

# Emission Test Report

## Standard: FCC Part 15 Subpart C & E / IC RSS-210

### Class II Permissive Change

Document Number: FCC/IC 19-0304-0

Model Number: WM3B2915ABG

measured with ThinkPad Z60m Series

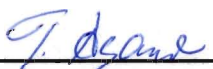
FCC ID: S2L20040601CX2  
IC: 5903D-WM3B29AG

August 25, 2005

Prepared :

EMC R&D Staff Engineer

Takeshi Asano

Signature: 

IBM Japan, Ltd.

EMC Engineering

LAB-S59

1623-14, Shimotsuruma,

Yamato-shi Kanagawa-ken 242, Japan

Phone: +81-46-215-4779

Fax: +81-46-273-7420

E-Mail: asano@jp.ibm.com

Reviewed and Checked :

Manager, EMC Engineering

Shinichi Ikami

Signature: 

IBM Japan, Ltd.

EMC Engineering

LAB-S59

1623-14, Shimotsuruma,

Yamato-shi Kanagawa-ken 242, Japan

Phone: +81-46-215-2236

Fax: +81-46-273-7420

E-Mail: ji03260@jp.ibm.com

Approved :

Manager, Technology Dev. Center

/ NVLAP signatory

Akihisa Sakurai

Signature: 

IBM Japan, Ltd.

EMC Engineering

LAB-S59

1623-14, Shimotsuruma,

Yamato-shi Kanagawa-ken 242, Japan

Phone: +81-46-215-2613

Fax: +81-46-273-7420

E-Mail: akihisa@jp.ibm.com

YS # : EMD13

**MEASUREMENT / TECHNICAL REPORT**  
**Part 15 Subpart C & E, RSS-210**  
**(Intentional Radiator)**

**Model: WM3B2915ABG (802.11a/b/g Wireless LAN Adapter)**  
**with**  
**ThinkPad Z60m Series**  
**(Machine Type: 2529, 2530, 2531, 2532)**

**FCC ID: S2L20040602CX2**  
**IC: 5903D-WM3B29AG**

**August 25, 2005**

This report concerns: (check one)

Original Grant \_\_\_\_\_

Class I change \_\_\_\_\_

Class II change ✓

Equipment type: Wireless LAN device

This report shall not be reproduced except in full, without the written permission of this test lab.

The measurement results contained in this report relate only to the item which was tested.

Measurement procedure used is ANSI C63.4-2003 unless otherwise specified.

Other test procedure: \_\_\_\_\_

The FCC has issued provisional acceptance of this test laboratory for Declaration of Conformity testing per letter dated 1997.

**APPLICANT ANTI-DRUG ABUSE CERTIFICATION:**

By checking yes, the applicant certifies that, in the case of an individual applicant, he or she is not subject to a denial of federal benefits, that includes FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse of 1988, 21 U.S.C. 853(a), or, in the case of a non-individual applicant (e.g. corporation, partnership or other unincorporated association), no party to the application is subject to a denial of federal benefits, that includes FCC benefits, pursuant to that section. For the definition of a "party" for these purposes, see 47 CFR 1.2002(b).

Yes or No

"Report shall not be reproduced except in full, without the written approval of the laboratory" "the report must not be used by the client to claim product endorsement by NVLAP or any agency of the US government"

Prepared by: Takeshi Asano

IBM Japan Corporation, Yamato EMC Enginnering  
LAB-S59, 1623-14, Shimotsuruma, Yamato-shi Kanagawa-ken 242-8502, Japan  
Tel: +81-46-215-4779 Fax: +81-46-273-7420

**- Index -**

|            |                                                                |           |
|------------|----------------------------------------------------------------|-----------|
| <b>A.</b>  | <b>General Information .....</b>                               | <b>4</b>  |
| <b>A.1</b> | <b>Test Methodology .....</b>                                  | <b>4</b>  |
| <b>A.2</b> | <b>Test Facility / NVLAP Accreditation.....</b>                | <b>4</b>  |
| <b>A.3</b> | <b>EUT details.....</b>                                        | <b>5</b>  |
| <b>B.</b>  | <b>Operation Mode of EUT .....</b>                             | <b>6</b>  |
| <b>C.</b>  | <b>Antenna Information .....</b>                               | <b>7</b>  |
| <b>D.</b>  | <b>Justification.....</b>                                      | <b>9</b>  |
| <b>E.</b>  | <b>Test Instruments .....</b>                                  | <b>10</b> |
| <b>F.</b>  | <b>Measurement Uncertainty.....</b>                            | <b>11</b> |
| <b>G.</b>  | <b>Temperature and Humidity .....</b>                          | <b>11</b> |
| <b>H.</b>  | <b>Related Submittal(s)/Grant(s)/Notes .....</b>               | <b>11</b> |
| <b>I.</b>  | <b>Summary of Test Results .....</b>                           | <b>12</b> |
| <br>       |                                                                |           |
| <b>1.</b>  | <b>Conducted Transmit Output Power .....</b>                   | <b>14</b> |
| <b>1.1</b> | <b>Test Procedure .....</b>                                    | <b>14</b> |
| <b>1.2</b> | <b>Measurement Results .....</b>                               | <b>15</b> |
| <b>1.3</b> | <b>Trace Data.....</b>                                         | <b>16</b> |
| <b>2.</b>  | <b>Restricted Bands Radiation (1GHz – 40GHz).....</b>          | <b>22</b> |
| <b>2.1</b> | <b>Test Procedure .....</b>                                    | <b>22</b> |
| <b>2.2</b> | <b>Test Instruments and Measurement Setup.....</b>             | <b>22</b> |
| <b>2.3</b> | <b>Field Strength Calculation.....</b>                         | <b>24</b> |
| <b>2.4</b> | <b>Bandedge Measurement plots .....</b>                        | <b>25</b> |
| <b>2.5</b> | <b>Radiated Emission Measurement Results (above 1GHz).....</b> | <b>36</b> |
| <b>3.</b>  | <b>Restricted Bands Radiation (30MHz – 1GHz) .....</b>         | <b>41</b> |
| <b>3.1</b> | <b>Test Procedure .....</b>                                    | <b>41</b> |
| <b>3.2</b> | <b>Test Instruments and Measurement Setup.....</b>             | <b>41</b> |
| <b>3.3</b> | <b>Field Strength Calculation.....</b>                         | <b>42</b> |
| <b>3.4</b> | <b>Measurement Results .....</b>                               | <b>43</b> |
| <b>4.</b>  | <b>AC Wireline Conducted Emissions (150KHz – 30MHz) .....</b>  | <b>46</b> |
| <b>4.1</b> | <b>Test Procedure .....</b>                                    | <b>46</b> |
| <b>4.2</b> | <b>Test Instruments and Measurement Setup.....</b>             | <b>46</b> |
| <b>4.3</b> | <b>Powerline Voltage Calculation .....</b>                     | <b>47</b> |
| <b>4.4</b> | <b>Measurement Results .....</b>                               | <b>48</b> |

## A. General Information

|                                    |                                                                                                             |
|------------------------------------|-------------------------------------------------------------------------------------------------------------|
| APPLICANT                          | : Lenovo(Japan)Ltd.                                                                                         |
| TEST SITE                          | : IBM Japan, Ltd., Yamato Semi-anechoic chamber #1                                                          |
| TEST SITE ADDRESS                  | : 1623 – 14 Shimotsuruma, Yamato-shi, Kanagawa 242-8502 Japan<br>Tel: +81-46-215-4779, Fax: +81-46-273-7420 |
| REGULATION                         | : FCC Part 15 Subpart C, and Subpart E<br>Industry Canada RSS-210 (Issue No.5)                              |
| MODEL NUMBER<br>(Advertising Name) | : WM3B2915ABG<br>(Intel PRO/Wireless 2915 ABG Mini-PCI Adapter)                                             |
| FCC ID<br>IC Certification Number  | : S2L20040601CX2<br>: 5903E-WM3B29AG                                                                        |
| SERIAL NUMBER                      | : Z9H949X09G                                                                                                |
| PHYSICAL CONDITION                 | : the applying card ; Production level, Host PC device; Preproduction                                       |
| KIND OF EQUIPMENT                  | : Personal computer with IEEE802.11a, 11b & 11g Wireless LAN<br>Mini-PCI Combo Card (Composite application) |
| TESTED DATE                        | : August 5, 8, 9, 10, 11 and 12, 2005                                                                       |

### A.1 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4-2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### A.2 Test Facility / NVLAP Accreditation

The semi-anechoic chamber #1 and measurement facility used to collect the data are located in Yamato Laboratory, IBM Japan.

- This facility has been fully described in a report dated September 1998, submitted to the FCC office, and accepted in a letter, dated Nov. 2, 1998(31040/SIT).

1. IBM Yamato EMC Engineering is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with Criteria established in Title 15, Part 285 Code of Federal Regulations. (**NVLAP Lab code: 200198-0**, effective through June 30, 2006)

- These facilities are accepted by **Industry Canada** as number **IC 4221** for chamber #1 (expiry date: December 22, 2007), and as number **IC 4221-1** for chamber #2 (expiry date: February 16, 2007).

### A.3 EUT details

**Table A** EUT details

| Model and S/N                                                                                                                        | FCC ID<br>IC Certification Number            | Description                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| WM3B2915ABG<br>(s/n Z9H949X09G)                                                                                                      | FCC ID: S2L20040601CX2<br>IC: 5903D-WM3B29AG | <b>Applying modular transmitter</b><br>Built_in type IEEE802.11a/b/g Wireless<br>LAN Mini-PCI card without antenna                     |
| ThinkPad Z60m Series<br>M/T 2529-FLU<br>(LCD : CFRP Aluminum)<br>(s/n WC6LR00001)<br>M/T 2529-FPU<br>(LCD : ABS)<br>(s/n WC5LR00002) | N/A                                          | Lenovo Notebook PC with built_in antennas<br><br>CPU: Intel® Pentium M Processor, 2.13GHz<br><br>CPU: Intel® Pentium M Processor, 2GHz |
| J07M081<br>(s/n 05S5ARM4SIT023)                                                                                                      | FCC ID: MCLJ07M081<br>IC: 2878D-J07H081      | Co-located built-in type Bluetooth modular<br>transmitter device without antenna                                                       |
| P/N 92P1105                                                                                                                          | N/A                                          | Universal AC adapter 90W, Unshielded<br>power cord                                                                                     |

## B. Operation Mode of EUT

- All tests were performed using the “CRTU III, version 3.2.15.0000” test program provided by Intel Corporation. This tool supports the continuous or burst transmission mode for the testing purpose. The parameter GAIN of the test software was set to the Intel’s power specification shown in Table-B below.
- The following frequencies were chosen for the measurements of each 2.4GHz or 5.8GHz band.
  - 2412MHz (lowest), 2437MHz(middle), and 2462MHz (highest) for 2.4GHz band
  - 5180MHz (lowest), 5260MHz(middle), and 5320MHz (highest) for 5.2GHz band
  - 5745MHz (lowest), 5785MHz(middle), and 5825MHz (highest) for 5.8GHz band
- As for the RF receiving test, the middle channels (2437MHz, 5260MHz or 5785MHz) were selected representatively.

**Table-B Transmission mode of EUT**

| Operation<br>Frequency<br>[GHz] | Designed <b>average</b> output power (conducted) [dBm] |             |            |             |           |            |            |            |            |            |            |
|---------------------------------|--------------------------------------------------------|-------------|------------|-------------|-----------|------------|------------|------------|------------|------------|------------|
|                                 | IEEE802.11b                                            |             |            | IEEE802.11g |           |            |            |            |            |            |            |
|                                 | 1/2M<br>bps                                            | 5.5M<br>bps | 11M<br>bps | 6M<br>bps   | 9M<br>bps | 12M<br>bps | 18M<br>bps | 24M<br>bps | 36M<br>bps | 48M<br>bps | 54M<br>bps |
| 2.412 (Ch. 1)                   | 15                                                     | 15          | 15         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
| 2.417 (Ch. 2)                   | 15                                                     | 15          | 15         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
| 2.422 (Ch. 3)                   | 16                                                     | 16          | 16         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
| 2.427 (Ch. 4)                   | 17                                                     | 17          | 17         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
| 2.432 (Ch. 5)                   | 17                                                     | 17          | 17         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
| 2.437 (Ch. 6)                   | 17                                                     | 17          | 17         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
| 2.442 (Ch. 7)                   | 17                                                     | 17          | 17         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
| 2.447 (Ch. 8)                   | 17                                                     | 17          | 17         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
| 2.452 (Ch. 9)                   | 17                                                     | 17          | 17         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
| 2.457 (Ch. 10)                  | 17                                                     | 17          | 17         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
| 2.462 (Ch. 11)                  | 17                                                     | 17          | 17         | 15          | 15        | 15         | 15         | 15         | 15         | 15         | 15         |
|                                 |                                                        |             |            | IEEE802.11a |           |            |            |            |            |            |            |
| 5.180 (Ch. 36)                  | N/A                                                    |             |            | 12          | 12        | 12         | 12         | 12         | 12         | 12         | 12         |
| 5.200 (Ch. 40)                  |                                                        |             |            | 12          | 12        | 12         | 12         | 12         | 12         | 12         | 12         |
| 5.220 (Ch. 44)                  |                                                        |             |            | 12          | 12        | 12         | 12         | 12         | 12         | 12         | 12         |
| 5.240 (Ch. 48)                  |                                                        |             |            | 12          | 12        | 12         | 12         | 12         | 12         | 12         | 12         |
| 5.260 (Ch. 52)                  | N/A                                                    |             |            | 16          | 16        | 16         | 16         | 16         | 16         | 16         |            |
| 5.280 (Ch. 56)                  |                                                        |             |            | 16          | 16        | 16         | 16         | 16         | 16         | 16         |            |
| 5.300 (Ch. 60)                  |                                                        |             |            | 16          | 16        | 16         | 16         | 16         | 16         | 16         |            |
| 5.320 (Ch. 64)                  |                                                        |             |            | 16          | 16        | 16         | 16         | 16         | 16         | 16         |            |
| 5.745 (Ch.149)                  | N/A                                                    |             |            | 17          | 17        | 17         | 17         | 17         | 17         | 17         |            |
| 5.765 (Ch.153)                  |                                                        |             |            | 14          | 14        | 14         | 14         | 14         | 13         | 13         | 11         |
|                                 |                                                        |             |            | 17          | 17        | 17         | 17         | 17         | 17         | 17         | 17         |
| 5.785 (Ch.157)                  |                                                        |             |            | 14          | 14        | 14         | 14         | 14         | 13         | 13         | 11         |
|                                 |                                                        |             |            | 17          | 17        | 17         | 17         | 17         | 17         | 17         | 17         |
| 5.805 (Ch.161)                  |                                                        |             |            | 14          | 14        | 14         | 14         | 14         | 13         | 13         | 11         |
|                                 |                                                        |             |            | 17          | 17        | 17         | 17         | 17         | 17         | 17         | 17         |
| 5.825 (Ch.165)                  |                                                        |             |            | 14          | 14        | 14         | 14         | 14         | 13         | 13         | 11         |

Note) The power values on 5GHz band are reduced by the driver for best performance according EVM (Error Vector Magnitude) factor.

Prepared by T. Asano

## C. Antenna Information

The Table-C indicates the applicable host antenna systems used for FCC ID: S2L20040601CX2 and IC: 5903D-WM3B29AG. The original grantee of the device was IBM Corp., and the original FCC ID and IC number were ANO20040601CX2 and IC: 349E-WM3B29AG. The all grants shown in the table were given to IBM Corp., then transferred to Lenovo in May/2005 (FCC) and July/2005 (IC).

**Table-C Antenna Information**

The highest antenna gains in each frequency band are marked in red.

| ThinkPad Z60m Series | Antenna Designator | Manufacture                                       | Antenna type                                   | Cable type and length | Freq.       | LCD rear cover material | Peak Gain |
|----------------------|--------------------|---------------------------------------------------|------------------------------------------------|-----------------------|-------------|-------------------------|-----------|
| Main antenna         | 023-0100-2400      | FOXCONN HON HAI PRECISION IND. Co., Ltd. (R.O.C.) | Dual Band Meander (Planner Inverted F) Antenna | Coax 570 mm           | 2.4GHz band | ABS                     | -0.14 dBi |
|                      |                    |                                                   |                                                |                       |             | CFRP Aluminum           | 0.63 dBi  |
|                      |                    |                                                   |                                                |                       | 5.2GHz band | ABS                     | 2.71 dBi  |
|                      |                    |                                                   |                                                |                       |             | CFRP Aluminum           | 2.72 dBi  |
| Auxiliary antenna    | 023-0100-2399      |                                                   |                                                | Coax 390 mm           | 5.8GHz band | ABS                     | 2.37 dBi  |
|                      |                    |                                                   |                                                |                       |             | CFRP Aluminum           | 1.80 dBi  |
|                      |                    |                                                   |                                                |                       | 2.4GHz band | ABS                     | 0.73 dBi  |
|                      |                    |                                                   |                                                |                       |             | CFRP Aluminum           | 0.60 dBi  |
|                      |                    | 5.2GHz band                                       | ABS                                            | 1.48 dBi              |             |                         |           |
|                      |                    |                                                   | CFRP Aluminum                                  | 1.53 dBi              |             |                         |           |
| 5.8GHz band          | ABS                | 0.57 dBi                                          |                                                |                       |             |                         |           |
|                      | CFRP Aluminum      | 0.71 dBi                                          |                                                |                       |             |                         |           |

**Granted on 10/07/2004 (FCC), 10/11/2004 (IC)**

| ThinkPad R50 Series |           | Antenna Designator | Manufacture                | Antenna type              | Cable type and length | Peak Gain      |                 |
|---------------------|-----------|--------------------|----------------------------|---------------------------|-----------------------|----------------|-----------------|
| LCD 14 inch Model   | Main      | 91P6810            | Hitachi Cable Ltd. (Japan) | Dual Band Meander Antenna | Coax 750 mm           | 2.4GHz band    | 1.52 dBi        |
|                     |           |                    |                            |                           |                       | 5.15 - 5.35GHz | 2.66 dBi        |
|                     |           |                    |                            |                           |                       | 5.725-5.85GHz  | 0.02 dBi        |
|                     | Auxiliary | 91P6811            |                            |                           | Coax 635 mm           | 2.4GHz band    | <b>1.84 dBi</b> |
| LCD 15 inch Model   |           |                    | Hitachi Cable Ltd. (Japan) | Dual Band Meander Antenna | coax 775mm            | 5.15 - 5.35GHz | 1.37 dBi        |
|                     |           |                    |                            |                           |                       | 5.725-5.85GHz  | 0.19 dBi        |
|                     |           |                    |                            |                           |                       | 2.4GHz band    | 1.18 dBi        |
|                     | Main      | 91P6812            |                            |                           | coax 670mm            | 5.15 - 5.35GHz | 1.68 dBi        |
|                     |           |                    |                            |                           |                       | 5.725-5.85GHz  | 1.78 dBi        |
|                     |           |                    |                            |                           |                       | 2.4GHz band    | 1.71 dBi        |
|                     | Auxiliary | 91P6813            |                            |                           |                       | 5.15 - 5.35GHz | <b>2.84 dBi</b> |
|                     |           |                    |                            |                           |                       | 5.725-5.85GHz  | 1.51dBi         |

**Granted on 10/07/2004 (FCC), 10/11/2004 (IC)**

| ThinkPad<br>T40 Series  |           | Antenna<br>Designator | Manufacture                             | Antenna type                                             | Cable type<br>and length | Peak Gain      |           |
|-------------------------|-----------|-----------------------|-----------------------------------------|----------------------------------------------------------|--------------------------|----------------|-----------|
| LCD<br>14 inch<br>Model | Main      | 62P4204               | Foxconn<br>Electronics<br>Inc. (R.O.C.) | Dual Band<br>Meander Antenna                             | Coax<br>745 mm           | 2.4GHz band    | 0.99 dBi  |
|                         |           | 91P6900               |                                         |                                                          |                          | 5.15 - 5.35GHz | 0.83 dBi  |
|                         |           |                       |                                         |                                                          |                          | 5.725-5.85GHz  | -0.23 dBi |
|                         | Auxiliary | 62P4203               |                                         | Dual-Band Coupled<br>Floating Element<br>Meander Antenna | Coax<br>845 mm           | 2.4GHz band    | -0.48 dBi |
|                         |           | 91P6898               |                                         |                                                          |                          | 5.15 - 5.35GHz | 0.36 dBi  |
|                         |           | 5.725-5.85GHz         | -0.37 dBi                               |                                                          |                          |                |           |
| LCD<br>15 inch<br>Model | Main      | 91P6841               | Hitachi Cable<br>Ltd. (Japan)           | Dual Band<br>Meander Antenna                             | coax<br>755mm            | 2.4GHz band    | 1.24 dBi  |
|                         |           |                       |                                         |                                                          |                          | 5.15 - 5.35GHz | 2.00 dBi  |
|                         |           |                       |                                         |                                                          |                          | 5.725-5.85GHz  | 1.01 dBi  |
|                         | Auxiliary | 91P6840               |                                         |                                                          | coax<br>580mm            | 2.4GHz band    | 0.38 dBi  |
|                         |           |                       |                                         |                                                          |                          | 5.15 - 5.35GHz | 0.82 dBi  |
| 5.725-5.85GHz           |           |                       | -0.23 dBi                               |                                                          |                          |                |           |

**Granted on 12/17/2004(FCC), 12/17/2004 (IC)**

| IBM ThinkPad<br>X30 Series | Antenna<br>Designator | Manufacture                            | Antenna type                 | Cable type<br>and length | Peak Gain      |          |
|----------------------------|-----------------------|----------------------------------------|------------------------------|--------------------------|----------------|----------|
| Main antenna               | 08K4083               | Nissei Electric<br>Co. Ltd.<br>(Japan) | Dual Band<br>Meander Antenna | Coax<br>394 mm           | 2.4GHz band    | 0.62 dBi |
|                            |                       |                                        |                              |                          | 5.15 - 5.35GHz | 1.42 dBi |
|                            |                       |                                        |                              |                          | 5.725-5.85GHz  | 0.32 dBi |
| Auxiliary antenna          | 08K4084               |                                        |                              | Coax<br>534 mm           | 2.4GHz band    | 1.28 dBi |
|                            |                       |                                        |                              |                          | 5.15 - 5.35GHz | 0.19 dBi |
|                            |                       |                                        |                              |                          | 5.725-5.85GHz  | -0.87dBi |

**Granted on 12/17/2004(FCC), 12/17/2004 (IC)**

| IBM ThinkPad<br>X40 Series | Antenna<br>Designator | Manufacture                            | Antenna type                 | Cable type<br>and length | Peak Gain      |          |
|----------------------------|-----------------------|----------------------------------------|------------------------------|--------------------------|----------------|----------|
| Main antenna               | 13N5743               | Nissei Electric<br>Co. Ltd.<br>(Japan) | Dual Band<br>Meander Antenna | Coax<br>488 mm           | 2.4GHz band    | 0.39 dBi |
|                            |                       |                                        |                              |                          | 5.15 - 5.35GHz | 1.45 dBi |
|                            |                       |                                        |                              |                          | 5.725-5.85GHz  | 1.74 dBi |
| Auxiliary antenna          | 13N5742               |                                        |                              | Coax<br>449 mm           | 2.4GHz band    | 1.67 dBi |
|                            |                       |                                        |                              |                          | 5.15 - 5.35GHz | 2.15 dBi |
|                            |                       |                                        |                              |                          | 5.725-5.85GHz  | 2.04 dBi |

**Granted on 04/28/2005(FCC), 03/10/2005 (IC)**

| ThinkPad X41<br>Tablet Series | Antenna<br>Designator | Manufacture                           | Antenna type                    | Cable type<br>and length | Peak Gain      |          |           |
|-------------------------------|-----------------------|---------------------------------------|---------------------------------|--------------------------|----------------|----------|-----------|
| Main antenna                  | 91P6908               | Wistron<br>NeWeb<br>Corp.<br>(R.O.C.) | Dual Band<br>Meander<br>Antenna | Coax<br>600 mm           | 2.4GHz<br>band | Notebook | -1.37 dBi |
|                               |                       |                                       |                                 |                          |                | Tablet   | -0.15 dBi |
|                               |                       |                                       |                                 |                          | 5.2GHz<br>band | Notebook | 2.75 dBi  |
|                               |                       |                                       |                                 |                          |                | Tablet   | 2.11 dBi  |
|                               |                       |                                       |                                 |                          | 5.8GHz<br>band | Notebook | 0.84 dBi  |
|                               |                       |                                       |                                 |                          |                | Tablet   | -0.35 dBi |
| Auxiliary antenna             | 91P6909               |                                       |                                 | Coax<br>550 mm           | 2.4GHz<br>band | Notebook | 1.77 dBi  |
|                               |                       |                                       |                                 |                          |                | Tablet   | 1.82 dBi  |
|                               |                       |                                       |                                 |                          | 5.2GHz<br>band | Notebook | 1.36 dBi  |
|                               |                       |                                       |                                 |                          |                | Tablet   | 1.71 dBi  |
|                               |                       |                                       |                                 |                          | 5.8GHz<br>band | Notebook | -0.28 dBi |
|                               |                       |                                       |                                 |                          |                | Tablet   | 0.37 dBi  |



## D. Justification

The full testing results were already performed with the highest antenna gains of ThinkPad R50 Series in 2.4GHz and 5.2GHz bands as shown in the previous Table-C, then certified on October/07/2004 (FCC) or October/11/2004 (IC).

The new antenna system used for ThinkPad Z60m Series is similar antenna type to the granted antenna systems (i.e. Dual Band Meander Antenna), and the antenna locations are entirely the same as ones of the existing ThinkPad T40 and R50 Series.

Therefore, the applying new antenna system conforms with the FCC rule Part 15 Subpart C & E and IC RSS-210 in 2.4GHz and 5.2GHz bands without re-testing, pursuant to the ET Docket 03-201; FCC 04-165, July 12/2004 and Federal Register / Vol. 69, No. 172, September 7/2004.

But the antenna gain in 5.8GHz band of new system exceeds the certified value, then re-test is required for this band.

This test report includes the following measurement items.

- Conducted power  
Other conducted measurements were not performed, since neither hardware nor electrical modification was made to the applying modular transmitter itself.
- Restricted Bands Radiation
- AC Wireline Conducted Emissions

The tests were performed with the higher antenna gain in each operation mode as below.

| ThinkPad Z60m Series | Frequency band | LCD material  | Peak Gain | selected |
|----------------------|----------------|---------------|-----------|----------|
| Main antenna         | 2.4GHz         | ABS           | -0.14 dBi |          |
|                      |                | CFRP Aluminum | 0.63 dBi  | X        |
|                      | 5.2GHz         | ABS           | 2.71 dBi  | X        |
|                      |                | CFRP Aluminum | 2.72 dBi  | X        |
|                      | 5.8GHz         | ABS           | 2.37 dBi  | X        |
|                      |                | CFRP Aluminum | 1.80 dBi  | X        |
| Auxiliary antenna    | 2.4GHz         | ABS           | 0.73 dBi  | X        |
|                      |                | CFRP Aluminum | 0.60 dBi  |          |
|                      | 5.2GHz         | ABS           | 1.48 dBi  |          |
|                      |                | CFRP Aluminum | 1.53 dBi  |          |
|                      | 5.8GHz         | ABS           | 0.57 dBi  |          |
|                      |                | CFRP Aluminum | 0.71 dBi  |          |

## E. Test Instruments

**Table-E** List of Measuring Instruments

| Description                           | Model          | Serial Number | Calibration Date | Calibration Interval |
|---------------------------------------|----------------|---------------|------------------|----------------------|
| Computer                              | IBM 6868-30J   | 97-901X3      | N/A              | N/A                  |
| Computer                              | IBM 6589-13J   | 97-15613      | N/A              | N/A                  |
| Spectrum Analyzer (100Hz-1.5GHz)      | HP 85680B      | 2732A03651    | 07/13/05         | 1 year               |
| Spectrum Analyzer (100Hz-1.5GHz)      | HP 85680B      | 2841A04254    | 08/25/04         | 1 year               |
| Spectrum Analyzer (100Hz-1.5GHz)      | HP 85680B      | 3019A05155    | 02/25/05         | 1 year               |
| Spectrum Analyzer Display             | HP 85662A      | 2648A15255    | 07/13/05         | 1 year               |
| Spectrum Analyzer Display             | HP 85662A      | 2816A16831    | 08/25/04         | 1 year               |
| Spectrum Analyzer Display             | HP 85662A      | 3026A19353    | 02/25/05         | 1 year               |
| Quasi-Peak Adapter                    | HP 85650A      | 2521A00968    | 07/14/05         | 1 year               |
| Quasi-Peak Adapter                    | HP 85650A      | 2811A01156    | 08/25/04         | 1 year               |
| Quasi-Peak Adapter                    | HP 85650A      | 3033A01449    | 02/25/05         | 1 year               |
| Amplifier (100KHz - 1.3GHz)           |                |               |                  |                      |
| - for 30-200MHz                       | MITEQ AM-3A    | 898433        | 05/06/05         | 1 year               |
| - for 200-1000MHz                     | MITEQ AM-3A    | 898432        | 05/06/05         | 1 year               |
| Amplifier (1GHz - 18GHz)              | HP 8449B       | 3008A00582    | 07/06/05         | 1 year               |
| Amplifier (18 – 40GHz)                | Agilent 83051A | 3950M00193    | 01/18/05         | 1 year               |
| Spectrum Analyzer EMI Test Receiver   | R&S ESI26      | 836119/003    | 07/14/05         | 1 year               |
| Spectrum Analyzer                     | HP 8563E       | 3416A02248    | 09/10/04         | 1 year               |
| Harmonic Mixer                        | Agilent 11970A | 011269-001    | 08/04/05         | 1 year               |
| Receiver (9kHz-30MHz)                 | R&S ESH3       | 891806/012    | 11/04/04         | 1 year               |
| Receiver (20MHz-1.3GHz)               | R&S ESVP       | 892111/026    | 11/04/04         | 1 year               |
| Biconical Antenna (30-200MHz)         | EMCO 3108      | 2400          | 04/22/05         | 1 year               |
| Log-Periodic Antenna (200-1000MHz)    | EMCO 3146      | 2150          | 04/22/05         | 1 year               |
| Horn Antenna (1- 18GHz)               | EMCO 3115      | 9903-5774     | 07/14/05         | 1 year               |
| Horn Antenna (3.95- 5.85GHz)          | EMCO 3160-5    | 1099          | 07/14/05         | 1 year               |
| Horn Antenna (5.85- 8.20GHz)          | EMCO 3160-6    | 9712-1044     | 07/14/05         | 1 year               |
| Horn Antenna (8.20- 12.4GHz)          | EMCO 3160-7    | 1156          | 07/14/05         | 1 year               |
| Horn Antenna (12.4- 18GHz)            | EMCO 3160-8    | 1143          | 07/14/05         | 1 year               |
| Horn Antenna (18- 26.5GHz)            | EMCO 3160-9    | 0004-1202     | 07/14/05         | 1 year               |
| Horn Antenna (26.5- 40GHz)            | EMCO 3160-10   | 1175          | 07/14/05         | 1 year               |
| LISN                                  | EMCO 3810/2NM  | 00022007      | 11/09/05         | 1 year               |
| Switch/control unit                   | HP 3488A       | 2719A17226    | N/A              | N/A                  |
|                                       |                | 2719A17228    | N/A              | N/A                  |
| Plotter                               | HP 7550A       | 2631A33619    | N/A              | N/A                  |
| Coaxial cables (1 – 18GHz):           | Length:        |               |                  |                      |
| - Horn Ant <=> RF Amp.                | 6 m            | - EM206SCO    | 03/10/05         | 1 year               |
| - RF Amp.<=>Spectrum Analyzer(<12GHz) | 16m            | - GEM0101     | 03/10/05         | 1 year               |
| - RF Amp.<=>Spectrum Analyzer(>12GHz) | 3m             | - SF102-20166 | 06/02/05         | 1 year               |
| Coaxial cables (18 – 40GHz):          |                |               |                  |                      |
| - Horn Ant <=> RF Amp.                | 3m             | - SF102-20167 | 06/02/05         | 1 year               |
| - RF Amp.<=>Spectrum Analyzer         | 1m             | - SF102-21105 | 06/02/05         | 1 year               |

|                                                       |      |            |          |        |
|-------------------------------------------------------|------|------------|----------|--------|
| N-Coax cables:                                        |      |            |          |        |
| - Bi-coni Ant <=> 10m Cable                           | 9 m  | - EM103L01 | 05/07/05 | 1 year |
| - 10m Cable <=> Shield Panel                          | 10 m | - EM103L02 | 05/07/05 | 1 year |
| - Shield Panel <=> RF Amp                             | 7 m  | - EM103L03 | 05/07/05 | 1 year |
| - RF Amp <=> Power Splitter                           | 0.5m | - EM103L04 | 05/07/05 | 1 year |
| - Log-peri Ant <=> 10m Cable                          | 9 m  | - EM103H01 | 05/07/05 | 1 year |
| - 10m Cable <=> Shield Panel                          | 10 m | - EM103H02 | 05/07/05 | 1 year |
| - Shield Panel <=> RF Amp                             | 7 m  | - EM103H03 | 05/07/05 | 1 year |
| - RF Amp <=> Power Splitter                           | 0.5m | - EM103H04 | 05/07/05 | 1 year |
| Coax cables:                                          |      |            |          |        |
| - Power Splitter <=> SW/Con.unit (SW110)              | 1 m  | - EM103L05 | 05/07/05 | 1 year |
| - Power Splitter <=> SW/Con.unit (SW300)              | 1 m  | - EM103L06 | 05/07/05 | 1 year |
| - Power Splitter <=> SW/Con.unit (SW100)              | 1 m  | - EM103H05 | 05/07/05 | 1 year |
| - Power Splitter <=> SW/Con.unit (SW301)              | 1 m  | - EM103H06 | 05/07/05 | 1 year |
| - SW/Con.unit <=> Receiver (Input)                    | 2 m  | - EM1RCV   | 05/07/05 | 1 year |
| - SW/Con.unit <=> Spe Ana.(Signal In) for 30- 200MHz  | 2 m  | - EM1SPL   | 05/07/05 | 1 year |
| - SW/Con.unit <=> Spe Ana.(Signal In) for 200-1000MHz | 2 m  | - EM1SPH   | 05/07/05 | 1 year |

Notes. - The above equipment calibration is traceable to National standards.

- HP: Hewlett Packard, R&S: Rohde & Schwarz

## F. Measurement Uncertainty

Uncertainties of the both, the Yamato EMI radiated test facilities (EMI chambers, #1 and #2) and the Yamato EMI conducted test facility are derived with the NIS 81 " Treatment of uncertainty in EMC measurements" 1994.

Estimated site uncertainty values are as follows.

EMI chamber #1 : 4.39dB

EMI chamber #2 : 4.40dB

EMI conducted measurement system : 2.4dB

Detail should be referred to "Treatment of Uncertainty, Calculations and Policy" report, document number TCR 10-0015.

## G. Temperature and Humidity

The temperature is controlled within range of 17° to 28°

The relative humidity is controlled within range of 40% to 70%.

## H. Related Submittal(s)/Grant(s)/Notes

During the applying modular device stops RF transmission, the host unit with full peripheral devices including the applying modular device is classified as an unintentional radiator, Digital Device under the FCC Part 15 Subpart B or the Industry Canada Class B Emission Compliance (ICES-003), and subject to DoC.

## I. Summary of Test Results

Table-I shows the list of the measurement items of FCC Part 15 Subpart C & E, and Industry Canada RSS-210 (Issue 5). The upper section numbers are FCC Part 15, and the lower ones are IC RSS-210.

**Table-I** List of the measurements

| Section(s)                                                                          | Test Items                                                                    |                                                                                                                                                                                                                                                                                                   | Condition                  | Result                                        |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------------------------------------|
| 15.247(a)(2)<br>6.2.2(o) *1                                                         | Bandwidth at 6 dB below                                                       | At least 500kHz.<br>(*1: RSS-210 Issue5: Amendment)                                                                                                                                                                                                                                               | Conducted                  | Pass (Not changed from the certified values.) |
| 15.215(c)<br>5.9.1                                                                  | Bandwidth at 20 dB below                                                      | 20 dB bandwidth of the emission to be within the allocation band.                                                                                                                                                                                                                                 |                            |                                               |
| 15.407(a)(1)(2)<br>6.2.2 (q1)(i)(ii)                                                | Bandwidth at 26 dB below                                                      | 26dB BW was also taken for IC instead of 99% BW, according to RSS-210 6.2.2q(iv)(b).                                                                                                                                                                                                              |                            |                                               |
| 15.247(c)<br>6.2.2(o)(e1)                                                           | Out of Band Emissions                                                         | The radiated emission in any 100kHz of outband shall be at least 20dB below the highest inband spectral density.                                                                                                                                                                                  |                            |                                               |
| 15.247(b)(3)<br>6.2.2(o)(b)<br><br>15.407(a)(1)(2)<br>6.2.2 (q1)(i)(ii)             | Conducted Transmit Output Power                                               | 2400-2483.5MHz / 5725-5850MHz<br>Shall not exceed 1.0 W.<br>5150-5250MHz:<br>FCC: 50mW or (4+10logB)dBm<br>IC : 200mW* or (10+10logB)dBm*<br>*: EIRP<br>5250-5350MHz:<br>FCC: 250mW or (11+10logB)dBm<br>IC : 250mW or (11+10logB)dBm<br>IC : 1W* or (17+10logB)dBm*<br>*: EIRP B: 26dB BW in MHz | Conducted                  | Pass                                          |
| 15.247(d)<br>6.2.2(o)(b)<br><br>15.407(a)(1)(2)<br>6.2.2 (q1)(i)(ii)                | Peak Power Spectral Density                                                   | 2400-2483.5MHz / 5725-5850MHz<br>Shall not be greater than 8 dBm in any 3kHz band.<br>5150-5250MHz:<br>FCC: 4 dBm in any 1MHz<br>IC : 10 dBm in any 1MHz (EIRP)<br>5250-5350MHz:<br>FCC: 11 dBm in any 1MHz<br>IC : 11 dBm in any 1MHz                                                            |                            |                                               |
| N/A<br>6.2.2 (q1)(iv)(b)                                                            | Peak Spectral Density                                                         | IC: 3 + 10logB dBm/MHz                                                                                                                                                                                                                                                                            |                            |                                               |
| 15.407(a)(6)<br>N/A                                                                 | Peak Excursion                                                                | The ratio of the peak excursion of the modulation envelope to the peak transmit shall not exceed 13 dB across any 1 MHz .                                                                                                                                                                         |                            |                                               |
| 15.207<br>407(b)(5)<br>6.2.2(o)(e3)<br>6.2.2 (q1)(v)<br>6.6 / 7.4                   | AC Wireline Conducted Emissions<br>150kHz – 30MHz                             | Class B:<br>Freq.(MHz) QP(dBμV) Ave.(dBμV)<br>0.15 - 0.5 66 - 56 56 - 46<br>0.5 - 5 56 46<br>5 - 30 60 50                                                                                                                                                                                         | Radiated<br>(30MHz - 1GHz) | Pass                                          |
| 15.205 & 209 /<br>407(b)(1)(2)(5)(6)<br>6.2.1 /<br>6.2.2(q1)(i)(ii)(v)<br>6.3 / 7.3 | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | Shall not exceed the limits specified in FCC 15.209 or RSS-210 Table3.<br>Ave. 54dBμV/m, peak 74dBμV/m<br>and<br>FCC 15.407(b)(1)(2) or RSS-210 6.2.2(q1)(i)(ii) : EIRP –27dBm/MHz                                                                                                                | Radiated<br>(1G - 40GHz)   | Pass                                          |

|                                          | <b>Other general requirements</b>                                     |                                                                                                         | Result   |
|------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|----------|
| 15.247(b)(4)(i)<br>15.407(a)(1)(2)<br>—  | Antenna gain of the applying host device                              | Peak gain of the device : 0.73 dBi in 2.4GHz band<br>2.72 dBi in 5.2GHz band<br>2.37 dBi in 5.8GHz band | N/A      |
| —<br>5.2                                 | Supply Voltage                                                        | Main power source: Universal AC adapter 90W<br>Mini-PCI PC bus to applying card : DC 3.3V ± 0.3V        | N/A      |
| —<br>6.2.2(q1)(iv)(a)                    | Digital modulation                                                    | Applying equipment employs IEEE802.11a, 11g(OFDM) or 11b(CCK) digital modulation technology.            | complies |
| 15.407(c)<br>6.2.2(q1)(iv)(d)            | Automatic link disconnection in no transaction state                  | Not changed from the certified document “Circuitry Description”.                                        | complies |
| 15.407(d)<br>6.2.2(q1)(i)                | Integral antenna in the 5150M -5250MHz band                           | The device employs an unique electronic connector so called <b>Electronic Handshake</b> .               | complies |
| 15.407(e)<br>6.2.2(q1)(i)<br>(q1)(iv)(g) | Indoor use in the 5150M - 5250MHz band, and interference from radars. | Refer to the manual (Regulatory Notice) of ThinkPad Z60m Series.                                        | complies |
| 15.407(f)<br>6.2.2(q1)(iv)(g)            | RF Exposure Requirement                                               | Refer to “RF Exposure Evaluation” documents.                                                            | complies |
| 15.407(g)<br>6.2.2(q1)(iv)(e)            | Frequency stability                                                   | Not changed from the certified document “Circuitry Description”.                                        | complies |

# 1. Conducted Transmit Output Power

Subpart C / DSSS [ FCC 15.247(b)(3), RSS-210 6.2.2(o)(b) ]  
Subpart E / LELAN [ FCC 15.407(a)(1), RSS 6.2.2q1(i) / q1(iv)(b) ]  
[ FCC 15.407(a)(2), RSS 6.2.2q1(ii) / q1(iv)(b) ]

## 1.1 Test Procedure

The spectrum analyzer was connected to the antenna terminal, while EUT was operating in continuous transmission mode at the appropriate center frequencies.

The both tests were performed with the spectrum analyzer in accordance with the Method #3 of the FCC Public Notice, DA 02-2138, August/30/2002.

However, the spectrum analyzer setting for each peak or mean power measurement was different as follows.

RBW:

|                                                              |                                                                             |
|--------------------------------------------------------------|-----------------------------------------------------------------------------|
| Peak power measurement<br>FCC Subpart C, IC RSS-210 6.2.2(o) | 1MHz                                                                        |
| Mean power measurement<br>FCC Subpart E, IC RSS-210 6.2.2(q) | 30kHz ( $\geq 1/T$ , where T is transmission pulse duration. See Plot 1-1.) |

VBW = RBW or more

Span = 50MHz encompassing the entire 26dB emission bandwidth of the transmission signal,

Mode = sample detector,

Trigger = free run

The band power measurement function was used to measure the conducted transmission output power for each transmission mode. The analyzer computed each power by integrating the spectrum across the 26 dB emission bandwidth.

**Table 1-1:** Test instruments of spectrum analyzer method

| Description                                 | Model                                                                   | Serial Number |
|---------------------------------------------|-------------------------------------------------------------------------|---------------|
| Spectrum Analyzer EMI Test Receiver         | R&S ESI26                                                               | 836119/003    |
| Coax cables:<br>- Spectrum Analyzer <=> EUT | Length: Loss:<br>110 cm 2.4GHz 1.3 dB<br>5.2GHz 2.2 dB<br>5.8GHz 2.3 dB |               |

Notes: - R&S: Rohde & Schwarz

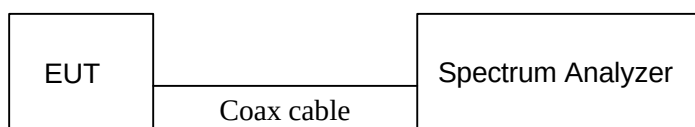


Figure 1-1 : Measurement setup of spectrum analyzer method

## 1.2 Measurement Results

Test Date: August 2, 3 and 4, 2005

The test was performed for all the transmission rates, then the highest measurement values are listed below.

**Table 1-2** 2.4GHz DSSS Tx mode

| Measured Frequency (MHz) | Tx Rate (Mb/s) | Analyzer reading (dBm) | Trace number | Cable Loss (dB) | Results (dBm) | Limit     |          | Margin to limit (dBm) |
|--------------------------|----------------|------------------------|--------------|-----------------|---------------|-----------|----------|-----------------------|
|                          |                |                        |              |                 |               | FCC (dBm) | IC (dBm) |                       |
| 2412                     | 11             | 19.73                  | omitted      | 1.3             | 21.03         | 30        | 30       | 8.97                  |
| 2437                     | 11             | 20.66                  | Plot 1-2b    | 1.3             | <b>21.96</b>  | 30        | 30       | 8.04                  |
| 2462                     | 11             | 20.54                  | omitted      | 1.3             | 21.84         | 30        | 30       | 8.16                  |

**Table 1-3** 2.4GHz OFDM Tx mode

| Measured Frequency (MHz) | Tx Rate (Mb/s) | Analyzer reading (dBm) | Trace number | Cable Loss (dB) | Results (dBm) | Limit     |          | Margin to limit (dBm) |
|--------------------------|----------------|------------------------|--------------|-----------------|---------------|-----------|----------|-----------------------|
|                          |                |                        |              |                 |               | FCC (dBm) | IC (dBm) |                       |
| 2412                     | 6              | 19.97                  | Plot 1-3b    | 1.3             | <b>21.27</b>  | 30        | 30       | 8.73                  |
| 2437                     | 6              | 19.19                  | omitted      | 1.3             | 20.49         | 30        | 30       | 9.51                  |
| 2462                     | 6              | 19.85                  | omitted      | 1.3             | 21.15         | 30        | 30       | 8.85                  |

**Table 1-4** 5.2GHz OFDM Tx mode

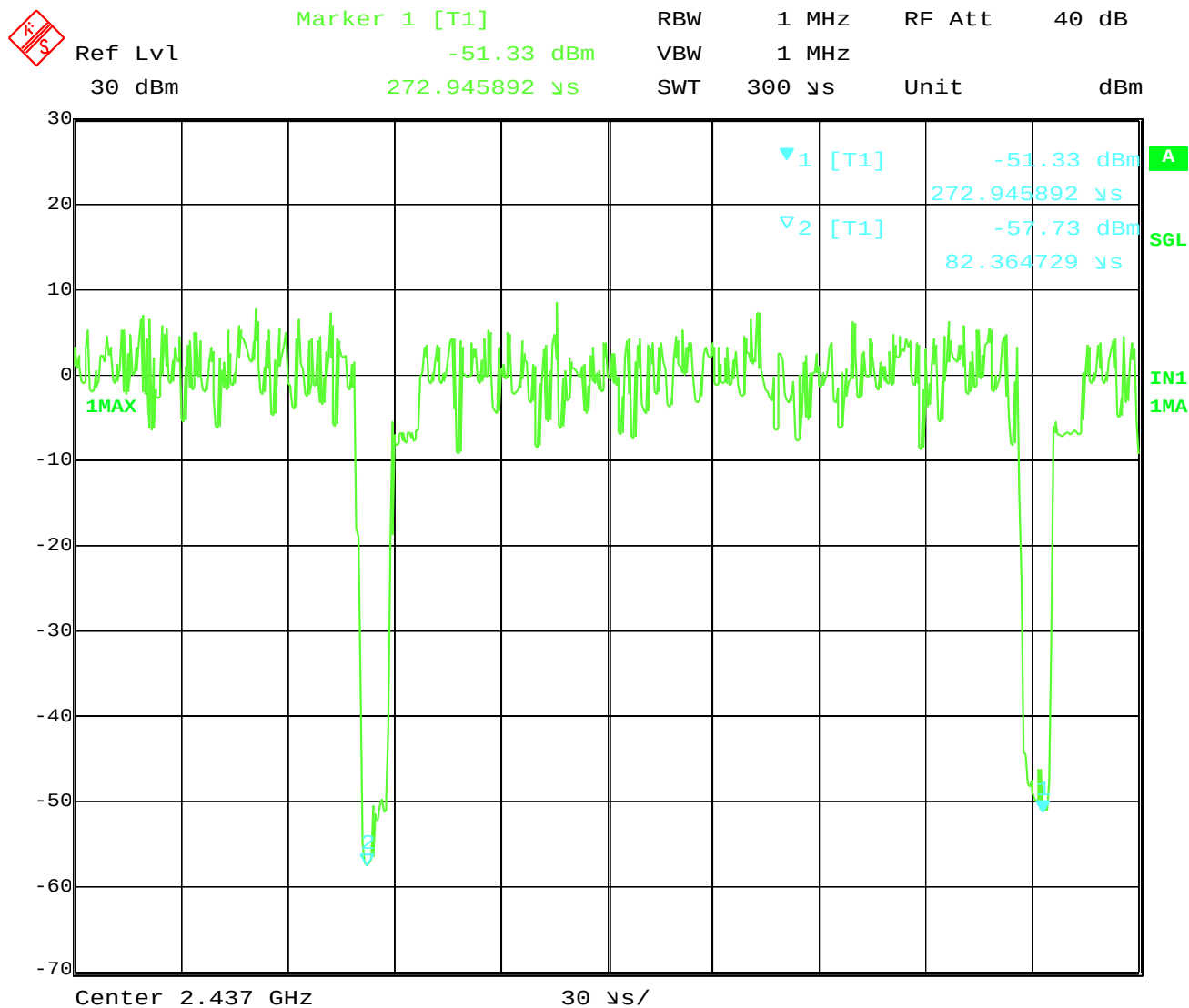
| Measured Frequency (MHz) | Tx Rate (Mb/s) | Analyzer reading (dBm) | Trace number | Cable Loss (dB) | Results (dBm) | Limit     |          | Peak antenna gain of EUT (dBi) | EIRP (dBm) | IC limit (dBm) |
|--------------------------|----------------|------------------------|--------------|-----------------|---------------|-----------|----------|--------------------------------|------------|----------------|
|                          |                |                        |              |                 |               | FCC (dBm) | IC (dBm) |                                |            |                |
| 5180                     | 6              | 9.61                   | omitted      | 2.2             | 11.81         | 17        | N/A      | 2.72                           | 14.53      | 23             |
| 5240                     | 6              | 9.61                   | Plot 1-4b    | 2.2             | <b>11.81</b>  | 17        | N/A      |                                | 14.53      | 23             |
| 5260                     | 6              | 13.59                  | Plot 1-5b    | 2.2             | <b>15.79</b>  | 24        | 24       |                                | 18.51      | 30             |
| 5320                     | 6              | 13.52                  | omitted      | 2.2             | 15.72         | 24        | 24       |                                | 18.44      | 30             |

**Table 1-5** 5.8GHz OFDM Tx mode

| Measured Frequency (MHz) | Tx Rate (Mb/s) | Analyzer reading (dBm) | Trace number | Cable Loss (dB) | Results (dBm) | Limit     |          | Margin to limit (dBm) |
|--------------------------|----------------|------------------------|--------------|-----------------|---------------|-----------|----------|-----------------------|
|                          |                |                        |              |                 |               | FCC (dBm) | IC (dBm) |                       |
| 5745                     | 6              | 21.90                  | Plot 1-6b    | 2.3             | <b>24.20</b>  | 30        | 30       | 5.80                  |
| 5785                     | 6              | 21.89                  | omitted      | 2.3             | 24.19         | 30        | 30       | 5.81                  |
| 5825                     | 6              | 21.81                  | omitted      | 2.3             | 24.11         | 30        | 30       | 5.89                  |

## 1.3 Trace Data

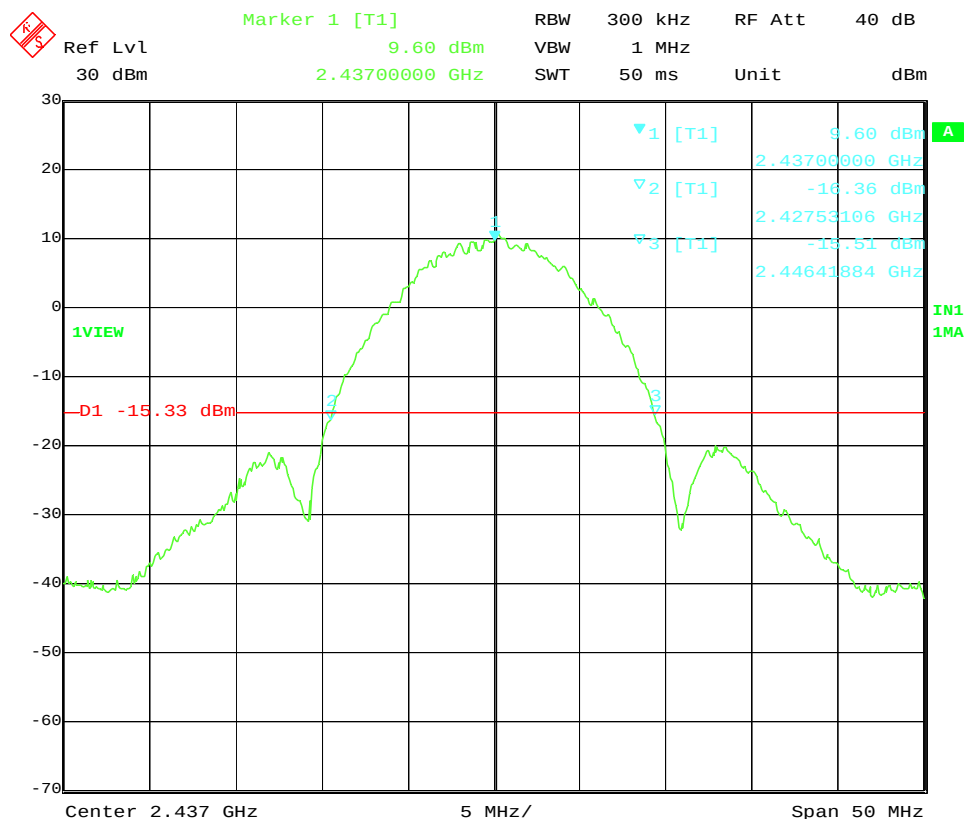
**T (transmission pulse duration) = 272.9 – 82.4 = 190.5 mS**



Date: 2.AUG.2005 17:47:16

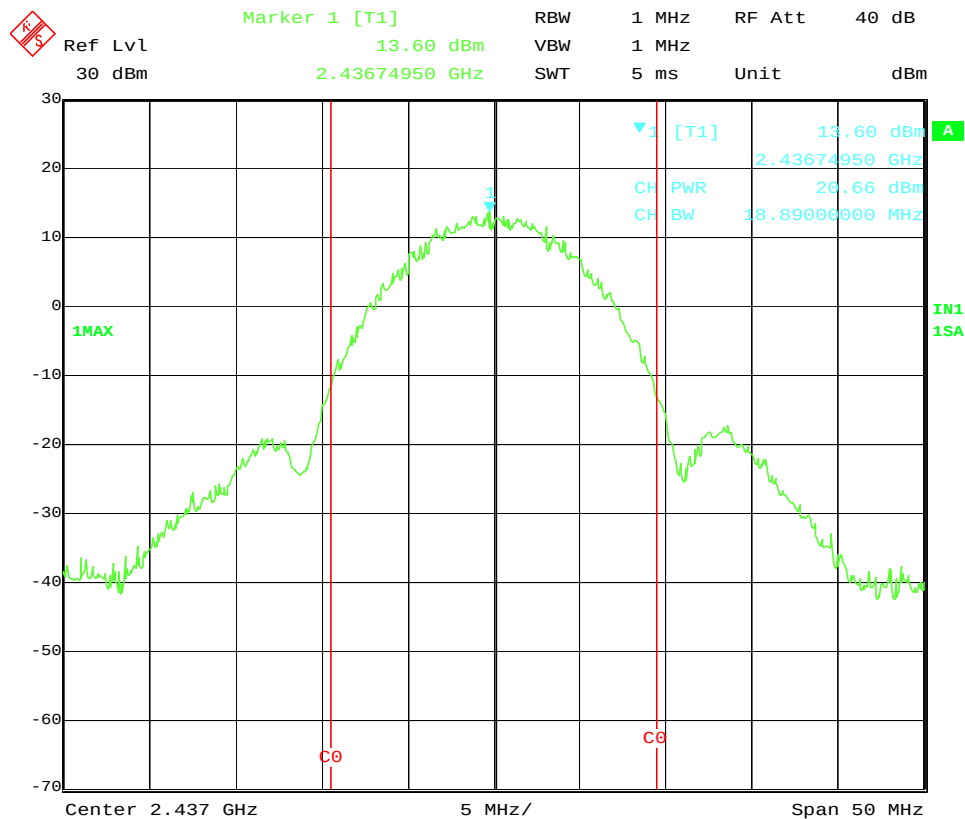
Plot 1-1 Transmission Pulse Duration of OFDM Tx mode





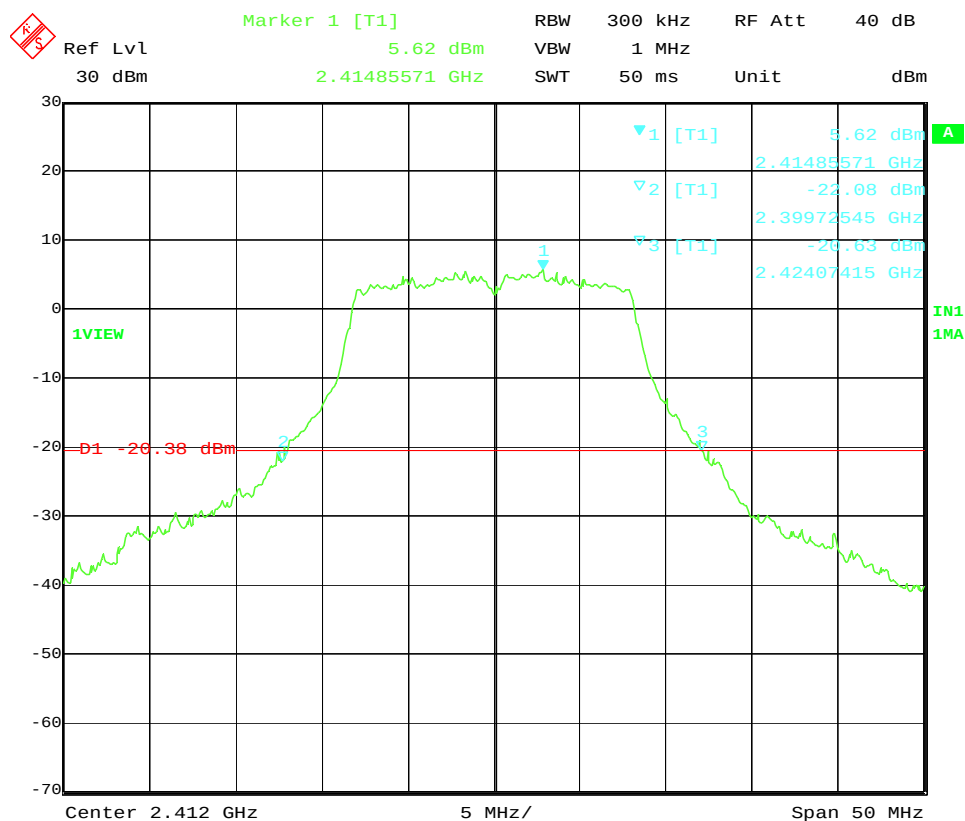
Date: 2.AUG.2005 15:06:38

**Plot 1-2a. 26dB Bandwidth of 2437MHz (DSSS, 11Mbps)**



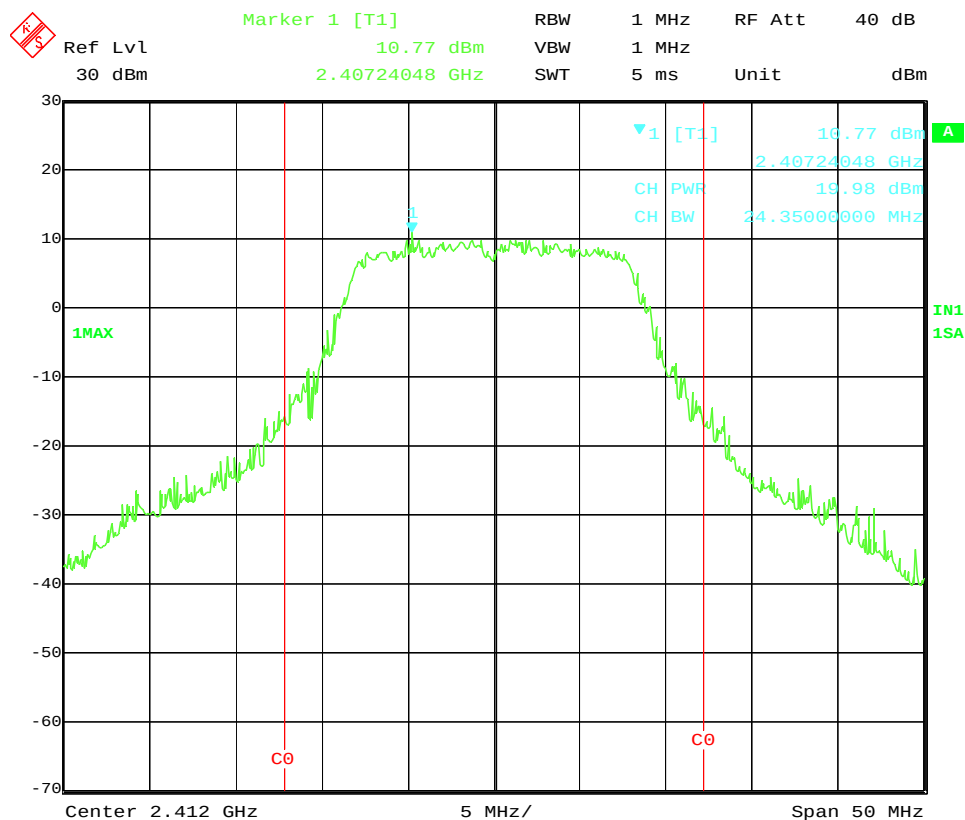
Date: 2.AUG.2005 16:43:56

**Plot 1-2b. Conducted Peak Output Power of 2437MHz (DSSS, 11Mbps, peak power)**



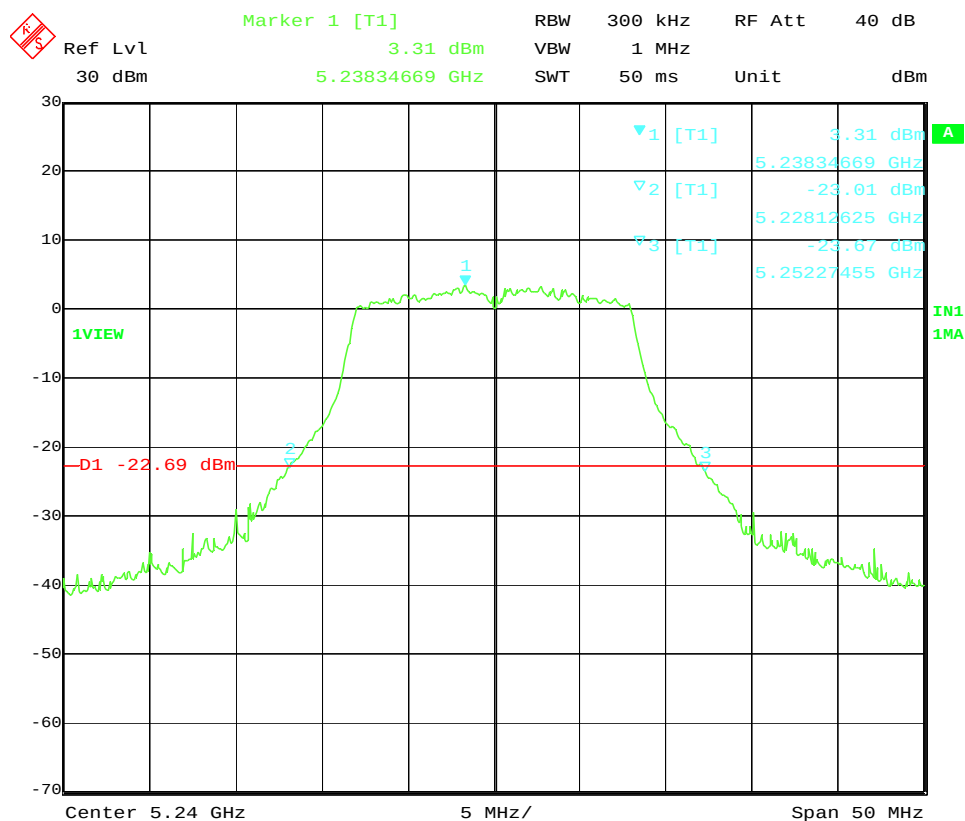
Date: 2.AUG.2005 15:20:40

**Plot 1-3a. 26dB Bandwidth of 2412MHz (OFDM, 6Mbps)**



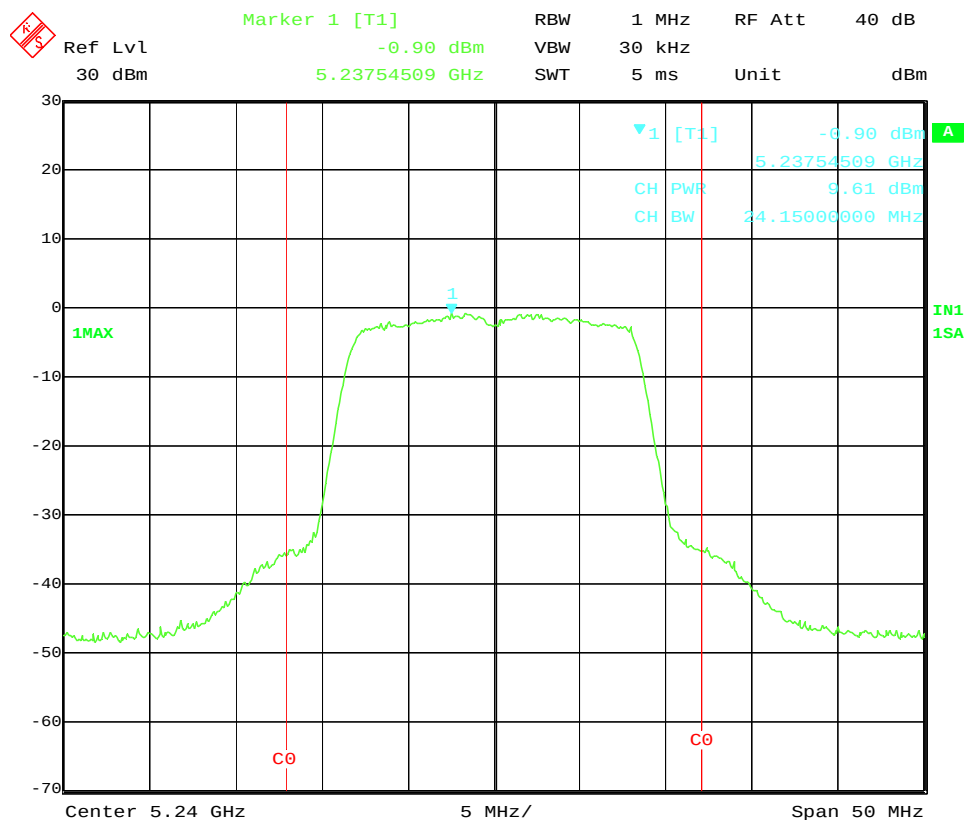
Date: 2.AUG.2005 17:57:12

**Plot 1-3b. Conducted Peak Output Power of 2412MHz (OFDM, 6Mbps, peak power)**



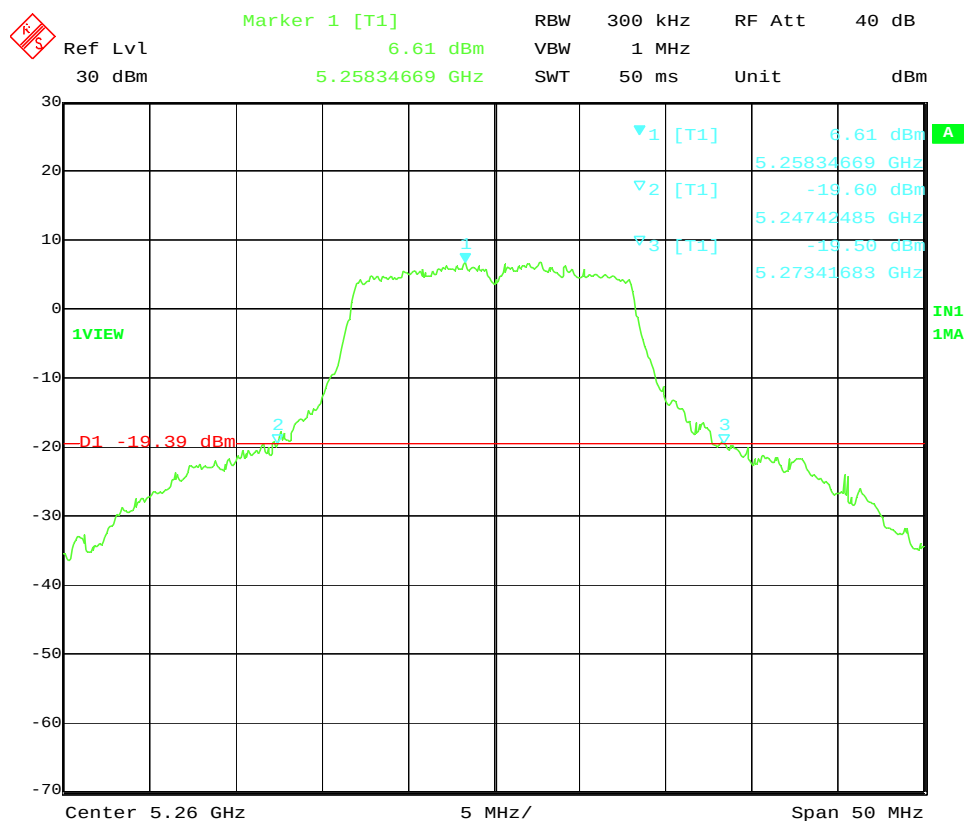
Date: 2.AUG.2005 20:56:12

**Plot 1-4a. 26dB Bandwidth of 5240MHz (OFDM, 6Mbps)**



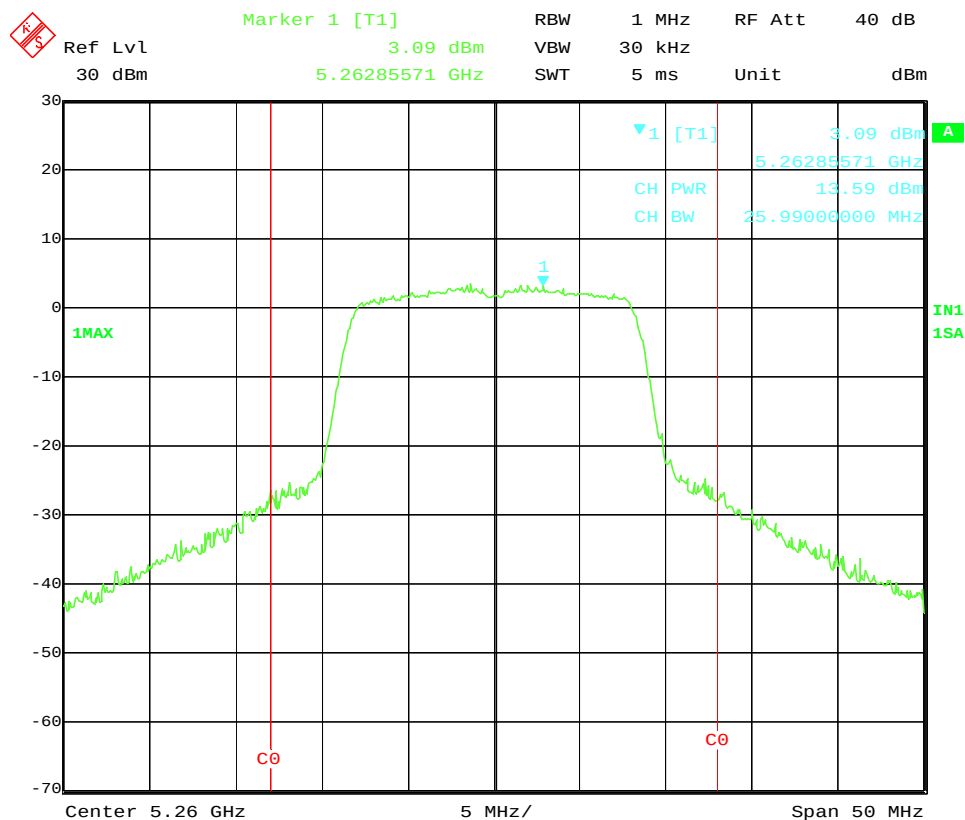
Date: 3.AUG.2005 21:11:53

**Plot 1-4b. Conducted Transmit Output Power of 5240MHz (OFDM, 6Mbps, mean power)**



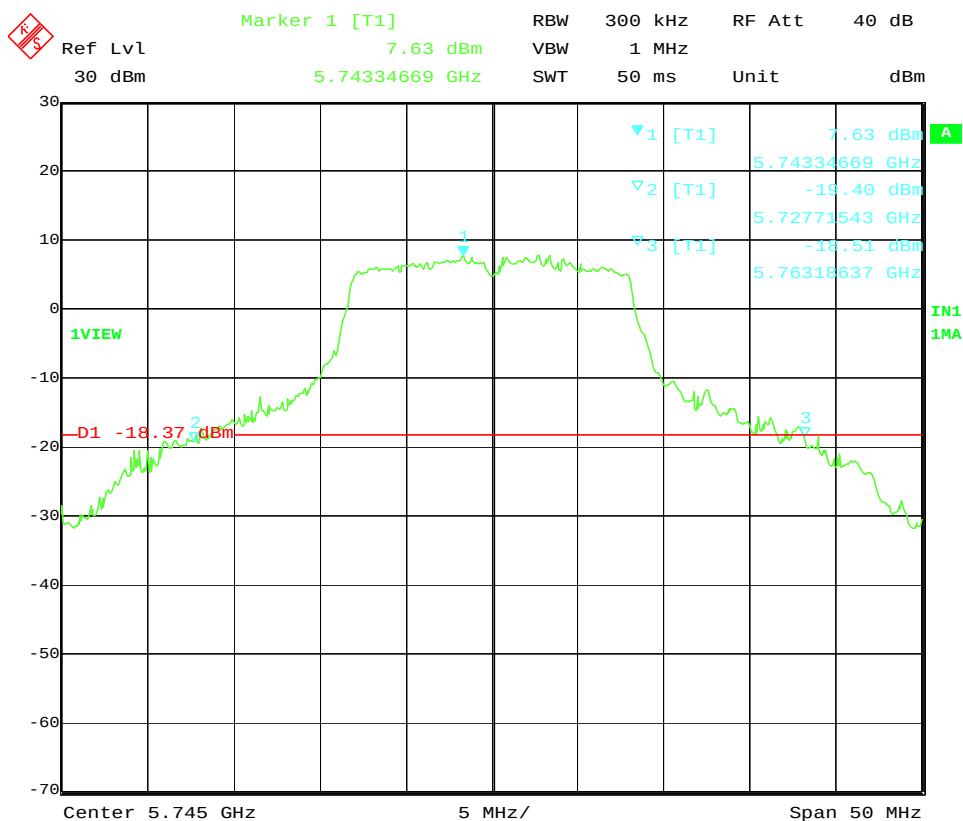
Date: 3.AUG.2005 14:31:48

Plot 1-5a. 26dB Bandwidth of 5260MHz (OFDM, 6Mbps)



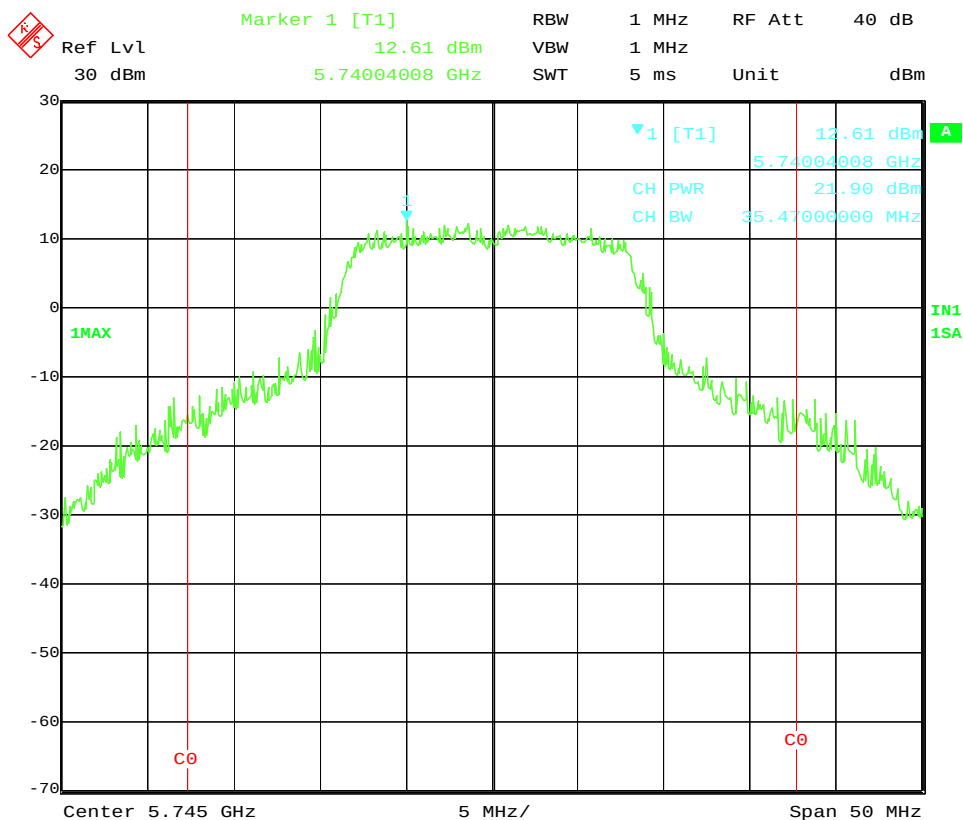
Date: 3.AUG.2005 21:30:18

Plot 1-5b. Conducted Transmit Output Power of 5260MHz (OFDM, 6Mbps, mean power)



Date: 3.AUG.2005 18:55:20

**Plot 1-6a. 26dB Bandwidth of 5745MHz (OFDM, 6Mbps)**



Date: 4.AUG.2005 10:34:58

**Plot 1-6b. Conducted Peak Output Power of 5745MHz (OFDM, 6Mbps, peak power)**

## 2. Restricted Bands Radiation (1GHz – 40GHz)

**Subpart C / DSSS** [ FCC 15.205 / 209, RSS-210 6.3 / 7.3 ]  
**Subpart E** [ FCC 15.205&209 / 15.407(b)(1),(2),(5),(6) ]  
**LELAN** [ RSS-210 6.2.1 / 6.2.2(q1)(i),(ii),(v) / 6.3 / 7.3 ]

### 2.1 Test Procedure

Radiated emissions were measured in the frequency range with 1 GHz to 40GHz in transmitting mode and 1 GHz to 25GHz in receiving mode. All tests were performed in the semi-anechoic chamber at a 3-meter distance (except for the frequency range with 18 GHz to 40 GHz where test distance was reduced to 1 meter) on both horizontal and vertical polarities. The antenna was also scanned in height. The emissions are recorded with a spectrum analyzer in peak hold mode. The identified emissions are further maximized as a function of cable manipulation, azimuth, and antenna height. The emissions closest to the limits are measured in the peak mode with the tuned spectrum analyzer using resolution bandwidth of 1MHz / video bandwidth of 1MHz, and the average setting mode with the tuned spectrum analyzer using resolution bandwidth of 1MHz / video bandwidth of 100Hz or 10Hz. The highest emissions relative to the limit are listed.

### 2.2 Test Instruments and Measurement Setup

**Table 2-1** Radiated Emission Test Instrumentation (1GHz – 40GHz)

| Description                                                                                                                                                                                                                     | Model                                    | Serial Number                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------------------------------------|
| Spectrum Analyzer EMI Test Receiver                                                                                                                                                                                             | R&S ESI26                                | 836119/003                                                                     |
| Spectrum Analyzer                                                                                                                                                                                                               | HP 8563E                                 | 3416A02248                                                                     |
| Harmonic Mixer (26.5 – 40GHz)                                                                                                                                                                                                   | Agilent 11970A                           | 011269-001                                                                     |
| Amplifier (1 - 18GHz)                                                                                                                                                                                                           | HP 8449B                                 | 3008A00582                                                                     |
| Amplifier (18 – 40GHz)                                                                                                                                                                                                          | Agilent 83051A                           | 3950M00193                                                                     |
| Horn Antenna (1 - 18GHz)                                                                                                                                                                                                        | EMCO 3115                                | 9903-5774                                                                      |
| Horn Antenna (3.95 – 5.85GHz)                                                                                                                                                                                                   | EMCO 3160-5                              | 1099                                                                           |
| Horn Antenna (5.85 – 8.2GHz)                                                                                                                                                                                                    | EMCO 3160-6                              | 9712-1044                                                                      |
| Horn Antenna (8.2 – 12.4GHz)                                                                                                                                                                                                    | EMCO 3160-7                              | 1156                                                                           |
| Horn Antenna (12.4 – 18GHz)                                                                                                                                                                                                     | EMCO 3160-8                              | 1143                                                                           |
| Horn Antenna (18 - 26.5GHz)                                                                                                                                                                                                     | EMCO 3160-9                              | 0004-1202                                                                      |
| Horn Antenna (26.5 - 40GHz)                                                                                                                                                                                                     | EMCO 3160-10                             | 1175                                                                           |
| Coaxial cables:<br>- Horn Ant <=> RF Amp. (1-18GHz)<br>- RF Amp.<=>Spectrum Analyzer (1-12.4GHz)<br>- RF Amp.<=>Spectrum Analyzer (12.4-18GHz)<br>- Horn Ant <=> RF Amp. (18-40GHz)<br>- RF Amp.<=>Spectrum Analyzer (18-40GHz) | Length:<br>6 m<br>16 m<br>3m<br>3m<br>1m | <br>- EM206SCO<br>- GEM0101<br>- SF102-20166<br>- SF102-20167<br>- SF102-21105 |

Notes: HP: Hewlett Packard, R&S: Rohde & Schwarz

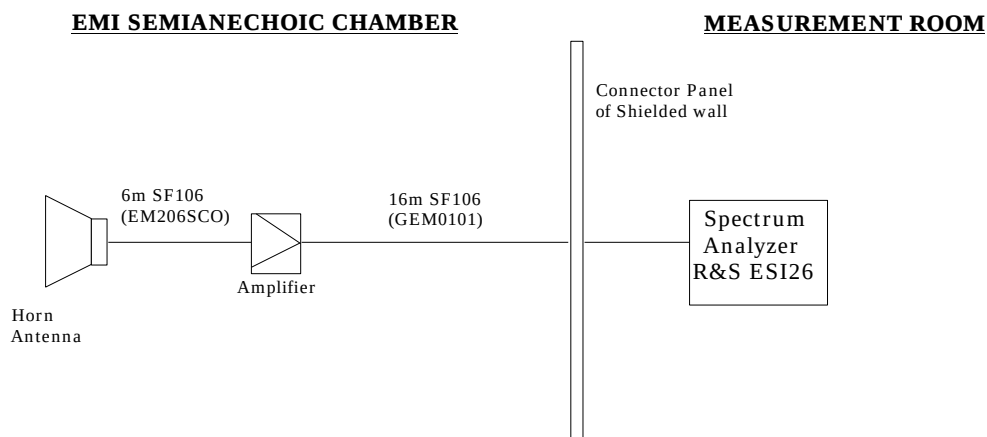


Figure 2-1. Cables for Radiated Emission Test (1 – 12.4 GHz)

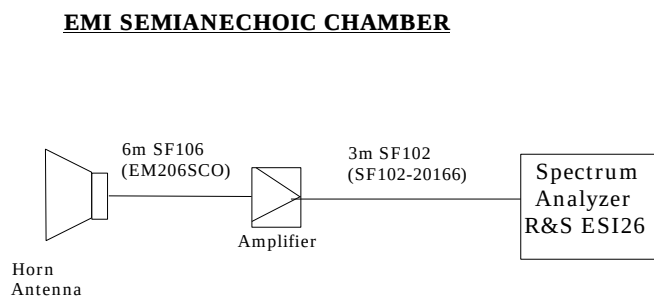


Figure 2-2. Cables for Radiated Emission Test (12.4 - 18GHz)

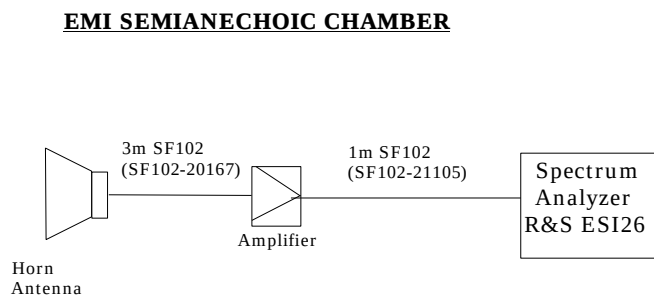


Figure 2-3. Cables for Radiated Emission Test (18 – 26.5GHz)

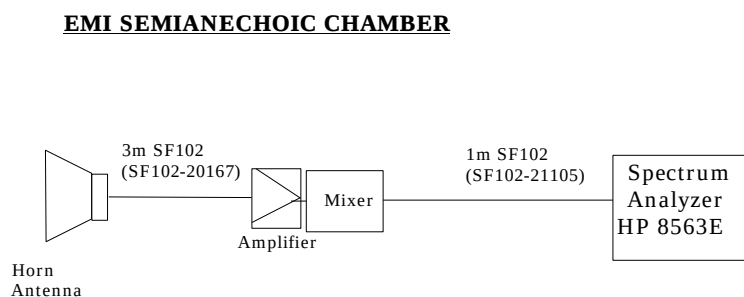


Figure 2-4. Cables for Radiated Emission Test (26.5 - 40GHz)

## 2.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

$$FS = R + AF + CORR - FO$$

where:

FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL-AG

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

For example:

Given a Spectrum Analyzer input reading of 51.5 dBμV; Antenna Factor of 8.5 dB/m; Cable Loss of 1.3 dB; Falloff Factor of 0 dB; and an Amplifier Gain of 26 dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26 - 0.0 = 35.6 \text{ dB}\mu\text{V/m}$$

Conversions between dBμV/m (or dBμV) and μV/m (or μV) are done as :

$$\text{Level(dB}\mu\text{V/m)} = 20 \times \text{Log (Level(}\mu\text{V/m))}$$

$$40 \text{ dB}\mu\text{V/m} = 100 \mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250 \mu\text{V/m}$$



## 2.4 Bandedge Measurement plots

The test was performed with the co-located Bluetooth device (FCC ID: MCLJ07M81, IC: 2878D-J07H081) in active and transmitting simultaneously.

The **Table 2-4-1** through **Table 2-4-4** shows the highest emission results. The highest powers in each Tx mode shown in the previous Chapter 1 were selected for the test.

Test Date: August 5 and 9, 2005

**Table 2-4-1 2.4GHz DSSS transmission mode (11Mb/s)**

| Ch. | LCD material | Frequency (GHz) | Polarity (H/V) | Reading (dBμV) (peak) | Rading (dBμV) (average) | Antenna Factor (dB/m) | Corr. Factor (dB) | Falloff Factor (dB) | Field Strength (dBμV/m) (peak) | Margin to Limit (dB) (peak) | Field Strength (dBμV/m) (average) | Margin to Limit (dB) (average) |
|-----|--------------|-----------------|----------------|-----------------------|-------------------------|-----------------------|-------------------|---------------------|--------------------------------|-----------------------------|-----------------------------------|--------------------------------|
| 1   | ABS          | 2.387           | H              | 53.3                  | 42.1                    | 28.2                  | -29.8             | 0.0                 | 51.7                           | 22.3                        | 40.5                              | 13.5                           |
|     | CFRP AL      | 2.387           | H              | 60.1                  | 48.9                    | 28.2                  | -29.8             | 0.0                 | 58.5                           | 15.5                        | 47.3                              | 6.7                            |
| 11  | ABS          | 2.486           | H              | 56.4                  | 45.1                    | 28.4                  | -29.6             | 0.0                 | 55.2                           | 18.8                        | 43.9                              | 10.1                           |
|     | CFRP AL      | 2.487           | H              | 61.2                  | 49.5                    | 28.4                  | -29.6             | 0.0                 | 60.0                           | 14.0                        | 48.3                              | 5.7                            |

**Table 2-4-2 2.4GHz OFDM transmission mode (6Mb/s)**

| Ch. | Tx rate (Mb/s) | Frequency (GHz) | Polarity (H/V) | Reading (dBμV) (peak) | Rading (dBμV) (average) | Antenna Factor (dB/m) | Corr. Factor (dB) | Falloff Factor (dB) | Field Strength (dBμV/m) (peak) | Margin to Limit (dB) (peak) | Field Strength (dBμV/m) (average) | Margin to Limit (dB) (average) |
|-----|----------------|-----------------|----------------|-----------------------|-------------------------|-----------------------|-------------------|---------------------|--------------------------------|-----------------------------|-----------------------------------|--------------------------------|
| 1   | ABS            | 2.390           | V              | 64.2                  | 47.7                    | 28.2                  | -29.8             | 0.0                 | 62.6                           | 11.4                        | 46.1                              | 7.9                            |
|     | CFRP AL        | 2.390           | H              | 70.7                  | 54.0                    | 28.2                  | -29.8             | 0.0                 | 69.1                           | 4.9                         | 52.4                              | 1.6                            |
| 11  | ABS            | 2.484           | H              | 65.8                  | 47.0                    | 28.4                  | -29.6             | 0.0                 | 64.6                           | 9.4                         | 45.8                              | 8.2                            |
|     | CFRP AL        | 2.484           | H              | 70.2                  | 50.3                    | 28.4                  | -29.6             | 0.0                 | 69.0                           | 5.0                         | 49.1                              | 4.9                            |

**Table 2-4-3 5.2GHz OFDM transmission mode (6Mb/s)**

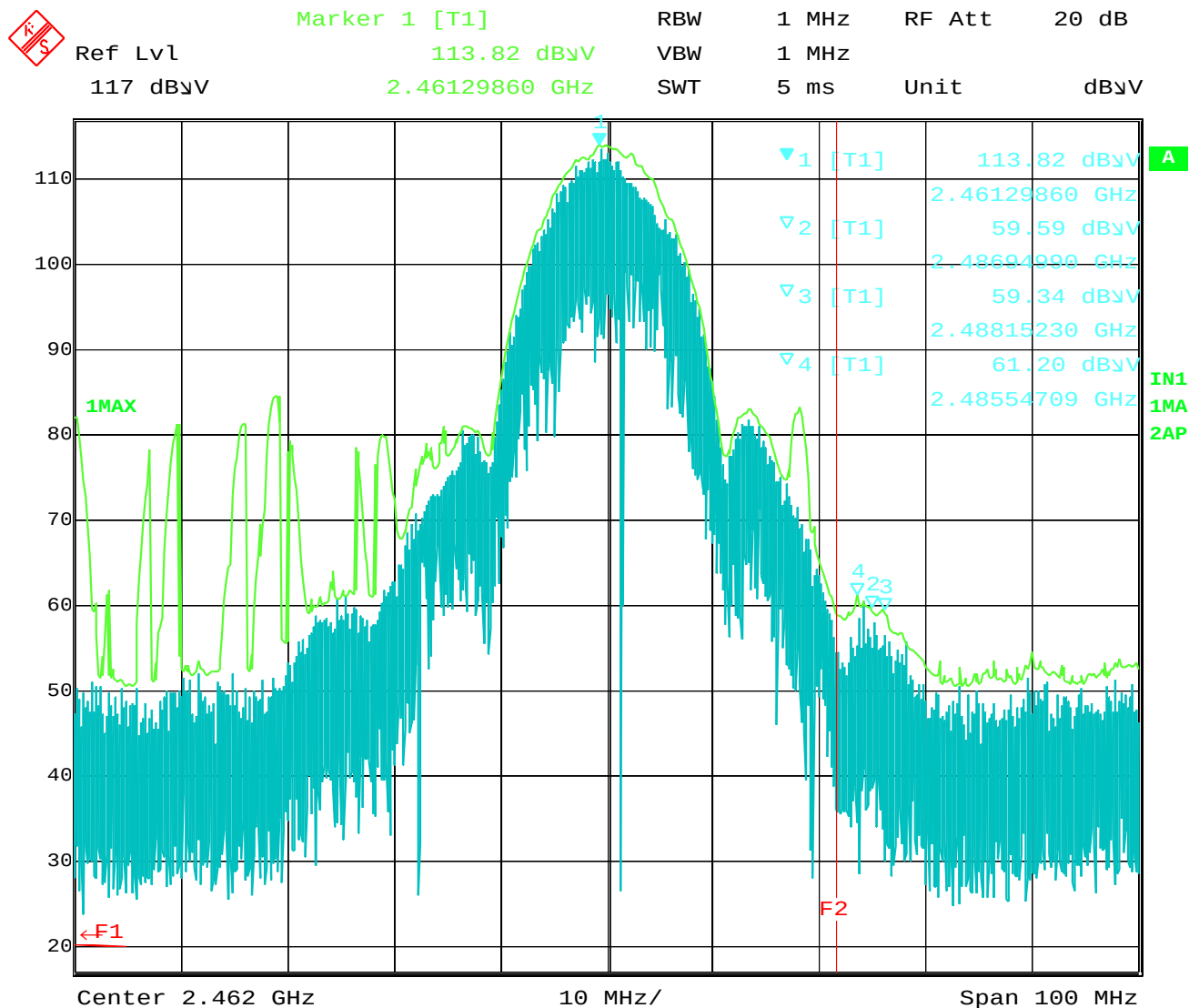
| Ch. | Tx rate (Mb/s) | Frequency (GHz) | Polarity (H/V) | Reading (dBμV) (peak) | Rading (dBμV) (average) | Antenna Factor (dB/m) | Corr. Factor (dB) | Falloff Factor (dB) | Field Strength (dBμV/m) (peak) | Margin to Limit (dB) (peak) | Field Strength (dBμV/m) (average) | Margin to Limit (dB) (average) |
|-----|----------------|-----------------|----------------|-----------------------|-------------------------|-----------------------|-------------------|---------------------|--------------------------------|-----------------------------|-----------------------------------|--------------------------------|
| 36  | ABS            | 5.150           | V              | 49.6                  | 33.2                    | 33.6                  | -26.8             | 0.0                 | 56.4                           | 17.6                        | 40.0                              | 14.0                           |
|     | CFRP AL        | 5.143           | H              | 44.6                  | 31.8                    | 33.6                  | -26.8             | 0.0                 | 51.4                           | 22.6                        | 38.6                              | 15.4                           |
| 64  | ABS            | 5.350           | H              | 57.7                  | 40.9                    | 33.9                  | -26.5             | 0.0                 | 65.1                           | 8.9                         | 48.3                              | 5.7                            |
|     | CFRP AL        | 5.350           | H              | 55.3                  | 38.4                    | 33.9                  | -26.5             | 0.0                 | 62.7                           | 11.3                        | 45.8                              | 8.2                            |

**Table 2-4-4 5.8GHz OFDM transmission mode (6Mb/s)**

Note) There is no restricted band near 5.8GHz band. The measurement results show peak emissions in the operation band.

| Ch. | Tx rate (Mb/s) | Frequency (GHz) | Polarity (H/V) | Reading (dBμV) (peak) | Rading (dBμV) (average) | Antenna Factor (dB/m) | Corr. Factor (dB) | Falloff Factor (dB) | Field Strength (dBμV/m) (peak) | Field Strength (dBμV/m) (average) |
|-----|----------------|-----------------|----------------|-----------------------|-------------------------|-----------------------|-------------------|---------------------|--------------------------------|-----------------------------------|
| 149 | ABS            | 5.746           | H              | 101.4                 | 91.4                    | 34.0                  | -26.3             | 0.0                 | 109.1                          | 99.1                              |
|     | CFRP AL        | 5.743           | H              | 100.4                 | 90.3                    | 34.0                  | -26.3             | 0.0                 | 108.1                          | 98.0                              |
| 157 | ABS            | 5.781           | V              | 102.5                 | 92.4                    | 34.0                  | -26.1             | 0.0                 | 110.4                          | 100.3                             |
|     | CFRP AL        | 5.786           | H              | 100.5                 | 90.7                    | 34.0                  | -26.1             | 0.0                 | 108.4                          | 98.6                              |
| 165 | ABS            | 5.820           | H              | 101.9                 | 91.7                    | 34.0                  | -26.3             | 0.0                 | 109.6                          | 99.4                              |
|     | CFRP AL        | 5.820           | H              | 101.5                 | 91.3                    | 34.0                  | -26.3             | 0.0                 | 109.2                          | 99.0                              |

Note) The traces hereafter are the worse cases in each Table 2-1 through Table 2-4.

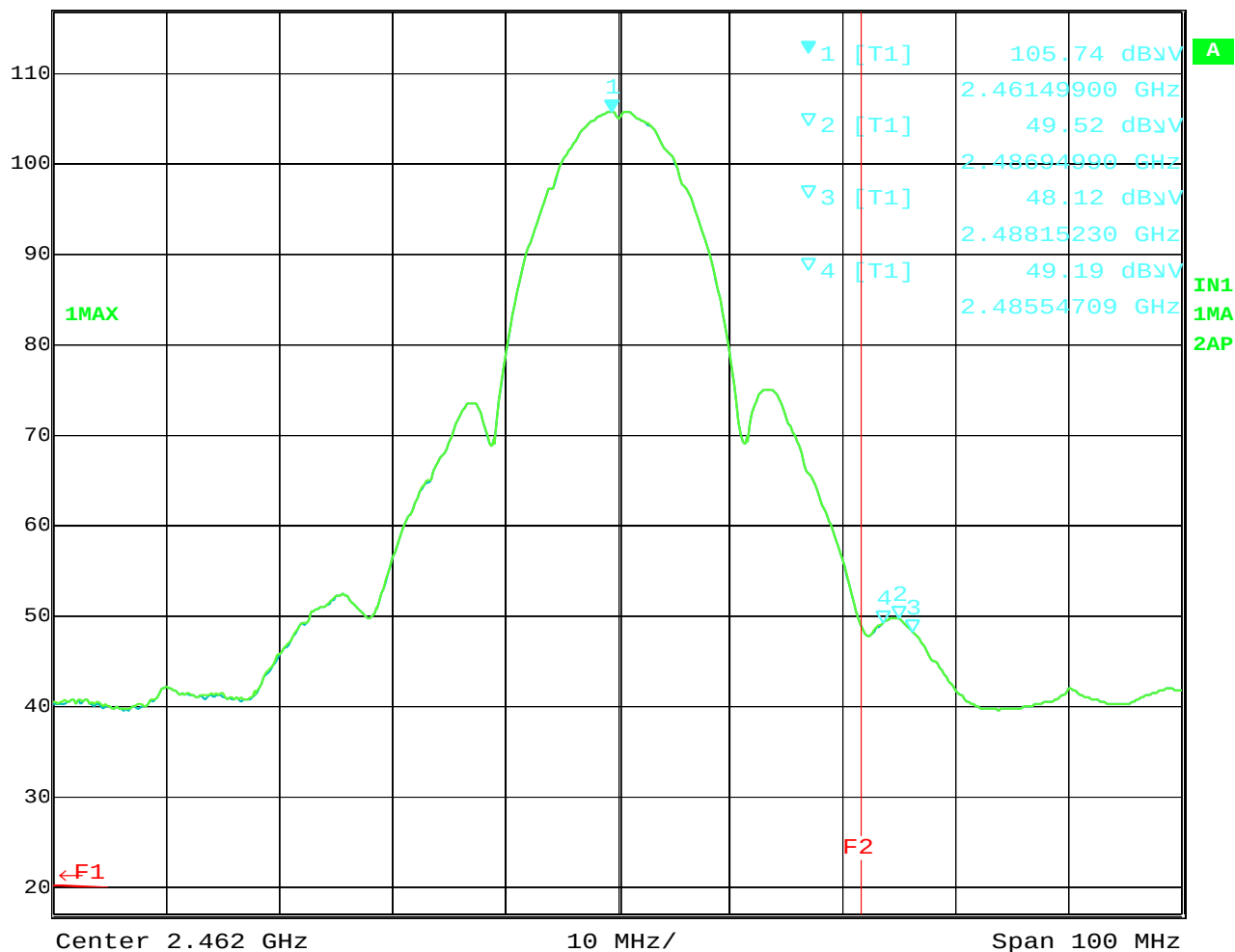


Date: 9.AUG.2005 20:18:37

Plot-2-1 Ch.11 2462MHz TX, DSSS 11Mbps (Peak) : LCD CFRP Aluminum



Ref Lvl 117 dBμV  
 Marker 1 [T1] 105.74 dBμV  
 2.46149900 GHz  
 RBW 1 MHz  
 VBW 10 Hz  
 SWT 25 s  
 RF Att 20 dB  
 Unit dBμV

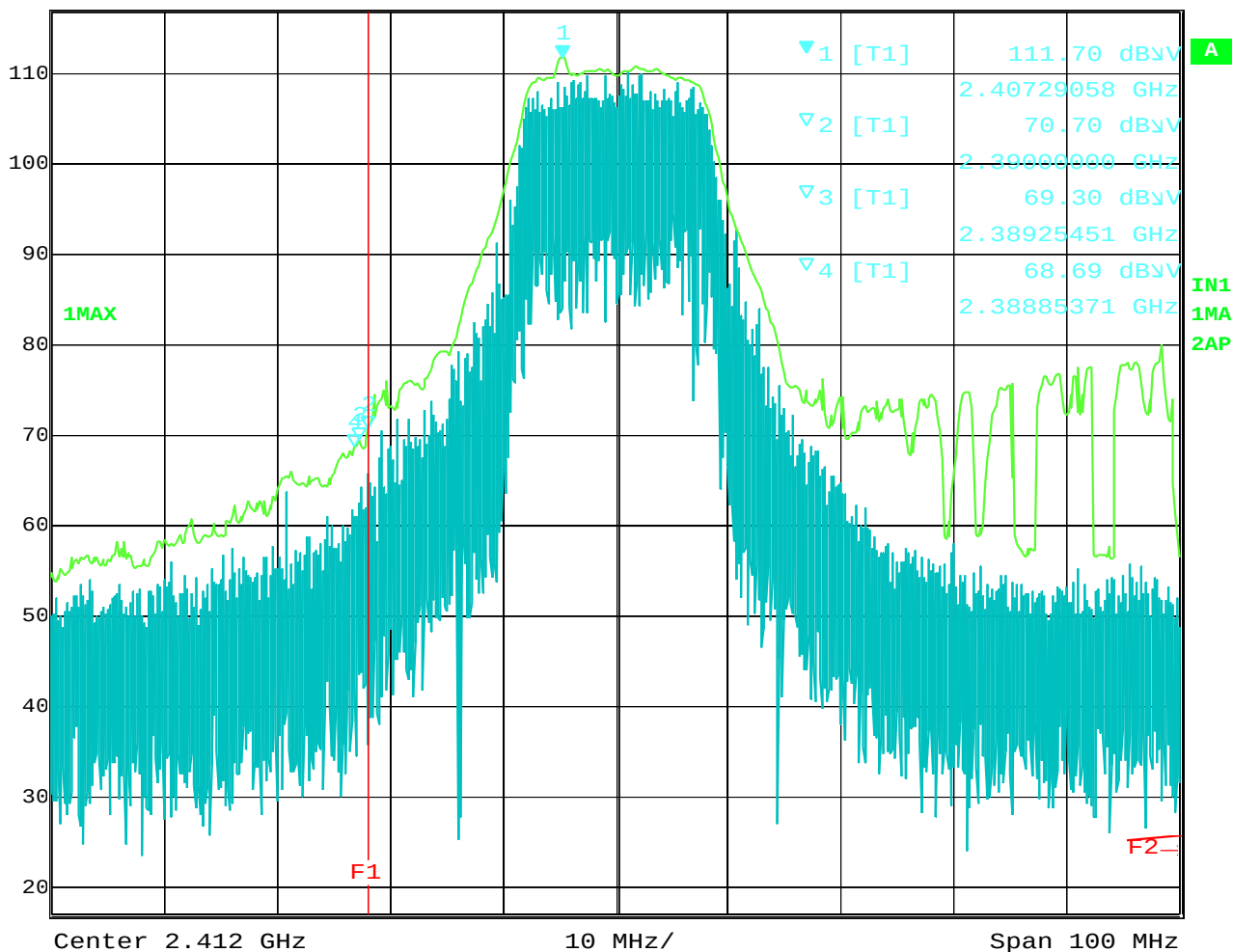


Date: 9.AUG.2005 20:19:37

Plot 2-2 Ch.11 2462MHz TX, DSSS 11Mbps (Average) : LCD CFRP Aluminum



Ref Lvl 117 dBμV  
 Marker 1 [T1] 111.70 dBμV  
 2.40729058 GHz  
 RBW 1 MHz  
 VBW 1 MHz  
 SWT 5 ms  
 RF Att 20 dB  
 Unit dBμV

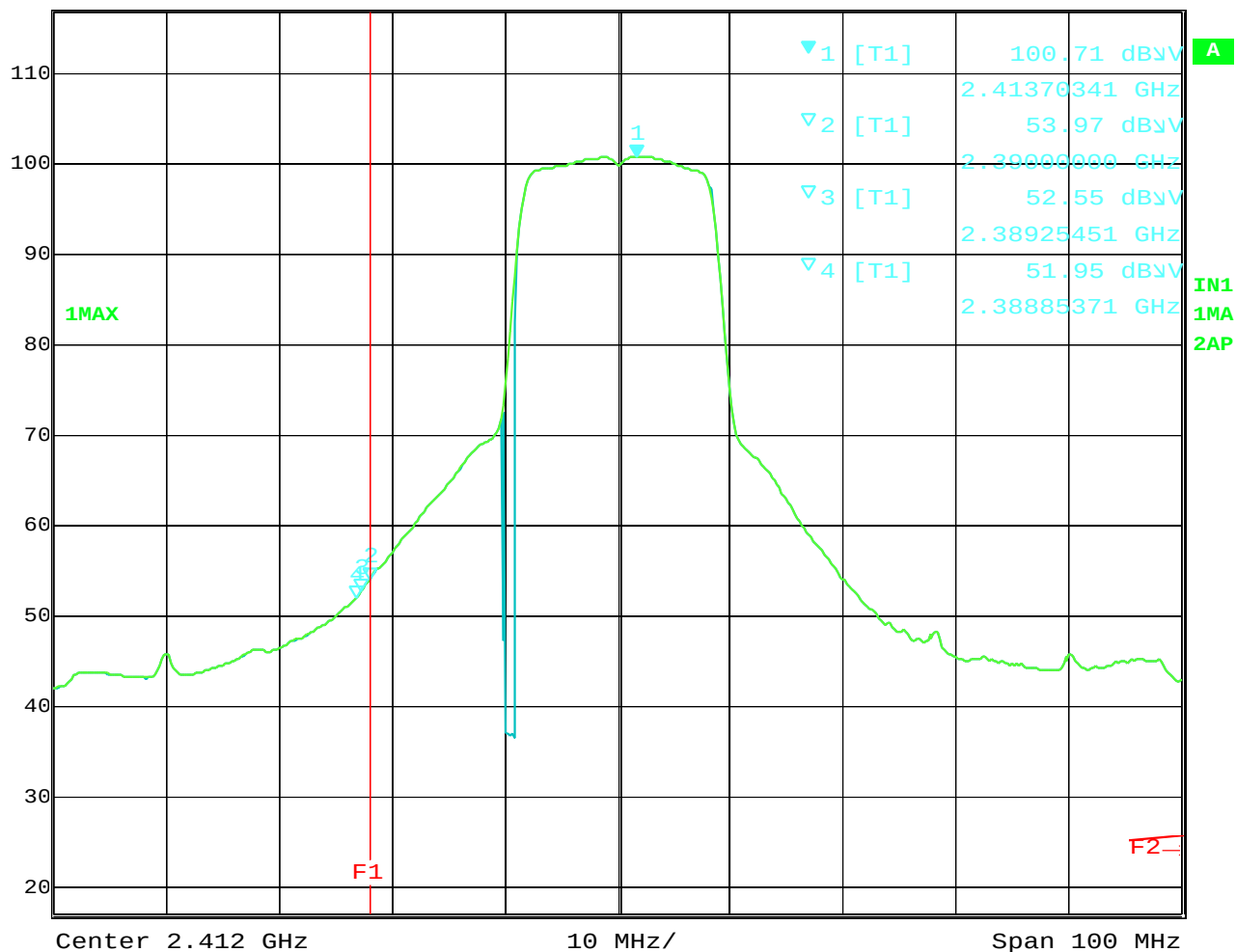


Date: 9.AUG.2005 21:09:55

Plot 2-3 Ch.1 2412MHz TX, OFDM 6Mbps (Peak) : LCD CFRP Aluminum



Ref Lvl 117 dBμV  
 Marker 1 [T1] 100.71 dBμV  
 2.41370341 GHz  
 RBW 1 MHz  
 VBW 10 Hz  
 SWT 25 s  
 RF Att 20 dB  
 Unit dBμV



Date: 9.AUG.2005 21:11:02

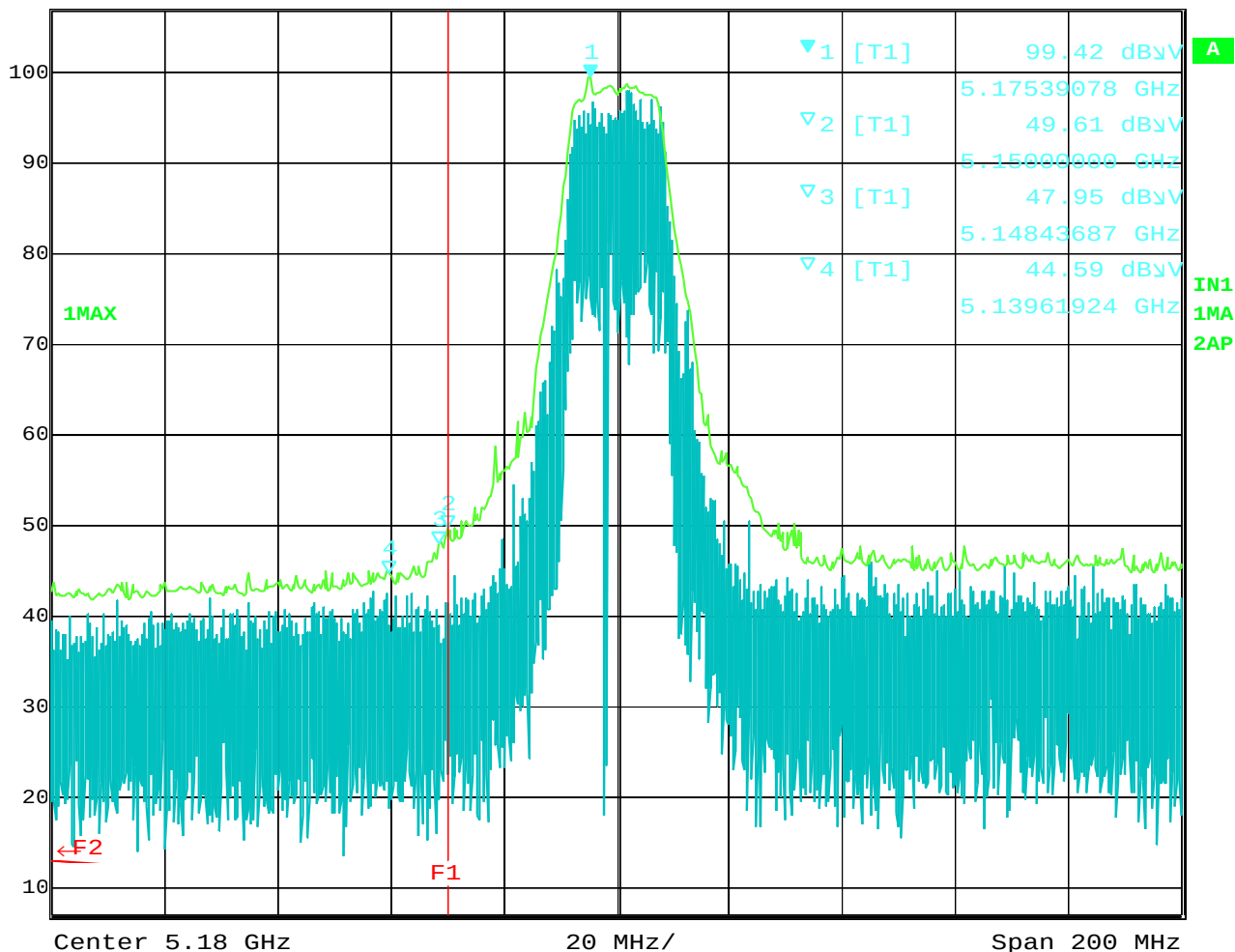
Plot 2-4 Ch.1 2412MHz TX, OFDM 6Mbps (Average) : LCD CFRP Aluminum



Ref Lvl  
107 dBμV

Marker 1 [T1]  
99.42 dBμV  
5.17539078 GHz

RBW 1 MHz RF Att 10 dB  
 VBW 1 MHz  
 SWT 5 ms Unit dBμV

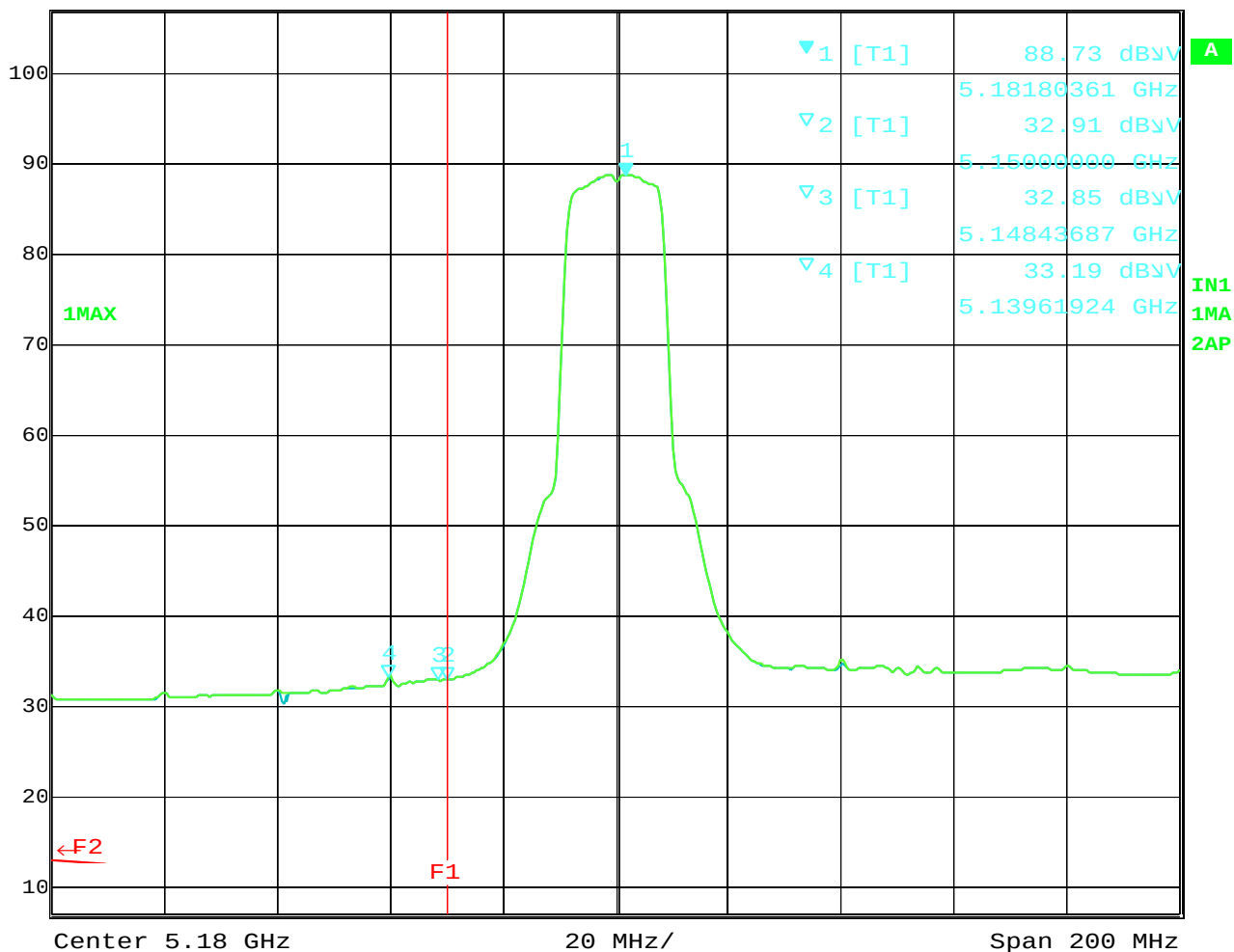


Date: 5.AUG.2005 16:33:47

Plot 2-5 Ch.36 5180MHz TX, OFDM 6Mbps (Peak) : LCD ABS



Ref Lvl 107 dBμV  
 Marker 1 [T1] 88.73 dBμV  
 5.18180361 GHz  
 RBW 1 MHz  
 VBW 10 Hz  
 SWT 50 s  
 RF Att 10 dB  
 Unit dBμV

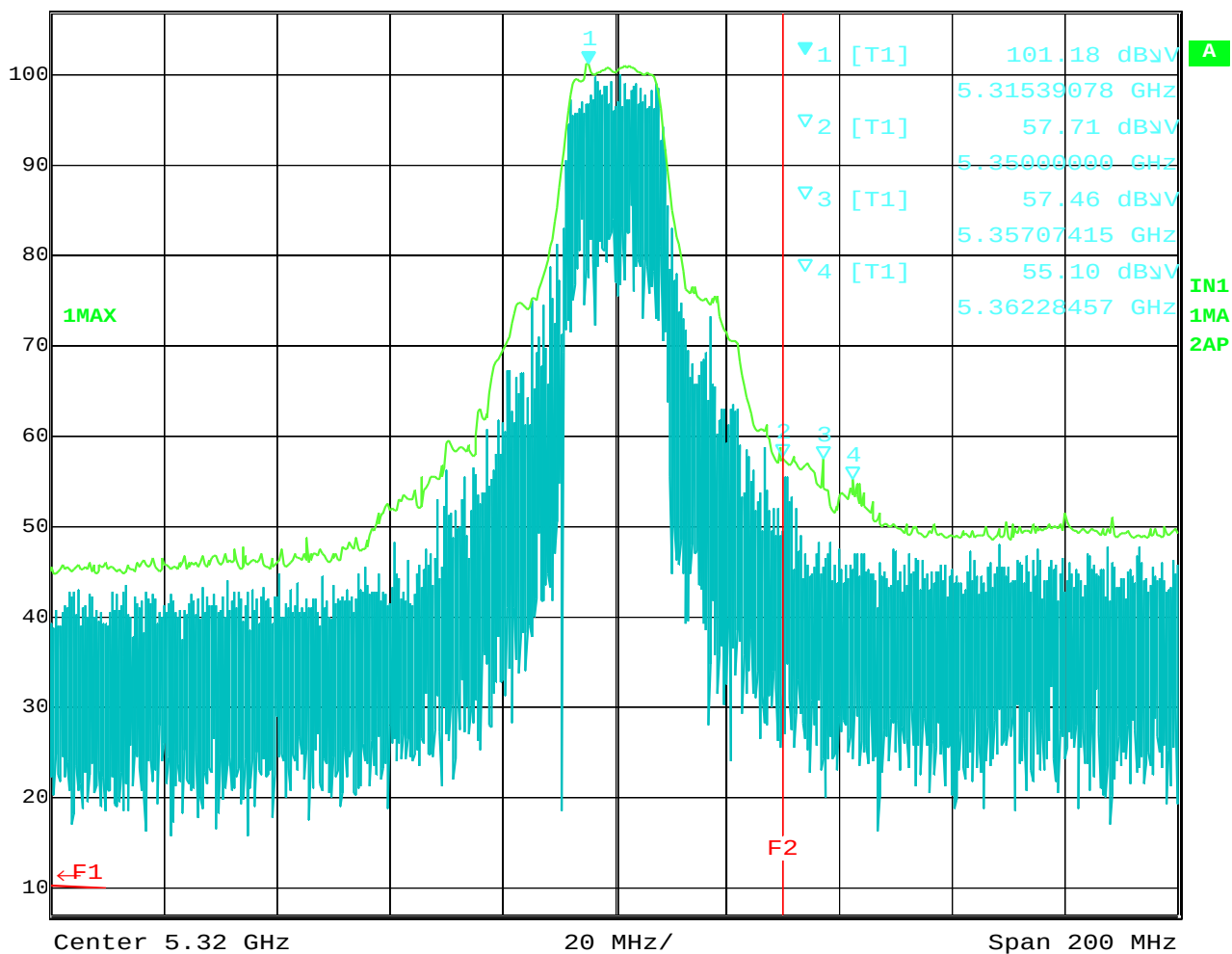


Date: 5.AUG.2005 16:35:34

Plot 2-6 Ch.36 5180MHz TX, OFDM 6Mbps (Average) : LCD ABS



Ref Lvl 107 dBμV  
 Marker 1 [T1] 101.18 dBμV 5.31539078 GHz  
 RBW 1 MHz RF Att 10 dB  
 VBW 1 MHz  
 SWT 5 ms Unit dBμV



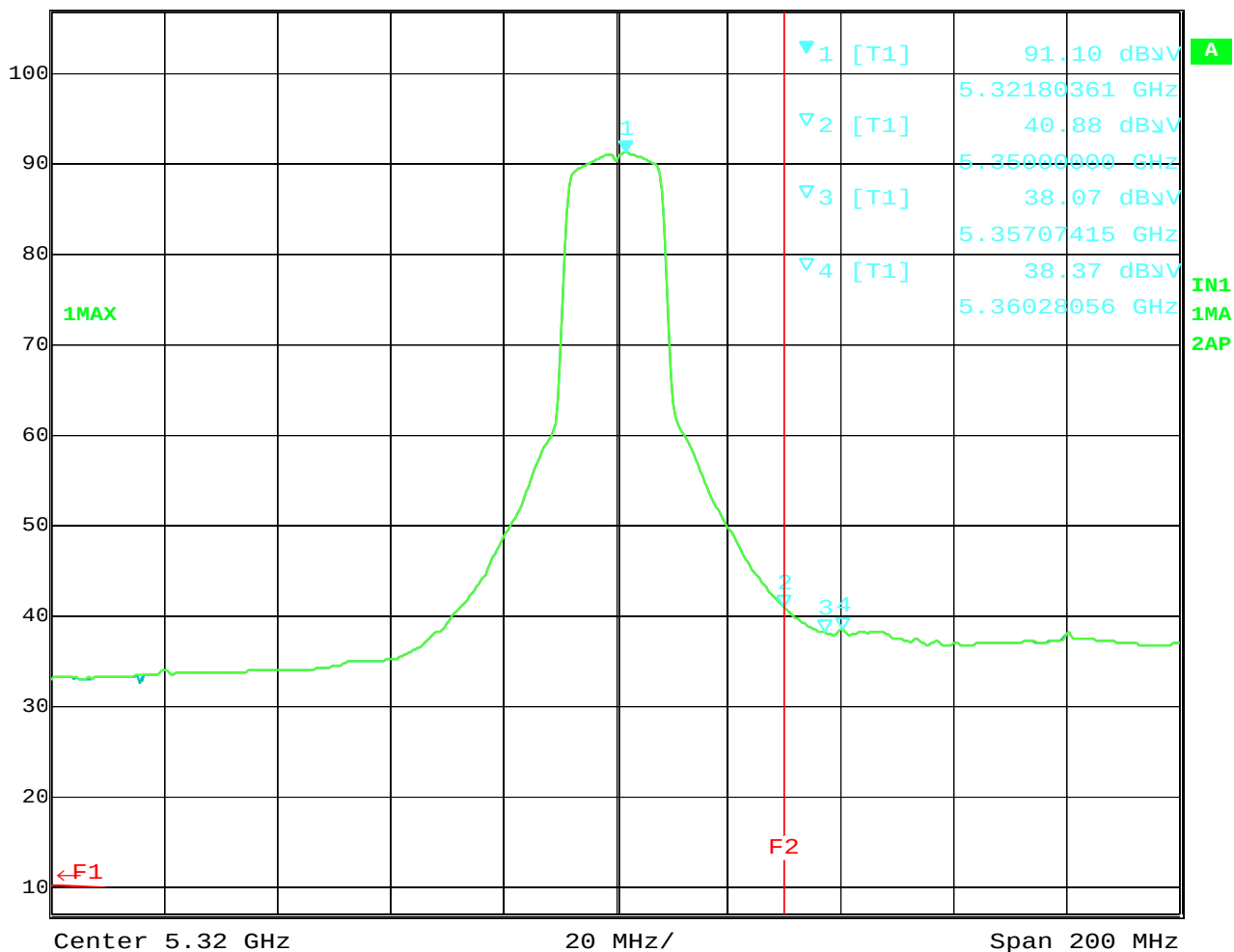
Date: 5.AUG.2005 17:44:11

Plot 2-7 Ch.64 5320MHz TX, OFDM 6Mbps (Peak) : LCD ABS





Ref Lvl 107 dBμV  
 Marker 1 [T1] 91.10 dBμV  
 5.32180361 GHz  
 RBW 1 MHz  
 VBW 10 Hz  
 SWT 50 s  
 RF Att 10 dB  
 Unit dBμV



Date: 5.AUG.2005 17:45:36

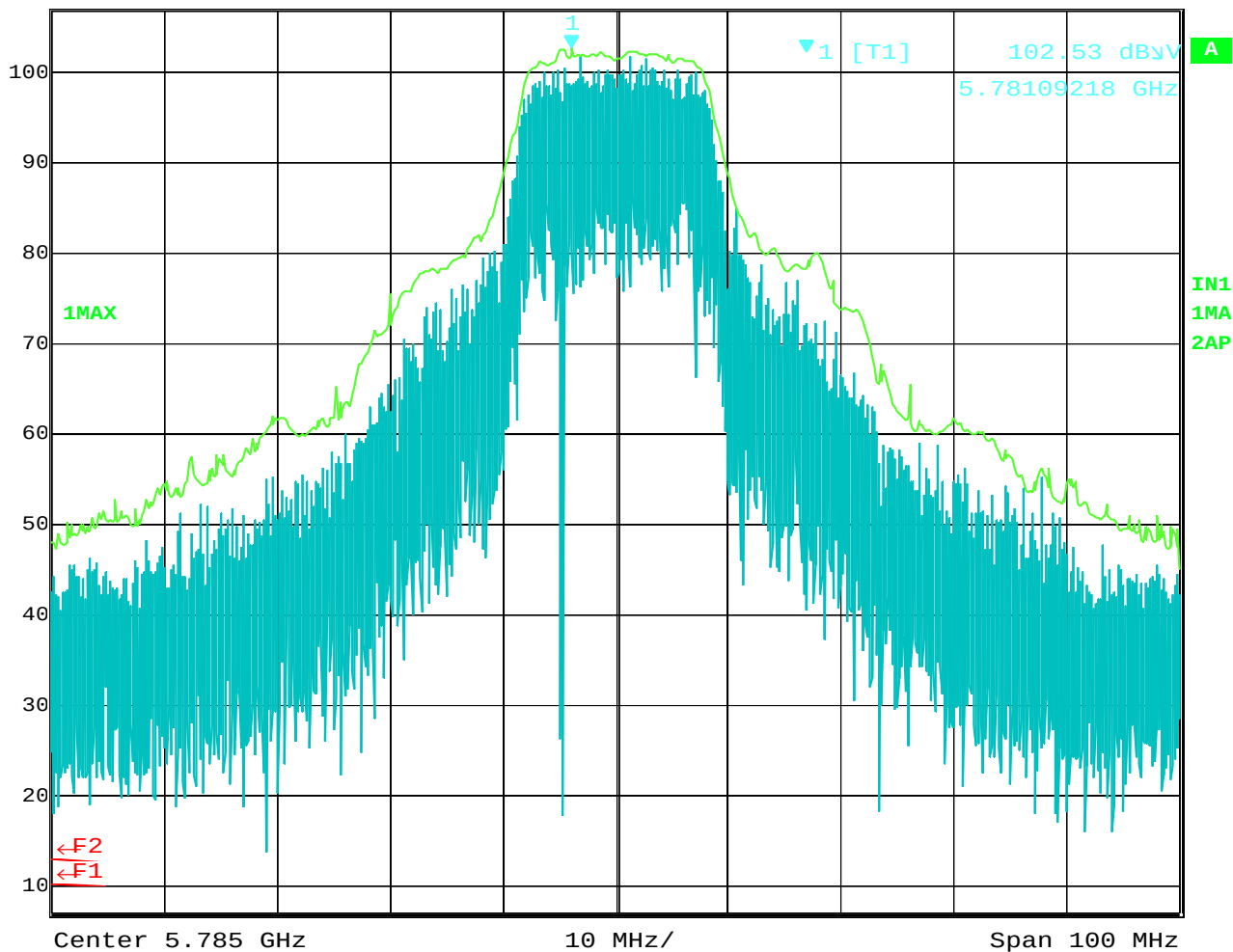
Plot 2-8 Ch.64 5320MHz TX, OFDM 6Mbps (Average) : LCD ABS



Ref Lvl  
 107 dBμV

Marker 1 [T1]  
 102.53 dBμV  
 5.78109218 GHz

RBW 1 MHz RF Att 10 dB  
 VBW 1 MHz  
 SWT 5 ms Unit dBμV

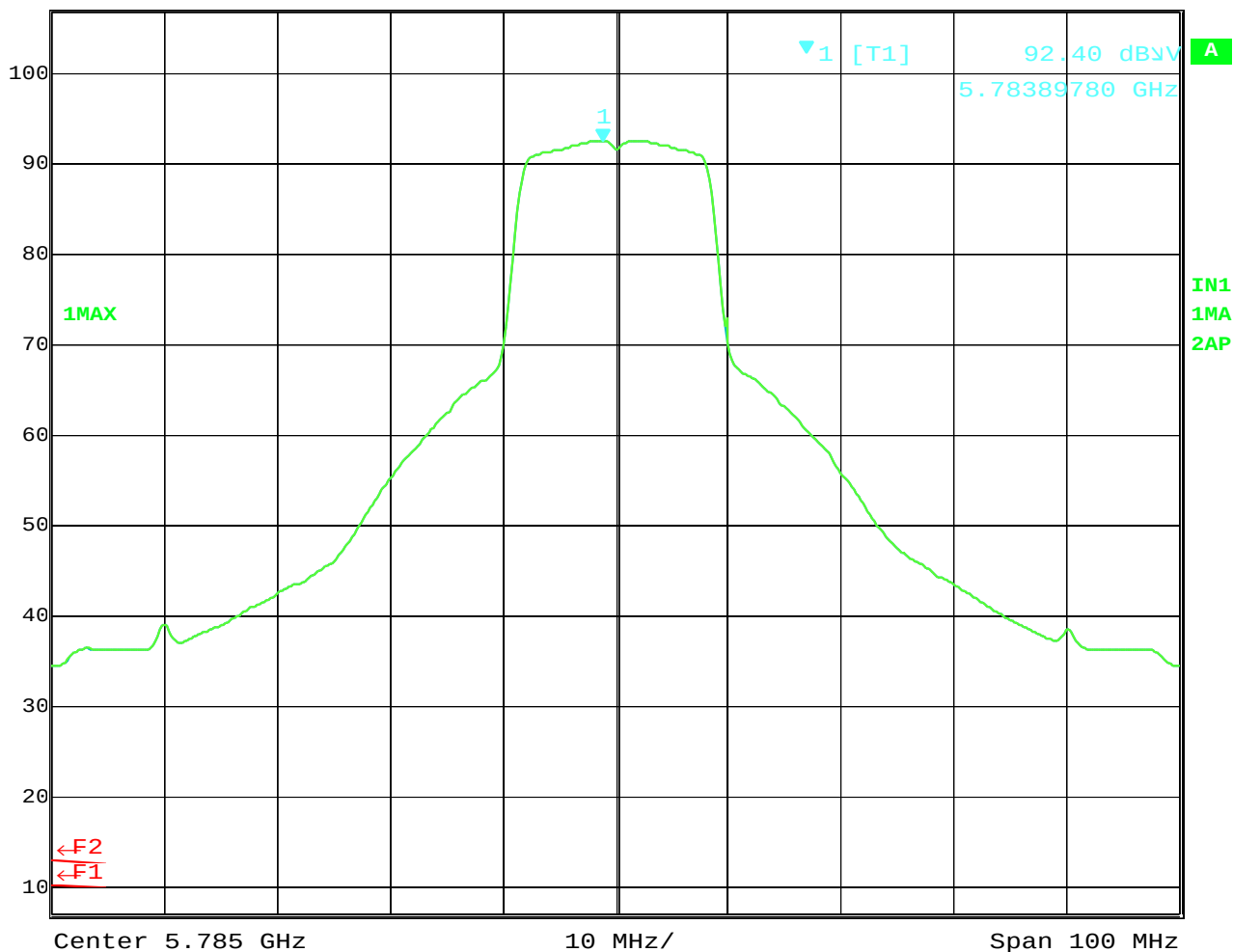


Date: 5.AUG.2005 18:40:28

Plot 2-9 Ch.157 5785MHz TX, OFDM 6Mbps (Peak) : LCD ABS



Ref Lvl 107 dBμV  
 Marker 1 [T1] 92.40 dBμV  
 5.78389780 GHz  
 RBW 1 MHz  
 VBW 10 Hz  
 SWT 25 s  
 RF Att 10 dB  
 Unit dBμV



Date: 5.AUG.2005 18:41:32

Plot 2-10 Ch.157 5785MHz TX, OFDM 6Mbps (Average) : LCD ABS

## 2.5 Radiated Emission Measurement Results (above 1GHz)

The EUT was found to comply to the limits of FCC Part 15 Subpart C & E and RSS-210 with a margin of 1.6dB. The measurement was done for the frequency range of 1 GHz to 40GHz in TX mode and 1 GHz to 25GHz in RX mode.

Test Date: August 5, 8, 9, 10, 11 and 12, 2005

### 2.5.1 EUT in 2.4GHz DSSS/OFDM modes

The full testing with the highest gain antenna was already certified at the previous grant. Therefore only the worst cases in previous Table-2-4-1 and 2-4-2 were selected and tested with the co-located Bluetooth device (FCC ID: MCLJ07M081, IC: 2878D-J07H081) in active and transmitting simultaneously.

\*Note1: OB means “operation band” (2400-2483.5MHz); in this case limit is 1W (measured conducted with power meter)

\*Note2: NR means “Non-Restricted band” (just reference only for EU compliance)

**Table 2-5-1** Ch.11 (2462MHz) DSSS 11Mbps **TX** mode (LCD: CFRP Aluminum)

| Frequency<br>(GHz) | Polarity<br>(H/V) | Measured<br>(dBμV)<br>(peak) | Measured<br>(dBμV)<br>(average) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Falloff<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) |
|--------------------|-------------------|------------------------------|---------------------------------|-----------------------------|-------------------------|---------------------------|-------------------------------|--------------------------|----------------------------|-------------------------------|--------------------------|----------------------------|
|                    |                   |                              |                                 |                             |                         |                           | (peak)                        |                          |                            | (average)                     |                          |                            |
| Inband             |                   |                              |                                 |                             |                         |                           |                               |                          |                            |                               |                          |                            |
| 2.461              | H                 | 113.8                        | 105.7                           | 28.4                        | -29.6                   | 0.0                       | 112.6                         | OB*1                     | -                          | 104.5                         | OB*1                     | -                          |
| bandedge           |                   |                              |                                 |                             |                         |                           |                               |                          |                            |                               |                          |                            |
| 2.486              | H                 | 61.2                         | 49.2                            | 28.4                        | -29.6                   | 0.0                       | 60.0                          | 74.0                     | 14.0                       | 48.0                          | 54.0                     | 6.0                        |
| 2.487              | H                 | 59.6                         | 49.5                            | 28.4                        | -29.6                   | 0.0                       | 58.4                          | 74.0                     | 15.6                       | 48.3                          | 54.0                     | 5.7                        |
| 2.488              | H                 | 59.3                         | 48.1                            | 28.4                        | -29.6                   | 0.0                       | 58.1                          | 74.0                     | 15.9                       | 46.9                          | 54.0                     | 7.1                        |
| 1.066              | V                 | 50.4                         | -                               | 24.6                        | -32.2                   | 0.0                       | 42.8                          | 74.0                     | 31.2                       | -                             | 54.0                     | -                          |
| 1.199              | V                 | 51.8                         | -                               | 25.2                        | -31.9                   | 0.0                       | 45.1                          | 74.0                     | 28.9                       | -                             | 54.0                     | -                          |
| 1.332              | V                 | 53.9                         | -                               | 25.2                        | -31.6                   | 0.0                       | 47.5                          | 74.0                     | 26.5                       | -                             | 54.0                     | -                          |
| 1.595              | V                 | 53.2                         | -                               | 25.6                        | -31.0                   | 0.0                       | 47.8                          | 74.0                     | 26.2                       | -                             | 54.0                     | -                          |
| 1.863              | V                 | 46.6                         | 31.5                            | 27.4                        | -30.4                   | 0.0                       | 43.6                          | NR*2                     | -                          | 28.5                          | NR*2                     | -                          |
| 1.896              | V                 | 43.1                         | 32.3                            | 27.6                        | -30.3                   | 0.0                       | 40.4                          | NR*2                     | -                          | 29.6                          | NR*2                     | -                          |
| 2.346              | H                 | 50.0                         | -                               | 28.1                        | -29.8                   | 0.0                       | 48.3                          | 74.0                     | 25.7                       | -                             | 54.0                     | -                          |
| 2.361              | H                 | 55.1                         | -                               | 28.1                        | -29.7                   | 0.0                       | 53.5                          | 74.0                     | 20.5                       | -                             | 54.0                     | -                          |
| 2.382              | H                 | 52.0                         | -                               | 28.2                        | -29.8                   | 0.0                       | 50.4                          | 74.0                     | 23.6                       | -                             | 54.0                     | -                          |
| 2.389              | H                 | 52.9                         | -                               | 28.2                        | -29.8                   | 0.0                       | 51.3                          | 74.0                     | 22.7                       | -                             | 54.0                     | -                          |
| 4.822              | V                 | 50.8                         | -                               | 27.1                        | -27.2                   | 0.0                       | 50.7                          | 74.0                     | 23.3                       | -                             | 54.0                     | -                          |
| 4.866              | V                 | 51.7                         | -                               | 27.0                        | -27.2                   | 0.0                       | 51.5                          | 74.0                     | 22.5                       | -                             | 54.0                     | -                          |
| 4.918              | V                 | 51.3                         | -                               | 27.0                        | -27.1                   | 0.0                       | 51.2                          | 74.0                     | 22.8                       | -                             | 54.0                     | -                          |
| 4.944              | V                 | 54.1                         | 25.6                            | 27.1                        | -27.1                   | 0.0                       | 54.1                          | 74.0                     | 19.9                       | 25.6                          | 54.0                     | 28.4                       |
| 5.233              | V                 | 39.1                         | 25.4                            | 27.1                        | -25.9                   | 0.0                       | 40.3                          | NR*2                     | -                          | 26.6                          | NR*2                     | -                          |
| 7.294              | H                 | 50.9                         | 24.8                            | 29.9                        | -25.3                   | 0.0                       | 55.5                          | 74.0                     | 18.5                       | 29.4                          | 54.0                     | 24.6                       |
| 7.306              | H                 | 49.1                         | -                               | 29.8                        | -25.3                   | 0.0                       | 53.6                          | 74.0                     | 20.4                       | -                             | 54.0                     | -                          |
| 7.398              | V                 | 47.3                         | -                               | 29.8                        | -25.3                   | 0.0                       | 51.8                          | 74.0                     | 22.2                       | -                             | 54.0                     | -                          |
| 7.440              | H                 | 48.0                         | -                               | 29.8                        | -25.2                   | 0.0                       | 52.6                          | 74.0                     | 21.4                       | -                             | 54.0                     | -                          |

**Table 2-5-2** Ch.1 (2412MHz) OFDM 6Mbps **TX** mode (LCD: CFRP Aluminum)

| Frequency<br>(GHz) | Polarity<br>(H/V) | Measured<br>(dBμV)<br>(peak) | Measured<br>(dBμV)<br>(average) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Falloff<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) |
|--------------------|-------------------|------------------------------|---------------------------------|-----------------------------|-------------------------|---------------------------|-------------------------------|--------------------------|----------------------------|-------------------------------|--------------------------|----------------------------|
|                    |                   |                              |                                 |                             |                         |                           | (peak)                        |                          |                            | (average)                     |                          |                            |
| Inband             |                   |                              |                                 |                             |                         |                           |                               |                          |                            |                               |                          |                            |
| 2.407              | H                 | 111.7                        | 100.7                           | 28.3                        | -29.7                   | 0.0                       | 110.3                         | OB*1                     | -                          | 99.3                          | OB*1                     | -                          |
| bandedge           |                   |                              |                                 |                             |                         |                           |                               |                          |                            |                               |                          |                            |
| 2.389              | H                 | 69.3                         | 52.6                            | 28.2                        | -29.8                   | 0.0                       | 67.7                          | 74.0                     | 6.3                        | 51.0                          | 54.0                     | 3.0                        |
| 2.390              | H                 | 70.7                         | 54.0                            | 28.2                        | -29.8                   | 0.0                       | 69.1                          | 74.0                     | 4.9                        | 52.4                          | 54.0                     | 1.6                        |
| 1.063              | V                 | 50.7                         | -                               | 24.6                        | -32.2                   | 0.0                       | 43.1                          | 74.0                     | 30.9                       | -                             | 54.0                     | -                          |
| 1.198              | V                 | 52.0                         | -                               | 25.2                        | -31.9                   | 0.0                       | 45.3                          | 74.0                     | 28.7                       | -                             | 54.0                     | -                          |
| 1.328              | V                 | 53.4                         | -                               | 25.2                        | -31.6                   | 0.0                       | 47.0                          | 74.0                     | 27.0                       | -                             | 54.0                     | -                          |
| 1.599              | V                 | 51.5                         | -                               | 25.6                        | -31.0                   | 0.0                       | 46.1                          | 74.0                     | 27.9                       | -                             | 54.0                     | -                          |
| 1.859              | V                 | 46.4                         | 31.6                            | 27.4                        | -30.4                   | 0.0                       | 43.4                          | NR*2                     | -                          | 28.6                          | NR*2                     | -                          |
| 1.895              | V                 | 43.4                         | 32.0                            | 27.6                        | -30.3                   | 0.0                       | 40.7                          | NR*2                     | -                          | 29.3                          | NR*2                     | -                          |
| 2.313              | H                 | 56.2                         | 43.1                            | 28.0                        | -29.8                   | 0.0                       | 54.4                          | 74.0                     | 19.6                       | 41.3                          | 54.0                     | 12.7                       |
| 2.340              | H                 | 51.3                         | -                               | 28.1                        | -29.8                   | 0.0                       | 49.6                          | 74.0                     | 24.4                       | -                             | 54.0                     | -                          |
| 4.814              | V                 | 48.6                         | -                               | 27.1                        | -27.2                   | 0.0                       | 48.5                          | 74.0                     | 25.5                       | -                             | 54.0                     | -                          |
| 4.852              | H                 | 50.2                         | -                               | 27.0                        | -27.2                   | 0.0                       | 50.0                          | 74.0                     | 24.0                       | -                             | 54.0                     | -                          |
| 4.894              | H                 | 50.2                         | -                               | 27.0                        | -27.1                   | 0.0                       | 50.1                          | 74.0                     | 23.9                       | -                             | 54.0                     | -                          |
| 4.960              | V                 | 52.7                         | -                               | 27.1                        | -27.0                   | 0.0                       | 52.8                          | 74.0                     | 21.2                       | -                             | 54.0                     | -                          |
| 5.191              | V                 | 39.8                         | 25.5                            | 27.1                        | -26.6                   | 0.0                       | 40.3                          | NR*2                     | -                          | 26.0                          | NR*2                     | -                          |
| 7.260              | H                 | 48.8                         | -                               | 30.0                        | -25.4                   | 0.0                       | 53.4                          | 74.0                     | 20.6                       | -                             | 54.0                     | -                          |
| 7.290              | H                 | 51.9                         | 24.8                            | 29.9                        | -25.3                   | 0.0                       | 56.5                          | 74.0                     | 17.5                       | 29.4                          | 54.0                     | 24.6                       |
| 7.330              | V                 | 49.9                         | 24.8                            | 29.8                        | -25.1                   | 0.0                       | 54.6                          | 74.0                     | 19.4                       | 29.5                          | 54.0                     | 24.5                       |
| 7.417              | V                 | 49.3                         | -                               | 29.8                        | -25.2                   | 0.0                       | 53.9                          | 74.0                     | 20.1                       | -                             | 54.0                     | -                          |

**Table 2-5-3** Ch.6 (2437MHz) DSSS **RX** mode (LCD: CFRP Aluminum)

| Frequency<br>(GHz) | Polarity<br>(H/V) | Measured<br>(dBμV)<br>(peak) | Measured<br>(dBμV)<br>(average) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Falloff<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) |
|--------------------|-------------------|------------------------------|---------------------------------|-----------------------------|-------------------------|---------------------------|-------------------------------|--------------------------|----------------------------|-------------------------------|--------------------------|----------------------------|
|                    |                   |                              |                                 |                             |                         |                           | (peak)                        |                          |                            | (average)                     |                          |                            |
| 1.066              | V                 | 51.7                         | -                               | 24.6                        | -32.2                   | 0.0                       | 44.1                          | 74.0                     | 29.9                       | -                             | 54.0                     | -                          |
| 1.199              | V                 | 52.3                         | -                               | 25.2                        | -31.9                   | 0.0                       | 45.6                          | 74.0                     | 28.4                       | -                             | 54.0                     | -                          |
| 1.332              | V                 | 52.6                         | -                               | 25.2                        | -31.6                   | 0.0                       | 46.2                          | 74.0                     | 27.8                       | -                             | 54.0                     | -                          |
| 1.598              | V                 | 52.6                         | -                               | 25.6                        | -31.0                   | 0.0                       | 47.2                          | 74.0                     | 26.8                       | -                             | 54.0                     | -                          |
| 1.866              | V                 | 45.7                         | 30.2                            | 27.4                        | -30.4                   | 0.0                       | 42.7                          | NR*2                     | -                          | 27.2                          | NR*2                     | -                          |
| 1.896              | V                 | 43.0                         | 31.3                            | 27.6                        | -30.3                   | 0.0                       | 40.3                          | NR*2                     | -                          | 28.6                          | NR*2                     | -                          |
| 5.191              | V                 | 37.6                         | 25.5                            | 27.1                        | -26.6                   | 0.0                       | 38.1                          | NR*2                     | -                          | 26.0                          | NR*2                     | -                          |

**Table 2-5-4** Ch.6 (2437MHz) OFDM **RX** mode (LCD: CFRP Aluminum)

| Frequency<br>(GHz) | Polarity<br>(H/V) | Measured<br>(dBμV)<br>(peak) | Measured<br>(dBμV)<br>(average) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Falloff<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) |
|--------------------|-------------------|------------------------------|---------------------------------|-----------------------------|-------------------------|---------------------------|-------------------------------|--------------------------|----------------------------|-------------------------------|--------------------------|----------------------------|
|                    |                   |                              |                                 |                             |                         |                           | (peak)                        |                          |                            | (average)                     |                          |                            |
| 1.065              | V                 | 51.3                         | -                               | 24.6                        | -32.2                   | 0.0                       | 43.7                          | 74.0                     | 30.3                       | -                             | 54.0                     | -                          |
| 1.198              | V                 | 52.4                         | -                               | 25.2                        | -31.9                   | 0.0                       | 45.7                          | 74.0                     | 28.3                       | -                             | 54.0                     | -                          |
| 1.332              | V                 | 53.6                         | -                               | 25.2                        | -31.6                   | 0.0                       | 47.2                          | 74.0                     | 26.8                       | -                             | 54.0                     | -                          |
| 1.596              | V                 | 52.2                         | -                               | 25.6                        | -31.0                   | 0.0                       | 46.8                          | 74.0                     | 27.2                       | -                             | 54.0                     | -                          |
| 1.866              | V                 | 45.8                         | 29.4                            | 27.4                        | -30.4                   | 0.0                       | 42.8                          | NR*2                     | -                          | 26.4                          | NR*2                     | -                          |
| 1.895              | V                 | 43.7                         | 31.3                            | 27.6                        | -30.3                   | 0.0                       | 41.0                          | NR*2                     | -                          | 28.6                          | NR*2                     | -                          |
| 5.277              | H                 | 37.8                         | 25.4                            | 27.1                        | -26.8                   | 0.0                       | 38.1                          | NR*2                     | -                          | 25.7                          | NR*2                     | -                          |

## 2.5.2 EUT in 5.2GHz OFDM mode

The full testing with the highest gain antenna was already certified at the previous grant. Therefore only the worst cases in previous Table-2-4-3 were selected and tested with the co-located Bluetooth device (FCC ID: MCLJ07M081, IC: 2878D-J07H081) in active and transmitting simultaneously.

\*Note1: OB means “operation band” (5150-5350MHz); in this case limit is 1W (measured conducted with power meter)

\*Note2: NRB means “non restricted band”: The limit of FCC Part 15.407(b)(1),(2) and RSS-210 6.2.2(q1)(I),(ii) apply.

**Table 2-5-5** Ch.36 (5180MHz) OFDM 6Mbps **TX** mode (LCD: ABS)

| Frequency<br>(GHz) | Polarity<br>(H/V) | Measured<br>(dBμV)<br>(peak) | Measured<br>(dBμV)<br>(average) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Falloff<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) |
|--------------------|-------------------|------------------------------|---------------------------------|-----------------------------|-------------------------|---------------------------|-------------------------------|--------------------------|----------------------------|-------------------------------|--------------------------|----------------------------|
|                    |                   |                              |                                 |                             |                         |                           | (peak)                        |                          |                            | (average)                     |                          |                            |
| Inband             |                   |                              |                                 |                             |                         |                           |                               |                          |                            |                               |                          |                            |
| 5.175              | V                 | 99.4                         | 88.7                            | 33.7                        | -26.8                   | 0.0                       | 106.3                         | OB*1                     | -                          | 95.6                          | OB*1                     | -                          |
| bandedge           |                   |                              |                                 |                             |                         |                           |                               |                          |                            |                               |                          |                            |
| 5.140              | V                 | 44.6                         | -                               | 33.6                        | -26.8                   | 0.0                       | 51.4                          | 74.0                     | 22.6                       | -                             | 54.0                     | -                          |
| 5.148              | V                 | 48.0                         | 32.9                            | 33.6                        | -26.8                   | 0.0                       | 54.8                          | 74.0                     | 19.2                       | 39.7                          | 54.0                     | 14.3                       |
| 5.150              | V                 | 49.6                         | 32.9                            | 33.6                        | -26.8                   | 0.0                       | 56.4                          | 74.0                     | 17.6                       | 39.7                          | 54.0                     | 14.3                       |
| 1.066              | V                 | 63.5                         | 37.5                            | 24.6                        | -32.3                   | 0.0                       | 55.8                          | 74.0                     | 18.2                       | 29.8                          | 54.0                     | 24.2                       |
| 1.329              | V                 | 56.9                         | -                               | 25.6                        | -31.6                   | 0.0                       | 50.9                          | 74.0                     | 23.1                       | -                             | 54.0                     | -                          |
| 1.501              | V                 | 56.0                         | -                               | 25.5                        | -31.2                   | 0.0                       | 50.3                          | 74.0                     | 23.7                       | -                             | 54.0                     | -                          |
| 1.597              | V                 | 61.8                         | 38.4                            | 25.6                        | -31.0                   | 0.0                       | 56.4                          | 74.0                     | 17.6                       | 33.0                          | 54.0                     | 21.0                       |
| 2.126              | V                 | 54.3                         | -                               | 27.9                        | -30.0                   | 0.0                       | 52.2                          | 68.2                     | 16.0                       | -                             | NRB*2                    | -                          |
| 4.808              | V                 | 53.7                         | -                               | 27.1                        | -27.2                   | 0.0                       | 53.6                          | 74.0                     | 20.4                       | -                             | 54.0                     | -                          |
| 4.916              | V                 | 55.0                         | 34.0                            | 27.0                        | -27.1                   | 0.0                       | 54.9                          | 74.0                     | 19.1                       | 33.9                          | 54.0                     | 20.1                       |
| 4.932              | V                 | 55.2                         | 34.0                            | 27.1                        | -27.1                   | 0.0                       | 55.2                          | 74.0                     | 18.8                       | 34.0                          | 54.0                     | 20.0                       |
| 4.950              | V                 | 55.8                         | 33.7                            | 27.1                        | -27.1                   | 0.0                       | 55.8                          | 74.0                     | 18.2                       | 33.7                          | 54.0                     | 20.3                       |
| 5.437              | H                 | 52.3                         | 39.2                            | 34.1                        | -26.5                   | 0.0                       | 59.9                          | 74.0                     | 14.1                       | 46.8                          | 54.0                     | 7.2                        |
| 6.016              | H                 | 41.3                         | -                               | 29.8                        | -26.2                   | 0.0                       | 44.9                          | 68.2                     | 23.3                       | -                             | NRB*2                    | -                          |
| 6.906              | H                 | 52.7                         | -                               | 29.9                        | -25.5                   | 0.0                       | 57.1                          | 68.2                     | 11.1                       | -                             | NRB*2                    | -                          |
| 7.347              | H                 | 57.9                         | 25.0                            | 29.8                        | -25.4                   | 0.0                       | 62.3                          | 74.0                     | 11.7                       | 29.4                          | 54.0                     | 24.6                       |

**Table 2-5-6** Ch.64 (5320MHz) OFDM 6Mbps **TX** mode (LCD: ABS)

| Frequency<br>(GHz) | Polarity<br>(H/V) | Measured<br>(dBμV)<br>(peak) | Measured<br>(dBμV)<br>(average) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Falloff<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) |
|--------------------|-------------------|------------------------------|---------------------------------|-----------------------------|-------------------------|---------------------------|-------------------------------|--------------------------|----------------------------|-------------------------------|--------------------------|----------------------------|
|                    |                   |                              |                                 |                             |                         |                           | (peak)                        |                          |                            | (average)                     |                          |                            |
| Inband             |                   |                              |                                 |                             |                         |                           |                               |                          |                            |                               |                          |                            |
| 5.315              | H                 | 101.2                        | 91.1                            | 33.7                        | -26.5                   | 0.0                       | 108.4                         | OB*1                     | -                          | 98.3                          | OB*1                     | -                          |
| bandedge           |                   |                              |                                 |                             |                         |                           |                               |                          |                            |                               |                          |                            |
| 5.350              | H                 | 57.7                         | 40.9                            | 33.9                        | -26.5                   | 0.0                       | 65.1                          | 74.0                     | 8.9                        | 48.3                          | 54.0                     | 5.7                        |
| 5.357              | H                 | 57.5                         | 38.1                            | 33.9                        | -26.5                   | 0.0                       | 64.9                          | 74.0                     | 9.1                        | 45.5                          | 54.0                     | 8.5                        |
| 5.362              | H                 | 55.1                         | 38.4                            | 33.9                        | -26.5                   | 0.0                       | 62.5                          | 74.0                     | 11.5                       | 45.8                          | 54.0                     | 8.2                        |
| 1.066              | V                 | 60.2                         | -                               | 24.6                        | -32.3                   | 0.0                       | 52.5                          | 74.0                     | 21.5                       | -                             | 54.0                     | -                          |
| 1.329              | V                 | 59.1                         | -                               | 25.6                        | -31.6                   | 0.0                       | 53.1                          | 74.0                     | 20.9                       | -                             | 54.0                     | -                          |
| 1.501              | V                 | 56.3                         | -                               | 25.5                        | -31.2                   | 0.0                       | 50.6                          | 74.0                     | 23.4                       | -                             | 54.0                     | -                          |
| 1.597              | V                 | 61.4                         | 37.6                            | 25.6                        | -31.0                   | 0.0                       | 56.0                          | 74.0                     | 18.0                       | 32.2                          | 54.0                     | 21.8                       |
| 2.132              | V                 | 54.6                         | -                               | 27.8                        | -30.0                   | 0.0                       | 52.4                          | 68.2                     | 15.8                       | -                             | NRB*2                    | -                          |
| 4.824              | H                 | 49.8                         | -                               | 27.1                        | -27.2                   | 0.0                       | 49.7                          | 74.0                     | 24.3                       | -                             | 54.0                     | -                          |
| 4.868              | V                 | 52.5                         | -                               | 27.0                        | -27.2                   | 0.0                       | 52.3                          | 74.0                     | 21.7                       | -0.2                          | 54.0                     | 54.2                       |
| 4.918              | V                 | 50.2                         | -                               | 27.0                        | -27.1                   | 0.0                       | 50.1                          | 74.0                     | 23.9                       | -0.1                          | 54.0                     | 54.1                       |
| 4.932              | H                 | 50.0                         | -                               | 27.1                        | -27.1                   | 0.0                       | 50.0                          | 74.0                     | 24.0                       | 0.0                           | 54.0                     | 54.0                       |
| 5.451              | H                 | 52.1                         | 39.6                            | 34.2                        | -26.4                   | 0.0                       | 59.9                          | 74.0                     | 14.1                       | 47.4                          | 54.0                     | 6.6                        |
| 6.012              | H                 | 41.4                         | -                               | 29.8                        | -26.2                   | 0.0                       | 45.0                          | 68.2                     | 23.2                       | -                             | NRB*2                    | -                          |
| 6.417              | H                 | 39.6                         | -                               | 29.9                        | -25.7                   | 0.0                       | 43.8                          | 68.2                     | 24.4                       | -                             | NRB*2                    | -                          |
| 7.094              | V                 | 42.2                         | -                               | 30.0                        | -25.4                   | 0.0                       | 46.8                          | 68.2                     | 21.4                       | -                             | NRB*2                    | -                          |
| 7.279              | H                 | 58.6                         | 25.0                            | 29.9                        | -25.4                   | 0.0                       | 63.1                          | 74.0                     | 10.9                       | 29.5                          | 54.0                     | 24.5                       |

**Table 2-5-7** Ch.52 (5260MHz) OFDM **RX** mode (LCD: ABS)

| Frequency<br>(GHz) | Polarity<br>(H/V) | Measured<br>(dBμV)<br>(peak) | Measured<br>(dBμV)<br>(average) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Falloff<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) |
|--------------------|-------------------|------------------------------|---------------------------------|-----------------------------|-------------------------|---------------------------|-------------------------------|--------------------------|----------------------------|-------------------------------|--------------------------|----------------------------|
|                    |                   |                              |                                 |                             |                         |                           | (peak)                        |                          |                            | (average)                     |                          |                            |
| 1.064              | V                 | 64.7                         | 38.0                            | 24.6                        | -32.3                   | 0.0                       | 57.0                          | 74.0                     | 17.0                       | 30.3                          | 54.0                     | 23.7                       |
| 1.330              | V                 | 58.6                         | -                               | 25.6                        | -31.6                   | 0.0                       | 52.6                          | 74.0                     | 21.4                       | -                             | 54.0                     | -                          |
| 1.501              | V                 | 55.4                         | -                               | 25.5                        | -31.2                   | 0.0                       | 49.7                          | 74.0                     | 24.3                       | -                             | 54.0                     | -                          |
| 1.595              | V                 | 63.6                         | 37.0                            | 25.6                        | -31.0                   | 0.0                       | 58.2                          | 74.0                     | 15.8                       | 31.6                          | 54.0                     | 22.4                       |

## 2.5.3 EUT in 5.8GHz OFDM mode

The worse cases in previous Table-2-4-4 were selected and tested with the co-located Bluetooth device (FCC ID: MCLJ07M081, IC: 2878D-J07H081) in active and transmitting simultaneously.

\*Note: OB means “operation band” (5725-5850MHz); in this case limit is 1W (measured conducted with power meter)

**Table 2-5-8** Ch.157 (5785MHz) OFDM 6Mbps **TX** mode (LCD: ABS)

| Frequency<br>(GHz) | Polarity<br>(H/V) | Measured<br>(dBμV)<br>(peak) | Measured<br>(dBμV)<br>(average) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Falloff<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) |
|--------------------|-------------------|------------------------------|---------------------------------|-----------------------------|-------------------------|---------------------------|-------------------------------|--------------------------|----------------------------|-------------------------------|--------------------------|----------------------------|
|                    |                   |                              |                                 |                             |                         |                           | (peak)                        |                          |                            | (average)                     |                          |                            |
| Inband<br>5.781    | V                 | 102.5                        | 92.4                            | 34.0                        | -26.1                   | 0.0                       | 110.4                         | OB*1                     | -                          | 100.3                         | OB*1                     | -                          |
| 1.064              | V                 | 59.3                         | -                               | 24.6                        | -32.2                   | 0.0                       | 51.7                          | 74.0                     | 22.3                       | -                             | 54.0                     | -                          |
| 1.156              | V                 | 63.5                         | 36.6                            | 24.6                        | -32.0                   | 0.0                       | 56.1                          | 74.0                     | 17.9                       | 29.2                          | 54.0                     | 24.8                       |
| 1.501              | V                 | 55.4                         | -                               | 25.5                        | -31.2                   | 0.0                       | 49.7                          | 74.0                     | 24.3                       | -                             | 54.0                     | -                          |
| 1.597              | V                 | 62.3                         | 37.3                            | 25.6                        | -31.0                   | 0.0                       | 56.9                          | 74.0                     | 17.1                       | 31.9                          | 54.0                     | 22.1                       |
| 4.810              | V                 | 55.3                         | 31.4                            | 27.1                        | -27.2                   | 0.0                       | 55.2                          | 74.0                     | 18.8                       | 31.3                          | 54.0                     | 22.7                       |
| 4.834              | V                 | 50.1                         | -                               | 27.0                        | -27.1                   | 0.0                       | 50.0                          | 74.0                     | 24.0                       | -                             | 54.0                     | -                          |
| 4.902              | V                 | 57.8                         | 34.0                            | 27.0                        | -27.1                   | 0.0                       | 57.7                          | 74.0                     | 16.3                       | 33.9                          | 54.0                     | 20.1                       |
| 4.926              | V                 | 56.2                         | 35.0                            | 27.0                        | -27.1                   | 0.0                       | 56.1                          | 74.0                     | 17.9                       | 34.9                          | 54.0                     | 19.1                       |
| 5.409              | H                 | 51.7                         | 39.3                            | 33.9                        | -26.6                   | 0.0                       | 59.0                          | 74.0                     | 15.0                       | 46.6                          | 54.0                     | 7.4                        |
| 7.251              | H                 | 54.9                         | 24.9                            | 30.0                        | -25.4                   | 0.0                       | 59.5                          | 74.0                     | 14.5                       | 29.5                          | 54.0                     | 24.5                       |
| 7.367              | H                 | 58.1                         | 24.8                            | 29.8                        | -25.3                   | 0.0                       | 62.6                          | 74.0                     | 11.4                       | 29.3                          | 54.0                     | 24.7                       |
| 7.431              | H                 | 53.9                         | 24.6                            | 29.8                        | -25.2                   | 0.0                       | 58.5                          | 74.0                     | 15.5                       | 29.2                          | 54.0                     | 24.8                       |
| 7.715              | H                 | 48.0                         | -                               | 30.0                        | -25.1                   | 0.0                       | 52.9                          | 74.0                     | 21.1                       | -                             | 54.0                     | -                          |
| 11.575             | H                 | 39.7                         | -                               | 33.5                        | -20.9                   | 0.0                       | 52.3                          | 74.0                     | 21.7                       | -                             | 54.0                     | -                          |

**Table 2-5-9** Ch.157 (5785MHz) OFDM **RX** mode (LCD: ABS)

| Frequency<br>(GHz) | Polarity<br>(H/V) | Measured<br>(dBμV)<br>(peak) | Measured<br>(dBμV)<br>(average) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Falloff<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(dBμV/m) | FCC<br>Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) |
|--------------------|-------------------|------------------------------|---------------------------------|-----------------------------|-------------------------|---------------------------|-------------------------------|--------------------------|----------------------------|-------------------------------|--------------------------|----------------------------|
|                    |                   |                              |                                 |                             |                         |                           | (peak)                        |                          |                            | (average)                     |                          |                            |
| 1.064              | V                 | 60.0                         | -                               | 24.6                        | -32.2                   | 0.0                       | 52.4                          | 74.0                     | 21.6                       | -                             | 54.0                     | -                          |
| 1.329              | V                 | 59.0                         | -                               | 25.6                        | -31.6                   | 0.0                       | 53.0                          | 74.0                     | 21.0                       | -                             | 54.0                     | -                          |
| 1.501              | V                 | 55.9                         | -                               | 25.5                        | -31.2                   | 0.0                       | 50.2                          | 74.0                     | 23.8                       | -                             | 54.0                     | -                          |
| 1.597              | V                 | 59.9                         | 37.5                            | 25.6                        | -31.0                   | 0.0                       | 54.5                          | 74.0                     | 19.5                       | 32.1                          | 54.0                     | 21.9                       |



### 3. Restricted Bands Radiation (30MHz – 1GHz)

**Subpart C / DSSS** [ FCC 15.205 / 209, RSS-210 6.3 / 7.3 ]  
**Subpart E** [ FCC 15.205&209 / 15.407(b)(1),(2),(5),(6) ]  
**LELAN** [ RSS-210 6.2.1 / 6.2.2(q1)(i),(ii),(v) / 6.3 / 7.3 ]

#### 3.1 Test Procedure

Preliminary radiated emissions are measured in the semi-anechoic chamber at a 3 meter distance on every azimuth in both horizontal and vertical polarity. The antennas are also scanned in height. The emissions are recorded with a spectrum analyzer in peak hold mode. The identified emissions are further maximized by a cable manipulation. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120kHz. The highest emissions relative to the limit are listed.

#### 3.2 Test Instruments and Measurement Setup

**Table 3-1** Radiated Emission Test Instrumentation

| Description                                           | Model        | Serial Number |
|-------------------------------------------------------|--------------|---------------|
| Computer                                              | IBM 6868-30J | 97-901X3      |
| Spectrum Analyzer (100Hz-1.5GHz) for 30-200MHz        | HP 85680B    | 3019A05155    |
| Spectrum Analyzer Display for 30-200MHz               | HP 85662A    | 3026A19353    |
| Quasi-Peak Adapter for 30-200MHz                      | HP 85650A    | 3033A01449    |
| Spectrum Analyzer (100Hz-1.5GHz) for 200-1000MHz      | HP 85680B    | 2841A04254    |
| Spectrum Analyzer Display for 200-1000MHz             | HP 85662A    | 2816A16831    |
| Quasi-Peak Adapter for 200-1000MHz                    | HP 85650A    | 2811A01156    |
| Amplifier (100KHz-1.3GHz)                             |              |               |
| - for 30-200MHz                                       | MITEQ AM-3A  | 898433        |
| - for 200-1000MHz                                     | MITEQ AM-3A  | 898432        |
| Biconical Antenna (30-200MHz)                         | EMCO 3108    | 2400          |
| Log-Periodic Antenna (200-1000MHz)                    | EMCO 3146    | 2150          |
| Receiver (20MHz-1.3GHz)                               | R&S ESVP     | 892111/026    |
| Switch/control unit                                   | HP 3488A     | 2719A17226    |
| N-Coax cables:                                        | Length:      |               |
| - Bi-coni Ant <=> 10m Cable                           | 9 m          | - EM103L01    |
| - 10m Cable <=> Shield Panel                          | 10 m         | - EM103L02    |
| - Shield Panel <=> RF Amp                             | 7 m          | - EM103L03    |
| - RF Amp <=> Power Splitter                           | 0.5m         | - EM103L04    |
| - Log-peri Ant <=> 10m Cable                          | 9 m          | - EM103H01    |
| - 10m Cable <=> Shield Panel                          | 10 m         | - EM103H02    |
| - Shield Panel <=> RF Amp                             | 7 m          | - EM103H03    |
| - RF Amp <=> Power Splitter                           | 0.5m         | - EM103H04    |
| Coax cables:                                          |              |               |
| - Power Splitter <=> SW/Con.unit (SW110)              | 1 m          | - EM103L05    |
| - Power Splitter <=> SW/Con.unit (SW300)              | 1 m          | - EM103L06    |
| - Power Splitter <=> SW/Con.unit (SW100)              | 1 m          | - EM103H05    |
| - Power Splitter <=> SW/Con.unit (SW301)              | 1 m          | - EM103H06    |
| - SW/Con.unit <=> Receiver (Input)                    | 2 m          | - EM1RCV      |
| - SW/Con.unit <=> Spe Ana.(Signal In) for 30- 200MHz  | 2 m          | - EM1SPL      |
| - SW/Con.unit <=> Spe Ana.(Signal In) for 200-1000MHz | 2 m          | - EM1SPH      |

Notes: HP: Hewlett Packard, R&S: Rohde & Schwarz

Prepared by T. Asano

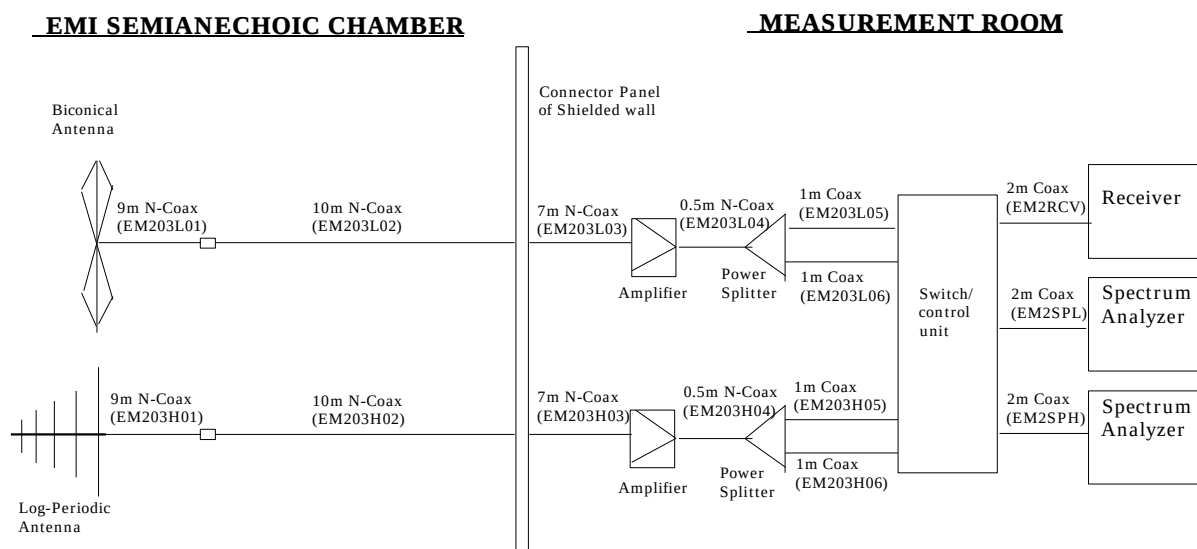


Figure 3 Cables for Radiated Emission Test

### 3.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver. All factors are included in the reported data.

$$FS = R + AF + CORR$$

where:

- FS = Field Strength
- R = Measured Receiver Input Amplitude
- AF = Antenna Factor
- CORR = Correction Factor = CL - AG
- CL = Cable Loss
- AG = Amplifier Gain

For example:

Given a Receiver input reading of 51.5dBμV; Antenna Factor of 8.5dB/m; Cable Loss of 1.3dB; and an Amplifier Gain of 26dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 = 35.3\text{dB}\mu\text{V/m}$$

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

$$\text{Level(dB}\mu\text{V/m)} = 20 \times \text{Log( Level(}\mu\text{V/m) )}$$

$$40\text{dB}\mu\text{V/m} = 100\mu\text{V/m}$$

$$48\text{dB}\mu\text{V/m} = 250\mu\text{V/m}$$

### 3.4 Measurement Results

The same worst cases selected for the previous Chapter 2 were tested with the co-located Bluetooth device (FCC ID: MCLJ07M081, IC: 2878D-J07H081) in active and transmitting simultaneously.

The EUT was found to comply to the limits of FCC Part 15 Subpart C & E and RSS-210 with a margin of 2.2dB at 30MHz - 1000MHz band.

The 6 highest emissions relative to the limits are reported.

Test Date: August 11, 2005

#### 3.4.1 EUT in 2.4GHz DSSS/OFDM modes

**Table 3-4-1** Ch.11 (2462MHz) DSSS 11Mbps **TX** mode (LCD: CFRP Aluminum)

| Frequency<br>(MHz) | Polarity<br>(H/V) | Measured<br>(dBμV) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(μV/m) | Limit<br>(μV/m) |
|--------------------|-------------------|--------------------|-----------------------------|-------------------------|-------------------------------|-------------------|----------------------------|-----------------------------|-----------------|
| 58.802             | V                 | 47.0               | 9.8                         | -26.7                   | 30.1                          | 40.0              | 9.9                        | 32.0                        | 100             |
| 199.107            | H                 | 45.0               | 14.2                        | -24.2                   | 35.0                          | 43.5              | 8.5                        | 56.2                        | 150             |
| 242.228            | V                 | 46.2               | 12.2                        | -23.3                   | 35.1                          | 46.0              | 10.9                       | 56.9                        | 200             |
| 427.367            | V                 | 43.3               | 16.4                        | -20.4                   | 39.3                          | 46.0              | 6.7                        | 92.3                        | 200             |
| 799.358            | H                 | 39.9               | 21.8                        | -19.0                   | 42.7                          | 46.0              | 3.3                        | 136.5                       | 200             |
| 864.063            | H                 | 32.1               | 23.0                        | -18.8                   | 36.3                          | 46.0              | 9.7                        | 65.3                        | 200             |

**Table 3-4-2** Ch.1 (2412MHz) OFDM 6Mbps **TX** mode (LCD: CFRP Aluminum)

| Frequency<br>(MHz) | Polarity<br>(H/V) | Measured<br>(dBμV) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(μV/m) | Limit<br>(μV/m) |
|--------------------|-------------------|--------------------|-----------------------------|-------------------------|-------------------------------|-------------------|----------------------------|-----------------------------|-----------------|
| 58.908             | V                 | 49.1               | 9.8                         | -26.7                   | 32.2                          | 40.0              | 7.8                        | 40.7                        | 100             |
| 199.107            | H                 | 46.6               | 14.2                        | -24.2                   | 36.6                          | 43.5              | 6.9                        | 67.6                        | 150             |
| 241.853            | V                 | 48.6               | 12.2                        | -23.3                   | 37.5                          | 46.0              | 8.5                        | 75.0                        | 200             |
| 288.021            | H                 | 47.4               | 14.2                        | -22.3                   | 39.3                          | 46.0              | 6.7                        | 92.3                        | 200             |
| 425.867            | V                 | 42.1               | 16.4                        | -20.7                   | 37.8                          | 46.0              | 8.2                        | 77.6                        | 200             |
| 799.615            | H                 | 41.0               | 21.8                        | -19.0                   | 43.8                          | 46.0              | 2.2                        | 154.9                       | 200             |

**Table 3-4-3** Ch.6 (2437MHz) DSSS **RX** mode (LCD: CFRP Aluminum)

| Frequency<br>(MHz) | Polarity<br>(H/V) | Measured<br>(dBμV) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(μV/m) | Limit<br>(μV/m) |
|--------------------|-------------------|--------------------|-----------------------------|-------------------------|-------------------------------|-------------------|----------------------------|-----------------------------|-----------------|
| 58.917             | V                 | 47.0               | 9.8                         | -26.7                   | 30.1                          | 40.0              | 9.9                        | 32.0                        | 100             |
| 199.108            | H                 | 45.7               | 14.2                        | -24.2                   | 35.7                          | 43.5              | 7.8                        | 61.0                        | 150             |
| 241.852            | V                 | 47.9               | 12.2                        | -23.3                   | 36.8                          | 46.0              | 9.2                        | 69.2                        | 200             |
| 288.021            | H                 | 48.4               | 14.2                        | -22.3                   | 40.3                          | 46.0              | 5.7                        | 103.5                       | 200             |
| 425.867            | V                 | 41.9               | 16.4                        | -20.7                   | 37.6                          | 46.0              | 8.4                        | 75.9                        | 200             |
| 799.006            | H                 | 39.9               | 21.8                        | -19.0                   | 42.7                          | 46.0              | 3.3                        | 136.5                       | 200             |

**Table 3-4-4** Ch.6 (2437MHz) OFDM **RX** mode (LCD: CFRP Aluminum)

| Frequency<br>(MHz) | Polarity<br>(H/V) | Measured<br>(dBμV) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(μV/m) | Limit<br>(μV/m) |
|--------------------|-------------------|--------------------|-----------------------------|-------------------------|-------------------------------|-------------------|----------------------------|-----------------------------|-----------------|
| 58.839             | V                 | 46.6               | 9.8                         | -26.7                   | 29.7                          | 40.0              | 10.3                       | 30.5                        | 100             |
| 199.107            | H                 | 46.5               | 14.2                        | -24.2                   | 36.5                          | 43.5              | 7.0                        | 66.8                        | 150             |
| 241.853            | V                 | 48.1               | 12.2                        | -23.3                   | 37.0                          | 46.0              | 9.0                        | 70.8                        | 200             |
| 288.021            | H                 | 43.9               | 14.2                        | -22.3                   | 35.8                          | 46.0              | 10.2                       | 61.7                        | 200             |
| 427.273            | V                 | 43.6               | 16.4                        | -20.4                   | 39.6                          | 46.0              | 6.4                        | 95.5                        | 200             |
| 798.878            | H                 | 39.9               | 21.8                        | -19.0                   | 42.7                          | 46.0              | 3.3                        | 136.5                       | 200             |

### 3.4.2 EUT in 5.2GHz OFDM mode

**Table 3-4-5** Ch.36 (5180MHz) OFDM 6Mbps **TX** mode (LCD: ABS)

| Frequency<br>(MHz) | Polarity<br>(H/V) | Measured<br>(dBμV) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(μV/m) | Limit<br>(μV/m) |
|--------------------|-------------------|--------------------|-----------------------------|-------------------------|-------------------------------|-------------------|----------------------------|-----------------------------|-----------------|
| 182.046            | H                 | 43.3               | 13.1                        | -24.5                   | 31.9                          | 43.5              | 11.6                       | 39.4                        | 150             |
| 243.455            | V                 | 48.5               | 12.3                        | -23.3                   | 37.5                          | 46.0              | 8.5                        | 75.0                        | 200             |
| 365.565            | V                 | 44.3               | 15.2                        | -20.9                   | 38.6                          | 46.0              | 7.4                        | 85.1                        | 200             |
| 426.443            | V                 | 47.4               | 16.4                        | -20.6                   | 43.2                          | 46.0              | 2.8                        | 144.5                       | 200             |
| 700.008            | H                 | 31.9               | 21.2                        | -19.4                   | 33.7                          | 46.0              | 12.3                       | 48.4                        | 200             |
| 799.630            | V                 | 41.0               | 21.8                        | -19.0                   | 43.8                          | 46.0              | 2.2                        | 154.9                       | 200             |

**Table 3-4-6** Ch.64 (5320MHz) OFDM 6Mbps **TX** mode (LCD: ABS)

| Frequency<br>(MHz) | Polarity<br>(H/V) | Measured<br>(dBμV) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(μV/m) | Limit<br>(μV/m) |
|--------------------|-------------------|--------------------|-----------------------------|-------------------------|-------------------------------|-------------------|----------------------------|-----------------------------|-----------------|
| 242.943            | V                 | 46.9               | 12.2                        | -23.3                   | 35.8                          | 46.0              | 10.2                       | 61.7                        | 200             |
| 365.566            | V                 | 44.4               | 15.2                        | -20.9                   | 38.7                          | 46.0              | 7.3                        | 86.1                        | 200             |
| 424.768            | V                 | 47.3               | 16.4                        | -21.0                   | 42.7                          | 46.0              | 3.3                        | 136.5                       | 200             |
| 485.439            | V                 | 37.7               | 18.0                        | -21.1                   | 34.6                          | 46.0              | 11.4                       | 53.7                        | 200             |
| 700.008            | V                 | 32.8               | 21.2                        | -19.4                   | 34.6                          | 46.0              | 11.4                       | 53.7                        | 200             |
| 799.022            | V                 | 39.5               | 21.8                        | -19.0                   | 42.3                          | 46.0              | 3.7                        | 130.3                       | 200             |

**Table 3-4-7** Ch.52 (5260MHz) OFDM **RX** mode (LCD: ABS)

| Frequency<br>(MHz) | Polarity<br>(H/V) | Measured<br>(dBμV) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(μV/m) | Limit<br>(μV/m) |
|--------------------|-------------------|--------------------|-----------------------------|-------------------------|-------------------------------|-------------------|----------------------------|-----------------------------|-----------------|
| 182.273            | H                 | 41.3               | 13.1                        | -24.3                   | 30.1                          | 43.5              | 13.4                       | 32.0                        | 150             |
| 243.456            | V                 | 49.3               | 12.3                        | -23.3                   | 38.3                          | 46.0              | 7.7                        | 82.2                        | 200             |
| 365.632            | V                 | 42.9               | 15.2                        | -20.6                   | 37.5                          | 46.0              | 8.5                        | 75.0                        | 200             |
| 426.430            | V                 | 47.5               | 16.4                        | -20.6                   | 43.3                          | 46.0              | 2.7                        | 146.2                       | 200             |
| 701.573            | V                 | 29.9               | 21.2                        | -19.3                   | 31.8                          | 46.0              | 14.2                       | 38.9                        | 200             |
| 799.022            | V                 | 39.4               | 21.8                        | -19.0                   | 42.2                          | 46.0              | 3.8                        | 128.8                       | 200             |

### 3.4.3 EUT in 5.8GHz OFDM mode

**Table 3-4-8** Ch.157 (5785MHz) OFDM 6Mbps **TX** mode (LCD: ABS)

| Frequency<br>(MHz) | Polarity<br>(H/V) | Measured<br>(dBμV) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(μV/m) | Limit<br>(μV/m) |
|--------------------|-------------------|--------------------|-----------------------------|-------------------------|-------------------------------|-------------------|----------------------------|-----------------------------|-----------------|
| 243.456            | V                 | 49.0               | 12.3                        | -23.3                   | 38.0                          | 46.0              | 8.0                        | 79.4                        | 200             |
| 364.064            | V                 | 42.3               | 15.2                        | -21.3                   | 36.2                          | 46.0              | 9.8                        | 64.6                        | 200             |
| 426.463            | V                 | 47.3               | 16.4                        | -20.6                   | 43.1                          | 46.0              | 2.9                        | 142.9                       | 200             |
| 546.048            | V                 | 34.6               | 18.6                        | -20.4                   | 32.8                          | 46.0              | 13.2                       | 43.7                        | 200             |
| 700.009            | H                 | 33.6               | 21.2                        | -19.4                   | 35.4                          | 46.0              | 10.6                       | 58.9                        | 200             |
| 796.815            | V                 | 40.6               | 21.8                        | -18.9                   | 43.5                          | 46.0              | 2.5                        | 149.6                       | 200             |

**Table 3-4-9** Ch.157 (5785MHz) OFDM **RX** mode (LCD: ABS)

| Frequency<br>(MHz) | Polarity<br>(H/V) | Measured<br>(dBμV) | Antenna<br>Factor<br>(dB/m) | Corr.<br>Factor<br>(dB) | Field<br>Strength<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>to limit<br>(dB) | Field<br>Strength<br>(μV/m) | Limit<br>(μV/m) |
|--------------------|-------------------|--------------------|-----------------------------|-------------------------|-------------------------------|-------------------|----------------------------|-----------------------------|-----------------|
| 243.489            | V                 | 47.7               | 12.3                        | -23.3                   | 36.7                          | 46.0              | 9.3                        | 68.4                        | 200             |
| 364.320            | V                 | 40.8               | 15.2                        | -21.3                   | 34.7                          | 46.0              | 11.3                       | 54.3                        | 200             |
| 426.430            | V                 | 47.9               | 16.4                        | -20.6                   | 43.7                          | 46.0              | 2.3                        | 153.1                       | 200             |
| 546.016            | V                 | 34.6               | 18.6                        | -20.4                   | 32.8                          | 46.0              | 13.2                       | 43.7                        | 200             |
| 700.009            | V                 | 34.3               | 21.2                        | -19.4                   | 36.1                          | 46.0              | 9.9                        | 63.8                        | 200             |
| 799.182            | V                 | 39.6               | 21.8                        | -19.0                   | 42.4                          | 46.0              | 3.6                        | 131.8                       | 200             |

## 4. AC Wireline Conducted Emissions (150KHz – 30MHz)

**Subpart C / DSSS** [ FCC 15.207, RSS-210 6.6 / 7.4 ]  
**Subpart E** [ FCC 15.207/ 15.407(b)(5) ]  
**LELAN** [ RSS-210 6.2.2(q1)(v) / 6.6 / 7.4 ]

### 4.1 Test Procedure

The conducted emissions are measured in the IBM shielded room with a spectrum analyzer in peak hold. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

### 4.2 Test Instruments and Measurement Setup

**Table 4-1.** Conducted Emission Test Instrumentation

| Description                                                                                                                                                      | Model                               | Serial Number                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------------------------------------|
| Computer                                                                                                                                                         | IBM 6589-13J                        | 97-15613                                     |
| Spectrum Analyzer (100Hz-1.5GHz)                                                                                                                                 | HP 85680B                           | 2732A03651                                   |
| Spectrum Analyzer Display                                                                                                                                        | HP 85662A                           | 2648A15255                                   |
| Quasi-Peak Adapter                                                                                                                                               | HP 85650A                           | 2521A00968                                   |
| Receiver (9kHz-30MHz)                                                                                                                                            | R&S ESH3                            | 891806/012                                   |
| LISN                                                                                                                                                             | EMCO 3810/2NM                       | 00022007                                     |
| Switch/control unit                                                                                                                                              | HP 3488A                            | 2719A17228                                   |
| Plotter                                                                                                                                                          | HP 7550A                            | 2631A33619                                   |
| Coax cables:<br>- Lisen-L <=> SW/Con.unit (SW100)<br>- Lisen-N <=> SW/Con.unit (SW101)<br>- SW/Con.unit <=> RCVR (Input)<br>- SW/Con.unit<=> Spe Ana.(Signal In) | Length:<br>4 m<br>4 m<br>1 m<br>1 m | - EMIC-L<br>- EMIC-N<br>- EMIC-R<br>- EMIC-S |

Notes: - HP: Hewlett Packard, R&S: Rohde & Schwarz

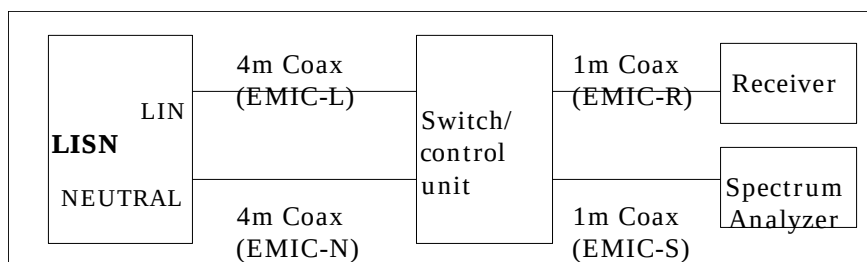


Figure 4. Cables for Conducted Emission Test

### 4.3 Powerline Voltage Calculation

The powerline voltage is calculated by adding insertion losses of LISN, Cable, Switch control unit and Pulse limiter to the measured reading. All factors are included in the reported data.

$$PV = R + CORR$$

where:

PV = Powerline Voltage (dBμV)

R = Measured Receiver Input Amplitude (dBμV)

CORR = Correction Factor (dB) = LL+CL+SWL+PLL

LL = Insertion loss of LISN (dB)

CL = Insertion loss of Cable (dB)

SWL = Insertion loss of Switch control unit (dB)

PLL = Insertion loss of Pulse Limiter (dB)

Given a Receiver input reading of 50.0 dBμV, LISN loss of 0.6 dB, Cable loss of 0.1dB, Switch control unit loss of 0.1dB and Pulse limiter loss of 0.2dB. The Powerline Voltage of the measured emission is:

$$CORR = 0.6 + 0.1 + 0.1 + 0.2 = 1.0 \text{ (dB)}$$

$$PV = 50.0 + 1.0 = 51.0 \text{ (dBμV)}$$

## 4.4 Measurement Results

The same worst cases selected for the previous Chapter 2 were tested with the co-located Bluetooth device (FCC ID: MCLJ07M081, IC: 2878D-J07H081) in active and transmitting simultaneously.

The EUT was found to comply to the limits of FCC Part 15 Subpart C & E and RSS-210 with a margin of 16.6dB. The 6 highest emissions relative to the limits are reported.

Test Date: August 9, 2005

### 4.4.1 EUT in 2.4GHz DSSS/OFDM modes

**Table 4-4-1** Ch.11 (2462MHz) DSSS 11Mbps **TX** mode (LCD: CFRP Aluminum)

| Frq.<br>(MHz) | QP                            |                         |                                | AV                            |                         |                                | CISPR22<br>QP Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | CISPR22<br>AV Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | Phase   |
|---------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|----------------------------|-------------------------------|----------------------------|---------|
|               | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) |                               |                            |                               |                            |         |
| 0.1781        | 47.1                          | 0.5                     | 47.6                           | 22.8                          | 0.5                     | 23.3                           | 64.6                          | 17.0                       | 54.6                          | 31.3                       | Neutral |
| 0.3884        | 38.0                          | 0.6                     | 38.6                           | 22.5                          | 0.6                     | 23.1                           | 58.1                          | 19.5                       | 48.1                          | 25.0                       | Neutral |
| 0.4557        | 36.4                          | 0.6                     | 37.0                           | 21.1                          | 0.6                     | 21.7                           | 56.8                          | 19.8                       | 46.8                          | 25.1                       | Line    |
| 0.5420        | 34.9                          | 0.6                     | 35.5                           | 20.4                          | 0.6                     | 21.0                           | 56.0                          | 20.5                       | 46.0                          | 25.0                       | Neutral |
| 6.5318        | 32.3                          | 1.0                     | 33.3                           | 22.7                          | 1.0                     | 23.7                           | 60.0                          | 26.7                       | 50.0                          | 26.3                       | Neutral |
| 15.8291       | 29.6                          | 1.5                     | 31.1                           | 22.8                          | 1.5                     | 24.3                           | 60.0                          | 28.9                       | 50.0                          | 25.7                       | Neutral |

**Table 4-4-2** Ch.1 (2412MHz) OFDM 6Mbps **TX** mode (LCD: CFRP Aluminum)

| Frq.<br>(MHz) | QP                            |                         |                                | AV                            |                         |                                | CISPR22<br>QP Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | CISPR22<br>AV Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | Phase   |
|---------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|----------------------------|-------------------------------|----------------------------|---------|
|               | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) |                               |                            |                               |                            |         |
| 0.1817        | 47.2                          | 0.5                     | 47.7                           | 29.4                          | 0.5                     | 29.9                           | 64.4                          | 16.7                       | 54.4                          | 24.5                       | Neutral |
| 0.3027        | 35.3                          | 0.6                     | 35.9                           | 20.3                          | 0.6                     | 20.9                           | 60.2                          | 24.3                       | 50.2                          | 29.3                       | Line    |
| 0.4509        | 35.5                          | 0.6                     | 36.1                           | 20.6                          | 0.6                     | 21.2                           | 56.9                          | 20.8                       | 46.9                          | 25.7                       | Line    |
| 0.6536        | 33.3                          | 0.6                     | 33.9                           | 16.8                          | 0.6                     | 17.4                           | 56.0                          | 22.1                       | 46.0                          | 28.6                       | Neutral |
| 1.5010        | 29.9                          | 0.6                     | 30.5                           | 15.8                          | 0.6                     | 16.4                           | 56.0                          | 25.5                       | 46.0                          | 29.6                       | Neutral |
| 16.9405       | 29.9                          | 1.6                     | 31.5                           | 22.9                          | 1.6                     | 24.5                           | 60.0                          | 28.5                       | 50.0                          | 25.5                       | Neutral |

**Table 4-4-3** Ch.6 (2437MHz) DSSS **RX** mode (LCD: CFRP Aluminum)

| Frq.<br>(MHz) | QP                            |                         |                                | AV                            |                         |                                | CISPR22<br>QP Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | CISPR22<br>AV Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | Phase   |
|---------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|----------------------------|-------------------------------|----------------------------|---------|
|               | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) |                               |                            |                               |                            |         |
| 0.1771        | 45.6                          | 0.5                     | 46.1                           | 21.3                          | 0.5                     | 21.8                           | 64.6                          | 18.5                       | 54.6                          | 32.8                       | Neutral |
| 0.3136        | 36.2                          | 0.6                     | 36.8                           | 20.8                          | 0.6                     | 21.4                           | 59.9                          | 23.1                       | 49.9                          | 28.5                       | Line    |
| 0.4526        | 35.6                          | 0.6                     | 36.2                           | 20.9                          | 0.6                     | 21.5                           | 56.8                          | 20.6                       | 46.8                          | 25.3                       | Line    |
| 0.8223        | 31.2                          | 0.6                     | 31.8                           | 14.0                          | 0.6                     | 14.6                           | 56.0                          | 24.2                       | 46.0                          | 31.4                       | Neutral |
| 1.3069        | 30.3                          | 0.6                     | 30.9                           | 15.2                          | 0.6                     | 15.8                           | 56.0                          | 25.1                       | 46.0                          | 30.2                       | Neutral |
| 6.4862        | 32.9                          | 1.0                     | 33.9                           | 23.0                          | 1.0                     | 24.0                           | 60.0                          | 26.1                       | 50.0                          | 26.0                       | Neutral |



**Table 4-4-4** Ch.6 (2437MHz) OFDM **RX** mode (LCD: CFRP Aluminum)

| Frq.<br>(MHz) | QP                            |                         |                                | AV                            |                         |                                | CISPR22<br>QP Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | CISPR22<br>AV Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | Phase   |
|---------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|----------------------------|-------------------------------|----------------------------|---------|
|               | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) |                               |                            |                               |                            |         |
| 0.1826        | 47.0                          | 0.5                     | 47.5                           | 30.0                          | 0.5                     | 30.5                           | 64.4                          | 16.9                       | 54.4                          | 23.9                       | Neutral |
| 0.3032        | 35.4                          | 0.6                     | 36.0                           | 20.5                          | 0.6                     | 21.1                           | 60.2                          | 24.2                       | 50.2                          | 29.1                       | Line    |
| 0.4674        | 36.8                          | 0.6                     | 37.4                           | 19.2                          | 0.6                     | 19.8                           | 56.6                          | 19.2                       | 46.6                          | 26.8                       | Neutral |
| 0.6720        | 34.5                          | 0.6                     | 35.1                           | 20.7                          | 0.6                     | 21.3                           | 56.0                          | 20.9                       | 46.0                          | 24.7                       | Neutral |
| 6.4318        | 33.8                          | 1.0                     | 34.8                           | 23.8                          | 1.0                     | 24.8                           | 60.0                          | 25.2                       | 50.0                          | 25.2                       | Neutral |
| 16.0506       | 29.8                          | 1.6                     | 31.4                           | 23.4                          | 1.6                     | 25.0                           | 60.0                          | 28.6                       | 50.0                          | 25.0                       | Neutral |

## 4.4.2 EUT in 5.2GHz OFDM mode

**Table 4-4-5** Ch.36 (5180MHz) OFDM 6Mbps **TX** mode (LCD: ABS)

| Frq.<br>(MHz) | QP                            |                         |                                | AV                            |                         |                                | CISPR22<br>QP Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | CISPR22<br>AV Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | Phase   |
|---------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|----------------------------|-------------------------------|----------------------------|---------|
|               | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) |                               |                            |                               |                            |         |
| 0.1774        | 45.6                          | 0.5                     | 46.1                           | 22.1                          | 0.5                     | 22.6                           | 64.6                          | 18.5                       | 54.6                          | 32.0                       | Line    |
| 0.3017        | 35.4                          | 0.6                     | 36.0                           | 19.5                          | 0.6                     | 20.1                           | 60.2                          | 24.2                       | 50.2                          | 30.1                       | Line    |
| 0.3914        | 37.7                          | 0.6                     | 38.3                           | 22.4                          | 0.6                     | 23.0                           | 58.0                          | 19.7                       | 48.0                          | 25.0                       | Neutral |
| 0.4816        | 34.5                          | 0.6                     | 35.1                           | 16.8                          | 0.6                     | 17.4                           | 56.3                          | 21.2                       | 46.3                          | 28.9                       | Line    |
| 1.1345        | 31.0                          | 0.6                     | 31.6                           | 16.6                          | 0.6                     | 17.2                           | 56.0                          | 24.4                       | 46.0                          | 28.8                       | Neutral |
| 6.4878        | 32.7                          | 1.0                     | 33.7                           | 23.3                          | 1.0                     | 24.3                           | 60.0                          | 26.3                       | 50.0                          | 25.7                       | Neutral |

**Table 4-4-6** Ch.64 (5320MHz) OFDM 6Mbps **TX** mode (LCD: ABS)

| Frq.<br>(MHz) | QP                            |                         |                                | AV                            |                         |                                | CISPR22<br>QP Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | CISPR22<br>AV Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | Phase   |
|---------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|----------------------------|-------------------------------|----------------------------|---------|
|               | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) |                               |                            |                               |                            |         |
| 0.1824        | 47.3                          | 0.5                     | 47.8                           | 30.0                          | 0.5                     | 30.5                           | 64.4                          | 16.6                       | 54.4                          | 23.9                       | Line    |
| 0.3248        | 37.0                          | 0.6                     | 37.6                           | 22.1                          | 0.6                     | 22.7                           | 59.6                          | 22.0                       | 49.6                          | 26.9                       | Line    |
| 0.4548        | 35.4                          | 0.6                     | 36.0                           | 19.6                          | 0.6                     | 20.2                           | 56.8                          | 20.8                       | 46.8                          | 26.6                       | Line    |
| 0.8492        | 31.9                          | 0.6                     | 32.5                           | 17.4                          | 0.6                     | 18.0                           | 56.0                          | 23.5                       | 46.0                          | 28.0                       | Neutral |
| 6.5346        | 32.7                          | 1.0                     | 33.7                           | 23.3                          | 1.0                     | 24.3                           | 60.0                          | 26.3                       | 50.0                          | 25.7                       | Neutral |
| 16.9842       | 28.4                          | 1.6                     | 30.0                           | 21.8                          | 1.6                     | 23.4                           | 60.0                          | 30.0                       | 50.0                          | 26.6                       | Neutral |

**Table 4-4-7** Ch.52 (5260MHz) OFDM **RX** mode (LCD: ABS)

| Frq.<br>(MHz) | QP                            |                         |                                | AV                            |                         |                                | CISPR22<br>QP Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | CISPR22<br>AV Limit<br>(dBμV) | Margin<br>to limit<br>(dB) | Phase   |
|---------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|-------------------------|--------------------------------|-------------------------------|----------------------------|-------------------------------|----------------------------|---------|
|               | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) | Measured<br>Reading<br>(dBμV) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dBμV) |                               |                            |                               |                            |         |
| 0.1819        | 47.3                          | 0.5                     | 47.8                           | 29.6                          | 0.5                     | 30.1                           | 64.4                          | 16.6                       | 54.4                          | 24.3                       | Neutral |
| 0.3213        | 36.8                          | 0.6                     | 37.4                           | 21.6                          | 0.6                     | 22.2                           | 59.7                          | 22.3                       | 49.7                          | 27.5                       | Line    |
| 0.4822        | 34.3                          | 0.6                     | 34.9                           | 17.4                          | 0.6                     | 18.0                           | 56.3                          | 21.4                       | 46.3                          | 28.3                       | Line    |
| 0.7779        | 31.5                          | 0.6                     | 32.1                           | 16.5                          | 0.6                     | 17.1                           | 56.0                          | 23.9                       | 46.0                          | 28.9                       | Neutral |
| 1.0478        | 30.2                          | 0.6                     | 30.8                           | 15.9                          | 0.6                     | 16.5                           | 56.0                          | 25.2                       | 46.0                          | 29.5                       | Neutral |
| 6.4155        | 32.7                          | 1.0                     | 33.7                           | 23.5                          | 1.0                     | 24.5                           | 60.0                          | 26.3                       | 50.0                          | 25.5                       | Neutral |

### 4.4.3 EUT in 5.8GHz OFDM mode

**Table 4-4-8** Ch.157 (5785MHz) OFDM 6Mbps **TX** mode (LCD: ABS)

| Frq.<br>(MHz) | QP                                  |                         |                                      | AV                                  |                         |                                      | CISPR22<br>QP Limit<br>(dB $\mu$ V) | Margin<br>to limit<br>(dB) | CISPR22<br>AV Limit<br>(dB $\mu$ V) | Margin<br>to limit<br>(dB) | Phase   |
|---------------|-------------------------------------|-------------------------|--------------------------------------|-------------------------------------|-------------------------|--------------------------------------|-------------------------------------|----------------------------|-------------------------------------|----------------------------|---------|
|               | Measured<br>Reading<br>(dB $\mu$ V) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dB $\mu$ V) | Measured<br>Reading<br>(dB $\mu$ V) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dB $\mu$ V) |                                     |                            |                                     |                            |         |
| 0.1783        | 44.0                                | 0.5                     | 44.5                                 | 20.8                                | 0.5                     | 21.3                                 | 64.6                                | 20.1                       | 54.6                                | 33.3                       | Neutral |
| 0.4248        | 36.1                                | 0.6                     | 36.7                                 | 22.5                                | 0.6                     | 23.1                                 | 57.4                                | 20.7                       | 47.4                                | 24.3                       | Line    |
| 0.4979        | 34.6                                | 0.6                     | 35.2                                 | 18.2                                | 0.6                     | 18.8                                 | 56.0                                | 20.8                       | 46.0                                | 27.2                       | Neutral |
| 0.7818        | 33.2                                | 0.6                     | 33.8                                 | 20.7                                | 0.6                     | 21.3                                 | 56.0                                | 22.2                       | 46.0                                | 24.7                       | Neutral |
| 1.5559        | 31.2                                | 0.6                     | 31.8                                 | 17.5                                | 0.6                     | 18.1                                 | 56.0                                | 24.2                       | 46.0                                | 27.9                       | Neutral |
| 4.6144        | 30.1                                | 0.7                     | 30.8                                 | 16.5                                | 0.7                     | 17.2                                 | 56.0                                | 25.2                       | 46.0                                | 28.8                       | Line    |

**Table 4-4-9** Ch.157 (5785MHz) OFDM **RX** mode (LCD: ABS)

| Frq.<br>(MHz) | QP                                  |                         |                                      | AV                                  |                         |                                      | CISPR22<br>QP Limit<br>(dB $\mu$ V) | Margin<br>to limit<br>(dB) | CISPR22<br>AV Limit<br>(dB $\mu$ V) | Margin<br>to limit<br>(dB) | Phase   |
|---------------|-------------------------------------|-------------------------|--------------------------------------|-------------------------------------|-------------------------|--------------------------------------|-------------------------------------|----------------------------|-------------------------------------|----------------------------|---------|
|               | Measured<br>Reading<br>(dB $\mu$ V) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dB $\mu$ V) | Measured<br>Reading<br>(dB $\mu$ V) | Corr.<br>Factor<br>(dB) | Powerline<br>Voltage<br>(dB $\mu$ V) |                                     |                            |                                     |                            |         |
| 0.1820        | 47.3                                | 0.5                     | 47.8                                 | 29.4                                | 0.5                     | 29.9                                 | 64.4                                | 16.6                       | 54.4                                | 24.5                       | Neutral |
| 0.3102        | 36.1                                | 0.6                     | 36.7                                 | 20.1                                | 0.6                     | 20.7                                 | 60.0                                | 23.3                       | 50.0                                | 29.3                       | Line    |
| 0.4896        | 34.5                                | 0.6                     | 35.1                                 | 17.1                                | 0.6                     | 17.7                                 | 56.2                                | 21.1                       | 46.2                                | 28.5                       | Line    |
| 0.6533        | 32.9                                | 0.6                     | 33.5                                 | 16.8                                | 0.6                     | 17.4                                 | 56.0                                | 22.5                       | 46.0                                | 28.6                       | Neutral |
| 1.1353        | 30.8                                | 0.6                     | 31.4                                 | 16.6                                | 0.6                     | 17.2                                 | 56.0                                | 24.6                       | 46.0                                | 28.8                       | Neutral |
| 6.4981        | 33.1                                | 1.0                     | 34.1                                 | 23.4                                | 1.0                     | 24.4                                 | 60.0                                | 25.9                       | 50.0                                | 25.6                       | Neutral |