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Radio Satellite Communication

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RSC14

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Page 1 (69)

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DAR-Registration Number

TTI-P-G 166/98



Independent ETSI
compliance test house



Accredited Bluetooth™ Test Facility (BQTF)

Test Report No.: 2-2955-01-03/02
FCC Part 15.247 / CANADA RSS-210
BIRMA P4
FCC ID: QXB-BIRMABT-V50

CETECOM – ICT Services GmbH
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Table of Contents

1 General Information

1.1 Notes

1.2 Testing Laboratory

1.3 Details of Applicant

1.4 Application Details

1.5 Test Item

1.6 Test Specifications

2 Technical Test

2.1 Summary of Test Results

2.2 Test Report

1 General Information

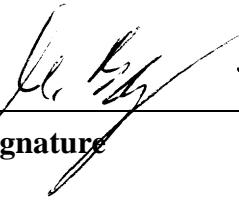
1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

Test Laboratory Manager:

2003-03-06	RSC8411	Berg M.
Date	Section	Name

Signature



Technical Responsibility for Area of Testing:

2003-03-06	RSC8412	Hausknecht D.
Date	Section	Name

Signature



1.2 Testing Laboratory

CETECOM ICT Services GmbH

Untertürkheimer Straße 6 - 10

66117 Saarbrücken

Germany

Telephone : + 49 681 598 - 0

Telefax : + 49 681 598 - 9075

E-mail : info@ict.cetecom.de

Internet : www.cetecom-ict.de

Accredited testing laboratory

The Test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025.

DAR-registration number : TTI-P-G 166/98-30

Accredited Bluetooth™ Test Facility (BQTF)

BLUETOOTH is a trademark owned by Bluetooth SIG, Inc. and licensed to CETECOM

1.3 Details of Applicant

Name : Flander Oy

Street : Satakunnankatu 18B

City : F-33210 Tampere

Country : Finland

Telephone : +35-83233 9000

Telefax : +35-83233 9090

Contact : Mr. Mika Heikinheimo

Telephone : +35-83233 9000

1.3 Application Details

Date of receipt of application : 2002-08-13

Date of receipt of test item : 2003-01-27

Date of test : 2003-01-29/30/31

1.4 Test Item

Type of equipment : **JPEG Image receiver from PDA's**
Type designation : **BIRMA P4**
Manufacturer : **See applicant**
Street :
City :
Country :
Serial number :
FCC ID : **QXB-BIRMA BT-V50**
Hardware : 4.0
Software : 1.0
Additional information :
Frequency : 2402 – 2480 MHz
Type of modulation : 1M00FXD / 79M8FXD (FHSS)
Number of channels : 79
Antenna : Print antenna
Power supply : Ext. AC/DC Adapter 100-240V AC/ 12V DC
Output power : EIRP: 1.08 mW (worst case); conducted : 1.38 mW
Temperature range : 0°C - +35°C

1.5 Test Specifications:

FCC Part 15 §15.247

CANADA RSS-210

2 Technical Test

2.1 Summary of Test Results

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform with specifications ANSI C63.2-1987 clause 15 and ANSI C63.4-1992 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.4-1992 clause 4.2.

Antennas are conform with ANSI C63.2-1996 item 15.

150 kHz - 30 MHz: Quasi Peak measurement, 9kHz Bandwidth, passive loop antenna.

30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna

200MHz - 1GHz: Quasi Peak measurement, 120KHz Bandwidth, log periodic antenna

1GHz: Average, RBW 1MHz, VBW 10 MHz, waveguide horn

All measurements are done in accordance with the Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems DA 00-705 and Appendix A "BLUETOOTH APPROVALS"

The product fulfills also the requirements for CANADA RSS-210

No deviations from the technical specification(s) were ascertained in the course of the tests performed.

Final verdict : PASS

Remark :

2.2 Test Report

TEST REPORT

Test Report No. : 2-2955-01-03/02

TEST REPORT REFERENCE**LIST OF MEASUREMENTS**

Paragraph	PARAMETER TO BE MEASURED	PAGE
	Transmitter parameters	
	Antenna gain	9
§ 15.247 (a)(1)	Carrier frequency separation	10
§ 15.247 (a)(1)	Number of hopping channels	11
§ 15.247 (a)(1 iii)	Time of occupancy (dwell time)	13
§ 15.247 (d)	Power spectral density (Inquiry/Page mode)	14
§ 15.247 (a)(1)	Spectrum bandwidth of a FHSS System	15
§ 15.247 (b)(2)	Maximum peak output power	19
§ 15.247 (c)	Band edge compliance	24
§ 15.247 (c)	Emission limitations	33
	Receiver parameters	
§ 15.109	Spurious radiations - Radiated	50
§ 15.107	Conducted emissions	56
	Test equipment listing	58
	Photographs of the equipment	60

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****Antenna Gain**

The antenna gain of the complete system is calculated by the difference of conducted power of the module and the radiated power in EIRP.

	low channel	mid channel	high channel
Conducted power	+0.87 dBm	1.13 dBm	+1.41 dBm
Radiated power	+0.35 dBm	0.00 dBm	0.08 dBm
Gain	-0.52 dB	-1.13 dB	-1.33 dB

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

Carrier frequency separation

§15.247(a1)



Date: 31.JAN.2003 10:58:10

Channel separation is ~ 1 MHz

Limit: minimum 25 kHz or the 20 dB Bandwidth of the hopping system

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4

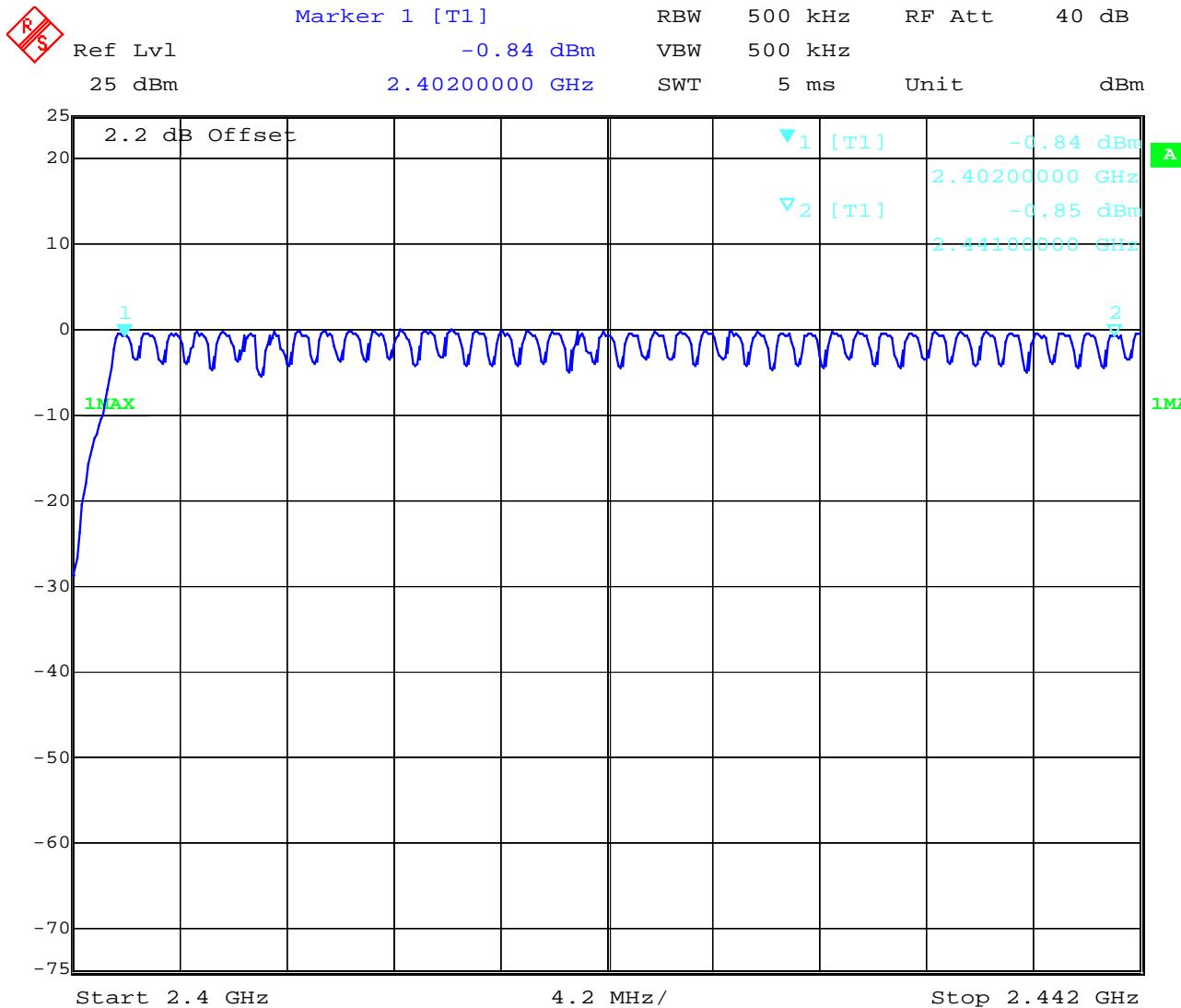
Ambient temperature : 23.3°C

Relative humidity : 28%

Number of hopping channels

§15.247(a1)

Channel 1 - 40



Date: 31.JAN.2003 11:00:20

The number of hopping channels is 79.

Limit: at least 15 non-overlapping channels

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4

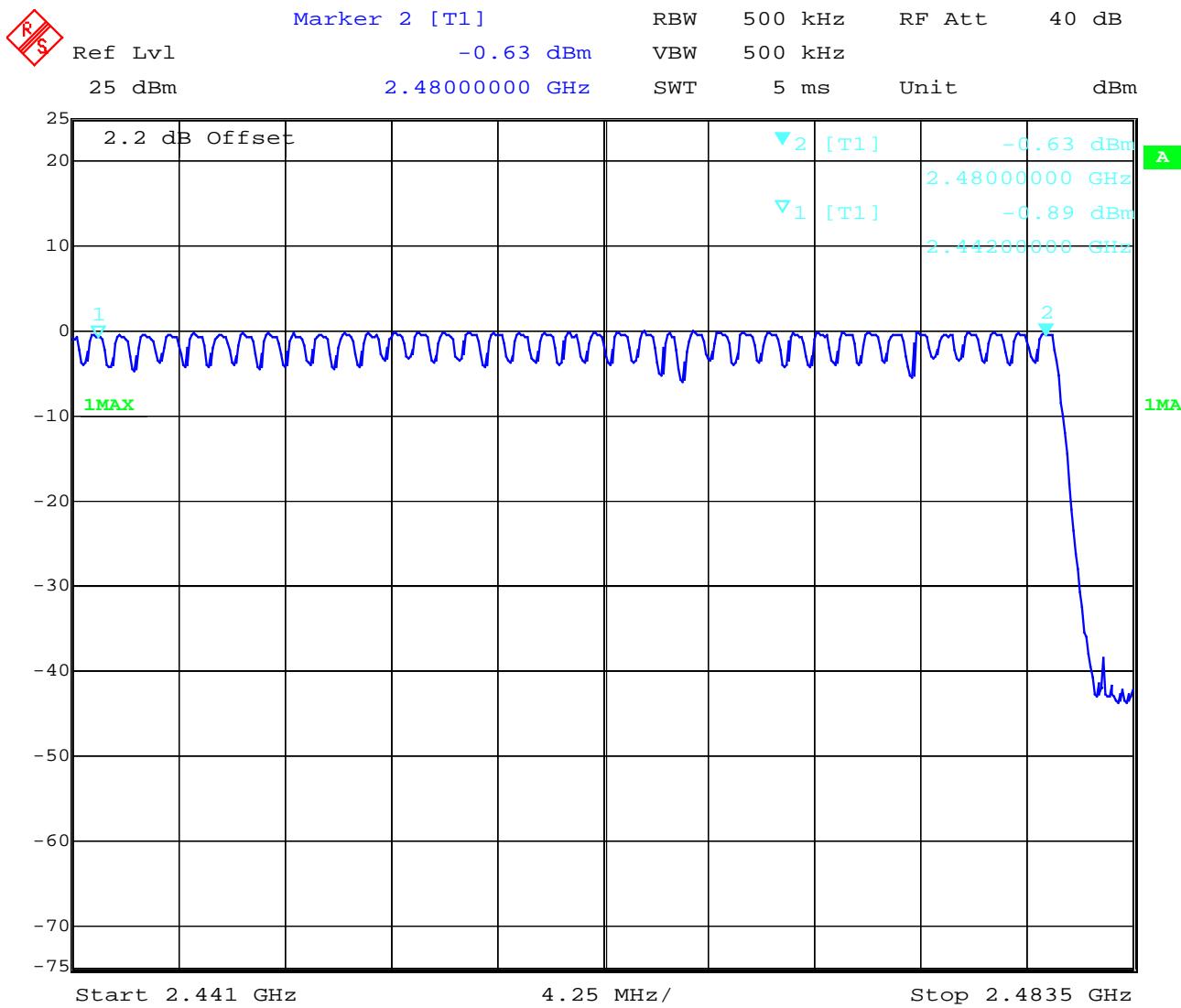
Ambient temperature : 23.3°C

Relative humidity : 28%

Number of hopping channels

Channel 41 - 79

§15.247(a1)



Date: 31.JAN.2003 11:01:53

The number of hopping channels is 79.

Limit: at least 15 non-overlapping channels

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****Time of occupancy (dwell time)****§15.247(a1 iii)****For Bluetooth devices:**

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is as follows:

Dwell time = time slot length * hop rate / number of hopping channels *30s

Example for a DH1 packet (with a maximum length of one time slot)

Dwell time = 625 µs * 1600 1/s / 79 * 30s = 0.3797s (in a 30s period)

For multi-slot packet the hopping is reduced according to the length of the packet.

Example for a DH5 packet (with a maximum length of five time slots)

Dwell time = 5 * 625 µs * 1600 * 1/5 *1/s / 79 * 30s = 0.3797s (in a 30s period)

This is according to the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. Therefore, all Bluetooth devices **comply** with the FCC dwell time requirement in the data mode.

This was checked during the Bluetooth Qualification tests.

The Dwell time in hybrid mode is approximately 2.6 mS (in a 12.8s period)

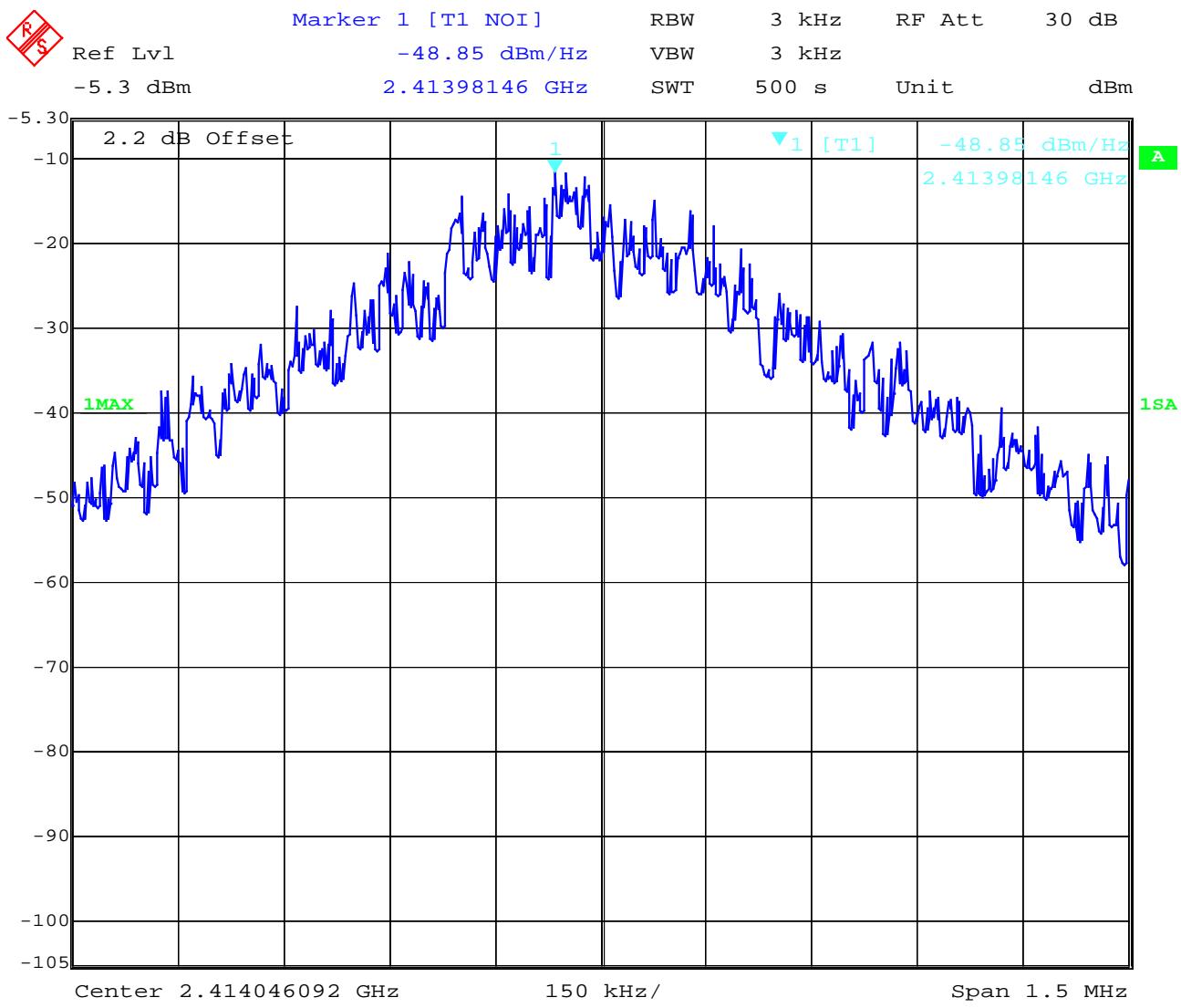
Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

Power Spectral density (Hybrid system in Inquiry mode / Page scan)

§15.247(d)



Date: 31.JAN.2003 12:02:45

Power density : -48.85 dBm/Hz = ---14.85 dBm / 3 KHz

Correction factor from dBm/Hz to dBm/3KHz is +34,8 dB

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****Spectrum Bandwidth of a FHSS System****§15.247(a1)****20 dB bandwidth**

TEST CONDITIONS		20 dB BANDWIDTH (kHz)		
		2402	2441	2480
T_{nom}(24)°C	V_{nom}(110)V	835.671	835.671	835.671
Measurement uncertainty		±1kHz		

RBW / VBW as provided in the „Measurement Guidelines“ (DA 00-705, March 30, 2000)**RBW: 10 kHz / VBW 100 kHz****REFERENCE NUMBER(S) OF TEST EQUIPMENT USED****(for reference numbers see test equipment listing)**

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

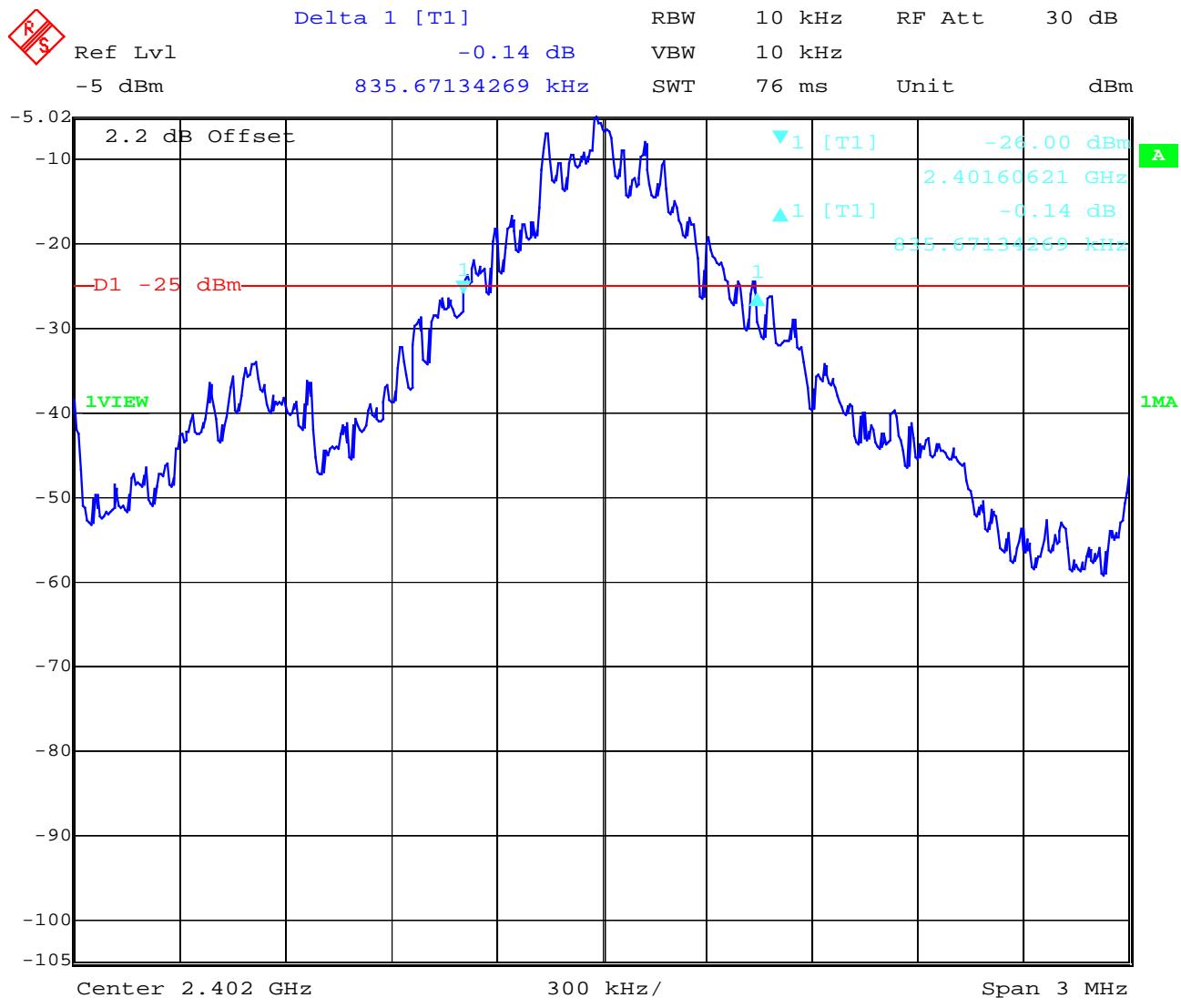
Relative humidity : 28%

Spectrum Bandwidth of a FHSS System

§15.247(a1)

20 dB bandwidth

Channel 1



Date: 31.JAN.2003 11:25:25

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

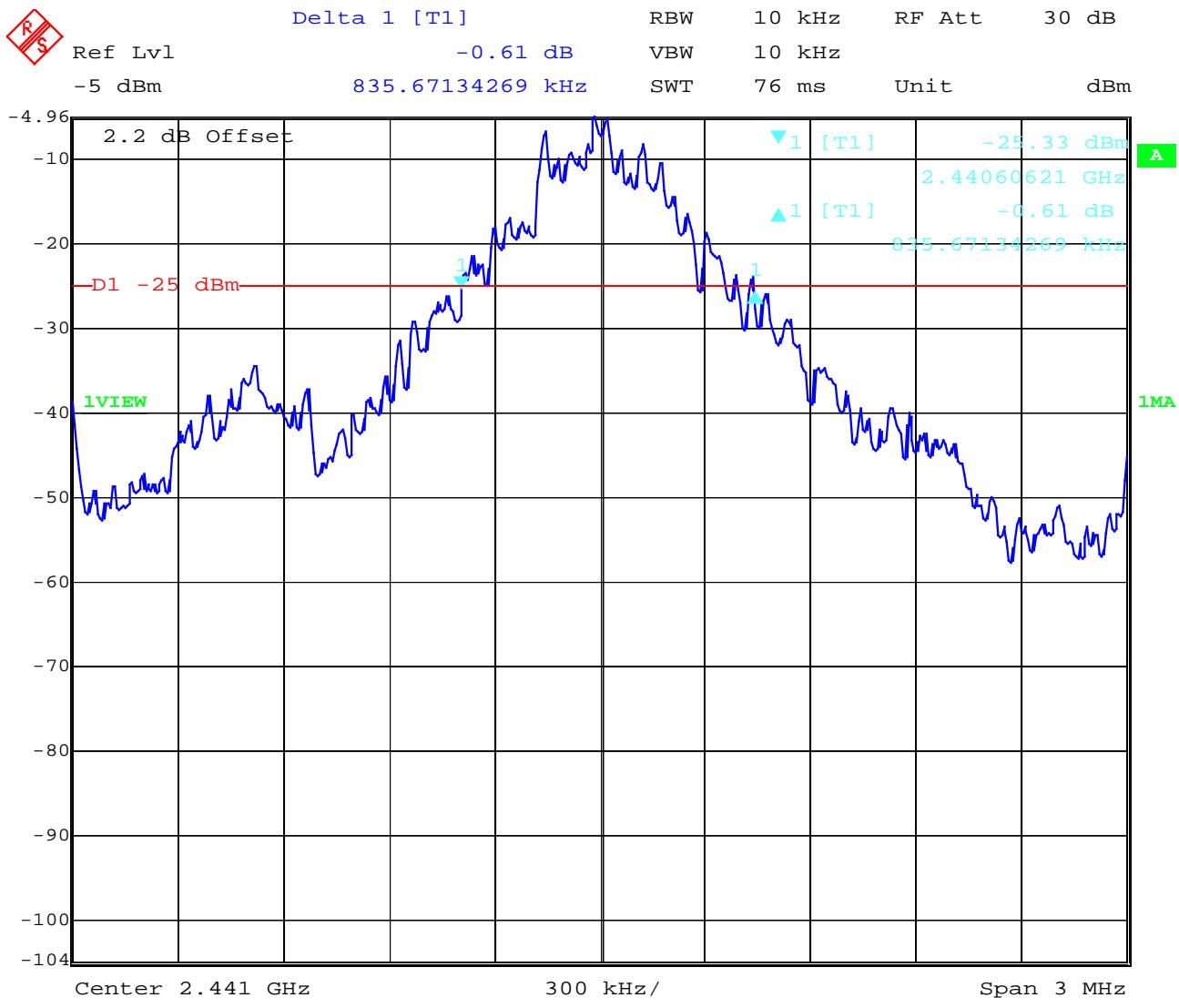
Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

Spectrum Bandwidth of a FHSS System §15.247(a1)
20 dB bandwidth

Channel 2



Date: 31.JAN.2003 11:27:01

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

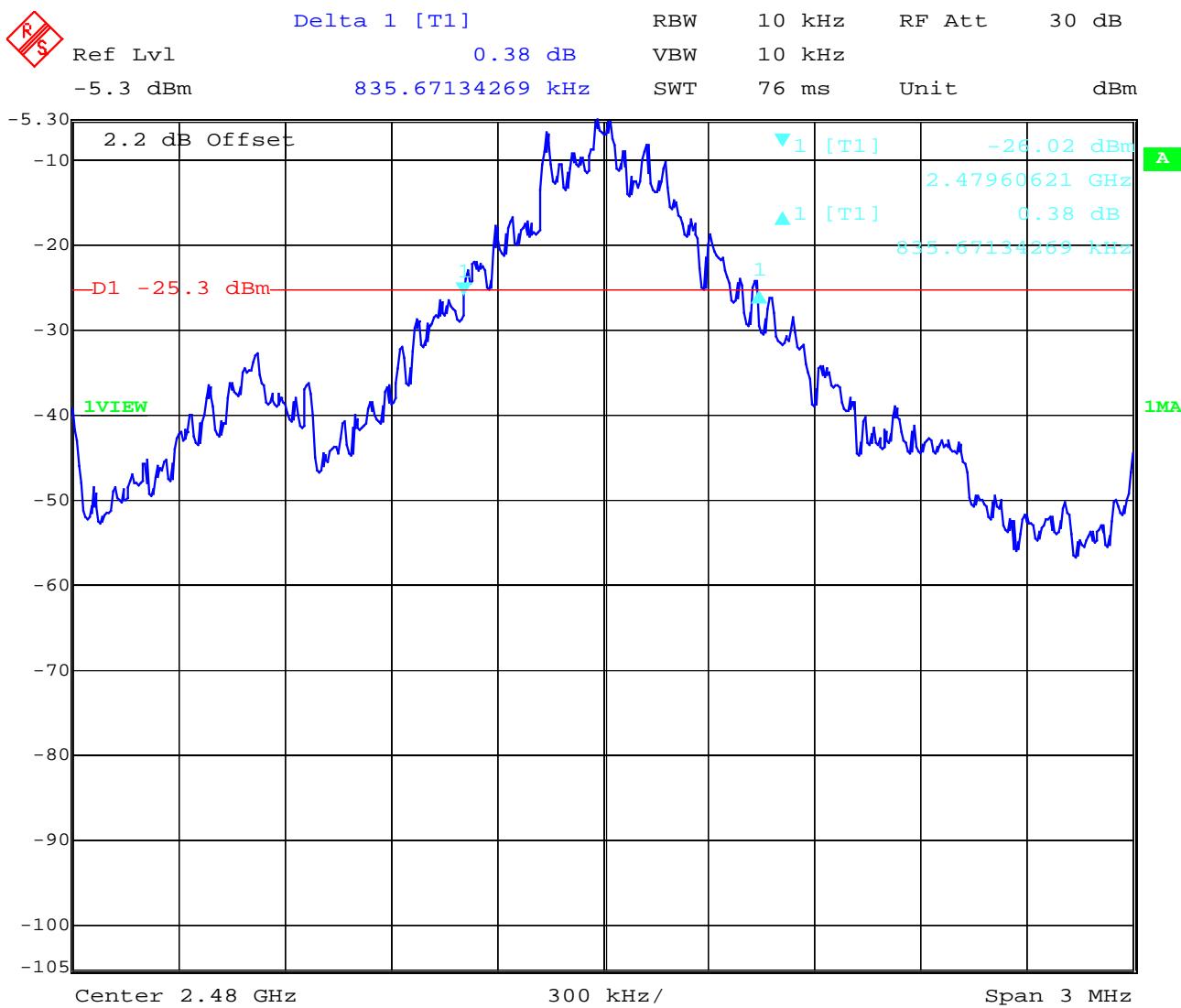
Relative humidity : 28%

Spectrum Bandwidth of a FHSS System

§15.247(a1)

20 dB bandwidth

Channel 3:



Date: 31.JAN.2003 11:28:45

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****MAXIMUM PEAK OUTPUT POWER
(conducted)****SUBCLAUSE § 15.247 (b) (1)**

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (mW)		
		2402	2442	2480
T_{nom} (23.3)°C	V_{nom} (3.7)V	PK 1.22	1.30	1.38
De facto EIRP (Peak)		1.08 mW (-0.52 dBi)	1.00 mW (-1.13 dBi)	1.02mw (-1.33 dBi)
Measurement uncertainty		$\pm 3\text{dB}$		

RBW / VBW : 3 MHz**LIMIT****SUBCLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)**

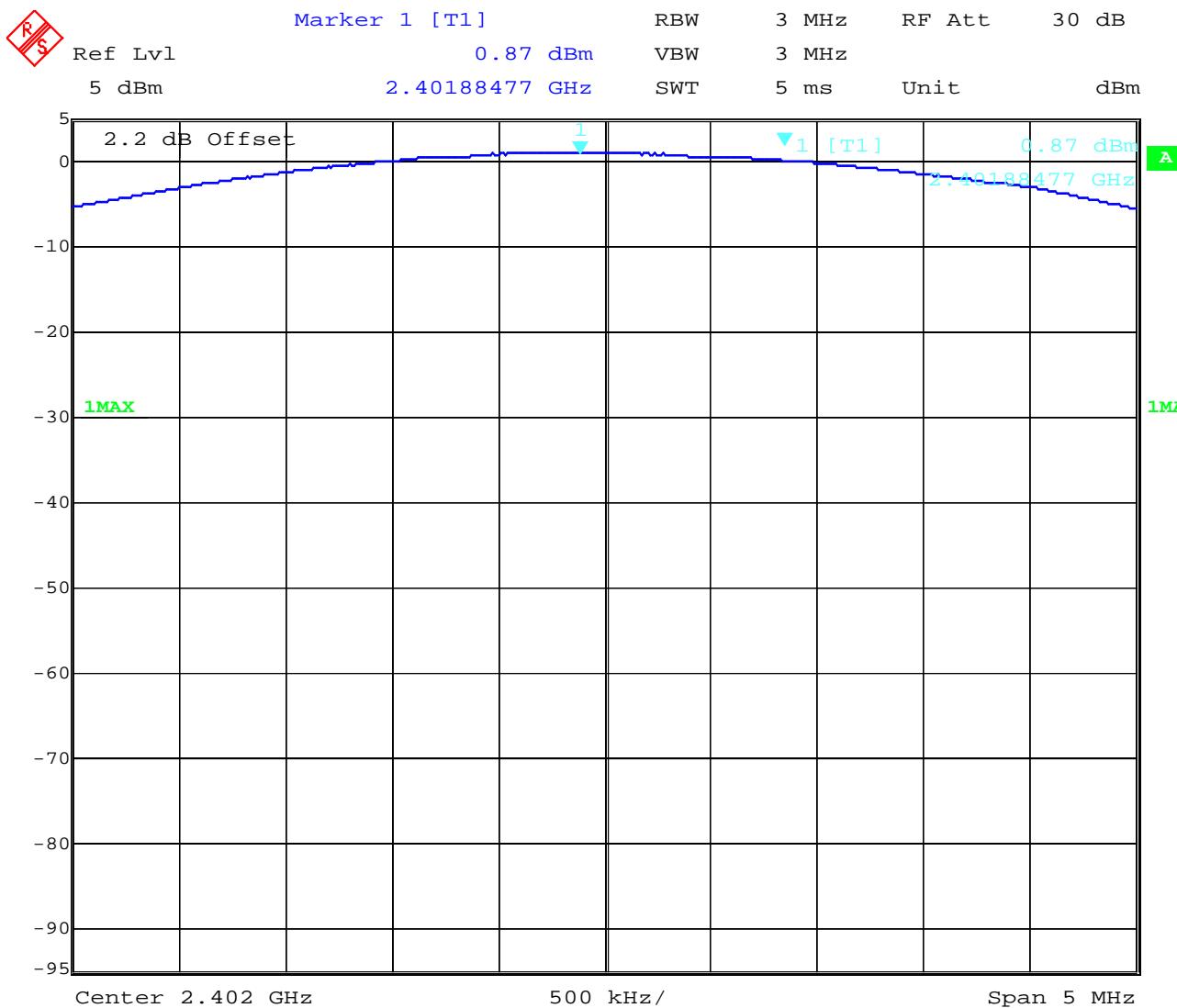
Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

**MAXIMUM PEAK OUTPUT POWER
(conducted)
Channel 1**

SUBCLAUSE § 15.247 (b) (1)



Date: 31.JAN.2003 11:13:09

SUBCLAUSE § 15.247 (b) (1)

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4

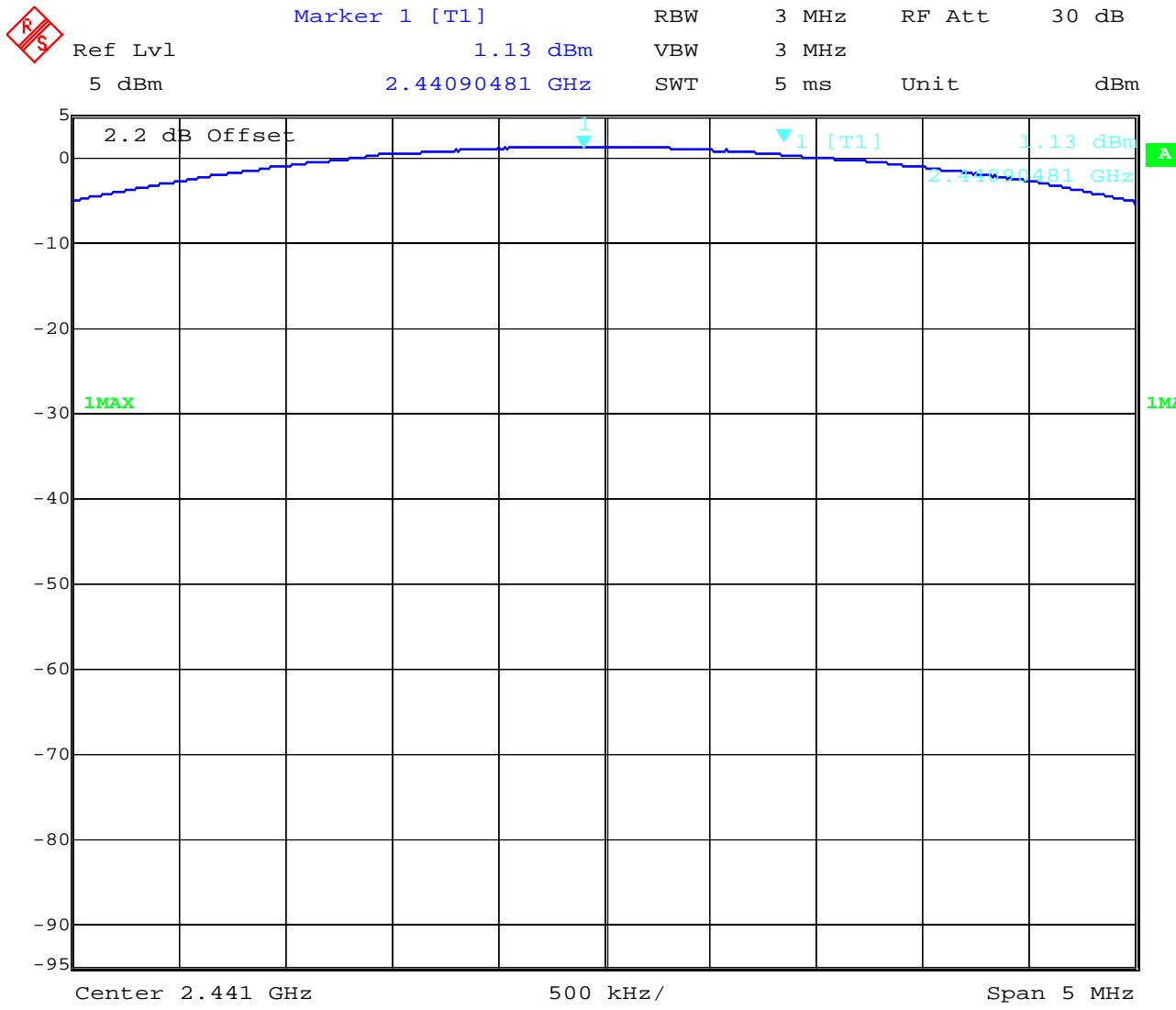
Ambient temperature : 23.3°C

Relative humidity : 28%

MAXIMUM PEAK OUTPUT POWER

(conducted)

Channel 2



Date: 31.JAN.2003 11:13:55

LIMIT

SUBCLAUSE § 15.247 (b) (1)

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4

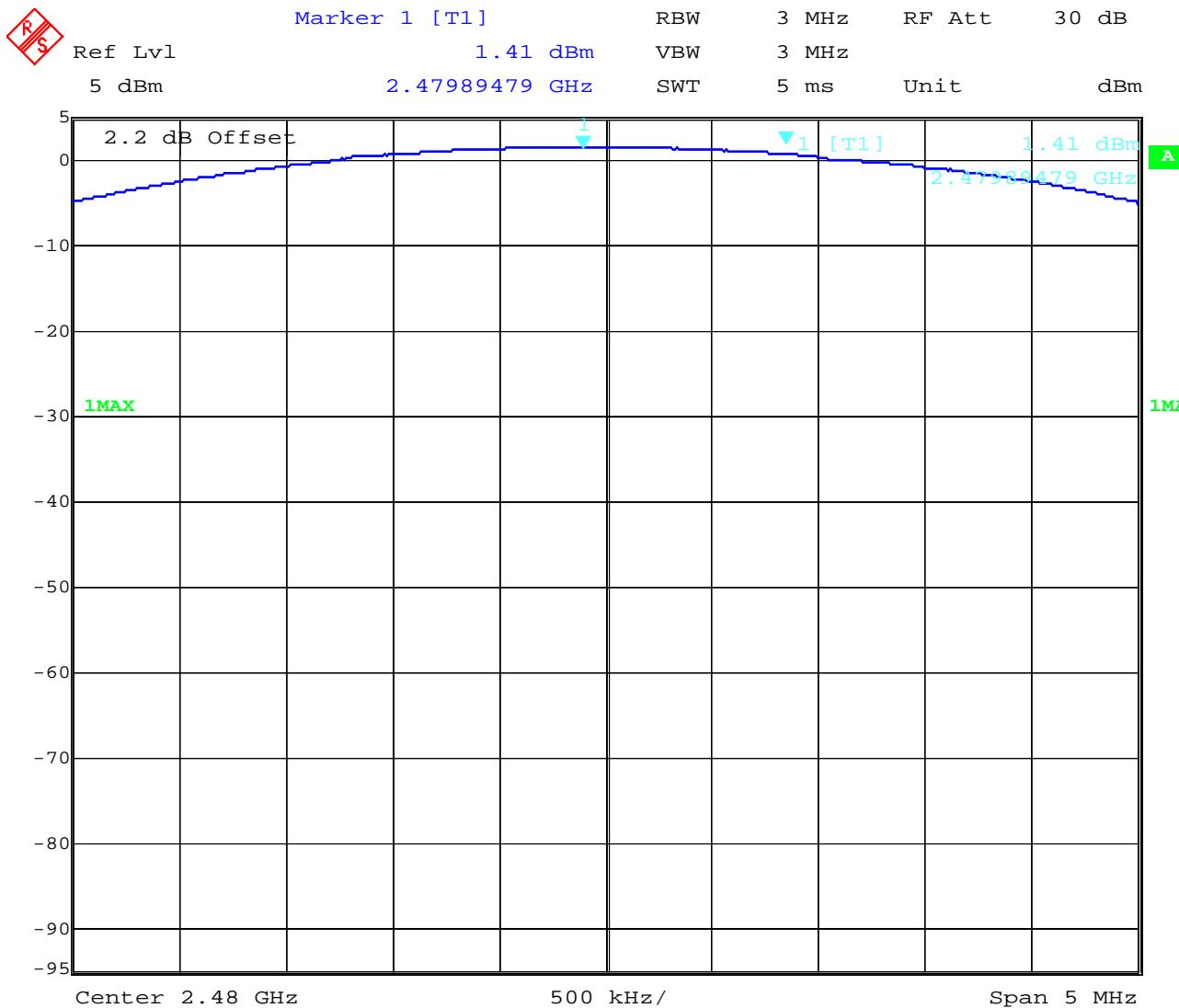
Ambient temperature : 23.3°C

Relative humidity : 28%

MAXIMUM PEAK OUTPUT POWER

(conducted)

Channel 3



Date: 31.JAN.2003 11:14:32

LIMIT

SUBCLAUSE § 15.247 (b) (1)

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****MAXIMUM PEAK OUTPUT POWER
(RADIATED)****SUBCLAUSE § 15.247 (b) (1)**

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER EIRP (mW)		
		2402	2441	2480
T_{nom} (23.3)°C	V_{nom} (110)V	1.08 mW	1.00 mW	1.02mw
Maximum deviation from output power under extreme test conditions (dBc)		not applicable	not applicable	not applicable
Measurement uncertainty		±3dB		

RBW/VBW : 3 MHz**Measured at a distance of 3m****LIMIT****SUBCLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

Equipment under test : BIRMA P4

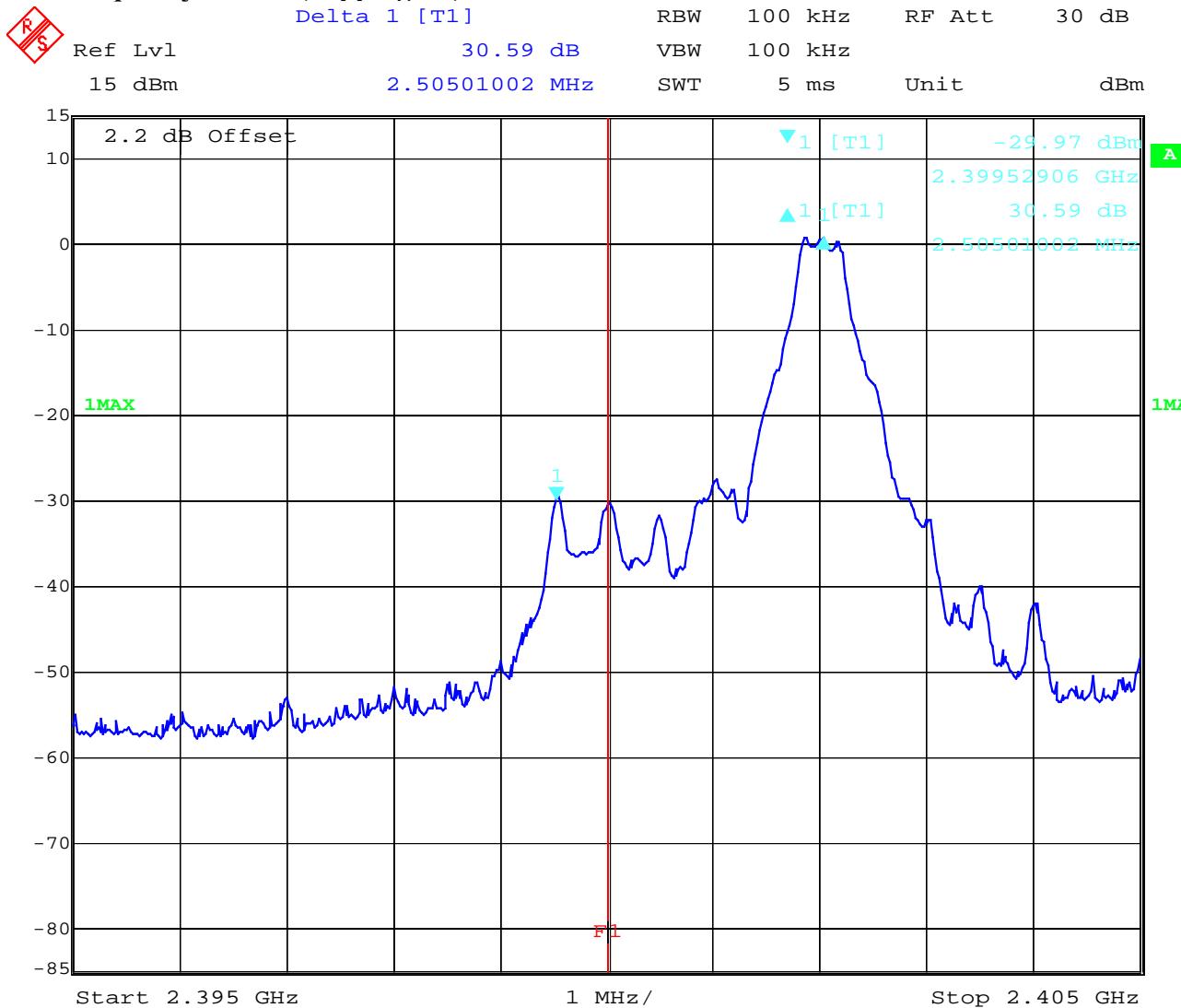
Ambient temperature : 23.3°C

Relative humidity : 28%

Band-edge compliance of conducted emissions

§15.247 (c)

Low frequency section (hopping off)



Date: 31.JAN.2003 11:09:02

Limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17 - 24

Equipment under test : BIRMA P4

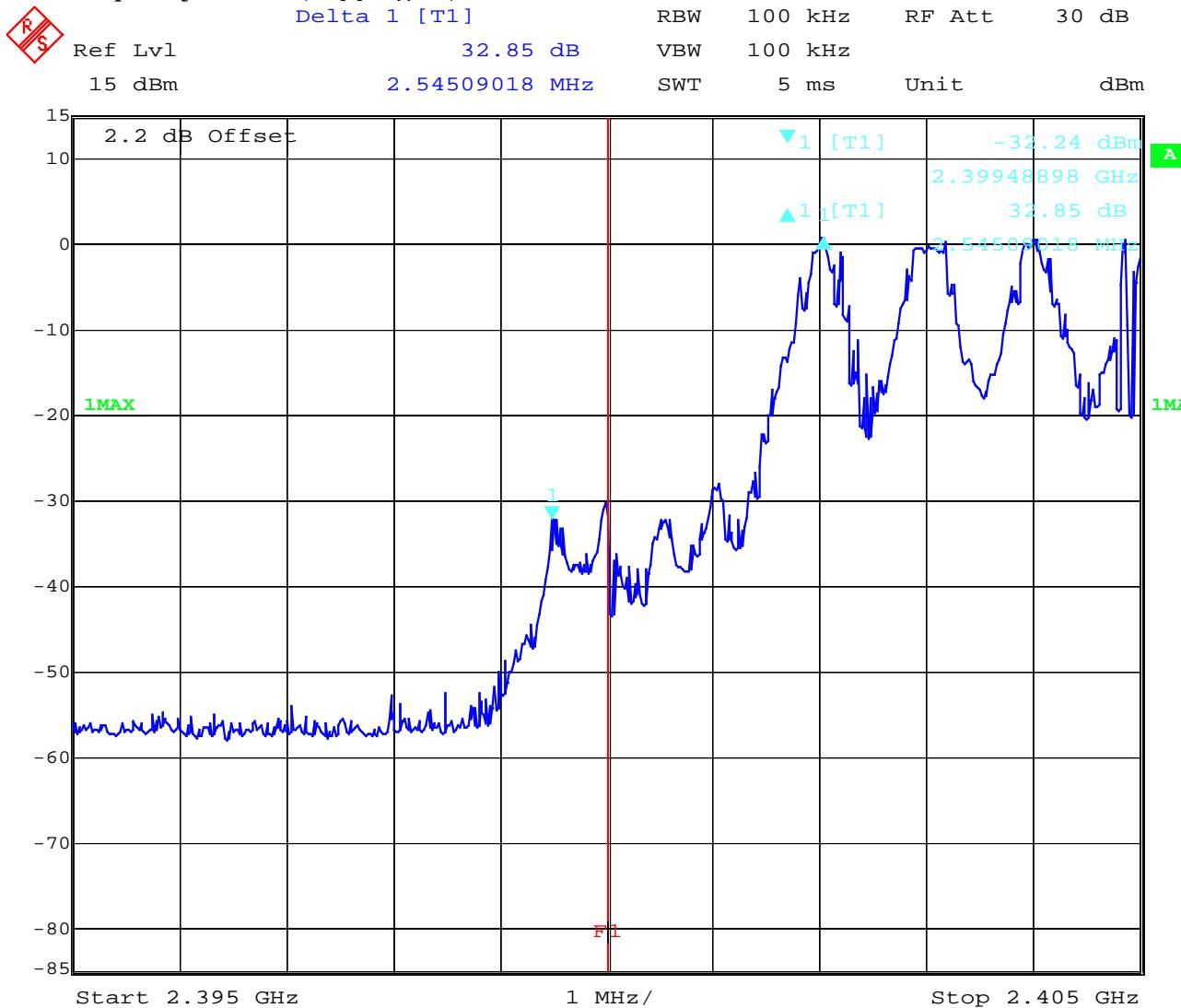
Ambient temperature : 23.3°C

Relative humidity : 28%

Band-edge compliance of conducted emissions

§15.247 (c)

Low frequency section (hopping on)



Date: 31.JAN.2003 11:10:22

Limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4

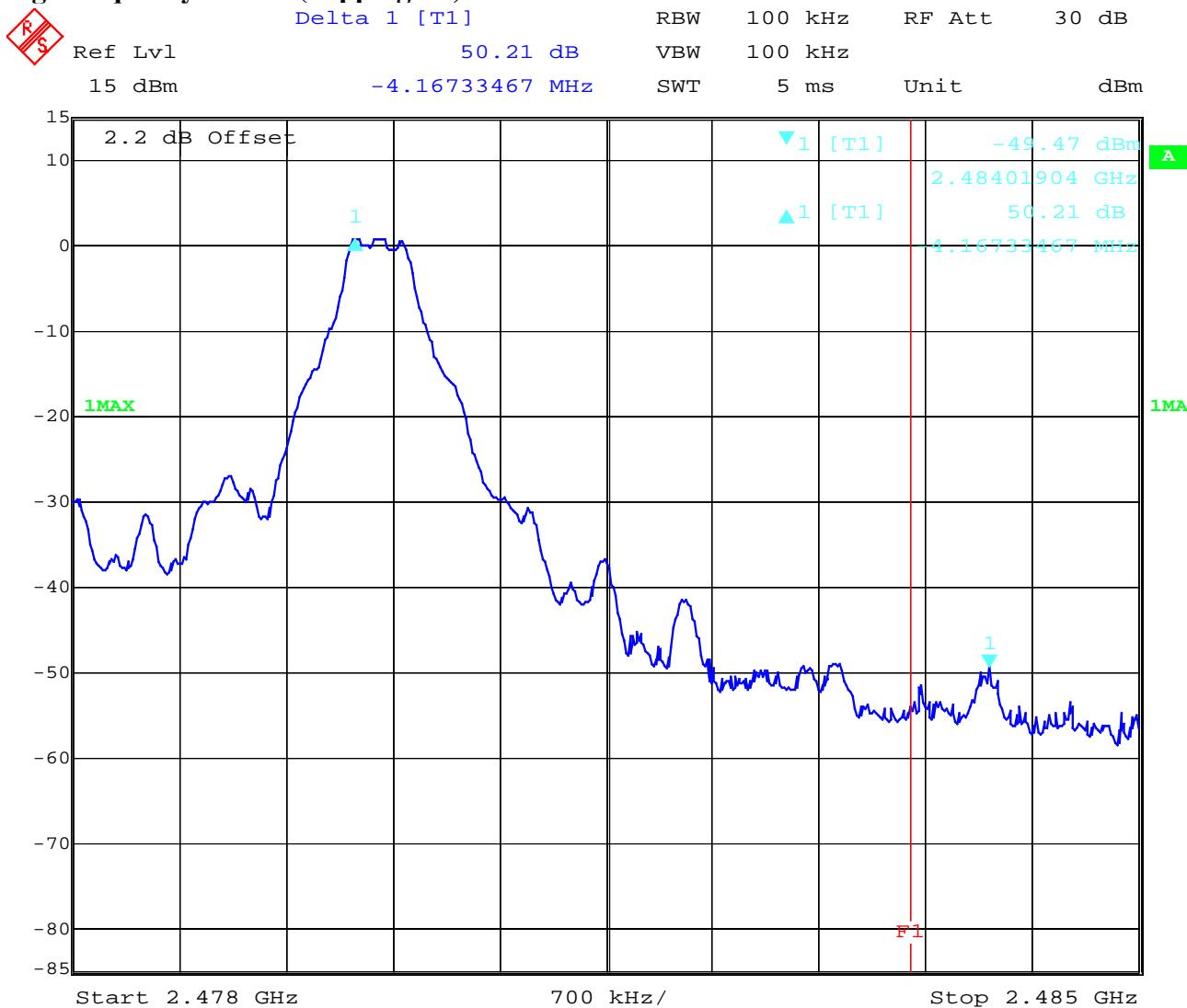
Ambient temperature : 23.3°C

Relative humidity : 28%

Band-edge compliance of conducted emissions

§15.247 (c)

high frequency section (hopping off)



Date: 31.JAN.2003 11:07:50

Limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

**REFERENCE NUMBER(S) OF TEST EQUIPMENT
(for reference numbers see test equipment listing)**

Equipment under test : BIRMA P4

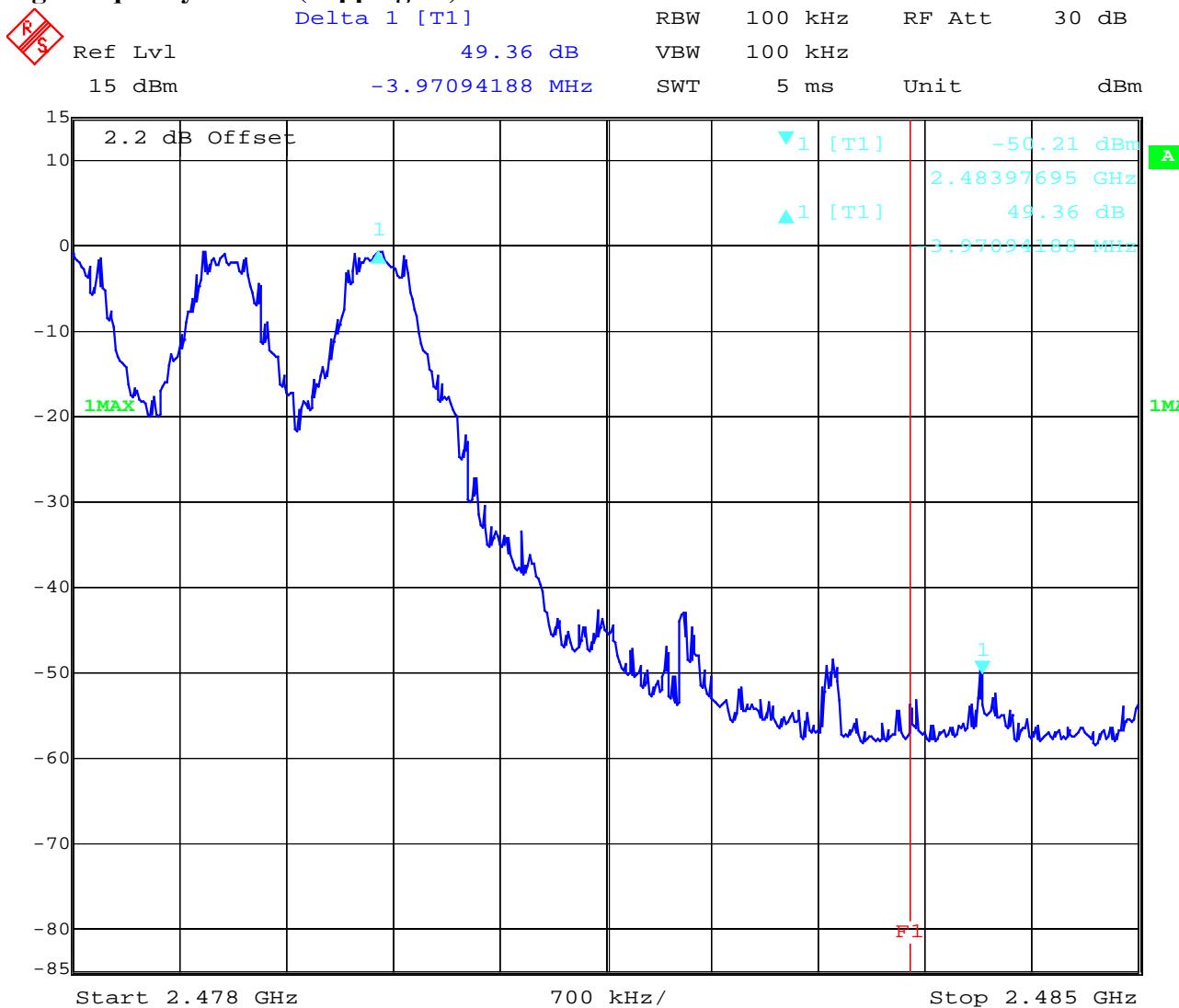
Ambient temperature : 23.3°C

Relative humidity : 28%

Band-edge compliance of conducted emissions

§15.247 (c)

high frequency section (hopping on)



Date: 31.JAN.2003 11:06:44

Limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

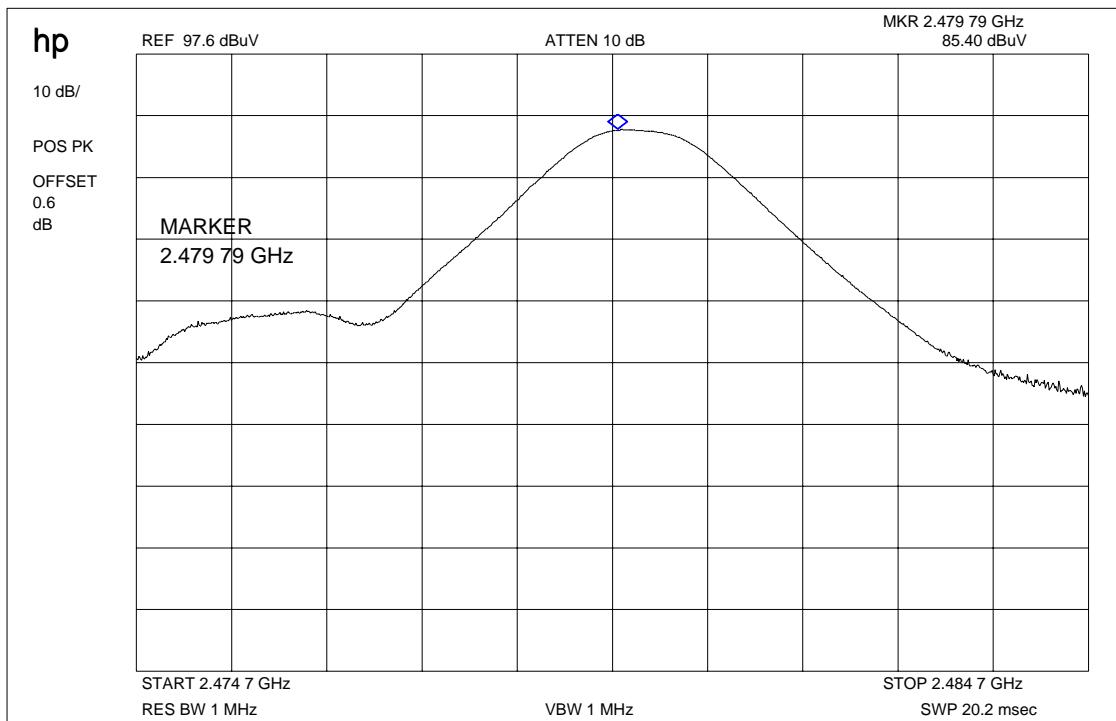
(for reference numbers see test equipment listing)

Equipment under test : BIRMA P4

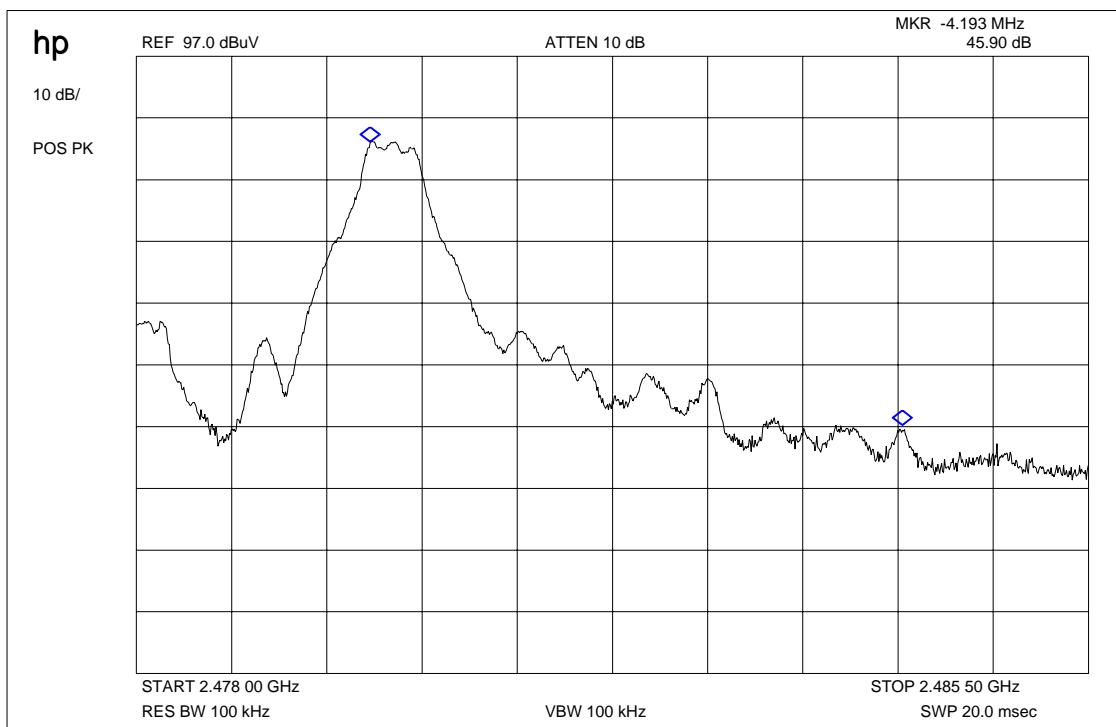
Ambient temperature : 23.3°C

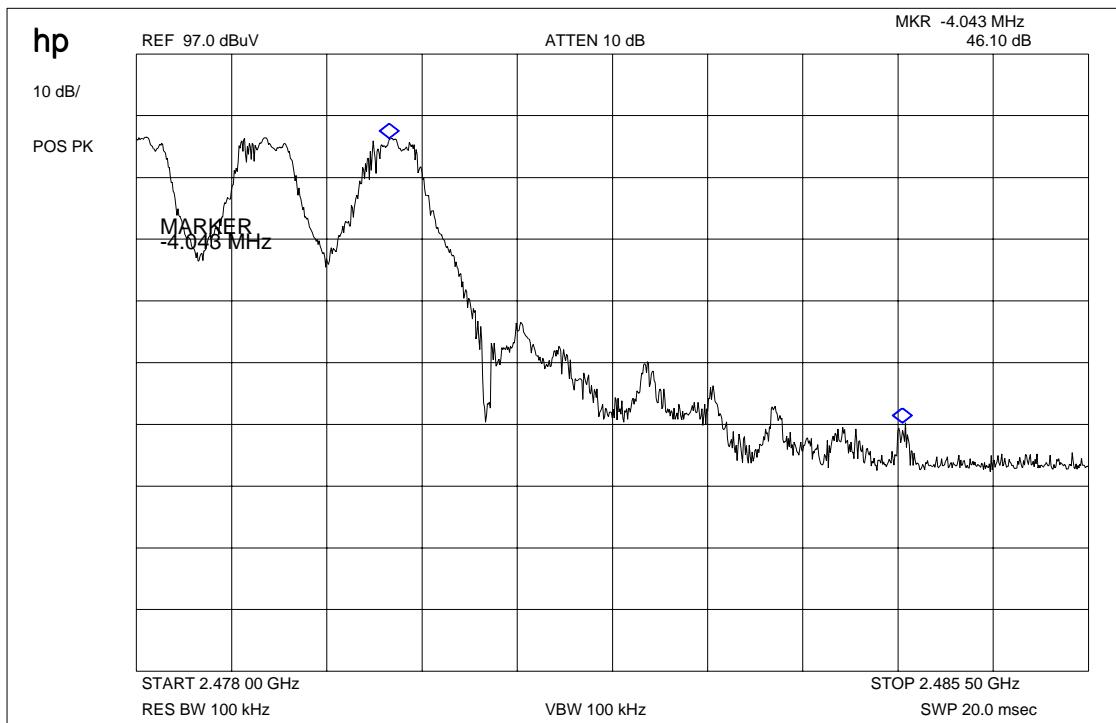
Relative humidity : 28%

**Band-edge compliance radiated
Max field strength in 3m distance
(singel frequency)**



Frequency	Meter reading	Cable loss	Antenna factor	Results
2480 MHz	84.8 dB μ V	7.8 dB	-7.2	85.4 dB μ V/m
		Coreccting factor in grafic implemented		

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****Band-edge compliance radiated
Marker-Delta Method (single carrier)****Marker-Delta-Value : 45.90dB****This measurement was made to show that the behavior of the system is conform to****FCC 15.205 (restricted bands)**

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****Band-edge compliance radiated
Marker-Delta Method (hopping mode)****Marker-Delta-Value : 46.10 dB**

This measurement was made to show that the behavior of the system is conform to
FCC 15.205 (restricted bands)

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****Band-edge compliance of radiated emissions****§15.205****Radiated field strength**

The field strength was measured with an EMI measuring receiver and 1 MHz RBW / VBW for peak and with 1MHz RBW / 10Hz VBW for average at a distance of 3m.

high channel	setup	measured value (3m)	correction factor (3m)	calculated value (3m)
Max. peak value	1 MHz RBW 1 MHz VBW	84.8 dB μ V/m	+0,6 dB	85.4 dB μ V/m
Max. average value	Calculated with duty cycle correction factor	85.4 dB μ V/m peak	-8.41 dB duty cycle correction factor	76.99 dB μ V/m
Delta value	Peak 30 kHz RBW/VBW	45.9 dB (single carrier) 46.10 dB (hopping mode)	-	-
Value at band edge	limit 54 dB μ V/m			31.09 dB μ V/m (single carrier) 30.89 dB μ V/m (hopping mode)
Statement:				Complies

The product complies with the limit of the restricted bands.**Delta marker plots see above pages**

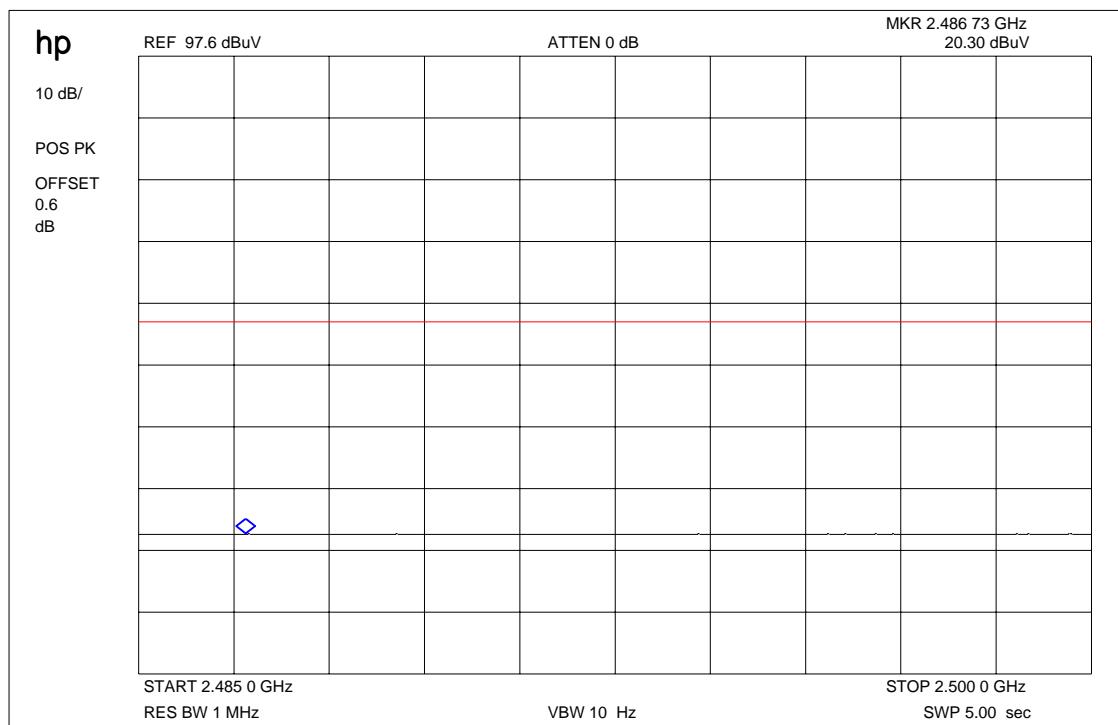
Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

Band-edge compliance radiated (average)

Restricted band)



Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS- Conducted (Transmitter)

§ 15.247 (c) (1)

EMISSION LIMITATIONS					
f (MHz)	amplitude of emission (dBm)	limit max. allowed emmision power	actual attenuation below frequency of operation (dB)	results	
2402	0.87	30 dBm	-	Operating frequency	
1202.4	-54.41		55.28	complies	
		-20 dBc (-19.13 dBm)			
2441	1.13	30 dBm	-	Operating frequency	
14529	-55.13		56.26	complies	
		-20 dBc (-18.87 dBm)		complies	
2480	1.41	30 dBm		Operating frequency	
1202.4	-53.67		55.08	complies	
		-20 dBc (-18.59 dBm)		complies	
Measurement uncertainty		± 3dB			

RBW : 100 kHz VBW: 100 MHz

For emissions that fall into restricted bands you find the radiated emissions later in the report.

LIMITS

SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17 – 24, 64

Equipment under test : BIRMA P4

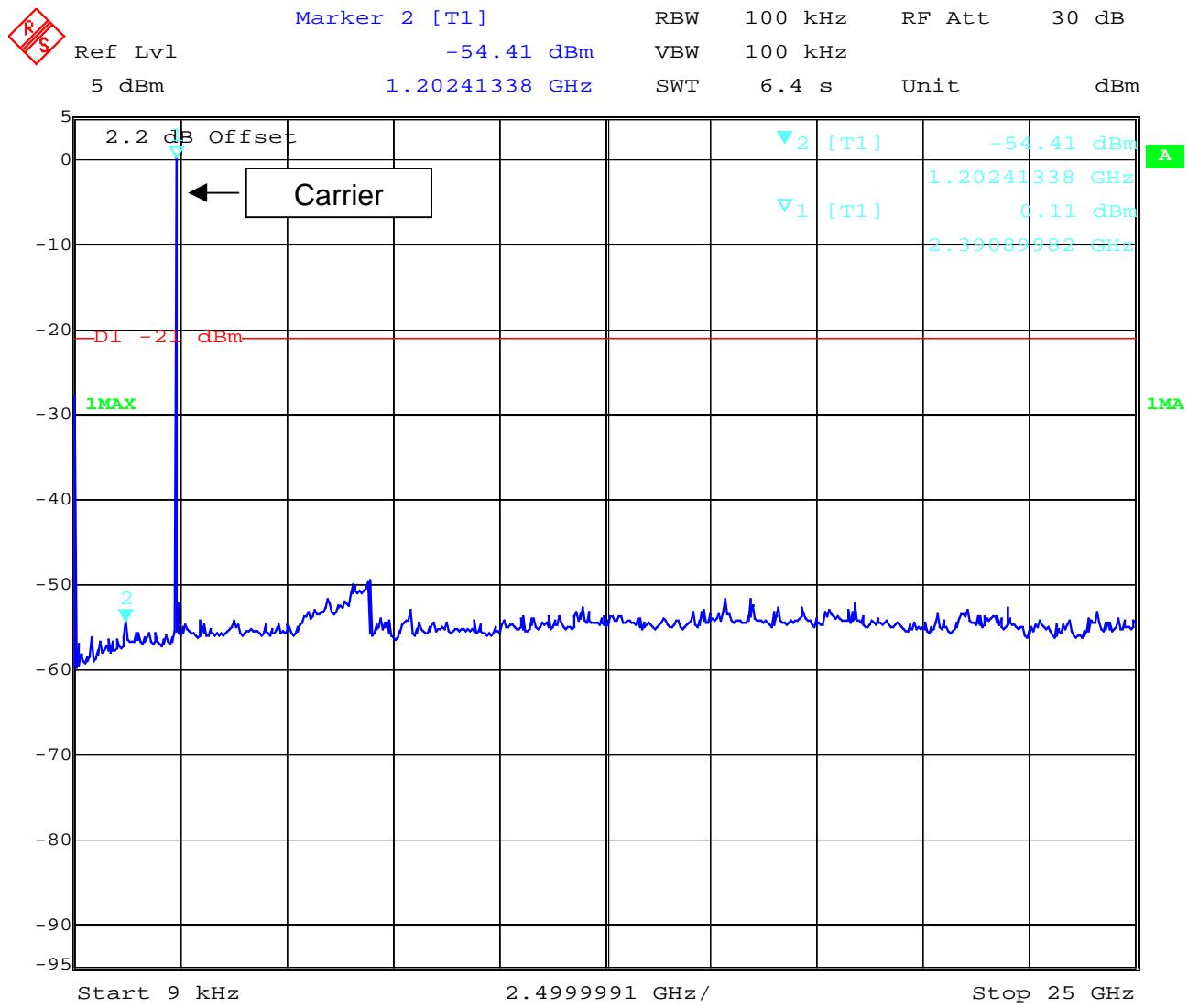
Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS- Conducted (Transmitter)

§ 15.247 (c) (1)

Channel 1: 9 kHz - 25 GHz



Date: 31.JAN.2003 11:20:47

RBW:100 kHz / VBW: 100 kHz

Equipment under test : BIRMA P4

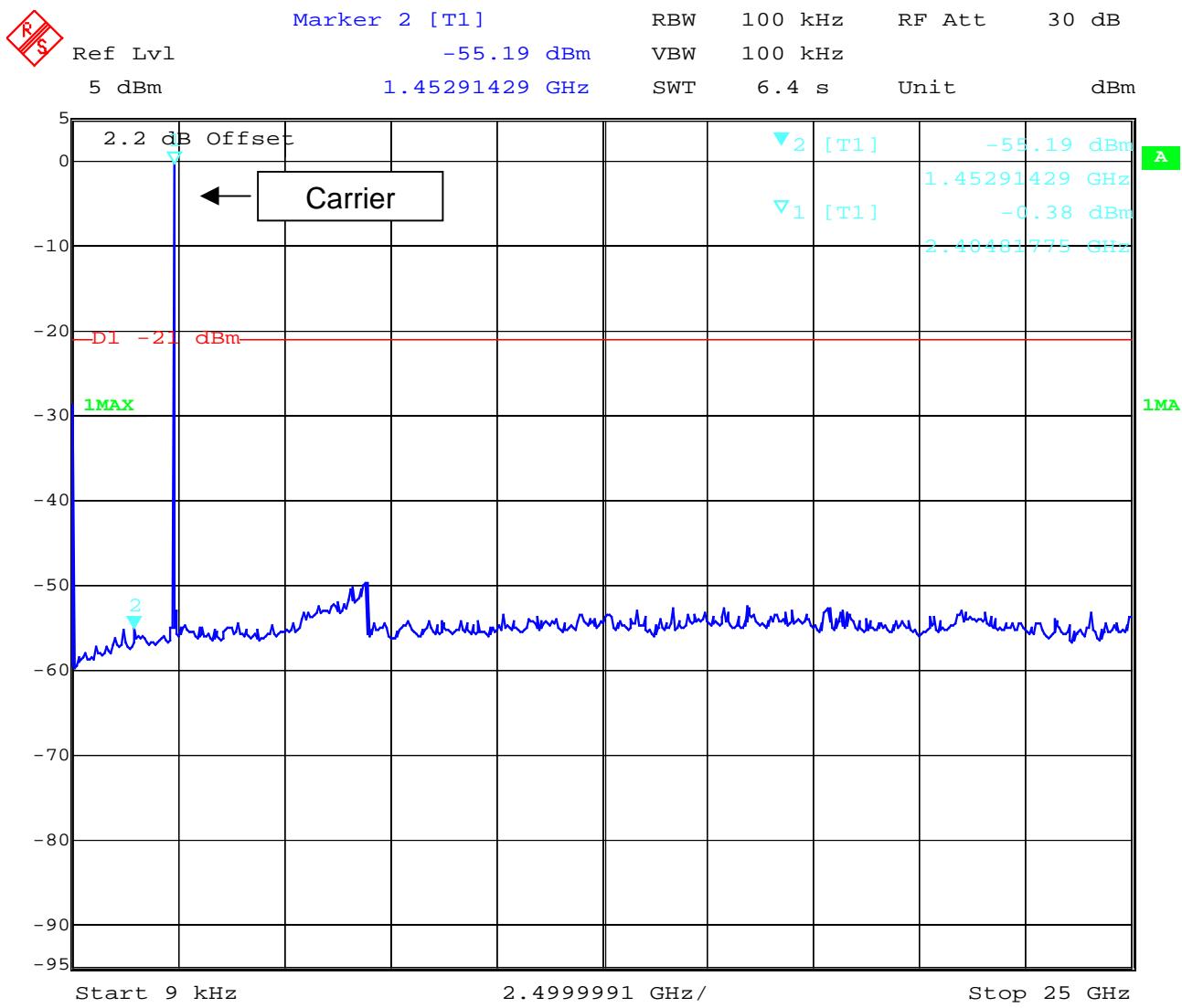
Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS- Conducted (Transmitter)

§ 15.247 (c) (1)

Channel 2: 9 kHz – 25 GHz



Date: 31.JAN.2003 11:22:32

RBW:100 kHz / VBW: 100 kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17 – 24, 64

Equipment under test : BIRMA P4

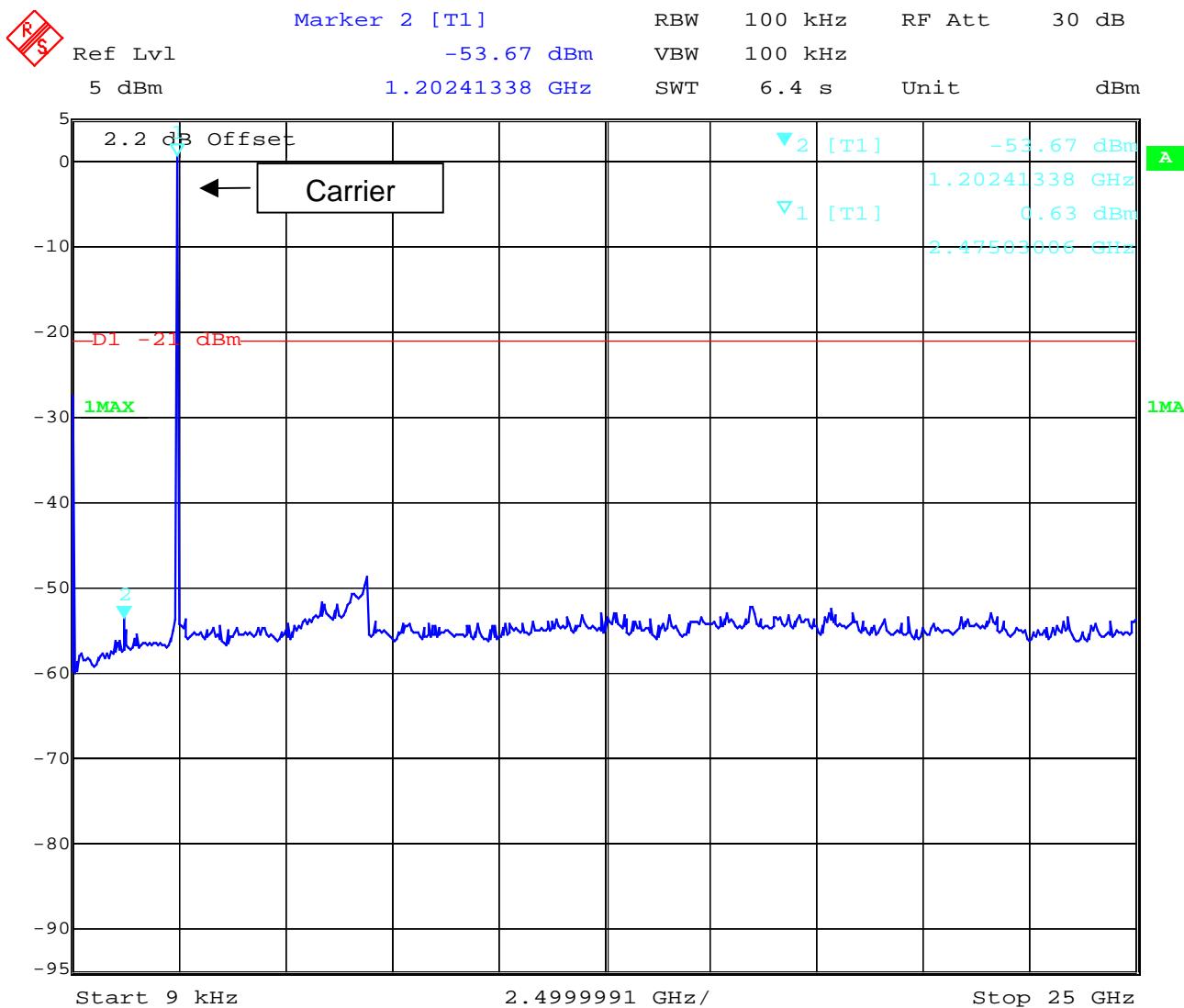
Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS- Conducted (Transmitter)

§ 15.247 (c) (1)

Channel 3: 9kHz – 25 GHz



Date: 31.JAN.2003 11:18:15

RBW:100 kHz / VBW: 100 kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17 – 24, 64

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

SPURIOUS RADIATED EMISSION

§ 15.247 (c) (1)

SPURIOUS EMISSIONS LEVEL (μ V/m)								
2402 MHz			2441 MHz			2480 MHz		
f (MHz)	Detector	Level (μ V/m)	f (MHz)	Detector	Level (μ V/m)	f (MHz)	Detector	Level (μ V/m)
46.58	QP/V	26.2	46.58	QP/V	23.1	46.58	QP/V	27.8
69.88	QP/H	24.3	69.88	QP/H	22.3	69.88	QP/H	26.0
103.32	QP/V	17.2	141.27	QP/V	28.1	103.32	QP/V	18.4
141.27	QP/V	28.7	200.86	QP/V	24.7	141.27	QP/V	30.6
200.86	QP/H	23.4	278.69	QP/V	22.3	200.86	QP/H	22.6
278.69	QP/H	26.2	418.14	QP/H	30.7	278.69	QP/H	27.0
418.14	QP/H	31.4	566.15	QP/H	41.5	418.14	QP/H	29.7
566.15	QP/H	41.9	740.78	QP/H	28.2	566.15	QP/H	41.7
1127.8	AV/V	36.0	1127.8	AV/V	35.3	1122.3	AV/V	36.1
1190.1	AV/V	31.1	1190.1	AV/H	30.3	1190.1	AV/V	30.2
1651.3	AV/V	35.8	1255.9	AV/H	30.1	1651.3	AV/V	34.9
			1391.7	AV/H	30.3			
			1651.3	AV/V	35.5			
Measurement uncertainty			± 3 dB					

f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1 GHz : RBW/VBW: 1 MHz

LIMITS

SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Limits

SUBCLAUSE § 15.209

Frequency (MHz)	Field strength (μ V/m)	Measurement distance (m)
30 - 88	100 (40 dB μ V/m)	3
88 - 216	150 (43.5 dB μ V/m)	3
216 - 960	200 (46 dB μ V/m)	3
above 960	500 (54 dB μ V/m)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

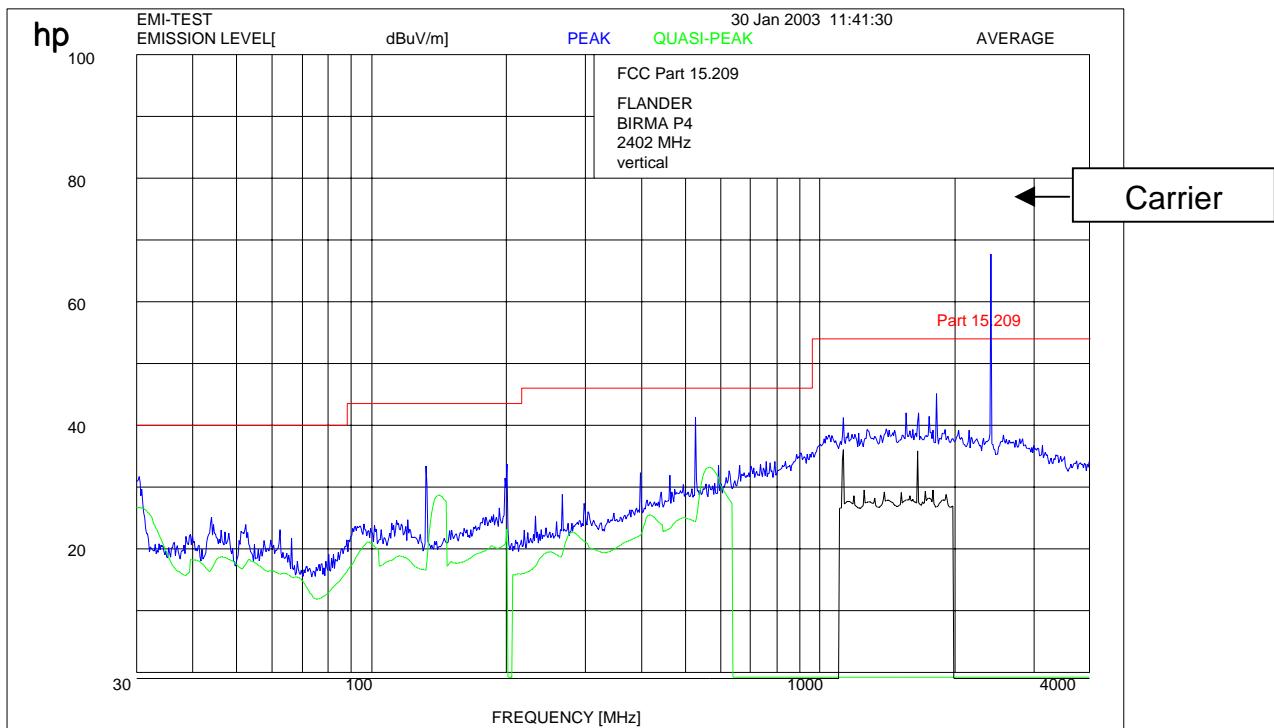
(for reference numbers see test equipment listing)

17-24,64

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS
2402 MHz
SUBCLAUSE § 15.247 (c) (1) $f < 1 \text{ GHz}$: RBW/VBW: 100 kHz $f \geq 1 \text{ GHz}$: RBW/VBW: 1 MHz**LIMITS****SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

Equipment under test : BIRMA P4

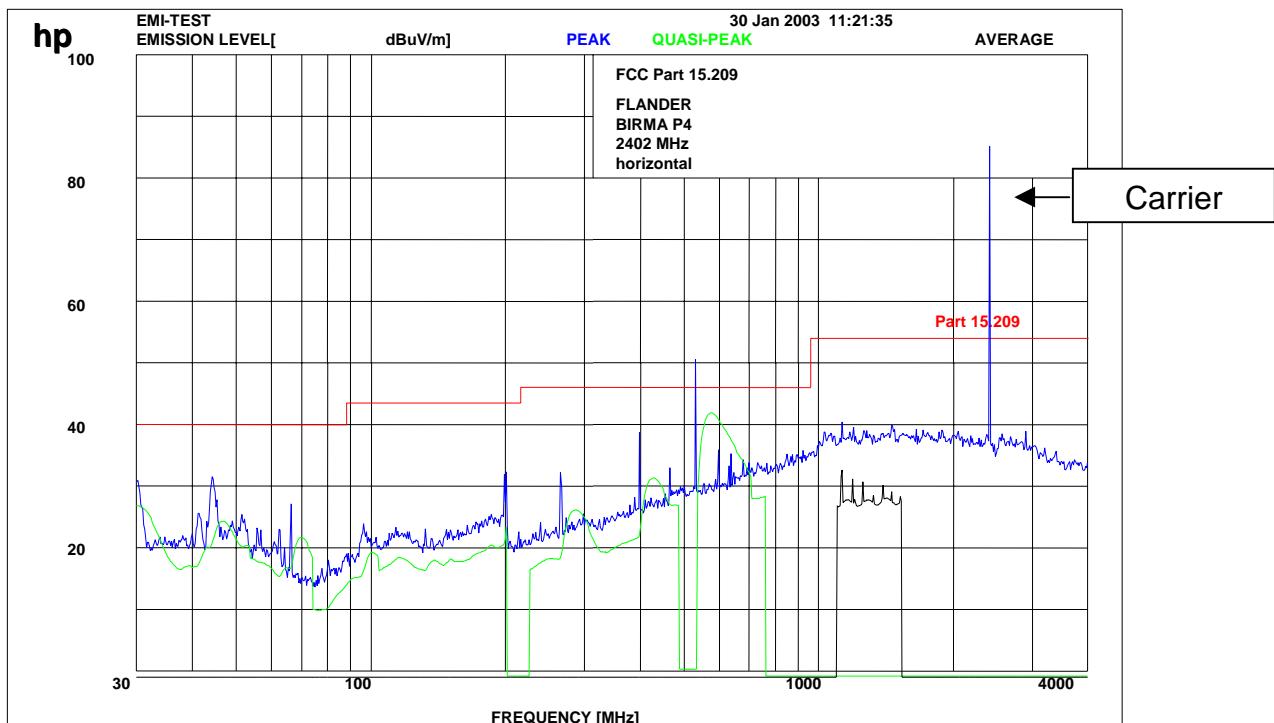
Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS

SUBCLAUSE § 15.247 (c) (1)

2402 MHz

 $f < 1 \text{ GHz}$: RBW/VBW: 100 kHz $f \geq 1 \text{ GHz}$: RBW/VBW: 1 MHz

LIMITS

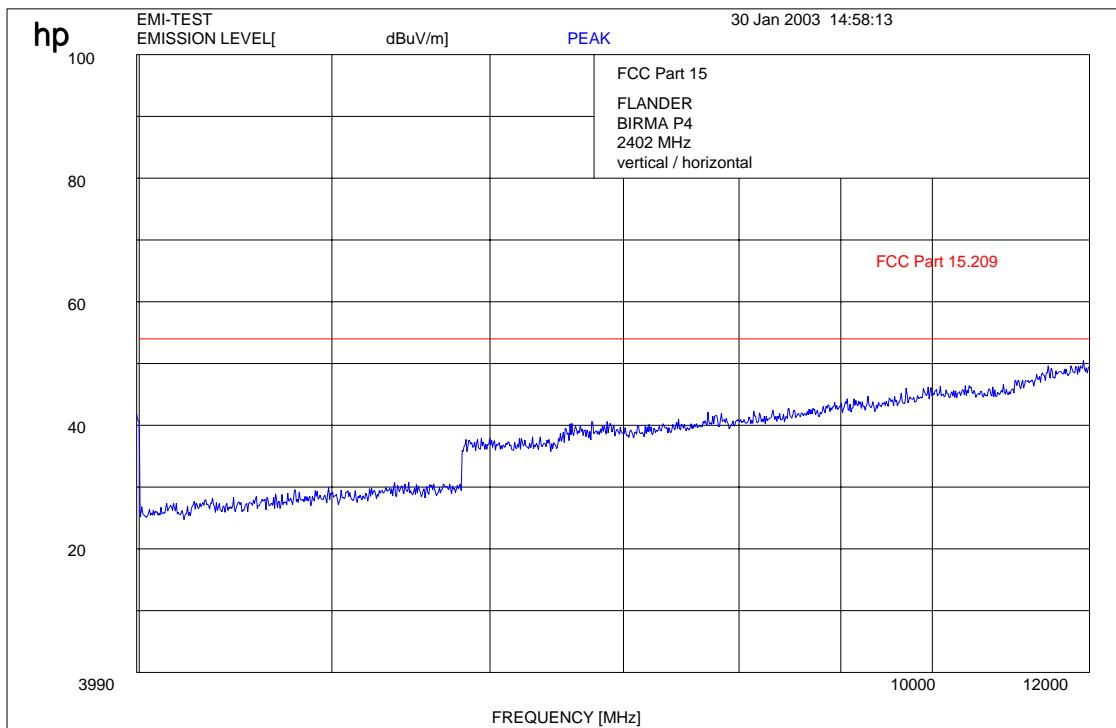
SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****EMISSION LIMITATIONS
2402 MHz****SUBCLAUSE § 15.247 (c) (1)****f < 1 GHz : RBW/VBW: 100 kHz****f ≥ 1GHz : RBW/VBW: 1 MHz****LIMITS****SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

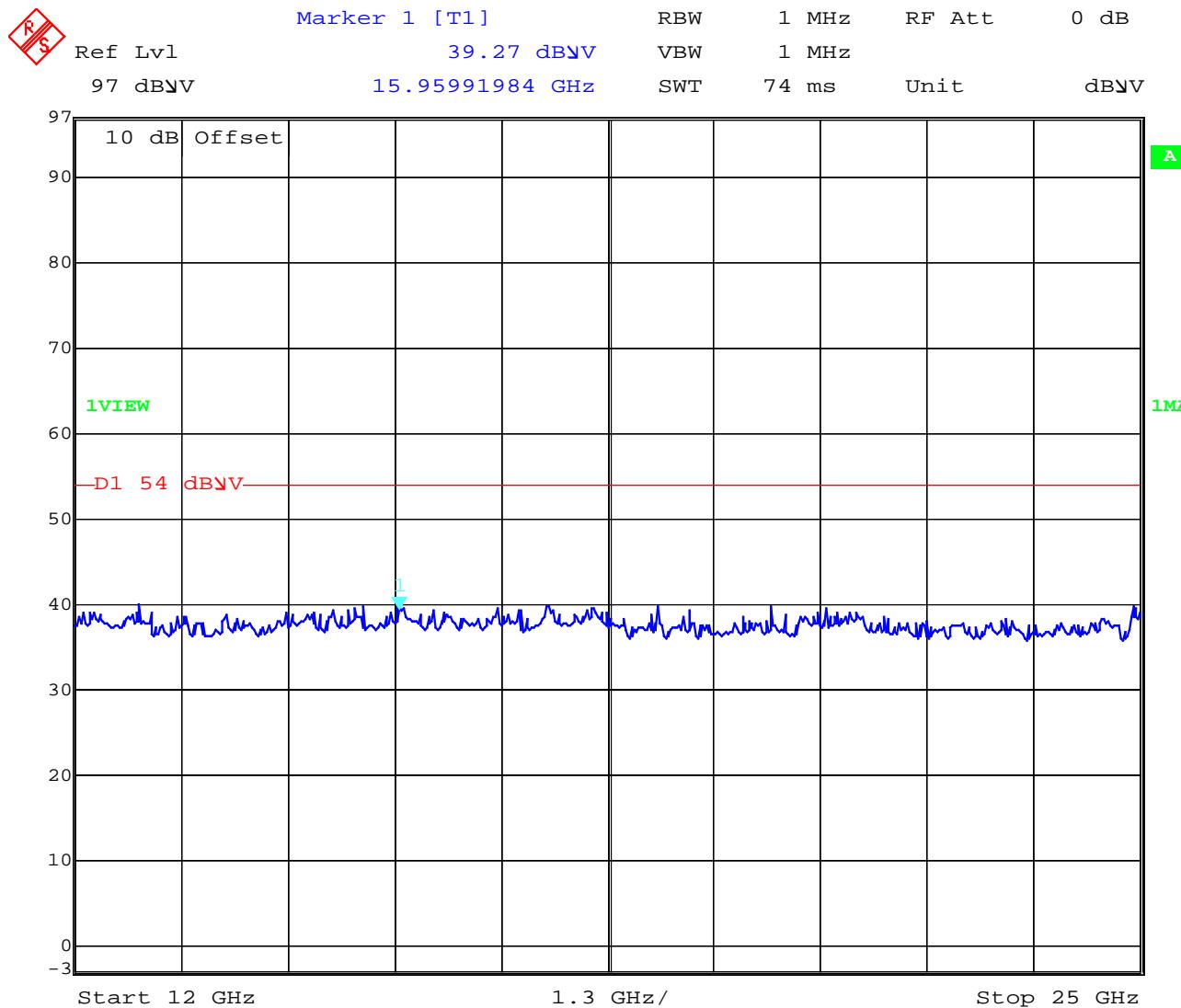
Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS

2402 MHz



Date: 31.JAN.2003 10:43:47

f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

LIMITS

SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

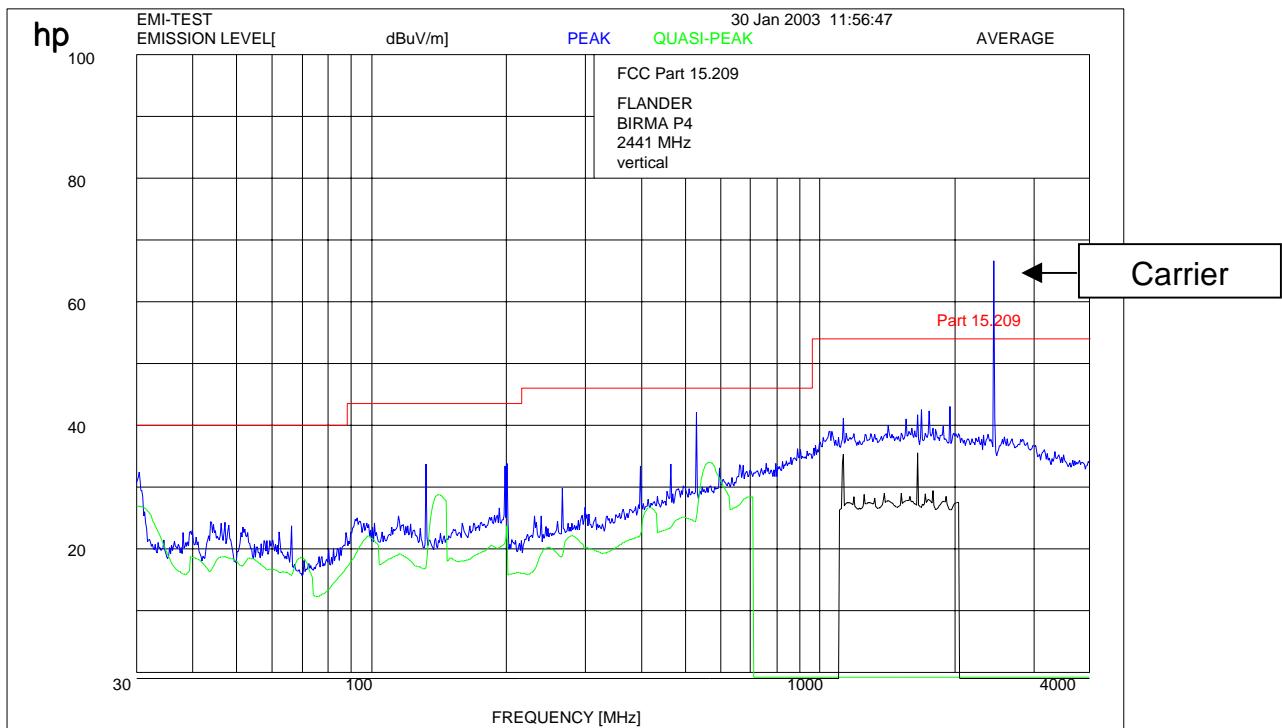
Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

**EMISSION LIMITATIONS
2441 MHz**

SUBCLAUSE § 15.247 (c) (1)



$f < 1 \text{ GHz}$: RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$: RBW/VBW: 1 MHz

LIMITS

SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

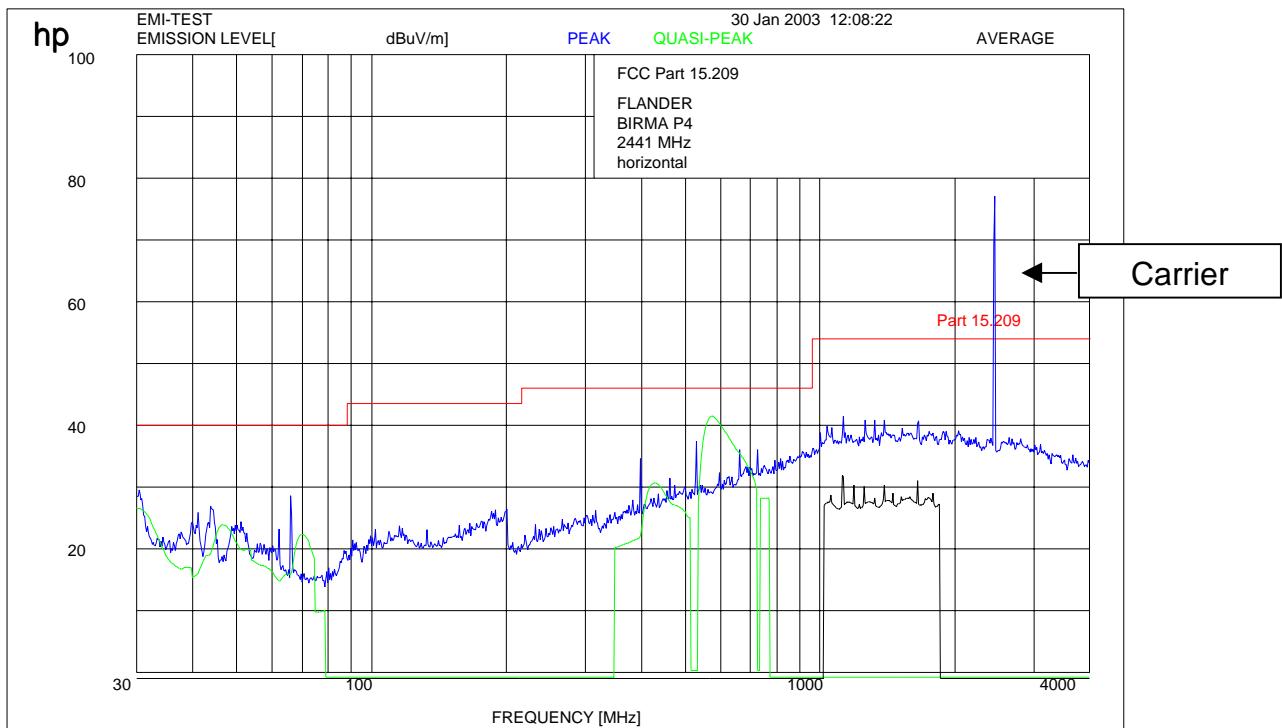
Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

**EMISSION LIMITATIONS
2441 MHz**

SUBCLAUSE § 15.247 (c) (1)



$f < 1 \text{ GHz}$: RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$: RBW/VBW: 1 MHz

LIMITS

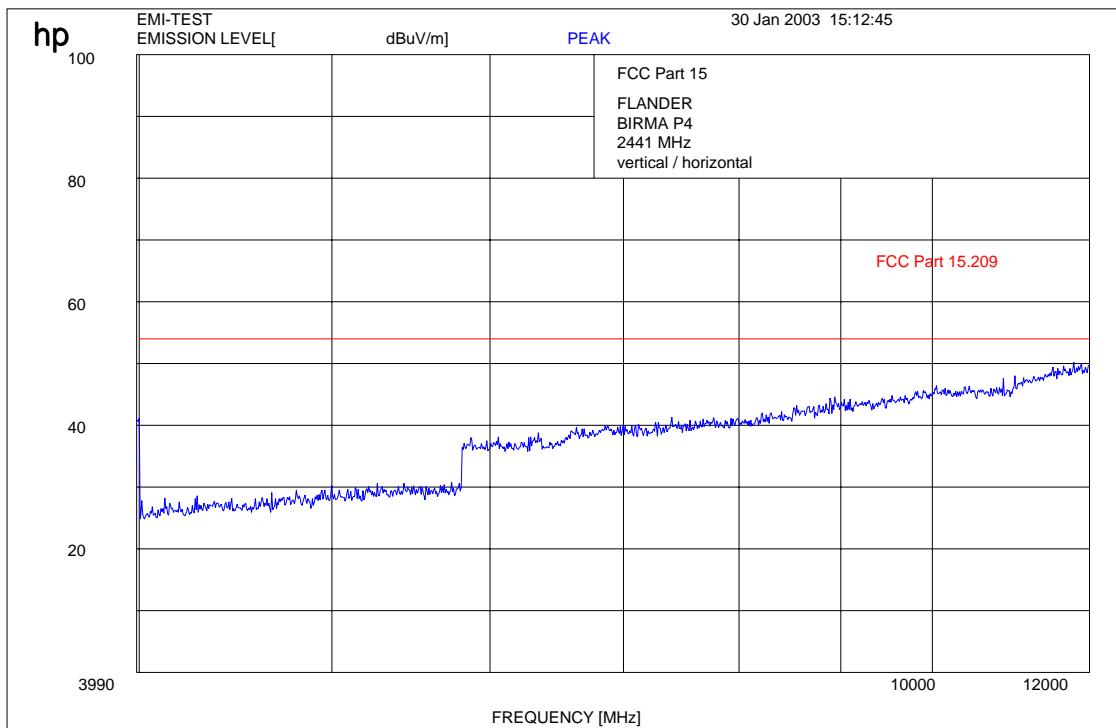
SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****EMISSION LIMITATIONS
2441 MHz****SUBCLAUSE § 15.247 (c) (1)****f < 1 GHz : RBW/VBW: 100 kHz****f ≥ 1GHz : RBW/VBW: 1 MHz****LIMITS****SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

Equipment under test : BIRMA P4

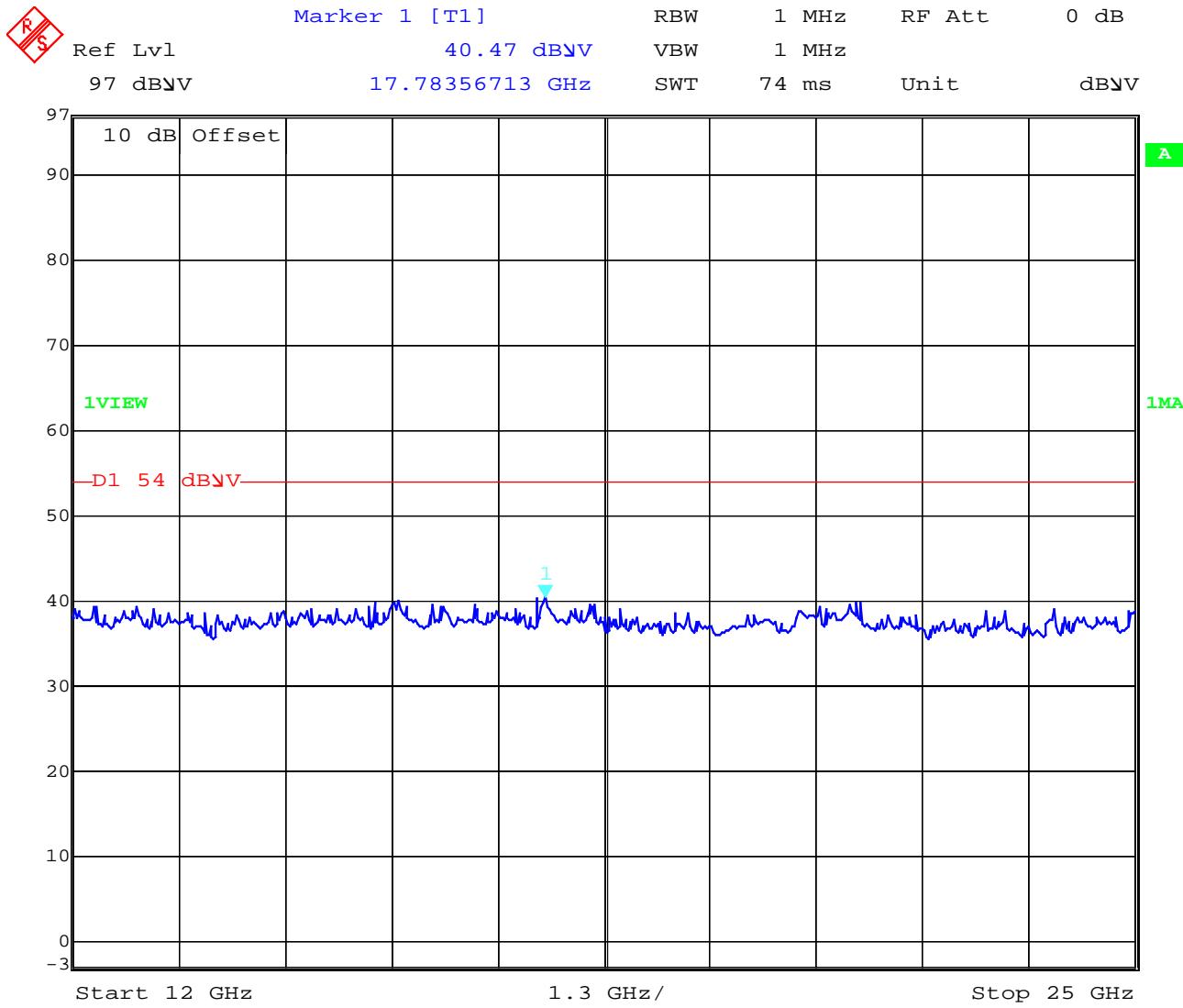
Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS

SUBCLAUSE § 15.247 (c) (1)

2441 MHz



Date: 31.JAN.2003 10:44:42

$f < 1 \text{ GHz}$: RBW/VBW: 100 kHz $f \geq 1 \text{ GHz}$: RBW/VBW: 1 MHz

LIMITS

SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

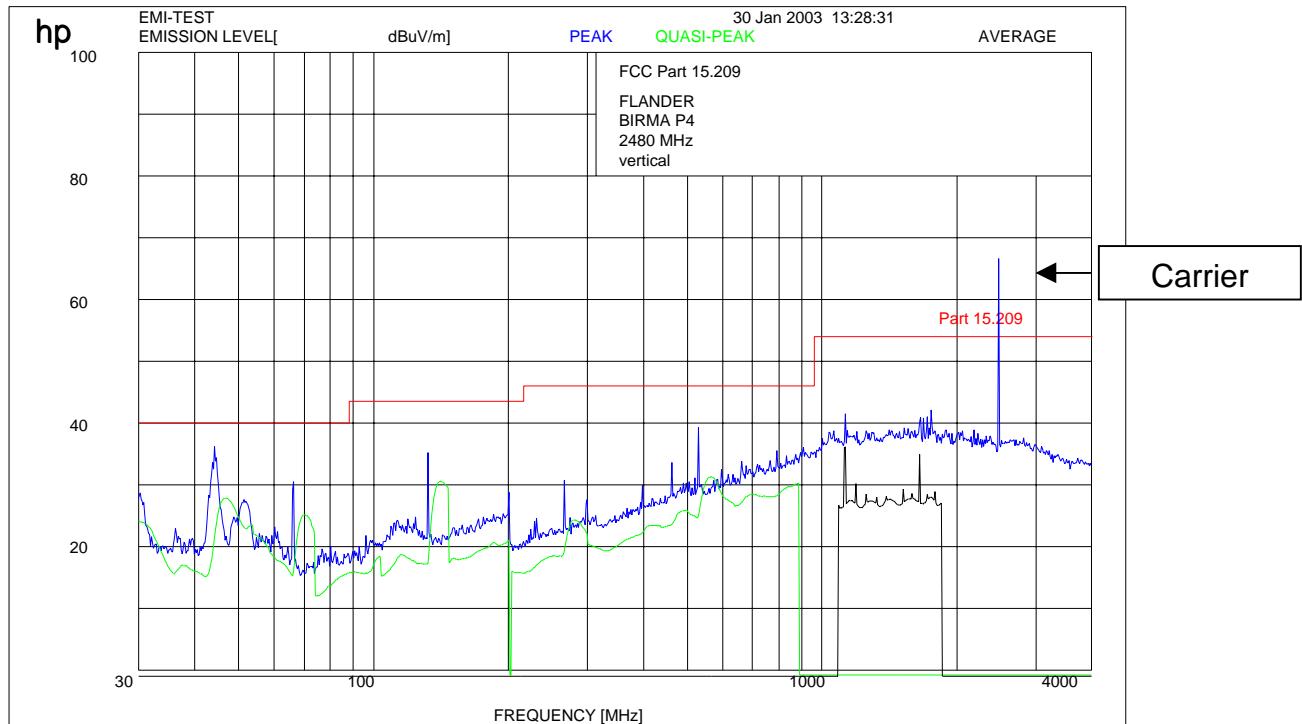
(for reference numbers see test equipment listing)

17-24,64

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

**EMISSION LIMITATIONS
2480 MHz****SUBCLAUSE § 15.247 (c) (1)**

f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

LIMITS**SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

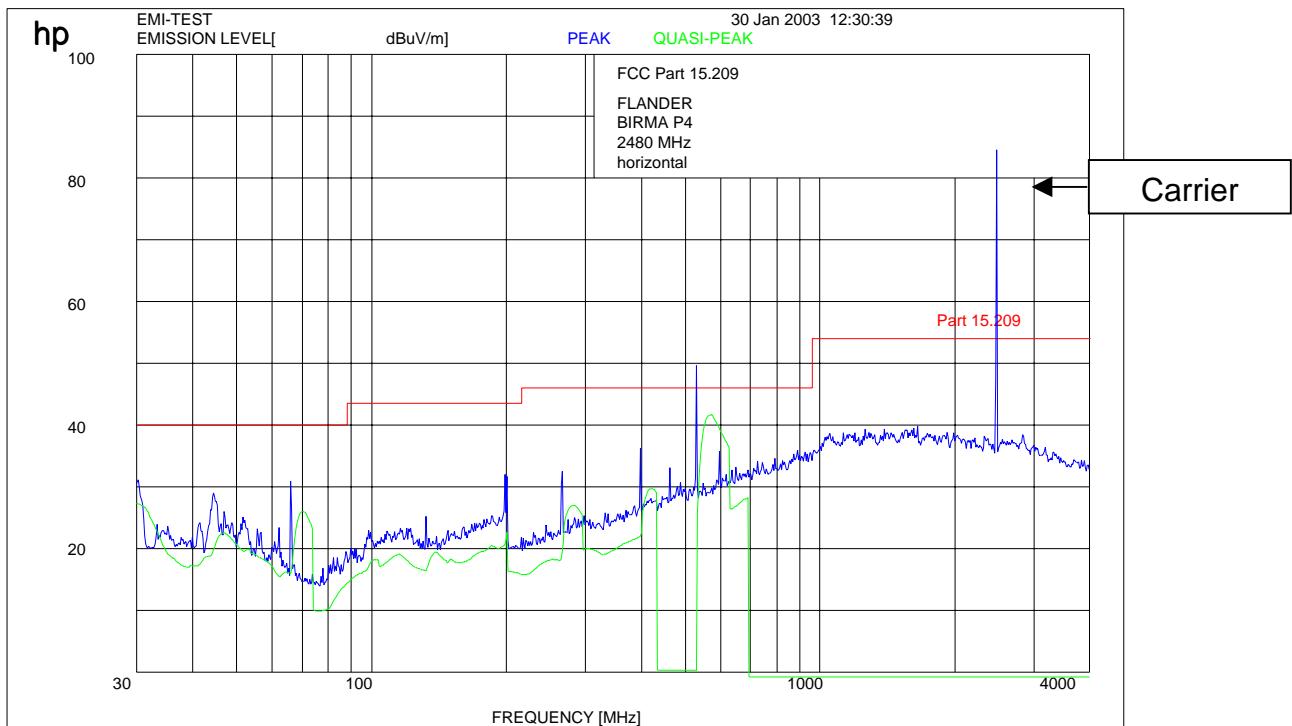
Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

**EMISSION LIMITATIONS
2480 MHz**

SUBCLAUSE § 15.247 (c) (1)



$f < 1 \text{ GHz}$: RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$: RBW/VBW: 1 MHz

LIMITS

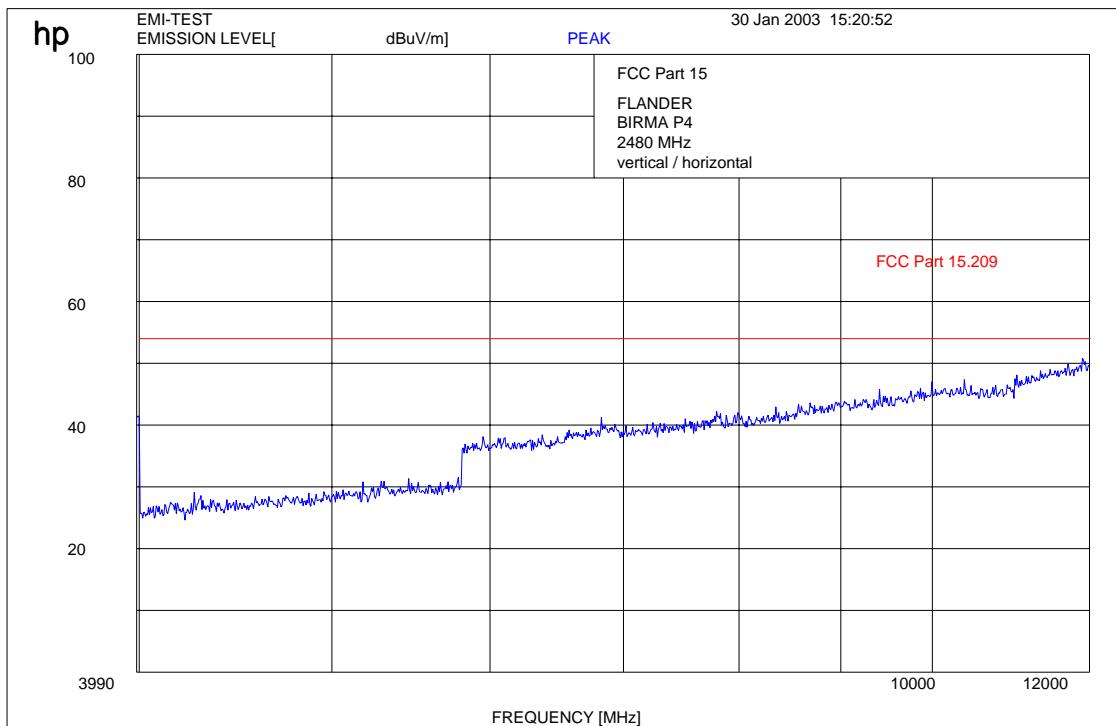
SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

Equipment under test : BIRMA P4**Ambient temperature : 23.3°C****Relative humidity : 28%****EMISSION LIMITATIONS (Transmitter/Receiver)**
2480 MHz**SUBCLAUSE § 15.247 (c) (1)****f < 1 GHz : RBW/VBW: 100 kHz****f ≥ 1GHz : RBW/VBW: 1 MHz****LIMITS****SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

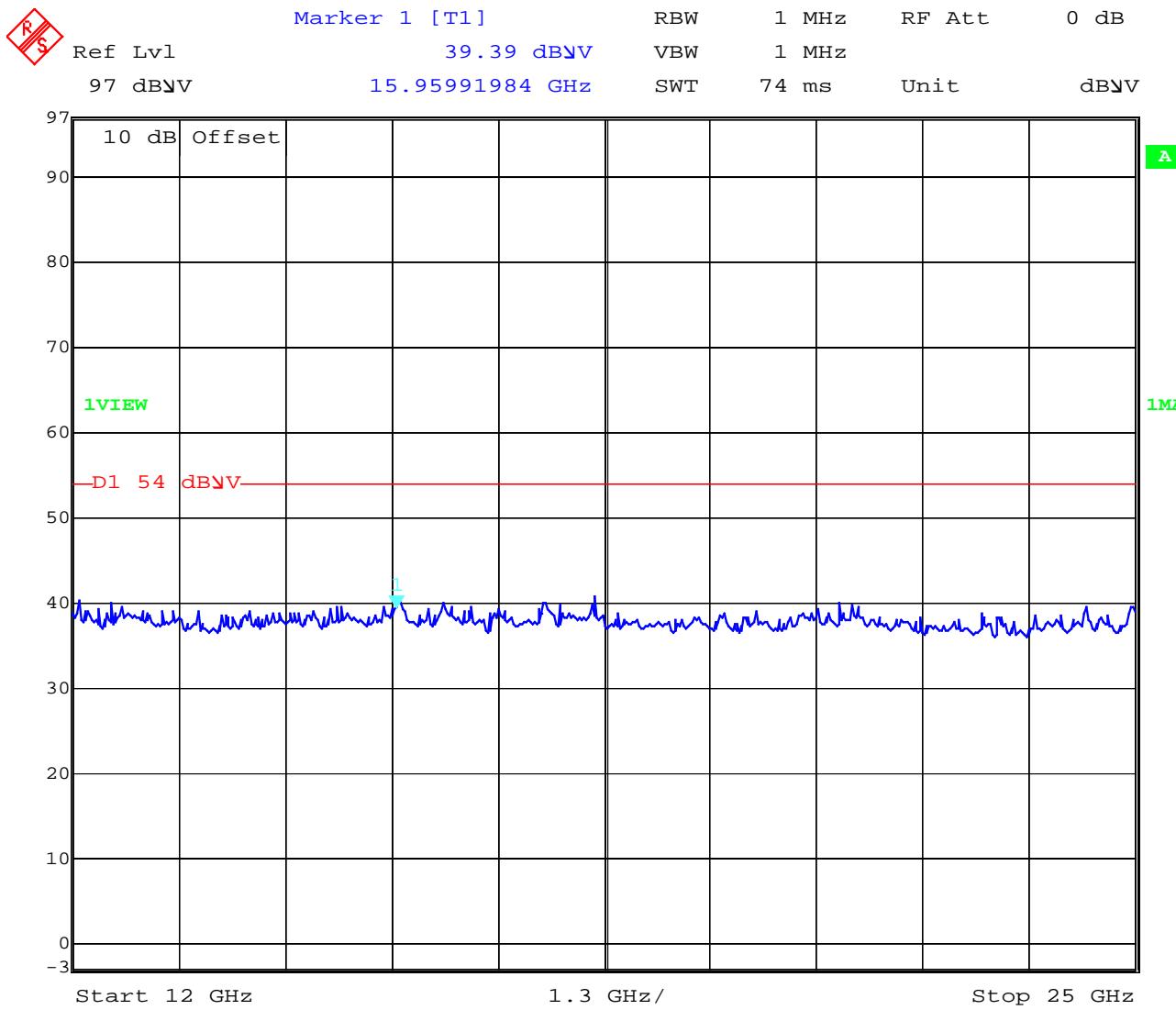
(for reference numbers see test equipment listing)

17-24,64

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

**EMISSION LIMITATIONS
2480 MHz****SUBCLAUSE § 15.247 (c) (1)**

Date: 31.JAN.2003 10:42:43

f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

LIMITS**SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

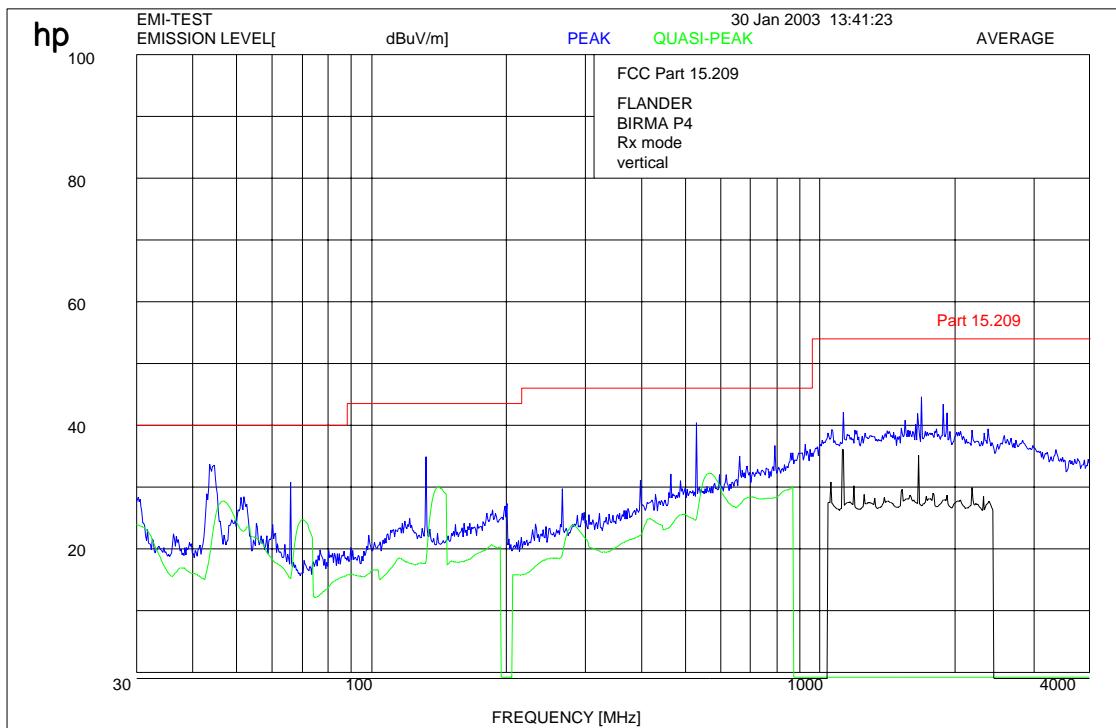
17-24,64

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109



$f < 1 \text{ GHz}$: RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$: RBW/VBW: 1 MHz

Limits

SUBCLAUSE § 15.109

Frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Measurement distance (m)
30 - 88	100 (40 dB $\mu\text{V}/\text{m}$)	3
88 - 216	150 (43.5 dB $\mu\text{V}/\text{m}$)	3
216 - 960	200 (46 dB $\mu\text{V}/\text{m}$)	3
above 960	500 (54 dB $\mu\text{V}/\text{m}$)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

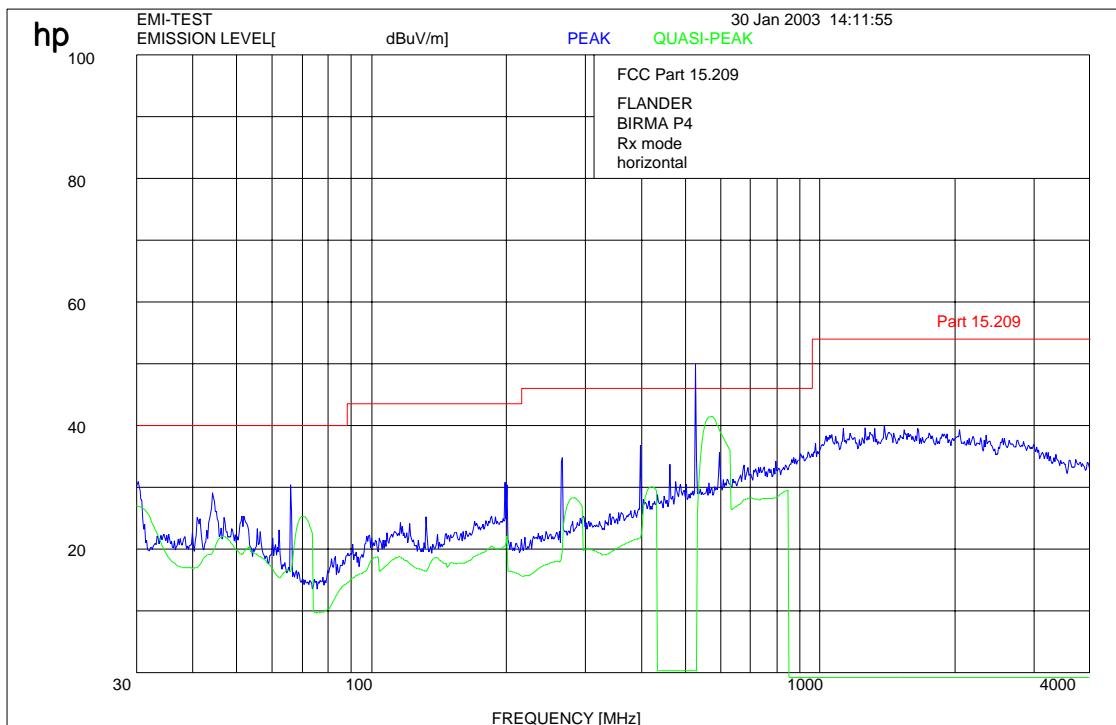
17-24,64

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109



$f < 1 \text{ GHz}$: RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$: RBW/VBW: 1 MHz

Limits

SUBCLAUSE § 15.109

Frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Measurement distance (m)
30 - 88	100 (40 dB $\mu\text{V}/\text{m}$)	3
88 - 216	150 (43.5 dB $\mu\text{V}/\text{m}$)	3
216 - 960	200 (46 dB $\mu\text{V}/\text{m}$)	3
above 960	500 (54 dB $\mu\text{V}/\text{m}$)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

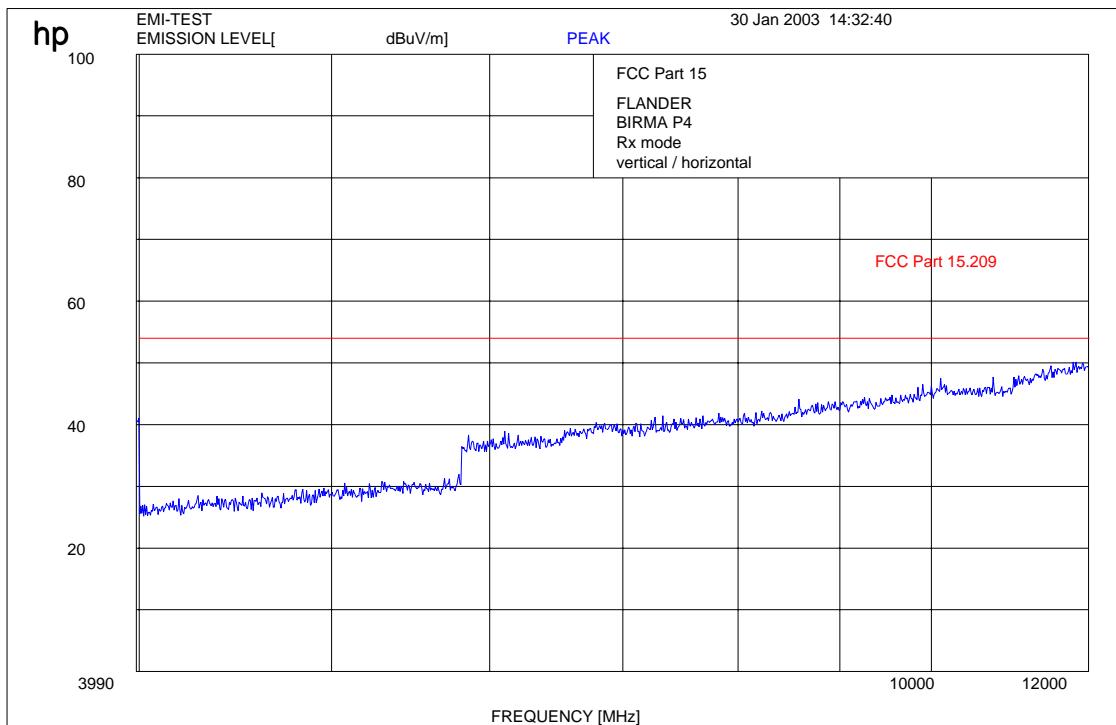
17-24,64

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109



$f < 1 \text{ GHz}$: RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$: RBW/VBW: 1 MHz

Limits

SUBCLAUSE § 15.109

Frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Measurement distance (m)
30 - 88	100 (40 dB $\mu\text{V}/\text{m}$)	3
88 - 216	150 (43.5 dB $\mu\text{V}/\text{m}$)	3
216 - 960	200 (46 dB $\mu\text{V}/\text{m}$)	3
above 960	500 (54 dB $\mu\text{V}/\text{m}$)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

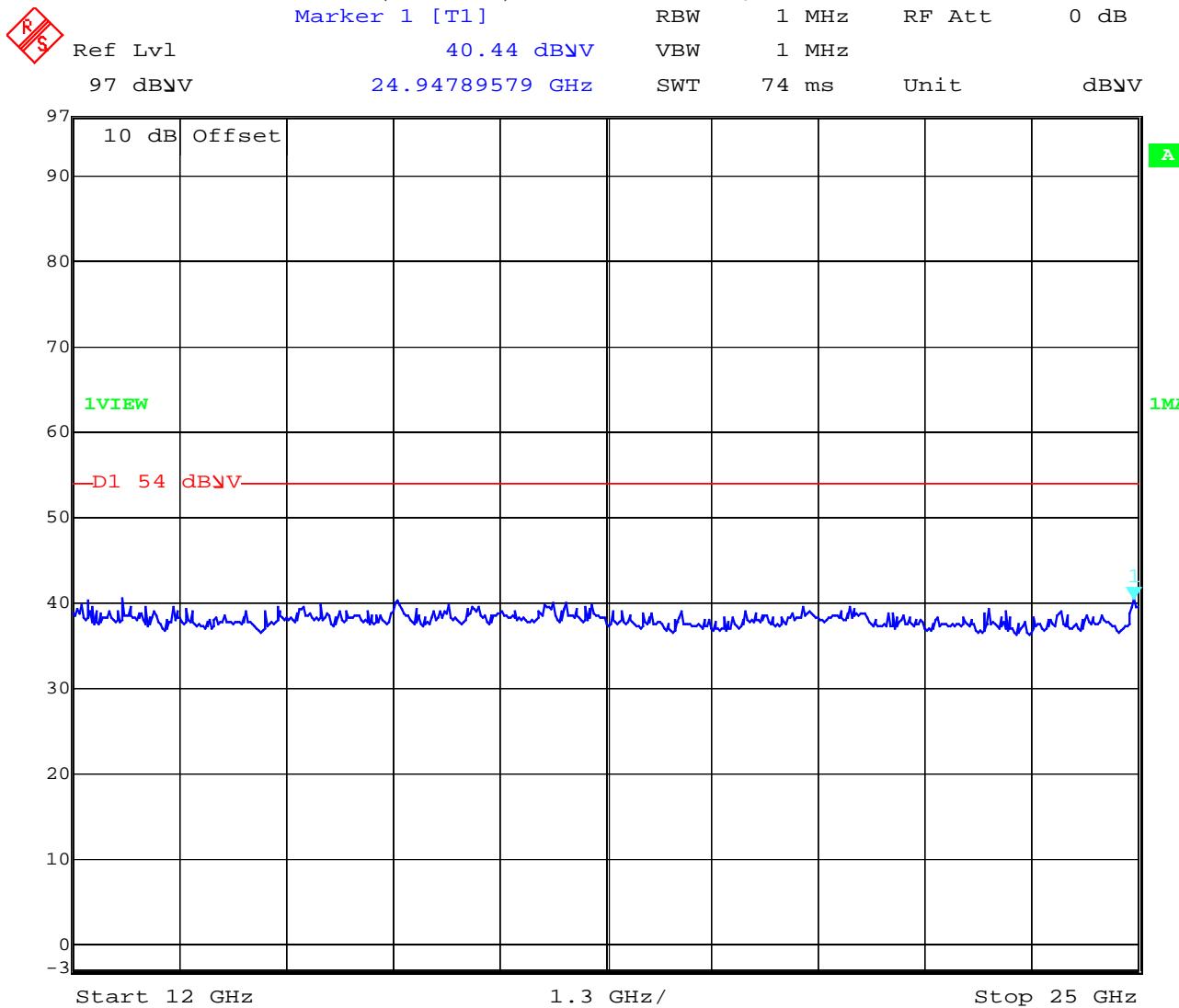
17-24,64

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109



Date: 31.JAN.2003 10:46:14

$f < 1 \text{ GHz}$: RBW/VBW: 100 kHz $f \geq 1 \text{ GHz}$: RBW/VBW: 1 MHz

Limits

SUBCLAUSE § 15.109

Frequency (MHz)	Field strength (μ V/m)	Measurement distance (m)
30 - 88	100 (40 dB μ V/m)	3
88 - 216	150 (43.5 dB μ V/m)	3
216 - 960	200 (46 dB μ V/m)	3
above 960	500 (54 dB μ V/m)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

Equipment under test : BIRMA P4

Ambient temperature : 23.3°C

Relative humidity : 28%

RECEIVER SPURIOUS RADIATION

§ 15.109

Radiated

SPURIOUS EMISSIONS LEVEL (μ V/m)								
CH 1 / 2 / 3								
f (MHz)	Detector	Level (μ V/m)	f (MHz)	Detector	Level (μ V/m)	f (MHz)	Detector	Level (μ V/m)
46.58	QP/V	27.7	1190.1	AV/V	30.2			
69.88	QP/H	25.3	1659.4	AV/V	35.1			
141.27	QP/V	30.0	2181.9	AV/V	29.9			
185.75	QP/V	20.7						
200.86	QP/H	22.1						
281.43	QP/H	28.3						
422.25	QP/H	30.1						
566.15	QP/H	41.5						
849.43	QP/H	30.0						
1058.4	AV/V	30.8						
1122.3	AV/V	36.1						
Measurement uncertainty			± 3 dB					

f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1 GHz : RBW/VBW: 1 MHz

see above plots

Measurement distance see table

Limits

SUBCLAUSE § 15.109

Frequency (MHz)	Field strength (μ V/m)	Measurement distance (m)
30 - 88	100 (40 dB μ V/m)	3
88 - 216	150 (43.5 dB μ V/m)	3
216 - 960	200 (46 dB μ V/m)	3
above 960	500 (54 dB μ V/m)	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17-24,64

Equipment under test : BIRMA P4

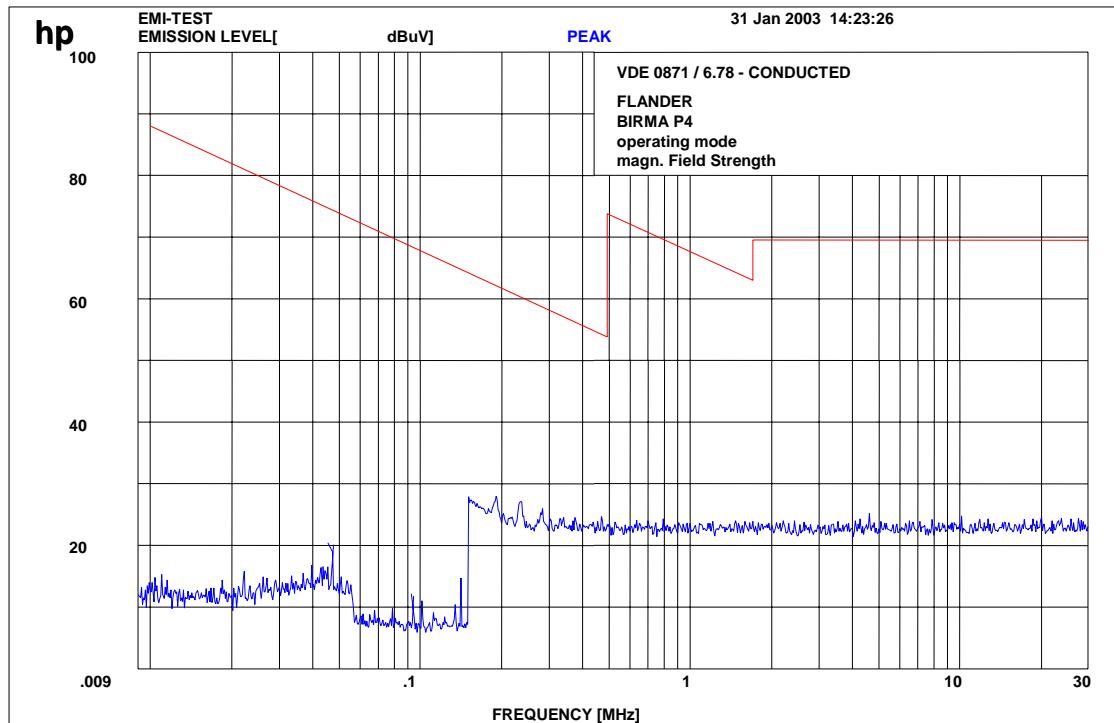
Ambient temperature : 23.3°C

Relative humidity : 28%

< 30 MHz

measured at 10 m distance.

Values recalculated with 40 dB/decade according to FCC rules.



Limits

SUBCLAUSE § 15.109

Frequency (MHz)	Field strength (μ V/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30 / 29.5 dB μ V/m	30
30 - 88	100 / 40 dB μ V/m	3
88 - 216	150 / 43.5 dB μ V/m	3
216 - 960	200 / 46 dB μ V/m	3
above 960	500 / 54 dB μ V/m	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

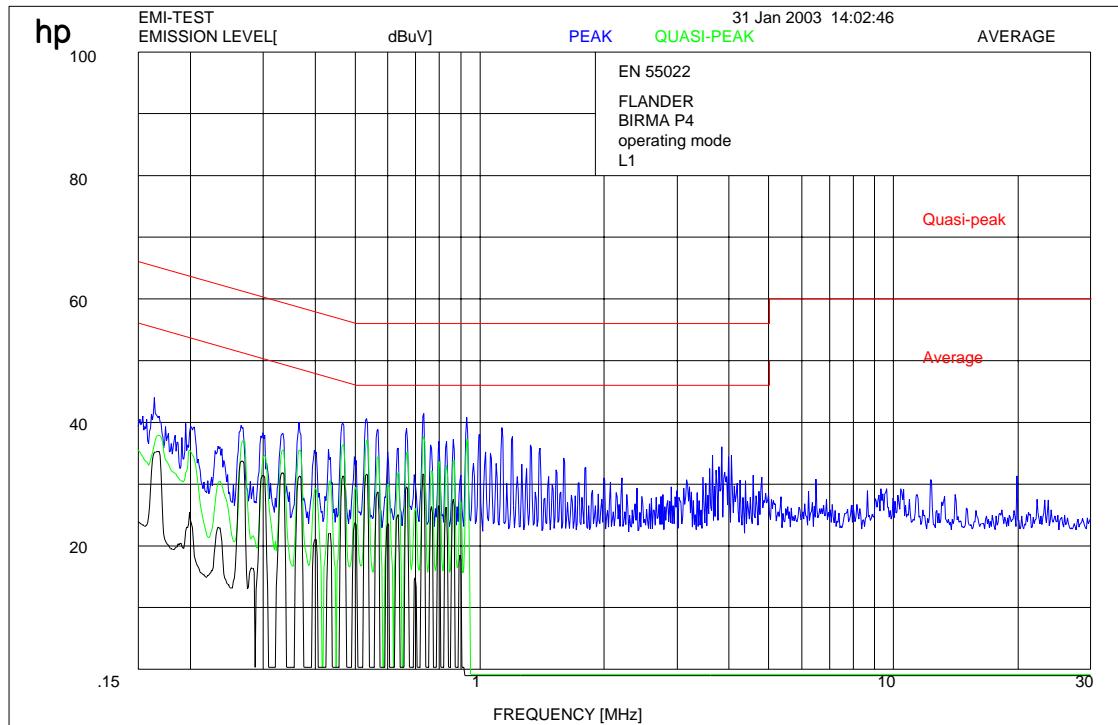
17-24,64

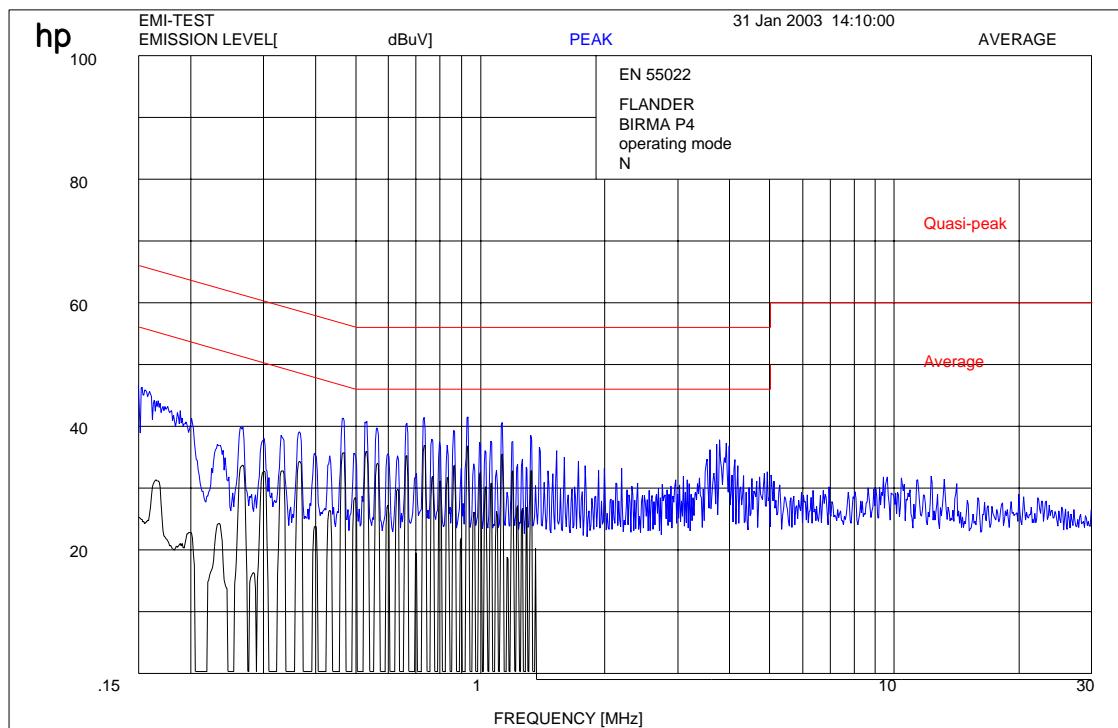
Conducted emissions
§ 15.107/207
FCC Part 15 / CISPR 22
EN 55022

EUT: BIRMA P4
 Manufacturer: FLANDER
 Operation condition: operating mode
 Test Site: Room 006
 Operator: Berg
 Power Supply: 115V AC / 60 Hz
 Comment: ---
 Start of Test: 31.01.03 / 14:25:11

SCAN TABLE: "EN 55022 V"

Short Description:			Voltage	Mains	1.60	Detector	Meas.	IF	Transducer
Start	Stop	Step							
Frequency	Frequency	Width					Time	Bandw.	
150.0 kHz	30.0 MHz	7.5 kHz					100.0 ms	10 kHz	ESH3-Z5 L1 1458
							Average		

L1


N

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

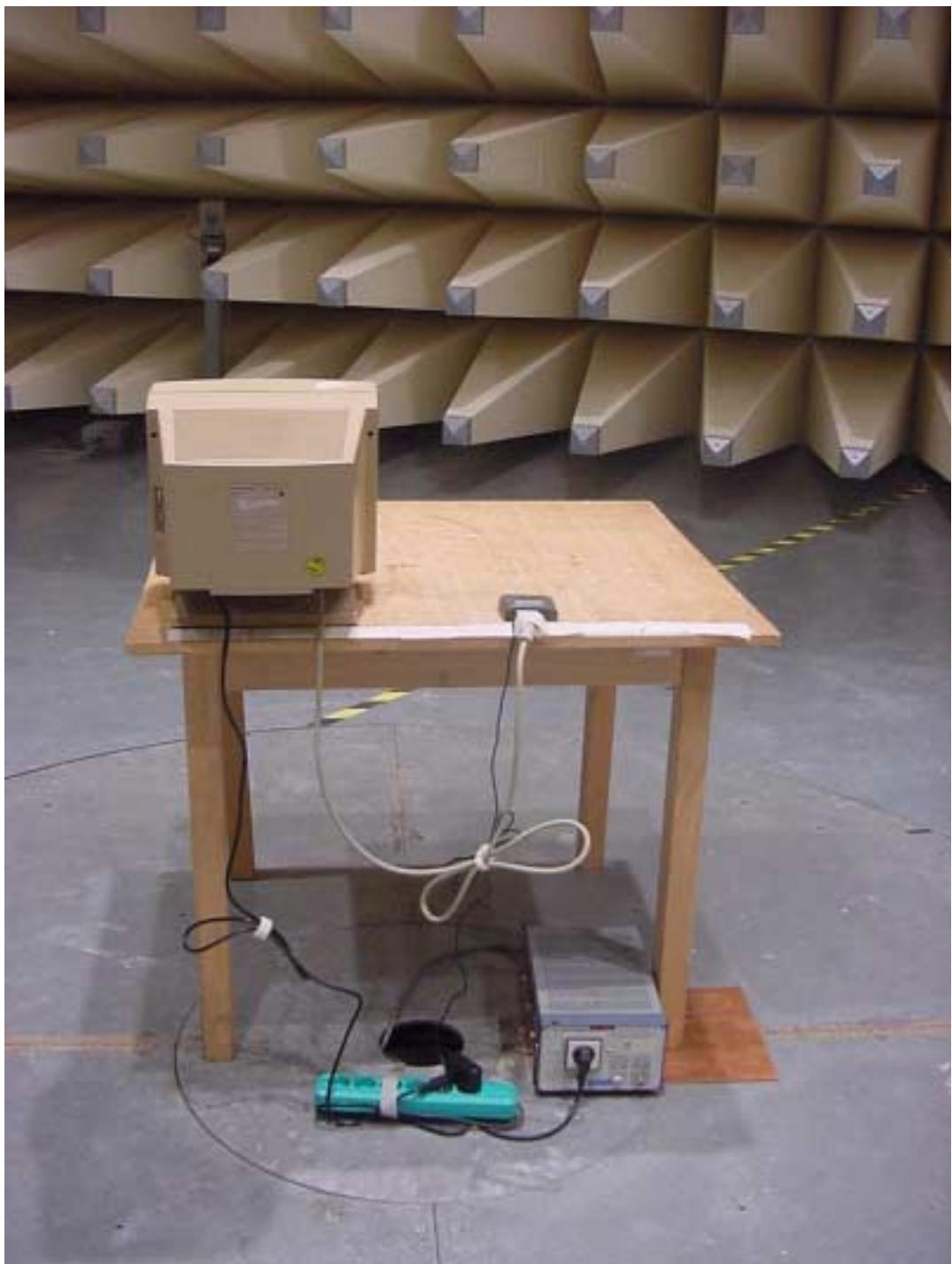
No	Instrument/Ancillary	Type	Manufacturer	Serial No.
01	Spectrum Analyzer	8566 A	Hewlett-Packard	1925A00257
02	Analyzer Display	8566 A	Hewlett-Packard	1925A00860
03	Oscilloscope	7633	Tektronix	230054
04	Radio Analyzer	CMTA 54	Rohde & Schwarz	894 043/010
05	System Power Supply	6038 A	Hewlett-Packard	2848A07027
06	Signal Generator	8111 A	Hewlett-Packard	2215G00867
07	Signal Generator	8662 A	Hewlett-Packard	2224A01012
08	Funktionsgenerator	AFGU	Rohde & Schwarz	862 480/032
09	Regeltrenntrafo	MPL	Erfi	91350
10	Netznachbildung	NNLA 8120	Schwarzbeck	8120331
11	Relais-Matrix	PSU	Rohde & Schwarz	893 285/020
12	Power-Meter	436 A	Hewlett-Packard	2101A12378
13	Power-Sensor	8484 A	Hewlett-Packard	2237A10156
14	Power-Sensor	8482 A	Hewlett-Packard	2237A00616
15	Modulationsmeter	9008	Racal-Dana	2647
16	Frequenzzähler	5340 A	Hewlett-Packard	1532A03899
17	Absorber Schirmkabine	---	MWB	87400/002
18	Spectrum Analyzer	85660 B	Hewlett-Packard	2747A05306
19	Analyzer Display	85662 A	Hewlett-Packard	2816A16541
20	Quasi Peak Adapter	85650 A	Hewlett-Packard	2811A01131
21	RF-Preselector	85685 A	Hewlett-Packard	2833A00768
22	Biconical Antenne	3104	Emco	3758
23	Log. Per. Antenne	3146	Emco	2130
24	Double Ridge Horn	3115	Emco	3088
25	EMI-Testreceiveiver	ESAI	Rohde & Schwarz	863 180/013
26	EMI-Analyzer-Display	ESAI-D	Rohde & Schwarz	862 771/008
27	Biconical Antenne	HK 116	Rohde & Schwarz	888 945/013
28	Log. Per. Antenne	HL 223	Rohde & Schwarz	825 584/002
29	Relais-Switch-Unit	RSU	Rohde & Schwarz	375 339/002
30	Highpass	HM985955	FSY Microwave	001
31	Amplifier	P42-GA29	Tron-Tech	B 23602
32	Absorber Schirmkabine		Frankonia	
33	Steuerrechner	PSM 7	Rohde & Schwarz	834 621/004
34	EMI Test Reciever	ESMI	Rohde & Schwarz	827 063/010
35	EMI Test Receiver	Display	Rohde & Schwarz	829 808/010

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
36	Controller	HD 100	Deisel	100/322/93
37	Relais Matrix	PSN	Rohde & Schwarz	829 065/003
38	Control Unit	GB 016 A2	Rohde & Schwarz	344 122/008
39	Relais Switch Unit	RSU	Rohde & Schwarz	316 790/001
40	Power Supply	6032A	Hewlett Packard	2846A04063
41	Spektrum Monitor	EZM	Rohde & Schwarz	883 720/006
42	Meßempfänger	ESH 3	Rohde & Schwarz	890 174/002
43	Meßempfänger	ESVP	Rohde & Schwarz	891 752/005
44	Biconi Ant. 20-300MHz	HK 116	Rohde & Schwarz	833 162/011
45	Logper Ant. 0.3-1 GHz	HL 223	Rohde & Schwarz	832 914/010
46	Amplifier 0.1-4 GHz	AFS4	Miteq Inc.	206461
47	Logper Ant. 1-18 GHz	HL 024 A2	Rohde & Schwarz	342 662/002
48	Polarisationsnetzwerk	HL 024 Z1	Rohde & Schwarz	341 570/002
49	Double Ridge G Horn Antenne 1-26.5 GHz	3115	EMCO	9107-3696
50	Microw. Sys. Amplifier 0.5- 26.5 GHz	8317A	Hewlett Packard	3123A00105
51	Audio Analyzer	UPD	Rohde & Schwarz	1030.7500.04
52	Steuerrechner	PSM 7	Rohde & Schwarz	883 086/026
53	DC V-Netzwerk	ESH3-Z6	Rohde & Schwarz	861 406/005
54	DC V-Netzwerk	ESH3-Z6	Rohde & Schwarz	893 689/012
55	AC 2 Phasen V- Netzwerk	ESH3-Z5	Rohde & Schwarz	861 189/014
56	AC 2 Phasen V- Netzwerk	ESH3-Z5	Rohde & Schwarz	894 981/019
57	AC-3 Phasen V- Netzwerk	ESH2-Z5	Rohde & Schwarz	882 394/007
58	Stromversorgung	6032A	Rohde & Schwarz	2933A05441
59	HF-Test Empfänger	ESVP.52	Rohde & Schwarz	881 487/021
60	Spectrum Monitor	EZM	Rohde & Schwarz	883 086/026
61	HF-Test Empfänger	ESH3	Rohde & Schwarz	881 515/002
62	Relais Matrix	PSU	Rohde & Schwarz	882 943/029
63	Relais Matrix	PSU	Rohde & Schwarz	828 628/007
64	Spectrum Analyzer	FSIQ 26	Rohde & Schwarz	119.6001.27
65	Spectrum Analyzer	HP 8565E	Hewlett Packard	3473A00773
66				

Test setup



Test setup



Test setup



Photographs of the equipment



Photographs of the equipment



Photographs of the equipment



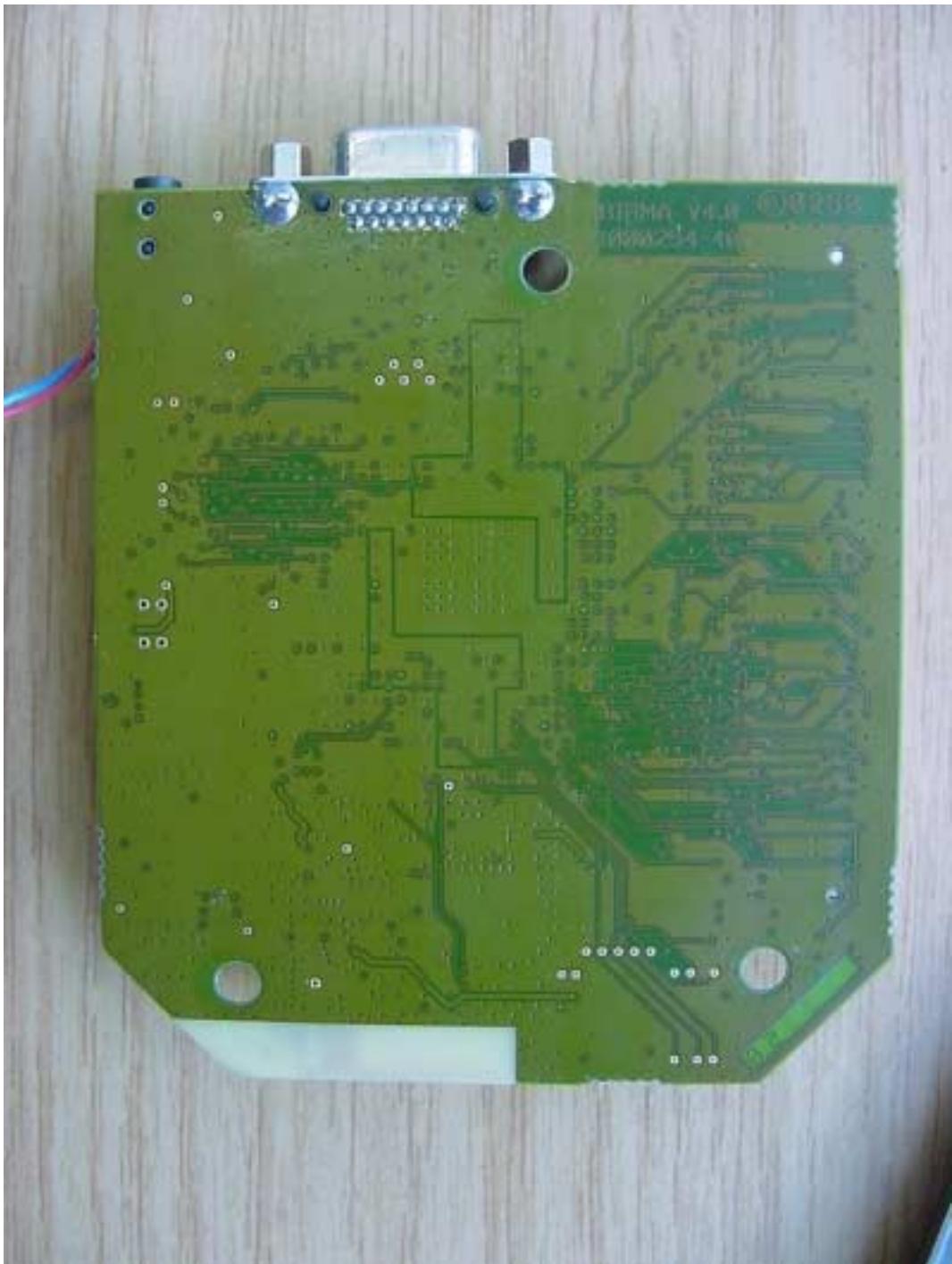
Photographs of the equipment



Photographs of the equipment



Photographs of the equipment



Photographs of the equipment

