# EMC
# TEST REPORT

**Report No.:** **TS13070144-EME**
**Model No.:** **T416**
**Issued Date:** **Sep. 04, 2013**

**Applicant:** **Kobo Inc**
**135 Liberty Street, Suite 101, Toronto, Ontario, M6K1A7 Canada**

**Test Method / Standard:** **CFR 47 FCC Part 15.247 & ANSI C63.4 2003**

**Registration No.:** **93910**

**Test By:** **Intertek Testing Services Taiwan Ltd.**
**No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li, Shiang-Shan District, Hsinchu City, Taiwan**



Testing Laboratory
0597

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**These measurements were taken by:** Arthur Tsai

Arthur Tsai / Senior Engineer

**The test report was reviewed by:**

**Name** Jimmy Yang
**Title** Engineer

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## 1. Summary of Test Data

| Test/Requirement Description | Applicable Rule | Result |
|---|---|---|
| - 6dB Bandwidth | 15.247(a)(2) | Pass |
| Maximum Output Power | 15.247(b) | Pass |
| Power Spectral Density | 15.247(e) | Pass |
| RF Antenna Conducted Spurious | 15.247(d) | Pass |
| Radiated Spurious Emission | 15.247(d), 15.205, 15.209 | Pass |
| Emission on the Band Edge | 15.247(d) | Pass |
| AC Power Line Conducted Emission | 15.207 | Pass |

## 2. General Information

### Identification of the EUT

| | |
|---|---|
| Product: | Tablet |
| Model No.: | T416 |
| FCC ID.: | ZJLKOBOT416 |
| Frequency Range: | 2412MHz~2462MHz for 802.11b, 802.11g, 802.11n HT20 |
| Channel Number: | 11 channels for 2412MHz~2462MHz |
| Frequency of Each Channel: | 2412+5 k MHz, k＝0~10 for 802.11b, 802.11g, 802.11n HT20 |
| Type of Modulation: | DSSS, OFDM |
| Rated Power: | 1. DC 5.35 V from adapter<br>2. DC 3.7 V from battery |
| Power Cord: | N/A |
| Data Cable: | USB shielded cable 1 meter × 1 |
| Sample Received: | Jul. 19, 2013 |
| Test Date(s): | Jul. 19, 2013~Aug. 19, 2013 |
| Note 1: | This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program. |
| Note 2: | When determining the test conclusion, the Measurement Uncertainty of test has been considered. |

**Description of EUT**

The EUT is Tablet, and was defined as information technology equipment.

For more detail features, please refer to User's manual as file name “Installation guide.pdf”

**Adapter Information**

The EUT will be supplied with a power supply from below list:

| No. | Brand | Model no. | Specification |
|---|---|---|---|
| Adapter | kobo | PSAI10R-050Q | I/P: 100-240V~, 0.3A, 50-60Hz<br>O/P: 5.35V, 2.0A |

**Antenna Description**

The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector.

Antenna Gain : 0.36dBi
Antenna Type : PIFA Antenna
Connector Type : I-PEX

**Operation Mode**

The EUT is supplied with DC 3.7 V from battery for all test items except for conducted emission test.

The EUT is supplied with DC 5.35 V from adapter (Test voltage: 120VAC, 60Hz) for conducted emission test.

The EUT executes test by “MS-DOS” and enters the relevant commands provided by Wistron.

The signal is maximized through rotation and placement in the three orthogonal axes (The EUT configuration refers to the “Spurious set-up photo.pdf”).
After verifying three axes, we found the maximum electromagnetic field was occurred at X axis. The final test data was executed under this configuration.

With individual verifying, the maximum output power was found out 1 Mbps data rate for 802.11b mode, 6 Mbps data rate for 802.11g mode, 7.2 Mbps data rate for 802.11n HT 20 mode.

The final tests were executed under these conditions recorded in this report individually.

Please refer the details below:

| Chain 0: 802.11b channel 6 | |
|---|---|
| **Data rate (Mbps)** | **PK(dBm)** |
| 1 | 18.96 |
| 2 | 18.90 |
| 5.5 | 18.88 |
| 11 | 18.91 |

| Chain 0: 802.11g channel 6 | |
|---|---|
| **Data rate (Mbps)** | **PK(dBm)** |
| 6 | 20.59 |
| 9 | 20.01 |
| 12 | 19.99 |
| 18 | 19.9 |
| 24 | 19.80 |
| 36 | 19.85 |
| 48 | 19.81 |
| 54 | 19.80 |

| Chain 0: 802.11n HT20 channel 6 | |
|---|---|
| **Data rate (Mbps)** | **PK(dBm)** |
| 7.2 | 20.47 |
| 14.4 | 20.41 |
| 21.7 | 20.39 |
| 28.9 | 20.35 |
| 43.3 | 20.39 |
| 57.8 | 19.22 |
| 65.0 | 19.29 |
| 72.2 | 19.20 |

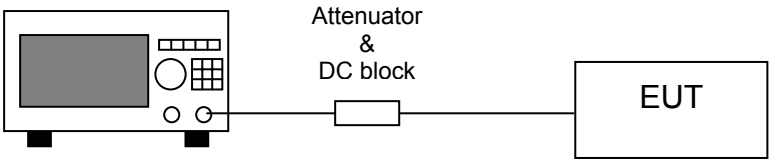
## 3. - 6dB Bandwidth

| Name of Test | - 6dB Bandwidth |
|---|---|
| Base Standard | FCC 15.247 (a)(2) |

**Test Result:** Complies
**Measurement Data:** See Table & plots below
**Test Date:** Aug. 19, 2013

**Method of Measurement:**
**Reference FCC document: KDB558074 D01**
Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 1-5 % of the DTS channel bandwidth and not to exceed 100kHz, video bandwidth (VBW) ≥ 3 x RBW. In order to make an accurate measurement, set the span greater than DTS channel bandwidth. The - 6dB bandwidth must be greater than 500 kHz.

**Test Diagram:**



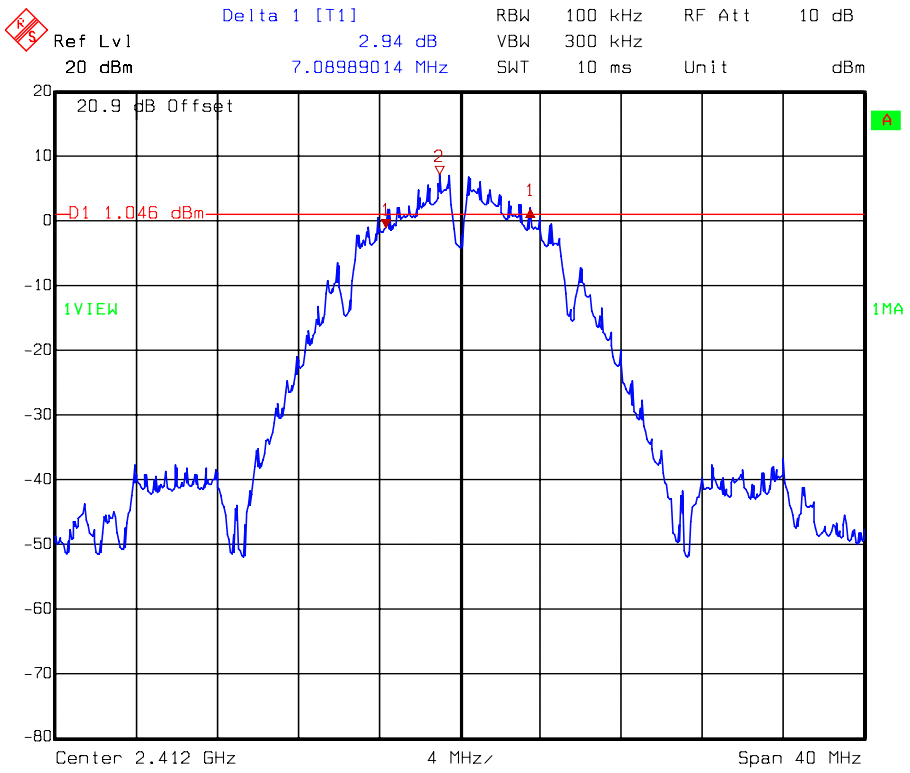

Spectrum Analyzer

**Note:** The EUT was tested while in a continuous transmit mode and the worst case data rates are 1 Mbps data rate for 802.11b mode, 6 Mbps data rate for 802.11g mode, 7.2 Mbps data rate for 802.11n HT20 mode. The EUT was tuned to a low, middle and high channel.

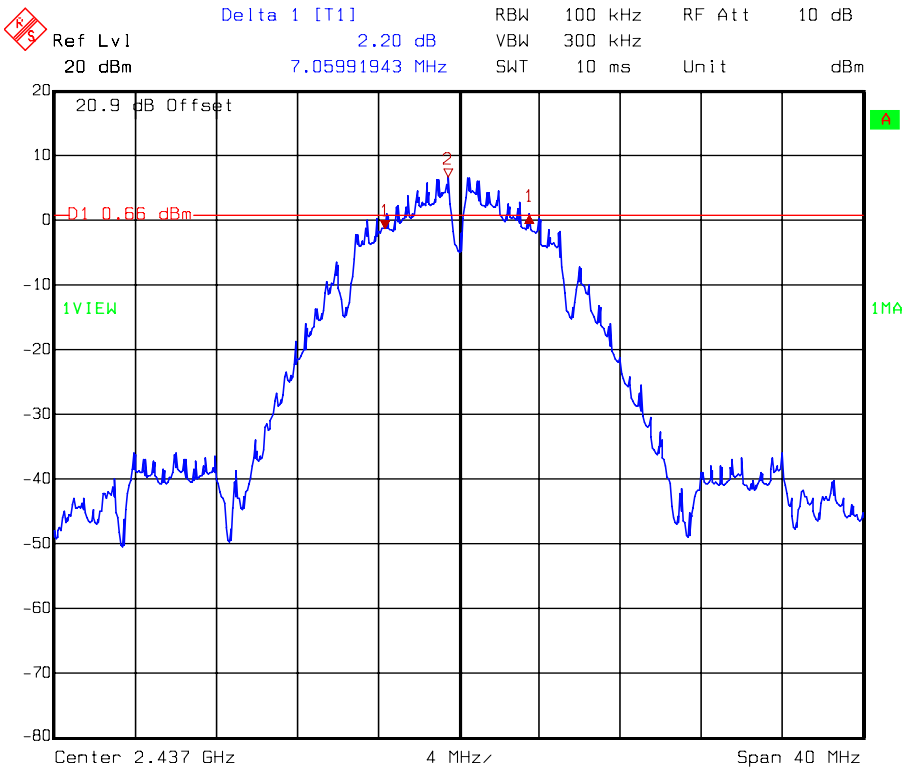
**Table: - 6dB Bandwidth**

| 1TX Mode | Channel | Frequency (MHz) | - 6dB Bandwidth (MHz) | Min. Limit (MHz) | Pass/Fail |
|---|---|---|---|---|---|
| 802.11b | 1 | 2412 | 7.090 | 0.5 | Pass |
| | 6 | 2437 | 7.060 | 0.5 | Pass |
| | 11 | 2462 | 8.016 | 0.5 | Pass |
| 802.11g | 1 | 2412 | 16.463 | 0.5 | Pass |
| | 6 | 2437 | 16.385 | 0.5 | Pass |
| | 11 | 2462 | 16.421 | 0.5 | Pass |
| 802.11n HT20 | 1 | 2412 | 17.194 | 0.5 | Pass |
| | 6 | 2437 | 17.624 | 0.5 | Pass |
| | 11 | 2462 | 17.286 | 0.5 | Pass |

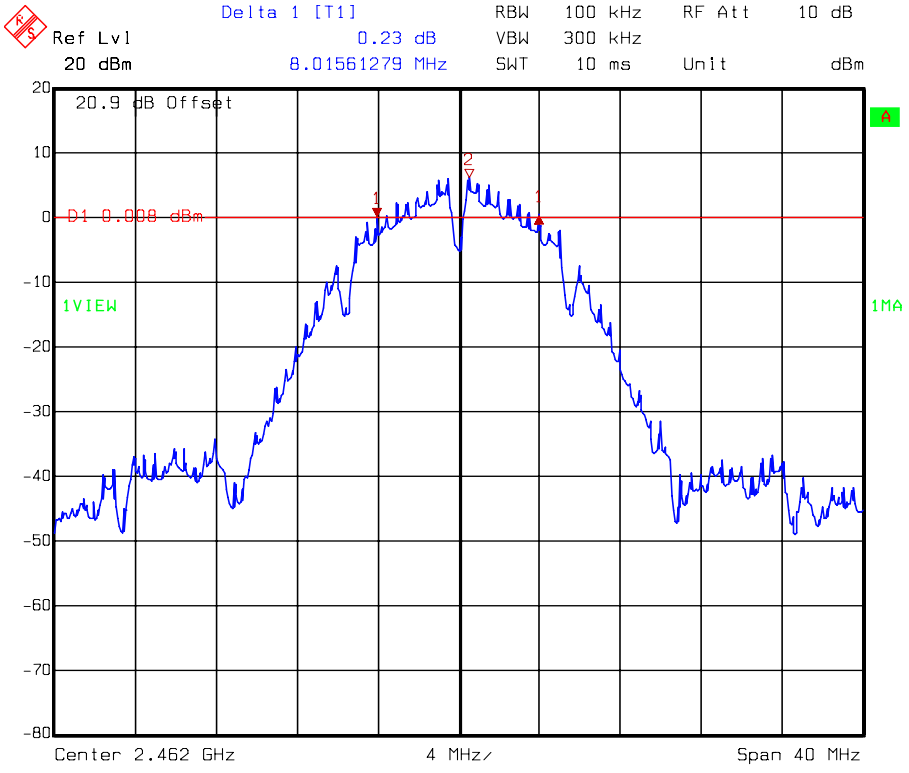
**Chain 0: - 6dB Bandwidth @ 802.11b mode Channel 1**



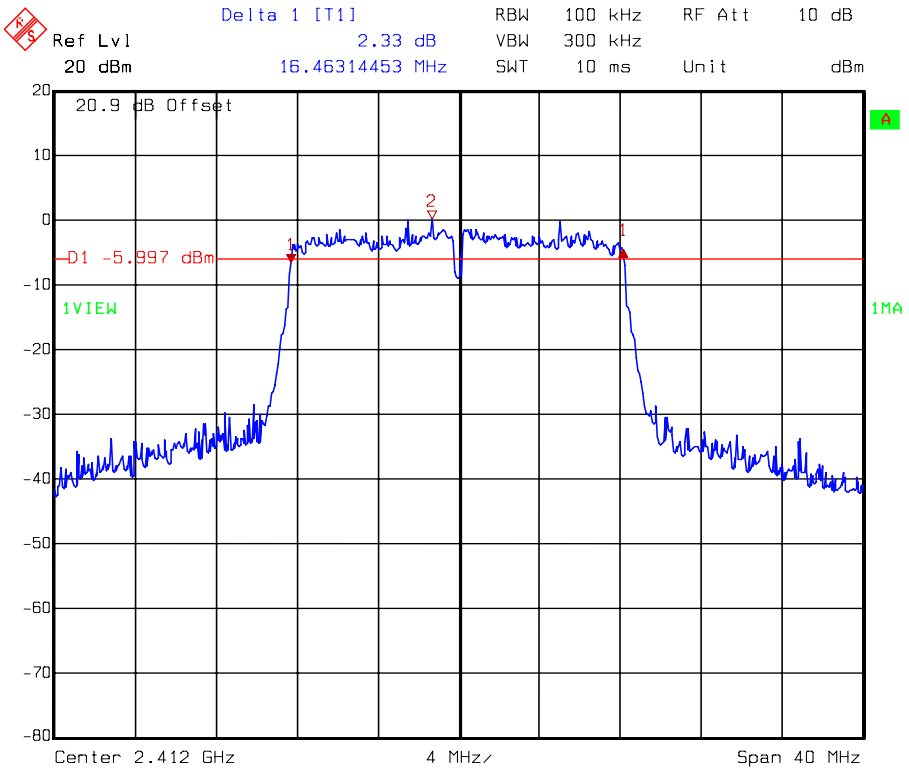
## Chain 0: - 6dB Bandwidth @ 802.11b mode Channel 6



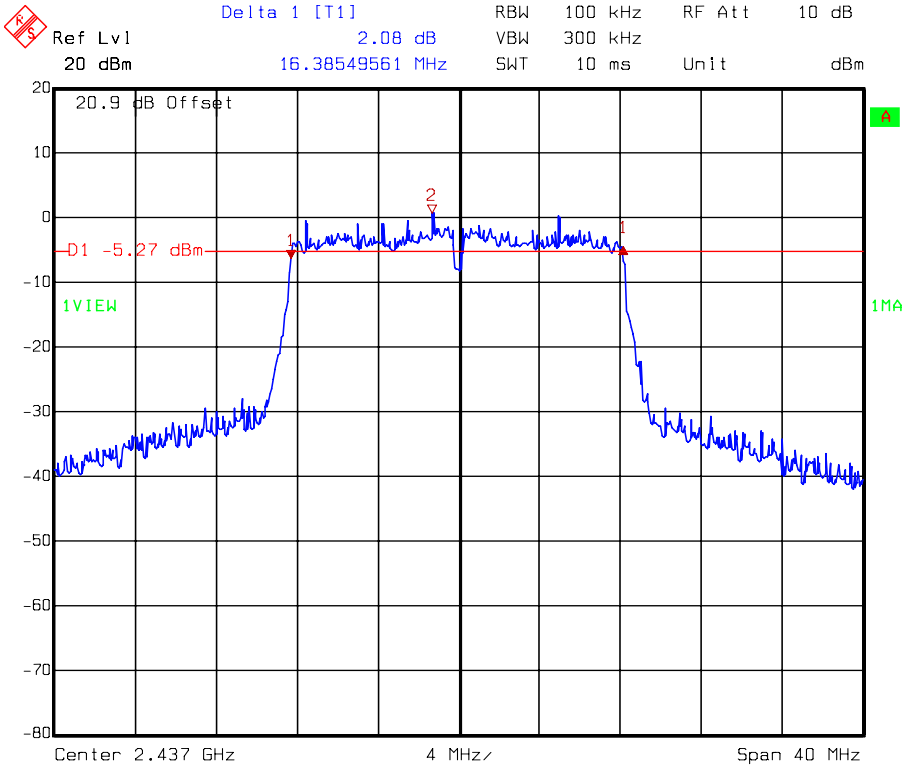

## Chain 0: - 6dB Bandwidth @ 802.11b mode Channel 11



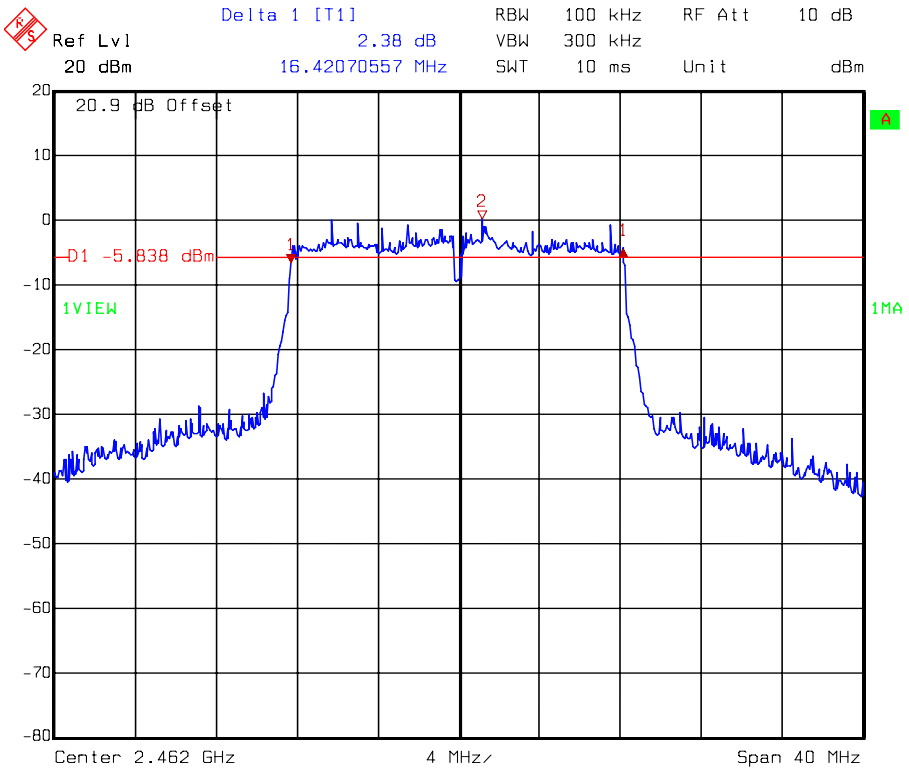
## Chain 0: - 6dB Bandwidth @ 802.11g mode Channel 1



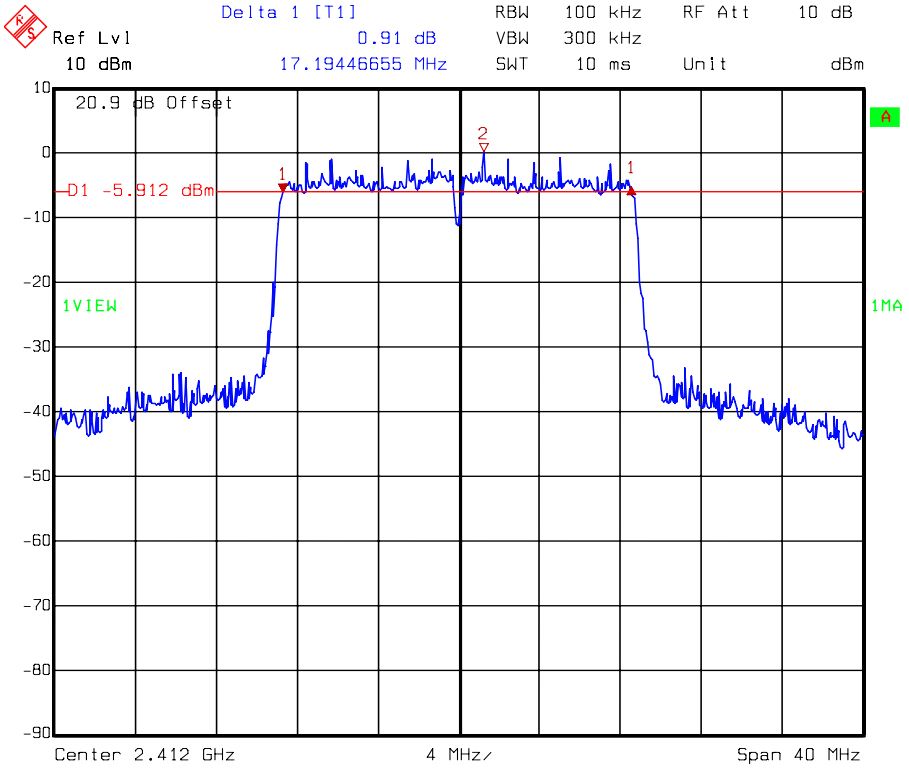

## Chain 0: - 6dB Bandwidth @ 802.11g mode Channel 6



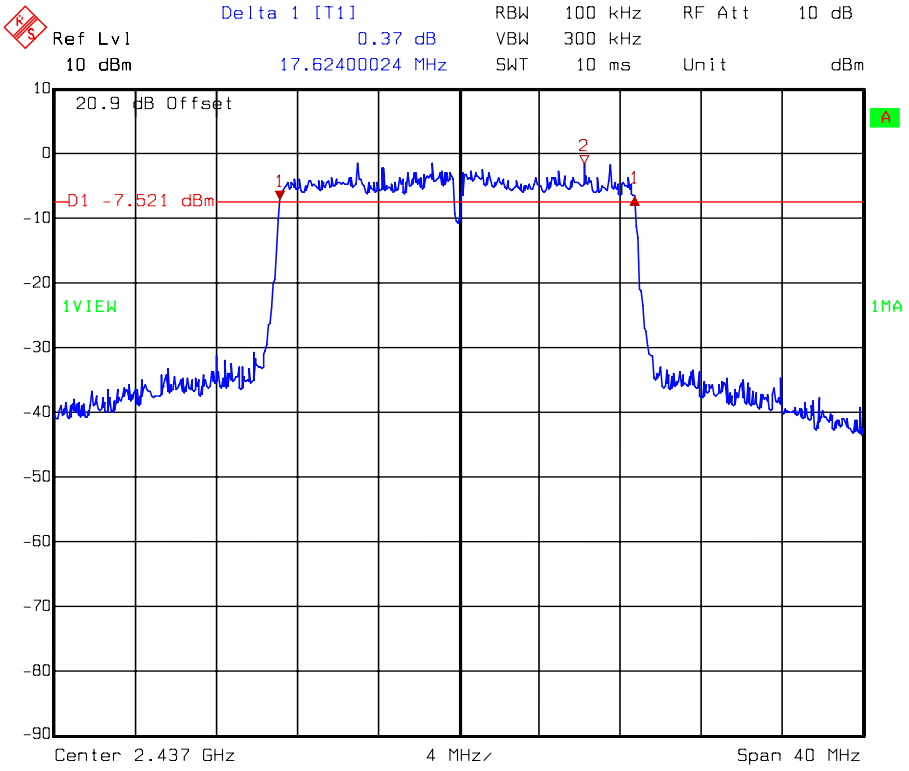
## Chain 0: - 6dB Bandwidth @ 802.11g mode Channel 11



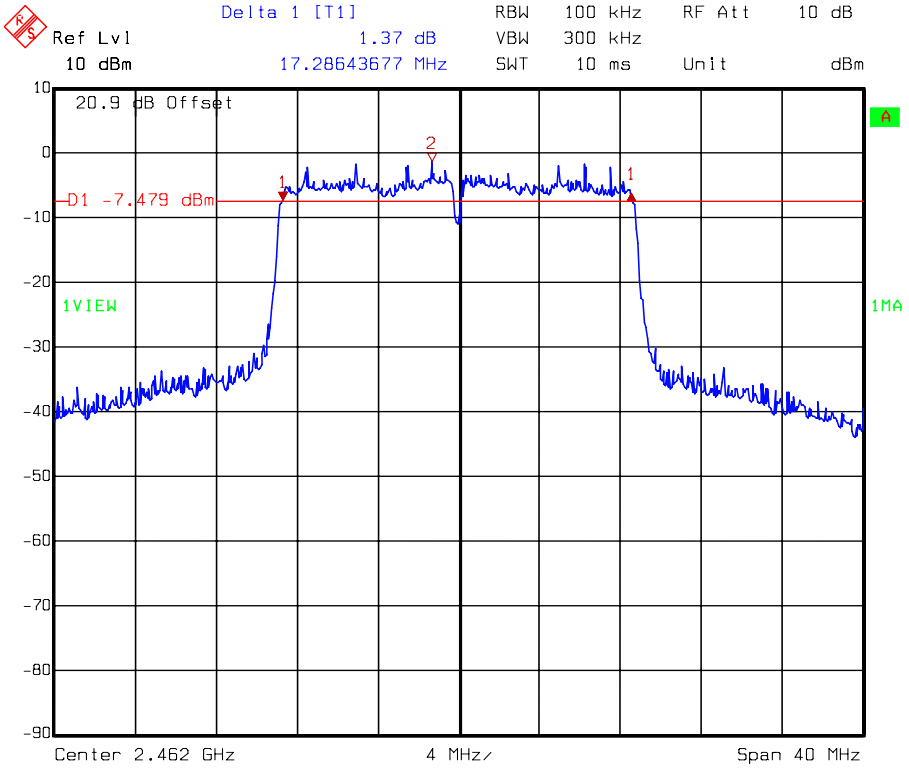

## Chain 0: - 6dB Bandwidth @ 802.11n HT20 mode Channel 1



## Chain 0: - 6dB Bandwidth @ 802.11n HT20 mode Channel 6




## Chain 0: - 6dB Bandwidth @ 802.11n HT20 mode Channel 11



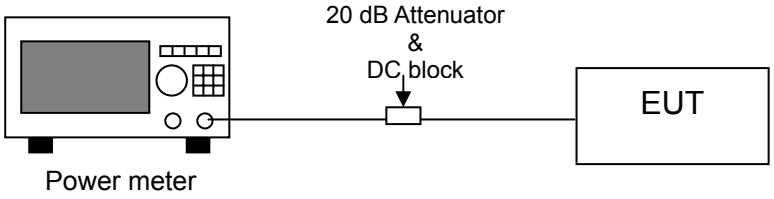
## 4. Maximum Output Power

| Name of Test | Maximum Output Power |
|---|---|
| Base Standard | FCC 15.247(b) |

**Measurement Uncertainty:** ±0.392 dB (k=2)
**Test Result:** Complies
**Measurement Data:** See Table below
**Test Date:** Aug. 15, 2013

**Method of Measurement: Peak Power Meter**
**Reference FCC document: KDB558074 D01**
The power output was measured on the EUT using a 50 ohm SMA Cable connected to peak and average power meter via power sensor. Connect the 20 dB attenuator and DC block at the input port of the power sensor. Measure the conducted transmitting power at each antenna port. Power output was measured with the maximum rated input level.

**Test Diagram:**




**Note 1:** §15.247 (b) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) 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) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**Table: Maximum Output Power**

| 1TX Mode | Channel | Frequency (MHz) | Output Power (dBm) PK | Total Calculated Power (mW) PK | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| 802.11b | 1 | 2412 | 18.70 | 74.13 | 30 | -11.30 |
| | 6 | 2437 | 18.96 | 78.70 | 30 | -11.04 |
| | 11 | 2462 | 18.29 | 67.45 | 30 | -11.71 |
| 802.11g | 1 | 2412 | 20.52 | 112.72 | 30 | -9.48 |
| | 6 | 2437 | 20.59 | 114.55 | 30 | -9.41 |
| | 11 | 2462 | 20.15 | 103.51 | 30 | -9.85 |
| 802.11n HT20 | 1 | 2412 | 20.59 | 114.55 | 30 | -9.41 |
| | 6 | 2437 | 20.47 | 111.43 | 30 | -9.53 |
| | 11 | 2462 | 20.47 | 111.43 | 30 | -9.53 |

## 5. Power Spectral Density

| Name of Test | Power Spectral Density |
|---|---|
| Base Standard | FCC 15.247(e) |

**Test Result:** Complies
**Measurement Data:** See Table & plots below
**Test Date:** Aug. 19, 2013

**Method of Measurement: Peak PSD**
**Reference FCC document: KDB558074 D01**
The power spectrum density was measured from the antenna port of the EUT using a 50 ohm spectrum analyzer. Set RBW = 100 kHz, VBW ≥ 300 kHz, sweep= auto couple. The peak level measured must be no greater than + 8 dBm. Power spectrum density was read directly and cable loss (1 dB)/external attenuator (20 dB) correction was added to the reading to obtain power at the EUT antenna terminals.

**Test Diagram:**

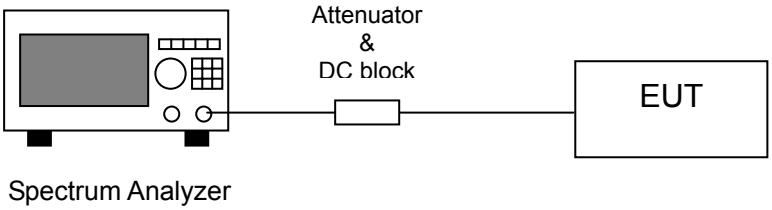
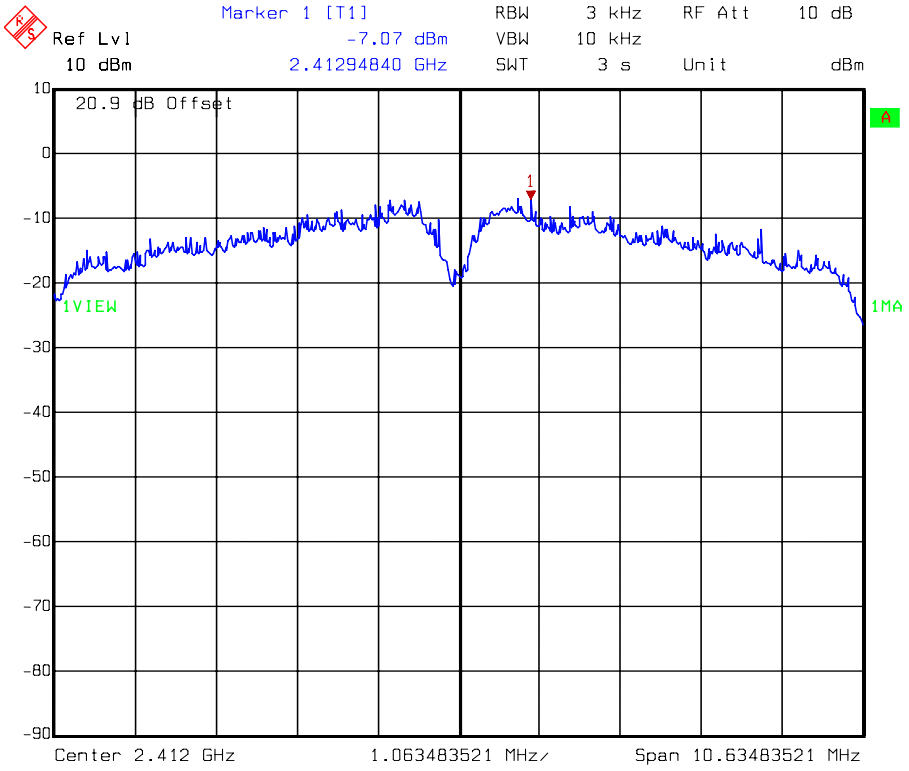


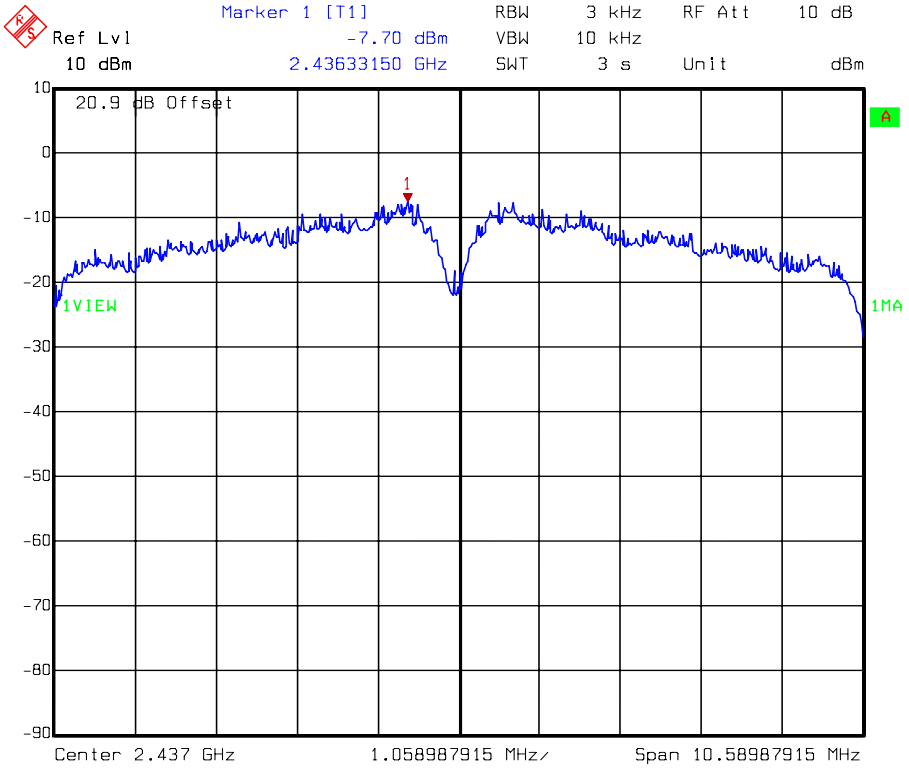

**Table: Power Spectral Density**

| 1TX Mode | Channel | Frequency (MHz) | PSD (dBm) | PSD (mW) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| 802.11b | 1 | 2412 | -7.07 | 0.20 | 8 | -15.07 |
| | 6 | 2437 | -7.70 | 0.17 | 8 | -15.70 |
| | 11 | 2462 | -6.78 | 0.21 | 8 | -14.78 |
| 802.11g | 1 | 2412 | -13.46 | 0.05 | 8 | -21.46 |
| | 6 | 2437 | -14.00 | 0.04 | 8 | -22.00 |
| | 11 | 2462 | -14.09 | 0.04 | 8 | -22.09 |
| 802.11n HT20 | 1 | 2412 | -14.98 | 0.03 | 8 | -22.98 |
| | 6 | 2437 | -14.25 | 0.04 | 8 | -22.25 |
| | 11 | 2462 | -15.58 | 0.03 | 8 | -23.58 |

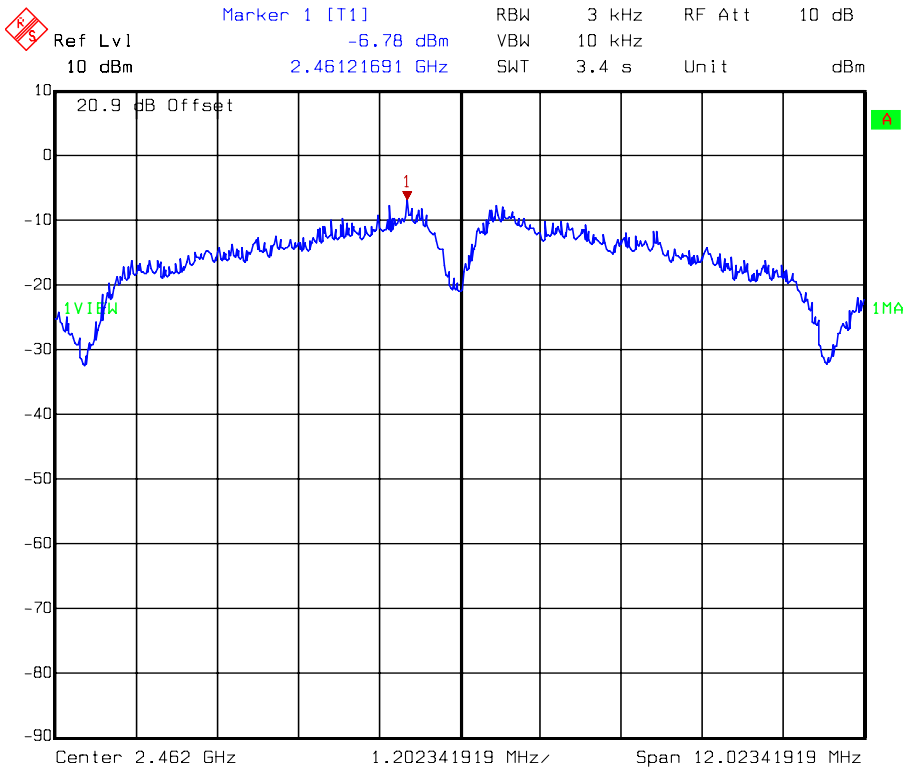
## Chain 0: Power Spectral Density @ 802.11b mode Channel 1



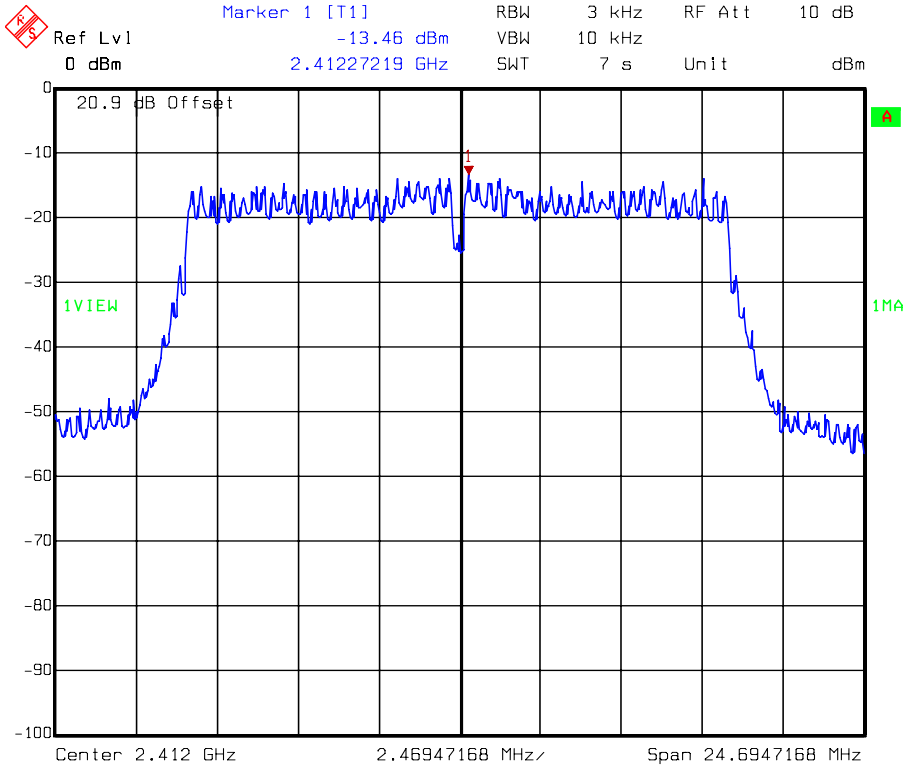

## Chain 0: Power Spectral Density @ 802.11b mode Channel 6



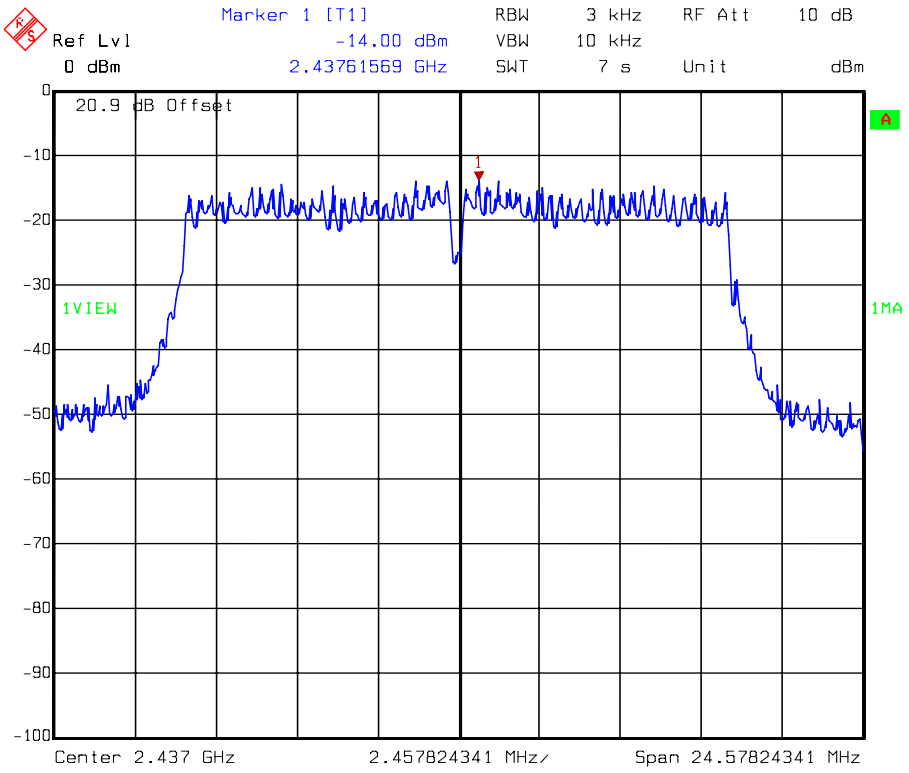
## Chain 0: Power Spectral Density @ 802.11b mode Channel 11



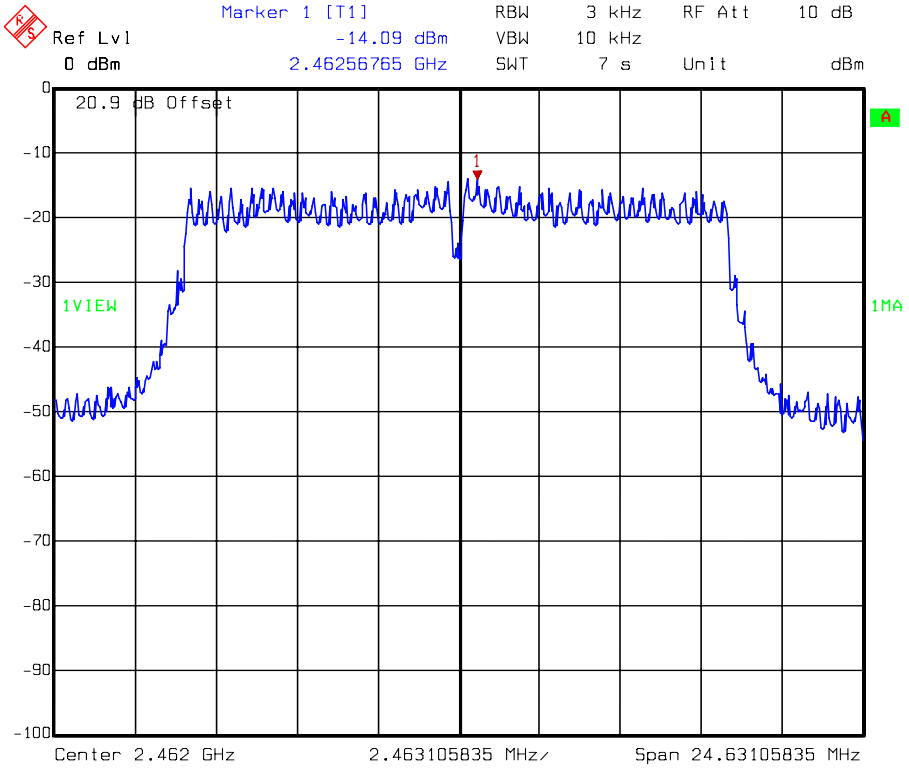

## Chain 0: Power Spectral Density @ 802.11g mode Channel 1



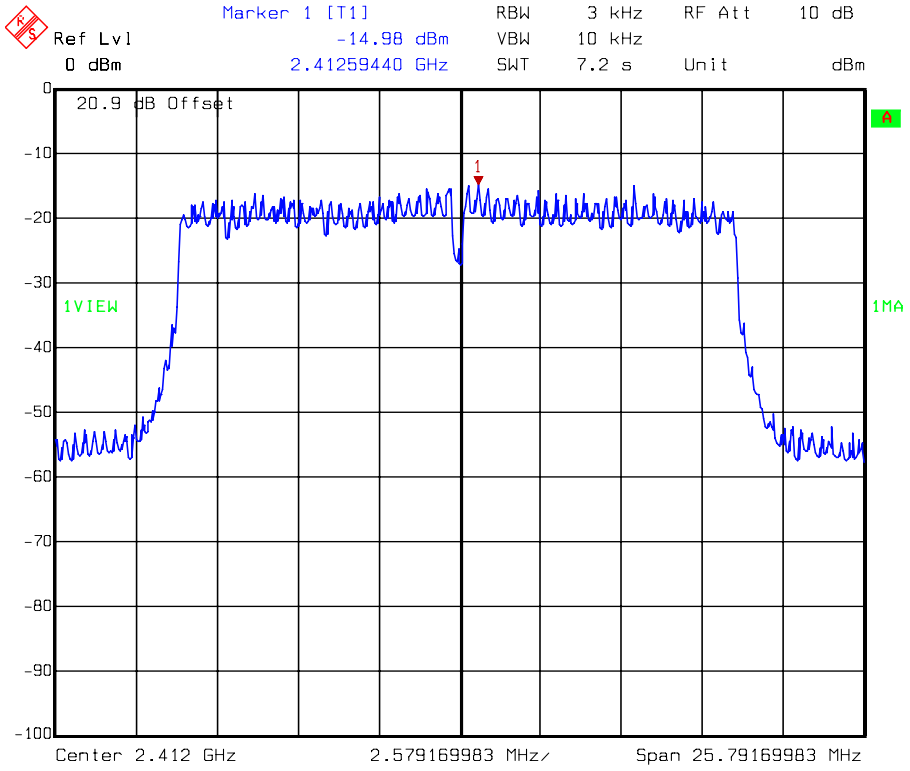
## Chain 0: Power Spectral Density @ 802.11g mode Channel 6



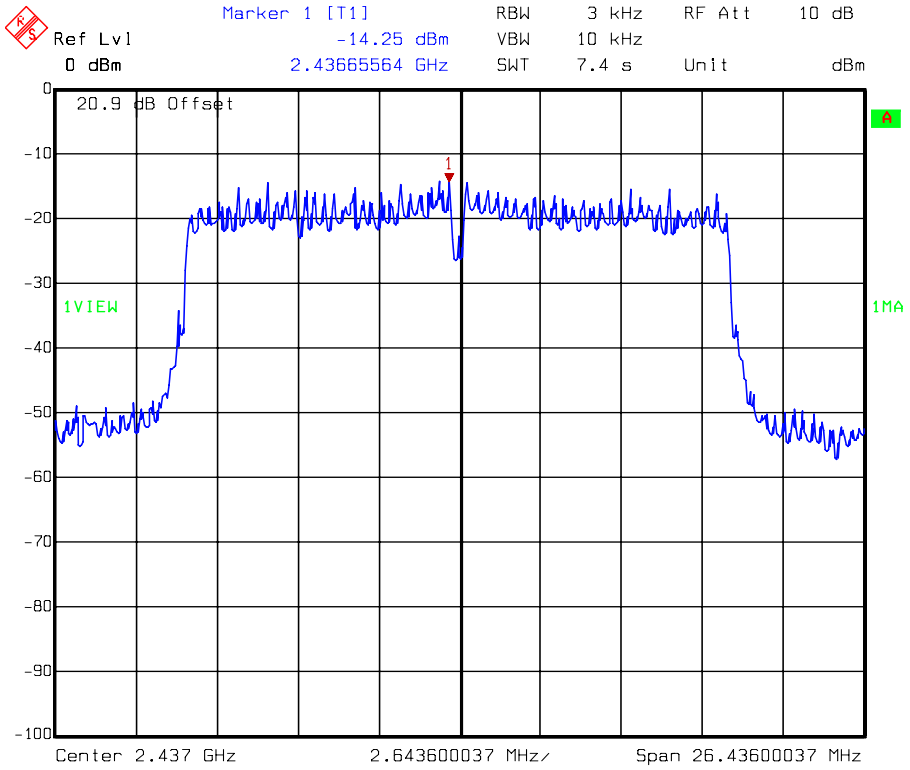

## Chain 0: Power Spectral Density @ 802.11g mode Channel 11



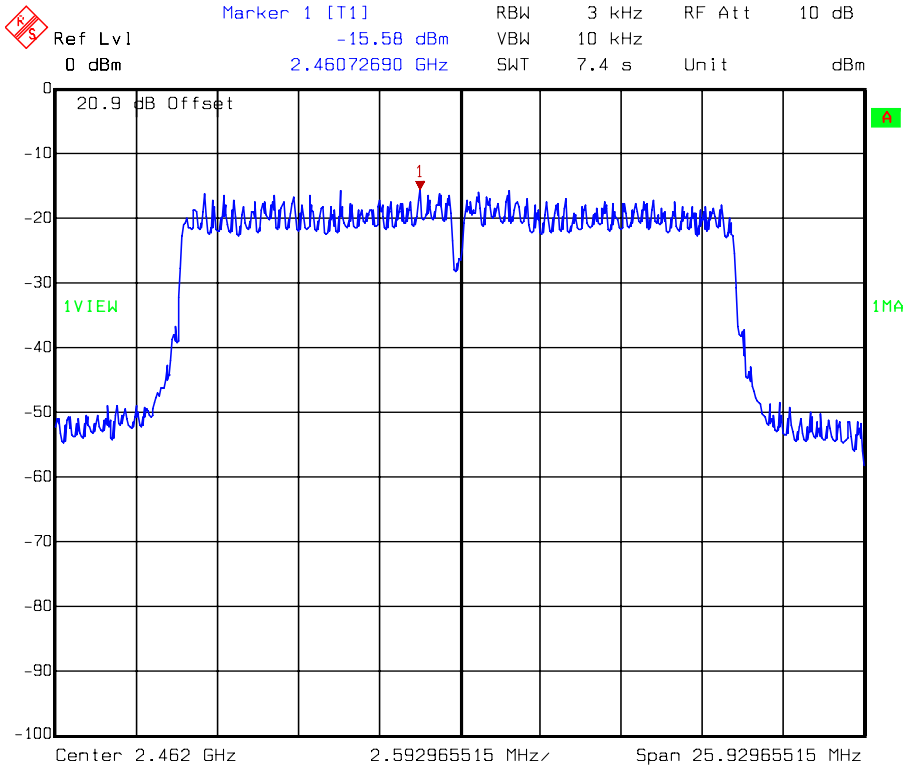
## Chain 0: Power Spectral Density @ 802.11n HT20 mode Channel 1




## Chain 0: Power Spectral Density @ 802.11n HT20 mode Channel 6



## Chain 0: Power Spectral Density @ 802.11n HT20 mode Channel 11



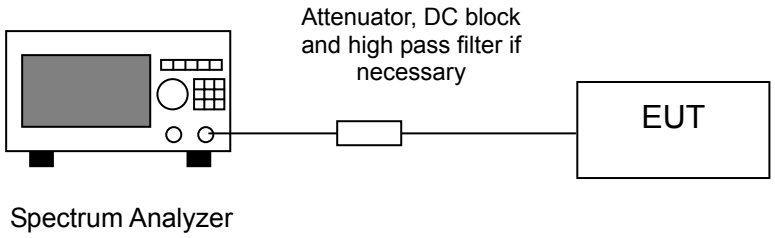
## 6. RF Antenna Conducted Spurious

| Name of Test | RF Antenna Conducted Spurious |
|---|---|
| Base Standard | FCC 15.247(d) |

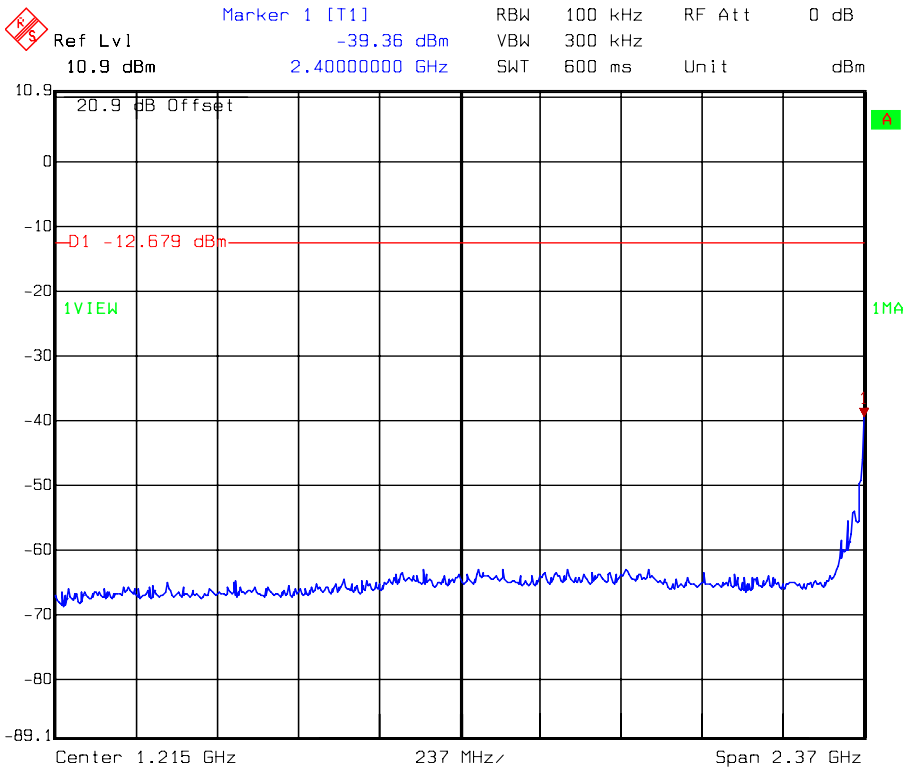
**Test Result:** Complies
**Measurement Data:** See plots below
**Test Date:** Aug. 19, 2013

**Method of Measurement:**
**Reference FCC document: KDB558074 D01**
The measurements were performed from 12 MHz to 25 GHz RF antenna conducted per FCC 15.247 (d) was measured from the EUT antenna port using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. Harmonics and spurious noise must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. If maximum (average) conducted output power was used to demonstrate compliance to **15.247(b)(3)** requirements, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz.

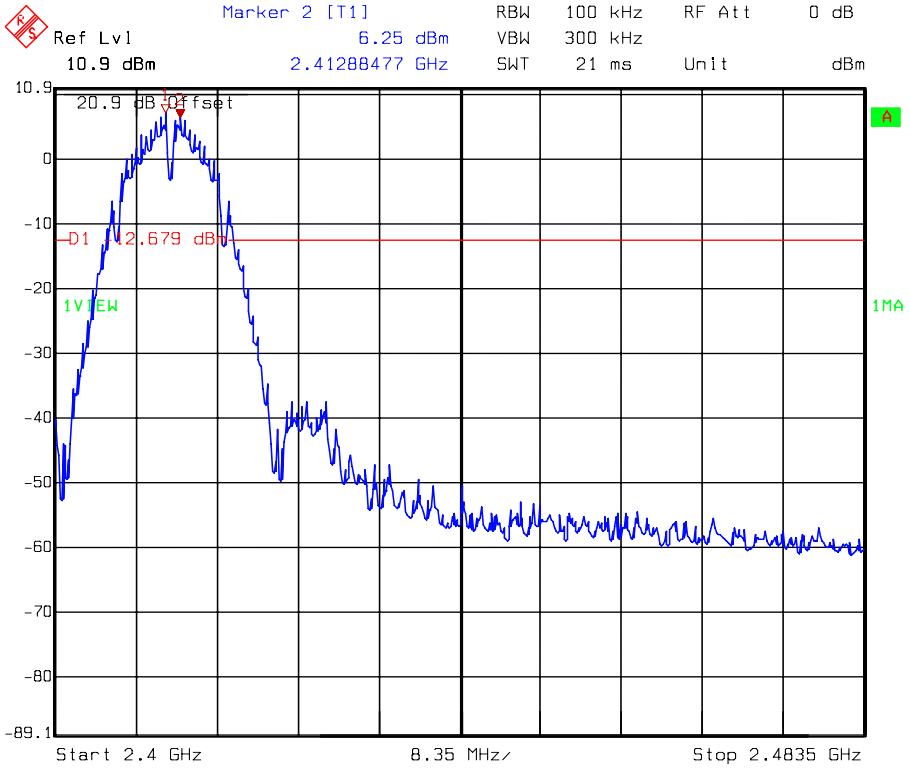
**Test Diagram:**



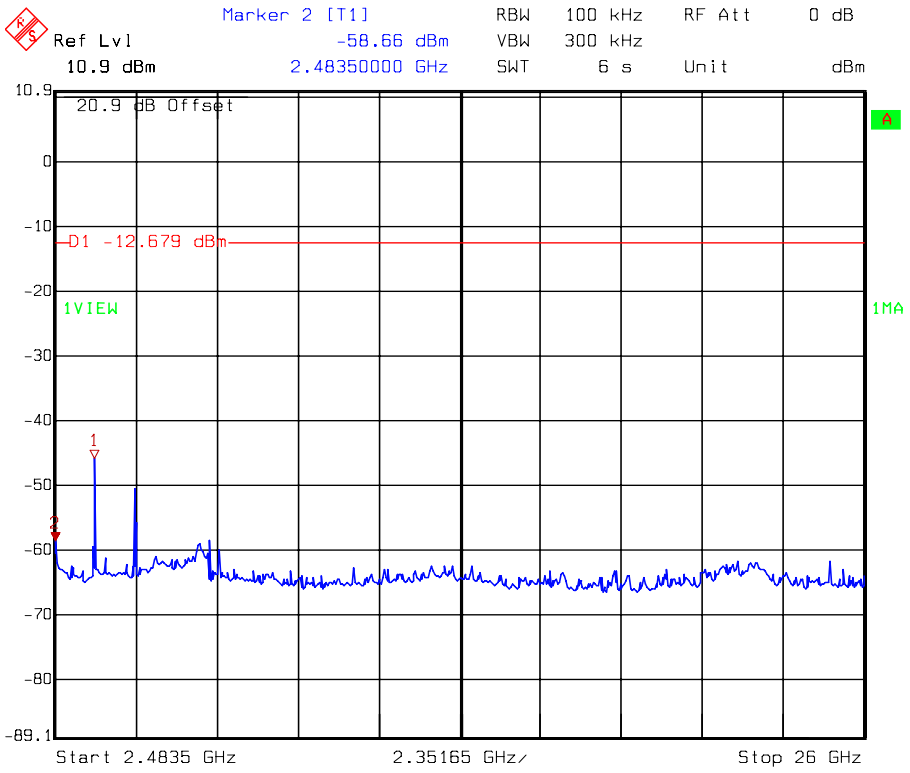
## Chain 0: Conducted Spurious @ 802.11b mode Channel 1 (1 of 3)



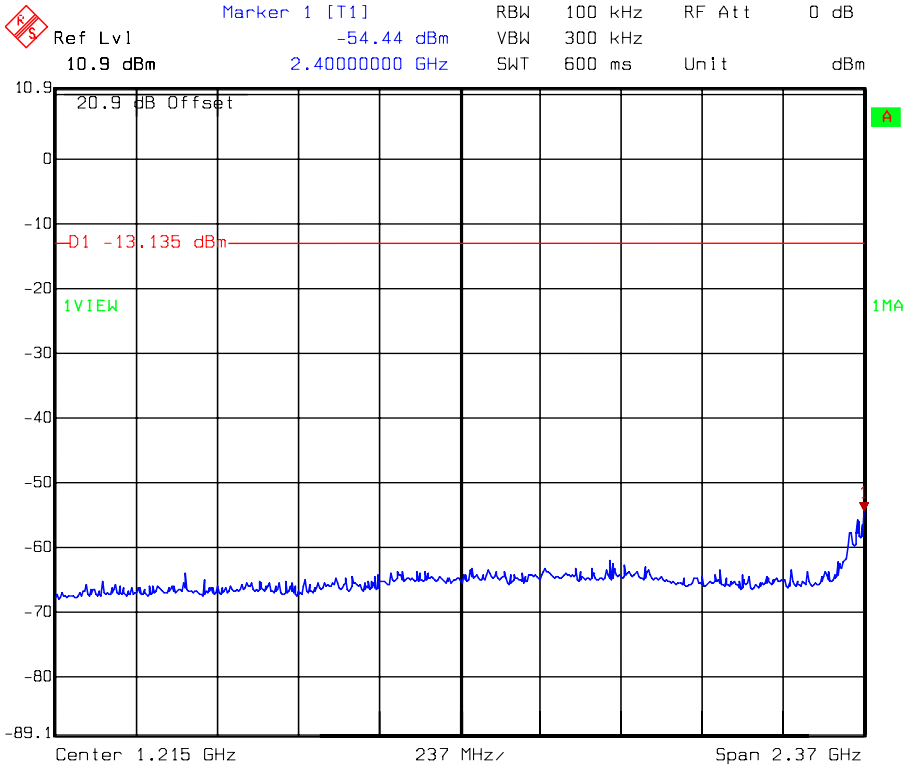

## Chain 0: Conducted Spurious @ 802.11b mode Channel 1 (2 of 3)



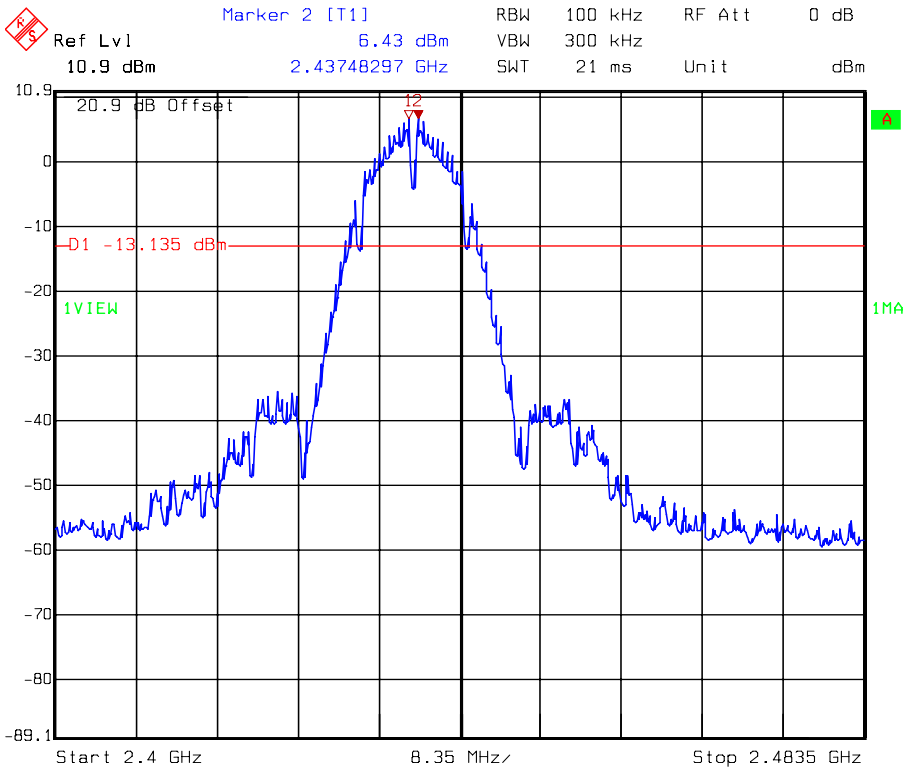
## Chain 0: Conducted Spurious @ 802.11b mode Channel 1 (3 of 3)



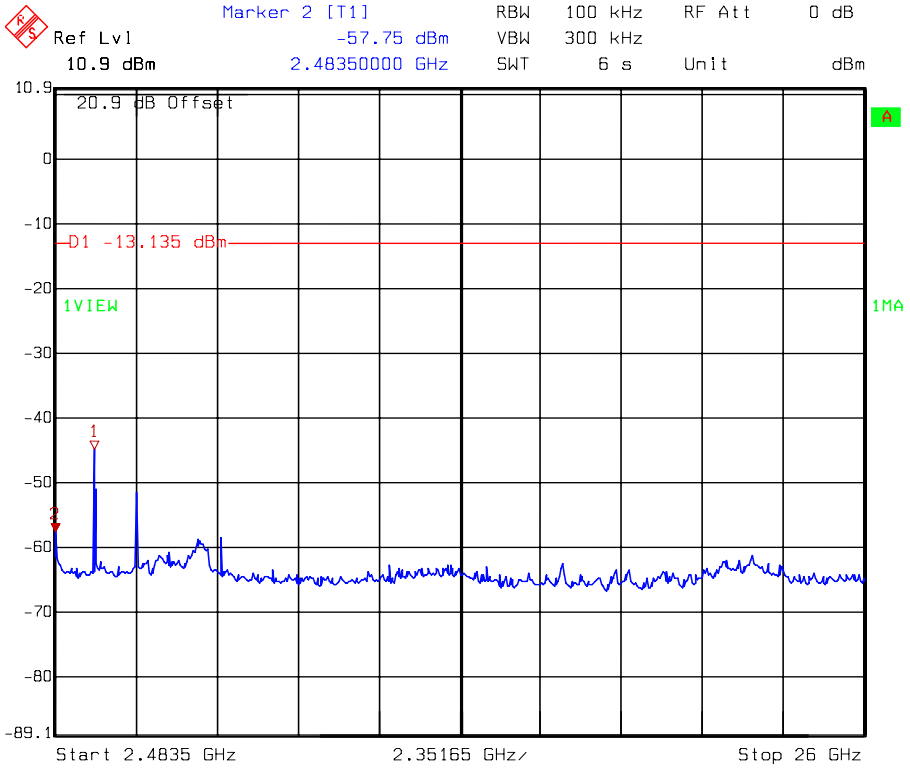

## Chain 0: Conducted Spurious @ 802.11b mode Channel 6 (1 of 3)



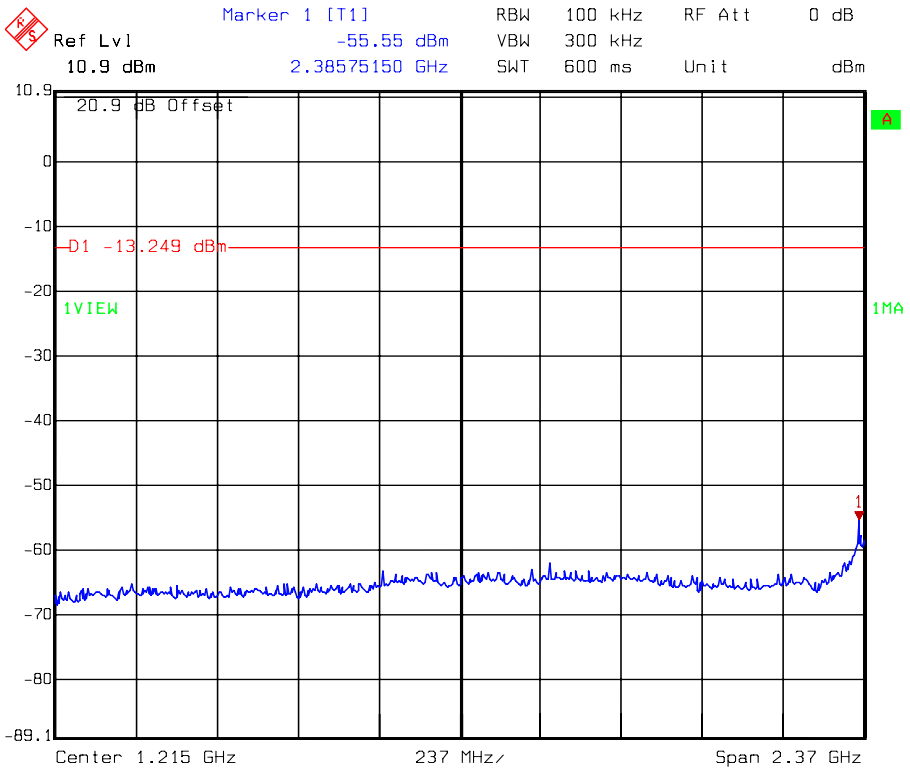
## Chain 0: Conducted Spurious @ 802.11b mode Channel 6 (2 of 3)



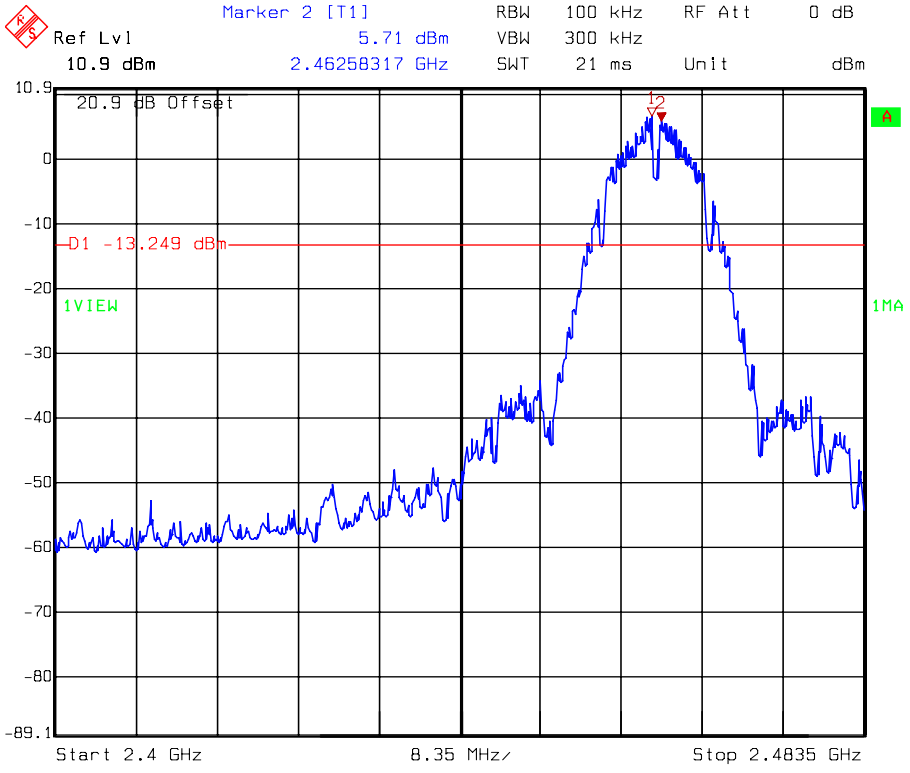

## Chain 0: Conducted Spurious @ 802.11b mode Channel 6 (3 of 3)



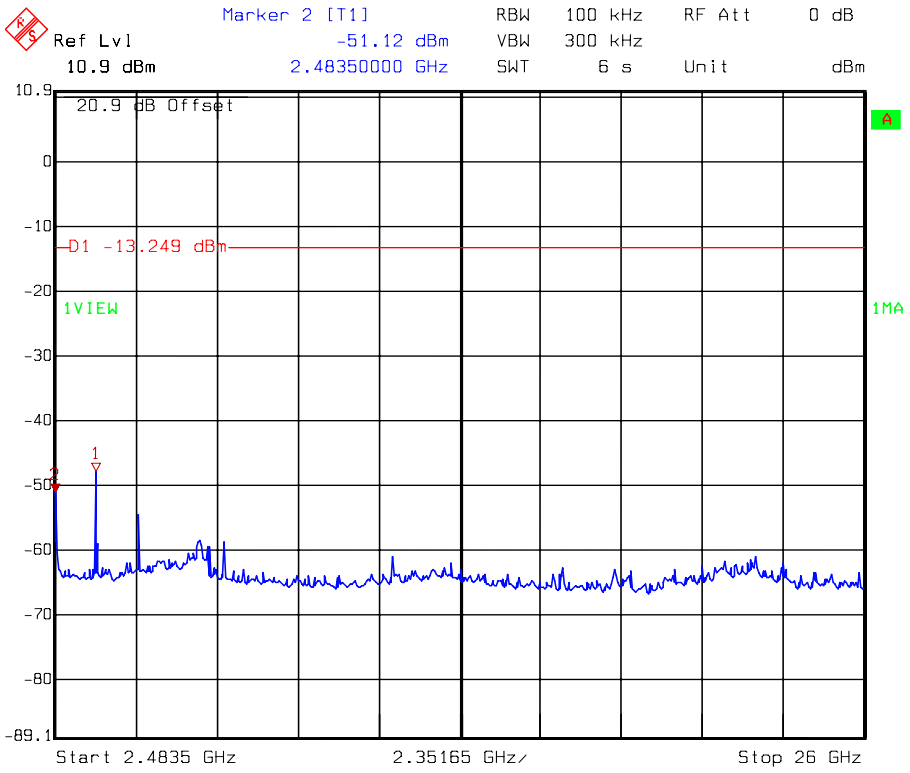
## Chain 0: Conducted Spurious @ 802.11b mode Channel 11 (1 of 3)



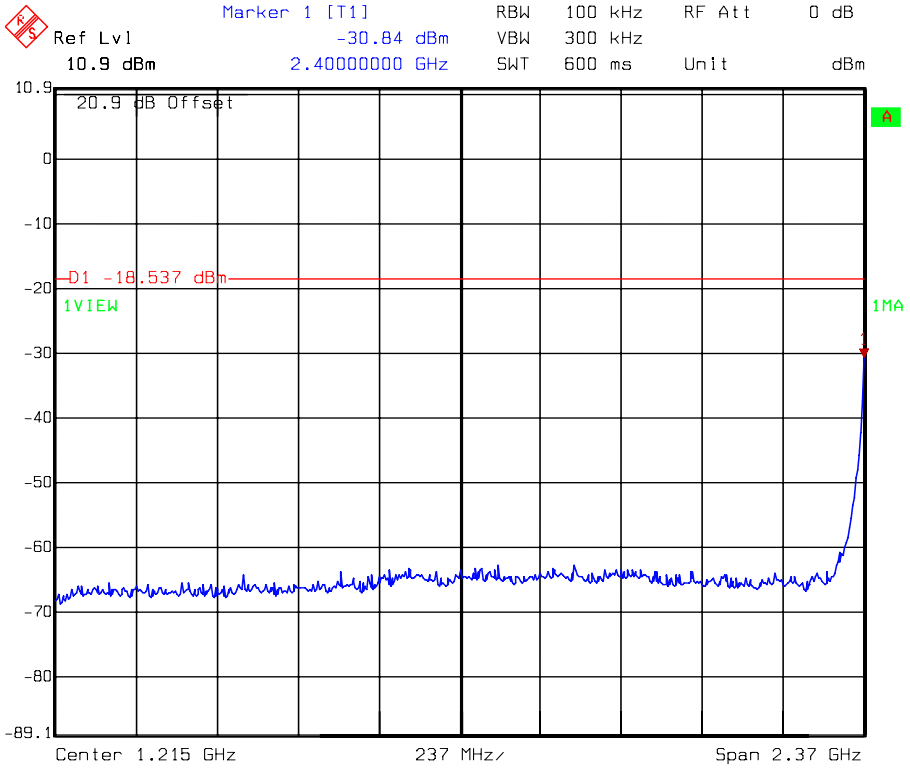

## Chain 0: Conducted Spurious @ 802.11b mode Channel 11 (2 of 3)



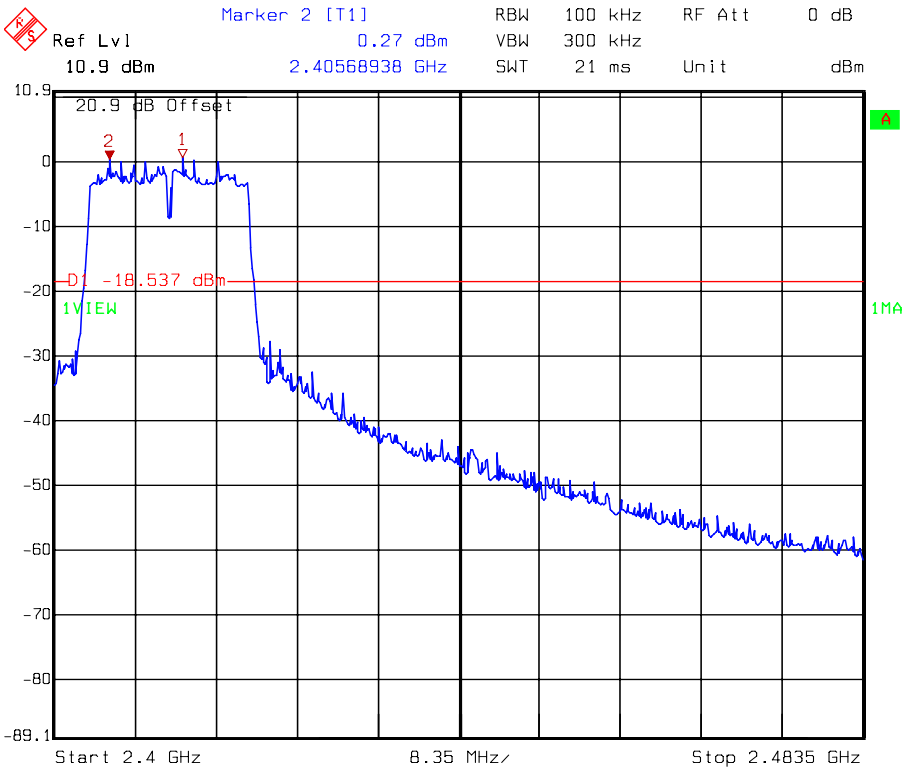
## Chain 0: Conducted Spurious @ 802.11b mode Channel 11 (3 of 3)



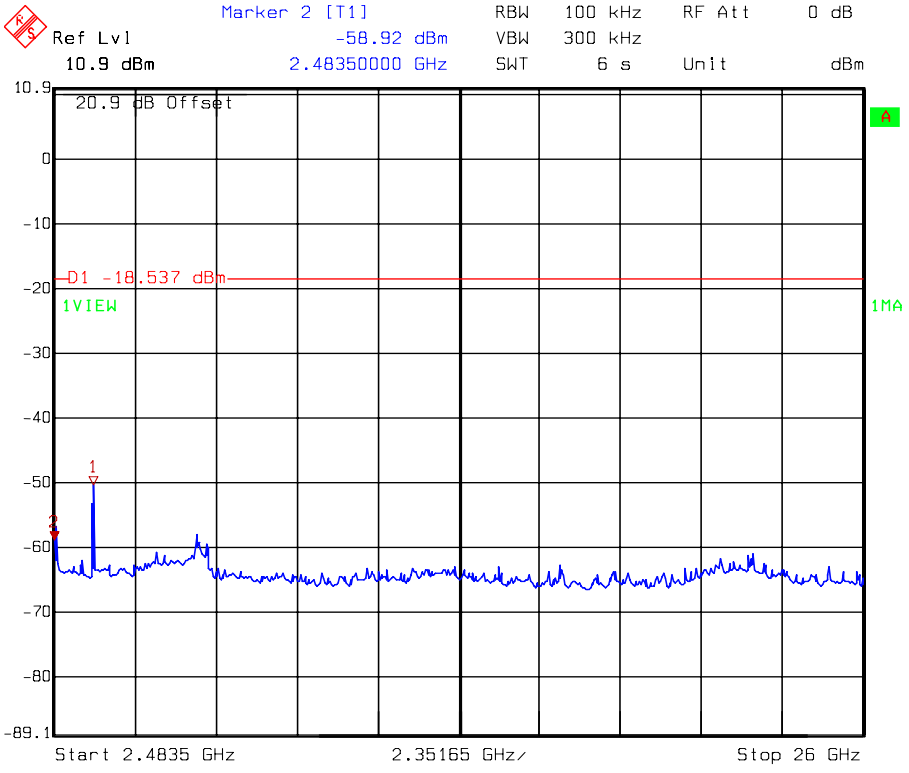

## Chain 0: Conducted Spurious @ 802.11g mode Channel 1 (1 of 3)



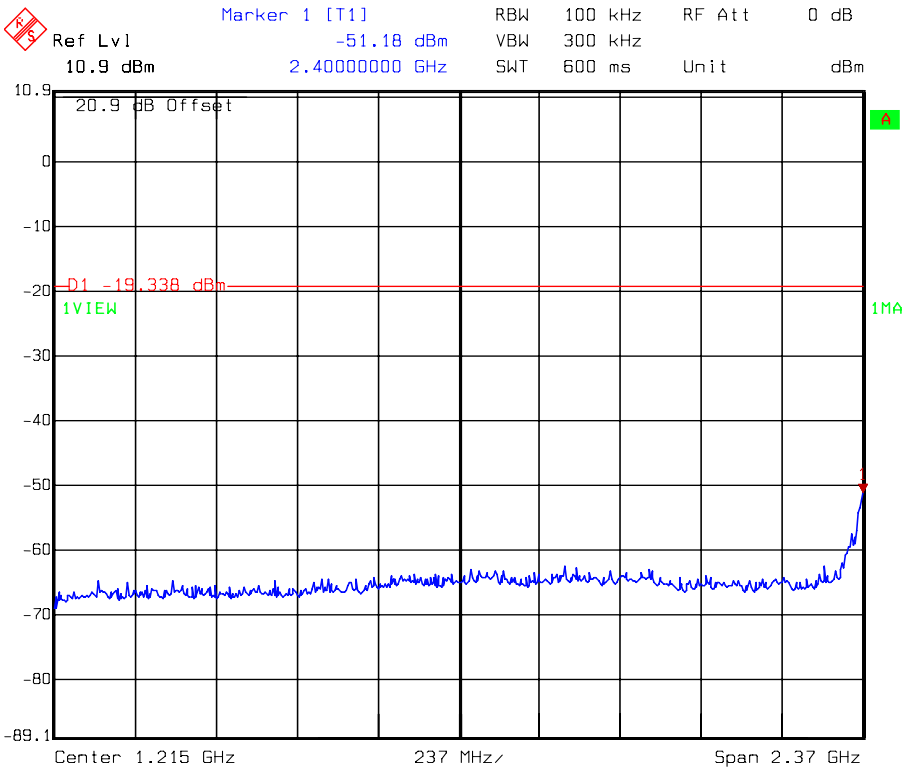
## Chain 0: Conducted Spurious @ 802.11g mode Channel 1 (2 of 3)



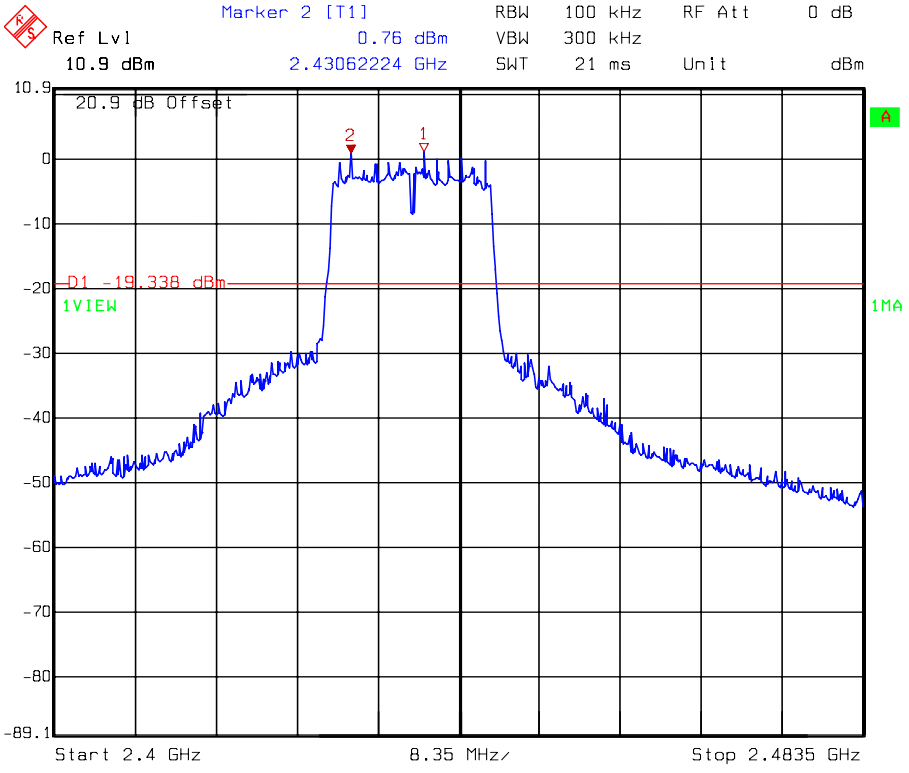

## Chain 0: Conducted Spurious @ 802.11g mode Channel 1 (3 of 3)



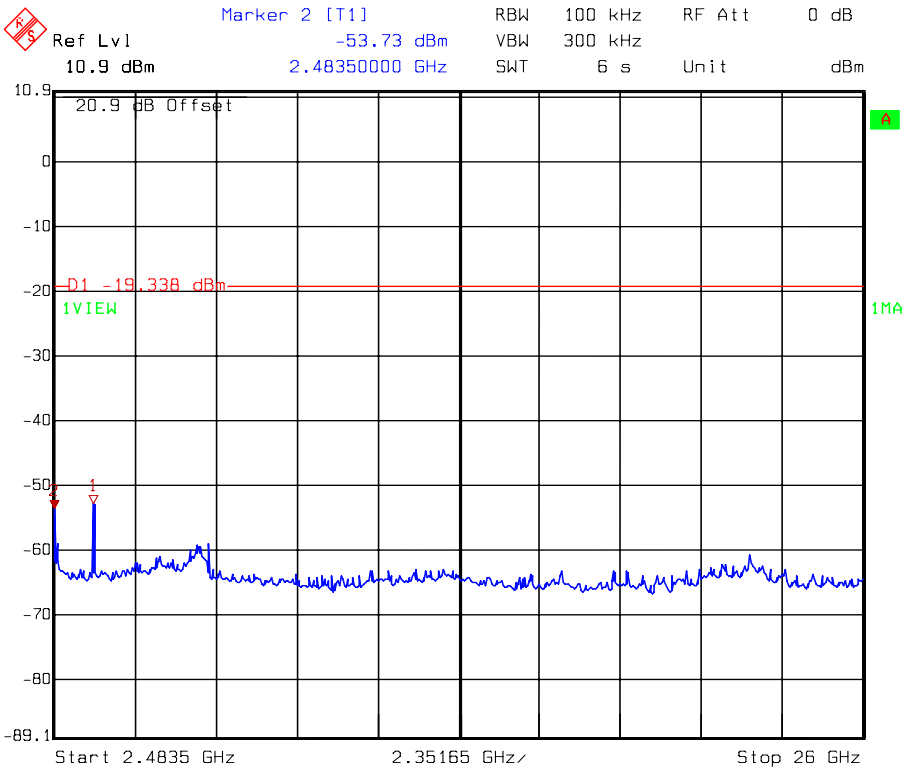
## Chain 0: Conducted Spurious @ 802.11g mode Channel 6 (1 of 3)



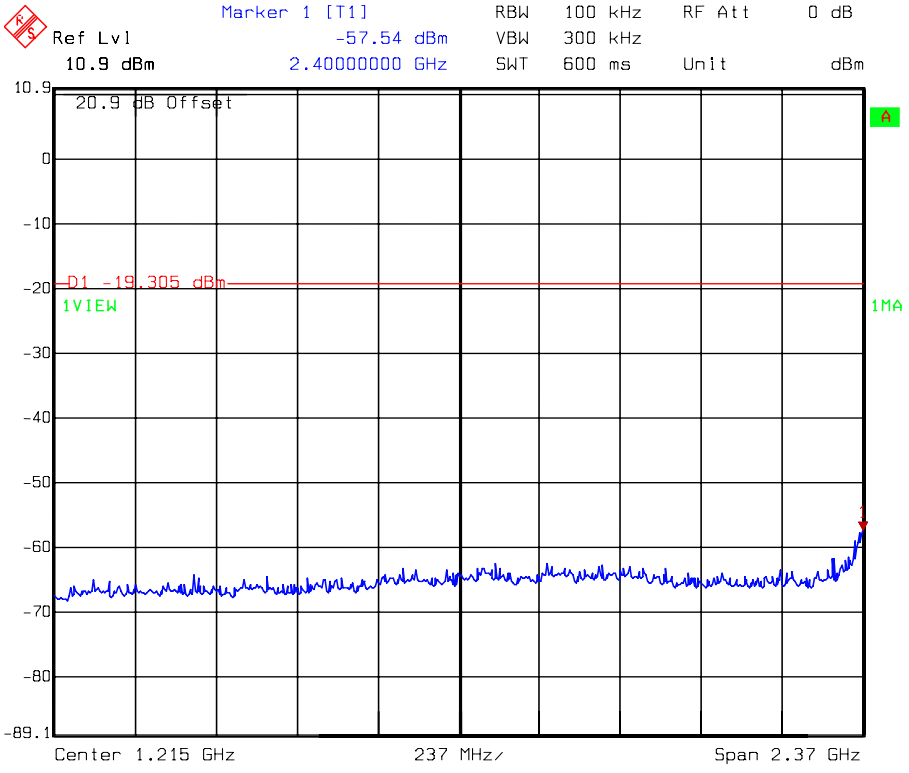

## Chain 0: Conducted Spurious @ 802.11g mode Channel 6 (2 of 3)



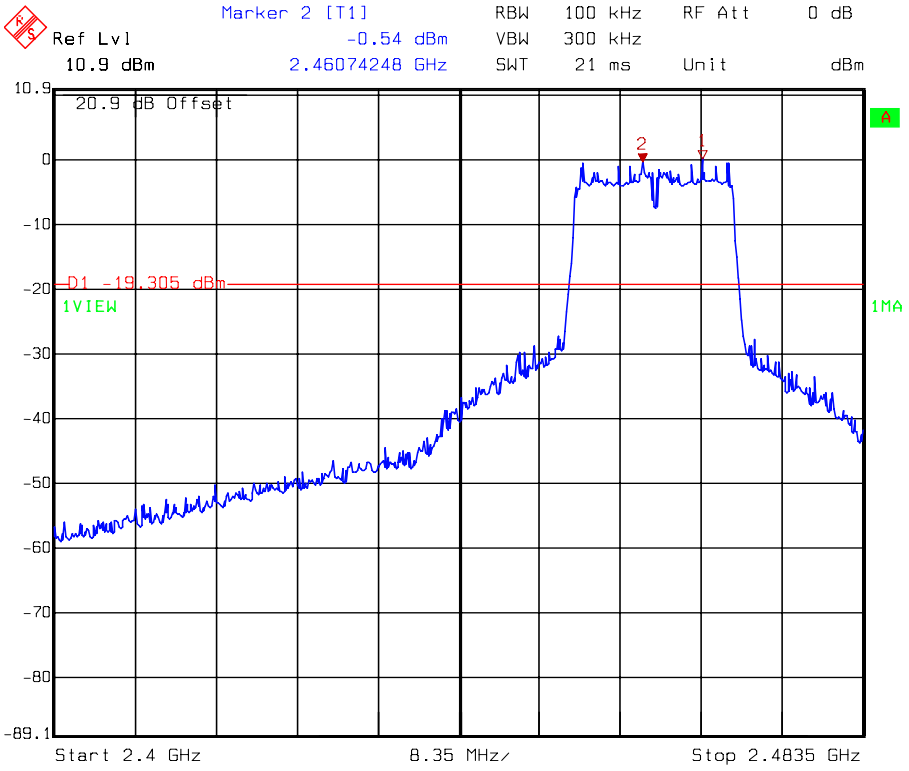
## Chain 0: Conducted Spurious @ 802.11g mode Channel 6 (3 of 3)



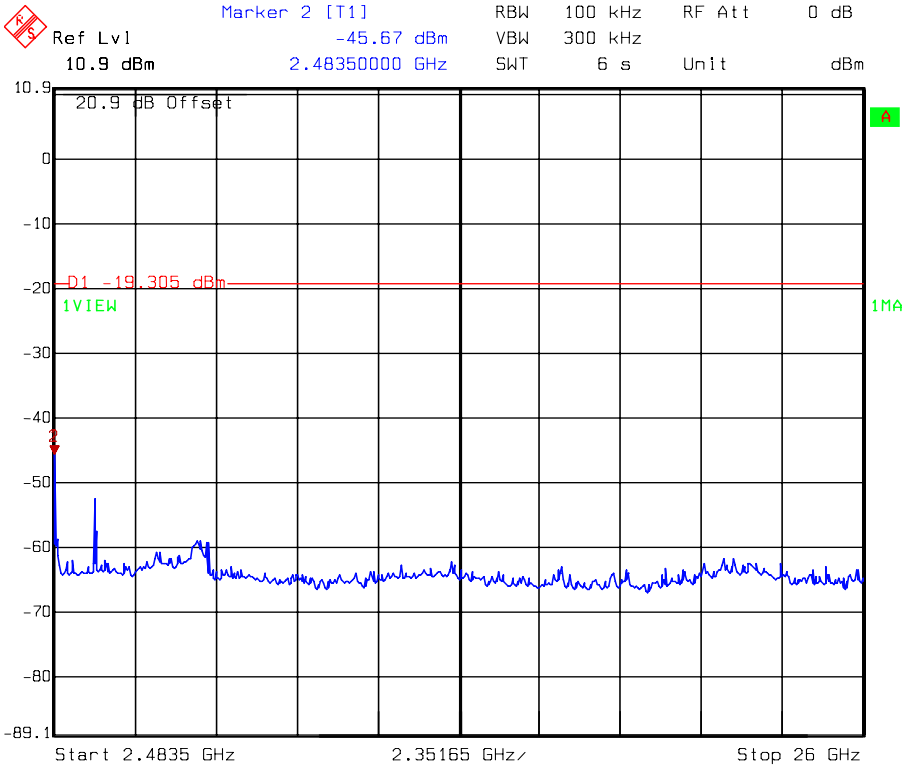

## Chain 0: Conducted Spurious @ 802.11g mode Channel 11 (1 of 3)



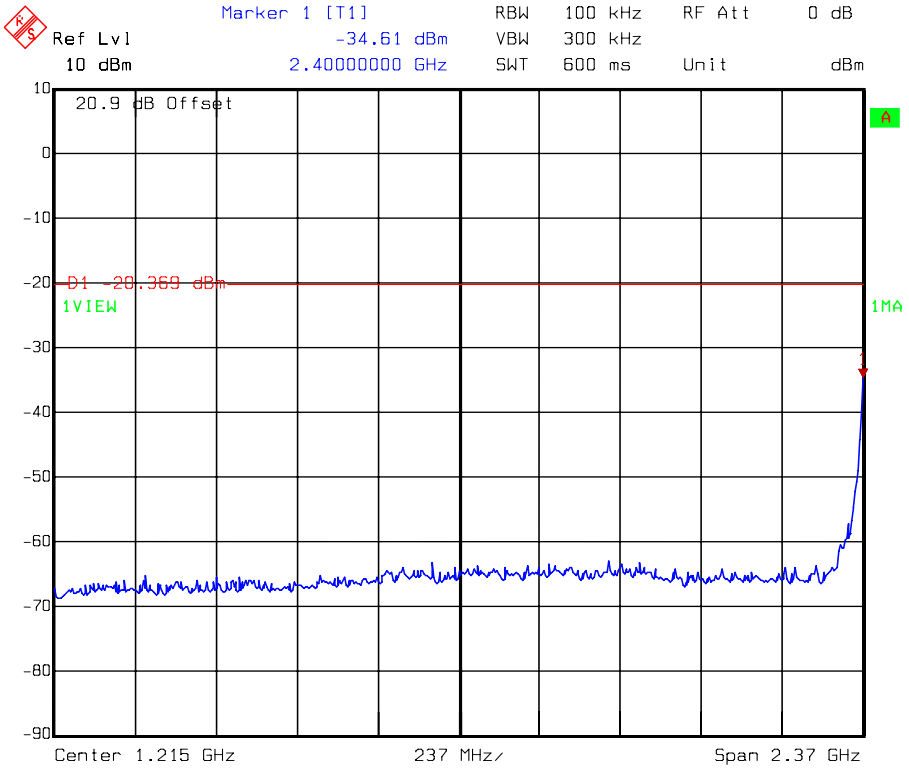
## Chain 0: Conducted Spurious @ 802.11g mode Channel 11 (2 of 3)



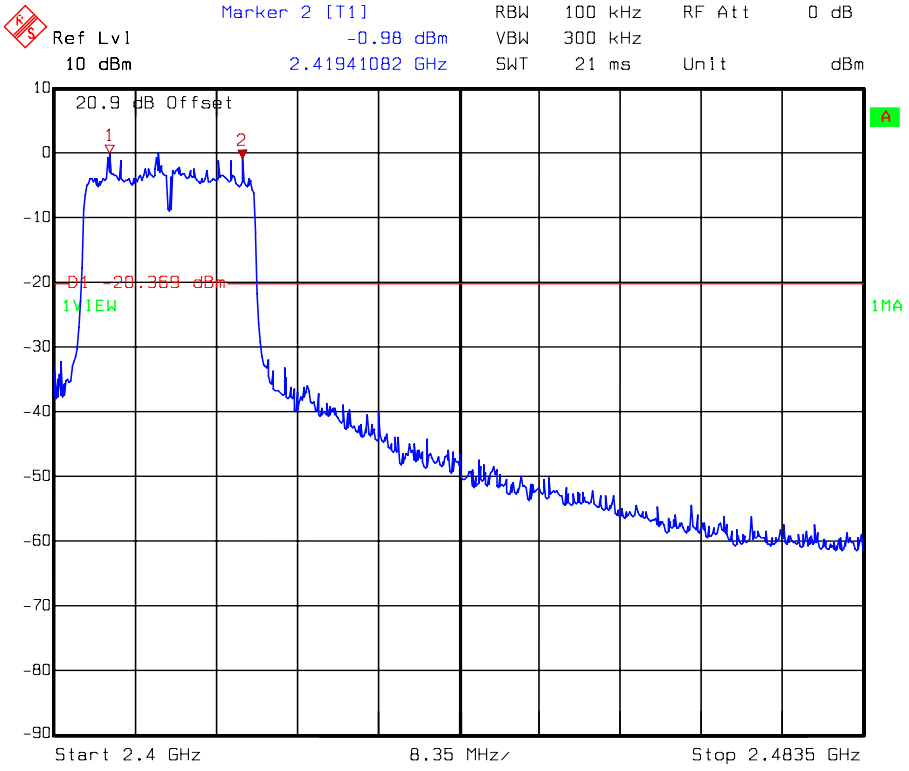

## Chain 0: Conducted Spurious @ 802.11g mode Channel 11 (3 of 3)



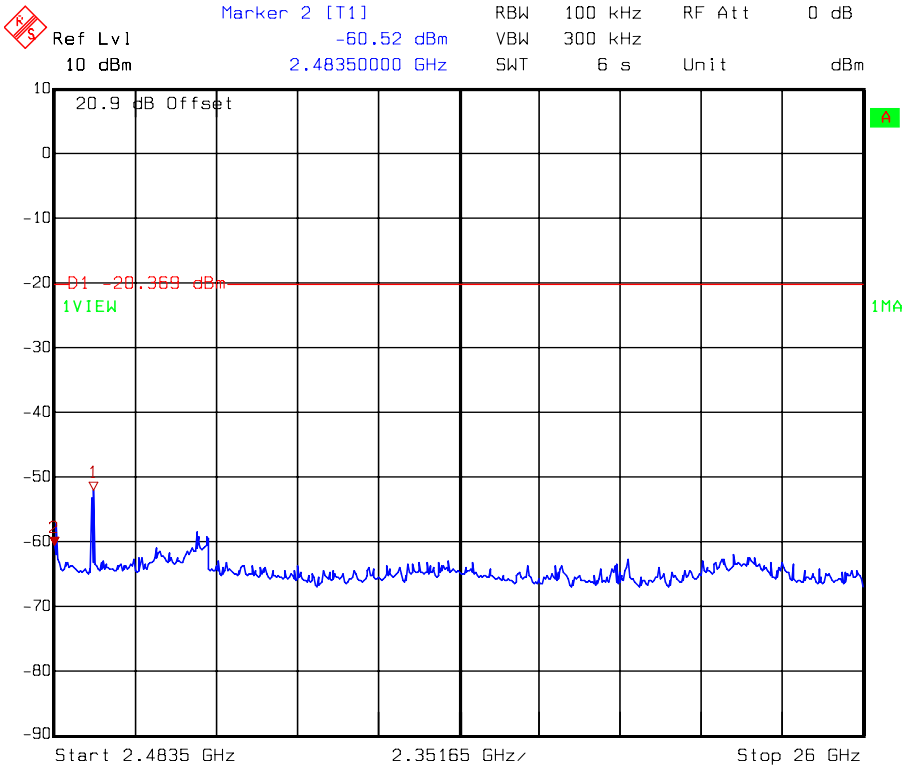
## Chain 0: Conducted Spurious @ 802.11n HT20 mode Channel 1 (1 of 3)



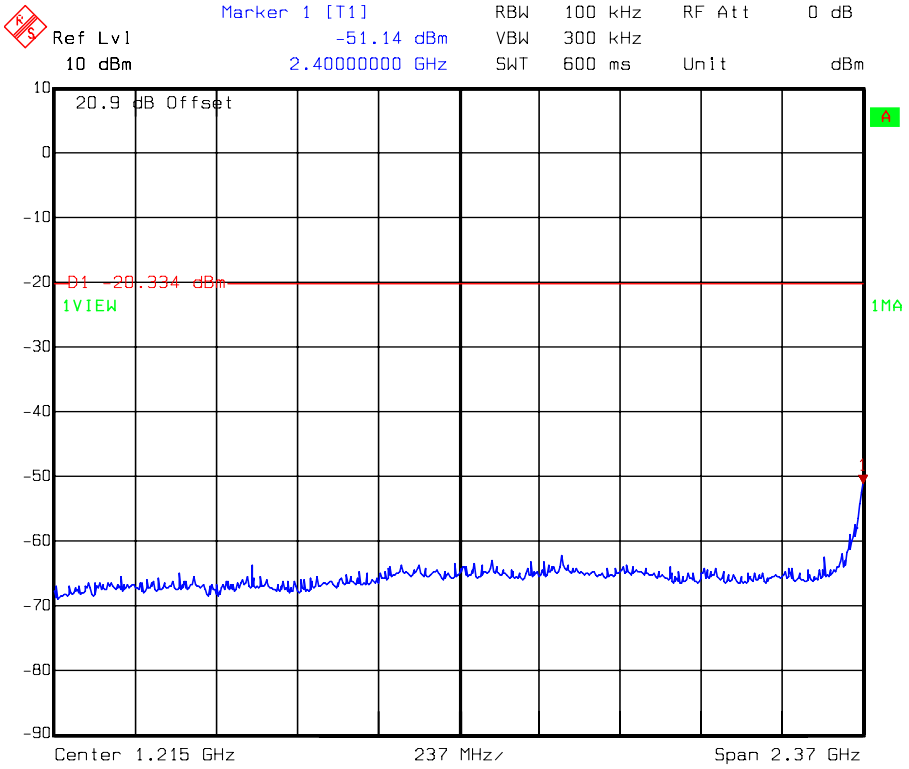

## Chain 0: Conducted Spurious @ 802.11n HT20 mode Channel 1 (2 of 3)



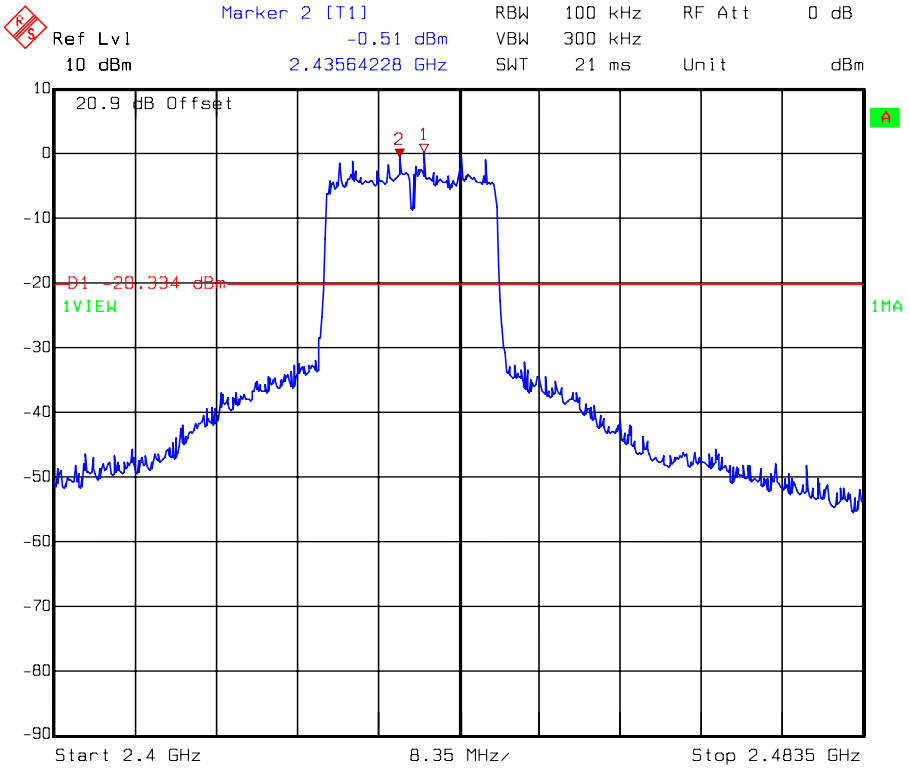
## Chain 0: Conducted Spurious @ 802.11n HT20 mode Channel 1 (3 of 3)



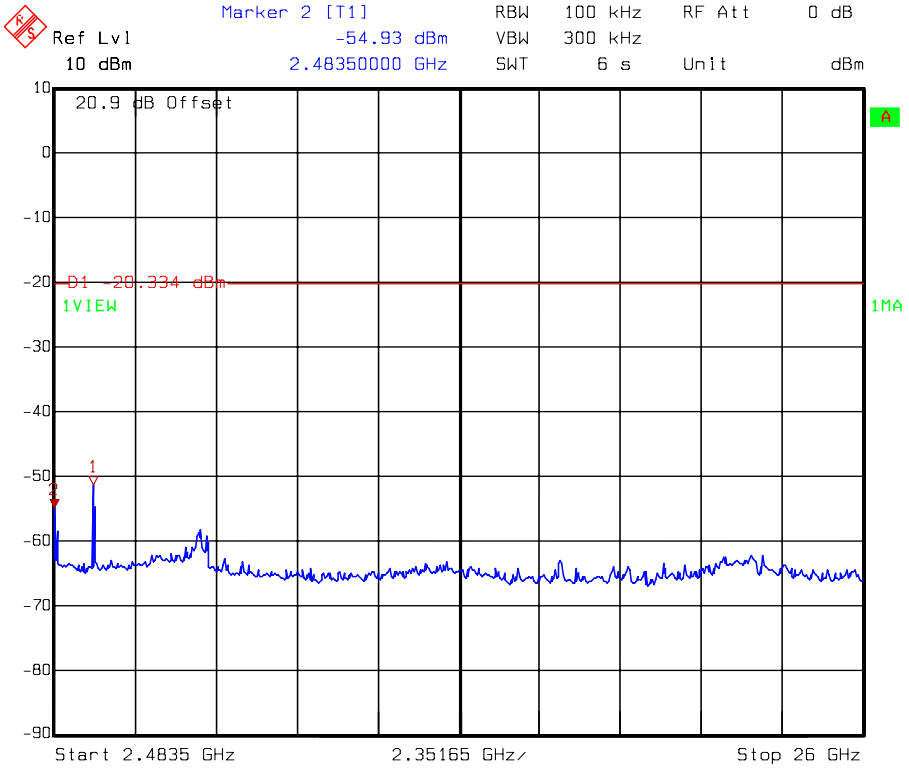

## Chain 0: Conducted Spurious @ 802.11n HT20 mode Channel 6 (1 of 3)



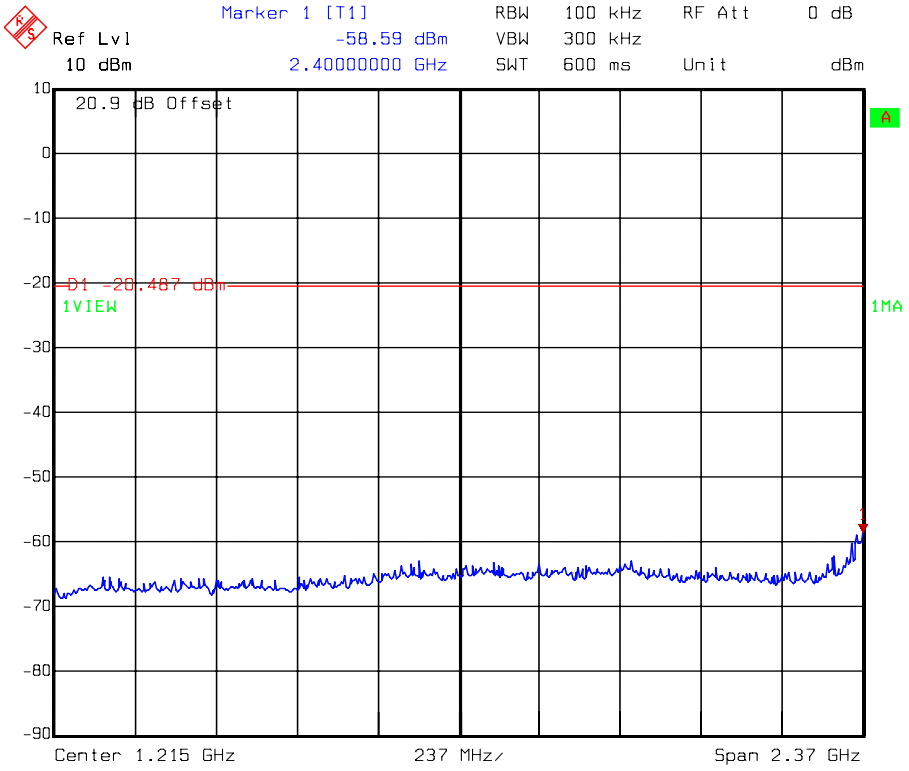
## Chain 0: Conducted Spurious @ 802.11n HT20 mode Channel 6 (2 of 3)



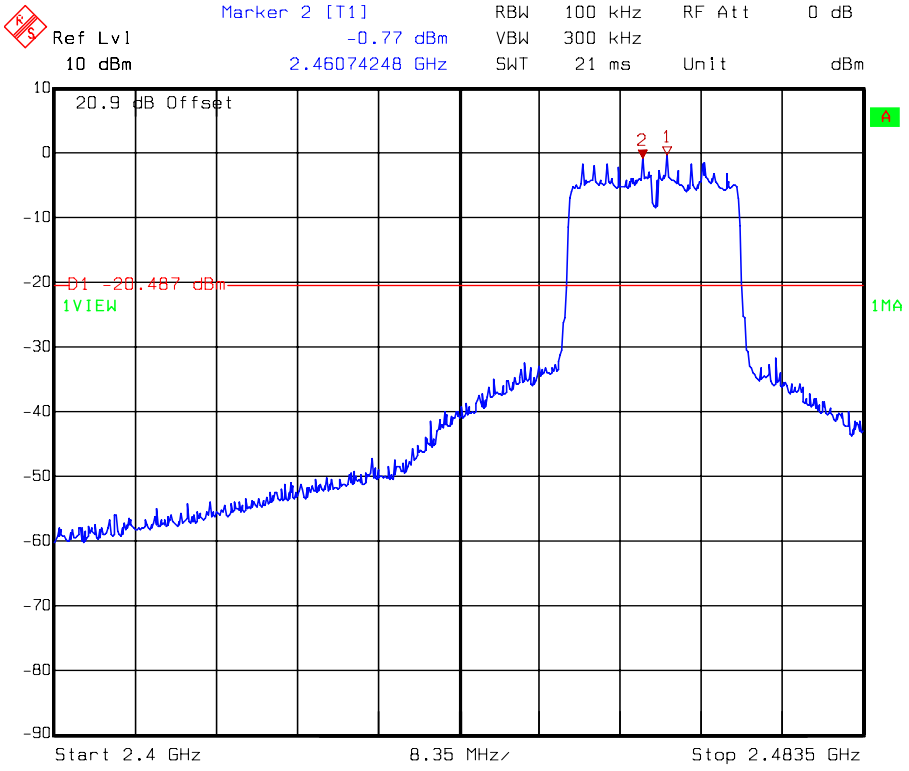

## Chain 0: Conducted Spurious @ 802.11n HT20 mode Channel 6 (3 of 3)



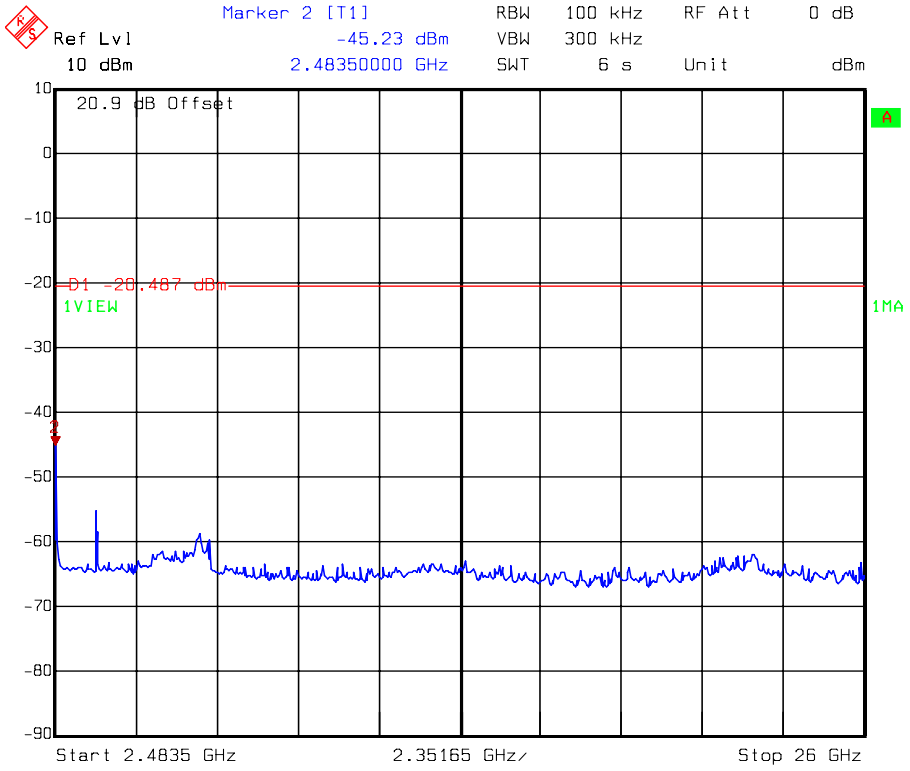
## Chain 0: Conducted Spurious @ 802.11n HT20 mode Channel 11 (1 of 3)




## Chain 0: Conducted Spurious @ 802.11n HT20 mode Channel 11 (2 of 3)



## Chain 0: Conducted Spurious @ 802.11n HT20 mode Channel 11 (3 of 3)



## 7. Radiated Spurious Emission

| Name of Test | Radiated Spurious Emission |
|---|---|
| Base Standard | FCC 15.247(d), 15.209, 15.205, 15.33(a) |

**Test Result:** Complies
**Measurement Data:** See Tables below
**Test Date:** Aug. 15, 2013~Aug. 19, 2013

**Method of Measurement:**
**Reference FCC document: KDB558074 D01, ANSI C63.4**

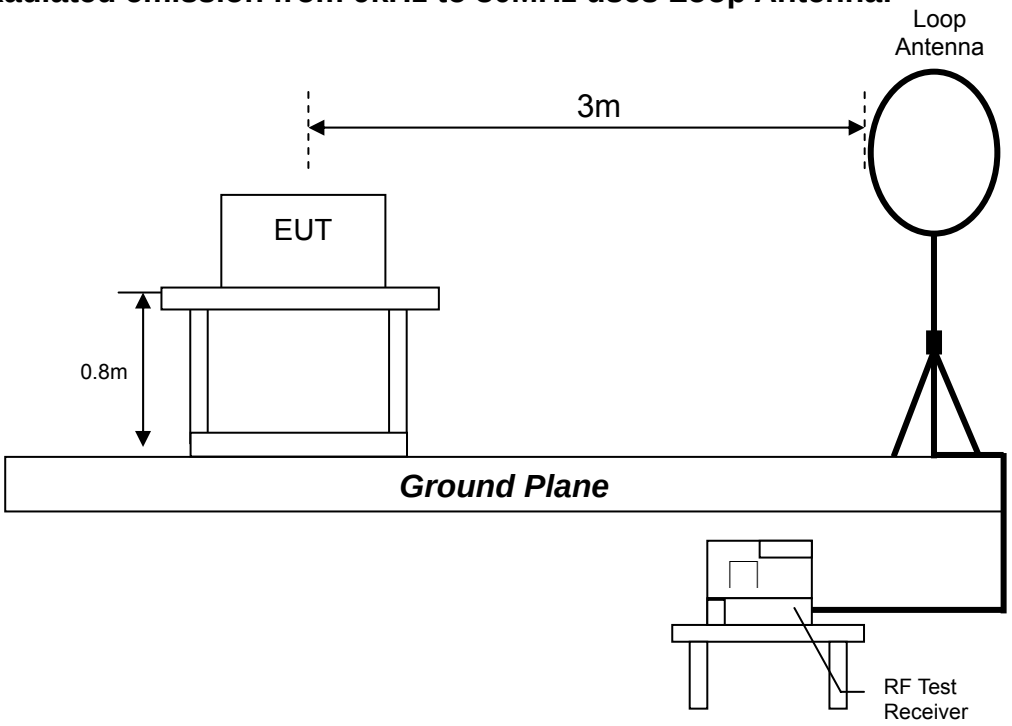
The signal is maximized through rotation and placement in the three orthogonal axes. According to §15.33(a), the spectrum shall be investigated from the lowest radio frequency signal generated in the device, to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Spectrum Analyzer Resolution Bandwidth is 100kHz or greater for frequencies 30MHz to 1GHz, 1MHz – for frequencies above 1GHz.

The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter. The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent 3 meters reading using inverse scaling with distance.

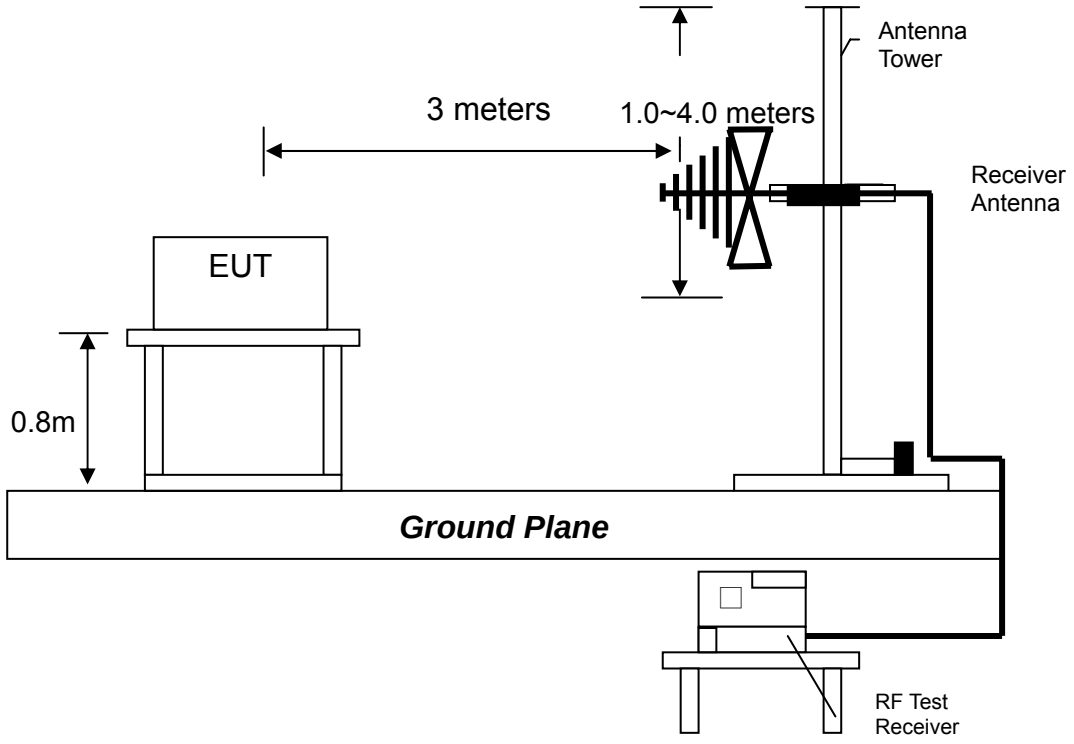
The EUT configuration refers to the “Spurious set-up photo.pdf”.

**Test Diagram:**

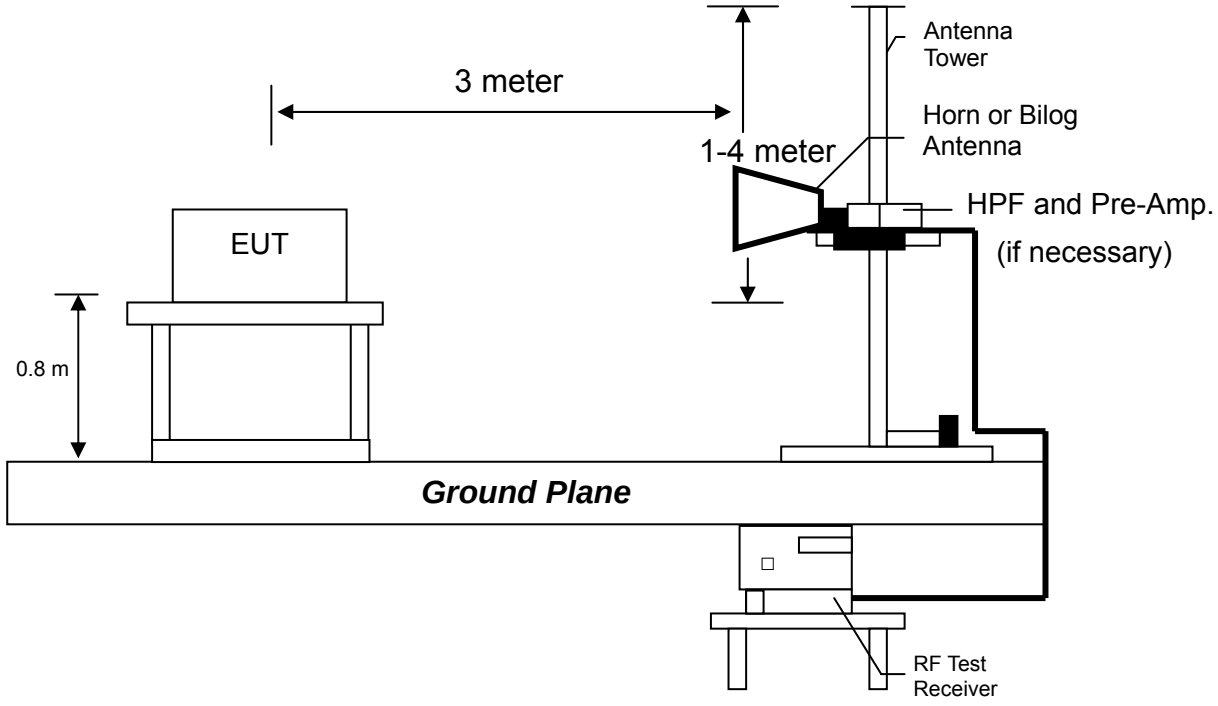
**Radiated emission from 9kHz to 30MHz uses Loop Antenna:**




**Radiated emission from 30MHz to 1GHz uses Bilog Antenna:**



**Radiated emission above 1GHz uses Horn Antenna:**




**Emission Limit:**

The spurious Emission shall test through the 10th harmonic. 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).

| Frequency (MHz) | Field Strength (microvolts/meter) |
|---|---|
| 0.009~0.490 | 2400/F(kHz) |
| 0.490~1.705 | 2400/F(kHz) |
| 1.705~30 | 30 |
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| Above 960 | 500 |

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

**Note:** (1) The EUT was tested while in a continuous transmit mode and the worst case data rates are 1 Mbps data rate for 802.11b mode, 6 Mbps data rate for 802.11g mode, 7.2 Mbps data rate for 802.11n HT20 mode. The EUT was tuned to a low, middle and high channel.

(2) The EUT operating at 2.4 GHz ISM band. Frequency Range scanned from 32.768 kHz to 25 GHz.

**Measurement Results: Frequencies Equal to or Less than 1 GHz**

The test was performed on EUT under 802.11b, 802.11g and 802.11n HT20 continuously transmitting mode. The worst case occurred at 802.11b TX Channel 1.

EUT : T416
Worst Case : 802.11b TX at Channel 1

| Antenna Polariz. (V/H) | Freq. (MHz) | Receiver Detector | Corr. Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| V | 30.70 | QP | 12.60 | 8.31 | 20.90 | 40.00 | -19.10 |
| V | 487.84 | QP | 18.43 | 8.12 | 26.54 | 46.00 | -19.46 |
| V | 518.88 | QP | 18.56 | 9.54 | 28.09 | 46.00 | -17.91 |
| V | 586.78 | QP | 20.71 | 8.45 | 29.16 | 46.00 | -16.84 |
| V | 656.62 | QP | 21.50 | 8.16 | 29.66 | 46.00 | -16.34 |
| V | 788.54 | QP | 23.19 | 8.50 | 31.69 | 46.00 | -14.31 |
| H | 142.52 | QP | 13.24 | 7.42 | 20.65 | 43.50 | -22.85 |
| H | 218.18 | QP | 11.10 | 8.59 | 19.68 | 46.00 | -26.32 |
| H | 270.56 | QP | 13.21 | 7.92 | 21.12 | 46.00 | -24.88 |
| H | 445.16 | QP | 18.12 | 6.84 | 24.96 | 46.00 | -21.04 |
| H | 485.90 | QP | 18.64 | 7.43 | 26.07 | 46.00 | -19.93 |
| H | 534.40 | QP | 19.65 | 7.34 | 26.99 | 46.00 | -19.01 |

Remark: 1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor

Note: The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

**Measurement Results: Frequency above 1GHz**

EUT : T416
Test Condition : 802.11b TX at Channel 1

| Frequency (MHz) | Spectrum Analyzer Detector | Antenna Polariz. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 4824 | PK | V | 35.1 | 38.54 | 40.67 | 44.11 | 54 | -9.89 |
| 3600 | PK | H | 33.9 | 36.16 | 45.91 | 48.17 | 54 | -5.83 |
| 4824 | PK | H | 35.1 | 38.54 | 35.02 | 38.46 | 54 | -15.54 |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

EUT : T416
Test Condition : 802.11b TX at Channel 6

| Frequency (MHz) | Spectrum Analyzer Detector | Antenna Polariz. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 3630 | PK | V | 33.9 | 36.16 | 39.97 | 42.23 | 54 | -11.77 |
| 4874 | PK | V | 35.1 | 38.54 | 39.07 | 42.51 | 54 | -11.49 |
| 3630 | PK | H | 33.9 | 36.16 | 45.42 | 47.68 | 54 | -6.32 |
| 4874 | PK | H | 35.1 | 38.54 | 37.97 | 41.41 | 54 | -12.59 |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

EUT : T416
Test Condition : 802.11b TX at Channel 11

| Frequency (MHz) | Spectrum Analyzer Detector | Antenna Polariz. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 3690 | PK | V | 33.9 | 36.16 | 41.59 | 43.85 | 54 | -10.15 |
| 4924 | PK | V | 35.1 | 38.54 | 37.97 | 41.41 | 54 | -12.59 |
| 3690 | PK | H | 33.9 | 36.16 | 45.90 | 48.16 | 54 | -5.84 |
| 4924 | PK | H | 35.1 | 38.54 | 36.98 | 40.42 | 54 | -13.58 |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz.The data value listed above which is higher than the system noise floor.

EUT : T416
Test Condition : 802.11g TX at Channel 1

| Frequency (MHz) | Spectrum Analyzer Detector | Antenna Polariz. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 3600 | PK | V | 33.9 | 36.16 | 38.20 | 40.46 | 54 | -13.54 |
| 4824 | PK | V | 35.1 | 38.54 | 37.61 | 41.05 | 54 | -12.95 |
| 3600 | PK | H | 33.9 | 36.16 | 43.31 | 45.57 | 54 | -8.43 |
| 4824 | PK | H | 35.1 | 38.54 | 38.43 | 41.87 | 54 | -12.13 |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

EUT : T416
Test Condition : 802.11g TX at Channel 6

| Frequency (MHz) | Spectrum Analyzer Detector | Antenna Polariz. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 4874 | PK | V | 35.1 | 38.54 | 36.73 | 40.17 | 54 | -13.83 |
| 3660 | PK | H | 33.9 | 36.16 | 42.62 | 44.88 | 54 | -9.12 |
| 4874 | PK | H | 35.1 | 38.54 | 36.85 | 40.29 | 54 | -13.71 |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

EUT : T416
Test Condition : 802.11g TX at Channel 11

| Frequency (MHz) | Spectrum Analyzer Detector | Antenna Polariz. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 3690 | PK | V | 33.9 | 36.16 | 39.71 | 41.97 | 54 | -12.03 |
| 4924 | PK | V | 35.1 | 38.54 | 35.76 | 39.20 | 54 | -14.80 |
| 3690 | PK | H | 33.9 | 36.16 | 45.51 | 47.77 | 54 | -6.23 |
| 4924 | PK | H | 35.1 | 38.54 | 35.77 | 39.21 | 54 | -14.79 |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

EUT : T416
Test Condition : 802.11n HT20 TX at Channel 1

| Frequency (MHz) | Spectrum Analyzer Detector | Antenna Polariz. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 4824 | PK | V | 35.1 | 38.54 | 37.20 | 40.64 | 54 | -13.36 |
| 4824 | PK | H | 35.1 | 38.54 | 37.18 | 40.62 | 54 | -13.38 |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

EUT : T416
Test Condition : 802.11n HT20 TX at Channel 6

| Frequency (MHz) | Spectrum Analyzer Detector | Antenna Polariz. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 4874 | PK | V | 35.1 | 38.54 | 38.03 | 41.47 | 54 | -12.53 |
| 3660 | PK | H | 33.9 | 36.16 | 41.14 | 43.40 | 54 | -10.60 |
| 4874 | PK | H | 35.1 | 38.54 | 36.46 | 39.90 | 54 | -14.10 |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

EUT : T416
Test Condition : 802.11n HT20 TX at Channel 11

| Frequency (MHz) | Spectrum Analyzer Detector | Antenna Polariz. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 3690 | PK | V | 33.9 | 36.16 | 38.94 | 41.20 | 54 | -12.80 |
| 4924 | PK | V | 35.1 | 38.54 | 36.46 | 39.90 | 54 | -14.10 |
| 3690 | PK | H | 33.9 | 36.16 | 40.91 | 43.17 | 54 | -10.83 |
| 4924 | PK | H | 35.1 | 38.54 | 36.76 | 40.20 | 54 | -13.80 |

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. The data value listed above which is higher than the system noise floor.

## 8. Emission on Band Edge

| Name of Test | Emission on Band Edge |
|---|---|
| Base Standard | FCC 15.247(d) |

**Test Result:** Complies
**Measurement Data:** See Tables & plots below
**Test Date:** Aug. 15, 2013

**Method of Measurement:**
**Reference FCC document: KDB558074 D01, ANSI C63.4**

Radiated emissions were invested cover the frequency range from 30 MHz to 1000 MHz using a receiver RBW of 120 kHz record QP reading, and the frequency over 1 GHz using a spectrum analyzer RBW of 1 MHz and 10 Hz VBW record Average reading. (15.209 paragraph), the Peak reading (1MHz / 3MHz; RBW / VBW) recorded also on the report.

| Mode | Restricted Band (MHz) | Freq. (MHz) | Spectrum Analyzer Detector | Ant. Pol. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 802.11b | 2310~2390 | 2389.44 | PK | V | 38.021 | 31.847 | 66.934 | 60.76 | 74 | -13.24 |
| | | 2389.44 | AV | V | 38.021 | 31.847 | 56.294 | 50.12 | 54 | -3.88 |
| | - | 2412.00 | PK | V | 38.027 | 31.955 | 117.733 | 111.66 | - | 111.66 |
| | | 2412.00 | AV | V | 38.027 | 31.955 | 112.513 | 106.44 | - | 106.44 |
| | - | 2462.00 | PK | V | 38.040 | 32.192 | 116.338 | 110.49 | - | 110.49 |
| | | 2462.00 | AV | V | 38.040 | 32.192 | 111.298 | 105.45 | - | 105.45 |
| | 2483.5~2500 | 2484.80 | PK | V | 38.046 | 32.301 | 67.696 | 61.95 | 74 | -12.05 |
| | | 2484.80 | AV | V | 38.046 | 32.301 | 58.976 | 53.23 | 54 | -0.77 |

| Mode | Restricted Band (MHz) | Freq. (MHz) | Spectrum Analyzer Detector | Ant. Pol. (H/V) | Preamp. Gain (dB) | Correction Factor (dB/m) | Reading (dBuV) | Corrected Level (dBuV/m) | Limit @ 3 m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 802.11g | 2310 ~ 2390 | 2389.68 | PK | V | 38.021 | 31.849 | 78.433 | 72.26 | 74 | -1.74 |
| | | 2389.68 | AV | V | 38.021 | 31.849 | 59.773 | 53.60 | 54 | -0.40 |
| | - | 2412.00 | PK | V | 38.027 | 31.955 | 118.213 | 112.14 | - | 112.14 |
| | | 2412.00 | AV | V | 38.027 | 31.955 | 99.483 | 93.41 | - | 93.41 |
| | - | 2462.00 | PK | V | 38.040 | 32.192 | 115.308 | 109.46 | - | 109.46 |
| | | 2462.00 | AV | V | 38.040 | 32.192 | 97.798 | 91.95 | - | 91.95 |
| | 2483.5 ~ 2500 | 2483.50 | PK | V | 38.046 | 32.294 | 77.301 | 71.55 | 74 | -2.45 |
| | | 2483.50 | AV | V | 38.046 | 32.294 | 59.331 | 53.58 | 54 | -0.42 |
| 802.11n HT20 | 2310 ~ 2390 | 2389.68 | PK | H | 38.021 | 31.849 | 75.743 | 69.57 | 74 | -4.43 |
| | | 2389.68 | AV | H | 38.021 | 31.849 | 58.113 | 51.94 | 54 | -2.06 |
| | - | 2412.00 | PK | H | 38.027 | 31.955 | 115.743 | 109.67 | - | 109.67 |
| | | 2412.00 | AV | H | 38.027 | 31.955 | 97.833 | 91.76 | - | 91.76 |
| | - | 2462.00 | PK | H | 38.040 | 32.192 | 114.698 | 108.85 | - | 108.85 |
| | | 2462.00 | AV | H | 38.040 | 32.192 | 96.508 | 90.66 | - | 90.66 |
| | 2483.5 ~ 2500 | 2483.50 | PK | H | 38.046 | 32.294 | 79.231 | 73.48 | 74 | -0.52 |
| | | 2483.50 | AV | H | 38.046 | 32.294 | 59.171 | 53.42 | 54 | -0.58 |

## 9. AC Power Line Conducted Emission

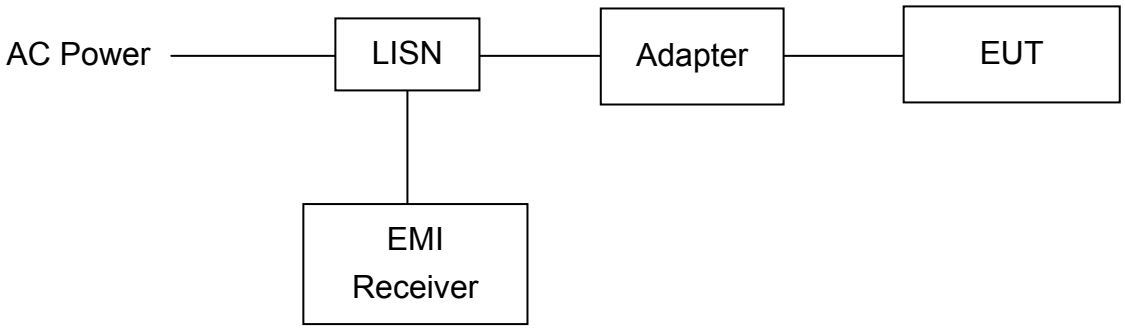
| Name of Test | AC Power Line Conducted Emission |
|---|---|
| Base Standard | FCC 15.207 |

**Test Result:** Complies
**Measurement Data:** See Tables & plots below
**Test Date:** Jul. 19, 2013

**Method of Measurement:**
**Reference FCC document: ANSI C63.4**
The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50 uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 ohm/ 50 uH coupling impedance with 50 ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/2003 on conducted measurement.
The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9 kHz.

The EUT configuration refers to the “Conducted set-up photo.pdf”.

**Test Diagram:**



**Emission Limit:**

| Freq. (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | Q.P. | Ave. |
| 0.15~0.50 | 66 – 56* | 56 – 46* |
| 0.50~5.00 | 56 | 46 |
| 5.00~30.0 | 60 | 50 |

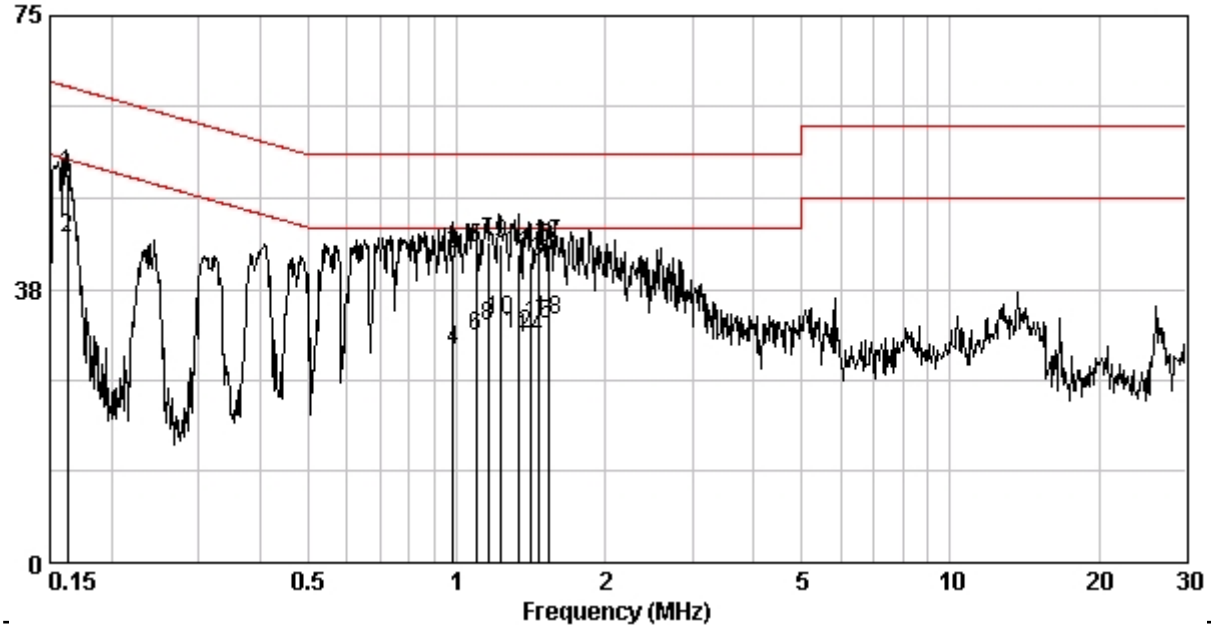
*Decreases with the logarithm of the frequency.

**Note:** The EUT was tested while in normal communication mode.

**Phase : Line**
**EUT : T416**
**Test Condition : Adapter mode**

| Frequency (MHz) | Corr. Factor (dB) | Level Qp (dBuV) | Limit Qp (dBuV) | Level Av (dBuV) | Limit Av (dBuV) | Margin (dB) Qp | Margin (dB) Av |
|---|---|---|---|---|---|---|---|
| 0.162 | 0.13 | 53.43 | 65.34 | 44.63 | 55.34 | -11.91 | -10.71 |
| 0.984 | 0.20 | 42.22 | 56.00 | 29.23 | 46.00 | -13.78 | -16.77 |
| 1.094 | 0.21 | 43.11 | 56.00 | 31.15 | 46.00 | -12.89 | -14.85 |
| 1.160 | 0.21 | 44.08 | 56.00 | 32.38 | 46.00 | -11.92 | -13.62 |
| 1.229 | 0.22 | 43.66 | 56.00 | 33.15 | 46.00 | -12.34 | -12.85 |
| 1.331 | 0.23 | 42.21 | 56.00 | 31.23 | 46.00 | -13.79 | -14.77 |
| 1.411 | 0.23 | 41.11 | 56.00 | 30.74 | 46.00 | -14.89 | -15.26 |
| 1.472 | 0.24 | 43.07 | 56.00 | 32.80 | 46.00 | -12.93 | -13.20 |
| 1.544 | 0.24 | 43.59 | 56.00 | 33.26 | 46.00 | -12.41 | -12.74 |

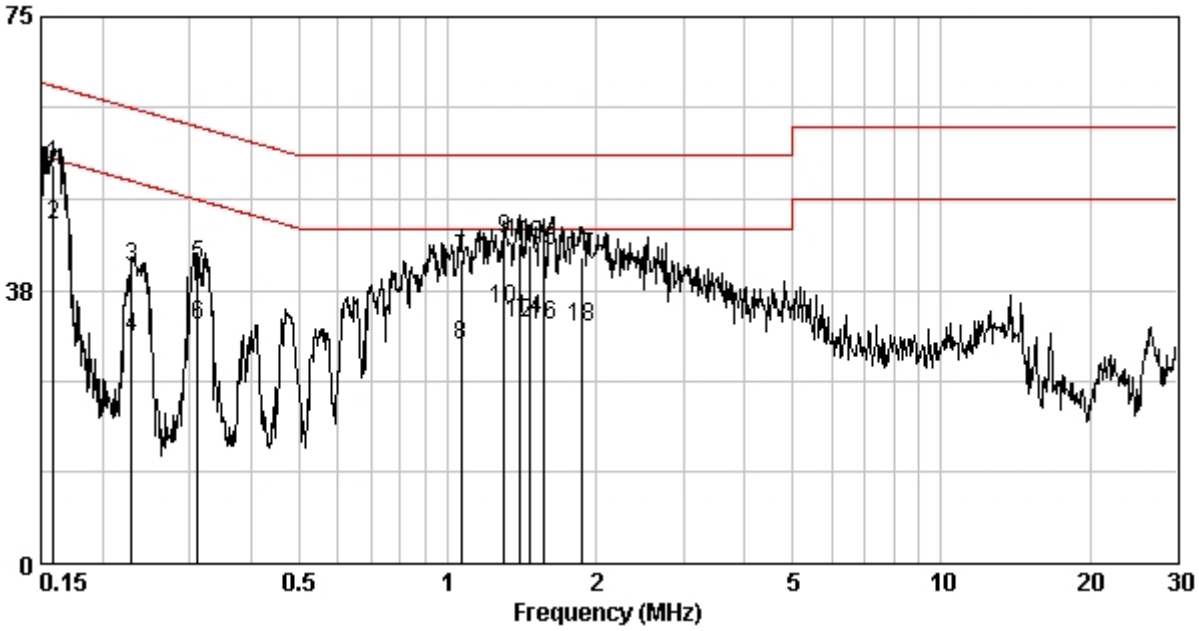
Remark:
1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



**Phase : Neutral**
**EUT : T416**
**Test Condition : Adapter mode**

| Frequency (MHz) | Corr. Factor (dB) | Level Qp (dBuV) | Limit Qp (dBuV) | Level Av (dBuV) | Limit Av (dBuV) | Margin (dB) Qp | Margin (dB) Av |
|---|---|---|---|---|---|---|---|
| 0.159 | 0.10 | 54.81 | 65.52 | 46.39 | 55.52 | -10.71 | -9.12 |
| 0.229 | 0.11 | 40.79 | 62.48 | 31.01 | 52.48 | -21.69 | -21.47 |
| 0.312 | 0.12 | 40.87 | 59.93 | 32.66 | 49.93 | -19.06 | -17.26 |
| 1.065 | 0.17 | 41.72 | 56.00 | 30.06 | 46.00 | -14.28 | -15.94 |
| 1.303 | 0.19 | 44.60 | 56.00 | 34.89 | 46.00 | -11.40 | -11.11 |
| 1.396 | 0.19 | 43.96 | 56.00 | 32.96 | 46.00 | -12.04 | -13.04 |
| 1.472 | 0.20 | 43.54 | 56.00 | 33.63 | 46.00 | -12.46 | -12.37 |
| 1.560 | 0.21 | 42.81 | 56.00 | 32.81 | 46.00 | -13.19 | -13.19 |
| 1.878 | 0.22 | 41.92 | 56.00 | 32.30 | 46.00 | -14.08 | -13.70 |

Remark:
1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



# Appendix: Test Equipment List

| Equipment | Brand | Model No. | Serial No. | Calibration Date | Next Calibration Date |
|---|---|---|---|---|---|
| EMI Test Receiver | Rohde & Schwarz | ESCI | 100018 | 2012/11/30 | 2013/11/29 |
| Spectrum Analyzer | Rohde&schwarz | FSP30 | 100137 | 2013/06/21 | 2014/06/20 |
| Spectrum Analyzer | Rohde&schwarz | FSEK30 | 100186 | 2013/01/23 | 2014/01/22 |
| Horn Antenna (1-18G) | Schwarzbeck | BBHA 9120 D | 9120D-456 | 2012/09/03 | 2013/09/02 |
| Horn Antenna (14-42G) | SHWARZBECK | BBHA 9170 | BBHA9170159 | 2012/09/05 | 2013/09/04 |
| Broadband Antenna | SCHWARZBECK | VULB 9168 | 9168-172 | 2013/08/08 | 2014/08/07 |
| Loop Antenna | RolfHeine | LA-285 | 02/10033 | 2013/03/20 | 2014/03/19 |
| Pre-Amplifier | MITEQ | AFS44-00102650--42-10P-44 | 1495287 | 2011/10/27 | 2013/10/26 |
| Pre-Amplifier | MITEQ | JS4-26004000--27-8A | 828825 | 2012/9/18 | 2014/9/17 |
| Power Meter | Anritsu | ML2495A | 0844001 | 2012/10/09 | 2013/10/08 |
| Power Senor | Anritsu | MA2411B | 0738452 | 2012/10/09 | 2013/10/08 |
| Temperature& Humidity Test Chamber | TERCHY | MHU-225LRU (SA) | 950838 | 2013/06/14 | 2014/06/13 |
| Two-Line V-Network | Rohde&schwarz | ESH3-Z5 | 838979/014 | 2012/10/29 | 2013/10/28 |

Note: The above equipments are within the valid calibration period.

**Measurement Uncertainty**:
Measurement uncertainty was calculated in accordance with TR 100 028-1.

| Parameter | Uncertainty | | |
|---|---|---|---|
| Radiated Emission | Below 1 GHz | Vertical | 3.90 dB |
| | | Horizontal | 3.86 dB |
| | Above 1 GHz | Vertical | 5.74 dB |
| | | Horizontal | 5.55 dB |
| Conducted Emission | 2.08 dB | | |

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