Test Reports
for
IBM 11a/b/g Wireless LAN Mini PCI Adapter
with
ThinkPad T40 Series
ThinkPad X30 Series

This exhibit covers the following emission measurement results.

FCC Part 15C : DTS device

IEEE802.11**a**, 5745M-5825MHz band OFDM transmission modes
&
IEEE802.11**b**, 2412M-2462MHz band DSSS transmission modes

Document number : ***FCC 19-0215-0*** *; Test Report for IBM ThinkPad X30 Series*
FCC 19-0246-0 *; Test Report for IBM ThinkPad T40 Series*

[Transmission mode details]

MHz (Ch.No.)	IEEE802.11b 1/2M bps	5.5M bps	11M bps	IEEE802.11g 6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	18M bps	54M bps
2.412 (Ch. 1)	**o**	**o**	**o**	See the separate Test Report exhibit.							
2.417 (Ch. 2)	**o**	**o**	**o**								
2.422 (Ch. 3)	**o**	**o**	**o**								
2.427 (Ch. 4)	**o**	**o**	**o**								
2.432 (Ch. 5)	**o**	**o**	**o**								
2.437 (Ch. 6)	**o**	**o**	**o**								
2.442 (Ch. 7)	**o**	**o**	**o**								
2.447 (Ch. 8)	**o**	**o**	**o**								
2.452 (Ch. 9)	**o**	**o**	**o**								
2.457 (Ch. 10)	**o**	**o**	**o**								
2.462 (Ch. 11)	**o**	**o**	**o**								
				IEEE802.11a							
5.745 (Ch.149)	**N/A**			**o**	**o**	**o**	**o**	**o**	**o**	**o**	**o**
5.765 (Ch.153)				**o**	**o**	**o**	**o**	**o**	**o**	**o**	**o**
5.785 (Ch.157)				**o**	**o**	**o**	**o**	**o**	**o**	**o**	**o**
5.805 (Ch.161)				**o**	**o**	**o**	**o**	**o**	**o**	**o**	**o**
5.825 (Ch.165)				**o**	**o**	**o**	**o**	**o**	**o**	**o**	**o**

Emission Test Report
Standard: FCC Part 15 Subpart C / IC RSS-210

Document Number : FCC 19-0215-0

Product: IBM 11a/b/g Wireless LAN Mini PCI Adapter

measured with **IBM ThinkPad X30 Series**

FCC ID: ANO20030400LEG
IC: 349E-PH12127E

May 12, 2003

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Note :

The measurements in this test report were performed for the previous submission of the following device.

FCC ID: ANO20020304T2L(Granted date: Feb/26/2003)
IC: 349E-PH11107E (Approval date:Feb/26/2003, TAC number: 17674)

However, the core PCB and RF components of the applying transmitter module supplied by Philips Components are the same as the previous ones except a slight modification.
Refer to the attestation of the Philips Components in the “Submittal Outline” exhibit.

Therefore there is no change placed on the RF characteristics, and the measurement results in this report are valid for the applying device.

The following is the comparison of the measurement results to prove the equivalence between the previous and the applying device.

6dB Bandedge

Center Frequency (MHz)	submittal results (MHz)	sampling results tested with the new adapter (MHz)
2412 (ch. 1, 11Mb/s)	10.88	11.18
2437 (ch. 6, 11Mb/s)	11.12	11.30
2462 (ch. 11, 11Mb/s)	10.46	10.76
5745 (ch.149, 24Mb/s)	16.66	16.66
5785 (ch.157, 24Mb/s)	16.66	16.66
5825 (ch.165, 24Mb/s)	16.66	16.66

Peak conducted transmission output power

Center Frequency (MHz)	submittal results (dBm)	sampling results tested with the new adapter (dBm)
2412 (ch. 1, 11Mb/s)	17.1	17.1
2437 (ch. 6, 11Mb/s)	17.0	17.0
2462 (ch. 11, 11Mb/s)	17.1	17.1
5745 (ch.149, 24Mb/s)	16.7	16.7
5785 (ch.157, 24Mb/s)	16.6	16.6
5825 (ch.165, 24Mb/s)	16.6	16.6

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

IBM 11a/b/g Wireless LAN Mini PCI Adapter
with
IBM ThinkPad X30 Series
(Machine type : 2672, 2673, 2890, 2891)

FCC ID : ANO20030400LEG

May 12, 2003

This report concerns: (check one) Original Grant _____ Class I change _____ Class II change ___✓___ Equipment type: Wireless LAN device
This report shall not be reproduced except in full, without the written permission of this test lab.
The measurement results contained in this report relate only to the item which was tested.
Measurement procedure used is ANSI C63.4-2000 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.
APPLICANT ANTI-DRUG ABUSE CERTIFICATION: By checking yes, the applicant certifies that, in the case of an individual applicant, he or she is not subject to a denial of federal benefits, that includes FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse of 1988, 21 U.S.C. 853(a), or, in the case of a non-individual applicant (e.g. corporation, partnership or other unincorporated association), no party to the application is subject to a denial of federal benefits, that includes FCC benefits, pursuant to that section. For the definition of a "party" for these purposes, see 47 CFR 1.2002(b). (Yes) or No
"Report shall not be reproduced except in full, without the written approval of the laboratory" "the report must not be used by the client to claim product endorsement by NVLAP or any agency of the US government"
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- Index -

A. GENERAL INFORMATION **6**
A.1 TEST METHODOLOGY 6
A.2 TEST FACILITY / NVLAP ACCREDITATION 6
A.3 EUT DETAILS 6
B. SUMMARY OF TEST RESULTS **7**
C. OPERATION MODE OF EUT **8**
D. JUSTIFICATION **8**
E. TEST INSTRUMENTS **9**
F. MEASUREMENT UNCERTAINTY **10**
G. TEMPERATURE AND HUMIDITY **11**
H. RELATED SUBMITTAL(S)/GRANT(S)/NOTES **11**

1. BANDWIDTH AT 6 DB BELOW **12**
1.1 TEST PROCEDURE 12
1.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 12
1.3 MEASUREMENT RESULTS 12
1.4 TRACE DATA OF 6DB BANDWIDTH 13
2. OUT OF BAND EMISSIONS AND OCCUPIED BANDWIDTH AT 20 DB BELOW / BANDEDGE **19**
2.1 TEST PROCEDURE 19
2.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 19
2.3 MEASUREMENT RESULTS OF OCCUPIED BANDWIDTH/BAND-EDGE 19
2.4 MEASUREMENT RESULTS OF OUT OF BAND EMISSIONS 19
2.5 TRACE DATA OF 20DB BANDWIDTH 20
2.6 TRACE DATA OF OUT OF BAND EMISSIONS 26
3. CONDUCTED PEAK OUTPUT POWER **32**
3.1 TEST PROCEDURE 32
3.2 MEASUREMENT RESULTS 33
3.4 TRACE DATA OF CONDUCTED PEAK OUTPUT POWER 34
4. PEAK POWER SPECTRAL DENSITY **40**
4.1 TEST PROCEDURE 40
4.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 40
4.3 MEASUREMENT RESULTS 40
4.4 TRACE DATA OF PEAK POWER SPECTRAL DENSITY 41
5. AC WIRELINE CONDUCTED EMISSIONS (150KHZ – 30MHZ) **47**
5.1 TEST PROCEDURE 47
5.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 47
5.3 MEASUREMENT RESULTS 48

6. RESTRICTED BANDS RADIATIONS (30MHZ – 1GHZ) 50

6.1 TEST PROCEDURE 50
6.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 50
6.3 FIELD STRENGTH CALCULATION 52
6.4 MEASUREMENT RESULTS 53

7. RESTRICTED BANDS RADIATIONS (1GHZ – 40GHZ) 56

7.1 TEST PROCEDURE 56
7.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 56
7.3 FIELD STRENGTH CALCULATION 58
7.4 MEASUREMENT RESULTS 59
7.5 MEASUREMENT PLOTS OF ADJACENT RESTRICTED BAND 62

A. General Information

APPLICANT	: IBM Japan, Ltd.
TEST SITE	: IBM Japan, Ltd., Yamato Semi-anechoic chamber #1
TEST SITE ADDRESS	: 1623 – 14 Shimotsuruma, Yamato-shi, Kanagawa 242-8502 Japan Tel: +81-46-215-4779, Fax: +81-46-273-7420
REGULATION	: FCC Part 15 Subpart C Industry Canada RSS-210 (Issue No.5)
MODEL NUMBER	: 2672-CHU (ThinkPad X30 Series)
FCC ID IC Certification Number	: ANO20030400LEG : 349E-PH12127E
SERIAL NUMBER	: ZZ-00094
PYSICAL CONDITION	: Preproduction
KIND OF EQUIPMENT	: Personal computer with an IEEE802.11a, 11b & 11g Wireless LAN Mini-PCI Combo Card (Composite application)
TESTED DATE	: November 18, 22, 25, 26, 27, December 4, 5, 11, 16, 24, 2002 and January 8, 2003

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 #2 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)
- This facility is accepted by **Industry Canada** in a letter dated March 19, 2001 as number **IC 349E** for chamber #2, and January 25, 2002 as number **IC 4221** for chamber #1.

A.3 EUT details

Table-A EUT details

Model and S/N	**FCC ID** **IC Certification Number**	**Description**
IBM 11a/b/g Wireless LAN Mini PCI Adapter (s/n A310037307)	FCC ID: ANO20030400LEG IC: 349E-PH12127E	**Applying equipment** IEEE802.11a/b/g Wireless LAN Mini-PCI Combo Card without antenna
ThinkPad X30 Series M/T 2672-CHU (s/n ZZ-00094)	N/A	IBM Notebook PC with built_in antenna CPU: Intel® Pentium® M Processor, 1.3GHz
P/N 02K6808	N/A	Universal AC adapter 56W, 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) **–**	Bandwidth at 6 dB below	FCC requirement	Conducted	Pass
– **5.9.1**	Bandwidth at 20 dB below Occupied BW(or Band-edge)	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 : 1.28 dBi	N/A
15.203 **6.2.2(o)(e2)**	Unique antenna connector	The device employs an unique **electronic handshake** connector. Refer to “Confidential_BIOS_Lock” exhibit.	complies
– **6.2.2(o)(d1)**	Power Spectral density for 2.4GHz unlicensed use	Conducted power / 20dB BW = 3.2mW/MHz	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 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	See the separate test report (Document number: FCC 19-0217-0).							
2.417 (Ch. 2)	+17	+17	+17								
2.422 (Ch. 3)	+17	+17	+17								
2.427 (Ch. 4)	+17	+17	+17								
2.432 (Ch. 5)	+17	+17	+17								
2.437 (Ch. 6)	+17	+17	+17								
2.442 (Ch. 7)	+17	+17	+17								
2.447 (Ch. 8)	+17	+17	+17								
2.452 (Ch. 9)	+17	+17	+17								
2.457 (Ch. 10)	+17	+17	+17								
2.462 (Ch. 11)	+17	+17	+17								
				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. The worse case data taken in this report represents the measurement result of the right antenna that has comparatively higher gain in 2.4GHz band, and the left antenna in 5.8GHz band as shown in the following table.

Table-D Peak Antenna Gains of EUT

2.4GHz band	Left Antenna gain	0.62 dBi (peak)
	Right Antenna gain	**1.28** dBi (peak)
5.8GHz band	Left Antenna gain	**0.32** dBi (peak)
	Right Antenna gain	-0.87 dBi (peak)

And the columns marked with shading in the Table-C are the worst cases of each Tx mode for all measurement items (i.e. conducted power, 6dB BW ..etc.). This test report represents the measurement results performed with those Tx modes.

Prepared by T. Asano

E. Test Instruments

Table-E List of Measuring Instruments

Description	Model	Serial Number	Calibration Date	Calibration Interval
Computer	IBM 5551-L	#4	N/A	N/A
Computer	IBM 6589-13J	97-15613	N/A	N/A
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2601A02634	08/28/02	1 year
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	3019A05155	02/15/02	1 year
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2841A04252	06/17/02	1 year
Spectrum Analyzer Display	HP 85662A	2542A12308	08/28/02	1 year
Spectrum Analyzer Display	HP 85662A	3026A19353	02/15/02	1 year
Spectrum Analyzer Display	HP 85662A	2816A16831	06/17/02	1 year
Quasi-Peak Adapter	HP 85650A	2043A00062	08/28/02	1 year
Quasi-Peak Adapter	HP 85650A	2811A01156	06/17/02	1 year
Quasi-Peak Adapter	HP 85650A	3033A01449	02/15/02	1 year
Amplifier (100KHz - 1.3GHz)				
- for 30-200MHz	HP 8447D	2805A02919	04/15/02	1 year
- for 200-1000MHz	HP 8447D	2944A03506	04/15/02	1 year
Amplifier (1 - 26.5GHz)	HP 8449B	3008A00582	06/13/02	1 year
Amplifier (26.5 - 40GHz)	Agilent 83051A	3950M00193	12/06/01	1 year
Spectrum Analyzer EMI Test Receiver	R&S ESI26	836119/003	07/18/02	1 year
Spectrum Analyzer	HP 8563E	3416A02248	08/14/02	1 year
Harmonic Mixer	Agilent 11970A	011269-001	07/19/02	1 year
Receiver (9kHz-30MHz)	R&S ESH3	891806/012	10/07/02	1 year
Receiver (20MHz-1.3GHz)	R&S ESVP	893202/018	02/06/02	1 year
Biconical Antenna (30-200MHz)	EMCO 3108	2309	05/06/02	1 year
Log-Periodic Antenna (200-1000MHz)	EMCO 3146	1585	05/06/02	1 year
Horn Antenna (1- 18GHz)	EMCO 3115	9903-5774	07/18/02	1 year
Horn Antenna (3.95- 5.85GHz)	EMCO 3160-5	1099	04/17/02	1 year
Horn Antenna (5.85- 8.20GHz)	EMCO 3160-6	9712-1044	04/17/02	1 year
Horn Antenna (8.2- 12.4GHz)	EMCO 3160-7	1156	04/17/02	1 year
Horn Antenna (12.4- 18GHz)	EMCO 3160-8	1143	04/17/02	1 year
Horn Antenna (18- 26.5GHz)	EMCO 3160-9	0004-1202	04/17/02	1 year
Horn Antenna (26.5- 40GHz)	EMCO 3160-10	1175	04/17/02	1 year
LISN	EMCO 3825/2	1426	09/01/02	1 year
Power Meter	HP 437B	3043U03437	11/08/02	1 year
Power Sensor	HP 8481A	US41030582	11/08/02	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	09/05/02	1 year
- RF Amp.<=>Spectrum Analyzer(<12GHz)	15m	- EM215SCO	09/05/02	1 year
- RF Amp.<=>Spectrum Analyzer(>12GHz)	3 m	- SF102-20166	09/05/02	1 year
Coaxial cables (18 – 40GHz):				
- Horn Ant <=> RF Amp.	3m	- SF102-20167	09/05/02	1 year
- RF Amp.<=>Spectrum Analyzer	1m	- SF102-21105	09/05/02	1 year
N-Coax cables:				
- Bi-coni Ant <=> 10m Cable	9 m	- EM103L01	04/15/02	1 year
- 10m Cable <=> Shield Panel	10 m	- EM103L02	04/15/02	1 year
- Shield Panel <=> RF Amp	7 m	- EM103L03	04/15/02	1 year
- RF Amp <=> Power Splitter	0.5m	- EM103L04	04/15/02	1 year
- Log-peri Ant <=> 10m Cable	9 m	- EM103H01	04/15/02	1 year
- 10m Cable <=> Shield Panel	10 m	- EM103H02	04/15/02	1 year
- Shield Panel <=> RF Amp	7 m	- EM103H03	04/15/02	1 year
- RF Amp <=> Power Splitter	0.5m	- EM103H04	04/15/02	1 year
Coax cables:				
- Lisn-L <=> SW/Con.unit (SW100)	4 m	- EMIC-L	04/15/02	1 year
- Lisn-N <=> SW/Con.unit (SW101)	4 m	- EMIC-N	04/15/02	1 year
- SW/Con.unit <=> RCVR (Input)	1 m	- EMIC-R	04/15/02	1 year
- SW/Con.unit<=> Spe Ana.(Signal In)	1 m	- EMIC-S	04/15/02	1 year
- Power Splitter <=> SW/Con.unit (SW110)	1 m	- EM103L05	04/15/02	1 year
- Power Splitter <=> SW/Con.unit (SW300)	1 m	- EM103L06	04/15/02	1 year
- Power Splitter <=> SW/Con.unit (SW100)	1 m	- EM103H05	04/15/02	1 year
- Power Splitter <=> SW/Con.unit (SW301)	1 m	- EM103H06	04/15/02	1 year
- SW/Con.unit <=> Receiver (Input)	2 m	- EM1RCV	04/15/02	1 year
- SW/Con.unit <=> Spe Ana.(Signal In) for 30- 200MHz	2 m	- EM1SPL	04/15/02	1 year
- SW/Con.unit <=> Spe Ana.(Signal In) for 200-1000MHz	2 m	- EM1SPH	04/15/02	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

1.1 Test Procedure

The bandwidth at 6 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.
The spectrum analyzer is set to :
RBW=100kHz, VBW=100kHz[*1], Span=30MHz, 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

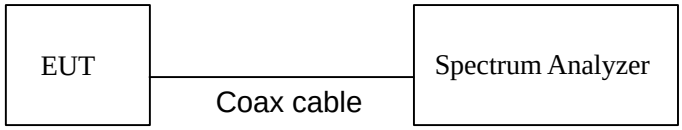


Figure 1: Measurement setup for 6dB bandwidth test

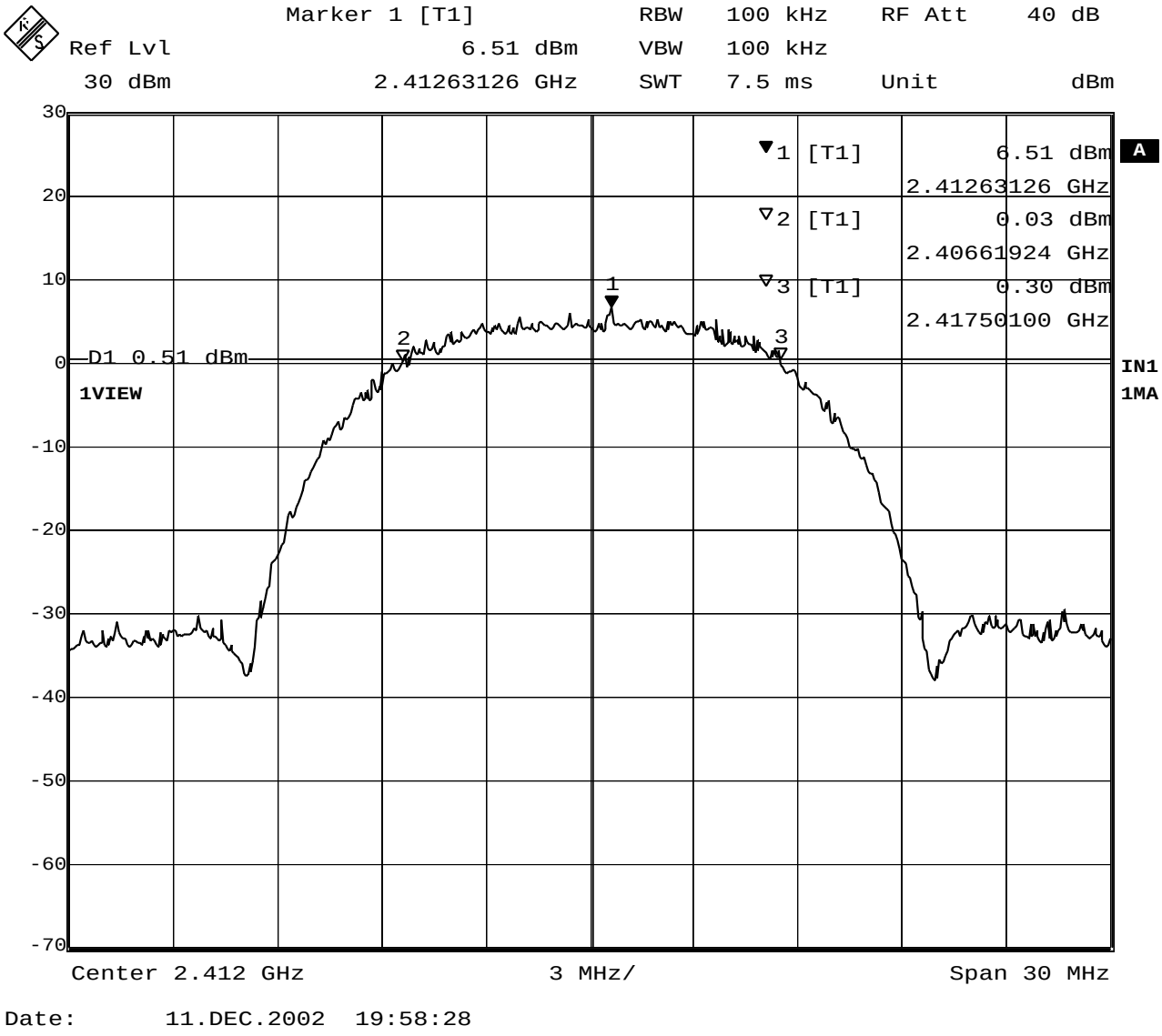
1.3 Measurement Results

Test Date: December 11 and 16, 2002

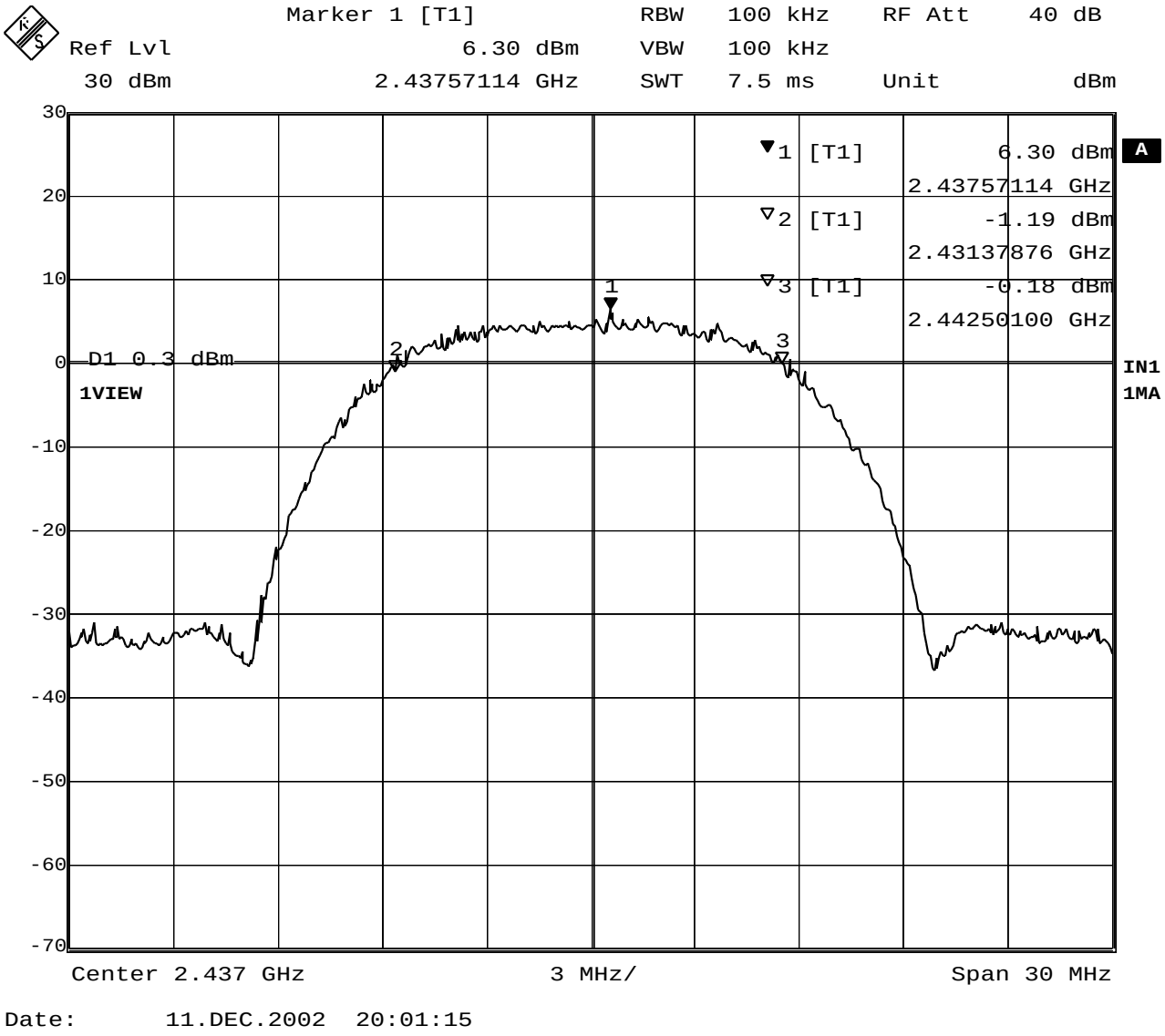
Table 1-2. EUT: M/T 2672-CHU, s/n ZZ-00094 , TX mode

Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 6 dB below (MHz)	note
2412	Plot 1-1	2406.62	2417.50	10.88	> 500kHz
2437	Plot 1-2	2431.38	2442.50	11.12	
2462	Plot 1-3	2456.62	2467.08	10.46	
5745	Plot 1-4	5736.67	5753.33	16.66	> 500kHz
5785	Plot 1-5	5776.67	5793.33	16.66	
5825	Plot 1-6	5816.67	5833.33	16.66	

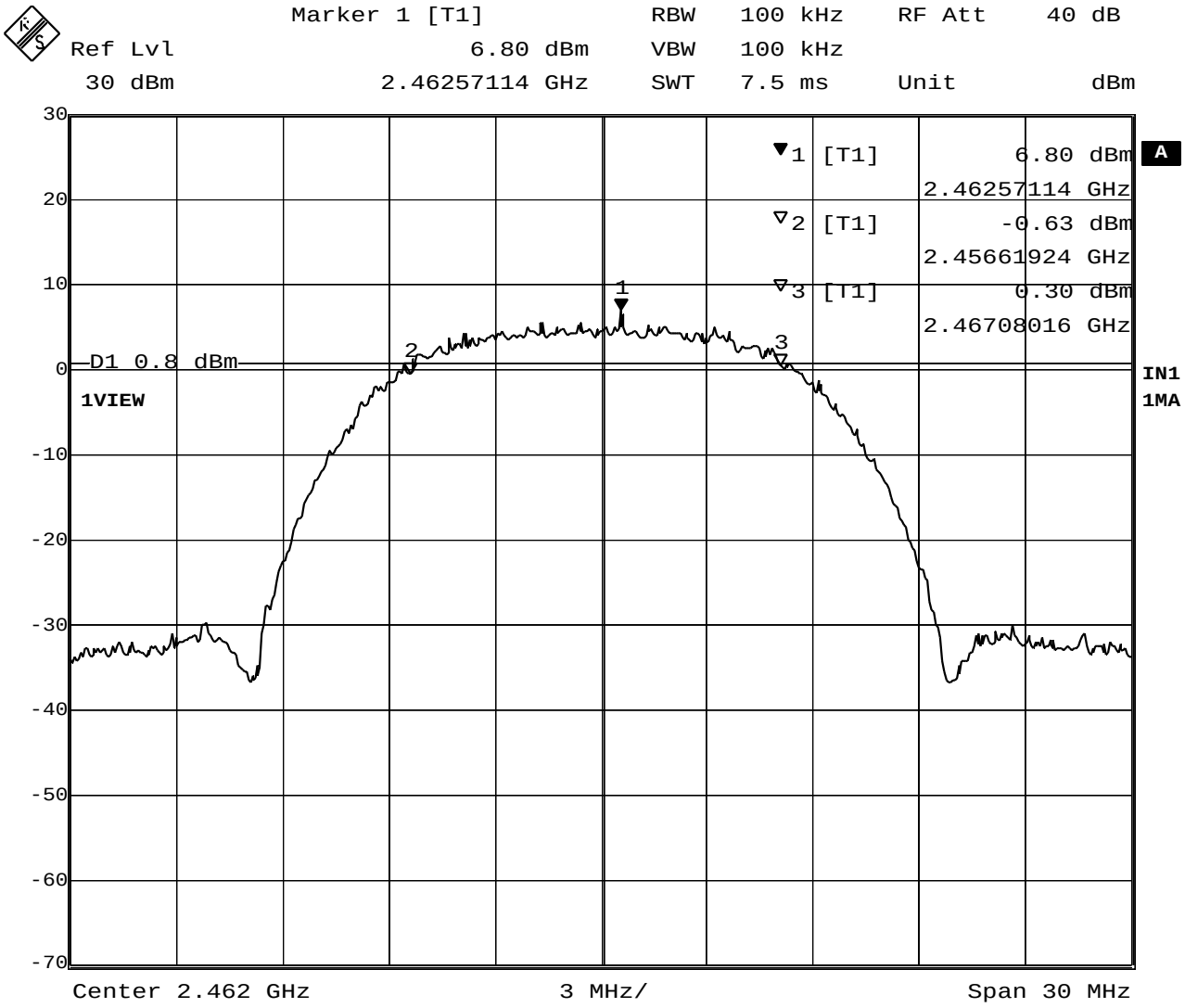
1.4 Trace Data of 6dB bandwidth



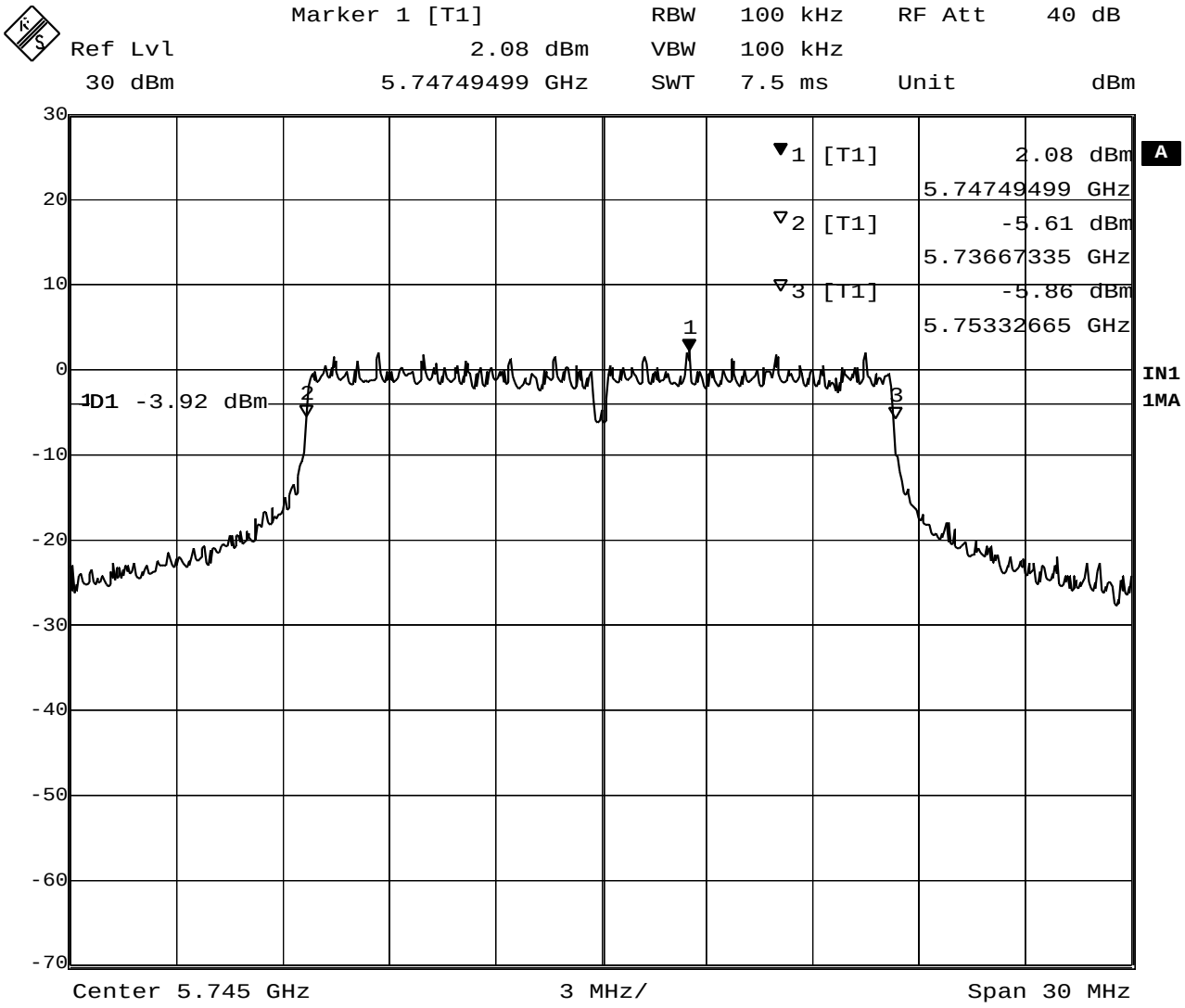
Plot 1-1. 6dB BW at 2412MHz



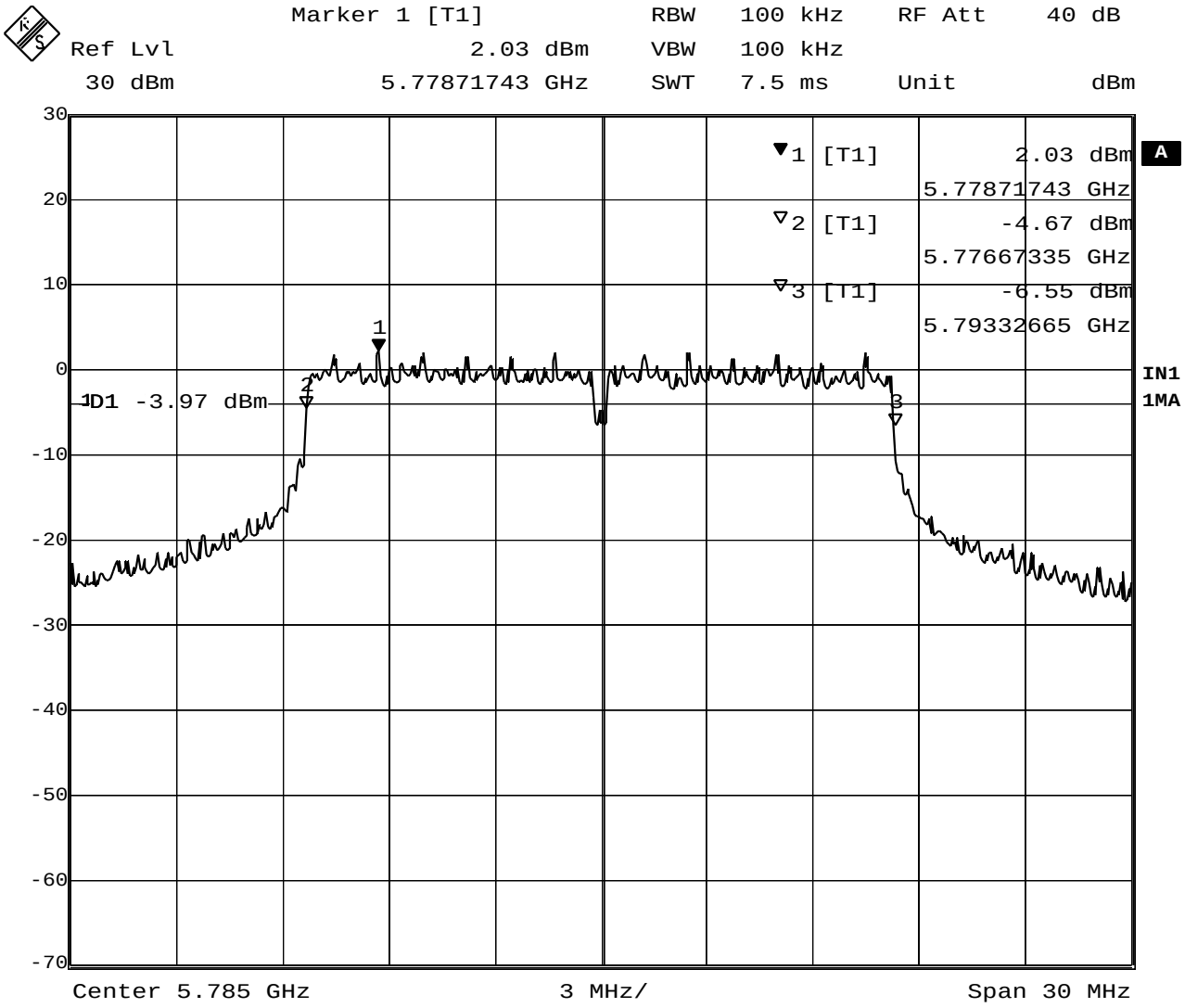
Plot 1-2. 6dB BW at 2437MHz



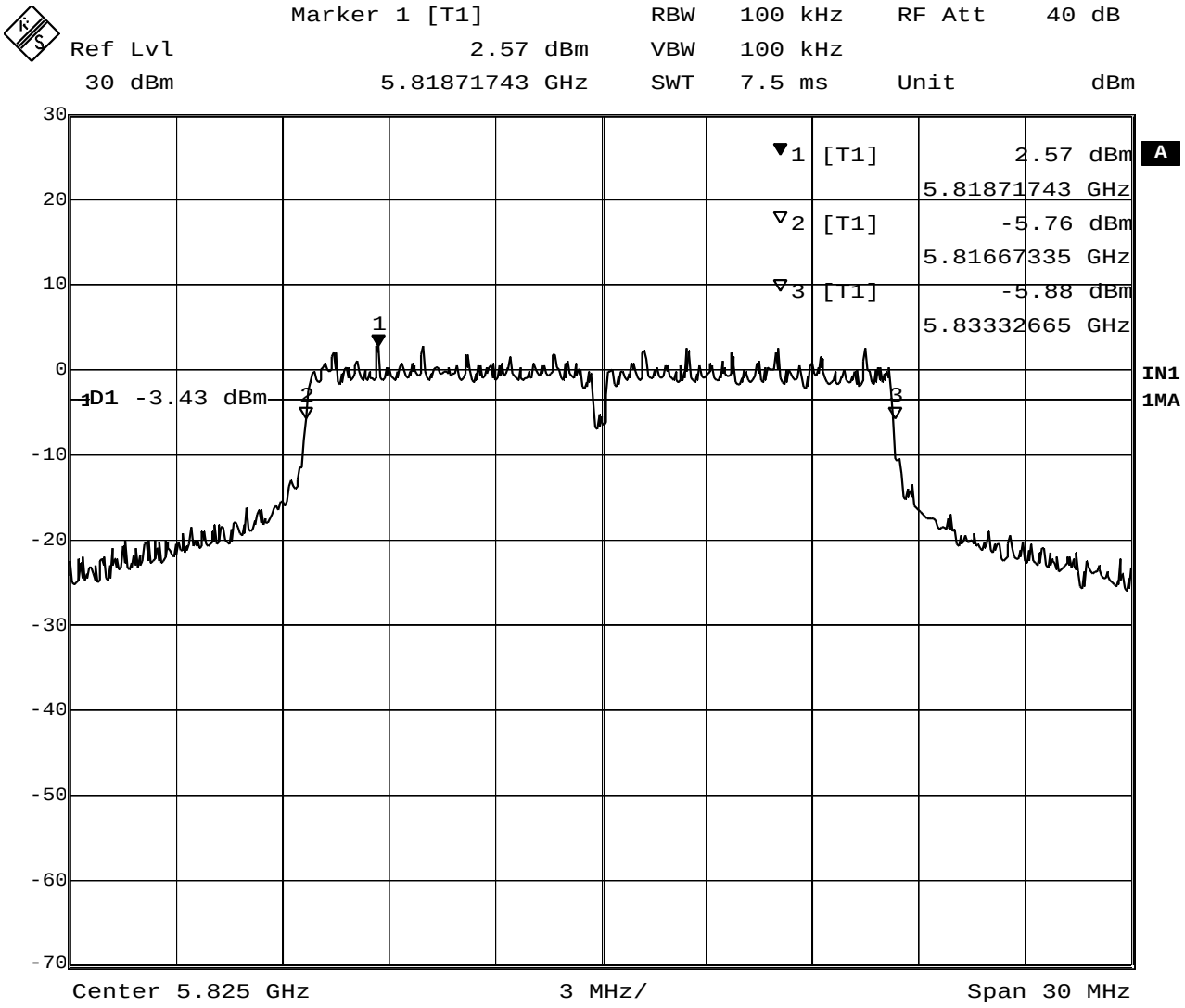
Plot 1-3. 6dB BW at 2462MHz



Plot 1-4. 6dB BW at 5745MHz



Plot 1-5. 6dB BW at 5785MHz



Plot 1-6. 6dB BW at 5825MHz

2. Out of Band Emissions and Occupied Bandwidth at 20 dB below / Bandedge

2.1 Test Procedure

The bandwidth at 20 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.
The spectrum analyzer is set to:
RBW=100kHz, VBW=100kHz[*1], Span=50MHz, 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 of Occupied Bandwidth/Band-edge

note) Canadian requirement

Test Date: December 11 and 16, 2002

Table 2-1. EUT: M/T 2672-CHU, s/n ZZ-00094 , TX mode

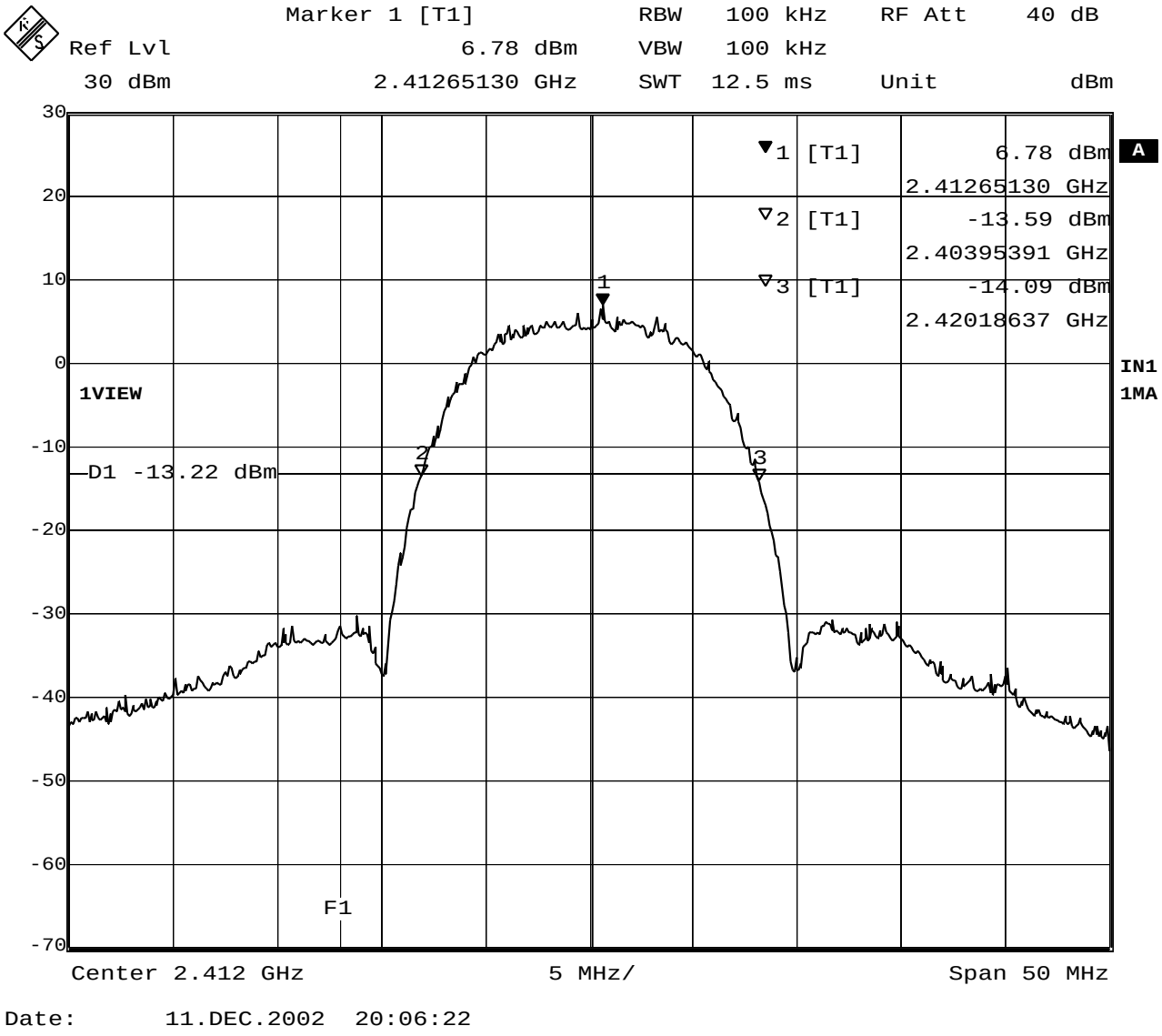
Center Frequency (MHz)	Trace number	Lower Frequency 20dB below (MHz)	Upper Frequency 20dB below (MHz)	Bandwidth at 20dB below (MHz)	Margin to Lower bandedge (MHz)	Margin to Upper bandedge (MHz)
2412	Plot 2-1	2403.95	2420.19	16.24	3.95	
2437	Plot 2-2	2428.83	2445.24	16.41		
2462	Plot 2-3	2453.83	2470.09	16.26		13.41
5745	Plot 2-4	5735.65	5754.49	18.84	10.65	
5785	Plot 2-5	5774.83	5794.47	19.64		
5825	Plot 2-6	5814.53	5834.97	20.44		15.03

2.4 Measurement Results of Out of Band Emissions

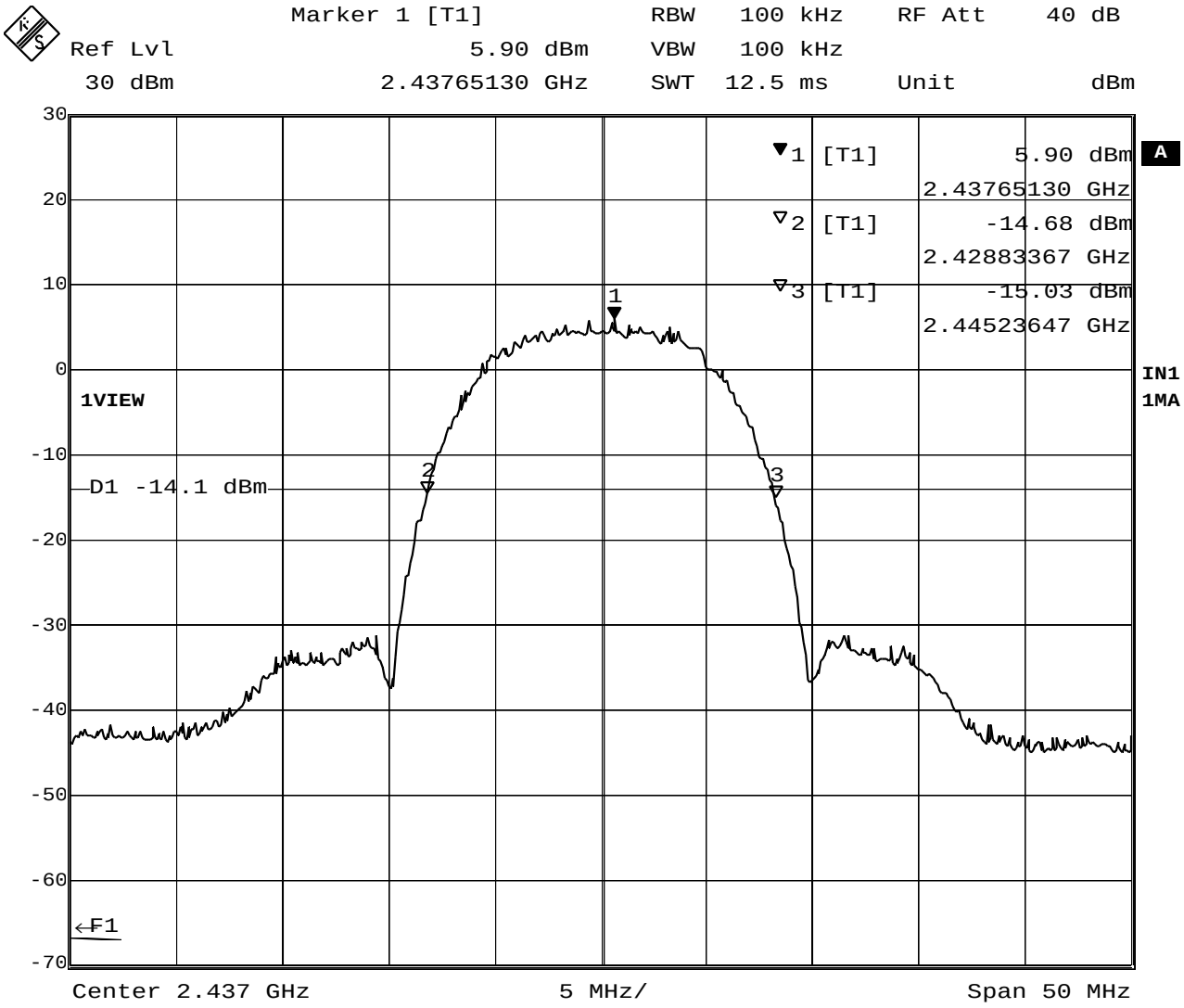
All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density.

Test Date: December 11 and 16, 2002 : See Plot 2-7 to 2-12.

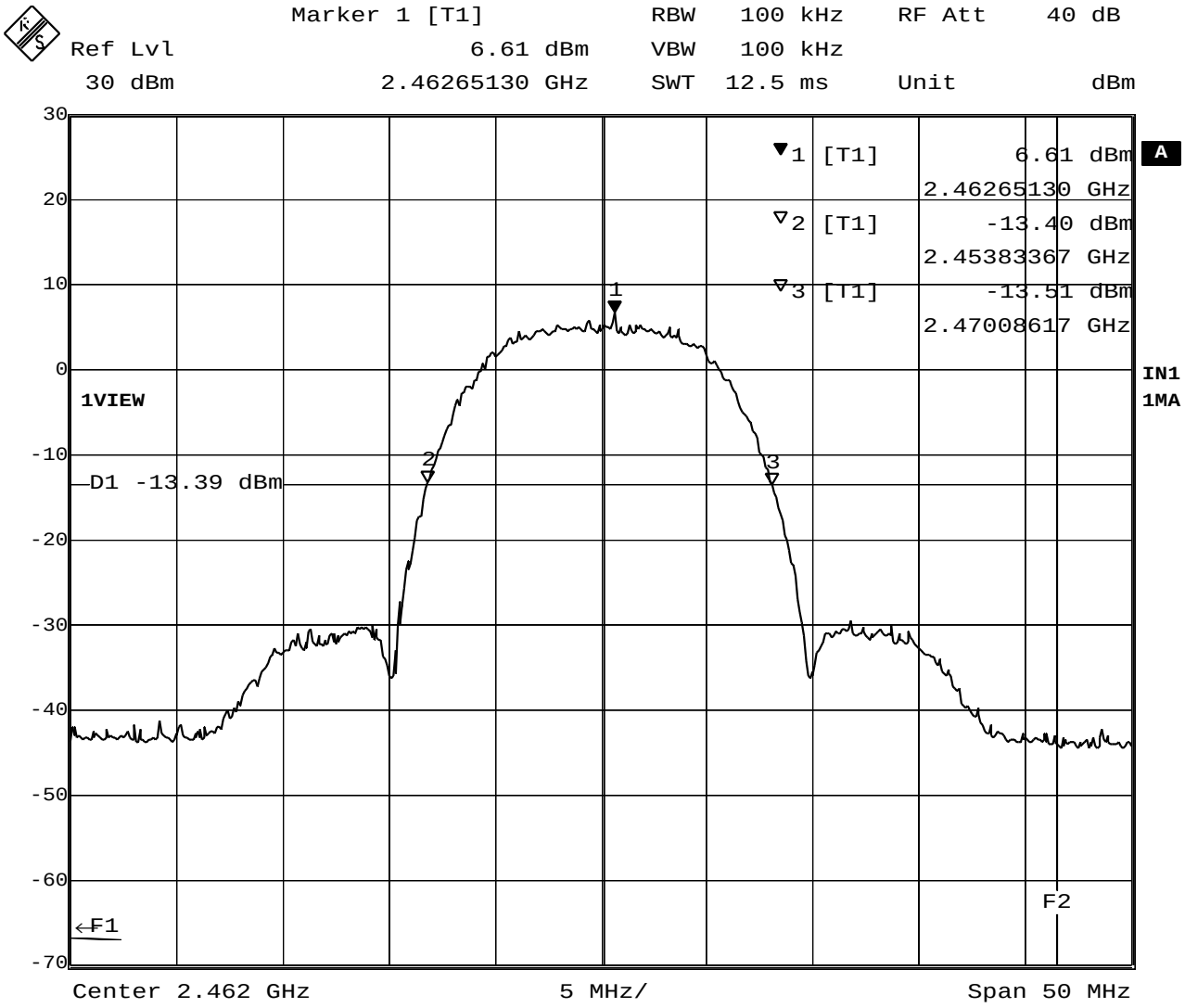
2.5 Trace Data of 20dB bandwidth



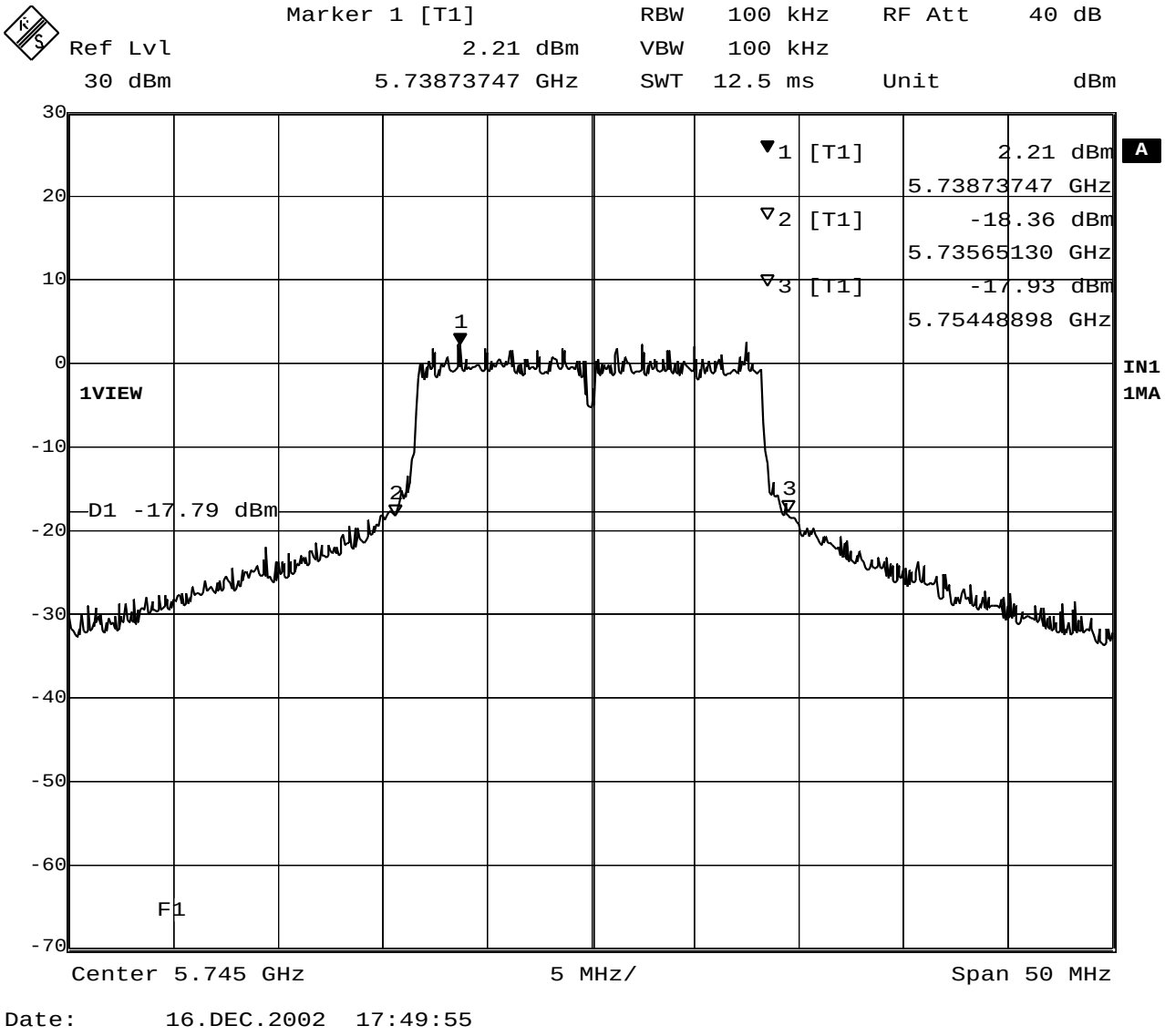
Plot 2-1. 20dB BW at 2412MHz



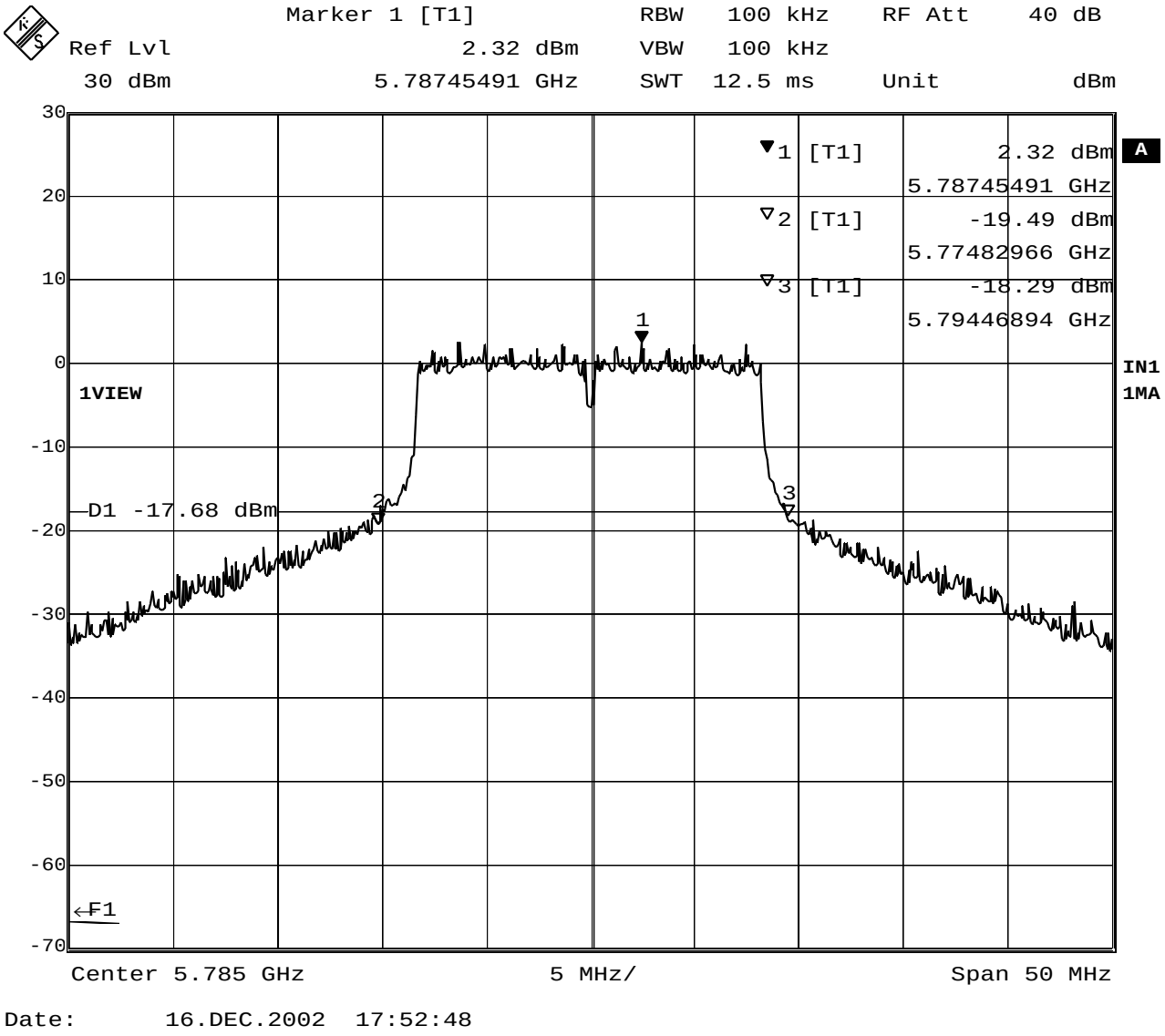
Plot 2-2. 20dB BW at 2437MHz



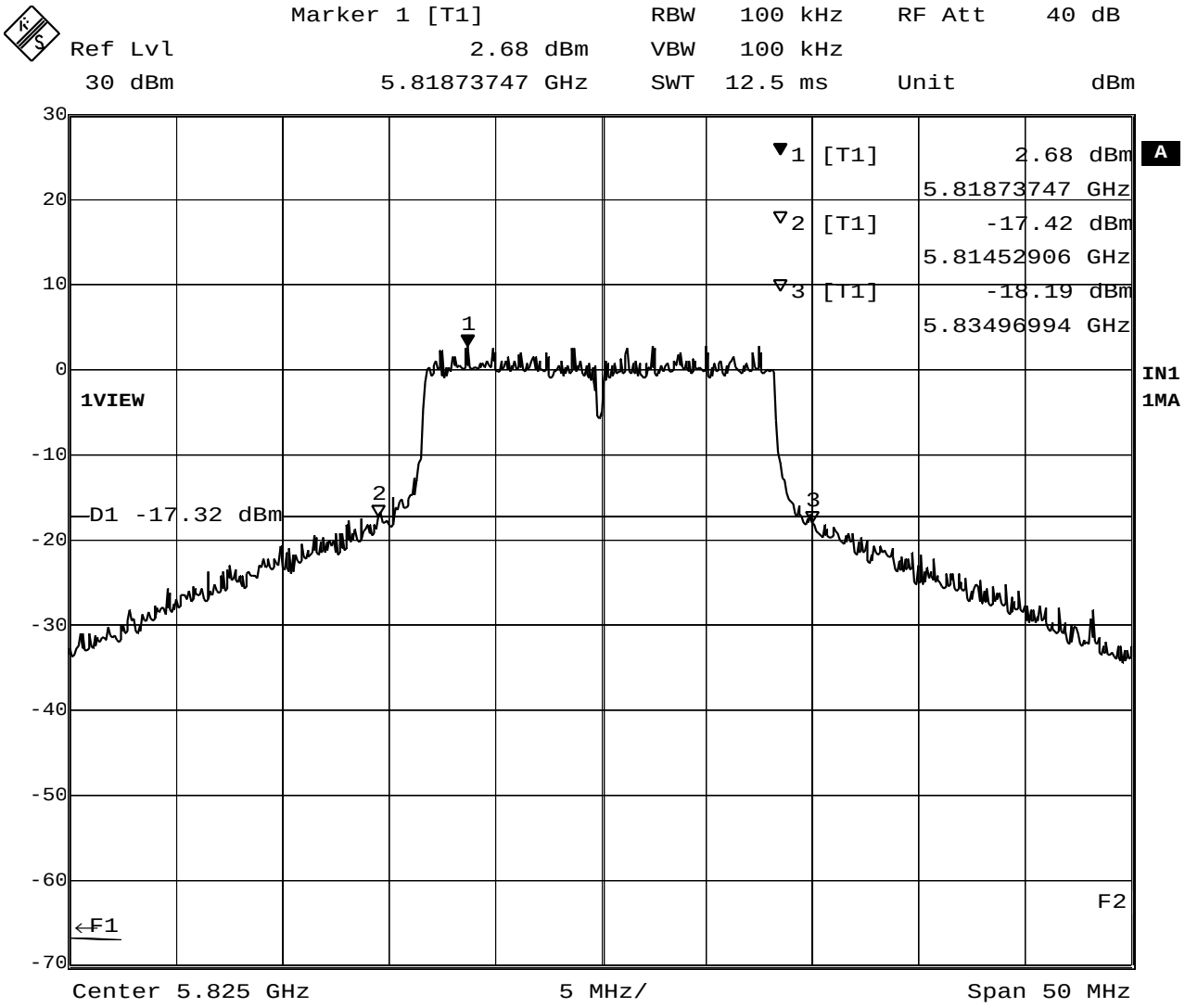
Plot 2-3. 20dB BW at 2462MHz



Plot 2-4. 20dB BW at 5745MHz

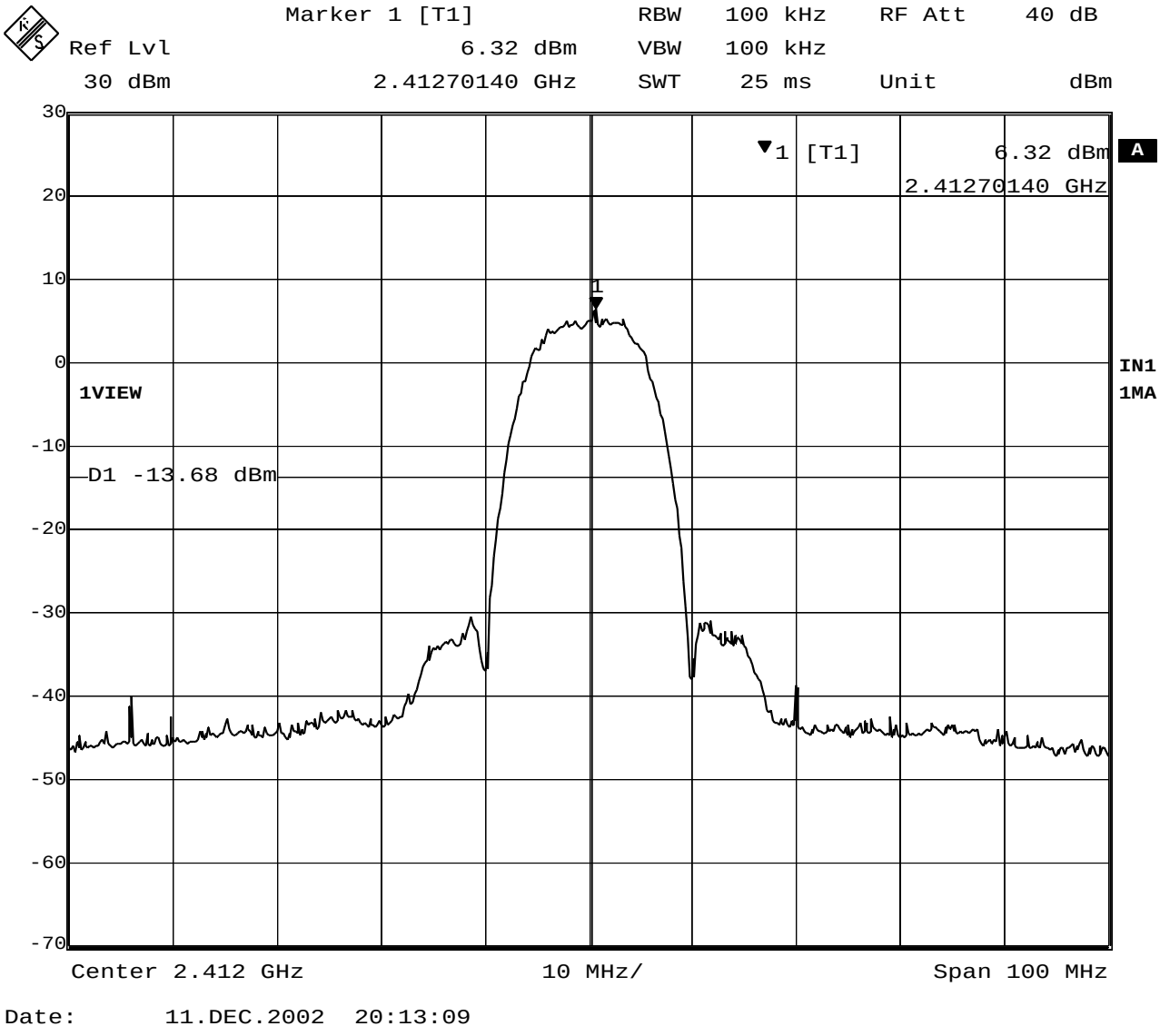


Plot 2-5. 20dB BW at 5785MHz

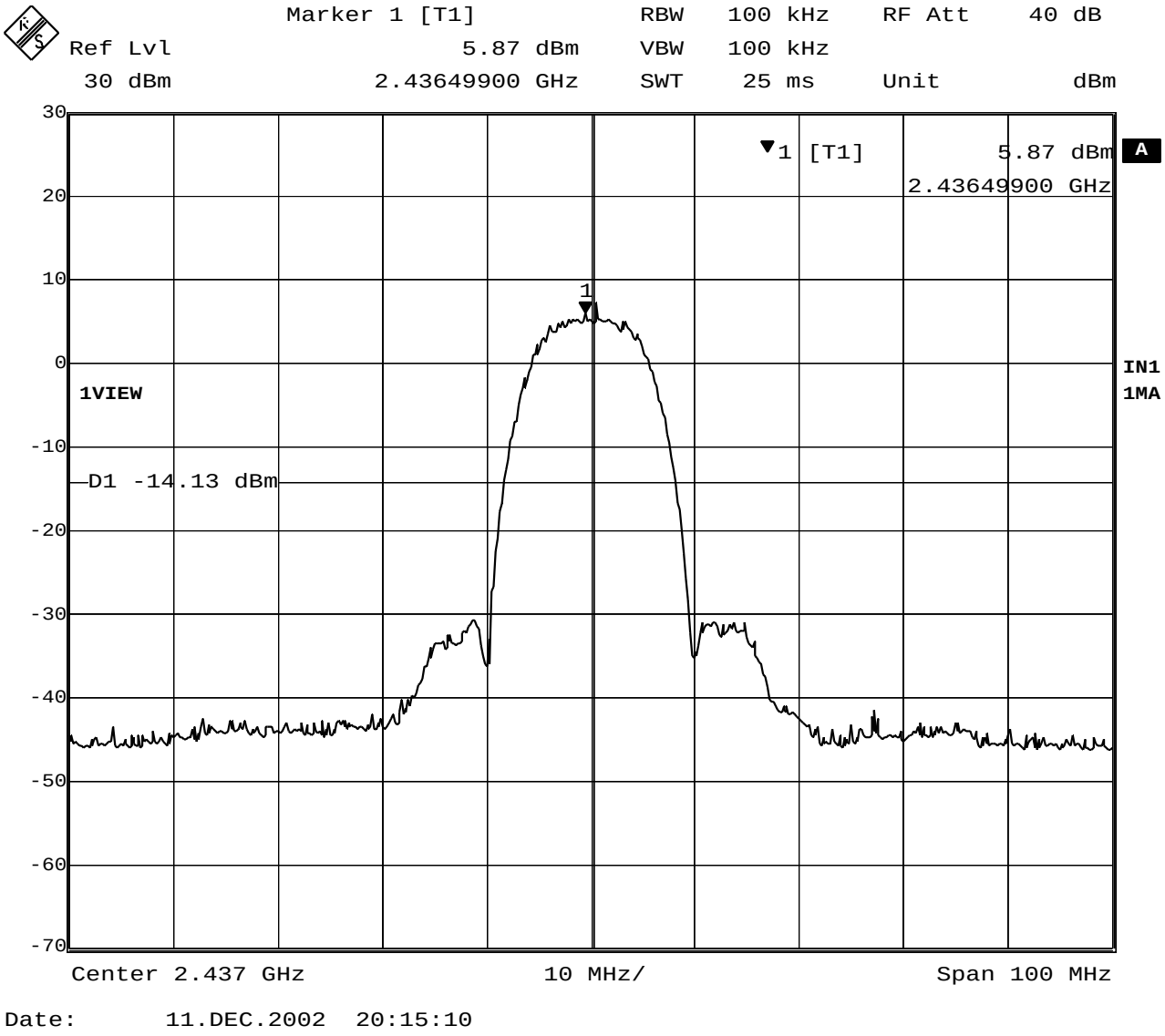


Plot 2-6. 20dB BW at 5825MHz

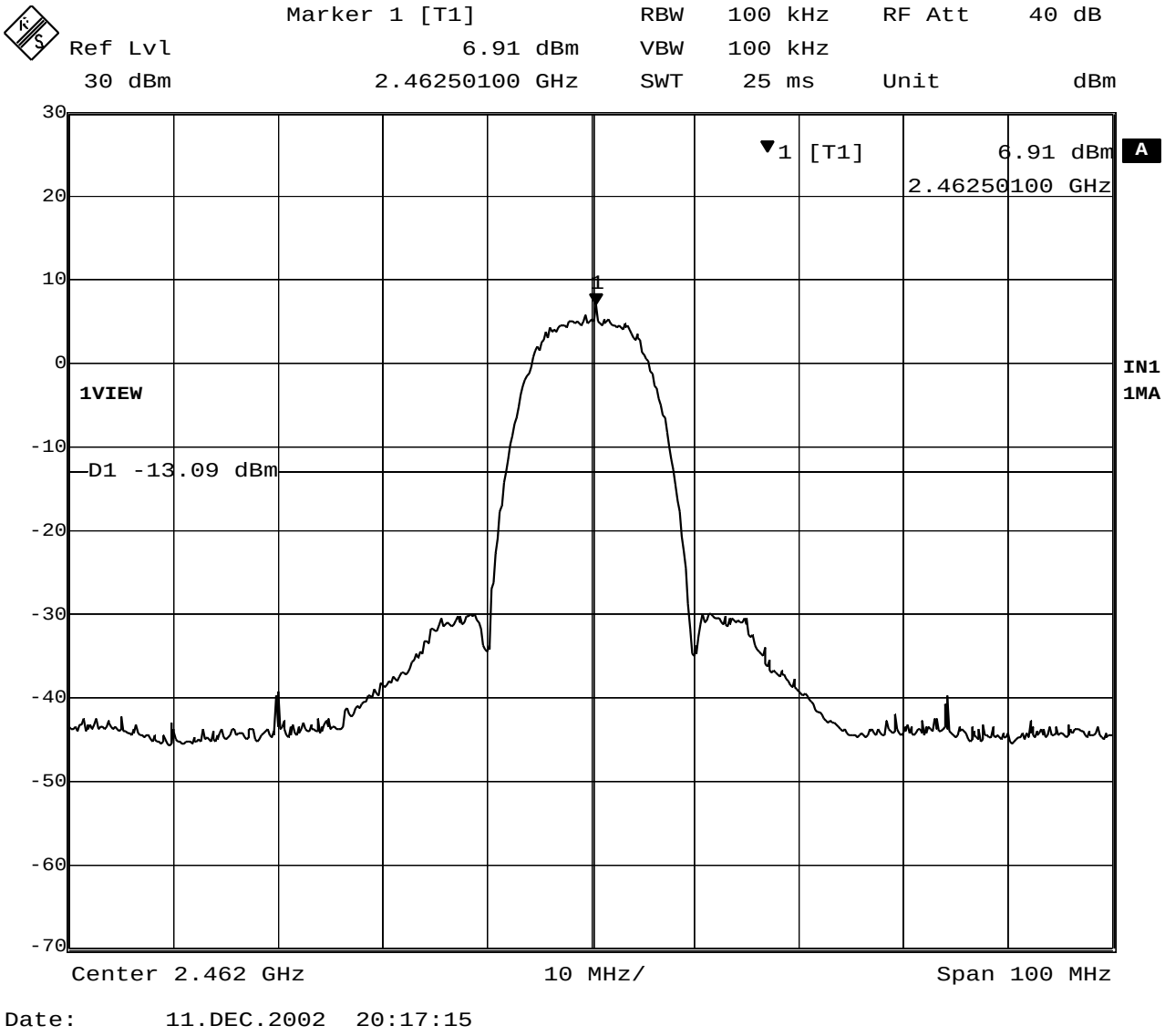
2.6 Trace Data of Out of Band Emissions



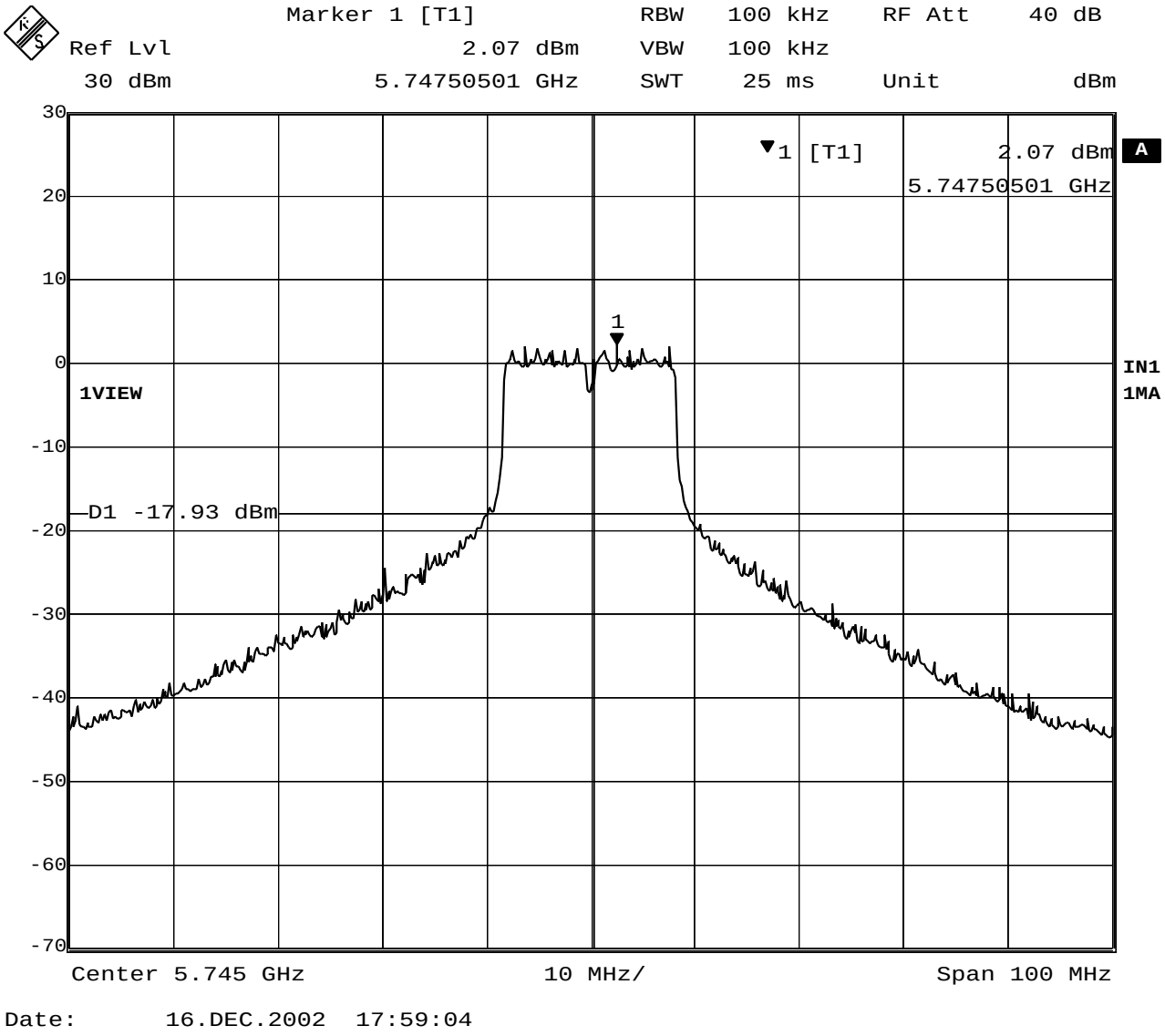
Plot 2-7. Out of band emissions around 2412MHz



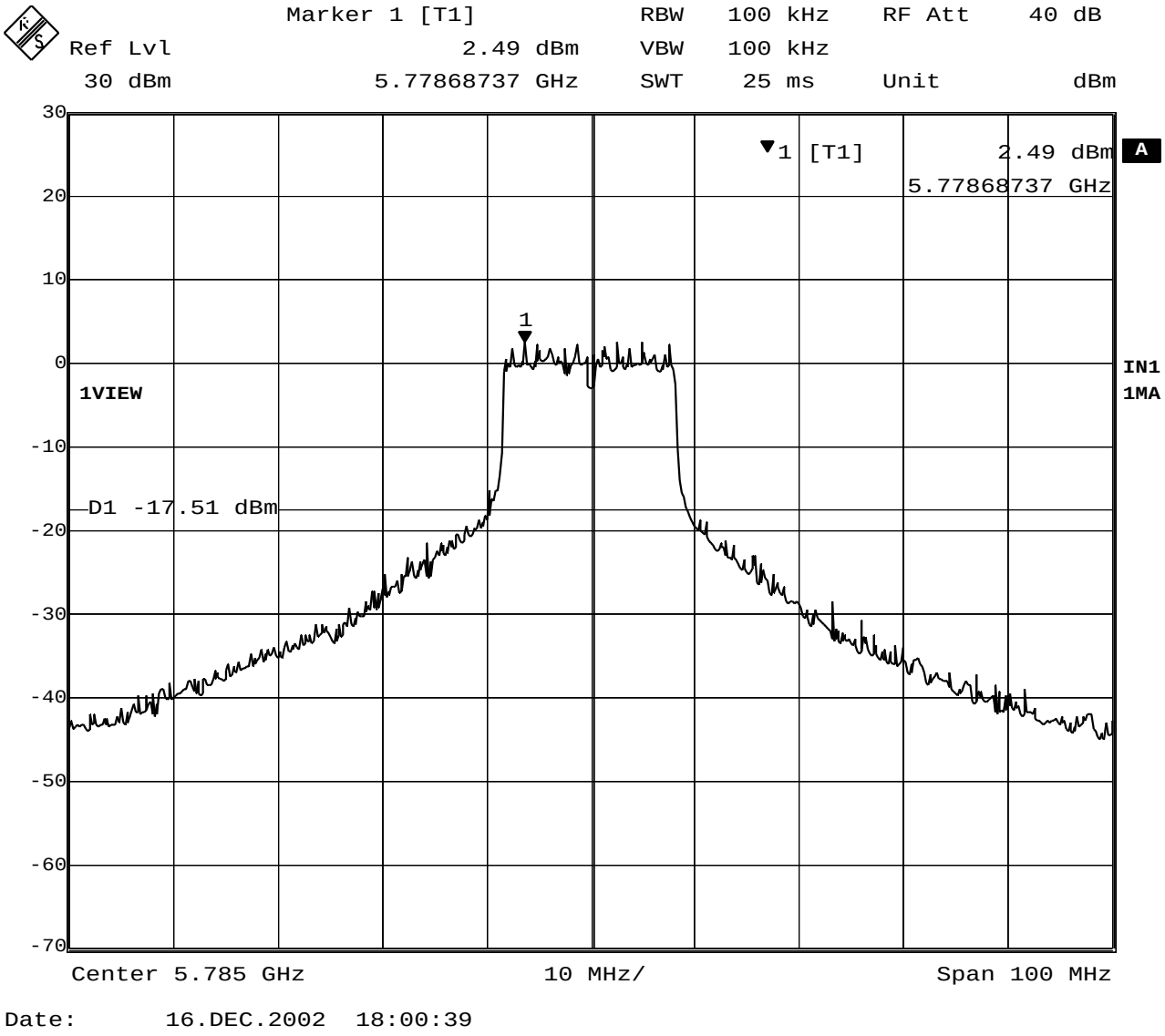
Plot 2-8. Out of band emissions around 2437MHz



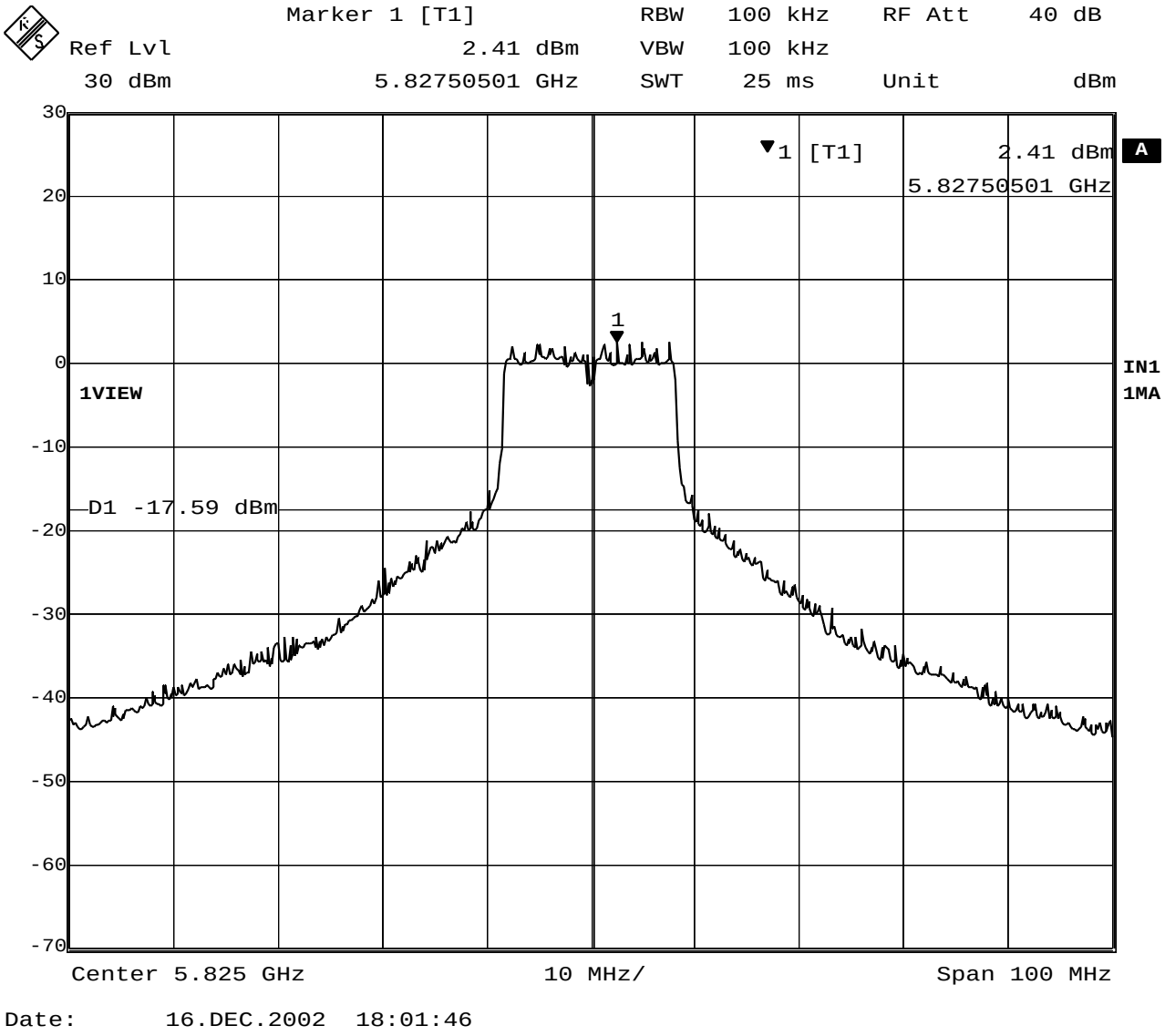
Plot 2-9. Out of band emissions around 2462MHz



Plot 2-10. Out of band emissions around 5745MHz



Plot 2-11. Out of band emissions around 5785MHz



Plot 2-12. Out of band emissions around 5825MHz

3. Conducted Peak Output Power

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: Loss: 20 cm 0.7dB (for 2.4GHz) 1.3dB (for 5.8GHz)	

Notes: - HP: Hewlett Packard

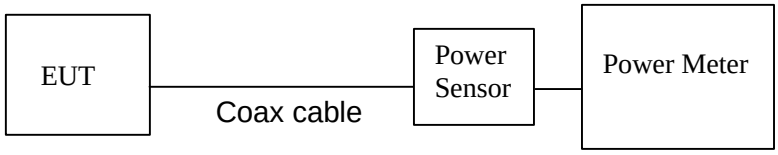


Figure 3-1: Measurement setup of power meter method

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: November 18, December 16 and 24, 2002

Table 3-2-1. Power meter measurement results (EUT: M/T 2672-CHU, s/n ZZ-00094)

Operation Frequency [GHz]	Rated output power (conducted) [dBm]									
	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)	16.2	**16.2**	NA							
Specification	17									
2.437 (Aux)	16.1	**16.1**	N/A							
Specification	17									
2.462 (Aux)	16.1	**16.2**	N/A							
Specification	17									
5.745 (Main)	N/A		15.2	-	-	-	**15.2**	14.0	11.8	9.3
Specification			16					15	12	10
5.785 (Main)	N/A		15.1	-	-	-	**15.2**	14.3	11.4	9.7
Specification			16					15	12	10
5.825 (Main)	N/A		15.1	-	-	-	**15.1**	14.3	11.1	9.6
specification			16					15	12	10

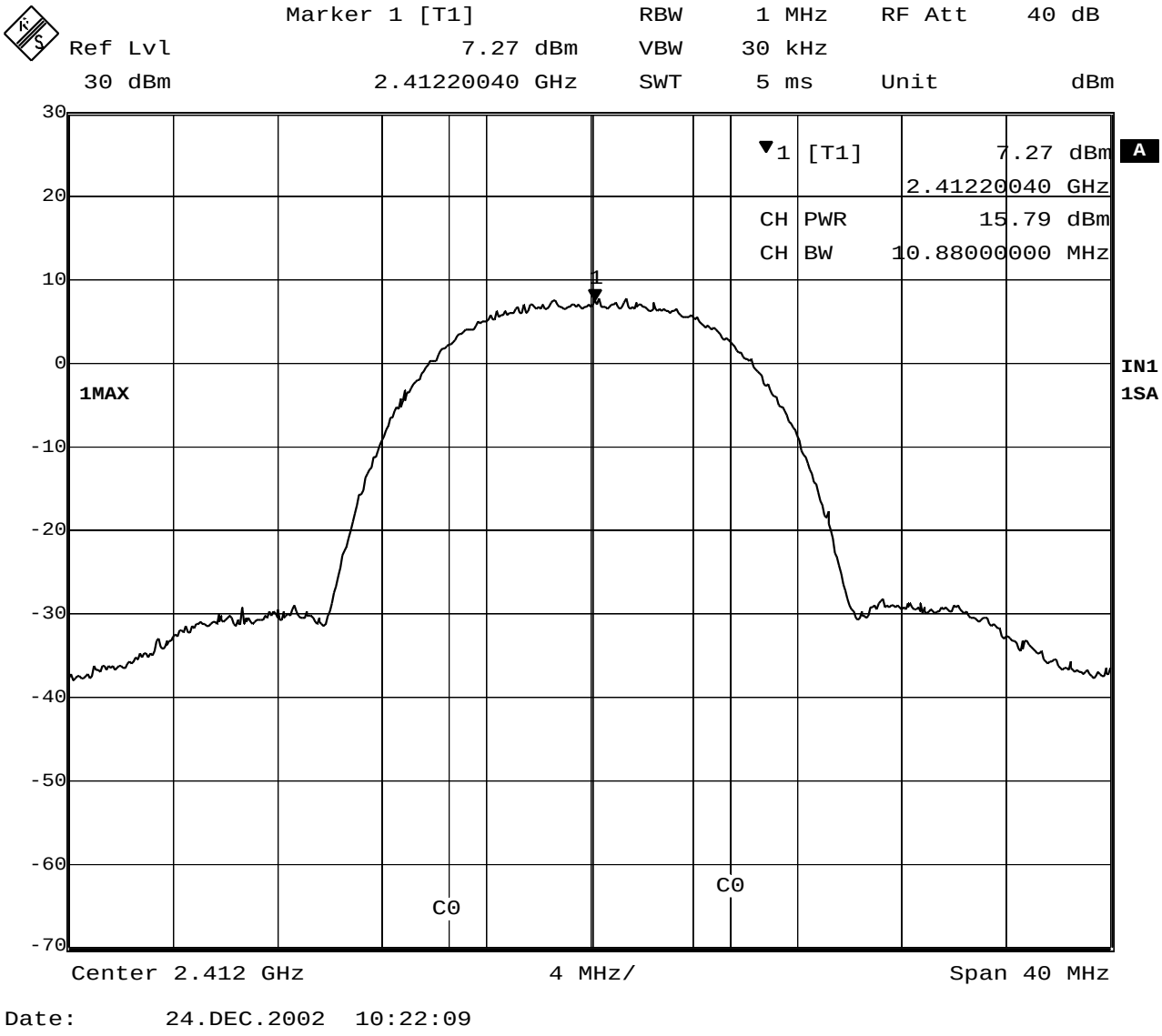
[Calculation table]

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	16.2	0.7	**16.9**	30	30	-	**-**	N/A
2437	16.1	0.7	**16.8**					
2462	16.2	0.7	**16.9**					
5745	15.2	1.3	**16.5**			0.32	**16.8**	36
5785	15.2	1.3	**16.5**				**16.8**	
5825	15.1	1.3	**16.4**				**16.7**	

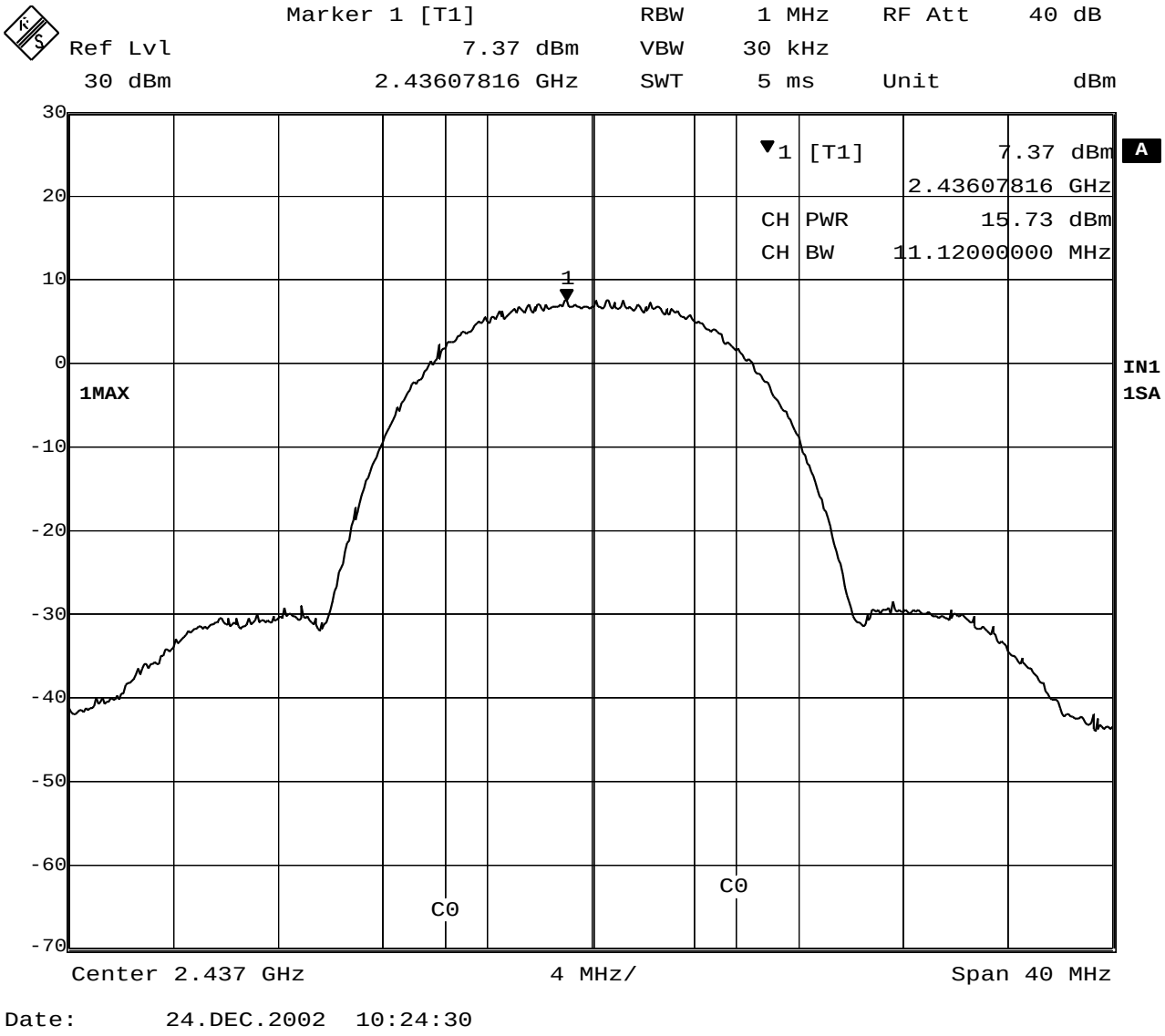
Table 3-2-2. Spectrum analyzer measurement results (EUT: M/T 2672-CHU, s/n ZZ-00094)

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	15.79	Plot 3-1	1.3	**17.1**	30	30	-	**-**	N/A
2437	15.73	Plot 3-2	1.3	**17.0**					
2462	15.75	Plot 3-3	1.3	**17.1**					
5745	14.35	Plot 3-4	2.3	**16.7**			0.32	**17.0**	36
5785	14.31	Plot 3-5	2.3	**16.6**				**16.9**	
5825	14.33	Plot 3-6	2.3	**16.6**				**16.9**	

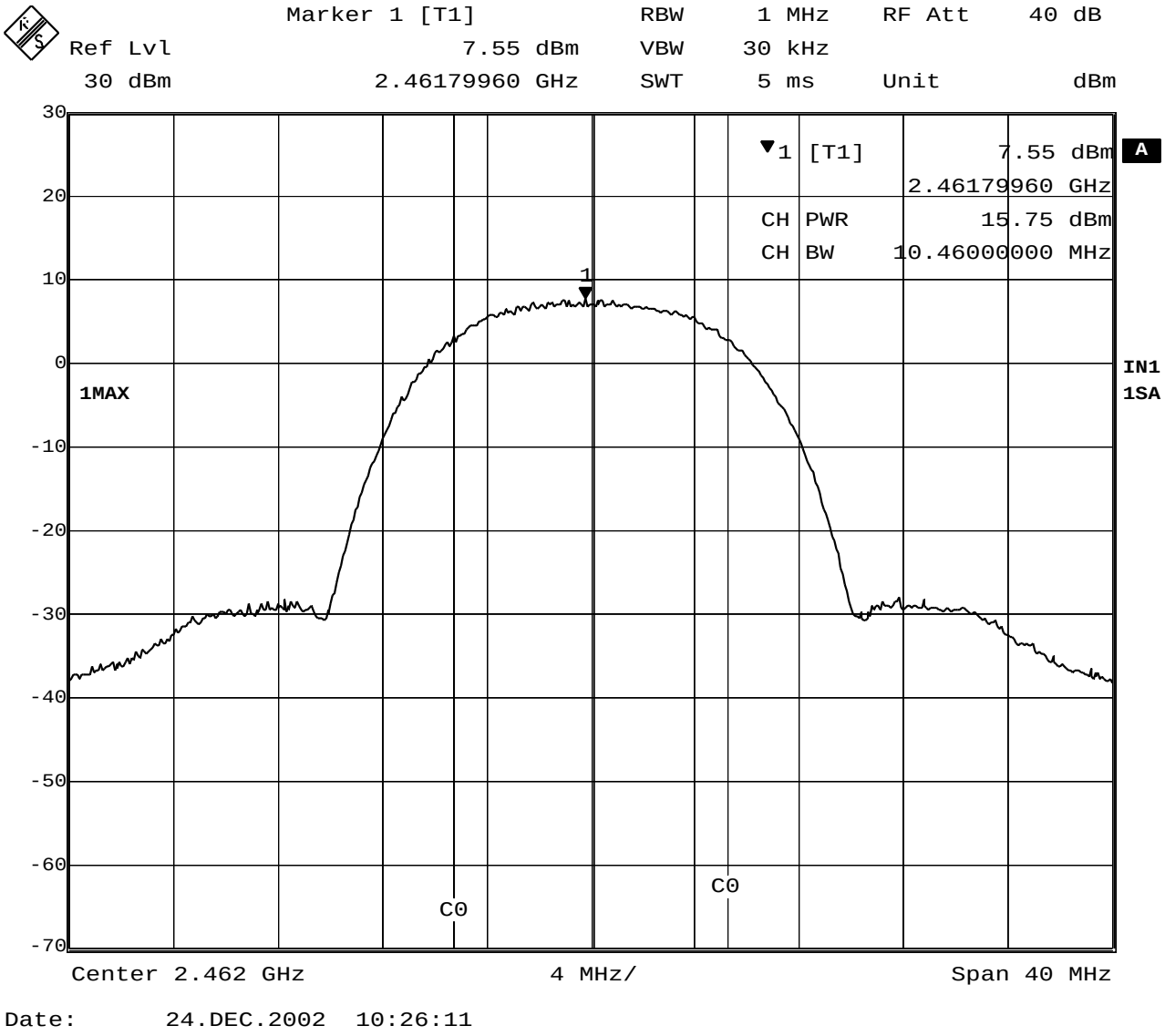
3.4 Trace Data of Conducted Peak Output Power



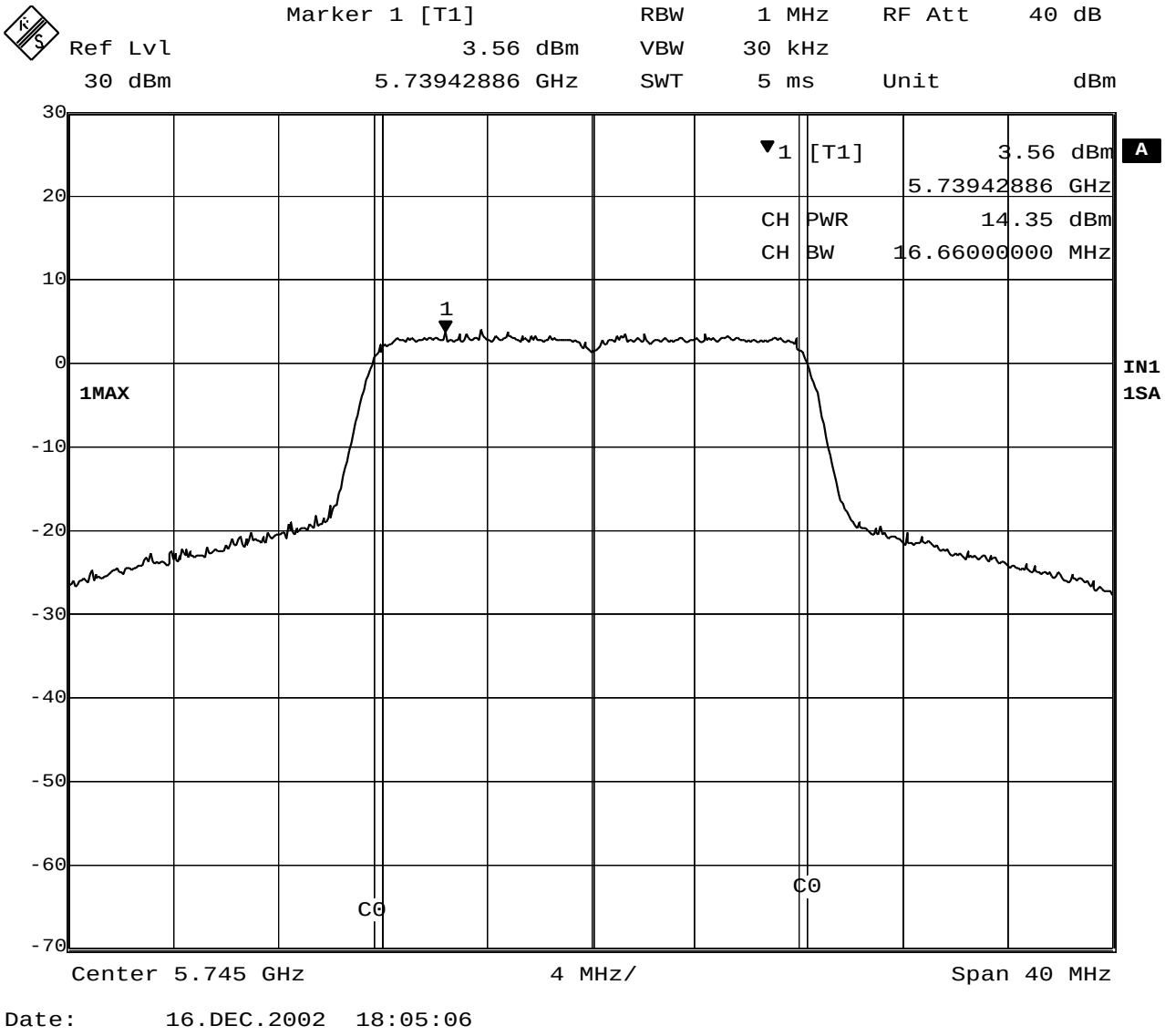
Plot 3-1. Conducted Peak Output Power of 2412MHz



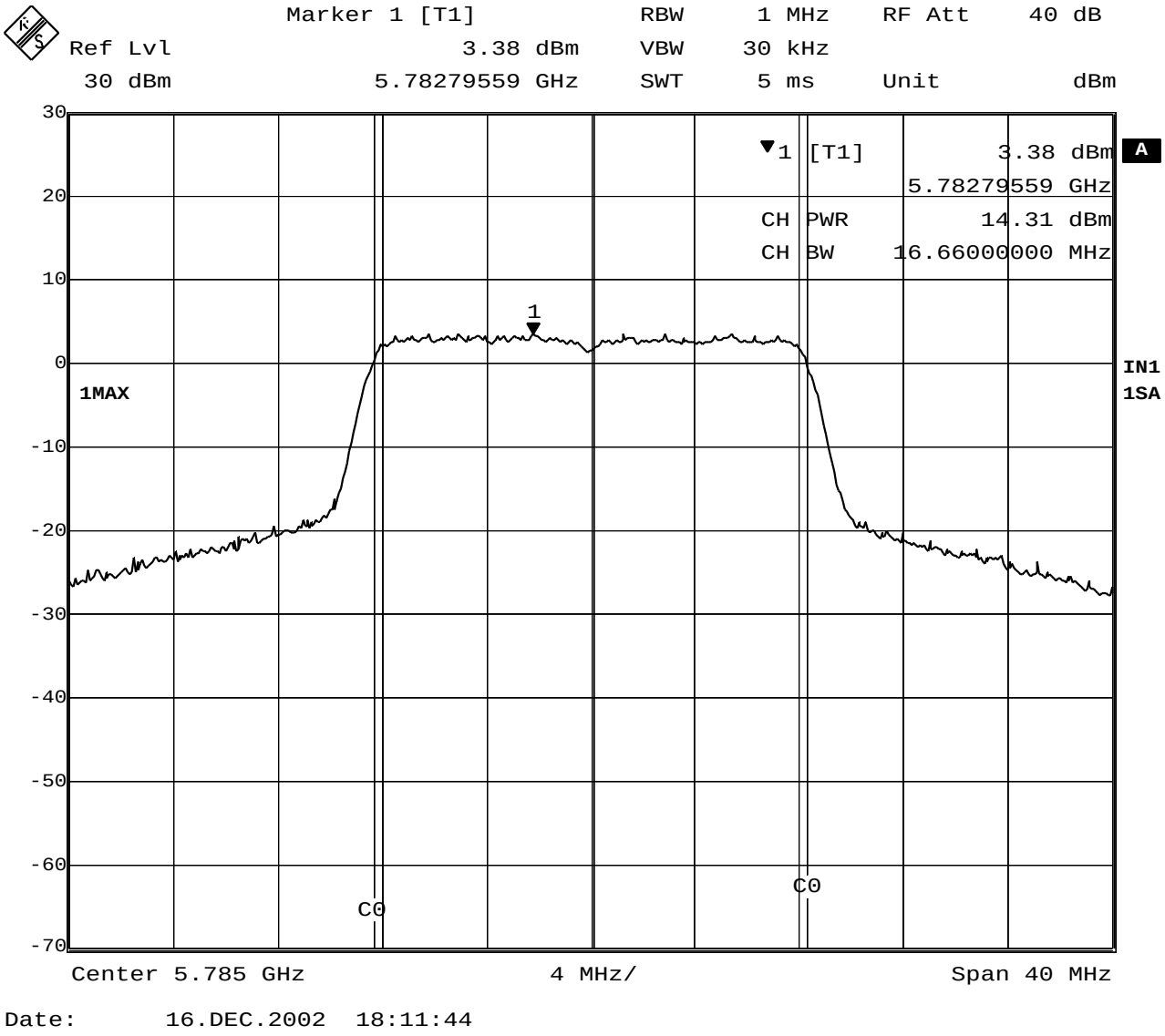
Plot 3-2. Conducted Peak Output Power of 2437MHz



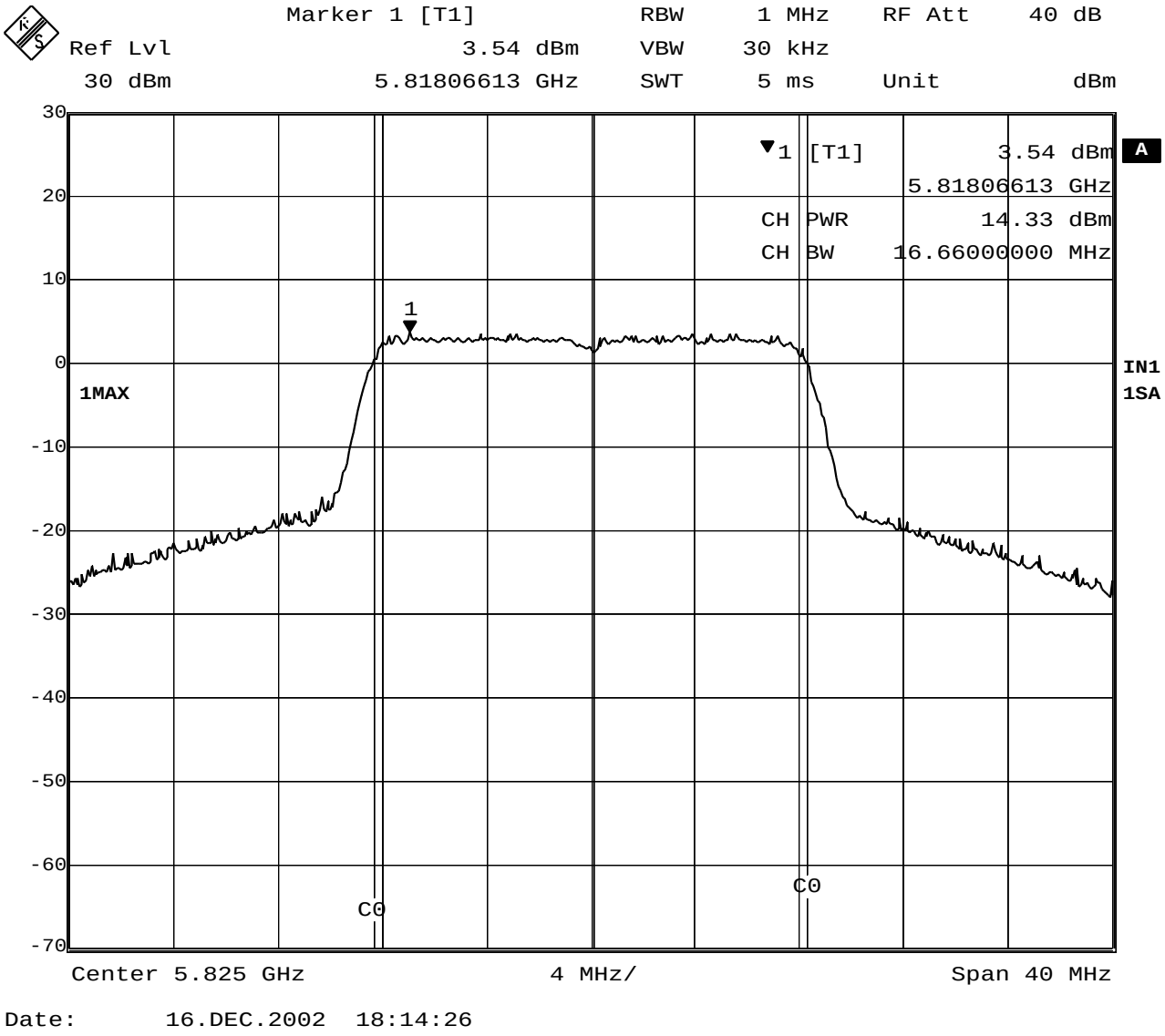
Plot 3-3. Conducted Peak Output Power of 2462MHz



Plot 3-4. Conducted Peak Output Power of 5745MHz



Plot 3-5. Conducted Peak Output Power of 5785MHz



Plot 3-6. Conducted Peak Output Power of 5825MHz

4. Peak Power Spectral Density

4.1 Test Procedure

The peak power density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequencies of each 2.4GHz or 5.8GHz band.
The spectrum analyzer is set to:
RBW= 3kHz, VBW=100kHz, Span=10MHz(for 2.4GHz band) or 20MHz(for 5.8GHz band), Sweep=2.8 seconds

4.2 Test Instruments and Measurement Setup

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

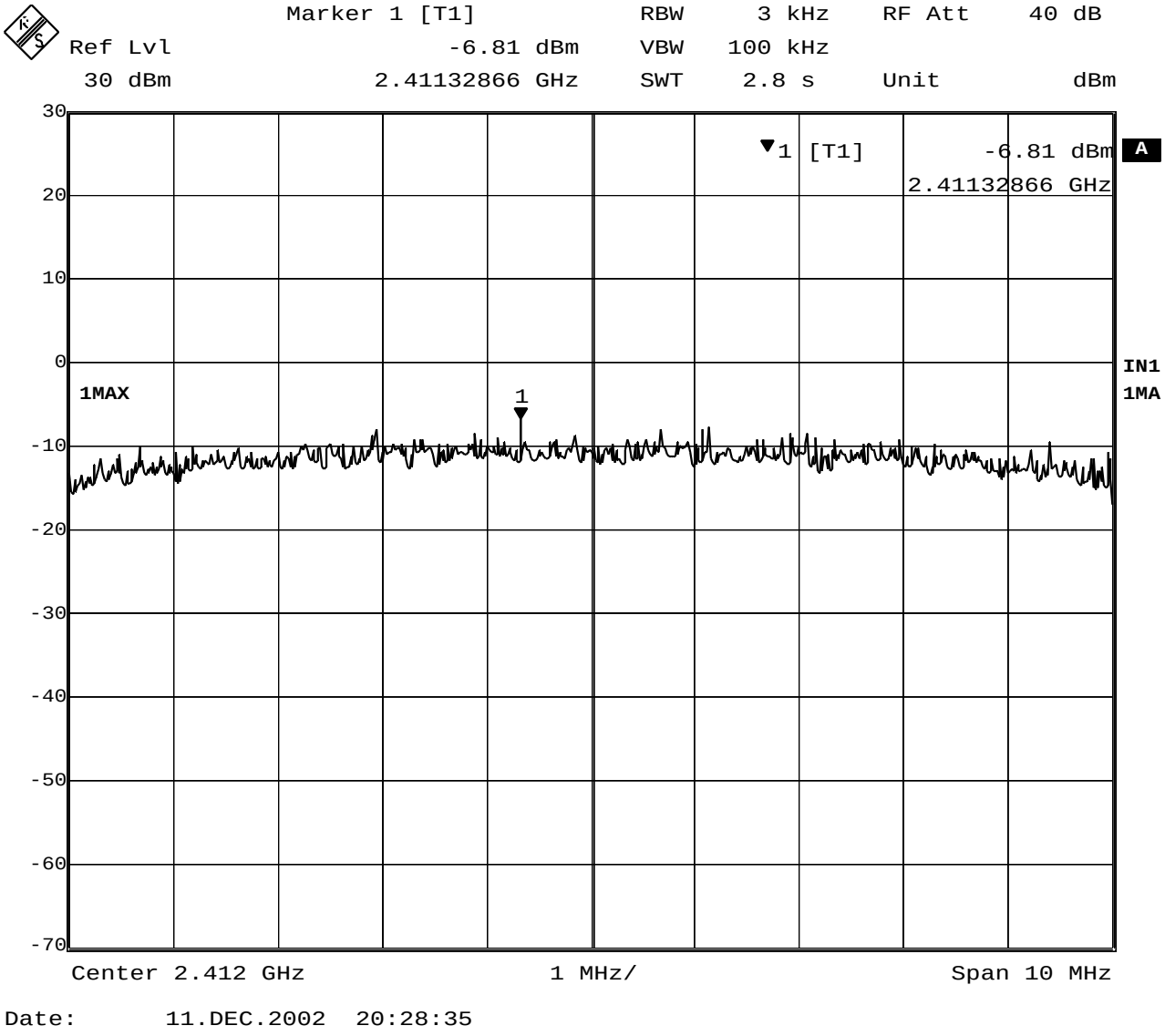
4.3 Measurement Results

Test Date: December 11 and 16, 2002

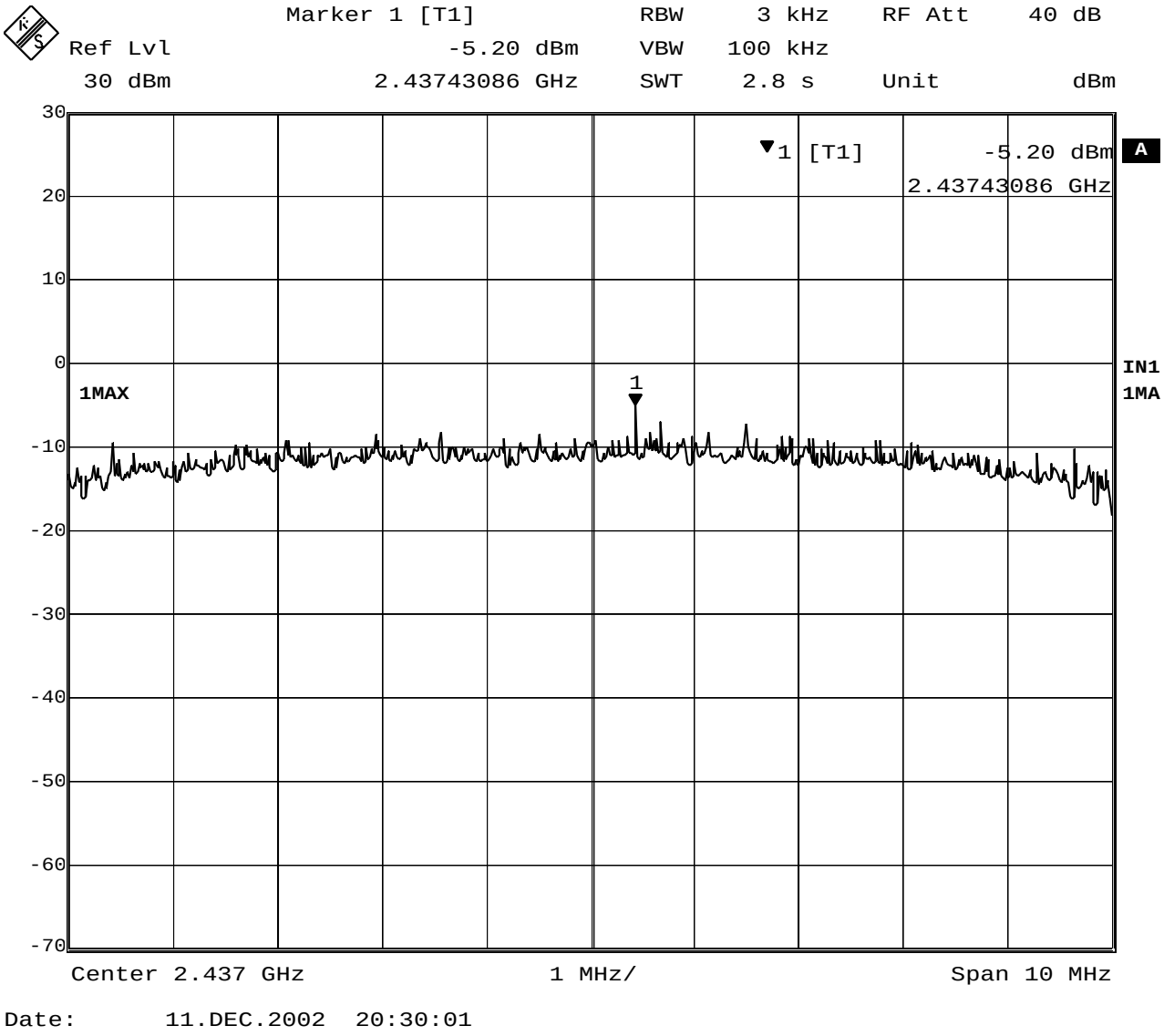
Table 4-1. EUT: M/T 2672-CHU, s/n ZZ-00094 , TX mode

Ch No.	Frequency (MHz)	**Analyzer Reading** (dBm)	Trace number	Cable loss (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
1	2411.33	-6.81	Plot 4-1	1.3	- 5.5	8.0	13.5
6	2437.43	-5.20	Plot 4-2	1.3	- 3.9	8.0	11.9
11	2459.83	-6.41	Plot 4-3	1.3	- 5.1	8.0	13.1
149	5748.71	-11.45	Plot 4-4	2.3	- 9.2	8.0	17.2
157	5786.22	-11.39	Plot 4-5	2.3	- 9.1	8.0	17.1
165	5822.17	-11.05	Plot 4-6	2.3	- 8.8	8.0	16.8

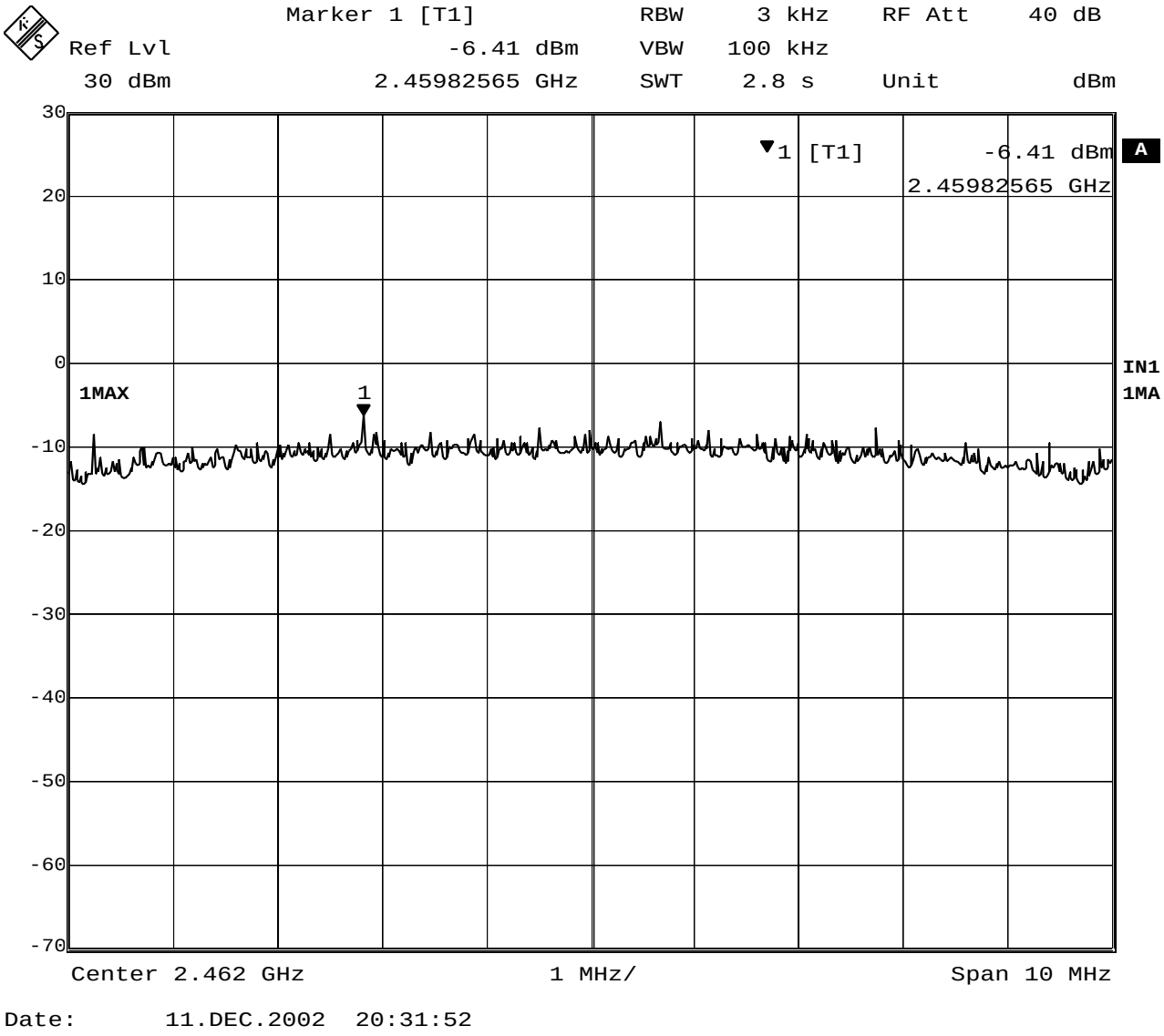
4.4 Trace Data of Peak Power Spectral Density



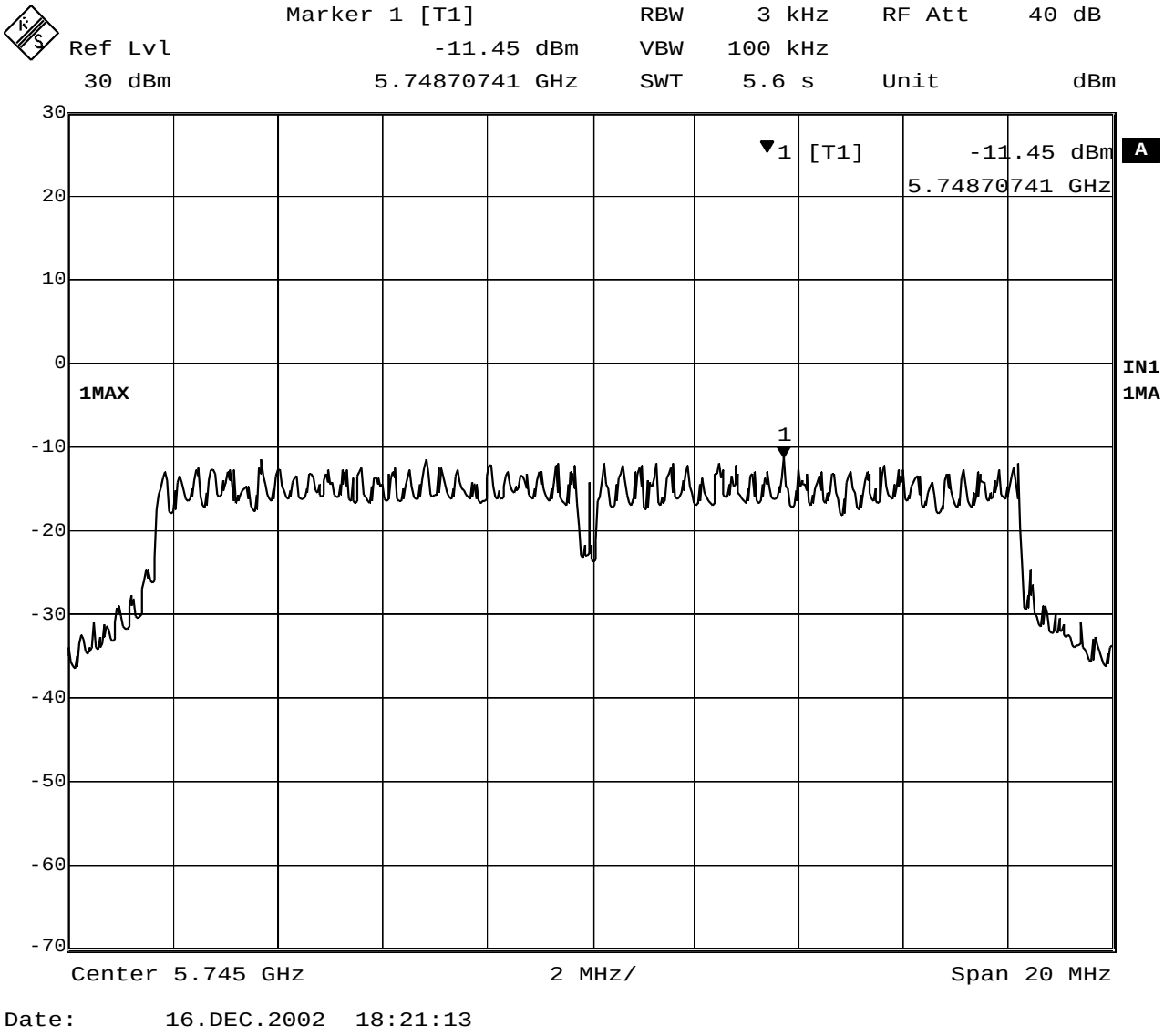
Plot 4-1. Peak Power Spectral Density of 2412MHz



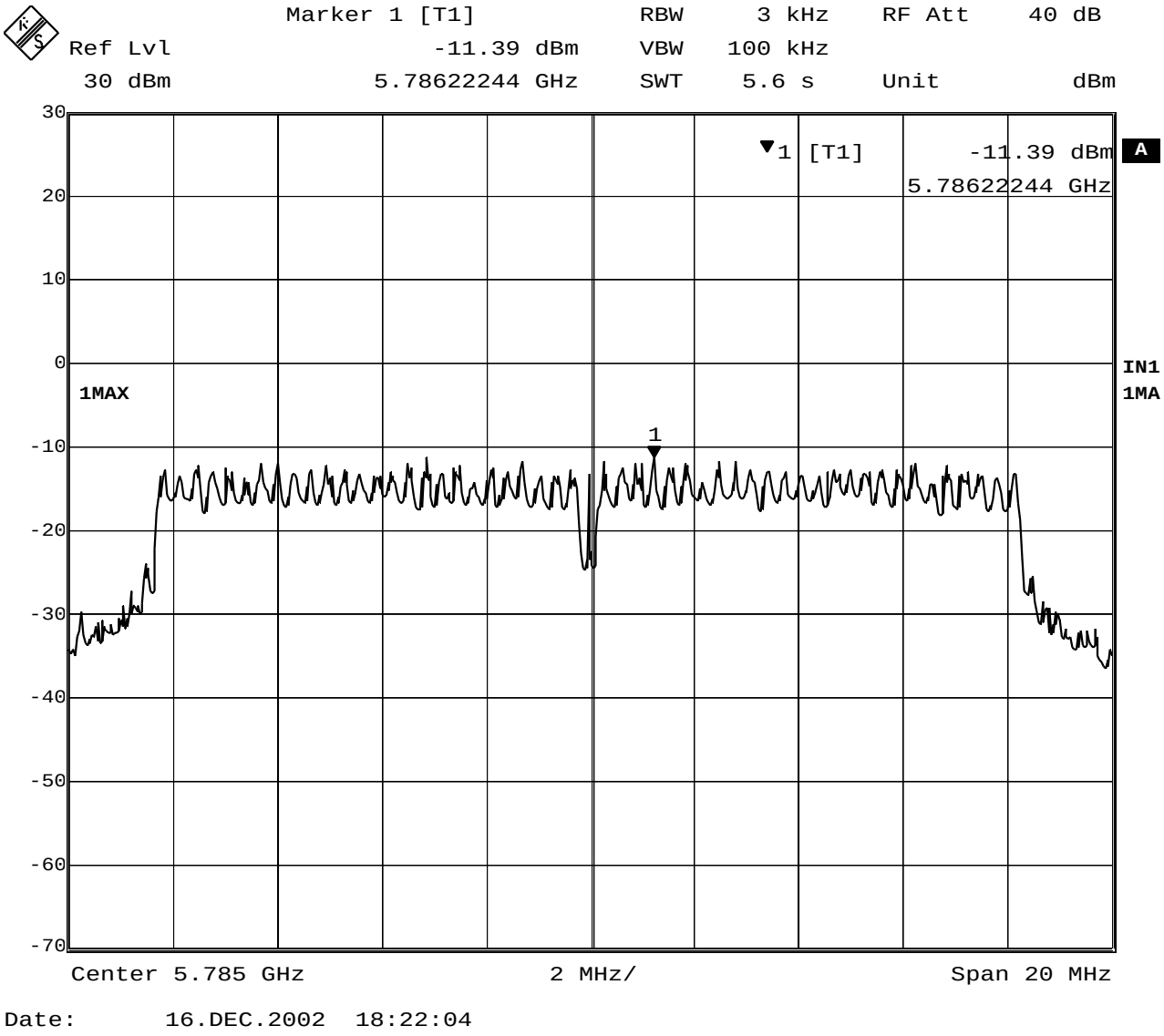
Plot 4-2. Peak Power Spectral Density of 2437MHz



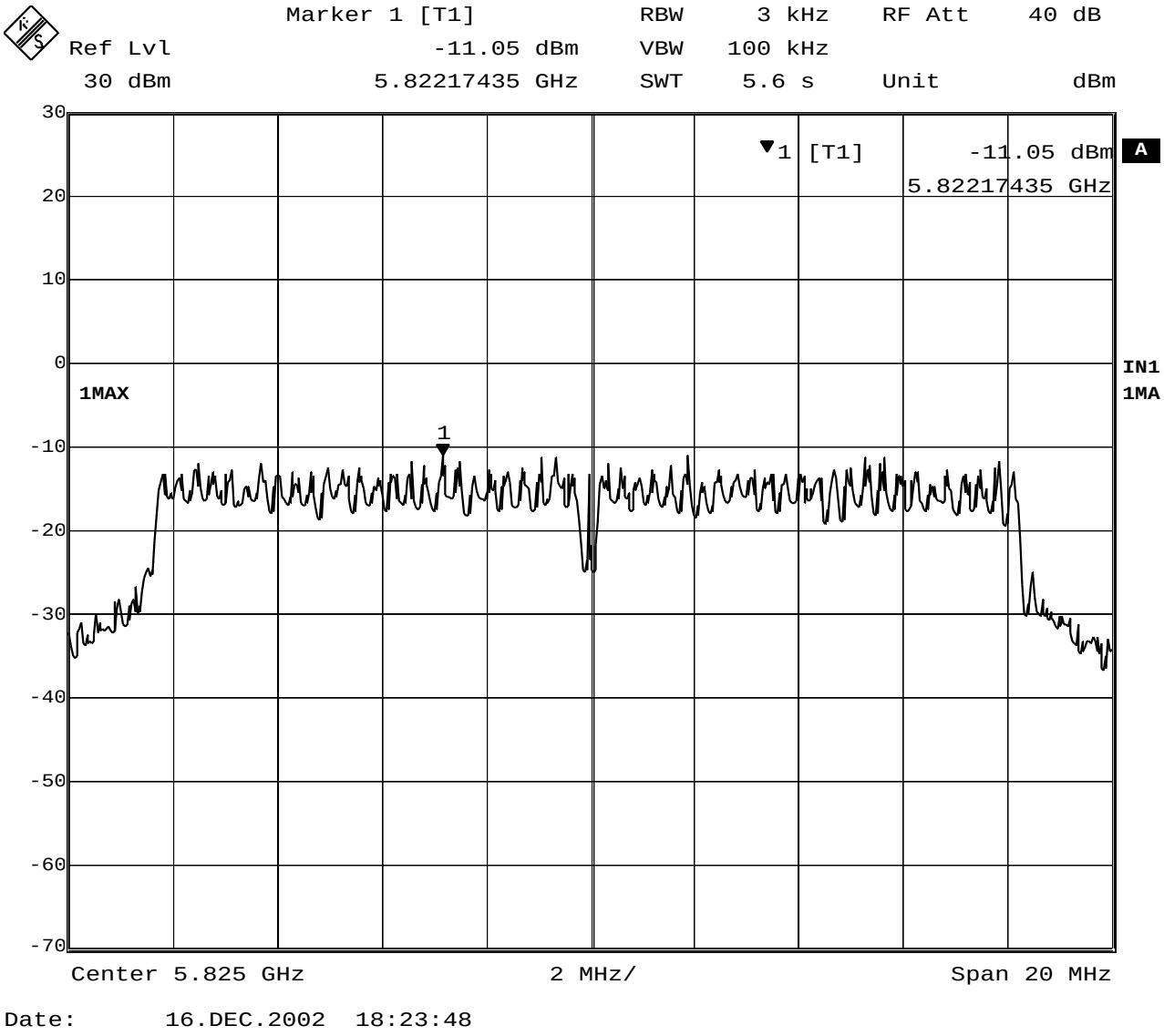
Plot 4-3. Peak Power Spectral Density of 2462MHz



Plot 4-4. Peak Power Spectral Density of 5745MHz



Plot 4-5. Peak Power Spectral Density of 5785MHz



Plot 4-6. Peak Power Spectral Density of 5825MHz

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

[FCC 15.207, RSS-210 6.6 / 7.4]

5.1 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.

5.2 Test Instruments and Measurement Setup

Table 5-1. Conducted Emission Test Instrumentation

Description	**Model**	**Serial Number**
Computer	IBM 6589-13J	97-15613
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2601A02634
Spectrum Analyzer Display	HP 85662A	2542A12308
Quasi-Peak Adapter	HP 85650A	2043A00062
Receiver (9kHz-30MHz)	R&S ESH3	891806/012
LISN	EMCO 3825/2	1426
Switch/control unit	HP 3488A	2719A17228
Plotter	HP 7550A	2631A33619
Coax cables: - Lisn-L <=> SW/Con.unit (SW100) - Lisn-N <=> SW/Con.unit (SW101) - SW/Con.unit <=> RCVR (Input) - SW/Con.unit<=> Spe Ana.(Signal In)	Length: 4 m 4 m 1 m 1 m	 - EMIC-L - EMIC-N - EMIC-R - EMIC-S

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

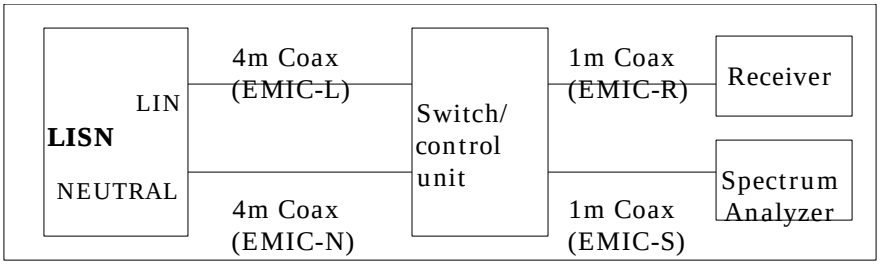


Figure 5. Cables for Conducted Emission Test

5.3 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 16.3dB. The 6 highest emissions relative to the limits are reported.

Test Date: January 8, 2003

5.3.1 EUT in 2.4GHz IEEE802.11b transmission mode

Table 5-2-1. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.1(2412MHz) **TX** mode 11Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.2028	LINE	42.8	63.5	37.2	53.5
0.2713	LINE	34.7	61.1	30.4	51.1
0.3422	LINE	31.4	59.1	27.4	49.1
0.4131	LINE	24.8	57.6	21.1	47.6
0.4789	LINE	25.4	56.4	22.0	46.4
0.6202	LINE	21.8	56.0	17.5	46.0

Table 5-2-2. EUT: M/T 2672-CHU, s/n ZZ-00094 , Ch.6(2437MHz) **TX** mode 11Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.2017	LINE	38.2	63.5	33.1	53.5
0.2718	LINE	33.8	61.1	29.2	51.1
0.3427	LINE	30.0	59.1	26.1	49.1
0.4797	LINE	26.0	56.3	22.4	46.3
0.6162	LINE	22.7	56.0	18.7	46.0
24.9973	NEUTRAL	29.8	60.0	28.2	50.0

Table 5-2-3. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.11(2462MHz) **TX** mode 11Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.2028	LINE	39.4	63.5	34.3	53.5
0.2723	LINE	33.8	61.0	29.1	51.0
0.3407	LINE	29.3	59.2	25.5	49.2
0.4804	LINE	26.0	56.3	22.4	46.3
0.6159	LINE	22.8	56.0	18.8	46.0
6.5199	NEUTRAL	22.4	60.0	16.7	50.0

Table 5-2-4. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch. 6 (2437MHz) **RX** mode

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.2028	LINE	39.5	63.5	34.4	53.5
0.2729	LINE	34.2	61.0	29.3	51.0
0.3415	LINE	29.8	59.2	25.9	49.2
0.4116	LINE	24.1	57.6	19.9	47.6
0.4799	LINE	25.9	56.3	22.4	46.3
0.6151	LINE	22.5	56.0	18.5	46.0

5.3.2 EUT in 5.8GHz IEEE802.11a transmission mode

Table 5-3-1. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.149(5745MHz) **TX** mode 24Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.2035	NEUTRAL	42.5	63.5	37.2	53.5
0.2747	LINE	36.5	61.0	31.5	51.0
0.3422	NEUTRAL	30.5	59.2	26.5	49.2
0.4104	NEUTRAL	24.4	57.6	20.8	47.6
0.4799	NEUTRAL	25.8	56.3	22.3	46.3
1.9915	NEUTRAL	20.5	56.0	17.5	46.0

Table 5-3-2 EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.157(5785MHz) **TX** mode 24Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.2081	LINE	40.1	63.3	34.6	53.3
0.2738	NEUTRAL	34.8	61.0	30.0	51.0
0.3415	NEUTRAL	29.4	59.2	25.6	49.2
0.4117	LINE	23.1	57.6	20.1	47.6
0.4767	NEUTRAL	23.6	56.4	19.8	46.4
0.6158	NEUTRAL	22.8	56.0	19.0	46.0

Table 5-3-3 EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.165(5825MHz) **TX** mode 24Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.1991	NEUTRAL	31.4	63.6	27.7	53.6
0.2747	NEUTRAL	34.3	61.0	29.0	51.0
0.3404	NEUTRAL	27.6	59.2	22.8	49.2
0.4136	NEUTRAL	23.7	57.6	18.8	47.6
0.4793	NEUTRAL	25.1	56.4	21.1	46.4
0.5499	LINE	19.6	56.0	14.3	46.0

Table 5-3-4 EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.157(5785MHz) **RX** mode

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.2737	NEUTRAL	34.0	61.0	28.9	51.0
0.3422	NEUTRAL	28.7	59.1	24.5	49.1
0.4075	NEUTRAL	22.4	57.7	17.0	47.7
0.4792	NEUTRAL	25.2	56.4	21.4	46.4
0.6152	NEUTRAL	22.8	56.0	19.5	46.0
1.7858	NEUTRAL	20.1	56.0	16.8	46.0

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

[FCC 15.205 / 209, RSS-210 6.2.1 / 6.3 / 7.3]

6.1 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.

6.2 Test Instruments and Measurement Setup

Table 6-1 Radiated Emission Test Instrumentation

Description	**Model**	**Serial Number**
Computer	IBM 5551-L	#4
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	2841A04252
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 - for 200-1000MHz	 HP 8447D HP 8447D	 2805A02919 2944A03506
Biconical Antenna (30-200MHz)	EMCO 3108	2309
Log-Periodic Antenna (200-1000MHz)	EMCO 3146	1585
Receiver (20MHz-1.3GHz)	R&S ESVP	893202/018
Switch/control unit	HP 3488A	2719A17226
N-Coax cables: - Bi-coni Ant <=> 10m Cable - 10m Cable <=> Shield Panel - Shield Panel <=> RF Amp - RF Amp <=> Power Splitter - Log-peri Ant <=> 10m Cable - 10m Cable <=> Shield Panel - Shield Panel <=> RF Amp - RF Amp <=> Power Splitter	Length: 9 m 10 m 7 m 0.5m 9 m 10 m 7 m 0.5m	 - EM103L01 - EM103L02 - EM103L03 - EM103L04 - EM103H01 - EM103H02 - EM103H03 - EM103H04
Coax cables: - Power Splitter <=> SW/Con.unit (SW110) - Power Splitter <=> SW/Con.unit (SW300) - Power Splitter <=> SW/Con.unit (SW100) - Power Splitter <=> SW/Con.unit (SW301)	 1 m 1 m 1 m 1 m	 - EM103L05 - EM103L06 - EM103H05 - 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

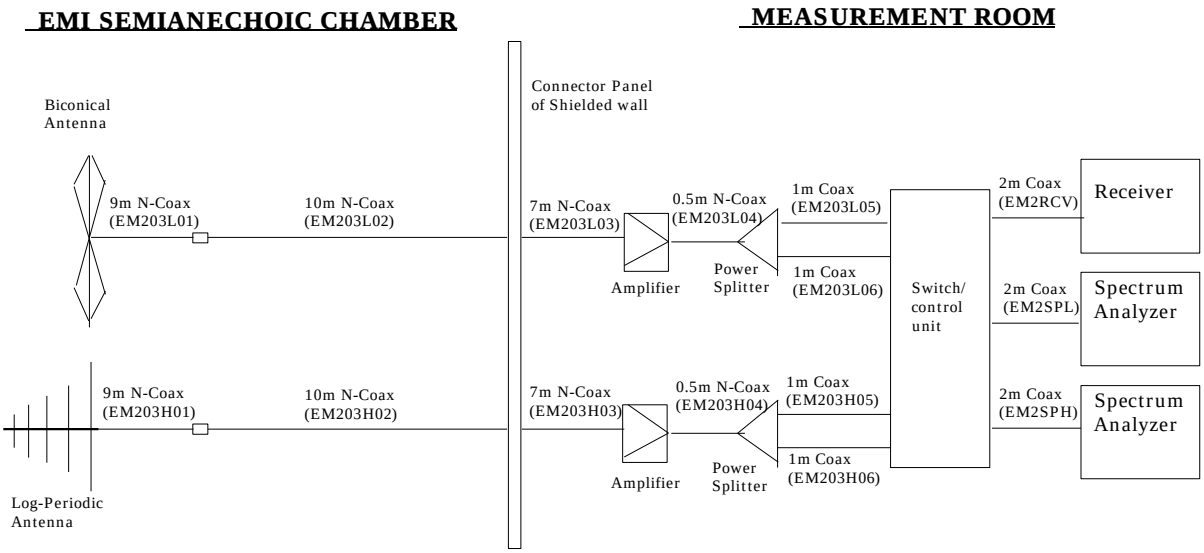


Figure 6 Cables for Radiated Emission Test

6.3 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:

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

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

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

$40 dB\mu V/m = 100 \mu V/m$
$48 dB\mu V/m = 250 \mu V/m$

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 1.5 dB at 30MHz - 1000MHz band.
The 6 highest emissions relative to the limits are reported.

Test Date: November 22 and 25, 2002

6.4.1 EUT in 2.4GHz IEEE802.11b transmission mode

Table 6-2-1. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.1(2412MHz) **TX** mode 11Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
39.261	V	32.1	12.2	-18.5	25.8	40.0	19.5	100
199.973	H	38.7	13.8	-15.7	36.8	43.5	69.2	150
266.629	H	34.8	12.3	-14.4	32.7	46.0	43.2	200
454.779	V	41.4	16.5	-13.8	44.1	46.0	160.3	200
630.003	H	24.1	19.1	-11.9	31.3	46.0	36.7	200
933.202	V	20.1	22.6	-9.0	33.7	46.0	48.4	200

Table 6-2-2. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.6(2437MHz) **TX** mode 11Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
36.456	V	34.4	12.5	-18.6	28.3	40.0	26.0	100
199.970	H	36.8	13.8	-15.7	34.9	43.5	55.6	150
259.873	H	34.7	12	-14.8	31.9	46.0	39.4	200
454.779	V	41.1	16.5	-13.8	43.8	46.0	154.9	200
859.872	V	21.6	22.1	-10.3	33.4	46.0	46.8	200
933.195	V	20.0	22.6	-9.0	33.6	46.0	47.9	200

Table 6-2-3. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.11(2462MHz) **TX** mode 11Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
36.511	V	34.6	12.5	-18.6	28.5	40.0	26.6	100
199.969	H	38.5	13.8	-15.7	36.6	43.5	67.6	150
266.626	V	28.7	12.3	-14.4	26.6	46.0	21.4	200
454.780	V	41.6	16.5	-13.8	44.3	46.0	164.1	200
630.002	H	22.6	19.1	-11.9	29.8	46.0	30.9	200
932.563	H	18.3	22.6	-9.0	31.9	46.0	39.4	200

Table 6-2-4. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.6(2437MHz) **RX** mode

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
38.823	V	32.0	12.2	-18.5	25.7	40.0	19.3	100
199.969	H	38.2	13.8	-15.7	36.3	43.5	65.3	150
266.626	H	33.8	12.3	-14.4	31.7	46.0	38.5	200
454.779	V	41.5	16.5	-13.8	44.2	46.0	162.2	200
899.865	H	23.3	22.5	-9.3	36.5	46.0	66.8	200
930.685	V	19.4	22.6	-9.1	32.9	46.0	44.2	200

6.4.2 EUT in 5.8GHz IEEE802.11a transmission mode

Table 6-3-1. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.149(5745MHz) **TX** mode 24Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
37.423	H	34.6	12.4	-18.6	28.4	40.0	26.3	100
58.249	V	38.2	9.5	-18.2	29.5	40.0	29.9	100
63.850	V	38.7	9.1	-18.0	29.8	40.0	30.9	100
454.779	V	41.8	16.5	-13.8	44.5	46.0	167.9	200
863.996	V	25.5	22.2	-10.3	37.4	46.0	74.1	200
899.860	V	24.5	22.5	-9.3	37.7	46.0	76.7	200

Table 6-3-2 EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.157(5785MHz) **TX** mode 24Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
38.561	V	35.1	12.2	-18.5	28.8	40.0	27.5	100
58.637	V	38.0	9.5	-18.2	29.3	40.0	29.2	100
454.779	V	41.5	16.5	-13.8	44.2	46.0	162.2	200
733.221	V	25.4	20.6	-10.9	35.1	46.0	56.9	200
859.869	V	22.0	22.1	-10.3	33.8	46.0	49.0	200
899.862	V	24.3	22.5	-9.3	37.5	46.0	75.0	200

Table 6-3-3 EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.165(5825MHz) **TX** mode 24Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
38.326	V	36.5	12.3	-18.7	30.1	40.0	32.0	100
58.187	V	38.2	9.5	-18.2	29.5	40.0	29.9	100
454.779	V	41.7	16.5	-13.8	44.4	46.0	166.0	200
733.220	V	23.5	20.6	-10.9	33.2	46.0	45.7	200
863.996	V	27.1	22.2	-10.3	39.0	46.0	89.1	200
899.861	V	24.6	22.5	-9.3	37.8	46.0	77.6	200

Table 6-3-4 EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.157(5785MHz) **RX** mode

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
38.642	V	38.6	12.2	-18.5	32.3	40.0	41.2	100
57.845	V	37.0	9.6	-18.2	28.4	40.0	26.3	100
454.779	V	41.7	16.5	-13.8	44.4	46.0	166.0	200
733.226	V	24.7	20.6	-10.9	34.4	46.0	52.5	200
899.868	V	24.0	22.5	-9.3	37.2	46.0	72.4	200
928.567	H	19.7	22.6	-9.1	33.2	46.0	45.7	200

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

[FCC 15.205 / 209, RSS-210 6.2.1 / 6.3 / 7.3]

7.1 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.

7.2 Test Instruments and Measurement Setup

Table 7 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 - 26.5GHz)	HP 8449B	3008A00582
Amplifier (26.5 – 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	1158
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 15 m 3m 3m 1m	 - EM206SCO - EM215SCO - SF102-20166 - SF102-20167 - SF102-21105

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

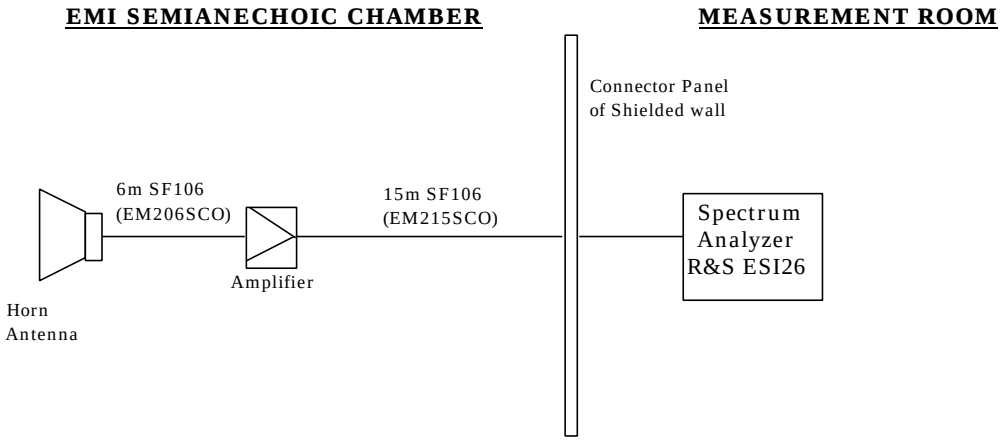


Figure 7-1. Cables for Radiated Emission Test (1 – 12.4 GHz)

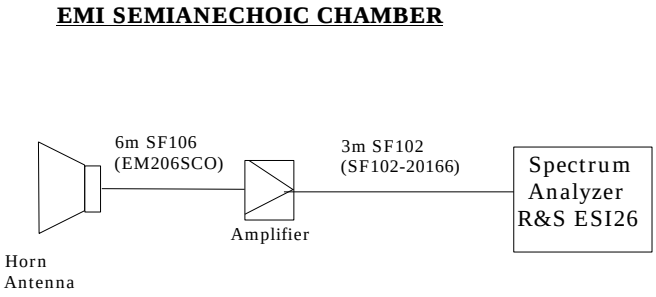


Figure 7-2. Cables for Radiated Emission Test (12.4 - 18GHz)

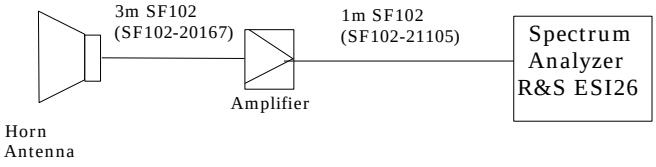


Figure 7-3. Cables for Radiated Emission Test (18 - 26.5GHz)

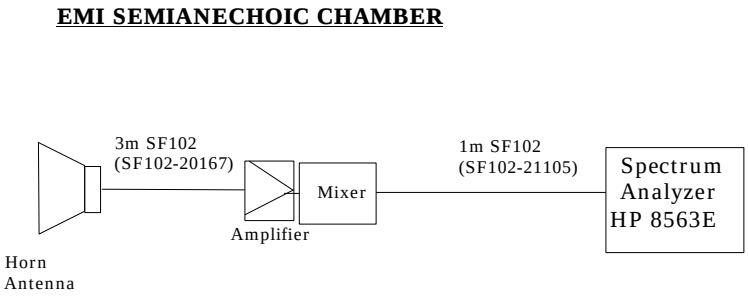


Figure 7-4. Cables for Radiated Emission Test (26.5 - 40GHz)

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. 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 dBμV/m

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

Level(dBμV/m) = 20 × Log (Level(μV/m))
40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/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 3.0 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: November 25, 26, 27, December 4 and 5, 2002

7.4.1 EUT in 2.4GHz IEEE802.11b transmission mode

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

Table 7-2-1. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.1(2412MHz) **TX** mode 11Mbps

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										
2.414	H	110.2	102.0	28.3	-30.4	0.0	108.1	OB*	99.9	OB*
Adjacent RB										
2.390	H	62.5	53.2	28.2	-30.4	0.0	60.3	74.0	51.0	54.0
1.008	V	48.9	-	24.1	-32.9	0.0	40.1	74.0	-	54.0
1.130	V	52.8	-	24.6	-32.4	0.0	45.0	74.0	-	54.0
1.152	V	50.0	-	24.6	-32.4	0.0	42.2	74.0	-	54.0
1.196	V	58.2	-	25.2	-32.3	0.0	51.1	74.0	-	54.0
2.270	H	54.4	-	27.8	-30.5	0.0	51.7	74.0	-	54.0
2.349	H	56.7	46.5	28.1	-30.3	0.0	54.5	74.0	44.3	54.0
2.368	H	59.4	49.8	28.1	-30.4	0.0	57.1	74.0	47.5	54.0
4.824	V	45.6	-	27.1	-27.2	0.0	45.5	74.0	-	54.0
7.237	V	41.3	-	30.0	-26.4	0.0	44.9	74.0	-	54.0

Table 7-2-2. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.6(2437MHz) **TX** mode 11Mbps

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										
2.436	H	109.1	101.0	28.3	-28.4	0.0	109.0	OB*	100.9	OB*
Adjacent RB										
2.390	H	56.7	47.2	28.2	-30.4	0.0	54.5	74.0	45.0	54.0
2.496	H	56.4	50.5	28.4	-30.2	0.0	54.6	74.0	48.7	54.0
1.008	V	49.0	-	24.1	-32.9	0.0	40.2	74.0	-	54.0
1.130	V	52.8	-	24.6	-32.4	0.0	45.0	74.0	-	54.0
1.152	V	49.9	-	24.6	-32.4	0.0	42.1	74.0	-	54.0
1.198	V	54.2	-	25.2	-32.3	0.0	47.1	74.0	-	54.0
2.310	H	54.0	-	28.0	-30.3	0.0	51.7	74.0	-	54.0
2.337	H	52.2	-	28.1	-30.3	0.0	50.0	74.0	-	54.0
2.368	H	58.0	49.5	28.1	-30.4	0.0	55.7	74.0	47.2	54.0
4.874	V	45.9	-	27.0	-26.9	0.0	46.0	74.0	-	54.0
7.316	V	40.0	-	29.9	-25.8	0.0	44.1	74.0	-	54.0

Table 7-2-3. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.11(2462MHz) **TX** mode 11Mbps

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										
2.461	H	109.1	101.0	28.4	-30.2	0.0	107.3	OB*	99.2	OB*
Adjacent RB										
2.484	H	60.4	51.5	28.4	-30.2	0.0	58.6	74.0	49.7	54.0
2.496	H	58.0	50.3	28.4	-30.2	0.0	56.2	74.0	48.5	54.0
1.008	V	48.2	-	24.1	-32.9	0.0	39.4	74.0	-	54.0
1.130	V	52.3	-	24.6	-32.4	0.0	44.5	74.0	-	54.0
1.152	V	50.3	-	24.6	-32.4	0.0	42.5	74.0	-	54.0
1.196	V	55.1	-	25.2	-32.3	0.0	48.0	74.0	-	54.0
2.305	H	52.7	-	28.0	-30.3	0.0	50.4	74.0	-	54.0
2.337	H	54.1	-	28.1	-30.3	0.0	51.9	74.0	-	54.0
2.369	H	55.2	-	28.1	-30.4	0.0	52.9	74.0	-	54.0
4.924	V	48.0	-	27.0	-27.7	0.0	47.3	74.0	-	54.0
7.387	V	40.9	-	29.8	-26.2	0.0	44.5	74.0	-	54.0

Table 7-2-4. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.6(2437MHz) **RX** mode

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)***
1.008	V	49.4	-	24.1	-32.9	0.0	40.6	74.0	-	54.0
1.130	V	52.2	-	24.6	-32.4	0.0	44.4	74.0	-	54.0
1.152	V	49.3	-	24.6	-32.4	0.0	41.5	74.0	-	54.0
1.198	V	55.6	-	25.2	-32.3	0.0	48.5	74.0	-	54.0
1.860	V	49.0	-	27.4	-30.9	0.0	45.5	74.0	-	54.0

7.4.2 EUT in 5.8GHz IEEE802.11a transmission mode

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

Table 7-3-1. EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.149(5745MHz) **TX** mode 24Mbps

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										
5.751	V	102.6	91.3	34.0	-26.6	0.0	110.0	OB*	98.7	OB*
1.066	V	51.1	-	24.6	-32.7	0.0	43.0	74.0	-	54.0
1.130	V	52.6	-	24.6	-32.4	0.0	44.8	74.0	-	54.0
1.152	V	51.1	-	24.6	-32.4	0.0	43.3	74.0	-	54.0
1.192	V	56.0	-	25.2	-32.3	0.0	48.9	74.0	-	54.0
5.416	V	48.7	38.2	34.1	-26.9	0.0	55.9	74.0	45.4	54.0
11.491	V	36.0	-	33.5	-21.6	0.0	47.9	74.0	-	54.0

Table 7-3-2 EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.157(5785MHz) **TX** mode 24Mbps

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										
5.791	V	103.9	91.4	34.2	-26.3	0.0	111.8	OB*	99.3	OB*
1.066	V	51.1	-	24.6	-32.7	0.0	43.0	74.0	-	54.0
1.130	V	52.6	-	24.6	-32.4	0.0	44.8	74.0	-	54.0
1.152	V	49.0	-	24.6	-32.4	0.0	41.2	74.0	-	54.0
1.192	V	55.1	-	25.2	-32.3	0.0	48.0	74.0	-	54.0
5.416	V	49.2	37.9	34.1	-26.9	0.0	56.4	74.0	45.1	54.0
11.569	H	38.6	-	33.5	-21.7	0.0	50.4	74.0	-	54.0

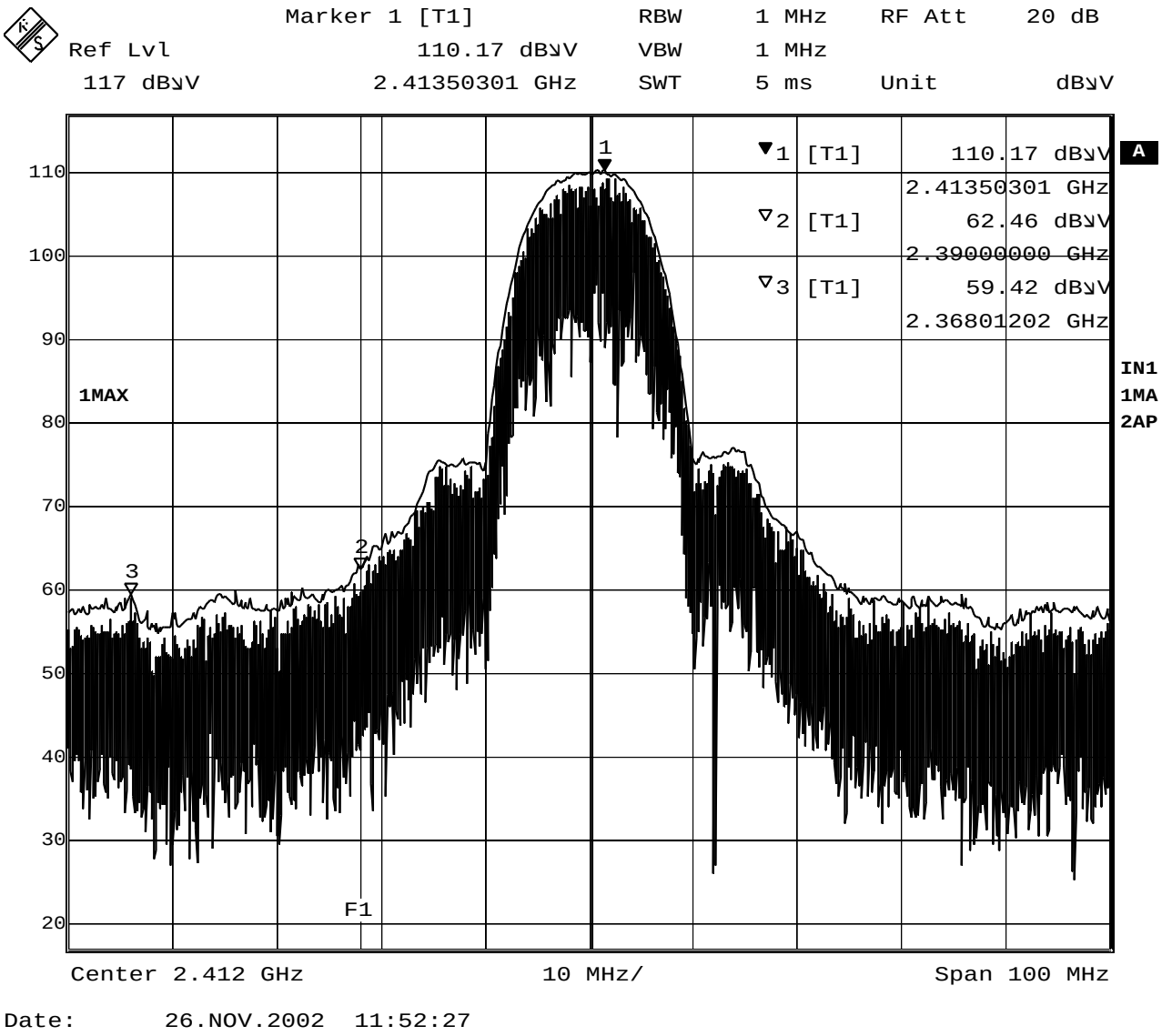
Table 7-3-3 EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.165(5825MHz) **TX** mode 24Mbps

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										
5.830	V	104.3	92.3	34.0	-26.2	0.0	112.1	OB*	100.1	OB*
1.064	V	52.5	-	24.6	-32.7	0.0	44.4	74.0	-	54.0
1.130	V	52.4	-	24.6	-32.4	0.0	44.6	74.0	-	54.0
1.152	V	50.2	-	24.6	-32.4	0.0	42.4	74.0	-	54.0
1.198	V	55.8	-	25.2	-32.3	0.0	48.7	74.0	-	54.0
4.665	V	49.0	-	32.5	-28.2	0.0	53.3	74.0	-	54.0
5.416	V	49.2	37.8	34.1	-26.9	0.0	56.4	74.0	45.0	54.0
11.651	H	35.5	-	33.6	-21.6	0.0	47.5	74.0	-	54.0

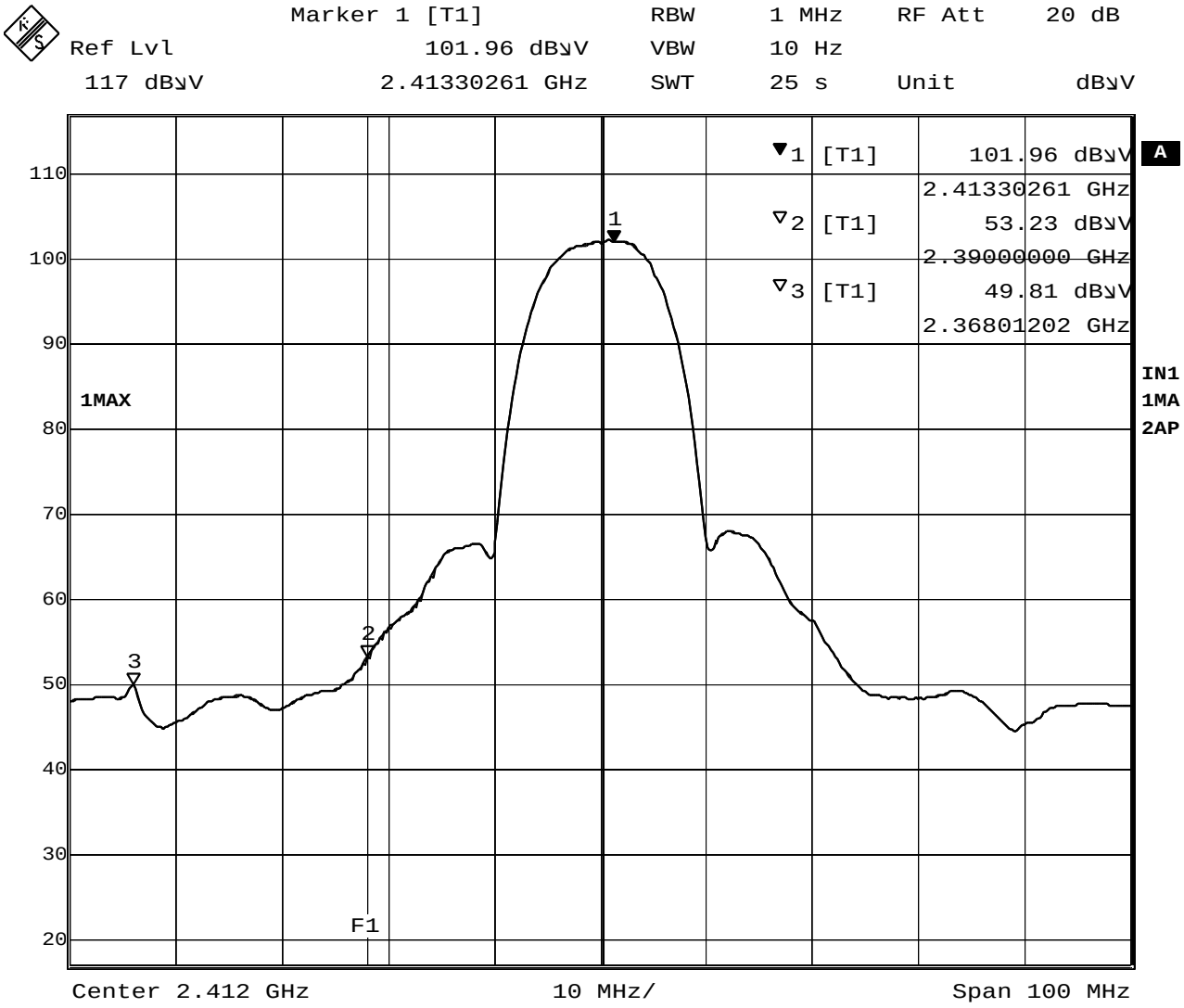
Table 7-3-4 EUT: M/T 2672-CHU, s/n ZZ-00094, Ch.157(5785MHz) **RX** mode

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)***
1.062	V	55.3	-	24.6	-32.7	0.0	47.2	74.0	-	54.0
1.130	V	52.5	-	24.6	-32.4	0.0	44.7	74.0	-	54.0
1.152	V	51.6	-	24.6	-32.4	0.0	43.8	74.0	-	54.0
1.192	V	56.4	-	25.2	-32.3	0.0	49.3	74.0	-	54.0

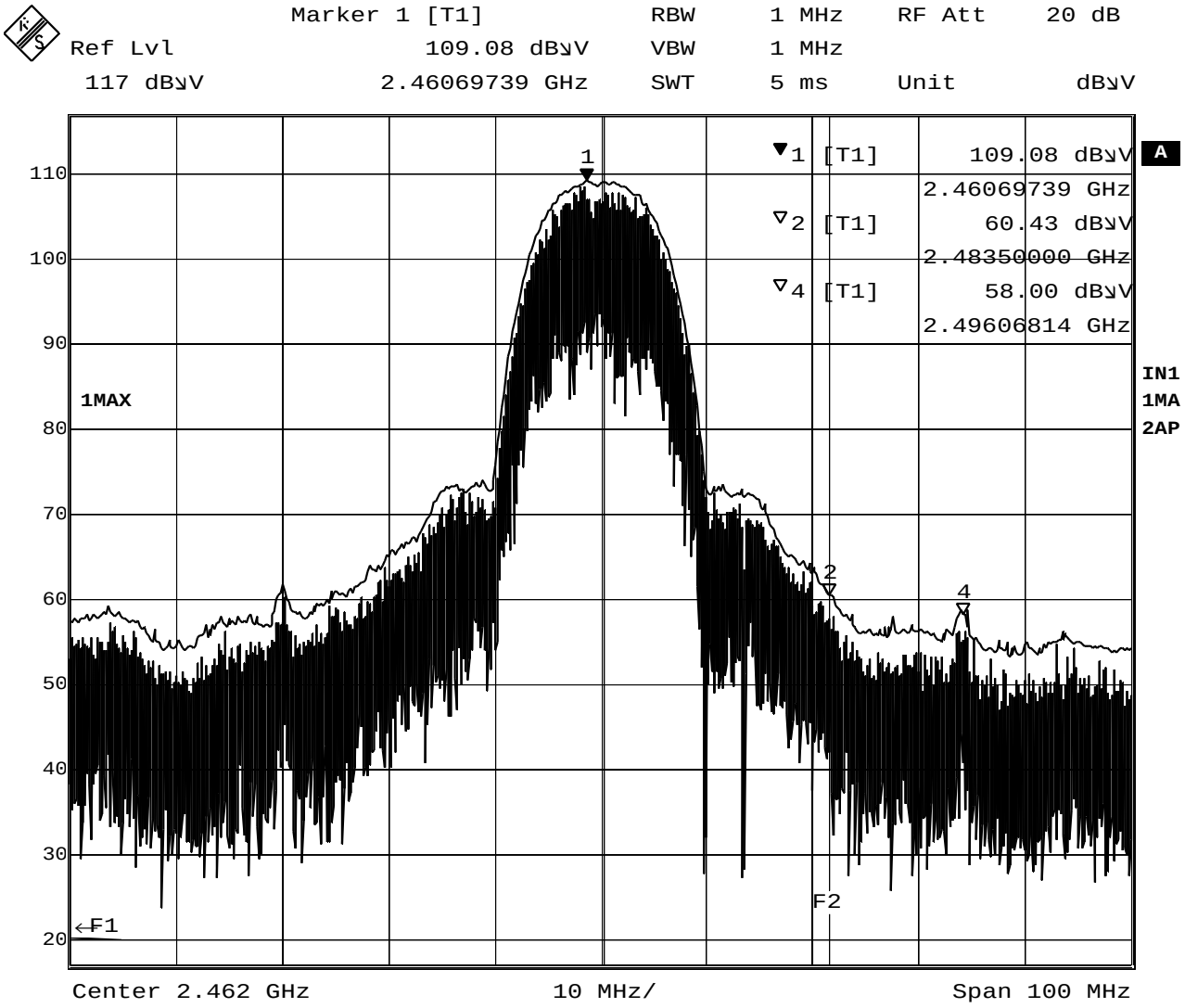
7.5 Measurement plots of adjacent restricted band



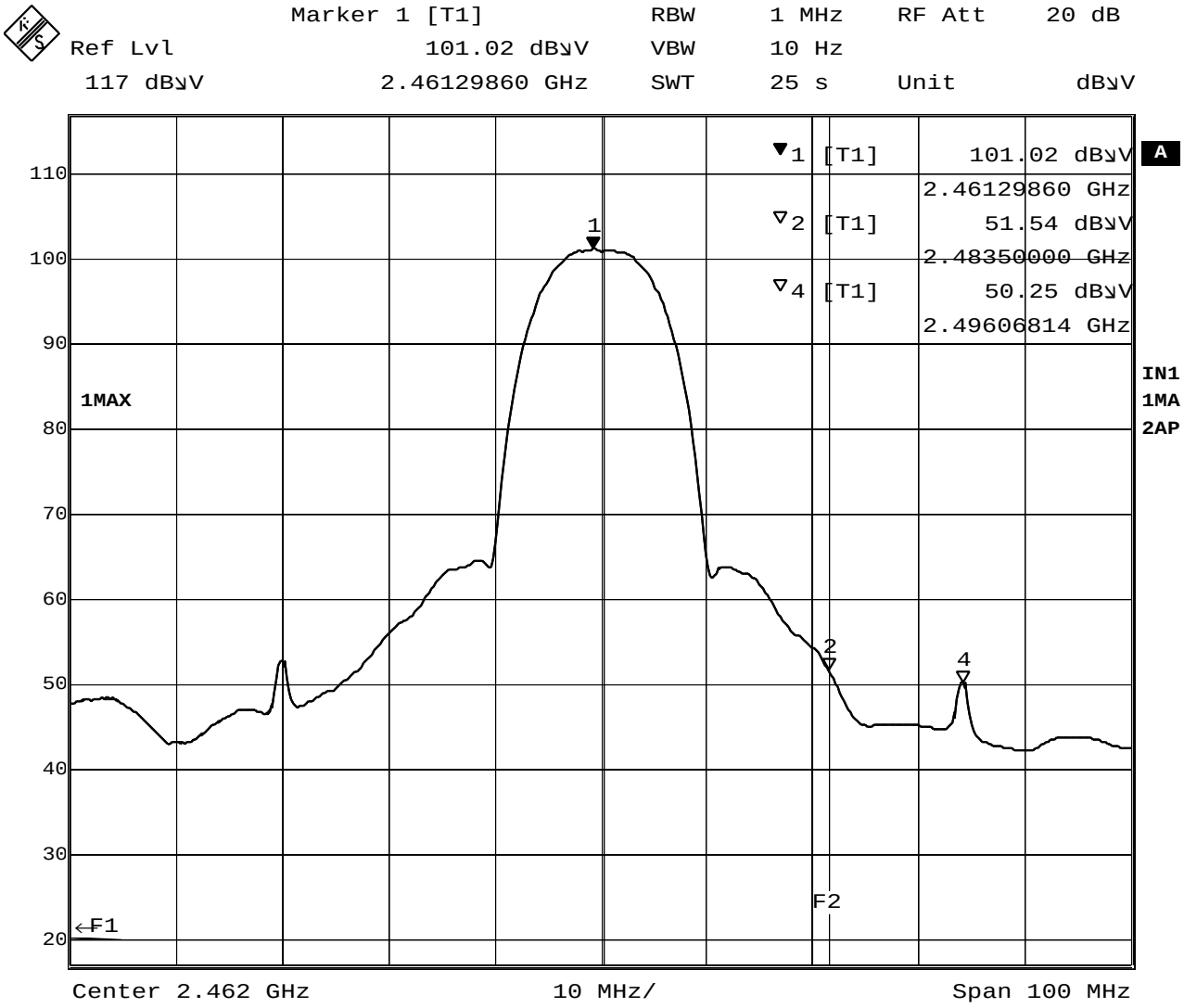
Plot 7-3-1 Ch.1 2412MHz TX 11Mb/s (Peak)



Plot 7-3-2 Ch.1 2412MHz TX11Mb/s (Average)



Plot 7-3-3 Ch.11 2462MHz TX 11Mb/s (Peak)



Plot 7-3-4 Ch.11 2462MHz TX 11Mb/s (Average)

Emission Test Report
Standard: FCC Part 15 Subpart C / IC RSS-210

Document Number : FCC 19-0246-0

Product: IBM 11a/b/g Wireless LAN Mini PCI Adapter

measured with **IBM ThinkPad T40 Series**

FCC ID: ANO20030400LEG
IC: 349E-PH12127E

May 22, 2003

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Note :

The measurements in this test report were performed for the previous submission of the following device.

FCC ID: ANO20020302R1L(Granted date: Feb/26/2003)
IC: 349E-PH11107E (Approval date:Feb/26/2003, TAC number: 17674)

However, the core PCB and RF components of the applying transmitter module supplied by Philips Components are the same as the previous ones except a slight modification.
Refer to the attestation of the Philips Components in the “Submittal Outline” exhibit.

Therefore there is no change placed on the RF characteristics, and the measurement results in this report are valid for the applying device.

The following is the comparison of the measurement results to prove the equivalence between the previous and the applying device.

6dB Bandedge

Center Frequency (MHz)	submittal results (MHz)	sampling results tested with the new adapter (MHz)
2412 (ch. 1, 11Mb/s)	10.82	10.84
2437 (ch. 6, 11Mb/s)	11.12	11.36
2462 (ch. 11, 11Mb/s)	10.70	11.06
5745 (ch.149, 24Mb/s)	16.66	16.66
5785 (ch.157, 24Mb/s)	16.66	16.66
5825 (ch.165, 24Mb/s)	16.66	16.66

Peak conducted transmission output power

Center Frequency (MHz)	submittal results (dBm)	sampling results tested with the new adapter (dBm)
2412 (ch. 1, 11Mb/s)	17.1	17.0
2437 (ch. 6, 11Mb/s)	16.8	16.8
2462 (ch. 11, 11Mb/s)	17.0	17.0
5745 (ch.149, 24Mb/s)	16.7	16.7
5785 (ch.157, 24Mb/s)	16.4	16.4
5825 (ch.165, 24Mb/s)	16.5	16.3

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

IBM 11a/b/g Wireless LAN Mini PCI Adapter
with
IBM ThinkPad T40 Series
(Machine type : 2373, 2374, 2375, 2376, 2378, 2379)

FCC ID : ANO20030400LEG

May 22, 2003

This report concerns: (check one) Original Grant _____ Class I change _____ Class II change ✓ Equipment type: Wireless LAN device
This report shall not be reproduced except in full, without the written permission of this test lab.
The measurement results contained in this report relate only to the item which was tested.
Measurement procedure used is ANSI C63.4-2000 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.
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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Prepared by: Takeshi Asano IBM Japan Corporation, Yamato EMC Enginnering LAB-S59, 1623-14, Shimotsuruma, Yamato-shi Kanagawa-ken 242-8502, Japan Tel: +81-46-215-4779 Fax: +81-46-273-7420

- Index -

A. GENERAL INFORMATION 6

A.1 TEST METHODOLOGY 6
A.2 TEST FACILITY / NVLAP ACCREDITATION 6
A.3 EUT DETAILS 6

B. SUMMARY OF TEST RESULTS 7

C. OPERATION MODE OF EUT 8

D. JUSTIFICATION 8

E. TEST INSTRUMENTS 9

F. MEASUREMENT UNCERTAINTY 10

G. TEMPERATURE AND HUMIDITY 11

H. RELATED SUBMITTAL(S)/GRANT(S)/NOTES 11

1. BANDWIDTH AT 6 DB BELOW 12

1.1 TEST PROCEDURE 12
1.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 12
1.3 MEASUREMENT RESULTS 12
1.4 TRACE DATA OF 6DB BANDWIDTH 13

2. OCCUPIED BANDWIDTH AT 20 DB BELOW / BANDEDGE, AND OUT OF BAND EMISSIONS 19

2.1 TEST PROCEDURE 19
2.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 19
2.3 MEASUREMENT RESULTS OF OCCUPIED BANDWIDTH/BAND-EDGE 19
2.4 MEASUREMENT RESULTS OF OUT OF BAND EMISSIONS 19
2.5 TRACE DATA OF 20DB BANDWIDTH 20
2.6 TRACE DATA OF OUT OF BAND EMISSIONS 26

3. CONDUCTED PEAK OUTPUT POWER 32

3.1 TEST PROCEDURE 32
3.2 MEASUREMENT RESULTS 33
3.4 TRACE DATA OF CONDUCTED PEAK OUTPUT POWER 34

4. PEAK POWER SPECTRAL DENSITY 40

4.1 TEST PROCEDURE 40
4.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 40
4.3 MEASUREMENT RESULTS 40
4.4 TRACE DATA OF PEAK POWER SPECTRAL DENSITY 41

5. AC WIRELINE CONDUCTED EMISSIONS (150KHZ – 30MHZ) 47

5.1 TEST PROCEDURE 47
5.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 47
5.3 MEASUREMENT RESULTS 48

6. RESTRICTED BANDS RADIATIONS (30MHZ – 1GHZ) 50

6.1 TEST PROCEDURE 50
6.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 50
6.3 FIELD STRENGTH CALCULATION 52
6.4 MEASUREMENT RESULTS 53

7. RESTRICTED BANDS RADIATIONS (1GHZ – 40GHZ) 56

7.1 TEST PROCEDURE 56
7.2 TEST INSTRUMENTS AND MEASUREMENT SETUP 56
7.3 FIELD STRENGTH CALCULATION 58
7.4 MEASUREMENT RESULTS 59
7.5 MEASUREMENT PLOTS OF ADJACENT RESTRICTED BAND 62

A. General Information

APPLICANT	: IBM Japan, Ltd.
TEST SITE	: IBM Japan, Ltd., Yamato Semi-anechoic chamber #1
TEST SITE ADDRESS	: 1623 – 14 Shimotsuruma, Yamato-shi, Kanagawa 242-8502 Japan Tel: +81-46-215-4779, Fax: +81-46-273-7420
REGULATION	: FCC Part 15 Subpart C Industry Canada RSS-210 (Issue No.5)
MODEL NUMBER	: 2373-92U (ThinkPad T40 Series)
FCC ID IC Certification Number	: ANO20030400LEG : 349E-PH12127E
SERIAL NUMBER	: ZZ-00129
PYSICAL CONDITION	: Preproduction
KIND OF EQUIPMENT	: Personal computer with a IEEE802.11a, 11b & 11g Wireless LAN Mini-PCI Combo Card (Composite application)
TESTED DATE	: November 18, December 5, 6, 9, 11, 18, 2002 and January 7, 2003

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 #2 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)
- This facility is accepted by **Industry Canada** in a letter dated March 19, 2001 as number **IC 349E** for chamber #2, and January 25, 2002 as number **IC 4221** for chamber #1.

A.3 EUT details

Table-A EUT details

Model and S/N	**FCC ID** **IC Certification Number**	**Description**
IBM 11a/b/g Wireless LAN Mini PCI Adapter (s/n A310037307)	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 2373-92U (s/n ZZ-00129)	N/A	IBM Notebook PC with built_in antenna CPU: Intel® Pentium® M Processor, 1.6GHz
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) **–**	Bandwidth at 6 dB below	FCC requirement	Conducted	Pass
– **5.9.1**	Bandwidth at 20 dB below Occupied BW (or Band-edge)	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 : 0.99 dBi	N/A
15.203 **6.2.2(o)(e2)**	Unique antenna connector	The device employs an unique **electronic handshake** connector. Refer to “Confidential_BIOS_Lock” exhibit.	complies
– **6.2.2(o)(d1)**	Power Spectral density for 2.4GHz unlicensed use	Conducted power / 20dB BW = 3.2mW/MHz	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 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	See the separate test report (Document number: FCC 19-0247-0).							
2.417 (Ch. 2)	+17	+17	+17								
2.422 (Ch. 3)	+17	+17	+17								
2.427 (Ch. 4)	+17	+17	+17								
2.432 (Ch. 5)	+17	+17	+17								
2.437 (Ch. 6)	+17	+17	+17								
2.442 (Ch. 7)	+17	+17	+17								
2.447 (Ch. 8)	+17	+17	+17								
2.452 (Ch. 9)	+17	+17	+17								
2.457 (Ch. 10)	+17	+17	+17								
2.462 (Ch. 11)	+17	+17	+17								
				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 in both 2.4GHz and 5.8GHz bands as shown below.

Table-D Peak Antenna Gains of EUT

2.4GHz	Left Antenna gain	**0.99** dBi (peak)
	Right Antenna gain	-0.48 dBi (peak)
5.8GHz	Left Antenna gain	**-0.23** dBi (peak)
	Right Antenna gain	-0.37 dBi (peak)

And the columns marked with shading in the Table-C are the worst cases of each Tx mode for all measurement items (i.e. conducted power, 6dB BW ..etc.). 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 5551-L	#4	N/A	N/A
Computer	IBM 6589-13J	97-15613	N/A	N/A
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2601A02634	08/28/02	1 year
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	3019A05155	02/15/02	1 year
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2841A04252	06/17/02	1 year
Spectrum Analyzer Display	HP 85662A	2542A12308	08/28/02	1 year
Spectrum Analyzer Display	HP 85662A	3026A19353	02/15/02	1 year
Spectrum Analyzer Display	HP 85662A	2816A16831	06/17/02	1 year
Quasi-Peak Adapter	HP 85650A	2043A00062	08/28/02	1 year
Quasi-Peak Adapter	HP 85650A	2811A01156	06/17/02	1 year
Quasi-Peak Adapter	HP 85650A	3033A01449	02/15/02	1 year
Amplifier (100KHz - 1.3GHz) - for 30-200MHz - for 200-1000MHz Amplifier (1 - 26.5GHz) Amplifier (26.5 - 40GHz)	 HP 8447D HP 8447D HP 8449B Agilent 83051A	 2805A02919 2944A03506 3008A00582 3950M00193	 04/15/02 04/15/02 06/13/02 12/06/01	 1 year 1 year 1 year 1 year
Spectrum Analyzer EMI Test Receiver	R&S ESI26	836119/003	07/18/02	1 year
Spectrum Analyzer	HP 8563E	3416A02248	08/14/02	1 year
Harmonic Mixer	Agilent 11970A	011269-001	07/19/02	1 year
Receiver (9kHz-30MHz)	R&S ESH3	891806/012	10/07/02	1 year
Receiver (20MHz-1.3GHz)	R&S ESVP	893202/018	02/06/02	1 year
Biconical Antenna (30-200MHz)	EMCO 3108	2309	05/06/02	1 year
Log-Periodic Antenna (200-1000MHz)	EMCO 3146	1585	05/06/02	1 year
Horn Antenna (1- 18GHz)	EMCO 3115	9903-5774	07/18/02	1 year
Horn Antenna (3.95- 5.85GHz)	EMCO 3160-5	1099	04/17/02	1 year
Horn Antenna (5.85- 8.20GHz)	EMCO 3160-6	9712-1044	04/17/02	1 year
Horn Antenna (8.2- 12.4GHz)	EMCO 3160-7	1156	04/17/02	1 year
Horn Antenna (12.4- 18GHz)	EMCO 3160-8	1143	04/17/02	1 year
Horn Antenna (18- 26.5GHz)	EMCO 3160-9	0004-1202	04/17/02	1 year
Horn Antenna (26.5- 40GHz)	EMCO 3160-10	1175	04/17/02	1 year
LISN	EMCO 3825/2	1426	09/01/02	1 year
Power Meter	HP 437B	3043U03437	11/08/02	1 year
Power Sensor	HP 8481A	US41030582	11/08/02	1 year
Switch/control unit	HP 3488A	2719A17226 2719A17228	N/A N/A	N/A N/A
Plotter	HP 7550A	2631A33619	N/A	N/A
Coaxial cables (1 – 18GHz):	Length:			

- Horn Ant <=> RF Amp.	6 m	- EM206SCO	09/05/02	1 year
- RF Amp.<=>Spectrum Analyzer(<12GHz)	15m	- EM215SCO	09/05/02	1 year
- RF Amp.<=>Spectrum Analyzer(>12GHz)	3 m	- SF102-20166	09/05/02	1 year
Coaxial cables (18 – 40GHz):				
- Horn Ant <=> RF Amp.	3m	- SF102-20167	09/05/02	1 year
- RF Amp.<=>Spectrum Analyzer	1m	- SF102-21105	09/05/02	1 year
N-Coax cables:				
- Bi-coni Ant <=> 10m Cable	9 m	- EM103L01	04/15/02	1 year
- 10m Cable <=> Shield Panel	10 m	- EM103L02	04/15/02	1 year
- Shield Panel <=> RF Amp	7 m	- EM103L03	04/15/02	1 year
- RF Amp <=> Power Splitter	0.5m	- EM103L04	04/15/02	1 year
- Log-peri Ant <=> 10m Cable	9 m	- EM103H01	04/15/02	1 year
- 10m Cable <=> Shield Panel	10 m	- EM103H02	04/15/02	1 year
- Shield Panel <=> RF Amp	7 m	- EM103H03	04/15/02	1 year
- RF Amp <=> Power Splitter	0.5m	- EM103H04	04/15/02	1 year
Coax cables:				
- Lisn-L <=> SW/Con.unit (SW100)	4 m	- EMIC-L	04/15/02	1 year
- Lisn-N <=> SW/Con.unit (SW101)	4 m	- EMIC-N	04/15/02	1 year
- SW/Con.unit <=> RCVR (Input)	1 m	- EMIC-R	04/15/02	1 year
- SW/Con.unit<=> Spe Ana.(Signal In)	1 m	- EMIC-S	04/15/02	1 year
- Power Splitter <=> SW/Con.unit (SW110)	1 m	- EM103L05	04/15/02	1 year
- Power Splitter <=> SW/Con.unit (SW300)	1 m	- EM103L06	04/15/02	1 year
- Power Splitter <=> SW/Con.unit (SW100)	1 m	- EM103H05	04/15/02	1 year
- Power Splitter <=> SW/Con.unit (SW301)	1 m	- EM103H06	04/15/02	1 year
- SW/Con.unit <=> Receiver (Input)	2 m	- EM1RCV	04/15/02	1 year
- SW/Con.unit <=> Spe Ana.(Signal In) for 30- 200MHz	2 m	- EM1SPL	04/15/02	1 year
- SW/Con.unit <=> Spe Ana.(Signal In) for 200-1000MHz	2 m	- EM1SPH	04/15/02	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

1.1 Test Procedure

The bandwidth at 6 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.
The spectrum analyzer is set to :
RBW=100kHz, VBW=100kHz[*1], Span=30MHz, 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

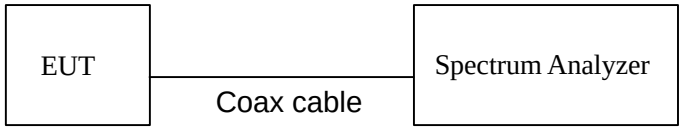


Figure 1: Measurement setup for 6dB bandwidth test

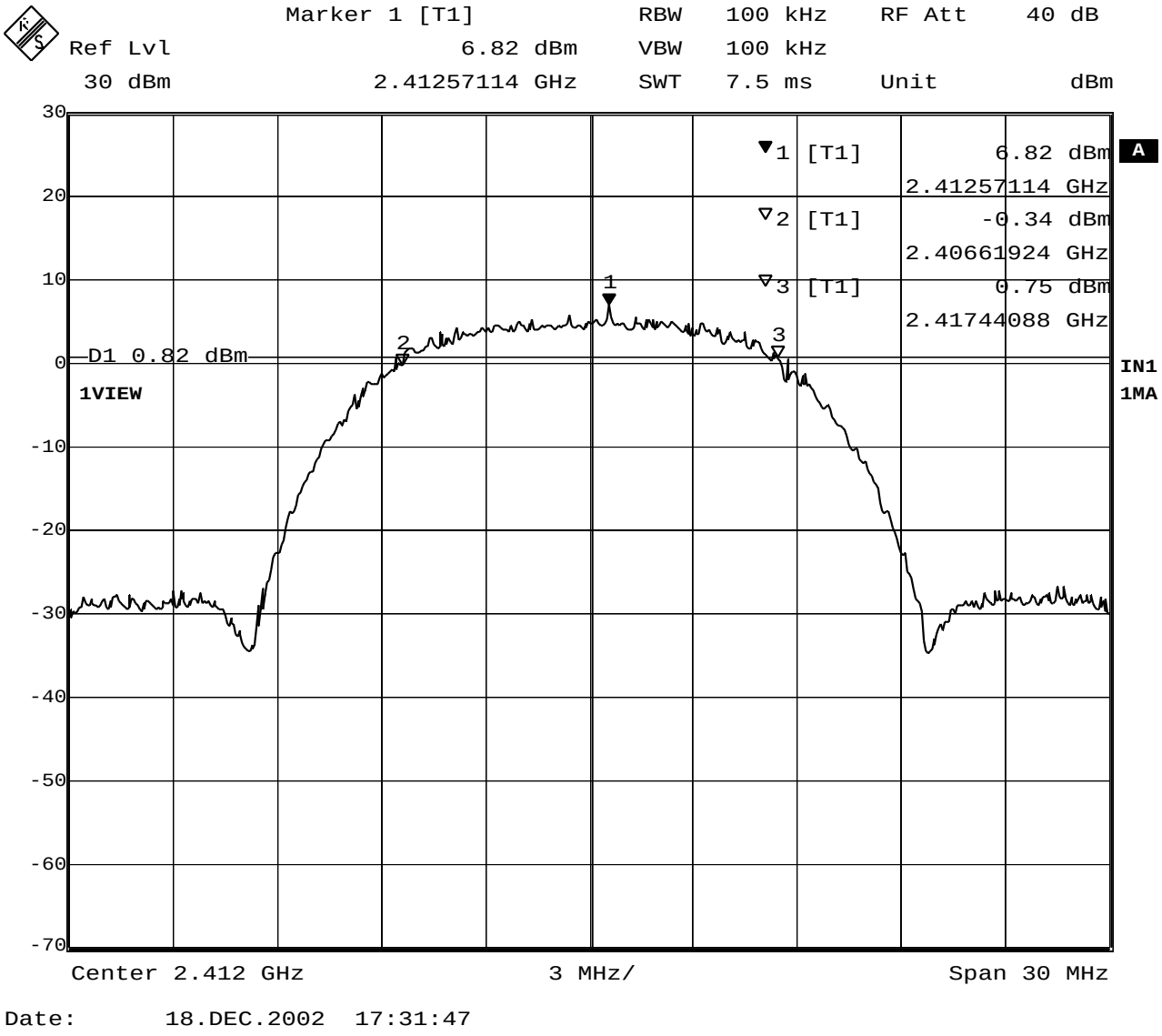
1.3 Measurement Results

Test Date: December 18, 2002

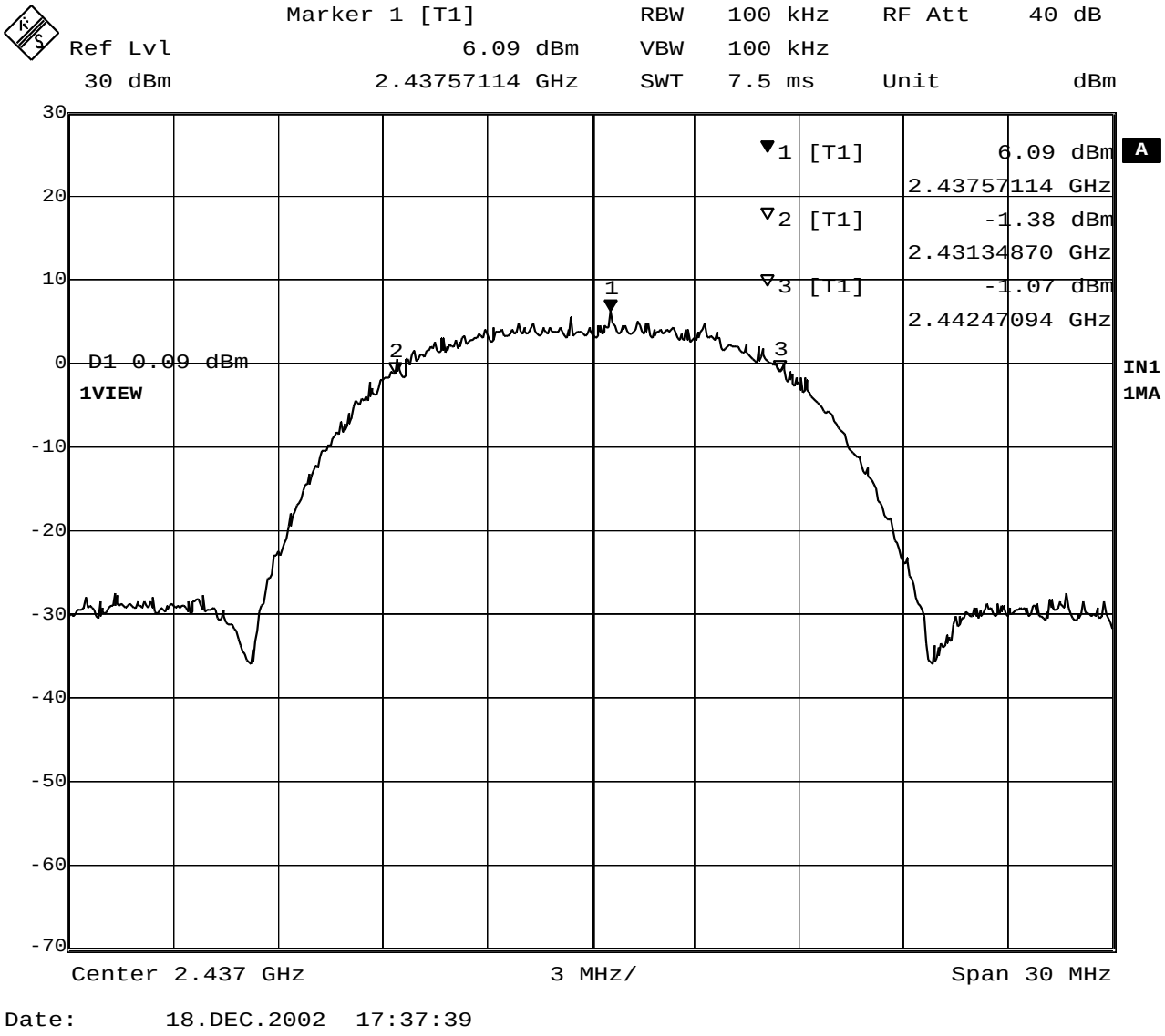
Table 1-2. EUT: M/T 2373-92U, s/n ZZ-00129 , TX mode

Center Frequency (MHz)	Trace number	Lower frequency (MHz)	Upper frequency (MHz)	Bandwidth at 6 dB below (MHz)	note
2412	Plot 1-1	2406.62	2417.44	10.82	> 500kHz
2437	Plot 1-2	2431.35	2442.47	11.12	
2462	Plot 1-3	2456.38	2467.08	10.70	
5745	Plot 1-4	5736.67	5753.33	16.66	> 500kHz
5785	Plot 1-5	5776.67	5793.33	16.66	
5825	Plot 1-6	5816.67	5833.33	16.66	

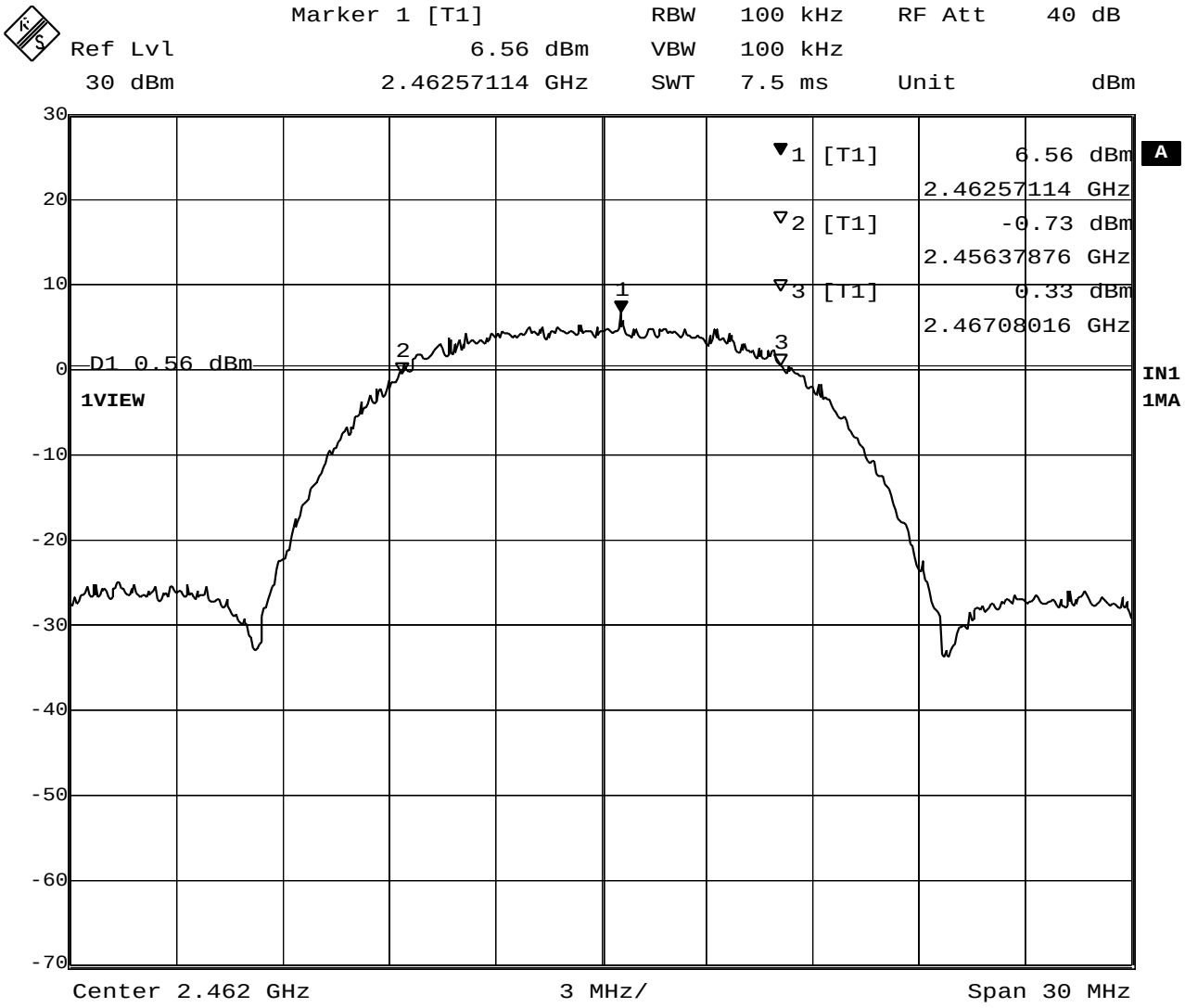
1.4 Trace Data of 6dB bandwidth



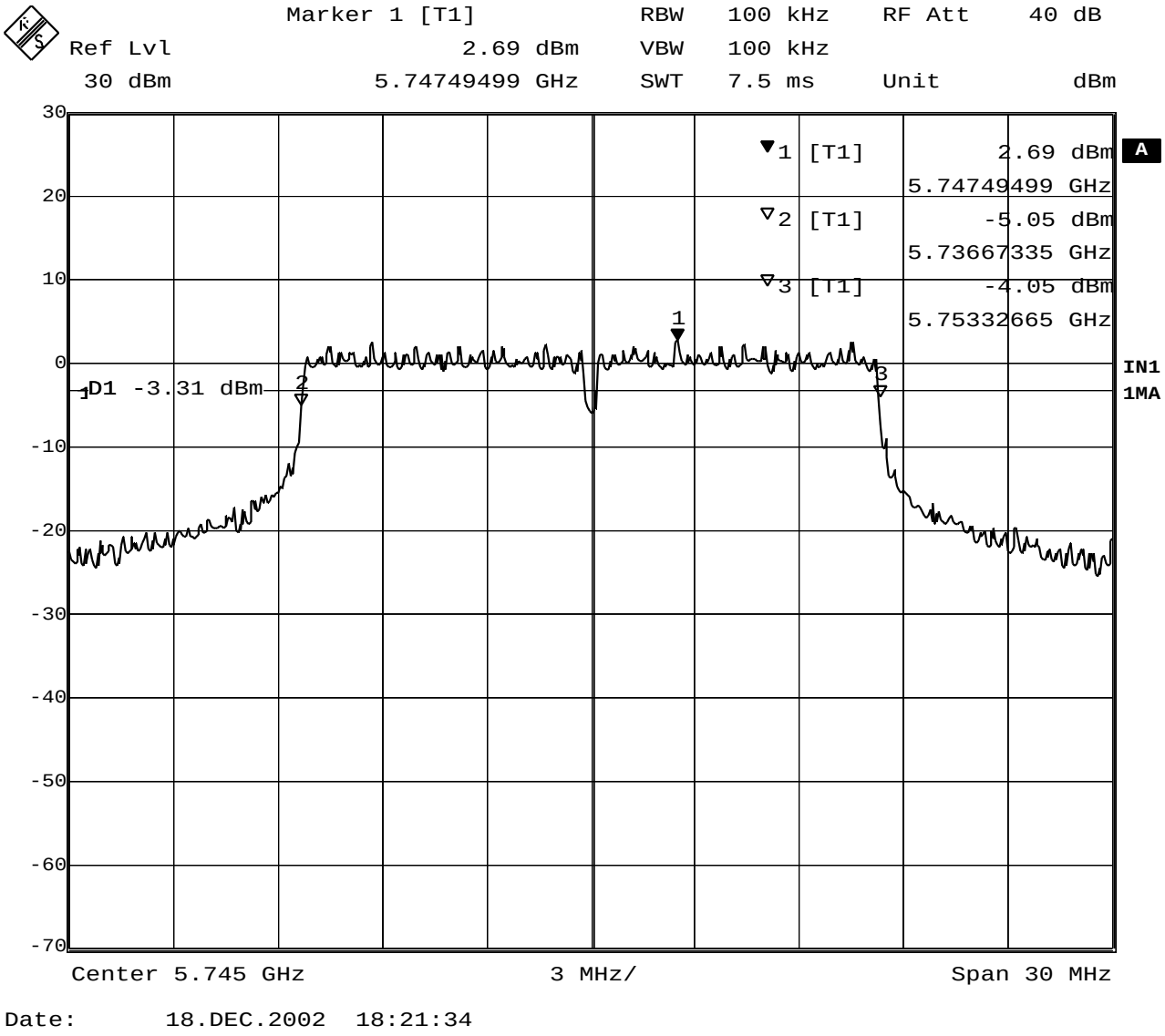
Plot 1-1. 6dB BW at 2412MHz



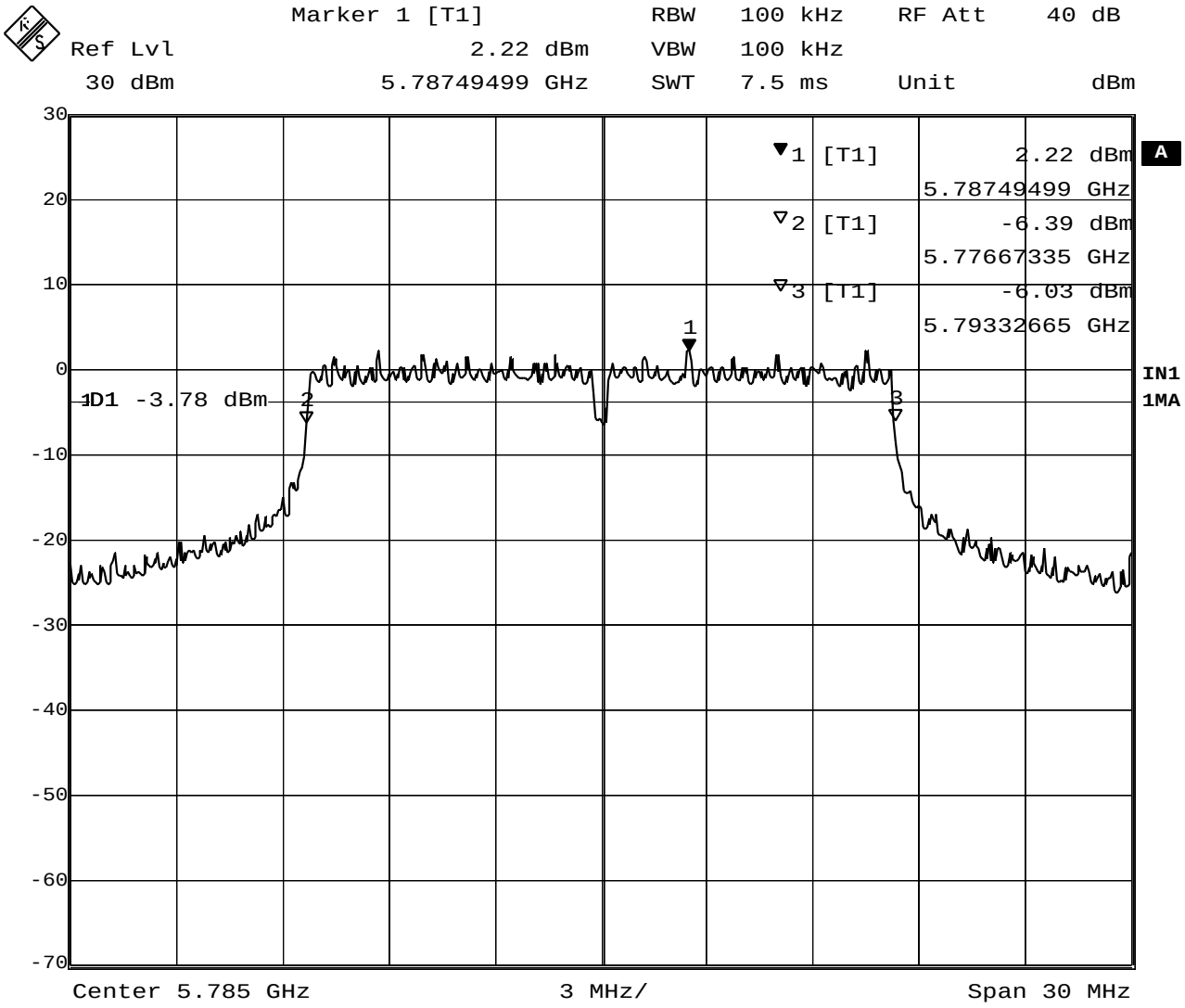
Plot 1-2. 6dB BW at 2437MHz



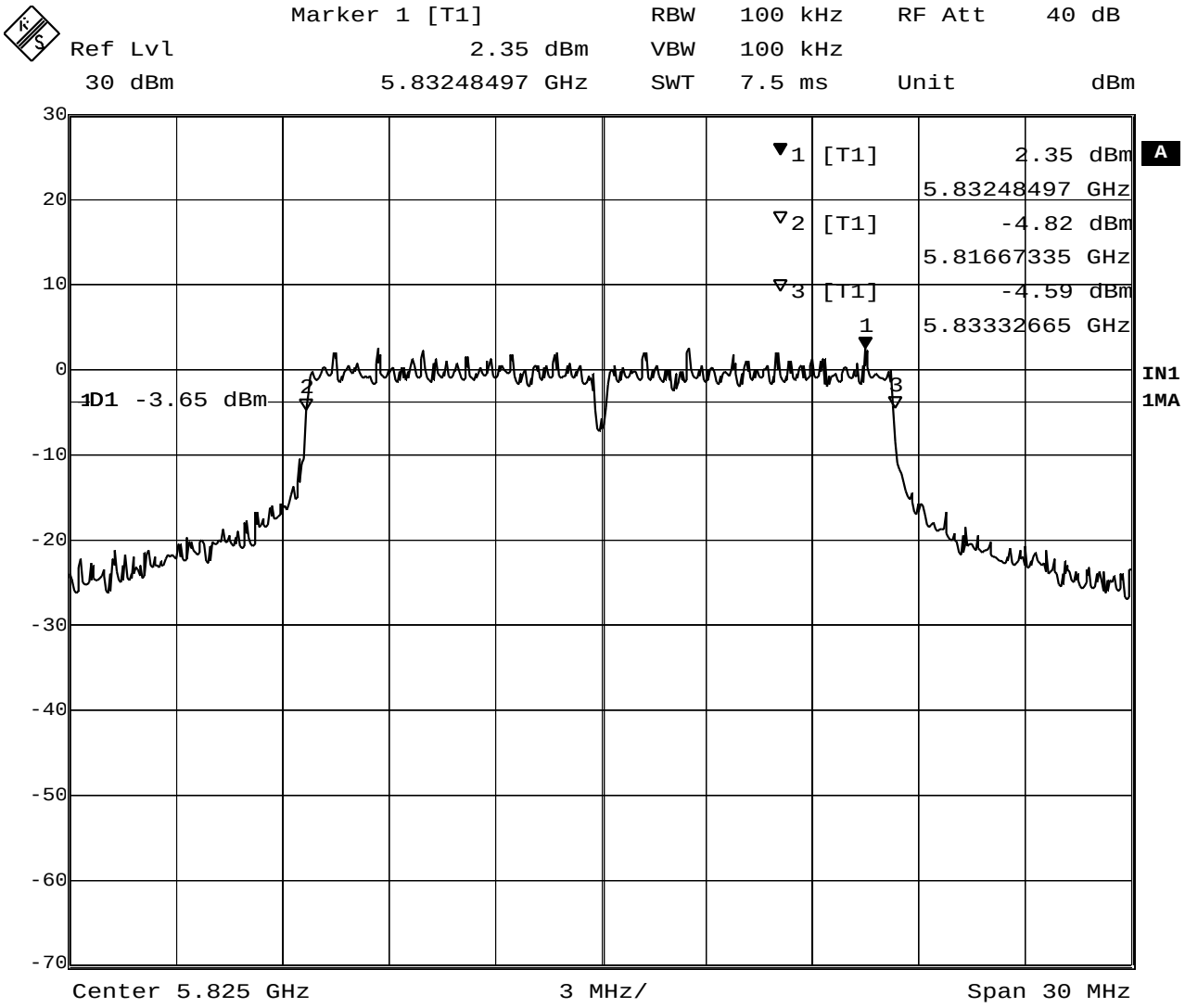
Plot 1-3. 6dB BW at 2462MHz



Plot 1-4. 6dB BW at 5745MHz



Plot 1-5. 6dB BW at 5785MHz



Plot 1-6. 6dB BW at 5825MHz

2. Occupied Bandwidth at 20 dB below / Bandedge, and Out of Band Emissions

2.1 Test Procedure

The bandwidth at 20 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.
The spectrum analyzer is set to:
RBW=100kHz, VBW=100kHz[*1], Span=50MHz, 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 of Occupied Bandwidth/Band-edge

Test Date: December 18, 2002

Table 2-1. EUT: M/T 2373-92U, s/n ZZ-00129 , TX mode

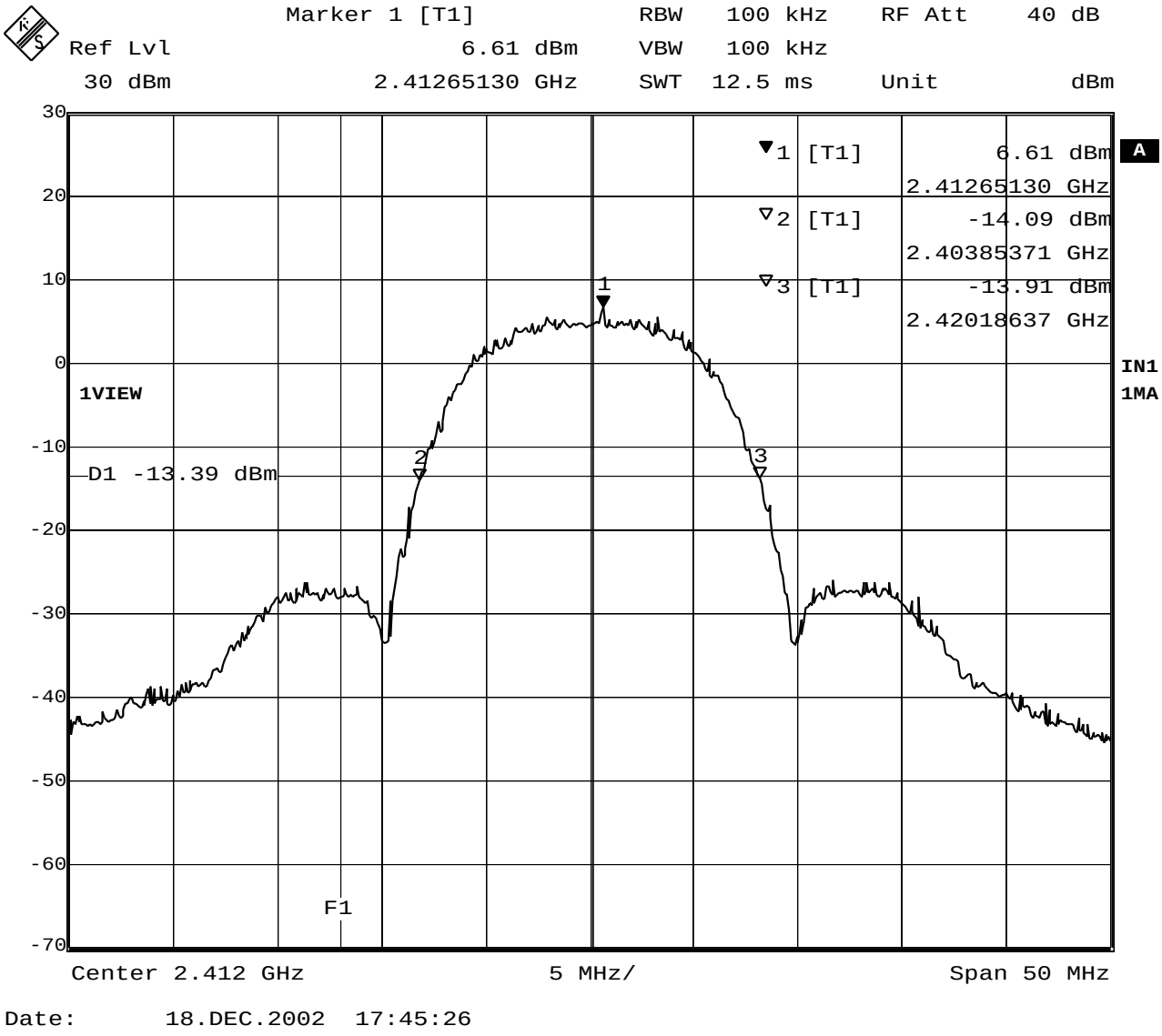
Center Frequency (MHz)	Trace number	Lower Frequency 20dB below (MHz)	Upper Frequency 20dB below (MHz)	Bandwidth at 20dB below (MHz)	Margin to Lower bandedge (MHz)	Margin to Upper bandedge (MHz)
2412	Plot 2-1	2403.85	2420.19	16.34	3.85	
2437	Plot 2-2	2428.73	2445.34	16.61		
2462	Plot 2-3	2453.83	2470.09	16.26		13.41
5745	Plot 2-4	5734.65	5754.59	19.94	9.65	
5785	Plot 2-5	5775.43	5794.27	18.84		
5825	Plot 2-6	5815.23	5834.27	19.04		15.73

2.4 Measurement Results of Out of Band Emissions

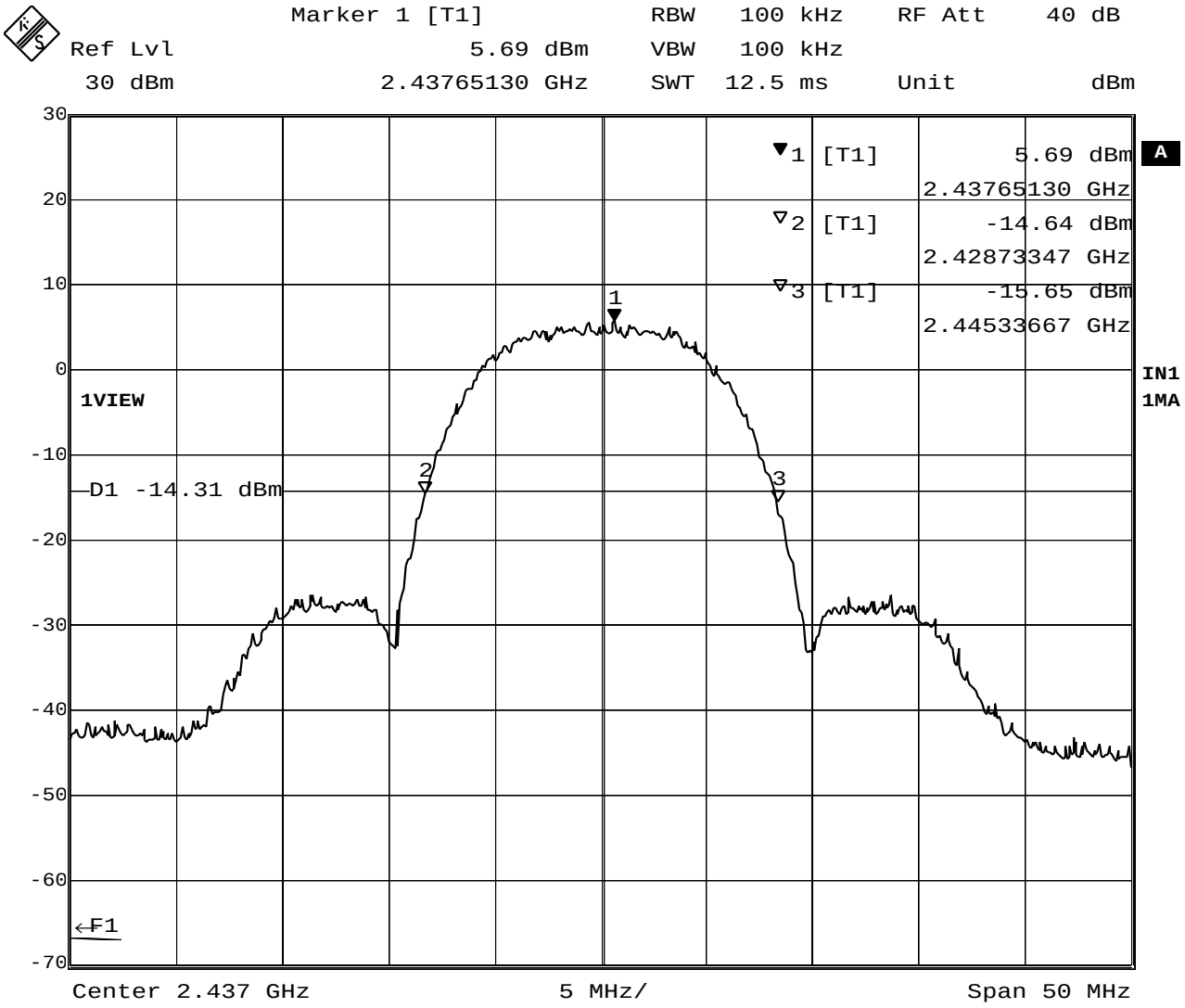
All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density.

Test Date: December 18, 2002 : See Plot 2-7 to 2-12.

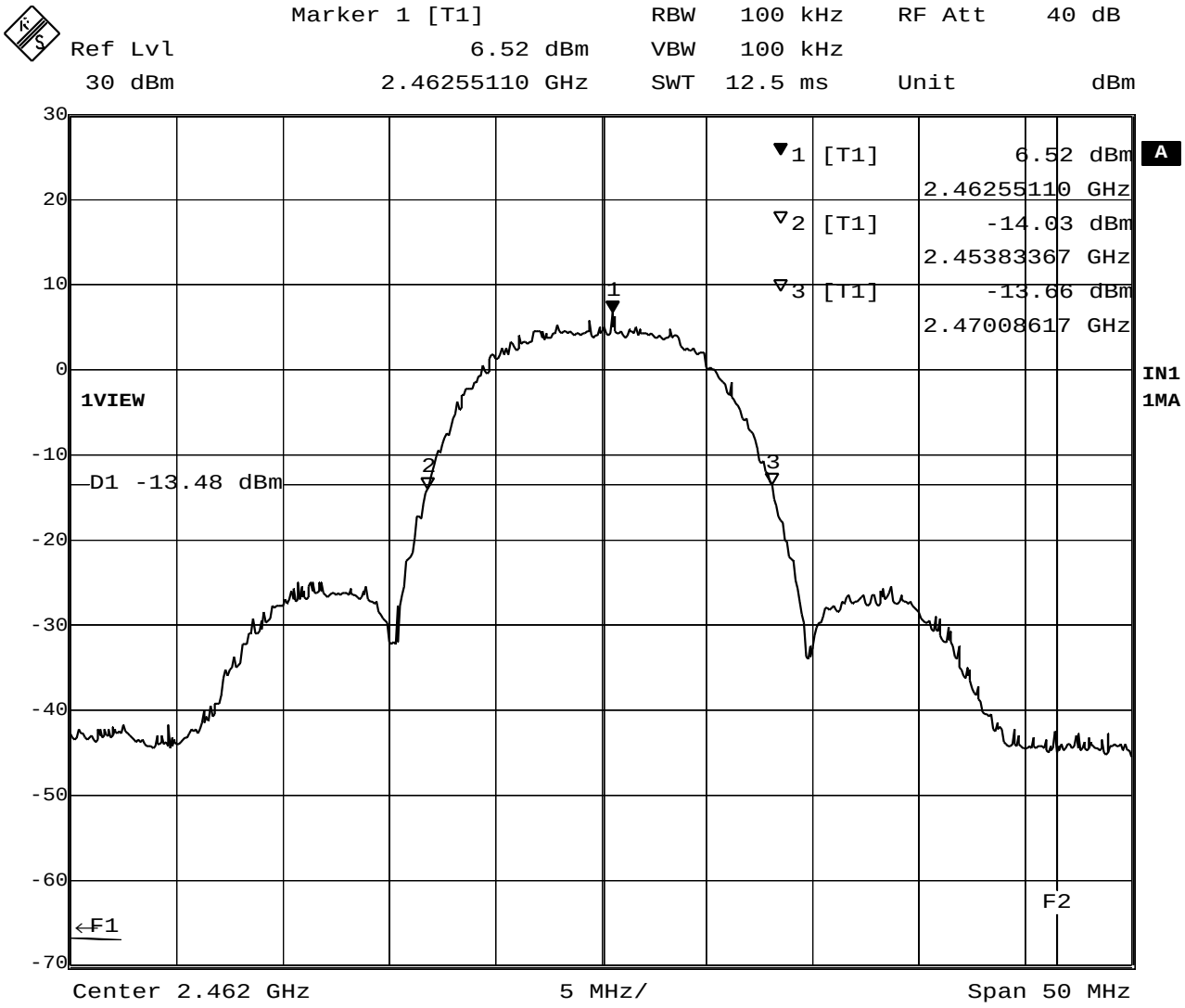
2.5 Trace Data of 20dB bandwidth



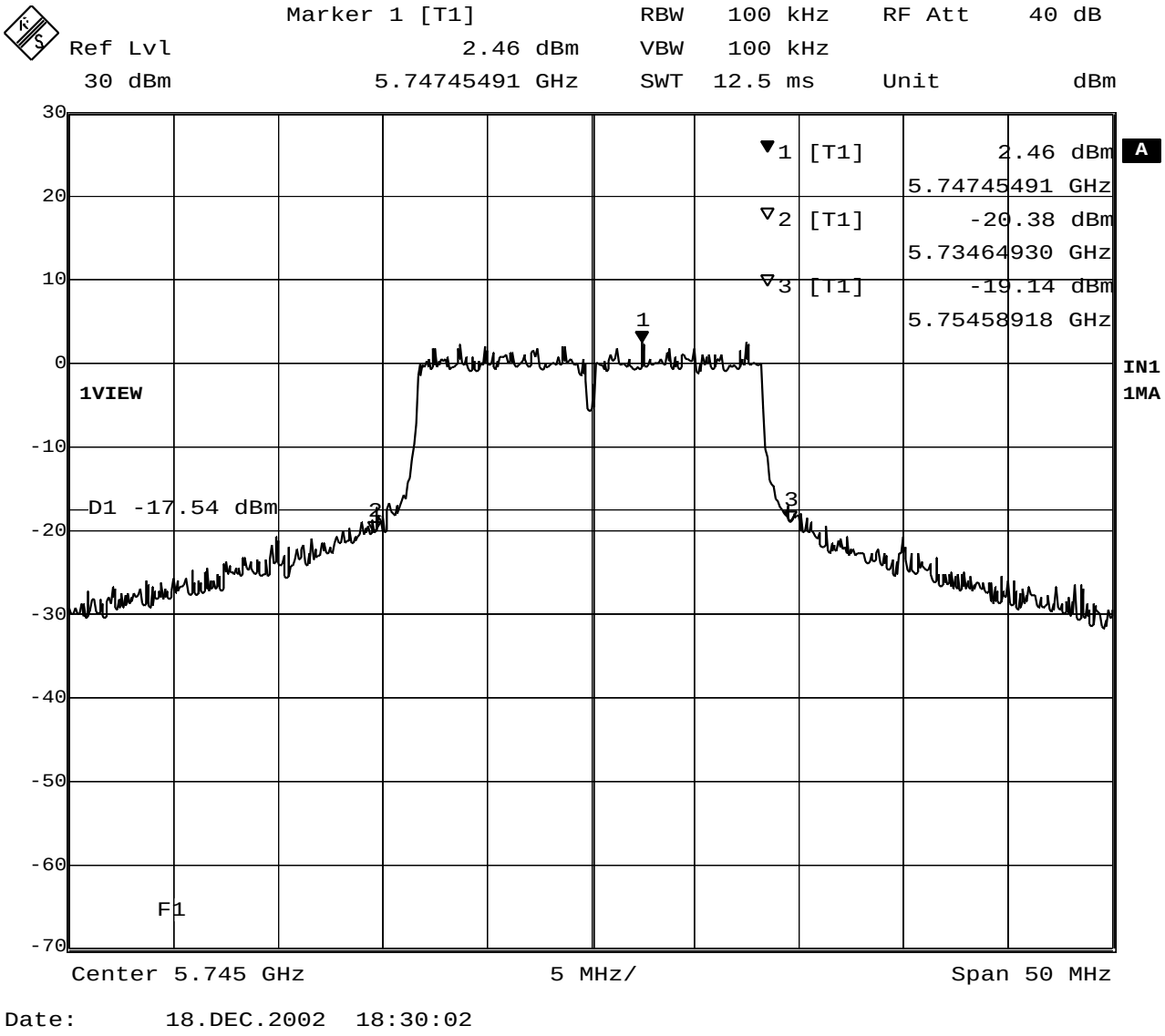
Plot 2-1. 20dB BW at 2412MHz



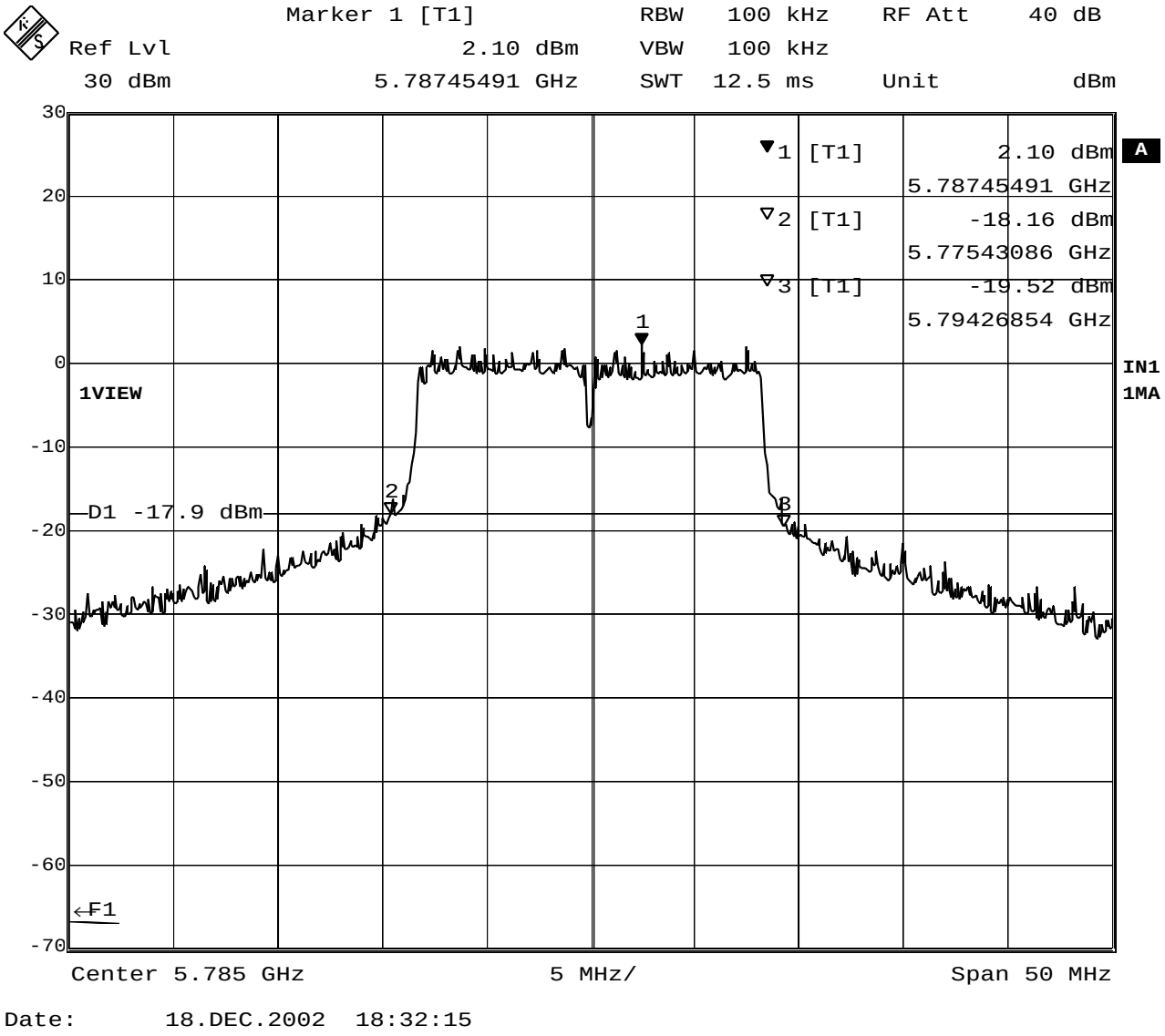
Plot 2-2. 20dB BW at 2437MHz



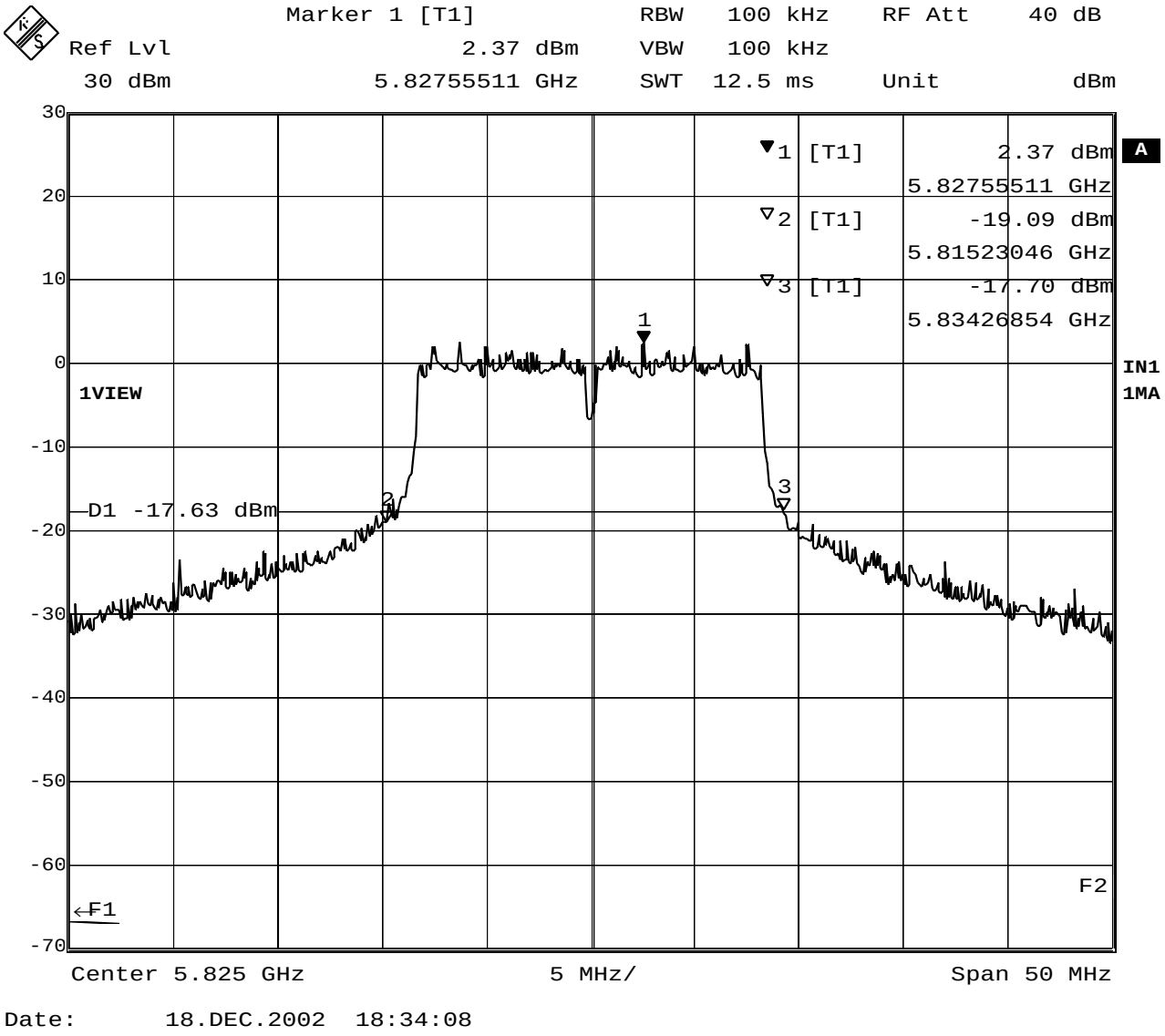
Plot 2-3. 20dB BW at 2462MHz



Plot 2-4. 20dB BW at 5745MHz

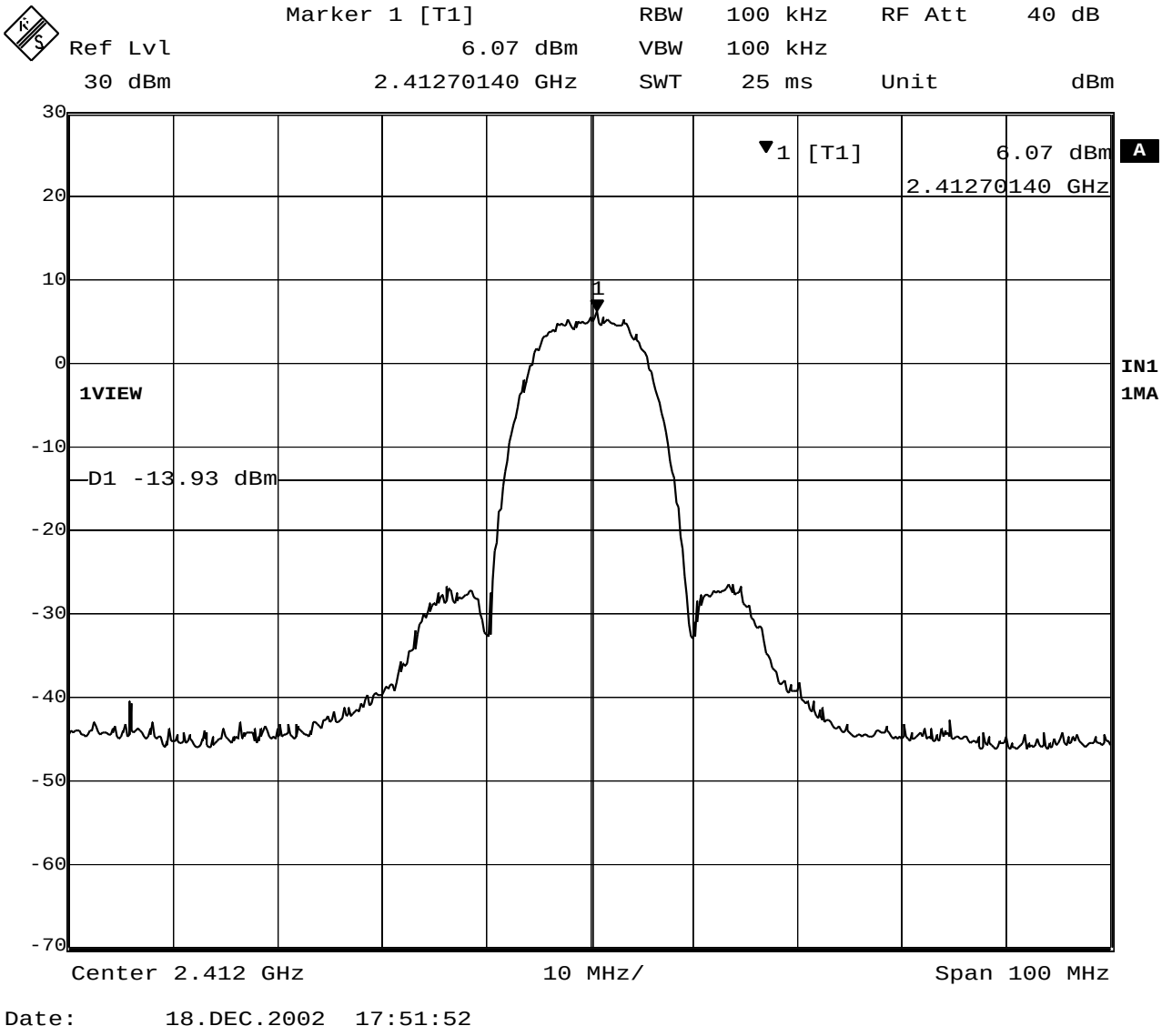


Plot 2-5. 20dB BW at 5785MHz

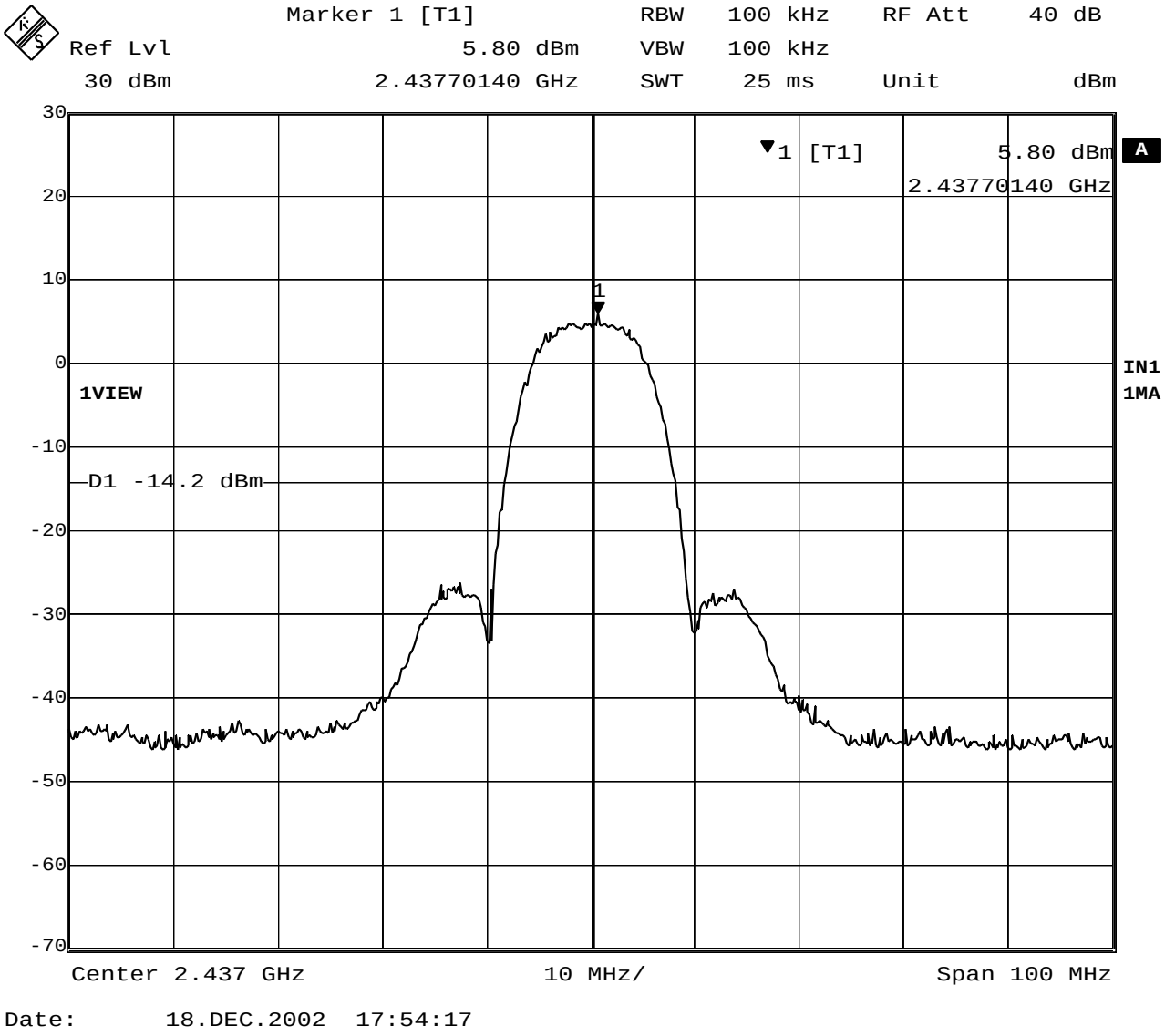


Plot 2-6. 20dB BW at 5825MHz

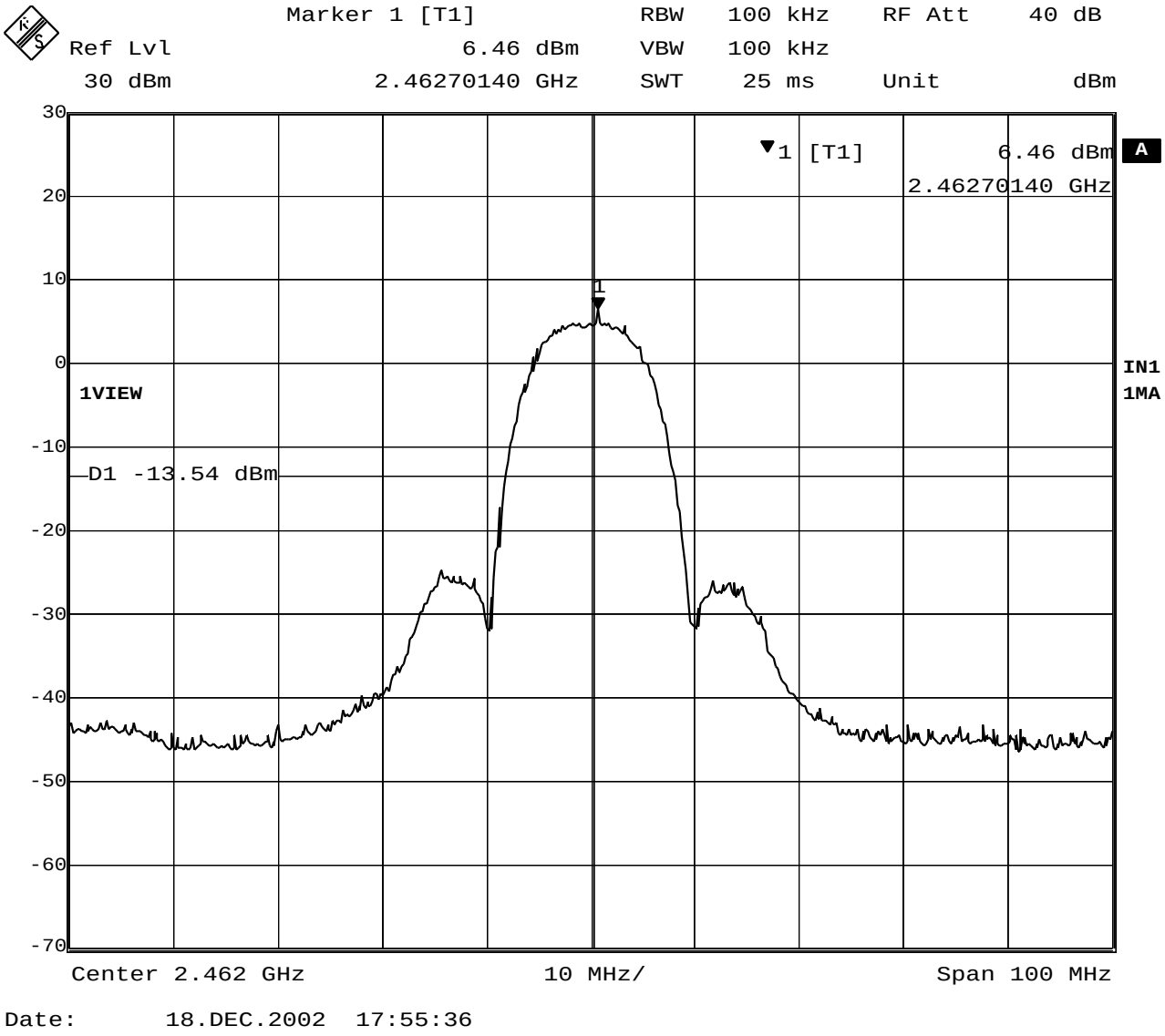
2.6 Trace Data of Out of Band Emissions



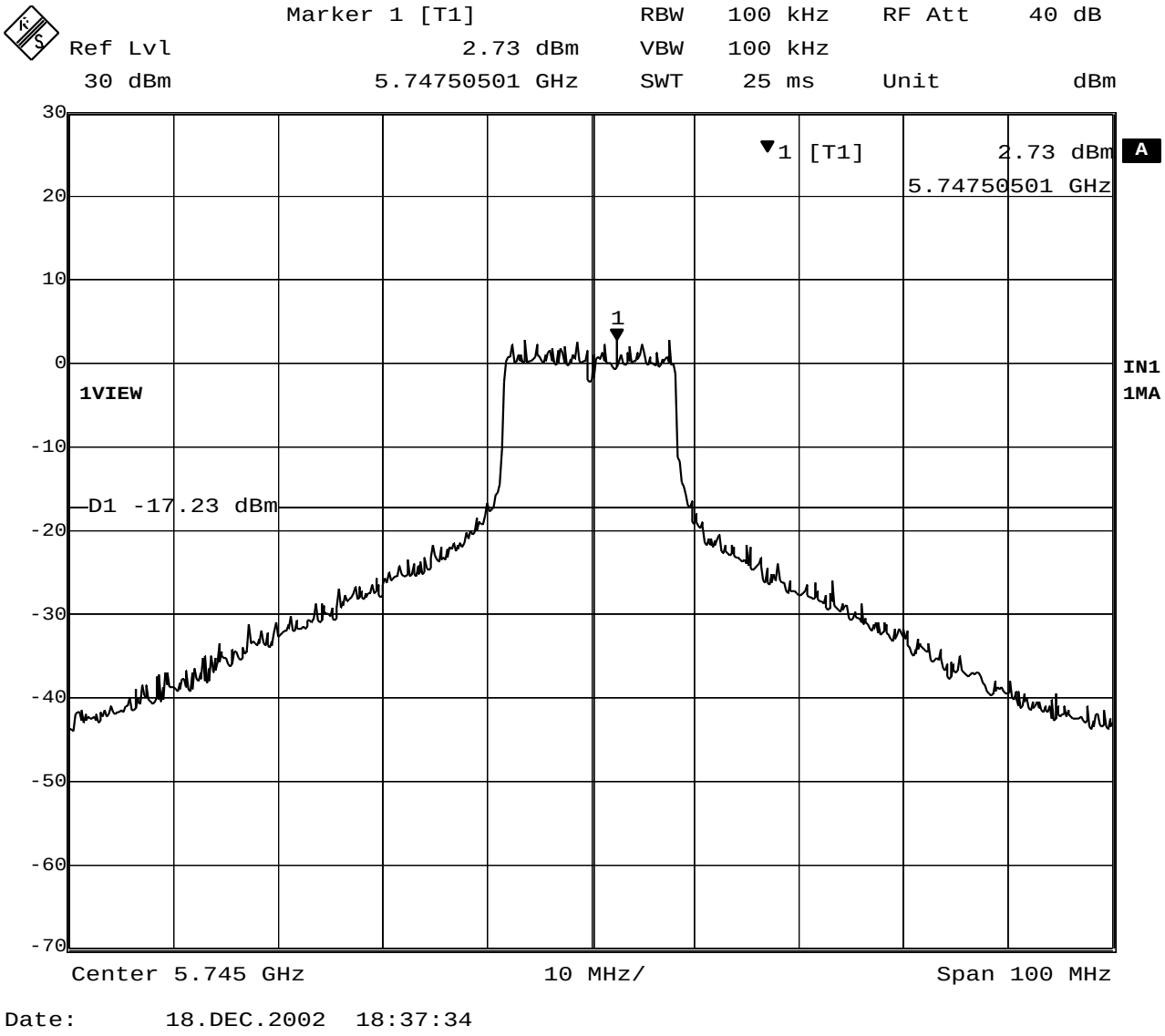
Plot 2-7. Out of band emissions around 2412MHz



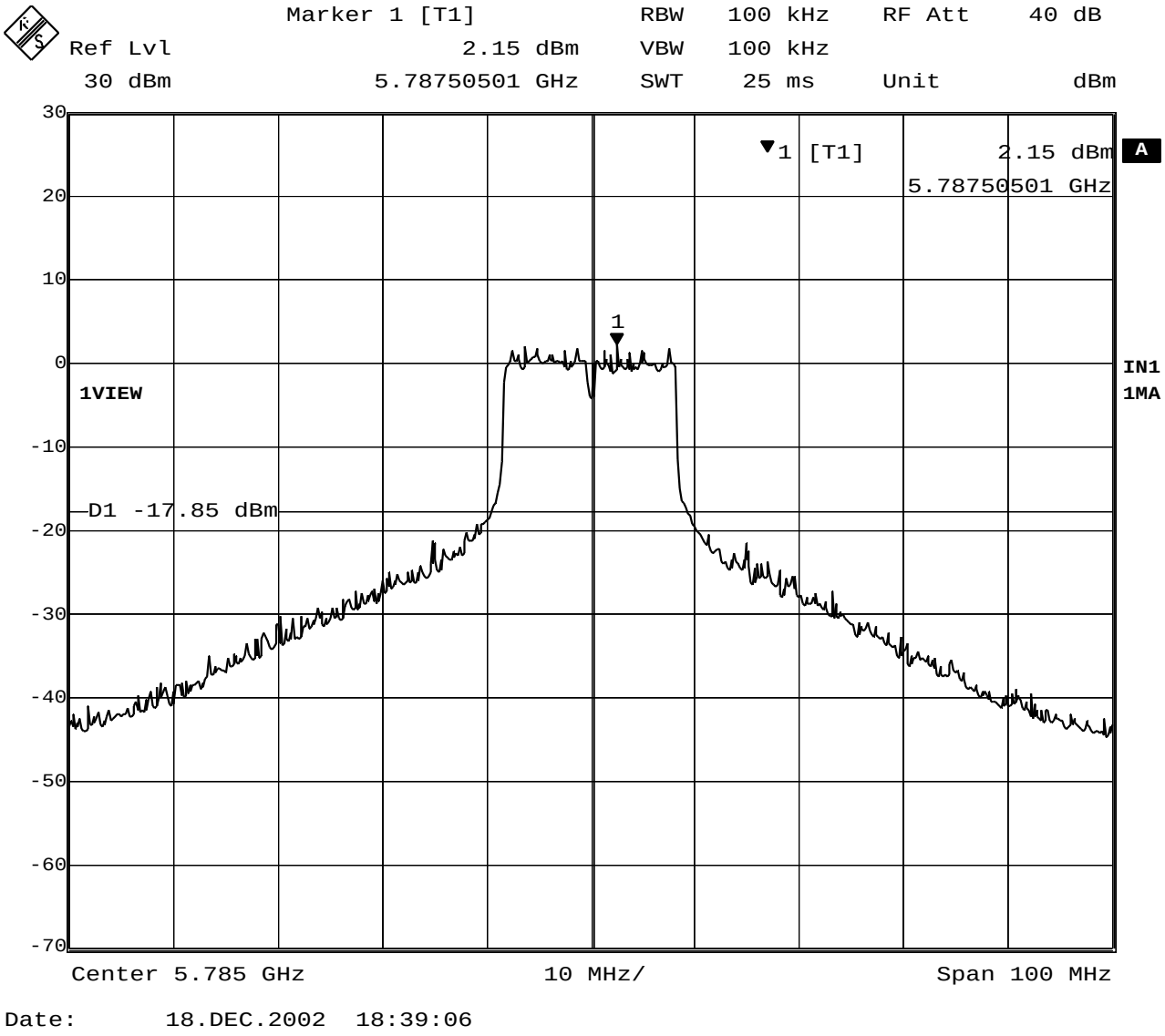
Plot 2-8. Out of band emissions around 2437MHz



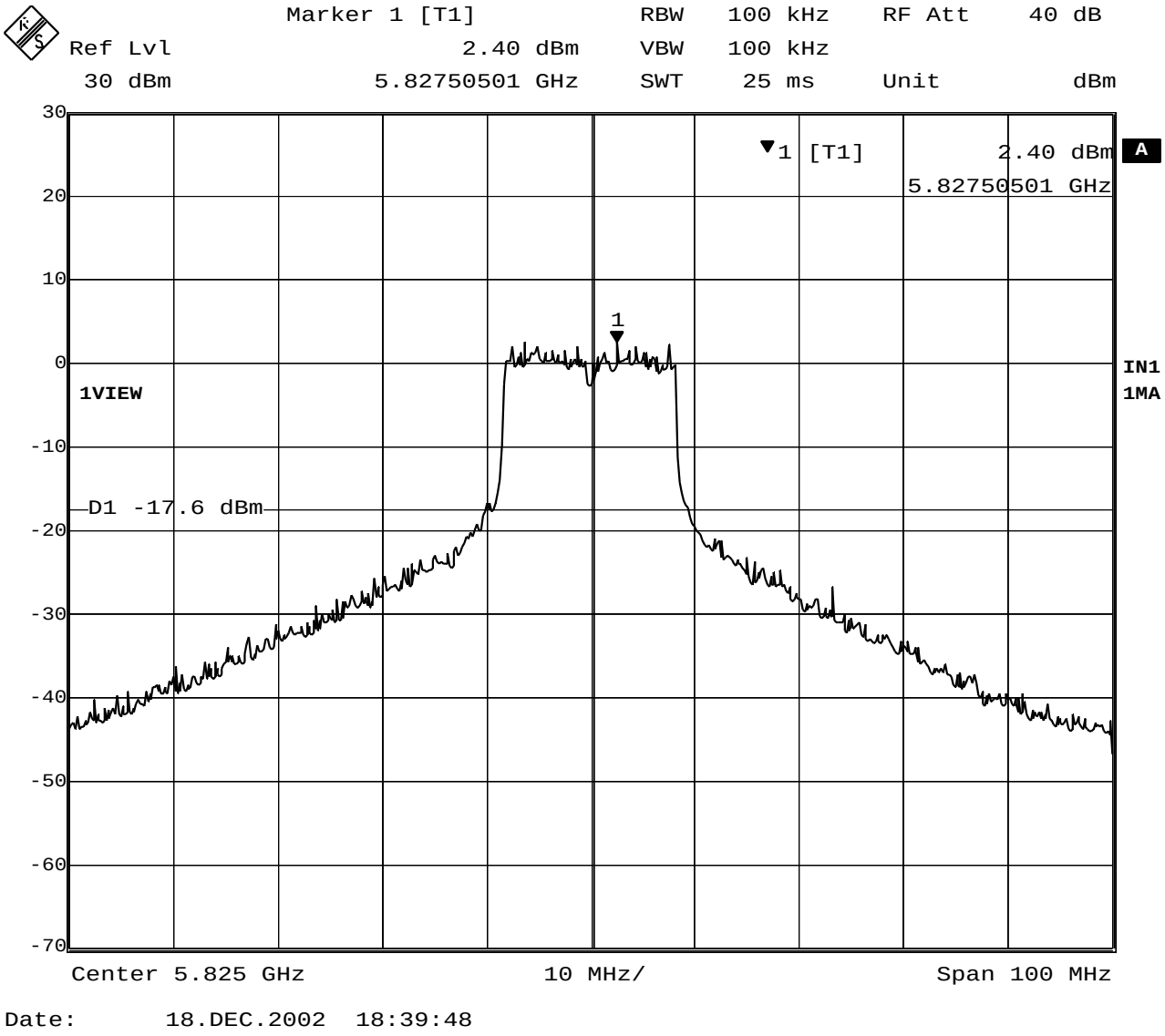
Plot 2-9. Out of band emissions around 2462MHz



Plot 2-10. Out of band emissions around 5745MHz



Plot 2-11. Out of band emissions around 5785MHz



Plot 2-12. Out of band emissions around 5825MHz

3. Conducted Peak Output Power

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: Loss: 20 cm 0.7dB (for 2.4GHz) 1.3dB (for 5.8GHz)	

Notes: - HP: Hewlett Packard

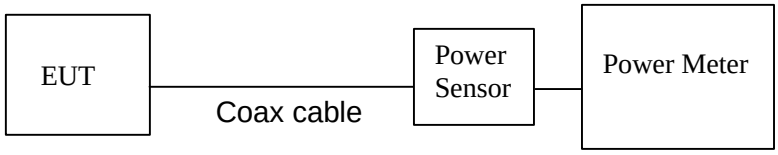


Figure 3-1: Measurement setup of power meter method

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: November 18 and December 18, 2002

Table 3-2-1. Power meter measurement results (EUT: M/T 2373-92U, s/n ZZ-00129)

Operation Frequency [GHz]	Rated output power (conducted) [dBm]									
	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 (Main)	16.3	**16.4**	NA							
Specification	17									
2.437 (Main)	15.9	**16.1**	N/A							
Specification	17									
2.462 (Main)	16.3	**16.3**	N/A							
Specification	17									
5.745 (Main)	N/A		15.4	-	-	-	**15.4**	14.1	11.4	9.2
Specification			16					15	12	10
5.785 (Main)	N/A		15.1	-	-	-	**15.1**	14.1	11.1	9.8
Specification			16					15	12	10
5.825 (Main)	N/A		15.1	-	-	-	**15.2**	14.1	11.5	9.5
specification			16					15	12	10

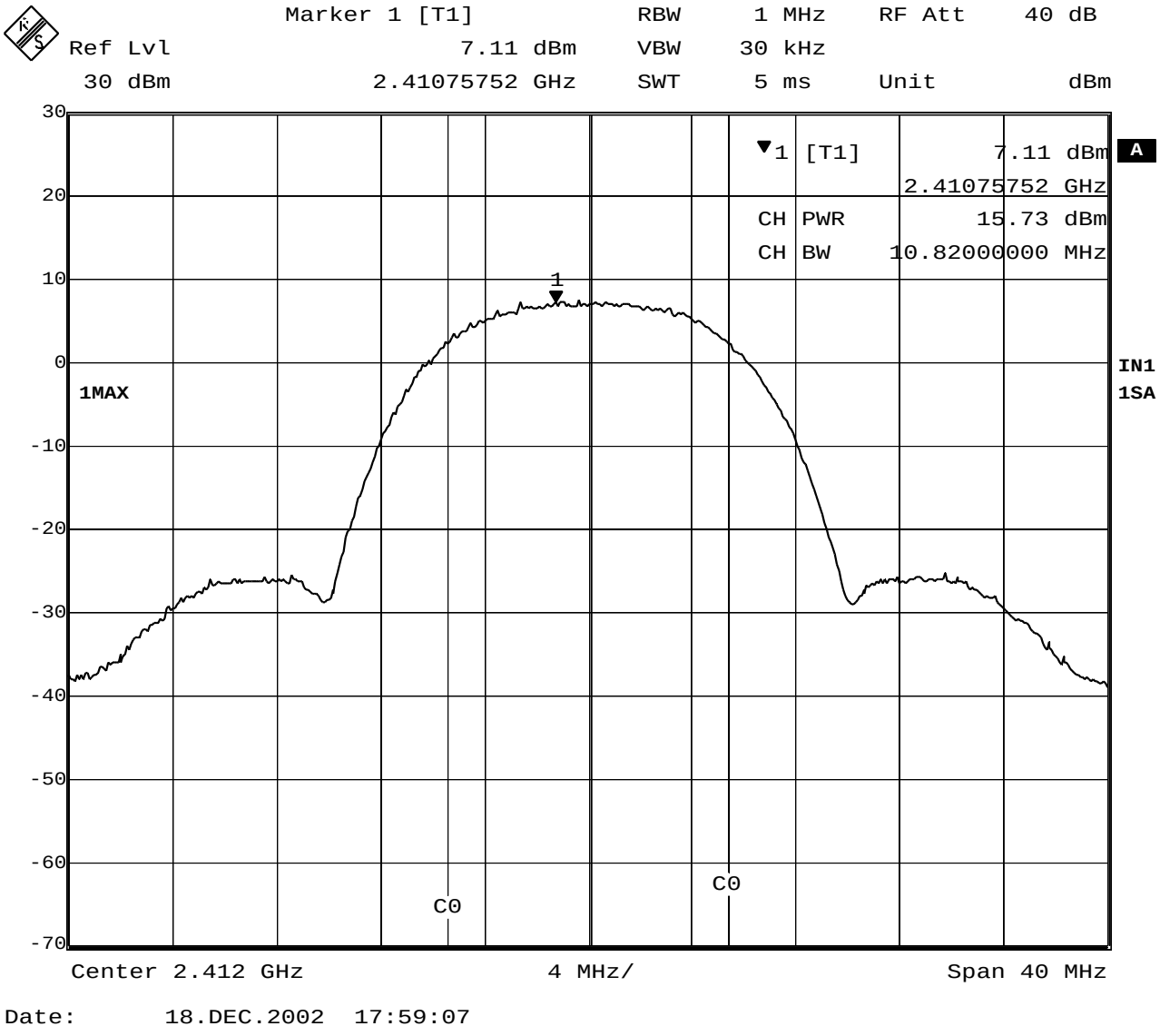
[Calculation table]

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	16.4	0.7	**17.1**	30	30	-	**-**	N/A
2437	16.1	0.7	**16.8**					
2462	16.3	0.7	**17.0**					
5745	15.4	1.3	**16.7**			-0.23	**16.5**	36
5785	15.1	1.3	**16.4**				**16.2**	
5825	15.2	1.3	**16.5**				**16.3**	

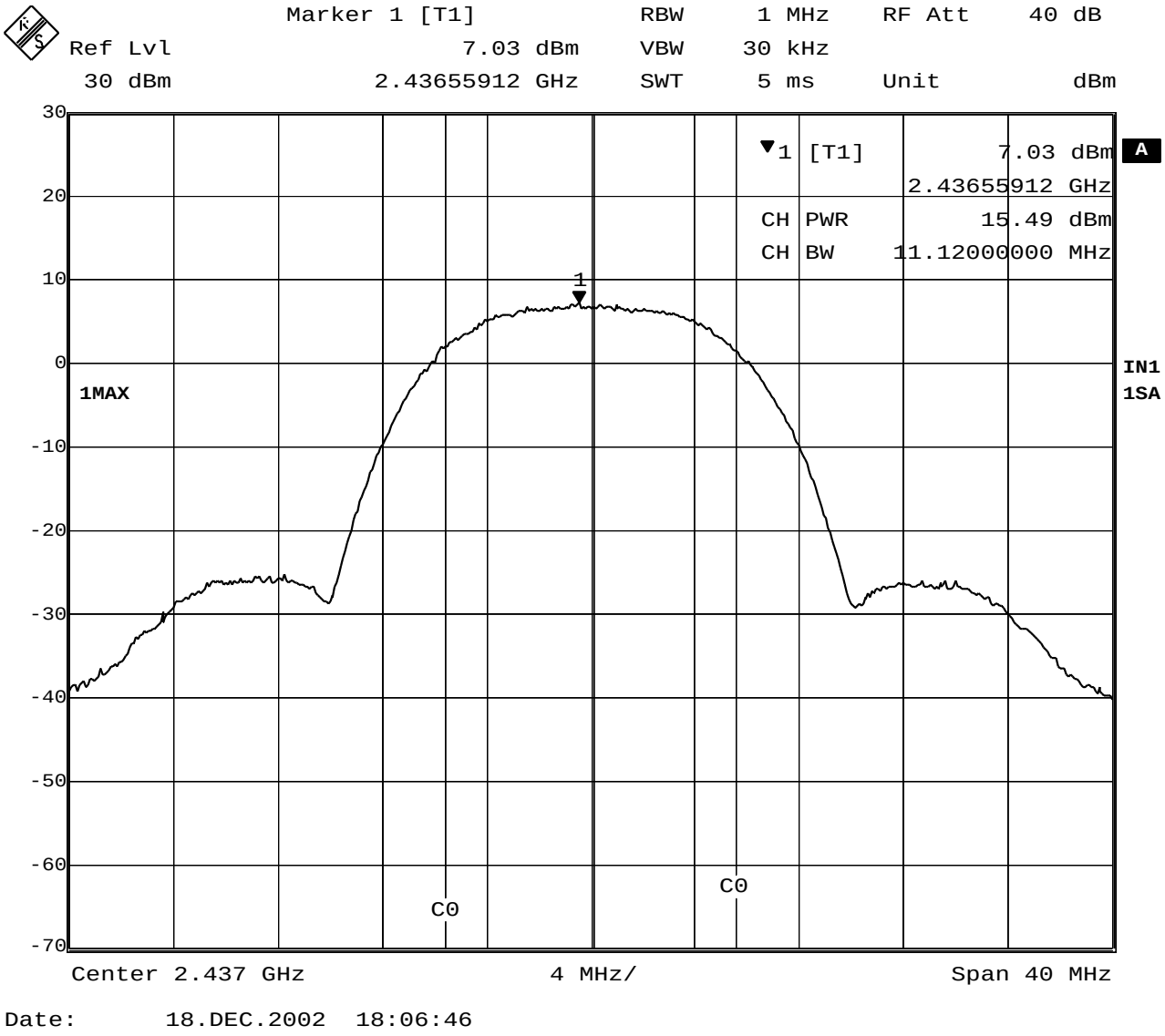
Table 3-2-2. Spectrum analyzer measurement results (EUT: M/T 2373-92U, s/n ZZ-00129)

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	15.73	Plot 3-1	1.3	**17.0**	30	30	-	**-**	N/A
2437	15.49	Plot 3-2	1.3	**16.8**					
2462	15.71	Plot 3-3	1.3	**17.0**					
5745	14.44	Plot 3-4	2.3	**16.7**			-0.23	**16.5**	36
5785	13.95	Plot 3-5	2.3	**16.3**				**16.1**	
5825	14.15	Plot 3-6	2.3	**16.5**				**16.3**	

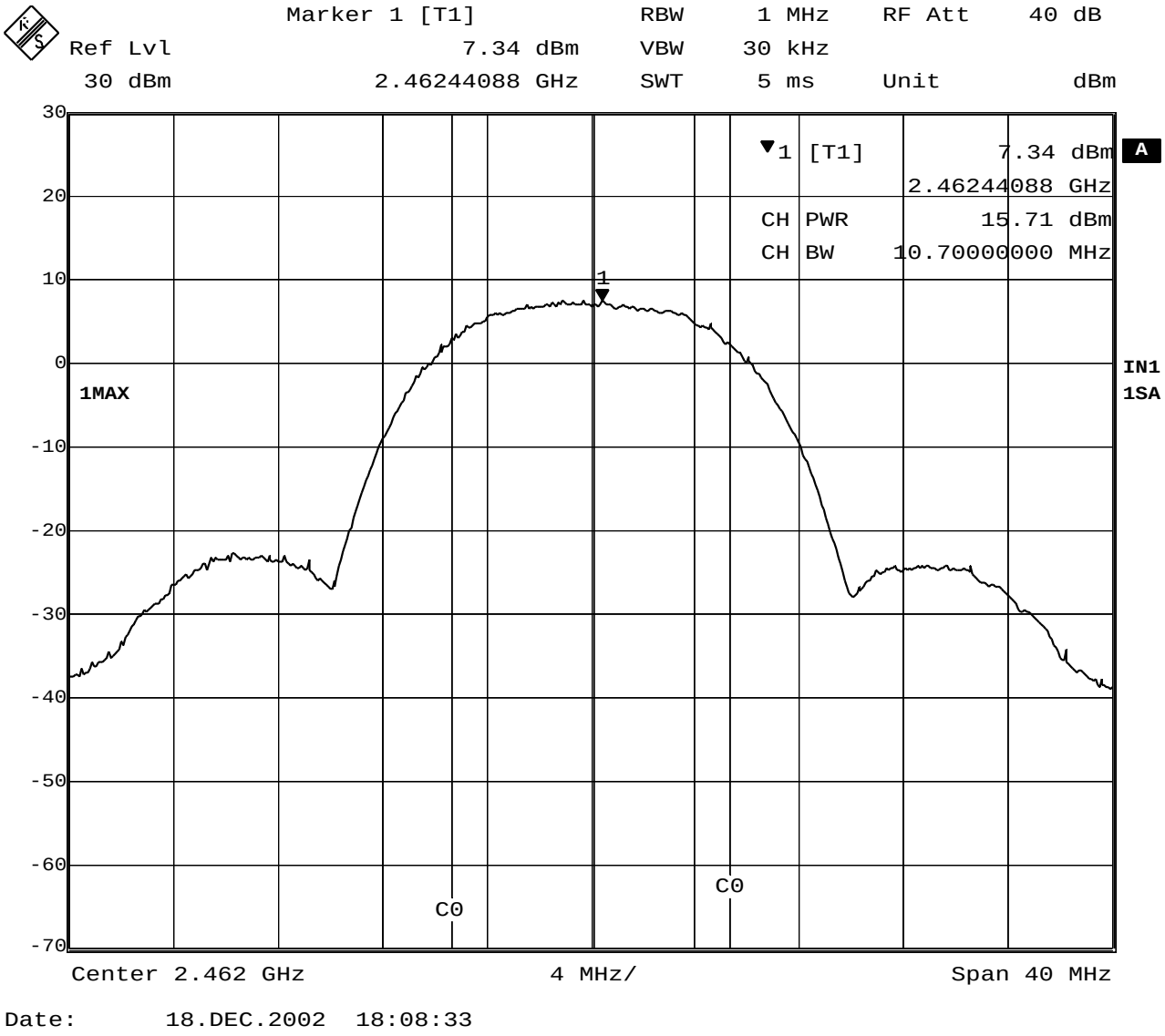
3.4 Trace Data of Conducted Peak Output Power



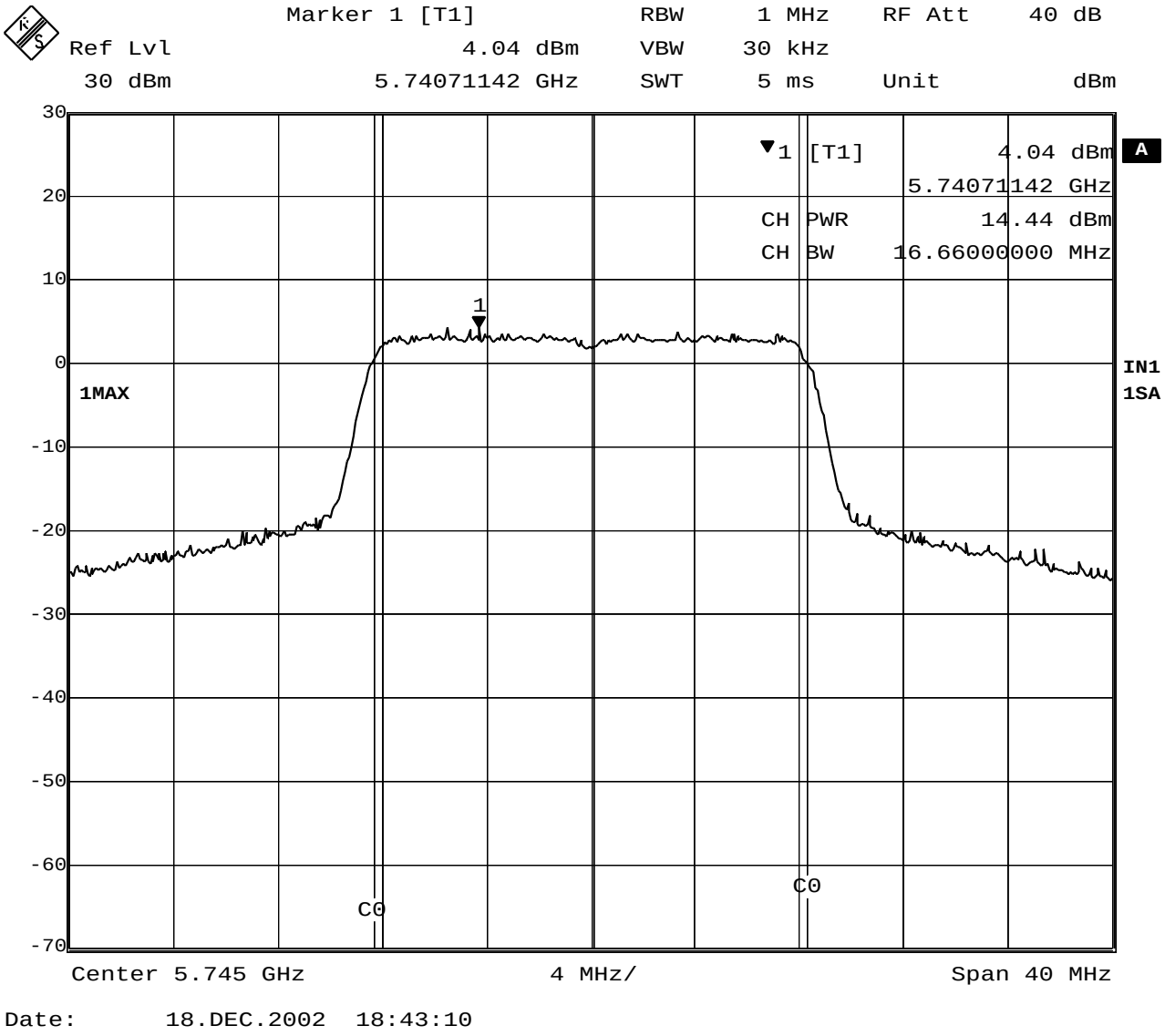
Plot 3-1. Conducted Peak Output Power of 2412MHz



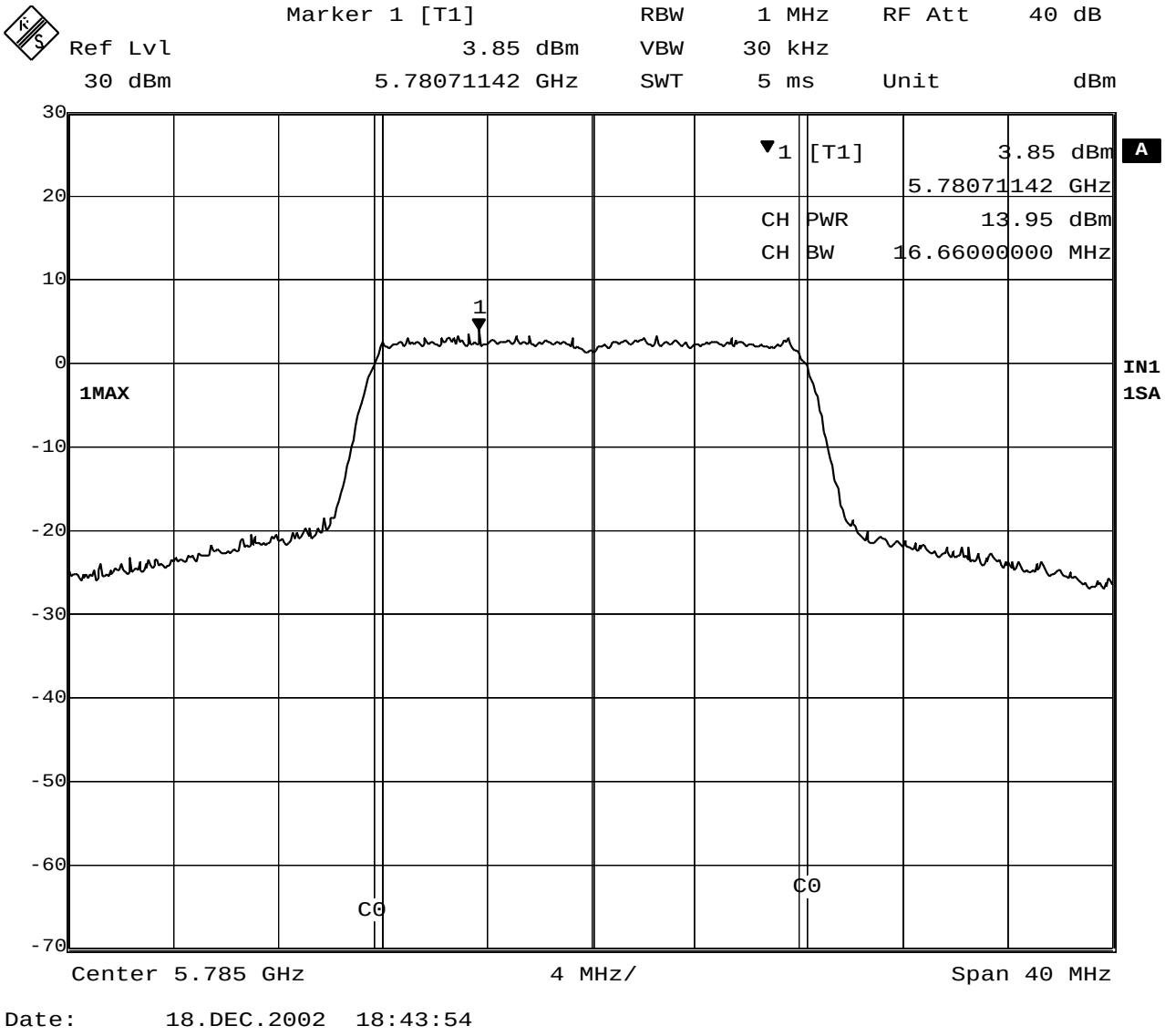
Plot 3-2. Conducted Peak Output Power of 2437MHz



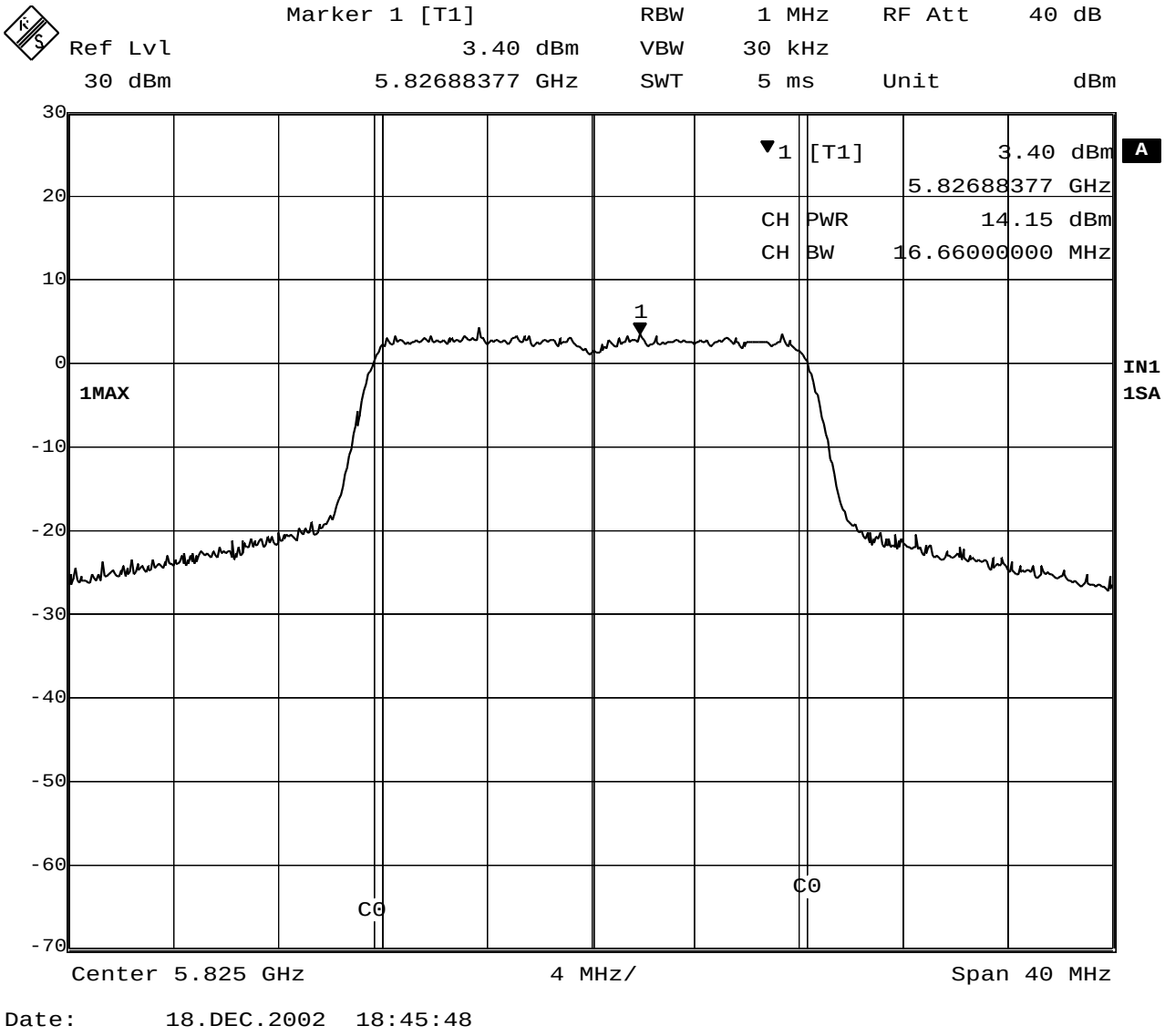
Plot 3-3. Conducted Peak Output Power of 2462MHz



Plot 3-4. Conducted Peak Output Power of 5745MHz



Plot 3-5. Conducted Peak Output Power of 5785MHz



Plot 3-6. Conducted Peak Output Power of 5825MHz

4. Peak Power Spectral Density

4.1 Test Procedure

The peak power density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequencies of each 2.4GHz or 5.8GHz band.
The spectrum analyzer is set to:
RBW= 3kHz, VBW=100kHz, Span=10MHz(for 2.4GHz band) or 20MHz(for 5.8GHz band), Sweep=2.8 seconds

4.2 Test Instruments and Measurement Setup

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

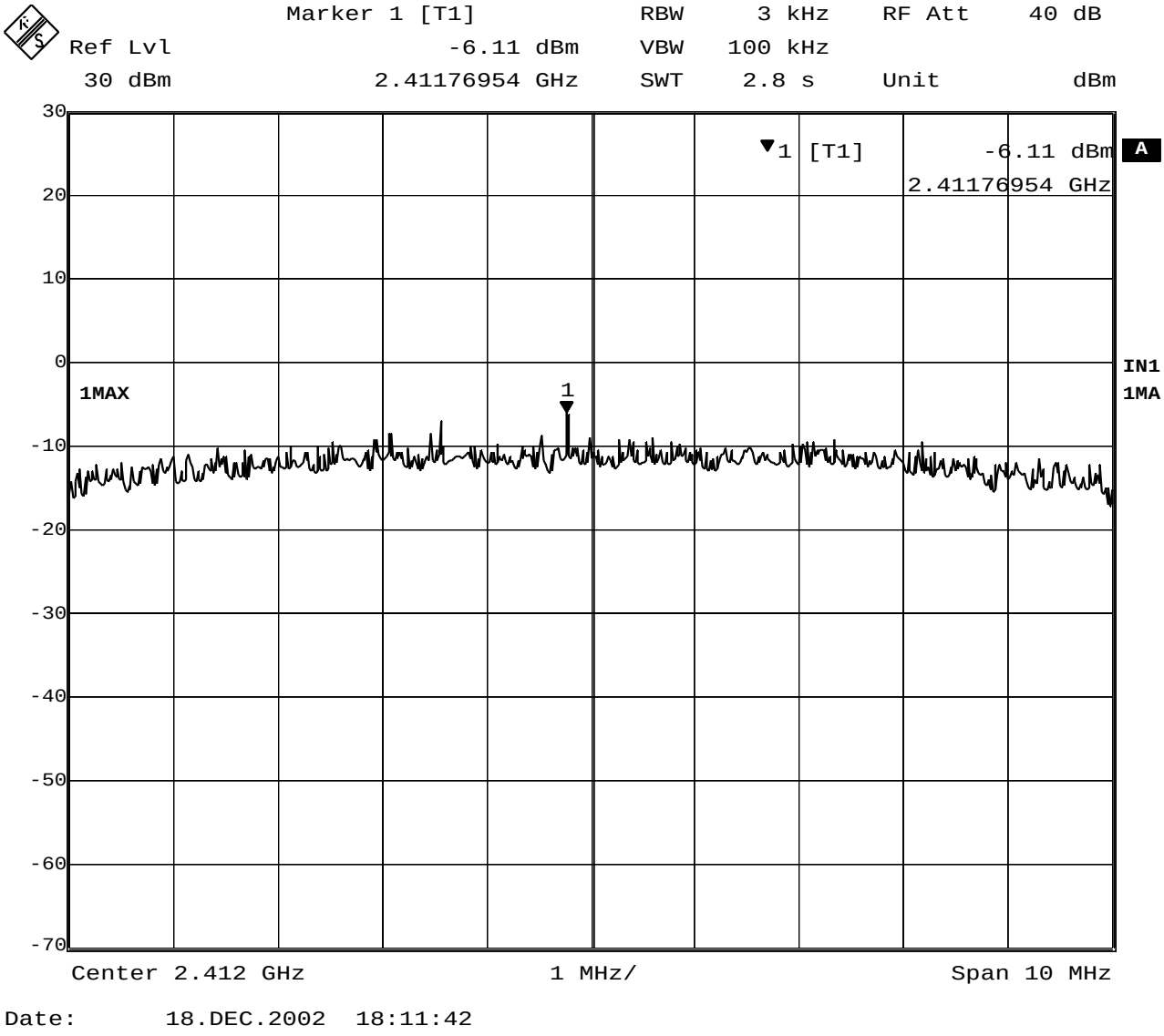
4.3 Measurement Results

Test Date: December 18, 2002

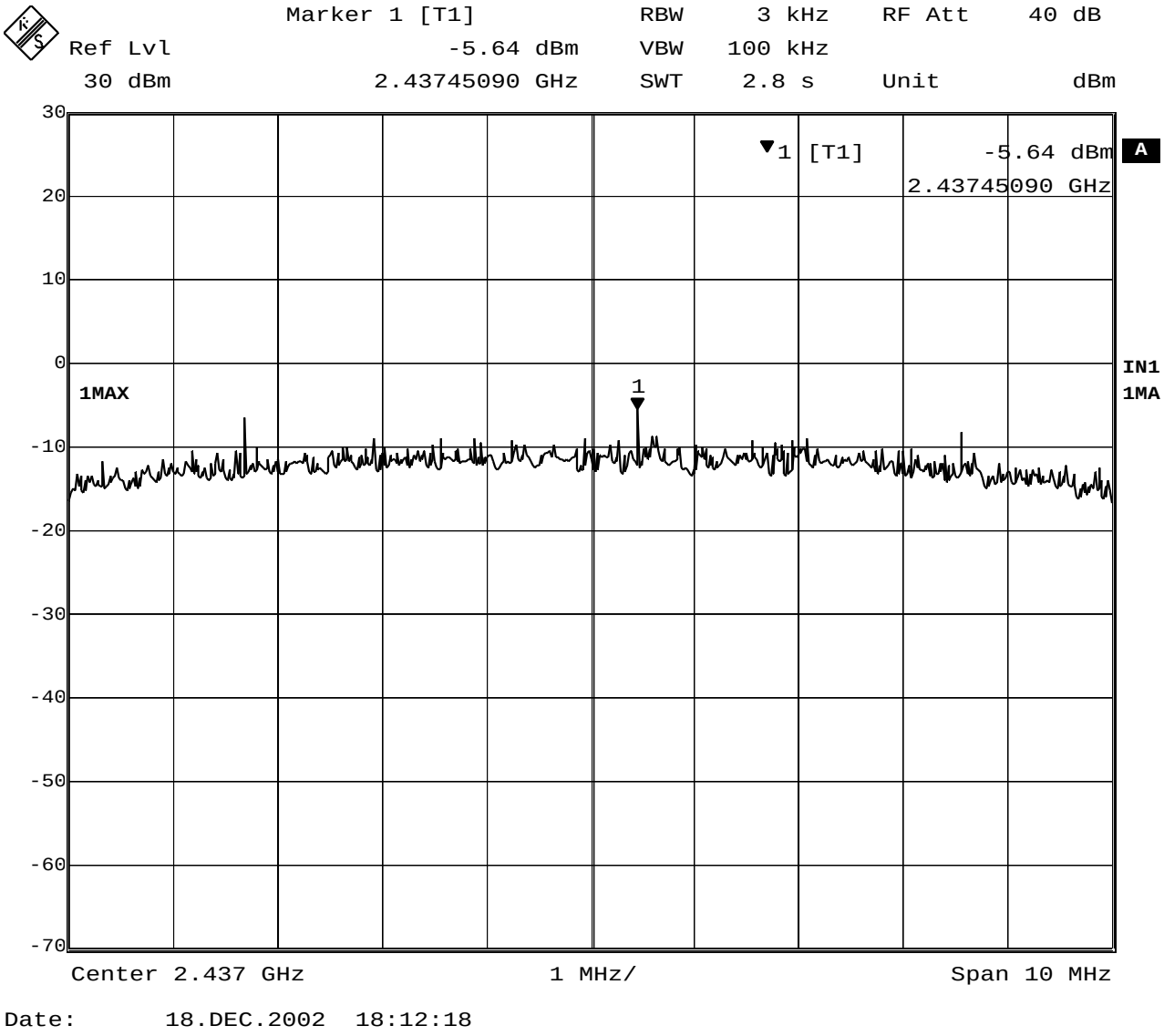
Table 4-1. EUT: M/T 2373-92U, s/n ZZ-00129 , TX mode

Ch No.	Frequency (MHz)	**Analyzer Reading** (dBm)	Trace number	Cable loss (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
1	2411.77	-6.11	Plot 4-1	1.3	- 4.8	8.0	12.8
6	2437.45	-5.64	Plot 4-2	1.3	- 4.3	8.0	12.3
11	2462.45	-5.41	Plot 4-3	1.3	- 4.1	8.0	12.1
149	5740.61	-10.87	Plot 4-4	2.3	- 8.6	8.0	16.6
157	5780.57	-10.41	Plot 4-5	2.3	- 8.1	8.0	16.1
165	5824.34	-11.01	Plot 4-6	2.3	- 8.7	8.0	16.7

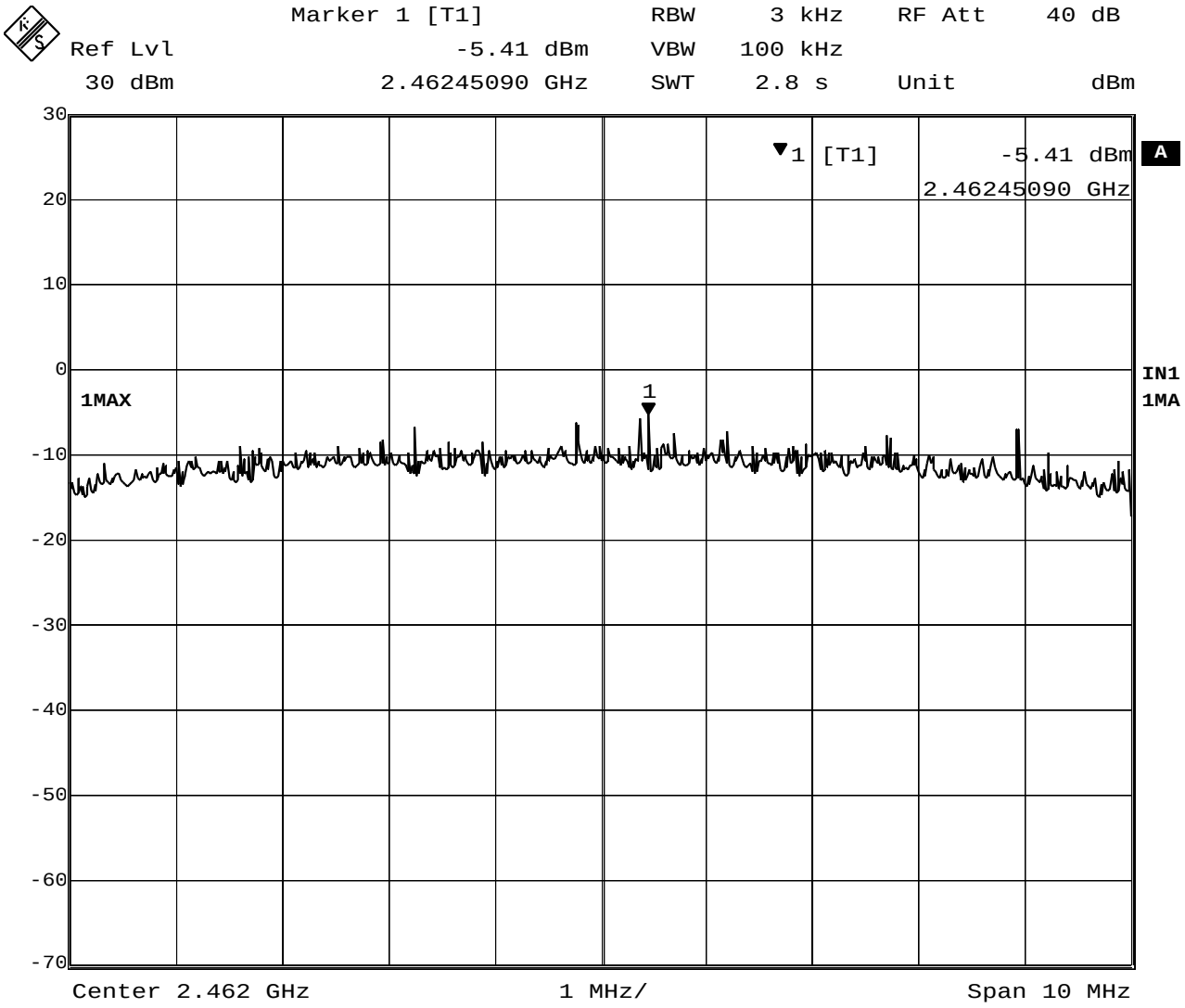
4.4 Trace Data of Peak Power Spectral Density



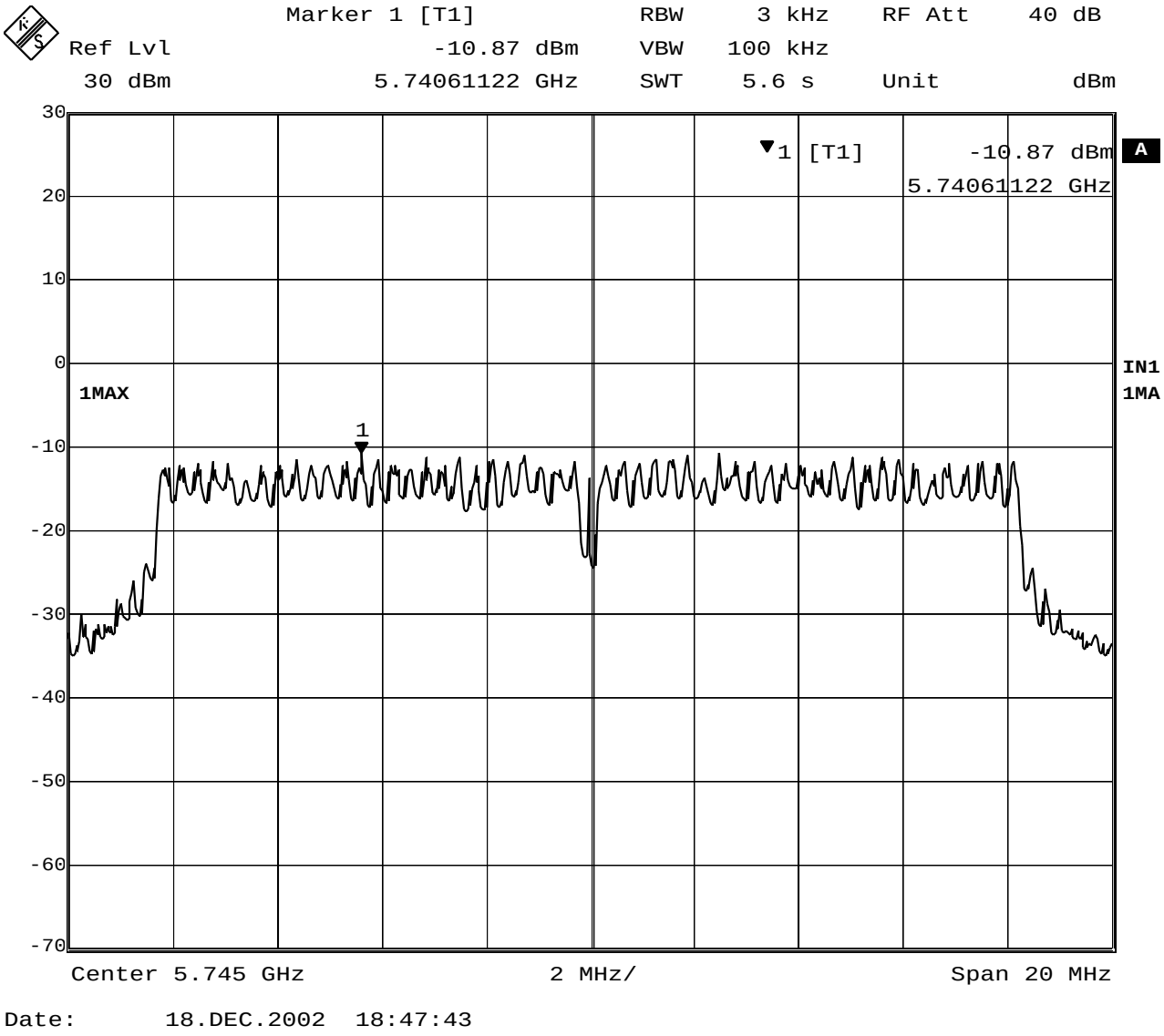
Plot 4-1. Peak Power Spectral Density of 2412MHz



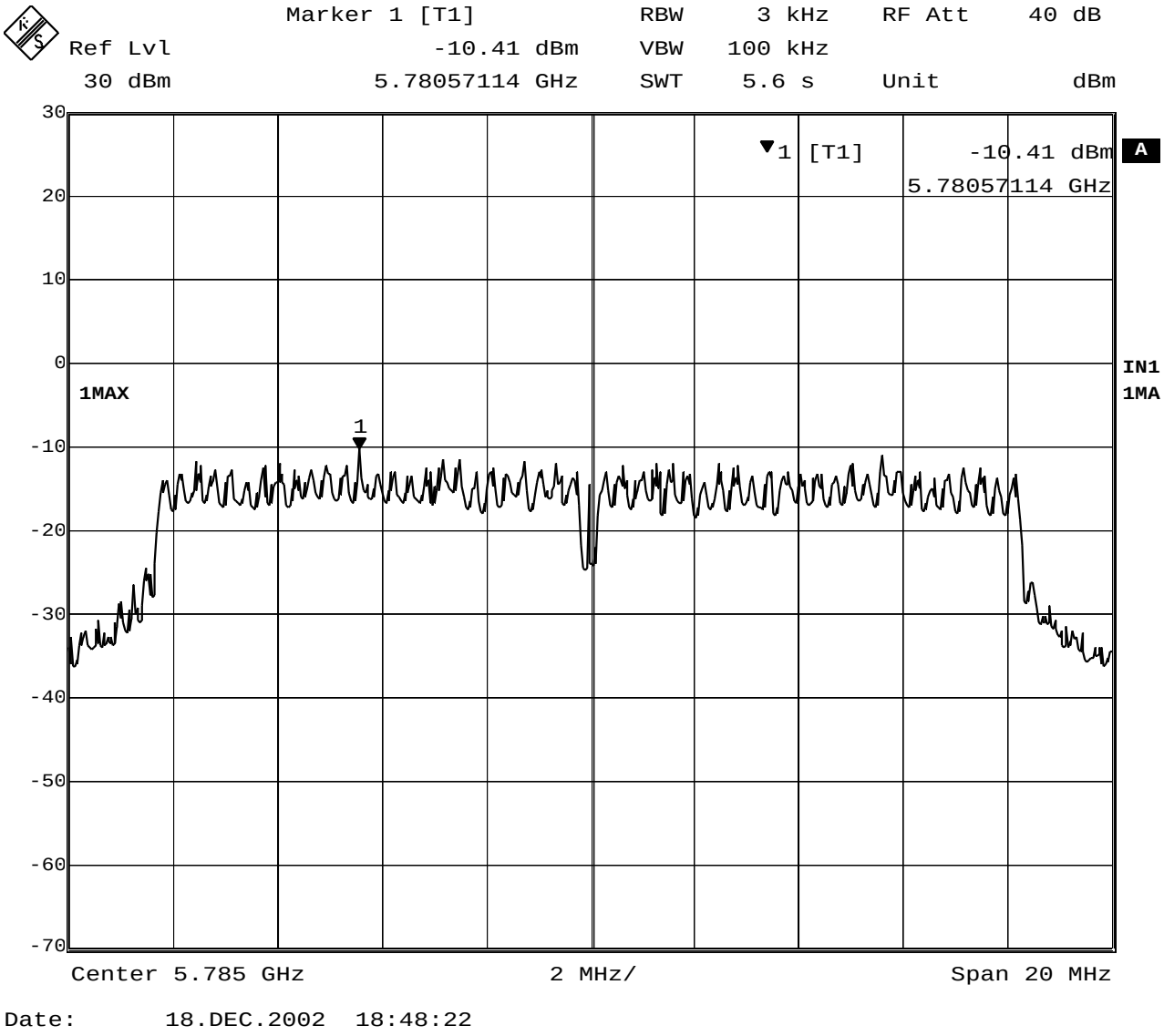
Plot 4-2. Peak Power Spectral Density of 2437MHz



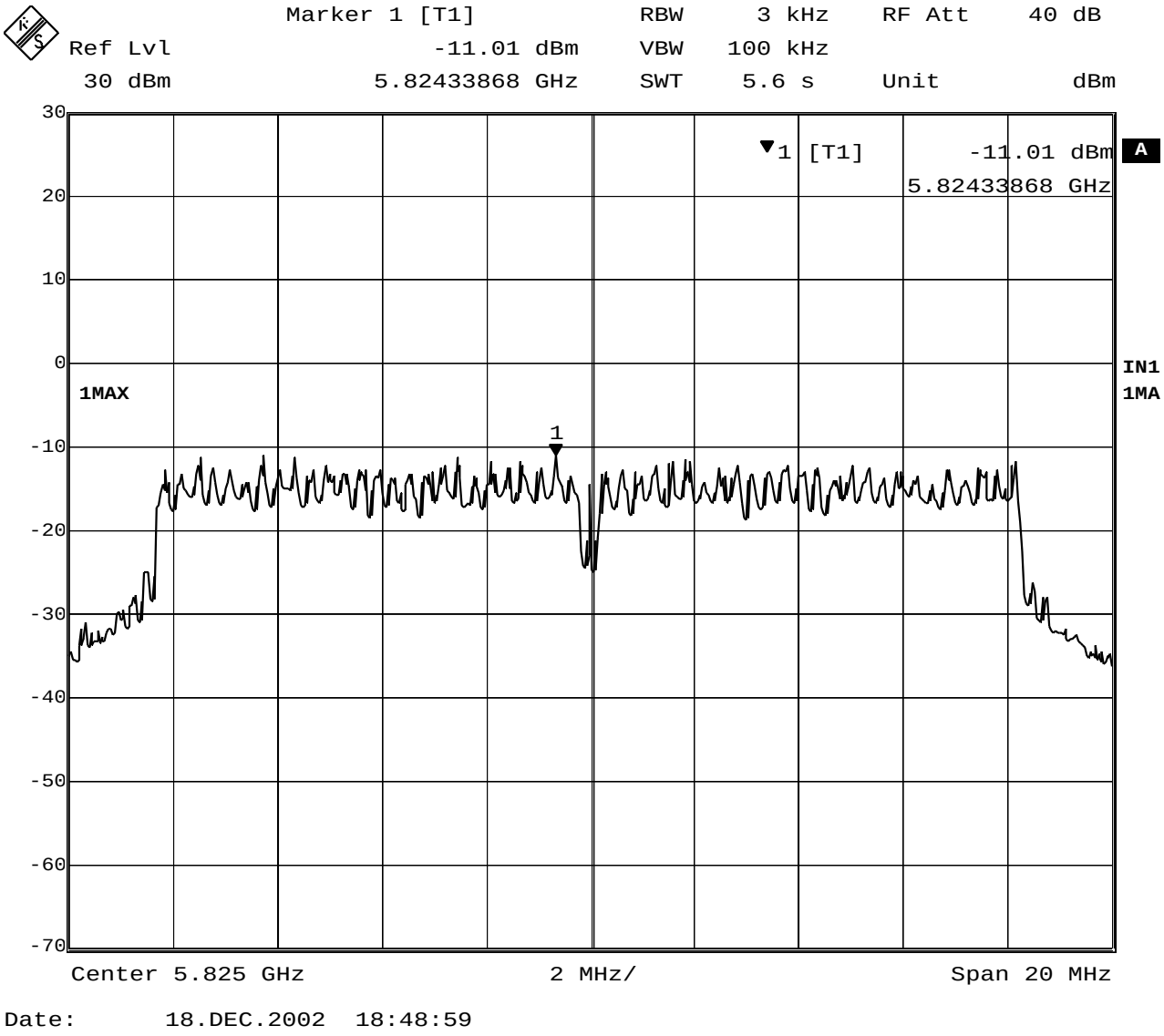
Plot 4-3. Peak Power Spectral Density of 2462MHz



Plot 4-4. Peak Power Spectral Density of 5745MHz



Plot 4-5. Peak Power Spectral Density of 5785MHz



Plot 4-6. Peak Power Spectral Density of 5825MHz

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

[FCC 15.207, RSS-210 6.6 / 7.4]

5.1 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.

5.2 Test Instruments and Measurement Setup

Table 5-1. Conducted Emission Test Instrumentation

Description	**Model**	**Serial Number**
Computer	IBM 6589-13J	97-15613
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2601A02634
Spectrum Analyzer Display	HP 85662A	2542A12308
Quasi-Peak Adapter	HP 85650A	2043A00062
Receiver (9kHz-30MHz)	R&S ESH3	891806/012
LISN	EMCO 3825/2	1426
Switch/control unit	HP 3488A	2719A17228
Plotter	HP 7550A	2631A33619
Coax cables: - Lisn-L <=> SW/Con.unit (SW100) - Lisn-N <=> SW/Con.unit (SW101) - SW/Con.unit <=> RCVR (Input) - SW/Con.unit<=> Spe Ana.(Signal In)	Length: 4 m 4 m 1 m 1 m	 - EMIC-L - EMIC-N - EMIC-R - EMIC-S

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

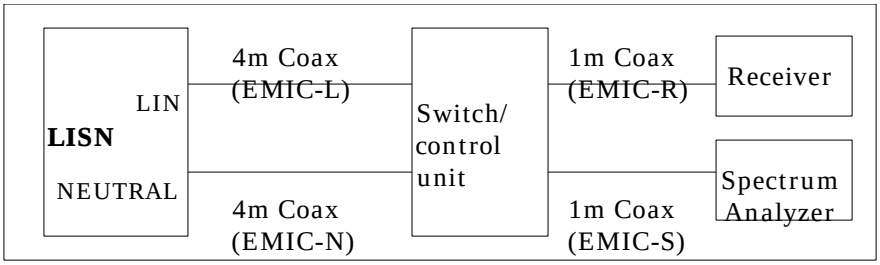


Figure 5. Cables for Conducted Emission Test

5.3 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 10.6dB. The 6 highest emissions relative to the limits are reported.

Test Date: January 7, 2003

5.3.1 EUT in 2.4GHz IEEE802.11b transmission mode

Table 5-2-1. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.1(2412MHz) **TX** mode 11Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.1895	LINE	53.2	64.1	43.5	54.1
0.2985	LINE	41.3	60.3	34.5	50.3
0.3943	LINE	34.0	58.0	26.6	48.0
0.5040	NEUTRAL	32.5	56.0	27.7	46.0
0.6115	NEUTRAL	31.4	56.0	27.7	46.0
0.7046	NEUTRAL	30.8	56.0	26.3	46.0

Table 5-2-2. EUT: M/T 2373-92U, s/n ZZ-00129 , Ch.6(2437MHz) **TX** mode 11Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.1964	NEUTRAL	52.2	63.8	43.0	53.8
0.2995	LINE	40.7	60.3	33.4	50.3
0.4858	LINE	32.8	56.2	26.6	46.2
0.6141	LINE	32.7	56.0	29.1	46.0
0.7124	LINE	31.0	56.0	26.7	46.0
0.7891	LINE	29.4	56.0	26.2	46.0

Table 5-2-3. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.11(2462MHz) **TX** mode 11Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.1958	LINE	51.3	63.8	42.2	53.8
0.2988	LINE	40.2	60.3	32.5	50.3
0.4013	LINE	35.3	57.8	28.7	47.8
0.5124	LINE	32.7	56.0	27.7	46.0
0.6144	LINE	32.7	56.0	28.6	46.0
0.7114	LINE	31.1	56.0	27.2	46.0

Table 5-2-4. EUT: M/T 2373-92U, s/n ZZ-00129, Ch. 6 (2437MHz) **RX** mode

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.1898	LINE	51.0	64.0	41.8	54.0
0.2736	LINE	38.8	61.0	31.1	51.0
0.4017	LINE	35.5	57.8	28.3	47.8
0.5310	LINE	32.4	56.0	26.9	46.0
0.6140	LINE	32.5	56.0	28.5	46.0
0.7120	LINE	31.3	56.0	27.3	46.0

5.3.2 EUT in 5.8GHz IEEE802.11a transmission mode

Table 5-3-1. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.149(5745MHz) **TX** mode 24Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.1896	LINE	51.2	64.1	41.9	54.1
0.2993	LINE	40.4	60.3	33.3	50.3
0.4023	LINE	36.2	57.8	29.1	47.8
0.5131	LINE	33.4	56.0	28.8	46.0
0.6144	LINE	33.1	56.0	29.2	46.0
0.7124	LINE	31.9	56.0	27.6	46.0

Table 5-3-2 EUT: M/T 2373-92U, s/n ZZ-00129, Ch.157(5785MHz) **TX** mode 24Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.1958	LINE	51.8	63.8	42.6	53.8
0.2977	NEUTRAL	39.5	60.3	32.8	50.3
0.4862	LINE	32.7	56.2	26.3	46.2
0.6147	LINE	33.3	56.0	29.0	46.0
0.7110	LINE	31.2	56.0	27.7	46.0
0.7888	LINE	29.7	56.0	25.9	46.0

Table 5-3-3 EUT: M/T 2373-92U, s/n ZZ-00129, Ch.165(5825MHz) **TX** mode 24Mbps

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.1893	LINE	51.0	64.1	41.7	54.1
0.2993	LINE	40.4	60.3	33.2	50.3
0.4016	LINE	35.9	57.8	29.4	47.8
0.5130	LINE	33.1	56.0	28.5	46.0
0.6145	LINE	33.2	56.0	29.2	46.0
0.7115	LINE	31.5	56.0	27.6	46.0

Table 5-3-4 EUT: M/T 2373-92U, s/n ZZ-00129, Ch.157(5785MHz) **RX** mode

Frequency (MHz)	Phase	QP Voltage (dBμV)	CISPR22 QP Limit (dBμV)	AV Voltage (dBμV)	CISPR22 AV Limit (dBμV)
0.1961	LINE	51.3	63.8	42.2	53.8
0.2991	LINE	39.7	60.3	32.4	50.3
0.4020	LINE	35.4	57.8	28.0	47.8
0.5311	NEUTRAL	32.7	56.0	27.1	46.0
0.6147	LINE	33.2	56.0	28.9	46.0
0.7113	LINE	31.2	56.0	27.4	46.0

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

[FCC 15.205 / 209, RSS-210 6.2.1 / 6.3 / 7.3]

6.1 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.

6.2 Test Instruments and Measurement Setup

Table 6-1 Radiated Emission Test Instrumentation

Description	**Model**	**Serial Number**
Computer	IBM 5551-L	#4
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	2841A04252
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 - for 200-1000MHz	 HP 8447D HP 8447D	 2805A02919 2944A03506
Biconical Antenna (30-200MHz)	EMCO 3108	2309
Log-Periodic Antenna (200-1000MHz)	EMCO 3146	1585
Receiver (20MHz-1.3GHz)	R&S ESVP	893202/018
Switch/control unit	HP 3488A	2719A17226
N-Coax cables: - Bi-coni Ant <=> 10m Cable - 10m Cable <=> Shield Panel - Shield Panel <=> RF Amp - RF Amp <=> Power Splitter - Log-peri Ant <=> 10m Cable - 10m Cable <=> Shield Panel - Shield Panel <=> RF Amp - RF Amp <=> Power Splitter	Length: 9 m 10 m 7 m 0.5m 9 m 10 m 7 m 0.5m	 - EM103L01 - EM103L02 - EM103L03 - EM103L04 - EM103H01 - EM103H02 - EM103H03 - EM103H04
Coax cables: - Power Splitter <=> SW/Con.unit (SW110) - Power Splitter <=> SW/Con.unit (SW300) - Power Splitter <=> SW/Con.unit (SW100) - Power Splitter <=> SW/Con.unit (SW301)	 1 m 1 m 1 m 1 m	 - EM103L05 - EM103L06 - EM103H05 - 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

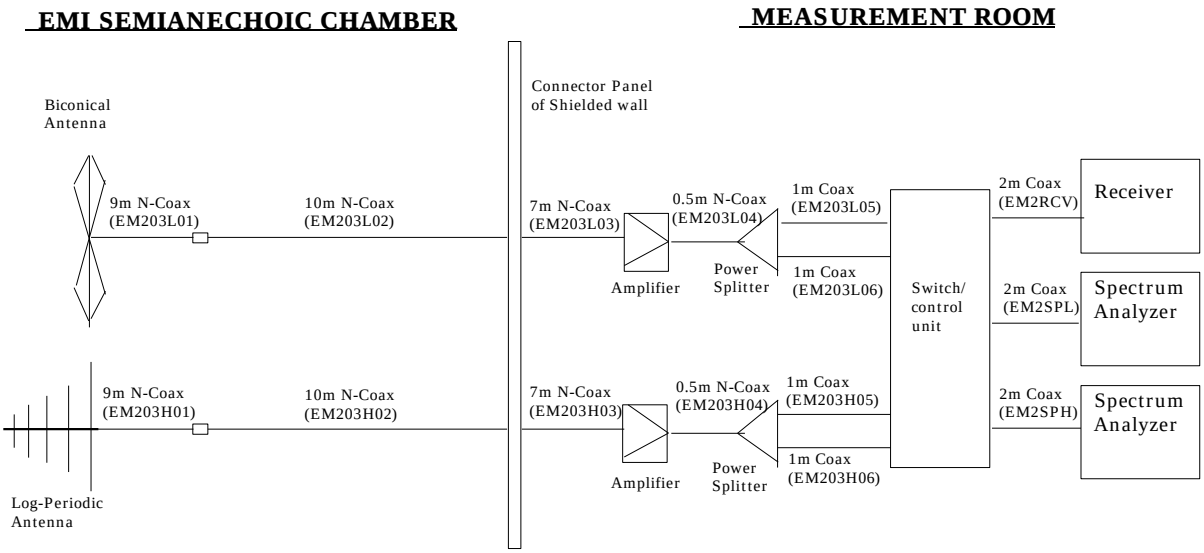


Figure 6 Cables for Radiated Emission Test

6.3 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:

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

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

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

40dBμV/m = 100μV/m
48dBμV/m = 250μV/m

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 2.4 dB at 30MHz - 1000MHz band.
The 6 highest emissions relative to the limits are reported.

Test Date: December 5 and 6, 2002

6.4.1 EUT in 2.4GHz IEEE802.11b transmission mode

Table 6-2-1. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.1(2412MHz) **TX** mode 11Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
143.180	V	37.5	12.2	-16.6	33.1	43.5	45.2	150
158.296	V	39.0	12.4	-16.4	35.0	43.5	56.2	150
200.452	V	32.5	11.3	-12.6	31.2	43.5	36.3	150
257.998	H	37.0	12.0	-14.6	34.4	46.0	52.5	200
283.267	H	36.7	13.3	-14.2	35.8	46.0	61.7	200
597.870	V	28.3	18.6	-12.7	34.2	46.0	51.3	200

Table 6-2-2. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.6(2437MHz) **TX** mode 11Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
161.579	H	43.2	12.4	-16.4	39.2	43.5	91.2	150
200.452	H	37.2	11.3	-12.6	35.9	43.5	62.4	150
258.122	H	37.0	12.0	-14.6	34.4	46.0	52.5	200
283.418	H	37.1	13.3	-14.2	36.2	46.0	64.6	200
465.332	V	28.2	16.8	-13.8	31.2	46.0	36.3	200
600.422	V	26.1	18.7	-12.7	32.1	46.0	40.3	200

Table 6-2-3. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.11(2462MHz) **TX** mode 11Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
160.077	H	41.8	12.4	-16.4	37.8	43.5	77.6	150
200.452	V	33.1	11.3	-12.6	31.8	43.5	38.9	150
258.124	H	37.3	12.0	-14.6	34.7	46.0	54.3	200
283.518	H	36.9	13.3	-14.2	36.0	46.0	63.1	200
399.624	V	32.3	15.2	-14.3	33.2	46.0	45.7	200
680.481	V	23.4	20.7	-11.8	32.3	46.0	41.2	200

Table 6-2-4. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.6(2437MHz) **RX** mode

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
143.929	H	31.3	12.3	-16.7	26.9	43.5	22.1	150
161.543	H	41.2	12.4	-16.4	37.2	43.5	72.4	150
200.452	H	37.4	11.3	-12.6	36.1	43.5	63.8	150
258.123	H	37.2	12.0	-14.6	34.6	46.0	53.7	200
283.123	H	35.7	13.2	-14.2	34.7	46.0	54.3	200
596.869	H	27.4	18.6	-12.8	33.2	46.0	45.7	200

6.4.2 EUT in 5.8GHz IEEE802.11a transmission mode

Table 6-3-1. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.149(5745MHz) **TX** mode 24Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
157.926	H	45.1	12.4	-16.4	41.1	43.5	113.5	150
200.452	H	38.5	11.3	-12.6	37.2	43.5	72.4	150
257.997	H	36.2	12.0	-14.6	33.6	46.0	47.9	200
280.670	H	35.5	13.1	-14.1	34.5	46.0	53.1	200
399.624	V	33.1	15.2	-14.3	34.0	46.0	50.1	200
597.245	H	25.7	18.6	-12.8	31.5	46.0	37.6	200

Table 6-3-2 EUT: M/T 2373-92U, s/n ZZ-00129, Ch.157(5785MHz) **TX** mode 24Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
114.544	H	38.8	10.8	-17.2	32.4	43.5	41.7	150
159.517	H	39.9	12.4	-16.5	35.8	43.5	61.7	150
200.453	H	39.4	11.3	-12.6	38.1	43.5	80.4	150
258.123	H	35.9	12.0	-14.6	33.3	46.0	46.2	200
281.359	H	35.1	13.1	-14.2	34.0	46.0	50.1	200
599.001	V	27.9	18.6	-12.7	33.8	46.0	49.0	200

Table 6-3-3 EUT: M/T 2373-92U, s/n ZZ-00129, Ch.165(5825MHz) **TX** mode 24Mbps

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
114.544	H	38.4	10.8	-17.2	32.0	43.5	39.8	150
157.716	H	40.9	12.4	-16.4	36.9	43.5	70.0	150
200.452	H	37.3	11.3	-12.6	36.0	43.5	63.1	150
229.088	H	35.4	10.7	-14.8	31.3	46.0	36.7	200
258.123	H	35.0	12.0	-14.6	32.4	46.0	41.7	200
280.876	H	34.4	13.1	-14.2	33.3	46.0	46.2	200

Table 6-3-4 EUT: M/T 2373-92U, s/n ZZ-00129, Ch.157(5785MHz) **RX** mode

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
114.544	H	38.7	10.8	-17.2	32.3	43.5	41.2	150
143.181	H	36.5	12.2	-16.6	32.1	43.5	40.3	150
155.859	H	40.3	12.4	-16.5	36.2	43.5	64.6	150
200.452	H	36.8	11.3	-12.6	35.5	43.5	59.6	150
281.799	H	35.0	13.2	-14.1	34.1	46.0	50.7	200
399.624	V	32.8	15.2	-14.3	33.7	46.0	48.4	200

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

[FCC 15.205 / 209, RSS-210 6.2.1 / 6.3 / 7.3]

7.1 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.

7.2 Test Instruments and Measurement Setup

Table 7 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 - 26.5GHz)	HP 8449B	3008A00582
Amplifier (26.5 – 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	1158
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 15 m 3m 3m 1m	 - EM206SCO - EM215SCO - SF102-20166 - SF102-20167 - SF102-21105

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

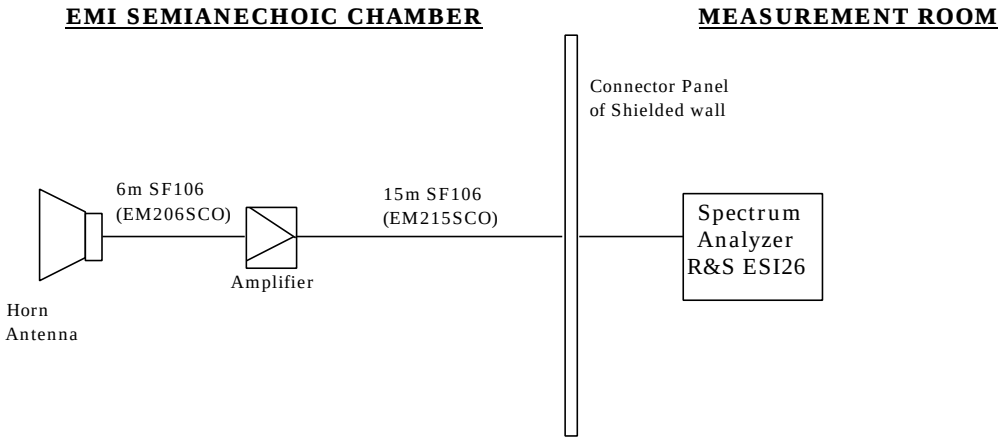


Figure 7-1. Cables for Radiated Emission Test (1 – 12.4 GHz)

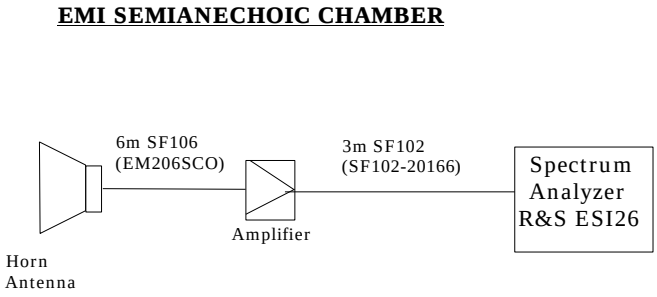


Figure 7-2. Cables for Radiated Emission Test (12.4 - 18GHz)

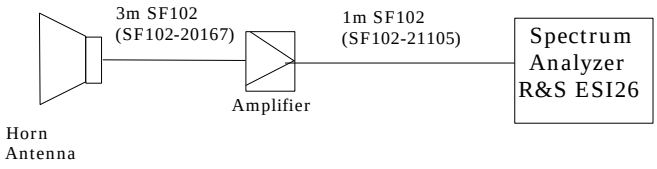


Figure 7-3. Cables for Radiated Emission Test (18 - 26.5GHz)

EMI SEMIANECHOIC CHAMBER

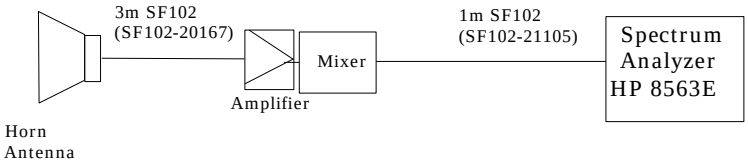


Figure 7-4. Cables for Radiated Emission Test (26.5 - 40GHz)

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. 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 dBμV/m

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

Level(dBμV/m) = 20 × Log (Level(μV/m))
40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/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 1.1 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: December 5, 6, 9 and 11, 2002

7.4.1 EUT in 2.4GHz IEEE802.11b transmission mode

Table 7-2-1. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.1(2412MHz) **TX** mode 11Mbps

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										
2.414	H	114.2	106.0	28.3	-30.4	0.0	112.1	OB*	103.9	OB*
Adjacent RB										
2.349	H	55.7	-	28.1	-30.3	0.0	53.5	74.0	-	54.0
2.368	H	59.8	50.1	28.1	-30.4	0.0	57.5	74.0	47.8	54.0
2.389	H	65.5	54.7	28.2	-30.4	0.0	63.3	74.0	52.5	54.0
1.130	V	50.3	-	24.6	-32.4	0.0	42.5	74.0	-	54.0
1.199	V	51.8	-	25.2	-32.3	0.0	44.7	74.0	-	54.0
1.327	V	48.3	-	25.6	-31.8	0.0	42.1	74.0	-	54.0
2.273	H	52.9	-	27.8	-30.5	0.0	50.2	74.0	-	54.0
4.826	V	50.4	-	27.1	-27.2	0.0	50.3	74.0	-	54.0
7.235	V	53.2	41.3	30.0	-26.4	0.0	56.8	74.0	44.9	54.0

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

Table 7-2-2. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.6(2437MHz) **TX** mode 11Mbps

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										
2.436	H	114.3	106.9	28.3	-28.4	0.0	114.2	OB*	106.8	OB*
Adjacent RB										
2.337	H	53.6	-	28.1	-30.3	0.0	51.4	74.0	-	54.0
2.367	H	59.3	51.8	28.1	-30.4	0.0	57.0	74.0	49.5	54.0
2.496	H	57.1	46.5	28.4	-30.2	0.0	55.3	74.0	44.7	54.0
1.101	V	47.1	-	24.4	-32.6	0.0	38.9	74.0	-	54.0
1.130	V	50.9	-	24.6	-32.4	0.0	43.1	74.0	-	54.0
1.199	V	51.1	-	25.2	-32.3	0.0	44.0	74.0	-	54.0
2.272	H	50.7	-	27.8	-30.5	0.0	48.0	74.0	-	54.0
4.876	V	50.8	-	27.0	-26.9	0.0	50.9	74.0	-	54.0
7.312	V	52.0	41.1	29.9	-25.8	0.0	56.1	74.0	45.2	54.0

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

Table 7-2-3. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.11(2462MHz) **TX** mode 11Mbps

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										
2.461	H	114.6	106.4	28.4	-30.2	0.0	112.8	OB*	104.6	OB*
Adjacent RB										
2.337	H	54.0	-	28.1	-30.3	0.0	51.8	74.0	-	54.0
2.369	H	57.3	50.0	28.1	-30.4	0.0	55.0	74.0	47.7	54.0
2.485	H	65.1	54.7	28.4	-30.2	0.0	63.3	74.0	52.9	54.0
2.496	H	60.9	51.0	28.4	-30.2	0.0	59.1	74.0	49.2	54.0
1.130	V	54.1	-	24.6	-32.7	0.0	46.0	74.0	-	54.0
1.199	V	51.9	-	25.2	-32.3	0.0	44.8	74.0	-	54.0
1.328	V	47.7	-	25.6	-31.9	0.0	41.4	74.0	-	54.0
2.272	H	51.8	-	27.8	-30.5	0.0	49.1	74.0	-	54.0
4.926	V	49.6	-	27.0	-27.7	0.0	48.9	74.0	-	54.0
7.387	V	49.0	-	29.8	-26.2	0.0	52.6	74.0	-	54.0

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

Table 7-2-4. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.6(2437MHz) **RX** mode

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)***
1.101	V	47.5	-	24.4	-32.7	0.0	39.2	74.0	-	54.0
1.130	V	49.5	-	24.6	-32.3	0.0	41.8	74.0	-	54.0
1.199	V	50.6	-	25.2	-31.9	0.0	43.9	74.0	-	54.0

7.4.2 EUT in 5.8GHz IEEE802.11a transmission mode

Table 7-3-1. EUT: M/T 2373-92U, s/n ZZ-00129, Ch.149(5745MHz) **TX** mode 24Mbps

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										
5.747	H	103.9	92.4	34.0	-26.6	0.0	111.3	OB*	99.8	OB*
1.130	V	49.7	-	24.6	-32.4	0.0	41.9	74.0	-	54.0
1.198	V	49.5	-	25.2	-32.3	0.0	42.4	74.0	-	54.0
1.329	V	50.1	-	25.6	-31.8	0.0	43.9	74.0	-	54.0
11.491	V	45.4	33.8	33.5	-21.6	0.0	57.3	74.0	45.7	54.0
17.236	V	38.4	-	37.2	-21.8	0.0	53.8	74.0	-	54.0

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

Table 7-3-2 EUT: M/T 2373-92U, s/n ZZ-00129, Ch.157(5785MHz) **TX** mode 24Mbps

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										
5.791	H	104.6	91.9	34.2	-26.3	0.0	112.5	OB*	99.8	OB*
1.130	V	50.8	-	24.6	-32.4	0.0	43.0	74.0	-	54.0
1.198	V	49.9	-	25.2	-32.3	0.0	42.8	74.0	-	54.0
1.329	V	47.3	-	25.6	-31.8	0.0	41.1	74.0	-	54.0
11.567	V	45.3	31.6	33.5	-21.7	0.0	57.1	74.0	43.4	54.0
17.359	V	39.0	27.4	37.2	-21.6	0.0	54.6	74.0	43.0	54.0

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

Table 7-3-3 EUT: M/T 2373-92U, s/n ZZ-00129, Ch.165(5825MHz) **TX** mode 24Mbps

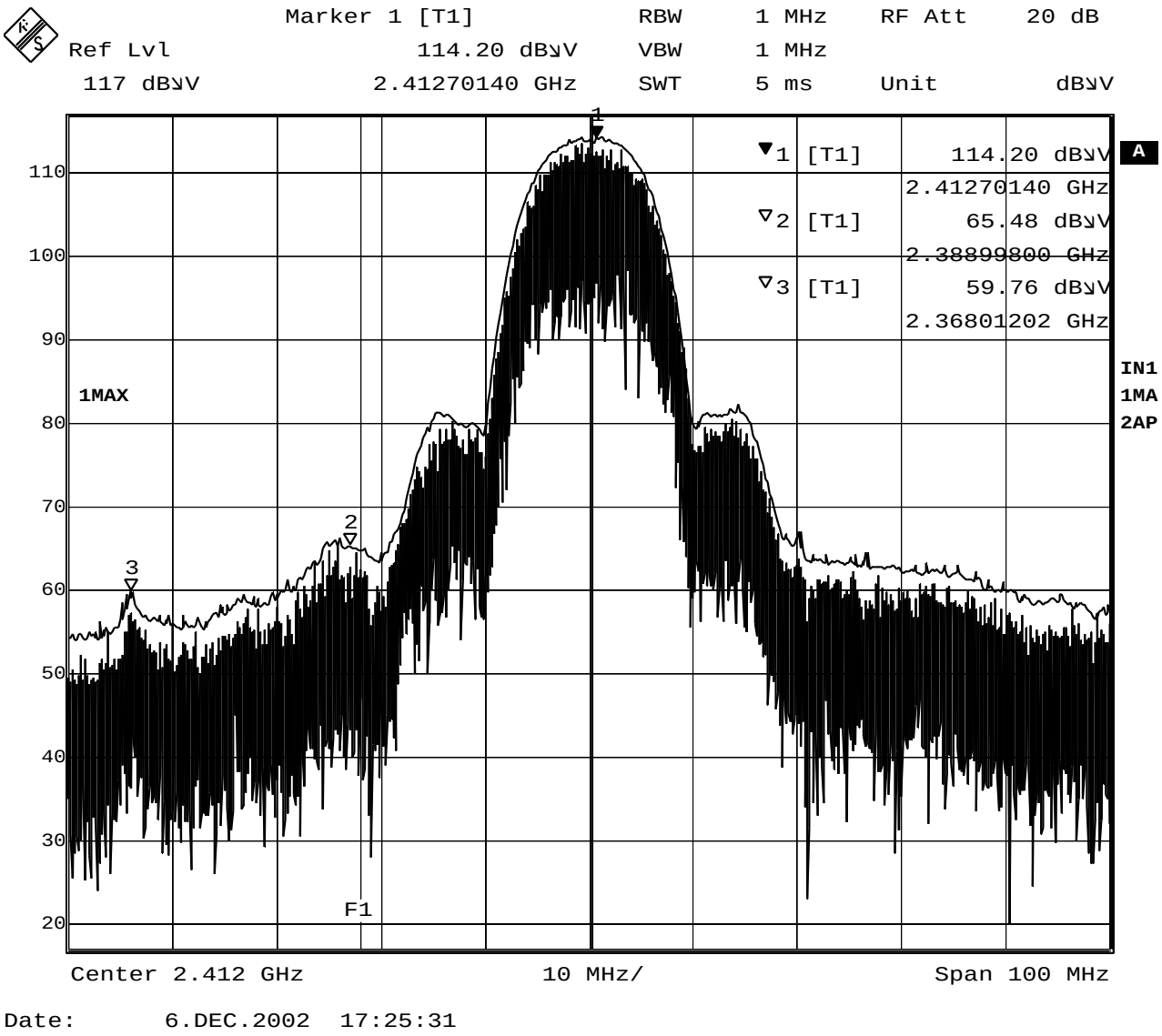
Frequency (GHz)	Polarity (H/V)	Measured (dBμV) ***(peak)***	Measured (dBμV) ***(average)***	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m) ***(peak)***	FCC Limit (dBμV/m) ***(peak)***	Field Strength (dBμV/m) ***(average)***	FCC Limit (dBμV/m) ***(average)***
Inband										
5.829	H	101.7	90.0	34.0	-26.2	0.0	109.5	OB*	97.8	OB*
1.064	V	51.5	-	24.6	-32.7	0.0	43.4	74.0	-	54.0
1.130	V	50.8	-	24.6	-32.4	0.0	43.0	74.0	-	54.0
1.198	V	49.9	-	25.2	-32.3	0.0	42.8	74.0	-	54.0
11.651	V	41.2	-	33.6	-21.6	0.0	53.2	74.0	-	54.0
17.473	V	38.8	27.3	37.2	-21.6	0.0	54.4	74.0	42.9	54.0

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

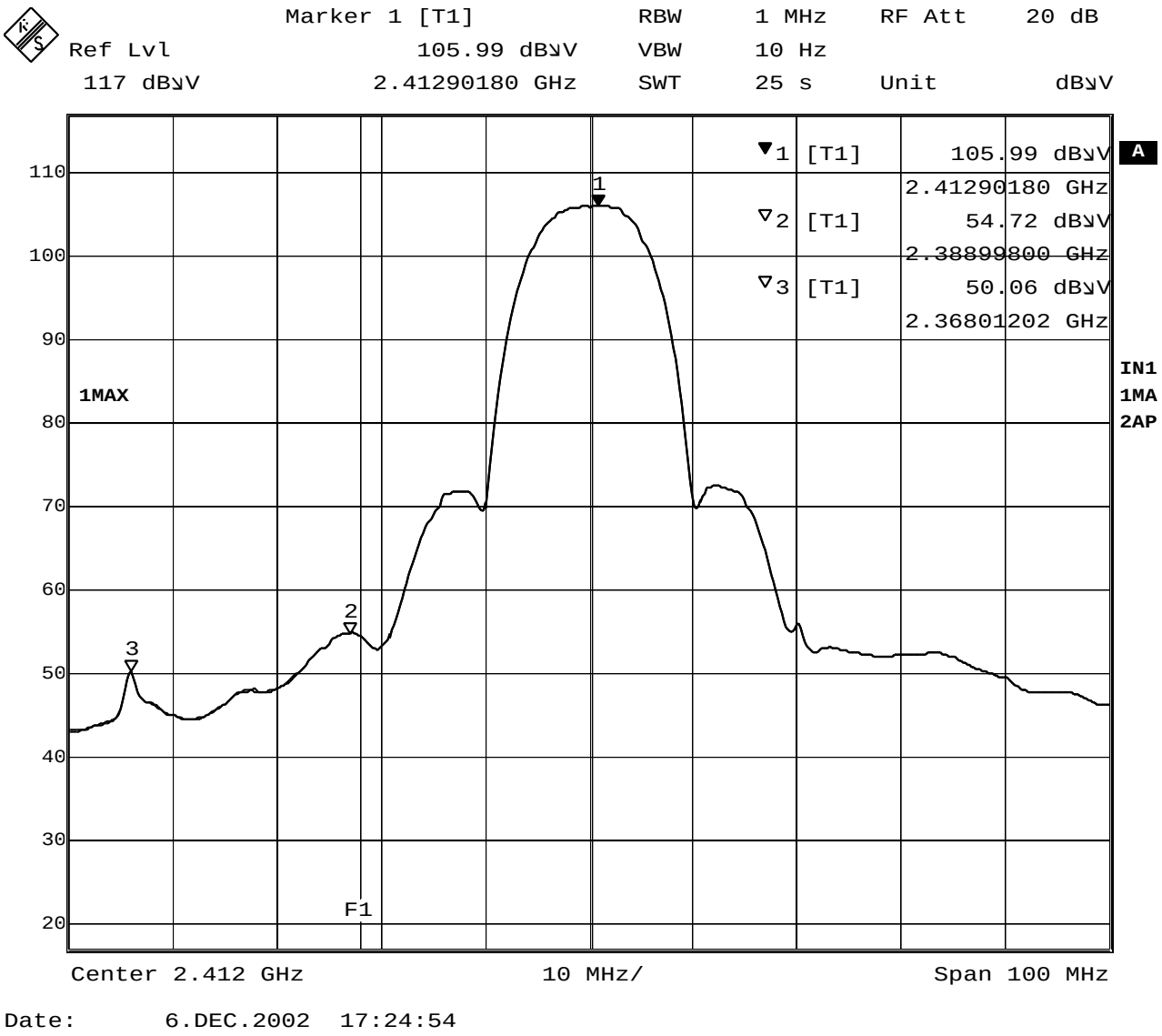
Table 7-3-4 EUT: M/T 2373-92U, s/n ZZ-00129, Ch.157(5785MHz) **RX** mode

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)***
1.064	V	51.5	-	24.6	-32.7	0.0	43.4	74.0	-	54.0
1.130	V	50.8	-	24.6	-32.4	0.0	43.0	74.0	-	54.0
1.198	V	49.9	-	25.2	-32.3	0.0	42.8	74.0	-	54.0

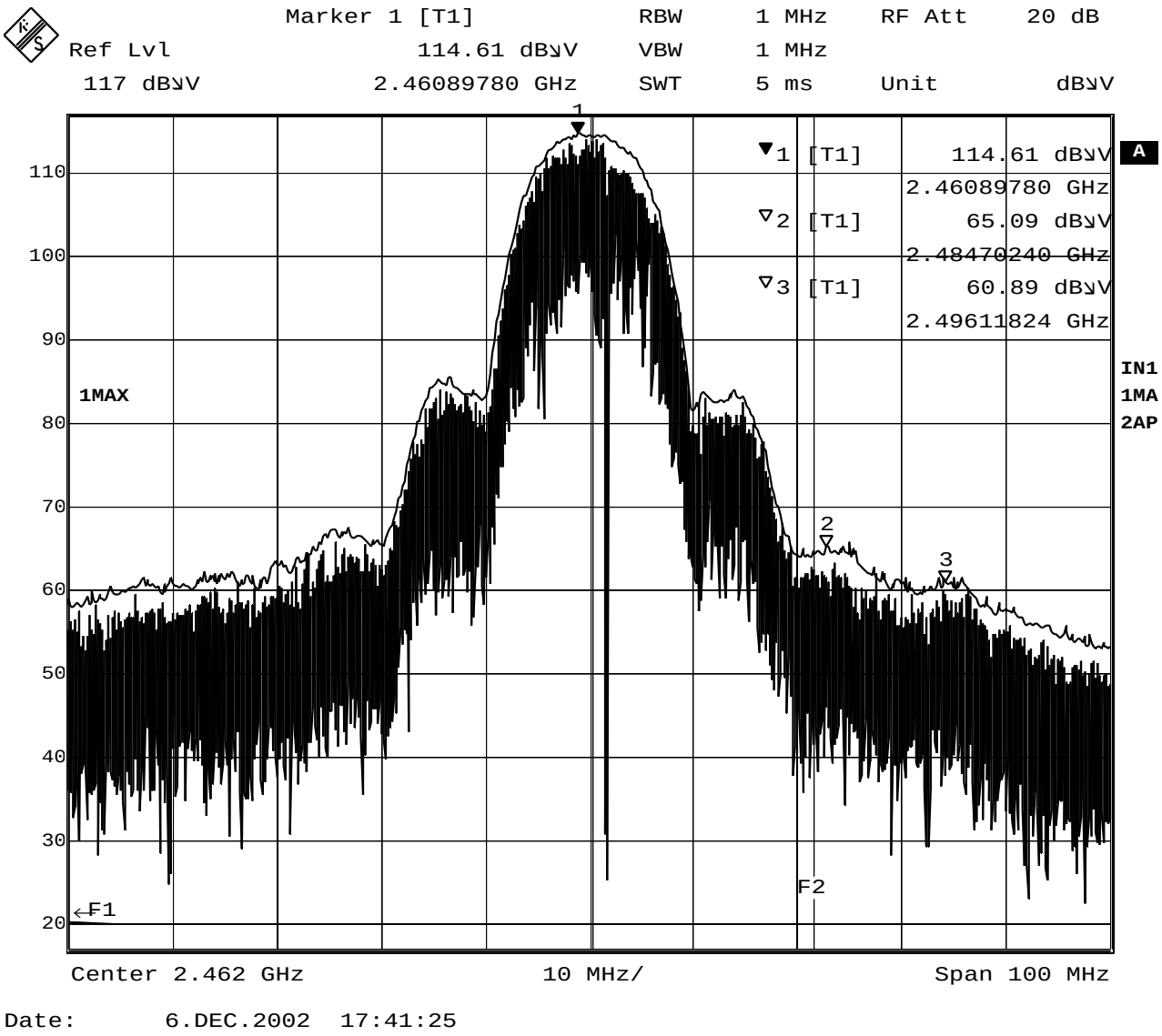
7.5 Measurement plots of adjacent restricted band



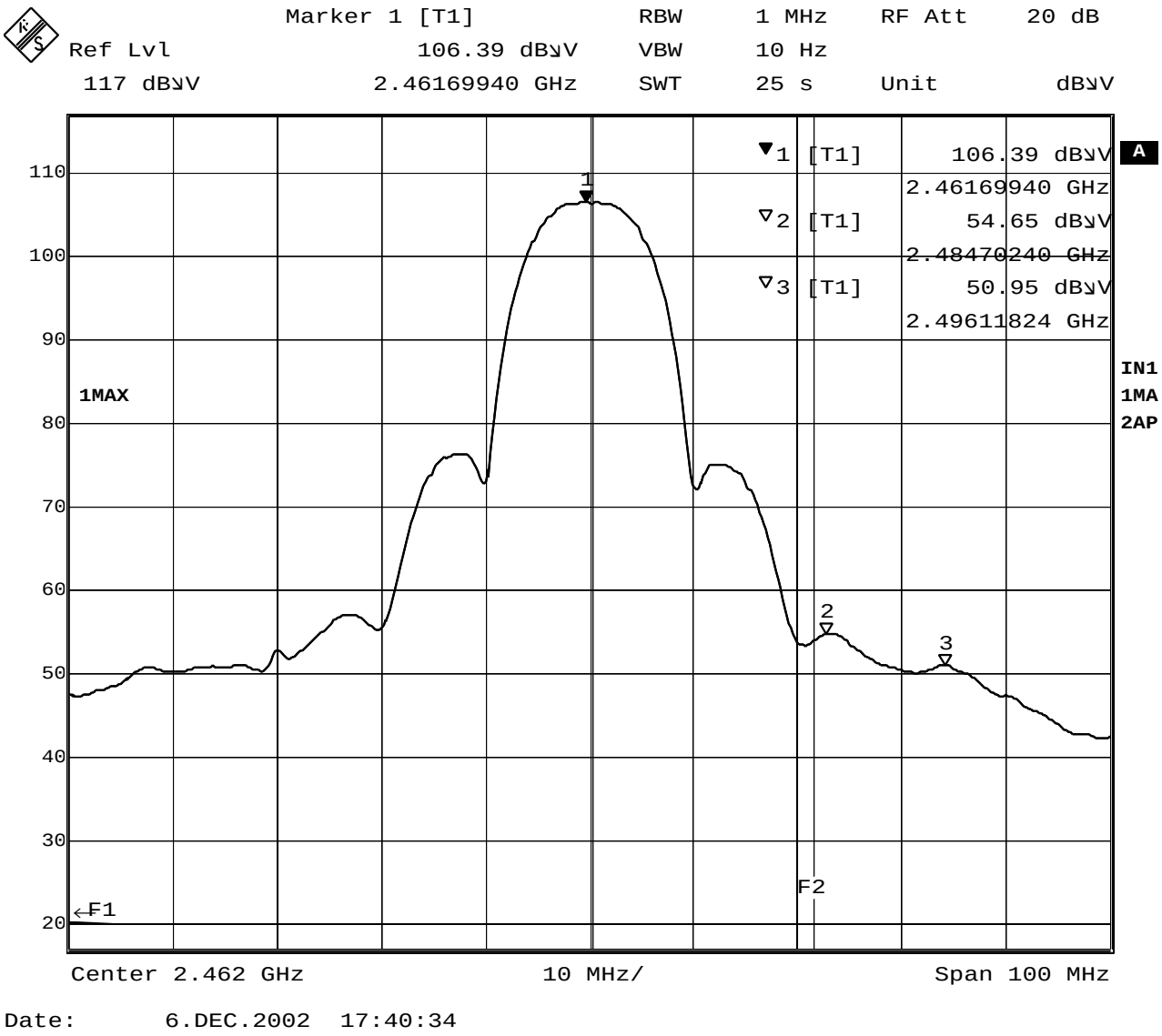
Plot 7-3-1 Ch.1 2412MHz TX 11Mb/s (Peak)



Plot 7-3-2 Ch.1 2412MHz TX11Mb/s (Average)



Plot 7-3-3 Ch.11 2462MHz TX 11Mb/s (Peak)



Plot 7-3-4 Ch.11 2462MHz TX 11Mb/s (Average)