

TEST REPORT

Applicant : B&PLUS K.K.
Address : 2452-5 Koya Ogawa-machi Hiki-gun Saitama Japan
Products : 5bit RFID Reader
Model No. : Z5-EA05P-FCC-02
FCC ID : 2AT4D-Z5EA05PFCC02
Serial No. : -
Test Standard : CFR 47 FCC Rules and Regulations Part 15
Test Results : **Passed**
Date of Test : April 8 ~ 10, 2020



A handwritten signature in black ink, reading 'K. Makimoto', written over a horizontal line.

Makimoto Kazuyuki

Manager

Japan Quality Assurance Organization
SAFETY & EMC CENTER

Testing Dept.

EMC Testing Div.

4-4-4, Minamiosawa, Hachioji-shi, Tokyo 192-0364, 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.
 - The contents of this test report cannot be used for the purposes, such as advertisement for consumers.
 - This test report shall not be reproduced except in full without the written approval of JQA.
 - 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” means Equipment Under the Test.

“AE” means Associated Equipment.

“N/A” means that Not Applicable.

“N/T” means that 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

The following contents such as identification information in this clause were provided by the applicant, if the information is difference, it can affect the validity of results.

- | | | |
|----|-------------------------------------|---|
| 1 | Manufacturer | : B&PLUS K.K.
2452-5 Koya Ogawa-machi Hiki-gun Saitama Japan |
| 2 | Products | : 5bit RFID Reader |
| 3 | Model No. | : Z5-EA05P-FCC-02 |
| | Derivative model | : Z5-EA05BKP-FCC-02
The only difference is the color of the housing. |
| 4 | Serial No. | : - |
| 5 | Product Type | : Mass Production |
| 6 | Date of Manufacture | : - |
| 7 | Power Rating | : 24 VDC |
| 8 | Grounding | : None |
| 9 | Transmitting Frequency | : 13.56 MHz |
| 10 | Receiving Frequency | : 13.56 MHz |
| 11 | Modulation | : ASK |
| 12 | Antenna Type | : Internal Antenna |
| 13 | Operating Temperature
/ Humidity | : 0 ~ 50 degree/ 30 ~ 90%RH |
| 14 | EUT Authorization | : Certification |
| 15 | Received Date of EUT | : April 7, 2020 |

<EUT Description>

The EUT is an ID system that reads 5bit data, this Read-Only system needs no particular program to read data, for the Reader reads data of a Data carrier automatically when the Data carrier come into the reading area of the reader. The 5bit system uses the ISO 15693 compliant ID tag and occupies the first 3 bytes (00, 01, 02 address) of the tag memory as the data area.

2 Summary of Test Results

Applied Standard : CFR 47 FCC Rules and Regulations Part 15

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:



Makimoto Kazuyuki
Manager
SAFETY & EMC CENTER
Testing Dept.
EMC Testing Div.



Naohiko Ueno
Assistant Manager
SAFETY & EMC CENTER
Testing Dept.
EMC Testing Div.

3 Test Procedure

Test Requirements: §15.225, §15.207 and §15.209

Test Procedure : ANSI C63.10–2013
Testing unlicensed wireless devices.
KDB937606 (Publication Date: October 10, 2014)
Test Site Requirements for Part 15 and 18 Devices Operating Below 30MHz.

4 Test Location

Japan Quality Assurance Organization
SAFETY & EMC CENTER
Testing Dept.
EMC Testing Div.
4-4-4, Minamiosawa, Hachioji-shi, Tokyo 192-0364, Japan

5 Recognition of Test Laboratory

Japan Quality Assurance Organization, Safety & EMC Center Testing Dept. EMC Testing Div.
is accredited under ISO/IEC 17025 by following accreditation bodies and the test facility of Testing
Division is registered by the following bodies .

VLAC Code : VLAC-001-5 (Effective through : March 30, 2022)
VCCI Registration Number : A-0001 (Effective through : March 30, 2022)
FCC Registration Number : 349652 (Effective through : March 30, 2022)

Accredited as conformity assessment body for Japan electrical appliances and material law
by METI. (Effective through : February 22, 2022)

6 Description of Test Setup

The following contents such as identification information in this clause were provided by the applicant.

6.1 Test Configuration

The EUT consists of :

Sign	Item	Manufacturer	Model No.	Serial No.	FCC ID
A	5bit RFID Reader	B&PLUS K.K.	Z5-EA05P-FCC-02	-	2AT4D-Z5EA05P FCC02

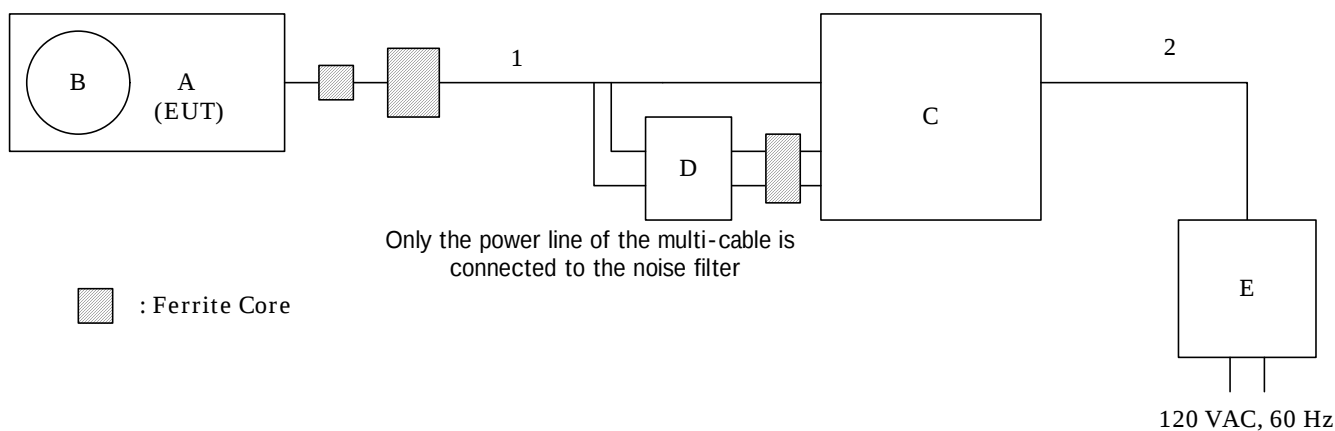
The AE used for testing :

Sign	Item	Manufacturer	Model No.	Serial No.
B	RFID tag	B&PLUS K.K.	Z1-EA02	-
C	Power supply Board	B&PLUS K.K.	PCB-30/60X70DEM	-
D	EMC Noise Filter	TDK	RSEL-2001W	-
E	AC Adapter	GO FORWARD ENTERPRISE CORP.	GF12-US2405	-

Type of Cable used for testing :

No.	Description	Identification (Manu. Etc.)	Connector Shielded	Cable Shielded	Ferrite Core	Length (m)
1	Connection Cable	-	No	No	Yes	2.0
2	DC Power Cable	-	No	No	No	1.6

6.2 Test Arrangement (Drawings)



6.3 Operating Condition

Power Supply Voltage : 24 VDC

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

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

The test mode is instructed by the applicant.

RFID tag continuous transmission / reception mode

7 Test Requirements

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	-
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

7.1.1 Test Results

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

Min. Limit Margin (Quasi-Peak) 6.1 dB at 13.56 MHz

Min. Limit Margin (Average) 1.4 dB at 13.56 MHz

Uncertainty of Measurement Results ± 2.9 dB(2σ)

Remarks : The measurement results is within the range of measurement uncertainty.

7.1.2 Test Instruments

ID No.	Type	Model No.	Manufacturer	Serial No.	Last Cal.	Interval
M-1	Shield Room	-	TDK	-	-	-
R04	Test Receiver	ESW44	Rohde & Schwarz	101602	2019/11	1 Year
CB03	RF Cable	RG223/U	Suhner	-	2019/10	1 Year
L03	LISN	KNW-407	Kyoritsu	8-1130-6	2019/10	1 Year
PL02	Pulse Limiter	ESH3-Z2	Rohde & Schwarz	-	2020/04	1 Year
F02	High Pass Filter	KFL-009	Kyoritsu	8-2072-5	2020/04	1 Year

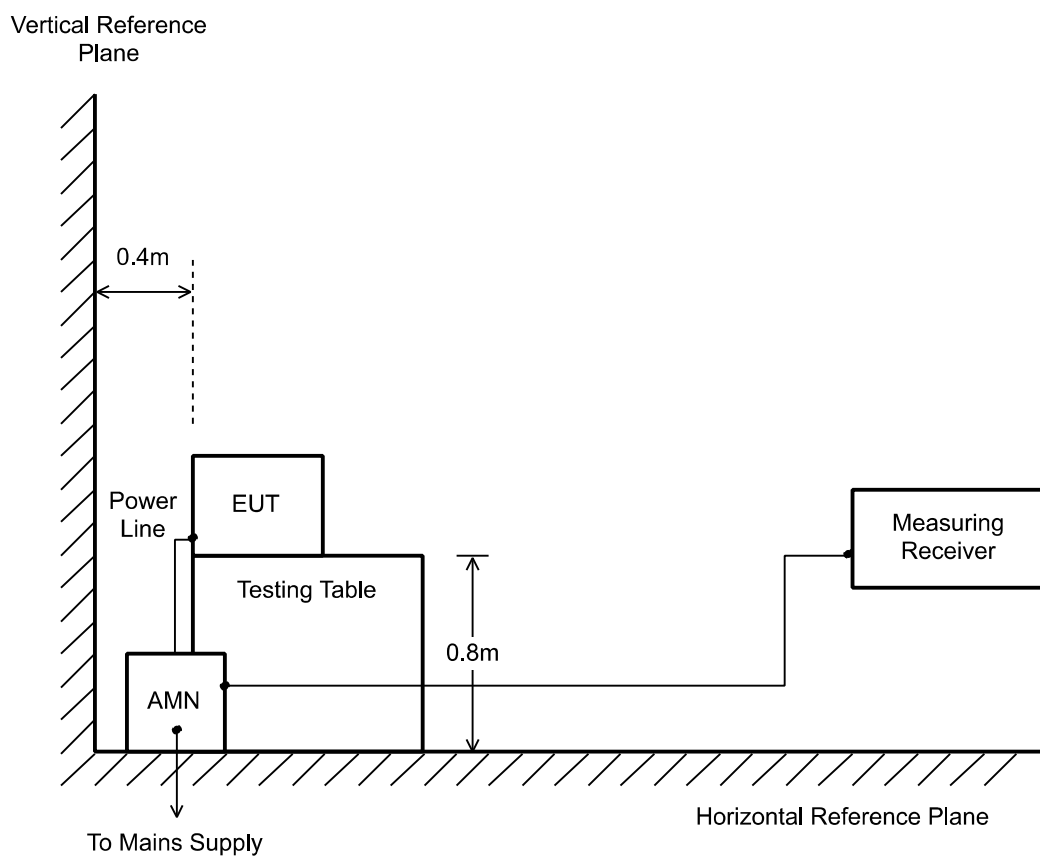
7.1.3 Test Method and Test Setup (Diagrammatic illustration)

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 –

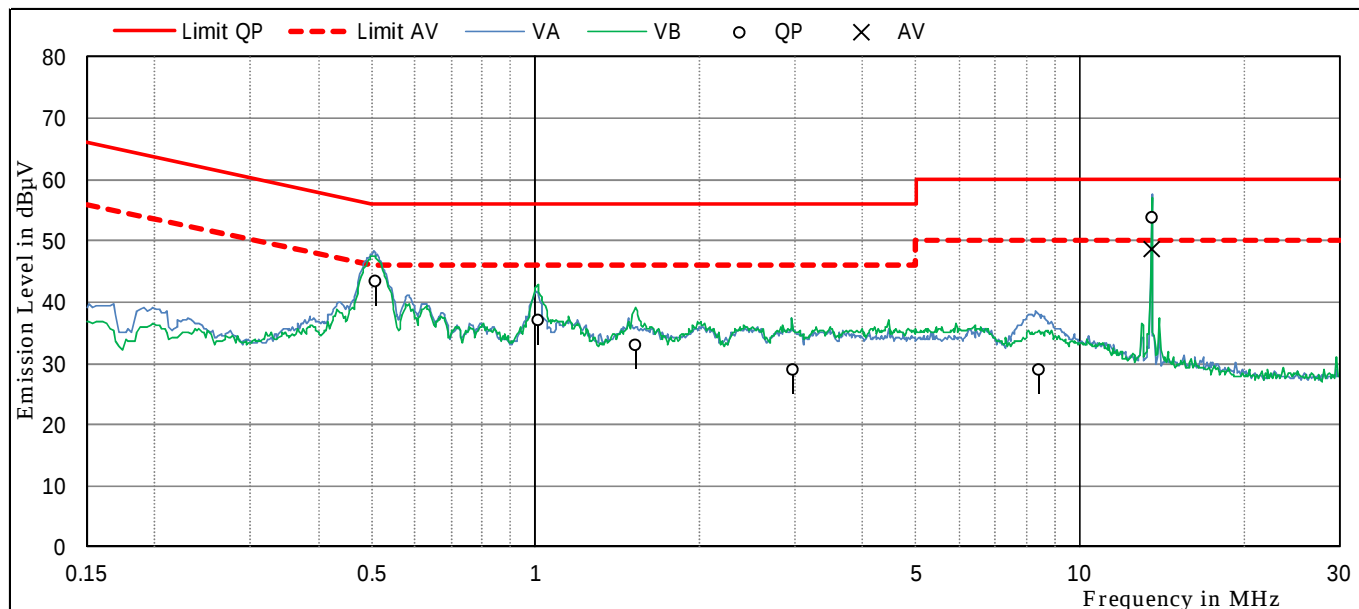


NOTE

AMN : Artificial Mains Network

7.1.4 Test Data

Measurement Date	Ambient Temperature	Relative Humidity	Atmospheric pressure
April 8, 2020	23	38 %	1005 hPa



Frequency [MHz]	Terminal	Factor [dB]	Meter Reading [dBμV]		Limit [dBμV]		Emission Level [dBμV]		Margin [dB]	
			QP	AV	QP	AV	QP	AV	QP	AV
0.51	VA	20.1	23.3	-	56.0	46.0	43.4	-	12.6	-
0.51	VB	20.1	23.3	-	56.0	46.0	43.4	-	12.6	-
1.01	VA	20.0	14.5	-	56.0	46.0	34.5	-	21.5	-
1.01	VB	20.0	17.0	-	56.0	46.0	37.0	-	19.0	-
1.53	VA	20.0	8.9	-	56.0	46.0	28.9	-	27.1	-
1.53	VB	20.0	13.1	-	56.0	46.0	33.1	-	22.9	-
2.97	VA	20.1	7.7	-	56.0	46.0	27.8	-	28.2	-
2.97	VB	20.1	8.9	-	56.0	46.0	29.0	-	27.0	-
8.43	VA	20.3	8.6	-	60.0	50.0	28.9	-	31.1	-
8.43	VB	20.3	7.8	-	60.0	50.0	28.1	-	31.9	-
13.56	VA	20.5	33.4	27.1	60.0	50.0	53.9	47.6	6.1	2.4
13.56	VB	20.5	32.4	28.1	60.0	50.0	52.9	48.6	7.1	1.4

Note

- 1) QP:Quasi-Peak, AV:Average
- 2) VA:One end & Ground, VB:Other end & Ground
- 3) The symbol of '<' means 'or less'.
- 4) The symbol of '>' means 'or greater'.
- 5) The symbol of '-' means 'Not applicable'.
- 6) Factor includes Artificial Mains Network factor, Hi-Pass Filter loss, Pulse Limiter loss and a cable loss.
- 7) A sample calculation was made at 13.56MHz
Factor + Meter Reading = 20.5 + 32.4 = 52.9

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>78.5</u>	dB	at	<u>13.560</u>	MHz
Min. Limit Margin (§15.225(b)) (Quasi-Peak)	<u>>60.3</u>	dB	at	<u>13.567</u>	MHz
Min. Limit Margin (§15.225(c)) (Quasi-Peak)	<u>51.4</u>	dB	at	<u>13.410</u>	MHz

Uncertainty of Measurement Results 9 kHz – 30 MHz ± 2.5 dB(2σ)

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>4.2</u>	dB	at	<u>420.4</u>	MHz
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Uncertainty of Measurement Results 9 kHz – 30 MHz ± 2.5 dB(2σ)
 30 MHz – 200 MHz ± 4.5 dB(2σ)
 200 MHz – 1000 MHz ± 4.5 dB(2σ)

Remarks : X axis position. The measurement results is within the range of measurement uncertainty.

7.2.2 Test Instruments

ID No.	Type	Model No.	Manufacturer	Serial No.	Last Cal.	Interval
A-1	Anechoic Chamber	-	TDK	-	2019/06	1 Year
R04	Test Receiver	ESW44	Rohde & Schwarz	101602	2019/11	1 Year
CS02	RF Cable	MWX221	Junkosha Inc.	1701S347	2019/07	1 Year
CS12	RF Cable	MWX122	Junkosha Inc.	J12J104317-00	2019/07	1 Year
C-2	Loop Antenna	HFH2-Z2	Rohde & Schwarz	872096/25	2019/08	1 Year
AB01	Biconical Antenna	BBA9106	Schwarzbeck	VHA91032399	2019/08	1 Year
AL04	Log-periodic Antenna	VULP9118A	Schwarzbeck	00776	2019/08	1 Year

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.

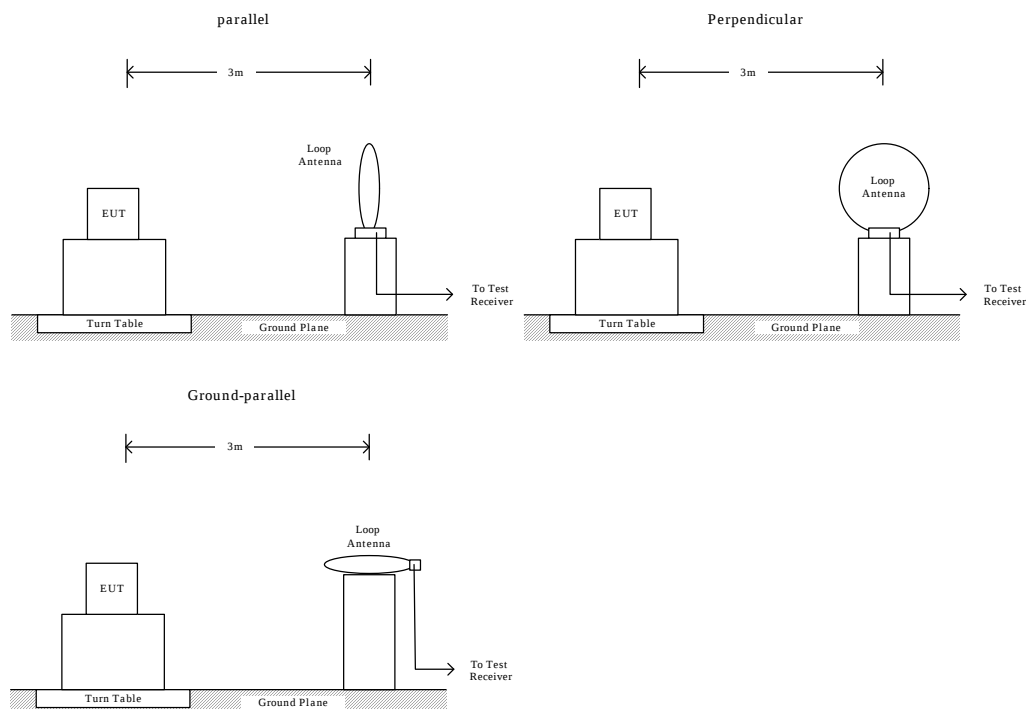
The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.

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 –



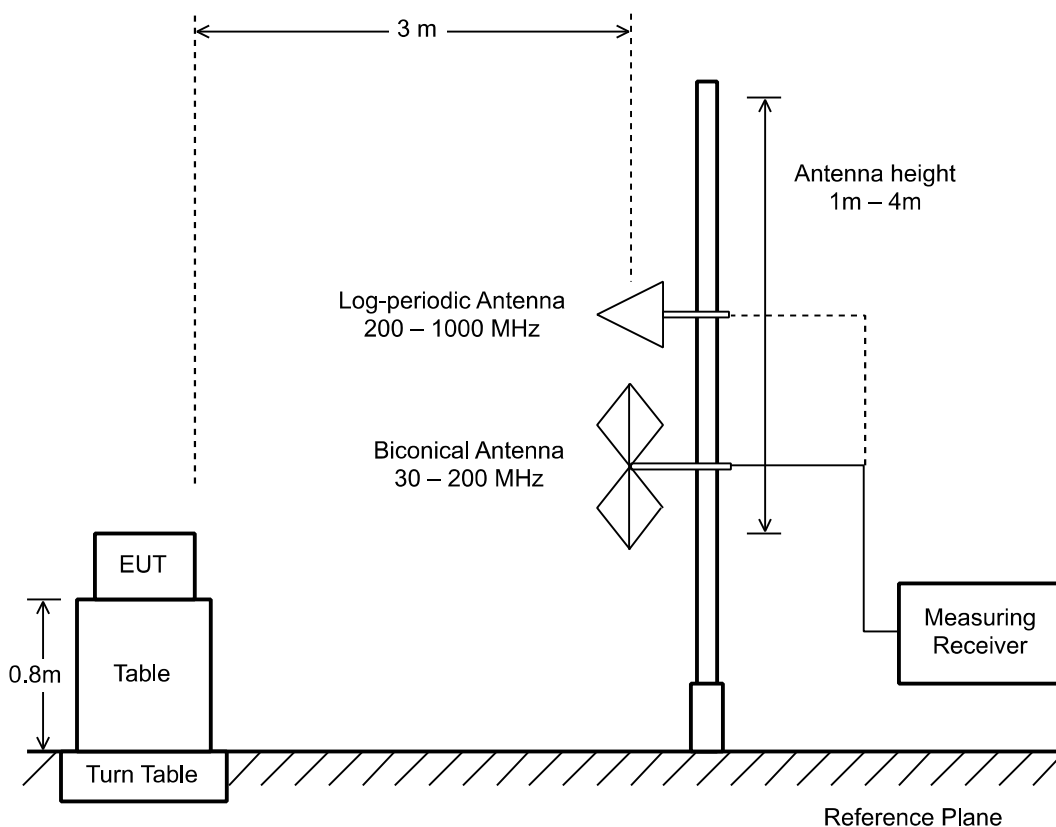
7.2.3.2 Radiated Emission 30 MHz – 1000 MHz

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 –

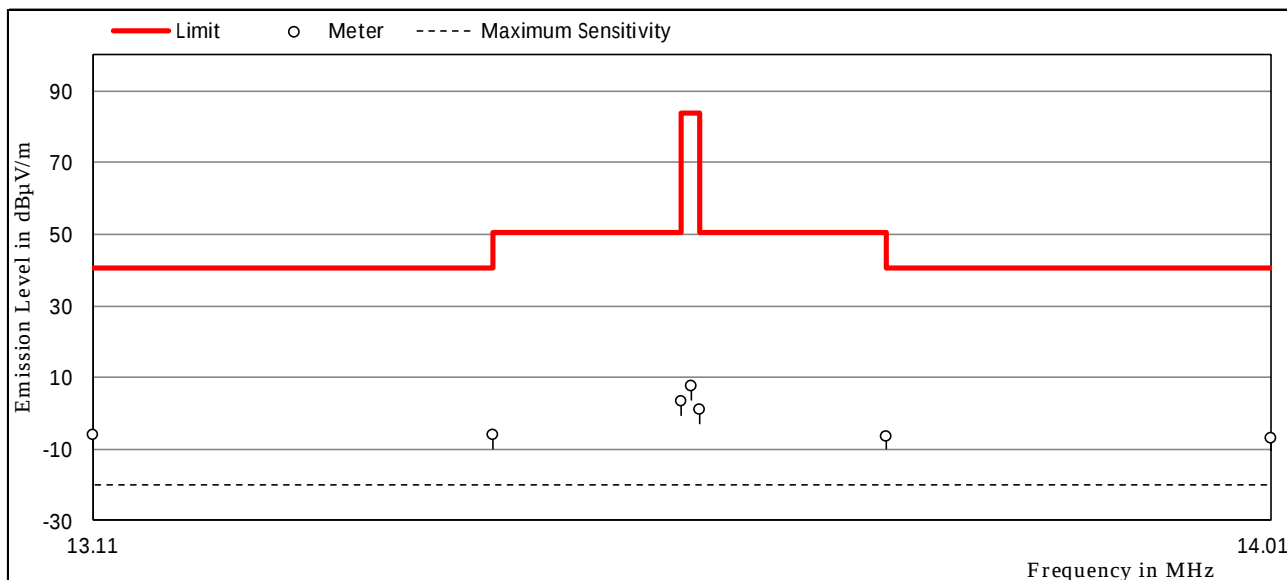


7.2.4 Test Data

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

7.2.4.1.1 Emission Mask (§15.225(a)(b)(c))

Measurement Date	Ambient Temperature	Relative Humidity	Atmospheric pressure
May 19, 2020	23	42 %	998 hPa



Frequency [MHz]	Correction Factor [dB(1m)]	Meter Readings at 3m [dBμV]	Limits [dBμV/m]	Specified Distance [m]	Extrapolated Result [dBμV/m]	Margin [dB]	Note
13.11	20.0	14.0	40.5	30.0	- 6.0	46.5	
13.41	20.0	13.9	40.5	30.0	- 6.1	46.6	
13.553	20.0	23.4	50.5	30.0	3.4	47.1	
13.56	20.0	27.7	84.0	30.0	7.7	76.3	
13.567	20.0	21.2	50.5	30.0	1.2	49.3	
13.71	20.0	13.8	40.5	30.0	- 6.2	46.7	
14.01	20.0	13.3	40.5	30.0	- 6.7	47.2	

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 = 20.0 + 27.7 = 47.7 dB(μV/m)

Result at 30 m = -40 + 47.7 = 7.7 dB(μV/m) (Conversion Factor : 40dB/decade)

Limits for 13.553-13.567MHz(§15.225(a)) = $20\log_{10}(15848) = 84.0$ dBμV/m

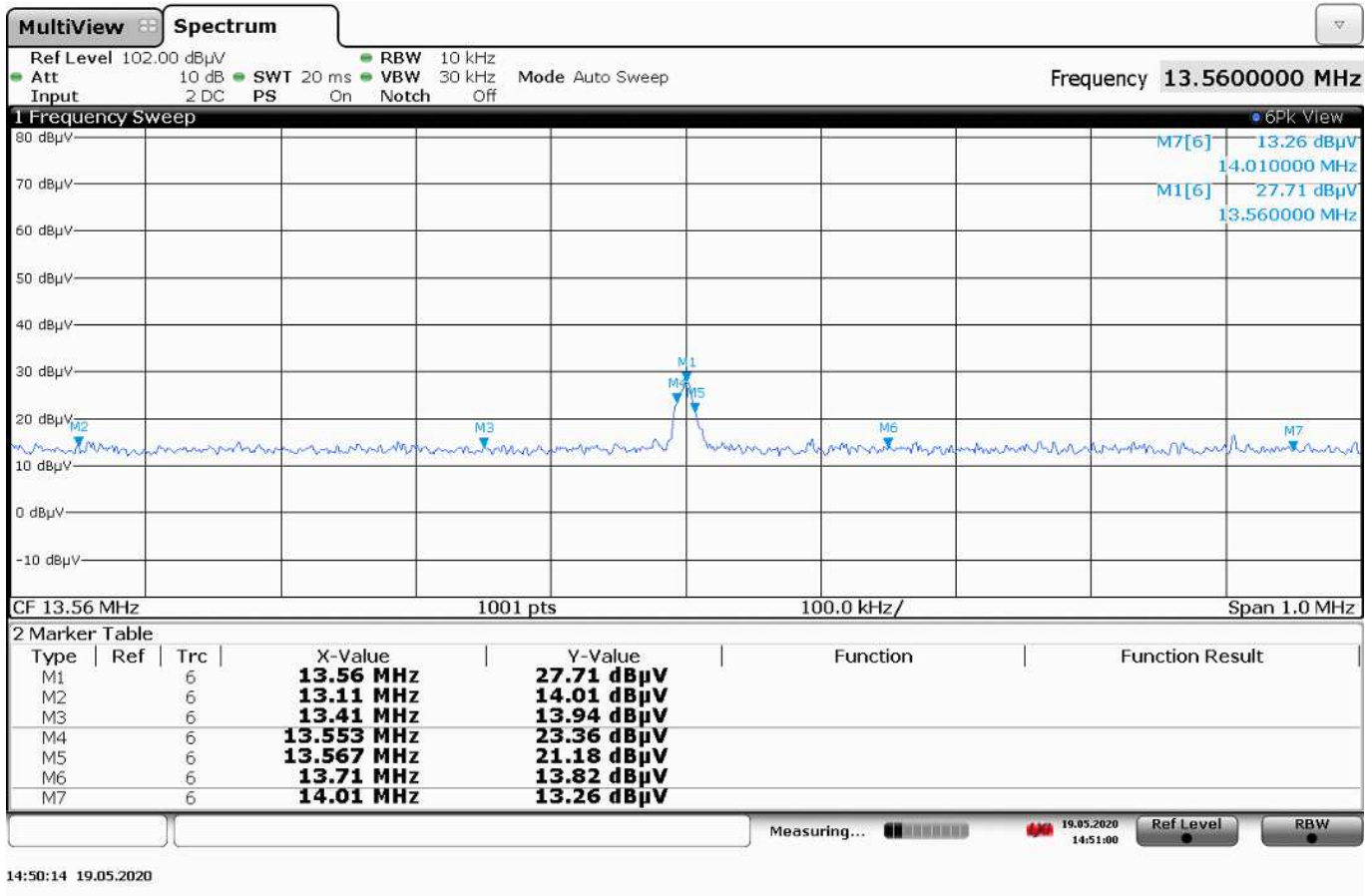
Limits for 13.410-13.553,13.567-13.710MHz(§15.225(b)) = $20\log_{10}(334) = 50.5$ dBμV/m

Limits for 13.110-13.410,13.710-14.010MHz (§15.225(c)) = $20\log_{10}(106) = 40.5$ 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)

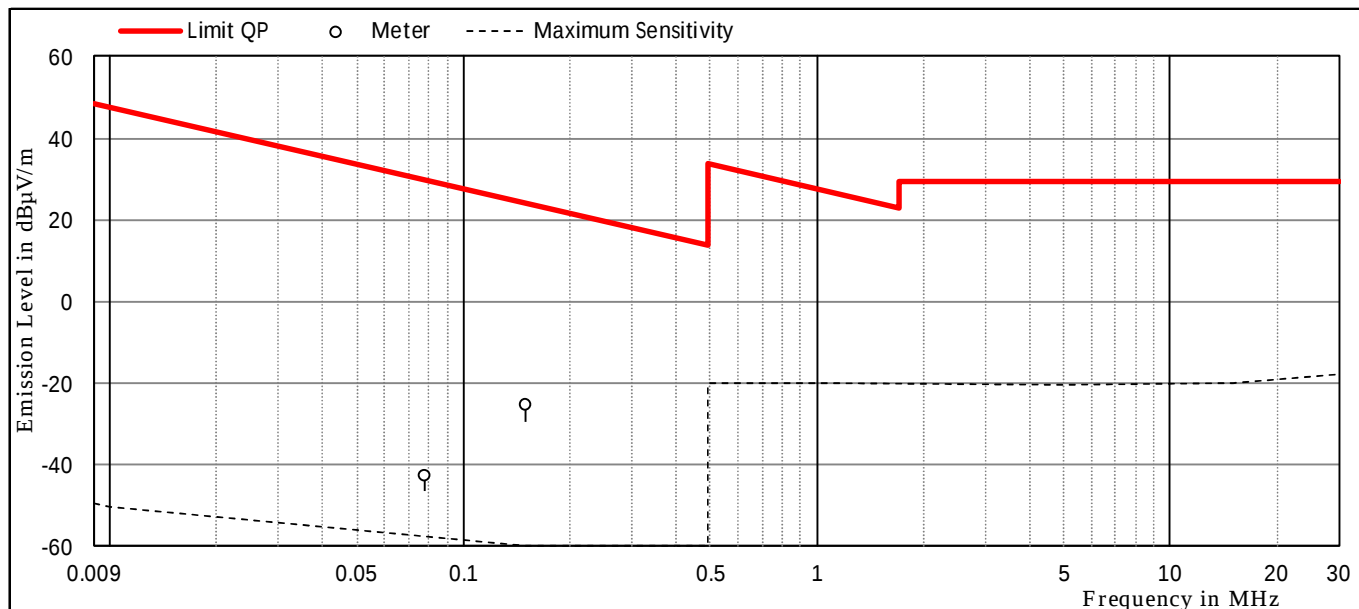
Average Detector, IF Bandwidth: 9kHz or 200Hz(9 kHz -90 kHz, 110 kHz -490 kHz)



Fundamental Emission (Detector: Peak)

7.2.4.1.2 Radiated Emission (§15.209(a))(9kHz – 30MHz)

Measurement Date	Ambient Temperature	Relative Humidity	Atmospheric pressure
April 8, 2020	23	38 %	1005 hPa



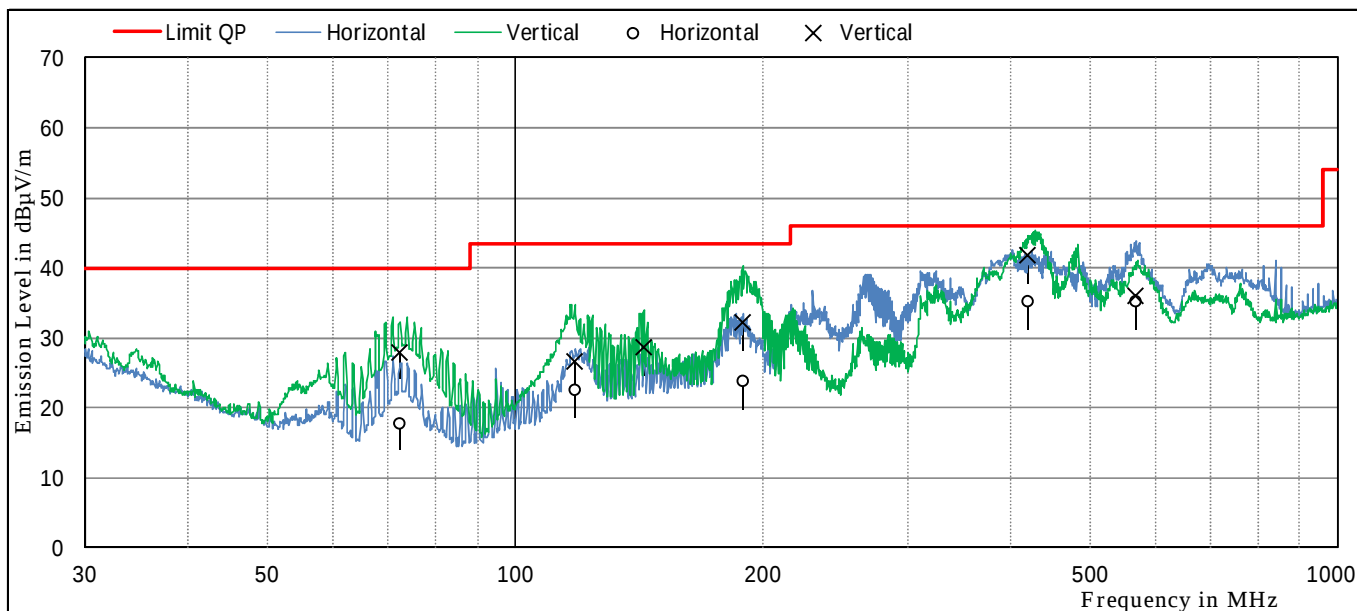
Frequency [MHz]	Factor [dB]	Meter Reading [dBμV]	Limit [dBμV/m] QP	Emission Level [dBμV/m]	Margin [dB]	Azimuth
0.078	-57.5	15.2	29.8	- 42.3	72.1	270deg
0.15	-59.8	34.5	24.1	- 25.3	49.4	242deg

Note

- 1) QP:Quasi-Peak
- 2) The symbol of '<' means 'or less' .
- 3) The symbol of '>' means 'or greater' .
- 4) The symbol of '-' means 'Not applicable' .
- 5) Factor includes Antenna factor, Conversion Factor and a cable loss.
- 6) A sample calculation was made at 0.15MHz
 Factor + Meter Reading = -59.8 + 34.5 = -25.3
- 7) The measured field strength was extrapolated to distance 30m/300m,
 using the formula that field strength using the formula that field strength
 aries as the inverse distance square(40 dB per decade of distance).

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

Measurement Date	Ambient Temperature	Relative Humidity	Atmospheric pressure
April 8, 2020	23	38 %	1005 hPa



Frequency [MHz]	Polarity	Factor [dB/m]	Meter Reading [dBμV]	Limit [dBμV/m] QP	Emission Level [dBμV/m]	Margin [dB]	Azimuth / Ant.Height
72.7	Hori.	9.9	8.0	40.0	17.9	22.1	177deg/2.53m
72.7	Vert.	9.9	18.1	40.0	28.0	12.0	207deg/1.00m
118.5	Hori.	16.6	5.9	43.5	22.5	21.0	168deg/1.56m
118.5	Vert.	16.6	10.0	43.5	26.6	16.9	174deg/1.00m
143.8	Hori.	18.4	< - 2.0	43.5	< 16.4	> 27.1	
143.8	Vert.	18.4	10.2	43.5	28.6	14.9	86deg/1.00m
189.6	Hori.	20.3	3.6	43.5	23.9	19.6	136deg/1.69m
189.6	Vert.	20.3	11.9	43.5	32.2	11.3	148deg/1.00m
420.4	Hori.	20.5	14.7	46.0	35.2	10.8	150deg/2.32m
420.4	Vert.	20.5	21.3	46.0	41.8	4.2	172deg/1.18m
568.8	Hori.	23.3	11.9	46.0	35.2	10.8	73deg/2.09m
568.8	Vert.	23.3	12.8	46.0	36.1	9.9	356deg/1.00m

Note

- 1) QP:Quasi-Peak
- 2) The symbol of '<' means 'or less' .
- 3) The symbol of '>' means 'or greater' .
- 4) The symbol of '-' means 'Not applicable' .
- 5) Factor includes Antenna factor, and a cable loss.
- 6) A sample calculation was made at 420.4MHz
 Factor + Meter Reading = 20.5 + 21.3 = 41.8

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)

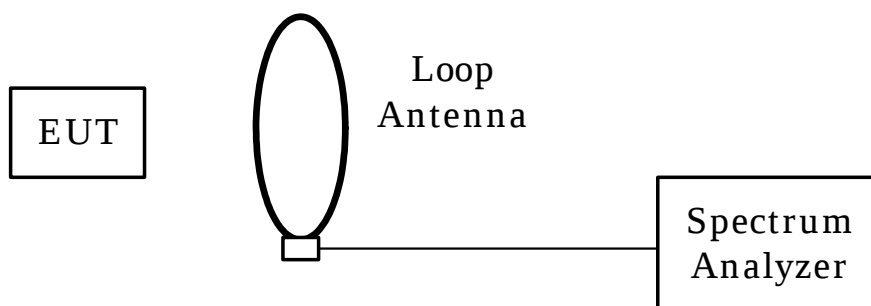
Remarks : “ Because the measured signal is CW or CW like, adjusting the RBW per C63.10 would not be practical. Measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.”

7.3.2 Test Instruments

ID No.	Type	Model No.	Manufacturer	Serial No.	Last Cal.	Interval
R04	Test Receiver	ESW44	Rohde & Schwarz	101602	2019/11	1 Year
CB02	RF Cable	RG223/U	Suhner	-	2019/10	1 Year
-	Loop Antenna	L7-105ASC	Singer Instr.	113	-	-

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:

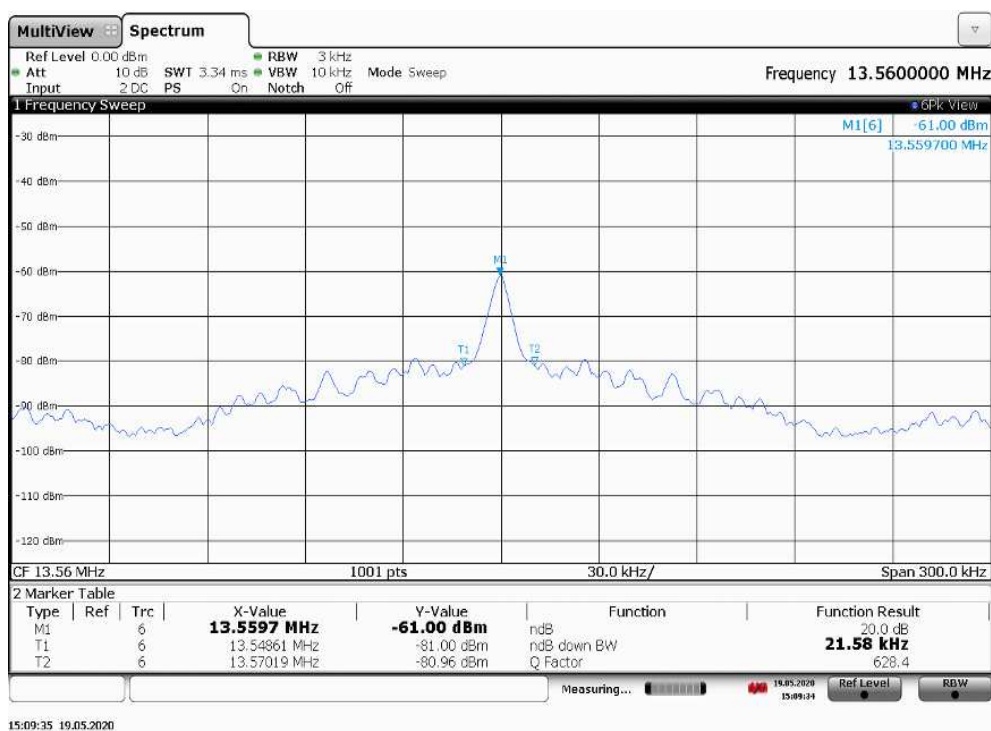
Res. Bandwidth	3 kHz
Video Bandwidth	10 kHz
Span	300 kHz
Sweep Time	AUTO
Trace	Maxhold

7.3.4 Test Data

Test Date : May 19, 2020
 Temp.: 23°C, Humi.: 42%, Atm.: 998hPa

Test Mode : TX

Frequency (MHz)	-20dBc Bandwidth (kHz)
13.56	21.58



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 -0.000546 % at 13.560 MHz

Min. Limit Margin +0.009454 % at 13.560 MHz

Uncertainty of Measurement Results ± 1.3 ppm(2σ)

Remarks : _____

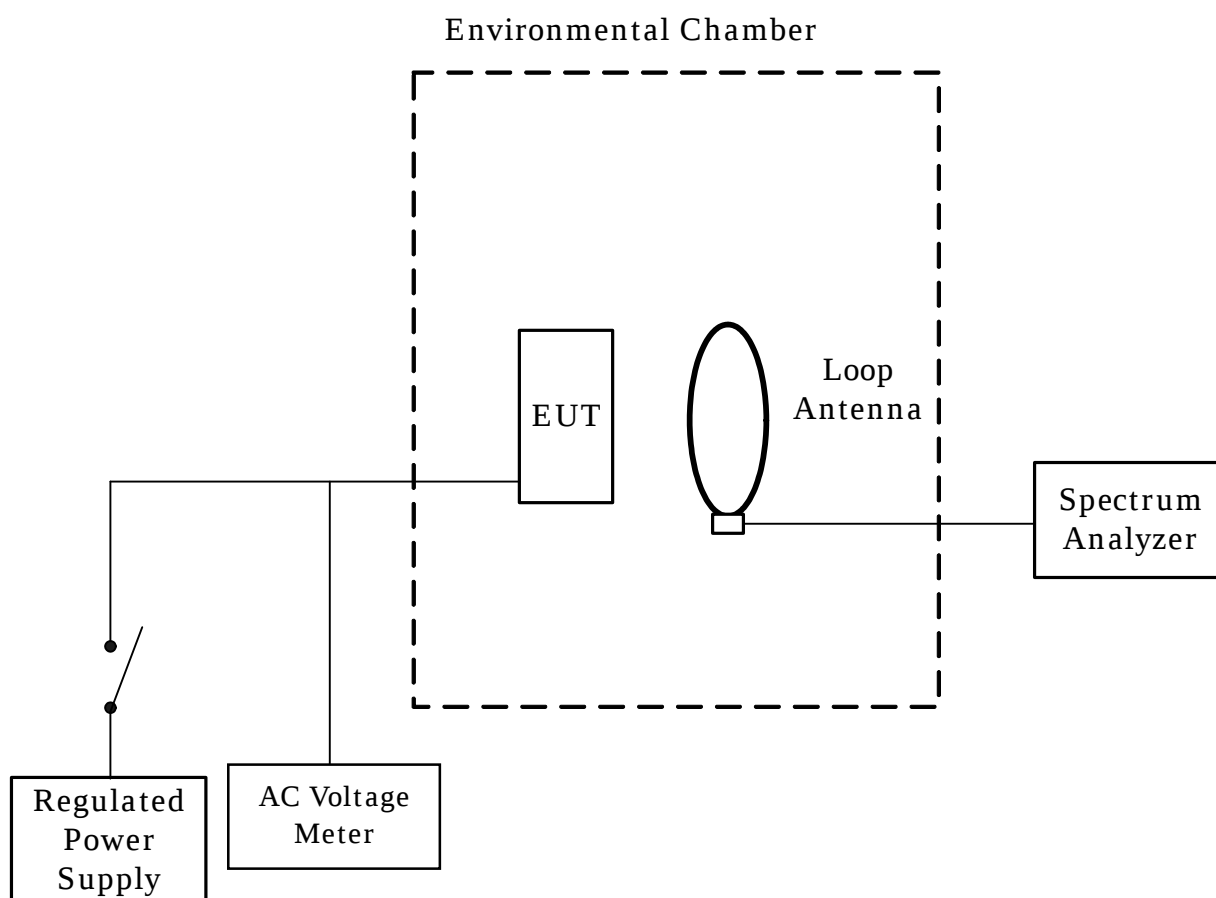
7.4.2 Test Instruments

ID No.	Type	Model No.	Manufacturer	Serial No.	Last Cal.	Interval
R04	Test Receiver	ESW44	Rohde & Schwarz	101602	2019/11	1 Year
CB02	RF Cable	RG223/U	Suhner	-	2019/10	1 Year
-	Loop Antenna	L7-105ASC	Singer Instr.	113	-	-
-	Environmental Test Chamber	PFL-3K	Espec	-	-	-
-	Mercury thermometer	-	SANSYO	30206	2020/1	1 Year

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 Date : April 10, 2020

Transmitting Frequency : 13.560 MHz

Power Supply [VDC]	Ambient Temperature []	Startup	Frequency with time elapse [MHz]			Limits [%]	Margin [%]
			2 minutes	5 minutes	10 minutes		
24	-20	13.559958	13.560010	13.560010	13.560010		
20.4	20	13.559958	13.559942	13.559942	13.559942		
24	20	13.559942	13.559928	13.559928	13.559942		
27.6	20	13.559958	13.559942	13.559942	13.559928		
24	50	13.559942	13.559926	13.559942	13.559942		
Power Supply [VDC]	Ambient Temperature []	Startup	Frequency with time elapse [MHz]			Limits [%]	Margin [%]
			2 minutes	5 minutes	10 minutes		
24	-20	-0.000310	0.000074	0.000074	0.000074	0.01	0.009690
20.4	20	-0.000310	-0.000428	-0.000428	-0.000428	0.01	0.009572
24	20	-0.000428	-0.000531	-0.000531	-0.000428	0.01	0.009469
27.6	20	-0.000310	-0.000428	-0.000428	-0.000531	0.01	0.009469
24	50	-0.000428	-0.000546	-0.000428	-0.000428	0.01	0.009454

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

Ambient Temperature : 20 / Startup

DC supply Voltage : 20.4 / 27.6 VDC

Minimum Margin : $0.010000 - 0.000310 = 0.009690(\%)$

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