# FCC 47 CFR PART 15 SUBPART C
# ISED RSS-210 ISSUE 10

# CERTIFICATION TEST REPORT

*For*

**WiseCube**

**MODEL NUMBER: CHB65**

**FCC ID: 2AB7X-CHB6V1**

**IC: 28493-CHB6V1**

**REPORT NUMBER: 4790391063-10**

**ISSUE DATE: June 15, 2022**

*Prepared for*

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*Prepared by*

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Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| V0 | 6/15/2022 | Initial Issue | \ |

| Summary of Test Results | | | |
|---|---|---|---|
| Clause | Test Items | FCC Rules | Test Results |
| 1 | Transmitter 99% Emission Bandwidth / 20dB Bandwidth | RSS-Gen 6.7/ Part 15.215 (c) | PASS |
| 2 | Transmitter Frequency Stability (Temperature & Voltage Variation) | CFR 47 FCC §15.225(e) ISED RSS-Gen Clause 6.11 ISED RSS-210 Annex B.6 | PASS |
| 3 | Fundamental Field Strength | CFR 47 FCC §15.225(a)(b)(c)(d) ISED RSS-Gen Clause 6.12 ISED RSS-210 Annex B.6 | PASS |
| 4 | Radiated Emissions | CFR 47 FCC§15.209(a) CFR 47 FCC§15.225(d) ISED RSS-Gen Clause 6.13 ISED RSS-210 Annex B.6 | PASS |
| 5 | Band Edge Radiated Emissions | CFR 47 FCC §15.209(a) CFR 47 FCC §15.225(c)(d) ISED RSS-Gen Clause 6.13 ISED RSS-210 Annex B.6 | PASS |
| 6 | Conducted Emission Test for AC Power Port | CFR 47 FCC §15.207 ISED RSS-Gen Clause 8.8 | PASS |
| 7 | Antenna Requirement | CFR 47 FCC §15.203 ISED RSS-Gen Clause 6.8 | Pass |
| Note 1: This test report is only published to and used by the applicant, and it is not for evidence purpose in China.<br>Note 2: The measurement result for the sample received is <Pass> according to < CFR 47 FCC PART 15 SUBPART C, ISED RSS-210 Issue 9 and ISED RSS-GEN Issue 5 > when <Accuracy Method> decision rule is applied. | | | |

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# 1. ATTESTATION OF TEST RESULTS

**Applicant Information**

| | |
|---|---|
| **Company Name:** | BBPOS Limited |
| **Address:** | Suite 1902-04, Tower 2, Nina Tower, 8 Yeung Uk Road, Tsuen Wan, NT, Hong Kong |

**Manufacturer Information**

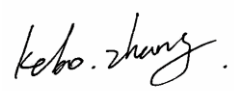
| | |
|---|---|
| **Company Name:** | BBPOS Limited |
| **Address:** | Suite 1902-04, Tower 2, Nina Tower, 8 Yeung Uk Road, Tsuen Wan, NT, Hong Kong |

**EUT Information**

| | |
|---|---|
| EUT Name: | WiseCube |
| Model: | CHB65 |
| Brand: | BBPOS |
| Sample Received Date: | April 29, 2022 |
| Sample Status: | Normal |
| Sample ID: | 4915229 |
| Date of Tested: | April 29, 2022 ~ June 15, 2022 |

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 FCC PART 15 SUBPART C | PASS |
| ISED RSS-210 Issue 10 | PASS |
| ISED RSS-GEN Issue 5 | PASS |

Prepared By:



Kebo Zhang
Project Engineer

Checked By:

Shawn Wen
Laboratory Leader

Approved By:

Stephen Guo
Laboratory Manager

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with KDB 414788 D01 Radiated Test Site v01r01, FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, ISED RSS-210 Issue 10 and RSS-GEN Issue 5.

## 3. FACILITIES AND ACCREDITATION

| | |
|---|---|
| Accreditation Certificate | **A2LA (Certificate No.: 4102.01)**<br>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA.<br>**FCC (FCC Designation No.: CN1187)**<br>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Delcaration of Conformity (DoC) and Certification rules<br>**ISED (Company No.: 21320)**<br>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with ISED.<br>The Company Number is 21320 and the test lab Conformity Assessment Body Identifier (CABID) is CN0046.<br>**VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)**<br>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793.<br>Facility Name:<br>Chamber D, the VCCI registration No. is G-20019 and R-20004<br>Shielding Room B , the VCCI registration No. is C-20012 and T-20011 |

Note:

1. All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi-tech Development Zone, Dongguan, 523808, China
2. The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.
3. For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30MHz had been correlated to measurements performed on an OFS.

# 4. CALIBRATION AND UNCERTAINTY

## 4.1. MEASURING INSTRUMENT CALIBRATION

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

## 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Test Item | Uncertainty |
|---|---|
| Conduction emission | 3.62 dB |
| Radiation Emission test (include Fundamental emission) (9KHz-30MHz) | 2.2 dB |
| Radiation Emission test (include Fundamental emission) (30MHz-1GHz) | 4.00 dB |
| Radiation Emission test (1GHz to 26GHz) (include Fundamental emission) | 5.78 dB (1 GHz-18 GHz) |
| | 5.23 dB (18 GHz-26 GHz) |
| Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2. | |

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

| | |
|---|---|
| EUT Name | WiseCube |
| Model | CHB65 |
| Operation Frequency | 13.56 MHz |
| Modulation | ASK |
| Battery | DC 3.7 V, 500 mAh |

Note: NFC support both ISO/IEC 14443A and ISO/IEC 14443B. All lowest and highest data rates as per the standards are supported - 106 kbps, 212 kbps, 424 kbps and 848 kbps. After pre-scanning, only the worst data of ISO/IEC 14443A with 848kbps is recorded in the report.

## 5.2. MAXIMUM FIELD STRENGTH

| Frequency (MHz) | Max Peak field strength (dBµV/m) |
|---|---|
| 13.56 | 18.67 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

| Frequency (MHz) | Antenna Type | Antenna Gain (dBi) |
|---|---|---|
| 13.56 | Coil | 1 |

## 5.4. TEST ENVIRONMENT

| Environment Parameter | Selected Values During Tests | |
|---|---|---|
| Relative Humidity | 55 ~ 65% | |
| Atmospheric Pressure: | 1025Pa | |
| Temperature | TN | 20 ~ 28°C |
| Voltage: | VL | DC 3.33 V |
| | VN | DC 3.70 V |
| | VH | DC 4.07 V |

Note:

1. VL= Lower Extreme Test Voltage
2. VN= Nominal Voltage
3. VH= Upper Extreme Test Voltage
4. TN= Normal Temperature

## 5.5. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Item | Equipment | Brand Name | Model Name | Remarks |
|---|---|---|---|---|
| 1 | Laptop | Lenovo | E14 | / |
| 2 | Adapter | SAMSUNG | ETA-U90CBC | Input: 120Vac, 60Hz<br>Output:5Vdc,2A |
| 3 | Card (Tap) | / | / | / |
| 4 | Mobile Phone | HUAWEI | ALP-AL00 | / |

**I/O CABLES**

| Cable No | Port | Connector Type | Cable Type | Cable Length(m) | Remarks |
|---|---|---|---|---|---|
| \ | \ | \ | \ | \ | \ |

**ACCESSORY**

| No | Port | Connector Type | Cable Type | Cable Length(m) | Remarks |
|---|---|---|---|---|---|
| 1 | USB | USB-A to USB-C | Unshielded | 1.2 | N/A |

Note:
1. The USB cable is provided by the client.

**TEST SETUP**

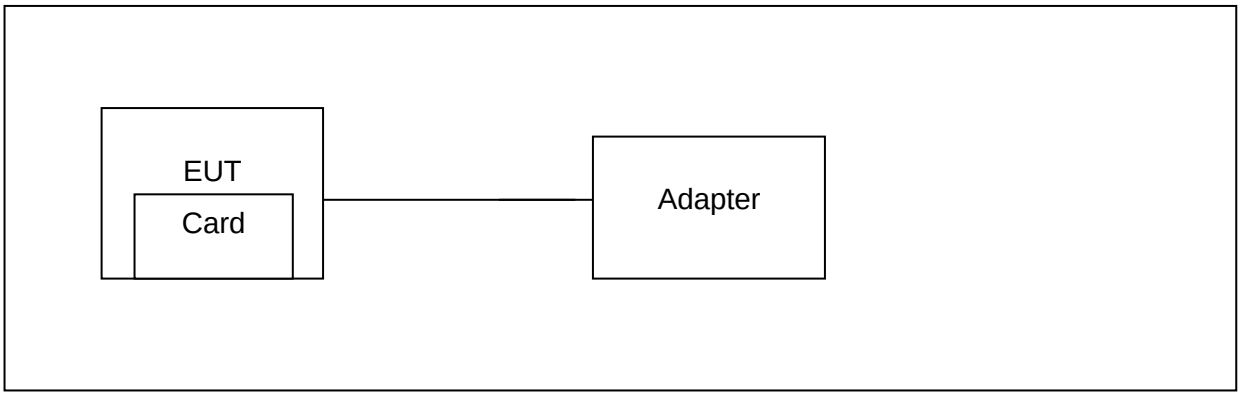
The EUT can transmit the NFC signal by Swiping card (Tap).

The EUT can work in continuous transmit mode with an APP through a Mobile Phone.

New battery has been used during measurement.

Note: The device was tested with and without a tag and found the worst-case configuration is in continuous transmit mode with tag.

**SETUP DIAGRAM FOR TESTS**



## 5.6. MEASURING INSTRUMENT AND SOFTWARE USED

| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Due Date |
|---|---|---|---|---|---|
| EMI Test Receiver | R&S | ESR3 | 101961 | Oct.30, 2021 | Oct.29, 2022 |
| Two-Line V-Network | R&S | ENV216 | 101983 | Oct.30, 2021 | Oct.29, 2022 |
| Artificial Mains Networks | Schwarzbeck | NSLK 8126 | 8126465 | Oct.30, 2021 | Oct.29, 2022 |
| Software | | | | | |
| Description | | | Manufacturer | Name | Version |
| Test Software for Conducted Emissions | | | Farad | EZ-EMC | Ver. UL-3A1 |

| **Radiated Emissions** | | | | | |
|---|---|---|---|---|---|
| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Due Date |
| MXE EMI Receiver | KESIGHT | N9038A | MY56400036 | Oct.30, 2021 | Oct.29, 2022 |
| Hybrid Log Periodic Antenna | TDK | HLP-3003C | 130959 | Aug.02, 2021 | Aug.01, 2024 |
| Preamplifier | HP | 8447D | 2944A09099 | Oct.30, 2021 | Oct.29, 2022 |
| Loop antenna | Schwarzbeck | 1519B | 00008 | Dec.14, 2021 | Dec.13, 2024 |
| Preamplifier | TDK | PA-02-001-3000 | TRS-302-00050 | Oct.31, 2021 | Oct.30, 2022 |
| Preamplifier | Mini-Circuits | ZX60-83LN-S+ | SUP01201941 | Oct.31, 2021 | Oct.30, 2022 |
| Software | | | | | |
| Description | | | Manufacturer | Name | Version |
| Test Software for Radiated Emissions | | | Farad | EZ-EMC | Ver. UL-3A1 |

| **Other instruments** | | | | | | |
|---|---|---|---|---|---|---|
| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
| ☑ | Temperature & Humidity Chamber | SANMOOD | SG-80-CC-2 | 2088 | Nov.10, 2021 | Nov.09, 2022 |

# 6. ANTENNA PORT TEST RESULTS

## 6.1. 99% & 20dB BANDWIDTH

**LIMITS**

| FCC Part15 (15.247) Subpart C<br>RSS-247 ISSUE 2 | | |
|---|---|---|
| Section | Test Item | Limit |
| ANSI C63.10 Section 6.9.2 | 20dB% Bandwidth | For reporting purposes only. |
| ISED RSS-Gen Clause 6.7 Issue 5 | 99 % Occupied Bandwidth | For reporting purposes only. |

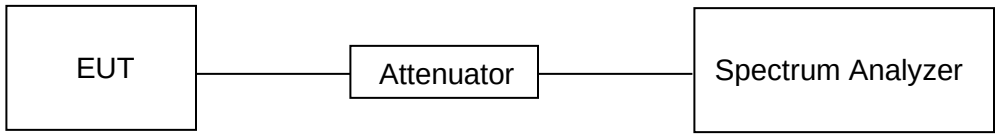
**TEST PROCEDURE**

Connect the UUT to the spectrum analyzer and use the following settings:

| | |
|---|---|
| Center Frequency | The center frequency of the channel under test |
| Detector | Peak |
| RBW | For 20dB Occupied Bandwidth: 1% to 5% of the 20 dB bandwidth<br>For 99% Occupied Bandwidth: 1% to 5% of the occupied bandwidth |
| VBW | For 20dB Occupied Bandwidth: approximately 3×RBW<br>For 99% Occupied Bandwidth: ≥ 3×RBW |
| Span | Between 2 times and 5 times the 20dB OBW.<br>Between 1.5 times and 5.0 times the 99% OBW. |
| Trace | Max hold |
| Sweep | Auto couple |

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 99%/20dB relative to the maximum level measured in the fundamental emission.

**TEST SETUP**



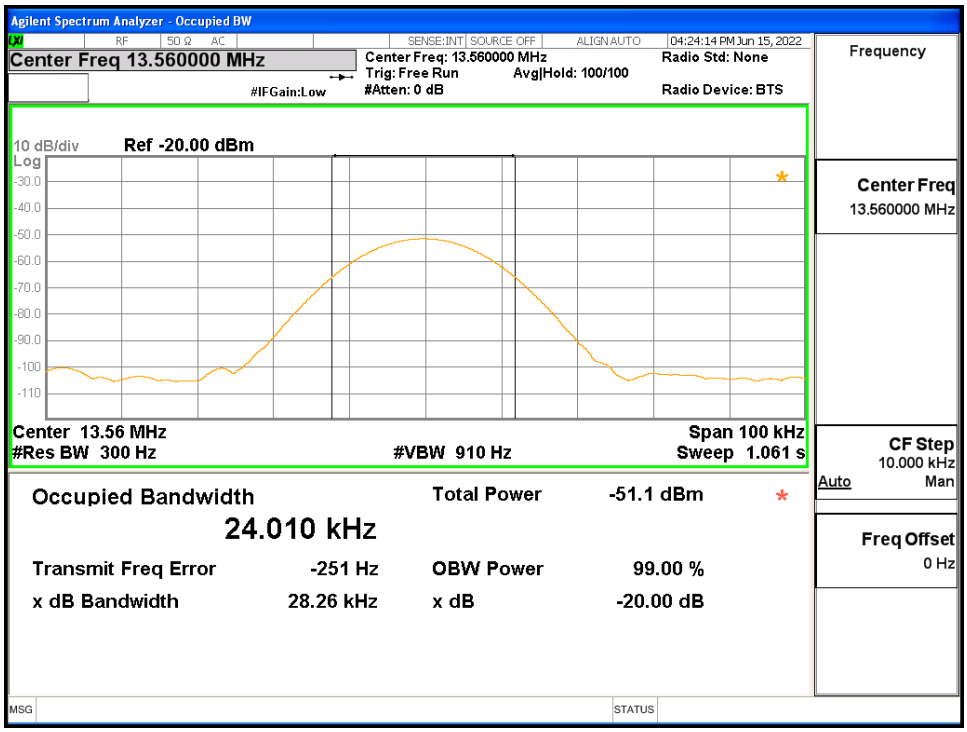
**TEST ENVIRONMENT**

| | | | |
|---|---|---|---|
| Temperature | 22.1 °C | Relative Humidity | 62 % |
| Atmosphere Pressure | 101 kPa | Test Voltage | DC 3.7 V |

**RESULTS**

| Frequency (MHz) | 99% Occupied Bandwidth (kHz) | 20dB bandwidth (kHz) |
|---|---|---|
| 13.56 | 24.010 | 28.26 |

**99%&20dB bandwidth**



## 6.2. TRANSMITTER FREQUENCY STABILITY

**LIMITS**

CFR 47 FCC §15.225(e)
ISED RSS-210 Annex B B.6

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

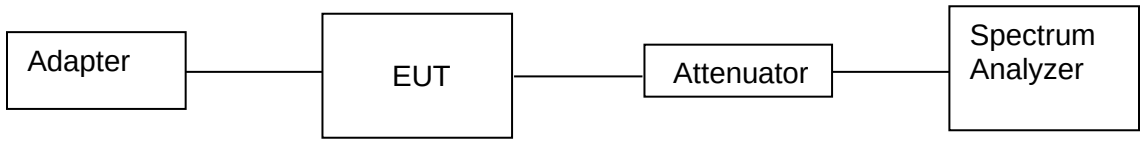
**TEST SETUP AND PROCEDURE**

Connect the UUT to the spectrum analyzer and use the following settings:

| | |
|---|---|
| Center Frequency | The center frequency of the channel under test |
| Detector | PEAK |
| RBW | 10KHz |
| VBW | ≥3 × RBW |
| Span | Encompass the entire emissions bandwidth (EBW) of the signal |
| Trace | Max hold |
| Sweep time | Auto |

Allow the trace to stabilize, find the peak value of the power envelope and record the frequency, then calculated the frequency drift.

**TEST SETUP**




Note: The manufacturer claims that the normal operating voltage range of the battery is 3.4 ~ 4.2 Vdc, beyond this range, the sample will not work properly.

**TEST RESULTS**

Maximum frequency error of the EUT with variations in ambient temperature

| Temperature (°C) | Time after Start-up | | | |
|---|---|---|---|---|
| | 0 minutes | 2 minutes | 5 minutes | 10 minutes |
| -20 | 13.5642 | 13.5615 | 13.5605 | 13.5601 |
| -10 | 13.5642 | 13.5645 | 13.5615 | 13.5621 |
| 0 | 13.5614 | 13.5620 | 13.5605 | 13.5567 |
| 10 | 13.5613 | 13.5646 | 13.5578 | 13.5588 |
| 20 | 13.5648 | 13.5582 | 13.5613 | 13.5606 |
| 30 | 13.5569 | 13.5639 | 13.5565 | 13.5594 |
| 40 | 13.5561 | 13.5649 | 13.5588 | 13.5611 |
| 50 | 13.5622 | 13.5633 | 13.5596 | 13.5621 |
| Maximum frequency error | 0.0048% | 0.0049% | 0.0015% | 0.0021% |
| Limit | 0.01% | | | |
| Result | Pass | Pass | Pass | Pass |

Maximum frequency error of the EUT with declared battery operation voltage at a temperature of 20 degrees C.

| Supply Voltage by Battery | Time after Start-up | | | |
|---|---|---|---|---|
| | 0 minutes | 2 minutes | 5 minutes | 10 minutes |
| 4.2 Vdc | 13.5597 | 13.5637 | 13.5618 | 13.5619 |
| 3.7 Vdc | 13.5593 | 13.5621 | 13.5638 | 13.5573 |
| 3.4 Vdc | 13.5585 | 13.5556 | 13.5642 | 13.5627 |
| Maximum frequency error | -0.0003% | 0.0037% | 0.0042% | 0.0027% |
| Limit | 0.01% | | | |
| Result | Pass | Pass | Pass | Pass |

Maximum frequency error of the EUT with 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

| Supply Voltage by adapter | Time after Start-up | | | |
|---|---|---|---|---|
| | 0 minutes | 2 minutes | 5 minutes | 10 minutes |
| 138 Vac, 60Hz | 13.5568 | 13.5554 | 13.5641 | 13.5553 |
| 120 Vac, 60Hz | 13.5614 | 13.5609 | 13.5636 | 13.5579 |
| 102 Vac, 60Hz | 13.5549 | 13.5641 | 13.5639 | 13.5564 |
| Maximum frequency error | 0.0014% | 0.0041% | 0.0041% | -0.0021% |
| Limit | 0.01% | | | |
| Result | Pass | Pass | Pass | Pass |

# 7. RADIATED EMISSION TEST RESULTS

**LIMITS**

Fundamental field strength

| | |
|---|---|
| FCC Reference: | Part 15.225(a)(b)(c)(d) & 15.209(a) |
| ISED Canada Reference: | RSS-Gen 6.13 & RSS-210 B.6 & RSS-GEN Clause 8.9 |
| Test Method Used: | ANSI C63.10 Sections 6.3, 6.4 and 6.5 |

| Frequency (MHz) | Field Strength (uV/m) | Field Strength (dBuV/m) | Measured Distance (Meters) |
|---|---|---|---|
| 13.553-13.567 | 15848 | 84 | 30 |
| 13.410-13.553/13.567-13.710 | 334 | 50.47 | 30 |
| 13.110-13.410/13.710-14.010 | 106 | 40.51 | 30 |

Note(s):
1. The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

2. The limit is specified at a test distance of 30 meters. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).

Radiation Disturbance Test Limit for FCC (Class B) (9KHz-1GHz)

| 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 |
| 960~1000 | 500 | 3 |

ISED General field strength limits at frequencies below 30 MHz

**Table 6 – General field strength limits at frequencies below 30 MHz**

| Frequency | Magnetic field strength (H-Field) (µA/m) | Measurement distance (m) |
|---|---|---|
| 9 - 490 kHz[Note 1] | 6.37/F (F in kHz) | 300 |
| 490 - 1705 kHz | 63.7/F (F in kHz) | 30 |
| 1.705 - 30 MHz | 0.08 | 30 |

**Note 1:** The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

Note: 1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

(2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). This paragraph (f) shall not apply to Access BPL devices operating below 30MHz.

Restricted bands of operation

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| [1]0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | ([2]) |
| 13.36-13.41 | | | |

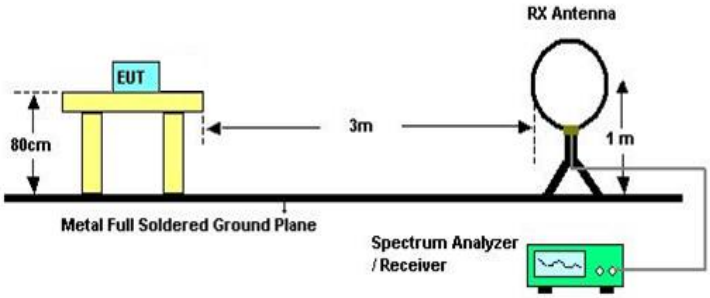
Note: [1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2]Above 38.6c

| Table 7 – Restricted frequency bands[Note 1] | | |
|---|---|---|
| **MHz** | **MHz** | **GHz** |
| 0.090 - 0.110 | 149.9 - 150.05 | 9.0 - 9.2 |
| 0.495 - 0.505 | 156.52475 - 156.52525 | 9.3 - 9.5 |
| 2.1735 - 2.1905 | 156.7 - 156.9 | 10.6 - 12.7 |
| 3.020 - 3.026 | 162.0125 - 167.17 | 13.25 - 13.4 |
| 4.125 - 4.128 | 167.72 - 173.2 | 14.47 - 14.5 |
| 4.17725 - 4.17775 | 240 – 285 | 15.35 - 16.2 |
| 4.20725 - 4.20775 | 322 - 335.4 | 17.7 - 21.4 |
| 5.677 - 5.683 | 399.9 - 410 | 22.01 - 23.12 |
| 6.215 - 6.218 | 608 - 614 | 23.6 - 24.0 |
| 6.26775 - 6.26825 | 960 - 1427 | 31.2 - 31.8 |
| 6.31175 - 6.31225 | 1435 - 1626.5 | 36.43 - 36.5 |
| 8.291 - 8.294 | 1645.5 - 1646.5 | Above 38.6 |
| 8.362 - 8.366 | 1660 - 1710 | |
| 8.37625 - 8.38675 | 1718.8 - 1722.2 | |
| 8.41425 - 8.41475 | 2200 - 2300 | |
| 12.29 - 12.293 | 2310 - 2390 | |
| 12.51975 - 12.52025 | 2483.5 - 2500 | |
| 12.57675 - 12.57725 | 2655 - 2900 | |
| 13.36 - 13.41 | 3260 – 3267 | |
| 16.42 - 16.423 | 3332 - 3339 | |
| 16.69475 - 16.69525 | 3345.8 - 3358 | |
| 16.80425 - 16.80475 | 3500 - 4400 | |
| 25.5 - 25.67 | 4500 - 5150 | |
| 37.5 - 38.25 | 5350 - 5460 | |
| 73 - 74.6 | 7250 - 7750 | |
| 74.8 - 75.2 | 8025 – 8500 | |
| 108 – 138 | | |

**Note 1:** Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

**TEST SETUP AND PROCEDURE**

Below 30 MHz




The setting of the spectrum analyzer

| | |
|---|---|
| RBW | 200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz) |
| VBW | 200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz) |
| Sweep | Auto |
| Trace | Max hold |

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.4.

2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both Horizontal, Face-on and Face-off polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm above ground.

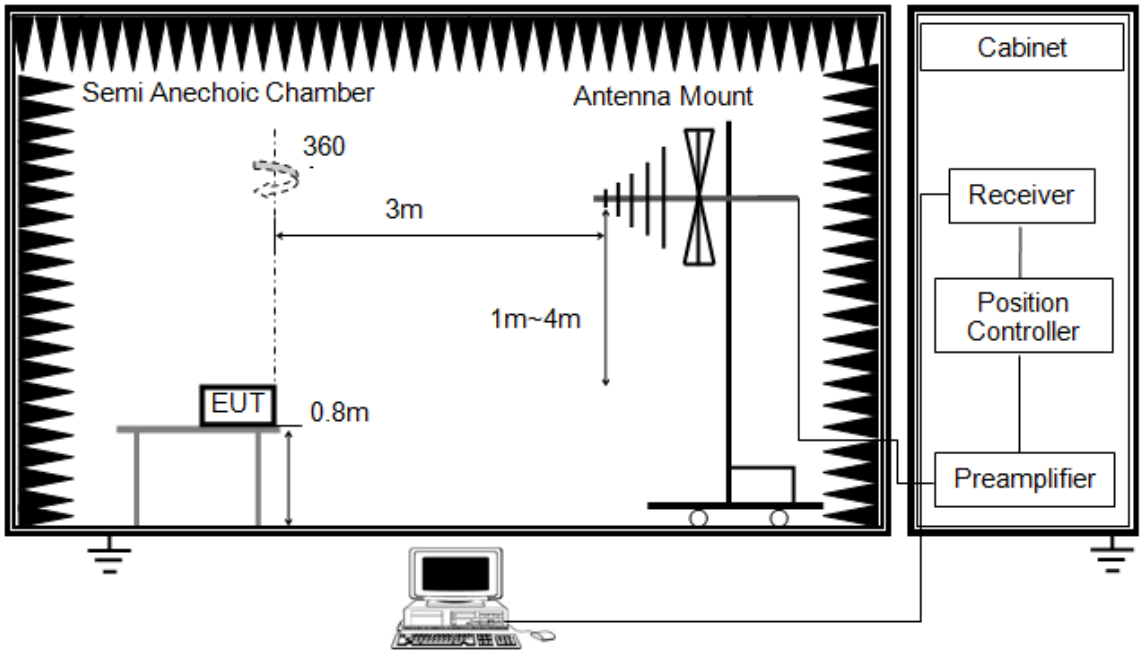
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a 1 m height antenna tower.

5. The radiated emission limits 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.

6. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak and average detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak and average detector and reported.

7. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field site based on KDB 414788.
8. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ω; For example, the measurement frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

Below 1G




The setting of the spectrum analyzer

| | |
|---|---|
| RBW | 120K |
| VBW | 300K |
| Sweep | Auto |
| Detector | Peak/QP |
| Trace | Max hold |

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.5.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80cm above ground.

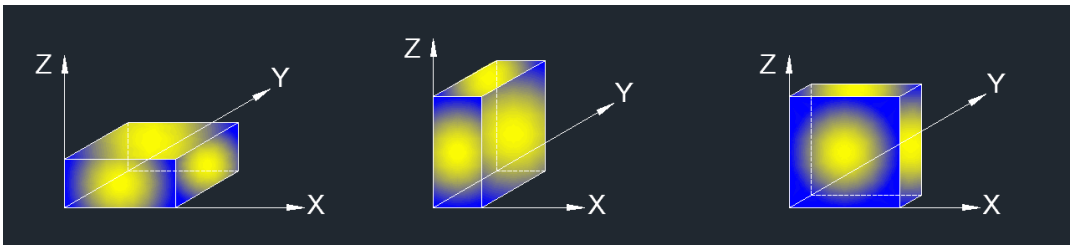
4. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

5. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

6. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

7. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

X axis, Y axis, Z axis positions:




Note 1: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

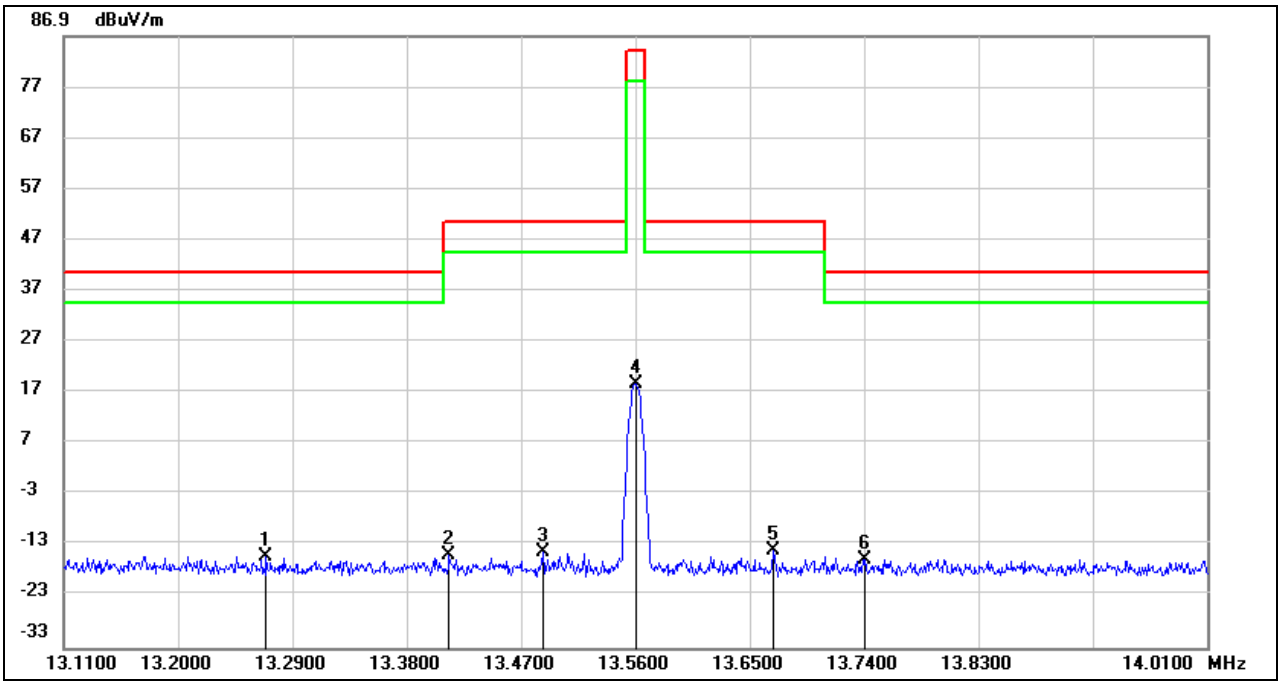
**TEST ENVIRONMENT**

| | | | |
|---|---|---|---|
| Temperature | 23.4 °C | Relative Humidity | 61 % |
| Atmosphere Pressure | 101kPa | Test Voltage | DC 3.7 V |

**RESULTS**

## 7.1. FIELD STRENGTH OF INTENTIONAL EMISSIONS

**FIELD STRENGTH OF INTENTIONAL EMISSIONS (LOOP ANTENNA FACE ON TO THE EUT)**



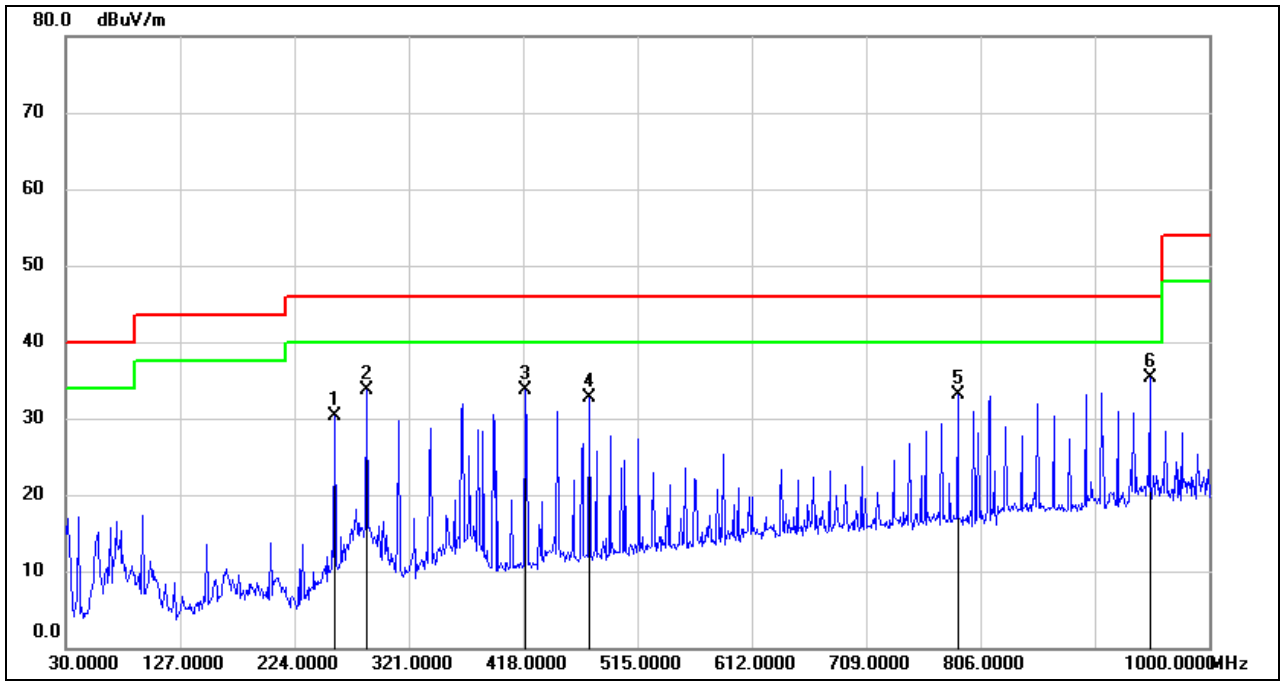

| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 13.2693 | 46.19 | -61.40 | -15.21 | 40.51 | -55.72 | peak |
| 2 | 13.4133 | 46.39 | -61.40 | -15.01 | 50.47 | -65.48 | peak |
| 3 | 13.4871 | 47.19 | -61.41 | -14.22 | 50.47 | -64.69 | peak |
| 4 | 13.5600 | 80.08 | -61.41 | 18.67 | 84.00 | -65.33 | peak |
| 5 | 13.6689 | 47.40 | -61.41 | -14.01 | 50.47 | -64.48 | peak |
| 6 | 13.7409 | 45.73 | -61.43 | -15.70 | 40.51 | -56.21 | peak |

Note:

1. Result Level = Read Level + Correct Factor.
2. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

## 7.2. SPURIOUS EMISSIONS BELOW 1GHz AND ABOVE 30MHz

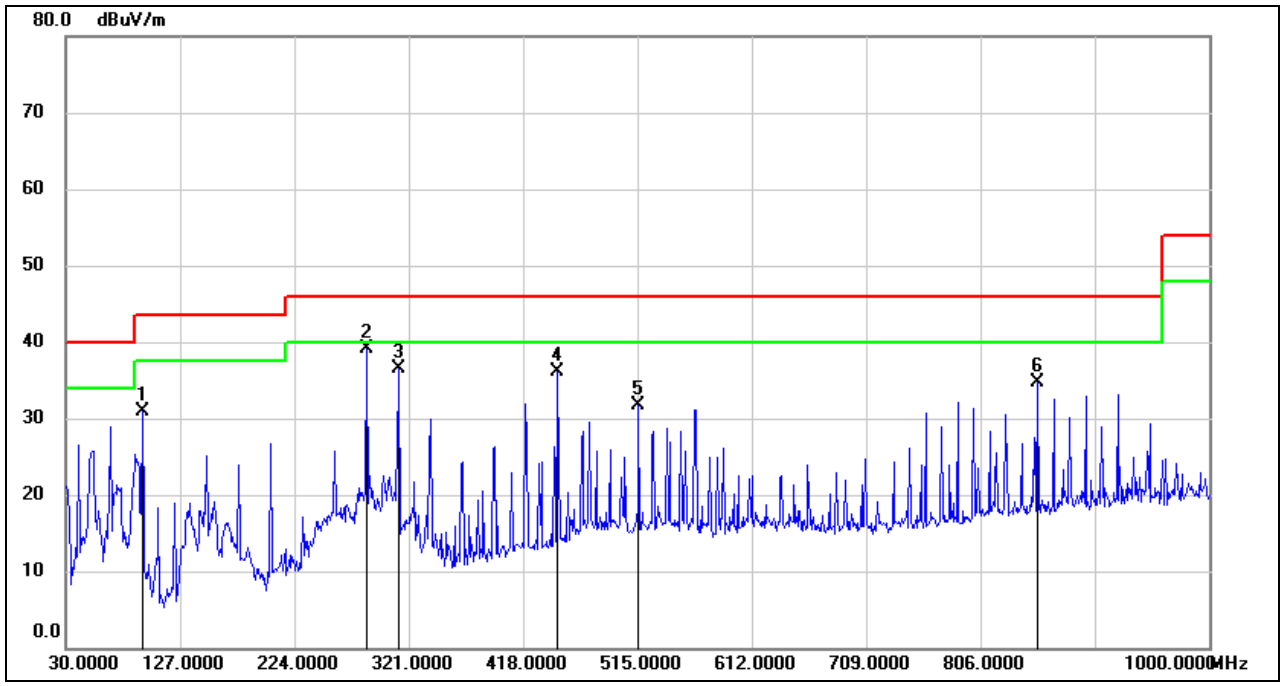
**SPURIOUS EMISSIONS (HORIZONTAL)**




| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 257.9500 | 48.92 | -18.62 | 30.30 | 46.00 | -15.70 | QP |
| 2 | 285.1099 | 50.07 | -16.29 | 33.78 | 46.00 | -12.22 | QP |
| 3 | 419.9400 | 46.77 | -12.99 | 33.78 | 46.00 | -12.22 | QP |
| 4 | 474.2600 | 44.58 | -11.93 | 32.65 | 46.00 | -13.35 | QP |
| 5 | 786.6000 | 40.49 | -7.47 | 33.02 | 46.00 | -12.98 | QP |
| 6 | 949.5600 | 39.72 | -4.41 | 35.31 | 46.00 | -10.69 | QP |

Note:
1. Result Level = Read Level + Correct Factor.

## HARMONICS AND SPURIOUS EMISSIONS (VERTICAL)




| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 94.9900 | 52.44 | -21.51 | 30.93 | 43.50 | -12.57 | QP |
| 2 | 285.1099 | 55.38 | -16.29 | 39.09 | 46.00 | -6.91 | QP |
| 3 | 312.2700 | 51.58 | -15.01 | 36.57 | 46.00 | -9.43 | QP |
| 4 | 447.1000 | 48.53 | -12.51 | 36.02 | 46.00 | -9.98 | QP |
| 5 | 515.9699 | 42.79 | -11.15 | 31.64 | 46.00 | -14.36 | QP |
| 6 | 854.5000 | 40.88 | -6.14 | 34.74 | 46.00 | -11.26 | QP |

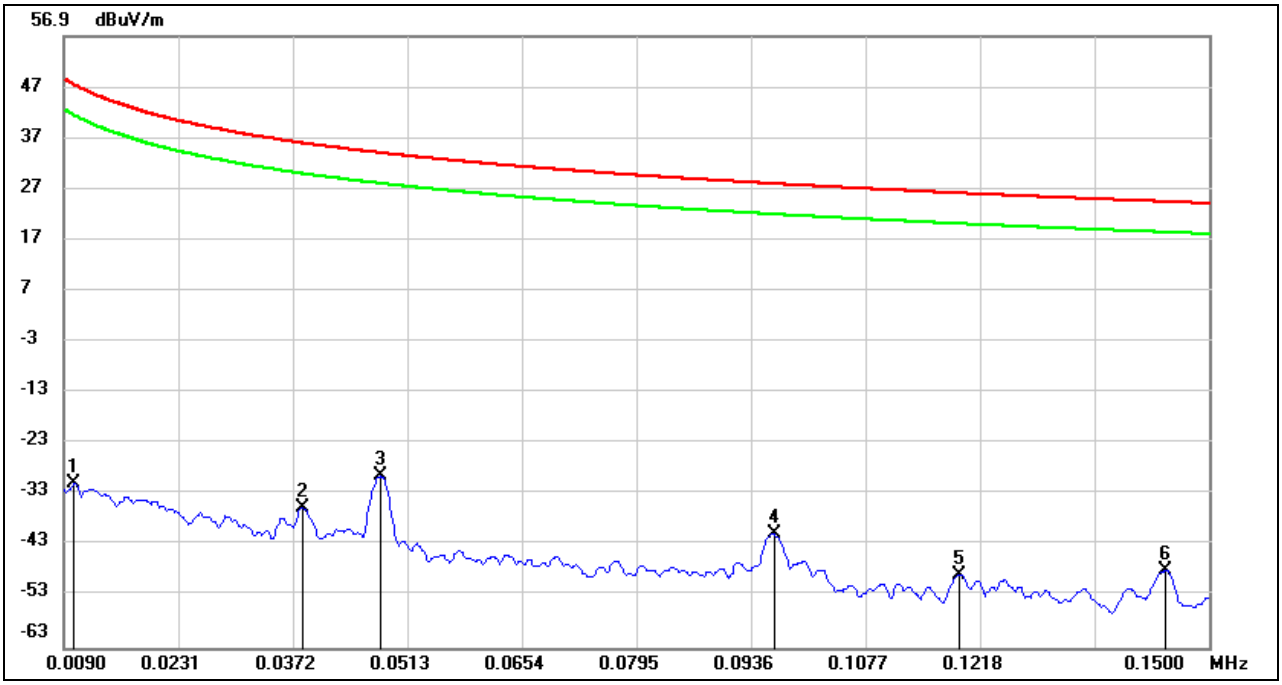
Note:

1. Result Level = Read Level + Correct Factor.

# SPURIOUS EMISSIONS BELOW 30MHz

## SPURIOUS EMISSIONS (LOOP ANTENNA FACE ON TO THE EUT)

### 9 kHz~ 150 kHz

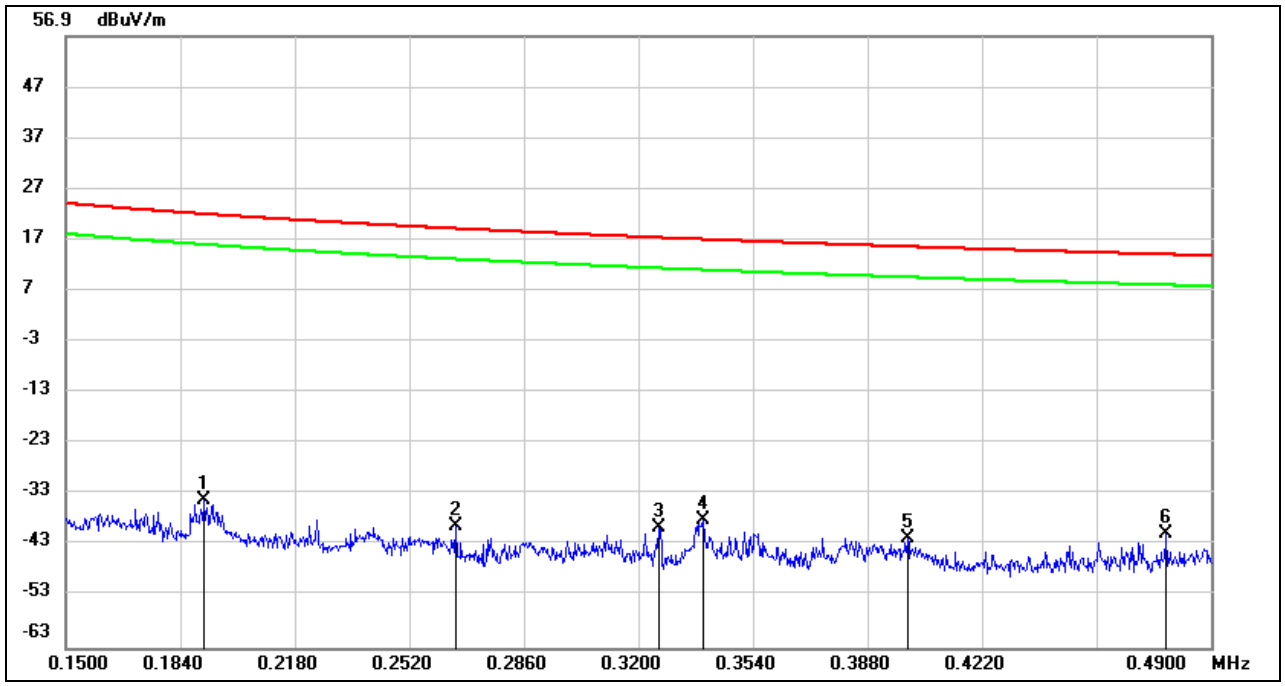



| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 0.0102 | 70.60 | -101.57 | -30.97 | 47.43 | -78.40 | peak |
| 2 | 0.0383 | 65.52 | -101.22 | -35.70 | 35.94 | -71.64 | peak |
| 3 | 0.0480 | 71.85 | -101.35 | -29.50 | 33.97 | -63.47 | peak |
| 4 | 0.0963 | 60.58 | -101.22 | -40.64 | 27.93 | -68.57 | peak |
| 5 | 0.1192 | 52.80 | -101.52 | -48.72 | 26.08 | -74.80 | peak |
| 6 | 0.1446 | 53.88 | -101.83 | -47.95 | 24.40 | -72.35 | peak |

Note:

1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.
3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

**150 kHz ~ 490 kHz**

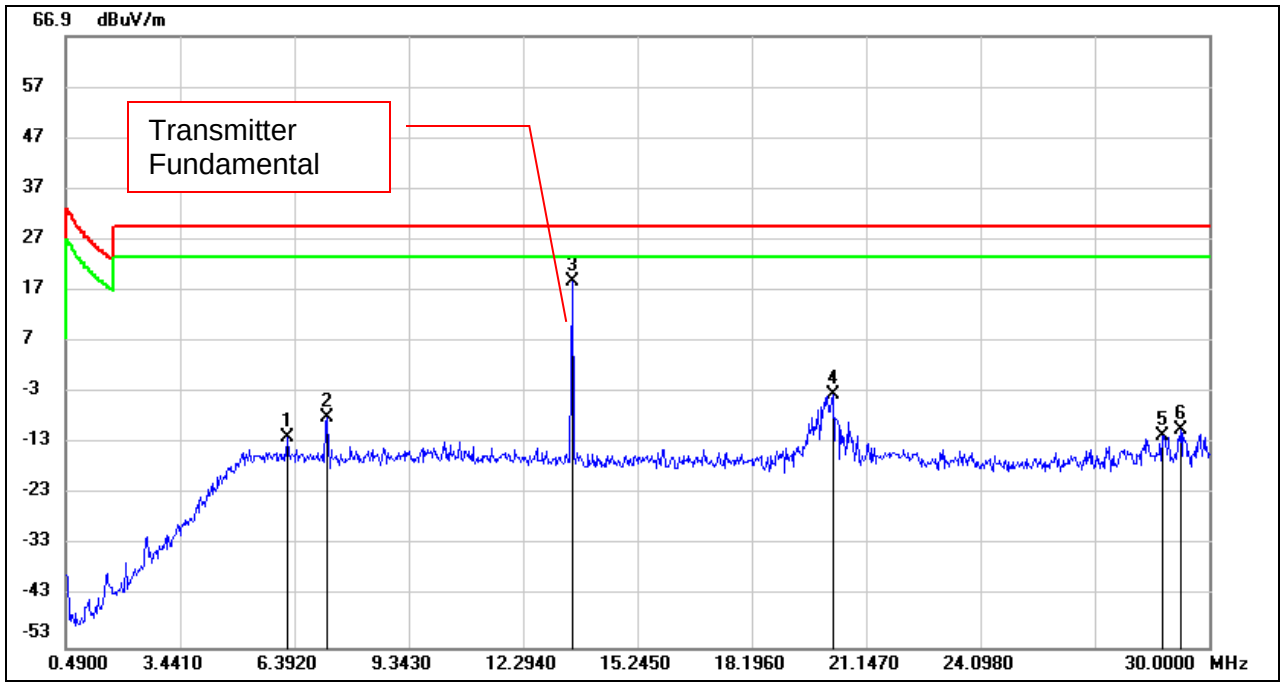



| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 0.1910 | 67.58 | -101.85 | -34.27 | 21.98 | -56.25 | peak |
| 2 | 0.2655 | 62.53 | -101.78 | -39.25 | 19.12 | -58.37 | peak |
| 3 | 0.3261 | 62.22 | -101.77 | -39.55 | 17.33 | -56.88 | peak |
| 4 | 0.3390 | 63.61 | -101.76 | -38.15 | 17.00 | -55.15 | peak |
| 5 | 0.3997 | 59.96 | -101.74 | -41.78 | 15.57 | -57.35 | peak |
| 6 | 0.4767 | 60.87 | -101.71 | -40.84 | 14.04 | -54.88 | peak |

Note:

1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.
3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

**490kHz ~ 30MHz**




| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 6.2149 | 49.76 | -61.75 | -11.99 | 29.54 | -41.53 | peak |
| 2 | 7.2182 | 53.57 | -61.60 | -8.03 | 29.54 | -37.57 | peak |
| 3 | 13.5629 | 80.13 | -61.41 | 18.72 | \ | \ | peak |
| 4 | 20.2911 | 57.70 | -61.08 | -3.38 | 29.54 | -32.92 | peak |
| 5 | 28.7900 | 49.27 | -60.73 | -11.46 | 29.54 | -41.00 | peak |
| 6 | 29.2621 | 50.39 | -60.70 | -10.31 | 29.54 | -39.85 | peak |

Note:

1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.
3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.
4. About the Fundamental emission test result please refer to section 7.1.

# 8. AC POWER LINE CONDUCTED EMISSIONS

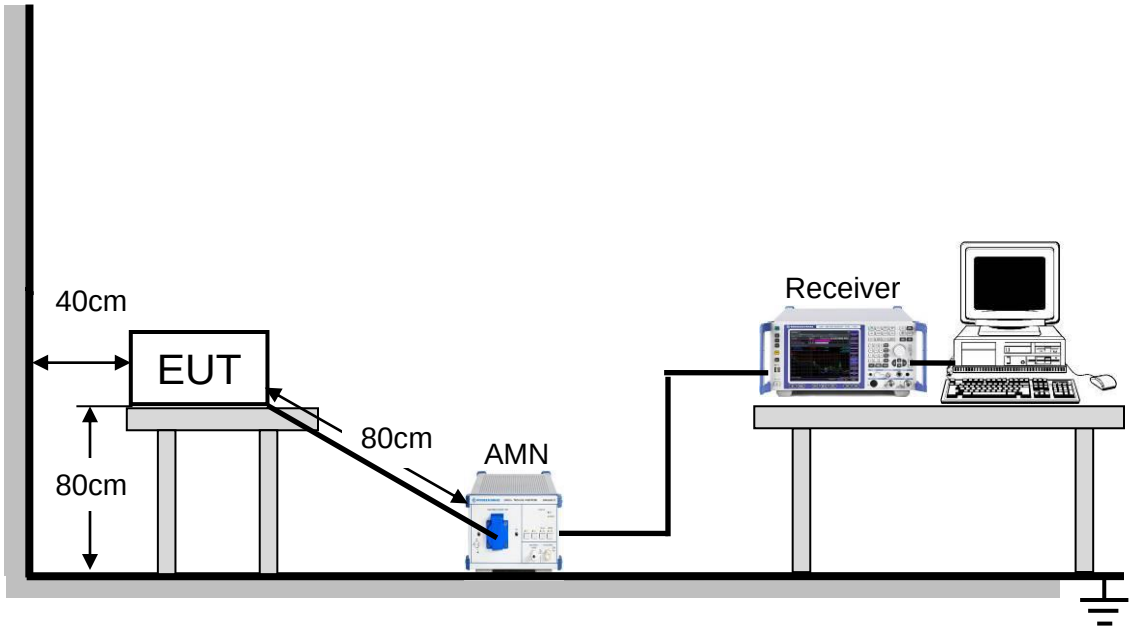
**LIMITS**

Please refer to CFR 47 FCC §15.207 (a).

| FREQUENCY (MHz) | Quasi-peak | Average |
|---|---|---|
| 0.15 -0.5 | 66 - 56 * | 56 - 46 * |
| 0.50 -5.0 | 56.00 | 46.00 |
| 5.0 -30.0 | 60.00 | 50.00 |

Note:
1. The tighter limit applies at the band edges.
2. The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

**TEST SETUP AND PROCEDURE**




The following table is the setting of the receiver

| Receiver Parameters | Setting |
|---|---|
| Attenuation | 10 dB |
| Start Frequency | 0.15 MHz |
| Stop Frequency | 30 MHz |
| IF Bandwidth | 9 kHz |

1. The testing follows the guidelines in ANSI C63.10-2013.

2. The EUT was placed on the top of a rotating table 0.8 meters above the horizontal ground plane and being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

3. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

4. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

5. LISN at least 80 cm from nearest part of EUT chassis.

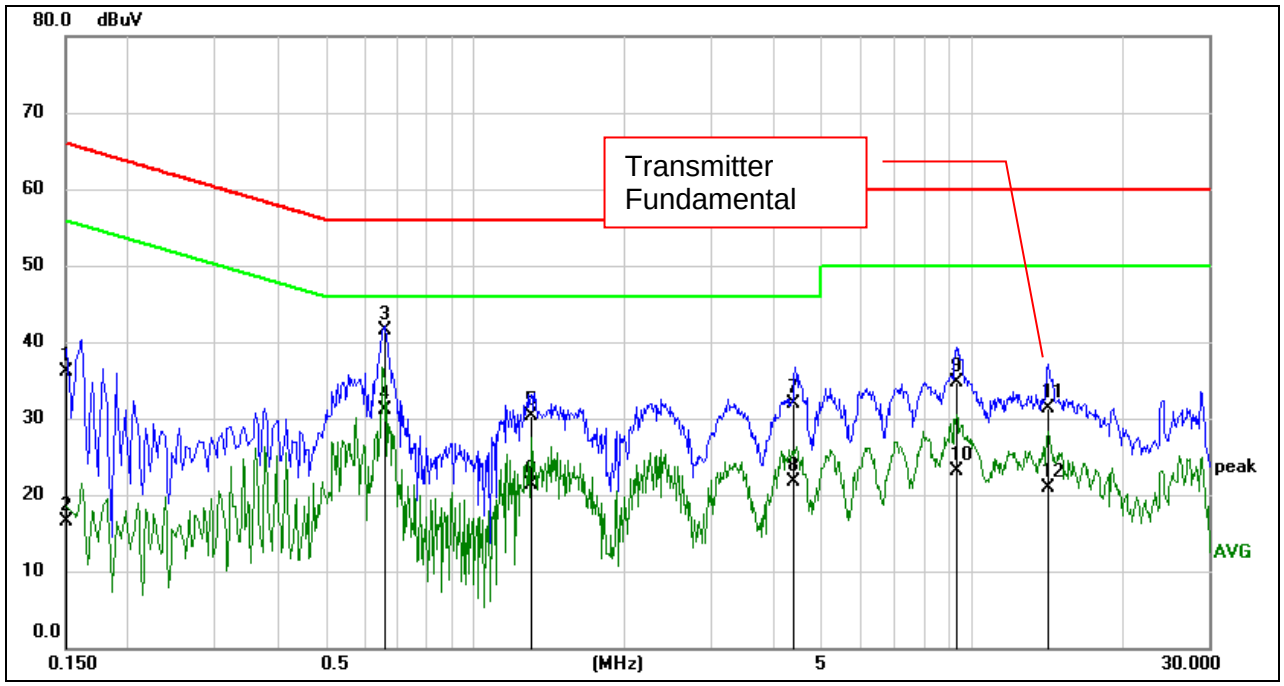
6. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode.

7. The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

**TEST ENVIRONMENT**

| | | | |
|---|---|---|---|
| Temperature | 21.6 °C | Relative Humidity | 60.1 % |
| Atmosphere Pressure | 101kPa | Test Voltage | AC 120V_60Hz |

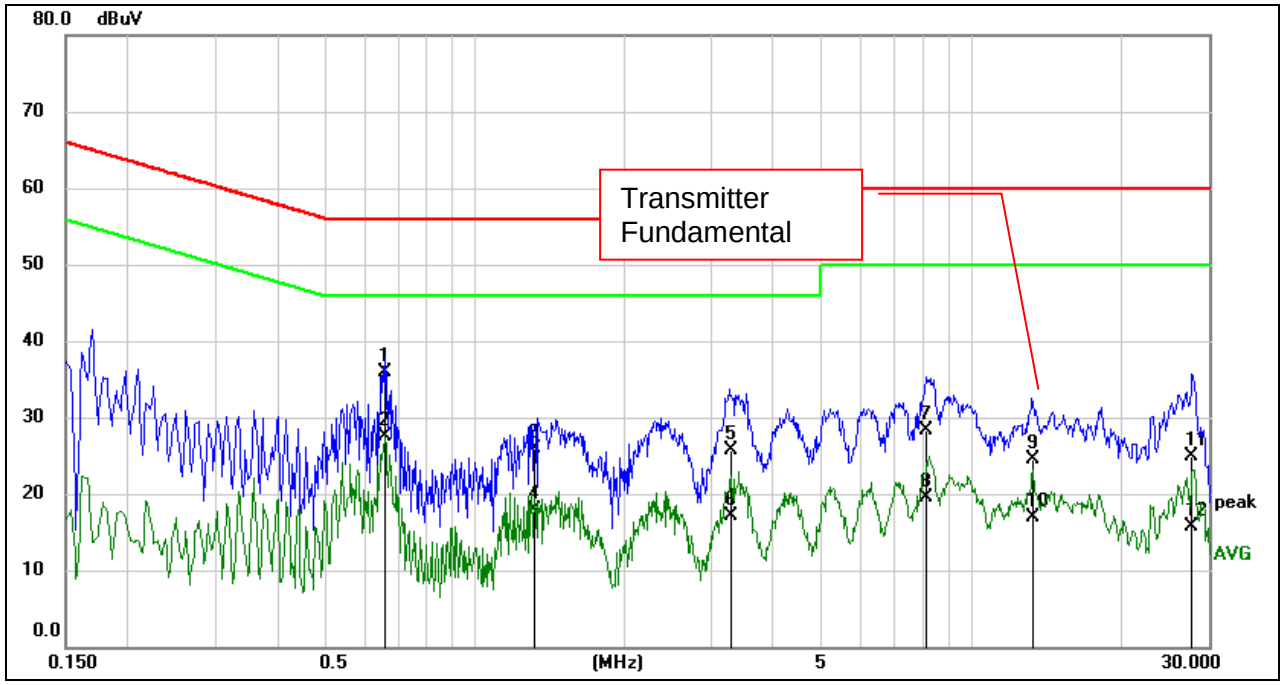
**LINE N RESULTS with modified sample (transmitter terminated into a dummy load)**




| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 0.1511 | 26.48 | 9.59 | 36.07 | 65.94 | -29.87 | QP |
| 2 | 0.1511 | 6.88 | 9.59 | 16.47 | 55.94 | -39.47 | AVG |
| 3 | 0.6554 | 32.06 | 9.53 | 41.59 | 56.00 | -14.41 | QP |
| 4 | 0.6554 | 21.51 | 9.53 | 31.04 | 46.00 | -14.96 | AVG |
| 5 | 1.2974 | 20.75 | 9.61 | 30.36 | 56.00 | -25.64 | QP |
| 6 | 1.2974 | 11.73 | 9.61 | 21.34 | 46.00 | -24.66 | AVG |
| 7 | 4.3893 | 22.39 | 9.60 | 31.99 | 56.00 | -24.01 | QP |
| 8 | 4.3893 | 12.03 | 9.60 | 21.63 | 46.00 | -24.37 | AVG |
| 9 | 9.3135 | 24.96 | 9.70 | 34.66 | 60.00 | -25.34 | QP |
| 10 | 9.3135 | 13.46 | 9.70 | 23.16 | 50.00 | -26.84 | AVG |
| 11 | 14.1707 | 21.47 | 9.76 | 31.23 | 60.00 | -28.77 | QP |
| 12 | 14.1707 | 11.07 | 9.76 | 20.83 | 50.00 | -29.17 | AVG |

Note:
1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.

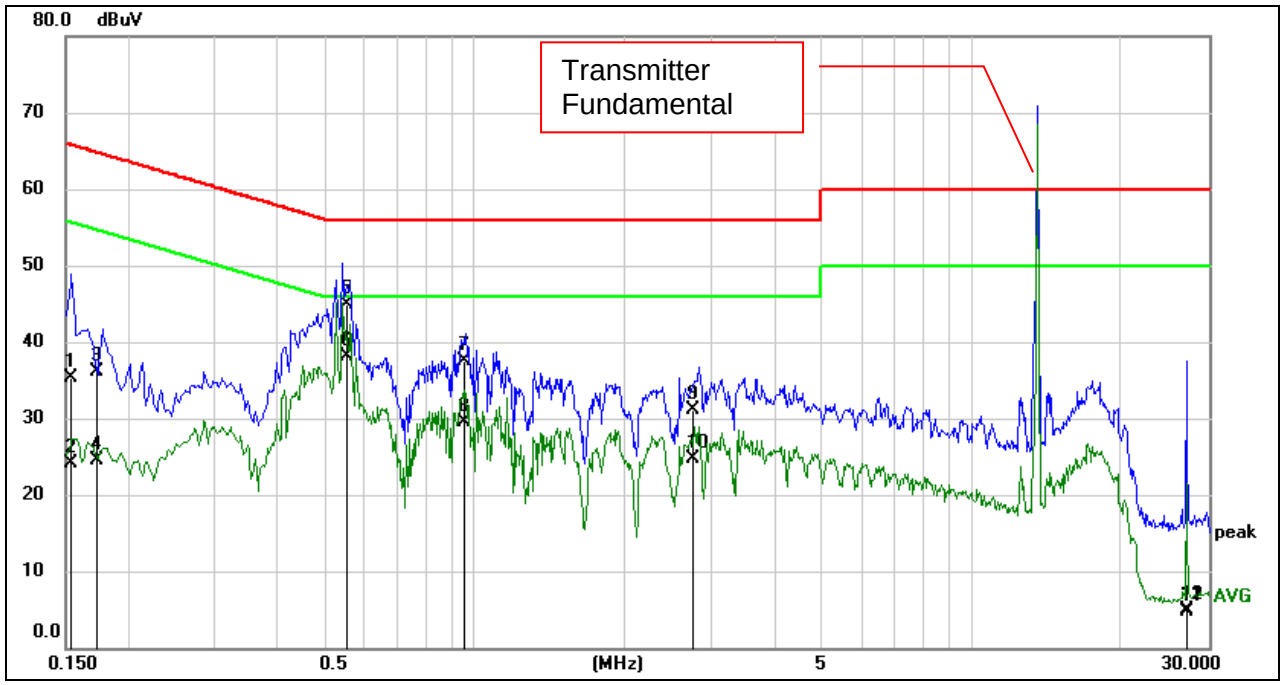
**LINE L RESULTS with modified sample (transmitter terminated into a dummy load)**




| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 0.6598 | 26.46 | 9.54 | 36.00 | 56.00 | -20.00 | QP |
| 2 | 0.6598 | 17.88 | 9.54 | 27.42 | 46.00 | -18.58 | AVG |
| 3 | 1.3181 | 16.24 | 9.61 | 25.85 | 56.00 | -30.15 | QP |
| 4 | 1.3181 | 8.22 | 9.61 | 17.83 | 46.00 | -28.17 | AVG |
| 5 | 3.2844 | 16.17 | 9.61 | 25.78 | 56.00 | -30.22 | QP |
| 6 | 3.2844 | 7.45 | 9.61 | 17.06 | 46.00 | -28.94 | AVG |
| 7 | 8.1463 | 18.59 | 9.65 | 28.24 | 60.00 | -31.76 | QP |
| 8 | 8.1463 | 9.83 | 9.65 | 19.48 | 50.00 | -30.52 | AVG |
| 9 | 13.3127 | 14.71 | 9.76 | 24.47 | 60.00 | -35.53 | QP |
| 10 | 13.3127 | 7.16 | 9.76 | 16.92 | 50.00 | -33.08 | AVG |
| 11 | 27.8634 | 15.18 | 9.73 | 24.91 | 60.00 | -35.09 | QP |
| 12 | 27.8634 | 5.93 | 9.73 | 15.66 | 50.00 | -34.34 | AVG |

Note:
1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.

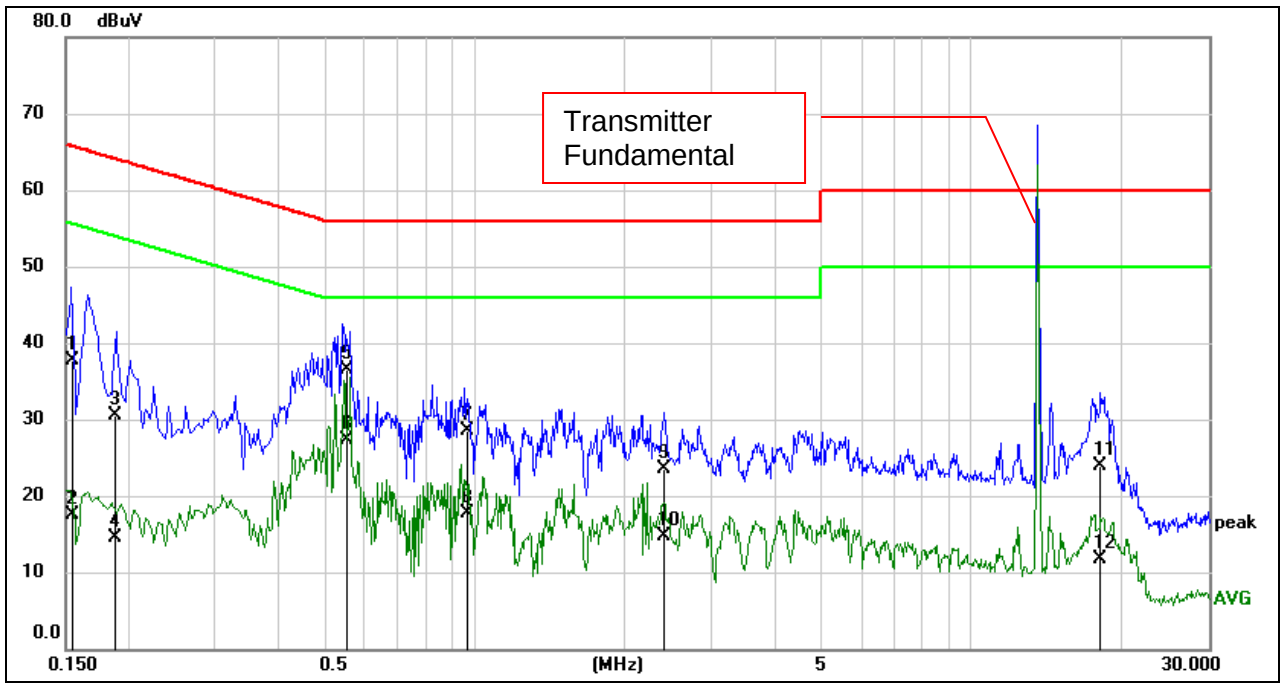
**LINE N RESULTS with unmodified sample (antenna present)**




| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 0.1539 | 25.86 | 9.50 | 35.36 | 65.79 | -30.43 | QP |
| 2 | 0.1539 | 14.66 | 9.50 | 24.16 | 55.79 | -31.63 | AVG |
| 3 | 0.1737 | 26.63 | 9.54 | 36.17 | 64.78 | -28.61 | QP |
| 4 | 0.1737 | 14.89 | 9.54 | 24.43 | 54.78 | -30.35 | AVG |
| 5 | 0.5570 | 35.37 | 9.50 | 44.87 | 56.00 | -11.13 | QP |
| 6 | 0.5570 | 28.59 | 9.50 | 38.09 | 46.00 | -7.91 | AVG |
| 7 | 0.9509 | 27.97 | 9.51 | 37.48 | 56.00 | -18.52 | QP |
| 8 | 0.9509 | 20.08 | 9.51 | 29.59 | 46.00 | -16.41 | AVG |
| 9 | 2.7461 | 21.41 | 9.62 | 31.03 | 56.00 | -24.97 | QP |
| 10 | 2.7461 | 15.15 | 9.62 | 24.77 | 46.00 | -21.23 | AVG |
| 11 | 27.1201 | -5.06 | 9.78 | 4.72 | 60.00 | -55.28 | QP |
| 12 | 27.1201 | -4.89 | 9.78 | 4.89 | 50.00 | -45.11 | AVG |

Note:
1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.

**LINE L RESULTS with unmodified sample (antenna present)**




| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 0.1556 | 28.25 | 9.50 | 37.75 | 65.70 | -27.95 | QP |
| 2 | 0.1556 | 8.05 | 9.50 | 17.55 | 55.70 | -38.15 | AVG |
| 3 | 0.1884 | 20.96 | 9.57 | 30.53 | 64.11 | -33.58 | QP |
| 4 | 0.1884 | 4.94 | 9.57 | 14.51 | 54.11 | -39.60 | AVG |
| 5 | 0.5536 | 26.96 | 9.50 | 36.46 | 56.00 | -19.54 | QP |
| 6 | 0.5536 | 17.76 | 9.50 | 27.26 | 46.00 | -18.74 | AVG |
| 7 | 0.9660 | 19.03 | 9.51 | 28.54 | 56.00 | -27.46 | QP |
| 8 | 0.9660 | 8.19 | 9.51 | 17.70 | 46.00 | -28.30 | AVG |
| 9 | 2.3984 | 13.84 | 9.63 | 23.47 | 56.00 | -32.53 | QP |
| 10 | 2.3984 | 5.02 | 9.63 | 14.65 | 46.00 | -31.35 | AVG |
| 11 | 18.1804 | 14.10 | 9.71 | 23.81 | 60.00 | -36.19 | QP |
| 12 | 18.1804 | 2.08 | 9.71 | 11.79 | 50.00 | -38.21 | AVG |

Note:
1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.

# 9. ANTENNA REQUIREMENTS

**APPLICABLE REQUIREMENTS**

Please refer to FCC §15.203
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.

Please refer to FCC §15.247(b)(4)
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**RESULTS**

Complies

**END OF REPORT**