



# SPORTON International Inc.

No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, TaoYuan Hsien, Taiwan, R.O.C.  
Ph: 886-3-327-3456 / FAX: 886-3-327-0973 / www.sporton.com.tw

## FCC RADIO TEST REPORT

|                        |                                                                        |
|------------------------|------------------------------------------------------------------------|
| Applicant's company    | Cameo Communications, Inc.                                             |
| Applicant Address      | No.42 Sec. 6, Mincyuan E. Rd., Neihu District, Taipei City 114, Taiwan |
| FCC ID                 | NHPWLN1500                                                             |
| Manufacturer's company | Cameo Communications, Inc.                                             |
| Manufacturer Address   | No.42 Sec. 6, Mincyuan E. Rd., Neihu District, Taipei City 114, Taiwan |

|                  |                                       |
|------------------|---------------------------------------|
| Product Name     | EWC MIMO USB Adapter                  |
| Brand Name       | Cameo                                 |
| Model Name       | WLN-1500                              |
| Test Rule        | 47 CFR FCC Part 15 Subpart C § 15.247 |
| Test Freq. Range | 2400 ~ 2483.5MHz                      |
| Receive Date     | Aug. 2, 2006                          |
| Final Test Date  | Aug. 29, 2006                         |
| Submission Type  | Original Equipment                    |



### Statement

**Test result included is only for the 802.11n part of the product.**

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.4-2003** and **47 CFR FCC Part 15 Subpart C**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.

NVLAQ®

Lab Code: 200079-0

## Table of Contents

|                                                          |                |
|----------------------------------------------------------|----------------|
| <b>1. CERTIFICATE OF COMPLIANCE .....</b>                | <b>1</b>       |
| <b>2. SUMMARY OF THE TEST RESULT .....</b>               | <b>2</b>       |
| <b>3. GENERAL INFORMATION .....</b>                      | <b>3</b>       |
| 3.1. Product Details.....                                | 3              |
| 3.2. Accessories.....                                    | 4              |
| 3.3. Table for Filed Antenna.....                        | 5              |
| 3.4. Table for Carrier Frequencies .....                 | 5              |
| 3.5. Table for Test Modes .....                          | 6              |
| 3.6. Table for Testing Locations.....                    | 6              |
| 3.7. Table for Supporting Units .....                    | 6              |
| 3.8. Table for Parameters of Test Software Setting ..... | 7              |
| 3.9. Test Configurations .....                           | 8              |
| <b>4. TEST RESULT .....</b>                              | <b>11</b>      |
| 4.1. AC Power Line Conducted Emissions Measurement.....  | 11             |
| 4.2. Maximum Peak Output Power Measurement .....         | 15             |
| 4.3. Power Spectral Density Measurement .....            | 17             |
| 4.4. 6dB Spectrum Bandwidth Measurement .....            | 25             |
| 4.5. Radiated Emissions Measurement .....                | 33             |
| 4.6. Band Edge Emissions Measurement .....               | 65             |
| 4.7. Antenna Requirements .....                          | 78             |
| <b>5. LIST OF MEASURING EQUIPMENTS .....</b>             | <b>79</b>      |
| <b>6. TEST LOCATION.....</b>                             | <b>81</b>      |
| <b>7. NVLAP CERTIFICATE OF ACCREDITATION .....</b>       | <b>82</b>      |
| <b>APPENDIX A. PHOTOGRAPHS OF EUT.....</b>               | <b>A1 ~ A7</b> |
| <b>APPENDIX B. TEST PHOTOS.....</b>                      | <b>B1 ~ B6</b> |
| <b>APPENDIX C. MAXIMUM PERMISSIBLE EXPOSURE.....</b>     | <b>C1 ~C4</b>  |



## History of This Test Report

Original Issue Date: Sep. 4, 2006

Report No.: FR682815AA

☒ No additional attachment.

☐ Additional attachment were issued as following record:

| Attachment No. | Issue Date | Description |
|----------------|------------|-------------|
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |
|                |            |             |



## 1. CERTIFICATE OF COMPLIANCE

Product Name : EWC MIMO USB Adapter  
Brand Name : Cameo  
Model Name : WLN-1500  
Applicant : Cameo Communications, Inc.  
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart C § 15.247

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Aug. 2, 2006 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.

Sharon Jiang 5.9.06

Prepared By:

Sharon Jiang / Specialist

Steven Lu 5.9.06

Tested By:

Steven Lu / Engineer

Wayne Hsu 5.9.06

Reviewed By:

Wayne Hsu

## 2. SUMMARY OF THE TEST RESULT

| Applied Standard: 47 CFR FCC Part 15 Subpart C |              |                                     |          |             |
|------------------------------------------------|--------------|-------------------------------------|----------|-------------|
| Part                                           | Rule Section | Description of Test                 | Result   | Under Limit |
| 4.1                                            | 15.207       | AC Power Line Conducted Emissions   | Complies | 17.46 dB    |
| 4.2                                            | 15.247(b)(3) | Maximum Peak Conducted Output Power | Complies | 6.1 dB      |
| 4.3                                            | 15.247(e)    | Power Spectral Density              | Complies | 0.33 dB     |
| 4.4                                            | 15.247(a)(2) | 6dB Spectrum Bandwidth              | Complies | -           |
| 4.5                                            | 15.247(d)    | Radiated Emissions                  | Complies | 0.35 dB     |
| 4.6                                            | 15.247(d)    | Band Edge Emissions                 | Complies | 0.12 dB     |
| 4.7                                            | 15.203       | Antenna Requirements                | Complies | -           |

| Test Items                              | Uncertainty               | Remark                   |
|-----------------------------------------|---------------------------|--------------------------|
| AC Power Line Conducted Emissions       | $\pm 2.26\text{dB}$       | Confidence levels of 95% |
| Maximum Peak Conducted Output Power     | $\pm 0.5\text{dB}$        | Confidence levels of 95% |
| Power Spectral Density                  | $\pm 0.71\text{dB}$       | Confidence levels of 95% |
| 6dB Spectrum Bandwidth                  | $\pm 6.25 \times 10^{-7}$ | Confidence levels of 95% |
| Radiated Emissions/ Band Edge Emissions | $\pm 3.72\text{dB}$       | Confidence levels of 95% |

### 3. GENERAL INFORMATION

#### 3.1. Product Details

| Items                    | Description                                          |
|--------------------------|------------------------------------------------------|
| Product Type             | WLAN                                                 |
| Radio Type               | Intentional Transceiver                              |
| Power Type               | From Host system                                     |
| Modulation               | see the below table for 802.11n                      |
| Data Modulation          | OFDM (BPSK / QPSK / 16QAM / 64QAM)                   |
| Data Rate (Mbps)         | see the below table for 802.11n                      |
| Frequency Range          | 2400 ~ 2483.5MHz                                     |
| Channel Number           | 11 for 20MHz bandwidth ; 7 for 40MHz bandwidth       |
| Channel Band Width (99%) | MCS8 (20MHz) : 17.80 MHz<br>MCS8 (40MHz) : 36.32 MHz |
| Conducted Output Power   | MCS8(20MHz) : 23.90 dBm<br>MCS8 (40MHz) : 22.47 dBm  |
| Carrier Frequencies      | Please refer to section 3.4                          |
| Antenna                  | Please refer to section 3.3                          |

#### Antenna & Band width

| Antenna         | Single (TX) |        | Two (TX) |        |
|-----------------|-------------|--------|----------|--------|
| Band width Mode | 20 MHz      | 40 MHz | 20 MHz   | 40 MHz |
| 802.11n         | V           | V      | V        | V      |

### 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   |
| 8         | 2   | BPSK       | 1/2 | 1     | 104   | 216   | 52    | 108   | 13.0           | 27.0  | 14.444  | 30    |
| 9         | 2   | QPSK       | 1/2 | 2     | 208   | 432   | 104   | 216   | 26.0           | 54.0  | 28.889  | 60    |
| 10        | 2   | QPSK       | 3/4 | 2     | 208   | 432   | 156   | 324   | 39.0           | 81.0  | 43.333  | 90    |
| 11        | 2   | 16-QAM     | 1/2 | 4     | 416   | 864   | 208   | 432   | 52.0           | 108.0 | 57.778  | 120   |
| 12        | 2   | 16-QAM     | 3/4 | 4     | 416   | 864   | 312   | 648   | 78.0           | 162.0 | 86.667  | 180   |
| 13        | 2   | 64-QAM     | 2/3 | 6     | 624   | 1296  | 416   | 864   | 104.0          | 216.0 | 115.556 | 240   |
| 14        | 2   | 64-QAM     | 3/4 | 6     | 624   | 1296  | 468   | 972   | 117.0          | 243.0 | 130.000 | 270   |
| 15        | 2   | 64-QAM     | 5/6 | 6     | 624   | 1296  | 520   | 1080  | 130.0          | 270.0 | 144.444 | 300   |

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

### 3.2. Accessories

| USB Cable | Cable Lenth    |
|-----------|----------------|
| 1         | 1.6m, shielded |
| 2         | 0.5m, shielded |

Due to USB Cable 1 is worst cases, so USB Cable 1 tested and recorded in this report.

### 3.3. Table for Filed Antenna

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) |
|------|-------|------------|--------------|-----------|------------|
| A    | -     | DWA-142    | PIFA Antenna | NA        | 2.68       |
| B    | -     | DWA-142    | PIFA Antenna | NA        | 2.51       |

### 3.4. Table for Carrier Frequencies

There are two bandwidth systems for 802.11n.

For both 20MHz bandwidth systems, use Channel 1~Channel 11.

For both 40MHz bandwidth systems, use Channel 3~Channel 9.

| Frequency Band | Channel No. | Frequency | Channel No. | Frequency |
|----------------|-------------|-----------|-------------|-----------|
| 2400~2483.5MHz | 1           | 2412 MHz  | 7           | 2442 MHz  |
|                | 2           | 2417 MHz  | 8           | 2447 MHz  |
|                | 3           | 2422 MHz  | 9           | 2452 MHz  |
|                | 4           | 2427 MHz  | 10          | 2457 MHz  |
|                | 5           | 2432 MHz  | 11          | 2462 MHz  |
|                | 6           | 2437 MHz  |             |           |

For 802.11n, the two TX Ant. A & Ant. B could transmit simultaneously.

### 3.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Test Items                                                    | Mode        | Channel | Antenna |
|---------------------------------------------------------------|-------------|---------|---------|
| AC Power Line Conducted Emissions                             | Normal Link | 6       | A+B     |
| 6dB Spectrum Bandwidth                                        | MCS8/20MHz  | 1/6/11  | A / A+B |
|                                                               | MCS8/40MHz  | 3/6/9   | A / A+B |
| Maximum Peak Conducted Output Power<br>Power Spectral Density | MCS8/20MHz  | 1/6/11  | A / A+B |
|                                                               | MCS8/40MHz  | 3/6/9   | A / A+B |
| Radiated Emissions 9kHz~1GHz                                  | 11n /BPSK   | 6       | A / A+B |
| Radiated Emissions 1GHz~10 <sup>th</sup> Harmonic             | MCS8/20MHz  | 1/6/11  | A / A+B |
|                                                               | MCS8/40MHz  | 3/6/9   | A / A+B |
| Band Edge Emissions                                           | MCS8/20MHz  | 1/11    | A / A+B |
|                                                               | MCS8/40MHz  | 3/9     | A / A+B |

### 3.6. Table for Testing Locations

| Test Site No. | Site Category | Location | FCC Reg. No. | IC File No. | VCCI Reg. No |
|---------------|---------------|----------|--------------|-------------|--------------|
| 03CH03-HY     | SAC           | Hwa Ya   | 101377       | IC 4088     | -            |
| CO04-HY       | Conduction    | Hwa Ya   | 101377       | IC 4088     | -            |
| TH01-HY       | OVEN Room     | Hwa Ya   | -            | -           | -            |

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC); Fully Anechoic Chamber (FAC).

Please refer section 6 for Test Site Address.

### 3.7. Table for Supporting Units

| Support Unit | Brand | Model   | FCC ID     |
|--------------|-------|---------|------------|
| Notebook     | DELL  | D505    | DoC        |
| Printer      | EPSON | LQ-300  | DOC        |
| Modem        | ACEEX | DM-1414 | IFAXDM1414 |
| AP           | 3COM  | AP2750  | O9C-AP2750 |

### 3.8. Table for Parameters of Test Software Setting

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

#### Power Parameters of IEEE 802.11n MCS8 20MHz Ant. A

| Test Software Version | DutApiClient_Usb |          |          |
|-----------------------|------------------|----------|----------|
| Frequency             | 2412 MHz         | 2437 MHz | 2462 MHz |
| IEEE 802.11n Ant. A   | 56               | 56       | 52       |

#### Power Parameters of IEEE 802.11n MCS8 20MHz Ant. A + Ant. B

| Test Software Version | DutApiClient_Usb |          |          |
|-----------------------|------------------|----------|----------|
| Frequency             | 2412 MHz         | 2437 MHz | 2462 MHz |
| IEEE 802.11n Ant. A   | 50               | 50       | 4E       |
| IEEE 802.11n Ant. B   | 51               | 51       | 4F       |

#### Power Parameters of IEEE 802.11n MCS8 40MHz Ant. A

| Test Software Version | DutApiClient_Usb |          |          |
|-----------------------|------------------|----------|----------|
| Frequency             | 2422 MHz         | 2437 MHz | 2452 MHz |
| IEEE 802.11n Ant. A   | 58               | 58       | 53       |

#### Power Parameters of IEEE 802.11n MCS8 40MHz Ant. A + Ant. B

| Test Software Version | DutApiClient_Usb |          |          |
|-----------------------|------------------|----------|----------|
| Frequency             | 2422 MHz         | 2437 MHz | 2452 MHz |
| IEEE 802.11n Ant. A   | 4F               | 4F       | 4F       |
| IEEE 802.11n Ant. B   | 50               | 50       | 50       |

An executive program, EMCTEST.EXE under WIN XP, which generates a complete line of continuously repeating "H" pattern was used as the test software.

The program was executed as follows:

Turn on the power of all equipment.

The NB sends "H" messages to the panel, and the panel displays "H" patterns on the screen.

The NB sends "H" messages to the printer, then the printer prints them on the paper.

The NB sends "H" messages to the modem.

At the same time, the following programs were executed:

Executed "ping.exe" to link with the remote workstation to receive and transmit data by WLAN.

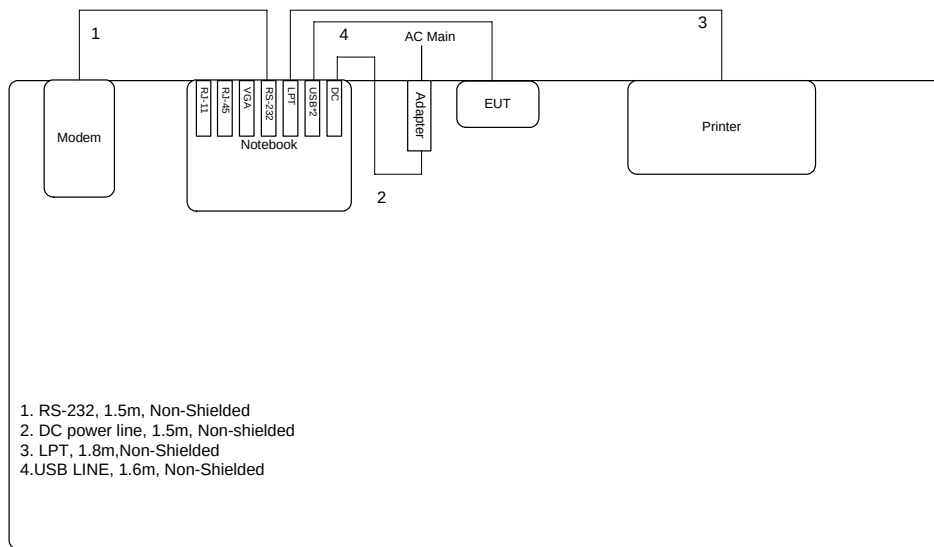
Executed "DutApiClient\_Usb" to control the EUT continuously transmit RF signal.

### 3.9. Test Configurations

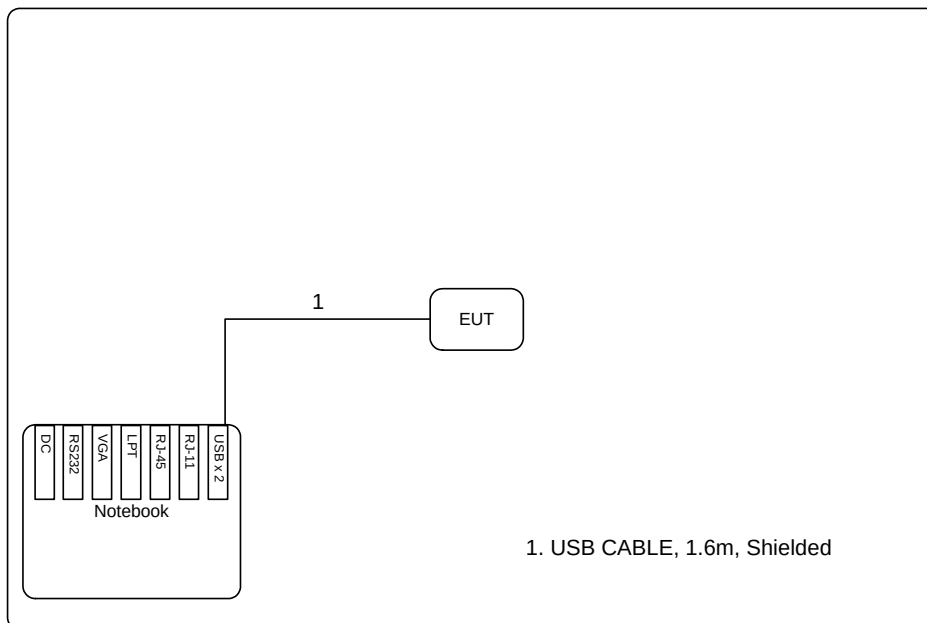
#### 3.9.1. Radiation Emissions Test Configuration

##### USB Cable 1

Test Configuration: 9KHz~1GHz

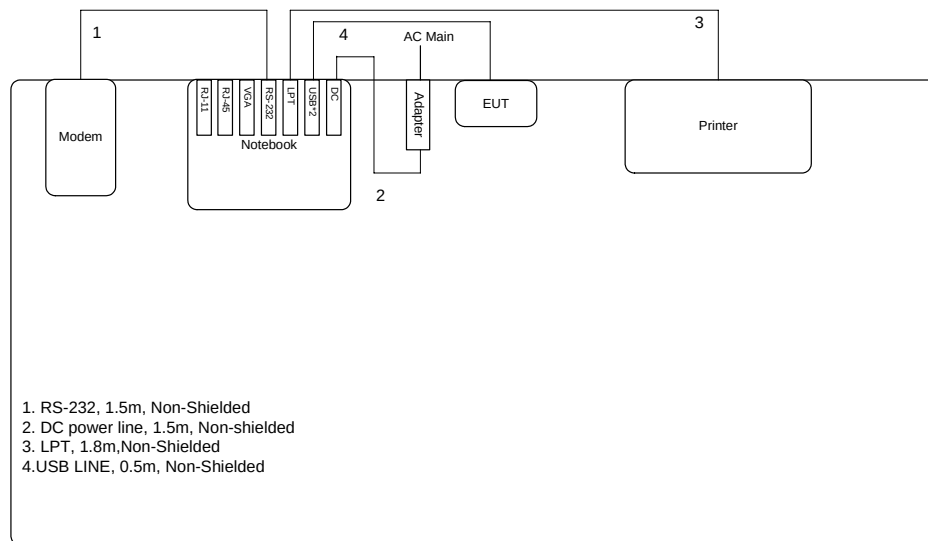


Test Configuration: above 1GHz

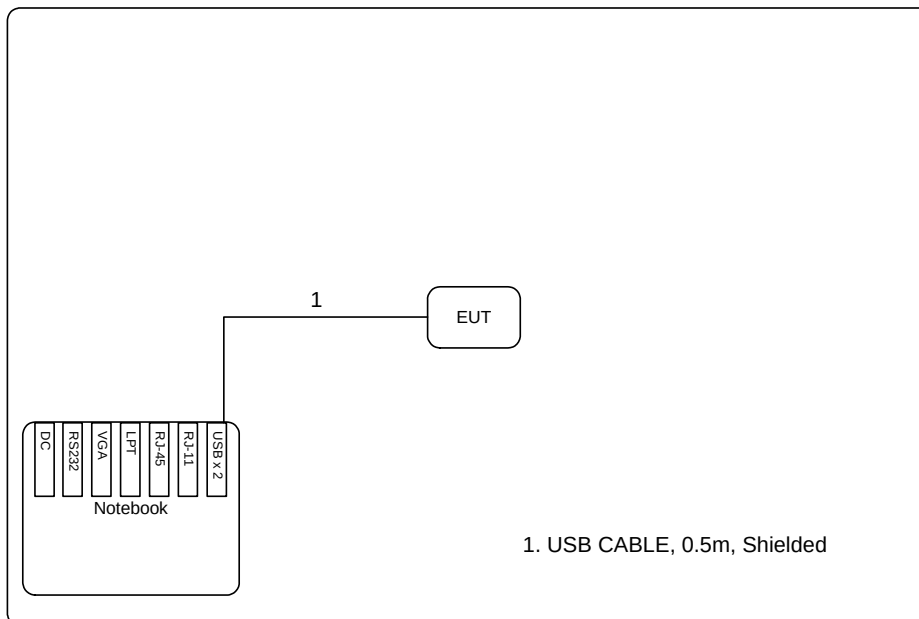


## USB Cable 2

### Test Configuration: 9KHz~1GHz

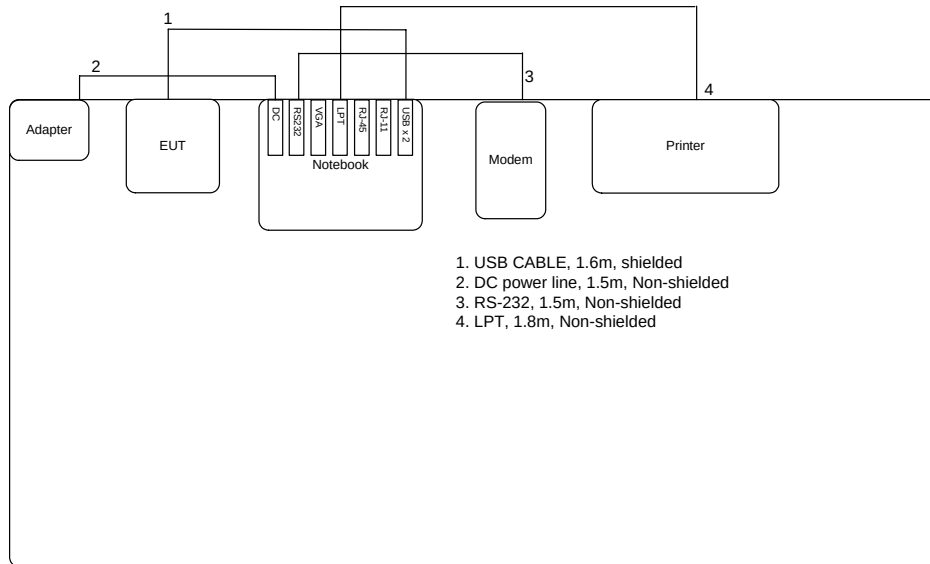


### Test Configuration: above 1GHz



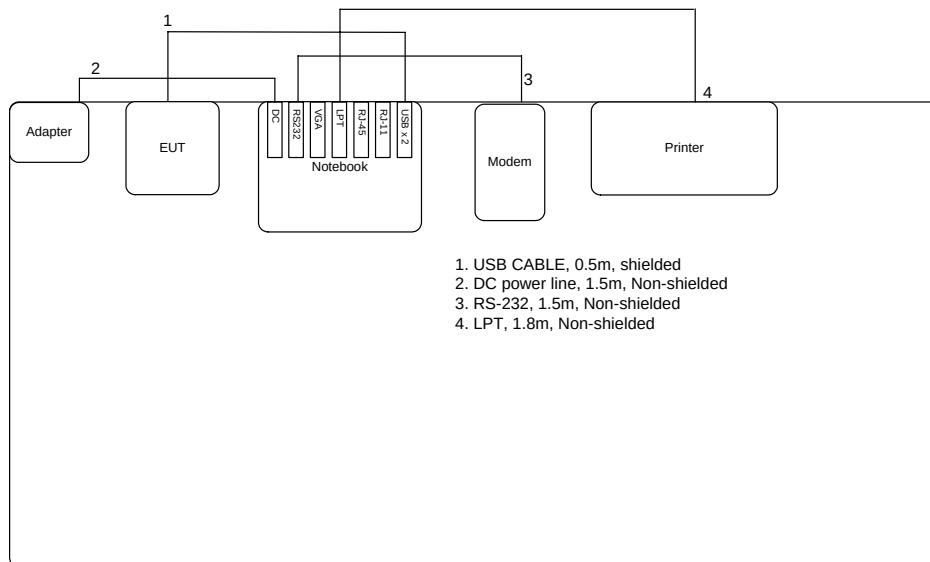
### 3.9.2. AC Power Line Conduction Emissions Test Configuration

#### USB Cable 1



WLAN AP

#### USB Cable 2



WLAN AP

## 4. TEST RESULT

### 4.1. AC Power Line Conducted Emissions Measurement

#### 4.1.1. Limit

For this product which is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

| Frequency (MHz) | QP Limit (dBuV) | AV Limit (dBuV) |
|-----------------|-----------------|-----------------|
| 0.15~0.5        | 66~56           | 56~46           |
| 0.5~5           | 56              | 46              |
| 5~30            | 60              | 50              |

#### 4.1.2. Measuring Instruments and Setting

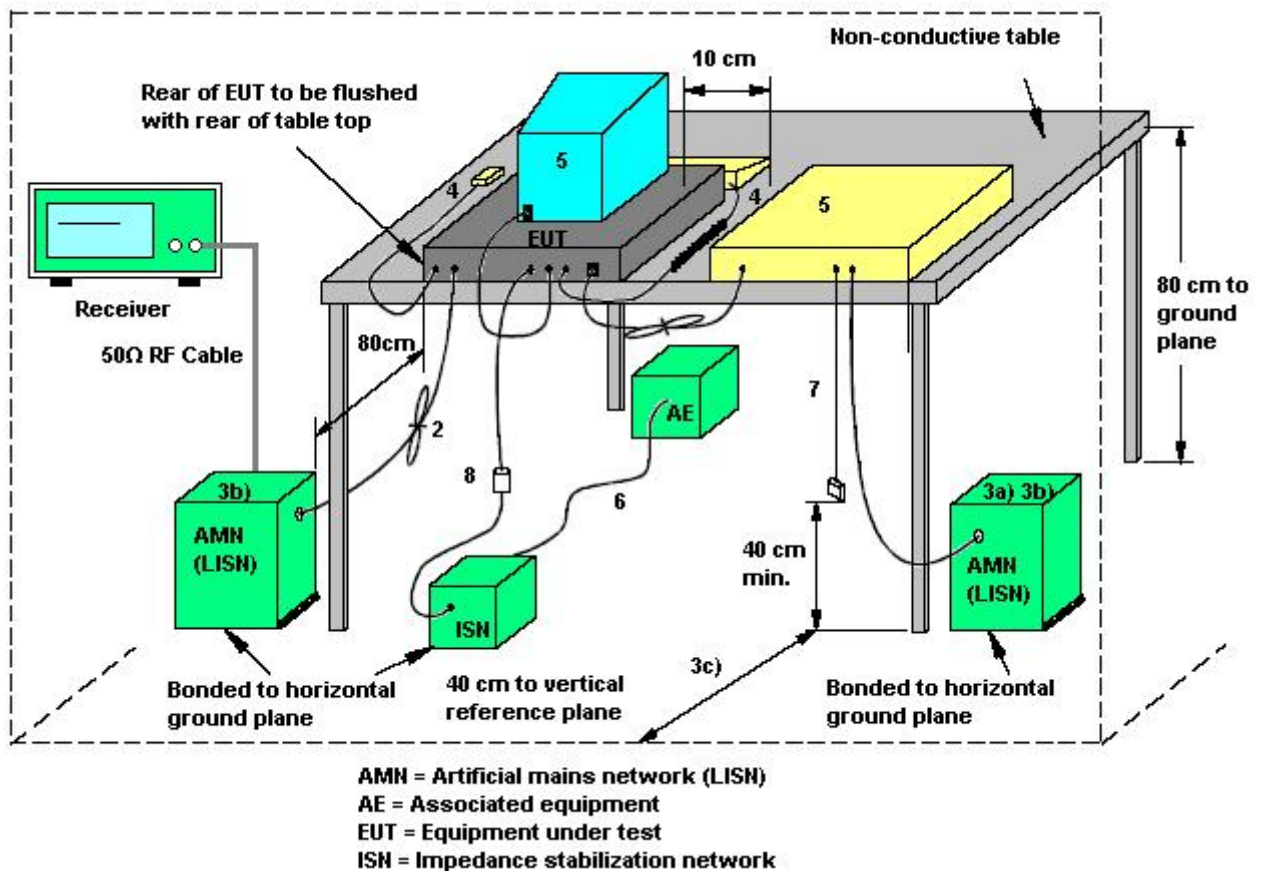
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

| Receiver Parameters | Setting  |
|---------------------|----------|
| Attenuation         | 10 dB    |
| Start Frequency     | 0.15 MHz |
| Stop Frequency      | 30 MHz   |
| IF Bandwidth        | 9 KHz    |

#### 4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.4. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 KHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

#### 4.1.4. Test Setup Layout



1. If cables, which hang closer than 40 cm to the horizontal metal groundplane, cannot be shortened to appropriate length, the excess shall be folded back and forth forming a bundle 30 cm to 40 cm long.
2. Excess mains cord shall be bundled in the centre or shortened to appropriate length.
3. EUT is connected to one artificial mains network (AMN). All AMNs and ISNs may alternatively be connected to a vertical reference plane or metal wall.
4. All other units of a system are powered from a second AMN. A multiple outlet strip can be used for multiple mains cords.
5. AMN and ISN are 80 cm from the EUT and at least 80 cm from other units and other metal planes.
6. Mains cords and signal cables shall be positioned for their entire lengths, as far as possible, at 40 cm from the vertical reference plane.
7. Cables of hand operated devices, such as keyboards, mice, etc. shall be placed as for normal usage.
8. Peripherals shall be placed at a distance of 10 cm from each other and from the controller, except for the monitor which, if this is an acceptable installation practice, shall be placed directly on the top of the controller.
9. I/O signal cable intended for external connection.
10. The end of the I/O signal cables which are not connected to an AE may be terminated, if required, using correct terminating impedance.
11. If used, the current probe shall be placed at 0,1 m from the ISN.

#### 4.1.5. Test Deviation

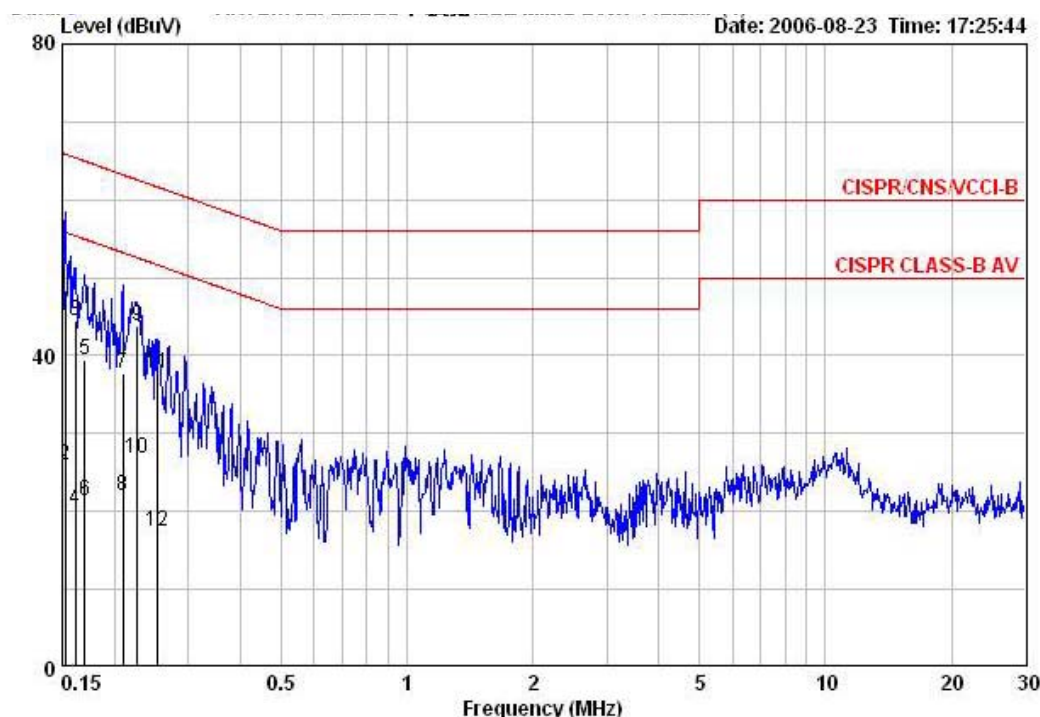
There is no deviation with the original standard.

#### 4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

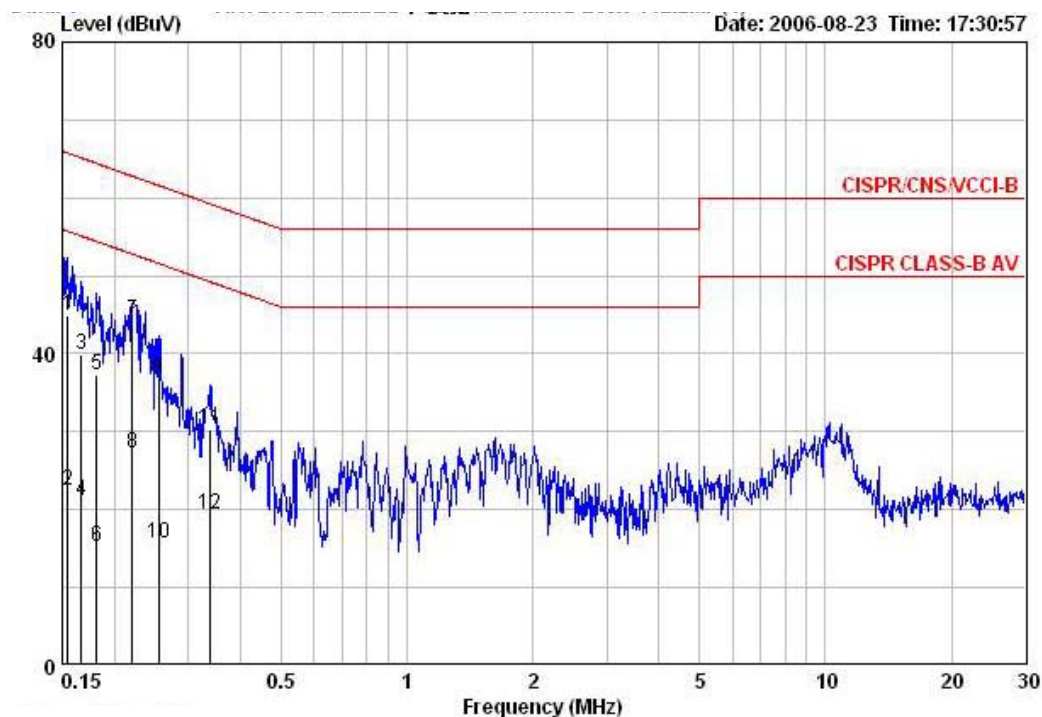
#### 4.1.7. Results of AC Power Line Conducted Emissions Measurement

|               |             |          |      |
|---------------|-------------|----------|------|
| Temperature   | 24°C        | Humidity | 64%  |
| Test Engineer | Leo Hung    | Phase    | Line |
| Configuration | Normal Link |          |      |



|    | Freq    | Level | Over   | Limit | Read  | LISN   | Cable |         |
|----|---------|-------|--------|-------|-------|--------|-------|---------|
|    | MHz     | dBuV  | Limit  | Line  | Level | Factor | Loss  | Remark  |
|    |         |       | dB     | dBuV  | dBuV  | dB     | dB    |         |
| 1  | 0.15240 | 48.41 | -17.46 | 65.87 | 46.18 | 2.03   | 0.20  | QP      |
| 2  | 0.15240 | 26.00 | -29.87 | 55.87 | 23.77 | 2.03   | 0.20  | AVERAGE |
| 3  | 0.16155 | 44.54 | -20.85 | 65.38 | 42.27 | 2.07   | 0.20  | QP      |
| 4  | 0.16155 | 20.20 | -35.19 | 55.38 | 17.93 | 2.07   | 0.20  | AVERAGE |
| 5  | 0.16944 | 39.53 | -25.46 | 64.99 | 37.41 | 1.92   | 0.20  | QP      |
| 6  | 0.16944 | 21.31 | -33.68 | 54.99 | 19.19 | 1.92   | 0.20  | AVERAGE |
| 7  | 0.20944 | 37.73 | -25.50 | 63.23 | 36.32 | 1.21   | 0.20  | QP      |
| 8  | 0.20944 | 21.93 | -31.30 | 53.23 | 20.52 | 1.21   | 0.20  | Average |
| 9  | 0.22676 | 43.87 | -18.69 | 62.57 | 42.64 | 1.03   | 0.20  | QP      |
| 10 | 0.22676 | 26.82 | -25.74 | 52.57 | 25.59 | 1.03   | 0.20  | AVERAGE |
| 11 | 0.25345 | 37.63 | -24.01 | 61.64 | 36.53 | 0.90   | 0.20  | QP      |
| 12 | 0.25345 | 17.40 | -34.24 | 51.64 | 16.30 | 0.90   | 0.20  | AVERAGE |

|               |             |          |         |
|---------------|-------------|----------|---------|
| Temperature   | 24°C        | Humidity | 64%     |
| Test Engineer | Leo Hung    | Phase    | Neutral |
| Configuration | Normal Link |          |         |



|    | Freq    | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark  |
|----|---------|-------|------------|------------|------------|-------------|------------|---------|
|    | MHz     | dBuV  | dB         | dBuV       | dBuV       | dB          | dB         |         |
| 1  | 0.15485 | 44.96 | -20.78     | 65.74      | 42.86      | 1.90        | 0.20       | QP      |
| 2  | 0.15485 | 22.46 | -33.28     | 55.74      | 20.36      | 1.90        | 0.20       | AVERAGE |
| 3  | 0.16677 | 39.81 | -25.31     | 65.12      | 37.84      | 1.77        | 0.20       | QP      |
| 4  | 0.16677 | 21.16 | -33.96     | 55.12      | 19.19      | 1.77        | 0.20       | AVERAGE |
| 5  | 0.18152 | 37.22 | -27.20     | 64.42      | 35.61      | 1.41        | 0.20       | QP      |
| 6  | 0.18152 | 15.20 | -39.22     | 54.42      | 13.59      | 1.41        | 0.20       | AVERAGE |
| 7  | 0.22083 | 44.21 | -18.58     | 62.79      | 43.02      | 0.99        | 0.20       | QP      |
| 8  | 0.22083 | 27.30 | -25.49     | 52.79      | 26.11      | 0.99        | 0.20       | AVERAGE |
| 9  | 0.25480 | 36.84 | -24.76     | 61.60      | 35.84      | 0.80        | 0.20       | QP      |
| 10 | 0.25480 | 15.69 | -35.91     | 51.60      | 14.69      | 0.80        | 0.20       | AVERAGE |
| 11 | 0.33740 | 30.30 | -28.97     | 59.27      | 29.50      | 0.60        | 0.20       | QP      |
| 12 | 0.33740 | 19.30 | -29.97     | 49.27      | 18.50      | 0.60        | 0.20       | AVERAGE |

Note:

Level = Read Level + LISN Factor + Cable Loss.

## 4.2. Maximum Peak Output Power Measurement

### 4.2.1. Limit

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

### 4.2.2. Measuring Instruments and Setting

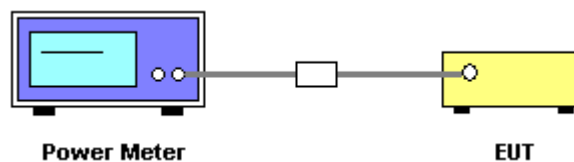
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

| Power Meter Parameter | Setting            |
|-----------------------|--------------------|
| Filter No.            | Auto               |
| Measurement time      | 0.135 s ~ 26 s     |
| Used Peak Sensor      | NRV-Z32 (model 04) |

### 4.2.3. Test Procedures

1. The transmitter output (antenna port) was connected to the power meter.
2. Turn on the EUT and power meter and then record the peak power value.
3. Repeat above procedures on all channels needed to be tested.

### 4.2.4. Test Setup Layout



### 4.2.5. Test Deviation

There is no deviation with the original standard.

### 4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.2.7. Test Result of Maximum Peak Output Power

|               |          |                |         |
|---------------|----------|----------------|---------|
| Temperature   | 24°C     | Humidity       | 64%     |
| Test Engineer | Leo Hung | Configurations | 802.11n |

##### Configuration IEEE 802.11n MCS8 20MHz Ant. A

| Channel | Frequency | Conducted Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|-----------------------|------------------|----------|
| 1       | 2412 MHz  | 20.3                  | 30.00            | Complies |
| 6       | 2437 MHz  | 20.12                 | 30.00            | Complies |
| 11      | 2462 MHz  | 17.86                 | 30.00            | Complies |

##### Configuration IEEE 802.11n MCS8 20MHz Ant. A + Ant. B

| Channel | Frequency | Ant. A Port (dBm) | Ant. B Port (dBm) | Combination Conducted Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|-------------------|-------------------|-----------------------------------|------------------|----------|
| 1       | 2412 MHz  | 20.88             | 20.47             | 23.69                             | 30.00            | Complies |
| 6       | 2437 MHz  | 20.92             | 20.87             | 23.90                             | 30.00            | Complies |
| 11      | 2462 MHz  | 19.36             | 19.84             | 22.61                             | 30.00            | Complies |

##### Configuration IEEE 802.11n MCS8 40MHz Ant. A

| Channel | Frequency | Conducted Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|-----------------------|------------------|----------|
| 3       | 2422 MHz  | 20.23                 | 30.00            | Complies |
| 6       | 2437 MHz  | 20.12                 | 30.00            | Complies |
| 9       | 2452 MHz  | 17.71                 | 30.00            | Complies |

##### Configuration IEEE 802.11n MCS8 40MHz Ant. A + Ant. B

| Channel | Frequency | Ant. A Port (dBm) | Ant. B Port (dBm) | Combination Conducted Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|-------------------|-------------------|-----------------------------------|------------------|----------|
| 3       | 2422 MHz  | 19.7              | 19.22             | 22.47                             | 30.00            | Complies |
| 6       | 2437 MHz  | 19.12             | 19.02             | 22.08                             | 30.00            | Complies |
| 9       | 2452 MHz  | 16.26             | 16.75             | 19.52                             | 30.00            | Complies |

### 4.3. Power Spectral Density Measurement

#### 4.3.1. Limit

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

#### 4.3.2. Measuring Instruments and Setting

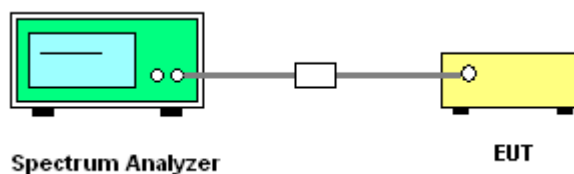
Please refer to section 5 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

| Spectrum Parameter | Setting  |
|--------------------|----------|
| Attenuation        | Auto     |
| Span Frequency     | 1.5MHz   |
| RB                 | 3 kHz    |
| VB                 | 30 kHz   |
| Detector           | Peak     |
| Trace              | Max Hold |
| Sweep Time         | 500s     |

#### 4.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser.
2. Set RBW of spectrum analyzer to 3kHz and VBW to 30kHz. Set Detector to Peak, Trace to Max Hold.
3. Mark the frequency with maximum peak power as the center of the display of the spectrum.
4. Set the span to 1.5MHz and the sweep time to 500s and record the maximum peak value.

#### 4.3.4. Test Setup Layout



#### 4.3.5. Test Deviation

There is no deviation with the original standard.

#### 4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.3.7. Test Result of Power Spectral Density

|               |          |                |         |
|---------------|----------|----------------|---------|
| Temperature   | 24°C     | Humidity       | 64%     |
| Test Engineer | Leo Hung | Configurations | 802.11n |

##### Configuration IEEE 802.11n MCS8 20MHz Ant. A

| Channel | Frequency | Power Density (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|---------------------|------------------|----------|
| 1       | 2412 MHz  | -14.74              | 8.00             | Complies |
| 6       | 2437 MHz  | -14.65              | 8.00             | Complies |
| 11      | 2462 MHz  | -15.83              | 8.00             | Complies |

##### Configuration IEEE 802.11n MCS8 20MHz Ant. A + Ant. B

| Channel | Frequency | Power Density (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|---------------------|------------------|----------|
| 1       | 2412 MHz  | -9.27               | 8.00             | Complies |
| 6       | 2437 MHz  | -8.33               | 8.00             | Complies |
| 11      | 2462 MHz  | -10.08              | 8.00             | Complies |

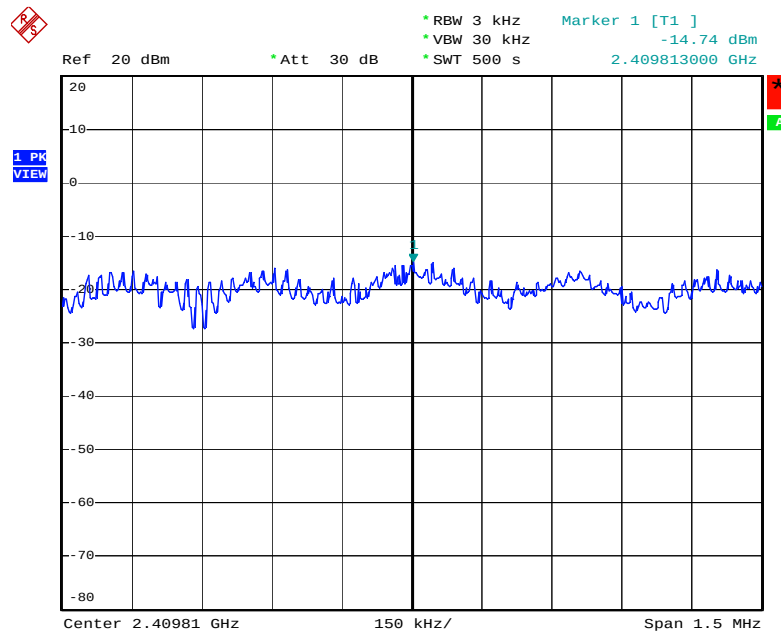
##### Configuration IEEE 802.11n MCS8 40MHz Ant. A

| Channel | Frequency | Power Density (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|---------------------|------------------|----------|
| 3       | 2422 MHz  | -16.6               | 8.00             | Complies |
| 6       | 2437 MHz  | -16.13              | 8.00             | Complies |
| 9       | 2452 MHz  | -18.07              | 8.00             | Complies |

##### Configuration IEEE 802.11n MCS8 40MHz Ant. A + Ant. B

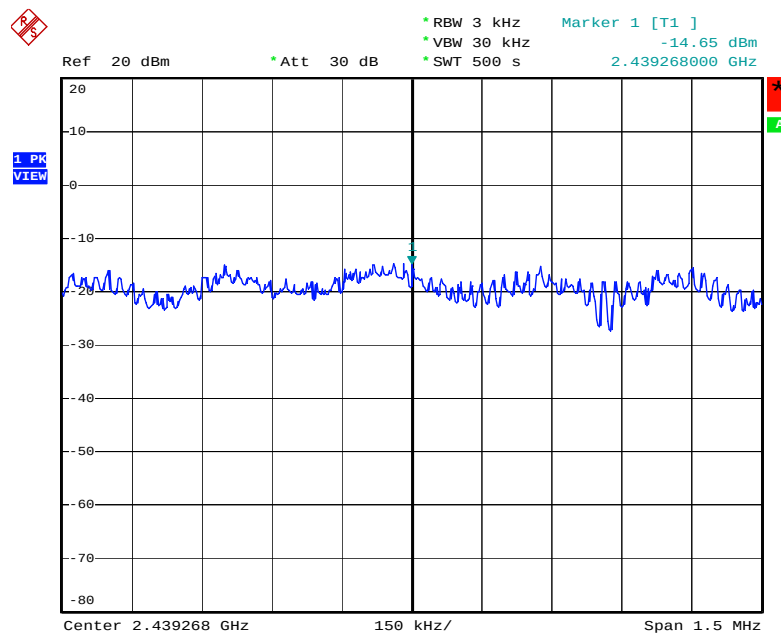
| Channel | Frequency | Power Density (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|---------------------|------------------|----------|
| 3       | 2422 MHz  | -10.18              | 8.00             | Complies |
| 6       | 2437 MHz  | -10.45              | 8.00             | Complies |
| 9       | 2452 MHz  | -12.35              | 8.00             | Complies |

### Power Density Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A / 2412 MHz



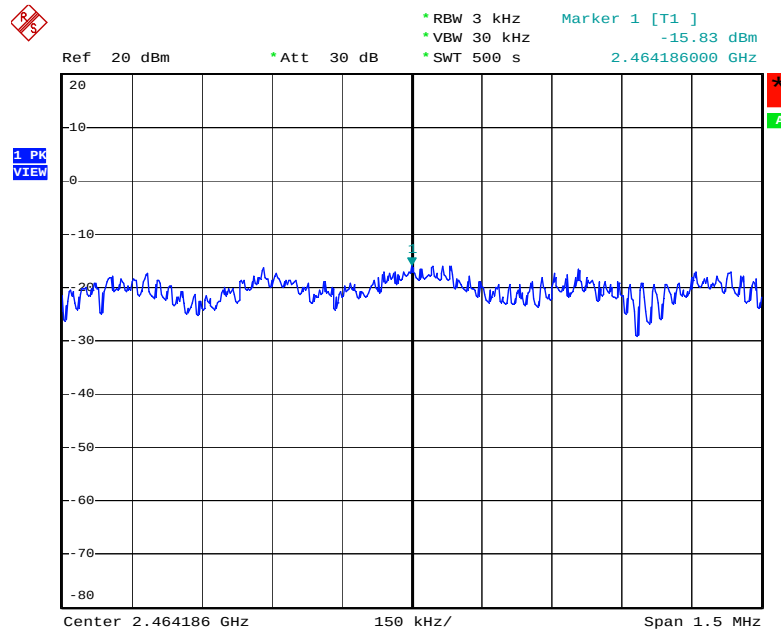
Date: 17.AUG.2006 09:47:44

### Power Density Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A / 2437 MHz



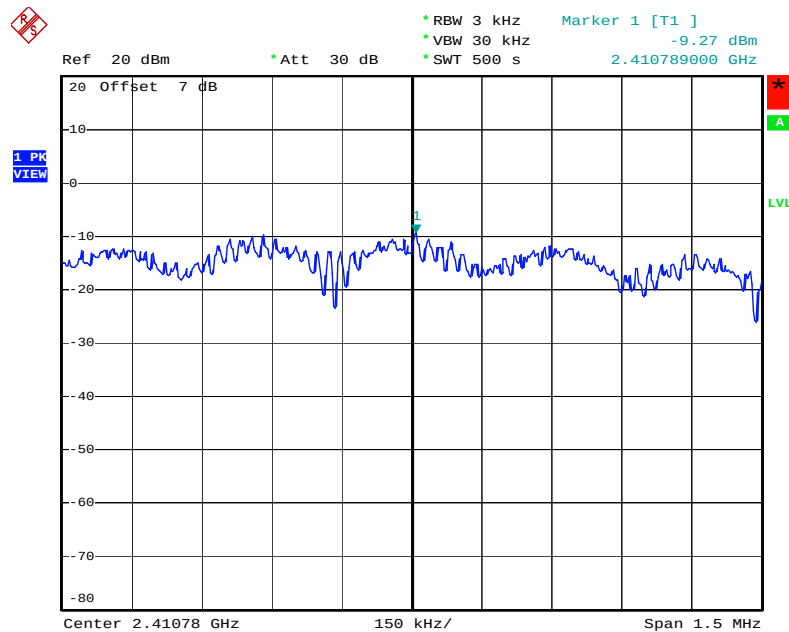
Date: 17.AUG.2006 09:48:47

### Power Density Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A / 2462 MHz



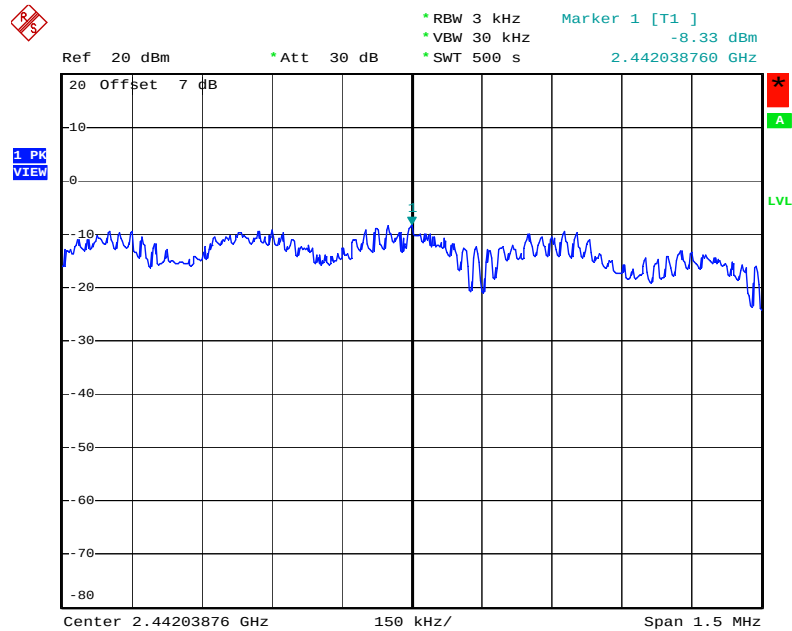
Date: 17.AUG.2006 09:52:05

### Power Density Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A + Ant. B / 2412 MHz



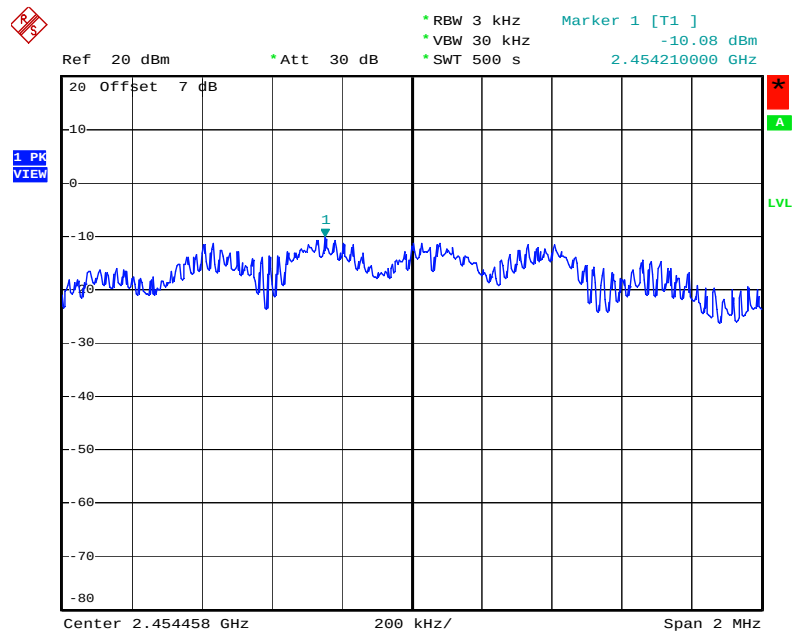
Date: 17.AUG.2006 05:59:02

### Power Density Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A + Ant. B / 2437 MHz



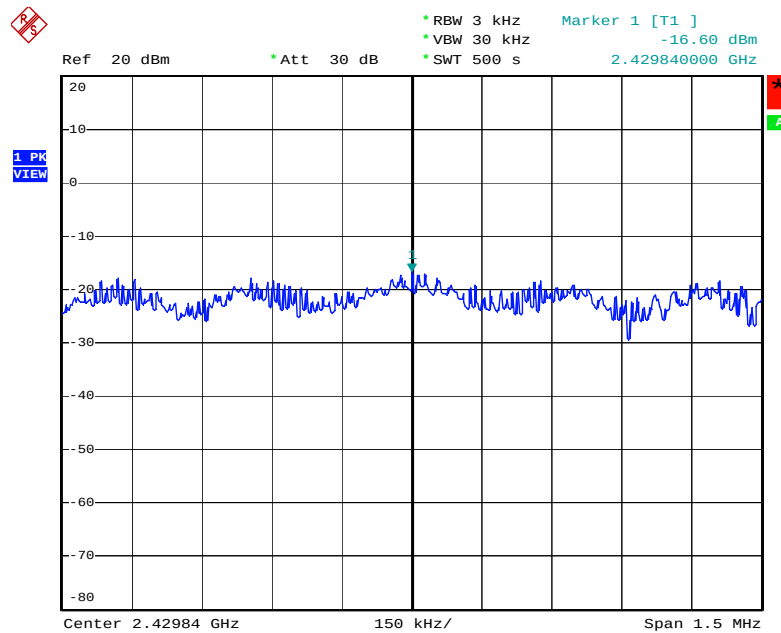
Date: 17.AUG.2006 06:00:22

### Power Density Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A + Ant. B / 2462 MHz



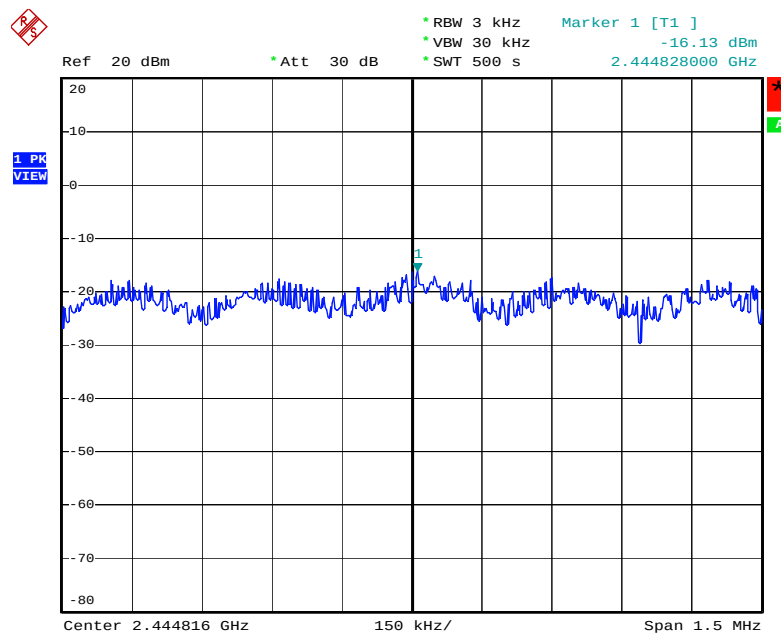
Date: 17.AUG.2006 06:04:49

### Power Density Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A / 2422 MHz



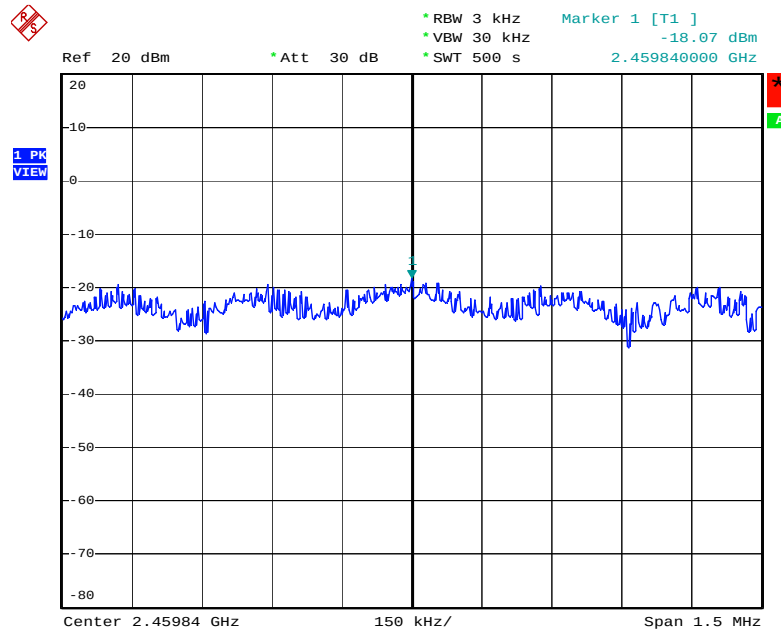
Date: 17.AUG.2006 10:03:16

### Power Density Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A / 2437 MHz



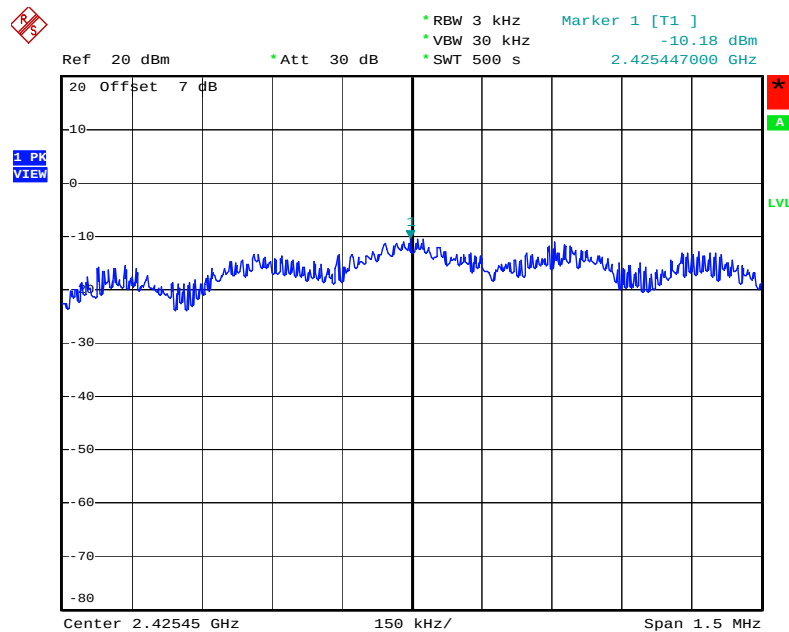
Date: 17.AUG.2006 10:05:00

### Power Density Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A / 2452 MHz



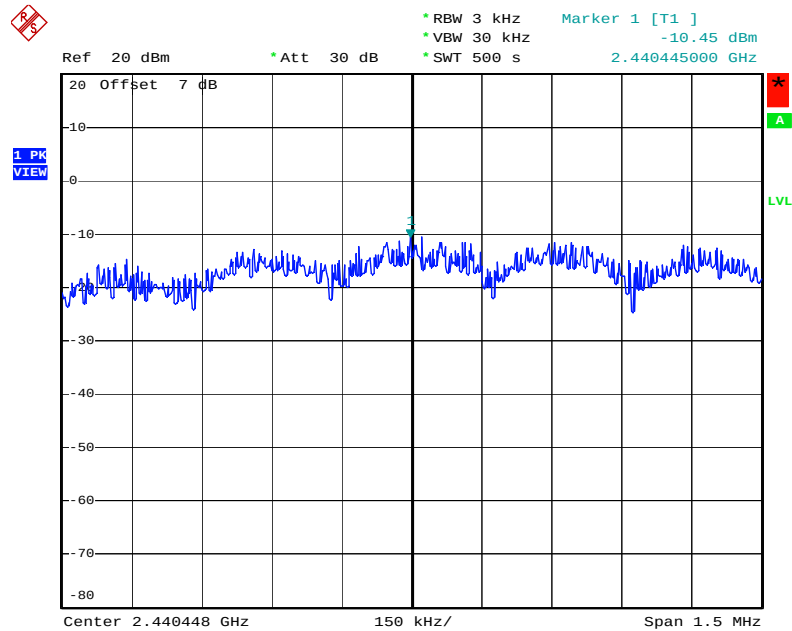
Date: 17.AUG.2006 10:08:20

### Power Density Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A + Ant. B/ 2422 MHz



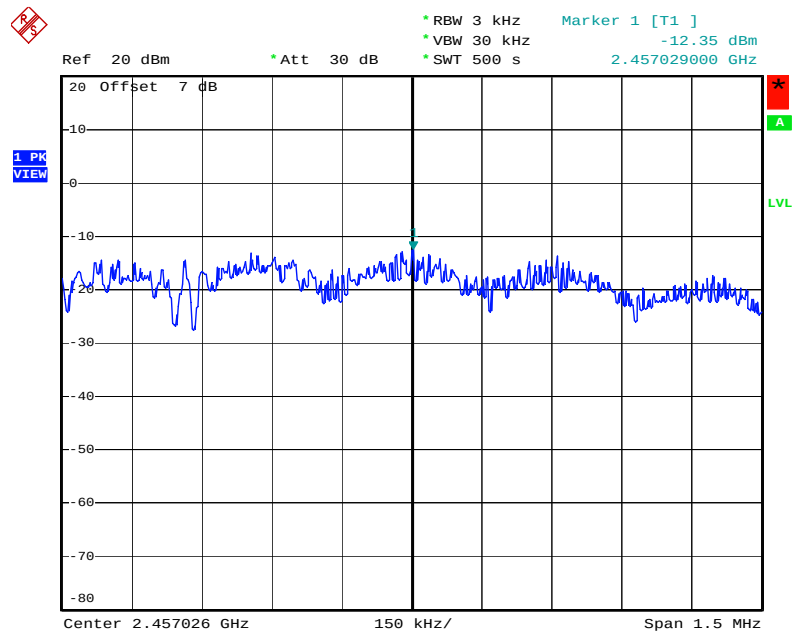
Date: 17.AUG.2006 08:05:23

### Power Density Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A + Ant. B / 2437 MHz



Date: 17.AUG.2006 08:06:37

### Power Density Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A + Ant. B / 2452 MHz



Date: 17.AUG.2006 08:10:49

#### 4.4. 6dB Spectrum Bandwidth Measurement

##### 4.4.1. Limit

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

##### 4.4.2. Measuring Instruments and Setting

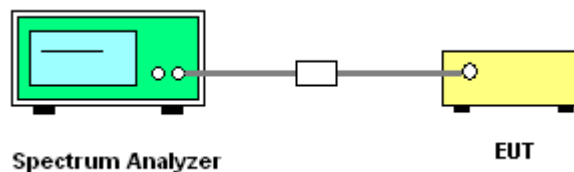
Please refer to section 5 of equipments list in this report. The following table is the setting of the Spectrum Analyzer.

| Spectrum Parameters | Setting         |
|---------------------|-----------------|
| Attenuation         | Auto            |
| Span Frequency      | > 6dB Bandwidth |
| RB                  | 100 kHz         |
| VB                  | 100 kHz         |
| Detector            | Peak            |
| Trace               | Max Hold        |
| Sweep Time          | Auto            |

##### 4.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were used.
3. Measured the spectrum width with power higher than 6dB below carrier.

##### 4.4.4. Test Setup Layout



##### 4.4.5. Test Deviation

There is no deviation with the original standard.

##### 4.4.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.4.7. Test Result of 6dB Spectrum Bandwidth

|               |          |                |         |
|---------------|----------|----------------|---------|
| Temperature   | 24°C     | Humidity       | 64%     |
| Test Engineer | Leo Hung | Configurations | 802.11n |

##### Configuration IEEE 802.11n MCS8 20MHz Ant. A

| Channel | Frequency | 6dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Min. Limit (kHz) | Test Result |
|---------|-----------|---------------------|------------------------------|------------------|-------------|
| 1       | 2412 MHz  | 17.8                | 17.72                        | 500              | Complies    |
| 6       | 2437 MHz  | 17.8                | 17.72                        | 500              | Complies    |
| 11      | 2462 MHz  | 17.88               | 17.72                        | 500              | Complies    |

##### Configuration IEEE 802.11n MCS8 20MHz Ant. A + Ant. B

| Channel | Frequency | 6dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Min. Limit (kHz) | Test Result |
|---------|-----------|---------------------|------------------------------|------------------|-------------|
| 1       | 2412 MHz  | 17.8                | 17.8                         | 500              | Complies    |
| 6       | 2437 MHz  | 16.48               | 17                           | 500              | Complies    |
| 11      | 2462 MHz  | 16.68               | 16.98                        | 500              | Complies    |

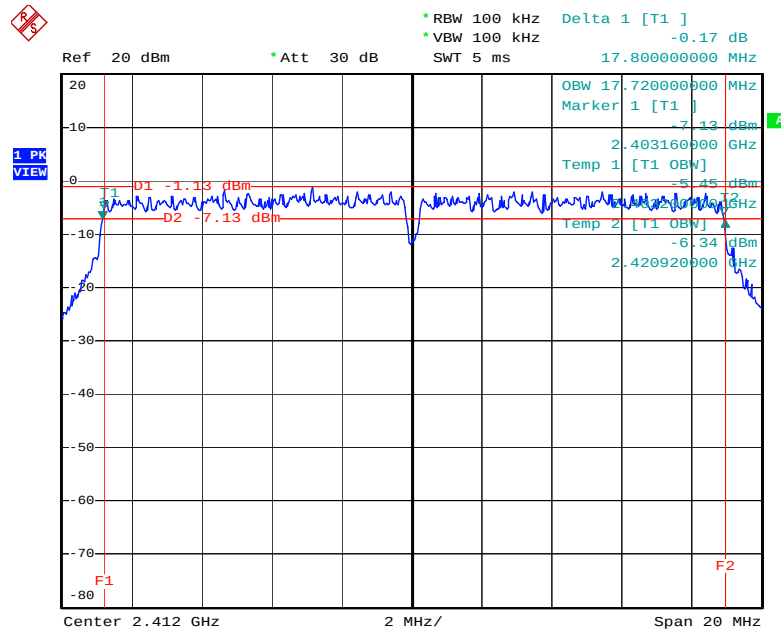
##### Configuration IEEE 802.11n MCS8 40MHz Ant. A

| Channel | Frequency | 6dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Min. Limit (kHz) | Test Result |
|---------|-----------|---------------------|------------------------------|------------------|-------------|
| 3       | 2422 MHz  | 36.64               | 36.32                        | 500              | Complies    |
| 6       | 2437 MHz  | 36.64               | 36.32                        | 500              | Complies    |
| 9       | 2452 MHz  | 36.64               | 36.16                        | 500              | Complies    |

##### Configuration IEEE 802.11n MCS8 40MHz Ant. A + Ant. B

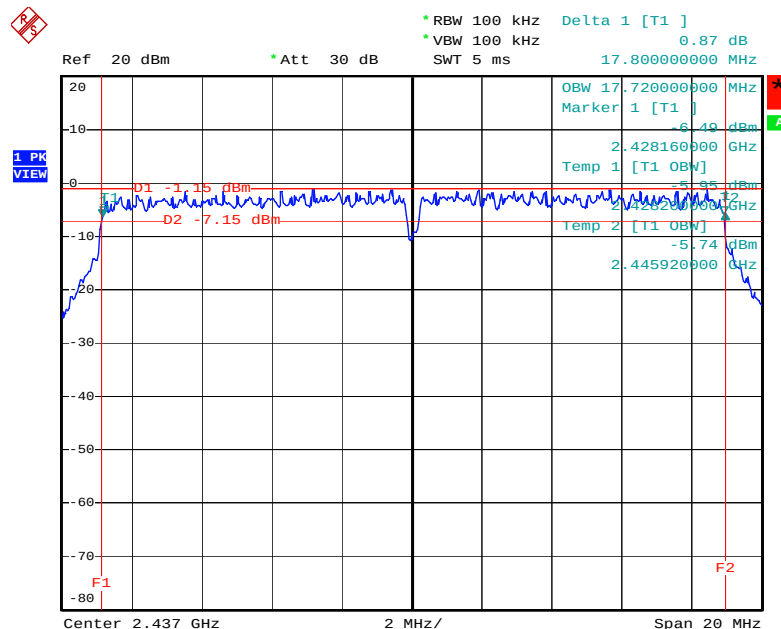
| Channel | Frequency | 6dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Min. Limit (kHz) | Test Result |
|---------|-----------|---------------------|------------------------------|------------------|-------------|
| 3       | 2422 MHz  | 35.28               | 35.76                        | 500              | Complies    |
| 6       | 2437 MHz  | 35.12               | 35.92                        | 500              | Complies    |
| 9       | 2452 MHz  | 36.24               | 36.16                        | 500              | Complies    |

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A / 2412 MHz



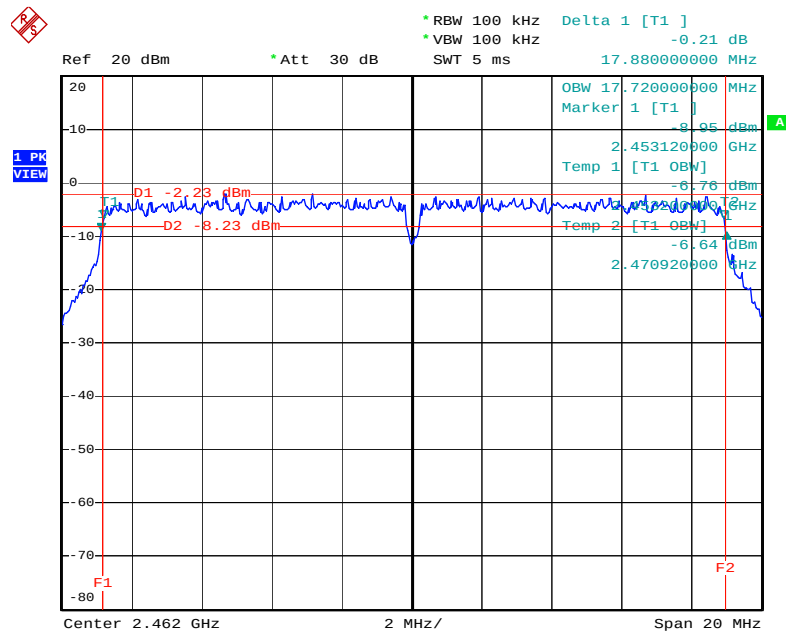
Date: 17.AUG.2006 09:46:21

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A / 2437 MHz



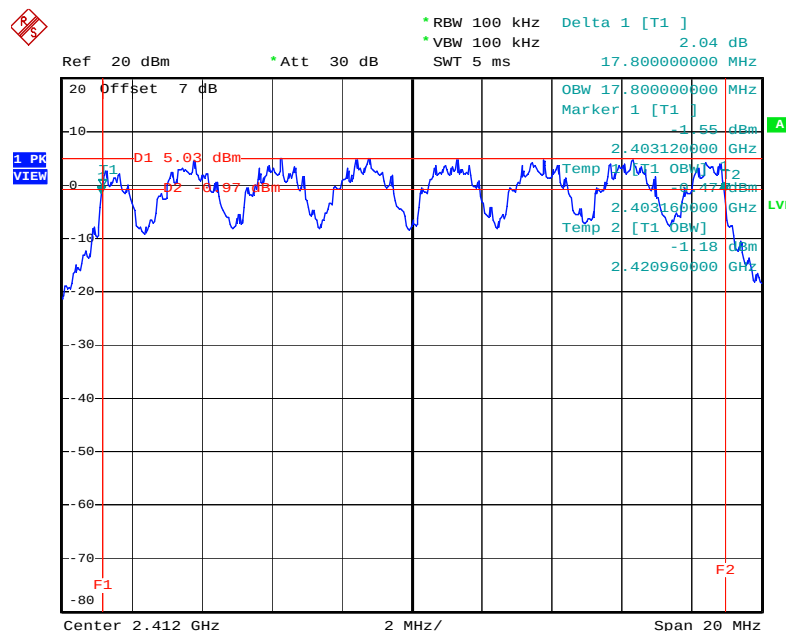
Date: 17.AUG.2006 09:49:30

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A / 2462 MHz



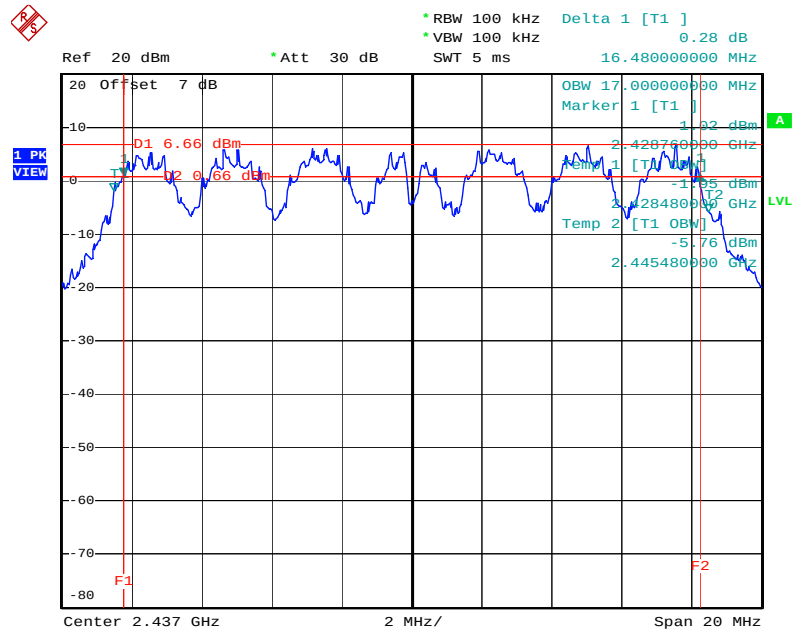
Date: 17.AUG.2006 09:50:41

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A + Ant. B / 2412 MHz



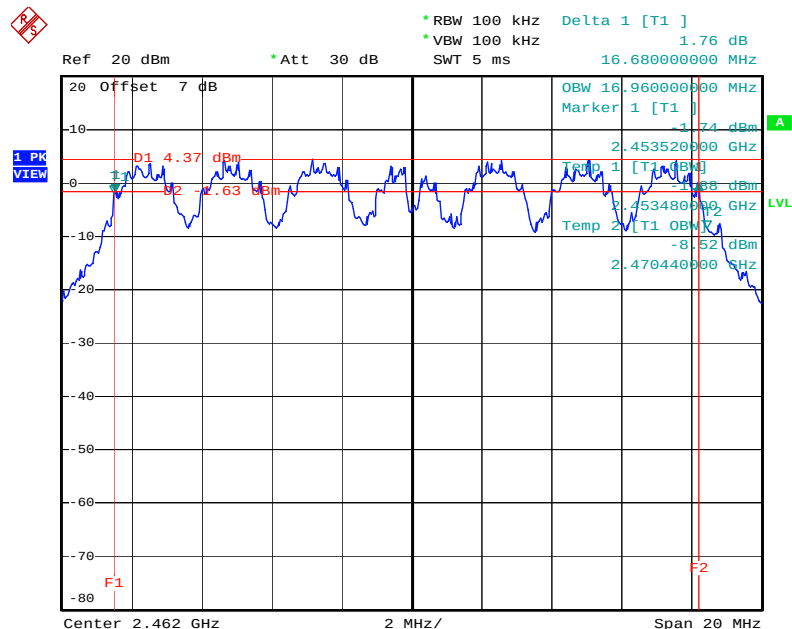
Date: 17.AUG.2006 06:08:07

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A + Ant. B / 2437 MHz



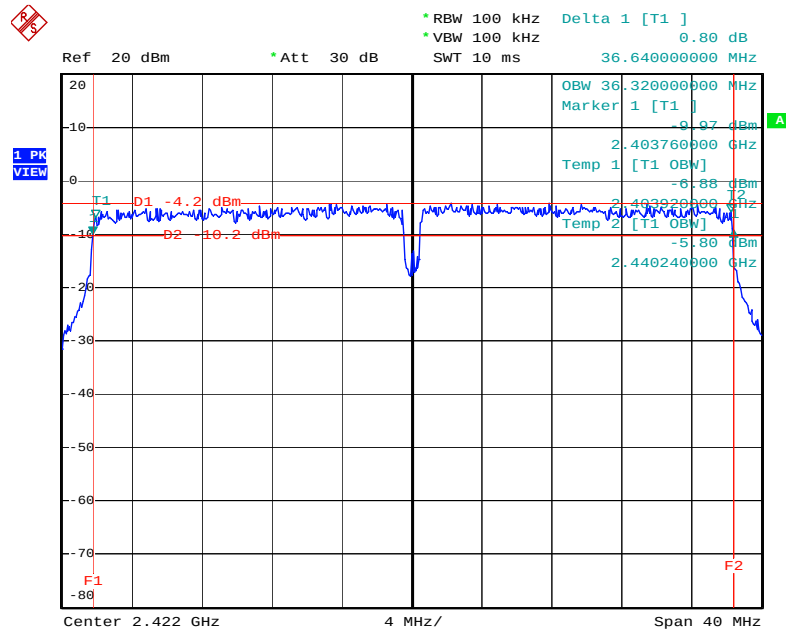
Date: 17.AUG.2006 06:01:05

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 20MHz Ant. A + Ant. B / 2462 MHz



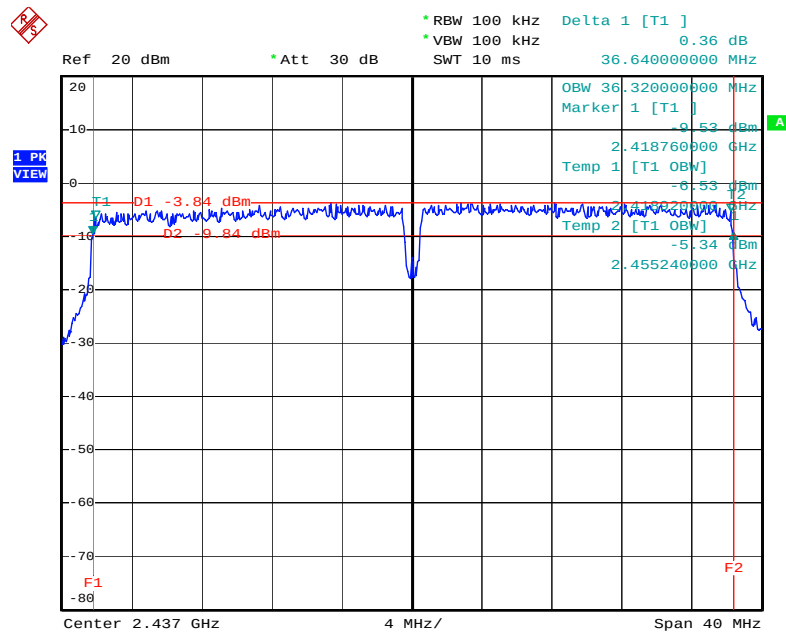
Date: 17.AUG.2006 06:06:36

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A / 2422 MHz



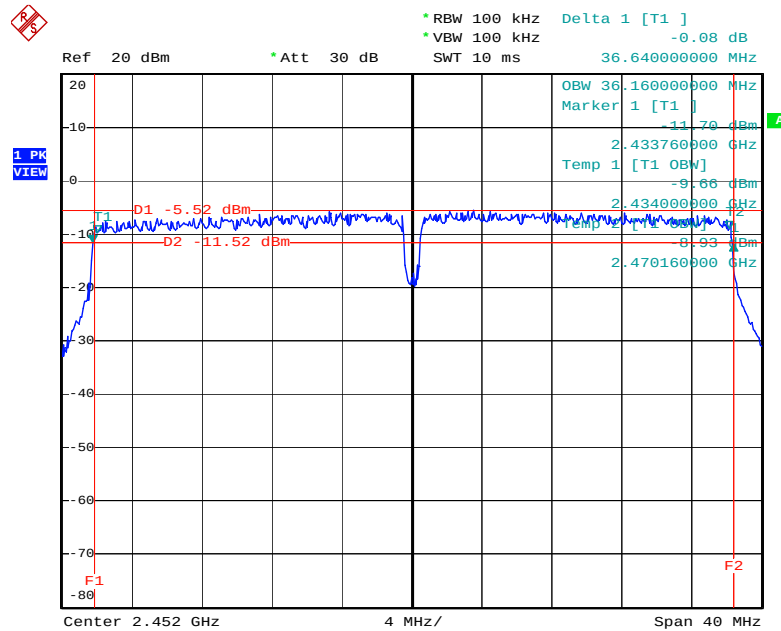
Date: 17.AUG.2006 10:01:41

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A / 2437 MHz



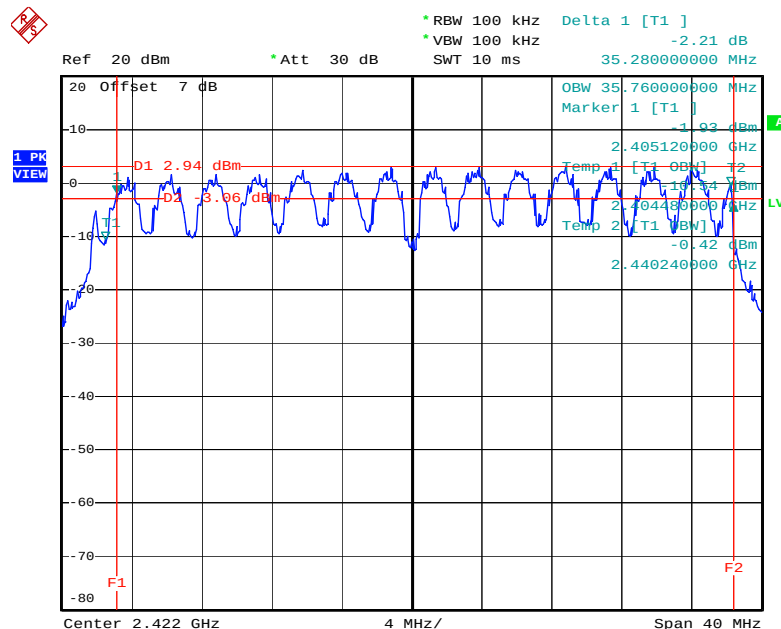
Date: 17.AUG.2006 10:05:53

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A / 2452 MHz



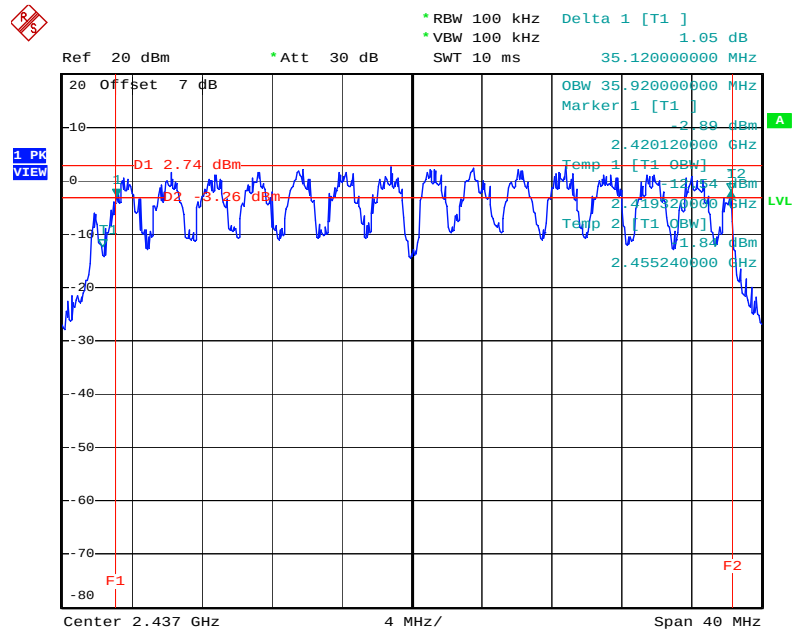
Date: 17.AUG.2006 10:07:07

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A + Ant. B / 2422 MHz



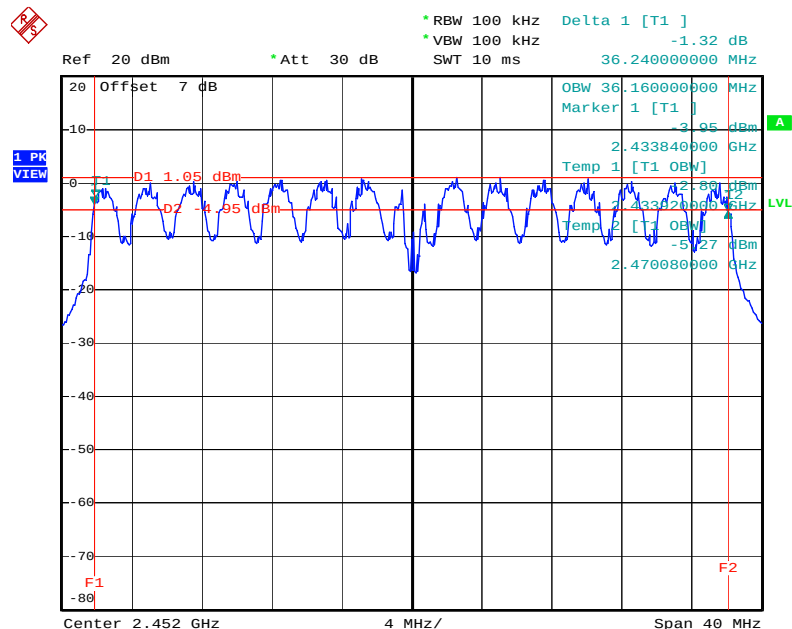
Date: 17.AUG.2006 08:03:29

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A + Ant. B / 2437 MHz



Date: 17.AUG.2006 08:07:32

### 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS8 40MHz Ant. A + Ant. B / 2452 MHz



Date: 17.AUG.2006 08:08:48