# VIII. Section 15.247 (C): Spurious Emissions (Radiated)

## 8.1 Test Condition & Setup

We' d performed the test by the *radiated emission* skill: The EUT was placed in an anechoic chamber, and set the EUT transmitting continuously and scanned at 3-meter distance to determine its emission characteristics. The physical arrangement of the EUT was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude, directivity, and frequency. The exact system configuration, which produced the highest emissions was noted so it could be reproduced later during the final tests. For the measurement above 1GHz, according to the guidance we' d set the spectrum analyzer's 6dB bandwidth RBW to 1MHz.

This was done to ensure that the final measurements would demonstrate the worst-case interference potential of the EUT. Final radiation measurements were made on a three-meter, anechoic chamber. The EUT system was placed on a nonconductive turntable, which is 0.8 meters height, top surface 1.0 x 1.5 meter.

The spectrum was examined from 30 MHz to 1000 MHz using an Hewlett Packard 85460A EMI Receiver, Schwarzeck whole range Small Biconical antenna (Model No.: BBVU9135) is used to measure frequency from 30 MHz to 1GHz. The final test is used the HP 85460A spectrum and 8564E spectrum was examined from 1GHz to 25GHz using an Hewlett Packard Spectrum Analyzer, EMCO/CMT Horn Antenna (Model 3115 / RA42-K-F-4B-C) for 1G - 25GHz.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. There are two spectrum analyzers use on this testing, HP 85460A for frequency 30MHz to 1000MHz, and 8564E for frequency 1GHz to 25GHz. No post-detector video filters were used in the test. The spectrum analyzer's 6dB bandwidth was set to 120KHz (spectrum was examined from 30 MHz to 1000 MHz), the spectrum analyzer's 6dB bandwidth was set to 1 MHz (spectrum was examined from 1GHz to 25GHz) and the analyzer was operated in the maximum hold mode. There is a test condition applies in this test item, the test procedure description as the <1.3> test method:

Three channels were tested, one in the top (CH01), one in the middle (CH06) and the other in bottom (CH11).

With the transmitter operating from a AC source and using the internal of EUT, radiates spurious emissions falling within the restricted bands of 15.209 were measured at operating frequencies corresponding to upper, middle and bottom channels in the 2400 ~ 2483.5 MHz band.

The actual field intensity in decibels referenced to 1 microvolt per meter (dBμV/m) is determined by algebraically adding the measured reading in dBμV, the antenna factor (dB), and cable loss (dB) at the appropriate frequency. Since the EUT was set to transmit continuously, no *duty cycle* is present.

**For frequency between 30MHz to 1000MHz**

FIa (dBuV/m) = FIr (dBμV) + Correction Factors

FIa : Actual Field Intensity

FIr : Reading of the Field Intensity

Correction Factors = Antenna Factor + Cable Loss – Amplifier Gain

**For frequency between 1 GHz to 25 GHz**

FIa (dBμV/m) = FIr (dBμV) + Correction Factor

FIa : Actual Field Intensity

FIr : Reading of the Field Intensity

Correction Factors = Antenna Factor + Cable Loss – Amplifier Gain

## 8.2 List of Test Instruments

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| EMI Receiver | 8546A | H P | 3520A00242 | 06/28/02 | 06/28/03 |
| RF Filter Section | 85460A | H P | 3448A00217 | 06/28/02 | 06/28/03 |
| Small Biconical Antenna | BBVU9135 | Schwarzeck | 127 | 05/07/02 | 05/07/03 |
| and Balun | UBAA9114 | | | | |
| Switch/Control Unit | | | | | |
| (> 30MHz) | 3488A | HP | N/A | 11/20/02 | 11/20/03 |
| Auto Switch Box | | | | | |
| (> 30MHz) | ASB-01 | TRC | 9904-01 | 11/20/02 | 11/20/03 |
| Spectrum Analyzer | 8564E | HP | US36433002 | 08/01/02 | 08/01/03 |
| Microwave Preamplifier | 83051A | HP | 3232A00347 | 08/01/02 | 08/01/03 |
| Horn Antenna | 3115 | EMCO | 9704 – 5178 | 08/01/02 | 08/01/03 |
| Horn Antenna | RA42-K-F-4B-C | CMT | 961505-003 | 02/01/03 | 02/01/04 |
| Anechoic Chamber (cable calibrated together) | | | | 05/20/02 | 05/20/03 |

The level of confidence of 95% , the uncertainty of measurement of radiated emission is ± 3.44dB .

### 8.3 Test Result of Spurious Radiated Emissions

**EUT's transmit only**

The highest peak values of radiated emissions form the EUT at various antenna heights, antenna polarizations, EUT orientation, etc. are recorded on the following.

Test Conditions: Testing room : Temperature : 24.6 ° C Humidity : 54.2 % RH

***Table 4 Radiated Emissions for 30MHz to 1GHz [Horizontal]***

| *Radiated Emission* | | | | *Correction Factors* | *Corrected Amplitude* | *FCC Class B ( 3 m )* | |
|---|---|---|---|---|---|---|---|
| *Frequency (MHz)* | *Amplitude (dBmV)* | *Ant. H. (m)* | *Table ( ° )* | *(dB)* | *(dBmV/m)* | *Limit (dBmV/m)* | *Margin (dB)* |
| 161.56 | 29.72 | 1.00 | 269 | 1.92 | 31.64 | 43.50 | -11.86 |
| 214.30 | 29.77 | 1.00 | 92 | 1.58 | 31.35 | 43.50 | -12.15 |
| 252.50 | 26.86 | 1.00 | 84 | 1.43 | 28.29 | 46.00 | -17.71 |
| 279.77 | 32.10 | 1.00 | 39 | 1.96 | 34.06 | 46.00 | -11.94 |
| 336.06 | 31.79 | 1.00 | 58 | 2.83 | 34.62 | 46.00 | -11.38 |
| 477.41 | 21.33 | 1.00 | 349 | 8.12 | 29.45 | 46.00 | -16.55 |

***Table 5 Radiated Emissions For 30MHz to 1GHz [Vertical]***

| *Radiated Emission* | | | | *Correction Factors* | *Corrected Amplitude* | *FCC Class B ( 3 m )* | |
|---|---|---|---|---|---|---|---|
| *Frequency (MHz)* | *Amplitude (dBmV)* | *Ant. H. (m)* | *Table ( ° )* | *(dB)* | *(dBmV/m)* | *Limit (dBmV/m)* | *Margin (dB)* |
| 144.01 | 28.97 | 1.00 | 297 | 2.10 | 31.07 | 43.50 | -12.43 |
| 241.58 | 28.26 | 1.00 | 287 | 1.63 | 29.89 | 46.00 | -16.11 |
| 336.76 | 26.17 | 1.00 | 160 | 2.84 | 29.01 | 46.00 | -16.99 |
| 433.16 | 26.31 | 1.00 | 179 | 6.54 | 32.85 | 46.00 | -13.15 |
| 558.65 | 20.85 | 1.00 | 328 | 12.30 | 33.15 | 46.00 | -12.85 |
| 598.01 | 15.33 | 1.00 | 316 | 13.64 | 28.97 | 46.00 | -17.03 |

Note: 1. Margin = Amplitude – limit, *if margin is minus means under limit.*

2. Corrected Amplitude = Reading Amplitude + Correction Factors

3. Correction factor = Antenna factor + [ Cable Loss – Amplitude gain ]

***Table 6 Radiated Emissions For 1GHz to 25GHz [Horizontal] [CH 1]***

| Radiated Emission | | | | Corrected Amplitude (dBμV/m) | | FCC Class B ( 3m ) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Limit (dBμV/m) | | Margin (dB) |
| Frequency (MHz) | Ant. H. (m) | Table ( ° ) | Correction Factors (dB) | Peak | Average | Peak | Ave. | |
| 4824.13 | 1.00 | 22 | 3.76 | 59.86 | 49.20 | 74.00 | 54.00 | -4.80 |
| 7234.58 | 1.00 | 107 | 10.08 | 58.68 | 50.69 | 74.00 | 54.00 | -3.31 |

***Table 7 Radiated Emissions For 1GHz to 25GHz [ Vertical] [CH 1]***

| Radiated Emission | | | | Corrected Amplitude (dBμV/m) | | FCC Class B ( 3m ) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Limit (dBμV/m) | | Margin (dB) |
| Frequency (MHz) | Ant. H. (m) | Table ( ° ) | Correction Factors (dB) | Peak | Average | Peak | Ave. | |
| 4824.12 | 1.00 | 246 | 3.76 | 57.03 | 46.70 | 74.00 | 54.00 | -7.30 |
| 7233.75 | 1.00 | 171 | 10.07 | 49.68 | --- | 74.00 | 54.00 | -4.32 |

Note:

1. Margin = Corrected - Limit.
2. The EUT utilizes a *permanently attached antenna*. In addition the spurious RF Radiated emissions levels do comply with the *20dBc limit* both at its bandedges and other spurious emissions.
3. As stated in Section 15.35(b), for any frequencies above 1000MHz, radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. As the results of our test, the peak amplitudes are already below the FCC limit. Thus the average amplitudes of the rest are omitted.

***Table 8 Radiated Emissions For 1GHz to 25GHz [Horizontal] [CH 6]***

| Radiated Emission | | | | Corrected Amplitude (dBμV/m) | | FCC Class B ( 3m ) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Limit (dBμV/m) | | Margin (dB) |
| Frequency (MHz) | Ant. H. (m) | Table ( ° ) | Correction Factors (dB) | Peak | Average | Peak | Ave. | |
| 4872.91 | 1.00 | 25 | 3.96 | 59.39 | 48.89 | 74.00 | 54.00 | -5.11 |
| 7309.92 | 1.00 | 99 | 10.29 | 58.57 | 49.56 | 74.00 | 54.00 | -4.44 |

***Table 9 Radiated Emissions For 1GHz to 25GHz [ Vertical] [CH 6]***

| Radiated Emission | | | | Corrected Amplitude (dBμV/m) | | FCC Class B ( 3m ) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Limit (dBμV/m) | | Margin (dB) |
| Frequency (MHz) | Ant. H. (m) | Table ( ° ) | Correction Factors (dB) | Peak | Average | Peak | Ave. | |
| 4874.13 | 1.00 | 339 | 3.96 | 56.39 | 45.90 | 74.00 | 54.00 | -8.10 |
| 7312.29 | 1.00 | 201 | 10.30 | 50.24 | --- | 74.00 | 54.00 | -3.76 |

Note:

1. Margin = Corrected - Limit.
2. The EUT utilizes a *permanently attached antenna*. In addition the spurious RF Radiated emissions levels do comply with the *20dBc limit* both at its bandedges and other spurious emissions.
3. As stated in Section 15.35(b), for any frequencies above 1000MHz, radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. As the results of our test, the peak amplitudes are already below the FCC limit. Thus the average amplitudes of the rest are omitted.

***Table 10 Radiated Emissions For 1GHz to 25GHz [Horizontal] [CH 11]***

| Radiated Emission | | | | Corrected Amplitude (dBμV/m) | | FCC Class B ( 3m ) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Limit (dBμV/m) | | Margin (dB) |
| Frequency (MHz) | Ant. H. (m) | Table ( ° ) | Correction Factors (dB) | Peak | Average | Peak | Ave. | |
| 4924.12 | 1.00 | 14 | 4.13 | 55.90 | 46.74 | 74.00 | 54.00 | -7.26 |
| 7384.57 | 1.00 | 108 | 10.42 | 57.70 | 48.36 | 74.00 | 54.00 | -5.64 |

***Table 11 Radiated Emissions For 1GHz to 25GHz [ Vertical] [CH 11]***

| Radiated Emission | | | | Corrected Amplitude (dBμV/m) | | FCC Class B ( 3m ) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Limit (dBμV/m) | | Margin (dB) |
| Frequency (MHz) | Ant. H. (m) | Table ( ° ) | Correction Factors (dB) | Peak | Average | Peak | Ave. | |
| 4925.83 | 1.00 | 56 | 4.13 | 51.90 | --- | 74.00 | 54.00 | -2.10 |
| 7384.79 | 1.00 | 18 | 10.42 | 50.86 | --- | 74.00 | 54.00 | -3.14 |

Note:

1. Margin = Corrected - Limit.
2. The EUT utilizes a *permanently attached antenna*. In addition the spurious RF Radiated emissions levels do comply with the *20dBc limit* both at its bandedges and other spurious emissions.
3. As stated in Section 15.35(b), for any frequencies above 1000MHz, radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. As the results of our test, the peak amplitudes are already below the FCC limit. Thus the average amplitudes of the rest are omitted.

## 8.4 Test Result of the Bandedge

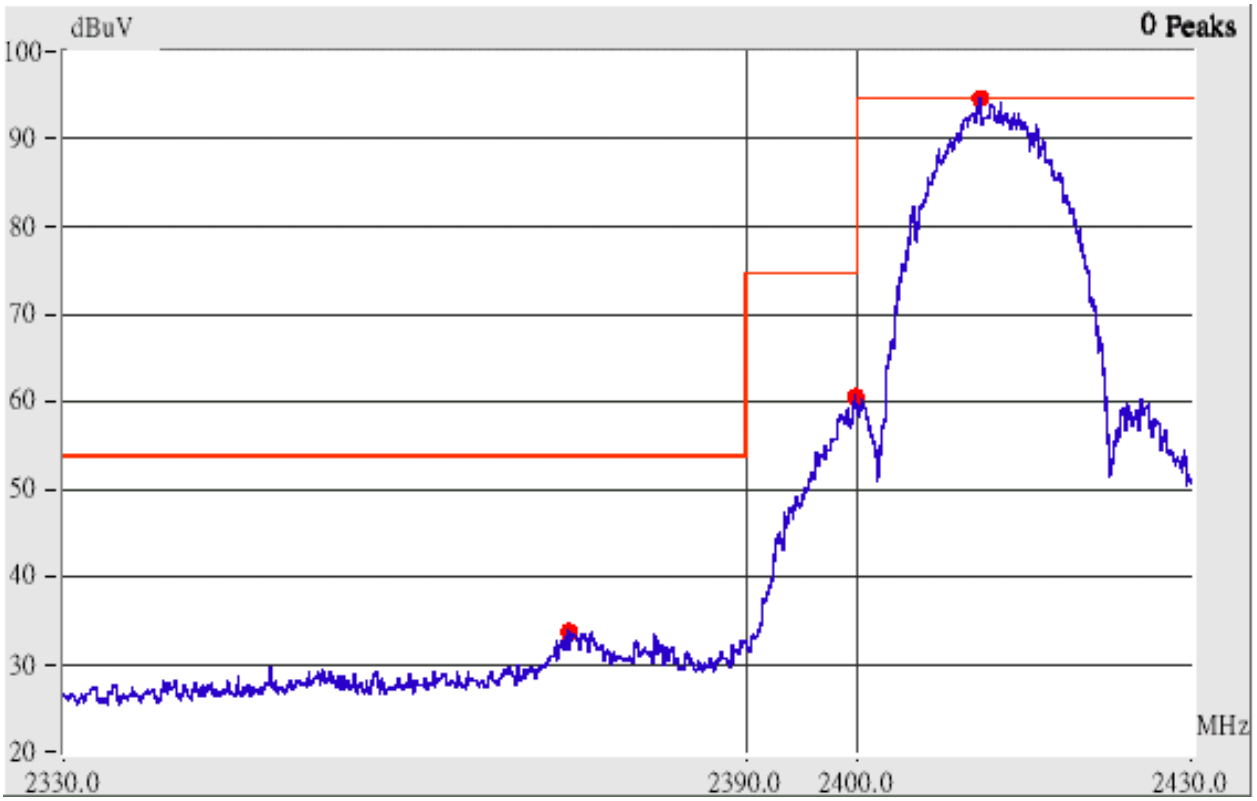
If any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either *at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified id §15.209(a),*

We perform this section by the *radiated manner*, the RBW is set to 100kHz and VBW>RBW. We' d made the observation *up to 10th harmonics and the criterion is all the harmonic/spurious emissions must be 20dB below the highest emission level measured.* If the emissions fall in the restricted bands stated in the Part 15.205(a) must also *comply with the radiated emission limits specified in Part 15.209(a). (Peak mode: RBW=VBW=1MHz, Average mode: RBW=1MHz; VBW=10Hz)*

The following pages show our observations referring to the channel 1 and 11 respectively.

Test Condition & Setup: same as < 8.1 >

***Channel 1***

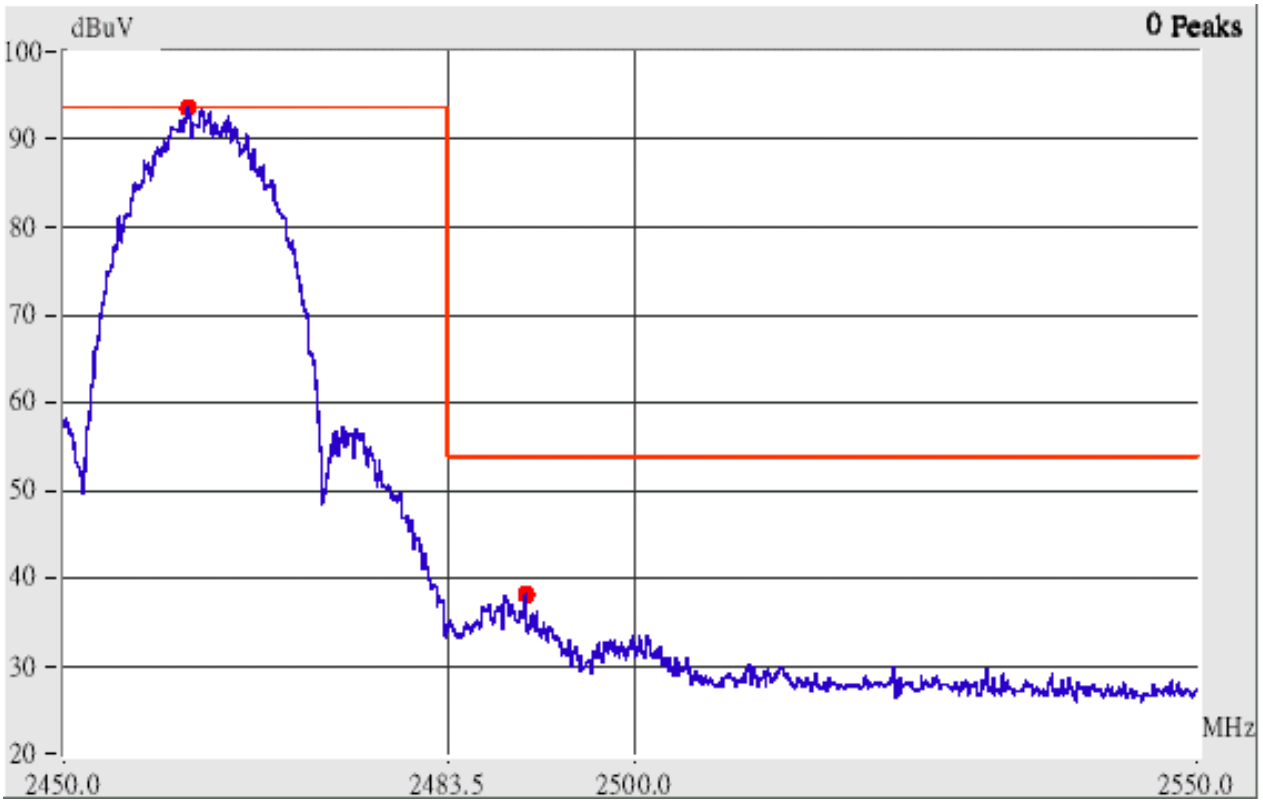



This is the hard copy of our bandedge measurement generated by our bandedge testing program. The plot shown above is the bandedge of channel 1.

1. The lobe left by the fundamental side is already 20dB below the highest emission level.
2. The emissions recorded in the restricted band is do comply with the Part 15.209(a) – as below.

| *Radiated Emission* | | | | | *Corrected Amplitude (dBμV/m)* | | *FCC Class B ( 3m )* | | |
|---|---|---|---|---|---|---|---|---|---|
| *Frequency (MHz)* | *Ant. P.* | *Ant. H. (m)* | *Table ( ° )* | *Factors (dB)* | *Peak* | *Average* | *Limit (dBμV/m) Peak* | *Ave.* | *Margin (dB)* |
| 2374.31 | Hor | 1.00 | 251 | 3.08 | 42.92 | --- | 74.00 | 53.96 | -11.04 |
| 2384.60 | Ver | 1.00 | 33 | 3.12 | 41.14 | --- | 74.00 | 53.96 | -12.82 |
| 2390.07 | Hor | 1.00 | 148 | 3.14 | 39.62 | --- | 74.00 | 53.96 | -14.34 |
| 2390.07 | Ver | 1.00 | 109 | 3.14 | 37.47 | --- | 74.00 | 53.96 | -16.49 |

***Channel 11***




This is the hard copy of our bandedge measurement generated by our bandedge testing program. The plot shown above is the bandedge of channel 11.

1. The lobe right by the fundamental side is already 20dB below the highest emission level.
2. The emissions recorded in the restricted band is do comply with the Part 15.209(a) – as below

| *Radiated Emission* | | | | | *Corrected Amplitude (dBμV/m)* | | *FCC Class B ( 3m )* | | |
|---|---|---|---|---|---|---|---|---|---|
| *Frequency (MHz)* | *Ant. P.* | *Ant. H. (m)* | *Table ( ° )* | *Factors (dB)* | *Peak* | *Average* | *Limit (dBμV/m) Peak* | *Ave.* | *Margin (dB)* |
| 2483.50 | Hor | 1.00 | 217 | 3.45 | 45.28 | --- | 74.00 | 53.96 | -8.68 |
| 2487.93 | Hor | 1.00 | 338 | 3.46 | 48.13 | --- | 74.00 | 53.96 | -5.83 |
| 2489.22 | Ver | 1.00 | 98 | 3.46 | 44.13 | --- | 74.00 | 53.96 | -9.83 |
| 2500.01 | Hor | 1.00 | 21 | 3.50 | 42.50 | --- | 74.00 | 53.96 | -11.46 |

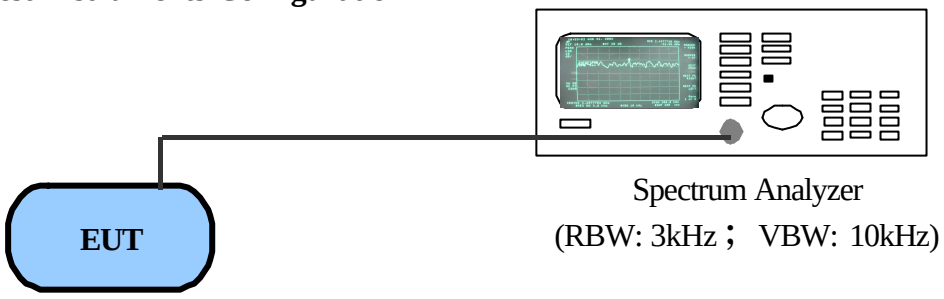
# IX. Section 15.247(d): Power Spectral Density

## 9.1 Test Condition & Setup

The tests below are running with the EUT transmitter set at high power in TDD mode. The EUT is needed to force selection of output power level and channel number. While testing, the EUT was set to transmit continuously and to be tested by the contact manner with the spectrum analyzer.

The attachments below show our observation.

## 9.2 Test Instruments Configuration




***P.S.: Notebook computer to control the EUT at maximal power output and channel number and set antenna kit***

Test Configuration of Power Spectral Density

## 9.3 List of Test Instruments

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| Spectrum Analyzer | 8564E | HP | US36433002 | 08/01/02 | 08/01/03 |

## 9.4 Test Result of Power spectral density

The following table shows a summary of the test results of the Power Spectral Density.

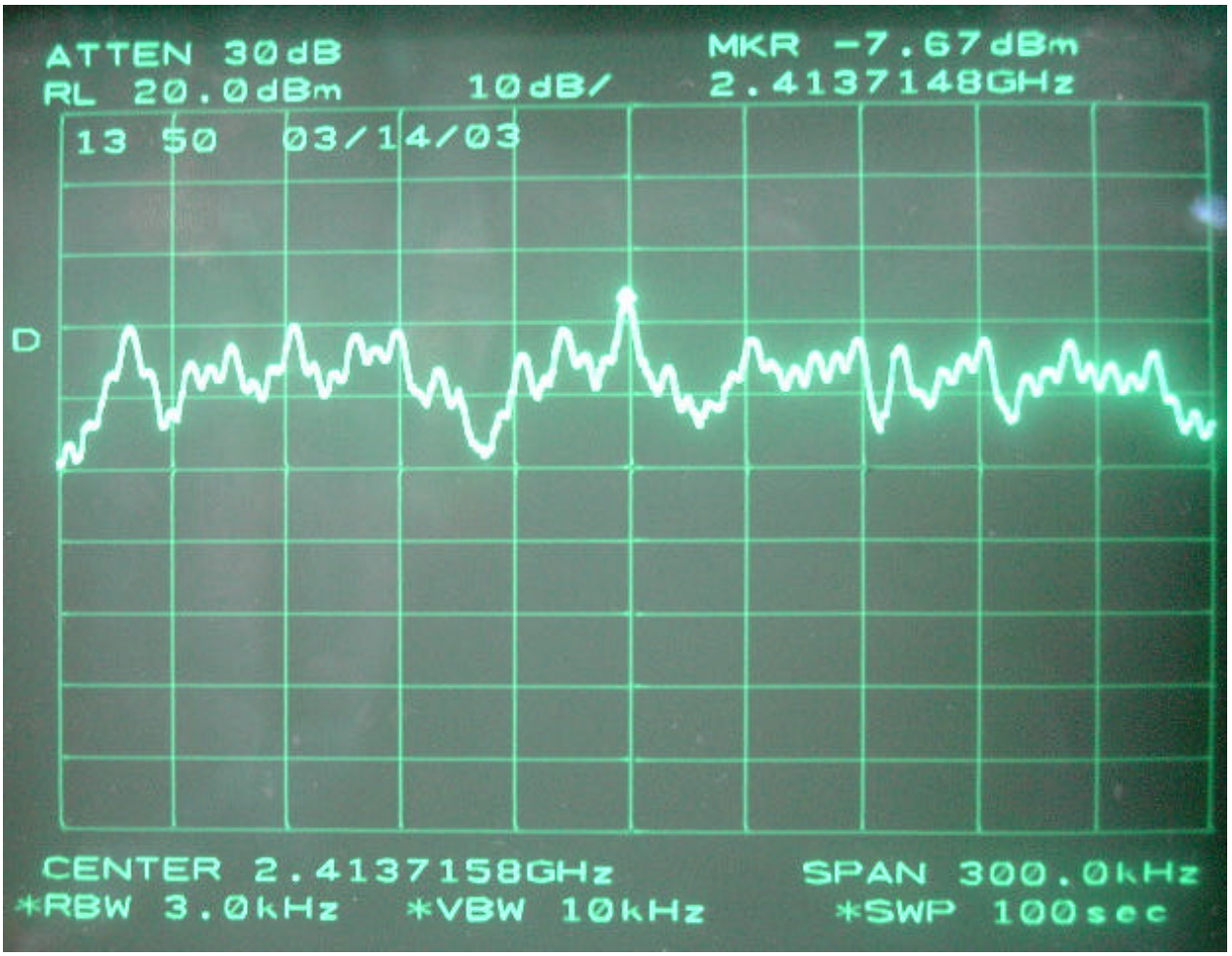
| *Channel* | *Frequency (GHz)* | *Ppr (dBm)* | *Cable Loss (dB)* | *Ppq (dBm)* | *Limit (dB)* | *Margin (dB)* |
|---|---|---|---|---|---|---|
| CH 01 | 2.412 | -7.67 | 1.80 | -5.87 | 8.00 | -13.87 |
| CH 06 | 2.437 | -7.67 | 1.85 | -5.82 | 8.00 | -13.82 |
| CH 11 | 2.462 | -8.00 | 1.93 | -6.07 | 8.00 | -14.07 |

Note:

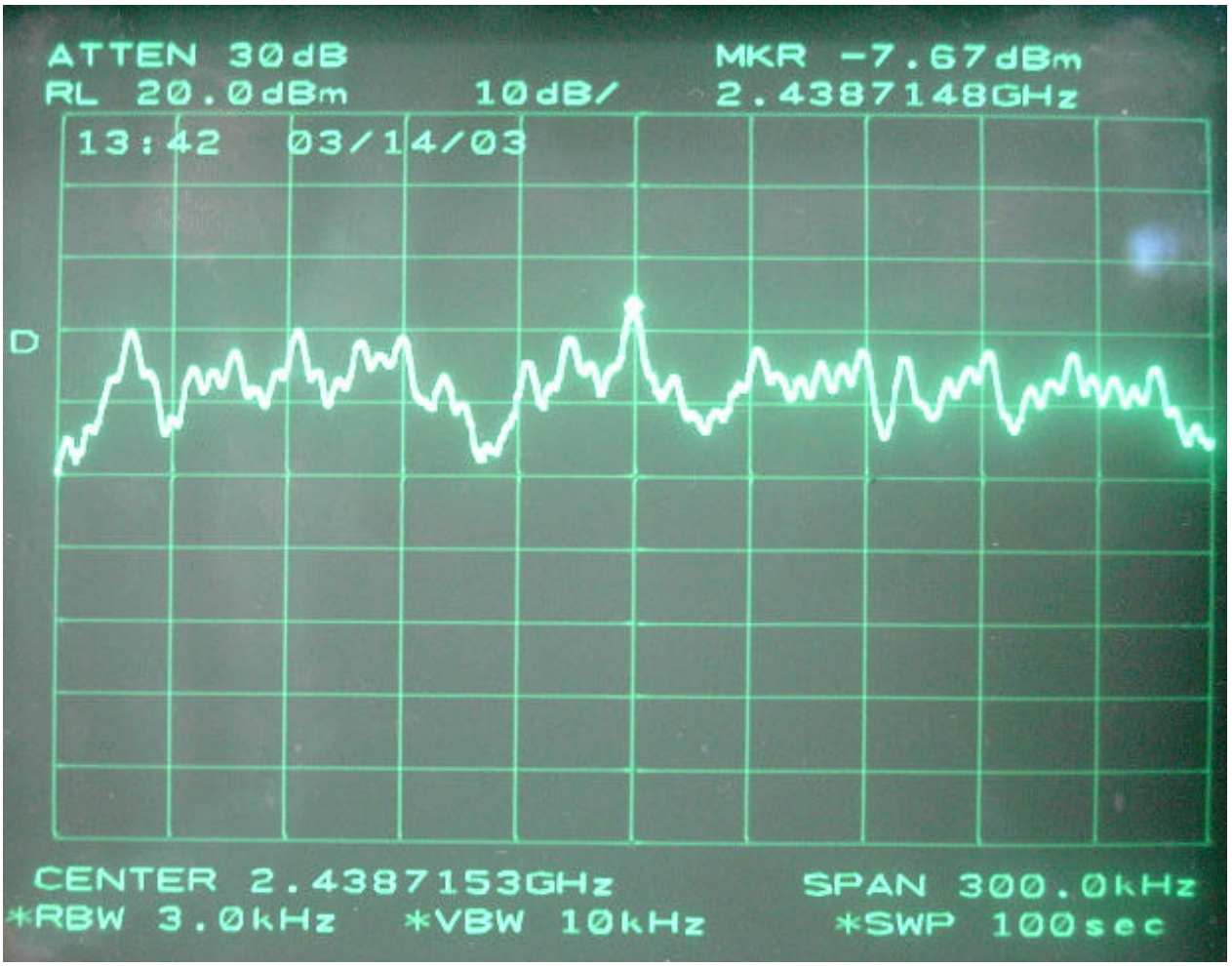
1. The attachment following by this page.
2. Ppr: spectrum read power density (using peak search mode),

   Ppq: actual peak power density in the spread spectrum band.
3. Ppq = Ppr + |Cable Loss|

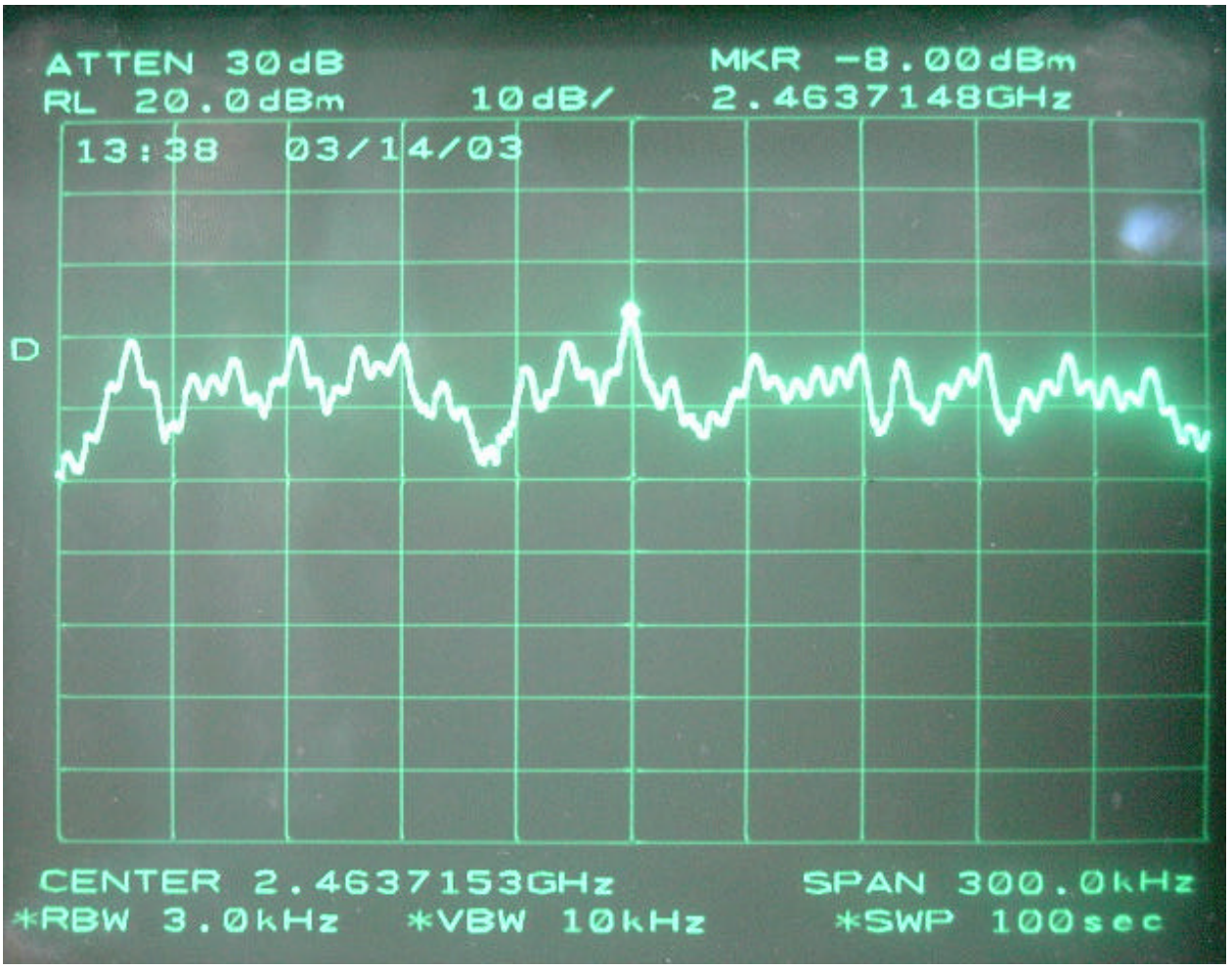
***Channel 01***


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -7.67dBm
2.4137148GHz
13 50 03/14/03
D
CENTER 2.4137158GHz
SPAN 300.0kHz
*RBW 3.0kHz
*VBW 10kHz
*SWP 100sec

***Channel 06***


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -7.67dBm
2.4387148GHz
13:42 03/14/03
D
CENTER 2.4387153GHz
SPAN 300.0kHz
*RBW 3.0kHz
*VBW 10kHz
*SWP 100sec

***Channel 11***


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -8.00dBm
2.4637148GHz
13:38 03/14/03
D
CENTER 2.4637153GHz
SPAN 300.0kHz
*RBW 3.0kHz
*VBW 10kHz
*SWP 100sec

# Appendix A

**Brand Name and Model Name List:**

| Brand Name | Model Name |
|---|---|
| LevelOne | WPC-0101 |
| PLANET | WL-3553 |
| Pheenet | WL-0011RT |
| JAHT | WN-1011P(E), WN-1011P(P) |
| EUSSO | GL2411-01R, WL-RTL8108 |
| CebitA AirWell | CWL110C |
| Intellinet | 520614 |
| Maxim Communications Inc. | WL-1000R |
| XNET | EW220C |
| LanTech | WL-530 |
| MECER | EW-7106PC |
| Genuine | GE-WPC2011BED |
| Asanté | AL-1311-DP, AreoLAN Wireless Cardbus |
| Asanté | AL-1311-PC, AreoLAN Wireless Cardbus |
| Peabird | PEAB-WL / PCMCIA |
| CONNECTLAND | WIRE-CNL-PCMCIA |
| MITSUBISHI Chemical | VWCAA10 |
| Aopen | AC802b-r |
| KOBISHI | EW-7106PC |
| LanReady | EW-7106PC |
| ConnectGear | WE320 |
| Sweex | LC500010 |
| Digitus | DN-7001 |
| hama | 49077 |
| Conceptronic | C11CC |
| PCLine | 777119 |
| Billionton | WL-300RX-B, WL-300RX-N |
| None Brand | WL-300RX-N |