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NUMBER: 905266

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TEST REPORT

Report No.: 17566RET.101

TEST NAME: FCC PART 15.247 TESTING FOR BLUETOOTH RADIO DEVICE

Product : BLUETOOTH BARCODE READER
Trade Mark : Baracoda
Model/type Ref. : BaracodaPencil
Manufacturer : Baracoda Wireless Technology
Requested by : Baracoda Wireless Technology
Other identification of the product : BP04
Standard(s) : FCC Part 15.247

This test report includes 2 annexes and therefore the total number of pages is 47.

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Date: 2002-12-12	Test operator Date: 2002-12-12 A. Llamas 	Revised by: Date: 2002-12-13 A. Rojas 	Approved by: Date: Dec 16 th , 2002 F. Cañas Area Director 	Page: 1 of 8
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ANNEX A. TEST RESULTS

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1. COMPETENCE AND GUARANTEES

Centro de Tecnología de las Comunicaciones (CETECOM), S.A. is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 905266.

In order to assure the traceability to other national and international laboratories, CETECOM has a calibration and maintenance programme for its measuring equipment.

CETECOM guarantees the reliability of the data presented in this report, which is the result of measurements and tests performed to the item under test on the date and under the conditions stated on the report and is based on the knowledge and technical facilities available at CETECOM at the time of execution of the test.

CETECOM is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the item under test and the results of the test.

2. GENERAL CONDITIONS

1. This report only refers to the item that has undergone the test.
2. This report does not constitute or imply by its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without written approval of CETECOM.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of CETECOM and the Accreditation Bodies.

3. CHARACTERISTICS OF THE TEST

3.1 TEST REQUESTED

Measurements for frequency hopping equipment (Bluetooth) operating in the 2400 MHz -2483.5 MHz band and using, according to FCC Part 15.247.

3.2 REQUIREMENTS AND METHOD

The test has been carried out according to FCC parts 15.33, 15.35, 15.205, 15.209, 15.247 and the document DA 00-705."Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems".

The testing was performed according to the procedure in ANSI C63.4 (1992). Radiated testing was performed in Cetecom's semi-anechoic chamber. This site has been fully described in a report submitted to the FCC and was accepted in a letter dated July 25, 2002.

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The instrumentation used to perform the testing is listed below:

1. Semianechoic Absorber Lined Chamber IR 11. BS.
2. Control Chamber IR 12.BC.
3. Spectrum Analyzer HP 8566 B.
4. RF Preselector HP 85685A.
5. Quasi-peak adaptor HP 85650A.
6. RF linear amplifier HP 8447.F
7. Antenna mast EM 1072 NMT.
8. Rotating table EM 1084-4. ON.
9. Mast controller EM 1053-22.
10. Rotating table controller EM 1064-4023.
11. Process controller HP 98581C.
12. Harddisk HP 9153.
13. Peripheral unit HP 9153 C.
14. Measurement software HP 85879A.
15. 3 dB attenuator HP 8491A.
16. Bilog antenna CHASE CBL6111.
17. Bilog antenna CHASE CBL6111.
18. Antenna tripod EMCO 11968C.
19. Double-ridge Guide Horn antenna 1-18 GHz HP 11966E.
20. Double-ridge Guide Horn antenna 18-40 GHz Agilent 119665J.
21. Switch Unit with RF pre-amplifiers R&S TS8930SU.
22. RF pre-amplifier Miteq JS4-12002600-30-5A.
23. EMI Test Receiver R&S ESIB26.

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4. IDENTIFICATION DATA SUPPLIED BY THE APPLICANT

Identificaton data in this section has been supplied by the client.

4.1 APPLICANT

Name or Company: BARACODA WIRELESS TECHNOLOGY

V.A.T.: FR 64428768600

Address: 55, Avenue Auguste Renoir (Marly Le-Roi)

Postal code: F 78160

Country: FRANCE

Telephone: +33 1 30088900

Fax: +33 1 39168063

4.2 REPRESENTATIVE

Name: Mickaël Bouffaut

4.3 TEST SAMPLES SUPPLIER

Company: Same as indicated in point 4.1.

Samples undergoing test have been selected by: **the client**.

4.4 IDENTIFICATION OF ITEM/ITEMS TESTED

Product: BLUETOOTH BARCODE READER

Trade mark: Baracoda

Model: BaracodaPencil

Manufacturer: BARACODA WIRELESS TECHNOLOGY

Country of manufacture: FRANCE

Manufacture site: Data not available

Description: Bluetooth (Class 2) barcode reader with rechargeable Ni-MH battery. It is designed for scanning barcodes according to the following types: EAN/UPC, Code 39 or Code 128. The user simply press a button when scanning a barcode. The color of the LED (red, green or yellow) shows the status of the device. You can also find a Reset button, located on the back; this button can help you to reset the default parameters. The bar codes are transmitted either in real time or memorized for later transmission, to remote terminals which use the Bluetooth protocol.

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5. USAGE OF SAMPLES, PERIOD OF TESTING AND ENVIRONMENTAL CONDITIONS

5.1 USAGE OF SAMPLES

Sample M/01 is formed by the following elements:

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
17566/06	Bluetooth module with integral antenna	BaracodaPencil	---	07/11/02

Sample M/02 is formed by the following elements:

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
17566/04	Bluetooth module with antenna connector	BaracodaPencil	---	04/11/02

1. Sample M/01 has undergone following test(s).
Radiated measurements indicated in annex A.
2. Sample M/02 has undergone following test(s).
All tests indicated in annex A, except radiated measurements.

5.2 PERIOD OF TESTING

The performed test started on 2002-11-06 and finished on 2002-11-15.

The tests as detailed in this report have been performed at CETECOM.

5.3 ENVIRONMENTAL CONDITIONS

In the control chamber the following limits were not exceeded during the test:

Temperature	Min. = 22 °C Max. = 23 °C
Relative humidity	Min. = 57 % Max. = 58 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

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In the semianechoic chamber (21 meters x 11 meters x 8 meters) the following limits were no exceeded during the test.

Temperature	Min. = 22 °C Max. = 23 °C
Relative humidity	Min. = 58 % Max. = 58 %
Air pressure	Min. = 1005 mbar Max. = 1008 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogenousity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

In the chamber for conducted measurements the following limits were no exceeded during the test:

Temperature	Min. = 25 °C Max. = 26 °C
Relative humidity	Min. = 52 % Max. = 53 %
Air pressure	Min. = 1011 mbar Max. = 1013 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

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6. TEST RESULTS

Abbreviations used in the VEREDICT column of the following tables are:

P Pass
F Fail
NA not applicable
NM not measured

FCC PART 15 PARAGRAPH	VERDICT			
	NA	P	F	NM
15.247 Subclause (a) (1). 20 dB Bandwidth and Carrier frequency separation	P			
15.247 Subclause (a) (1) (iii). Number of hopping channels	P			
15.247 Subclause (a) (1) (iii). Time of occupancy (Dwell Time)	P			
15.247 Subclause (b). Maximum peak output power and antenna gain	P			
15.247 Subclause (c). Band-edge of conducted emissions (Transmitter)	P			
15.247 Subclause (c). Emission limitations conducted (Transmitter)	P			
15.247 Subclause (c). Emission limitations radiated (Transmitter)	P			
15.207. Conducted limits	NA			
15.209. Receiver spurious radiation	P			

7. REMARKS AND COMMENTS

None.

8. SUMMARY

Based on the results of the performed test, stated in annex A the item under test is **IN COMPLIANCE** with the specifications listed in section 3.1 “TEST REQUESTED”.

NOTE: The results presented in this Test Report apply only to the particular item under test declared in section 4.4 “IDENTIFICATION OF ITEM/ITEMS TESTED” of this document, as presented for test on the date(s) declared in section 5, “USAGE OF SAMPLES, PERIOD OF TESTING AND ENVIRONMENTAL CONDITIONS”.

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ANNEX A
TEST RESULTS

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TEST CONDITIONS

Power supply (V):

$V_{nominal} = 3.6 \text{ Vdc}$

Type of power supply = Rechargeable battery Ni-MH

Type of antenna = Integral antenna (patch antenna)

Maximum Declared Gain for antenna = + 1 dB

Operating Temperature Range (°C):

$T_n = +0 \text{ to } +45$

TEST FREQUENCIES:

Lowest channel: 2402 MHz

Middle channel: 2441 MHz

Highest channel: 2480 MHz

The test set-up was made in accordance to the general provisions of ANSI C63.4-1992.

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is directly connected to the spectrum analyzer via the antenna connector (sma type) provided with the test sample. No coaxial low-loss connecting cable was necessary for such connection so no cable attenuation correction was made.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive (wooden) table one meter above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

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Section 15.247 Subclause (a) (1). 20 dB Bandwidth and Carrier frequency separation**SPECIFICATION**

Frequency hopping system shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

RESULTS

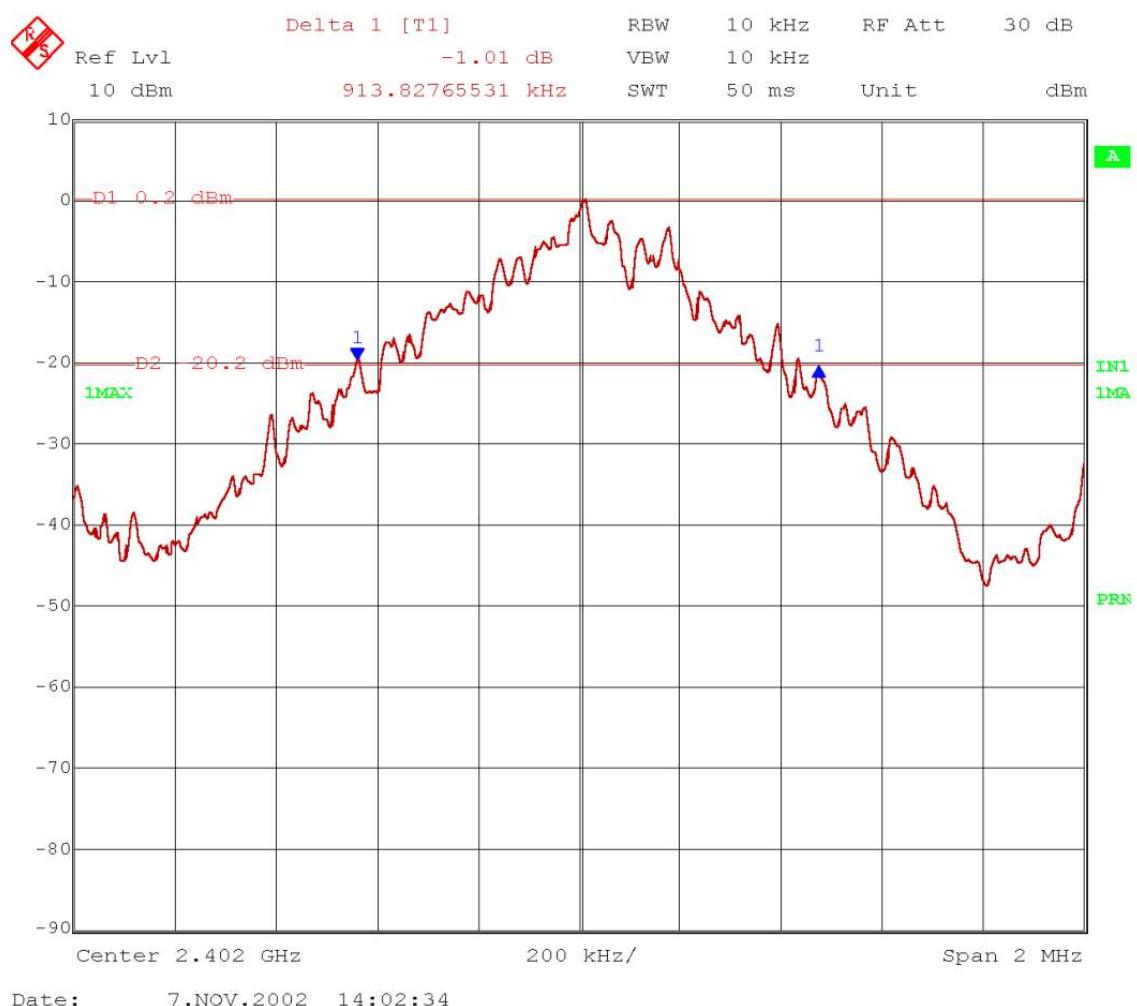
20 dB Bandwidth (see next 3 plots).

	Lowest frequency 2402 MHz	Middle frequency 2441 MHz	Highest frequency 2480 MHz
20 dB Spectrum bandwidth (kHz)	913.83	921.84	917.84
Measurement uncertainty (kHz)	±11		

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20 dB BANDWIDTH.

Lowest Channel: 2402 MHz.



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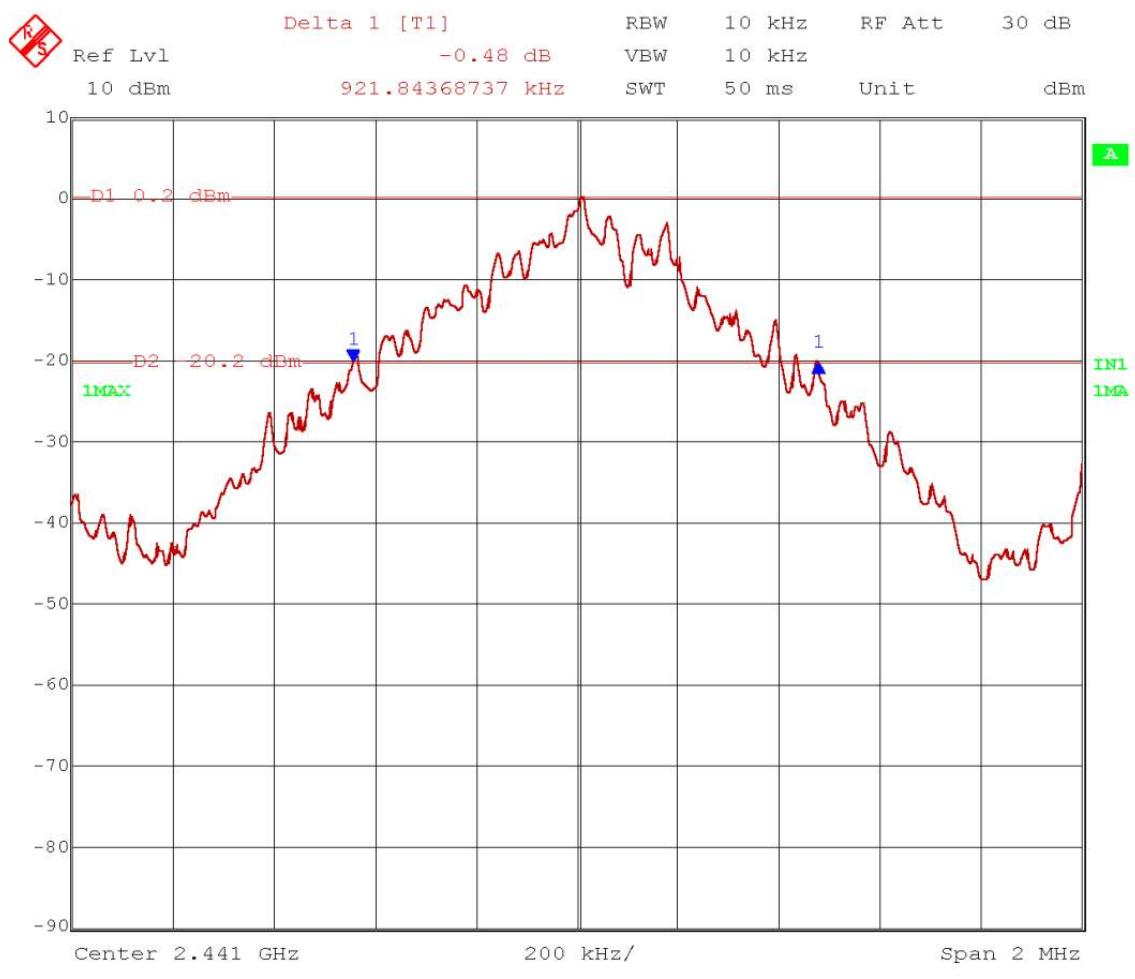
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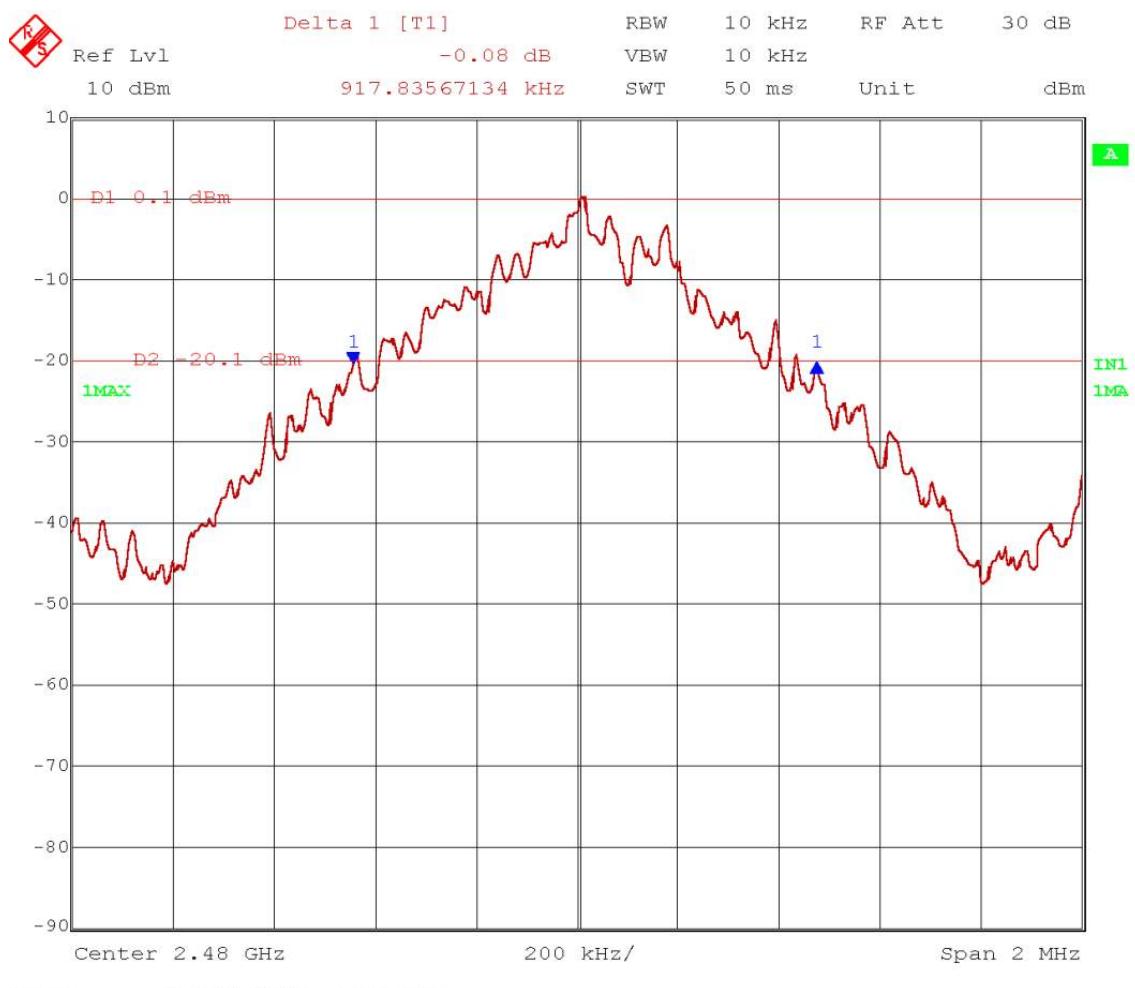
20 dB BANDWIDTH.

Middle Channel: 2402 MHz.



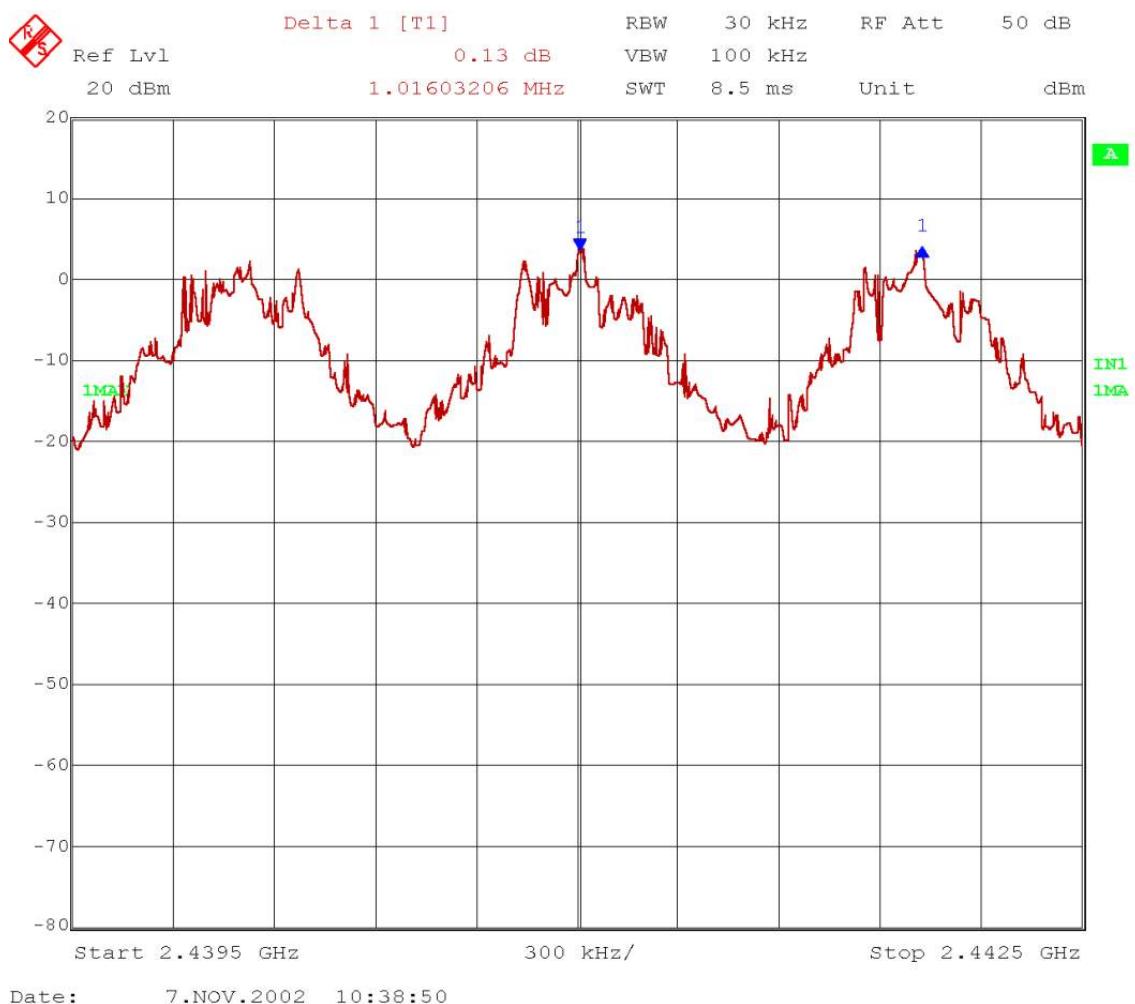
20 dB BANDWIDTH.

Highest Channel: 2480 MHz.



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Carrier frequency separation (see next plot).



The hopping channel carrier frequencies are separated by a minimum of the 20 dB bandwidth of the hopping channel.

Verdict: PASS

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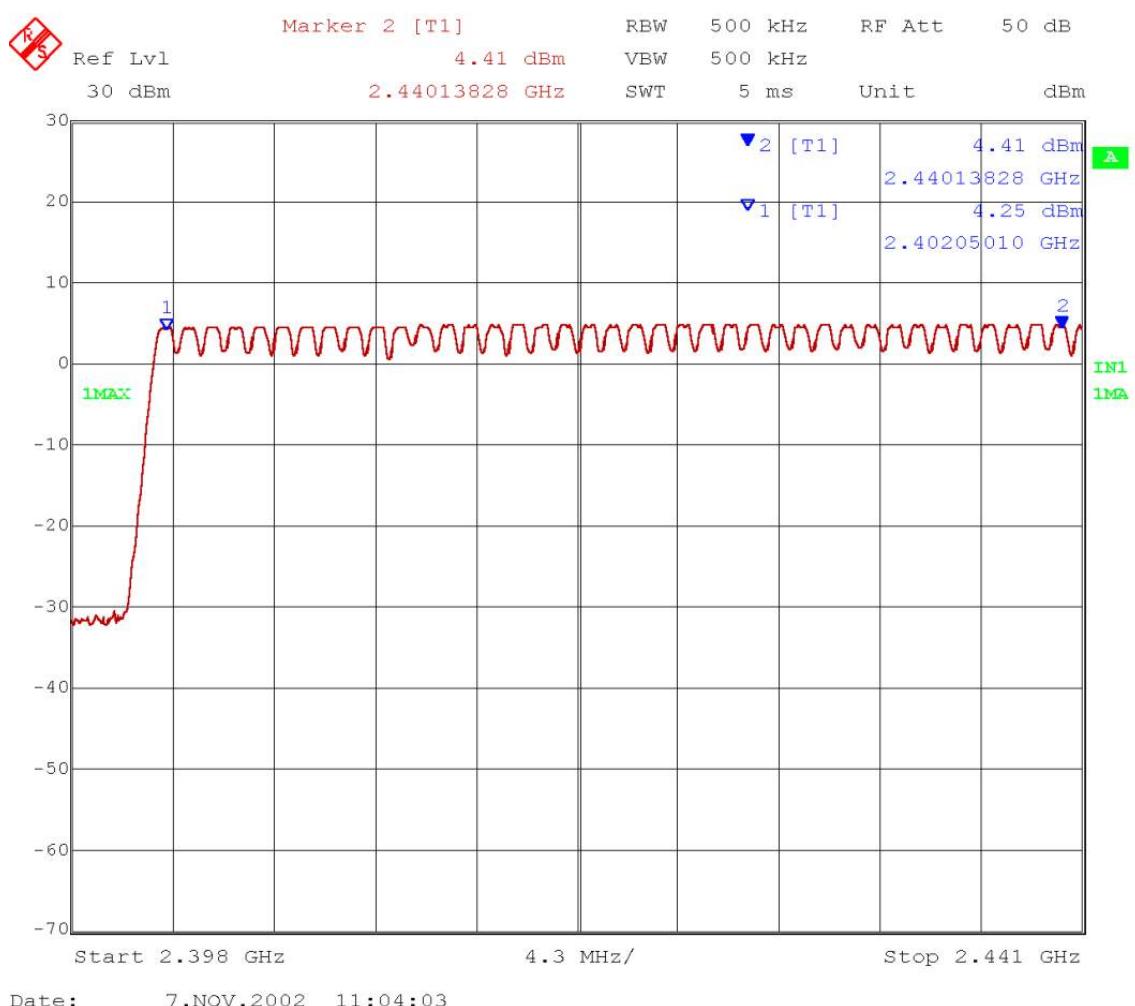
Section 15.247 Subclause (a) (1) (iii). Number of hopping channels

SPECIFICATION

Frequency hopping system in the 2400-2483.5 MHz band shall use at least 15 non-overlapping channels.

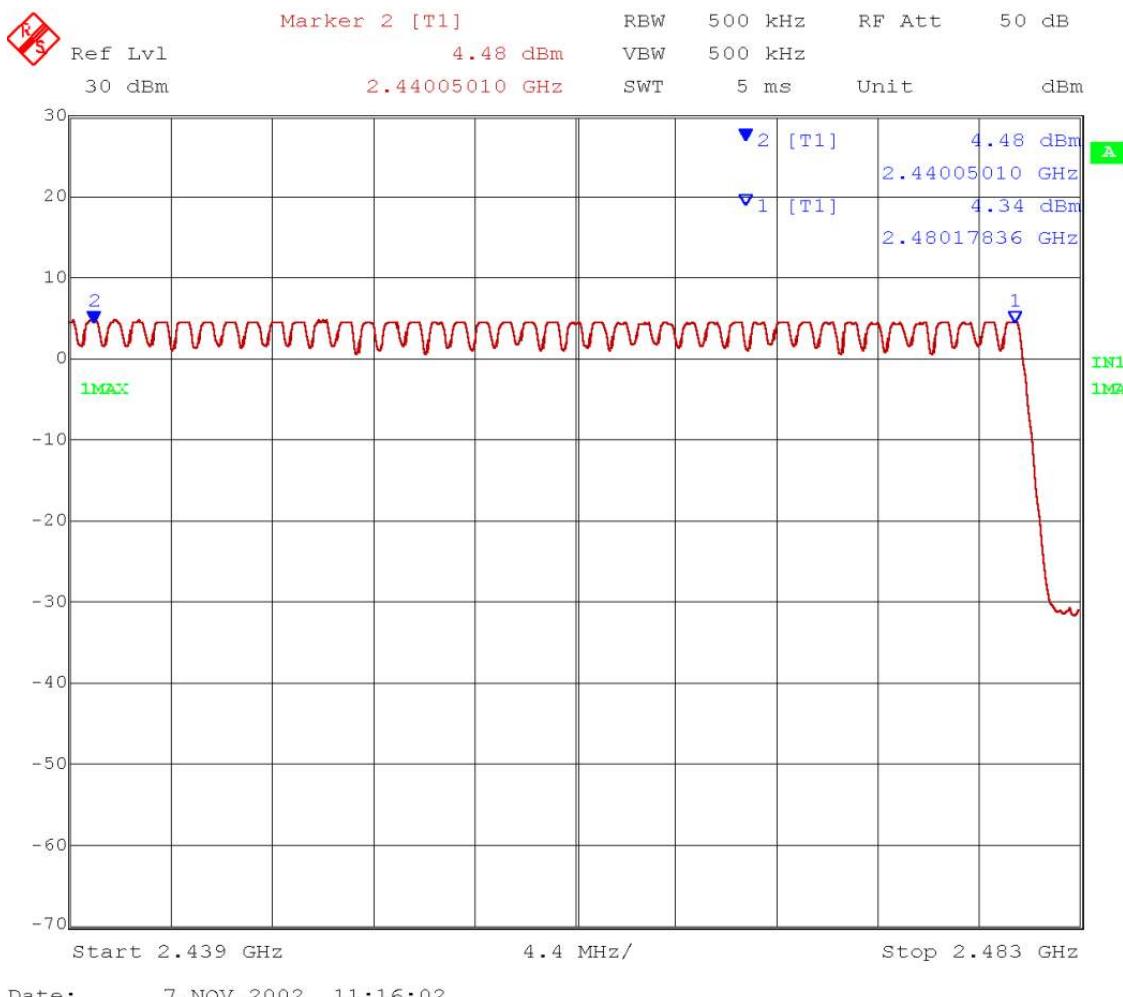
RESULTS

The number of hopping channels is 79 (see next two plots).



Number of hopping frequencies: 39

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Number of hopping frequencies: 40

Total number of hopping frequencies: 79

Verdict: PASS

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Section 15.247 Subclause (a) (1) (iii). Time of occupancy (Dwell Time)

SPECIFICATION

The average time of occupancy on any channel shall not be greater than 0.4 seconds (400 ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed = $0.4 \times 79 = 31.6$ seconds.

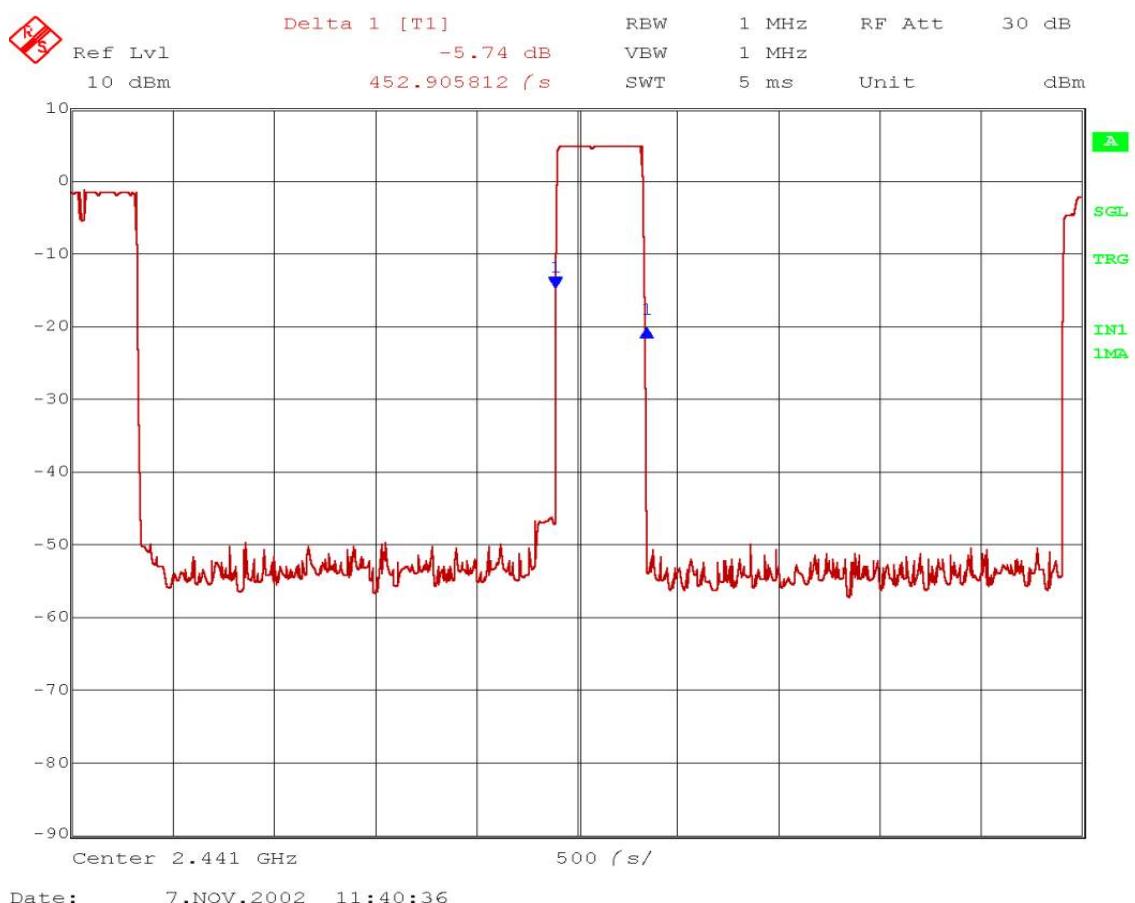
RESULTS

1. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH1.

The system makes worst case 1600 hops per second or 1 time slot has a length of 625 μ s with 79 channels. A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case $1600/2 = 800$ hops per second with 79 channels. So you have each channel $800/79 = 10.13$ times per second and so for a period of $0.4 \times 79 = 31.6$ seconds you have $10.13 \times 31.6 = 320.11$ times of appearance.

Each Tx-time per appearance is 453 μ s (see next plot).

So we have $320.11 \times 453 \mu\text{s} = 145.01 \text{ ms}$ per 31.6 seconds.



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Verdict: PASS

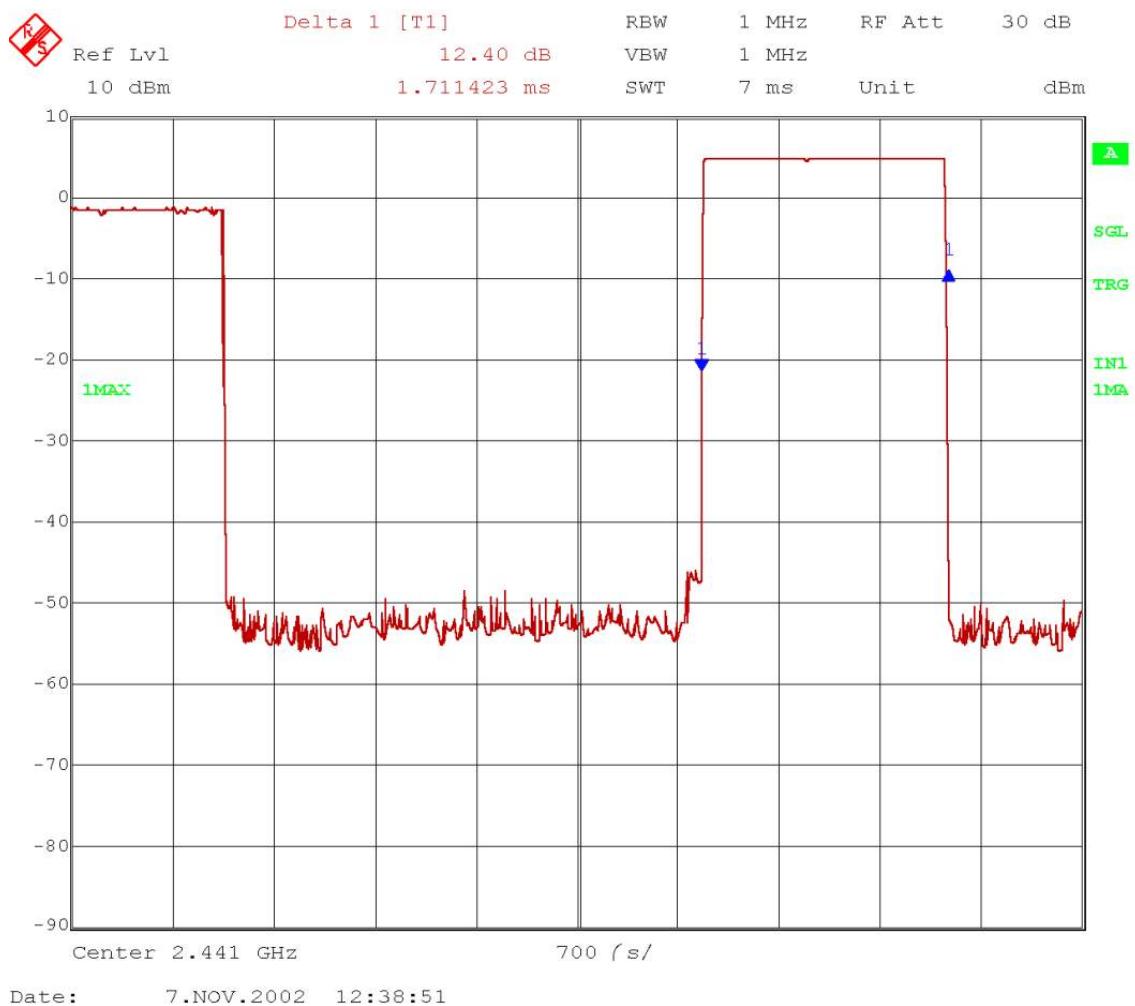
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2. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH3.

A DH3 Packet need 3 time slots for transmitting and 1 time slot for receiving. Then the system makes worst case $1600/4 = 400$ hops per second with 79 channels. So you have each channel $400/79 = 5.1$ times per second and so for a period of $0.4 \times 79 = 31.6$ seconds you have $5.1 \times 31.6 = 161.16$ times of appearance.

Each Tx-time per appearance is 1.71 ms (see next plot).

So we have 161.16×1.71 ms = 275.58 ms per 31.6 seconds.



Verdict: PASS

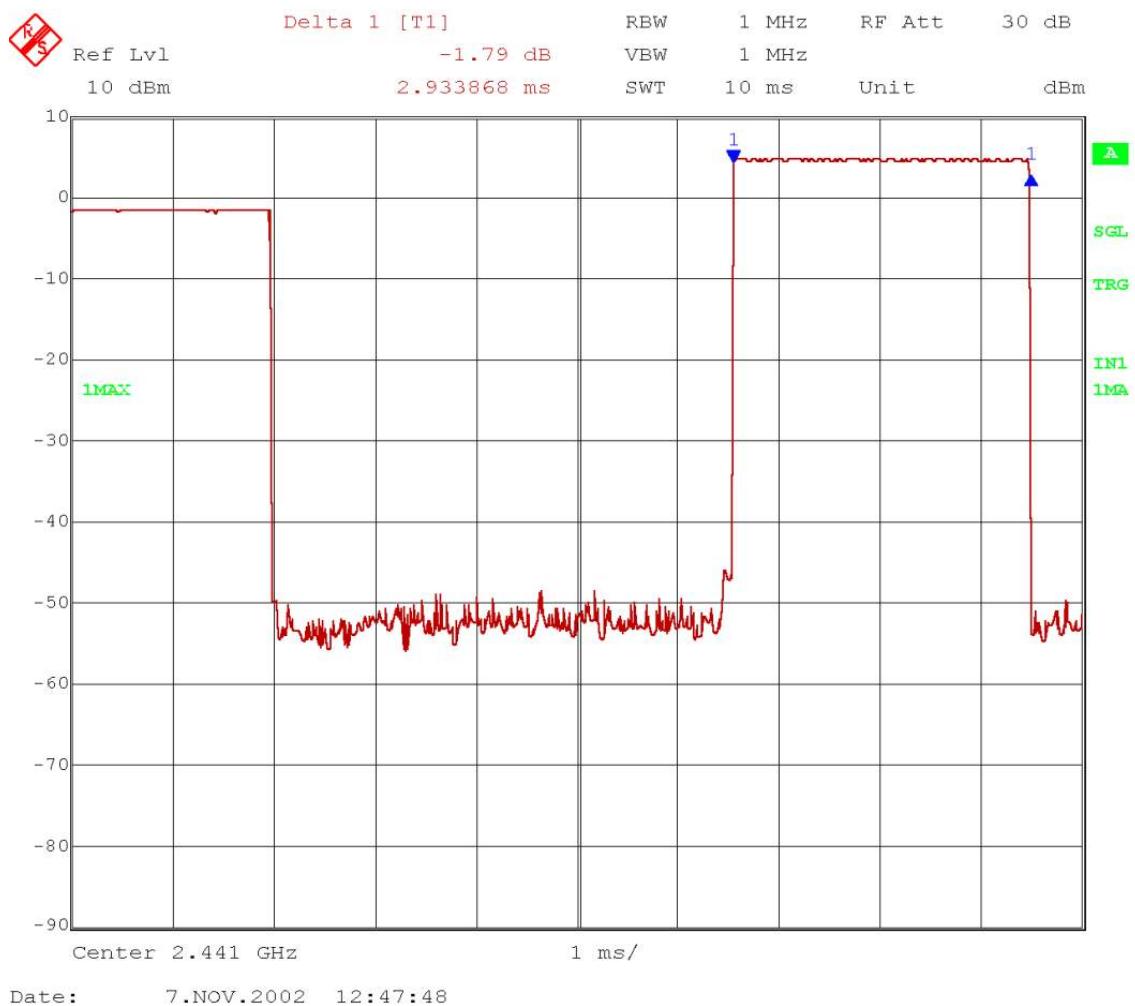
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3. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH5.

A DH5 Packet need 5 time slots for transmitting and 1 time slot for receiving. Then the system makes worst case $1600/6 = 266.67$ hops per second with 79 channels. So you have each channel $266.67/79 = 3.37$ times per second and so for a period of $0.4 \times 79 = 31.6$ seconds you have $3.37 \times 31.6 = 106.49$ times of appearance.

Each Tx-time per appearance is 2.93 ms (see next plot).

So we have 106.49×2.93 ms = 312.02 ms per 31.6 seconds.



Verdict: PASS

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Section 15.247 Subclause (b). Maximum peak output power and antenna gain**SPECIFICATION**

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt (30 dBm).

RESULTS

MAXIMUM PEAK OUTPUT POWER (CONDUCTED). See next plots.

	Lowest frequency 2402 MHz	Middle frequency 2441 MHz	Highest frequency 2480 MHz
Maximum peak power (dBm)	4.49	4.71	4.60
Measurement uncertainty (dB)		±1.5	

The maximum declared antenna gain for this device is +1 dBi, therefore the maximum theoretical peak radiated power (EIRP) in the three measurement channels for this device is 5.71 dBm or 3.72 mW.

The actual peak radiated power (EIRP) was measured for the lowest, middle and highest frequency (see next plots):

MAXIMUM PEAK OUTPUT POWER (RADIATED).

	Lowest frequency 2402 MHz	Middle frequency 2441 MHz	Highest frequency 2480 MHz
Instrument reading (dBm)	-27.62	-30.78	-31.94
Correction Factor (dB)	19.85	20.02	20.24
Maximum EIRP peak power (dBm)	-7.77	-10.76	-11.70
Measurement uncertainty (dB)		+1.98 / -1.75	

The antenna is integrated in the class 2 surface mountable Bluetooth module UB1-1112 incorporated in the BaracodaPencil.

Peak gain: +0.5 dBi (Typical) and +1 dBi (Maximum).

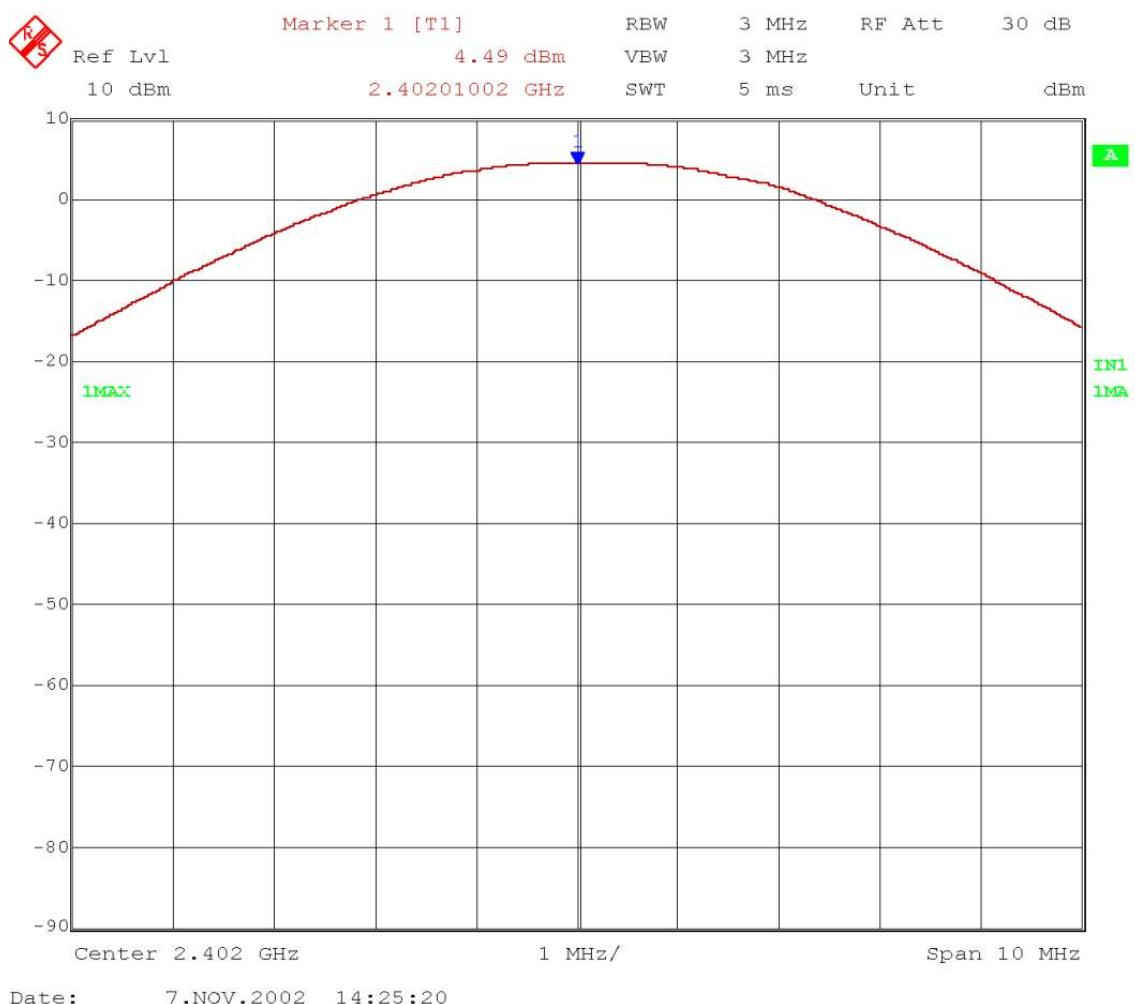
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

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PEAK OUTPUT POWER (CONDUCTED).

Lowest Channel: 2402 MHz.

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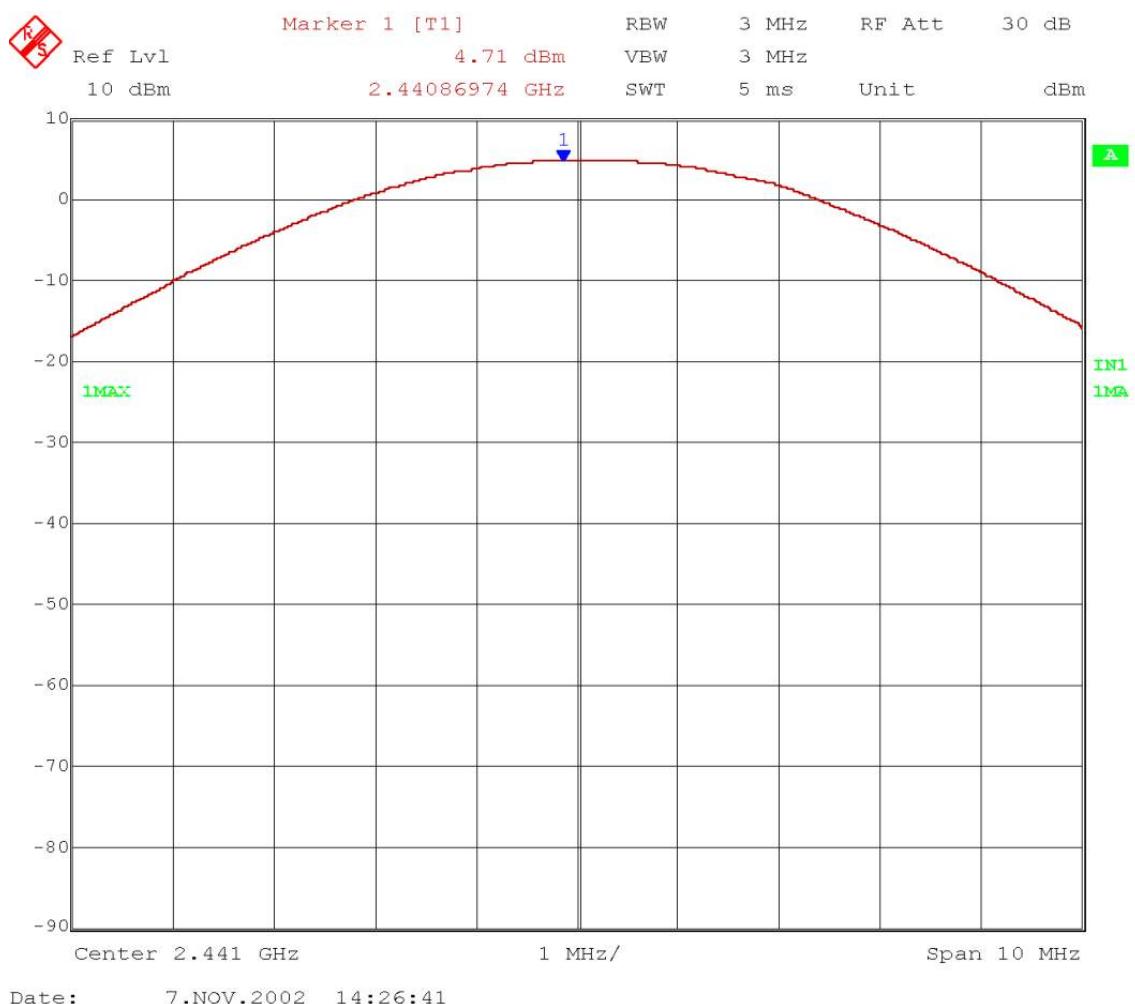
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PEAK OUTPUT POWER (CONDUCTED).

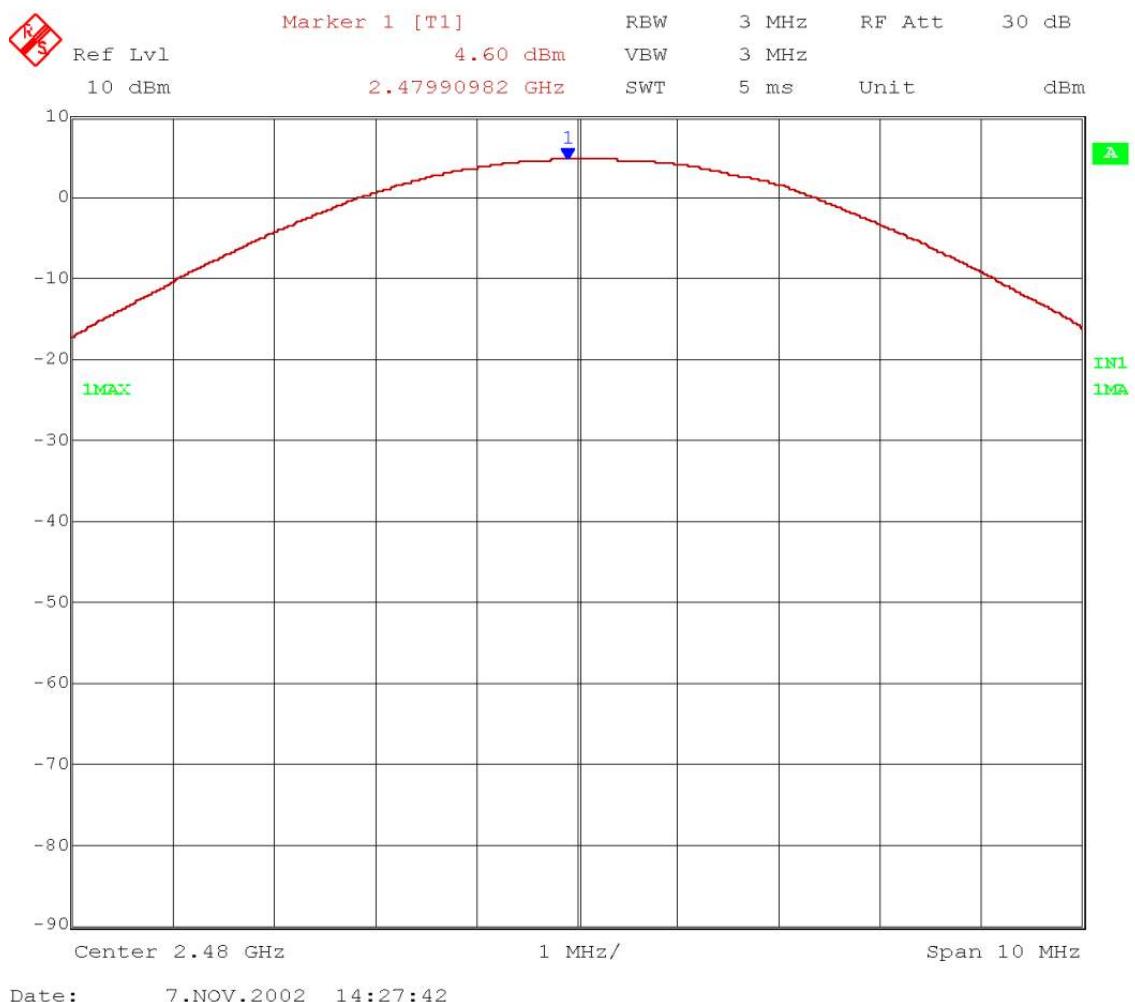
Middle Channel: 2441 MHz.



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PEAK OUTPUT POWER (CONDUCTED).

Highest Channel: 2480 MHz.

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