

Powercore Technology Co., Ltd.

RF TEST REPORT

Report Type:

FCC Part 15.225 & ISED RSS-210 RF report

Model:

ADC002C130C130, ADC002C160C130,
ADC002C160C160, ADC002C190C160,
ADC002C190C190

REPORT NUMBER:

230501370SHA-001

ISSUE DATE:

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Report no.: 230501370SHA-001

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FCC ID: 2A98K-ADC002

IC: 30675-ADC002

SUMMARY:

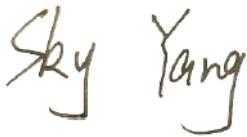
The equipment complies with the requirements according to the following standard(s) or Specification:

47CFR Part 15 (2021): Radio Frequency Devices (Subpart C)

ANSI C63.10 (2020): American National Standard of Procedures for Compliance Testing of Unlicensed
Wireless Devices

RSS-210 Issue 10 (December 2019): Licence-Exempt Radio Apparatus: Category I Equipment

RSS-Gen Issue 5, Amendment 1 (March 2019): General Requirements for Compliance of Radio Apparatus

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TEST REPORT**Revision History**

Report No.	Version	Description	Issued Date
230501370SHA-001	Rev. 01	Initial issue of report	August 1, 2023

TEST REPORT**Measurement result summary**

TEST ITEM	FCC REFERENCE	IC REFERENCE	RESULT
Fundamental emission	15.225(a) (b) (c)	RSS 210 B.6	Pass
Spurious emission	15.225(d)	RSS 210 B.6	Pass
Frequency stability	15.225(e)	RSS 210 B.6	Pass
Conducted emissions	15.207	RSS-Gen Issue 5 Clause 8.8	Pass
99% and 20dB Bandwidth	15.215(c)	RSS-Gen Issue 5 Clause 6.6	Pass
Antenna requirement	15.203	RSS-GEN 6.8	Pass

Notes: 1: NA =Not Applicable

2: Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.

TEST REPORT**1 GENERAL INFORMATION****1.1 Description of Equipment Under Test (EUT)**

Product name:	DC Electric Vehicle Charging Station
Type/Model:	ADC002C130C130, ADC002C160C130, ADC002C160C160, ADC002C190C160, ADC002C190C190
Description of EUT:	The EUT is electric vehicle DC charger. It contains two certified modules, the WIFI/Bluetooth module FCC ID is 2AC7Z-ESPWROOM32UE(grant date:01/25/2022), the LTE module FCC ID is XMR201903EG25G, the WIFI/Bluetooth module IC is 21098-ESPWROOMUE(grant date:01/27/2022), the LTE module IC is 10224A-201903EG25G. All models are electric identical except the rated power. We test ADC002C190C190 as representative and list the result in this report.
Rating:	ADC002C130C130: Input: 480VAC±10%, 50/60Hz, 76A Output: 150-1000VDC, 200ADC, 60kW Max ADC002C160C130: Input: 480VAC±10%, 50/60Hz, 114A Output: 150-1000VDC, 200ADC, 90kW Max ADC002C160C160: Input: 480VAC±10%, 50/60Hz, 152A Output: 150-1000VDC, 200ADC, 120kW Max ADC002C190C160: Input: 480VAC±10%, 50/60Hz, 190A Output: 150-1000VDC, 200ADC, 150kW Max ADC002C190C190: Input: 480VAC±10%, 50/60Hz, 228A Output: 150-1000VDC, 200ADC, 180kW Max
EUT type:	<input type="checkbox"/> Table top <input checked="" type="checkbox"/> Floor standing
Software Version:	-
Hardware Version:	-
Serial numbers:	0230510-29
Sample received date:	May 10, 2023
Date of test:	May 29, 2023 ~ June 9, 2023

1.2 Technical Specification

Frequency Range:	13.56 MHz ~ 13.56 MHz
Modulation:	ASK
Antenna:	PCB antenna

TEST REPORT**1.3 Description of Test Facility**

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN0175
	IC Registration Lab CAB identifier.: CN0014
	VCCI Registration Lab Member No.: 3598 (Registration No.: R-14243, G-10845, C-14723, T-12252)
	A2LA Accreditation Lab Certificate Number: 3309.02

Fundamental emission, Spurious emission and Conducted emissions tests were sub-contracted.

Name:	Shenzhen Academy of Metrology and Quality Inspection
Address:	NETC Building, No.4 Tongfa Road Xili, Nanshan, Shenzhen, Guangdong, China
Telephone:	+86-13600419320
The test facility is recognized, certified, or accredited by these organizations:	FCC Accredited Lab Designation Number: CN1165
	IC Registration Lab CAB identifier.: CN0009

TEST REPORT**2 TEST SPECIFICATIONS****2.1 Standards or specification**

47CFR Part 15 (2021)
ANSI C63.10 (2020)
RSS-210 Issue 10 (December 2019)
RSS-Gen Issue 5, Amendment 1 (March 2019)

2.2 Mode of operation during the test

While testing, the internal modulation and continuously transmission was applied.

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No	Description	Band and Model	S/No

2.5 Test environment condition:

Test items	Temperature	Humidity
Radiated emission	26°C	53% RH
Power line conducted emission	27°C	53% RH

TEST REPORT**2.6 Instrument list**

Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESW8	SB21192	2023-7-26
☒	LISN	schwarzbeck	NNLK8130	SB21542	2024-4-16
☒	Test Receiver	R&S	ESI26	SB3436	2023-10-18
☒	Loop Antenna	Schwarzbeck	FMZB1519B	SB19178	2023-11-30
☒	Broadband Antenna	Schwarzbeck	VULB9163	SB19658/01	2023-8-7
☒	Active loop antenna	Schwarzbeck	FMZB1519	EC 5345	2023-06-15
☒	Spectrum Analyzer	Keysight	N9030B	EC 6078	2024-06-03
☒	Climate chamber	GWS	MT3065	EC 6021	2024-03-07
☒	Thermo-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3783	2024-03-24

TEST REPORT**2.7 Measurement uncertainty**

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Frequency	Expanded Uncertainty (k=2)
Conducted emission at mains ports	9kHz ~ 150kHz	3.52 dB
	150kHz ~ 30MHz	3.19 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.06 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.02 dB
	6GHz ~ 18GHz	5.28 dB

TEST REPORT**3 Fundamental Emission****Test result:** **Pass****3.1 Limit**

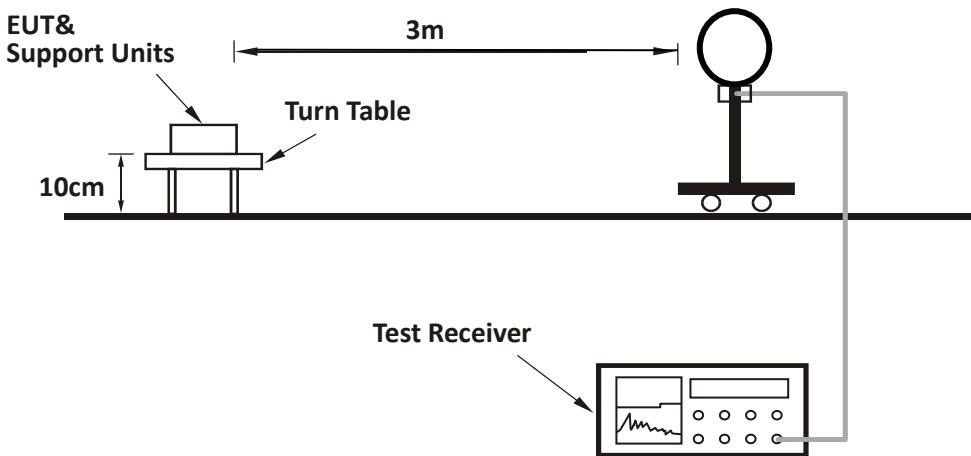
Frequencies (MHz)	Limit at 30m (dBuV/m)	Limit at 3m (dBuV/m)
13.110 – 13.410	40.50	80.50
13.410 – 13.553	50.50	90.50
13.553 – 13.567	84.00	124.00
13.567 – 13.710	50.50	90.50
13.710 – 14.010	40.50	80.50

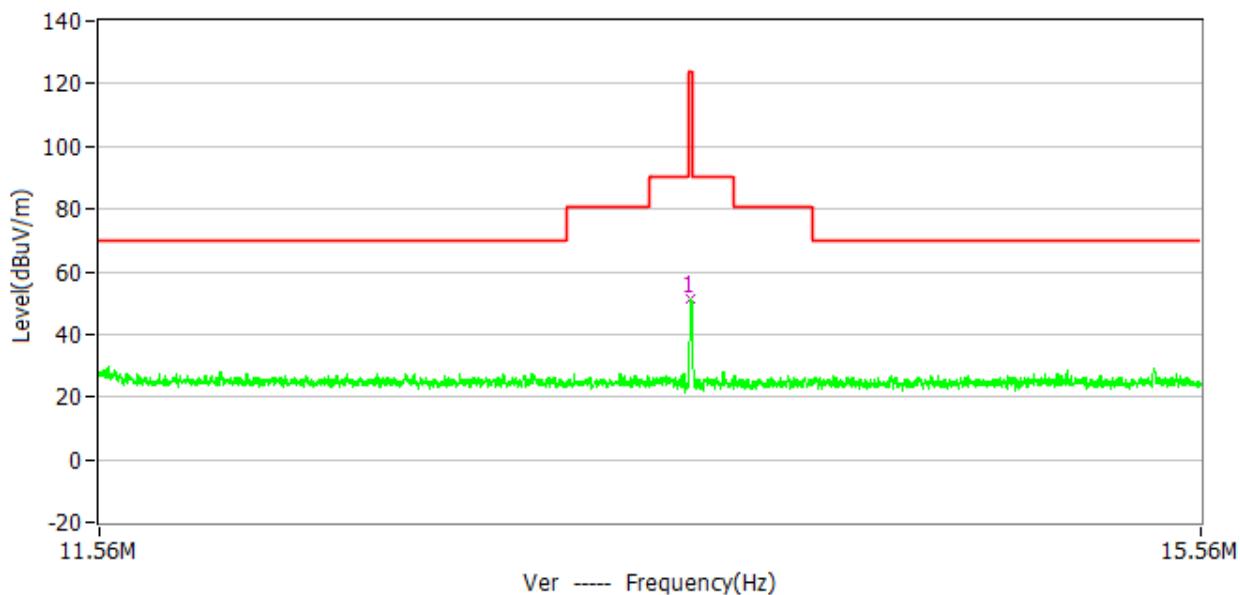
3.2 Measurement Procedure

- a) The EUT was placed on a 0.1m plank above the ground at a 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c) Both X and Y axes of the antenna are set to make the measurement.
- d) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e) The test-receiver system was set to PK Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

TEST REPORT**3.3 Test Configuration**

TEST REPORT
3.4 Test Results of Fundamental Emissions


Antenna Polarization	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin	Detector
X	13.56	52.1	20.4	124.00	71.9	PK
Y	13.56	50.3	20.4	124.00	73.7	PK

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
 2. Corrected Reading = Original Receiver Reading + Correct Factor
 3. Margin = Limit - Corrected Reading

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
 Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
 Limit = 40.00dBuV/m.
 Then Correct Factor = $30.20 + 2.00 - 32.00 = 0.20$ dB/m;
 Corrected Reading = $10.00 + 0.20 = 10.20$ dBuV/m;
 Margin = $40.00 - 10.20 = 29.80$ dB.

TEST REPORT

4 Spurious Emission

Test result: Pass

4.1 Limit

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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

4.2 Measurement Procedure

For Radiated emission below 30MHz:

- f) The EUT was placed on a 0.1m plank above the ground at a 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- g) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- h) Both X and Y axes of the antenna are set to make the measurement.
- i) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- j) The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz:

- a) The EUT was placed on a 0.1m plank above the ground at a 10 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c) The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

TEST REPORT

- d) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. All modes of operation were evaluated and the worst-case emissions were reported

TEST REPORT**4.3 Test Results of Radiated Emissions**

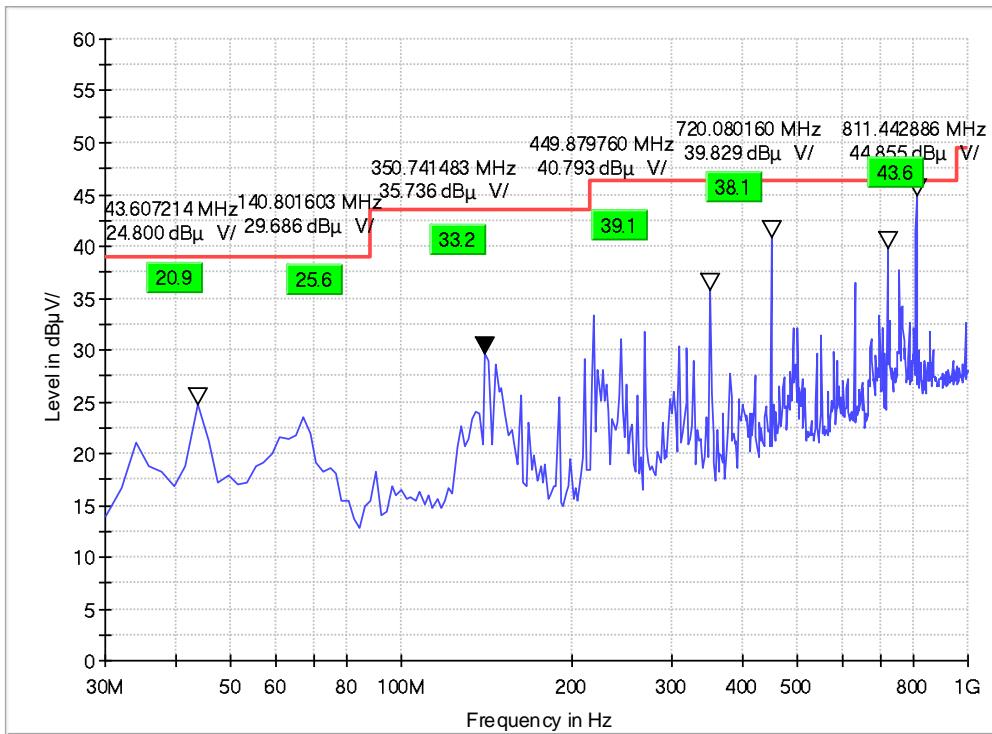
The EUT has been tested in all two orthogonal planes, it has the worst case when it is in horizontal position for both below 30MHz & above 30MHz.

Test data below 30MHz:

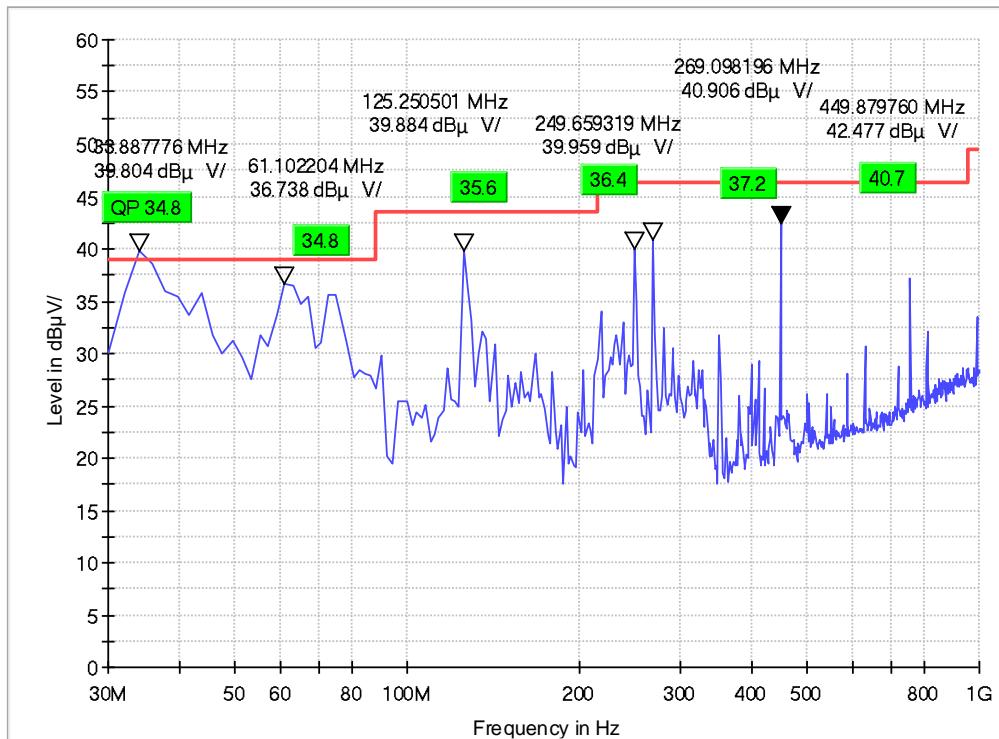
Frequency	Limit (dBuV/m)	Corrected Reading (dBuV/m)	Margin	Detector	Polarity
496.500kHz	73.7	44.4	-29.3	PK	X
636.000kHz	71.5	45.5	-26.0	PK	X
5.717MHz	69.5	32.2	-37.3	PK	X
9.551MHz	69.5	34.5	-35.0	PK	X
15.365MHz	69.5	31.4	-38.1	PK	X
22.934MHz	69.5	33.0	-36.5	PK	Y
631.500kHz	71.6	44.7	-26.9	PK	Y
5.744MHz	69.5	41.9	-27.6	PK	Y
7.445MHz	69.5	44.3	-25.2	PK	Y
9.596MHz	69.5	37.9	-31.6	PK	Y
15.365MHz	69.5	37.1	-32.4	PK	Y
22.682MHz	69.5	31.8	-37.7	PK	Y

TEST REPORT

H



V



TEST REPORT
Test data from 30MHz to 1000MHz:

Antenna Polarization	Frequency	Limit (dBuV/m)	Corrected Reading (dBuV/m)	Margin	Detector
H	43.61	39.0	20.9	18.1	QP
H	140.80	43.5	25.6	17.9	QP
H	350.74	46.4	33.2	13.2	QP
H	449.88	46.4	39.1	7.3	QP
H	720.08	46.4	38.1	8.3	QP
H	811.44	46.4	43.6	2.8	QP
V	33.89	39.0	34.8	4.2	QP
V	61.10	39.0	34.8	4.2	QP
V	125.25	43.5	35.6	7.9	QP
V	249.66	46.4	36.4	10.0	QP
V	269.10	46.4	37.2	9.2	QP
V	449.88	46.4	40.7	5.7	QP

Remark:

1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

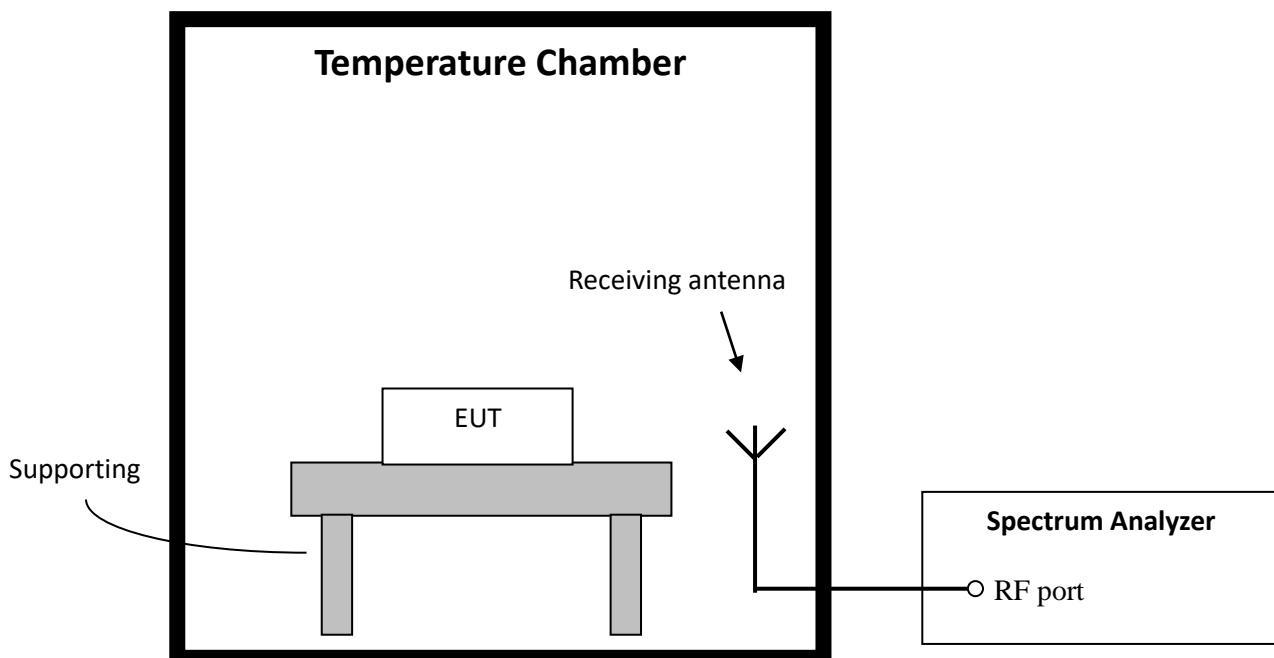
Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
 Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
 Limit = 40.00dBuV/m.
 Then Correct Factor = $30.20 + 2.00 - 32.00 = 0.20$ dB/m;
 Corrected Reading = $10\text{dBuV} + 0.20\text{dB/m} = 10.20\text{dBuV/m}$;
 Margin = $40.00\text{dBuV/m} - 10.20\text{dBuV/m} = 29.80\text{dB}$.

TEST REPORT**5 Frequency Stability (Temperature Variation)**

Test result: PASS

5.1 Test limit

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage.

5.2 Test Configuration

TEST REPORT**5.3 Test procedure and test setup**

Test Procedure as per ANSI 63.10 clause 6.8.1.

5.4 Test protocol

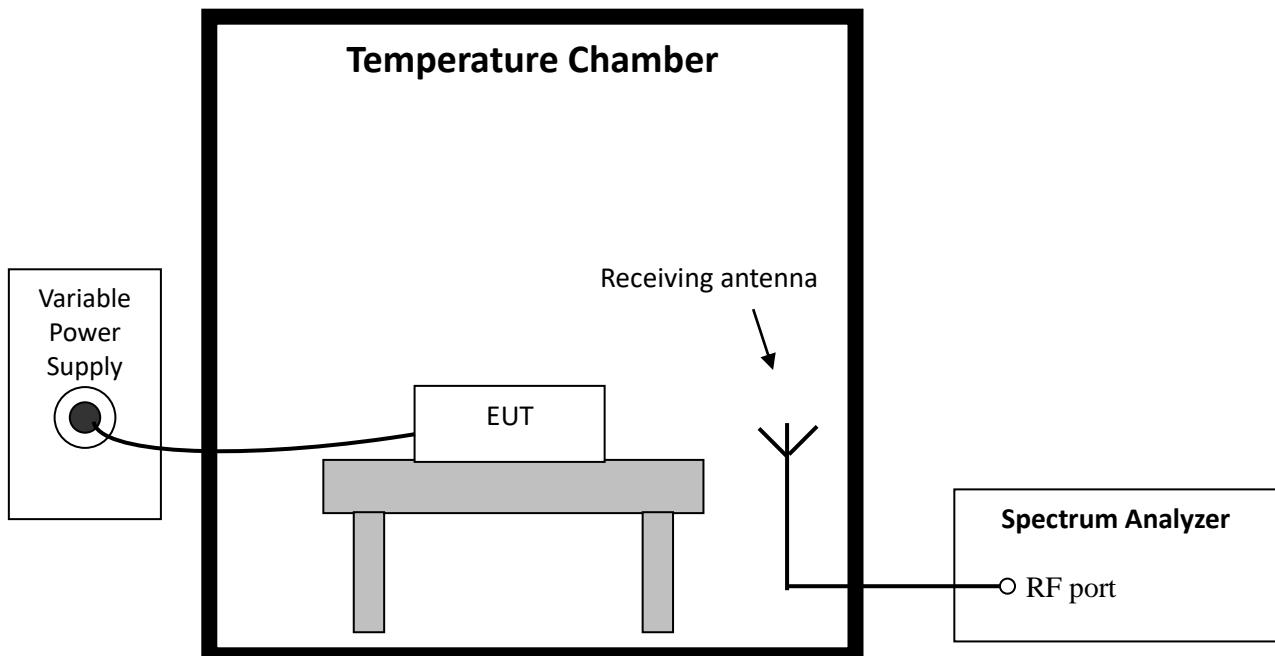
Voltage (V)	Temp (°C)	Freq measured (MHz)	Freq nominal (MHz)	Tolerance (%)	Limit (%)
480	-20	13.5593	13.56	-0.005	±.01
	-10	13.5597		-0.002	
	0	13.5600		0	
	10	13.5600		0	
	20	13.5600		0	
	30	13.5602		0.001	
	40	13.5592		-0.006	
	50	13.5596		-0.003	

TEST REPORT**6 Frequency Stability (Voltage Variation)**

Test result: PASS

6.1 Test limit

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

6.2 Test Configuration**6.3 Test procedure and test setup**

Test Procedure as per ANSI 63.10 clause 6.8.2.

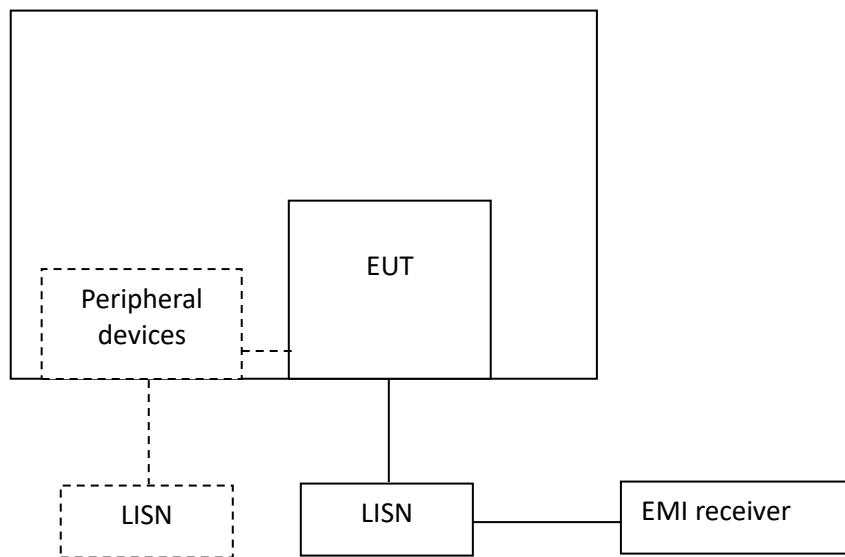
TEST REPORT**6.4 Test protocol**

Temp (°C)	Voltage (V)	Freq Measured (MHz)	Freq nominal (MHz)	Tolerance (%)	Limit (%)
20	432	13.5604	13.56	0.003	±0.01
	480	13.5600		0	
	528	13.5603		0.002	

TEST REPORT**7 Conducted emissions**Test result: **Pass****7.1 Limit**

Frequency of Emission (MHz)	Conducted Emissions Limit (dBuV)	
	QP	AV
0.15 ~ 0.5	79	66
0.5 ~ 30	73	60

* Decreases with the logarithm of the frequency.

7.2 Test Configuration

TEST REPORT**7.3 Measurement Procedure**

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the $50\ \Omega$ LISN port (to which the EUT is connected), where permitted, terminated into a $50\ \Omega$ measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the $50\ \Omega$ measuring port is terminated by a measuring instrument having $50\ \Omega$ input impedance. All other ports are terminated in $50\ \Omega$ loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

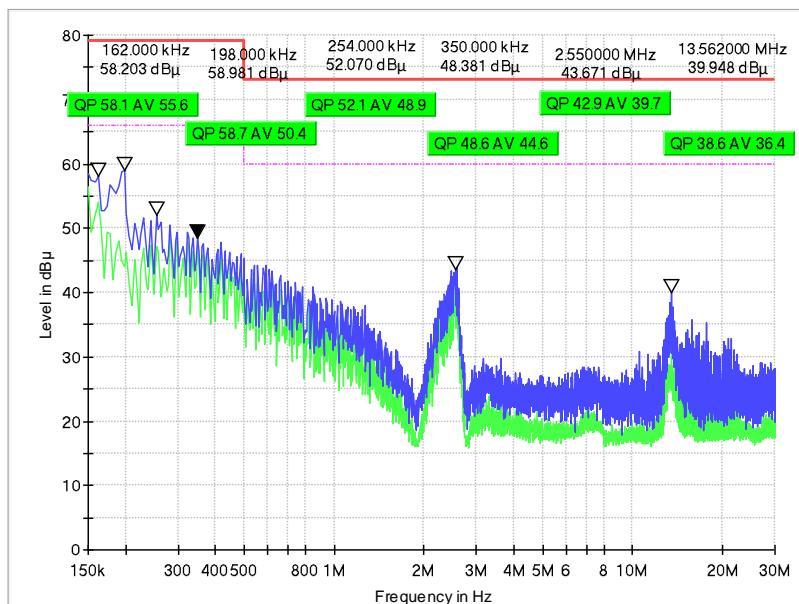
The bandwidth of the test receiver is set at 9 kHz.

TEST REPORT

7.4 Test Results of Conducted Emissions

Test Voltage: 480VAC/60Hz

L1 Line

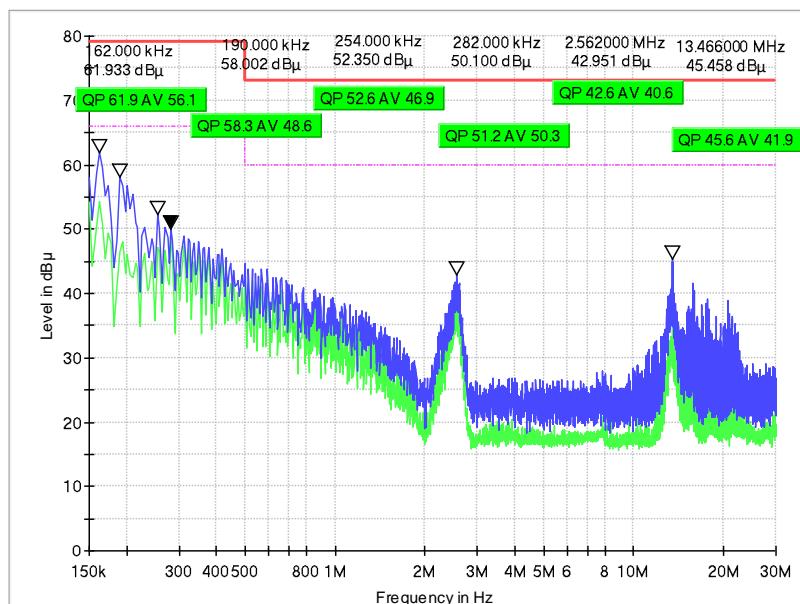


Frequency (MHz)	Quasi-peak			Average		
	Level (dBμV)	Limit (dBμV)	Delta (dB)	Level (dBμV)	Limit (dBμV)	Delta (dB)
0.162	58.1	79.0	20.9	55.6	66.0	10.4
0.198	58.7	79.0	20.3	50.4	66.0	15.6
0.254	52.1	79.0	26.9	48.9	66.0	17.1
0.350	48.6	79.0	30.4	44.6	66.0	21.4
2.550	42.9	73.0	30.1	39.7	60.0	20.3

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.
 2. Level = Original Receiver Reading + Correct Factor
 3. Delta = Limit - Level
 4. If the PK Level is lower than AV limit, the AV test can be elided.
 5. the emissions of 13.56MHz are the product's RF signal.

TEST REPORT

L2 Line

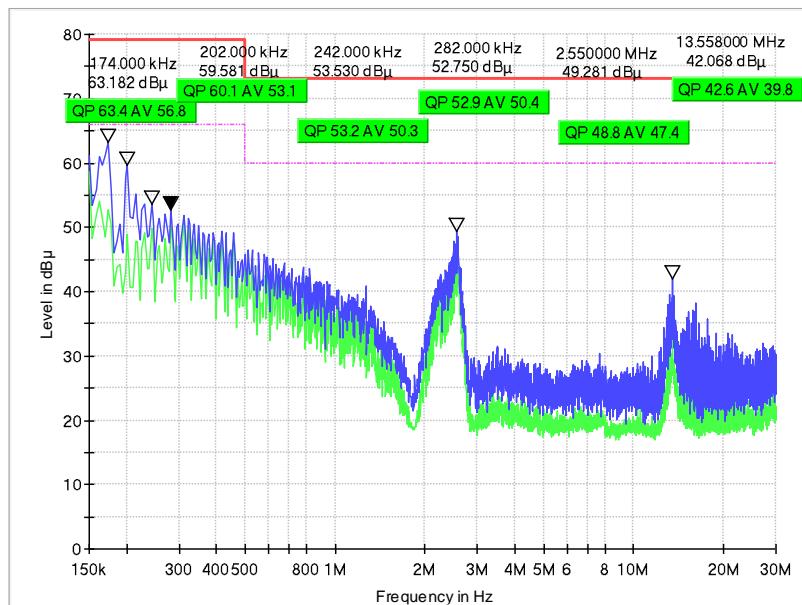


Frequency (MHz)	Quasi-peak			Average		
	Level (dBμV)	Limit (dBμV)	Delta (dB)	Level (dBμV)	Limit (dBμV)	Delta (dB)
0.162	61.9	79.0	17.1	56.1	66.0	9.9
0.190	58.3	79.0	20.7	48.6	66.0	17.4
0.254	52.6	79.0	26.4	46.9	66.0	19.1
0.282	51.2	79.0	27.8	50.3	66.0	15.7
2.562	42.6	73.0	30.4	40.6	60.0	19.4

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.
 2. Level = Original Receiver Reading + Correct Factor
 3. Delta = Limit - Level
 4. If the PK Level is lower than AV limit, the AV test can be elided.
 5. the emissions of 13.56MHz are the product's RF signal.

TEST REPORT

L3 Line



Frequency (MHz)	Quasi-peak			Average		
	Level (dB μ V)	Limit (dB μ V)	Delta (dB)	Level (dB μ V)	Limit (dB μ V)	Delta (dB)
0.174	63.4	79.0	15.6	56.8	66.0	9.2
0.202	60.1	79.0	18.9	53.1	66.0	12.9
0.242	53.2	79.0	25.8	50.3	66.0	15.7
0.282	52.9	79.0	26.1	50.4	66.0	15.6
2.550	48.8	73.0	24.2	47.4	60.0	12.6

Remark:

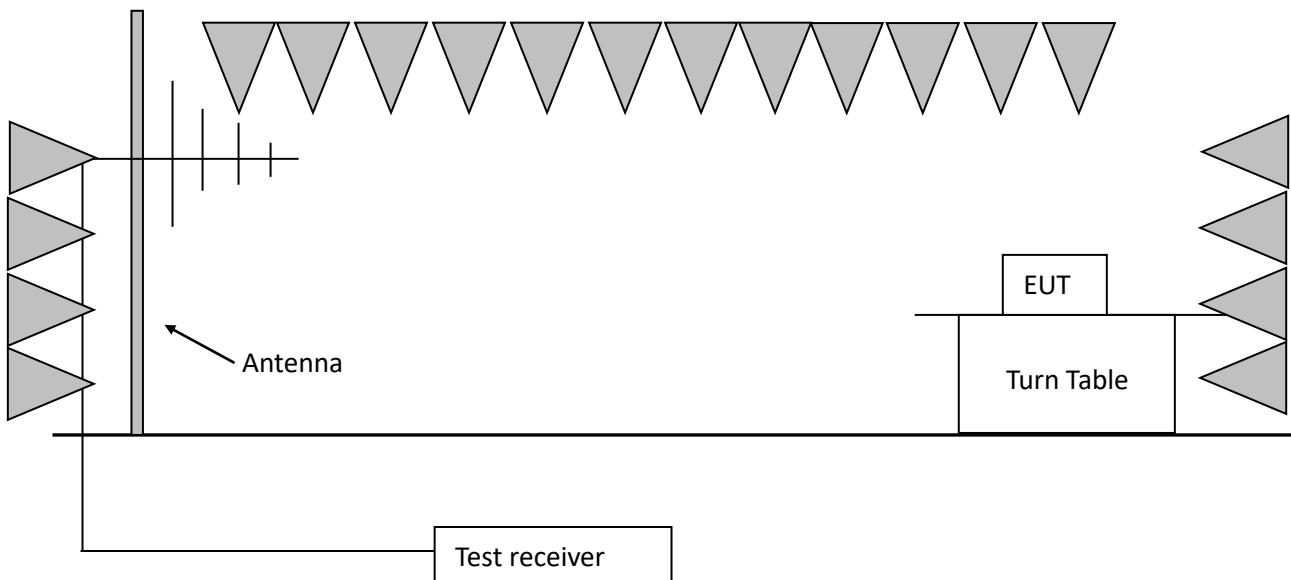
1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.
2. Level = Original Receiver Reading + Correct Factor
3. Delta = Limit - Level
4. If the PK Level is lower than AV limit, the AV test can be elided.
5. the emissions of 13.56MHz are the product's RF signal.

TEST REPORT**8 20dB Bandwidth**

Test result: Pass

8.1 Limit

The 20dB bandwidth should be fallen in the allocated operating frequency range.
No limit for 99% bandwidth.

8.2 Test configuration

TEST REPORT**8.3 Test procedure and test set up**

The measurement was applied in a 3m semi-anechoic chamber.

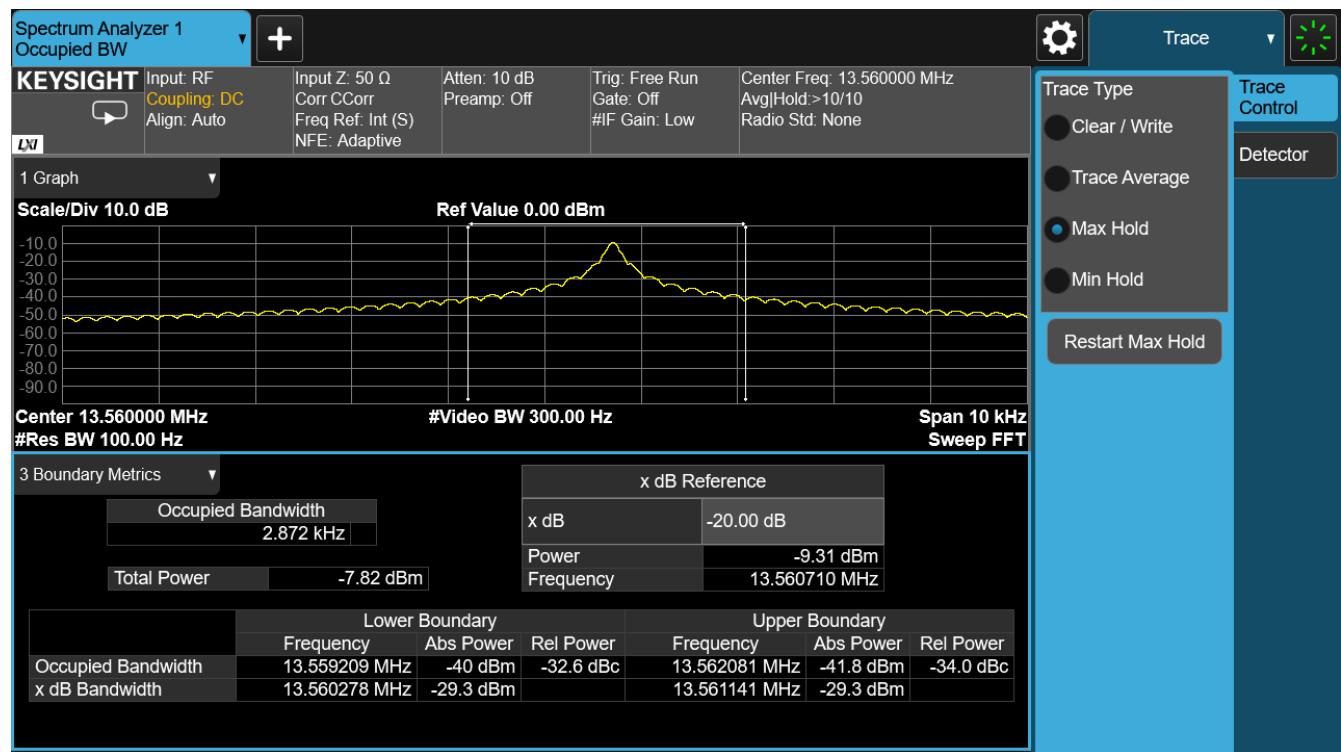
The center of the loop antenna shall be 1 m above the horizontal metal ground plane.

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set RBW = 1 % to 5 % of the OBW
3. Set VBW $\geq 3 \cdot \text{RBW}$
4. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
5. Use the 99 % power bandwidth function of the instrument (if available).
6. the 20dB bandwidth is also measured with the same setting.

TEST REPORT
8.4 Test protocol

	Lower point (MHz)	Higher point (MHz)	Bandwidth (kHz)	Allocated bandwidth (MHz)
20dB Bandwidth	13.560278	13.561141	0.863	13.553 ~ 13.567
Occupied bandwidth	13.559209	13.562081	2.872	13.553 ~ 13.567



TEST REPORT

9 Antenna requirement

Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Result:

EUT uses permanently attached antenna to the intentional radiator, so it can comply with the provisions of this section.

***** END *****