# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT AND INDUSTRY CANADA RSS 210

*OF*

| | |
|---|---|
| **Product Name:** | **RED AP – High Power 802.11n 2.4GHz Wireless Access Point** |
| **Brand Name:** | **Cranberry Networks** |
| **Model No.:** | **Cranberry Red CN-AP2050** |
| **Model Difference:** | **N/A** |
| **FCC ID:** | **2ACBBCN-AP2050** |
| **IC:** | **11949A-CNAP2050** |
| **Report No.:** | **E2/2014/30056** |
| **Issue Date:** | **Jul. 16, 2014** |
| **FCC Rule Part:** | **§15.247, Cat: DTS** |
| **IC Rule Part:** | **RSS-210 issue 8 :2010, Annex 8** |
| **Prepared for:** | **Circle Reliance, Inc.**<br>**921 Rose Avenue, Menlo Park, CA 94025, U.S.A.** |
| **Prepared by:** | **SGS Taiwan Ltd.**<br>**Electronics & Communication Laboratory**<br>**No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan 333** |

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# VERIFICATION OF COMPLIANCE

| | |
|---|---|
| **Applicant:** | Circle Reliance, Inc.<br>921 Rose Avenue, Menlo Park, CA 94025, U.S.A. |
| **Product Name:** | RED AP – High Power 802.11n 2.4GHz Wireless Access Point |
| **Brand Name:** | Cranberry Networks |
| **Model No.:** | Cranberry Red CN-AP2050 |
| **Model Difference:** | N/A |
| **FCC ID:** | 2ACBBCN-AP2050 |
| **IC:** | 11949A-CNAP2050 |
| **File Number:** | E2/2014/30056 |
| **Date of test:** | Apr. 02, 2014 ~ Jul. 16, 2014 |
| **Date of EUT Received:** | Apr. 02, 2014 |

## We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2009 and RSS-Gen. issue 3 the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247 and IC RSS 210 issue 8: 2010 Annex 8.
The test results of this report relate only to the tested sample identified in this report.

| | | | |
|---|---|---|---|
| ***Test By:*** | Jazz Huang | ***Date*** | Jul. 16, 2014 |
| | ***Jazz Huang / Sr. Engineer*** | | |
| ***Prepared By:*** | Julia Chang | ***Date*** | Jul. 16, 2014 |
| | ***Julia Chang / Clerk*** | | |
| ***Approved By:*** | Jim Chang | ***Date*** | Jul. 16, 2014 |
| | ***Jim Chang / Supervisor*** | | |

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# Version

| Version No. | Date | Description |
|---|---|---|
| 00 | Jul. 16, 2014 | Initial creation of document |
| | | |

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# 1 GENERAL INFORMATION

## 1.1 Product description

General:

| | |
|---|---|
| Product Name: | RED AP – High Power 802.11n 2.4GHz Wireless Access Point |
| Brand Name: | Cranberry Networks |
| Model No.: | Cranberry Red CN-AP2050 |
| Model Difference: | N/A |
| Hardware Version: | N/A |
| Software Version: | N/A |
| Power Supply: | 48Vdc from PoE: IEEE 802.3af |

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WLAN 2.4GHz:

| Wi-Fi | Frequency Range | Channels | Rated Power (Peak) | Modulation Technology | Type of Emission |
|---|---|---|---|---|---|
| 11b/g | 2412-2462 | 11 | b: 23.13dBm<br>g: 23.99dBm | DSSS,<br>OFDM | b: 13M9G1D<br>g: 16M5D1D |
| 11n HT20 | 2412-2462 | 11 | Main:<br>24.33dBm<br>MIMO Chain0:<br>23.93dBm<br>MIMO Chain1:<br>23.76dBm<br>MIMO Chain0+1:<br>26.86dBm | OFDM | 16M7D1D |
| 11n HT40 | 2422-2452 | 7 | Main:<br>24.45dBm<br>MIMO Chain0:<br>24.05dBm<br>MIMO Chain1:<br>23.86dBm<br>MIMO Chain0+1:<br>26.97dBm | OFDM | 36M5D1D |
| Antenna Designation: | | PIFA Antenna,<br>Part Number:AEPA-2402-05E-01 (Main), AEPA-2402-05E-02 (Aux)<br>Gain: 1.5dBi (Main), Gain: 1.5dBi (Aux) | | | |
| Modulation type: | | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM | | | |
| Transition Rate: | | 802.11 b: 1/2/5.5/11 Mbps<br>802.11 g: 6/9/12/18/24/36/48/54 Mbps<br>802.11 n_20MHz: 6.5 – 150Mbps<br>802.11 n_40MHz: 13.5 – 300Mbps | | | |

The 2.4G max antenna gain is 1.5dBi which was choosing for Radiated Spurious Emission test.

The test report applies for WLAN 802.11 b/g/n function.

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IEEE 802.11n Spec:

| MCS Index | Nss | Modulation | R | NBPSC | NCBPS | | NDBPS | | Datarate(Mbps) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 800nsGI | | 400nsGI | |
| | | | | | 20MHz | 40MHz | 20MHz | 40MHz | 20MHz | 40MHz | 20MHz | 40MHz |
| 0 | 1 | BPSK | 1/2 | 1 | 52 | 108 | 26 | 54 | 6.5 | 13.5 | 7.200 | 15 |
| 1 | 1 | QPSK | 1/2 | 2 | 104 | 216 | 52 | 108 | 13.0 | 27.0 | 14.400 | 30 |
| 2 | 1 | QPSK | 3/4 | 2 | 104 | 216 | 78 | 162 | 19.5 | 40.5 | 21.700 | 45 |
| 3 | 1 | 16-QAM | 1/2 | 4 | 208 | 432 | 104 | 216 | 26.0 | 54.0 | 28.900 | 60 |
| 4 | 1 | 16-QAM | 3/4 | 4 | 208 | 432 | 156 | 324 | 39.0 | 81.0 | 43.300 | 90 |
| 5 | 1 | 64-QAM | 2/3 | 6 | 312 | 648 | 208 | 432 | 52.0 | 108.0 | 57.800 | 120 |
| 6 | 1 | 64-QAM | 3/4 | 6 | 312 | 648 | 234 | 486 | 58.5 | 121.5 | 65.000 | 135 |
| 7 | 1 | 64-QAM | 5/6 | 6 | 312 | 648 | 260 | 540 | 65.0 | 135.0 | 72.200 | 150 |

| Symbol | Explanation |
|---|---|
| NSS | Number of spatial streams |
| R | Code rate |
| NBPSC | Number of coded bite per single carrier |
| NCBPS | Number of coded bite per symbol |
| NDBPS | Number of data bite per symbol |
| GI | Guard interval |

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| MCS Index | Modulation | $R$ | $N_{BPSCS(iSS)}$ | $N_{SD}$ | $N_{SP}$ | $N_{CBPS}$ | $N_{DBPS}$ | Data rate (Mb/s) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 800 ns GI | 400 ns GI (see NOTE) |
| 8 | BPSK | 1/2 | 1 | 52 | 4 | 104 | 52 | 13.0 | 14.4 |
| 9 | QPSK | 1/2 | 2 | 52 | 4 | 208 | 104 | 26.0 | 28.9 |
| 10 | QPSK | 3/4 | 2 | 52 | 4 | 208 | 156 | 39.0 | 43.3 |
| 11 | 16-QAM | 1/2 | 4 | 52 | 4 | 416 | 208 | 52.0 | 57.8 |
| 12 | 16-QAM | 3/4 | 4 | 52 | 4 | 416 | 312 | 78.0 | 86.7 |
| 13 | 64-QAM | 2/3 | 6 | 52 | 4 | 624 | 416 | 104.0 | 115.6 |
| 14 | 64-QAM | 3/4 | 6 | 52 | 4 | 624 | 468 | 117.0 | 130.0 |
| 15 | 64-QAM | 5/6 | 6 | 52 | 4 | 624 | 520 | 130.0 | 144.4 |
| NOTE—The 400 ns GI rate values are rounded to 1 decimal place. | | | | | | | | | |

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| MCS Index | Modulation | R | $N_{BPSCS(i_{SS})}$ | $N_{SD}$ | $N_{SP}$ | $N_{CBPS}$ | $N_{DBPS}$ | Data rate (Mb/s) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 800 ns GI | 400 ns GI |
| 8 | BPSK | 1/2 | 1 | 108 | 6 | 216 | 108 | 27.0 | 30.0 |
| 9 | QPSK | 1/2 | 2 | 108 | 6 | 432 | 216 | 54.0 | 60.0 |
| 10 | QPSK | 3/4 | 2 | 108 | 6 | 432 | 324 | 81.0 | 90.0 |
| 11 | 16-QAM | 1/2 | 4 | 108 | 6 | 864 | 432 | 108.0 | 120.0 |
| 12 | 16-QAM | 3/4 | 4 | 108 | 6 | 864 | 648 | 162.0 | 180.0 |
| 13 | 64-QAM | 2/3 | 6 | 108 | 6 | 1296 | 864 | 216.0 | 240.0 |
| 14 | 64-QAM | 3/4 | 6 | 108 | 6 | 1296 | 972 | 243.0 | 270.0 |
| 15 | 64-QAM | 5/6 | 6 | 108 | 6 | 1296 | 1080 | 270.0 | 300.0 |

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## 1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2ACBBCN-AP2050** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. And **IC: 11949A-CNAP2050** filing to comply with Industry Canada RSS-210 issue 8: 2010 Annex 8.

## 1.3 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4:2009 and RSS-Gen: 2010. Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with Jun 2014 KDB558074 D01 v03r02 for compliance to FCC 47CFR 15.247 requirements.

## 1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan 333 which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2009. FCC Registration Number: 628985.The address of SGS Taiwan Ltd. Electronics & Communication Laboratory 1F, No.134, Wukung Road New Taipei City TAIWAN 24803, Canada Registration Number: 4620A-5.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County,Taiwan which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. FCC Registration Number: 455997. The address of SGS Taiwan Ltd. Electronics & Communication Laboratory 1F, No.134, Wukung Road New Taipei City TAIWAN 24803, IC Registration Number: 4620A-6.

## 1.5 Special Accessories

There are no special accessories used while test was conducted.

## 1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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# 2 SYSTEM TEST CONFIGURATION

## 2.1 EUT Configuration

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

## 2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

## 2.3 Test Procedure

### 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the general criterion in Section 7.1 of ANSI C63.4:2009.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz, and the measurement procedure 7.3 in ANSI 63.4:2009 is followed to carry out the test. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107

### 2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna. according to the requirements in Section 8 and 13 and of ANSI C63.4:2009 and RSS-Gen:2010.

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## 2.4 Configuration of Tested System

**Fig. 2-1 Radiated Emission**

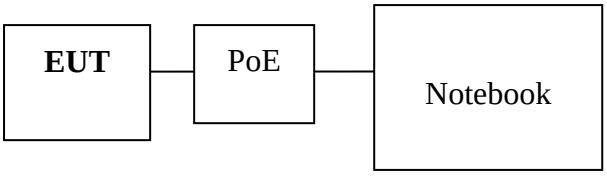


**Fig. 2-2 AC Power Line Conducted Emission & Conducted (Antenna Port) Configuration**

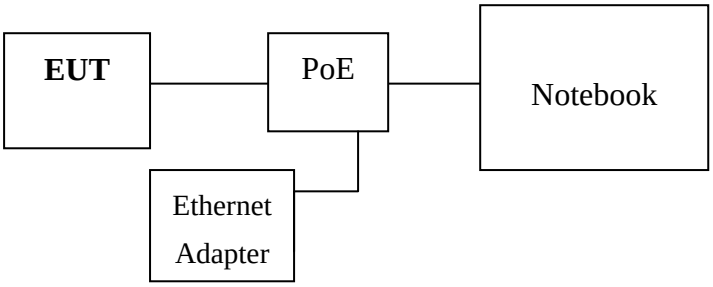


**Table 2-1 Equipment Used in Tested System**

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1. | WLAN Test Software | Atheros | Atheros Radio Test 2 | N/A | N/A | N/A |
| 2. | PoE | D-Link | DWL-P200 | N/A | N/A | N/A |
| 3. | Power Over Ethernet Adapter Base Unit | D-Link | DWL-200 | F3784CB0 0012 | N/A | N/A |
| 4. | Notebook | Lenovo | L430 | R9-YYG88 | shielding | Un-shielding |

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# 3 SUMMARY OF TEST RESULTS

| FCC/IC Rules | Description Of Test | Result |
|---|---|---|
| §15.207(a)<br>RSS-Gen §7.2.4 | AC Power Line Conducted Emission | Compliant |
| §15.247(b) (3)<br>RSS-210 §A8.4(4) | Peak Output Power | Compliant |
| §15.247(a)(2)<br>RSS-210 §A8.2 (a) | 6dB Bandwidth | Compliant |
| §15.247(d)<br>RSS-210 §A8.5 | 100 KHz Bandwidth Of Frequency Band Edges | Compliant |
| §15.247(d)<br>RSS-210 §A8.5 | Spurious Emission | Compliant |
| §15.247(e)<br>RSS-210 §A8.2(b) | Peak Power Density | Compliant |
| §15.203<br>RSS-GEN §7.1.2, | Antenna Requirement | Compliant |
| RSS-Gen §4.6.1 | 99% Power Bandwidth | Compliant |

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# 4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.
Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

802.11 b mode: Channel low (2412MHz)、mid (2437MHz) and high (2462MHz) with 1Mbps lowest data rate are chosen for full testing.

802.11 g mode: Channel low (2412MHz)、mid (2437MHz) and high (2462MHz) with 6Mbps lowest data rate are chosen for full testing.

802.11 n_20MHz mode: Channel low (2412MHz)、mid (2437MHz) and high (2462MHz) with 6.5Mbps lowest data rate are chosen for full testing.

802.11 n_40MHz: Lowest (2422MHz) and mid (2437MHz) and high (2452MHz) with 13.5Mbps lowest data rate are chosen for full testing.

The worst case is determined by the output power that generates the highest emission. As examined in the section of output power measurement, the section 7.5, the lowest data rate at b/g/n_HT20/n_HT40 resulted the highest level of fundamental emission, and therefore, the lowest data rate is chosen as the worst-case to conduct the remaining of other mandatory test cases.

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 802.11b/g/n WLAN Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

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Directional gain (MIMO)

The Tx transmission to construct MIMO operation is cyclic delay diversity, and the following deduction to obtain the array gain of MIMO operation is based on the approach given by KDB 662911 D01.

Gain with 5.8G is combined with the identical gain:

(i) If all antennas have the same gain, $G_{ANT}$, Directional gain = $G_{ANT}$ + Array Gain, where Array Gain is as follows.

- For power spectral density (PSD) measurements on all devices,
  *Array Gain = 10 log($N_{ANT}/N_{SS}$) dB.*

- For power measurements on IEEE 802.11 devices, [1,2]
  *Array Gain = 0 dB* (i.e., no array gain) for $N_{ANT} \leq 4$;
  *Array Gain = 0 dB* (i.e., no array gain) for channel widths ≥ 40 MHz for any $N_{ANT}$;
  *Array Gain = 5 log($N_{ANT}/N_{SS}$) dB or 3 dB*, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

Array gain = 0dBi (ERP/EIRP related measurement)
Array gain = 3.01dBi (peak spectral density)

MIMO gain = gain (nominal gain) + array gain = (2.04 + 0)dBi = 2.04dBi

Gain with 2.4G is combined with different magnitude of two antennas:

(ii) If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream:

- Directional gain may be calculated by using the formulas applicable to equal gain antennas with $G_{ANT}$ set equal to the gain of the antenna having the highest gain; or,

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- $$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

*where*

Each antenna is driven by no more than one spatial stream;
$N_{SS}$ = the number of independent spatial streams of data;
$N_{ANT}$ = the total number of antennas
$g_{j,k} = 10^{G_k/20}$ if the $k$th antenna is being fed by spatial stream $j$, or zero if it is not;
$G_k$ is the gain in dBi of the kth antenna.

Directive Gain = 1.50dBi(Wifi 2.4G),

MIMO Gain = (1.50+1.50)=3dBi (Wifi 2.4G)

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# 5 MEASUREMENT UNCERTAINTY

| Test Items | Uncertainty |
|---|---|
| AC Power Line Conducted Emission | +/- 2.586 dB |
| Peak Output Power | +/- 1.55dB (for Spectrum)<br>+/- 1.42 dB (for Power Meter) |
| 6dB Bandwidth | +/- 123.36 Hz |
| 100 KHz Bandwidth Of Frequency Band Edges | +/- 1.55 dB |
| Peak Power Density | +/- 1.55 dB |
| 99% Power Bandwidth | +/- 123.36 Hz |
| Temperature | +/- 0.8 °C |
| Humidity | +/- 4.7 % |
| DC / AC Power Source | DC= +/- 1%, AC=+/- 0.2% |

Radiated Spurious Emission:

| | |
|---|---|
| Measurement uncertainty (Polarization : **Vertical**) | 30MHz - 180MHz: +/- 3.37dB |
| | 180MHz -417MHz: +/- 3.19dB |
| | 0.417GHz-1GHz: +/- 3.19dB |
| | 1GHz - 18GHz: +/- 4.04dB |
| | 18GHz - 40GHz: +/- 4.04dB |

| | |
|---|---|
| Measurement uncertainty (Polarization : **Horizontal**) | 30MHz - 167MHz: +/- 4.22dB |
| | 167MHz -500MHz: +/- 3.44dB |
| | 0.5GHz-1GHz: +/- 3.39dB |
| | 1GHz - 18GHz: +/- 4.08dB |
| | 18GHz - 40GHz: +/- 4.08dB |

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

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# 6 CONDUCTED EMISSION TEST

## 6.1 Standard Applicable:

According to §15.207 and RSS-Gen §7.2.4, frequency range within 150KHz to 30MHz shall not exceed the Limit table as below.

| Frequency range | Limits dB(uV) | |
|---|---|---|
| MHz | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |
| Note<br>1.The lower limit shall apply at the transition frequencies<br>2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. | | |

## 6.2 Measurement Equipment Used:

| SGS Conducted Emission Test Site No.A | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| EMI Test Receiver | R&S | ESCI 3 | 101311 | 2014/06/20 | 2015/06/19 |
| Coaxial Cables | N/A | N30N30-1042-150cm | N/A | 2014/02/07 | 2015/02/06 |
| LISN | Schwarzbeck | NSLK 8127 | 8127-648 | 2014/06/10 | 2015/06/09 |
| LISN | Rolf-Heine | NNB-2/16Z | 99012 | 2014/03/26 | 2015/03/25 |
| Test Software | Farad | EZ-EMC | Ver. SGS-03A2 | N.C.R. | N.C.R. |

## 6.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4:2009.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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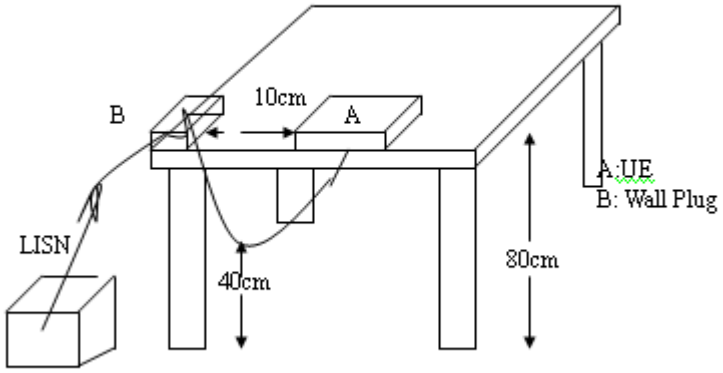
## 6.4 Test SET-UP (Block Diagram of Configuration)




## 6.5 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed

## 6.6 Measurement Result:

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit

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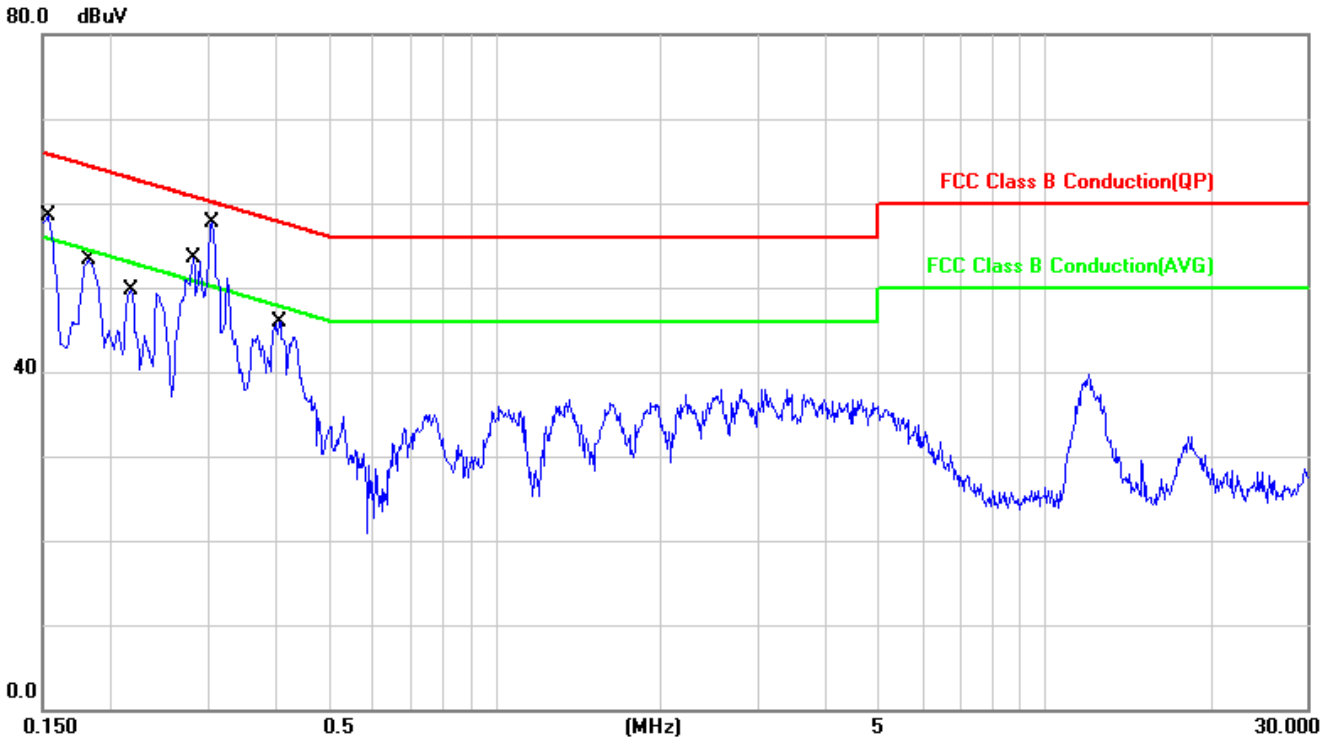
# AC POWER LINE CONDUCTED EMISSION TEST DATA

| | | | | | |
|---|---|---|---|---|---|
| Operation Mode: | Operation mode | | | Test Date: | Jul. 08, 2014 |
| Temperature: | 24 ℃ | Humidity: | 60 % | Test By: | Jazz |
| Phase: | L1 | | | | |




| No. | Mk. | Freq. (MHz) | Reading dBuV | Factor (dB) | Measurement (dBuV) | Limit (dBuV) | Over (dB) | Detector | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.1540 | 57.50 | 0.09 | 57.59 | 65.78 | -8.19 | QP | |
| 2 | | 0.1540 | 47.94 | 0.09 | 48.03 | 55.78 | -7.75 | AVG | |
| 3 | | 0.1820 | 50.43 | 0.09 | 50.52 | 64.39 | -13.87 | QP | |
| 4 | | 0.1820 | 41.10 | 0.09 | 41.19 | 54.39 | -13.20 | AVG | |
| 5 | | 0.2180 | 47.90 | 0.09 | 47.99 | 62.89 | -14.90 | QP | |
| 6 | | 0.2820 | 50.03 | 0.12 | 50.15 | 60.76 | -10.61 | QP | |
| 7 | | 0.2820 | 42.94 | 0.12 | 43.06 | 50.76 | -7.70 | AVG | |
| 8 | | 0.3060 | 53.70 | 0.13 | 53.83 | 60.08 | -6.25 | QP | |
| 9 | * | 0.3060 | 46.86 | 0.13 | 46.99 | 50.08 | -3.09 | AVG | |
| 10 | | 0.4060 | 42.63 | 0.17 | 42.80 | 57.73 | -14.93 | QP | |
| 11 | | 0.4060 | 33.41 | 0.17 | 33.58 | 47.73 | -14.15 | AVG | |

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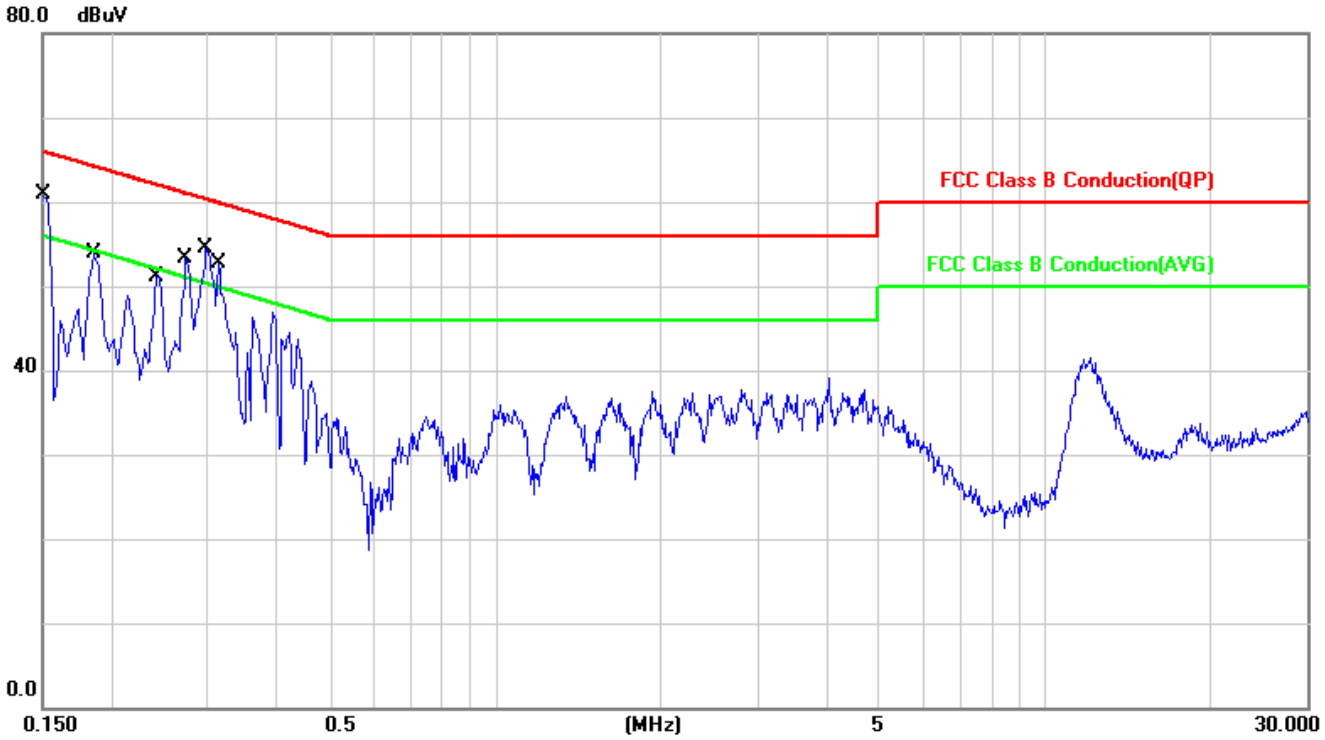
| Operation Mode: | Operation mode | | | Test Date: | Jul. 08, 2014 |
|---|---|---|---|---|---|
| Temperature: | 24 ℃ | Humidity: | 60 % | Test By: | Jazz |
| Phase: | N | | | | |




| No. | Mk. | Freq. (MHz) | Reading dBuV | Factor (dB) | Measurement (dBuV) | Limit (dBuV) | Over (dB) | Detector | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.1500 | 57.94 | 0.09 | 58.03 | 66.00 | -7.97 | QP | |
| 2 | | 0.1500 | 48.51 | 0.09 | 48.60 | 56.00 | -7.40 | AVG | |
| 3 | | 0.1860 | 51.50 | 0.09 | 51.59 | 64.21 | -12.62 | QP | |
| 4 | | 0.1860 | 42.30 | 0.09 | 42.39 | 54.21 | -11.82 | AVG | |
| 5 | | 0.2420 | 49.18 | 0.11 | 49.29 | 62.03 | -12.74 | QP | |
| 6 | | 0.2420 | 43.70 | 0.11 | 43.81 | 52.03 | -8.22 | AVG | |
| 7 | | 0.2740 | 50.72 | 0.12 | 50.84 | 61.00 | -10.16 | QP | |
| 8 | | 0.2740 | 45.16 | 0.12 | 45.28 | 51.00 | -5.72 | AVG | |
| 9 | | 0.2980 | 52.90 | 0.13 | 53.03 | 60.30 | -7.27 | QP | |
| 10 | * | 0.2980 | 44.93 | 0.13 | 45.06 | 50.30 | -5.24 | AVG | |
| 11 | | 0.3140 | 49.00 | 0.14 | 49.14 | 59.86 | -10.72 | QP | |
| 12 | | 0.3140 | 41.80 | 0.14 | 41.94 | 49.86 | -7.92 | AVG | |

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# 7 PEAK OUTPUT POWER MEASUREMENT

## 7.1 Standard Applicable:

According to §15.247 (b)

(3) For systems using digital modulation in the 902-928 MHz and 2400-2483.5 MHz: 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 antennas and antenna elements. The average must not include any time 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.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to RSS-210 issue 8,§A8.4(4), for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section A8.4 (5), the e.i.r.p. shall not exceed 4 W.

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As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is 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 antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

## 7.2 Measurement Equipment Used:

| SGS Conducted Room | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Spectrum Analyzer | Agilent | N9010A | MY53400256 | 2013/10/26 | 2014/10/25 |
| Power Meter | Anritsu | ML2496A | 1326001 | 2014/06/20 | 2015/06/19 |
| Power Sensor | Anritsu | MA2411B | 1315048 | 2014/06/20 | 2015/06/19 |
| Power Sensor | Anritsu | MA2411B | 1315049 | 2014/06/20 | 2015/06/19 |
| Coaxial Cable 30cm | WOKEN | 00100A1F1A195C | 2 | 2014/01/06 | 2015/01/05 |
| Coaxial Cable 30cm | WOKEN | 00100A1F1A195C | 3 | 2014/01/06 | 2015/01/05 |
| Coaxial Cable 80cm | WOKEN | 00100A1F1A185C | 1 | 2014/01/06 | 2015/01/05 |
| DC Block | Mini-Circuits | BLK-18-S+ | 4 | 2014/01/06 | 2015/01/05 |
| DC Block | PASTERNACK | PE8210 | 5 | 2014/01/06 | 2015/01/05 |
| Splitter | RF-LAMBAD | RFLT2W1G18G | 11-JSPF412-019 | 2014/01/06 | 2015/01/05 |
| Splitter | WOKEN | NA | DOM35LW1A2 | 2014/01/06 | 2015/01/05 |
| Attenuator | Mini-Circuits | BW-S10W2+ | 6 | 2014/01/06 | 2015/01/05 |
| Attenuator | WOKEN | 218FS-10 | 7 | 2014/01/06 | 2015/01/05 |
| Temperature Chamber | TERCHY | MHK-120LK | 1020582 | 2014/06/18 | 2015/06/17 |
| Communication Tester | R&S | CMW500 | 131121 | 2014/01/16 | 2015/01/15 |
| Communication Tester | Anritsu | MT8820C | 6201107337 | 2014/04/24 | 2015/04/23 |
| DC Power Supply | Agilent | E3640A | MY53140006 | 2014/05/31 | 2015/05/30 |
| DC Power Supply | Agilent | E3640A | MY53130054 | 2014/05/21 | 2015/05/20 |

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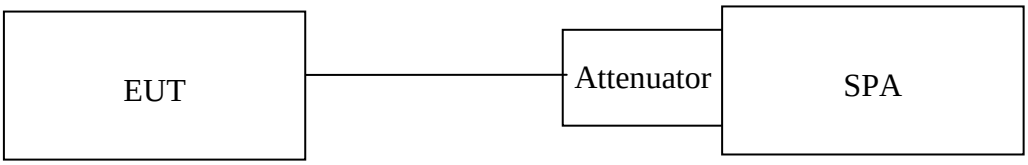
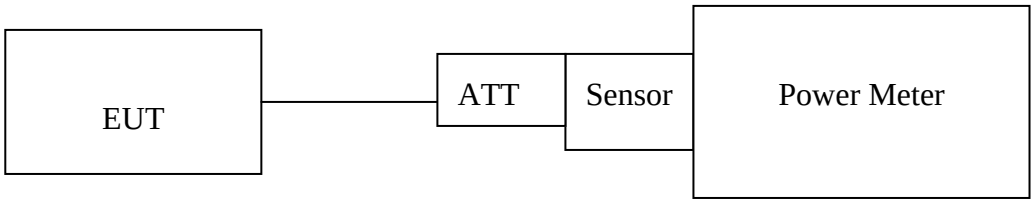
## 7.3 Test Set-up:

Spectrum:




Power Meter:




## 7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (**Peak power setting on Spectrum:** Channel power function, RBW = 1MHz, VBW = 3MHz, Span: 30/60MHz, Detector =peak, Sweep = Auto. Setting on spectrum is adjusted based on the mandatory procedure in 9.1.2 of the KDB558074). Power Meter is used as the auxiliary test equipment to conduct the output power measurement. 9.1.3 in KDB558074 is followed.

   (**Avg. power setting on Spectrum:** Channel power function, RBW = 1MHz, VBW = 3MHz, Span: 30/60MHz, Detector =Avg., Trace avg =100, Sweep = Auto, Setting on spectrum is adjusted based on the mandatory procedure in 9.2.2.4 of the KDB558074). Power Meter is used as the auxiliary test equipment to conduct the output power measurement. 9.2.3, option 3 in KDB558074 is followed.
3. Record the max. Reading as observed from Spectrum or Power Meter.
4. Repeat above procedures until all frequency of interest measured was complete.

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*Pre-anaysis Check: While conducting average power measurement, duty cycle of each mode (a/n_ht20 /n_ht40) shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle. All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones*

*b = 99.4%, g = 96.5%, and n_ht_20 (MIMO) = 92.8%, n_ht_40 (MIMO) = 90%, where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.*

***Formula:***

*Duty Cycle = Ton / (Ton+Toff)*

***Test Procedure:***

*Set span = 0, RBW = 8MHz, VBW = 8MHz, Detector = Peak*

*Duty Cycle:*

| | Antenna | Duty Cycle | Duty Factor (dBm) |
|---|---|---|---|
| 802.11b | Single | 0.994 | 0.026 |
| 802.11g | Single | 0.965 | 0.157 |
| 802.11n_20 (2.4G) | SISO_Main | 0.962 | 0.167 |
| 802.11n_20 (2.4G) | MIMO | 0.927 | 0.330 |
| 802.11n_40 (2.4G) | SISO_Main | 0.943 | 0.256 |
| 802.11n_40 (2.4G) | MIMO | 0.899 | 0.460 |

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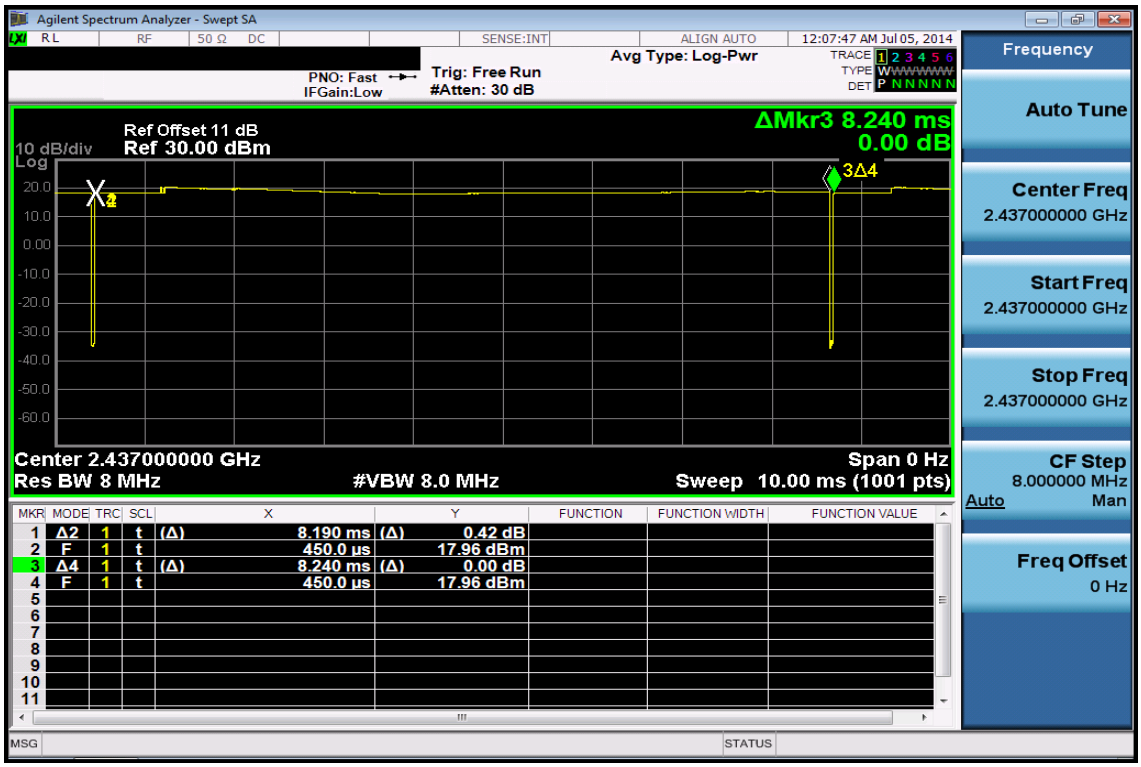
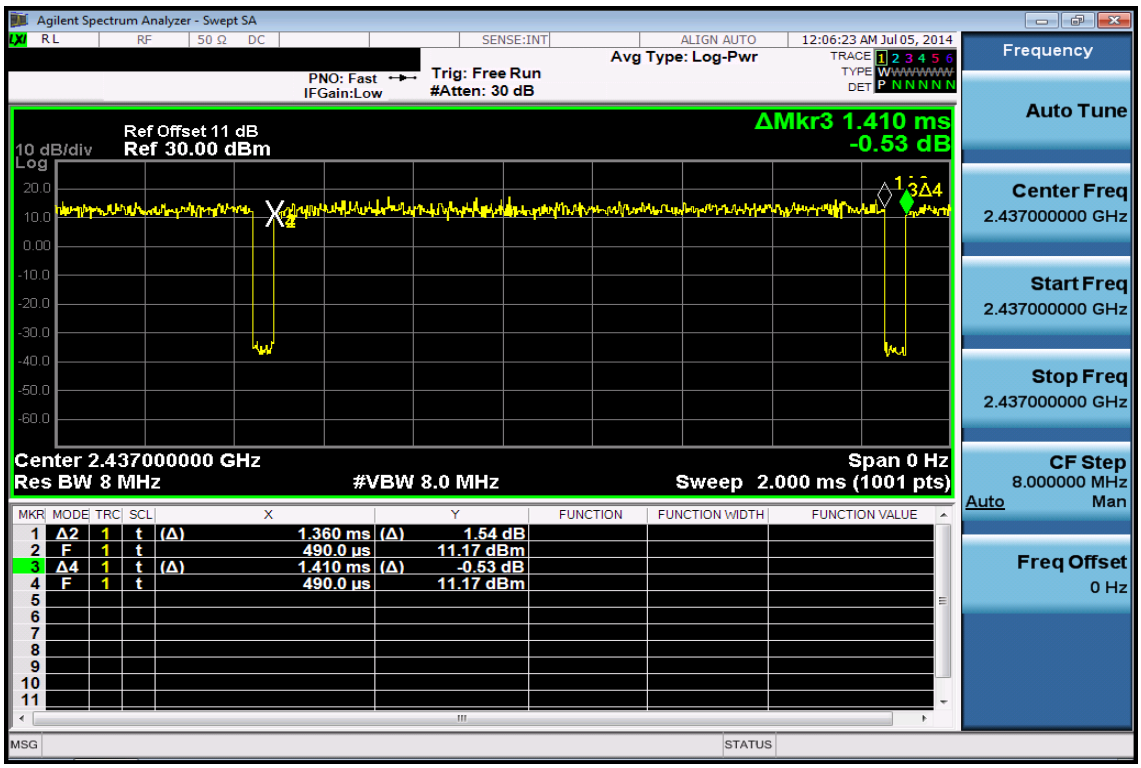
## Duty Factor:

### 802.11 b




### 802.11 g

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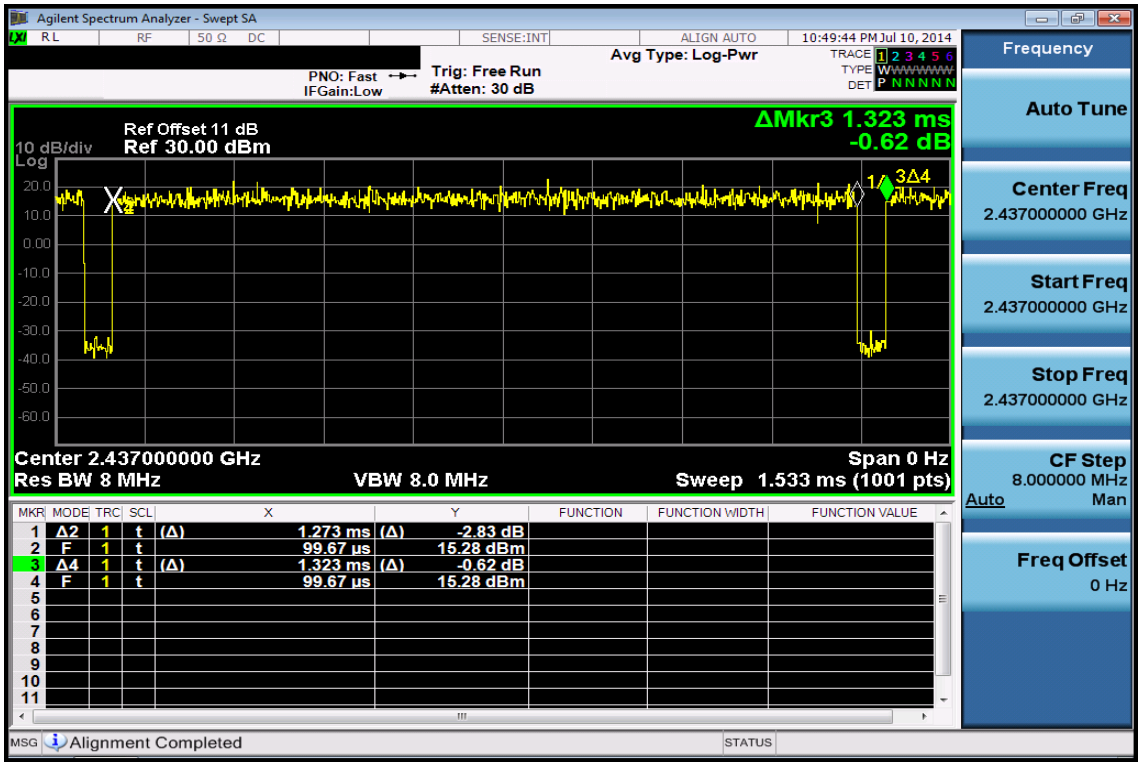
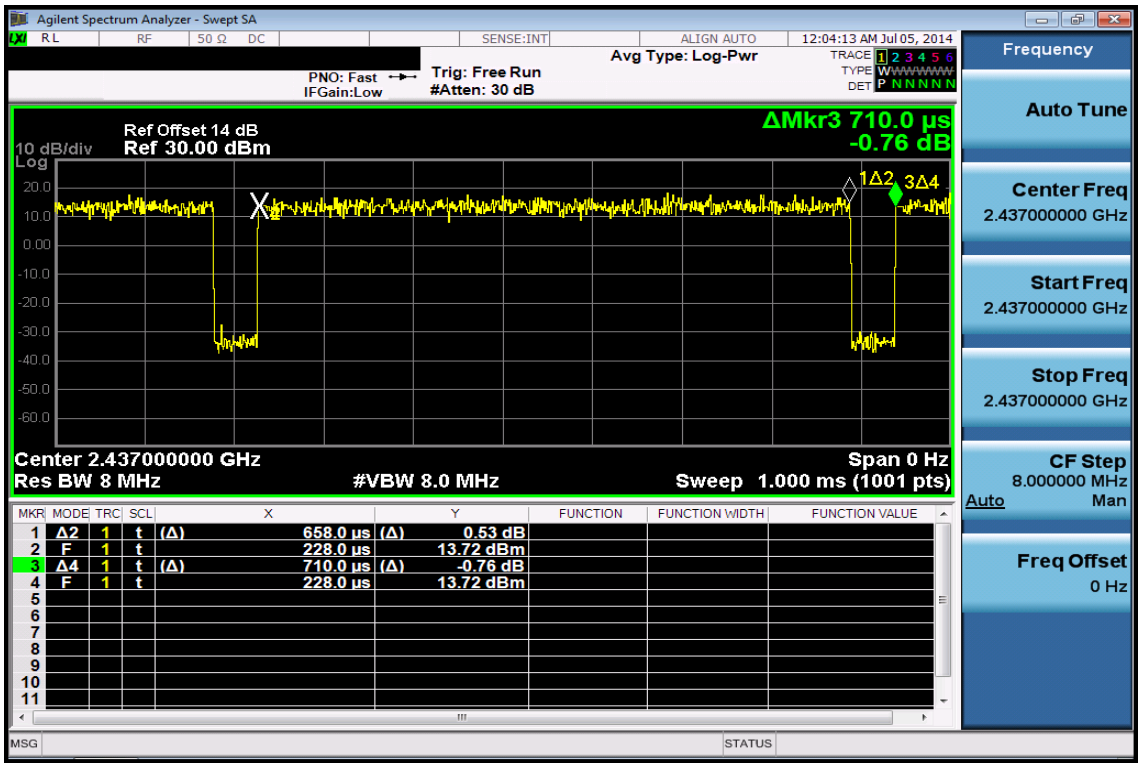
## 802.11 n_20 MHz (Main)




## 802.11 n_20 MHz (MIMO)

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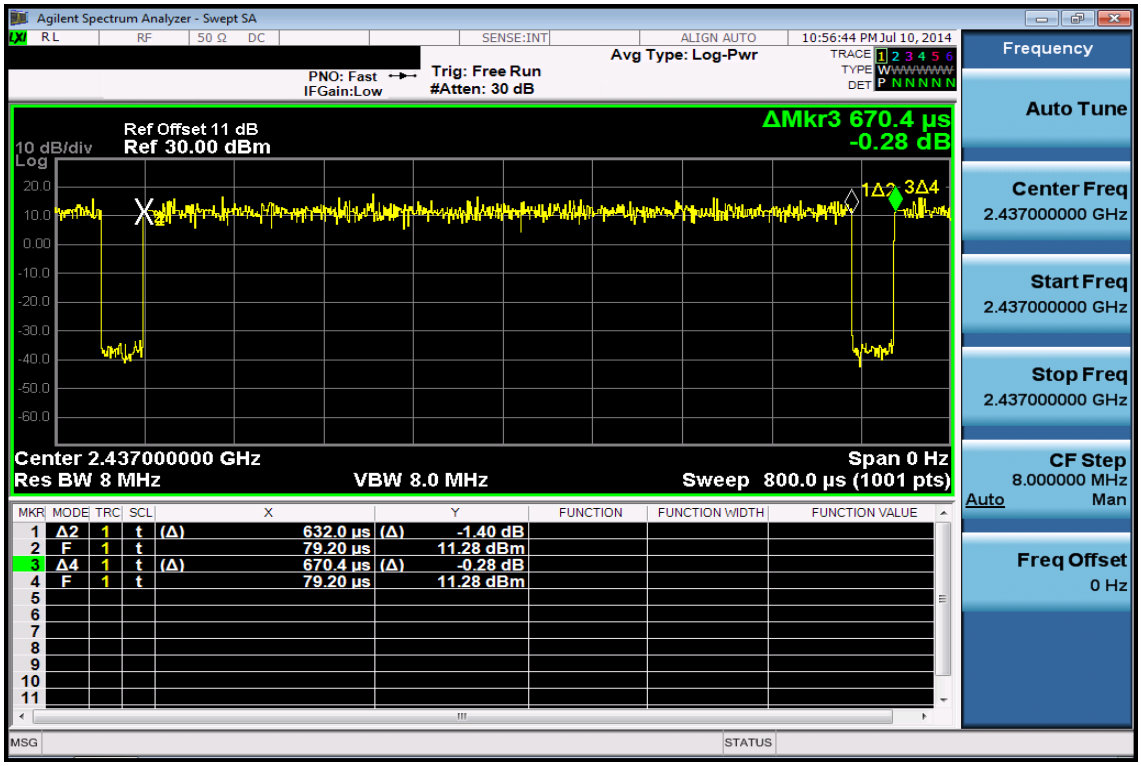
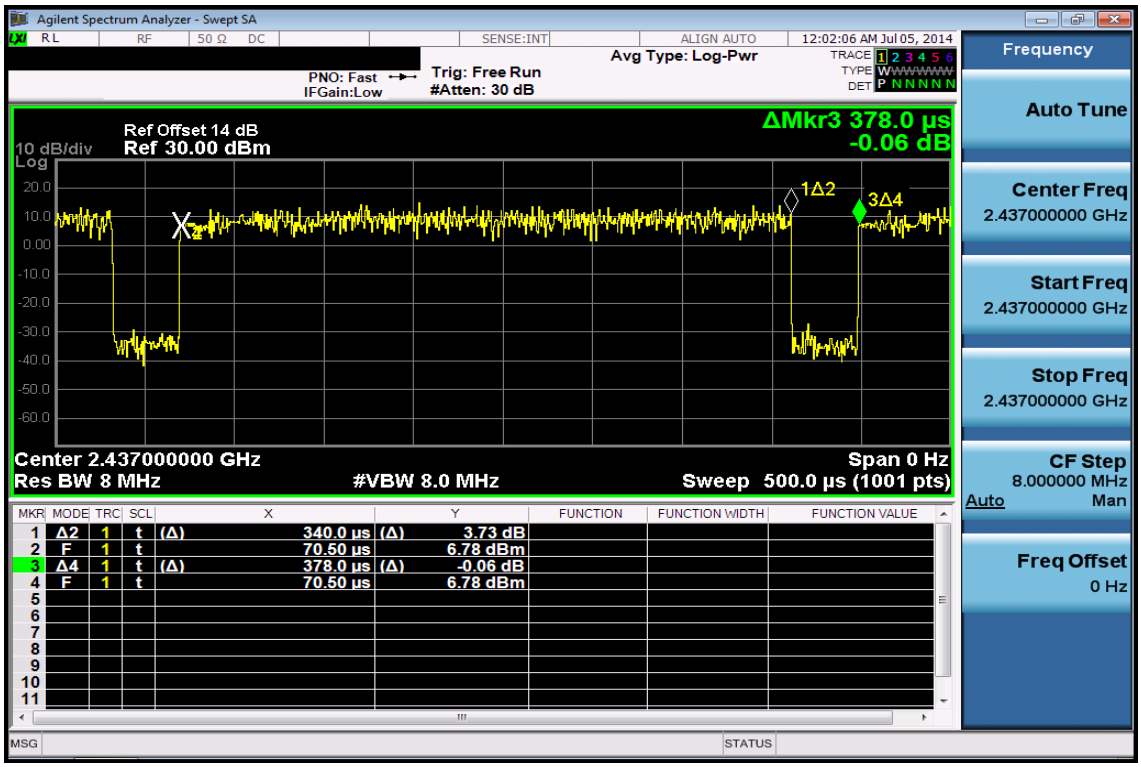
## 802.11 n_40 MHz (Main)




## 802.11 n_40 MHz (MIMO)

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## 7.5 Measurement Result (Worst Case Data Rate):

### 802.11b (Main)

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | 1 | |
| 1 | 2412 | **23.13** | 1 Watt = 30 dBm |
| 6 | 2437 | 22.77 | 1 Watt = 30 dBm |
| 11 | 2462 | 22.18 | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | 1 | |
| 1 | 2412 | **20.88** | 1 Watt = 30 dBm |
| 6 | 2437 | 20.34 | 1 Watt = 30 dBm |
| 11 | 2462 | 19.89 | 1 Watt = 30 dBm |

### 802.11g (Main)

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | 6 | |
| 1 | 2412 | **23.99** | 1 Watt = 30 dBm |
| 6 | 2437 | 23.83 | 1 Watt = 30 dBm |
| 11 | 2462 | 23.82 | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | 6 | |
| 1 | 2412 | 14.27 | 1 Watt = 30 dBm |
| 6 | 2437 | 14.02 | 1 Watt = 30 dBm |
| 11 | 2462 | 13.98 | 1 Watt = 30 dBm |

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**802.11n_20M (Main)**

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2412 | 24.33 | 1 Watt = 30 dBm |
| 6 | 2437 | 24.04 | 1 Watt = 30 dBm |
| 11 | 2462 | 24.04 | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2412 | 14.14 | 1 Watt = 30 dBm |
| 6 | 2437 | 13.89 | 1 Watt = 30 dBm |
| 11 | 2462 | 13.80 | 1 Watt = 30 dBm |

**802.11n_20M (Aux)**

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2412 | 24.28 | 1 Watt = 30 dBm |
| 6 | 2437 | 24.00 | 1 Watt = 30 dBm |
| 11 | 2462 | 23.95 | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2412 | 14.11 | 1 Watt = 30 dBm |
| 6 | 2437 | 13.87 | 1 Watt = 30 dBm |
| 11 | 2462 | 13.77 | 1 Watt = 30 dBm |

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**802.11n_20M (MIMO Chain 0)**

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2412 | **23.93** | 1 Watt = 30 dBm |
| 6 | 2437 | 23.77 | 1 Watt = 30 dBm |
| 11 | 2462 | 23.61 | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2412 | 13.85 | 1 Watt = 30 dBm |
| 6 | 2437 | 13.45 | 1 Watt = 30 dBm |
| 11 | 2462 | 13.34 | 1 Watt = 30 dBm |

**802.11n_20M (MIMO Chain 1)**

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2412 | **23.76** | 1 Watt = 30 dBm |
| 6 | 2437 | 23.34 | 1 Watt = 30 dBm |
| 11 | 2462 | 23.44 | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2412 | 13.41 | 1 Watt = 30 dBm |
| 6 | 2437 | 13.36 | 1 Watt = 30 dBm |
| 11 | 2462 | 13.26 | 1 Watt = 30 dBm |

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### 802.11n_20M (MIMO Chain 0+1)

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2412 | **26.86** | 1 Watt = 30 dBm |
| 6 | 2437 | 26.57 | 1 Watt = 30 dBm |
| 11 | 2462 | 26.54 | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2412 | 16.65 | 1 Watt = 30 dBm |
| 6 | 2437 | 16.42 | 1 Watt = 30 dBm |
| 11 | 2462 | 16.31 | 1 Watt = 30 dBm |

### 802.11n_40M (Main)

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2422 | 24.01 | 1 Watt = 30 dBm |
| 6 | 2437 | 24.12 | 1 Watt = 30 dBm |
| 11 | 2452 | **24.45** | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2422 | 13.79 | 1 Watt = 30 dBm |
| 6 | 2437 | 13.88 | 1 Watt = 30 dBm |
| 11 | 2452 | 14.00 | 1 Watt = 30 dBm |

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**802.11n_40M (Aux)**

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2422 | 23.99 | 1 Watt = 30 dBm |
| 6 | 2437 | 24.08 | 1 Watt = 30 dBm |
| 11 | 2452 | **24.40** | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2422 | 13.76 | 1 Watt = 30 dBm |
| 6 | 2437 | 13.85 | 1 Watt = 30 dBm |
| 11 | 2452 | 13.98 | 1 Watt = 30 dBm |

**802.11n_40M (MIMO Chain 0)**

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2422 | 23.66 | 1 Watt = 30 dBm |
| 6 | 2437 | 23.77 | 1 Watt = 30 dBm |
| 11 | 2452 | **24.05** | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2422 | 13.40 | 1 Watt = 30 dBm |
| 6 | 2437 | 13.55 | 1 Watt = 30 dBm |
| 11 | 2452 | 13.65 | 1 Watt = 30 dBm |

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**802.11n_40M (MIMO Chain 1)**

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2422 | 23.42 | 1 Watt = 30 dBm |
| 6 | 2437 | 23.51 | 1 Watt = 30 dBm |
| 11 | 2452 | **23.86** | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2422 | 13.15 | 1 Watt = 30 dBm |
| 6 | 2437 | 13.26 | 1 Watt = 30 dBm |
| 11 | 2452 | 13.40 | 1 Watt = 30 dBm |

**802.11n_40M (MIMO Chain 0+1)**

| | | Peak Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2422 | 26.55 | 1 Watt = 30 dBm |
| 6 | 2437 | 26.65 | 1 Watt = 30 dBm |
| 11 | 2452 | **26.97** | 1 Watt = 30 dBm |

| | | Average Power Output (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2422 | 16.29 | 1 Watt = 30 dBm |
| 6 | 2437 | 16.42 | 1 Watt = 30 dBm |
| 11 | 2452 | 16.54 | 1 Watt = 30 dBm |

**** Note: The duty cycle factor is compensated to obtain the maximum value of measurement in average.***

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**802.11b (Main)**

| | | EIRP(dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | 1 | |
| 1 | 2412 | **22.38** | 1 Watt = 30 dBm |
| 6 | 2437 | 21.84 | 1 Watt = 30 dBm |
| 11 | 2462 | 21.39 | 1 Watt = 30 dBm |

**802.11g (Main)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | 6 | |
| 1 | 2412 | **15.77** | 1 Watt = 30 dBm |
| 6 | 2437 | 15.52 | 1 Watt = 30 dBm |
| 11 | 2462 | 15.48 | 1 Watt = 30 dBm |

**802.11n_20M (Main)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2412 | **15.64** | 1 Watt = 30 dBm |
| 6 | 2437 | 15.39 | 1 Watt = 30 dBm |
| 11 | 2462 | 15.30 | 1 Watt = 30 dBm |

**802.11n_20M (Aux)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2412 | **15.61** | 1 Watt = 30 dBm |
| 6 | 2437 | 15.37 | 1 Watt = 30 dBm |
| 11 | 2462 | 15.27 | 1 Watt = 30 dBm |

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**802.11n_20M (MIMO Chain 0)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2412 | **16.85** | 1 Watt = 30 dBm |
| 6 | 2437 | 16.45 | 1 Watt = 30 dBm |
| 11 | 2462 | 16.34 | 1 Watt = 30 dBm |

**802.11n_20M (MIMO Chain 1)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2412 | **16.41** | 1 Watt = 30 dBm |
| 6 | 2437 | 16.36 | 1 Watt = 30 dBm |
| 11 | 2462 | 16.26 | 1 Watt = 30 dBm |

**802.11n_20M (MIMO Chain 0+1)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2412 | **19.65** | 1 Watt = 30 dBm |
| 6 | 2437 | 19.42 | 1 Watt = 30 dBm |
| 11 | 2462 | 19.31 | 1 Watt = 30 dBm |

**802.11n_40M (Main)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2422 | 15.29 | 1 Watt = 30 dBm |
| 6 | 2437 | 15.38 | 1 Watt = 30 dBm |
| 11 | 2452 | **15.50** | 1 Watt = 30 dBm |

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**802.11n_40M (Aux)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS0 | |
| 1 | 2422 | 15.26 | 1 Watt = 30 dBm |
| 6 | 2437 | 15.35 | 1 Watt = 30 dBm |
| 11 | 2452 | **15.48** | 1 Watt = 30 dBm |

**802.11n_40M (MIMO Chain 0)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2422 | 16.40 | 1 Watt = 30 dBm |
| 6 | 2437 | 16.55 | 1 Watt = 30 dBm |
| 11 | 2452 | **16.65** | 1 Watt = 30 dBm |

**802.11n_40M (MIMO Chain 1)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2422 | 16.15 | 1 Watt = 30 dBm |
| 6 | 2437 | 16.26 | 1 Watt = 30 dBm |
| 11 | 2452 | **16.40** | 1 Watt = 30 dBm |

**802.11n_40M (MIMO Chain 0+1)**

| | | EIRP (dBm) | |
|---|---|---|---|
| CH | Frequency (MHz) | Data Rate | Required Limit |
| | | MCS8 | |
| 1 | 2422 | 19.29 | 1 Watt = 30 dBm |
| 6 | 2437 | 19.42 | 1 Watt = 30 dBm |
| 11 | 2452 | **19.54** | 1 Watt = 30 dBm |

* Note: EIRP = Average Power + Gain, where the nominal gain of the antenna (1.5dBi for 2.4GHz Main, 1.5dBi for 2.4GHz Aux and 3dBi for 2.4GHz MIMO), where MIMO gain= directive gain+nominal gain.

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# 8 6dB BANDWIDTH

## 8.1 Standard Applicable:

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

According to RSS 210 issue 8: 2010Annex 8.2. Systems employing digital modulation techniques (which includes direct sequence) can now be certified under RSS-210 provided they comply with the following requirements: The minimum 6 dB bandwidth shall be at least 500 kHz.

## 8.2 Measurement Equipment Used:

| SGS Conducted Room | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Spectrum Analyzer | Agilent | N9010A | MY53400256 | 2013/10/26 | 2014/10/25 |
| Power Meter | Anritsu | ML2496A | 1326001 | 2014/06/20 | 2015/06/19 |
| Power Sensor | Anritsu | MA2411B | 1315048 | 2014/06/20 | 2015/06/19 |
| Power Sensor | Anritsu | MA2411B | 1315049 | 2014/06/20 | 2015/06/19 |
| Coaxial Cable 30cm | WOKEN | 00100A1F1A195C | 2 | 2014/01/06 | 2015/01/05 |
| Coaxial Cable 30cm | WOKEN | 00100A1F1A195C | 3 | 2014/01/06 | 2015/01/05 |
| Coaxial Cable 80cm | WOKEN | 00100A1F1A185C | 1 | 2014/01/06 | 2015/01/05 |
| DC Block | Mini-Circuits | BLK-18-S+ | 4 | 2014/01/06 | 2015/01/05 |
| DC Block | PASTERNACK | PE8210 | 5 | 2014/01/06 | 2015/01/05 |
| Splitter | RF-LAMBAD | RFLT2W1G18G | 11-JSPF412-019 | 2014/01/06 | 2015/01/05 |
| Splitter | WOKEN | NA | DOM35LW1A2 | 2014/01/06 | 2015/01/05 |
| Attenuator | Mini-Circuits | BW-S10W2+ | 6 | 2014/01/06 | 2015/01/05 |
| Attenuator | WOKEN | 218FS-10 | 7 | 2014/01/06 | 2015/01/05 |
| Temperature Chamber | TERCHY | MHK-120LK | 1020582 | 2014/06/18 | 2015/06/17 |
| Communication Tester | R&S | CMW500 | 131121 | 2014/01/16 | 2015/01/15 |
| Communication Tester | Anritsu | MT8820C | 6201107337 | 2014/04/24 | 2015/04/23 |
| DC Power Supply | Agilent | E3640A | MY53140006 | 2014/05/31 | 2015/05/30 |
| DC Power Supply | Agilent | E3640A | MY53130054 | 2014/05/21 | 2015/05/20 |

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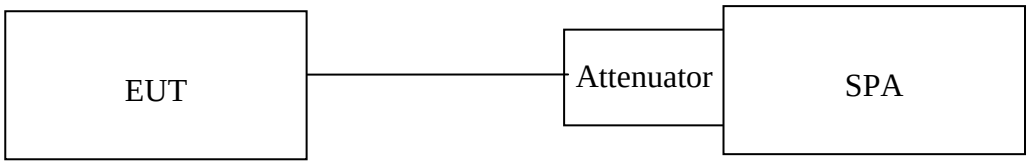
## 8.3 Test Set-up:




## 8.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100 kHz, VBW = 3*RBW, Span = 30M/50MHz, Detector=Peak, Sweep=auto, the setting on spectrum is adjusted based on the procedure as guide in 8.1 option 1 of KDB558074.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat above procedures until all frequency of interest measured was complete.

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## 8.5 Measurement Result:

**802.11b**

| Frequency (MHz) | Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| 2412 | 10100 | > 500 | PASS |
| 2437 | 10100 | > 500 | PASS |
| 2462 | 10100 | > 500 | PASS |

**802.11g**

| Frequency (MHz) | Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| 2412 | 16360 | > 500 | PASS |
| 2437 | 16360 | > 500 | PASS |
| 2462 | 16360 | > 500 | PASS |

**802.11n_20M**

| Frequency (MHz) | Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| 2412 | 17690 | > 500 | PASS |
| 2437 | 17710 | > 500 | PASS |
| 2462 | 17680 | > 500 | PASS |

**802.11n_40M**

| Frequency (MHz) | Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| 2422 | 36450 | > 500 | PASS |
| 2437 | 36450 | > 500 | PASS |
| 2452 | 36460 | > 500 | PASS |

** Note: Offset 11dB for 2.4G 802.11b/g; Offset 14dB for 2.4G 802.11 n_20/n_40.*

** Note: The arrow "->" reveals X decibel level , and refer to next page for plots*

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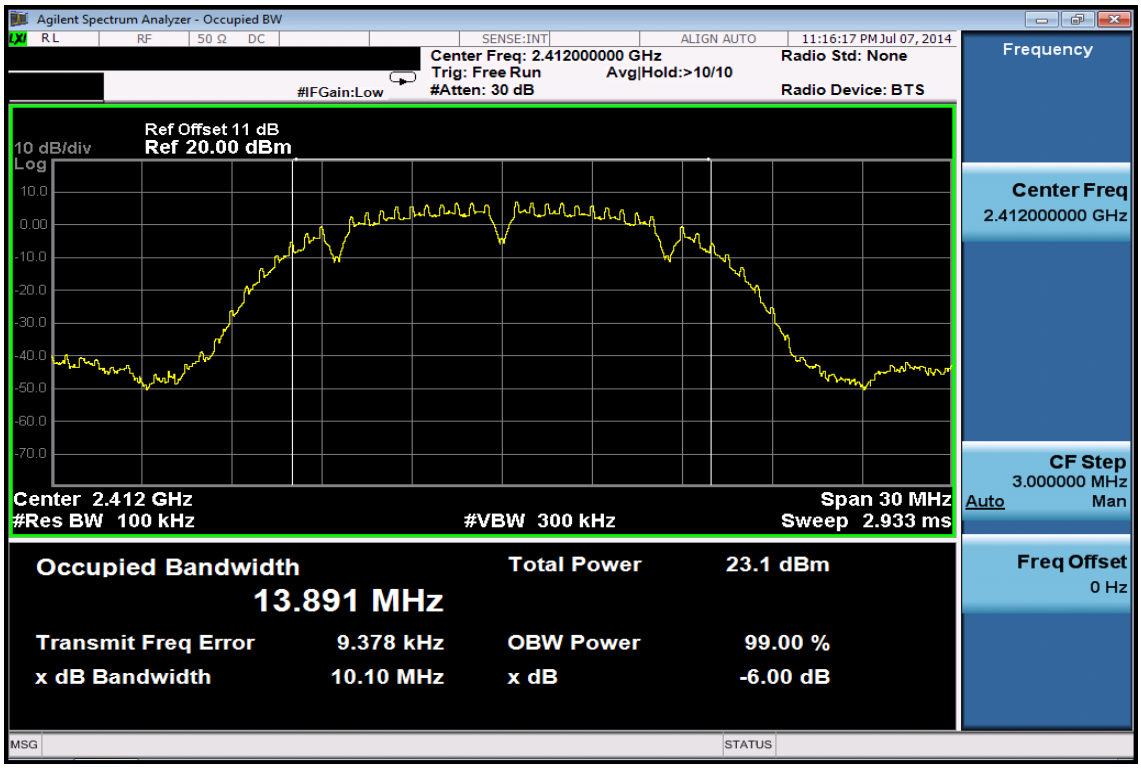
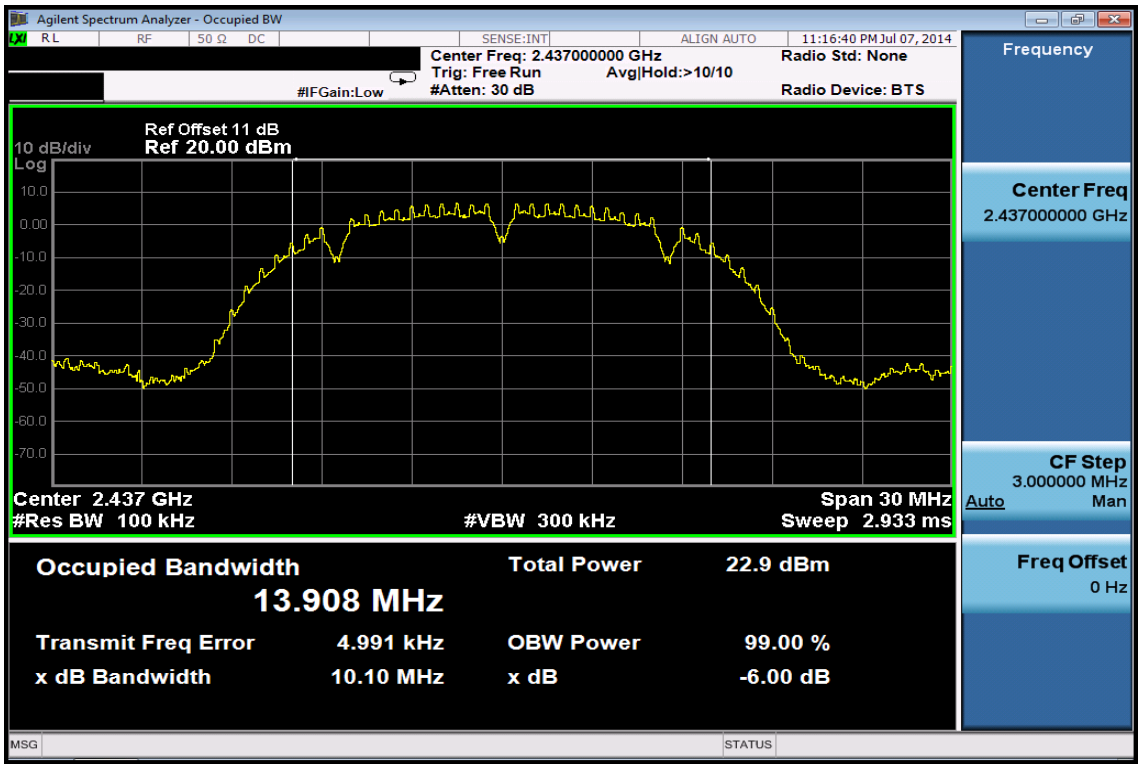
# 802.11b

## 6dB Band Width Test Data CH-Low




## 6dB Band Width Test Data CH-Mid

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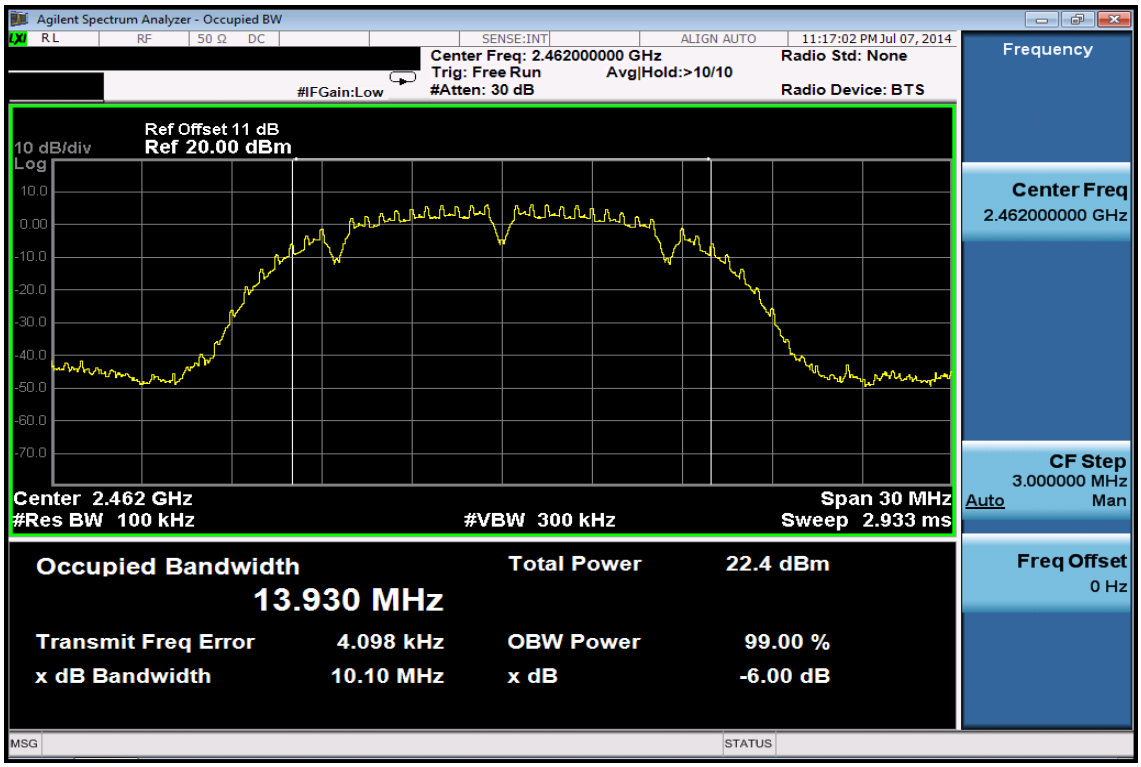
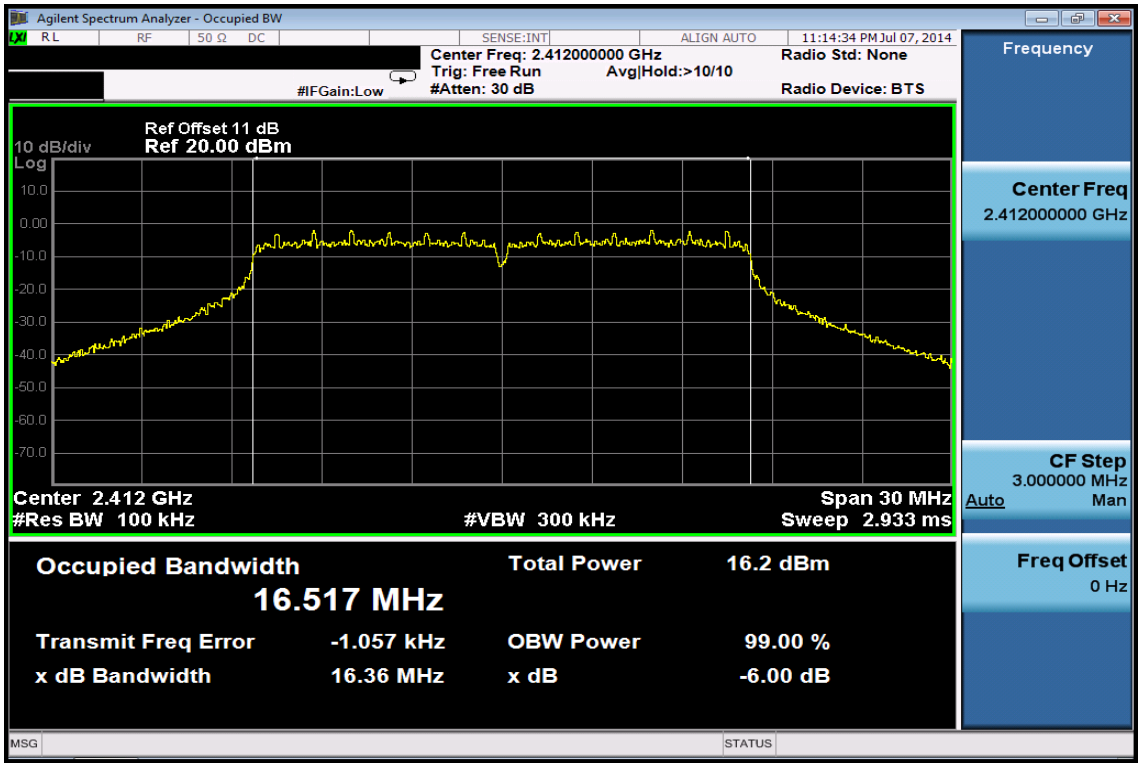
## 6dB Band Width Test Data CH-High




# 802.11g

## 6dB Band Width Test Data CH-Low

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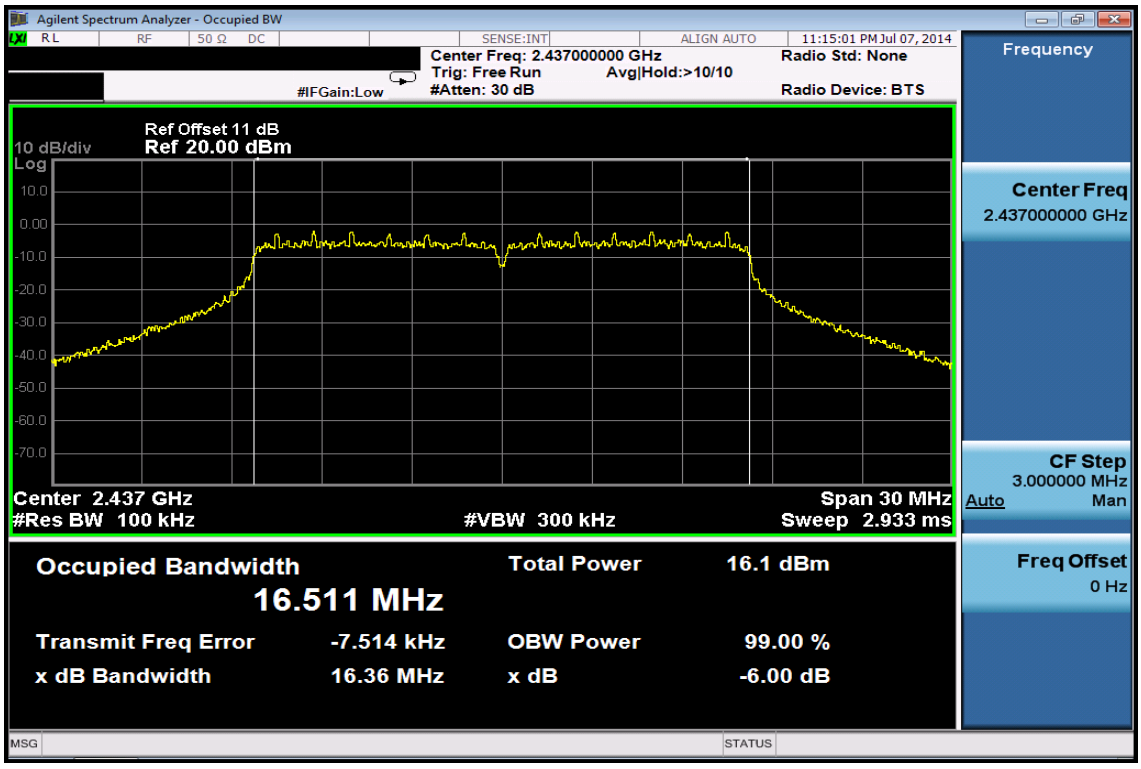
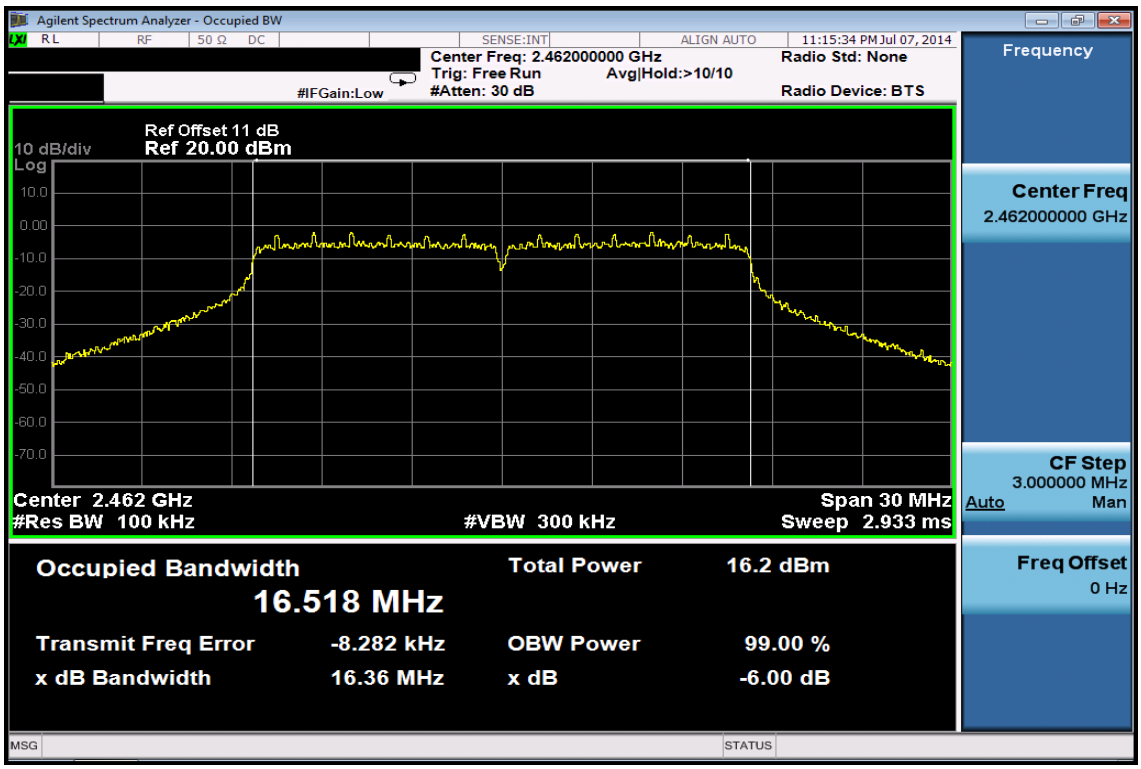
## 6dB Band Width Test Data CH-Mid




## 6dB Band Width Test Data CH-High

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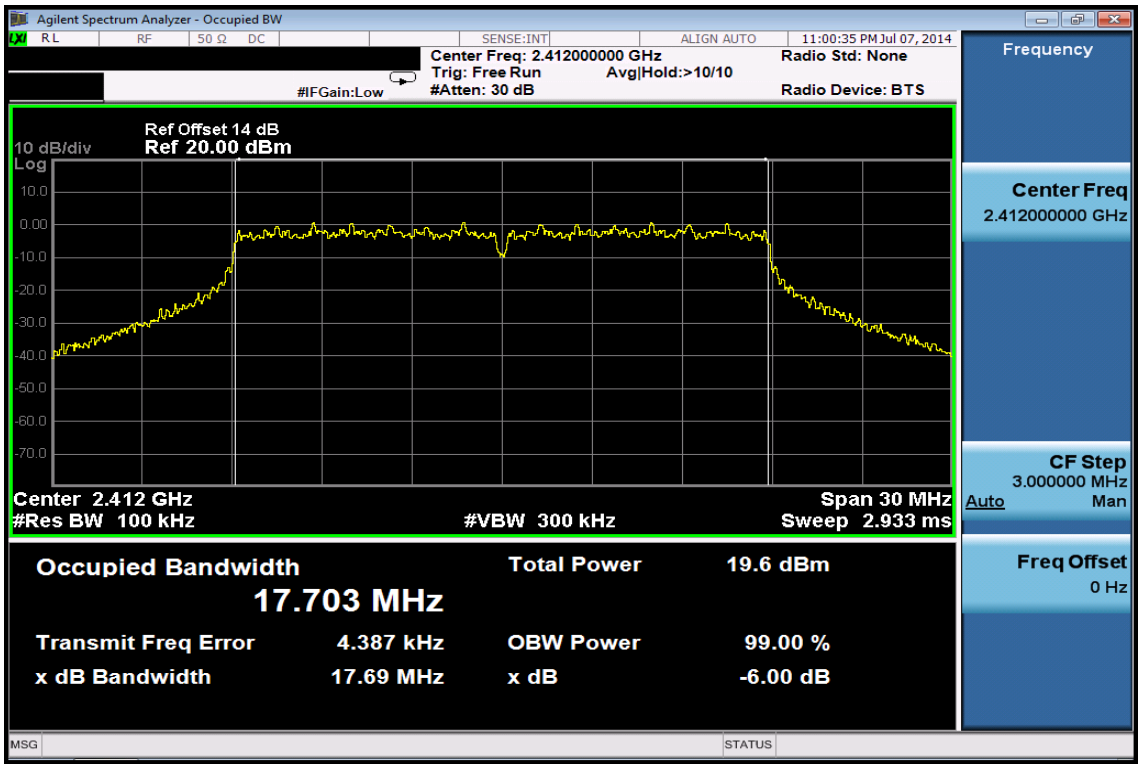
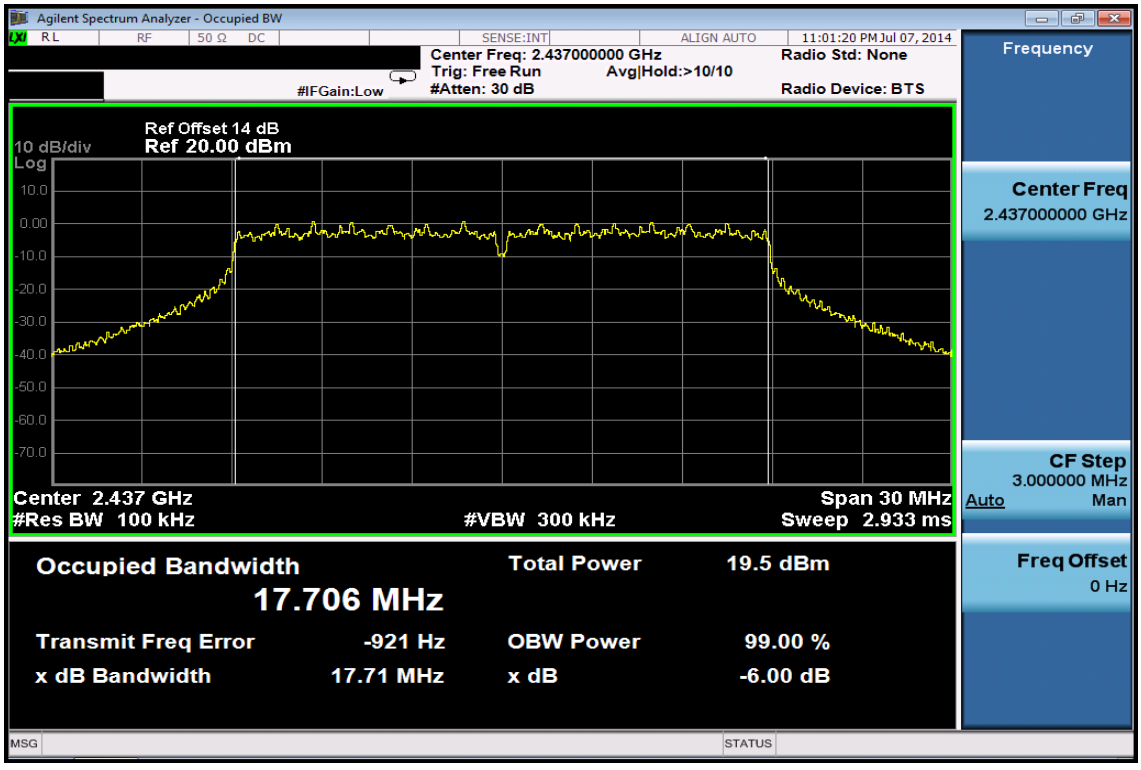
# 802.11n_20M

## 6dB Band Width Test Data CH-Low




## 6dB Band Width Test Data CH-Mid

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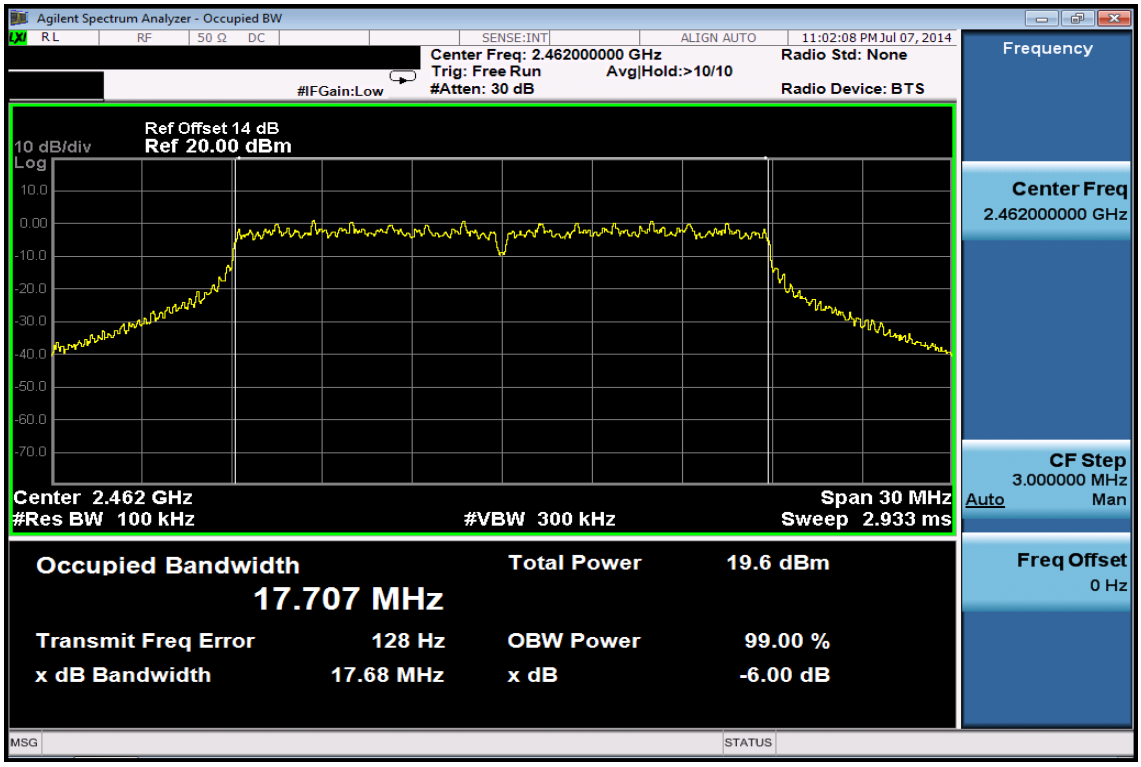
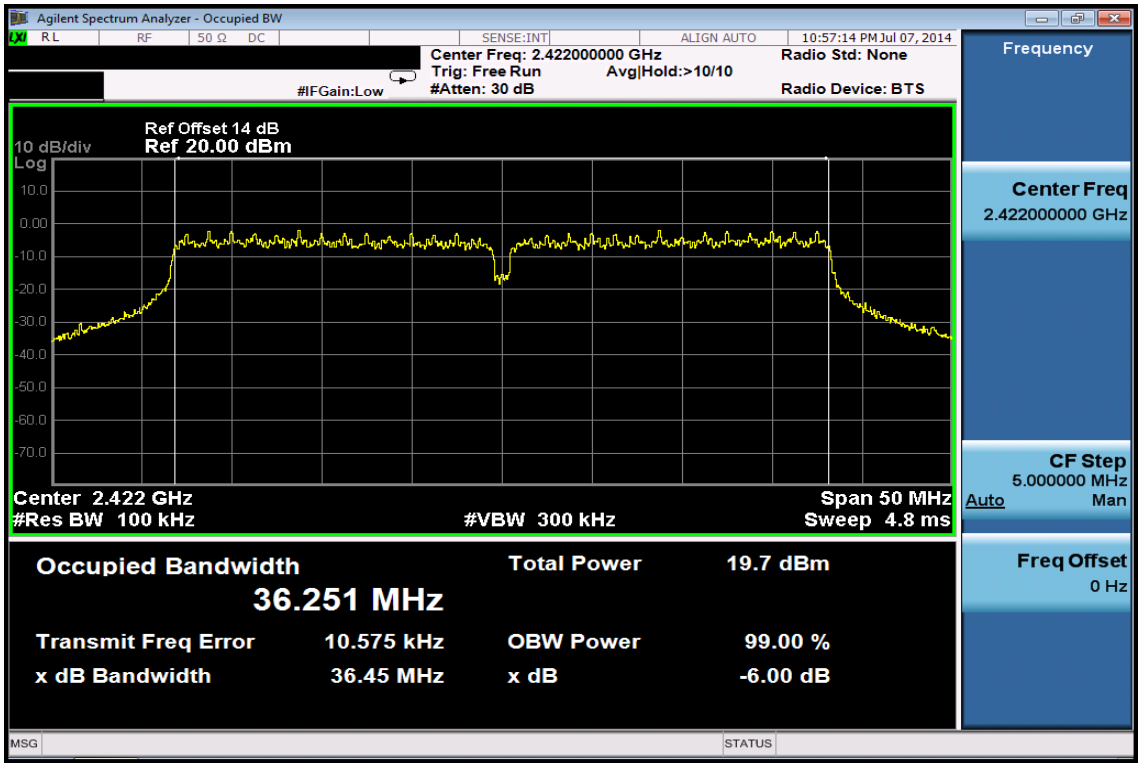
## 6dB Band Width Test Data CH-High




## 802.11n_40M

## 6dB Band Width Test Data CH-Low

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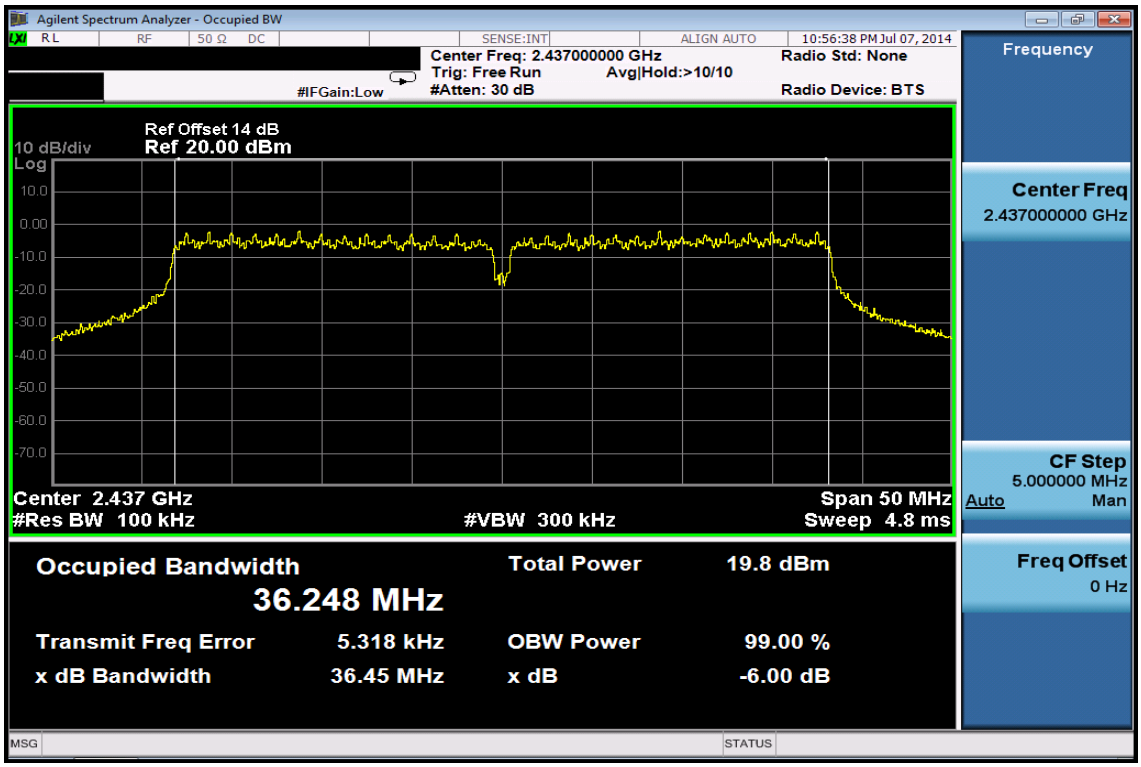
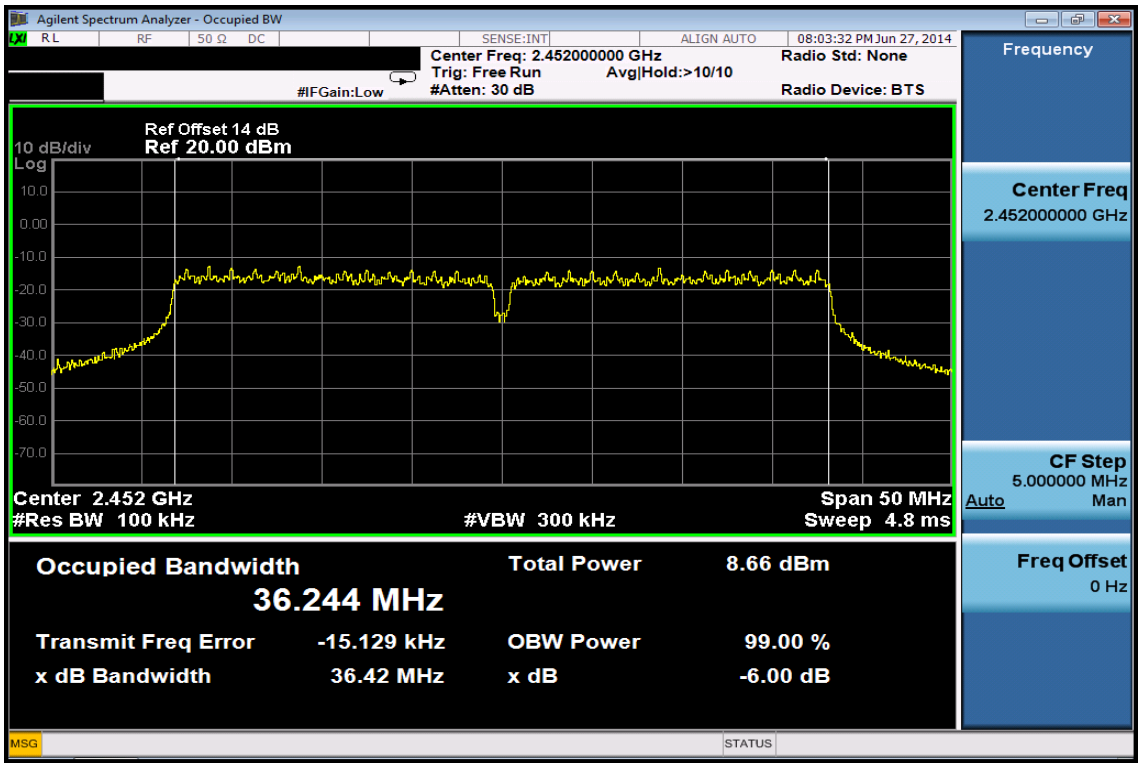
## 6dB Band Width Test Data CH-Mid




## 6dB Band Width Test Data CH-High

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# 9 BAND EDGES MEASUREMENT

## 9.1 Standard Applicable:

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, 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 in15.209(a).

According to RSS-Gen §7.2.5 and RSS-210 issue 8,§A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 5 and 6 is not required. In addition, radiated emissions which fall in the restricted bands of Table 3 must also comply with the radiated emission limits specified in Tables 5 and 6.

## 9.2 Measurement Equipment Used:

### 9.2.1 Conducted Emission at antenna port:

Refer to section 7.2 for details.

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### 9.2.2 Radiated emission:

| SGS 966 Chamber No.C | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| EMI Test Receiver | R&S | ESU 40 | 100363 | 2014/04/12 | 2015/04/11 |
| Loop Antenna | ETS-Lindgren | 6502 | 00143303 | 2014/01/16 | 2015/01/15 |
| Broadband Antenna | TESEQ | CBL 6112D | 35240 | 2014/01/17 | 2015/01/16 |
| Horn Antenna | ETS-Lindgren | 3117 | 00143272 | 2014/01/27 | 2015/01/26 |
| Horn Antenna | Schwarzbeck | BBHA9170 | BBHA9170-184 | 2014/01/23 | 2015/01/22 |
| Horn Antenna | ETS-Lindgren | 3160-09 | 00117911 | 2014/01/22 | 2015/01/21 |
| Horn Antenna | ETS-Lindgren | 3160-10 | 00117783 | 2014/01/22 | 2015/01/21 |
| Pre Amplifier | R&S | SCU-18 | 10204 | 2014/03/26 | 2015/03/25 |
| Pre Amplifier | R&S | SCU-26 | 100780 | 2014/03/26 | 2015/03/25 |
| Pre Amplifier | R&S | SCU-40 | 100356 | 2014/03/26 | 2015/03/25 |
| Pre Amplifier | EMC Instruments | EMC330 | 980096 | 2014/03/26 | 2015/03/25 |
| Pre Amplifier | EMC Instruments | EMC184045 | 980135 | 2014/01/24 | 2015/01/23 |
| Coaxial Cable | Huber+Suhner | RG 214/U | W21.03 | 2014/03/26 | 2015/03/25 |
| Coaxial Cable | Huber+Suhner | RG 214/U | W22.03 | 2014/03/26 | 2015/03/25 |
| Coaxial Cable | Huber+Suhner | SUCCOFLEX 104 | MY17413/4 | 2014/03/26 | 2015/03/25 |
| Coaxial Cable | Huber+Suhner | SUCCOFLEX 104 | MY17404/4 | 2014/03/26 | 2015/03/25 |
| Coaxial Cable | Huber+Suhner | SUCCOFLEX 104 | MY17394/4 | 2014/03/26 | 2015/03/25 |
| Coaxial Cable | Huber+Suhner | SUCCOFLEX 104 | MY17386/4 | 2014/03/26 | 2015/03/25 |
| Coaxial Cable | Huber+Suhner | SUCCOFLEX 104 | MY17388/4 | 2014/03/26 | 2015/03/25 |
| Attenuator | WOKEN | 218FS-10 | HY-151 | 2014/01/06 | 2015/01/05 |
| Communication Tester | R&S | CMW500 | 131121 | 2014/01/16 | 2015/01/15 |
| Communication Tester | Anritsu | MT8820C | 6201107337 | 2014/04/23 | 2015/04/22 |
| Controller | MF | MF-7802 | N/A | N.C.R. | N.C.R. |
| Antenna Master | MF | N/A | N/A | N.C.R. | N.C.R. |
| Turn Table | MF | N/A | N/A | N.C.R. | N.C.R. |
| Site NSA | SGS | 966 Chamber C | SAC-C | 2014/03/05 | 2015/03/04 |
| Site VSWR | SGS | 966 Chamber C | SAC-C | 2014/04/10 | 2015/04/09 |
| Test Software | World-Pallas | Dr. E | V 3.0 Lite | N.C.R. | N.C.R. |

*Note: N.C.R refers to Not Calibrated Required.*

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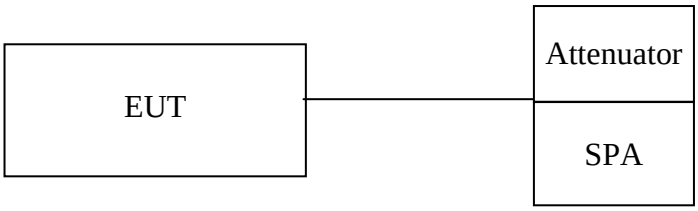
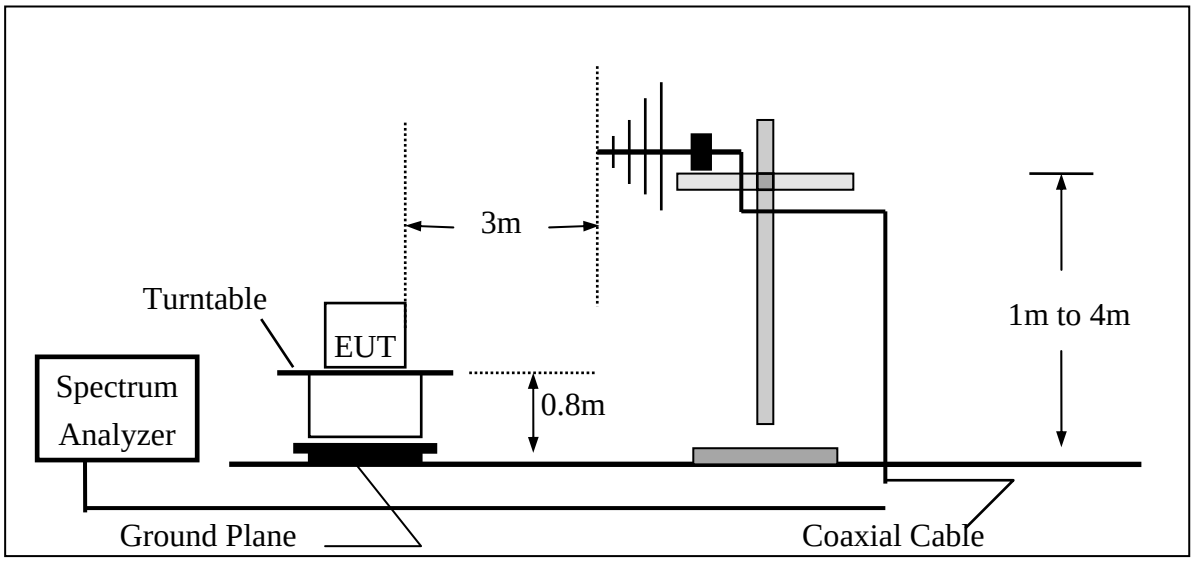
## 9.3 Test SET-UP:

### 9.3.1 Conducted Emission at antenna port:

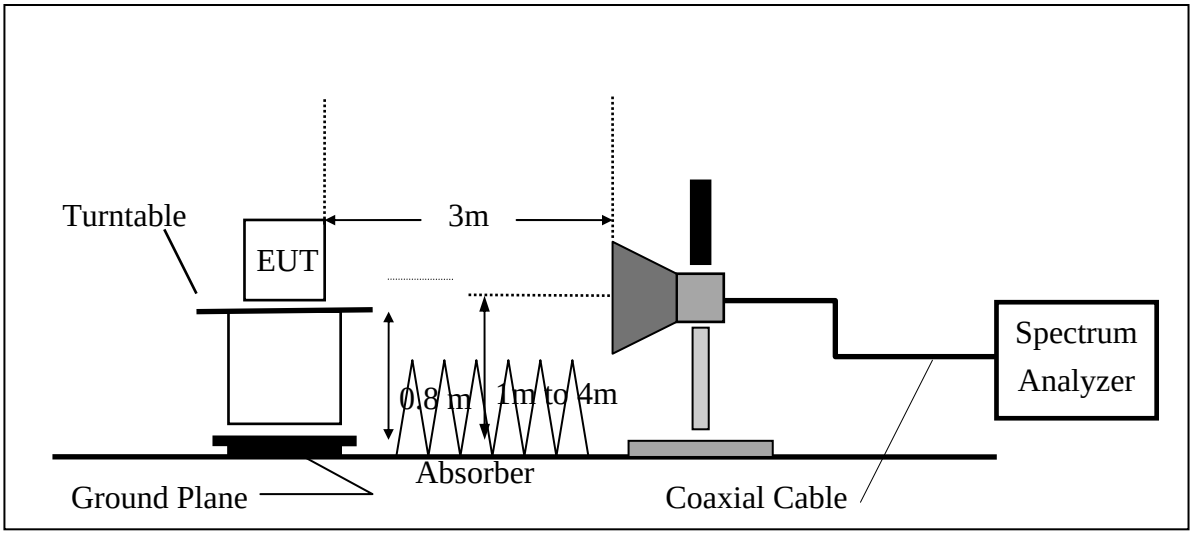



### 9.3.2 Radiated emission:

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz




(B) Radiated Emission Test Set-UP Frequency Over 1 GHz

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## 9.4 Measurement Procedure:

Unwanted Emissions into Non-Restricted Frequency Bands, Measurement Procedure followed by 11.1 of KDB558074 D01

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
4. Set the spectrum analyzer as RBW, VBW=300KHz, Detector = Peak, Sweep = auto
5. Mark the highest reading of the emission as the reference level measurement.
6. Set DL as the limit = reading on marker 1 – 20dBm
7. Marker on frequency, 2.3999GHz and 2.4836GHz, and examine shall 100 KHz immediately outside the authorized (2400~2483.5) be attenuated by 20dB at least relative to the maximum emission of power.
8. Repeat above procedures until all default test channel (low, middle, and high) was complete.

Unwanted Emission falling into Restricted Frequency Bands, Measurement Procedure followed by 12.1 of KDB558074:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. On spectrum, following 8.1.2, and RBW = 1MHz, VBW = 3MHz, & Marker 2390MHz, and 2483.5MHz (Peak Measurement). Average Measurement: following 8.2 with the modification span to 1MHz, &RBW = 1MHz, VBW = 3MHz and peak marker function to obtain the highest reading on 2390, and 2483.5MHz.
8. Repeat above procedures until all default test channel (low, middle, and high) was complete

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## 9.5 Field Strength Calculation:

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

**FS = RA + AF + CL - AG**

| | | |
|---|---|---|
| Where | FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| | RA = Reading Amplitude | AG = Amplifier Gain |
| | AF = Antenna Factor | |

## 9.6 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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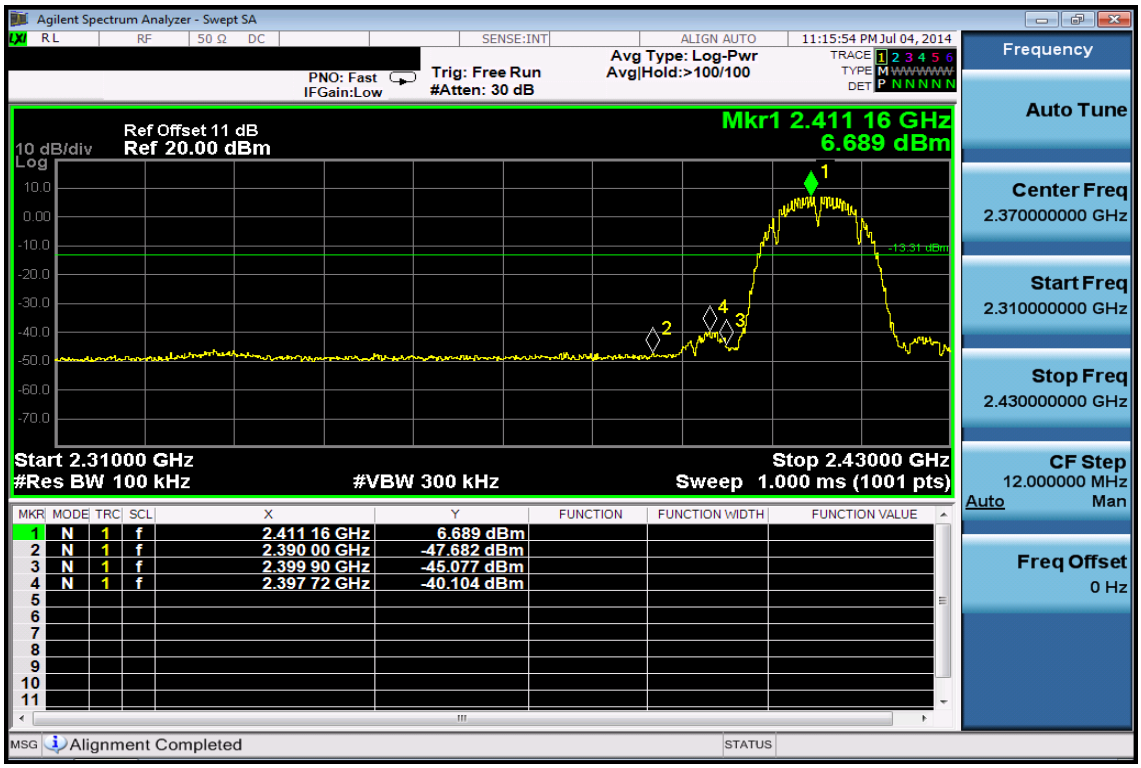
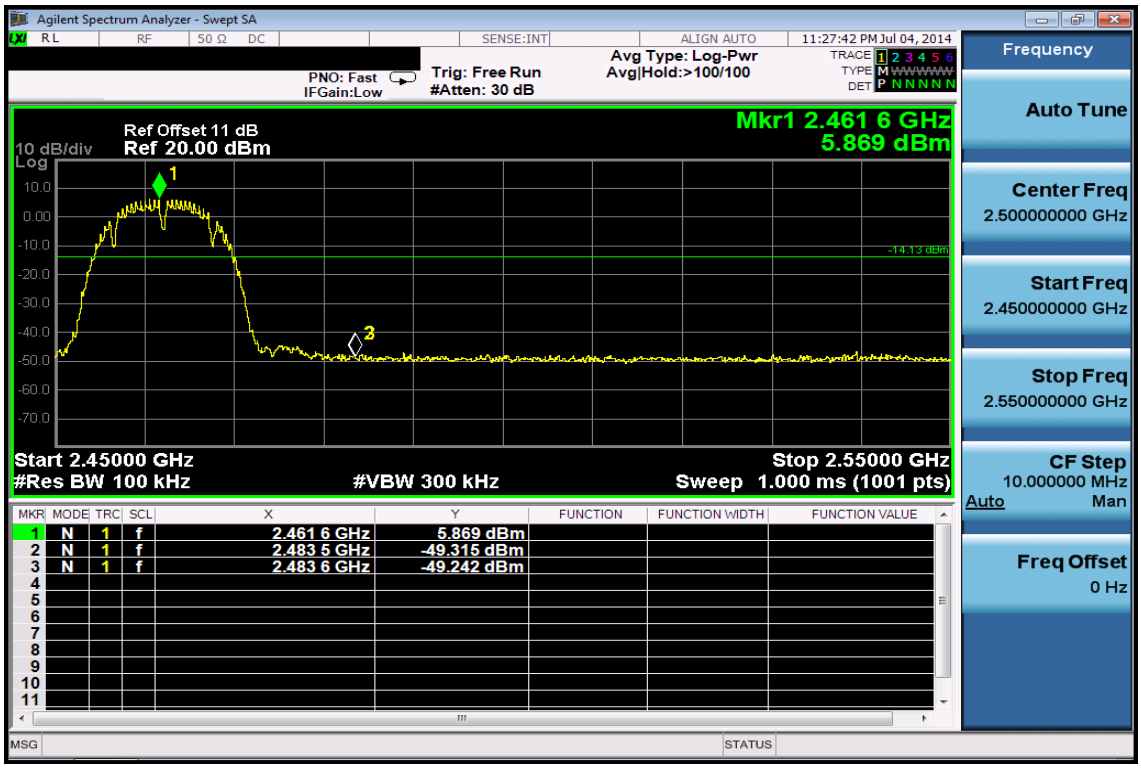
# 802.11b - Unwanted Emissions into Non-Restricted Frequency Bands

## Band Edges Test Data CH-Low




## Band Edges Test Data CH-High

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**Radiated Emission:**

(Unwanted Emissions into Restricted Frequency Bands): 802.11 b mode

| | | | |
|---|---|---|---|
| Operation Band | :802.11 b | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2390.00 | E | Peak | 52.03 | 3.59 | 55.62 | 74.00 | -18.38 |
| 2390.00 | E | Average | 37.34 | 3.59 | 40.93 | 54.00 | -13.07 |

| | | | |
|---|---|---|---|
| Operation Band | :802.11 b | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2390.00 | E | Peak | 54.30 | 3.59 | 57.89 | 74.00 | -16.11 |
| 2390.00 | E | Average | 39.32 | 3.59 | 42.91 | 54.00 | -11.09 |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 b | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2483.50 | E | Peak | 51.87 | 4.12 | 55.99 | 74.00 | -18.01 |
| 2483.50 | E | Average | 37.26 | 4.12 | 41.38 | 54.00 | -12.62 |

| | | | |
|---|---|---|---|
| Operation Band | :802.11 b | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2483.50 | E | Peak | 51.71 | 4.12 | 55.83 | 74.00 | -18.17 |
| 2483.50 | E | Average | 38.99 | 4.12 | 43.11 | 54.00 | -10.89 |

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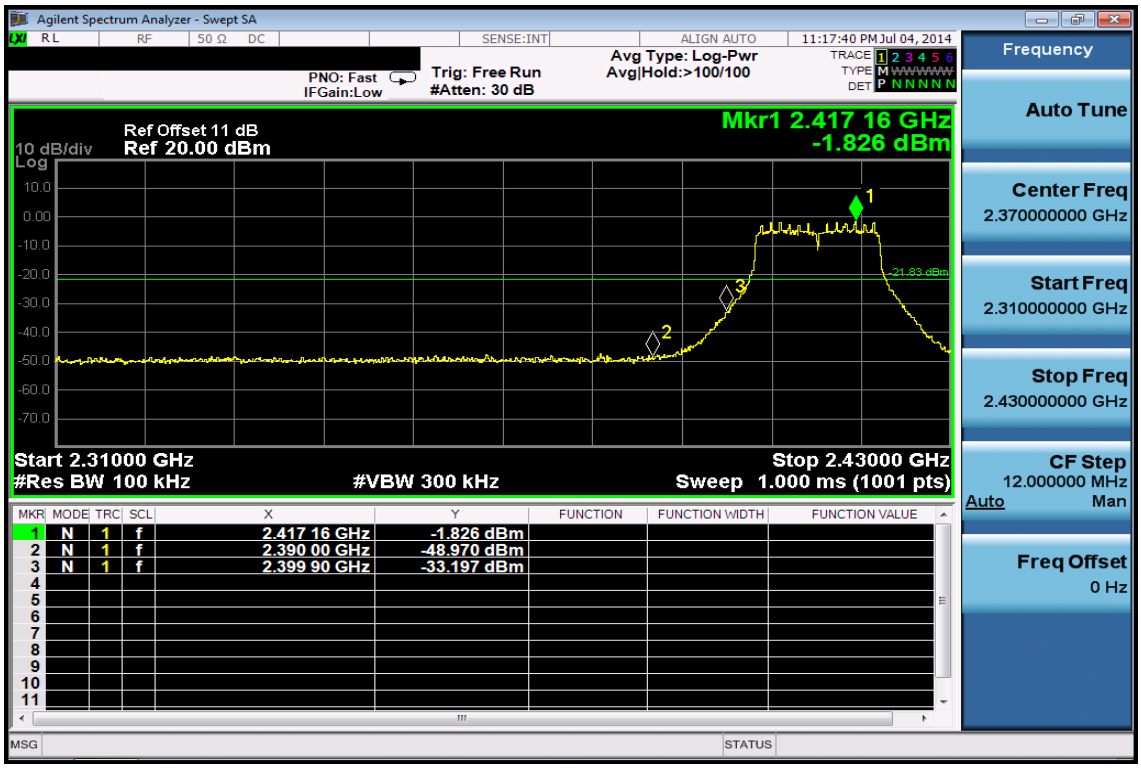
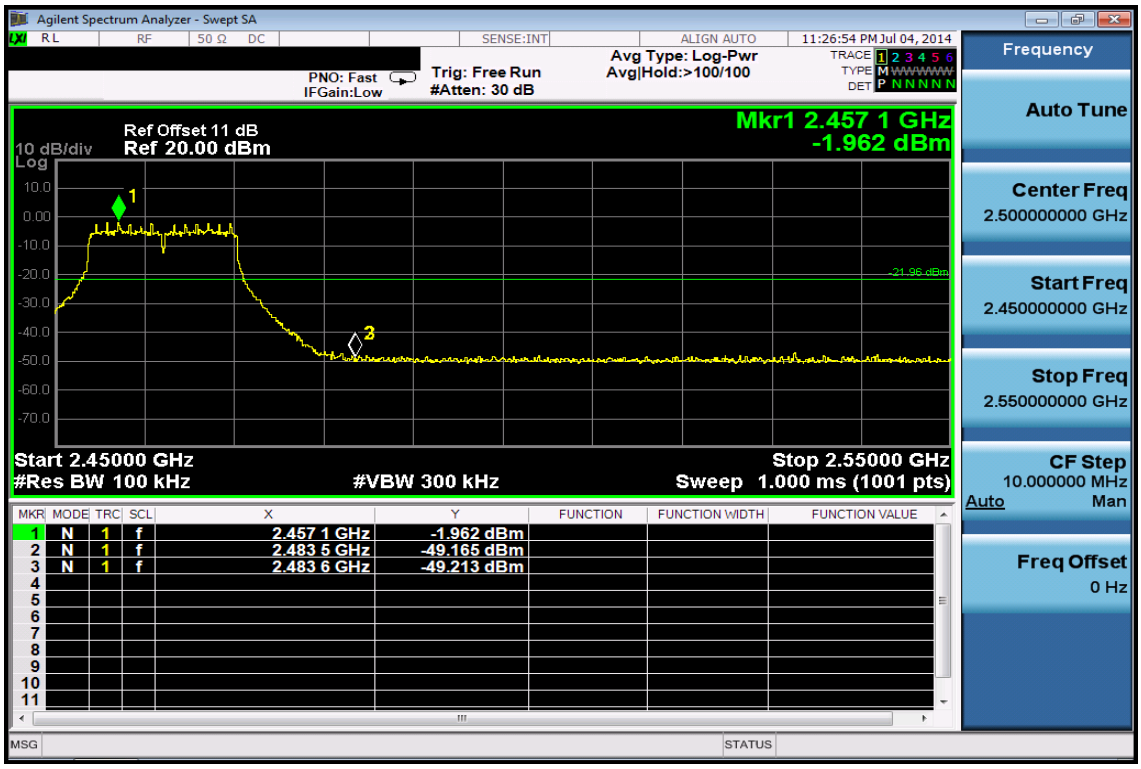
# 802.11g - Unwanted Emissions into Non-Restricted Frequency Bands

## Band Edges Test Data CH-Low




## Band Edges Test Data CH-High

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**Radiated Emission:**

(Unwanted Emissions into Restricted Frequency Bands): 802.11 g mode

| | | | |
|---|---|---|---|
| Operation Band | :802.11 g | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2390.00 | E | Peak | 57.33 | 3.59 | 60.92 | 74.00 | -13.08 |
| 2390.00 | E | Average | 38.47 | 3.59 | 42.06 | 54.00 | -11.94 |

| | | | |
|---|---|---|---|
| Operation Band | :802.11 g | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2390.00 | E | Peak | 60.59 | 3.59 | 64.18 | 74.00 | -9.82 |
| 2390.00 | E | Average | 39.58 | 3.59 | 43.17 | 54.00 | -10.83 |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 g | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2483.50 | E | Peak | 52.84 | 4.12 | 56.96 | 74.00 | -17.04 |
| 2483.50 | E | Average | 36.73 | 4.12 | 40.85 | 54.00 | -13.15 |

| | | | |
|---|---|---|---|
| Operation Band | :802.11 g | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2483.50 | E | Peak | 58.75 | 4.12 | 62.86 | 74.00 | -11.14 |
| 2483.50 | E | Average | 39.36 | 4.12 | 43.48 | 54.00 | -10.52 |

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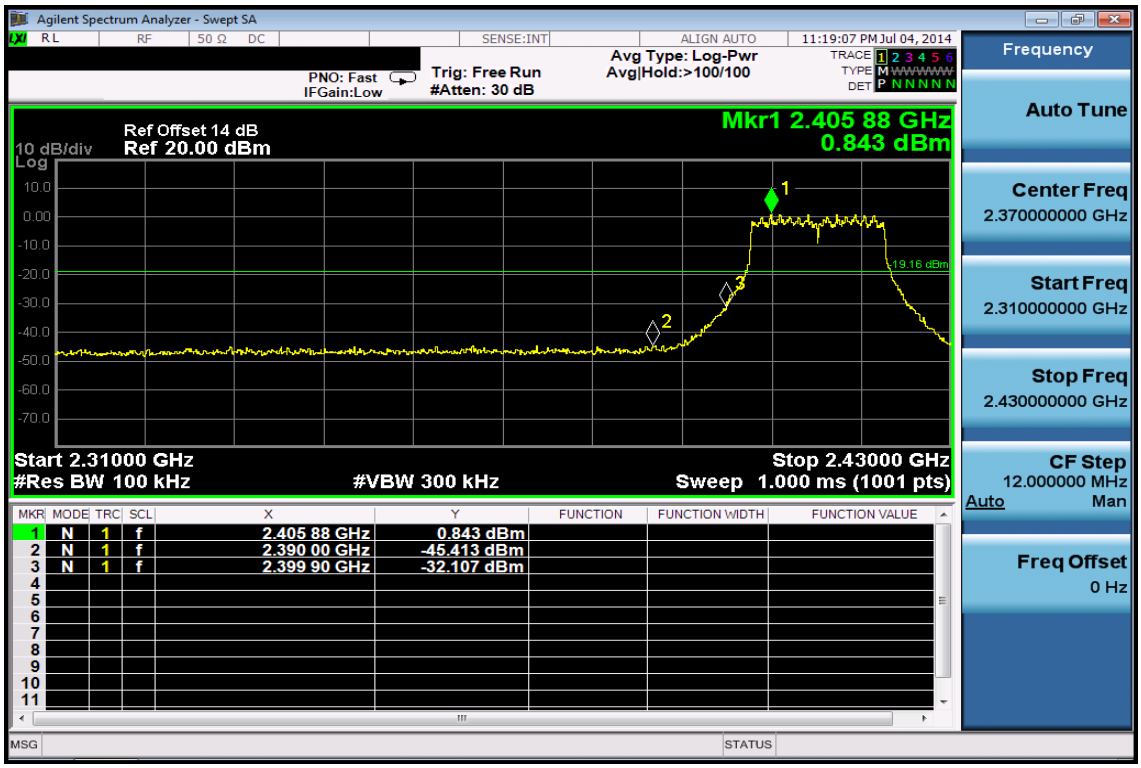
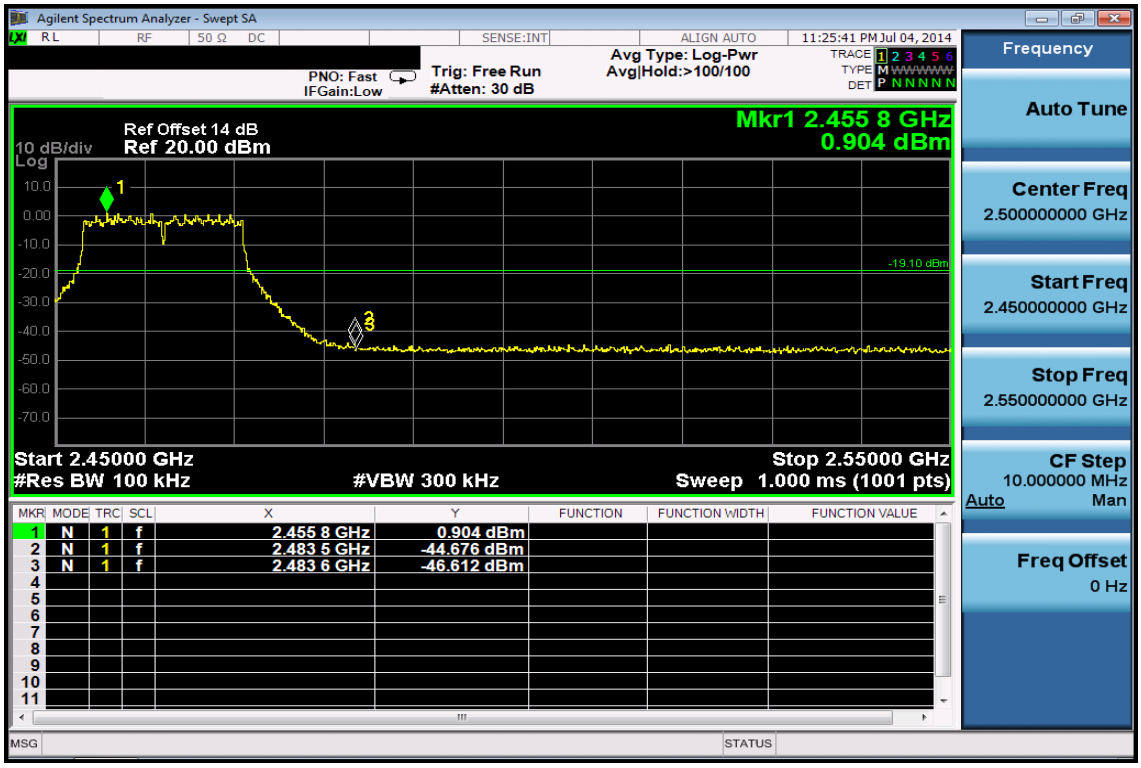
# 802.11n_20M- Unwanted Emissions into Non-Restricted Frequency Bands

## Band Edges Test Data CH-Low




## Band Edges Test Data CH-High

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## Radiated Emission: 802.11 n_20M mode

(Unwanted Emissions into Restricted Frequency Bands): 802.11 n_20M mode

| | | | |
|---|---|---|---|
| Operation Band | :802.11 n20M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2390.00 | E | Peak | 58.62 | 3.59 | 62.21 | 74.00 | -11.79 |
| 2390.00 | E | Average | 39.93 | 3.59 | 43.52 | 54.00 | -10.48 |

| | | | |
|---|---|---|---|
| Operation Band | :802.11 n20M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2390.00 | E | Peak | 62.18 | 3.59 | 65.77 | 74.00 | -8.23 |
| 2390.00 | E | Average | 43.37 | 3.59 | 46.96 | 54.00 | -7.04 |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n20M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2483.50 | E | Peak | 53.05 | 4.12 | 57.16 | 74.00 | -16.84 |
| 2483.50 | E | Average | 37.91 | 4.12 | 42.03 | 54.00 | -11.97 |

| | | | |
|---|---|---|---|
| Operation Band | :802.11 n20M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2483.50 | E | Peak | 60.42 | 4.12 | 64.54 | 74.00 | -9.46 |
| 2483.50 | E | Average | 40.75 | 4.12 | 44.87 | 54.00 | -9.13 |

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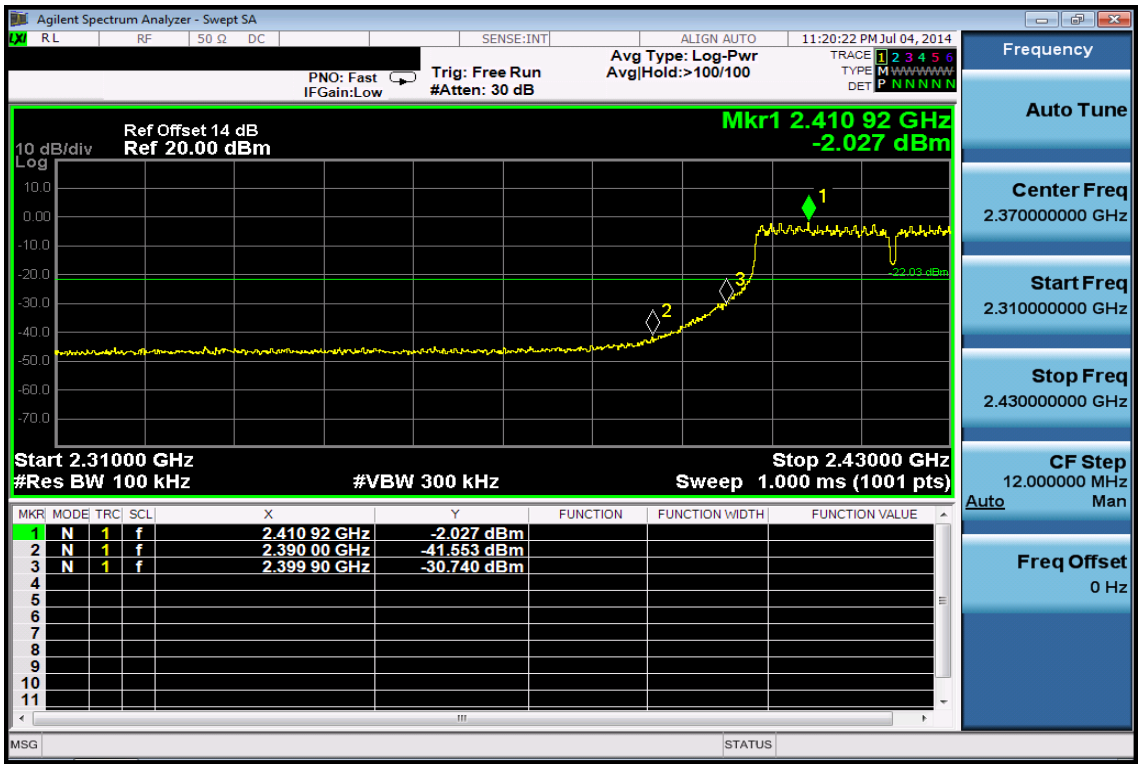
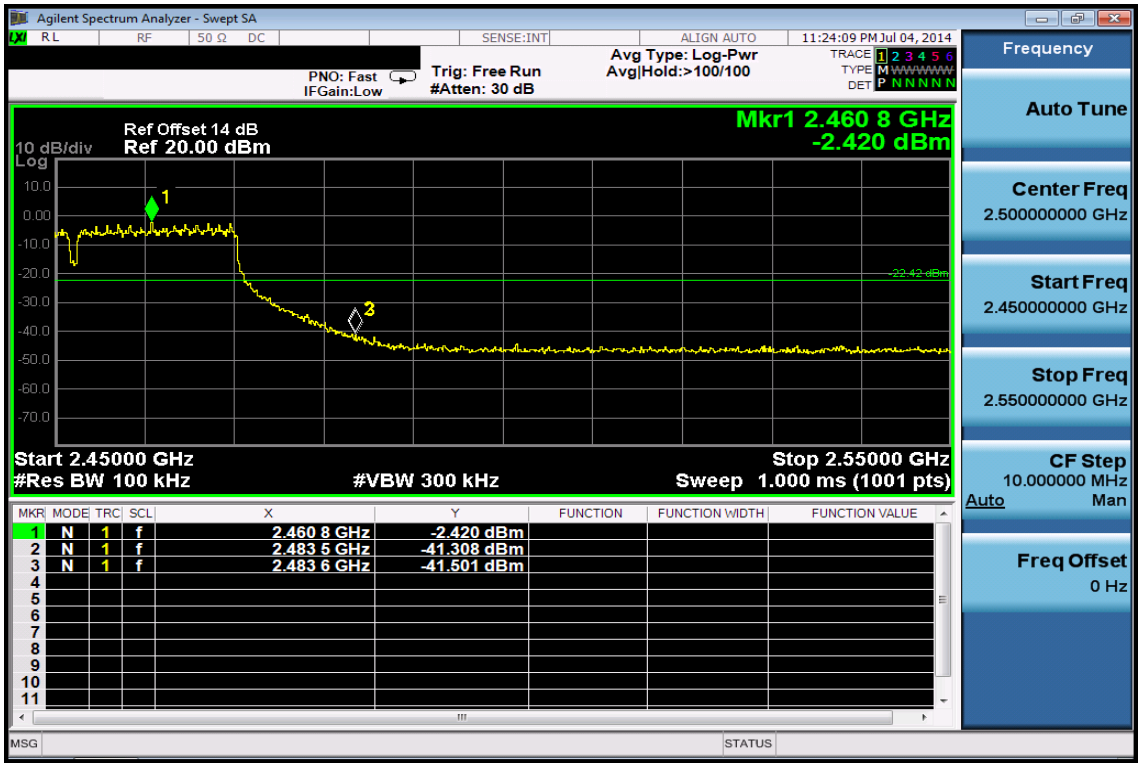
# 802.11n_40M - Unwanted Emissions into Non-Restricted Frequency Bands

## Band Edges Test Data CH-Low




## Band Edges Test Data CH-High

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## Radiated Emission: 802.11 n_40M mode

(Unwanted Emissions into Restricted Frequency Bands): 802.11 n_40M mode

| | | | |
|---|---|---|---|
| Operation Band | :802.11 n40M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2422 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2390.00 | E | Peak | 64.38 | 3.59 | 67.97 | 74.00 | -6.03 |
| 2390.00 | E | Average | 44.77 | 3.59 | 48.36 | 54.00 | -5.64 |

| | | | |
|---|---|---|---|
| Operation Band | :802.11 n40M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2422 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2390.00 | E | Peak | 68.66 | 3.59 | 72.25 | 74.00 | -1.75 |
| 2390.00 | E | Average | 47.99 | 3.59 | 51.58 | 54.00 | -2.42 |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n40M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2452 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2483.50 | E | Peak | 63.97 | 4.12 | 68.09 | 74.00 | -5.91 |
| 2483.50 | E | Average | 41.53 | 4.12 | 45.65 | 54.00 | -8.35 |

| | | | |
|---|---|---|---|
| Operation Band | :802.11 n40M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2452 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :Band Edge HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 2483.50 | E | Peak | 67.37 | 4.12 | 71.48 | 74.00 | -2.52 |
| 2483.50 | E | Average | 44.53 | 4.12 | 48.65 | 54.00 | -5.35 |

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# 10 SPURIOUS EMISSION TEST

## 10.1 Standard Applicable

According to §15.247(d),

Emission at antenna port:

In any 100 kHz 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 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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 dB instead of 20 dB.

Radiated Spurious Emission

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

And according to §15.33(a) (1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

According to RSS-Gen §7.2.5 and RSS-210 issue 8,§A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 5 and 6 is not required. In addition, radiated emissions which fall in the restricted bands of Table 3 must also comply with the radiated emission limits specified in Tables 5 and 6 of RSS-GEN.

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## 10.2 Measurement Equipment Used:

### 10.2.1 Conducted Emission at antenna port:

Refer to section 7.2 for details.

### 10.2.2 Radiated emission:

Refer to section 9.2.2 for details.

## 10.3 Test SET-UP:

### 10.3.1 Conducted Emission at antenna port:

Refer to section 7.3 for details.

### 10.3.2 Radiated emission:

Refer to section 9.3.2 for details.

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## 10.4 Measurement Procedure:

**Radiated Emission:**

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
7. Repeat above procedures until all default test channel measured were complete.

**Conducted Emission:**

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 100K & VBW = 300K on Spectrum.
3. Sweep the frequency to determine spurious emission as seen on spectrum from span of 30 to 3G, 3G to 8G, 8G to 13G, 13G to 18G and 18G to 26.5GHz, 18G to 40GHz (applicable if operation mode is 5GHz)
4. Via Software, combine 5 spans of frequency range into one plot
5. Repeat above procedures until all default test channel measured were complete.

## 10.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

**FS = RA + AF + CL - AG**

| | | |
|---|---|---|
| Where | FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| | RA = Reading Amplitude | AG = Amplifier Gain |
| | AF = Antenna Factor | |

## 10.6 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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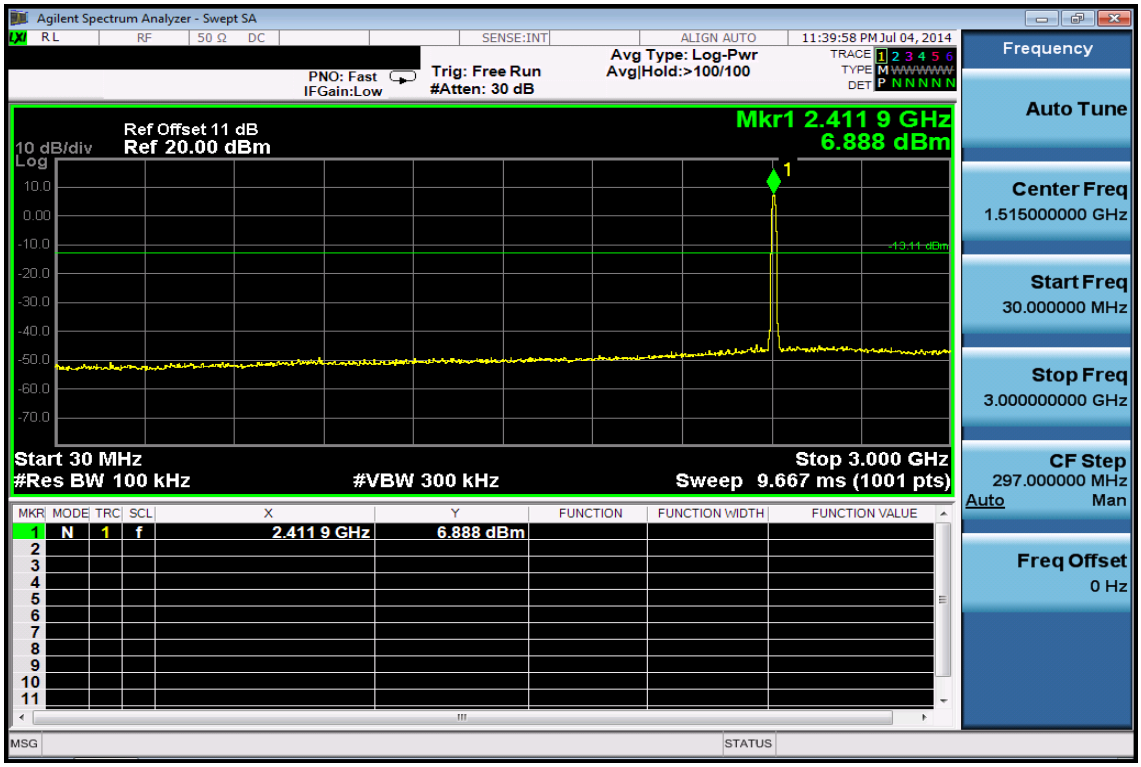
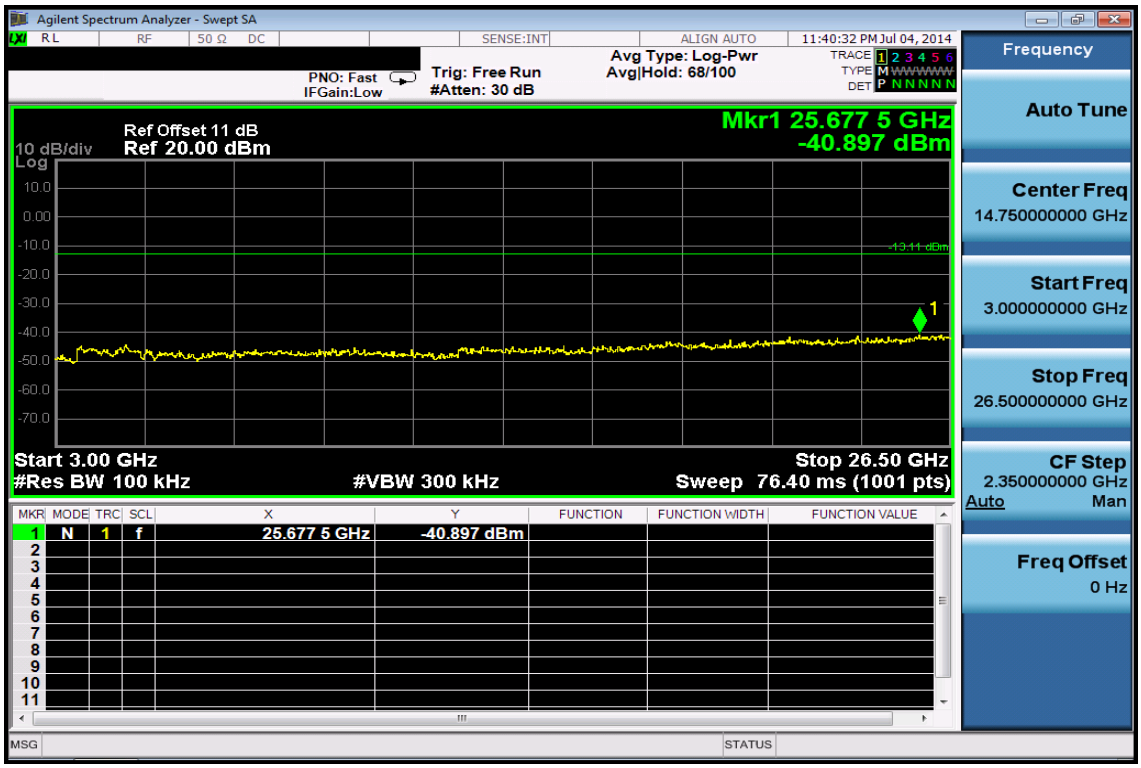
# Conducted Spurious Emission Measurement Result (802.11b)

## Ch Low 30MHz – 3GHz




## Ch Low 3GHz – 26.5GHz

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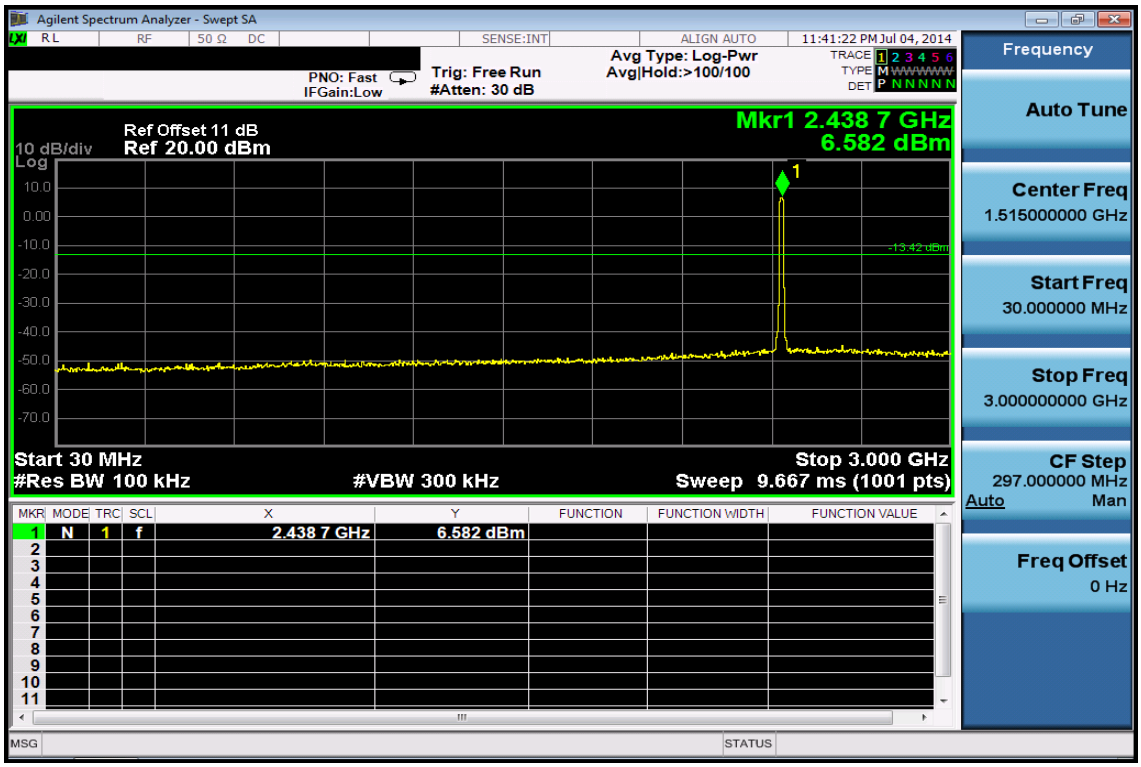
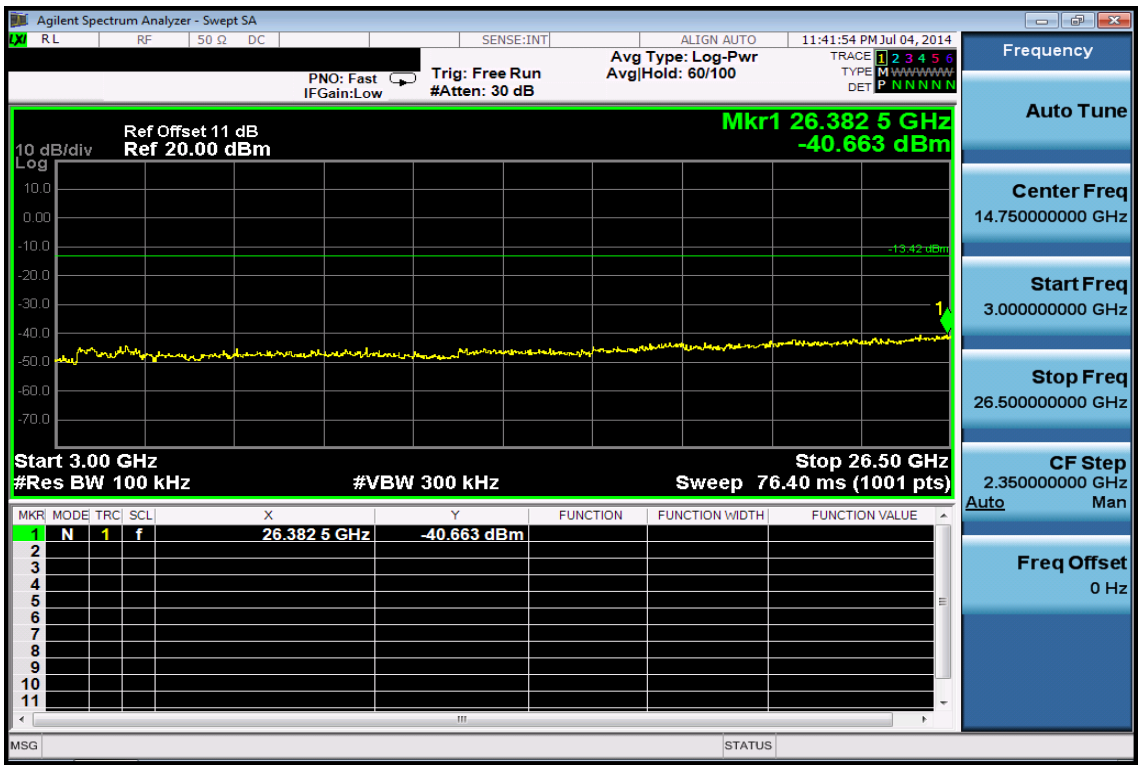
## Ch Mid 30MHz – 3GHz




## Ch Mid 3GHz – 26.5GHz

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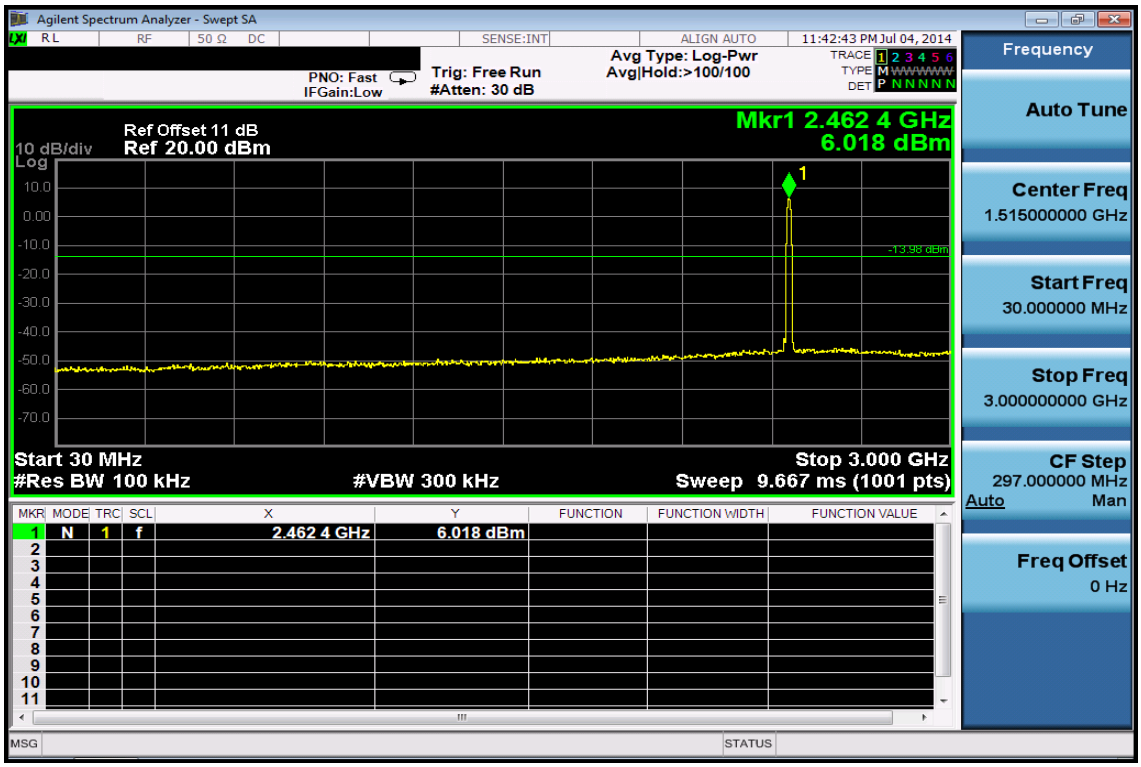
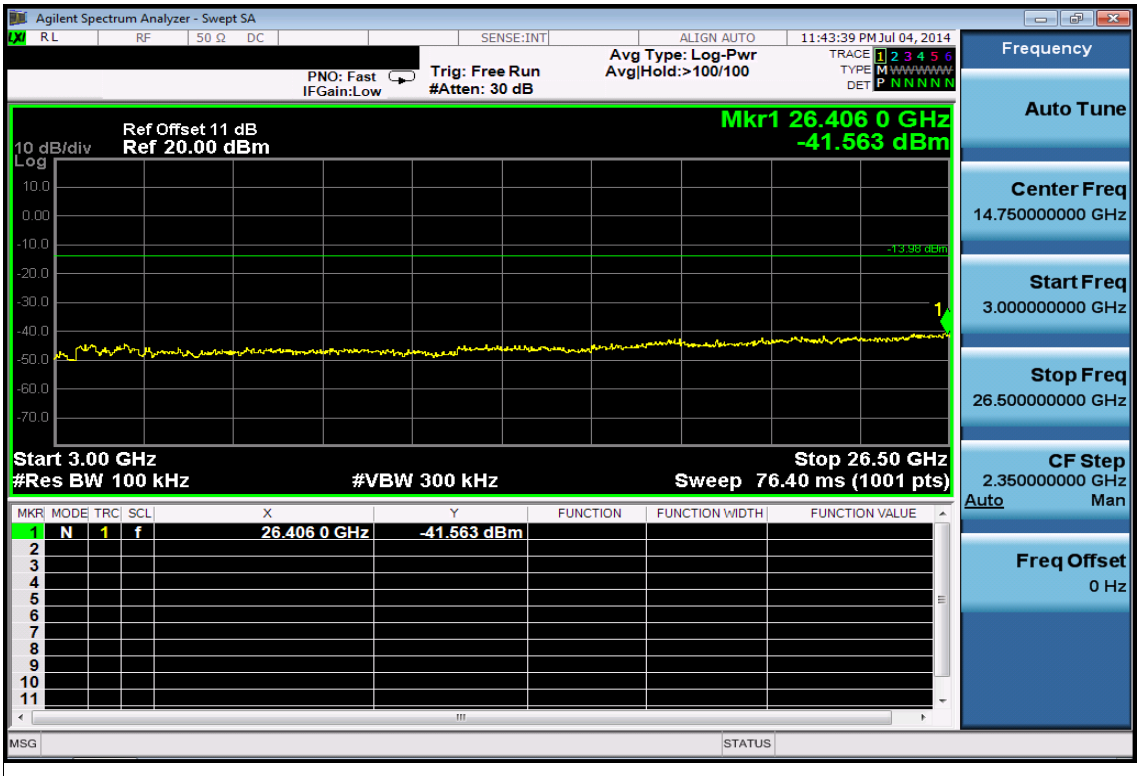
## Ch High 30MHz – 3GHz




## Ch High 3GHz – 26.5GHz

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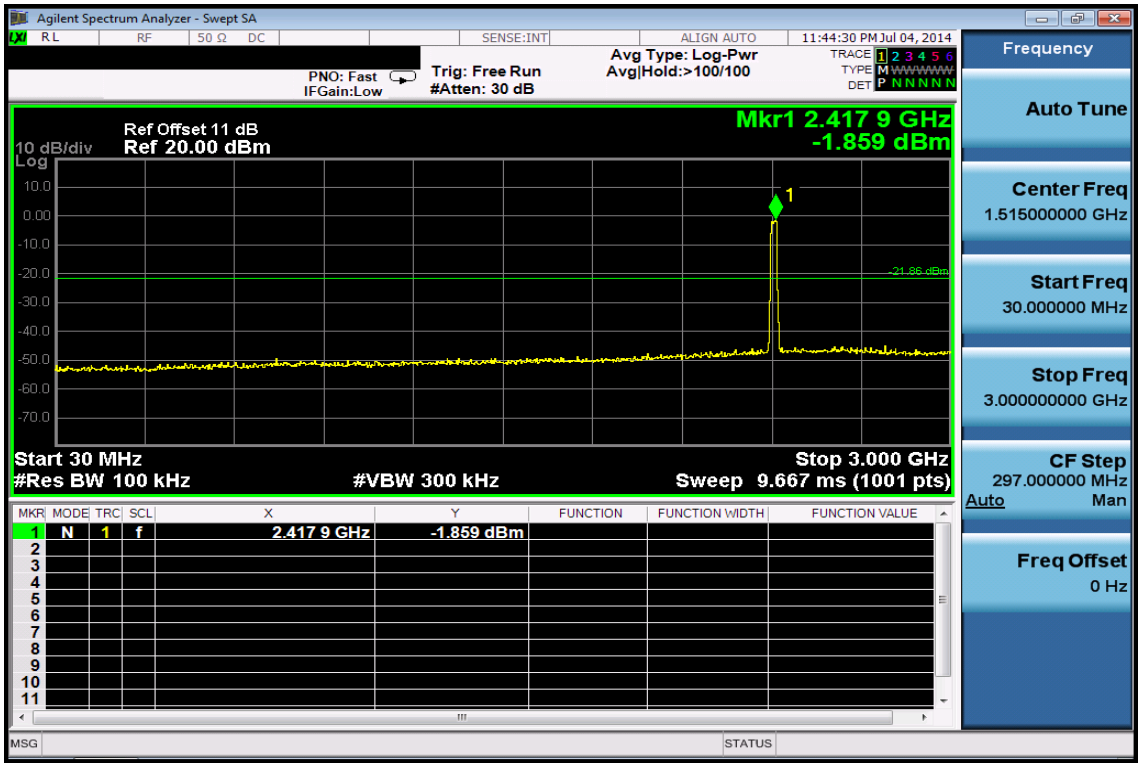
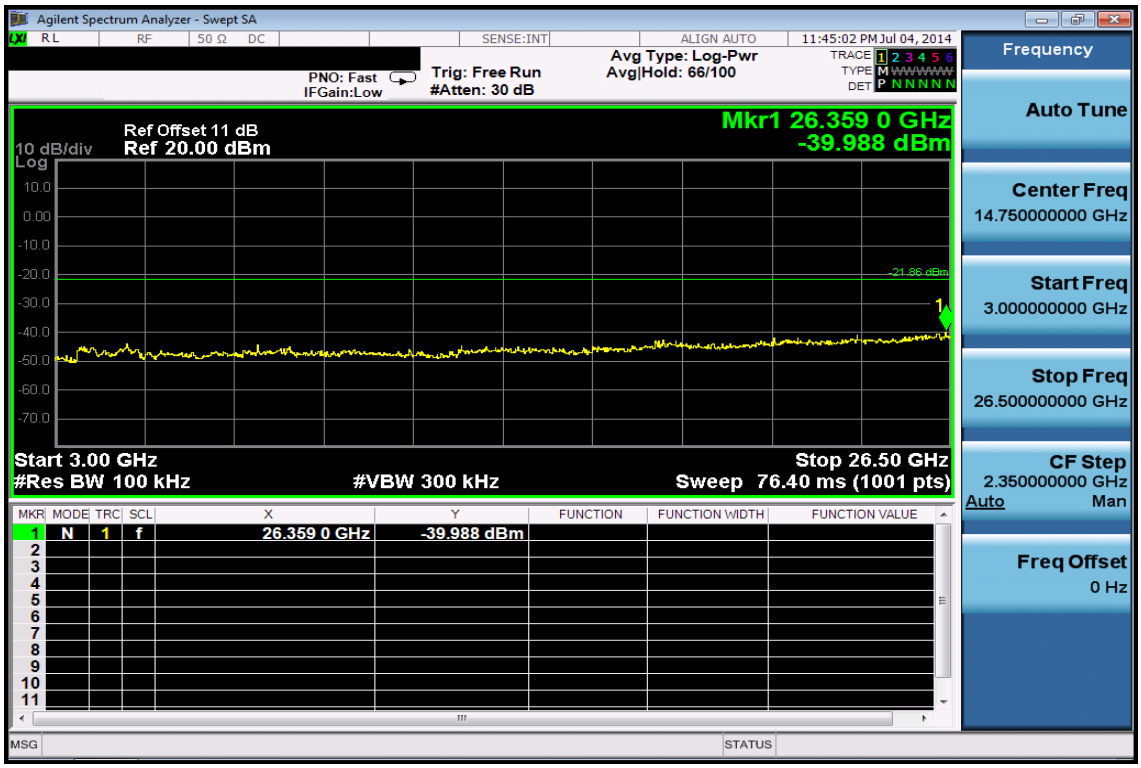
# Conducted Spurious Emission Measurement Result (802.11g)

## Ch Low 30MHz – 3GHz




## Ch Low 3GHz – 26.5GHz

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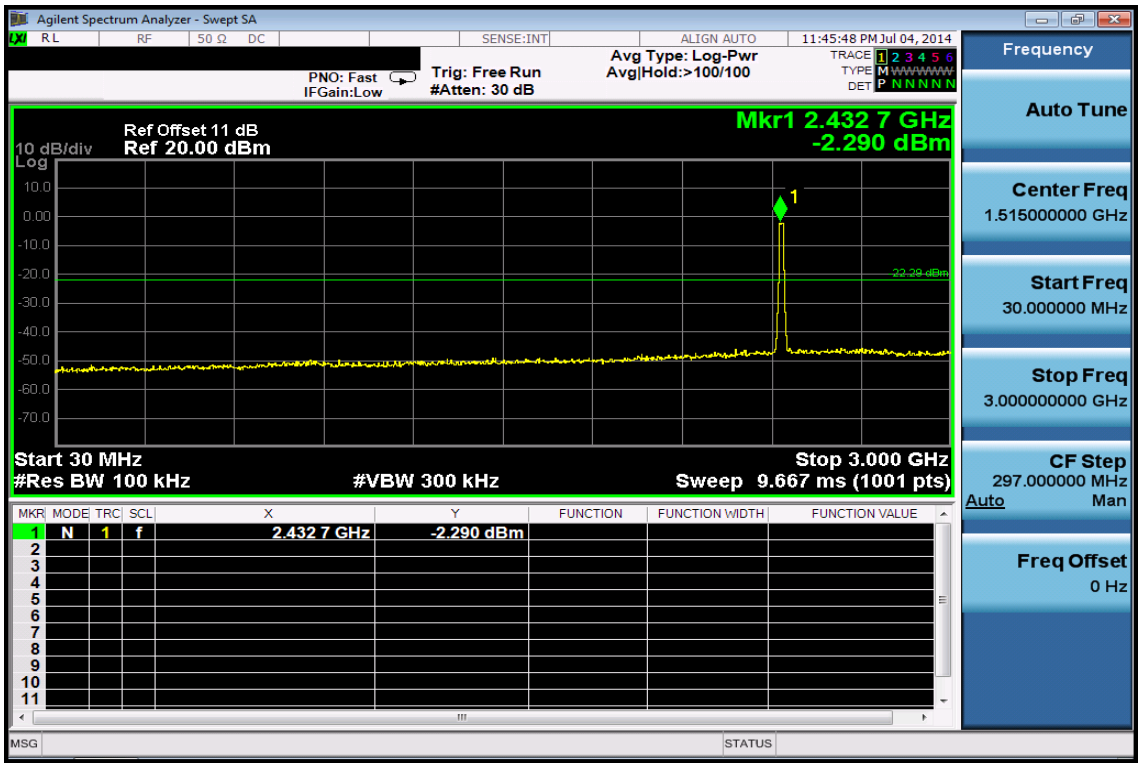
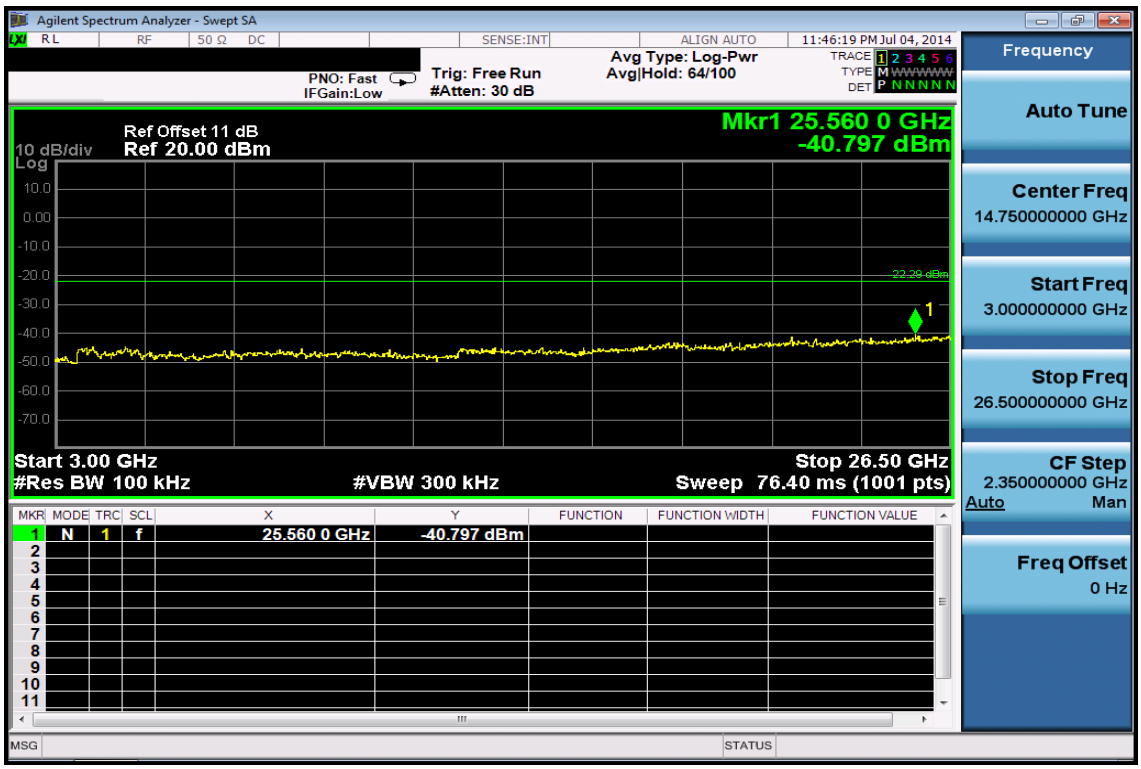
## Ch Mid 30MHz – 3GHz




## Ch Mid 3GHz – 26.5GHz

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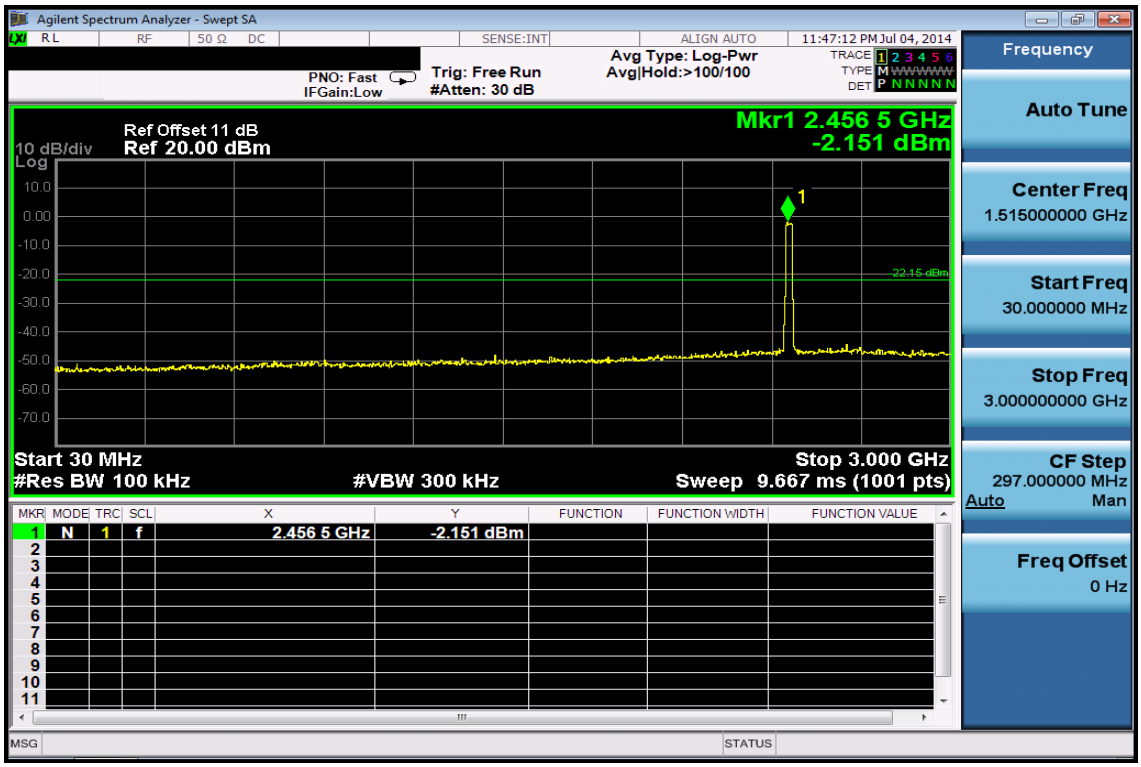
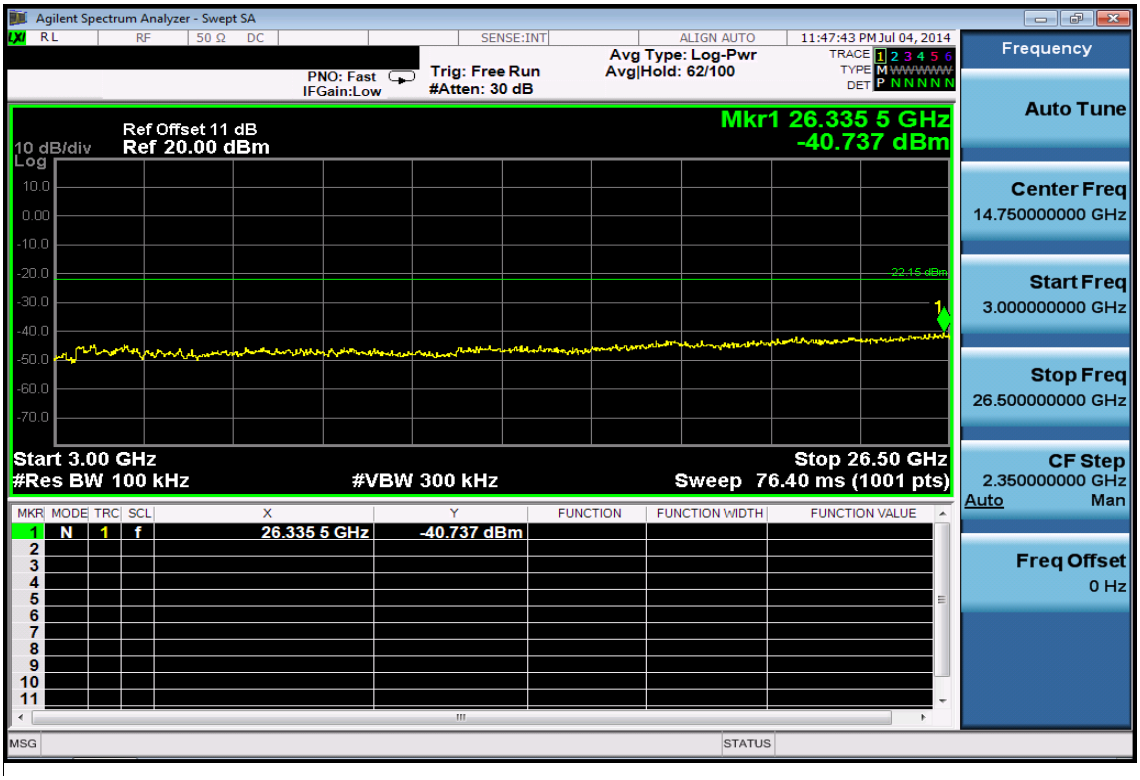
## Ch High 30MHz – 3GHz




## Ch High 3GHz – 26.5GHz

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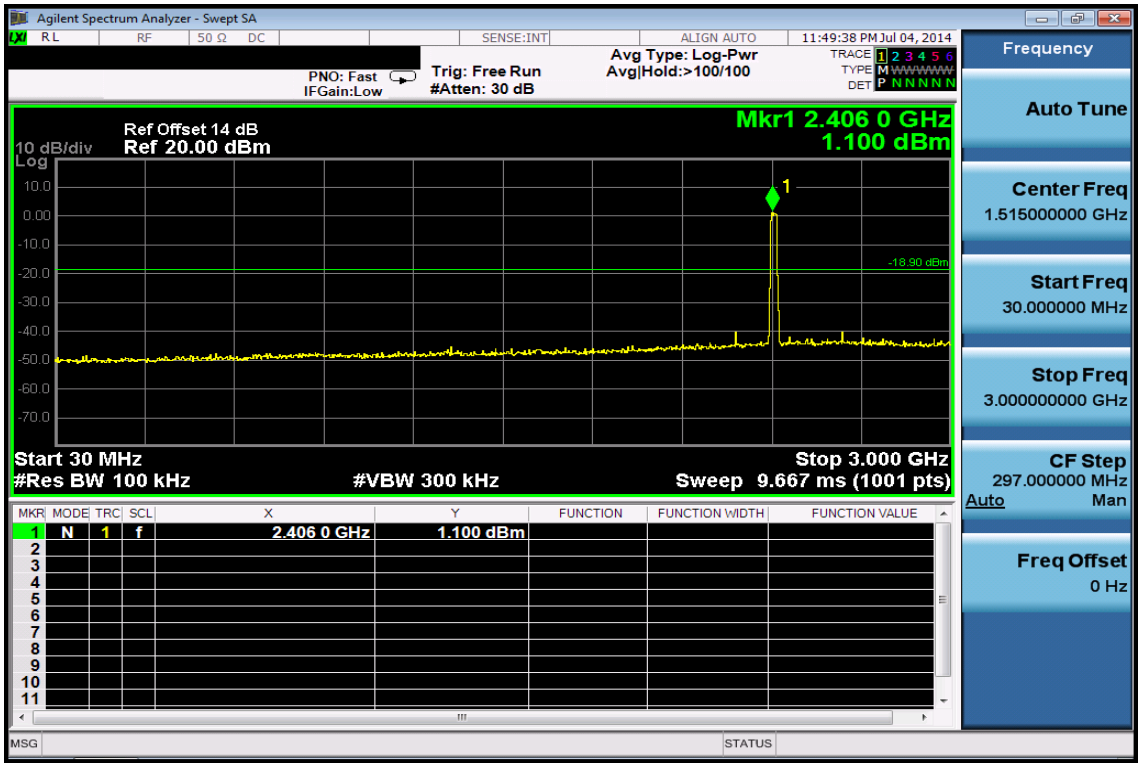
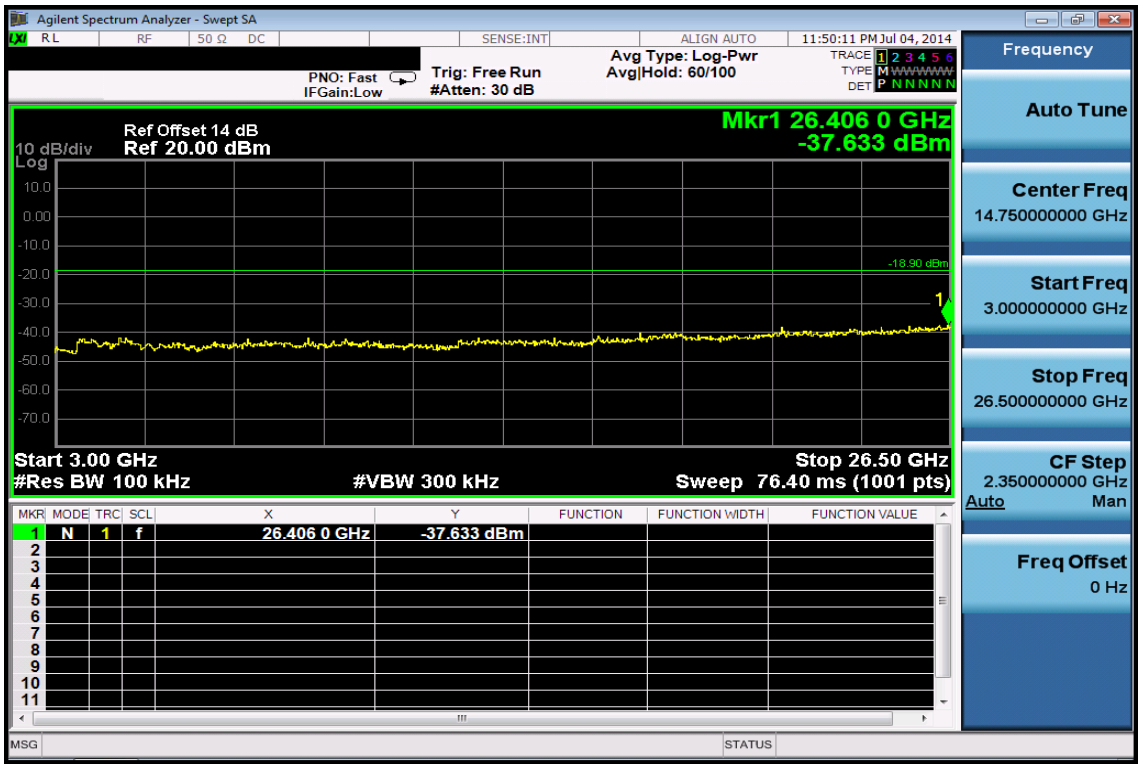
# Conducted Spurious Emission Measurement Result (802.11n_20M)

## Ch Low 30MHz – 3GHz




## Ch Low 3GHz – 26.5GHz

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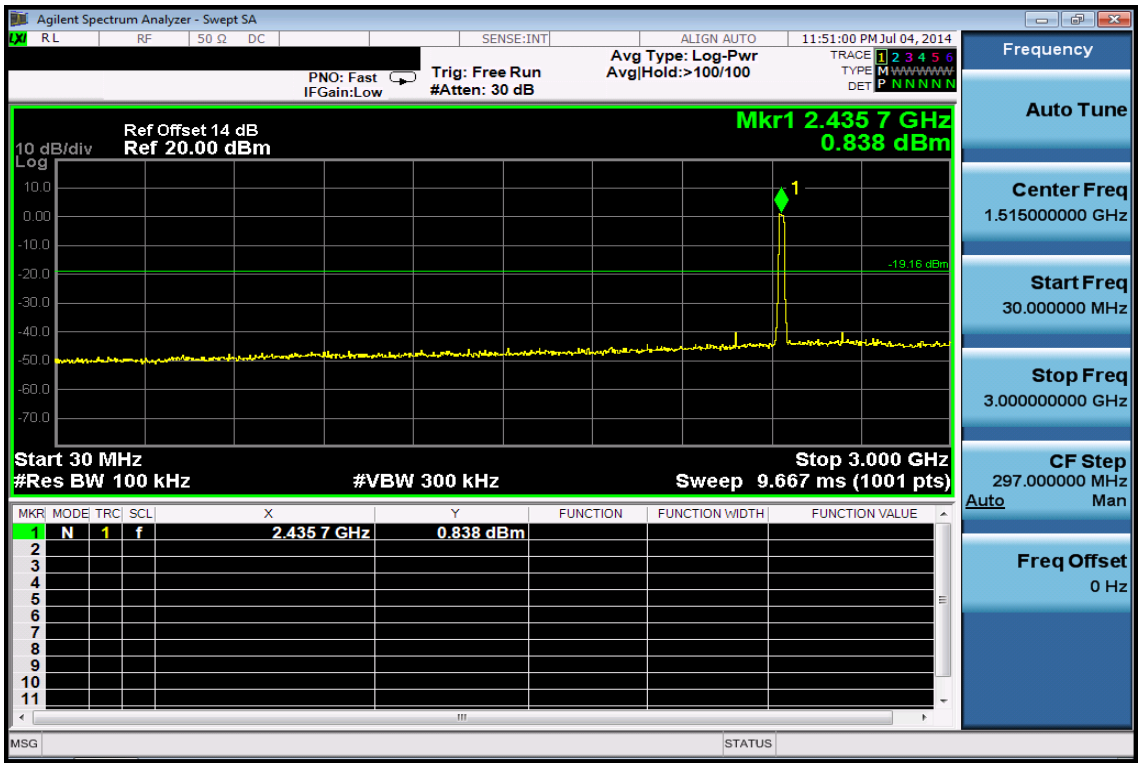
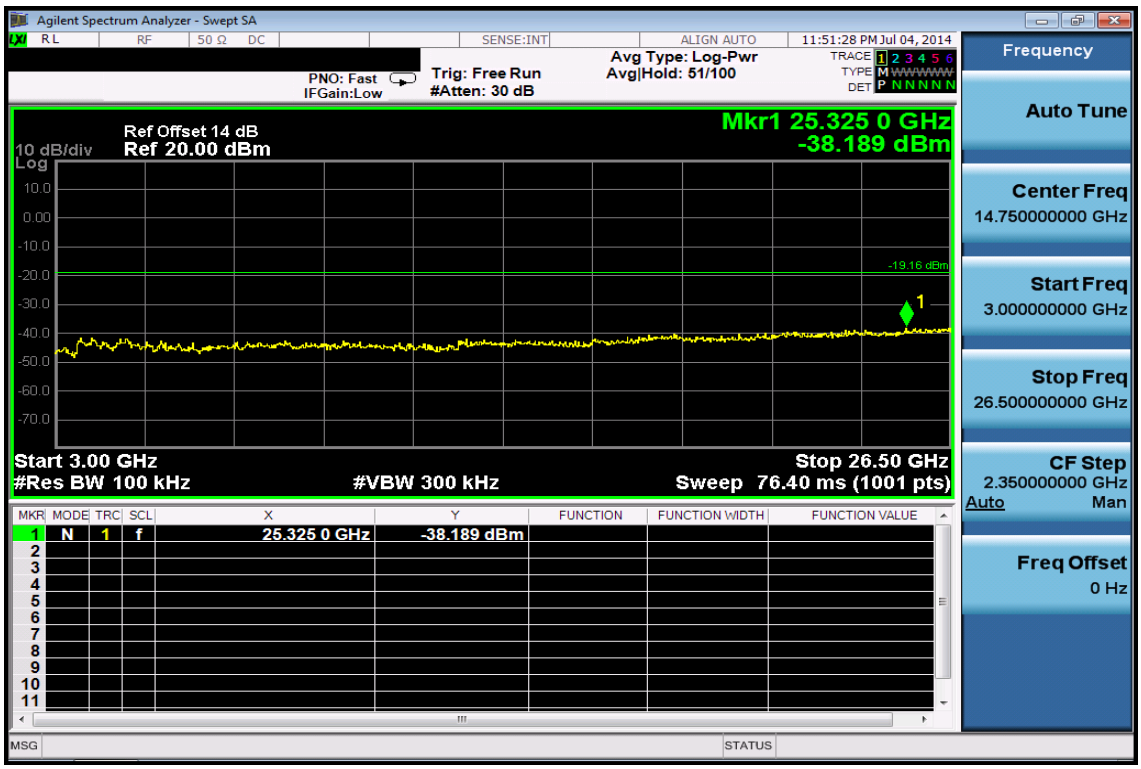
## Ch Mid 30MHz – 3GHz




## Ch Mid 3GHz – 26.5GHz

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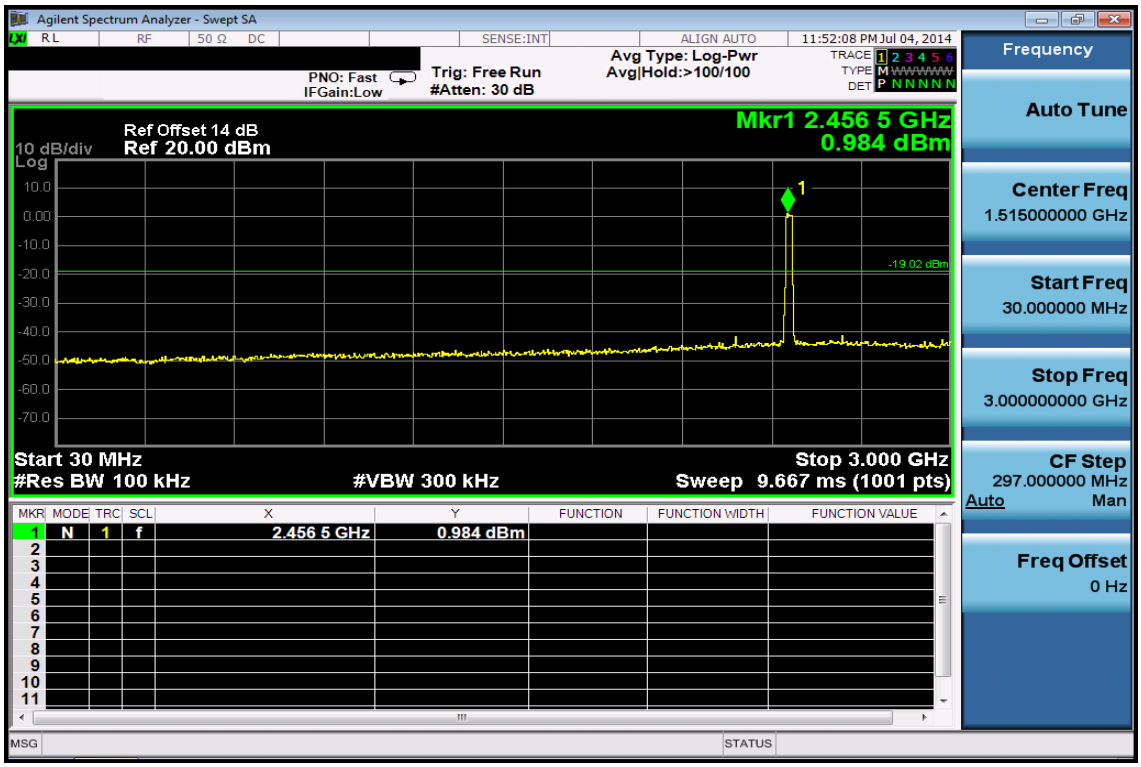
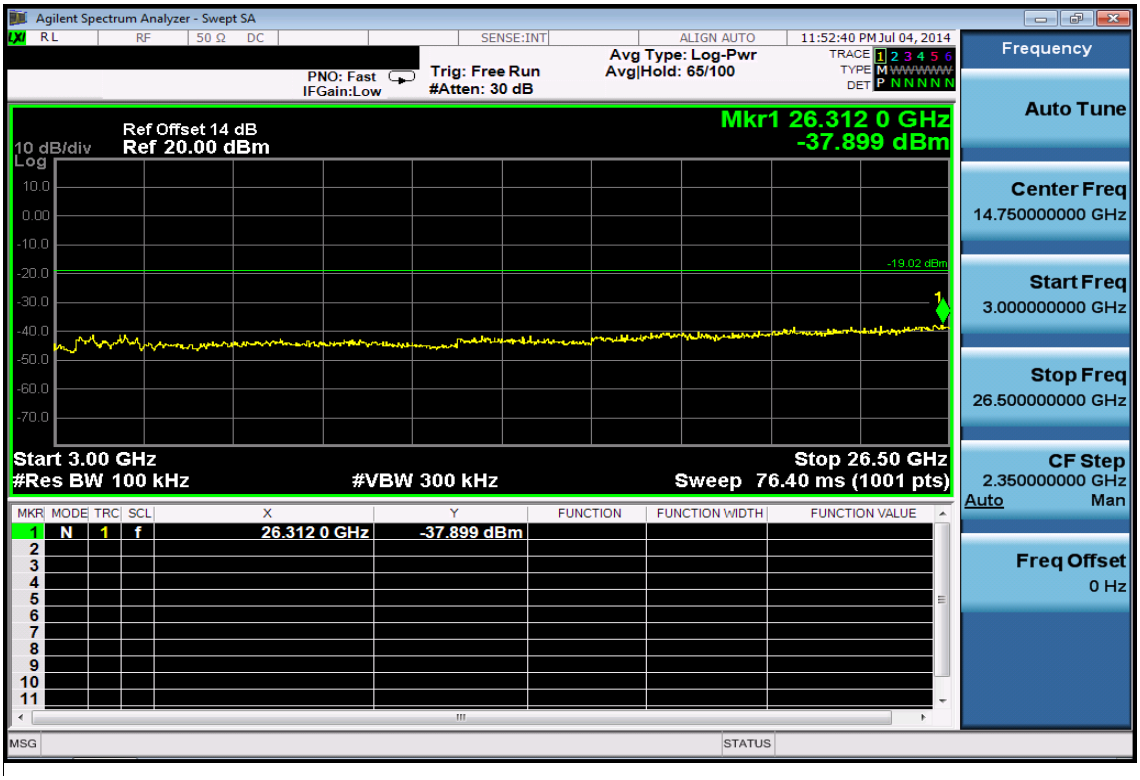
## Ch High 30MHz – 3GHz




## Ch High 3GHz – 26.5GHz

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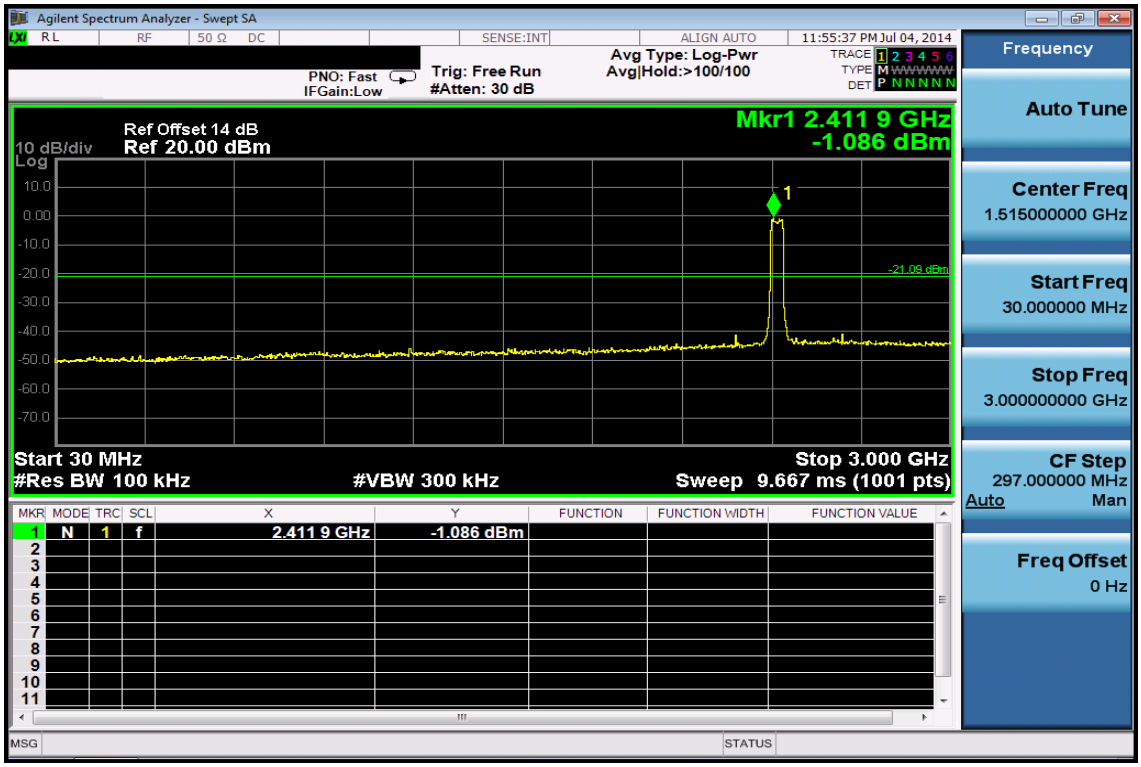
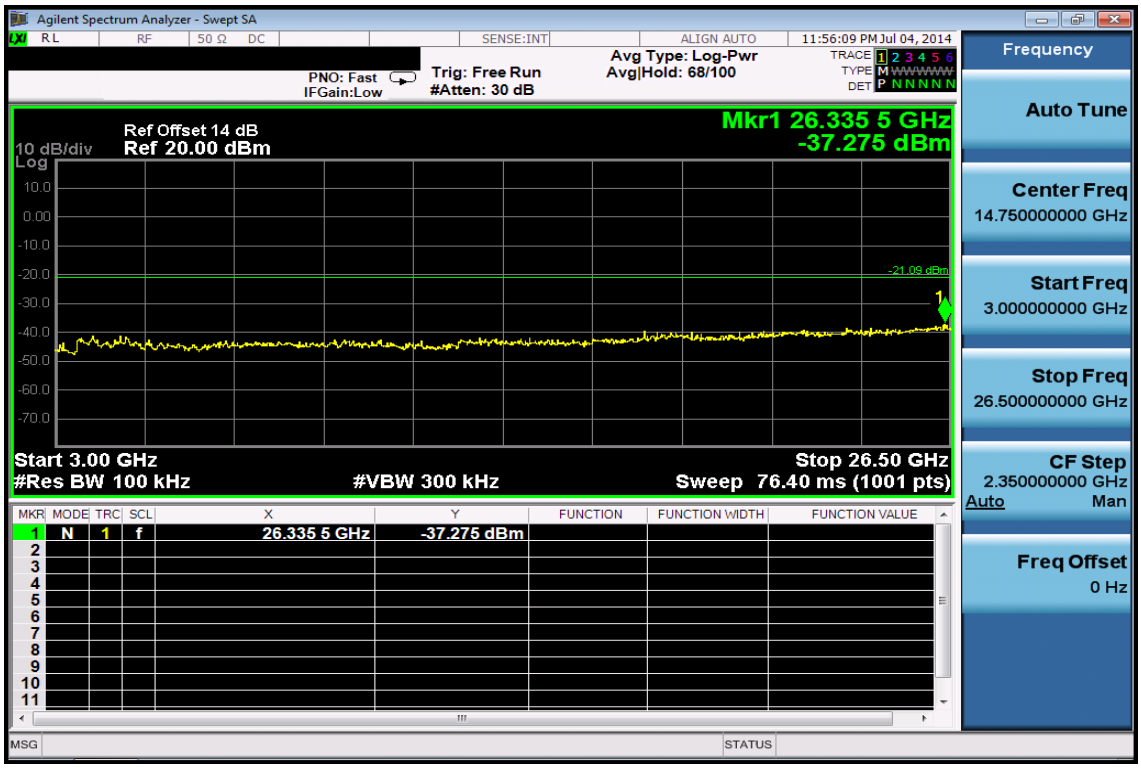
# Conducted Spurious Emission Measurement Result (802.11n_40M)

## Ch Low 30MHz – 3GHz




## Ch Low 3GHz – 26.5GHz

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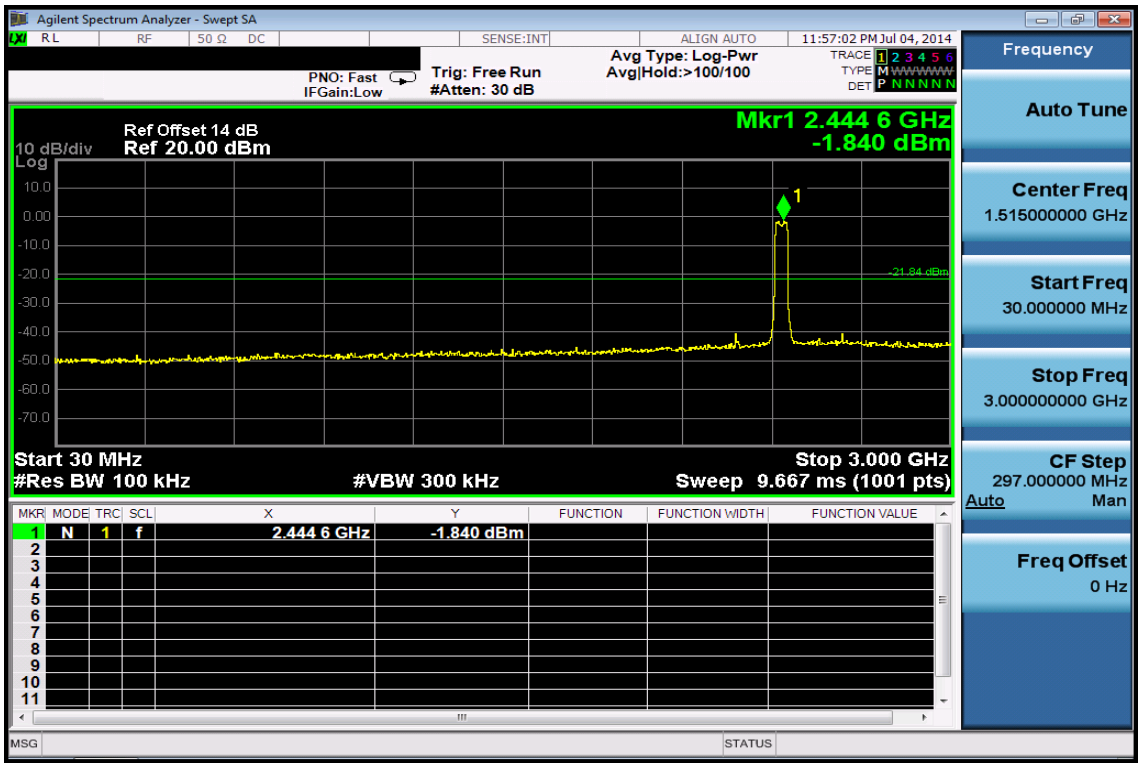
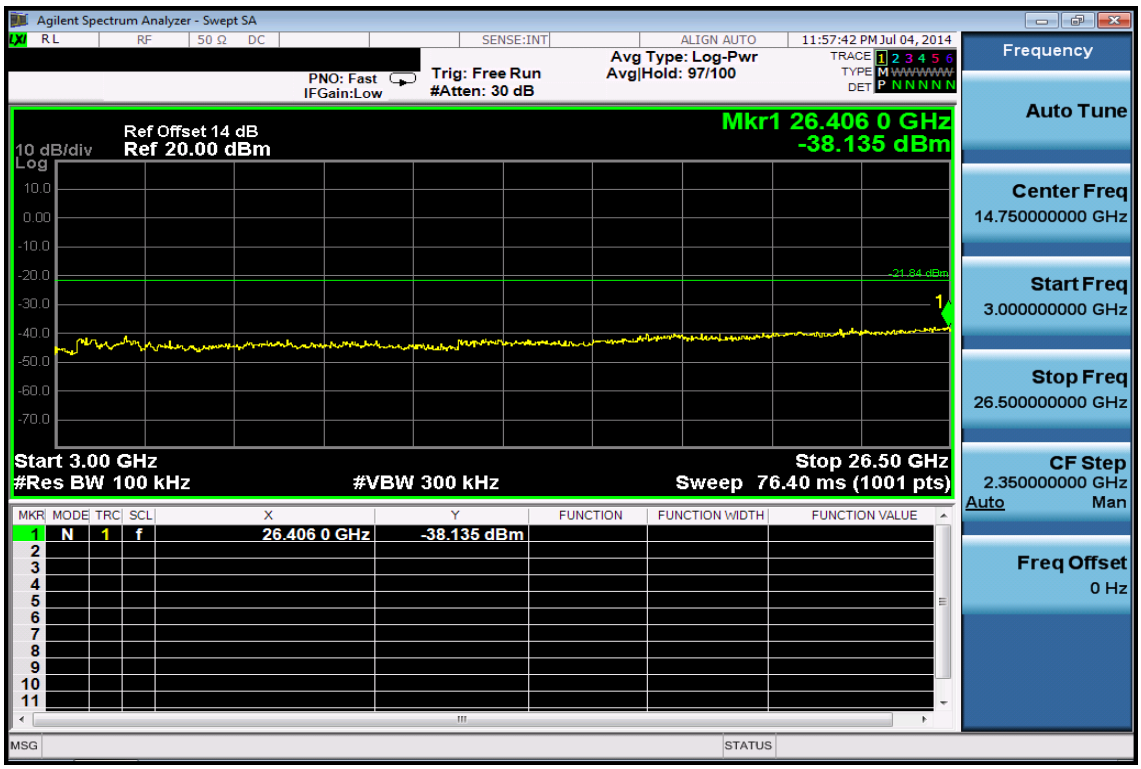
## Ch Mid 30MHz – 3GHz




## Ch Mid 3GHz – 26.5GHz

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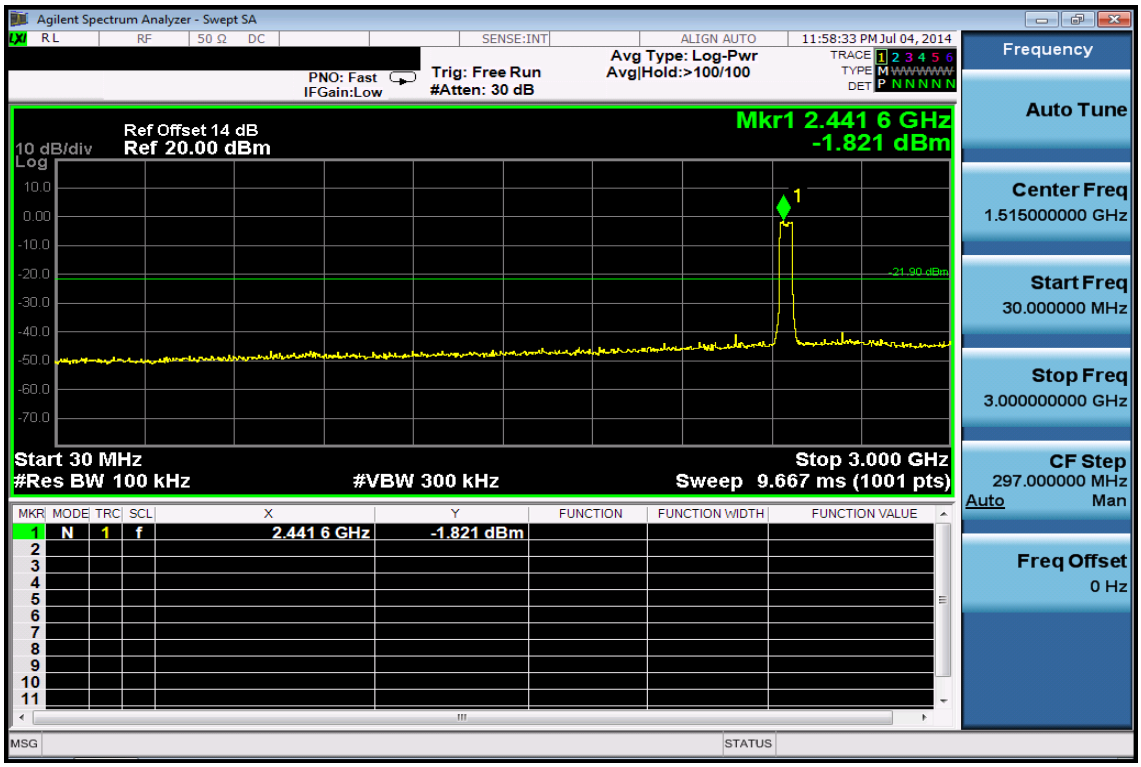
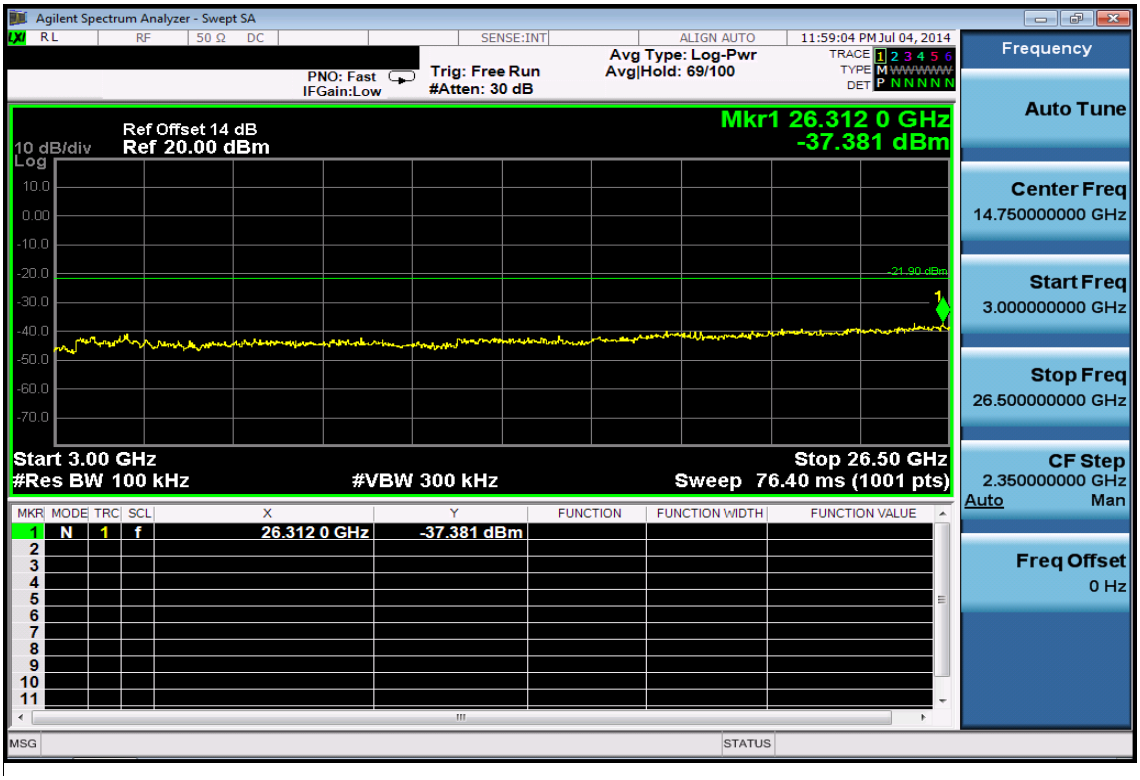
## Ch High 30MHz – 3GHz




## Ch High 3GHz – 26.5GHz

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## Radiated Spurious Emission Measurement Result (802.11b)

| | | | |
|---|---|---|---|
| Operation Band | :802.11 b | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 39.70 | S | QP | 55.73 | -21.08 | 34.65 | 40.00 | -5.35 |
| 65.89 | S | QP | 60.26 | -29.24 | 31.02 | 40.00 | -8.98 |
| 101.78 | S | Peak | 62.83 | -22.93 | 39.90 | 43.50 | -3.60 |
| 224.97 | S | Peak | 53.09 | -23.61 | 29.48 | 46.00 | -16.52 |
| 450.01 | S | Peak | 44.28 | -15.10 | 29.19 | 46.00 | -16.81 |
| 675.05 | S | Peak | 50.44 | -11.38 | 39.06 | 46.00 | -6.94 |
| 4824.00 | H | Peak | 43.22 | 0.70 | 43.92 | 74.00 | -30.08 |
| 4824.00 | H | Average | 30.13 | 0.70 | 30.83 | 54.00 | -23.17 |
| 7236.00 | H | Peak | 53.59 | 5.02 | 58.61 | 74.00 | -15.39 |
| 7236.00 | H | Average | 47.56 | 5.02 | 52.58 | 54.00 | -1.42 |
| 9648.00 | H | Peak | | | | | |
| 12060.00 | H | Peak | | | | | |
| 14472.00 | H | Peak | | | | | |
| 16884.00 | H | Peak | | | | | |
| 19296.00 | H | Peak | | | | | |
| 21708.00 | H | Peak | | | | | |
| 24120.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 b | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 63.95 | S | Peak | 61.31 | -29.19 | 32.12 | 40.00 | -7.88 |
| 98.87 | S | Peak | 60.88 | -23.34 | 37.54 | 43.50 | -5.96 |
| 224.97 | S | Peak | 61.35 | -23.61 | 37.74 | 46.00 | -8.26 |
| 399.57 | S | Peak | 52.38 | -15.64 | 36.74 | 46.00 | -9.26 |
| 675.05 | S | Peak | 46.16 | -11.38 | 34.78 | 46.00 | -11.22 |
| 901.06 | S | Peak | 41.68 | -9.17 | 32.52 | 46.00 | -13.48 |
| 4824.00 | H | Peak | 43.56 | 0.70 | 44.26 | 74.00 | -29.74 |
| 4824.00 | H | Average | 39.22 | 0.70 | 39.92 | 54.00 | -14.08 |
| 7236.00 | H | Peak | 52.98 | 5.02 | 58.00 | 74.00 | -16.00 |
| 7236.00 | H | Average | 48.03 | 5.02 | 53.05 | 54.00 | -0.95 |
| 9648.00 | H | Peak | | | | | |
| 12060.00 | H | Peak | | | | | |
| 14472.00 | H | Peak | | | | | |
| 16884.00 | H | Peak | | | | | |
| 19296.00 | H | Peak | | | | | |
| 21708.00 | H | Peak | | | | | |
| 24120.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 b | Test Date | :2014-07-04 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX MID | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 39.70 | S | QP | 56.23 | -21.08 | 35.15 | 40.00 | -4.85 |
| 65.89 | S | QP | 60.26 | -29.24 | 31.02 | 40.00 | -8.98 |
| 101.78 | S | Peak | 61.42 | -22.93 | 38.49 | 43.50 | -5.01 |
| 224.97 | S | Peak | 53.55 | -23.61 | 29.93 | 46.00 | -16.07 |
| 399.57 | S | Peak | 48.66 | -15.64 | 33.03 | 46.00 | -12.97 |
| 675.05 | S | Peak | 48.04 | -11.38 | 36.66 | 46.00 | -9.34 |
| 4874.00 | H | Peak | 45.30 | 0.70 | 46.00 | 74.00 | -28.00 |
| 4874.00 | H | Average | 41.23 | 0.70 | 41.93 | 54.00 | -12.07 |
| 7311.00 | H | Peak | 53.48 | 5.07 | 58.55 | 74.00 | -15.45 |
| 7311.00 | H | Average | 47.36 | 5.07 | 52.43 | 54.00 | -1.57 |
| 9748.00 | H | Peak | | | | | |
| 12185.00 | H | Peak | | | | | |
| 14622.00 | H | Peak | | | | | |
| 17059.00 | H | Peak | | | | | |
| 19496.00 | H | Peak | | | | | |
| 21933.00 | H | Peak | | | | | |
| 24370.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 b | Test Date | :2014-07-04 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX MID | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 64.92 | S | Peak | 62.84 | -29.22 | 33.62 | 40.00 | -6.38 |
| 101.78 | S | Peak | 60.32 | -22.93 | 37.39 | 43.50 | -6.11 |
| 224.97 | S | Peak | 62.59 | -23.61 | 38.97 | 46.00 | -7.03 |
| 390.84 | S | Peak | 52.75 | -16.25 | 36.50 | 46.00 | -9.50 |
| 675.05 | S | Peak | 46.18 | -11.38 | 34.80 | 46.00 | -11.20 |
| 901.06 | S | Peak | 41.30 | -9.17 | 32.14 | 46.00 | -13.86 |
| 4874.00 | H | Peak | 42.54 | 0.70 | 43.24 | 74.00 | -30.76 |
| 4874.00 | H | Average | 36.26 | 0.70 | 36.96 | 54.00 | -17.04 |
| 7311.00 | H | Peak | 51.48 | 5.07 | 56.55 | 74.00 | -17.45 |
| 7311.00 | H | Average | 47.85 | 5.07 | 52.92 | 54.00 | -1.08 |
| 9748.00 | H | Peak | | | | | |
| 12185.00 | H | Peak | | | | | |
| 14622.00 | H | Peak | | | | | |
| 17059.00 | H | Peak | | | | | |
| 19496.00 | H | Peak | | | | | |
| 21933.00 | H | Peak | | | | | |
| 24370.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 b | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 37.76 | S | QP | 49.83 | -19.82 | 30.01 | 40.00 | -9.99 |
| 52.31 | S | QP | 58.45 | -27.05 | 31.40 | 40.00 | -8.60 |
| 100.81 | S | Peak | 62.71 | -23.05 | 39.66 | 43.50 | -3.84 |
| 224.97 | S | Peak | 55.04 | -23.61 | 31.43 | 46.00 | -14.57 |
| 390.84 | S | Peak | 49.22 | -16.25 | 32.98 | 46.00 | -13.02 |
| 675.05 | S | Peak | 49.08 | -11.38 | 37.70 | 46.00 | -8.30 |
| 4924.00 | H | Peak | 43.85 | 0.78 | 44.63 | 74.00 | -29.37 |
| 4924.00 | H | Average | 39.54 | 0.78 | 40.32 | 54.00 | -13.68 |
| 7386.00 | H | Peak | 51.33 | 5.21 | 56.54 | 74.00 | -17.46 |
| 7386.00 | H | Average | 47.26 | 5.21 | 52.47 | 54.00 | -1.53 |
| 9848.00 | H | Peak | | | | | |
| 12310.00 | H | Peak | | | | | |
| 14772.00 | H | Peak | | | | | |
| 17234.00 | H | Peak | | | | | |
| 19696.00 | H | Peak | | | | | |
| 22158.00 | H | Peak | | | | | |
| 24620.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 b | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 64.92 | S | Peak | 61.28 | -29.22 | 32.06 | 40.00 | -7.94 |
| 101.78 | S | Peak | 58.69 | -22.93 | 35.76 | 43.50 | -7.74 |
| 224.97 | S | Peak | 61.82 | -23.61 | 38.21 | 46.00 | -7.79 |
| 390.84 | S | Peak | 52.98 | -16.25 | 36.73 | 46.00 | -9.27 |
| 675.05 | S | Peak | 46.17 | -11.38 | 34.79 | 46.00 | -11.21 |
| 901.06 | S | Peak | 41.42 | -9.17 | 32.26 | 46.00 | -13.74 |
| 4924.00 | H | Peak | 42.84 | 0.78 | 43.62 | 74.00 | -30.38 |
| 4924.00 | H | Average | 33.26 | 0.78 | 34.04 | 54.00 | -19.96 |
| 7386.00 | H | Peak | 53.80 | 5.21 | 59.01 | 74.00 | -14.99 |
| 7386.00 | H | Average | 47.51 | 5.21 | 52.72 | 54.00 | -1.28 |
| 9848.00 | H | Peak | | | | | |
| 12310.00 | H | Peak | | | | | |
| 14772.00 | H | Peak | | | | | |
| 17234.00 | H | Peak | | | | | |
| 19696.00 | H | Peak | | | | | |
| 22158.00 | H | Peak | | | | | |
| 24620.00 | H | Peak | | | | | |

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## Radiated Spurious Emission Measurement Result (802.11g)

| | | | |
|---|---|---|---|
| Operation Band | :802.11 g | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 37.76 | S | QP | 50.83 | -19.82 | 31.01 | 40.00 | -8.99 |
| 64.92 | S | QP | 59.66 | -29.22 | 30.44 | 40.00 | -9.56 |
| 101.78 | S | Peak | 61.90 | -22.93 | 38.97 | 43.50 | -4.53 |
| 224.97 | S | Peak | 55.31 | -23.61 | 31.70 | 46.00 | -14.30 |
| 390.84 | S | Peak | 50.82 | -16.25 | 34.57 | 46.00 | -11.43 |
| 675.05 | S | Peak | 48.48 | -11.38 | 37.10 | 46.00 | -8.90 |
| 4824.00 | H | Peak | 42.01 | 0.70 | 42.70 | 74.00 | -31.30 |
| 4824.00 | H | Average | 29.62 | 0.70 | 30.32 | 54.00 | -23.68 |
| 7236.00 | H | Peak | 53.59 | 5.02 | 58.61 | 74.00 | -15.39 |
| 7236.00 | H | Average | 31.85 | 5.02 | 36.87 | 54.00 | -17.13 |
| 9648.00 | H | Peak | | | | | |
| 12060.00 | H | Peak | | | | | |
| 14472.00 | H | Peak | | | | | |
| 16884.00 | H | Peak | | | | | |
| 19296.00 | H | Peak | | | | | |
| 21708.00 | H | Peak | | | | | |
| 24120.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 g | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 64.92 | S | Peak | 62.37 | -29.22 | 33.14 | 40.00 | -6.86 |
| 100.81 | S | Peak | 60.25 | -23.05 | 37.20 | 43.50 | -6.30 |
| 224.97 | S | Peak | 62.16 | -23.61 | 38.55 | 46.00 | -7.45 |
| 390.84 | S | Peak | 52.92 | -16.25 | 36.67 | 46.00 | -9.33 |
| 675.05 | S | Peak | 48.61 | -11.38 | 37.23 | 46.00 | -8.77 |
| 901.06 | S | Peak | 40.78 | -9.17 | 31.61 | 46.00 | -14.39 |
| 4824.00 | H | Peak | 41.39 | 0.70 | 42.08 | 74.00 | -31.92 |
| 4824.00 | H | Average | 29.53 | 0.70 | 30.23 | 54.00 | -23.77 |
| 7236.00 | H | Peak | 44.65 | 5.02 | 49.67 | 74.00 | -24.33 |
| 7236.00 | H | Average | 27.18 | 5.02 | 32.20 | 54.00 | -21.80 |
| 9648.00 | H | Peak | | | | | |
| 12060.00 | H | Peak | | | | | |
| 14472.00 | H | Peak | | | | | |
| 16884.00 | H | Peak | | | | | |
| 19296.00 | H | Peak | | | | | |
| 21708.00 | H | Peak | | | | | |
| 24120.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 g | Test Date | :2014-07-04 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX MID | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 37.76 | S | QP | 51.53 | -19.82 | 31.71 | 40.00 | -8.29 |
| 64.92 | S | Peak | 66.86 | -29.22 | 37.63 | 40.00 | -2.37 |
| 101.78 | S | Peak | 63.09 | -22.93 | 40.16 | 43.50 | -3.34 |
| 224.97 | S | Peak | 53.72 | -23.61 | 30.11 | 46.00 | -15.89 |
| 675.05 | S | Peak | 48.39 | -11.38 | 37.01 | 46.00 | -8.99 |
| 797.27 | S | Peak | 40.22 | -10.17 | 30.05 | 46.00 | -15.95 |
| 4874.00 | H | Peak | 41.86 | 0.70 | 42.56 | 74.00 | -31.44 |
| 4874.00 | H | Average | 29.17 | 0.70 | 29.87 | 54.00 | -24.13 |
| 7311.00 | H | Peak | 53.05 | 5.07 | 58.12 | 74.00 | -15.88 |
| 7311.00 | H | Average | 32.39 | 5.07 | 37.46 | 54.00 | -16.54 |
| 9748.00 | H | Peak | | | | | |
| 12185.00 | H | Peak | | | | | |
| 14622.00 | H | Peak | | | | | |
| 17059.00 | H | Peak | | | | | |
| 19496.00 | H | Peak | | | | | |
| 21933.00 | H | Peak | | | | | |
| 24370.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 g | Test Date | :2014-07-04 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX MID | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 63.95 | S | Peak | 61.07 | -29.19 | 31.88 | 40.00 | -8.12 |
| 98.87 | S | Peak | 61.02 | -23.34 | 37.68 | 43.50 | -5.82 |
| 224.97 | S | Peak | 61.46 | -23.61 | 37.85 | 46.00 | -8.15 |
| 390.84 | S | Peak | 53.17 | -16.25 | 36.92 | 46.00 | -9.08 |
| 675.05 | S | Peak | 46.25 | -11.38 | 34.87 | 46.00 | -11.13 |
| 901.06 | S | Peak | 40.68 | -9.17 | 31.51 | 46.00 | -14.49 |
| 4874.00 | H | Peak | 42.40 | 0.70 | 43.11 | 74.00 | -30.89 |
| 4874.00 | H | Average | 29.34 | 0.70 | 30.04 | 54.00 | -23.96 |
| 7311.00 | H | Peak | 44.96 | 5.07 | 50.02 | 74.00 | -23.98 |
| 7311.00 | H | Average | 28.30 | 5.07 | 33.37 | 54.00 | -20.63 |
| 9748.00 | H | Peak | | | | | |
| 12185.00 | H | Peak | | | | | |
| 14622.00 | H | Peak | | | | | |
| 17059.00 | H | Peak | | | | | |
| 19496.00 | H | Peak | | | | | |
| 21933.00 | H | Peak | | | | | |
| 24370.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 g | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 39.70 | S | QP | 55.83 | -21.08 | 34.75 | 40.00 | -5.25 |
| 52.31 | S | QP | 58.45 | -27.05 | 31.40 | 40.00 | -8.60 |
| 101.78 | S | Peak | 62.91 | -22.93 | 39.98 | 43.50 | -3.52 |
| 224.97 | S | Peak | 53.18 | -23.61 | 29.57 | 46.00 | -16.43 |
| 390.84 | S | Peak | 47.83 | -16.25 | 31.58 | 46.00 | -14.42 |
| 675.05 | S | Peak | 45.88 | -11.38 | 34.50 | 46.00 | -11.50 |
| 4924.00 | H | Peak | 41.44 | 0.78 | 42.21 | 74.00 | -31.79 |
| 4924.00 | H | Average | 29.13 | 0.78 | 29.90 | 54.00 | -24.10 |
| 7386.00 | H | Peak | 52.79 | 5.21 | 58.00 | 74.00 | -16.00 |
| 7386.00 | H | Average | 32.06 | 5.21 | 37.27 | 54.00 | -16.73 |
| 9848.00 | H | Peak | | | | | |
| 12310.00 | H | Peak | | | | | |
| 14772.00 | H | Peak | | | | | |
| 17234.00 | H | Peak | | | | | |
| 19696.00 | H | Peak | | | | | |
| 22158.00 | H | Peak | | | | | |
| 24620.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 g | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 64.92 | S | Peak | 61.95 | -29.22 | 32.73 | 40.00 | -7.27 |
| 98.87 | S | Peak | 60.80 | -23.34 | 37.45 | 43.50 | -6.05 |
| 224.97 | S | Peak | 61.37 | -23.61 | 37.75 | 46.00 | -8.25 |
| 390.84 | S | Peak | 52.56 | -16.25 | 36.32 | 46.00 | -9.68 |
| 675.05 | S | Peak | 45.67 | -11.38 | 34.29 | 46.00 | -11.71 |
| 901.06 | S | Peak | 40.73 | -9.17 | 31.57 | 46.00 | -14.43 |
| 4924.00 | H | Peak | 42.48 | 0.78 | 43.25 | 74.00 | -30.75 |
| 4924.00 | H | Average | 29.20 | 0.78 | 29.97 | 54.00 | -24.03 |
| 7386.00 | H | Peak | 43.79 | 5.21 | 49.00 | 74.00 | -25.00 |
| 7386.00 | H | Average | 28.37 | 5.21 | 33.58 | 54.00 | -20.42 |
| 9848.00 | H | Peak | | | | | |
| 12310.00 | H | Peak | | | | | |
| 14772.00 | H | Peak | | | | | |
| 17234.00 | H | Peak | | | | | |
| 19696.00 | H | Peak | | | | | |
| 22158.00 | H | Peak | | | | | |
| 24620.00 | H | Peak | | | | | |

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## Radiated Spurious Emission Measurement Result (802.11n_20M)

| | | | |
|---|---|---|---|
| Operation Band | :802.11 n20M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 37.76 | S | QP | 50.03 | -19.82 | 30.21 | 40.00 | -9.79 |
| 52.31 | S | QP | 58.55 | -27.05 | 31.50 | 40.00 | -8.50 |
| 98.87 | S | Peak | 62.70 | -23.34 | 39.36 | 43.50 | -4.14 |
| 353.98 | S | Peak | 55.73 | -17.21 | 38.53 | 46.00 | -7.47 |
| 675.05 | S | Peak | 47.42 | -11.38 | 36.04 | 46.00 | -9.96 |
| 800.18 | S | Peak | 39.71 | -10.16 | 29.55 | 46.00 | -16.46 |
| 4829.00 | H | Peak | 44.11 | 0.70 | 44.80 | 74.00 | -29.20 |
| 4829.00 | H | Average | 29.55 | 0.70 | 30.25 | 54.00 | -23.75 |
| 7236.00 | H | Peak | 59.42 | 5.02 | 64.44 | 74.00 | -9.56 |
| 7236.00 | H | Average | 44.83 | 5.02 | 49.85 | 54.00 | -4.15 |
| 9648.00 | H | Peak | | | | | |
| 12060.00 | H | Peak | | | | | |
| 14472.00 | H | Peak | | | | | |
| 16884.00 | H | Peak | | | | | |
| 19296.00 | H | Peak | | | | | |
| 21708.00 | H | Peak | | | | | |
| 24120.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n20M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 65.89 | S | Peak | 59.15 | -29.24 | 29.91 | 40.00 | -10.09 |
| 101.78 | S | Peak | 60.68 | -22.93 | 37.75 | 43.50 | -5.75 |
| 224.97 | S | Peak | 60.14 | -23.61 | 36.53 | 46.00 | -9.47 |
| 390.84 | S | Peak | 53.04 | -16.25 | 36.79 | 46.00 | -9.21 |
| 675.05 | S | Peak | 45.74 | -11.38 | 34.36 | 46.00 | -11.64 |
| 901.06 | S | Peak | 42.22 | -9.17 | 33.06 | 46.00 | -12.94 |
| 4824.00 | H | Peak | 41.32 | 0.70 | 42.02 | 74.00 | -31.98 |
| 4824.00 | H | Average | 29.89 | 0.70 | 30.59 | 54.00 | -23.41 |
| 7236.00 | H | Peak | 47.00 | 5.02 | 52.02 | 74.00 | -21.98 |
| 7236.00 | H | Average | 33.60 | 5.02 | 38.62 | 54.00 | -15.38 |
| 9648.00 | H | Peak | | | | | |
| 12060.00 | H | Peak | | | | | |
| 14472.00 | H | Peak | | | | | |
| 16884.00 | H | Peak | | | | | |
| 19296.00 | H | Peak | | | | | |
| 21708.00 | H | Peak | | | | | |
| 24120.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n20M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX MID | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 39.70 | S | QP | 56.03 | -21.08 | 34.95 | 40.00 | -5.05 |
| 101.78 | S | Peak | 61.88 | -22.93 | 38.95 | 43.50 | -4.55 |
| 144.46 | S | Peak | 57.70 | -22.35 | 35.35 | 43.50 | -8.15 |
| 390.84 | S | Peak | 50.02 | -16.25 | 33.77 | 46.00 | -12.23 |
| 675.05 | S | Peak | 49.49 | -11.38 | 38.11 | 46.00 | -7.89 |
| 901.06 | S | Peak | 37.99 | -9.17 | 28.82 | 46.00 | -17.18 |
| 4874.00 | H | Peak | 41.82 | 0.70 | 42.53 | 74.00 | -31.47 |
| 4874.00 | H | Average | 30.19 | 0.70 | 30.89 | 54.00 | -23.11 |
| 7311.00 | H | Peak | 56.56 | 5.07 | 61.63 | 74.00 | -12.37 |
| 7311.00 | H | Average | 36.27 | 5.07 | 41.34 | 54.00 | -12.66 |
| 9748.00 | H | Peak | | | | | |
| 12185.00 | H | Peak | | | | | |
| 14622.00 | H | Peak | | | | | |
| 17059.00 | H | Peak | | | | | |
| 19496.00 | H | Peak | | | | | |
| 21933.00 | H | Peak | | | | | |
| 24370.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n20M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX MID | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 63.95 | S | Peak | 61.25 | -29.19 | 32.06 | 40.00 | -7.94 |
| 99.84 | S | Peak | 59.87 | -23.19 | 36.69 | 43.50 | -6.81 |
| 224.97 | S | Peak | 60.69 | -23.61 | 37.07 | 46.00 | -8.93 |
| 390.84 | S | Peak | 52.65 | -16.25 | 36.40 | 46.00 | -9.60 |
| 675.05 | S | Peak | 45.77 | -11.38 | 34.39 | 46.00 | -11.61 |
| 901.06 | S | Peak | 41.51 | -9.17 | 32.34 | 46.00 | -13.66 |
| 4874.00 | H | Peak | 42.23 | 0.70 | 42.93 | 74.00 | -31.07 |
| 4874.00 | H | Average | 29.26 | 0.70 | 29.96 | 54.00 | -24.04 |
| 7311.00 | H | Peak | 43.81 | 5.07 | 48.88 | 74.00 | -25.12 |
| 7311.00 | H | Average | 28.80 | 5.07 | 33.87 | 54.00 | -20.13 |
| 9748.00 | H | Peak | | | | | |
| 12185.00 | H | Peak | | | | | |
| 14622.00 | H | Peak | | | | | |
| 17059.00 | H | Peak | | | | | |
| 19496.00 | H | Peak | | | | | |
| 21933.00 | H | Peak | | | | | |
| 24370.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n20M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 37.76 | S | QP | 50.43 | -19.82 | 30.61 | 40.00 | -9.39 |
| 101.78 | S | Peak | 62.26 | -22.93 | 39.33 | 43.50 | -4.17 |
| 224.97 | S | Peak | 53.92 | -23.61 | 30.31 | 46.00 | -15.69 |
| 390.84 | S | Peak | 43.91 | -16.25 | 27.66 | 46.00 | -18.34 |
| 507.24 | S | Peak | 42.13 | -14.02 | 28.11 | 46.00 | -17.89 |
| 675.05 | S | Peak | 46.49 | -11.38 | 35.11 | 46.00 | -10.89 |
| 4924.00 | H | Peak | 42.21 | 0.78 | 42.99 | 74.00 | -31.01 |
| 4924.00 | H | Average | 30.02 | 0.78 | 30.80 | 54.00 | -23.20 |
| 7386.00 | H | Peak | 59.27 | 5.22 | 64.49 | 74.00 | -9.51 |
| 7386.00 | H | Average | 41.35 | 5.22 | 46.57 | 54.00 | -7.43 |
| 9848.00 | H | Peak | | | | | |
| 12310.00 | H | Peak | | | | | |
| 14772.00 | H | Peak | | | | | |
| 17234.00 | H | Peak | | | | | |
| 19696.00 | H | Peak | | | | | |
| 22158.00 | H | Peak | | | | | |
| 24620.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n20M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 64.92 | S | Peak | 60.07 | -29.22 | 30.85 | 40.00 | -9.15 |
| 98.87 | S | Peak | 60.50 | -23.34 | 37.16 | 43.50 | -6.34 |
| 224.97 | S | Peak | 59.64 | -23.61 | 36.02 | 46.00 | -9.98 |
| 399.57 | S | Peak | 52.51 | -15.64 | 36.87 | 46.00 | -9.13 |
| 675.05 | S | Peak | 48.51 | -11.38 | 37.13 | 46.00 | -8.87 |
| 901.06 | S | Peak | 40.36 | -9.17 | 31.19 | 46.00 | -14.81 |
| 4924.00 | H | Peak | 42.29 | 0.78 | 43.07 | 74.00 | -30.93 |
| 4924.00 | H | Average | 30.28 | 0.78 | 31.06 | 54.00 | -22.94 |
| 7386.00 | H | Peak | 50.25 | 5.22 | 55.47 | 74.00 | -18.53 |
| 7386.00 | H | Average | 34.71 | 5.22 | 39.93 | 54.00 | -14.07 |
| 9848.00 | H | Peak | | | | | |
| 12310.00 | H | Peak | | | | | |
| 14772.00 | H | Peak | | | | | |
| 17234.00 | H | Peak | | | | | |
| 19696.00 | H | Peak | | | | | |
| 22158.00 | H | Peak | | | | | |
| 24620.00 | H | Peak | | | | | |

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## Radiated Spurious Emission Measurement Result (802.11n_40M)

| | | | |
|---|---|---|---|
| Operation Band | :802.11 n40M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2422 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 37.76 | S | QP | 51.23 | -19.82 | 31.41 | 40.00 | -8.59 |
| 101.78 | S | Peak | 61.56 | -22.93 | 38.63 | 43.50 | -4.87 |
| 140.58 | S | Peak | 56.71 | -22.15 | 34.56 | 43.50 | -8.94 |
| 390.84 | S | Peak | 48.79 | -16.25 | 32.55 | 46.00 | -13.45 |
| 675.05 | S | Peak | 49.02 | -11.38 | 37.64 | 46.00 | -8.36 |
| 800.18 | S | Peak | 40.25 | -10.16 | 30.08 | 46.00 | -15.92 |
| 4844.00 | H | Peak | 41.89 | 0.70 | 42.59 | 74.00 | -31.41 |
| 4844.00 | H | Average | 29.36 | 0.70 | 30.06 | 54.00 | -23.94 |
| 7266.00 | H | Peak | 53.49 | 5.03 | 58.52 | 74.00 | -15.48 |
| 7266.00 | H | Average | 38.26 | 5.03 | 43.29 | 54.00 | -10.71 |
| 9688.00 | H | Peak | | | | | |
| 12110.00 | H | Peak | | | | | |
| 14532.00 | H | Peak | | | | | |
| 16954.00 | H | Peak | | | | | |
| 19376.00 | H | Peak | | | | | |
| 21798.00 | H | Peak | | | | | |
| 24220.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n40M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2422 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX LOW | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 63.95 | S | Peak | 61.27 | -29.19 | 32.08 | 40.00 | -7.92 |
| 100.81 | S | Peak | 59.03 | -23.05 | 35.98 | 43.50 | -7.52 |
| 224.97 | S | Peak | 61.38 | -23.61 | 37.76 | 46.00 | -8.24 |
| 390.84 | S | Peak | 52.36 | -16.25 | 36.12 | 46.00 | -9.88 |
| 675.05 | S | Peak | 46.67 | -11.38 | 35.30 | 46.00 | -10.71 |
| 901.06 | S | Peak | 40.42 | -9.17 | 31.25 | 46.00 | -14.75 |
| 4844.00 | H | Peak | 41.31 | 0.70 | 42.01 | 74.00 | -31.99 |
| 4844.00 | H | Average | 29.74 | 0.70 | 30.44 | 54.00 | -23.56 |
| 7266.00 | H | Peak | 43.85 | 5.03 | 48.88 | 74.00 | -25.12 |
| 7266.00 | H | Average | 30.14 | 5.03 | 35.17 | 54.00 | -18.83 |
| 9688.00 | H | Peak | | | | | |
| 12110.00 | H | Peak | | | | | |
| 14532.00 | H | Peak | | | | | |
| 16954.00 | H | Peak | | | | | |
| 19376.00 | H | Peak | | | | | |
| 21798.00 | H | Peak | | | | | |
| 24220.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n40M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX MID | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 39.70 | S | QP | 55.63 | -21.08 | 34.55 | 40.00 | -5.45 |
| 52.31 | S | QP | 58.35 | -27.05 | 31.30 | 40.00 | -8.70 |
| 101.78 | S | Peak | 61.60 | -22.93 | 38.67 | 43.50 | -4.83 |
| 138.64 | S | Peak | 58.29 | -21.99 | 36.30 | 43.50 | -7.20 |
| 390.84 | S | Peak | 50.40 | -16.25 | 34.16 | 46.00 | -11.84 |
| 675.05 | S | Peak | 49.75 | -11.38 | 38.37 | 46.00 | -7.63 |
| 4874.00 | H | Peak | 41.81 | 0.70 | 42.51 | 74.00 | -31.49 |
| 4874.00 | H | Average | 29.26 | 0.70 | 29.96 | 54.00 | -24.04 |
| 7311.00 | H | Peak | 55.15 | 5.07 | 60.22 | 74.00 | -13.78 |
| 7311.00 | H | Average | 42.18 | 5.07 | 47.25 | 54.00 | -6.75 |
| 9748.00 | H | Peak | | | | | |
| 12185.00 | H | Peak | | | | | |
| 14622.00 | H | Peak | | | | | |
| 17059.00 | H | Peak | | | | | |
| 19496.00 | H | Peak | | | | | |
| 21933.00 | H | Peak | | | | | |
| 24370.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n40M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX MID | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 64.92 | S | Peak | 62.03 | -29.22 | 32.81 | 40.00 | -7.19 |
| 100.81 | S | Peak | 60.99 | -23.05 | 37.94 | 43.50 | -5.56 |
| 224.97 | S | Peak | 61.39 | -23.61 | 37.78 | 46.00 | -8.22 |
| 390.84 | S | Peak | 52.09 | -16.25 | 35.84 | 46.00 | -10.16 |
| 675.05 | S | Peak | 49.17 | -11.38 | 37.79 | 46.00 | -8.21 |
| 901.06 | S | Peak | 40.45 | -9.17 | 31.29 | 46.00 | -14.71 |
| 4874.00 | H | Peak | 41.78 | 0.70 | 42.48 | 74.00 | -31.52 |
| 4874.00 | H | Average | 29.33 | 0.70 | 30.03 | 54.00 | -23.97 |
| 7311.00 | H | Peak | 48.06 | 5.07 | 53.13 | 74.00 | -20.87 |
| 7311.00 | H | Average | 36.02 | 5.07 | 41.09 | 54.00 | -12.91 |
| 9748.00 | H | Peak | | | | | |
| 12185.00 | H | Peak | | | | | |
| 14622.00 | H | Peak | | | | | |
| 17059.00 | H | Peak | | | | | |
| 19496.00 | H | Peak | | | | | |
| 21933.00 | H | Peak | | | | | |
| 24370.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n40M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2452 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 39.70 | S | QP | 56.13 | -21.08 | 35.05 | 40.00 | -4.95 |
| 63.95 | S | QP | 60.06 | -29.19 | 25.48 | 40.00 | -14.52 |
| 101.78 | S | Peak | 62.52 | -22.93 | 39.59 | 43.50 | -3.91 |
| 224.97 | S | Peak | 53.05 | -23.61 | 29.44 | 46.00 | -16.56 |
| 499.48 | S | Peak | 44.50 | -14.28 | 30.22 | 46.00 | -15.78 |
| 675.05 | S | Peak | 48.30 | -11.38 | 36.92 | 46.00 | -9.08 |
| 4904.00 | H | Peak | 41.69 | 0.72 | 42.41 | 74.00 | -31.59 |
| 4904.00 | H | Average | 30.06 | 0.72 | 30.78 | 54.00 | -23.22 |
| 7356.00 | H | Peak | 54.80 | 5.16 | 59.96 | 74.00 | -14.04 |
| 7356.00 | H | Average | 39.64 | 5.16 | 44.80 | 54.00 | -9.20 |
| 9808.00 | H | Peak | | | | | |
| 12260.00 | H | Peak | | | | | |
| 14712.00 | H | Peak | | | | | |
| 17164.00 | H | Peak | | | | | |
| 19616.00 | H | Peak | | | | | |
| 22068.00 | H | Peak | | | | | |
| 24520.00 | H | Peak | | | | | |

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| | | | |
|---|---|---|---|
| Operation Band | :802.11 n40M | Test Date | :2014-07-04 |
| Fundamental Frequency | :2452 MHz | Temp./Humi. | :27.6 deg_C / 54 RH |
| Operation Mode | :TX HIGH | Engineer | :Vito |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq. | Note | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|---|
| MHz | F/H/E/S | PK/QP/AV | dBμV | dB | dBμV/m | dBμV/m | dB |
| 63.95 | S | Peak | 61.10 | -29.19 | 31.91 | 40.00 | -8.09 |
| 98.87 | S | Peak | 60.58 | -23.34 | 37.24 | 43.50 | -6.26 |
| 224.97 | S | Peak | 60.73 | -23.61 | 37.12 | 46.00 | -8.88 |
| 390.84 | S | Peak | 52.49 | -16.25 | 36.25 | 46.00 | -9.75 |
| 675.05 | S | Peak | 47.22 | -11.38 | 35.84 | 46.00 | -10.16 |
| 901.06 | S | Peak | 41.05 | -9.17 | 31.89 | 46.00 | -14.11 |
| 4904.00 | H | Peak | 42.04 | 0.72 | 42.76 | 74.00 | -31.24 |
| 4904.00 | H | Average | 29.16 | 0.72 | 29.88 | 54.00 | -24.12 |
| 7356.00 | H | Peak | 46.15 | 5.16 | 51.31 | 74.00 | -22.69 |
| 7356.00 | H | Average | 32.66 | 5.16 | 37.82 | 54.00 | -16.18 |
| 9808.00 | H | Peak | | | | | |
| 12260.00 | H | Peak | | | | | |
| 14712.00 | H | Peak | | | | | |
| 17164.00 | H | Peak | | | | | |
| 19616.00 | H | Peak | | | | | |
| 22068.00 | H | Peak | | | | | |
| 24520.00 | H | Peak | | | | | |

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# 11 PEAK POWER SPECTRAL DENSITY

## 11.1 Standard Applicable:

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

According to RSS-210 issue 8, §A8.2(b) The transmitter power spectral density (into the antenna) shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## 11.2 Measurement Equipment Used:

Refer to section 7.2 for details.

## 11.3 Test Set-up:

Refer to section 7.3 for details. (Spectrum Option)

## 11.4 Measurement Procedure (following the measurement procedure 10.2 of KDB558074):

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW ≥ 3 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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## 11.5 Measurement Result:

### 802.11b

| Frequency MHz | RF Power Density Reading (dBm) | Maximum Limit (dBm) |
|---|---|---|
| 2412 | -7.532 | 8 |
| 2437 | -8.011 | 8 |
| 2462 | -8.086 | 8 |

### 802.11g

| Frequency MHz | RF Power Density Reading (dBm) | Maximum Limit (dBm) |
|---|---|---|
| 2412 | -14.862 | 8 |
| 2437 | -16.013 | 8 |
| 2462 | -15.108 | 8 |

### 802.11n_20M

| Frequency MHz | RF Power Density Reading (dBm) | Maximum Limit (dBm) |
|---|---|---|
| 2412 | -13.114 | 8 |
| 2437 | -13.489 | 8 |
| 2462 | -12.777 | 8 |

### 802.11n_40M

| Frequency MHz | RF Power Density Reading (dBm) | Maximum Limit (dBm) |
|---|---|---|
| 2422 | -16.230 | 8 |
| 2437 | -15.969 | 8 |
| 2452 | -16.603 | 8 |

** Note: Offset 11dB for 2.4G 802.11b/g;*

*Offset 14dB for 2.4G 802.11n_20/n_40.*

**Refer to next page for plots*

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## 802.11b

## Power Spectral Density Test Plot (CH-Low)


## Power Spectral Density Test Plot (CH-Mid)


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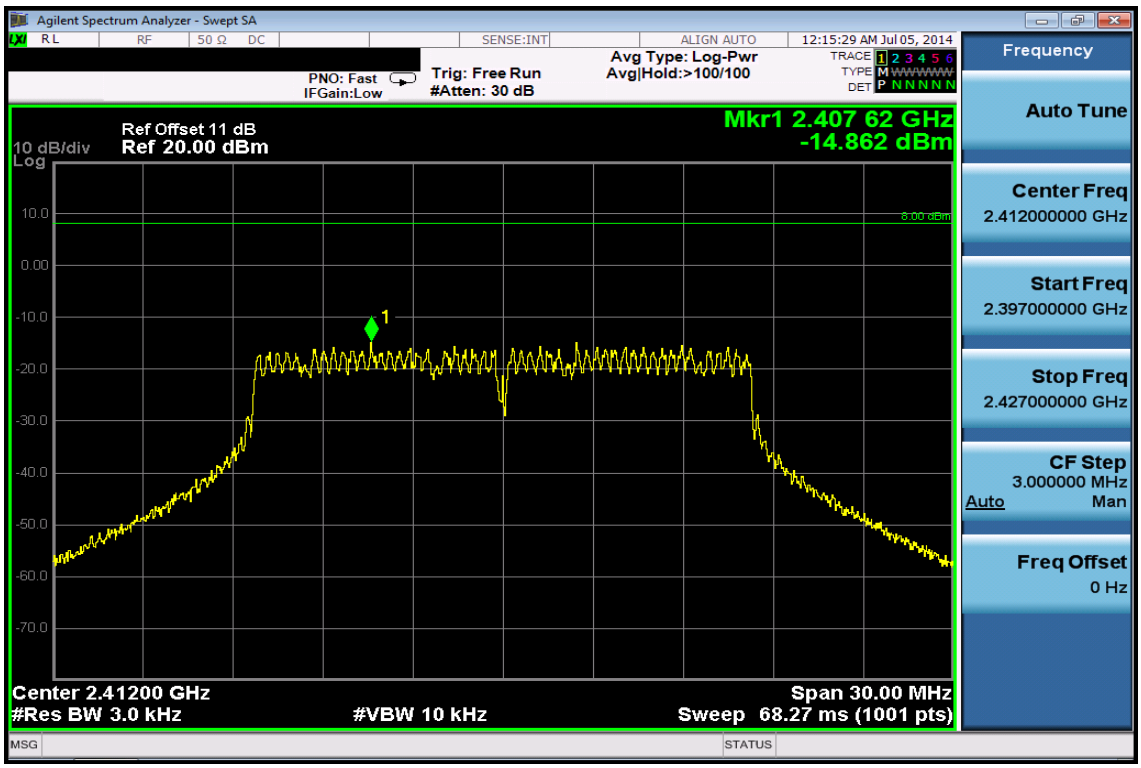
## Power Spectral Density Test Plot (CH-High)


## 802.11g

## Power Spectral Density Test Plot (CH-Low)

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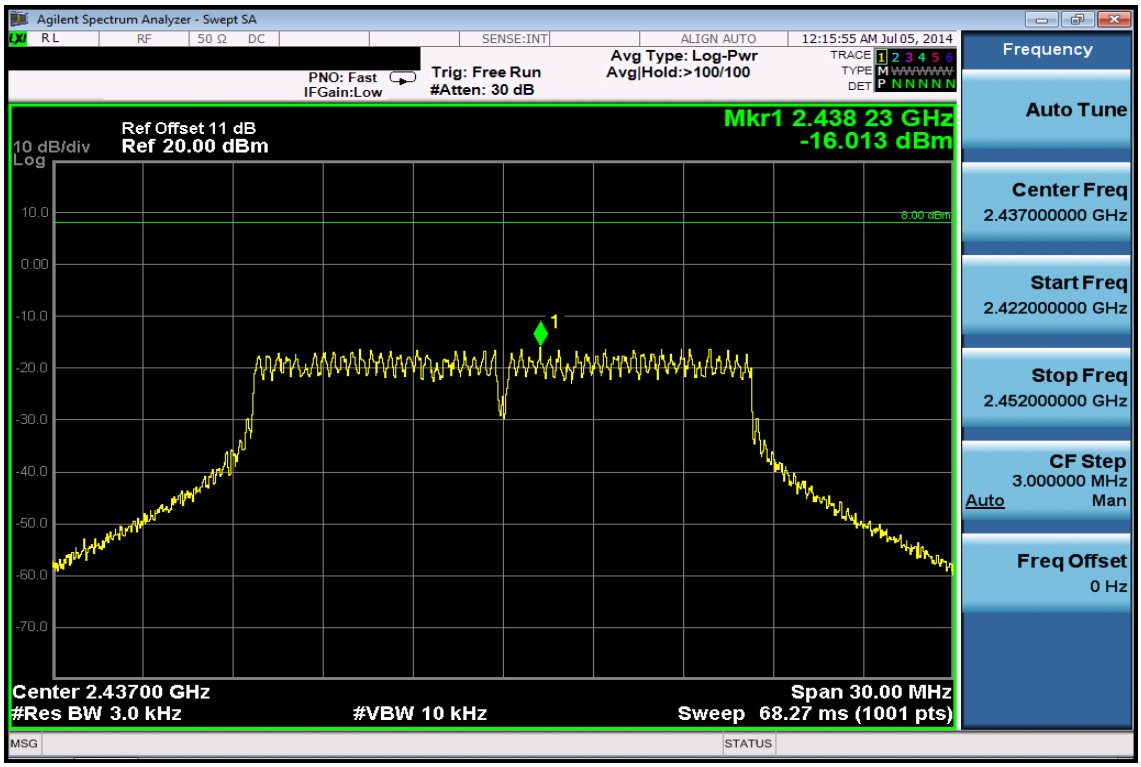
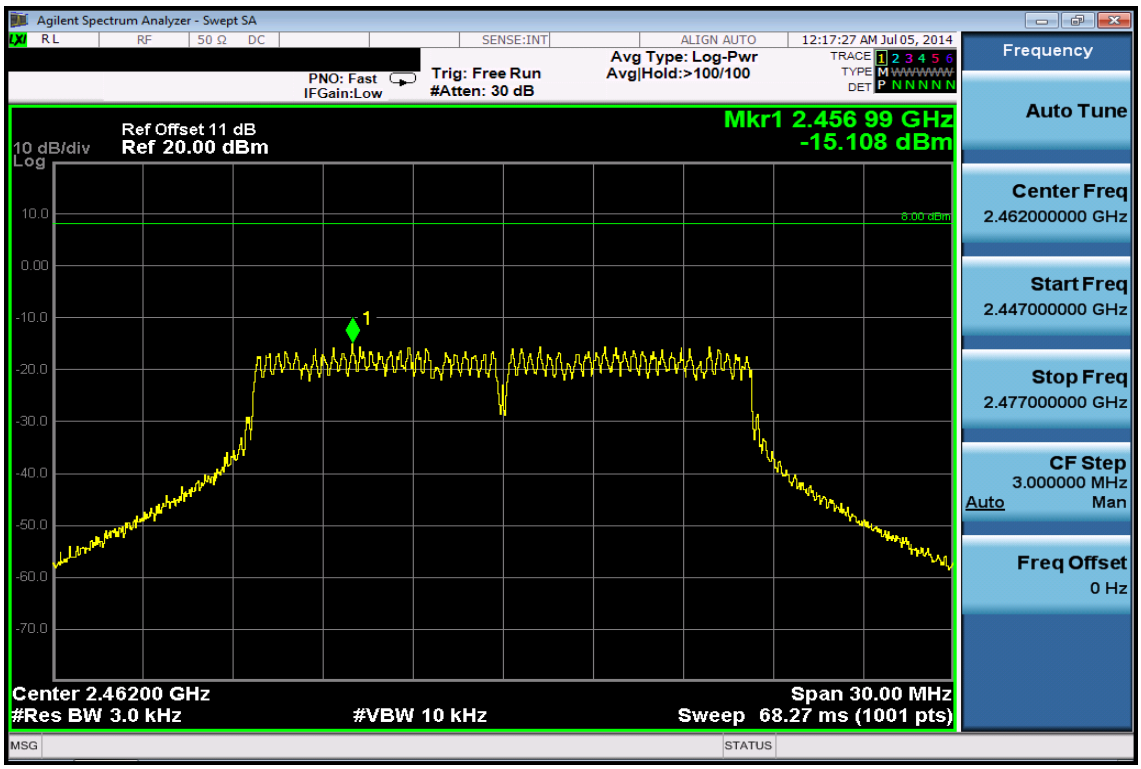
## Power Spectral Density Test Plot (CH-Mid)




## Power Spectral Density Test Plot (CH-High)

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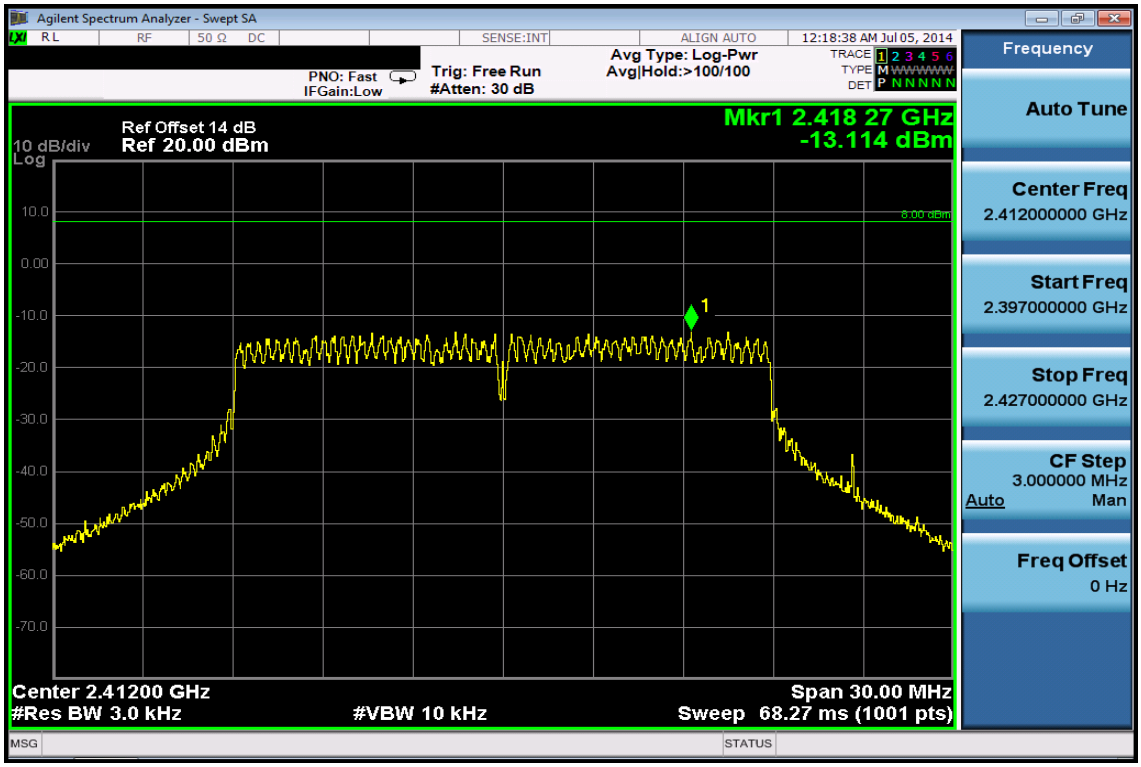
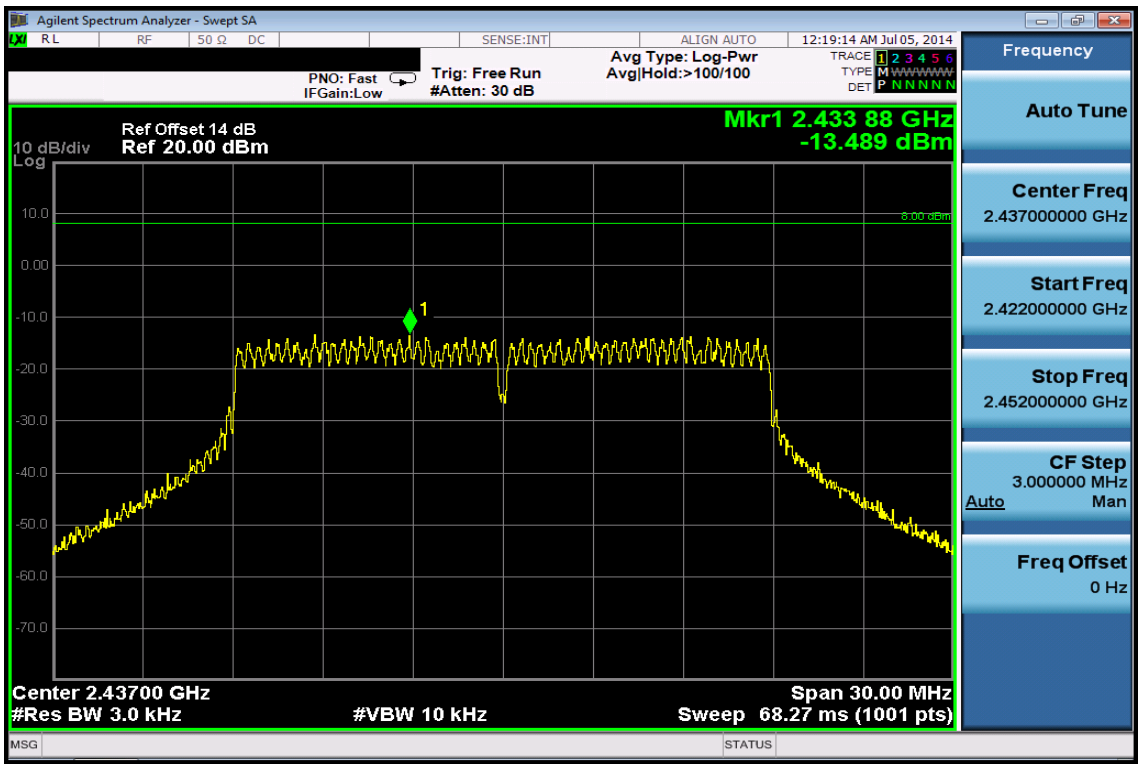
## 802.11n_20M

## Power Spectral Density Test Plot (CH-Low)




## Power Spectral Density Test Plot (CH-Mid)

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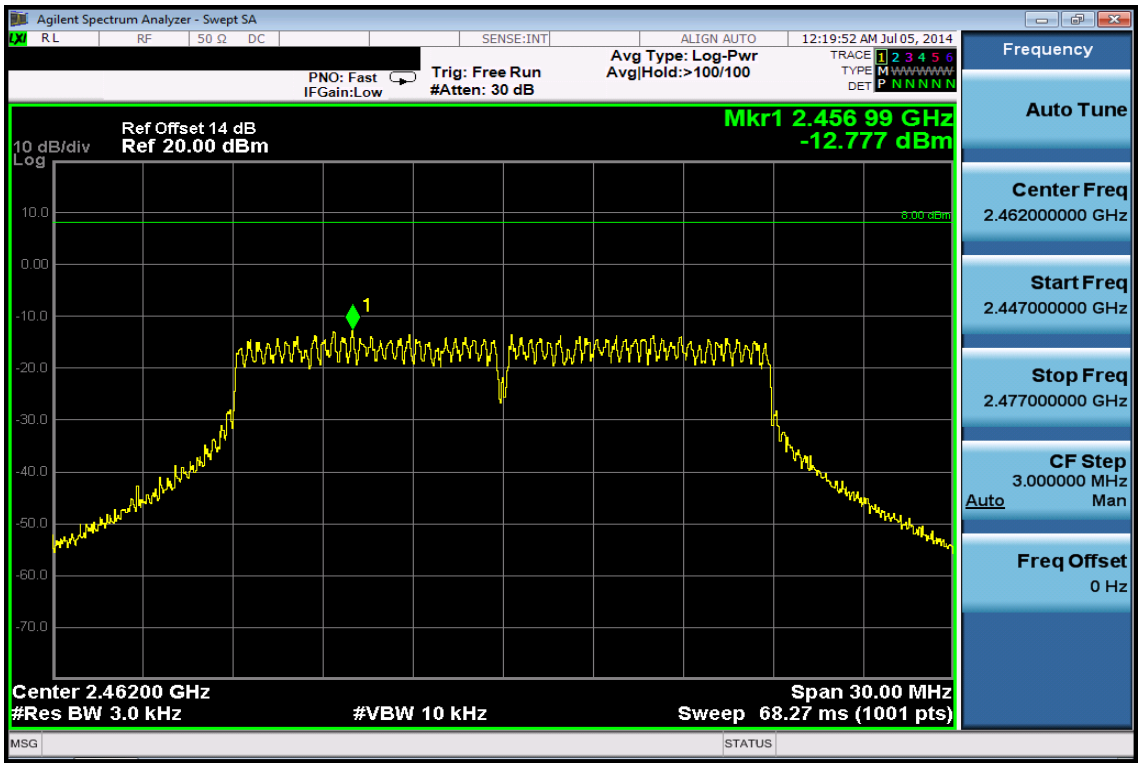
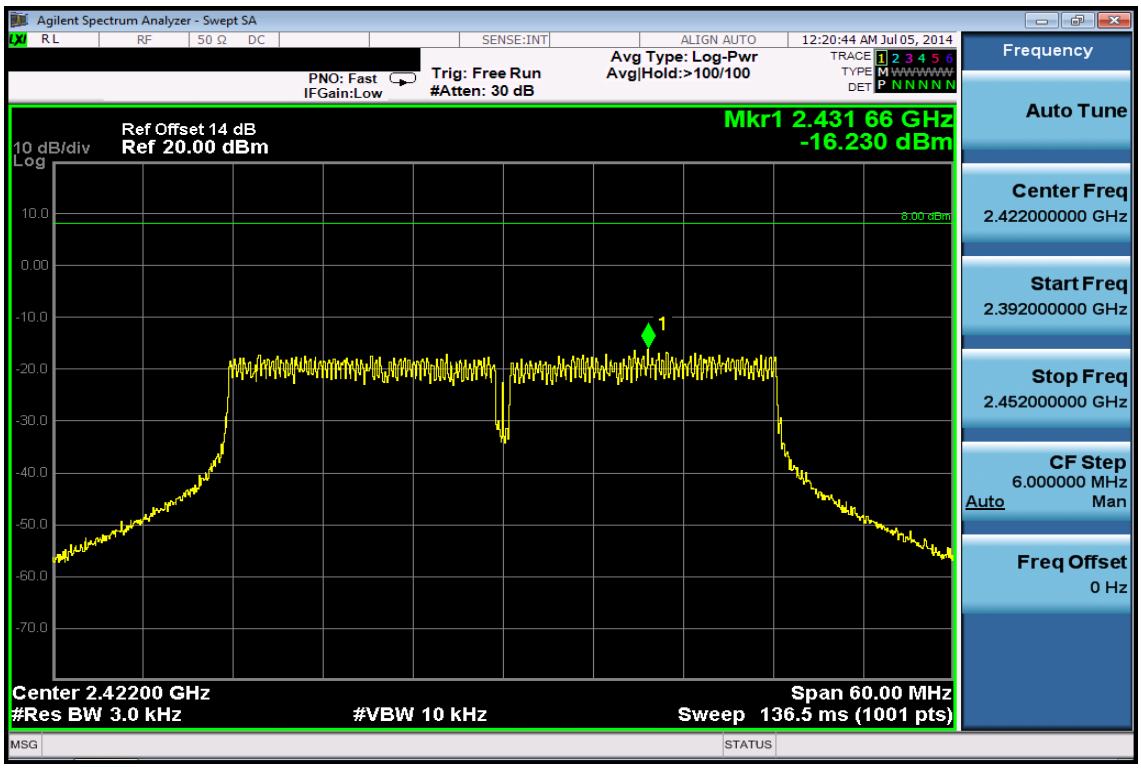
## Power Spectral Density Test Plot (CH-High)




## 802.11n_40M

## Power Spectral Density Test Plot (CH-Low)

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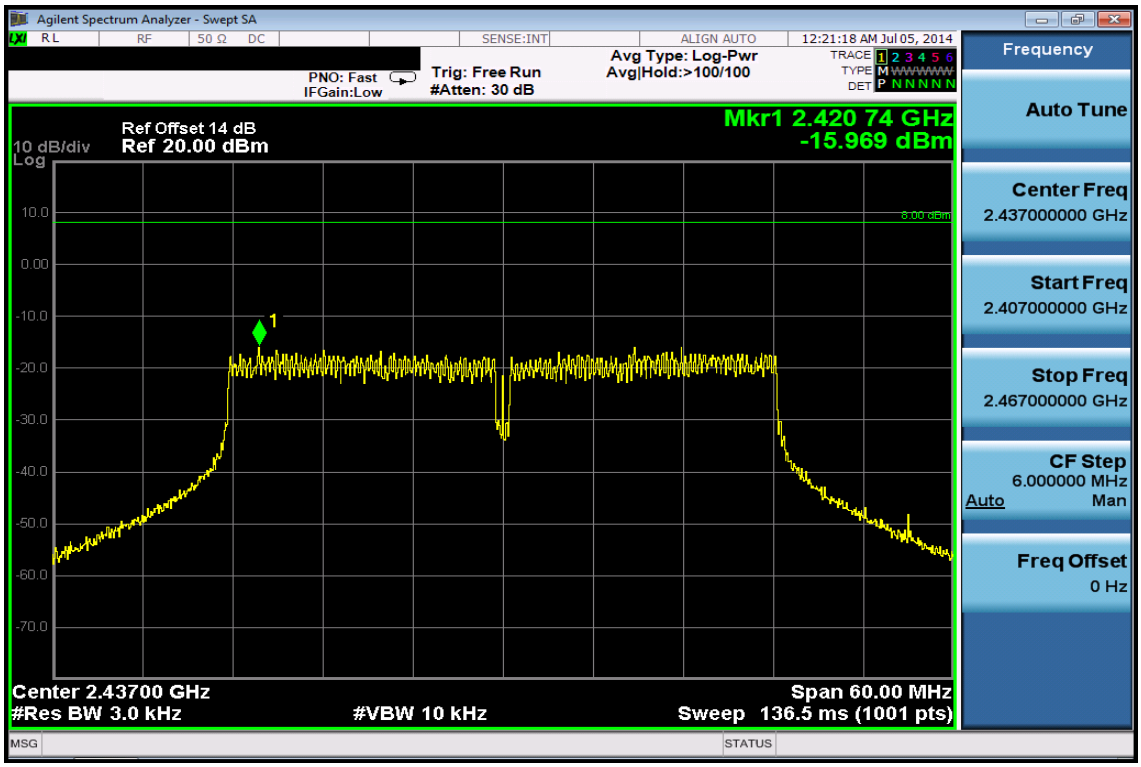
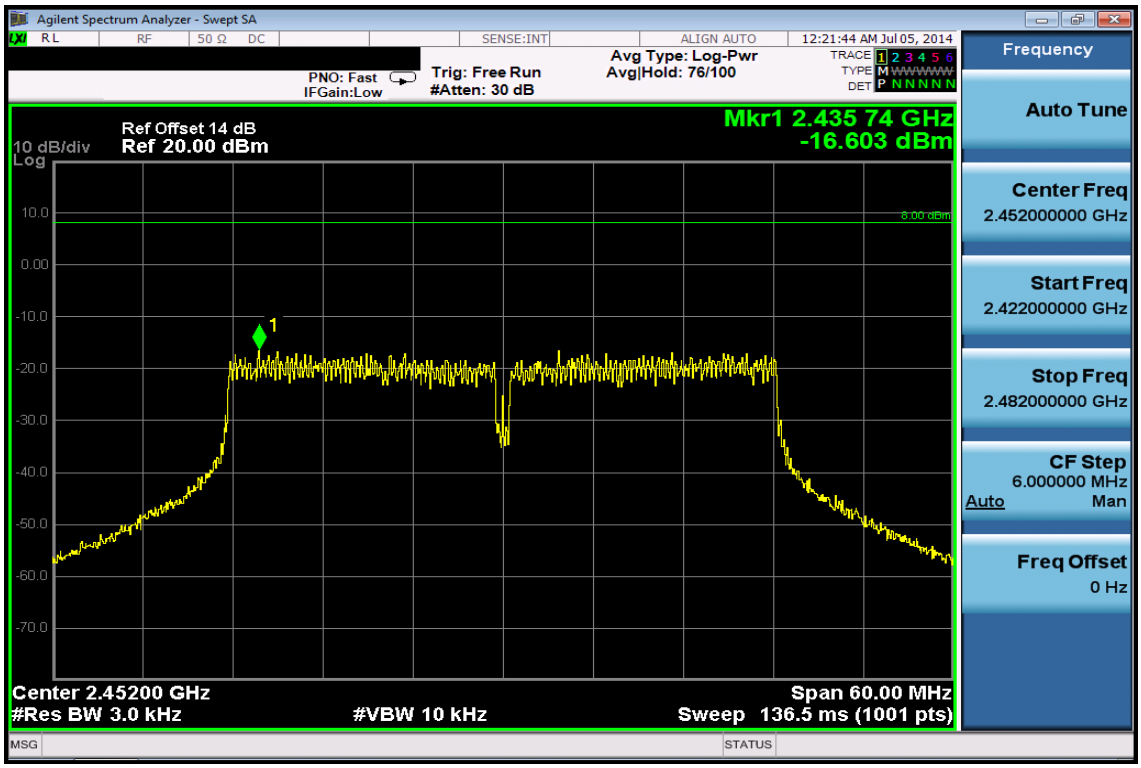
## Power Spectral Density Test Plot (CH-Mid)




## Power Spectral Density Test Plot (CH-High)

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# 12 ANTENNA REQUIREMENT

## 12.1 Standard Applicable:

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

According to RSS-GEN 7.1.2, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

## 12.2 Antenna Connected Construction:

The directional gains of antenna used for transmitting is 1.5dBi for 2.4GHz (Main), 1.5dBi for 2.4GHz (Aux), 3dBi for 2.4GHz (MIMO) and the antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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# 13 99% BANDWIDTH MEASUREMENT

## 13.1 Standard Applicable:

RSS-Gen §4.6.1, the transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

## 13.2 Measurement Equipment Used:

Refer to section 7.2 for details.

## 13.3 Test Set-up:

Refer to section 7.3 for details. (Spectrum analyzer)

## 13.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=1% of the Span, VBW = 3 times RBW, Span= 30 MHz /50MHz.
4. Turn on the 99% bandwidth function, max reading..
5. Repeat above procedures until all frequency measured were complete.

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## 13.5 Measurement Result:

**802.11b**

| Frequency MHz | 99%Bandwidth (MHz) |
|---|---|
| 2412 | 13.739 |
| 2437 | 13.863 |
| 2462 | 13.848 |

**802.11g**

| Frequency MHz | 99%Bandwidth (MHz) |
|---|---|
| 2412 | 16.516 |
| 2437 | 16.518 |
| 2462 | 16.463 |

**802.11n_20M**

| Frequency MHz | 99%Bandwidth (MHz) |
|---|---|
| 2412 | 16.678 |
| 2437 | 16.662 |
| 2462 | 16.207 |

**802.11n_40M**

| Frequency MHz | 99%Bandwidth (MHz) |
|---|---|
| 2422 | 36.472 |
| 2437 | 36.397 |
| 2452 | 36.468 |

** Note: Offset 11dB for 2.4G 802.11b/g;*

*Offset 14dB for 2.4G 802.11n_20/n_40.*

**Note: Refer to next page for plots.*

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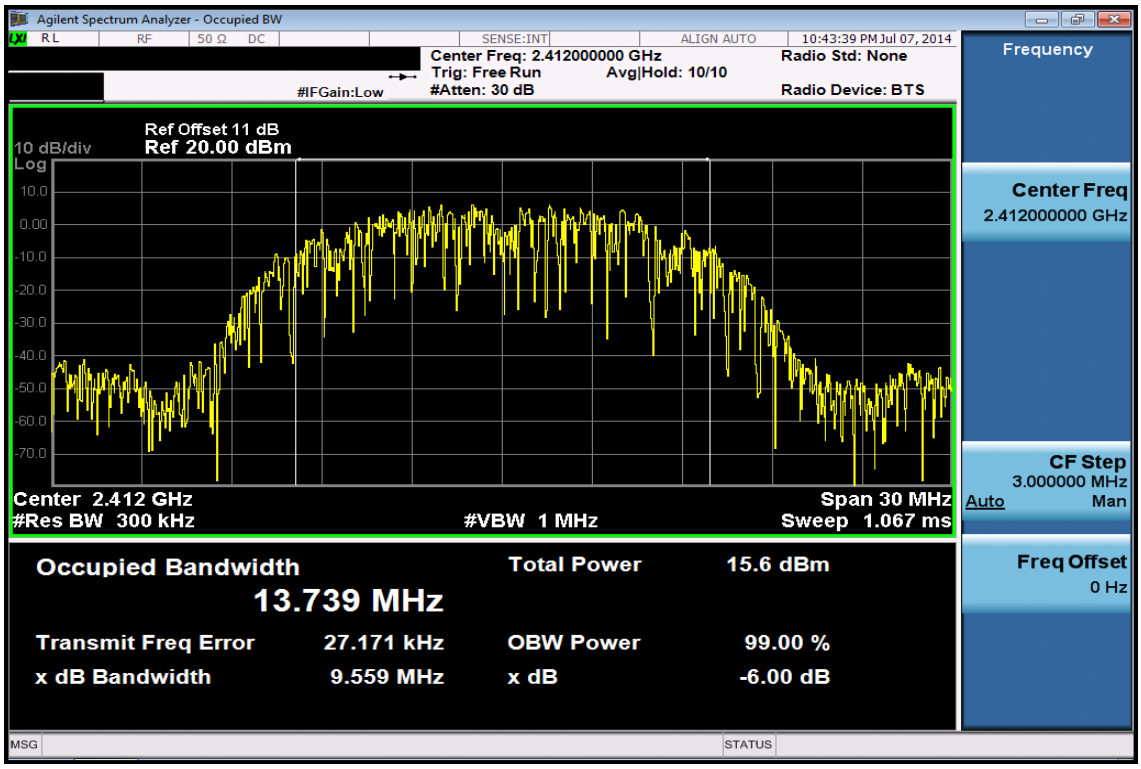
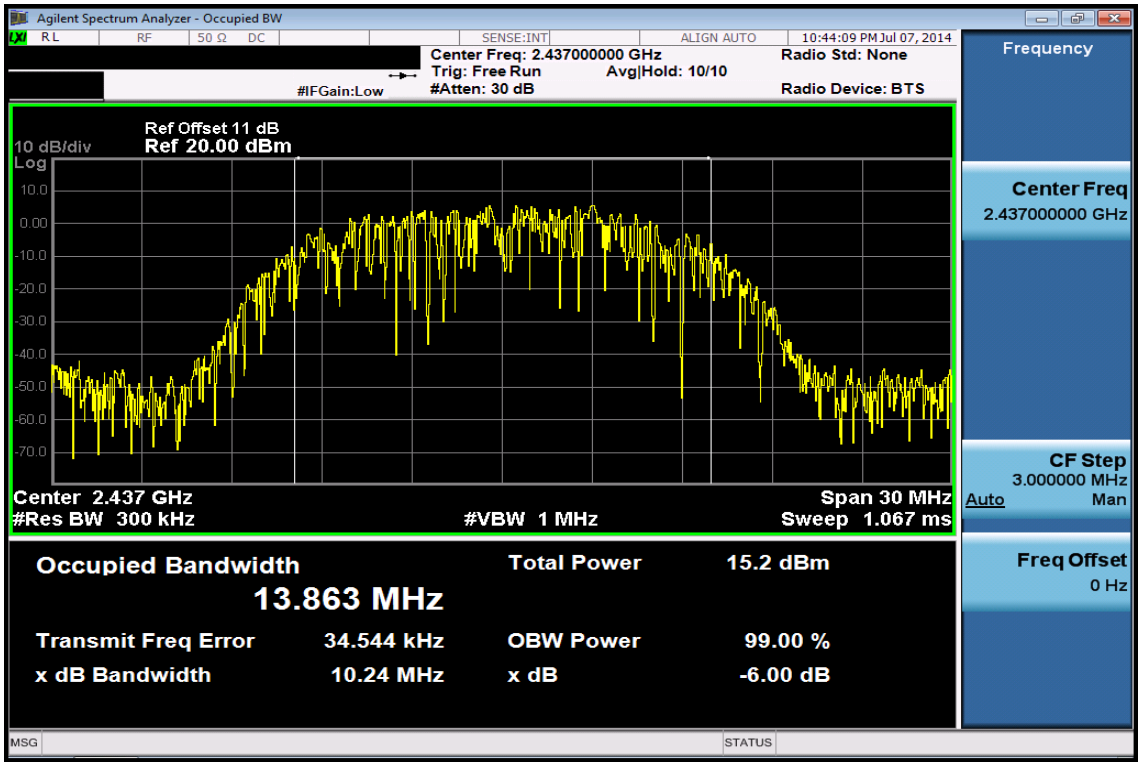
## 802.11b

## 99% Band Width Test Data CH-Low




## 99% Band Width Test Data CH-Mid

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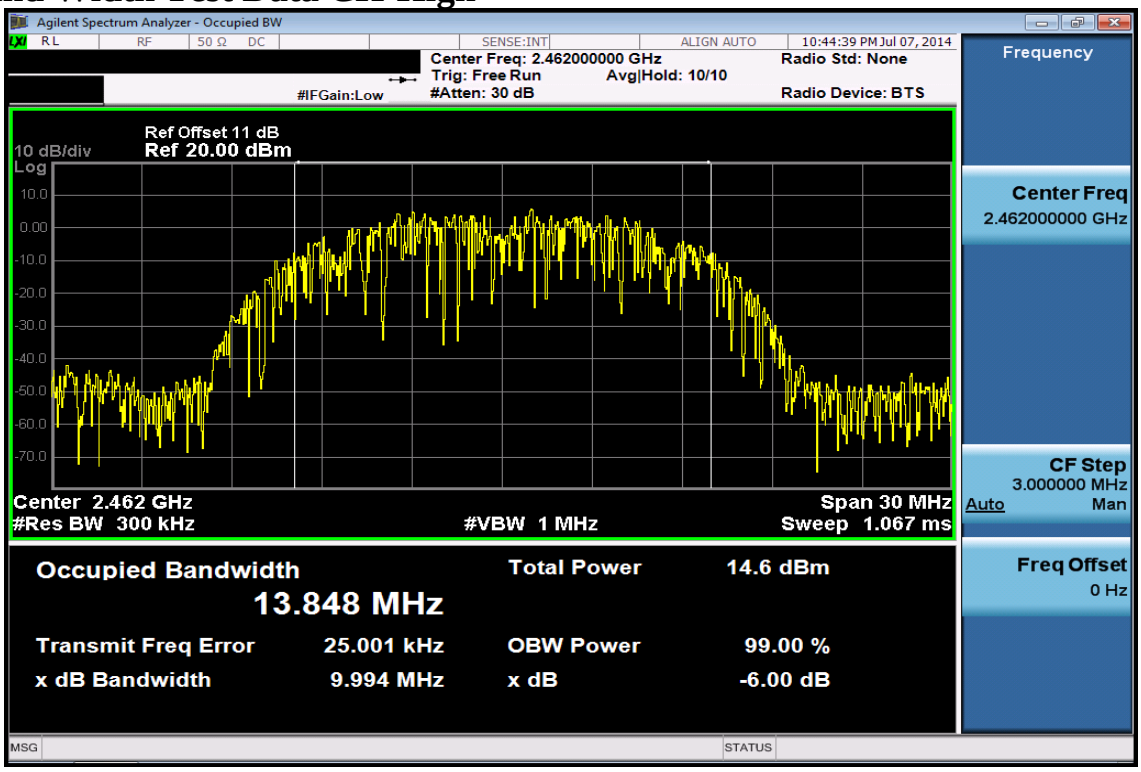
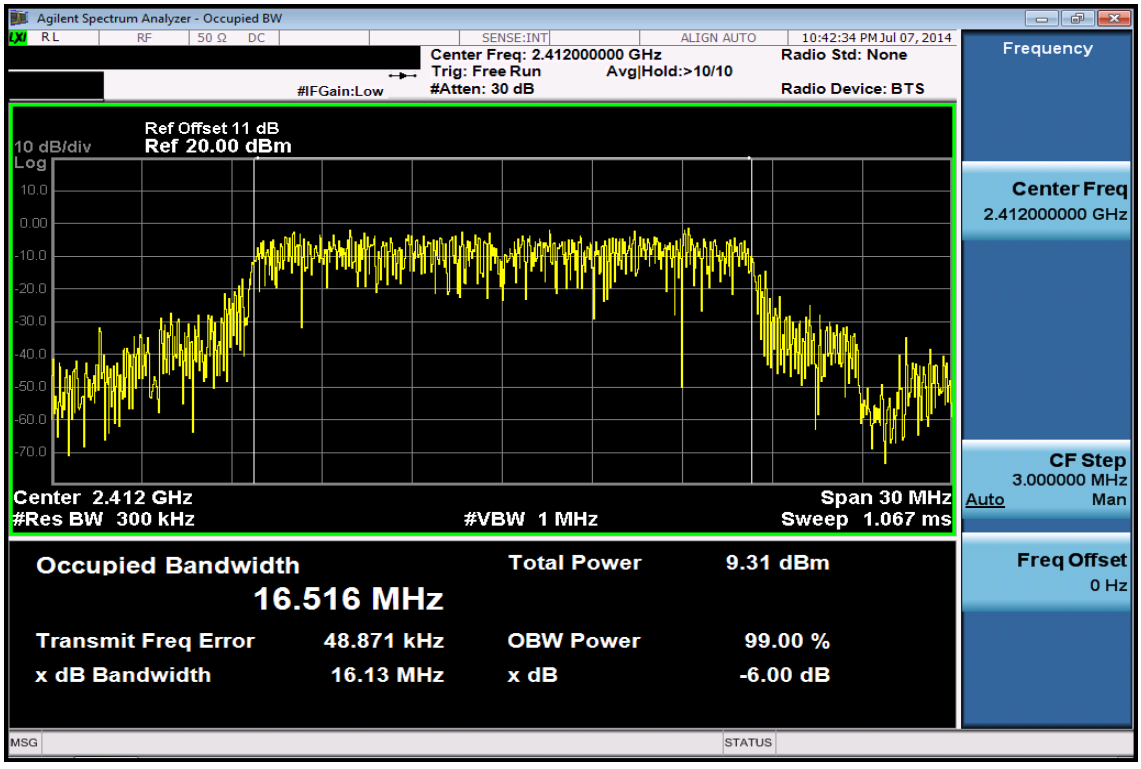
## 99% Band Width Test Data CH-High




## 802.11g

## 99% Band Width Test Data CH-Low

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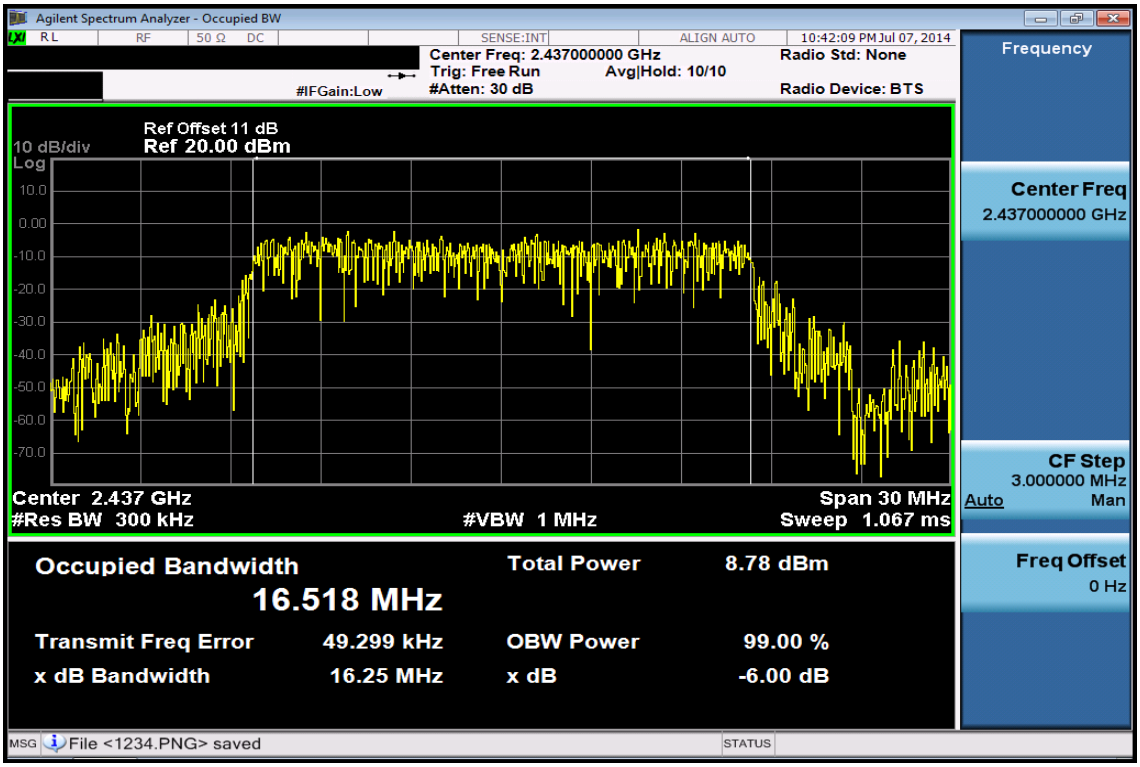
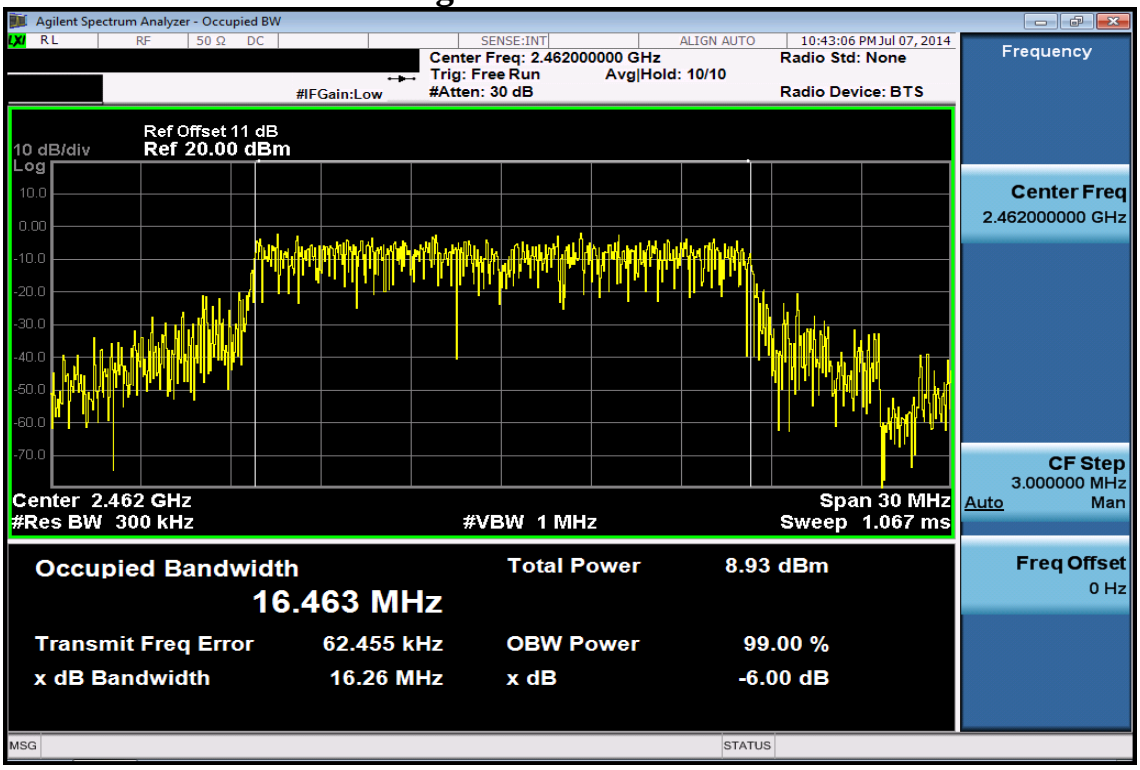
# 99% Band Width Test Data CH-Mid




# 99% Band Width Test Data CH-High

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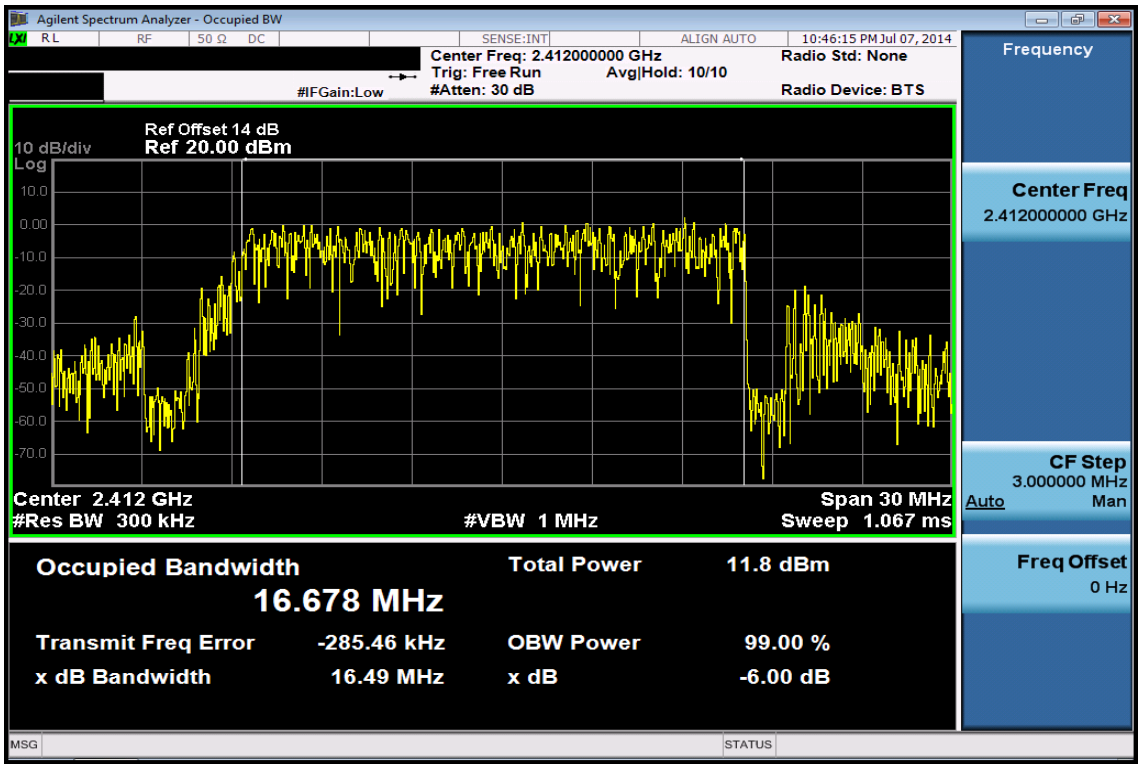
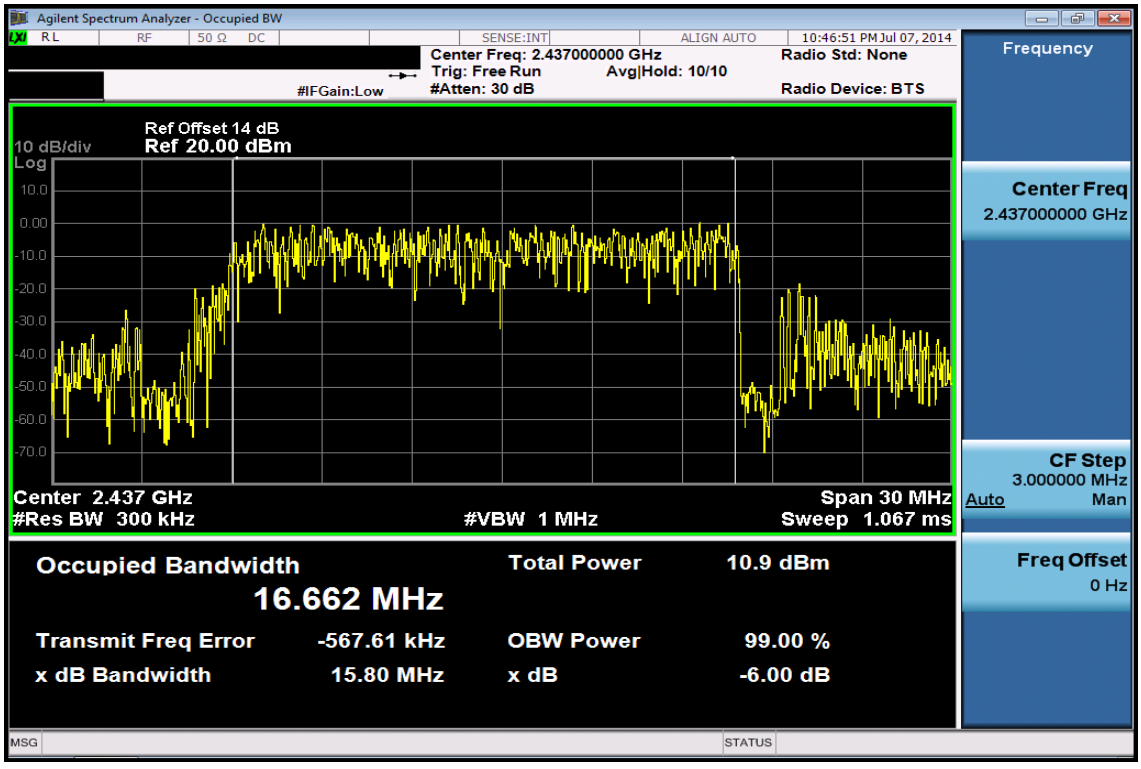
## 802.11n_20M

## 99% Band Width Test Data CH-Low




## 99% Band Width Test Data CH-Mid

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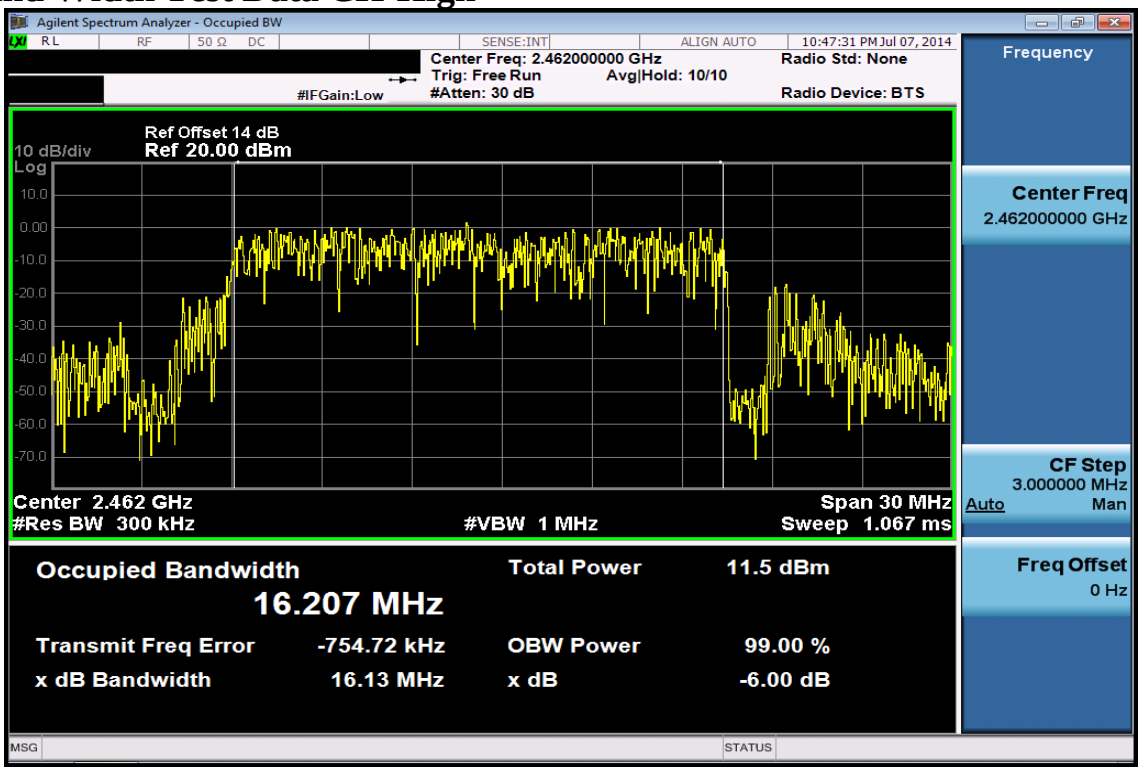
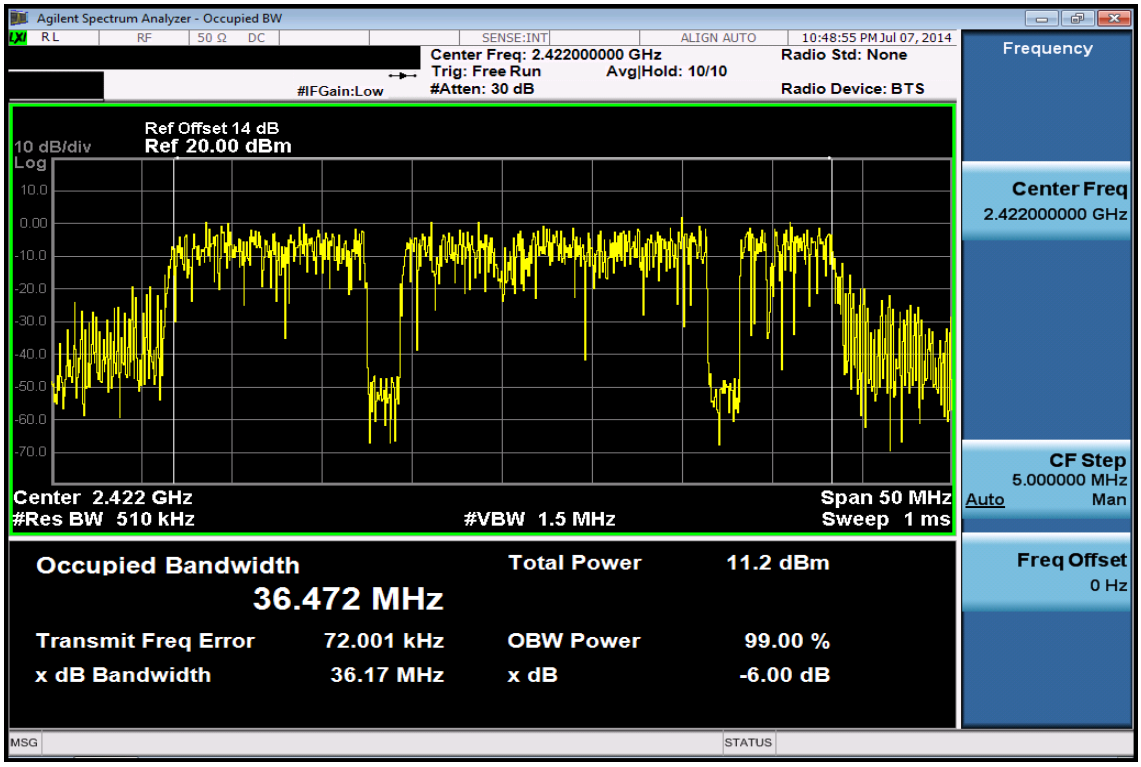
## 99% Band Width Test Data CH-High




## 802.11 n_40M

## 99% Band Width Test Data CH-Low

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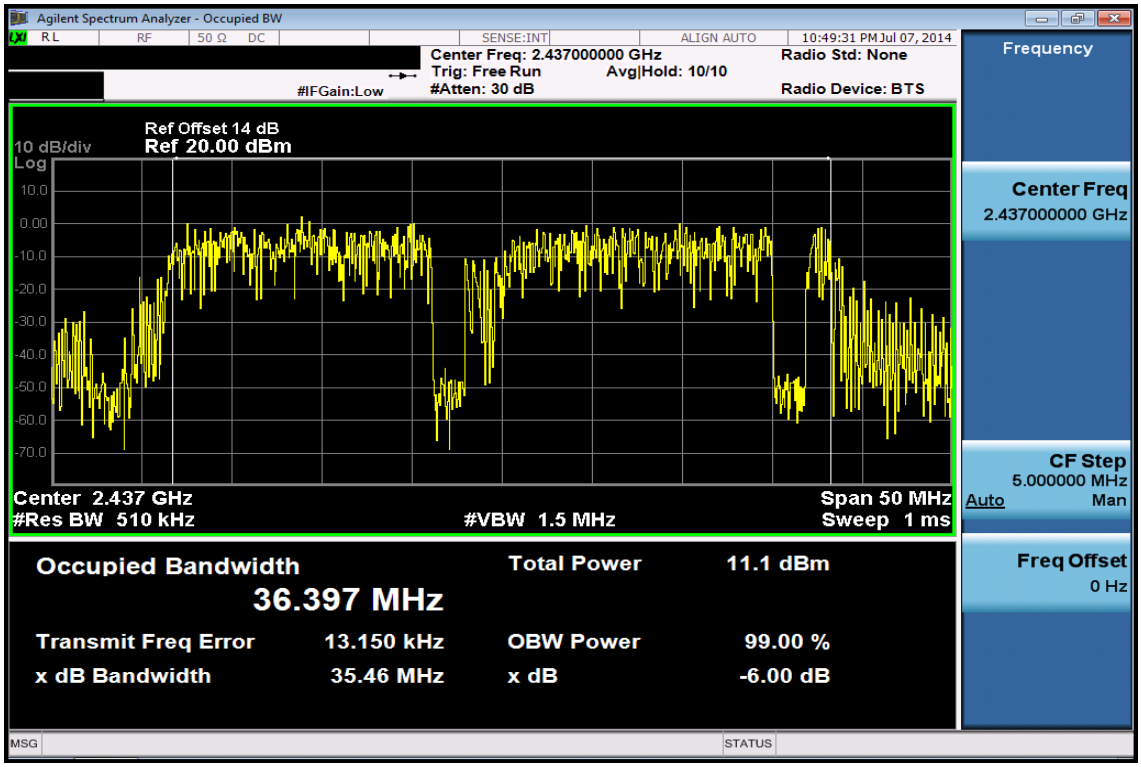
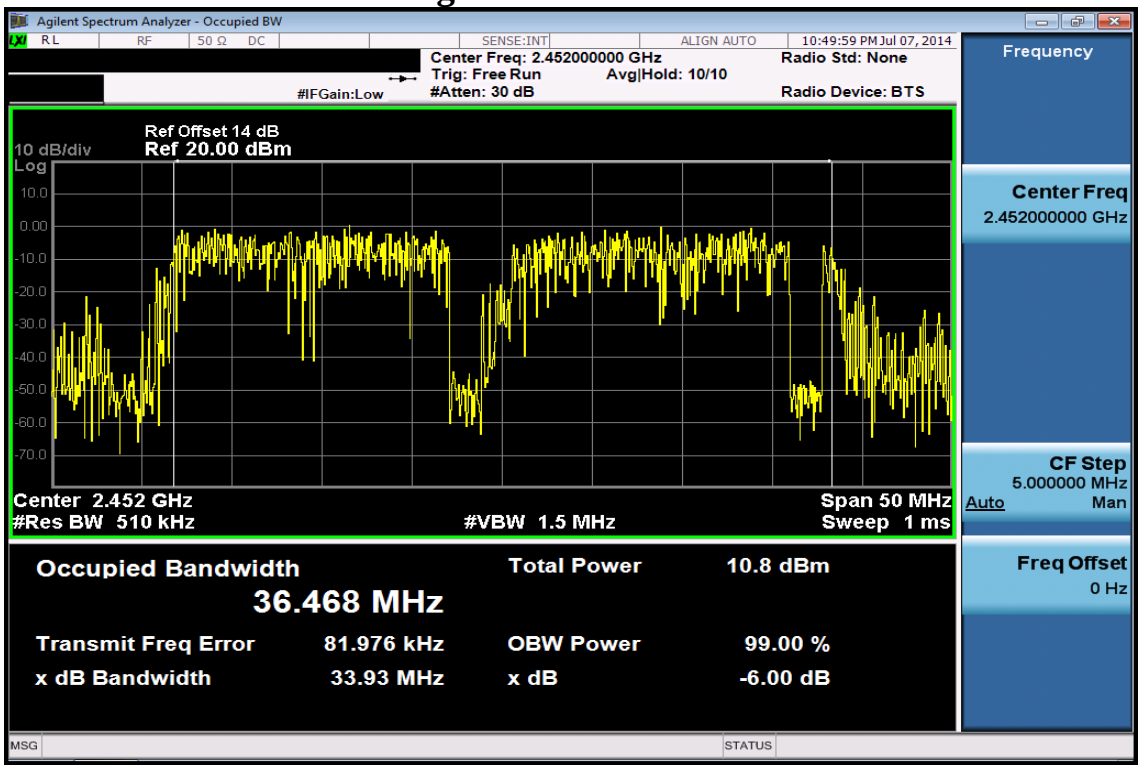
## 99% Band Width Test Data CH-Mid




## 99% Band Width Test Data CH-High

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