

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

Document Number : FCC 19-0257-0

Model Number: PH12127-E

measured with **IBM ThinkPad T40 Series, 15 inch model**

FCC ID: ANO20030400LEG
IC: 349E-PH12127E

March 5, 2004

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

Model: PH12127-E (802.11a/b/g Wireless LAN Adapter)
with
IBM ThinkPad T40 Series, 15 inch model
(Machine Type: 2373, 2374, 2375, 2376, 2378, 2379)

FCC ID : ANO20030400LEG**March 5, 2004**

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 C63.4-2000 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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A. General Information

APPLICANT : IBM Japan, Ltd.
 TEST SITE : IBM Japan, Ltd., Yamato Semi-anechoic chamber #1
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 REGULATION : FCC Part 15 Subpart C
 Industry Canada RSS-210 (Issue No.5)
 MODEL NAME : PH12127-E
 (Advertising Name) (IBM 11a/b/g Wireless LAN Mini PCI Adapter)
 FCC ID : ANO20030400LEG
 IC Certification Number : 349E-PH12127E
 SERIAL NUMBER : 11S91P7300Z1Z8MK3A30PA
 PHYSICAL CONDITION : Preproduction
 KIND OF EQUIPMENT : Personal computer with a IEEE802.11a, 11b & 11g Wireless LAN
 Mini-PCI Combo Card (**Composite application**)
 TESTED DATE : February 16, 19, 23, 24, 25, 26 and 27, 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
PH12127-E (s/n:11S91P7300Z1Z8MK3A30PA)	FCC ID: ANO20030400LEG IC: 349E-PH12127E	Applying equipment IEEE802.11a/b/g Wireless LAN Mini-PCI Combo Card without antenna
ThinkPad T40 Series M/T : 2373-PUU(15inch) (s/n ZZ-22134)	N/A	IBM Notebook PC with built in antenna CPU: Intel® Pentium® M Processor 735
P/N 02K6746	N/A	Universal AC adapter 72W, 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)	Bandwidth at 6 dB below	FCC requirement RSS-210 Issue5: Amendment	Conducted	Pass
– 5.9.1	Occupied BW (Bandwidth at 20 dB below)	IC requirement		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)	Transmitter peak 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		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.	Radiated (30MHz-1GHz)	Pass
			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	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.	Radiated (30MHz -1GHz)	Pass
			Radiated (1– 25GHz)	Pass

	Other requirements		Result
15.247(b)(4)(i) –	Antenna gain	Peak gain of the device : 1.24 dBi and 1.01dBi	N/A
– 5.2	Supply Voltage	Main power source: Universal AC adapter 72W 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 handshake connector. Refer to “Confidential_E-Handshake.pdf (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 measurements of each 2.4GHz or 5.8GHz band.
 - 2412MHz (lowest), 2437MHz(middle), and 2462MHz (highest) for 2.4GHz band
 - 5745MHz (lowest), 5785MHz(middle), and 5825MHz (highest) for 5.8GHz band
3. 11Mbps, 18Mb/s, and 24Mbps transmission modes were selected for full testing as the worse case samplings. See “Chapter 3. Conducted Peak Output Power” as to the determination of measurement plots.
4. As for the RF receiving test, the middle channels (2437MHz or 5785MHz) were selected representatively.

Table-C Transmission mode of EUT (The measurement plots are shown in shading.)

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	18M bps	54M bps
2.412 (Ch. 1)	+17	+17	+17	+14	+14	+14	+14	+14	+14	13.5	11.5
2.417 (Ch. 2)	+17	+17	+17	+17	+17	+17	+17	+17	15.5	13.5	11.5
2.422 (Ch. 3)	+17	+17	+17	+17	+17	+17	+17	+17	15.5	13.5	11.5
2.427 (Ch. 4)	+17	+17	+17	+17	+17	+17	+17	+17	15.5	13.5	11.5
2.432 (Ch. 5)	+17	+17	+17	+17	+17	+17	+17	+17	15.5	13.5	11.5
2.437 (Ch. 6)	+17	+17	+17	+17	+17	+17	+17	+17	15.5	13.5	11.5
2.442 (Ch. 7)	+17	+17	+17	+17	+17	+17	+17	+17	15.5	13.5	11.5
2.447 (Ch. 8)	+17	+17	+17	+17	+17	+17	+17	+17	15.5	13.5	11.5
2.452 (Ch. 9)	+17	+17	+17	+17	+17	+17	+17	+17	15.5	13.5	11.5
2.457 (Ch. 10)	+17	+17	+17	+17	+17	+17	+17	+17	15.5	13.5	11.5
2.462 (Ch. 11)	+17	+17	+17	+14	+14	+14	+14	+14	+14	13.5	11.5
				IEEE802.11a							
5.745 (Ch.149)	N/A			+16	+16	+16	+16	+16	+15	+12	+10
5.765 (Ch.153)				+16	+16	+16	+16	+16	+15	+12	+10
5.785 (Ch.157)				+16	+16	+16	+16	+16	+15	+12	+10
5.805 (Ch.161)				+16	+16	+16	+16	+16	+15	+12	+10
5.825 (Ch.165)				+16	+16	+16	+16	+16	+15	+12	+10

D. Justification

The EUT was investigated for both the main (left) and the auxiliary (right) antennas for each Tx mode. The worse case data taken in this report represents the measurement result of the left antenna that has comparatively higher gain for both 2.4GHz and 5.8GHz bands as shown below.

Table-D Peak Antenna Gains of EUT

	Left Antenna gain	Right Antenna gain
2.4GHz band	1.24 dBi (peak)	0.38 dBi (peak)
5.8GHz band	1.01 dBi (peak)	- 0.23 dBi (peak)

And the columns marked with shading in the Table-C are the worst cases of each Tx mode for all measurement items. This test report represents the measurement results performed with those Tx modes.

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	3019A05156	08/14/03	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	3026A19366	08/14/03	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	2811A01433	08/14/03	1 year
Quasi-Peak Adapter	HP 85650A	2811A01156	08/25/03	1 year
Amplifier (100KHz - 1.3GHz)				
- for 30-200MHz	HP 8447F	2805A02919	04/14/03	1 year
- for 200-1000MHz	MITEQ AM-3A	898432	02/20/04	1 year
Amplifier (1 - 18GHz)	HP 8449B	3008A00582	06/11/03	1 year
Amplifier (18 - 40GHz)	Agilent 83051A	3950M00193	01/27/04	1 year
Spectrum Analyzer EMI Test Receiver	R&S ESI26	836119/003	05/01/03	1 year
Spectrum Analyzer	HP 8563E	3416A02248	08/21/03	1 year
Harmonic Mixer	Agilent 11970A	011269-001	07/19/03	1 year
Receiver (9kHz-30MHz)	R&S ESH3	891806/012	10/17/03	1 year
Receiver (20MHz-1.3GHz)	R&S ESVP	892111/030	03/17/03	1 year
Biconical Antenna (30-200MHz)	EMCO 3108	2536	04/23/03	1 year
Log-Periodic Antenna (200-1000MHz)	EMCO 3146	2849	04/23/03	1 year
Horn Antenna (1- 18GHz)	EMCO 3115	9903-5774	07/17/03	1 year
Horn Antenna (3.95- 5.85GHz)	EMCO 3160-5	1099	07/17/03	1 year
Horn Antenna (5.85- 8.20GHz)	EMCO 3160-6	9712-1044	07/17/03	1 year
Horn Antenna (8.2- 12.4GHz)	EMCO 3160-7	1156	07/17/03	1 year
Horn Antenna (12.4- 18GHz)	EMCO 3160-8	1143	07/17/03	1 year
Horn Antenna (18- 26.5GHz)	EMCO 3160-9	0004-1202	07/17/03	1 year
Horn Antenna (26.5- 40GHz)	EMCO 3160-10	1175	07/17/03	1 year
LISN	EMCO 3810/2NM	00022007	05/20/03	1 year
Power Meter	HP 437B	3043U03437	11/19/03	1 year
Power Sensor	HP 8481A	US41030582	11/19/03	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	03/27/03	1 year
- RF Amp.<=>Spectrum Analyzer(<12GHz)	16m	- GEM0101	03/27/03	1 year
- RF Amp.<=>Spectrum Analyzer(>12GHz)	3 m	- SF102-20166	03/27/03	1 year

Coaxial cables (18 – 40GHz):				
- Horn Ant <=> RF Amp.	3m	- SF102-20167	03/27/03	1 year
- RF Amp.<=>Spectrum Analyzer	1m	- SF102-21105	03/27/03	1 year
N-Coax cables:				
- Bi-coni Ant <=> 10m Cable	9 m	- EM103L01	04/14/03	1 year
- 10m Cable <=> Shield Panel	10 m	- EM103L02	04/14/03	1 year
- Shield Panel <=> RF Amp	7 m	- EM103L03	04/14/03	1 year
- RF Amp <=> Power Splitter	0.5m	- EM103L04	04/14/03	1 year
- Log-peri Ant <=> 10m Cable	9 m	- EM103H01	04/14/03	1 year
- 10m Cable <=> Shield Panel	10 m	- EM103H02	04/14/03	1 year
- Shield Panel <=> RF Amp	7 m	- EM103H03	04/14/03	1 year
- RF Amp <=> Power Splitter	0.5m	- EM103H04	04/14/03	1 year
Coax cables:				
- Lisn-L <=> SW/Con.unit (SW100)	4 m	- EMIC-L	04/14/03	1 year
- Lisn-N <=> SW/Con.unit (SW101)	4 m	- EMIC-N	04/14/03	1 year
- SW/Con.unit <=> RCVR (Input)	1 m	- EMIC-R	04/14/03	1 year
- SW/Con.unit<=> Spe Ana.(Signal In)	1 m	- EMIC-S	04/14/03	1 year
- Power Splitter <=> SW/Con.unit (SW110)	1 m	- EM103L05	04/14/03	1 year
- Power Splitter <=> SW/Con.unit (SW300)	1 m	- EM103L06	04/14/03	1 year
- Power Splitter <=> SW/Con.unit (SW100)	1 m	- EM103H05	04/14/03	1 year
- Power Splitter <=> SW/Con.unit (SW301)	1 m	- EM103H06	04/14/03	1 year
- SW/Con.unit <=> Receiver (Input)	2 m	- EM1RCV	04/14/03	1 year
- SW/Con.unit <=> Spe Ana.(Signal In) for 30- 200MHz	2 m	- EM1SPL	04/14/03	1 year
- SW/Con.unit <=> Spe Ana.(Signal In) for 200-1000MHz	2 m	- EM1SPH	04/14/03	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

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

1. Bandwidth at 6 dB below

[FCC 15.247(a)(2)]

1.1 Test Procedure

The bandwidth at 6 dB down from the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT was operating in transmission mode at the appropriate center frequency.

The spectrum analyzer was set to :

RBW=100kHz, VBW=100kHz^{*1}, Span=30MHz, Mode= Peak detector,

Sweep=suitable duration based on the EUT specification

*1: To be adjusted accordingly based on the spectrum stability

1.2 Test Instruments and Measurement Setup

Table 1-1 : 6 dB Bandwidth Test Instruments

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

Notes: - R&S: Rohde & Schwarz

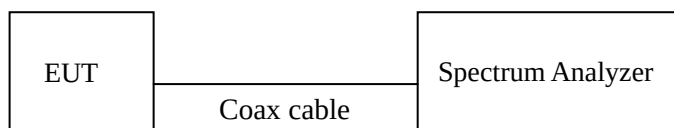


Figure 1: Measurement setup for 6dB bandwidth test

1.3 Measurement Results

Test Date: February 16, 2004

1.3.1 2.4GHz band DSSS mode

Table 1-2-1. 6dB bandwidth, 2.4GHz band DSSS mode, TX mode 1Mbps

Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 6 dB below (MHz)	Limit (MHz)
2412 (ch. 1)	omitted	2405.96	2418.10	12.14	> 0.5
2437 (ch. 6)	omitted	2430.96	2443.64	12.68	
2462 (ch. 11)	Plot 1-1	2455.96	2468.10	12.14	

Table 1-2-2. 6dB bandwidth, 2.4GHz band DSSS mode, TX mode 11Mbps

Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 6 dB below (MHz)	Limit (MHz)
2412 (ch. 1)	omitted	2406.14	2417.62	11.48	> 0.5
2437 (ch. 6)	omitted	2431.14	2442.62	11.48	
2462 (ch. 11)	Plot 1-2	2456.14	2467.50	11.36	

1.3.2 2.4GHz band OFDM mode

Table 1-2-3. 6dB bandwidth, 2.4GHz band OFDM mode, TX mode 6Mbps

Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 6 dB below (MHz)	Limit (MHz)
2412 (ch. 1)	omitted	2403.67	2420.39	16.72	> 0.5
2437 (ch. 6)	omitted	2428.67	2445.39	16.72	
2462 (ch. 11)	Plot 1-3	2453.73	2470.39	16.66	

Table 1-2-4. 6dB bandwidth, 2.4GHz band OFDM mode, TX mode 18Mbps

Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 6 dB below (MHz)	Limit (MHz)
2412 (ch. 1)	omitted	2403.73	2420.33	16.60	> 0.5
2437 (ch. 6)	omitted	2428.73	2445.33	16.60	
2462 (ch. 11)	Plot 1-4	2453.73	2470.33	16.60	

1.3.3 5.8GHz band OFDM mode

Table 1-2-5. 6dB bandwidth, 5.8GHz band OFDM mode, TX mode 6Mbps

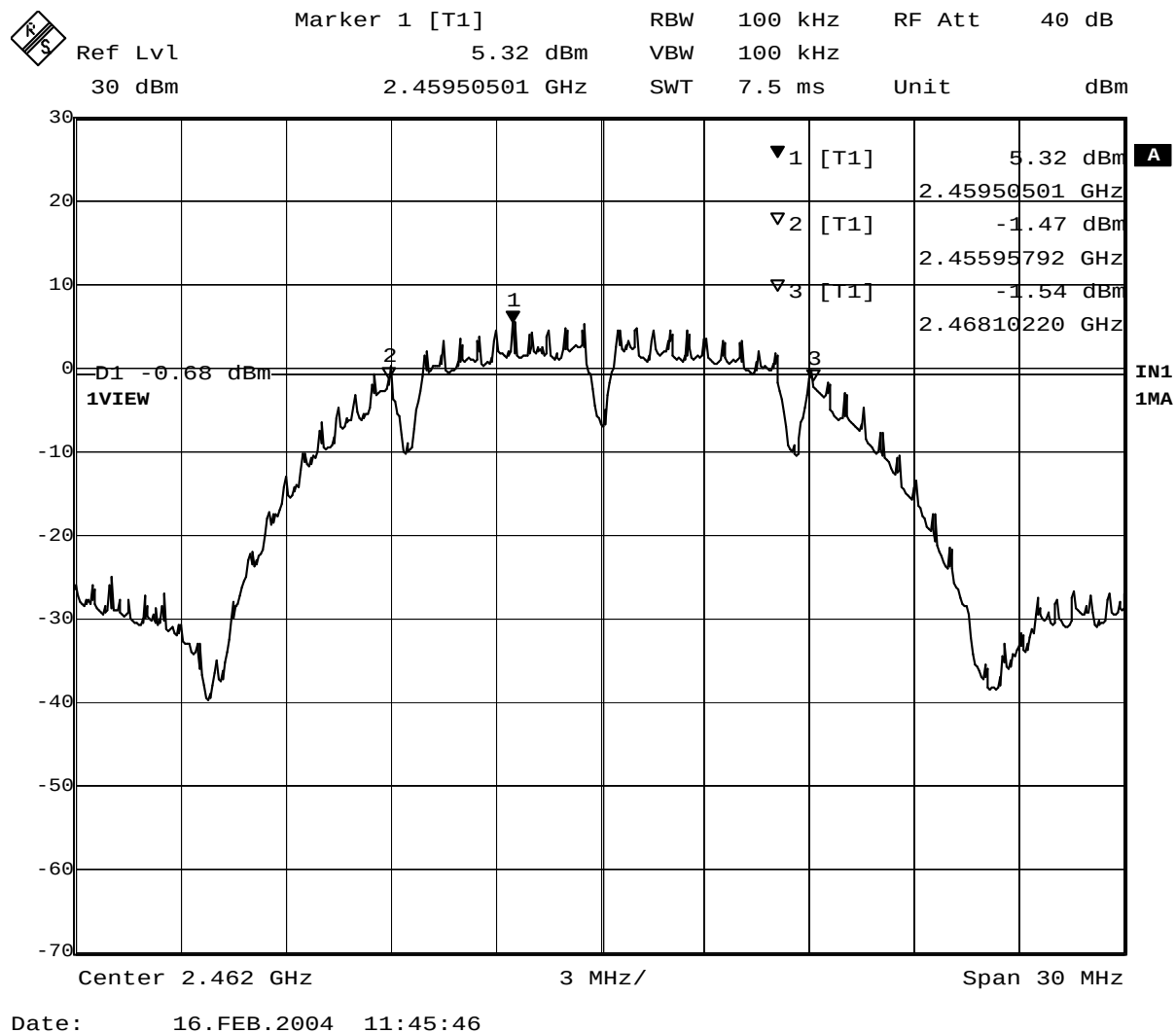
Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 6 dB below (MHz)	Limit (MHz)
5745 (ch. 149)	omitted	5736.67	5753.33	16.66	> 0.5
5785 (ch. 157)	omitted	5776.67	5793.33	16.66	
5825 (ch. 165)	Plot 1-5	5816.67	5833.33	16.66	

Table 1-2-6. 6dB bandwidth, 5.8GHz band OFDM mode, TX mode 24Mbps

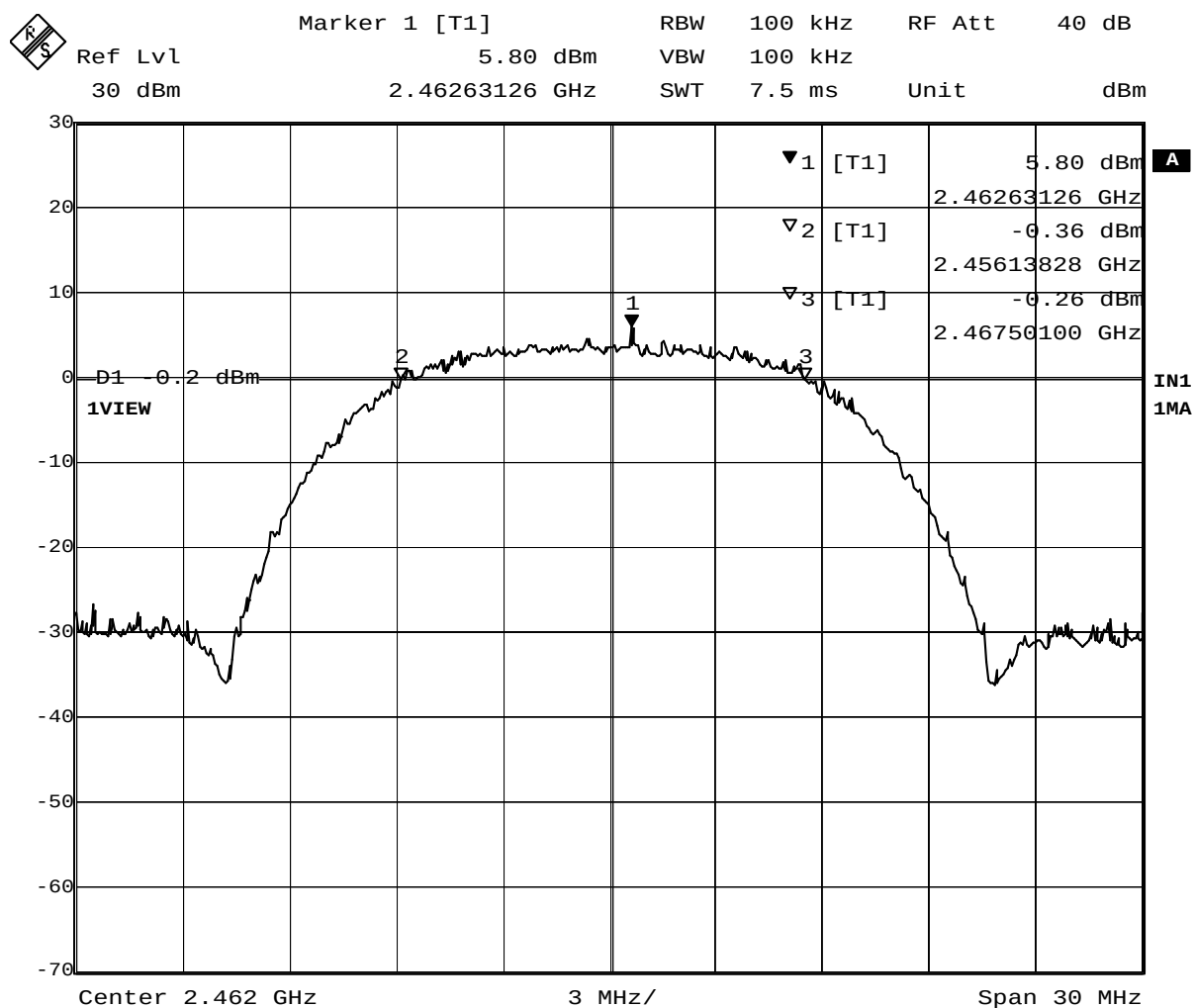
Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 6 dB below (MHz)	Limit (MHz)
5745 (ch. 149)	omitted	5736.73	5753.39	16.66	> 0.5
5785 (ch. 157)	omitted	5776.67	5793.33	16.66	
5825 (ch. 165)	Plot 1-6	5816.73	5833.33	16.60	

1.4 Trace Data of 6dB bandwidth

The plots are comparatively worse measurement cases in the previous [Table 1-2-1](#) through [Table 1-2-6](#).



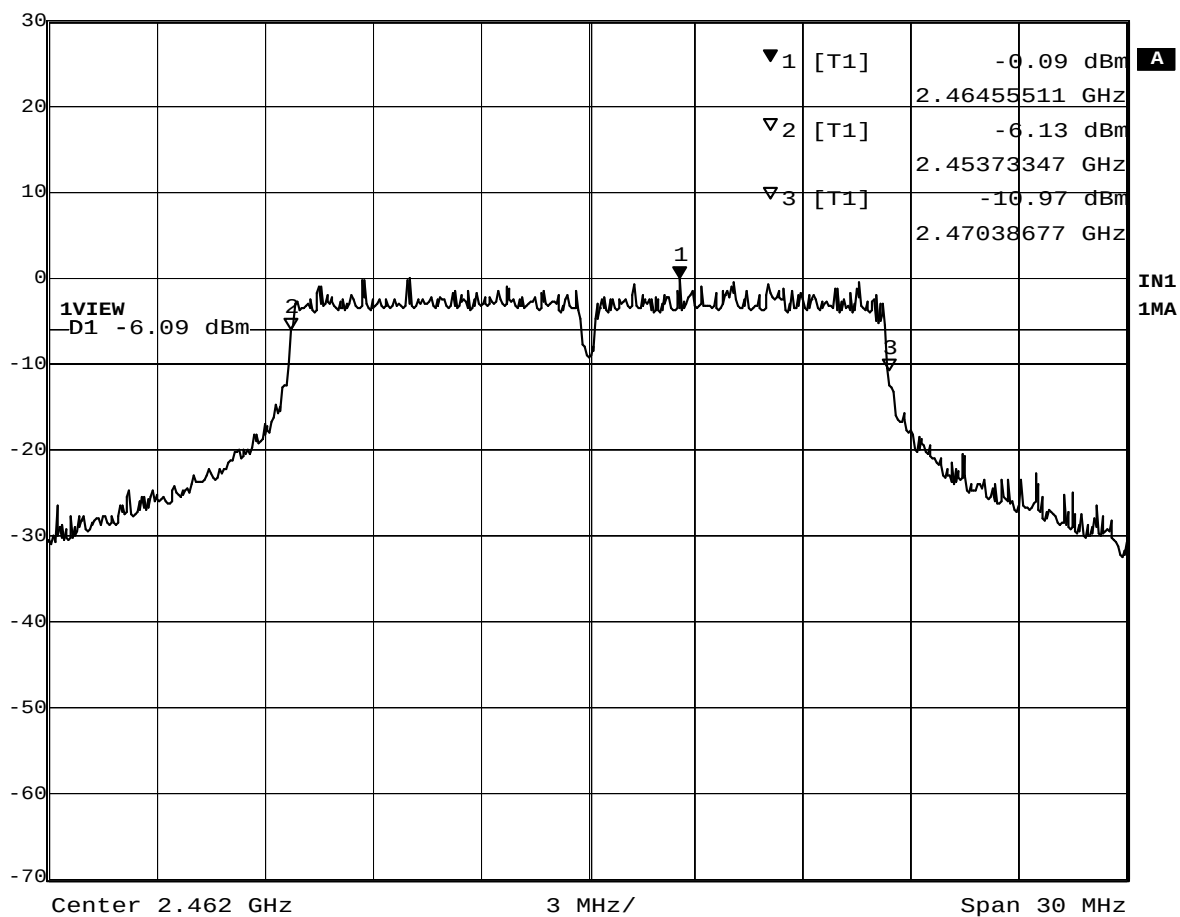
Plot 1-1. 6dB BW at 2462MHz, (DSSS, 1Mbps)



Plot 1-2. 6dB BW at 2462MHz (DSSS, 11Mbps)

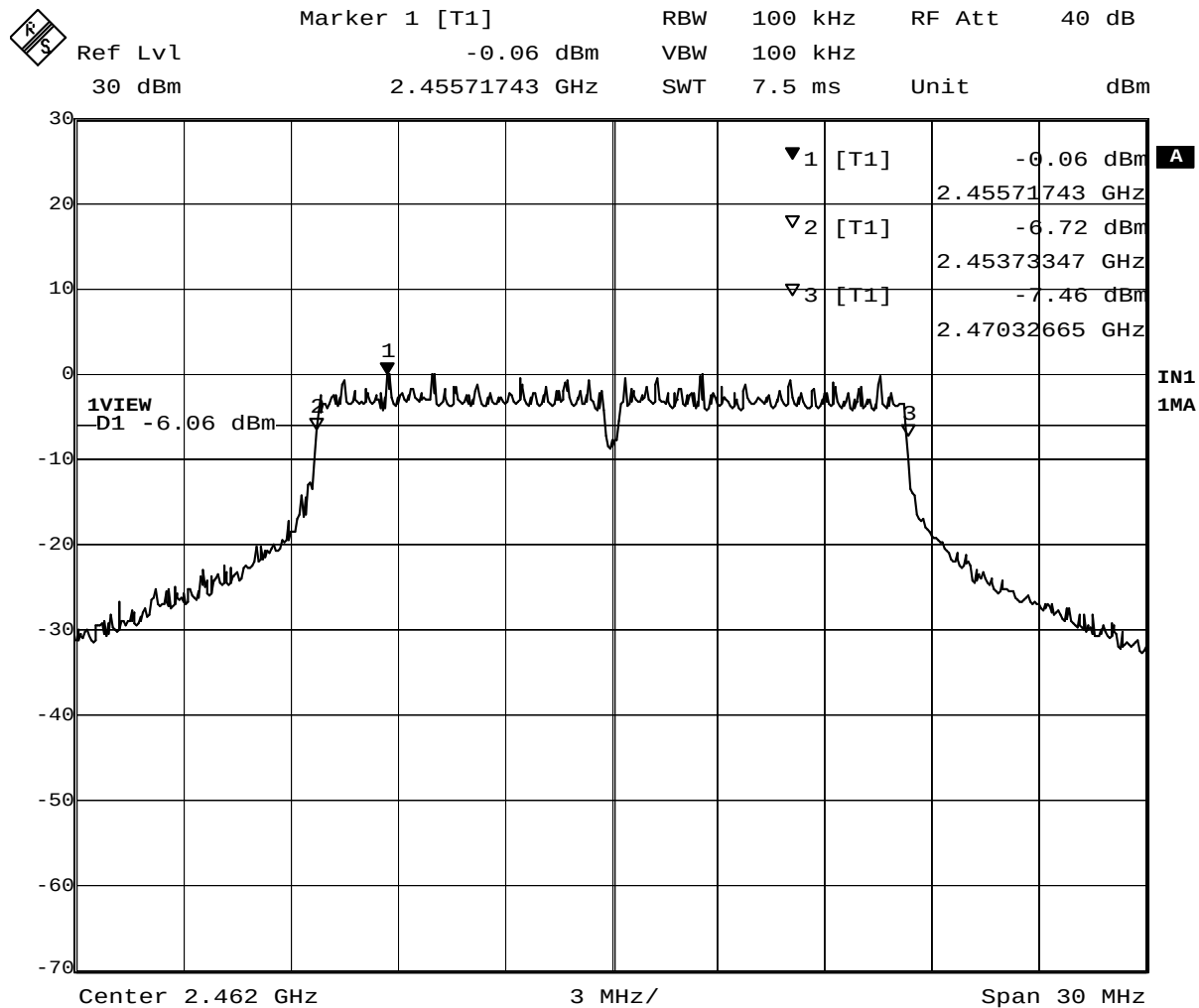


Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl -0.09 dBm VBW 100 kHz
30 dBm 2.46455511 GHz SWT 7.5 ms Unit dBm



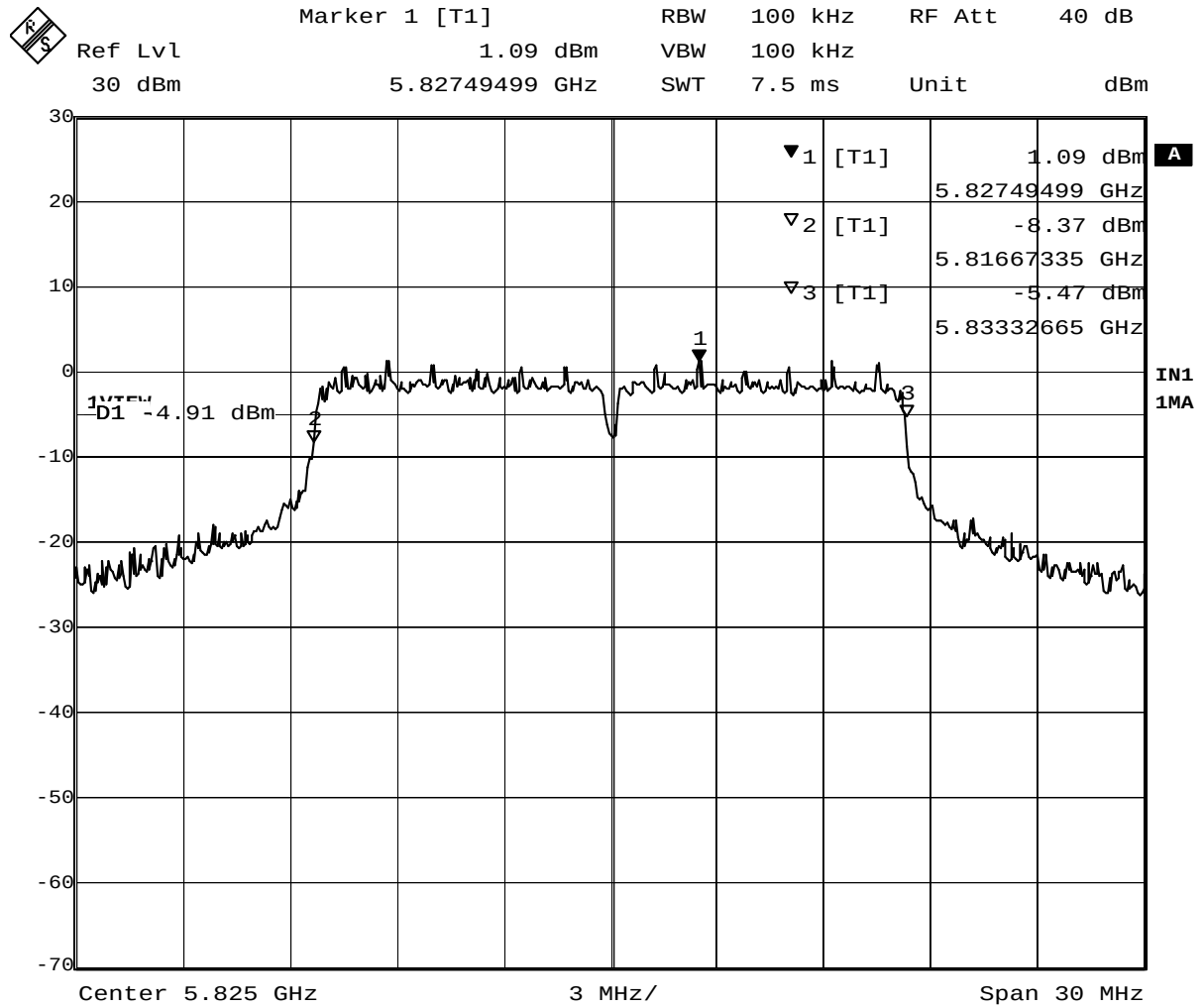
Date: 16.FEB.2004 13:34:19

Plot 1-3. 6dB BW at 2462MHz (OFDM, 6Mbps)



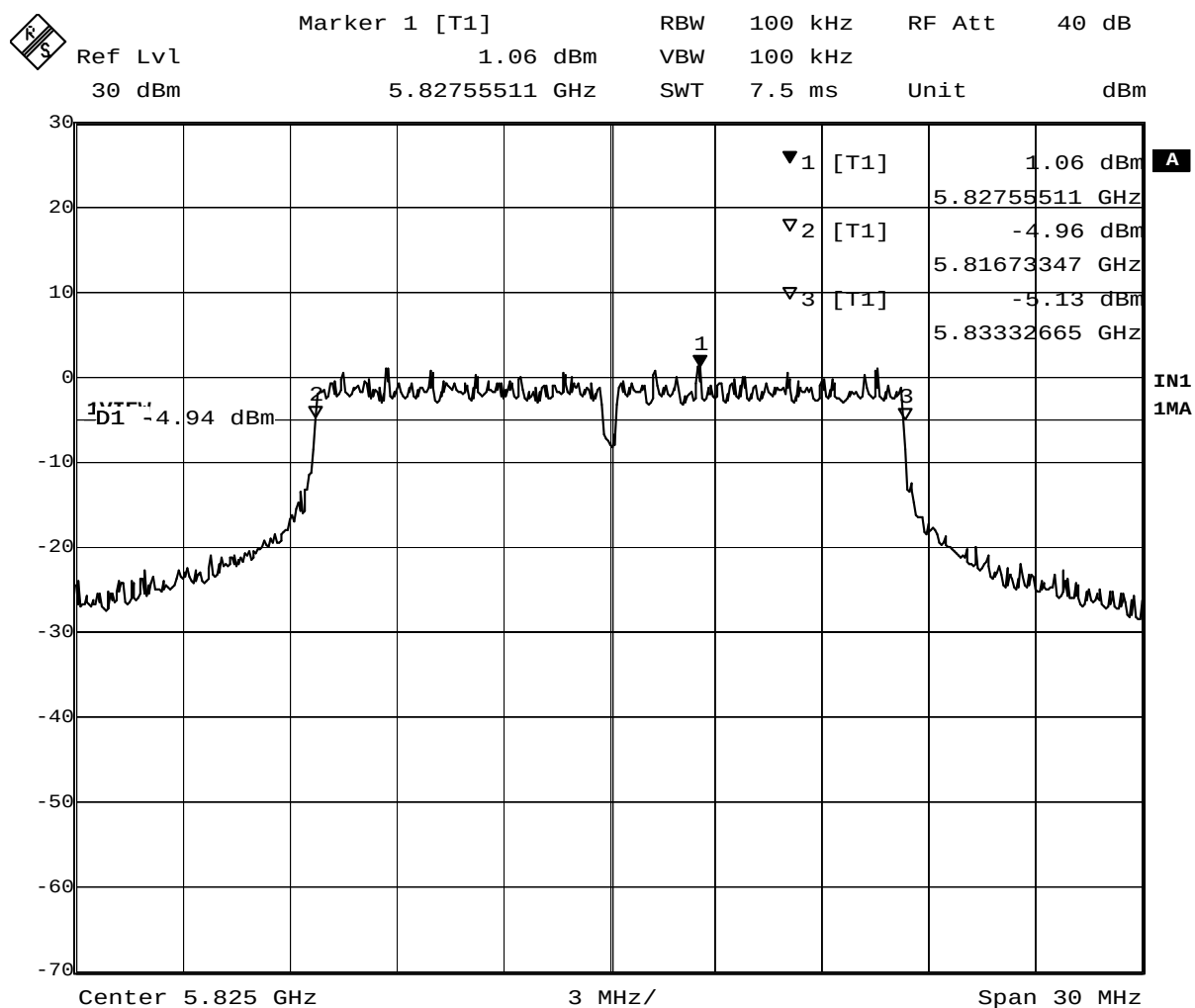
Date: 16.FEB.2004 13:30:43

Plot 1-4. 6dB BW at 2462MHz (OFDM, 18Mbps)



Date: 16.FEB.2004 14:55:09

Plot 1-5. 6dB BW at 5825MHz (OFDM, 6Mbps)



Date: 16.FEB.2004 14:51:50

Plot 1-6. 6dB BW at 5825MHz (OFDM, 24Mbps)

2. Occupied Bandwidth (20 dB Bandwidth)

[RSS-210 5.9.1]

2.1 Test Procedure

The bandwidth at 20 dB down from the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT was operating in transmission mode at the appropriate center frequency.

The spectrum analyzer was set to:

RBW=100kHz, VBW=100kHz^{*1}, Span=50MHz, Mode= Peak detector,

Sweep= suitable duration based on the EUT specification

*1: To be adjusted accordingly based on the spectrum stability

2.2 Test Instruments and Measurement Setup

Same as the Chapter 1 (Table 1-1 & Figure 1).

2.3 Measurement Results

note) The transmission speed rate for the measurement was determined based on the results of previous 6 dB bandwidth measurement. The worse cases were selected representatively.

Test Date: February 16, 2004

2.3.1 2.4GHz band DSSS mode

Table 2-2-1. Occupied bandwidth, 2.4GHz band DSSS mode, TX 11Mbps

Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 20 dB below (MHz)
2412 (ch. 1)	omitted	2403.15	2420.99	17.84
2437 (ch. 6)	omitted	2428.03	2445.84	17.81
2462 (ch. 11)	Plot 2-1	2452.93	2470.89	17.96

2.3.2 2.4GHz band OFDM mode

Table 2-2-2. Occupied bandwidth, 2.4GHz band OFDM mode, TX 18Mbps

Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 20 dB below (MHz)
2412 (ch. 1)	omitted	2402.73	2421.77	19.04
2437 (ch. 6)	Plot 2-2	2426.83	2446.72	19.89
2462 (ch. 11)	omitted	2452.13	2471.37	19.24

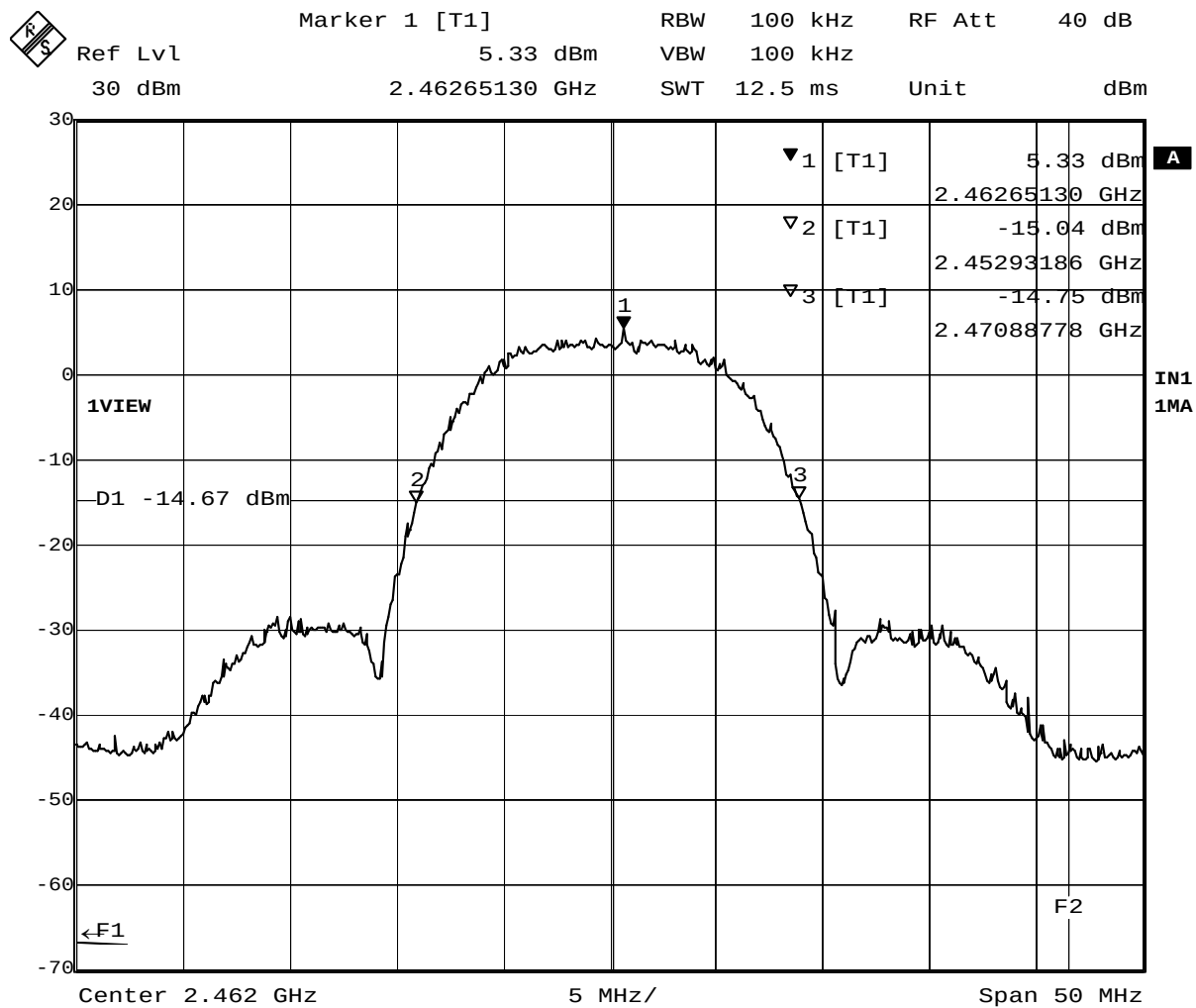
2.3.3 5.8GHz band OFDM mode

Table 2-2-3. Occupied bandwidth, 5.8GHz band OFDM mode, TX 24Mbps

Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 20 dB below (MHz)
5745 (ch. 149)	Plot 2-3	5735.13	5754.37	19.24
5785 (ch. 157)	omitted	5775.13	5794.17	19.04
5825 (ch. 165)	omitted	5815.23	5834.27	19.04

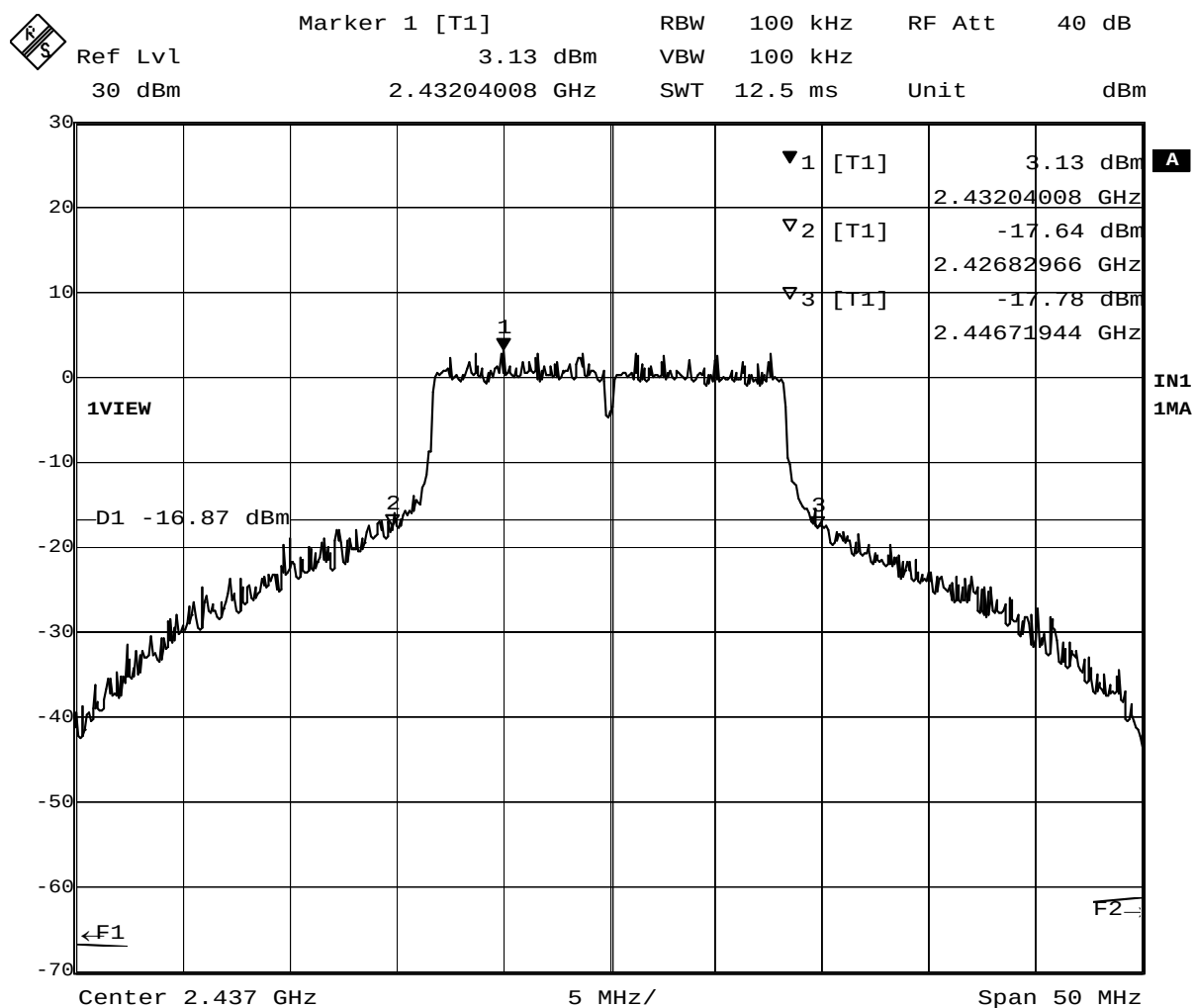
2.4 Trace Data of Occupied Bandwidth

The plots are comparatively worse measurement cases in the previous [Table 2-2-1](#) through [Table 2-2-3](#).



Date: 16.FEB.2004 15:08:49

Plot 2-1. 20dB BW at 2462MHz (DSSS, 11Mbps)

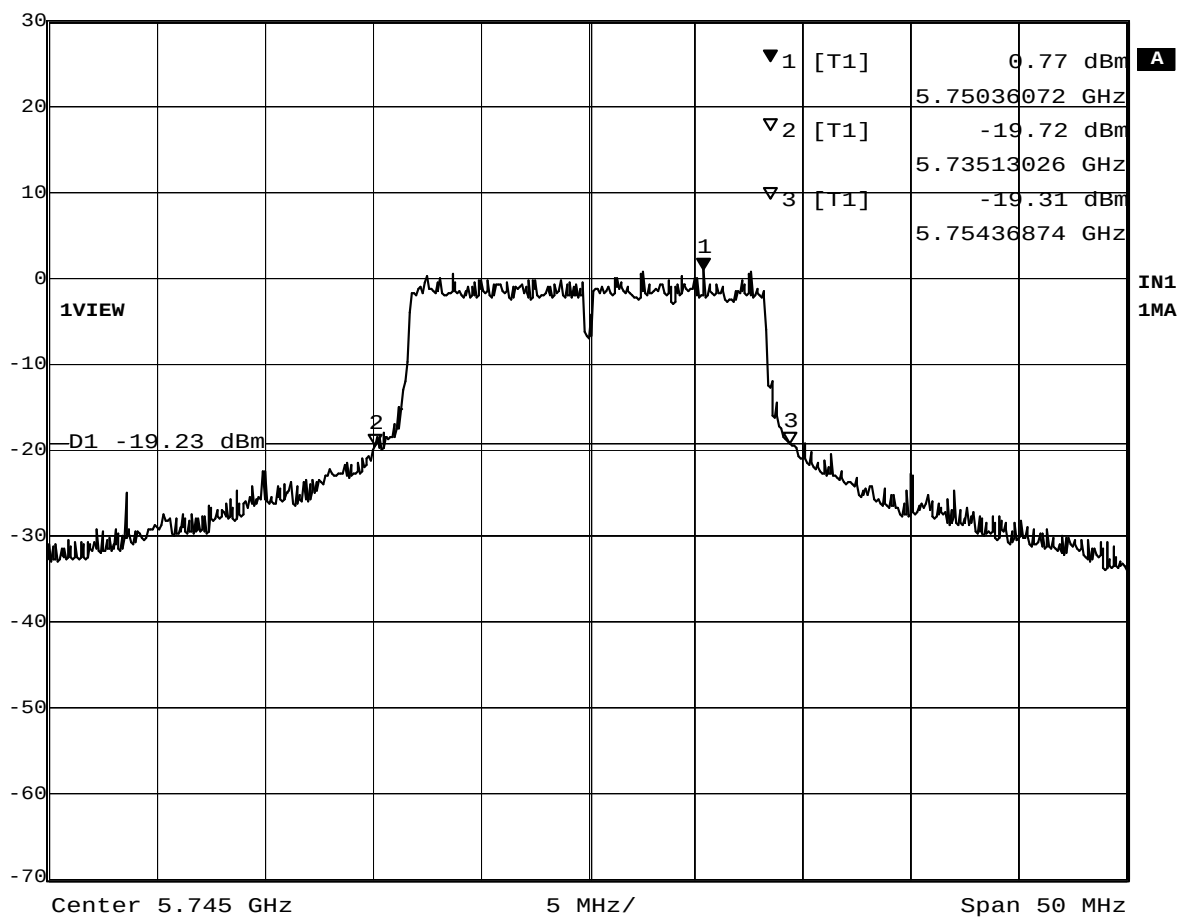


Date: 16.FEB.2004 15:22:20

Plot 2-2. 20dB BW at 2437MHz (OFDM, 18Mbps)



Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl 0.77 dBm VBW 100 kHz
30 dBm 5.75036072 GHz SWT 12.5 ms Unit dBm



Date: 16.FEB.2004 15:38:43

Plot 2-3. 20dB BW at 5745MHz (OFDM, 24Mbps)

3. Conducted Peak Output Power

[FCC 15.247(b)(3), RSS-210 6.2.2(o)(b)]

The test was performed with two kinds of measurement methods using power meter or spectrum analyzer.

3.1 Test Procedure

3.1.1 Power Meter measurement method

- A transmitter antenna terminal of EUT was connected to the input of a RF power sensor.
- Measurement was performed while EUT was operating in continuous transmission mode at the appropriate center frequencies. i.e. the lowest, middle, and highest frequencies of each 2.4GHz or 5.8GHz band.

Table 3-1 : Test Instruments of power meter method

Description	Model	Serial Number
Power Meter	HP 437B	3043U03437
Power Sensor	HP 8481A	US41030582
Coax cables: - Power Sensor <=> EUT	Length: 20 cm Loss: 0.7dB (for 2.4GHz) 1.3dB (for 5.8GHz)	

Notes: - HP: Hewlett Packard

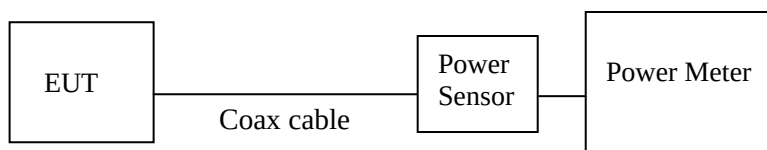


Figure 3-1: Measurement setup of power meter method

3.1.2 Spectrum Analyzer measurement method

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

The spectrum analyzer was set to :

VBW= 30kHz, RBW=1MHz,

Span=30-40MHz encompassing the entire 6 dB emission bandwidth of the transmission signal,

Mode= sample detector, Trigger= free run

The band power measurement function was used to measure the peak power of each transmission mode selected by the step 3.1.1. The analyzer computed the peak power by integrating the spectrum across the 6 dB emission bandwidth given by the previous chapter.

The test instruments and setup configuration are the same as the Table 1-1 and Figure 1.

3.2 Measurement Results

Test Date: February 16, 2004

Table 3-2-1. Power meter measurement results

Operation Frequency [GHz]	Rated output power (conducted) [dBm]									
	DSSS		OFDM							
	1 / 2M bps	5.5/11M bps	6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
2.412 (Aux)	16.29	16.39	13.40	13.42	13.43	13.46	13.38	13.33	-	-
Specification	17		14						13.5	11.5
2.437 (Aux)	16.24	16.27	16.10	16.11	16.13	16.15	16.11	-	-	-
Specification	17		17						15.5	13.5
2.462 (Aux)	16.14	16.18	12.92	12.94	13.00	13.03	12.89	12.68	-	-
Specification	17		14						13.5	11.5
5.745 (Aux)	N/A		14.60	14.61	14.63	14.65	14.67	-	-	-
Specification			16						15	12
5.785 (Aux)	N/A		14.78	14.78	14.79	14.80	14.82	-	-	-
Specification			16						15	12
5.825 (Aux)	N/A		14.68	14.69	14.72	14.75	14.78	-	-	-
specification			16						15	12

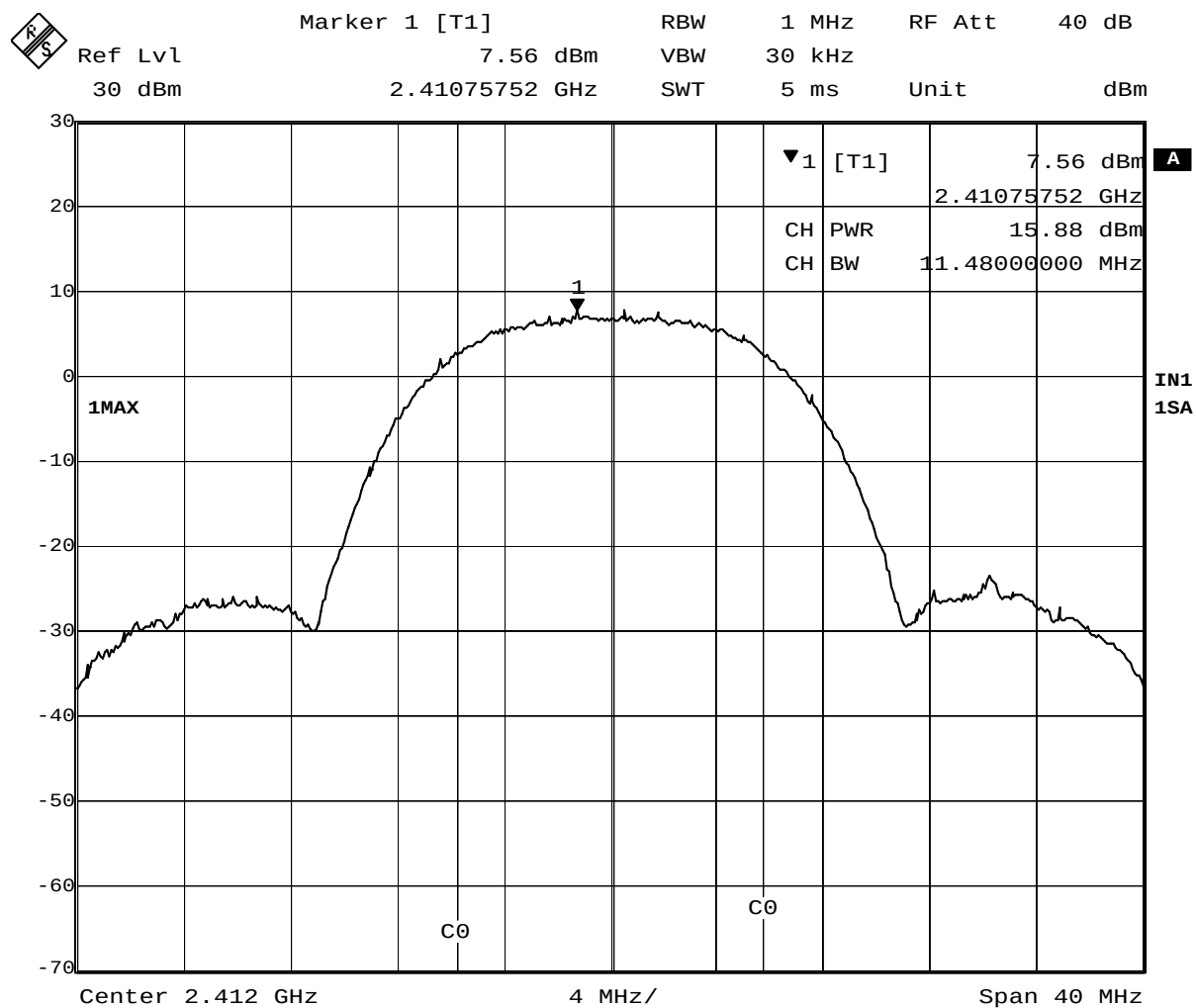
[Calculation table]

Measured Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Results (dBm)	Limit		Peak antenna gain of EUT (dBi)	EIRP (dBm)	IC limit (dBm)
				FCC (dBm)	IC (dBm)			
2412 (DSSS)	16.39	0.7	17.09	30	30	-	-	N/A
2437 (DSSS)	16.27	0.7	16.97					
2462 (DSSS)	16.18	0.7	16.88					
2412 (OFDM)	13.46	0.7	14.16					
2437 (OFDM)	16.15	0.7	16.85					
2462 (OFDM)	13.03	0.7	13.73					
5745 (OFDM)	14.67	1.3	15.97	1.01	30	1.01	16.98	36
5785 (OFDM)	14.82	1.3	16.12				17.13	
5825 (OFDM)	14.78	1.3	16.08				17.09	

Table 3-2-2. Spectrum analyzer measurement results

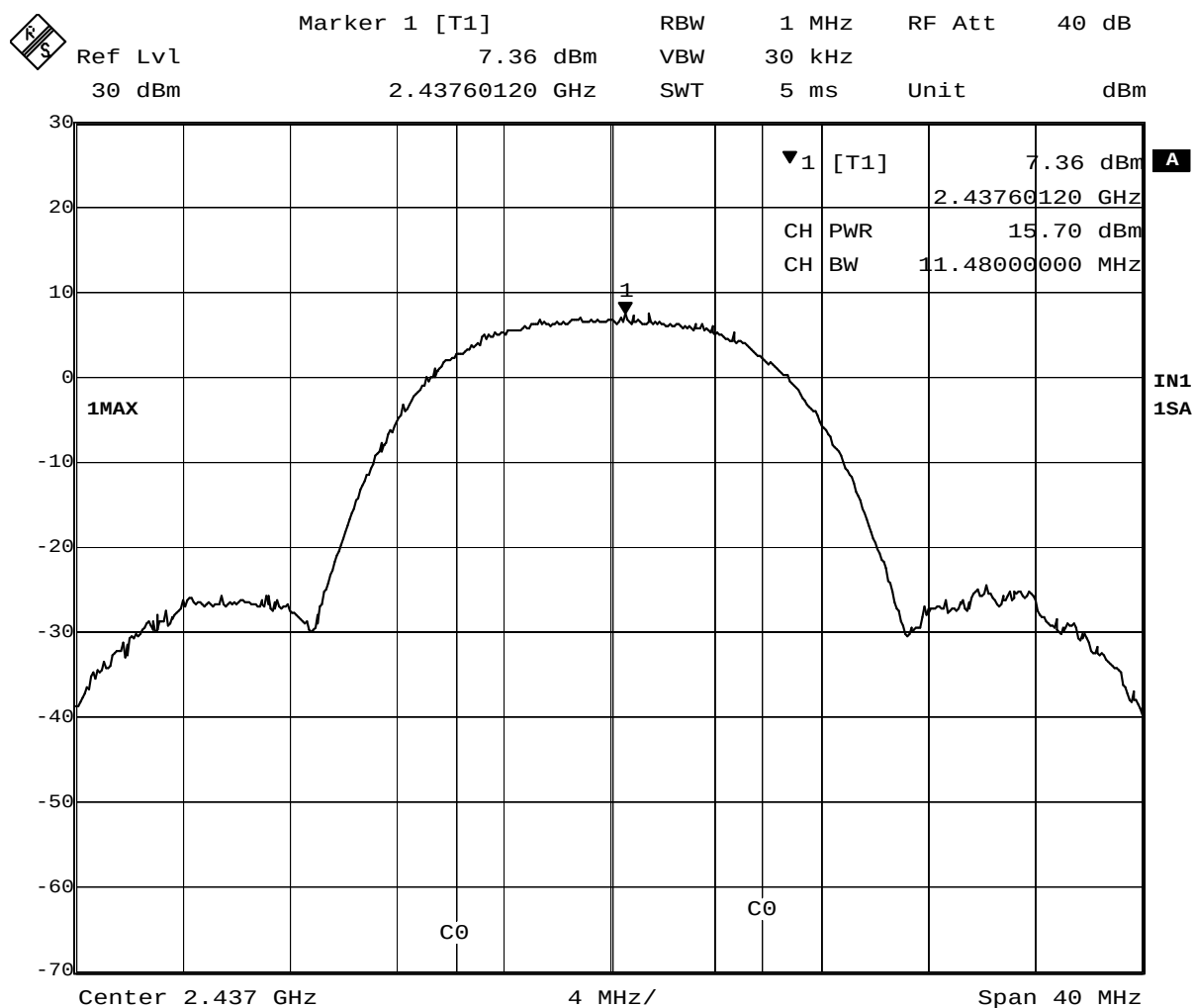
Measured Frequency (MHz)	Analyzer reading (dBm)	Trace number	Cable Loss (dB)	Results (dBm)	Limit		Peak antenna gain of EUT (dBi)	EIRP (dBm)	IC limit (dBm)
					FCC (dBm)	IC (dBm)			
2412 (DSSS)	15.88	Plot 3-1	1.3	17.18	30	30	-	-	N/A
2437 (DSSS)	15.70	Plot 3-2	1.3	17.00					
2462 (DSSS)	15.67	Plot 3-3	1.3	16.97					
2412 (OFDM)	12.90	Plot 3-4	1.3	14.20					
2437 (OFDM)	15.69	Plot 3-5	1.3	16.99					
2462 (OFDM)	12.63	Plot 3-6	1.3	13.93					
5745 (OFDM)	13.75	Plot 3-7	2.3	16.05	1.01	30	1.01	17.06	36
5785 (OFDM)	13.85	Plot 3-8	2.3	16.15				17.16	
5825 (OFDM)	13.99	Plot 3-9	2.3	16.29				17.30	

3.3 Trace Data of Conducted Peak Output Power



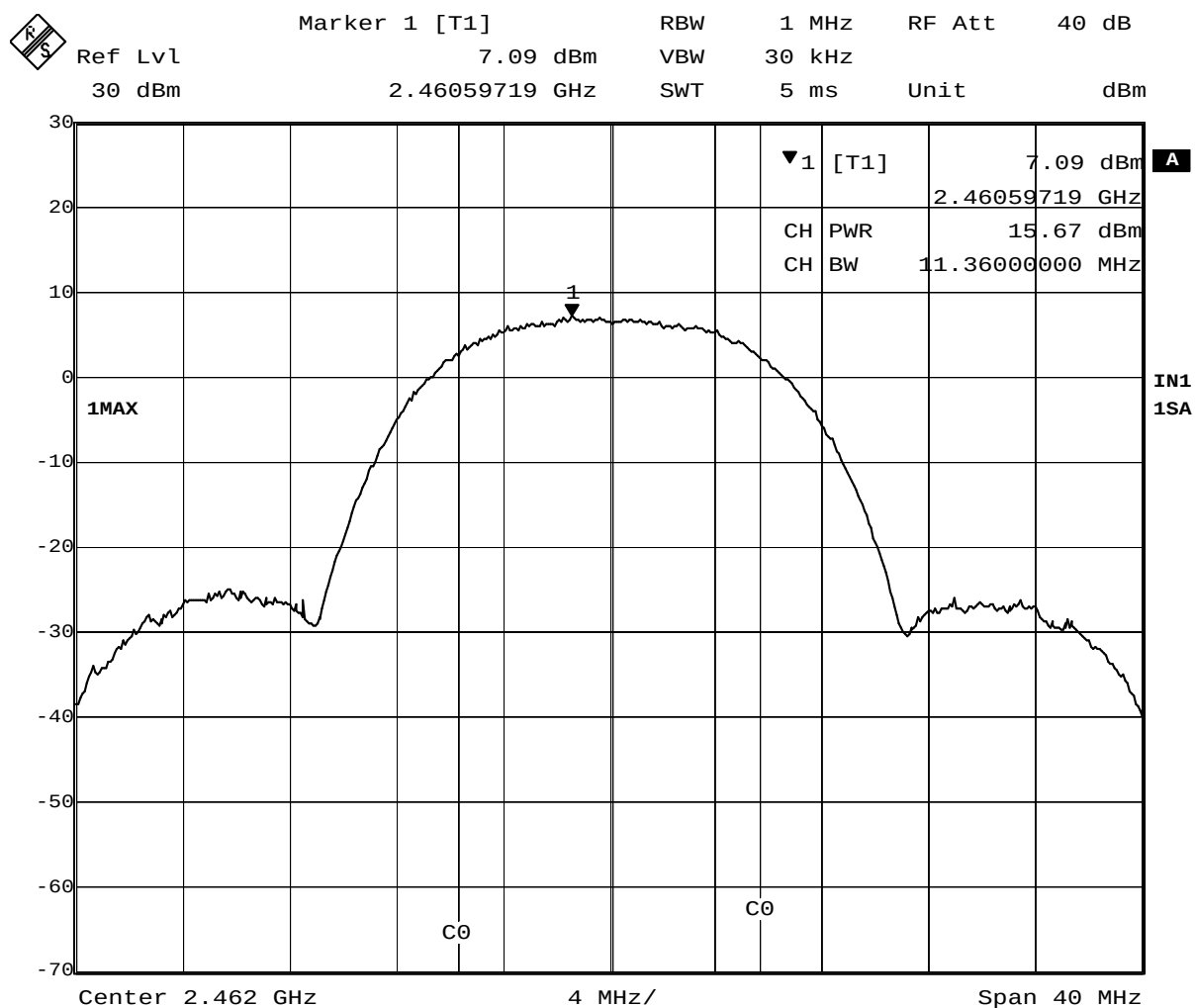
Date: 16.FEB.2004 17:13:49

Plot 3-1. Conducted Peak Output Power of 2412MHz (DSSS, 11Mbps)



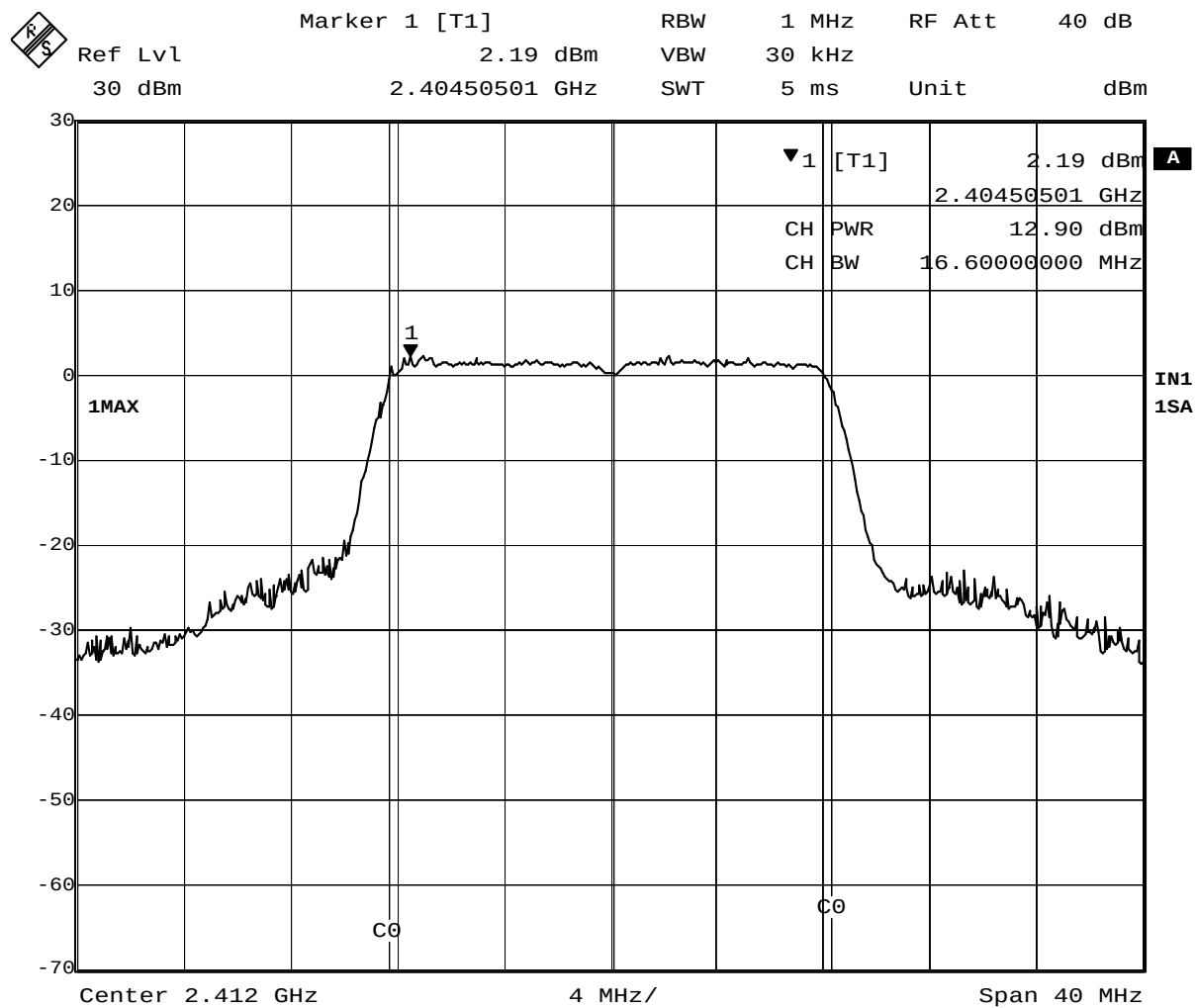
Date: 16.FEB.2004 17:25:42

Plot 3-2. Conducted Peak Output Power of 2437MHz (DSSS, 11Mbps)



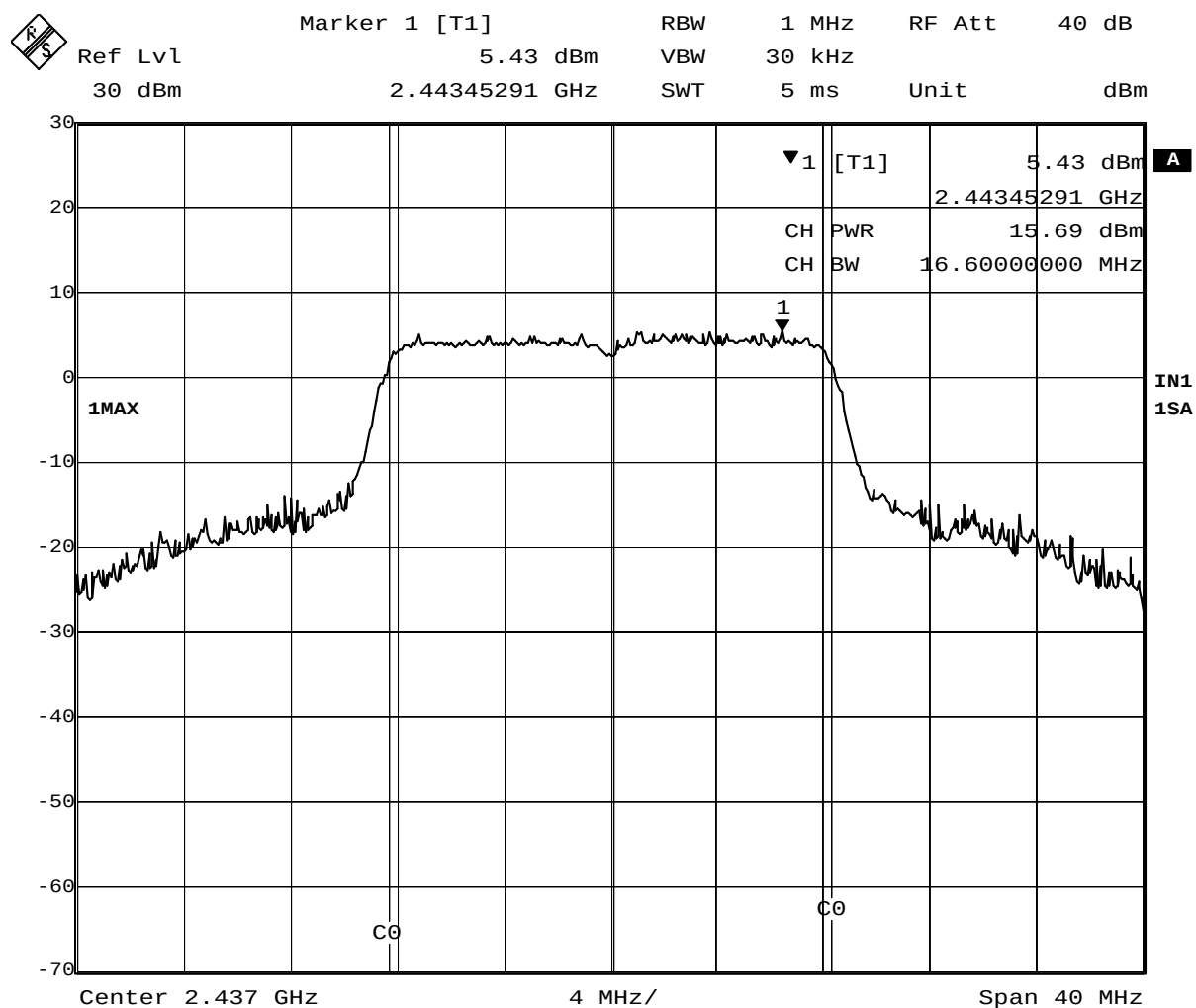
Date: 16.FEB.2004 18:03:30

Plot 3-3. Conducted Peak Output Power of 2462MHz (DSSS, 11Mbps)



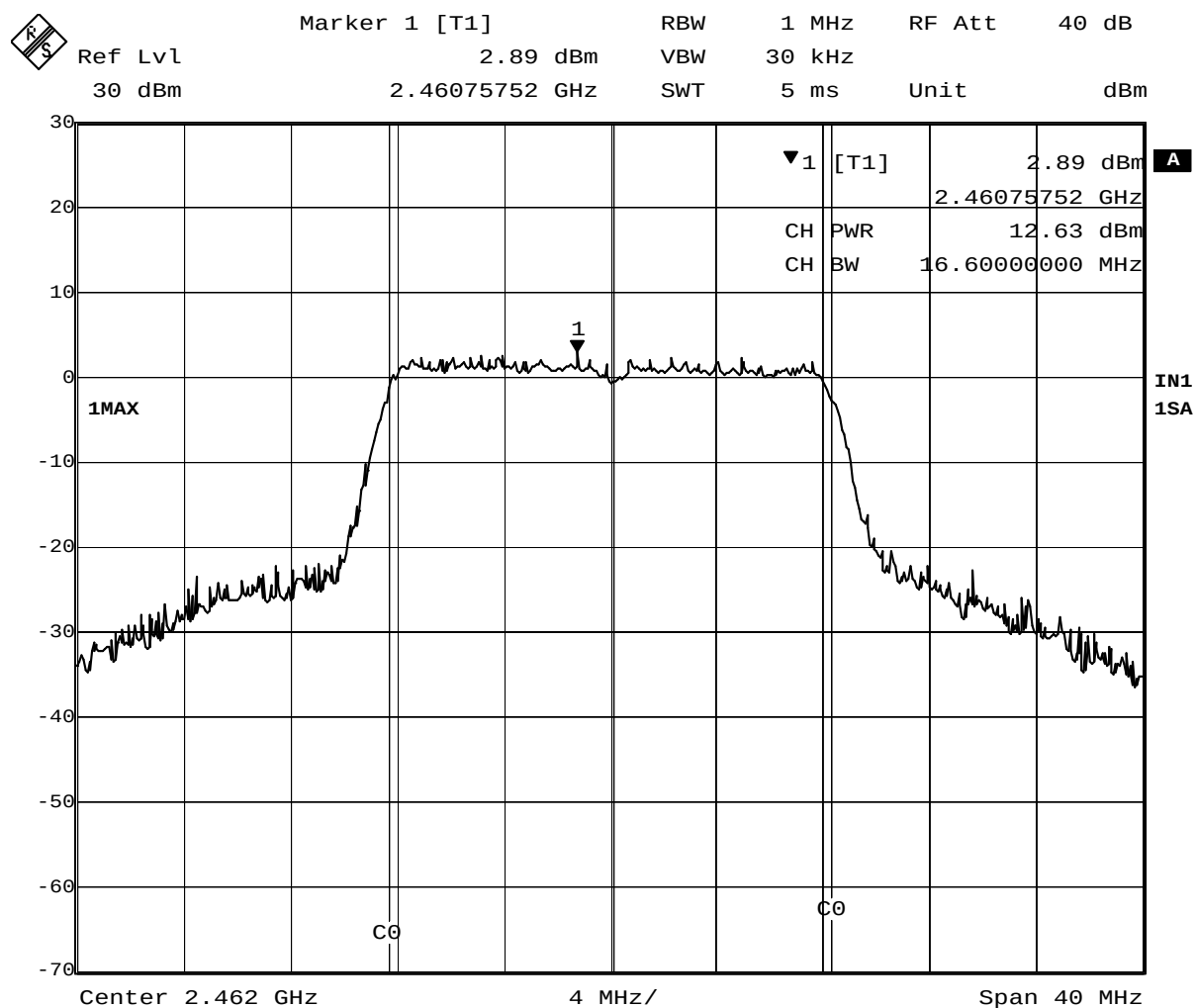
Date: 16.FEB.2004 18:16:36

Plot 3-4. Conducted Peak Output Power of 2412MHz (OFDM, 18Mbps)



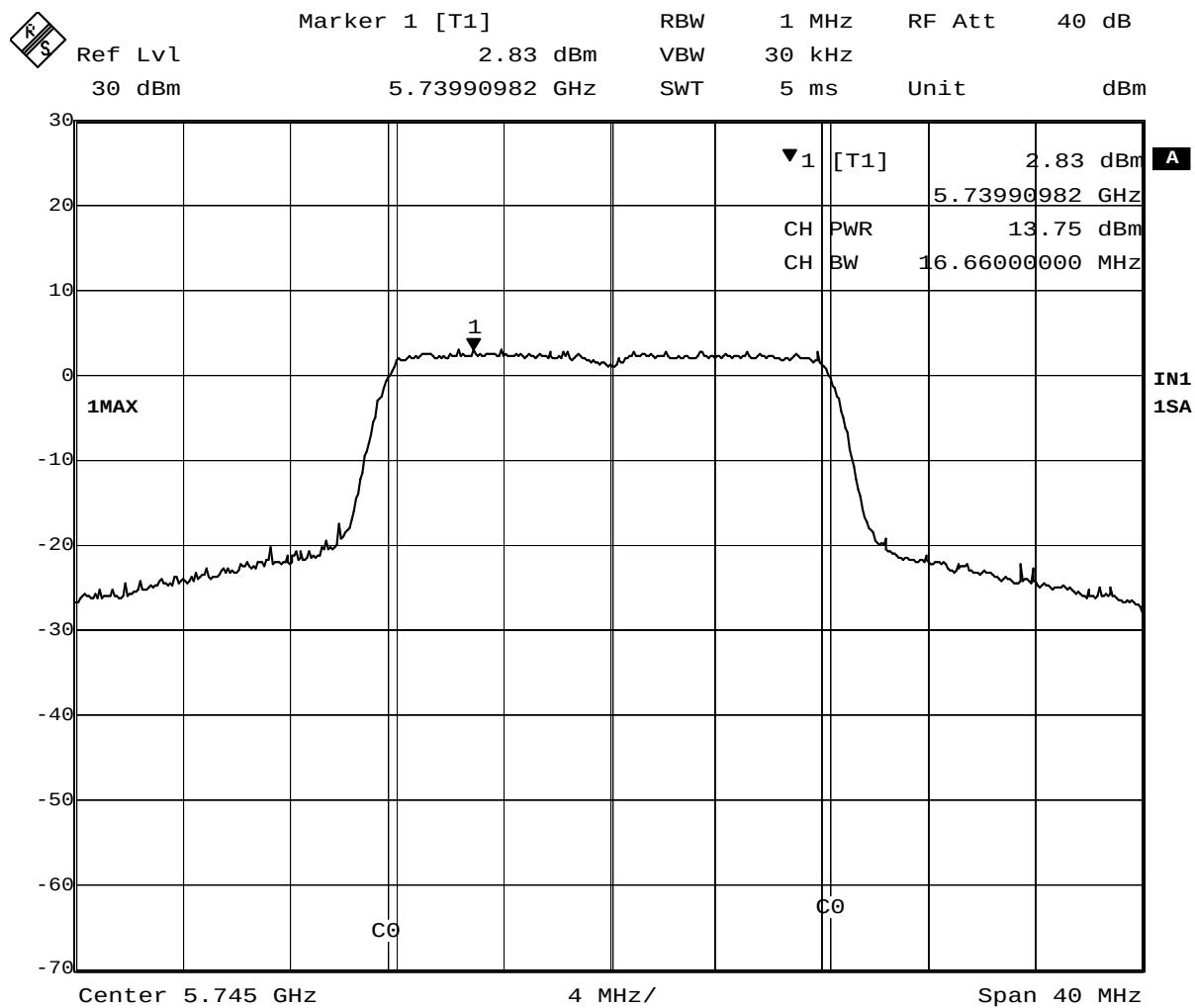
Date: 16.FEB.2004 18:22:05

Plot 3-5. Conducted Peak Output Power of 2437MHz (OFDM, 18Mbps)



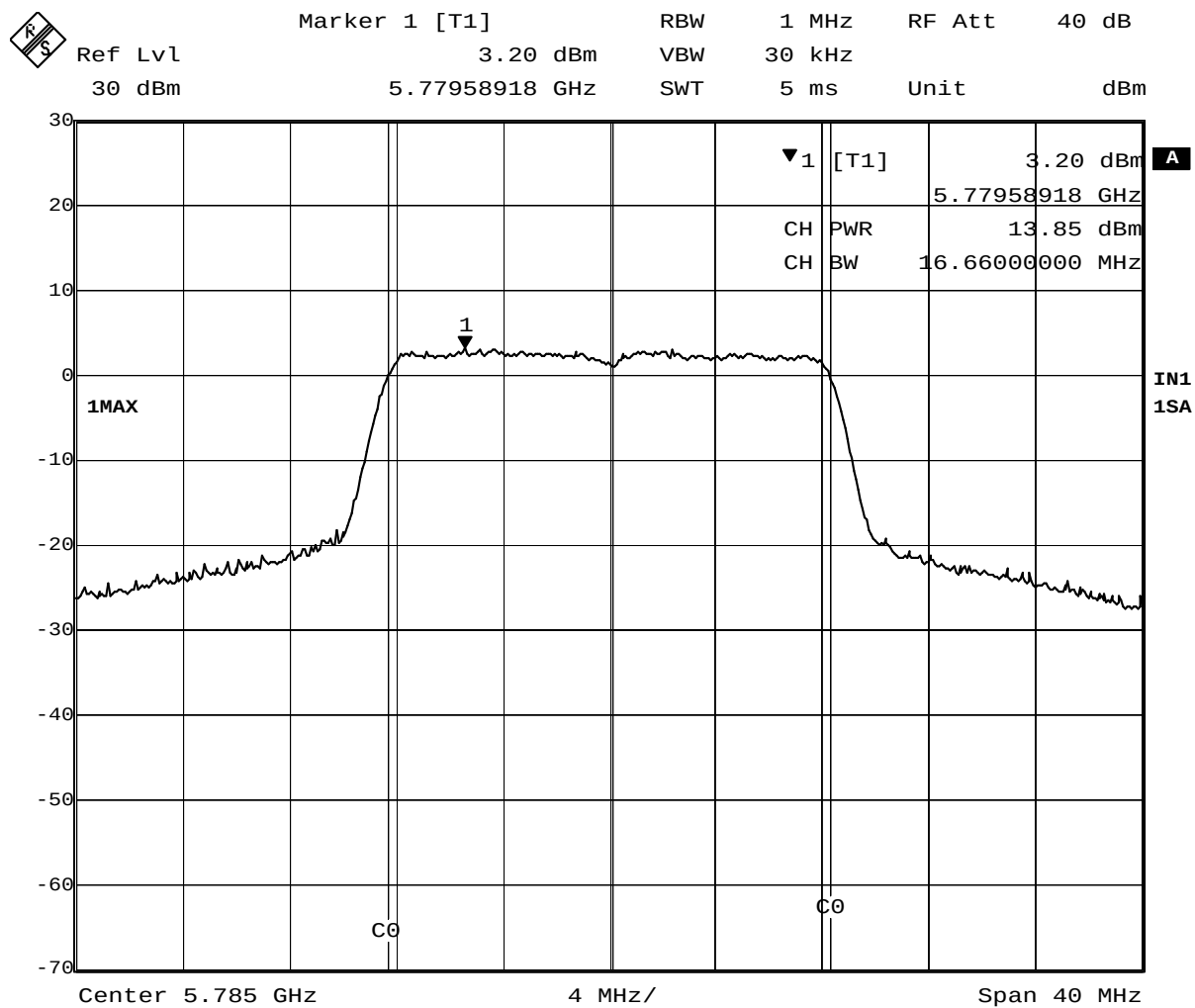
Date: 16.FEB.2004 18:26:51

Plot 3-6. Conducted Peak Output Power of 2462MHz (OFDM, 18Mbps)



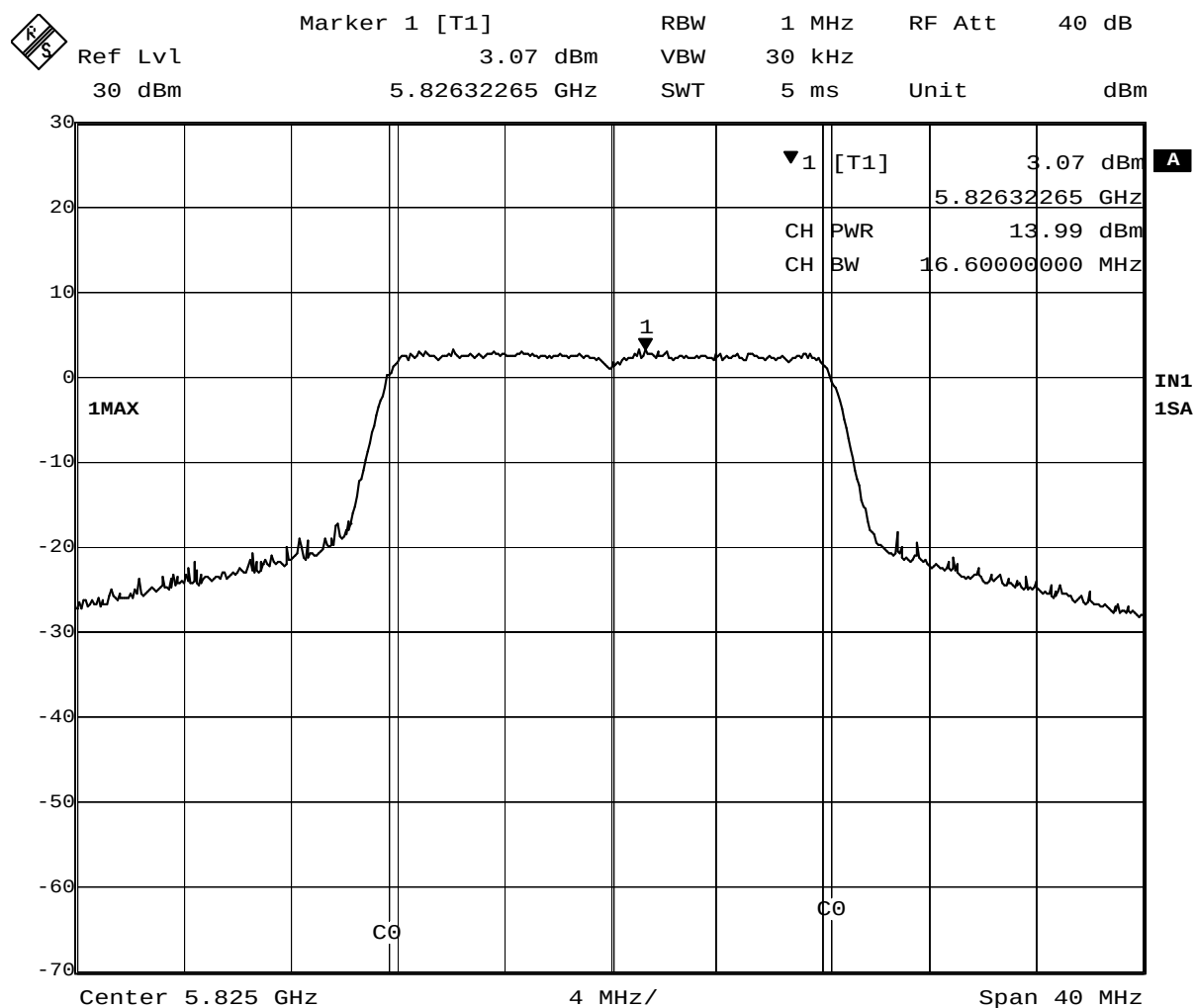
Date: 16.FEB.2004 19:24:48

Plot 3-7. Conducted Peak Output Power of 5745MHz (OFDM, 24Mbps)



Date: 16.FEB.2004 20:41:35

Plot 3-8. Conducted Peak Output Power of 5785MHz (OFDM, 24Mbps)



Date: 16.FEB.2004 20:50:23

Plot 3-9. Conducted Peak Output Power of 5825MHz (OFDM, 24Mbps)

4. Out of Band Emissions (Conducted Spurious)

[FCC 15.247(c), RSS-210 6.2.2(o)(e1)]

4.1 Test Procedure

The outband emissions in any 100kHz bandwidth was measured with a spectrum analyzer connected to the antenna terminal, while EUT was operating in transmission mode at the appropriate center frequency. The spectrum analyzer was set to:

RBW = 100kHz, VBW = 100kHz^{*1}, Scanning frequency range = 30MHz~2GHz, 2GHz~3GHz, 3GHz~26.5GHz, and 26.5GHz~40GHz, Sweep = suitable duration based on the EUT specification, Mode= Peak detector

*1: To be adjusted accordingly based on the spectrum stability

4.2 Test Instruments and Measurement Setup

4.2.1 Below 26.5GHz

Same as the Chapter 1 (Table 1-1 & Figure 1).

4.2.2 Above 26.5GHz

Table 4-1 Conducted Spurious Test Instrumentation

Description	Model	Serial Number
Spectrum Analyzer	HP 8563E	3416A02248
Harmonic Mixer (26.5 – 40GHz)	Agilent 11970A	011269-001
Coaxial cables: - EUT <=> Mixer (26.5-40GHz)	Length: Cable loss: 1m 2.9dB (at 40GHz)	- SF102-21108
- Mixer <=> Spectrum Analyzer (26.5-40GHz)	1m 2.9dB (at 40GHz)	- SF102-21105

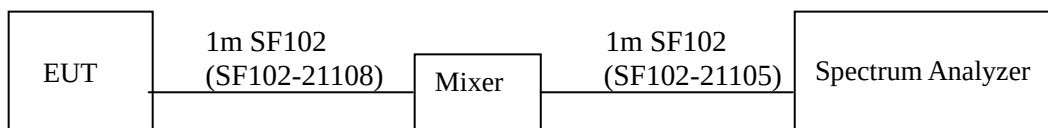


Figure 4: Measurement setup for Conducted Spurious test

4.3 Measurement Results

All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density.

The measurement was performed with the worst cases of each transmission mode, that tend to have the highest conducted peak power, based on the results of previous Chapter 3, “Conducted Peak Output Power” measurement.

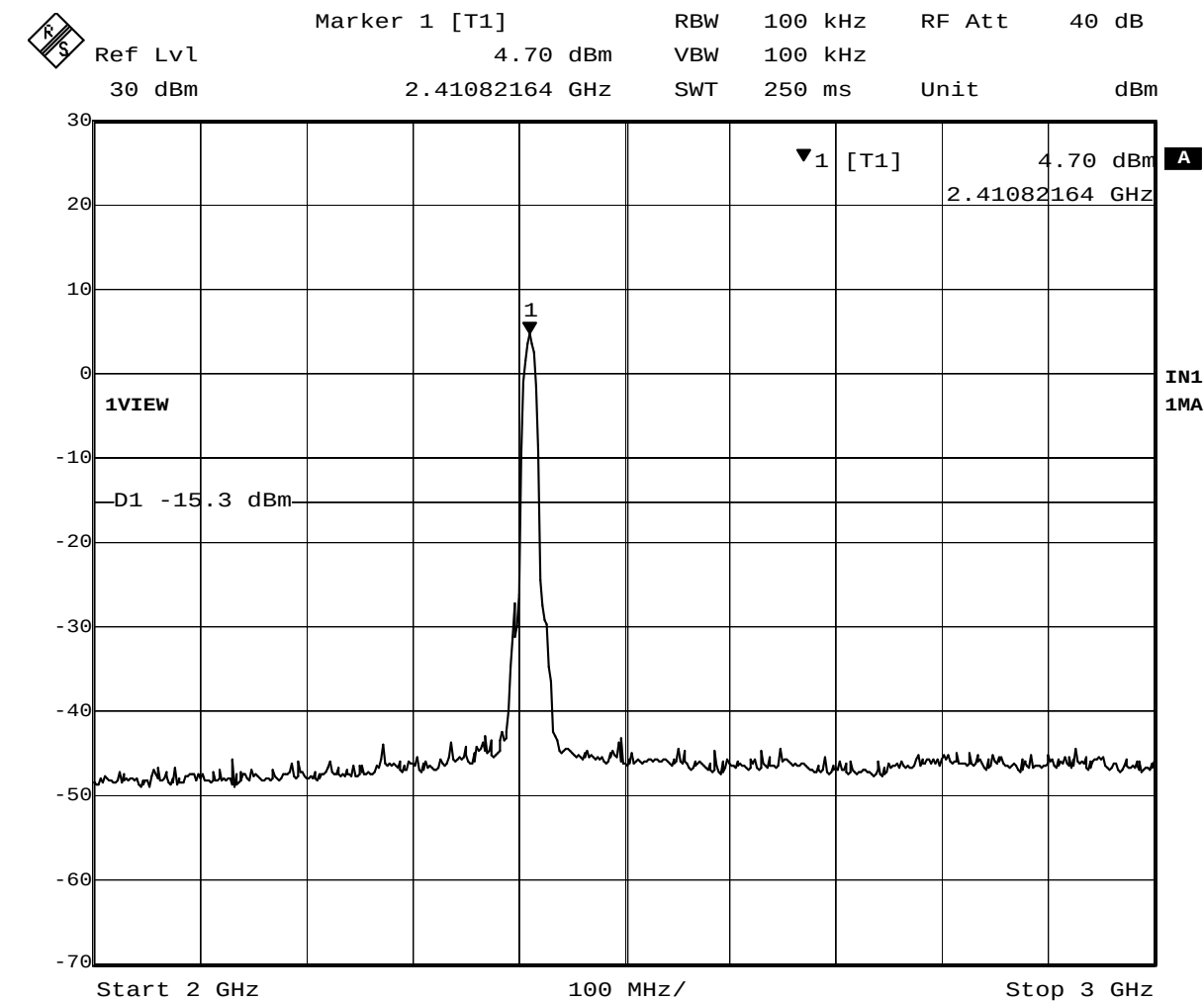
Test Date: February 16, 2004 : See the following plots.

Center Frequency (MHz)			Trace number *1
2412 (ch. 1)	DSSS	11Mbps	Plot 4-1
2437 (ch. 6)			Plot 4-2
2462 (ch. 11)			Plot 4-3
2412 (ch. 1)	OFDM	18Mbps	Plot 4-4
2437 (ch. 6)			Plot 4-5
2462 (ch. 11)			Plot 4-6
5745 (ch. 149)		24Mbps	Plot 4-7
5785 (ch. 157)			Plot 4-8
5825 (ch. 165)			Plot 4-9

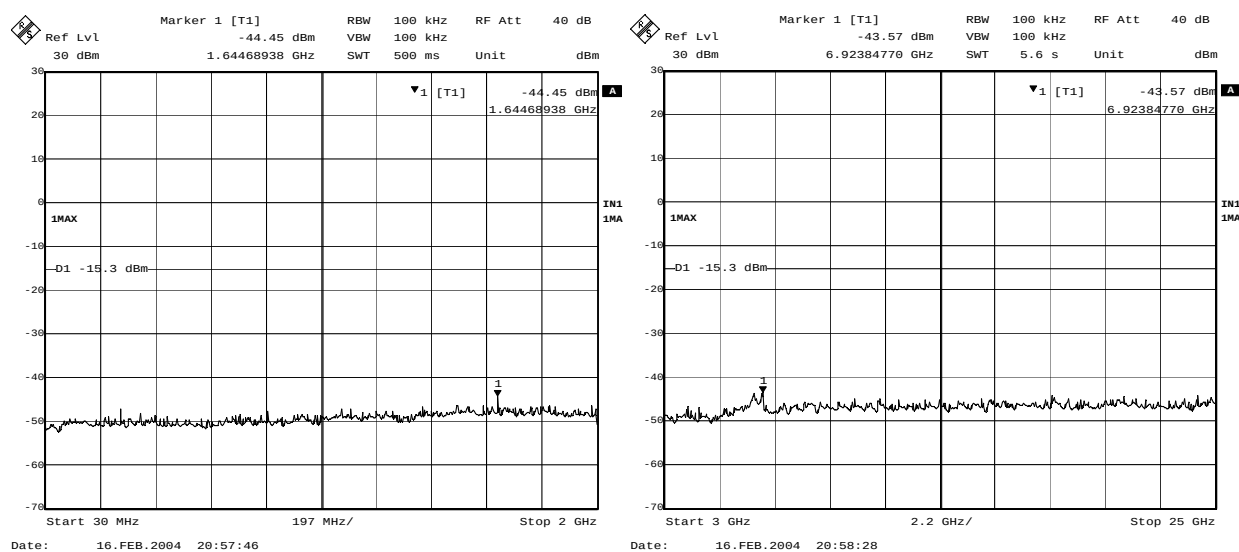
*1 : Each submittal plot includes the highest conducted spurious in the 10th harmonics frequency range among each measured Tx mode.

*2 : The plots above 26.5GHz are omitted since no remarkable spurious was noted.

4.4 Trace Data of Out of Band Emissions



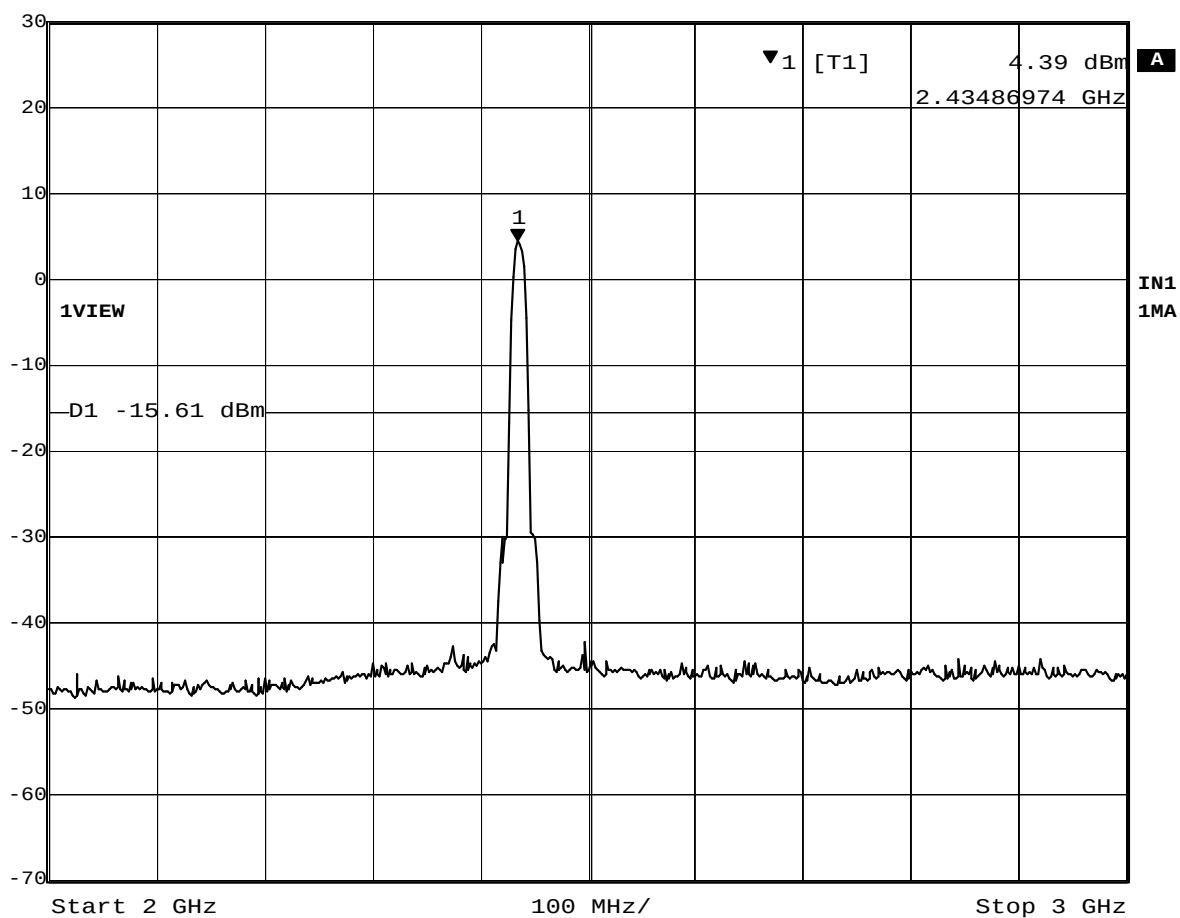
Date: 16.FEB.2004 20:57:16



Plot 4-1. Conducted Spurious (DSSS, 11Mbps, ch.1)



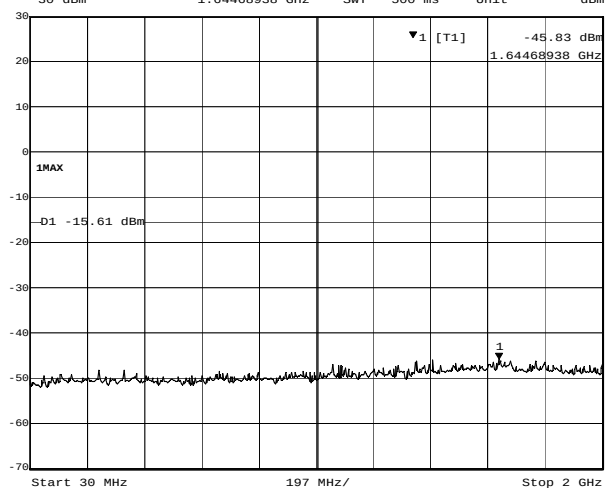
Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl 4.39 dBm VBW 100 kHz
30 dBm 2.43486974 GHz SWT 250 ms Unit dBm



Date: 16.FEB.2004 21:02:01



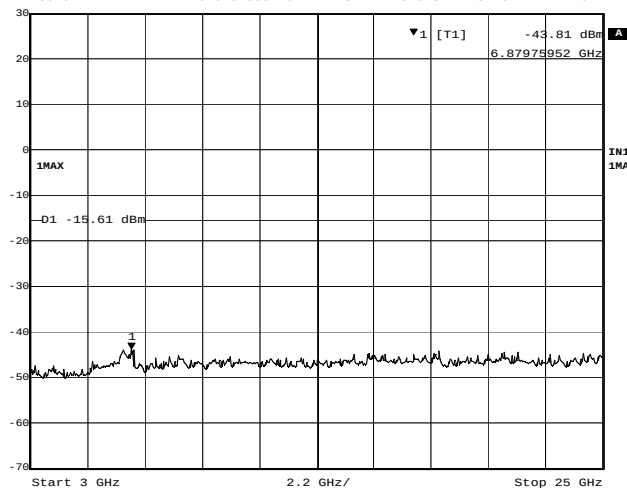
Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl -45.83 dBm VBW 100 kHz
30 dBm 1.64468938 GHz SWT 500 ms Unit dBm



Date: 16.FEB.2004 21:02:31

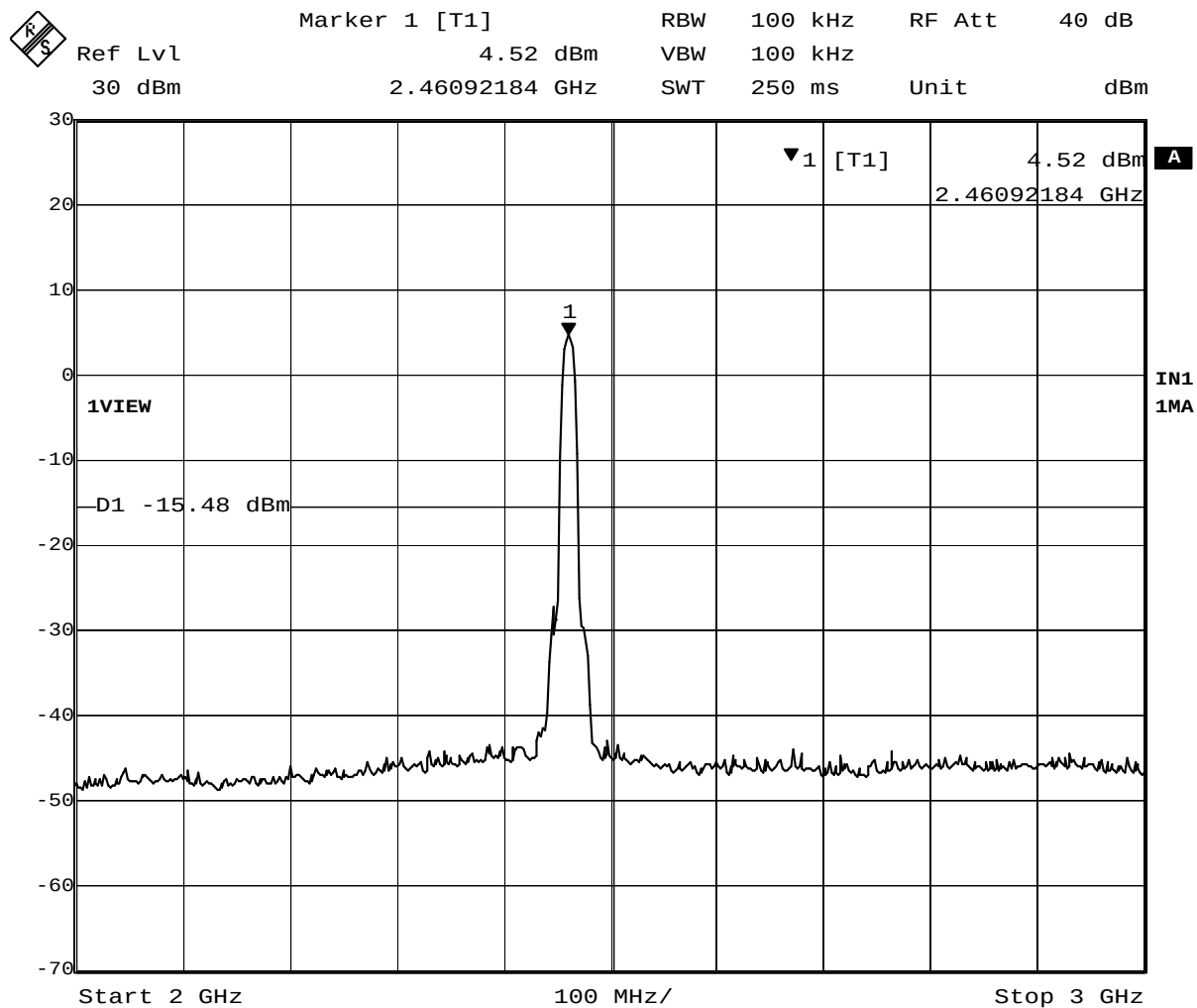


Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl -43.81 dBm VBW 100 kHz
30 dBm 6.87975952 GHz SWT 5.6 s Unit dBm

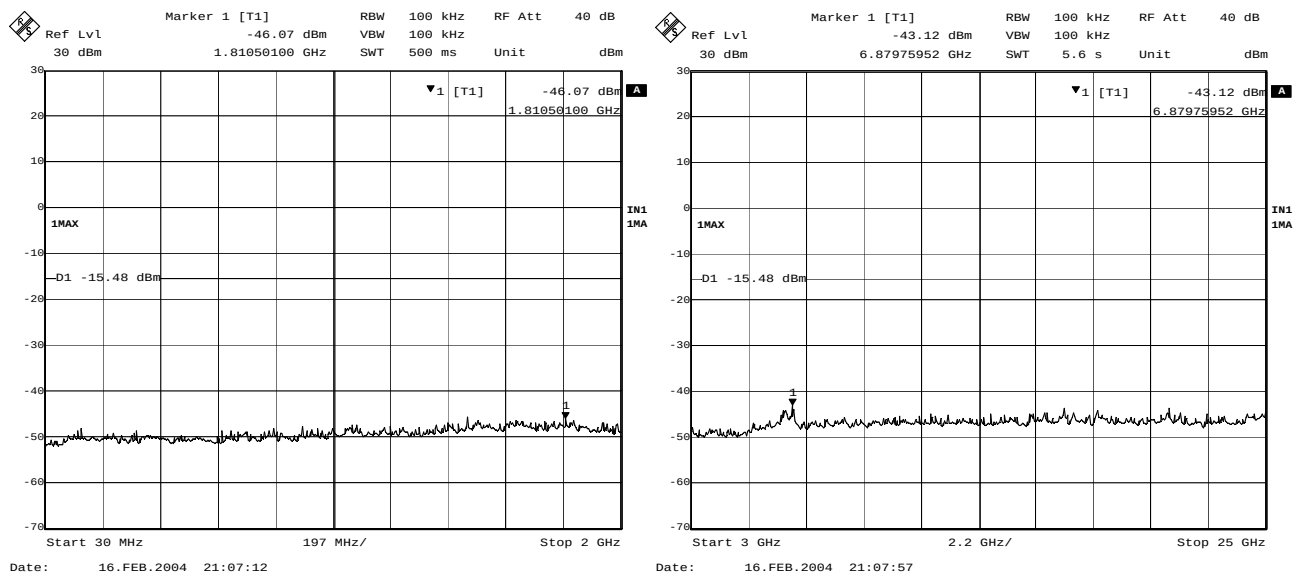


Date: 16.FEB.2004 21:03:10

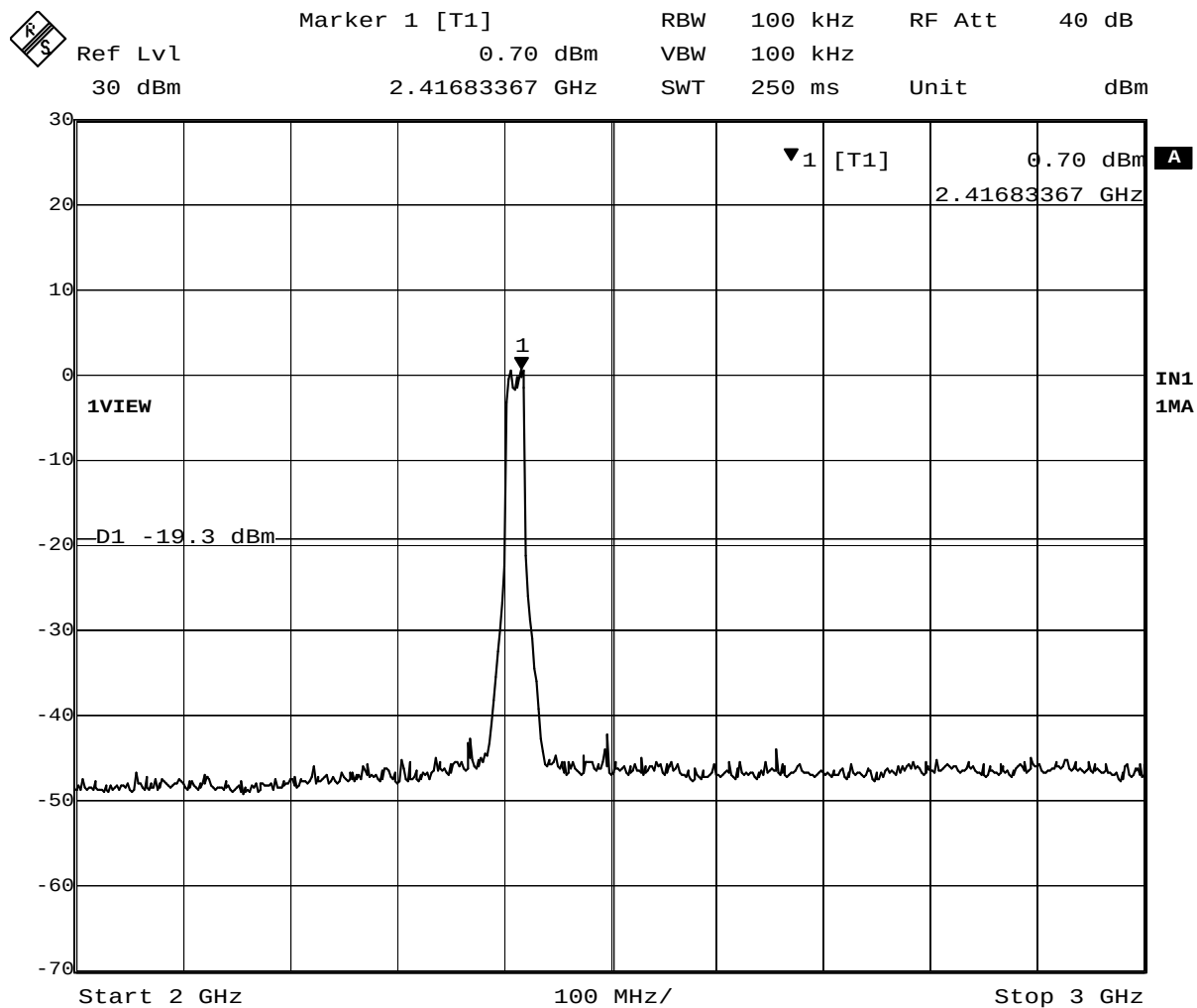
Plot 4-2. Conducted Spurious (DSSS, 11Mbps, ch. 6)



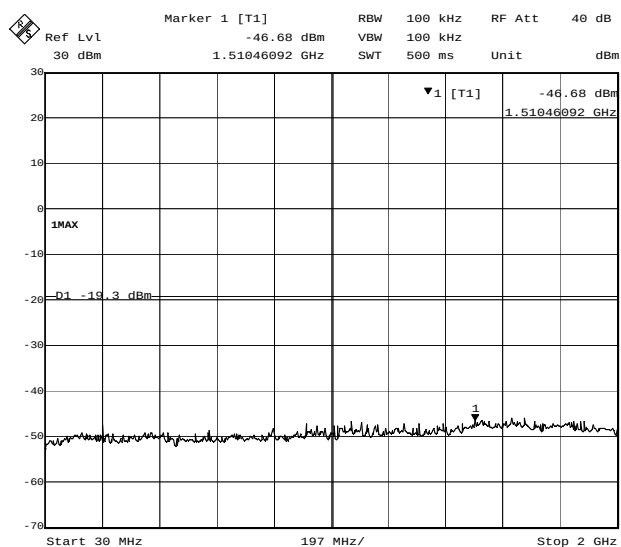
Date: 16.FEB.2004 21:06:38



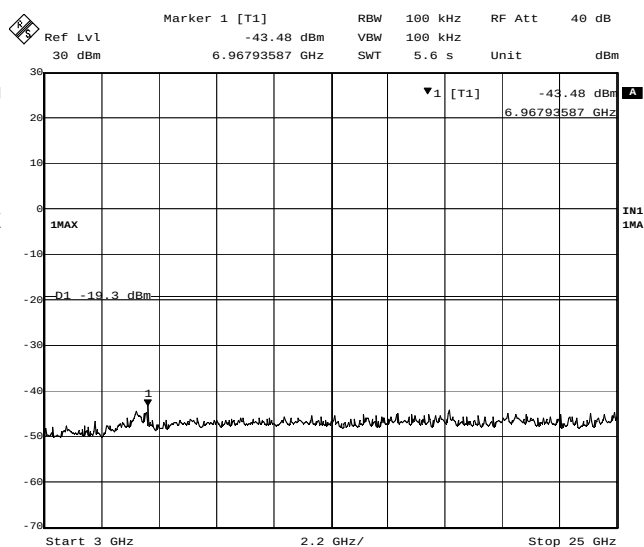
Plot 4-3. Conducted Spurious (DSSS, 11Mbps, ch. 11)



Date: 16.FEB.2004 21:13:18

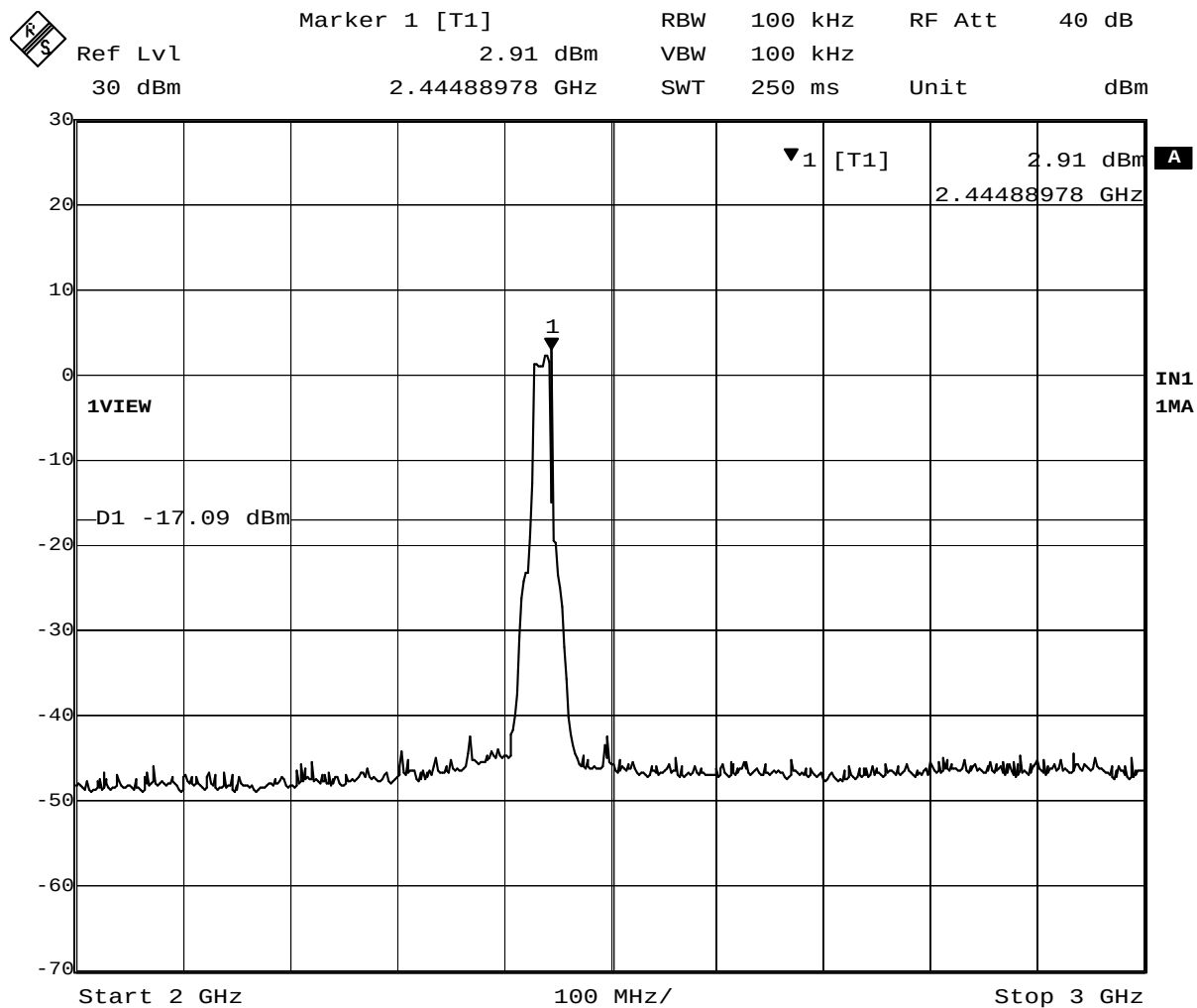


Date: 16.FEB.2004 21:13:51

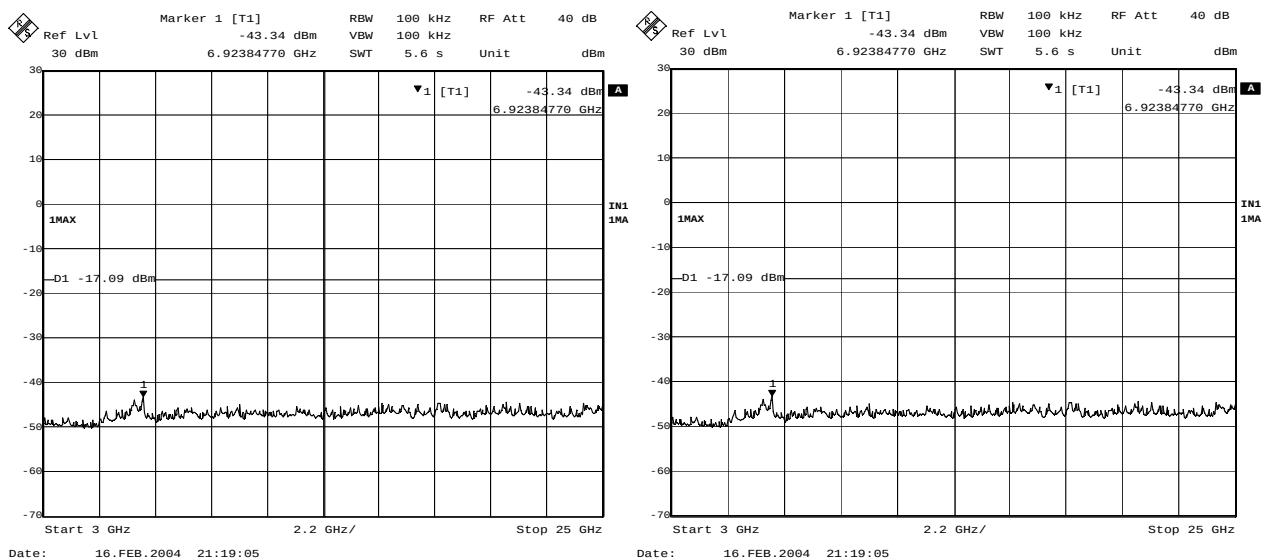


Date: 16.FEB.2004 21:14:21

Plot 4-4. Conducted Spurious (OFDM, 18Mbps, ch. 1)

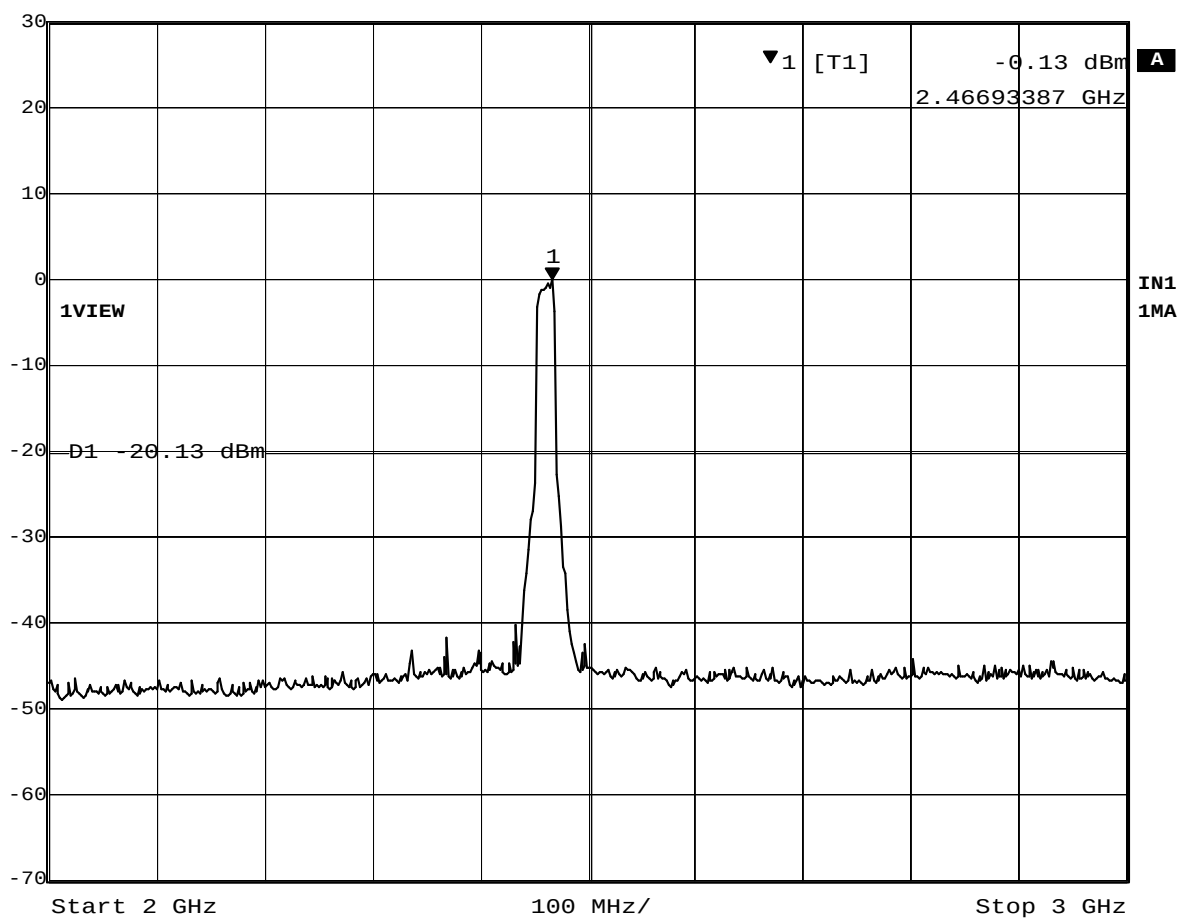


Date: 16.FEB.2004 21:17:57

**Plot 4-5. Conducted Spurious (OFDM, 18Mbps, ch. 6)**



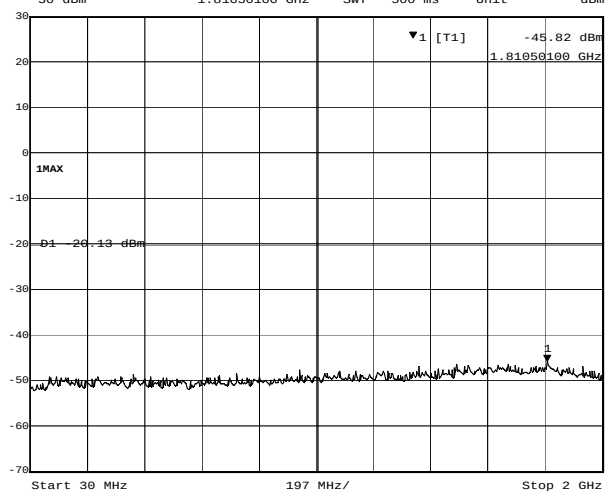
Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl -0.13 dBm VBW 100 kHz
30 dBm 2.46693387 GHz SWT 250 ms Unit dBm



Date: 16.FEB.2004 21:22:27



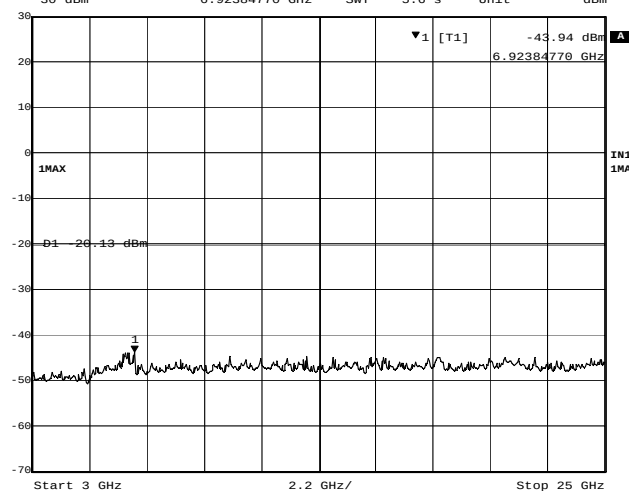
Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl -45.82 dBm VBW 100 kHz
30 dBm 1.81050100 GHz SWT 500 ms Unit dBm



Date: 16.FEB.2004 21:23:00



Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl -43.94 dBm VBW 100 kHz
30 dBm 6.92384770 GHz SWT 5.6 s Unit dBm

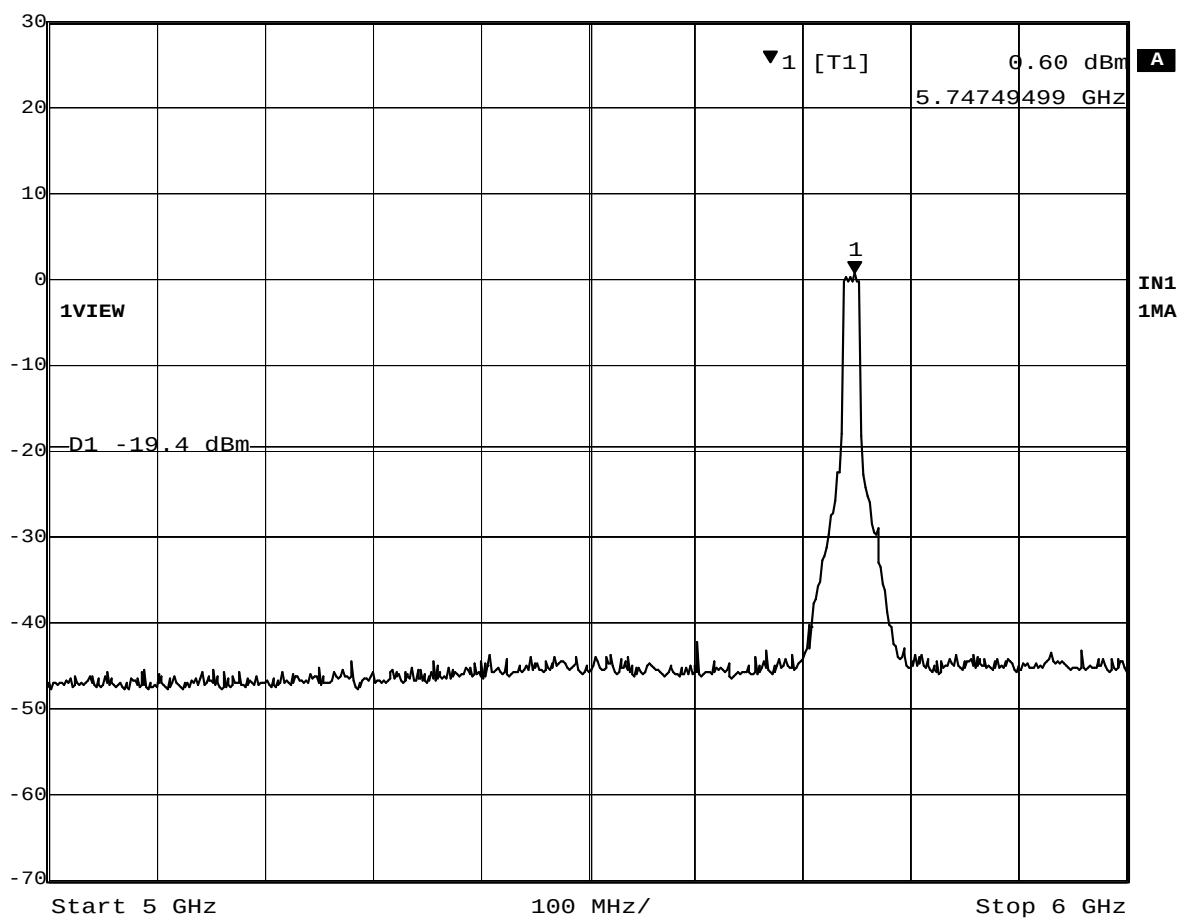


Date: 16.FEB.2004 21:23:29

Plot 4-6. Conducted Spurious (OFDM, 18Mbps, ch. 11)



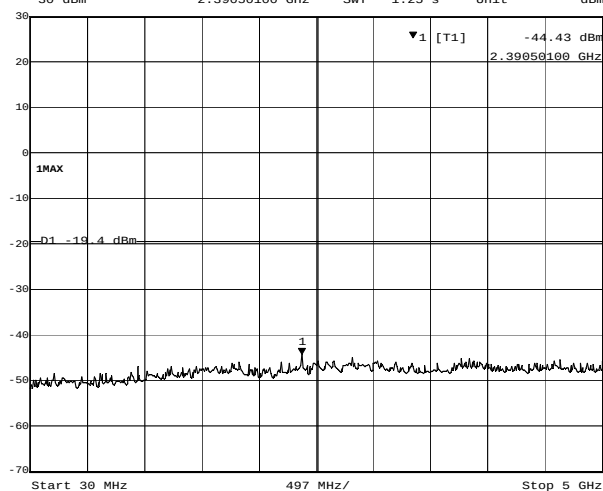
Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl 0.60 dBm VBW 100 kHz
30 dBm 5.74749499 GHz SWT 250 ms Unit dBm



Date: 16.FEB.2004 21:28:43



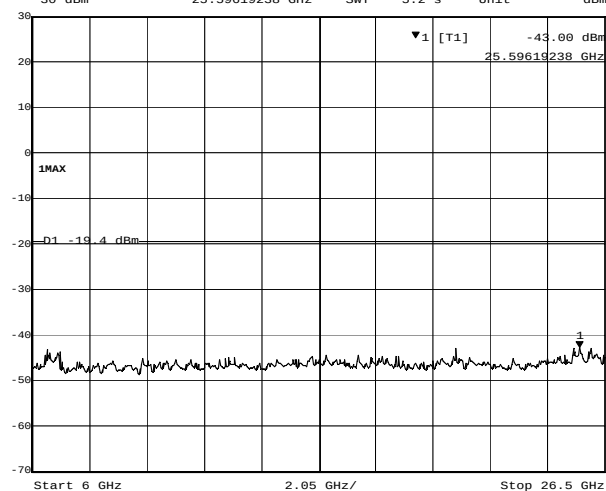
Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl -44.43 dBm VBW 100 kHz
30 dBm 2.39050100 GHz SWT 1.25 s Unit dBm



Date: 16.FEB.2004 21:29:27

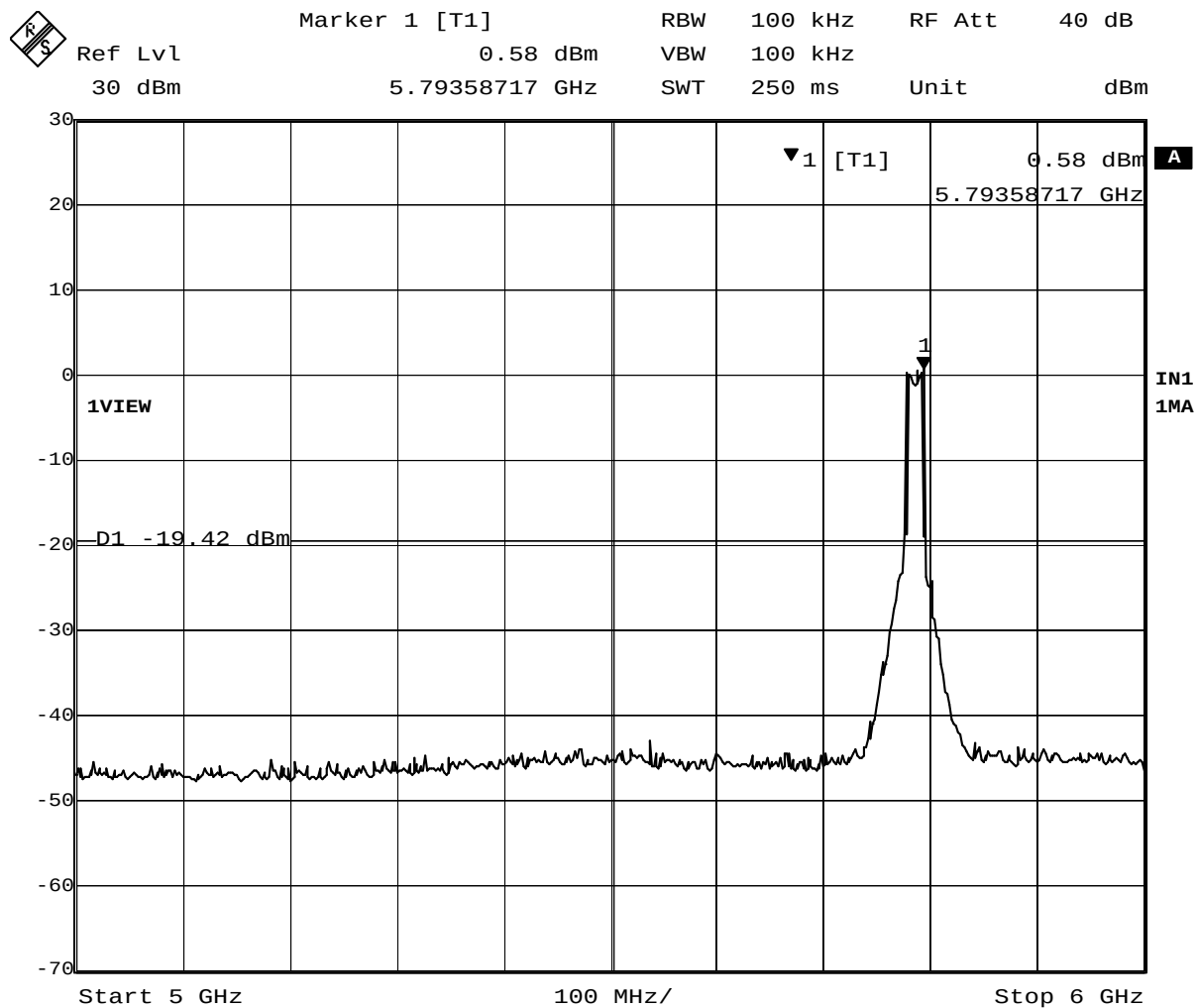


Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl -43.00 dBm VBW 100 kHz
30 dBm 25.59619238 GHz SWT 5.2 s Unit dBm

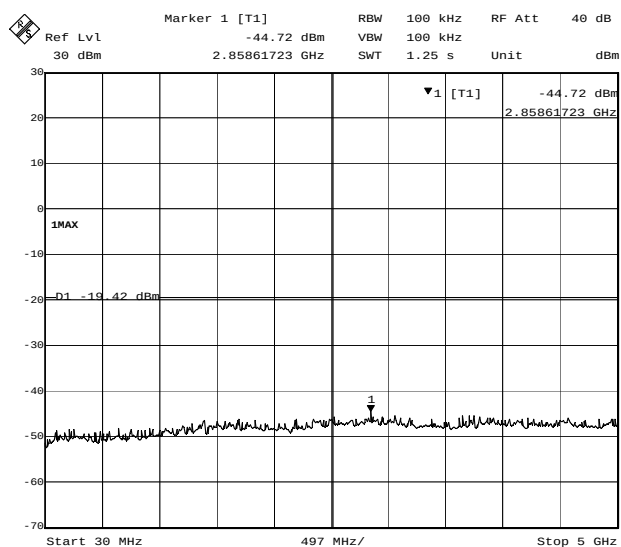


Date: 16.FEB.2004 21:30:08

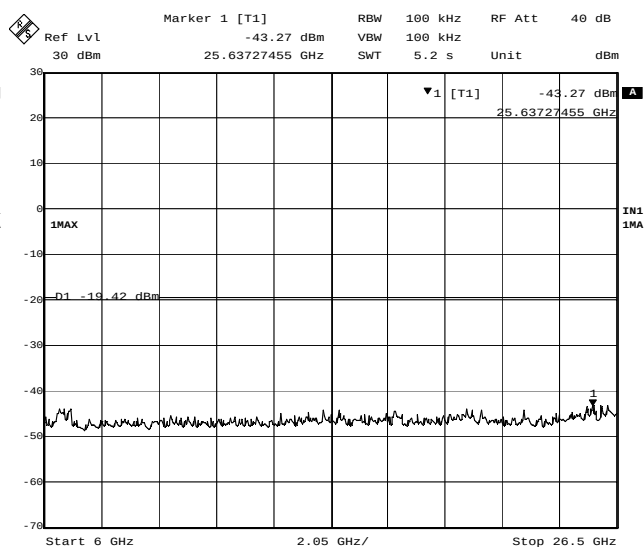
Plot 4-7. Conducted Spurious (OFDM, 24Mbps, ch. 149)



Date: 16.FEB.2004 21:33:22



Date: 16.FEB.2004 21:33:56

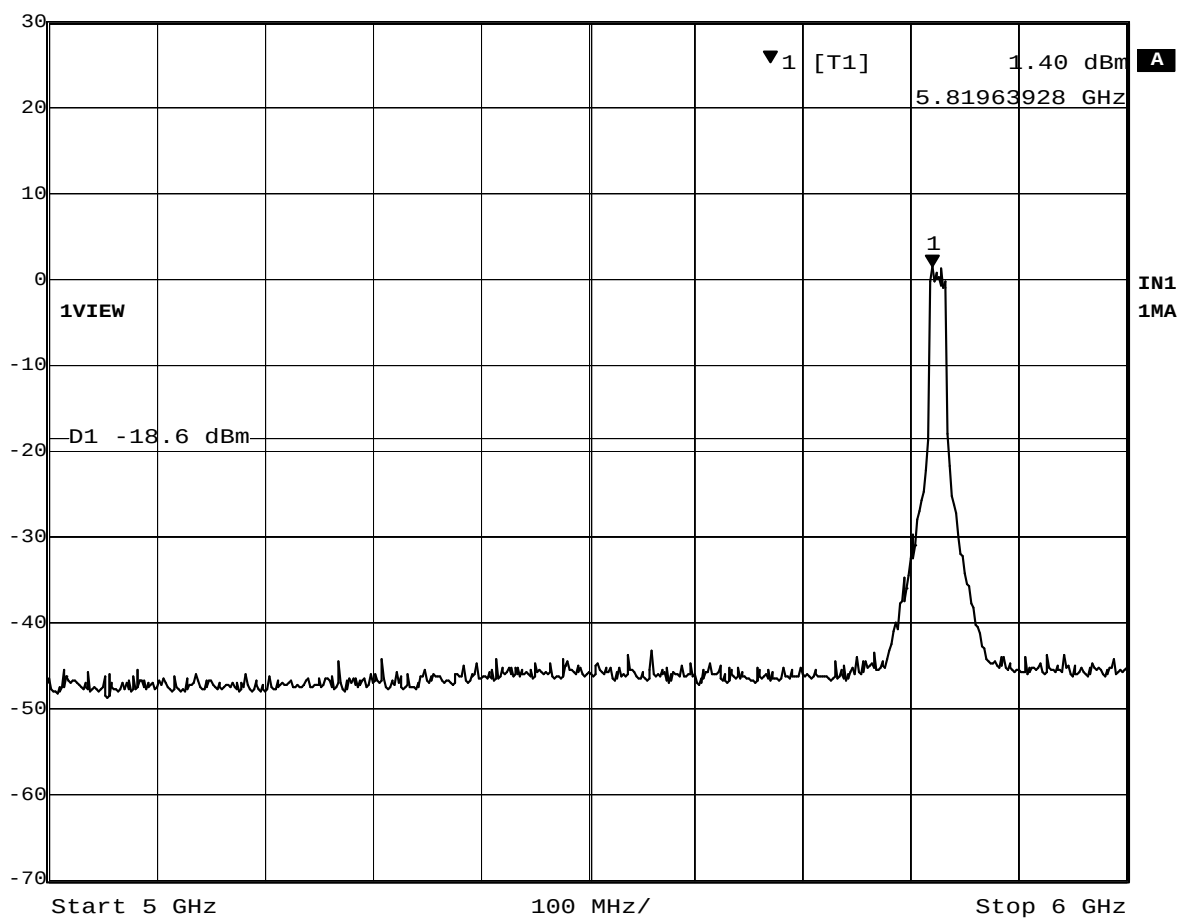


Date: 16.FEB.2004 21:34:34

Plot 4-8. Conducted Spurious (OFDM, 24Mbps, ch. 157)



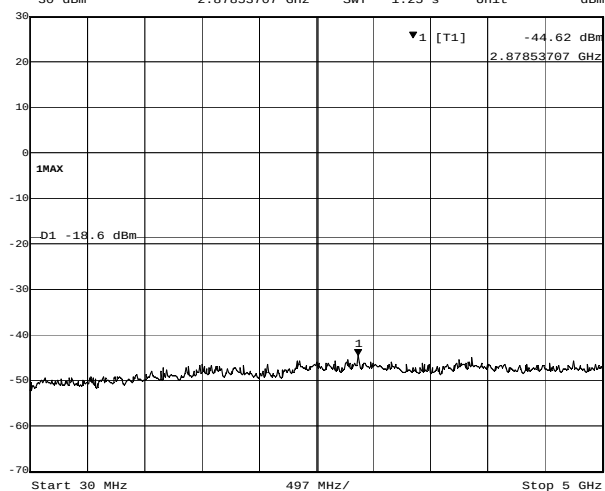
Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl 1.40 dBm VBW 100 kHz
30 dBm 5.81963928 GHz SWT 250 ms Unit dBm



Date: 16.FEB.2004 21:38:05



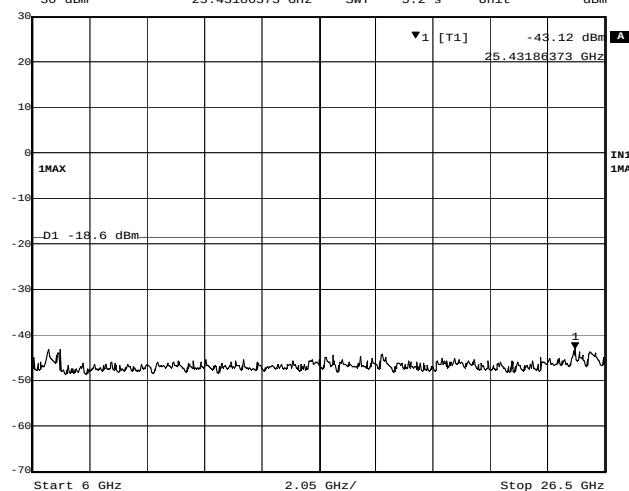
Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl -44.62 dBm VBW 100 kHz
30 dBm 2.87853707 GHz SWT 1.25 s Unit dBm



Date: 16.FEB.2004 21:38:37



Marker 1 [T1] RBW 100 kHz RF Att 40 dB
Ref Lvl -43.12 dBm VBW 100 kHz
30 dBm 25.43186373 GHz SWT 5.2 s Unit dBm



Date: 16.FEB.2004 21:39:10

Plot 4-9. Conducted Spurious (OFDM, 24Mbps, ch. 165)

5. Peak Power Spectral Density

[FCC 15.247(d), RSS-210 6.2.2(o)(b)]

5.1 Test Procedure

The power spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT was operating in transmission mode at the appropriate center frequency.

The pre-scanning was performed with the spectrum analyzer to search and locate the center frequency at the peak emission of each transmission mode.

Then, the spectral analyzer was set to the emission peak found in the pre-scan and the peak power spectral density was measured with:

RBW = 3 kHz, VBW = 3 kHz, Span = 300 KHz, Sweep = 100 seconds, Mode= Peak detector

5.2 Test Instruments and Measurement Setup

Same as the Chapter 1 (Table 1-1 & Figure 1).

5.3 Measurement Results

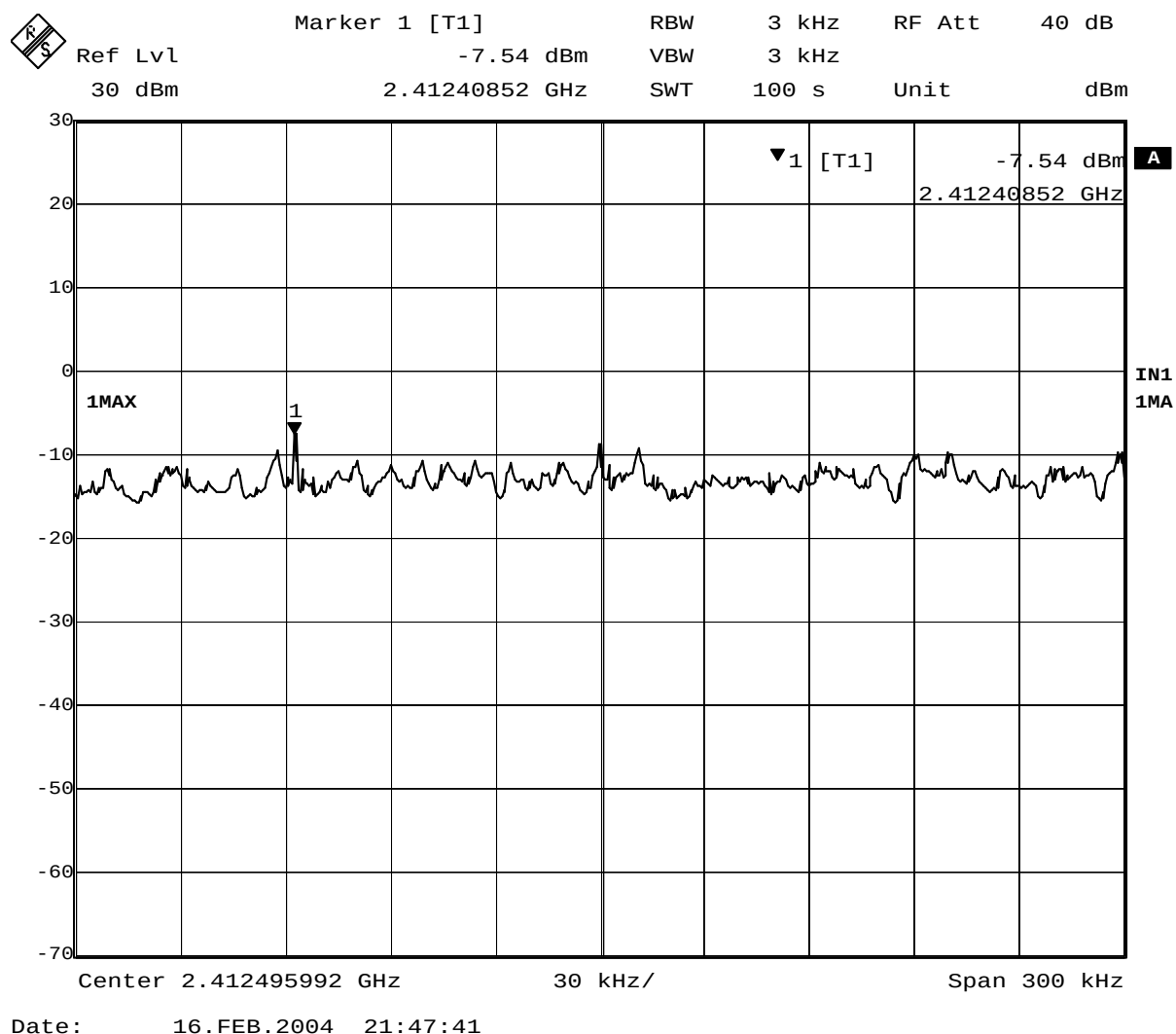
The measurement was performed with the worst cases of each transmission mode, that tend to have the highest conducted peak power, based on the results of previous Chapter 3, “Conducted Peak Output Power” measurement.

Test Date: February 16, 2004

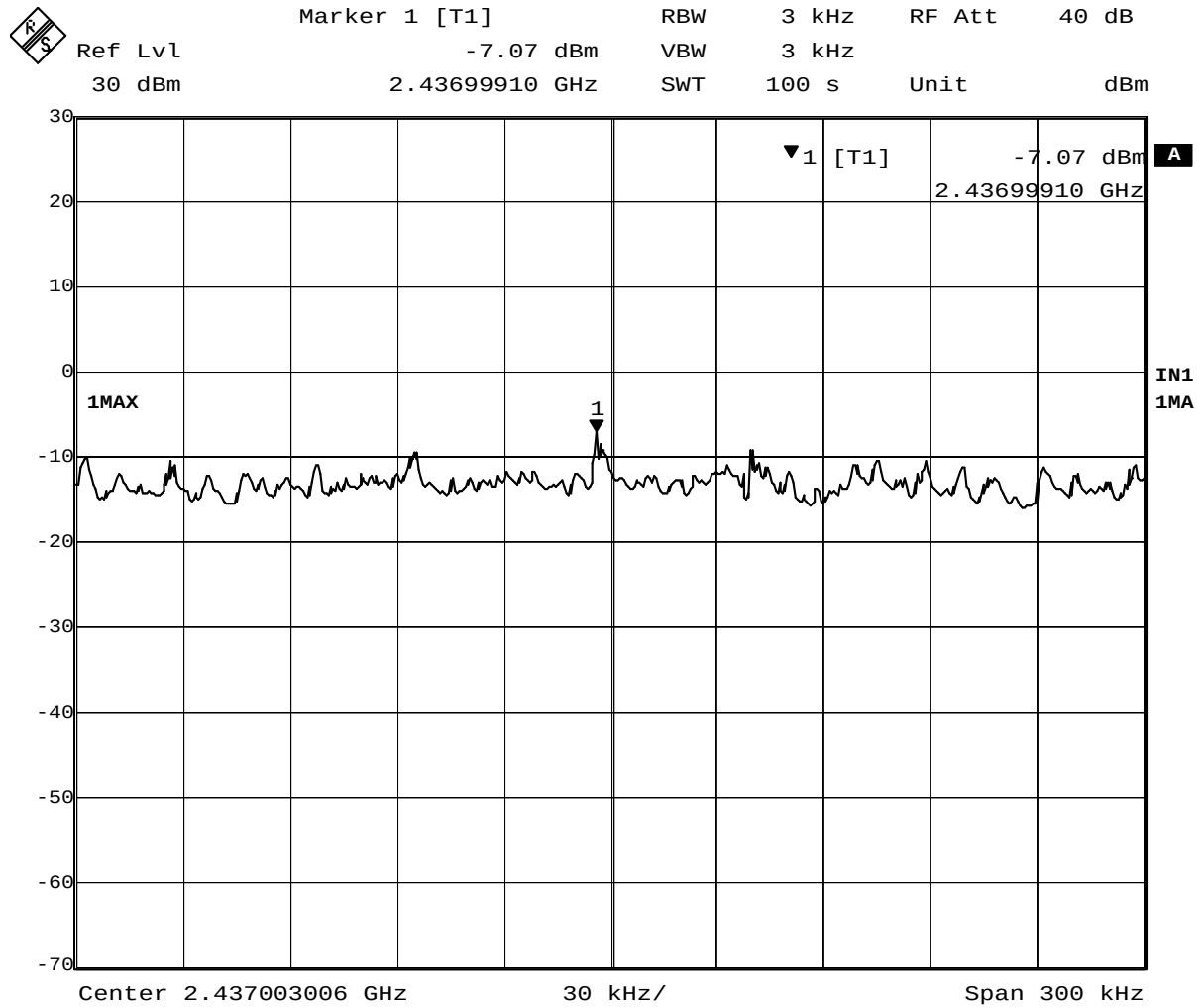
Table 5-1. Peak Power Spectrum Density, TX mode

Ch No.			Frequency (MHz)	Analyzer Reading (dBm)	Trace number	Cable loss (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
DSSS	2.4GHz 11Mbps	1	2412.41	-7.54	Plot 5-1	1.3	- 6.2	8.0	14.2
		6	2437.00	-7.07	Plot 5-2	1.3	- 5.8	8.0	13.8
		11	2461.48	-9.55	Plot 5-3	1.3	- 8.3	8.0	16.3
OFDM	2.4GHz 18Mbps	1	2410.76	-12.88	Plot 5-4	1.3	-11.6	8.0	19.6
		6	2437.29	-8.93	Plot 5-5	1.3	- 7.6	8.0	15.6
		11	2463.19	-12.59	Plot 5-6	1.3	-11.3	8.0	19.3
	5.8GHz 24Mbps	149	5743.74	-13.02	Plot 5-7	2.3	-10.7	8.0	18.7
		157	5784.69	-13.42	Plot 5-8	2.3	-11.1	8.0	19.1
		165	5824.69	-12.73	Plot 5-9	2.3	-10.4	8.0	18.4

5.4 Trace Data of Peak Power Spectral Density

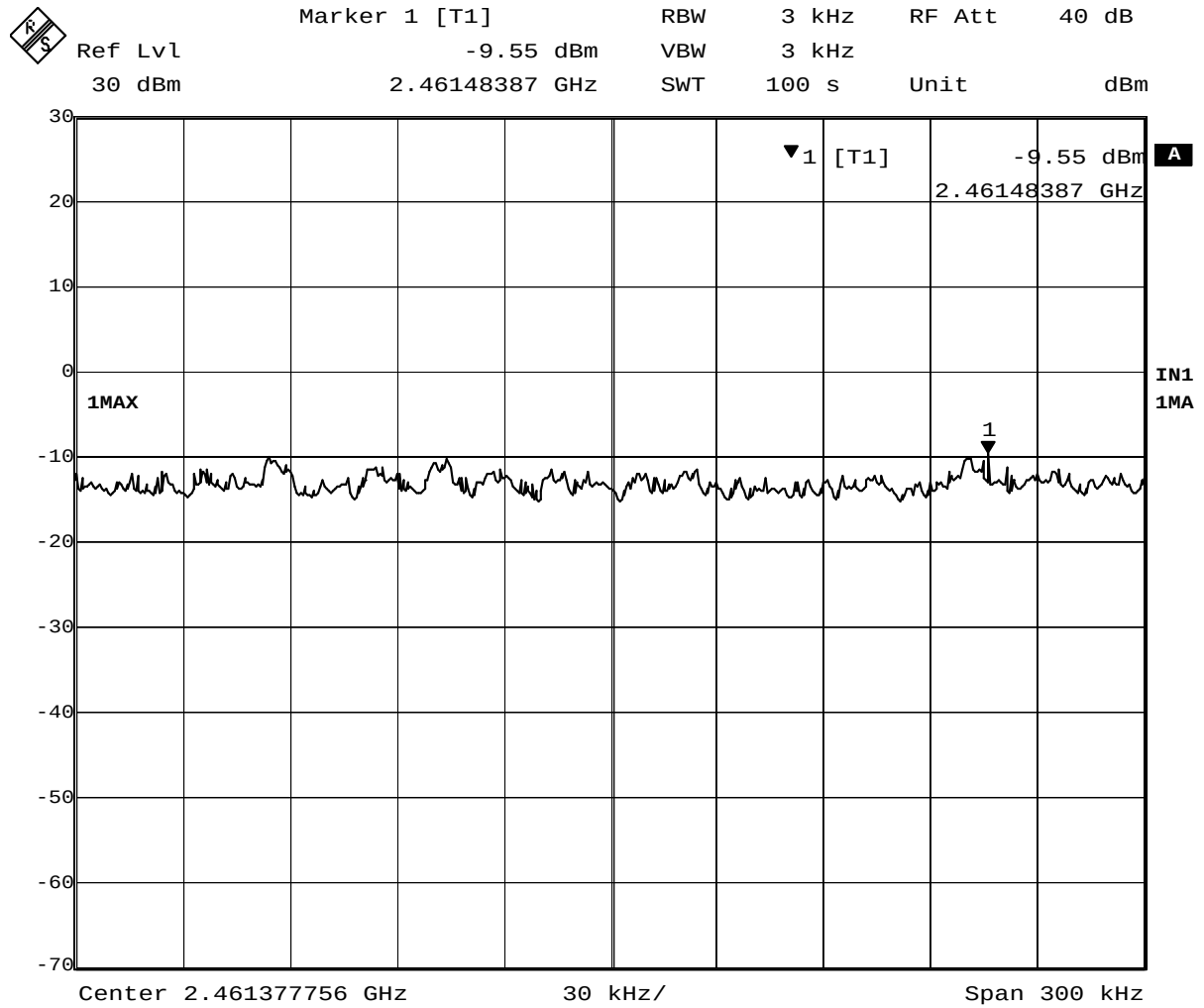


Plot 5-1. Peak Power Spectral Density of 2412MHz (DSSS, 11Mbps)



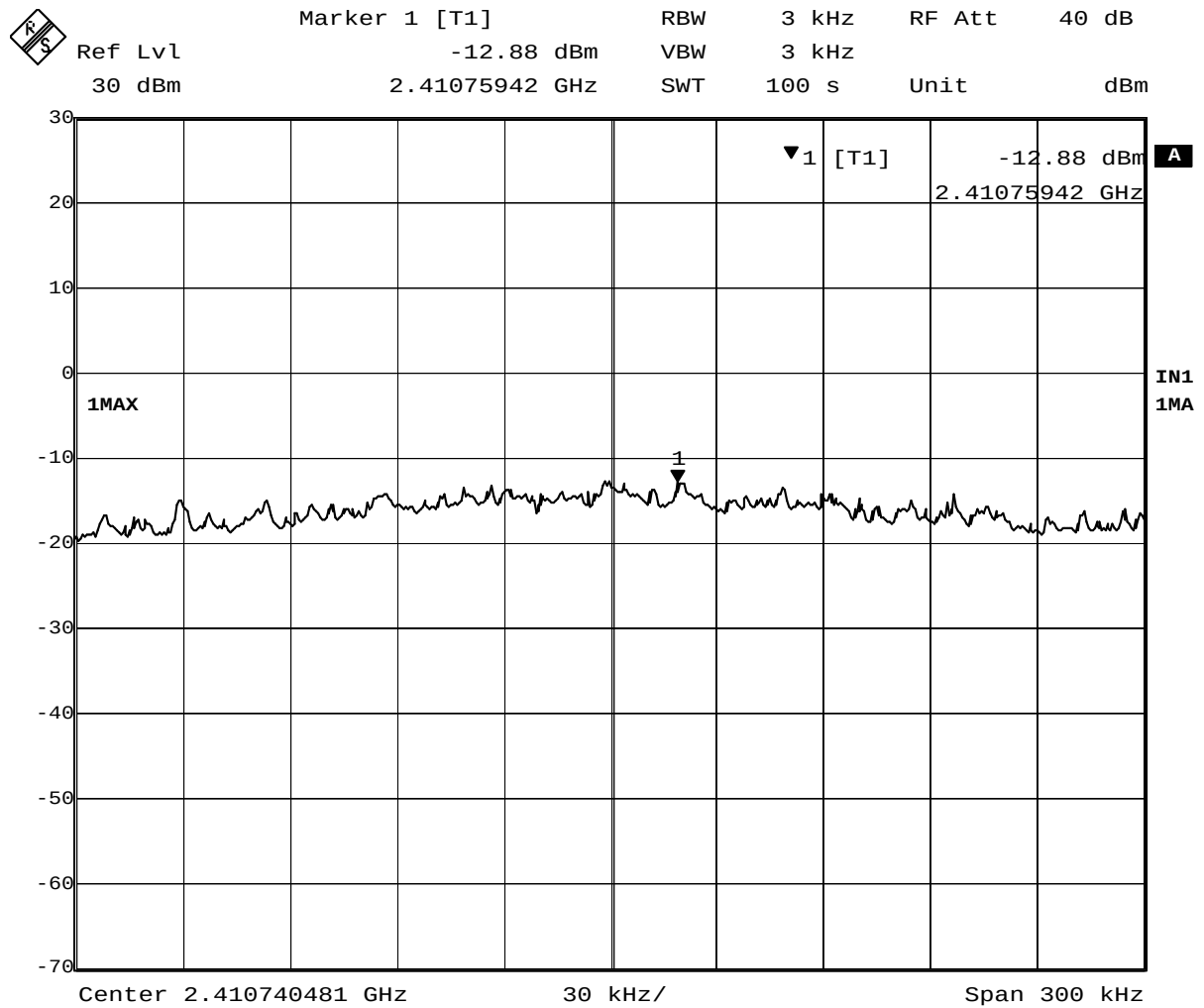
Date: 16.FEB.2004 21:55:58

Plot 5-2. Peak Power Spectral Density of 2437MHz (DSSS, 11Mbps)



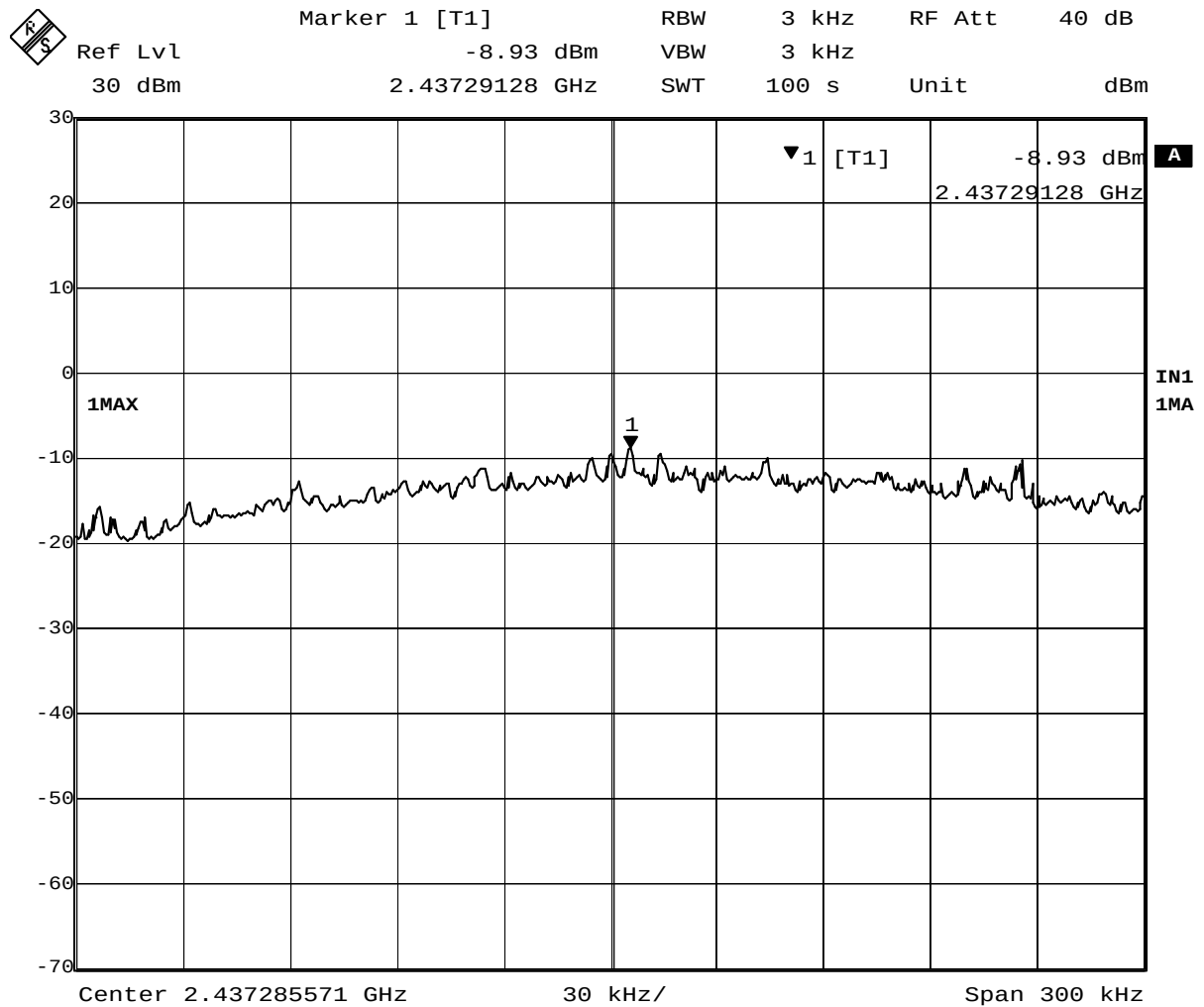
Date: 16.FEB.2004 22:03:12

Plot 5-3. Peak Power Spectral Density of 2462MHz (DSSS, 11Mbps)



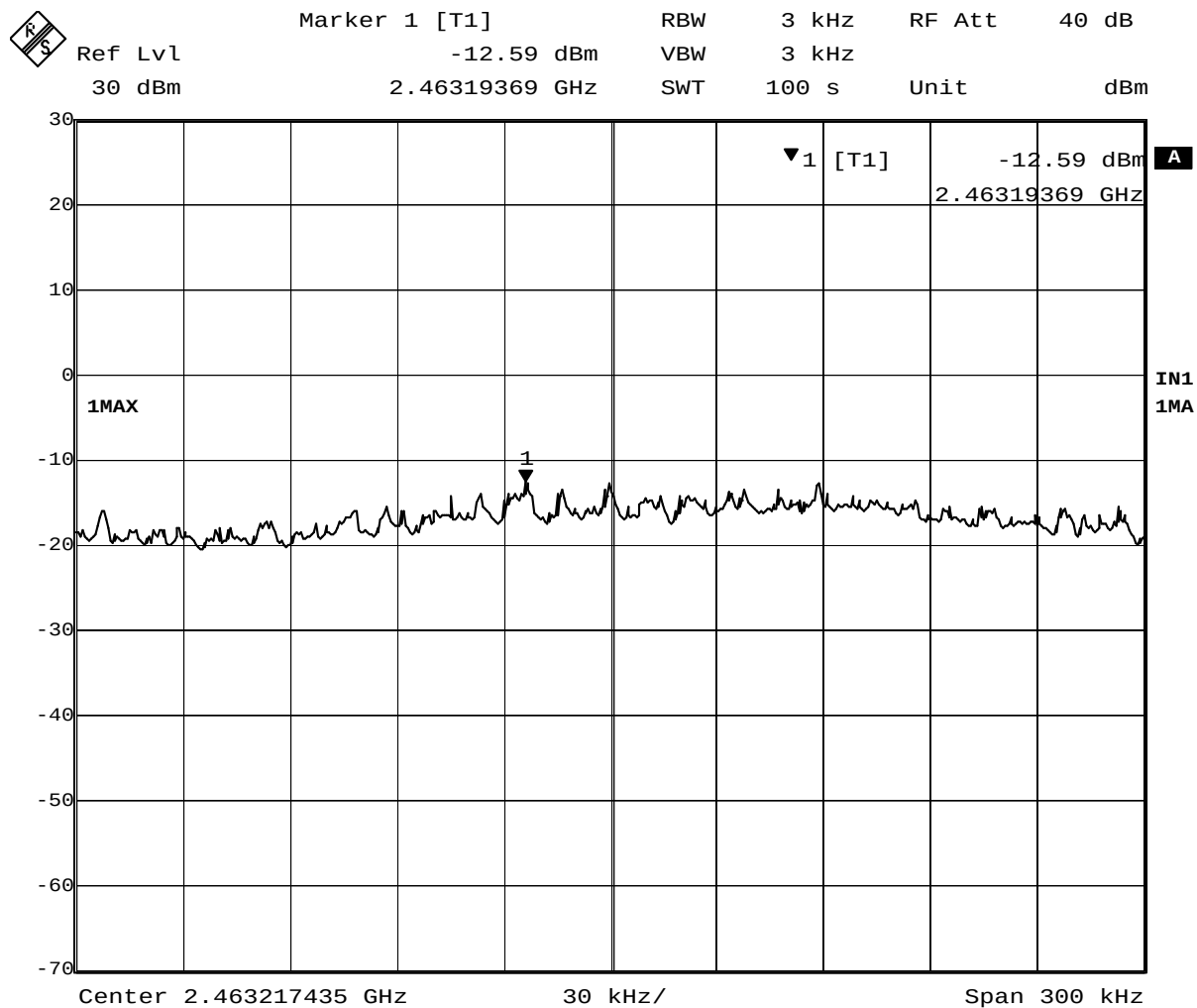
Date: 16.FEB.2004 22:09:54

Plot 5-4. Peak Power Spectral Density of 2412MHz (OFDM, 18Mbps)



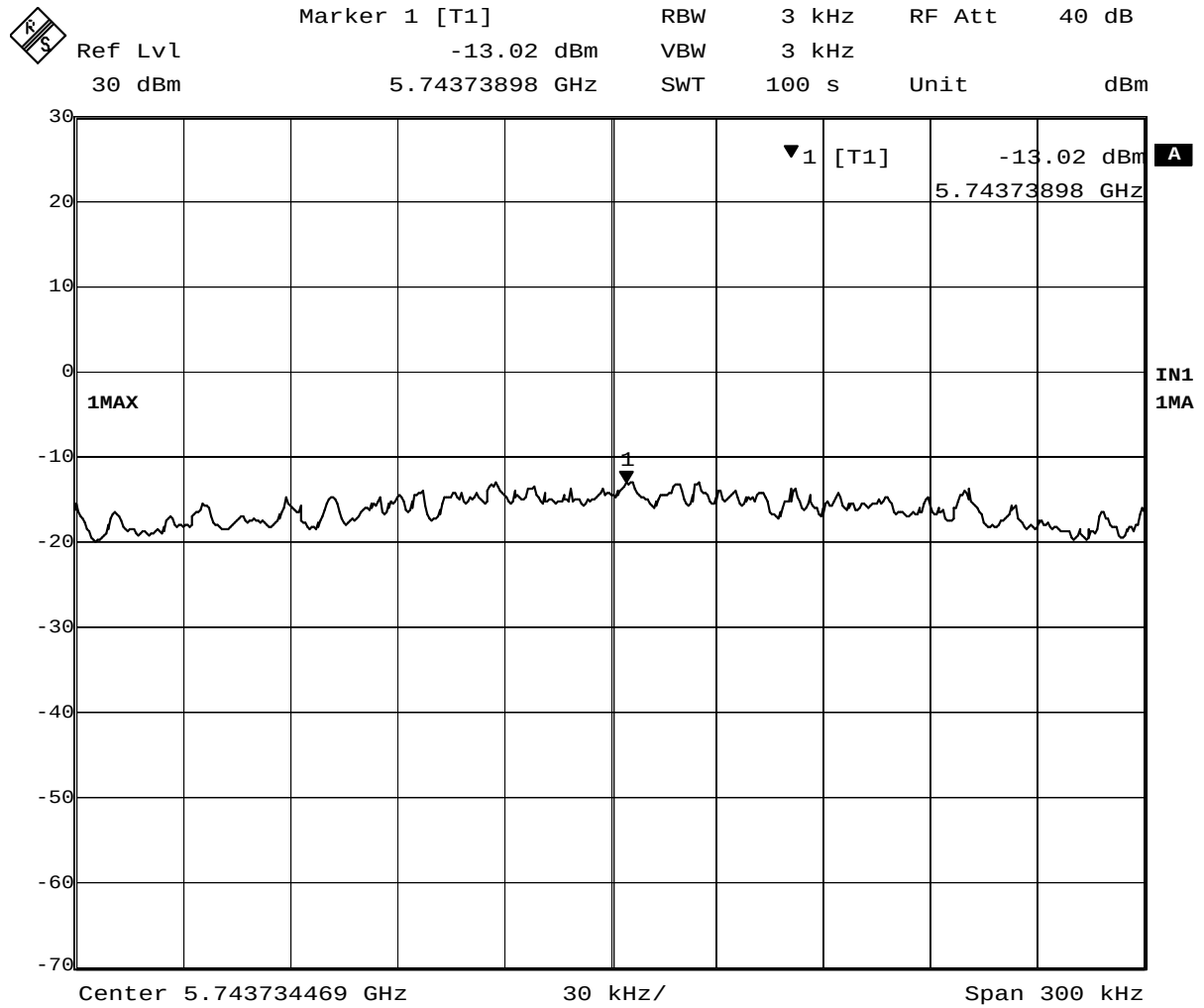
Date: 16.FEB.2004 22:15:56

Plot 5-5. Peak Power Spectral Density of 2437MHz (OFDM, 18Mbps)



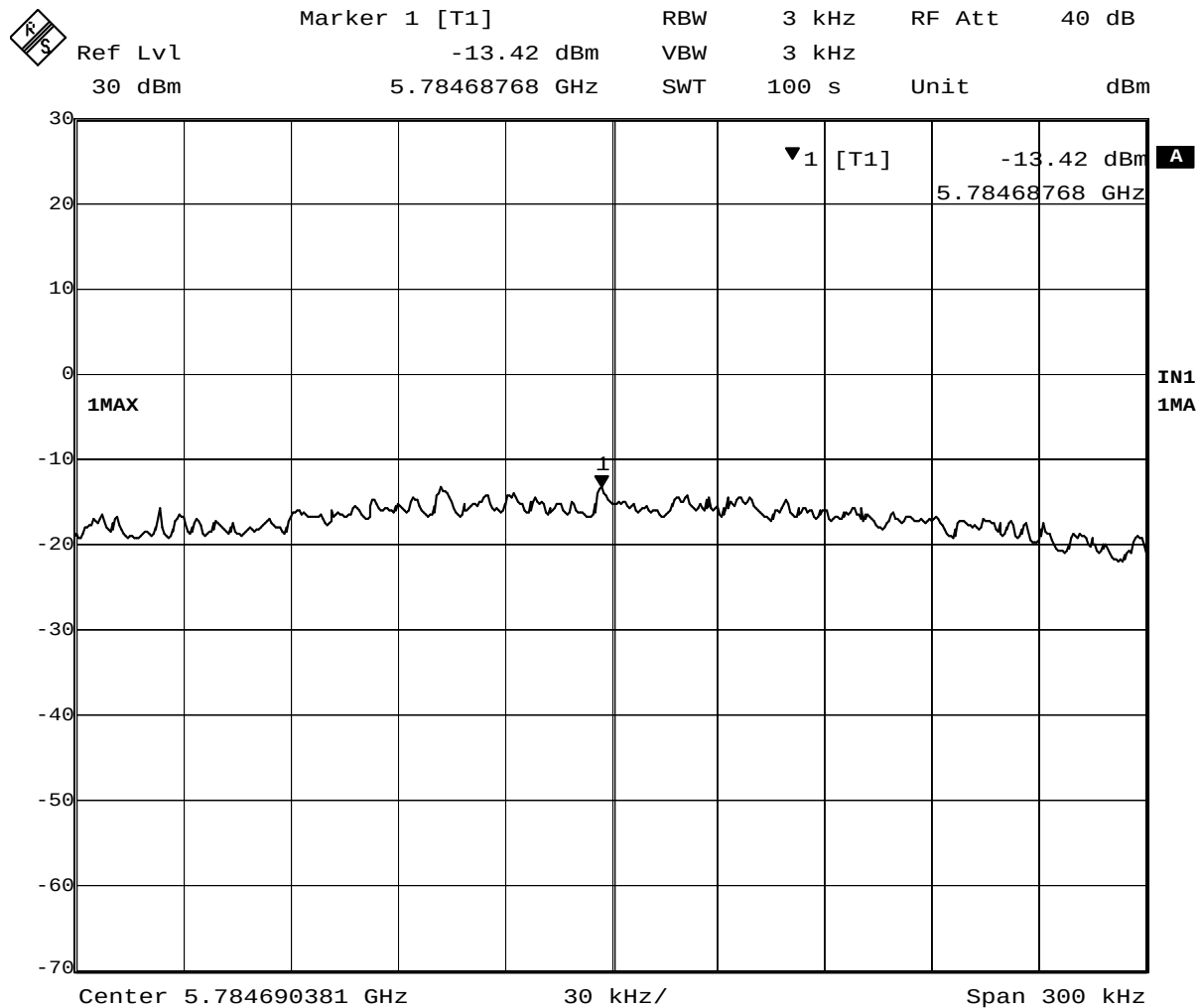
Date: 16.FEB.2004 22:21:14

Plot 5-6. Peak Power Spectral Density of 2462MHz (OFDM, 18Mbps)



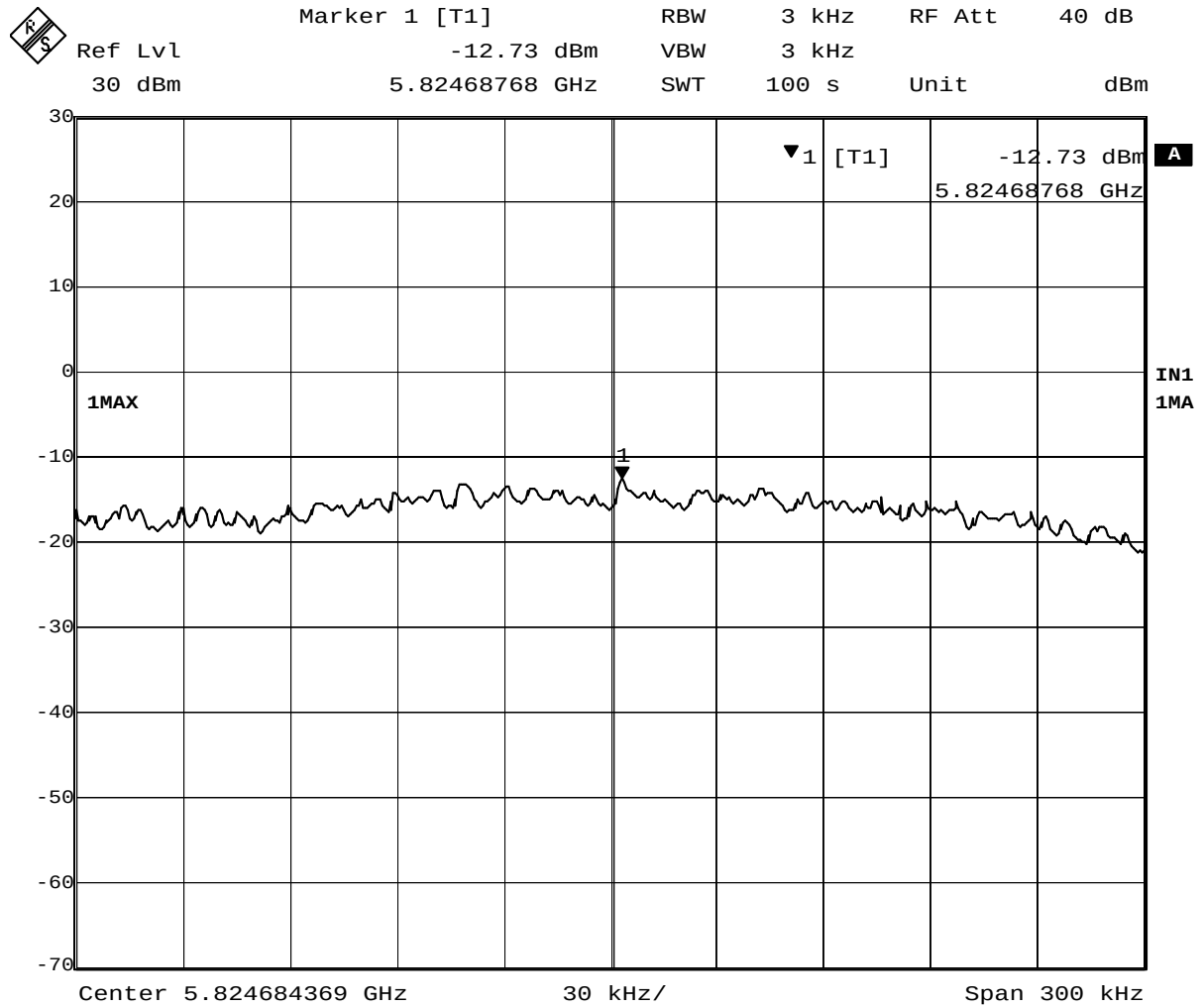
Date: 16.FEB.2004 22:27:43

Plot 5-7. Peak Power Spectral Density of 5745MHz (OFDM, 24Mbps)



Date: 16.FEB.2004 22:33:01

Plot 5-8. Peak Power Spectral Density of 5785MHz (OFDM, 24Mbps)



Date: 16.FEB.2004 22:38:22

Plot 5-9. Peak Power Spectral Density of 5825MHz (OFDM, 24Mbps)

6. AC WIRELINE CONDUCTED EMISSIONS (150KHz – 30MHz)

[FCC 15.207, RSS-210 6.6 / 7.4]

6.1 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.

6.2 Test Instruments and Measurement Setup

Table 6-1. 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: - 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

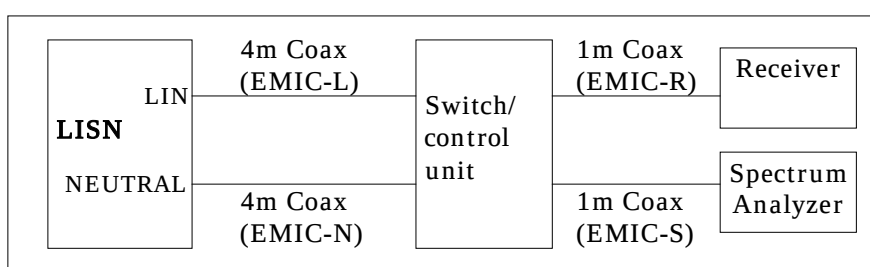


Figure 6. Cables for Conducted Emission Test

6.3 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:

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

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

6.4 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 17.7dB. The 6 highest emissions relative to the limits are reported.

Test Date: February 26, 2004

6.3.1 EUT in 2.4GHz DSSS transmission mode

Table 6-2-1. 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)			
0.2105	43.7	0.5	44.2	33.0	0.5	33.5	63.2	53.2	Neutral
0.4851	26.2	0.6	26.8	24.2	0.6	24.8	56.3	46.3	Line
0.6958	26.0	0.6	26.6	23.1	0.6	23.7	56.0	46.0	Line
1.3253	28.1	0.6	28.7	23.9	0.6	24.5	56.0	46.0	Line
1.5351	26.5	0.6	27.1	22.7	0.6	23.3	56.0	46.0	Line
1.8857	26.3	0.7	27.0	23.7	0.7	24.4	56.0	46.0	Line

Table 6-2-2. 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)			
0.2112	43.7	0.5	44.2	32.9	0.5	33.4	63.2	53.2	Neutral
0.4206	29.9	0.6	30.5	24.8	0.6	25.4	57.4	47.4	Line
0.4888	28.0	0.6	28.6	26.3	0.6	26.9	56.2	46.2	Line
0.6982	26.9	0.6	27.5	23.9	0.6	24.5	56.0	46.0	Line
0.7692	25.9	0.6	26.5	23.5	0.6	24.1	56.0	46.0	Line
1.6051	26.9	0.6	27.5	23.6	0.6	24.2	56.0	46.0	Line

Table 6-2-3. 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)			
0.2113	43.8	0.5	44.3	33.1	0.5	33.6	63.2	53.2	Neutral
0.2788	35.7	0.6	36.3	28.5	0.6	29.1	60.9	50.9	Line
0.4196	30.6	0.6	31.2	25.3	0.6	25.9	57.5	47.5	Line
0.4861	27.0	0.6	27.6	25.3	0.6	25.9	56.2	46.2	Line
0.6993	26.1	0.6	26.7	23.1	0.6	23.7	56.0	46.0	Line
1.2567	28.4	0.6	29.0	22.8	0.6	23.4	56.0	46.0	Line

Table 6-2-4. 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)			
0.2107	44.3	0.5	44.8	34.9	0.5	35.4	63.2	53.2	Line
0.3506	32.6	0.6	33.2	27.7	0.6	28.3	58.9	48.9	Line
0.4184	31.7	0.6	32.3	26.5	0.6	27.1	57.5	47.5	Neutral
0.5565	28.5	0.6	29.1	26.2	0.6	26.8	56.0	46.0	Line
0.9773	30.1	0.6	30.7	24.9	0.6	25.5	56.0	46.0	Line
1.1879	30.7	0.6	31.3	24.8	0.6	25.4	56.0	46.0	Line

6.3.2 EUT in 2.4GHz OFDM transmission modeTable 6-2-5. 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)			
0.2083	44.2	0.5	44.7	34.3	0.5	34.8	63.3	53.3	Line
0.3503	33.0	0.6	33.6	25.5	0.6	26.1	59.0	49.0	Neutral
0.4887	28.0	0.6	28.6	26.2	0.6	26.8	56.2	46.2	Line
0.9780	27.9	0.6	28.5	22.2	0.6	22.8	56.0	46.0	Line
1.2571	28.6	0.6	29.2	22.9	0.6	23.5	56.0	46.0	Line
1.3247	26.9	0.6	27.5	22.4	0.6	23.0	56.0	46.0	Line

Table 6-2-6. 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)			
0.2111	44.0	0.5	44.5	33.2	0.5	33.7	63.2	53.2	Neutral
0.3496	33.4	0.6	34.0	25.7	0.6	26.3	59.0	49.0	Neutral
0.4898	27.7	0.6	28.3	25.9	0.6	26.5	56.2	46.2	Line
0.6999	26.1	0.6	26.7	23.1	0.6	23.7	56.0	46.0	Line
1.0462	28.9	0.6	29.5	23.8	0.6	24.4	56.0	46.0	Line
1.2578	28.6	0.6	29.2	22.9	0.6	23.5	56.0	46.0	Line

Table 6-2-7. 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)			
0.2092	44.7	0.5	45.2	33.9	0.5	34.4	63.2	53.2	Neutral
0.2769	34.7	0.6	35.3	27.3	0.6	27.9	60.9	50.9	Lien
0.3505	33.5	0.6	34.1	25.5	0.6	26.1	58.9	48.9	Neutral
0.4202	30.0	0.6	30.6	24.3	0.6	24.9	57.4	47.4	Line
0.4855	26.4	0.6	27.0	24.7	0.6	25.3	56.2	46.2	Line
1.0443	27.4	0.6	28.0	22.3	0.6	22.9	56.0	46.0	Line

Table 6-2-8. 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)			
0.2110	44.5	0.5	45.0	35.0	0.5	35.5	63.2	53.2	Line
0.3497	32.7	0.6	33.3	27.8	0.6	28.4	59.0	49.0	Line
0.4183	31.7	0.6	32.3	26.5	0.6	27.1	57.5	47.5	Neutral
0.5574	29.1	0.6	29.7	26.8	0.6	27.4	56.0	46.0	Line
0.7697	27.9	0.6	28.5	24.6	0.6	25.2	56.0	46.0	Line
0.9776	30.2	0.6	30.8	25.0	0.6	25.6	56.0	46.0	Line

6.3.3 EUT in 5.8GHz OFDM transmission modeTable 6-2-9. Ch.149 (5745MHz) **TX** mode 24Mbps

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)			
0.2109	44.6	0.5	45.1	33.9	0.5	34.4	63.2	53.2	Neutral
0.2795	35.4	0.6	36.0	27.8	0.6	28.4	60.8	50.8	Line
0.3503	33.5	0.6	34.1	25.8	0.6	26.4	59.0	49.0	Neutral
0.4857	27.0	0.6	27.6	25.2	0.6	25.8	56.2	46.2	Line
1.0475	28.9	0.6	29.5	23.8	0.6	24.4	56.0	46.0	Line
1.8844	26.4	0.7	27.1	23.8	0.7	24.5	56.0	46.0	Line

Table 6-2-10 Ch.157 (5785MHz) **TX** mode 24Mbps

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)			
0.2108	44.5	0.5	45.0	33.9	0.5	34.4	63.2	53.2	Neutral
0.4888	27.8	0.6	28.4	26.2	0.6	26.8	56.2	46.2	Line
0.6998	26.1	0.6	26.7	23.1	0.6	23.7	56.0	46.0	Line
1.0459	28.7	0.6	29.3	23.6	0.6	24.2	56.0	46.0	Line
1.2565	28.7	0.6	29.3	23.2	0.6	23.8	56.0	46.0	Line
1.8836	26.0	0.7	26.7	23.4	0.7	24.1	56.0	46.0	Line

Table 6-2-11 Ch.165 (5825MHz) **TX** mode 24Mbps

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)			
0.2104	44.8	0.5	45.3	34.0	0.5	34.5	63.2	53.2	Neutral
0.2799	35.6	0.6	36.2	27.9	0.6	28.5	60.8	50.8	Line
0.4854	26.8	0.6	27.4	24.9	0.6	25.5	56.2	46.2	Line
1.2562	28.8	0.6	29.4	23.2	0.6	23.8	56.0	46.0	Line
1.3254	27.8	0.6	28.4	23.4	0.6	24.0	56.0	46.0	Line
1.6030	26.1	0.6	26.7	23.0	0.6	23.6	56.0	46.0	Line

Table 6-2-12 Ch.157 (5785MHz) **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)			
0.2110	43.9	0.5	44.4	34.5	0.5	35.0	63.2	53.2	Line
0.5580	29.6	0.6	30.2	27.4	0.6	28.0	56.0	46.0	Line
0.7675	28.5	0.6	29.1	25.4	0.6	26.0	56.0	46.0	Line
0.9776	30.6	0.6	31.2	25.6	0.6	26.2	56.0	46.0	Line
1.1864	31.1	0.6	31.7	25.3	0.6	25.9	56.0	46.0	Line
1.8847	27.7	0.7	28.4	25.5	0.7	26.2	56.0	46.0	Line

7. RESTRICTED BANDS RADIATIONS (30MHz – 1GHz)

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

7.1 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.

7.2 Test Instruments and Measurement Setup

Table 7-1 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	3019A05156
Spectrum Analyzer Display for 200-1000MHz	HP 85662A	3026A19366
Quasi-Peak Adapter for 200-1000MHz	HP 85650A	2811A01433
Amplifier (100KHz-1.3GHz)		
- for 30-200MHz	HP 8447F	2805A02919
- 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	892111/030
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

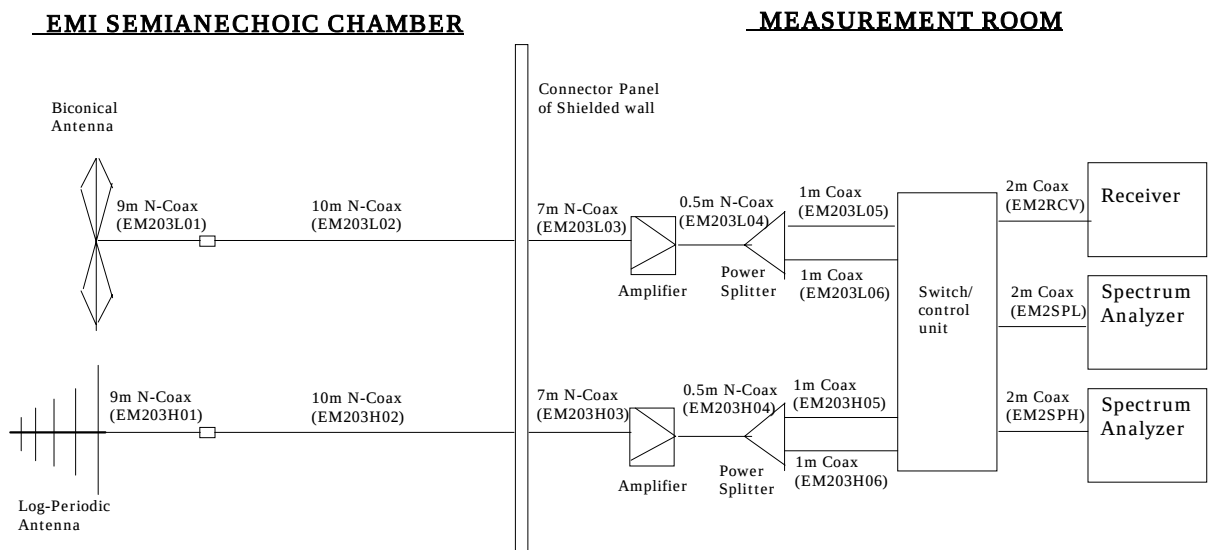


Figure 7 Cables for Radiated Emission Test

7.3 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:

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

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

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

7.4 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 10.3dB at 30MHz - 1000MHz band.

The 6 highest emissions relative to the limits are reported.

Test Date: February 23, 2004

7.4.1 EUT in 2.4GHz DSSS transmission mode

Table 7-2-1. 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)
143.181	V	34.6	12.2	-16.6	30.2	43.5	32.4	150
196.607	H	32.7	13.6	-15.8	30.5	43.5	33.5	150
563.517	V	34.7	18.2	-20.4	32.5	46.0	42.2	200
701.534	V	32.6	21.0	-20.1	33.5	46.0	47.3	200
809.980	V	29.8	21.4	-19.1	32.1	46.0	40.3	200
901.974	V	30.7	22.7	-18.6	34.8	46.0	55.0	200

Table 7-2-2. 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)
143.181	V	34.4	12.2	-16.6	30.0	43.5	31.6	150
196.607	H	33.3	13.6	-15.8	31.1	43.5	35.9	150
563.611	V	34.8	18.2	-20.4	32.6	46.0	42.7	200
701.536	V	34.7	21.0	-20.1	35.6	46.0	60.3	200
809.980	V	29.8	21.4	-19.1	32.1	46.0	40.3	200
901.974	V	30.7	22.7	-18.6	34.8	46.0	55.0	200

Table 7-2-3. 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)
143.181	V	34.3	12.2	-16.6	29.9	43.5	31.3	150
196.607	H	32.6	13.6	-15.8	30.4	43.5	33.1	150
563.704	V	34.8	18.2	-20.4	32.6	46.0	42.7	200
701.536	V	34.4	21.0	-20.1	35.3	46.0	58.2	200
809.979	V	29.8	21.4	-19.1	32.1	46.0	40.3	200
901.975	V	31.2	22.7	-18.6	35.3	46.0	58.2	200

Table 7-2-4. 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)
143.181	V	34.4	12.2	-16.6	30.0	43.5	31.6	150
171.817	H	33.5	12.5	-16.2	29.8	43.5	30.9	150
563.610	V	33.8	18.2	-20.4	31.6	46.0	38.0	200
701.541	V	32.4	21.0	-20.1	33.3	46.0	46.2	200
809.979	V	30.4	21.4	-19.1	32.7	46.0	43.2	200
901.982	V	30.6	22.7	-18.6	34.7	46.0	54.3	200

7.4.2 EUT in 2.4GHz OFDM transmission mode

Table 7-2-5. 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)
143.181	V	35.0	12.2	-16.6	30.6	43.5	33.9	150
196.607	H	33.7	13.6	-15.8	31.5	43.5	37.6	150
498.339	V	33.8	17.7	-21.7	29.8	46.0	30.9	200
701.552	V	32.7	21.0	-20.1	33.6	46.0	47.9	200
809.980	V	29.7	21.4	-19.1	32.0	46.0	39.8	200
901.995	V	31.3	22.7	-18.6	35.4	46.0	58.9	200

Table 7-2-6. 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)
143.181	V	35.2	12.2	-16.6	30.8	43.5	34.7	150
196.606	H	33.9	13.6	-15.8	31.7	43.5	38.5	150
563.704	V	34.7	18.2	-20.4	32.5	46.0	42.2	200
701.546	V	32.3	21.0	-20.1	33.2	46.0	45.7	200
809.980	V	29.2	21.4	-19.1	31.5	46.0	37.6	200
901.989	V	31.1	22.7	-18.6	35.2	46.0	57.5	200

Table 7-2-7. 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)
143.181	V	35.1	12.2	-16.6	30.7	43.5	34.3	150
196.607	H	33.5	13.6	-15.8	31.3	43.5	36.7	150
563.611	V	34.9	18.2	-20.4	32.7	46.0	43.2	200
701.545	V	32.5	21.0	-20.1	33.4	46.0	46.8	200
809.980	V	30.0	21.4	-19.1	32.3	46.0	41.2	200
901.986	V	31.6	22.7	-18.6	35.7	46.0	61.0	200

Table 7-2-8. 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)
143.181	V	35.0	12.2	-16.6	30.6	43.5	33.9	150
196.607	V	30.6	13.6	-15.8	28.4	43.5	26.3	150
563.516	V	34.5	18.2	-20.4	32.3	46.0	41.2	200
701.549	V	32.7	21.0	-20.1	33.6	46.0	47.9	200
809.978	V	30.5	21.4	-19.1	32.8	46.0	43.7	200
901.991	V	31.1	22.7	-18.6	35.2	46.0	57.5	200

7.4.3 EUT in 5.8GHz OFDM transmission mode

Table 7-2-9. Ch.149 (5745MHz) **TX** mode 24Mbps

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)
143.181	V	35.0	12.2	-16.6	30.6	43.5	33.9	150
196.607	H	33.2	13.6	-15.8	31.0	43.5	35.5	150
563.610	V	35.2	18.2	-20.4	33.0	46.0	44.7	200
701.535	V	33.5	21.0	-20.1	34.4	46.0	52.5	200
809.979	V	30.5	21.4	-19.1	32.8	46.0	43.7	200
901.972	V	31.0	22.7	-18.6	35.1	46.0	56.9	200

Table 7-2-10 Ch.157 (5785MHz) **TX** mode 24Mbps

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)
143.181	V	34.7	12.2	-16.6	30.3	43.5	32.7	150
196.607	H	33.3	13.6	-15.8	31.1	43.5	35.9	150
563.517	V	35.0	18.2	-20.4	32.8	46.0	43.7	200
701.534	V	33.9	21.0	-20.1	34.8	46.0	55.0	200
809.980	V	30.0	21.4	-19.1	32.3	46.0	41.2	200
901.969	V	30.9	22.7	-18.6	35.0	46.0	56.2	200

Table 7-2-11 Ch.165 (5825MHz) **TX** mode 24Mbps

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)
143.181	V	34.9	12.2	-16.6	30.5	43.5	33.5	150
196.607	H	33.5	13.6	-15.8	31.3	43.5	36.7	150
563.611	V	35.3	18.2	-20.4	33.1	46.0	45.2	200
701.533	V	32.4	21.0	-20.1	33.3	46.0	46.2	200
809.979	V	30.0	21.4	-19.1	32.3	46.0	41.2	200
901.971	V	30.7	22.7	-18.6	34.8	46.0	55.0	200

Table 7-2-12 Ch.157 (5785MHz) **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)
143.181	V	34.8	12.2	-16.6	30.4	43.5	33.1	150
196.607	H	31.5	13.6	-15.8	29.3	43.5	29.2	150
563.610	V	34.2	18.2	-20.4	32.0	46.0	39.8	200
701.540	V	32.4	21.0	-20.1	33.3	46.0	46.2	200
809.978	V	29.8	21.4	-19.1	32.1	46.0	40.3	200
901.981	V	31.2	22.7	-18.6	35.3	46.0	58.2	200

8. RESTRICTED BANDS RADIATIONS (1GHz – 40GHz)

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

8.1 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.

8.2 Test Instruments and Measurement Setup

Table 8 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

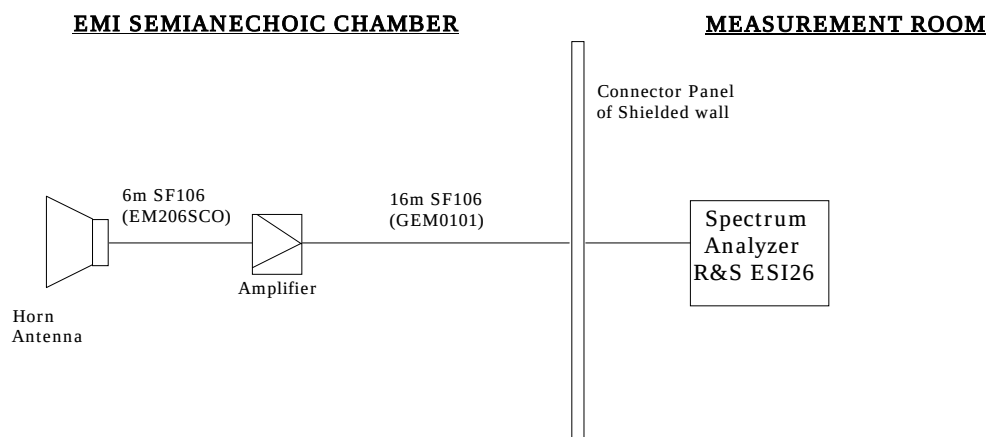


Figure 8-1. Cables for Radiated Emission Test (1 – 12.4 GHz)

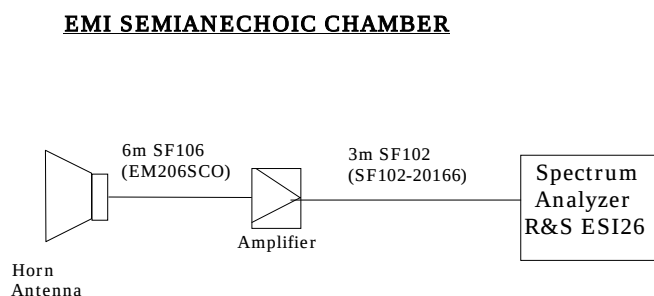


Figure 8-2. Cables for Radiated Emission Test (12.4 - 18GHz)

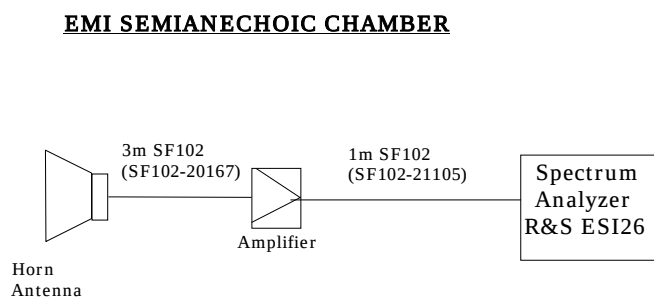


Figure 8-3. Cables for Radiated Emission Test (18 - 26.5GHz)

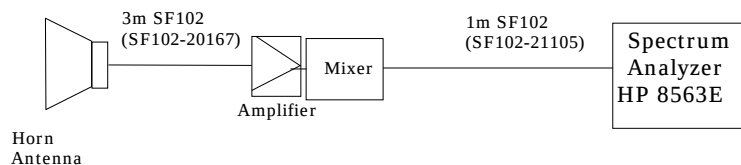
EMI SEMIANECHOIC CHAMBER

Figure 8-4. Cables for Radiated Emission Test (26.5 - 40GHz)

8.3 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 :

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

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

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

8.4 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 1.0 dB. The measurement was done for the frequency range of 1 GHz to 40 GHz in TX mode and 1 GHz to 25GHz in RX mode.

Test Date: February 19, 23, 24, 25 and 27, 2004

8.4.1 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)

Table 8-2-1. 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	113.2	104.8	28.3	-29.6	0.0	111.9	OB*	103.5	OB*
Adjacent RB 2.368	H	59.5	51.6	28.1	-29.6	0.0	58.0	74.0	50.1	54.0
2.386	H	63.6	52.5	28.2	-29.6	0.0	62.2	74.0	51.1	54.0
2.390	H	61.5	51.1	28.2	-29.6	0.0	60.1	74.0	49.7	54.0
1.013	V	49.6	-	24.3	-32.2	0.0	41.7	74.0	-	54.0
1.102	V	48.7	-	24.4	-31.9	0.0	41.2	74.0	-	54.0
1.136	V	51.2	-	24.6	-31.8	0.0	44.0	74.0	-	54.0
1.198	V	54.0	-	25.2	-31.6	0.0	47.6	74.0	-	54.0
2.272	H	55.5	-	27.8	-29.8	0.0	53.5	74.0	-	54.0
2.349	H	58.6	46.8	28.1	-29.6	0.0	57.1	74.0	45.3	54.0
4.826	H	46.7	-	27.1	-27.2	0.0	46.6	74.0	-	54.0

Table 8-2-2. Ch.6 (2437MHz) **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 2.436	H	113.4	105.2	28.4	-29.6	0.0	112.2	OB*	104.0	OB*
Adjacent RB 2.368	H	61.1	52.8	28.1	-29.6	0.0	59.6	74.0	51.3	54.0
2.390	H	60.5	49.7	28.2	-29.6	0.0	59.1	74.0	48.3	54.0
2.484	H	57.2	46.4	28.4	-29.6	0.0	56.0	74.0	45.2	54.0
1.013	V	49.4	-	24.3	-32.2	0.0	41.5	74.0	-	54.0
1.102	V	51.6	-	24.4	-31.9	0.0	44.1	74.0	-	54.0
1.144	V	50.9	-	24.6	-31.8	0.0	43.7	74.0	-	54.0
1.194	V	56.4	-	25.2	-31.6	0.0	50.0	74.0	-	54.0
2.336	H	56.7	43.2	28.1	-29.6	0.0	55.2	74.0	41.7	54.0
2.361	H	57.6	45.1	28.1	-29.6	0.0	56.1	74.0	43.6	54.0
4.876	V	47.0	-	27.0	-27.0	0.0	47.0	74.0	-	54.0
7.313	V	38.8	-	29.9	-24.9	0.0	43.8	74.0	-	54.0

Table 8-2-3. Ch.11 (2462MHz) **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 2.463	H	113.1	104.8	28.4	-29.6	0.0	111.9	OB*	103.6	OB*
Adjacent RB 2.484	H	61.7	51.4	28.4	-29.6	0.0	60.5	74.0	50.2	54.0
2.490	H	62.1	51.0	28.4	-29.6	0.0	60.9	74.0	49.8	54.0
2.496	H	60.5	50.3	28.4	-29.6	0.0	59.3	74.0	49.1	54.0
1.013	V	50.2	-	24.3	-32.2	0.0	42.3	74.0	-	54.0
1.161	V	57.0	-	24.6	-31.7	0.0	49.9	74.0	-	54.0
1.196	V	55.5	-	25.2	-31.6	0.0	49.1	74.0	-	54.0
1.334	V	52.0	-	25.2	-31.3	0.0	45.9	74.0	-	54.0
2.272	H	52.6	-	27.8	-29.8	0.0	50.6	74.0	-	54.0
2.299	H	52.4	-	27.8	-29.6	0.0	50.6	74.0	-	54.0
2.337	H	56.2	44.3	28.1	-29.6	0.0	54.7	74.0	42.8	54.0
2.369	H	60.2	46.5	28.1	-29.6	0.0	58.7	74.0	45.0	54.0
4.926	V	47.6	-	27.0	-27.0	0.0	47.6	74.0	-	54.0
7.390	H	38.5	-	29.8	-24.9	0.0	43.4	74.0	-	54.0

Table 8-2-4. 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>)
1.013	V	49.3	-	24.3	-32.2	0.0	41.4	74.0	-	54.0
1.083	V	48.6	-	24.5	-32.0	0.0	41.1	74.0	-	54.0
1.215	V	47.7	-	25.2	-31.6	0.0	41.3	74.0	-	54.0
1.696	V	51.6	-	26.0	-30.5	0.0	47.1	74.0	-	54.0

8.4.2 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)

Table 8-2-5. Ch.1 (2412MHz) **TX** mode 18Mbps

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) (peak)	FCC Limit (dBμV/m) (peak)	Field Strength (dBμV/m) (average)	FCC Limit (dBμV/m) (average)
Inband 2.417	H	110.2	98.5	28.3	-29.6	0.0	108.9	OB*	97.2	OB*
Adjacent RB 2.368	H	60.2	54.0	28.1	-29.6	0.0	58.7	74.0	52.5	54.0
2.389	H	72.3	52.2	28.2	-29.6	0.0	70.9	74.0	50.8	54.0
2.390	H	70.7	54.1	28.2	-29.6	0.0	69.3	74.0	52.7	54.0
1.013	V	50.2	-	24.3	-32.2	0.0	42.3	74.0	-	54.0
1.102	V	49.4	-	24.4	-31.9	0.0	41.9	74.0	-	54.0
1.196	V	55.4	-	25.2	-31.6	0.0	49.0	74.0	-	54.0
1.331	V	51.9	-	25.2	-31.3	0.0	45.8	74.0	-	54.0
2.272	H	52.8	-	27.8	-29.8	0.0	50.8	74.0	-	54.0
2.354	H	55.0	-	28.1	-29.6	0.0	53.5	74.0	-	54.0
4.822	H	39.9	-	27.1	-27.2	0.0	39.8	74.0	-	54.0

Table 8-2-6. Ch.6 (2437MHz) **TX** mode 18Mbps

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) (peak)	FCC Limit (dBμV/m) (peak)	Field Strength (dBμV/m) (average)	FCC Limit (dBμV/m) (average)
Inband 2.434	H	114.0	101.5	28.4	-29.6	0.0	112.8	OB*	100.3	OB*
Adjacent RB 2.368	H	61.9	53.8	28.1	-29.6	0.0	60.4	74.0	52.3	54.0
2.390	H	59.8	48.4	28.2	-29.6	0.0	58.4	74.0	47.0	54.0
2.484	H	55.6	44.1	28.4	-29.6	0.0	54.4	74.0	42.9	54.0
1.013	V	48.7	-	24.3	-32.2	0.0	40.8	74.0	-	54.0
1.160	V	56.9	-	24.6	-31.7	0.0	49.8	74.0	-	54.0
1.198	V	54.3	-	25.2	-31.6	0.0	47.9	74.0	-	54.0
1.328	V	52.8	-	25.6	-31.3	0.0	47.1	74.0	-	54.0
2.272	H	52.7	-	27.8	-29.8	0.0	50.7	74.0	-	54.0
2.355	H	53.8	-	28.1	-29.6	0.0	52.3	74.0	-	54.0
4.876	V	53.3	-	27.0	-27.0	0.0	53.3	74.0	-	54.0
7.306	V	42.1	-	29.9	-24.9	0.0	47.1	74.0	-	54.0

Table 8-2-7. 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 2.458	H	109.4	98.1	28.4	-29.6	0.0	108.2	OB*	96.9	OB*
Adjacent RB 2.484	H	72.4	54.2	28.4	-29.6	0.0	71.2	74.0	53.0	54.0
2.485	H	70.2	50.6	28.4	-29.6	0.0	69.0	74.0	49.4	54.0
2.496	H	59.3	49.9	28.4	-29.6	0.0	58.1	74.0	48.7	54.0
1.062	V	50.1	-	24.6	-32.0	0.0	42.7	74.0	-	54.0
1.098	V	52.0	-	24.4	-31.9	0.0	44.5	74.0	-	54.0
1.196	V	54.6	-	25.2	-31.6	0.0	48.2	74.0	-	54.0
1.497	V	50.9	-	25.5	-30.9	0.0	45.5	74.0	-	54.0
2.272	H	51.8	-	27.8	-29.8	0.0	49.8	74.0	-	54.0
2.337	H	53.7	-	28.1	-29.6	0.0	52.2	74.0	-	54.0
2.369	H	56.9	43.9	28.1	-29.6	0.0	55.4	74.0	42.4	54.0
2.383	H	55.1	-	28.1	-29.6	0.0	53.6	74.0	-	54.0
4.926	V	42.6	-	27.0	-27.0	0.0	42.6	74.0	-	54.0
7.387	V	37.7	-	29.8	-24.9	0.0	42.6	74.0	-	54.0

Table 8-2-8. 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>)
1.013	V	49.3	-	24.3	-32.2	0.0	41.4	74.0	-	54.0
1.083	V	47.8	-	24.5	-32.0	0.0	40.3	74.0	-	54.0
1.102	V	49.9	-	24.4	-31.9	0.0	42.4	74.0	-	54.0
1.693	V	52.1	-	26.0	-30.5	0.0	47.6	74.0	-	54.0

8.4.3 EUT in 5.8GHz OFDM transmission mode

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

Table 8-2-9. Ch.149 (5745MHz) **TX** mode 24Mbps

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 5.750	V	100.6	89.2	34.0	-26.0	0.0	108.6	OB*	97.2	OB*
1.094	V	51.6	-	24.4	-31.9	0.0	44.1	74.0	-	54.0
1.126	V	51.6	-	24.5	-31.8	0.0	44.3	74.0	-	54.0
1.196	V	55.2	-	25.2	-31.6	0.0	48.8	74.0	-	54.0
1.331	V	51.1	-	25.2	-31.3	0.0	45.0	74.0	-	54.0
5.402	V	50.2	36.6	33.9	-26.2	0.0	57.9	74.0	44.3	54.0

Table 8-2-10 Ch.157 (5785MHz) **TX** mode 24Mbps

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										
5.782	V	100.4	88.7	34.0	-26.0	0.0	108.4	OB*	96.7	OB*
1.112	V	50.3	-	24.5	-31.8	0.0	43.0	74.0	-	54.0
1.142	V	50.3	-	24.6	-31.8	0.0	43.1	74.0	-	54.0
1.196	V	54.9	-	25.2	-31.6	0.0	48.5	74.0	-	54.0
1.331	V	52.4	-	25.2	-31.3	0.0	46.3	74.0	-	54.0
5.472	V	49.4	37.4	34.3	-26.1	0.0	57.6	74.0	45.6	54.0

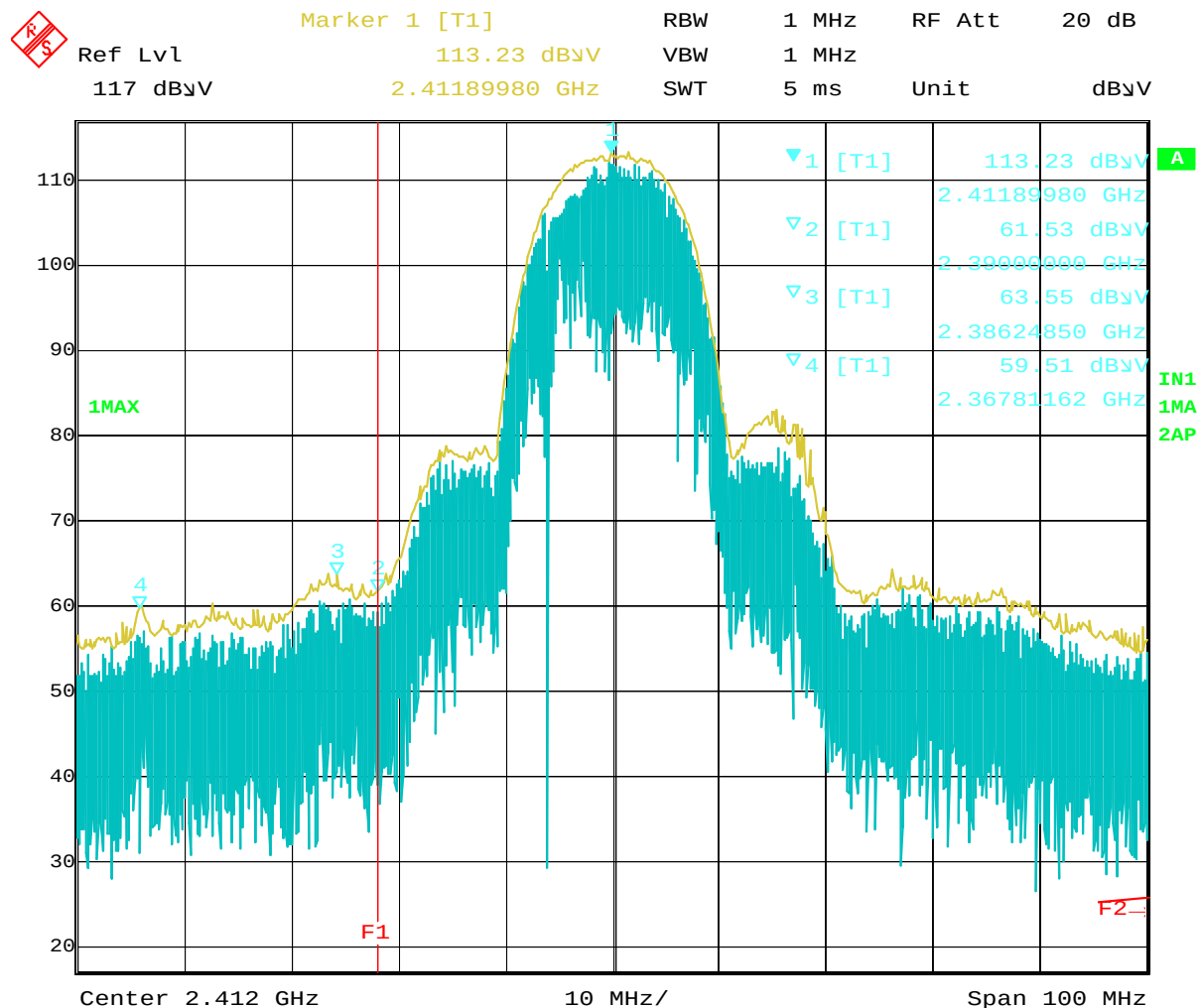
Table 8-2-11 EUT: Ch.165 (5825MHz) **TX** mode 24Mbps

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										
5.829	H	98.2	86.2	34.0	-25.9	0.0	106.3	OB*	94.3	OB*
1.012	V	50.3	-	24.3	-32.2	0.0	42.4	74.0	-	54.0
1.162	V	53.9	-	24.5	-31.8	0.0	46.6	74.0	-	54.0
1.196	V	54.1	-	25.2	-31.6	0.0	47.7	74.0	-	54.0
1.328	V	50.6	-	25.6	-31.3	0.0	44.9	74.0	-	54.0
5.472	V	49.3	36.6	34.3	-26.1	0.0	57.5	74.0	44.8	54.0

Table 8-2-12 Ch.157 (5785MHz) **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>)
1.012	V	49.1	-	24.3	-32.2	0.0	41.2	74.0	-	54.0
1.162	V	47.9	-	24.5	-31.8	0.0	40.6	74.0	-	54.0
1.196	V	48.3	-	25.2	-31.6	0.0	41.9	74.0	-	54.0
1.325	V	47.3	-	25.6	-31.3	0.0	41.6	74.0	-	54.0

8.5 Measurement plots of adjacent restricted band

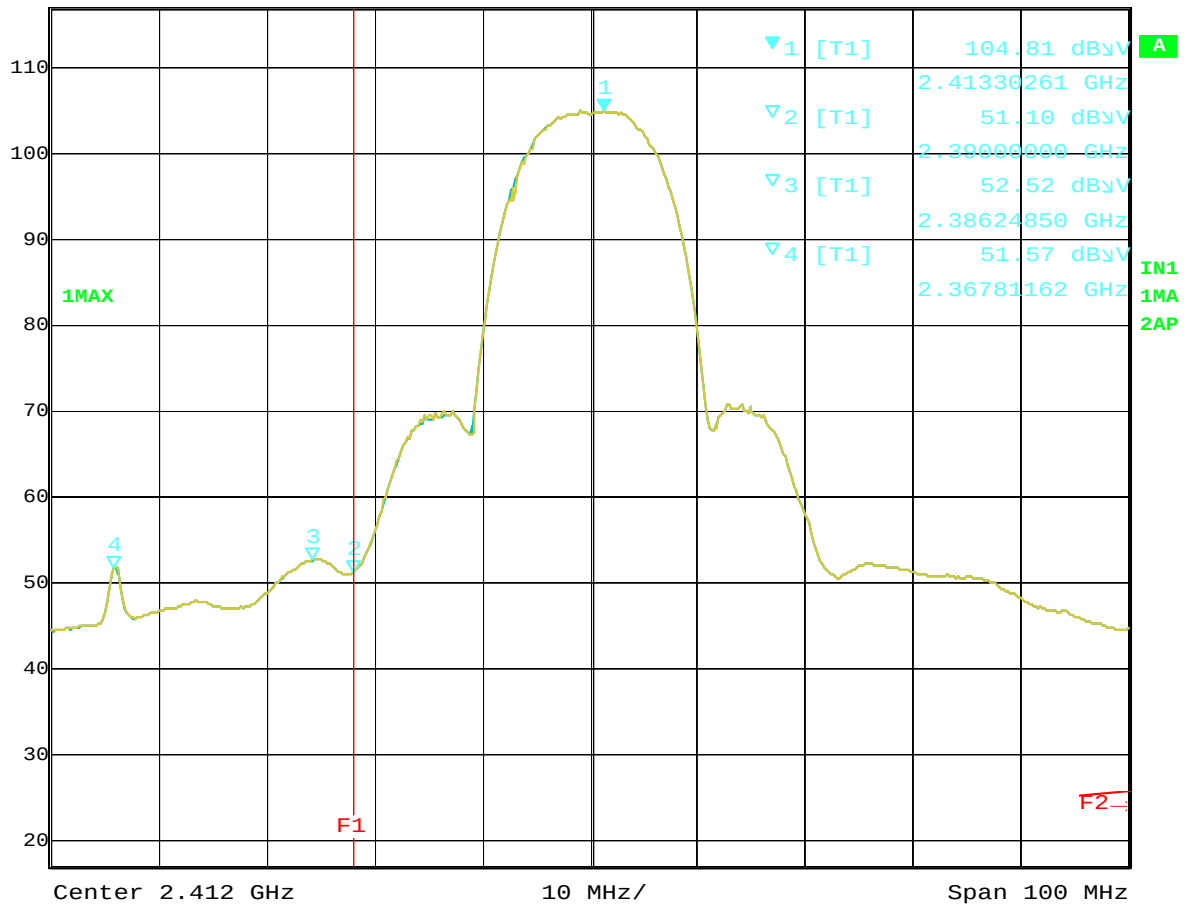


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Plot 8-1 Ch.1 2412MHz TX, DSSS 11Mbps (Peak)

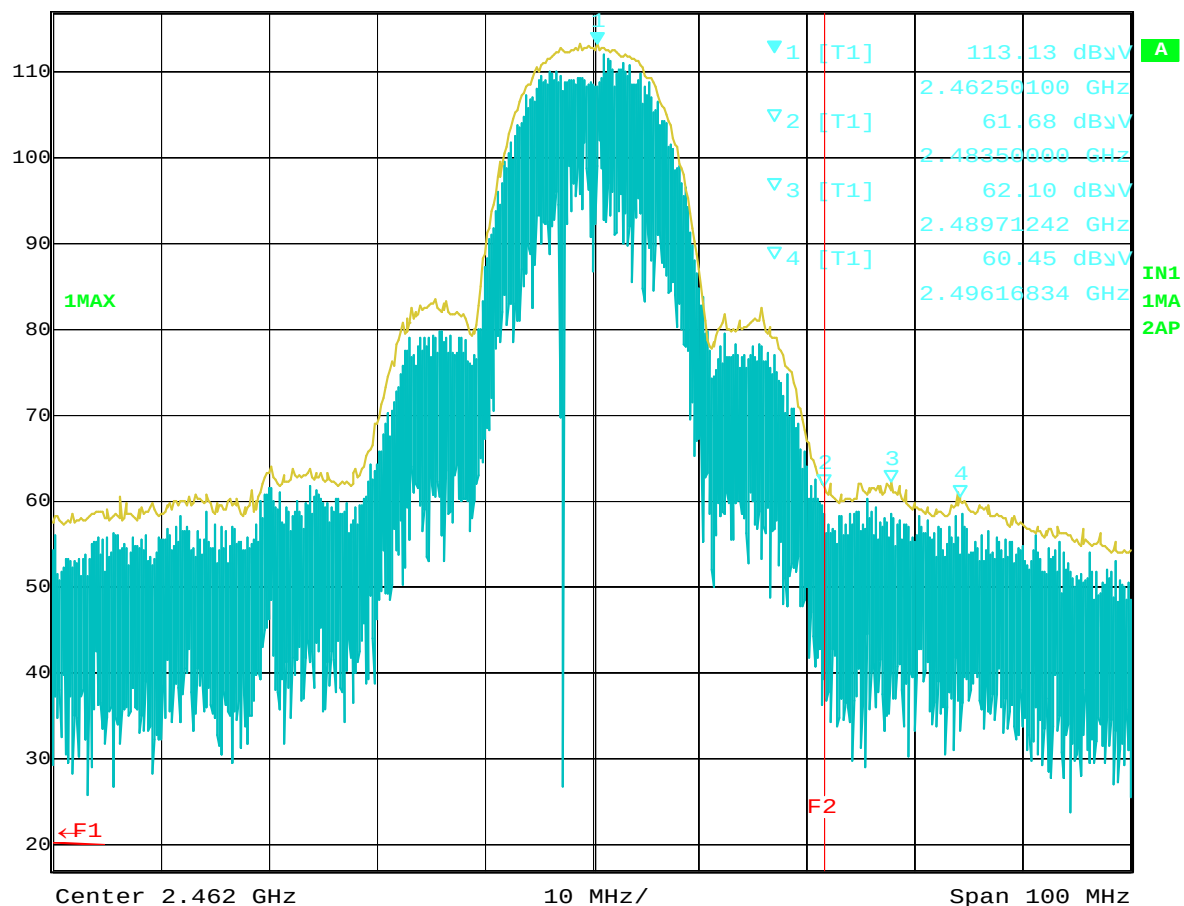


Ref Lvl 117 dBμV
Marker 1 [T1] 104.81 dBμV
2.41330261 GHz
RBW 1 MHz RF Att 20 dB
VBW 10 Hz
SWT 25 s Unit dBμV



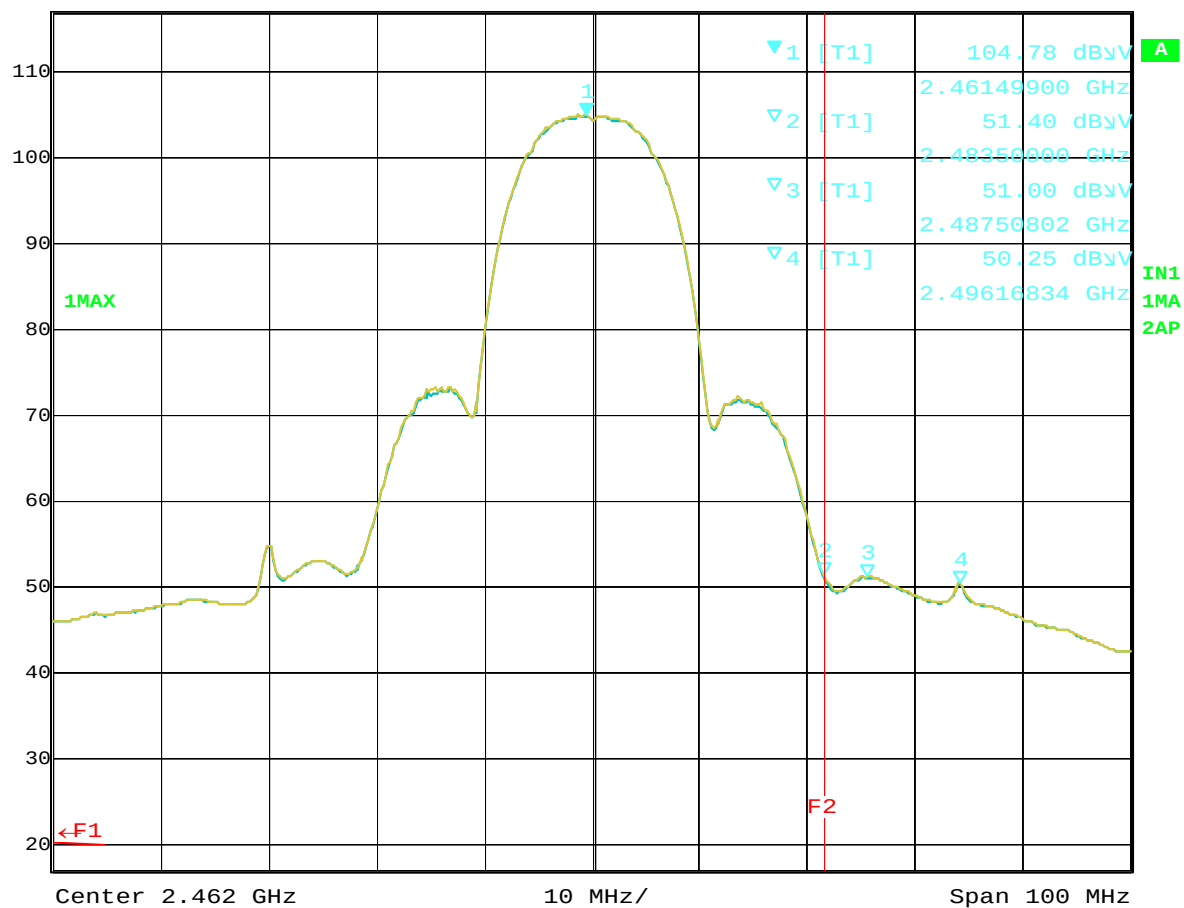
Date: 19.FEB.2004 16:20:15

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

Ref Lvl
117 dBμVMarker 1 [T1]
113.13 dBμV
2.46250100 GHzRBW 1 MHz RF Att 20 dB
VBW 1 MHz
SWT 5 ms Unit dBμV

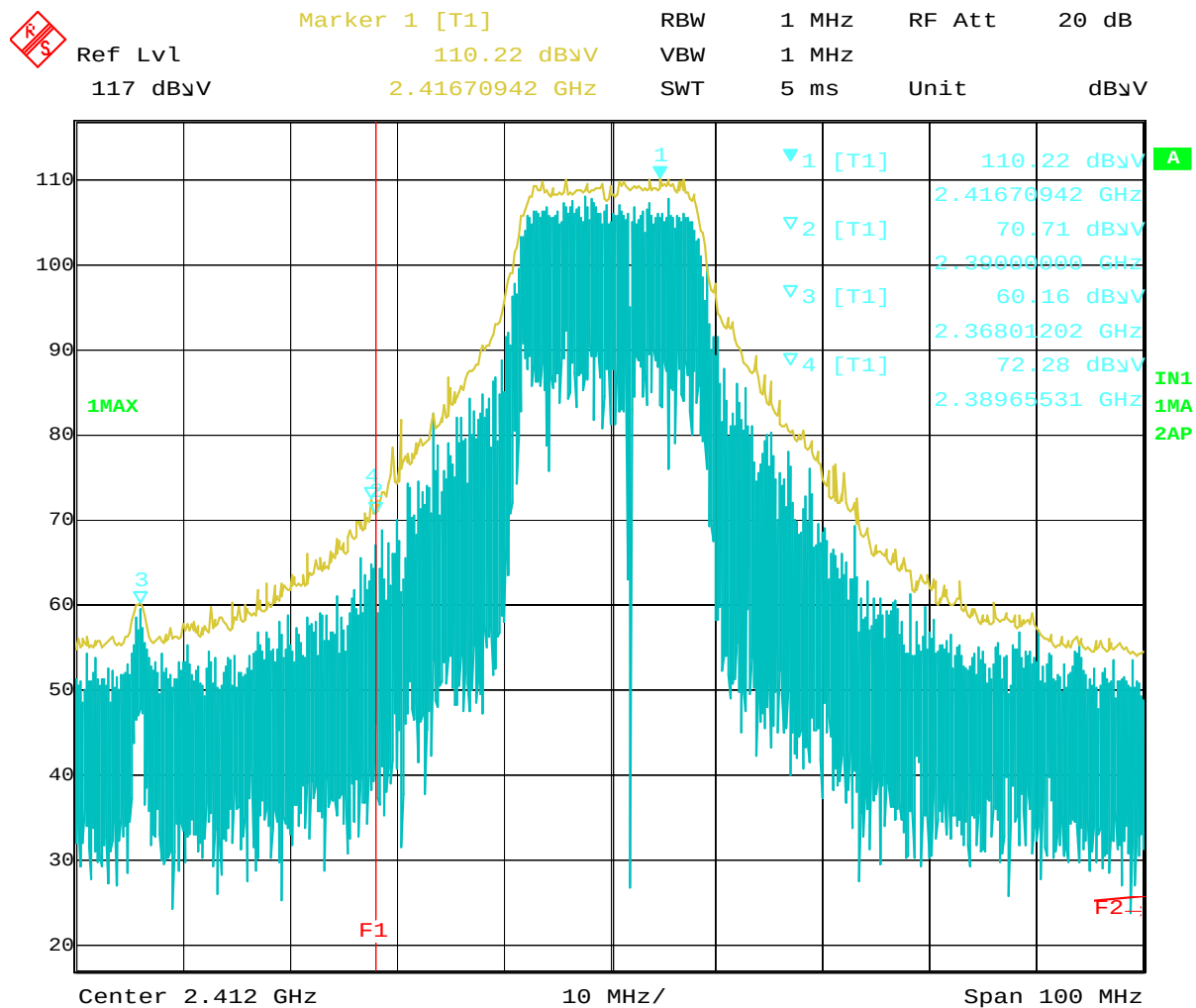
Date: 19.FEB.2004 16:16:19

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

Ref Lvl
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104.78 dBμV
2.46149900 GHzRBW 1 MHz RF Att 20 dB
VBW 10 Hz
SWT 25 s Unit dBμV

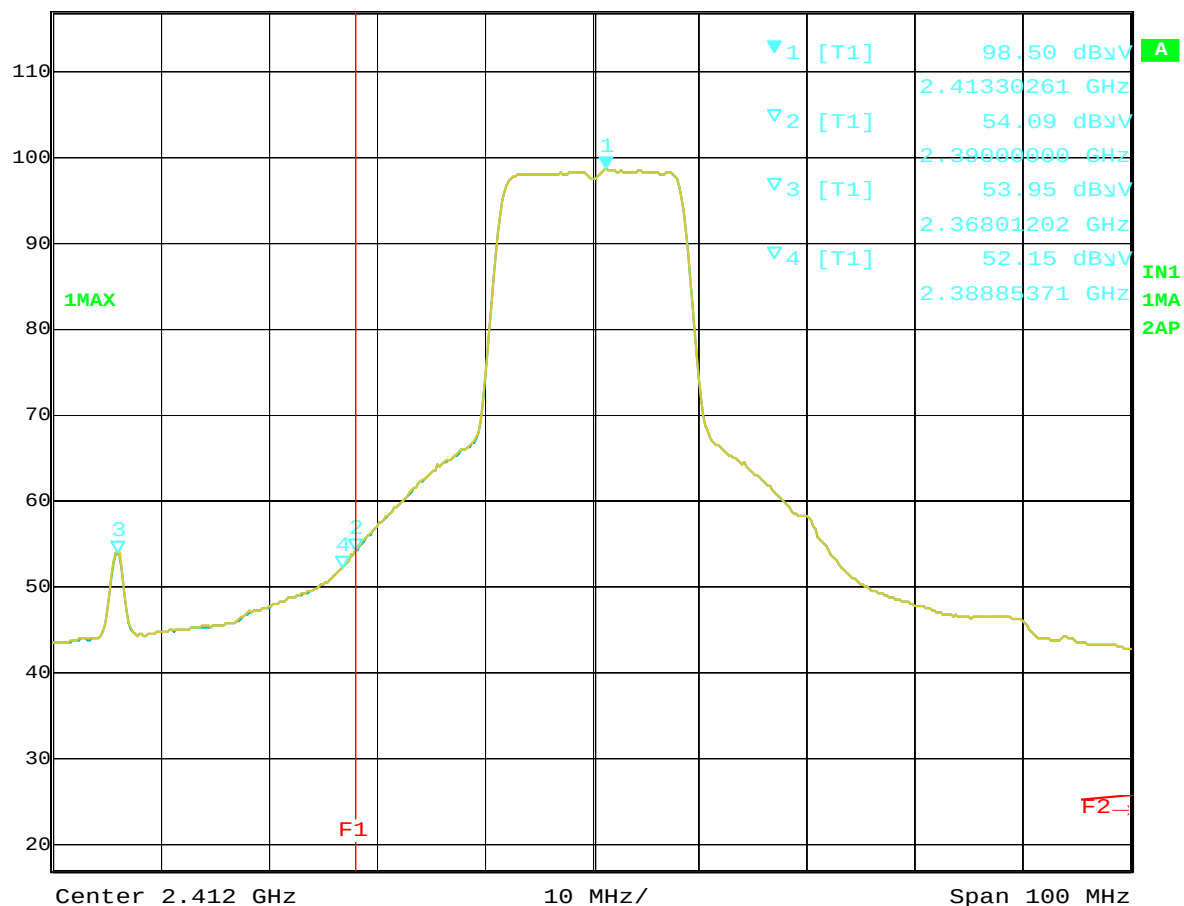
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Plot 8-4 Ch.11 2462MHz TX, DSSS 11Mbps (Average)



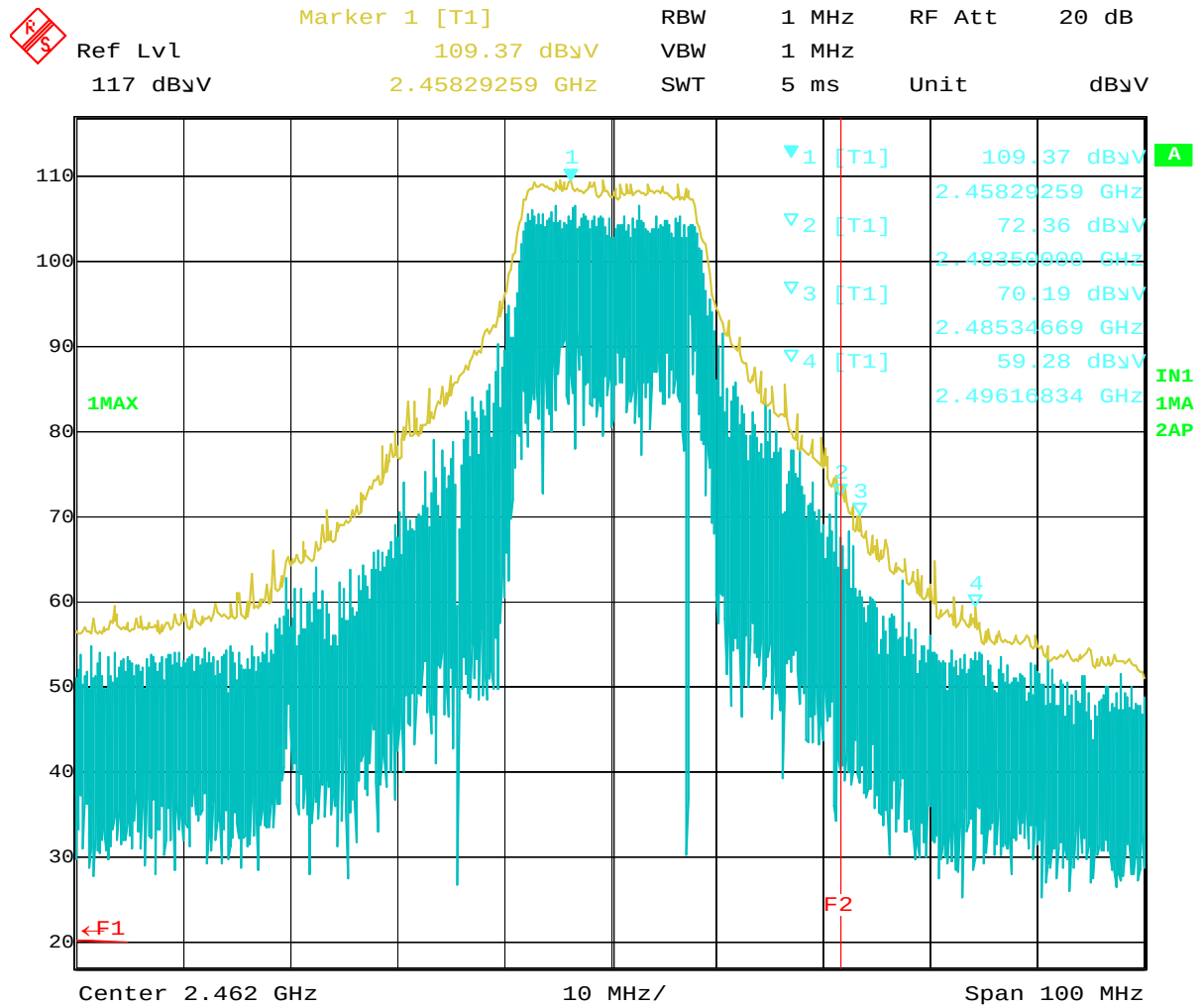
Date: 19.FEB.2004 16:06:58

Plot 8-5 Ch.1 2412MHz TX, OFDM 18Mbps (Peak)

Ref Lvl
117 dBμVMarker 1 [T1]
98.50 dBμV
2.41330261 GHzRBW 1 MHz RF Att 20 dB
VBW 10 Hz
SWT 25 s Unit dBμV

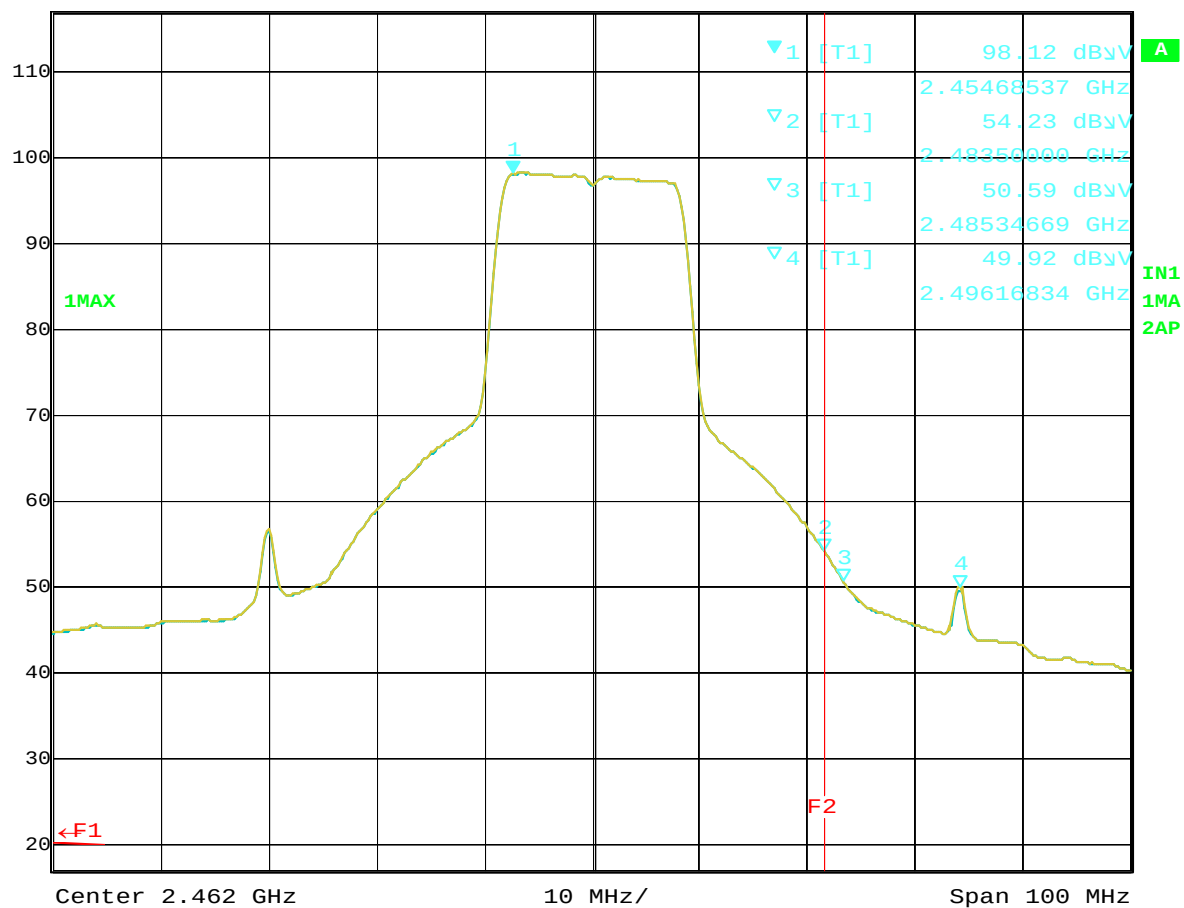
Date: 19.FEB.2004 16:06:18

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



Date: 19.FEB.2004 16:03:04

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

Ref Lvl
117 dBμVMarker 1 [T1]
98.12 dBμV
2.45468537 GHzRBW 1 MHz RF Att 20 dB
VBW 10 Hz
SWT 25 s Unit dBμV

Date: 19.FEB.2004 15:58:41

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