

# Test Report

**Report No.:** MTi220829009-02E1

**Date of issue:** 2023-06-01

**Applicant:** Chug Inc.

**Product:** 3-in-1 multi-charger

**Model(s):** QIC37, HKWP2993-25

**FCC ID:** 2AO23-QIC37

Shenzhen Microtest Co., Ltd.

<http://www.mtitest.com>

## Instructions

1. This test report shall not be partially reproduced without the written consent of the laboratory.
2. The test results in this test report are only responsible for the samples submitted
3. This test report is invalid without the seal and signature of the laboratory.
4. This test report is invalid if transferred, altered, or tampered with in any form without authorization.
5. Any objection to this test report shall be submitted to the laboratory within 15 days from the date of receipt of the report.

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| Test Result Certification  |                                                  |
|----------------------------|--------------------------------------------------|
| <b>Applicant:</b>          | Chug Inc.                                        |
| <b>Address:</b>            | 7157 Shady Oak Road, Eden Prairie, MN 55344, USA |
| <b>Manufacturer:</b>       | Chug Inc.                                        |
| <b>Address:</b>            | 7157 Shady Oak Road, Eden Prairie, MN 55344, USA |
| <b>Product description</b> |                                                  |
| <b>Product name:</b>       | 3-in-1 multi-charger                             |
| <b>Trademark:</b>          | heyday                                           |
| <b>Model name:</b>         | QIC37                                            |
| <b>Series Model:</b>       | HKWP2993-25                                      |
| <b>Standards:</b>          | FCC 47 CFR Part 15 Subpart C                     |
| <b>Test method:</b>        | ANSI C63.10-2013                                 |
| <b>Date of Test</b>        |                                                  |
| <b>Date of test:</b>       | 2023-03-30 ~ 2023-04-18                          |
| <b>Test result:</b>        | Pass                                             |

Test Engineer :



(Yanice Xie)

Reviewed By :



(Leon Chen)

Approved By :



(Tom Xue)

## 1. General Description

### 1.1 Description of the EUT

|                          |                                                                                                                                                             |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product name:            | 3-in-1 multi-charger                                                                                                                                        |
| Model name:              | QIC37                                                                                                                                                       |
| Series Model:            | HKWP2993-25                                                                                                                                                 |
| Model difference:        | All the models are the same circuit and module, except the model name.                                                                                      |
| Electrical rating:       | Input: DC 12V/2.5A, 15V/2A<br>Output: MagSafe Output: 15W, iWatch Output: 5W, Earphone Output: 5W                                                           |
| Accessories:             | 1. Adapter:<br>Model: HKAP3891-30US<br>Input: 100-240V~ 50/60Hz 0.8A<br>Output: 5V=3A, 9V=3A, 12V=2.5A, 15V=2A<br><br>2. Cable: Type-C to Type-C cable 1.8m |
| Hardware version:        | V1.0                                                                                                                                                        |
| Software version:        | V1.0                                                                                                                                                        |
| Test sample(s) number:   | MTi220829009-02S1001                                                                                                                                        |
| <b>RF specification:</b> |                                                                                                                                                             |
| Operation frequency:     | Transmitter 1(Earphone): 115 kHz – 205 kHz<br>Transmitter 2(Phone): 115 kHz – 205 kHz&360 kHz<br>Transmitter 3(Watch): 326.5 kHz                            |
| Modulation type:         | ASK                                                                                                                                                         |
| Antenna type:            | Coil Antenna                                                                                                                                                |

## 1.2 Description of test modes

All the test modes were carried out with the EUT in normal operation, the final test mode of the EUT was the worst test mode for emission test, which was shown in this report and defined as:

| No.                                                       | Emission test modes                                   |
|-----------------------------------------------------------|-------------------------------------------------------|
| Mode 1                                                    | Wireless MagSafe Output(5W)+iWatch(5W)+Earphone(5W)   |
| Mode 2                                                    | Wireless MagSafe Output(7.5W)+iWatch(5W)+Earphone(5W) |
| Mode 3                                                    | Wireless MagSafe Output(15W)+iWatch(5W)+Earphone(5W)  |
| Mode 4                                                    | Wireless MagSafe Output(5W)+iWatch(5W)                |
| Mode 5                                                    | Wireless MagSafe Output(7.5W)+iWatch(5W)              |
| Mode 6                                                    | Wireless MagSafe Output(15W)+iWatch(5W)               |
| Mode 7                                                    | Wireless MagSafe Output(5W)+Earphone(5W)              |
| Mode 8                                                    | Wireless MagSafe Output(7.5W)+Earphone(5W)            |
| Mode 9                                                    | Wireless MagSafe Output(15W)+Earphone(5W)             |
| Mode 10                                                   | Wireless iWatch(5W)+Earphone(5W)                      |
| Mode 11                                                   | Wireless MagSafe Output(5W)                           |
| Mode 12                                                   | Wireless MagSafe Output(7.5W)                         |
| Mode 13                                                   | Wireless MagSafe Output(15W)                          |
| Mode 14                                                   | Wireless iWatch(5W)                                   |
| Mode 15                                                   | Wireless Earphone(5W)                                 |
| Mode 16                                                   | Standby                                               |
| <b>The worst test mode of conducted emissions: Mode 1</b> |                                                       |
| <b>The worst test mode of radiated emissions: Mode 3</b>  |                                                       |

### 1.3 Description of support units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Support equipment list |            |              |              |
|------------------------|------------|--------------|--------------|
| Description            | Model      | Serial No.   | Manufacturer |
| Load                   | YBZ1.1     | /            | YBZ          |
| Iphone 12              | A2404      | F17DLCK70DYN | Apple        |
| Air Pods               | /          | /            | Apple        |
| Earphone               | /          | /            | Xiaomi       |
| Support cable list     |            |              |              |
| Description            | Length (m) | From         | To           |
| /                      | /          | /            | /            |

### 1.4 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

|                       |                   |
|-----------------------|-------------------|
| Temperature:          | 15°C~35°C         |
| Humidity:             | 20 % RH ~ 75 % RH |
| Atmospheric pressure: | 98 kPa~101 kPa    |

## 2. Measurement uncertainty

| Measurement                        | Uncertainty    |
|------------------------------------|----------------|
| Conducted emission (9 kHz~30 MHz)  | $\pm 2.5$ dB   |
| Radiated emission (9 kHz ~ 30 MHz) | $\pm 4.0$ dB   |
| Radiated emission (30 MHz~1 GHz)   | $\pm 4.2$ dB   |
| Radiated emission (above 1 GHz)    | $\pm 4.3$ dB   |
| Occupied bandwidth                 | $\pm 3$ %      |
| Temperature                        | $\pm 1$ degree |
| Humidity                           | $\pm 5$ %      |

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

## 3. Test laboratory

|                        |                                                                                                                                      |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Test laboratory:       | Shenzhen Microtest Co., Ltd.                                                                                                         |
| Test site location:    | 101, No.7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China |
| Telephone:             | (86-755)88850135                                                                                                                     |
| Fax:                   | (86-755)88850136                                                                                                                     |
| CNAS Registration No.: | CNAS L5868                                                                                                                           |
| FCC Registration No.:  | 448573                                                                                                                               |

#### 4. Summary of Test Result

| No.             | FCC reference   | Description of test               | Result |
|-----------------|-----------------|-----------------------------------|--------|
| <b>Emission</b> |                 |                                   |        |
| 1               | FCC Part 15.203 | Antenna requirement               | Pass   |
| 2               | FCC Part 15.207 | AC power line Conducted emissions | Pass   |
| 3               | FCC Part 15.209 | Radiated emissions                | Pass   |
| 4               | FCC Part 15.215 | Occupied bandwidth                | Pass   |

## 5. List of test equipment

| No.      | Equipment                              | Manufacturer    | Model       | Serial No.        | Cal. date  | Cal. Due   |
|----------|----------------------------------------|-----------------|-------------|-------------------|------------|------------|
| MTi-E043 | EMI test receiver                      | R&S             | ESCI7       | 101166            | 2022/05/05 | 2023/05/04 |
| MTi-E044 | Broadband antenna                      | Schwarzbeck     | VULB9163    | 9163-1338         | 2021/05/30 | 2024/05/29 |
| MTi-E045 | Horn antenna                           | Schwarzbeck     | BBHA9120D   | 9120D-2278        | 2021/05/30 | 2024/05/29 |
| MTi-E046 | Active Loop Antenna                    | Schwarzbeck     | FMZB 1519 B | 00066             | 2021/05/30 | 2024/05/29 |
| MTi-E047 | Pre-amplifier                          | Hewlett-Packard | 8447F       | 3113A06184        | 2022/05/05 | 2023/05/04 |
| MTi-E048 | Pre-amplifier                          | Agilent         | 8449B       | 3008A01120        | 2022/05/05 | 2023/05/04 |
| MTi-E120 | Broadband antenna                      | Schwarzbeck     | VULB9163    | 9163-1419         | 2021/05/30 | 2024/05/29 |
| MTi-E121 | Pre-amplifier                          | Hewlett-Packard | 8447D       | 2944A09365        | 2022/05/05 | 2023/05/04 |
| MTi-E123 | Pre-amplifier                          | Agilent         | 8449B       | 3008A04723        | 2022/05/05 | 2023/05/04 |
| MTi-E122 | MXA signal analyzer                    | Agilent         | N9020A      | MY5444085<br>9    | 2022/05/05 | 2023/05/04 |
| MTi-E001 | Artificial Mains Network               | R&S             | ESH2-Z5     | 100263            | 2022/05/05 | 2023/05/04 |
| MTi-E002 | EMI Test Receiver                      | R&S             | ESCI3       | 101368            | 2022/05/05 | 2023/05/04 |
| MTi-E023 | Artificial power network               | Schwarzbeck     | NSLK8127    | NSLK8127#<br>841  | 2022/05/05 | 2023/05/04 |
| MTi-E025 | Artificial power network               | Schwarzbeck     | NSLK8127    | 8127183           | 2022/05/05 | 2023/05/04 |
| MTi-E026 | 8-wire Impedance Stabilization Network | Schwarzbeck     | NTFM 8158   | NTFM 8158<br>#199 | 2022/05/05 | 2023/05/04 |
| MTi-E021 | EMI Test Receiver                      | R&S             | ESCS30      | 100210            | 2022/05/05 | 2023/05/04 |
| MTi-E024 | Artificial power network               | Schwarzbeck     | NSLK8127    | 01001             | 2022/05/05 | 2023/05/04 |

**Note:** the calibration interval of the test equipment is 12 or 24 months and the calibrations are traceable to international system unit(SI)

## 6. Test Results

### 6.1 Antenna 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

#### Description of the EUT antenna

The antenna of EUT is coil antenna, which is integrated on the main PCB of the EUT and no consideration of replacement.

## 6.2 AC power line conducted emissions

### 6.2.1 Limits

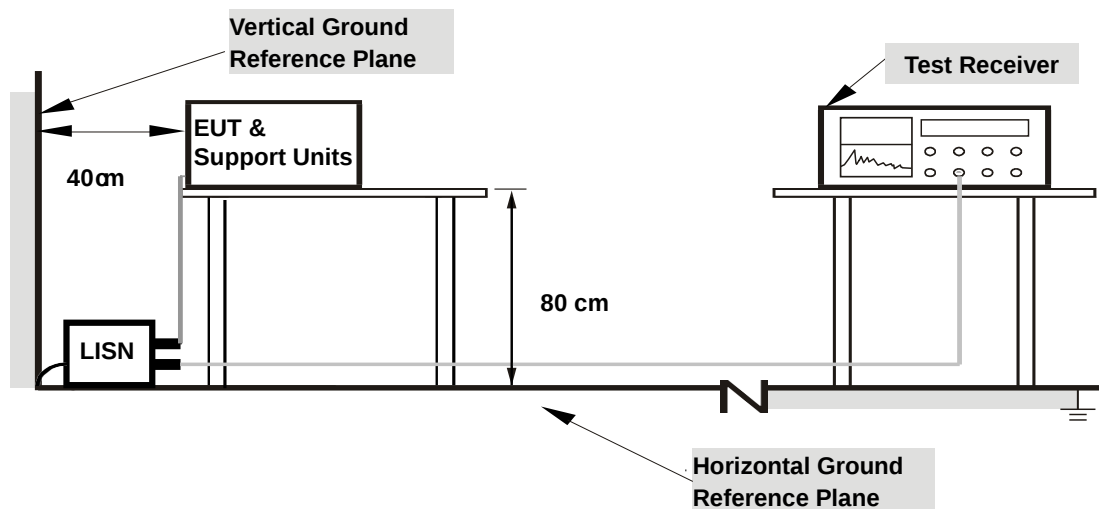
| Frequency (MHz) | Detector type / Bandwidth | Limit-Quasi-peak dB $\mu$ V | Limit-Average dB $\mu$ V |
|-----------------|---------------------------|-----------------------------|--------------------------|
| 0.15 -0.5       | Average / 9 kHz           | 66 to 56                    | 56 to 46                 |
| 0.5 -5          |                           | 56                          | 46                       |
| 5 -30           |                           | 60                          | 50                       |

**Note 1:** the limit decreases with the logarithm of the frequency in the range of 0.15 MHz to 0.5 MHz.

### 6.2.2 Test Procedures

- The test setup is refer to the standard ANSI C63.10-2013.
- The EUT is connected to the main power through a line impedance stabilization network (LISN). All support equipment is powered from additional LISN(s).
- Emissions were measured on each current carrying line of the EUT using an EMI test receiver connected to the LISN powering the EUT.
- The test receiver scanned from 150 kHz to 30 MHz for emissions in each of the test modes described in Item 1.2.
- The test data of the worst-case condition(s) was recorded.

### 6.2.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the test setup.

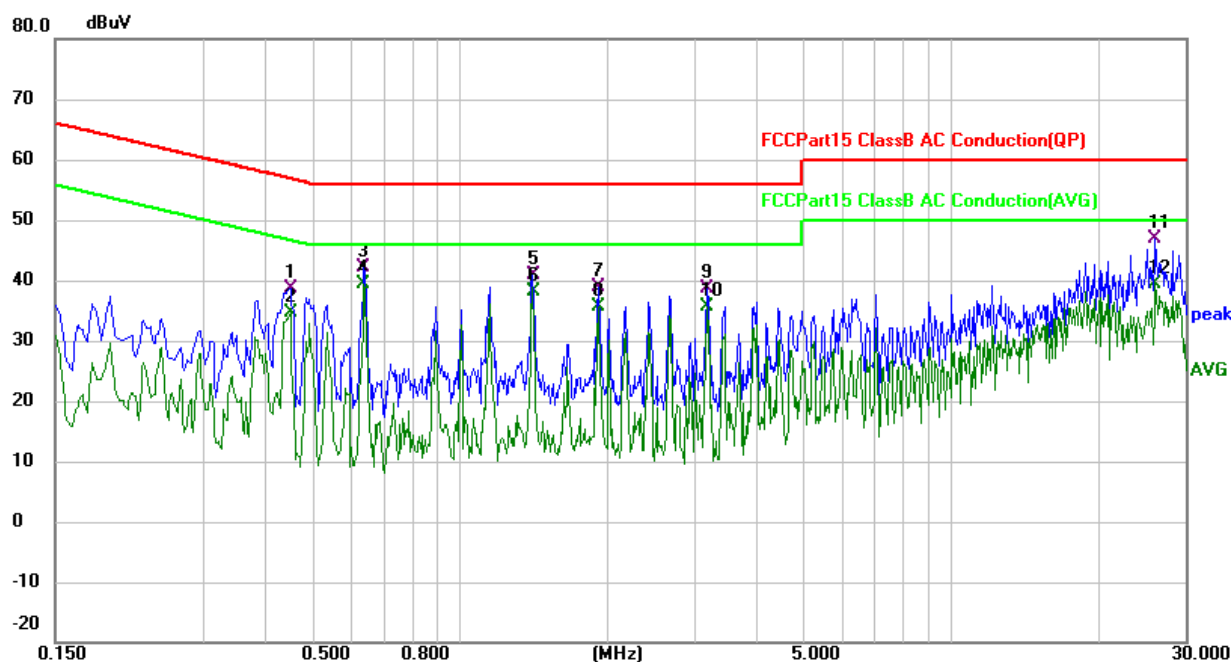
### 6.2.4 Test Result

#### Calculation formula:

Measurement (dB $\mu$ V) = Reading Level (dB $\mu$ V) + Correct Factor (dB)

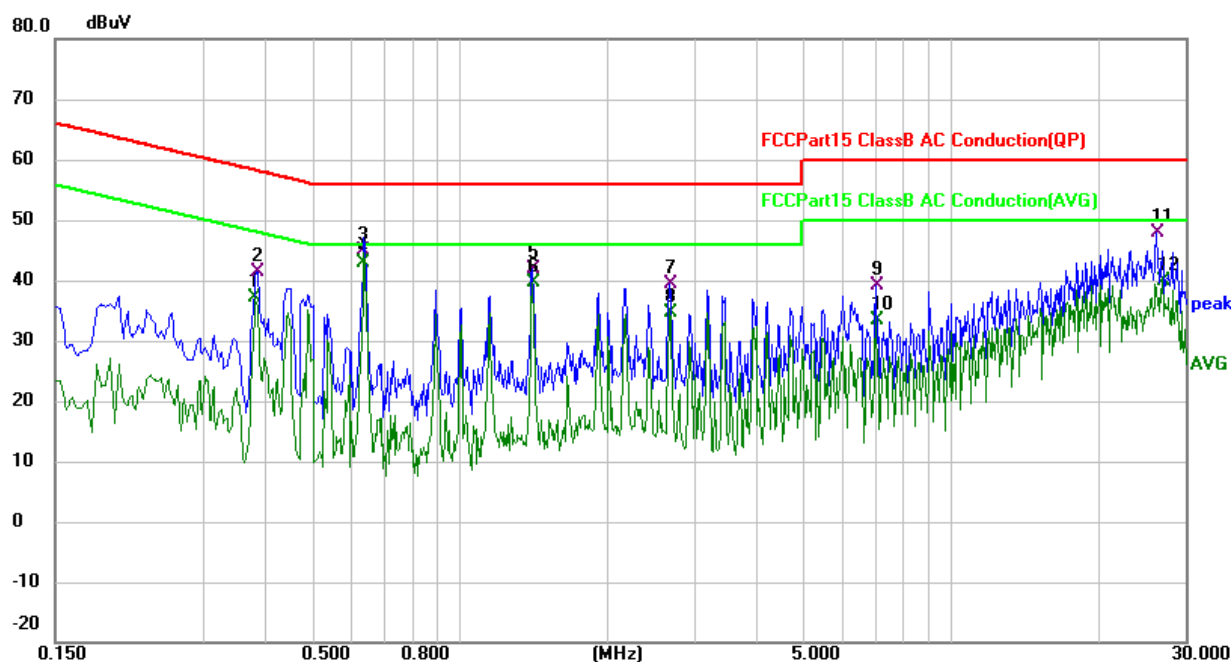
Over (dB) = Measurement (dB $\mu$ V) – Limit (dB $\mu$ V)

|               |                                         |            |              |
|---------------|-----------------------------------------|------------|--------------|
| Test mode:    | Mode 1                                  | Phase:     | L            |
| Power supply: | Powered by AC/DC adapter (AC 120V/60Hz) | Test site: | CE chamber 1 |



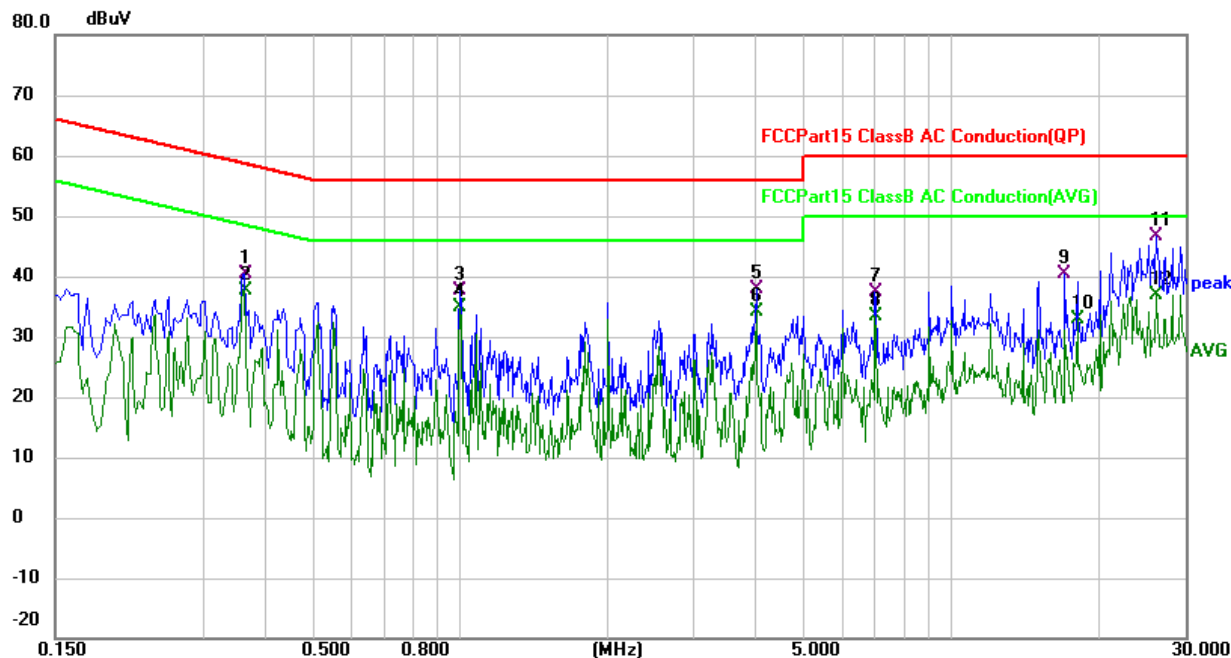
| No. | Mk. | Freq.   | Reading Level | Correct Factor | Measurement | Limit | Over   |          |
|-----|-----|---------|---------------|----------------|-------------|-------|--------|----------|
|     |     | MHz     | dBuV          | dB             | dBuV        | dBuV  | dB     | Detector |
| 1   |     | 0.4500  | 27.38         | 11.21          | 38.59       | 56.88 | -18.29 | QP       |
| 2   |     | 0.4500  | 23.34         | 11.21          | 34.55       | 46.88 | -12.33 | AVG      |
| 3   |     | 0.6380  | 30.50         | 11.63          | 42.13       | 56.00 | -13.87 | QP       |
| 4   | *   | 0.6380  | 27.80         | 11.63          | 39.43       | 46.00 | -6.57  | AVG      |
| 5   |     | 1.4060  | 27.70         | 13.06          | 40.76       | 56.00 | -15.24 | QP       |
| 6   |     | 1.4060  | 24.96         | 13.06          | 38.02       | 46.00 | -7.98  | AVG      |
| 7   |     | 1.9180  | 28.95         | 10.03          | 38.98       | 56.00 | -17.02 | QP       |
| 8   |     | 1.9180  | 25.49         | 10.03          | 35.52       | 46.00 | -10.48 | AVG      |
| 9   |     | 3.1860  | 28.41         | 10.27          | 38.68       | 56.00 | -17.32 | QP       |
| 10  |     | 3.1860  | 25.26         | 10.27          | 35.53       | 46.00 | -10.47 | AVG      |
| 11  |     | 26.1299 | 36.07         | 10.80          | 46.87       | 60.00 | -13.13 | QP       |
| 12  |     | 26.1299 | 28.46         | 10.80          | 39.26       | 50.00 | -10.74 | AVG      |

|               |                                         |            |              |
|---------------|-----------------------------------------|------------|--------------|
| Test mode:    | Mode 1                                  | Phase:     | N            |
| Power supply: | Powered by AC/DC adapter (AC 120V/60Hz) | Test site: | CE chamber 1 |



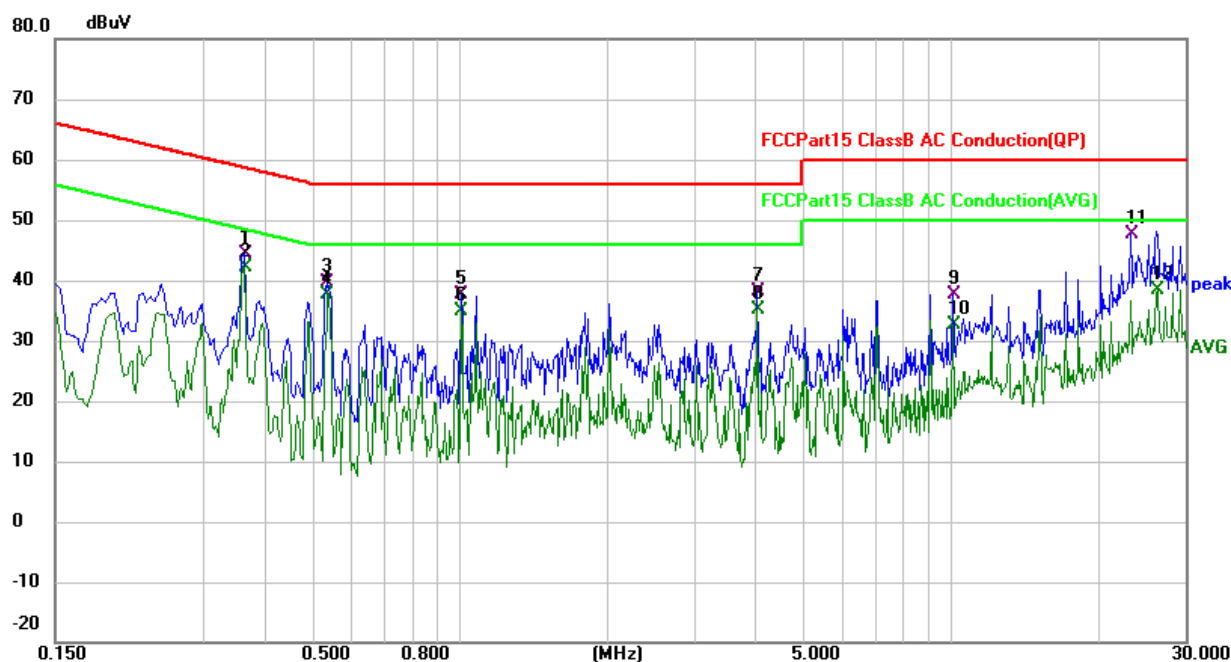
| No. | Mk. | Freq.   | Reading Level | Correct Factor | Measurement | Limit | Over   |          |
|-----|-----|---------|---------------|----------------|-------------|-------|--------|----------|
|     |     | MHz     | dBuV          | dB             | dBuV        | dBuV  | dB     | Detector |
| 1   |     | 0.3820  | 26.11         | 11.00          | 37.11       | 48.24 | -11.13 | AVG      |
| 2   |     | 0.3860  | 30.45         | 11.02          | 41.47       | 58.15 | -16.68 | QP       |
| 3   |     | 0.6380  | 33.16         | 11.64          | 44.80       | 56.00 | -11.20 | QP       |
| 4   | *   | 0.6380  | 31.26         | 11.64          | 42.90       | 46.00 | -3.10  | AVG      |
| 5   |     | 1.4060  | 28.63         | 13.20          | 41.83       | 56.00 | -14.17 | QP       |
| 6   |     | 1.4060  | 26.31         | 13.20          | 39.51       | 46.00 | -6.49  | AVG      |
| 7   |     | 2.6740  | 28.95         | 10.35          | 39.30       | 56.00 | -16.70 | QP       |
| 8   |     | 2.6740  | 24.39         | 10.35          | 34.74       | 46.00 | -11.26 | AVG      |
| 9   |     | 7.0380  | 28.76         | 10.28          | 39.04       | 60.00 | -20.96 | QP       |
| 10  |     | 7.0380  | 23.08         | 10.28          | 33.36       | 50.00 | -16.64 | AVG      |
| 11  |     | 26.1540 | 37.14         | 10.81          | 47.95       | 60.00 | -12.05 | QP       |
| 12  |     | 26.8980 | 29.02         | 10.83          | 39.85       | 50.00 | -10.15 | AVG      |

|               |                                         |            |              |
|---------------|-----------------------------------------|------------|--------------|
| Test mode:    | Mode 3                                  | Phase:     | L            |
| Power supply: | Powered by AC/DC adapter (AC 240V/60Hz) | Test site: | CE chamber 1 |



| No. | Mk. | Freq.   | Reading Level | Correct Factor | Measurement | Limit | Over   |          |
|-----|-----|---------|---------------|----------------|-------------|-------|--------|----------|
|     |     | MHz     | dBuV          | dB             | dBuV        | dBuV  | dB     | Detector |
| 1   |     | 0.3620  | 29.47         | 11.01          | 40.48       | 58.68 | -18.20 | QP       |
| 2   | *   | 0.3620  | 26.64         | 11.01          | 37.65       | 48.68 | -11.03 | AVG      |
| 3   |     | 1.0020  | 25.15         | 12.41          | 37.56       | 56.00 | -18.44 | QP       |
| 4   |     | 1.0020  | 22.52         | 12.41          | 34.93       | 46.00 | -11.07 | AVG      |
| 5   |     | 4.0140  | 27.58         | 10.27          | 37.85       | 56.00 | -18.15 | QP       |
| 6   |     | 4.0140  | 23.98         | 10.27          | 34.25       | 46.00 | -11.75 | AVG      |
| 7   |     | 7.0219  | 27.19         | 10.28          | 37.47       | 60.00 | -22.53 | QP       |
| 8   |     | 7.0219  | 23.13         | 10.28          | 33.41       | 50.00 | -16.59 | AVG      |
| 9   |     | 17.1018 | 29.85         | 10.57          | 40.42       | 60.00 | -19.58 | QP       |
| 10  |     | 18.1059 | 22.18         | 10.59          | 32.77       | 50.00 | -17.23 | AVG      |
| 11  |     | 26.2420 | 35.93         | 10.80          | 46.73       | 60.00 | -13.27 | QP       |
| 12  |     | 26.2420 | 26.19         | 10.80          | 36.99       | 50.00 | -13.01 | AVG      |

|               |                                         |            |              |
|---------------|-----------------------------------------|------------|--------------|
| Test mode:    | Mode 3                                  | Phase:     | N            |
| Power supply: | Powered by AC/DC adapter (AC 240V/60Hz) | Test site: | CE chamber 1 |



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   |     | 0.3620       | 33.47                    | 10.96                   | 44.43                    | 58.68         | -14.25     | QP       |
| 2   | *   | 0.3620       | 31.18                    | 10.96                   | 42.14                    | 48.68         | -6.54      | AVG      |
| 3   |     | 0.5340       | 28.31                    | 11.39                   | 39.70                    | 56.00         | -16.30     | QP       |
| 4   |     | 0.5380       | 26.16                    | 11.41                   | 37.57                    | 46.00         | -8.43      | AVG      |
| 5   |     | 1.0100       | 25.30                    | 12.35                   | 37.65                    | 56.00         | -18.35     | QP       |
| 6   |     | 1.0100       | 22.58                    | 12.35                   | 34.93                    | 46.00         | -11.07     | AVG      |
| 7   |     | 4.0420       | 27.74                    | 10.29                   | 38.03                    | 56.00         | -17.97     | QP       |
| 8   |     | 4.0420       | 24.87                    | 10.29                   | 35.16                    | 46.00         | -10.84     | AVG      |
| 9   |     | 10.0940      | 27.40                    | 10.31                   | 37.71                    | 60.00         | -22.29     | QP       |
| 10  |     | 10.0940      | 22.43                    | 10.31                   | 32.74                    | 50.00         | -17.26     | AVG      |
| 11  |     | 23.2380      | 36.96                    | 10.76                   | 47.72                    | 60.00         | -12.28     | QP       |
| 12  |     | 26.2820      | 27.56                    | 10.81                   | 38.37                    | 50.00         | -11.63     | AVG      |

### 6.3 Radiated emissions

#### 6.3.1 Limits

| Frequency (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                             |

**Note 1:** the tighter limit applies at the band edges.

**Note 2:** the emission limits shown in 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 emission limits in these three bands are based on measurements employing an average detector

§ 15.35 (b) requirements:

When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

According to ANSI C63.10, the tests shall be performed in the frequency range shown in the following table:

#### Frequency range of measurements for unlicensed wireless device

| Lowest frequency generated in the device | Upper frequency range of measurement                                                                        |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 9 kHz to below 10 GHz                    | 10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower                             |
| At or above 10 GHz to below 30 GHz       | 5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower                             |
| At or above 30 GHz                       | 5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified |

#### Frequency range of measurements for unlicensed wireless device with digital device

| Highest frequency generated or used in the device or on which the device operates or tunes | Upper frequency range of measurement                                |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Below 1.705 MHz                                                                            | 30 MHz                                                              |
| 1.705 MHz to 108 MHz                                                                       | 1000 MHz                                                            |
| 108 MHz to 500 MHz                                                                         | 2000 MHz                                                            |
| 500 MHz to 1000 MHz                                                                        | 5000 MHz                                                            |
| Above 1000 MHz                                                                             | 5th harmonic of the highest frequency or 40 GHz, whichever is lower |

**Test instrument setup**

| Frequency        | Test receiver / Spectrum analyzer setting |
|------------------|-------------------------------------------|
| 9 kHz ~ 150 kHz  | Quasi Peak / 200 Hz                       |
| 150 kHz ~ 30 MHz | Quasi Peak / 9 kHz                        |
| 30 MHz ~ 1 GHz   | Quasi Peak / 120 kHz                      |

**6.3.2 Test Procedures**

The EUT is placed on a non-conducting table 80cm above the ground plane for measurement below 1 GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10-2013.

For measurement below 1 GHz, the resolution bandwidth is set as item 5.4.2.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4m meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and horizontal positions.

**Special requirements for 9 kHz to 30 MHz:**

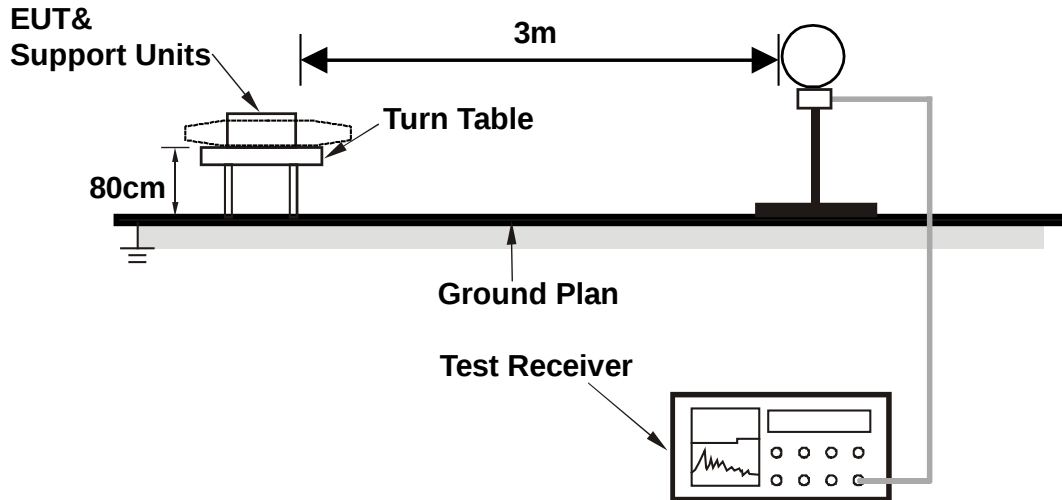
The lowest height of the magnetic antenna shall be 1 m above the ground

When the EUT contains a loop antenna that can only be placed in a vertical axis, normal measurements shall be made aligning the measurement antenna along the site axis, and then orthogonal to the axis. For each measurement antenna alignment, the EUT shall be rotated through 0° to 360° on a turntable.

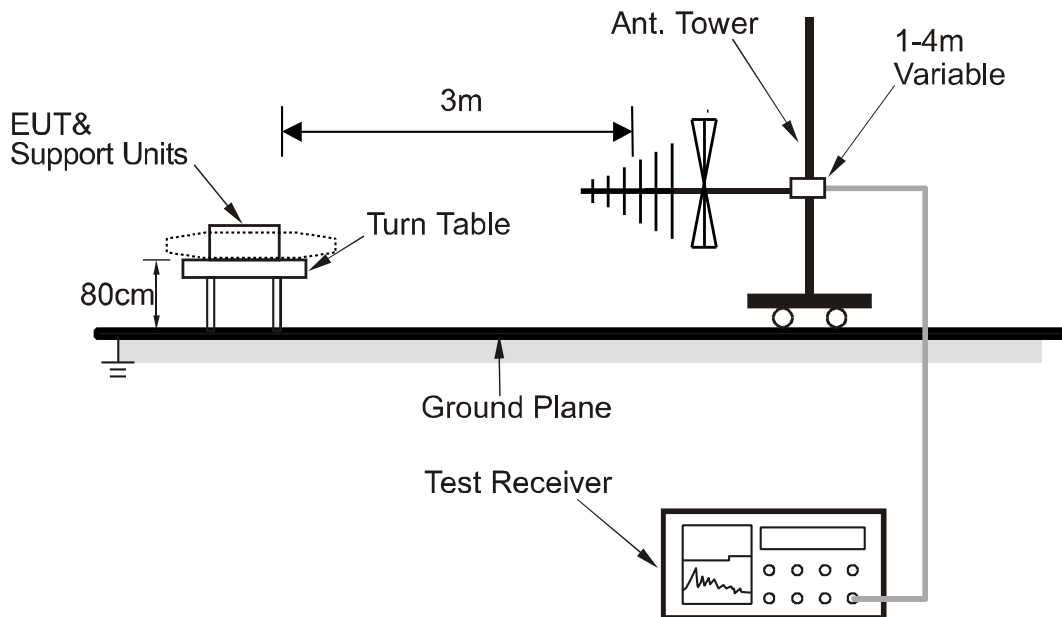
When the EUT contains a loop antenna that can be placed in a horizontal or vertical axis, normal measurements shall be made aligning the measurement antenna along the site axis, orthogonal to the axis, and then with the measurement antenna horizontal. For each measurement antenna alignment, the EUT shall be rotated through 0° to 360° on a turntable.

### 6.3.3 Test Setup

**Below 30 MHz:**



**Below 1 GHz:**



For the actual test configuration, please refer to the related item – Photographs of the test setup.

### 6.3.4 Test result

**Calculation formula:**

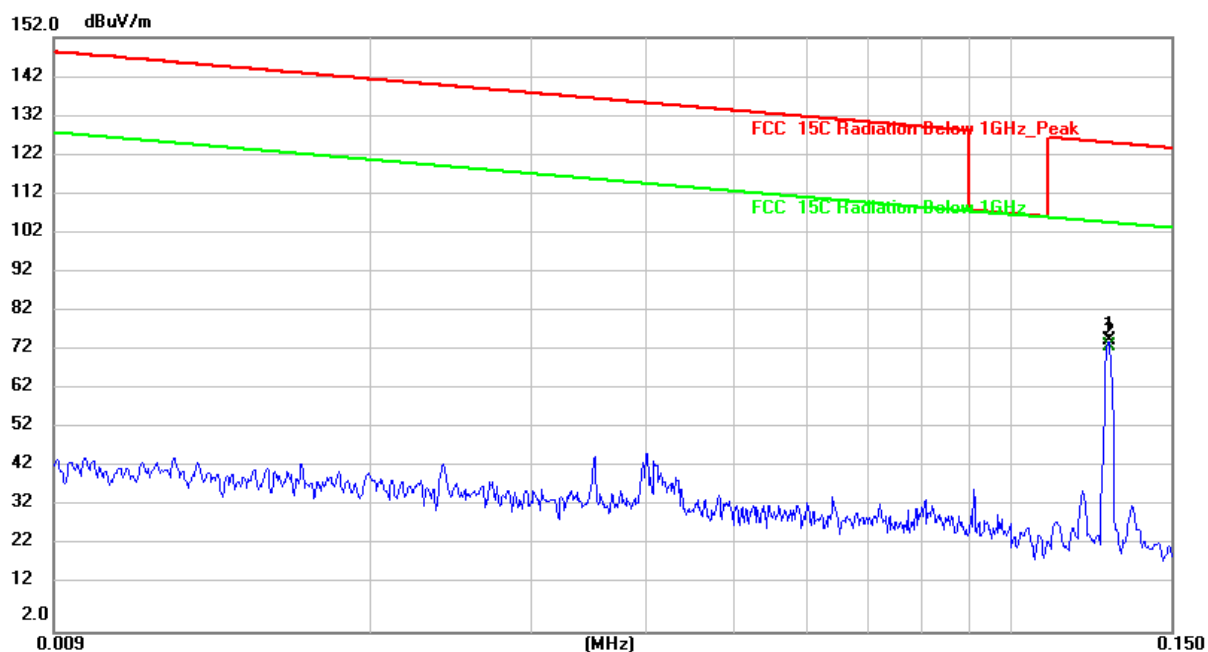
Measurement (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Correct Factor (dB/m)

Over (dB) = Measurement (dB $\mu$ V/m) – Limit (dB $\mu$ V/m)

**Note:** For 9 kHz - 30 MHz testing, all the required orthogonal orientations of the measurement loop antenna were performed for pre-scan, the maximum radiated transmissions (Site axis) were recorded.

**Frequency 9 kHz ~ 150 kHz**

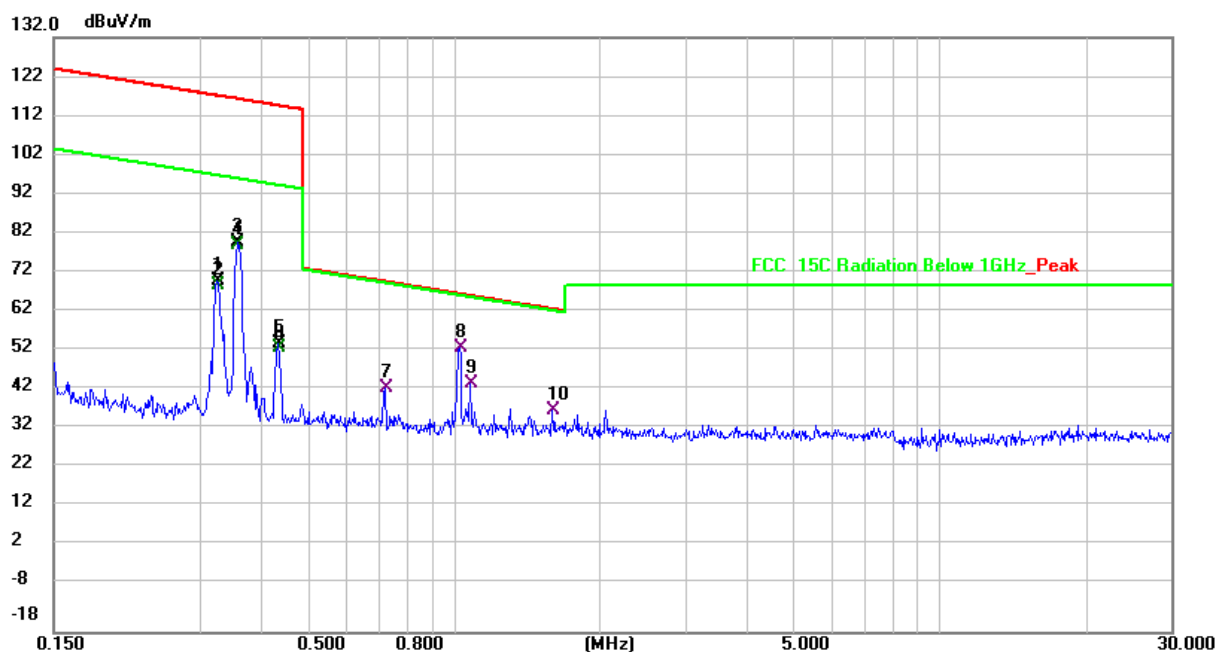
|               |                                         |               |              |
|---------------|-----------------------------------------|---------------|--------------|
| Test mode:    | Mode 3                                  | Polarization: | Site axis    |
| Power supply: | Powered by AC/DC adapter (AC 120V/60Hz) | Test site:    | RE chamber 1 |



| No. | Mk. | Freq.  | Reading Level | Correct Factor | Measurement | Limit  | Over   |          |
|-----|-----|--------|---------------|----------------|-------------|--------|--------|----------|
|     |     | MHz    | dBuV          | dB             | dBuV/m      | dBuV/m | dB     | Detector |
| 1   |     | 0.1281 | 54.40         | 21.20          | 75.60       | 125.47 | -49.87 | peak     |
| 2   | *   | 0.1281 | 53.00         | 21.20          | 74.20       | 105.47 | -31.27 | AVG      |

**Frequency 150 kHz ~ 30 MHz**

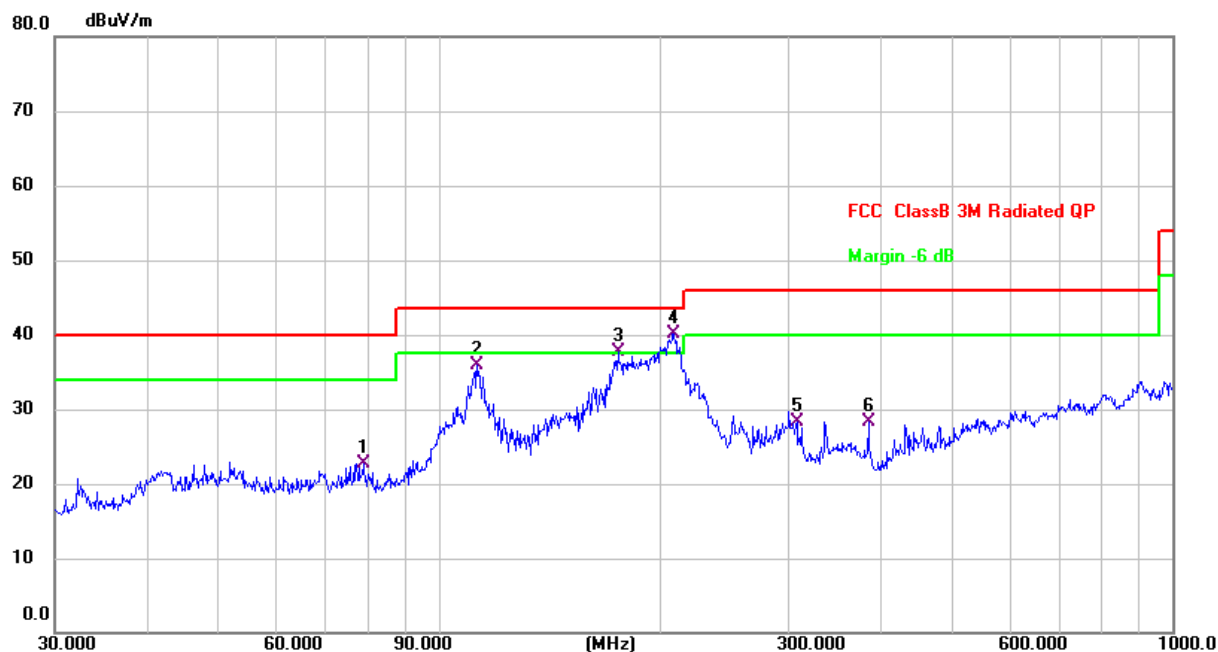
|               |                                         |               |              |
|---------------|-----------------------------------------|---------------|--------------|
| Test mode:    | Mode 3                                  | Polarization: | Site axis    |
| Power supply: | Powered by AC/DC adapter (AC 120V/60Hz) | Test site:    | RE chamber 1 |



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|
| 1   |     | 0.3261       | 49.34                    | 21.33                   | 70.67                      | 117.34          | -46.67     | peak     |
| 2   |     | 0.3261       | 48.17                    | 21.33                   | 69.50                      | 97.34           | -27.84     | AVG      |
| 3   |     | 0.3593       | 59.07                    | 21.33                   | 80.40                      | 116.50          | -36.10     | peak     |
| 4   |     | 0.3593       | 58.27                    | 21.33                   | 79.60                      | 96.50           | -16.90     | AVG      |
| 5   |     | 0.4351       | 33.55                    | 21.32                   | 54.87                      | 114.83          | -59.96     | peak     |
| 6   |     | 0.4351       | 32.58                    | 21.32                   | 53.90                      | 94.83           | -40.93     | AVG      |
| 7   |     | 0.7236       | 21.99                    | 21.57                   | 43.56                      | 70.42           | -26.86     | QP       |
| 8   | *   | 1.0265       | 32.06                    | 21.87                   | 53.93                      | 67.39           | -13.46     | QP       |
| 9   |     | 1.0824       | 22.78                    | 21.87                   | 44.65                      | 66.94           | -22.29     | QP       |
| 10  |     | 1.5935       | 13.05                    | 25.05                   | 38.10                      | 63.59           | -25.49     | QP       |

**Frequency 30 MHz ~ 1 GHz**

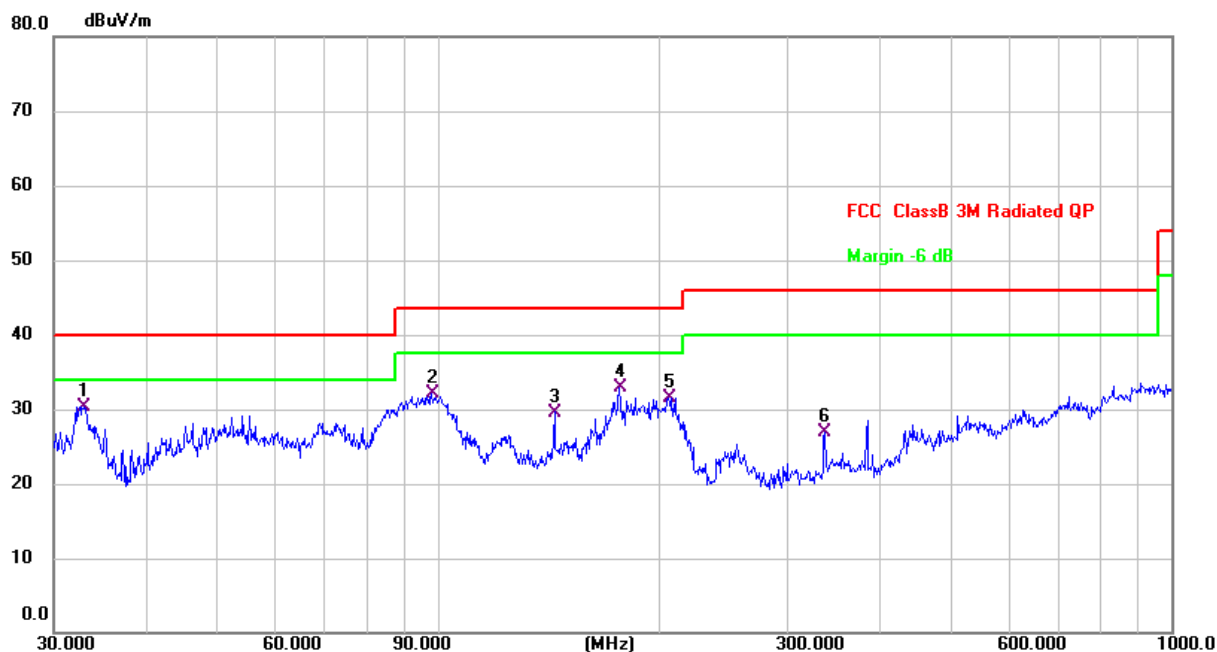
|               |                                         |               |              |
|---------------|-----------------------------------------|---------------|--------------|
| Test mode:    | Mode 3                                  | Polarization: | Horizontal   |
| Power supply: | Powered by AC/DC adapter (AC 120V/60Hz) | Test site:    | RE chamber 1 |



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|
| 1   |     | 78.9652      | 33.57                    | -10.84                  | 22.73                      | 40.00           | -17.27     | QP       |
| 2   |     | 112.9196     | 43.33                    | -7.49                   | 35.84                      | 43.50           | -7.66      | QP       |
| 3   | !   | 175.6516     | 46.60                    | -8.96                   | 37.64                      | 43.50           | -5.86      | QP       |
| 4   | *   | 209.3129     | 46.30                    | -6.25                   | 40.05                      | 43.50           | -3.45      | QP       |
| 5   |     | 307.8313     | 32.46                    | -4.14                   | 28.32                      | 46.00           | -17.68     | QP       |
| 6   |     | 385.2805     | 30.54                    | -2.33                   | 28.21                      | 46.00           | -17.79     | QP       |

**Frequency 30 MHz ~ 1 GHz**

|               |                                         |               |              |
|---------------|-----------------------------------------|---------------|--------------|
| Test mode:    | Mode 3                                  | Polarization: | Vertical     |
| Power supply: | Powered by AC/DC adapter (AC 120V/60Hz) | Test site:    | RE chamber 1 |



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Over   |          |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|
|     |     | MHz      | dBuV          | dB             | dBuV/m      | dBuV/m | dB     | Detector |
| 1   | *   | 32.9791  | 39.58         | -9.18          | 30.40       | 40.00  | -9.60  | QP       |
| 2   |     | 98.1419  | 39.46         | -7.35          | 32.11       | 43.50  | -11.39 | QP       |
| 3   |     | 144.3348 | 39.78         | -10.18         | 29.60       | 43.50  | -13.90 | QP       |
| 4   |     | 176.8878 | 41.64         | -8.77          | 32.87       | 43.50  | -10.63 | QP       |
| 5   |     | 206.3976 | 37.82         | -6.25          | 31.57       | 43.50  | -11.93 | QP       |
| 6   |     | 337.2155 | 30.65         | -3.74          | 26.91       | 46.00  | -19.09 | QP       |

## 6.4 Occupied bandwidth test

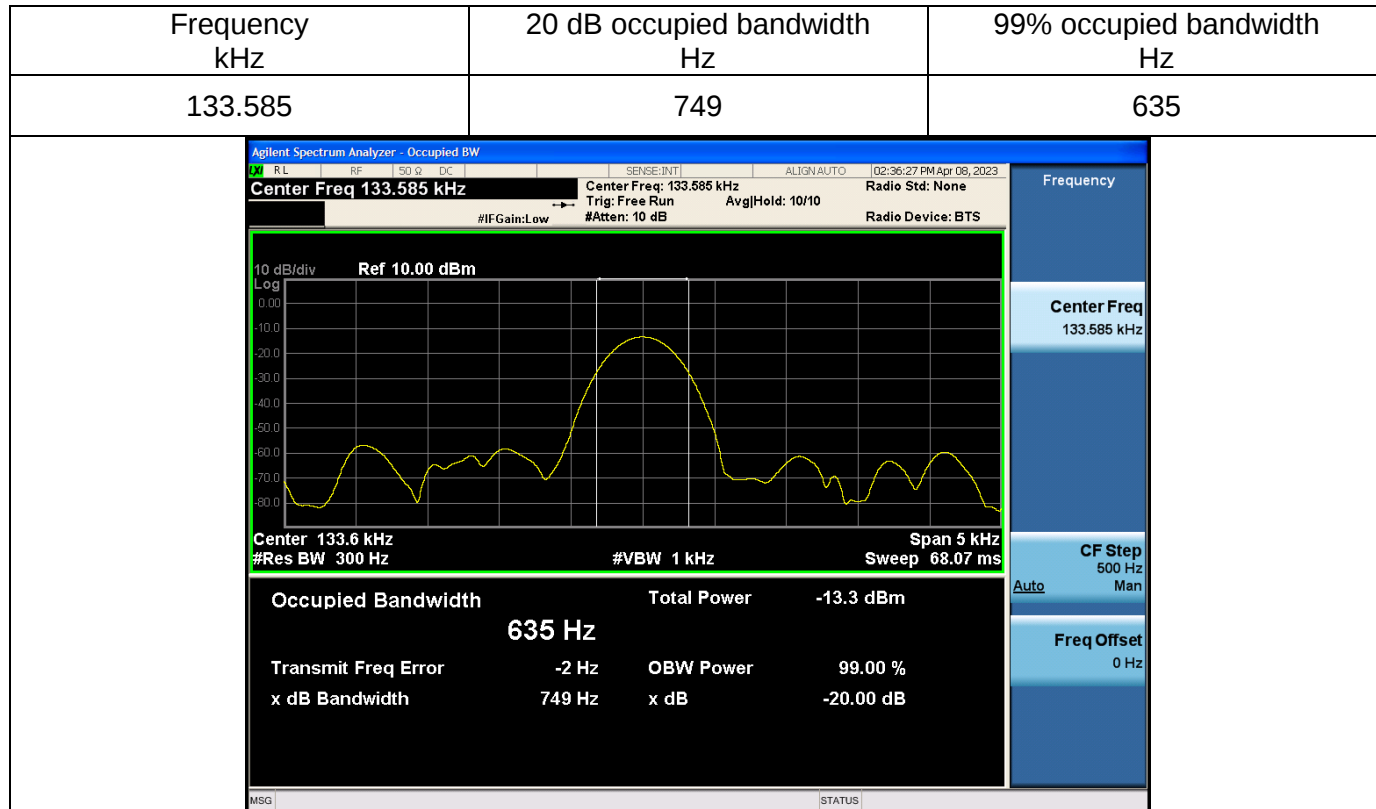
### 6.4.1 Test Procedures

- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation.
- The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target “-xx dB down” requirement
- Set detection mode to peak and trace mode to max hold.
- Determine the “-xx dB down amplitude” using [(reference value) - xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.

### 6.4.2 Test Result

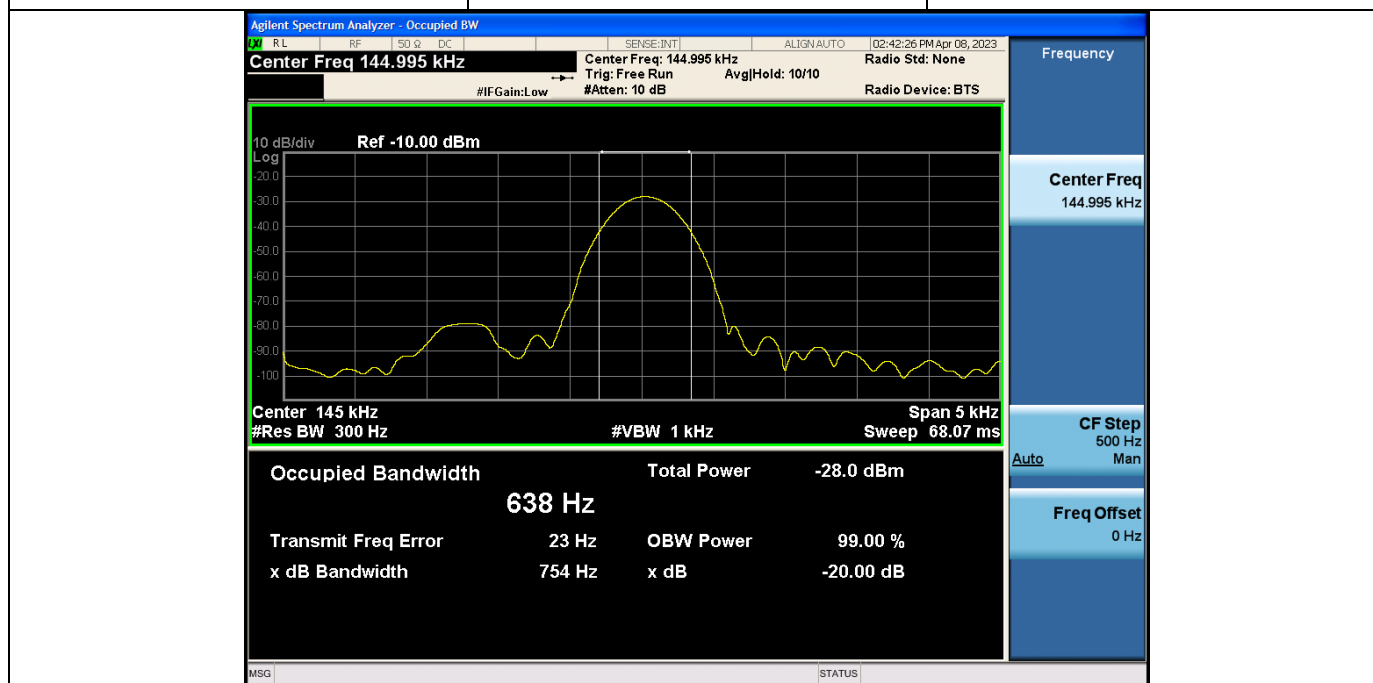
**Note:** Because the measured signal is CW-like, adjusting the RBW per C63.10 would not be practical since measurement bandwidth will always follow the RBW. The RBW is set to 300 Hz to perform the occupied bandwidth test.

Transmitter 1:

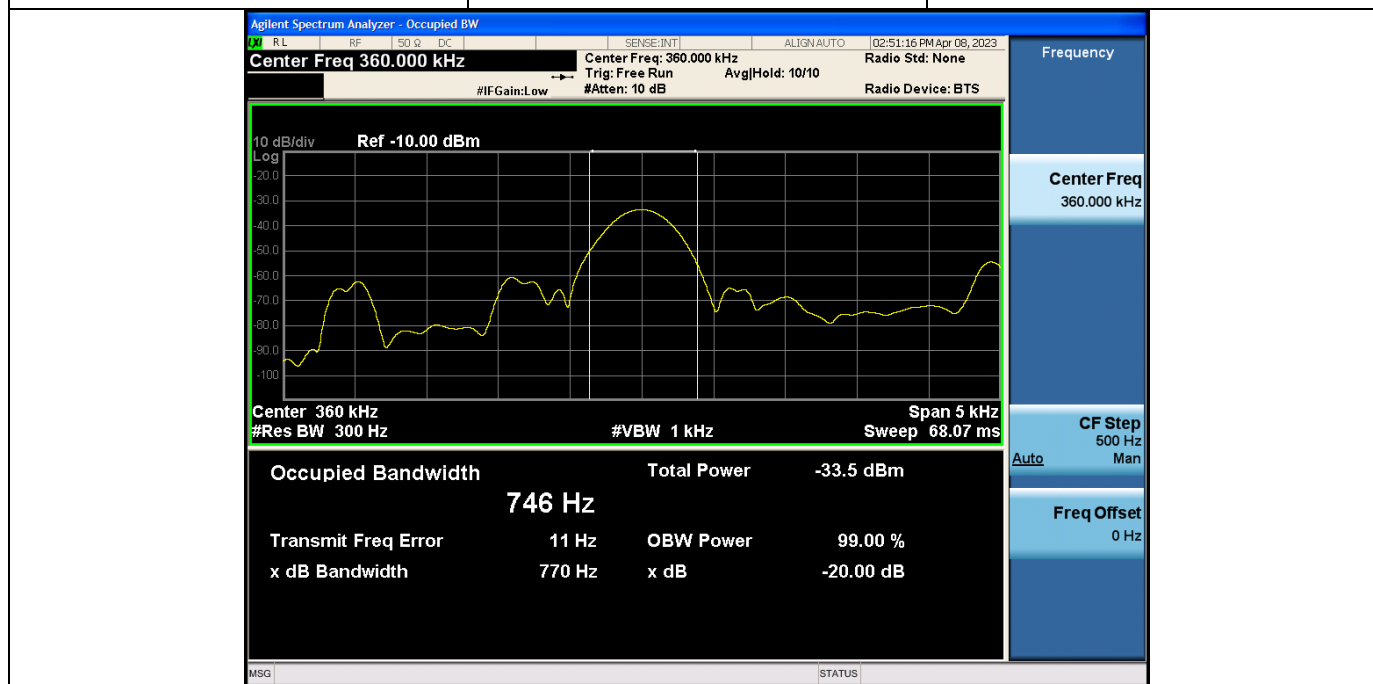


## Transmitter 2:

| Frequency<br>kHz | 20 dB occupied bandwidth<br>Hz | 99% occupied bandwidth<br>Hz |
|------------------|--------------------------------|------------------------------|
| 144.995          | 754                            | 638                          |

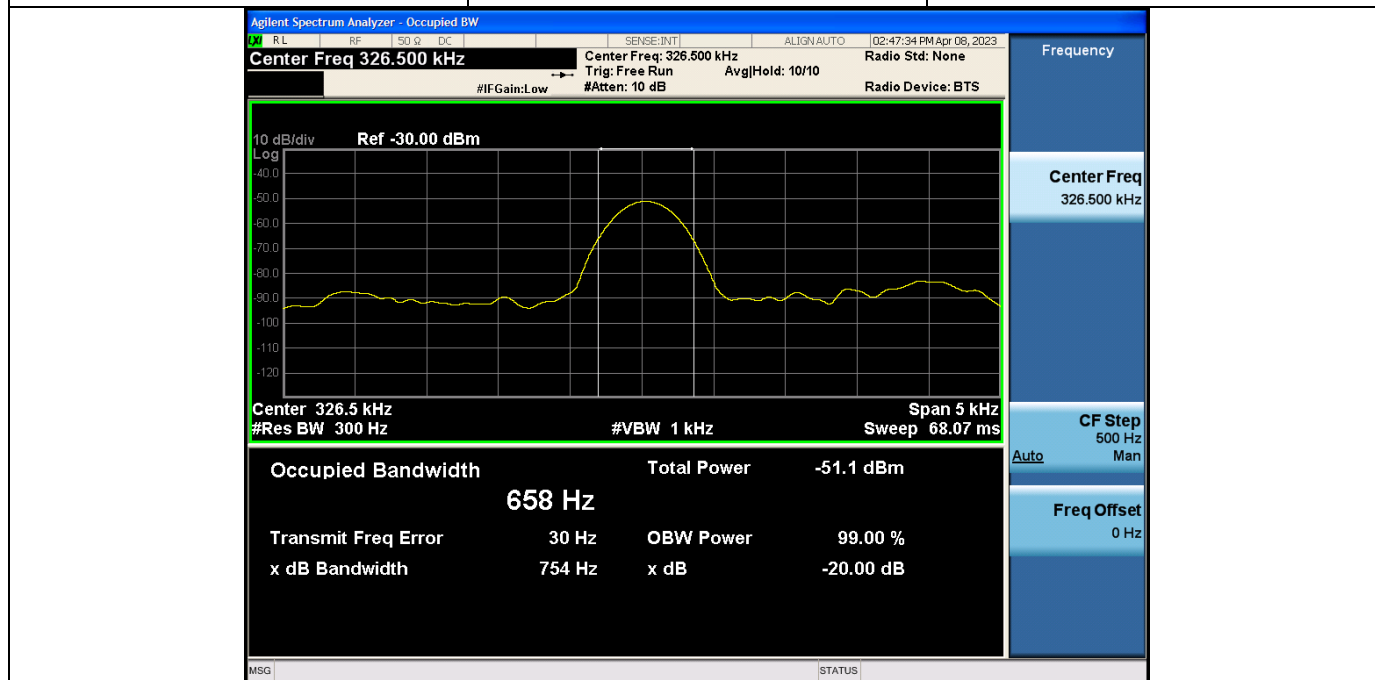


| Frequency<br>kHz | 20 dB occupied bandwidth<br>Hz | 99% occupied bandwidth<br>Hz |
|------------------|--------------------------------|------------------------------|
| 360.000          | 770                            | 746                          |



## Transmitter 3:

| Frequency<br>kHz | 20 dB occupied bandwidth<br>Hz | 99% occupied bandwidth<br>Hz |
|------------------|--------------------------------|------------------------------|
| 326.5            | 754                            | 658                          |



## **Photographs of the test setup**

See the Appendix – Test Setup Photos.

## **Photographs of the EUT**

See the Appendix - EUT Photos.

**----End of Report----**