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

Document Number : FCC 19-0280-0

Model Number: J07M067

FCC ID: ANO20040700HER
IC: 349E-J07M067

November 5, 2004

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MEASUREMENT / TECHNICAL REPORT – Part 15 Subpart C

(Intentional Radiator)

FCC ID : ANO20040700HER

Model: J07M067 (Bluetooth Standard Class 2 Adapter)

with

IBM ThinkPad T40 Series

(Machine Type: 1871, 1875, 1873, 1874, 1875, 1876, 2373, 2374, 2375, 2376, 2378, 2379, 2668, 2669, 2678, 2679, 2686, 2687)

IBM ThinkPad R50 Series

(Machine Type: 1829, 1830, 1831, 1832, 1833, 1834, 1835, 1836, 1840, 1841, 1842, 2883, 2887, 2888, 2889, 2894, 2895)

IBM ThinkPad X30 Series

(Machine Type: 2672, 2673, 2884, 2885, 2890, 2891)

IBM ThinkPad X40 Series

(Machine Type: 2369, 2370, 2371, 2372, 2382, 2386)

November 5, 2004

This report concerns: (check one)

Original Grant ✓

Class I change _____

Class II change _____

Equipment type: Bluetooth modular device

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

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

Other test procedure: _____

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

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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 (Advertising Name)	: J07M067 (IBM Integrated Bluetooth IV with 56K Modem)
FCC ID IC Certification Number	: ANO20040700HER : 349E-J07M067
SERIAL NUMBER	: 05S5A-RM4SIT023
PYSICAL CONDITION	: Preproduction
KIND OF EQUIPMENT	: DTS: Bluetooth modular device with AFH (Advanced Frequency Hopping) function
TESTED DATE	: October 18, 19, 20, 21, 22, 25, 26, 27, 28, 29 and November 2, 2004

A.1 Test Methodology

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

A.2 Test Facility / NVLAP Accreditation

The semi-anechoic chamber #1 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).

1.

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

- Theses facilities are accepted by **Industry Canada** as number **IC 4221** for chamber #1 (expiry date: January 25, 2005), and as number **IC 4221-1** for chamber #2 (expiry date: February 16, 2007).

A.3 EUT details

Table A EUT details

Model and S/N	FCC ID IC Certification Number	Description
J07M067 (s/n 05S5ARM4SIT023)	FCC ID: ANO20040700HER IC:349E-J07M067	**Applying modular transmitter** Built-in type Bluetooth modular transmitter device without antenna
ThinkPad T40 Series M/T 2373-GEU (14 inch) (s/n ZZ-02250) M/T 2373-PUU (15 inch) (s/n ZZ-22134)	N/A	Host equipment IBM Notebook PC with built_in antenna CPU: Intel® Pentium® M Processor, 1.7GHz
ThinkPad R50 Series M/T 1829-38x (14 inch) (s/n ZZ-08189)		IBM Notebook PC with built_in antenna CPU: Intel® Pentium® M Processor, 1.5GHz
ThinkPad X40 Series M/T : 2371-SD1 (s/n SIT#15023)		IBM Notebook PC with built-in antenna CPU: Intel® Pentium M Processor, 1.4 GHz
ThinkPad X30 Series M/T 2672-UPx (s/n zz-04049)		IBM Notebook PC with built_in antenna CPU: Intel® Pentium® M Processor, 1.7GHz
WM3B2200BG (s/n 006FA0473)	FCC ID: ANO20040501CX2 IC: 349E-MW3B22BG	Co-located WLAN modular transmitter Built_in type IEEE802.11b/g Wireless LAN Mini-PCI card without antenna
T60H786-U (s/n DX39105T)	FCC ID: ANO20030500CMR IC: 349E-T60H786U	Co-located WLAN modular transmitter Built_in type IEEE802.11b/g Wireless LAN Mini-PCI card without antenna
WM3B2100 (s/n 0004234572F6)	FCC ID: ANO20020201CLK IC:349E-WM3B2100	Co-located WLAN modular transmitter Built_in type IEEE802.11b Wireless LAN Mini-PCI card without antenna
P/N 02K6810	N/A	Universal AC adapter 56W, Unshielded power cord for ThinkPad X30/X40 Series
P/N 02K6746	N/A	Universal AC adapter 72W, Unshielded power cord for ThinkPad T40/R50 Series

B. Summary of Test Results

Table-B presents the list of the measurement items for Spread Spectrum Digital Transmission System under FCC Part 15 Subpart C and Spread Spectrum Frequency Hopping System under 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		Condition	Result
	Transmit mode (TX):			
15.247(a)(1) **6.2.2(o)(a1)**	Carrier Frequency Separation	min. 25 kHz	Conducted	Pass
15.247(a)(1)(iii) **6.2.2(o)(a3)**	Number of Hopping Frequencies	at least 15 non-overlapping channels		Pass
	Dwell Time	0.4 seconds within a 31.6 second (79 hops × 0.4sec) period		Pass
15.247(f) **6.2.2 (o)(c2)(6)**	Dwell Time of Hybrid mode	0.4 seconds within a 12.8 second (32 hops × 0.4sec) period		Pass
– **5.9.1 / 5.9.2**	Occupied bandwidth, and Designation of Emissions	IC requirement.		N/A
15.247(b)(1) **6.2.2(o)(a3)**	Peak output power	Shall not exceed 0.125W.		Pass
15.247(c) **6.2.2 (o) (e1)**	Conducted spurious (Out of Band Emissions), and Bandedge compliance	The radiated emission to any 100 kHz of outband shall be at least 20 dB below the highest inband spectral density.		Pass Pass
15.207 **6.6**	AC Wireline Conducted emissions 150 kHz – 30 MHz	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 / 6.3**	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Shall not exceed the limits specified in FCC 15.209, or RSS-210, Table 3.	Radiated (30M -1GHz) Radiated (1G –25GHz)	Pass Pass
	Receive mode (RX):			
15.207 **7.4**	AC Wireline Conducted Emissions 150 kHz – 30 MHz	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 **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, Table 3.	Radiated (30M -1GHz) Radiated (1G –25GHz)	Pass Pass
	Other requirements			Result
15.247(b)(4)(i) **–**	Antenna gain	Peak gain of the device : 2.84 dBi		N/A
– **5.2**	Supply Voltage	Main power source: Universal AC adapter 72W CDC bus to applying card : DC 3.3V ± 0.3V		N/A
15.203 **6.2.2(o)(e2)**	Unique antenna connector	The device employs an unique electronic connector so called **BIOS Lock**. Refer to "Confidential_BIOS-Lock" exhibit.		Pass

C. Operation Mode of EUT

All tests were performed using the “Broadcom BlueTool version 0.7.8.4”.

Hopping channels

The applying modular transmitter device is designed to the Bluetooth Standard Class 2 (3mW level). The lowest hopping frequency is 2402MHz, and the highest one is 2480MHz. Total 79 hopping channels are used with each 1MHz of channel spacing in normal hopping operation.

Also the applying device supports AFH (Advanced Frequency Hopping) mode with 20 hopping channels. The 20 frequencies for AFH are determined randomly in 79 of full hopping slots, or any continuous 20 slots are chosen.

This test report (Chapter 2) was performed with the latter sequence representatively, and selected channels were as follows.

- Low band AFH : ch.1 ~ ch.20
- Middle band AFH : ch.30 ~ ch.49
- high band AFH : ch.60 ~ ch.79

: AFH channels tested in this report.

Ch.	Operation Frequency [GHz]	Ch.	Operation Frequency [GHz]	Ch.	Operation Frequency [GHz]	Ch.	Operation Frequency [GHz]
1	2.402	21	2.422	41	2.442	61	2.462
2	2.403	22	2.423	42	2.443	62	2.463
3	2.404	23	2.424	43	2.444	63	2.464
4	2.405	24	2.425	44	2.445	64	2.465
5	2.406	25	2.426	45	2.446	65	2.466
6	2.407	26	2.427	46	2.447	66	2.467
7	2.408	27	2.428	47	2.448	67	2.468
8	2.409	28	2.429	48	2.449	68	2.469
9	2.410	29	2.430	49	2.450	69	2.470
10	2.411	30	2.431	50	2.451	70	2.471
11	2.412	31	2.432	51	2.452	71	2.472
12	2.413	32	2.433	52	2.453	72	2.473
13	2.414	33	2.434	53	2.454	73	2.474
14	2.415	34	2.435	54	2.455	74	2.475
15	2.416	35	2.436	55	2.456	75	2.476
16	2.417	36	2.437	56	2.457	76	2.477
17	2.418	37	2.438	57	2.458	77	2.478
18	2.419	38	2.439	58	2.459	78	2.479
19	2.420	39	2.440	59	2.460	79	2.480
20	2.421	40	2.441	60	2.461		

Test Frequencies (Section 15.31m)

In line with the Section 15.31(m) of Public Notice DA 00-705 dated March/30/2000, some measurements are performed at the highest, middle, and lowest available channels with the hopping function disabled. (i.e. at 2402MHz, 2441MHz and 2480MHz)

Unless otherwise specified the above condition, the test was performed while EUT had its hopping function enabled.

D. Justification

In accordance with the ET Docket 03–201; FCC 04–165, July 12/2004, and Federal Register / Vol. 69, No. 172, September 7/2004, the full testing was performed with the highest peak antenna gain among the supported host devices shown in Table-D. IBM laptop PC, ThinkPad T40 Series (15 inch LCD model) was selected for the testing.

Table-D Peak Antenna Gains of EUT

ThinkPad T40 Series, 14 inch LCD model	1.20 dBi (peak)
ThinkPad T40 Series, 15 inch LCD model	2.84 dBi (peak)
ThinkPad R50 Series, 14 & 15 inch LCD models	2.16 dBi (peak)
ThinkPad X30 Series	1.80 dBi (peak)
ThinkPad X40 Series	1.99 dBi (peak)

E. Test Instruments

Table-D List of Measuring Instruments

Description	**Model**	**Serial Number**	**Calibration Date**	**Calibration Interval**
Computer	IBM 6868-30J	97-901X3	N/A	N/A
Computer	IBM 6589-13J	97-15613	N/A	N/A
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	3019A05156	08/05/04	1 year
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2732A03651	07/21/04	1 year
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	2841A04254	08/25/04	1 year
Spectrum Analyzer Display	HP 85662A	3026A19366	08/05/04	1 year
Spectrum Analyzer Display	HP 85662A	2648A15255	07/21/04	1 year
Spectrum Analyzer Display	HP 85662A	2816A16831	08/25/04	1 year
Quasi-Peak Adapter	HP 85650A	2811A01433	08/05/04	1 year
Quasi-Peak Adapter	HP 85650A	2521A00968	07/20/04	1 year
Quasi-Peak Adapter	HP 85650A	2811A01156	08/25/04	1 year
Amplifier (100KHz - 1.3GHz)				
- for 30-200MHz	MITEQ AM-3A	898433	04/23/04	1 year
- for 200-1000MHz	MITEQ AM-3A	898432	04/23/04	1 year
Amplifier (1 - 18GHz)	HP 8449B	3008A00582	06/01/04	1 year
Amplifier (18 – 25GHz)	Agilent 83051A	3950M00193	01/27/04	1 year
Spectrum Analyzer EMI Test Receiver	R&S ESI26	836119/003	05/10/04	1 year
Receiver (9kHz-30MHz)	R&S ESH3	892108/003	11/17/03	1 year
Receiver (20MHz-1.3GHz)	R&S ESVP	893202/018	02/10/04	1 year
Biconical Antenna (30-200MHz)	EMCO 3108	2536	04/23/04	1 year
Log-Periodic Antenna (200-1000MHz)	EMCO 3146	2849	04/23/04	1 year
Horn Antenna (1- 18GHz)	EMCO 3115	9903-5774	07/20/04	1 year
Horn Antenna (3.95- 5.85GHz)	EMCO 3160-5	1099	07/20/04	1 year
Horn Antenna (5.85- 8.20GHz)	EMCO 3160-6	9712-1044	07/20/04	1 year

Horn Antenna (8.20- 12.4GHz)	EMCO 3160-7	1156	07/20/04	1 year
Horn Antenna (18- 26.5GHz)	EMCO 3160-9	0004-1202	07/20/04	1 year
LISN	EMCO 3810/2NM	00022007	06/15/04	1 year
Switch/control unit	HP 3488A	2719A17226 2719A17228	N/A N/A	N/A N/A
Plotter	HP 7550A	2631A33619	N/A	N/A
Coaxial cables (1 – 18GHz): - Horn Ant <=> RF Amp. - RF Amp.<=>Spectrum Analyzer Coaxial cables (18 – 25GHz): - Horn Ant <=> RF Amp. - RF Amp.<=>Spectrum Analyzer 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 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) - Power Splitter <=> SW/Con.unit (SW110) - Power Splitter <=> SW/Con.unit (SW300) - Power Splitter <=> SW/Con.unit (SW100) - Power Splitter <=> SW/Con.unit (SW301) - SW/Con.unit <=> Receiver (Input) - SW/Con.unit <=> Spe Ana.(Signal In) for 30- 200MHz - SW/Con.unit <=> Spe Ana.(Signal In) for 200-1000MHz	Length: 6 m 16m 3m 1m 9 m 10 m 7 m 0.5m 9 m 10 m 7 m 0.5m 4 m 4 m 1 m 1 m 1 m 1 m 1 m 1 m 2 m 2 m 2 m	 - EM206SCO - GEM0101 - SF102-20167 - SF102-21105 - EM103L01 - EM103L02 - EM103L03 - EM103L04 - EM103H01 - EM103H02 - EM103H03 - EM103H04 - EMIC-L - EMIC-N - EMIC-R - EMIC-S - EM103L05 - EM103L06 - EM103H05 - EM103H06 - EM1RCV - EM1SPL - EM1SPH	 03/25/04 03/25/04 04/08/04 04/08/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04 04/23/04	 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year 1 year

Notes.

- The above equipment calibration is traceable to National standards.
- HP: Hewlett Packard, R&S: Rohde & Schwarz

Prepared by T. Asano

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°C to 28°C.
The relative humidity is controlled within range of 40% to 70%.

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

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

1. Carrier Frequency Separation

[FCC 15.247(a)(1), RSS-210 6.2.2(o)(a1)]

1.1 Test Procedure

- The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.
- The spectrum analyzer was set to :
  Span = 3 MHz (wide enough to capture the peaks of two adjacent channels),
  Resolution Bandwidth (RBW) = 30 kHz (1% of the span or more),
  Video Bandwidth (VBW) = 30 kHz (= RBW or more), Sweep = auto,
  Detector function = peak, Trace = max hold
- After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

1.2 Test Instruments and Measurement Setup

Table 1-1 : Test Instruments

Description	**Model**	**Serial Number**
Spectrum Analyzer EMI Test Receiver	R&S ESI26	836119/003
Coax cables: - Spectrum Analizer <=> EUT	Length: Loss: 110 cm 1.3 dB	

Notes: - R&S : Rohde & Schwarz

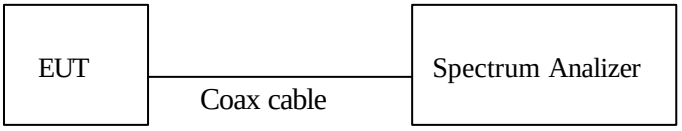


Figure 1: Measurement setup for the carrier frequency separation

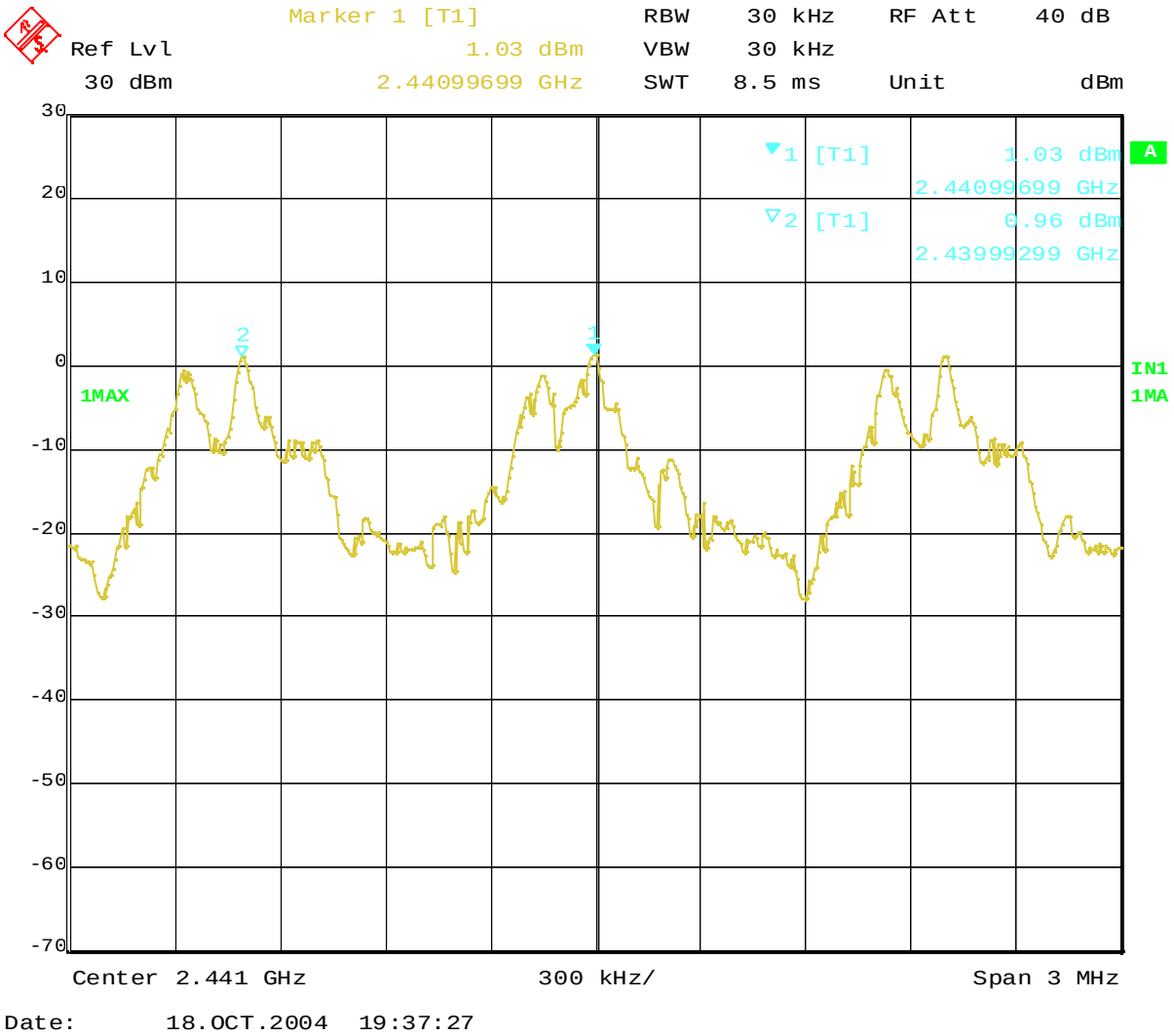
1.3 Measurement Results

Test Date: October 18, 2004

Table 1-2. Carrier Frequency Separation, TX hopping mode

Frequency of marker #1 (MHz)	Frequency of marker #2 (MHz)	Carrier Frequency Separation (kHz)	Note
2439.99	2441.00	1010	Min. 25 kHz

1.4 Trace Data



Plot 1-1. Carrier Frequency Separation

2. Number of Hopping Frequencies

[FCC 15.247(a)(1)(iii), RSS-210 6.2.2(o)(a3)]

2.1 Test Procedure

- The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.
- To get higher resolution, seven frequency ranges within the 2400- 2483.5 MHz FH band were examined for both normal hopping operation and AFH (Advanced Frequency Hopping) mode.
- The spectrum analyzer was set to :

  - Frequency range for normal hopping mode

    1: Start = 2389.5 MHz, Stop = 2414.5 MHz
    2: Start = 2414.5 MHz, Stop = 2439.5 MHz
    3: Start = 2439.5 MHz, Stop = 2464.5 MHz
    4: Start = 2464.5 MHz, Stop = 2489.5 MHz

  - Frequency range for AFH mode *1

    5: Start = 2398.0 MHz, Stop = 2427.0 MHz (Ch.1 ~ Ch.19)
    6: Start = 2427.0 MHz, Stop = 2456.0 MHz (Ch.30 ~ Ch.49)
    7: Start = 2456.0 MHz, Stop = 2485.0 MHz (Ch.60 ~ Ch.79)

  RBW ≥ 1% of the span, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold

*1: The AFH (Advanced Frequency Hopping) mode employs short hopping of 20 channels. The 20 frequencies for AFH are determined randomly in 79 of full hopping slots, or any continuous 20 slots are chosen. This test was performed with the latter sequence representatively.

2.2 Test Instruments and Measurement Setup

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

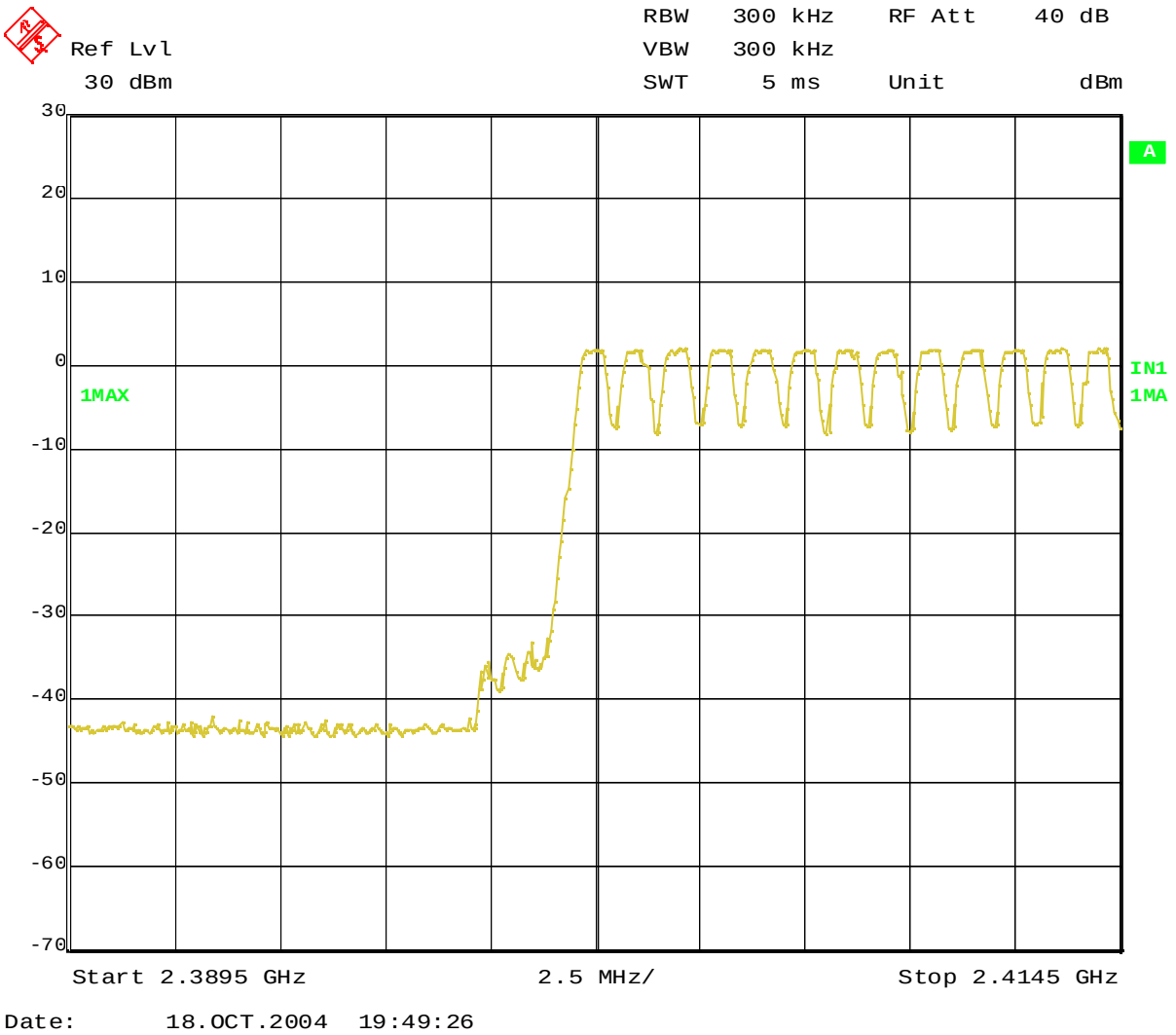
2.3 Measurement Results

Test Date: October 18 and 29, 2004

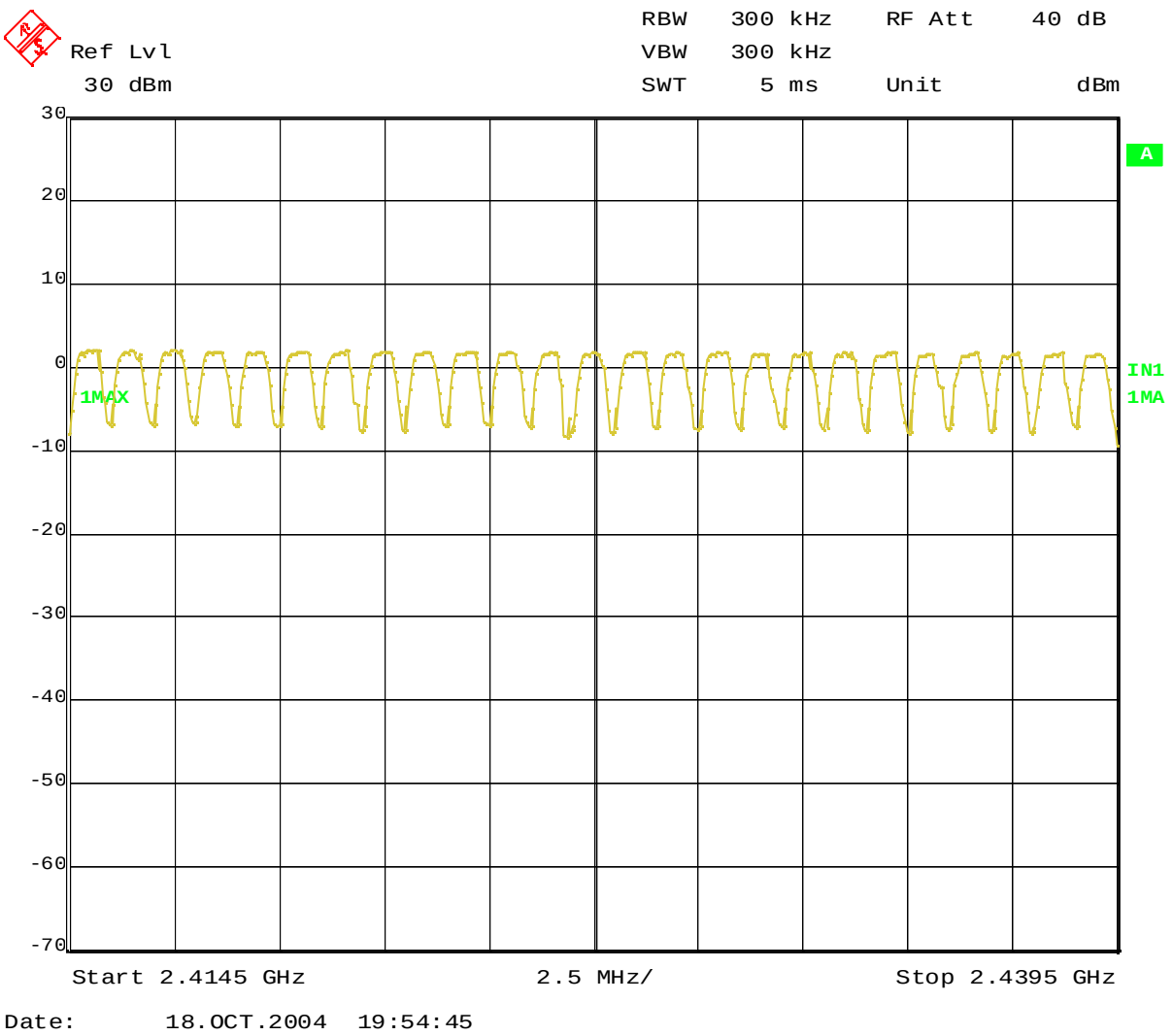
Table 2. Number of Hopping Frequencies, TX hopping mode

Operation mode	Total number of Hopping Channels	Note
normal	79	at least 15 non-overlapping channels
AFH low	20	
AFH middle	20	
AFH high	20	

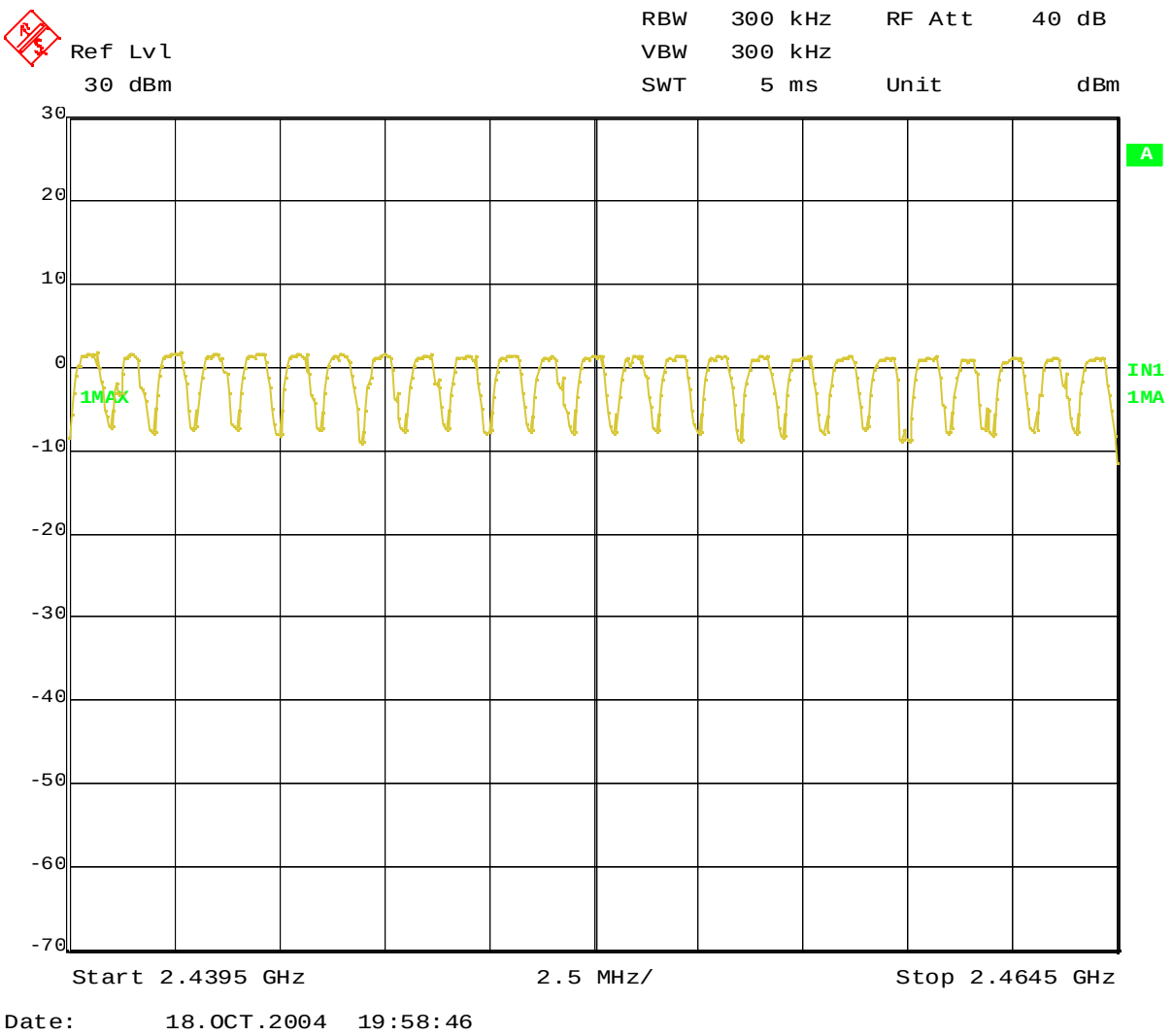
2.4 Trace Data



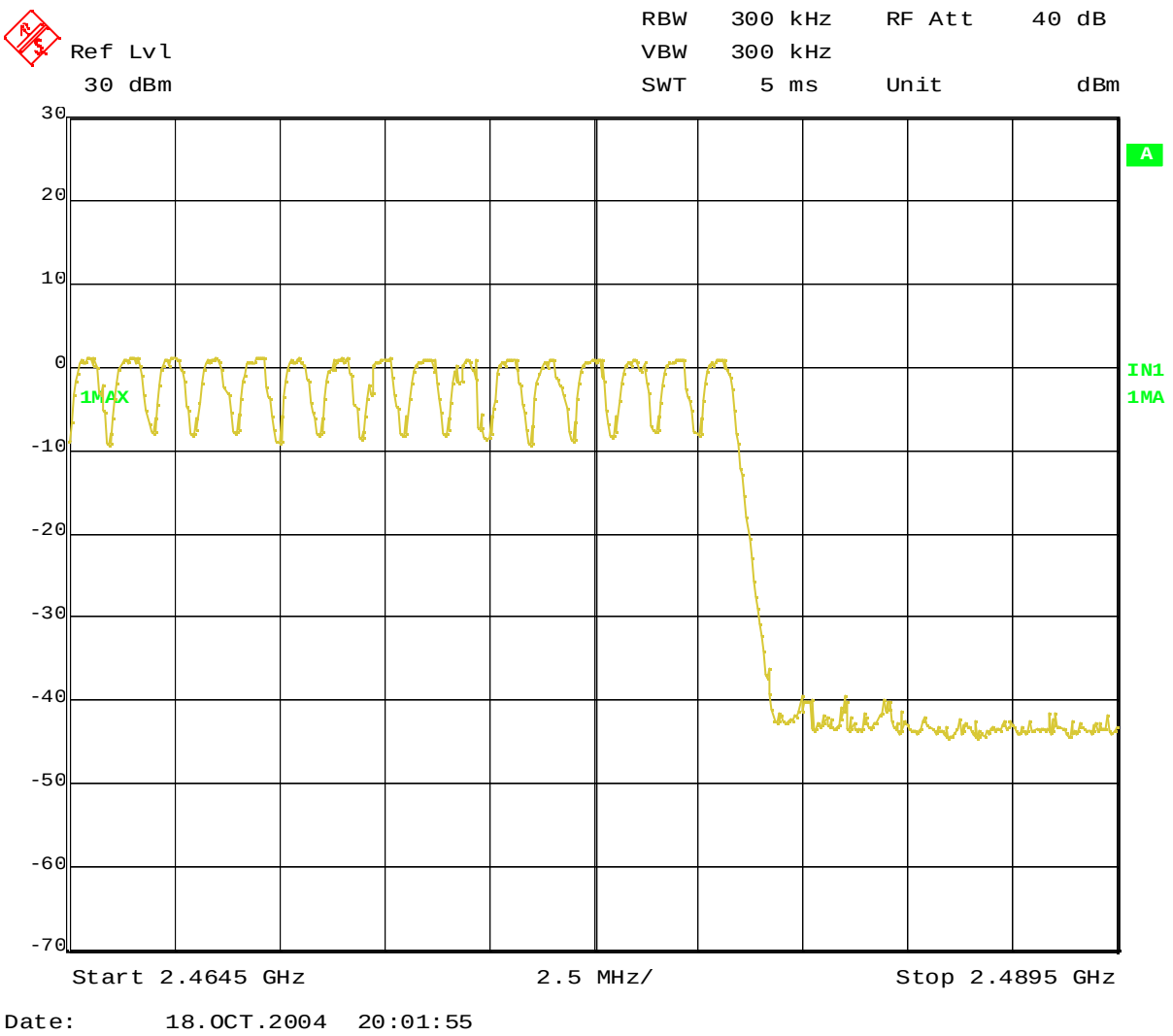
Plot 2-1. Number of Hopping Frequencies (range 1)



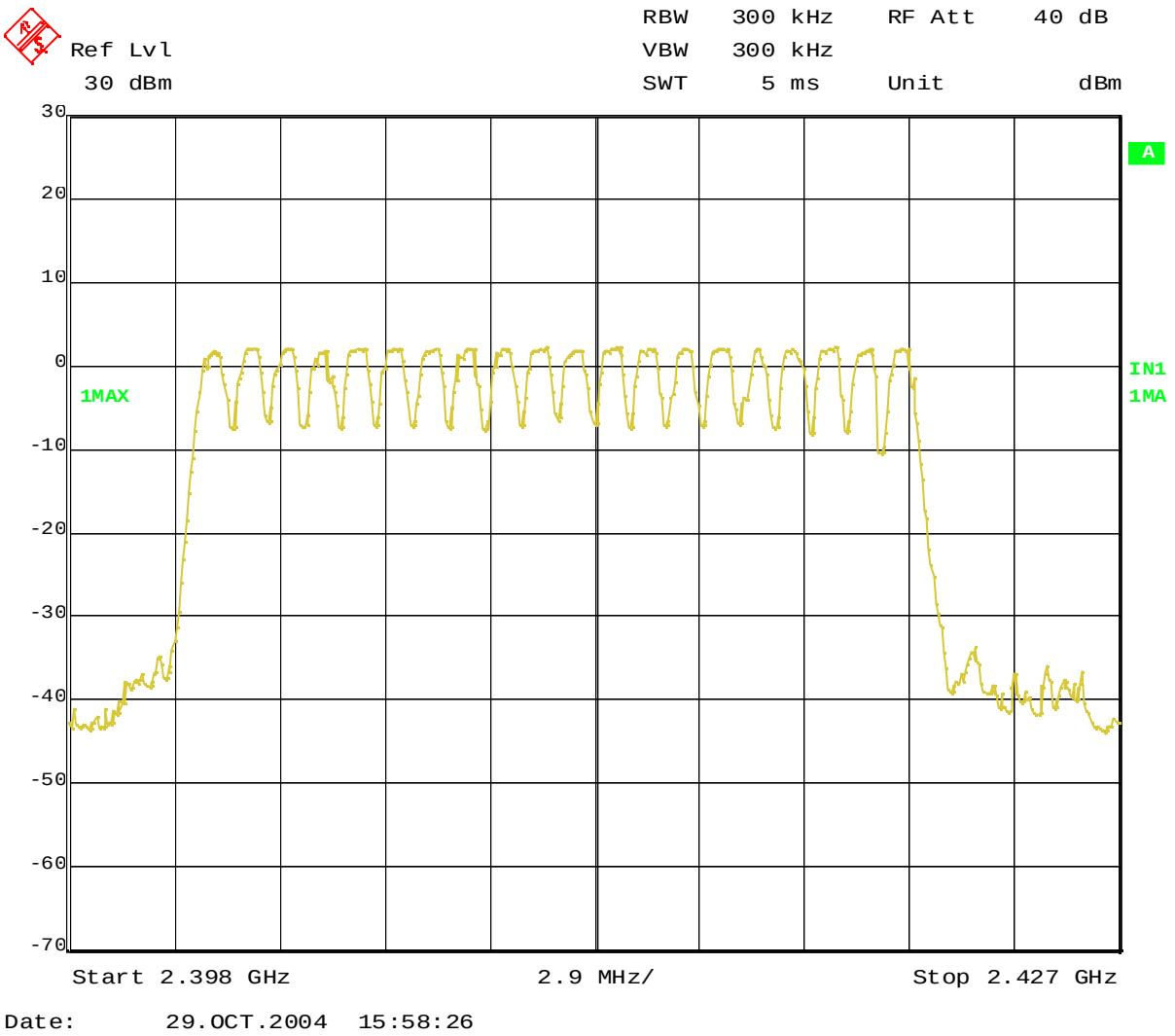
Plot 2-2. Number of Hopping Frequencies (range 2)



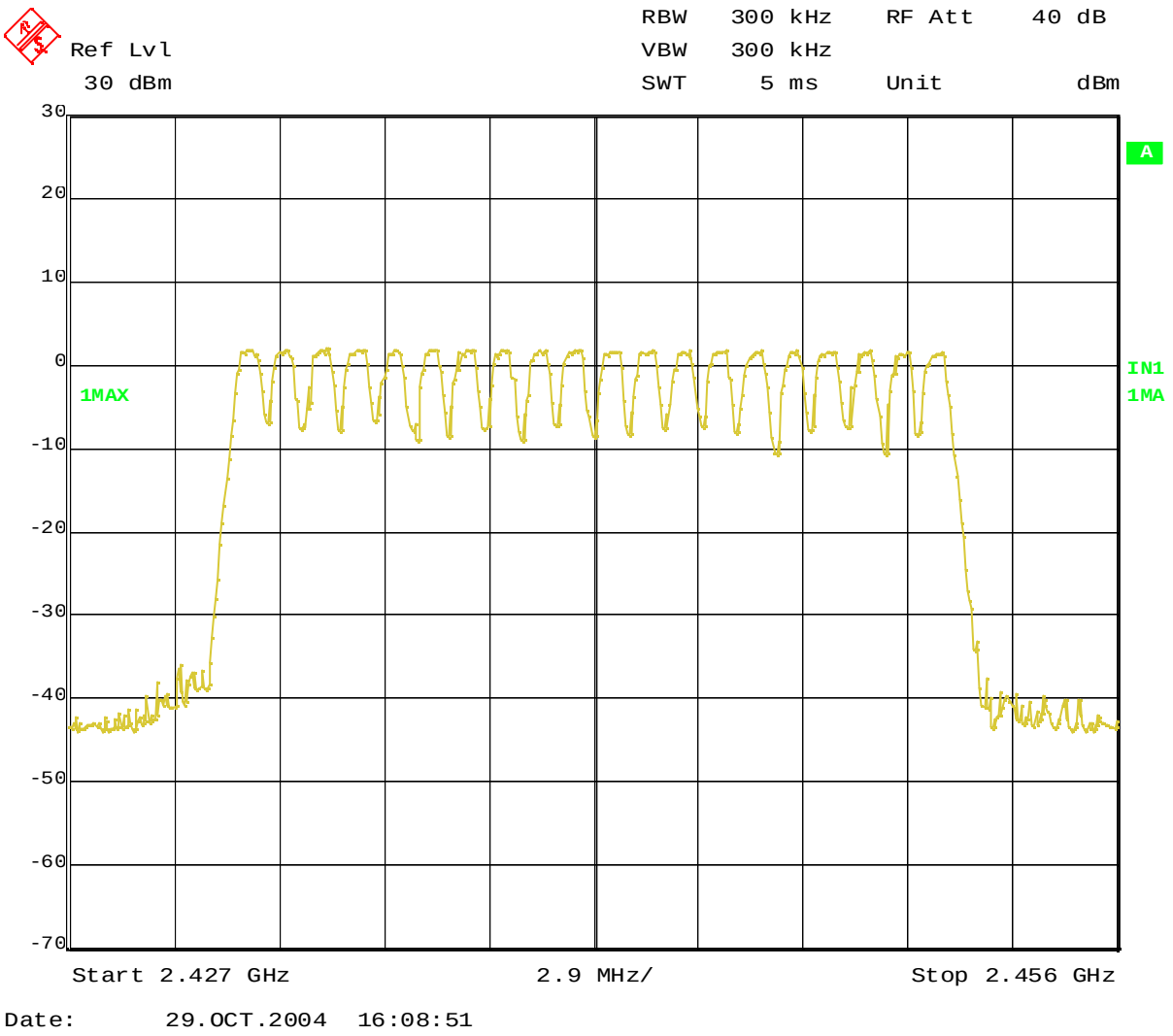
Plot 2-3. Number of Hopping Frequencies (range 3)



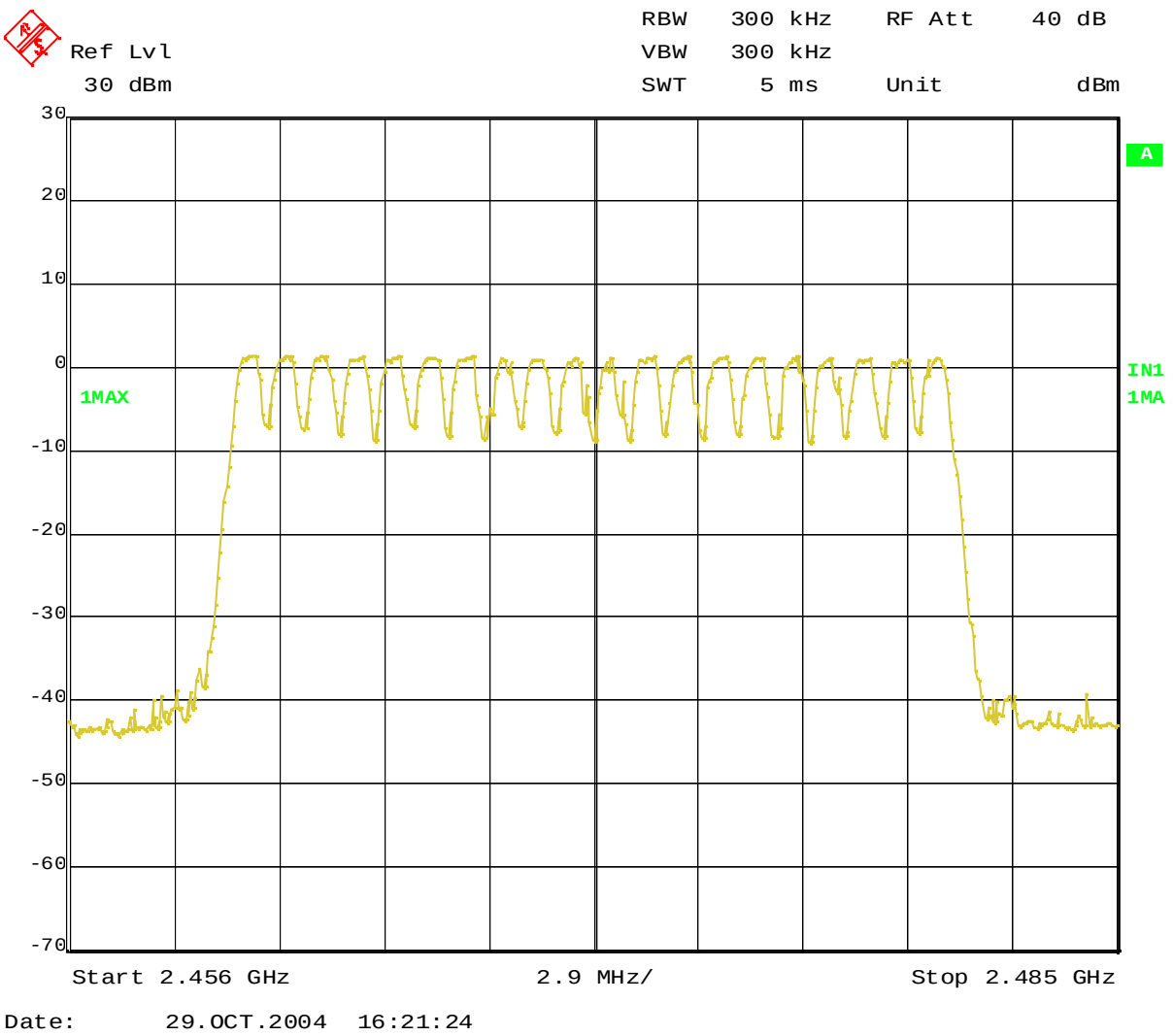
Plot 2-4. Number of Hopping Frequencies (range 4)



Plot 2-5. Number of Hopping Frequencies (AFH low band)



Plot 2-6. Number of Hopping Frequencies (AFH middle band)



Plot 2-7. Number of Hopping Frequencies (AFH high band)

3. Occupied Bandwidth (20 dB Bandwidth)
[RSS-210 5.9.1]

3.1 Test Procedure

- The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.
- The spectrum analyzer was set to :
  - Center frequency = the highest, middle and the lowest channels,
  - Span : approximately 2 or 3 times of the 20 dB bandwidth = 2 MHz
  - RBW : 1% of the 20 dB bandwidth or more = 10 kHz
  - VBW : equal to RBW or more = 30 kHz
  - Sweep = auto, Detector function = peak, Trace = max hold
- After the trace being stable. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

3.2 Test Instruments and Measurement Setup

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

3.3 Measurement Results

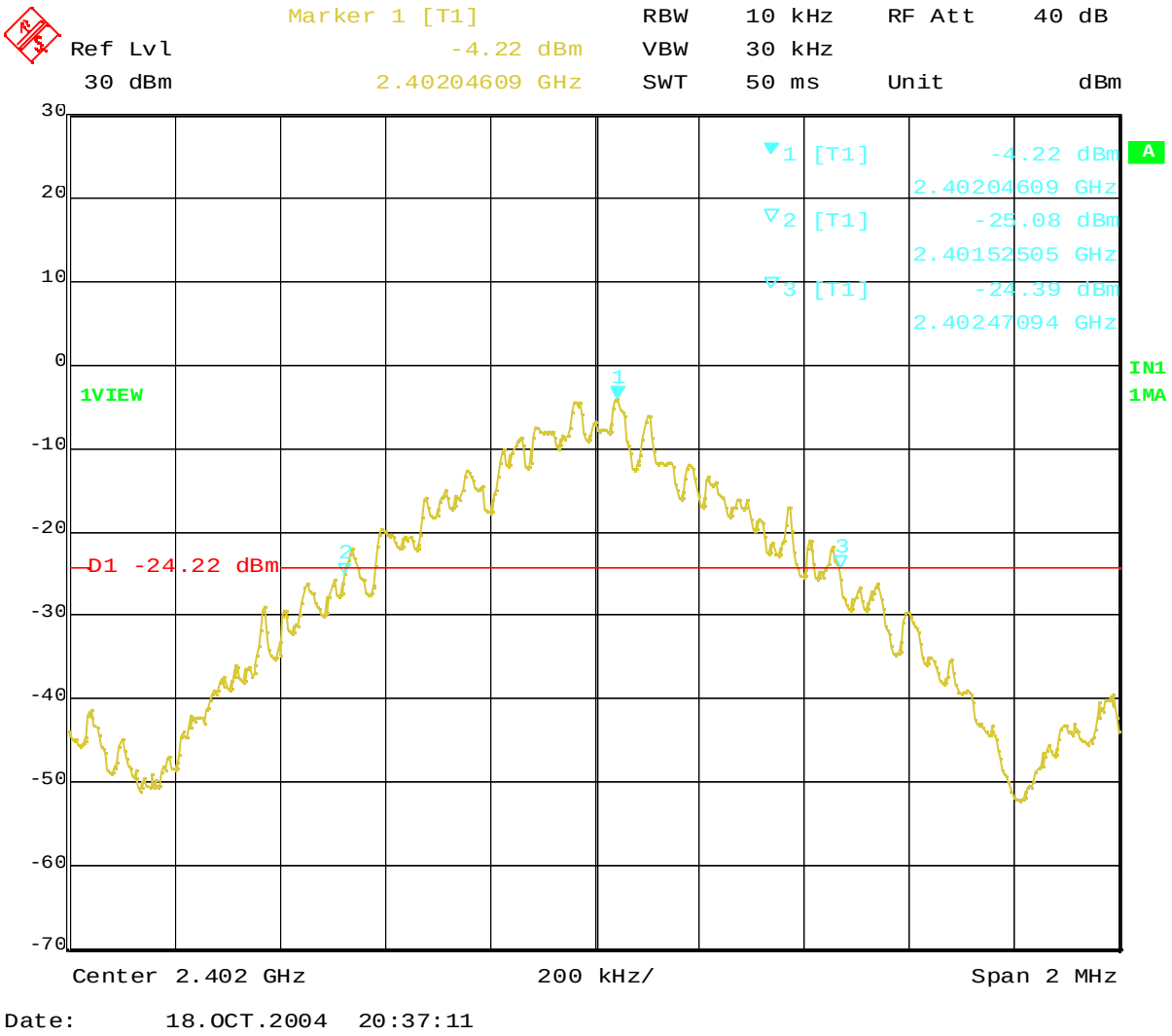
Test Date: October 18, 19 and 20, 2004

Table 3. 20dB Bandwidth

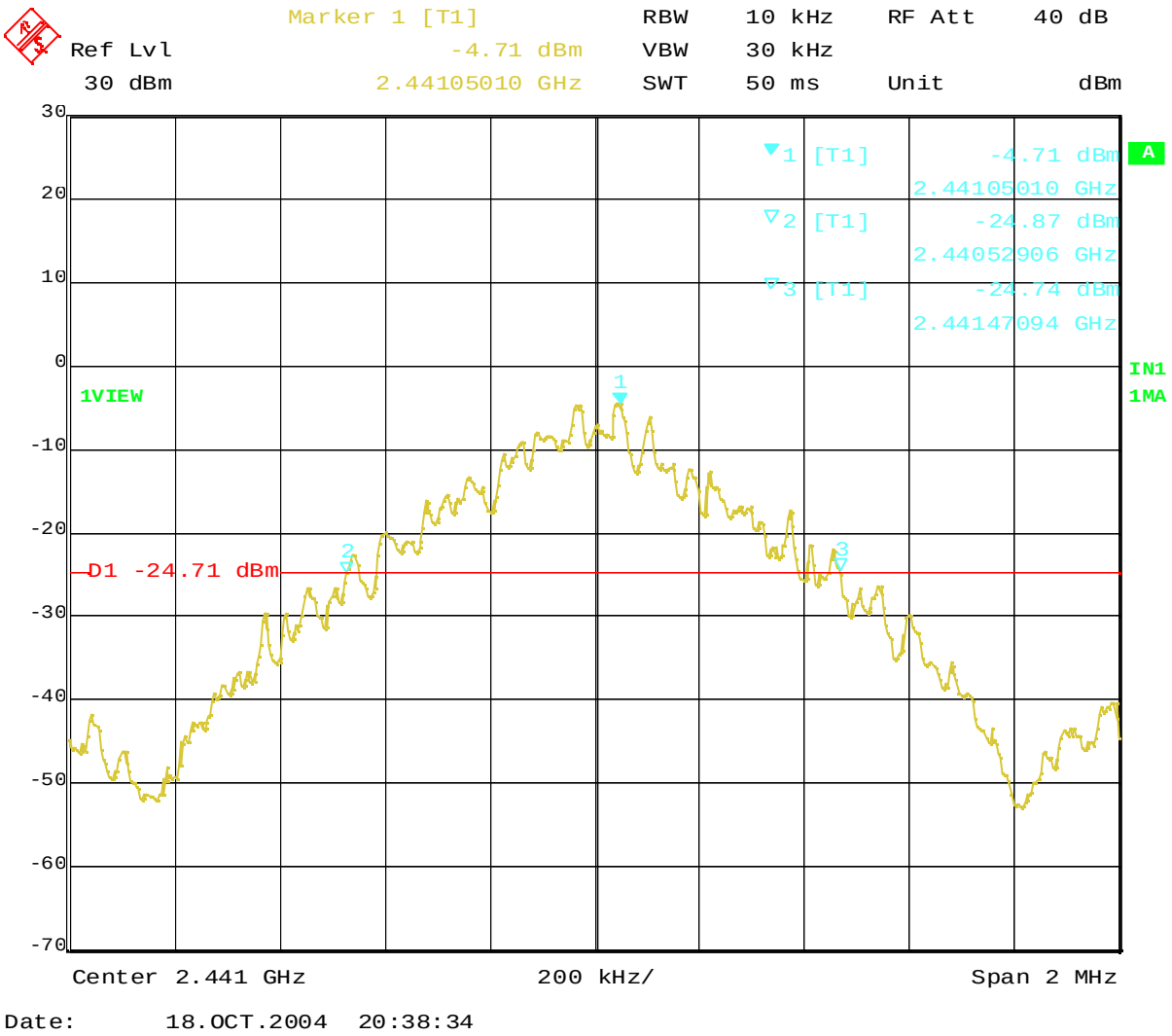
	FCC		IC	
	N/A	N/A	Measured 20 dB Bandwidth (MHz)	Limit
Tx at the lowest ch. (2402 MHz)*1			0.946	N/A
Tx at the middle ch.(2441 MHz)*1			0.942	
Tx at the highest ch.(2480 MHz)*1			0.946	
Inquiry			0.621	
Paging			0.750	

*1 : The measurement was performed at the highest, middle and lowest available channels.

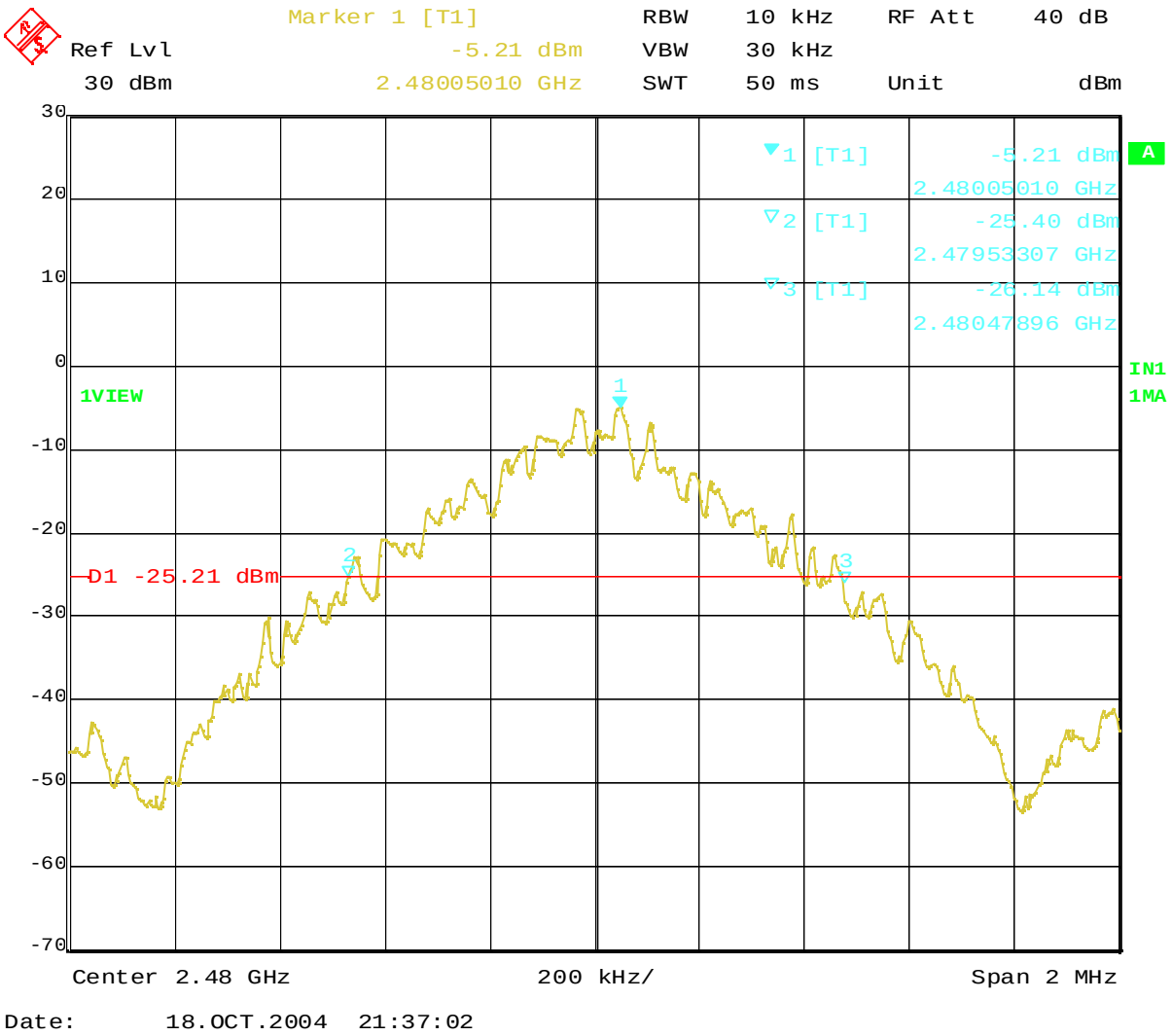
3.4 Trace Data



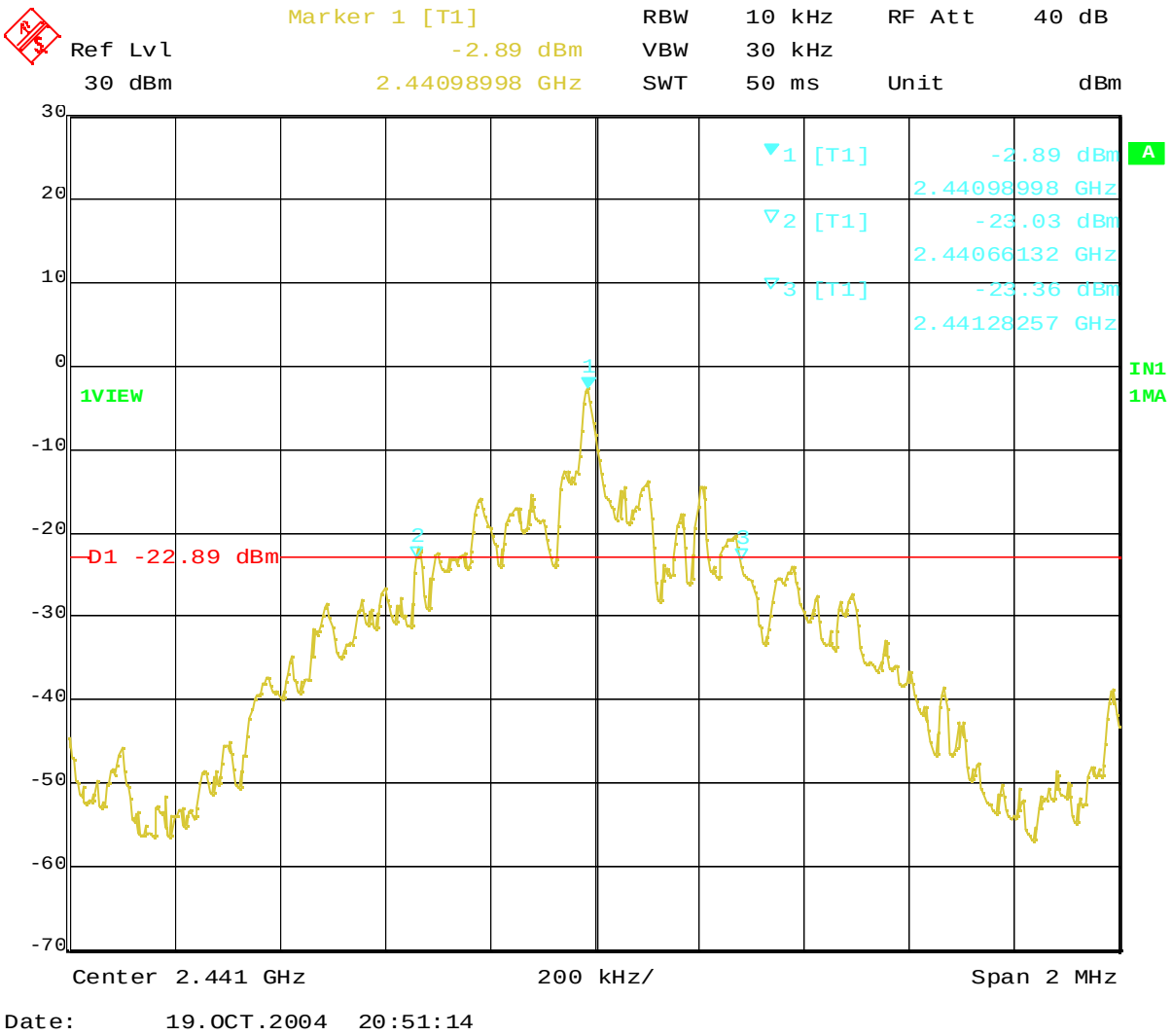
Plot 3-1. 20 dB Bandwidth (TX on 2402MHz)



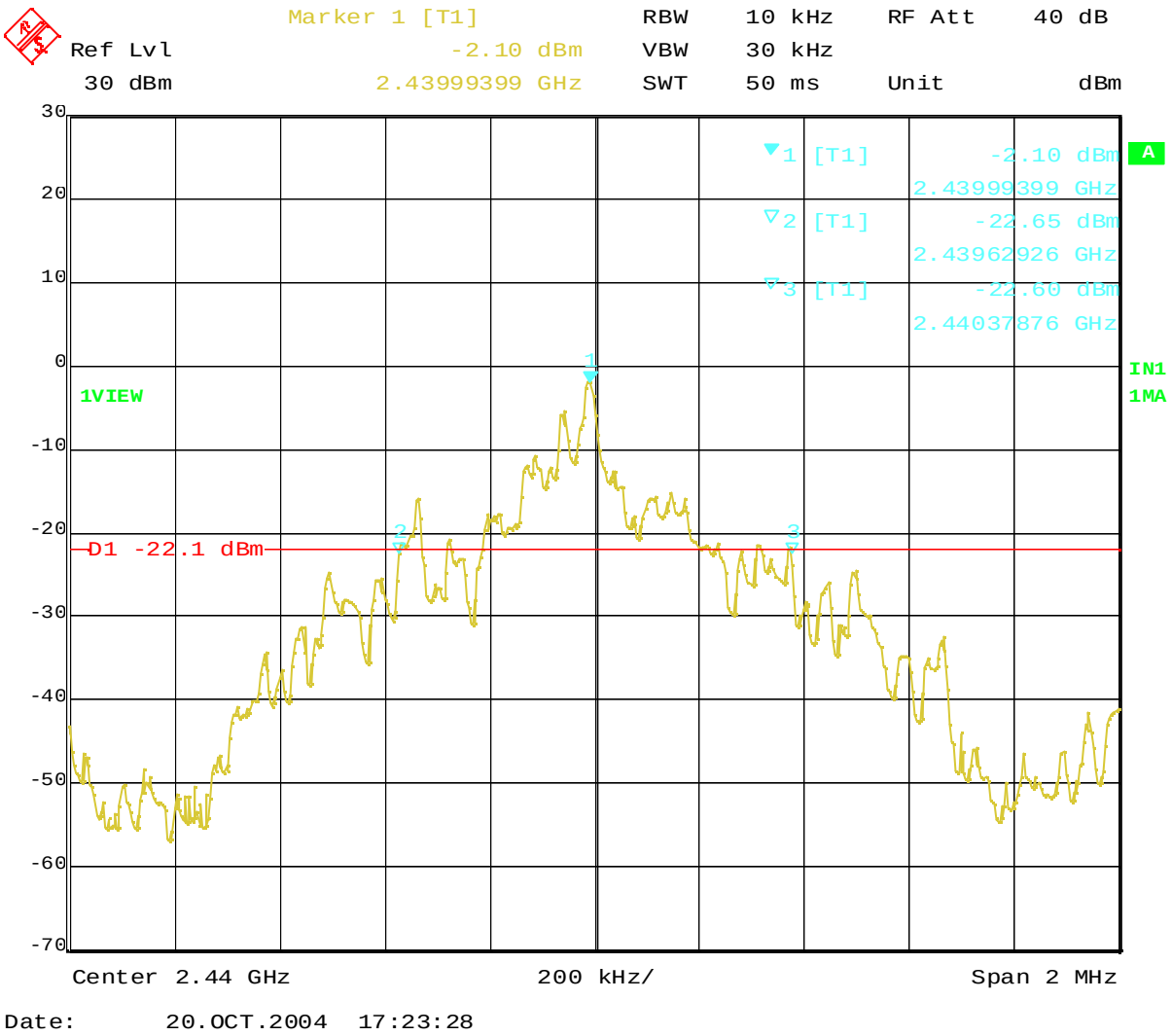
Plot 3-2. 20 dB Bandwidth (TX on 2441MHz)



Plot 3-3. 20 dB Bandwidth (TX on 2480MHz)



Plot 3-4. 20 dB Bandwidth (Inquiry)



Plot 3-5. 20 dB Bandwidth (Paging)

4. Time of Occupancy (Dwell Time)

[FCC 15.247(a)(1)(iii)/15.247(f), RSS-210 6.2.2(o)(a3)/6.2.2(o)(c2)(6)]

4.1 Test Procedure

- The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

- The spectrum analyzer was set to :
  Center Frequency: 2441MHz (2440MHz for Paging)
  RBW = 500 kHz, VBW = 500 kHz (= RBW or more), Span = zero,
  Detector function = peak, Trace = max hold,
  Sweep : Inquiry ; 300 μs for Burst duration plots, 100 ms for Repetition rate plots
  Paging ; 300 μs for Burst duration plots, 100 ms for Repetition rate plots
  Data transmission ; 300 μs for Burst duration plots, 100 ms for Repetition rate plots

4.2 Test Instruments and Measurement Setup

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

4.3 Measurement Results

Test Date: October 18, 19 and 20, 2004

Table 4. Time of Occupancy (Dwell Time)

Hopping phase	Burst duration in one hop (μs) *1	Repetition rate on one channel *2	Dwell Time (mS) *1 × *2	Limit
Inquiry	137.68	1280	176.23	less than 400 mS in 12.8*3 seconds period
Paging	135.87	640	86.96	
Data transmission	141.88	1580	224.17	less than 400 mS in 31.6*4 seconds period

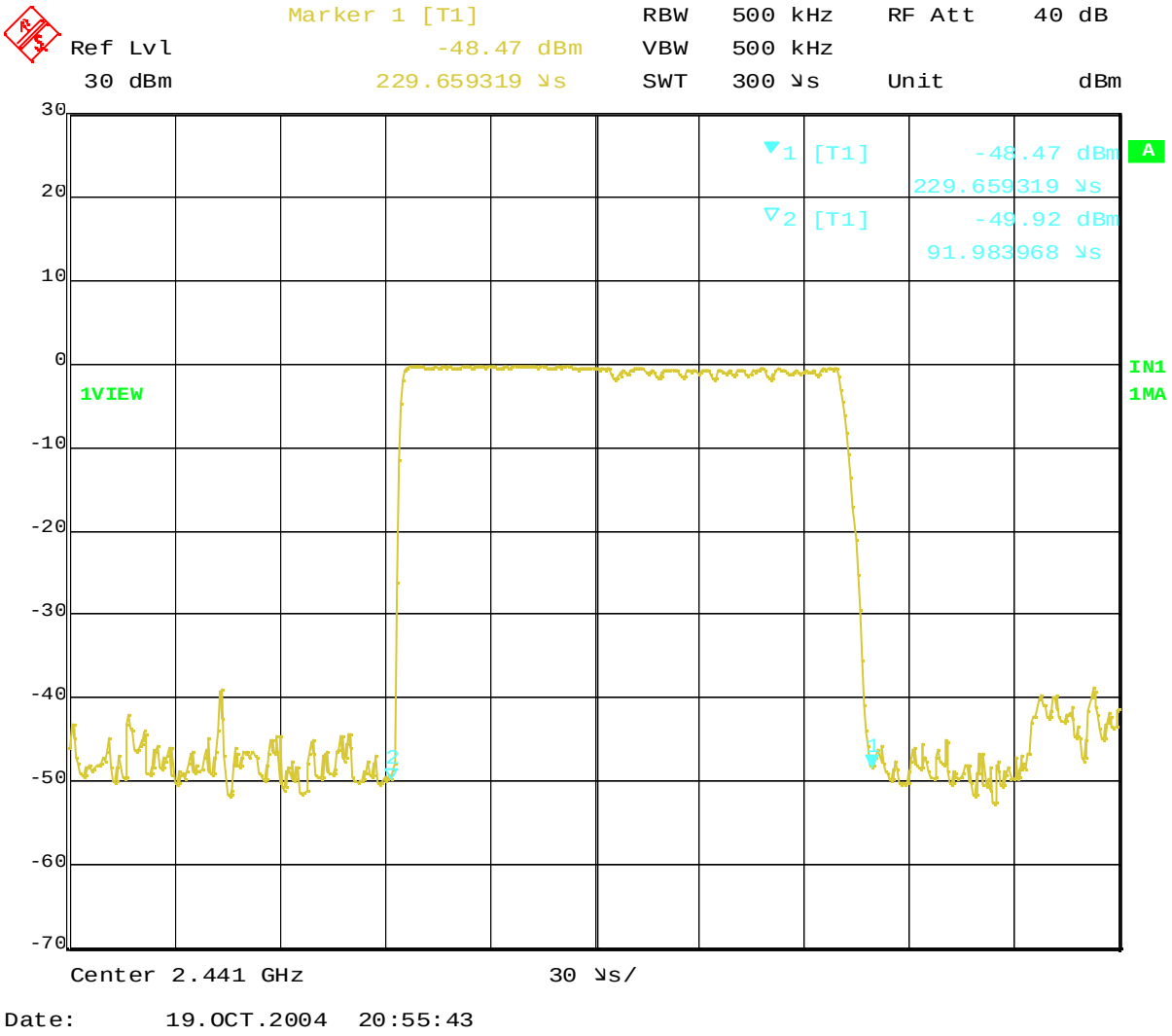
***1 :** attached measurement plot

***2** : - (number of hops in measurement plot 4-2=10) × 12800 ms / 100 ms for Inquiry
- (number of hops in measurement plot 4-4 = 5) × 12800 ms / 100 ms for Paging
- (number of hops in measurement plot 4-6 = 5) × 31600 ms / 100 ms for Data transmission

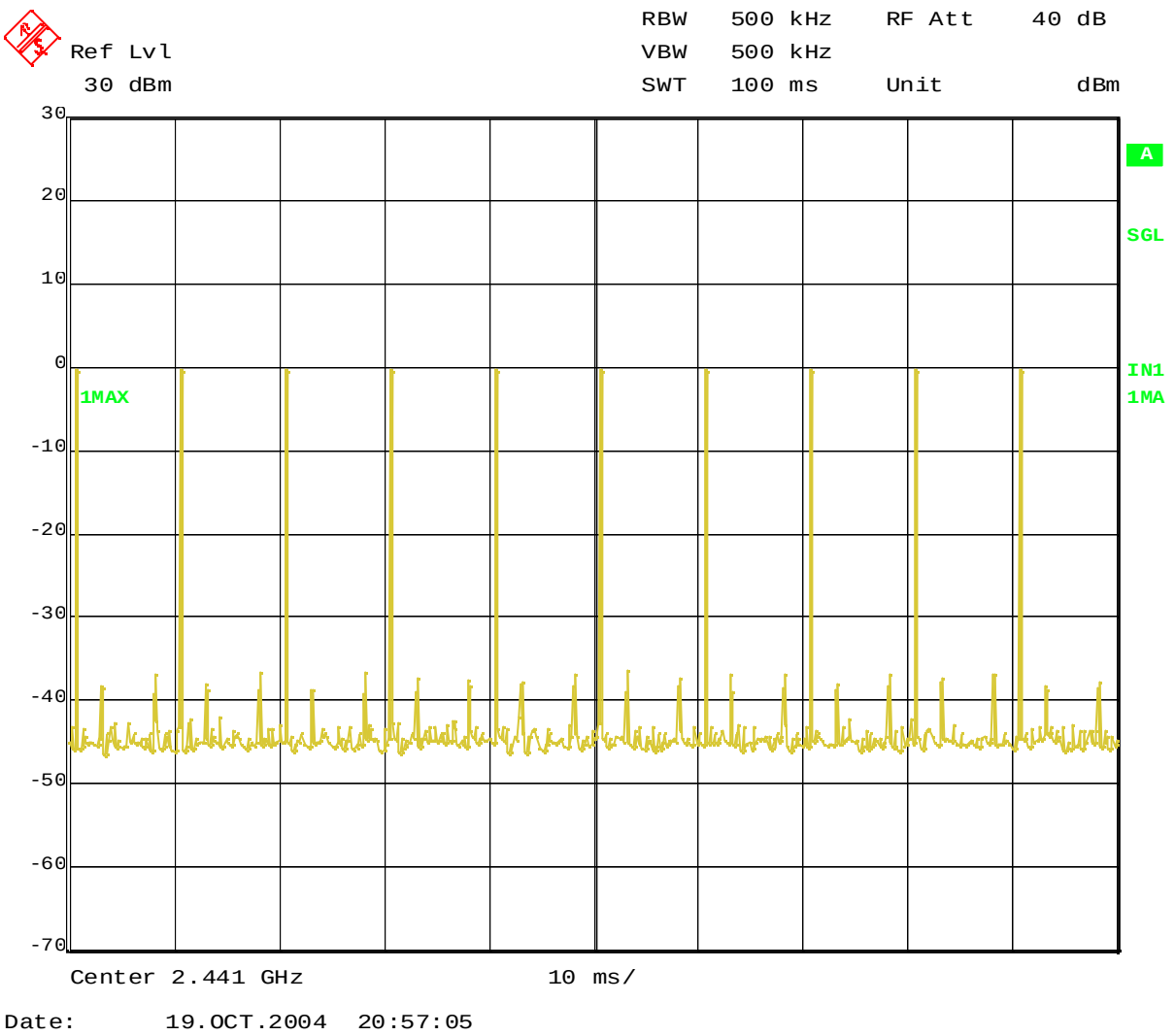
***3** : 32 hops (Bluetooth Standard) × 0.4sec

***4** : 79 hops (Bluetooth Standard) × 0.4sec

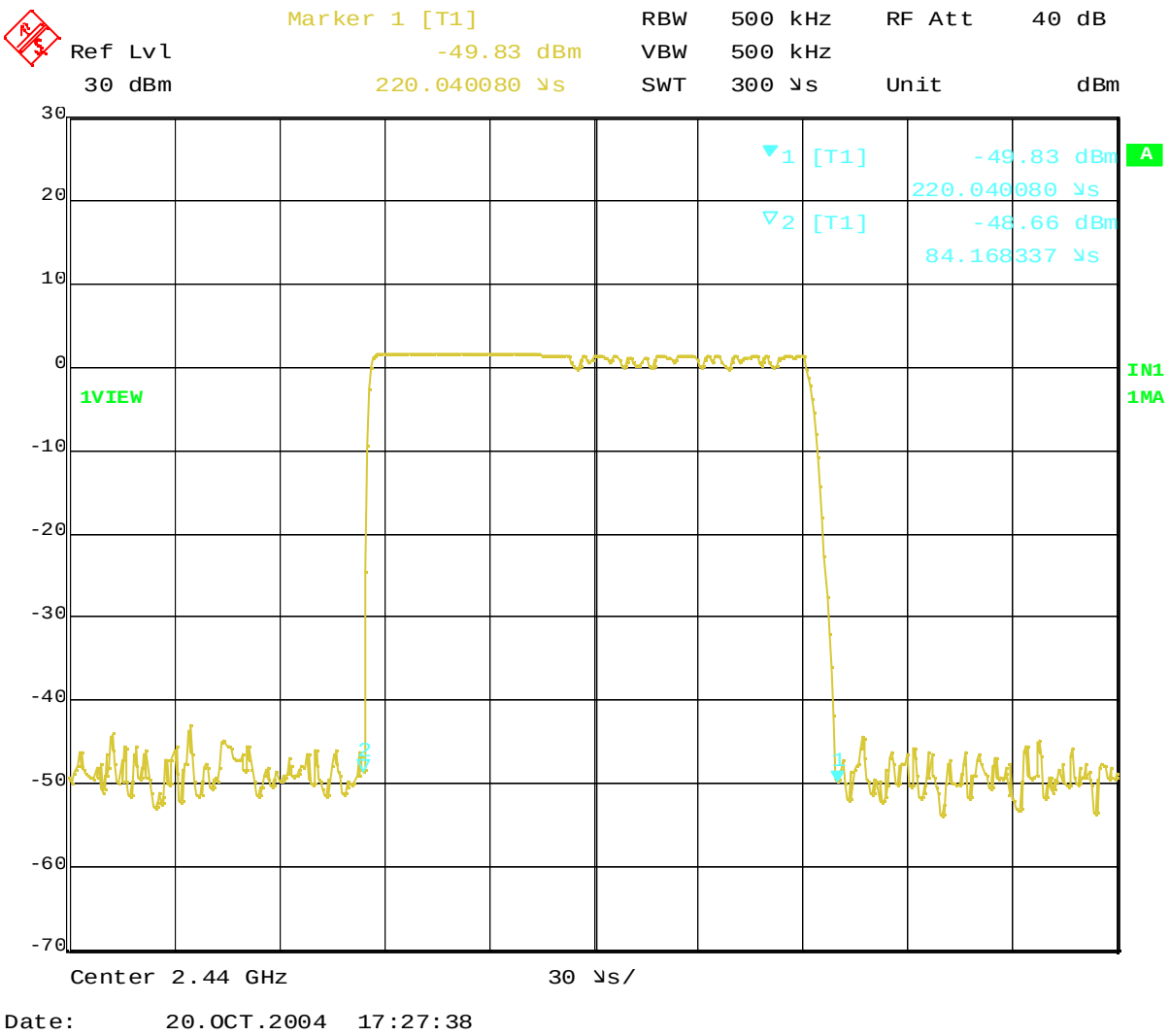
4.4 Trace Data



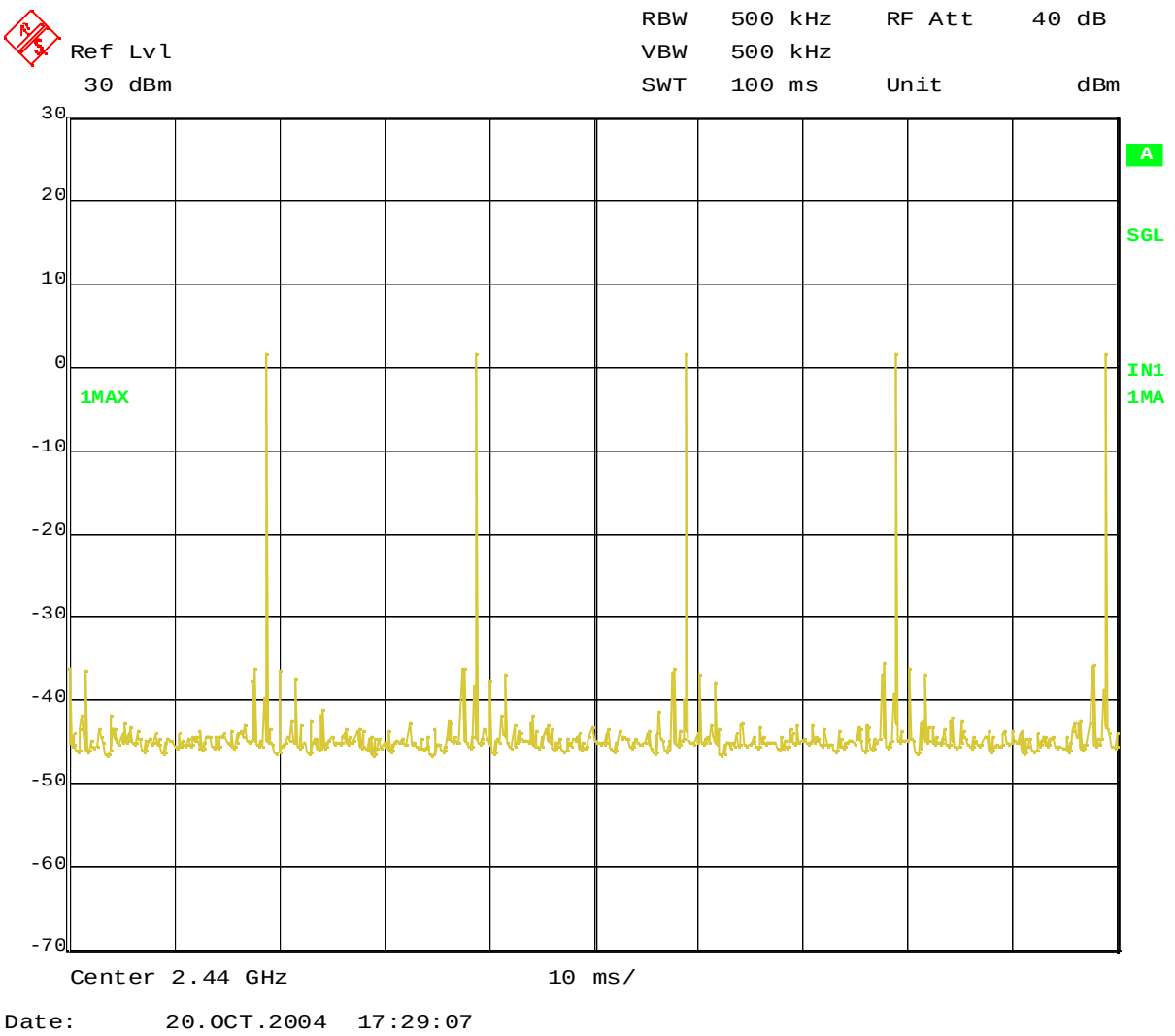
Plot 4-1. Time of Occupancy (Inquiry, Burst duration)



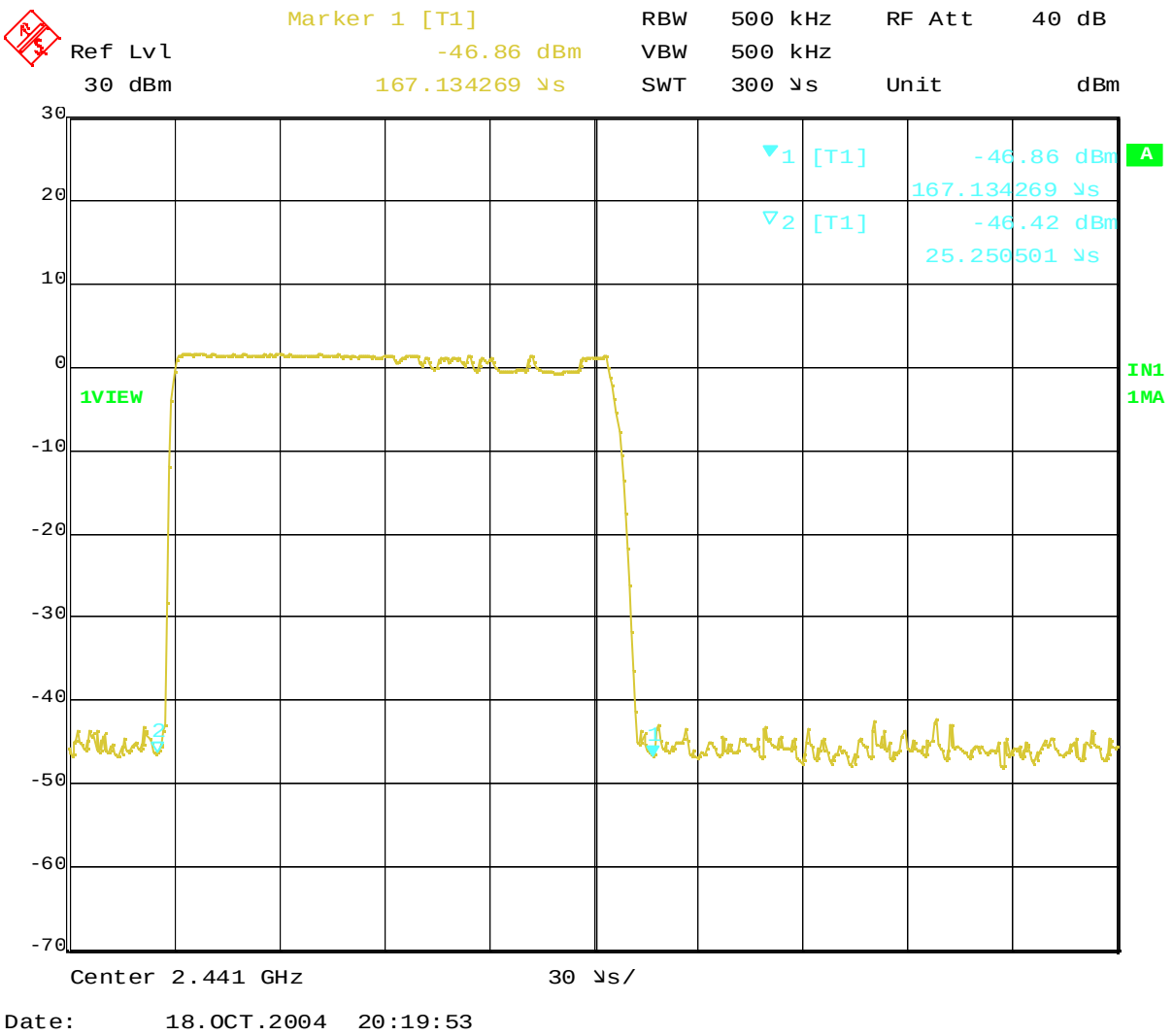
Plot 4-2. Time of Occupancy (Inquiry, Repetition rate)



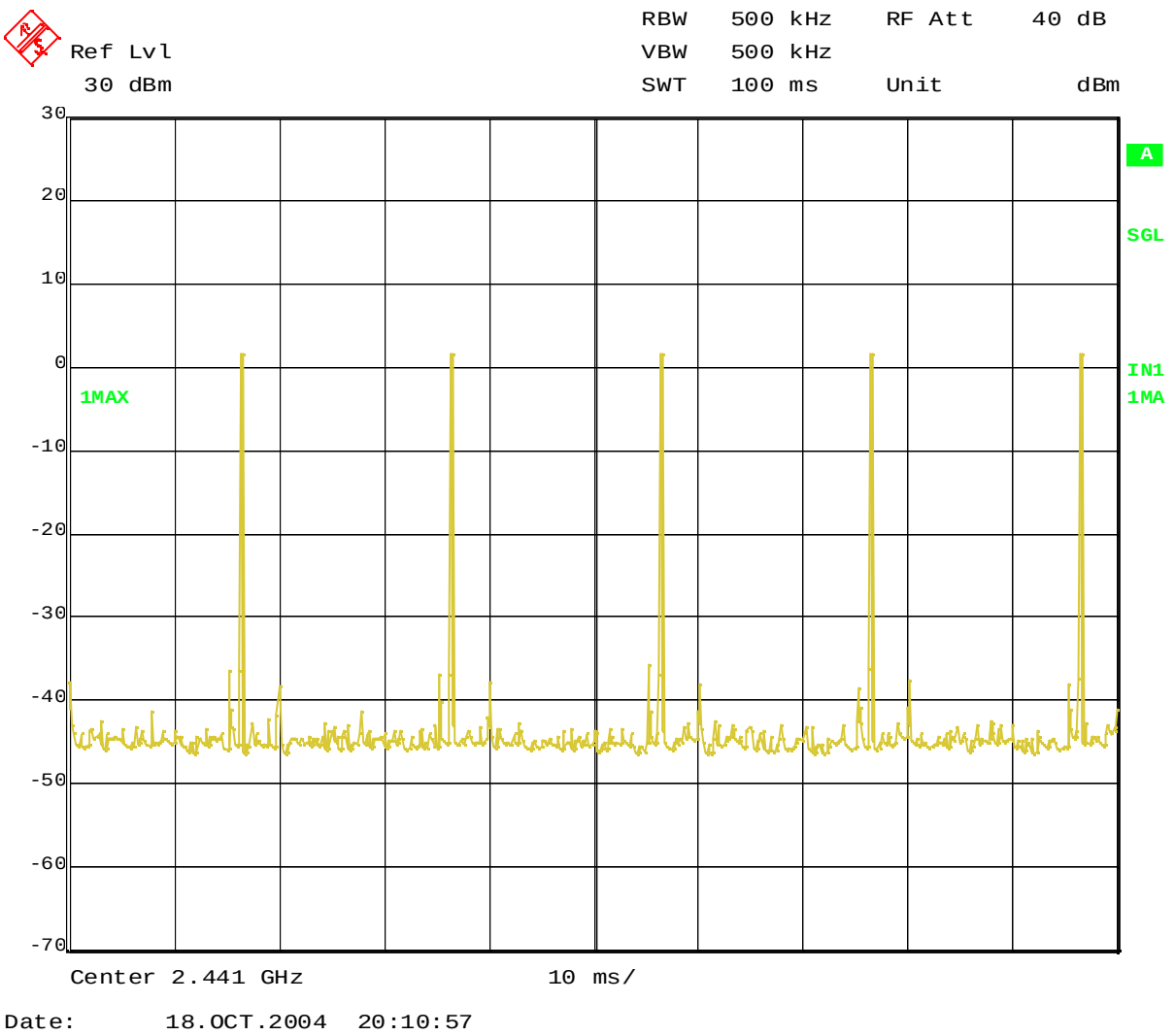
Plot 4-3. Time of Occupancy (Paging, Burst duration)



Plot 4-4. Time of Occupancy (Paging, Repetition rate)



Plot 4-5. Time of Occupancy (Data transmission, Burst duration)



Plot 4-6. Time of Occupancy (Data transmission, Repetition rate)

5. Conducted Peak Output Power
[FCC 15.247(b)(1), RSS-210 6.2.2(o)(a3)]

5.1 Test Procedure

- The peak output power is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.
- The spectrum analyzer is set to :
  - Center frequency = the highest, middle and the lowest channels,
  - Span : approximately 5 times of the 20 dB bandwidth = 5 MHz (3 MHz for Inquiry/Paging)
  - RBW : greater than the 20 dB bandwidth of the emission being measured = 1 MHz
  - VBW : equal to RBW or more = 3 MHz
  - Sweep = auto, Detector function = peak, Trace = max hold
- Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

5.2 Test Instruments and Measurement Setup

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

5.3 Measurement Results

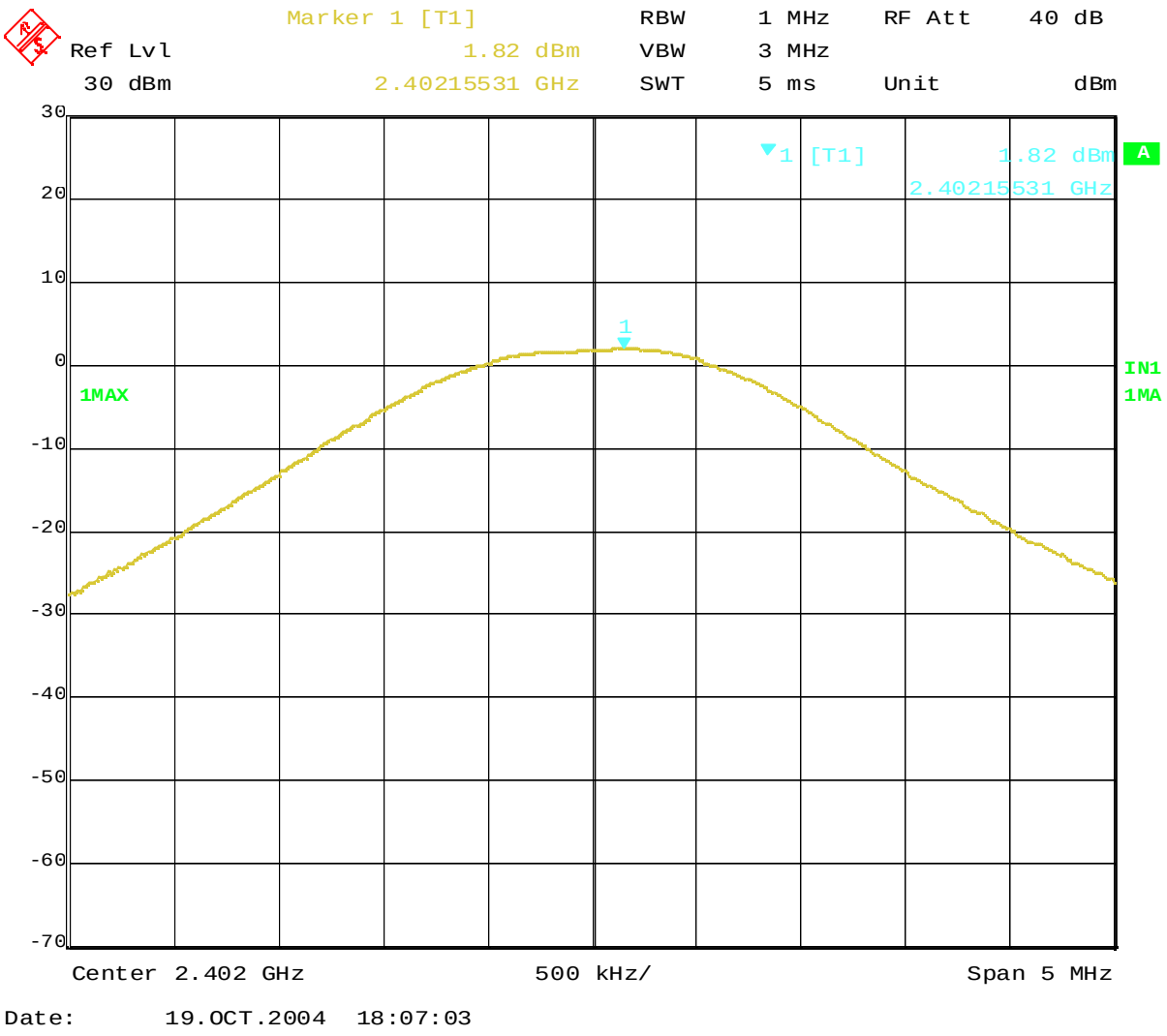
Test Date: October 19 and 20, 2004

Table 5. Peak Output Power

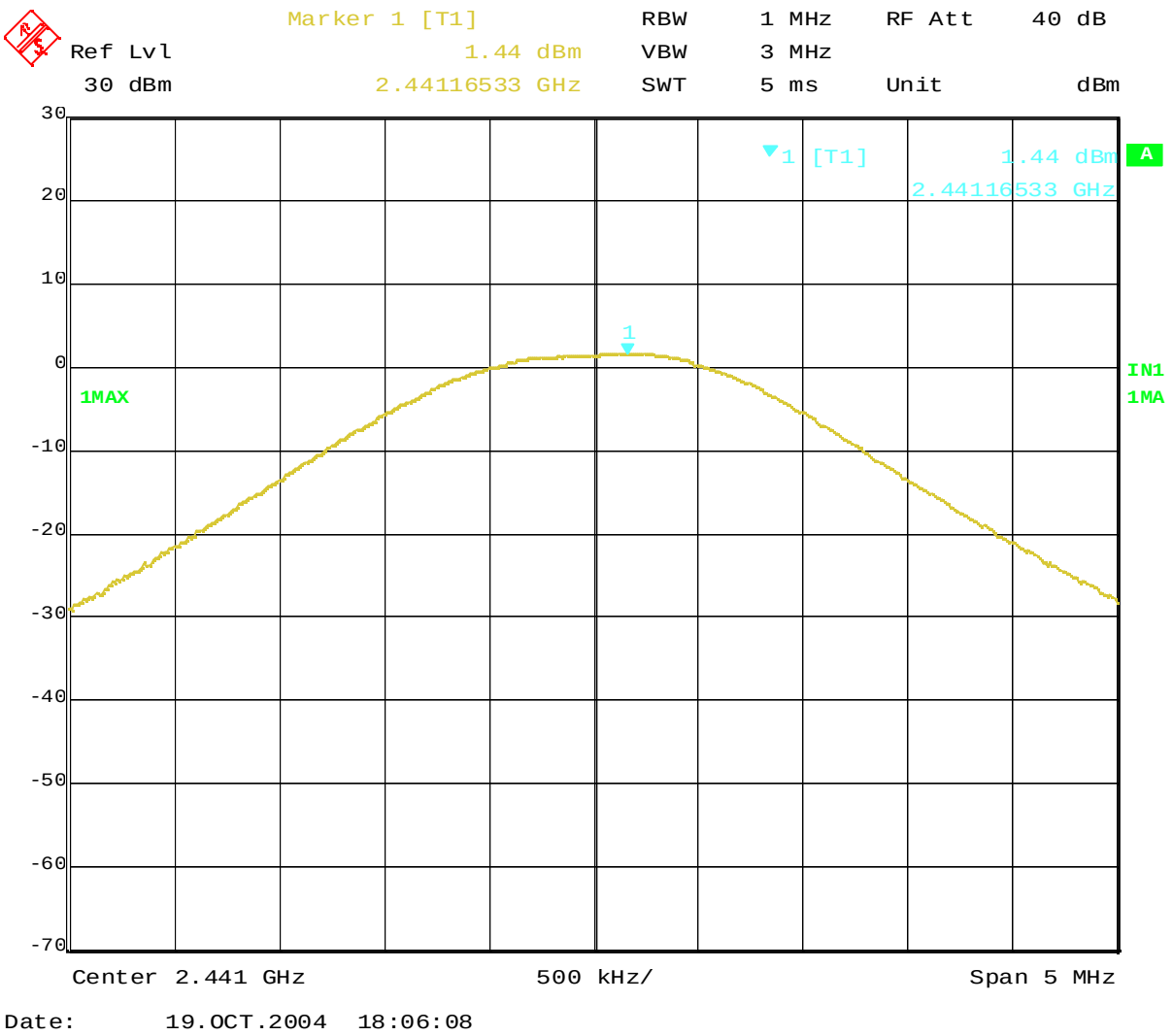
Measured Frequency (MHz)	Analyzer Reading (dBm)	Cable Loss (dB)	Results		Limit [0.125W] (dBm)	Margin (dB)
			(dBm)	(W)		
2402 (ch. 1) *1	1.82	1.3	3.1	0.00204	21.0	17.9
2441 (ch. 40) *1	1.44	1.3	2.7	0.00186	21.0	18.3
2480 (ch. 79) *1	0.82	1.3	2.1	0.00162	21.0	18.9
Inquiry (ch. 40)	-0.20	1.3	1.1	0.00129	21.0	19.9
Paging (ch. 39)	1.57	1.3	2.9	0.00195	21.0	18.1

*1 : In line with Section 15.31(m) of Public Notice DA 00-705 dated March 30, 2000, the measurement was performed at the highest, middle and lowest available channels.

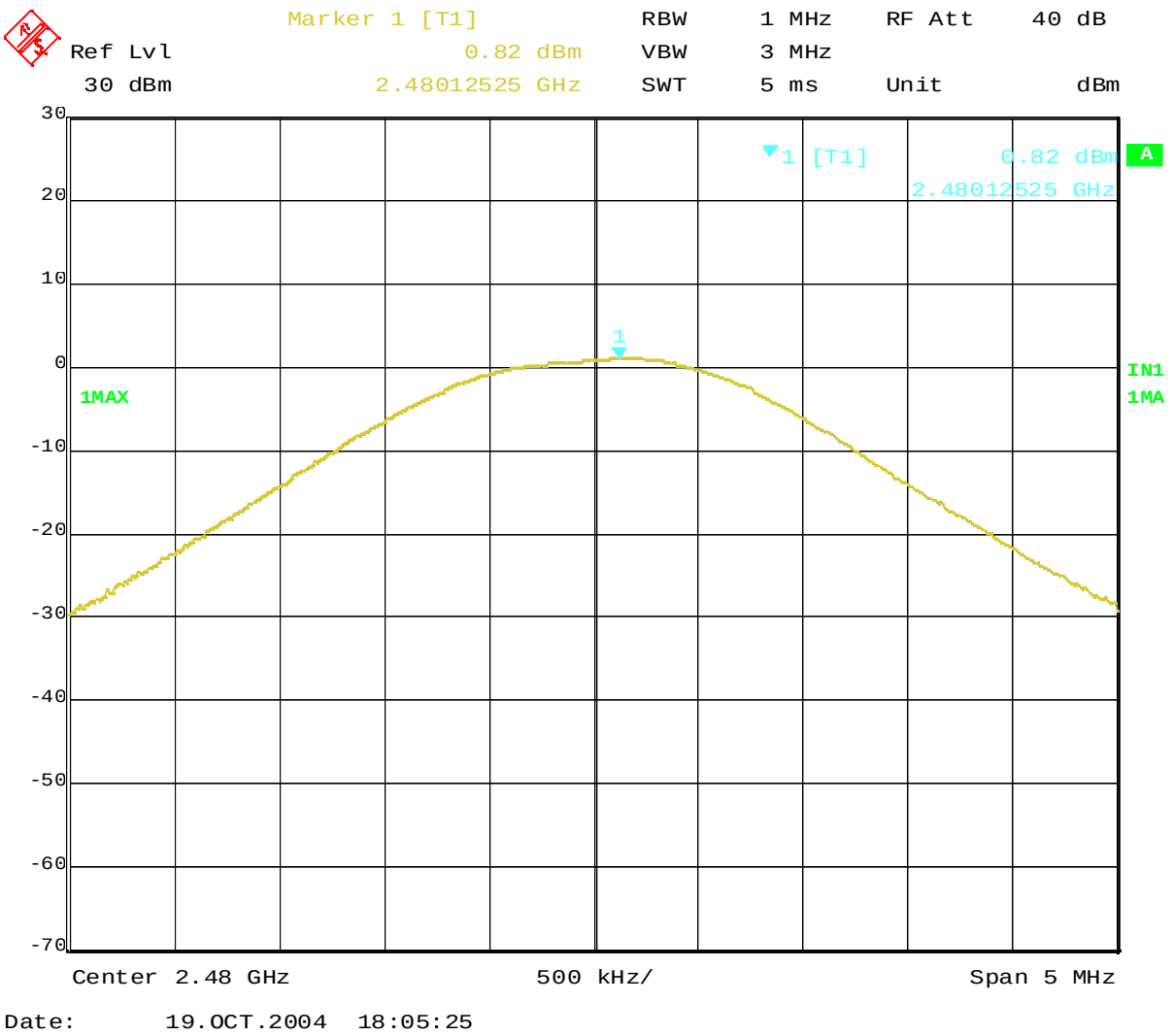
5.4 Trace Data



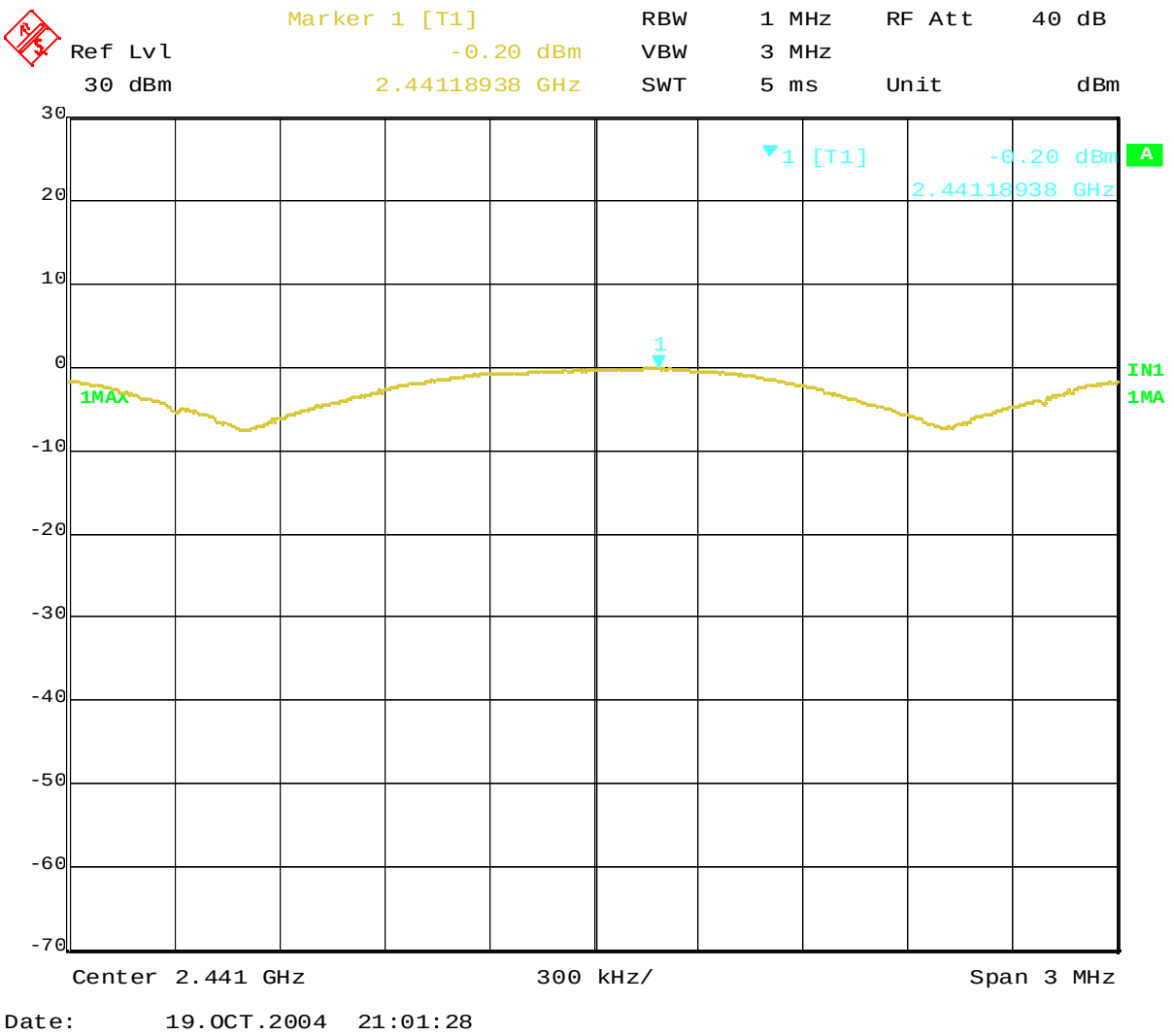
Plot 5-1. Peak Output Power (TX on 2402MHz)



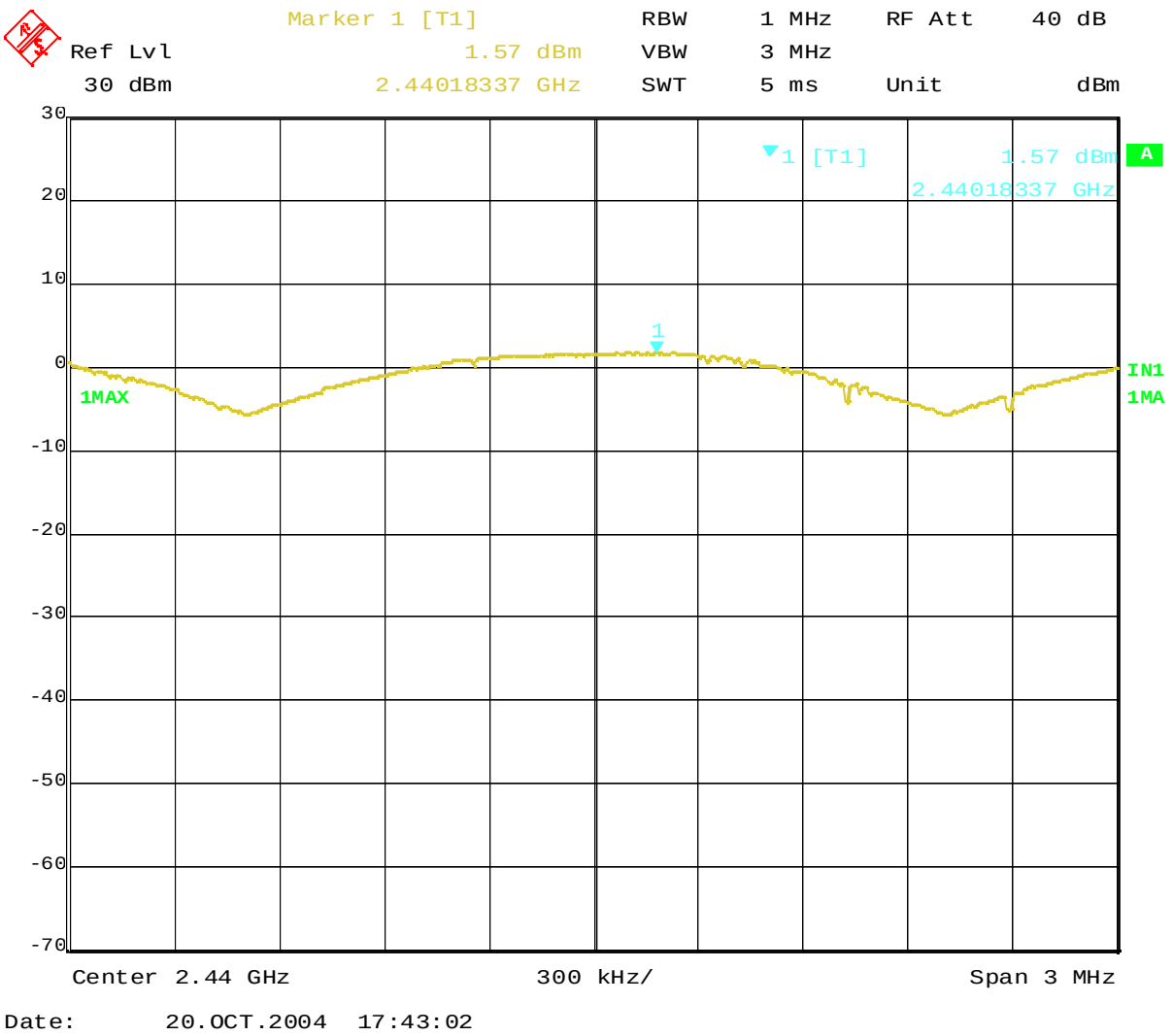
Plot 5-2. Peak Output Power (TX on 2441MHz)



Plot 5-3. Peak Output Power (TX on 2480MHz)



Plot 5-4. Peak Output Power (Inquiry)



Plot 5-5. Peak Output Power (Paging)

6. Conducted Band-edge

[FCC 15.247(c) regarding FCC Public Notice DA 00-705 dated March 30, 2000 **]**

6.1 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 had its hopping function disabled at the highest, middle and the lowest available channels.
- The spectrum analyzer is set to :
  - Center frequency = the highest, middle and the lowest channels,
  - Span = 8 MHz
  - RBW : 1% of span or more = 100 kHz
  - VBW : equal to RBW or more = 100 kHz
  - Sweep = auto, Detector function = peak, Trace = max hold
- After the trace being stable. Set the marker on the emission at the bandedge, or on the highest spurious emission outside of the operation band, if this level is greater than that at the bandedge. Use the marker-to-peak function to set the marker to the peak of the emission. Read and record both values, then confirm the delta of both values is at least 20 dB.

6.2 Test Instruments and Measurement Setup

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

6.3 Measurement Results

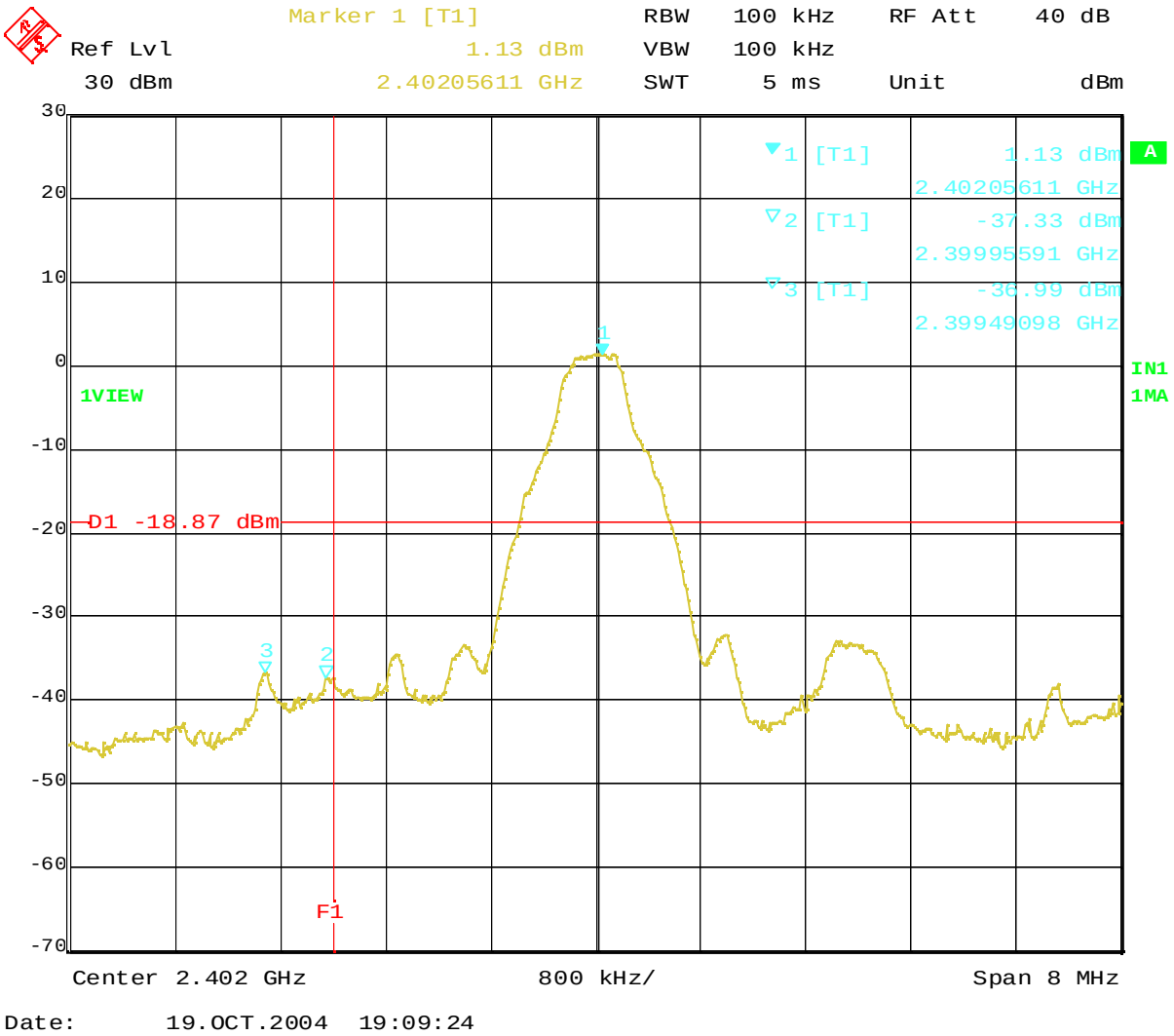
Test Date: October 19, 2004

Table 6. Band-edge

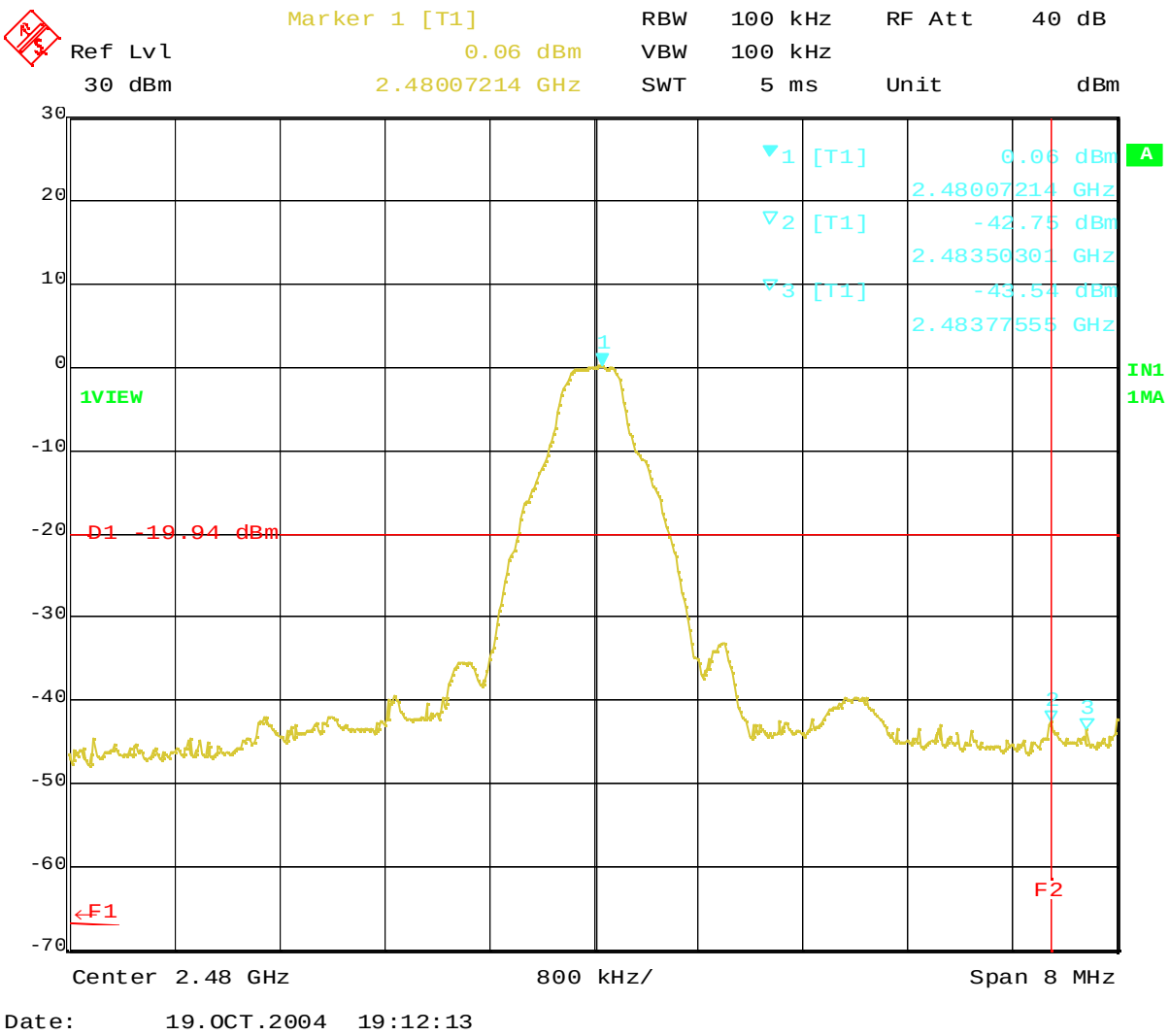
Center Frequency (MHz)	Peak power of operation band (dBm)	Emission level at bandedge or outside of operation band (dBm)	delta (dB)	limit (dB)
2402 (ch. 1)	1.13	-36.99	38.12	> 20
2480 (ch. 79)	0.06	-42.75	42.81	

Prepared by T. Asano

6.4 Trace Data



Plot 6-1. Band-edge (TX on 2402MHz)



Plot 6-2. Band-edge (TX on 2480MHz)

7. Out of Band Emissions (Conducted Spurious)

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

7.1 Test Procedure

- The out of band emissions is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.
- The spectrum analyzer is set to :
  - Scanning frequency span: 30MHz~2GHz, 2GHz~3GHz, and 3GHz~25GHz
  - RBW : 100 kHz
  - VBW : 100 kHz
  - Sweep = auto, Detector function = peak, Trace = max hold
- After the trace being stable. Use the marker-to-peak function to set the marker to the peak of the inband emission. Use the marker-delta function to measure 20 dB down the peak of the inband emission.

7.2 Test Instruments and Measurement Setup

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

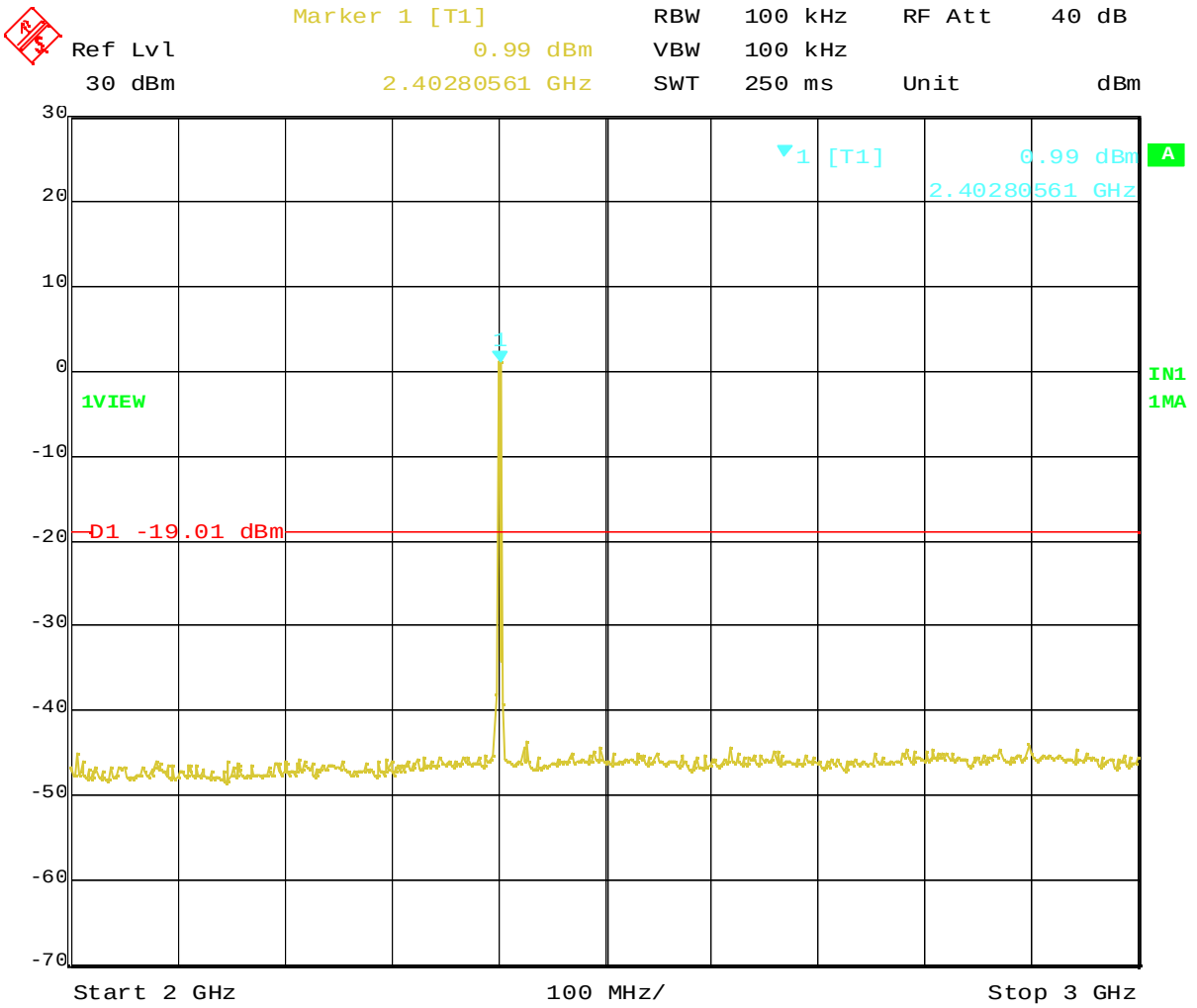
7.3 Measurement Results

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

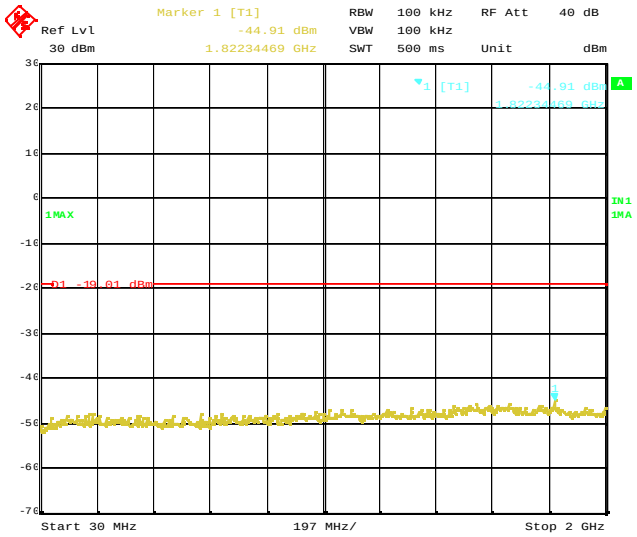
Test Date: October 19, 2004 : See the following plots.

Transmission Frequency (MHz)	Trace number
2402 (ch. 1)	Plot 4-1
2441 (ch. 40)	Plot 4-2
2480 (ch. 79)	Plot 4-3

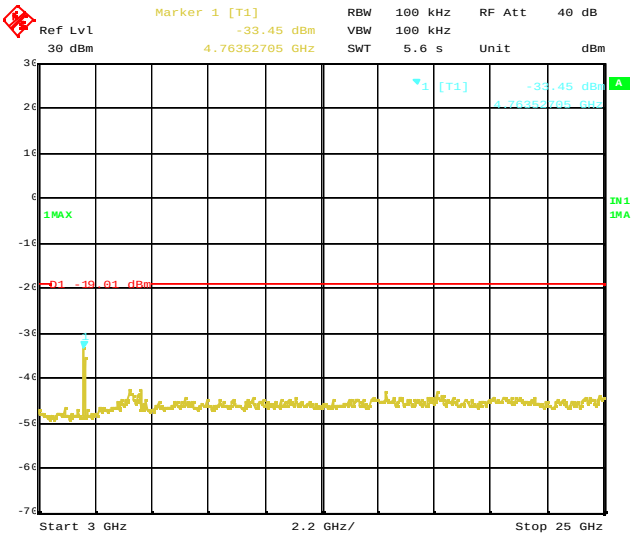
7.4 Trace Data



Date: 19.OCT.2004 19:16:36



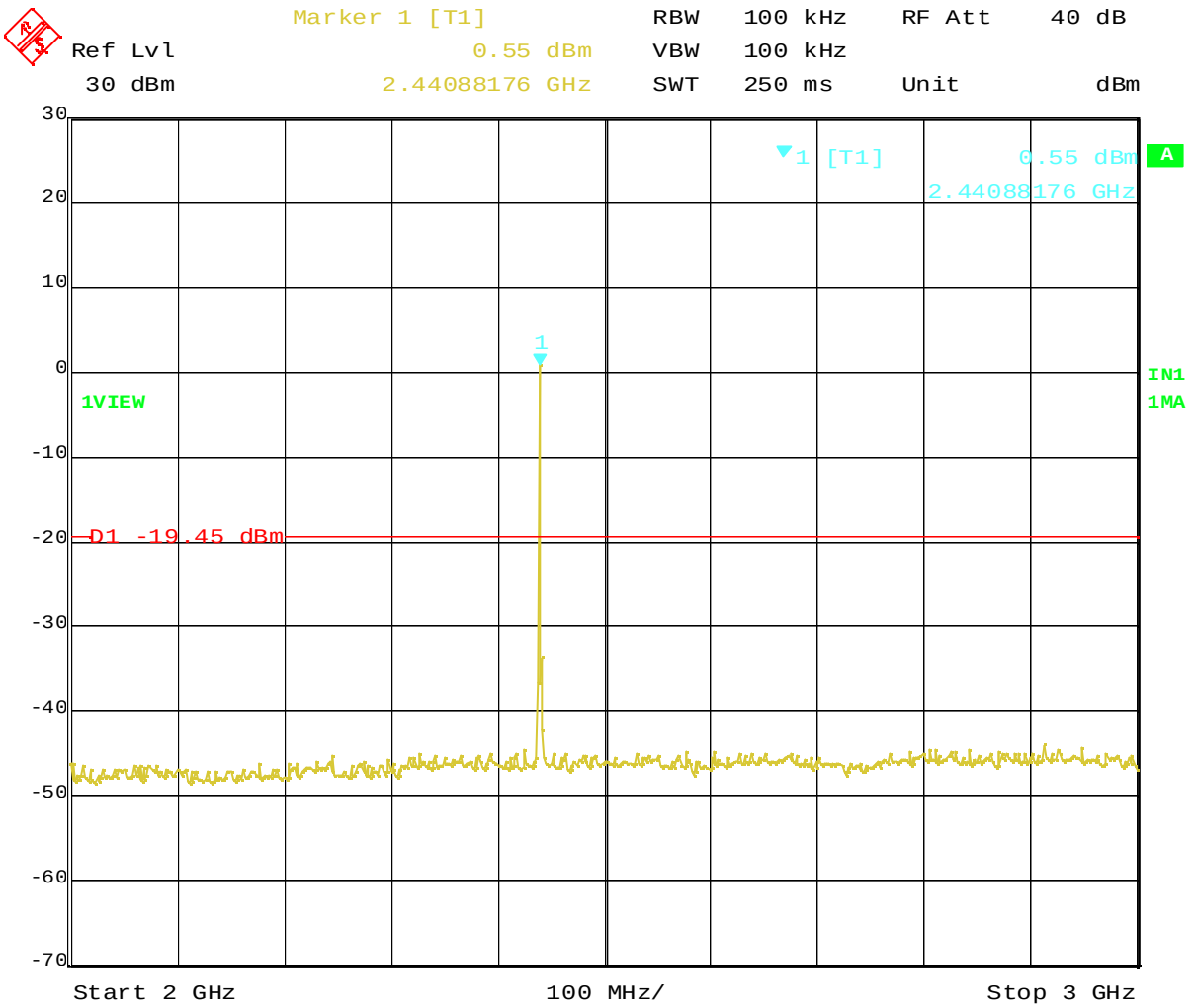
Date: 19.OCT.2004 19:17:21

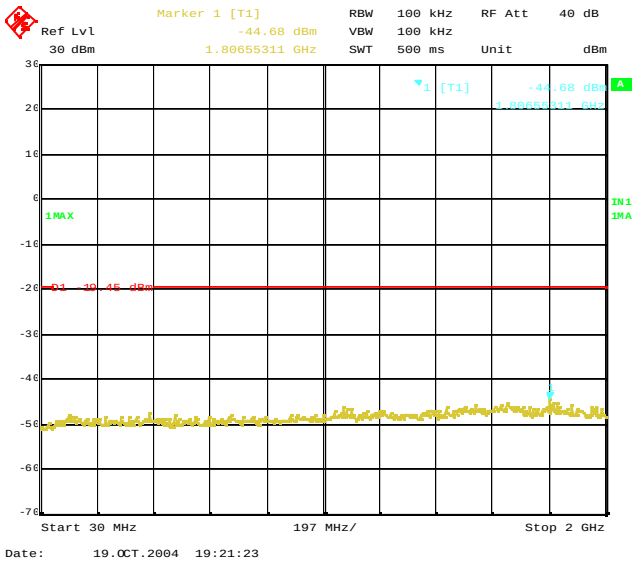


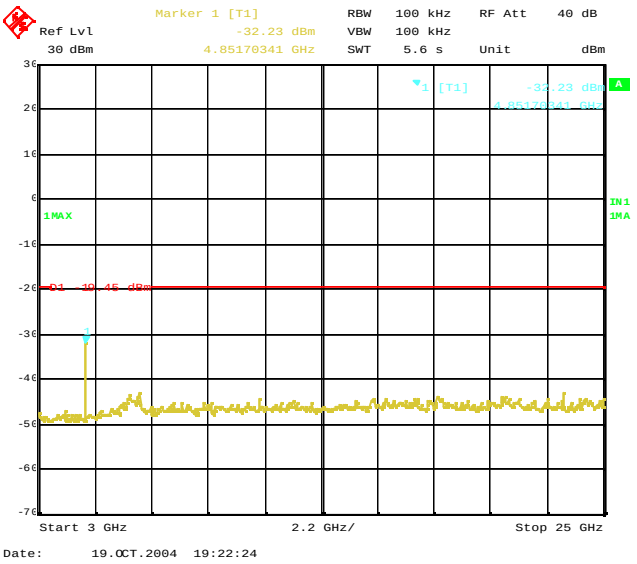
Date: 19.OCT.2004 19:19:07

Plot 7-1. Out of Band Emissions (TX on 2402MHz)

Prepared by T. Asano

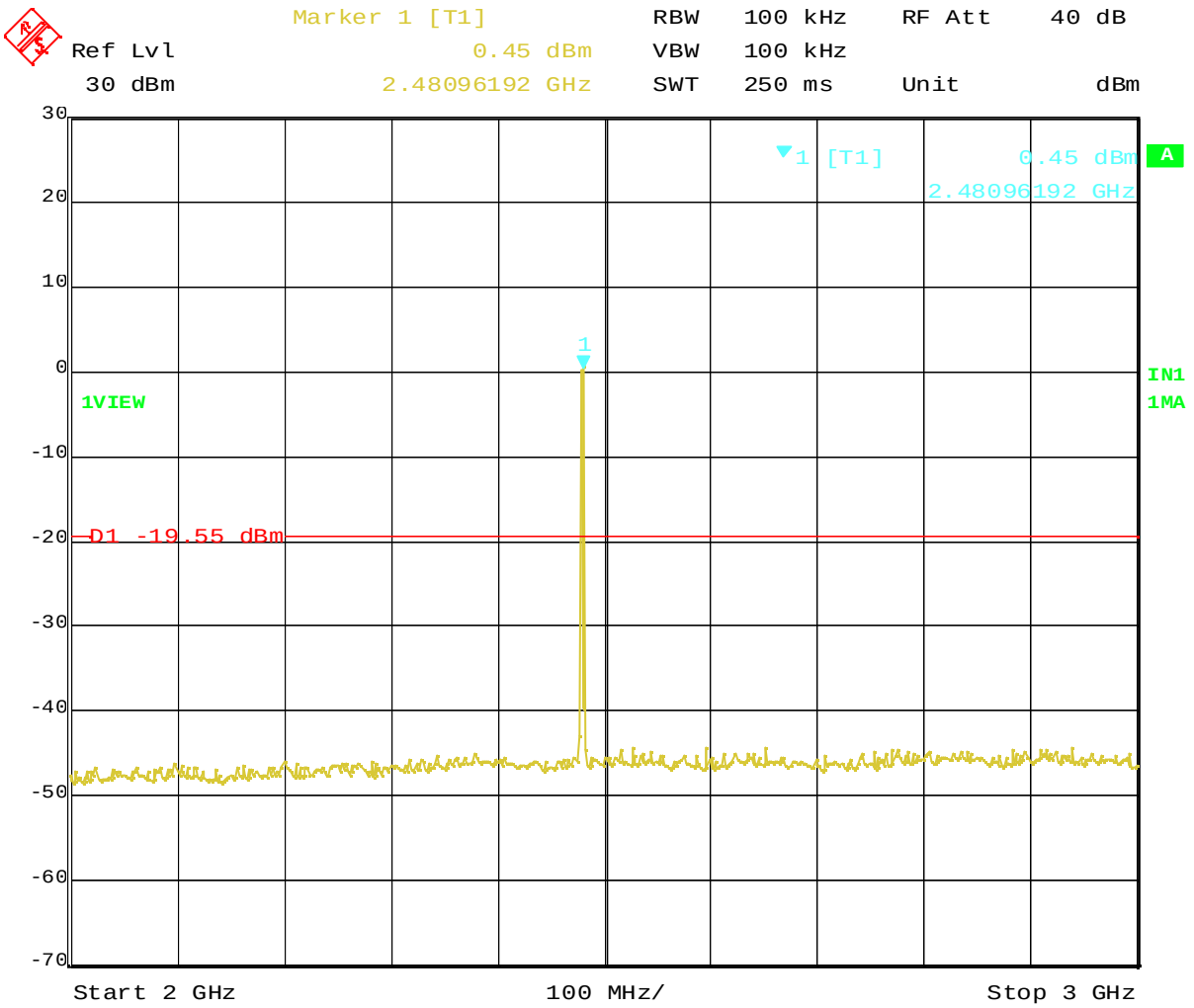




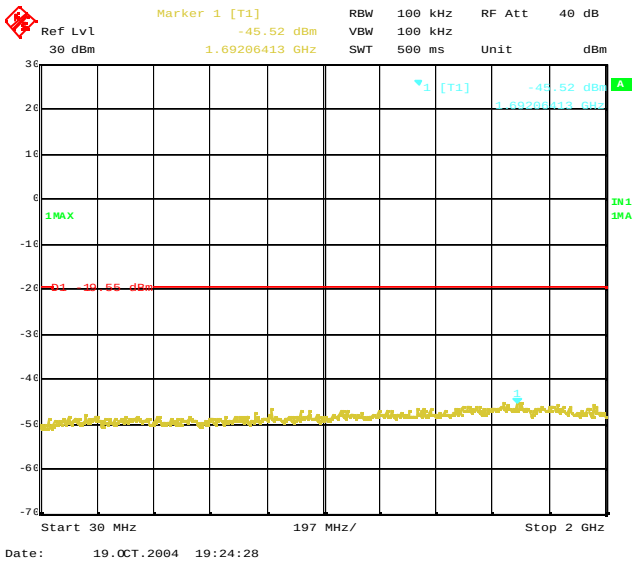


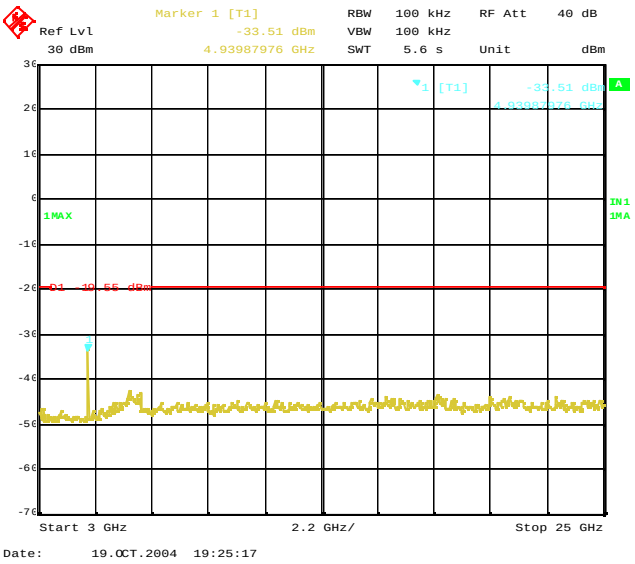
Plot 7-2. Out of Band Emissions (TX on 2441MHz)

Prepared by T. Asano



Date: 19.OCT.2004 19:23:36





Plot 7-3. Out of Band Emissions (TX on 2480MHz)

Prepared by T. Asano

8. AC WIRELINE CONDUCTED EMISSIONS (150 kHz – 30 MHz)
[FCC 15.207, RSS-210 6.6 / 7.4]

8.1 Test Procedure

The conducted emissions are measured in the IBM shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the highest, middle and lowest available channels in line with Section 15.31(m) of Public Notice DA 00-705 dated March 30, 2000. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

8.2 Test Instruments and Measurement Setup

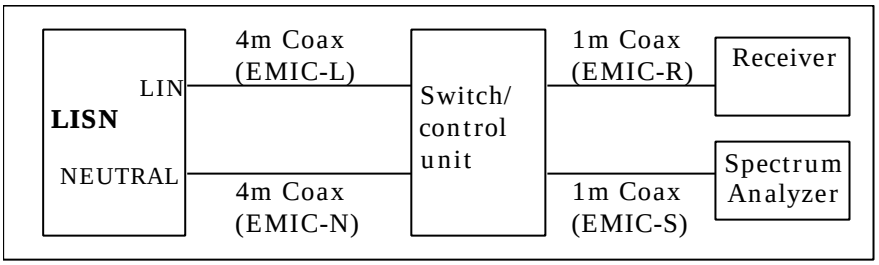


Figure 8. Cables for Conducted Emission Test

Table 8-1. Conducted Emission Test Instrumentation

Description	Model	Serial Number
Computer	IBM 6589-13J	97-15613
Spectrum Analyzer (100Hz-1.5GHz)	HP 85680B	3019A05156
Spectrum Analyzer Display	HP 85662A	3026A19366
Quasi-Peak Adapter	HP 85650A	2811A01433
Receiver (9kHz-30MHz)	R&S ESH3	892108/003
LISN	EMCO 3810/2NM	00022007
Switch/control unit	HP 3488A	2719A17228
Plotter	HP 7550A	2631A33619
Coax cables: - Lisn-L <=> SW/Con.unit (SW100) - Lisn-N <=> SW/Con.unit (SW101) - SW/Con.unit <=> RCVR (Input) - SW/Con.unit<=> Spe Ana.(Signal In)	Length: 4 m 4 m 1 m 1 m	 - EMIC-L - EMIC-N - EMIC-R - EMIC-S

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

8.3 Powerline Voltage Calculation

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

PV = R + CORR

where:

PV = Powerline Voltage (dBμV)
R = Measured Receiver Input Amplitude (dBμV)
CORR = Correction Factor (dB) = LL+CL+SWL+PLL
LL = Insertion loss of LISN (dB)
CL = Insertion loss of Cable (dB)
SWL = Insertion loss of Switch control unit (dB)
PLL = Insertion loss of Pulse Limiter (dB)

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

CORR = 0.6 + 0.1 + 0.1 + 0.2 = 1.0 (dB)
PV = 50.0 + 1.0 = 51.0 (dBμV)

8.4 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 9.0dB. The 6 highest emissions relative to the limits are reported.

Test Date: October 22, 2004

1) EUT in transmission mode

Table 8-2-1. Ch.1 (2402MHz), **Tx** mode

Frq. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)					
0.2061	46.5	0.5	47.0	37.5	0.5	38.0	63.4	16.4	53.4	15.4	Line
0.2755	39.3	0.6	39.9	32.8	0.6	33.4	60.9	21.0	50.9	17.5	Line
0.4118	39.9	0.6	40.5	37.8	0.6	38.4	57.6	17.1	47.6	9.2	Line
0.4794	32.2	0.6	32.8	30.9	0.6	31.5	56.3	23.5	46.3	14.8	Line
0.6173	29.4	0.6	30.0	28.2	0.6	28.8	56.0	26.0	46.0	17.2	Line
0.6868	31.1	0.6	31.7	29.4	0.6	30.0	56.0	24.3	46.0	16.0	Line

Table 8-2-2. Ch.40 (2441MHz) , **Tx** mode

Frq. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)					
0.2059	46.3	0.5	46.8	37.3	0.5	37.8	63.4	16.6	53.4	15.6	Line
0.2759	39.0	0.6	39.6	32.6	0.6	33.2	60.9	21.3	50.9	17.7	Line
0.4098	39.8	0.6	40.4	37.7	0.6	38.3	57.7	17.3	47.7	9.4	Line
0.4828	32.2	0.6	32.8	31.0	0.6	31.6	56.3	23.5	46.3	14.7	Line
0.6159	29.5	0.6	30.1	28.3	0.6	28.9	56.0	25.9	46.0	17.1	Line
0.6849	30.8	0.6	31.4	29.4	0.6	30.0	56.0	24.6	46.0	16.0	Line

Table 8-2-3. Ch.79 (2480MHz) , **Tx** mode

Frq. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)					
0.2061	46.1	0.5	46.6	37.2	0.5	37.7	63.4	16.8	53.4	15.7	Line
0.2759	38.7	0.6	39.3	32.6	0.6	33.2	60.9	21.6	50.9	17.7	Line
0.4115	39.9	0.6	40.5	38.0	0.6	38.6	57.6	17.1	47.6	9.0	Line
0.4781	32.6	0.6	33.2	31.4	0.6	32.0	56.4	23.2	46.4	14.4	Line
0.6163	29.5	0.6	30.1	28.4	0.6	29.0	56.0	25.9	46.0	17.0	Line
0.6855	31.0	0.6	31.6	29.4	0.6	30.0	56.0	24.4	46.0	16.0	Line

2) EUT in receiving mode

Table 8-2-4. **RX** mode

Frq. (MHz)	QP			AV			CISPR22 QP Limit (dBμV)	Margin to limit (dB)	CISPR22 AV Limit (dBμV)	Margin to limit (dB)	Phase
	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)	Measured Reading (dBμV)	Corr. Factor (dB)	Powerline Voltage (dBμV)					
0.2063	46.0	0.5	46.5	37.2	0.5	37.7	63.4	16.9	53.4	15.7	Line
0.2751	39.2	0.6	39.8	32.9	0.6	33.5	61.0	21.2	51.0	17.5	Line
0.4105	39.8	0.6	40.4	37.8	0.6	38.4	57.6	17.2	47.6	9.2	Line
0.4820	33.0	0.6	33.6	31.8	0.6	32.4	56.3	22.7	46.3	13.9	Line
0.6184	29.8	0.6	30.4	28.8	0.6	29.4	56.0	25.6	46.0	16.6	Line
0.6859	30.7	0.6	31.3	29.2	0.6	29.8	56.0	24.7	46.0	16.2	Line

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

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

9.1 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 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 120 kHz. The highest emissions relative to the limit are listed.
While the measurement, EUT had its hopping function disabled at the highest, middle and lowest available channels in line with Section 15.31(m) of Public Notice DA 00-705 dated March 30, 2000.

9.2 Test Instruments and Measurement Setup

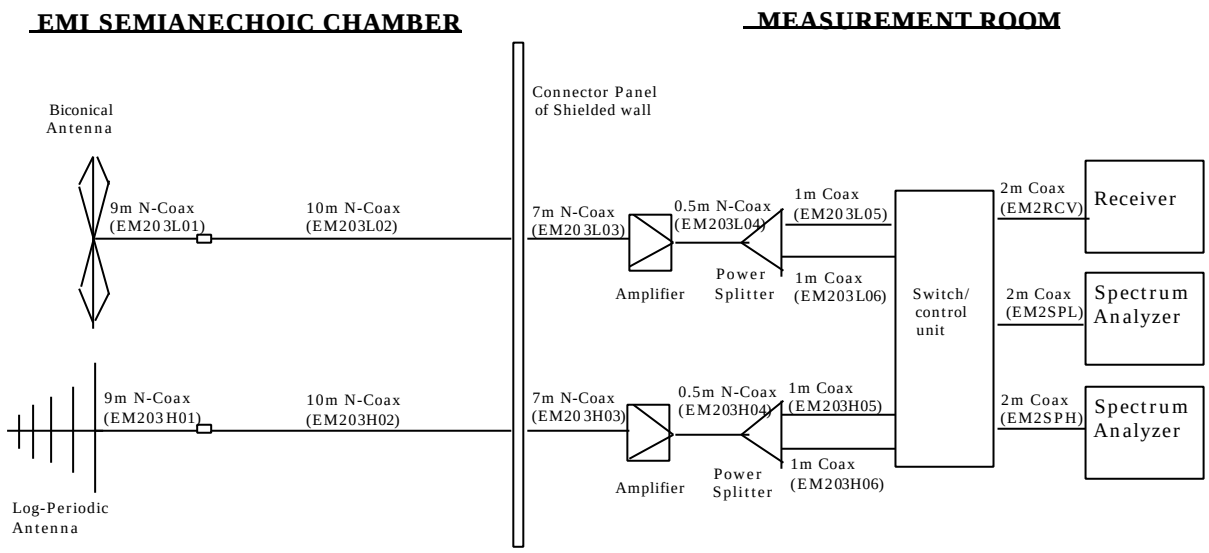


Figure 9 Cables for Radiated Emission Test

Table 9-1 Radiated Emission Test Instrumentation

Description	**Model**	**Serial Number**
Computer	IBM 6868-30J	97-901X3
Spectrum Analyzer (100Hz-1.5GHz) for 30-200MHz	HP 85680B	2732A03651
Spectrum Analyzer Display for 30-200MHz	HP 85662A	2521A00968
Quasi-Peak Adapter for 30-200MHz	HP 85650A	2043A00062
Spectrum Analyzer (100Hz-1.5GHz) for 200-1000MHz	HP 85680B	2841A04254
Spectrum Analyzer Display for 200-1000MHz	HP 85662A	2816A16831
Quasi-Peak Adapter for 200-1000MHz	HP 85650A	2811A01156
Amplifier (100KHz-1.3GHz)		
- for 30-200MHz	MITEQ AM-3A	898433
- for 200-1000MHz	MITEQ AM-3A	898432
Biconical Antenna (30-200MHz)	EMCO 3108	2536
Log-Periodic Antenna (200-1000MHz)	EMCO 3146	2849
Receiver (20MHz-1.3GHz)	R&S ESVP	893202/018
Switch/control unit	HP 3488A	2719A17226
N-Coax cables:	Length:	
- Bi-coni Ant <=> 10m Cable	9 m	- EM103L01
- 10m Cable <=> Shield Panel	10 m	- EM103L02
- Shield Panel <=> RF Amp	7 m	- EM103L03
- RF Amp <=> Power Splitter	0.5m	- EM103L04
- Log-peri Ant <=> 10m Cable	9 m	- EM103H01
- 10m Cable <=> Shield Panel	10 m	- EM103H02
- Shield Panel <=> RF Amp	7 m	- EM103H03
- RF Amp <=> Power Splitter	0.5m	- EM103H04
Coax cables:		
- Power Splitter <=> SW/Con.unit (SW110)	1 m	- EM103L05
- Power Splitter <=> SW/Con.unit (SW300)	1 m	- EM103L06
- Power Splitter <=> SW/Con.unit (SW100)	1 m	- EM103H05
- Power Splitter <=> SW/Con.unit (SW301)	1 m	- EM103H06
- SW/Con.unit <=> Receiver (Input)	2 m	- EM1RCV
- SW/Con.unit <=> Spe Ana.(Signal In) for 30- 200MHz	2 m	- EM1SPL
- SW/Con.unit <=> Spe Ana.(Signal In) for 200-1000MHz	2 m	- EM1SPH

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

9.3 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 = 35.3dBµV/m

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

Level(dBµV/m) = 20 × Log(Level(µV/m))

40dBµV/m = 100µV/m
48dBµV/m = 250µV/m

9.4 Measurement Results of applying transmitter

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 11.5dB at 30 – 1000 MHz band. The 6 highest emissions relative to the limits are reported.

Test Date: October 22, 2004

Table 9-2-1. Ch.1 (2402MHz) **TX** mode

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (μV/m)
143.180	V	44.6	12.2	-27.3	29.5	43.5	14.0	29.9	150
175.907	H	46.0	12.6	-26.8	31.8	43.5	11.7	38.9	150
564.733	V	31.6	18.2	-20.0	29.8	46.0	16.2	30.9	200
599.540	V	32.9	18.7	-19.8	31.8	46.0	14.2	38.9	200
666.485	V	28.7	20.5	-19.3	29.9	46.0	16.1	31.3	200
809.976	V	28.8	21.4	-18.2	32.0	46.0	14.0	39.8	200

Table 9-2-2. Ch.40 (2441MHz) **TX** mode

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (μV/m)
143.181	V	43.6	12.2	-27.3	28.5	43.5	15.0	26.6	150
176.371	H	46.2	12.7	-26.9	32.0	43.5	**11.5**	39.8	150
499.622	V	32.0	17.8	-20.9	28.9	46.0	17.1	27.9	200
563.702	V	32.5	18.2	-19.7	31.0	46.0	15.0	35.5	200
599.547	V	33.0	18.7	-19.8	31.9	46.0	14.1	39.4	200
666.164	V	30.7	20.5	-19.5	31.7	46.0	14.3	38.5	200

Table 9-2-3. Ch.79 (2480MHz) **TX** mode

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (μV/m)
143.180	V	44.8	12.2	-27.3	29.7	43.5	13.8	30.5	150
175.356	H	45.9	12.6	-26.9	31.6	43.5	11.9	38.0	150
196.606	H	44.8	13.6	-26.7	31.7	43.5	11.8	38.5	150
563.702	V	32.3	18.2	-19.7	30.8	46.0	15.2	34.7	200
599.549	V	33.1	18.7	-19.8	32.0	46.0	14.0	39.8	200
666.167	V	31.6	20.5	-19.5	32.6	46.0	13.4	42.7	200

Table 9-2-4. Ch.40 (2441MHz) **RX** mode

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (μV/m)
143.180	V	45.0	12.2	-27.3	29.9	43.5	13.6	31.3	150
176.283	H	46.1	12.6	-26.9	31.8	43.5	**11.7**	38.9	150
196.606	H	44.6	13.6	-26.7	31.5	43.5	12.0	37.6	150
499.627	V	32.3	17.8	-20.9	29.2	46.0	16.8	28.8	200
564.733	V	31.3	18.2	-20.0	29.5	46.0	16.5	29.9	200
599.552	V	33.4	18.7	-19.8	32.3	46.0	13.7	41.2	200

Prepared by T. Asano

9.5 Measurement Results being co-located with ANO20040501CX2

The test was performed with the representative worst case among the previously certified host PC devices shown below, while both the applying Bluetooth transmitter and the co-located WLAN transmitter (FCC ID: ANO20040501CX2) were active and emitted radio frequencies simultaneously.

Host device name	Granted date	Highest emission	Margin to limit (dB)
ThinkPad T40 Series 14", 15" and ThinkPad R50 Series 14", 15"	03/19/2004	DSSS: 44.1 dBμV/m (H) at 729.016MHZ with Ch.1/1Mb/s on AUX antenna of R50 14" model	**1.9**
		42.3 dBmV/m (V) at 729.016MHZ with Ch.6/**RX** on AUX antenna of R50 14" model	3.7
		OFDM: 34.9 dBμV/m (H) at 176.979MHz with Ch.11/6Mb/s on Main antenna of T40 15" model	8.6
		34.2 dBμV/m (H) at 174.478MHz with Ch.6/**RX** on Main antenna of T40 15" model	9.3
ThinkPad X30 Series and ThinkPad X40 Series	03/04/2004	DSSS: 42.8 dBμV/m (V) at 902.255MHZ with Ch.6/1Mb/s on AUX antenna of X40	3.2
		42.2 dBmV/m (V) at 902.231MHZ with Ch.6/**RX** on AUX antenna of X40	3.8
		OFDM: 42.5 dBμV/m (V) at 902.237MHz with Ch.6/6Mb/s on AUX antenna of X40	3.5
		42.0 dBmV/m (V) at 902.237MHZ with Ch.6/**RX** on AUX antenna of X40	3.5

The EUT was found to comply with the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 2.3dB at 30MHz - 1000MHz band.
The 6 highest emissions relative to the limits are reported.

Test Date: October 25, 2004

Table 9-2-5. Ch.1 (2412MHz) 1Mb/s DSSS mode with the applying Bluetooth device in active
Host device: IBM ThinkPad R50 Series, LCD 14" model, AUX antenna

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (μV/m)
143.181	H	48.2	12.2	-27.3	33.1	43.5	10.4	45.2	150
341.999	V	48.5	14.3	-22.8	40.0	46.0	6.0	100.0	200
354.001	V	52.0	14.4	-22.7	**43.7**	46.0	2.3	153.1	200
366.001	H	45.1	14.4	-22.3	37.2	46.0	8.8	72.4	200
458.447	V	42.0	16.6	-21.4	37.2	46.0	8.8	72.4	200
729.015	V	38.3	21.1	-19.0	40.4	46.0	5.6	104.7	200

9.6 Measurement Results being co-located with ANO20030500CMR

The test was performed with the representative worst case among the previously certified host PC devices shown below, while both the applying Bluetooth transmitter and the co-located WLAN transmitter (FCC ID: ANO20030500CMR) were active and emitted radio frequencies simultaneously.

Host device name	Granted date	Highest emission	Margin to limit (dB)
ThinkPad T40 Series 14" and ThinkPad R50 Series 14", 15"	03/24/2004	DSSS: 41.8 dBμV/m (H) at 200.176MHz with Ch.11/11Mb/s on Main antenna of T40 14" model	**1.7**
		41.8 dBμV/m (H) at 200.451MHZ with Ch.6/**RX** on Main antenna of T40 14" model	**1.7**
		OFDM: 42.6 dBμV/m (H) at 364.508MHz with Ch.11/18Mb/s on Main antenna of R50 14" model	3.4
		43.3 dBμV/m (H) at 364.508MHZ with Ch.6/**RX** on AUX antenna of R50 14" model	2.7
ThinkPad T40 Series 15"	05/04/2004	DSSS: 34.9 dBμV/m (H) at 196.607MHZ with Ch.11/11Mb/s on Main antenna	8.6
		35.7 dBμV/m (V) at 701.570MHZ with Ch.6/**RX** on Main antenna	10.3
		OFDM: 34.8 dBμV/m (H) at 196.607MHZ with Ch.6/18Mb/s on Main antenna	8.7
		36.6 dBμV/m (V) at 701.545MHZ with Ch.6/**RX** on Main antenna	9.4
ThinkPad X30 Series and ThinkPad X40 Series	12/19/2003	DSSS: 43.7 dBμV/m (V) at 902.305MHz with Ch.6/11Mb/s on AUX antenna of X40	2.3
		44.0 dBμV/m (V) at 902.295MHZ with Ch.6/**RX** on AUX antenna of X40	2.0
		OFDM: 44.2 dBμV/m (V) at 902.273MHz with Ch.6/18Mb/s on AUX antenna of X40	1.8
		43.5 dBμV/m (V) at 902.280MHZ with Ch.6/**RX** on AUX antenna of X40	2.5

The EUT was found to comply with the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 2.3dB at 30MHz - 1000MHz band.
The 6 highest emissions relative to the limits are reported.

Test Date: October 26, 2004

Table 9-2-6. Ch.11 (2462MHz) 11Mb/s DSSS mode with the applying Bluetooth device in active
Host device: IBM ThinkPad T40 Series, LCD 14" model, Main antenna

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (μV/m)
195.799	H	41.6	13.6	-26.6	28.6	43.5	14.9	26.9	150
199.627	H	54.2	13.7	-26.7	**41.2**	43.5	2.3	114.8	150
413.998	V	42.6	15.5	-22.2	35.9	46.0	10.1	62.4	200
425.997	V	42.0	15.7	-21.5	36.2	46.0	9.8	64.6	200
664.903	V	30.2	20.5	-19.5	31.2	46.0	14.8	36.3	200
801.008	V	33.0	21.2	-18.5	35.7	46.0	10.3	61.0	200

Table 9-2-7. Ch.6 (2437MHz) DSSS **RX** mode with the applying Bluetooth device in active
Host device: IBM ThinkPad T40 Series, LCD 14" model, Main antenna

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (μV/m)
195.799	H	42.5	13.6	-26.6	29.5	43.5	14.0	29.9	150
199.630	H	53.9	13.7	-26.7	**40.9**	43.5	2.6	110.9	150
400.505	V	40.8	15.3	-22.4	33.7	46.0	12.3	48.4	200
413.998	V	42.7	15.5	-22.2	36.0	46.0	10.0	63.1	200
425.999	V	41.8	15.7	-21.5	36.0	46.0	10.0	63.1	200
801.008	V	32.9	21.2	-18.5	35.6	46.0	10.4	60.3	200

9.7 Measurement Results being co-located with ANO20020201CLK

The test was performed with the representative worst case among the previously certified host PC devices shown below, while both the applying Bluetooth transmitter and the co-located WLAN transmitter (FCC ID: ANO20020101CLK) were active and emitted radio frequencies simultaneously.

Host device name	Granted date	Highest emission	Margin to limit (dB)
ThinkPad X40 Series	12/17/2003	DSSS: 42.3 dBμV/m (V) at 902.275MHz with Ch.11/11Mb/s on Main antenna	**3.7**
		41.8 dBμV/m (V) at 902.276MHz with Ch.6/**RX** on Main antenna	4.2
ThinkPad X30 Series and ThinkPad T40 Series 14"	02/26/2003	DSSS: 40.9 dBμV/m (V) at 800.427MHz with Ch.11/11Mb/s on Main antenna of T40 14" model	5.1
		39.2 dBμV/m (V) at 700.375MHz with Ch.6/**RX** on Main antenna of T40 14" model	6.8
ThinkPad T40 Series 15"	05/04/2004	DSSS: 34.9 dBμV/m (H) at 173.874MHz with Ch.6/11Mb/s on Main antenna	8.6
		34.0 dBμV/m (H) at 200.453MHz with Ch.6/**RX** on Main antenna	9.5
ThinkPad R50 Series 14", 15"	09/29/2003	DSSS: 39.5 dBμV/m (H) at 171.817MHz with Ch.6/11Mb/s on Main antenna of R50 14" model	3.8
		39.6 dBμV/m (H) at 171.818MHz with Ch.6/**RX** on Main antenna of R50 14" model	3.9

The EUT was found to comply with the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 2.8dB at 30MHz - 1000MHz band.
The 6 highest emissions relative to the limits are reported.

Test Date: October 25, 2004

Table 9-2-8. Ch.11 (2462MHz) 11Mb/s DSSS mode with the applying Bluetooth device in active
Host device: IBM ThinkPad X40 Series, Main antenna

Frequency (MHz)	Polarity (H/V)	Measured (dBμV)	Antenna Factor (dB/m)	Corr. Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin to limit (dB)	Field Strength (μV/m)	Limit (μV/m)
54.000	V	48.2	10.1	-28.8	29.5	40.0	10.5	29.9	100
60.000	V	56.6	9.3	-28.7	**37.2**	40.0	2.8	72.4	100
72.000	V	46.0	8.7	-28.3	26.4	40.0	13.6	20.9	100
84.000	V	47.7	7.9	-28.5	27.1	40.0	12.9	22.6	100
282.000	V	47.1	13.1	-23.5	36.7	46.0	9.3	68.4	200
379.302	V	40.5	14.7	-22.5	32.7	46.0	13.3	43.2	200

10. RESTRICTED BANDS RADIATIONS (1 GHz – 25 GHz)

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

10.1 Test Procedure

Radiated emissions were measured in the frequency range with 1 to 25 GHz in transmitting mode and 1 to 12.5 GHz in receiving mode. All tests were performed in the semi-anechoic chamber at a 3-meter distance (except for the frequency range with 18 to 25 GHz where test distance was reduced to 1 meter) on both horizontal and vertical polarities. The antenna was also scanned in height. The 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 a bandwidth of 1MHz and the average setting mode with the tuned spectrum analyzer using resolution bandwidth of 1 MHz / video bandwidth of 1 kHz or 100 Hz. The highest emissions relative to the limit are listed.
While the measurement, EUT had its hopping function disabled at the highest, middle and lowest available channels in line with Section 15.31(m) of Public Notice DA 00-705 dated March 30, 2000.

10.2 Test Instruments and Measurement

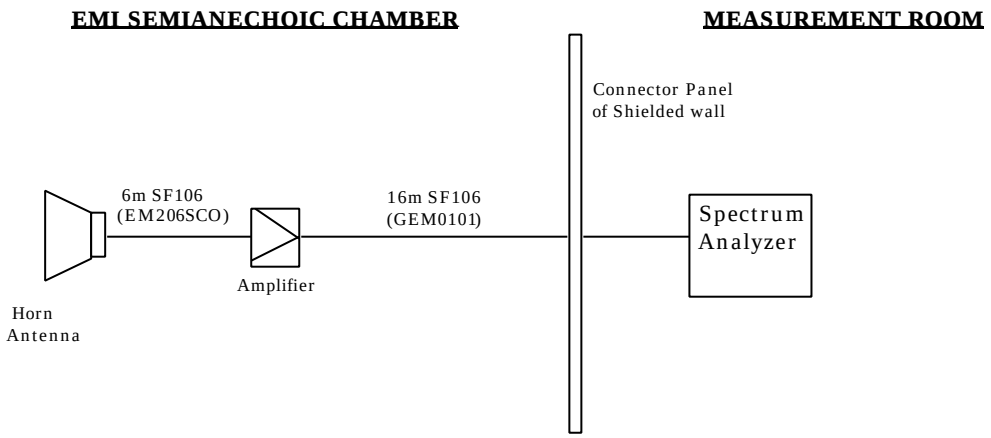


Figure 10-1. Cables for Radiated Emission Test (1 – 18GHz)

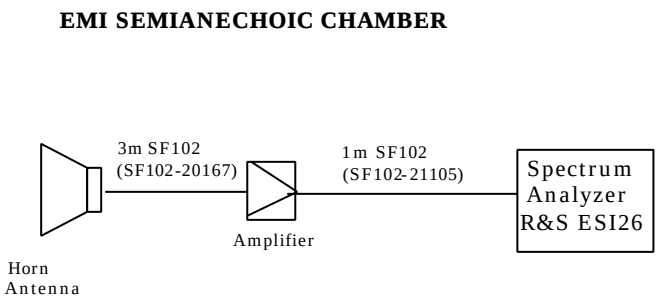


Figure 10-2. Cables for Radiated Emission Test (18 - 25GHz)

Table 10 Radiated Emission Test Instrumentation (1 – 25 GHz)

Description	**Model**	**Serial Number**
Spectrum Analyzer EMI Test Receiver	R&S ESI26	836119/003
Amplifier (1 - 18GHz)	HP 8449B	3008A00582
Amplifier (18 – 25GHz)	Agilent 83051A	3950M00193
Horn Antenna (1- 18GHz)	EMCO 3115	9903-5774
Horn Antenna (3.95 – 5.85GHz)	EMCO 3160-5	1099
Horn Antenna (5.85 – 8.20GHz)	EMCO 3160-6	9712-1044
Horn Antenna (8.20 – 12.4GHz)	EMCO 3160-7	1156
Horn Antenna (18- 25GHz)	EMCO 3160-9	0004-1202
Coaxial cables: - Horn Ant <=> RF Amp. (1-18GHz) - RF Amp.<=>Spectrum Analyzer (1-18GHz) - Horn Ant <=> RF Amp. (18-25GHz) - RF Amp.<=>Spectrum Analyzer (18-25GHz)	Length: 6 m 16 m 3m 1m	 - EM206SCO - GEM0101 - SF102-20167 - SF102-21105

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

10.3 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

10.4 Measurement Results of applying transmitter

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 4.2dB. The measurement was done for the frequency range of 1 to 25 GHz in TX mode and 1 to 12.5 GHz in RX mode.

Test Date: October 21, 29 and November 2, 2004

Table 10-2-1. Ch.1 (2402MHz), **TX** 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)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)
							(peak)			*(average)*		
Inband												
2.402	V	100.4	99.4	28.3	-29.1	0.0	99.6	OB*	-	98.6	OB*	-
bandedge												
2.378	V	51.7	-	28.2	-29.2	0.0	50.7	74.0	23.3	-	54.0	-
2.390	V	50.8	-	28.2	-29.2	0.0	49.8	74.0	24.2	-	54.0	-
1.015	V	47.7	-	24.3	-31.9	0.0	40.1	74.0	33.9	-	54.0	-
1.065	V	48.6	-	24.6	-31.7	0.0	41.5	74.0	32.5	-	54.0	-
1.129	V	48.4	-	24.5	-31.5	0.0	41.4	74.0	32.6	-	54.0	-
1.198	V	50.6	-	25.2	-31.3	0.0	44.5	74.0	29.5	-	54.0	-
1.807	H	50.1	36.0	26.4	-29.9	0.0	46.6	NR	-	32.5	NR	-
1.873	H	49.5	35.5	27.5	-29.7	0.0	47.3	NR	-	33.3	NR	-
4.806	V	44.6	-	27.1	-26.7	0.0	45.0	74.0	29.0	-	54.0	-
5.170	H	39.0	24.9	27.2	-26.1	0.0	40.1	NR	-	26.0	NR	-
5.229	H	39.1	24.9	27.1	-26.0	0.0	40.2	NR	-	26.0	NR	-

*Note: OB means "operation band" (2400-2483.5MHz); in this case limit is 1W (measured conducted with power meter).
NR : Non-Restricted band (just reference only for EU compliance)

Table 10-2-2. Ch.40 (2441MHz) , **TX** 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)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)
							(peak)			*(average)*		
Inband												
2.441	V	100.3	99.7	28.4	-29.2	0.0	99.5	OB*	-	98.9	OB*	-
bandedge												
2.390	V	48.3	-	28.2	-29.2	0.0	47.3	74.0	26.7	-	54.0	-
2.484	V	48.6	-	28.4	-29.1	0.0	47.9	74.0	26.1	-	54.0	-
2.489	V	51.4	-	28.4	-29.6	0.0	50.2	74.0	23.8	-	54.0	-
1.015	V	46.9	-	24.3	-31.9	0.0	39.3	74.0	34.7	-	54.0	-
1.065	V	48.8	-	24.6	-31.7	0.0	41.7	74.0	32.3	-	54.0	-
1.129	V	48.6	-	24.5	-31.5	0.0	41.6	74.0	32.4	-	54.0	-
1.195	V	53.4	-	25.2	-31.3	0.0	47.3	74.0	26.7	-	54.0	-
1.802	V	49.7	36.1	26.4	-29.9	0.0	46.2	NR	-	32.6	NR	-
1.866	V	49.2	35.4	27.4	-29.9	0.0	46.7	NR	-	32.9	NR	-
4.884	V	46.4	-	27.0	-26.6	0.0	46.8	74.0	27.2	-	54.0	-
5.175	V	39.1	24.9	27.2	-26.1	0.0	40.2	NR	-	26.0	NR	-
5.210	V	39.1	25.0	27.1	-26.1	0.0	40.1	NR	-	26.0	NR	-
7.324	V	47.0	-	29.8	-24.4	0.0	52.4	74.0	21.6	-	54.0	-

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

with power meter).
NR : Non-Restricted band (just reference only for EU compliance)

Table 10-2-3. Ch.79 (2480MHz) , **TX** 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)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)
							(peak)			*(average)*		
Inband												
2.480	V	99.5	98.7	28.4	-29.1	0.0	98.8	OB*	-	98.0	OB*	-
bandedge												
2.484	V	57.9	50.5	28.4	-29.1	0.0	57.2	74.0	16.8	49.8	54.0	**4.2**
2.500	V	54.0	-	28.4	-29.1	0.0	53.3	74.0	20.7	-	54.0	-
1.015	V	48.7	-	24.3	-31.9	0.0	41.1	74.0	32.9	-	54.0	-
1.065	V	49.9	-	24.6	-31.7	0.0	42.8	74.0	31.2	-	54.0	-
1.128	V	49.3	-	24.5	-31.5	0.0	42.3	74.0	31.7	-	54.0	-
1.195	V	50.0	-	25.2	-31.3	0.0	43.9	74.0	30.1	-	54.0	-
1.804	H	49.4	36.0	26.4	-29.9	0.0	45.9	NR	-	32.5	NR	-
1.866	H	48.3	35.4	27.4	-29.9	0.0	45.8	NR	-	32.9	NR	-
4.962	V	45.6	-	27.1	-26.6	0.0	46.1	74.0	27.9	-	54.0	-
5.157	H	37.2	25.0	27.2	-26.0	0.0	38.4	NR	-	26.2	NR	-
5.213	H	38.9	25.0	27.1	-26.0	0.0	40.0	NR	-	26.1	NR	-
7.441	V	43.3	-	29.8	-24.3	0.0	48.8	74.0	25.2	-	54.0	-

*Note: OB means “operation band” (2400-2483.5MHz); in this case limit is 1W (measured conducted with power meter).
NR : Non-Restricted band (just reference only for EU compliance)

Table 10-2-4. Ch.40 (2441MHz), **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)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)
							(peak)			*(average)*		
1.015	V	47.0	-	24.3	-31.9	0.0	39.4	74.0	34.6	-	54.0	-
1.069	V	47.2	-	24.6	-31.7	0.0	40.1	74.0	33.9	-	54.0	-
1.198	V	49.2	-	25.2	-31.3	0.0	43.1	74.0	30.9	-	54.0	-
1.832	V	43.0	28.8	27.4	-29.9	0.0	40.5	NR	-	26.3	NR	-
1.836	V	42.6	28.9	27.4	-29.9	0.0	40.1	NR	-	26.4	NR	-
1.852	V	42.3	28.8	27.4	-29.9	0.0	39.8	NR	-	26.3	NR	-
1.871	V	42.6	28.8	27.5	-29.7	0.0	40.4	NR	-	26.6	NR	-
5.157	V	38.1	25.1	27.2	-26.0	0.0	39.3	NR	-	26.3	NR	-
5.203	V	38.3	24.9	27.1	-26.0	0.0	39.4	NR	-	26.0	NR	-

*Note: NR : Non-Restricted band (just reference only for EU compliance)

10.5 Measurement Results being co-located with ANO20040501CX2

The test was performed with the representative worst case among the previously certified host PC devices shown below, while both the applying Bluetooth transmitter and the co-located WLAN transmitter (FCC ID: ANO20040501CX2) were active and emitted radio frequencies simultaneously.

Host device name	Granted date	Highest emission	Margin to limit (dB)
ThinkPad T40 Series 14", 15"	03/19/2004	DSSS: Ave. 51.6 dBμV/m (H) at 2488MHZ with Ch.11/1Mb/s on Main antenna of 15" model	2.4
		OFDM: Ave. 53.2 dBμV/m (H) at 2484MHz with Ch.11/6Mb/s on Main antenna of 15" model	**0.8**
ThinkPad R50 Series 14", 15"		DSSS: Ave. 52.2 dBμV/m (H) at 2488MHZ with Ch.11/1Mb/s on AUX antenna of 14" model	1.8
		OFDM: Ave. 51.1 dBμV/m (H) at 2484MHz with Ch.11/6Mb/s on AUX antenna of 14" model	2.9
ThinkPad X30 Series	03/04/2004	DSSS: Ave. 46.9 dBμV/m (H) at 2488MHZ with Ch.11/1Mb/s on AUX antenna	7.1
		OFDM: Ave. 49.1 dBμV/m (H) at 2484MHz with Ch.11/6Mb/s on AUX antenna	4.9
ThinkPad X40 Series		DSSS: Ave. 53.1 dBμV/m (H) at 2488MHZ with Ch.11/1Mb/s on AUX antenna	0.9
		OFDM: Ave. 53.2 dBμV/m (H) at 2484MHz with Ch.11/6Mb/s on AUX antenna	**0.8**

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 1.0dB. The measurement was done for the frequency range of 1 to 25 GHz in TX mode and 1 to 12.5 GHz in RX mode.

Test Date: October 27 and 28, 2004

Table 10-2-5. Ch.11 (2462MHz) 6Mb/s OFDM mode with the applying Bluetooth device in active
Host device: IBM ThinkPad T40 Series, LCD 15" model, Main antenna

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)*	Margin to limit (dB) *(peak)*	Field Strength (dBμV/m) *(average)*	FCC Limit (dBμV/m) *(average)*	Margin to limit (dB) *(average)*
Inband												
2.466	H	109.2	94.6	28.4	-29.2	0.0	108.4	OB*	-	93.8	OB*	-
bandedge												
2.484	H	72.2	53.7	28.4	-29.1	0.0	71.5	74.0	2.5	**53.0**	54.0	1.0
2.485	H	71.1	52.7	28.4	-29.1	0.0	70.4	74.0	3.6	52.0	54.0	2.0
1.008	V	48.1	-	24.1	-31.9	0.0	40.3	74.0	33.7	-	54.0	-
1.083	V	48.6	-	24.5	-31.5	0.0	41.6	74.0	32.4	-	54.0	-
1.196	V	53.9	-	25.2	-31.3	0.0	47.8	74.0	26.2	-	54.0	-
1.598	V	49.9	-	25.6	-30.3	0.0	45.2	74.0	28.8	-	54.0	-
1.807	V	49.1	35.9	26.4	-29.9	0.0	45.6	NR	-	32.4	NR	-
1.873	V	49.2	35.5	27.5	-29.7	0.0	47.0	NR	-	33.3	NR	-
2.257	H	51.9	-	27.7	-29.3	0.0	50.3	74.0	23.7	-	54.0	-
2.289	H	53.5	-	27.8	-29.3	0.0	52.0	74.0	22.0	-	54.0	-
2.360	H	53.7	-	28.1	-29.2	0.0	52.6	74.0	21.4	-	54.0	-
2.387	H	52.9	-	28.2	-29.2	0.0	51.9	74.0	22.1	-	54.0	-
4.822	V	45.5	-	27.1	-26.6	0.0	46.0	74.0	28.0	-	54.0	-
4.890	V	44.7	-	27.0	-26.6	0.0	45.1	74.0	28.9	-	54.0	-
4.938	V	43.8	-	27.1	-26.4	0.0	44.5	74.0	29.5	-	54.0	-
4.954	V	46.3	-	27.1	-26.6	0.0	46.8	74.0	27.2	-	54.0	-
5.199	V	38.3	24.7	27.1	-26.1	0.0	39.3	NR	-	25.7	NR	-
5.262	V	38.1	24.8	27.1	-26.0	0.0	39.2	NR	-	25.9	NR	-
7.255	V	43.5	-	30.0	-24.5	0.0	49.0	74.0	25.0	-	54.0	-
7.272	V	44.3	-	29.9	-24.6	0.0	49.6	74.0	24.4	-	54.0	-
7.278	V	41.3	-	29.9	-24.6	0.0	46.6	74.0	27.4	-	54.0	-
7.288	V	45.3	-	29.9	-24.4	0.0	50.8	74.0	23.2	-	54.0	-

*Note: OB means "operation band" (2400-2483.5MHz).
NR : Non-Restricted band (just reference only for EU compliance)

Table 10-2-6. Ch.11 (2462MHz) 6Mb/s OFDM mode with the applying Bluetooth device in active
Host device: IBM ThinkPad X40 Series, AUX antenna

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)*	Margin to limit (dB) *(peak)*	Field Strength (dBμV/m) *(average)*	FCC Limit (dBμV/m) *(average)*	Margin to limit (dB) *(average)*
Inband												
2.466	H	108.3	94.7	28.4	-29.2	0.0	107.5	OB*	-	93.9	OB*	-
bandedge												
2.484	H	71.0	53.5	28.4	-29.1	0.0	70.3	74.0	3.7	**52.8**	54.0	1.2
2.485	H	68.6	52.5	28.4	-29.1	0.0	67.9	74.0	6.1	51.8	54.0	2.2
1.031	V	48.8	-	24.6	-31.8	0.0	41.6	74.0	32.4	-	54.0	-
1.086	V	48.9	-	24.5	-31.5	0.0	41.9	74.0	32.1	-	54.0	-
1.137	V	52.8	-	24.6	-31.4	0.0	46.0	74.0	28.0	-	54.0	-
1.513	V	52.7	-	25.5	-30.4	0.0	47.8	74.0	26.2	-	54.0	-
1.806	V	49.4	35.9	26.4	-29.9	0.0	45.9	NR	-	32.4	NR	-
1.849	V	49.0	35.6	27.4	-29.9	0.0	46.5	NR	-	33.1	NR	-
2.227	H	50.2	-	27.6	-29.3	0.0	48.5	74.0	25.5	-	54.0	-
2.257	H	53.0	-	27.7	-29.3	0.0	51.4	74.0	22.6	-	54.0	-
2.289	H	55.5	43.6	27.8	-29.3	0.0	54.0	74.0	20.0	42.1	54.0	11.9
2.360	H	55.9	42.8	28.1	-29.2	0.0	54.8	74.0	19.2	41.7	54.0	12.3
4.910	V	59.5	25.4	27.0	-26.6	0.0	59.9	74.0	14.1	25.8	54.0	28.2
4.926	V	60.5	25.4	27.0	-26.4	0.0	61.1	74.0	12.9	26.0	54.0	28.0
4.944	V	61.0	25.3	27.1	-26.4	0.0	61.7	74.0	12.3	26.0	54.0	28.0
4.952	V	61.9	25.3	27.1	-26.6	0.0	62.4	74.0	11.6	25.8	54.0	28.2
5.155	V	37.3	24.9	27.2	-26.0	0.0	38.5	NR	-	26.1	NR	-
5.249	V	37.6	24.8	27.1	-26.0	0.0	38.7	NR	-	25.9	NR	-
7.263	V	40.1	-	29.9	-24.6	0.0	45.4	74.0	28.6	-	54.0	-
7.276	V	41.8	-	29.9	-24.6	0.0	47.1	74.0	26.9	-	54.0	-
7.294	V	38.5	-	29.9	-24.4	0.0	44.0	74.0	30.0	-	54.0	-
7.384	V	39.0	-	29.8	-24.5	0.0	44.3	74.0	29.7	-	54.0	-

*Note: OB means "operation band" (2400-2483.5MHz).
NR : Non-Restricted band (just reference only for EU compliance)

10.6 Measurement Results being co-located with ANO20030500CMR

The test was performed with the representative worst case among the previously certified host PC devices shown below, while both the applying Bluetooth transmitter and the co-located WLAN transmitter (FCC ID: ANO20030500CMR) were active and emitted radio frequencies simultaneously.

Host device name	Granted date	Highest emission	Margin to limit (dB)
ThinkPad T40 Series 14”	03/24/2004	DSSS: Ave. 44.3 dBμV/m (H) at 2390MHZ with Ch.1/11Mb/s on Main antenna	9.7
		OFDM: Peak 71.7 dBμV/m (H) at 2484MHz with Ch.11/18Mb/s on Main antenna	**2.3**
ThinkPad R50 Series 14”, 15”		DSSS: Peak 63.9 dBμV/m (H) at 2484MHZ with Ch.11/11Mb/s on AUX antenna of 14” model	10.1
		OFDM: Ave. 49.4 dBμV/m (H) at 2484MHz with Ch.11/18Mb/s on AUX antenna of 14” model	4.6
ThinkPad T40 15”	05/04/2004	DSSS: Ave. 46.2 dBμV/m (H) at 2390MHZ with Ch.1/11Mb/s on Main antenna	7.8
		OFDM: Ave. 49.0 dBμV/m (H) at 2484MHz with Ch.11/18Mb/s on Main antenna	5.0
ThinkPad X30 Series	12/19/2003	DSSS: Peak 53.8 dBμV/m (H) at 2377MHZ with Ch.1/11Mb/s on AUX antenna	20.2
		OFDM: Peak 68.8 dBμV/m (H) at 2484MHz with Ch.11/18Mb/s on AUX antenna	5.2
ThinkPad X40 Series		DSSS: Ave. 44.0 dBμV/m (H) at 2390MHZ with Ch.1/11Mb/s on AUX antenna	10.0
		OFDM: Peak 69.4 dBμV/m (H) at 2484MHz with Ch.11/18Mb/s on AUX antenna	4.6

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 2.8dB. The measurement was done for the frequency range of 1 to 25 GHz in TX mode and 1 to 12.5 GHz in RX mode.

Test Date: October 27 and 28, 2004

Table 10-2-7. Ch.11 (2462MHz) 18Mb/s OFDM mode with the applying Bluetooth device in active
Host device: IBM ThinkPad T40 Series, LCD 14" model, Main antenna

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)*	Margin to limit (dB) *(peak)*	Field Strength (dBμV/m) *(average)*	FCC Limit (dBμV/m) *(average)*	Margin to limit (dB) *(average)*
Inband												
2.456	H	110.8	99.3	28.4	-29.2	0.0	110.0	OB*	-	98.5	OB*	-
bandedge												
2.484	H	72.4	51.9	28.4	-29.1	0.0	71.7	74.0	2.3	**51.2**	54.0	2.8
2.488	H	68.6	43.8	28.4	-29.1	0.0	67.9	74.0	6.1	43.1	54.0	10.9
1.004	V	52.6		24.1	-31.9	0.0	44.8	74.0	29.2	-	54.0	-
1.161	V	53.9		24.6	-31.3	0.0	47.2	74.0	26.8	-	54.0	-
1.195	V	52.1		25.2	-31.3	0.0	46.0	74.0	28.0	-	54.0	-
1.328	V	56.8		25.6	-31.0	0.0	51.4	74.0	22.6	-	54.0	-
1.807	H	48.2	35.9	26.4	-29.9	0.0	44.7	NR	-	32.4	NR	-
1.893	H	48.1	35.3	27.6	-29.7	0.0	46.0	NR	-	33.2	NR	-
2.358	H	54.3		28.1	-29.2	0.0	53.2	74.0	20.8	-	54.0	-
2.373	H	57.5	41.6	28.2	-29.2	0.0	56.5	74.0	17.5	40.6	54.0	13.4
2.382	H	56.8	42.3	28.2	-29.2	0.0	55.8	74.0	18.2	41.3	54.0	12.7
2.386	H	56.9	42.7	28.2	-29.2	0.0	55.9	74.0	18.1	41.7	54.0	12.3
4.818	V	53.1		27.1	-26.6	0.0	53.6	74.0	20.4	-	54.0	-
4.862	V	48.8		27.0	-26.6	0.0	49.2	74.0	24.8	-	54.0	-
4.932	V	45.2		27.1	-26.4	0.0	45.9	74.0	28.1	-	54.0	-
5.197	V	38.1	24.6	27.1	-26.1	0.0	39.1	NR	-	25.6	NR	-
5.278	V	38.3	24.7	27.1	-25.9	0.0	39.5	NR	-	25.9	NR	-
7.303	V	44.8		29.9	-24.4	0.0	50.3	74.0	23.7	-	54.0	-
7.343	V	44.0		29.8	-24.5	0.0	49.3	74.0	24.7	-	54.0	-
7.357	V	45.2		29.8	-24.5	0.0	50.5	74.0	23.5	-	54.0	-
7.366	V	45.6		29.8	-24.5	0.0	50.9	74.0	23.1	-	54.0	-

*Note: OB means "operation band" (2400-2483.5MHz).
NR : Non-Restricted band (just reference only for EU compliance)

10.7 Measurement Results being co-located with ANO20020201CLK

The test was performed with the representative worst case among the previously certified host PC devices shown below, while both the applying Bluetooth transmitter and the co-located WLAN transmitter (FCC ID: ANO20020101CLK) were active and emitted radio frequencies simultaneously.

Host device name	Granted date	Highest emission	Margin to limit (dB)
ThinkPad X30 Series	02/26/2003	DSSS: Ave. 51.6 dBμV/m (V) at 2484MHZ with Ch.11/11Mb/s on Main antenna	**2.4**
ThinkPad X40 Series	12/17/2003	DSSS: Ave. 43.0 dBμV/m (H) at 2390MHz with Ch.1/11Mb/s on Main antenna	11.0
ThinkPad T40 Series 14”	02/26/2003	DSSS: Ave. 48.9 dBμV/m (V) at 2390MHz with Ch.1/11Mb/s on Main antenna	**5.1**
ThinkPad T40 Series 15”	05/04/2004	DSSS: Ave. 46.5 dBμV/m (H) at 2390MHz with Ch.1/11Mb/s on Main antenna	7.5
ThinkPad R50 Series 14”, 15”	09/29/2003	DSSS: Ave. 47.6 dBμV/m (H) at 2390MHz with Ch.1/11Mb/s on Main antenna of 14” model	6.4

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 6.0dB. The measurement was done for the frequency range of 1 to 25 GHz in TX mode and 1 to 12.5 GHz in RX mode.

Test Date: October 27 and 28, 2004

Table 10-2-8. Ch.11 (2462MHz) 11Mb/s DSSS mode with the applying Bluetooth device in active
Host device: IBM ThinkPad X30 Series, Main antenna

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)*	Margin to limit (dB) *(peak)*	Field Strength (dBμV/m) *(average)*	FCC Limit (dBμV/m) *(average)*	Margin to limit (dB) *(average)*
Inband												
2.461	H	110.6	100.8	28.4	-29.2	0.0	109.8	OB*	-	100.0	OB*	-
bandedge												
2.484	H	53.7	43.1	28.4	-29.1	0.0	53.0	74.0	21.0	42.4	54.0	11.6
2.485	H	55.6	42.8	28.4	-29.1	0.0	54.9	74.0	19.1	42.1	54.0	11.9
2.486	H	55.1	42.1	28.4	-29.1	0.0	54.4	74.0	19.6	41.4	54.0	12.6
1.067	V	56.0	-	24.6	-31.7	0.0	48.9	74.0	25.1	-	54.0	-
1.152	V	51.2	-	24.6	-31.3	0.0	44.5	74.0	29.5	-	54.0	-
1.201	V	52.0	-	25.2	-31.3	0.0	45.9	74.0	28.1	-	54.0	-
1.603	V	53.5	-	25.6	-30.3	0.0	48.8	74.0	25.2	-	54.0	-
1.821	V	48.1	35.9	26.9	-29.9	0.0	45.1	NR	-	32.9	NR	-
1.865	V	49.5	36.2	27.4	-29.9	0.0	47.0	NR	-	33.7	NR	-
2.365	V	50.4	-	28.1	-29.2	0.0	49.3	74.0	24.7	-	54.0	-
2.373	V	50.7	-	28.2	-29.2	0.0	49.7	74.0	24.3	-	54.0	-
2.379	V	50.1	-	28.2	-29.2	0.0	49.1	74.0	24.9	-	54.0	-
2.384	V	50.2	-	28.2	-29.2	0.0	49.2	74.0	24.8	-	54.0	-
4.846	V	63.0	25.5	27.0	-26.5	0.0	**63.5**	74.0	10.5	26.0	54.0	28.0
4.874	V	63.0	25.5	27.0	-26.6	0.0	63.4	74.0	10.6	25.9	54.0	28.1
4.882	V	63.0	25.3	27.0	-26.6	0.0	63.4	74.0	10.6	25.7	54.0	28.3
4.930	V	57.2	27.1	27.0	-26.4	0.0	57.8	74.0	16.2	27.7	54.0	26.3
5.163	V	39.3	24.6	27.2	-26.1	0.0	40.4	NR	-	25.7	NR	-
5.291	V	38.8	24.8	27.1	-25.9	0.0	40.0	NR	-	26.0	NR	-
7.257	V	42.4	-	30.0	-24.5	0.0	47.9	74.0	26.1	-	54.0	-
7.269	V	43.3	-	29.9	-24.6	0.0	48.6	74.0	25.4	-	54.0	-
7.312	V	42.2	-	29.9	-24.4	0.0	47.7	74.0	26.3	-	54.0	-
7.398	V	39.4	-	29.8	-24.5	0.0	44.7	74.0	29.3	-	54.0	-

*Note: OB means "operation band" (2400-2483.5MHz).
NR : Non-Restricted band (just reference only for EU compliance)

Table 10-2-9. Ch.1 (2412MHz) 11Mb/s DSSS mode with the applying Bluetooth device in active
Host device: IBM ThinkPad T40 Series, LCD 14" model, Main antenna

Frequency (GHz)	Polarity (H/V)	Measured (dBμV) *(peak)*	Measured (dBμV) *(average)*	Antenna Factor (dB/m)	Corr. Factor (dB)	Falloff Factor (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)	Field Strength (dBμV/m)	FCC Limit (dBμV/m)	Margin to limit (dB)
							(peak)			*(average)*		
Inband												
2.411	H	114.9	105.0	28.3	-29.1	0.0	114.1	OB*	-	104.2	OB*	-
bandedge												
2.386	H	60.5	48.4	28.2	-29.2	0.0	59.5	74.0	14.5	47.4	54.0	6.6
2.389	H	60.3	49.0	28.2	-29.2	0.0	59.3	74.0	14.7	**48.0**	54.0	6.0
2.390	H	59.4	48.6	28.2	-29.2	0.0	58.4	74.0	15.6	47.6	54.0	6.4
1.001	V	51.5	-	24.1	-31.9	0.0	43.7	74.0	30.3	-	54.0	-
1.198	V	51.8	-	25.2	-31.3	0.0	45.7	74.0	28.3	-	54.0	-
1.226	V	50.1	-	25.2	-31.3	0.0	44.0	74.0	30.0	-	54.0	-
1.326	V	55.3	-	25.6	-31.0	0.0	49.9	74.0	24.1	-	54.0	-
1.802	V	48.9	36.0	26.4	-29.9	0.0	45.4	NR	-	32.5	NR	-
1.894	V	48.1	35.3	27.6	-29.7	0.0	46.0	NR	-	33.2	NR	-
2.357	H	53.7	-	28.1	-29.2	0.0	52.6	74.0	21.4	-	54.0	-
2.368	H	53.9	-	28.1	-29.2	0.0	52.8	74.0	21.2	-	54.0	-
2.379	H	54.4	-	28.2	-29.2	0.0	53.4	74.0	20.6	-	54.0	-
4.822	V	52.6	-	27.1	-26.6	0.0	53.1	74.0	20.9	-	54.0	-
4.834	V	49.1	-	27.0	-26.5	0.0	49.6	74.0	24.4	-	54.0	-
4.846	V	51.3	-	27.0	-26.5	0.0	51.8	74.0	22.2	-	54.0	-
4.864	V	49.4	-	27.0	-26.6	0.0	49.8	74.0	24.2	-	54.0	-
5.152	H	38.3	24.8	27.2	-26.0	0.0	39.5	NR	-	26.0	NR	-
5.247	H	38.8	24.9	27.1	-26.0	0.0	39.9	NR	-	26.0	NR	-
7.255	V	43.5	-	30.0	-24.5	0.0	49.0	74.0	25.0	-	54.0	-
7.384	V	44.3	-	29.8	-24.5	0.0	49.6	74.0	24.4	-	54.0	-
7.396	V	43.3	-	29.8	-24.5	0.0	48.6	74.0	25.4	-	54.0	-

*Note: OB means "operation band" (2400-2483.5MHz).
NR : Non-Restricted band (just reference only for EU compliance)

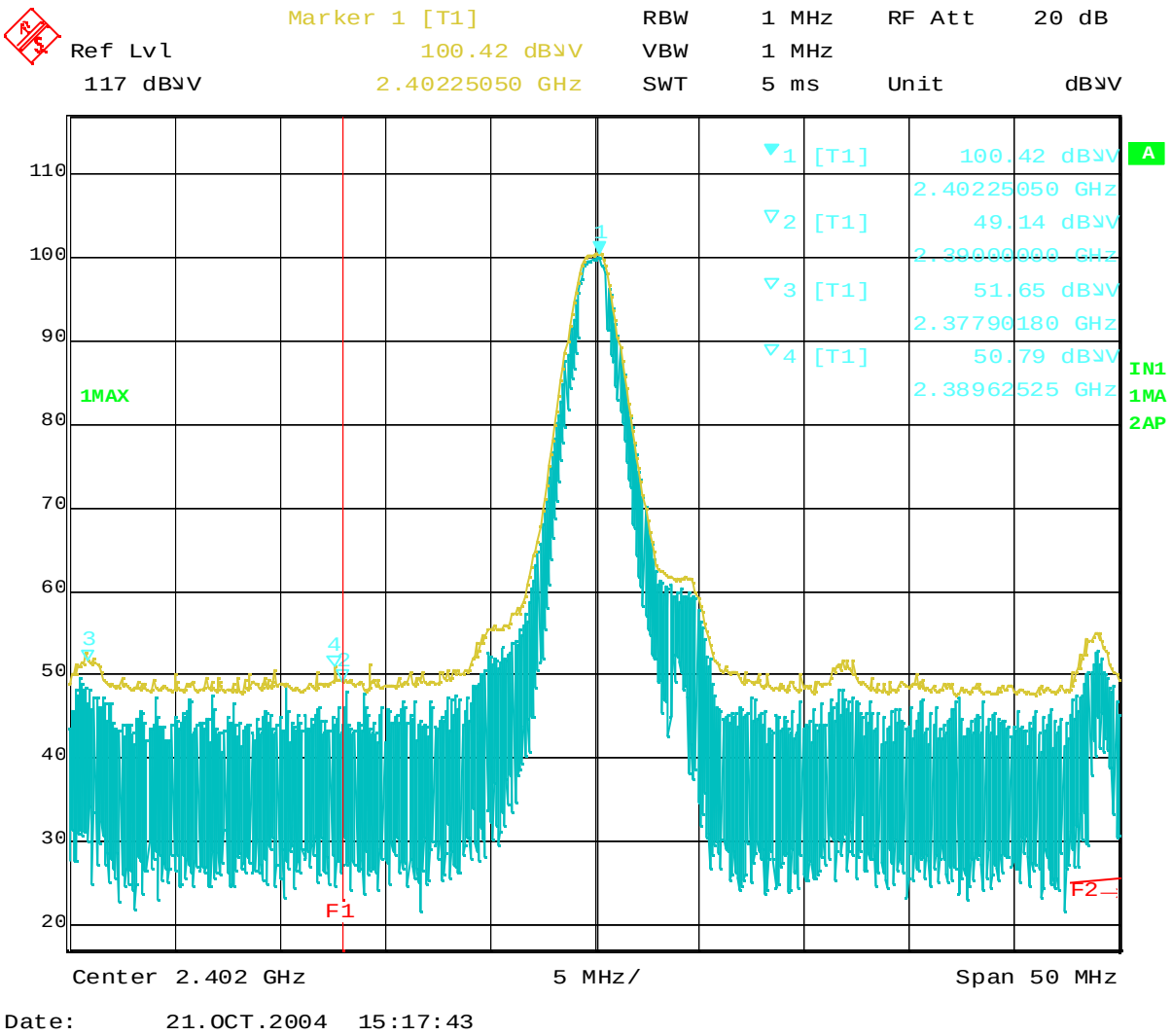
10.8 Measurement plots for adjacent restricted band

Single transmission of the applying Bluetooth device

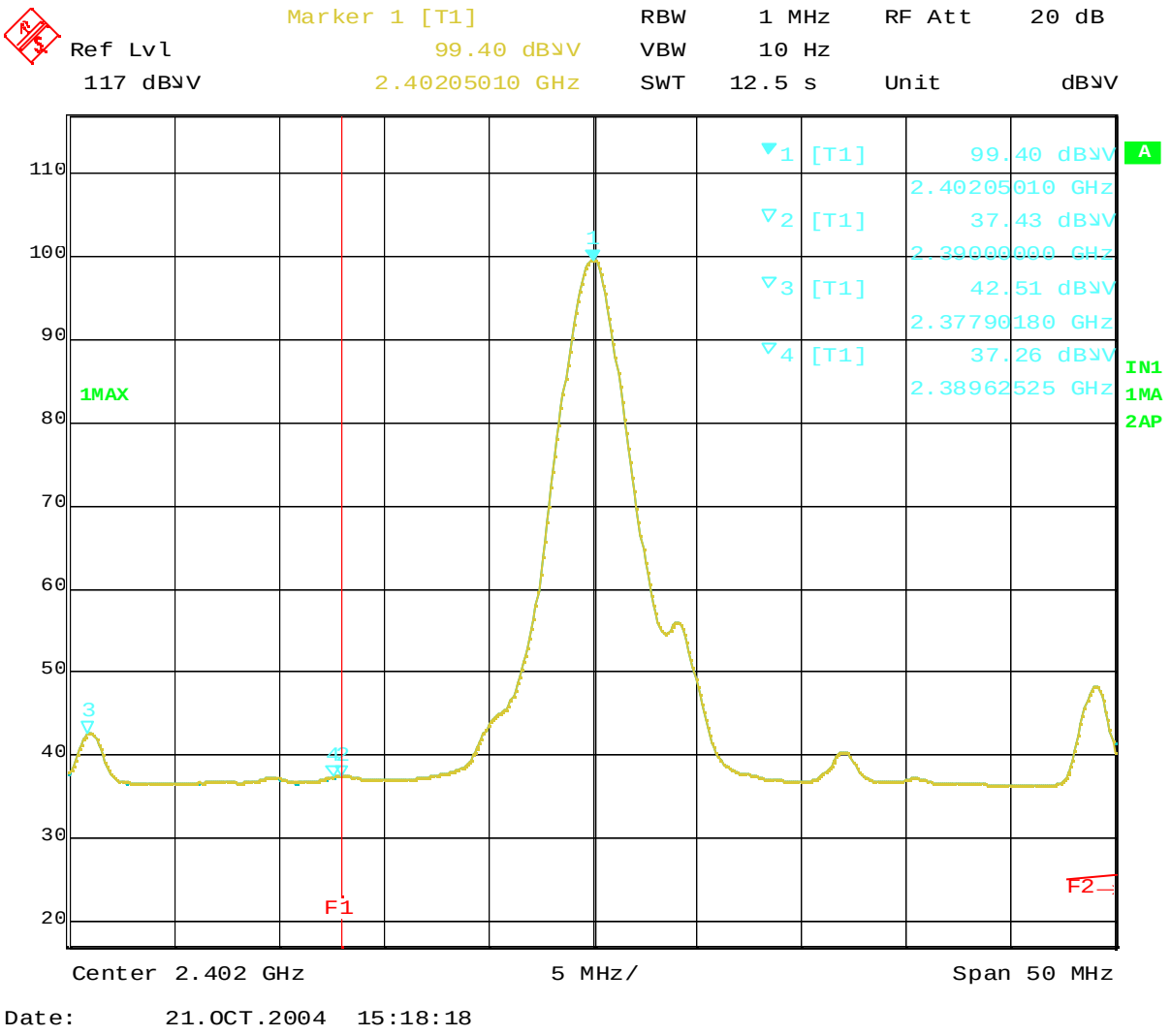
Plot 10-1: Trace of Table 10.2.1 - Ch.1 Peak
Plot 10-2: ditto - Ch.1 Ave.
Plot 10-3: Trace of Table 10.2.3 - Ch.79 Peak
Plot 10-4: ditto - Ch.79 Ave.

Multiple transmission of the applying Bluetooth device with co-located WLAN card (The worst case only)

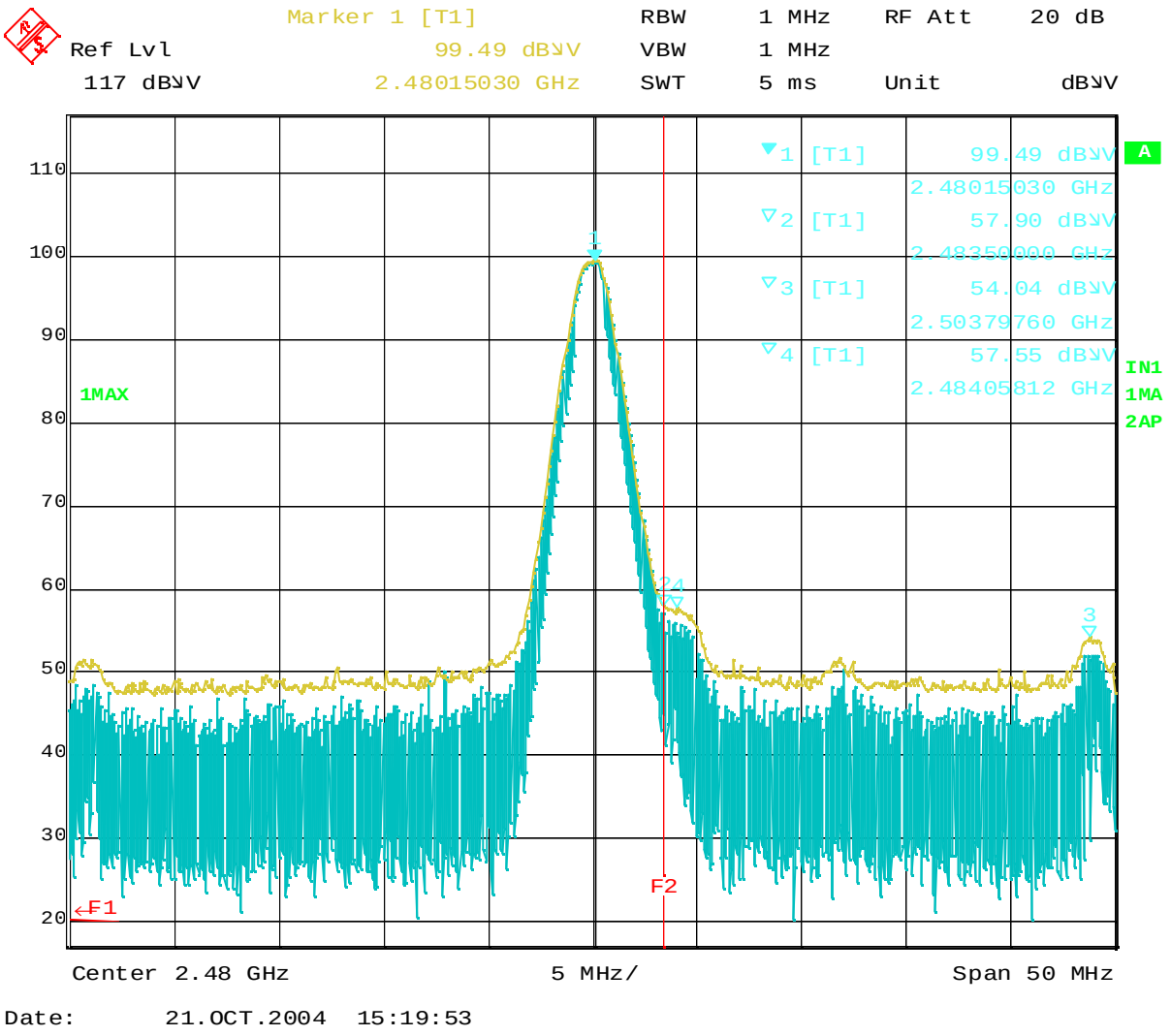
Plot 10-5: Trace of Table 10.2.9 - WLAN Ch.1 Peak
Plot 10-6: ditto - WLAN Ch.1 Ave.
Plot 10-7: Trace of Table 10.2.5 - WLAN Ch.11 Peak
Plot 10-8: ditto - WLAN Ch.11 Ave.



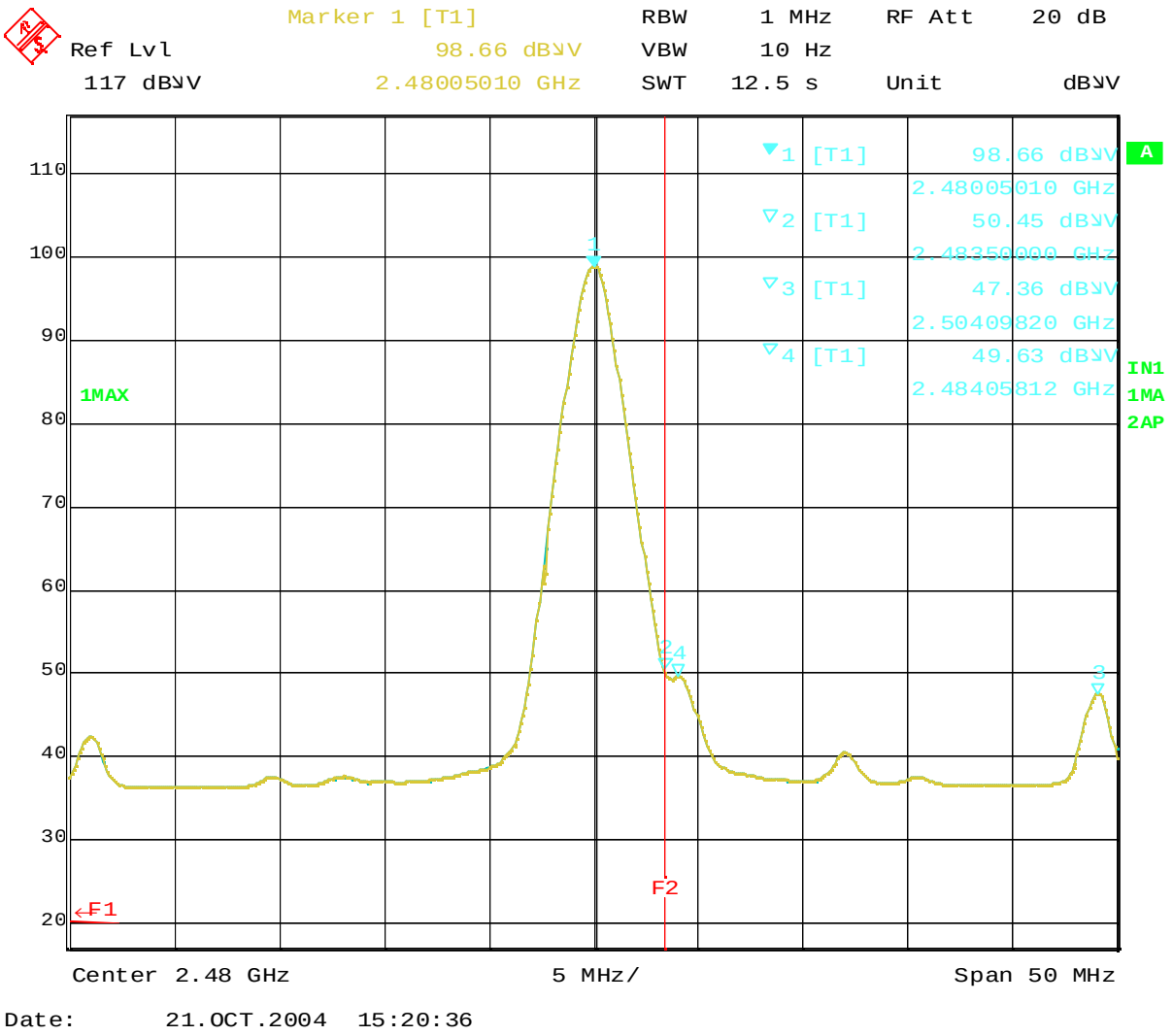
Plot 10-1 Ch.1 2402MHz TX (Peak)



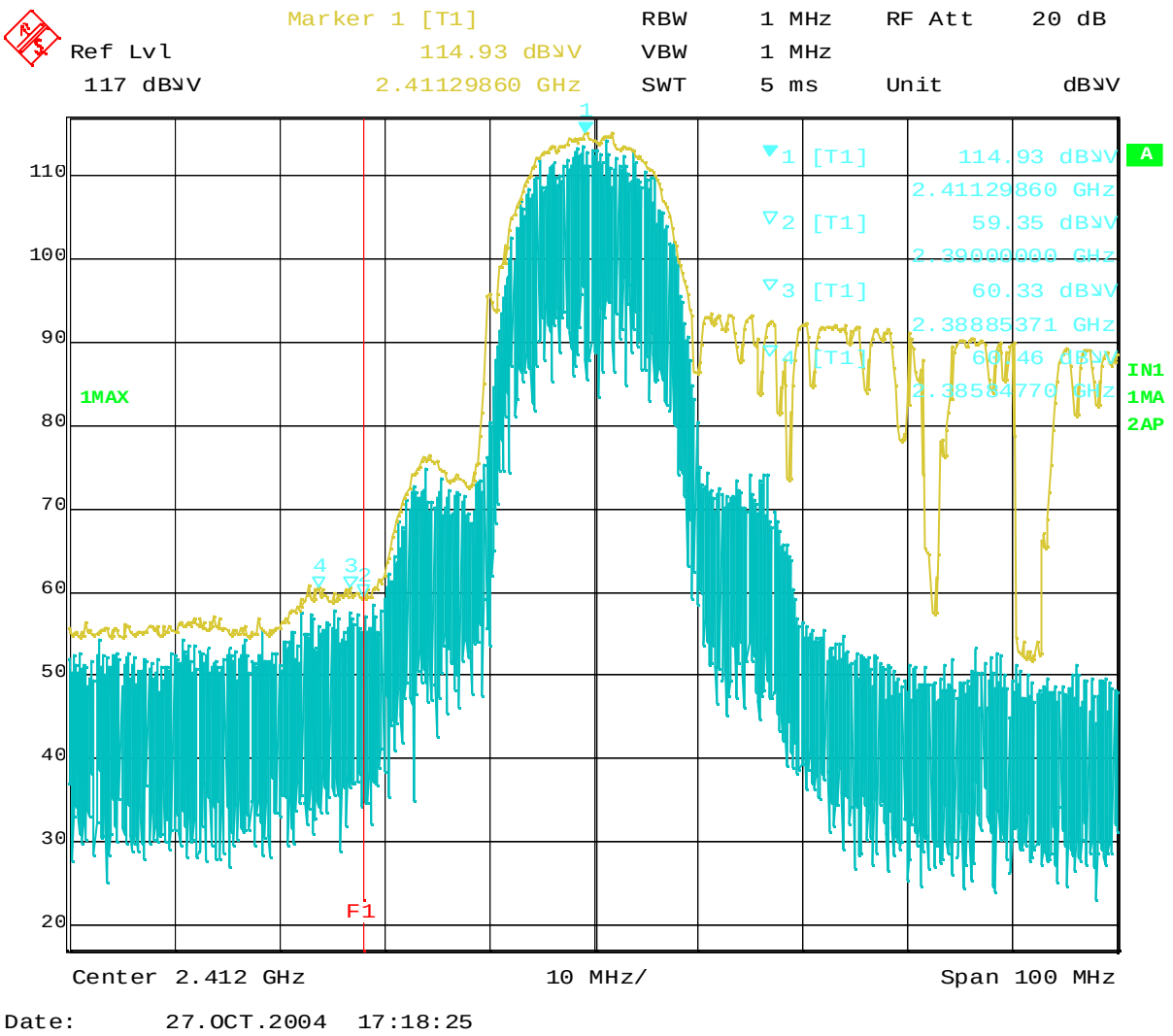
Plot 10-2 Ch.1 2402MHz TX (Average)



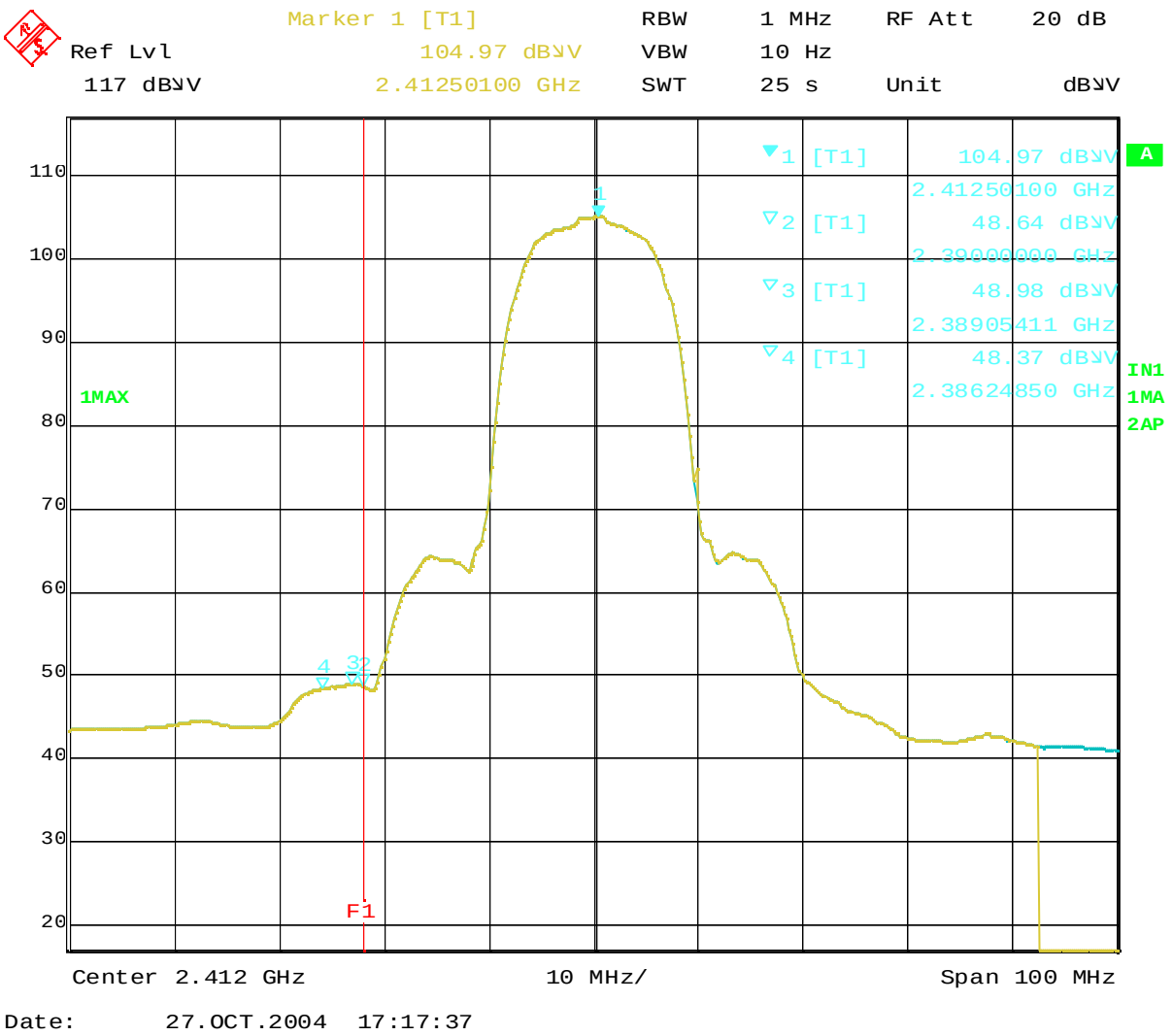
Plot 10-3 Ch.79 2480MHz TX (Peak)



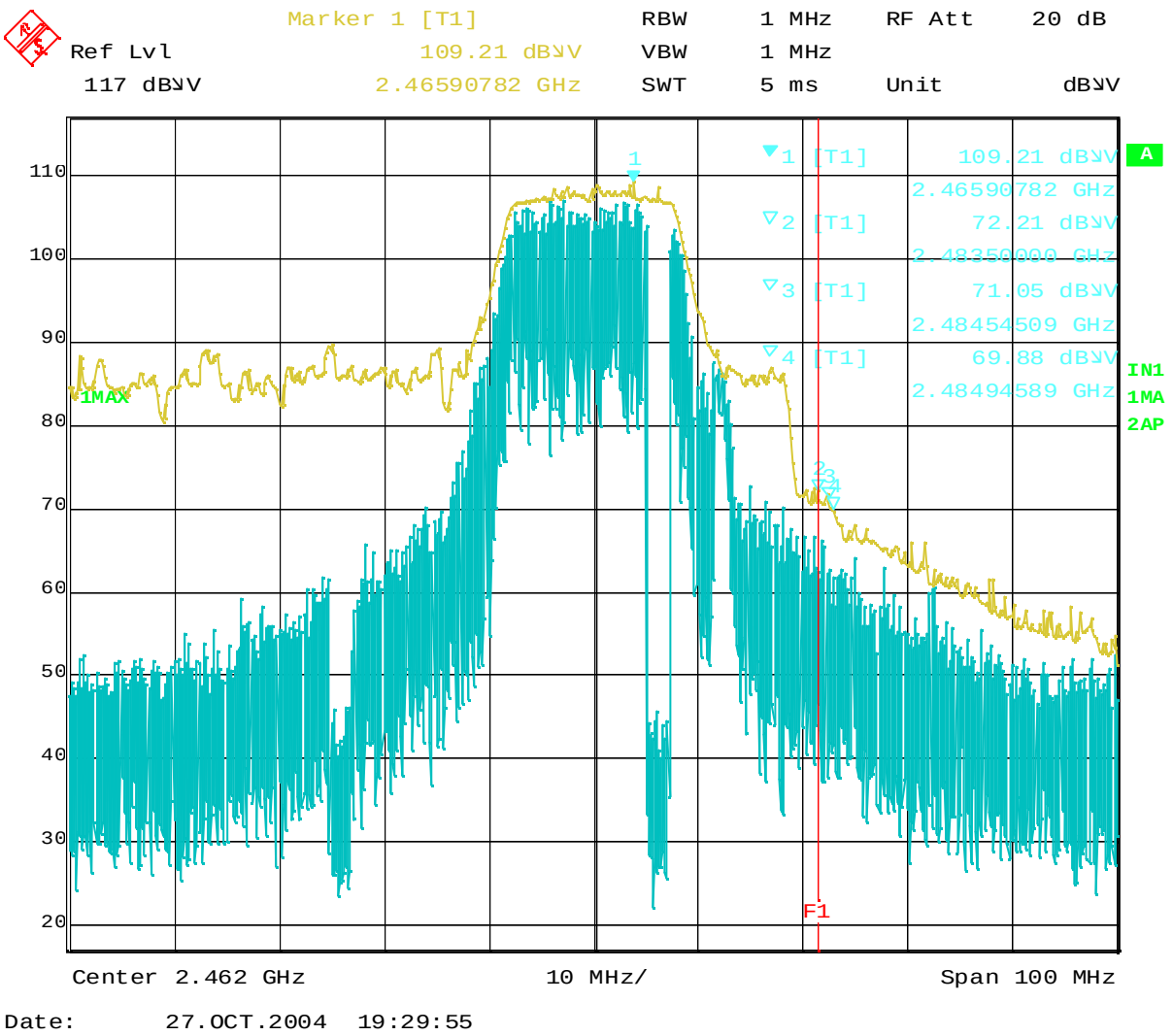
Plot 10-4 Ch.79 2480MHz TX (Average)



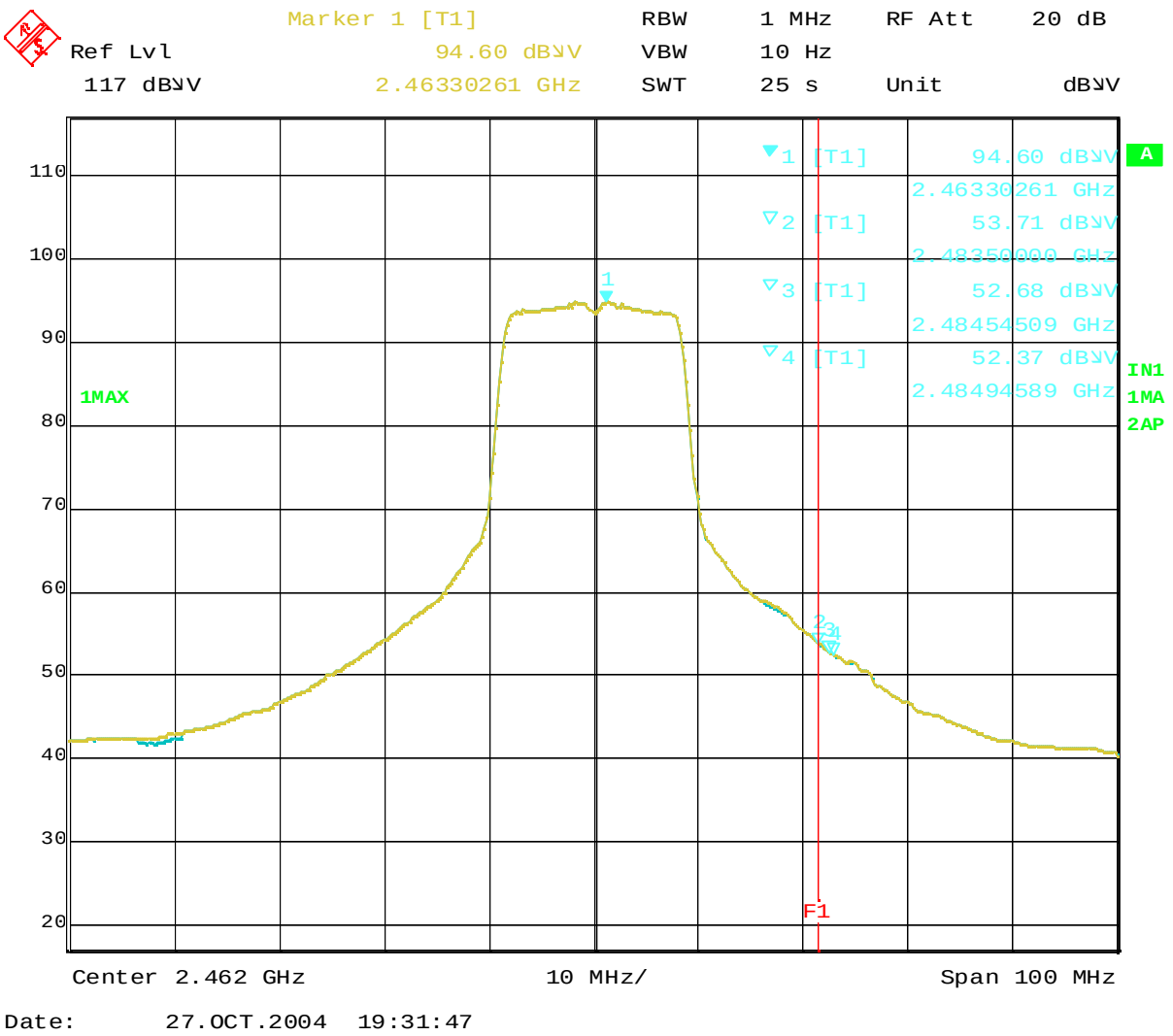
Plot 10-5 WLAN Ch.1 2412MHz TX (Peak)



Plot 10-6 WLAN Ch.1 2412MHz TX (Average)



Plot 10-7 WLAN Ch.11 2462MHz TX (Peak)



Plot 10-8 WLAN Ch.11 2462MHz TX (Average)