



FCC 47 CFR PART 15 SUBPART C

for

Speed & Cadence Sensor

Model: TPB-CS01

Brand: TOPEAK

Test Report Number:

C121105Z02-RP1

Issued for

Topeak, Inc.

8F-4, No.20, Ta-Long Road, Taichung, Taiwan(40310)

Issued by:

Compliance Certification Services (Shenzhen) Inc.

No.10-1, Mingkeda Logistics Park, No.18 Huanguan South Rd.,

Guan Lan Town, Baoan District, Shenzhen, China

TEL: 86-755-28055000

FAX: 86-755-28055221

Issued Date: November 19, 2012



TESTING CERT #2861.01

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Revision History

| Rev. | Issue No. | Revisions | Effect Page | Revised By |
|------|----------------|---------------|-------------|------------|
| 00 | C121105Z02-RP1 | Initial Issue | ALL | Sunny Wang |
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1 TEST CERTIFICATION

| | |
|---------------------|---|
| Product | Speed & Cadence Sensor |
| Model | TPB-CS01 |
| Brand | TOPEAK |
| Tested | November 5~19, 2012 |
| Applicant | Topeak, Inc. 8F-4, No.20, Ta-Long Road, Taichung, Taiwan(40310) |
| Manufacturer | Maxwell Guider Technology Rm., 4E07, No.5, Hsin Yi Rd., Sec.5, Hsin Yi Dist., Taipei City, Taiwan |

| APPLICABLE STANDARDS | | | |
|----------------------|--------------------------------|------------------------------|---|
| Standard | Test Type | Standard | Test Type |
| 15.207(a) | Power Line Conducted Emissions | 15.247(d) 15.209(a) | ● Spurious Emissions ● Conducted Measurement ● Radiated Emissions |
| 15.247(a)(2) | 6dB Bandwidth Measurement | 15.247(b)(3) 15.247(b)(4) | Peak Power Measurement |
| 15.247(d) | Band Edges Measurement | 15.247(e) | Peak Power Spectral Density |

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in **ANSI C63.4: 2009** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Tom Gan
Supervisor of EMC Dept.
Compliance Certification Service Inc.

Reviewed by:

Ruby Zhang
Supervisor of Report Dept.
Compliance Certification Service Inc.

**2 TEST RESULT SUMMARY**

| APPLICABLE STANDARDS | | | |
|------------------------------|---|--------|---|
| Standard | Test Type | Result | Remark |
| 15.247(a)(2) | 6dB Bandwidth Measurement | Pass | Meet the requirement of limit. |
| 15.247(b)(3) 15.247(b)(4) | Peak Power Measurement | Pass | Meet the requirement of limit. |
| 15.247(d) | Band Edges Measurement | Pass | Meet the requirement of limit. |
| 15.247(e) | Peak Power Spectral Density | Pass | Meet the requirement of limit. |
| 15.247(d) 15.209(a) | ● Spurious Emissions ● Conducted Measurement ● Radiated Emissions | Pass | Meet the requirement of limit. |
| 15.207(a) | Power line Conducted Emissions | N/A | Not applicable since the EUT supplied by the battery. |

Note: 1. The statements of test result on the above are decided by the request of test standard only; the measurement uncertainties are not factored into this compliance determination.

2. The information of measurement uncertainty is available upon the customer's request.



3 EUT DESCRIPTION

| | |
|------------------------------|---------------------------------------|
| Product | Speed & Cadence Sensor |
| Model | TPB-CS01 |
| Brand | TOPEAK |
| Model Discrepancy | N/A |
| Identify Number | C121105Z02-RP1 |
| Received Date | November 5, 2012 |
| Power Supply | DC3.0V supplied by the battery |
| Frequency Range | 2402-2480 MHz |
| Transmit Power | -7.18dBm |
| Modulation Technique | DSSS (GFSK for 1Mbps) |
| Number of Channels | 40 Channels |
| Antenna Specification | Chip Antenna with -1.80dBi gain (Max) |
| Temperature Range | -20°C ~ +50°C |

Note: 1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.

2. This submittal(s) (test report) is intended for FCC ID: R3SCS01 filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.



4 TEST METHODOLOGY

4.1. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

| Test Item | Test mode | Worse mode |
|--------------------|---|-------------------------------------|
| Conducted Emission | Not applicable since the EUT supplied by the battery. | <input type="checkbox"/> |
| Radiated Emission | Mode1: TX | <input checked="" type="checkbox"/> |

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 power line conducted emission below 30MHz, which worst case was in normal link mode.



5 SETUP OF EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF SUPPORT UNITS

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

| No. | Equipment | Model No. | Serial No. | FCC ID | Brand | Data Cable | Power Cord |
|-----|-----------|-----------|--------------|--------|----------|------------|------------|
| 1 | Phone | MD245CH/A | C37GX9FADTDF | N/A | Iphone4S | N/A | N/A |

Note:

Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

5.2. CONFIGURATION OF SYSTEM UNDER TEST

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



6 FACILITIES AND ACCREDITATIONS

6.1. FACILITIES

All measurement facilities used to collect the measurement data are located at **No.10-1, Mingkeda Logistics Park, No.18 Huanguan South Rd., Guan Lan Town, Baoa Shenzhen, China n District,**

The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

6.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

| | |
|--------------|-------------|
| USA | A2LA |
| China | CNAS |

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

| | |
|---------------|------------------------------------|
| USA | FCC |
| Japan | VCCI(C-3478, R-3135, T-652) |
| Canada | INDUSTRY CANADA |
| Taiwan | BSMI |
| Norway | Nemko |

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsrf.com>

6.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement | Frequency | Uncertainty |
|---------------------|------------------|--------------------|
| Conducted emissions | 9kHz~30MHz | +/- 3.18dB |
| Radiated emissions | 30MHz ~ 200MHz | +/- 3.79dB |
| | 200MHz ~1000MHz | +/- 3.62dB |
| | Above 1000MHz | +/- 5.04dB |
| Band Edges | +/-0.182 dB | |

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

The measured result is above (below) the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance (non-compliance) is more probable than non-compliance) with the specification limit.



7 FCC PART 15.247 REQUIREMENTS

7.1. POWER LINE CONDUCTED EMISSIONS MEASUREMENT

7.1.1. LIMITS OF CONDUCTED EMISSIONS MEASUREMENT

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 μ H/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 (dB μ V) | |
|--------------------------|------------------------|-----------|
| | 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 |

NOTE:

- (1) The lower limit shall apply at the transition frequencies.
- (2) The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
- (3) All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

7.1.2. TEST INSTRUMENTS

| Conducted Emission Test Site | | | | | |
|------------------------------|---------------|--------------------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model Number | Serial Number | Last Calibration | Due Calibration |
| ESCI EMI TEST RECEIVER.ESCI | ROHDE&SCHWARZ | ESCI | 100783 | 03/17/2012 | 03/17/2013 |
| LISN | ROHDE&SCHWARZ | ENV216 | 101543 | 09/20/2012 | 09/20/2013 |
| LISN | EMCO | 3825/2 | 8901-1459 | 03/19/2012 | 03/19/2013 |
| Temp. / Humidity Meter | VICTOR | HTC-1 | 2 | 03/20/2012 | 03/20/2013 |
| Test S/W | FARAD | EZ-EMC/ CCS-3A1-CE | | | |

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. N.C.R = No Calibration Request.

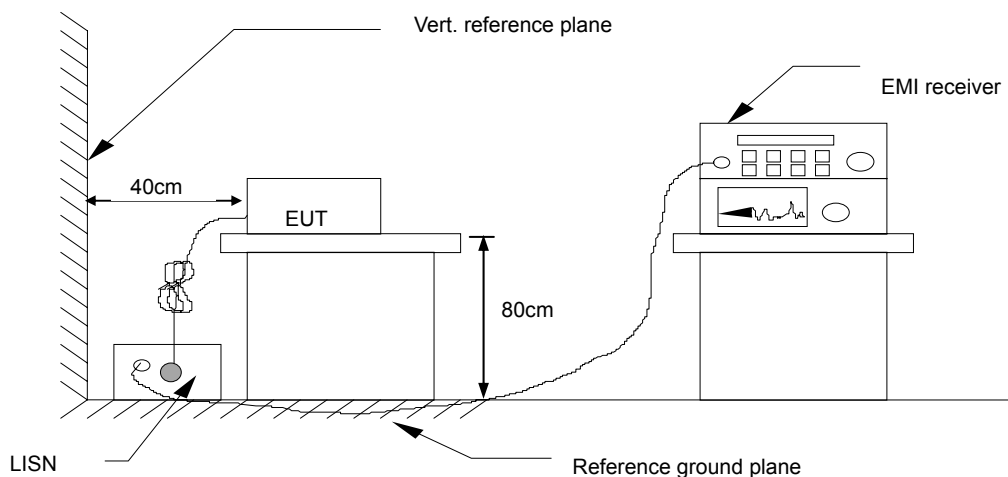


7.1.3. TEST PROCEDURES (please refer to measurement standard)

- The EUT and Support equipment, if needed, was placed on a non-conducted table, which is 0.8m above the ground plane and 0.4m away from the conducted wall.
- The test equipment EUT installed received AC main power, through a Line Impedance Stabilization Network (LISN), which supplied power source and was grounded to the ground plane. All support equipment power received from a second LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
- The frequency range from 150 kHz to 30 MHz was searched. The test data of the worst-case condition(s) was recorded. Emission levels under limit 20dB were not recorded.



7.1.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

7.1.5. DATA SAMPLE

| Frequency (MHz) | QuasiPeak Reading (dBuV) | Average Reading (dBuV) | Correction Factor (dB) | QuasiPeak Result (dBuV) | Average Result (dBuV) | QuasiPeak Limit (dBuV) | Average Limit (dBuV) | QuasiPeak Margin (dB) | Average Margin (dB) | Remark (Pass/Fail) |
|-----------------|--------------------------|------------------------|------------------------|-------------------------|-----------------------|------------------------|----------------------|-----------------------|---------------------|--------------------|
| X.XXXX | 34.99 | 19.33 | 10.15 | 45.14 | 29.48 | 65.99 | 56.00 | -20.85 | -26.52 | Pass |

Factor = Insertion loss of LISN + Cable Loss
Result = Quasi-peak Reading/ Average Reading + Factor
Limit = Limit stated in standard
Margin = Result (dBuV) – Limit (dBuV)

7.1.6. TEST RESULTS

Not applicable, since the EUT supplied by the battery.

**7.2. SPURIOUS EMISSIONS MEASUREMENT****7.2.1. LIMITS OF CONDUCTED EMISSIONS MEASUREMENT**

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

7.2.2. TEST INSTRUMENTS

| Name of Equipment | Manufacturer | Model | Serial Number | Last Calibration | Due Calibration |
|-------------------|--------------|--------|---------------|------------------|-----------------|
| Spectrum Analyzer | Agilent | E4446A | US44300399 | 03/19/2012 | 03/19/2013 |

7.2.3. TEST PROCEDURE (please refer to measurement standard)

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

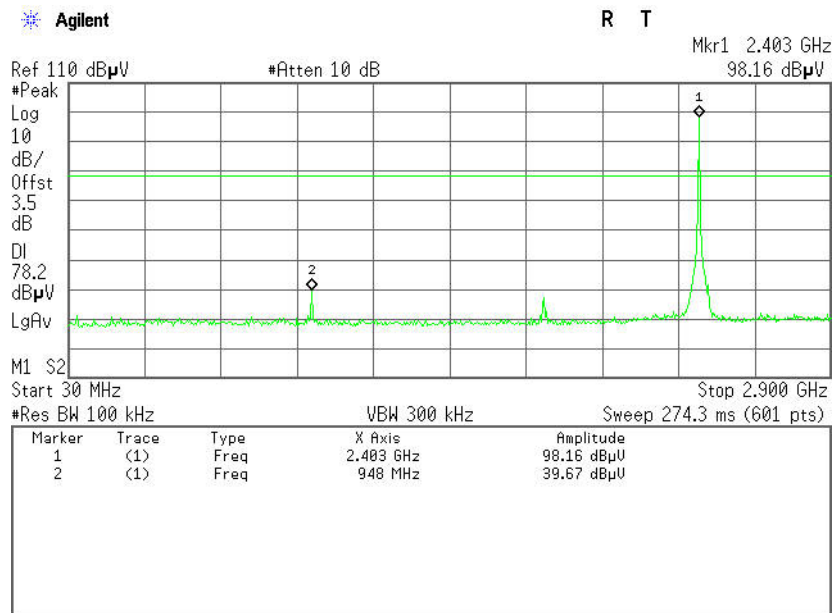
Measurements are made over the 30MHz to 26.5GHz range with the transmitter set to the lowest, middle, and highest channels.



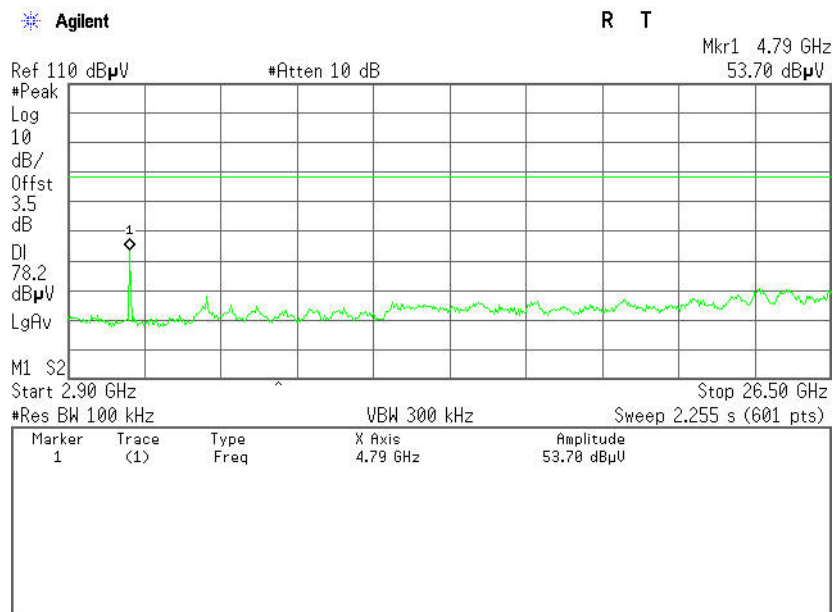
7.2.4. TEST RESULTS

Test Plot

CH Low (30MHz ~2.9GHz)

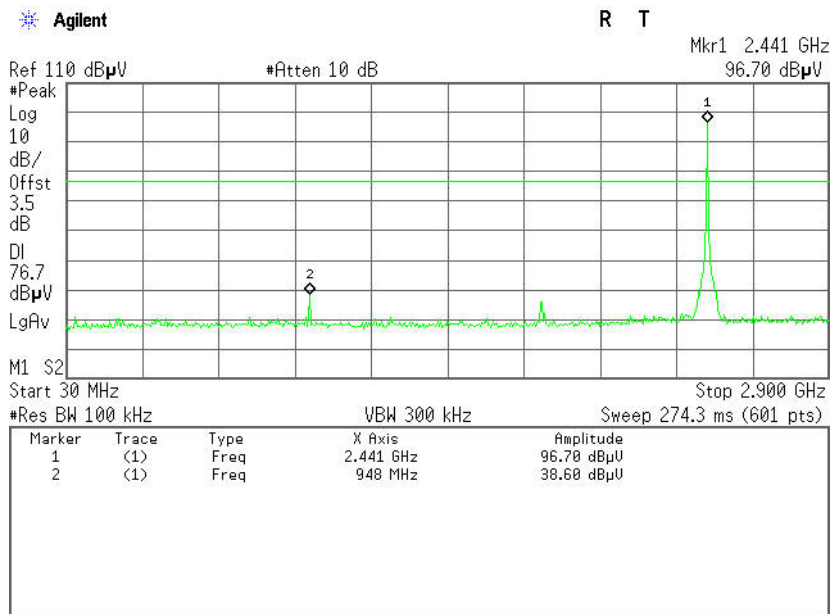


CH Low (2.9GHz ~26.5GHz)

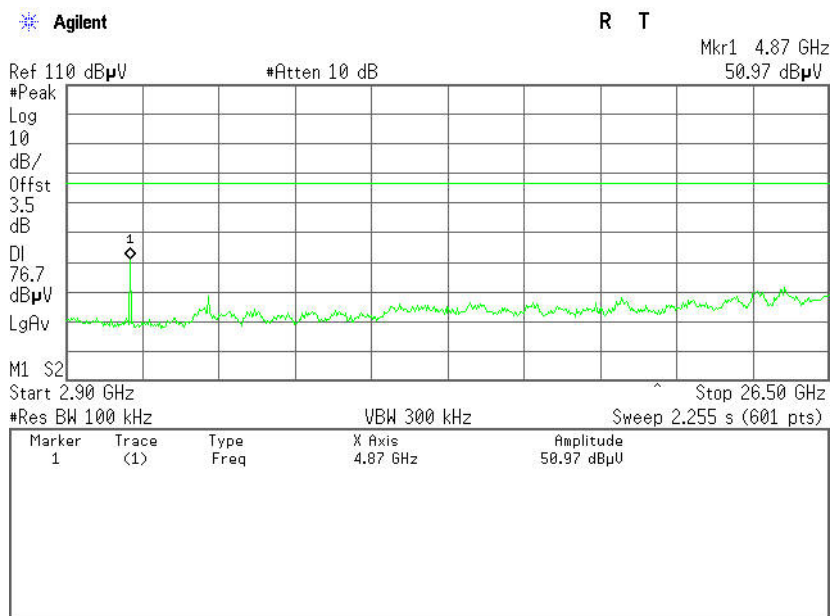




CH Mid (30MHz ~2.9GHz)

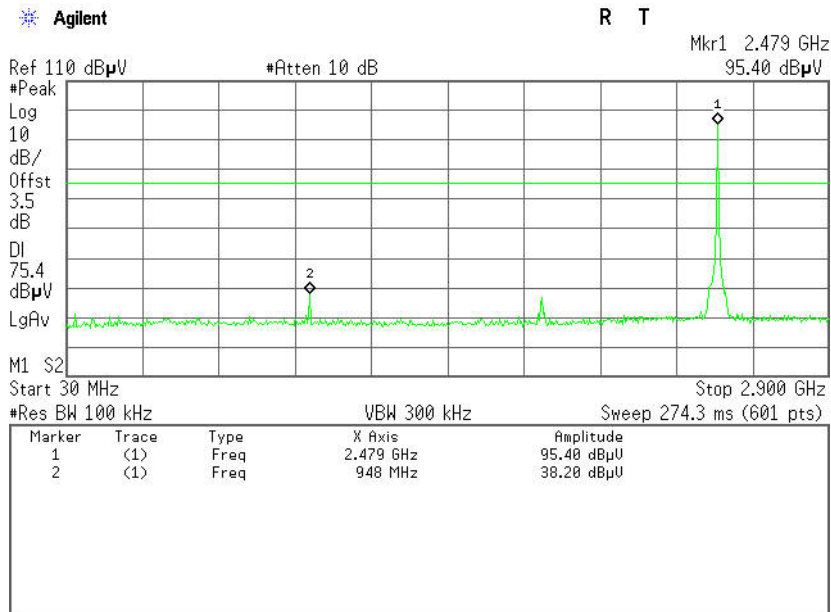


CH Mid (2.9GHz ~26.5GHz)

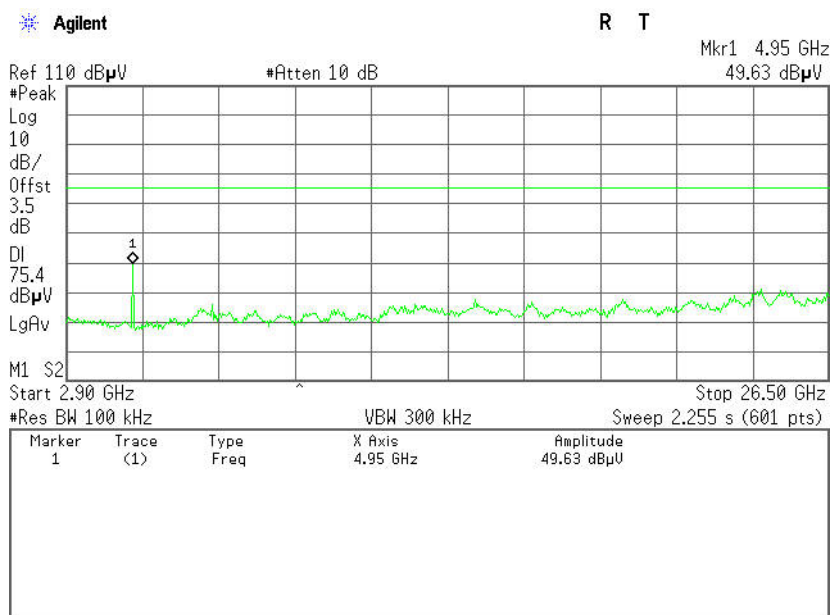




CH High (30MHz ~2.9GHz)



CH High(2.9GHz ~26.5GHz)



**7.2.4.1. LIMITS OF RADIATED EMISSIONS MEASUREMENT**

According to §15.209(a), 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 (mV/m) | Measurement Distance (m) |
|-----------------|-----------------------|--------------------------|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100* | 3 |
| 88-216 | 150* | 3 |
| 216-960 | 200* | 3 |
| Above 960 | 500 | 3 |

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.

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

| Frequency (MHz) | Field Strength ($\mu\text{V}/\text{m}$ at 3-meter) | Field Strength (dB $\mu\text{V}/\text{m}$ at 3-meter) |
|-----------------|---|---|
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

NOTE: (1) The lower limit shall apply at the transition frequencies.

(2) Emission level (dB $\mu\text{V}/\text{m}$) = 20 log Emission level ($\mu\text{V}/\text{m}$).

**7.2.4.2. TEST INSTRUMENTS**

| Radiated Emission Test Site 966(2) | | | | | |
|------------------------------------|---------------|--------------------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model Number | Serial Number | Last Calibration | Due Calibration |
| PSA Series Spectrum Analyzer | Agilent | E4446A | US44300399 | 03/19/2012 | 03/19/2013 |
| ESCI EMI TEST RECEIVER.ESCI | ROHDE&SCHWARZ | ESCI | 100783 | 03/17/2012 | 03/17/2013 |
| Amplifier | MITEQ | AM-1604-3000 | 1123808 | 03/18/2012 | 03/18/2013 |
| Turn Table | EMCO | 2081-1.21 | N/A | N.C.R | N.C.R |
| Controller | CT | N/A | N/A | N.C.R | N.C.R |
| High Noise Amplifier | Agilent | 8449B | 3008A01838 | 03/18/2012 | 03/18/2013 |
| Bilog Antenna | SCHAFFNER | CBL6143 | 5082 | 03/17/2012 | 03/17/2013 |
| Horn Antenna | SCHWARZBECK | BBHA9120 | D286 | 03/17/2012 | 03/17/2013 |
| Loop Antenna | A.R.A | PLA-1030/B | 1029 | 03/23/2012 | 03/23/2013 |
| Temp. / Humidity Meter | VICTOR | VC230 | N/A | 03/19/2012 | 03/19/2013 |
| Antenna Tower | SUNOL | TLT2 | N/A | N.C.R | N.C.R |
| Test S/W | FARAD | LZ-RF / CCS-SZ-3A2 | | | |

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The FCC Site Registration number is 101879.

3. N.C.R = No Calibration Required.

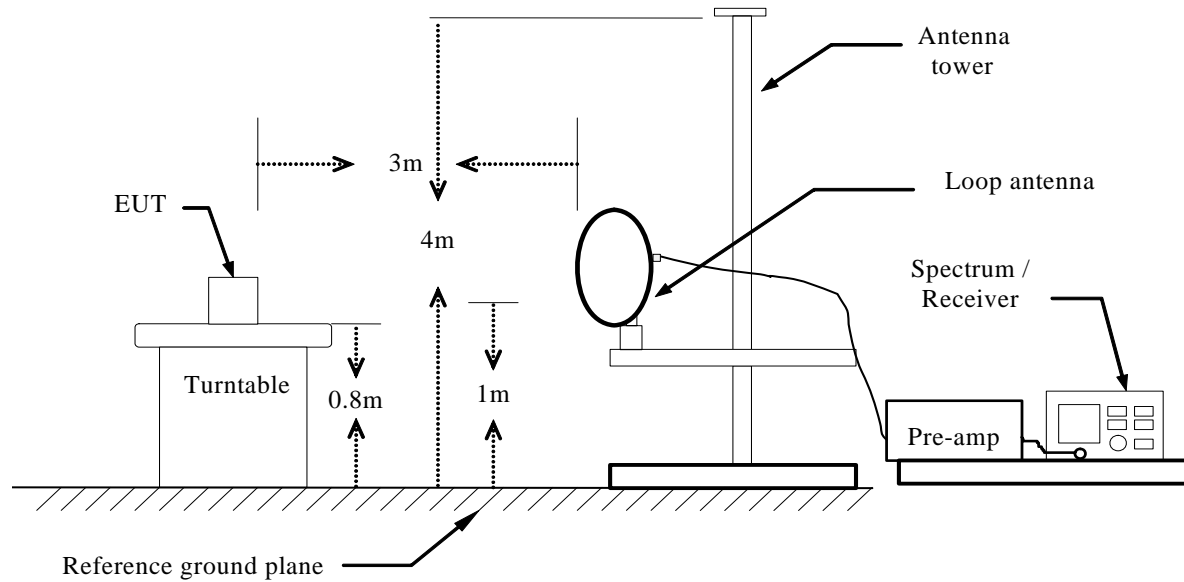
7.2.4.3. TEST PROCEDURE (please refer to measurement standard)

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 / 3 MHz / Sweep=AUTO
(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

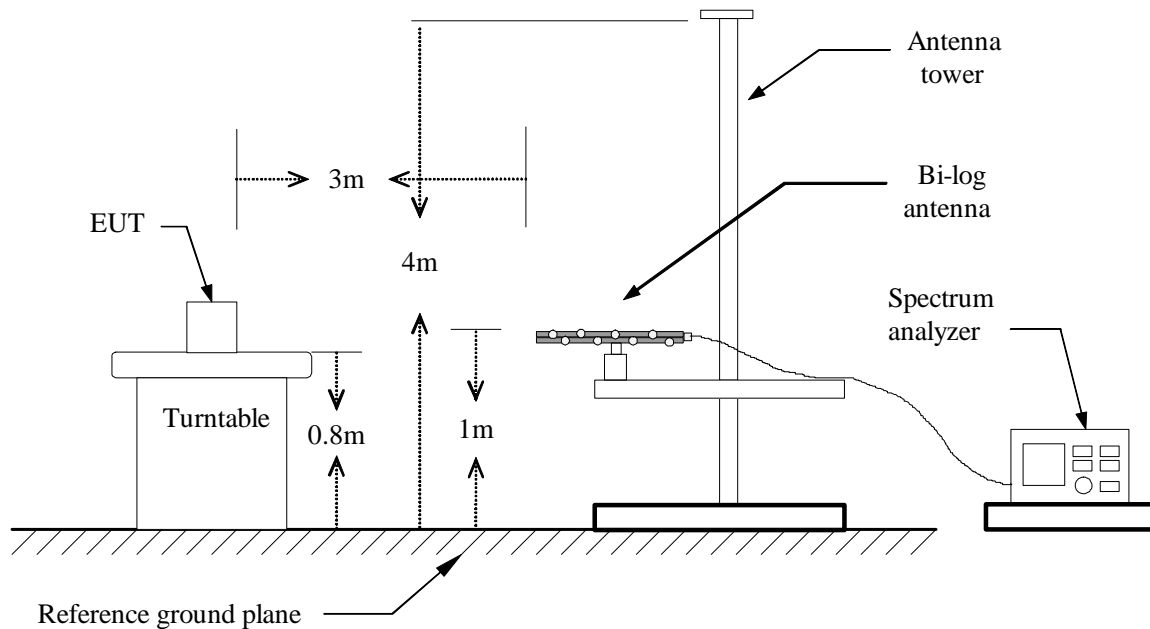


7.2.4.4. TEST SETUP

Below 30MHz

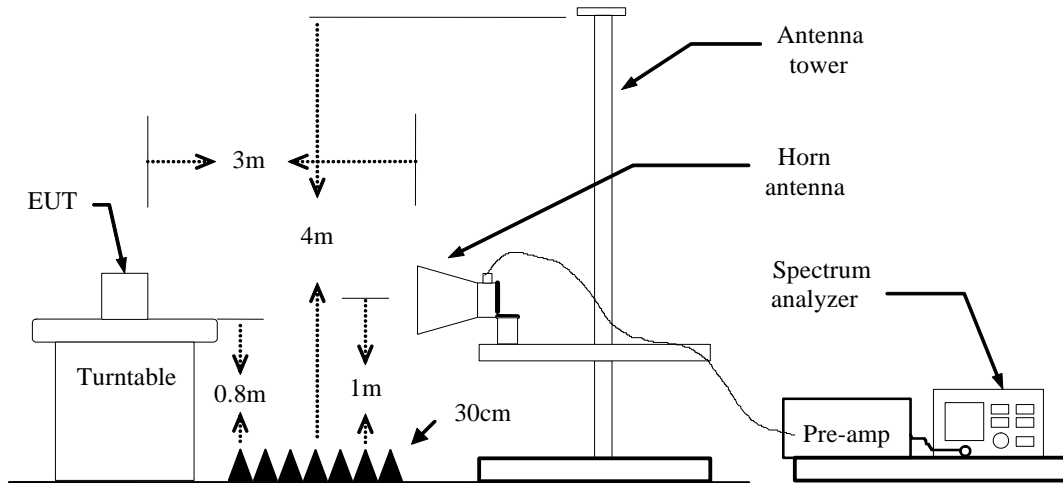


Below 1 GHz





Above 1 GHz



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

**7.2.4.5. DATA SAMPLE****Below 1GHz**

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|-----------------------|-----------------|----------------|-------------|--------------------|--------|
| XXX.XXXX | 53.41 | -18.63 | 34.78 | 43.50 | -8.72 | V | QP |

Frequency (MHz) = Emission frequency in MHz
 Reading (dBuV) = Uncorrected Analyzer / Receiver reading
 Correct Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain
 Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)
 Limit (dBuV/m) = Limit stated in standard
 Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)
 Q.P. = Quasi-peak Reading

Above 1GHz

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| XXXX.XXXX | 62.09 | -11.42 | 50.67 | 74.00 | -23.33 | V | Peak |
| XXXX.XXXX | 49.78 | -11.42 | 38.36 | 54.00 | -15.64 | V | AVG |

Frequency (MHz) = Emission frequency in MHz
 Reading (dBuV) = Uncorrected Analyzer / Receiver reading
 Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain
 Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)
 Limit (dBuV/m) = Limit stated in standard
 Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)
 Peak = Peak Reading
 AVG = Average Reading

Calculation Formula

Margin (dB) = Result (dBuV/m) – Limits (dBuV/m)
 Result (dBuV/m) = Reading (dBuV) + Correction Factor

**7.2.4.6. TEST RESULTS****Operation Mode:** TX**Test Date:** November 15, 2012**Temperature:** 24°C**Tested by:** Leevin Li**Humidity:** 52% RH**Polarity:** Ver. / Hor.

(The chart below shows the highest readings taken from the final data.)

| Frequency (MHz) | Reading (dBμV) | Correction Factor (dB/m) | Result (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| 60.7167 | 46.86 | -21.49 | 25.37 | 40.00 | -14.63 | V | QP |
| 89.8167 | 45.67 | -23.32 | 22.35 | 43.50 | -21.15 | V | QP |
| 246.6333 | 34.74 | -17.43 | 17.31 | 46.00 | -28.69 | V | QP |
| 469.7333 | 32.75 | -14.78 | 17.97 | 46.00 | -28.03 | V | QP |
| 697.6833 | 31.64 | -10.50 | 21.14 | 46.00 | -24.86 | V | QP |
| 954.7333 | 32.27 | -8.20 | 24.07 | 46.00 | -21.93 | V | QP |
| 93.0500 | 50.92 | -22.77 | 28.15 | 43.50 | -15.35 | H | QP |
| 123.7667 | 40.99 | -20.21 | 20.78 | 43.50 | -22.72 | H | QP |
| 398.6000 | 32.40 | -16.24 | 16.16 | 46.00 | -29.84 | H | QP |
| 595.8333 | 33.47 | -12.82 | 20.65 | 46.00 | -25.35 | H | QP |
| 679.9000 | 32.27 | -10.94 | 21.33 | 46.00 | -24.67 | H | QP |
| 827.0167 | 32.82 | -10.55 | 22.27 | 46.00 | -23.73 | H | QP |

****Remark:** No emission found between lowest internal used/generated frequency to 30MHz.**Notes:**

1. Radiated emissions measured in frequency range from 9kHz to 1GHz were made with an instrument using Quasi-peak detector mode.
2. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. The IF bandwidth of Receiver between 30MHz to 1GHz was 120kHz.
4. Frequency (MHz). = Emission frequency in MHz
 Reading (dBμV/m) = Receiver reading
 Correction Factor (dB) = Antenna factor + Cable loss – Amplifier gain
 Limit (dBμV/m) = Limit stated in standard
 Margin (dB) = Measured (dBμV/m) – Limits (dBμV/m)
 Antenna Pol e(H/V) = Current carrying line of reading

**Above 1 GHz****Operation Mode:** TX / CH Low**Test Date:** November 15, 2012**Temperature:** 24°C**Tested by:** Leevin Li**Humidity:** 52% RH**Polarity:** Ver. / Hor.

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| 2020.0000 | 46.24 | -6.63 | 39.61 | 74.00 | -34.39 | V | Peak |
| 3521.6667 | 45.21 | -1.01 | 44.20 | 74.00 | -29.80 | V | Peak |
| 4938.3333 | 44.06 | 3.55 | 47.61 | 74.00 | -26.39 | V | Peak |
| 5788.3333 | 43.99 | 6.23 | 50.22 | 74.00 | -23.78 | V | Peak |
| 6156.6667 | 44.22 | 7.52 | 51.74 | 74.00 | -22.26 | V | Peak |
| 7035.0000 | 44.59 | 7.15 | 51.74 | 74.00 | -22.26 | V | Peak |
| | | | | | | | |
| 1283.3333 | 48.82 | -10.49 | 38.33 | 74.00 | -35.67 | H | Peak |
| 3493.3333 | 45.75 | -1.09 | 44.66 | 74.00 | -29.34 | H | Peak |
| 4286.6667 | 45.91 | 0.28 | 46.19 | 74.00 | -27.81 | H | Peak |
| 5391.6667 | 44.49 | 4.27 | 48.76 | 74.00 | -25.24 | H | Peak |
| 5703.3333 | 44.76 | 5.68 | 50.44 | 74.00 | -23.56 | H | Peak |
| 6213.3333 | 44.51 | 7.49 | 52.00 | 74.00 | -22.00 | H | Peak |

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. 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.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** TX / CH Mid**Test Date:** November 15, 2012**Temperature:** 24°C**Tested by:** Leevin Li**Humidity:** 52% RH**Polarity:** Ver. / Hor.

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| 1991.6667 | 47.55 | -6.67 | 40.88 | 74.00 | -33.12 | V | Peak |
| 3606.6667 | 45.78 | -0.92 | 44.86 | 74.00 | -29.14 | V | Peak |
| 5108.3333 | 44.16 | 4.02 | 48.18 | 74.00 | -25.82 | V | Peak |
| 5618.3333 | 44.28 | 5.13 | 49.41 | 74.00 | -24.59 | V | Peak |
| 6241.6667 | 44.11 | 7.48 | 51.59 | 74.00 | -22.41 | V | Peak |
| 7063.3333 | 44.64 | 7.17 | 51.81 | 74.00 | -22.19 | V | Peak |
| | | | | | | | |
| 1651.6667 | 47.72 | -8.37 | 39.35 | 74.00 | -34.65 | H | Peak |
| 3776.6667 | 45.78 | -0.75 | 45.03 | 74.00 | -28.97 | H | Peak |
| 4995.0000 | 44.11 | 3.89 | 48.00 | 74.00 | -26.00 | H | Peak |
| 5363.3333 | 44.47 | 4.25 | 48.72 | 74.00 | -25.28 | H | Peak |
| 6100.0000 | 44.94 | 7.54 | 52.48 | 74.00 | -21.52 | H | Peak |
| 7573.3333 | 44.79 | 7.50 | 52.29 | 74.00 | -21.71 | H | Peak |

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. 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.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** TX / CH High**Test Date:** November 15, 2012**Temperature:** 24°C**Tested by:** Leevin Li**Humidity:** 52% RH**Polarity:** Ver. / Hor.

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| 3436.6667 | 45.82 | -1.64 | 44.18 | 74.00 | -29.82 | V | Peak |
| 4230.0000 | 46.11 | 0.12 | 46.23 | 74.00 | -27.77 | V | Peak |
| 5051.6667 | 44.88 | 3.97 | 48.85 | 74.00 | -25.15 | V | Peak |
| 6185.0000 | 44.63 | 7.50 | 52.13 | 74.00 | -21.87 | V | Peak |
| 6950.0000 | 44.51 | 7.15 | 51.66 | 74.00 | -22.34 | V | Peak |
| 7800.0000 | 44.79 | 7.64 | 52.43 | 74.00 | -21.57 | V | Peak |
| | | | | | | | |
| 1991.6667 | 46.66 | -6.67 | 39.99 | 74.00 | -34.01 | H | Peak |
| 3550.0000 | 45.43 | -0.98 | 44.45 | 74.00 | -29.55 | H | Peak |
| 4343.3333 | 45.22 | 0.44 | 45.66 | 74.00 | -28.34 | H | Peak |
| 5165.0000 | 44.21 | 4.07 | 48.28 | 74.00 | -25.72 | H | Peak |
| 6043.3333 | 43.53 | 7.57 | 51.10 | 74.00 | -22.90 | H | Peak |
| 6355.0000 | 44.01 | 7.43 | 51.44 | 74.00 | -22.56 | H | Peak |

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. 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.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



7.3. 6dB BANDWIDTH MEASUREMENT

7.3.1. LIMITS

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

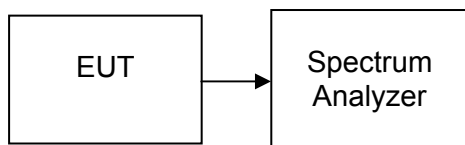
7.3.2. TEST INSTRUMENTS

| Name of Equipment | Manufacturer | Model | Serial Number | Last Calibration | Calibration Due |
|-------------------|--------------|--------|---------------|------------------|-----------------|
| Spectrum Analyzer | Agilent | E4446A | US44300399 | 03/19/2012 | 03/19/2013 |

7.3.3. TEST PROCEDURES (please refer to measurement standard)

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 = 100kHz, VBW = 300kHz, Span = 5MHz, Sweep = auto.
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

7.3.4. TEST SETUP



7.3.5. TEST RESULTS

No non-compliance noted

Test Data

| Channel | Frequency (MHz) | Bandwidth (kHz) | Limit (kHz) | Margin (kHz) |
|---------|-----------------|-----------------|-------------|--------------|
| Low | 2402 | 695.998 | >500 | PASS |
| Mid | 2440 | 686.321 | | PASS |
| High | 2480 | 687.161 | | PASS |

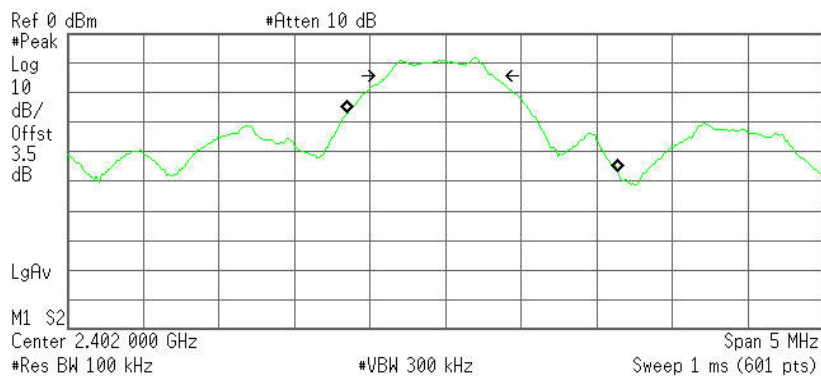


Test Plot

6dB Bandwidth (CH Low)

Agilent

R T



Occupied Bandwidth
1.7907 MHz

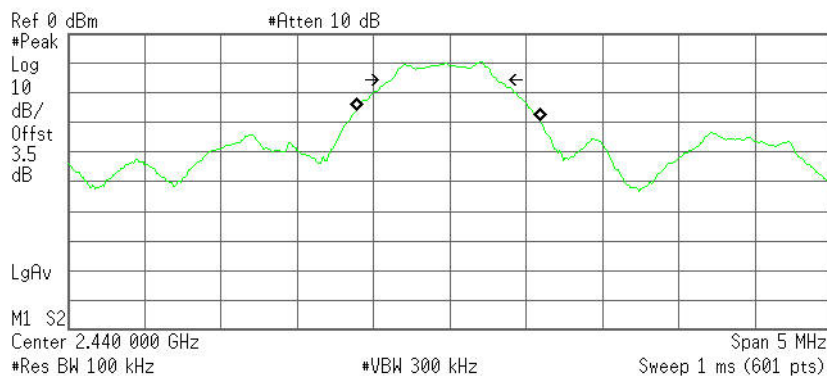
Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 248.477 kHz
x dB Bandwidth 695.558 kHz

6dB Bandwidth (CH Mid)

Agilent

R T



Occupied Bandwidth
1.1999 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

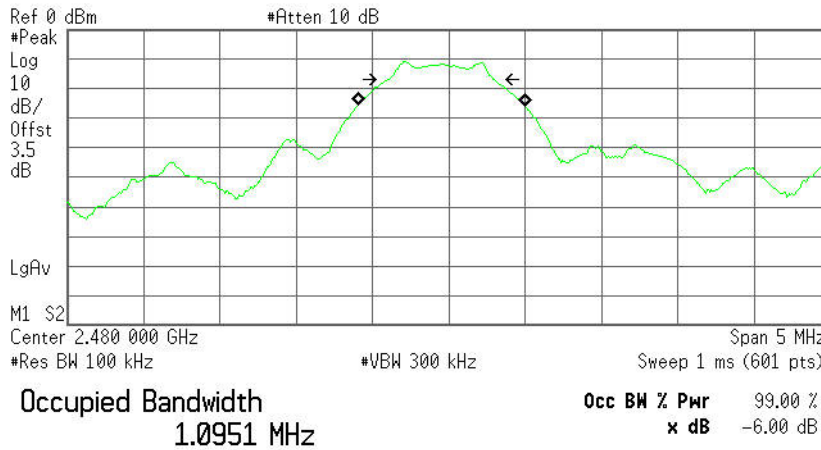
Transmit Freq Error -9.238 kHz
x dB Bandwidth 686.321 kHz



6dB Bandwidth (CH High)

Agilent

R T



Transmit Freq Error -46.972 kHz
x dB Bandwidth 687.161 kHz



7.4. PEAK OUTPUT POWER

7.4.1. LIMITS

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §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.

7.4.2. TEST INSTRUMENTS

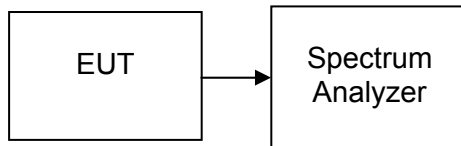
| Name of Equipment | Manufacturer | Model | Serial Number | Last Calibration | Calibration Due |
|-------------------|--------------|--------|---------------|------------------|-----------------|
| Spectrum Analyzer | Agilent | E4446A | US44300399 | 03/19/2012 | 03/19/2013 |

7.4.3. TEST PROCEDURES (please refer to measurement standard)

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz.
3. Set VBW \geq 3 MHz.
4. Use sample detector mode if bin width (i.e., span/number of points in spectrum display) < 0.5 RBW. Otherwise use peak detector mode.
5. Use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at full control power for entire sweep of every sweep. If the device transmits continuously, with no off intervals or reduced power intervals, the trigger may be set to "free run".
6. Trace average 100 traces in power averaging mode.
7. Compute power by integrating the spectrum across the 26 dB EBW of the signal. The integration can be performed using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges or by summing power levels in each 1 MHz band in linear power terms. The 1 MHz band power levels to be summed can be obtained by averaging, in linear power terms, power levels in each frequency bin across the 1 MHz.



7.4.4. TEST SETUP



7.4.5. TEST RESULTS

No non-compliance noted

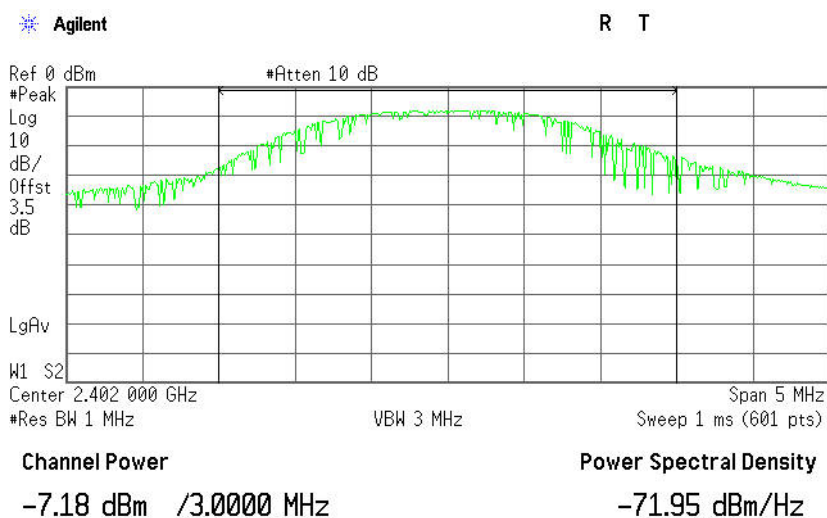
Test Data

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (W) | Limit (W) | Result |
|---------|-----------------|--------------------|------------------|-----------|--------|
| Low | 2402 | -7.18 | 0.00019 | 1 | PASS |
| Mid | 2440 | -8.44 | 0.00014 | | PASS |
| High | 2480 | -9.86 | 0.00010 | | PASS |

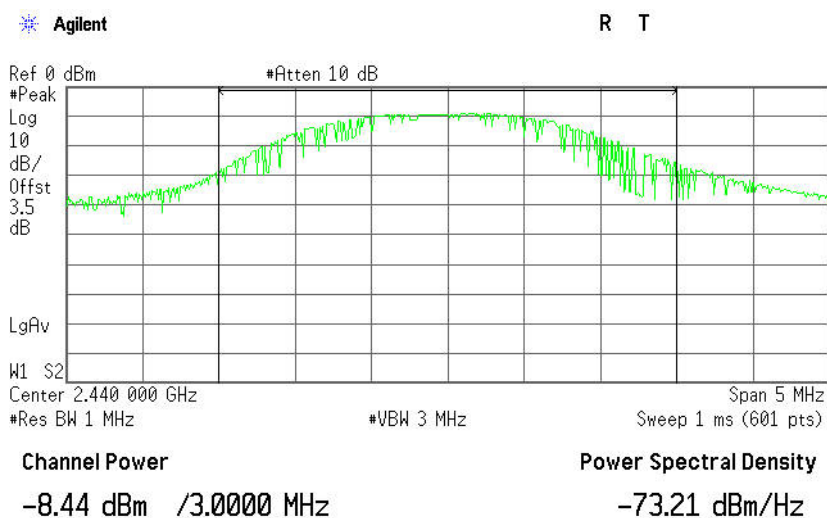


Test Plot

Peak power (CH Low)



Peak power (CH Mid)

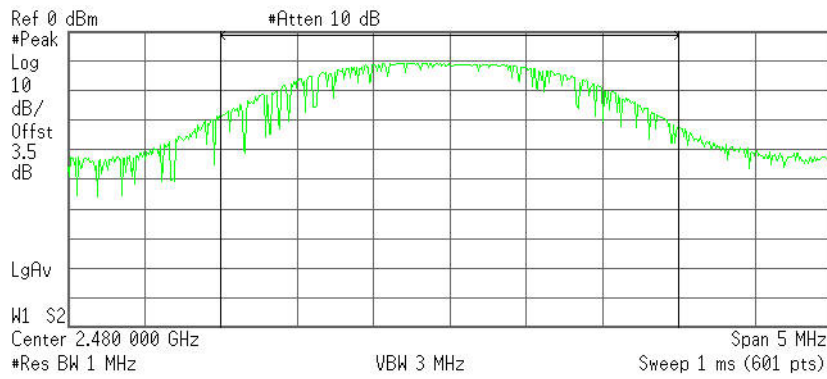




Peak power (CH High)

Agilent

R T



Channel Power

-9.86 dBm /3.0000 MHz

Power Spectral Density

-74.63 dBm/Hz



7.5. BAND EDGES MEASUREMENT

7.5.1. LIMITS

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

7.5.2. TEST INSTRUMENTS

| Radiated Emission Test Site 966 (2) | | | | | |
|-------------------------------------|---------------|--------------------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model Number | Serial Number | Last Calibration | Due Calibration |
| PSA Series Spectrum Analyzer | Agilent | E4446A | US44300399 | 03/19/2012 | 03/19/2013 |
| ESCI EMI TEST RECEIVER.ESCI | ROHDE&SCHWARZ | ESCI | 100783 | 03/17/2012 | 03/17/2013 |
| Amplifier | MITEQ | AM-1604-3000 | 1123808 | 03/18/2012 | 03/18/2013 |
| Turn Table | EMCO | 2081-1.21 | N/A | N.C.R | N.C.R |
| Controller | CT | N/A | N/A | N.C.R | N.C.R |
| High Noise Amplifier | Agilent | 8449B | 3008A01838 | 03/18/2012 | 03/18/2013 |
| Bilog Antenna | SCHAFFNER | CBL6143 | 5082 | 03/17/2012 | 03/17/2013 |
| Horn Antenna | SCHWARZBECK | BBHA9120 | D286 | 03/17/2012 | 03/17/2013 |
| Loop Antenna | A、R、A | PLA-1030/B | 1029 | 03/23/2012 | 03/23/2013 |
| Temp. / Humidity Meter | VICTOR | VC230 | N/A | 03/19/2012 | 03/19/2013 |
| Antenna Tower | SUNOL | TLT2 | N/A | N.C.R | N.C.R |
| Test S/W | FARAD | LZ-RF / CCS-SZ-3A2 | | | |

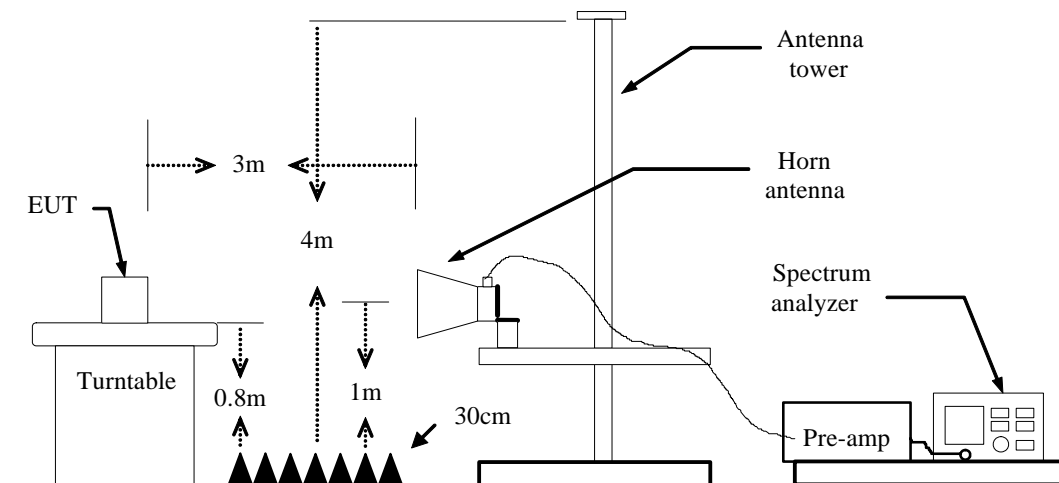
NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The FCC Site Registration number is 101879.
3. N.C.R = No Calibration Required.



7.5.3. TEST PROCEDURES (please refer to measurement standard)

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=1MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are

7.5.4. TEST SETUP





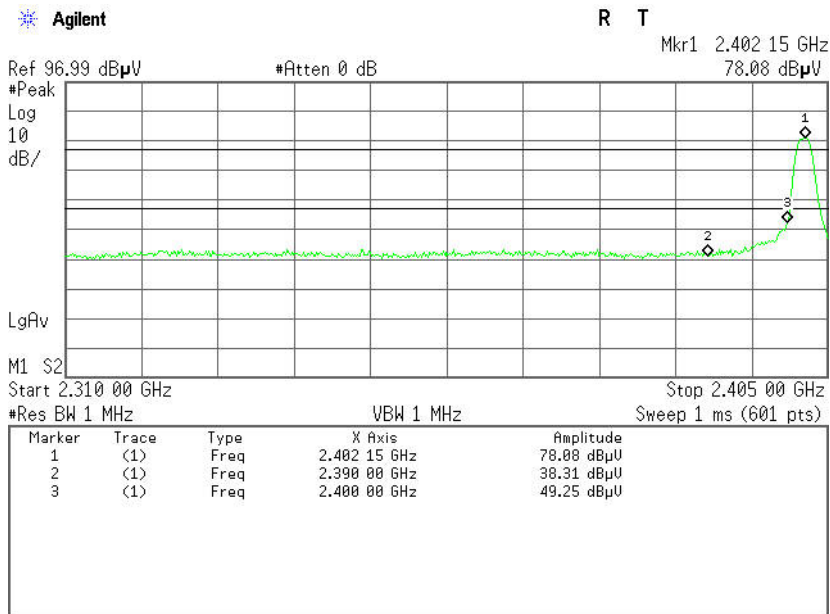
7.5.5. TEST RESULTS

Test Plot

Band Edges (CH Low)

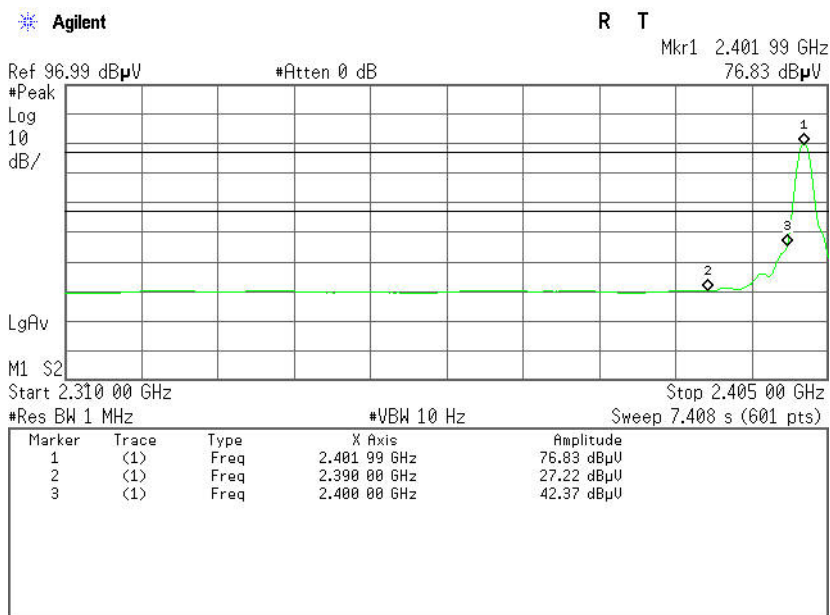
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

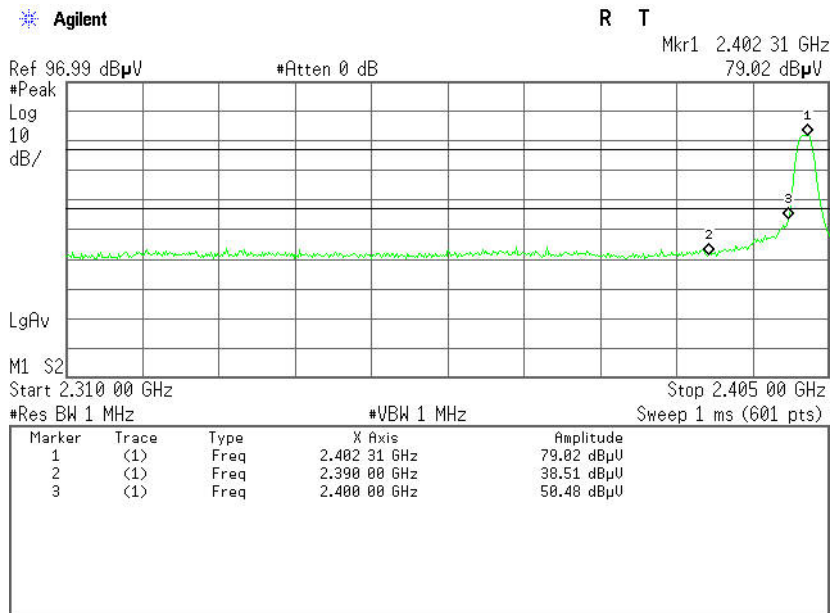
Polarity: Vertical





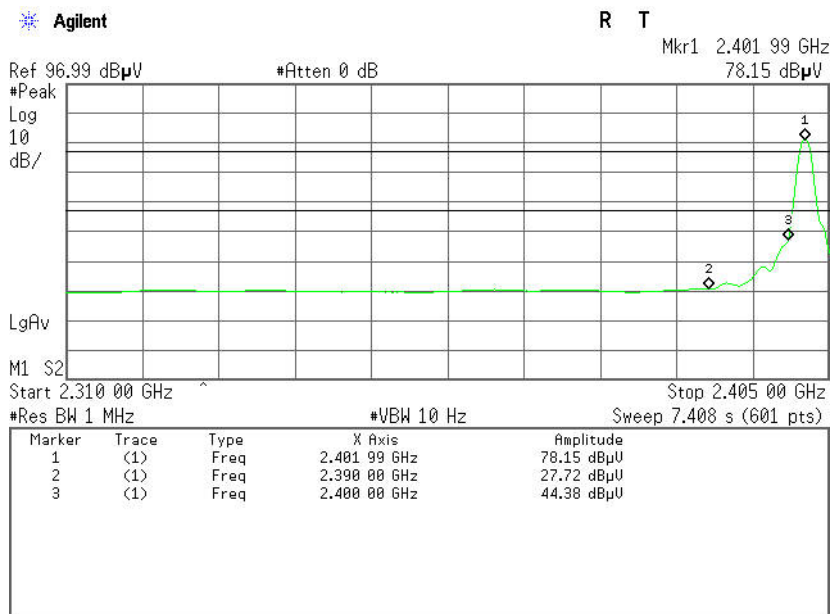
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

Polarity: Horizontal

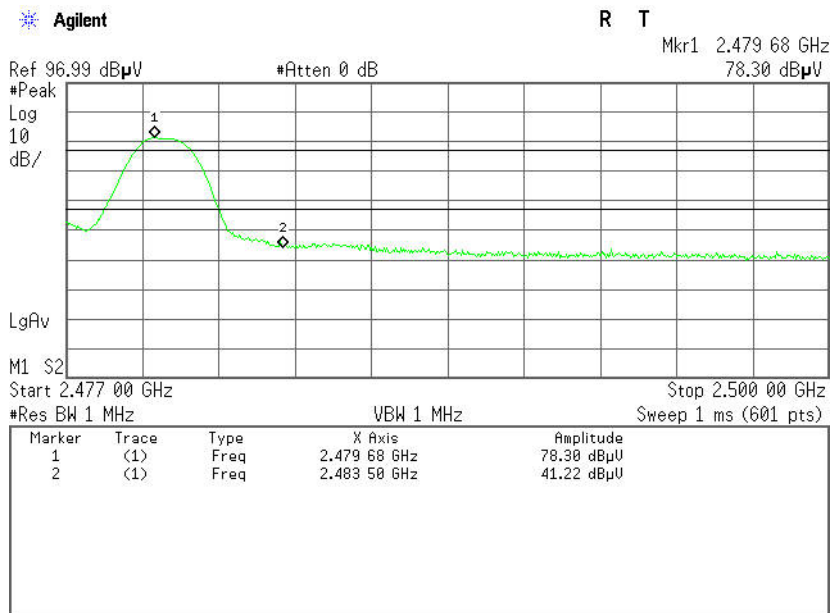




Band Edges (CH High)

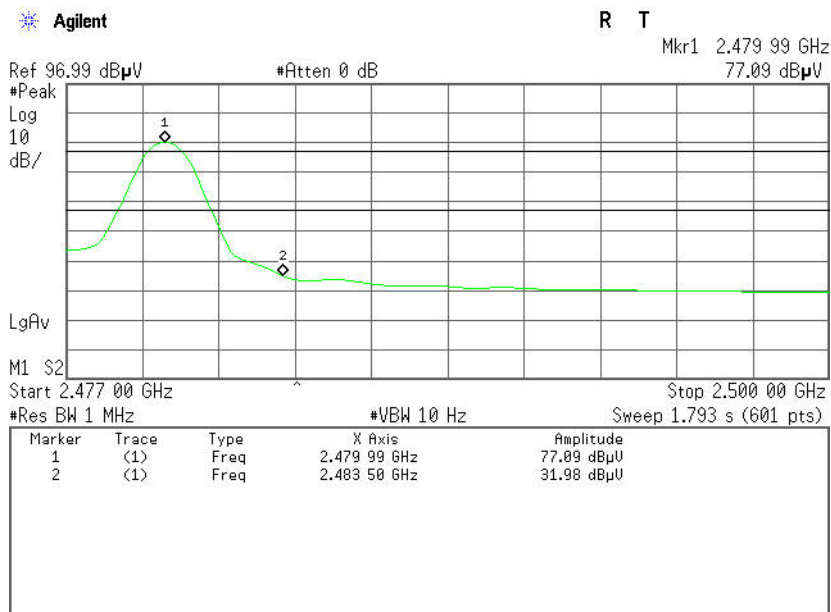
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

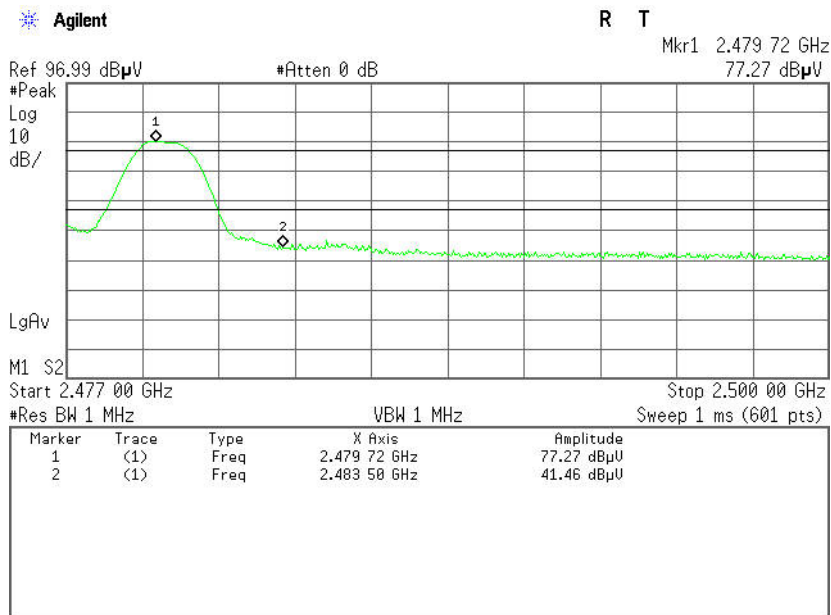
Polarity: Vertical





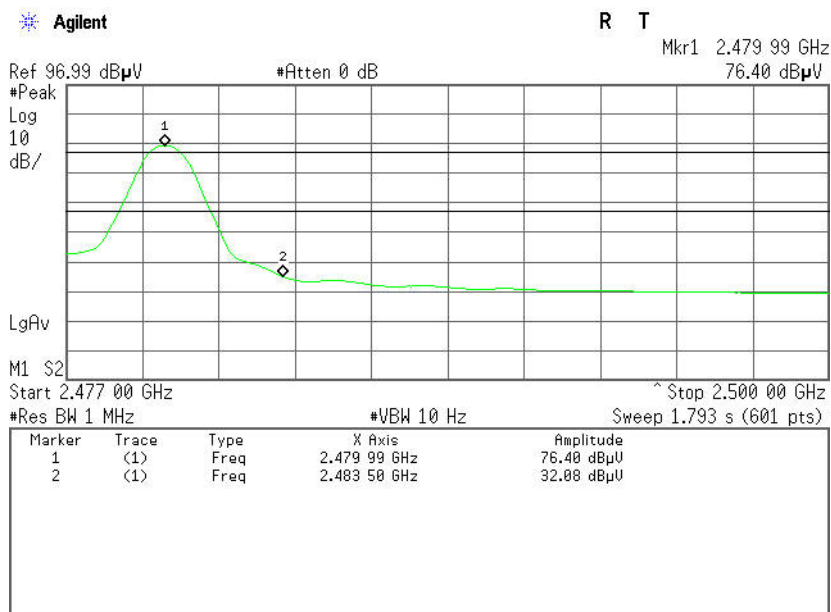
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

Polarity: Horizontal





7.6. PEAK POWER SPECTRAL DENSITY MEASUREMENT

7.6.1. LIMITS

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

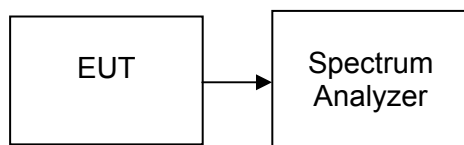
7.6.2. TEST INSTRUMENTS

| Name of Equipment | Manufacturer | Model | Serial Number | Last Calibration | Calibration Due |
|-------------------|--------------|--------|---------------|------------------|-----------------|
| Spectrum Analyzer | Agilent | E4446A | US44300399 | 03/19/2012 | 03/19/2013 |

7.6.3. TEST PROCEDURES (please refer to measurement standard)

1. Place the EUT on the table and set it in transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 100kHz, VBW = 300kHz, Span = 3MHz, Sweep = 1ms
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

7.6.4. TEST SETUP



**7.6.5. TEST RESULTS**

No non-compliance noted

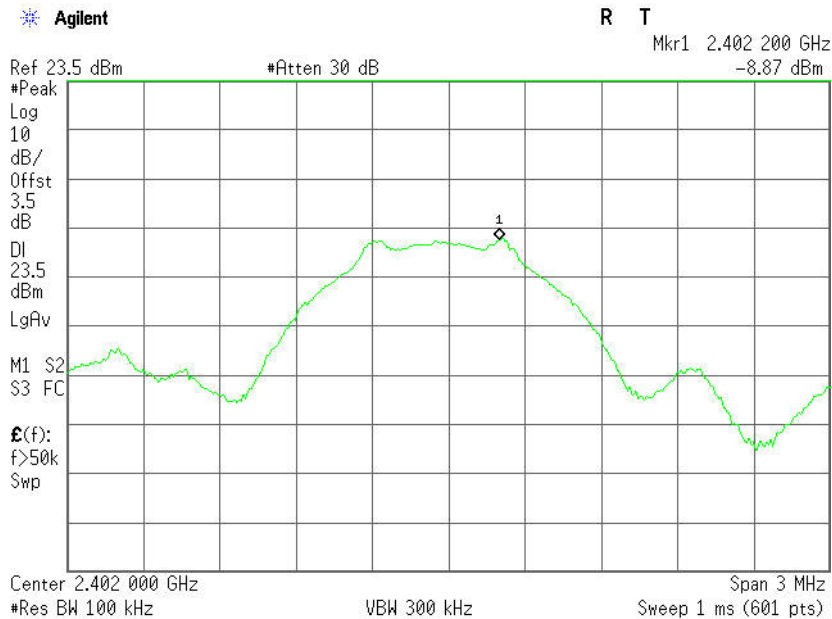
Test Data

| Channel | Frequency (MHz) | PPSD (dBm) | Limit (dBm) | Test Result |
|---------|-----------------|------------|-------------|-------------|
| Low | 2402 | -8.87 | 8.00 | PASS |
| Mid | 2440 | -9.21 | | PASS |
| High | 2480 | -11.12 | | PASS |

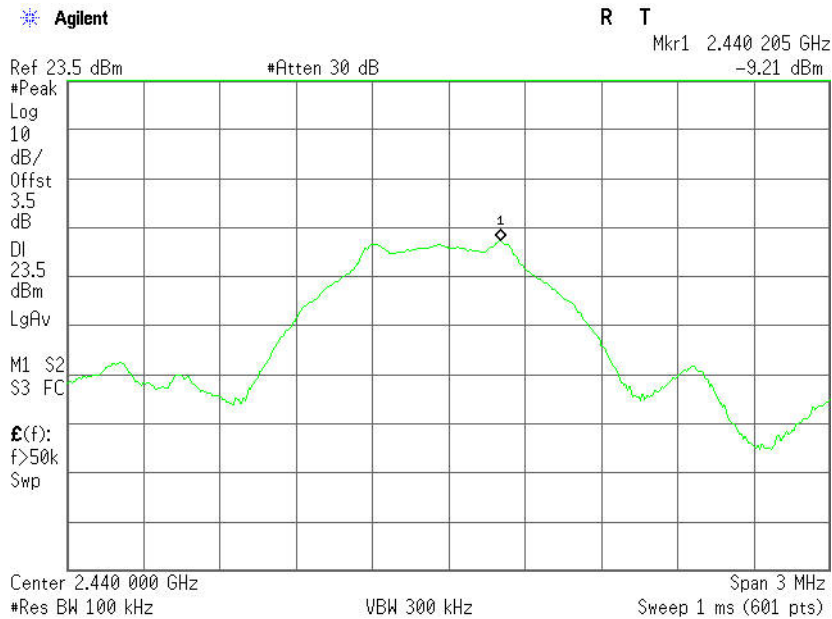


Test Plot

PPSD (CH Low)



PPSD (CH Mid)





PPSD (CH High)

