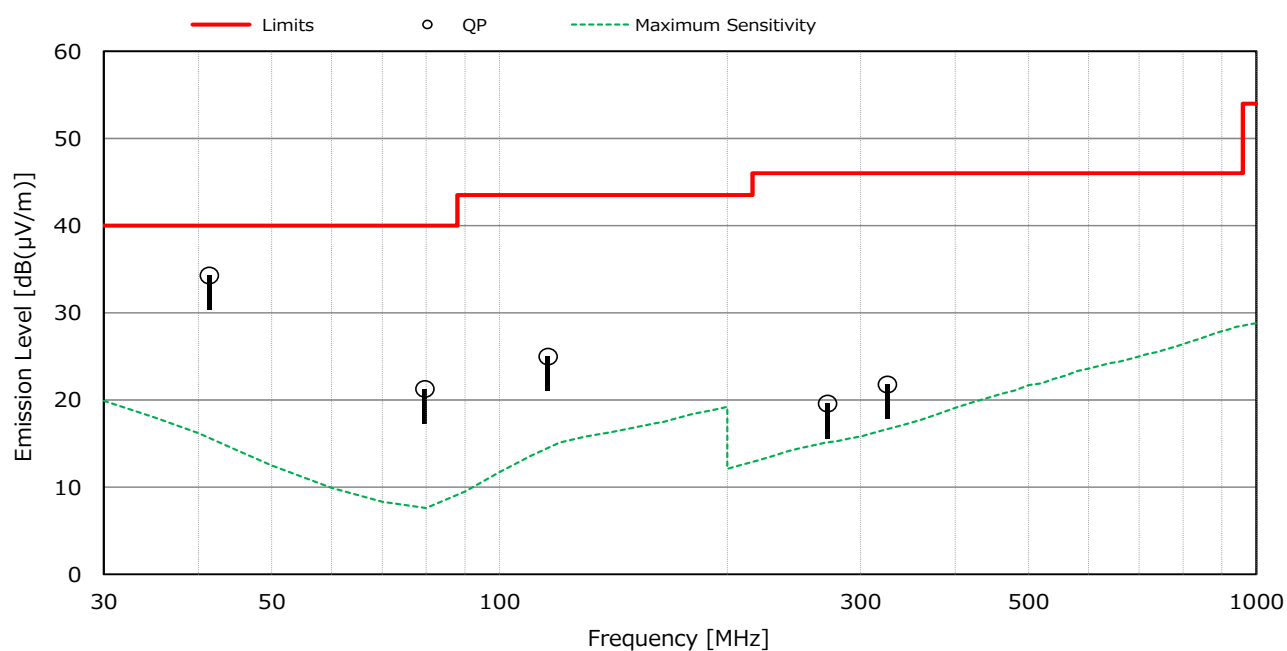
Test condition : TX: USB Bus Power Operation (worst case)

Antenna polarization : Vertical

Test Date: December 4, 2018

Temp.: 21 °C, RH: 67 %, Atm.: 1000 hPa

Frequency	Factor	Readings	Limits	Results	Margin	Remarks
[MHz]	[dB]	[dB(μV)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	
41.340	15.6	18.7	40.0	34.3	+ 5.7	-
79.688	7.6	13.7	40.0	21.3	+ 18.7	-
115.848	14.5	10.5	43.5	25.0	+ 18.5	-
271.200	15.1	4.5	46.0	19.6	+ 26.4	-
325.440	16.7	5.1	46.0	21.8	+ 24.2	-



NOTES

- 1) Measurement Distance : 3 m
- 2) The spectrum was checked from 30 MHz to 1000 MHz.
- 3) The factor includes the antenna factor and the cable loss.
- 4) Calculated result as the worst point shown on underline :
Factor + Reading (QP) = 15.6 + 18.7 = 34.3 dB(μV) at 41.340 MHz
Antenna Height : 100 cm, Turntable Rotation Position : 113 °
- 5) QP : Quasi-Peak detector
- 6) Bandwidth : 120 kHz (30 MHz - 1000 MHz)

7.3 Occupied Bandwidth

For the requirements, ☒ - Applicable [☒ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.3.1 Test Results

For the standard, ☒ - Passed ☐ - Failed ☐ - Not judged

Uncertainty of Measurement Results ± 0.9 %(2 σ)

Remarks : _____

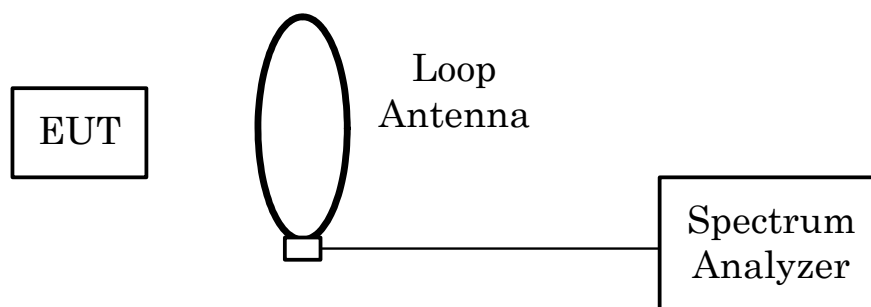
7.3.2 Test Instruments

Shielded Room S4				
Type	Model	Serial No. (ID)	Manufacturer	Cal. Due
Spectrum Analyzer	E4446A	US44300388 (A-39)	Agilent	2019/03/27
Loop Antenna	LU-100A	--- (C-33)	TEXIO	N/A

NOTE : The calibration interval of the above test instruments is 12 months.

7.3.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

Res. Bandwidth	3 kHz
Video Bandwidth	9.1 kHz
Span	300 kHz
Sweep Time	AUTO
Trace	Maxhold

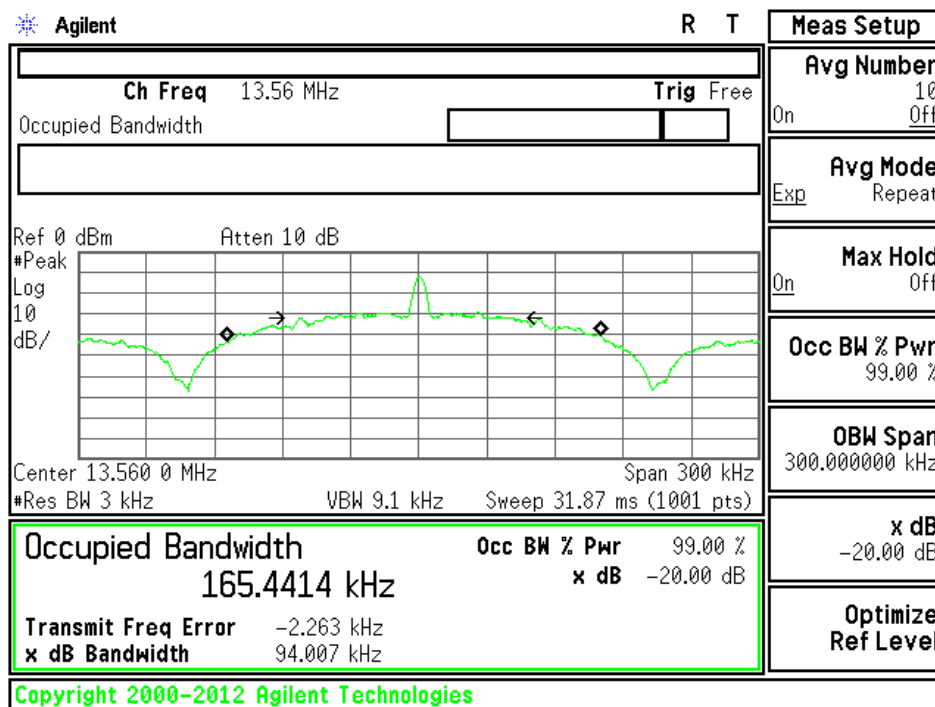
7.3.4 Test Data

Test Date :December 5, 2018

Temp.:24°C, Humi.:49%, Atm.: 1006hPa

Test Mode : TX

Frequency (MHz)	-20dBc Bandwidth (kHz)
13.56	94.01



7.4 Frequency Stability

For the requirements, ☒ - Applicable [☒ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.4.1 Test Results

For the standard, ☒ - Passed ☐ - Failed ☐ - Not judged

The Frequency Stability level is +0.001527 % at 13.560 MHz

Min. Limit Margin +0.008473 % at 13.560 MHz

Uncertainty of Measurement Results ± 1.3 ppm(2σ)

Remarks : _____

7.4.2 Test Instruments

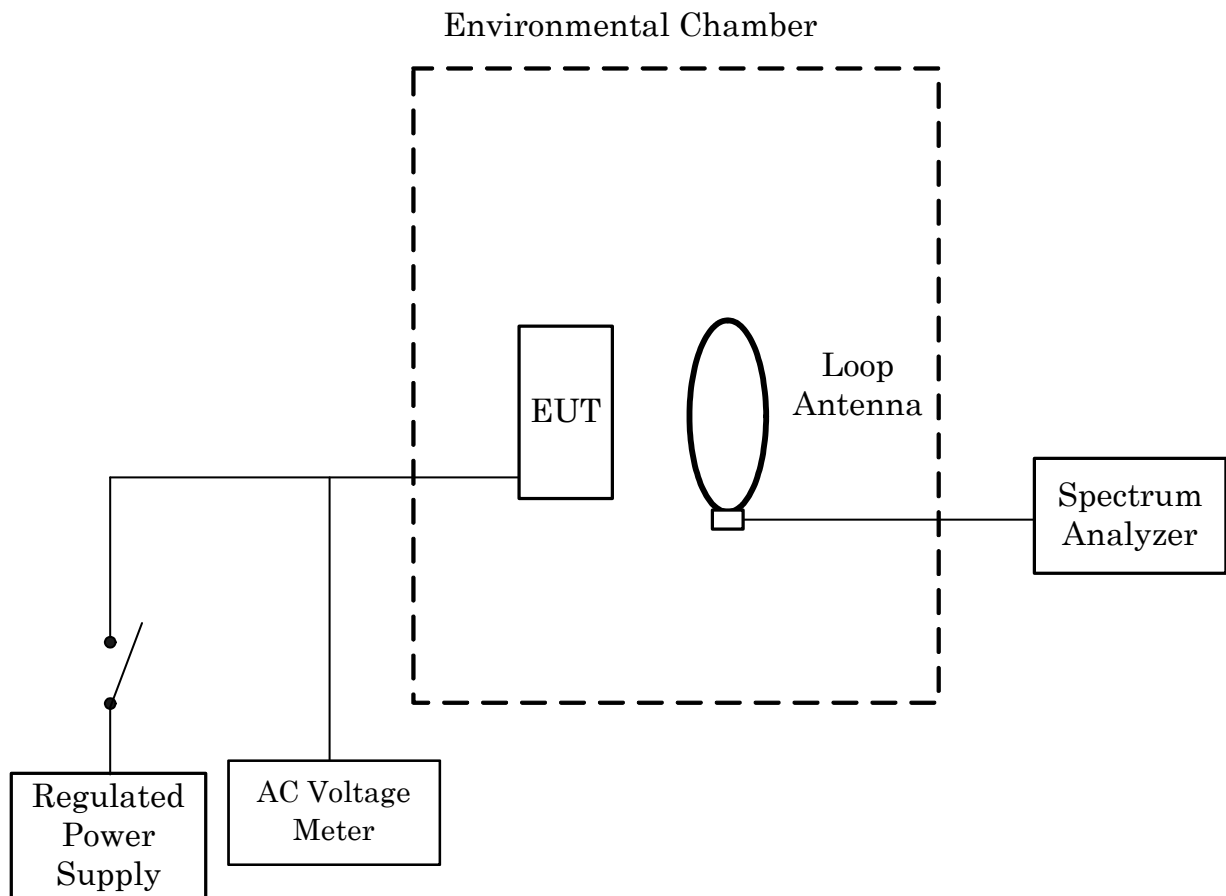
Shielded Room S4				
Type	Model	Serial No. (ID)	Manufacturer	Cal. Due
Spectrum Analyzer	E4446A	US44300388 (A-39)	Agilent	2019/03/27
Loop Antenna	LU-100A	--- (C-33)	TEXIO	N/A
Environmental Test Chamber	SH-641	92010990 (F-32)	ESPEC	2019/08/23
Digital MultiMeter	CD772	07125007747 (F-51)	SANWA ELECTRIC	2019/04/03
CVCF Power Supply	ES2000S	9123839 (F-82)	NF	N/A

NOTE : The calibration interval of the above test instruments is 12 months.

7.4.3 Test Method and Test Setup (Diagrammatic illustration)

Frequency Stability versus Temperature

The EUT was placed in an environmental chamber and was tested in the range from -20 to $+50$ degrees Celsius. The EUT was stabilized at each temperature. The power supplied was applied to the transmitter and allowed to stabilize for 10 minutes. The transmitting frequency was measured at startup and 2 minutes, 5 minutes and 10 minutes after startup. This procedure was repeated from -20 , $+20$ and $+50$ degrees Celsius.



7.4.4 Test Data

Test condition: TX: USB Bus Power Operation (worst case)

Test Date: December 5, 2018

Transmitting Frequency : 13.560 MHz

AC Supply Voltage : 120 VAC

Power Supply [VAC]	Ambient Temperature [°C]	Startup	Frequency with time elapse[MHz]		
			2 minutes	5 minutes	10 minutes
120	-20	13.560130	13.560149	13.560175	13.560180
102	20	13.560207	13.560199	13.560196	13.560195
120	20	13.560205	13.560199	13.560196	13.560194
138	20	13.560207	13.560199	13.560196	13.560195
120	50	13.560163	13.560163	13.560163	13.560163

Power Supply [VAC]	Ambient Temperature [°C]	Startup	Diviation with time elapse[%]			Limits [%]	Margin [%]
			2 minutes	5 minutes	10 minutes		
120	-20	+ 0.000959	+ 0.001099	+ 0.001291	+ 0.001327	0.01	+ 0.008673
102	20	+ 0.001527	+ 0.001468	+ 0.001445	+ 0.001438	0.01	+ 0.008473
120	20	+ 0.001512	+ 0.001468	+ 0.001445	+ 0.001431	0.01	+ 0.008488
138	20	+ 0.001527	+ 0.001468	+ 0.001445	+ 0.001438	0.01	+ 0.008473
120	50	+ 0.001202	+ 0.001202	+ 0.001202	+ 0.001202	0.01	+ 0.008798

Sample of calculated result at 13.560 MHz, as the Minimum Margin point:

Ambient Temperature : 20 °C / Startup

AC Supply Voltage 102/138 VAC

Minimum Margin: $0.010000 - 0.001527 = 0.008473$ (%)

The point shown on “**_____**” is the Minimum Margin Point. The Maximum Deviation Point is shown on a thick letter.

Note: The measurement were made after all of components of the oscillator sufficiently stabilized at each temperature.