# FCC 47 CFR PART 15 SUBPART C:2008 AND ANSI C63.4: 2003

## TEST REPORT

**For**

## Industrial Radio Remote Control

**Model Number: TWISTER 2X**

**Trade Name: FOMOTECH**

**Issued to**

**Fomotech International Corp.**
**2F-1, 286-3, Hsin Ya Road, Chien Chen District, Kaohsiung, Taiwan, R.O.C.**

**Issued by**

**Compliance Certification Services Inc.**
**Tainan Lab.**
**No. 8, Jiu Cheng Ling, Jiaokeng Village,Sinhua Township, Tainan Hsien 712, Taiwan R.O.C.**
**TEL: 886-6-580-2201**
**FAX: 886-6-580-2202**
**Issued Date: June 30, 2009**

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# 1. TEST RESULT CERTIFICATION

| | |
|---|---|
| **Applicant** | FOMOTECH International Corp. |
| **Address** | 2F-1, 286-3, HSIN-YA ROAD, CHIEN CHEN DISTRICT, KAOHSIUNG, TAIWAN |
| **Manufacture** | FOMOTECH International Corp. |
| **Address** | 2F-1, 286-3, HSIN-YA ROAD, CHIEN CHEN DISTRICT, KAOHSIUNG, TAIWAN |
| **Equipment Under Test** | Industrial Radio Remote Control |
| **Model Number** | TWISTER 2X |
| **Trade Name** | FOMOTECH |
| **Date of Test** | March 31, 2009 ~ April 27, 2009 |

| **APPLICABLE STANDARD** | |
|---|---|
| **STANDARD** | **TEST RESULT** |
| FCC Part 15 Subpart C : 2008 AND ANSI C63.4 : 2003 | No non-compliance noted |

**Approved by:**

**Jeter Wu**
Section Manger
Compliance Certification Services Inc.

**Reviewed by:**

**Eric Yang**
Engineer
Compliance Certification Services Inc.

# 2. EUT DESCRIPTION

| | |
|---|---|
| **Product** | Industrial Radio Remote Control |
| **Model Number** | TWISTER 2X |
| **Brand Name** | FOMOTECH |
| **Received Date** | March 27, 2009 |
| **Power Supply** | DC 7.2V 600mA |
| **Frequency Range** | 910.500 ~ 915.400 MHz |
| **Transmit Peak Power** | 93.4dBuV(0.043mW) |
| **Transmit Data Rate** | 0.01 Mbps |
| **Modulation Technique** | FSK |
| **Number of Channels** | 99 Channels |
| **Channels Spacing** | 0.05 MHz |
| **Antenna Specification** | Gain : 1 dBi |
| **Antenna Designation** | Monopole Antenna |
| **Temperature Range** | 0 ~ +55°C |

**Remark:**

1. The sample selected for test was production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **LZ6TWISTER2X** filing to comply with Section 15.107 & 15.109 (FCC Part 15, Subpart B) and Section 15.207, 15.209, 15.249.

# 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 : 2003 and FCC CFR 47 15.207, 15.209 and 15.247.

## 3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

## 3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.107 and 15.109 under the FCC Rules Part 15 Subpart B and Section 15.207, 15.209,15.249 under the FCC Rules Part 15 Subpart C.

## 3.3GENERAL TEST PROCEDURES

**Conducted Emissions**

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 : 2003 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

**Radiated Emissions**

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4 : 2003.

## 3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| 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 - | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.52525 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 156.7 - 156.9 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 162.0125 - 167.17 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 167.72 - 173.2 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 240 - 285 | 3600 - 4400 | ([2]) |
| 13.36 - 13.41 | 322 - 335.4 | | |

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

## 3.5 DESCRIPTION OF TEST MODES

The EUT (model: TWISTER 2X) had been tested under operating condition.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only, and powerline conducted emission below 30MHz, which worst case was in normal link mode.

# 4. INSTRUMENT CALIBRATION

## 4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

## 4.2 MEASUREMENT EQUIPMENT USED

**Equipment Used for Emissions Measurement**

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

| Conducted Emission room | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| L.I.S.N. | SCHWARZBECK | NNLK 8121 | 8121-446 | NOV. 19, 2009 For Insertion loss |
| | Rohde & Schwarz | ESH 3-Z5 | 840062/021 | OCT. 05, 2009 |
| TEST RECEIVER | Rohde & Schwarz | ESCS 30 | 100348 | JUL. 02, 2009 |
| BNC COAXIAL CABLE | CCS | BNC50 | 11 | JAN. 14, 2010 |
| Test S/W | e-3 (5.04211c) R&S (2.27) | | | |

| Open Area Test Site # 6 | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| TYPE N COAXIAL CABLE | SUHNER | CHA9513 | 6 | AUG. 26, 2009 |
| EMI Receiver | R&S | ESVS10 | 833206/012 | APR. 28, 2010 |
| Spectrum Analyzer | R&S | FSEK 30 | 835253/002 | OCT. 14, 2009 |
| BI-LOG Antenna | Sunol | JB1 | A070506-2 | SEP. 8, 2009 |
| Horn Antenna | Com-Power | AH-118 | 071032 | DEC. 22, 2009 |
| SMA RF CABLE | SUHNER | SUCOFLEX104PEA | 20520/4PEA | NOV. 12, 2009 |
| Pre-Amplifier | MITEQ | AFS44-00108650-42-10P -44 | 1205908 | OCT. 23, 2009 |
| Signal Generator | HP | 8673C | 2938A00663 | JUL. 16, 2009 |
| Pre-Amplifier | HP | 8447F | 2944A03817 | NOV. 01, 2009 |
| Turn Table | Yo Chen | 001 | ---------- | N.C.R. |
| Antenna Tower | AR | TP1000A | 309874 | N.C.R. |
| Controller | CT | SC101 | ---------- | N.C.R. |
| Test S/W | e-3 (5.04303e) | | | |

# 5. FACILITIES AND ACCREDITATIONS

## 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ No. 8, Jiu Cheng Ling, Jiaokeng Village,Sinhua Township, Tainan Hsien 712, Taiwan R.O.C.

The sites are constructed in conformance with the requirements of ANSI C63.7:1992, ANSI C63.4 : 2003 and CISPR Publication 22.

## 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

## 5.3 TABLE OF ACCREDITATIONS AND LISTINGS

| Country | Agency | Scope of Accreditation | Logo |
|---|---|---|---|
| USA | FCC | 3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements | TW-1037 |
| Japan | VCCI | 3/10 meter Open Area Test Sites and conducted test sites to perform radiated/conducted measurements | C-2882<br>R-2635 |
| Taiwan | TAF | CISPR 11, FCC METHOD-47 CFR Part 18, EN 55011, EN 60601-1-2,<br>CISPR 22, CNS 13438, EN 55022, EN 55024, AS/NZS CISPR 22<br>CISPR 14, EN 55014-1, EN 55014-2, CNS 13783-1, CISPR 22,<br>CNS 13439, EN 55013,<br>FCC Method-47 CFR Part 15 Subpart B,<br>IC ICES-003, VCCI V-3 & V-4<br>FCC Method-47 CFR Part 15 Subpart C and ANSI C63.4, LP 0002<br>EN / IEC 61000-4-2 / -3 / -4 / -5 / -6 / -8 / -11<br>EN 61000-3-2, EN 61000-3-3<br>EN 61000-6-3, EN 61000-6-1, AS/NZS 4251.1,<br>EN 61000-6-4, EN 61000-6-2, AS/NZS 4251.2,<br>EN 61204-3, EN 50130-4, EN 62040-2,<br>EN 50371, EN 50385, AS/NZS 4268,<br>ETSI EN 300 386<br>ETSI EN 300 328, ETSI EN 301 489-1/-3/-9/-17<br>ETSI EN 301 893, ETSI EN 300 220-2/-1<br>ETSI EN 300 440-2/-1<br>ETSI EN 301 357-2/-1<br>RSS-310, RSS-210 Issue 7, RSS-Gen Issue 2 | Testing Laboratory 1109 |
| Taiwan | BSMI | CNS 13438, CNS 13783-1, CNS13439 | SL2-IN-E-0039<br>SL2-R1/R2-0039<br>SL2-A1-E-0039 |
| Canada | Industry Canada | RSS210, Issue 7 | IC 2324H-1 |

* No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

# 6. SETUP OF EQUIPMENT UNDER TEST

## 6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix I for the actual connections between EUT and support equipment.

## 6.2 SUPPORT EQUIPMENT

| No. | Product | Manufacturer | Model No. | Certify No. | Signal cable |
|---|---|---|---|---|---|
| 1 | N/A | ------ | ------ | ------ | ------ |

| No. | Signal cable description | |
|---|---|---|
| A | Power Cable | Unshielded, 0.6m, 1 pcs |

**Remark:**
1. All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

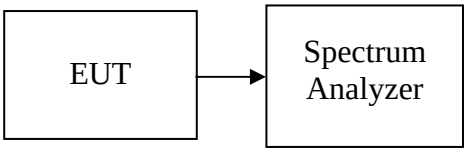
# 7. FCC PART 15.249 REQUIREMENTS

## 7.1 20 dB BANDWIDTH

### LIMIT

None; for reporting purposes only.

**Test Configuration**




### TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=30kHz, VBW = 100kHz, Span = 250kHz, Sweep = auto.
4. Mark the peak frequency and 20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

### TEST RESULTS

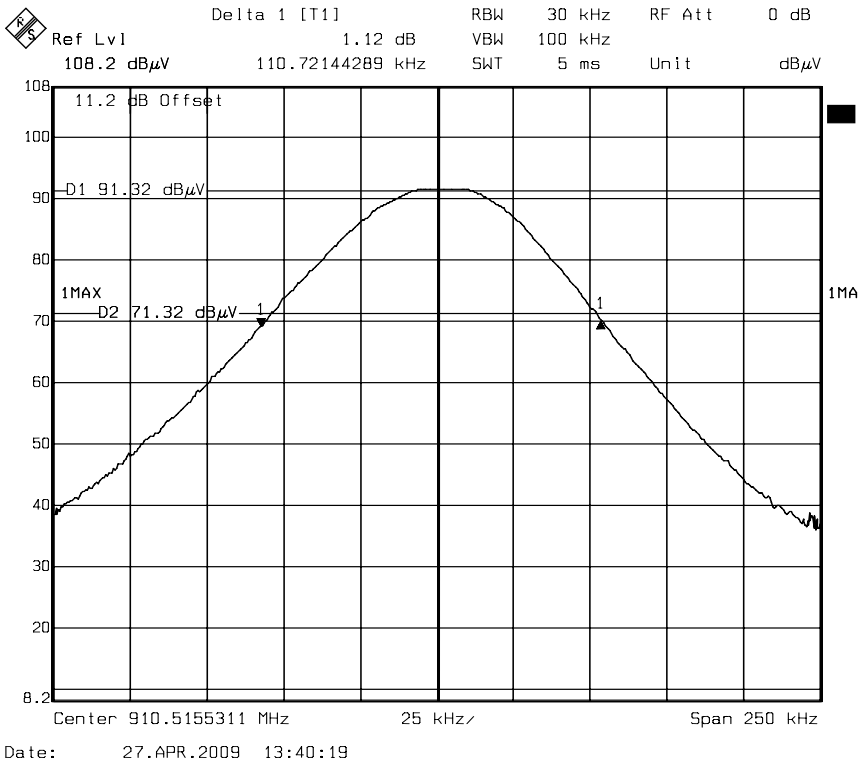
*No non-compliance noted*

**Test Data**

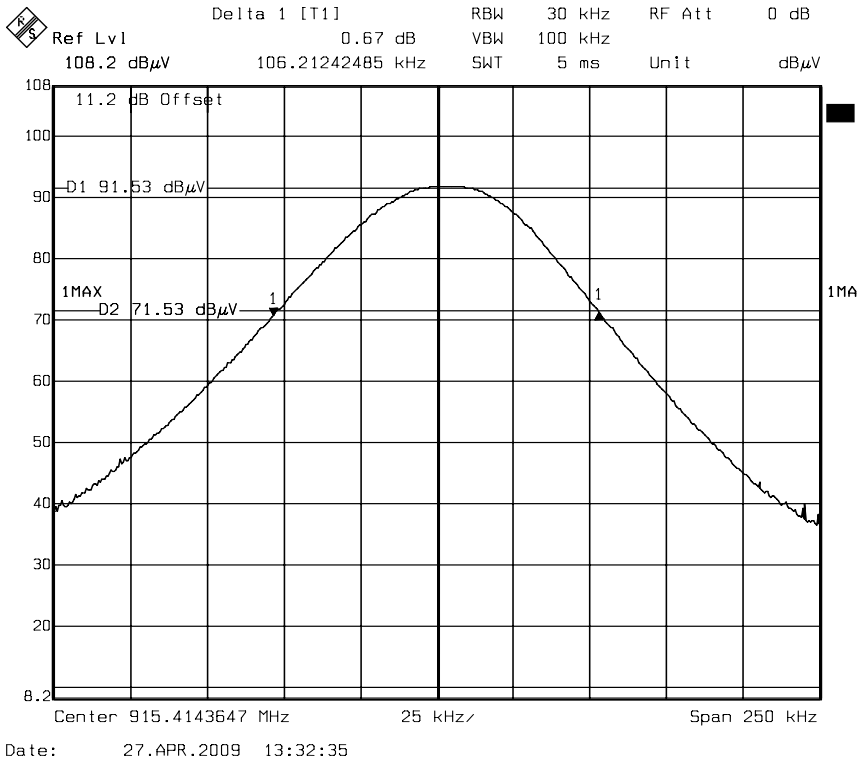
| Channel | Frequency (MHz) | Bandwidth (kHz) |
|---|---|---|
| Low | 910.51 | 110.72 |
| High | 915.41 | 106.21 |

## Test Plot

### Channel Low




### Channel High



## 7.2 BAND EDGES MEASUREMENT

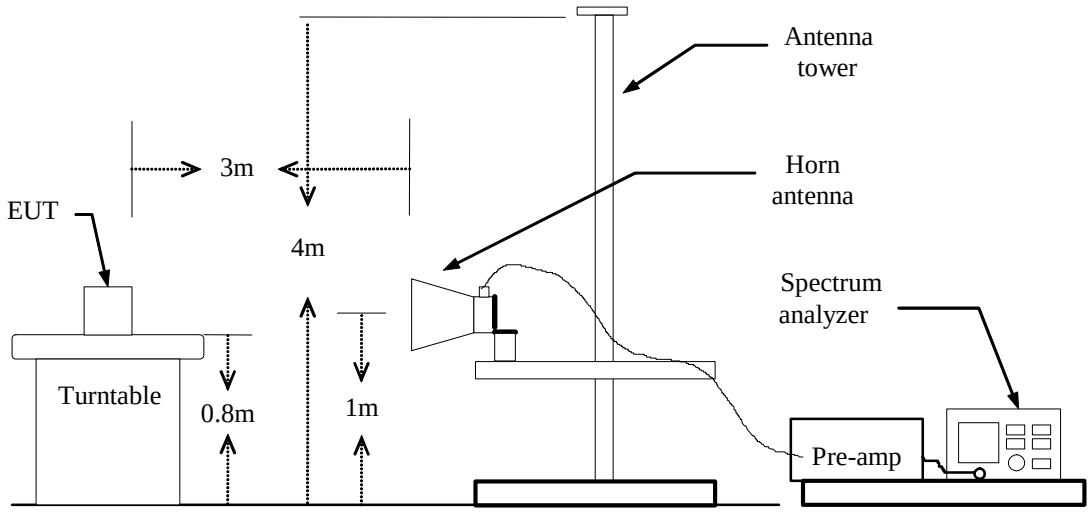
## LIMIT

1. In the above emission table, the tighter limit applies at the band edges.

| Frequency (MHz) | Field Strength (μV/m at 3-meter) | Field Strength (dBμV/m at 3-meter) |
|---|---|---|
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

2. As shown in Section 15.35(b), for frequencies above 1000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

**Test Configuration**




## TEST PROCEDURE

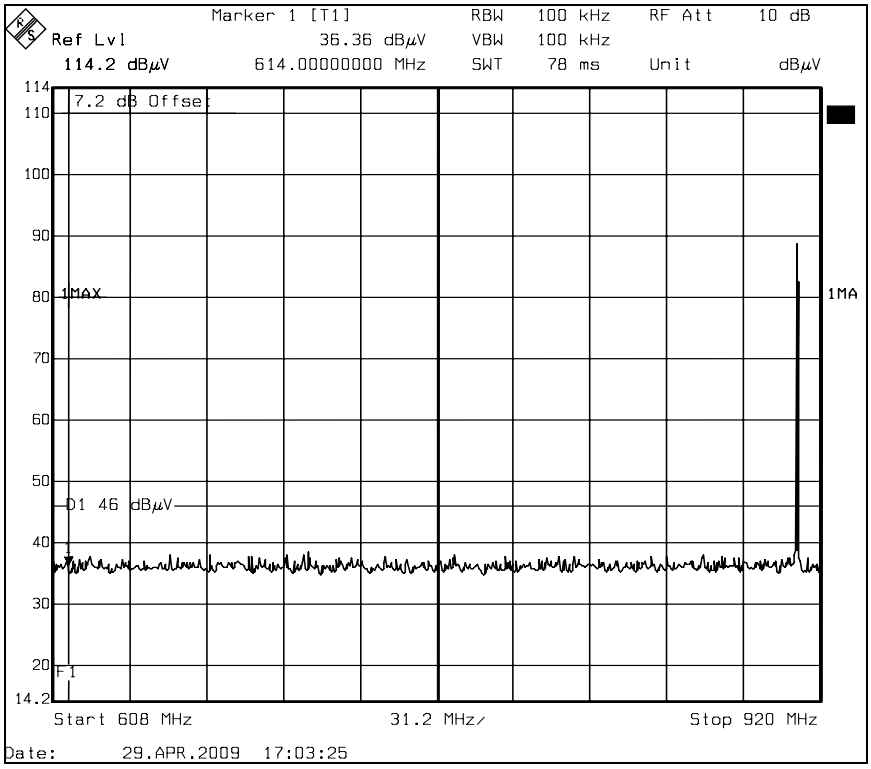
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=VBW=100kHz / Sweep=AUTO
5. Repeat the procedures until all the PEAK versus POLARIZATION are measured.

## TEST RESULTS

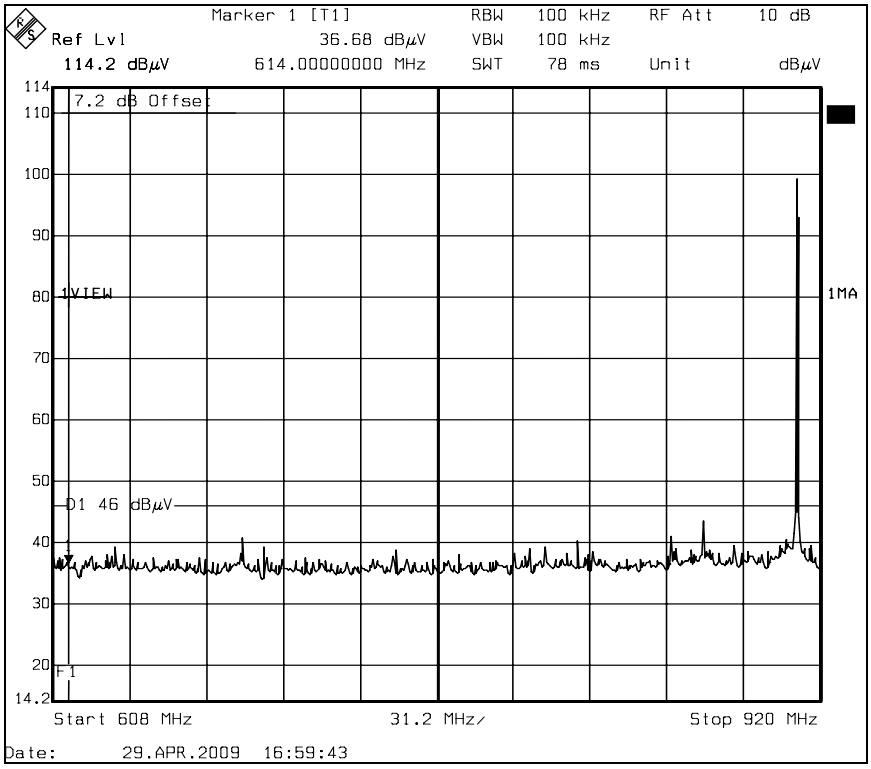
Refer to attach spectrum analyzer data chart.

## Band Edges (CH Low) X axis

### Polarity: Vertical

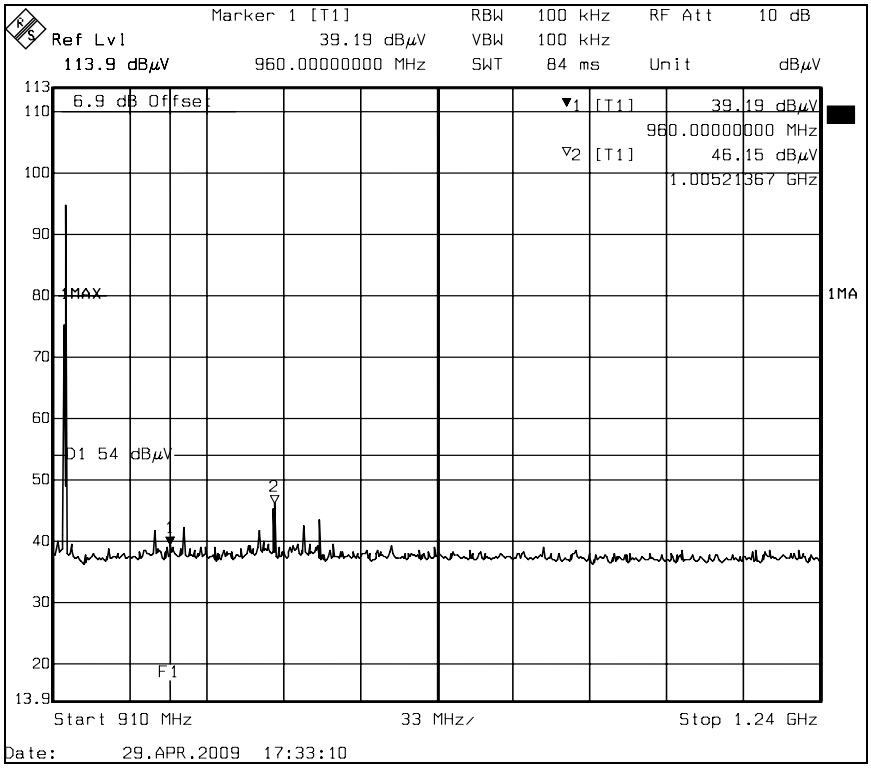



### Polarity: Horizontal

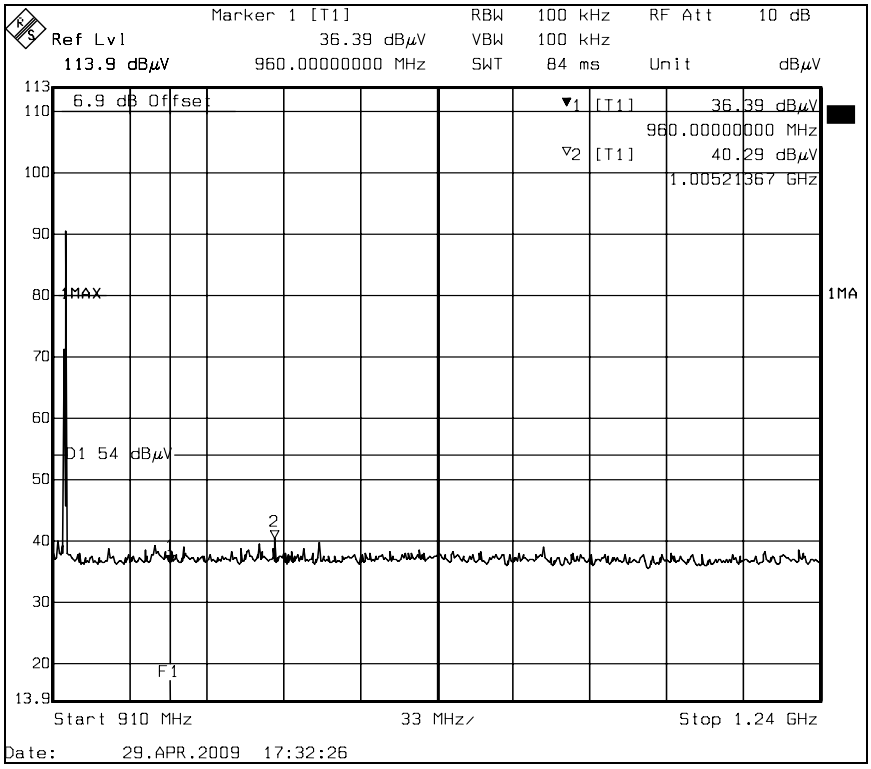


## Band Edges (CH High) X axis

### Polarity: Vertical

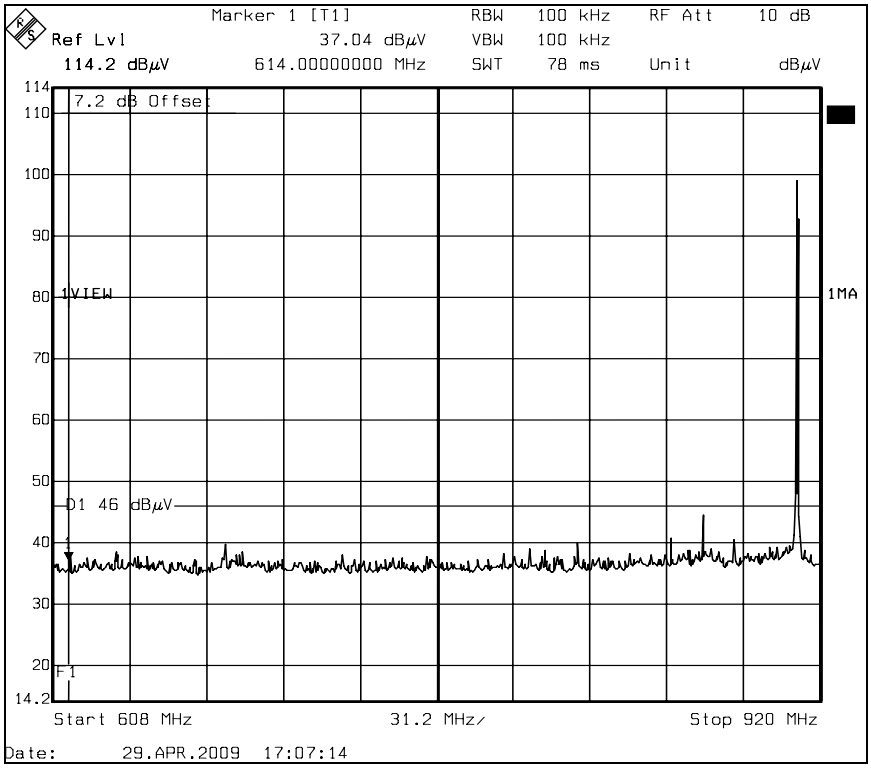



### Polarity: Horizontal

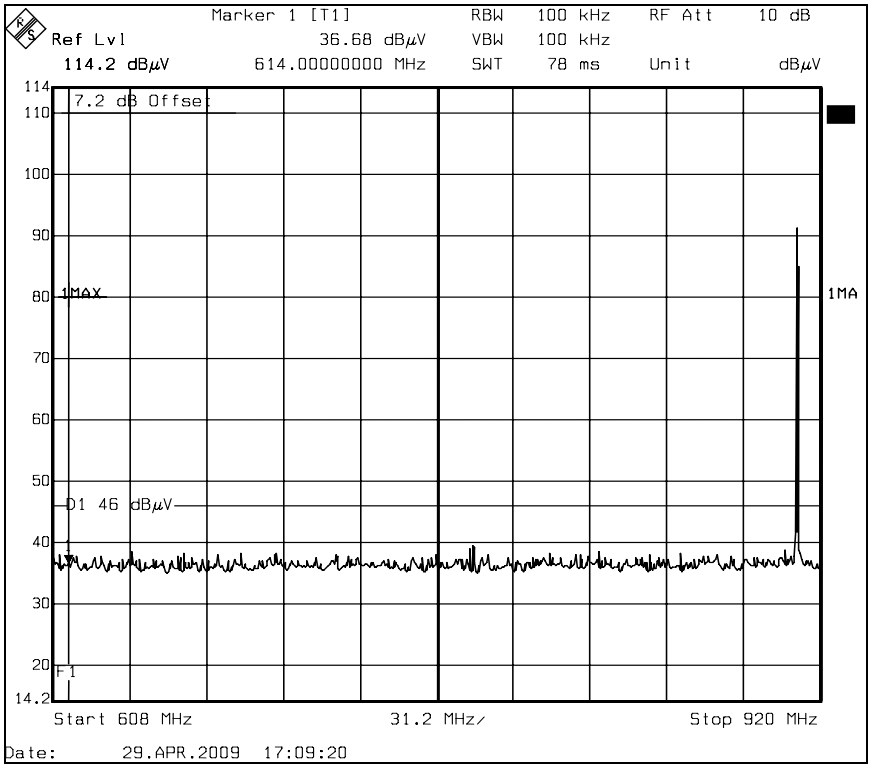


## Band Edges (CH Low) Y axis

### Polarity: Vertical

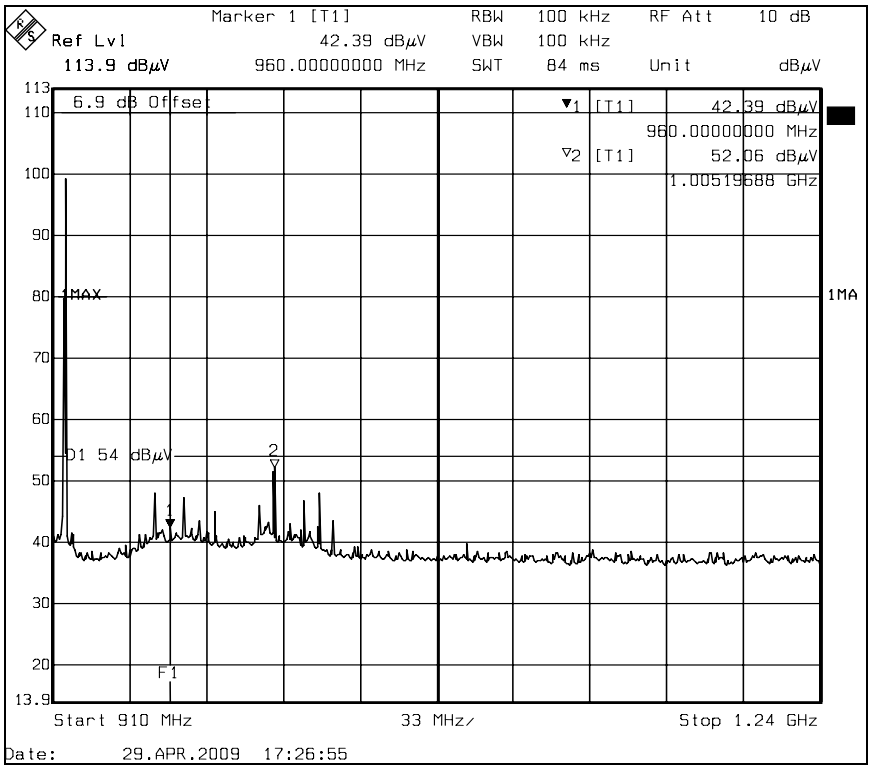



### Polarity: Horizontal

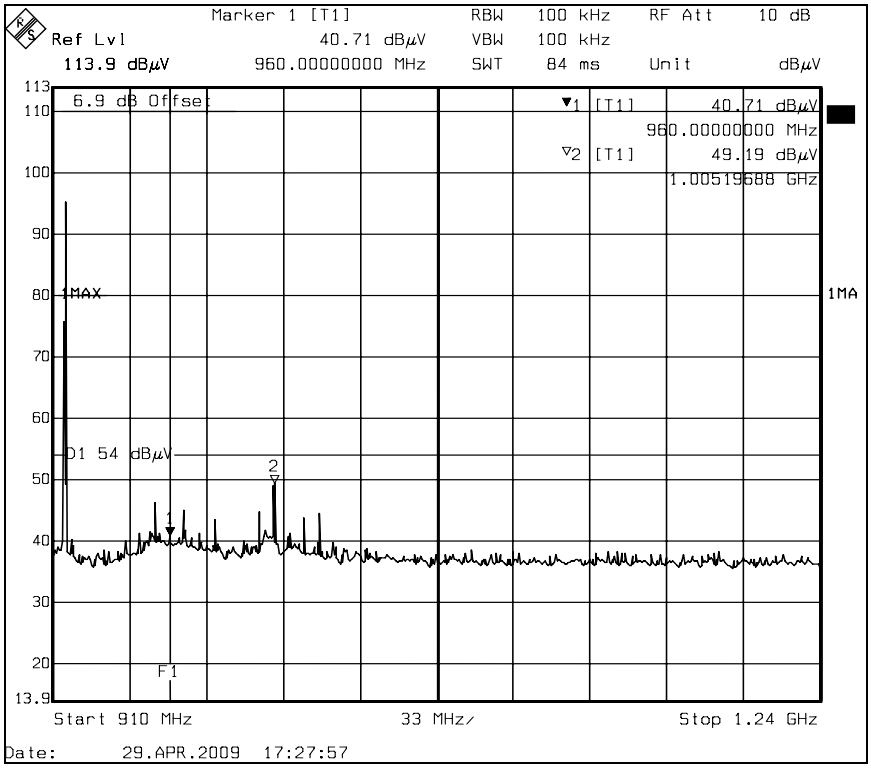


## Band Edges (CH High) Y axis

### Polarity: Vertical

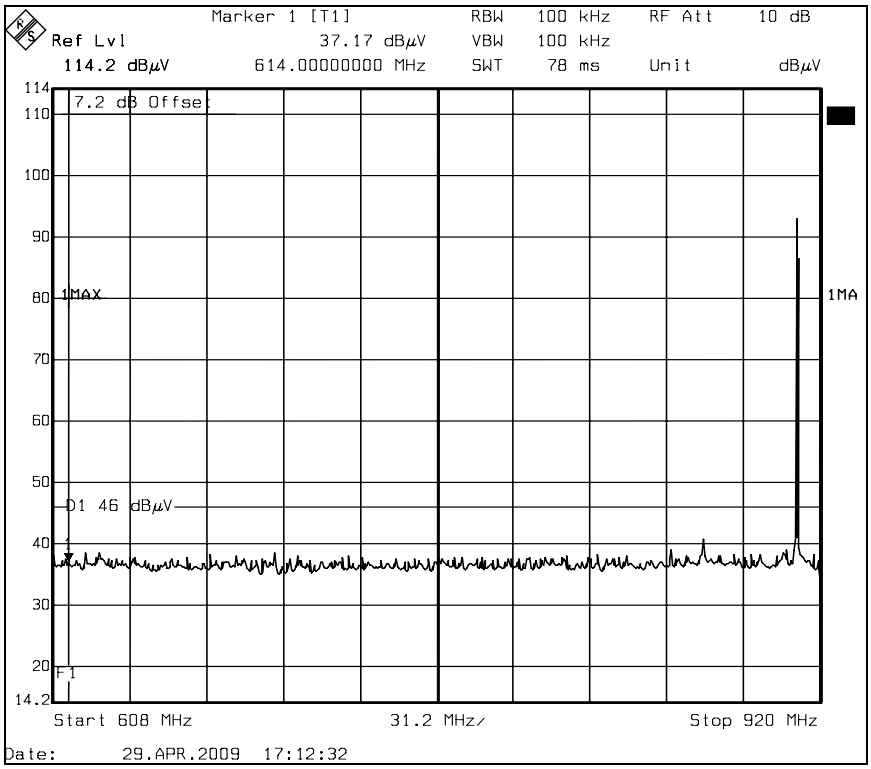



### Polarity: Horizontal

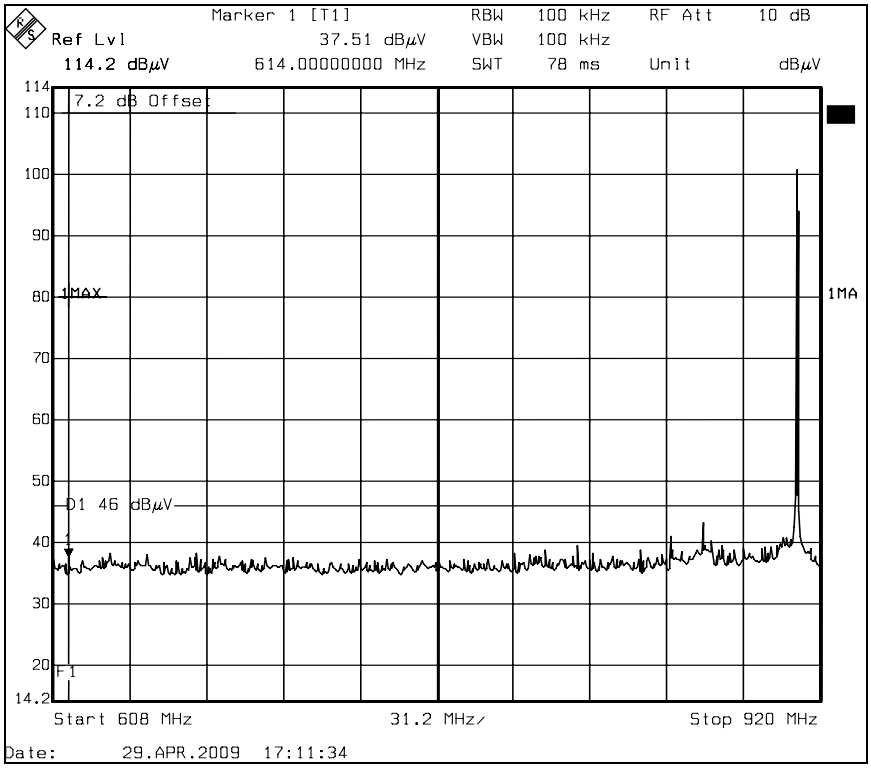


## Band Edges (CH Low) Z axis

### Polarity: Vertical

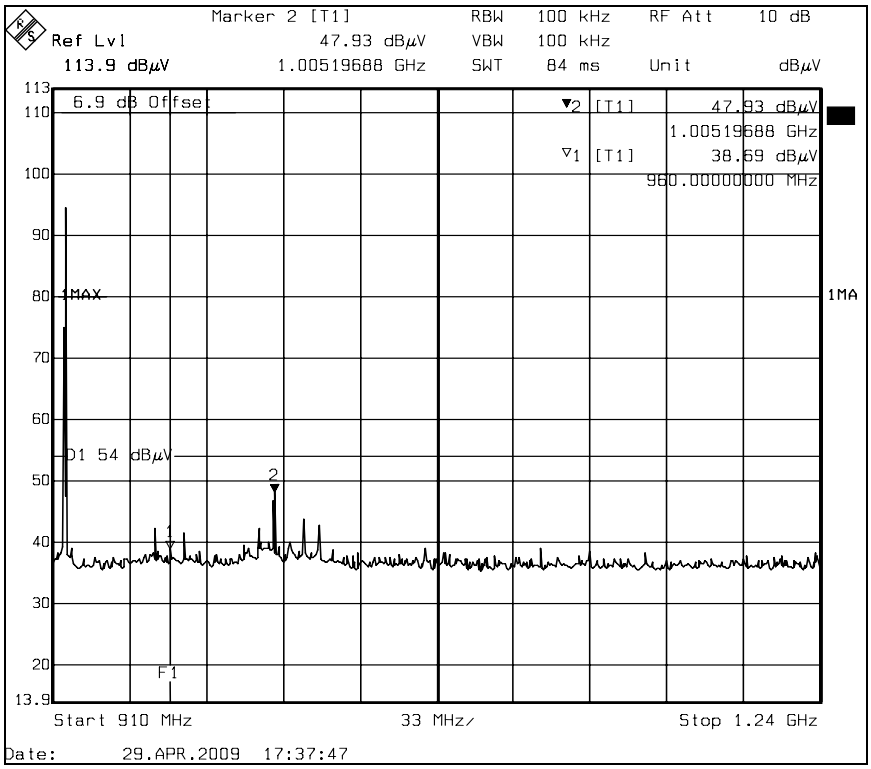



### Polarity: Horizontal

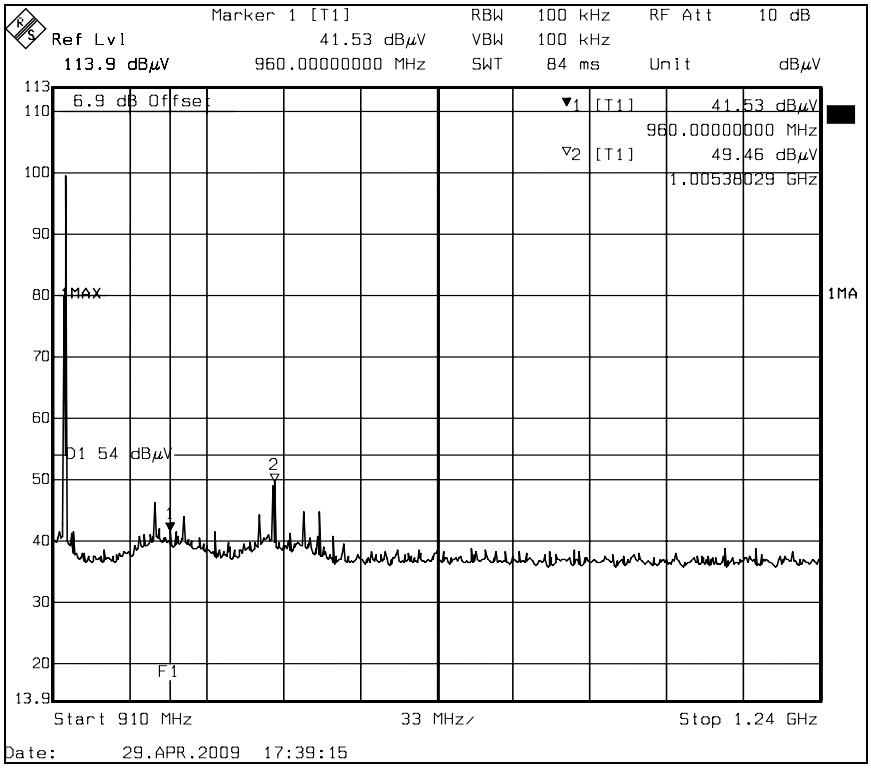


## Band Edges (CH High) Z axis

### Polarity: Vertical




### Polarity: Horizontal



## 7.3 SPURIOUS EMISSION

## LIMIT

1. In the section 15.249(a):
   Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental Frequency (MHz) | Field Strength of Fundamental Field Strength (mV/m) | Field Strength of Harmonics (μV/m) |
|---|---|---|
| 902-928 MHz | 50 | 500 |
| 2400 - 2483.5 MHz | 50 | 500 |
| 5725 - 5875 MHz | 50 | 500 |
| 24.0 - 24.25 GHz | 250 | 2500 |

2. Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength (μV/m) | Measurement Distance (m) |
|---|---|---|
| 30-88 | 100* | 3 |
| 88-216 | 150* | 3 |
| 216-960 | 200* | 3 |
| Above 960 | 500 | 3 |

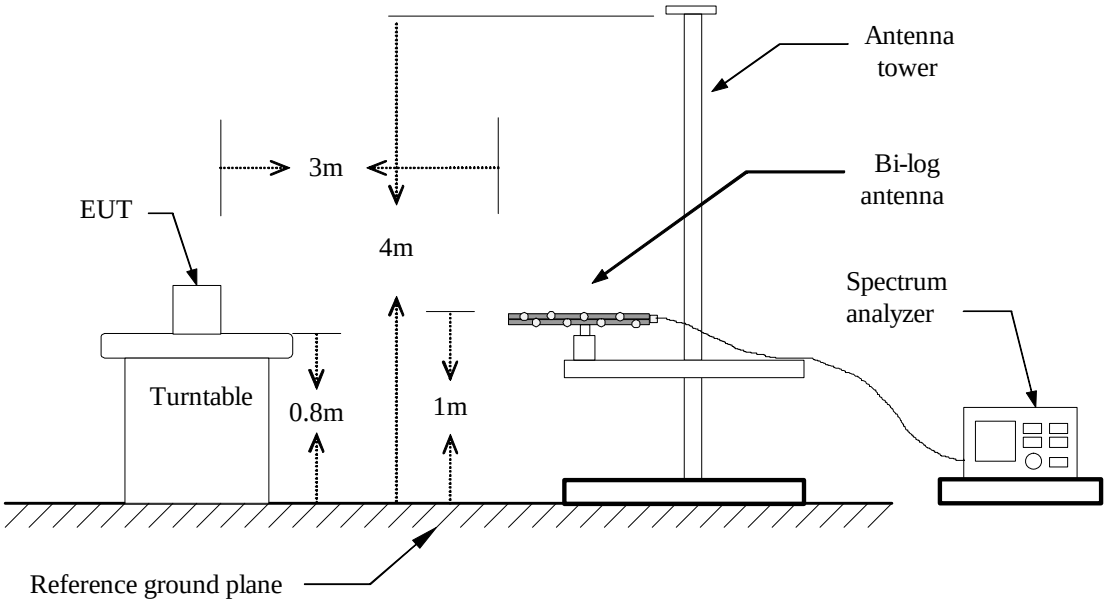
   **Remark:** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

3. In the above emission table, the tighter limit applies at the band edges.

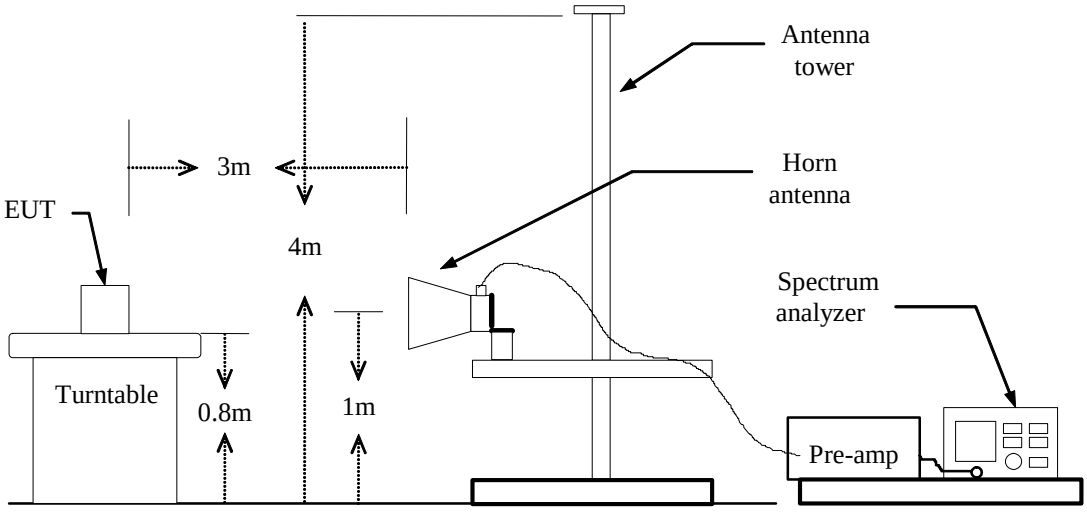
| Frequency (MHz) | Field Strength (μV/m at 3-meter) | Field Strength (dBμV/m at 3-meter) |
|---|---|---|
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

## Test Configuration

### Below 1 GHz




### Above 1 GHz



## TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

   Below 1GHz:

   RBW=100kHz / VBW=300kHz / Sweep=AUTO

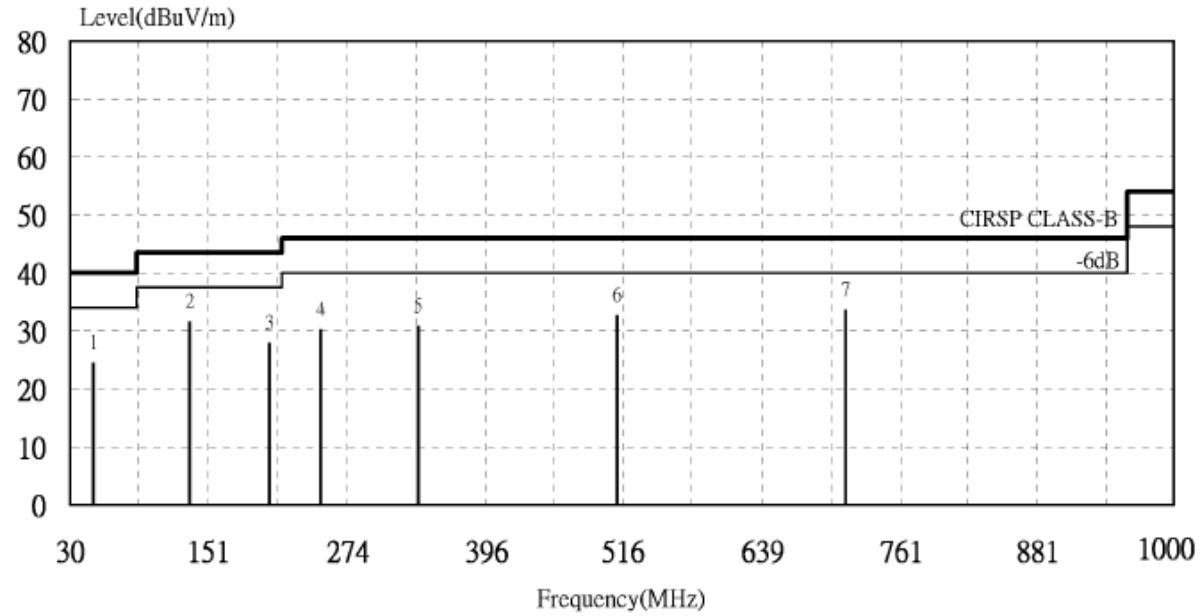
   Above 1GHz:

   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

**Below 1 GHz**

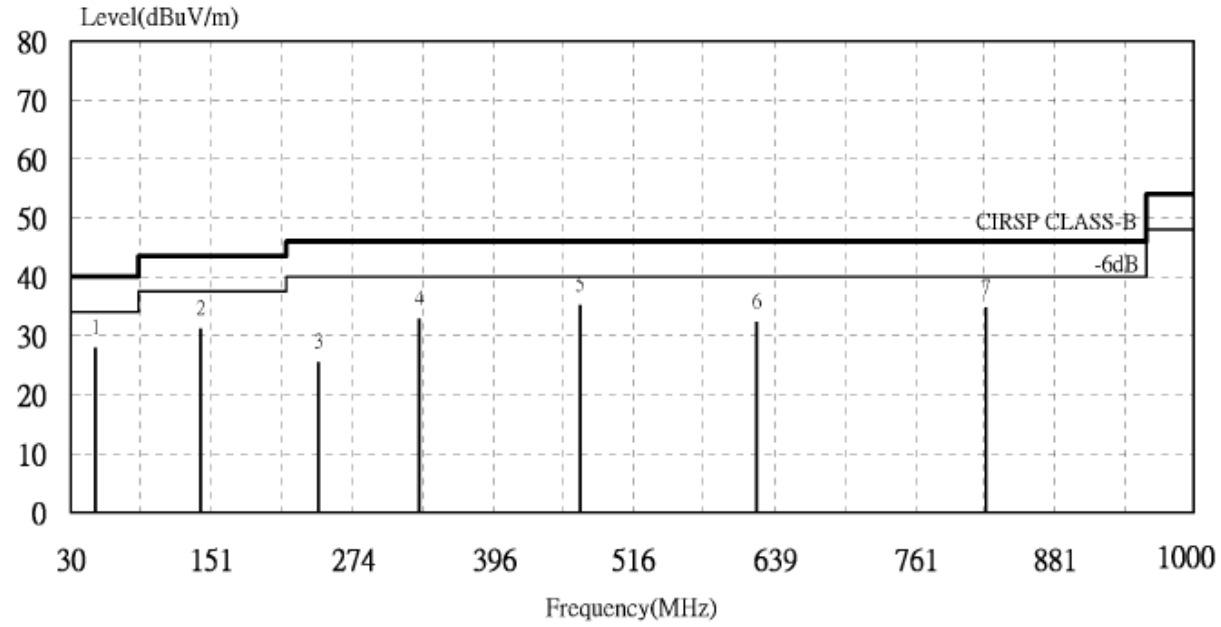
| | | | |
|---|---|---|---|
| **Operation Mode:** | Normal Operation | **Test Date:** | April 30, 2009 |
| **Temperature:** | 25.8 °C | **Tested by:** | Eric Yang |
| **Humidity:** | 46 % RH | **Polarity:** | Vertical |




| No. | Freq-Uency (MHz) | Meter Reading at 3 m Level (dBµV) | Antenna Factor (dB/m) | Cable Loss (dB) | Emission at 3 m Level (dBµV/m) | Limits (dBµV/m) | Margin (dB) | Detector Mode PK/QP |
|---|---|---|---|---|---|---|---|---|
| 1 | 50.42 | 14.70 | 8.24 | 1.39 | 24.33 | 40.00 | **-15.67** | QP |
| 2 | 135.00 | 15.80 | 13.47 | 2.21 | 31.48 | 43.50 | **-12.02** | QP |
| 3 | 205.61 | 12.10 | 12.96 | 2.71 | 27.77 | 43.50 | **-15.73** | QP |
| 4 | 250.00 | 14.70 | 12.37 | 3.04 | 30.10 | 46.00 | **-15.90** | QP |
| 5 | 336.57 | 12.50 | 14.75 | 3.45 | 30.70 | 46.00 | **-15.30** | QP |
| 6 | 511.24 | 9.80 | 18.16 | 4.56 | 32.53 | 46.00 | **-13.47** | QP |
| 7 | 712.30 | 7.20 | 20.76 | 5.53 | 33.49 | 46.00 | **-12.51** | QP |

**Remark:**
1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

| | | | |
|---|---|---|---|
| **Operation Mode:** | Normal Operation | **Test Date:** | April 30, 2009 |
| **Temperature:** | 25.8 °C | **Tested by:** | Eric Yang |
| **Humidity:** | 46 % RH | **Polarity:** | Horizontal |




| No. | Freq-Uency (MHz) | Meter Reading at 3 m Level (dBµV) | Antenna Factor (dB/m) | Cable Loss (dB) | Emission at 3 m Level (dBµV/m) | Limits (dBµV/m) | Margin (dB) | Detector Mode PK/QP |
|---|---|---|---|---|---|---|---|---|
| 1 | 51.20 | 18.23 | 8.19 | 1.40 | 27.82 | 40.00 | **-12.18** | QP |
| 2 | 142.27 | 15.49 | 13.26 | 2.26 | 31.01 | 43.50 | **-12.49** | QP |
| 3 | 244.05 | 10.11 | 12.23 | 3.02 | 25.36 | 46.00 | **-20.64** | QP |
| 4 | 331.04 | 14.67 | 14.63 | 3.42 | 32.71 | 46.00 | **-13.29** | QP |
| 5 | 470.35 | 13.28 | 17.45 | 4.29 | 35.03 | 46.00 | **-10.97** | QP |
| 6 | 623.58 | 7.22 | 19.66 | 5.23 | 32.10 | 46.00 | **-13.90** | QP |
| 7 | 821.35 | 6.59 | 21.99 | 6.04 | 34.61 | 46.00 | **-11.39** | QP |

**Remark:**
1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

**Above 1 GHz**

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / X (CH Low) | **TEMP& Humidity** | 26.8℃, 48% |

Horizontal

| | **TX / X (CH Low)** | | | | **Measurement Distance at 3m Horizontal polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 910.50 | 88.57 | 22.81 | 4.52 | 26.18 | 0.00 | 89.72 | 114.00 | -24.28 | Q |
| | 1820.99 | 53.64 | 29.30 | 2.23 | 41.70 | 0.95 | 44.42 | 74.00 | -29.58 | P |
| | 1820.99 | 50.24 | 29.30 | 2.23 | 41.70 | 0.95 | 41.02 | 54.00 | -12.98 | A |
| * | 2731.55 | 56.40 | 30.24 | 2.38 | 42.07 | 1.41 | 48.35 | 74.00 | -25.65 | P |
| * | 2731.55 | 52.34 | 30.24 | 2.38 | 42.07 | 1.41 | 44.29 | 54.00 | -9.71 | A |
| * | 3642.03 | 51.99 | 30.98 | 3.26 | 42.93 | 0.81 | 44.11 | 74.00 | -29.89 | P |
| * | 3642.03 | 44.78 | 30.98 | 3.26 | 42.93 | 0.81 | 36.90 | 54.00 | -17.10 | A |
| * | 4552.43 | 50.38 | 32.93 | 3.56 | 43.70 | 0.59 | 43.75 | 74.00 | -30.25 | P |
| * | 4552.43 | 40.71 | 32.93 | 3.56 | 43.70 | 0.59 | 34.08 | 54.00 | -19.92 | A |

**Remark:**
1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / X (CH Low) | **TEMP& Humidity** | 26.8℃, 48% |

Vertical

| | **TX / X (CH Low)** | | | | **Measurement Distance at 3m Vertical polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 910.49 | 84.36 | 22.80 | 4.52 | 26.18 | 0.00 | 85.51 | 114.00 | -28.49 | Q |
| | 1820.99 | 50.24 | 29.30 | 2.23 | 41.70 | 0.95 | 41.02 | 74.00 | -32.98 | P |
| | 1820.99 | 47.31 | 29.30 | 2.23 | 41.70 | 0.95 | 38.09 | 54.00 | -15.91 | A |
| * | 2731.58 | 52.14 | 30.24 | 2.38 | 42.07 | 1.41 | 44.09 | 74.00 | -29.91 | P |
| * | 2731.58 | 48.70 | 30.24 | 2.38 | 42.07 | 1.41 | 40.65 | 54.00 | -13.35 | A |
| * | 3642.05 | 49.67 | 30.98 | 3.26 | 42.93 | 0.81 | 41.79 | 74.00 | -32.21 | P |
| * | 3642.05 | 41.57 | 30.98 | 3.26 | 42.93 | 0.81 | 33.69 | 54.00 | -20.31 | A |
| * | 4552.47 | 49.58 | 32.93 | 3.56 | 43.70 | 0.59 | 42.95 | 74.00 | -31.05 | P |
| * | 4552.47 | 38.78 | 32.93 | 3.56 | 43.70 | 0.59 | 32.15 | 54.00 | -21.85 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / X (CH High) | **TEMP& Humidity** | 26.8℃, 48% |

Horizontal

| | **TX / X (CH High)** | | | | **Measurement Distance at 3m Horizontal polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 915.39 | 89.11 | 22.85 | 4.53 | 26.17 | 0.00 | 90.32 | 114.00 | -23.68 | Q |
| | 1830.78 | 53.94 | 29.38 | 2.24 | 41.71 | 0.96 | 44.80 | 74.00 | -29.20 | P |
| | 1830.78 | 50.25 | 29.38 | 2.24 | 41.71 | 0.96 | 41.11 | 54.00 | -12.89 | A |
| * | 2746.22 | 55.34 | 30.25 | 2.38 | 42.09 | 1.41 | 47.30 | 74.00 | -26.70 | P |
| * | 2746.22 | 51.40 | 30.25 | 2.38 | 42.09 | 1.41 | 43.36 | 54.00 | -10.64 | A |
| * | 3661.54 | 51.83 | 31.02 | 3.26 | 42.95 | 0.80 | 43.96 | 74.00 | -30.04 | P |
| * | 3661.54 | 45.35 | 31.02 | 3.26 | 42.95 | 0.80 | 37.48 | 54.00 | -16.52 | A |
| * | 4577.03 | 51.24 | 32.98 | 3.57 | 43.72 | 0.60 | 44.68 | 74.00 | -29.32 | P |
| * | 4577.03 | 41.52 | 32.98 | 3.57 | 43.72 | 0.60 | 34.96 | 54.00 | -19.04 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / X (CH High) | **TEMP& Humidity** | 26.8℃, 48% |

Vertical

| | **TX / X (CH High)** | | | | **Measurement Distance at 3m Vertical polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 915.40 | 85.25 | 22.85 | 4.53 | 26.17 | 0.00 | 86.46 | 114.00 | -27.54 | Q |
| | 1830.72 | 51.24 | 29.38 | 2.24 | 41.71 | 0.96 | 42.10 | 74.00 | -31.90 | P |
| | 1830.72 | 48.25 | 29.38 | 2.24 | 41.71 | 0.96 | 39.11 | 54.00 | -14.89 | A |
| * | 2746.28 | 52.64 | 30.25 | 2.38 | 42.09 | 1.41 | 44.60 | 74.00 | -29.40 | P |
| * | 2746.28 | 48.32 | 30.25 | 2.38 | 42.09 | 1.41 | 40.28 | 54.00 | -13.72 | A |
| * | 3661.57 | 48.25 | 31.02 | 3.26 | 42.95 | 0.80 | 40.38 | 74.00 | -33.62 | P |
| * | 3661.57 | 41.35 | 31.02 | 3.26 | 42.95 | 0.80 | 33.48 | 54.00 | -20.52 | A |
| * | 4577.05 | 50.22 | 32.98 | 3.57 | 43.72 | 0.60 | 43.66 | 74.00 | -30.34 | P |
| * | 4577.05 | 40.39 | 32.98 | 3.57 | 43.72 | 0.60 | 33.83 | 54.00 | -20.17 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / Y (CH Low) | **TEMP& Humidity** | 26.8℃, 48% |

Horizontal

| | **TX / Y (CH Low)** | | | | **Measurement Distance at 3m Horizontal polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 910.51 | 84.60 | 22.81 | 4.52 | 26.18 | 0.00 | 85.75 | 114.00 | -28.25 | Q |
| | 1820.97 | 49.87 | 29.30 | 2.23 | 41.70 | 0.95 | 40.65 | 74.00 | -33.35 | P |
| | 1820.97 | 46.38 | 29.30 | 2.23 | 41.70 | 0.95 | 37.16 | 54.00 | -16.84 | A |
| * | 2731.59 | 48.75 | 30.24 | 2.38 | 42.07 | 1.41 | 40.70 | 74.00 | -33.30 | P |
| * | 2731.59 | 43.26 | 30.24 | 2.38 | 42.07 | 1.41 | 35.21 | 54.00 | -18.79 | A |
| * | 3642.05 | 47.81 | 30.98 | 3.26 | 42.93 | 0.81 | 39.93 | 74.00 | -34.07 | P |
| * | 3642.05 | 38.26 | 30.98 | 3.26 | 42.93 | 0.81 | 30.38 | 54.00 | -23.62 | A |
| * | 4552.48 | 47.11 | 32.93 | 3.56 | 43.70 | 0.59 | 40.48 | 74.00 | -33.52 | P |
| * | 4552.48 | 37.59 | 32.93 | 3.56 | 43.70 | 0.59 | 30.96 | 54.00 | -23.04 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / Y (CH Low) | **TEMP& Humidity** | 26.8℃, 48% |

Vertical

| | **TX / Y (CH Low)** | | | | **Measurement Distance at 3m Vertical polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 910.52 | 92.25 | 22.81 | 4.52 | 26.18 | 0.00 | 93.40 | 114.00 | -20.60 | Q |
| | 1820.98 | 51.24 | 29.30 | 2.23 | 41.70 | 0.95 | 42.02 | 74.00 | -31.98 | P |
| | 1820.98 | 48.35 | 29.30 | 2.23 | 41.70 | 0.95 | 39.13 | 54.00 | -14.87 | A |
| * | 2731.56 | 50.29 | 30.24 | 2.38 | 42.07 | 1.41 | 42.24 | 74.00 | -31.76 | P |
| * | 2731.56 | 45.87 | 30.24 | 2.38 | 42.07 | 1.41 | 37.82 | 54.00 | -16.18 | A |
| * | 3642.08 | 49.38 | 30.98 | 3.26 | 42.93 | 0.81 | 41.50 | 74.00 | -32.50 | P |
| * | 3642.08 | 40.25 | 30.98 | 3.26 | 42.93 | 0.81 | 32.37 | 54.00 | -21.63 | A |
| * | 4552.46 | 48.79 | 32.93 | 3.56 | 43.70 | 0.59 | 42.16 | 74.00 | -31.84 | P |
| * | 4552.46 | 38.97 | 32.93 | 3.56 | 43.70 | 0.59 | 32.34 | 54.00 | -21.66 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / Y (CH High) | **TEMP& Humidity** | 26.8℃, 48% |

Horizontal

| | **TX / Y (CH High)** | | | | **Measurement Distance at 3m Horizontal polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 915.39 | 85.64 | 22.85 | 4.53 | 26.17 | 0.00 | 86.85 | 114.00 | -27.15 | Q |
| | 1830.79 | 50.24 | 29.38 | 2.24 | 41.71 | 0.96 | 41.10 | 74.00 | -32.90 | P |
| | 1830.79 | 42.11 | 29.38 | 2.24 | 41.71 | 0.96 | 32.97 | 54.00 | -21.03 | A |
| * | 2746.18 | 48.75 | 30.25 | 2.38 | 42.09 | 1.41 | 40.71 | 74.00 | -33.29 | P |
| * | 2746.18 | 46.35 | 30.25 | 2.38 | 42.09 | 1.41 | 38.31 | 54.00 | -15.69 | A |
| * | 3661.58 | 48.72 | 31.02 | 3.26 | 42.95 | 0.80 | 40.85 | 74.00 | -33.15 | P |
| * | 3661.58 | 40.17 | 31.02 | 3.26 | 42.95 | 0.80 | 32.30 | 54.00 | -21.70 | A |
| * | 4577.17 | 48.51 | 32.99 | 3.57 | 43.72 | 0.60 | 41.95 | 74.00 | -32.05 | P |
| * | 4577.17 | 37.26 | 32.99 | 3.57 | 43.72 | 0.60 | 30.70 | 54.00 | -23.30 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / Y (CH High) | **TEMP& Humidity** | 26.8℃, 48% |

Vertical

| | **TX / Y (CH High)** | | | | **Measurement Distance at 3m Vertical polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 915.45 | 91.67 | 22.85 | 4.53 | 26.17 | 0.00 | 92.88 | 114.00 | -21.12 | Q |
| | 1830.84 | 52.58 | 29.38 | 2.24 | 41.71 | 0.96 | 43.44 | 74.00 | -30.56 | P |
| | 1830.84 | 45.73 | 29.38 | 2.24 | 41.71 | 0.96 | 36.59 | 54.00 | -17.41 | A |
| * | 2746.16 | 50.24 | 30.25 | 2.38 | 42.09 | 1.41 | 42.20 | 74.00 | -31.80 | P |
| * | 2746.16 | 48.58 | 30.25 | 2.38 | 42.09 | 1.41 | 40.54 | 54.00 | -13.46 | A |
| * | 3661.64 | 50.25 | 31.02 | 3.26 | 42.95 | 0.80 | 42.38 | 74.00 | -31.62 | P |
| * | 3661.64 | 42.34 | 31.02 | 3.26 | 42.95 | 0.80 | 34.47 | 54.00 | -19.53 | A |
| * | 4577.18 | 50.18 | 32.99 | 3.57 | 43.72 | 0.60 | 43.62 | 74.00 | -30.38 | P |
| * | 4577.18 | 39.84 | 32.99 | 3.57 | 43.72 | 0.60 | 33.28 | 54.00 | -20.72 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / Z (CH Low) | **TEMP& Humidity** | 26.8℃, 48% |

Horizontal

| | **TX / Z (CH Low)** | | | | **Measurement Distance at 3m Horizontal polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 910.49 | 91.35 | 22.80 | 4.52 | 26.18 | 0.00 | 92.50 | 114.00 | -21.50 | Q |
| | 1821.02 | 53.65 | 29.30 | 2.23 | 41.70 | 0.95 | 44.43 | 74.00 | -29.57 | P |
| | 1821.02 | 49.78 | 29.30 | 2.23 | 41.70 | 0.95 | 40.56 | 54.00 | -13.44 | A |
| * | 2731.53 | 51.24 | 30.24 | 2.38 | 42.07 | 1.41 | 43.19 | 74.00 | -30.81 | P |
| * | 2731.53 | 47.22 | 30.24 | 2.38 | 42.07 | 1.41 | 39.17 | 54.00 | -14.83 | A |
| * | 3642.08 | 50.22 | 30.98 | 3.26 | 42.93 | 0.81 | 42.34 | 74.00 | -31.66 | P |
| * | 3642.08 | 40.25 | 30.98 | 3.26 | 42.93 | 0.81 | 32.37 | 54.00 | -21.63 | A |
| * | 4552.49 | 49.35 | 32.93 | 3.56 | 43.70 | 0.59 | 42.72 | 74.00 | -31.28 | P |
| * | 4552.49 | 38.65 | 32.93 | 3.56 | 43.70 | 0.59 | 32.02 | 54.00 | -21.98 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / Z (CH Low) | **TEMP& Humidity** | 26.8℃, 48% |

Vertical

| | **TX / Z (CH Low)** | | | | **Measurement Distance at 3m Vertical polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 910.50 | 81.35 | 22.81 | 4.52 | 26.18 | 0.00 | 82.50 | 114.00 | -31.50 | Q |
| | 1820.98 | 50.24 | 29.30 | 2.23 | 41.70 | 0.95 | 41.02 | 74.00 | -32.98 | P |
| | 1820.98 | 46.35 | 29.30 | 2.23 | 41.70 | 0.95 | 37.13 | 54.00 | -16.87 | A |
| * | 2731.55 | 49.85 | 30.24 | 2.38 | 42.07 | 1.41 | 41.80 | 74.00 | -32.20 | P |
| * | 2731.55 | 45.17 | 30.24 | 2.38 | 42.07 | 1.41 | 37.12 | 54.00 | -16.88 | A |
| * | 3642.07 | 48.57 | 30.98 | 3.26 | 42.93 | 0.81 | 40.69 | 74.00 | -33.31 | P |
| * | 3642.07 | 38.62 | 30.98 | 3.26 | 42.93 | 0.81 | 30.74 | 54.00 | -23.26 | A |
| * | 4552.50 | 47.58 | 32.93 | 3.56 | 43.70 | 0.59 | 40.95 | 74.00 | -33.05 | P |
| * | 4552.50 | 37.46 | 32.93 | 3.56 | 43.70 | 0.59 | 30.83 | 54.00 | -23.17 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / Z (CH High) | **TEMP& Humidity** | 26.8℃, 48% |

Horizontal

| | **TX / Z (CH High)** | | | | **Measurement Distance at 3m Horizontal polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 915.39 | 91.61 | 22.85 | 4.53 | 26.17 | 0.00 | 92.82 | 114.00 | -21.18 | Q |
| | 1830.81 | 54.04 | 29.38 | 2.24 | 41.71 | 0.96 | 44.90 | 74.00 | -29.10 | P |
| | 1830.81 | 48.78 | 29.38 | 2.24 | 41.71 | 0.96 | 39.64 | 54.00 | -14.36 | A |
| * | 2746.32 | 49.77 | 30.25 | 2.38 | 42.09 | 1.41 | 41.73 | 74.00 | -32.27 | P |
| * | 2746.32 | 40.32 | 30.25 | 2.38 | 42.09 | 1.41 | 32.28 | 54.00 | -21.72 | A |
| * | 3661.62 | 50.09 | 31.02 | 3.26 | 42.95 | 0.80 | 42.22 | 74.00 | -31.78 | P |
| * | 3661.62 | 40.80 | 31.02 | 3.26 | 42.95 | 0.80 | 32.93 | 54.00 | -21.07 | A |
| * | 4576.91 | 49.43 | 32.98 | 3.57 | 43.72 | 0.60 | 42.87 | 74.00 | -31.13 | P |
| * | 4576.91 | 38.59 | 32.98 | 3.57 | 43.72 | 0.60 | 32.03 | 54.00 | -21.97 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

| **Product Name** | Industrial Radio Remote Control | **Test Date** | 2009/4/27 |
|---|---|---|---|
| **Model** | TWISTER 2X | **Test By** | Eric Yang |
| **Test Mode** | TX / Z (CH High) | **TEMP& Humidity** | 26.8℃, 48% |

Vertical

| | **TX / Z (CH High)** | | | | **Measurement Distance at 3m Vertical polarity** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Freq.** | **Reading** | **AF** | **Cable Loss** | **Pre-amp** | **Filter** | **Level** | **Limit** | **Margin** | **Mark** |
| | **(MHz)** | **(dBμV)** | **(dB/m)** | **(dB)** | **(dB)** | **(dB)** | **(dBμV/m)** | **(dBμV/m)** | **(dB)** | **(P/Q/A)** |
| | 915.39 | 81.57 | 22.85 | 4.53 | 26.17 | 0.00 | 82.78 | 114.00 | -31.22 | Q |
| | 1830.79 | 50.24 | 29.38 | 2.24 | 41.71 | 0.96 | 41.10 | 74.00 | -32.90 | P |
| | 1830.79 | 45.60 | 29.38 | 2.24 | 41.71 | 0.96 | 36.46 | 54.00 | -17.54 | A |
| * | 2746.29 | 47.85 | 30.25 | 2.38 | 42.09 | 1.41 | 39.81 | 74.00 | -34.19 | P |
| * | 2746.29 | 38.26 | 30.25 | 2.38 | 42.09 | 1.41 | 30.22 | 54.00 | -23.78 | A |
| * | 3661.60 | 48.14 | 31.02 | 3.26 | 42.95 | 0.80 | 40.27 | 74.00 | -33.73 | P |
| * | 3661.60 | 38.59 | 31.02 | 3.26 | 42.95 | 0.80 | 30.72 | 54.00 | -23.28 | A |
| * | 4577.02 | 47.58 | 32.98 | 3.57 | 43.72 | 0.60 | 41.02 | 74.00 | -32.98 | P |
| * | 4577.02 | 37.11 | 32.98 | 3.57 | 43.72 | 0.60 | 30.55 | 54.00 | -23.45 | A |

**Remark:**

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (1.2GHz)
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
4. The test limit distance is 3M limit.

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## 7.4 POWERLINE CONDUCTED EMISSIONS

## LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency Range (MHz) | Limits (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56* | 56 to 46* |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

***** *Decreases with the logarithm of the frequency.*

**Test Configuration**

See test photographs attached in Appendix I for the actual connections between EUT and support equipment.

## TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

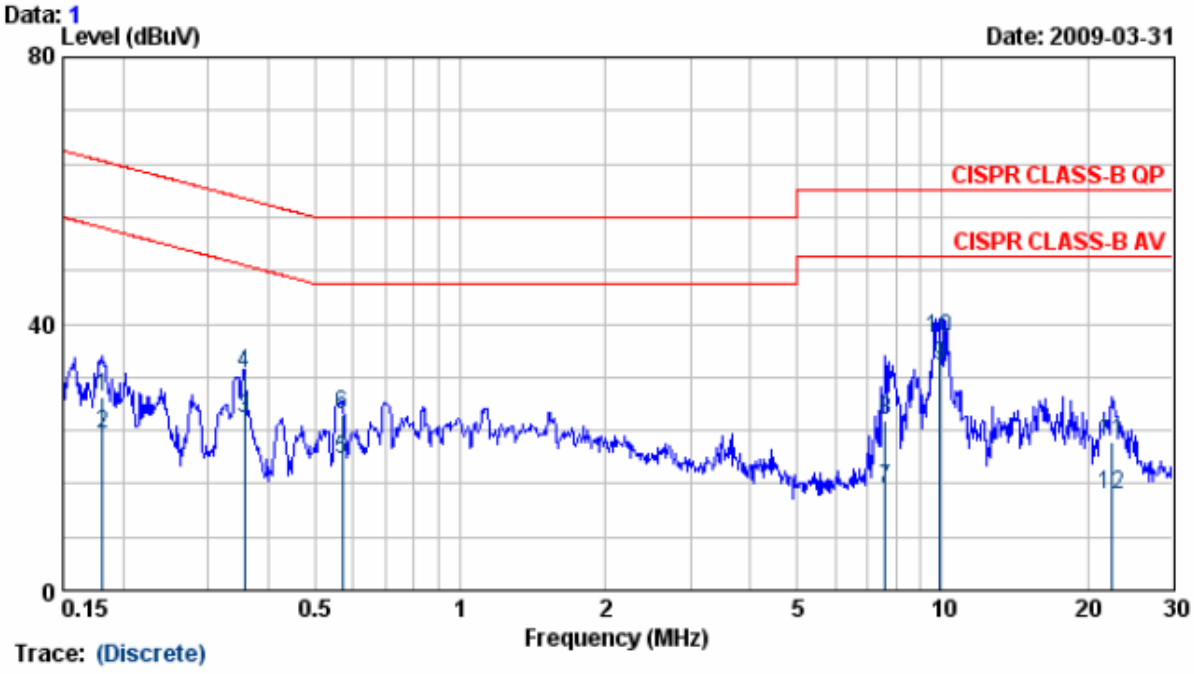
# TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

**Test Data**

| | | | |
|---|---|---|---|
| **Operation Mode:** | Normal Operation | **Test Date:** | March 31, 2009 |
| **Temperature:** | 27 °C | **Tested by:** | Taiyu Cuy |
| **Humidity:** | 56 % RH | | |

**Line**




Trace: (Discrete)

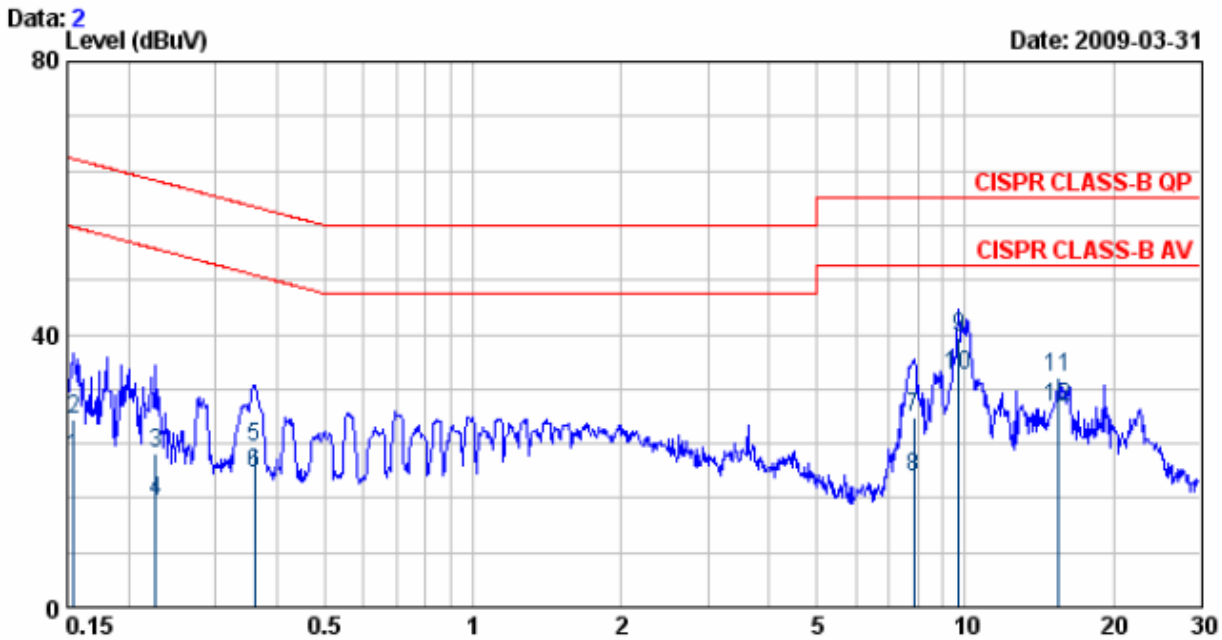
| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.182 | 9.80 | 0.06 | 19.03 | 28.89 | 64.42 | -35.53 | QP |
| 0.182 | 9.80 | 0.06 | 13.66 | 23.52 | 54.42 | -30.90 | AVERAGE |
| 0.358 | 9.88 | 0.05 | 15.84 | 25.77 | 48.78 | -23.01 | AVERAGE |
| 0.358 | 9.88 | 0.05 | 22.72 | 32.65 | 58.78 | -26.13 | QP |
| 0.570 | 9.90 | 0.05 | 9.59 | 19.54 | 46.00 | -26.46 | AVERAGE |
| 0.570 | 9.90 | 0.05 | 16.29 | 26.24 | 56.00 | -29.76 | QP |
| 7.606 | 9.87 | 0.48 | 4.93 | 15.28 | 50.00 | -34.72 | AVERAGE |
| 7.606 | 9.87 | 0.48 | 15.03 | 25.38 | 60.00 | -34.62 | QP |
| 9.913 | 9.90 | 0.62 | 23.08 | 33.60 | 50.00 | -16.40 | AVERAGE |
| 9.913 | 9.90 | 0.62 | 27.21 | 37.73 | 60.00 | -22.27 | QP |
| 22.535 | 10.00 | 0.51 | 11.85 | 22.36 | 60.00 | -37.64 | QP |
| 22.535 | 10.00 | 0.51 | 3.79 | 14.30 | 50.00 | -35.70 | AVERAGE |

**Remark:**

1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
3. The IF bandwidth of SPN between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz

| | | | |
|---|---|---|---|
| **Operation Mode:** | Normal Operation | **Test Date:** | March 31, 2009 |
| **Temperature:** | 27 °C | **Tested by:** | Taiyu Cuy |
| **Humidity:** | 56 % RH | | |

**Neutral**




Trace: (Discrete)

| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.155 | 9.80 | 0.07 | 12.23 | 22.10 | 55.74 | -33.64 | AVERAGE |
| 0.155 | 9.80 | 0.07 | 17.66 | 27.53 | 65.74 | -38.21 | QP |
| 0.227 | 9.82 | 0.05 | 12.69 | 22.56 | 62.57 | -40.01 | QP |
| 0.227 | 9.82 | 0.05 | 5.68 | 15.55 | 52.57 | -37.02 | AVERAGE |
| 0.360 | 9.88 | 0.05 | 13.42 | 23.35 | 58.74 | -35.38 | QP |
| 0.360 | 9.88 | 0.05 | 9.82 | 19.75 | 48.74 | -28.98 | AVERAGE |
| 7.852 | 9.87 | 0.49 | 17.52 | 27.89 | 60.00 | -32.11 | QP |
| 7.852 | 9.87 | 0.49 | 8.79 | 19.16 | 50.00 | -30.84 | AVERAGE |
| 9.705 | 9.90 | 0.61 | 29.06 | 39.57 | 60.00 | -20.43 | QP |
| 9.705 | 9.90 | 0.61 | 23.53 | 34.04 | 50.00 | -15.96 | AVERAGE |
| 15.388 | 9.91 | 0.23 | 23.61 | 33.75 | 60.00 | -26.26 | QP |
| 15.388 | 9.91 | 0.23 | 19.08 | 29.22 | 50.00 | -20.79 | AVERAGE |

**Remark:**
1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
3. The IF bandwidth of SPN between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz