

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

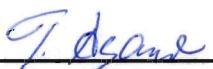
FCC ID: S2L20040601CX2
IC: 5903D-WM3B29AG

August 25, 2005

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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

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

Measurement procedure used is ANSI C63.4-2003 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

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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 Tel: +81-46-215-4779, Fax: +81-46-273-7420
REGULATION	: FCC Part 15 Subpart C, and Subpart E Industry Canada RSS-210 (Issue No.5)
MODEL NUMBER (Advertising Name)	: WM3B2915ABG (Intel PRO/Wireless 2915 ABG Mini-PCI Adapter)
FCC ID IC Certification Number	: S2L20040601CX2 : 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 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 IC Certification Number	Description
WM3B2915ABG (s/n Z9H949X09G)	FCC ID: S2L20040601CX2 IC: 5903D-WM3B29AG	Applying modular transmitter Built_in type IEEE802.11a/b/g Wireless LAN Mini-PCI card without antenna
ThinkPad Z60m Series M/T 2529-FLU (LCD : CFRP Aluminum) (s/n WC6LR00001) M/T 2529-FPU (LCD : ABS) (s/n WC5LR00002)	N/A	Lenovo Notebook PC with built_in antennas CPU: Intel® Pentium M Processor, 2.13GHz CPU: Intel® Pentium M Processor, 2GHz
J07M081 (s/n 05S5ARM4SIT023)	FCC ID: MCLJ07M081 IC: 2878D-J07H081	Co-located built-in type Bluetooth modular transmitter device without antenna
P/N 92P1105	N/A	Universal AC adapter 90W, Unshielded 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 Frequency [GHz]	Designed average 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)	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	1.84 dBi
						5.15 - 5.35GHz	1.37 dBi
						5.725-5.85GHz	0.19 dBi
LCD 15 inch Model	Main	91P6812	Hitachi Cable Ltd. (Japan)	Dual Band Meander Antenna	coax 775mm	2.4GHz band	1.18 dBi
						5.15 - 5.35GHz	1.68 dBi
						5.725-5.85GHz	1.78 dBi
	Auxiliary	91P6813			coax 670mm	2.4GHz band	1.71 dBi
						5.15 - 5.35GHz	2.84 dBi
						5.725-5.85GHz	1.51dBi

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

ThinkPad T40 Series		Antenna Designator	Manufacture	Antenna type	Cable type and length	Peak Gain	
LCD 14 inch Model	Main	62P4204	Foxconn Electronics Inc. (R.O.C.)	Dual Band Meander Antenna	Coax 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 Floating Element Meander Antenna	Coax 845 mm	2.4GHz band	-0.48 dBi
		91P6898				5.15 - 5.35GHz	0.36 dBi
		5.725-5.85GHz	-0.37 dBi				
LCD 15 inch Model	Main	91P6841	Hitachi Cable Ltd. (Japan)	Dual Band Meander Antenna	coax 755mm	2.4GHz band	1.24 dBi
						5.15 - 5.35GHz	2.00 dBi
						5.725-5.85GHz	1.01 dBi
	Auxiliary	91P6840			coax 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 X30 Series	Antenna Designator	Manufacture	Antenna type	Cable type and length	Peak Gain	
Main antenna	08K4083	Nissei Electric Co. Ltd. (Japan)	Dual Band Meander Antenna	Coax 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 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 X40 Series	Antenna Designator	Manufacture	Antenna type	Cable type and length	Peak Gain	
Main antenna	13N5743	Nissei Electric Co. Ltd. (Japan)	Dual Band Meander Antenna	Coax 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 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 Tablet Series	Antenna Designator	Manufacture	Antenna type	Cable type and length	Peak Gain		
Main antenna	91P6908	Wistron NeWeb Corp. (R.O.C.)	Dual Band Meander Antenna	Coax 600 mm	2.4GHz band	Notebook ----- Tablet	-1.37 dBi ----- -0.15 dBi
					5.2GHz band	Notebook ----- Tablet	2.75 dBi ----- 2.11 dBi
					5.8GHz band	Notebook ----- Tablet	0.84 dBi ----- -0.35 dBi
Auxiliary antenna	91P6909			Coax 550 mm	2.4GHz band	Notebook ----- Tablet	1.77 dBi ----- 1.82 dBi
					5.2GHz band	Notebook ----- Tablet	1.36 dBi ----- 1.71 dBi
					5.8GHz band	Notebook ----- Tablet	-0.28 dBi ----- 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) 6.2.2(o) *1	Bandwidth at 6 dB below	At least 500kHz. (*1: RSS-210 Issue5: Amendment)	Conducted	Pass (Not changed from the certified values.)
15.215(c) 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) 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) 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) 6.2.2(o)(b) 15.407(a)(1)(2) 6.2.2 (q1)(i)(ii)	Conducted Transmit Output Power	2400-2483.5MHz / 5725-5850MHz Shall not exceed 1.0 W. 5150-5250MHz: FCC: 50mW or (4+10logB)dBm IC : 200mW* or (10+10logB)dBm* *: EIRP 5250-5350MHz: FCC: 250mW or (11+10logB)dBm IC : 250mW or (11+10logB)dBm IC : 1W* or (17+10logB)dBm* *: EIRP B: 26dB BW in MHz		Pass
15.247(d) 6.2.2(o)(b) 15.407(a)(1)(2) 6.2.2 (q1)(i)(ii)	Peak Power Spectral Density	2400-2483.5MHz / 5725-5850MHz Shall not be greater than 8 dBm in any 3kHz band. 5150-5250MHz: FCC: 4 dBm in any 1MHz IC : 10 dBm in any 1MHz (EIRP) 5250-5350MHz: FCC: 11 dBm in any 1MHz IC : 11 dBm in any 1MHz		Pass (Not changed from the certified values.)
N/A 6.2.2 (q1)(iv)(b)	Peak Spectral Density	IC: 3 + 10logB dBm/MHz		Pass
15.407(a)(6) 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 .		
15.207 407(b)(5) 6.2.2(o)(e3) 6.2.2 (q1)(v) 6.6 / 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		Pass
15.205 & 209 / 407(b)(1)(2)(5)(6) 6.2.1 / 6.2.2(q1)(i)(ii)(v) 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. Ave. 54dBμV/m, peak 74dBμV/m and	Radiated (30MHz - 1GHz)	Pass
		FCC 15.407(b)(1)(2) or RSS-210 6.2.2(q1)(i)(ii) : EIRP –27dBm/MHz	Radiated (1G - 40GHz)	Pass

	Other general requirements		Result
15.247(b)(4)(i) 15.407(a)(1)(2) —	Antenna gain of the applying host device	Peak gain of the device : 0.73 dBi in 2.4GHz band 2.72 dBi in 5.2GHz band 2.37 dBi in 5.8GHz band	N/A
— 5.2	Supply Voltage	Main power source: Universal AC adapter 90W Mini-PCI PC bus to applying card : DC 3.3V ± 0.3V	N/A
— 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) 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) 6.2.2(q1)(i)	Integral antenna in the 5150M -5250MHz band	The device employs an unique electronic connector so called Electronic Handshake .	complies
15.407(e) 6.2.2(q1)(i) (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) 6.2.2(q1)(iv)(g)	RF Exposure Requirement	Refer to “RF Exposure Evaluation” documents.	complies
15.407(g) 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 FCC Subpart C, IC RSS-210 6.2.2(o)	1MHz
Mean power measurement 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: - Spectrum Analyzer <=> EUT	Length: Loss: 110 cm 2.4GHz 1.3 dB 5.2GHz 2.2 dB 5.8GHz 2.3 dB	

Notes: - R&S: Rohde & Schwarz

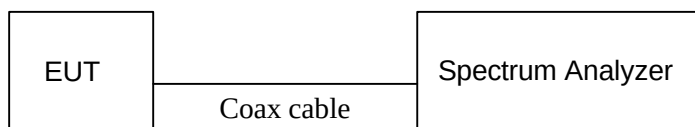


Figure 1-1 : Measurement setup of spectrum analyzer method

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	21.96	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	21.27	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

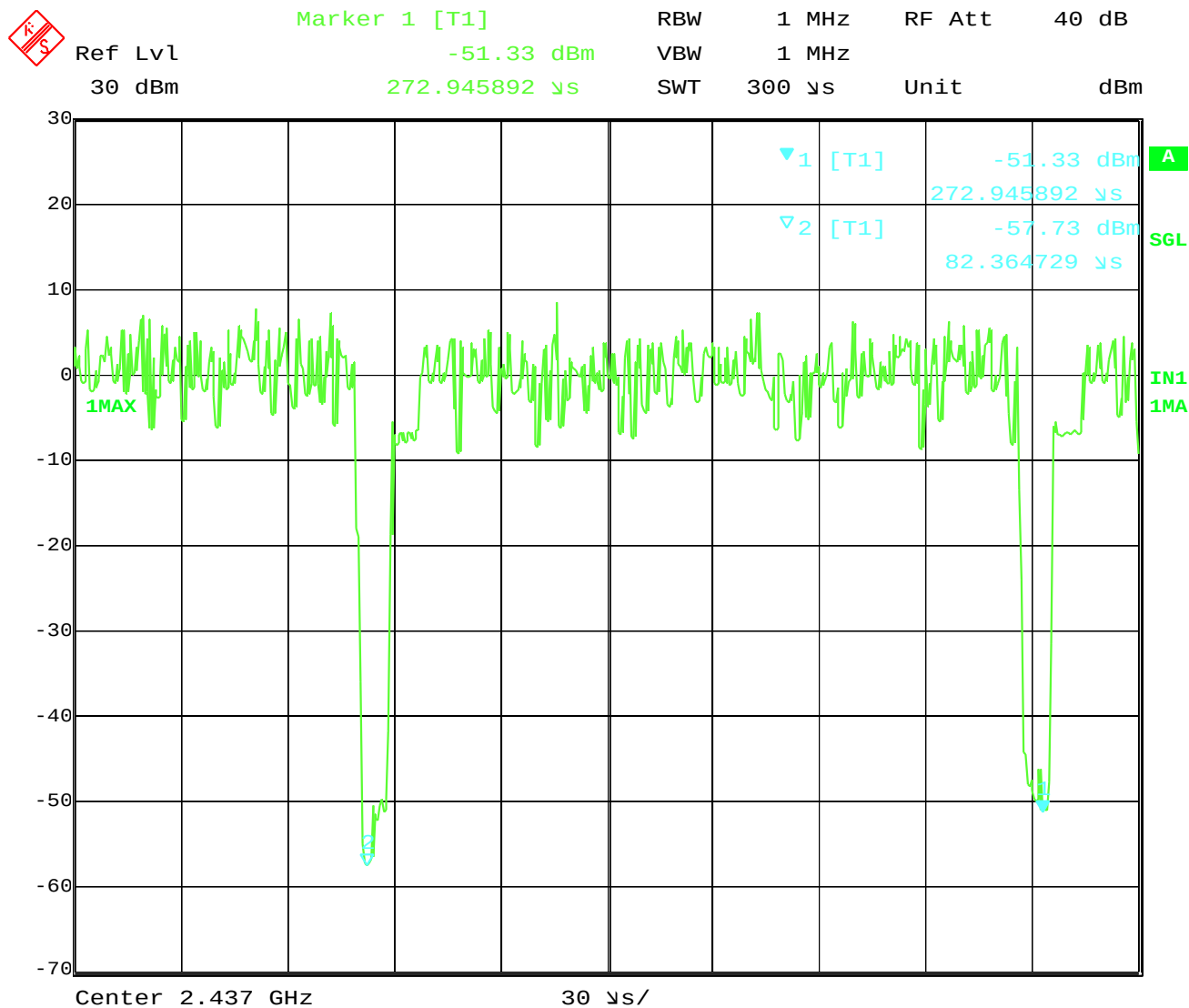
Measured Frequency (MHz)	Tx Rate (Mb/s)	Analyzer reading (dBm)	Trace number	Cable Loss (dB)	Results (dBm)	Limit		Peak antenna gain of EUT (dBi)	EIRP (dBm)	IC limit (dBm)
						FCC (dBm)	IC (dBm)			
5180	6	9.61	omitted	2.2	11.81	17	N/A	2.72	14.53	23
5240	6	9.61	Plot 1-4b	2.2	11.81	17	N/A		14.53	23
5260	6	13.59	Plot 1-5b	2.2	15.79	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	24.20	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

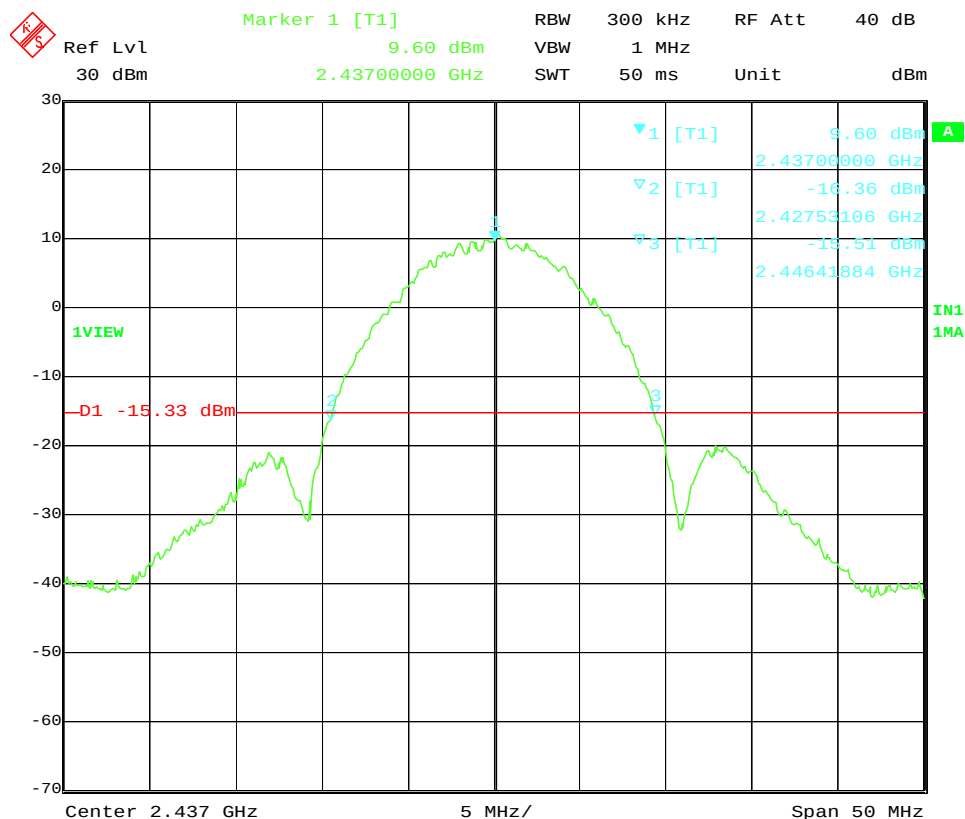
1.3 Trace Data

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



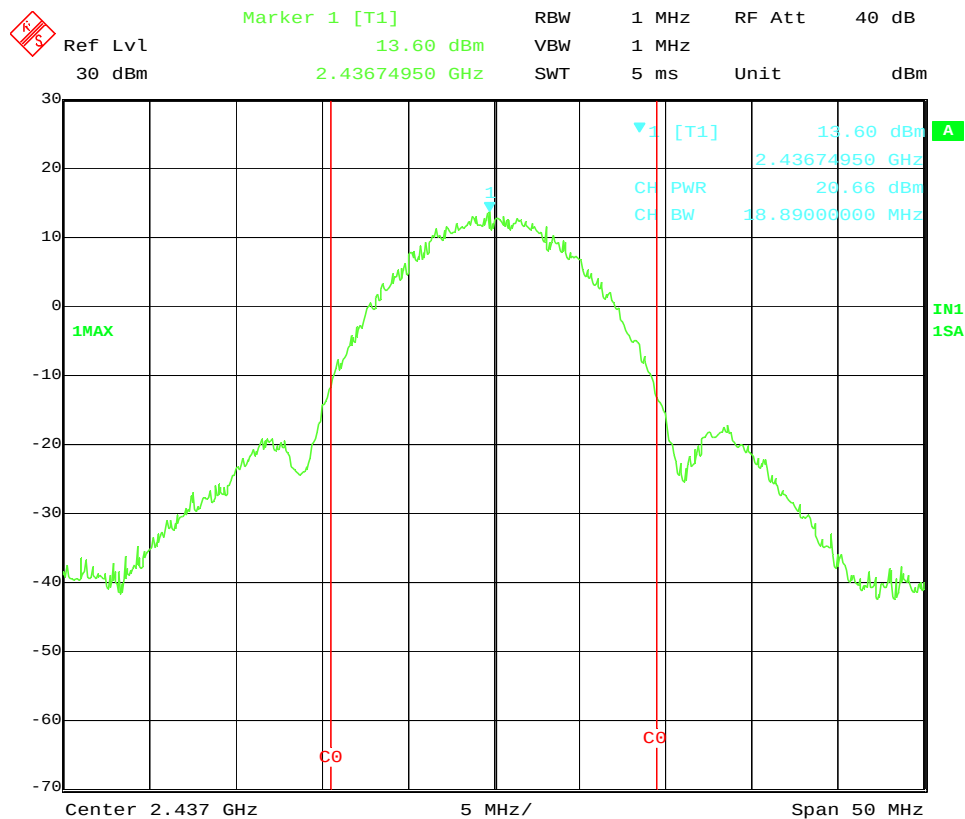
Date: 2.AUG.2005 17:47:16

Plot 1-1 Transmission Pulse Duration of OFDM Tx mode



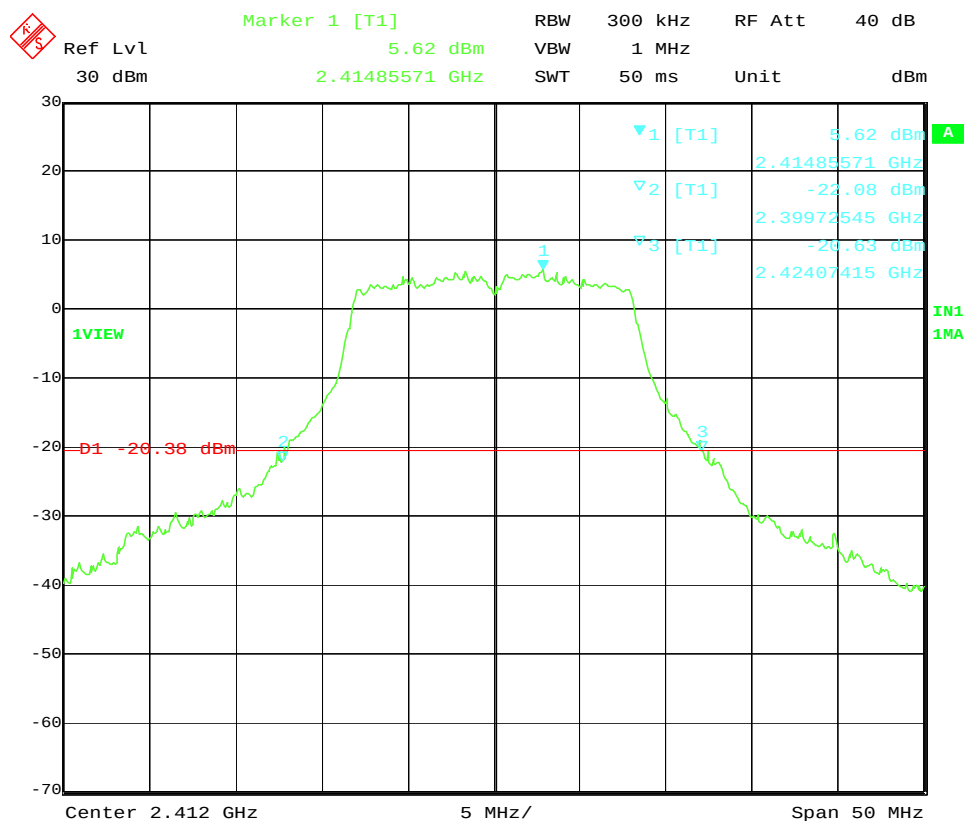
Date: 2.AUG.2005 15:06:38

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



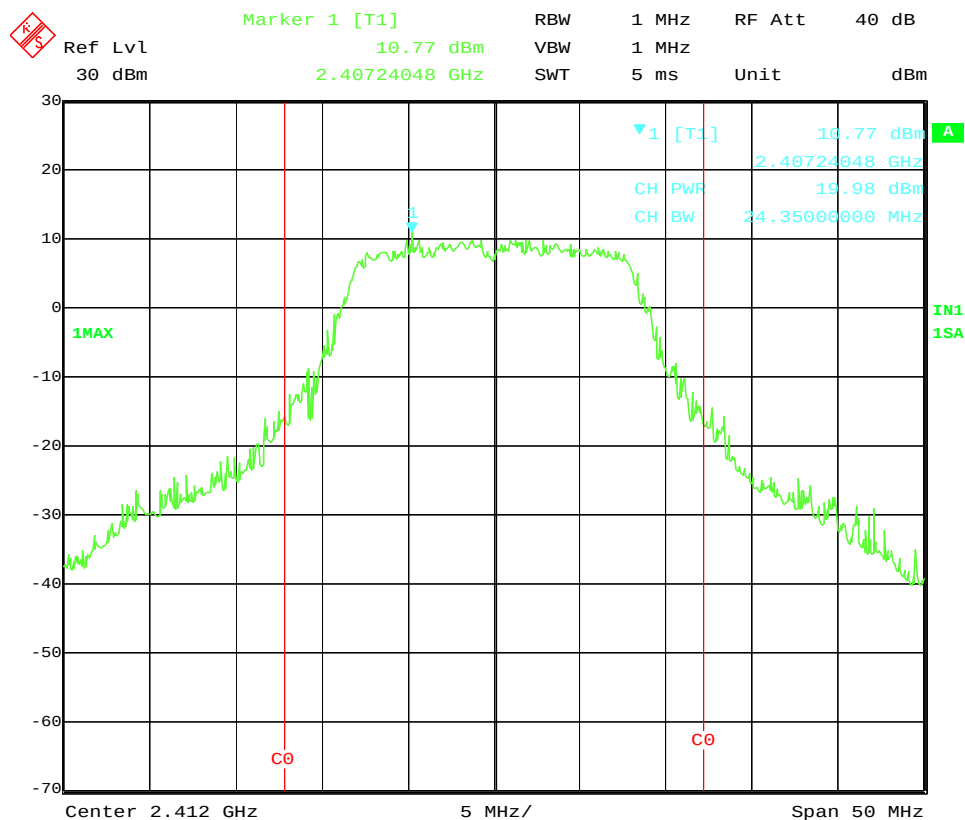
Date: 2.AUG.2005 16:43:56

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



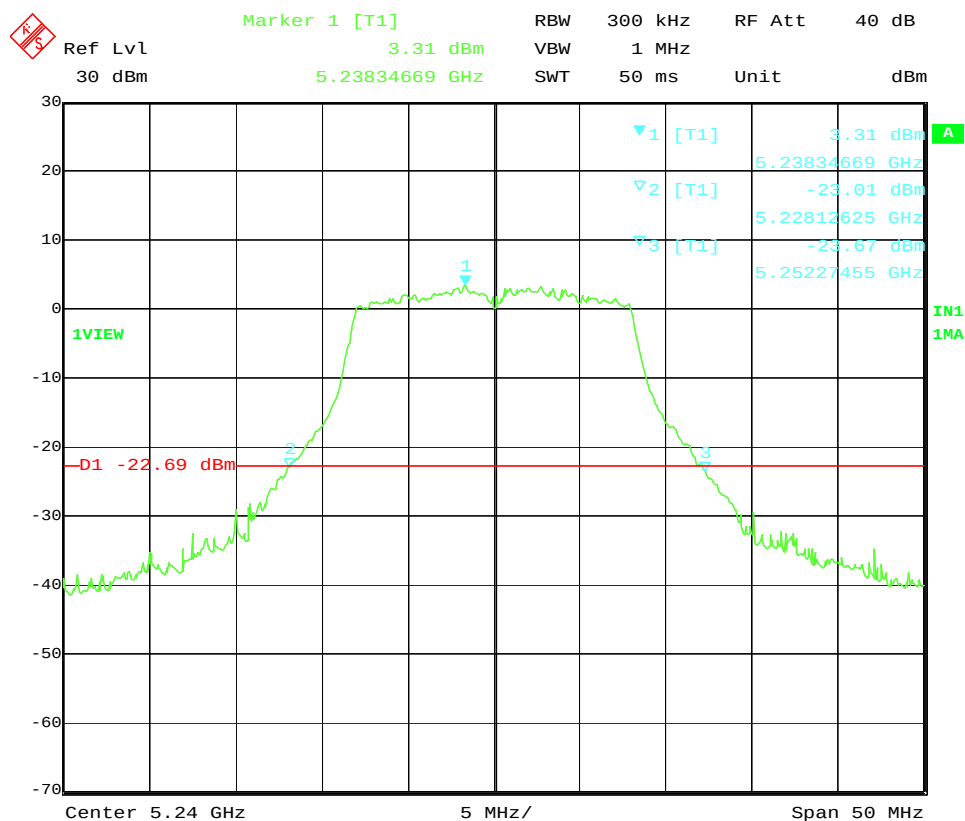
Date: 2.AUG.2005 15:20:40

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

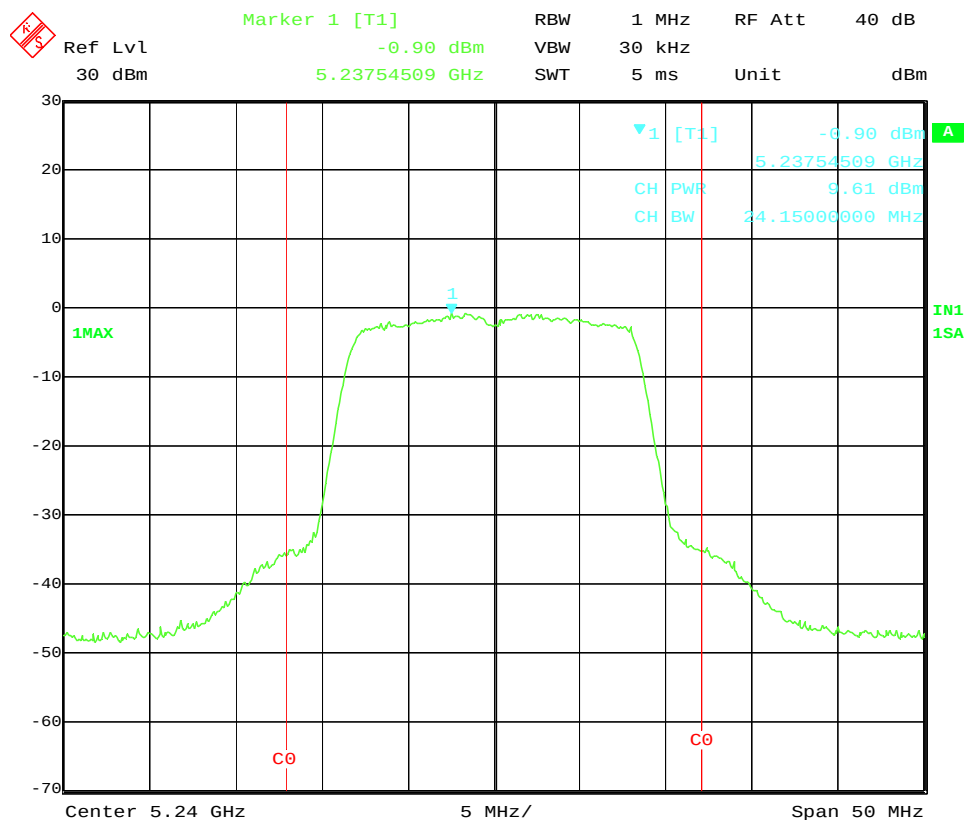


Date: 2.AUG.2005 17:57:12

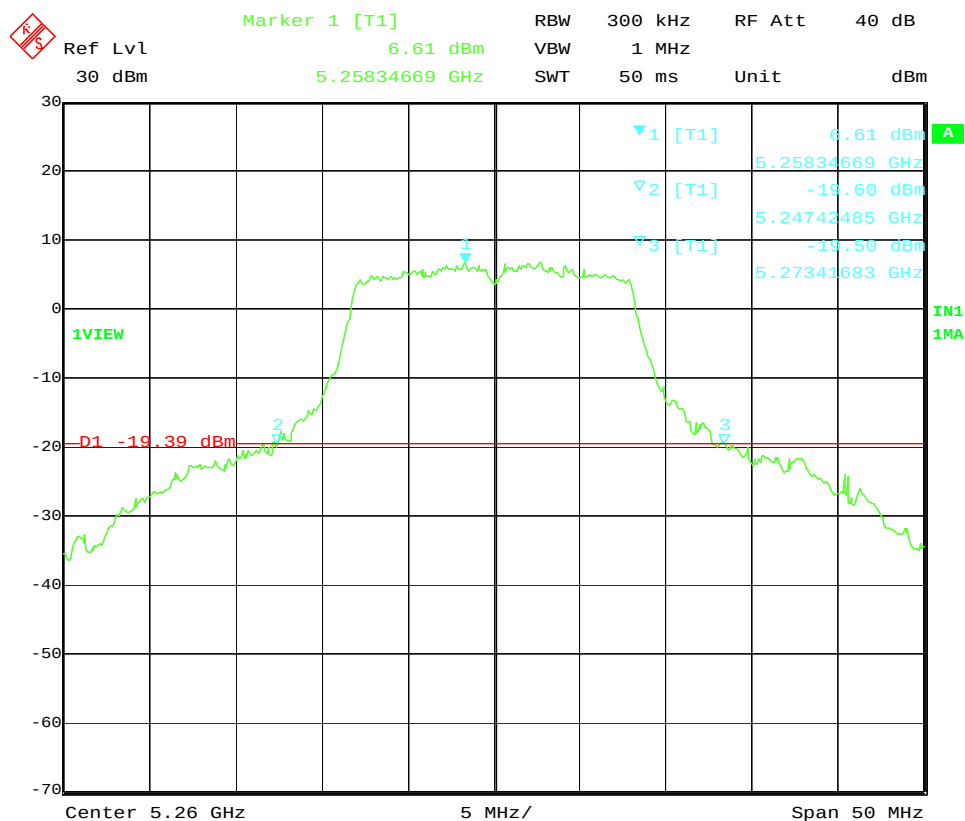
Plot 1-3b. Conducted Peak Output Power of 2412MHz (OFDM, 6Mbps, peak power)



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

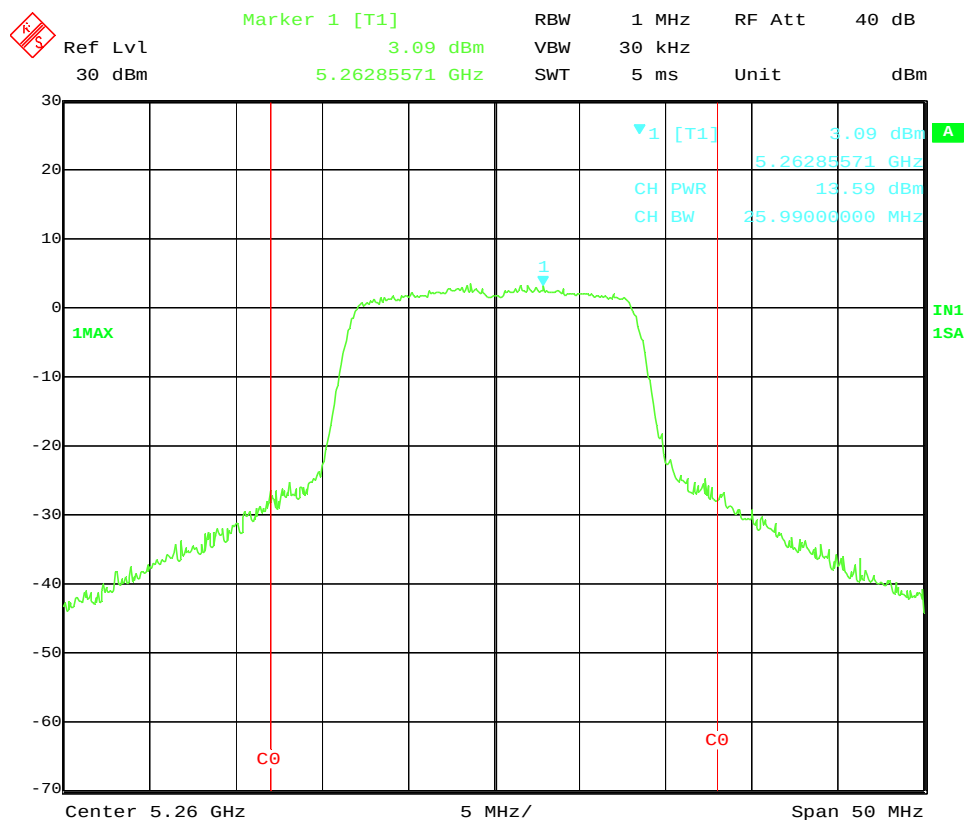


Plot 1-4b. Conducted Transmit Output Power of 5240MHz (OFDM, 6Mbps, mean power)



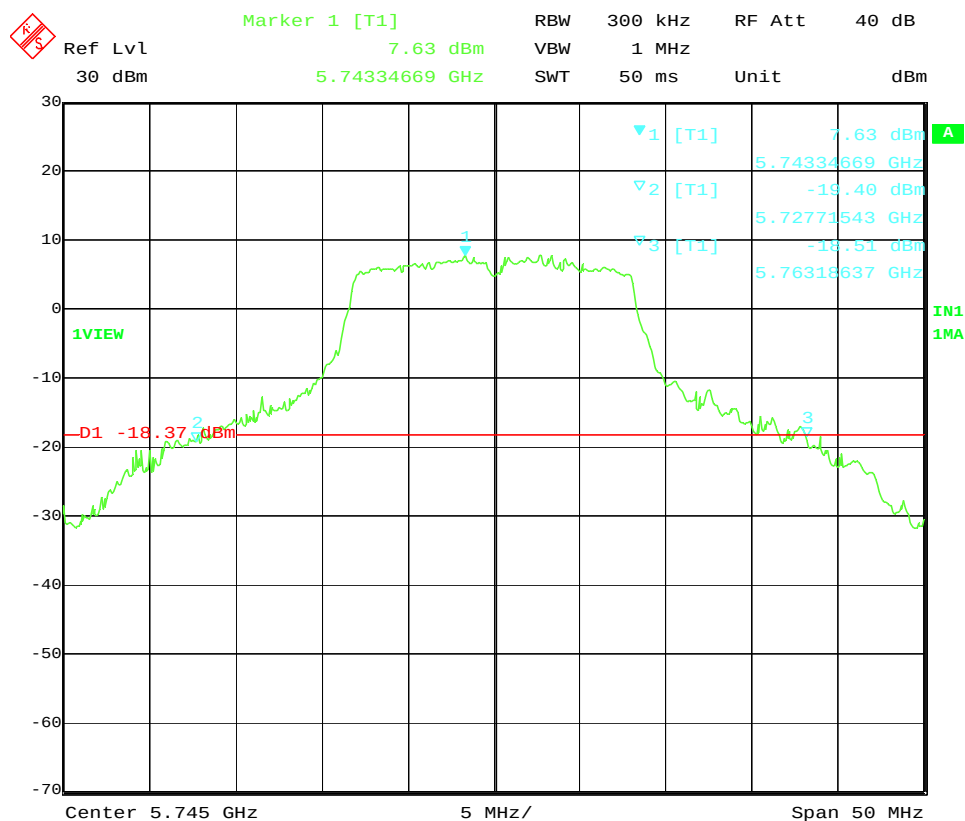
Date: 3.AUG.2005 14:31:48

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



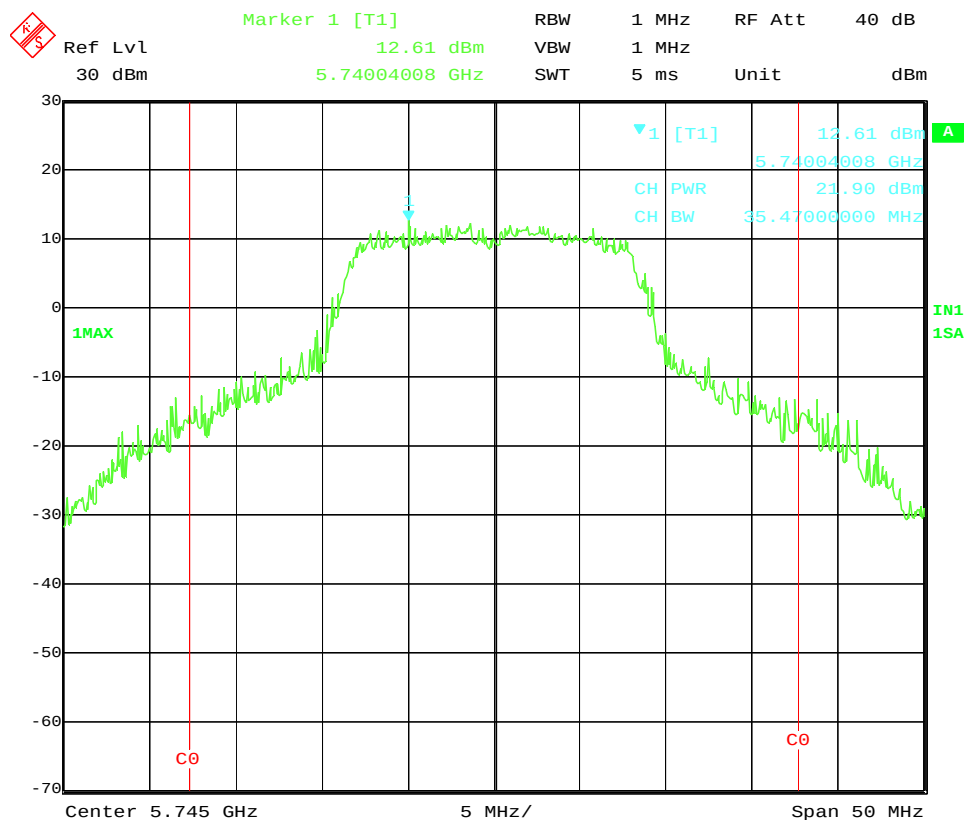
Date: 3.AUG.2005 21:30:18

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: - Horn Ant <=> RF Amp. (1-18GHz) - RF Amp.<=>Spectrum Analyzer (1-12.4GHz) - RF Amp.<=>Spectrum Analyzer (12.4-18GHz) - Horn Ant <=> RF Amp. (18-40GHz) - RF Amp.<=>Spectrum Analyzer (18-40GHz)	Length: 6 m 16 m 3m 3m 1m	 - EM206SCO - GEM0101 - SF102-20166 - SF102-20167 - SF102-21105

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

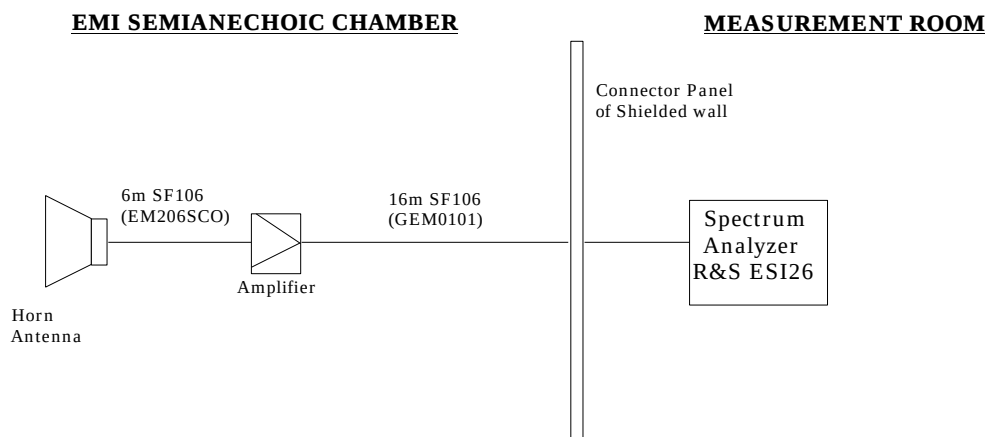


Figure 2-1. Cables for Radiated Emission Test (1 – 12.4 GHz)

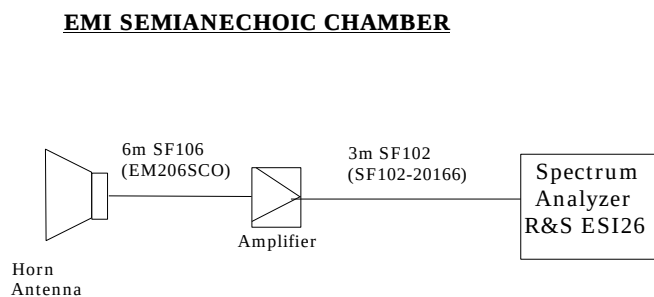


Figure 2-2. Cables for Radiated Emission Test (12.4 - 18GHz)

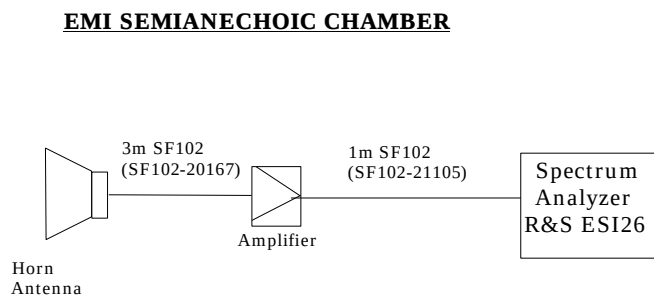


Figure 2-3. Cables for Radiated Emission Test (18 – 26.5GHz)

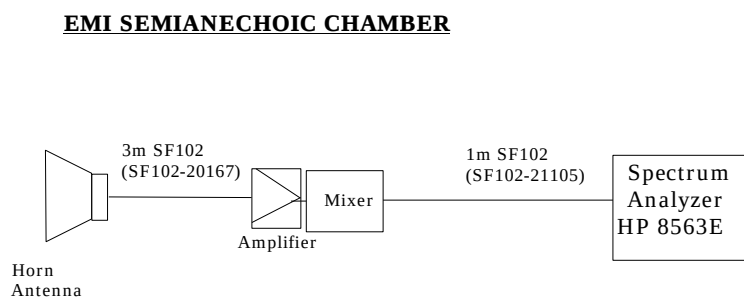


Figure 2-4. Cables for Radiated Emission Test (26.5 - 40GHz)

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)

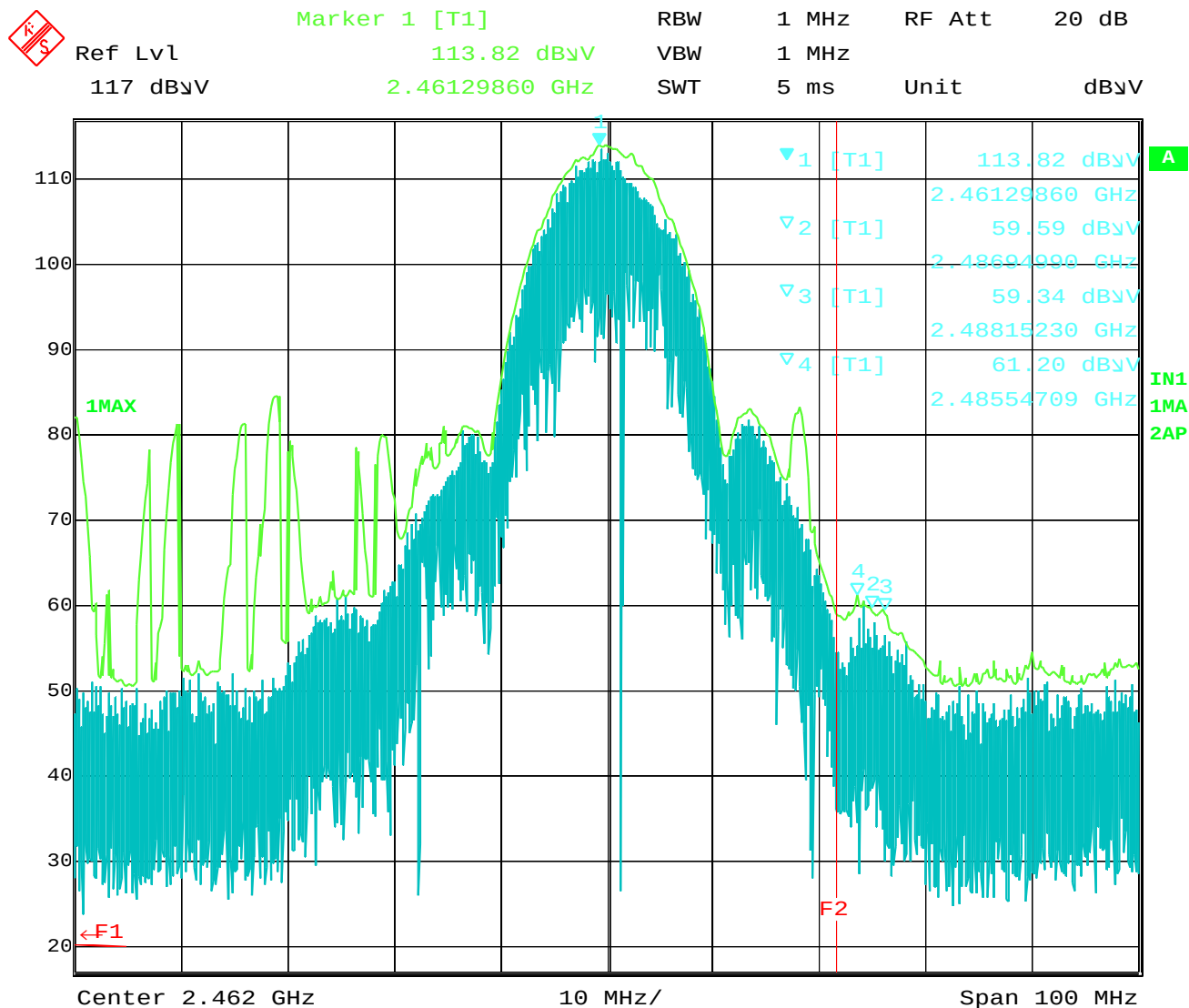
Ch.	Tx rate (Mb/s)	Frequency (GHz)	Polarity (H/V)	Reading (dBμV) (peak)	Rading (dBμV) (average)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m) (peak)	Margin to Limit (dB) (peak)	Field Strength (dBμV/m) (average)	Margin to Limit (dB) (average)
36	ABS	5.150	V	49.6	33.2	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.

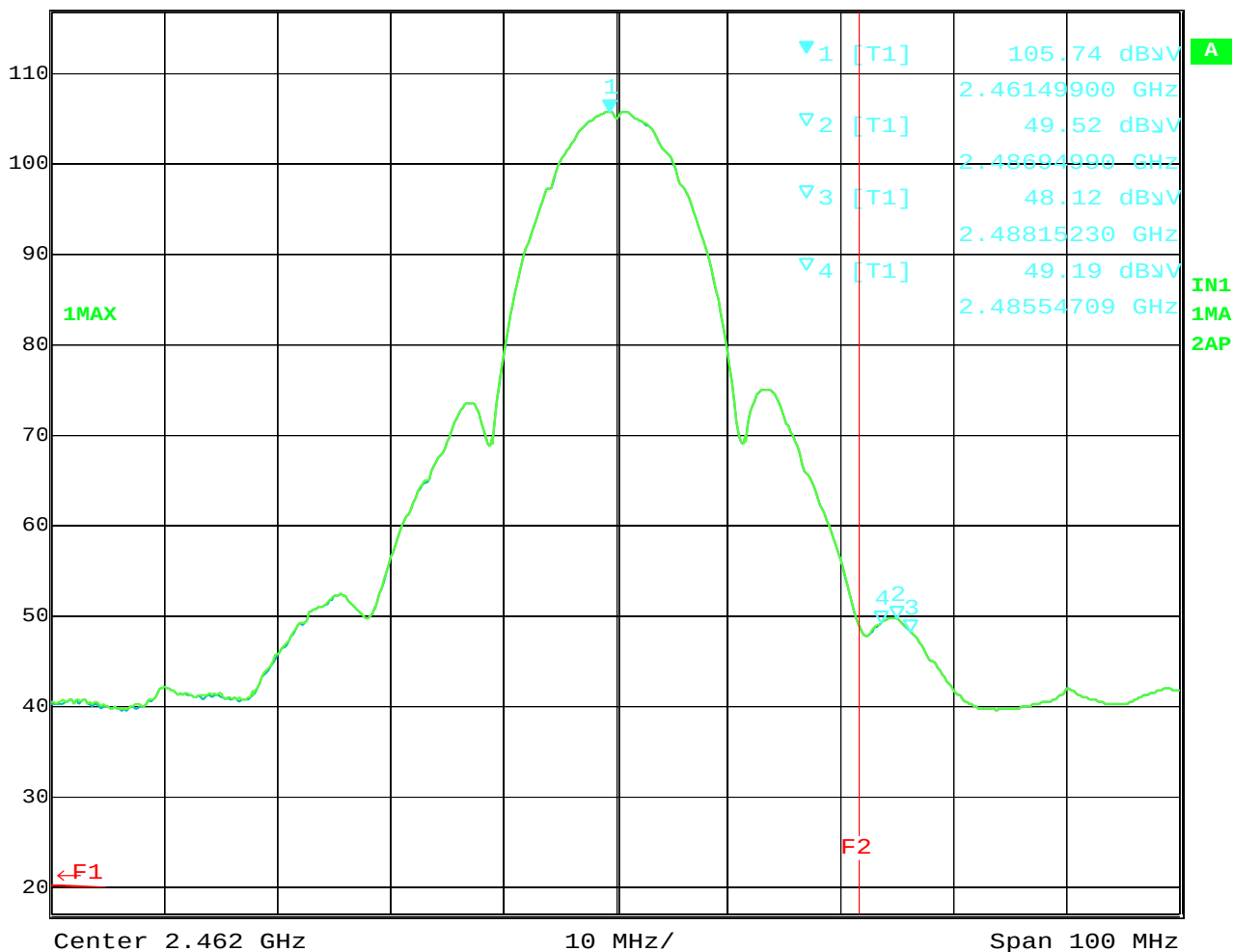


Date: 9.AUG.2005 20:18:37

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

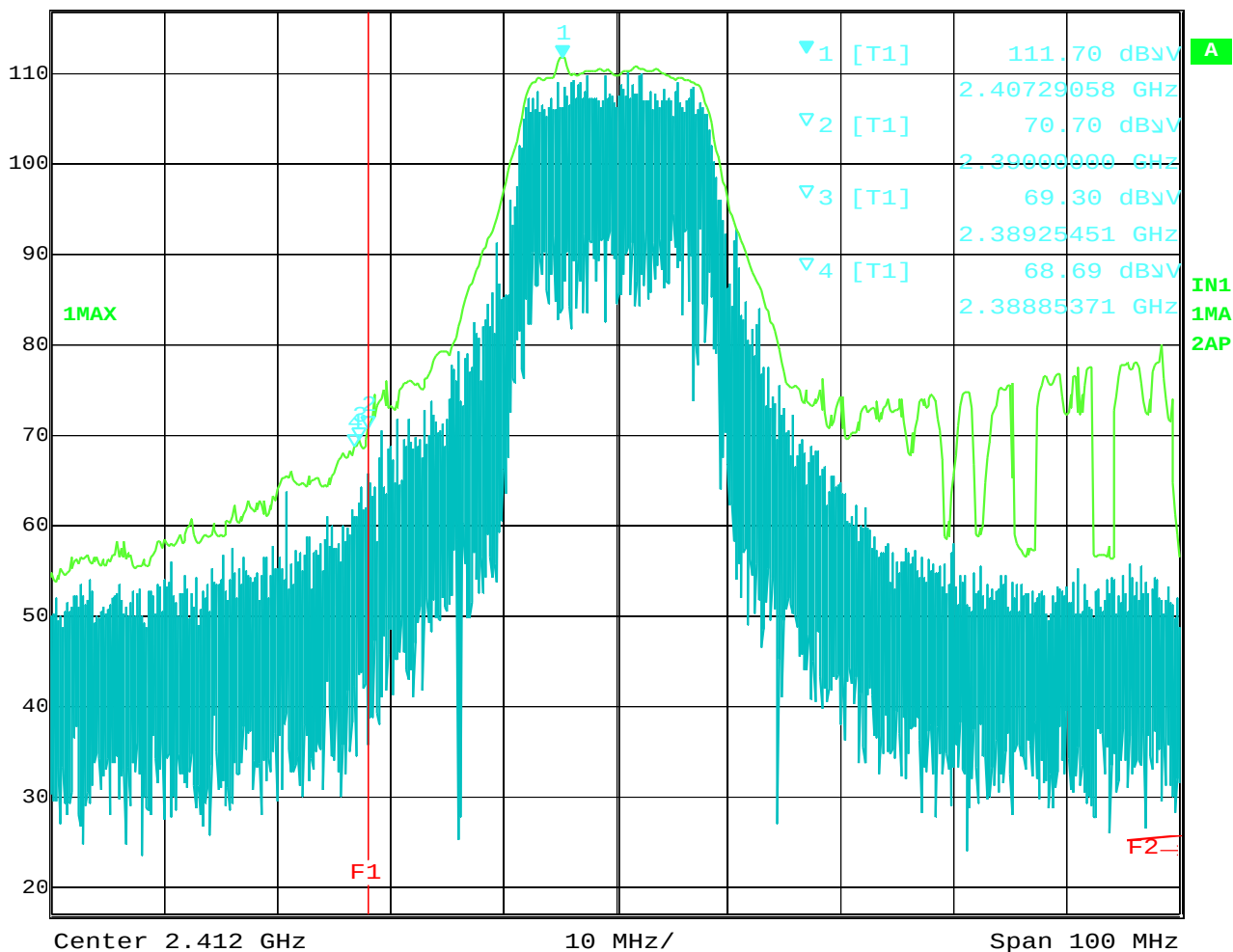


Date: 9.AUG.2005 20:19:37

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

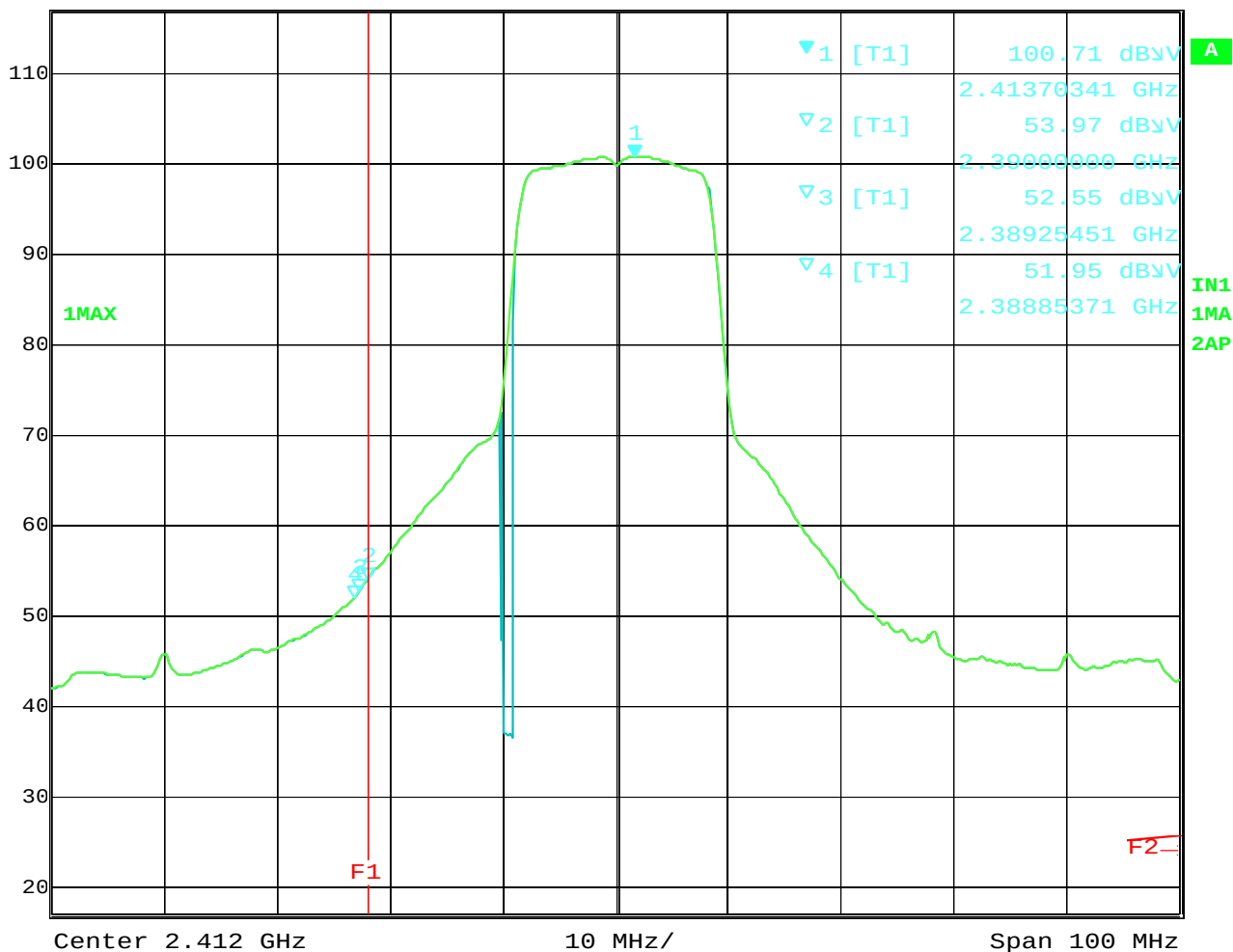


Date: 9.AUG.2005 21:09:55

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

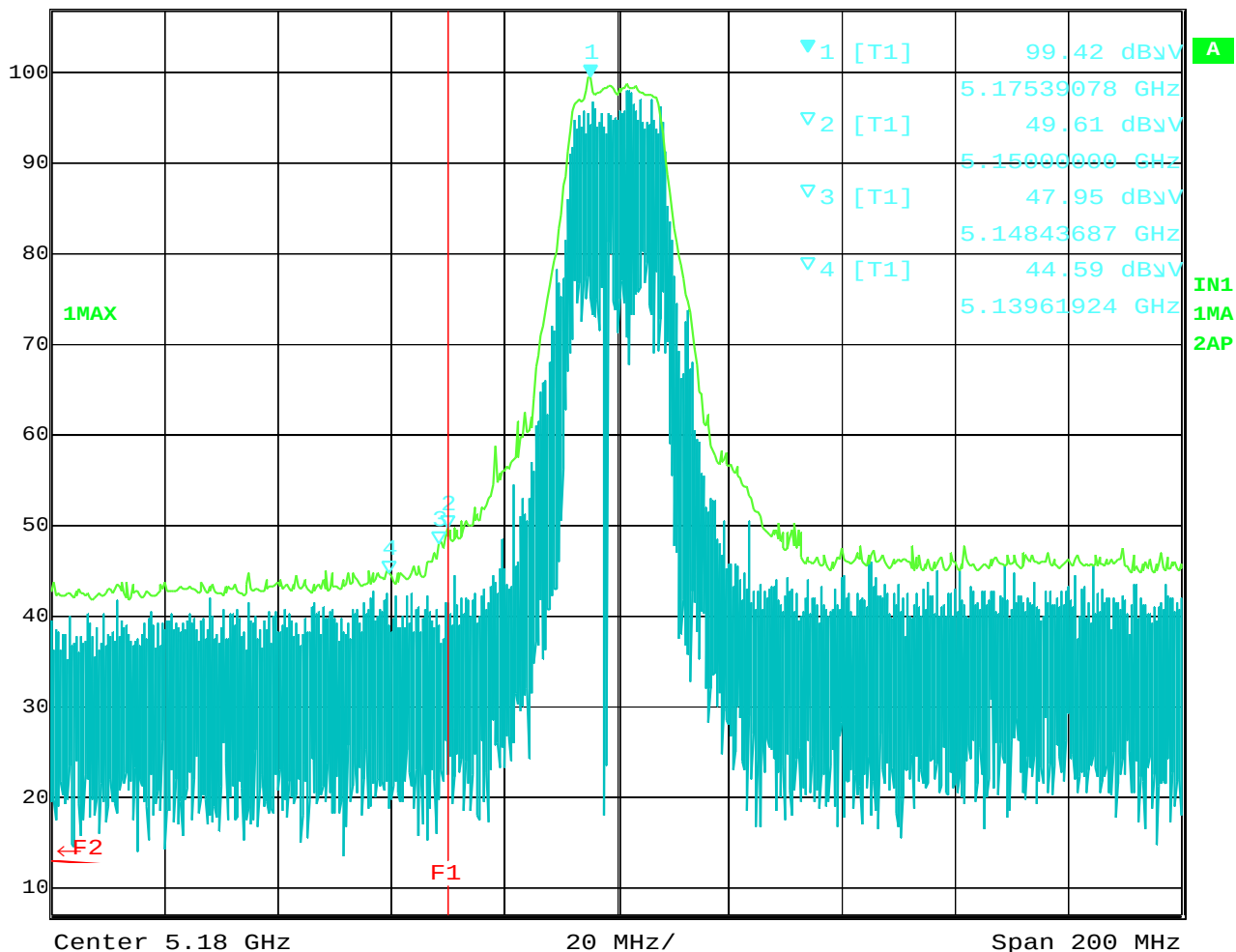
Plot 2-4 Ch.1 2412MHz TX, OFDM 6Mbps (Average) : LCD CFRP Aluminum



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

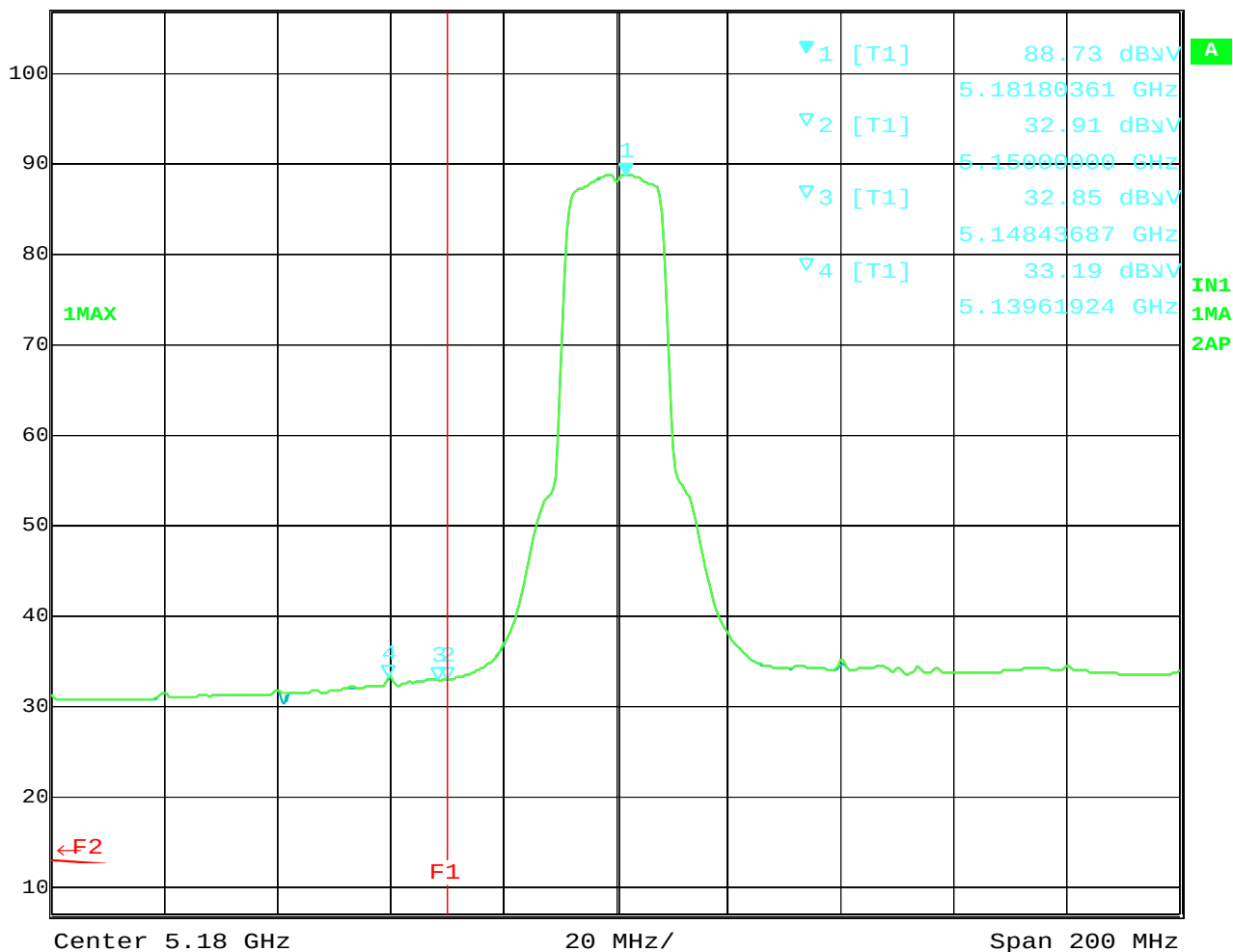


Date: 5.AUG.2005 16:33:47

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

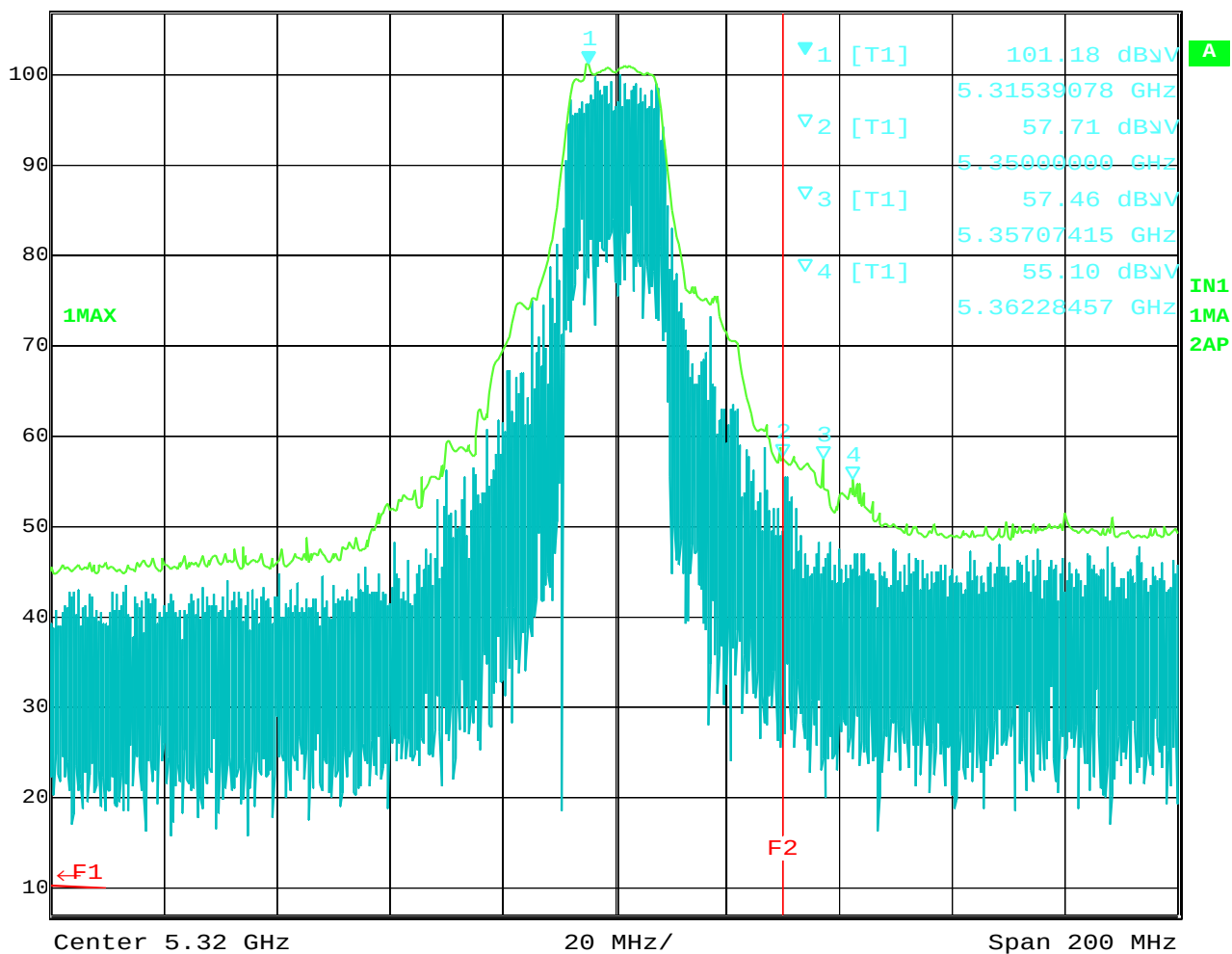


Date: 5.AUG.2005 16:35:34

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

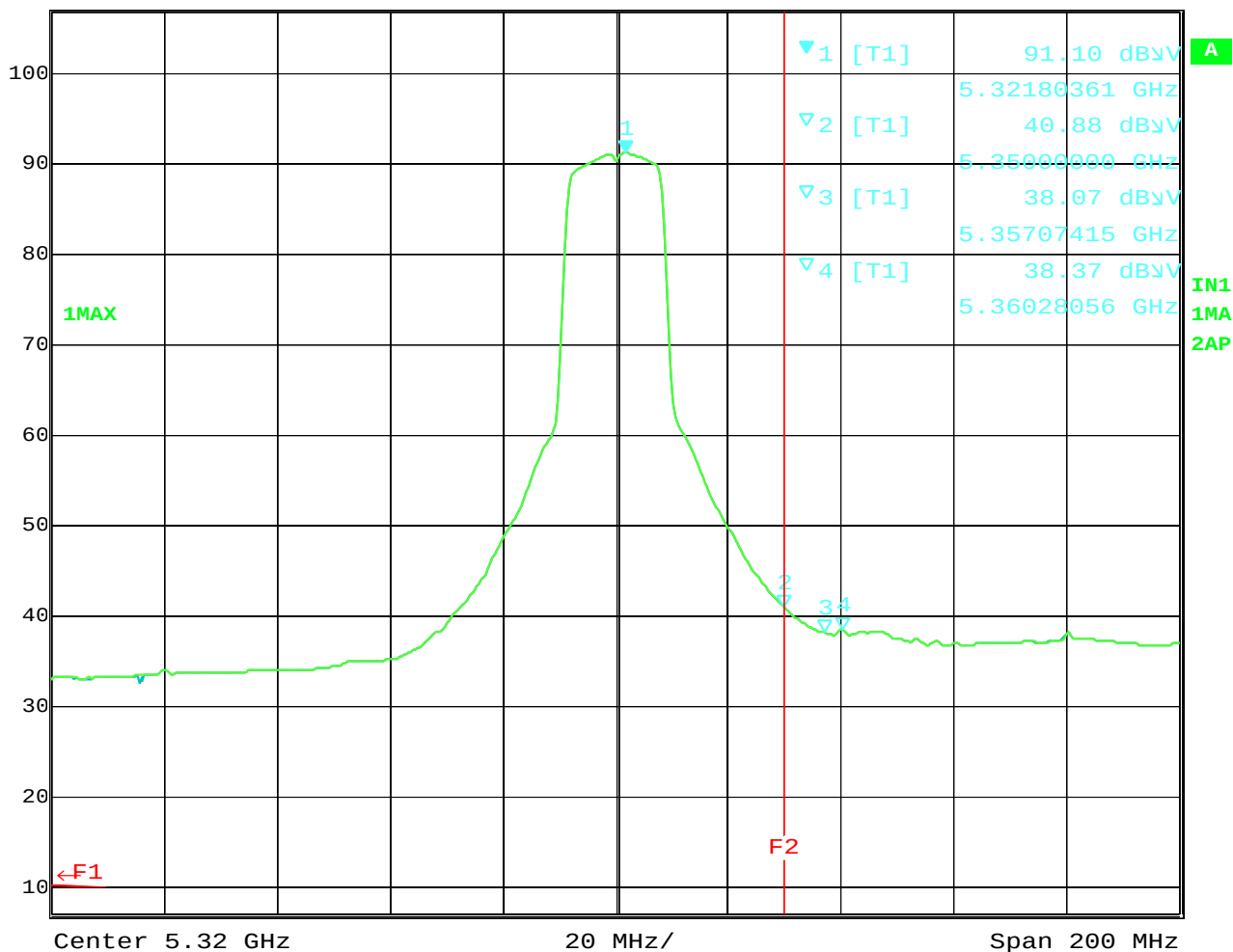


Date: 5.AUG.2005 17:44:11

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

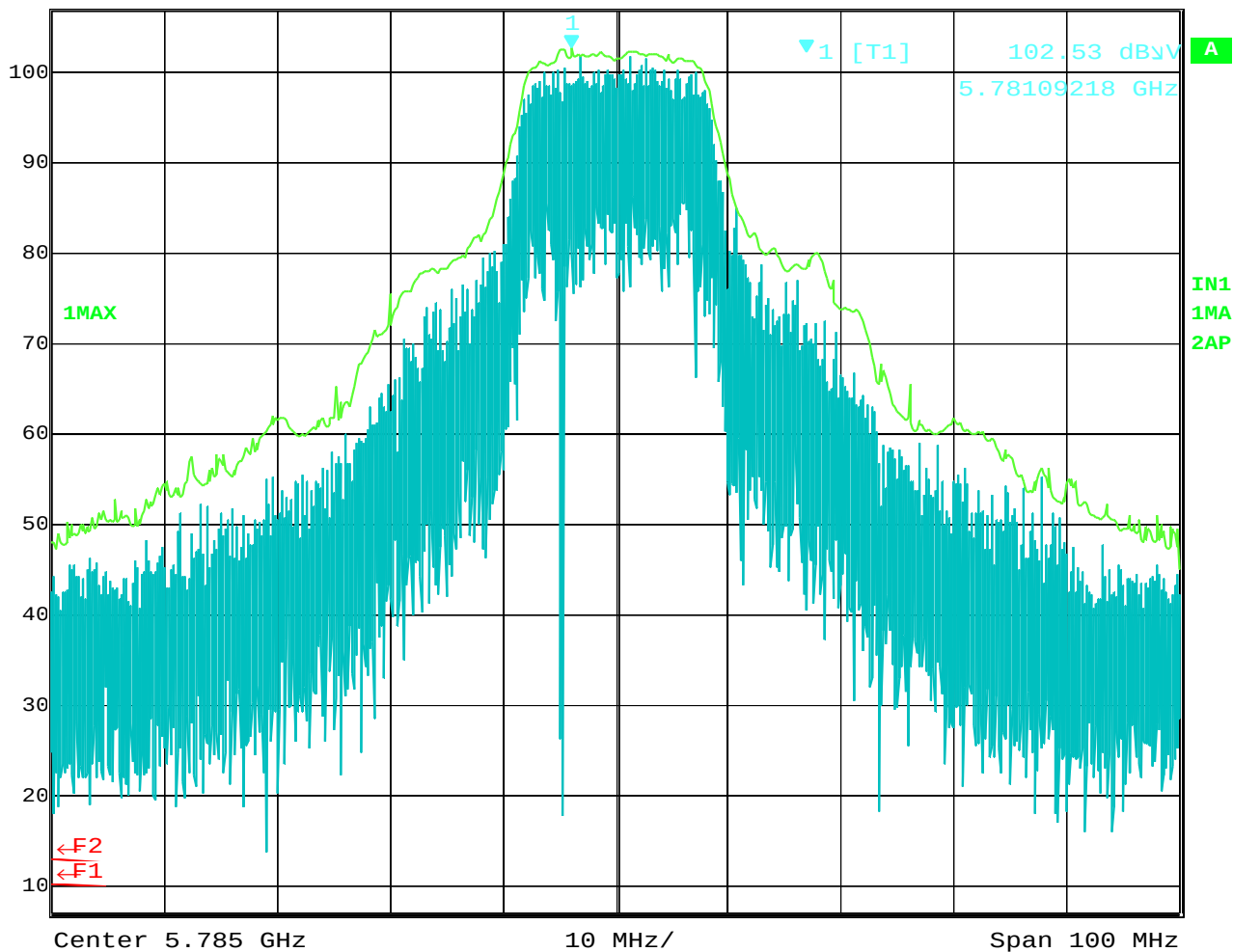
Plot 2-8 Ch.64 5320MHz TX, OFDM 6Mbps (Average) : LCD ABS



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

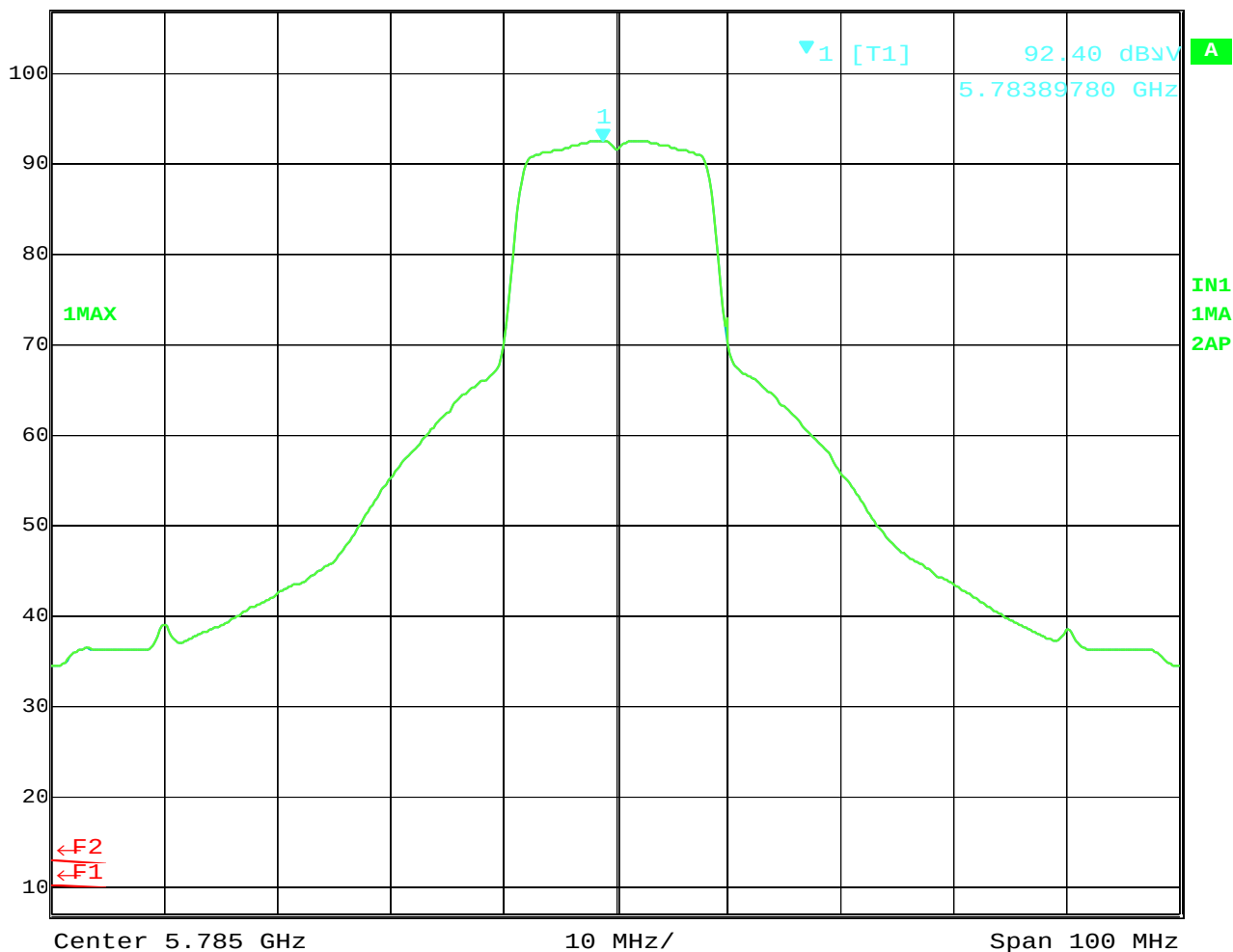


Date: 5.AUG.2005 18:40:28

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



Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	10 dB
107 dBμV	92.40 dBμV	VBW	10 Hz		
	5.78389780 GHz	SWT	25 s	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 (GHz)	Polarity (H/V)	Measured (dBμV) (peak)	Measured (dBμV) (average)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (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 (GHz)	Polarity (H/V)	Measured (dBμV) (peak)	Measured (dBμV) (average)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (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 (GHz)	Polarity (H/V)	Measured (dBμV) (peak)	Measured (dBμV) (average)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (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 (GHz)	Polarity (H/V)	Measured (dBμV) (peak)	Measured (dBμV) (average)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (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 (GHz)	Polarity (H/V)	Measured (dBμV) (peak)	Measured (dBμV) (average)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (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 (GHz)	Polarity (H/V)	Measured (dBμV) (peak)	Measured (dBμV) (average)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (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 (GHz)	Polarity (H/V)	Measured (dBμV) (peak)	Measured (dBμV) (average)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (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 (GHz)	Polarity (H/V)	Measured (dBμV) (peak)	Measured (dBμV) (average)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)
							(peak)			(average)		
Inband 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 (GHz)	Polarity (H/V)	Measured (dBμV) (peak)	Measured (dBμV) (average)	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (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

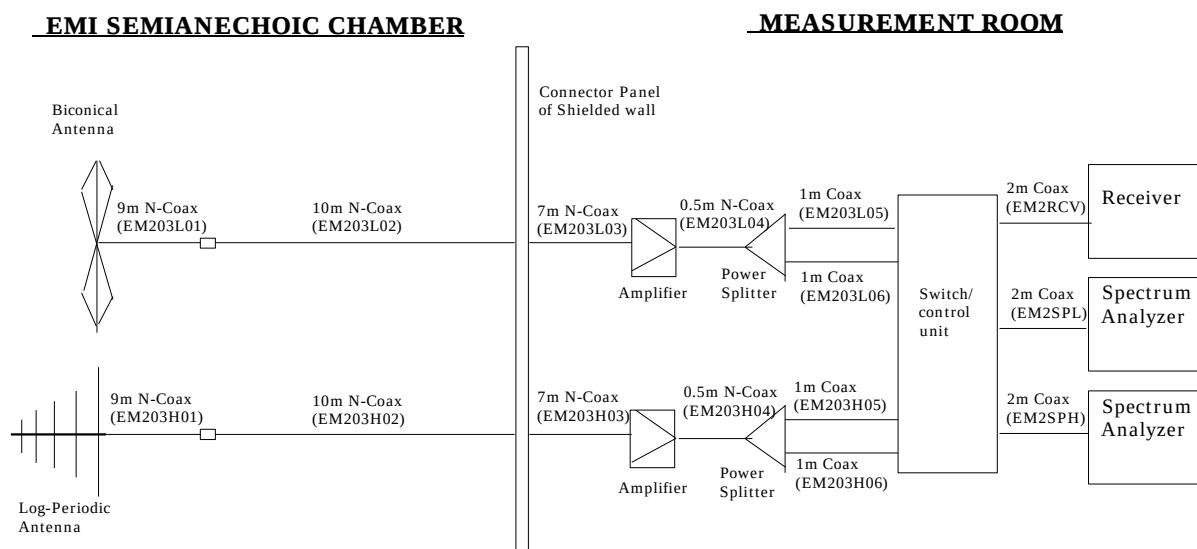


Figure 3 Cables for Radiated Emission Test

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 (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (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 (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (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 (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (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 (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (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 (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (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 (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (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 (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (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 (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (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 (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (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: - Lisen-L <=> SW/Con.unit (SW100) - Lisen-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

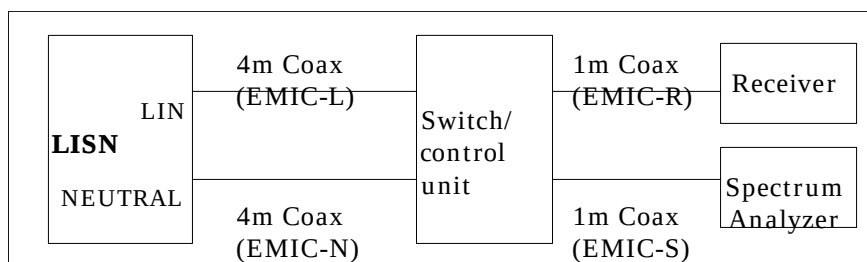


Figure 4. Cables for Conducted Emission Test

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. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (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. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (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. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (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. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (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. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (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. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (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. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (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. (MHz)	QP			AV			CISPR22 QP Limit (dB μ V)	Margin to limit (dB)	CISPR22 AV Limit (dB μ V)	Margin to limit (dB)	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)					
0.1783	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. (MHz)	QP			AV			CISPR22 QP Limit (dB μ V)	Margin to limit (dB)	CISPR22 AV Limit (dB μ V)	Margin to limit (dB)	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)					
0.1820	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