# FCC 47 CFR PART 15 SUBPART C AND ANSI C63.4: 2009

# TEST REPORT

## For

## Smart Plug On/Off

## Model: SPO120

## Issued for

## ST&T Electric Corp.

1F, No. 18, 31 Lane, Sec.1, Huan Dung Road, Tainan Science Park, Tainan 741, Taiwan

## Issued by

**Compliance Certification Services Inc.**
**Tainan Lab.**
**No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)**

**TEL: 886-6-580-2201**
**FAX: 886-6-580-2202**

**Date of Issue: January 28, 2013**

Testing Laboratory
1109

***Note:*** *This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. Ltd. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document*

# REVISION HISTORY

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|---|---|---|---|---|
| 00 | January 28, 2013 | Initial Issue | ALL | Eva Lin |
| | | | | |
| | | | | |
| | | | | |

# TABLE OF CONTENTS

**1. TEST REPORT CERTIFICATION ..... 4**
**2. EUT DESCRIPTION ..... 5**
**3. DESCRIPTION OF TEST MODES ..... 6**
**4. TEST METHODOLOGY ..... 7**
**5. FACILITIES AND ACCREDITATIONS ..... 7**
5.1 FACILITIES ..... 7
5.2 EQUIPMENT ..... 7
5.3 LABORATORY ACCREDITATIONS LISTINGS ..... 7
5.4 TABLE OF ACCREDITATIONS AND LISTINGS ..... 8
**6. CALIBRATION AND UNCERTAINTY ..... 8**
6.1 MEASURING INSTRUMENT CALIBRATION ..... 8
6.2 MEASUREMENT UNCERTAINTY ..... 8
**7. SETUP OF EQUIPMENT UNDER TEST ..... 9**
7.1 SETUP CONFIGURATION OF EUT ..... 9
7.2 SUPPORT EQUIPMENT ..... 9
7.2 SUPPORT EQUIPMENT ..... 10
7.3 EUT OPERATING CONDITION ..... 11
**8. APPLICABLE LIMITS AND TEST RESULTS ..... 12**
8.1 6DB BANDWIDTH ..... 12
8.2 MAXIMUM PEAK OUTPUT POWER ..... 23
8.3 MAXIMUM PERMISSIBLE EXPOSURE ..... 36
8.4 POWER SPECTRAL DENSITY ..... 38
8.5 CONDUCTED SPURIOUS EMISSION ..... 48
8.6 RADIATED EMISSIONS ..... 61
8.7 POWERLINE CONDUCTED EMISSIONS ..... 96
8.8 DUTY CYCLE ..... 100
**9. ANTENNA REQUIREMENT ..... 109**
9.1 STANDARD APPLICABLE ..... 109
9.2 ANTENNA CONNECTED CONSTRUCTION ..... 109
**APPENDIX SETUP PHOTOS ..... 110**
**APPENDIX II PHOTOGRAPHS OF EUT ..... A1**

# 1. TEST REPORT CERTIFICATION

**Applicant** ：ST&T Electric Corp.

**Address** ：1F, No. 18, 31 Lane, Sec.1, Huan Dung Road, Tainan Science Park, Tainan 741, Taiwan

**Manufacturer** ：ST&T Electric Corp.

**Address** ：No. 82, Gongye 2nd Rd., Tainan City 70955, Taiwan, R.O.C.

**Equipment Under Test** ：Smart Plug On/Off

**Model** ：SPO120

**Date of Test** ：November 20, 2013 – January 07, 2014

| APPLICABLE STANDARD | |
|---|---|
| **STANDARD** | **TEST RESULT** |
| FCC Part 15 Subpart C AND ANSI C63.4 : 2009 | No non-compliance noted |

***Approved by:***

**Jeter Wu**
Assistant Manager

***Reviewed by:***

**Eric Huang**
Assistant Section Manager

# 2. EUT DESCRIPTION

| | |
|---|---|
| **Product Name** | Smart Plug On/Off |
| **Model** | SPO120 |
| **Received Date** | November 19, 2013 |
| **Frequency Range** | IEEE 802.11b/g, 802.11n HT20 (DTS Band):2412MHz~2462MHz<br>IEEE 802.11n HT40 (DTS Band):2422MHz~2452MHz |
| **Transmit Power** | IEEE 802.11b Mode : 15.00dBm (DTS Band) (31.6228mW)<br>IEEE 802.11g Mode : 20.29dBm (DTS Band) (106.905mW)<br>IEEE 802.11n HT20 Mode : 19.75dBm (DTS Band) (94.4061mW)<br>IEEE 802.11n HT40 Mode : 16.49dBm (DTS Band) (44.5656mW) |
| **Channel Spacing** | IEEE 802.11b/g, 802.11n HT20/HT40: 5MHz |
| **Channel Number** | IEEE 802.11b/g, 802.11n HT20:11 Channels<br>IEEE 802.11n HT40 :7 Channels |
| **Transmit Data Rate** | IEEE 802.11b：11, 5.5, 2, 1 Mbps<br>IEEE 802.11g：54, 48 ,36, 24, 18, 12, 9, 6 Mbps<br>IEEE 802.11n HT20 : 72.2 , 65 , 57.8 , 43.3 , 28.9 , 21.7 , 14.4 , 7.2 Mbps<br>IEEE 802.11n HT40 : 150 , 135 , 120 , 90 , 60 , 45 , 30 , 15 Mbps |
| **Type of Modulation** | IEEE 802.11b：DSSS (CCK, DQPSK, DBPSK) |
| | IEEE 802.11g：OFDM (64QAM, 16QAM, QPSK, BPSK) |
| | IEEE 802.11n HT20/40：OFDM (64QAM, 16QAM, QPSK, BPSK) |
| **Frequency Selection** | By software / firmware |
| **Antenna Type** | **Antenna (1T1R)**<br>Manufacturer: Master Wave Technology Co., Ltd.<br>Type: PCB<br>Model: 98P63MIPF000<br>Gain: 3.35 dBi |
| **Power Source** | **100-240Vac, 50/60Hz, 15A** |
| **Temperature Range** | 0 ~ +55°C |

**REMARK:**

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: **QBL-RTSPO120-0** filing to comply with Section 15.207,15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*
3. *For more details, please refer to the User's manual of the EUT.*

# 3. DESCRIPTION OF TEST MODES

The EUT is a Smart Plug On/Off. It has one transmitter chains and one receive chains (1x1 configurations). The 1x1 configuration is implemented with one outside chains (Chain 0).

The RF chipset is manufactured by Ralink Technology, Corp.

The antenna peak gain 3.35 dBi (highest gain) were chosen for full testing.

**IEEE 802.11 b ,802.11g ,802.11n HT20 mode (DTS Band)**

The EUT had been tested under operating condition.

There are three channels have been tested as following:

| Channel | Frequency (MHz) |
|---|---|
| Low | 2412 |
| Middle | 2437 |
| High | 2462 |

IEEE 802.11b mode: 1Mbps long data rate (worst case) were chosen for full testing.

IEEE 802.11g mode: 6Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11n HT20 mode: 7.2 Mbps data rate (worst case) were chosen for full testing.

**IEEE 802.11n HT40 mode (DTS Band)**

The EUT had been tested under operating condition.

There are three channels have been tested as following:

| Channel | Frequency (MHz) |
|---|---|
| Low | 2422 |
| Middle | 2437 |
| High | 2452 |

IEEE 802.11n HT40 mode: 15 Mbps data rate (worst case) were chosen for full testing.

The worst-case data rates are determined according to the description above, based on the investigations by measuring the PSD, peak power and average power across all the data rates, bandwidths, modulations and spatial stream modes.

# 4. TEST METHODOLOGY

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

# 5. FACILITIES AND ACCREDITATIONS

## 5.1 FACILITIES

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

No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 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, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors 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 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW-1037 and 455173).

## 5.4 TABLE OF ACCREDITATIONS AND LISTINGS

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

| | |
|---|---|
| **Taiwan** | TAF |

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

| | |
|---|---|
| **Canada** | Industry Canada |
| **Germany** | TUV NORD |
| **Taiwan** | BSMI |
| **USA** | FCC |

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

# 6. CALIBRATION AND UNCERTAINTY

## 6.1 MEASURING INSTRUMENT CALIBRATION

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

## 6.2 MEASUREMENT UNCERTAINTY

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

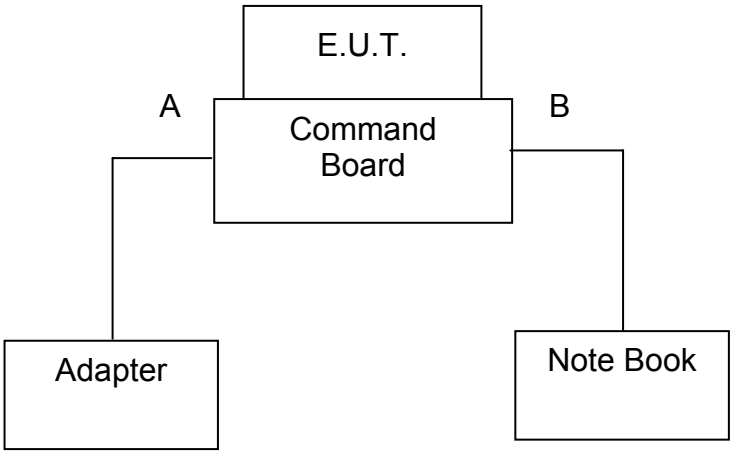
| PARAMETER | UNCERTAINTY |
|---|---|
| Radiated Emission, 30 to 200 MHz<br>Test Site : OATS-6 | ±3.59dB |
| Radiated Emission, 200 to 1000 MHz<br>Test Site : OATS-6 | ±3.27dB |
| Radiated Emission, 1 to 26.5 GHz | ± 3.20dB |
| Power Line Conducted Emission | ± 2.90dB |

Uncertainty figures are valid to a confidence level of 95%, K=2

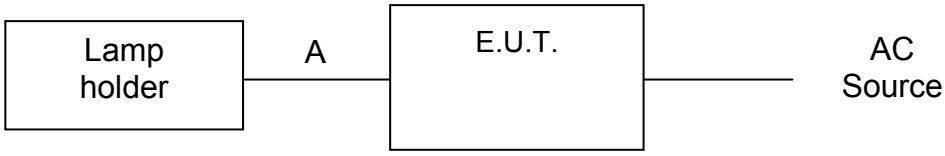
# 7. SETUP OF EQUIPMENT UNDER TEST

## 7.1 SETUP CONFIGURATION OF EUT

**For RF test**




**For EMI test**



## 7.2 SUPPORT EQUIPMENT

### RF test

| No. | Product | Manufacturer | Model No. | Certify No. | Signal cable |
|---|---|---|---|---|---|
| 1. | Note Book | IBM | T43 | DoC | Power cable, unshd, 1.6m |

| No. | Signal cable description | |
|---|---|---|
| A | DC Power | Unshielded, 1.5m, 1pcs. |
| B | LAN | Unshielded, 10m, 1pcs. |

### EMI test

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

| No. | Signal cable description | |
|---|---|---|
| A | AC output power | Unshielded, 1.6m, 1pcs. |

**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.

## 7.3 EUT OPERATING CONDITION

**RF Setup**

1. Set up all computers like the setup diagram.
2. The Ralink QA Test Program "RT5350QA V1.0.0.2" software was used for testing
   The EUT driver software installed in the host support equipment during testing was Ralink QA Test Program for "RT5350QA V1.0.0.2" Drive

**TX Mode:**

⇨ **Tx Mode:CCK 、OFDM、 HT MixMode** (Bandwidth: 20、40)

⇨ **Tx Data Rate: 1Mbps long** (IEEE 802.11b mode ,chain 0 TX)
**6Mbps** (IEEE 802.11g mode ,chain 0 TX)
**7.2 Mbps** (IEEE 802.11n HT20 mode ,chain 0)
**15 Mbps (**IEEE 802.11n HT40 mode, chain 0**)**

**Power control mode**

**Target Power:** IEEE 802.11b Channel Low (2412MHz) =12 **(Chain 0)**
IEEE 802.11b Channel Middle (2437MHz) =13 **(Chain 0)**
IEEE 802.11b Channel High (2462MHz) = 14 **(Chain 0)**
**Target Power:** IEEE 802.11g Channel Low (2412MHz) = 0E **(Chain 0)**
IEEE 802.11g Channel Middle (2437MHz) = 0F **(Chain 0)**
IEEE 802.11g Channel High (2462MHz) = 10 **(Chain 0)**
**Target Power:** IEEE 802.11n HT20 Channel Low (2412MHz) = 0C **(Chain 0)**
IEEE 802.11 n HT20 Channel Middle (2437MHz) =0D **(Chain 0)**
IEEE 802.11 n HT20 Channel High (2462MHz) = 0E **(Chain 0)**
**Target Power:** IEEE 802.11n HT40 Channel Low (2422MHz) = 04 **(Chain 0)**
IEEE 802.11 n HT40 Channel Middle (2437MHz) = 08 **(Chain 0)**
IEEE 802.11 n HT40 Channel High (2452MHz) = 08 **(Chain 0)**

(2) **RX Mode：**

**Start RX**

3. All of the function are under run.
4. Start test.

**Normal Link Setup**

1. Set up all computers like the setup diagram.
2. All of the function are under run.
3. Notebook PC (2) ping 192.168.0.10 –t to Notebook PC (1).
4. Notebook PC (1) ping 192.168.0.20 –t to Notebook PC (2).
5. Notebook PC (1) ping 192.168.0.50 –t to Wireless Access Point (3).

Start test.

# 8. APPLICABLE LIMITS AND TEST RESULTS

## 8.1 6DB BANDWIDTH

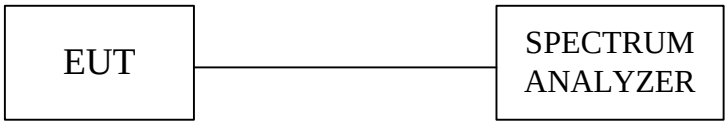
**LIMIT**

§ 15.247(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

**TEST EQUIPMENTS**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSEK 30 | 835253/002 | SEP. 28, 2014 |

**TEST SETUP**




**TEST PROCEDURE**

1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW).
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.

## TEST RESULTS

No non-compliance noted.

**IEEE 802.11b mode**

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Minimum Limit (kHz) | Pass / Fail |
|---|---|---|---|---|
| Low | 2412 | 12.14 | 500 | PASS |
| Middle | 2437 | 12.08 | 500 | PASS |
| High | 2462 | 12.08 | 500 | PASS |

**NOTE :** 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

**IEEE 802.11g mode**

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Minimum Limit (kHz) | Pass / Fail |
|---|---|---|---|---|
| Low | 2412 | 16.53 | 500 | PASS |
| Middle | 2437 | 16.53 | 500 | PASS |
| High | 2462 | 16.47 | 500 | PASS |

**NOTE :** 1. At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

**IEEE 802.11n HT20 mode**

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Minimum Limit (kHz) | Pass / Fail |
|---|---|---|---|---|
| | | Chain 0 | | |
| Low | 2412 | 17.68 | 500 | PASS |
| Middle | 2437 | 17.62 | 500 | PASS |
| High | 2462 | 17.49 | 500 | PASS |

**NOTE :** 1. At finial test to get the worst-case emission at 7.2 Mbps.
2. The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

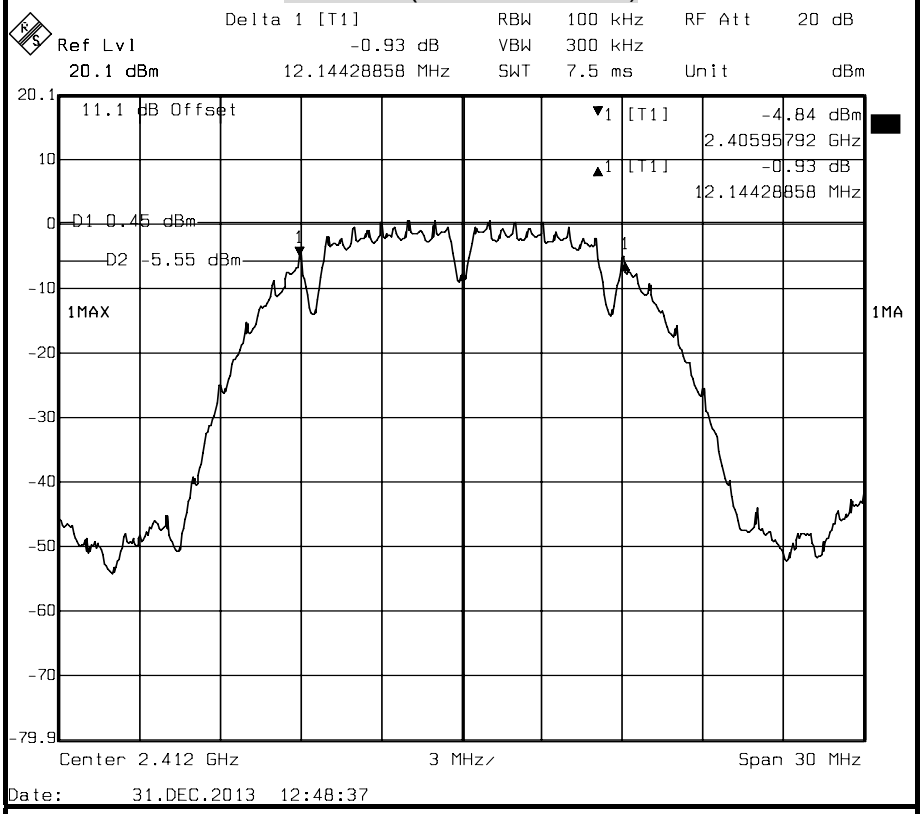
**IEEE 802.11n HT40 mode**

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Minimum Limit (kHz) | Pass / Fail |
|---|---|---|---|---|
| | | Chain 0 | | |
| Low | 2422 | 35.83 | 500 | PASS |
| Middle | 2437 | 35.95 | 500 | PASS |
| High | 2452 | 35.83 | 500 | PASS |

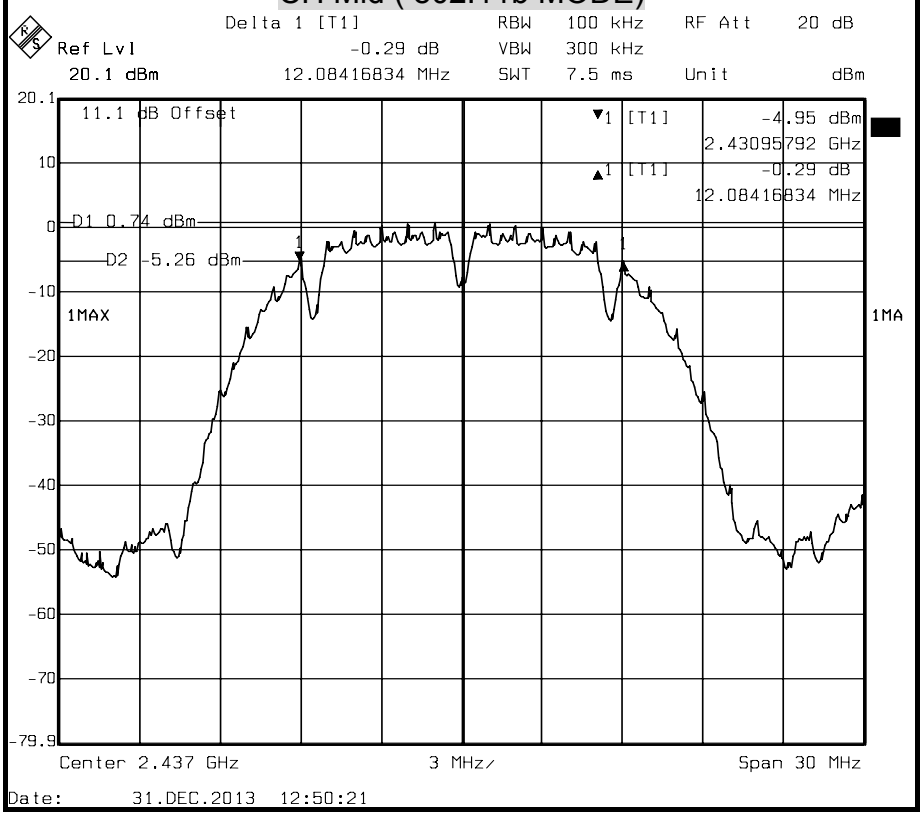
**NOTE :** 1. At finial test to get the worst-case emission at 15 Mbps.
2. The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

## 6dB BANDWIDTH ( 802.11b MODE)

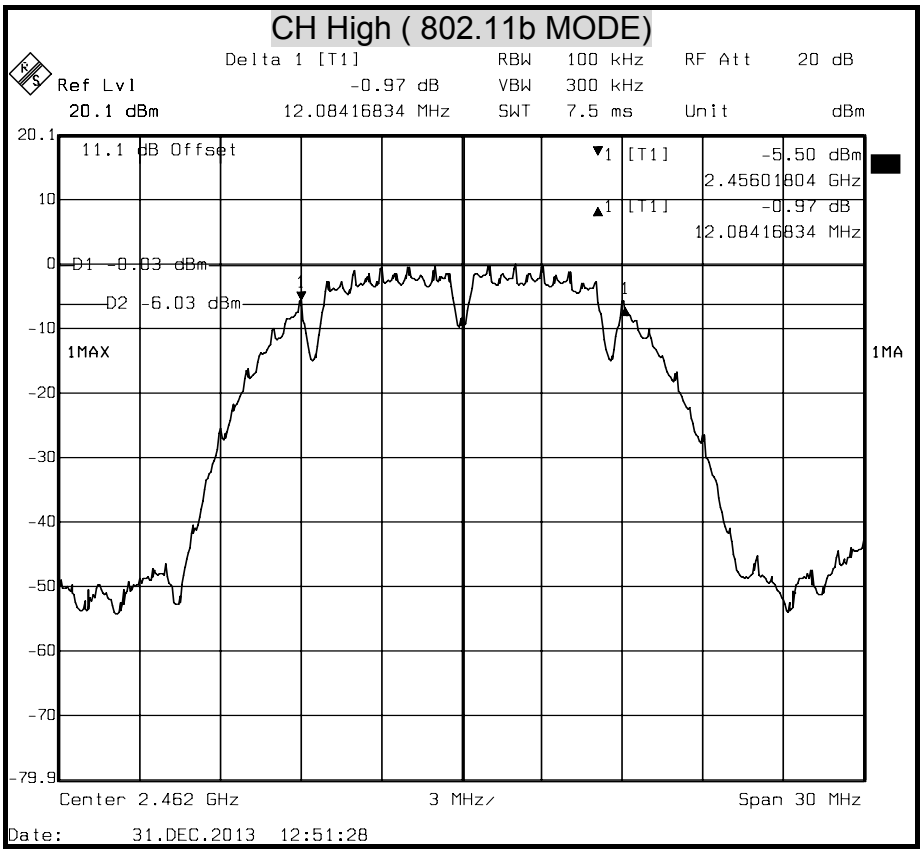
CH Low ( 802.11b MODE)




CH Mid ( 802.11b MODE)

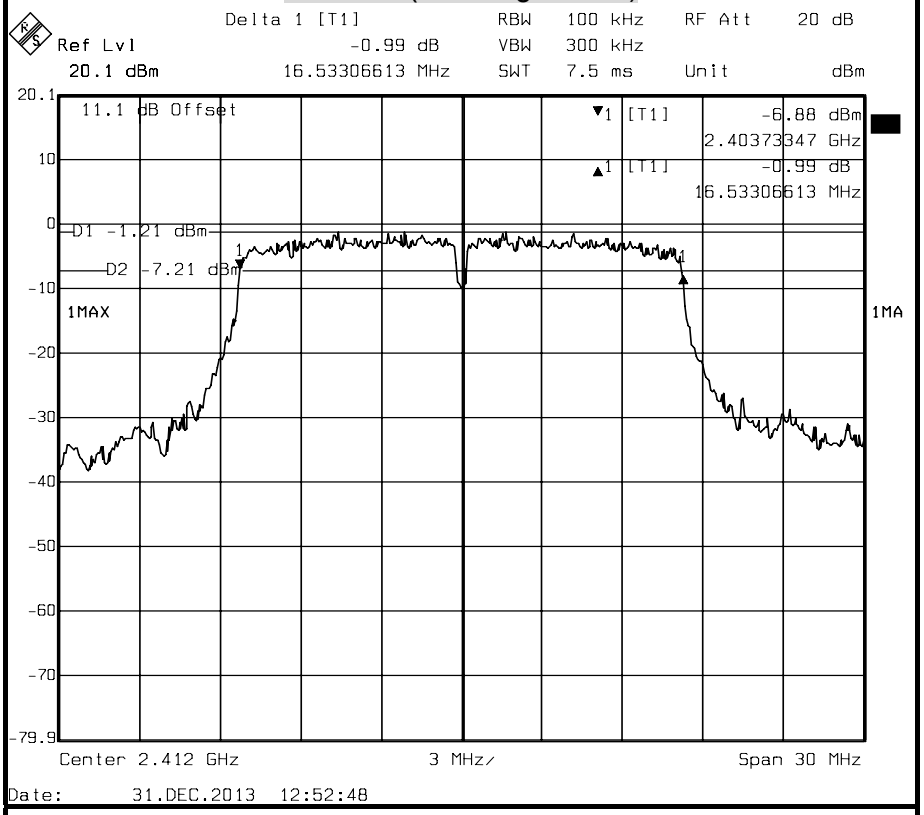


CH High ( 802.11b MODE)

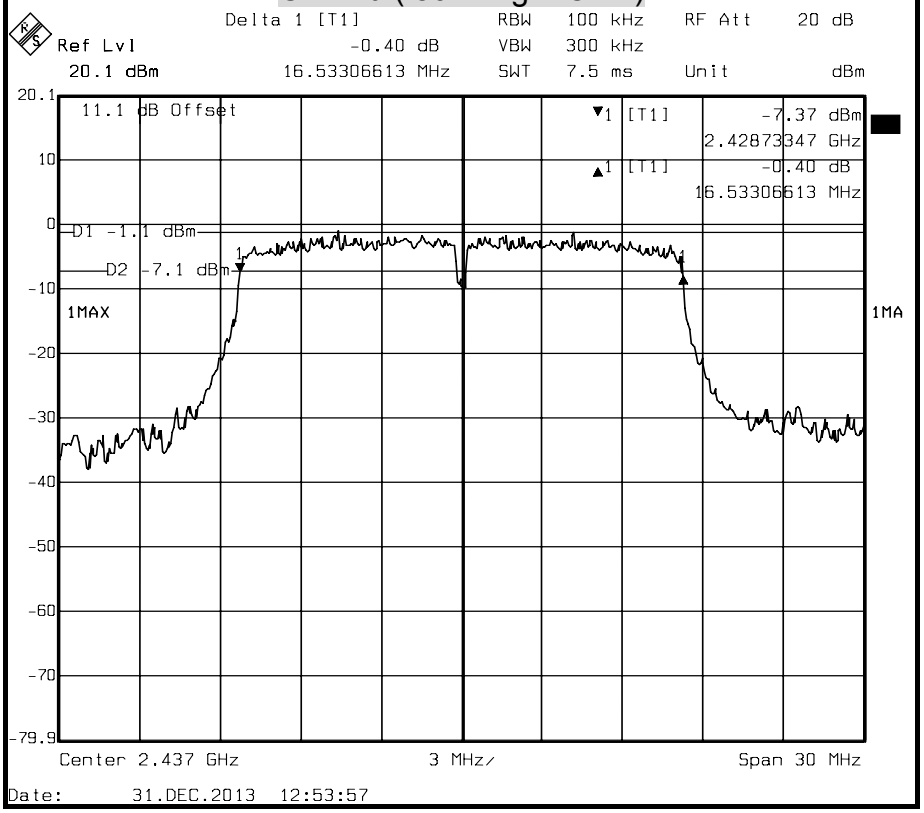


## 6dB BANDWIDTH ( 802.11g MODE)

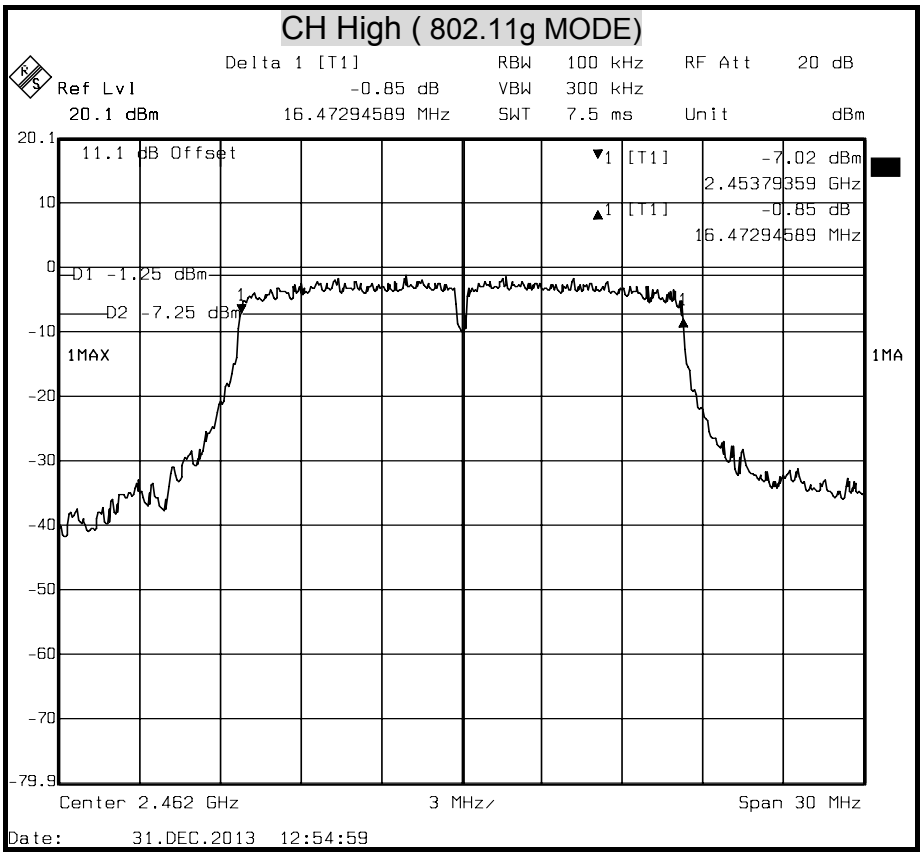
CH Low ( 802.11g MODE)




CH Mid ( 802.11g MODE)

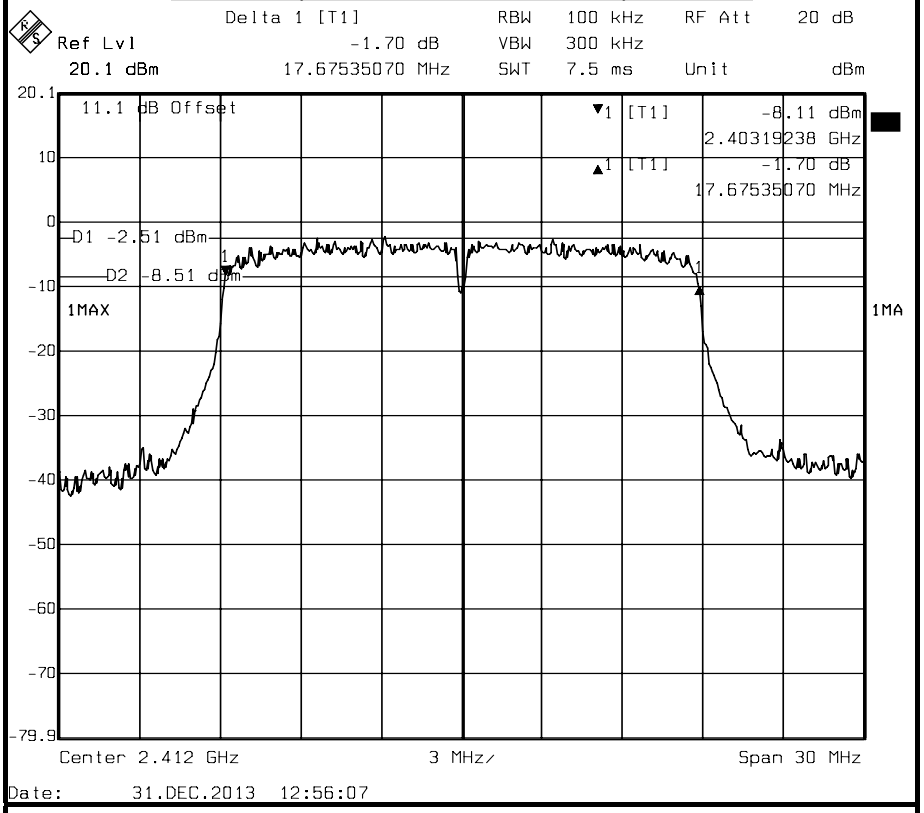


CH High ( 802.11g MODE)

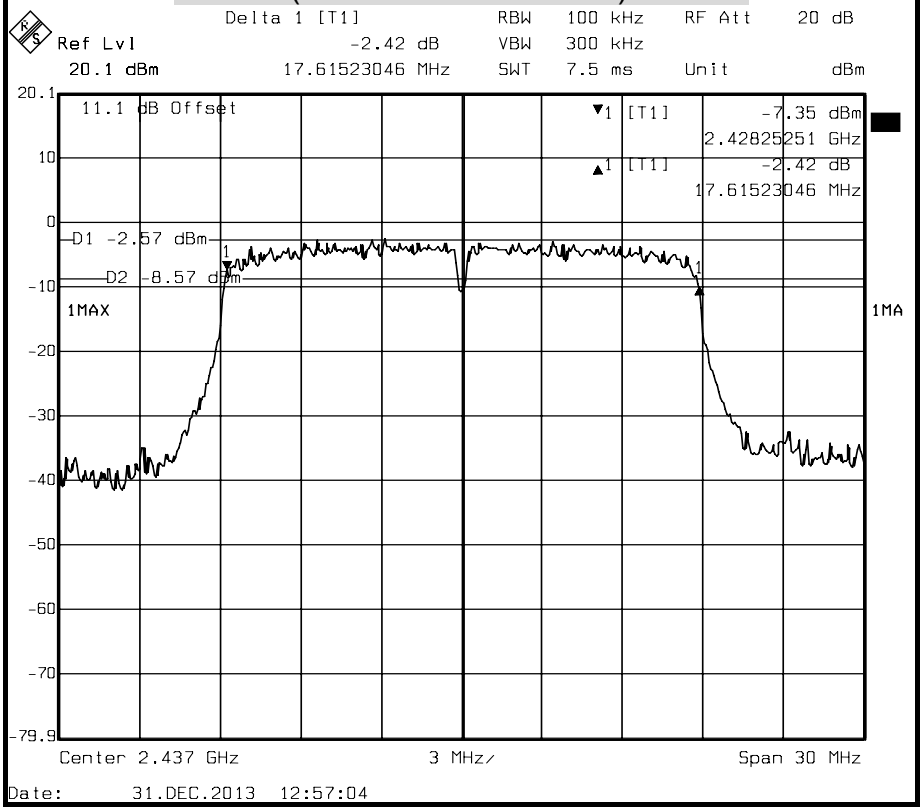


## 6dB BANDWIDTH ( 802.11n HT20 MODE) Chain 0

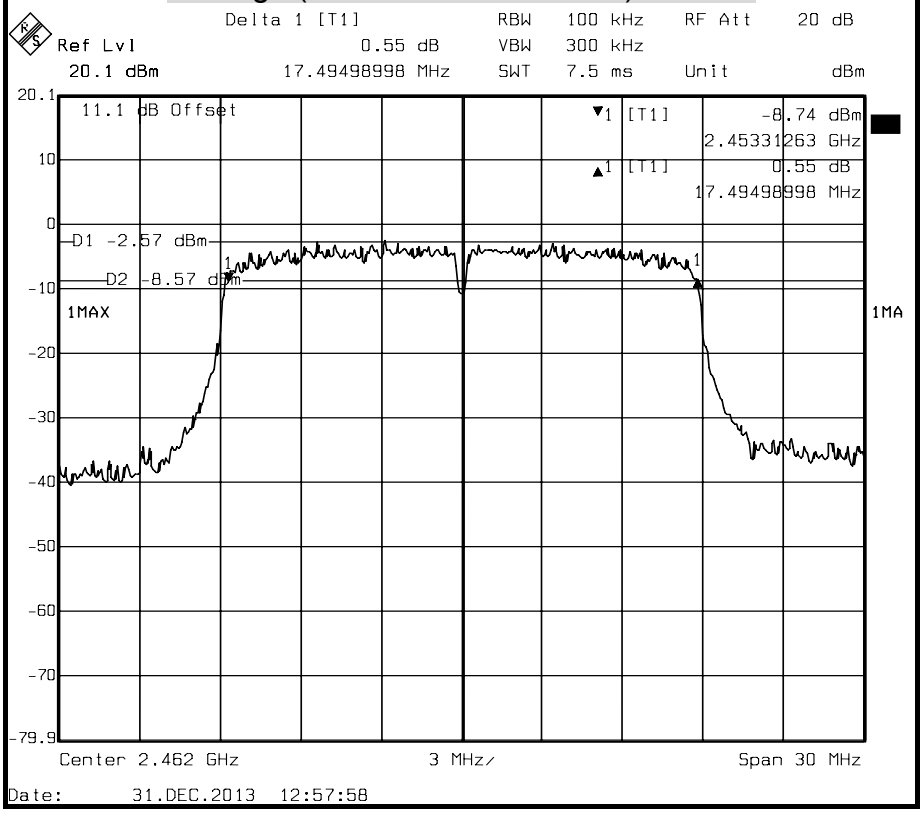
CH Low ( 802.11n HT20 MODE)-Chain 0




CH Mid ( 802.11n HT20 MODE)-Chain 0

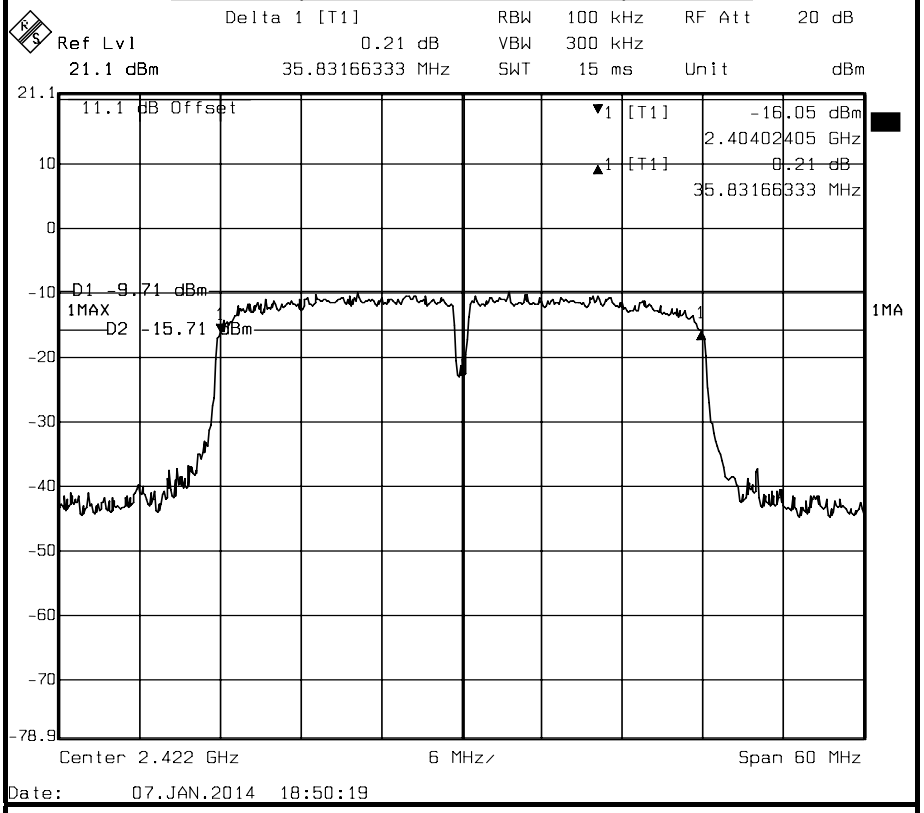


CH High ( 802.11n HT20 MODE)-Chain 0

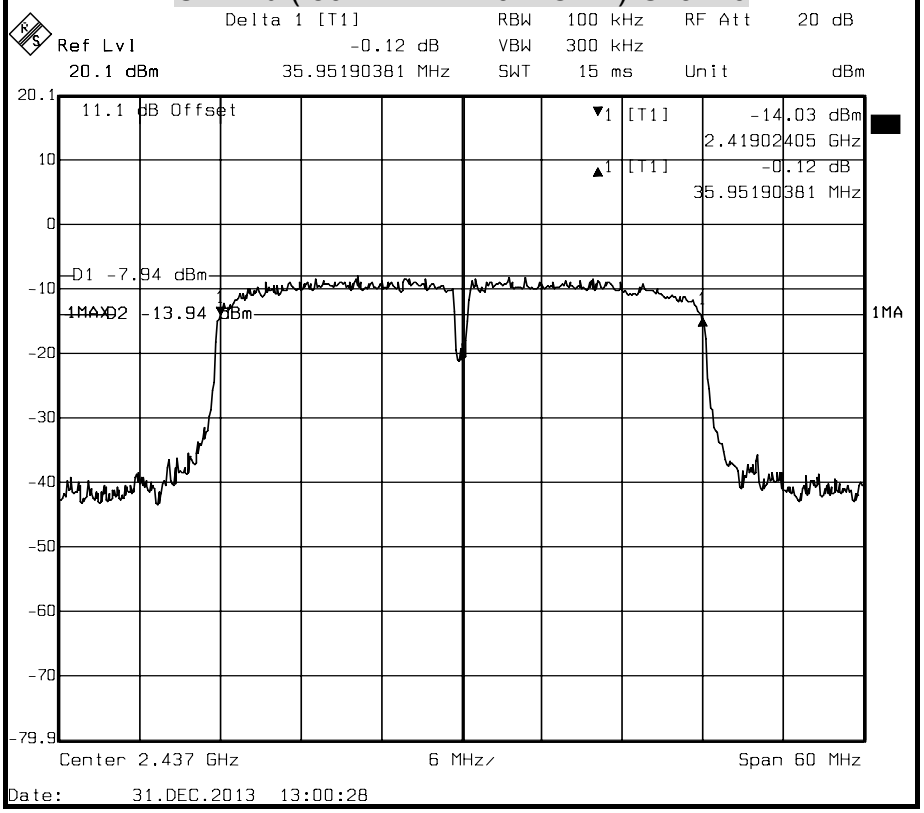


## 6dB BANDWIDTH ( 802.11n HT40 MODE) Chain 0

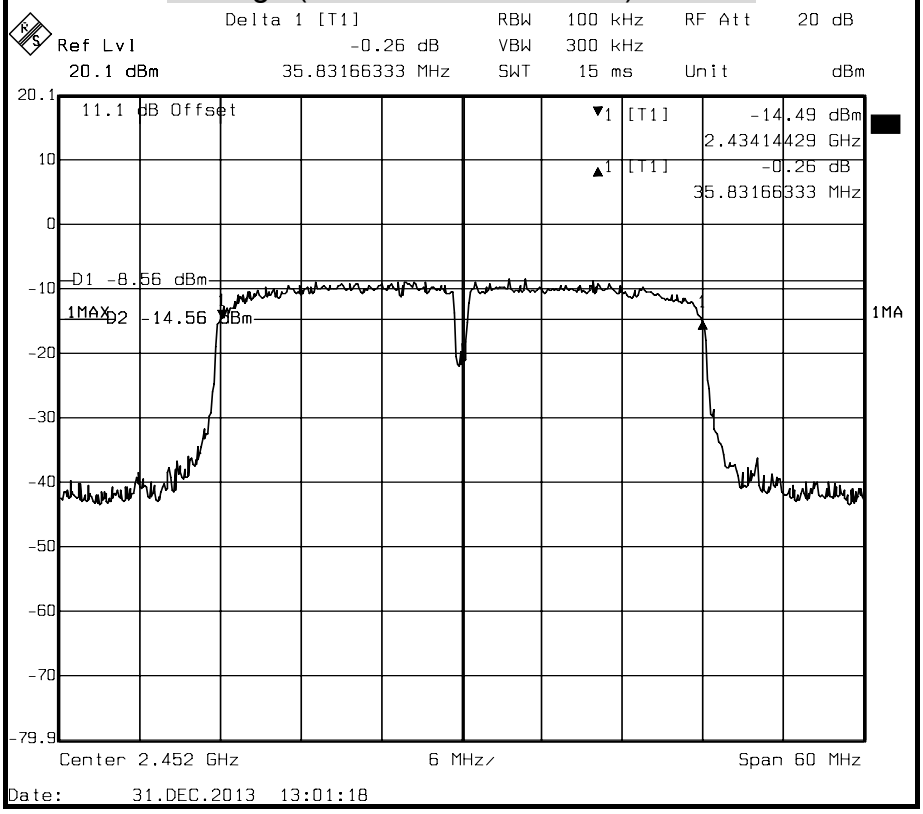
CH Low ( 802.11n HT40 MODE)-Chain 0




CH Mid ( 802.11n HT40 MODE)-Chain 0



CH High ( 802.11n HT40 MODE)-Chain 0



## 8.2 MAXIMUM PEAK OUTPUT POWER

**LIMIT**

§ 15.247(b) The maximum peak output power of the intentional radiator shall not exceed the following :

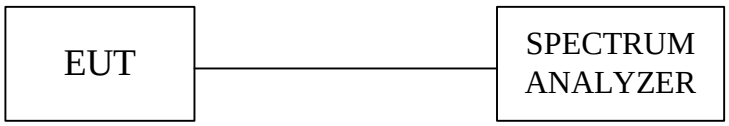
§ 15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands : 1 watt.

§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (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.

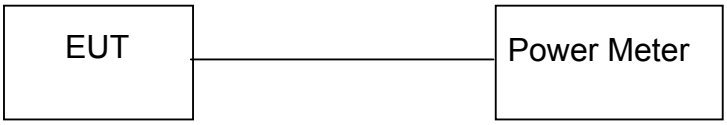
**TEST EQUIPMENTS**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSEK 30 | 835253/002 | SEP. 28, 2014 |
| Power Meter | Anritsu | ML2487A | 6K00003888 | JUN. 24, 2014 |

**TEST SETUP**




**For Average Power**



## TEST PROCEDURE

The tests were performed in accordance with KDB 558074 5.2.1.2 and 5.2.2.1.

**5.2.1.2 Measurement Procedure PK2:**

1. This procedure provides an integrated measurement alternative when the maximum available RBW < EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW = 3 MHz.
4. Set the span to a value that is 5-30 % greater than the EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges(for some analyzers, this may require a manual overrideto ensure use of peak detector). If the spectrum analyzer does not have a band power function, sum the spectrum levels (in linear power units) at 1 MHz intervals extending across the EBW of the spectrum.

**5.2.2.1 Measurement Procedure AVG1(power averaging over the EBW with slow sweep speed):**

1. Set the analyzer span to 5-30% greater than the EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW ≥ 3 MHz.
4. Detector = power average (RMS).
5. Ensure that the number of measurement points in the sweep ≥ 2 x (span/RBW).
6. Manually set the sweep time to: ≥10 x (number of measurement points in sweep) x (transmission symbol period).
7. Perform the measurement over a single sweep.
8. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges to determine the maximum conducted output power of the EUTover the EBW. Note: If the analyzer does not have a band power function, sum the spectral levels (in linear power units) at 1 MHz intervals extending across the entire EBW.

## TEST RESULTS

No non-compliance noted

**IEEE 802.11b mode**

| Channel | Channel Frequency (MHz) | Peak Power (dBm) | Peak Power Limit (dBm) | Pass / Fail |
|---|---|---|---|---|
| Low | 2412 | 14.80 | 30.00 | PASS |
| Middle | 2437 | 14.95 | 30.00 | PASS |
| High | 2462 | 15.00 | 30.00 | PASS |

**NOTE** : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

**IEEE 802.11g mode**

| Channel | Channel Frequency (MHz) | Peak Power (dBm) | Peak Power Limit (dBm) | Pass / Fail |
|---|---|---|---|---|
| Low | 2412 | 20.20 | 30.00 | PASS |
| Middle | 2437 | 20.29 | 30.00 | PASS |
| High | 2462 | 20.28 | 30.00 | PASS |

**NOTE** : 1.At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

**IEEE 802.11n HT20 mode**

| Channel | Channel Frequency (MHz) | Peak Power (dBm) | Peak Power Limit (dBm) | Pass / Fail |
|---|---|---|---|---|
| | | Chain 0 | | |
| Low | 2412 | 19.75 | 30.00 | PASS |
| Middle | 2437 | 19.65 | 30.00 | PASS |
| High | 2462 | 19.61 | 30.00 | PASS |

**NOTE** : 1. At finial test to get the worst-case emission at 7.2 Mbps.
2. The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

**IEEE 802.11n HT40 mode**

| Channel | Channel Frequency (MHz) | Peak Power (dBm) | Peak Power Limit (dBm) | Pass / Fail |
|---|---|---|---|---|
| | | Chain 0 | | |
| Low | 2422 | 14.99 | 30.00 | PASS |
| Middle | 2437 | 16.49 | 30.00 | PASS |
| High | 2452 | 15.94 | 30.00 | PASS |

**NOTE** : 1. At finial test to get the worst-case emission at 15 Mbps.
2. The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

## Average Power Data

### IEEE 802.11b mode

| Channel | Channel Frequency (MHz) | Average Power (dBm) |
|---|---|---|
| Low | 2412 | 12.44 |
| Middle | 2437 | 12.31 |
| High | 2462 | 12.42 |

### IEEE 802.11g mode

| Channel | Channel Frequency (MHz) | Average Power (dBm) |
|---|---|---|
| Low | 2412 | 13.15 |
| Middle | 2437 | 13.13 |
| High | 2462 | 13.05 |

### IEEE 802.11n HT20 mode

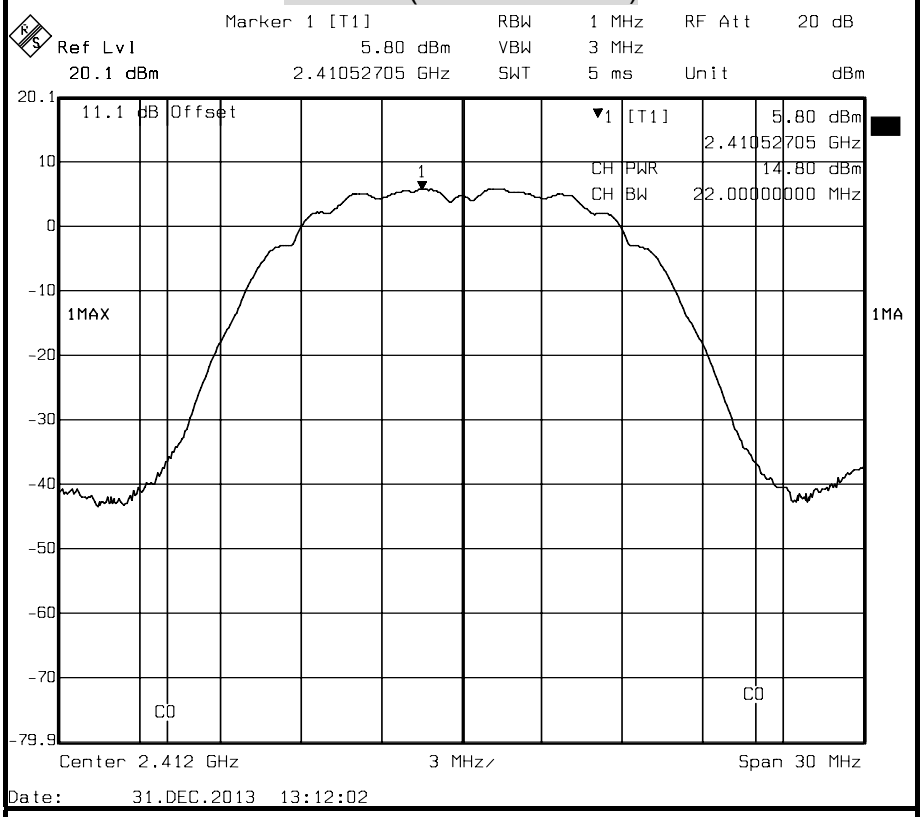
| Channel | Channel Frequency (MHz) | Average Power (dBm) |
|---|---|---|
| | | Chain 0 |
| Low | 2412 | 12.43 |
| Middle | 2437 | 12.38 |
| High | 2462 | 12.24 |

### IEEE 802.11n HT40 mode

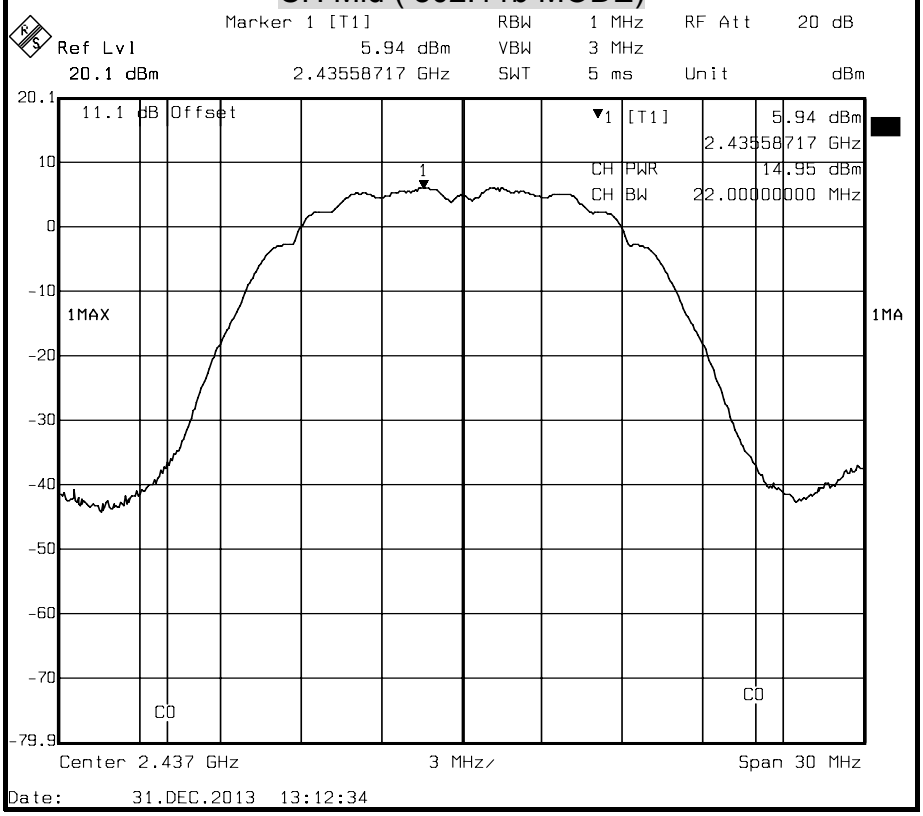
| Channel | Channel Frequency (MHz) | Average Power (dBm) |
|---|---|---|
| | | Chain 0 |
| Low | 2422 | 8.42 |
| Middle | 2437 | 10.01 |
| High | 2452 | 9.39 |

## MAXIMUM PEAK OUTPUT POWER ( 802.11b MODE)

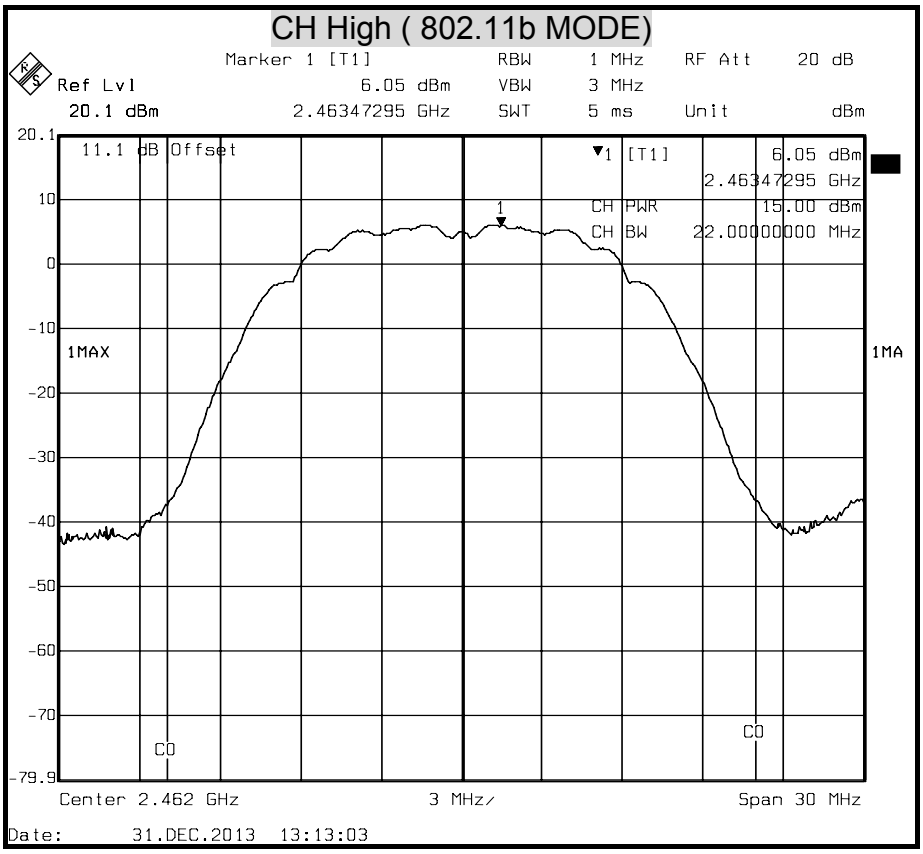
CH Low ( 802.11b MODE)




CH Mid ( 802.11b MODE)

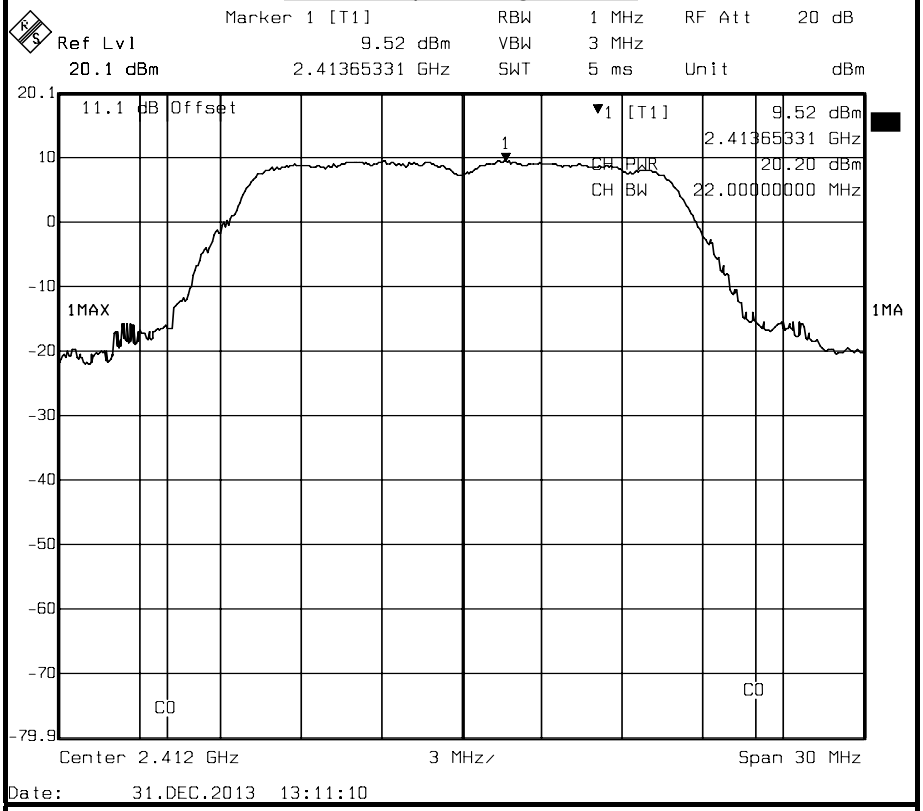


CH High ( 802.11b MODE)

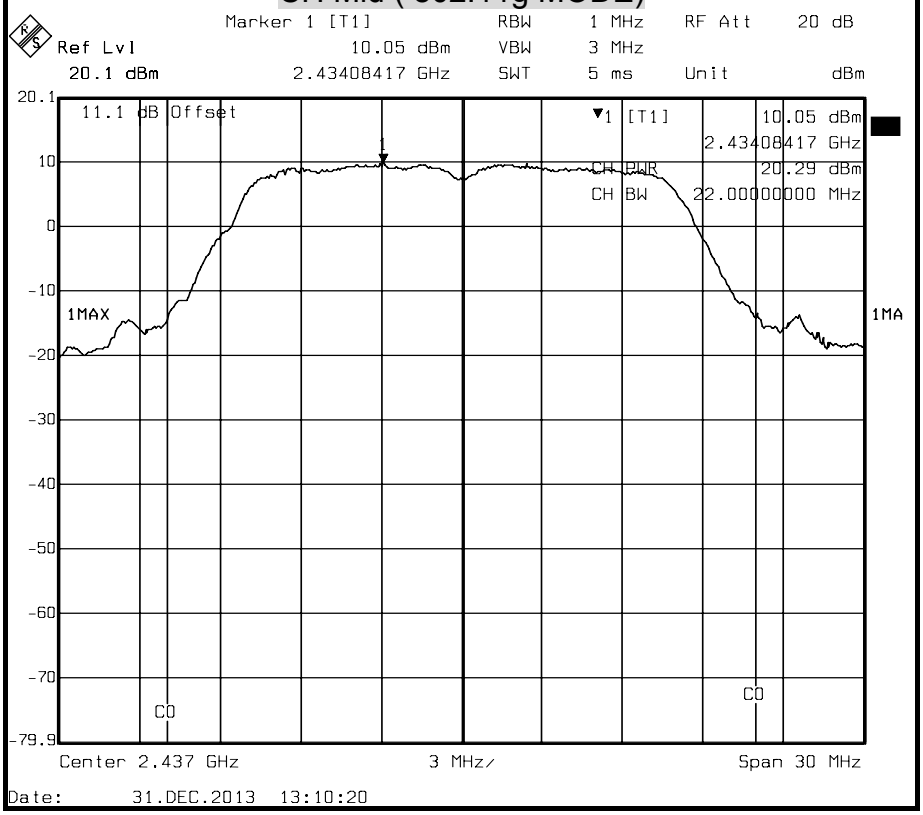


## MAXIMUM PEAK OUTPUT POWER ( 802.11g MODE)

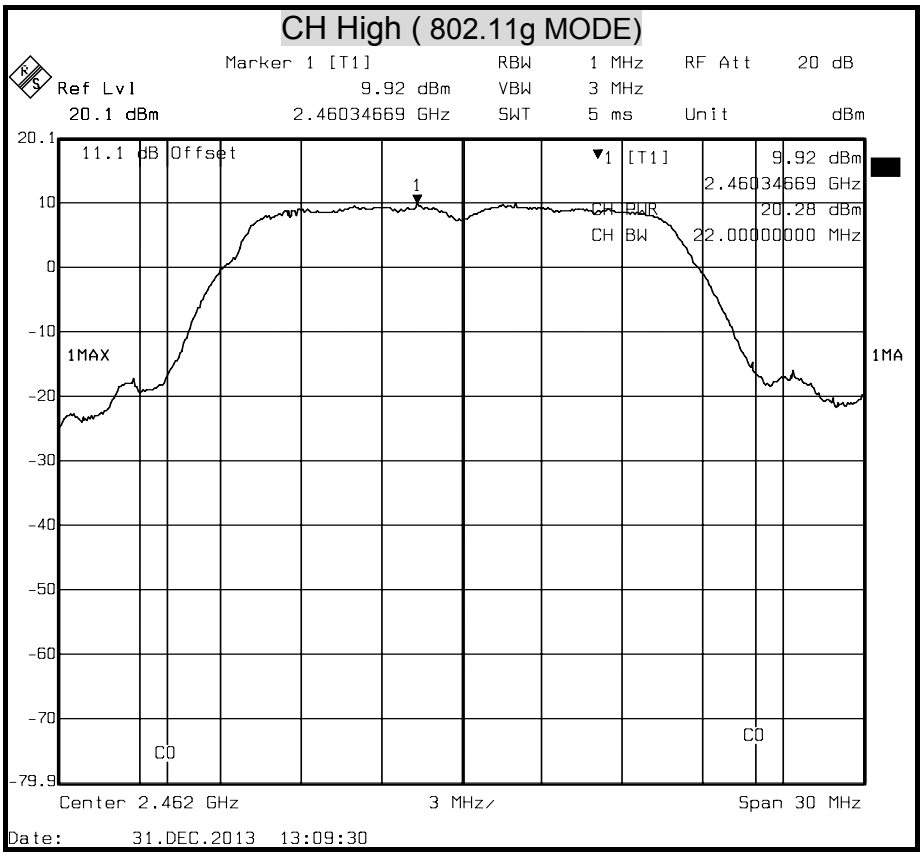
CH Low ( 802.11g MODE)




CH Mid ( 802.11g MODE)

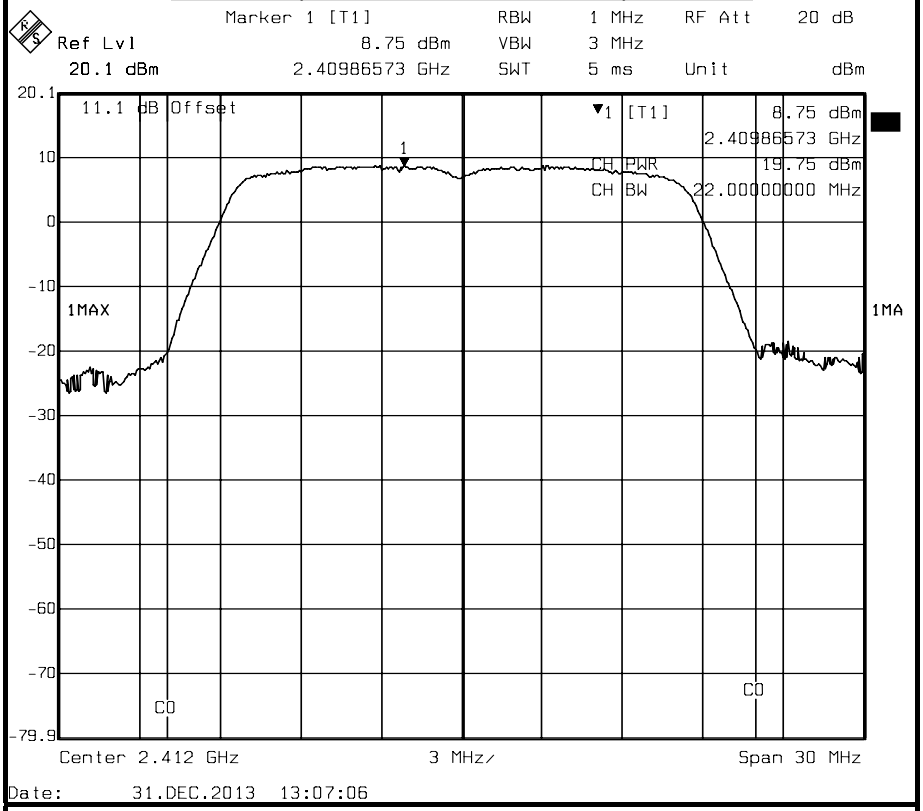


CH High ( 802.11g MODE)

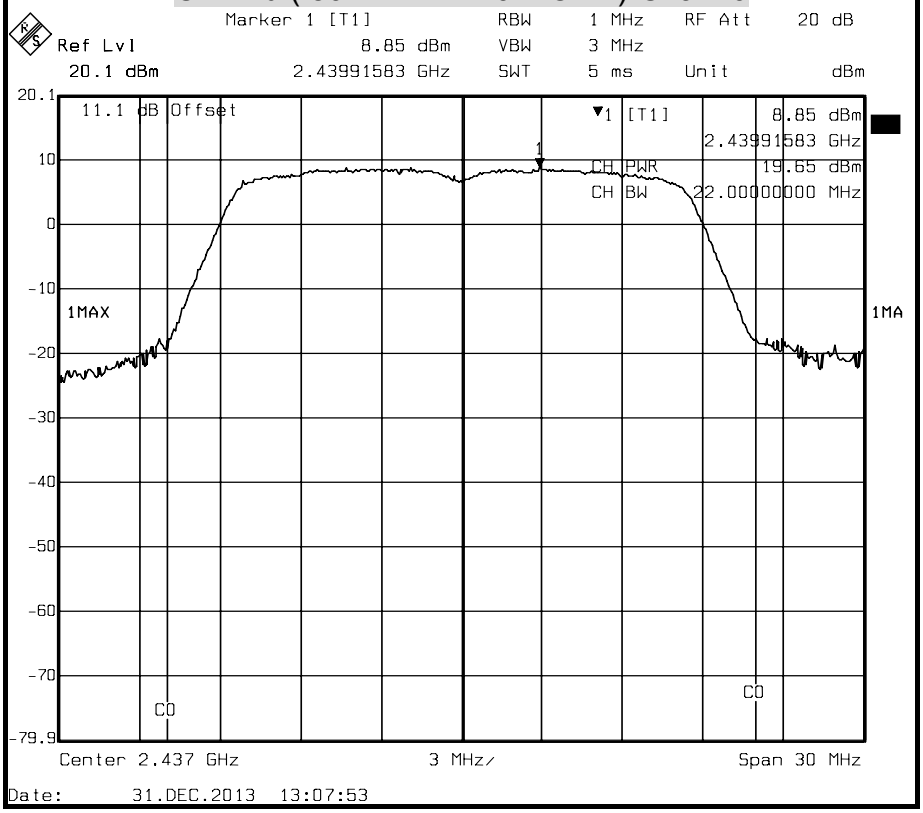


## MAXIMUM PEAK OUTPUT POWER ( 802.11n HT20 MODE) Chain 0

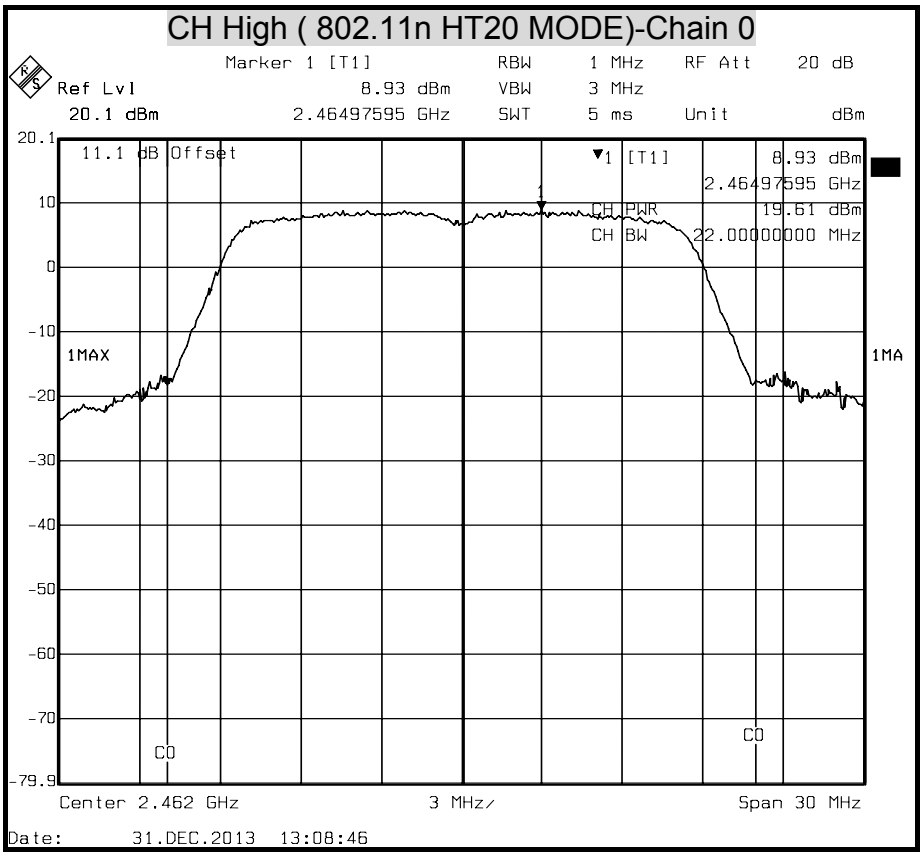
CH Low ( 802.11n HT20 MODE)-Chain 0




CH Mid ( 802.11n HT20 MODE)-Chain 0

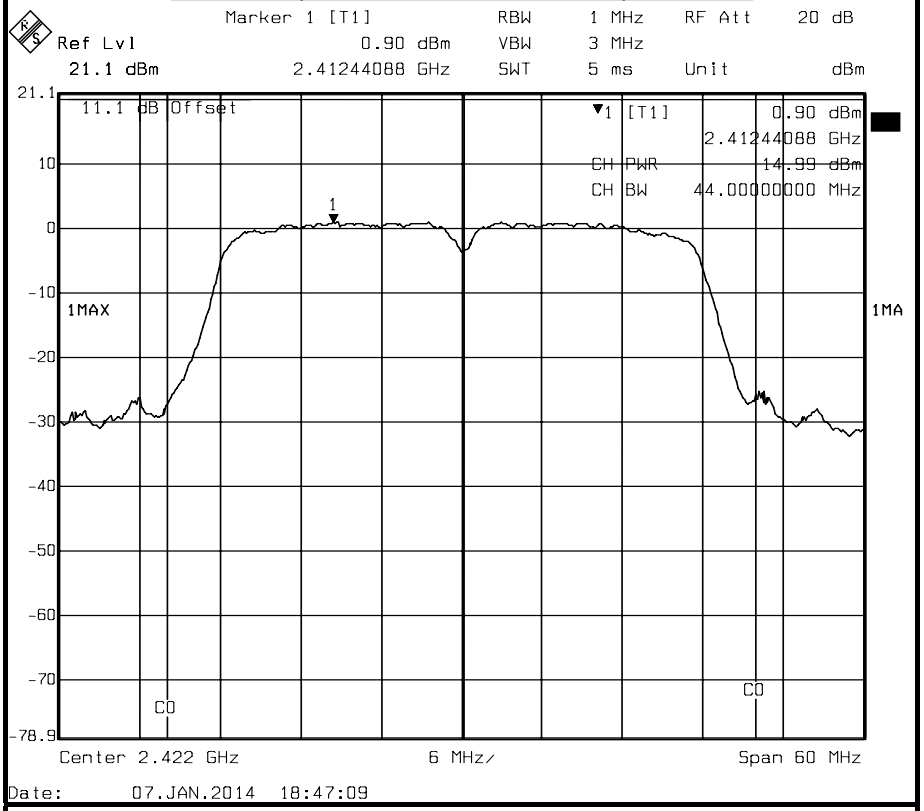


CH High ( 802.11n HT20 MODE)-Chain 0

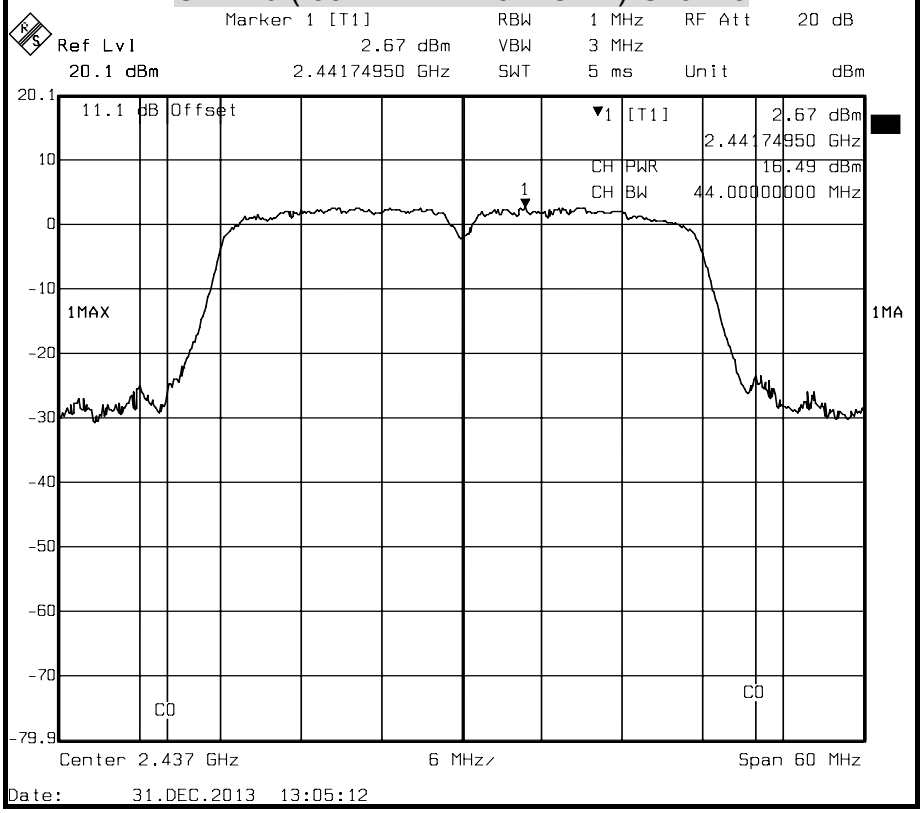


## MAXIMUM PEAK OUTPUT POWER ( 802.11n HT40 MODE) Chain 0

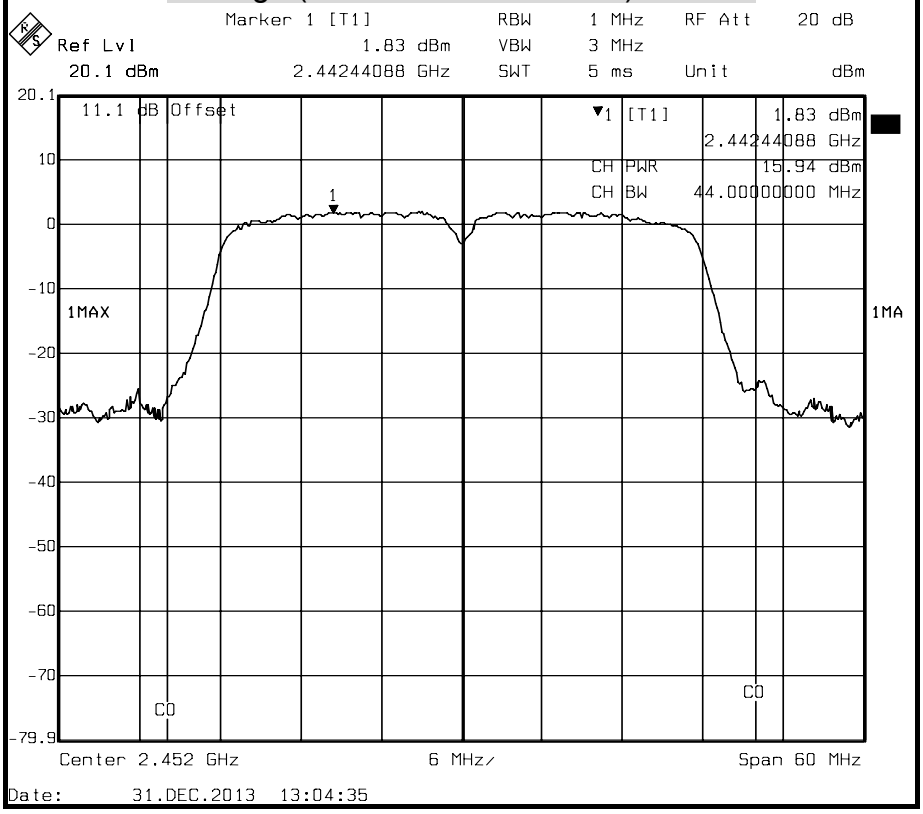
CH Low ( 802.11n HT40 MODE)-Chain 0




CH Mid ( 802.11n HT40 MODE)-Chain 0



CH High ( 802.11n HT40 MODE)-Chain 0



## _8.3 MAXIMUM PERMISSIBLE EXPOSURE

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm$^2$) | Average Time |
|---|---|---|---|---|
| (A) Limits for Occupational / Control Exposures | | | | |
| 300-1,500 | -- | -- | F/300 | 6 |
| 1,500-100,000 | -- | -- | 5 | 6 |
| (B) Limits for General Population / Uncontrol Exposures | | | | |
| 300-1,500 | -- | -- | F/1500 | 6 |
| 1,500-100,000 | -- | -- | 1 | 30 |

**CALCULATIONS**

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{3770}$

*Where E = Field strength in Volts / meter*

*P = Power in Watts*

*G = Numeric antenna gain*

*d = Distance in meters*

*S = Power density in milliwatts / square centimeter*

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

*P (mW) = P (W) / 1000 and*

*d (cm) = d(m) / 100*

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

*Where d = Distance in cm*

*P = Power in mW*

*G = Numeric antenna gain*

*S = Power density in mW / cm$^2$*

**LIMIT**

Power Density Limit, S=1.0mW/cm$^2$

**TEST RESULTS**

No non-compliance noted.

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

G= 3.35 dBi = 2.16271852 mW

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| IEEE 802.11b | = | 0.0796 * | 31.6228 | * | 2.16271852 | ÷ 400 = | 0.01361 |
| IEEE 802.11g | = | 0.0796 * | 106.9055 | * | 2.16271852 | ÷ 400 = | 0.04601 |
| IEEE 802.11n HT20 | = | 0.0796 * | 94.4061 | * | 2.16271852 | ÷ 400 = | 0.040631 |
| IEEE 802.11n HT40 | = | 0.0796 * | 44.5656 | * | 2.16271852 | ÷ 400 = | 0.01918 |

| Mode | Minimum separation distance (cm) | Output Power (dBm) | Output Power (mw) | Antenna Gain (dBi) | Power Density Limit (mW/cm$^2$) | Power Density at 20cm (mW/cm$^2$) |
|---|---|---|---|---|---|---|
| IEEE 802.11b | 20 | 15.00 | 31.62 | 3.35 | 1.00 | 0.013610 |
| IEEE 802.11g | 20 | 20.29 | 106.91 | 3.35 | 1.00 | 0.046010 |
| IEEE 802.11n HT20 | 20 | 19.75 | 94.41 | 3.35 | 1.00 | 0.040631 |
| IEEE 802.11n HT40 | 20 | 16.49 | 44.57 | 3.35 | 1.00 | 0.019180 |

**REMARK:** For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm$^2$ even if the calculation indicates that the power density would be larger.

## 8.4 POWER SPECTRAL DENSITY

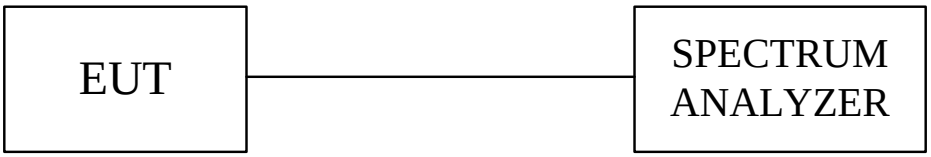
**LIMIT**

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

**TEST EQUIPMENTS**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSEK 30 | 835253/002 | SEP. 28, 2013 |

**TEST SETUP**




**TEST PROCEDURE**

The tests were performed in accordance with KDB 558074 5.3.1.

**5.3.1 Measurement Procedure PKPSD:**

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ 300 kHz.
4. Set the span to 5-30 % greater than the EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(3 kHz/100 kHz= -15.2 dB).11.The resulting peak PSD level must be ≤ 8 dBm.

## TEST RESULTS

**IEEE 802.11b mode**

| Channel | Frequency (MHz) | Reading (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|---|
| Low | 2412 | 1.05 | 8.00 | -6.95 | PASS |
| Middle | 2437 | 0.37 | 8.00 | -7.63 | PASS |
| High | 2462 | 0.61 | 8.00 | -7.39 | PASS |

**NOTE** : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

**IEEE 802.11g mode**

| Channel | Frequency (MHz) | Reading (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|---|
| Low | 2412 | -0.26 | 8.00 | -8.26 | PASS |
| Middle | 2437 | -1.21 | 8.00 | -9.21 | PASS |
| High | 2462 | -1.35 | 8.00 | -9.35 | PASS |

**NOTE** : 1. At finial test to get the worst-case emission at 6Mbps..
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

**IEEE 802.11n HT20 mode**

| Channel | Frequency (MHz) | Reading (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|---|
| Low | 2412 | -2.39 | 8.00 | -10.39 | PASS |
| Middle | 2437 | -2.34 | 8.00 | -10.34 | PASS |
| High | 2462 | -2.83 | 8.00 | -10.83 | PASS |

**NOTE** : 1. At finial test to get the worst-case emission at 7.2 Mbps long.
2. The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

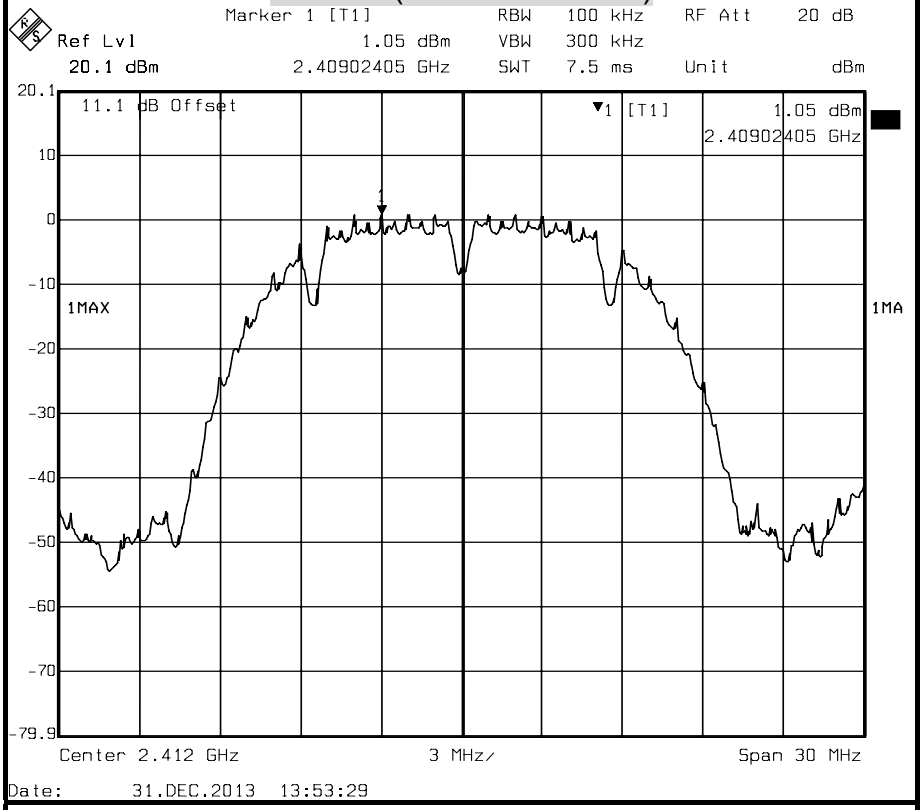
**IEEE 802.11n HT40 mode**

| Channel | Frequency (MHz) | Reading (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|---|
| Low | 2412 | -9.72 | 8.00 | -17.72 | PASS |
| Middle | 2437 | -7.97 | 8.00 | -15.97 | PASS |
| High | 2462 | -8.50 | 8.00 | -16.50 | PASS |

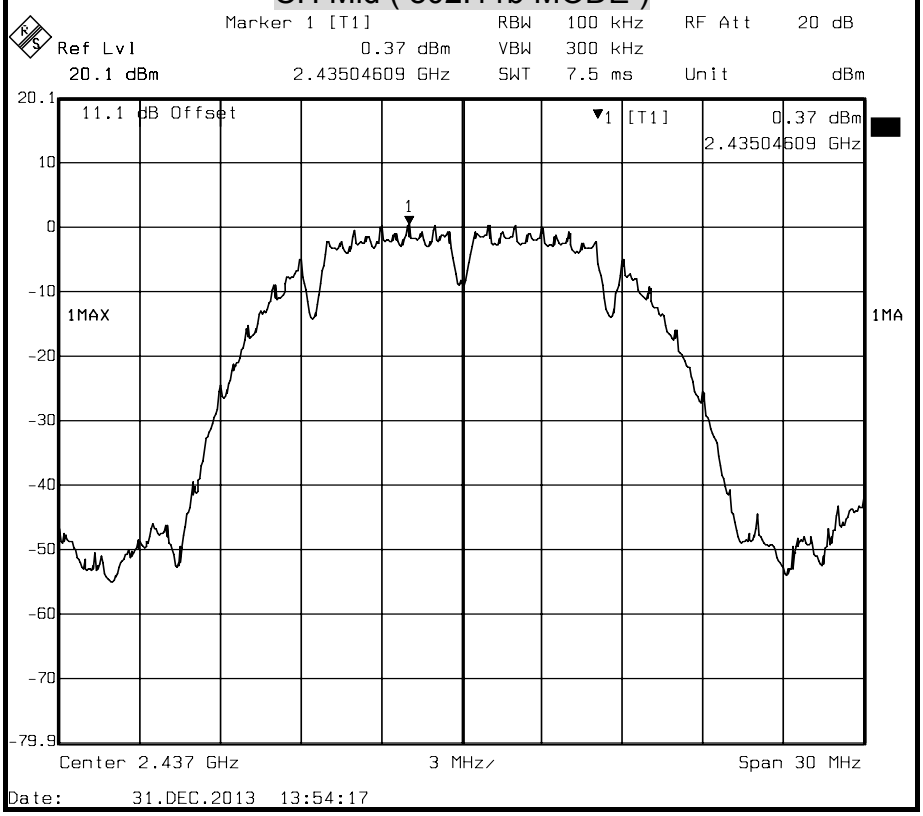
**NOTE** : 1. At finial test to get the worst-case emission at 15 Mbps..
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

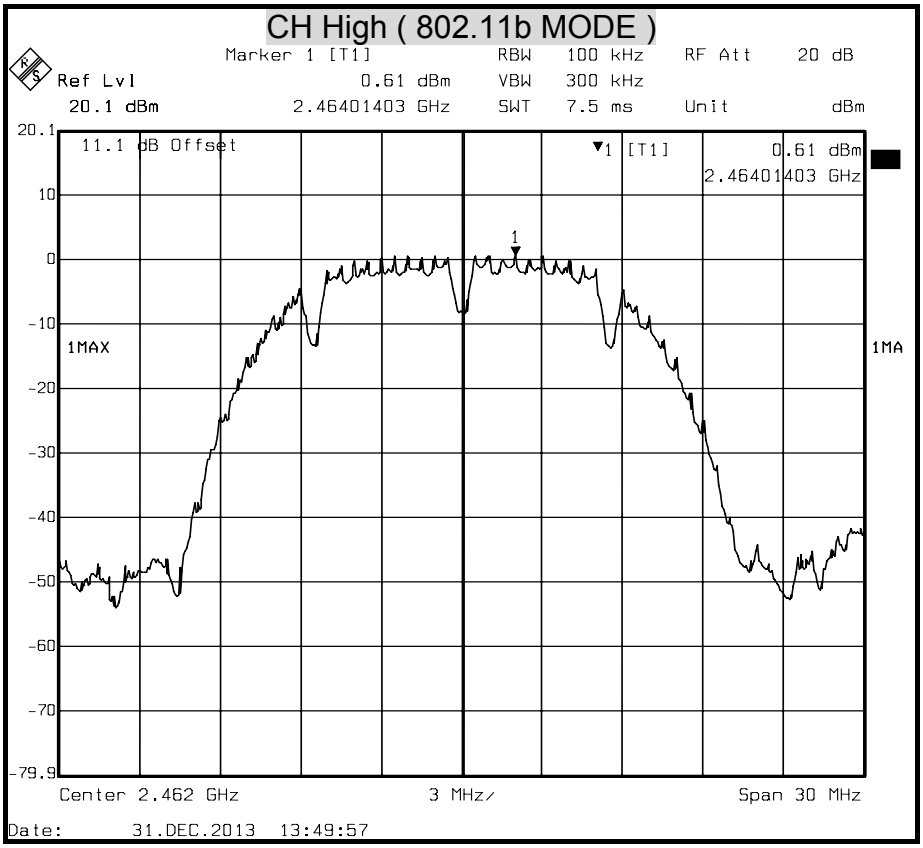
## POWER SPECTRAL DENSITY ( IEEE 802.11b MODE)

CH Low ( 802.11b MODE )



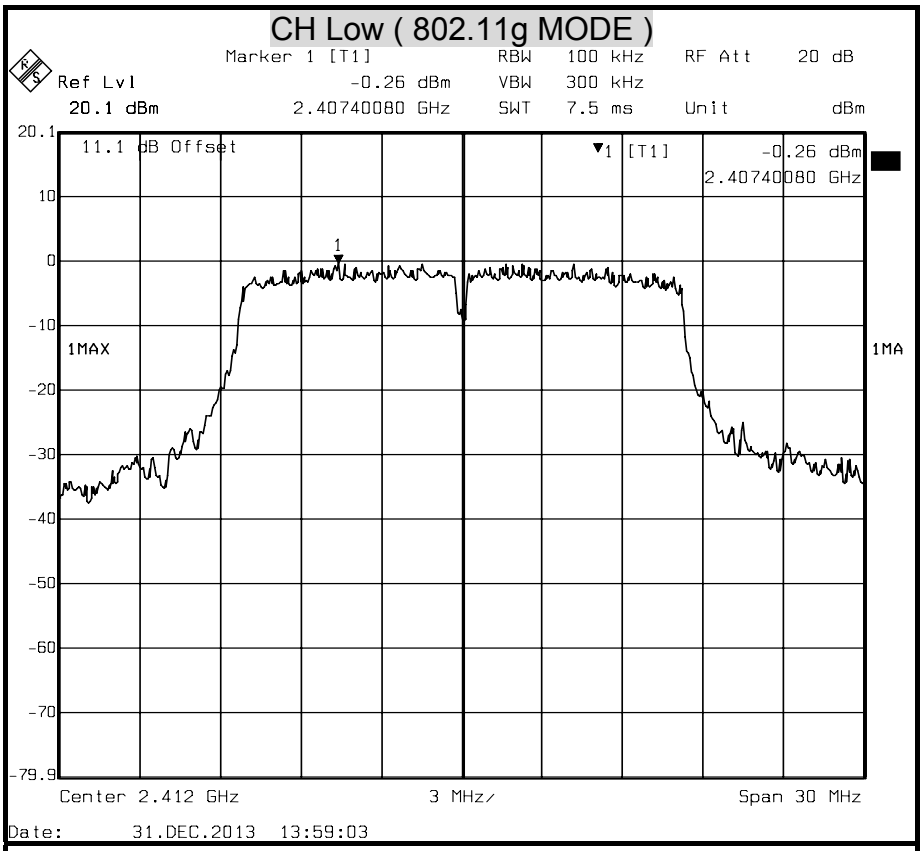

CH Mid ( 802.11b MODE )



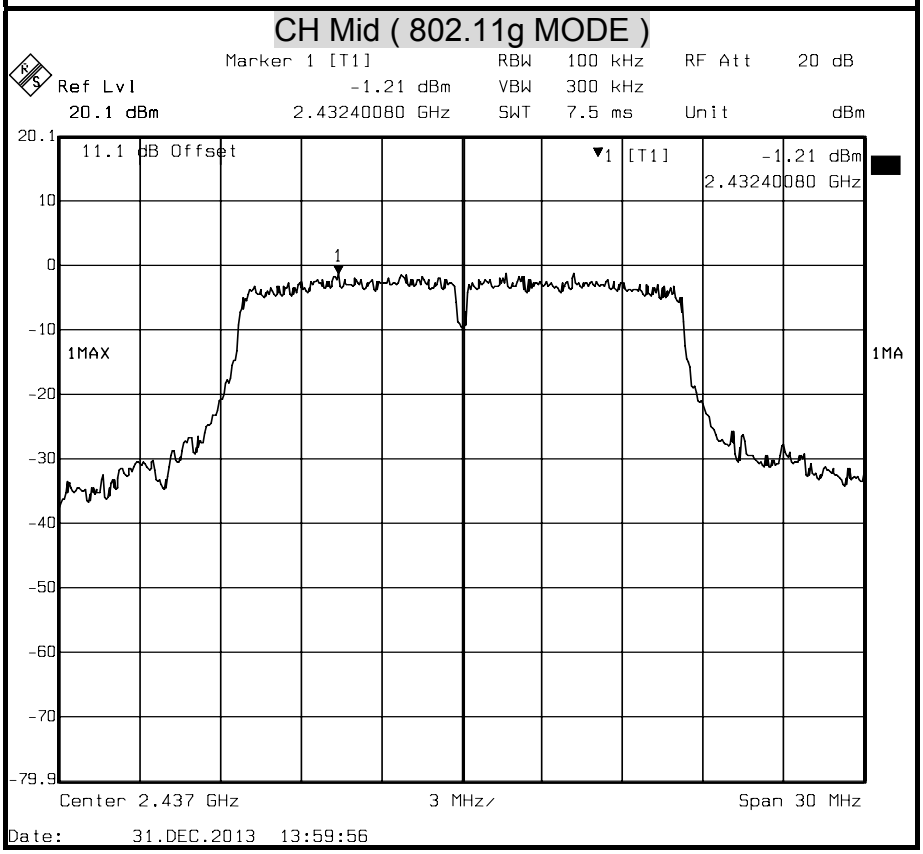

CH High ( 802.11b MODE )
Marker 1 [T1]
RBW 100 kHz
RF Att 20 dB
Ref Lvl
0.61 dBm
VBW 300 kHz
20.1 dBm
2.46401403 GHz
SWT 7.5 ms
Unit dBm
11.1 dB Offset
1 [T1]
0.61 dBm
2.46401403 GHz
1MAX
1MA
Center 2.462 GHz
3 MHz/
Span 30 MHz
Date: 31.DEC.2013 13:49:57

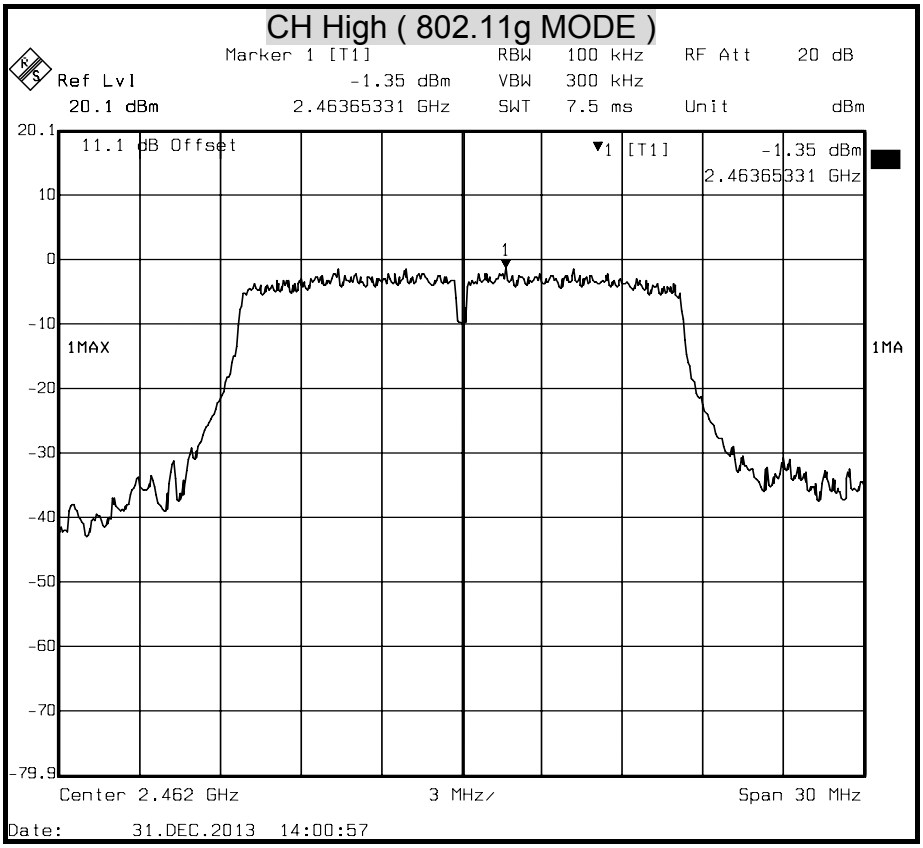
## POWER SPECTRAL DENSITY ( IEEE 802.11g MODE )

CH Low ( 802.11g MODE )



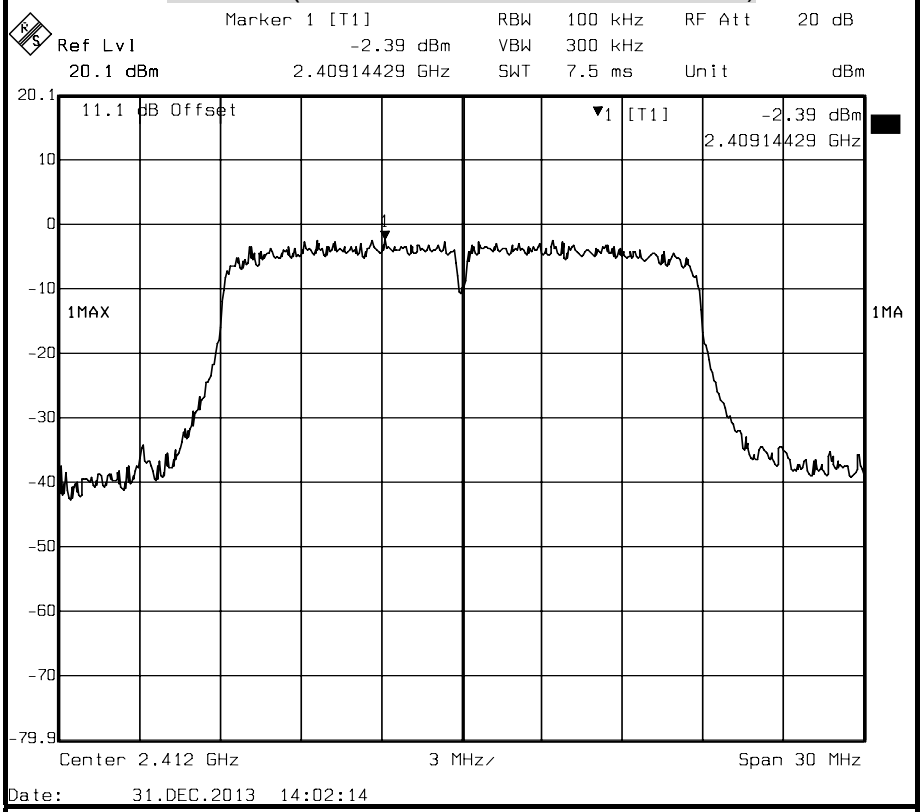

CH Mid ( 802.11g MODE )



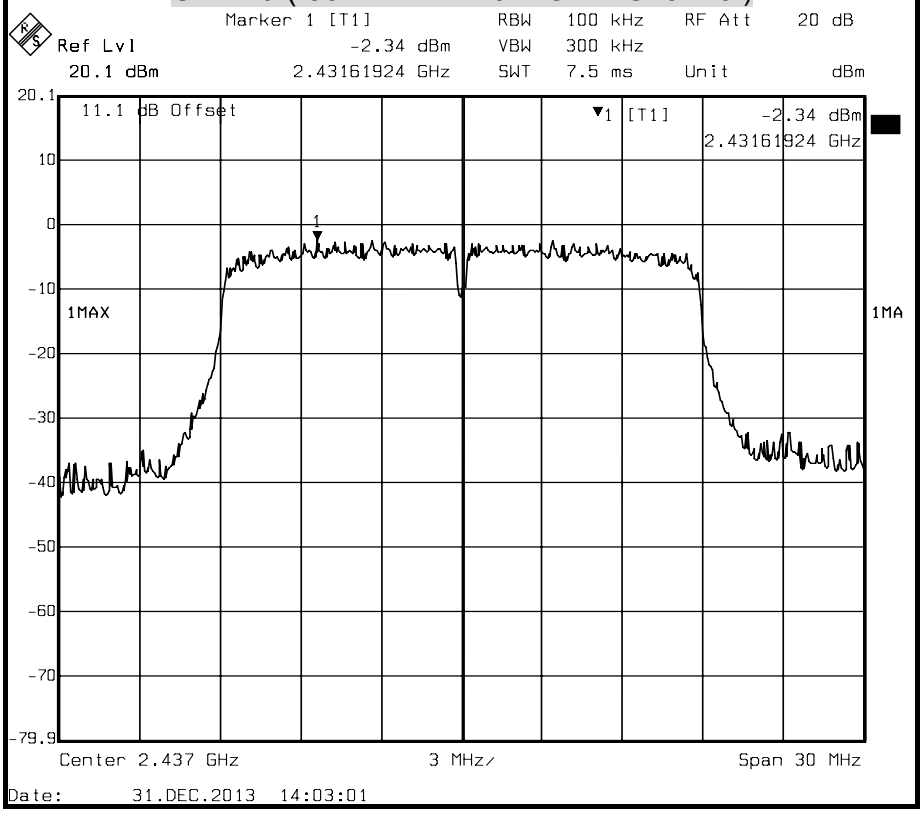

CH High ( 802.11g MODE )
Marker 1 [T1]
RBW 100 kHz
RF Att 20 dB
Ref Lvl
-1.35 dBm
VBW 300 kHz
20.1 dBm
2.46365331 GHz
SWT 7.5 ms
Unit dBm
11.1 dB Offset
▼1 [T1] -1.35 dBm
2.46365331 GHz
1MAX
1MA
Center 2.462 GHz
3 MHz/
Span 30 MHz
Date: 31.DEC.2013 14:00:57

## POWER SPECTRAL DENSITY ( 802.11n HT20 MODE )

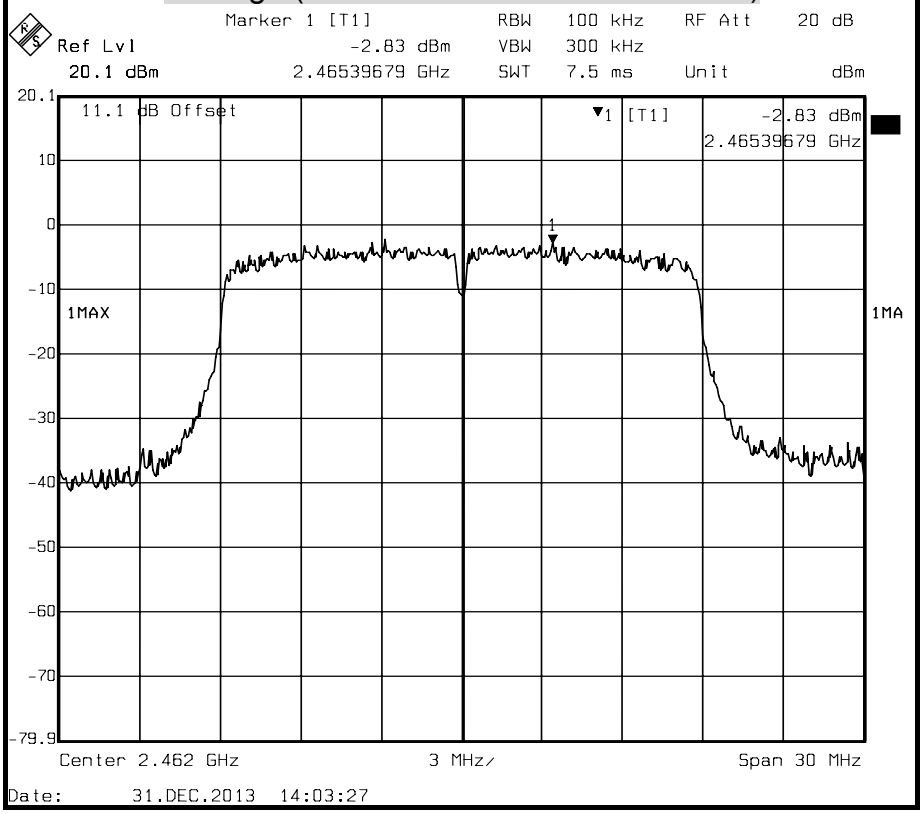
CH Low ( 802.11n HT20 MODE-Chain 0 )




CH Mid ( 802.11n HT20 MODE-Chain 0 )

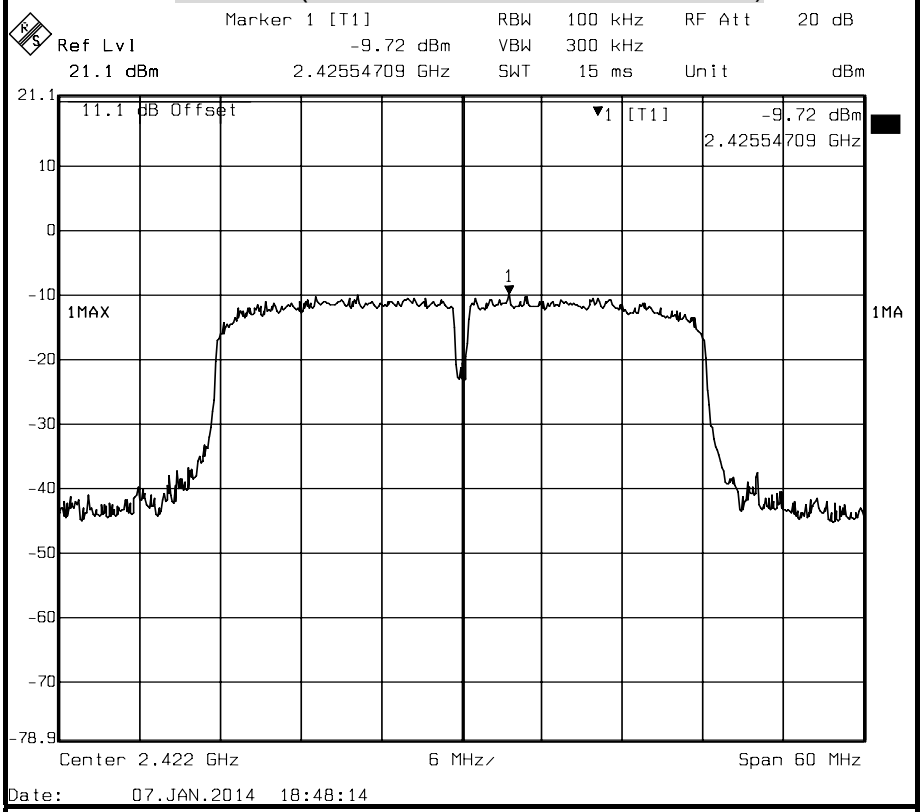


CH High ( 802.11n HT20 MODE-Chain 0 )

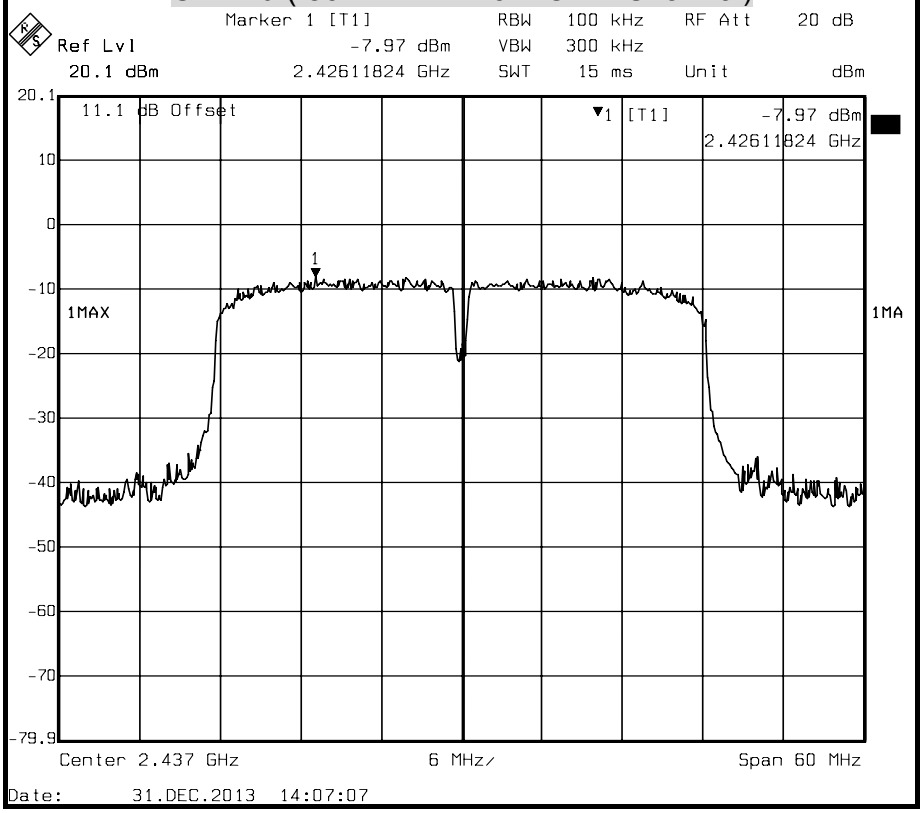


## POWER SPECTRAL DENSITY ( 802.11n HT40 MODE )

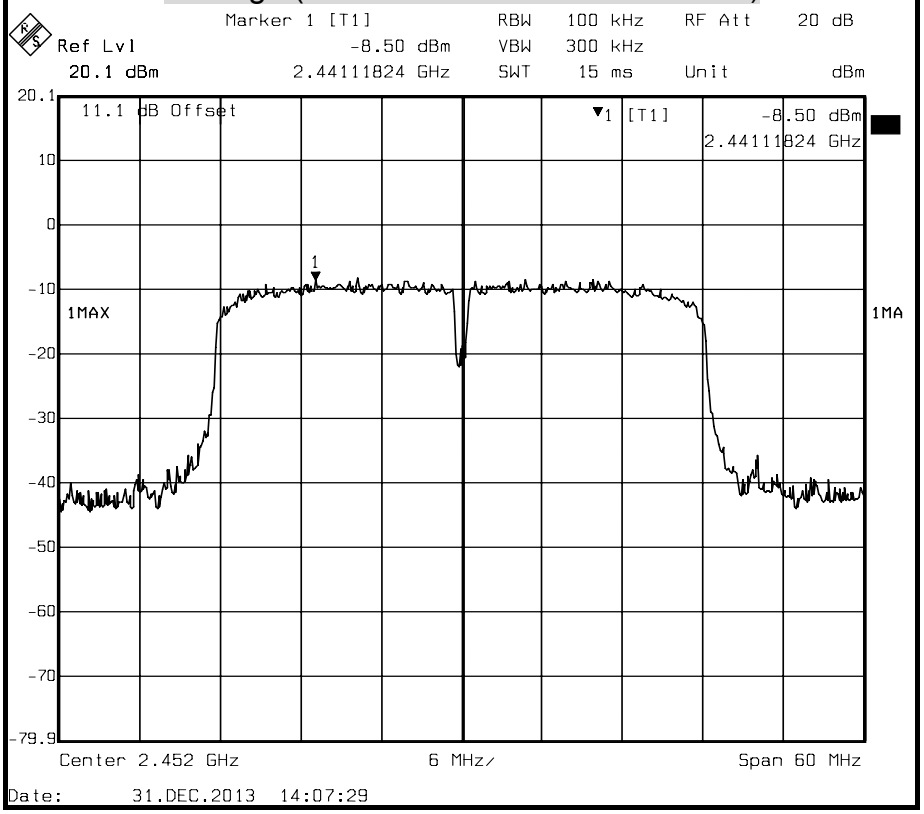
CH Low ( 802.11n HT40 MODE-Chain 0 )




CH Mid ( 802.11n HT40 MODE-Chain 0 )



CH High ( 802.11n HT40 MODE-Chain 0 )



## 8.5 CONDUCTED SPURIOUS EMISSION

**LIMITS**

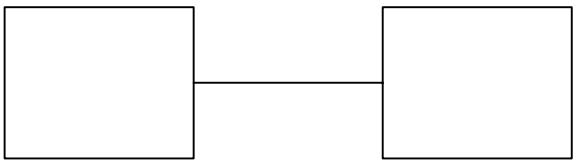
§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the and that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. 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 § 15.205(c)).

**TEST EQUIPMENT**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSEK 30 | 835253/002 | SEP. 29, 2014 |

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

**TEST SETUP**



**TEST PROCEDURE**

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

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

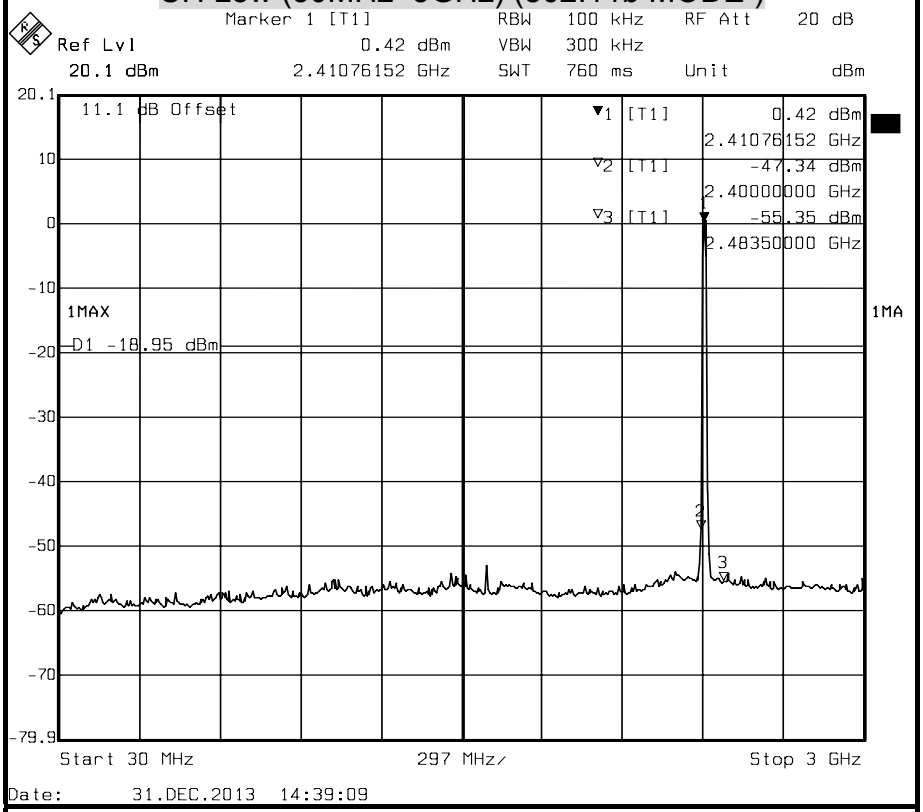
**TEST RESULTS**

No non-compliance noted.

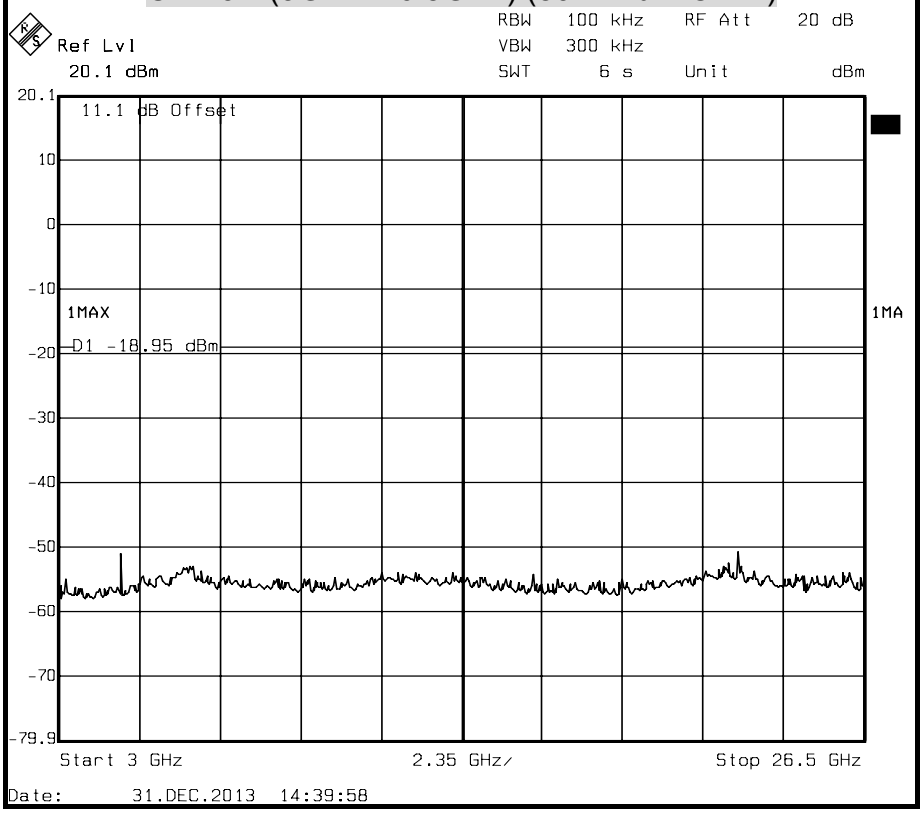
## OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

### ( IEEE 802.11b MODE )

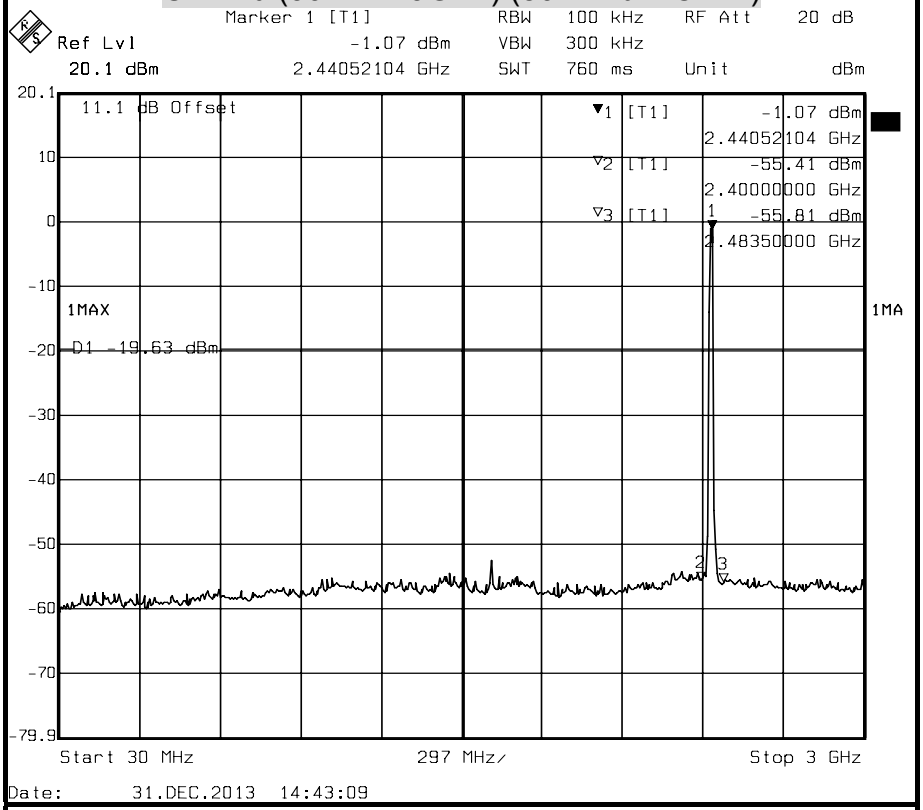
CH Low (30MHz~3GHz) (802.11b MODE )



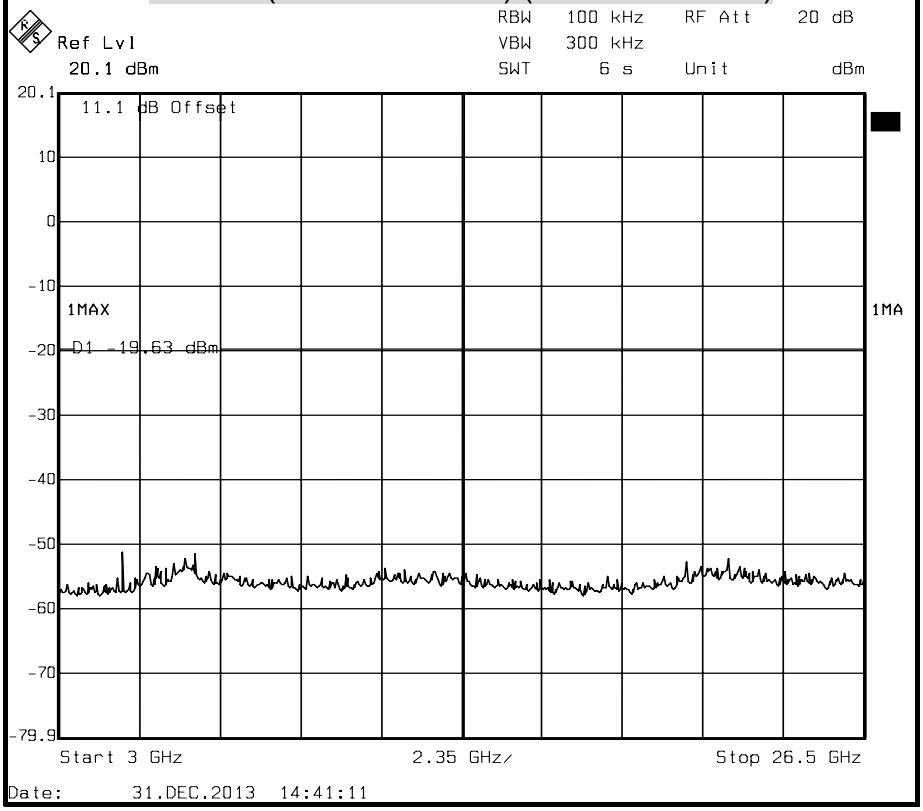

CH Low (3GHz~26.5GHz) (802.11b MODE )



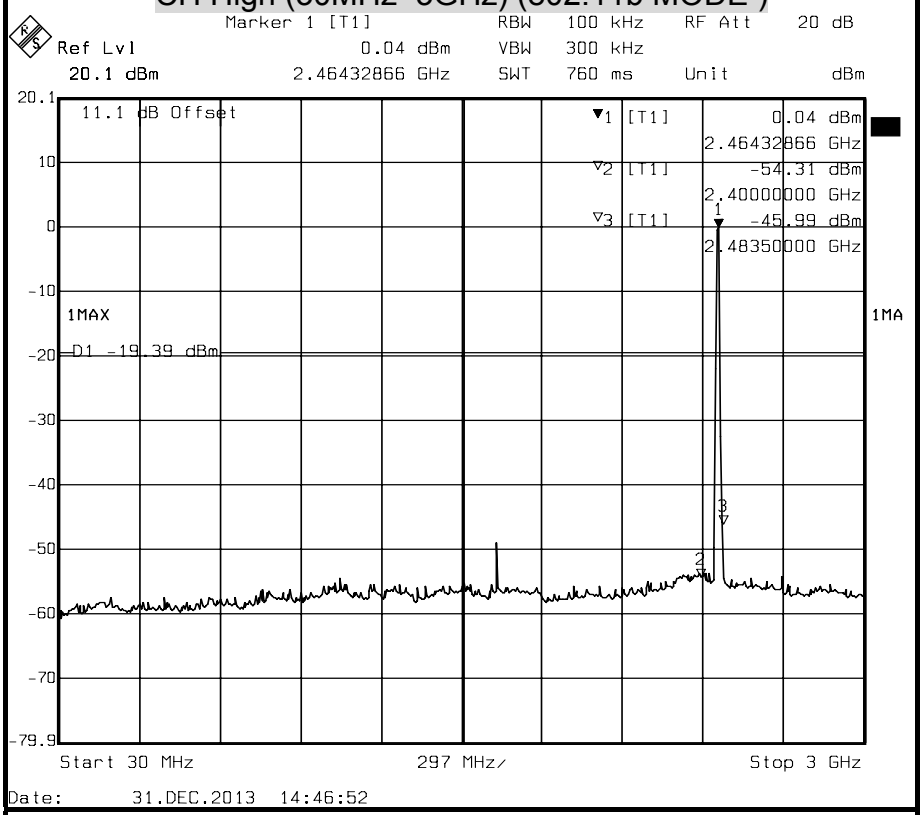
CH Mid (30MHz~3GHz) (802.11b MODE )



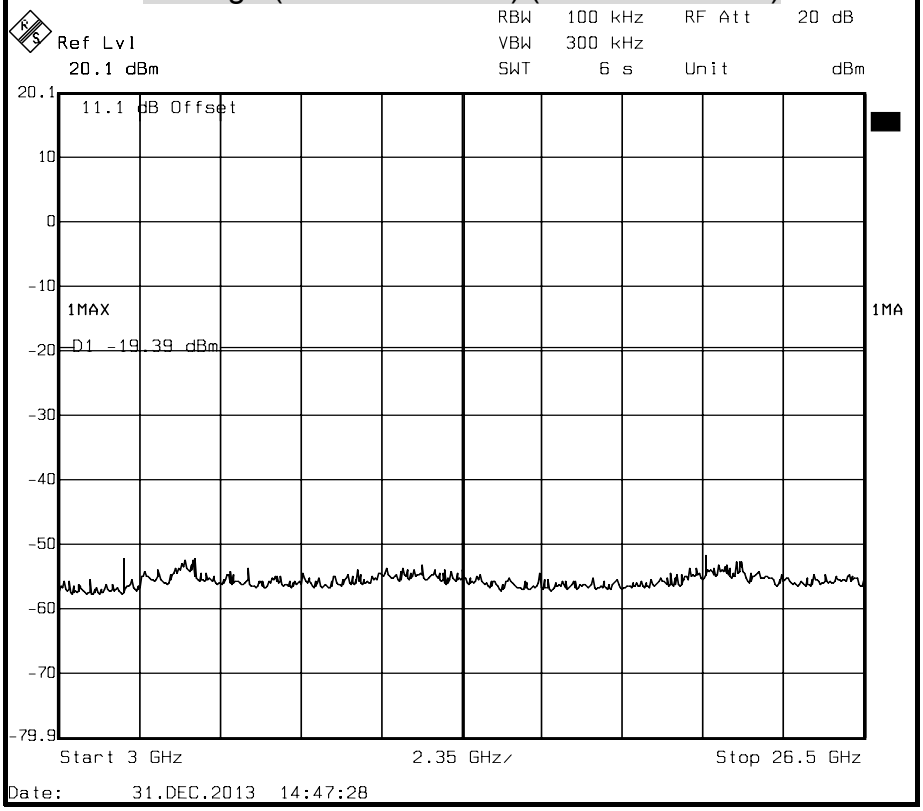

CH Mid (3GHz~26.5GHz) (802.11b MODE )



CH High (30MHz~3GHz) (802.11b MODE )



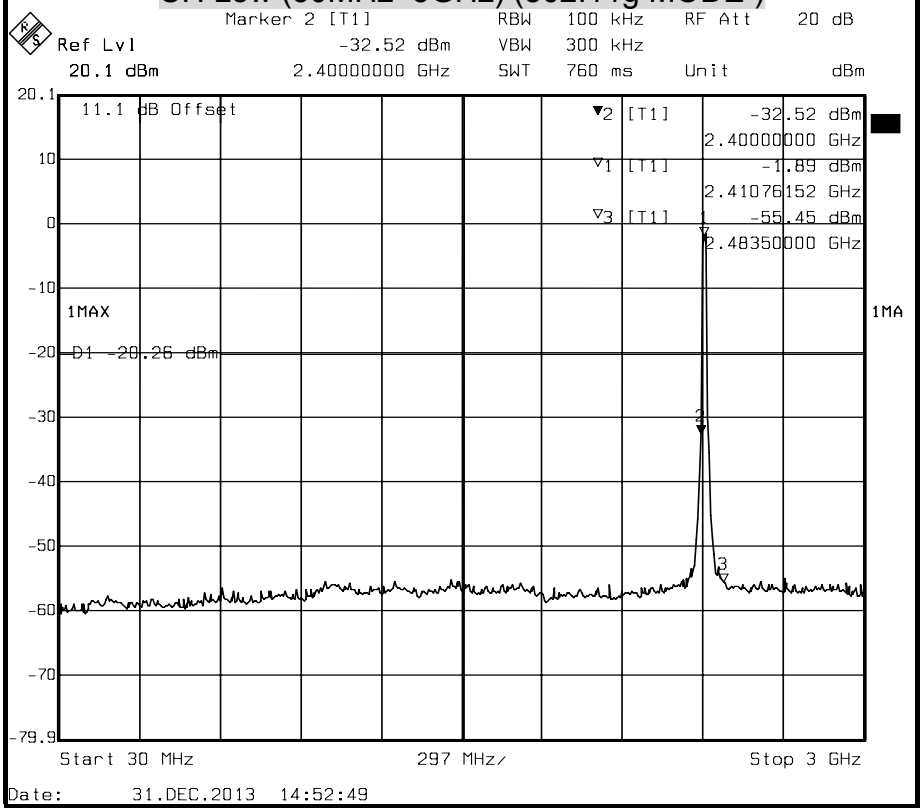

CH High (3GHz~26.5GHz) (802.11b MODE )



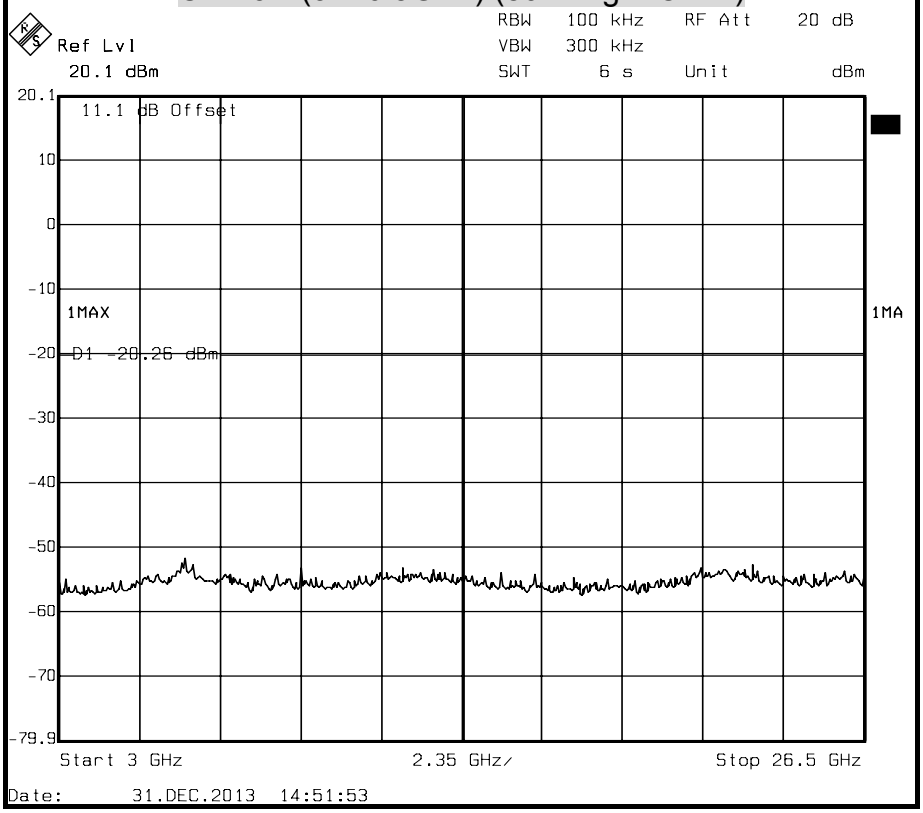
## OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

### ( 802.11g MODE )

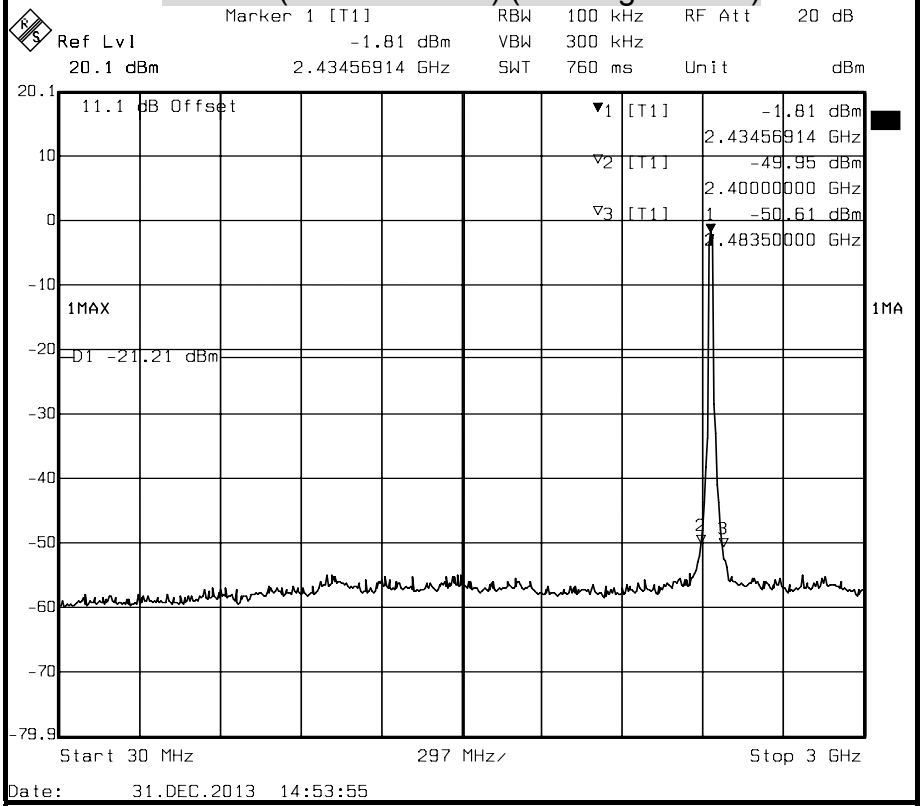
CH Low (30MHz~3GHz) (802.11g MODE )



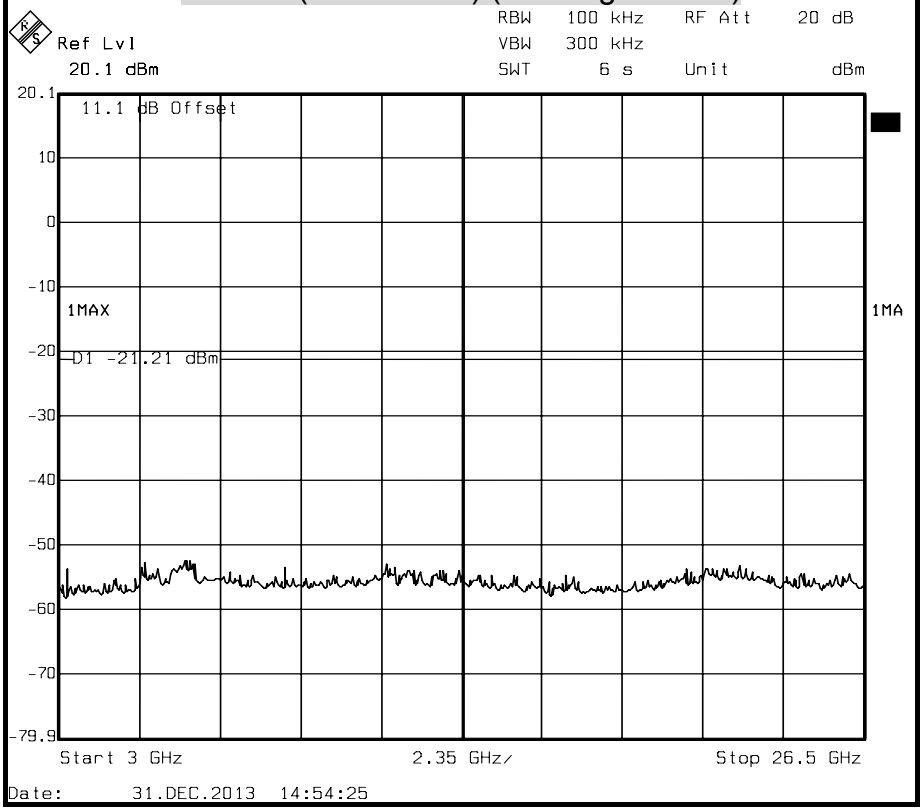

CH Low (3~26.5GHz) (802.11g MODE )



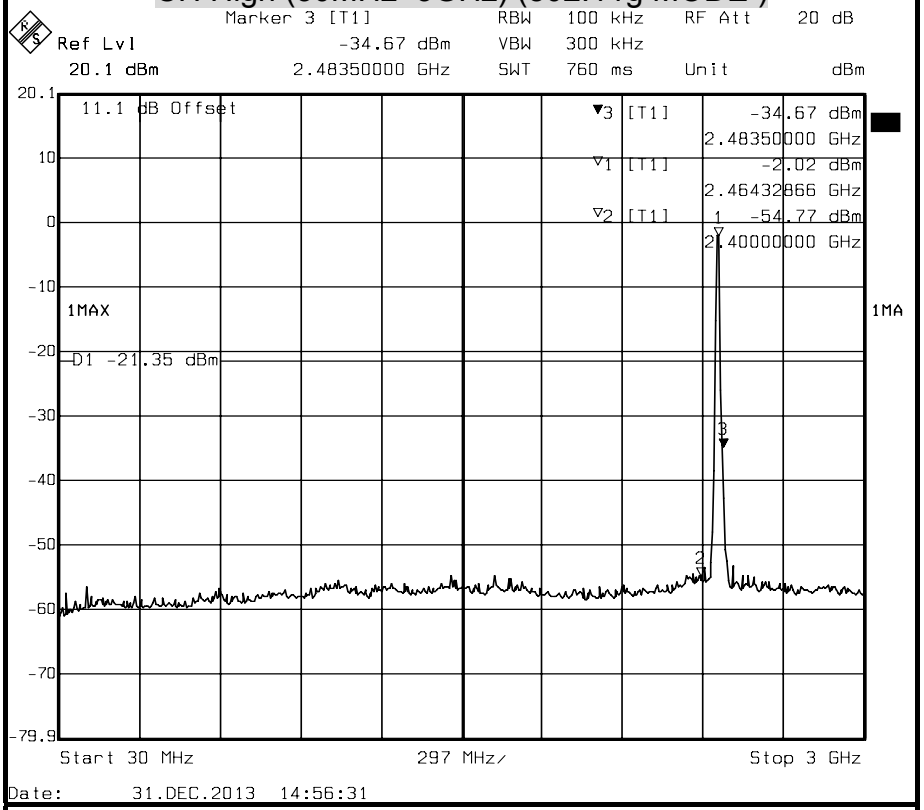
CH Mid (30MHz~3GHz) (802.11g MODE )



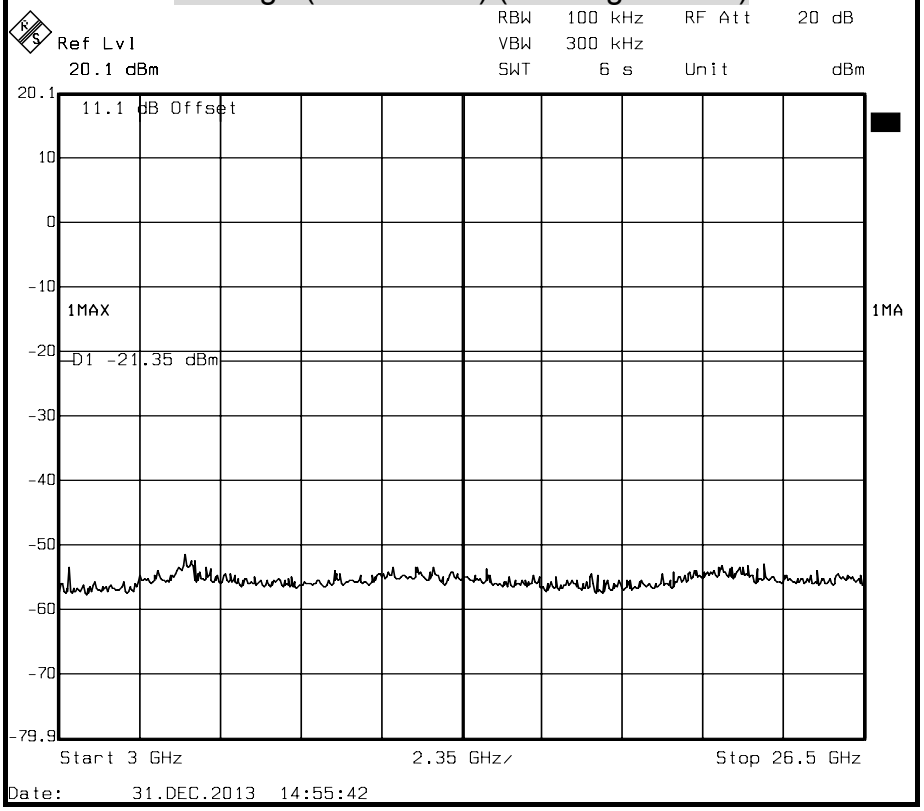

CH Mid (3~26.5GHz) (802.11g MODE )



CH High (30MHz~3GHz) (802.11g MODE )



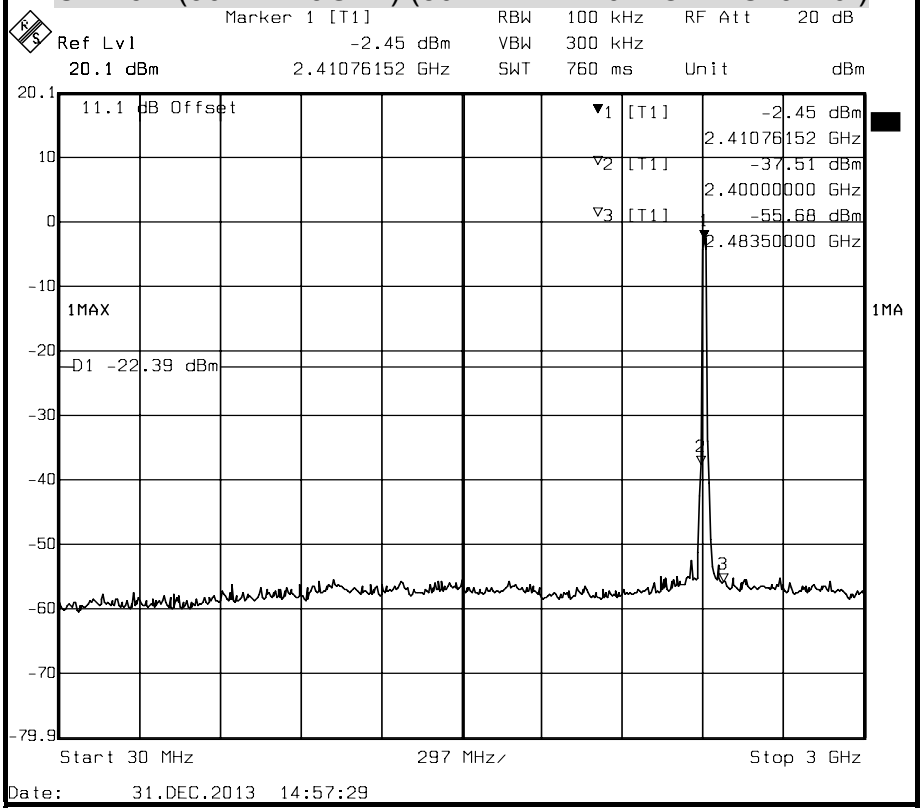

CH High (3~26.5GHz) (802.11g MODE )



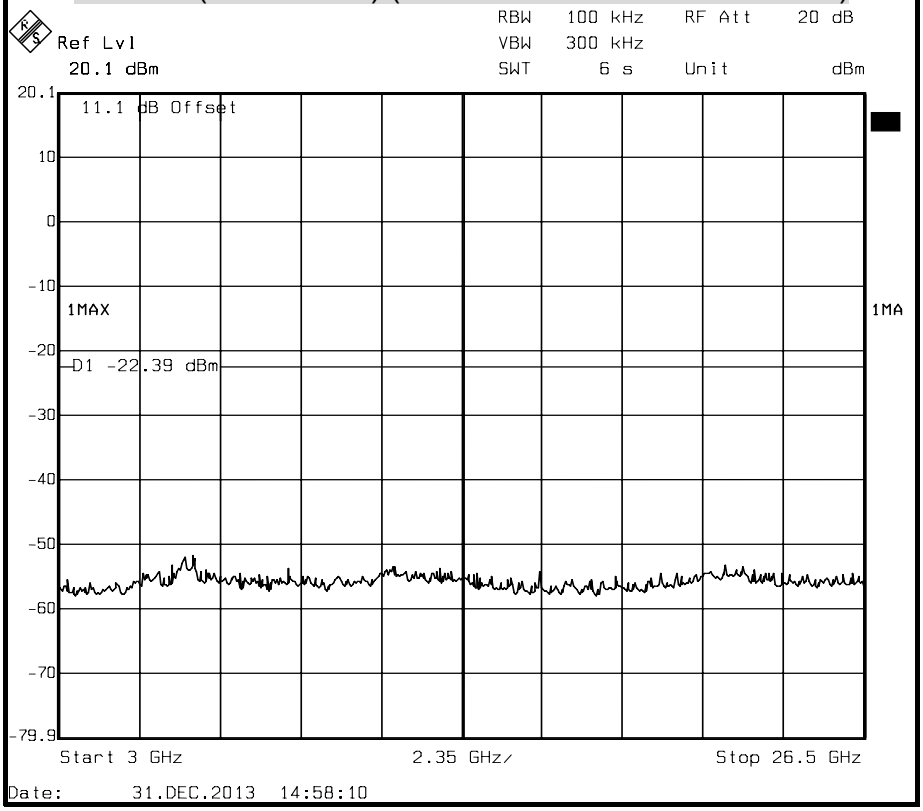
## OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

### ( 802.11n HT20 MODE )

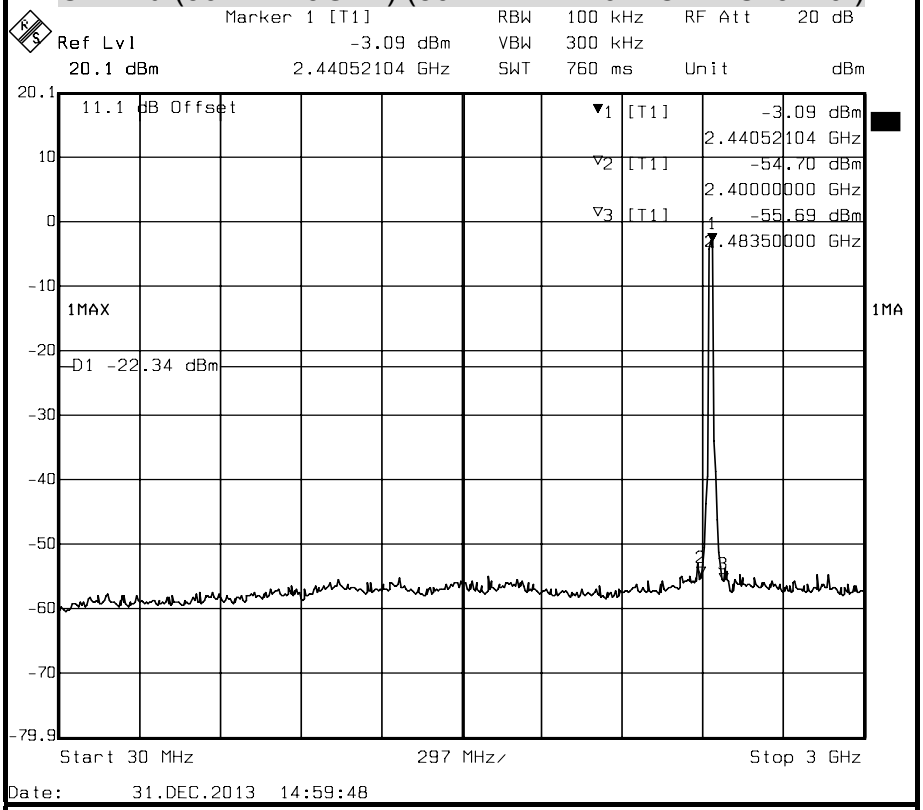
CH Low (30MHz~3GHz) (802.11n HT20 MODE-Chain 0 )



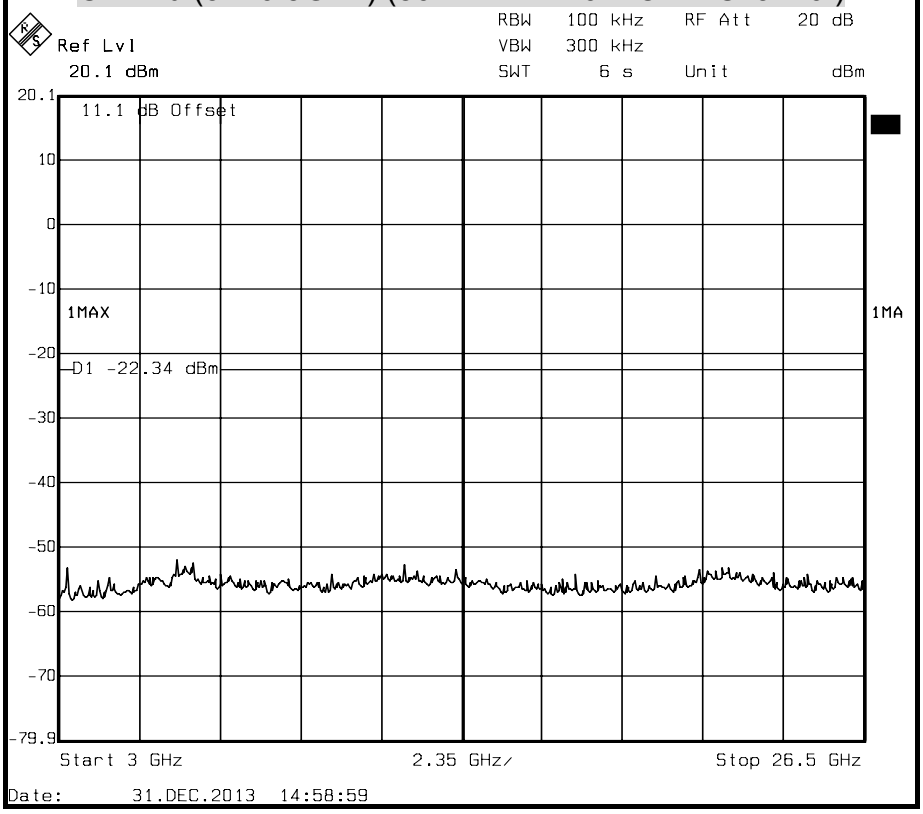

CH Low (3~26.5GHz) (802.11n HT20 MODE-Chain 0 )



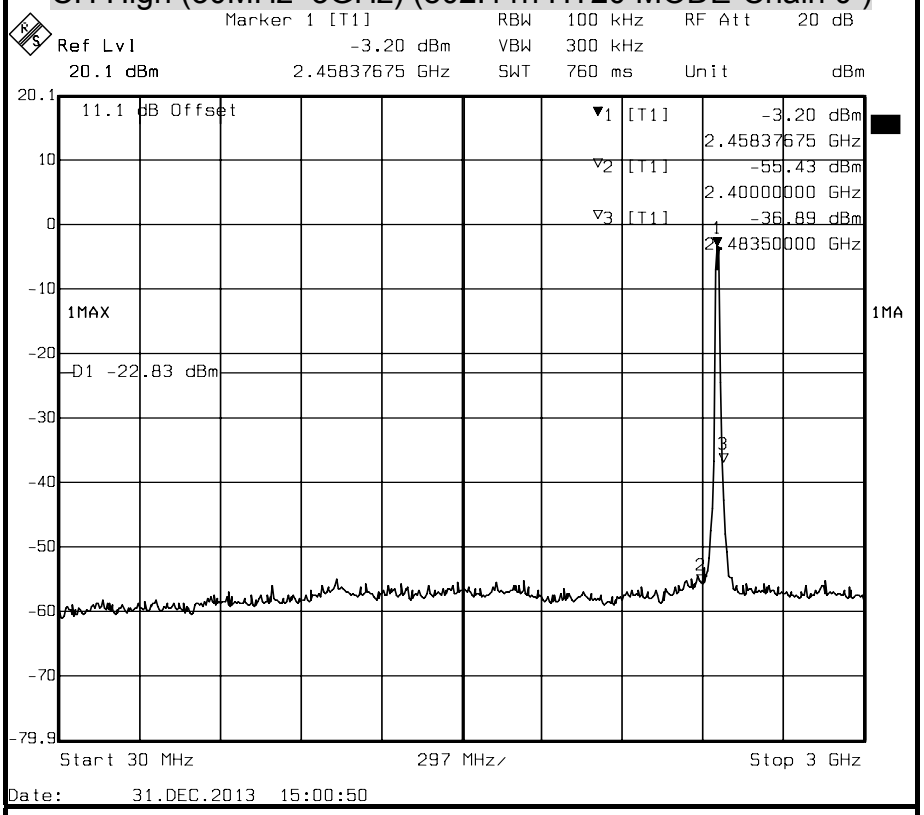
CH Mid (30MHz~3GHz) (802.11n HT20 MODE-Chain 0 )



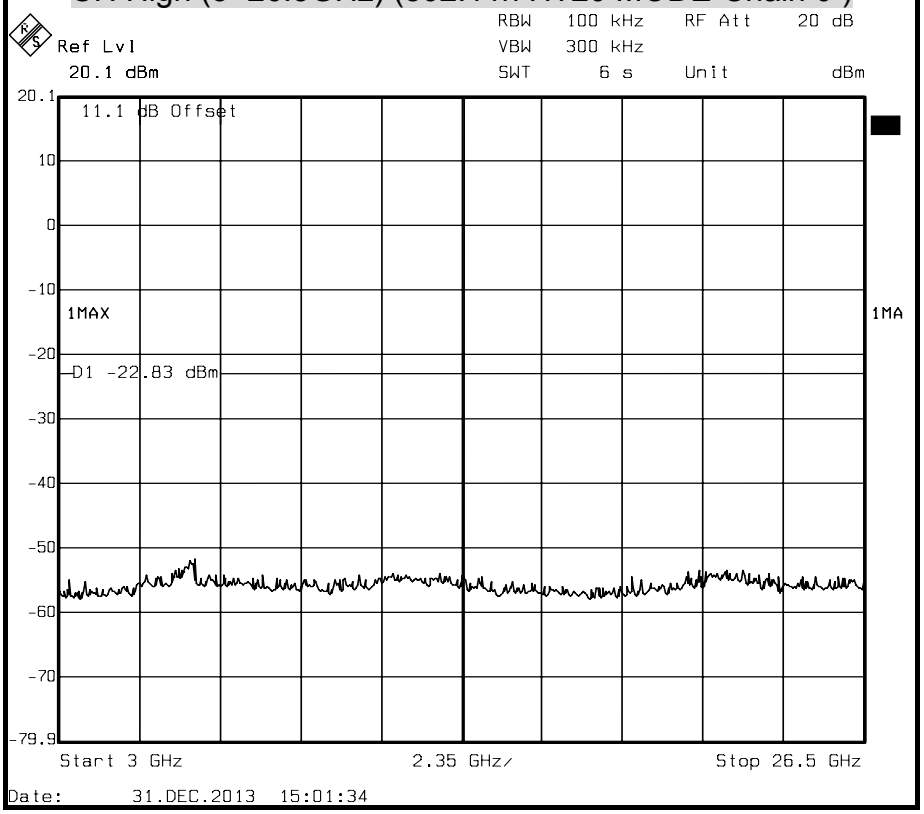

CH Mid (3~26.5GHz) (802.11n HT20 MODE-Chain 0 )



CH High (30MHz~3GHz) (802.11n HT20 MODE-Chain 0 )



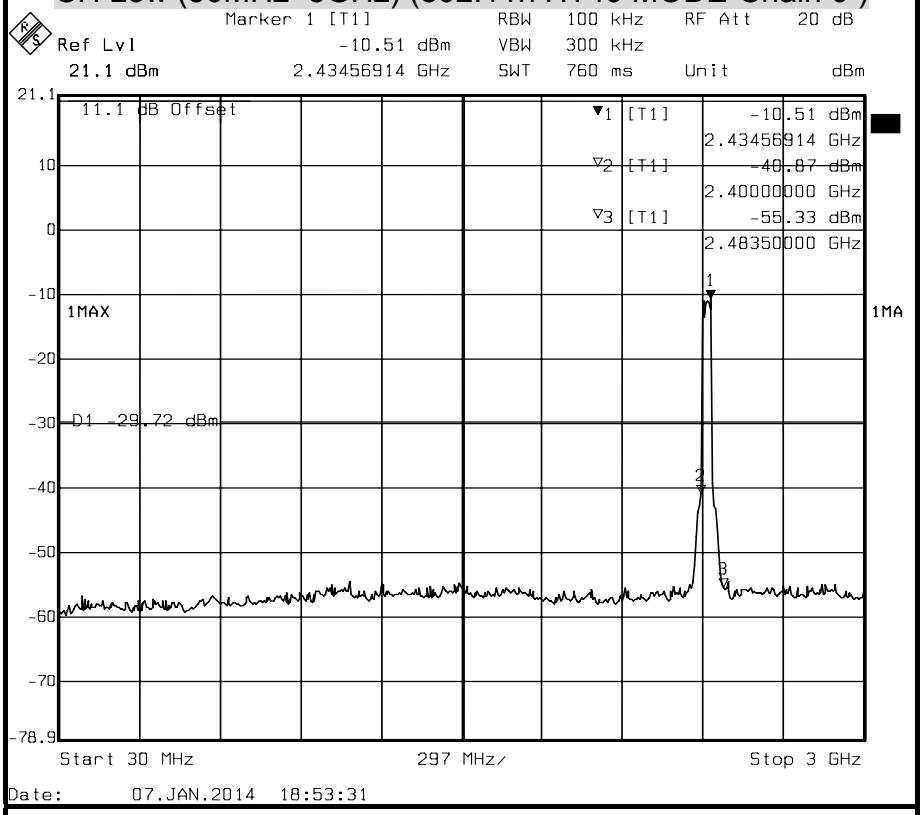

CH High (3~26.5GHz) (802.11n HT20 MODE-Chain 0 )



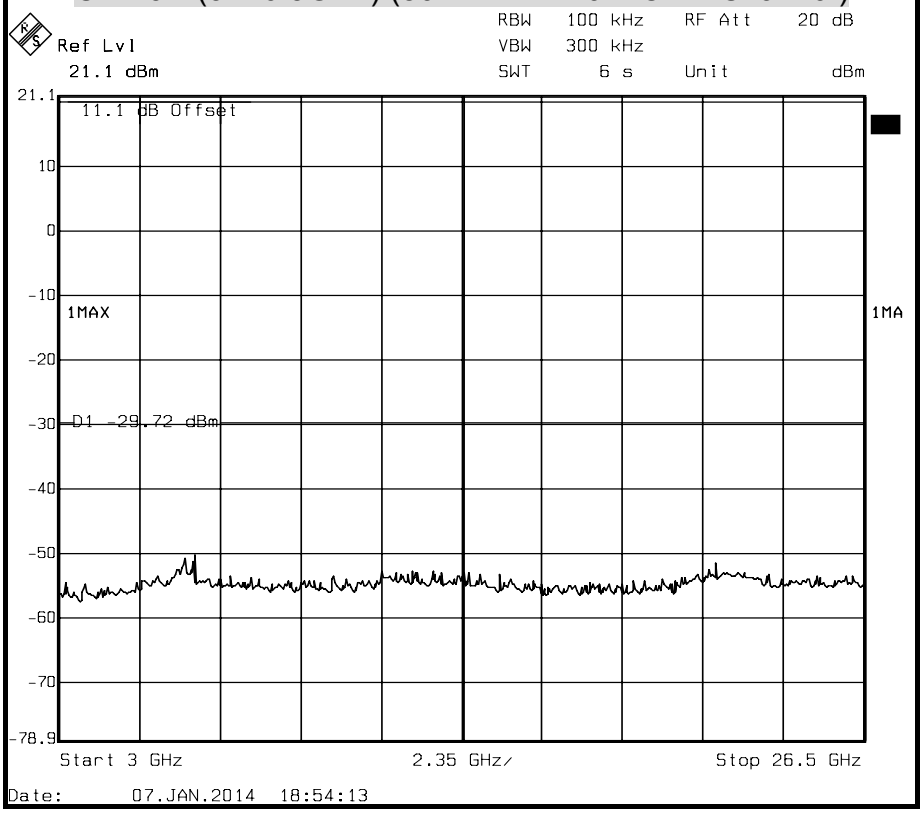
## OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

### ( 802.11n HT40 MODE )

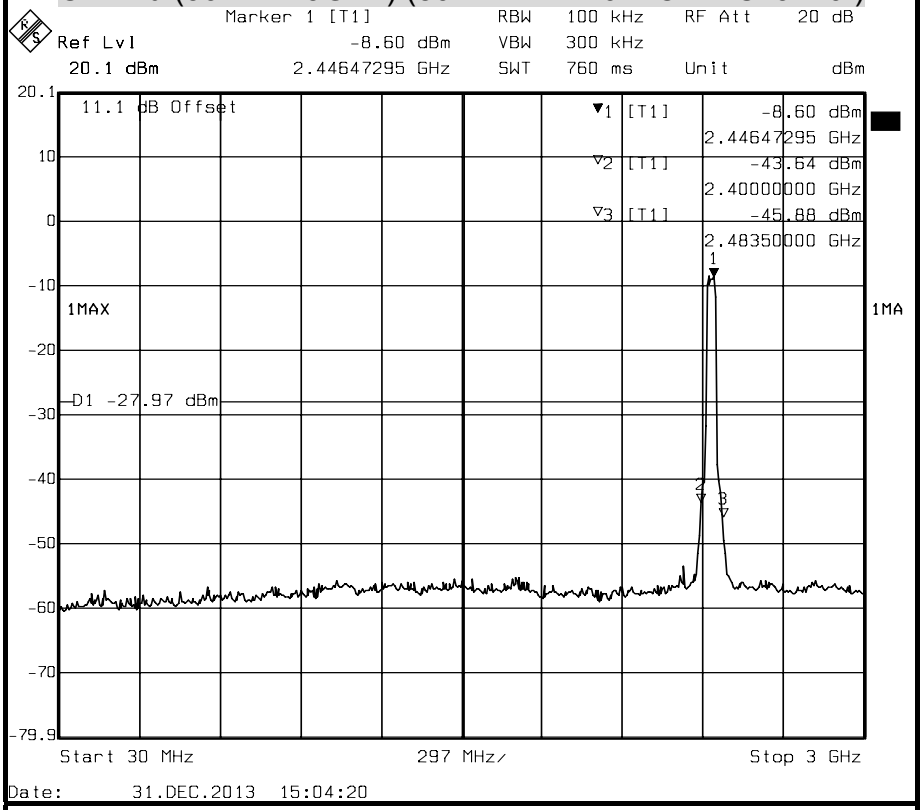
CH Low (30MHz~3GHz) (802.11n HT40 MODE-Chain 0 )



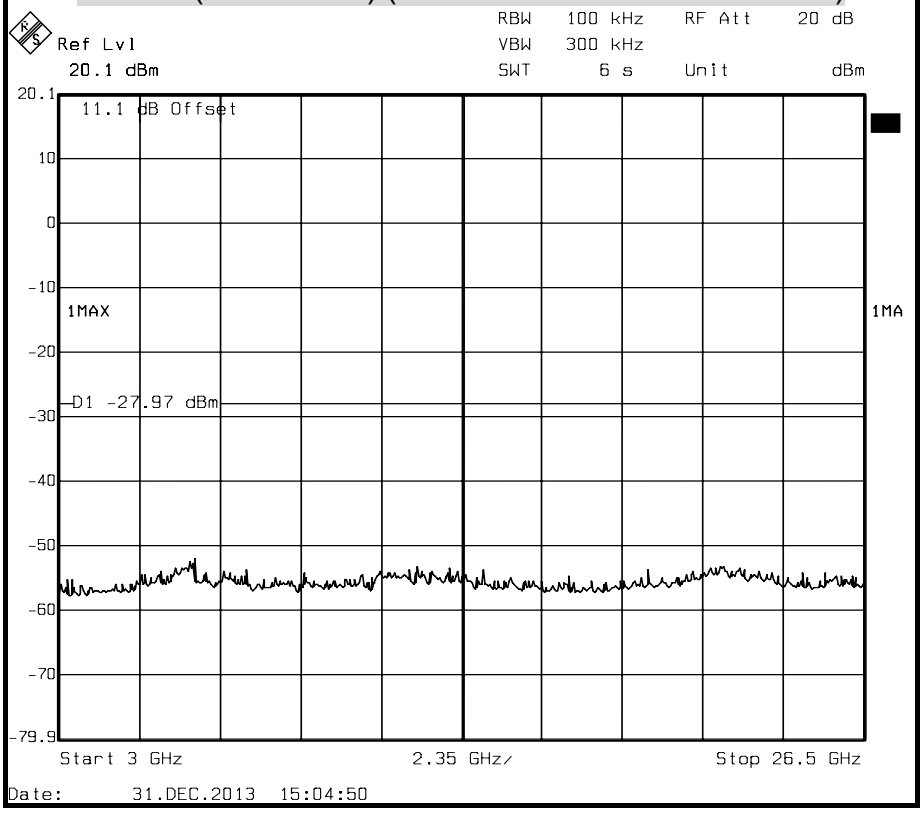

CH Low (3~26.5GHz) (802.11n HT40 MODE-Chain 0 )



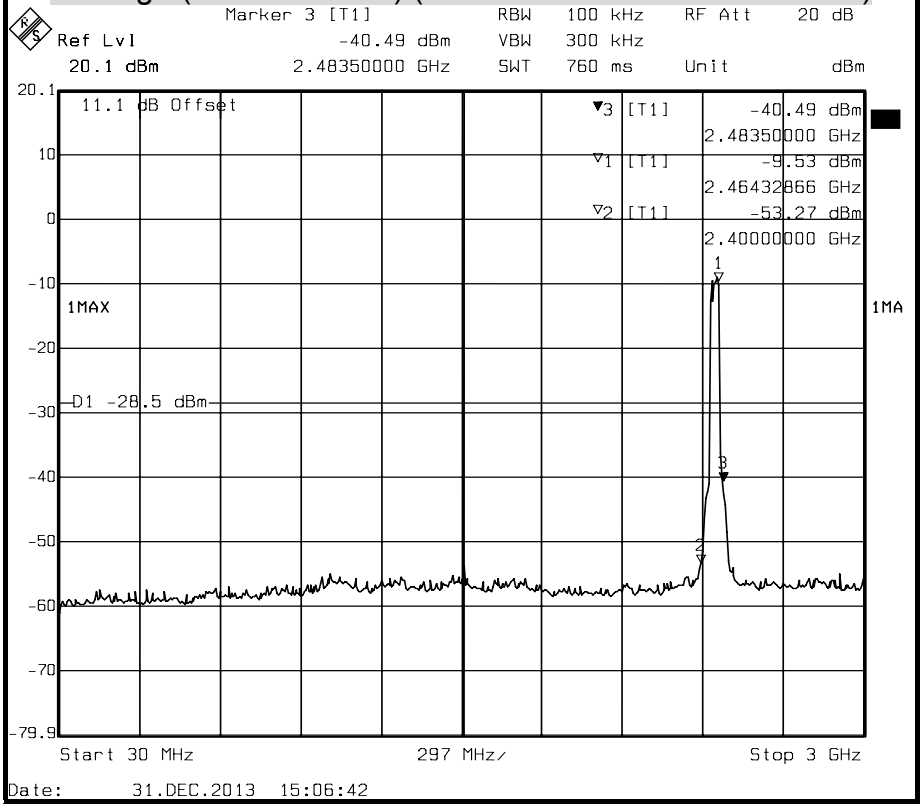
CH Mid (30MHz~3GHz) (802.11n HT40 MODE-Chain 0 )



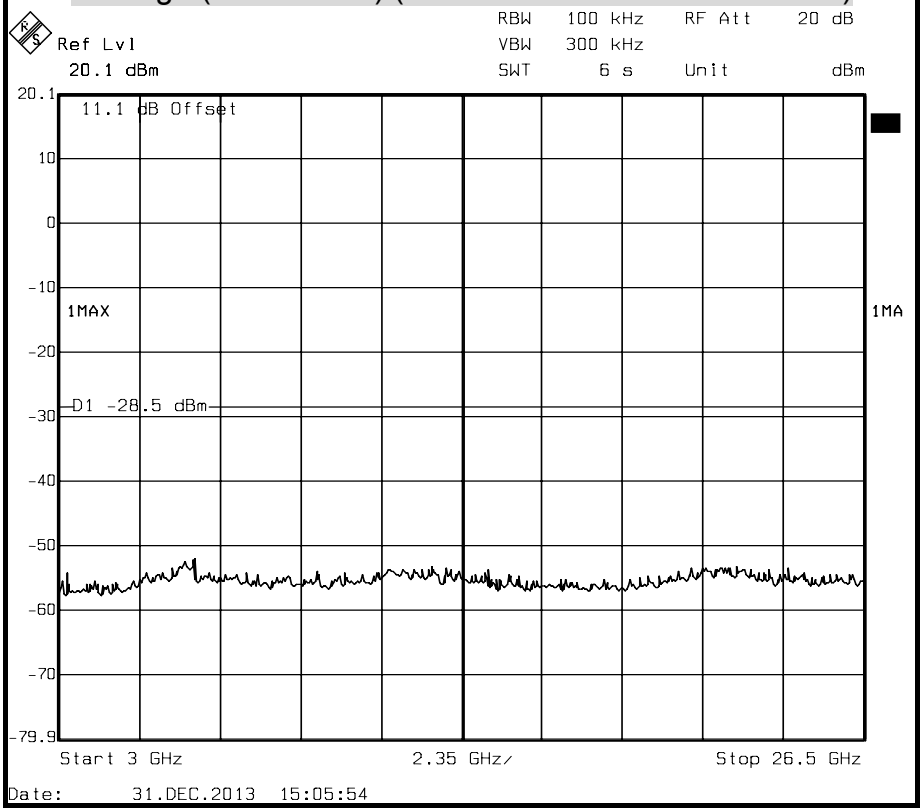

CH Mid (3~26.5GHz) (802.11n HT40 MODE-Chain 0 )



CH High (30MHz~3GHz) (802.11n HT40 MODE-Chain 0 )




CH High (3~26.5GHz) (802.11n HT40 MODE-Chain 0 )



## 8.6 RADIATED EMISSIONS

### 8.6.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS

**LIMITS**

§ 15.205 (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 - 156.52525 | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.7 - 156.9 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 162.0125 - 167.17 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 240 - 285 | 3345.8 - 3338 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 322 -335.4 | 3600 - 4400 | ([2]) |
| 13.36 - 13.41 | | | |

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

[2] Above 38.6

§ 15.205 (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 is 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.

§ 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 (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 30 - 88 | 100 ** | 3 |
| 88 - 216 | 150 ** | 3 |
| 216 - 960 | 200 ** | 3 |
| Above 960 | 500 | 3 |

** 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.

§ 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

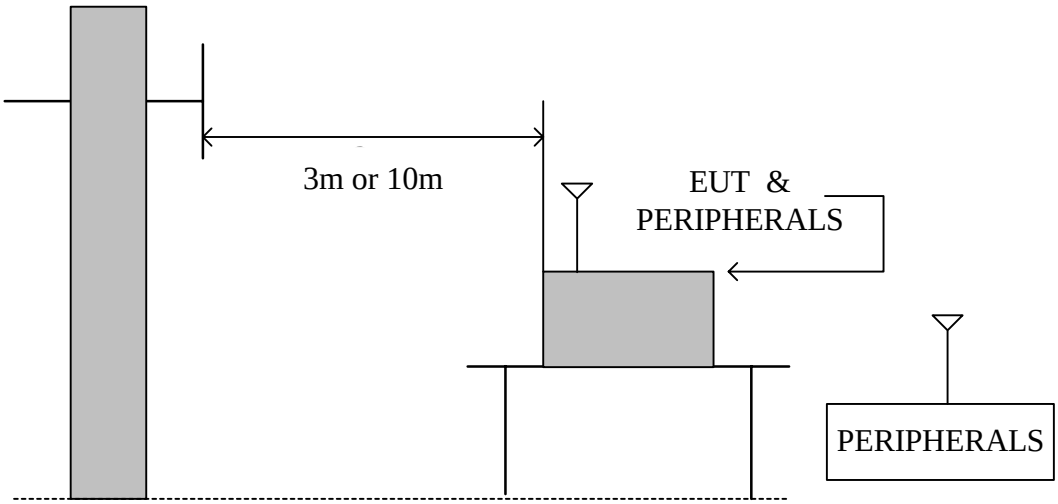
**TEST EQUIPMENTS**

The following test equipments are utilized in making the measurements contained in this report.

| Open Area Test Site # 6 | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| TYPE N COAXIAL CABLE | SUHNER | CHA9513 | 6 | DEC. 18, 2013 |
| BI-LOG Antenna | Sunol | JB1 | A070506-2 | SEP. 09, 2014 |
| LOOP ANTENNA | EMCO | 6502 | 8905-2356 | JUN. 10, 2011 |
| Pre-Amplifier | HP | 8447F | 2944A03817 | DEC.18, 2013 |
| Pre-Amplifier | EMCI | EMC 012645 | 833206/012 | DEC.20.2013 |
| EMI Receiver | R&S | ESVS10 | 20520/4PEA | JUN.29, 2013 |
| Horn Antenna | Com-Power | AH-118 | 071032 | DEC. 05, 2014 |
| 3116 Double Ridge Antenna (40G) | ETS-LINDGREN | 3116 | 835253/002 | JAN. 27, 2014 |
| Turn Table | Yo Chen | 001 | 200789 | N.C.R. |
| Antenna Tower | AR | TP1000A | 1205908 | N.C.R. |
| Controller | CT | SC101 | 00078 | N.C.R. |
| RF Swicth | E-INSTRUMENT TELH LTD | ERS-180A | ---------- | N.C.R |
| Spectrum Analyzer | R&S | FSU | 309874 | JUL.01.2013 |
| Spectrum Analyzer | R&S | FSEM | ---------- | NCR |
| Spectrum Analyzer | R&S | FSEK 30 | EC1204141 | SEP.28.2013 |
| Signal Analyzer | ROHDE&SCHWARZ | FSV 40 | 6K00003888 | APR. 25.2014 |
| Test S/W | e-3 (5.04303e) | | | |

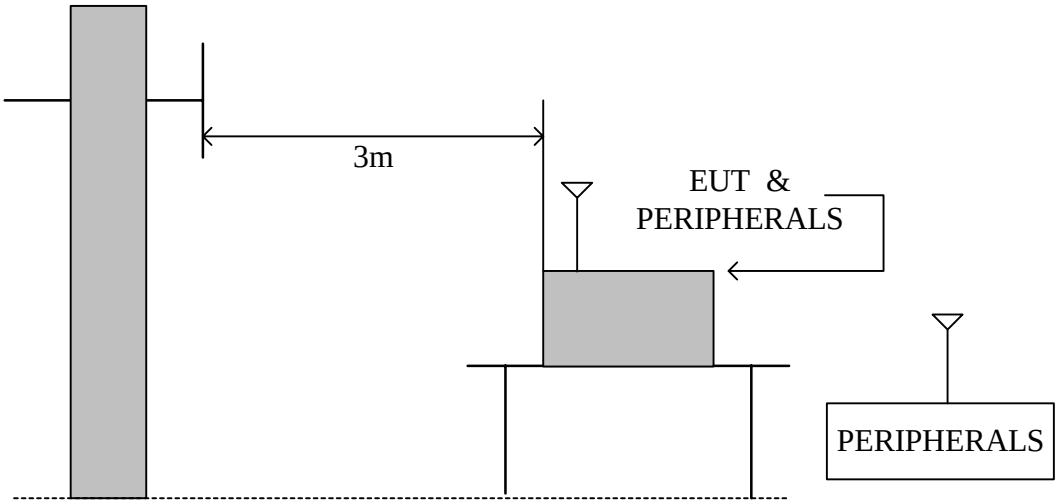
**TEST SETUP**

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 to 1GHz.




Antenna Elevation Variable

The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.




Antenna Elevation Variable

## TEST PROCEDURE

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.

b. White measuring the radiated emission below 1GHz, the EUT was set 3/10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. White measuring the radiated emission above 1GHz, the EUT was set 3 meters away from the interference-receiving antenna

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. The tests were performed in accordance with KDB 558074 5.4 .

**NOTE：**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.

2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.

3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.

4. No emission is found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)

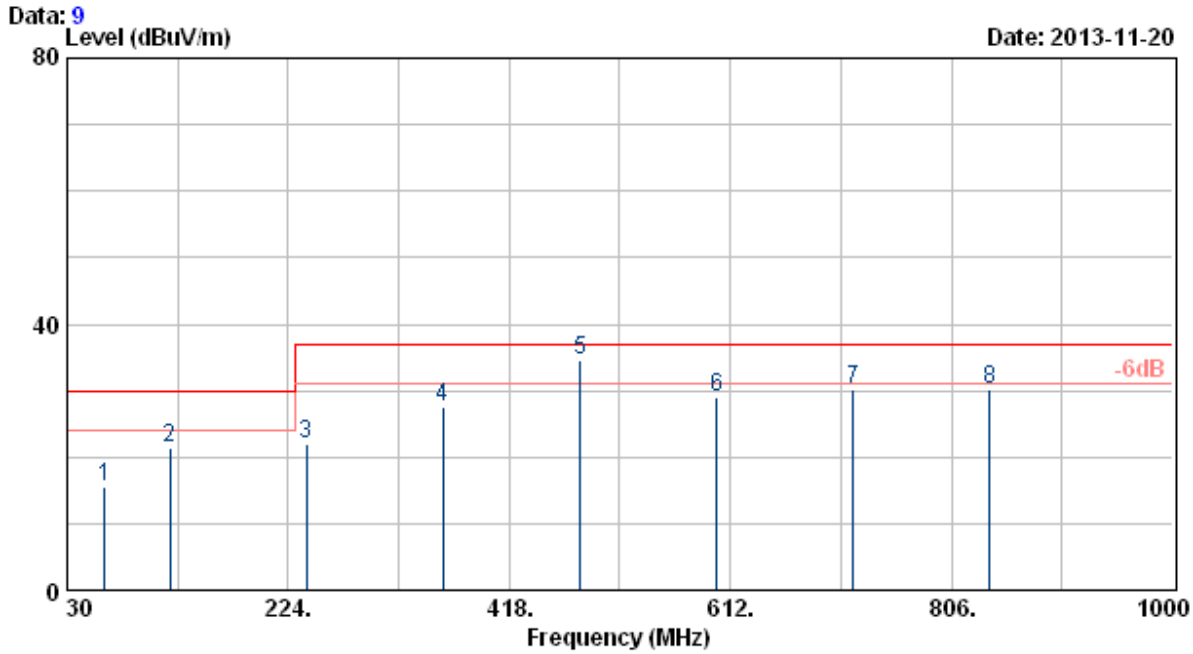
## TEST RESULTS

No non-compliance noted.

## 8.6.2 WORST-CASE RADIATED EMISSION BELOW 1 GHz

| | | | |
|---|---|---|---|
| **Model No.** | SPO120 | **Test Mode** | Normal Operation |
| **Environmental Conditions** | 28℃, 57% RH | **Resolution Bandwidth** | 120 kHz |
| **Antenna Pole** | Vertical | **Antenna Distance** | 10m |
| **Detector Function:** | Quasi-peak. | **Tested By** | Taiyu Cyu |
| **Test Site** | OATS 7 | | |

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

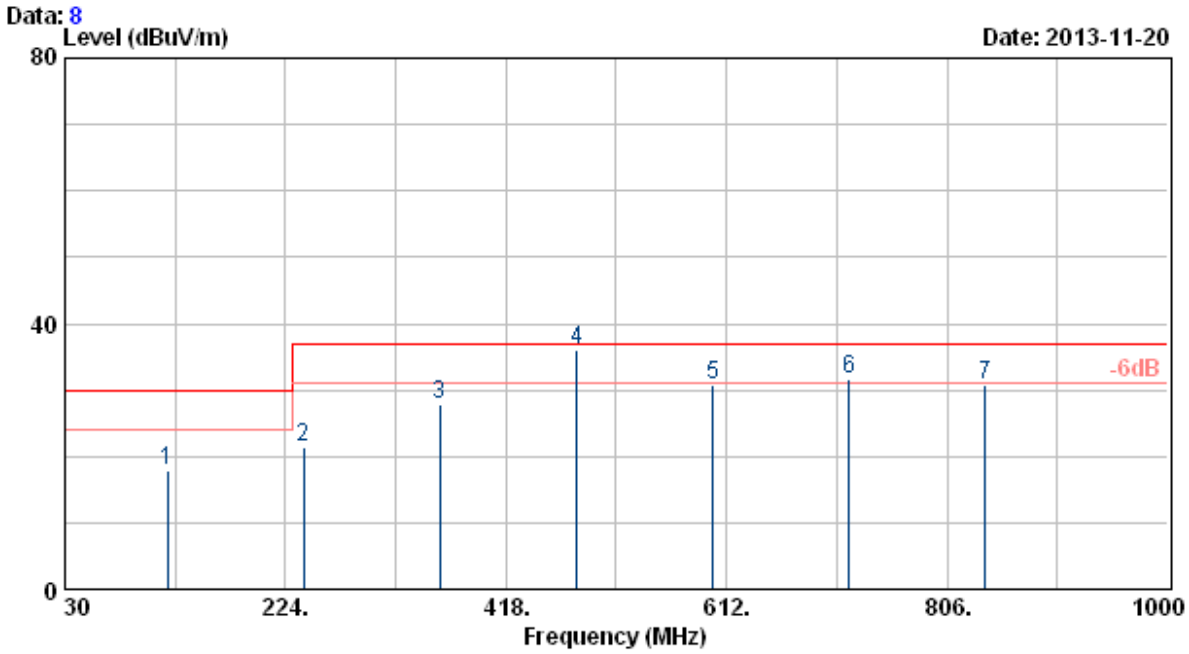



| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 63.35 | 6.23 | 7.66 | 1.63 | 15.52 | 30.00 | -14.48 | QP |
| 120.00 | 5.10 | 14.00 | 2.20 | 21.30 | 30.00 | -8.70 | QP |
| 240.00 | 7.05 | 11.60 | 3.44 | 22.09 | 37.00 | -14.91 | QP |
| 360.00 | 8.49 | 14.56 | 4.38 | 27.43 | 37.00 | -9.57 | QP |
| 480.00 | 11.87 | 17.45 | 5.34 | 34.66 | 37.00 | -2.34 | QP |
| 600.00 | 4.26 | 18.52 | 6.30 | 29.08 | 37.00 | -7.92 | QP |
| 720.00 | 2.99 | 20.27 | 6.96 | 30.22 | 37.00 | -6.78 | QP |
| 840.00 | 0.46 | 21.90 | 7.76 | 30.12 | 37.00 | -6.88 | QP |

Note: 1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit

| | | | |
|---|---|---|---|
| **Model No.** | SPO120 | **Test Mode** | Normal Operation |
| **Environmental Conditions** | 28℃, 57% RH | **Resolution Bandwidth** | 120 kHz |
| **Antenna Pole** | Horizontal | **Antenna Distance** | 10m |
| **Detector Function** | Quasi-peak. | **Tested By** | Taiyu Cyu |
| **Test Site** | OATS 7 | | |

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




| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 120.00 | 1.67 | 14.00 | 2.20 | 17.87 | 30.00 | -12.13 | QP |
| 240.00 | 6.38 | 11.60 | 3.44 | 21.42 | 37.00 | -15.58 | QP |
| 360.00 | 8.87 | 14.56 | 4.38 | 27.81 | 37.00 | -9.19 | QP |
| 480.00 | 13.12 | 17.45 | 5.34 | 35.91 | 37.00 | -1.09 | QP |
| 600.00 | 6.09 | 18.52 | 6.30 | 30.91 | 37.00 | -6.09 | QP |
| 720.00 | 4.37 | 20.27 | 6.96 | 31.60 | 37.00 | -5.40 | QP |
| 840.00 | 1.06 | 21.90 | 7.76 | 30.72 | 37.00 | -6.28 | QP |

Note: 1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit

## 8.6.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz

| Product Name | Smart Plug On/Offr | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11b TX (CH Low) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11b mode / 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) |
| * | 1320.00 | 58.12 | 26.02 | 2.07 | 44.82 | 0.30 | 41.68 | 74.00 | -32.32 | P |
| * | 1320.00 | 52.72 | 26.02 | 2.07 | 44.82 | 0.30 | 36.28 | 54.00 | -17.72 | A |
| | 3215.99 | 57.62 | 30.44 | 3.23 | 44.28 | 0.30 | 47.31 | 74.00 | -26.69 | P |
| | 3215.99 | 49.51 | 30.44 | 3.23 | 44.28 | 0.30 | 39.20 | 54.00 | -14.80 | A |
| * | 4823.90 | 62.17 | 33.47 | 3.84 | 45.07 | 0.40 | 54.80 | 74.00 | -19.20 | P |
| * | 4823.90 | 56.92 | 33.47 | 3.84 | 45.07 | 0.40 | 49.55 | 54.00 | -4.45 | A |

| | TX / IEEE 802.11b mode / 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) |
| * | 1320.02 | 59.18 | 26.02 | 2.07 | 44.82 | 0.30 | 42.74 | 74.00 | -31.26 | P |
| * | 1320.02 | 53.16 | 26.02 | 2.07 | 44.82 | 0.30 | 36.72 | 54.00 | -17.28 | A |
| | 3216.01 | 55.42 | 30.44 | 3.23 | 44.28 | 0.30 | 45.11 | 74.00 | -28.89 | P |
| | 3216.01 | 47.69 | 30.44 | 3.23 | 44.28 | 0.30 | 37.38 | 54.00 | -16.62 | A |
| * | 4823.91 | 59.70 | 33.47 | 3.84 | 45.07 | 0.40 | 52.33 | 74.00 | -21.67 | P |
| * | 4823.94 | 54.48 | 33.47 | 3.84 | 45.07 | 0.40 | 47.11 | 54.00 | -6.89 | A |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11b TX (CH Middle) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11b mode / CH Middle | | | | 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) |
| * | 1320.11 | 60.25 | 26.02 | 2.07 | 44.82 | 0.30 | 43.81 | 74.00 | -30.19 | P |
| * | 1320.11 | 55.35 | 26.02 | 2.07 | 44.82 | 0.30 | 38.91 | 54.00 | -15.09 | A |
| * | 4874.02 | 59.42 | 33.65 | 3.85 | 45.13 | 0.40 | 52.19 | 74.00 | -21.81 | P |
| * | 4874.02 | 55.02 | 33.65 | 3.85 | 45.13 | 0.40 | 47.79 | 54.00 | -6.21 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

l

| | TX / IEEE 802.11b mode / CH Middle | | | | 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) |
| * | 1320.00 | 58.42 | 26.02 | 2.07 | 44.82 | 0.30 | 41.98 | 74.00 | -32.02 | P |
| * | 1320.00 | 52.69 | 26.02 | 2.07 | 44.82 | 0.30 | 36.25 | 54.00 | -17.75 | A |
| * | 4873.67 | 58.45 | 33.65 | 3.85 | 45.13 | 0.40 | 51.22 | 74.00 | -22.78 | P |
| * | 4873.67 | 54.09 | 33.65 | 3.85 | 45.13 | 0.40 | 46.86 | 54.00 | -7.14 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11b TX (CH High) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11b mode / 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) |
| * | 1320.08 | 59.42 | 26.02 | 2.07 | 44.82 | 0.30 | 42.98 | 74.00 | -31.02 | P |
| * | 1320.08 | 54.50 | 26.02 | 2.07 | 44.82 | 0.30 | 38.06 | 54.00 | -15.94 | A |
| * | 4923.98 | 60.06 | 33.83 | 3.86 | 45.18 | 0.40 | 52.97 | 74.00 | -21.03 | P |
| * | 4923.98 | 55.61 | 33.83 | 3.86 | 45.18 | 0.40 | 48.52 | 54.00 | -5.48 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

| | TX / IEEE 802.11b mode / 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) |
| * | 1320.04 | 58.93 | 26.02 | 2.07 | 44.82 | 0.30 | 42.49 | 74.00 | -31.51 | P |
| * | 1320.04 | 52.92 | 26.02 | 2.07 | 44.82 | 0.30 | 36.48 | 54.00 | -17.52 | A |
| * | 4923.94 | 59.62 | 33.83 | 3.86 | 45.18 | 0.40 | 52.53 | 74.00 | -21.47 | P |
| * | 4923.94 | 55.14 | 33.83 | 3.86 | 45.18 | 0.40 | 48.05 | 54.00 | -5.95 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11g TX (CH Low) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11g mode / 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) |
| * | 1320.04 | 60.24 | 26.02 | 2.07 | 44.82 | 0.30 | 43.80 | 74.00 | -30.20 | P |
| * | 1320.04 | 54.69 | 26.02 | 2.07 | 44.82 | 0.30 | 38.25 | 54.00 | -15.75 | A |
| * | 4826.26 | 67.21 | 33.47 | 3.84 | 45.08 | 0.40 | 59.85 | 74.00 | -14.15 | P |
| * | 4826.26 | 53.78 | 33.47 | 3.84 | 45.08 | 0.40 | 46.42 | 54.00 | -7.58 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

| | TX / IEEE 802.11g mode / 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) |
| * | 1320.00 | 58.42 | 26.02 | 2.07 | 44.82 | 0.30 | 41.98 | 74.00 | -32.02 | P |
| * | 1320.00 | 52.60 | 26.02 | 2.07 | 44.82 | 0.30 | 36.16 | 54.00 | -17.84 | A |
| * | 4823.19 | 63.03 | 33.46 | 3.84 | 45.07 | 0.40 | 55.66 | 74.00 | -18.34 | P |
| * | 4823.19 | 51.52 | 33.46 | 3.84 | 45.07 | 0.40 | 44.15 | 54.00 | -9.85 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11g TX (CH Middle) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11g mode / CH Middle | | | | 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) |
| * | 1320.06 | 60.34 | 26.02 | 2.07 | 44.82 | 0.30 | 43.90 | 74.00 | -30.10 | P |
| * | 1320.06 | 55.59 | 26.02 | 2.07 | 44.82 | 0.30 | 39.15 | 54.00 | -14.85 | A |
| * | 4872.16 | 65.41 | 33.64 | 3.85 | 45.12 | 0.40 | 58.17 | 74.00 | -15.83 | P |
| * | 4872.16 | 51.69 | 33.64 | 3.85 | 45.12 | 0.40 | 44.45 | 54.00 | -9.55 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

| | TX / IEEE 802.11g mode / CH Middle | | | | 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) |
| * | 1320.01 | 58.46 | 26.02 | 2.07 | 44.82 | 0.30 | 42.02 | 74.00 | -31.98 | P |
| * | 1320.01 | 52.39 | 26.02 | 2.07 | 44.82 | 0.30 | 35.95 | 54.00 | -18.05 | A |
| * | 4874.62 | 59.25 | 33.65 | 3.85 | 45.13 | 0.40 | 52.02 | 74.00 | -21.98 | P |
| * | 4874.62 | 47.00 | 33.65 | 3.85 | 45.13 | 0.40 | 39.77 | 54.00 | -14.23 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11g TX (CH High) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11g mode / 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) |
| * | 1319.98 | 59.93 | 26.02 | 2.07 | 44.82 | 0.30 | 43.49 | 74.00 | -30.51 | P |
| * | 1319.98 | 55.01 | 26.02 | 2.07 | 44.82 | 0.30 | 38.57 | 54.00 | -15.43 | A |
| * | 4925.42 | 62.14 | 33.83 | 3.86 | 45.18 | 0.40 | 55.05 | 74.00 | -18.95 | P |
| * | 4925.42 | 50.08 | 33.83 | 3.86 | 45.18 | 0.40 | 42.99 | 54.00 | -11.01 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

| | TX / IEEE 802.11g mode / 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) |
| * | 1320.06 | 58.46 | 26.02 | 2.07 | 44.82 | 0.30 | 42.02 | 74.00 | -31.98 | P |
| * | 1320.06 | 52.69 | 26.02 | 2.07 | 44.82 | 0.30 | 36.25 | 54.00 | -17.75 | A |
| * | 4923.73 | 57.24 | 33.83 | 3.86 | 45.18 | 0.40 | 50.15 | 74.00 | -23.85 | P |
| * | 4923.73 | 45.92 | 33.83 | 3.86 | 45.18 | 0.40 | 38.83 | 54.00 | -15.17 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11n HT20 TX (CH Low) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11n HT20 mode / 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) |
| * | 1319.95 | 61.52 | 26.02 | 2.07 | 44.82 | 0.30 | 45.08 | 74.00 | -28.92 | P |
| * | 1319.95 | 55.73 | 26.02 | 2.07 | 44.82 | 0.30 | 39.29 | 54.00 | -14.71 | A |
| * | 4819.33 | 65.57 | 33.45 | 3.84 | 45.07 | 0.40 | 58.19 | 74.00 | -15.81 | P |
| * | 4819.33 | 51.86 | 33.45 | 3.84 | 45.07 | 0.40 | 44.48 | 54.00 | -9.52 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

| | TX / IEEE 802.11n HT20 mode / 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) |
| * | 1320.08 | 59.62 | 26.02 | 2.07 | 44.82 | 0.30 | 43.18 | 74.00 | -30.82 | P |
| * | 1320.08 | 53.54 | 26.02 | 2.07 | 44.82 | 0.30 | 37.10 | 54.00 | -16.90 | A |
| * | 4825.86 | 59.70 | 33.47 | 3.84 | 45.08 | 0.40 | 52.34 | 74.00 | -21.66 | P |
| * | 4825.86 | 48.94 | 33.47 | 3.84 | 45.08 | 0.40 | 41.58 | 54.00 | -12.42 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11n HT20 TX (CH Middle) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11n HT20 mode / CH Middle | | | | 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) |
| * | 1320.04 | 60.01 | 26.02 | 2.07 | 44.82 | 0.30 | 43.57 | 74.00 | -30.43 | P |
| * | 1320.04 | 54.82 | 26.02 | 2.07 | 44.82 | 0.30 | 38.38 | 54.00 | -15.62 | A |
| * | 4873.86 | 64.24 | 33.65 | 3.85 | 45.13 | 0.40 | 57.01 | 74.00 | -16.99 | P |
| * | 4873.86 | 50.30 | 33.65 | 3.85 | 45.13 | 0.40 | 43.07 | 54.00 | -10.93 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

| | TX / IEEE 802.11n HT20 mode / CH Middle | | | | 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) |
| * | 1320.08 | 58.84 | 26.02 | 2.07 | 44.82 | 0.30 | 42.40 | 74.00 | -31.60 | P |
| * | 1320.08 | 53.21 | 26.02 | 2.07 | 44.82 | 0.30 | 36.77 | 54.00 | -17.23 | A |
| * | 4876.30 | 57.01 | 33.65 | 3.85 | 45.13 | 0.40 | 49.79 | 74.00 | -24.21 | P |
| * | 4876.30 | 45.75 | 33.65 | 3.85 | 45.13 | 0.40 | 38.53 | 54.00 | -15.47 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11n HT20 TX (CH High) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11n HT20 mode / 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) |
| * | 1319.92 | 60.31 | 26.02 | 2.07 | 44.82 | 0.30 | 43.87 | 74.00 | -30.13 | P |
| * | 1319.92 | 55.29 | 26.02 | 2.07 | 44.82 | 0.30 | 38.85 | 54.00 | -15.15 | A |
| * | 4924.27 | 61.42 | 33.83 | 3.86 | 45.18 | 0.40 | 54.33 | 74.00 | -19.67 | P |
| * | 4924.27 | 47.38 | 33.83 | 3.86 | 45.18 | 0.40 | 40.29 | 54.00 | -13.71 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

| | TX / IEEE 802.11n HT20 mode / 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) |
| * | 1319.97 | 59.24 | 26.02 | 2.07 | 44.82 | 0.30 | 42.80 | 74.00 | -31.20 | P |
| * | 1319.97 | 54.00 | 26.02 | 2.07 | 44.82 | 0.30 | 37.56 | 54.00 | -16.44 | A |
| * | 4922.82 | 56.73 | 33.82 | 3.86 | 45.18 | 0.40 | 49.64 | 74.00 | -24.36 | P |
| * | 4922.82 | 45.41 | 33.82 | 3.86 | 45.18 | 0.40 | 38.32 | 54.00 | -15.68 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11n HT40 TX (CH Low) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11n HT40 mode / 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) |
| * | 1320.00 | 59.62 | 26.02 | 2.07 | 44.82 | 0.30 | 43.18 | 74.00 | -30.82 | P |
| * | 1320.00 | 54.72 | 26.02 | 2.07 | 44.82 | 0.30 | 38.28 | 54.00 | -15.72 | A |
| * | 4841.98 | 56.87 | 33.53 | 3.84 | 45.09 | 0.40 | 49.55 | 74.00 | -24.45 | P |
| * | 4841.98 | 45.41 | 33.53 | 3.84 | 45.09 | 0.40 | 38.09 | 54.00 | -15.91 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

| | TX / IEEE 802.11n HT40 mode / 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) |
| * | 1320.03 | 59.24 | 26.02 | 2.07 | 44.82 | 0.30 | 42.80 | 74.00 | -31.20 | P |
| * | 1320.03 | 53.00 | 26.02 | 2.07 | 44.82 | 0.30 | 36.56 | 54.00 | -17.44 | A |
| * | 4844.74 | 57.32 | 33.54 | 3.84 | 45.10 | 0.40 | 50.01 | 74.00 | -23.99 | P |
| * | 4844.00 | 45.59 | 33.54 | 3.84 | 45.09 | 0.40 | 38.28 | 54.00 | -15.72 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11n HT40 TX (CH Middle) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11n HT40 mode / CH Middle | | | | 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) |
| * | 1319.97 | 60.24 | 26.02 | 2.07 | 44.82 | 0.30 | 43.80 | 74.00 | -30.20 | P |
| * | 1319.97 | 55.27 | 26.02 | 2.07 | 44.82 | 0.30 | 38.83 | 54.00 | -15.17 | A |
| * | 4873.88 | 57.42 | 33.65 | 3.85 | 45.13 | 0.40 | 50.19 | 74.00 | -23.81 | P |
| * | 4873.88 | 45.83 | 33.65 | 3.85 | 45.13 | 0.40 | 38.60 | 54.00 | -15.40 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

| | TX / IEEE 802.11n HT40 mode / CH Middle | | | | 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) |
| * | 1319.98 | 59.20 | 26.02 | 2.07 | 44.82 | 0.30 | 42.76 | 74.00 | -31.24 | P |
| * | 1319.98 | 53.01 | 26.02 | 2.07 | 44.82 | 0.30 | 36.57 | 54.00 | -17.43 | A |
| * | 4873.92 | 57.21 | 33.65 | 3.85 | 45.13 | 0.40 | 49.98 | 74.00 | -24.02 | P |
| * | 4873.92 | 45.23 | 33.65 | 3.85 | 45.13 | 0.40 | 38.00 | 54.00 | -16.00 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
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 other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

| Product Name | Smart Plug On/Off | Test Date | 2013/12/31 |
|---|---|---|---|
| Model | SPO120 | Test By | John Chen |
| Test Mode | IEEE 802.11n HT40 TX (CH High) | TEMP& Humidity | 15.4℃, 53% |

| | TX / IEEE 802.11n HT40 mode / 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) |
| * | 1320.12 | 60.83 | 26.02 | 2.07 | 44.82 | 0.30 | 44.39 | 74.00 | -29.61 | P |
| * | 1320.12 | 55.49 | 26.02 | 2.07 | 44.82 | 0.30 | 39.05 | 54.00 | -14.95 | A |
| * | 4903.74 | 57.93 | 33.75 | 3.86 | 45.16 | 0.40 | 50.78 | 74.00 | -23.22 | P |
| * | 4903.74 | 45.66 | 33.75 | 3.86 | 45.16 | 0.40 | 38.51 | 54.00 | -15.49 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

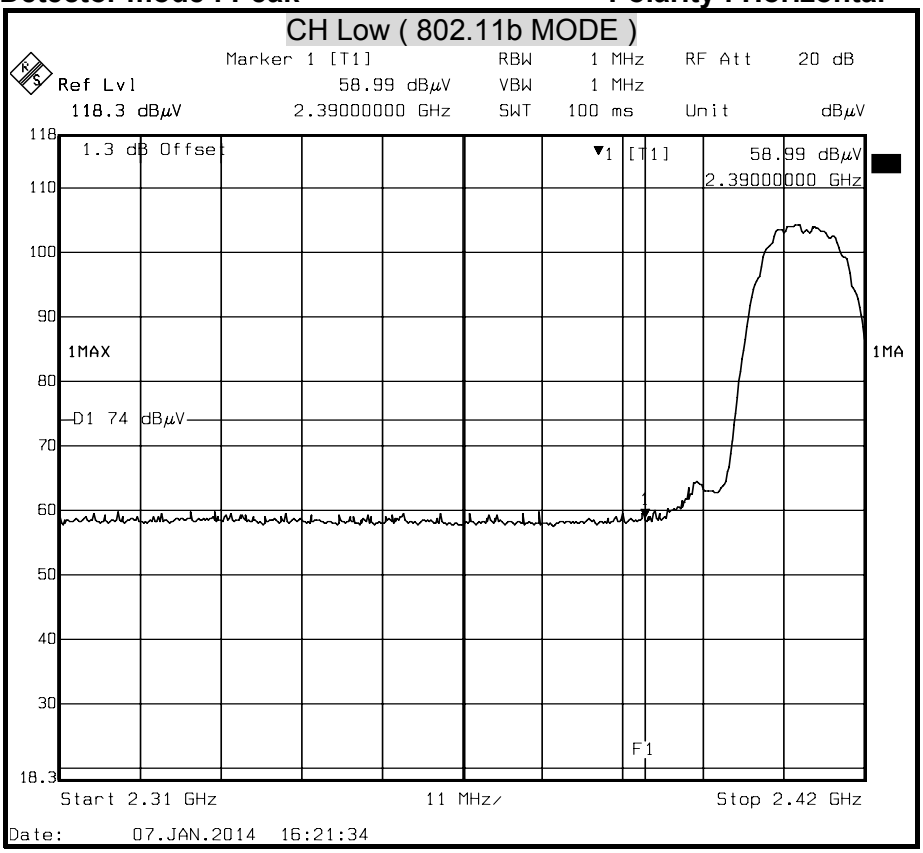
| | TX / IEEE 802.11n HT40 mode / CH High | | | | Measurement Distance at 3m Vertical polarity | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Freq. | Reading | AF | Cable Loss | Pre-amp | Filter | Level | Limit | Margin | Mark |
| | (MHz) | (dBμV) | (dB/m) | (dB) | (dB) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | (P/Q/A) |
| * | 1320.02 | 59.36 | 26.02 | 2.07 | 44.82 | 0.30 | 42.92 | 74.00 | -31.08 | P |
| * | 1320.02 | 53.21 | 26.02 | 2.07 | 44.82 | 0.30 | 36.77 | 54.00 | -17.23 | A |
| * | 4902.58 | 56.68 | 33.75 | 3.86 | 45.16 | 0.40 | 49.53 | 74.00 | -24.47 | P |
| * | 4902.58 | 45.24 | 33.75 | 3.86 | 45.16 | 0.40 | 38.09 | 54.00 | -15.91 | A |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| | N/A | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

*REMARK:*

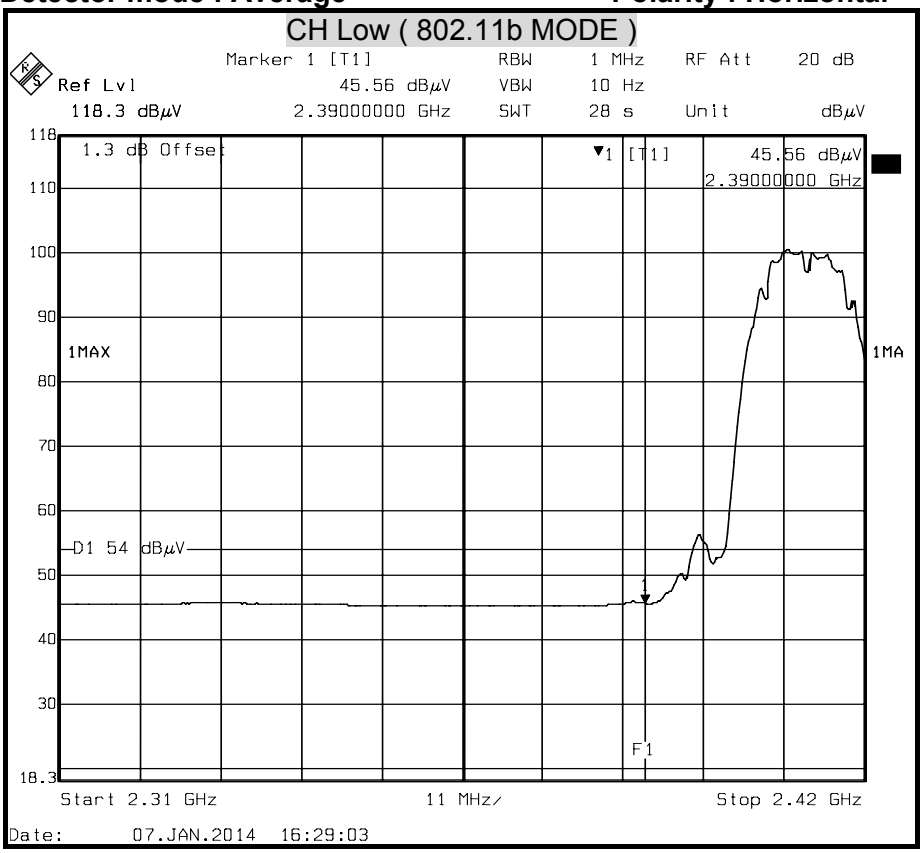
1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   *Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit*
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

## 8.6.4 RESTRICTED BAND EDGES

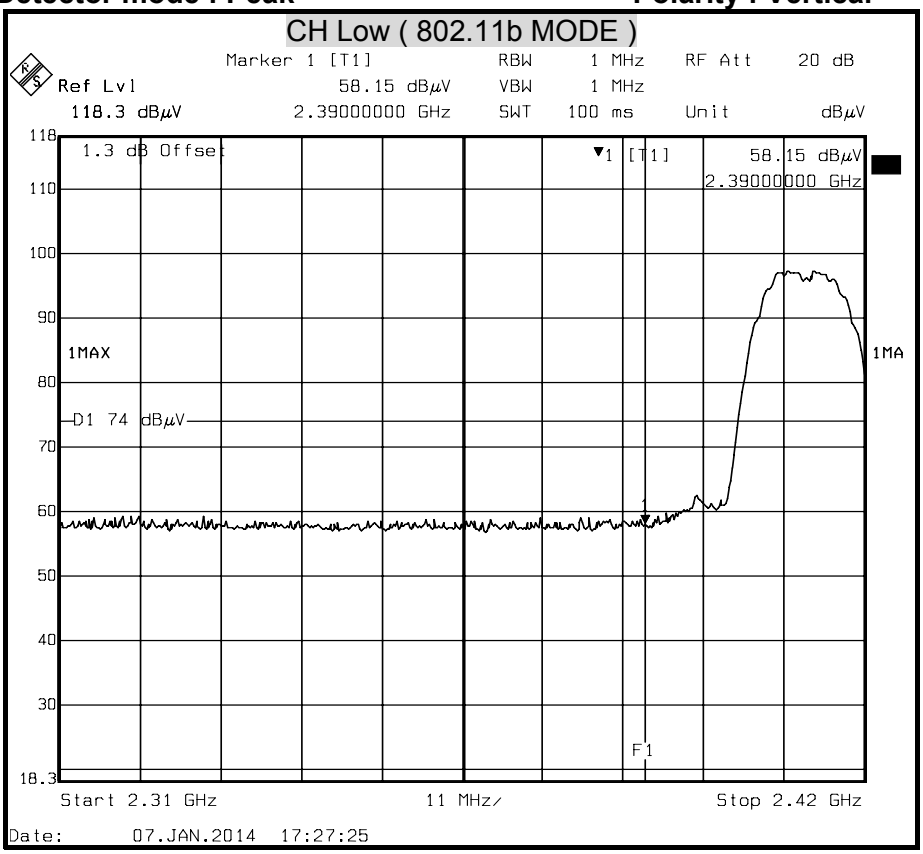
**Detector mode : Peak** **Polarity : Horizontal**



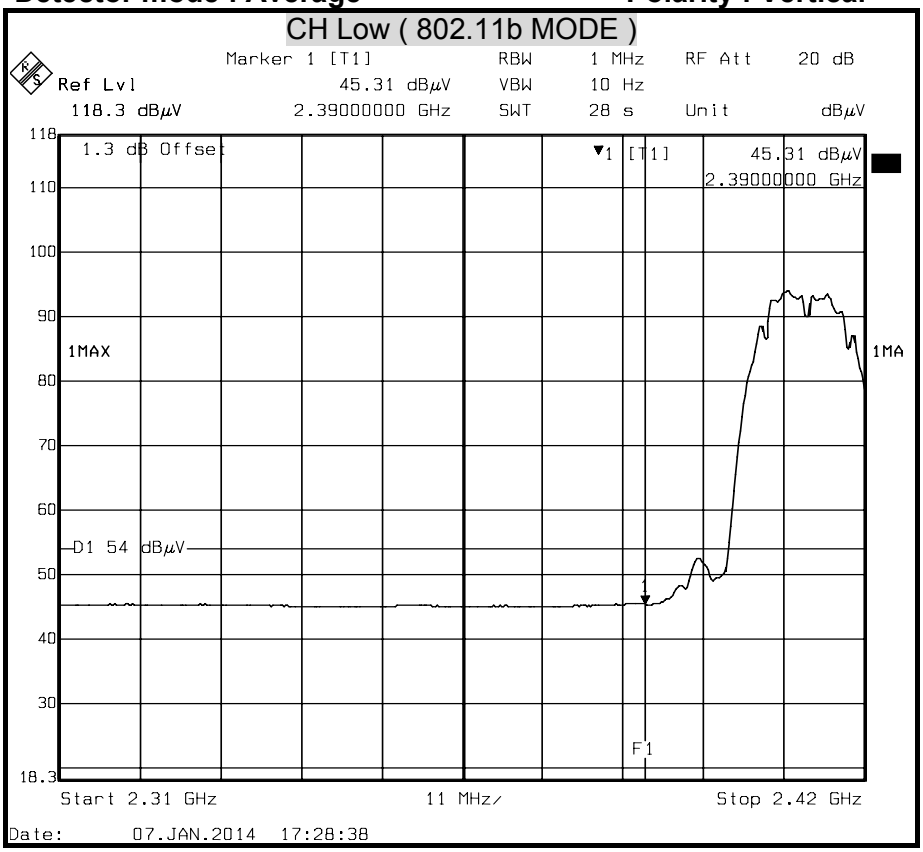

**Detector mode : Average** **Polarity : Horizontal**



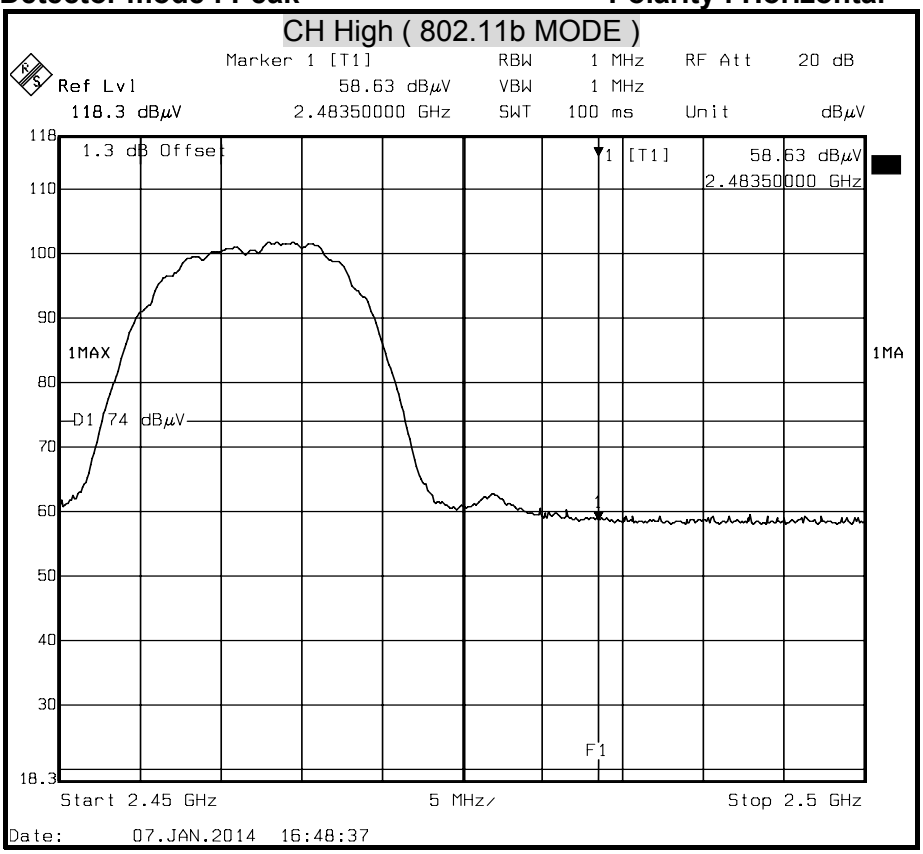
**Detector mode : Peak** **Polarity : Vertical**



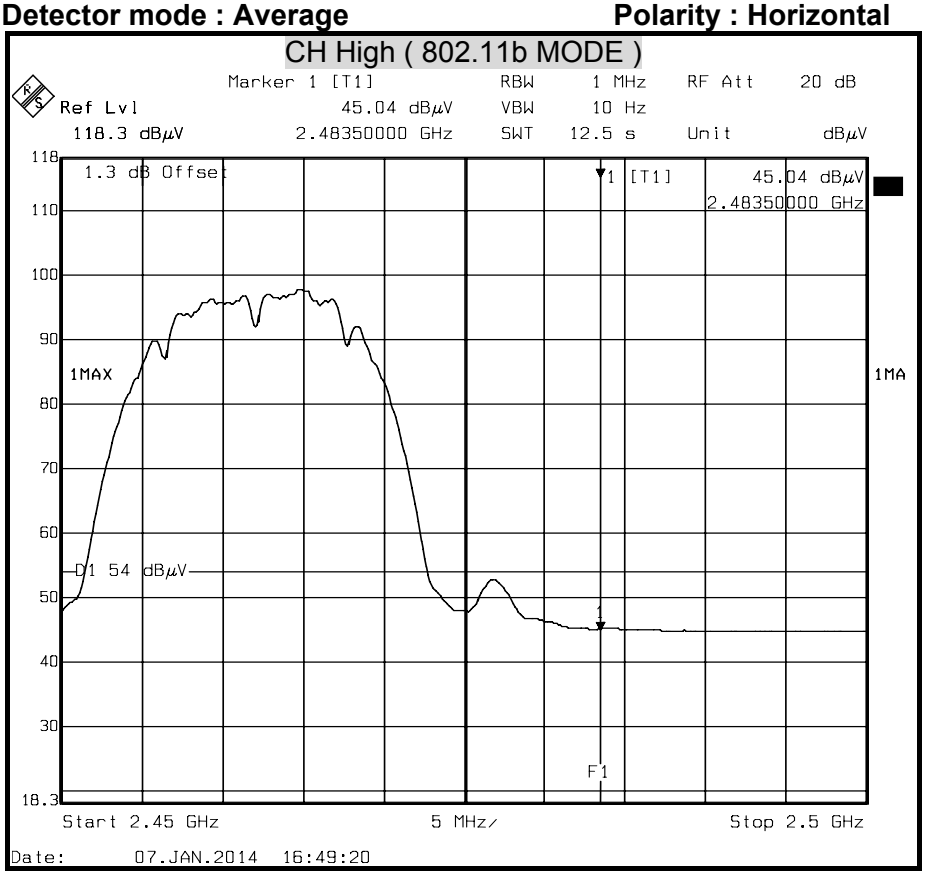

**Detector mode : Average** **Polarity : Vertical**



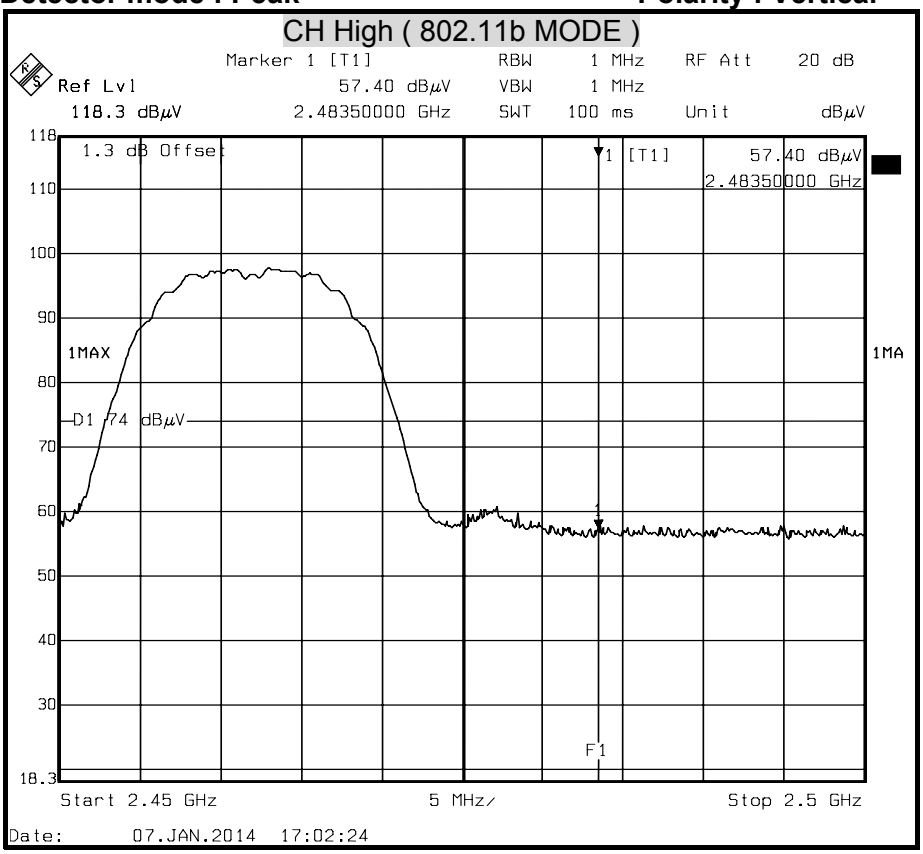
**Detector mode : Peak** **Polarity : Horizontal**



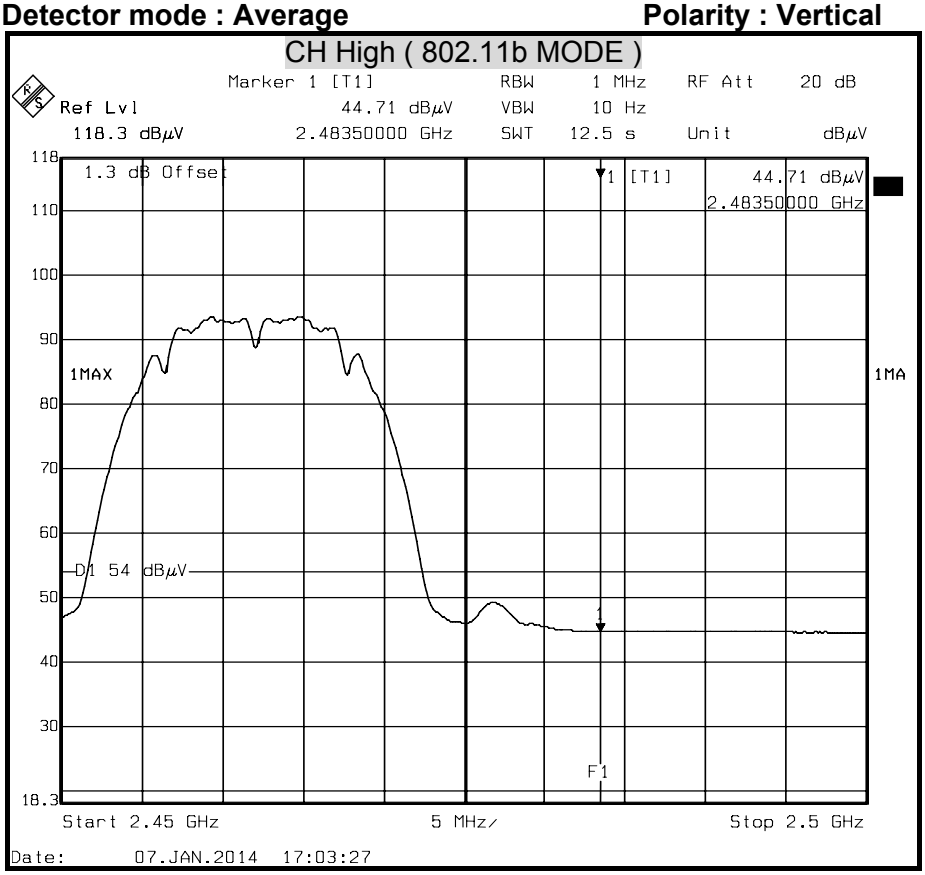

**Detector mode : Average** **Polarity : Horizontal**



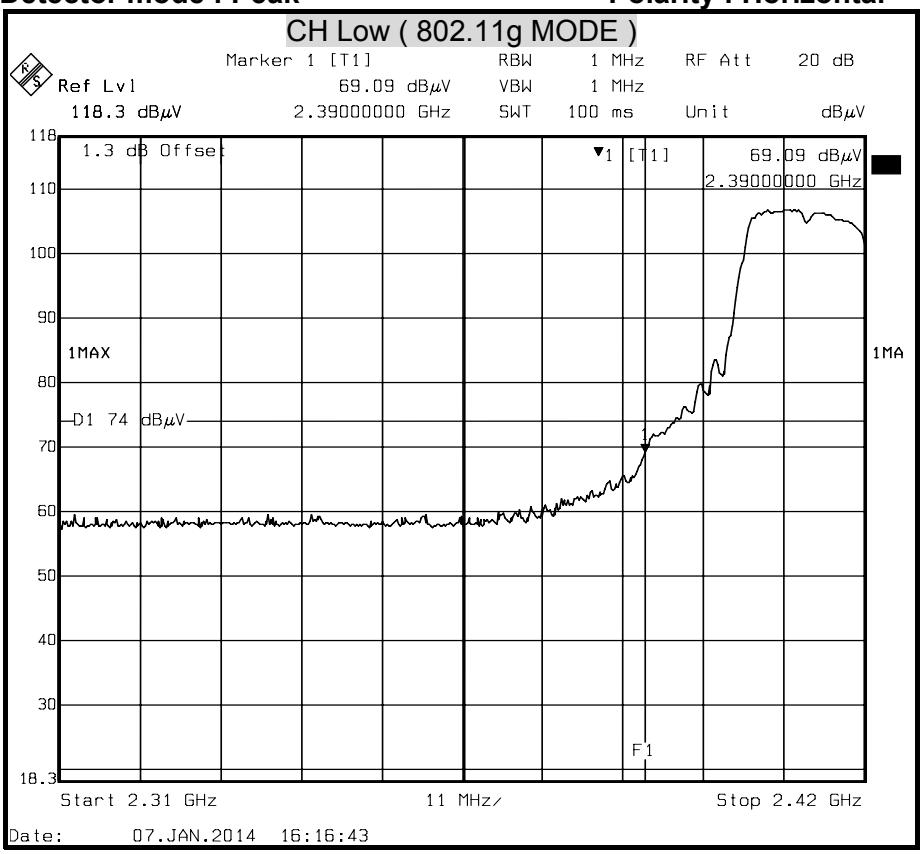
**Detector mode : Peak** **Polarity : Vertical**



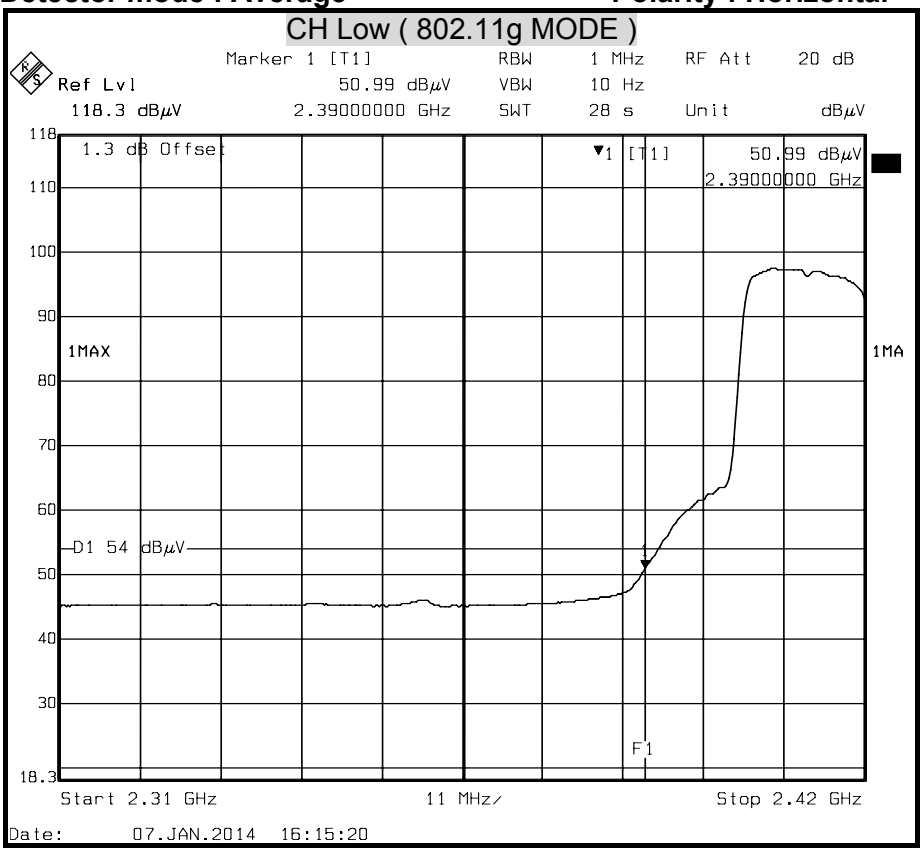

**Detector mode : Average** **Polarity : Vertical**



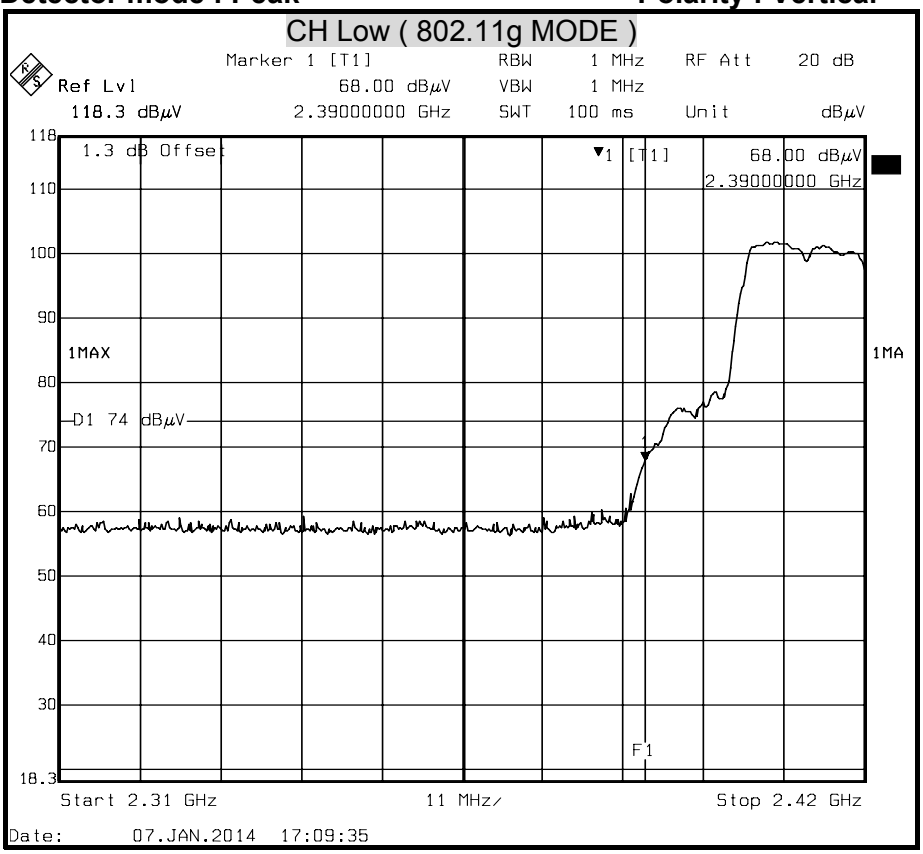
**Detector mode : Peak** **Polarity : Horizontal**



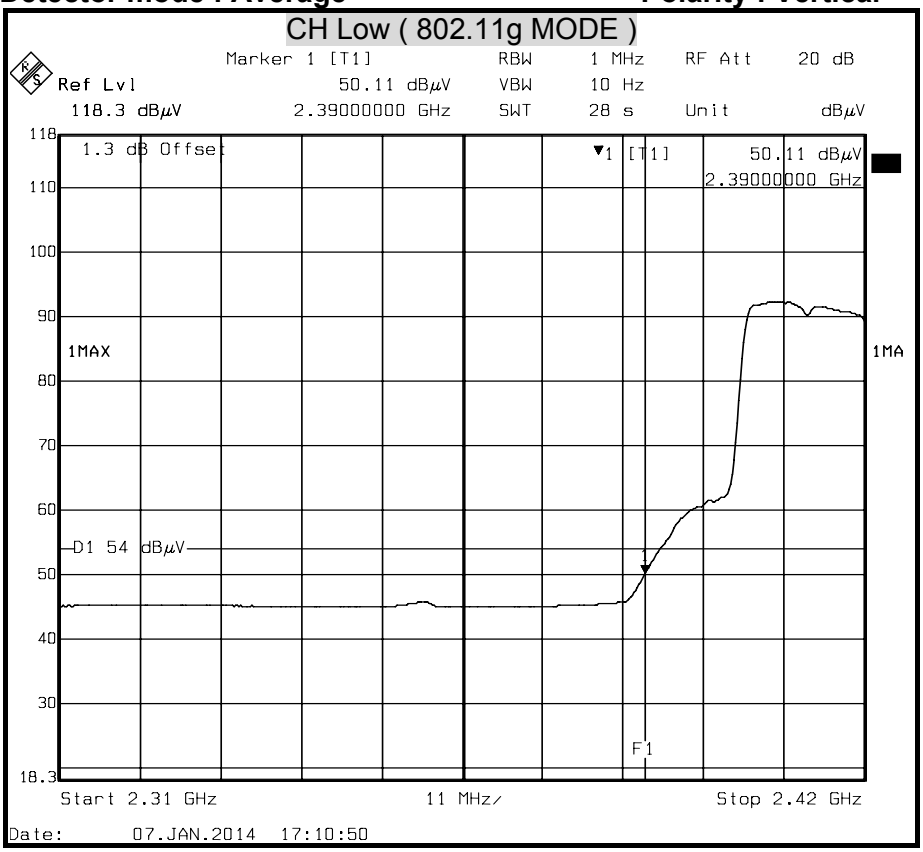

**Detector mode : Average** **Polarity : Horizontal**



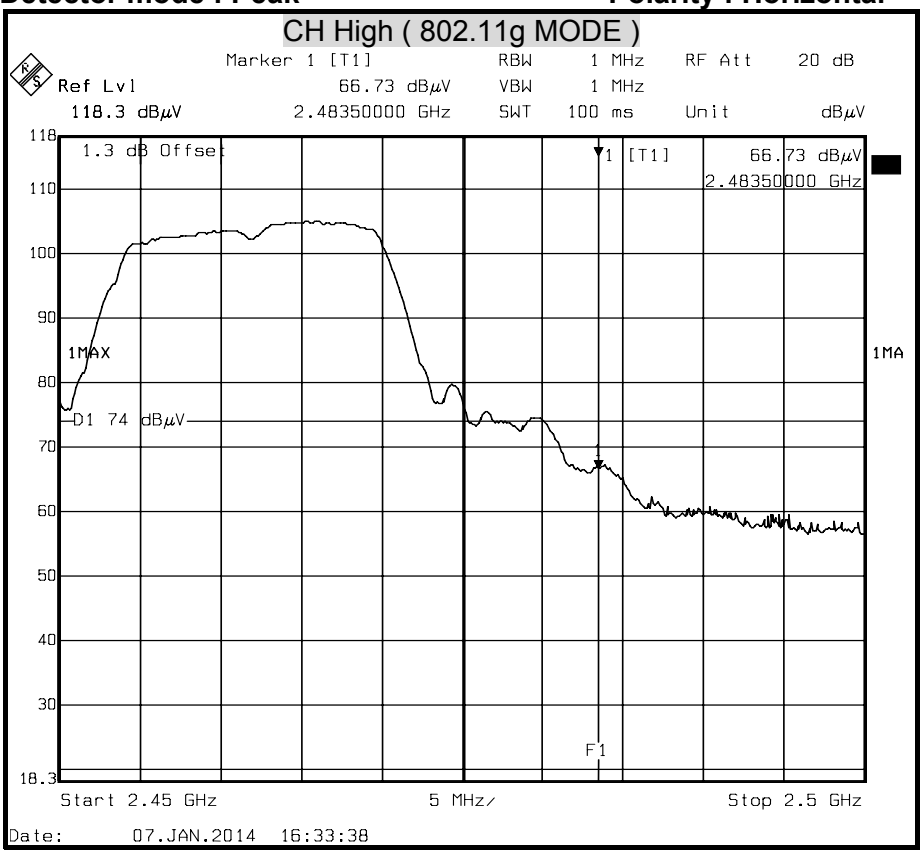
**Detector mode : Peak** **Polarity : Vertical**



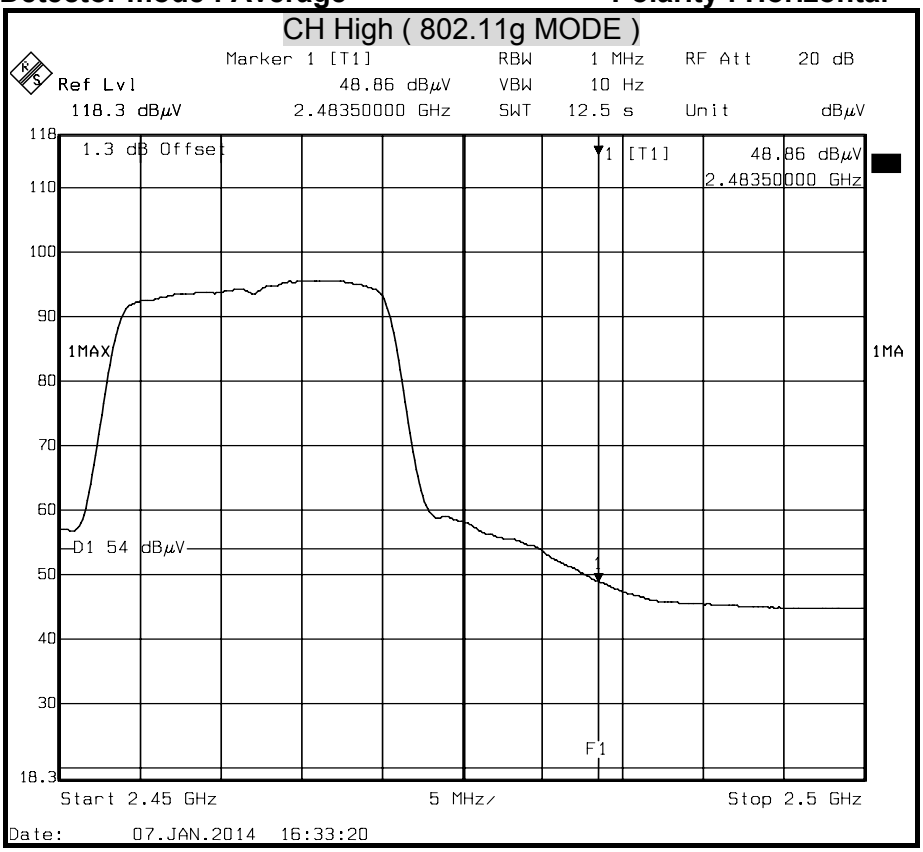

**Detector mode : Average** **Polarity : Vertical**



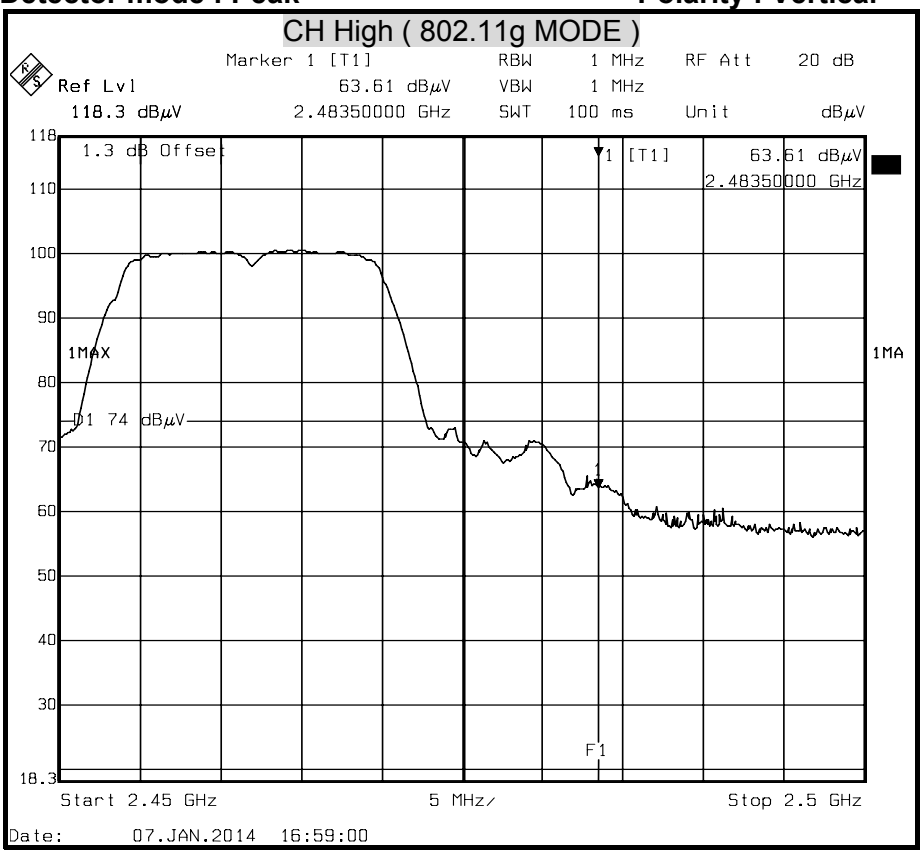
**Detector mode : Peak** **Polarity : Horizontal**



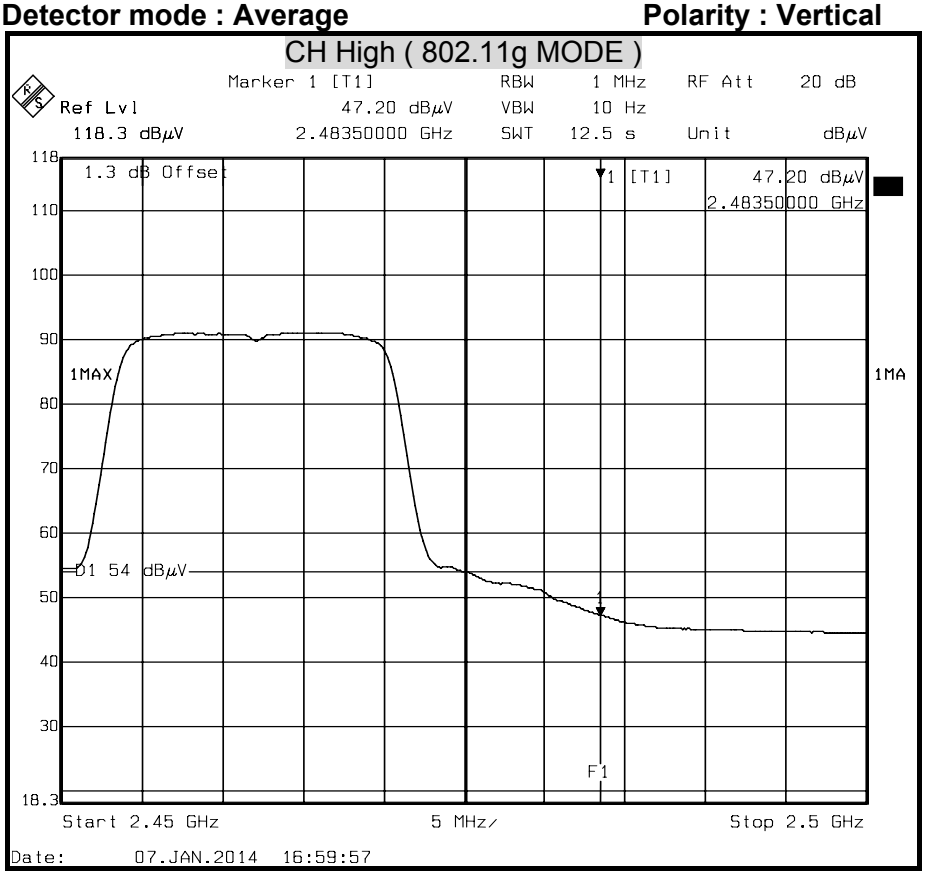

**Detector mode : Average** **Polarity : Horizontal**



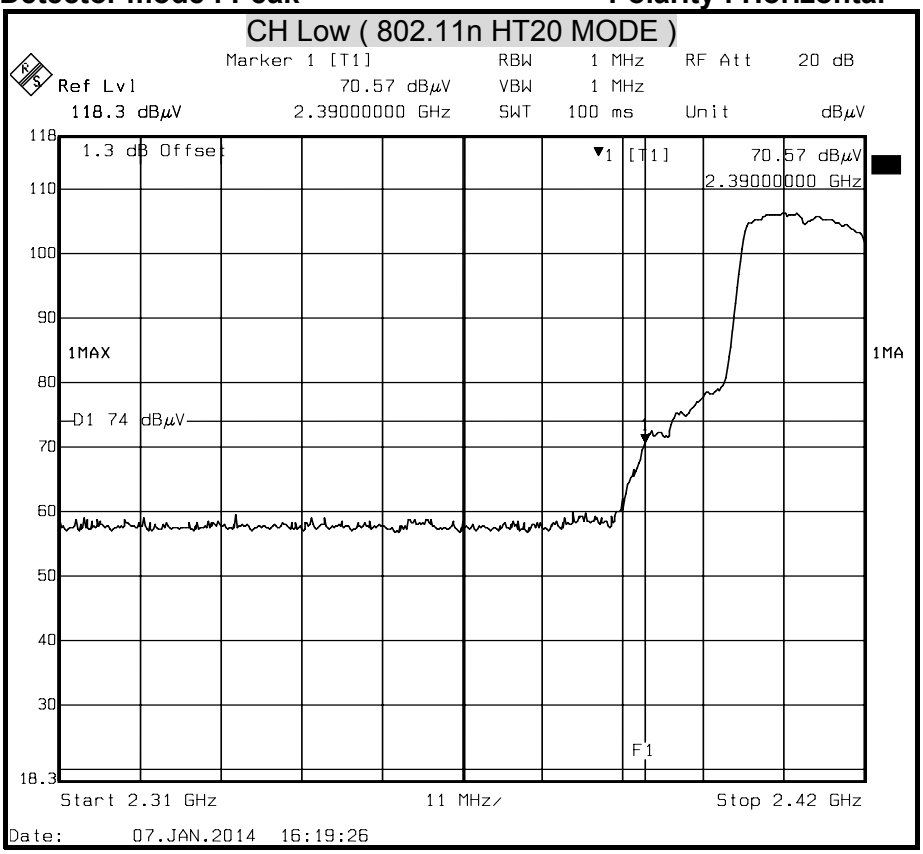
**Detector mode : Peak** **Polarity : Vertical**



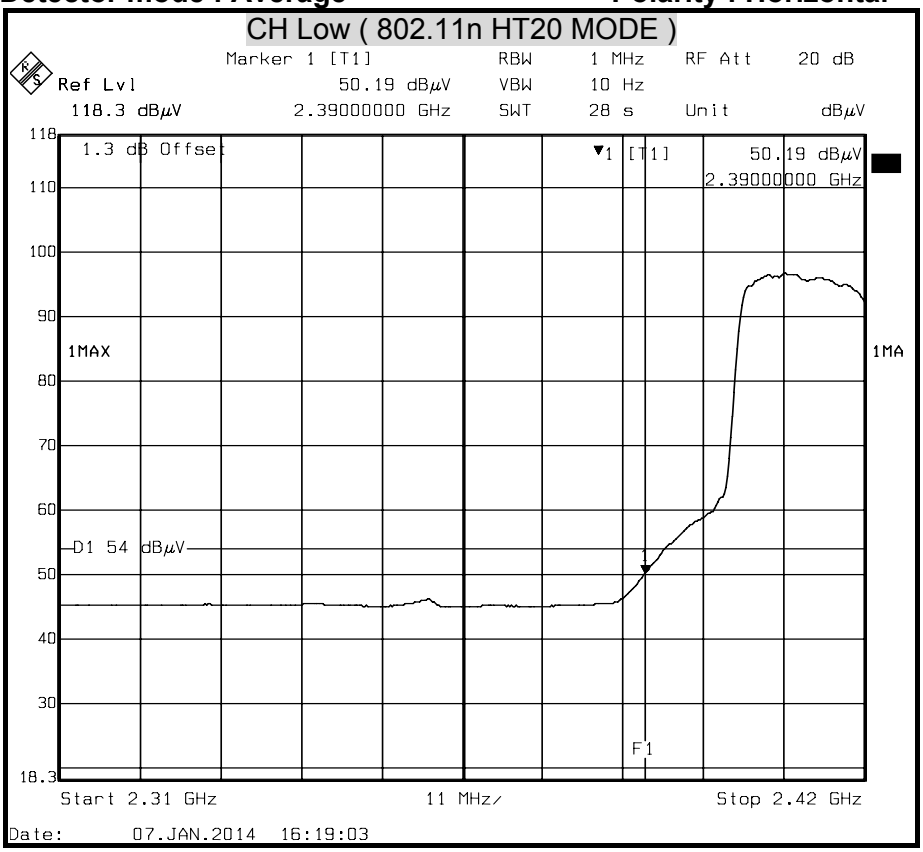

**Detector mode : Average** **Polarity : Vertical**



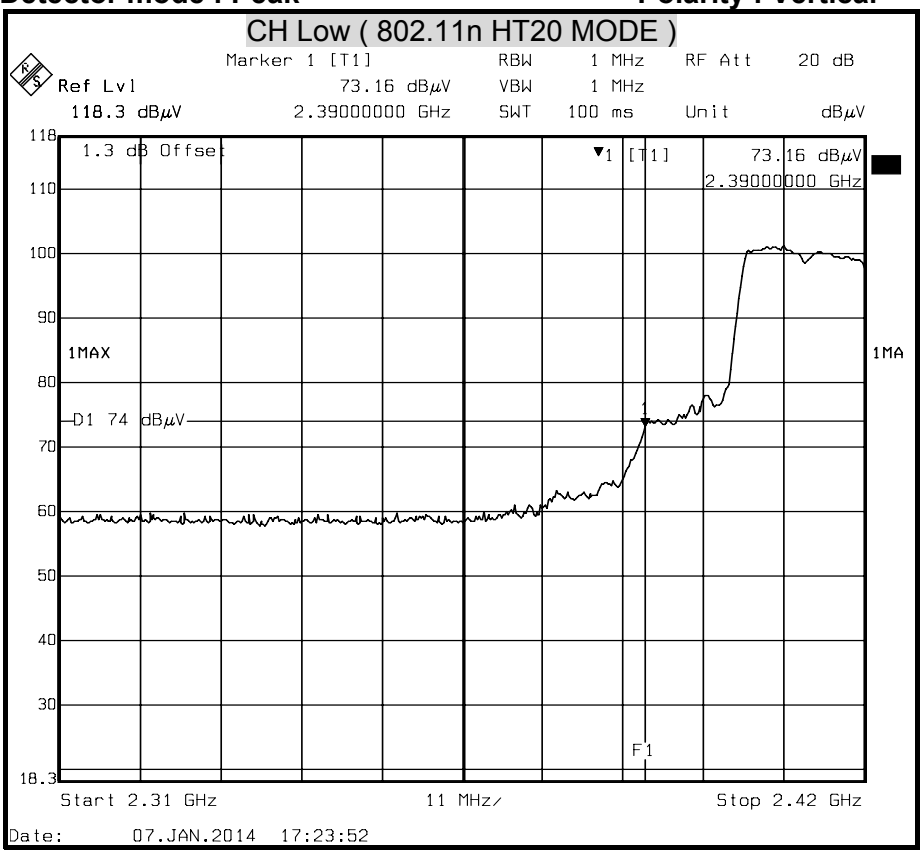
**Detector mode : Peak** **Polarity : Horizontal**



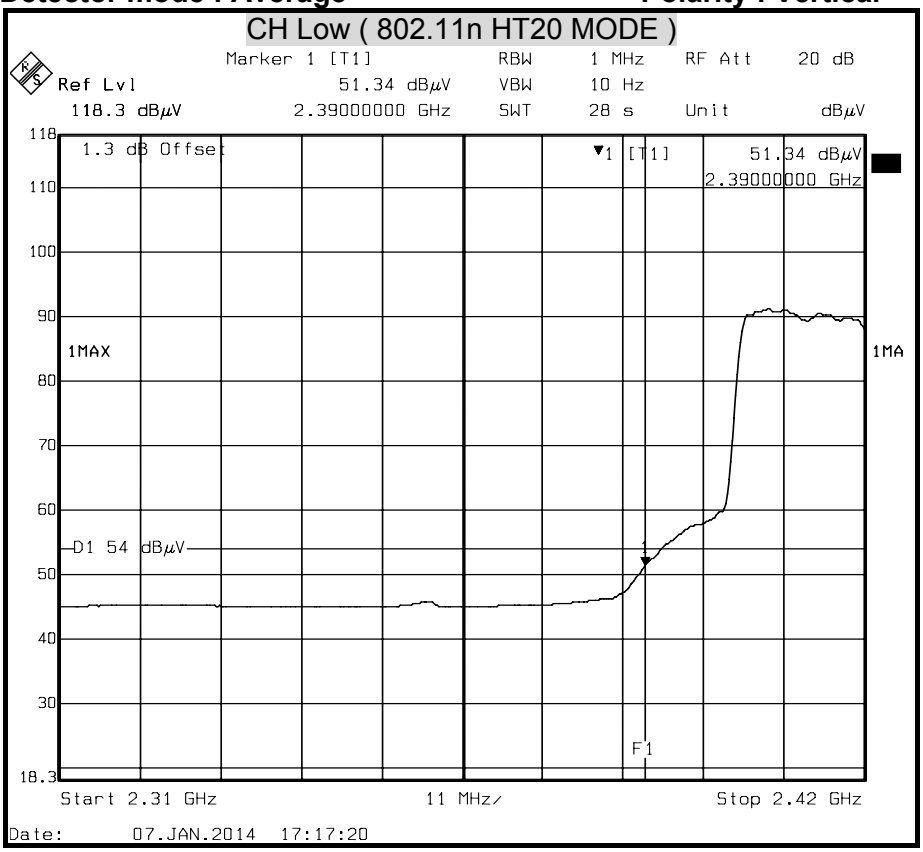

**Detector mode : Average** **Polarity : Horizontal**



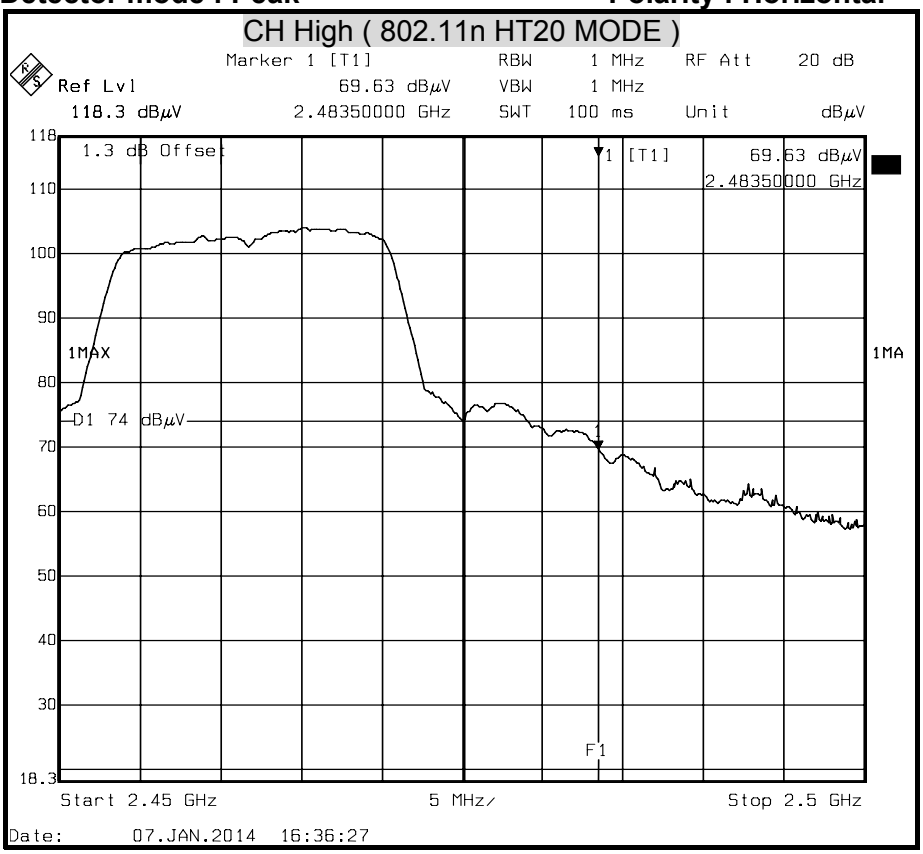
**Detector mode : Peak** **Polarity : Vertical**



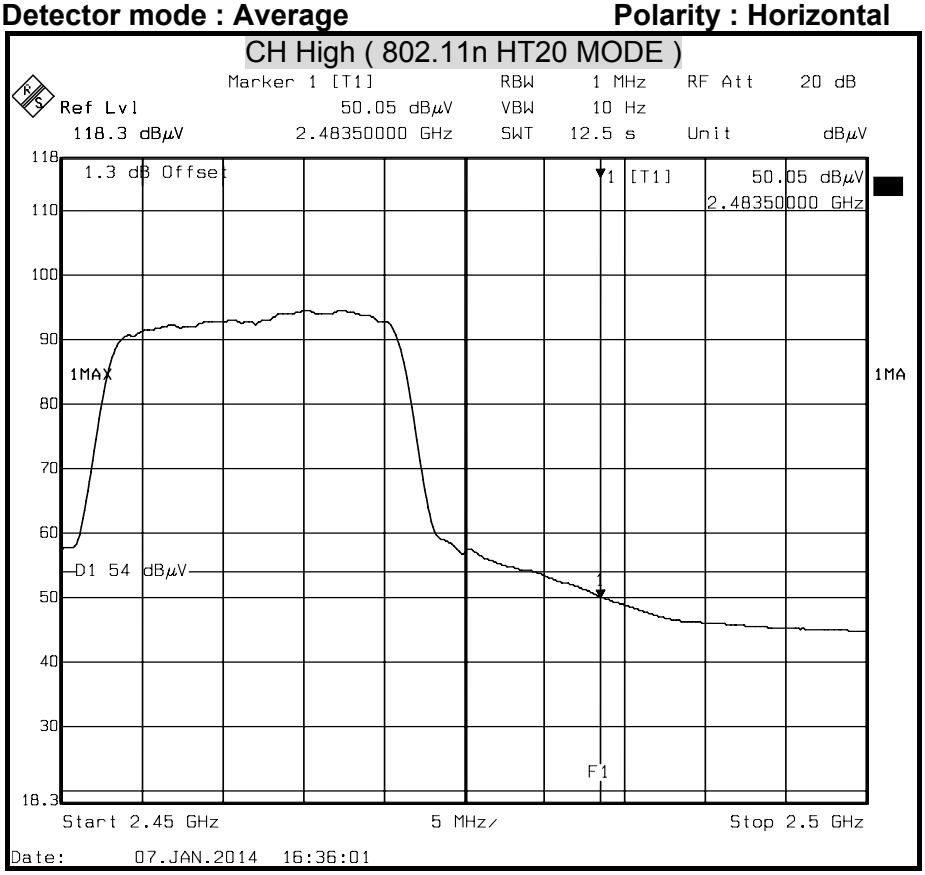

**Detector mode : Average** **Polarity : Vertical**



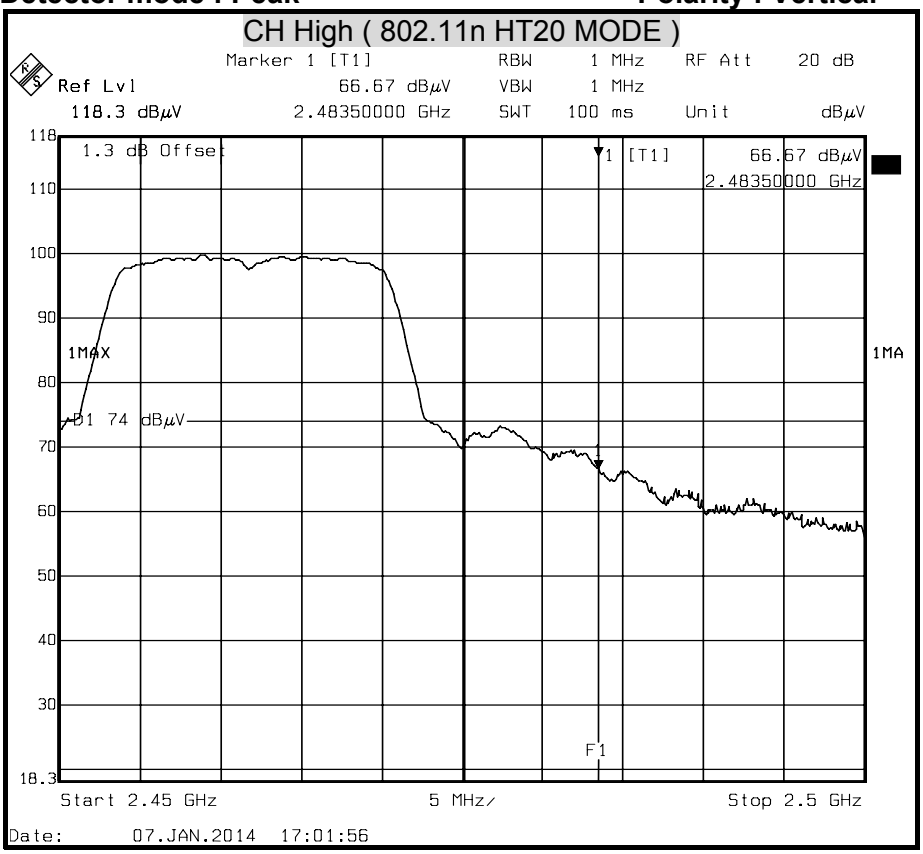
**Detector mode : Peak** **Polarity : Horizontal**



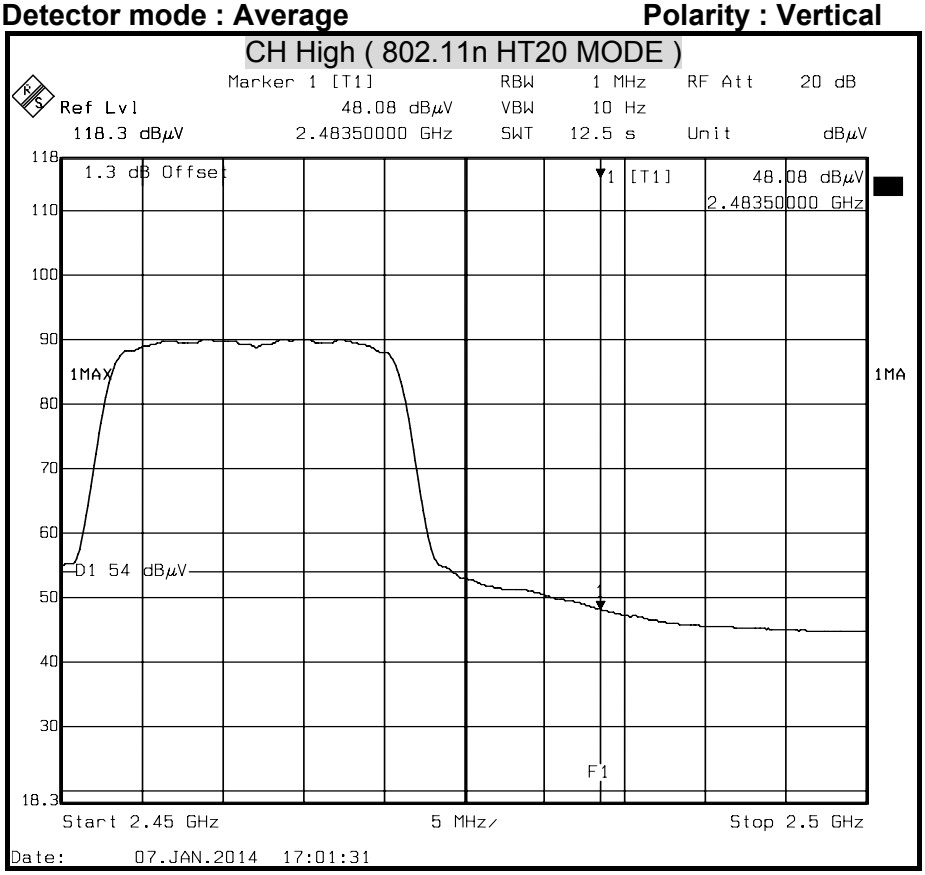

**Detector mode : Average** **Polarity : Horizontal**



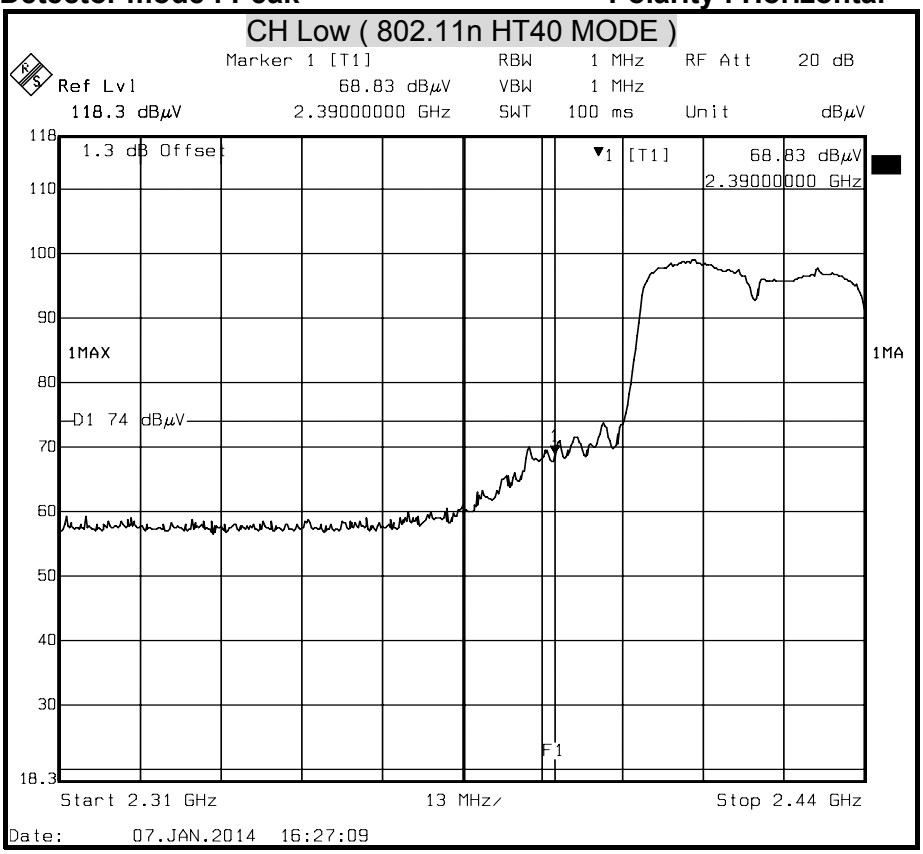
**Detector mode : Peak** **Polarity : Vertical**



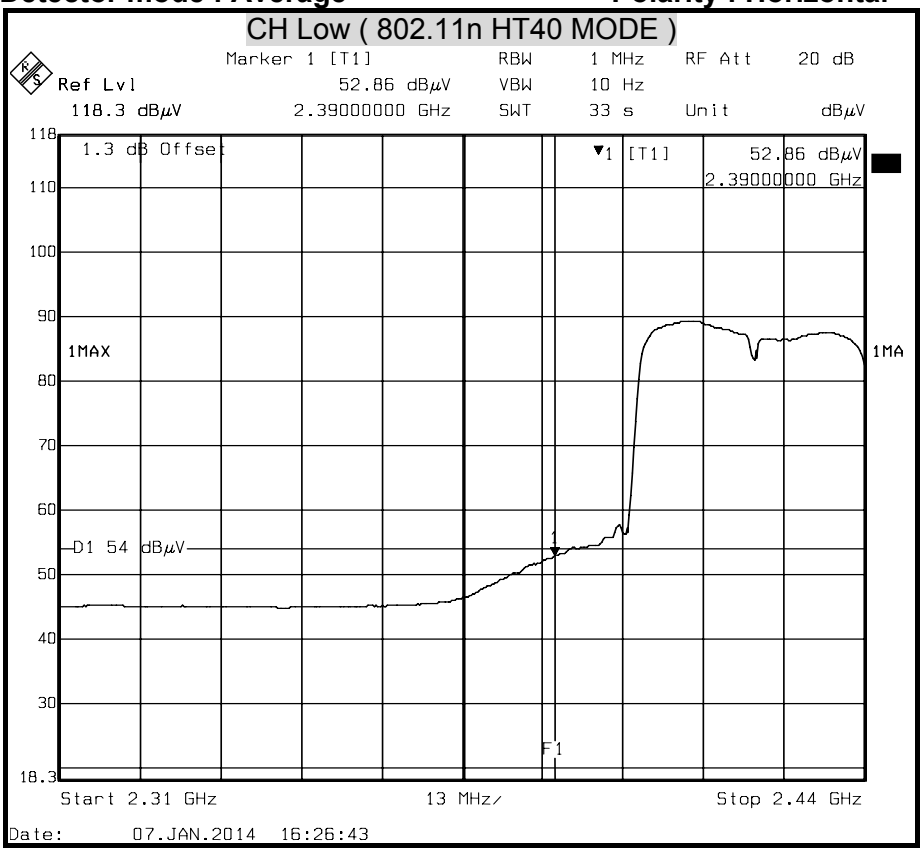

**Detector mode : Average** **Polarity : Vertical**



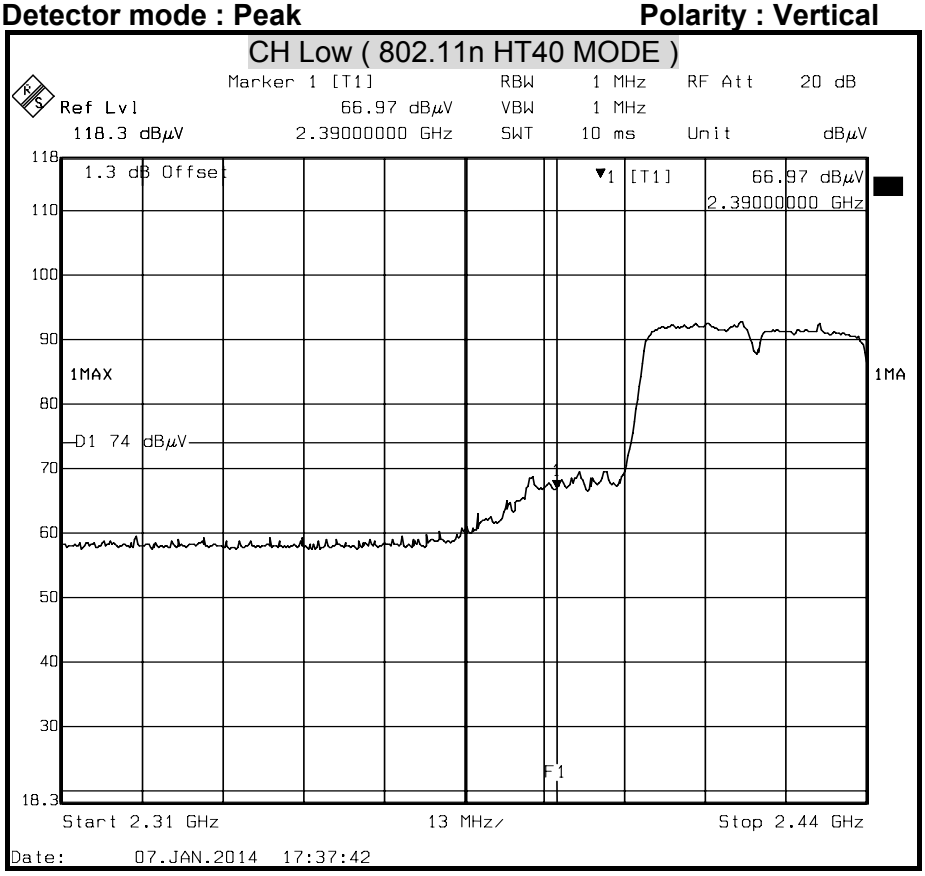
**Detector mode : Peak** **Polarity : Horizontal**



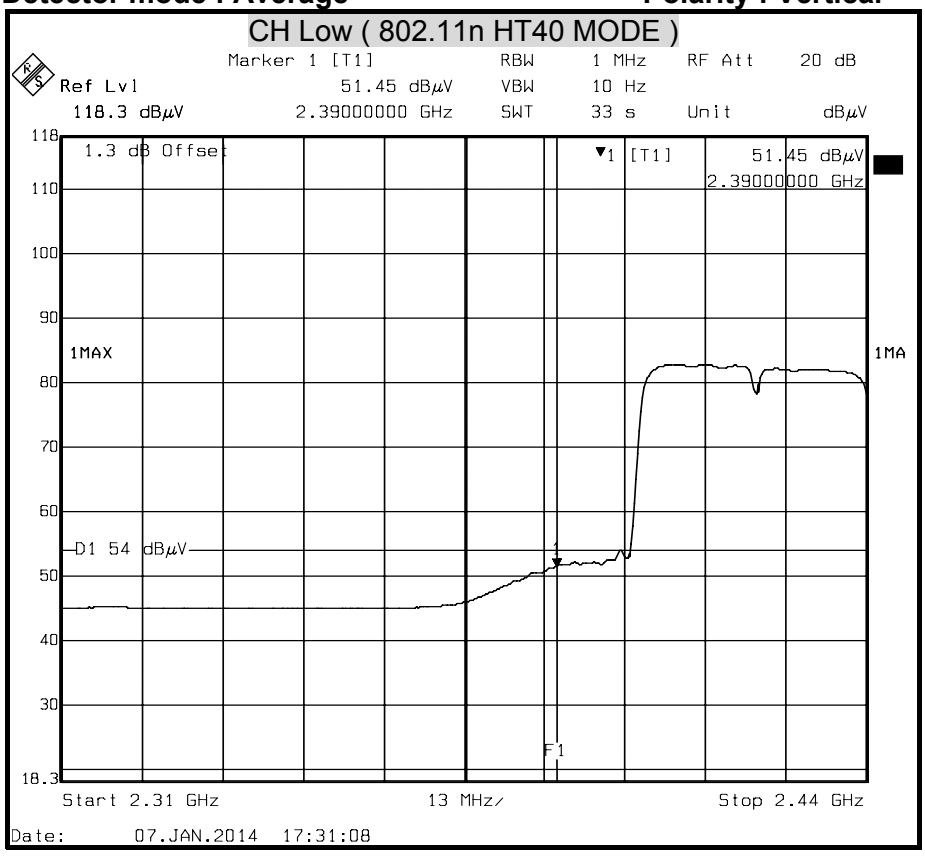

**Detector mode : Average** **Polarity : Horizontal**



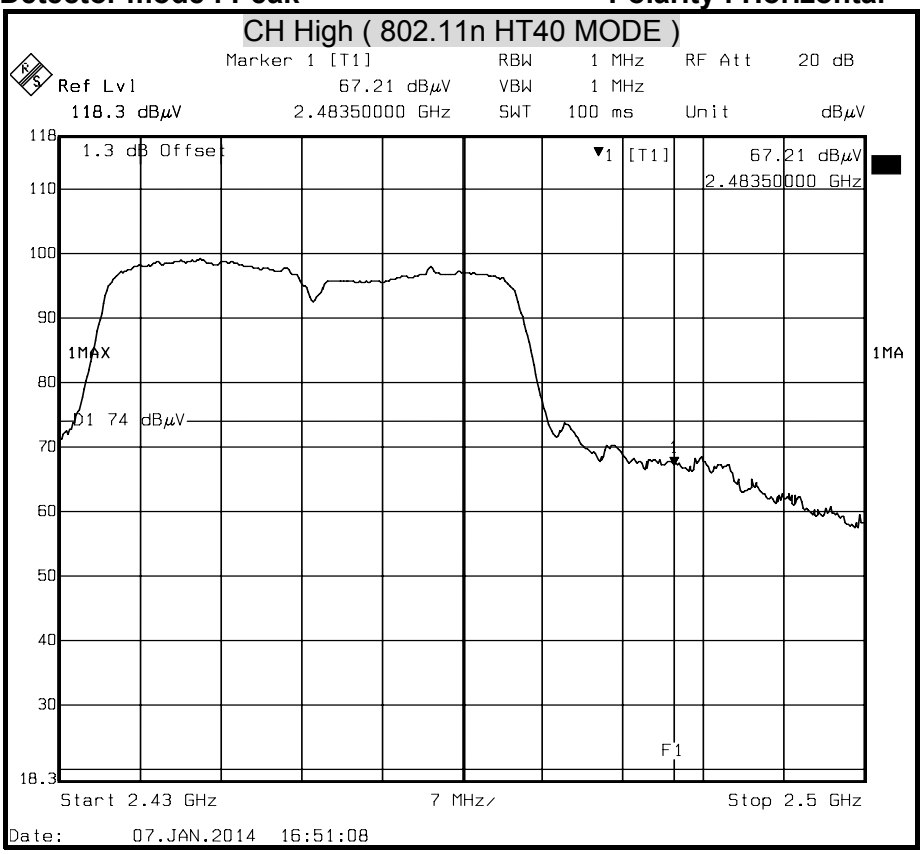
**Detector mode : Peak** **Polarity : Vertical**



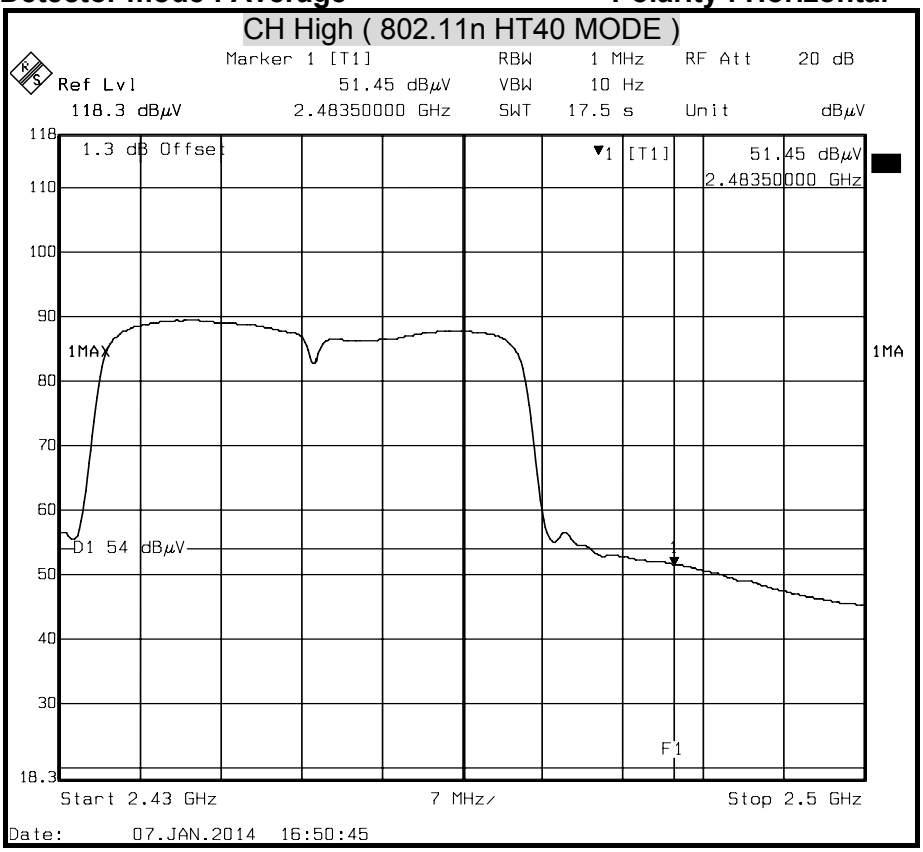

**Detector mode : Average** **Polarity : Vertical**



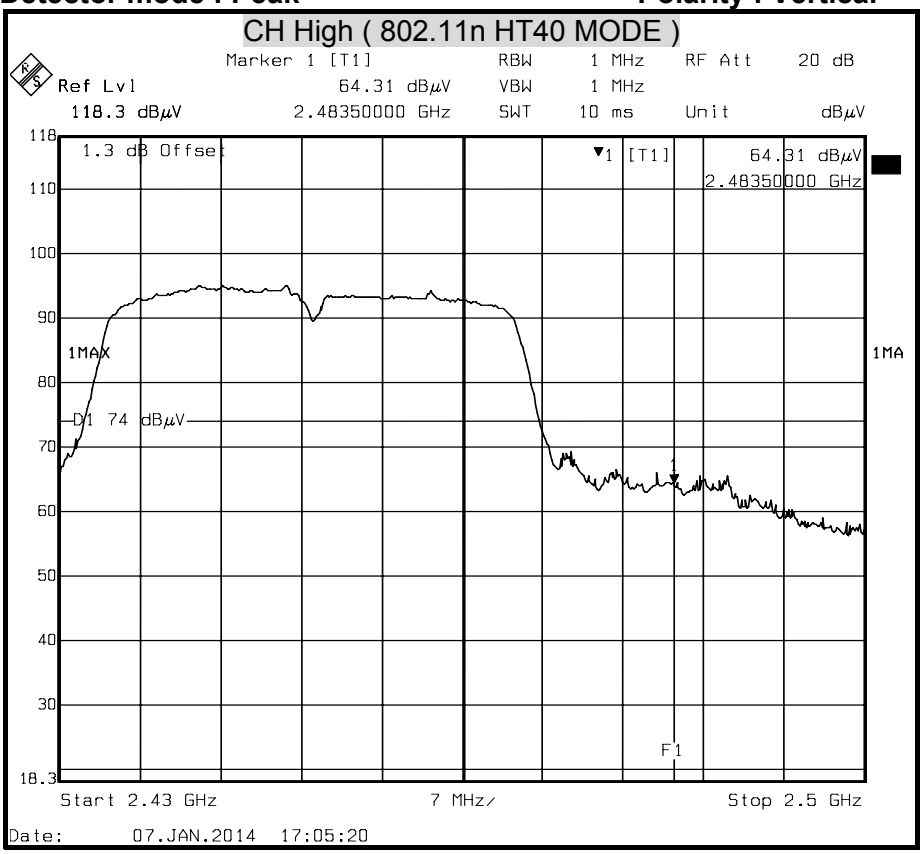
**Detector mode : Peak** **Polarity : Horizontal**



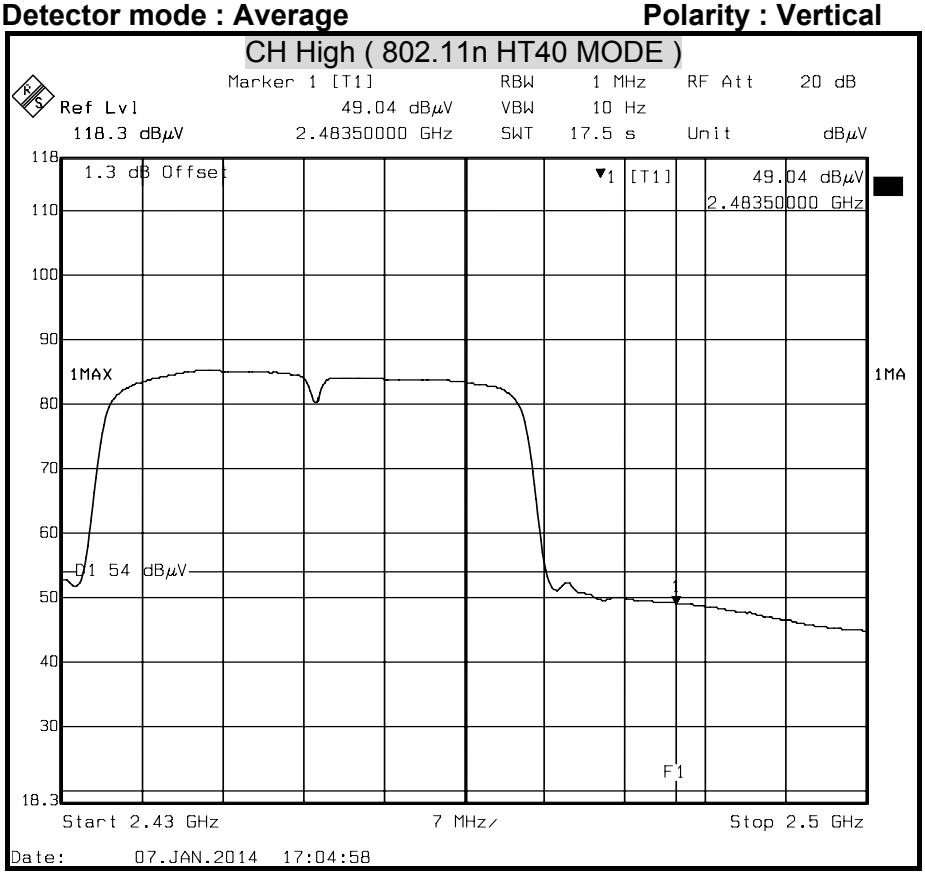

**Detector mode : Average** **Polarity : Horizontal**



**Detector mode : Peak** **Polarity : Vertical**




**Detector mode : Average** **Polarity : Vertical**



## 8.7 POWERLINE CONDUCTED EMISSIONS

**LIMITS**

§ 15.207 (a) Except as shown in paragraph (b) and (c) 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.

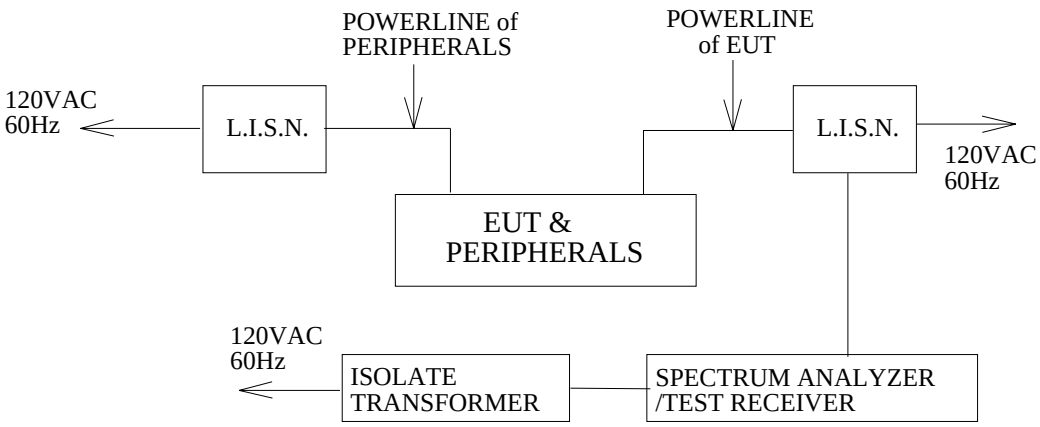
| Frequency of Emission (MHz) | Conducted limit (dBμv) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 - 0.5 | 66 to 56 | 56 to 46 |
| 0.5 - 5 | 56 | 46 |
| 5 - 30 | 60 | 50 |

**TEST EQUIPMENTS**

The following test equipments are used during the conducted power line tests：

| Conducted Emission room #1 | | | | |
|---|---|---|---|---|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| L.I.S.N. | SCHWARZBECK | NNLK 8130 | 8130124 | AUG. 12, 2014 |
| | Rohde & Schwarz | ESH 3-Z5 | 840062/021 | SEP. 09, 2014 |
| TEST RECEIVER | Rohde & Schwarz | ESCS 30 | 100348 | AUG. 09, 2014 |
| TYPE N COAXIAL CABLE | CCS | BNC50 | 11 | NOV. 19, 2014 |
| Test S/W | e-3 (5.04211c)<br>R&S (2.27) | | | |

## TEST SETUP




## TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80cm above the horizontal ground plane. The EUT IS CONFIGURED IN ACCORDANCE WITH ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

Line conducted data is recorded for both NEUTRAL and LINE.

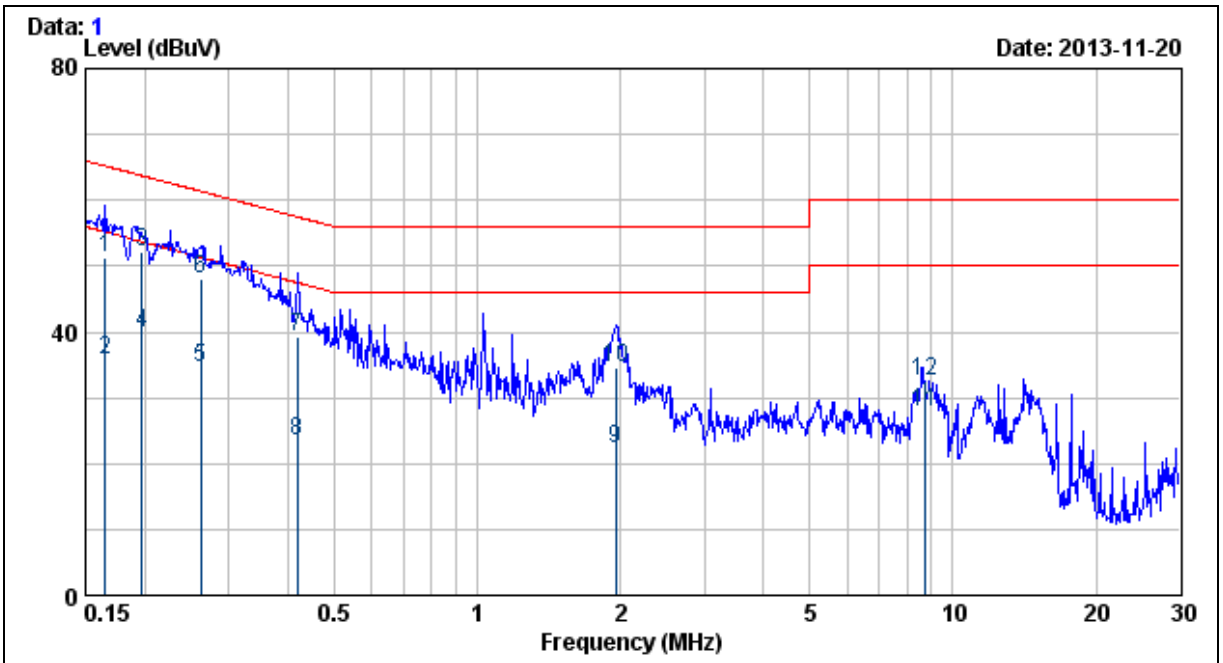
## TEST RESULTS

No non-compliance noted.

## CONDUCTED RF VOLTAGE MEASUREMENT

| Model | SPO120 | Test Date | 2013/11/20 |
|---|---|---|---|
| TEMP& Humidity | 24°C, 49% | Test By | Sam Shen |
| Test Mode | Normal Operation | | |

LINE

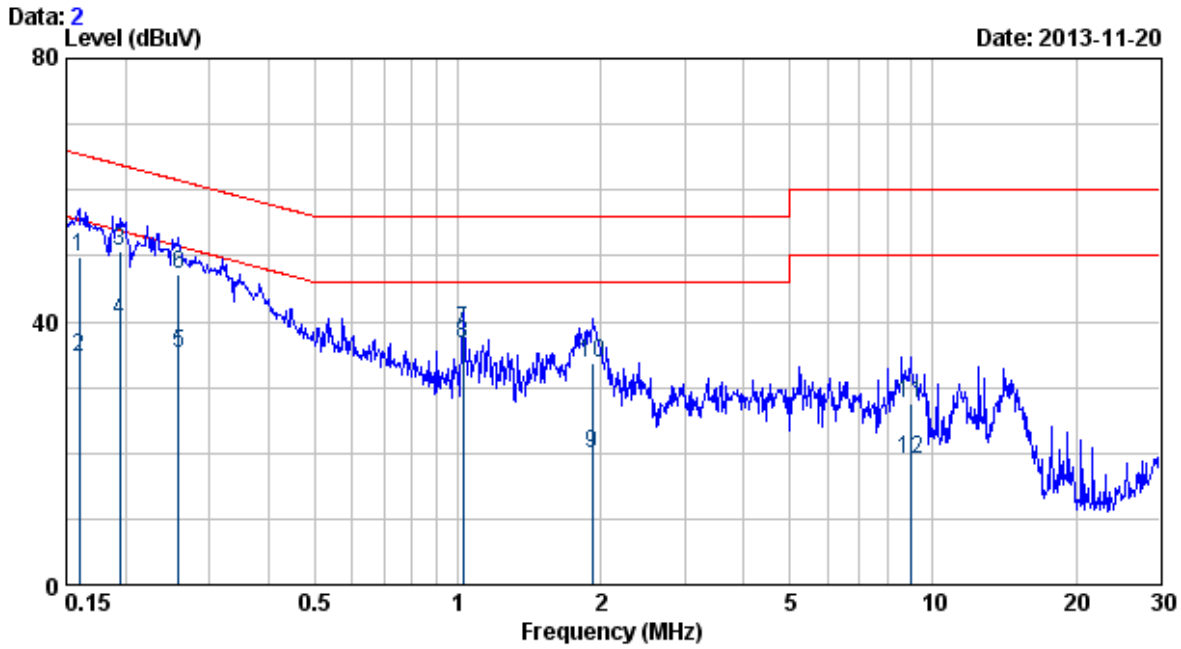



| Freq. MHz | ANT. Factor dB | Cable Loss dB | Meter Reading dBuA | Measured Level dBuA | Limits dBuA | Over Limits dBuA | Detector |
|---|---|---|---|---|---|---|---|
| 0.165 | 10.03 | 0.08 | 41.04 | 51.15 | 65.21 | -14.06 | QP |
| 0.165 | 10.03 | 0.08 | 25.65 | 35.76 | 55.21 | -19.45 | AVERAGE |
| 0.197 | 9.85 | 0.08 | 42.28 | 52.21 | 63.75 | -11.54 | QP |
| 0.197 | 9.85 | 0.08 | 29.92 | 39.85 | 53.75 | -13.90 | AVERAGE |
| 0.262 | 9.82 | 0.09 | 24.79 | 34.70 | 51.38 | -16.68 | AVERAGE |
| 0.262 | 9.82 | 0.09 | 38.06 | 47.97 | 61.38 | -13.41 | QP |
| 0.419 | 9.81 | 0.09 | 29.36 | 39.26 | 57.46 | -18.20 | QP |
| 0.419 | 9.81 | 0.09 | 13.68 | 23.58 | 47.46 | -23.88 | AVERAGE |
| 1.959 | 9.86 | 0.11 | 12.24 | 22.21 | 46.00 | -23.79 | AVERAGE |
| 1.959 | 9.86 | 0.11 | 24.74 | 34.71 | 56.00 | -21.29 | QP |
| 8.721 | 9.85 | 0.15 | 17.95 | 27.95 | 50.00 | -22.05 | AVERAGE |
| 8.721 | 9.85 | 0.15 | 22.40 | 32.40 | 60.00 | -27.60 | QP |

**REMARK:**
1. Correction Factor = Insertion loss + cable loss
2. Margin value = Emission level – Limit value

| Model | SPO120 | Test Date | 2013/11/20 |
|---|---|---|---|
| TEMP& Humidity | 24°C, 49% | Test By | Sam Shen |
| Test Mode | Normal Operation | | |

NEUTRAL




| Freq. MHz | ANT. Factor dB | Cable Loss dB | Meter Reading dBuA | Measured Level dBuA | Limits dBuA | Over Limits dBuA | Detector |
|---|---|---|---|---|---|---|---|
| 0.160 | 10.06 | 0.08 | 39.70 | 49.84 | 65.47 | -15.63 | QP |
| 0.160 | 10.06 | 0.08 | 24.38 | 34.52 | 55.47 | -20.95 | AVERAGE |
| 0.194 | 9.86 | 0.08 | 40.86 | 50.80 | 63.84 | -13.05 | QP |
| 0.194 | 9.86 | 0.08 | 30.20 | 40.14 | 53.84 | -13.71 | AVERAGE |
| 0.259 | 9.82 | 0.09 | 25.29 | 35.20 | 51.47 | -16.27 | AVERAGE |
| 0.259 | 9.82 | 0.09 | 37.38 | 47.29 | 61.47 | -14.18 | QP |
| 1.027 | 9.86 | 0.10 | 28.78 | 38.74 | 56.00 | -17.26 | QP |
| 1.027 | 9.86 | 0.10 | 26.59 | 36.55 | 46.00 | -9.45 | AVERAGE |
| 1.918 | 9.86 | 0.11 | 10.08 | 20.05 | 46.00 | -25.95 | AVERAGE |
| 1.918 | 9.86 | 0.11 | 23.84 | 33.81 | 56.00 | -22.19 | QP |
| 8.964 | 9.85 | 0.15 | 17.42 | 27.42 | 60.00 | -32.58 | QP |
| 8.964 | 9.85 | 0.15 | 9.02 | 19.02 | 50.00 | -30.98 | AVERAGE |

**REMARK:**
1. Correction Factor = Insertion loss + cable loss
2. Margin value = Emission level – Limit value

## 8.8 DUTY CYCLE

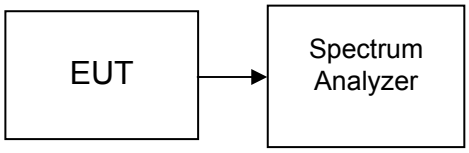
### LIMIT

Nil (No dedicated limit specified in the Rules)

### MEASUREMENT EQUIPMENT USED

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSEK 30 | 835253/002 | SEP. 29, 2014 |

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




**TEST CONFIGURATION**

### TEST PROCEDURE

1. Place the EUT on the table and set it in 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 center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span = 0Hz, a suitable Sweep Time.
5. Repeat above procedures until all frequency measured were complete.

### TEST RESULTS

No non-compliance noted.

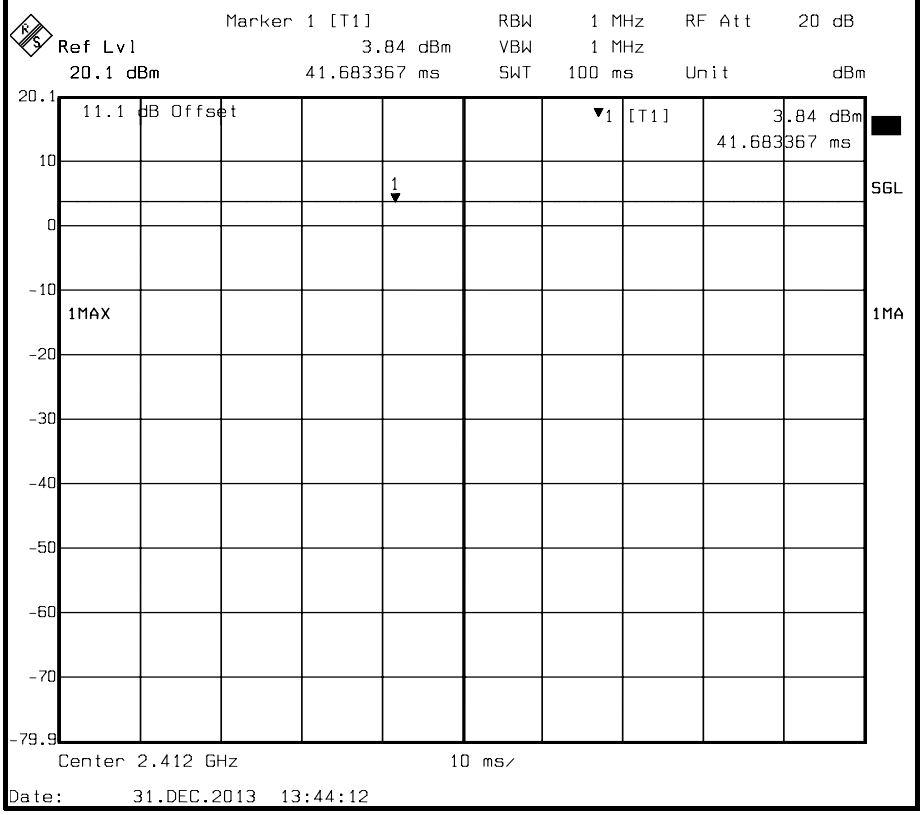
**TEST DATA**

| | us | Times | Ton | Total Ton times(ms) |
|---|---|---|---|---|
| Ton1 | 100000.000 | 1 | 100000.000 | 100.000 |
| Ton2 | | 0 | 0.000 | |
| Ton3 | | 0 | 0.000 | |
| Tp | | | | 100.000 |

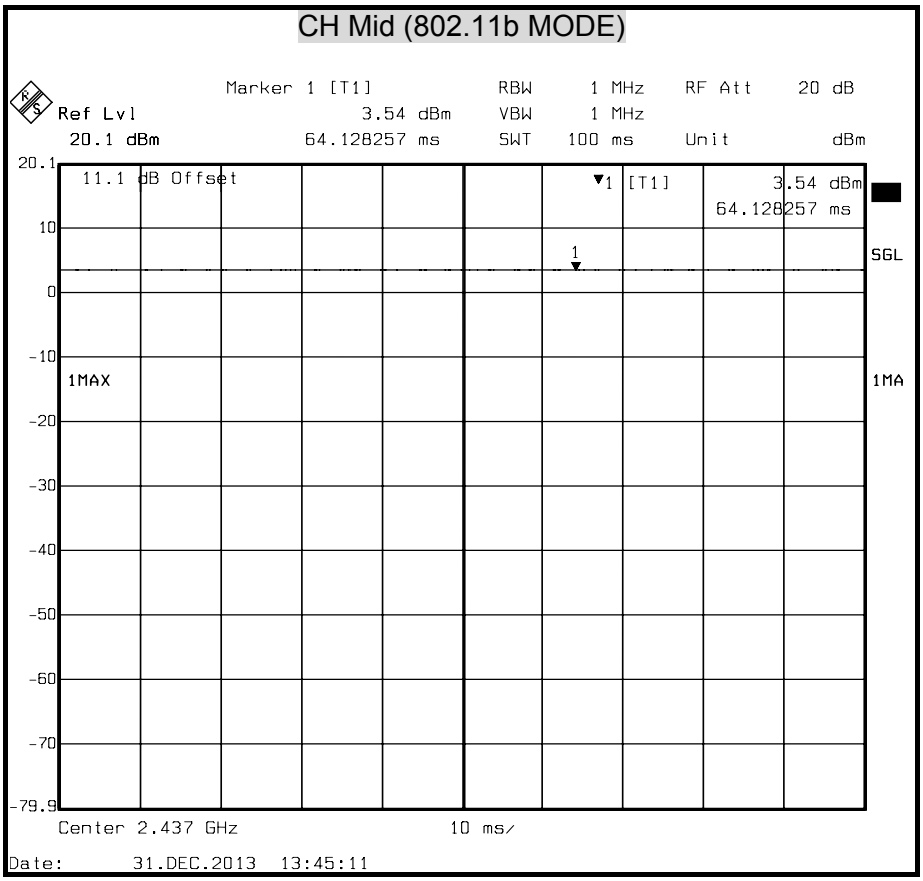
| | | | |
|---|---|---|---|
| Ton | 100.000 | | |
| Tp(Ton+Toff) | 100.000 | | |
| Duty Cycle | 1.000 | 100 | % |
| Duty Factor | 0.000 | | |

## Test Plot

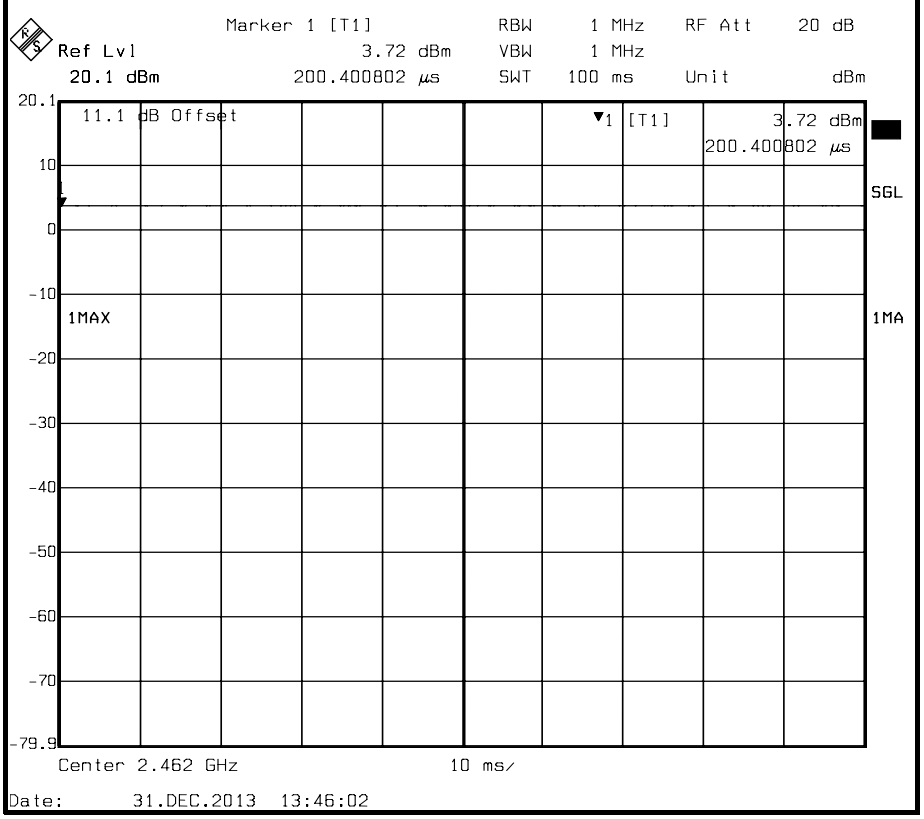
CH Low (802.11b MODE)



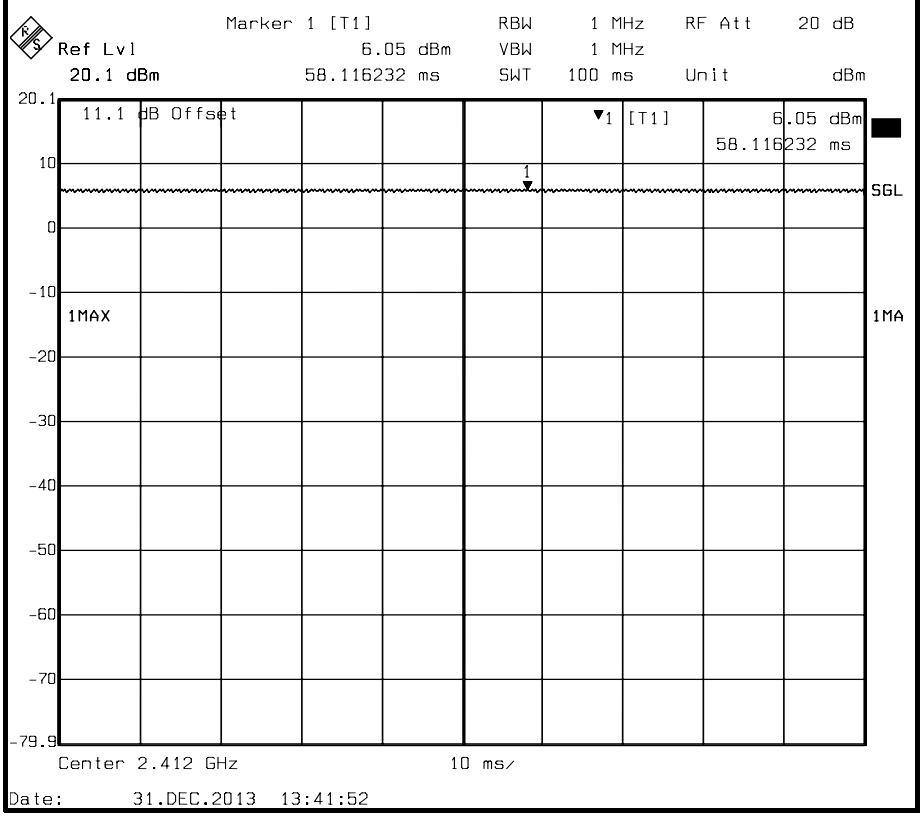

CH Mid (802.11b MODE)



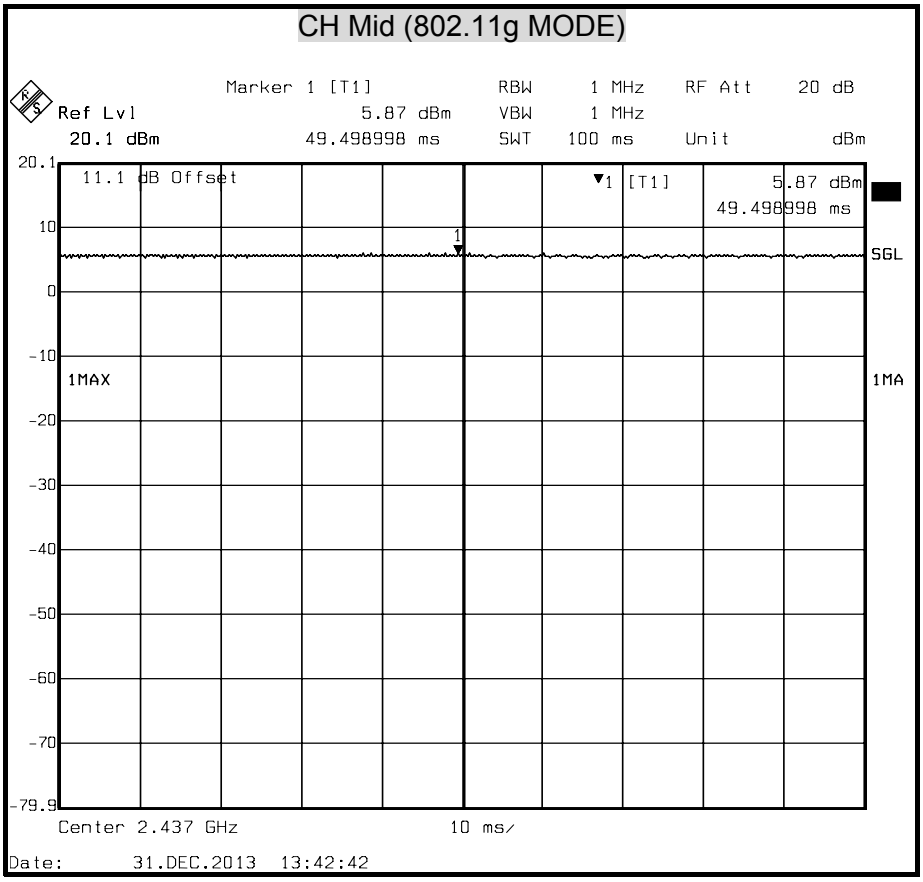
CH High (802.11b MODE)



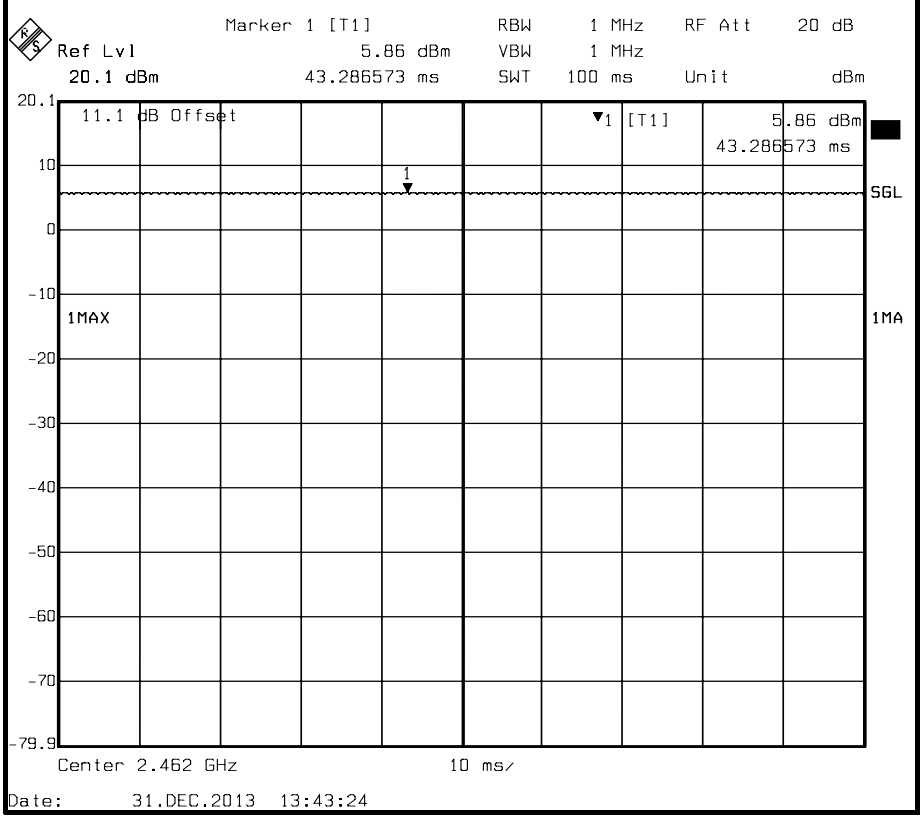
CH Low (802.11g MODE)



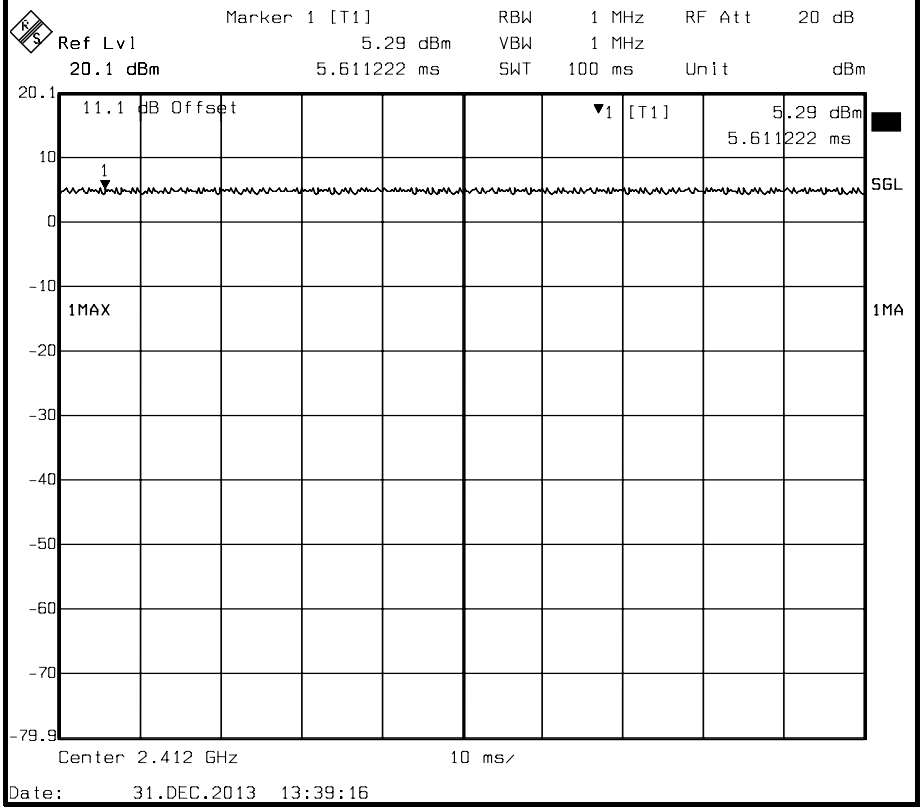

CH Mid (802.11g MODE)



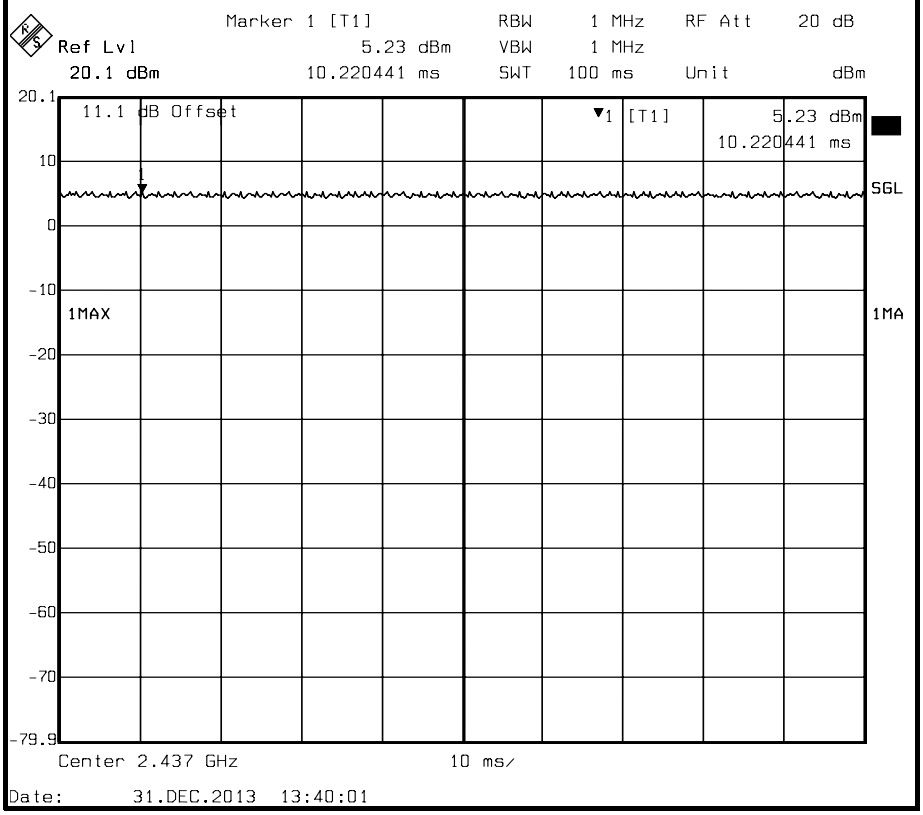
CH High (802.11g MODE)



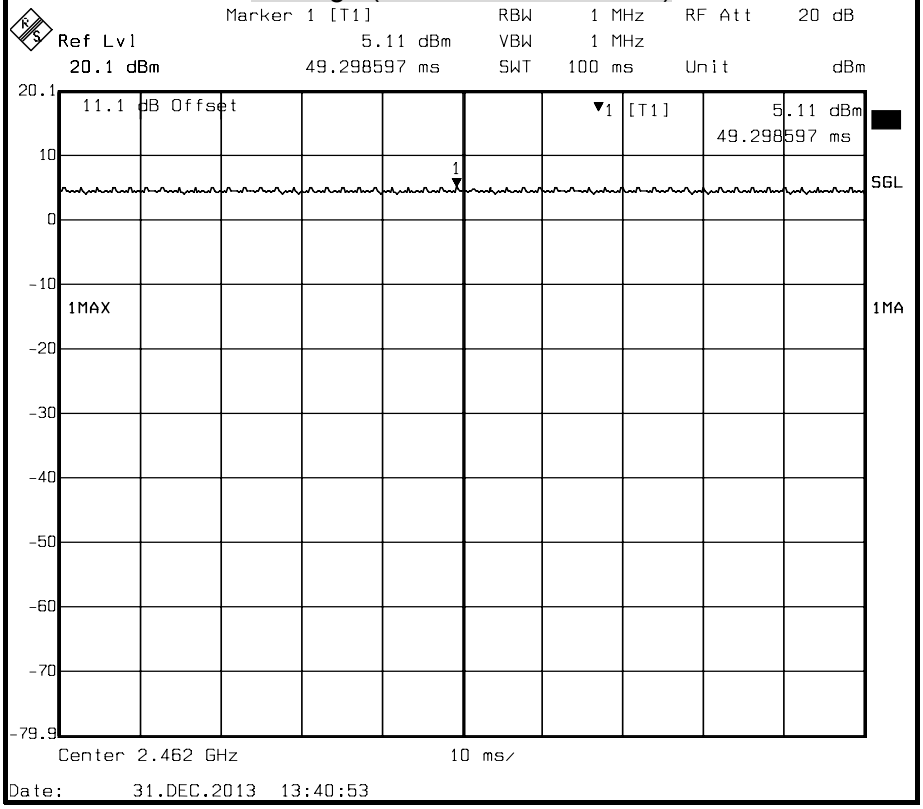
CH Low (802.11n HT20 MODE)



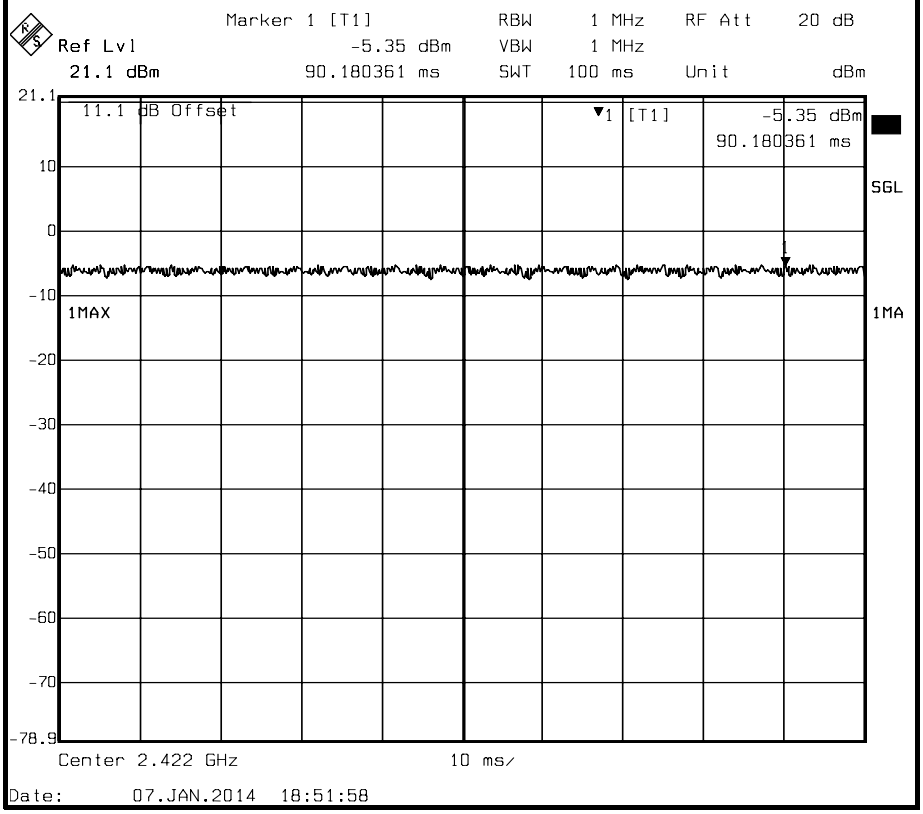

CH Mid (802.11n HT20 MODE)



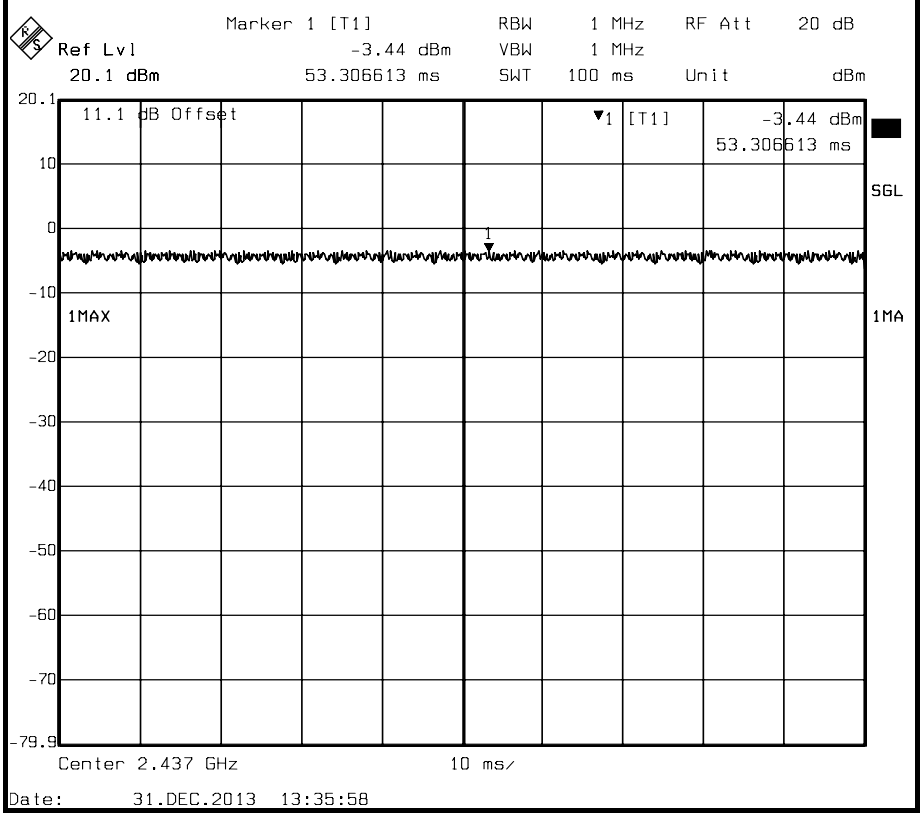
CH High (802.11n HT20 MODE)



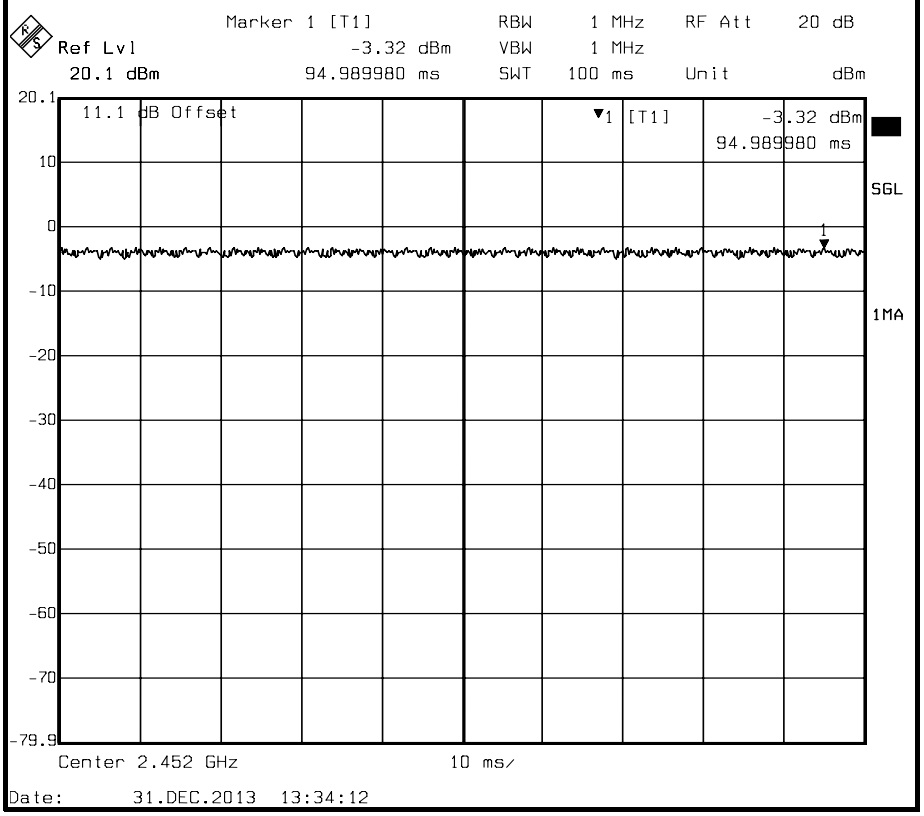
CH Low (802.11n HT40 MODE)




CH Mid (802.11n HT40 MODE)



CH High (802.11n HT40 MODE)



# 9. ANTENNA REQUIREMENT

## 9.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

## 9.2 ANTENNA CONNECTED CONSTRUCTION

The antenna spec. As below:

**Antenna (1T1R)**
Manufacturer: Master Wave Technology Co., Ltd.
Type: PCB
Model: 98P63MIPF000

Gain: 3.35 dBi