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Radio Satellite Communication

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RSC14

issue test report consist of 66 Pages

Page 1 (66)

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Accredited by the
German Accreditation Council
DAR-Registration Number
TTI-P-G 166/98



Independent ETSI
compliance test house



Accredited Bluetooth™ Test Facility (BQTF)

Test Report No.: 2-3107-01-02/02
FCC Part 15.247 / CANADA RSS-210
TEC-BTM
FCC ID: BJIOH0001

CETECOM – ICT Services GmbH
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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:

2003-01-02 RSC8411 Berg M.

Date

Section

Name

Signature



Technical Responsibility for Area of Testing:

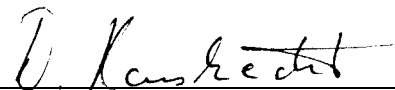
2003-01-02 RSC8412 Hausknecht D.

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 : Toshiba TEC Corp.

Street : 570 Ohito, Ohito-Cho, Togata-Gun

City : Shizuoka-Ken 410-2392

Country : Japan

Telephone : +81-558-76-9679

Telefax : +81-558-76-9856

Contact : Eiji Watanabe

Telephone : +81-558-76-9679

1.3 Application Details

Date of receipt of application : 2002-12-10

Date of receipt of test item : 2002-12-10

Date of test : 2002-12-12/13

1.4 Test Item

Type of equipment : **Bluetooth™ Transmitter Module**
Type designation : **TEC-BTM**
Manufacturer : Toshiba TEC Corp.
Street : **570 Ohito, Ohito-Cho, Togata-Gun**
City : **Shizuoka-Ken 410-2392**
Country : **Japan**
Serial number : **-.-**
FCC ID : **BJIOH0001**
Hardware : 6.0
Software : 6.0
Additional information :
Frequency : 2402 – 2480 MHz
Type of modulation : 1M00FXD / 79M8FXD (FHSS)
Number of channels : 79
Antenna : Chip Herical Antenna 3,2 dBi/50 Ohm
Power supply : Exr. 3,3V DC
Output power : EIRP: 2,05 mW (worst case)
Temperature range : -20°C - +55°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

The product fullfills 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 :

During all radiated tests the equipment under test was powered from a "Test board" (Bar Code Printer B-415-GH25-QQ-FE) see test setup and photographs.

2.2 Test Report

TEST REPORT

Test Report No. : 2-3107-01-02/02

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
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Equipment under test : TEC-BTM
Ambient temperature : 23.3°C
Relative humidity : 30%

Antenna Gain

The gain is 3.2 dBi (worst case)

(manufacturer declarartion)

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

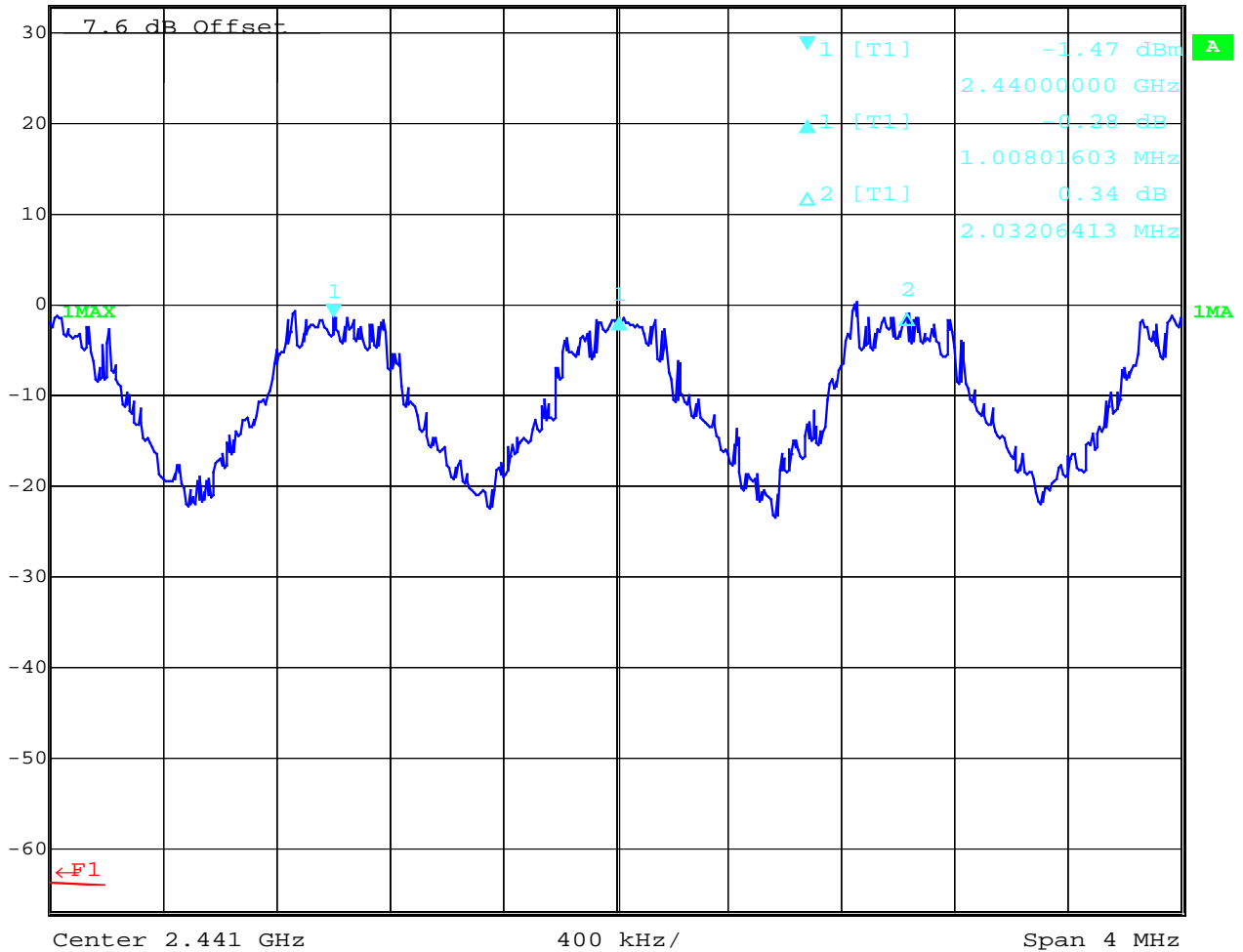
-

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Carrier frequency separation

§15.247(a1)

	Delta 1 [T1]	RBW	50 kHz	RF Att	50 dB
Ref Lvl	-0.28 dB	VBW	1 MHz		
33 dBm	1.00801603 MHz	SWT	5 ms	Unit	dBm



Date: 12.DEC.2002 10:59:36

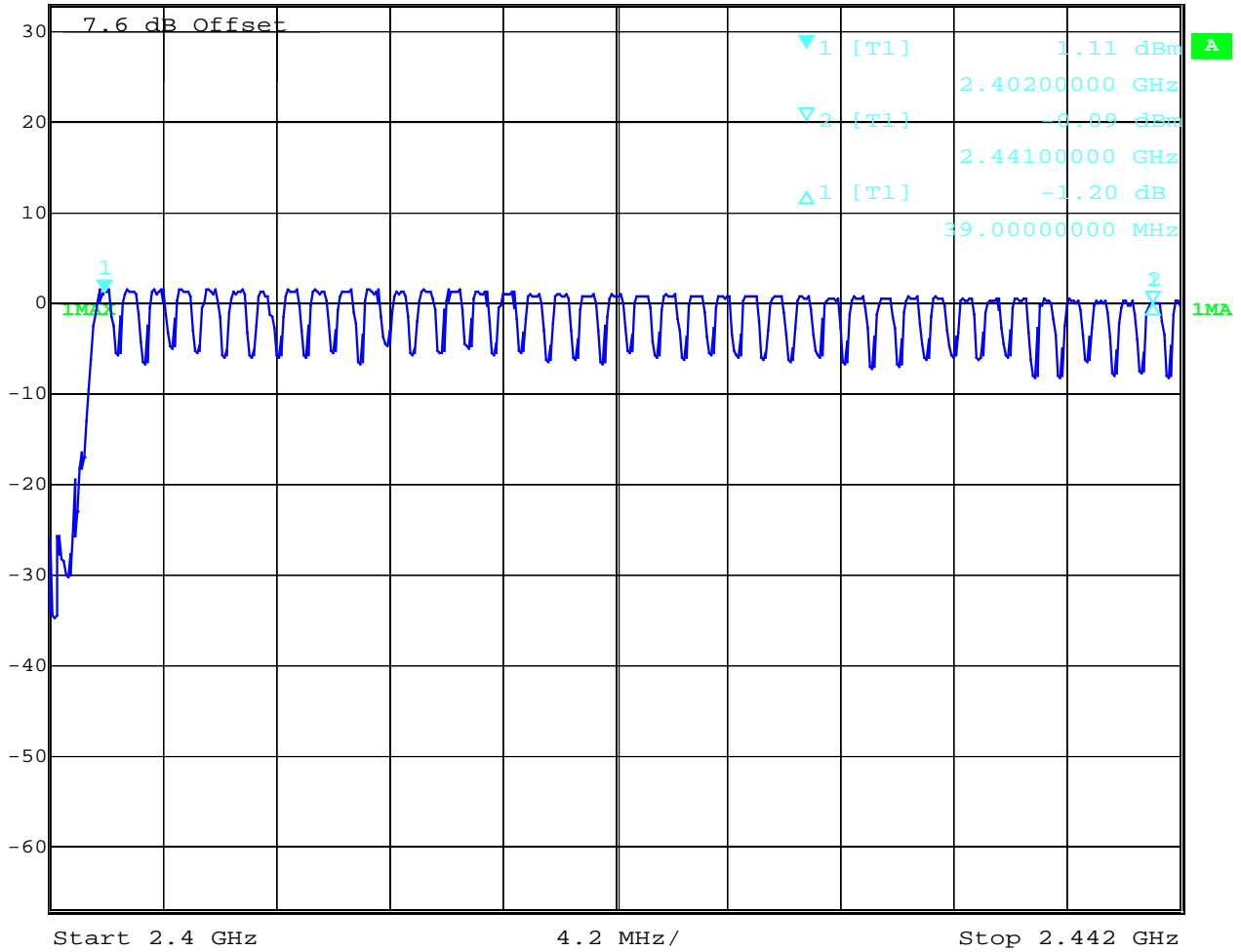
Channel separation is ~ 1 MHz

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Number of hopping channels §15.247(a1)
 Channel 1 - 40

	Marker 1 [T1]	RBW	300 kHz	RF Att	40 dB
Ref Lvl	1.11 dBm	VBW	1 MHz		
33 dBm	2.40200000 GHz	SWT	5 ms	Unit	dBm



Date: 12.DEC.2002 11:02:19

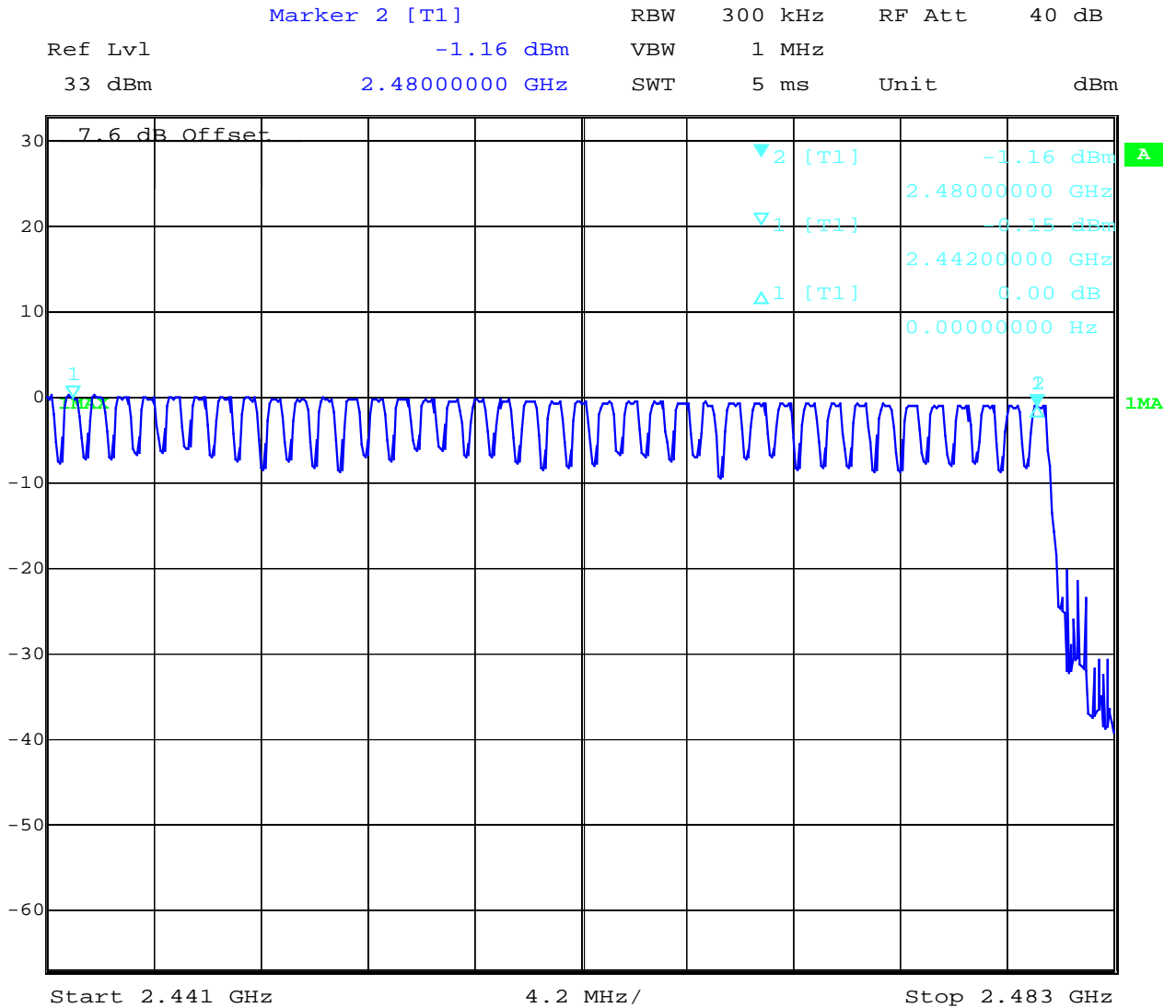
The number of hopping channels is 79.

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Number of hopping channels
 Channel 41 - 79

§15.247(a1)



Date: 12.DEC.2002 11:04:57
The number of hopping channels is 79.

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

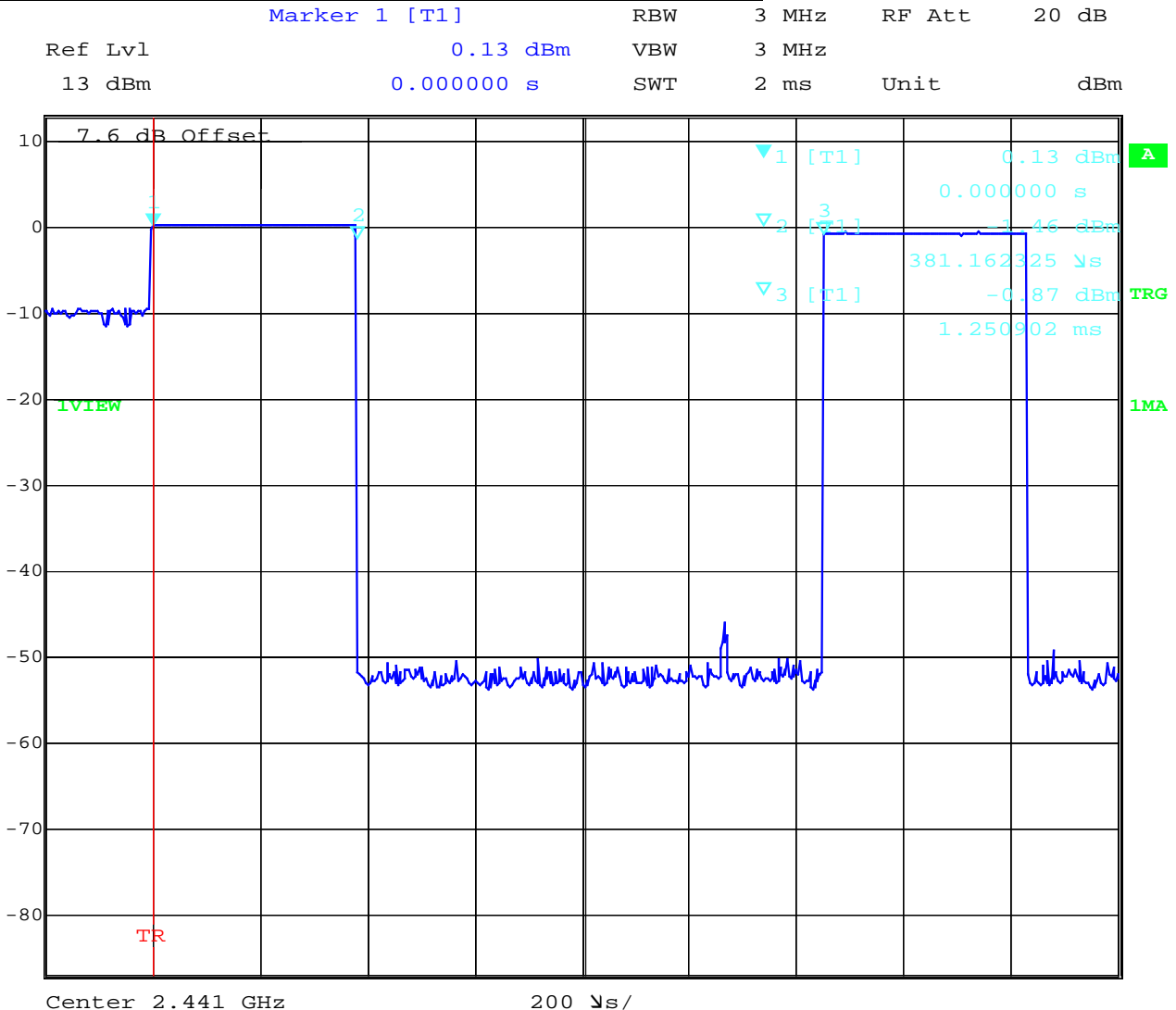
Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Time of occupancy (dwell time) for DH1 §15.247(a1 iii)

The system makes worst case 1600 hops per second or 1 time slot has a length of 625µs with 79 channels. A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 800 hops per second with 79 channels. So you have each channel 10.13 times per second and for 31.6 seconds you have 320.11 times of appearance .

Each tx-time per appearance is 381.162 µs.

So we have 320.11 * 381.162 µs = 122.014 ms per 31.6 seconds.



Date: 12.DEC.2002 11:11:29

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

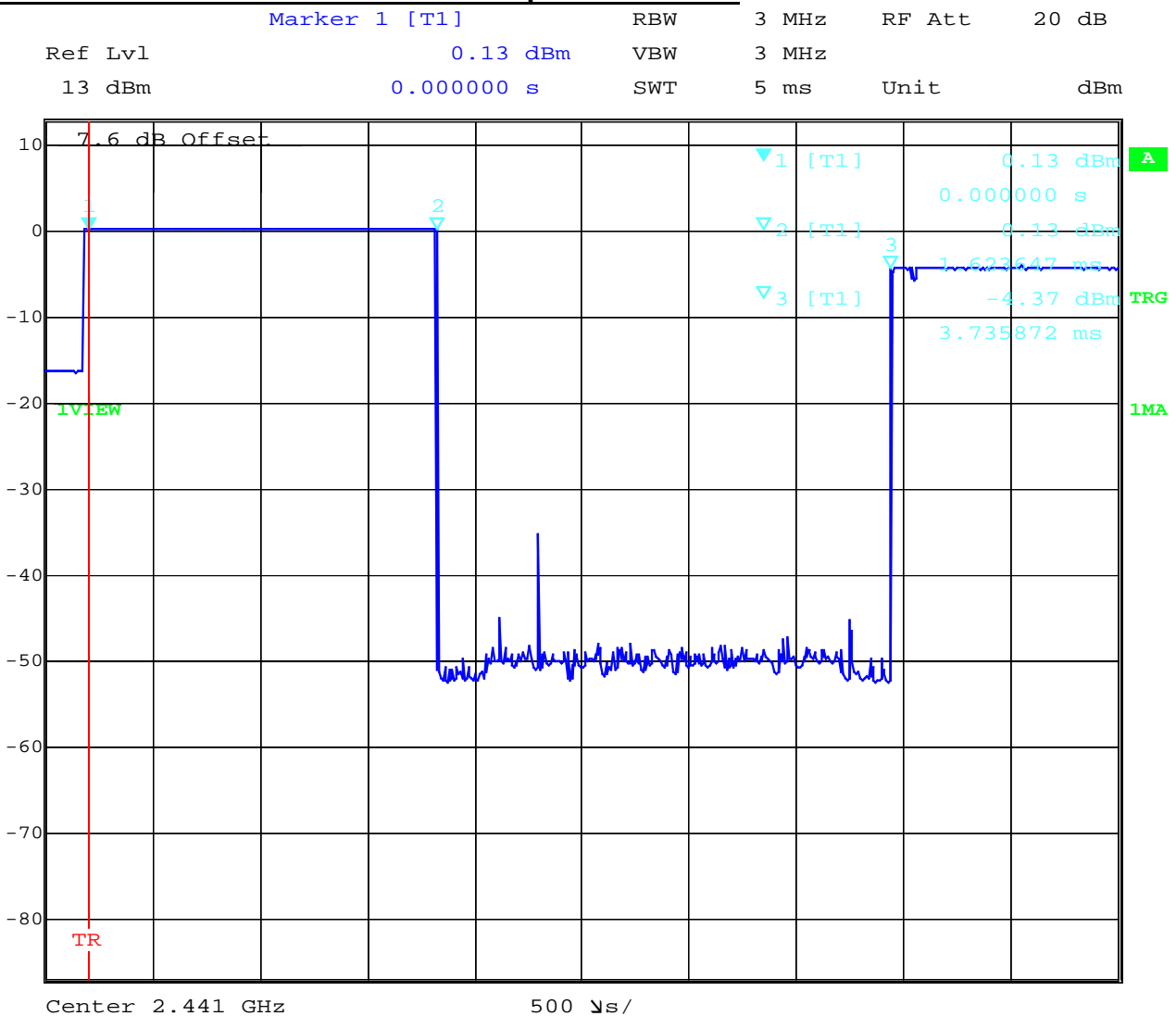
Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Time of occupancy (dwell time) for DH3 §15.247(a1 iii)

A DH3 Packets need 3 time slots for transmit and 1 for receiving, then the system makes worst case 400 hops per second with 79 channels. So you have each channel 5.1 times per second and for 31.6 seconds you have 161.16 times of appearance .

Each tx-time per appearance is 1.624 ms.

So we have 161.16 * 1.624 ms = 261.724 ms per 31.6 seconds.



Date: 12.DEC.2002 11:10:29

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

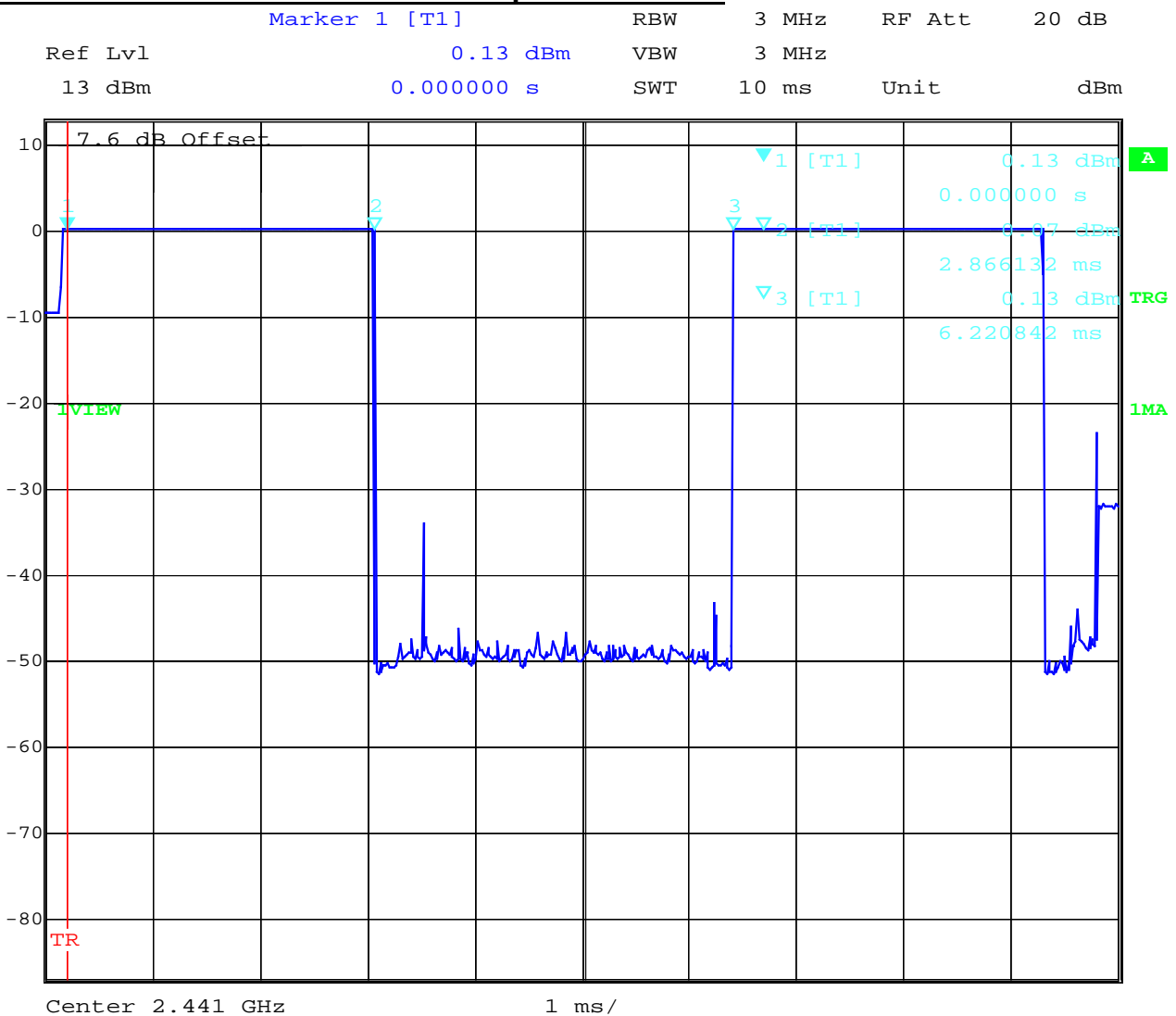
Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Time of occupancy (dwell time) for DH5 §15.247(a1 iii)

At DH5 Packets you need 5 time slots for transmit and 1 for receiving, so the system makes worst case 266,7 hops per second with 79 channels. So you have each channel 3.36 times per second and for 31.6 seconds you have 106.176 times of appearance .

Each tx-time per appearance is 2.866 ms.

So we have 106.176 * 2.866 ms = 304.3 ms per 31.6 seconds.



Date: 12.DEC.2002 11:12:25

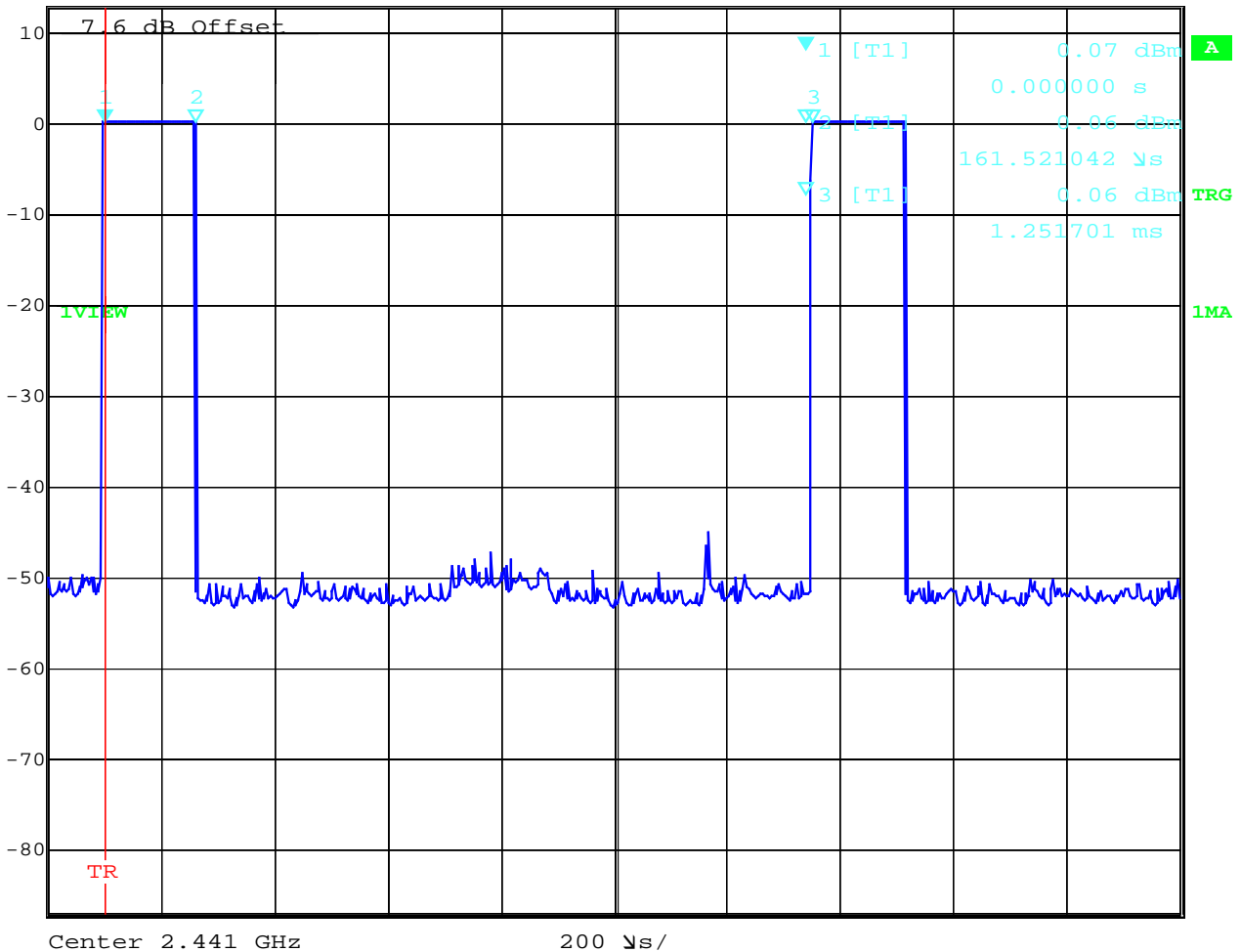
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Time of occupancy (dwell time) for page mode /Inquiry mode (TX-on time) §15.247(a1 iii)
 At paging mode the system makes first hopping with 16 channels. One sequence(called train A) lasts 10 ms. Every 1.28s frequencies change and a second train A starts with different frequencies. After max 7*1.28 s 16 new more distance frequencies (Train B) are used. So we have in the worst case (same frequency is in every train) the following time scedule. First: 7*128*10ms. For the next 7 seconds train B with other frequencies. Then train A and B changes frequently.
 ⇒ so we have 7*128*161.521 μs, then 8.96 s other frequencies, then again 7*128*161.521 μs
 ⇒ together in 6.4 s maximal 1 sequences =>maximal 0.289 s per 6.4 second period.

Page mode (TX-on time) / Inquiry mode (TX-on time)

Ref Lvl	0.07 dBm	RBW	3 MHz	RF Att	20 dB
13 dBm	0.000000 s	VBW	3 MHz		
		SWT	2 ms	Unit	dBm

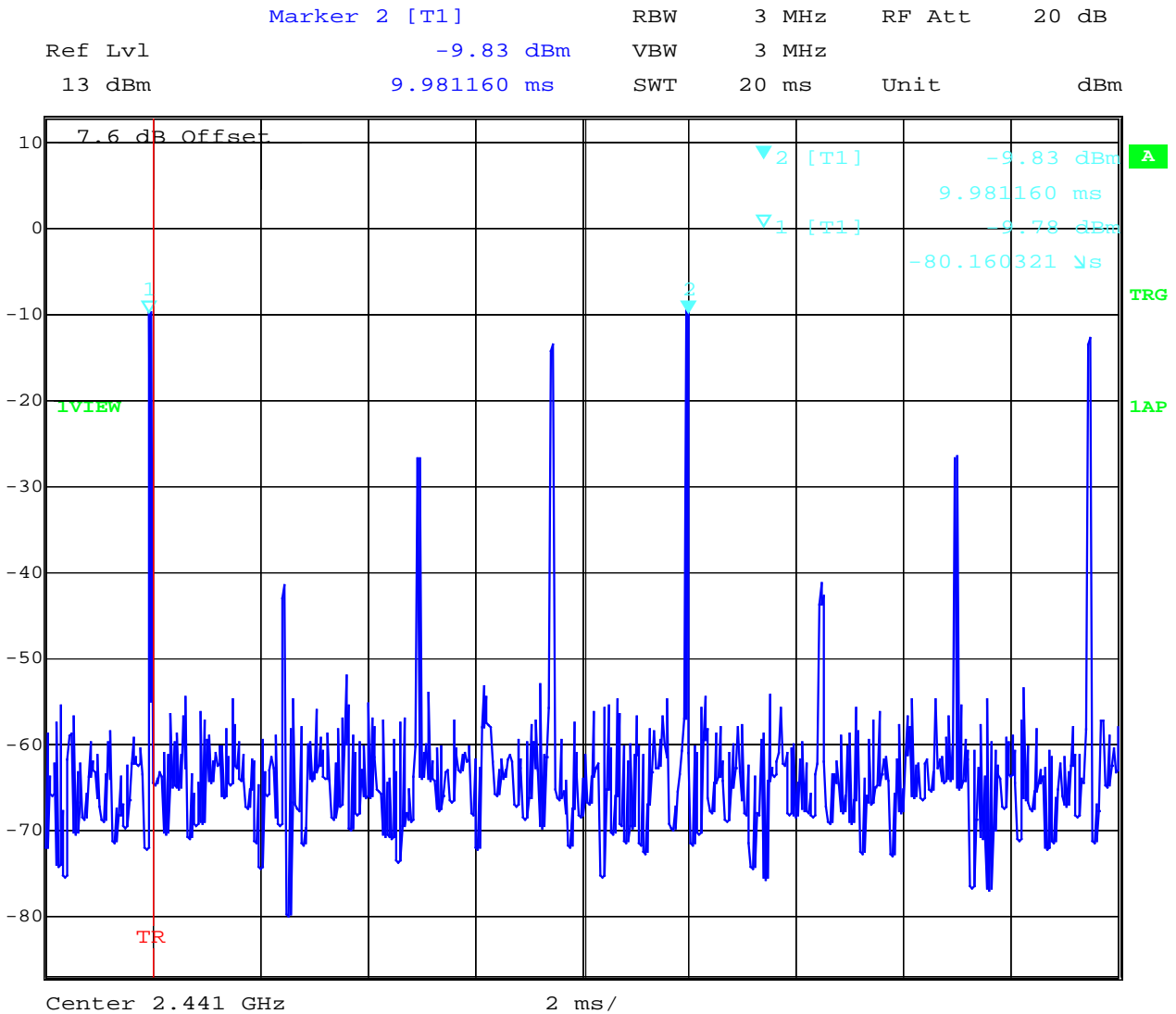


Date: 12.DEC.2002 13:34:50

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Page mode (complete sequence) / Inquiry mode (complete sequence)

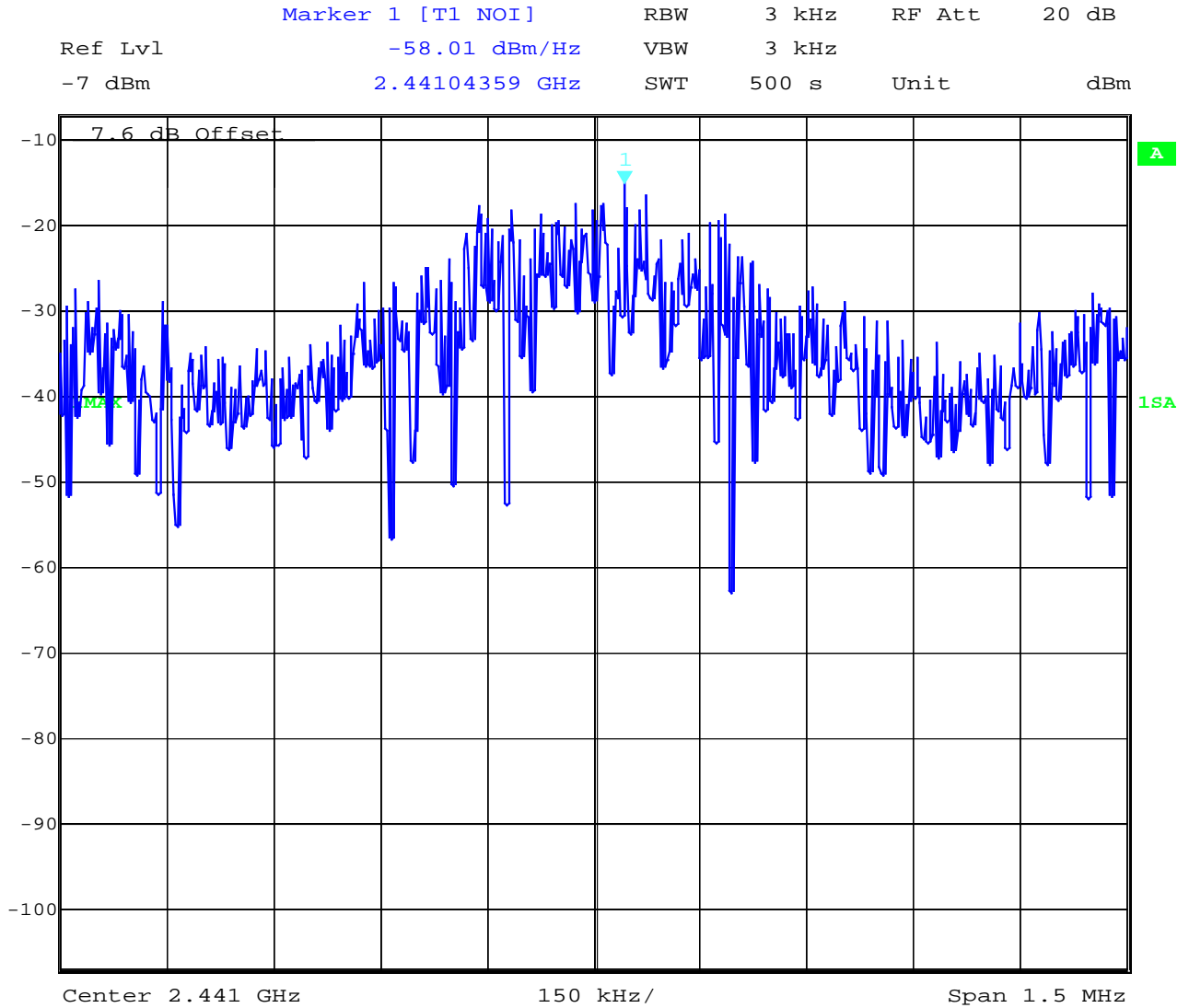


Date: 12.DEC.2002 13:39:25

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

Equipment under test : TEC-BTM
Ambient temperature : 23.3°C
Relative humidity : 30%

Power Spectral density (Hybrid system in Inquiry mode / Page scan) §15.247(d)



Date: 12.DEC.2002 13:20:05

Power density : -58.01 dBm/Hz = -23.21 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 : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Spectrum Bandwidth of a FHSS System

§15.247(a1)

20 dB bandwidth

TEST CONDITIONS		20 dB BANDWIDTH (kHz)		
		2402	2441	2480
Frequency (MHz)				
T _{nom} (23.3)°C	V _{nom} (3.3)V	943.885	955.912	961.924
Measurement uncertainty		±1kHz		

RBW / VBW as provided in the „Measurement Guidelines“ (DA 00-705, March 30, 2000)
 RBW: 10 kHz / VBW 100 kHz

LIMIT

SUBCLAUSE §15.247(a) (1)

The maximum 20dB bandwidth shall be at maximum 1000 KHz

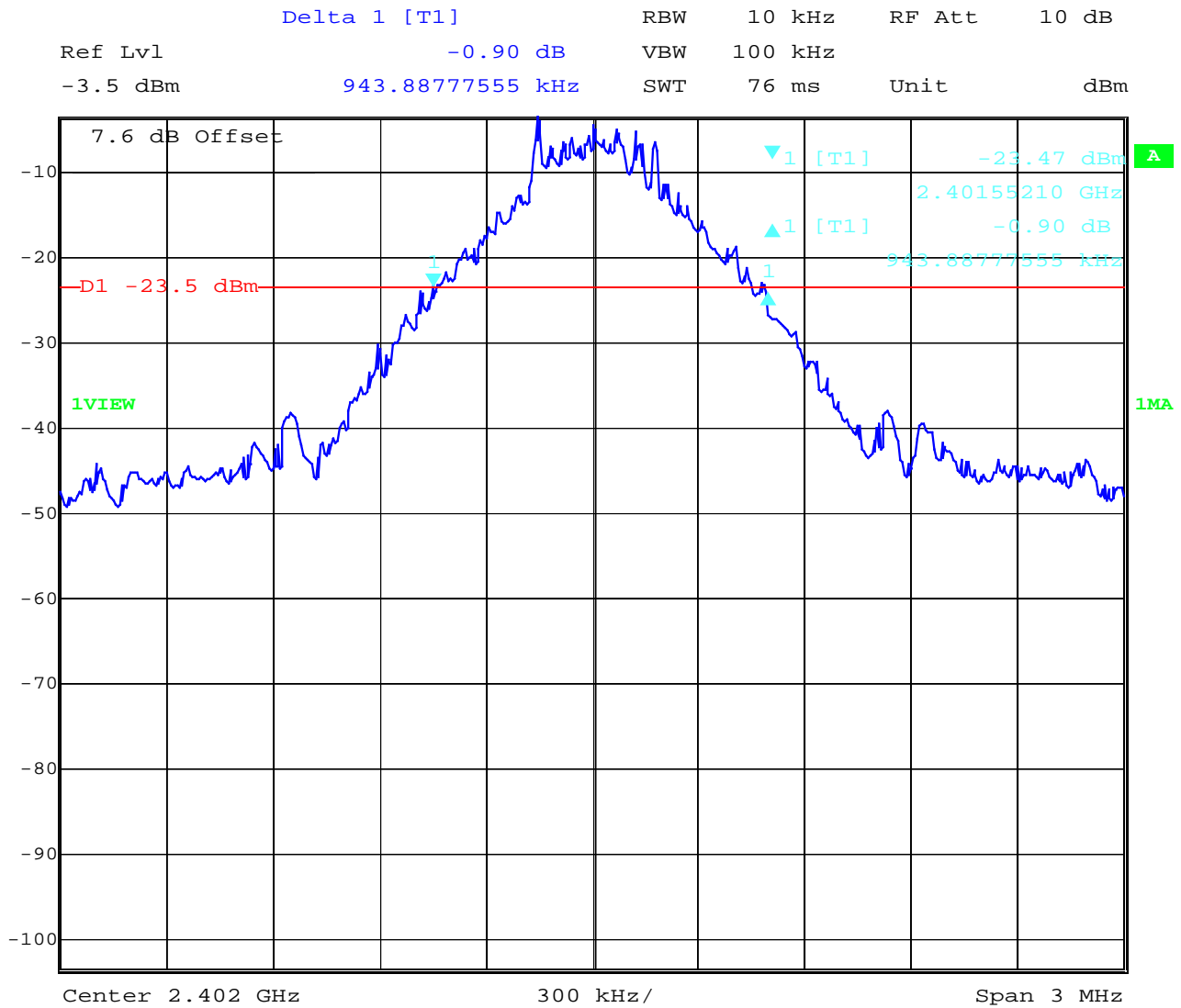
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

**Spectrum Bandwidth of a FHSS System
 20 dB bandwidth**

§15.247(a1)

Channel 1



Date: 12.DEC.2002 10:31:37

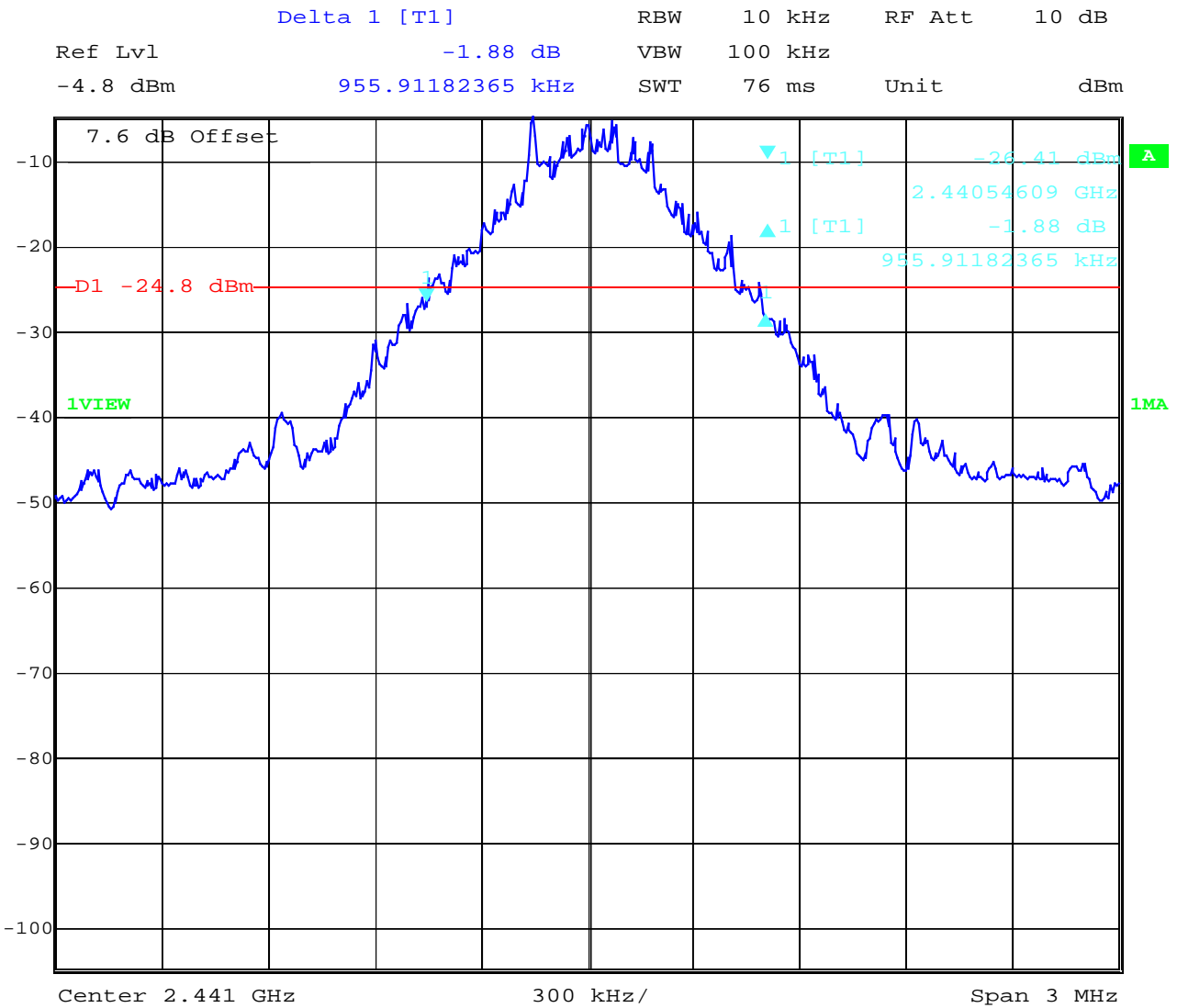
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

**Spectrum Bandwith of a FHSS System
 20 dB bandwidth**

§15.247(a1)

Channel 2



Date: 12.DEC.2002 10:29:41

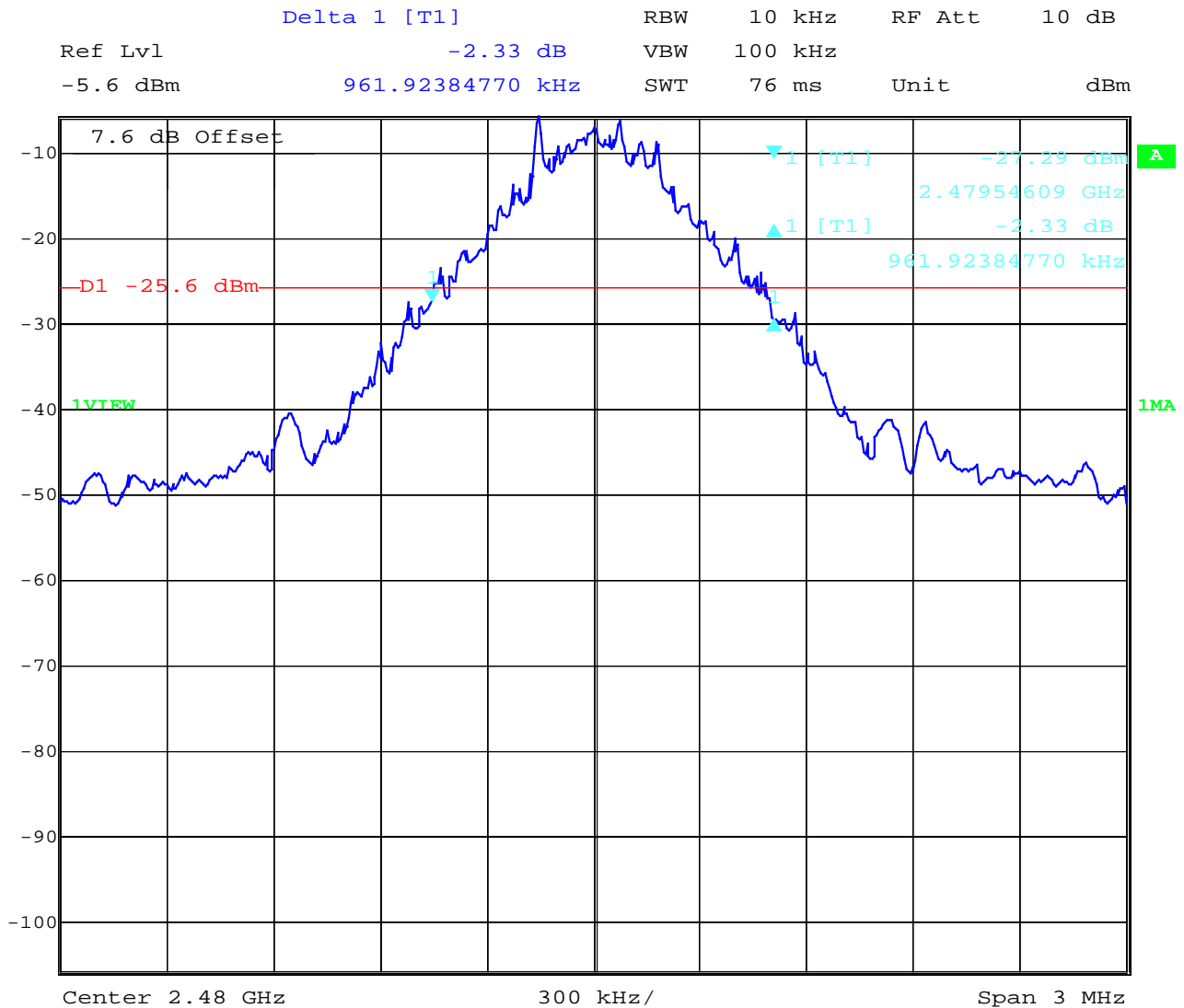
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Spectrum Bandwidth of a FHSS System
 20 dB bandwidth

§15.247(a1)

Channel 3:



Date: 12.DEC.2002 10:27:50

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

**MAXIMUM PEAK OUTPUT POWER
 (conducted)**

SUBCLAUSE § 15.247 (b) (1)

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (mW)			
		2402		2442	2480
Frequency (MHz)		PK	1.449	1.069	0.809
T_{nom} (23.3) °C	V_{nom} (3.3) V	AV			
De facto EIRP (Peak) (Antenna gain 3.2 dBi)		3.03 (+4.81 dBm)	2.23 (+3.49 dBm)	1.69 (2.28 dBm)	
Measurement uncertainty		±3dB			

RBW / VBW : 3 MHz

LIMIT

SUBCLAUSE § 15.247 (b) (1)

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

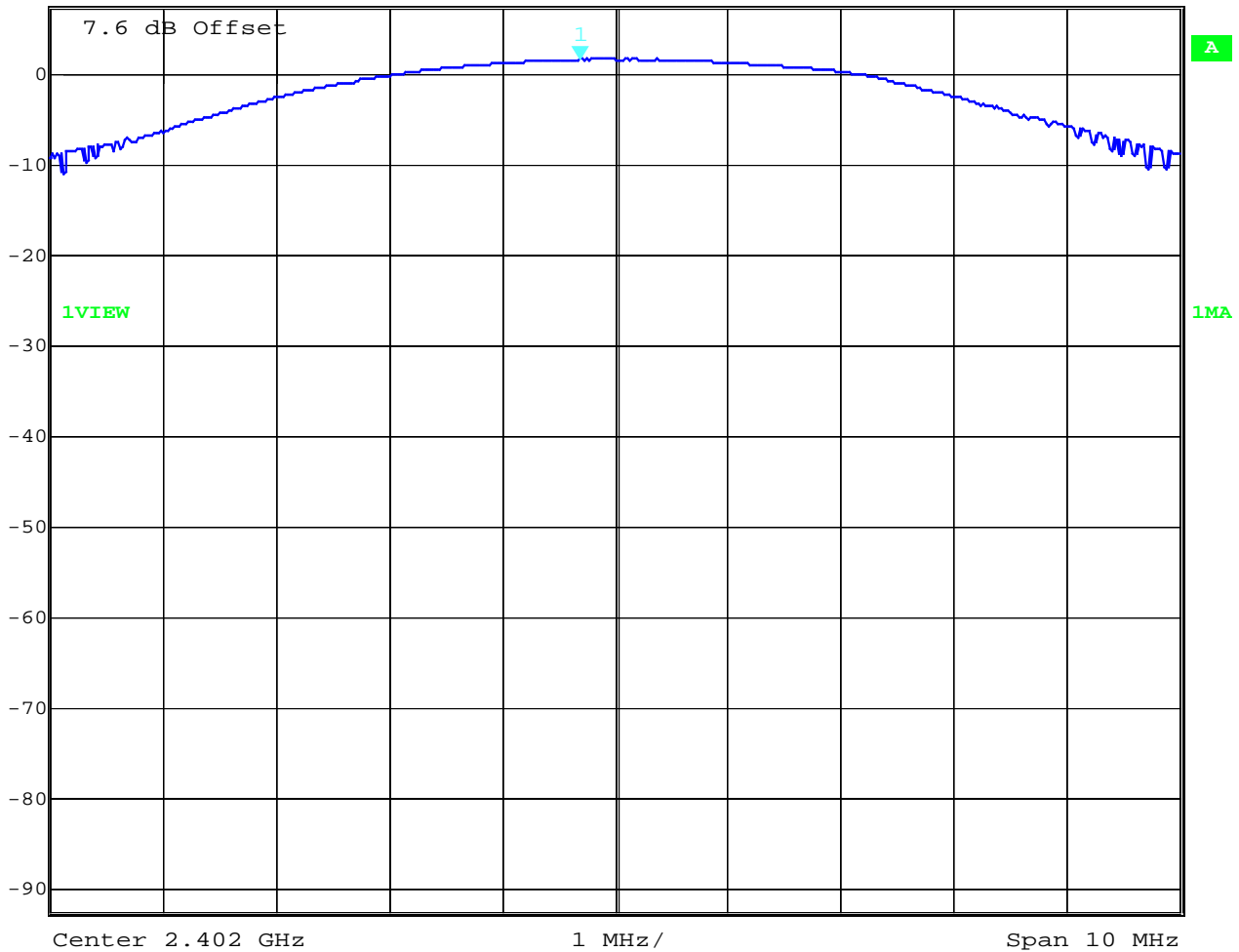
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

MAXIMUM PEAK OUTPUT POWER
 (conducted)
 Channel 1

SUBCLAUSE § 15.247 (b) (1)

Marker 1 [T1] RBW 5 MHz RF Att 30 dB
 Ref Lvl 1.61 dBm VBW 5 MHz
 7.6 dBm 2.40168938 GHz SWT 5 ms Unit dBm



Date: 12.DEC.2002 10:15:01

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

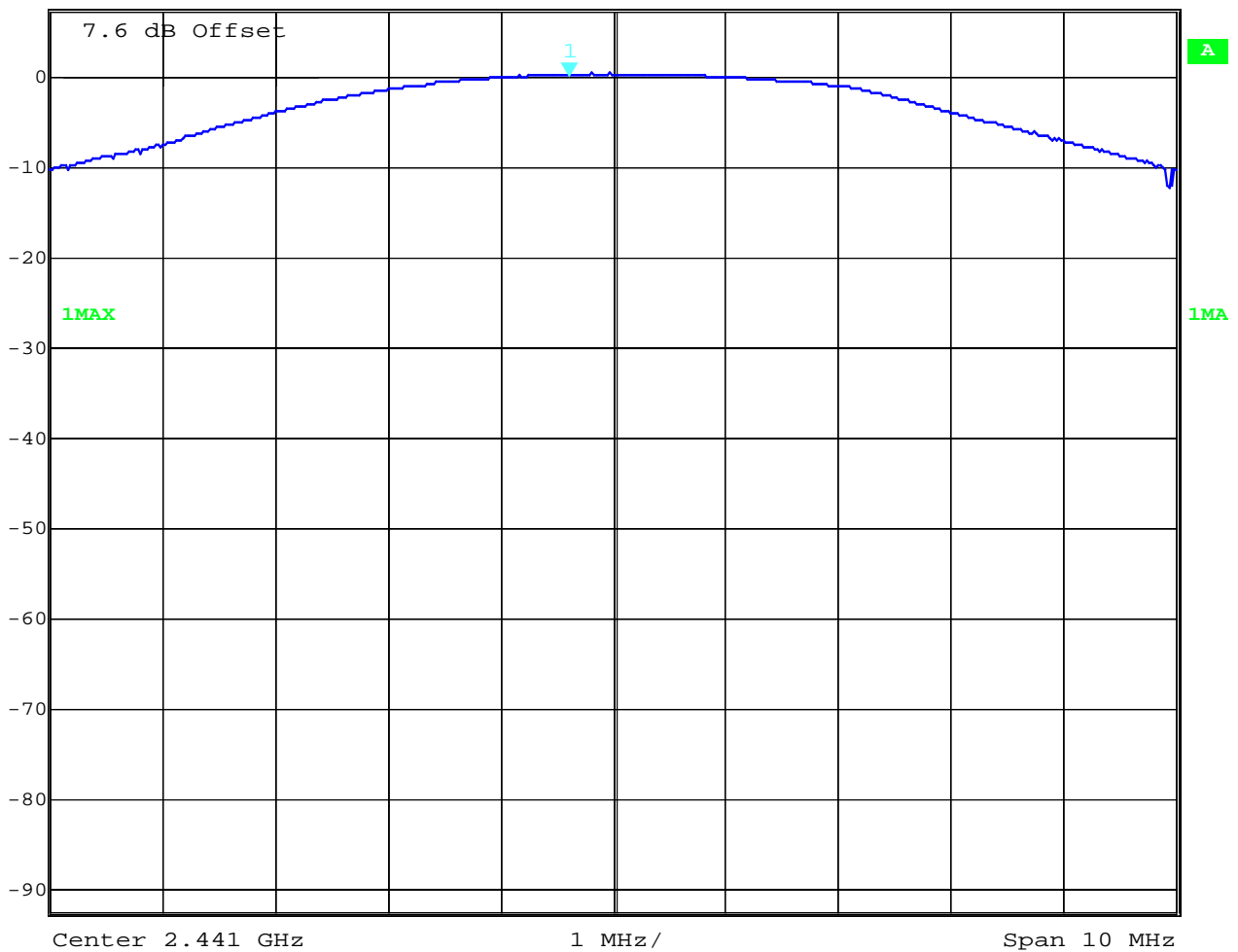
(for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

**MAXIMUM PEAK OUTPUT POWER
 (conducted)
 Channel 2**

SUBCLAUSE § 15.247 (b) (1)

Marker 1 [T1] RBW 5 MHz RF Att 30 dB
 Ref Lvl 0.29 dBm VBW 5 MHz
 7.6 dBm 2.44060922 GHz SWT 5 ms Unit dBm



Date: 12.DEC.2002 10:15:43

LIMIT

SUBCLAUSE § 15.247 (b) (1)

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

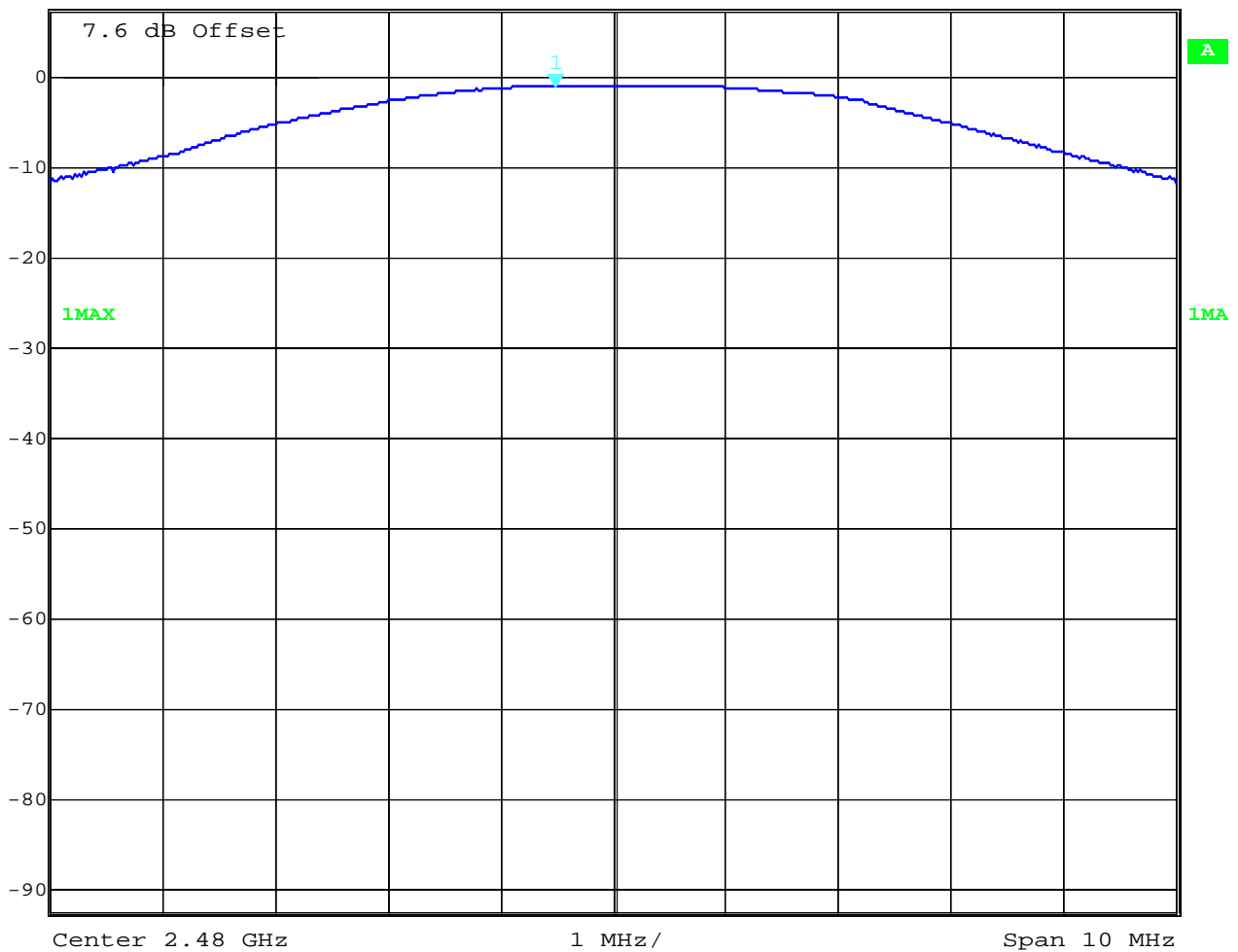
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

**MAXIMUM PEAK OUTPUT POWER
 (conducted)
 Channel 3**

SUBCLAUSE § 15.247 (b) (1)

Marker 1 [T1] RBW 5 MHz RF Att 30 dB
 Ref Lvl -0.92 dBm VBW 5 MHz
 7.6 dBm 2.47948898 GHz SWT 5 ms Unit dBm



Date: 12.DEC.2002 10:16:20

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 : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

**MAXIMUM PEAK OUTPUT POWER
 (RADIATED)**

SUBCLAUSE § 15.247 (b) (1)

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER		
		EIRP (mW)		
Frequency (MHz)		2402	2441	2480
T _{nom} (23.3)°C	V _{nom} (3.3)V	2.05	1.58	1.12
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)

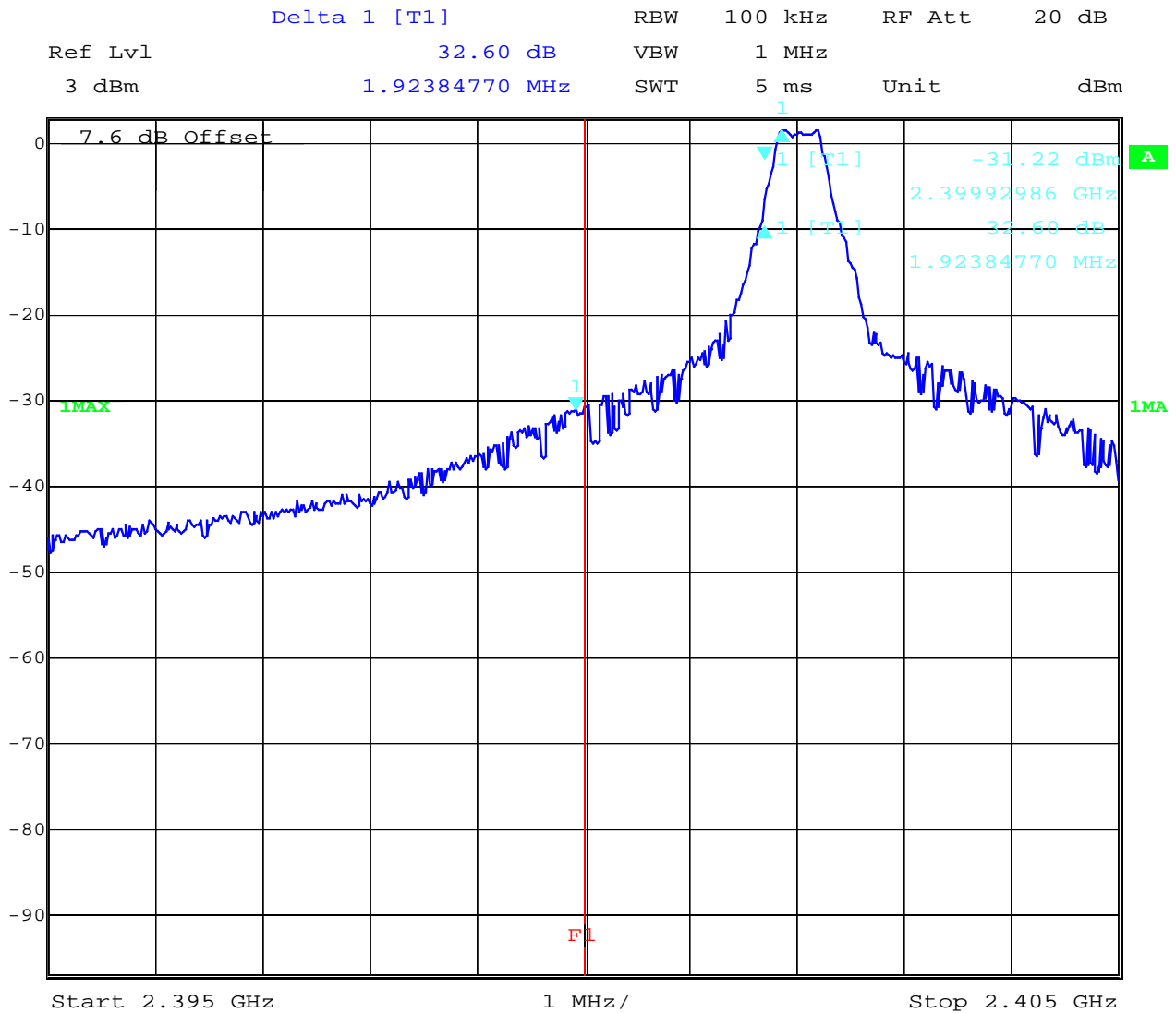
Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Band-edge compliance of conducted emissions

§15.247 (c)

Low frequency section (hopping off)



Date: 12.DEC.2002 10:56:19

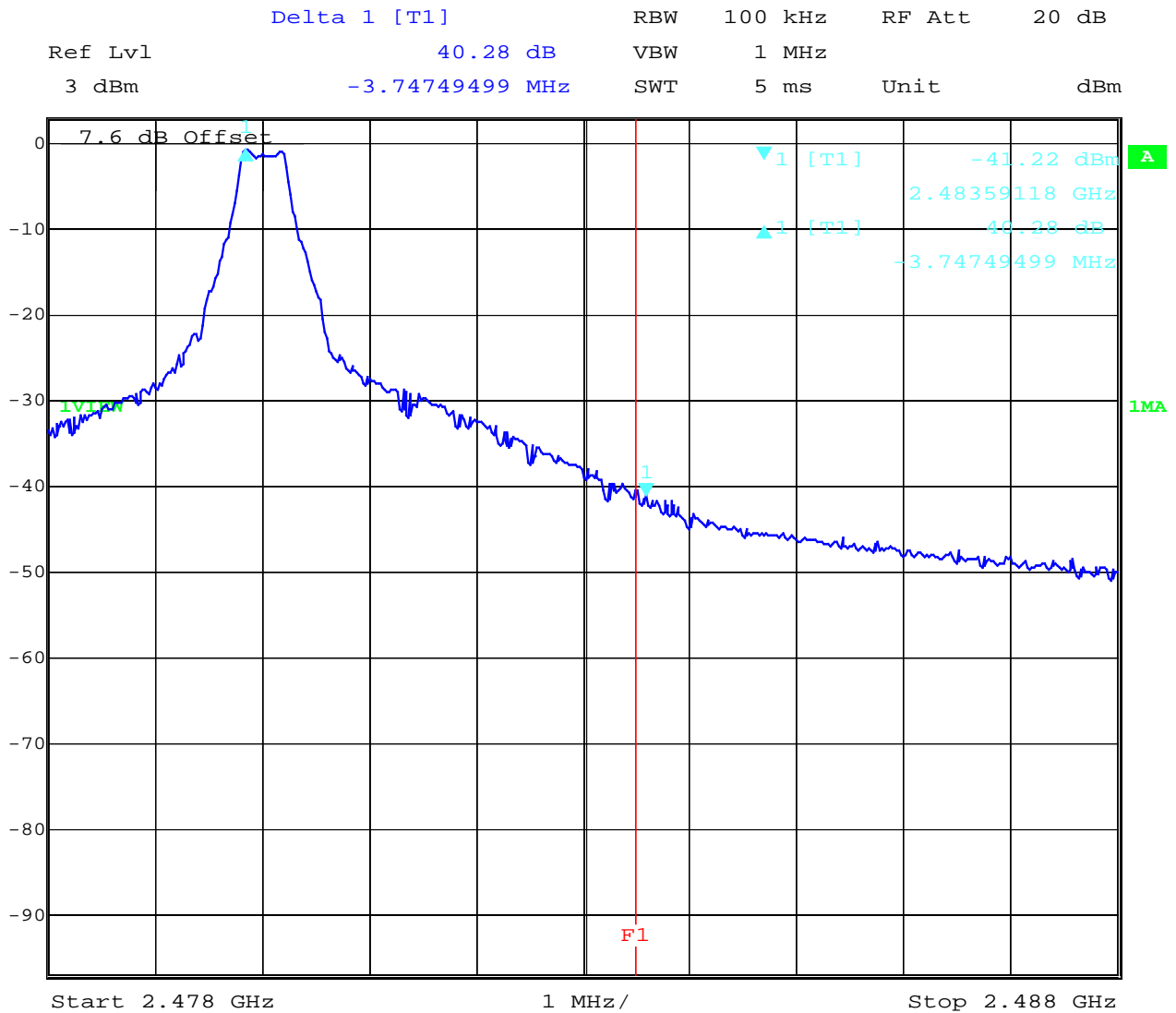
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Band-edge compliance of conducted emissions

§15.247 (c)

high frequency section (hopping off)



Date: 12.DEC.2002 10:50:27

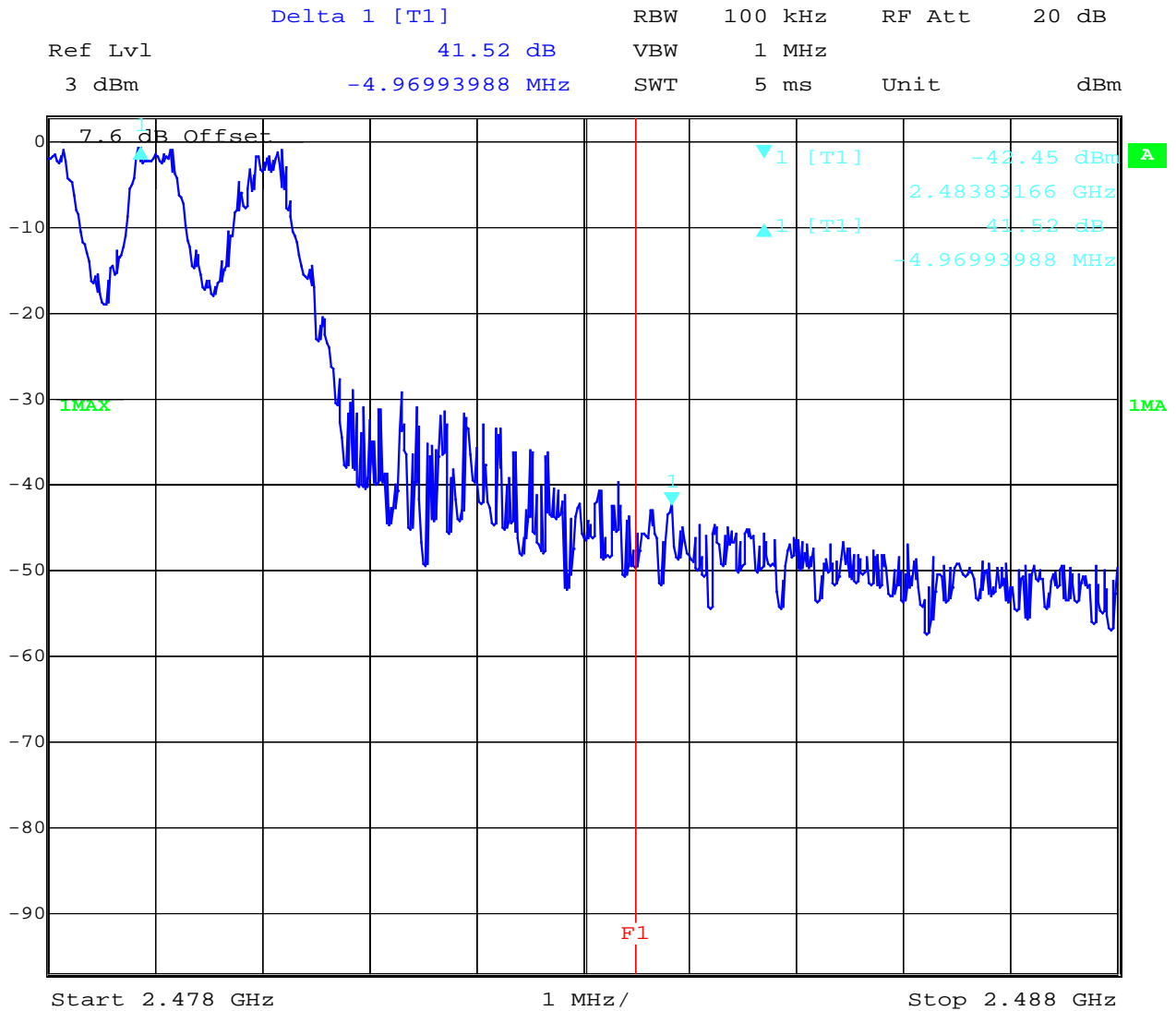
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

Band-edge compliance of conducted emissions

§15.247 (c)

high frequency section (hopping on)

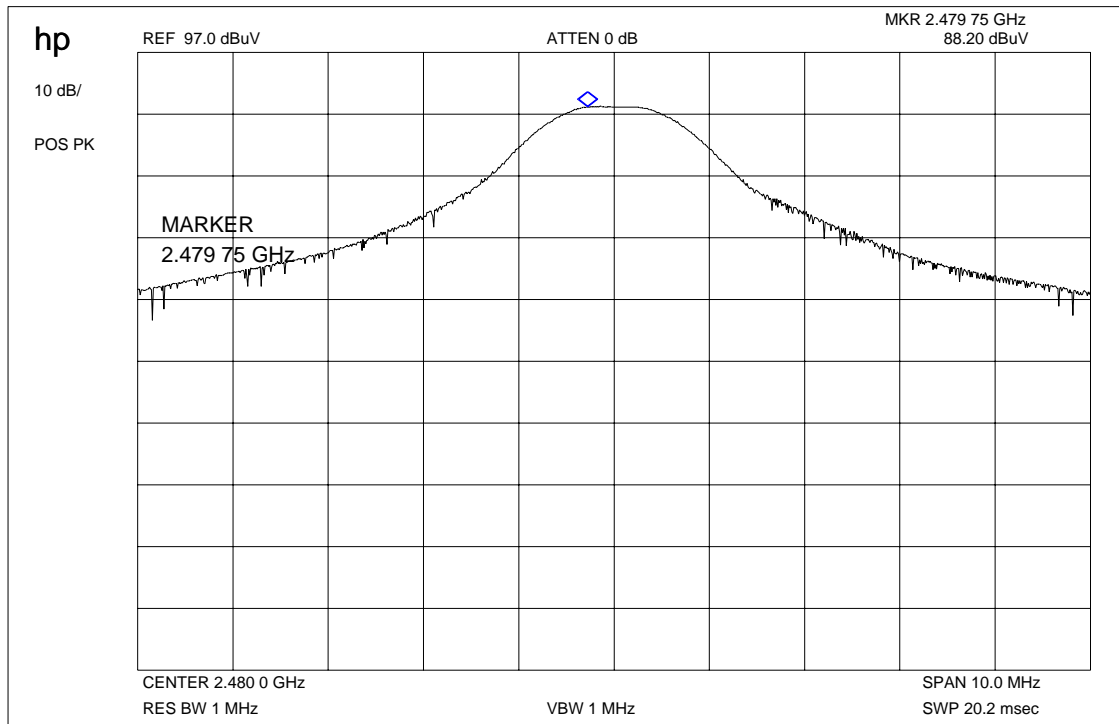


Date: 12.DEC.2002 10:53:27

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

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

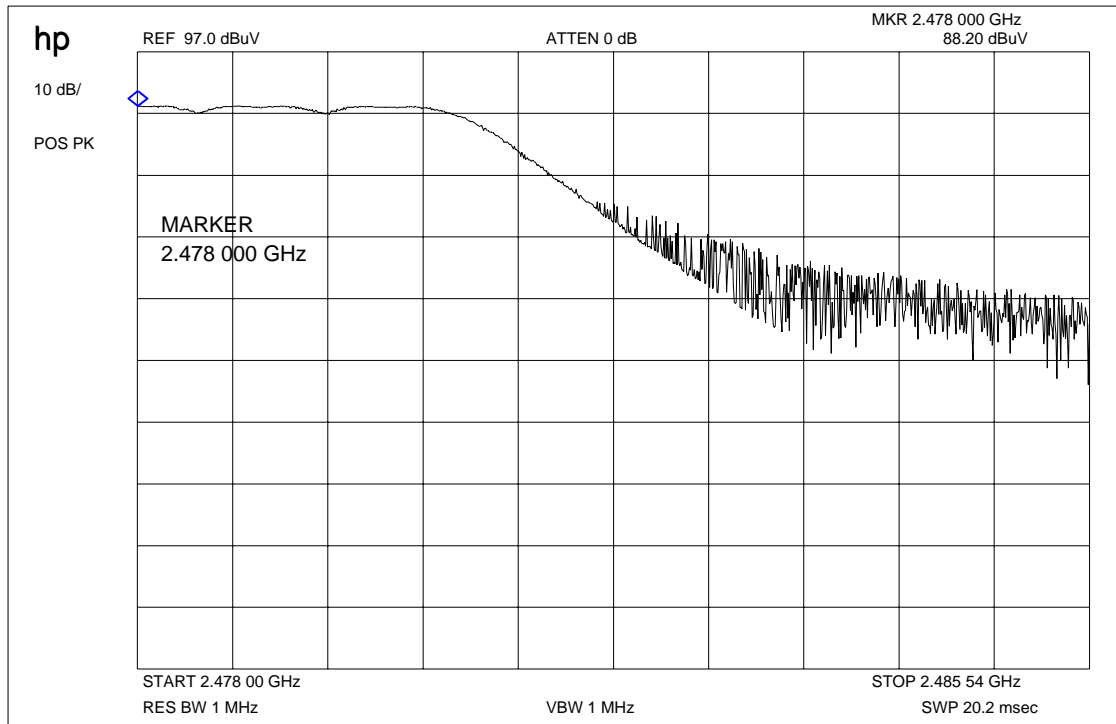


Frequency	Meter reading	Cable loss	Antenna factor	Results
2480 MHz	88.20 dB μ V	7.8 dB	8.9	104.9 dB μ V/m

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

**Band-edge compliance radiated
 Max field strength in 3m distance
 (hopping mode)**



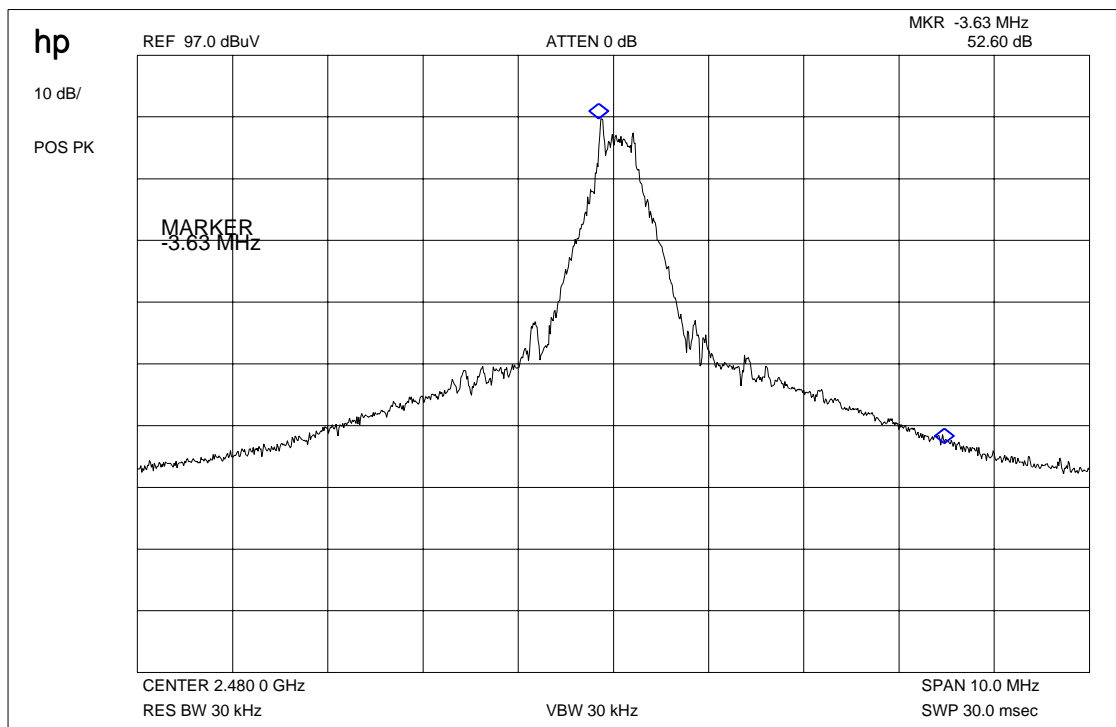
Frequency	Meter reading	Cable loss	Antenna factor	Results
2478 MHz	88.20 dB μ V	7.8 dB	8.9	104.9 dB μ V/m

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

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

Equipment under test : TEC-BTM
Ambient temperature : 23.3°C
Relative humidity : 30%

Band-edge compliance radiated Marker-Delta Method (single carrier)



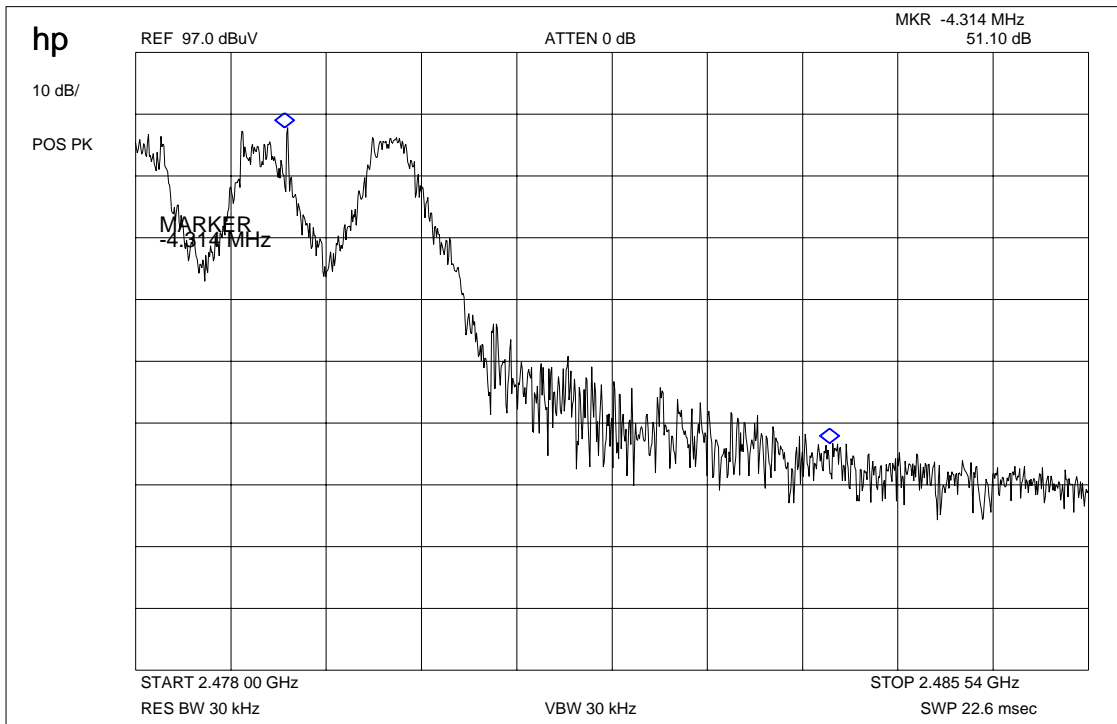
This measurement was made to show that the behavior of the system is conform to

FCC 15.205 (restricted bands)

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

Equipment under test : TEC-BTM
Ambient temperature : 23.3°C
Relative humidity : 30%

**Band-edge compliance radiated
Marker-Delta Method (hopping mode)**



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

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

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.

The correction factor is the summation of path loss, cable loss, antenna gain and amplifier gain.

The value at 2480 MHz is +16.7 dB.

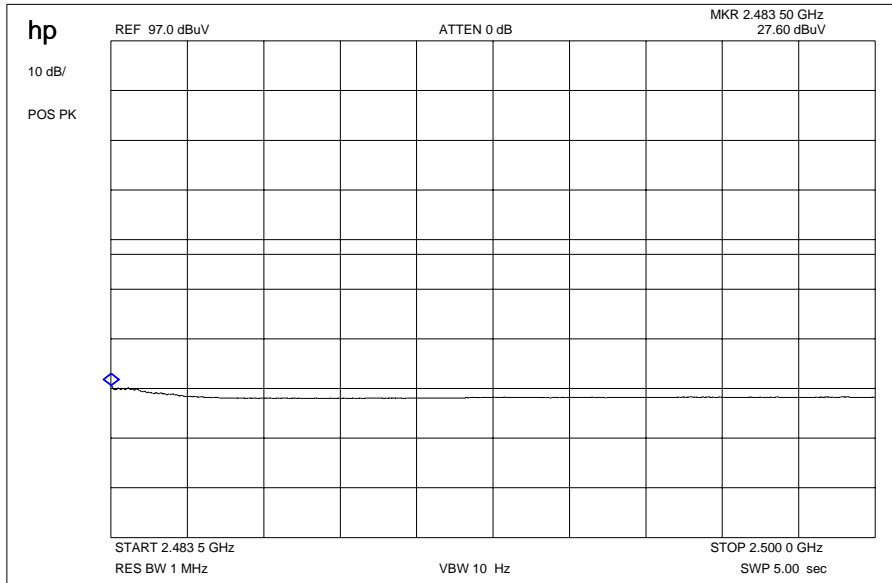
high channel	setup	measured value (3m)	correction factor (3m)	calculated value (3m)
Max. peak value	1 MHz RBW 1 MHz VBW	88.20 dBµV/m	16.7 dB	104.9 dBµV/m
Max. average value	Calculated with duty cycle correction factor	104.9 dBµV/m peak	-3.4 dB duty cycle correction factor	101.5 dBµV/m
Delta value	Peak 30 kHz RBW/VBW	52.60 dB (single carrier) 51.10 dB (hopping mode)	-	-
Value at band edge	limit 54 dBµV/m			48.9 dBµV/m (single carrier) 50.4 dBµV/m (hopping mode)
Statement:				Complies

The product complies with the limit of the restricted bands.

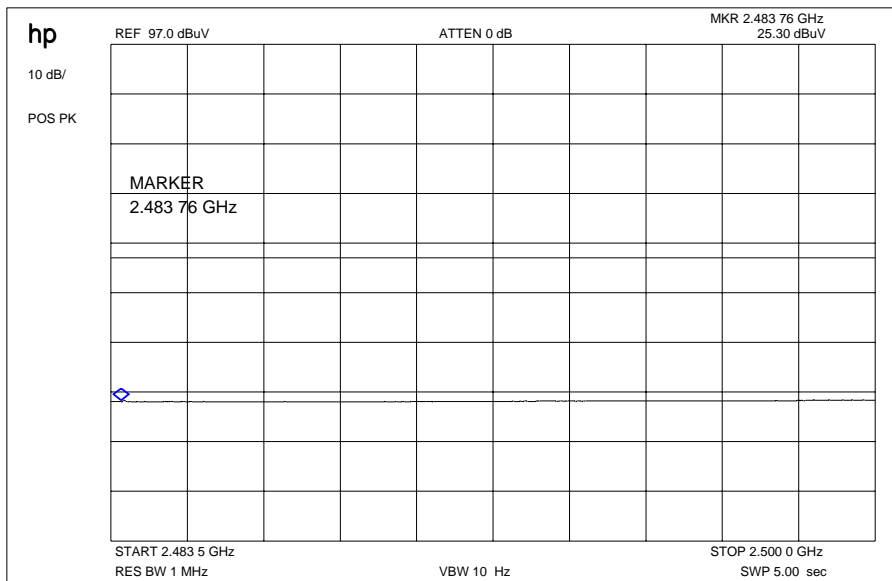
Delta marker plots see above pages

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

**Band-edge compliance radiated (average)
 Restricted band (no hopping)**



hopping mode



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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS- Conducted (Transmitter)

§ 15.247 (c) (1)

EMISSION LIMITATIONS					
f (MHz)	amplitude of emission (dBm)	limit max. allowed emmission power	actual attenuation below frequency of operation (dB)	results	
2402	1.61	30 dBm	-	Operating frequency	
4809.6	-50.41	-20 dBc (-18.39 dBm)	52.02	complies	
7214.4	-38.90		40.51	complies	
12024.1	-56.42		58.03	complies	
2441	+0.29	30 dBm	-	Operating frequency	
4847.3	-54.26	-20 dBc (-19.71 dBm)	54.55	complies	
7302.2	-32.15		32.44	complies	
12212.0	-53.51		53.80	complies	
2480	-0.91	30 dBm		Operating frequency	
4947.5	-48.08	-20 dBc (-20.91 dBm)	47.17	complies	
7402.4	-30.73		29.82	complies	
12362	-54.10		53.19	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)

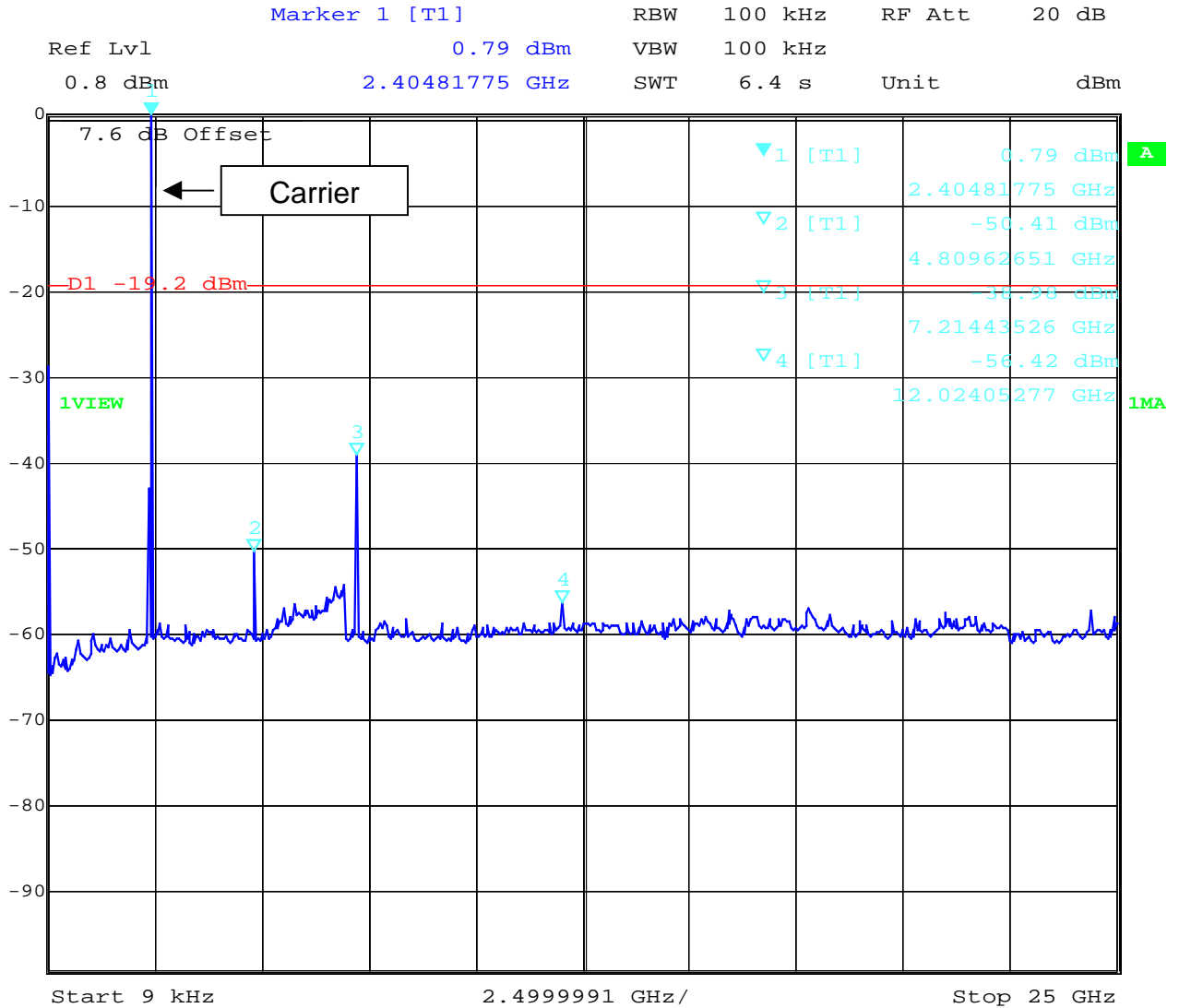
In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS- Conducted (Transmitter)
Channel 1: 9 kHz - 25 GHz

§ 15.247 (c) (1)



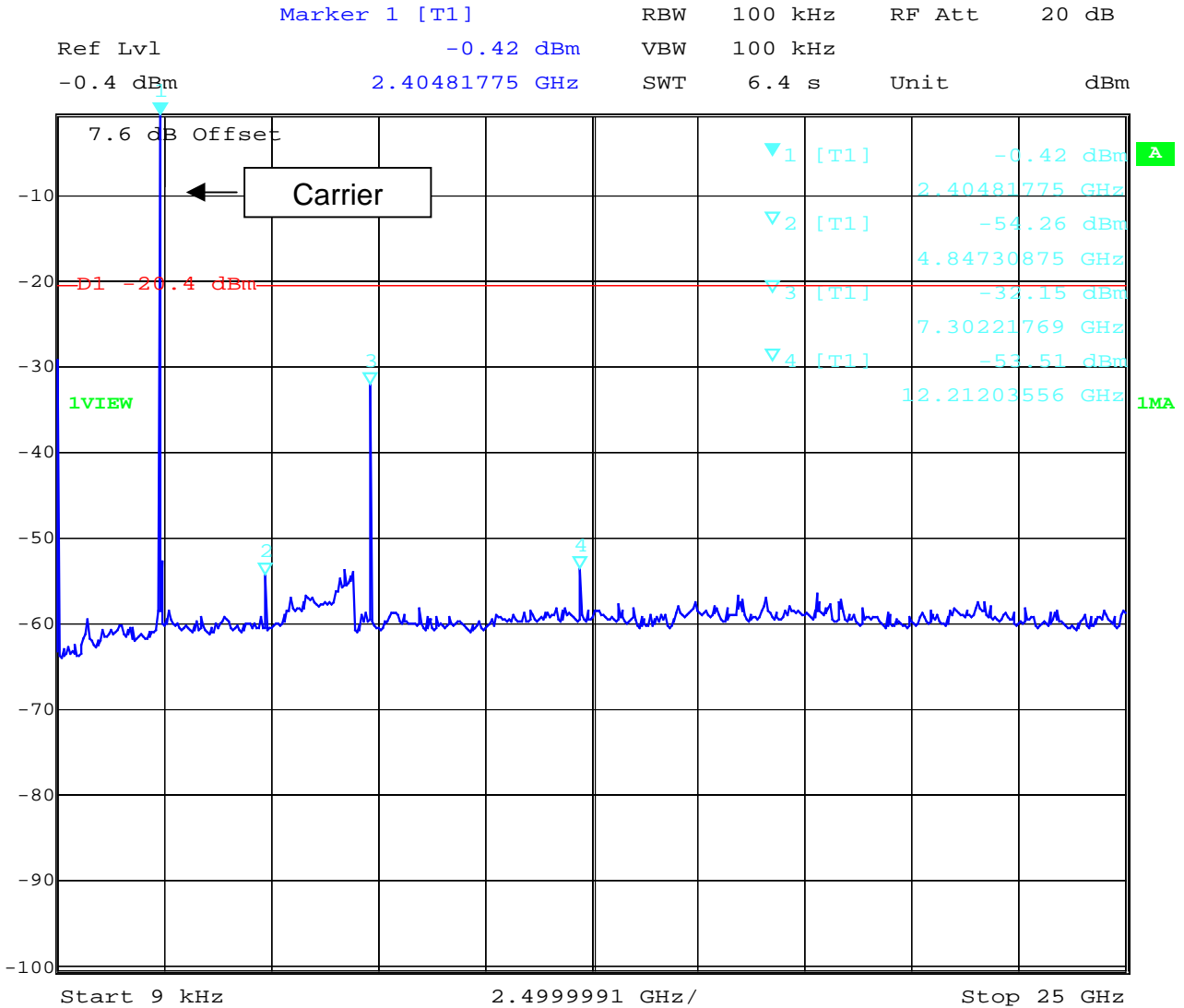
Date: 12.DEC.2002 10:38:13
RBW:100 kHz / VBW: 100 kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)
 17 - 24, 64

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS- Conducted (Transmitter)
Channel 2: 9 kHz – 25 GHz

§ 15.247 (c) (1)



Date: 12.DEC.2002 10:43:25

RBW:100 kHz / VBW: 100 kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

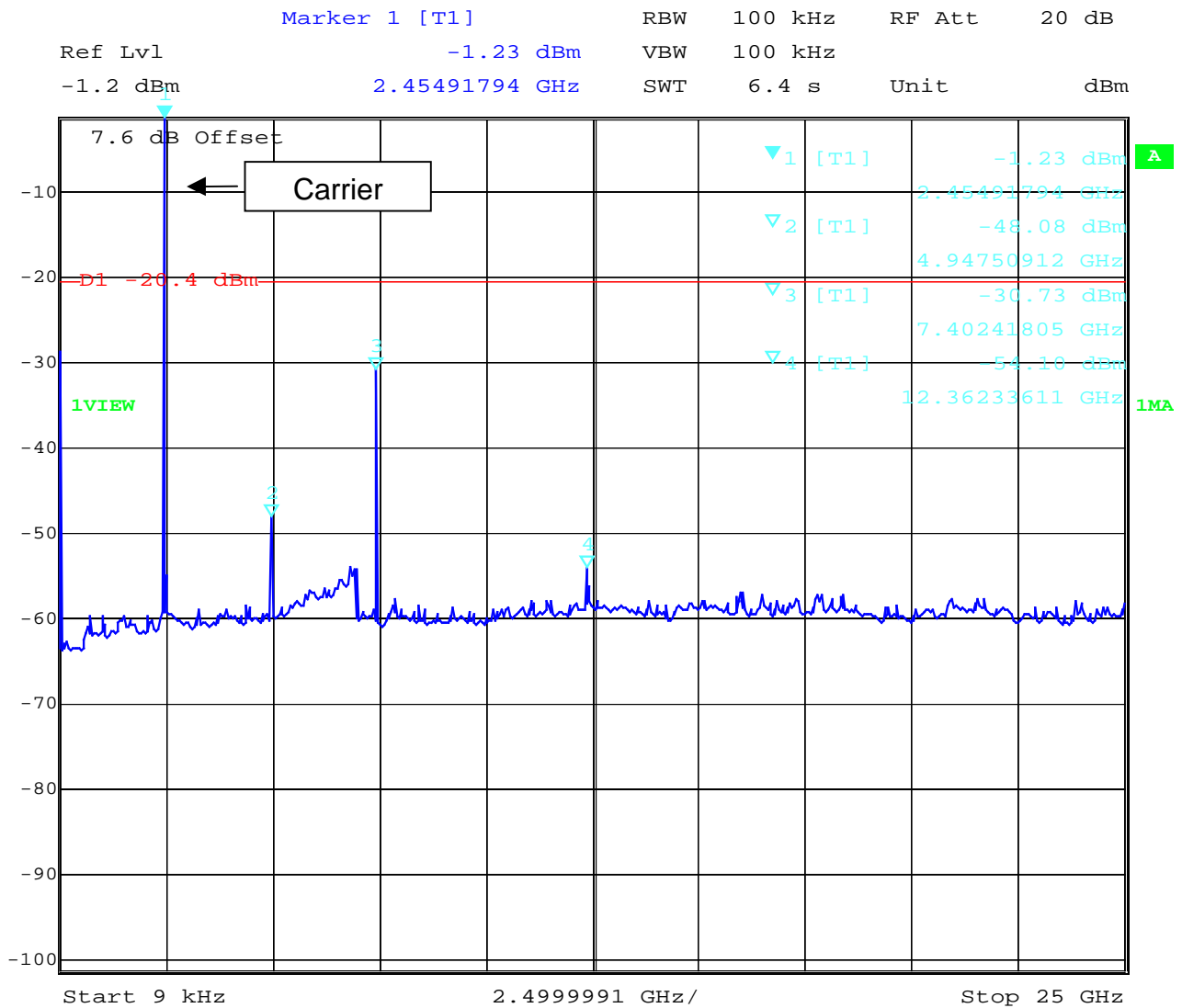
17 – 24, 64

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS- Conducted (Transmitter)

§ 15.247 (c) (1)

Channel 3: 9kHz – 25 GHz



Date: 12.DEC.2002 10:46:50

RBW:100 kHz / VBW: 100 kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

SPURIOUS RADIATED EMISSION

§ 15.247 (c) (1)

SPURIOUS EMISSIONS LEVEL (µV/m)								
2402 MHz			2441 MHz			2480 MHz		
f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)
No	peak	found	No	peak	found	No	peak	found
Measurement uncertainty			±3 dB					

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)).

Limits

SUBCLAUSE § 15.209

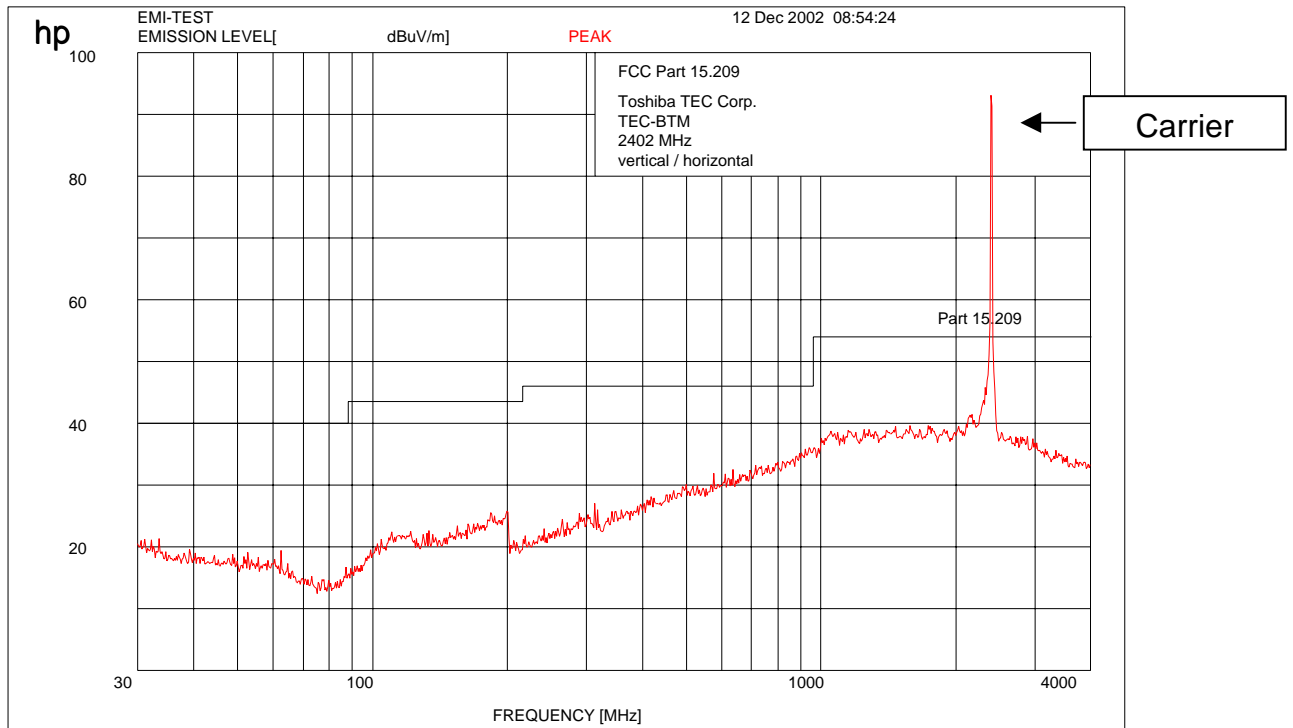
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

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

Equipment under test : TEC-BTM
Ambient temperature : 23.3°C
Relative humidity : 30%

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)

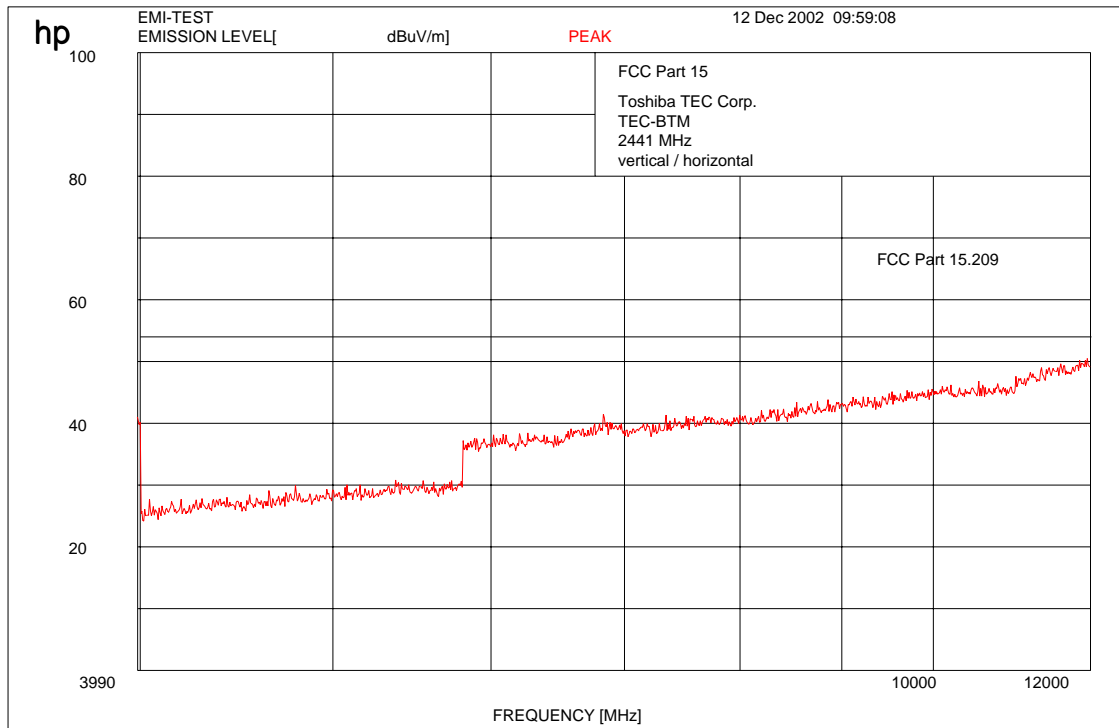
In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

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)).

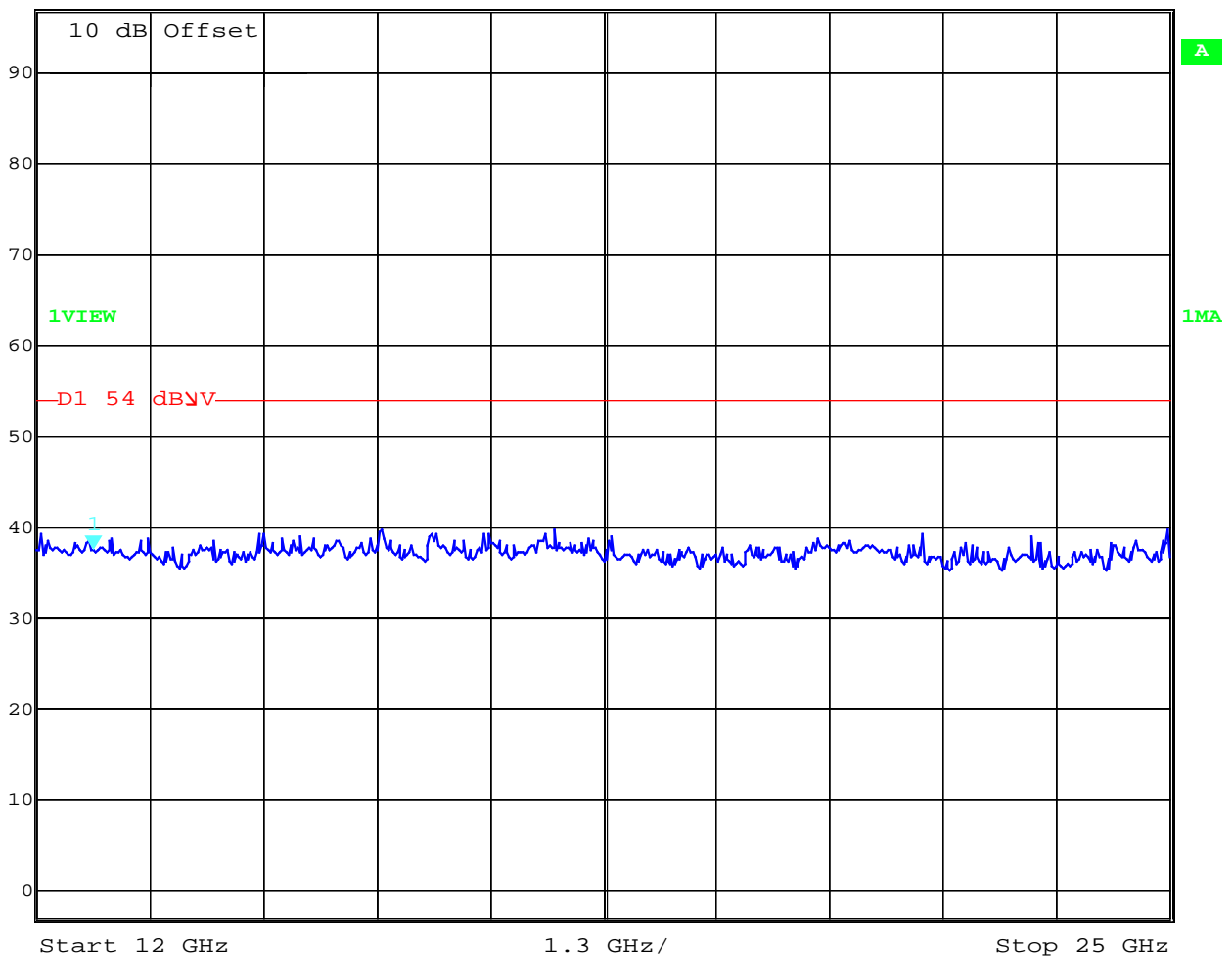
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
 (for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS 2402 MHz

SUBCLAUSE § 15.247 (c) (1)

	Marker 1 [T1]	RBW	1 MHz	RF Att	0 dB
Ref Lvl	37.64 dBµV	VBW	1 MHz		
97 dBµV	12.65130261 GHz	SWT	74 ms	Unit	dBµV



Date: 12.DEC.2002 10:00:13
 f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

LIMITS

SUBCLAUSE § 15.247 (c)

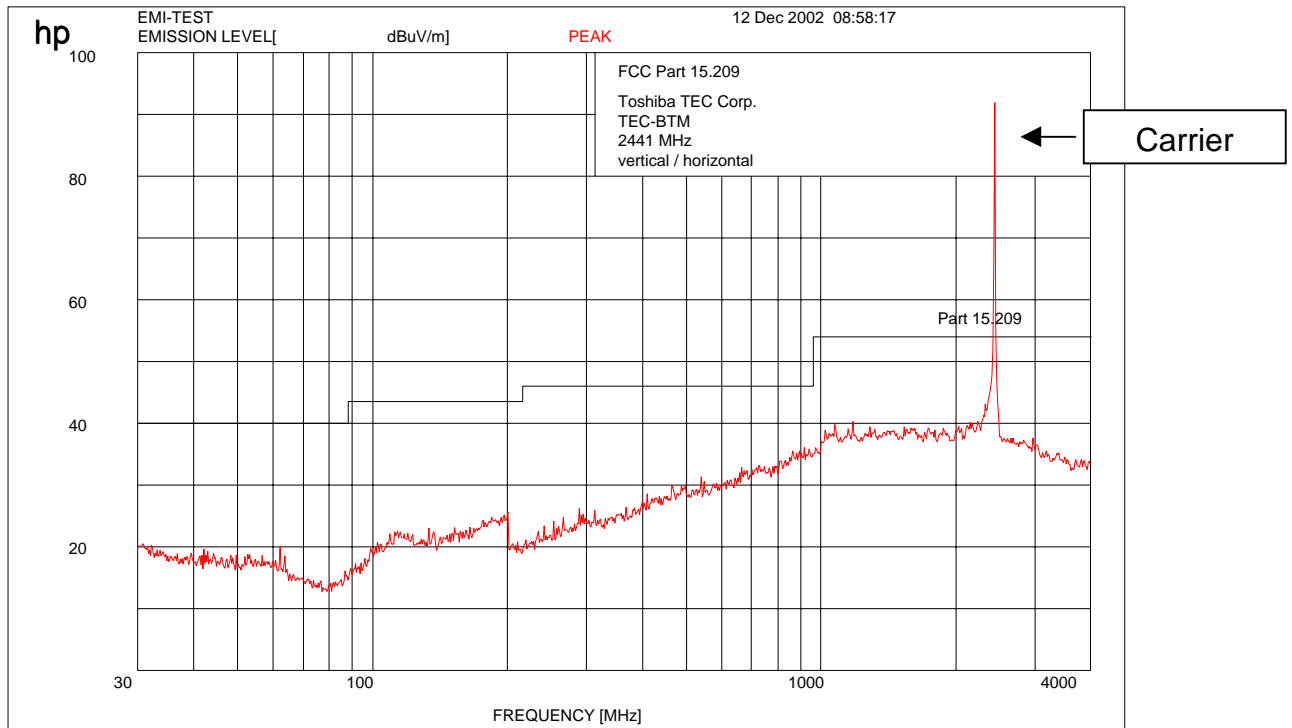
In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

Equipment under test : TEC-BTM
Ambient temperature : 23.3°C
Relative humidity : 30%

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)

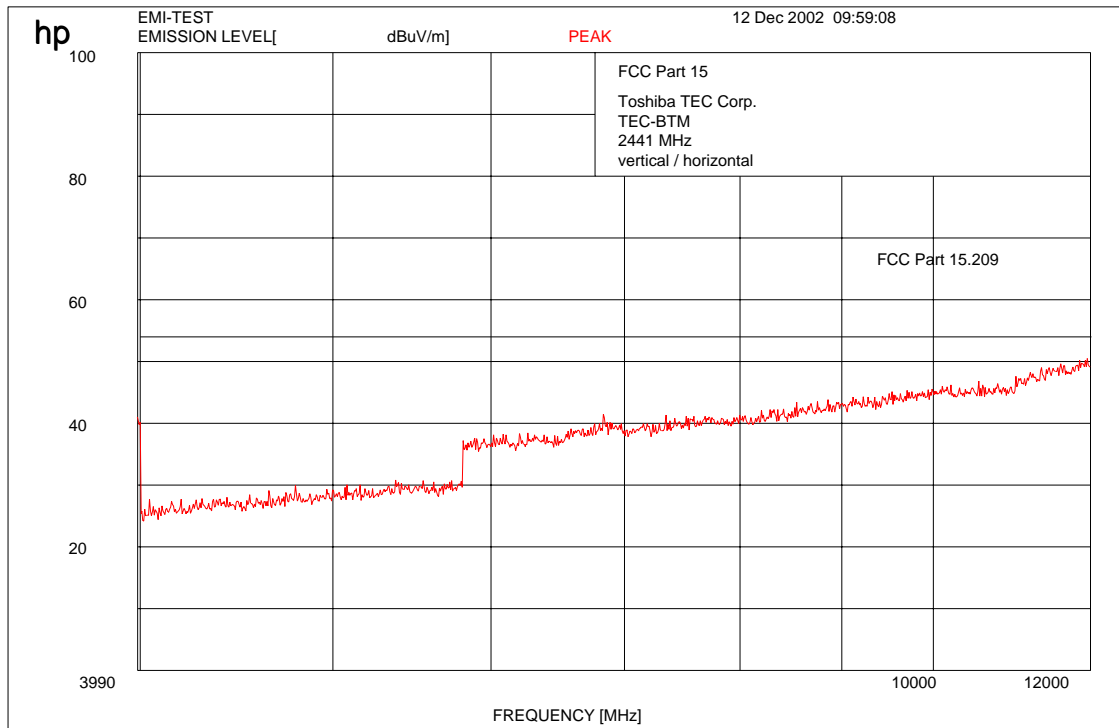
In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS
2441 MHz

SUBCLAUSE § 15.247 (c) (1)



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

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

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)

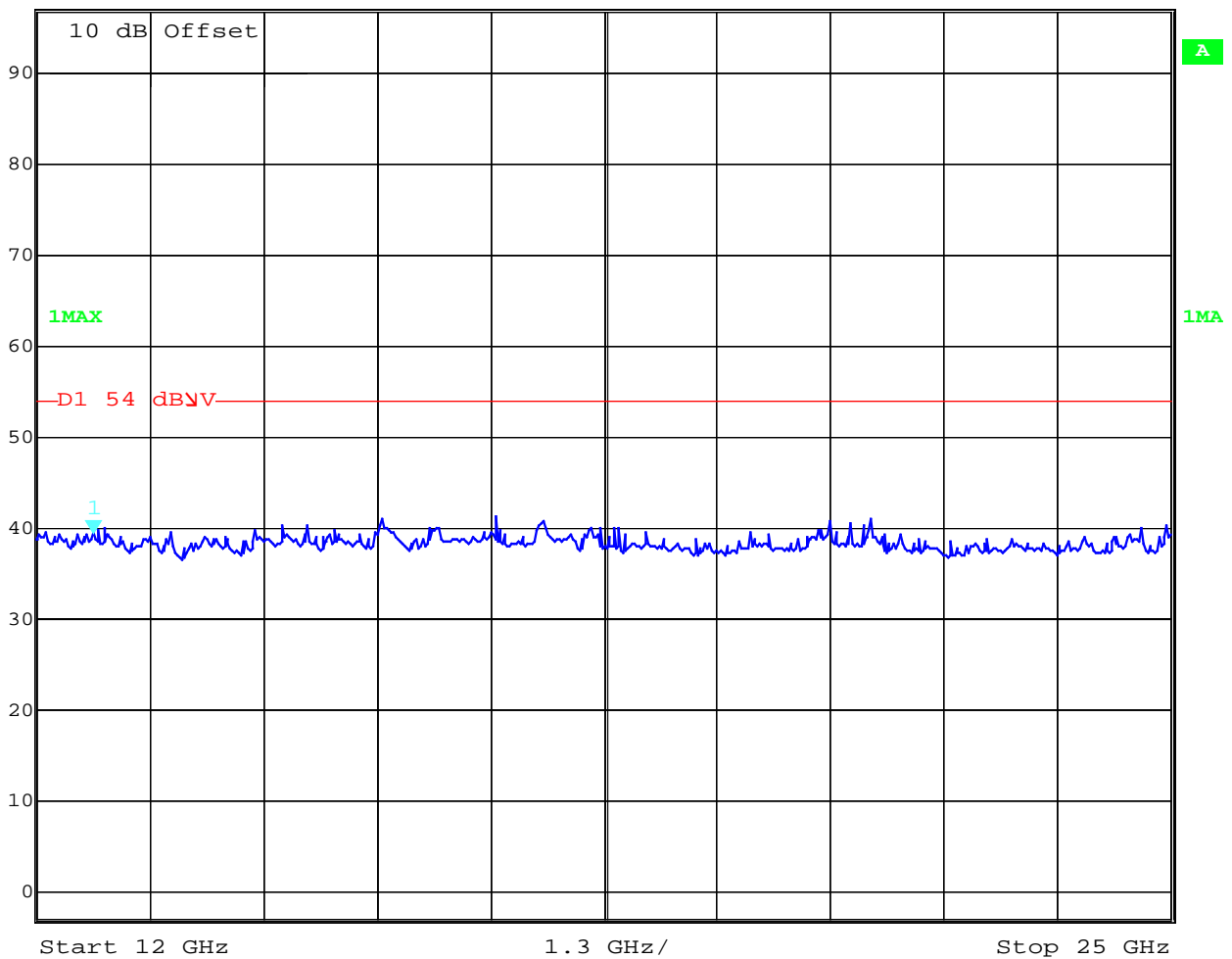
Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS

SUBCLAUSE § 15.247 (c) (1)

2441 MHz

Marker 1 [T1] RBW 1 MHz RF Att 0 dB
 Ref Lvl 39.33 dBµV VBW 1 MHz
 97 dBµV 12.65130261 GHz SWT 74 ms Unit dBµV



Date: 12.DEC.2002 09:59:54
 f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

LIMITS

SUBCLAUSE § 15.247 (c)

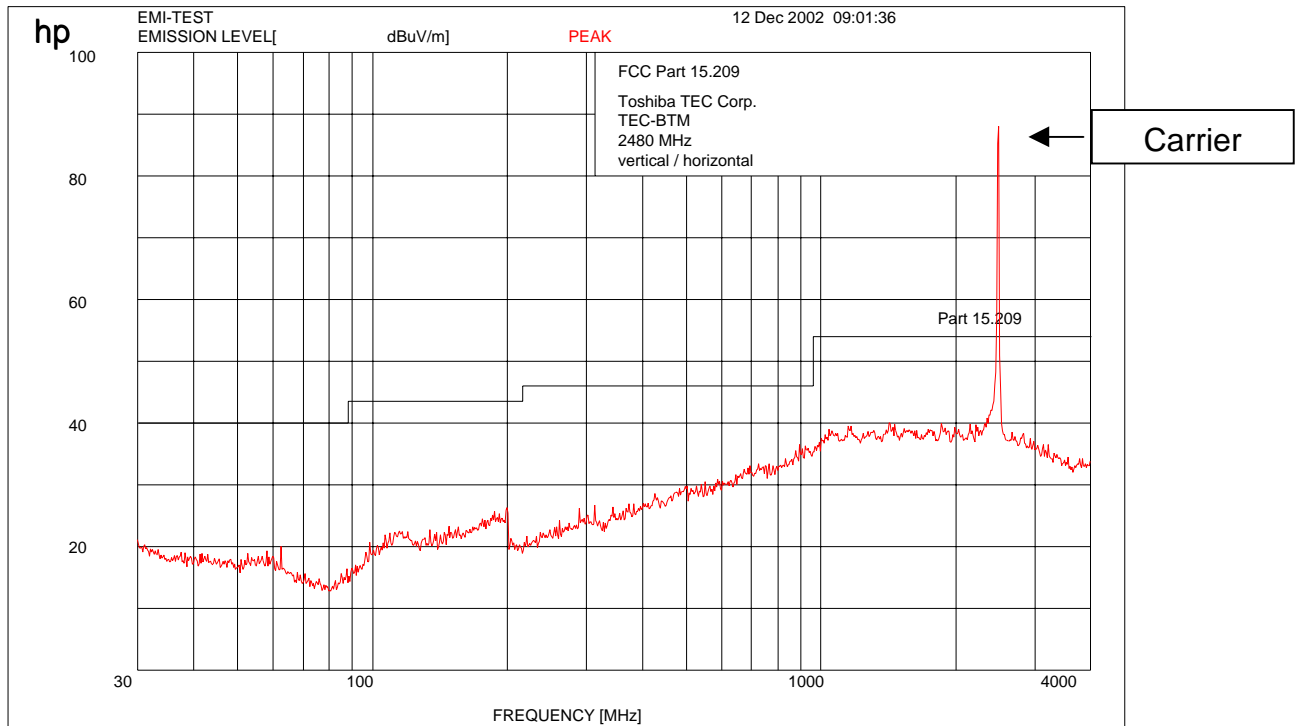
In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

Equipment under test : TEC-BTM
Ambient temperature : 23.3°C
Relative humidity : 30%

EMISSION LIMITATIONS
2480 MHz

SUBCLAUSE § 15.247 (c) (1)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

LIMITS

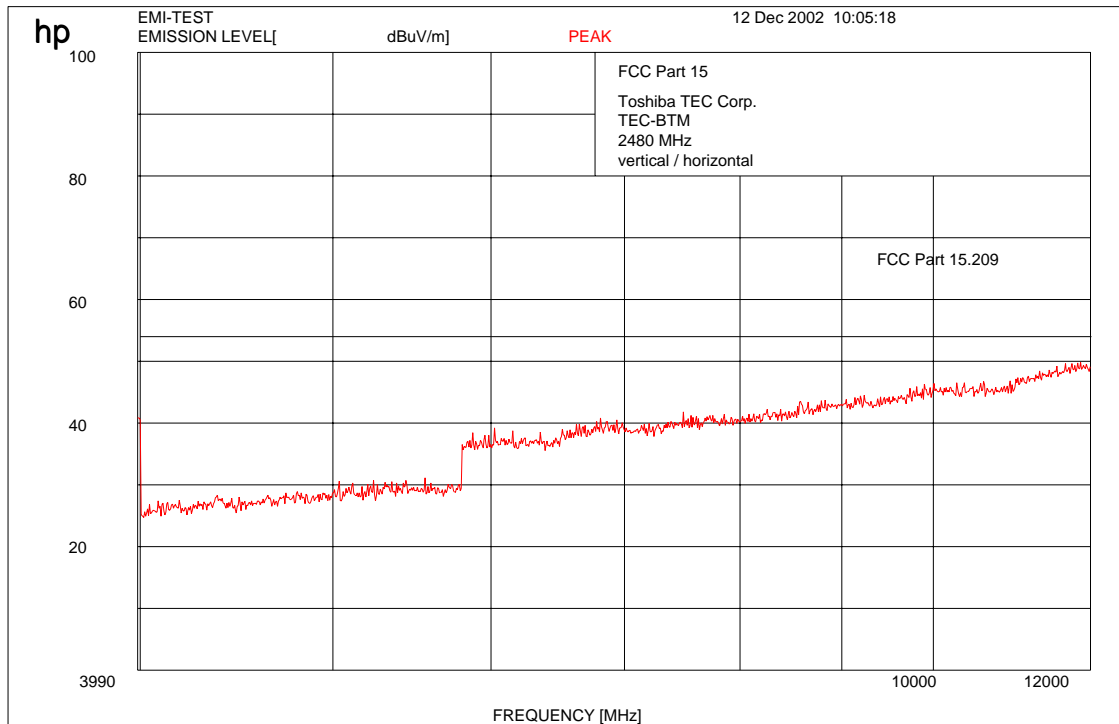
SUBCLAUSE § 15.247 (c)

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)

Equipment under test : TEC-BTM
Ambient temperature : 23.3°C
Relative humidity : 30%

EMISSION LIMITATIONS (Transmitter/Receiver) SUBCLAUSE § 15.247 (c) (1)
2480 MHz



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)).

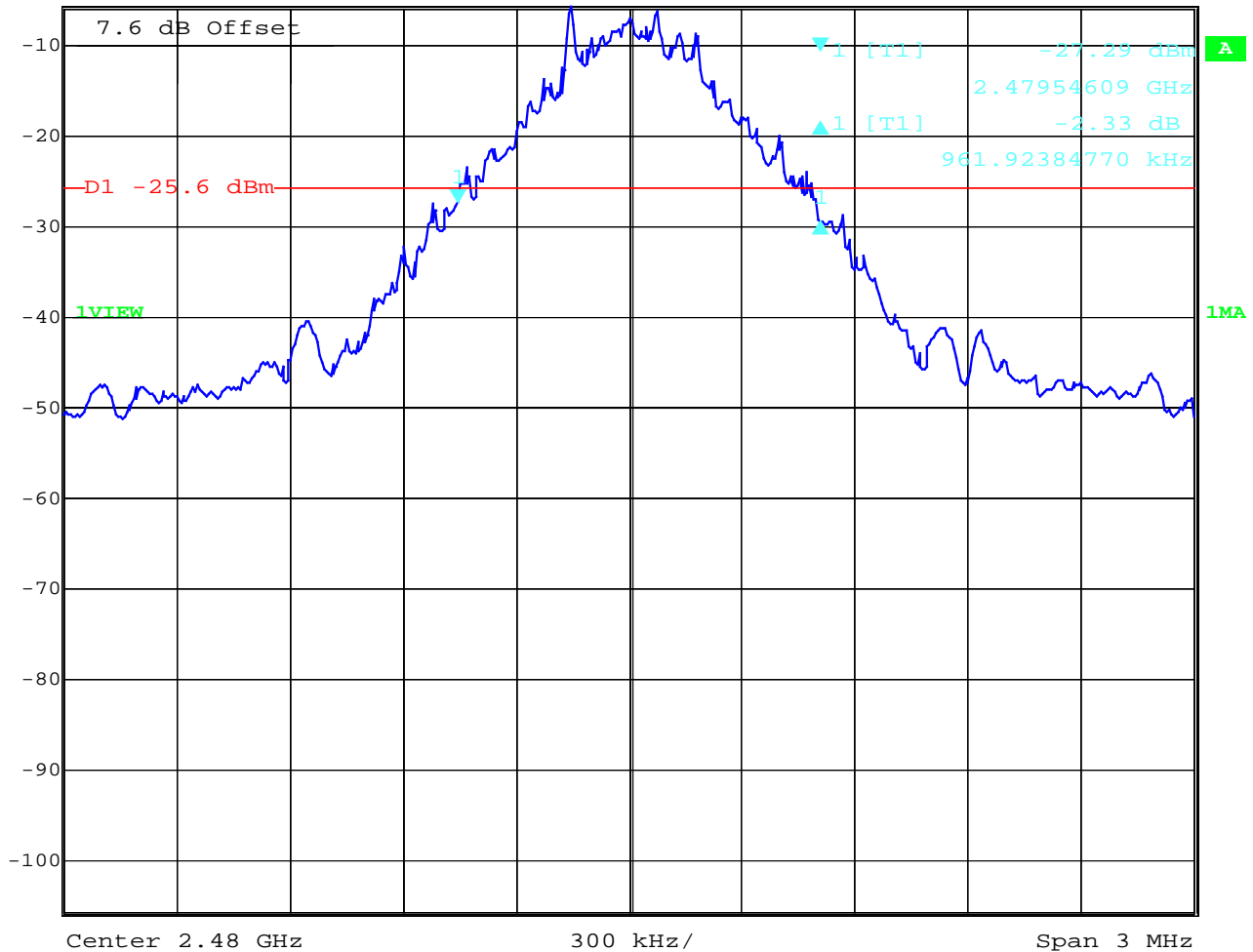
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS
2480 MHz

SUBCLAUSE § 15.247 (c) (1)

Delta 1 [T1] RBW 10 kHz RF Att 10 dB
 Ref Lvl -2.33 dB VBW 100 kHz
 -5.6 dBm 961.92384770 kHz SWT 76 ms Unit dBm



Date: 12.DEC.2002 10:27:50

f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

LIMITS

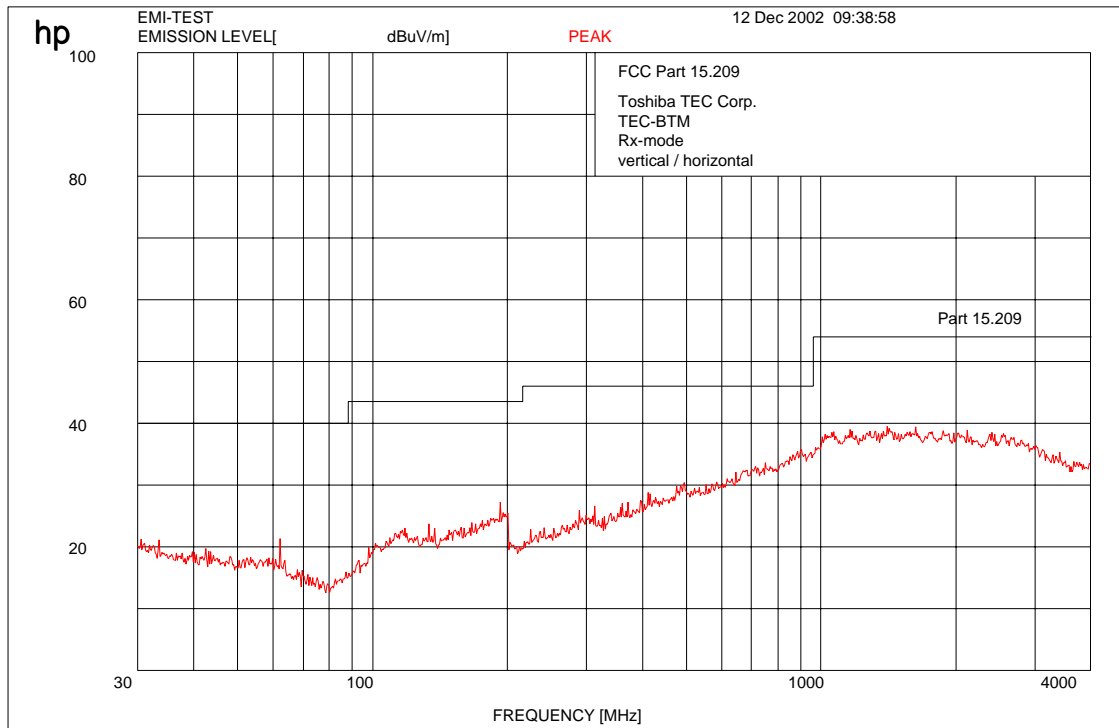
SUBCLAUSE § 15.247 (c)

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)

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

Limits

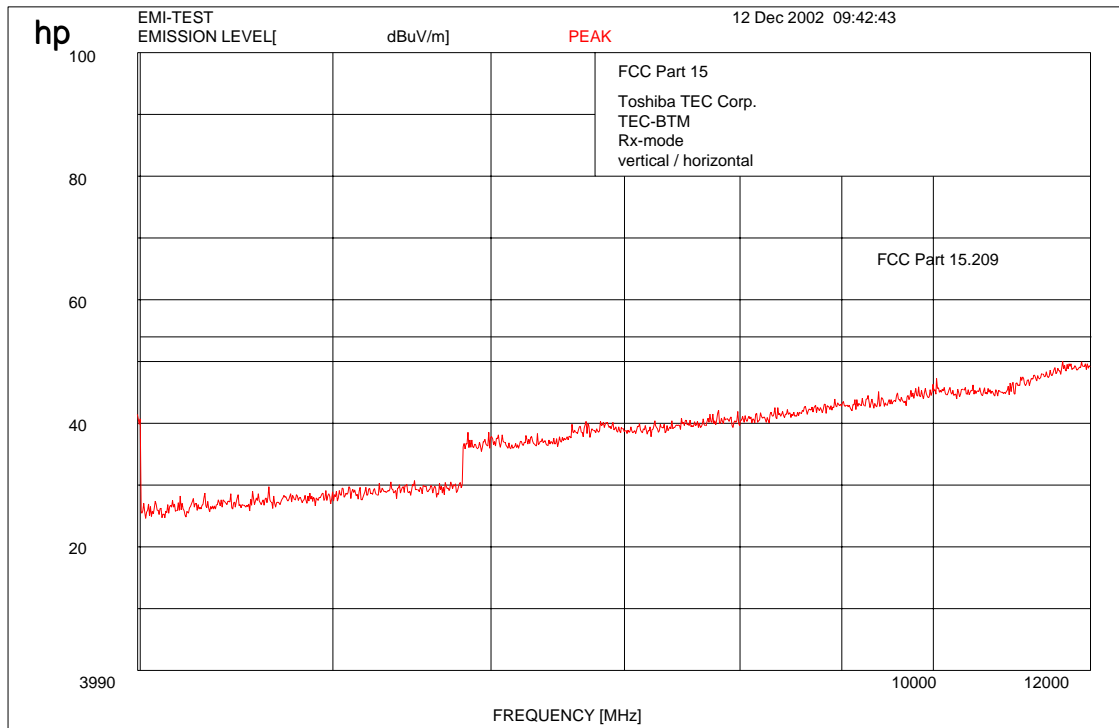
SUBCLAUSE § 15.109

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

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

Limits

SUBCLAUSE § 15.109

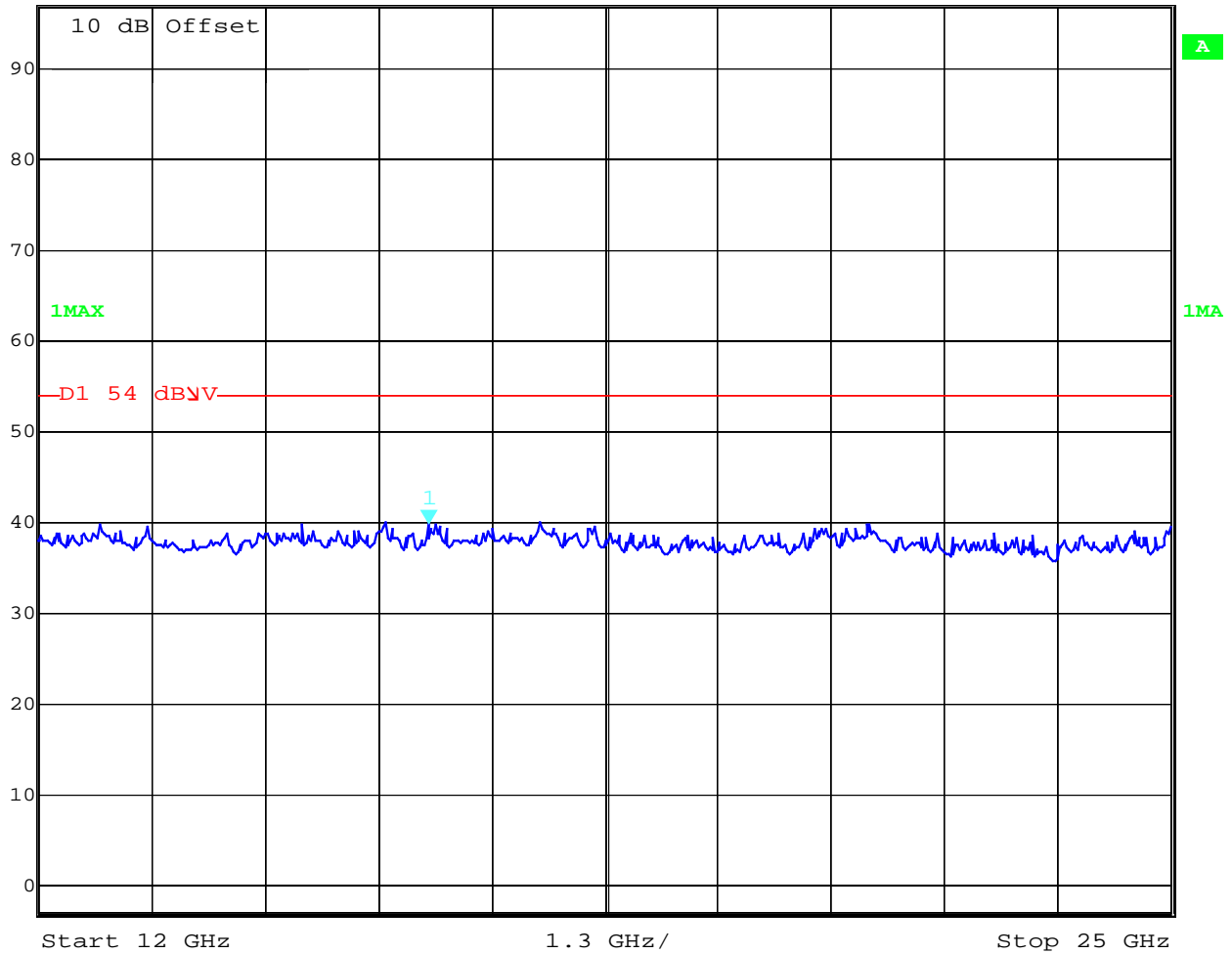
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

EMISSION LIMITATIONS (Receiver) SUBCLAUSE § 15.109

Marker 1 [T1] RBW 1 MHz RF Att 0 dB
 Ref Lvl 39.77 dBµV VBW 1 MHz
 97 dBµV 16.48096192 GHz SWT 74 ms Unit dBµV



Date: 12.DEC.2002 10:00:51
 f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Limits SUBCLAUSE § 15.109

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

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

Equipment under test : TEC-BTM
 Ambient temperature : 23.3°C
 Relative humidity : 30%

RECEIVER SPURIOUS RADIATION
Radiated

§ 15.109

SPURIOUS EMISSIONS LEVEL (µV/m)								
CH 1 / 2 / 3								
f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)
no	peak	found						
Measurement uncertainty			±3 dB					

f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz
 see above plots

Measurement distance see table

Limits

SUBCLAUSE § 15.109

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

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-Testreceiver	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	Controler	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				