

# **FCC TEST REPORT**

**for**

## **47 CFR Part 15 Subpart C**

**Equipment : 802.11 a/b/g WLAN Access Port**

**Trade Name : Symbol**

**Model No. : WSAP-5100 /WSAP-5110**

**FCC ID : H9PWSAP5100**

**Filing Type : Certification**

**Applicant : Universal Scientific Industrial Co., Ltd.**  
141, Lane 351, Taiping Road, Sec. 1, Tsao Tuen,  
Nan-Tou, Taiwan

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***SPORTON International Inc.***

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

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### History of this test report

Original Report Issue Date: Aug. 12, 2004

☒ No additional attachment.

☐ Additional attachment were issued as following record:

| Attachment No. | Issue Date | Description |
|----------------|------------|-------------|
|                |            |             |
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**CERTIFICATE OF COMPLIANCE**  
**for**  
**47 CFR Part 15 Subpart C**

**Equipment** : 802.11 a/b/g WLAN Access Port  
**Trade Name** : Symbol  
**Model No.** : WSAP-5100 /WSAP-5110  
**FCC ID** : H9PWSAP5100  
**Filing Type** : Certification  
**Applicant** : **Universal Scientific Industrial Co., Ltd.**  
141, Lane 351, Taiping Road, Sec. 1, Tsao Tuen,  
Nan-Tou, Taiwan

**HEREBY CERTIFY THAT :**

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 2001** and the equipment under test was **passed** all test items required in FCC Part 15 subpart C, relative to the equipment under test. Testing was carried out on Aug. 03, 2004 at **SPORTON International Inc. LAB.**



Daniel Lee  
Manager

**SPORTON International Inc.**

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

**SPORTON International Inc.**

TEL : 886-2-2696-2468  
FAX : 886-2-2696-2255

FCC ID : H9PWSAP5100  
Page No. : 1 of 50  
Issued Date : Aug. 09, 2004

## **1. General Description of Equipment under Test**

### **1.1. Applicant**

**Universal Scientific Industrial Co., Ltd.**

140, Lane 351, Taiping Road, Sec. 1, Tsao, Tuen, Nan\_Tou, Taiwan

### **1.2 Manufacturer**

**Universal Scientific Industrial Co., Ltd.**

140, Lane 351, Taiping Road, Sec. 1, Tsao, Tuen, Nan\_Tou, Taiwan

### **1.3 Basic Description of Equipment under Test**

|                   |                                 |
|-------------------|---------------------------------|
| Equipment         | : 802.11 a/b/g WLAN Access Port |
| Trade Name        | : Symbol                        |
| Model No.         | : WSAP-5100 /WSAP-5110          |
| FCC ID            | : H9PWSAP5100                   |
| Power Supply Type | : Power Over Ethenet (48V)      |

## 1.4 Feature of Equipment under Test

| Product Feature & Specification                       |                                                                                                           |                               |               |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------|---------------|
| 1. Host/Radio Interface                               | Power Over Ethernet/Wireless LAN Access Port                                                              |                               |               |
| 2. Housing Type                                       | Plastic Housing for WSAP-5110<br>Metallic Housing for WSAP-5100                                           |                               |               |
| 3. Modulation Type/Data Rate                          | OFDM:54/48/36/24/18/12/9/6Mbps<br>CCK:11/5Mbps<br>DQPSK:2Mbps<br>DBPSK:1Mbps                              |                               |               |
| 4. Freq.Range/Carrier Freqs.                          | 2400~2483.5MHz;5150 ~ 5250MHz (Band I); 5250 ~ 5350MHz (Band II);5725~5850MHz (Band III)                  |                               |               |
| 5. Number o f Channels                                | 802.11g/b: 11 Ch<br>802.11a:8Ch(5150~5350MHz),5Ch(5725~5850MHz)                                           |                               |               |
| 6. Carrier Frequency of each channel                  | 802.11g/b:2412+ m*5 MHz,m=1~11<br>802.11a: 5000+n*5 MHz,<br>n=36,40,44,48,52,56,60,64,149,153,157,161,165 |                               |               |
| 7. Channel Spacing                                    | 802.11g/b:5MHz<br>802.11a: 20MHz                                                                          |                               |               |
| 8. Maximum Output Power to Antenna (Normal condition) | Refer to power table 1.6                                                                                  |                               |               |
| 9. Type of Antenna Connector                          | Refer to Antenna list 1.5                                                                                 |                               |               |
| 10. Antenna Type                                      |                                                                                                           |                               |               |
| 11. Antenna Gain                                      |                                                                                                           |                               |               |
| 12. Main Board Version                                | Plastic Housing                                                                                           | Cypress<br>Mercury<br>Abracon |               |
|                                                       | Metallic Housing                                                                                          | Mercury<br>TXC-33.3MHz        |               |
| 13. Function Type                                     | Transmitter                                                                                               |                               | Transceiver V |
| 14. Power Rating (DC/AC , Voltage)                    | Power Over Ethernet (48V) (Symbol WS 2000)                                                                |                               |               |
| 15. Duty Cycle                                        | 100%                                                                                                      |                               |               |

## 1.5 Antenna List

| Antenna List | Antenna Type | Peak Gain (dBi) | Cable Loss (dB) | Net Gain (dBi) | Frequency Range (GHz)   | Application                     | Housing Type | Connector Type | Serial No.            |
|--------------|--------------|-----------------|-----------------|----------------|-------------------------|---------------------------------|--------------|----------------|-----------------------|
| Antenna 1    | Integral     | 2 / 3.8         | 0               | 2 / 3.8        | 2.4 ~ 2.5/ 5.15 ~ 5.825 | 11b/g;<br>11 a band<br>I/II/III | Plastic      | NA             | NA                    |
| Antenna 2    | Sector Panel | 11.2            | 2.7             | 8.5            | 2.4 ~ 2.5               | 11 b/g                          | Metallic     | RP-BNC         | ML-2499-11<br>PNA2-01 |
| Antenna 3    | Dipole       | 2               | 0               | 2              | 2.4 ~ 2.5               | 11 b/g                          | Metallic     | RP-BNC         | ML-2499-AP<br>A2-01   |
| Antenna 4    | Dipole Array | 4.6             | 1.3             | 3.3            | 2.4 ~ 2.5               | 11 b/g                          | Metallic     | RP-BNC         | ML-2499-HP<br>A3-01   |
| Antenna 5    | YAGI         | 14.2            | 1.3             | 12.9           | 2.4 ~ 2.5               | 11 b/g                          | Metallic     | N-Type         | ML-2499-BY<br>GA2-01  |
| Antenna 6    | Dipole       | 2.0             | 0               | 2.0            | 5.15 ~ 5.875            | 11 a Band II/III                | Metallic     | RP-SMA         | ML-5299-AP<br>A1-01   |
| Antenna 7    | Dipole Array | 5.9             | 0.84            | 5              | 5.15 ~ 5.875            | 11 a Band II/III                | Metallic     | RP-SMA         | ML-5299-HP<br>A1-01   |
| Antenna 8    | Panel        | 14.2            | 1.2             | 13             | 5.15 ~ 5.875            | 11 a Band II/III                | Metallic     | RP-SMA         | ML-5299-W<br>PNA1-01  |

**1.6 Power Table**

|           | 802.11b  | 802.11g  | 802.11a/band 1 | 802.11a/band 2 | 802.11a/band 3 |
|-----------|----------|----------|----------------|----------------|----------------|
| Antenna 1 | 20.3 dBm | 21.5 dBm | 16.6 dBm       | 22.1 dBm       | 23.4 dBm       |
| Antenna 2 | 18.1 dBm | 20.8 dBm | N/A            | N/A            | N/A            |
| Antenna 3 | 18.1 dBm | 19.9 dBm | N/A            | N/A            | N/A            |
| Antenna 4 | 18.1 dBm | 21.5 dBm | N/A            | N/A            | N/A            |
| Antenna 5 | 15.5 dBm | 19.7 dBm | N/A            | N/A            | N/A            |
| Antenna 6 | N/A      | N/A      | N/A            | 22.1 dBm       | 24 dBm         |
| Antenna 7 | N/A      | N/A      | N/A            | 23.5 dBm       | 23.4 dBm       |
| Antenna 8 | N/A      | N/A      | N/A            | 17 dBm         | 22.5 dBm       |



## 2 Test Configuration of Equipment under Test

### 2.1 Test Manner

- a. The EUT has been associated with peripherals pursuant to ANSI C63.4-2001 and configuration operated in a manner tended to maximize its emission characteristics in a typical application.
- b. The complete test system included DELL Notebook and EUT for EMI test.
- c. The EUT can operate on 11 channels for 802.11b/g and 13 channels for 802.11a(as listed in section 1.4).
- d. The following test modes were tested for conduction test:

**Plastic housing /WSAP5110**

Mode 1: 802.11g link mode

Mode 2: 802.11a link mode

Mode 3: 802.11g & 11a link mode

**Metallic housing WSAP5100**

Mode 4: 802.11g link mode

Mode 5: 802.11a link mode

Mode 6: 802.11g & 11a link mode

- e. The following test modes were tested for radiation test:

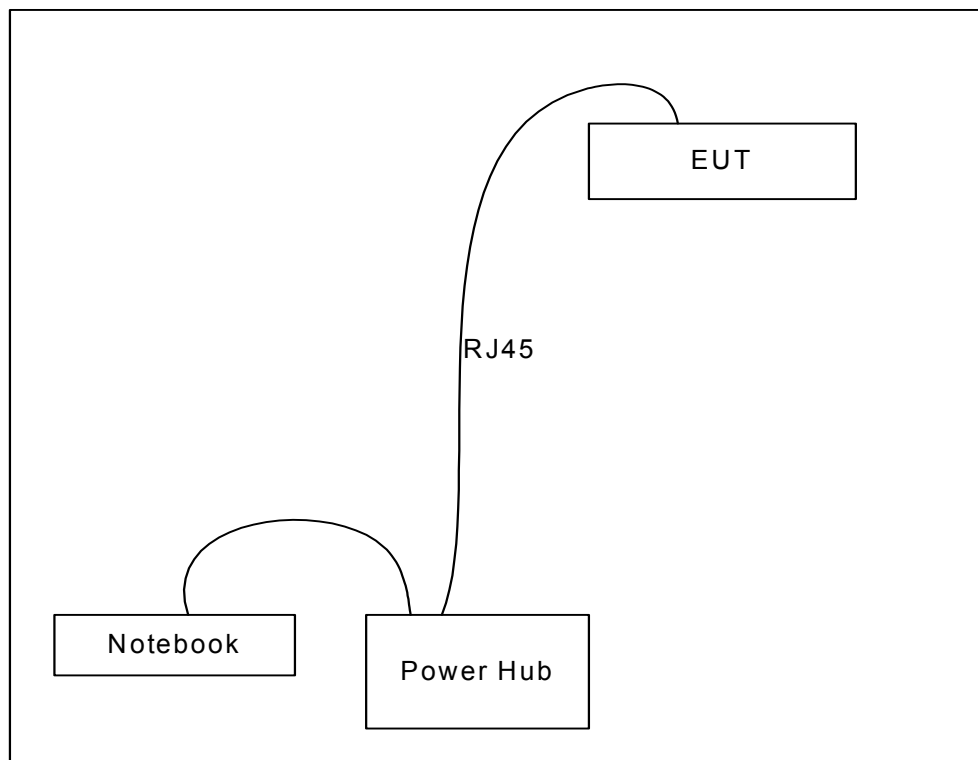
**Refer to testing matrix.**

| Antenna List | 11b TX Ch 1/6/11 /above 1 GHz | 11b TX Ch 6 /below 1 GHz | 11g TX Ch 1/ 6/11 /above 1 GHz | 11g TX Ch 6 /below 1 GHz | 11a TX f=5745 /5785/5825 MHz /above 1 GHz | 11a TX f=5825 MHz /below 1 GHz |
|--------------|-------------------------------|--------------------------|--------------------------------|--------------------------|-------------------------------------------|--------------------------------|
| Antenna 1    | Y                             | Y                        | Y                              | Y                        | Y                                         | Y                              |
| Antenna 2    | Y                             |                          | Y                              |                          |                                           |                                |
| Antenna 3    | Y                             |                          | Y                              |                          |                                           |                                |
| Antenna 4    | Y                             |                          | Y                              |                          |                                           |                                |
| Antenna 5    | Y                             | Y                        | Y                              | Y                        |                                           |                                |
| Antenna 6    |                               |                          |                                |                          | Y                                         |                                |
| Antenna 7    |                               |                          |                                |                          | Y                                         |                                |
| Antenna 8    |                               |                          |                                |                          | Y                                         | Y                              |

- f. Frequency range investigated: conduction 150 kHz to 30 MHz, radiation 30 MHz to 25000MHz for 802.11b/g and 30MHz to 40GHz for 802.11a.

**2.2 Description of Test System**

| Item | Asset           | Model Name | Power Cord | S/N    |
|------|-----------------|------------|------------|--------|
| 1    | Notebook (DELL) | PP05L      | N/A        | SP0005 |

**2.3 Connection Diagram of Test System**

Power Hub: Symbol WS 2000

### **3 Operation of Equipment under Test**

The following programs were executed:

one self test program "WinLEO Version 00.33" to keep transmitting signals.

## **4 General Information of Test**

Test Site Location : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,  
Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.  
TEL : 886-3-327-3456  
FAX : 886-3-318-0055  
Test Site No : CO01-HY, 03CH03-HY 、 03CH06-HY

### **4.1 Test Voltage**

110V/ 60Hz

### **4.2 Standard for Methods of Measurement**

ANSI C63.4-2001

### **4.3 Test in Compliance with**

47 CFR Part 15 Subpart C

### **4.4 Frequency Range Investigated**

- a. Conduction: from 150 kHz to 30 MHz
- b. Radiation: from 30 MHz to 25000 MHz for 802.11b/g
- c. Radiation: from 30MHz to 40000MHz for 802.11a/ band III.

### **4.5 Test Distance**

The test distance of radiated emission from antenna to EUT is 3 m.

## **5 Report of Measurements and Examinations**

### **5.1 List of Measurements and Examinations**

| FCC Rule               | Description of Test                      | Result |
|------------------------|------------------------------------------|--------|
| 15.207                 | Conducted Emission                       | Pass   |
| 15.247(a)(2)           | 6dB Bandwidth                            | Pass   |
| 15.247(b)              | Maximum Peak Output Power                | Pass   |
| 15.209(a)              | Radiated Emission                        | Pass   |
| 15.247 (c)             | 100kHz Bandwidth of Frequency Band Edges | Pass   |
| 15.247(d)              | Power Spectral Density                   | Pass   |
| 15.203<br>15.247(b)(4) | Antenna Requirement                      | Pass   |
| 1.1307<br>2.1091       | RF Exposure                              | Pass   |

## 5.2 6dB Bandwidth

### 5.2.1 Measuring Instruments :

As described in chapter 10 of this test report.

### 5.2.2 Test Procedure :

1. The transmitter output was connected to the spectrum analyzer directly.
2. Set RBW of spectrum analyzer to 100kHz and VBW to 100kHz.
3. The 6 dB bandwidth is defined as the frequency range where the power is higher than the peak power minus 6dB.

### 5.2.3 Test Setup Layout :



### 5.2.4 Test Result :

#### 5.2.4.1 Antenna 1

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11b

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 01      | 2412                 | 11.52                             | >0.5              | Antenna 1-1      |
| 06      | 2437                 | 11.52                             | >0.5              | Antenna 1-2      |
| 11      | 2462                 | 11.52                             | >0.5              | Antenna 1-3      |

- Application: 802.11g

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 01      | 2412                 | 16.44                             | >0.5              | Antenna 1-4      |
| 06      | 2437                 | 16.44                             | >0.5              | Antenna 1-5      |
| 11      | 2462                 | 16.44                             | >0.5              | Antenna 1-6      |

- Application: 802.11a

| Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|----------------------|-----------------------------------|-------------------|------------------|
| 5745                 | 16.48                             | >0.5              | Antenna 1-7      |
| 5785                 | 16.52                             | >0.5              | Antenna 1-8      |
| 5825                 | 16.48                             | >0.5              | Antenna 1-9      |

**5.2.4.2 Antenna 2**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11b

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 01      | 2412                 | 11.6                              | >0.5              | Antenna 2-1      |
| 06      | 2437                 | 11.6                              | >0.5              | Antenna 2-2      |
| 11      | 2462                 | 11.6                              | >0.5              | Antenna 2-3      |

- Application: 802.11g

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 01      | 2412                 | 16.52                             | >0.5              | Antenna 2-4      |
| 06      | 2437                 | 16.44                             | >0.5              | Antenna 2-5      |
| 11      | 2462                 | 16.52                             | >0.5              | Antenna 2-6      |

**5.2.4.3 Antenna 3**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11b

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 01      | 2412                 | 11.2                              | >0.5              | Antenna 3-1      |
| 06      | 2437                 | 11.6                              | >0.5              | Antenna 3-2      |
| 11      | 2462                 | 11.6                              | >0.5              | Antenna 3-3      |

- Application: 802.11g

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 01      | 2412                 | 16.48                             | >0.5              | Antenna 3-4      |
| 06      | 2437                 | 16.48                             | >0.5              | Antenna 3-5      |
| 11      | 2462                 | 16.48                             | >0.5              | Antenna 3-6      |

**5.2.4.4 Antenna 4**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11b

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 01      | 2412                 | 11.6                              | >0.5              | Antenna 4-1      |
| 06      | 2437                 | 11.6                              | >0.5              | Antenna 4-2      |
| 11      | 2462                 | 11.6                              | >0.5              | Antenna 4-3      |

- Application: 802.11g

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 01      | 2412                 | 16.52                             | >0.5              | Antenna 4-4      |
| 06      | 2437                 | 16.48                             | >0.5              | Antenna 4-5      |
| 11      | 2462                 | 16.48                             | >0.5              | Antenna 4-6      |



**5.2.4.5 Antenna 5**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11b

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 01      | 2412                 | 12.92                             | >0.5              | Antenna 5-1      |
| 06      | 2437                 | 12.28                             | >0.5              | Antenna 5-2      |
| 11      | 2462                 | 11.6                              | >0.5              | Antenna 5-3      |

- Application: 802.11g

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 01      | 2412                 | 16.52                             | >0.5              | Antenna 5-4      |
| 06      | 2437                 | 16.44                             | >0.5              | Antenna 5-5      |
| 11      | 2462                 | 16.44                             | >0.5              | Antenna 5-6      |

**5.2.4.6 Antenna 6**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11a

| Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|----------------------|-----------------------------------|-------------------|------------------|
| 5745                 | 16.8                              | >0.5              | Antenna 6-1      |
| 5785                 | 16.8                              | >0.5              | Antenna 6-2      |
| 5825                 | 16.8                              | >0.5              | Antenna 6-3      |

**5.2.4.7 Antenna 7**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11a

| Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|----------------------|-----------------------------------|-------------------|------------------|
| 5745                 | 16.8                              | >0.5              | Antenna 7-1      |
| 5785                 | 16.8                              | >0.5              | Antenna 7-2      |
| 5825                 | 16.8                              | >0.5              | Antenna 7-3      |

**5.2.4.8 Antenna 8**

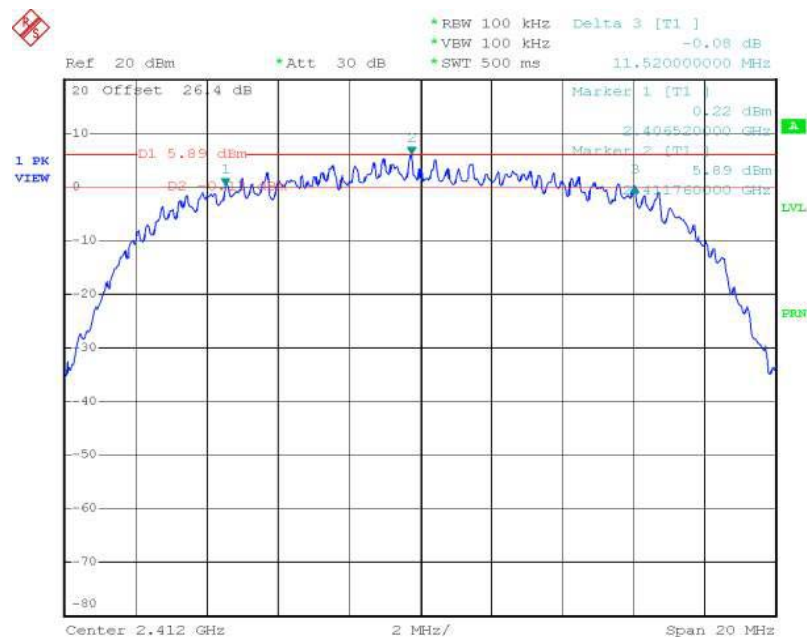
- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11a

| Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|----------------------|-----------------------------------|-------------------|------------------|
| 5745                 | 16.8                              | >0.5              | Antenna 8-1      |
| 5785                 | 16.8                              | >0.5              | Antenna 8-2      |
| 5825                 | 16.8                              | >0.5              | Antenna 8-3      |

## 5.2.5 Test Data

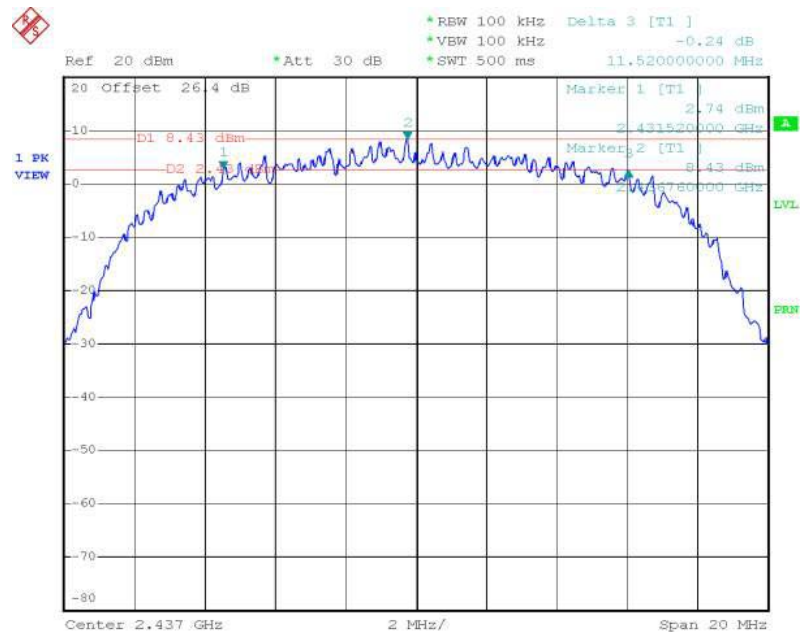
## 5.2.5.1 Antenna 1

1-1



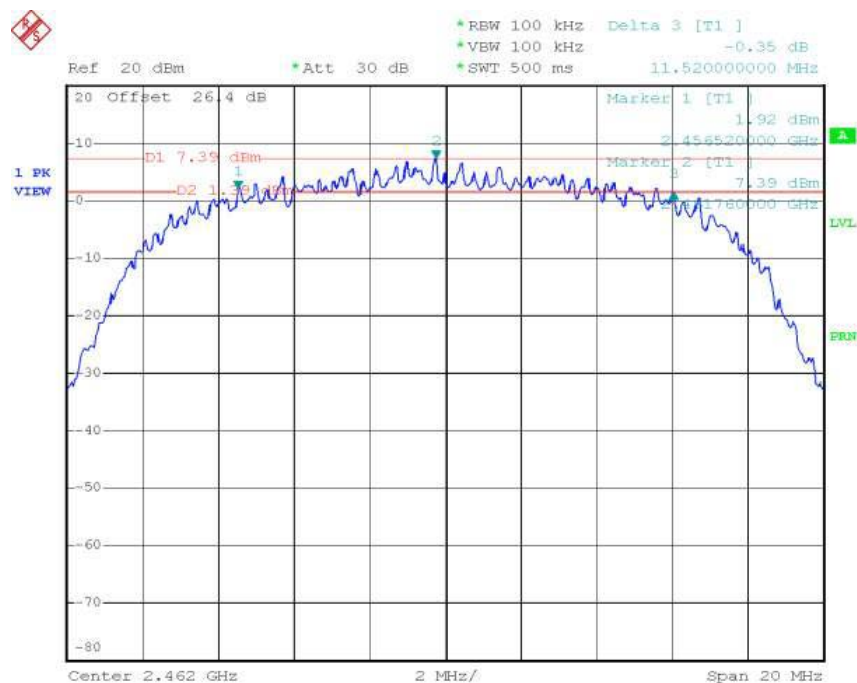
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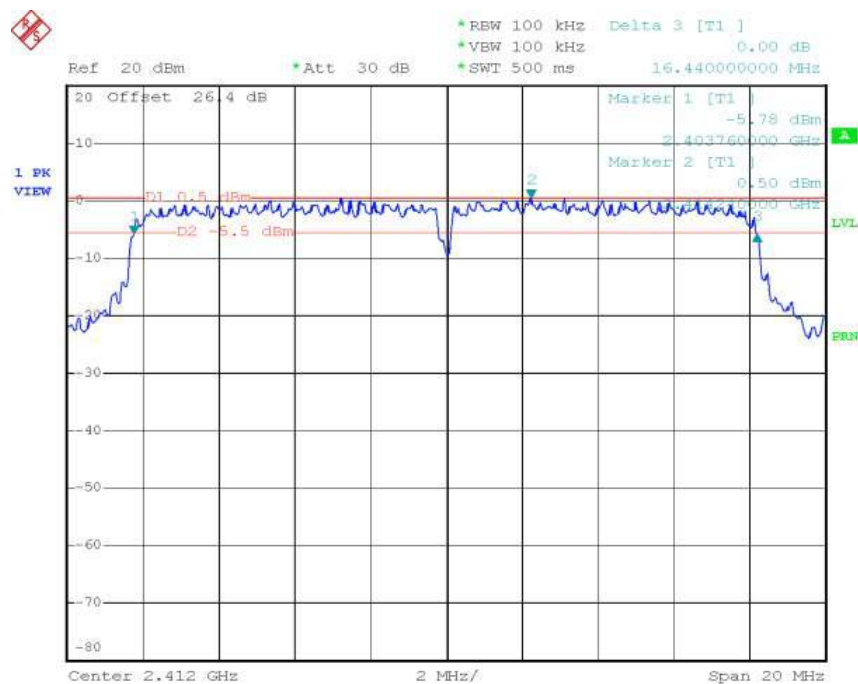
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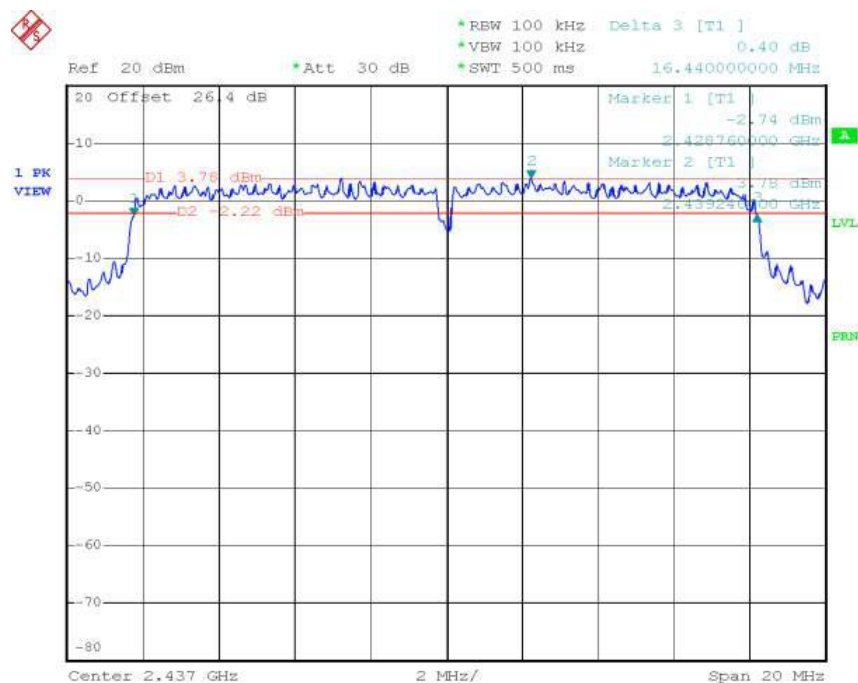
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1-4



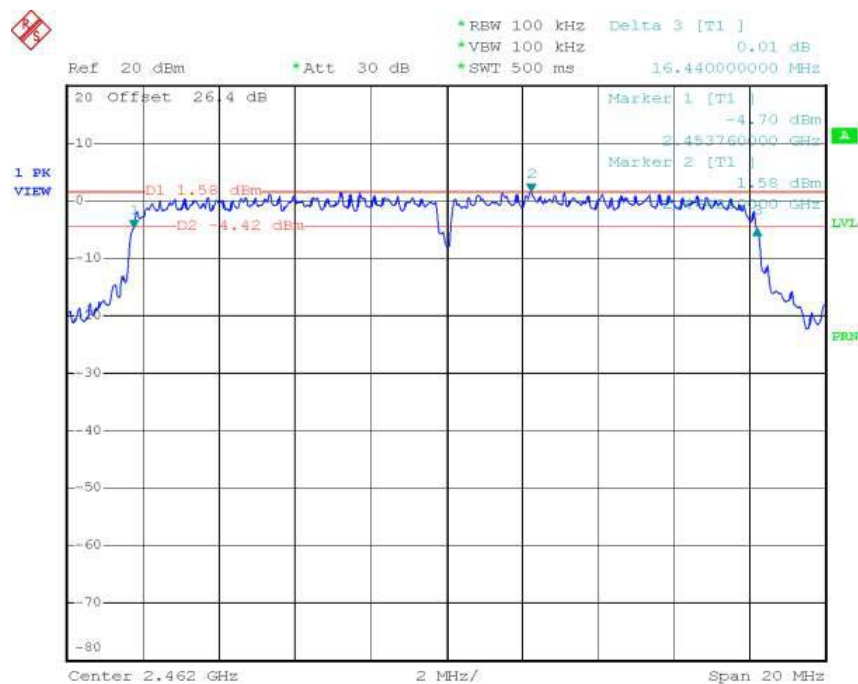
Date: 24.JUL.2004 02:41:15

1-5



Date: 24.JUL.2004 02:42:32

1-6

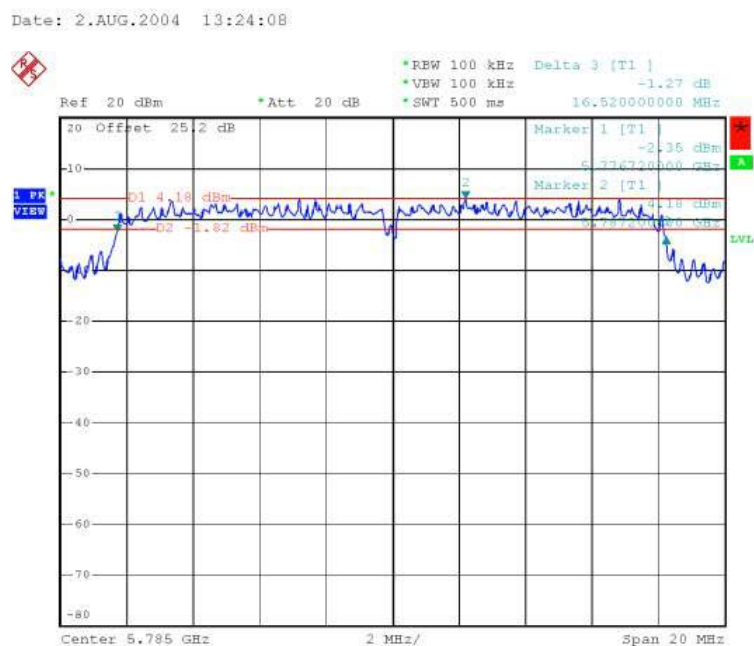


Date: 24.JUL.2004 02:47:31

1-7



1-8



Date: 2.AUG.2004 13:26:17

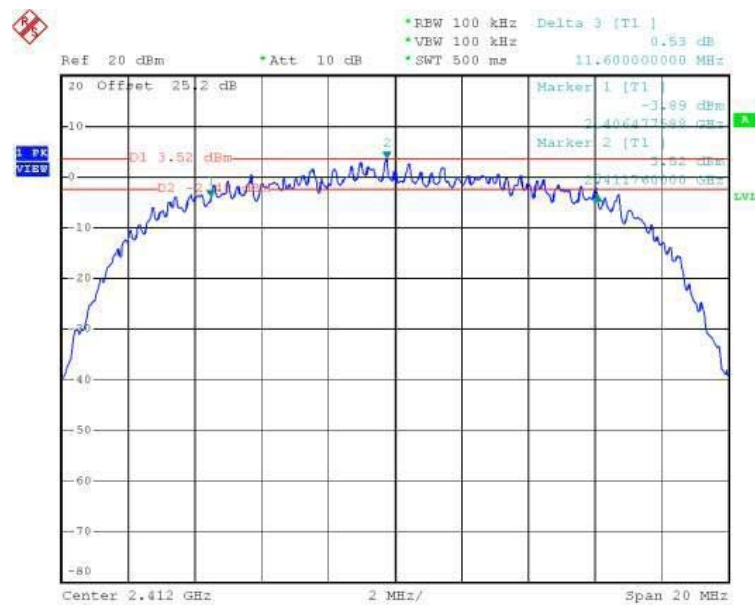
1-9



Date: 2.AUG.2004 13:27:39

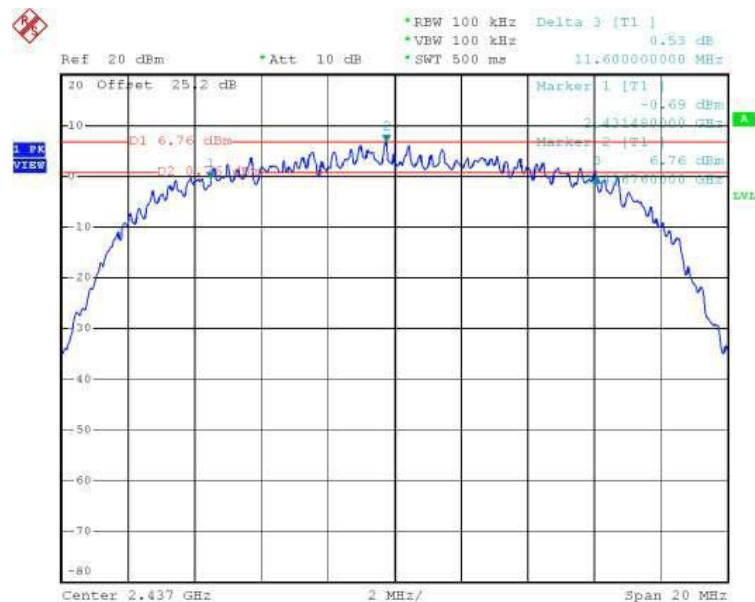
## 5.2.5.2 Antenna 2

2-1



Date: 26.JUL.2004 15:10:48

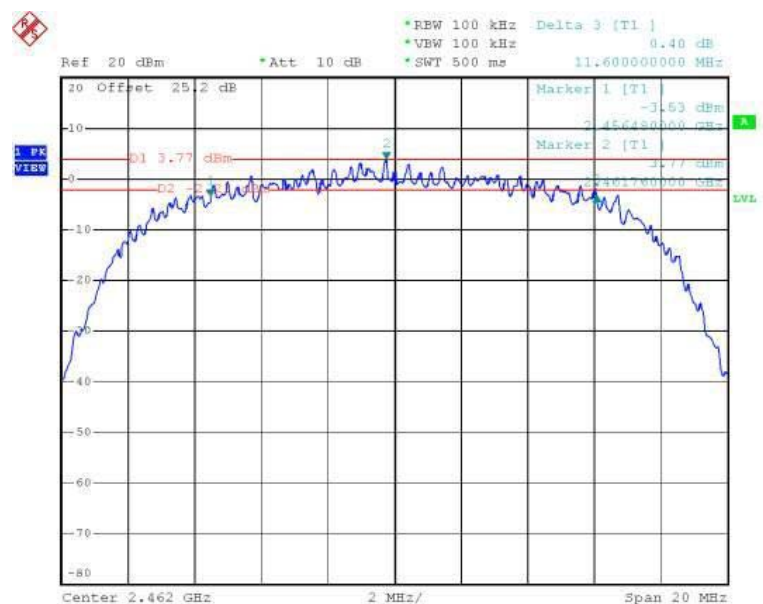
2-2



Date: 26.JUL.2004 15:13:01

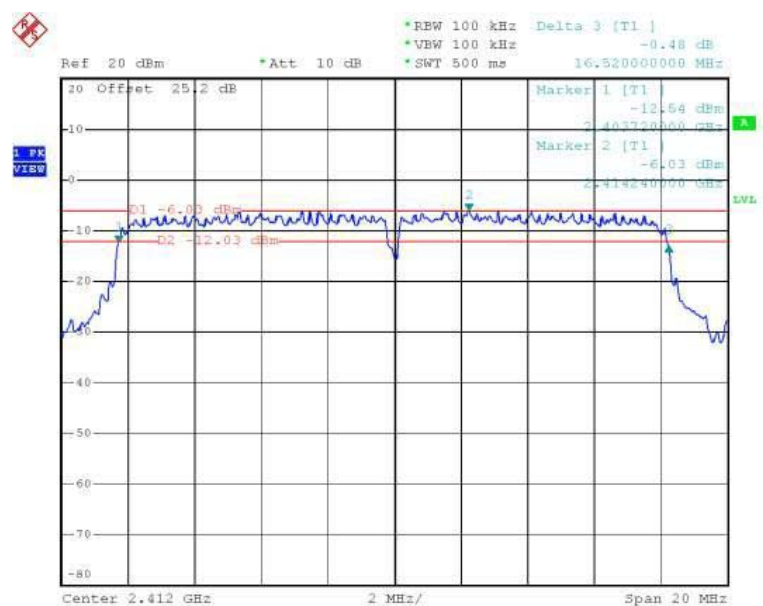


2-3

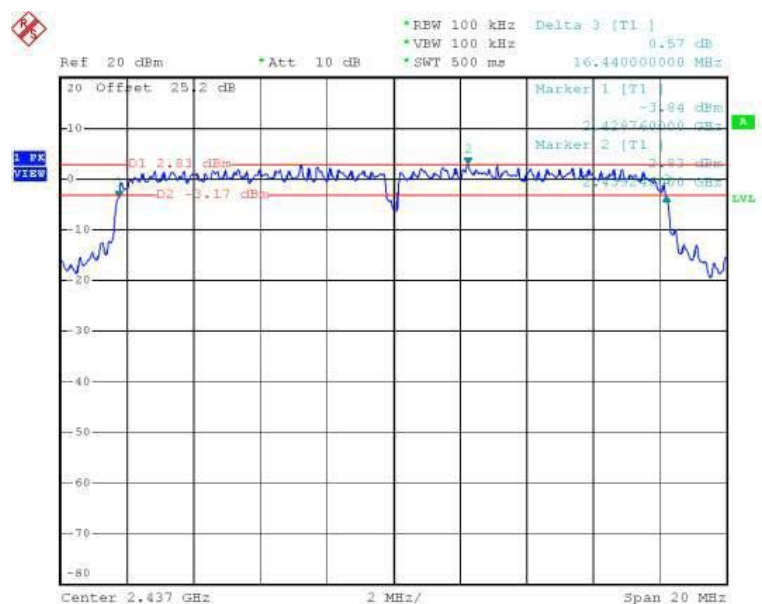


Date: 26.JUL.2004 15:17:38

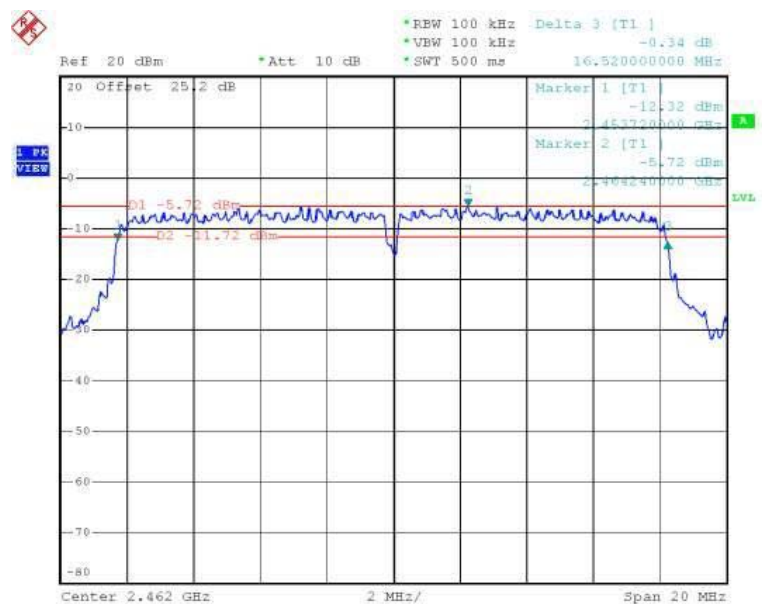
2-4



Date: 26.JUL.2004 15:51:56



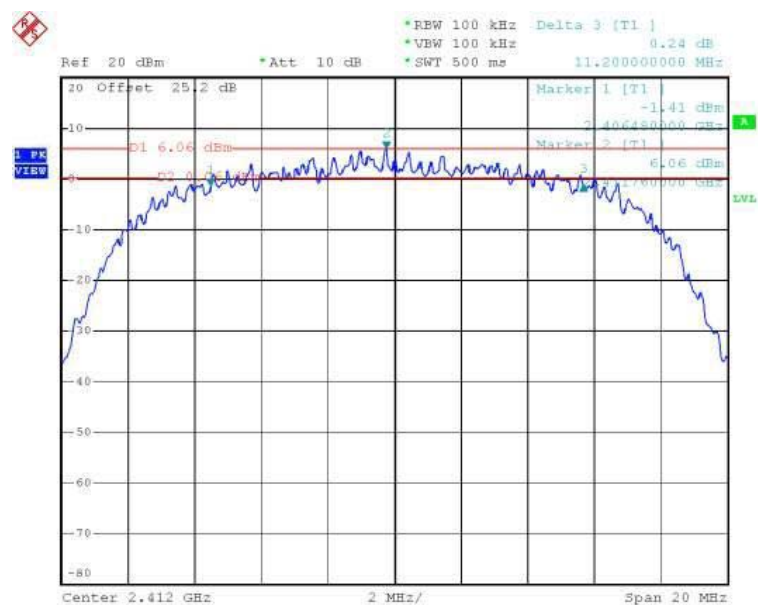
Date: 26.JUL.2004 15:54:10



Date: 26.JUL.2004 15:56:30

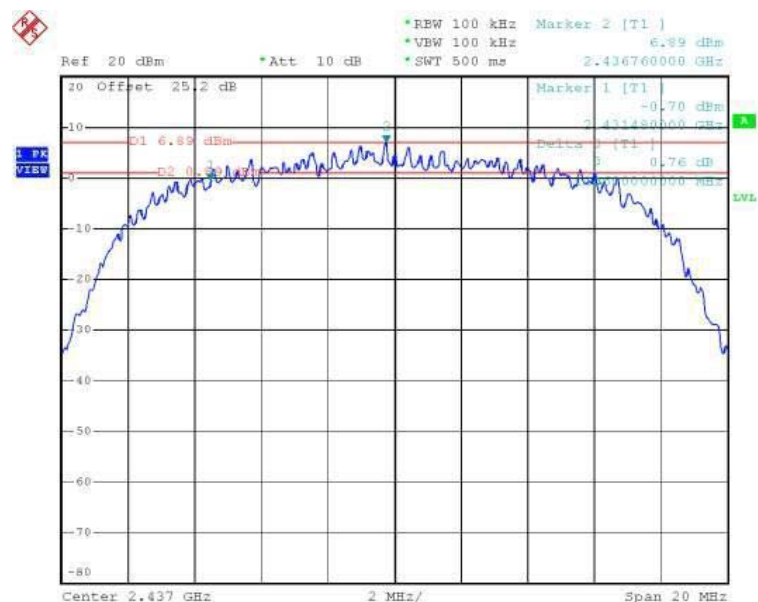
## 5.2.5.3 Antenna 3

3-1



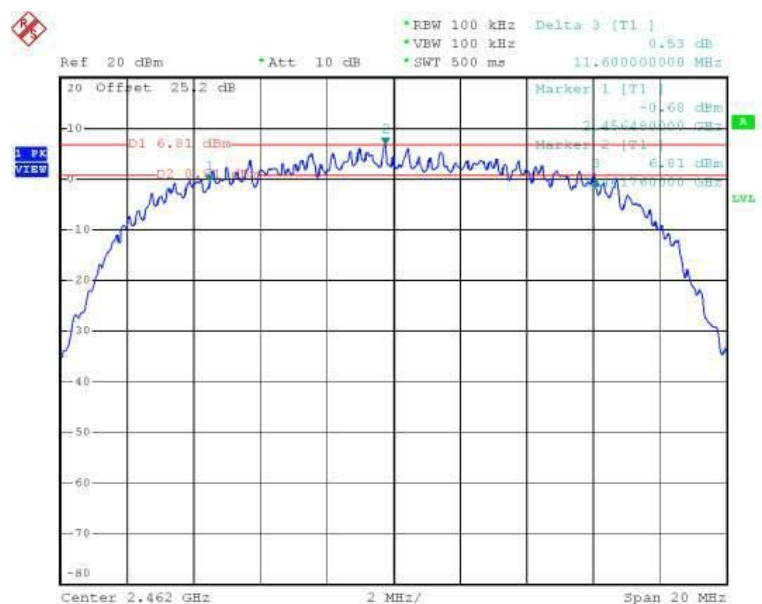
Date: 26.JUL.2004 13:38:46

3-2



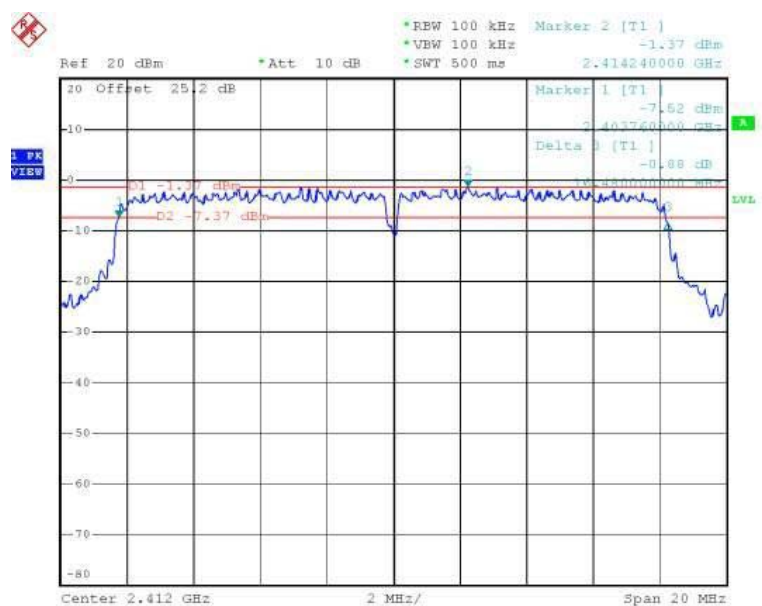
Date: 26.JUL.2004 13:35:23

3-3



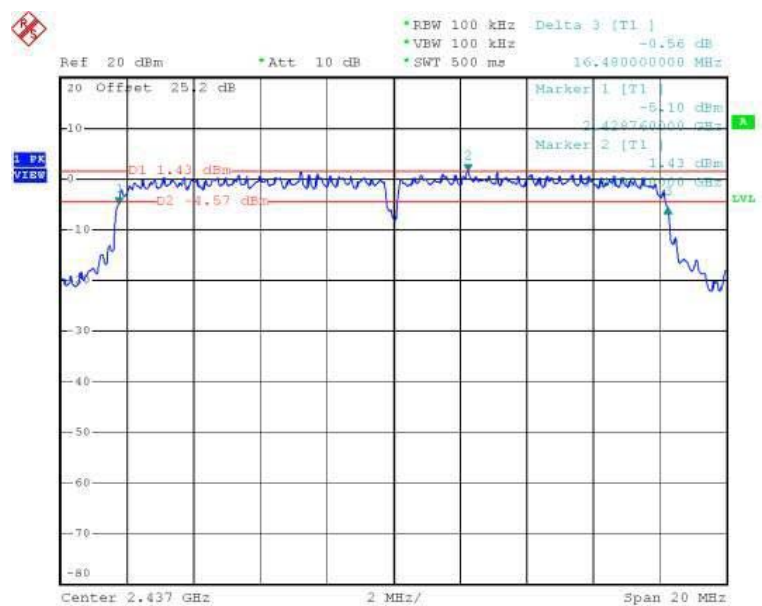
Date: 26.JUL.2004 13:27:37

3-4



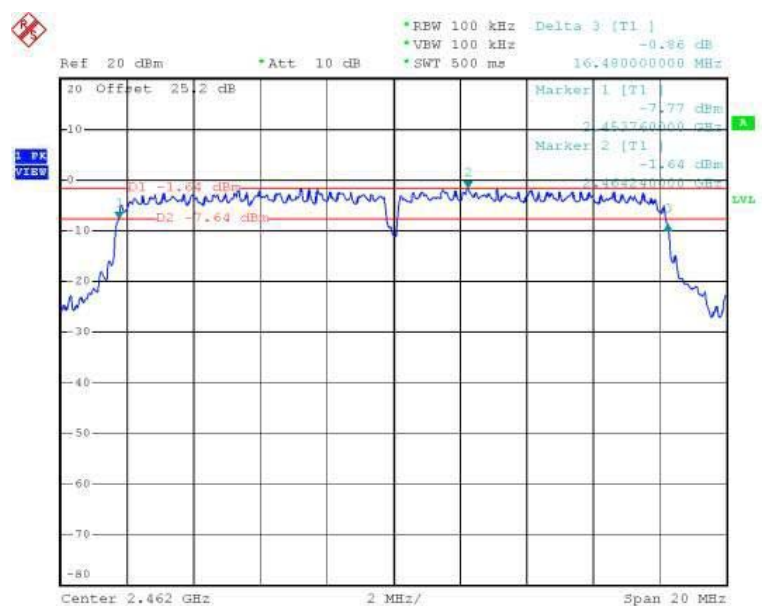
Date: 26.JUL.2004 14:10:20

3-5



Date: 26.JUL.2004 14:12:20

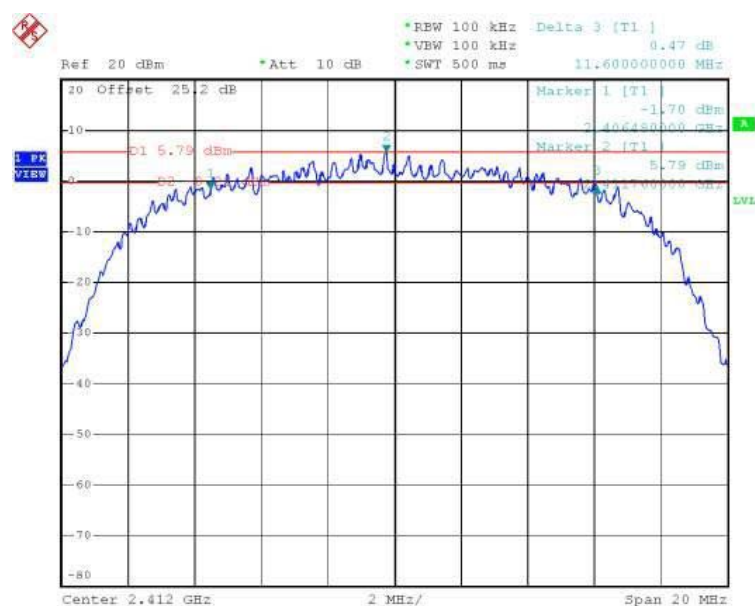
3-6



Date: 26.JUL.2004 14:14:25

## 5.2.5.4 Antenna 4

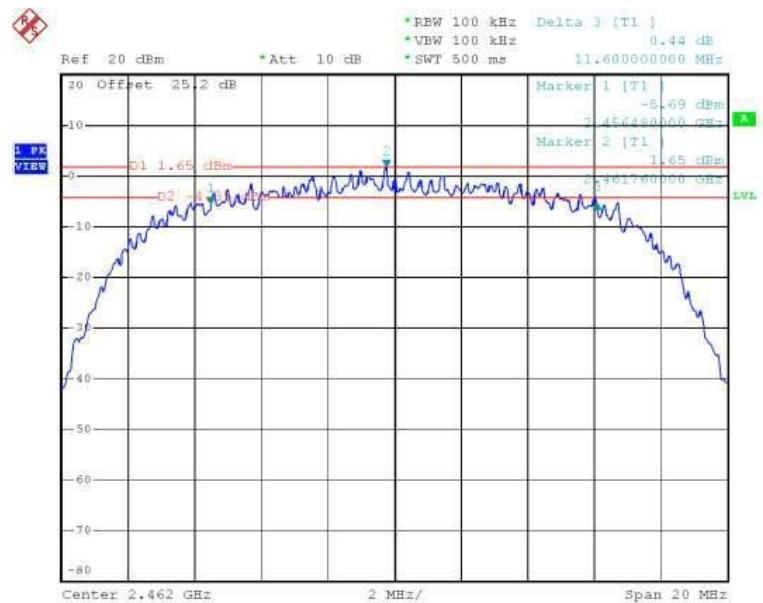
4-1



4-2

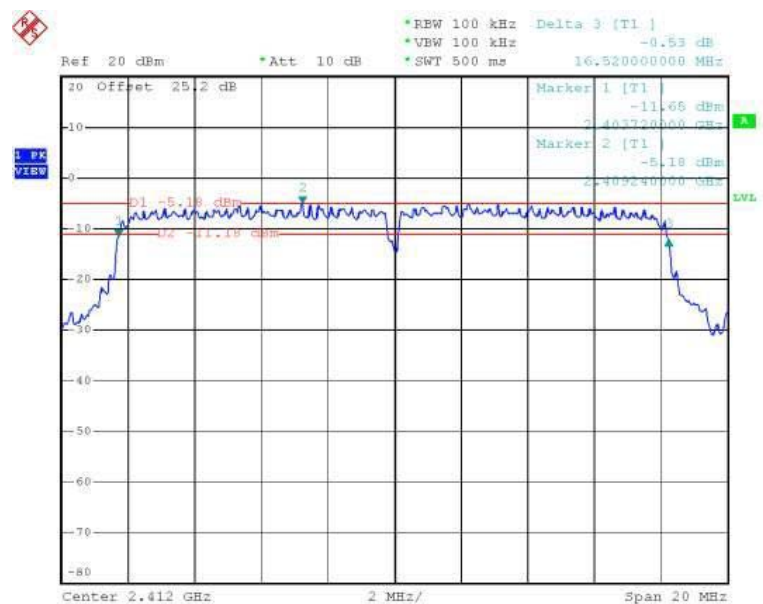


4-3



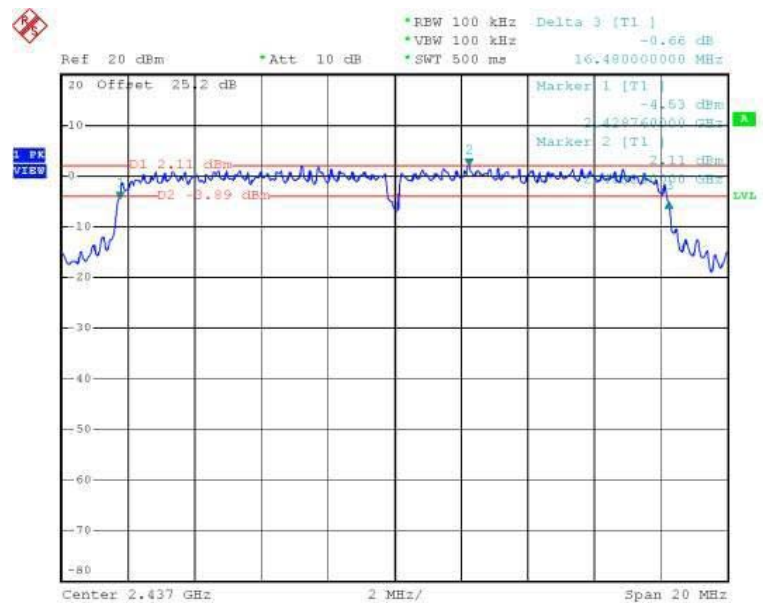
Date: 26.JUL.2004 16:54:05

4-4



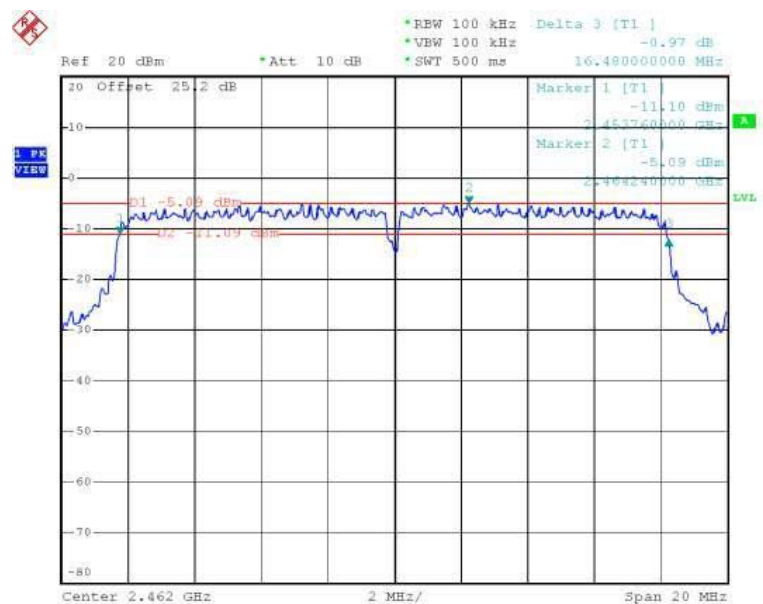
Date: 26.JUL.2004 17:17:56

4-5



Date: 26.JUL.2004 17:20:51

4-6

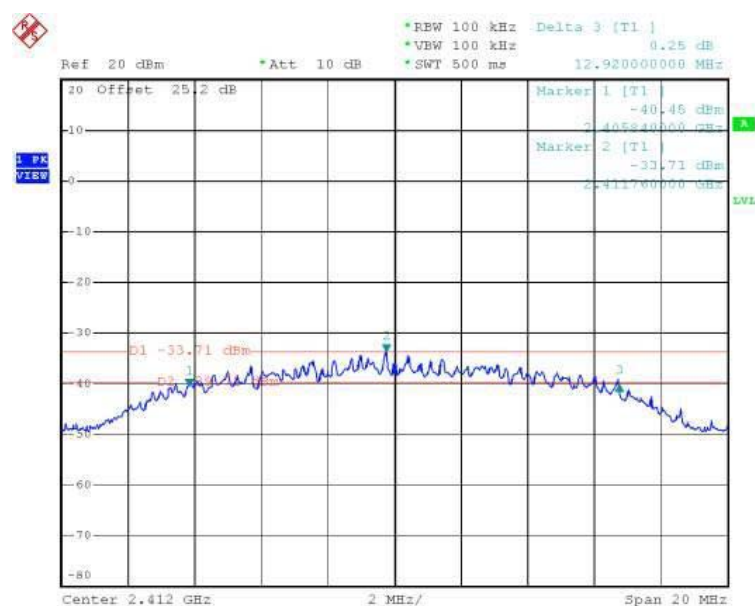


Date: 26.JUL.2004 17:23:13

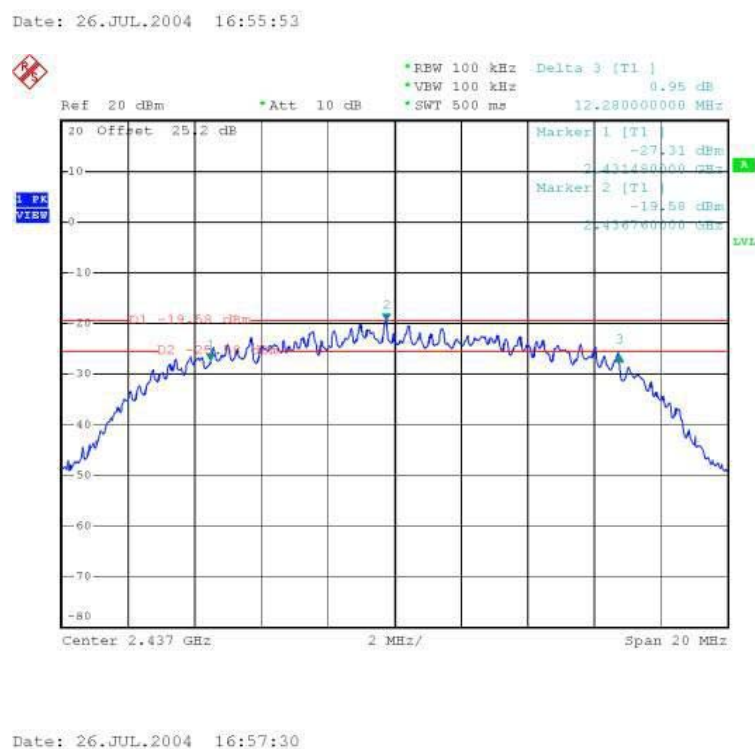


## 5.2.5.5 Antenna 5

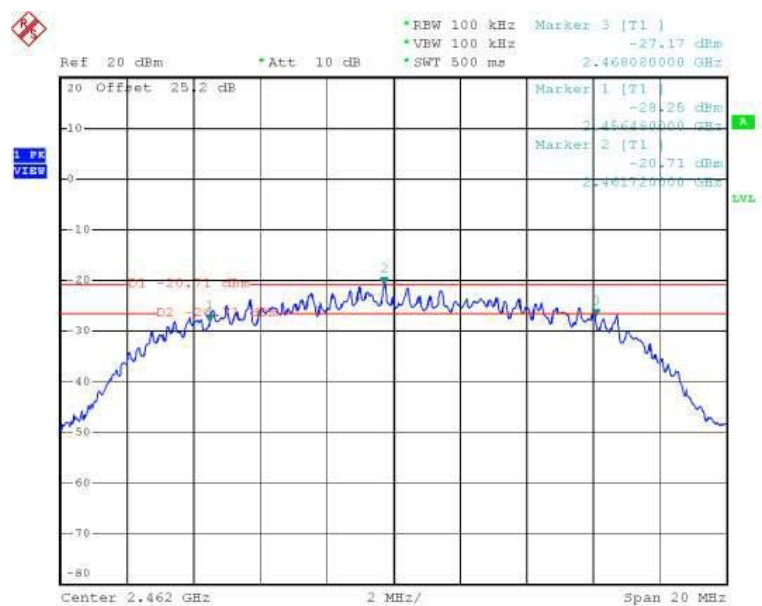
5-1



5-2

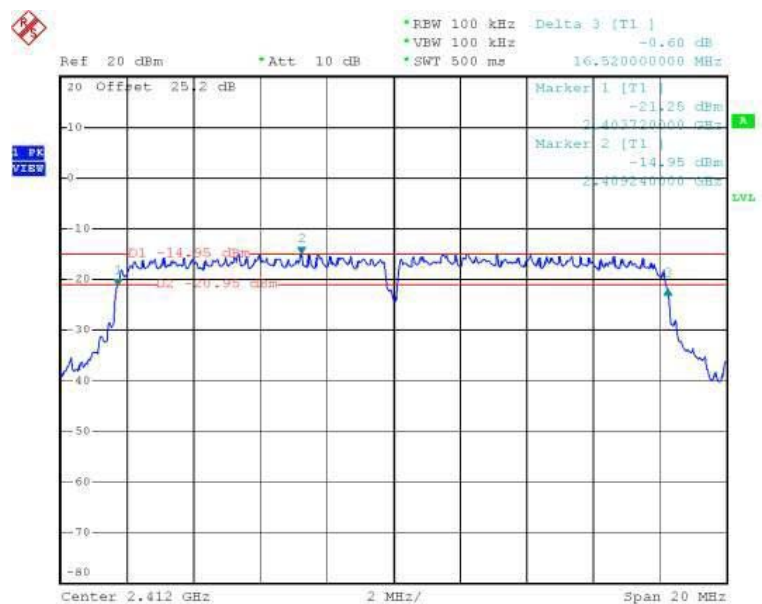


5-3



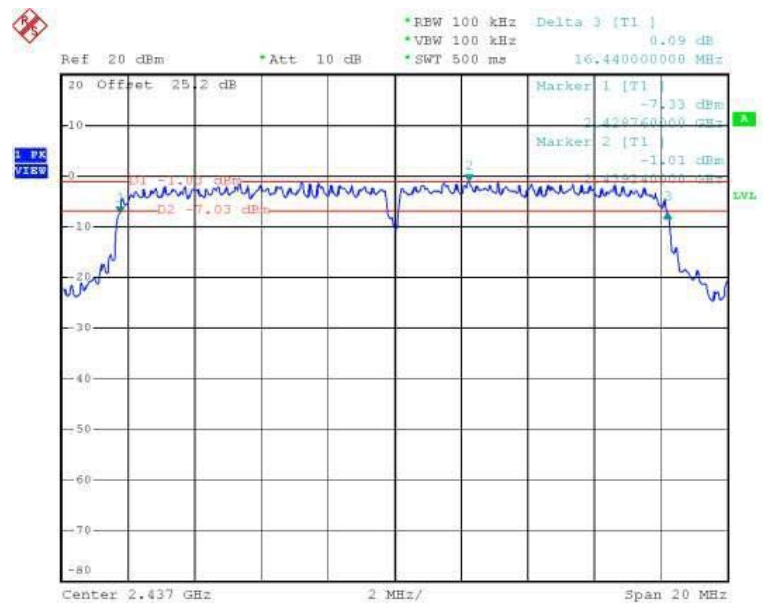
Date: 26.JUL.2004 16:59:27

5-4



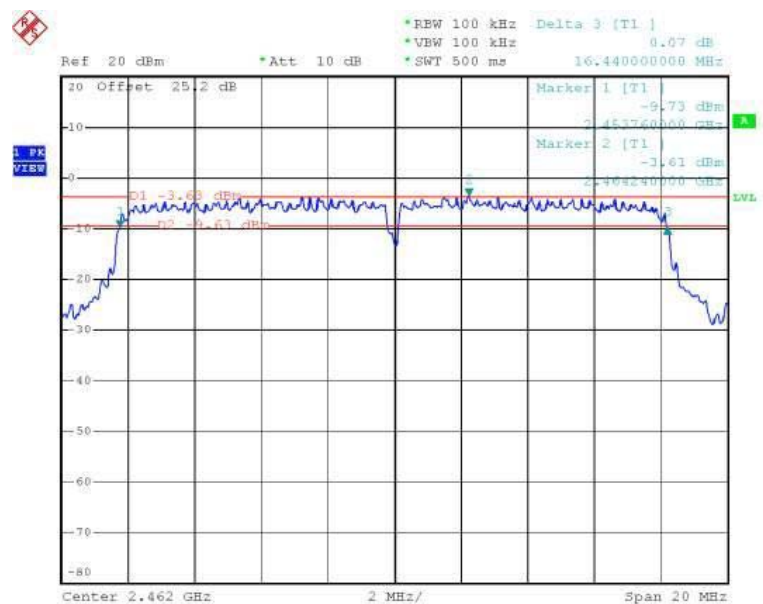
Date: 26.JUL.2004 17:24:41

5-5



Date: 26.JUL.2004 17:25:57

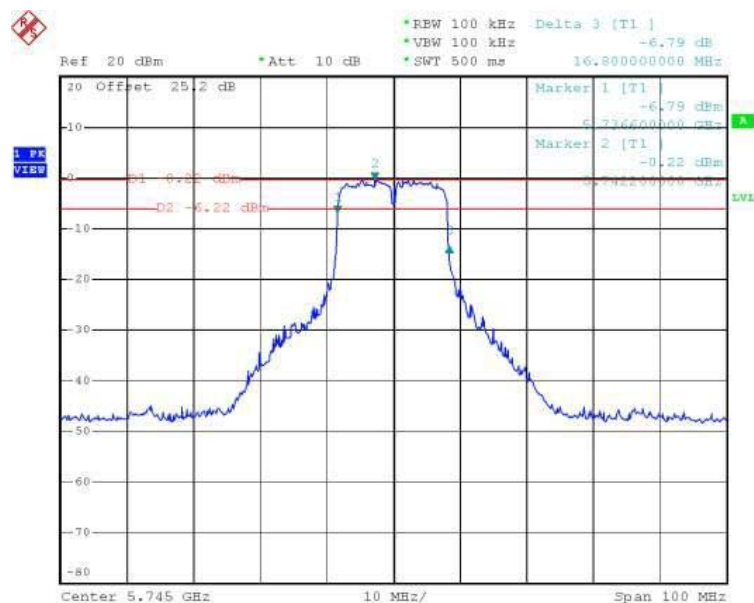
5-6



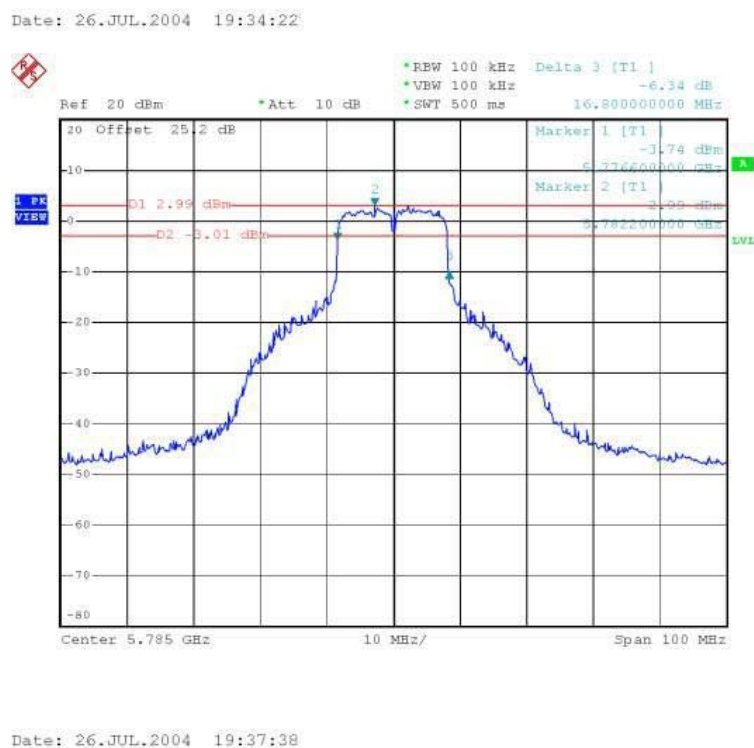
Date: 26.JUL.2004 17:27:07

## 5.2.5.6 Antenna 6

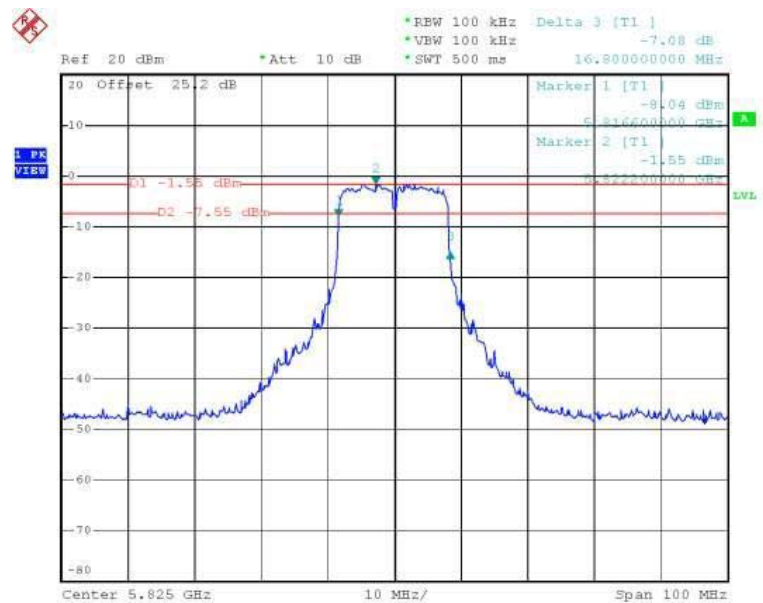
6-1



6-2



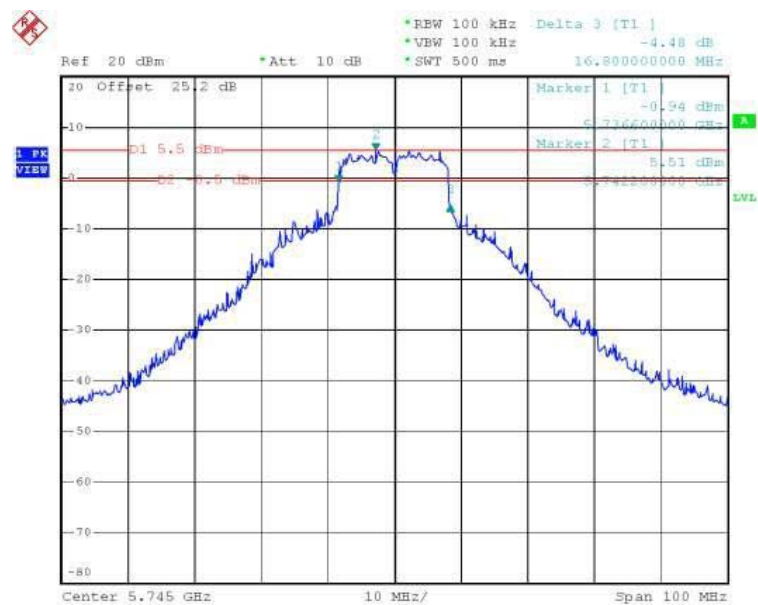
6-3



Date: 26.JUL.2004 19:41:42

## 5.2.5.7 Antenna 7

7-1

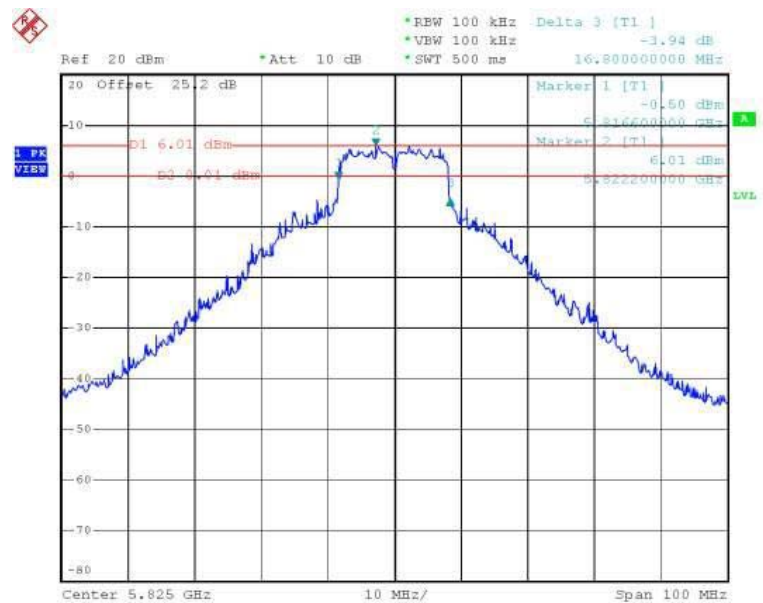


7-2



Date: 26.JUL.2004 19:36:40

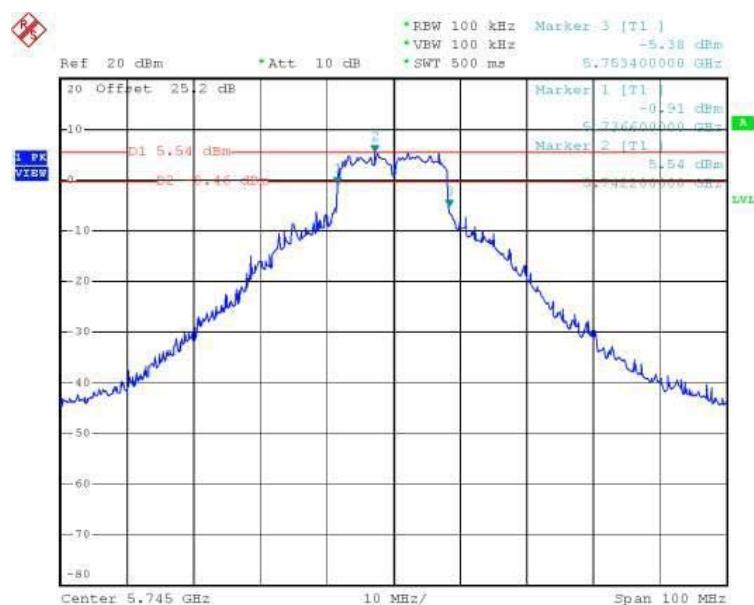
7-3



Date: 26.JUL.2004 19:40:33

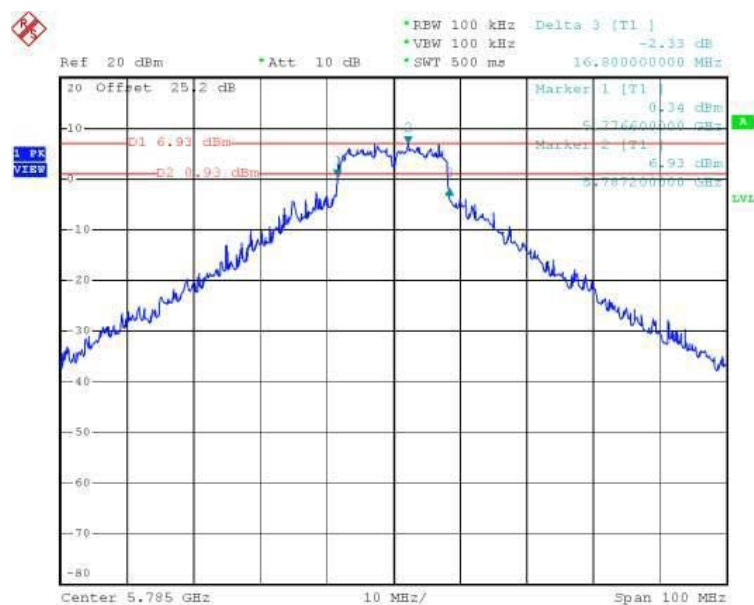
## 5.2.5.8 Antenna 8

8-1



Date: 26.JUL.2004 19:32:22

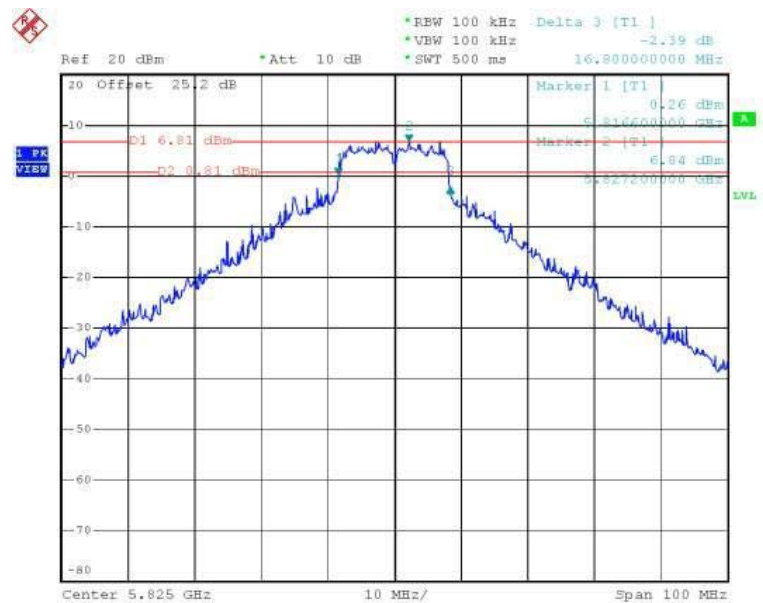
8-2



Date: 26.JUL.2004 19:35:37



8-3



Date: 26.JUL.2004 19:39:17

### 5.3 Power Spectral Density

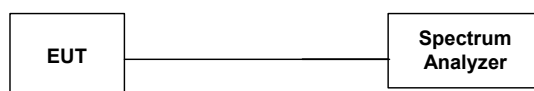
#### 5.3.1 Measuring Instruments :

As described in chapter 10 of this test report.

#### 5.3.2 Test Procedure :

1. The transmitter output was connected to spectrum analyzer directly.
2. The spectrum analyzer's resolution bandwidth was set at 3kHz RBW and 30kHz VBW as that of the fundamental frequency. Set the sweep time=span/3kHz.
3. The power spectral density was measured and recorded.
4. The sweep time is allowed to be longer than span/3kHz for a full response of the mixer in the spectrum analyzer.

#### 5.3.3 Test Setup Layout :



#### 5.3.4 Test Result :

##### 5.3.4.1 Antenna 1

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11b

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm ) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|------------------|------------------|
| 01      | 2412               | -8.59                           | 8                | Antenna 1-1      |
| 06      | 2437               | -6.50                           | 8                | Antenna 1-2      |
| 11      | 2462               | -7.50                           | 8                | Antenna 1-3      |

- Application: 802.11g

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm ) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|------------------|------------------|
| 01      | 2412               | -21.09                          | 8                | Antenna 1-4      |
| 06      | 2437               | -17.16                          | 8                | Antenna 1-5      |
| 11      | 2462               | -19.82                          | 8                | Antenna 1-6      |

- Application: 802.11a

| Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm) | Plot<br>Ref. No. |
|--------------------|---------------------------------|-----------------|------------------|
| 5745               | -11.39                          | 8               | Antenna 1-7      |
| 5785               | -11.56                          | 8               | Antenna 1-8      |
| 5825               | -11.40                          | 8               | Antenna 1-9      |

**5.3.4.2 Antenna 2**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11b

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm ) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|------------------|------------------|
| 01      | 2412               | -11.09                          | 8                | Antenna 2-1      |
| 06      | 2437               | -7.83                           | 8                | Antenna 2-2      |
| 11      | 2462               | -10.8                           | 8                | Antenna 2-3      |

- Application: 802.11g

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm ) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|------------------|------------------|
| 01      | 2412               | -27.52                          | 8                | Antenna 2-4      |
| 06      | 2437               | -18.51                          | 8                | Antenna 2-5      |
| 11      | 2462               | -27.11                          | 8                | Antenna 2-6      |

**5.3.4.3 Antenna 3**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11b

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm ) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|------------------|------------------|
| 01      | 2412               | -8.36                           | 8                | Antenna 3-1      |
| 06      | 2437               | -7.5                            | 8                | Antenna 3-2      |
| 11      | 2462               | -7.65                           | 8                | Antenna 3-3      |

- Application: 802.11g

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm ) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|------------------|------------------|
| 01      | 2412               | -23.22                          | 8                | Antenna 3-4      |
| 06      | 2437               | -20.42                          | 8                | Antenna 3-5      |
| 11      | 2462               | -23.6                           | 8                | Antenna 3-6      |

**5.3.4.4 Antenna 4**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11b

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm ) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|------------------|------------------|
| 01      | 2412               | -8.99                           | 8                | Antenna 4-1      |
| 06      | 2437               | -8.18                           | 8                | Antenna 4-2      |
| 11      | 2462               | -13.21                          | 8                | Antenna 4-3      |

- Application: 802.11g

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm ) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|------------------|------------------|
| 01      | 2412               | -24.86                          | 8                | Antenna 4-4      |
| 06      | 2437               | -17.13                          | 8                | Antenna 4-5      |
| 11      | 2462               | -24.7                           | 8                | Antenna 4-6      |

**5.3.4.5 Antenna 5**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11b

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm ) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|------------------|------------------|
| 01      | 2412               | -14.54                          | 8                | Antenna 5-1      |
| 06      | 2437               | -11.73                          | 8                | Antenna 5-2      |
| 11      | 2462               | -14.37                          | 8                | Antenna 5-3      |

- Application: 802.11g

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm ) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|------------------|------------------|
| 01      | 2412               | -23.25                          | 8                | Antenna 5-4      |
| 06      | 2437               | -10.64                          | 8                | Antenna 5-5      |
| 11      | 2462               | -23.02                          | 8                | Antenna 5-6      |

**5.3.4.6 Antenna 6**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11a

| Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm) | Plot<br>Ref. No. |
|--------------------|---------------------------------|-----------------|------------------|
| 5745               | -5.76                           | 8               | Antenna 6-1      |
| 5785               | -10.47                          | 8               | Antenna 6-2      |
| 5825               | -14.43                          | 8               | Antenna 6-3      |

**5.3.4.7 Antenna 7**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11a

---

| Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm) | Plot<br>Ref. No. |
|--------------------|---------------------------------|-----------------|------------------|
| 5745               | -11.08                          | 8               | Antenna 7-1      |
| 5785               | -8.09                           | 8               | Antenna 7-2      |
| 5825               | -8.16                           | 8               | Antenna 7-3      |

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**5.3.4.8 Antenna 8**

- Temperature : 25.5C
- Relative Humidity : 53%
- Application: 802.11a

---

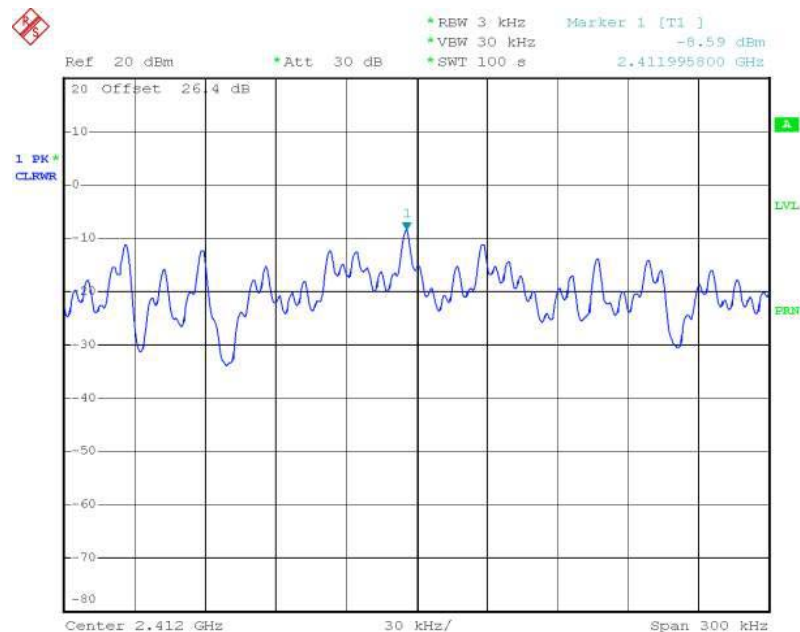
| Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm) | Plot<br>Ref. No. |
|--------------------|---------------------------------|-----------------|------------------|
| 5745               | -11.58                          | 8               | Antenna 8-1      |
| 5785               | -7.48                           | 8               | Antenna 8-2      |
| 5825               | -7.54                           | 8               | Antenna 8-3      |

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## 5.3.5 Power Spectral Density

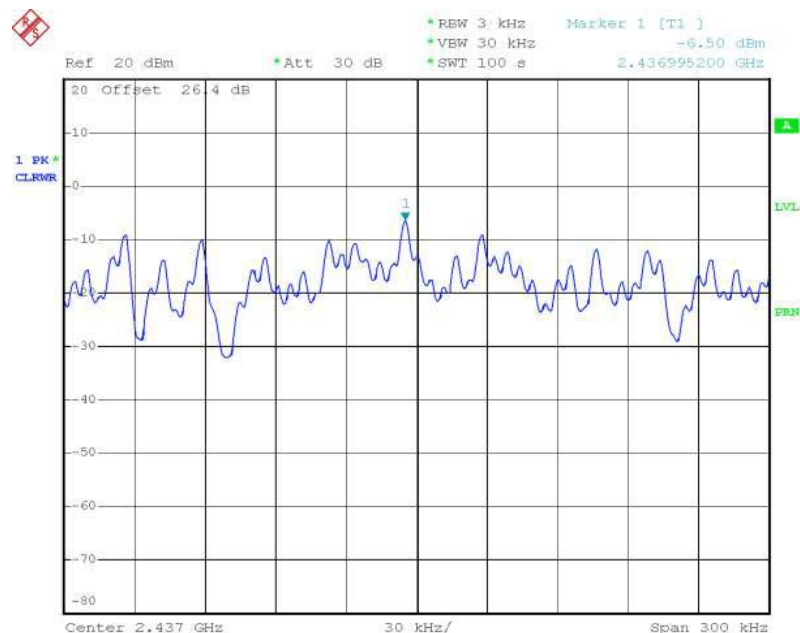
## 5.3.5.1 Antenna 1

1-1



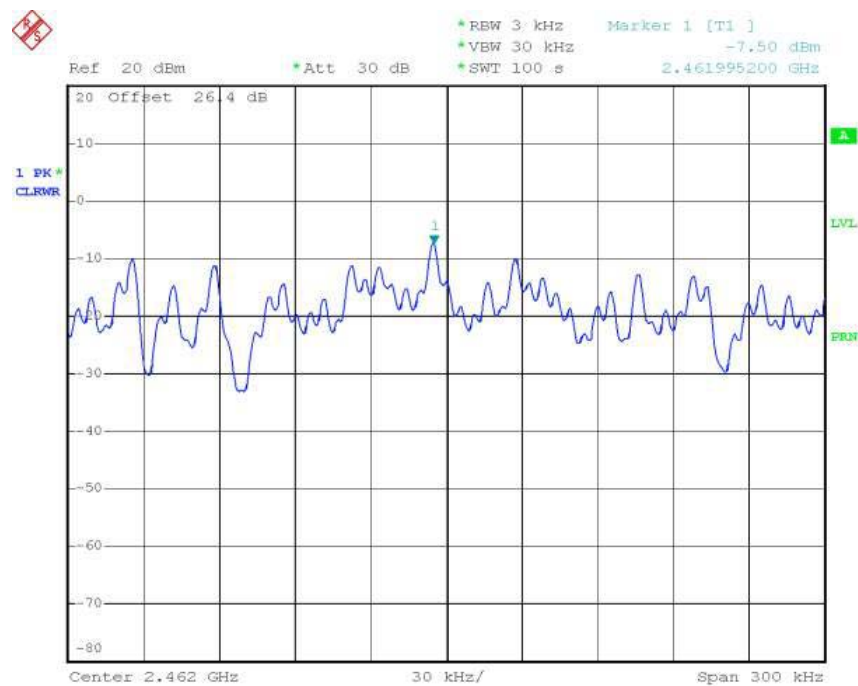
Date: 24.JUL.2004 02:16:46

1-2



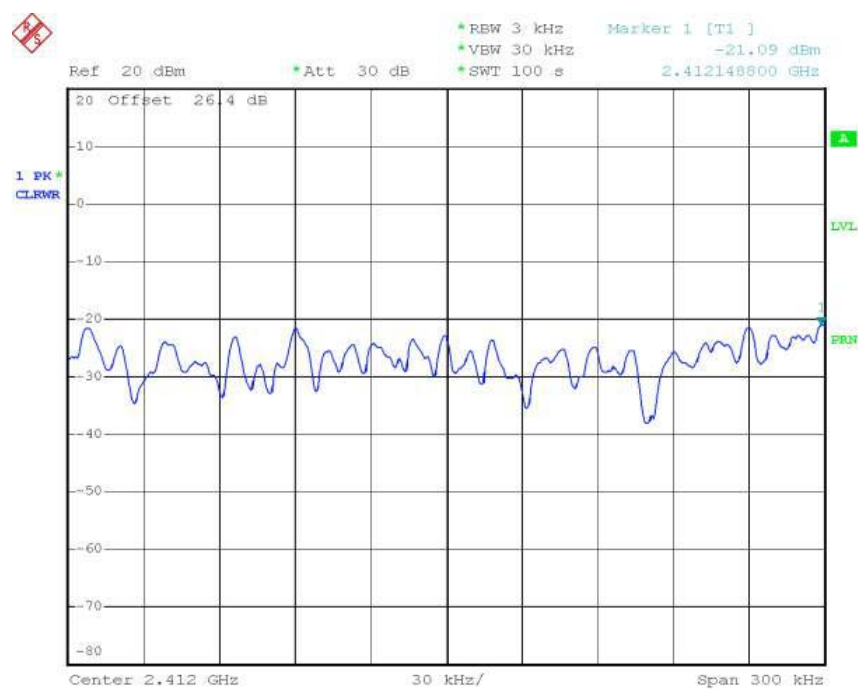
Date: 24.JUL.2004 02:21:31

1-3



Date: 24.JUL.2004 02:25:32

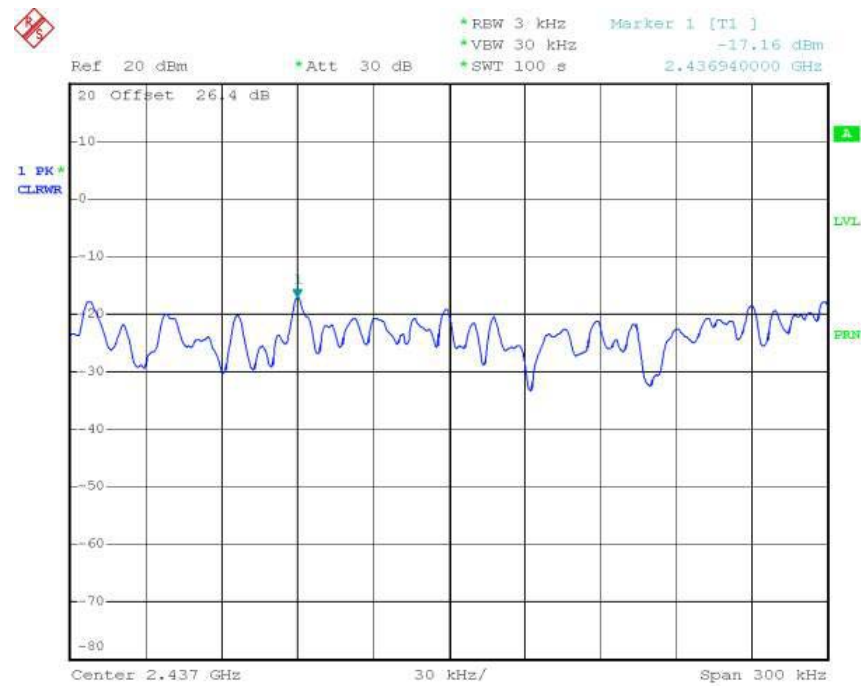
1-4



Date: 24.JUL.2004 02:38:43

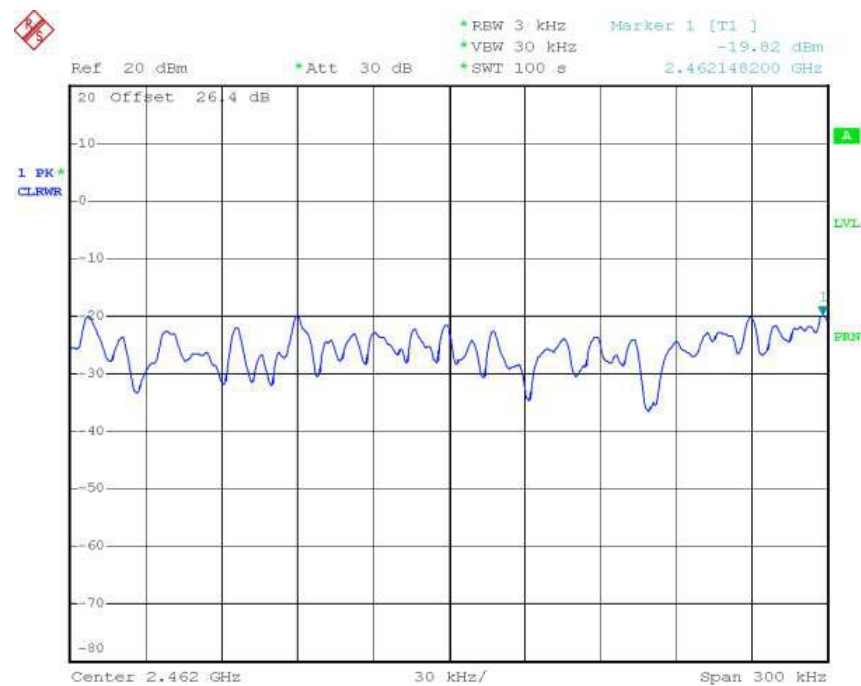


1-5



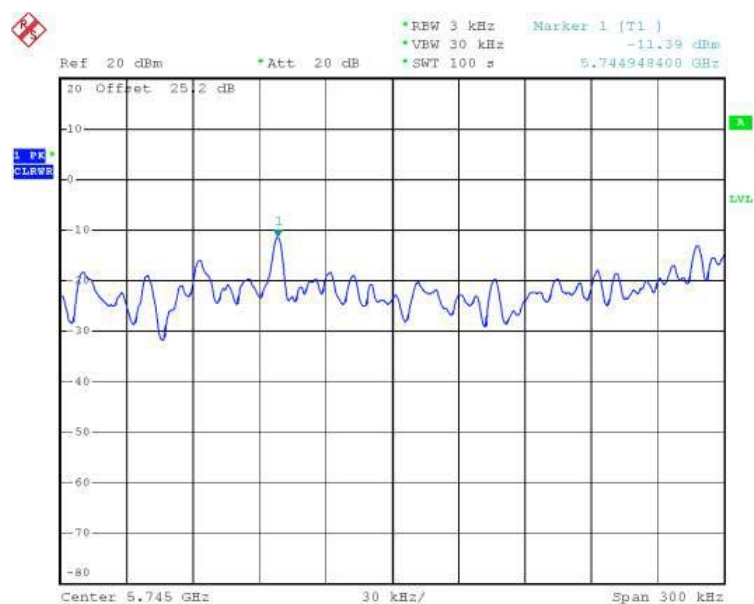
Date: 24.JUL.2004 02:34:28

1-6



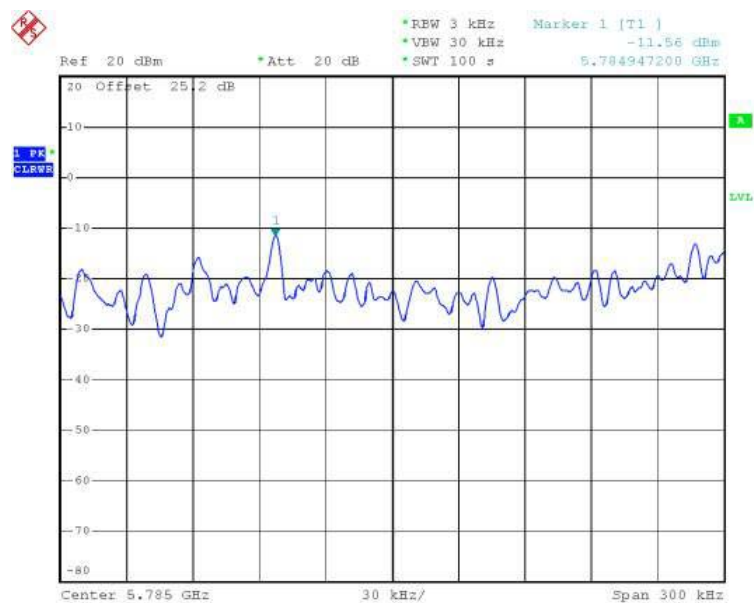
Date: 24.JUL.2004 02:29:47

1-7



Date: 2.AUG.2004 13:32:49

1-8



Date: 2.AUG.2004 13:38:12