

Emission Test Report
Standard: FCC Part 15 Subpart C / IC RSS-210
(Class II Permissive Change)

Document Number : FCC 19-0277-0

Model Number: T60H786-U

measured with IBM ThinkPad G40 Series

FCC ID: ANO20030500CMR
IC: 349E-T60H786U

September 1, 2004

**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

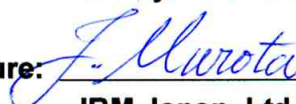
Fax: +81-46-273-7420

E-Mail: asano@jp.ibm.com

**Reviewed and Checked :
EMC Advisory R&D Engineer**

Toshiya Murota

Signature:



IBM Japan, Ltd.

EMC Engineering

LAB-S59

1623-14, Shimotsuruma,

Yamato-shi Kanagawa-ken 242, Japan

Phone: +81-46-215-6574

Fax: +81-46-273-7420

E-Mail: murota@jp.ibm.com

**Approved :
Manager, EMC Engineering
/ 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

MEASUREMENT / TECHNICAL REPORT – Part 15 Subpart C (Intentional Radiator)

Model: T60H786-U (802.11b/g Wireless LAN Adapter)
with
IBM ThinkPad G40 Series
(Machine Type: 2384, 2387, 2388, 2389, 2881, 2882, 2886)

FCC ID : ANO20030500CMR

September 1, 2004

This report concerns: (check one) Original Grant _____ Class I change _____ Class II change <u> ✓ </u>
Equipment type: <u>Wireless LAN device</u>
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The measurement results contained in this report relate only to the item which was tested.
Measurement procedure used is ANSI C63.4-2000 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.
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Prepared by: Takeshi Asano IBM Japan Corporation, Yamato EMC Engineering LAB-S59, 1623-14, Shimotsuruma, Yamato-shi Kanagawa-ken 242-8502, Japan Tel: +81-46-215-4779 Fax: +81-46-273-7420

- Index -

A.	General Information	4
A.1	Test Methodology	4
A.2	Test Facility / NVLAP Accreditation.....	4
A.3	EUT details.....	4
B.	Summary of Test Results.....	5
C.	Operation Mode of EUT	6
D.	Justification.....	6
E.	Test Instruments	7
F.	Measurement Uncertainty.....	8
G.	Temperature and Humidity	8
H.	Related Submittal(s)/Grant(s)/Notes	8
1.	AC Wireline Conducted Emissions (150KHz – 30MHz)	9
1.1	Test Procedure	9
1.2	Test Instruments and Measurement Setup.....	9
1.3	Powerline Voltage Calculation	10
1.4	Measurement Results	11
2.	Restricted Bands Radiation (30MHz – 1GHz)	14
2.1	Test Procedure	14
2.2	Test Instruments and Measurement Setup.....	14
2.3	Field Strength Calculation.....	15
2.4	Measurement Results	16
3.	Restricted Bands Radiatio (1GHz – 25GHz)	18
3.1	Test Procedure	18
3.2	Test Instruments and Measurement Setup.....	18
3.3	Field Strength Calculation.....	19
3.4	Measurement Results	20
3.5	Measurement plots of adjacent restricted band.....	24
3.5.1	List of Measurement Results	24
3.5.2	Bandedge Measurement Plots.....	25

A. General Information

APPLICANT : IBM Japan, Ltd.
 TEST SITE : IBM Japan, Ltd., Yamato Semi-anechoic chamber #1
 TEST SITE ADDRESS : 1623 – 14 Shimotsuruma, Yamato-shi, Kanagawa 242-8502 Japan
 Tel: +81-46-215-4779, Fax: +81-46-273-7420
 REGULATION : FCC Part 15 Subpart C
 Industry Canada RSS-210 (Issue No.5)
 MODEL NUMBER : T60H786-U
 (Advertising Name) (IBM 11b/g Wireless LAN Mini PCI Adapter)
 FCC ID : ANO20030500CMR
 IC Certification Number : 349E-T60H786U
 SERIAL NUMBER : DX39105T
 PHYSICAL CONDITION : Preproduction
 KIND OF EQUIPMENT : DTS: IEEE802.11b/g Wireless LAN Mini-PCI card
 TESTED DATE : August 2, 4, 5 and 6, 2004

A.1 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4-2000. Radiated testing was performed at an antenna to EUT distance of 3 meters.

A.2 Test Facility / NVLAP Accreditation

The semi-anechoic chamber #1 used to correct 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).
- 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**)
- These facilities are accepted by **Industry Canada** as number **IC 4221** for chamber #1 (expiry date: January 25, 2005), 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 IC Certification Number	Description
T60H786-U (s/n DX39105T)	FCC ID: ANO20030500CMR IC: 349E-T60H786U	Applying modular transmitter Built_in type IEEE802.11b/g Wireless LAN Mini-PCI card without antenna
ThinkPad G40 Series M/T 2381-4Ax (14") (s/n SIT34007) M/T 2381-4Fx (15") (s/n SIT34028)	N/A	Host equipment IBM Notebook PC with built_in antenna CPU: Intel® Desktop Pentium® Celeron, 2.66GHz
P/N 02K7085	N/A	Universal AC adapter 120W, Unshielded power cord

B. Summary of Test Results

Table-B presents the list of the measurement items for DTS (Digital Transmissions System) devices under FCC Part 15 Subpart C and Industry Canada RSS-210.

The section numbers of upper portion are showing FCC number, and the other (lower) ones are for IC.

Table-B List of the measurements

Section(s)	Test Items : Transmit mode (TX):		Condition	Result
15.247(a)(2) 6.2.2(o) *1	Bandwidth at 6 dB below	At least 500kHz. (*1: RSS-210 Issue5: Amendment)	Conducted	Pass
15.215(c) 5.9.1	Occupied BW (Bandwidth at 20 dB below)	20 dB bandwidth of the emission to be within the allocation band.		Pass
15.247(c) 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.		Pass
15.247(b)(3) 6.2.2(o)(b)	Conducted Peak Transmit Output Power	Shall not exceed 1.0 W.		Pass
15.247(d) 6.2.2(o)(b)	Transmitter power spectral Density	Shall not be greater than 8 dBm in any 3kHz band.		Pass
15.207 6.2.2(o)(e3) / 6.6	AC Wireline Conducted Emissions 150kHz – 30MHz	Class B: Freq.(MHz) QP(dBμV) Ave.(dBμV) 0.15 - 0.5 66 - 56 56 - 46 0.5 - 5 56 46 5 - 30 60 50	EMI Conducted	Pass
15.205 / 209 6.2.1 /6.2.2(o)(e3) /6.3	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Shall not exceed the limits specified in FCC 15.209 or RSS-210 Table3.	EMI Radiated (30MHz-1GHz)	Pass
			EMI Radiated (1– 25GHz)	Pass

	Test Items : Receive mode (RX):			
15.207 6.2.2(o)(e3) / 7.4	AC Wireline Conducted Emissions 150kHz – 30MHz	Class B: Freq.(MHz) QP(dBμV) Ave.(dBμV) 0.15 - 0.5 66 - 56 56 - 46 0.5 - 5 56 46 5 - 30 60 50	EMI Conducted	Pass
15.205 / 209 6.2.1 /6.2.2(o)(e3) /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.	EMI Radiated (30MHz -1GHz)	Pass
			EMI Radiated (1– 25GHz)	Pass

	Other requirements		Result
15.247(b)(4)(i) –	Antenna gain	Peak gain of the device : 0.87 dBi in 2.4GHz band	N/A
– 5.2	Supply Voltage	Main power source: Universal AC adapter 120W Mini-PCI PC bus to applying card : DC 3.3V ± 0.3V	N/A
15.203 6.2.2(o)(e2)	Unique antenna connector	The device employs an unique electronic connector so called BIOS Lock . Refer to “Confidential_BIOS_Lock” exhibit.	complies

C. Operation Mode of EUT

1. All tests were performed using the “Atheros Radio Test” program. This tool supports the continuous transmission mode for the testing purpose.
2. The following frequencies were chosen for the transmission measurements.
- 2412MHz (lowest), 2437MHz(middle), and 2462MHz (highest)
3. As for the RF receiving test, the middle channels (2437MHz) were selected representatively.

Table-C Transmission mode of EUT

Operation Frequency [GHz]	Rated output power (conducted) [dBm]										
	IEEE802.11b			IEEE802.11g							
	1/2M bps	5.5M bps	11M bps	6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
2.412 (Ch. 1)	+17	+17	+17	+14	+14	+14	+14	+14	+14	+14	+13
2.417 (Ch. 2)	+17	+17	+17	+17	+17	+17	+17	+17	+17	+15	+13
2.422 (Ch. 3)	+17	+17	+17	+17	+17	+17	+17	+17	+17	+15	+13
2.427 (Ch. 4)	+17	+17	+17	+17	+17	+17	+17	+17	+17	+15	+13
2.432 (Ch. 5)	+17	+17	+17	+17	+17	+17	+17	+17	+17	+15	+13
2.437 (Ch. 6)	+17	+17	+17	+17	+17	+17	+17	+17	+17	+15	+13
2.442 (Ch. 7)	+17	+17	+17	+17	+17	+17	+17	+17	+17	+15	+13
2.447 (Ch. 8)	+17	+17	+17	+17	+17	+17	+17	+17	+17	+15	+13
2.452 (Ch. 9)	+17	+17	+17	+17	+17	+17	+17	+17	+17	+15	+13
2.457 (Ch. 10)	+17	+17	+17	+17	+17	+17	+17	+17	+17	+15	+13
2.462 (Ch. 11)	+17	+17	+17	+14	+14	+14	+14	+14	+14	+14	+13

D. Justification

- The test results for conducted measurements were not changed from the certified values of previous grants (December/19/2003, March/24/2004 and May/04/2004), because neither hardware nor electrical modification was made to the applying modular transmitter itself.
Therefore this test report contains the EMI conducted and radiated measurement results only that tend to be affected by a change of antenna or host device.
- The EUT was investigated for both main (left) and auxiliary (right) antennas on each LCD 14 or 15 inch model. The worse case data taken in this report represents the measurement results of LCD 14 inch model with the auxiliary antenna for 2.4GHz band that have comparatively higher gain as shown by the Table-D below.
The actual highest emissions taken in this report were found at 11Mbps for 2.4GHz DSSS and 18Mbps for 2.4GHz OFDM transmission mode.
Refer to the Chapter 3.5 concerning the evaluation of the worst emission case.

Table-D Peak Antenna Gains of EUT

		14” model	15” model
2.4GHz band	Main Antenna gain	-0.25 dBi (peak)	0.18 dBi (peak)
	Auxiliary Antenna gain	0.87 dBi (peak)	0.52 dBi (peak)

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	2601A02634	09/09/03	1 year
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2732A03651	07/21/04	1 year
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2841A04254	08/25/03	1 year
Spectrum Analyzer Display	HP 85662A	2542A12308	09/09/03	1 year
Spectrum Analyzer Display	HP 85662A	2648A15255	07/21/04	1 year
Spectrum Analyzer Display	HP 85662A	2816A16831	08/25/03	1 year
Quasi-Peak Adapter	HP 85650A	2043A00062	09/09/03	1 year
Quasi-Peak Adapter	HP 85650A	2521A00968	07/20/04	1 year
Quasi-Peak Adapter	HP 85650A	2811A01156	08/25/03	1 year
Amplifier (100KHz - 1.3GHz)				
- for 30-200MHz	MITEQ AM-3A	898433	04/23/04	1 year
- for 200-1000MHz	MITEQ AM-3A	898432	04/23/04	1 year
Amplifier (1GHz - 18GHz)	HP 8449B	3008A00582	06/01/04	1 year
Amplifier (18 – 40GHz)	Agilent 83051A	3950M00193	01/27/04	1 year
Spectrum Analyzer EMI Test Receiver	R&S ESI26	836119/003	05/10/04	1 year
Receiver (9kHz-30MHz)	R&S ESH3	891806/012	10/17/03	1 year
Receiver (20MHz-1.3GHz)	R&S ESVP	893202/018	02/10/04	1 year
Biconical Antenna (30-200MHz)	EMCO 3108	2536	04/23/04	1 year
Log-Periodic Antenna (200-1000MHz)	EMCO 3146	2849	04/23/04	1 year
Horn Antenna (1- 18GHz)	EMCO 3115	9903-5774	07/20/04	1 year
Horn Antenna (3.95- 5.85GHz)	EMCO 3160-5	1099	07/20/04	1 year
Horn Antenna (5.85- 8.20GHz)	EMCO 3160-6	9712-1044	07/20/04	1 year
Horn Antenna (18- 26.5GHz)	EMCO 3160-9	0004-1202	07/20/04	1 year
LISN	EMCO 3810/2NM	00022007	06/15/04	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	03/25/04	1 year
- RF Amp.<=>Spectrum Analyzer	16m	- GEM0101	03/25/04	1 year
Coaxial cables (18 – 25GHz):				
- Horn Ant <=> RF Amp.	3m	- SF102-20167	04/08/04	1 year
- RF Amp.<=>Spectrum Analyzer	1m	- SF102-21105	04/08/04	1 year
N-Coax cables:				
- Bi-coni Ant <=> 10m Cable	9 m	- EM103L01	04/23/04	1 year
- 10m Cable <=> Shield Panel	10 m	- EM103L02	04/23/04	1 year
- Shield Panel <=> RF Amp	7 m	- EM103L03	04/23/04	1 year
- RF Amp <=> Power Splitter	0.5m	- EM103L04	04/23/04	1 year
- Log-peri Ant <=> 10m Cable	9 m	- EM103H01	04/23/04	1 year
- 10m Cable <=> Shield Panel	10 m	- EM103H02	04/23/04	1 year

- Shield Panel <=> RF Amp	7 m	- EM103H03	04/23/04	1 year
- RF Amp <=> Power Splitter	0.5m	- EM103H04	04/23/04	1 year
Coax cables:				
- Lisen-L <=> SW/Con.unit (SW100)	4 m	- EMIC-L	04/23/04	1 year
- Lisen-N <=> SW/Con.unit (SW101)	4 m	- EMIC-N	04/23/04	1 year
- SW/Con.unit <=> RCVR (Input)	1 m	- EMIC-R	04/23/04	1 year
- SW/Con.unit<=> Spe Ana.(Signal In)	1 m	- EMIC-S	04/23/04	1 year
- Power Splitter <=> SW/Con.unit (SW110)	1 m	- EM103L05	04/23/04	1 year
- Power Splitter <=> SW/Con.unit (SW300)	1 m	- EM103L06	04/23/04	1 year
- Power Splitter <=> SW/Con.unit (SW100)	1 m	- EM103H05	04/23/04	1 year
- Power Splitter <=> SW/Con.unit (SW301)	1 m	- EM103H06	04/23/04	1 year
- SW/Con.unit <=> Receiver (Input)	2 m	- EM1RCV	04/23/04	1 year
- SW/Con.unit <=> Spe Ana.(Signal In) for 30- 200MHz	2 m	- EM1SPL	04/23/04	1 year
- SW/Con.unit <=> Spe Ana.(Signal In) for 200-1000MHz	2 m	- EM1SPH	04/23/04	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.

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

[FCC 15.207, RSS-210 6.6 / 7.4]

1.1 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.

1.2 Test Instruments and Measurement Setup

Table 1-1. Conducted Emission Test Instrumentation

Description	Model	Serial Number
Computer	IBM 6589-13J	97-15613
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2841A04254
Spectrum Analyzer Display	HP 85662A	2816A16831
Quasi-Peak Adapter	HP 85650A	2811A01156
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: - Lisn-L <=> SW/Con.unit (SW100) - Lisn-N <=> SW/Con.unit (SW101) - SW/Con.unit <=> RCVR (Input) - SW/Con.unit<=> Spe Ana.(Signal In)	Length: 4 m 4 m 1 m 1 m	- EMIC-L - EMIC-N - EMIC-R - EMIC-S

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

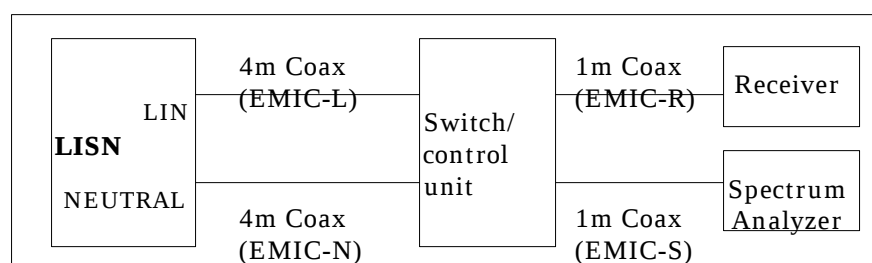


Figure 1. Cables for Conducted Emission Test

1.3 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:

$$PV = \text{Powerline Voltage (dB}\mu\text{V)}$$

$$R = \text{Measured Receiver Input Amplitude (dB}\mu\text{V)}$$

$$CORR = \text{Correction Factor (dB) = LL+CL+SWL+PLL}$$

$$LL = \text{Insertion loss of LISN (dB)}$$

$$CL = \text{Insertion loss of Cable (dB)}$$

$$SWL = \text{Insertion loss of Switch control unit (dB)}$$

$$PLL = \text{Insertion loss of Pulse Limiter (dB)}$$

Given a Receiver input reading of 50.0 dB μ V, 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:

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

$$PV = 50.0 + 1.0 = 51.0 \text{ (dB}\mu\text{V)}$$

1.4 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 6.7dB. The 6 highest emissions relative to the limits are reported.

Test Date: August 6, 2004

1.4.1 EUT in 2.4GHz DSSS transmission mode

The actual highest emissions were found on the auxiliary antenna of ThinkPad G40 Series, LCD 14 inch model.

Table 1-2-1. Ch.1 (2412MHz) **TX** mode 11Mbps

Frequency (MHz)	QP			AV			CISPR22 QP Limit (dB μ V)	CISPR22 AV Limit (dB μ V)	Phase
	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)			
0.4645	37.6	0.6	38.2	36.4	0.6	37.0	56.6	46.6	Neutral
0.5387	33.6	0.6	34.2	31.9	0.6	32.5	56.0	46.0	Neutral
0.6251	34.8	0.6	35.4	34.1	0.6	34.7	56.0	46.0	Neutral
0.8037	34.3	0.6	34.9	32.8	0.6	33.4	56.0	46.0	Neutral
1.7425	31.2	0.6	31.8	29.6	0.6	30.2	56.0	46.0	Neutral
4.2196	33.8	0.7	34.5	31.4	0.7	32.1	56.0	46.0	Line

Table 1-2-2. Ch.6 (2437MHz) **TX** mode 11Mbps

Frequency (MHz)	QP			AV			CISPR22 QP Limit (dB μ V)	CISPR22 AV Limit (dB μ V)	Phase
	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)			
0.4022	37.5	0.6	38.1	33.8	0.6	34.4	57.8	47.8	Neutral
0.4653	38.1	0.6	38.7	36.0	0.6	36.6	56.6	46.6	Neutral
0.5347	36.6	0.6	37.2	34.5	0.6	35.1	56.0	46.0	Neutral
0.6265	34.3	0.6	34.9	33.6	0.6	34.2	56.0	46.0	Neutral
3.6850	32.8	0.7	33.5	28.7	0.7	29.4	56.0	46.0	Line
10.0609	35.6	1.3	36.9	32.2	1.3	33.5	60.0	50.0	Line

Table 1-2-3. Ch.11 (2462MHz) **TX** mode 11Mbps

Frequency (MHz)	QP			AV			CISPR22 QP Limit (dB μ V)	CISPR22 AV Limit (dB μ V)	Phase
	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)			
0.3361	34.4	0.6	35.0	33.0	0.6	33.6	59.3	49.3	Neutral
0.3988	35.9	0.6	36.5	32.1	0.6	32.7	57.9	47.9	Neutral
0.4663	38.9	0.6	39.5	36.9	0.6	37.5	56.6	46.6	Neutral
0.5353	36.6	0.6	37.2	34.6	0.6	35.2	56.0	46.0	Neutral
0.6253	34.5	0.6	35.1	33.9	0.6	34.5	56.0	46.0	Neutral
1.7455	31.4	0.6	32.0	29.7	0.6	30.3	56.0	46.0	Neutral

Table 1-2-4. Ch. 6 (2437MHz) **RX** mode

Frequency (MHz)	QP			AV			CISPR22 QP Limit (dB μ V)	CISPR22 AV Limit (dB μ V)	Phase
	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)			
0.3993	33.8	0.6	34.4	32.4	0.6	33.0	57.9	47.9	Neutral
0.4689	37.5	0.6	38.1	36.9	0.6	37.5	56.5	46.5	Neutral
0.5375	34.3	0.6	34.9	33.5	0.6	34.1	56.0	46.0	Line
0.6269	34.3	0.6	34.9	33.6	0.6	34.2	56.0	46.0	Neutral
0.8053	33.6	0.6	34.2	31.3	0.6	31.9	56.0	46.0	Neutral
3.8300	35.1	0.7	35.8	32.8	0.7	33.5	56.0	46.0	Line

1.4.2 EUT in 2.4GHz OFDM transmission mode

The actual highest emissions were found on the auxiliary antenna of ThinkPad G40 Series, LCD 14 inch model.

Table 1-2-5. Ch.1 (2412MHz) **TX** mode 18Mbps

Frequency (MHz)	QP			AV			CISPR22 QP Limit (dB μ V)	CISPR22 AV Limit (dB μ V)	Phase
	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)			
0.3376	34.4	0.6	35.0	33.0	0.6	33.6	59.3	49.3	Neutral
0.4040	37.3	0.6	37.9	34.1	0.6	34.7	57.8	47.8	Neutral
0.4716	39.9	0.6	40.5	37.9	0.6	38.5	56.5	46.5	Neutral
0.5360	36.2	0.6	36.8	34.2	0.6	34.8	56.0	46.0	Neutral
0.6266	34.3	0.6	34.9	33.4	0.6	34.0	56.0	46.0	Neutral
1.0760	31.7	0.6	32.3	30.0	0.6	30.6	56.0	46.0	Neutral

Table 1-2-6. Ch.6 (2437MHz) **TX** mode 18Mbps

Frequency (MHz)	QP			AV			CISPR22 QP Limit (dB μ V)	CISPR22 AV Limit (dB μ V)	Phase
	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)			
0.3371	34.4	0.6	35.0	33.2	0.6	33.8	59.3	49.3	Neutral
0.4003	35.9	0.6	36.5	32.9	0.6	33.5	57.8	47.8	Neutral
0.4692	40.3	0.6	40.9	39.2	0.6	39.8	56.5	46.5	Neutral
0.5337	34.0	0.6	34.6	31.7	0.6	32.3	56.0	46.0	Neutral
0.6270	34.1	0.6	34.7	33.3	0.6	33.9	56.0	46.0	Neutral
1.4777	31.4	0.6	32.0	29.6	0.6	30.2	56.0	46.0	Neutral

Table 1-2-7. Ch.11 (2462MHz) **TX** mode 18Mbps

Frequency (MHz)	QP			AV			CISPR22 QP Limit (dB μ V)	CISPR22 AV Limit (dB μ V)	Phase
	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)			
0.3345	34.6	0.6	35.2	33.3	0.6	33.9	59.3	49.3	Neutral
0.4012	36.9	0.6	37.5	33.3	0.6	33.9	57.8	47.8	Line
0.4683	40.0	0.6	40.6	38.5	0.6	39.1	56.5	46.5	Neutral
0.5342	35.3	0.6	35.9	32.8	0.6	33.4	56.0	46.0	Neutral
0.6263	34.3	0.6	34.9	33.5	0.6	34.1	56.0	46.0	Neutral
0.7411	32.7	0.6	33.3	30.1	0.6	30.7	56.0	46.0	Neutral

Table 1-2-8. Ch.6 (2437MHz) **RX** mode

Frequency (MHz)	QP			AV			CISPR22 QP Limit (dB μ V)	CISPR22 AV Limit (dB μ V)	Phase
	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)	Measured Reading (dB μ V)	Corr. Factor (dB)	Powerline Voltage (dB μ V)			
0.4000	33.4	0.6	34.0	32.5	0.6	33.1	57.9	47.9	Neutral
0.4686	36.9	0.6	37.5	36.3	0.6	36.9	56.5	46.5	Neutral
0.5390	33.8	0.6	34.4	33.3	0.6	33.9	56.0	46.0	Line
0.6267	34.3	0.6	34.9	33.6	0.6	34.2	56.0	46.0	Neutral
0.8088	33.0	0.6	33.6	30.7	0.6	31.3	56.0	46.0	Neutral
3.6325	35.5	0.7	36.2	32.7	0.7	33.4	56.0	46.0	Line

2. Restricted Bands Radiation (30MHz – 1GHz)

[FCC 15.205 / 209, RSS-210 6.3 / 7.3]

2.1 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.

2.2 Test Instruments and Measurement Setup

Table 2-1 Radiated Emission Test Instrumentation

Description	Model	Serial Number
Computer	IBM 6868-30J	97-901X3
Spectrum Analyzer (100Hz-1.5GHz) for 30-200MHz	HP 85680B	2601A02634
Spectrum Analyzer Display for 30-200MHz	HP 85662A	2542A12308
Quasi-Peak Adapter for 30-200MHz	HP 85650A	2043A00062
Spectrum Analyzer (100Hz-1.5GHz) for 200-1000MHz	HP 85680B	2732A03651
Spectrum Analyzer Display for 200-1000MHz	HP 85662A	2648A15255
Quasi-Peak Adapter for 200-1000MHz	HP 85650A	2521A00968
Amplifier (100KHz-1.3GHz)		
- for 30-200MHz	MITEQ AM-3A	898433
- for 200-1000MHz	MITEQ AM-3A	898432
Biconical Antenna (30-200MHz)	EMCO 3108	2536
Log-Periodic Antenna (200-1000MHz)	EMCO 3146	2849
Receiver (20MHz-1.3GHz)	R&S ESVP	893202/018
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

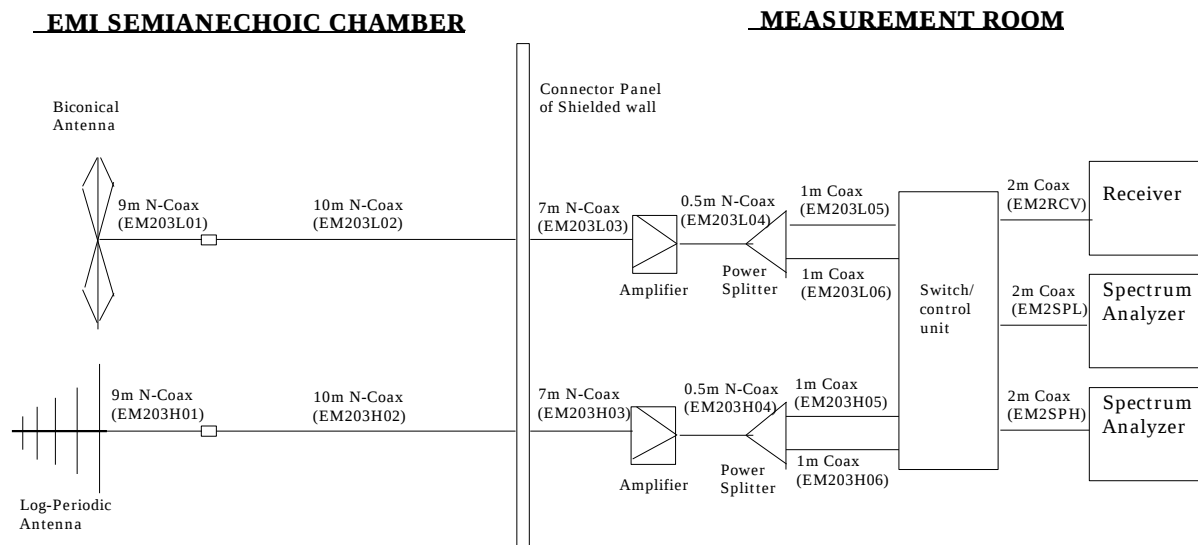


Figure 2 Cables for Radiated Emission Test

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. 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 51.5dB μ V; 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 dB μ V/m (or dB μ V) and μ V/m (or μ V) 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 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 6.5 dB at 30MHz - 1000MHz band.

The 6 highest emissions relative to the limits are reported.

Test Date: August 6, 2004

2.4.1 EUT in 2.4GHz DSSS transmission mode

The actual highest emissions were found on the auxiliary antenna of ThinkPad G40 Series, LCD 14 inch model.

Table 2-2-1. Ch.1 (2412MHz) **TX** mode 11Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dB μ V)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Field Strength (μ V/m)	Limit (μ V/m)
63.988	V	49.4	8.8	-28.6	29.6	40.0	30.2	100
200.051	H	49.7	11.4	-25.1	36.0	43.5	63.1	150
331.241	V	45.5	14.2	-23.0	36.7	46.0	68.4	200
451.597	V	41.2	16.4	-21.3	36.3	46.0	65.3	200
464.373	V	41.8	16.8	-21.4	37.2	46.0	72.4	200
863.681	H	32.6	22.3	-18.2	36.7	46.0	68.4	200

Table 2-2-2. Ch.6 (2437MHz) **TX** mode 11Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dB μ V)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Field Strength (μ V/m)	Limit (μ V/m)
58.872	V	49.8	9.4	-28.8	30.4	40.0	33.1	100
61.759	V	50.2	9.1	-28.6	30.7	40.0	34.3	100
200.052	H	49.9	11.4	-25.1	36.2	43.5	64.6	150
331.374	V	46.1	14.2	-23.0	37.3	46.0	73.3	200
463.667	V	41.7	16.8	-21.4	37.1	46.0	71.6	200
864.115	H	33.4	22.3	-18.4	37.3	46.0	73.3	200

Table 2-2-3. Ch.11 (2462MHz) **TX** mode 11Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dB μ V)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Field Strength (μ V/m)	Limit (μ V/m)
62.629	V	49.6	8.9	-28.7	29.8	40.0	30.9	100
200.052	H	49.9	11.4	-25.1	36.2	43.5	64.6	150
331.640	V	45.8	14.2	-23.0	37.0	46.0	70.8	200
450.976	V	40.7	16.4	-21.3	35.8	46.0	61.7	200
464.619	V	41.6	16.8	-21.4	37.0	46.0	70.8	200
862.874	H	32.7	22.3	-18.3	36.7	46.0	68.4	200

Table 2-2-4. Ch.6 (2437MHz) **RX** mode

Frequency (MHz)	Polarity (H/V)	Measured (dB μ V)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Field Strength (μ V/m)	Limit (μ V/m)
65.068	V	53.3	8.7	-28.5	33.5	40.0	47.3	100
200.045	H	49.5	11.4	-25.1	35.8	43.5	61.7	150
331.716	V	45.2	14.2	-23.0	36.4	46.0	66.1	200
450.226	V	40.8	16.4	-21.3	35.9	46.0	62.4	200
463.794	V	42.2	16.8	-21.4	37.6	46.0	75.9	200
864.118	V	30.9	22.3	-18.4	34.8	46.0	55.0	200

2.4.2 EUT in 2.4GHz OFDM transmission mode

The actual highest emissions were found on the auxiliary antenna of ThinkPad G40 Series, LCD 14 inch model.

Table 2-2-5. Ch.1 (2412MHz) **TX** mode 18Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dB μ V)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Field Strength (μ V/m)	Limit (μ V/m)
64.137	V	50.0	8.8	-28.6	30.2	40.0	32.4	100
200.047	H	50.5	11.4	-25.1	36.8	43.5	69.2	150
331.717	V	45.2	14.2	-23.0	36.4	46.0	66.1	200
451.042	V	40.7	16.4	-21.3	35.8	46.0	61.7	200
464.664	V	41.9	16.8	-21.4	37.3	46.0	73.3	200
863.692	H	32.8	22.3	-18.2	36.9	46.0	70.0	200

Table 2-2-6. Ch.6 (2437MHz) **TX** mode 18Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dB μ V)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Field Strength (μ V/m)	Limit (μ V/m)
65.078	V	50.2	8.7	-28.5	30.4	40.0	33.1	100
200.051	H	48.7	11.4	-25.1	35.0	43.5	56.2	150
331.546	V	45.5	14.2	-23.0	36.7	46.0	68.4	200
449.249	V	40.1	16.4	-21.3	35.2	46.0	57.5	200
463.743	V	42.5	16.8	-21.4	37.9	46.0	78.5	200
861.897	H	32.9	22.3	-18.5	36.7	46.0	68.4	200

Table 2-2-7. Ch.11 (2462MHz) **TX** mode 18Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dB μ V)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Field Strength (μ V/m)	Limit (μ V/m)
70.309	V	46.2	8.4	-28.3	26.3	40.0	20.7	100
200.051	H	50.0	11.4	-25.1	36.3	43.5	65.3	150
332.217	V	45.5	14.2	-23.1	36.6	46.0	67.6	200
450.613	V	39.5	16.4	-21.3	34.6	46.0	53.7	200
463.768	V	42.5	16.8	-21.4	37.9	46.0	78.5	200
864.855	H	32.9	22.4	-18.1	37.2	46.0	72.4	200

Table 2-2-8. Ch.6 (2437MHz) **RX** mode

Frequency (MHz)	Polarity (H/V)	Measured (dB μ V)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Field Strength (μ V/m)	Limit (μ V/m)
61.913	V	51.2	9.1	-28.5	31.8	40.0	38.9	100
331.893	V	44.8	14.2	-23.0	36.0	46.0	63.1	200
386.579	V	39.2	14.9	-22.5	31.6	46.0	38.0	200
451.108	V	40.8	16.4	-21.3	35.9	46.0	62.4	200
463.784	V	42.9	16.8	-21.4	38.3	46.0	82.2	200
862.610	H	33.5	22.3	-18.3	37.5	46.0	75.0	200

3. Restricted Bands Radiatio (1GHz – 25GHz)

[FCC 15.205 / 209, RSS-210 6.3 / 7.3]

3.1 Test Procedure

Radiated emissions were measured in the frequency range with 1 GHz to 25GHz in transmitting mode and 1 GHz to 12.5GHz 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 25 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.

3.2 Test Instruments and Measurement Setup

Table 3 Radiated Emission Test Instrumentation (1GHz – 25GHz)

Description	Model	Serial Number
Spectrum Analyzer EMI Test Receiver	R&S ESI26	836119/003
Amplifier (1 – 18GHz)	HP 8449B	3008A00582
Amplifier (18 – 25GHz)	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 (18 - 25GHz)	EMCO 3160-9	0004-1202
Coaxial cables: - Horn Ant <=> RF Amp. (1-18GHz) - RF Amp.<=>Spectrum Analyzer (1-18GHz) - Horn Ant <=> RF Amp. (18-25GHz) - RF Amp.<=>Spectrum Analyzer (18-25GHz)	Length: 6 m 16 m 3m 1m	- EM206SCO - GEM0101 - SF102-20167 - SF102-21105

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

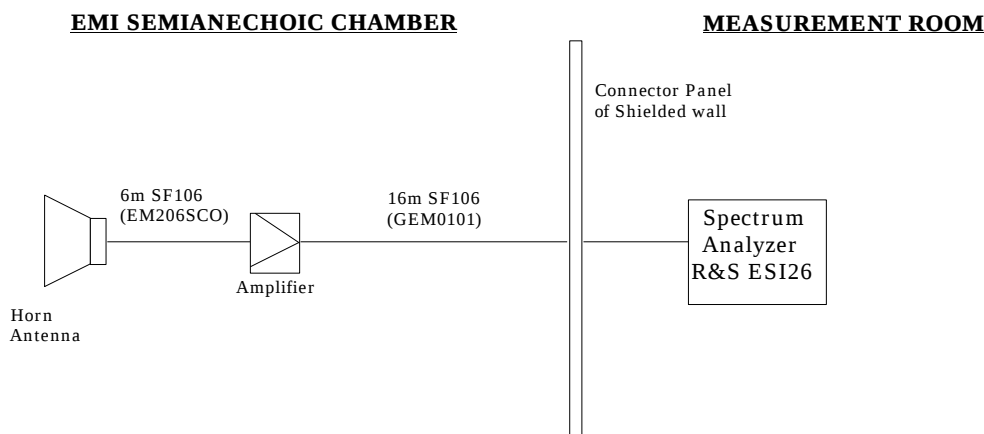


Figure 3-1. Cables for Radiated Emission Test (1 – 18 GHz)

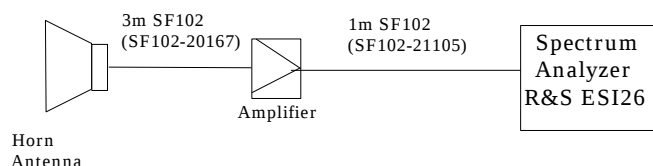
EMI SEMIANECHOIC CHAMBER

Figure 3-2. Cables for Radiated Emission Test (18 - 25GHz)

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. 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 dB μ V; 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 dB μ V/m (or dB μ V) and μ V/m (or μ V) are done as :

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

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

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

3.4 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 7.0 dB. The measurement was done for the frequency range of 1 GHz to 25 GHz in TX mode and 1 GHz to 12.5GHz in RX mode.

Test Date: August 5 and 6, 2004

3.4.1 EUT in 2.4GHz DSSS transmission mode

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

The actual highest emissions were found on the auxiliary antenna of ThinkPad G40 Series, LCD 14 inch model.

Table 3-2-1. Ch.1 (2412MHz) **TX** mode 11Mbps

Frequency (GHz)	Polarity (H/V)	Measured (dB μ V) (<i>peak</i>)	Measured (dB μ V) (<i>average</i>)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dB μ V/m) (<i>peak</i>)	FCC Limit (dB μ V/m) (<i>peak</i>)	Field Strength (dB μ V/m) (<i>average</i>)	FCC Limit (dB μ V/m) (<i>average</i>)
Inband 2.412	H	110.9	102.7	28.3	-29.1	0.0	110.1	OB*	101.9	OB*
Adjacent RB 2.381	H	56.7	41.1	28.2	-29.2	0.0	55.7	74.0	40.1	54.0
2.388	H	56.0	42.0	28.2	-29.2	0.0	55.0	74.0	41.0	54.0
2.390	H	56.0	43.5	28.2	-29.2	0.0	55.0	74.0	42.5	54.0
1.000	V	49.8	-	24.1	-31.9	0.0	42.0	74.0	-	54.0
1.125	V	53.8	-	24.5	-31.5	0.0	46.8	74.0	-	54.0
1.156	V	54.0	-	24.6	-31.3	0.0	47.3	74.0	-	54.0
1.192	V	53.0	-	25.2	-31.3	0.0	46.9	74.0	-	54.0
2.353	H	52.0	-	28.1	-29.2	0.0	50.9	74.0	-	54.0
2.362	H	53.3	-	28.1	-29.2	0.0	52.2	74.0	-	54.0
2.368	H	54.7	-	28.1	-29.2	0.0	53.6	74.0	-	54.0
4.826	H	54.8	38.7	27.1	-26.6	0.0	55.3	74.0	39.2	54.0

Table 3-2-2. Ch.6 (2437MHz) **TX** mode 11Mbps

Frequency (GHz)	Polarity (H/V)	Measured (dBμV) (<i>peak</i>)	Measured (dBμV) (<i>average</i>)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m) (<i>peak</i>)	FCC Limit (dBμV/m) (<i>peak</i>)	Field Strength (dBμV/m) (<i>average</i>)	FCC Limit (dBμV/m) (<i>average</i>)
Inband 2.437	H	109.7	101.4	28.4	-29.2	0.0	108.9	OB*	100.6	OB*
Adjacent RB 2.386	H	56.6	44.0	28.2	-29.2	0.0	55.6	74.0	43.0	54.0
2.390	H	55.4	44.2	28.2	-29.2	0.0	54.4	74.0	43.2	54.0
2.484	H	51.8	-	28.4	-29.1	0.0	51.1	74.0	-	54.0
1.000	V	50.1	-	24.1	-31.9	0.0	42.3	74.0	-	54.0
1.129	V	56.2	-	24.5	-31.5	0.0	49.2	74.0	-	54.0
1.159	V	55.0	-	24.6	-31.3	0.0	48.3	74.0	-	54.0
1.198	V	53.5	-	25.2	-31.3	0.0	47.4	74.0	-	54.0
2.357	H	55.9	42.6	28.1	-29.2	0.0	54.8	74.0	41.5	54.0
2.368	H	55.6	43.0	28.1	-29.2	0.0	54.5	74.0	41.9	54.0
2.375	H	55.8	43.4	28.2	-29.2	0.0	54.8	74.0	42.4	54.0
4.876	H	61.5	43.5	27.0	-26.6	0.0	61.9	74.0	43.9	54.0
7.314	V	35.7	-	29.8	-24.4	0.0	41.1	74.0	-	54.0

Table 3-2-3. Ch.11 (2462MHz) **TX** mode 11Mbps

Frequency (GHz)	Polarity (H/V)	Measured (dBμV) (<i>peak</i>)	Measured (dBμV) (<i>average</i>)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m) (<i>peak</i>)	FCC Limit (dBμV/m) (<i>peak</i>)	Field Strength (dBμV/m) (<i>average</i>)	FCC Limit (dBμV/m) (<i>average</i>)
Inband 2.462	H	109.7	101.2	28.4	-29.2	0.0	108.9	OB*	100.4	OB*
Adjacent RB 2.484	H	57.2	42.0	28.4	-29.1	0.0	56.5	74.0	41.3	54.0
2.485	H	63.9	41.7	28.4	-29.1	0.0	63.2	74.0	41.0	54.0
2.491	H	62.5	40.6	28.4	-29.1	0.0	61.8	74.0	39.9	54.0
1.000	V	49.6	-	24.1	-31.9	0.0	41.8	74.0	-	54.0
1.126	V	54.6	-	24.5	-31.5	0.0	47.6	74.0	-	54.0
1.163	V	54.4	-	24.6	-31.3	0.0	47.7	74.0	-	54.0
1.198	V	54.5	-	25.2	-31.3	0.0	48.4	74.0	-	54.0
2.357	H	54.0	-	28.1	-29.2	0.0	52.9	74.0	-	54.0
2.369	H	56.1	43.0	28.1	-29.2	0.0	55.0	74.0	41.9	54.0
2.375	H	56.7	43.4	28.2	-29.2	0.0	55.7	74.0	42.4	54.0
2.386	H	58.1	44.2	28.2	-29.2	0.0	57.1	74.0	43.2	54.0
4.926	H	62.1	43.5	27.0	-26.4	0.0	62.7	74.0	44.1	54.0
7.387	V	36.9	-	29.8	-24.5	0.0	42.2	74.0	-	54.0

Table 3-2-4. Ch.6 (2437MHz) **RX** mode

Frequency (GHz)	Polarity (H/V)	Measured (dBμV) (<i>peak</i>)	Measured (dBμV) (<i>average</i>)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m) (<i>peak</i>)	FCC Limit (dBμV/m) (<i>peak</i>)	Field Strength (dBμV/m) (<i>average</i>)	FCC Limit (dBμV/m) (<i>average</i>)
1.094	V	53.3	-	24.4	-31.9	0.0	45.8	74.0	-	54.0
1.129	V	50.6	-	24.5	-31.8	0.0	43.3	74.0	-	54.0
1.160	V	50.0	-	24.6	-31.7	0.0	42.9	74.0	-	54.0
1.196	V	51.8	-	25.2	-31.6	0.0	45.4	74.0	-	54.0

3.4.2 EUT in 2.4GHz OFDM transmission mode

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

The actual highest emissions were found on the auxiliary antenna of ThinkPad G40 Series, LCD 14 inch model.

Table 3-2-5. Ch.1 (2412MHz) **TX** mode 18Mbps

Frequency (GHz)	Polarity (H/V)	Measured (dBμV) (<i>peak</i>)	Measured (dBμV) (<i>average</i>)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m) (<i>peak</i>)	FCC Limit (dBμV/m) (<i>peak</i>)	Field Strength (dBμV/m) (<i>average</i>)	FCC Limit (dBμV/m) (<i>average</i>)
Inband 2.410	H	108.3	97.0	28.3	-29.1	0.0	107.5	OB*	96.2	OB*
Adjacent RB 2.389	H	62.2	45.1	28.2	-29.2	0.0	61.2	74.0	44.1	54.0
2.390	H	63.9	46.8	28.2	-29.2	0.0	62.9	74.0	45.8	54.0
1.000	V	50.1	-	24.1	-31.9	0.0	42.3	74.0	-	54.0
1.125	V	54.3	-	24.5	-31.5	0.0	47.3	74.0	-	54.0
1.159	V	54.0	-	24.6	-31.3	0.0	47.3	74.0	-	54.0
1.192	V	53.3	-	25.2	-31.3	0.0	47.2	74.0	-	54.0
2.366	H	52.8	-	28.1	-29.2	0.0	51.7	74.0	-	54.0
2.371	H	55.2	40.5	28.2	-29.2	0.0	54.2	74.0	39.5	54.0
2.380	H	55.0	41.2	28.2	-29.2	0.0	54.0	74.0	40.2	54.0
4.828	H	49.3	-	27.1	-26.6	0.0	49.8	74.0	-	54.0

Table 3-2-6. Ch.6 (2437MHz) **TX** mode 18Mbps

Frequency (GHz)	Polarity (H/V)	Measured (dBμV) (<i>peak</i>)	Measured (dBμV) (<i>average</i>)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m) (<i>peak</i>)	FCC Limit (dBμV/m) (<i>peak</i>)	Field Strength (dBμV/m) (<i>average</i>)	FCC Limit (dBμV/m) (<i>average</i>)
Inband 2.431	H	111.5	99.0	28.4	-29.2	0.0	110.7	OB*	98.2	OB*
Adjacent RB 2.388	H	59.1	43.4	28.2	-29.2	0.0	58.1	74.0	42.4	54.0
2.390	H	55.8	43.5	28.2	-29.2	0.0	54.8	74.0	42.5	54.0
2.484	H	50.5	-	28.4	-29.1	0.0	49.8	74.0	-	54.0
1.000	V	50.4	-	24.1	-31.9	0.0	42.6	74.0	-	54.0
1.128	V	56.1	-	24.5	-31.5	0.0	49.1	74.0	-	54.0
1.160	V	54.2	-	24.6	-31.3	0.0	47.5	74.0	-	54.0
1.196	V	53.9	-	25.2	-31.3	0.0	47.8	74.0	-	54.0
2.365	H	55.0	-	28.1	-29.2	0.0	53.9	74.0	-	54.0
2.371	H	55.5	43.6	28.2	-29.2	0.0	54.5	74.0	42.6	54.0
2.375	H	55.6	43.8	28.2	-29.2	0.0	54.6	74.0	42.8	54.0
2.379	H	55.8	44.2	28.2	-29.2	0.0	54.8	74.0	43.2	54.0
4.299	H	47.5	-	27.1	-27.2	0.0	47.4	74.0	-	54.0
4.882	H	61.1	46.6	27.0	-26.6	0.0	61.5	74.0	47.0	54.0
7.313	V	42.0	-	29.8	-24.4	0.0	47.4	74.0	-	54.0

Table 3-2-7. Ch.11 (2462MHz) **TX** mode 18Mbps

Frequency (GHz)	Polarity (H/V)	Measured (dB μ V) (<i>peak</i>)	Measured (dB μ V) (<i>average</i>)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dB μ V/m) (<i>peak</i>)	FCC Limit (dB μ V/m) (<i>peak</i>)	Field Strength (dB μ V/m) (<i>average</i>)	FCC Limit (dB μ V/m) (<i>average</i>)
Inband 2.456	H	107.7	95.6	28.4	-29.2	0.0	106.9	OB*	94.8	OB*
Adjacent RB 2.484	H	64.5	47.7	28.4	-29.1	0.0	63.8	74.0	47.0	54.0
2.485	H	63.8	45.5	28.4	-29.1	0.0	63.1	74.0	44.8	54.0
1.000	V	49.9	-	24.1	-31.9	0.0	42.1	74.0	-	54.0
1.125	V	55.3	-	24.5	-31.5	0.0	48.3	74.0	-	54.0
1.163	V	54.8	-	24.6	-31.3	0.0	48.1	74.0	-	54.0
1.191	V	54.0	-	25.2	-31.3	0.0	47.9	74.0	-	54.0
2.372	H	53.4	-	28.2	-29.2	0.0	52.4	74.0	-	54.0
2.378	H	54.7	-	28.2	-29.2	0.0	53.7	74.0	-	54.0
2.384	H	54.8	-	28.2	-29.2	0.0	53.8	74.0	-	54.0
2.389	H	56.4	42.2	28.2	-29.2	0.0	55.4	74.0	41.2	54.0
4.920	H	56.1	41.8	27.0	-26.4	0.0	56.7	74.0	42.4	54.0
7.387	V	40.1	-	29.8	-24.5	0.0	45.4	74.0	-	54.0

Table 3-2-8. Ch.6 (2437MHz) **RX** mode

Frequency (GHz)	Polarity (H/V)	Measured (dB μ V) (<i>peak</i>)	Measured (dB μ V) (<i>average</i>)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dB μ V/m) (<i>peak</i>)	FCC Limit (dB μ V/m) (<i>peak</i>)	Field Strength (dB μ V/m) (<i>average</i>)	FCC Limit (dB μ V/m) (<i>average</i>)
1.000	V	49.8	-	24.1	-31.9	0.0	42.0	74.0	-	54.0
1.125	V	56.9	-	24.5	-31.5	0.0	49.9	74.0	-	54.0
1.156	V	53.5	-	24.6	-31.3	0.0	46.8	74.0	-	54.0
1.192	V	55.0	-	25.2	-31.3	0.0	48.9	74.0	-	54.0

3.5 Measurement plots of adjacent restricted band

3.5.1 List of Measurement Results

The measurement was performed with the worse cases of each transmission mode that tend to have higher conducted output power based on the results of previous certified data. (i.e. 11Mbps for DSSS, and 18Mbps for OFDM.)

And the antenna with higher gain (i.e. auxiliary antenna) was selected for each transmission mode.

Table 3-3-1. Radiated peak emission in **2.4GHz** DSSS transmission mode, 11Mbps

Measured host device: IBM ThinkPad **G40** Series, auxiliary antenna

Host device	Frequency (GHz)	Polarity (H/V)	Reading (dB μ V) (<i>peak</i>)	Rading (dB μ V) (<i>average</i>)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dB μ V/m) (<i>peak</i>)	Margin to Limit (dB μ V/m) (<i>peak</i>)	Field Strength (dB μ V/m) (<i>average</i>)	Margin to Limit (dB μ V/m) (<i>average</i>)
G40 14"	2.390	H	56.0	43.5	28.2	-29.2	0.0	55.0	19.0	42.5	11.5
	2.485	H	63.9	41.7	28.4	-29.1	0.0	63.2	10.8	41.0	13.0
G40 15"	2.390	H	56.1	43.1	28.2	-29.2	0.0	55.1	18.9	42.1	11.9
	2.484	H	55.4	41.9	28.4	-29.1	0.0	54.7	19.3	41.2	12.8

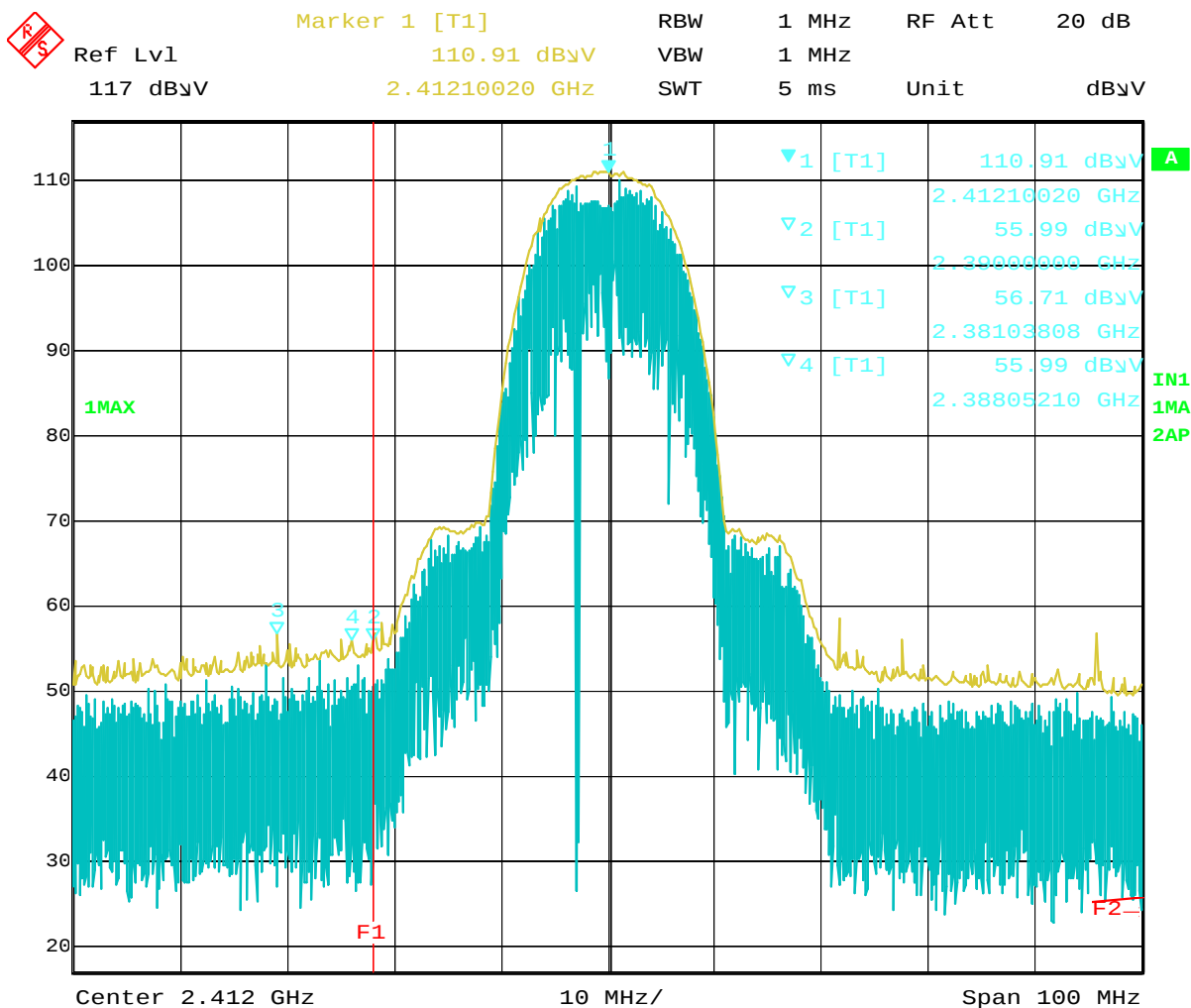
Table 3-3-2. Radiated peak emission in **2.4GHz** OFDM transmission mode, 18Mbps

Measured host device: IBM ThinkPad **G40** Series, auxiliary antenna

T x Rate (Mb/s)	Frequency (GHz)	Polarity (H/V)	Reading (dB μ V) (<i>peak</i>)	Rading (dB μ V) (<i>average</i>)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dB μ V/m) (<i>peak</i>)	Margin to Limit (dB μ V/m) (<i>peak</i>)	Field Strength (dB μ V/m) (<i>average</i>)	Margin to Limit (dB μ V/m) (<i>average</i>)
G40 14"	2.390	H	63.9	46.8	28.2	-29.2	0.0	62.9	11.1	45.8	8.2
	2.484	H	64.5	47.7	28.4	-29.1	0.0	63.8	10.2	47.0	7.0
G40 15"	2.390	H	61.9	45.6	28.2	-29.2	0.0	60.9	13.1	44.6	9.4
	2.484	H	64.0	46.6	28.4	-29.1	0.0	63.3	10.7	45.9	8.1

3.5.2 Bandedge Measurement Plots

The plots are comparatively worse measurement cases of each transmission mode in the Table 3-3-1 and Table 3-3-2.

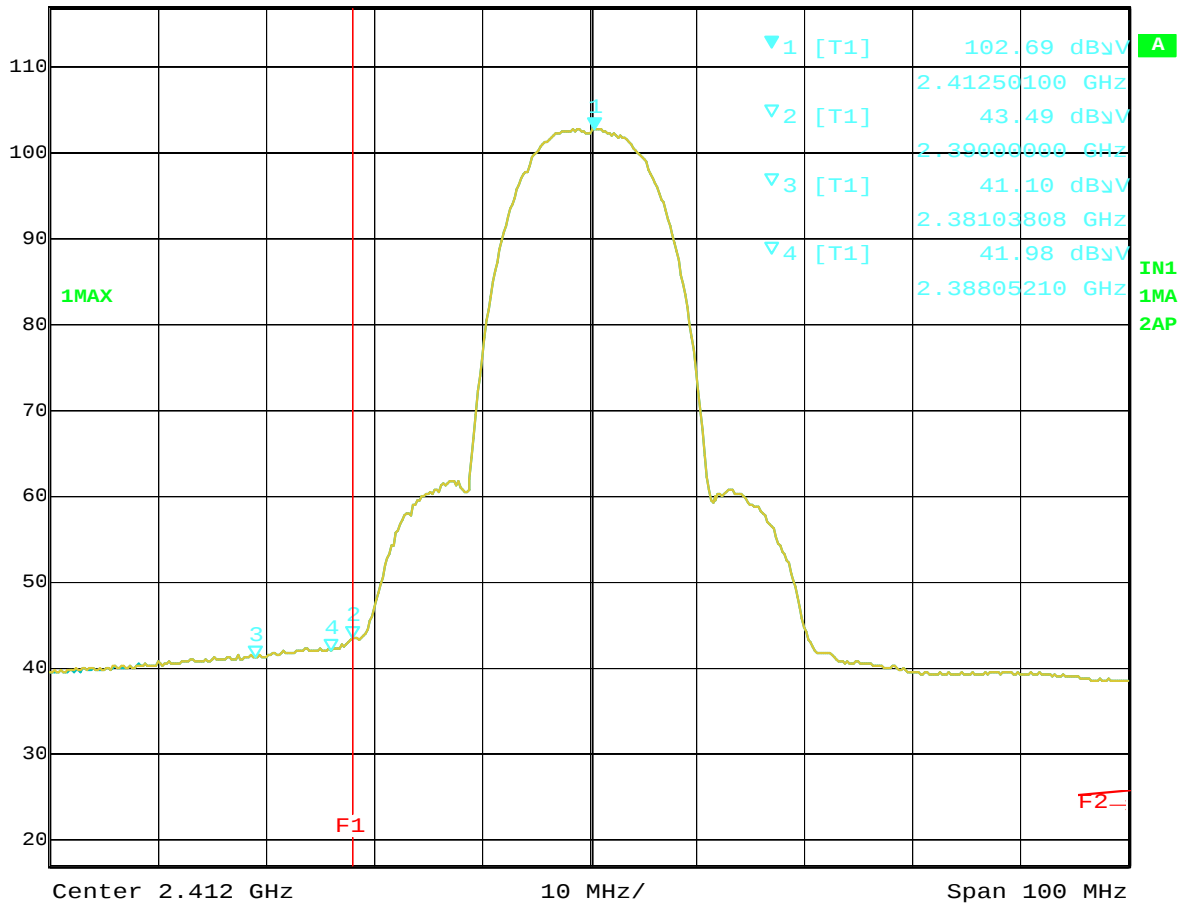


Date: 5.AUG.2004 15:39:39

Plot 8-1 Ch.1 2412MHz TX, DSSS 11Mbps (Peak), G40 14"



Ref Lvl 117 dBμV
Marker 1 [T1] 102.69 dBμV
2.41250100 GHz
RBW 1 MHz
VBW 10 Hz
SWT 25 s
RF Att 20 dB
Unit dBμV

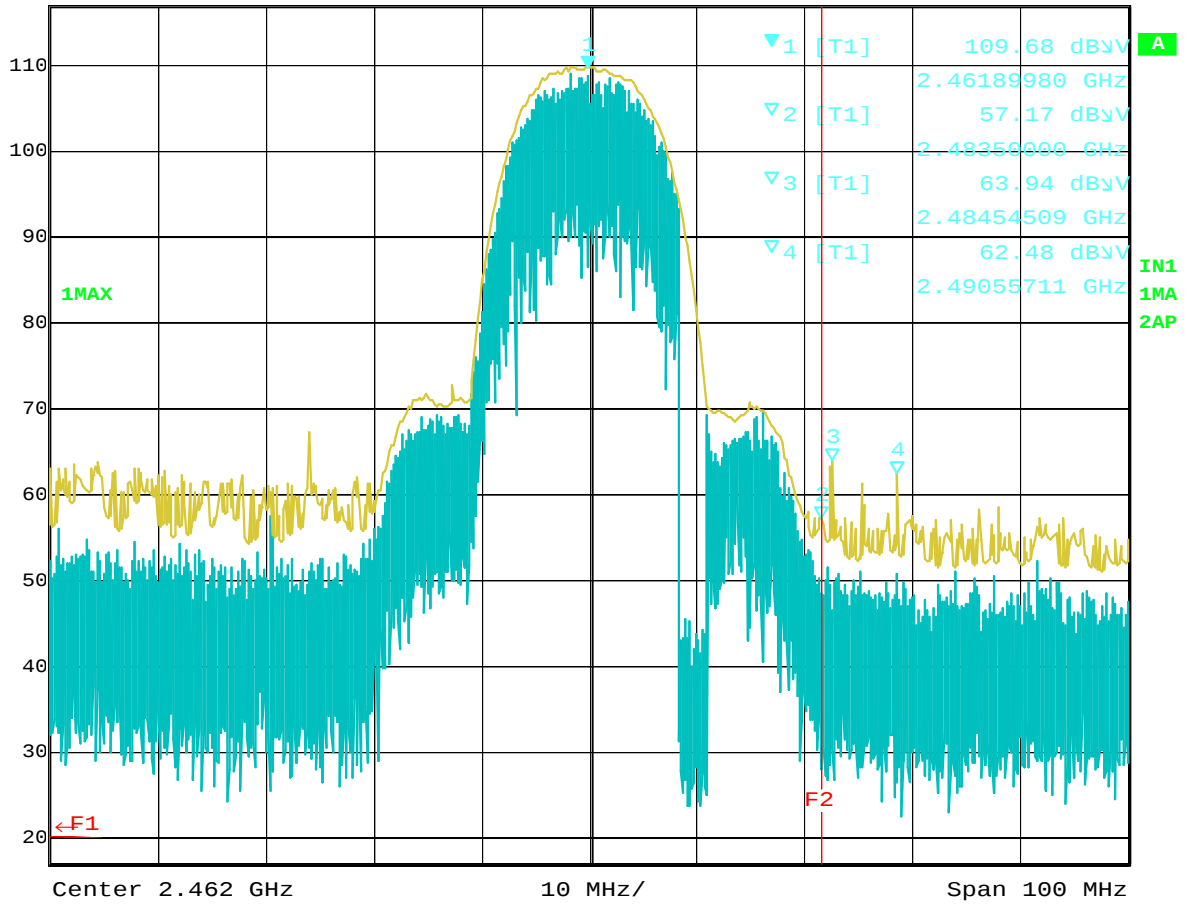


Date: 5.AUG.2004 15:40:43

Plot 8-2 Ch.1 2412MHz TX, DSSS 11Mbps (Average), G40 14"

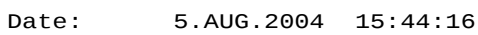


Ref Lvl 117 dBμV
Marker 1 [T1] 109.68 dBμV 2.46189980 GHz
RBW 1 MHz RF Att 20 dB
VBW 1 MHz
SWT 5 ms Unit dBμV

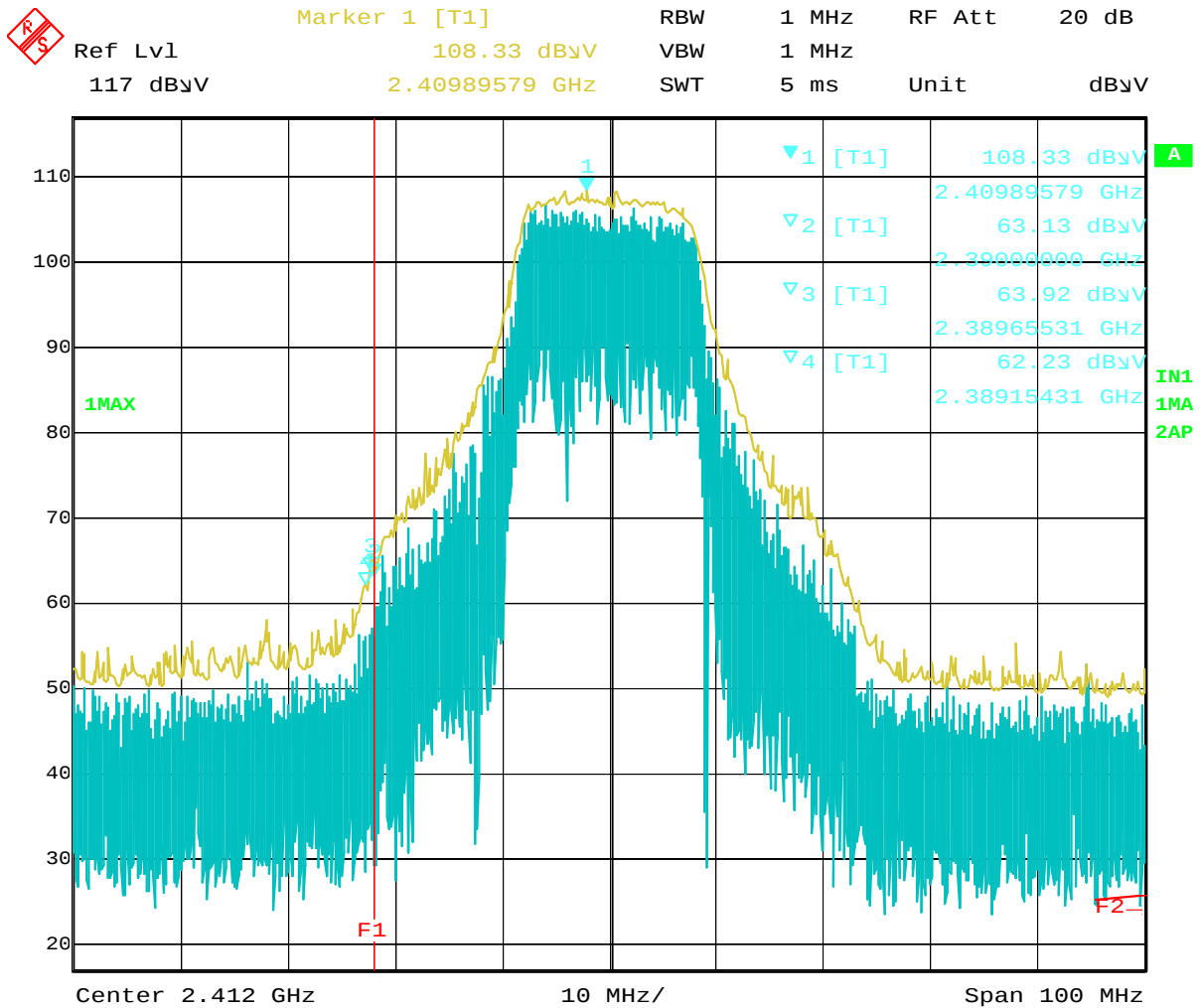


Date: 5.AUG.2004 15:42:17

Plot 8-3 Ch.11 2462MHz TX, DSSS 11Mbps (Peak), G40 14"

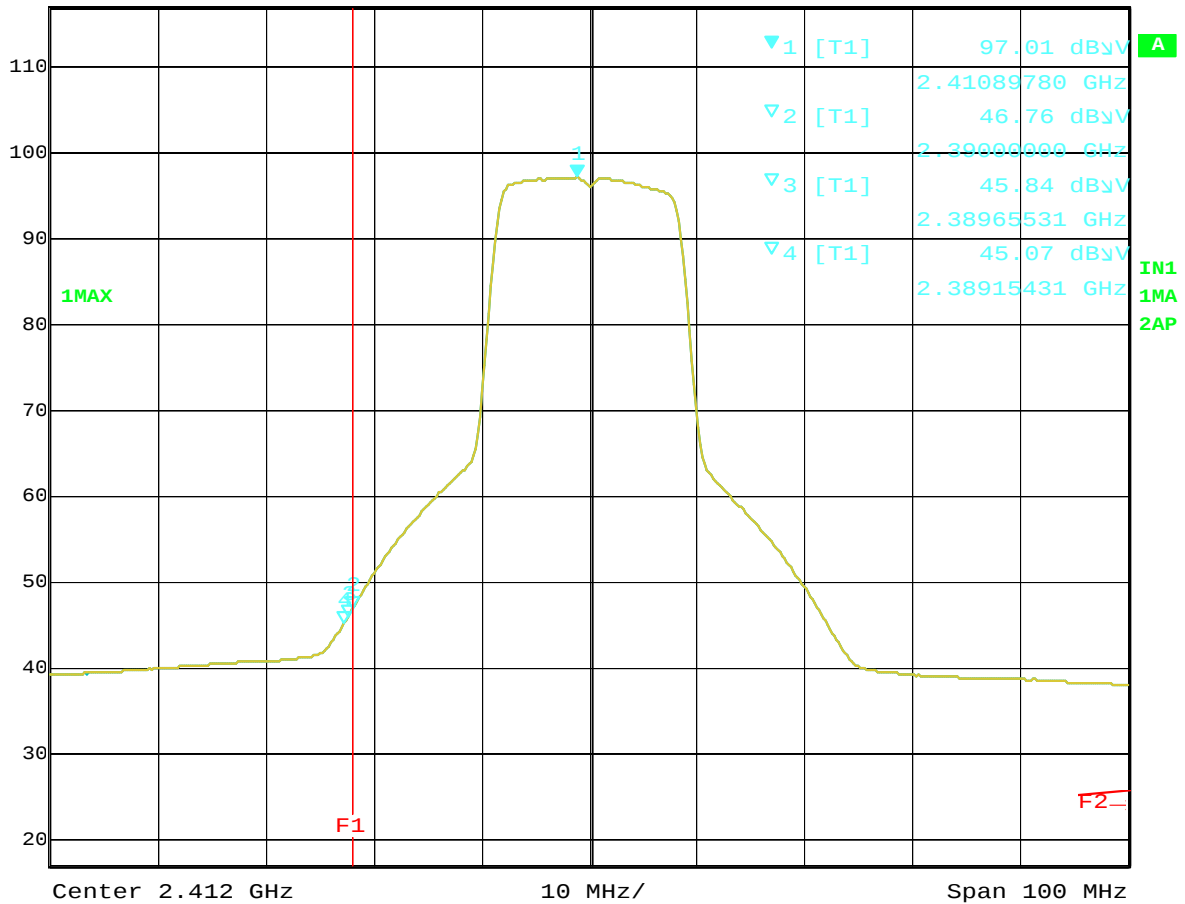


Plot 8-4 Ch.11 2462MHz TX, DSSS 11Mbps (Average), G40 14"





Ref Lvl 117 dBμV
Marker 1 [T1] 97.01 dBμV
2.41089780 GHz
RBW 1 MHz
VBW 10 Hz
SWT 25 s
RF Att 20 dB
Unit dBμV

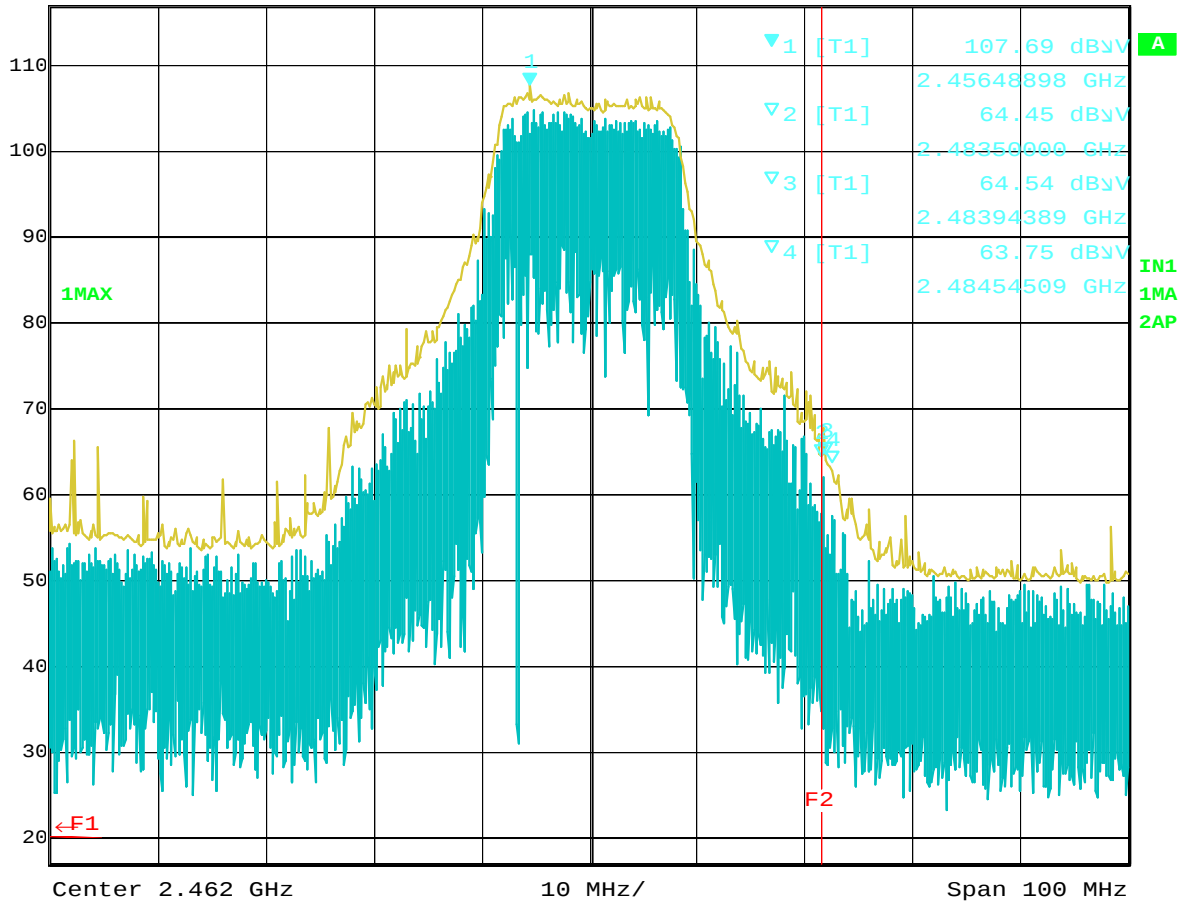


Date: 5.AUG.2004 16:25:33

Plot 8-6 Ch.1 2412MHz TX, OFDM 18Mbps (Average), G40 14"



Ref Lvl 117 dBμV
Marker 1 [T1] 107.69 dBμV 2.45648898 GHz
RBW 1 MHz RF Att 20 dB
VBW 1 MHz
SWT 5 ms Unit dBμV

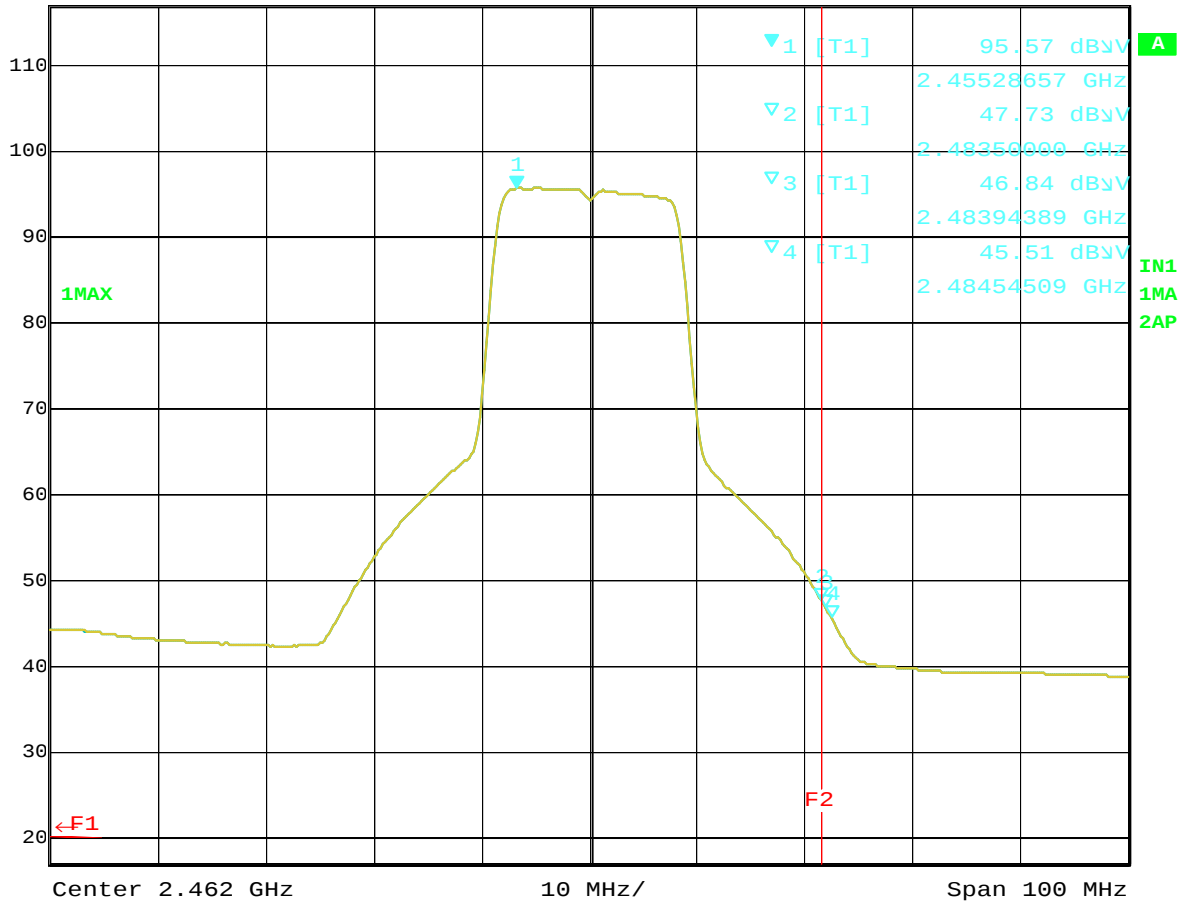


Date: 5.AUG.2004 16:26:37

Plot 8-7 Ch.11 2462MHz TX, OFDM 18Mbps (Peak), G40 14'



Ref Lvl 117 dBμV
Marker 1 [T1] 95.57 dBμV
2.45528657 GHz
RBW 1 MHz
VBW 10 Hz
SWT 25 s
RF Att 20 dB
Unit dBμV



Date: 5.AUG.2004 16:27:26

Plot 8-8 Ch.11 2462MHz TX, OFDM 18Mbps (Average), G40 14"