# TEST REPORT

**of**

FCC Part 15 Subpart C §15.247

FCC ID : TQ8-TS310B1AX

| | | |
|---|---|---|
| Equipment Under Test | : | Premium Gen 2.0 I-BOX |
| Model Name | : | TS310B1AX |
| Serial No. | : | N/A |
| Applicant | : | HYUNDAI MOBIS CO., LTD. |
| Manufacturer | : | HYUNDAI MOBIS CO., LTD. |
| Date of Test(s) | : | 2012.12.10 ~ 2013.01.11 |
| Date of Issue | : | 2013.03.08 |

In the configuration tested, the EUT complied with the standards specified above.

| | | | |
|---|---|---|---|
| **Tested By:** | **Logan Lee** | **Date** | **2013.03.08** |
| **Approved By:** | **Denny Ham** | **Date** | **2013.03.08** |

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# 1. General Information

## 1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- Wireless Div. 3FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.

Telephone : +82 31 428 5700
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## 1.2. Details of Applicant

Applicant : HYUNDAI MOBIS CO., LTD.
Address : 80-9, Mabook-Dong, Giheung-Gu, Yongin-shi, Gyunggi-Do, 446-912, South Korea
Contact Person : Kim, Jong-Tae
Phone No. : +82 31 260 0092

## 1.3. Description of EUT

| | |
|---|---|
| **Kind of Product** | Premium Gen 2.0 I-BOX |
| **Model Name** | TS310B1AX |
| **Serial Number** | N/A |
| **Power Supply** | DC 14.4 V (Vehicle Battery) |
| **Frequency Range** | 2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20) |
| **Modulation Technique** | DSSS, OFDM |
| **Number of Channels** | 11 channels (11b/g/n_HT20) |
| **Antenna Type** | Lead wire rod type |
| **Antenna Gain** | 2 412 ㎒ ~ 2 462 ㎒: 2.94 ㏈i |

## 1.4. Declaration by the manufacturer

- N/A

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## 1.5. Test Equipment List

| Equipment | Manufacturer | Model | S/N | Cal Date | Cal Interval | Cal Due. |
|---|---|---|---|---|---|---|
| Signal Generator | R&S | SMBV100A | 255834 | Jul. 02, 2012 | Annual | Jul. 02, 2013 |
| Signal Generator | R&S | SMR40 | 100272 | Aug. 23, 2012 | Annual | Aug. 23, 2013 |
| Spectrum Analyzer | Agilent | N9030A | US51350132 | Oct. 30, 2012 | Annual | Oct. 30, 2013 |
| High Pass Filter | Wainwright | WHK3.0/18G-6SS | 4 | Aug. 01, 2012 | Annual | Aug. 01, 2013 |
| Low Pass Filter | Mini circuits | NLP-1200+ | V9500401023-1 | Aug. 01, 2012 | Annual | Aug. 01, 2013 |
| Attenuator | AEROFLEX / INMET | 26A – 10dB | 1 | Apr. 02, 2012 | Annual | Apr. 02, 2013 |
| Power Sensor | R&S | NRP-Z81 | 100669 | Apr. 03. 2012 | Annual | Apr. 03. 2013 |
| DC Power Supply | Agilent | 6553A | MY40000695 | Jul. 02, 2012 | Annual | Jul. 02, 2013 |
| Preamplifier | H.P. | 8447F | 2944A03909 | Jul. 03, 2012 | Annual | Jul. 03, 2013 |
| Preamplifier | R&S | SCU18 | 10070 | Aug. 06, 2012 | Annual | Aug. 06, 2013 |
| Preamplifier | MITEQ Inc. | JS44-18004000-35-8P | 1546891 | Jul. 12, 2012 | Annual | Jul, 12, 2013 |
| Test Receiver | R&S | ESU26 | 100109 | Feb. 21, 2012 | Annual | Feb. 21, 2013 |
| Bilog Antenna | SCHWARZBECK | VULB9163 | 396 | May 12, 2011 | Biennial | May 12, 2013 |
| Horn Antenna | SCHWARZBECK | BBHA9170 | BBHA9170431 | May 15, 2012 | Biennial | May 15, 2014 |
| Horn Antenna | R&S | HF 906 | 100326 | Nov. 23, 2011 | Biennial | Nov. 23, 2013 |
| Antenna Master | INN-CO | MM4000 | N/A | N/A | N/A | N.C.R. |
| Turn Table | INN-CO | DS 1200 S | N/A | N/A | N/A | N.C.R. |
| Anechoic Chamber | SY Corporation | L × W × H (9.6 m × 6.4 m × 6.6 m) | N/A | N/A | N/A | N.C.R. |

### ▶ Support equipment

| Description | Manufacturer | Model | Serial Number |
|---|---|---|---|
| N/A | - | - | - |

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## 1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC Part15 Subpart C § 15.247 | | |
|---|---|---|
| **Standard section** | **Test Item(s)** | **Result** |
| 15.205<br>15.209<br>15.247(d) | Transmitter Radiated Spurious Emissions<br>Conducted Spurious Emission | Complied |
| 15.247(a)(2) | 6 ㏈ Bandwidth | Complied |
| 15.247(b)(3) | Maximum Peak Output Power | Complied |
| 15.247(e) | Power Spectral Density | Complied |

## 1.7. Test Procedure(s)

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 ㎑ to 40 ㎓ (ANSI C63.4-2003) and the guidance provided in KDB 558074 were used in the measurement of the DUT.

## 1.8. Sample calculation

Where relevant, the following sample calculation is provided:

### 1.8.1. Conducted test

Offset value (㏈) = Attenuator (㏈) + Cable loss (㏈)

### 1.8.2. Radiation test

Field strength level (㏈㎶/㎡) = Measured level (㏈㎶) + Antenna factor (㏈) + Cable loss (㏈) - amplifier gain(㏈)

## 1.9. Test report revision

| Revision | Report number | Description |
|---|---|---|
| 0 | F690501/RF-RTL006148 | Initial |
| 1 | F690501/RF-RTL006148-1 | Added Details of EUT setup |
| 2 | F690501/RF-RTL006148-2 | Separated Details of EUT setup from the report |

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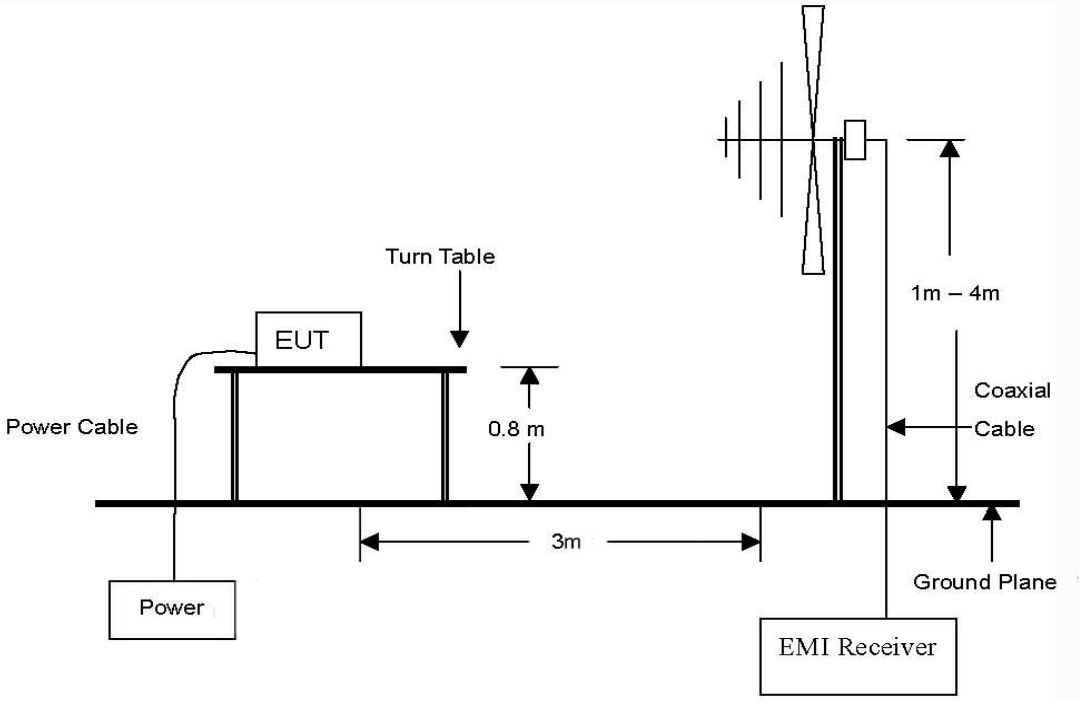
# 2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

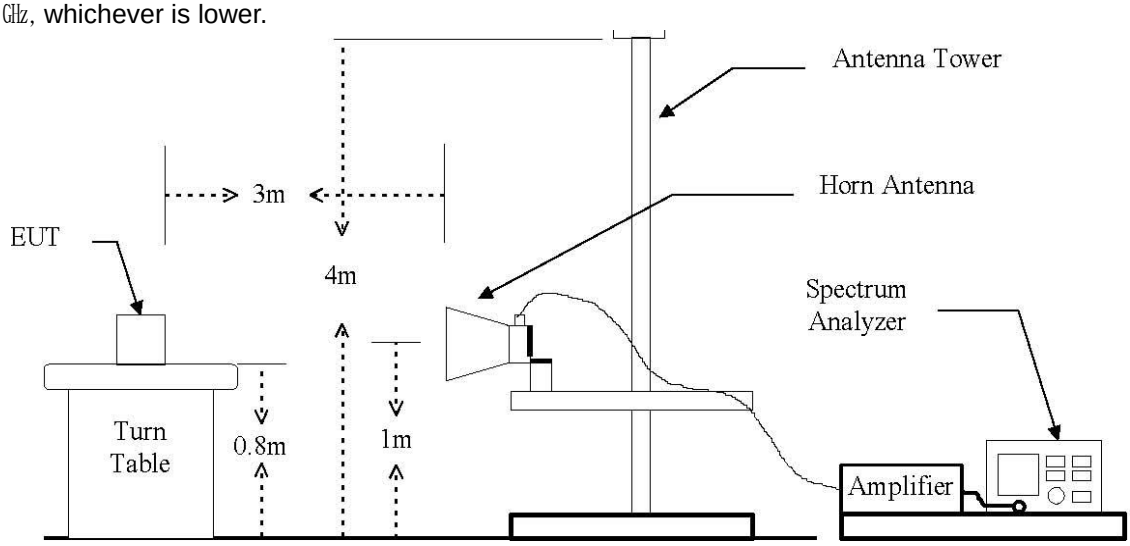
## 2.1. Test Setup

### 2.1.1. Transmitter Radiated Spurious Emissions

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




The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



### 2.1.2. Conducted Spurious Emission

| EUT | — | Attenuator | — | Spectrum Analyzer |
|---|---|---|---|---|

## 2.2. Limit

According to §15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement , provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section , the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 15.209(a), Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table：

| Frequency (㎒) | Distance (Meters) | Field Strength (㏈㎶/m) | Field Strength (㎶/m) |
|---|---|---|---|
| 30 - 88 | 3 | 40.0 | 100 |
| 88 – 216 | 3 | 43.5 | 150 |
| 216 – 960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

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## 2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates in section 10.0 of KDB 558074

### 2.3.1. Test Procedures for Radiated Spurious Emissions

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
3. 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 polarizations of the antenna are set to make the measurement.
4. 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.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 ㏈ 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 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE;

All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

1. Unwanted Emissions into Non-Restricted Frequency Bands
- The Reference Level Measurement refer to section 9.1 & 10.1.1
Set analyzer center frequency, SPAN = 1.5 times the DTS channel bandwidth, the RBW = 3 ㎑ and VBW ≥ 3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold (i.e., set = 100 ㎑ and VBW ≥ 300 ㎑)
- Unwanted Emissions Level Measurement refer to section 9.1 & 10.1.2
Set analyzer emission frequency, the RBW = 100 ㎑ and VBW ≥ 300 ㎑, Detector = Peak, Sweep time = Auto couple, Trace = Max hold

2. Unwanted Emissions into Restricted Frequency Bands
- Peak Power measurement procedure refer to section 8.1.1 & 10.2.3.2
Set RBW = 1 ㎒, VBW ≥ 3 x RBW, SPAN ≥ RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold
Note that if the peak measured value complies with the average limit, it is not necessary to perform a separate average measurement. If this option is exercised, it should be so noted in the test report.

-Average Power measurements procedure refer to section 8.2.1 & 10.2.3.3
Set the analyzer span to a minimum of 1.5 times the EBW, RBW = 1 ㎒, VBW ≥ 3 ㎒,
Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW, Sweep time = auto peak,
Detector = power averaging (RMS) or sample detector when RMS not available,
Employ trace averaging in power averaging (RMS) mode over a minimum of 100 traces.
Note : If the analyzer does not have a band power function, sum the spectral levels (in linear power units) at 1 ㎒ intervals extending across the entire EBW.

3. To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes.

### 2.3.2. Test Procedures for Conducted Spurious Emissions

All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

Per the guidance of KDB 558074, section 10.1.1 & 10.1.2, the reference level for out of band emissions is established from the plots of this section since the band edge emissions are measured with a RBW of 100 ㎑. This reference level is then used as the limit in subsequent plots for out of band spurious emissions shown in section 2.4.3. The limit for out of band spurious emission at the band edge is 30 ㏈ below the fundamental emission level measured in a 100 ㎑ bandwidth.

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## 2.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

### 2.4.1. Radiated Spurious Emission (Worst case configuration_11b mode, 1 Mbps, middle channel)

The frequency spectrum from 30 ㎒ to 1 000 ㎒ was investigated. All reading values are peak values.

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | AMP + CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| 53.28 | 34.64 | Peak | V | 13.07 | -24.36 | 23.35 | 40.00 | 16.65 |
| 127.39 | 37.89 | Peak | V | 9.63 | -23.48 | 24.04 | 43.50 | 19.46 |
| 129.33 | 36.31 | Peak | H | 9.41 | -23.46 | 22.26 | 43.50 | 21.24 |
| 139.80 | 38.00 | Peak | V | 8.21 | -23.38 | 22.83 | 43.50 | 20.67 |
| 146.01 | 37.55 | Peak | V | 8.33 | -23.30 | 22.58 | 43.50 | 20.92 |
| 220.12 | 35.45 | Peak | H | 11.07 | -22.68 | 23.84 | 46.00 | 22.16 |
| 251.94 | 34.32 | Peak | H | 11.85 | -22.49 | 23.68 | 46.00 | 22.32 |
| 253.88 | 34.90 | Peak | V | 11.90 | -22.47 | 24.33 | 46.00 | 21.67 |
| 300.44 | 34.84 | Peak | H | 13.07 | -22.10 | 25.81 | 46.00 | 20.19 |
| 560.01 | 33.00 | Peak | V | 17.70 | -22.58 | 28.12 | 46.00 | 17.88 |
| 592.21 | 32.99 | Peak | V | 18.30 | -22.52 | 28.77 | 46.00 | 17.23 |
| 724.91 | 33.69 | Peak | H | 19.38 | -21.81 | 31.26 | 46.00 | 14.74 |
| 818.42 | 32.74 | Peak | H | 20.25 | -21.39 | 31.60 | 46.00 | 14.40 |
| Above 900.00 | Not detected | - | - | - | - | - | - | - |

Remark:
1. All spurious emission at channels are almost the same below 1 ㎓, so that the middle channel was chosen at representative in final test.
2. Actual = Reading + AF + AMP + CL

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### 2.4.2. Spurious Radiated Emission

The frequency spectrum above 1 000 ㎒ was investigated.

**DSSS : 802.11b(1 Mbps)**
Low Channel (2 412 ㎒)

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *2 390.00 | 29.31 | Peak | V | 28.05 | 7.18 | 64.54 | 74.00 | 9.46 |
| *2 390.00 | 15.07 | Average | V | 28.05 | 7.18 | 50.30 | 54.00 | 3.70 |

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *4 823.77 | 49.77 | Peak | V | 32.30 | -32.66 | 49.38 | 74.00 | 24.62 |
| *4 823.77 | 45.73 | Average | V | 32.30 | -32.66 | 45.37 | 54.00 | 8.63 |
| Above 4 900.00 | Not detected | - | - | - | - | - | - | - |

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Middle Channel (2 437 ㎒)

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *4 874.23 | 46.90 | Peak | V | 32.79 | -32.61 | 47.08 | 74.00 | 26.92 |
| *4 874.23 | 41.73 | Average | V | 32.79 | -32.61 | 41.91 | 54.00 | 12.09 |
| Above 4 900.00 | Not detected | - | - | - | - | - | - | - |

High Channel (2 462 ㎒)

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *2 483.50 | 29.52 | Peak | V | 28.31 | 7.37 | 65.20 | 74.00 | 8.80 |
| *2 483.50 | 15.04 | Average | V | 28.31 | 7.37 | 50.72 | 54.00 | 3.28 |

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *4 923.64 | 46.55 | Peak | V | 33.10 | -32.42 | 47.23 | 74.00 | 26.77 |
| *4 923.64 | 41.37 | Average | V | 33.10 | -32.42 | 42.05 | 54.00 | 11.95 |
| Above 5 000.00 | Not detected | - | - | - | - | - | - | - |

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**DSSS : 802.11g(6 Mbps)**
Low Channel (2 412 ㎒)

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *2 390.00 | 31.23 | Peak | V | 28.05 | 7.18 | 66.46 | 74.00 | 7.54 |
| *2 390.00 | 15.47 | Average | V | 28.05 | 7.18 | 50.70 | 54.00 | 3.30 |

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *4 820.37 | 42.58 | Peak | V | 32.26 | -32.67 | 42.17 | 74.00 | 31.83 |
| *4 820.37 | 28.11 | Average | V | 32.26 | -32.67 | 27.70 | 54.00 | 26.30 |
| Above 4 900.00 | Not detected | - | - | - | - | - | - | - |

Middle Channel (2 437 ㎒)

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *4 874.25 | 39.88 | Peak | V | 32.79 | -32.61 | 40.06 | 74.00 | 33.94 |
| *4 874.25 | 26.24 | Average | V | 32.79 | -32.61 | 26.42 | 54.00 | 27.58 |
| Above 4 900.00 | Not detected | - | - | - | - | - | - | - |

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High Channel (2 462 ㎒)

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *2 483.50 | 30.11 | Peak | V | 28.31 | 7.37 | 65.79 | 74.00 | 8.21 |
| *2 483.50 | 14.93 | Average | V | 28.31 | 7.37 | 50.61 | 54.00 | 3.39 |

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *4 924.39 | 45.65 | Peak | V | 33.11 | -32.45 | 46.31 | 74.00 | 27.69 |
| *4 924.39 | 41.02 | Average | V | 33.11 | -32.45 | 41.68 | 54.00 | 12.32 |
| Above 5 000.00 | Not detected | - | - | - | - | - | - | - |

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**DSSS : 802.11n_HT20(MCS0)**
Low Channel (2 412 ㎒)

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *2 390.00 | 28.64 | Peak | V | 28.05 | 7.18 | 63.87 | 74.00 | 10.13 |
| *2 390.00 | 15.32 | Average | V | 28.05 | 7.18 | 50.55 | 54.00 | 3.45 |

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *4 823.32 | 43.42 | Peak | V | 32.30 | -32.66 | 43.06 | 74.00 | 30.94 |
| *4 823.32 | 25.51 | Average | V | 32.30 | -32.66 | 25.15 | 54.00 | 28.85 |
| Above 4 900.00 | Not detected | - | - | - | - | - | - | - |

Middle Channel (2 437 ㎒)

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *4 876.17 | 42.19 | Peak | V | 32.81 | -32.57 | 42.43 | 74.00 | 31.57 |
| *4 876.17 | 26.41 | Average | V | 32.81 | -32.57 | 26.65 | 54.00 | 27.35 |
| Above 4 900.00 | Not detected | - | - | - | - | - | - | - |

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High Channel (2 462 ㎒)

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *2 483.50 | 30.65 | Peak | V | 28.31 | 7.37 | 66.33 | 74.00 | 7.67 |
| *2 483.50 | 15.18 | Average | V | 28.31 | 7.37 | 50.86 | 54.00 | 3.14 |

| Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *4 924.28 | 39.76 | Peak | V | 33.11 | -32.44 | 40.43 | 74.00 | 33.57 |
| *4 924.28 | 25.39 | Average | V | 33.11 | -32.44 | 26.06 | 54.00 | 27.94 |
| Above 5 000.00 | Not detected | - | - | - | - | - | - | - |

Remarks :

1. "*" means the restricted band.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Actual = Reading + AF + AMP + CL

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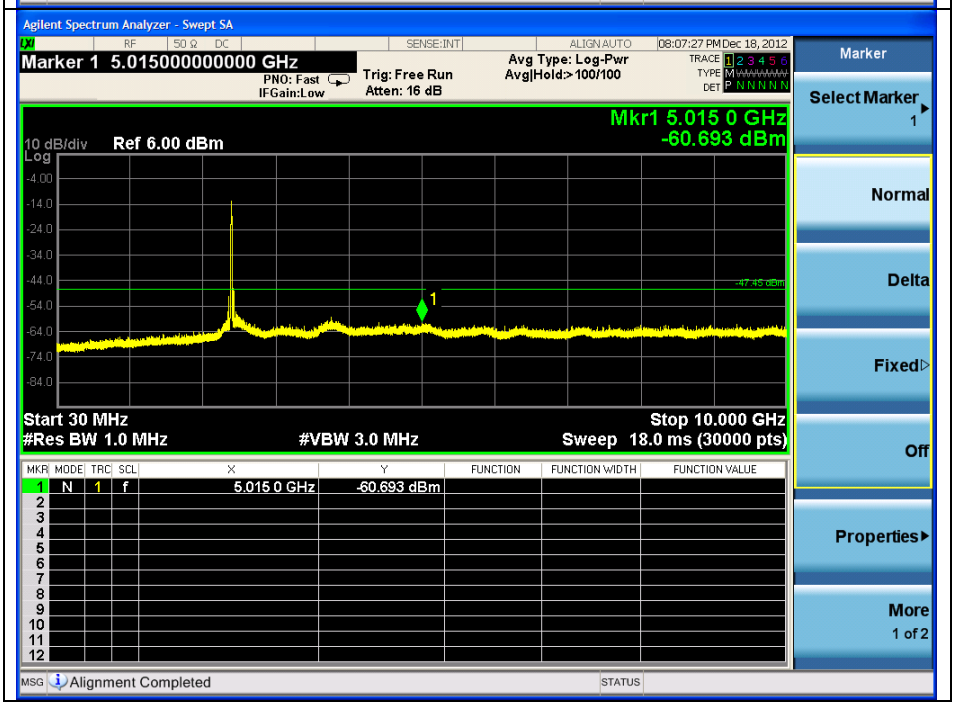
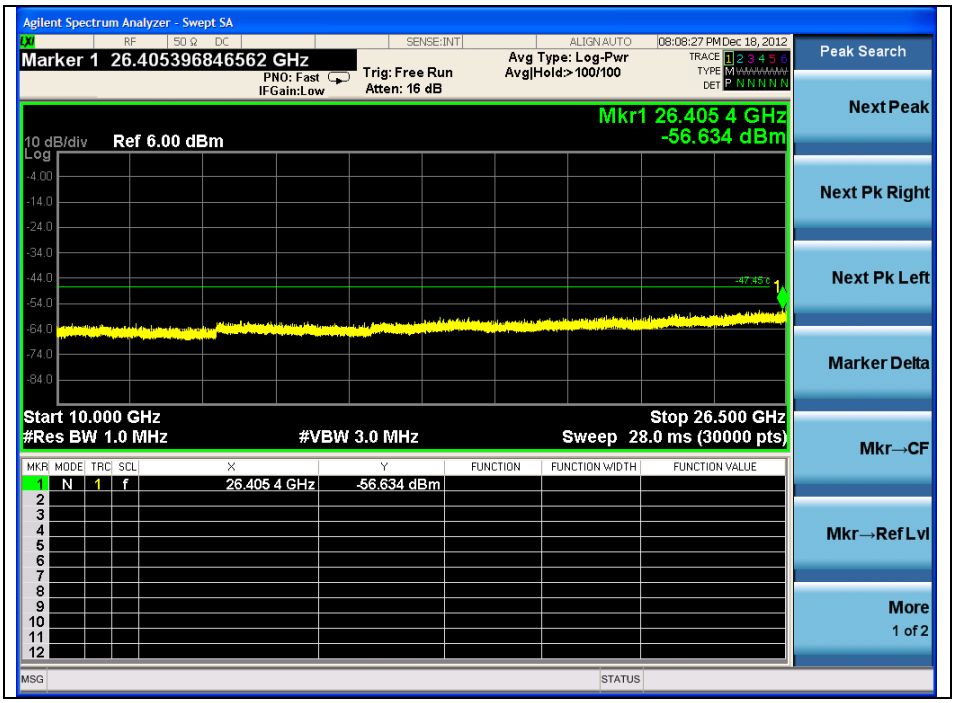
## 2.4.3. Spurious RF Conducted Emissions: Plot of Spurious RF Conducted Emission

**DSSS : 802.11b(1 Mbps)**

Low Channel






Note:
Offset (dB) = Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Reading values (dB m) | Spurious offset (dB) | Result (dB m) |
|---|---|---|---|
| 2 390.00 | -68.54 | 22.50 | -46.04 |
| 2 400.00 | -60.38 | 22.52 | -37.86 |
| 5 015.00 | Noise floor | - | - |
| 26 405.40 | Noise floor | - | - |

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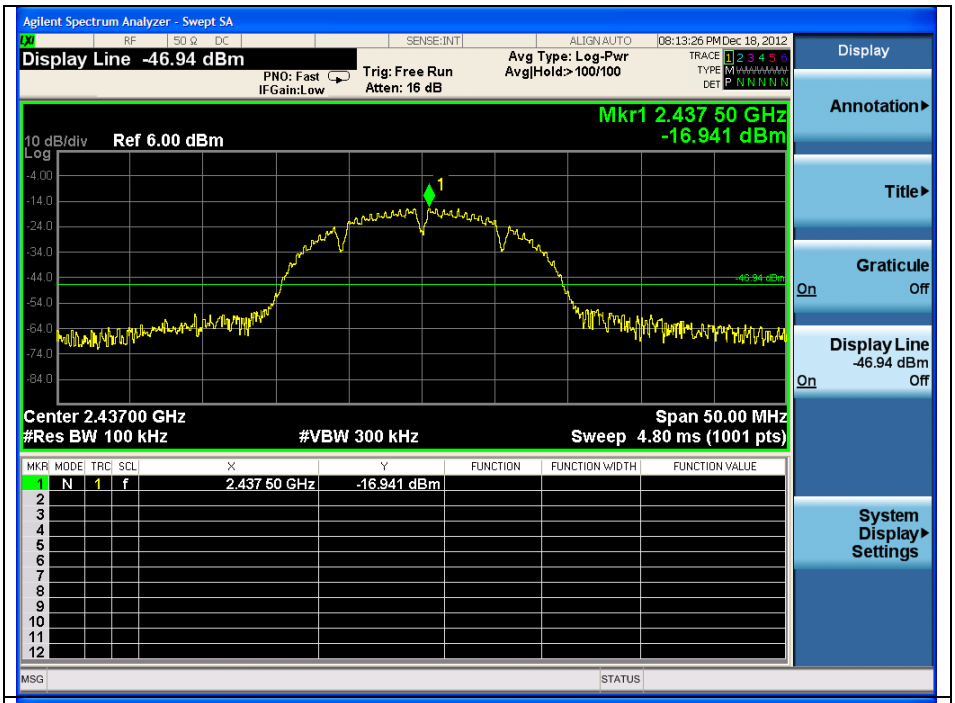
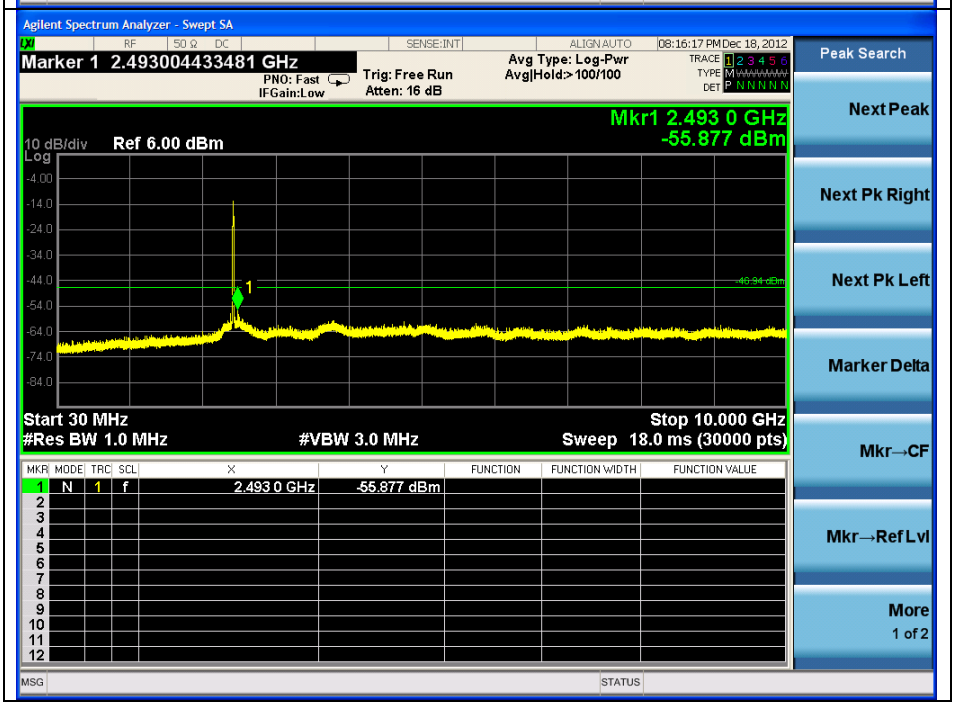
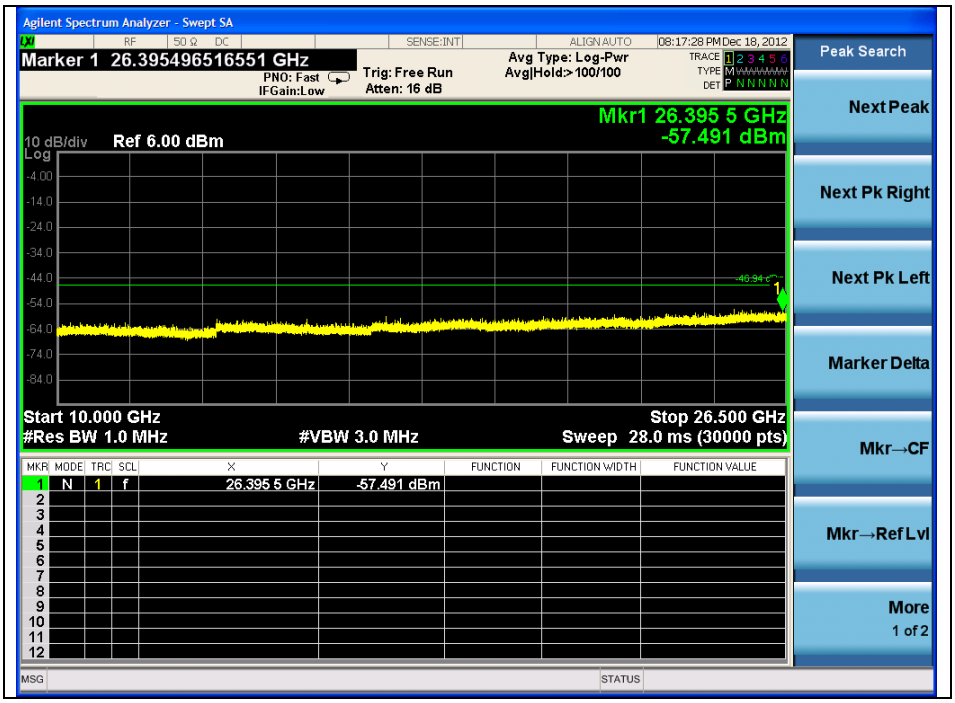
Middle Channel






Note:
Offset (dB) = Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Reading values (dB m) | Spurious offset (dB) | Result (dB m) |
|---|---|---|---|
| 2 493.00 | -55.88 | 22.57 | -33.31 |
| 26 395.50 | Noise floor | - | - |

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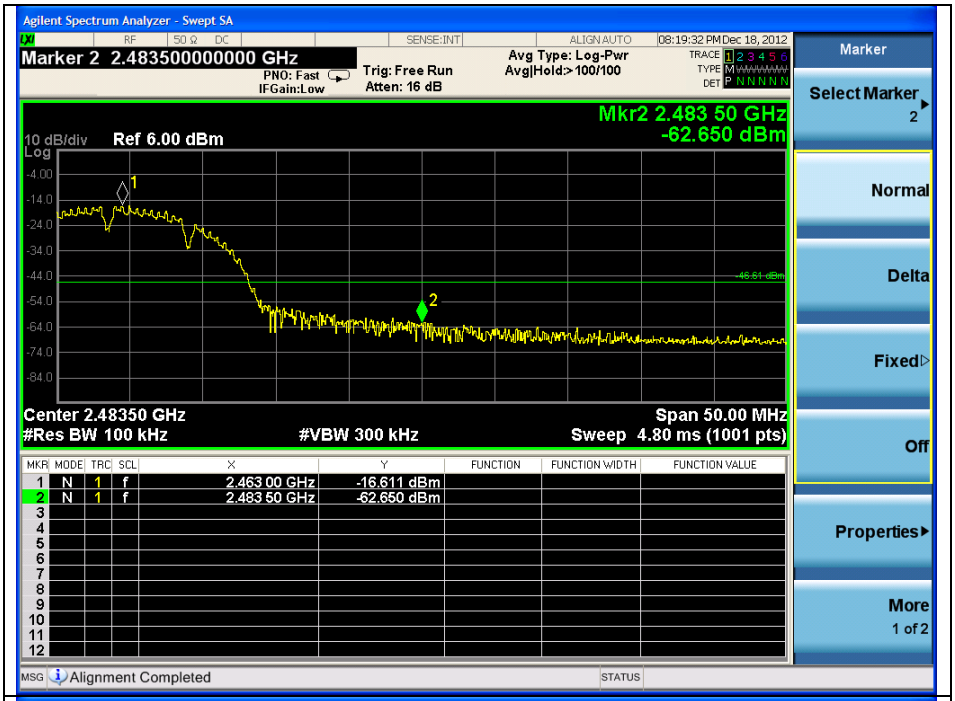
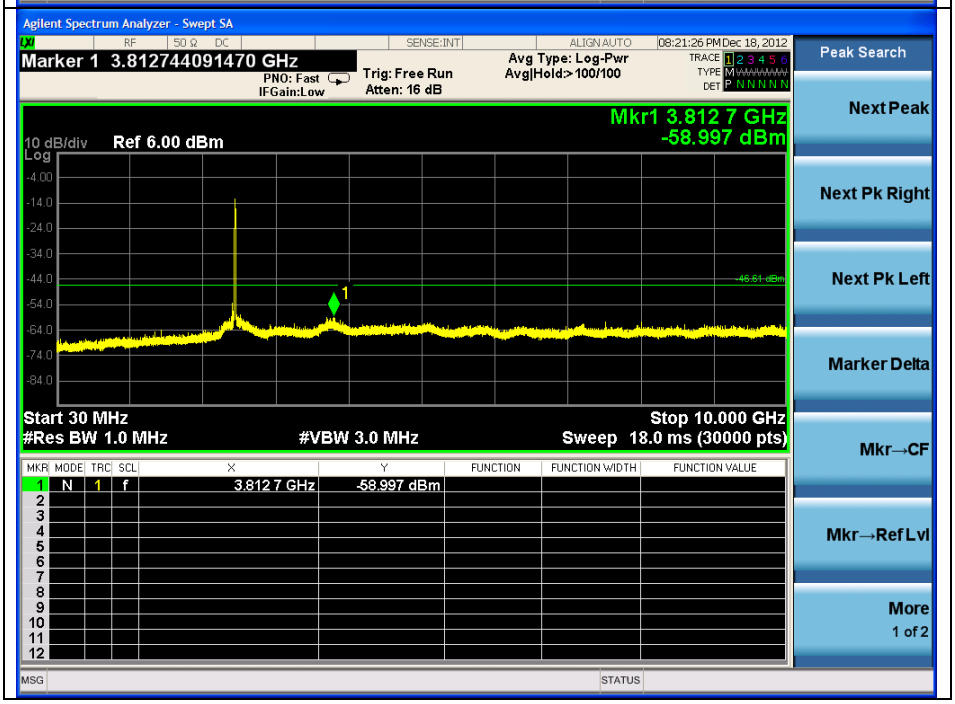
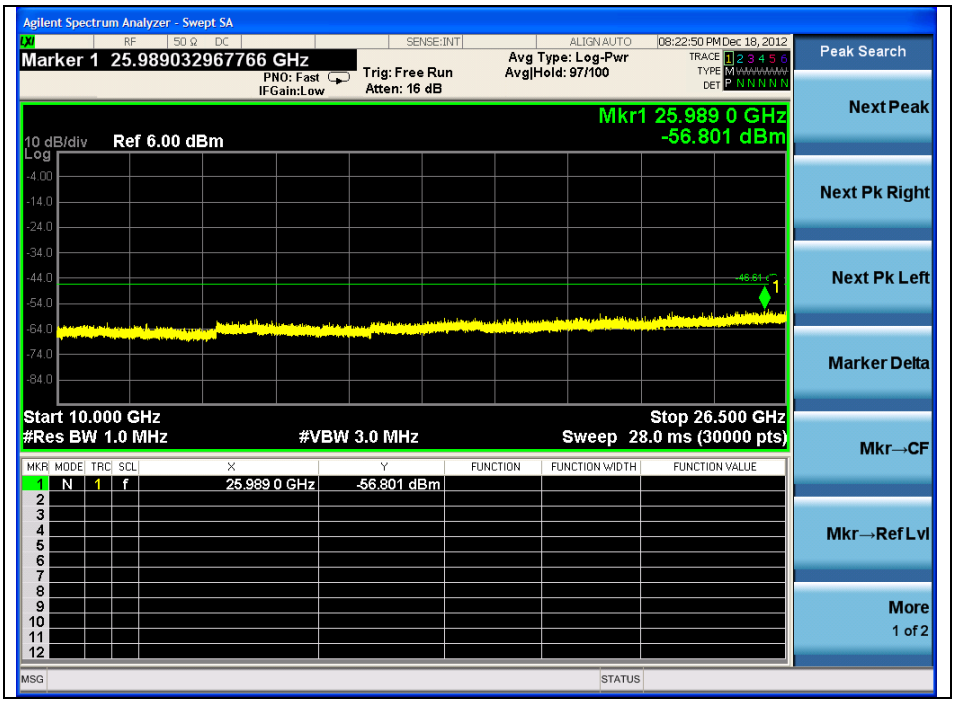
High Channel




*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*



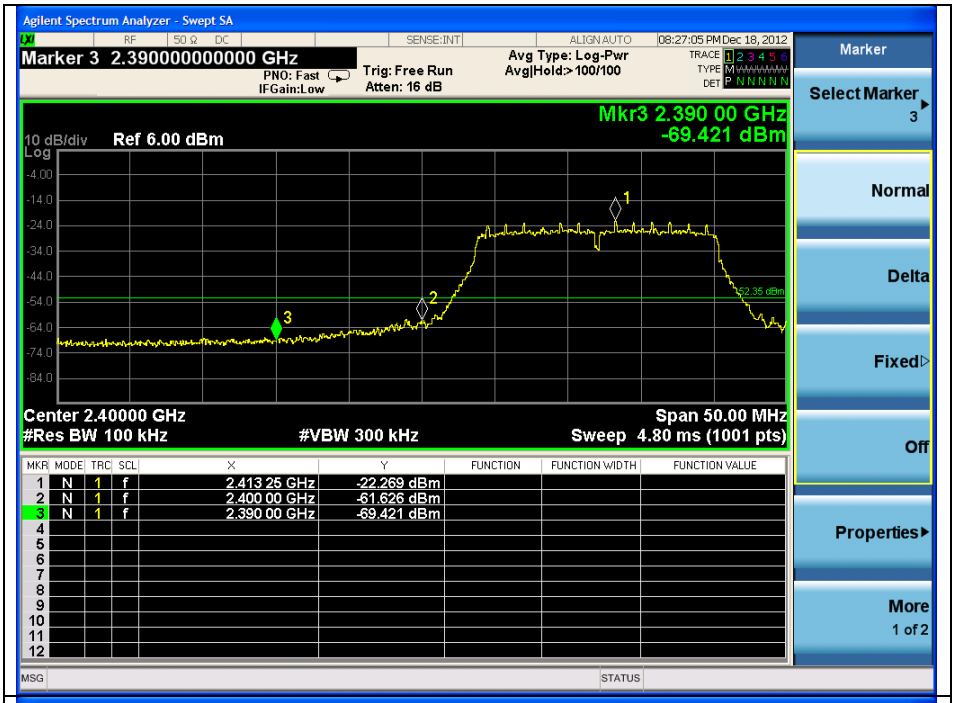

Note:
Offset (dB) = Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

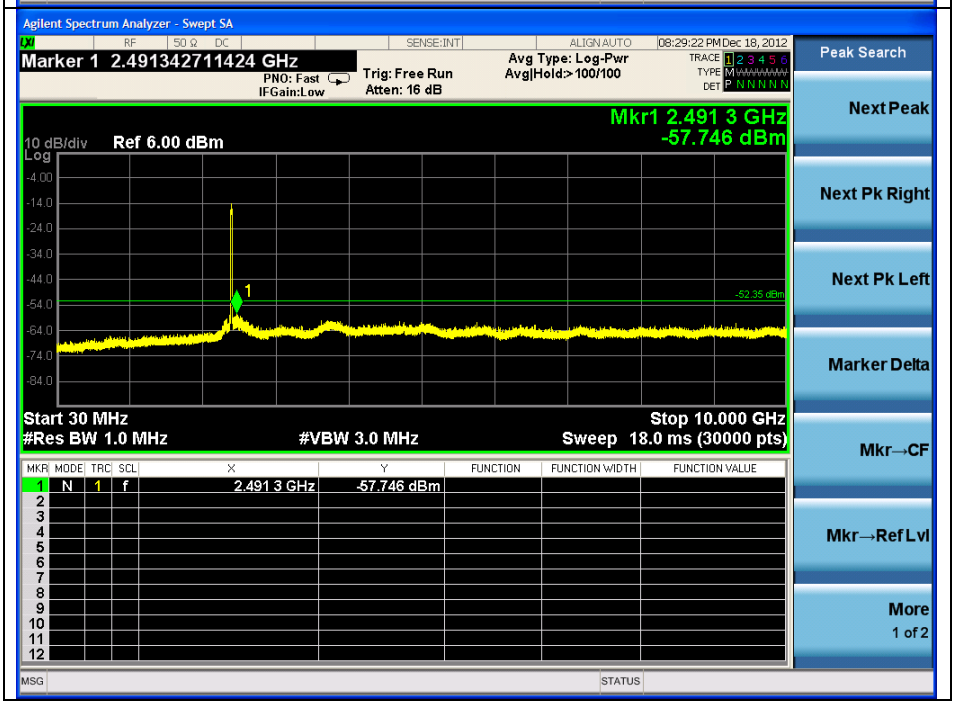
| Frequency (MHz) | Reading values (dB m) | Spurious offset (dB) | Result (dB m) |
|---|---|---|---|
| 2 483.50 | -62.65 | 22.58 | -40.07 |
| 3 812.70 | Noise floor | - | - |
| 25 989.00 | Noise floor | - | - |

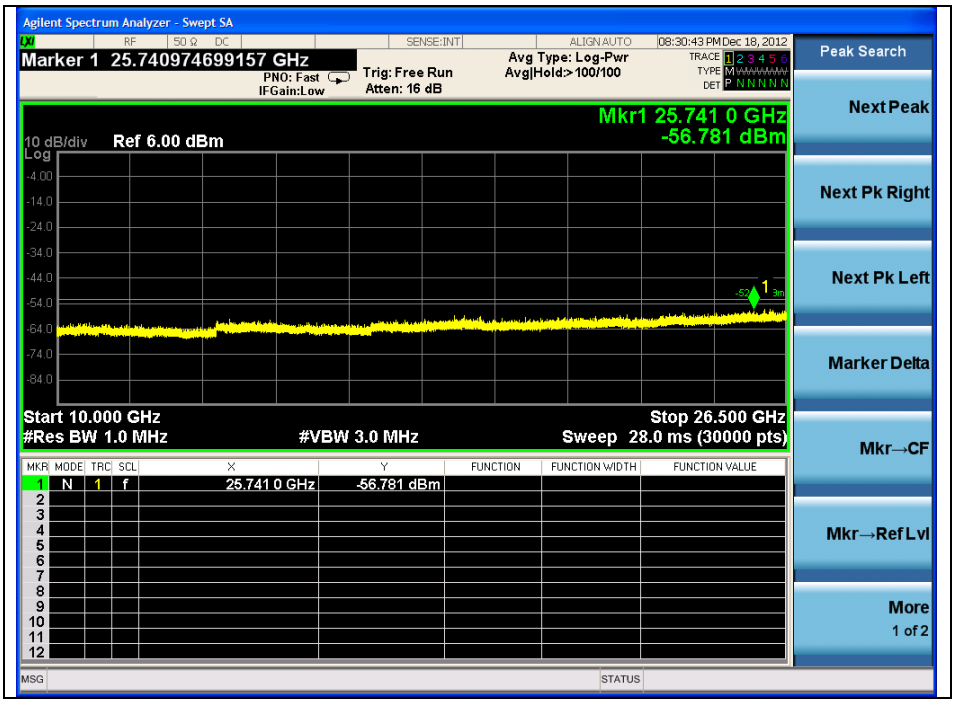
*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

**OFDM : 802.11g(6 Mbps)**

Low Channel






Note:
Offset (dB) = Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Reading values (dB m) | Spurious offset (dB) | Result (dB m) |
|---|---|---|---|
| 2 390.00 | -69.42 | 22.50 | -46.92 |
| 2 400.00 | -61.63 | 22.52 | -39.11 |
| 2 491.30 | -57.75 | 22.57 | -35.18 |
| 25 741.00 | Noise floor | - | - |

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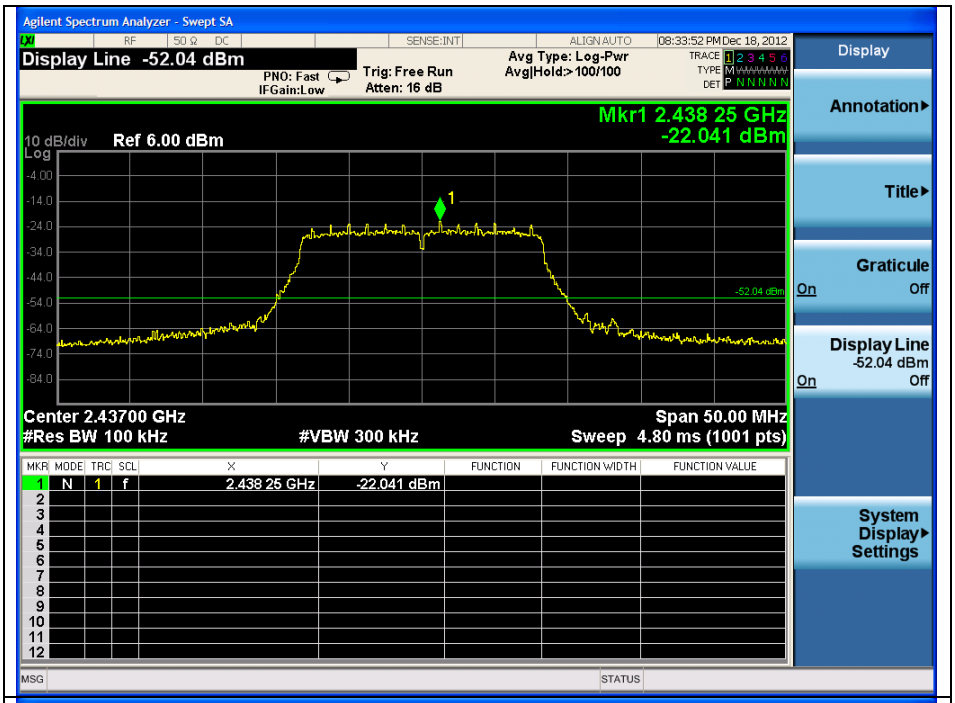
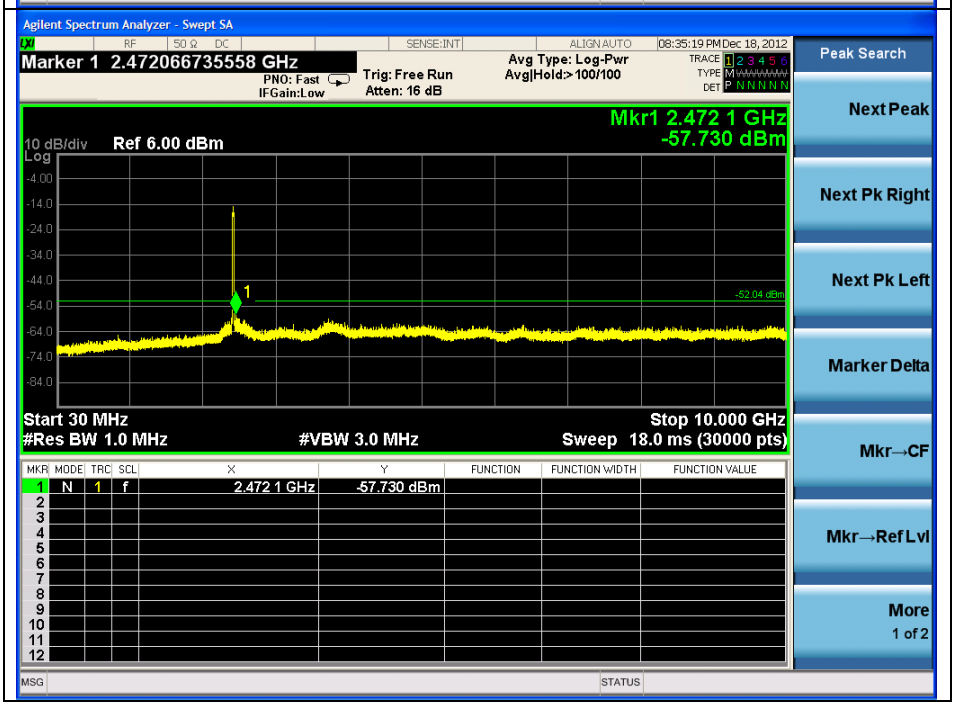
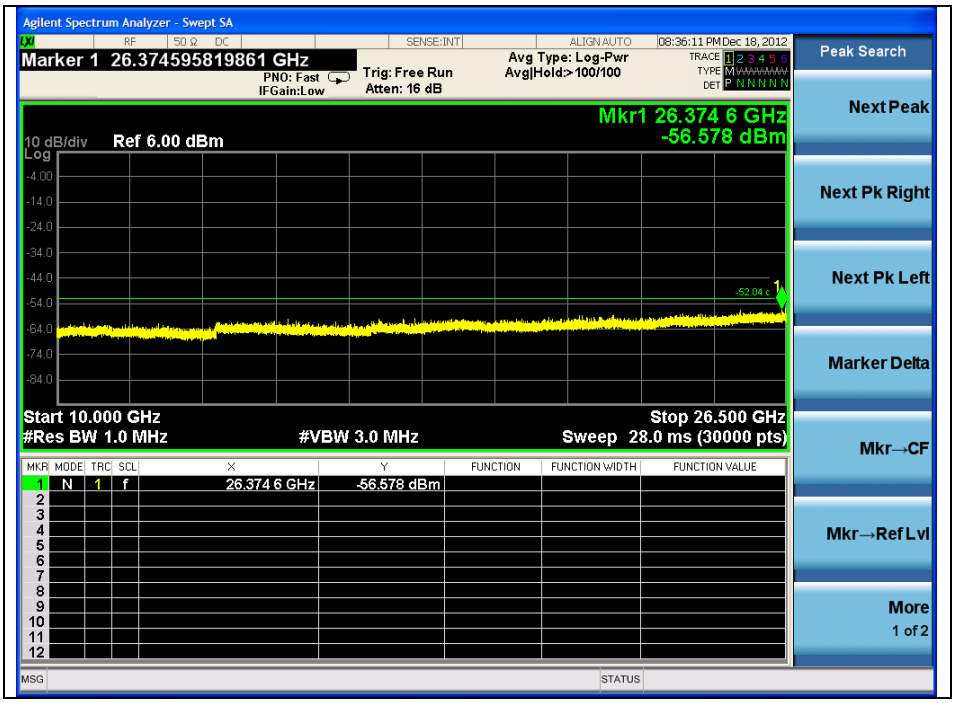
Middle Channel






Note:
Offset (dB) = Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Reading values (dB m) | Spurious offset (dB) | Result (dB m) |
|---|---|---|---|
| 2 472.10 | -57.73 | 22.58 | -35.15 |
| 26 374.60 | Noise floor | - | - |

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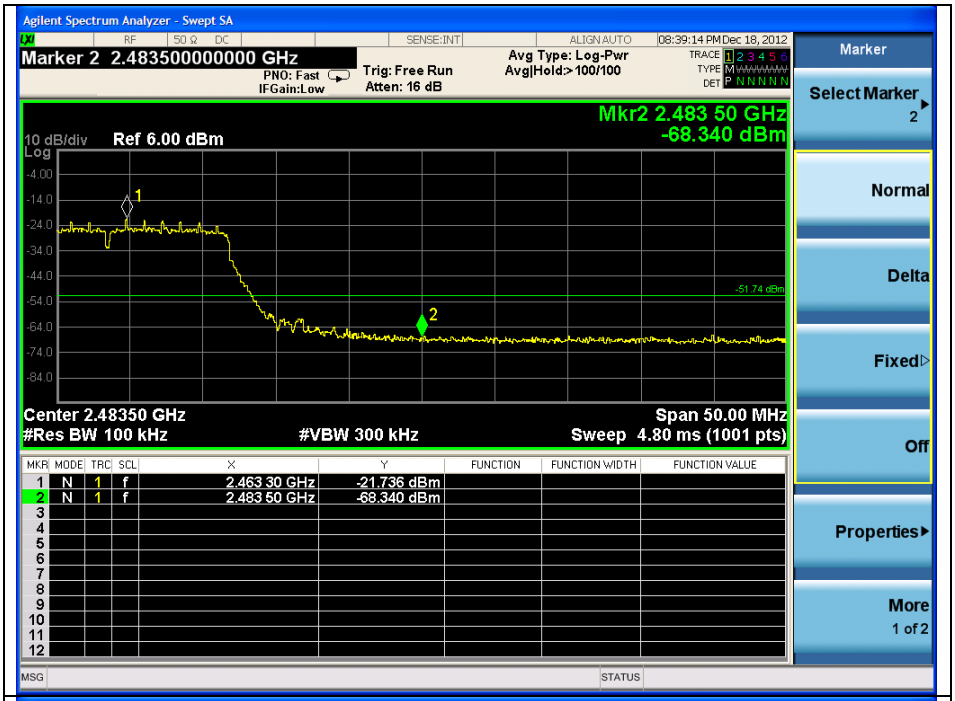
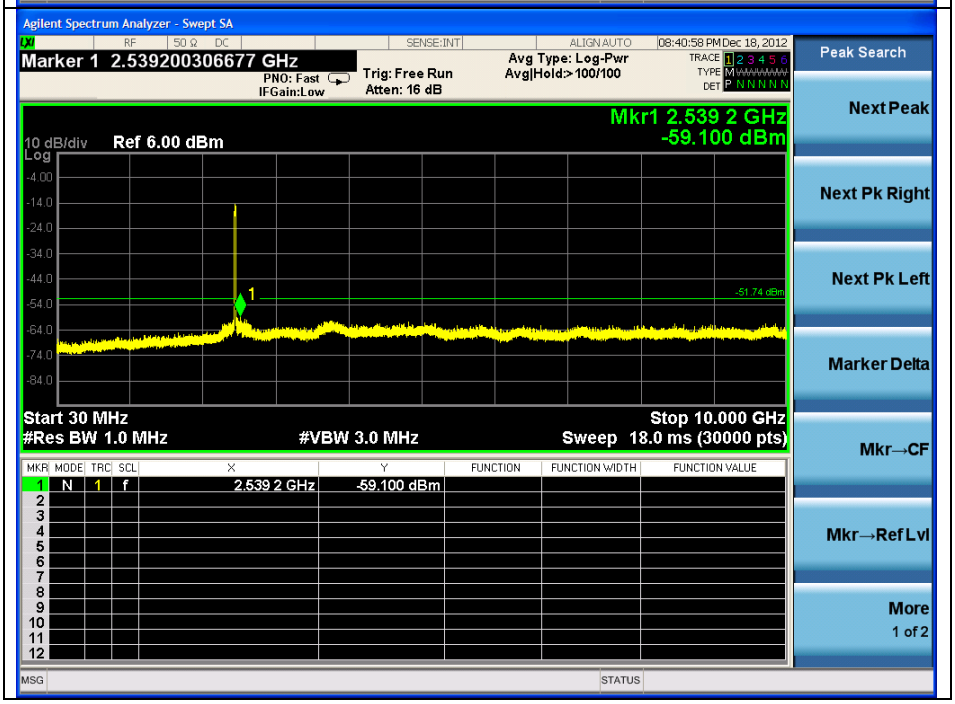
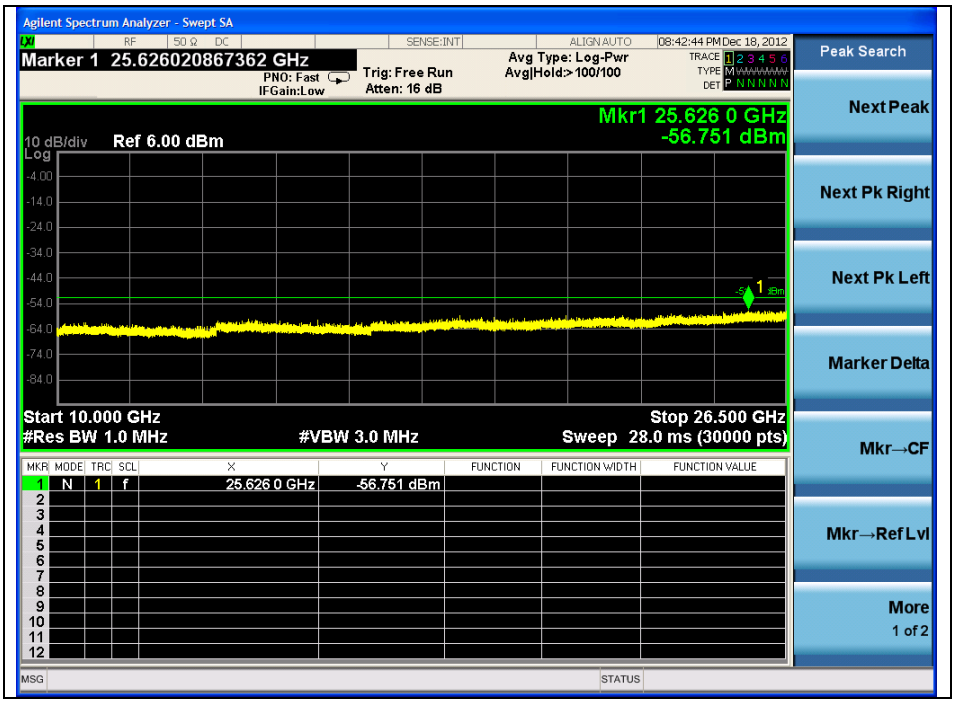
High Channel






Note:
Offset (dB) = Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Reading values (dB m) | Spurious offset (dB) | Result (dB m) |
|---|---|---|---|
| 2 483.50 | -68.34 | 22.58 | -47.58 |
| 2 539.20 | -59.10 | 22.60 | -36.50 |
| 25 626.00 | Noise floor | - | - |

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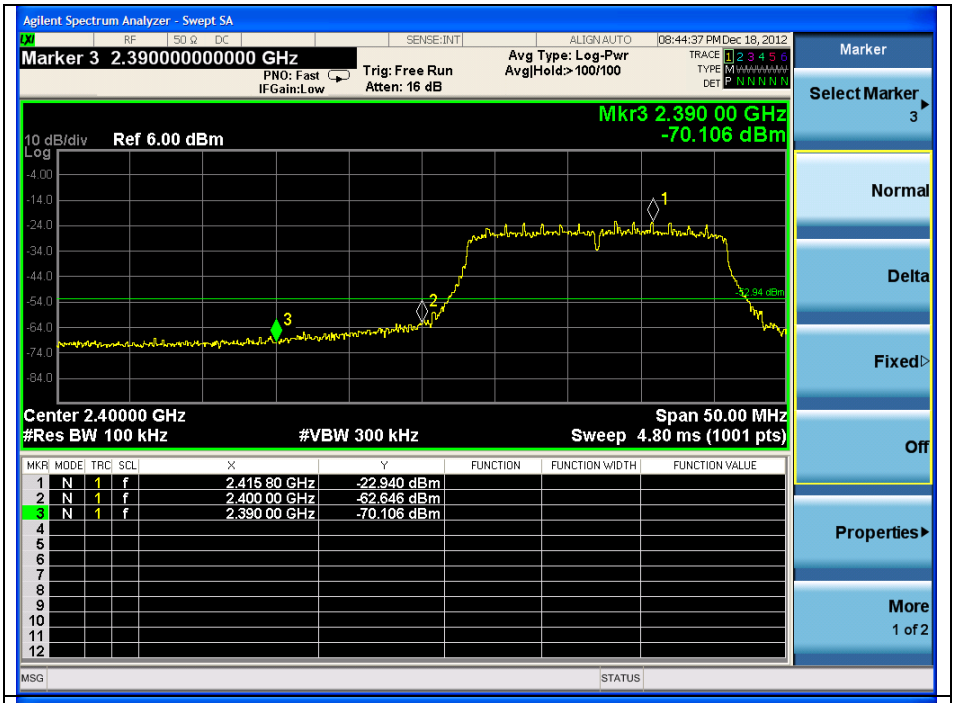
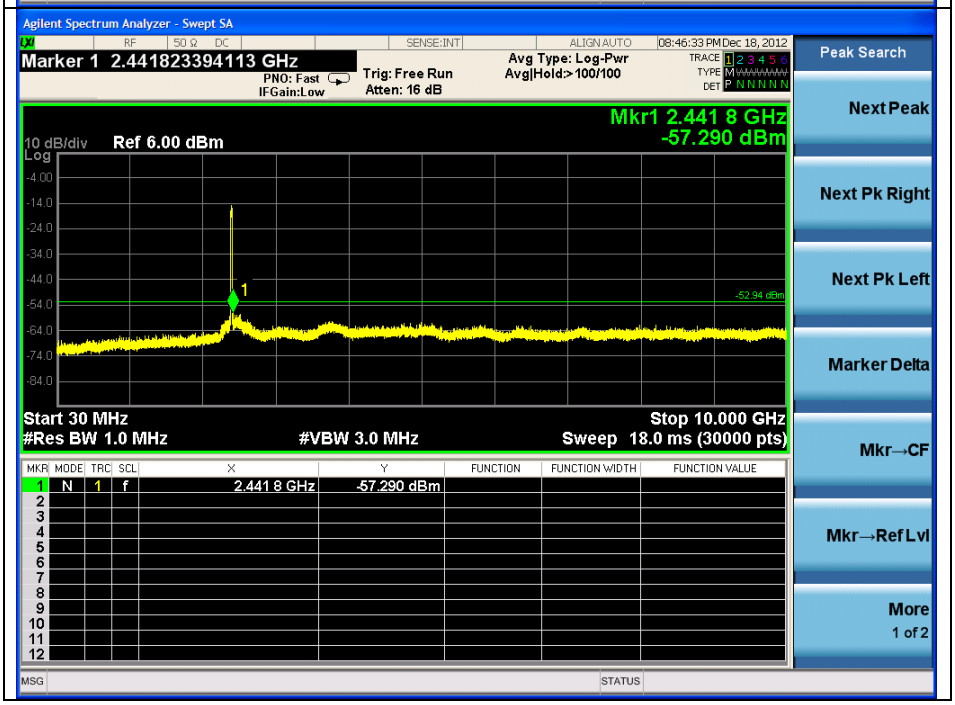
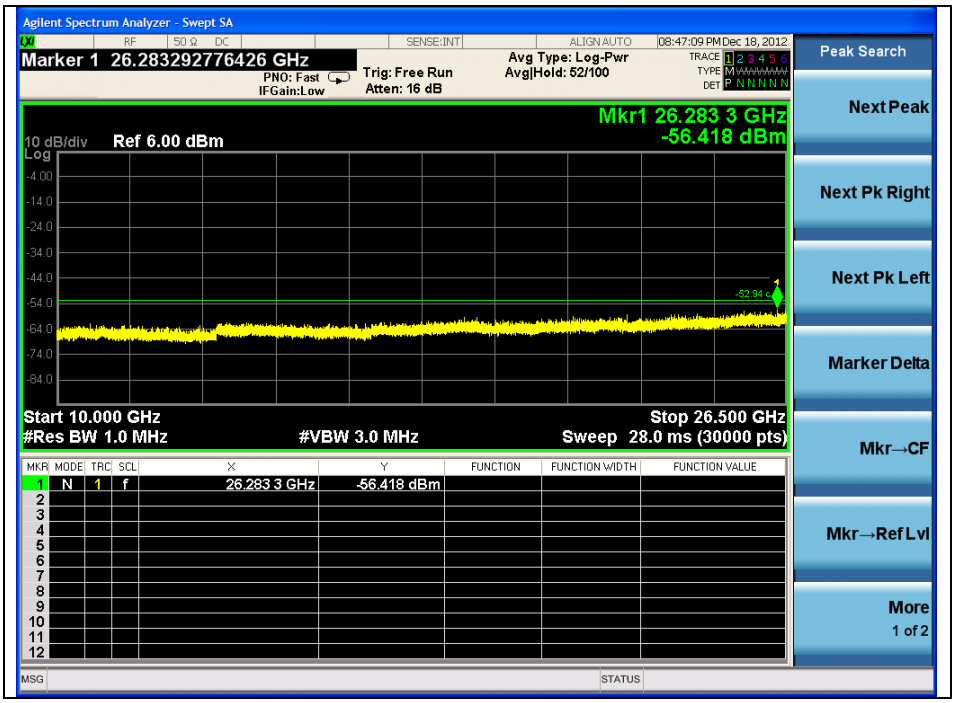
**OFDM : 802.11n_HT20(MCS0)**

Low Channel






Note:
Offset (dB) = Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Reading values (dB m) | Spurious offset (dB) | Result (dB m) |
|---|---|---|---|
| 2 390.00 | -70.11 | 22.50 | -47.61 |
| 2 400.00 | -62.65 | 22.52 | -40.13 |
| 2 441.80 | -57.29 | 22.53 | -34.76 |
| 26 283.30 | Noise floor | - | - |

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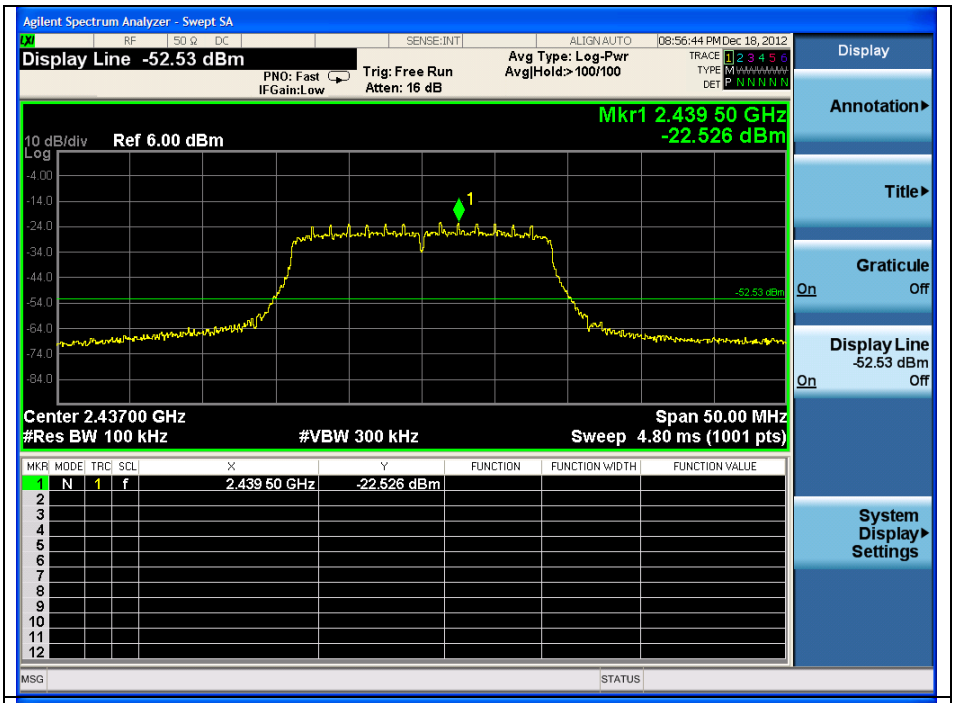
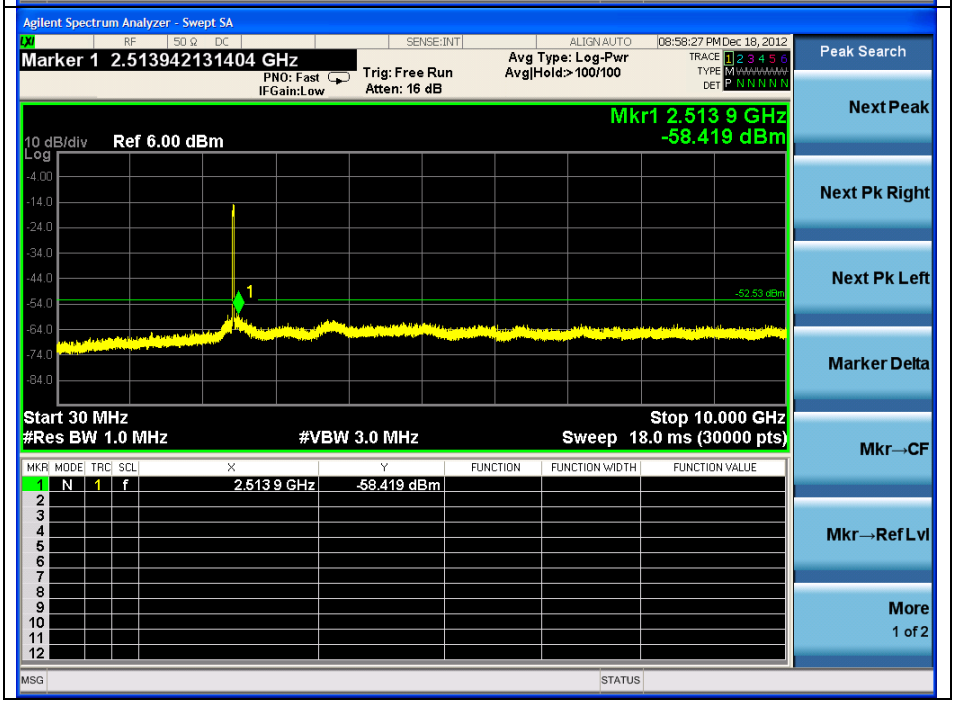
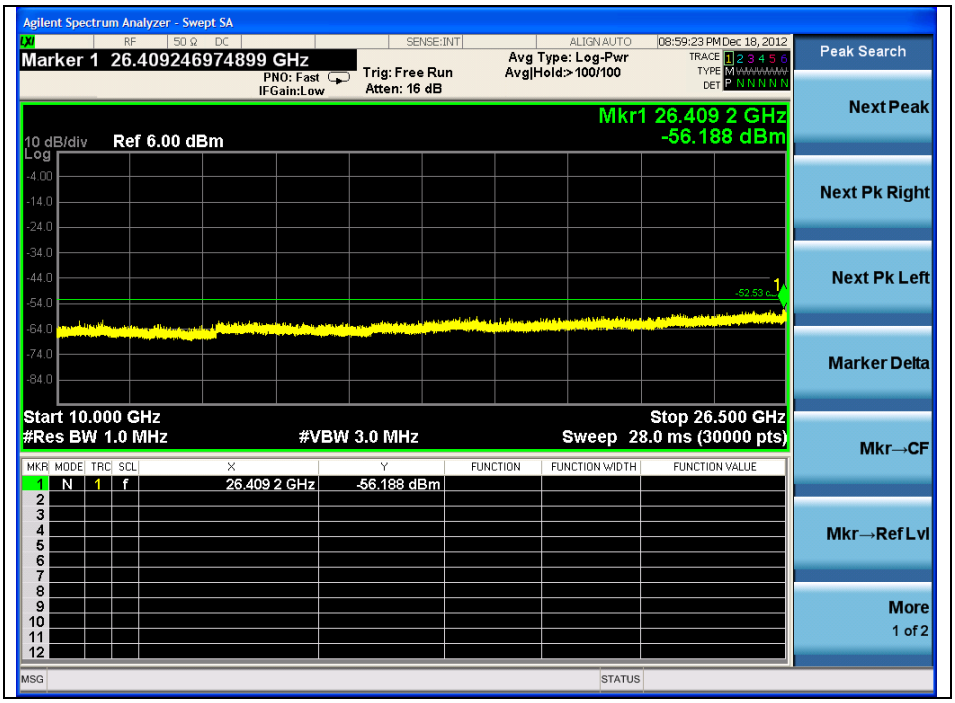
Middle Channel






Note:
Offset (dB) = Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Reading values (dB m) | Spurious offset (dB) | Result (dB m) |
|---|---|---|---|
| 2 513.90 | -58.42 | 22.60 | -35.82 |
| 26 409.20 | Noise floor | - | - |

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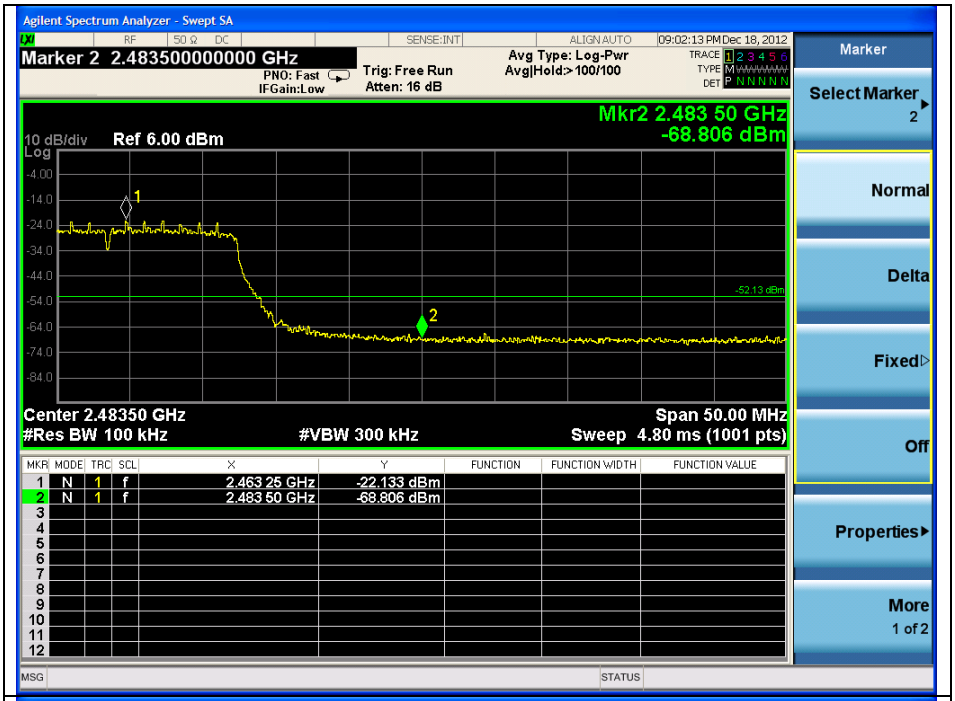
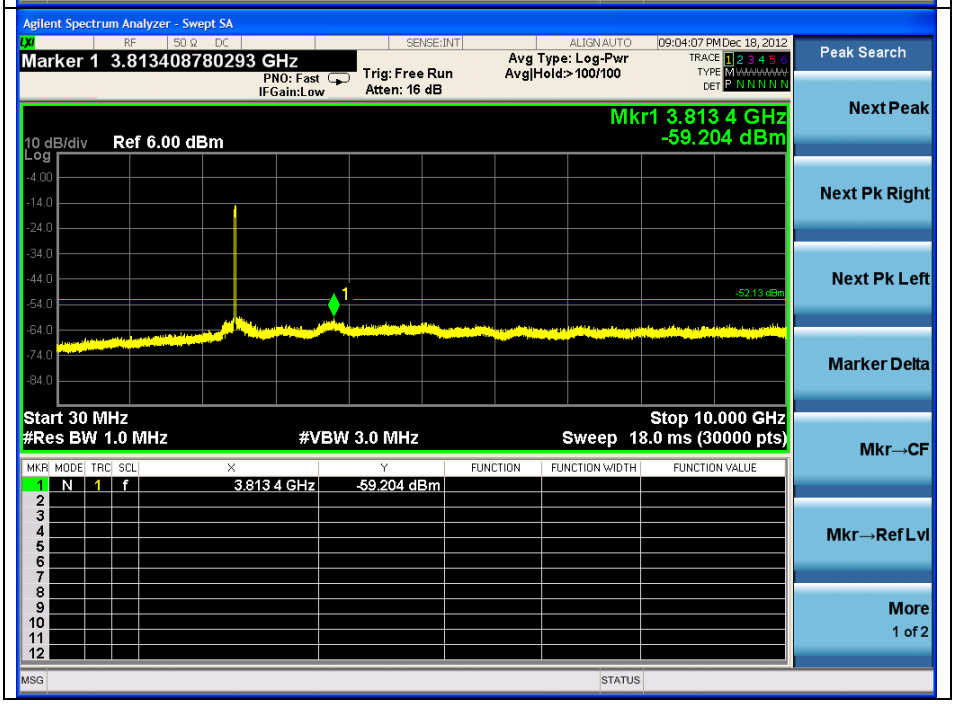
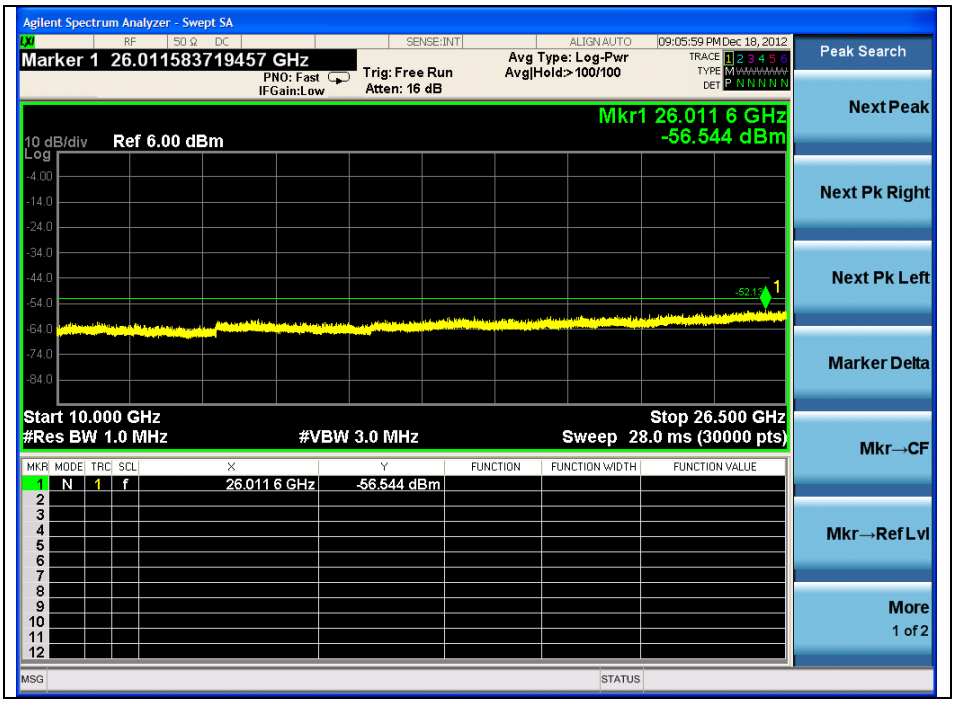
High Channel




*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*




Note:
Offset (dB) = Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Reading values (dB m) | Spurious offset (dB) | Result (dB m) |
|---|---|---|---|
| 2 483.50 | -68.81 | 22.58 | -46.23 |
| 3 813.40 | -59.20 | 22.71 | -36.49 |
| 26 011.60 | Noise floor | - | - |

*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

# 3. 6 ㎧ Bandwidth Measurement

## 3.1. Test Setup

| EUT | — | Attenuator | — | Spectrum Analyzer |
|---|---|---|---|---|

## 3.2. Limit

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 ~ 928 ㎒, 2 400 ~ 2 483.5 ㎒, and 5 725 ~ 5 825 ㎒ bands. The minimum of 6 ㎧ Bandwidth shall be at least 500 ㎑

## 3.3. Test Procedure

### 3.3.1. 6 ㎧ Bandwidth

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The test follows section 7.1 of FCC KDB Publication 558074

1. Set resolution bandwidth (RBW) = 1 – 5 % of DTS BW, not to exceed 100 ㎑
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 point (upper and lower) that are attenuated by 6 ㎧ relative to the maximum level measured in the fundamental emission.

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## 3.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

| Operation Mode | Data Rate (Mbps) | Channel | Channel Frequency (㎒) | 6 ㏈ Bandwidth (㎒) |
|---|---|---|---|---|
| DSSS (802.11b) | 1 | Low | 2 412 | 11.10 |
| | | Middle | 2 437 | 11.05 |
| | | High | 2 462 | 11.15 |
| OFDM (802.11g) | 6 | Low | 2 412 | 16.50 |
| | | Middle | 2 437 | 16.50 |
| | | High | 2 462 | 16.50 |
| OFDM (802.11n_HT20) | MCS0 | Low | 2 412 | 17.65 |
| | | Middle | 2 437 | 17.65 |
| | | High | 2 462 | 17.65 |

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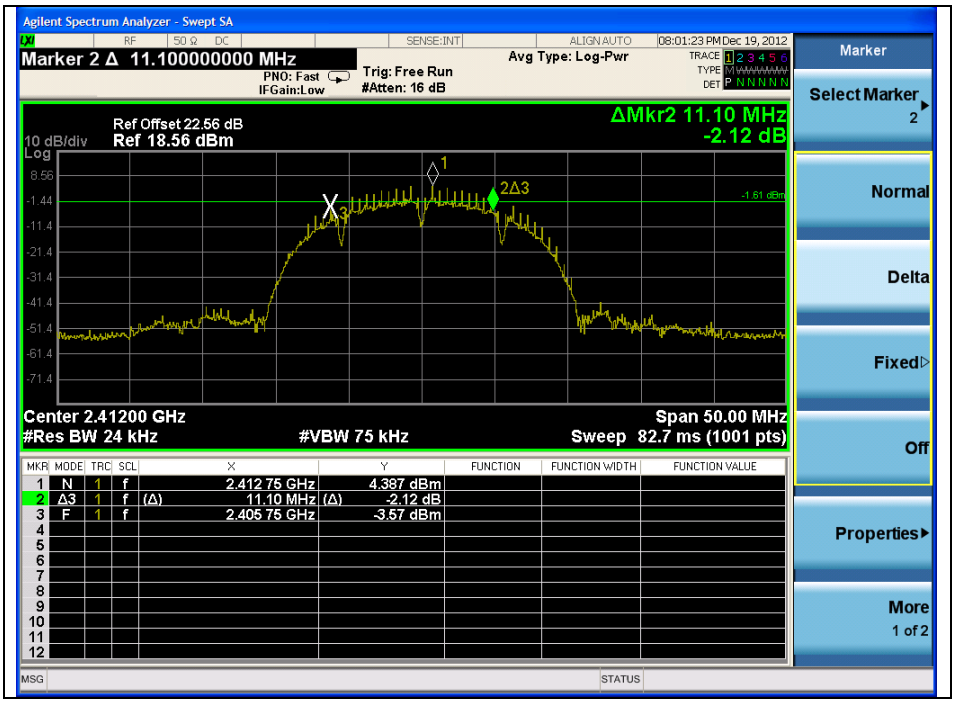
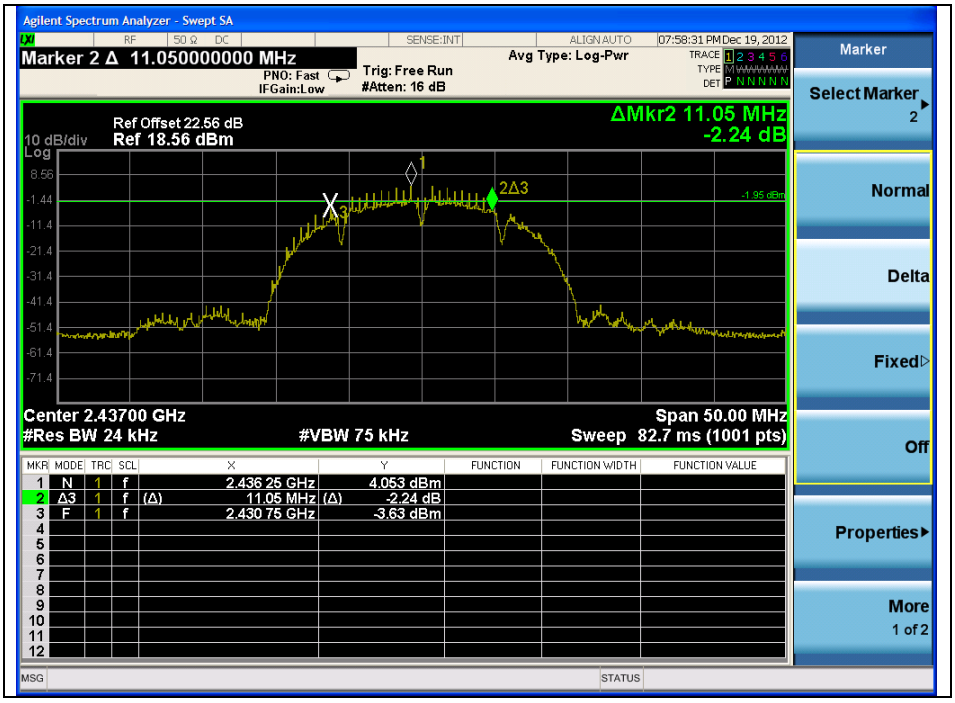
## 6 dB Bandwidth

**DSSS : 802.11b**

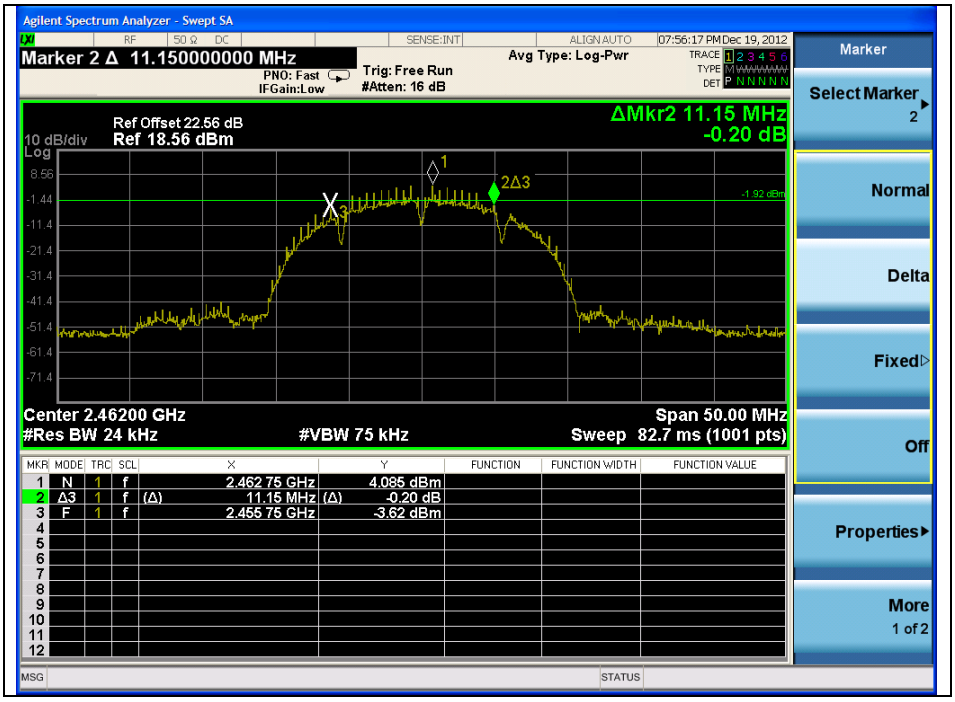
Low Channel




Middle Channel

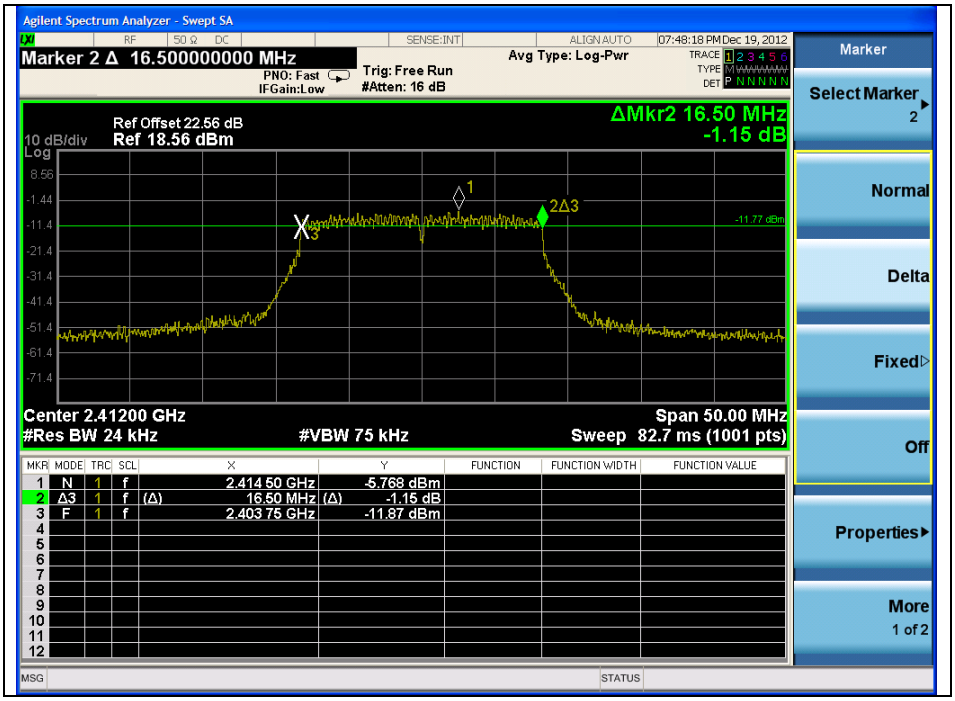


High Channel

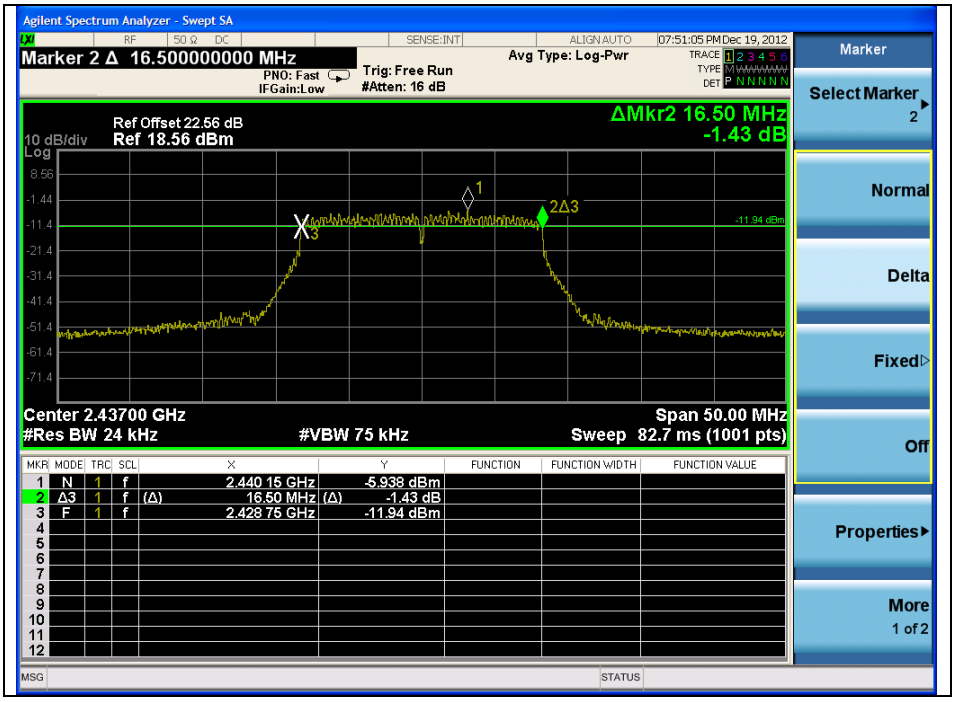



**OFDM : 802.11g**

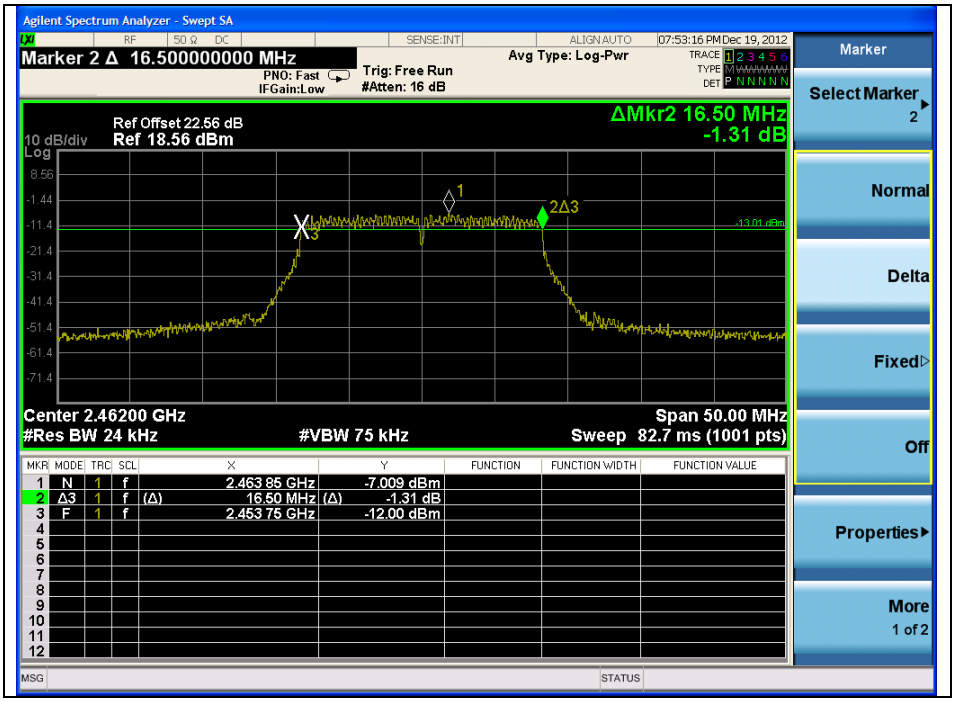
Low Channel



Middle Channel



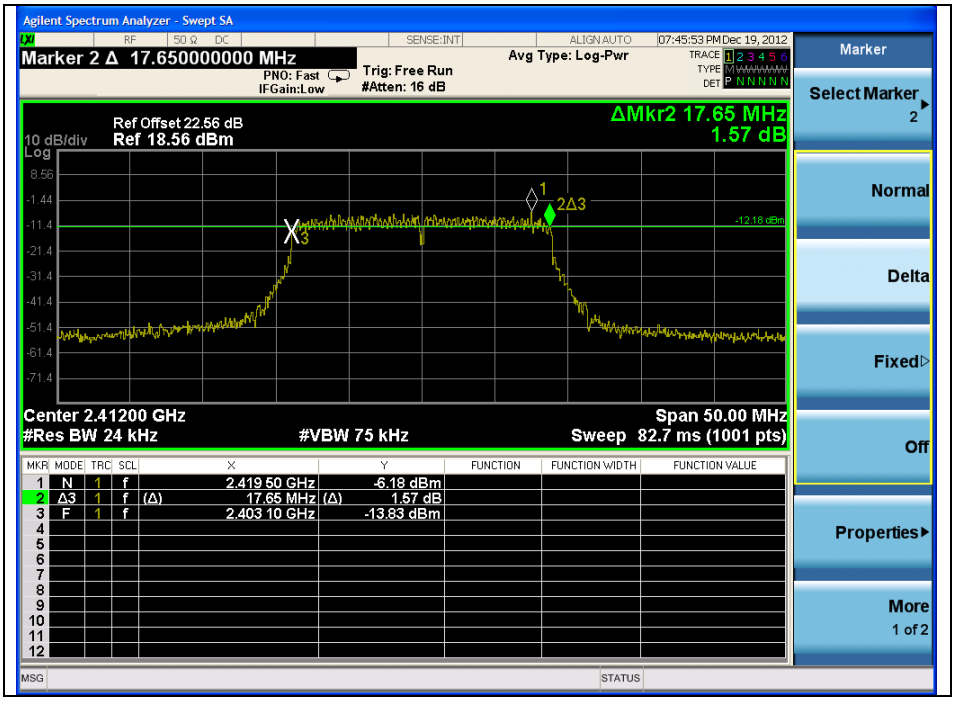

High Channel



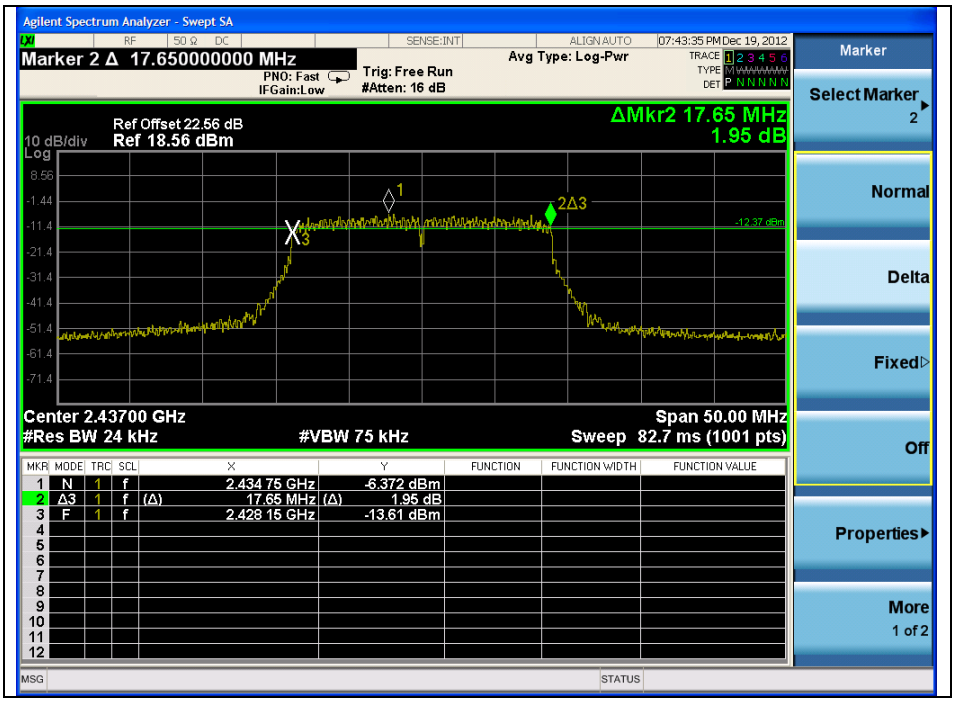

*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

**OFDM : 802.11n_HT20**

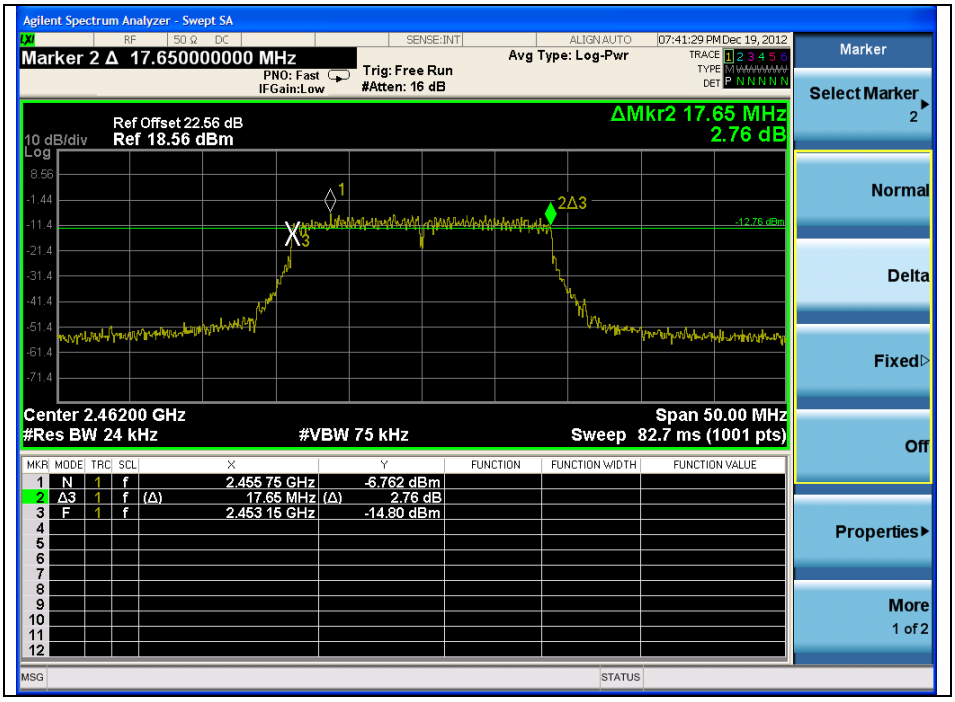
Low Channel




Middle Channel

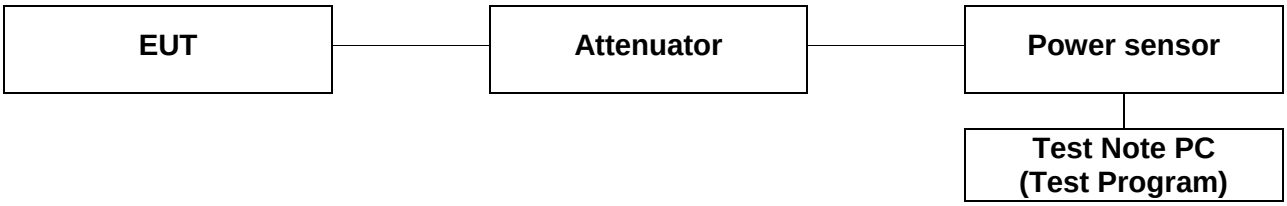


High Channel



# 4. Maximum Peak Output Power Measurement

## 4.1. Test Setup




## 4.2. Limit

According to §15.247(b)(3), for systems using digital modulation in the 902 ~ 928 ㎒, 2 400 ~2 483.5 ㎒, and 5 725 ~ 5 850 ㎒ band: 1 Watt. As an alternative to a peak power measurement, compliance with the one watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antenna elements. The average must not include any intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
According to §15.247(b)(4), the conducted output power limit specified in paragraph(b) of this section is based on the use of antenna with directional gains that do not exceed 6 ㏈i. Except as shown in paragraph(c) of this section, if transmitting antenna of directional gain greater than 6 ㏈i are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in ㏈ that the directional gain of the antenna exceeds 6㏈i.

## 4.3. Test Procedure

- **Peak and average power meter method.**

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The test follows section 8.1.3 & 8.2.3 of FCC KDB Publication 558074

-The maximum peak conducted output power can be measured using a broad band peak RF power meter. The power meter must have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast, average-responding diode type sensor.

-This procedure provides an alternative for determining the RMS output power using a broadband RF average power meter with a thermocouple detector if the EUT can be configured to transmit continuously or if the power meter can be triggered/signal-gated such that the power is measured only when the EUT is transmitting at its maximum power control level.

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor. (S/W name : R&S Power Viewer, Version : 3.2.0)
3. Measure peak & average power each channel.

*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

## 4.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

| Mode | Channel | Channel Frequency (MHz) | Data Rate (Mbps) | Attenuator + Cable offset (dB) | Average power Result (dB m) | Peak Power Result (dB m) |
|---|---|---|---|---|---|---|
| DSSS (802.11b) | Low | 2 412 | 1 | 21.68 | 14.70 | 17.06 |
| | | | 2 | | 14.63 | 17.05 |
| | | | 5.5 | | 14.67 | 17.03 |
| | | | 11 | | 14.50 | 17.04 |
| | Middle | 2 437 | 1 | 21.78 | 14.88 | 17.10 |
| | | | 2 | | 14.53 | 17.09 |
| | | | 5.5 | | 14.50 | 17.01 |
| | | | 11 | | 14.46 | 17.00 |
| | High | 2 462 | 1 | 21.86 | 14.86 | 17.13 |
| | | | 2 | | 14.77 | 17.12 |
| | | | 5.5 | | 14.71 | 17.00 |
| | | | 11 | | 14.69 | 17.03 |
| OFDM (802.11g) | Low | 2 412 | 6 | 21.68 | 10.60 | 20.70 |
| | | | 9 | | 10.58 | 20.69 |
| | | | 12 | | 10.55 | 20.63 |
| | | | 18 | | 10.49 | 20.64 |
| | | | 24 | | 10.49 | 20.65 |
| | | | 36 | | 10.56 | 20.68 |
| | | | 48 | | 10.57 | 20.63 |
| | | | 54 | | 10.44 | 20.69 |
| | Middle | 2 437 | 6 | 21.78 | 10.78 | 20.78 |
| | | | 9 | | 10.73 | 20.65 |
| | | | 12 | | 10.68 | 20.66 |
| | | | 18 | | 10.70 | 20.69 |
| | | | 24 | | 10.74 | 20.74 |
| | | | 36 | | 10.56 | 20.73 |
| | | | 48 | | 10.48 | 20.63 |
| | | | 54 | | 10.70 | 20.60 |
| | High | 2 462 | 6 | 21.86 | 10.70 | 20.76 |
| | | | 9 | | 10.68 | 20.75 |
| | | | 12 | | 10.64 | 20.73 |
| | | | 18 | | 10.66 | 20.70 |
| | | | 24 | | 10.69 | 20.75 |
| | | | 36 | | 10.63 | 20.72 |
| | | | 48 | | 10.61 | 20.75 |
| | | | 54 | | 10.65 | 20.73 |

*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

| Mode | Channel | Channel Frequency (MHz) | Data rate (Mbps) | Attenuator + Cable offset (dB) | Average power Result (dBm) | Peak Power Result (dBm) |
|---|---|---|---|---|---|---|
| OFDM (802.11n_HT20) | Low | 2 412 | MCS0 | 21.68 | 10.55 | 20.88 |
| | | | MCS1 | | 10.52 | 20.84 |
| | | | MCS2 | | 10.52 | 20.83 |
| | | | MCS3 | | 10.50 | 20.80 |
| | | | MCS4 | | 10.51 | 20.84 |
| | | | MCS5 | | 10.51 | 20.74 |
| | | | MCS6 | | 10.49 | 20.75 |
| | | | MCS7 | | 10.50 | 20.72 |
| | Middle | 2 437 | MCS0 | 21.78 | 10.35 | 20.76 |
| | | | MCS1 | | 9.91 | 20.74 |
| | | | MCS2 | | 9.88 | 20.73 |
| | | | MCS3 | | 9.92 | 20.68 |
| | | | MCS4 | | 10.03 | 20.59 |
| | | | MCS5 | | 10.11 | 20.64 |
| | | | MCS6 | | 10.24 | 20.55 |
| | | | MCS7 | | 10.01 | 20.53 |
| | High | 2 462 | MCS0 | 21.86 | 10.48 | 20.80 |
| | | | MCS1 | | 10.36 | 20.74 |
| | | | MCS2 | | 10.33 | 20.73 |
| | | | MCS3 | | 10.27 | 20.75 |
| | | | MCS4 | | 10.08 | 20.77 |
| | | | MCS5 | | 10.37 | 20.68 |
| | | | MCS6 | | 10.40 | 20.79 |
| | | | MCS7 | | 10.26 | 20.77 |

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# 5. Power Spectral Density Measurement

## 5.1. Test Setup

| EUT | — | Attenuator | — | Spectrum Analyzer |
|---|---|---|---|---|

## 5.2. Limit

§15.247(e) For digitally modulated system, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 ㎧ m in any 3 ㎑ band any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

## 5.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The measurements are recorded using the AVGPSD measurement procedure in section 9.2 of KDB 558074.

1. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
2. Set the analyzer span to at least 1.5 times the DTS channel bandwidth.
3. Set the RBW ≥ 3 ㎑
4. Set the VBW ≥ 3 x RBW
5. Detector = power average (RMS) or sample detector (when RMS not available).
6. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW
7. Sweep time = auto couple.
8. Employ trace averaging (RMS) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level.

*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

## 5.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

| Operation Mode | Data Rate (Mbps) | Channel | Frequency | Measured PSD (dB m) | Maximum Limit (dB m) |
|---|---|---|---|---|---|
| DSSS (802.11b) | 1 | Low | 2 412 ㎒ | -17.37 | 8 |
| | | Middle | 2 437 ㎒ | -16.74 | 8 |
| | | High | 2 462 ㎒ | -16.37 | 8 |
| OFDM (802.11g) | 6 | Low | 2 412 ㎒ | -29.03 | 8 |
| | | Middle | 2 437 ㎒ | -32.45 | 8 |
| | | High | 2 462 ㎒ | -29.48 | 8 |
| OFDM (802.11n_HT20) | MCS0 | Low | 2 412 ㎒ | -29.97 | 8 |
| | | Middle | 2 437 ㎒ | -30.72 | 8 |
| | | High | 2 462 ㎒ | -30.90 | 8 |

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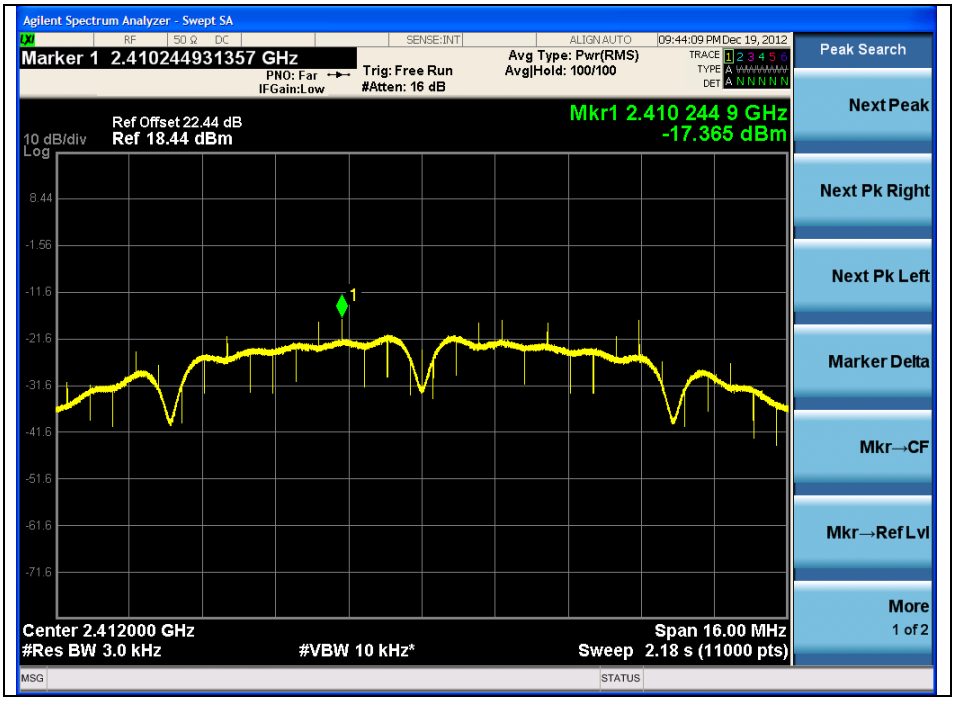
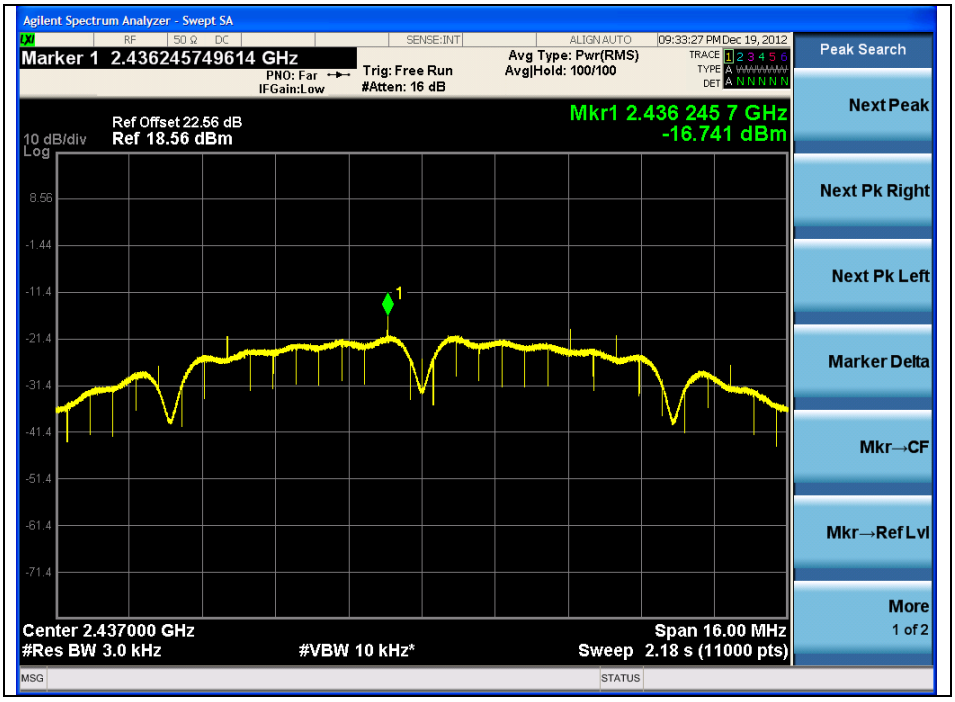
**DSSS : 802.11b**

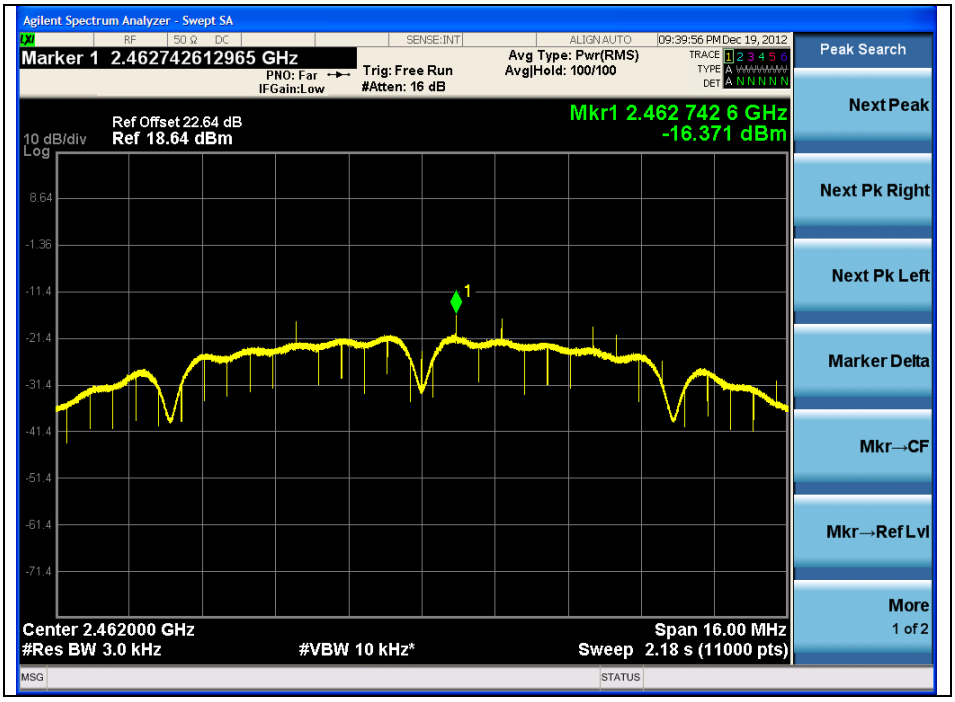
Low Channel




Middle Channel

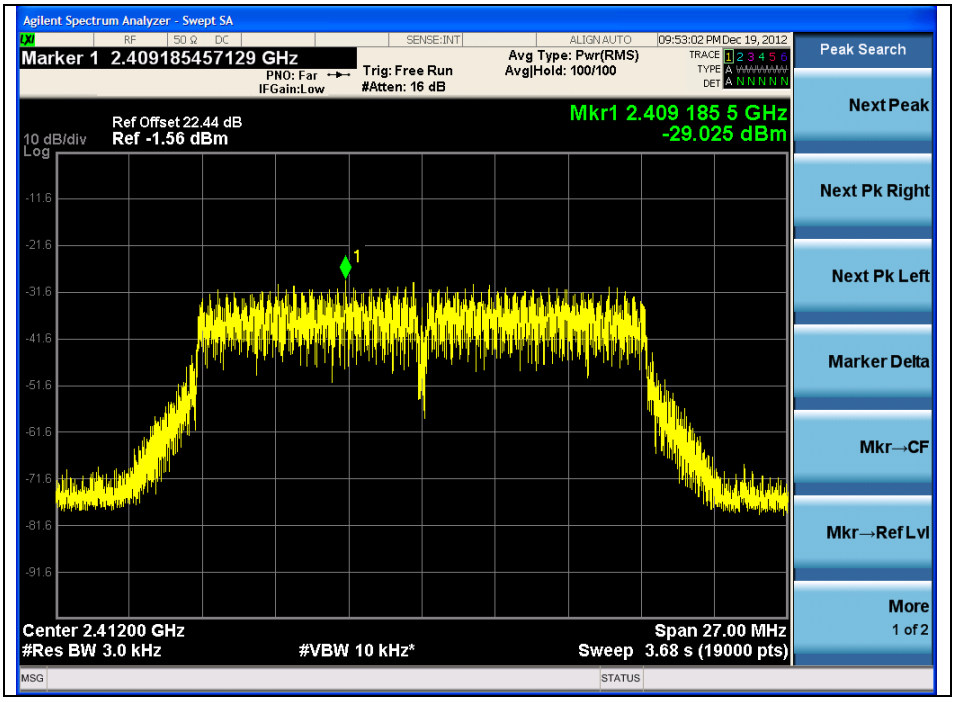


High Channel




**OFDM : 802.11g**

Low Channel

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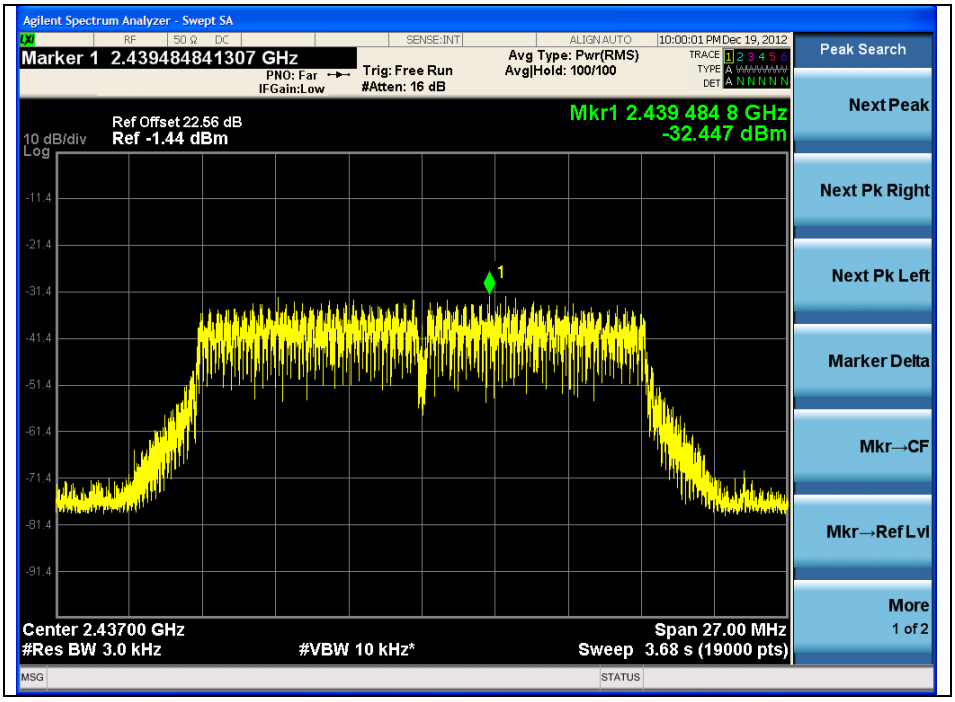
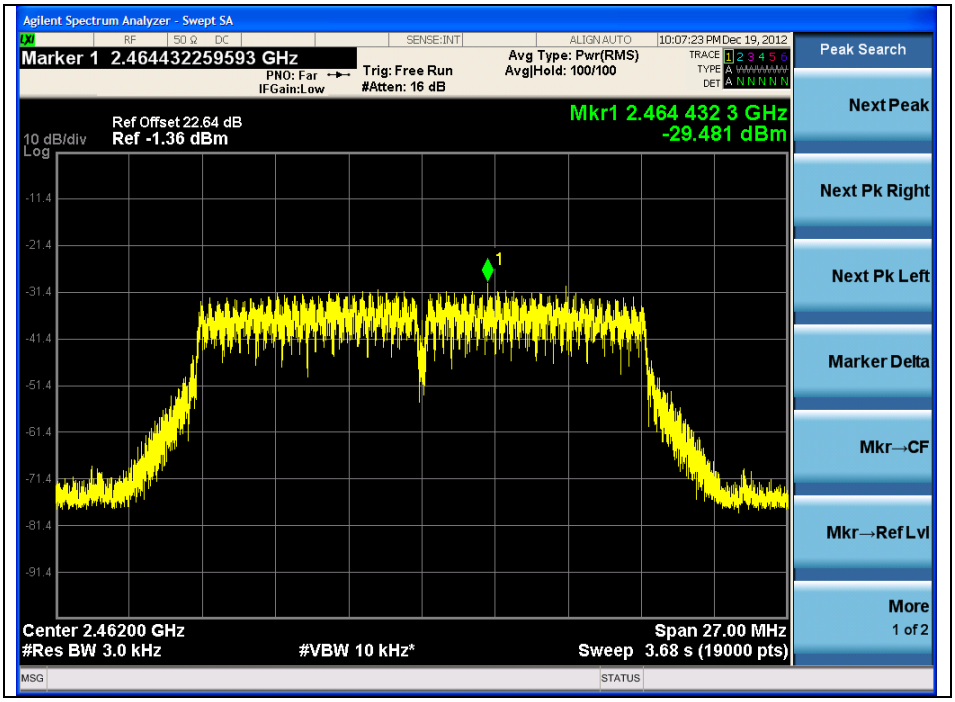
Middle Channel




High Channel

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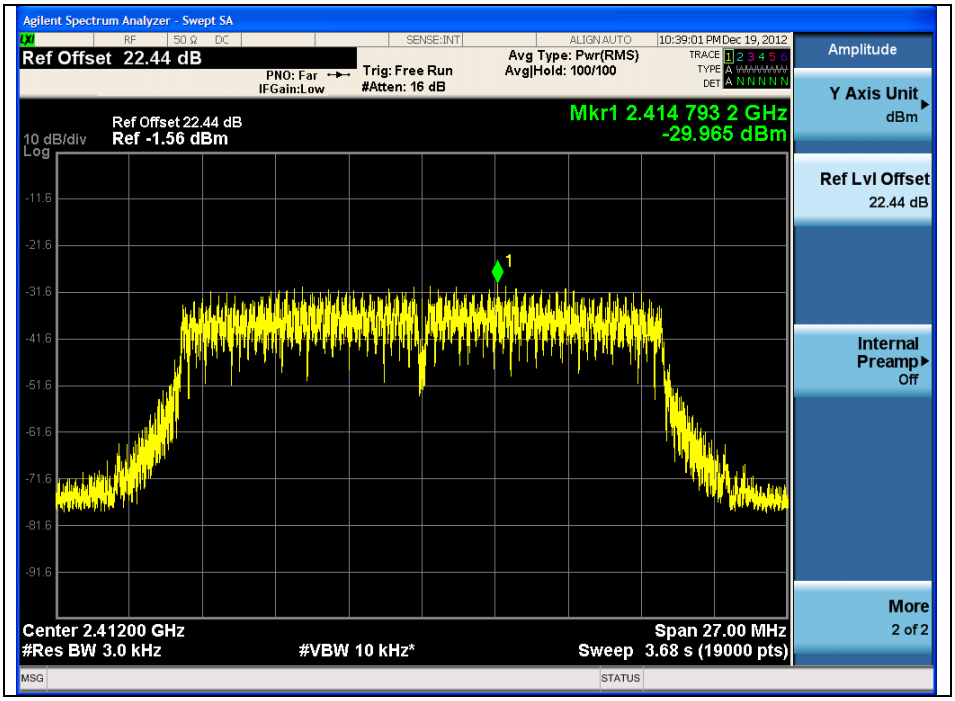
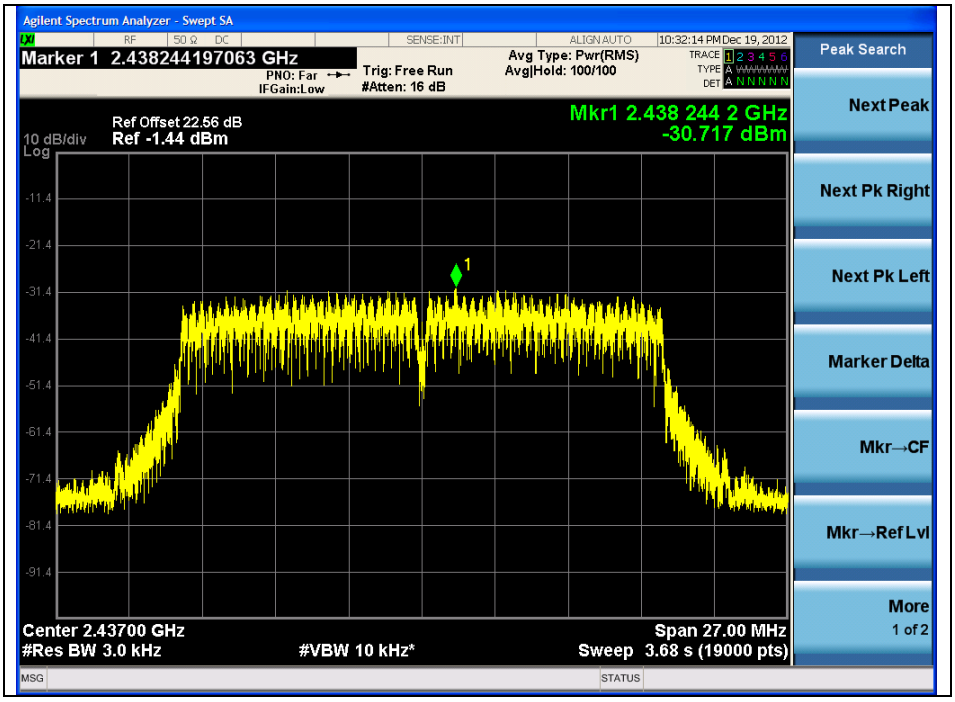
**OFDM : 802.11n_HT20**

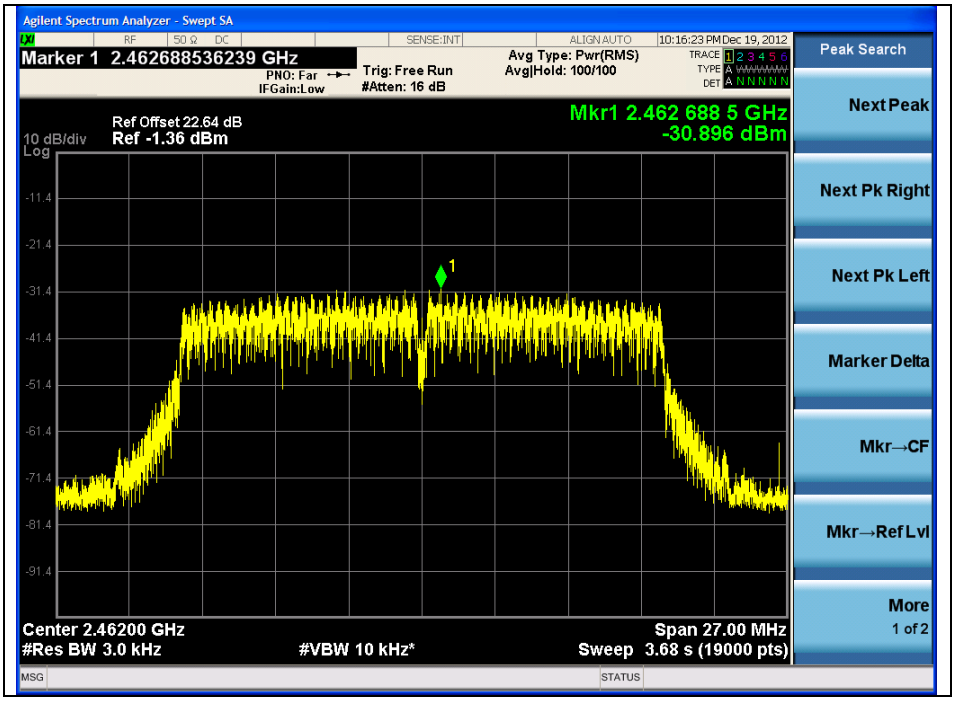
Low Channel




Middle Channel



High Channel



# 6. Antenna Requirement

## 6.1. 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 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

## 6.2. Antenna Connected Construction

Antenna used in this product is lead wire rod type with gain of 2.94 dBi.

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